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Surgery From an Osteopathic Standpoint

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SURGERY

FROM AN

OSTEOPATHIC STANDPOINT,

—BY—

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—WITH—

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PREFACE.

IN THIS volume an endeavor has been made to present the essential facts of practical Surgery, modified by the science of Osteopathy, as taught and practiced by its discoverer, ANDREW TAYLOR STILL. That Osteopathic practice has revolutionized Modern Surgery may be evidenced by a perusal of the following pages. In the preparation of this work the writer has attempted to be as brief as is compatible with clearness. But few operative methods have been detailed, since it is believed that these properly belong to works on operative surgery. For the Osteopathic treatment of the various surgical affections the writer has followed the teachings of Dr. ANDREW TAYLOR STILL and the instructions of Dr. CHARLES E. STILL, collaborator of the text. Special credit is due Dr. GEORGE M. LAUGHLIN for valuable advice in the preparation of this work, and also for the radiographs made by him and kindly loaned for the purpose of illustration.

The illustrations in this text, with the exception of the radiographs, were made from original drawings by Miss AGNES DANDY and Mr. WILLIAM RICHARDSON, students at the American School of Osteopathy. Credit is given the various standard works on surgery to which the author has had occasion to refer. Credit is also due Dr. HARRIET F. RICE for valuable assistance in the preparation of the manuscript.

F. P. YOUNG.

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PART I.

GENERAL PATHOLOGY AND SURGICAL DISEASES.

INFLAMMATION.

Definition.—Inflammation may be defined as the reaction of the tissues to an actual or referred injury, providing that injury is not so great as to produce death. Contrary to what was formerly believed, inflammation is essentially a reparative process, instead of a disease producing entity. It is a disease process which varies according to the nature of the injury and condition and character of the tissues. It has been defined as "nature's effort at the process of repair."

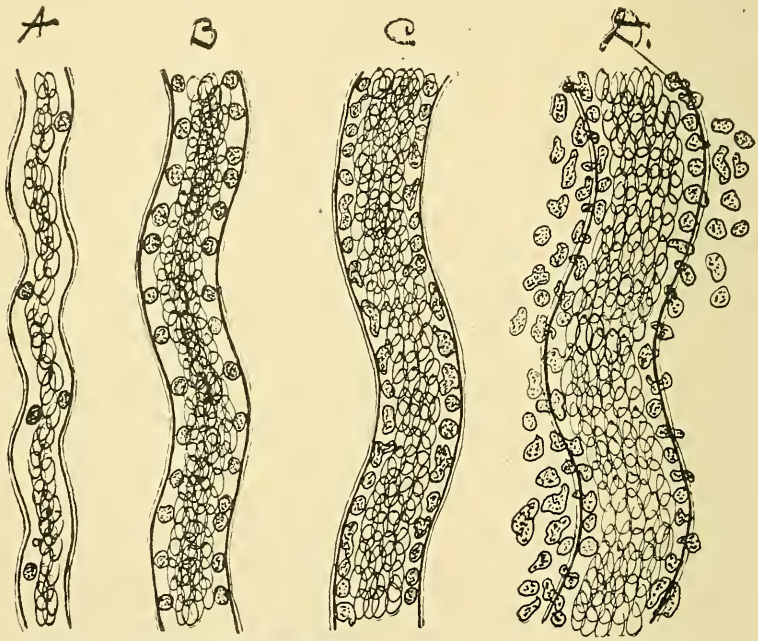
Pathology.

The changes taking place in inflammation may be grouped in the following manner:—Vascular and circulatory changes. (2) Exudation of fluids and the migration of leukocytes through the blood vessels, and (3) Changes in the perivascular tissues.

Vascular and Circulatory Changes.—When an irritant is applied to a vascular area, a momentary contraction of the blood vessels may or may not occur, but this is quickly followed by a dilatation of the capillaries, arterioles, and venules. The blood flows more swiftly to the injured area, hence we have "determination of the blood to the part." This engorgement with flowing blood is called active hyperemia, or congestion. If the blood current be slowed and the engorgement still continues, it is then termed passive congestion. This is usually due to some obstruction to the return circulation, perhaps, also, to a lack of tonicity to the vessel walls, or to a weak heart. But the active hyperemia continues and perhaps pulsation may occur in the venules and other smaller vessels. Capillaries previously invisible become highly distended. During this stage no exudation of fluid takes place. If the irritant be removed the blood vessels promptly return to their normal size and all evidences of hyperemia disappear. This is what often occurs in hives. If the irritation continues, certain changes will occur in the blood; white corpuscles will become separated from the

general blood stream and will align themselves along the vessel wall, the red corpuscles still continuing in the centre of the stream. Presently it will be noticed that the leukocyte finds an opening (stoma) in the vessel wall, through which it succeeds in escaping (diapedesis). In violent inflammation numbers of the red corpuscles may also escape at the same time (rhexis). It must be remembered that the leukocyte

FIG. 1.



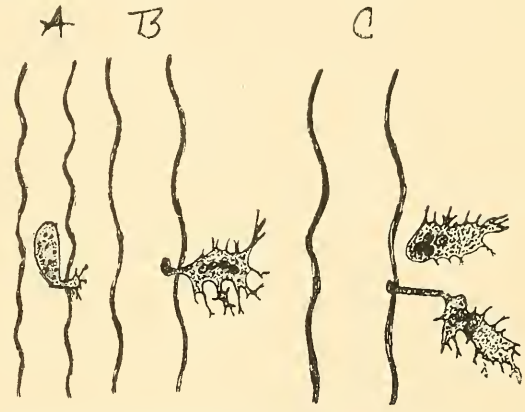
Inflammatory changes in a small vessel: *a*, normal circulation; *b*, dilatation; *c*, leukocytosis; *d*, migration of the leucocytes.

is an ameboid cell, which explains its ability to escape through the stomata in the vessel wall, which act, it readily and quickly accomplishes—variously estimated by different observers at from one-half to one and one-half hours. But during this time the blood current is slowed perceptibly until finally it actually stops (stasis), then the liquid elements of the blood pour out through and between the cells in the vessel wall, while the leukocytes swarm out in vast numbers, the number depending largely upon the severity of the inflammation. Migration of the leukocytes to the inflamed area next occurs. It is believed that the leukocytes are attracted by certain chemical substances (positive chemotaxis). It is also believed that they are repelled by other substances (negative chemotaxis). Certain it is that they are attracted to the inflamed area from the blood vessels from whence they come.

Phagocytosis.—It is known also that the leukocyte has the power to eat up, as it were, certain offending materials, such as portions of dead

cells or effete materials, but more important than all, bacteria which may have gained entrance into the body. The white corpuscle is able to destroy the bacteria by means of certain chemical compounds which it contains (phagocytosis), and it is also believed that certain connective-tissue cells and endothelial cells also have the same phagocytic properties, but to a less degree. If the inflammation is very severe the exudation of the fluids into the tissues may occasion great swelling. The blood vessels are greatly distended and, if the stasis is complete and extends to the arterioles, oscillation will take place in the blood stream, occasioning a throbbing sensation to the patient. Redness will be marked, and in severe inflammations where red corpuscles escape from the vessels, the area will be of a dark bluish color. The skin is often stretched to the utmost where the affection is superficial, presenting a shiny appearance. Considerable local heat is manifest.

FIG. 2. FIG. 3. FIG. 4.



A, B and C illustrating the various stages of diapedesis and migration of the leucocyte.

Changes in the Perivascular Tissues.—In addition to the exudation of the fluids and the migration of the leukocytes, there are other important changes in the tissues. Rapid proliferation of the resident connective-tissue cells takes place; these cells, with the assistance of the leukocytes, form more or less of a wall or barrier around the source of inflammation, or irritant, as if to prevent it spreading or extending to other tissues. These new cells are embryonal in character, but if the irritation continues some length of time they will become differentiated into other forms, chiefly fibrous tissue, and then if the irritation should be removed without the destruction of any cells, the part would perhaps be permanently altered by the formation of this new tissue. Where any tissue is destroyed, as in case of abscess formation, ulceration, or wounds, these proliferated resident tissue cells take the place of the destroyed tissue and will always remain as an evidence of the inflammation. In open wounds it constitutes the scar tissue or cicatrix. The changes taking place in the tissues depend largely upon the nature and cause of the inflammation.

Causes of Inflammation.

(A) Predisposing and (B) Exciting.

Predisposing Causes.—(1) Abnormal blood supply; abnormal in quantity as in obstruction to arterial, venous, or lymphatic circulation by bony lesions, contractions of fascia or muscles, or because of insufficient food, lack of fresh air, hemorrhage, anemia, etc. Abnormal in quality because of certain poisons circulating in the blood as occurs in chronic alcoholism, Bright's disease, diabetes, gout, syphilis, lead, mercury and phosphorus poisoning, etc.

(2) Abnormal nerve influence because of pressure on the nerve or disease of the nerve trunk supplying the part affected.

Exciting Causes.—These may be best considered as (1) chemical and (2) mechanical. By mechanical cause is meant any trauma, as a bruise, cut or other injury. The chemical causes consist of irritating chemical compounds and micro-organisms. These irritating chemical compounds consist of caustic alkalis and acids and toxic animal and vegetable substances. Micro-organisms cause irritation by means of certain chemical compounds which they produce either by the metabolism of their own bodies or by their action upon the tissue cells. It is a recognized fact that some of the most toxic substances known are produced by bacteria, further, that micro-organisms are perhaps the most important factor in the majority of inflammations, being always present, the injured cells give them an opportunity of entering the tissues, when inflammation will result. In the treatment of inflammation this cause should always be kept in mind.

Terminations of Inflammation.

Inflammation terminates in (1) resolution, (2) new formation, (3) ulceration and abscess formation, and (4) necrosis.

Resolution.—By resolution is meant that when the cause of the morbid process is removed or ceases, the tissues return to the normal condition.

New Formation.—This consists of inflammatory tissues, the result of proliferation of the resident connective-tissue cells; especially is this true of inflamed joints where injury, attended by long continued irritation brought about by efforts to use the member, results in the formation of fibrous tissue about the joint, binding down the tendons and ligaments, destroying bursae, lessening the range of motion, whilst terminal nerves are compressed, which results in more or less constant pain. Wherever injury or disease destroys any tissue, the tissue taking the place of that destroyed consists of regenerated nerves, muscles or other tissues as the case may be. Tissue the result of proliferation and development of the connective tissue cells is called a scar or cicatrix.

For other terminations of inflammation see Ulceration and Abscess Formation and Necrosis.

Varieties of Inflammation.

The varieties of inflammation are *acute,* when the tissue changes are active, and *chronic,* when the tissue changes are slow and the cause is long standing.

Chronic Inflammation.—The causes of chronic inflammation, are, as in acute inflammation, local and constitutional, but there is more frequently some constitutional cause operating. The color usually indicates venous congestion due to continued dilatation of the veins from obstruction of the return circulation. The pain, which is less severe than in acute inflammation, is usually of a dull, aching character, is more or less constant and is often severest at night. Swelling is often one of the most pronounced of the symptoms. The increased heat is often not perceptible when the inflammation is on the surface of the body. When an important organ is affected a slight rise of temperature may occur. The changes taking place in chronic inflammation are the same as these which occur in acute, except they are less rapid.

Other forms of inflammation are *traumatic,* that which is due to injury; *infective* or *specific* when produced by specific micro-organisms; *sthenic* when happening in full blooded people; *asthenic* when occurring in the old or debilitated; *parenchymatous* when affecting the parenchyma of an organ; *interstitial* when it involves the connective tissue of an organ; *serous* when accompanied by a serous exudate; *purulent* when attended by the formation of pus; *fibrinous* when the exudate is coagulable; *hemorrhagic* when the exudate contains red blood cells; *croupous* when a membrane forms over the inflamed area; *diphtheritic* when the membrane formed resembles that in diphtheria; *gangrenous* when the inflammation is accompanied by death of a mass of tissue; *simple* when due to no specific cause; *catarrhal* when it affects mucous membranes; *idiopathic,* a term formerly used to indicate an inflammation without a cause; *neuropathic* when there is an impairment of the trophic nerves to the part; *sympathetic* when inflammation takes place in one part because of an irritation in another part, as sometimes happens in the eye.

Signs and Symptoms.

The symptoms of inflammation are (1) pain, (2) heat, (3) redness, (4) swelling, (5) interference in function.

Pain is due to pressure upon the peripheral sensory nerves of the part.

Heat is produced by local irritation and by the circulation of certain products in the body which disturb the heat producing and heat regulating mechanism.

Redness may vary from a bright red, in acute inflammation, to a dark blue, in chronic inflammation, or in abscess formation to a dusky or very dark bluish color.

Swelling.—This varies with the part involved. In some loose cellular tissues the swelling may be very great. In the inflammation of bone little swelling may be evident, yet the pain may be extremely severe.

Interference in Function will largely depend upon the part involved, the severity of the inflammation and the violence of the other symptoms. As a general rule the severity of the symptoms varies with the violence of the inflammation.

Treatment of Inflammation.

(A) Osteopathic measures, and (B) Other measures.

Osteopathic Measures.—The results of inflammation depend largely upon the freedom of the circulating fluids and their quantity and quality. Degenerations, ulcerations, and necrosis are the result of impaired nutrition or its sudden arrest, therefore it should be the first duty of the physician to remove any obstruction to the lymphatic or venous circulation so as to prevent congestion, or any obstruction to the arterial circulation so that the tissues may receive their proper quota of fresh blood. Unless stasis occurs, destructive changes will not happen, hence it is of the utmost importance to prevent a stopping of the circulation. This may be done by encouraging the circulation through the agency of the vasomotor system. Furthermore, the metabolism and the tissue changes may be directly influenced by relieving the pressure on a nerve to a part, or reflexly by stimulating or inhibiting them as may be required. Bacteria constitute the most important factor in inflammation. Years ago Dr. A. T. Still contended that the most efficient germicide within the body was a free flow of fresh blood; this is now generally admitted. It is a recognized fact that under all circumstances nature heals the sore if given a chance. No salve, medicine, or other application has such properties. No chemical reagent will destroy the germs without destroying tissue as well. Bacteria are only destroyed by nature's forces, therefore it is of the utmost importance that a good free flow of fresh blood should be secured. This can be done by removing any obstruction to the arterial flow or to the return circulation, either lymphatic or venous. An increased flow of fresh blood can best be secured by stimulating the vasomotor nerves to the part. Lesions affecting the inflamed area may be found in the planes of fascia, in contracted muscles, or in the partial displacement of bones.

Other Measures.—The local treatment of inflammation consists of (1) removing the irritant, (2) cleanliness and asepsis, (3) antisepsis, (4) rest, (5) elevation of the part, (6) cold, (7) heat, (8) incisions, and (9) manipulation.

Removing the Irritant consists, in case of wounds, in searching for foreign bodies or the removal of any noxious chemical product.

Cleanliness and Asepsis.—Asepsis means not only that the part be apparently clean, but that it be surgically clean, which means that it

must be germ free. This can best be obtained by the methods detailed under "Asepsis."

Antisepsis in inflammation consists in using those agents which inhibit the growth of, or destroy, the micro-organisms which play such an important part in inflammation; this, however, is but another means of removing the cause of inflammation. The kind of antiseptics used and the method of their application is given elsewhere.

Rest must be both functional and physiological; it may be obtained by position or by immobilizing a joint. Physiological rest, in case of ulcer of the stomach, can best be obtained by fasting for a time.

Elevation of the Part is of great importance in inflammation of the lower extremity. Here elevation assists return circulation and secures a better blood supply to the inflamed area, which is of the greatest importance in chronic inflammation or in old ulcerations or varicose ulcers of the leg or foot.

Cold is of the greatest value in the early stages of inflammation and is best applied by means of an ice-pack or cold water coil; intense cold should be used. It is especially serviceable in sprains.

Heat applied early in inflammation is said to cause dilatation of the arterioles and to assist the circulation. In the later stages it hastens and localizes pus formation. It is best applied in the form of hot stupes, hot fomentations, hot water bags, poultices, and dry heat. Hot stupes may be applied by rinsing flannel, doubled so as to make three or four thicknesses, in boiling water. That this may be done without scalding the hands, a strip of flannel six inches wide and two feet long, the two ends being sewed together, is necessary. Now with two sticks about a foot long, this flannel may be dipped into the boiling water, when the sticks may be quickly twisted and the flannel thoroughly wrung out. While the flannel is very hot a few drops of turpentine may be dropped on the cloth, when a turpentine stupe is made. This is very effective in deep seated inflammations and where there is not a broken surface. The turpentine is an active antiseptic but is too irritating to be used on an open wound. Hot cloths may be wrung from a boiling saturated solution of boracic acid and placed over the inflamed area, when, in addition to heat, antisepsis is also secured. In the application of these hot stupes or fomentations, sheet-rubber should be applied over the hot cloths until they are changed, which should be every five or ten minutes to be effective. A poultice may be made of ground flaxseed, elm bark, starch, bread and milk, potatoes, etc. To make a flax-seed poultice, stir the ground flax-seed in a basin with a little boiling water; keep adding the flax-seed and stir constantly until it is of the consistency of thick mush. It can now be spread upon a piece of aseptic or antiseptic gauze, which can be doubled over the poultice to prevent its sticking to the surface of the body. It may then be applied to the inflamed area with a piece of sheet-rubber or oil-silk covering to retain the heat. The function of the poultice being heat and moisture, as soon as the heat has dis-

appeared a new poultice should be applied, which will be from every quarter to a half hour. In violent and very painful inflammations a sedative poultice is of value. This can be made by adding from ten to twenty drops of laudanum to the poultice—being well stirred in previous to spreading on the cloth. An antiseptic poultice may be made by rinsing several thicknesses of gauze in a saturated boric acid solution and applying to the inflamed area, placing over it oiled silk or sheet rubber, and then applying a hot water bag; by this means heat and antisepsis are likewise obtained. Dry heat may be applied in the form of hot water bag or hot sand bag, which is often times of service in deep seated inflammations, as of joints. When suppuration is imminent the application of heat gives great relief and should be applied until pus formation is evident, then a free incision should be made, the pus discharged and rigid antisepsis maintained.

Incisions are sometimes useful to relieve congestion in the case of tonsilitis and edema of the glottis.

General Treatment.—The old idea in the treatment of inflammation was diet, drugs, and blood letting. The drugs used were diuretics, diaphoretics, purgatives, emetics, anodynes, and other remedies, such as aconite, quinine, salicylic acid, mercury, etc. These have been eliminated and are no longer necessary. Phlebotomy and leeching are relics of the days of barber surgery. In the general treatment of inflammation diet, attention to the secretions, and the relief of the various symptoms arising are of importance. In severe inflammation the diet should be restricted to milk, gruel, soup, beef-tea, barley water, toast, and other easily digested foods. The urinary secretions should be kept free, the bowels open, and the liver acting. The secretions of the mouth should not be allowed to become foul. In severe cases of erysipelas and typhoid fever the mouth should be rinsed with Listerine or boric acid solution to prevent sordes forming on the teeth. The secretions of the skin should be kept active by baths. Symptoms arising may easily be combated; pain, the chief symptom, is an evidence of pressure on the nerve; by manipulation this pressure may be removed. In the treatment of chronic inflammation it is very essential to determine whether or not there are any constitutional causes operating, whether it is because of vicious habits of the individual or because he lives in unhealthy surroundings. Whatever the cause is, this should be corrected, the mode of life changed, the person should be well nourished, and the inflamed area protected from further irritation. Recovery from an old inflammation ofttimes takes place slowly and many times the prognosis is unfavorable.

SURGICAL BACTERIA.

Definition—A bacterium is a minute, one-celled vegetable organism. They belong to the class of moulds or fungi. Fungi may conveniently be divided into three classes:

1. Saccharomycetes, or yeast fungi.

2. Hyphomycetes, or moulds.
3. Schizomycetes, fission fungi, or bacteria.

Of these three classes of fungi the last is of the greatest importance to the physician, inasmuch as many of them produce disease, while not many of the moulds or yeast fungi are harmful.

Morphology of Bacteria.

Bacteria may be divided into three general classes—cocci, bacilli, and spirilla. Cocci are spherical shaped organisms and may, or may not have flagella. Flagella are small hair-like processes which project out from the bodies of the bacteria and furnish them means by which they may move. They are similar to the cilia upon ciliated epithelial cells. Bacilli are rod shaped organisms which may be joined end on end, forming a delicate thread called leptothrix. Spirilla are spiral shaped organisms, which, when joined end to end and showing no evidence of division are called spirochetae. Cocci vary in size from .15 to 2.8 mikrons. Bacilli vary from .2 by 1 mikron to 1.5 by 5 mikrons, while some of the spirilla may be as long as 40 mikrons. The weight of a bacterium has been estimated by Nageli to be 1-10,000,000,000 of a milligram.

Motion.

As before mentioned, some of the bacteria are capable of motion (motile), while others are not (non-motile), while some have flagella and others have not. In some cases bacteria may be capable of exceedingly rapid motion, while others move more slowly and are less active.

Reproduction.

Bacteria are capable of reproducing themselves by at least three different ways; by fission, endospores, and arthrospores. It has been estimated by Buchner that under favorable circumstances a bacterium can reproduce itself in from fifteen to forty minutes. At this rate he estimates that it would be possible for one bacterium, under favorable circumstances, to be the origin of sixteen million in twenty-four hours. It has been estimated that if bacteria were supplied with a sufficient amount of food, within three days one would develop a mass weighing 4752 tons; but fortunately the conditions are rarely present for such appallingly rapid reproduction. This likely accounts for the fact that bacteria produce disease less often than might be expected, also that many times when conditions are favorable it likely accounts for the rapidity of the course which the disease runs.

Bacteria group themselves in many different ways. Diplococci are cocci existing in pairs, as the diplococcus lanceolatus, or the diplococcus Neisseri. Tetrads are cocci grouped in fours, as happens with the micro-

coccus tetragenus. Sarcina is where the bacteria increase in all directions alike and where they present the formation of groups or blocks. Streptococci is where the bacteria exist in chains, which may be short or long. Staphylococci is where the bacteria form an irregular group or mass. Leptothrix is a condition where the bacilli form in long chains and where the division between the individual bacilli can not be readily made out. Spirochetae is where the spirilla form in long spiral-like threads. These are the commonest forms of bacteria. For a more extensive description, works on Bacteriology should be consulted.

Distribution in Nature.

Air.—Bacteria are found almost everywhere in nature, in the dust of the air, in water and in the soil. In 1686 Francesco Redi proved that maggots arising in putrid meat did not arise de novo, but that they came from the flies buzzing around the meat and frequently alighting thereon. It has been proven that fermentation, wherever found, comes from bacteria which may have gotten into the fermenting substance or liquid. Bacteria exist almost everywhere in nature except perhaps in mid-sea or at very high altitudes. John Tyndall proved that practically no bacteria were found at high Alpine altitudes. He furthermore proved that the bacteria causing decomposition very often come from the dust particles in the atmosphere. He proved that meat lying in a dust-proof chamber would keep for a long time, while that exposed to the dust particles of the air would quickly decompose. By experiment it has been shown that there are from 100 to 1000 bacteria of various kinds to each cubic meter of air. In crowded houses and in cities this number would be much greater, whereas in rural districts it likely is much smaller.

Water.—Bacteria are found extensively in all water, especially is it true of infected river water. In good pump water the number varies from 100 to 200 per cubic centimeter; in unfiltered river water from 6,000 to 20,000 per cubic centimeter. Contrary to what is popularly believed bacteria may frequently live in ice. Prudden proved that the average Hudson river ice contained 398 micro-organisms per cubic centimeter.

Soil.—It has been estimated that virgin soil contains 100,000 germs per cubic centimeter. These germs exist only in the upper strata of the soil, perhaps in the first two feet only, except where water containing a considerable amount of decomposing animal or vegetable matter is percolating through the ground, at which place the bacteria may be found at a depth of several feet. It would seem from these statements that one might be readily infected with disease germs, but it must be remembered that for the most part these germs are harmless saprophytes and will not produce disease. It is only when water or soil becomes infected with disease producing germs that infection spreads.

Human Body.—It is a known fact that about human habitations and about the animal body bacteria exist in large numbers, apparently living on the effete material or the excreta. They are found in the secretions of the mucous membranes, in the various mucous membranes and in the superficial layers of the surface epithelium. On the parts of the body covered with hair and in the flexures they are found in very large numbers, hence wounds in these regions are much more liable to infection. One thing is certain, that the fluids of the body are free from bacteria under normal conditions, and when bacteria are found in the body-juices it is an evidence of disease. In the salivary secretions large numbers of bacteria are found, likewise in the lachrymal secretions. Large numbers of bacteria are constantly being taken into the respiratory tract, lodging in the crypts of the tonsils and in the crevices of the pharynx, hence this cavity is teeming with them. Many of them are carried on into the stomach, escaping the gastric secretion they thrive in the intestines, so the contents of the intestines are exceedingly septic. Bacteria are not generally found in the urine within the bladder, but in diseased conditions they frequently get into the urine in large numbers.

Conditions Affecting Growth.

Oxygen.—Some bacteria live best without oxygen; these are called anaerobic; others grow best in oxygen; these are called aerobic. Some bacteria grow best without oxygen but can grow with it; these are called faculative aerobics; likewise some of those growing in oxygen may thrive without oxygen; these are called faculative anaerobic germs.

Nutriment.—Bacteria are not able to derive their nourishment from purely inorganic matter, but live for the most part, it seems, on highly organized compounds. They seem to grow best where diffuse albumins are present.

Moisture.—A certain amount of water is always necessary for the growth of bacteria, as with any other form of vegetable life; however, this does not mean that drying will destroy them, for bacteria may live upon clothing apparently dry, in some cases for some months, and if the clothing be damp, even a longer time. Bacteria may also be wafted great distances in a dried condition by means of dust particles in the atmosphere and they may live in this condition a considerable length of time.

Reaction.—The pabulum upon which bacteria thrive, to be most suitable for their growth, should be faintly alkaline or faintly acid; strong alkalis or strong acids destroy bacteria.

Light.—Most species of bacteria are not influenced to a great extent, in their growth, by the presence or absence of light; however, many of the bacteria will grow best in a dark room, while there are others whose growth seems to be retarded by the direct rays of the sun's light. Some colors, especially blue, are prejudicial to their growth.

Movement.—A condition of perfect rest seems to be most favorable for the development of bacteria. Movement of the culture medium, as sudden agitation, if kept up, will destroy the bacterial growth. It is this agency acting which seems to be one of the greatest sources of destruction of bacteria, and flowing water, especially falls and rapidly flowing streams, are peculiarly free from bacteria. Other things being equal, the water from such streams should be best for drinking purposes.

Association.—Very often in disease processes of the body several forms of bacteria are associated and it is not unusual that this association makes one or the other of the bacteria more virulent and active. Still it is known that in some cases one infection will, to some extent, render the individual more or less immune to the onslaughts of certain other bacteria.

Temperature.—Frankel states that bacteria grow best between the temperatures of 16 and 40 degrees C. Many bacteria will flourish in a higher temperature than 40 degrees C., many will flourish fairly well in a temperature lower than 16 degrees C. A temperature from 60 to 75 degrees C. (108 to 135 degrees F.) if continued for some length of time will arrest the growth of most bacteria. Boiling for a few minutes will entirely destroy nearly all bacteria. This is of the utmost importance to the physician, as it furnishes him a harmless method by which he may secure asepsis.

Results of Vital Activity.

1. Fermentation.—The various forms of fermentation, wherever found, are generally due to the development of bacteria. Some of these bacteria may be harmless, while many times they may be exceedingly poisonous.

2. Putrefaction.—The term putrefaction differs from fermentation, in that it especially refers to the fermentative process taking place in nitrogenous bodies. The manner in which this takes place seems to be that the albumins are converted into peptones and these are split up into gases, acids, bases, and salts. It is in this reaction that many times some of the most virulent poisons are produced. Ptomains, for instance, are the result of putrefactive changes taking place in organic matter, either animal or vegetable. According to Vaughan and Novy, ice-cream, meat, and cheese poisoning are really ptomain poisoning, the ptomains having been produced by putrefactive changes in the food products.

3. Gases.—It is not unusual for the bacteria to produce noxious gases. Many times this gas production gives rise to offensive odors. This is ofttimes seen in foul and infected wounds where the secretions are teeming with bacteria.

4. Enzymes.—That bacteria produce enzymes, or ferments, is well known and it is also known that many times these enzymes or ferments are exceedingly poisonous. Whether they result from the secretion of the bacteria themselves, or the action of the bacteria upon other matter, is not certainly known. These poisons are sometimes extremely virulent, as for instance, the purified toxin, tetanin, of the tetanus germ was found by Brieger and Colin to be fatal to mice in doses of 0.00000005 gram. Lambert holds that this is the most poisonous substance ever discovered. It is to these enzymes that bacteria owe their ability to produce disease.

5. Disease.—Bacteria are divided into two general classes, *pathogenic,* those capable of producing disease, and *non-pathogenic,* those not capable of producing disease. It is believed that their ability to produce disease depends very largely upon whether the substances produced by the bacteria are poisonous. These poisonous substances, as before stated, are either the result of the secretion of the bacterium itself, or the result of the action of the germ upon the body cell.

Infection.

Ziegler defines infection as "The entrance of bacteria into the body and their increase there." This means, of course, the multiplication of the bacteria within the tissues. Certain conditions are necessary before infection can take place; these are now generally admitted by most authors to be:

1. The bacteria must be present in sufficient numbers.
2. There must be an avenue of entrance into the tissues.
3. There must be a diminished resistance of the tissues.

There are other conditions, however, which modify infection:—These are the virulence of the germ and immunity of the subject. It is known that germs vary in virulence, some species of a certain germ may be extremely virulent and active, while others may scarcely produce evidence of disease. The infected subject may be to some extent immune to the organism in question. These conditions will modify the development of the bacteria within the tissues. This likely explains why infection occurs in some cases and not in others.

Avenues of Infection.

Skin.—Inasmuch as bacteria are found in large numbers upon the surface of the body, wounds are very liable to become infected; and as the bacteria are much more numerous in the hair, in the sweat glands, in the sebaceous glands, and in the roots of the hair, on parts of the body where these structures are found, infection is much more likely to happen.

Mucous Membranes.—Abscess of the tonsil likely arises from bacteria taken in through the air or by means of food or drink and lodging

in the crypts of the tonsil. The secretions of the mouth cavity are septic and it is essential in wounds of the mouth that measures be taken to cleanse the cavity. The lower bowel contains immense numbers of bacteria and in constipated conditions poisons of these germs are not infrequently absorbed; furthermore, were it not for the resisting power of the tissues, wounds of the lower bowel would always result in infection. It seems to be true that it is this resisting power of the tissues which protects the individual from infection, for often it is that every individual has sustained small wounds, either on the surface of the body or in some of the cavities of the body, when bacteria were undoubtedly present in large numbers, yet infection did not take place. This can readily be explained by the fact that the tissues prevented the entrance and multiplication of the bacteria.

Characteristics of Infection.

According to McFarland these are (1) phlogistic, (2) toxic, and (3) septic.

By phlogistic is meant an inflammatory reaction. The toxic effects consist of local growth with absorption of toxins. The septic effects are those characterized by the dissemination of the bacteria through the lymphatic fluids and the blood. In most instances the actual damage done by these germs and the poisonous effects produced are due to the ferments developed by the germ.

Toxins.

Bacteriologists seem not to be able as yet to classify the poisons generated by bacteria. They are likely all proteid substances, most of which probably belong to the class of substances called toxalbumins. The poisons of diphtheria and tetanus seem to belong to a class by themselves, inasmuch as they give no albumin reactions. As a general rule the poisons are highly organized and are readily destroyed by temperatures above 108 degrees F., also exposure to air and sunlight seem to readily destroy them. Some of the substances seem to be alkaloidal in nature and are readily soluble and quickly diffuse through the body. It is believed that this explains why some diseases run such a very rapid course and are so alarmingly fatal, since the poisons are readily soluble and are quickly diffused through an animal membrane and are carried through the body before the germ has actually entered the tissues.

Ptomains.

Many writers include ptomains under toxins. They are best considered as putrefactive alkaloids and are the result of the decomposition or breaking up of organic substances, in contradistinction to the decomposition or breaking up of organic substances, especially by bacterial action.

Leucomains.

Leucomains are alkaloidal substances existing normally in the body and which arise from retrograde metamorphosis or chemical changes in the cells. It is not unusual that these substances may be retained in the body and not eliminated, when autointoxication occurs. Certain substances found in the urine belong to this class, as xanthin and hypoxanthin. There are substances which exist normally in the bowel, but which under certain circumstances are absorbed and which will produce febrile, circulatory, and other disturbances.

Antitoxins.

The exact nature of antitoxin is unknown. Some maintain that it is a toxin in a changed form, others that it is a ferment produced by culture, and still others that it is produced by cellular activity. This last idea seems to have the most foundation in fact. Whatever is the nature of antitoxin, it is obvious that after the system has gotten rid of a certain infection it is not in the same condition that it was previous to the infection; that many times it is left more or less immune, for varying periods of time, to subsequent infections. It is believed by some that this resisting power of the body is contained largely in the blood and that the resisting power of the blood is due largely to the chemical changes which have taken place in the leukocytes. It is known that the antiseptic property of the blood from immune individuals is much greater with reference to the bacteria in question, than the blood from an individual not having such immunity.

Forms of Bacteria.

The forms of bacteria in which the surgeon perhaps is most interested are the following:

Staphylococcus Pyogenes Albus.—Passet found this germ in pure culture in four cases of suppuration out of thirty-three examined.

Staphylococcus Pyogenes Aureus.—This is the most common of the pus germs and is nearly always present in the pus of boils and furuncles.

Streptoccocus Pyogenes.—According to Rosenbach this germ is present in eighteen out of thirty-three cases of suppuration. The pus produced is usually thin, white, and flocculent. It produces diffuse pus formation and its activity is much greater than the other pus germs.

Streptoccocus Erysipelatis or Fehleisen's germ seems to be identical with the streptoccocus pyogenes of Rosenbach. It often produces pus and can be obtained in pure culture from serum which oozes from a puncture made at the margin of an erysipelatous area.

Bacillus Pyocyaneus is the germ of blue or green pus; it likewise produces disagreeable odors. It is rarely found in pure culture in pus, but is generally associated with other germs.

Micrococcus Gonorrhea (Neisser), when inoculated in any mucous membrane produces a characteristic ulcerative process, attended with pus formation.

Other germs which are associated with pus formation, but less frequently, are Diplococcus intracellularis meningitidis, Diplococcus pneumoniae, B. Tuberculosis, Leprous Bacillus, Streptothrix Actinomycosis, B. tetanus. B. diphtheriae, Micrococcus tetragenus, B. anthracis, B. typhi abdominalis, B. coli communis, B. pestis bubonicae, and B. mallei.

ANTISEPTICS.

An *antiseptic* is an agent which retards or inhibits the growth and development of bacteria. A *germicide* or *disinfectant* is an agent which destroys bacteria. A *deodorant* is an agent which destroys offensive odors, but which may not be a very active antiseptic. Chemical antiseptics are soluble substances which retard or inhibit the growth, or in some cases destroy the activity, of micro-organisms. It is easy to develop an antiseptic which will destroy bacteria in a test tube in the laboratory, but unfortunately it is not so easy to secure an antiseptic which will not be harmful to the tissues with which it comes in contact. Our best antiseptics are most destructive to the tissues. Perhaps the best of all known chemical antiseptics for practical use are bichloride of mercury and carbolic acid. These substances are well known active poisons and can be used only with certain limitations and under certain circumstances. The ideal antiseptic is yet to be devised. The most powerful of these antiseptics is corrosive sublimate and it is perhaps the most reliable. It is used in the strength of from 1:500 (in exceptional cases) or 1:1000 to 1:10,000 or 1:20,000 parts of distilled water. It can not be used in metallic vessels, nor can it be used to disinfect instruments. It is irritating to wounds and often causes copious exudation and in this way does harm. It is perhaps most useful as a disinfectant for the hands or the surface of the body or certain articles of clothing. When used on the various parts of the body these rules must be observed. In the eye it is used in the strength of 1.10,000; in the mouth and throat, never. In the vagina and uterus in strengths of 1:1000 to 1:5000, depending upon the requirements. In abscess cavities it may be used where there is free drainage, but under no circumstances must it be used where it is likely to be retained. In joints it may be used in strengths of 1:5000 or 1:10,000. It should not be used in the ear, nose, urinary tract, bowel, or the peritoneal cavity. In spite of its draw-backs, bichloride of mercury is generally considered to be the best of the antiseptics. It is prepared in two forms, a small tablet containing 1.41-50 grains, which when dissolved in a pint of water makes 1:4000 solution or in a larger sized tablet containing 7.5 grains, which when dissolved in a pint of water makes a solution of 1:1000. These tablets also contain muriate of ammonia, which hastens their solubility.

Carbolic Acid is very valuable as a germicide in strengths varying from 1:20 to 1:100. It has the advantage that it will not attack metal, hence the antiseptic solution can be made in any sort of an aseptic vessel. It is readily absorbed and produces toxic symptoms, hence it must not be used in cavities of the body where absorption may take place. Neither can it be used in the mouth or throat where it is liable to be swallowed, nor in the bowel, inasmuch as rapid absorption might take place with collapse and death. It is best used in a liquid form. Liquid carbolic acid is prepared by heating the crystals and adding five per cent. of water. For practical purposes a teaspoonful of the liquid drug added to a tin cup of boiling water makes a serviceable antiseptic solution. If a more active solution is desired, two teaspoonfuls of the drug should be added to the pint of water. It is irritating in wounds, and likewise has marked anesthetic properties, often attacking the surgeon's hands to the extent that it will materially interfere with an operation. It may be used in the mouth in the strength of one to two per cent. In tubercular abscesses and suppurating joints it may be used in a five per cent. solution. In the vagina and uterus it may be used in a two per cent solution. It should not be used in an abscess cavity where it is likely to be retained. Pure, it is of great service in cauterizing chancroids and sloughing ulcers, also old abscess cavities or old infected ulcers. It is likewise serviceable as an antiseptic when incorporated with vaselin. It has the advantage in from 1 to 5 per cent. strengths with vaselin, that it is a good anesthetic and will often allay itching and irritation; especially is this true about a wound or open sore.

Creolin is an active antiseptic and is prepared from coal-tar. It has not the toxic effects of carbolic acid or bichloride of mercury and is also not irritating. It is used in strengths of from 1 to 5 per cent. as an emulsion.

Peroxid of Hydrogen has active oxidizing properties and is a serviceable cleansing agent. Some preparations are slightly irritating but are not toxic. It has the advantage that it can be used almost anywhere and in any location of the body, with the exception of an abscess cavity with a small opening. It oxidizes the dead material and detritus in the abscess cavity, so that if there is but a small opening from the cavity, the active production of gas will force dead materials into other parts of the tissues leading to the extension of the infection, whereas, if the abscess cavity has a free opening the application of the peroxid of hydrogen loosens up and gets rid of the dead material. It is useful with other antiseptics, for instance, a pus cavity may be washed out with peroxid of hydrogen and when cleansed of the dead material it may then be washed out with bichloride of mercury or carbolic acid, which are much more active antiseptics. Furthermore, its long continued use is prejudicial in many ways. It prevents wounds healing. It should not be used in bed-sores, except occasionally for cleansing purposes. If used regularly the bed-sores will refuse to heal. It should not be used in large abscesses on the neck, inasmuch as the formation

of gas might dissect through the connective tissue planes and press upon the air passages. It is used in the strengths found on the market, or diluted, one part of the solution to one, two, three or more parts of boiled water, as is required. It may be used in suppuration of the middle ear. In weak solutions it is useful for cleansing the throat and mouth and the nasal mucous membrane.

Boracic Acid is mildly antiseptic, and while irritating in a fresh wound, or a granulating sore, it is of great advantage in many cases. It is useful as a dry powder sprinkled over an ulcer, or as a saturated solution for syringing out cavities. It has the advantage that it is not toxic, no poisonous effects resulting from its use. In the eye it is used in the strength of ten grains to the ounce and is perhaps the best of all antiseptic solutions for such use. When it is very irritating there may be combined with it cocaine (two grains to the ounce). In abscess of the middle ear, a saturated solution is of service in a fountain syringe with an ear-nozzle, the stream being directed into the external meatus. It washes out the pus and destroys the micro-organisms. It is useful for washing out the bladder in cases of cystitis or purulent inflammation of the bladder. Here it is useful in a saturated solution.

Permanganate of Potassium is an active oxidizing agent. It is irritating and will stain the skin or tissues, but yet it is useful in the strength of 1:200 or 1:400 to 1:3000 or 1:4000 in distilled water for washing out foul ulcers or old abscesses and many times it acts with a happy result where other antiseptics apparently failed. It is useful as a disinfectant in stronger solutions in gangrene after the tissues have died.

Nitrate of Silver, introduced by Crede, is used in strengths of 1:300 to 1:1000. It is valuable in gonorrheal affections in the strength of 1:1000 and in from ½ to 1 grain to the ounce it is a valuable antiseptic in purulent inflammation of the eye, e. g., gonorrheal ophthalmia and old cases of trachoma. It is of advantage in from 10 to 30 per cent. solutions in cauterizing sores, mucous patches in the mouth, ulcers of the gums, or old ulcers of the leg which refuse to heal.

Salicylic Acid exists in the form of small, needle-shaped crystals which are slightly soluble in water. It is best used as a powder or as an ointment, being most useful as a dusting powder in wounds. It is useful in ointments in skin affections to allay itching. It is valuable as a deodorant and disinfectant in eczema of the feet.

Iodoform is a bright yellow powder and is extensively used in the treatment of wounds. Its offensive odor is the greatest objection to its use. It is a valuable powder in the treatment of fresh wounds; however, poisoning has followed in numerous cases. It is especially valuable in tubercular cases. It may be used as a dry powder or as a ten per cent. emulsion with glycerin. This may be injected into the abscess cavity or tubercular joint. Many substitutes for iodoform have been prepared. The best of these are iodol, salol, aristol, and dermatol. These

may be of advantage used as a dry powder on wounds. Aristol is odorless and non-poisonous and is valuable in various skin diseases. It is also useful in the treatment of sores in the form of an ointment (5 or 10 per cent.) or as a dusting powder.

Ointments.

Ichthyol Ointment is a valuable antiseptic in inflammations, such as erysipelas, in strengths of 5 to 10 per cent.

Boracic Acid Ointment is an excellent preparation and is best prepared as three parts boracic acid, five parts vaselin, and ten parts paraffin, or, three parts boracic acid, four parts white wax, and twenty parts olive oil, or, a saturated solution of boracic acid and glycerin. These are excellent preparations as the case may require.

Salicylic Acid Ointment consists of one part salicylic acid, six parts white wax, twelve parts paraffin, and twelve parts olive oil.

Protonuclein is of advantage as a dusting powder in the treatment of ulcers.

Formalin is a valuable antiseptic and is useful for the disinfection of instruments and hands of the operator, but is too irritating and poisonous to be of use in wounds. It is used in strength of two per cent.

Surgical Dressings.

Surgical dressings consist of gauze, cotton, lint, lamb's wool, or other substances which have the property of absorbing moisture or secretions from wounds or abscess cavities. Surgical dressings have the following objects in view: First, protection of the part from further infection; second, to absorb the secretions and keep the wound thoroughly dry to prevent further development of any noxious material which may be already present in the wound. Formerly, during the era of antiseptics, antiseptic gauzes were very popular and in most cases were very excellent dressings, but it is a recognized fact that many times these gauzes are irritating because of the chemical antiseptics and do harm rather than good. This has led to the production of aseptic dressings. Aseptic dressings are produced by superheating the article for some length of time at different periods until all germ life has been destroyed. Things prepared in this manner probably furnish the best surgical dressings in any form of fresh wound. Where the wound is septic and foul, antiseptic dressings are needed. In such conditions, bichloride gauze in the strength of 1:1000, carbolic acid 5 per cent., borated gauze 10 per cent., or iodoform gauze 10 per cent. may be used. These gauzes are prepared by impregnating aseptic cheese cloth with the drug. Cotton is a very useful article for the protection of a wound and for absorption of the secretions. Surgeon's absorbent cotton is the kind used. This is prepared by removing the oil from the cotton, after which it is asepticized, and is then ready for use. Surgeon's aseptic or antiseptic lint is useful in many cases.

ANTISEPTIC PROPERTIES OF THE BLOOD.

Different theories are advocated concerning the methods by which the human blood resists infection. Metschnikoff advocated the theory of phagocytosis. This has recently been attacked and quite seriously. Some have maintained that the leukocytes do not have the power of destroying bacteria, but in all probability they possess such power. The antiseptic properties of the blood do not come entirely from the leukocytes but come largely from substances imparted to the blood by means of the red marrow of the bones, adenoid tissues generally, and fibroblasts, and perhaps the tissues of certain glands. These tissue cells, when the occasion demands, produce certain substances named by Henkin as "defensive proteids" and these impart to the blood its antiseptic properties. Therefore, in the reaction of the tissues to injury the antiseptic properties of the blood are markedly increased. Because of such properties a dry method of operation has been devised by certain operators. This consists in not introducing any liquids into an aseptic wound, but allowing the wound surfaces to be bathed with the blood, only dry sponges being used, so that after closing the wound the cut ends of the tissues and the margins of the wound are covered with blood. Some operators maintain that the antiseptic properties of the blood are equally as great as any safe antiseptic which might be introduced into the wound. Without doubt it is a most excellent method of operation. Vaughan and others attribute the antiseptic properties of the blood to nucleins or cell globulins which it contains. He says that the origin of these substances is in the leukocytes, fibroblasts, and adenoid tissues generally.

ASEPSIS.

By asepsis is meant surgical cleanliness. "Sepsis" comes from the Greek and means putrefaction. The term asepsis refers to that condition where all agents and substances causing putrefaction or decomposition are absent. Inasmuch as sepsis is the condition against which nearly all the surgeon's efforts are directed, an aseptic condition would be ideal if it could be obtained. Since Dr. Henle in 1840 propounded the germ theory of disease, physicians have sought for methods to prevent bacterial growth. Lord Lister, believing that the source of sepsis was largely through the atmosphere, devised means whereby the air and the surfaces of the wound were impregnated with pulverized antiseptics. The extremes to which this and other antiseptic methods were carried undoubtedly resulted in great injury many times. The monstrous outcome of such applications, however, was the result of an erroneous idea of the source of infection. It is now known that infection comes largely from the hands of the operator, from his instruments, from the surface of the body, and foreign bodies coming in contact with the wound and that very few, if any, pathogenic micro-

organisms gain access to the wound by means of the air. Therefore, because of the irritating qualities of the antiseptics, antiseptic methods really introduced into the wound irritating substances, destroyed tissue cells and added this burden to the healthy tissues and did not render infection less likely. Having recognized the source of infection, more simple and less harmful means have been devised for destroying the pathogenic germs. It has led to the theory of asepsis. The most difficult thing to obtain in a surgical operation, or in any surgical condition, is a condition approaching asepsis, and yet it is the condition hoped for by every operator; and every method known to destroy germs without the use of irritating chemical compounds should be used and is justifiable. Heat is the best of all agents to destroy micro-organisms, therefore instruments of any description used about the body, under any circumstances whatever, whether a fresh wound is present or not, universally such instruments should be boiled. The hands of the operator can readily be sterilized, at least made sufficiently clean for all practical purposes, by the following means. The nails should be pared closely and all dirt removed from beneath them; the hands and arms should then be thoroughly scrubbed with soap, water, and a brush which has previously been made sterile by boiling. The best soap, such as green soap, or castile soap, should be used. After the hands have been thoroughly scrubbed, they may be washed in alcohol to remove the oil from the sebaceous glands and the skin. Lastly the hands may be bathed in 1:1000 solution of bichloride of mercury. Under ordinary circumstances, after such preparation, the hands will be sufficiently clean. If the hand is to be introduced into the peritoneal cavity, more elaborate preparations may be made. The idea of using sterile rubber gloves in operative procedures was looked upon favorably by many most excellent surgeons, but they have gradually given way to approved methods of cleansing the hands. The surface of the body in the neighborhood of the wound or in the field of operation may be similarly treated. After having been thoroughly scrubbed it may be washed with an antiseptic solution, and if the antiseptic causes any uneasiness, it should afterwards be removed with boiled water. Surgical dressings, ligatures, and any other objects going in or about wounds should be sterilized, not by antiseptics, but by heat. Substances entering into and going about wounds impregnated with antiseptics are uniformly irritating and harmful.

Preparations for an Operation.

When an operation is to take place in a room in a dwelling house, all furniture, tapestries, and curtains should be removed, and the floor and walls thoroughly scrubbed and cleansed. The table should be an iron portable one, easily rendered sterile. Where this is not obtainable, an ordinary wooden table, well scrubbed and washed with an antiseptic, will do. Other small tables, one for the anesthetist, one for sponges, one for the instruments of the operator, and another for a basin con-

taining an antiseptic solution are needed. Previous to the operation the surgeon should see that he has a goodly number of sterile towels. For an ordinary operation, say resection of the knee-joint, two or three dozen towels should be available. These towels may be made sterile by means of heat, and placed conveniently at hand for use during the operation. The patient, in any major operation, or where a general anesthetic is to be given, requires preparation. Uniformly the bowel should be evacuated of its contents by means of a high enema previous to the operation. Under no circumstances, if the operation is to take place in the morning, should the patient be allowed breakfast, as the stomach should be entirely empty. The patient should be free from any excitement, and stimulants or drugs of any kind should not be allowed. A general bath should be given. The body should be scrubbed about the flexures, genitalia, and perineum, and the head shampooed. If the operation is to be on a part of the body covered with hair, the hair should be removed by shaving, when the skin may be thoroughly scrubbed and cleansed. The method of applying antiseptic poultices, soap poultices, or other such means is needless. The field of operation may be thoroughly scrubbed and cleansed by means of soap and water, alcohol and bichloride of mercury, when several layers of sterile or antiseptic gauze may be strapped to the surface to prevent any contamination of the part so cleansed. There should also be at hand a large quantity of boiled water or of normal salt solution for the purpose of thoroughly washing out the wound. This is of the utmost importance. Water does not act as an antiseptic, but, on the other hand, dilutes and washes away the substances upon which the bacteria live. Inasmuch as it is in no case harmful, the wound may be flooded with large quantities of water and all irritating and harmful substances can be removed without difficulty. Ten gallons of water may be run through, and into all parts of a large abscess cavity with very beneficial results. The present practice of injecting antiseptics into such cavities with the hope that they will destroy the bacteria is a most vicious practice. In operations where the peritoneal cavity is opened and where septic material becomes diffused between the viscera, large quantities of normal salt solution should be run through, and into every nook and cranny so as to wash out all offending materials. The sponges used in an operation can be made of gauze or cotton enveloped by gauze. Gauze pads are perhaps the most serviceable, as they are easily sterilized. Marine sponges are rarely used and formerly in the hands of many surgeons were the vehicles of infection instead of performing the function of removing offensive materials. All the sponges entering into an operation should be counted, so that if it becomes necessary at any time to account for them, this may be done. The misfortune of closing a wound in the peritoneal cavity with a sponge in situ has happened to good operators. The towels just previous to the operation should be spread over all parts of the table and those parts of the patient's body in the region of the operation, so that previous to oper-

ating the operator has a sterile "field" before him. This field of operation should, at all hazards, be maintained aseptic. During the operation no one should be allowed to touch any septic object and then touch the field of operation. The instruments selected by the operator should be those required in the operation. Any useless array of instruments is needless and certainly looks bad. The instruments should be wrapped in a towel previous to the operation and be allowed to boil for fifteen minutes. If the operator means to ligate an artery, bone forceps are hardly necessary. On the other hand a good supply of artery forceps, which are reliable, should be at hand.

SUPPURATION, ABSCESS, ULCER, FISTULA, AND SINUS.

Pus formation was at one time supposed to be the inevitable outcome of wounds. It has been proven erroneous. This was followed by the belief that all pus was produced by micro-organisms, which is likewise untrue. Pus, in a large majority of cases, is the result of the operations of micro-organisms within the tissues. It is not a specific infective process, but it is a form of reaction which may happen from various injurious agents. The pustules of croton oil contain true pus, and yet the pus is free from micro-organisms. Pus may be looked upon as a termination of inflammation, which may be caused by chemical agents, or bacterial action. An acute abscess is generally the result of the development of bacteria within the tissues, and as such, it will be described. Bacteria get into the tissues in various ways; sometimes at hair follicles, other times in small abrasions of the skin, and at other times at the open mouths of lymphatics in wounds. They circulate either in a healthy state or in the form of spores until they lodge in some part of the body where an inflammatory reaction follows. The beginning of the inflammation does not differ from the inflammation arising from other causes, but if the bacteria are present in large numbers the tissue changes are very rapid and the symptoms and signs of the process are more intensified. The invasion of the system by bacteria or the pus micro-organisms, in the case of suppuration, has been likened to the invasion of a country by a hostile army. The leukocytes which swarm to the inflamed area, attracted by chemotactic influences, pounce upon the germs and attempt to destroy them. The connective-tissue cells increase in number rapidly; these, too, exhibit phagocytic properties. Nature attempts to destroy the irritant. When this is impossible the proliferated connective-tissue cells, now called the round-cells of inflammation, or fibroblasts, and the leukocytes, form a wall around the bacteria. Inasmuch as the inflamed area is so crowded with leukocytes and round-cells it interferes with the flow of the fluids and the nutrition is cut off to the center of the inflamed area. Death of this central area follows. The first change occurring is a coagulation of the albuminous principles in the cell, the nucleus becomes less distinct, the protoplasm granular and cloudy *(Coagulation Necrosis)*. Coagulation

necrosis is the first step in pus formation. Now this central mass which has undergone coagulation necrosis becomes liquefied by the peptonizing influence of certain ferments which are developed by the micro-organism *(Liquefaction Necrosis)*. The result of the liquefying of the tissues is pus. This pus in ordinary abscess formation is limited by a membrane. It was called by the old writers a pyogenic membrane, inasmuch as they thought it produced pus. Now it is called the *Limiting Membrane* since it is this membrane which prevents the extravasation of the pus into the other tissues. Pus forms only after stasis occurs, and after the nutrition to the inflamed area has been arrested; therefore, to prevent pus formation, circulation of the fluids must be kept up. Pus of abscesses varies largely, depending upon the cause of its formation and the condition of the tissues.

Laudable Pus.—This term was formerly used by surgeons to indicate the pus flowing from a wound. It is usually of a specific gravity of 1028, is yellowish, yellowish-white, or a greenish fluid of the consistency of cream, with or without odor.

Ichorous Pus is a putrid fluid which is thin and watery and contains large numbers of the micro-organisms of putrefaction.

Foul Pus may be ichorous and may be due to various micro-organisms. Certain abscesses discharge this character of pus. Ischiorectal abscesses and those following typhoid fever are notoriously foul and stinking.

Sanious Pus is a term applied to bloody pus or that which contains coloring matter. Sometimes it is thin, reddish, and corroding.

Fibrinous Pus contains fibrinous masses or coagulated purulent masses. It is met with in the pus of serous cavities.

Blue or Green Pus is due to the presence of the B. Pyocyaneus.

Serous Pus is a serous-like fluid containing flakes of purulent matter.

Tubercular Pus is generally curdy, containing cheesy-like masses.

Muco-Pus is a term applied to the decomposed or purulent mucus found in catarrhal conditions.

Caseation is a term applied to the fatty degeneration of pus and dead tissues. These caseous masses may undergo calcification.

It may then be considered that pus only happens from micro-organisms when their onslaughts are so severe as to overwhelm certain portions of the tissues, thus causing death and destruction. This pus is confined, as before stated, by a limiting membrane. Pus is an offending substance nature wishes to get rid of, therefore, by the action of certain forces it burrows in the direction of least resistance. This is not always toward the surface. In the case of purulent synovitis of the knee-joint the pus generally burrows upward on either side of the thigh. Pus forming on the front of the body of a vertebra in the lumbar region, along the attachment of the psoas magnus muscle, forms a cavity in the sheath of this muscle, then burrows along down the sheath and

opens beneath Poupart's ligament. Pus may burrow a long distance. Pus from an abscess of the appendix may rupture at the umbilicus. The writer operated upon a case of this sort where the abscess had been of more than a year's standing. A rapid and complete recovery followed. In abscess on the thumb or little finger, as happens in whitlow, the pus may burrow along the sheath of the tendons and open above the anterior annular ligament of the wrist-joint. Pus may burrow from the chest cavity down the arm. Pus forming in the hip-joint may burrow in several directions. (See hip-joint disease). When it is toward the surface it gives the appearance of "pointing." This pointing is evidenced by a dark-bluish spot which afterwards becomes necrosed, and as the pus approaches the skin, it shows a yellowish color through the translucent epithelium. When pus ruptures from an abscess without the assistance of a knife, the opening is rarely sufficiently large; furthermore, necrosis of the superficial tissues results in the formation of an ugly scar; hence it should be a uniform practice, whenever pus formation is detected, to make a free incision and evacuate the pus. Pus formation is attended with an intensification of the symptoms of inflammation. The pain is more severe and more of a throbbing nature, the redness becomes more dusky, and the swelling very often edematous. The loss of function becomes more complete while the heat is greater and in large abscesses the absorption of the toxins from the abscess may be such as to cause fever and other systemic disturbances, such as anorexia and partial arrest of the secretions. Previous to the pointing of the abscess the skin becomes adherent to the deeper structures. Many times this is an indication of the formation of pus before fluctuation can be obtained. Fluctuation is the sensation obtained by holding the finger upon one side of the abscess and tapping the other side. This causes a wave-like motion in the fluid, which is transmitted to the finger. If the abscess be of sufficient size, a chill may attend the formation of pus. This chill is the result of circulatory disturbances brought about by the effect of the poisons upon the vasomotor centers. Following the chill there is usually a high fever and a drenching sweat. If the abscess be large and deep seated and is not soon evacuated of its contents, irregular chills may occur. This is one of the sure signs of pus formation. If the diagnosis can not yet be made, a tubular exploring-needle may be introduced into the abscess cavity, when the character of the contents may be determined to a certainty.

Abscess formation is generally of two kinds, *Circumscribed* and *Diffuse.* Circumscribed abscess formation is similar to that which occurs in a boil or furuncle. Diffuse pus formation is called *Phlegmon* or purulent infiltration.

Phlegmon.—This process may involve areas of varying sizes, from a small patch to the entire limb, and is generally due to the infection of the streptococcus pyogenes or streptococcus erysipelas. These germs are very often extremely virulent and active. The barrier set up by

the leukocytes and connective-tissue cells will not restrain them. They disseminate through the intercellular spaces and lymph channels and spread rapidly, causing intense inflammation, marked swelling, pain, and great discoloration. The pain very often is of a burning character. Necrosis of the superficial areas, because of the arrest of the circulation, is not unusual. Neighboring lymphatic glands become inflamed and enlarged. Chills may occur at the onset of the inflammation, or there may be severe chills at short intervals in conditions of rapid infection. Fever, under such circumstances, is more or less continuous, but following each chill there is a rapid rise, when it again falls to a minimum. In severe cases the fever may take on a typhoid character. In case of broken-down health, compound fracture with great destruction and injury to the soft-parts, in extravasation of the urine through the tissues, or in pus formation following an attack of an acute infectious disease, it is not unusual for the fever to be of a typhoid nature. It is a very grave condition, and means a septic intoxication, and unless evacuation of the pus and cleansing of the abscess cavity can be made, death is imminent. About the edges of the inflamed area there are red, fiery lines extending from it in forked directions, indicating that the inflammation extends along the lymphatics. Like cases may not suppurate, the leukocytes having destroyed the poisons. As soon as the tissues assert themselves and win the battle waged against the germ, a circumscribed abscess will follow, when the pus may be evacuated and the case recovers. When the pus cavity is evacuated, granulation tissue fills it up. This cicatrizes and a scar results which permanently marks the location of the abscess.

Varieties of Abscess.

1. **Acute**, which is the result of an active inflammatory reaction.

2. **Chronic**, which is one due to certain conditions of the tissues rather than germs. They are less active and are sometimes called strumous, cold, or tubercular.

3. **Circumscribed**, when the abscess has a well defined limiting membrane.

4. **Diffuse**, when no limiting membrane occurs.

5. **Hypostatic**, when it is the result of pus gravitating into a part.

6. **Embolic**, where the abscess is the result of an infective embolus.

7. **Encysted**, where the abscess is enclosed by a fibrinous wall.

8. **Fecal**, when the abscess contains feces.

9. **Metastatic**, when the abscess is caused by pyogenic cocci from another abscess.

10. **Hematic**, which arises from bloodclot.

11. **Milk Abscess**, an abscess of the breast in nursing women.

12. **Psoas**, an abscess in the psoas muscle.

13. **Tropical**, an abscess of the liver occurring in hot countries.

14. **Thecal**, when it occurs in the sheath of a tendon.

15. **Urinary**, when caused by the extravasation of urine.

16. **Brodie's Abscess**, is a chronic abscess of bone, most commonly occurring in the tibia.

17. **Deep Abscess**, when it occurs beneath the deep fascia.

18. **Superficial Abscess**, when it is above the deep fascia.

19. **Paget's Abscess**, one occurring from the residue of an old abscess after several years.

Acute Abscesses of Various Regions.

1. **Abscess of the Brain.**—See Cerebral Abscess.

2. **Abscess of the Appendix Vermiformis.**—See Appendicitis.

3. **Abscess of the Liver** may follow dysentery, appendicitis, or suppurative processes in other locations of the body. Where the abscess obstructs the gall-duct, jaundice will occur. In addition to the pain and tenderness over the liver and the enlargement of the liver, fever of an intermittent type is present, and there will be severe pain in the shoulder and back. The burrowing of the abscess towards the surface is announced by edema of the skin. Occasionally the condition is not diagnosed until late.

4. **Subphrenic Abscess**, as the term indicates, arises beneath the diaphragm, and is generally of the lesser peritoneal sac. It may arise from perforation of some of the hollow viscera, from Pott's disease, or from infection or injury of some of the viscera.

5. **Abscess of the Mediastinum** is difficult to diagnose except by the systemic signs.

6. **Abscess of the Lung** occurs in conditions of pyemia after pneumonia, or after injuries and perforating wounds of the lung.

7. **Perinephritic Abscess** is difficult to diagnose, but occasionally causes pain down the back of the leg, simulating hip-joint disease. Edema and fluctuation in the lumbar region may announce the pointing of the abscess.

8. **Ischiorectal Abscess** is caused by an infection of the cellular tissues of the ischiorectal fossa, by means of micro-organisms which have migrated from the rectum through the intestinal wall. See fistula in ano.

9. **Abscess of the Antrum of Highmore.**—See Abscess of Antrum.

10. **Postpharyngeal Abscess** may come from caries of the cervical spine. This may occasion difficulty in swallowing and breathing and puffiness in the postpharyngeal wall. Fluctuation may be felt.

11. **Prostatic and Urethral Abscesses** are attended by painful and frequent micturition or retention of urine, together with chills and fever.

12. Abscess of the Breast is caused by pyogenic micro-organisms entering from abrasions of the nipple, or is due to an obstruction of the milk-ducts, by pendulous breasts, or by luxations of the ribs, affecting the return circulation. The symptoms of this abscess are similar to those of abscesses in other regions.

13. Palmar Abscess and Felons.—See Thecal Abscess.

Symptoms of Acute Abscess.

(A) Local, and (B) Constitutional.

Local Symptoms.—1. Pain, throbbing or burning. 2. Dusky hue of the skin. 3. The skin is adherent to the underlying tissues. 4. Edema. 5. Fluctuation. 6. Great heat.

Constitutional Symptoms.—1. Chills, varying from a chilly sensation to distinct rigors. There may be one or several, happening irregularly, usually at the formation of each new abscess, as in pyemia. 2. Headache. 3. Muscular soreness. 4. Coated tongue. 5. Loss of appetite. 6. Sleeplessness. 7. Fever, varying from half a degree to a rise of several degrees. 8. Highly colored and scanty urine. 9. The bowels are confined. 10. Certain nerve symptoms which vary from irritability to delirium of a noisy character. Where the abscess is old and long continued it gives rise to what is called a hectic fever, which is sometimes attended by a peculiar flush upon the cheek (hectic flush). This is characteristic of tuberculosis, the fever in which is produced by pus formation.

Diagnosis of Acute Abscess.

The diagnosis of acute abscess formation is made by weighing the symptoms present. Where there is doubt the physician should temporize, unless urgent measures must be adopted. An exploring-needle may be introduced, which will determine the character of the contents of the tumefaction.

Abscess may be confounded with Aneurysm, when it is seated over an artery because it is pulsatile. It may be confounded with Cyst; an exploring needle will determine this. A tubercular abscess is differentiated by means of the absence of the inflammatory signs and the general condition of the patient. A rapidly growing Sarcoma has deceived some physicians, but here again an exploring-needle would determine the nature of the tumefaction. Where the character of the contents of the cavity is doubtful, cultures may be made to determine whether micro-organisms are present.

Treatment of Acute Abscess.

(A) Osteopathic and (B) Operative.

The Osteopathic treatment is of great value in the treatment of abscess when brought into use before pus is formed. Suppuration in

almost all forms of abscess may be arrested if seen sufficiently early. The treatment in general is similar to that of any inflammation, but is more especially directed toward relieving stasis, which must take place before pus is formed. Death of tissue anywhere is always the result of the arrest of nutrition. The treatment consists in relieving any obstruction to the circulation, whether it is within the fascia, muscles or other tissues. Relieving the obstruction and encouraging the circulation prevents stasis and the formation of abscess. In many cases the obstruction may be from bony displacements. These will be at once recognized and relief given immediately. By appropriate treatment resorption of the inflammatory products can be secured by opening up the mouths of the lymphatics and increasing this circulation. Where the pain is great it can be relieved by removing the obstruction to the circulation, thus relieving the tension. The fever may be reduced by appropriate treatment. The urinary secretions may be stimulated so that the poisons circulating within the body may be eliminated, while the bowels, if confined, should be freely opened.

Operative.—When suppuration is imminent, heat in the form of hot fomentations or hot poultices may be applied. In small abscesses it is perhaps the best practice to hasten pus formation and allow it to rupture of itself, unless the boil occurs on an exposed part of the body, when an incision by a small tenotome or dermal lancet may be made to evacuate the pus. Should such incision be made, the abscess should be washed out with an antiseptic solution and the cavity swabbed out and thoroughly cleansed so as to prevent further pus formation. In case of an abscess of large size a free incision should be made. The abscess cavity should be washed out with an antiseptic solution and good drainage established. Drainage is best obtained by introducing a strip of gauze, which is not too large to obstruct the free flow of the fluids, to the very bottom of the abscess. If the abscess is of large size and collapsible and of long standing the gauze should be lightly packed in so as to keep the abscess cavity distended to permit of drainage from all its parts. Drainage is the most important feature in the treatment of an open abscess. In an abscess that has opened of itself, it should be seen to by the attending physician that the opening is large enough to permit of free drainage of the fluids from it. If there be no general cause for the abscess, no systemic ailment, such as a strumous condition, syphilis, alcoholism, or a diathesis of any kind, and free drainage and antisepsis is maintained by washing out the abscess at least once daily, the abscess will readily heal in a short time. Should the abscess continue for some length of time, the antiseptics used to wash the cavity should be changed, e. g., carbolic acid one week, bichloride the next week, etc.

In abscess of the Appendix, the appendix may be removed and the pus cavity washed out. A cigarette drain may then be inserted.

In Pelvic Abscess drainage may be had by means of a glass tube. A fenestrated rubber tube may be serviceable in establishing drainage

from an abscess in joints, pleura, or other locations, but Treves' method of gauze drainage is usually the best.

In opening an abscess care should be taken to make the incision in the direction of the vessels and so as to not injure any important structures. Hilton's method of opening an abscess is an excellent one in case of abscess of the neck. This method consists in making a small incision or puncture in the abscess with a bistoury or small scalpel, when a closed artery forceps is introduced into the abscess cavity, then opened and withdrawn. While this operation is painful it is safe, for the arteries and nerves will not tear as readily as the connective tissues by which they are surrounded, hence you enlarge the opening at the least possible risk. After the abscess is evacuated, a small strip of gauze may be introduced to prevent closing of the opening and to establish drainage. The abscess should always be opened at the most dependent part so as to secure the benefit of gravity in drainage. Where the abscess is large it may be punctured and a grooved director inserted, and when it is known that no important structures lie between the grooved director and the surface the tissues may be readily divided and a large opening secured. In case of old abscess it is advisable to scrape out, with a dull curette, the inside of the abscess to get rid of the dead material, flocculent pus, and masses of dead tissue, and to permit the antiseptic solution, with which the cavity must be flooded, to get into every nook and cranny. The antiseptics used in abscesses should be, in acute abscesses, corrosive sublimate or carbolic acid solutions where free drainage can be had and there is no likelihood of the fluids being retained. Under no circumstances must peroxid of hydrogen be used unless there is a large opening and free drainage and plenty of opportunity for the gas to escape, as sometimes large quantities of gas are evolved when it comes in contact with pus. In acute abscesses, where there is not good drainage and there is much absorption of pus, the cavity should be washed out two or three times daily. Where there is good drainage once daily is sufficient, depending upon the nature of the discharge. As the abscess begins to heal the discharge will become less purulent and at the same time more serous, and as the discharge becomes less, and as the abscess heals from the bottom up, the gauze or other drainage material may be left out; not, however, until there is no possibility of any pockets forming. Boroglyceride solution and emulsions of iodoform are extensively used in chronic abscesses.

Dangers of Abscess.

1. Hemorrhage.—In certain conditions of pus formation where the pus burrows about blood-vessels, the walls of the vessels may become eroded and burst. Fatal hemorrhage has occurred from such cause.

2. Rupture into Large Cavities.—Where an abscess ruptures into a joint or serous cavity such as the pleura or peritoneal cavity, rapid

absorption of the pus will take place, inasmuch as these cavities are but large lymph spaces and furnish opportunity for very rapid absorption of pus, therefore a rupture into any such cavity is likely to be rapidly fatal.

3. The Formation of Sinus or Fistula occurs where foreign bodies remain at the bottom of the abscess cavity, where bone becomes necrosed and sequestra are formed or where the pus has burrowed through a long tortuous tract, where the abscess is poorly drained or where there is some constitutional disturbance. The fistula occurs where the pus has burrowed from one normal cavity of the body to another, or to the surface of the body.

4. General Sepsis takes place in diffuse pus formation where the pus extends around, through, and along the planes of connective tissue which extends around and between muscles, over bones, nerves, and blood-vessels in such a manner that rapid absorption of the toxins may take place. General sepsis may occur following the rupture of a circumscribed abscess into a large serous cavity or into the planes of connective tissue.

5. Deformity.—Pus formation may result in serious deformity, as happens in palmar abscess, caries of the spine, and in abscesses of the neck large and hideous scars may be formed. Abscesses of the middle ear oftentimes permanently impair the hearing. Such deformities should be anticipated and the abscess opened early so as to limit the formation of new tissue, which may bind down important structures, and the contractions of which may be unsightly.

Chronic or Cold Abscess.

A chronic or cold abscess is one which is not inflammatory, the signs of active inflammation being absent. It differs from acute abscess, in that it generally forms slowly; and, while the signs of inflammation are present to some extent, only in a minor degree. This abscess does not depend upon the presence of pyogenic micro-organisms. The contents of a cold abscess differ markedly from that of the acute, being very often thin and curdy, instead of thick and creamy. There are cases of superficial chronic abscess where the contents vary but slightly from the pus of an acute abscess. Its chief characteristics are that it is not inflammatory and the cause more obscure. It was formerly said to be idiopathic. They generally arise from carious bone, chronic joint disease, caseating lymphatics, and from retrograde changes taking place in connective tissue planes. The real causes of chronic abscess are bony, muscular, or fascial lesions affecting the circulation and nutrition. The tissues become debilitated and lose their resisting power. They easily undergo degeneration and form pus because of a trivial injury. These lesions may affect a part directly or reflexly. They not only constitute the most important causative factor in this disease, but also their removal will be attended by a disappear-

ance of the abscess. The depraved condition of the tissues local or general, directly the result of certain lesions, permits of the deposit of the tubercle bacillus, resulting in the formation of the tubercular abscess. By no means are all of these chronic abscesses tubercular. In the pus from some of them the tubercle bacilli may be demonstrated, but in many others not only can the tubercle bacilli not be found in the pus, but likewise not in the surrounding connective tissues. The practice of some physicians in calling all of these chronic abscesses "tubercular" is certainly bad. These abscesses may exist for months, and even years, without rupturing externally, during which time there may be no febrile reaction. Ofttimes the pus burrows for a long distance, and the sinuous tract is lined with fibrous tissue which may even, in some cases, be cartilagenous.

Symptoms of Chronic Abscess.

The symptoms are various, differing according to the location of the abscess; when it is due to a carious spine it is accompanied by marked spinal curvature; when associated with bone abscess it is usually very painful and accompanied by great thickening of the bone and induration of the tissues. Prior to the opening of the cold abscess no constitutional symptoms appear—no chill, no fever, no loss of appetite, or nervous symptoms, but on the other hand there is a certain amount of general debility in a large number of cases. After the abscess opens or is opened, pyogenic infection will most likely take place, when a general hectic fever follows and many times where the abscess is insufficiently drained and putrefactive changes take place in the retained discharge, the patient may grow rapidly worse and the case terminate fatally. This led old practitioners to avoid opening the abscess as long as possible, and to attempt to get rid of the diseased condition by other means. Where a chronic abscess becomes infected and the patient is debilitated, suppuration may extend over a long period. A hectic fever with the characteristic evening rise and morning remission, giving the mental picture of a wasting disease, will follow. The case may be terminated by exhaustion, renal disease, a diarrhea, or by an abscess forming in the liver.

Diagnosis of Cold Abscess.

The diagnosis of a cold abscess is somewhat difficult. It may be taken for blood extravasation, soft tumor, lipoma, cyst, etc. Where the diagnosis is questionable, a needle may be introduced and some of the fluid, if any is present, withdrawn.

Terminations of Cold Abscess.

A cold abscess after remaining quiescent for months, or even years, may again become active, enlarge, and rupture. A cold abscess may rupture upon mucous surfaces, in a serous cavity, or upon the surface

of the body. The contents may be only watery, containing curdy-like masses, or the fluids may be absorbed and this cheesy-like material may undergo calcification and remain quiescent for years. Perhaps after an injury or the person has become debilitated an abcess may arise from this cheesy mass. This is called by some writers, Residual Abscess.

Treatment of Cold Abscess.

In the treatment of cold abscess, constitutional derangement or bony lesions should be looked for. Whatever the derangement is, or whatever the lesion is, this should be corrected. The flow of the fluids and the nutrition in the affected tissues should be encouraged. If a person is of a constipated habit, this should be corrected. If he is suffering from general debility, his system must be built up. Every effort should be made to cure the abscess without opening, unless it enlarges, when aspiration should at first be resorted to, and the general treatment continued. In a large chronic abscess a person should lead an out-door life. If the abscess is opened it should be scraped well with a Volkmann's spoon to get rid of the detritus and dead material clinging to the abscess walls. Irrigation of the abscess cavity with antiseptic solutions and the enforcement of the most rigid cleanliness is essential.

Tubercular Abscess.

Tubercular abscess may occur wherever the deposit of the tubercle bacilli may take place, but this is generally in connection with bones, joints, lymphatics, and connective tissues. It differs from the ordinary chronic abscess in that the exciting cause of the disease process is the tubercle bacilli. Lesions, as misplaced bone or contracted muscle, affecting the flow of the fluids and weakening the tissues, render possible the deposit of the germs. Many of the abscesses which are tubercular, so-called, may not be turbercular, inasmuch as it is quite impossible to demonstrate the presence of the tubercle bacilli. They often happen in connection with the spine, where it is called "Pott's disease," or the hip-joint, where it is called "Morbus Coxarius," or the knee-joint, where it is popularly termed "White Swelling." They are found in persons who have inherited weakness of some sort, often where the parents or near relatives have been subjects of tuberculosis.

Symptoms of Tubercular Abscess.—It presents many of the symptoms of other forms of tuberculosis with chronic abscess formation. The pathology of this abscess formation is that of the deposit of the tubercle in the tissues.

Treatment of Tubercular Abscess.—The treatment of tubercular abscess has been greatly modified by the practice of osteopathy. The most important part of the treatment is to relieve any constitutional derangement or bony lesion which may account for the condition present. This latter idea is ridiculed by other practitioners, but the uni-

formity with which good results have been obtained by correcting such lesions and increasing the blood supply to the part, no longer leaves it open to question. In addition to the osteopathic treatment which may be instituted according as the case requires, the local treatment of the abscess may be included under the following heads:

1. Aspiration of the pus will sometimes lead to its disappearance. Repeated aspirations, together with other manipulative treatment, as the case requires, ought, in a large majority of cases, to be sufficient.

2. Tapping and Irrigation consist in removing the fluid and irrigating the cavity with an antiseptic solution. This treatment is fairly successful in some cases.

3. Extirpating the Tubercular Area.—This consists in dissecting out the abscess and its wall, thoroughly cleansing the wound and closing the incision or wound without drainage. This has been successful in some cases.

4. Iodoform Emulsion Treatment.—Iodoform was at one time extremely popular with surgeons, but the writer has never, in his experience, had any success which he felt he could conscientiously attribute to the action of iodoform emulsion injected in these cases. It may be useful as an antiseptic, but to inject it subcutaneously in the tubercular abscess or joint, is not good treatment and is hardly warranted.

5. Simple Drainage With Antiseptics, which is the same method as is used in the treatment of acute abscess, can be resorted to at any time, but here it should be understood that the most rigid antisepsis is necessary.

6. Open Method.—This method consists in laying the cavity open and cauterizing the area freely with carbolic acid and allowing the wound to heal from the bottom.

Ulcer.

An ulcer is an open sore produced by the destruction of surface tissues. The term "ulceration" means molecular destruction of the soft-parts, in contradistinction to "gangrene," which is death of the soft-parts by mass. Molecular death of bone is called "caries." "Necrosis" means death of bone by mass. Some writers maintain that any open wound is an ulcer, but this view is hardly a good one. Ulceration is best considered as a process similar to abscess formation, which takes place in surface tissue and results in death of certain small masses of tissue —gangrene—which are cast off, or which soften and break down and are discharged. The causes of the ulcer are similar to the causes of abscess formation, viz., an abnormal circulation, deficient nerve supply, obstruction to the return circulation, deficiency in the quality and quantity of the blood distributed to the part, or to the circulation of poison within the body, or to infection, or injury—*pressure,* or to the application of

corroding chemicals, or the existence of some constitutional affection, viz., syphilis, gout, tuberculosis, etc. Inasmuch as the ulcer is open, pyogenic cocci always play an important part in the process.

Varieties of Ulcers.—1. Simple.—A simple or healthy ulcer presents smooth, shelving edges and a granulating base and has but little discharge.

Treatment.—Promote the nutrition and circulation by proper treatment and wash the ulcer daily with an antiseptic solution. Use a protective ointment in small ulcers, with several thicknesses of antiseptic gauze and cotton, the bandage being applied in the direction of the return circulation. Where the ulcer is on a part of the body where a scar will produce serious deformity, *skin grafting* should be resorted to. This operation will promote cicatrization. There are three methods generally employed. One (Tiersch's method) is that the ulcer should be brought into a healthy condition by the use of strong antiseptics, lastly being washed by boiled normal salt solution. The surface of the body from which the skin is to be removed is made aseptic and the superficial layers of the epidermis scraped off, when by means of a razor or sharp knife, small longitudinal strips of the epidermis only are removed and laid over the healthy ulcer.

The second method is to remove small bits of skin by sticking a needle between the true and false skin and then by means of a knife cutting off a small patch of epithelial cells above the needle. Numbers of these patches are removed from the part of the body, which has previously been thoroughly cleansed, and are set around over the ulcer, which has been previously rendered thoroughly aseptic. The part is then protected from any irritation or injury, when healing generally takes place rapidly. From these small "grafts" the epithelium spreads out over the healthy granulating surface.

The third method of closing an ulcer is quite successful, when it is so located that the operation is feasible. This is a sliding flap operation. A suitable flap can be taken from near the ulcer and turned over so as to cover it. After the edges of the flap have united with the margins of the ulcer the pedicle of the flap may be cut off. The wound from which the flap is removed can be closed by interrupted sutures.

2. Fungating Ulcer.—A fungating ulcer is generally due to an obstruction to the return circulation. This may be due to undue contraction of the tissues between the ulcer and the heart. The edges of the ulcer are apparently healthy, but the granulations rise above the surface and are exuberant, are very red and bleed easily. The discharge is generally purulent.

Treatment.—Remove such obstruction, cauterize the fungus growth with creosote, copper sulphate, or nitrate of silver. Afterwards it may be treated as a healthy ulcer.

3. Edematous Ulcer.—Edematous ulcers happen in a part of the body where the tissues are weakened and there is an obstruction to the return circulation. The person suffers from a condition of general debility and the tissues about the ulcer are edematous because of the poor circulation. The ulcer is unhealthy. The discharge is watery and quite free.

Treatment.—Remove the cause, i. e., obstruction to the circulation, treat the general condition, enforce cleanliness, and antisepsis. Boracic acid powdered in the ulcer or equal parts of boracic acid and acetanilid make an excellent dressing.

4. Inflamed Ulcer.—This term applies to ulcers where the inflammatory reaction is the most marked feature. These ulcers are generally irregular and ragged, or they may be sharp cut. The skin about is red and edematous. The discharge is generally quite watery. It is due to septic conditions where the part is frequently irritated.

Treatment.—Rest, relieve the irritation, elevate the part, and assist the return circulation and use antiseptic lotions frequently until the ulcer presents a healthy appearance.

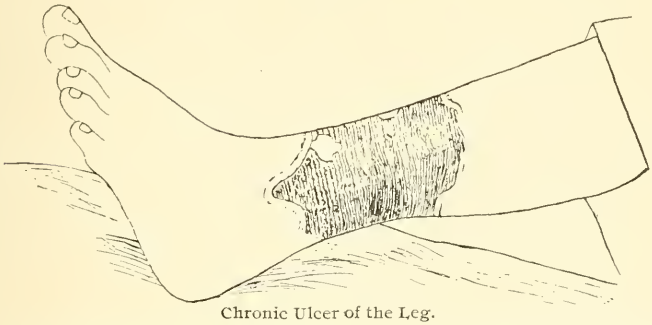
5. Sloughing Ulcer.—This is a severe form of ulceration. It is more frequently met with in venereal diseases, unclean conditions or in persons who have diminished vitality or suffering from general debility or some constitutional disease. The ulcer spreads rapidly, the edges are undermined and inverted; the surfaces of the ulcer are ash-gray or black. There is generally great pain and a continued fever. If the person is syphilitic, the syphilis should be treated. The dead tissues must be removed, the ulcer washed out twice daily with a 1:1000 mercurial solution, while the surfaces of the wound should be powdered with equal parts of boracic acid and acetanilid.

6. Phagedenic Ulcer.—These rarely occur except in very unsanitary conditions and in connection with venereal diseases, or in persons with broken-down health, or in those who are intemperate. These ulcers spread rapidly and are very destructive. In a case treated in the free clinic in the American School of Osteopathy, an ulcer arising on the side of the penis extended over the scrotum and around the buttocks. The ulcer was full of maggots and was extremely foul, yet by the use of antiseptics and proper osteopathic treatment the patient entirely recovered and suffers but little inconvenience from the extensive destruction of the tissues. The ulcer was washed out with a strong solution of permanganate potassium twice daily; after a few days a solution of mercuric chloride (1:1000) was used. It is essential to build up the person's general health before a satisfactory result can be obtained.

7. Indolent Ulcer.—This is a form of ulcer which simply refuses to heal and is caused by some local lesion, some constitutional defect, or by continued irritation and neglect. It is most common on the inner side of the lower third of the leg or foot where the circulation is defect-

ive. The edges of the ulcer are white and calloused, and often the ulcer is insensible to touch. The skin is often congested and edema-

FIG. 5.



Chronic Ulcer of the Leg.

tous. The base of the ulcer contains a whitish discharge and shows few, if any, granulations. These ulcers may exist for years. Simple osteopathic treatment cured a case of extensive ulceration of both lower legs which had existed continuously for thirty-eight years. Sometimes the discharge from these ulcers is very great. There is another peculiar thing in relation with these ulcers, and that is the system seems to have accommodated itself to their presence and to the discharge which takes place. Astringents or other agents arresting the secretions must not be used, but the ulcer must be allowed to gradually heal while the person's general health is improved. It was formerly thought that the healing of such ulcers would be accompanied by constitutional disturbances, inasmuch as the discharge could no longer get out of the body. The discharge from these ulcers is not a humor of any kind, but is a result of the devitalized condition of the tissues of the part.

Treatment.—*Better the Circulation to the Inflamed Area.*—Boracic acid powdered on the ulcer twice daily or washing it with an antiseptic solution twice daily, and a little carbolized vaselin smeared around the edges to prevent the gauze dressing from sticking to the ulcer, after which equal parts of boric acid and acetanilid, or pure boracic acid powdered over the ulcer, will assist healing. The important points in treating an indolent ulcer are (1) to remove the source of irritation; (2) remove the obstruction to the return circulation; (3) stimulation of the ulcer; (4) antisepsis. Where the circulation is poor the limb affected must be bandaged from the toes upward by a figure-of-8 bandage. The bandage should be silk or cotton elastic or a wet woolen bandage.

8. Varicose Ulcer.—A varicose ulcer is an indolent ulcer happening in a condition of varicose veins. For treatment see "Varicose Veins."

9. Irritable Ulcer.—The term "irritable ulcer" is applied to two kinds of ulcers, one opening about the inner surface of the ankle in women beyond middle life. It involves some of the peripheral nerves. The other is a small ulcer occurring in the rectum at the margin of the anus.

Treatment.—Improve the general health. Lotions of carbolic acid or carbolized ointment are generally sufficient.

10. Tubercular Ulcer.—These happen in tubercular subjects and are peculiar, in that they refuse to heal and are very painful. They occur in the larynx, mucous membranes, rectum, etc. The treatment should be directed towards relieving the tubercular conditions. Cauterization is sometimes useful.

11. Syphilitic Ulcer.—These occur in persons who have secondary or tertiary syphilis. In secondary syphilis small ulcers (mucous patches or serpiginous ulcers) occur in the mucous membranes of the mouth, pharynx, and larynx. The treatment should be directed toward relieving the syphilitic conditions. In secondary syphilis the ulcers are infectious and should always be cauterized as soon as seen to prevent any further spread of the infection. In tertiary syphilis the ulcers generally occur upon the surface of the body. These ulcers are not infectious.

12. Gouty Ulcer.—Gouty ulcers occur in gouty subjects and can not be cured until the diathesis is relieved.

13. Scorbutic Ulcer.—Scorbutic ulcers happen in subjects afflicted with scurvy. Proper diet and cleanliness will give relief.

14. Mucous Ulcer.—This is a form of tubercular ulceration of the skin. The treatment consists in cauterizing the ulcer or thoroughly scraping it out and then cauterizing the base.

15. Rodent Ulcer or **Jacob's Ulcer** is a form of epithelioma which requires cauterization or removal by the knife.

16. Trophic Ulcer is caused by some injury or disease of the central nervous system or of a nerve trunk, whereby the trophic fibres distributed to the part are destroyed, thereby cutting off this source of nutrition. These ulcers happen on the bottom of the foot in cases of hemiplegia and are frequently called perforating ulcers.

17. Decubital Ulcer or **Bed-sore** is really a form of gangrene. (See Gangrene.)

The **general treatment of Ulcers** consists in treating constitutional defects which may in any way be the cause of the ulcer, removing any obstruction to the nerve or blood supply, and removing any source of irritation whatsoever; to use cleanliness and antisepsis, to dress the ulcer once or twice daily with antiseptic gauze, first having powdered over the ulcer protonuclein, boracic acid, equal parts of boric acid and salicylic acid, aristol, or some other such powder, then over the gauze is applied a sufficient amount of absorbent cotton to absorb all the discharges. The dressing should be changed daily and the parts bandaged so as to assist the return circulation. Obstruction to nerve and blood supply can be relieved by removing whatever lesions are present.

Sinus.

Sinus is generally the result of pus burrowing through the tissues, and is an opening which leads from an abnormal cavity to one of the normal cavities or surface of the body. Examples of sinuses are seen in caries of the spine, psoas abscess, necrosis of the bone, in the formation of any deep seated abscess, or in the discharge of pus from the knee or hip joint. Frequently a sinus is long and tortuous. It may be lined with a pyogenic membrane or with fibrous tissue, or, in cases of long standing where the irritation has been severe, it may be lined with cartilagenous tissue. The origin of a sinus is really an unhealed abscess, healing having been prevented by bad circulation, irritating discharges, foreign bodies, general ill health, want of rest, or because of the rigidity of the walls preventing collapse. Foreign bodies, such as pieces of dead bone, bits of wood, septic ligatures, etc., may be the cause.

Fistula.

A fistula is an abnormal canal or opening connecting two normal cavities, or a normal cavity and the surface of the body. There are three varieties, (1) congenital, (2) traumatic, and (3) suppurative, or those produced by abscess formation and the burrowing of pus.

Treatment.—The treatment consists in removing the foreign body, relieving the irritation, and correcting the general health. When this is not sufficient, scrape out the sinus well and secure good drainage. In fistula, the walls should be freshened, the fistula thoroughly cleaned and made to heal from the bottom. Fistula of various parts will be discussed under "Disease and Injury of Regions."

GANGRENE.

Definition—Gangrene is death of the tissues by mass. It may be simply a patch of skin, or mucous membrane, or an entire limb. While this has been given as one of the results of inflammation, it may have other causes, in fact, gangrene is caused by more or less sudden arrest of the nutrition to a part, and, inasmuch as this may occur without inflammation, gangrene may happen without inflammatory reaction. In severe cases of inflammation, where the reaction brings about arrest of the nutrition to a part, gangrene in one of its forms is sure to develop.

Varieties.

1. Inflammatory.
2. Traumatic.
3. Infective or Hospital.
4. Phagedenic.
5. Cancrum oris.
6. Carbuncle.
7. Decubital (Bed-Sore.)
8. Diabetic.
9. Gangrene from ergotism.
10. Ludwig's Angina.
11. Gangrene from frost-bite.
12. Post-febrile.
13. Symmetrical or Raynaud's.

Classification.

1. Dry. 2. Moist. 3. Senile. 4. Microbic.

Gangrene is so classified because of the peculiar appearance it presents under certain circumstances.

Cause.

Gangrene is caused by any means which will interfere with the nutrition to a part as (1) injury, (2) infection, (3) thermal causes—freezing or scalding will arrest nutrition to the parts, bringing about chemical changes within the tissues thereby causing death. (4) Drugs, such as ergot, which in large doses causes a contraction of the peripheral arterioles so as to more or less cut off the circulation to a certain area. In the long continued use of carbolic acid as a lotion or where it is continuously in contact with the tissues, necrosis frequently follows. (5) Embolism and thrombosis. Plugging of an artery, either by a clot forming within the vessel or a clot lodging in the vessel and arresting the circulation to a part, may cause gangrene.

Signs and Symptoms.

1. Lack of pulsation in the vessels in an apparently dead area.
2. Loss of heat.
3. Anesthesia.
4. Loss of function of the necrosed area.
5. Changes in color.

In inflammatory gangrene in an area which was previously red, the color is changed into yellowish, yellowish-green, or an earthy hue, or it may be dark or even black. While approaching death may have caused pain, the part is now painless and when touched with the finger is cold, as the heat quickly departs from the dead tissues. If rubbed with the hand, the epidermis loosens from the true skin, leaving the true skin a moist surface, or if the epidermis has not been removed the exudation of the fluids underneath it will cause blebs and these may be filled with yellowish or reddish fluid, due to the disorganization of the red corpuscles and a breaking up of its coloring matter. Small cavities may form in the deeper tissues, some of these being filled with a dark fluid. When the tissues are pressed upon with the hand crepitation is felt. This crepitation is due to the formation of gases from putrefactive changes which have taken place within the tissues. An emphysematous condition of the tissues is one of the surest signs of death. As the condition proceeds, foul odors will arise, due to the decomposition of the albumins and the presence of saprophytic bacteria. There will be evidences of lymphangitis and phlebitis, shown by reddish streaks extending from the inflamed area into the healthy tissues. Should the tissues arrest the spread of the gangrene, a bright red line—*a line of demarcation*—

will be established. On one side of this line is healthy tissue, on the other side dead tissue. Here nature has arrested the process and later attempts at amputation. The tissue changes which lead to death in gangrene are similar to those which take place in abscess formation, but are more extensive. The leukocytes swarm into the inflamed area, active proliferation of the tissue cells occurs, the micro-organisms have gained entrance in enormous numbers, the warfare between the micro-organisms and the tissue cells is extremely severe and in the effort of the leukocytes and connective-tissue cells to overcome the micro-organisms they crowd into the inflamed area in such vast numbers as to obstruct the circulation. Thrombosis of the smaller arterioles occurs. This leads to gangrene. Gangrene is partly due to the mechanical obstruction of the circulation and partly to the action of the poisons produced by the bacteria. As the tissues decompose sulphureted gases are liberated which produce disagreeable odors. If bacteria do not enter the tissues mummification will likely take place. At the line of demarcation the ulcerative process is set up and in the treatment of gangrene we really have a large ulcer with which to deal, and when the dead tissues are removed granulations will spring up and cicatrization takes place, as in healing of an ordinary ulcer. If the gangrene has been at all extensive there will be absorption of certain toxic products, decomposed albumins, and toxins of bacteria. These produce a condition similar to sapremia, or septic poisoning. The heart and circulation are markedly depressed, pulse feeble and quickened, the tongue is dry, furred, and brown, breath foul, features pinched and drawn, the lips, teeth, and tongue are covered with sordes, and the appetite is lost. If the necrosed tissues are not removed death from septic intoxication or exhaustion will occur. If the gangrene is of a vital part of the body, as a knuckle of the intestines, the constitutional effects of the gangrene are very great and collapse is certain and rapid. Where it is of the superficial tissues they may slough off, the ulcers healing with but little care. There are two distinct types of gangrene, which present different symptoms; these are dry and moist gangrene. Dry gangrene is the variety where apparently the fluids seem to depart from the member affected and it withers and dies. The causes of these two forms seem to be the state of the tissues at the time gangrene occurs. In dry gangrene there is an obstruction to the arterial flow and none to the venous return and the fluids already in the part are carried out. In moist gangrene there is an obstruction to the venous return, as well as an obstruction to the arterial blood, the liquid being unable to get out of the tissues. It is not unusual to find conditions where the two forms of gangrene will run into each other. Moist gangrene also occurs in tissues where there has been a pre-existing inflammation.

Senile Gangrene is really one form of dry gangrene. It happens in old people, or persons whose tissues have undergone degeneration because of the action of some disease or certain pathologic conditions

brought about by vicious habits. It nearly always happens in the foot or one of the toes. Close examination will reveal the fact that there is a condition of atheroma or sclero-endarteritis. There will also be arcus or annulus senilis. The disease may happen in a person 40 or 50 years of age, but usually occurs in subjects from 70 to 80 or 90. In heavy drinkers and syphilitics, the arteries undergo degenerative changes, the walls become weakened because of endarteritis, calcification of this inflammatory tissue occurs, the artery is no longer able to respond to the call of the tissues for an increase in the nutritious materials. Sometimes the arteries may be so calcified as to be very brittle. Cases may happen which are due to thrombosis of the superficial femoral artery. In any case, because of the limited blood supply, any little injury will lead to destructive changes. It may begin as a pin prick, it may arise from an ingrown toe nail, or from a scratch or cut sustained in trimming the nail, or in paring a corn the skin may be slightly wounded. The wound becomes extremely painful and burns terrifically. The tissues become red and swollen and finally die. The tissues undergo the same changes as in other forms of gangrene, except that it is nearly always a dry process. The tissues show no evidence of establishing a line of demarcation or limiting the gangrenous process. There may be considerable absorption of septic materials from the gangrenous area which will cause great depression, death generally following quickly. In some instances the case may continue over a period of some months or even years. Nature will establish a line of demarcation at that point where the tissues receive the proper amount of nutrition. When gangrene happens in the toe, amputation should be done above the ankle. If it extends back onto the foot, it is advisable to amputate above the knee. Amputation should not be performed until there is some indication of the point where the chief obstruction to the circulation is located. The operation should be done above this point, if possible.

Microbic or Spreading Gangrene, as it is sometimes called, is that form whose chief cause is infection by certain micro-organisms; it may be the Streptococcus pyogenes, or erysipelas, B. edematous maligni, B. coli communis, etc. Rapid infection in conditions where the blood supply is limited or where the part has sustained injury and the person is in a debilitated state, will cause the spreading gangrene accompanied by an emphysematous condition of the tissues, produced by the development of gases from the action of the micro-organisms. Some writers hold that the gangrene is brought about by the action of the poisons of the germ, but these poisons only act by limiting the nutrition to the part. In fact gangrene is always caused by defective nutrition, except perhaps in cases where the injury is so great as to pulverize or crush the tissues, so the germs act only by arresting the nutrition. Fortunately this form of gangrene is rare. It happens in illy-nourished people under bad hygienic surroundings. It is alarmingly and rapidly fatal. It is most common after bad fractures with extensive injuries to the soft-parts. The limb becomes enormously swollen and the pulse below the

injury is absent. The member becomes cold within 36 to 48 hours and it may turn green or a greenish-black hue. Death does not seem to take place in a single patch, but an extensive area, in fact sometimes the whole limb dies apparently almost simultaneously. The products carried back into the healthy tissues cause extensive inflammation and enlargement of the lymphatics. No line of demarcation forms, while the patient suffers from septic intoxication; death quickly follows from collapse. It is not unusual to find the temperature subnormal. Traumatic or spreading gangrene must not be confounded with erysipelas. Erysipelas shows a red inflamed area. Traumatic or spreading gangrene is at first purple and finally turns to a dark greenish color. The surgeon is often at a loss to know when to amputate. If, in his judgment, the injury is so extensive as to cause gangrene, amputation should be done at once. After spreading gangrene has set in he may amputate higher up or he may wait for a line of demarcation, which sometimes never forms. In such cases, death follows quickly. If it is doubtful what should be done, the conditions presenting in each individual case should decide that one. If the surgeon feels that it requires an amputation to save the life of the patient, it is his duty to perform such an operation with the least possible delay. If he believes it is best to temporize, that should be done. At all events the conditions should be explained to the patient or the patient's next friend, so he may appreciate them and his consent obtained for amputation. In case the person is in an unconscious state and he has no next friend, or any relatives, the surgeon should do that which he feels is his duty.

Infective or Hospital Gangrene is said by some writers to be the same as Wound Diphtheria and Sloughing Phagedena. The term "Hospital Gangrene" seems to refer to a kind of gangrene which does not happen in this age, but formerly occurred in poorly ventilated and unsanitary and overcrowded hospitals. In short, it occurs under filthy conditions in debilitated people. It is a rapidly spreading and infectious form of microbic gangrene. Hutchinson says it is Syphilitic Phagedena.

Treatment of Gangrene.—As soon as the injured member comes under the observation of the physician, if it is not dead, it should be enveloped in cotton wool, heat applied, and the part elevated to assist the return circulation. All efforts should be made to restore life to the part by assisting the circulation by whatever manipulation may be necessary. The patient should be supported with nourishing food and stimulants. If there is a wound in the tissues the strictest cleanliness and asepsis should be maintained. The part should be thoroughly cleansed and good drainage secured. If the member begins to die it should be constantly kept moist with a solution of 1:5000 bichloride of mercury and as soon as the line of demarcation sets up amputation should be performed. If the line of demarcation is tardy in forming, the dead tissues become swollen and edematous and noxious gases are produced, punctures in the dead tissue should be made by a sharp

instrument and the member wrapped with cloths saturated with a 1:1000 solution of bichloride of mercury. Every effort should be made to destroy all micro-organisms in the dead tissues. If this is thoroughly done the part will not emit any stinking odor; also the tissues will more likely arrest the spread of the gangrenous process. As soon, then, as the line of demarcation is set up, amputation can be performed far enough up so that a healthy flap can be secured. In cases of hospital gangrene, stronger antiseptics may be necessary over the sloughing area. A solution of 1:500 mercuric chloride should be used and the slough and dead tissues should be trimmed off and the antiseptic solution be introduced into all crevices of the slough by means of a swab. One or two such treatments will be sufficient to stop the destructive process, then milder antiseptics may be used. The part should be kept dry by being powdered over with iodoform or equal parts of boric acid and acetanilid. It should be dressed frequently in order to get rid of the secretions from the slough and to not allow the fluids to decompose in the dressing. In traumatic gangrene the treatment will largely depend upon the judgment of the physician as to whether or not he can save the limb; if he feels he can not, amputation is necessary. After amputation, the stump should be treated the same as an ordinary amputation stump. If the amputation is done after gangrene has set up, the dead part should be thoroughly wrapped in cloths saturated in a 1:5000 solution of bichloride of mercury so as to permit of no opportunity for infection or the return of the gangrene in the stump.

Cancrum Oris is sloughing of the inside of the cheek in ill-fed and ill-nourished children. The course of the disease is extremely rapid and terribly destructive. If not treated with the utmost vigilance sloughing will take place through the cheek onto the face. As soon as the case is seen, the physician should at once cauterize the slough with carbolic acid or nitric acid. After cauterization the mouth should be rinsed and cleansed thoroughly and frequently with an antiseptic solution and the patient should be kept in a well-ventilated and clean apartment and be given supportive treatment.

Phagedena is described under Hospital Gangrene and Sloughing Phagedenic Ulcers.

Carbuncle.—Occasionally in debilitated persons where the case is neglected the formation of a carbuncle, which is evidenced by numerous small boils over a certain area, may lead to gangrene of a mass of the tissues. The treatment for the case is to open the boils and wash them several times daily with a 1:1000 solution of bichloride of mercury. The patient's general health should be treated and any local or spinal lesions found should be removed. These cases usually terminate favorably.

Decubital Gangrene is a variety of gangrene which occurs from prolonged pressure upon an area, cutting off the circulation and causing it to slough. It happens in persons confined to their beds because of

some wasting disease, or in paralytics where the tissues are deprived of nerve supply. The trophic influences being withdrawn, pressure cuts off the circulation and the part dies. The first sign of decubital gangrene is perhaps a little reddish pimple, upon the top of which a little black spot appears and this gradually spreads to an area of considerable size, depending upon the state of the tissues. Occasionally, in paralytic cases, the urine is voided involuntarily and as it dribbles away and saturates the clothing it adds to the irritation, when a little fold of the sheet or a small pin scratch or insect bite may be the starting point of an inflammation which results in the destruction of the tissues, forming what is popularly known as a "Bed-sore." The location of these sores is usually over the back part of the sacrum and the posterior part of the ilium or over the trochanter or sides of the buttock, because of the patient lying continuously upon these bony prominences. A pressure-sore sometimes happens upon the heel or one of the condyles of the humerus because of the unequal pressure of a splint. **The Treatment** of decubital gangrene or bed-sore is first preventive. The preventive treatment is especially important because in many cases it is almost impossible to heal the sore after it is once formed, therefore if it is prevented an infinite amount of pain and trouble may be avoided. It is well enough in these cases, as soon as the part shows any signs of irritation, to rub the surface with alcohol and dust it with oxid of zinc or talcum powder. When any particular point shows irritation an air-cushion may be used to remove the pressure from that point. If the person is a paralytic and can afford it, a water-bed should be used. This equalizes the pressure on all parts of the body in contact with the bed. Furthermore the strictest cleanliness should be maintained. If the urine has been in the habit of coming in contact with the skin it should be collected by means of a urinal. Care should be exercised in the use of a bed-pan and the parts kept dry and free from irritation or pressure. After a bed-sore is once formed it should be treated the same as an ordinary ulcer, pressure being kept off and the strictest cleanliness enforced. Do not use peroxid of hydrogen continuously as a cleansing agent, as it will stop cicatrization. There are numerous preparations which are of advantage. The history of these sores will extend over a period of some weeks, perhaps some months, so that the antiseptic will necessarily need to be varied. The ulcer should be dressed at least twice daily. The edges of the sore should be greased with a little carbolized vaselin and several layers of antiseptic gauze applied after the sore has been dusted with equal parts of boracic acid and acetanilid. Over the gauze a considerable mass of cotton should be placed. This will prevent any secretions getting into the sore and will keep it clean. If pressure is removed, the ulcer may then be in condition to administer another part of the treatment, which is of the very greatest importance, that is, to stimulate the nerve and blood supply to the ulcer. Osteopathic practice has shown that many very extensive decubital ulcers can be successfully treated. In fact it

seems to be the only method of curing very bad cases or the only hope of saving the life of persons whose spines have sustained extensive injury high up. This manipulation must be varied according to the cause, but is directed towards securing the proper blood and nerve supply. The method by which these sores may be cleansed is this: Kelly's rubber-pan should be placed under the buttocks. The sore is washed out by means of an irrigating apparatus filled with an antiseptic solution. The irrigating apparatus may be either a fountain syringe or a large glass jar having a small rubber hose leading from it. Protonuclein or other antiseptic powder may be dusted over the sore, the edge of the ulcer smeared with carbolized vaselin, and several layers of antiseptic gauze should be applied twice daily. Sometimes the destruction of the tissues from these bed-sores is very extensive, but as soon as the dead tissues slough away, if the part becomes healthy it will show a red or pink granulating surface. Sepsis under unsanitary and neglected conditions may occur, the gangrenous process extending to the deeper tissues.

Diabetic Gangrene.—It is a peculiar fact that gangrene happens with the slightest provocation in diabetes mellitus. The gangrene seems to be caused by the general defective nutrition, perhaps also by the presence of sugar in the blood. It may happen in the feet or legs, in the genitalia, or over the buttocks, back, hands, or face. It may simply affect a small area or a large mass of the tissues. It may happen at any time in the clinical history of diabetes. An injury seems to be necessary, but this may be only trivial. Very often there are some prodromic symptoms, sometimes not. If it comes from traumatism there are prodromic symptoms, such as violent pain, together with a red inflamed condition of the surface. The part turns cold and loses sensation. This form of gangrene is generally moist. The line of demarcation is not so readily set up. The case calls for the treatment of diabetes conjointly with gangrene. It spreads more rapidly than senile gangrene and is very often covered over with blisters. Operations should be performed only where nature establishes a line of demarcation. Diabetes mellitus is best treated by well known osteopathic methods. Should nature show an effort at arresting the process, the remainder of the treatment is clearly surgical.

Gangrene from Ergotism.—Ergot, when taken internally, among other things produces a spasm or contraction of the muscular fibres in the walls of the arteries. This affects the peripheral arterioles more than the large arteries. The spasm may be sufficiently great to so arrest the nutrition that gangrene may occur. Osler says that the gangrene is first preceded by anesthesia, muscular cramp, tingling, pain, itching, and gradual blood sepsis in certain vascular areas. History of the taking of ergot, together with the presence of the above named symptoms, should be sufficient to make a diagnosis. The gangrene is generally superficial and terminal and is very often symmetrical and may involve the toes of both feet, or may involve both limbs. Death

is said to have occurred in from ten to twelve days in very acute cases. Where the gangrene is superficial the parts should be washed twice daily with antiseptic solutions and the dead crusts should be trimmed off with forceps and scissors.

Ludwig's Angina is hardly a form of gangrene, but is a form of abscess of the submaxillary gland. It is said to be a condition of infection of the gland with the streptococcus pyogenes. Occasionally the abscess formation is attended by gangrene. The swelling is rapid and the pain extremely severe, the person being unable to open the mouth. Occasionally the swelling may extend back into the pharynx and back part of the tongue and cause edema of the glottis. As soon as fluctuation can be detected the abscess should be opened and the inside of the mouth and the abscess cavity should be thoroughly cleansed with an antiseptic solution and the person given supportive treatment.

Gangrene from Frost-Bite.—Frost-bite is more common on the exposed parts of the body and is extensive according to the exposure. It causes contraction of the arterioles, drives the blood out of the tissues, arrests the nutrition and the part becomes stiff, cold, and numb. After the tissues become warm the vessels dilate because of weakness, and congestion and inflammation follow. If the part has been cold sufficiently long to entirely arrest the nutrition, the part will likely die, but if the tissues have become only seriously devitalized a severe inflammation may result and this inflammation terminate in gangrene. The inflammation which is caused by exposure to cold is attended by a severe burning sensation, followed by great pain. Sometimes the cold is sufficiently great to actually disorganize the tissues. Especially is this true where the part is very cold, or is cold for a considerable length of time and then quickly brought to its normal temperature. The rapid changes in temperature seem to bring about destructive chemical changes in the blood and tissues. The area which has become livid with cold and which is not yet believed to be dead, should be first treated by friction with snow or towels soaked in ice water, and the part gradually brought to the normal temperature. This will frequently avoid serious inflammation. Amputation should be done only after the line of demarcation has been thoroughly established. Where the ends of the fingers and toes have died the part should be treated antiseptically and here it must be borne in mind that if the tissues slough and a sore results, that this sore will heal very slowly and that the slough should be removed after it has been loosened by nature. The ulcer should be treated as an ordinary open sore. If gangrene follows in a considerable area, the treatment, before the line of demarcation has been set up, is hot fomentations of antiseptic solutions. As in all cases of gangrene, the support of the patient is of the utmost importance.

Postfebrile Gangrene is a form following a severe attack of continued fever. It most frequently follows enteric fever, but may follow typhus fever, scarlet fever, measles, influenza, etc. It is most usual in the lower

extremities, but may happen in the upper extremities or in the upper parts of the body. The gangrene is generally believed to be due to embolism following endocarditis. In young girls gangrene is apt to occur in the genitalia. It is said that now and then the disease arises from phlebitis with the formation of thrombi. So in continued fevers examination of the extremities should be made from time to time to determine the presence of gangrene. The treatment after gangrene has set up, is antisepsis until the line of demarcation is established. Secondly, remove any lesions which will obstruct the return circulation or interfere with the nutrition of the tissues. This being removed and the line of demarcation set up, if the gangrene is sufficiently extensive, surgical interference is demanded.

Symmetrical or Raynaud's Gangrene occurs in Raynaud's disease. This disease is said to be a vasomotor neurosis which occurs in children and young adults. Clinical experience shows that there are distinct spinal lesions which account for the condition. The attacks appear in the tissues symmetrically, e. g., fingers and toes. The parts become cold, dead and bloodless, following severe mental excitement or injury. In some cases the part becomes livid and there is local asphyxia similar to a chilblain. The patient complains of shooting pains and tingling in the part. After local asphyxia occurs the prognosis should be guarded for gangrene is likely to happen. When death is about to occur the part becomes dark and blebs may arise. There is local coldness and anesthesia and the line of demarcation is generally quickly set up. The treatment is to restore the circulation and remove the pressure from the nerves. After the part has died antisepsis and surgical measures are necessary.

SEPTIC AND INFECTIVE DISEASES.

Classification.

A. Septic Diseases.

1. Septic Inflammation.
2. Traumatic fever.
3. Sapremia.

B. Infective Diseases.

1. Suppuration.
2. Cellulitis.
3. Septicemia.
4. Pyemia.
5. Hospital gangrene.
6. Wound diphtheria.
7. Erysipelas.
8. Tetanus.
9. Hpdrophobia.
10. Malignant pustule.
11. Actinomycosis.
12. Tuberculosis.
13. Glanders.
14. Syphilis.
15. Gonorrhea.
16. Scrofula.
17. Rachitis.
18. Scurvy.

Septic Diseases.

The diseases included under this head are due to the absorption of certain chemical products of putrefaction which causes local inflammation and certain systemic disturbances. Fevers following injury are variously classified by different writers, but the author prefers to include under septic diseases those conditions due to the absorption of

certain alkaloids or putrefactive substances which are not necessarily the result of bacterial action, but perhaps may be due to the decomposition of albuminous products in the wound. The nature of these products is not known. They do not multiply in the body and when the wound is freely opened the disease symptoms disappear. The symptoms to which they give rise are often severe in proportion to the amount of absorption, as is instanced in poorly drained abscess cavities. The freer the drainage the less fever and other constitutional symptoms. Furthermore, the poisons are not infective and the disease process does not extend to other parts of the body. It is said by some that the poisons are due to the multiplication of saprophytic bacteria in the secretions of the wound or cavity, so that the disease is virtually a toxemia. There seems to be considerable ground for this belief, inasmuch as in foul wounds and poorly drained cavities there is generally a considerable amount of dead tissue upon which these otherwise harmless saprophytes may grow. Also, in cases of gangrene after the member has died, amputation is many times followed by recovery. Previous to the amputation there may have been marked systemic disturbances, high fever, delirium, etc., the symptoms being produced by the absorption of the poisonous products from the decomposition of the albuminous fluids in the tissues and by the growth and development of the saprophytic bacteria. The reason for no absorption of poisons afterward is that the bacteria being saprophytes, live only on the dead tissues.

Septic Inflammation.—The pathological process of septic inflammation is similar to that of acute suppuration or acute inflammation from chemical cause.

Traumatic or Wound Fever.—There are various grades of traumatic fever. Following a major operation it is not unusual, in fact it is the rule, for the temperature to rise from one-half to one and one-half degrees. The person is more or less uncomfortable and may manifest some nervous symptoms. Under other circumstances the temperature may rise to 103 degrees F., this being accompanied by a general malaise with delirium. In the milder form the absorption of the broken-up nitrogenous compounds in the wound probably causes the fever, whereas in the severe form a certain number of germs may have entered the wound and these having caused more or less putrefaction the fever and other symptoms follow. These processes come within twelve to twenty-four hours after the injury. They disappear without serious damage. Either the poisonous products are taken up by the lymph channels and carried elsewhere and gotten rid of by the eliminating organs, or the products are discharged from the wound, nature having set up a wall of granulation tissue for the protection of the system from the absorption of these toxic products. This is traumatic fever or wound fever.

Sapremia.

Sapremia is generally considered to be the expression of the absorption of the toxic products from retained secretions where bacteria are

causing active fermentation. In fact, sapremia may be associated with severe forms of poisoning. It is thought milder grades of sepsis terminate in severer forms, therefore, what first was a sapremia may terminate in septicemia or pyemia. Sapremia calls for quick and vigorous treatment. If it be from a wound, it demands immediate drainage. If the wound has been closed it should be opened and thoroughly washed out, all the poisonous products and germs removed and free drainage established. Sapremia occurs under three conditions: (1) extensive wounds imperfectly drained which were not previously rendered aseptic; (2) wounds of serous cavities where there is abundant opportunity for the absorption of poisonous products, and (3) from granulating abscess cavities where the external opening is too small to permit of drainage. Very severe conditions may be fatal—this is unusual. The poisons act chiefly upon the blood and nerve centers, very often producing decomposition of the red corpuscles, resulting in a form of petechia. It sometimes acts upon the nerve centers, producing delirium, or sometimes thrombosis of some of the capillaries may occur. Microscopic examination made immediately after death shows that the tissues contain no micro-organisms.

Symptoms of Sapremia.—Chill or chilly feelings, vomiting or loss of appetite, headache, malaise, muscular soreness; the pulse is rapid and in severe cases becomes very weak, the temperature in the severe forms reaches 103 or 104 degrees F. If the absorption is very rapid, collapse may take place rapidly. Under such circumstances coma follows unconsciousness and delirium and the patient dies.

Treatment.—The treatment is directed towards the removal of the source of the poisons. Opening the wound and washing it out freely with antiseptics is sufficient. In operation cases, sapremia calls for the removal of part of the sutures and establishing drainage. Pent-up and decomposed pus or secretions give rise to the disease, hence treatment should, as in the treatment of any ailment, be directed towards removing the cause.

Suppuration and Cellulitis

have been described under circumscribed and diffuse abscess formation.

Septicemia.

Septicemia or "Blood-poisoning" is a general infective disease usually produced by the pyogenic micro-organisms, in contradistinction to septic processes, which are caused by the products of saprophytic bacteria. In septicemia these pyogenic micro-organisms develop at such an appallingly rapid rate and are present in such immense numbers that they swarm into the tissues, passing by means of the blood and lymph channels into the planes of connective tissues and producing such virulent poisons that the patient is overwhelmed. Sometimes he looks as if he had been struck down by some terrible malady. The disease called "Septicemia" presents a clinical picture

often seen and easily recognized. In some cases diagnosed as septicemia, micro-organisms are not found in the blood, but they exist in the tissues around the wound and the toxic products of the bacteria are produced in such immense quantities that the clinical picture is the same, whether the germs exist in the circulation or not. It differs from pyemia, in that in the latter there is multiple or metastatic abscess formation. It does not follow that because the bacteria have entered the circulation that multiple abscess will occur. Death may follow a rapid absorption of the germs before the formation of multiple abscess can take place. Conditions of septicemia and pyemia may occur coincidently or septicemia merge into pyemia.

Pathology.—First there is local infection of the pyogenic cocci and there may be phlegmonous signs of a rapidly spreading inflammation. The wound, if there be one, is generally foul, coated over with a grayish covering and looks unhealthy The secretion is yellowish and has a peculiar odor. The cocci develop within the tissues and spread through the lymphatics. In some cases they reach the circulation, when they increase and multiply in the blood. It is not unusual that cultures made from the blood will show large numbers of streptococci. These travel into the minutest vessels and finally reach the heart and develop upon the valves, which condition happens in malignant endocarditis. This may finally lead to the formation of infective emboli and result in pyemia. In other cases thrombi may form in the veins in the infected area. These clots being dislodged, form infective emboli, which may finally lead to general pyemia. On post-mortem examination there is a general congestion of the viscera in the gastro-intestinal tract. The intestines and peritoneum are frequently covered with flakes of coagulated lymph. These coagula often represent pure cultures of the streptococcus pyogenes. The peritoneum and pleura, together with the nerve centers, are all congested and frequently petechial spots may be seen. In more prolonged cases peritonitis or pleurisy or pneumonia or inflammation of other viscera may be present, and it is not unusual for the serous cavities to contain blood-stained serum. The spleen and lymphatic glands, in fact, all adenoid tissues, are greatly enlarged and congested. Doubtless many times micro-organisms enter the blood and are lost sight of, perish and do no harm. When they lodge in the parenchyma of the lung, liver, or kidney, they may increase and multiply and result in pyemia.

Cause.—The cause of septicemia, as has been indicated, is pyogenic micro-organisms. Sometimes several germs may be associated, bacilli and micrococci being present. In virulent cases there may be only one micro-organism doing the damage, but in all cases these germs have been introduced into the tissues in immense numbers, either through a wound or the open mouths of vessels, as in cases of puerperal septicemia. Where infection takes place in wounds the result of operation, it is caused by the septic condition already present in the patient, or

because of an unclean condition of the field of operation, or the germs have been derived from the instruments, sponges, ligatures, or the hands of the operator, or from something introduced into the wound during the operation. It is singular how much filth nature will apparently get rid of sometimes. Still, on the other hand, septicemia may follow when apparently considerable precaution has been taken. This may be explained by the fact that while streptococci are present, they may vary in virulence, in one case not producing serious symptoms, whereas in another the infection is obviously fatal at the beginning. The importance and frequency with which streptococci infection accompanies many of the acute infectious diseases in the puerperal state and in injuries is probably not sufficiently appreciated. In premature delivery brought about by measles, whooping cough, and similar diseases, septicemia is very likely to happen and is usually alarmingly fatal. While other of the pus germs may produce this disease, none is so rapidly fatal or produces such alarming symptoms as the streptococcus pyogenes or streptococcus erysipelatis. In hospitals where these cases occur they should be isolated. Clothing infected by them should be fumigated.

Symptoms.—The disease is generally introduced by a chill or chilly feelings. The rigor may be very severe. There may be several chills closely following each other, during the first twelve to twenty-four hours, but after that, if there are other chills, it usually indicates renewed absorption of toxic material or the formation of an abscess. The temperature rises rapidly to 103, 104, or 105 degrees F. There is at first nausea and vomiting, loss of appetite and the person looks dazed. The symptoms may take on a typhoid nature . The secretions are arrested, urine high-colored, and the patient greatly prostrated. The pulse, at first rapid and thready, becomes soft and weak. The patient soon becomes unconscious and delirium appears. In some cases there is great and rapid prostration, so that the person dies in a few days. The writer once saw a case of puerperal septicemia, following delivery at term attended by a mid-wife, where death occurred within forty-eight hours. On autopsy the peritoneum and bowels were markedly congested and of a reddish-black color. The lymph in the peritoneal cavity was coagulated in flakes.

Treatment.—The treatment is almost entirely preventive, for little can be done in the way of cure. The reason is, no agent introduced into the system is of any use after the poisons have entered the circulation. Antistreptococcic serum has been used, and some have claimed to obtain good results, but the statements are unreliable. Antistreptococcic serum is worthless. After infection has taken place, free incision, drainage, and curetting, together with frequent lavage of the infected area, may accomplish some good, but it is hardly likely, for blood infection is fatal. Nourishment and support of the patient, together with free use of stimulants, may assist the tissues in overcoming the onslaughts of the germ.

Pyemia.

Pyemia is distinguished from septicemia by the formation of metastatic abscesses in other parts of the body. It is but a special stage of septicemia in which abscesses are formed. Prior to the formation of the abscesses the clinical history of the two diseases is alike and indistinguishable.

Cause.—Without doubt the cause of the disease is the entrance into the tissue of pyogenic micro-organisms which have found their way there through the open mouths of lymphatics or veins. The disease generally develops amidst unhygienic surroundings or in ill-nourished and debilitated subjects, in over-crowded hospitals which are poorly ventilated and drained, and where there exist numbers of foul wounds. It occurs in alcoholic and diabetic subjects, or in persons with low resisting power. It generally occurs in connection with a wound. The poisonous chemical products absorbed from the wound debilitate the person to that extent that the micro-organisms absorbed circulate through the fluids in the body, lodging, in the parenchyma of some organ, producing the disease. The abscesses are often caused by infective emboli. Where these emboli lodge suppuration occurs, and, inasmuch as this generally takes place in some internal organ, clots form in the small veins and capillaries. These becoming dislodged, are carried back to the heart, when they are sent to some distant organ, where they lodge and, being infected, form another abscess. There are, therefore, two chief agents acting, one the poisonous products produced by the cocci, debilitating the system, and the other the deposit of the cocci and the formation of abscess. This abscess interferes with the function of the tissues in which it is located, causing the symptoms to vary in individual cases. Old writers mention idiopathic pyemia, but such cases do not occur. Abscesses may arise from various causes. (See abscess formation.) These abscesses, then, may be the exciting cause of the pyemia, pus having been absorbed from this cavity. Pyemia may follow typhoid fever, but in this case absorption takes place from the septic ulcers in the lower part of the small intestine. It is frequently associated with bone disease, osteomyelitis, osteitis, or periostitis. In some cases it arises from hospital gangrene, diffuse cellulitis, or abscesses of erysipelatous origin, or from gonorrhea. Ulcerative endocarditis may happen in rheumatism and many of the acute infectious diseases. Pyogenic cocci have entered the system through abrasions of the skin and lodge on the valves because of the weakened and unresisting condition of the tissues, then because of the clot, infective emboli occur, pyemia resulting. It has been known to follow dysentery. Trivial operations seem in some cases to have caused the disease, but here it is evidently due to infection introduced by the operator.

Pathology.—The post-mortem appearance of the tissues is similar to that of septicemia, with the addition of collections of pus distributed through the body in small masses. There is the same rapid tendency to the disintegration of the blood, subserous and subcutaneous extravasation

and congestion as occur in septicemia. The body is generally greatly emaciated, often jaundiced, and of a dirty or dirty-yellowish color. Purulent collections may be found in the serous cavities or in the joints or connective tissues generally. The abscesses vary from pin-head foci to the size of a nut. The lung may be honey-combed with abscesses the size of a pea. The viscera affected are, in order of frequency, the lung, liver, spleen, kidney, and brain. The abscesses occurring in the parenchyma of an organ are caused by thrombosis of the peripheral arterioles. Where pyemia is caused by wounds in the rectum, visceral abscesses occur first in the liver, since the blood must pass through the capillaries of that organ before it enters the general circulation. The pus is generally of a sweetish odor and is rarely, if ever, fetid, and in case of abscess in the lung the breath of the patient has a sweetish odor. As in septicemia, when there is a wound it is unhealthy and is surrounded by an inflammatory area and covered over by pus or dying tissues, or oftentimes by a grayish membrane. The veins leading from the wound generally contain a large number of thrombi which undergo purulent softening. The fragments which protrude out into the blood stream become dislodged and are carried to other parts of the body. Sometimes these thrombi form in small veins, extending back towards the heart into large venous trunks. Besides the foregoing conditions, inflammatory masses containing numbers of micro-organisms may be found in various parts of the body. The conditions present in pyemia may be caused in several ways. The visceral abscesses are largely due to embolism of the peripheral arterioles or capillaries, the septic products having come from venous thrombi, vegetations on the valves of the heart, or at the beginning of the arteries. In other cases the micro-organisms may have migrated through the walls of the vessels and upon entering the circulation may lodge in an organ where the circulation is weak, or having penetrated a mucous or serous membrane, they get into the lymphatics, finally the general circulation, when they may be deposited in a joint, causing purulent inflammation. The diffuse purulent infiltration of a joint is said by some to be due to the general poisoned condition of the system, and the lodgement at the joint of poisonous products. In many cases, as is indicated above, ulcerative endocarditis is caused by the germs getting into the system. An infected clot is formed upon the valve, when abscesses in various parts of the body are produced, this being the distributing point from which infectious emboli arise. Following typhoid fever, after some months an abscess may arise. This can only be explained by the fact that the pus micro-organisms get into the circulation, and not being destroyed, lodge and remain in a quiescent state for some time, finally forming abscesses. From this focus general infection may follow.

Symptoms.—The symptoms of pyemia may at first be quite similar to septicemia, but differ in that at the formation of each new abscess a separate and distinct rigor occurs, followed by a high temperature and

a drenching sweat. The fever is of a mild or severe hectic type. After the chill the temperature may rise to 105 degrees F., depending upon the amount of absorption of pus. It will rise in the evening to 103 or 104 degrees F., and drop in the morning to perhaps 100 or 101 degrees F. While the pus is pent up in the system the patient is not free of fever. In some instances where nature is fairly successful in walling off the abscess the temperature may almost approach normal. The pulse is quick and weak, the tongue, at first red and moist, becomes dry and brown as the case is more prolonged. Sordes form in the mouth, on the lips and teeth, and the breath becomes foul. The body wastes rapidly, the skin is frequently jaundiced (hepatogenous) because of the formation of an abscess in the liver which obstructs the gall-duct, or it may be caused by the disintegration of the blood (hematogenous) by the pyogenic micro-organisms. The face is anxious and pinched, the features drawn, the temperature high, and the hectic flush usually marked. It is not unusual for eruptions to take place on the skin or ulcerations in the fauces. The breath and exhalations from the body have a peculiar sweet odor. As the different structures are affected, peritonitis, pleuritis, or pericarditis may occur. Diarrhea may set in and this is generally exhausting and followed by delirium. The patient generally dies of exhaustion during the second or third week of the disease. It is said there are rare cases where the primary wound may heal.

Prognosis.—The prognosis is extremely unfavorable. It is only when the disease seems to run a chronic sort of course that there is any hope of recovery. In this case the viscera do not seem to be affected, but the connective tissues and joints suffer most. The patient may die after some weeks of lingering or may finally recover after the disease has existed for some months.

Treatment.—Little or nothing can be done in the way of treatment, inasmuch as we must depend upon the system to get rid of the micro-organisms, and when the infection is rapid this seems impossible. When abscesses form the pus should at once be evacuated. This is impossible when it occurs in the lung, brain, or other important organ. Where the seat of trouble can be reached it should be treated at once. Carious bone should be removed. If it arises from a wound, this should at once be irrigated with a solution of 1:1000 bichloride of mercury. All dead material should be immediately removed. The disease seems to be generally caused by the staphylococcus pyogenes aureus. Antistreptococcic serum is of no use. We must depend upon nourishing diet and support of the patient. If he resists the onset of the disease and the preliminary abscess formation, it is possible that he can be built up and the system enabled to get rid of the pus.

Wound Diphtheria.

Wound diphtheria is maintained by some to be a form of hospital gangrene. It may be due to the Klebs-Loeffler bacillus or

pyogenic cocci. In any case, it usually occurs in ill-nourished people or where there is some lesion which markedly devitalizes the tissues, permitting the entrance of the organisms with very little resistance. The wound looks unhealthy and is coated over with a membrane, which in some cases is quite thick and tough. The membrane is composed of a fibrinous mass, in which there are generally dead granulation tissue cells and leukocytes, together with numerous chains and colonies of pus micro-organisms and perhaps diphtheria bacilli. If the membrane is pulled off it leaves a bleeding surface. The onset of the disease is sudden. The wound quickly takes on an unhealthy appearance, the temperature rises, and the other constitutional symptoms are quite marked. The patient does badly. Rigid antisepsis and cleanliness are demanded at once. The wound should be thoroughly irrigated with a strong antiseptic solution and the patient given a nourishing and stimulating diet. All the secretions must be kept active by appropriate treatments. The disease arises most frequently in unsanitary surroundings, illy-nourished people, and poorly ventilated quarters surrounded with filth. Under good hygienic conditions, if the patient has reasonably good health, the prognosis should be favorable, but in diabetic or rheumatic conditions, or in alcoholics, the prognosis is unfavorable.

Erysipelas.

Erysipelas is an acute, diffuse, infective inflammation (lymphangitis) of the skin and subcutaneous tissues produced by the streptococcus erysipelatis (Fehleisen.) A wound or abrasion of the skin is also necessary for the entrance of the organism. In the description of idiopathic erysipelas by older writers it was said to arise from no particular cause. Such a disease does not exist. In facial erysipelas it is believed the organism often gets into the tissues through abrasions of the nasal mucous membranes. The contagion is likely conveyed by the air or water or the instruments or imperfectly sterilized dressings or ligatures. The morphology and characteristics of the streptococcus erysipelas do not differ from the streptococcus pyogenes, which produces diffuse pus formation. The clinical course of the case depends upon the condition of the tissues and the rapidity of infection and the virulence of the germs.

General Pathology.—When the virus effects an entrance into the tissues, it increases and multiplies rapidly and spreads quickly through the lymphatics and connective tissue spaces. The germ is found only, or at least in greatest abundance, along the margins of the inflamed area. If incisions are made through the skin, the serum which exudes will contain large numbers of the micro-organisms, whereas, in the center of the erysipelatous area there are no germs. Apparently the tissues have either gained mastery over the micro-organisms through the agency of the connective-tissue cells and the leukocytes or the germs have exhausted their food materials. At any rate, the germs continue spreading until their progress is arrested

by the combined efforts of all the tissues to rid themselves of this invading enemy. The constitutional symptoms of the disease are produced by the poisons being carried into the general circulation by the lymphatics. Now and then, where the inflammation is extremely severe, it is accompanied by exudations of serum beneath the epidermis, producing blebs or blisters. Sometimes the inflammation will extend into the larynx, producing edema of the glottis, or through the cribriform plate of the ethmoid into the brain, producing meningitis. It may produce middle ear disease and infect the lateral sinus, meningitis or abscess of the brain following.

Classification.—Erysipelas has been classified by writers generally into (1) simple or cutaneous, (2) cellulo-cutaneous or phlegmonous, and (3) cellular, which form is similar to acute diffuse cellulitis. Erysipelas is sometimes accompanied by pus formation, but not very often. This rarely, if ever, happens in the simple variety.

Signs and Symptoms.—(A) Local and (B) General.

Local Symptoms—Inasmuch as the pathology of the disease is that of an effective inflammation, the local symptoms are also similar. The patient complains of a burning or stinging pain, with stiffness of the tissues. The area is a rose-red, which in the majority of cases after a time changes into a dusky hue. The skin has a leathery feel and is hot to the touch. Generally the inflamed area presents sharply defined edges which fade into the healthy skin. These spread irregularly, frequently in the direction of the lymphatics, and in severe cases the edges of the inflamed area are forked. The lymphatic glands in the neighborhood are swollen, turgid, and painful. The inflammation may spread now in this direction, now in that, subside here and arise at another point. This previously has been looked upon as one of the whims of the disease, it choosing an erratic course, but this is explained by bony or muscular lesions. The inflamed area may be slightly or considerably raised above the surrounding tissues. If the inflammation is severe and exists about the eye, scrotum, or other location where there is an abundance of loose connective tissue, edema may be a marked symptom.

General Symptoms.—Previous malaise is followed by a distinct chill and a rapid rise in temperature. This chill generally precedes the inflammation from twelve to twenty-four hours. The temperature is high, according to the severity of the attack. In some cases it may be 103 degrees F. and in others 105 degrees F. At first there is more or less loss of appetite, the secretions are generally affected, and as the disease becomes more severe, there may be constipation. The urine is less in amount and highly-colored, tongue coated, breath foul, together with more or less muscular soreness and weakness. In debilitated states where the infection is rapid and the disease becomes progressively worse, the patient may enter a typhoid state, attended with high fever, albuminuria, and delirium. The pulse is generally very rapid and often

in mild cases of facial erysipelas the pulse may be 120 or 130, with but a slight rise of temperature.

Varieties.—

1. Migratory or wandering erysipelas is a form where it spreads widely over the body.

2. Bullous erysipelas is a form where the inflamed area is covered with blebs or blisters.

3. Metastatic erysipelas is a form where it leaves one part of the body and appears at another or appears on more than one place simultaneously.

4. Erythematous erysipelas is a mild form of cutaneous erysipelas where a red blush spreads over a certain area.

5. Erysipelas neonatorum is a term applied to erysipelas from an unhealed navel in the new-born.

6. Typhoid erysipelas is a form arising in adynamic conditions in alcoholics and diabetics and is attended by grave symptoms.

7. Edematous erysipelas where it is accompanied by marked edema of the skin. Sometimes the edema may be enormous.

8. Phlegmonous erysipelas is a variety where pus formation occurs.

9. Mucous erysipelas, a form which affects the mucous membranes.

10. Venous erysipelas is a term applied where there is marked venous congestion.

11. Lymphatic erysipelas is a term applied to certain cases where the inflammation is mostly confined apparently to the lymphatic channels, showing red lines in various directions.

Clinical Course.—The clinical course of the disease will depend upon the tissues affected. In simple erysipelas the inflamed area desquamates after the disease subsides. The disease may subside abruptly, which may be explained by the fact that the obstruction has been overcome and the circulation freed. The termination of simple erysipelas is generally favorable, as it readily responds to treatment. The parts may be weak for a long time after the disease subsides. In phlegmonous erysipelas, which is accompanied by abscess formation, the affected area is generally boggy and edematous and the redness is changed to a dark purple. Many times blebs appear filled with blood stained serum. The swelling is brawny. Just before pus formation happens, secondary chills occur. Sometimes instead of abscess formation there will be a sloughing of a patch of the tissues, leaving a ragged, ugly, and unhealthy sore. Often upon opening the abscess, the tissues, after the pus is evacuated, will present a white, stringy appearance. Repeated abscess formation may happen. Certain other diseases may set up, such as broncho-pneumonia, septicemia, pyemia, etc., when death generally follows. The severer forms of erysipelas are most fatal in case of chronic kidney disease. Phlegmonous erysipelas may often cause destruction of bone. In cellular erysipelas or diffuse cellulitis, the disease spreads through the planes of connective tis-

sue around the muscles and blood-vessels and may be attended by sphacelus or gangrene of a considerable area. The prognosis in these cases is not favorable.

Treatment.—Erysipelas is wrongly divided into idiopathic and traumatic by most authors. Trauma is responsible for all cases of erysipelas. It matters not whether the injury be external or some interference to the blood flow leading to such an amount of stasis as to deteriorate the resisting power of the organism, the result is the same. There must be some injury producing the conditions favorable for the growth of the germ. We know there are many organisms daily taken into the body which are capable of producing disease, but they are destroyed by agencies within, so that any cause which leads to the obstruction of the circulation through a part, the condition is then existing which favors the multiplication of the organisms, hence disease. In case of erysipelas the favorite site is the face, beginning at the upper part of the nose. It is usually found that some obstruction to the facial vein exists, e. g., at its junction with the jugular. Relief of this obstruction at once removes the condition upon which depends the possibility of the disorder continuing. In this case nature has cured the patient just as soon as given the power to act. The osteopath must be sure that the venous channels are free from obstruction and endeavor to flush the arterial blood to that part, as healthy blood is the greatest germicide. It must be remembered that while we handle a case of erysipelas with perfect immunity to ourselves, we may readily carry the organisms on our hands or clothing; it therefore behooves all who attend such cases to be scrupulously clean, especially so the one who does surgical and obstetrical work. Our experience with erysipelas has been sufficient to satisfy ourselves that all cases are handled successfully by osteopathic treatment. I do not at the present time recall a case in which we were not able to give relief in a very short time, and in most cases immediately. The treatment of such cases of course must be governed according to the location of the disease, as there is nothing to go by, and each case must be an individual one. If it is erysipelas around the face it is a facial disturbance, and if some other location it is a disturbance at that point. Erysipelas is nothing more than the blood being held in a place until it decomposes and it is nature's effort to dispose of it that causes the spread. It is a condition of a low grade of life coming immediately upon death of some structure. I have seen cases of chronic erysipelas, that have been of as long standing as seven or eight years, relieved by setting a partially dislocated angle of the jaw. I have seen cases of erysipelas in the leg caused by an interference at the saphenous opening or a twist of the hip which caused contraction of some of the muscles at that point. On some occasions the limb may be swollen to twice its natural size, when after the first treatment it will be reduced to almost normal within twenty-four hours. Osteopathic treatment should cure all cases, and if not, it is on account of the in-

ability of the practitioner in locating the cause. Great stress should be placed on the examination, and if the cause is found there is no reason why the effect cannot be relieved. Pulling teeth is a common cause of dislocating the jaw. Inasmuch as effect follows cause within the system, when the cause is removed the effect disappears, therefore it is the duty of the physician to locate and remove the obstruction. Abscess formation demands evacuation of the pus and the enforcement of rigid asepsis.

Tetanus.

Tetanus is a toxemia accompanied by more or less tonic spasm of the voluntary muscles, beginning in the muscles of mastication and gradually extending into the muscles of the back and extremities, finally involving nearly the entire muscular system. These more or less tonic spasms are attended with clonic exacerbations. The toxemia arises from the infection of a wound by the bacillus tetani (Nicolaier). The disease is much more common in hot climates and among the negro race. It is said that in Jamaica one-fourth of the new born negroes succumb to tetanus. The disease is likewise more common in men than in women, also in military than in civil practice. The germ produces the most exquisitely toxic substance known. The toxin circulating through the body seems to have an affinity for the nerve tissues. It produces marked congestion and inflammation of the gray matter of the spinal cord. The germ is found extensively throughout nature, especially is it found in dust, garden earth, manure and about stables. It is more common in some kinds of earth than others and in some countries than in others. In the islands of the New Hebrides the natives poison their arrows by dipping them in clay containing large numbers of tetanus bacilli. The wound in which infection takes place may be small or large, may vary from a pin scratch to a capital operation. It may happen at the stump of the umbilical cord in the new born child. It may arise from abrasions of the intestines, as the germ is frequently found in the contents of the intestines of animals. The so-called idiopathic tetanus likely arises from infection of a small wound in the mucous membrane of the intestines. Tetanus infection is especially common after lacerated or punctured wounds and burns. It has been observed that infection is more common when there is suppuration. This has been explained by the fact that the micro-organisms of suppuration use up the oxygen and as the tetanus bacillus is a saprophyte, it makes the conditions for its growth more favorable. Tetanus may be inoculated from animal to animal or from animal to man. Deaths have occurred in persons who have sustained small wounds in holding an autopsy on an animal which died of tetanus. Exposure to cold and sudden changes in temperature seem to predispose to tetanus. This observation may have been made because of the fact that the premonitory symptom of the disease is generally that of stiffness of the muscles, which the patient often attributes to cold or exposure. It has

been advocated that since the germ does not circulate within the body and lies in the tissues adjacent to the wound, that to remove the tissues would be a successful way to get rid of the poison. This has led to the observation that the poison is in the nature of a ferment and after the symptoms of the disease have appeared, if all the germs were removed, death would follow just as quickly. The poison, because it is of the nature of a ferment, sets up such destructive changes in the tissues that death results. Before the days of asepsis and antisepsis, tetanus caused the death of many patients undergoing surgical operations. It is said that a famous surgeon lost ten successive cases by lock-jaw following major operations, when he accidentally discovered his instruments were the source of infection, and having boiled these he lost no more cases. Illustrating how readily this disease may be transmitted from animal to man, the terrible, unfortunate, and fatal experience of the city of St. Louis, Mo., in the manufacture of the diphtheritic antitoxin shows how, by negligence, the poison could be dispensed with the diphtheritic antitoxin and injected into the diphtheria cases, producing death by tetanus. More than a dozen deaths resulted from the injection of the infected diphtheritic serum.

Pathology.—The pathology of the disease seems to be that of a toxemia, as proved in the cases of death happening as before mentioned in St. Louis. The germ is not necessary to the production of the disease, but the toxin only may be injected into the system and all the disease symptoms produced. The germ, if it gets into the tissues at all, stays in the margins of the wound and is more virulent when associated with the common bacillus of the colon and with the pus micro-organisms. The germ is found about horses, in horse stables, in manure, and in decomposing substances, hence wounds by a rusty nail or cut sustained in such localities should be carefully cleansed with an antiseptic solution. The opinion held by the laity that the disease is caused by pain is erroneous. The disease only happens after infection by the above named germ. The disease may be simulated by muscular contractions from other causes and these may be thought to be tetanus, but are not. The poison is eliminated, to a considerable extent, by the urine. The period of incubation of the disease is usually about five days, but varies from twenty-four hours to two or three weeks, and in some cases even longer.

Symptoms.—In the beginning the patient believes he has caught cold and has stiffness of the muscles. This stiffness is most pronounced in the muscles of mastication. The patient is unable to open his mouth widely and complains of a soreness in his throat and of the muscles of his neck. Acute tetanus comes on within ten days, the usual period being from three to five days. The muscles of deglutition and of the back, arms, legs, and abdomen become at first stiff and are then thrown into a tonic spasm. The part of the body upon which the wound occurs also shows stiffness and tonic spasm. This spasm finally extends to

the facial muscles and causes a spasm of the risorius (Santorini) muscle, the corners of the mouth are pulled up and the patient's face presents a horrible grinning expression (risus sardonicus). Often the contractions of the muscles of the back are sufficiently strong that the patient will lie upon his head and heels, the spine being markedly curved by the contraction of the erector spinae mass (opisthotonos). Sometimes the contraction is most manifest in the muscles of the side of the body and chest, when the person is turned to one side (pleurothotonos), while if the anterior muscles are affected the body and head will be drawn forward between the legs (emprosthotonos). The spasms are exaggerated by external irritation. The creaking of a door or jarring of the bed upon which the patient is lying will cause exacerbation of the spasms. The contractions of the muscles of the jaw may be severe enough to produce fracture, the teeth may be broken off and where the muscular spasm affects the upper extremities the finger nails may be buried in the palm. The mouth is sometimes covered with bloody froth due to the fact that the person has bitten off a piece of his tongue. The face expresses terrible suffering. The person is conscious until the last. The muscles of respiration are frequently affected, causing dyspnea. Sometimes the muscles of the glottis are affected, causing obstruction to the ingress and egress of air. While an interne in a metropolitan hospital the writer saw a prominent surgeon do a tracheotomy "in an unrecognized case of tetanus" to relieve strangulation because of spasm of the muscles of the larynx. Sometimes the person suffers from an agonizing girdle pain due to the implication of the diaphragm. The patient is severely constipated during the disease because of the contraction of the sphincters. Swallowing is almost impossible, and talking is difficult. The temperature may be normal, but is generally very high. Cases are reported where the temperature has attained a height of 111 degrees F. The person suffers from insomnia because of the muscular spasms. Death is due to exhaustion and narcosis from carbonic acid poisoning, because of the spasms of the respiratory muscles.

Varieties.—Clinically there are several forms of the disease recognized, viz.:

1. Idiopathic tetanus, described by old writers, is now known to arise from wounds.

2. Tetanus neonatorum occurs in new-born infants from the infected stump of the umbilical cord.

3. Puerperal tetanus from infection of a woman at the lying-in period.

4. Cephalic tetanus, resulting from wounds in the head and accompanied by facial paralysis.

5. Acute tetanus comes on early and is attended by great severity of the symptoms.

6. Chronic tetanus comes on late and successively involves different parts of the body and may extend over a long period of time.

The mortality in all forms of tetanus is about 50 per cent.; in the acute form 80 to 90 per cent. and in the chronic form about 20 per cent.

Diagnosis.—The diagnosis of tetanus is apparently easy. It must be differentiated from strychnin poisoning, hydrophobia, and hysteria. Strychnin poisoning begins with exhilaration and restlessness. The senses are for a time sharpened. The muscular symptoms develop rapidly and generally commence in the extremities. Sometimes it affects the whole body simultaneously, especially if the dose is large. The jaw is the last part of the body to be affected. If the convulsions are very severe the jaw may be set, but after the convulsion it drops. In strychnia there is muscular relaxation between convulsions, the patient is excited and sweats. If there is recovery the convulsions become less frequent and less severe. Consciousness is preserved during the convulsions. "The slightest breath of air" will produce a convulsion. The patient may cry out with pain, but his cries are only momentary and express fear and apprehension of the spasm. The eyes are stretched and wide-open, the legs extended and the feet turned out.

In hysteria there is often a history of globus hystericus. Muscular rigidity begins in the neck and spreads over the body. The patient generally persists in opisthotonos and muscular rigidity between the convulsions. Consciousness is usually lost and the eyes are closed. Crying spells often alternate the contractions. There is often a history of a neurosis in hysterical spasms. There may be an immense quantity of urine excreted, or urination may be frequent or suppressed.

In tetanus the disease begins with pain, stiffness of the jaw, produced not from pain (as tetany may be), but because of the toxemia. This stiffness gradually extends to the muscles of the back, thorax, and the lower extremities. It may affect the facial muscles and muscles of the upper extremities. The muscles of the neck and back become hard and rigid like iron, at no time relaxing. These tonic contractions are exacerbated by certain clonic spasms; drafts of air, loud noises, light, shaking of the bed, swallowing fluids, visceral actions, etc., bring on the spasms. In hysteria the spasms come on without cause, and sometimes are associated with the choice of the patient.

Treatment.—The treatment of tetanus consists of preventive and curative.

The preventive treatment is careful antisepsis. Aseptic and antiseptic methods in surgical operations will eliminate this complication in operative procedures. As soon as the disease appears the wound should be cleansed with 1:500 solution of bichloride of mercury, the patient kept in a dark, well ventilated room and should have absolute quietude, not even being exposed to drafts of air or rays of light. If the urine is retained it should be withdrawn by a catheter. If the bowels refuse to move, enemas should be given of soap-suds or castor oil.

After the bowel is cleaned out, the patient being unable to swallow, predigested food should be injected into the rectum. The patient should be fed regularly and supported, every effort being made to prevent a recurrence of spasms. Bromide of potassium in gram doses every three to six hours has been advised, but the writer has failed to observe where the administration of this drug was attended by favorable results. Other drugs, such as the application and use of alcohol, fomentations of tobacco, anesthetics, etc., have been used. So far there seems to be no remedy for the cure of tetanus. It remains to be proven whether an antitoxin can be developed which will effect a cure. The antitoxin serum of Tizzoni is said to be little short of useless. In chronic cases the antitoxin may be of value. Some recommend hypodermic injections of iodoform, three to five grains, three times a day. This treatment is valueless. If death does not occur before the ninth day the patient may be said to have a fair chance of recovering. Acute tetanus generally kills before that time. Osteopathic treatment consists in securing muscular relaxation and relieving the spasms whenever they appear.

Hydrophobia.

Hydrophobia is an acute specific toxemia, most common in the dog, wolf, cat, and skunk. It is said by some to have occasionally occurred in poultry. It may be transmitted to horses, cattle, and other animals, and often to man. The saliva of the affected animal seems to be the vehicle by which the poison is transmitted, consequently if the bite is through clothing the disease is less likely to follow than when the injury is on some exposed part of the body. No micro-organism has ever yet been discovered to which this disease may be attributed. The peculiarities of the affection leave little or no doubt in the minds of bacteriologists that one exists, and it is thought if there is a specific micro-organism that it is present in the saliva. It is believed the micro-organism flourishes in the tissues about the wound and that its growth and development result in the production of a toxin which affects the central nervous system. The masses of gray matter in the medulla, cerebral hemispheres, and the pia mater are markedly congested, causing the peculiar symptoms of the disease. The varying period of incubation has caused serious doubts to arise in the minds of many physicians as to whether the disease, *rabies* or *lyssa*, as it is sometimes called, actually exists. The period of incubation varies from a few days to twelve months. The average duration is said to be six weeks. Only about 14 per cent. of the bites of supposedly-rabid dogs result in the production of the disease in man. This is perhaps due to the fact that the bite very often takes place through clothing. It is said that bites on exposed parts are productive of the disease in 60 to 80 per cent. of the cases. Inasmuch as nothing can be done in the way of treatment, it is necessary to recognize the disease in the animal and prevent infection. Hydrophobia is not so common in this country as it

is in Europe. In central Russia, where there are many wolves, the disease is quite common. The animal when affected begins to droop, shuns the light and is restless. The disease manifests itself in two forms, one a furious form, where there is marked frenzy and madness. The symptoms after the preliminary drooping condition are alarmingly dangerous. The animal is insensible to pain and its taste is perverted so that it eats sticks, hay, and any objects it meets. Oftentimes on autopsy, if the stomach shows such foreign bodies or objects, it is safe to make a diagnosis of hydrophobia. There is a profuse secretion of ropy, sometimes frothy, mucus. Soon there is paralysis of deglutition, spasms of the muscles of the larynx and pharynx and the bark is changed. Respiration is rapid and the pupils dilated. The animal trembles and runs about wildly, madly biting everything with which it comes in contact.

The other is a paralytic form where the subject is quiet and the lower jaw becomes paralyzed early and drops down and the tongue hangs out of the mouth. If the animal is "suspicious" it should be kept under surveillance. If the animal has bitten another animal or a person, they should be kept under surveillance until it is determined whether they have the disease. If they have, the animal should be killed at once.

The symptoms in man are first respiratory. There is rapid respiration and more or less halting speech. The person becomes melancholic and anxious and shows great despair. Deglutition is interfered with because of reflex spasms. The word "Hydrophobia" indicates that the subject fears water, but this is not true. Any irritation of the throat will set up a reflex spasm of the pharynx and larynx, causing more or less suffocation. There is great palpitation of the heart and sometimes a breath of air will precipitate a paroxysm. The paroxysms are often furious, the delirium wild and muttering, and during the spasms of the muscles of the larynx the voice is hoarse and unnatural and ofttimes somewhat resembles the bark of an animal. There is great muscular tremor, followed by paralysis and death. The medulla and hemispheres of the brain, as before mentioned, seem to be the parts affected, together with certain areas of gray matter in the spinal cord. Hyperemia seems to take place, largely in the adventitious tissues of the nervous system. There are very often hallucinations during the disease. In the paralytic form the person has preliminary mental anxiety, and great depression and despair. The muscles of mastication become paralyzed, the lower jaw drops, the tongue hangs out of the mouth and the person looks haggard and wild. Paralytic symptoms supervene. The wound generally heals and the person may have forgotten about it, but at the time when the disease appears the scar becomes inflamed and congested.

Treatment.—No drugs seem to have any effect upon the disease, hence when the wound is made it should at once be relieved of infec-

tion. This can best be done, first, by thorough and exhaustive suction to remove the virus; second, cupping; third, the wound should be enlarged and allowed to bleed freely. Lastly, it should be washed out with an antiseptic solution or cauterized with carbolic acid. If the wound has not been immediately treated and it is believed that the animal is mad, emulsions should be made of the central nervous system of the animal and this injected into rabbits to determine whether or not the animal was the subject of hydrophobia. This will require three or four weeks' time, so it is essential to determine, if possible, whether or not the animal has hydrophobia without such experiment, since it delays treatment. The best treatment seems to be that administered by the Pasteur institutes, which is done by means of injecting within the tissues of an animal attenuated virus until the subject becomes immune, then emulsions are made from the spinal cord of this immune animal and this is injected into the subject thought to be infected. The treatment is said to be successful. Mad-stones, which have efficacy according to the beliefs in the minds of people, are of course one of the monstrous fallacious fancies handed down from generation to generation. The disease is always fatal when not treated.

Malignant Pustule.

Malignant pustule is sometimes called "Wool sorter's disease," inasmuch as it is generally contracted by the handling of wool or hides from infected sheep. The cause of the disease is the anthrax bacillus. The disease is not so common in this country as it is abroad. The incubation period appears to be two or three days. The disease generally appears on the face, hands, or arms and is first manifest by a little papule, after which follows a small vesicle. This enlarges and a mass of the tissues dies. The papule is indurated and inflamed, but there is no pain. Necrosis is manifest by the fact that a small patch turns black and sloughs out, leaving a ragged hole. Sometimes where there are several points of infection it may resemble a bad carbuncle. Sometimes the infection is pretty general on the body and may extend into the viscera, when death will result. The anthrax bacillus is extremely virulent and infectious, hence should be handled with great care. Where the case is seen early the prognosis is generally favorable.

Treatment.—The treatment is first local, by cautery. The entire sore should be burned out by means of a thermal cautery or by means of fuming nitric acid or carbolic acid and then the part treated in an antiseptic manner. The general treatment consists of cleanliness and support. After the necrosed area sloughs away the ulcer should be washed out twice daily with an antiseptic solution, 1:1000 bichloride of mercury, and boracic acid dusted over the sore. Then several layers of antiseptic gauze and cotton should be applied and held firmly by suitable bandage.

Actinomycosis.

This disease is rare in man. It is most common in cattle, where it is called "lumpy jaw" or "swelled head." The cause of the disease is the ray fungus. This consists of long, irregular, club-shaped prolongations which radiate from a common center. The infection is acquired by man from some of the lower animals. It is generally accompanied by pus formation and the pus is peculiar in that it contains yellowish gritty particles. The disease is more common on the face and neck and may involve the jaw, the pharynx and even the larynx, producing multiple abscess formation. It may also involve the bones and glands. The *diagnosis* can be made by the history of the case, by small yellow particles in the pus, and lastly by the microscope. The *treatment* is extirpation of the infected area.

Tuberculosis.

Tuberculosis is an infective disorder, characterized by its slow course and the formation of granulomatous masses. The cause of the disease is the bacillus tuberculosis (Koch), which varies in size from 1.5 to 3.5 mikrons long, and from .2 to .5 mikron broad. The rod-shaped organisms are very often undulated or beaded, lying parallel or with the ends of the bacilli closely approximated. The tubercle bacillus will affect any of the tissues of the body, and in fact almost all warm blooded animals. Cold blooded animals are less susceptible, but they may often contract it. That it is the cause of most of the processes called tubercular, is a fact beyond dispute, but there are many conditions which are called tubercular, simply because of the chronicity of the course and because the disease refuses to abate.

The *source of infection* to man lies in the dust particles in the air, in the food supply, and in the water. The germ resists drying, hence it may readily be carried through the air, where it gets into clothing, when it may infect the skin, or it may be breathed in, picked up by some leukocyte and carried to other parts of the body, where it may be lodged and set up the disease. The germ is readily found on articles of furniture, in carpets, in the dust, and on the walls of the apartments of a tubercular patient. Its infection is rather mild, but after infection takes place it is extremely fatal.

Pathology.—The characteristic lesions caused by the tubercle bacillus are simply small nodules or tubercles. These small nodules have been variously described, but consist for the most part of a central area in which there is a giant cell, containing one or more of the germs, around which there is an area of what are termed "epitheloid" cells, which seem to be derivatives of the resident connective tissue cells. These giant cells are said by some to be the result of fusion together of more or less wounded or destroyed connective-tissue cells; by others that their vitality is largely destroyed by the presence of the tubercle bacillus and the cell is unable to divide, that the nucleus divides without the cell dividing, somewhat resembling an endogenous form of cell

division. Around this there is a peripheral zone of leukocytes or round-cells. This forms a mass about the size of a millet seed or mustard seed. Several of these tubercles may be near each other and fuse together, making a larger mass. These tubercles are avascular, and the cells crowding in closely, more or less cut off the nutrition to the central area, when the mass dies and undergoes coagulation necrosis. Sometimes pus is formed, sometimes not. Even if pus is formed the fluids may be absorbed and the residuum undergoes caseation or may become calcified, forming a hard calcareous mass which may lie latent in the body for many years. It may undergo caseation with the tubercle still present, the mass being surrounded by an inflammatory area, the leukocytes having built up a solid wall or cordon, preventing the bacillus from getting into the fluids of the body. This may exist for years, finally, because the body becomes generally debilitated, the tissues inactive, and the resistance diminished, the germ takes on renewed activity and the patient develops acute tuberculosis. As before mentioned, the case is generally chronic, but it may run a rapid course. The writer once treated a man who had taken a large dose of laudanum because of a love affair. He recovered fairly well from the opium poisoning, but this seemed to have so weakened the system that it made him a suitable prey for the tubercle bacilli which were present in quiescent Pott's disease of the spine. This disease had been quiet for a number of years and the man enjoyed good health and had worked at hard labor. After recovering from the opium poisoning he contracted tuberculosis and died on the eleventh day, after taking the opium, of acute miliary tuberculosis. The germs, as before stated, lie in the center of the tubercle and because of the resistance of the surrounding tissues are kept imprisoned there. Some venturesome leukocyte attacks one of the germs and carries it away into the lymph spaces, only to fall a prey to its prisoner. Then the bacillus is transported by the lymph into the general circulation and perhaps into the distant tissues. The edge of the tubercular zone, or the zone of lymphoid cells, presents a characteristic inflammatory reaction. As before indicated, the tubercle bacillus may be walled up within the nodular mass and may remain there quiescent for a number of years. In some cases the germs may be entirely destroyed and almost all evidence of the tubercular inflammation removed by the absorbents. It is peculiar of tuberculosis that there is little tendency to recovery; that the cells developed fall short of maturity.

Changes in the Tubercle.—The changes following the deposit of the tubercle in the tissues are:—(1) Absorption of the bacillus and its consequent destruction, wherein there is no appreciable pathological change. (2) Caseation. (3) Fibrosis (Encapsulation). (4) Calcification. (5) Pus formation.

In caseation the tissues undergo coagulation necrosis. True pus is not formed, or if it is formed the liquid elements are absorbed and the

mass undergoes cheesy degeneration and forms a cheesy mass. This may later become calcified, or the epitheloid cells which are about the dead mass may become converted into spindle-shaped cells of fibrous tissue, when a hard fibrous wall is formed about the tubercle bacilli. This is the condition of "fibrosis." Calcareous materials may be deposited in this fibrous tissue or the cheesy mass may be converted into a calcareous mass by the deposit of lime salts, when it is said to undergo calcification. Now and then in tuberculosis subjects these calcareous masses or gritty particles may be expectorated. A substance quite akin to pus may be formed, but true or characteristic pus is rarely, if ever, formed unless there is infection by means of the pyogenic micro-organisms in addition to the tubercle bacillus. This sometimes happens. The pus in tuberculosis is more like that of a chronic abscess, and in fact they so closely resemble each other that some writers have held that all chronic abscesses are tubercular, which opinion is unwarranted.

Causes.—(A) Predisposing. (B) Exciting.

The *predisposing causes* of tuberculosis are (1) heredity. By heredity is meant, not the direct transmission of the disease from the mother or father to the child, as may happen in syphilis, but a tendency towards the disease is inherited so that children of consumptive parents are more prone to the disease than children born of healthy parents.

(2) Strumous diathesis, which means a condition in which there is a general tendency to the enlargement of the lymphatics and the production of adenoid tissue.

(3) Bad hygienic surroundings. The disease happens in persons who have not had sufficient out-door exercise and who breathe air of poorly-ventilated rooms. The tissues become devitalized and weakened and permit the bacillus to gain a foot-hold. More important than all these predisposing causes, and perhaps the actual cause in chronic conditions where the tubercle bacillus can not be found, may be stated *Osteopathic Lesions.*

(4) Osteopathic lesions. In all forms of infection osteopathic lesions are of the utmost importance. That a part may not receive its proper blood supply and proper nerve supply is a fact too well known to be disputed It is generally known that disuse of a part causes a weakening; furthermore, that when a bone assumes an abnormal position, which it frequently does, it interferes with the blood supply to a certain area, also presses upon the nerves so it interferes with the trophic influence. Other things being equal, the point to which these compressed nerves and arteries are distributed would be weakest. Now the fact that such lesions make tubercular infection possible can not be disputed. Furthermore, the irritation set up by the abnormal condition of the bony framework of the body brings about muscular contraction. This interferes markedly with the circulation, rendering weaker the parts to which the compressed arteries are distributed. Collateral circulation in some cases may be thoroughly established, but in other cases this may be

impossible, when then the part receives a small injury, inadequate to produce the disease under ordinary circumstances, yet in this weakened state inflammations are set up and a condition of the tissues suitable for the development of the germs is produced. This injury, and nearly always a history of one can be obtained, is of more importance than has generally been considered, for most likely it very often results in conditions of subluxation and contractions of muscles, fascia, ligaments, etc., interfering with the normal blood and nerve supply to the part, so that the lesions found may be at the joint affected or there may be spinal lesion affecting the structures upon the side of the body below. Very often the treatment of this spinal lesion will be attended by a cessation of the disease symptoms in some distant part. This happens when the spinal lesion has been the chief predisposing cause of the disease. The importance of this must not be under-estimated. Under all circumstances an eager and thorough search should be made for the above named causes.

The *exciting cause* is the Bacillus tuberculosis. It enters the body in many ways, through the air, food or drink, or may enter through the skin. They become disseminated in the following manner: (1) In conditions of lupus and anatomical tuberculosis the disease seems to be confined to one spot and spreads only by the extension of the inflammation of the skin, not affecting the connective tissues and muscles and lymphatic glands beyond to any great extent.

(2) They may spread to the lymphatic glands, where they excite inflammation.

(3) They may enter the lymphatic or hemic circulation and lodge in some distant organ where the characteristic tubercle is found. The tubercle bacillus seems to have an affinity for serous membranes. The organs most prone to be affected are the lungs. Next in frequency are the testicle, kidney, brain, liver, spleen, adrenals, ovaries, mucous membranes of the larynx and intestines. Bones and joints are affected in the following order of frequency: Hip-joint, knee-joint, joints of the ankle, foot, hand, and elbow, while the shoulder and collar bone are rarely affected; the scapula, ilium, and bodies of the vertebrae may be affected. The skin is affected less frequently than many other tissues. The inflammation is set up by apparently slight causes and is progressive, indolent and chronic in its nature, and has little tendency to recovery.

Tubercular Abscess.

The most important termination of the tubercular process is a cold abscess. It has the characteristics of an ordinary chronic abscess. There is present little inflammation. The symptoms of inflammation may be almost entirely absent. The most characteristic point about the cold abscess is its limiting membrane. This was formerly called a pyogenic membrane, as was the membrane lining an ordinary abscess

cavity. This limiting membrane is a defence-wall, built up by the tissues to prevent absorption of micro-organisms and the products of the decomposition and disorganization of the tissues. Strange to say, the tubercle bacilli are rarely, if ever, found in the contents of a cold abscess. It is said they exist in the margins of the limiting membrane. As a general rule the abscess causes but little trouble until it ruptures, when pyogenic infection follows, causing a severe systemic reaction. The abscess may gravitate and open at a distant point. It may exist for months, the fluid contents being finally absorbed. The solid residuum afterwards undergoes cheesy or calcareous degeneration. The common forms of these abscesses are gravitation abscess, psoas abscess, retropharyngeal abscess, lumbar abscess, etc., which will be discussed elsewhere.

Tubercular Gummata.

Tuberculosis is an infectious granulomatous disease similar to syphilis, leprosy, and glanders, so that the formation of gumma, as happens in these other diseases, may happen in tuberculosis. Gumma consists of a fusing together of tubercles which have undergone degeneration, together with a large mass of ill-formed and ill-developed granulation tissue cells. It consists of a mass of fungus granulations which readily break down and ulcerate. They happen in the cranial and peritoneal cavities least often, but are common in bones and joints. The gumma consists of a mass of condensed tissues, often uninfected. It has a poor blood supply and a tendency to break down and ulcerate.

Scrofula.

Scrofula is not a disease, but a condition of the system whereby the tissues become an inviting host to the tubercle bacillus. It is generally of congenital origin, one or the other of the parents being tubercular. The lymphatic glands are prone to enlarge and suppurate. Joints and bones are liable to be affected. Often there is a chronic catarrhal inflammation of the mucous membranes or chronic eye disease, granulated lids, etc., eczema of the scalp or face, all of which are evidences of bad health, malnutrition, etc. Generally the patient is a victim of unsanitary surroundings or poorly ventilated quarters.

Tuberculosis of Various Regions.

Skin.—(1) *Lupus* is tuberculosis of the skin. It usually happens upon the face, beginning before the age of twenty-five. The nose seems to be its choice point of origin. Three varieties are described. (a) *Lupus Vulgaris* is the most common form and appears as pink nodules, which ulcerate after a time and then cicatrize. This process of forming nodules, ulceration and cicatrization keeps up continuously, perhaps disappearing here, but appearing with renewed activity at another point. (b) *Lupus exedens* is characterized by severe ulceration. (c) *Lupus*

hypertrophicus is a form in which very large nodules appear. Lupus generally begins as a pimple, or group of pimples, which finally break down and ulcerate, leaving a soft irregular, not shelving, ulcer, which discharges a yellowish colored fluid. The bottom of the ulcer looks unhealthy and the skin about the ulcer is more or less inflamed. It is said the disease is painless, but sometimes it is extremely painful. It is not unusual that the ulcerating process may entirely heal up, but it finally recurs. It will heal up at one point and become more active at another, always destroying tissues over some part of the area. Cicatrization may have occurred, which will draw the surrounding tissues, often producing deformity. The process may be quite destructive, similar to a rodent ulcer, and produce hideous deformity. Scars produced by lupus are firm and hard, but yet break down easily. One of the characteristics of lupus is that the tuberculous secretions, drying, form yellowish crusts, often more or less scaly. Clinically it may be differentiated from a rodent ulcer, inasmuch as the rodent ulcer presents an everted appearance and is deep, while in the ulcer numerous vessels are visible. It does not spontaneously heal and its base and edges are hard and fibrous.

Treatment.—The best treatment for lupus is a free removal of the diseased tissues with a knife, curette, or cautery. If possible, the entire mass should be removed and the wound be made to heal by first intention. If the wound is allowed to heal by second intention, it is better that the cautery or curette be used. Where the curette is used, subsequent application of caustic, such as nitrate of silver or chloride of zinc (5 to 10 per cent.), or the electric cautery, may be made. After the cauterizing of the lupus the wound should be treated with an ointment of aristol. Concentrated electric or sunlight from which the heat rays have been removed seem to have given satisfactory results in some cases, but the treatment requires a long time, inasmuch as but a limited area can be exposed at a sitting. The result of the exposure to light is a sloughing out of the lupoid area.

(2) Anatomical Tubercle.—This lesion of the skin happens in surgeons or in operators holding post-mortems where infection takes place in wounds by means of tuberculous material. The anatomical tubercle is a red inflamed mass, often pustulating.

(3) Tubercular gummata.—Tubercular gummata of the skin are characterized by edematous inflammation and ulceration. The ulcers have grayish bases, show no tendency to heal and have inverted edges. Sometimes there is a chronic thickening of the skin, called sclero-derma.

Subcutaneous Connective Tissues.—In subcutaneous connective tissues the tubercular process is usually manifest in the form of cold abscess. It may be manifest by gummata and tubercular nodules.

Lung.—Pulmonary tuberculosis does not belong to the province of surgery and is best treated by well known osteopathic methods.

Alimentary Canal.—Tuberculosis of the mouth, pharynx, esophagus, stomach, and intestines is very rare. The germ may pass through the lining membranes of these cavities and set up inflammation in the deeper structures. The adenoid glands found in the mucous membranes of the intestines may become involved.

Peritoneum and Pleura.—Tuberculosis of these membranes becomes surgical only when abscesses are formed.

Bone.—Tuberculosis of bone is common in youth and is always preceded by injury. There exist osteopathic lesions which make the injured bone a point of least resistance. The deposit of the tubercle causes the characteristic inflammation, attended with softening of the bone and even of the production of an abscess. This calls for surgical intervention. (See necrosis of bone).

Joints.—Tuberculosis of joints is popularly termed "White Swelling" and consists of a chronic inflammation and degeneration of the synovial sac. Children are especially susceptible to the disease. It is brought about by injury and subluxation. The deposit of the tubercle may occur in the end of the bone, in the synovial sac or in the connective tissues just outside of the synovial sac or in the epiphyseal cartilage. Lesions affecting the circulation to the joint are responsible for the disease.

Lymphatic Glands.—Tuberculosis of lymphatic glands is known as "Tubercular Adenitis." The frequency with which enlargement of lymphatic glands occurs in tuberculosis is even popularly recognized. This enlargement is due to the fact that the inflammatory products and the tubercle bacillus are carried back through the lymph stream and lodge in the lymphatic glands. Caseation often occurs. Residual abscess may follow. Tubercular adenitis is more common in the neck and mesenteric glands, but may occur anywhere in the body. It may in some cases become very general. Suppuration arises from mixed infection. While the disease is generally local, it may became a source of infection, general tuberculosis following. It must not be confounded with lymph adenoma, which usually occurs in the lymphatics of the posterior triangles of the neck, whereas cervical lymphadenitis generally occurs in the anterior triangles of the neck. Tubercular glands very often run together and form a large inflamed mass. In every case obstruction to the local circulation may be noted, which is responsible for the inflammation.

Testicle.—Tuberculosis of the testicle is not rare. Generally but one testicle is affected in the beginning, but later both are affected. It is a form of painless epididymitis and orchitis. The tubercular mass many times softens and breaks down, forming an abscess which burrows towards the surface. The layers of the tunica vaginalis, the skin, and subcutaneous tissues become adherent and it may rupture externally. The diagnosis is made purely by the clinical facts presenting. The use of the microscope is of no avail, as the bacilli are not in the dis-

charge. In fact, it is not necessary to make the diagnosis of tuberculosis, for it does not modify the treatment.

Prognosis.—The prognosis varies with the condition of the patient, the structures involved, the extent of the infiltration and the rapidity of the process.

Treatment of Tuberculosis.

(1) Hygienic, dietary, and climatic. (2) Osteopathic. (3) Surgical.

Hygienic, dietary, and climatic treatment are of inestimable value in tuberculosis. The hygienic treatment consists chiefly in an open-air life in pleasant surroundings, etc. The chief dependence of the tuberculous patient seems to be in an appetite satisfied with wholesome and nourishing food. The patient should be instructed, if he has extensive tuberculosis, to eat less in amount and more frequently. The diet should consist of eggs, if they are well borne, from three to six daily, milk in large quantities, good steak, beans, rice, cereals, etc. If the person has lost his appetite, or if he has indigestion, predigested foods should be given, such as beef tea, prepared in the following manner: Place a piece of minced lean beef in a glass fruit jar which is then sealed up and put in a pan of water and gradually heated to boiling. The juice is decanted and the remaining liquid elements pressed from the beef. This juice may be seasoned to taste and is usually well borne and nourishing. Commercial beef tea is usually of not much value. Fruit juices are often well borne, encourage an appetite, and are pleasant.

Climate.—The pine covered hills of northern Georgia, the dry atmosphere of New Mexico, and the altitude of Colorado are all favorable to the health of tuberculosis patients. They encourage deep breathing, secure a better blood supply to the chest and cause the patient to do what he otherwise would not do, take more lung exercise.

The **Osteopathic Treatment** consists in increasing the blood supply to the affected area, adjusting vertebrae, ribs, clavicles, relaxing contracted muscles, etc., that may have excited or are aggravating the diseased conditions. Since our only hope of curing tuberculosis is in increasing the vitality and nutrition of the tissues, osteopathic treatment has this in view when it removes pressure from artery, vein or nerve or when it increases the blood supply to a part by means of stimulating the vasomotor nerves. It has been advocated by enemies of the practice of osteopathy that there is danger in manipulating a tubercular joint or area on account of scattering the germs and causing acute general tuberculosis. Clinical practice of the entire osteopathic profession in the enormous number of these cases treated shows that there is no such danger in this treatment properly applied. It is unnecessary to state here that drugs administered internally are of no value in the treatment of tuberculosis.

The *surgical treatment* consists in extirpating the tuberculous area

when it is accessible. Cold abscesses when opened should be thoroughly cleansed with a solution of bichloride of mercury (1:1000), then the abscess cavity should be scraped out and free drainage established. Iodoform emulsion in glycerin (10 parts iodoform to 90 parts glycerin) may be injected into the cavity, providing the drainage is good, after it has been thoroughly washed out with an antiseptic solution. The tuberculous area should be kept as nearly aseptic as possible and likewise at rest.

Koch's Tuberculin.—The specific treatment devised by Koch has been proven worthless and is no longer used.

Bier's method consists in placing an elastic band around the limb above the tuberculous area and is founded upon the principle of Laennec, that cyanosis was unfavorable to the tuberculous process. The elastic band causes venous congestion. Surgical interference should be advised only as a *dernier* resort, when it is shown that the condition can not be relieved by osteopathic treatment properly applied.

Glanders.

Glanders is an infectious disease produced by the bacillus mallei. It manifests itself in acute and chronic forms. It is classified as one of the infectious granulomatous diseases, because of the granulomatous masses formed in the mucous membranes and in the skin and connective tissues at which points the micro-organisms have obtained entrance, or having gotten into the circulation, have lodged at these points and set up the characteristic pathological changes. The disease is common in the horse, but is rarely seen in man, and then only in laborers about stables. It is contracted by laborers about stables from the fact that the pus is blown into the face or onto the body, from which point it either gets into a small wound in the skin or it effects an entrance through the mucous membranes. In man the disease is characterized by (1) copious, foul, and sanious discharge from the nose, (2) an eruption over the body quite resembling small-pox, and (3) enlargement of the lymphatic glands with formation of nodes, which break down and ulcerate, forming foul ulcers, which discharge a disagreeable pus. The onset of the disease is often announced by a chill. The febrile reaction is of a typhoid type, beginning with a slight elevation of temperature, which gradually rises, and after several days reaches its maximum intensity. The symptoms of the disease are, in addition to the chill and fever, evidences of pleurisy, pneumonia, or diarrhea. These symptoms will vary, depending upon the mucous membranes and the tissues most affected. The symptoms often resemble a septic intoxication like sapremia. Later, after the forming of foul ulcers, the symptoms may be those of septicemia and pyemia because of the rapid infection of the pus micro-organisms which are introduced into the ulcer. Usually death occurs within a week. In the acute form the mortality is from 85 to 90 per cent. In the chronic form it is much less severe and the patient may linger for

several weeks and even months. The disease runs a slow course and repeated abscesses form, which rupture, and the pus is discharged. Finally the patient may wear the disease out or the abscesses may have been opened and the pus discharged, the patient recovering after symptoms of chronic pyemia. Cases have been reported where twenty or more abscesses have been successively opened and the contents removed. The mortality in the chronic form is 50 per cent. In the acute form the pustules form over the face, hands, and arms and exposed parts of the body. The formation of the pustules in the skin is accompanied by edematous swelling so that the features are often horribly distorted. The history of the case and the eruption, together with the lymphatic enlargement and edematous swelling and evidences of pus forming, would be sufficient on which to base the diagnosis. The chronic form quite resembles syphilis, from which the diagnosis can be made by careful inquiry into the history of the case.

Treatment.—The treatment consists of (1) supportive, (2) surgical, and (3) antiseptic. The person should be given concentrated, highly nourishing, and digestible foods, and if necessary stimulants may be administered. Surgical treatment consists in opening the abscess as soon as it appears, removing the limiting membrane and the dead tissues. Rigid antisepsis should be maintained. All the abscesses, where they can be reached, should be drained and washed out with 1:20 solution of carbolic acid or 1:1000 mercuric chloride.

Syphilis.

Syphilis is an infectious, contagious constitutional disease which runs a slow course and affects successively mucous membranes, lymphatic glands, skin, connective tissues, bone, eye, and nervous system. The cause of this disease is unknown, but it is believed to be due to a micro-organism. There are those who believe it to be caused by the absorption of inflammatory products, which seriously damage the general metabolic process. Others believe that the micro-organisms, or its products, are absorbed into the body and these circulating through the fluids bring about the changes characteristic of the affection. Lustgarten's bacillus was thought to have been the cause of the disease, but this has been proven not true, inasmuch as the germ is found in gummatous formations in the tertiary stage, whereas these are not infectious. It is a well known fact that the disease may linger for years within the system, finally breaking out and assuming many peculiar forms. It is hardly likely that the micro-organisms could have existed in the body during this long period. The symptoms of the disease have been explained by the absorption of the inflammatory products, the toxins of which disturb the metabolic process and bring about the production of granulomatous tissue, which is prone to break down and ulcerate. Whatever is the cause of the disease, it seems to come in almost

all instances in a certain way and seems to run the same peculiar chronic or slow course. While the eruption may vary, yet it follows in sequence other symptoms, so that likely, as our bacteriological methods are improved, the cause of the disease will be determined. It is characterized by a period of incubation varying from two to four weeks, usually about twenty days, at which time a local sore appears, which is soon followed by lymphatic enlargement. This local sore is generally located on the genitalia, but may be found on the hands of the accoucheur, or upon the lips, tongue or nipple. Two to three months from the time of inoculation, or from forty to sixty days after the appearance of the primary sore, the skin and mucous membranes are affected. These are secondary manifestations or changes, the chief characteristics of which are that they are *generally symmetrical.* The second stage lasts from two months to two years, depending upon the treatment the case receives, and upon the habits of the patient and his surroundings. In some cases no further changes may be manifest. The disease seems to wear out, or after a few months or a few years, tertiary changes develop. They are usually asymmetrical and attack, besides the superficial tissues, the deeper structures, such as the connective tissues, bone, periosteum, muscles, viscera, liver, lungs, etc. The pathological formations in this stage consist chiefly of gummata. These gummata often lead to suppuration or to fibroid changes, perhaps to necrosis or to contractions of the tissues producing distortions or they may cause paralysis. Fibroid changes sometimes occur in the nervous system; these are manifest in various ways. The tertiary stage may last for life, the person dying of an intercurrent disease, whereas it may terminate fatally or the person may apparently get rid of the ailment after some years. Another peculiar fact about syphilis, which indicates that it is a specific disorder due to a micro-organism, is that it confers immunity to further attacks. *Chancre,* which is the primary sore of syphilis, may be multiple, where two points were infected simultaneously, but if a chancre has appeared at one point, having been thoroughly established, repeated efforts at inoculation at another point on the body have failed. Furthermore, after the chancre has healed and the patient is then the victim of secondary or tertiary syphilis, chancre will not again appear, nor can a person, under any circumstances, be inoculated. The disease is produced by direct contact with a chancre or the virus may linger upon a drinking cup or it may be introduced into the system by means of lymph in vaccination. The location of the chancre, as before mentioned, may be on the fingers, lips, tongue, tonsils, walls of the pharynx, or genitalia. In the female the chancre is usually located on the labia minora. It may be on the walls of the vagina or on the cervix uteri. In the male the chancre is usually found on the prepuce, but may be found upon the glans or situated in the skin back of the glans. It may be located in the meatus urinarius externus or back some little distance along the urethra. The appearances of a chancre are peculiar.

Chancre—Primary Syphilis.—Primary syphilis is the first stage in which there appears a chancre with enlargement of the lymphatic glands. The chancre must not be confounded with venereal ulcer or chancroid. Chancre exists in three forms:

1. Hunterian chancre is a hard, round, elevated, and inflamed mass which has ulcerated on the top. It does not suppurate and has a velvety edge or surface and bleeds easily. Hunter described the ulcerated surface as looking like raw ham. The discharge from the chancre is watery. This is not the most common form of chancre.

2. A hard, red, indurated mass which is situated beneath the epidermis, and from which the epidermis may, or may not, have been peeled off. This seems to be the most common form of chancre.

3. The rarer form is a purplish-red or purple patch situated in the skin, and which is exposed by removing the epidermis. This chancre is neither indurated nor ulcerated. Ulceration in a chancre seems to be brought about by irritation or friction or the presence of filth. A chancre is nearly always single. In most cases it has well defined margins which feel like encapsulated cartilagenous masses. These may be readily picked up between the fingers. The hard base is produced by inflammatory exudates. If the chancre is not properly treated it may exist for months, but the induration usually disappears after the secondary symptoms present themselves.

Chancroid.—A chancroid is a local sore which is very often multiple. It may be single in the beginning, but if allowed to remain for a few days will quickly become multiple. It appears in from one to ten days, never afterwards. The sore begins as a pustule, which ruptures, discharging a fluid which spreads over the surface and causes various other ulcers. The ulcer has thin undermined edges and is sharp-cut, and looks like it is punched out from the skin or mucous membrane. It looks sloughy and has a grayish base. The discharge is offensive. The tissues over which this pus flows will become inoculated. If the first sore was in the vestibule, other sores will be found along down the labia minora and labia majora, over which the discharge has run. It is a soft sore. They do not bleed or cause constitutional symptoms, but are followed (when situated on the genitalia) by inguinal adenitis or bubo. The lymphatic enlargement is on the side corresponding to the side of the genitalia affected. Should the chancroid be in the middle line, lymphatic enlargements may be manifest on both sides. This is unusual.

Herpetic Ulceration.—Herpetic ulceration may follow febrile reaction, but is usually due to an irritation set up by foul discharges or to filth. It first appears as a vesicle or group of vesicles, which rupture, discharging a clear fluid. These vesicles may run together, finally forming an ulcer. These ulcers are superficial, having no tendency to spread and are not indurated. They are, like chancroids, painful. Unless suppuration appears they are not attended by bubo.

Mixed Sore.—A mixed sore is a condition where the subject is infected with chancroidal poisoning and at the same time with syphilitic poisoning. In these cases the sore has the appearance and characteristics of a chancroid, but later along it comes to have a hard indurated base. These sores should always be regarded as "suspicious." In no case should an absolute diagnosis be made by the appearance of the sore, but in all cases they should be treated alike—*cauterized*—and then treated as simple sores. Before the diagnosis of syphilis is made, the attending physician should await the development of secondary symptoms. Instituting treatment before secondary symptoms have developed will in no way benefit the case, for just as soon as the chancre appears, just so soon is syphilis a constitutional disease. Amputation of the chancre, followed by the proper healing of the wound, will in no way affect the course of the disease. Secondary symptoms will appear in due time. Chancre may be mistaken for cancer of the tongue. Chancre of the tongue is brownish red, whereas cancer is bright red. The discharge from the cancer is bloody, from the chancre it is nonpurulent and free from blood. Cancer appears late in life. The lymphatic enlargements in cancer are painful, while those of chancre or syphilis are indolent. At all events, the diagnosis can be made in two or three months.

Syphilitic Phagedena.—This is a condition existing in persons surrounded by filth and debilitated by disease, in diabetics, drinkers, etc. Foul and spreading ulcers may happen coincident with the chancre or afterwards and these are best treated by methods advised for sloughing phagedena.

Relapsing Chancre.—After syphilis has been apparently cured for many years, the scar left by the chancre may become inflamed and enlarged, the chancre apparently returning.

Bubo.—A bubo is the enlargement from inflammation of the lymphatic glands above Poupart's ligament. In syphilis it is generally bilateral and indolent. They may be small or large, usually freely movable underneath the skin and rarely ulcerate. In debilitated subjects the glands may enlarge enormously. In cases of mixed sore the buboes are very often suppurative. Where the chancre appears in the mouth the bubo appears below the jaw. They may remain for many months and finally disappear by absorption or fatty degeneration. After some months there may be general lymphatic involvement. This lymphatic enlargement affects *all* of the lymphatics, but those found in the posterior triangles of the neck and in the epitrochlear space back of the humerus are characteristic of syphilis. In syphilis the bubo consists of a chain of enlarged lymphatic glands, whereas in chancroid the bubo consists of an inflamed mass, seemingly produced by the inflamed glands fusing together. Syphilitic buboes grow slowly and are almost painless and are not red and inflamed. Chancroidal buboes are extremely painful, are red and inflamed and show a tendency to

suppurate. It is maintained by some that a positive diagnosis of syphilis can be made when an indurated sore is followed by bilateral buboes with involvement of other lymphatic glands. I should not advise the diagnosis to be made so early, but would wait until the development of the secondary symptoms.

Secondary Syphilis.—Secondary syphilis consists of certain changes in the skin and mucous membranes with general lymphatic involvement, and in some cases it is said to attack the iris. These secondary signs appear about forty days after the appearance of the primary sore or about two months after inoculation. They may be so slight as to be overlooked or in some cases entirely absent. During the secondary syphilis the disease is very readily transmitted to the offspring through the ovum or spermatozoon, or by contact with the sores.

Skin.—The skin eruptions are various. It is peculiar that the eruption in syphilis may simulate the rash of almost any of the exanthemata. Frequently the onset of the rash is attended by a chill, high fever, and may be scarlatinous. In some cases it may be erythematous, in other cases it may resemble measles, while in still others it may be mistaken for small-pox. The eruption is usually a roseolous rash spreading over the back, chest, and abdomen. It is generally accompanied by a sore throat. The rash seems to be caused by a local congestion, since it fades under pressure. It usually disappears in a short time, but if the rash continues, inflammation of the skin will occur at the points of the rash. Sometimes the epithelium will form scales; these are called *scaly syphilides,* the eruption taking on the appearance of psoriasis. It may manifest itself in a distinctly papular rash, which is called a *papular syphilide.* In other cases, where it is still more severe, little vesicles may form on top of the papules, *vesicular syphilides.* In a certain class of vesicular syphilides, where the process seems to be more severe and there is marked exudation of serum, large bullae are formed; these are called *bullous syphilides* or *syphilitic pemphigus.* In some cases the contents of the vesicles are converted into pus. *pustular syphilides,* or *syphilitic ecthyma,* a condition where the pustules form scabs, which afterwards dry up and fall off, leaving no scar. *Syphilitic rupia* is a condition where marked ulceration takes place underneath the scabs.

Mucous Membrane.—Following the eruptions, ulcers appear upon the mucous membrane of the mouth and throat. They are called mucous patches. The first ulcers are usually symmetrical. They are usually painless and often temporary and superficial. Sometimes the mucous patch presents an appearance of condyloma. Mucous patches may also appear upon the mucous membranes of the genitalia and rectum. Mucous patches are prominent in smokers or people with badly neglected teeth. These patches sometimes affect the larynx, causing hoarseness and even loss of voice. The nasal mucous membranes may be affected so as to produce a discharge and evidence of

catarrh. It is not unusual that mucous patches may occur in the urethra, causing an infectious discharge. It is during this stage that the disease is communicated as the sores are very infectious.

Hair.—The hair falls out, sometimes rapidly and extensively. It may be so widespread as to affect the beard and eye-brows, or it may be limited to the production of bald spots on the scalp. This baldness, which is known as *alopecia,* begins about the time of the appearance of the eruption. The baldness is not permanent, as the hair will again appear. The bald places are not as smooth as in other forms of alopecia and the skin is scaly.

Nails.—The nails may be entirely or partially cast off, due to inflammation of the matrix. The new nail formed is often diseased.

Eyes.—Iritis is the commonest eye trouble in secondary syphilis. It appears about four months after the chancre; in fact, acute iritis developing is said to be a strong symptom of syphilis. It is shown by a pink zone around the sclera and a muddy, reddish iris. The pupil is irregular and there is intense photophobia and pain. The pupil may be hazy. The patient usually recovers from the syphilitic iritis with good vision. The retina may become affected by diffuse retinitis or there may be a choroiditis. The diagnosis of these affections can be made by means of the ophthalmoscope.

Ear.—Rarely temporary impairment of hearing takes place, generally symmetrical. Sometimes it may lead to deafness.

Bones and Joints.—Rarely there may be a periostitis set up, but this is usually a manifestation of tertiary syphilis. Likewise the synovial sacs may be affected, causing more or less synovitis, but these inflammations are more or less transitory and not very painful. No destructive disease either of the bones or joints occurs. Intense headache may appear because of periostitis of the bones of the skull.

Testicle.—Sometimes the epididymis and testis may become inflamed. This is sometimes followed by atrophic cirrhosis, while in others the plastic exudate is absorbed without injury to the organs.

Tertiary Syphilis.—Tertiary syphilis appears after a latent period which follows the secondary syphilis. This latent period varies in length; in fact, the secondary syphilis may exist for from four or five to eighteen months. Tertiary syphilis will appear within six months or two years. There are some cases in which the tertiary symptoms are manifest after a few months, in other cases they are greatly delayed. The tertiary symptoms are announced by chronic inflammation of the various organs and tissues leading to the formation of gummata. These gummata may vary from the size of a pea to that of a walnut and are very intimately blended with the surrounding tissues. These gummatous formations may undergo caseation and break down, producing, when in the submucous tissues, a characteristic ulcer or they may continue for some length of time, disappearing under favorable treatment, or in other cases may leave a hard fibrous mass, contractions

of which seriously interfere with function and produce great deformity. These gummata are formed of granulation tissue and are made up, for the most part, of three zones, a central zone, indicating degeneration, principally fatty. This is surrounded by a matrix made up of cells undergoing fibrillar changes. The outer zone contains numerous ramifying vessels between which are the granulation tissue cells.

Tertiary Lesions.—The tertiary lesions are (1) gummatous inflammations of the periosteum and of the bones leading to caries or necrosis occasioning deformity. When the nasal bones are affected the ulcerative and necrotic process may destroy the entire nose, the nasal septum and pterygoid bones, producing horrible deformity.

(2) Gummatous inflammations in the skin and mucous membranes (tubercular syphilides). This is a condition in which tubercles are formed. These sometimes break down and form *serpiginous* ulcers. These are symmetrical, involve the deeper tissues and show no tendency to heal. When the larynx, pharynx, and rectum are affected, serious damage may result by the formation of strictures and gummata.

(3) Gummata may form in the muscles, producing paralysis and injury to the muscles affected. Where this occurs in the tongue, serious damage from ulceration and cicatrization may take place.

(4) Gummata of the nervous system produce paralysis and when they involve the anterior or frontal lobes of the brain they produce marked psychical symptoms. It may lead to fibroid changes in columns of the cord, medulla, or in the cerebellum.

(5) Gummata of the blood vessels. The arteries are chiefly affected and this results in the formation of thrombi, emboli, and aneurysm and rupture of the arteries.

(6) Lastly, gummata may form in the viscera, liver, lung, or kidney, producing symptoms according to the nature of the organ and the extent of involvement.

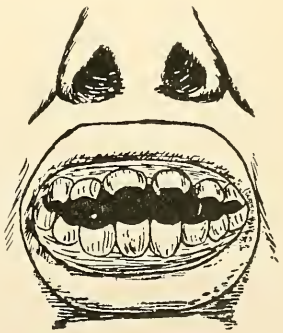
Hutchinson enumerates the lesions of tertiary syphilis in this manner: Diseases of the skin of the nature of rupia or lupus, periostitis of bone forming nodes, causing hypertrophy, caries or necrosis; gummata in various parts, as of the tongue, causing sclerosis, of the nervous system introducing structural changes, causing ataxia, ophthalmoplegia, internal and external; general paresis, paralysis of cerebral nerves, optic atrophy, myeloid degenerations; and chronic inflammations of certain mucous membranes, such as the mouth, pharynx, vagina, and rectum, with ulceration, thickenings, and strictures. It may affect the spine in the form of spondylitis, at the same time involving the meninges of the cord. Unilateral enlargements of the testicle and epididymis may take place. Serpiginous ulcers in tertiary syphilis are preceded by brown or copper colored spots. These spots break down often, forming crescentic shaped ulcers. They are more common about the lips and nostrils and on the face. Involvement of the periosteum and connective tissues will lead to severe pains, *syphilitic rheumatism,* so that

pressure on the front of the tibia will usually occasion considerable pain. These rheumatic pains are greater when a person becomes warm after retiring at night. They often involve the ribs, showing tenderness throughout the extent of one or more.

Syphilis of the nervous system comes on late and is indicated by meningitis, atheromatous condition of the vessels, fibrosis, and gummatous formation. Syphilitic paralysis is progressive, limited and not complete. Epilepsy appearing after the thirtieth year, not due to alcoholism, is likely due to latent syphilis. A syphilitic patient often has persistent headaches, insomnia, muscular tremor, paralysis, slowness of utterance, and vertigo. Spinal syphilis is manifested in the form of sclerosis as in Landry's paralysis. There may be a condition of softening and tumor. Syphilis sets up a neuritis of a chronic form, accompanied by degenerations as in locomotor ataxia.

Congenital Syphilis.—Congenital syphilis occurs in children only when both of the parents are syphilitic. It is transmitted to the child by means of the ovum or spermatozoon. The child is born healthy, while the disease usually appears from the fourth to the sixth week after birth. There are cases where it is said the child was born with evidence of syphilis. There are other cases where the development of the disease seems to be considerably delayed. The symptoms of the affection in general are those of "snuffles" or a chronic catarrh. Mucous tubercles and ulcerations are present about the mouth and anus. The discharge from the nose is generally copious and non-purulent. A rash appears on the body similar to that in secondary syphilis of the acquired form, later copper colored spots appear about the genitalia and buttocks and on the hands and feet. These may be followed by ulcerations. Eruptions may be papular, vesicular, or pustular. Generally the child is anemic and wasted. It has a shriveled and shrunken appearance and looks old, so that a child of a few months has the face of an old man. The hair falls out and eyes become affected, ulcers and keratitis producing an opaque condition of the cornea. Deafness usually follows while the bones and joints and viscera are all affected. Where the symptoms appear late or where the child seems to survive the secondary symptoms, changes in the bones occur, producing a broad bridge of the nose. Ulcerations take place at the angles of the mouth. These on healing leave scars (Hutchinson's lesion). Usually there is a peculiar conformation of the skull. The head is square with prominent frontal eminence. The incisor teeth are characteristic; the edges are serrated and concave, and sometimes they look as if they were cut out. Enlargements on the bones sometimes occur. These are called Parrot's nodes.

FIG. 6.



Hutchinson teeth in hereditary syphilis.

Rules governing the inheritance of syphilis may be summed up in the following:

1. **Colles's Law.**—Children having inherited syphilis from the father, the mother never having manifested the disease, the mother is immune to syphilis so that she will not contract it from the nursing child. A wet nurse would.

2. If one parent is syphilitic the child may be.

3. Syphilitic parents may bring forth healthy children.

4. If the mother, while enceinte, contracts pox, the child may have syphilis. Under such circumstances it becomes infected in utero.

5. The more recent the syphilis the more likely it is the child will be infected, and the more latent the syphilis the more tardy and less likely will be the development of the syphilis in the child.

6. Syphilitic parents may beget several syphilitic children when afterward they may bring forth healthy children.

7. Syphilis not having manifested itself for a number of years, the child may not have syphilis.

8. Syphilis in the mother is much more dangerous to the child. She often aborts at the fifth month.

Treatment.

A. Osteopathic. B. Other measures.

Osteopathic.—The treatment has not as yet been tested in full to determine its effects in all forms of this disease. We hold it to be a nutritive disorder due to the absorption of inflammatory products. In the lesions of tertiary syphilis osteopathy has been peculiarly successful. Especially is this true of gummata, paralysis, rheumatism, eye affections, and ulcerations. In all these conditions we depend upon increasing the blood supply to the diseased part. This enables the young granulation tissue cells to mature. It further hastens the resorption of the inflammatory, degenerated, and other products present in the disease. This treatment if properly applied ought to relieve the various forms of tertiary syphilis readily and completely. The treatment is the surest and most powerful method of reconstructing and renovating the tissues. The poison is eliminated by the excretories while the recuperative powers are replenished by securing a good free flow of fresh and wholesome blood.

Other Treatment.—Chancre.—As soon as seen a chancre must be cauterized with fuming nitric acid or carbolic acid. Afterwards it should be treated as a simple sore—dusted with calomel, and borated gauze and cotton applied and held in place by a bandage. When on a mucous surface an antiseptic solution may be used twice daily.

Bubo.—The treatment as advised in inflammation will be found applicable here. They rarely cause trouble. It will do no good to rub in salves or apply liniments. If the treatments are persisted in the inflammatory products may be absorbed.

There are three methods now in use which affect very favorably the course of syphilis. They are the following: 1. The inunction treatment consists of rubbing into the skin on different parts of the body fifteen to thirty grains of mercurial ointment daily. Rubber gloves are necessary. The treatment is extensively used.

2. Daily hypodermic injections of one-fourth grain of the bichloride of mercury over the back and buttock for one month is a treatment said to be very successful. If the disease reappears one-sixth grain of the drug may be similarly injected for a period of one month. If it again reappears one-eighth of a grain may be injected in the same manner.

3. Iodid of potassium in a saturated solution is extensively used in the treatment of old syphilitic lesions. It is begun with ten drops three times daily in a glass of water and increased one drop at each dose until two hundred drops are taken three times daily.

Diet and Hygiene.—In syphilis it is of the utmost importance that the patient eat plain, wholesome, and non-stimulating food. He should take frequent baths, drink copiously of pure water, avoid stimulants of all kinds such as tea, coffee, tobacco, and alcoholics. Good clothing should be worn and the victim should receive a good night's sleep. All the secretions should be kept active and regular.

Gonorrhea.

Gonorrhea is a specific ulcerative inflammation of the urethra in the male, and the vagina in the female. This inflammation frequently extends into other organs, sometimes even affecting the eye, it having been inoculated by pus transported to it from infected hands or cloths. There are two forms of urethritis usually described in the male, the specific and non-specific.

The non-specific form of urethritis is produced by irritating discharges, by injury or by micro-organisms. The symptoms are usually mild, the inflammatory reaction is not severe and it generally runs a short course. The sequels are of no consequence.

The specific form of urethritis is produced by infecting the mucous membrane with the diplococcus Neiseri. This micro-organism finds its way into the deeper layers of the epithelial cells and into the connective tissues, setting up an ulcerative process. There may be several ulcers along the urethra. These may extend partially or entirely around the canal, usually only upon one side. The inflammation is quite severe, the inflammatory products being carried through the lymphatic channels into the glands in the groin set up an inguinal adenitis producing bubo. In severe forms the dorsal veins may become involved, phlebitis occurring so that they appear as hard, fibrous, and painful cords. The corpus spongiosum becomes infiltrated with inflammatory material and is not capable of distention and stretching, as normally, when upon erection of the corpora cavernosa it occasions a condition of

chordee or bowing of the organ. The gonococci are found in large numbers in the pus discharged from the urethra. The germs inhabit the pus cells, epithelial cells, and the albuminous fluids. They can be readily stained with the ordinary anilin stains (dilute methyl blue or methyl violet). It is claimed that there is a certain proportion of cases where no gonococci can be found, in which the symptoms are quite as severe as in specific urethritis. The cause in these cases seems to be pus microorganisms.

Symptoms.—Gonorrheal urethritis may be divided into three stages. The first stage is from the time of inoculation until inflammation is set up. The second stage is the acute inflammatory stage, which lasts about ten days. The third stage is the defervescence of the inflammation, and lasts two or three weeks, sometimes less.

The first symptom of gonorrhea is an irritation within the meatus urinarius externus. The meatus becomes swollen, congested, and a watery fluid exudes. There is pain on urination and during the intervals a teasing sensation. The discharge becomes purulent within a few days. The disease, after inoculation, generally appears in from one to four or five days. The purulent discharge, as soon as the ulceration is set up, becomes quite copious and is sometimes greenish, due to the association of some of the pus germs. The organ becomes badly swollen, urination causes excruciating pain, while there is a continual ache extending along the back of the organ and about the rectum, sometimes being referred over the trochanters. After the acute stage is over the inflammation gradually subsides, the discharge becomes less free and thinner—seropurulent and finally serous, and eventually disappears. Cicatricial contractions take place in the ulcer formed within the urethra. This contraction may narrow the caliber of the urethra, producing stricture. In chronic cases the ulcer never quite heals, but cicatricial contraction takes place and because of the obstruction by the stricture the urethra behind the narrowed point becomes distended by the urinary flow. It is from this distended portion that the discharge in gleet or chronic urethritis comes.

Complications.—The complications of gonorrhea are:

1. Balanitis, and inflammation of the glans penis.

2. Posthitis, a condition where the prepuce becomes inflamed. In balanitis if the prepuce is redundant and becomes inflamed while behind the glans a condition of paraphimosis may result. If posthitis is set up a condition of phimosis may be caused, in which condition the prepuce cannot be brought back over the glans. (See Phimosis and Paraphimosis.)

3. Chordee is a condition of bowing of the organ and happens in many cases. The treatment consists of the application of cold or other means of preventing erection. The patient should be instructed to sleep on his side and with but little cover.

4. Stricture of either large or small caliber is a frequent result of

gonorrheal inflammations because of cicatricial tissue formed in the urethral wall, the contractions lessening the lumen of the urethra.

5. Prostatitis. In some cases the inflammation extends back the urethra into the prostate gland. Prostatitis can be recognized because of the swollen and inflamed condition of the prostate, and because of the febrile reaction due to the absorption of pus.

6. Epididymitis. The inflammation may travel back along through the vesiculae seminales and the vas deferens into the epididymis, causing epididymitis, or even the testicle itself may become inflamed, orchitis.

6. Gonorrheal Rheumatism. This is caused by the absorption of the inflammatory products of gonorrhea, which are carried about over the system and lodge in the connective tissues about joints, causing inflammation. It is not a rheumatic condition.

Treatment.—The Osteopathic treatment consists in increasing the urinary flow and lessening its acidity as recommended by Dr. A. T. Still. This will lessen the irritation during urination and quiet the desire for frequent micturition. The blood supply to the urethra must be stimulated and the penis carried in a sack containing cotton to catch the discharges. The acute inflammation will subside in a week or ten days. The bowels must be kept regular and the patient instructed to avoid undue exercise or excitement. He should get good sleep, avoid the use of stimulants and eat good plain food. *By all means avoid injections.* They do harm. Never good. In *chronic* gonorrhea or gleet a 4 per cent. solution of nitrate of silver may be injected gently into the urethra and held there just two minutes. If this does not effect a cure, every other day a 2 per cent. solution of the silver salt may be injected—care should be taken not to force the fluid into the bladder. The irrigation treatment is very popular. It consists of daily running through the diseased part of the urethra, or even into the bladder, a 1:4000 solution of permanganate of potassium. Two or three quarts should be allowed to pass through the urethra at a sitting. The treatment is said to be very successful. In the female the treatment is similar. When the disease is chronic the vagina may be tamponed daily with a boroglyceride tampon and irrigated with a solution of a teaspoonful of acetate of zinc to a pint or quart of distilled water.

Rachitis, or Rickets,

Is a disease of childhood. It occurs in children from eighteen months to two and a half years of age. It affects the entire system more or less, but especially the long bones and the bones of the skull. The cause of rickets is malnutrition. This malnutrition may be the result of lesions causing malassimilation or because of an insufficient quantity or quality of food. It may be caused by the debility of the mother or by the child being surrounded by bad hygienic conditions. It is characterized by the formation of embryonic tissues. These embryonic tissues never develop into the mature cell for which they were originally intended. Bones

are not properly formed, the cells proliferate, but the ossific process does not take place.

Symptoms.—The symptoms of the disease are, first, its occurrence in children eighteen months to two and a half years—or in the late form it may happen in children from nine to twelve. This is said to be a recrudescence of the disease. The child is at first restless and may have night sweats. Phosphates are abundant in the urine, and there are evidences of gastro-intestinal disturbance and flatulence. Swellings occur on the ends of bones, radius and tibia, beading of the ribs and thickening of the cranial bones at the sutures. The bones frequently bend, causing bowing of the legs. There may be bowing of the forearms. There may be many deformities, the most common being pigeon-breast. The person is often knock-kneed or bow-legged and there is curvature of the spine. There are various kinds of deformed pelves. The fontanels close late and the head is square. Dentition is delayed or may not occur at all and even if the teeth appear they may decay early and fall out. Ofttimes there are symptoms of bronchitis. There may be laryngismus stridulus, convulsions, diarrhea, etc.

Treatment.—The treatment of rickets is to locate the cause of the disease, if there is any. Generally there are Osteopathic lesions which account for the malnutrition. The reduction of the lesion, together with the proper food, will be attended by relief.

Scurvy.

Scurvy is a disease of malnutrition and malassimilation from improper food. The cause of the disease is lack of vegetables. It has occurred in prolonged sieges or Arctic expeditions. Scurvy was common among those who visited the Klondike. The pathology of the affection is the pathology of a condition of malnutrition. Improper food materials lead to disorganization of the blood and there is degeneration of muscles and great prostration. The skin becomes jaundiced (hematogenous). There is malaise, torpor, loss of appetite, and insomnia. The gums become inflamed, of a bluish-purple hue, are friable and break down and ulcerate. The breath becomes fetid, the skin dry and brittle and because of the changed condition of the blood there are ecchymoses underneath the skin and around through the muscles, even under the periosteum. The *prognosis* is generally good unless the case is in a very bad condition before the proper treatment can be administered. In prolonged and neglected cases death results from marasmus and sepsis. The *treatment* is a vegetable diet in small quantities, frequently repeated, fresh fruits, cranberries, lime juice, buttermilk and cider.

TUMORS.

Definition.—A tumor is an atypical neoplasm or new formation which is not the result of inflammation. The word "tumor" means a swelling,

but all swellings are not tumors. The term tumor is applied to those new formations which arise from other than inflammatory causes, although the tumor may be attended by an inflammatory reaction, and, furthermore, a long continued irritation and inflammation may even operate as one of the causes of a tumor.

Cause.—"All have agreed long since that tumors and issues mark a cut-off in an artery, vein, or nerve." (A. T. Still, Philosophy of Osteopathy, page 200.) Lesions acting in this manner occasion nutritional disturbances. These disturbances vary in nature and degree, causing abnormal development or destruction of cells from perverted nutrition or retained secretions. Among the various other causes which seem to have to do with the origin and development of tumors may be mentioned:

1. Constitutional Dyscrasia. By this is meant a certain morbid condition of the system which predisposes to the development of tumors.

2. External Irritation. External irritation seems in some instances to assist in the formation of tumor. It is not unusual that a cancer arises from a crack in the lip which has existed for several months or years.

3. Embryonic Remains. During development of the fetus embryonic tissue may be included in parts of the body where it should not be and afterwards in growing or developing forms a tumor. This without doubt explains teratomata, but does not explain sarcomata and many other tumors.

4. Parasites. Cancers can be readily transmitted. Because of this some writers maintain that a cancer is due to a parasite. This remains to be proven. Numerous forms of certain parasites have been described but they are most likely optical illusions.

5. Spermatic Influence on Cells. It is maintained by some pathologists that certain cells have a spermatic influence over others, changing their method of development and producing abnormal growth.

6. Defective Tissue Resistance. This has been advocated in explaining cancer. Cancer consists of a condition where the epithelial cells, instead of growing towards the surface, grow down amongst the deeper tissues and in the lymph spaces. Because of a lessened resistance which the connective tissues seem to have for the epithelial tissues, they grow the wrong way. This would not explain some of the tumors.

7. Certain Predisposing Causes. It is said that in some people there is a predisposition to the development of cancer. Not that they have a dyscrasia, but that they have inherited the condition from a cancerous mother or father. This remains to be proven.

Structure.—The structure of a tumor varies according to its location and the issues from which it arises. The tissues of a tumor always resemble the tissues from which they grow and develop. Metaplasia of tissue never occurs. By that we mean that from connective tissues epithelial cells never develop. If a tumor is derived from the connective tissues,

it will always be a mesoblastic tumor, not hypoblastic or epiblastic. Wherever a cancer is found it is always developed from epithelial tissue. Wherever a sarcoma is found it is developed from mesoblastic tissues, so that in structure the tumors resemble certain tissue types. Some tumors differ but very little from the normal tissues, while in others the cells vary in shape and become so distorted as to render it difficult to determine their nature. These are atypical. The most atypical of all tumors and tumor-cells is the cancer. A tumor is independent of the general nutrition of the body. While the body is becoming poor, thin and emaciated, a fatty tumor may grow to immense proportions. While the more emaciated and debilitated the patient becomes, the more luxuriantly does the cancer grow. Many of the tumors do not have a distinct blood supply. Many of them grow at the expense of the body.

Shape.—The shape of a tumor may be ragged or irregular, it may be circumscribed and enclosed within a capsule, or it may be difficult to tell where the tumor begins and the healthy tissues cease. In such conditions the tumor seems to infiltrate the surrounding tissues. The tumor may have a fungiform appearance or it may be papillary, or in some cases it may present a cauliflower excrescence, as in case of a cancer of the mucous surface.

Effects on the General Health.—The effect of a tumor on the general health varies according to the nature of the tumor and the tissues involved. The mechanical pressure of the tumor may be such as to markedly interfere with the general health. This is not the rule. Tumors may grow to enormous size and yet the person may be apparently healthy. Still, on the other hand, a little cancer not larger than a hickory nut may cause profound cachexia and a condition of malnutrition. The effects on the general health are produced by mechanical irritation and pressure upon an artery, vein, or nerve, which sometimes may be serious to a part, or by a certain form of poisoning whereby noxious chemical products are discharged into the body from the tumor. These carried about produce general systemic effects. Something like this occurring makes a cancer a constitutional affection. The general health is likewise impaired in malignant tumors by the using up of a great amount of nutritious material, thereby depriving the tissues generally of their nourishment.

Classification.

Clinical.—

A. Benign.

B. Malignant.

Tissue Types.—

A. Mesoblastic.

I. Simple tissues.

1. Fibroma.
2. Myxoma.
3. Lipoma.
4. Osteoma.
5. Papilloma.
6. Chondroma.

II. Complex tissues.

1. Myoma.
2. Angioma.
3. Lymphoma.
4. Lymphangioma.
5. Neuroma.
6. Glioma.
7. Adenoma.

III. Embryonic tissues.

1. Sarcoma.

a. Large round-celled.
b. Small round-celled.
c. Large spindle-celled.
d. Small spindle-celled.
e. Giant-celled.
f. Mixed-celled.
g. Alveolar sarcoma.
h. Melano-sarcoma.

B. Epiblastic and Hypoblastic.

I. Carcinoma, or Cancer.

1. Epithelioma, or squamous-celled carcinoma.
2. Glandular cancer, or cylindrical-celled carcinoma.
3. Acinous cancer, or spherical-celled carcinoma.

A **Benign** tumor is one which does not affect the general health, but the symptoms of which are entirely due to the mechanical pressure or irritation which the tumor may exert upon the surrounding structures.

A **Malignant** tumor is one which affects the body out of proportion to its size. It affects the general health. It usually runs a rapid course and results fatally. It is attended by cachexia, great pain, ulceration, etc.

A **Fibroma** is a tumor made up of bundles of wavy fibrous connective tissues. The varieties seen are (1) hard fibroma, (2) soft fibroma, (3) molluscum fibrosum, and (4) keloid. In addition to these varieties there may be intermingled with the fibrous structure of the tissue, fatty or myxomatous tissues, bone, cartilage, etc.,or in other cases a degenerated condition of the vessels, making the following additional varieties: (5) Myxo-fibroma, (6) Fibro-lipomatodes, (7) Osteo-fibroma, (8) chondro-fibroma, and (9) angio-fibroma.

Changes In.—The changes which these tissues very often undergo are calcification, ulceration, and mucoid degeneration.

Location.—The tumors are located in the connective tissues, beneath the mucous and serous membranes. Where they occur in the periosteum they produce a condition of fibrous epulis. Where they occur in the uterus a condition of myo-fibroma results. A tumor may form in the stumps of nerves after amputation. This is improperly called a neuroma, it is really a fibrous tumor or false neuroma. When fibrous tumors occur in the nose and rectum they are generally in the form of polypi. In subcutaneous tissues hard and soft fibromata occur. Soft fibromata are popularly called "wens." These tumors are never malignant.

Diagnosis.—The diagnosis is usually easy. The tumor is encapsulated, often lobulated, generally pedunculated, and is a hard fibrous mass. It is a benign tumor, may appear at any age and if removed will not tend to recur.

Molluscum Fibrosum.—This consists of an overgrowth of the fibrous structure of the skin and subcutaneous tissues. It may affect one side of the head or one entire side of the body. The skin may become enormously thickened. It is said the origin of the tumor is congenital.

Keloid.—This is a rare kind of tumor which occurs in two forms, spontaneous and cicatricial. The spontaneous consists of a fibrous mass beneath the epidermis and is more common in the negro.

The cicatricial form arises from scars, frequently from piercing of the ear. The tumor is benign, but is prone to recur unless every vestige is removed.

A **Myxoma** is a tumor consisting of mucoid tissues. The tissues of the tumor are not matured, but are an undeveloped form of connective tissue. The contents of the tumor are identical with the tissues surrounding the blood vessels in the umbilical cord. It is made up of stroma, having within the tissue-spaces a substance similar to Wharton's jelly. The tumor appears to the naked eye as being made up of a structureless gelatinous mass. It is a soft, gelatinous, grayish, or reddish-white tumor. It comes after middle life and grows slowly. They do not recur after removal. They are benign tumors. They may undergo fatty degeneration, inflammation, ulceration, or may form cysts.

Location.—They are located in the submucous, subcutaneous, and subserous tissues.

Treatment.—When easily accessible they should be removed.

A **Lipoma** is a tumor made up of fatty tissue. Its structure is that of ordinary adipose tissue. It is usually lobulated, soft, and pseudo-fluctuating. They are ovoid, spherical, and rarely pedunculated. The tumor is encapsulated and sometimes becomes slightly attached to the surrounding tissues so that gravitation may cause these tumors to migrate, say from the side of the chest to the brim of the pelvis.

Degeneration.—Degenerative changes taking place in these tumors are ulceration, calcification, and softening. Ulceration is sometimes serious. Calcification may lead to error in diagnosis.

Location.—The location of these tumors is generally the axilla, back, buttock, and thigh.

Diagnosis.—These tumors are benign, of slow growth, and variable in size. They appear at any age, are encapsulated, and if the tumor is grasped at its base and the skin stretched, dimpling of the surface will take place because of the fibrous bands extending down through the tumor.

An **Osteoma** is a tumor formation developed in bone after inflammation. It generally occurs at the junction of the bone and its cartilage. There are three forms usually described, depending upon their structure. (1) Eburnated osteoma consists of very dense bony structure, made up of lamellae extending parallel with the surface of the tumor. They are symmetrical and often multiple. (2) Compact osteoma is a

variety consisting of compact bone. It is found in the outer layers of long bones. (3) Cancellous, or spongy osteoma is a tumor made up of cancellous bone. In structure it resembles the spongy bone at the end of long bones. The tumor may become sarcomatous or it may undergo necrosis following inflammation. Rarely caries takes place.

Diagnosis.—It is a benign tumor of slow growth. It is generally arrested as age advances and never attains a very large size. If it exhibits malignant characteristics it is a sarcoma.

Papilloma.—The common name of this tumor is a wart and consists of a fibrous stroma containing blood vessels and lymphatics. It seems to be an overgrown or hypertrophied papilla of the skin. In some cases the papilla may be short or in other cases long, where it presents a villus-like appearance. Where the wart is situated in the skin the epithelial covering is sometimes dense and binds the wart in a solid mass.

Changes In.—Ulceration and hemorrhage; it may become cancerous.

Location.—Skin and mucous membranes.

Diagnosis.—The diagnosis is easy. They occur at any age, may be simple or multiple. They may disappear without operative interference. When they occur on mucous surfaces they are highly vascular, prone to bleed, and may occasion considerable trouble. Where they are at a point of irritation they should be removed.

Chondroma, sometimes called enchondroma, is a mass of new tissue composed of hyaline, white fibrous, or elastic cartilage. They are usually rounded, smooth. lobulated tumors of dense consistency. They sometimes have a well marked capsule. The cut surface presents a pink appearance identical with fresh cartilage. They are non-vascular.

Location.—Cartilages of the larynx, trachea, and costal cartilages.

Changes In.—They may undergo fatty, mucoid, or calcareous changes and are often found in bone developed from cartilage. They are not uncommon in the metatarsal bones and phalanges, and may occur in glands such as the testicle, ovaries, and mammae.

A **Myoma** is a tumor composed of muscle. There are two forms usually recognized, depending upon the kind of muscular tissue. That composed of striated muscle is called Rhabdomyoma. That composed of unstriped muscle is called Leiomyoma, *Rhabdomyoma* is very rare and it is maintained by some to never occur. It is usually congenital. The muscle fibres are irregularly formed, either spindle or club shaped. It is a benign tumor and occurs in the heart, uterus, and kidney. *Leiomyoma,* the variety made of unstriped muscle, frequently contains more fibrous than muscular tissue. It is most frequently located in the uterus, but may occur in the prostate, esophagus, stomach, and intestines. As a rule, they vary greatly in size; those located in the intestines are small, while those located in the uterine wall may attain an enormous size. Severanu removed one which

weighed 195 pounds. They are frequently the size of a fetal head. When located in the uterus they may be subserous, interstitial, or intramural. They may be pedunculated in the form of uterine polypi. They are generally encapsulated and made up of elongated, spindle-shaped cells with rod-shaped nuclei and have but few blood vessels. The tumors may undergo inflammatory changes or calcareous degeneration. They are benign, but may become sarcomatous.

An **Angioma** is a tumor made up of blood-vessels. There are three different forms, capillary, venous, and arterial, or, *simple, cavernous* and *plexiform.*

Simple or capillary angioma is a condition of telangiectasis, or mother's mark, or birth mark. It generally affects the skin and may be flat or slightly elevated and may vary in color from a pink or red to a dark-red or violet. They are generally located on the face, about the orbit, and on the neck, and are congenital. They may increase in size after birth. On microscopical section it is found that the walls of the capillaries and vessels are thin, dilated, and fusiform. They may be cylindrical or sacculated, or several large vessels may establish communication between the nevus, as it is sometimes called, and the main artery.

Location.—They are generally located in the skin and subcutaneous tissues in any of the organs which are vascular.

Arterial angioma, sometimes called cirsoid aneurysm, is really not a tumor, but a pathological alteration of the vessel wall. The vessels become distended and convoluted. Pressure upon the nerves and tissues causes atrophy. The vessel walls usually thicken because of inflammatory reaction. The tumor may be congenital or acquired. Both the venous and arterial angiomata may follow injury of the scalp, frontal region, and the pudendum.

Lymphoma.—The term "lymphoma" means a tumor of the lymphatic gland. There are various conditions which may perhaps be included under this head. Enlargement of the lymphatic glands in tubercle and syphilis is termed by some tubercular or syphilitic lymphoma. There is no inflammatory reaction due to the absorption of the products of inflammation, as in bubo or acute and infectious diseases. Sarcoma may occur in the lymphatic glands, but it does not differ from a sarcoma in any other region, except that it arises in the lymphoid tissue. This tumor is called lymphosarcoma. The lymphatic enlargement in leukemia is said by some to be malignant. Enlargement of the lymphatic glands with enormous hypertrophy, as occurs in Hodgkin's disease, is called lymphadenoma.

Lymphangioma is a tumor of the lymphatic vessels. It is very rare and consists of dilated and cavernous sacs. It is analogous to a tumor of the blood-vessels. It occurs most frequently in the tongue or lips, where it is termed macroglossia or macrocheilia, as the case may be.

A **Neuroma** is a tumor of the nervous tissue. The existence of these tumors is denied by some writers. An amputation neuroma is really a fibrous tumor due to the development of fibrous tissue in the stump of an amputated nerve. Pathologically there are other neuromata described in connection with ganglia and masses of nerve matter, but they are rare and not well understood.

A **Glioma** is a tumor developed from neuroglia and composed chiefly of glia cells. The tissue elements vary greatly. These tumors are often located in the eye. Some writers believe that they are true sarcomata. In the brain the glioma does not involve the membranes, while a sarcoma does. They are circumscribed, diffuse slowly, and generally affect the central nervous system (brain and spinal cord). The tumor may be very soft or firm and elastic and is single. When metastasis occurs it is believed to be sarcomatous.

An **Adenoma** is a tumor of the type of glandular tissue. It seems to be an enlargement of all parts of the gland. It is believed by some that the origin of the tumor is fragments of glandular tissue included within the tissues where it is found. Sometimes they are termed localized hypertrophies. They are benign, and secondary changes are not liable to occur, but when they do, they are fatty or mucoid in nature. Where gland tubules are developed, cysts may be formed because of the retention of the secretion.

Location.—Sebaceous glands, mammary glands, thyroid, prostate, testicle, liver, spleen, etc.

There are two forms described, depending upon the nature of the formation or structure. They are tubular and acinous.

A **Sarcoma** is an embryonic connective tissue tumor. The cellular elements of the tumor predominate over the interstitial substance. The cell elements tend to infiltrate the surrounding tissues, so that it is not always encapsulated.

Microscopical Structure.—The microscopical structure of a sarcoma is of great importance. It consists of embryonic cells, varying in size and shape, embedded in a stroma or intercellular substance, which varies in amount and character. It generally contains but little fibrous tissue. The cells are often protoplasmic masses and rarely possess a cell wall. The variety of the tumor depends upon the shape and size of the cells. The intercellular substance extends around between all the cells and lies in close connection with the individual cell. The blood-vessels of the tumor are very numerous and often have no well defined walls, the blood apparently flowing into cavernous spaces in the tumor, so that the blood is apparently brought in direct contact with the tumor cells. Sometimes these embryonic cells which form the vessel wall become detached and are carried by the blood current to other parts of the body (metastasis). When the tumor grows slowly there apparently is a condensation of the connective tissues about the tumor, which gives it the appearance of being encapsulated.

Location.—The *round-celled sarcomata* are situated in the periosteum, fascia, eye, antrum of Highmore, breast, testicle, and may occur in any of the connective tissues. The *giant-celled sarcomata* occur in connection with bone. The *alveolar sarcoma* develops in the subcutaneous connective tissues and in glands. *Melano-sarcomata* occur in the surface connective tissues. *Spindle-celled sarcomata* occur in the intermuscular septa, subcutaneous tissue, fascia, periosteum, interior of bones, eye, breast, and testicle.

Characteristics.—The characteristics of sarcomata are (1) Malignancy, (2) Occurrence, (3) Metastasis, (4) Infiltration, and (5) Degeneration.

Malignancy. The round-celled and spindle-celled varieties are of rapid growth and very malignant. Melanotic sarcomata are among the most malignant of tumors.

Occurrence. The tumor occurs at any age, but most frequently in early or middle life. They are prone to extend locally and after removal to recur locally. It is maintained by some surgeons that the tumor has never been successfully removed.

Metastasis may occur, but always by means of the blood-vessels. The neighbouring lymphatic glands are not enlarged unless the sarcoma becomes ulcerated. The tumor is generally localized and sharply circumscribed.

Infiltration takes place into the surrounding tissues and lymphatic glands. It disseminates by means of the blood-vessels, secondary growths occurring in the lung.

Degeneration in these tumors is common. Blood extravasations are frequent. The tumor rarely ulcerates, but more frequently it undergoes fatty degeneration or mucoid softening.

Cancer, or Carcinoma.—Definition.—Cancers are malignant tumors, consisting of masses of epithelial cells contained within alveoli and enclosed in masses of fibrous tissue. Like the tissue from which it is derived (epithelium) no stroma or connective tissue extends in between the individual cells. Cancers are the most atypical of all the neoplasms. The epithelial cells vary greatly in shape and size. One of its most peculiar characteristics is that the cells apparently grow the wrong way. Epithelial tissues grow towards the surface normally, but in cancer the tumor-cells grow down into the connective tissues in the interstices between the fibres and along the lymph spaces, sometimes forming distinct cell masses or cell nests, or at other times forming column-like prolongations. These columnar-like masses and cell nests are surrounded by dense layers of fibrous tissues, for when the cells grow down into the tissues they act like any other irritant and create a low-grade inflammation. This fibrous tissue surrounding the columns of epithelial cells extending into the subcutaneous tissues gives rise to the popular opinion that the cancer has roots. In some instances the cellular growth is very rapid and there is little production of fibrous tissue about the

cell masses. In this case the tumor is largely cellular. It is then soft and called encephaloid cancer. In other cases the tumor-cells proliferate less rapidly and there is an immense production of fibrous tissue about the cell nests, tubules, and columns of cells, when the tumor feels, because of the contraction of this fibrous tissue, like a hard nodular mass. This is called a scirrhus cancer. The blood-vessels of the tumor contain thickened walls, so that the wall of the artery is much thicker than in the normal tissues, whereas in the sarcoma the vessels have no walls, the blood being in actual contact with the tumor-cells. The fibrous tissue of the cancer, which is really inflammatory tissue, undergoes contraction, as happens in scars. This cuts off the nutrition to masses of the tumor, hence the frequency with which the tumor breaks down and ulcerates. This ulcerative process often extends into small blood-vessels, which accounts for the frequency with which cancer bleeds. The cancer spreads through the lymphatics and the lymph spaces and consequently the cells soon spread to the neighbouring lymphatic glands, causing enlargements. One of the most pronounced symptoms of cancer is *cachexia*. This cachexia is partly due to local ulceration and partly to the dissemination of the growth. The skin assumes a sallow, peculiar earthy color. The face is anxious and careworn and the body emaciated. This emaciation continues until the strength fails and the patient dies of exhaustion because of the general interference in nutrition, pain, mental anxiety, local ulceration, and hemorrhage.

Epithelioma or Squamous-Celled Carcinoma arises from the skin or mucous membranes. The cells of this tumor much resemble squamous epithelium. The alveolar characteristics of the tumor are not so marked as in acinous cancer.

Location.—Especially at points where the skin and mucous membranes meet—lips, nose, tongue, scrotum, or in scars, cheek, chronic ulcers, etc. In general this variety of cancer consists of solid columns of epithelial cells which have pushed down through the basement membrane and extend into the connective tissues.

Symptoms.—It usually begins as a warty tubercle which is soon converted into an ulcer with indurated, everted, and raised edges. It has a hard, warty, and irregular base. The tissues about are infiltrated and the neighbouring glands, through which the lymph channels of the affected area pass, become enlarged. On mucous surfaces the tumor may present a cauliflower excrescence. Sometimes there is a history of a crack or fissure of long standing. Unless the epithelioma is removed while the disease is local it will recur in the neighbouring lymphatic glands or in some distant organ. Frequently cells become isolated from the columns which extend into the connective tissues. These cells multiply and form masses of cells which are moulded, because of pressure, into roundish columns, or they may extend as a net-work through the tissues, making it often quite impossible

to remove all of the cancerous growth. This explains the frequency with which the tumor reappears after apparently all of the diseased tissue was removed. After removal, if the tumor recurs, it usually grows much more rapidly and more seriously affects the general health. The pain and ulceration, together with the growth of the tumor, bring about exhaustion, from which death is generally the result.

Glandular Cancer, or Cylindrical-Celled Carcinoma.—This tumor is derived from glands and surfaces covered with columnar or cylindrical epithelium. It is of slower growth than the other varieties. It begins as a warty outgrowth on mucous surfaces. It is most common in the rectum, but will occur in other parts of the intestinal tract or in the mammary gland.

Structure.—In structure the tumor consists of irregular tubules which are lined by columnar epithelium. These tubules are held together by a stroma or connective tissue which is more or less infiltrated by certain round-cells. The epithelial cells retain their shape more closely than any of the other forms of cancer. In very rapidly growing tumors the alveoli may become entirely filled with cells, when under such circumstances the cells are gradually destroyed. They infiltrate the surrounding tissues and affect the lymphatic glands and become disseminated into the internal organs. The liver is most frequently affected. With this tumor death occurs from obstruction of the bowel and from exudation and hemorrhage, due to the interference in the digestive process and to ulceration extending into the vessels. The general symptoms are of a malignant tumor.

Acinous Cancer, or Spherical-Celled Carcinoma.—These occur in three varieties, hard, soft, and colloid. The *hard* variety is medium sized, hard and nodular. Later they ulcerate and become disseminated through the body. Upon microscopic examination the alveoli in the older parts of the tumor contain cells undergoing fatty degeneration and in many cases the alveoli are shrunken and contain no cells, the cells having atrophied. It is around the circumference of the tumor where the characteristic microscopical structure is found.

Location. The usual locations are the breast, pylorus, and rarely in other situations.

The *soft acinous cancers* were called by the older writers encephaloids because of the resemblance to brain substance. The stroma is scanty in amount and does not contract like it does in hard cancer. The cells are prone to undergo fatty degeneration. On section they appear creamy colored or grayish-white. Frequently the cells may be diffluent. It is not unusual that ulceration may take place into the blood-vessels, leaving a fungating bleeding mass called fungus hematodes.

Location. Glands generally, as the breast, ovary, kidney, bladder, liver, testes. Secondary growths in other organs.

Colloid cancer is a term applied to any form of cancer undergoing mucoid or colloid degeneration. The colloid degeneration begins with the development of the cancer-cells; later the alveoli become distended with colloid material.

Location. The favorite location of this cancer is in the stomach, intestines, and ovary. It may occur in the breast or even in the throat.

Differential diagnosis between benign and malignant tumors, sarcoma, carcinoma, and lupus.

BENIGN TUMORS.	MALIGNANT TUMORS.
1. Age. Appear at any age.	1. Age. Generally appear late in life, except sarcoma, which may appear at any age.
2. Growth. Generally slow.	2. Growth. Generally rapid, but may be slow.
3. Dissemination. Does not infiltrate the surrounding tissues nor does it disseminate through the lymph or blood stream.	3. Dissemination. Surrounding tissues are infiltrated and dissemination takes place through the lymph spaces and blood channels.
4. Capsule. Generally encapsulated.	4. Capsule. Rarely encapsulated.
5. Adherent. Not adherent to the surrounding tissues.	5. Adherent. Generally adherent to the surrounding tissues, and are more or less fixed
6. Ulceration. Rarely break down and ulcerate.	6. Ulceration. Prone to break down and ulcerate.
7. Retraction. The tissues covering the tumor are not drawn and retracted.	7. Retraction. The retraction of the tissues over the tumor gives it a "bacon-rind" appearance.
8. Lymph glands. Lymphatic glands in the neighbourhood are not enlarged.	8. Lymph glands. Lymphatic glands in the neighbourhood are very often involved, except in sarcoma.
9. Pain. Generally not painful.	9. Pain. Generally painful.
10. Microscopical appearance. Closely resemble the tissues from which they grow.	10. Microscopical appearance. Very atypical.
11. Metastasis. Never occurs.	11. Metastasis. Secondary tumors usually occur in situ or in distant organs.
12. Cachexia. No cachexia. Affects the body mechanically only.	12. Cachexia. Pronounced cachexia and emaciation. Affects the body generally.

SARCOMATA.	CANCER.
1. Age. Appear at any age.	1. Age. Rare before thirty-five.
2. Growth. May be rapid or slow.	2. Growth. Generally rapid.
3. Dissemination. Surrounding tissues are more or less infiltrated and they desseminate by means of the blood-vessels.	3. Dissemination. Infiltrates the surrounding tissues and dissemination takes place by means of the lymphatics.
4. Capsule. Sometimes encapsulated.	4. Capsule. Never encapsulated.
5. Adherent. Adherent to the surrounding tissues.	5. Adherent. Adherent to the surrounding tissues.
6. Ulceration. Rare.	6. Ulceration. Very common.
7. Retraction. The tissues over the tumor are not so contracted as in cancer.	7. Retraction. The tissues overlying the tumor have "bacon-rind" appearance. In cancer of the breast the nipples are retracted.
8. Lymph glands. Not enlarged unless the tumor is ulcerating.	8. Lymph glands. Neighboring lymphatic glands are enlarged.
9. Degeneration. More common than in cancer.	9. Degenerations are not common.

10. Origin. Mesoblastic tissues.	10. Origin. Always from epithelial cells.
11. Blood-vessels. Have no walls.	11. Blood-vessels. Have distinct and thickened walls.
12. Stroma. Stroma lies in between the individual cells.	12. Stroma. Is around the cell masses and not between the individual cells.
13. Metastasis. Distant metastasis not common.	13. Metastasis. Distant metastasis is common.

LUPUS.

1. More frequently resembles epithelioma.
2. Does not precede the first evidences of disease-nodules.
3. Evidences of tubercular ulcer or diathesis present.
4. Occurs at more than one point.
5. No thickening around the ulcer.
6. The areas coalesce.
7. Abrupt and irregular borders. Has an "eaten" appearance.
8. Never appears like a fungus growth.
9. Its base is level with the surface.
10. Generally not painful.
11. Cicatrization follows ulceration so that while ulcerating at one point it heals at another.
12. Hemorrhage is rare.
13. It occurs at any age.
14. The discharge is generally not offensive.

Treatment of Tumors.—The principle of the treatment of tumors is the removing of mechanical obstructions and irritations which will occasion nutritional disturbances. Not all cases may be so cured, but many may be. Where the tumor is small, benign, pedunculated, or encapsulated and is superficial, it may readily be removed by a minor surgical operation, but where the tumor is large and can be reached only with considerable risk to the patient's health and life, manipulative treatment should be advised. In whatever part of the body the tumor is located, lesions will be found affecting the lymphatic stream, venous or arterial blood flow, or impinging upon the trunk or roots of the nerves of the part. Usually the favorable effect of the treatment will be evidenced within a short while. The tumor if hard will become softer, and if adherent, more movable. Absorption will gradually take place, following the correction of lesions and the removing of obstructions to the circulation. Not all tumors can be successfully treated. Many cases have been cured even after master minds have declared them incurable. This alone should commend the treatment in all cases before the knife is recommended. Should the tumor not yield to osteopathic treatment and should it manifest any malignant tendencies, or should it interfere with the general health, the knife should be resorted to and all parts of the tumor removed.

CYSTS.

A cyst is a tumefaction made up of an enclosed sac filled with fluid, semi-fluid, or other material.

Varieties.—1. Retention. 2. Exudation. 3. Extravasation. 4. Dermoid. 5. Hydatid.

Retention Cysts.—A retention cyst is generally due to the secretions of a gland being retained within the tissues, with a consequent

dilation of the tubules or acini of the gland. The wall of the cyst is formed of inflammatory or fibrous tissue, while the lining of the cyst is generally flattened epithelium. There are several forms of retention cysts described, viz., (a) *sebaceous cyst,* due to the closure of the duct of the sebaceous gland, which opens into a hair follicle, and a consequent dilatation of the gland tubules because of the retained secretion. The cells continue secreting until the cyst attains enormous size. They are generally semi-fluctuating and movable. They are adherent to the skin. They can be distinguished from fatty tumors, inasmuch as the tumor will not slip underneath the fingers. These tumors may undergo numerous secondary changes. Occasionally when the tumor is opened, the contents will be found to be extremely offensive, or the more liquid portion of the contents may exude and the remainder become hardened, or the cyst may become inflamed, causing suppuration and ulceration, or a sinus may result. Wounds may heal and cysts reappear, or while the sinus still exists, granulation tissue may form within the tumor, making the mass resemble an epithelioma. The *treatment* is often surgical. The tumor should be laid open and the contents evacuated and the sac scraped out. The wound is allowed to heal by granulation.

(b) **Mucous Cysts.**—These occur frequently in the mouth, or they may be due to the distension of Bartholin's glands at the entrance of the vagina. The walls are usually thin and they may attain great size.

Treatment.—Lay the tumor open and cauterize the interior.

There are other forms of retention cysts, such as those formed by the closure of Wharton's duct—ranula, encysted hydrocele and galactocele.

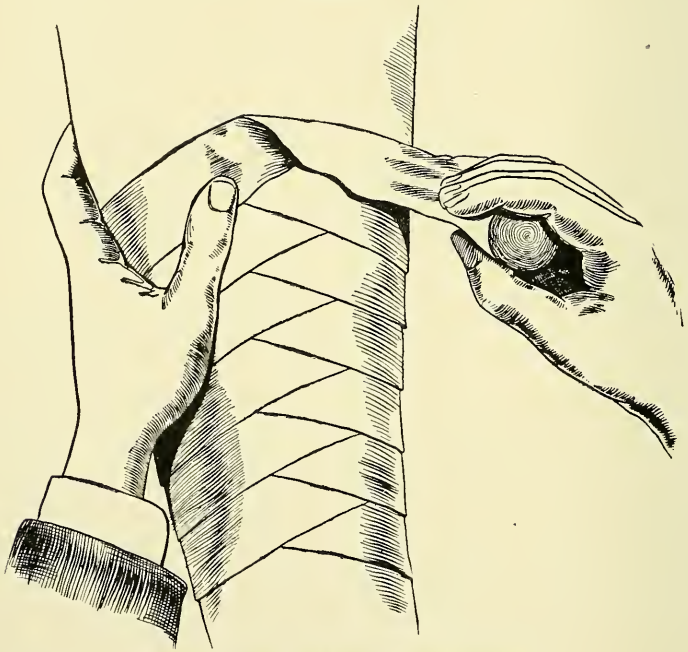
Exudation Cysts.—Exudation cysts are produced by the exudation of fluids into cavities which have no ducts or outlets. Examples of these cysts may be found in the ovary where distension of the Graafian follicles may occur, or in the bursae over the olecranon, or about the knee, or ganglia which happen in connection with extensor tendons on the back of the hands. These will be described under "Diseases of regions."

Extravasation cysts are produced by the extravasation of blood into the closed cavities of the body or into connective tissue spaces. They are called hematoceles. These may occur in the pelvis, tunica vaginalis, beneath the scalp or following the rupture of an artery within the skull.

Dermoid cysts are of congenital origin and are formed by the inclusion of a portion of the epiblastic tissues within the mesoblastic. In after life these inclusions develop epithelial tissues. There are certain of the dermoid cysts which can not be explained in this manner, as those containing hair, bone, cartilage, teeth, etc. These are said to be produced by the inclusion of blighted ovum in a part of the embryo.

By others it is said to be due to the development of atrophied fetal structures. Dermoid cysts occur in the tunica vaginalis, in the middle line of the neck, arising from the thyro-glossal duct, from the parovarium near the ovary, or they may arise from the ovary or testicle. Other forms of congenital cysts may occur in the axilla and scrotum. Dermoid cysts are the most common. In these are found all the structures forming the true skin and its appendages, such as hair, sebaceous glands, teeth, nails, etc. The contents vary, but consist for the most part of secretions of the glands in the cyst wall.

FIG. 7.



Method of applying a spiral reverse bandage.

The *treatment* of these cysts is most likely surgical, and where possible they should be removed.

Hydatid or Parasitic Cysts are produced by the tenia echinococcus, one of the forms of tape-worm or cestoda. The worm normally inhabits the intestine of the dog, but it sometimes gets into the intestine of the human from uncooked garden vegetables, the parasites having been deposited on them from the excreta of the dog. The ova taken into the system, hatch out and develop and the embryo makes its way by some channel to the liver or to some other organ, where the development of the embryo results in the production of a cyst.

The *diagnosis* of the cyst varies according to the locality in which the cyst is found.

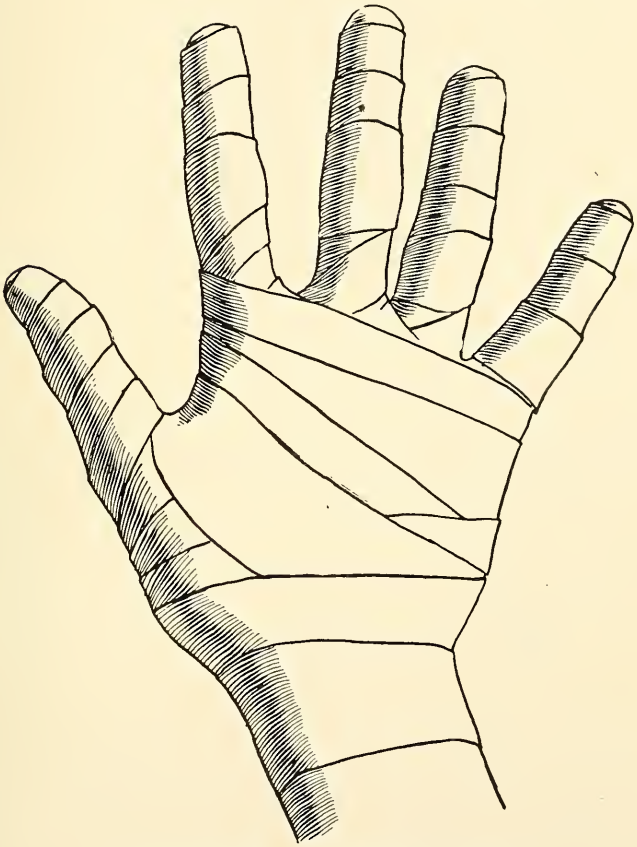
The *treatment* is entirely surgical. Puncture of the cyst is sometimes

attended by urticaria. Peritonitis and general infiltration of the tissues will produce death in some cases. Fortunately the disease is rare.

In general, cysts should be treated on the same principle as tumors.

After a fair trial of the treatment, if the cyst does not recede, operation may be advised.

FIG. 8.



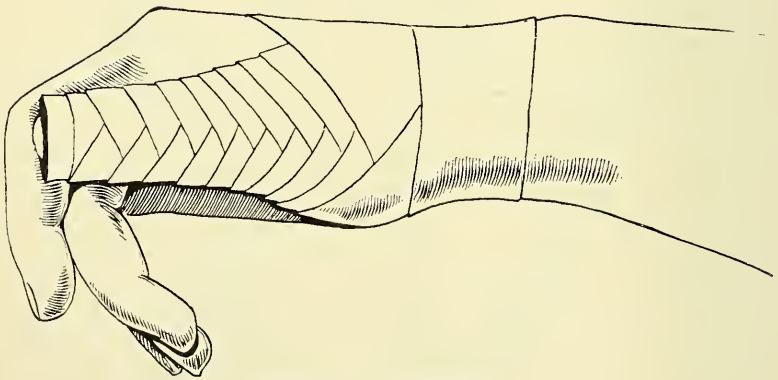
The gauntlet bandage for the fingers and hand.

BANDAGING.

Bandages are used to hold splints and dressings in place, to support parts, protect injured structures, and assist the return circulation. The materials usually used are unbleached muslin, gauze, crinolin, flannel, or rubber. Fabrics impregnated with plaster-of-Paris and starch paste, are often used as fixed dressings where support and immobility must be maintained. To hold surgical dressings in place the muslin or crinolin bandages are best. To assist the return circulation, a wet flannel or a rubber bandage should be used. A figure-of-8 bandage

is best and, if possible, should always be applied. It gives the most uniform pressure. The spiral reverse bandage is easy to apply, but is not so satisfactory. In applying the bandage, it should always be *rolled out*. It should be carried twice directly around the member at the beginning to anchor the bandage, after which the figure-of-8 turns may be made. Care should be taken to *keep the lower edges of the turns of the bandage parallel*. A part should always be bandaged, if possible, in the direction of the return circulation. Each turn of the bandage should be drawn equally tight and should cover one-half of the previous turn. To do this the bandages should consist of strips of from one to nine yards in length and should be rolled up into a single or double roller. In bandaging the fingers or thumb, a figure-of-8 bandage is used. Successive turns may be made over the end of the finger, while afterwards the bandage is carried around the finger to hold the turns

FIG. 9.



Spica bandage of the thumb.

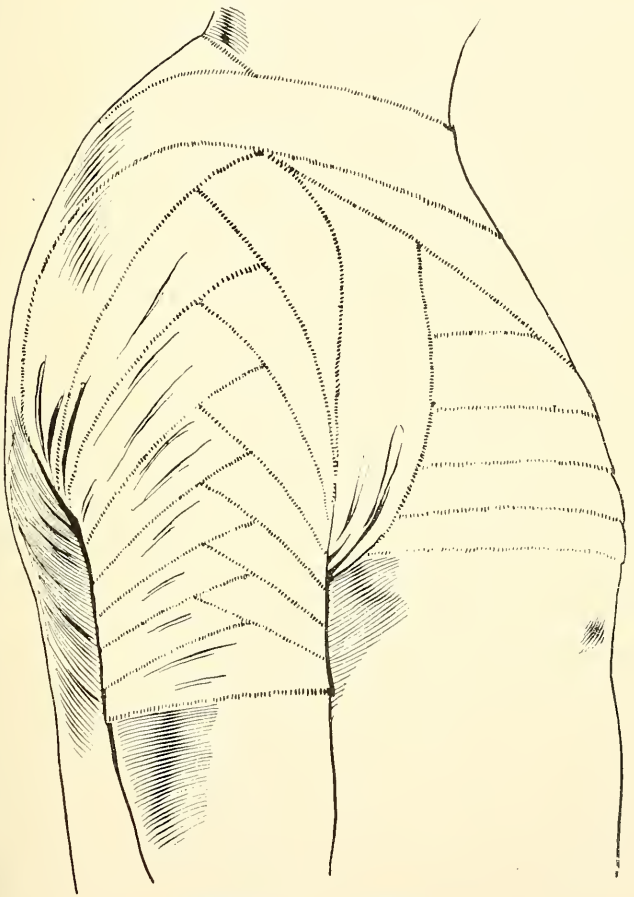
in position. This same method may be used in amputation stumps. For the knee or elbow a figure-of-8 bandage is best. The first turn of the bandage is made opposite the joint with succeeding figure-of-8 loops above and below. In bandaging a shoulder or thigh, a spica bandage is applied. The bandage is begun at the middle of the arm or the thigh and carried upward by figure-of-8 turns. A head bandage is best applied by means of a double roller which unrolls in opposite directions. One roller is carried around the head as successive turns from before backward are made by the second roller. The over-and-over turns may be made from before backward, or from side to side. The ends of the bandage must be firmly anchored by safety pins.

The figure-of-8 bandage is also useful in bandaging up an inflamed breast. A posterior figure-of-8 bandage is quite serviceable in case of fracture of the clavicle.

Velpeau's Bandage.—A bandage three inches wide and nine yards long is required. Pad the axilla on the injured side and place the hand

on the sound shoulder. The bandage is begun on the scapula of the sound side and carried across the back over the injured shoulder, down the front and outside of the arm, turning upward toward the axilla to the starting point. A second turn is made to fix the bandage. The third turn is made circularly around the chest and over the arm on the

FIG. 10.



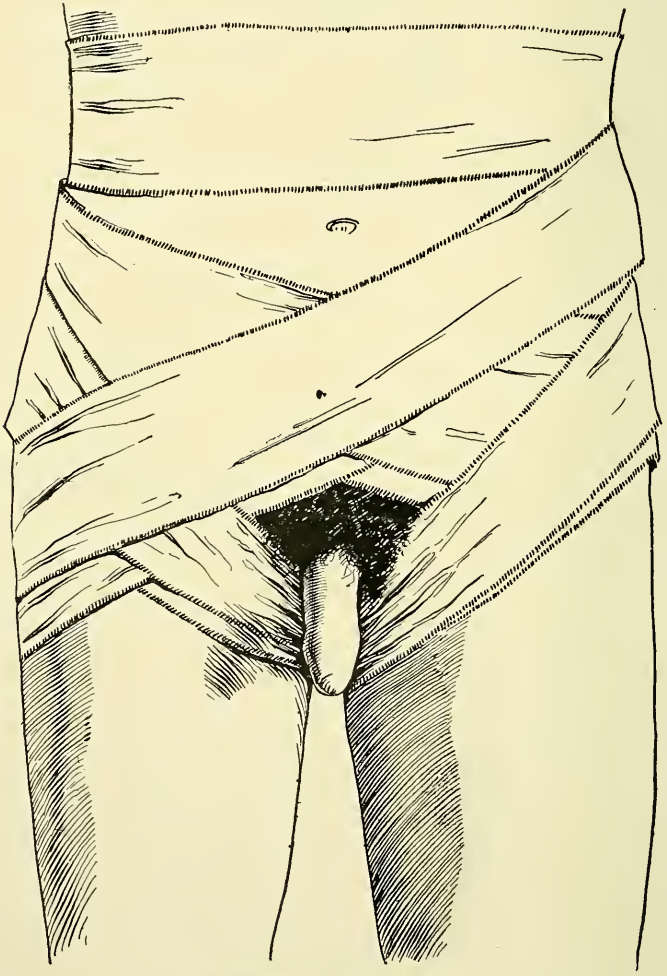
Spica bandage of the shoulder.

injured side, while the fourth turn is as the first. These turns are alternated so as to resemble an ascending spica (see figure). The turns of the bandage should be fastened over the arm. In bandaging the foot, care should be taken to cover all parts of the member by regular figure-of-8 turns. If there is faulty circulation the bandage should be carried beyond the calf of the leg. Barton's bandage, or a figure-of-8 of the lower jaw, is useful in case of fracture of the lower jaw. A crossed

figure-of-8 bandage is useful for both eyes, while single turns are sufficient for one eye.

A many-tailed bandage is made by means of a piece of cloth the width of the part to be bandaged and in length more than twice its cir-

FIG. 11.



Spica bandage of the groin.

cumference. The ends of the piece of cloth are torn into strips three inches wide, the torn part of the bandage comprising about half its length. These opposite strips of the torn ends are then tied together around the member to be bandaged. This bandage is suitable for the thigh or abdomen.

The "T" bandage is suitable for the perineum. It consists of a cir-

cular strip extending around the body and a vertical strip attached behind, passing between the thighs and fastened to the circular strip in front.

Fixed Dressings.

Starch Paste Dressing.—This bandage is made by means of a many-tailed bandage, pasteboard, and starch paste made by cooking a little flour or starch into a paste. The strip of pasteboard is smeared on one side with the starch paste and then applied to the middle of the many-

FIG. 12.

Head bandage applied by means of a double roller.

tailed bandage. This is then applied to the injured member after it has been suitably enveloped with cotton for protection. Several strips of pasteboard may be used and they may be placed on all sides of the member. If two layers of the pasteboard are used, a bandage of great strength may be made. The tails of the bandage are tied around the member. The bandage has the advantage that it can be enlarged to accommodate swelling. This bandage is preferred by Dr. Still.

Plaster-of-Paris Dressing.—A piece of crinolin four yards long should be torn in strips from three to six inches broad, depending upon the part of the body upon which the dressing must be applied. If it is

on the thigh it should be torn in strips six inches wide, but if for the lower leg or foot, three or four inches wide may be sufficient. Into this crinolin should be rubbed dry powdered plaster-of-Paris, which can best be done by heaping the plaster on a table, taking the bandage before it is rolled up and with a thin board or table knife, the plaster-

FIG. 13.

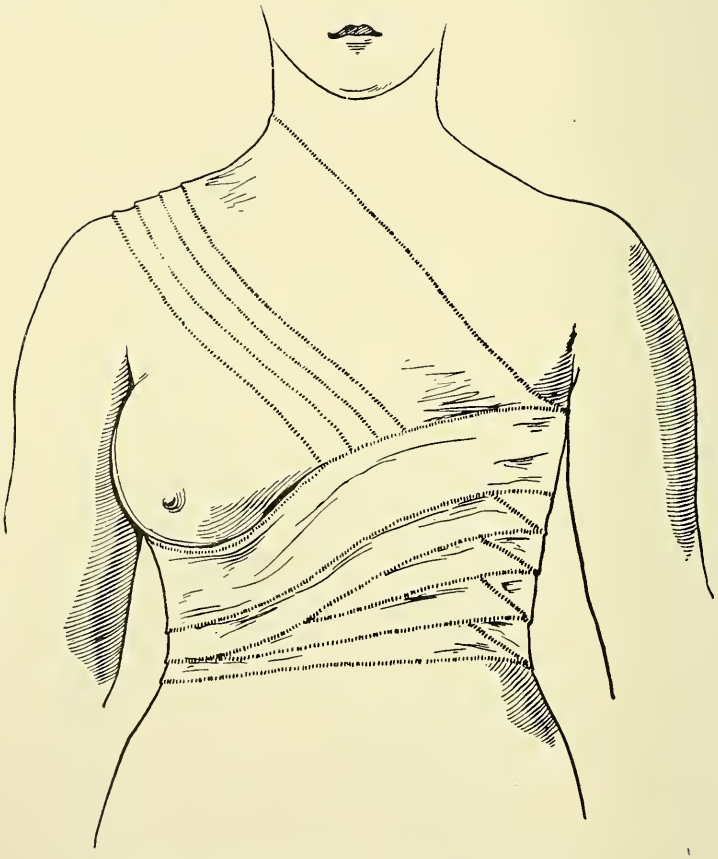
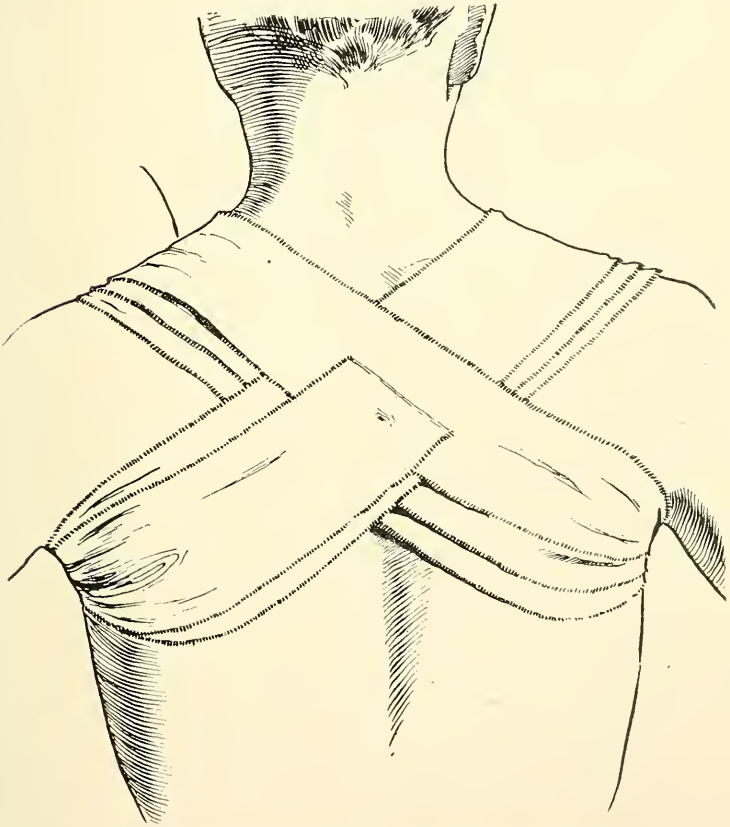


Figure-of-8 bandage applied to support the breast.

of-Paris may be pushed along over the bandage, an effort being made to scrape from the bandage as much of the plaster-of-Paris as possible. As the plaster-of-Paris is scraped off, the bandage is rolled up so that when the bandage is entirely rolled up it is thoroughly infiltrated with the dry plaster. This may be wrapped in oiled paper and kept ready for use. For fracture of the tibia and fibula at least one dozen of such bandages are required. Providing the limb has been put in proper position with the bones in apposition, the limb must be enveloped in lamb's

wool, surgeon's cotton or lint, and a roller bandage applied evenly over all. The cotton should be carried higher than the bandage. The plaster-of-Paris dressing is now immersed in warm water in which there has been a small quantity of common salt dissolved. Powdered alum will serve the same purpose, viz., to make the plaster set more quickly. When the bandage is thoroughly soaked, it may be applied as an ordinary

FIG. 14.

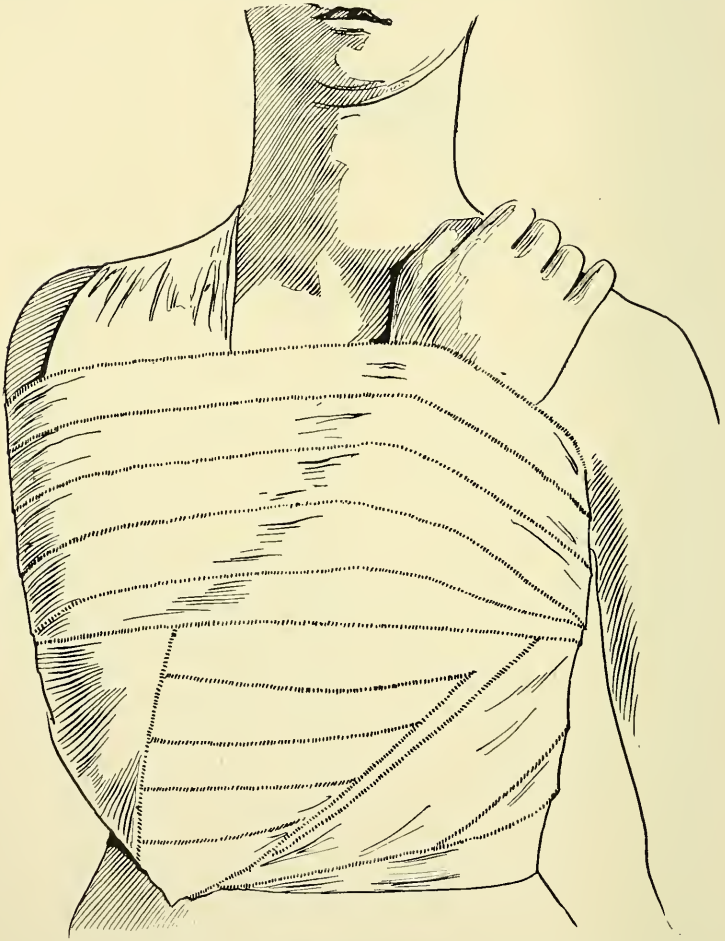


A posterior figure-of-8 bandage. Useful in fracture of clavicle.

bandage. Three or four layers of the plaster bandage should be applied. In case of fracture of the femur, a counter-extending apparatus may be applied before the leg is enveloped in cotton-wool. After the dressing is applied, extension and counter-extension should be kept up until the plaster sets, which may be within an hour. If the plaster bandage has been applied too tightly and interferes with the return circulation, as soon as it sets it may be cut along one side and pulled open so as to allow the blood to circulate freely in the limb. On the outside of this, a roller bandage may be put on to draw the plaster sufficiently close

to the limb to maintain immobility. In this condition the plaster bandage forms an excellent adjustable splint. The indications that the bandage is too tight are signs of obstructed circulation in the extremity, together with numbness and great pain. These demand immediate attention. The plaster dressing is of especial advantage in

FIG. 15.



Velpeau's bandage.

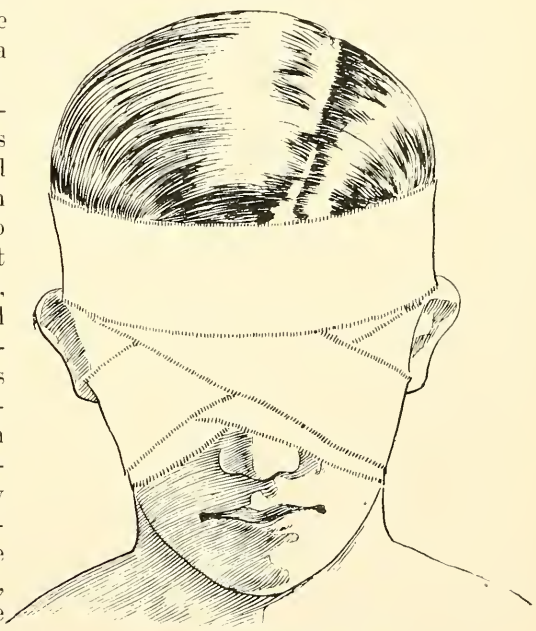
what is called the ambulatory method of treatment of fractures. It is bulky, cumbersome, and many times unclean.

ANESTHESIA AND ANESTHETICS.

Anesthesia means insensibility to pain. The word was coined by Dr. Oliver Wendell Holmes in November, 1846. It may be local, when produced by applications or injections or sprays of cocain, eucain,

ethyl chlorid, etc., or general when produced by the inhalations of ether, chloroform, nitrous oxid, ethyl chlorid, etc. Before the discovery of these drugs, alcohol and opium, together with the application of cold, were used for the purpose of deadening the sensibility. Ether was first discovered by Dr. Morton, a dentist in Boston, in September, 1846, while chloroform was discovered by Simpson, of Edinburgh, in 1847. Ether is the safest of the general anesthetics. The death rate of its administration is variously estimated by different observers, from 1 in 16,542, to 1 in 23,204, while in chloroform the death rate is 1 in 5,860, to 1 in 3,258. These proportions are given from more than one-half million collected cases. More than forty thousand etherizations have been collected without a single death reported.

FIG. 16.



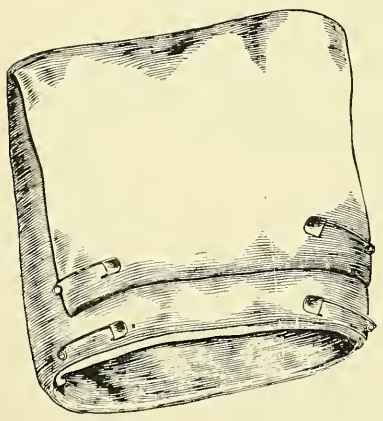
Method of bandaging both eyes.

Ether.—The chief objections to its use are its irritating qualities and inflammability (which makes it dangerous to use at night), while it often produces nausea, vomiting, and cerebral excitement. In administering an anesthetic it is best to have a third person present, inasmuch as curious mental impressions may be retained by the patient after recovery. In general, the heart, lungs, kidneys, great vessels, and the nervous system should be observed before the anesthetic is given. The patient should have nothing to eat for four hours previous. It should be looked to that the patient does not have false teeth, a chew of tobacco, or other objects within his mouth. The clothing should be loose about the chest. The anesthetic should always be given while the patient is in a recumbent position, with the head low. The anesthetist should have a mouth gag, and a pair of forceps handy with which to pull out the tongue if necessary. Ether is best administered by means of a cone which is made of several thicknesses of newspaper and a towel.

Chloroform is best administered by means of an Esmarch's inhaler, or a paper cone, containing within its apex a pledget of gauze, or a small handkerchief. The vapor of chloroform is more grateful, the

patient goes under the anesthetic easier and quicker and if is less irritating. It should be given when an anesthetic is required in children under ten years of age, or in elderly people over sixty who have no heart disease. It should be given in kidney diseases, diabetes, and in bronchial inflammations. It is used in labor because of its quick action. In operations on the mouth and nose, or in operations for cleft palate, it is best. Ether should be used in all other cases. In the administration of ether, the cone should be so held over the patient's face that the proportion of admixture of gas and air will be five per cent. of the air to ninety-five per cent. of the vapor, while in chloroform just the opposite condition is desired—from five to ten per cent. of the vapor of chloroform should be mixed with ninety-five to ninety per cent of air. Operable anesthesia is reached just after the conjunctival reflex has been paralyzed and before stertorous breathing occurs. The pupils should always be watched. Sudden dilatation of the pupil is grave. It is more essential to watch the respirations than the circulation. Because of the irritating qualities of the anesthetic, the patient may hold his breath and thus deceive the anesthetist. Especially is this true in the second stage of anesthesia, which is accompanied by excitement and muscular rigidity. It is essential that the drug should not be pushed under such circumstances, especially if the patient is strong and vigorous. During the early stage of excitement, the patient may shout, sing, fight, and swear, and it is necessary to give the drug easily and carefully, but surely, paying attention strictly to the condition of the patient. By touching the conjunctiva it will be observed that the reflex has disappeared. The patient is then ready for operation. Just enough of the drug should be given to keep the patient in this condition. Some operators give chloroform first, and after complete anesthesia ether is given, inasmuch as it stimulates the circulation. The face and neck are usually warm, moist, and flushed during the administration of ether. Not so with chloroform. Accidents may happen during the administration of anesthetics, the first and most important of which is the arrest of respiration. The tongue should at once be pulled out of the mouth, the drug removed, and the head fully extended in order to raise the epiglottis. At this same time the patient should be everted and artificial respiration performed by Sylvester's method. Laborde's method of rythmical traction of the tongue is of advantage. The tongue should be drawn out of the mouth sixteen times per minute,

FIG. 17.



The towel and paper cone suitable for administering ether or chloroform.

while in Sylvester's method, the manipulation should be done with the same frequency. The patient must be placed with the head low, while the flexed arms are compressed against the chest to expel the air, then extended above the patient's head to raise the ribs. These alternate motions must be done so as to simulate respiration. Should the circulation fail, the patient should immediately be suspended by his feet while the vasomotors are stimulated.

PROCESS OF REPAIR.

The reparative process is, in many respects, similar to the inflammatory process. Having removed the irritant from the tissues, as will, more than likely, sooner or later occur in the history of an inflammation, the return of the tissues to the normal condition, or as nearly the normal as is possible, is termed the reparative process. It has been falsely stated by some writers that it is a process taking place in aseptic inflammation. Obviously such conditions never exist about the human body. The reparative process differs according to the nature of the wound, the tissues involved, and the nature of the irritant in question. These differences are minor. Where pus formation occurs, the reparative process is greatly modified and thwarted because the tissues must not only repair the injury, but must get rid of the irritant (microorganism). In reference to wounds the reparative process has been divided into healing by *first* intention, by *second* intention, and by *third* intention.

Healing by First Intention.—In healing by first intention, the reparative process in the open wound begins just as soon as the tissues have recovered from the injury and the hemorrhage has been arrested and the cells are again receiving their proper quota of nutritious materials. If the edges of the wound are coaptated and the suppurative process is not set up, the inflammation will be slight and just sufficient to bring about adhesion of the tissues. During the first day or two, there will be a little redness extending slightly into the surrounding tissues and there will perhaps be a little swelling and a slight elevation of the local temperature, but the wound will be devoid of pain and only slightly tender to pressure. An effort to pull apart the edges of the wound will show that adhesion has occurred and in a few days the union is formed. Along the line of injury there will be a number of new cells formed which assist in welding together the tissues. It is hardly likely that in any case there is absolute adjustment of the tissues, as fascia to fascia, muscle to muscle, etc., therefore, even in healing by first intention, there would be some need for the formation of new tissue, but as before mentioned, this new formation is of the slightest amount possible. The tissue changes occurring in healing by first intention are worthy of note. Immediately in the surrounding area there is a dilatation of the vessels, stasis occurs, proliferation of the connective-tissue cells and the escape of the leukocytes and serum from the capillaries.

They infiltrate the surrounding tissues and fill up the lymph spaces. Proliferation of the connective-tissue cells results in the formation of new round cells which crowd into the mass of coagulated fibrin which fills up the slight spaces between the edges of the injured tissues, so that in a few days the entire wound is filled with new cells (granulation-tissue cells). The inflammation extends but a short distance back from the wound. The coagulated lymph, blood, and serum, which first filled up the wound and which later have become invaded by the granulation-tissue cells, now become absorbed. The inflammatory reaction becomes less and finally ceases, so that if in a few days a section of the part be made, it will be found that a layer of small round cells unites the edges of the wound. This mass of small round cells is permeated by capillaries which have stretched across the wound and serve the purpose of furnishing the new cells with nutrition. These capillary loops are thrown out coincident with the proliferation of the resident connective-tissue cells. This vascularization of the tissues is one of the characteristic parts of the process and furnishes the cause for the color of the scar immediately after the wound has healed. These round-cells which form the scar now become differentiated into fibrillar connective tissue which, like other fibrous connective tissue, contracts. The cells, at first elongated and spindle shaped, become wavy. This contraction of the scar squeezes the blood out of the capillary loops, when the scar is changed from a pink color to white. The fibrous tissue formed is generally in excess of the required amount, but absorption of the excess of new formation takes place and in a few months or years after, the scar will depreciate materially, or in some cases apparently disappear. After union takes place, if the wound be an incised one, only a faint streak remains to mark its site, and as time goes on this line changes, at first pink, later becoming white and after awhile it may entirely disappear so far as external appearances are concerned. There are few or no constitutional symptoms following or attending the repair of wounds in this manner. This is the condition which should be aimed at by every physician in the treatment of wounds. Considering that large bodies, such as bullets, splinters, thorns, or the penetrating object which produced the wound, have been removed, the only other agency, outside of constitutional defects or irregularities of circulation, etc., which would prevent the union by first intention, is the presence of micro-organisms. Other things being equal, the micro-organisms are the objects which prevent union by first intention, or in other words, cause immoderate inflammation or produce suppuration, therefore, before the wound is coaptated it must be rendered as nearly aseptic as possible. There are cases where coaptation of the wound has never been obtained and the wound having become filled with blood, heals up. This is said to be one special form of healing by first intention, or healing by blood clot. There is another method which properly belongs to healing by first intention—it is where, after a slight wound, a scab is formed and without suppuration the healing takes place under-

neath the scab. This is properly healing by first intention without any destruction of the tissues.

The conditions preventing union by first intention may be summarized as follows:—

1. Extensive contusion and destruction of the tissues.
2. Presence of septic material or foreign bodies.
3. Diminished vitality of the tissues because of debility or the use of alcohol, or the presence of diabetes, bad hygiene, etc.
4. The parts not having been kept at rest.
5. Insufficient drainage.

All of these conditions operate to permit of infection, and if infection occurs, the granulation tissues will be converted into pus, when healing by second intention will be necessary

Healing by Second Intention.—In healing by second intention, either coaptation of the wound has not taken place or infection has occurred through the operation of some of the above named conditions. If pus forms because of insufficient drainage, sepsis, etc., after coaptation of the wound, there may be a reaction quite similar to septic intoxication. Many times this will occur and has led to the popular belief that wounds may heal too quickly. If a wound is completely healed, under no circumstances may the repair take place too quickly, but the trouble is, because of the vascularity of the deeper layers of the true skin, it becomes glued together before the connective tissues beneath heal. The presence of foreign bodies, or the effusion of fluids which later become septic, cause pus formation. The tissues become distended and the wound opens and discharges pus. If the wound is large and the pus formation great, there may be a severe systemic reaction. After this change has taken place, the wound must then heal by second intention. If there has been extensive destruction of tissue or a mass of the tissue dies because of the injury, as soon as the hemorrhage is arrested and the wound has been cleansed, the connective-tissue cells begin to proliferate. The area becomes very vascular because of the dilatation and the formation of new vessels. The round cells, the source of which is the resident connective-tissue cells, increase and multiply and fill up the wound from the bottom. Capillary loops are formed which extend out into these layers of granulation tissue which are formed one above the other, extending from the bottom of the wound towards the top. When the wound is filled, the surface epithelium creeps out over the top from the surrounding epithelium. This epithelium is usually dwarfed, most likely because of an insufficient blood supply, so that the epithelial covering of a scar is not like that over the surrounding healthy tissues. After healing has taken place the scar, which is now red and elevated, grows smaller because of contraction. This cicatricial contraction is due to the differentiation of the round cells, which become spindle-shaped and long, and

afterwards contract into wavy bundles. Where the scar is extensive, this cicatricial contraction may produce great deformity, often rendering a member useless. In wounds through the cheek, cicatricial contraction and scar formation, if there is not good coaptation of the wound, may prevent the person from opening the mouth. Cicatricial contraction may bind down the tendons of the hand so as to render it useless. In burns about the face, the cicatricial contraction may distort the features. Should it happen that there is much destruction of the tissues, healing will not take place until all of the destroyed tissues are removed. These are removed by process of ulceration and gangrene.

Healing by Third Intention.—Should it happen that the wound is so extensive that it may not be coaptated, healing by second intention will continue and after a time the wound will become comparatively small. It may then be possible to coaptate the edges. Considering that the surface of the wound has been rendered aseptic, if the edges of the wound are brought together and held in apposition by some means, union of the two granulating surfaces will take place readily and quickly. This is healing by third intention.

Repair of Special Tissues.

Epithelium.—The repair of epithelium is generally complete. The new cells are derived from the epithelium at the margins of the injury by a process of division and subdivision, the cells spreading out over the basement membrane, but if the injury extends into the subepithelial tissues, a scar will be formed.

Skin.—Repair of the skin is accomplished by scar formation. Fibrous tissues take the place of the other structures. No nerves are found in the scar. After a time even the blood-vessels disappear. Hair, sebaceous glands, sweat glands, and the other appendages of the skin are not reformed. The rete Malphigii is not reformed, which likely accounts for the fact that the epithelium over the scar in the skin is imperfect. Inasmuch as a scar contains a poor epithelial covering, few vessels, few or no lymphatics, and no nerves, it is liable to injury.

Fascia and Tendons.—The repair of fascia means practically regeneration, inasmuch as it consists almost entirely of fibrous tissue. The repair of tendons is not quite so complete, the scar always remains in evidence, but a scar formation may fill up a considerable gap between the divided ends of the tendons. producing an excellent result, even though the tendon is somewhat defective.

Muscle.—Muscular tissue is only repaired by means of scar tissue derived from the endomysium, perimysium, and epimysium, or from the endothelial tissue elements. Regeneration of the muscles may follow to a limited extent, but as a general rule, no highly organized tissues, such as muscle, will regenerate. It is possible where there is absolute coaptation of muscle fibres, that union by adhesion will take

place. According to some writers, severed ends of muscle fibres die and the ends of the damaged muscle cells break up into spindle-shaped fragments, which undergo fatty degeneration and totally disappear by the twenty-first day. The disappearing fibril is then replaced by a bundle of longitudinally striated fibres, which are differentiated from the muscle nuclei. The growth of the muscle fibre into the granulation tissue and the disappearance of the destroyed muscle tissue, begin about the sixth day. The outgrowths of muscle may bifurcate and terminate in club-shaped extremities. The longitudinal striations may appear as early as the second week. The new muscle filaments which are formed, should this occur, interlace and extend in various directions. The interlacing of the fibres from the opposite side of the wound continues until the muscle is made thoroughly strong, when the interlacing fibres are gradually absorbed and the muscle seems to return to the normal condition.

Blood-Vessels.—The repair of blood-vessels frequently depends upon the organization of thrombi. A wound of an artery may heal by the formation of cicatricial or scar tissue. More or less arrest of the blood current is necessary for this to take place. If a thrombus forms it may undergo secondary changes. Capillaries are developed by the sprouting out of the endothelial cells. These outgrowths become united with other outgrowths, forming loops. The cells of these loops become hollowed out, in some manner, forming capillary loops.

Nerves.—Under proper circumstances the repair of nerves (nerve fibres) is complete. The immediate union of nerve fibres with the restoration of their power is said to have occurred clinically, but as yet has never been done experimentally. When nerve cells are destroyed, they are not reproduced, but when the fibre is destroyed, it may be regenerated or reproduced. When the fibre is cut off, the whole distal end of the nerve dies and degeneration of the proximal end takes place back to the first node of Ranvier. Regeneration of the nerve then takes place by the outgrowth of the proximal extremity. Zeigler maintains that the distal segment takes an active part in the regeneration of the nerve. The process which most likely takes place is as follows: In four or five days after section, the myelin sheath becomes segmented and the axis cylinder divides up into fragments in the distal portion of the nerve. As early as the seventh day, active proliferation begins in the neurolemma with migration of the newly formed cells, several occupying one internode. During the following week the myelin sheath and fragmented axis cylinder become absorbed and are completely removed by the fourteenth day. The nuclei in the internodes then acquire an investment of protoplasm. This process continues until a single-celled protoplasm fibre with imbedded nuclei is formed. It sometimes happens that more than one sheath and more than one protoplasmic fibre may occupy the old sheath. The fibre now grows down through the newly formed sheath and the function begins

to return by the twenty-first day and is complete in eighty days. These are the results of experiments upon dogs under favorable circumstances.

Bone.—The repair of bone takes place in the same manner as in soft tissues. Ossification follows in the soft callus, or in other words, the granulation tissue is converted into bone in much the same manner as bone is formed in cartilage or in membrane. The union may be sufficiently complete under very favorable circumstances, that it would be difficult to determine the point at which the fracture occurred.

WOUNDS.

Definition.—A wound is a solution of the continuity of the living tissues. In general, wounds may be divided into two great classes, open and closed. Open wounds are those in which there has been a solution of the continuity of the surface or the skin is broken. Wounds vary according to the instruments which produce them, the tissues affected, and the amount of force used. A slight force may produce an extremely severe wound in some tissues, while in others the effects would be but slight. The amount of damage inflicted by an object is by no means apparent by the slight wound at the surface, but on the other hand, the gravity of the wound will depend largely upon the nature and extent of the wound and the tissues involved.

Effect.—The effects of wounds are (A) Local and (B) General. The local effects are (1) pain, (2) hemorrhage, (3) retraction of the edges of the wound, and (4) more or less interference in function.

Pain, Retraction of Edges, etc.—The pain occasioned by a wound will depend upon the nature and location of the wound. In contused wounds, the bruising of the tissues will destroy the sensibility. More or less contusion attends a gunshot wound, and in moments of excitement, persons may not discover that they have been injured, unless a nerve trunk or some other vital structure has been injured. The pain may be quite severe, due to irritation of the peripheral nerves, or it may subsequently become more severe, due to secondary changes taking place in the wound, e. g., sepsis. Inflammatory changes will cause pressure on the terminal nerves. Pain at first acute will perhaps be converted into a dull ache, and if severe inflammation follows, the pain may become intense. Sometimes retraction of the edges of the wound will be very great, especially if muscular tissue has been severed. If the wound is directed across the cutaneous muscular fibres, instead of parallel to them, the retraction will be much greater. The interference in function will depend upon the extent of the injury and the structures involved.

The *General Effects* of wounds are (1) shock, and (2) hemorrhage.

Shock.

Shock constitutes the systemic effect of severe injury in which vasomotion and inhibition are profoundly disturbed.

Cause.—It is produced by the profound effects of afferent impulses on the centers. There is a marked fall of blood pressure, due to temporary paralysis of the splanchnic area. This results in the engorgement of the abdominal viscera and consequent anemia of the nerve centers. Where it is suddenly fatal, it is perhaps due to the effect of severe impressions directly on the centers or to the effect on certain nerves, such as the pneumogastric. Death is said to result in such cases from inhibition. Shock is more disastrous in old people and in the debilitated or in victims of heart disease, diabetes, or alcoholism. Injury to the viscera, or even simple exposure of the intestines to the air, as in the opening of the peritoneal cavity, very often occasions great shock. Operations on the urethra or injury to the testicle or ovary or uterus are attended with great shock. Burns over considerable areas, even though it is but an injury of the epithelium, may cause fatal shock. Especially is this true where it involves the trunk. Irritant poisons or profound mental emotions may superinduce fatal shock. Prolonged anesthesia or the removal of a tumor or a considerable quantity of fluid from the abdominal cavity may bring about considerable shock. The constant abstraction of the body heat may occasion great shock. Hemorrhage will cause shock according to its severity.

Symptoms.—The onset of shock is sudden and is generally easily recognized. It may be confounded with hemorrhage. The symptoms may be thus summarized:

Mental.—The person may be conscious or semiconscious, depending upon the severity of the shock or upon its prolongation.

Skin.—The person is blue, the lips are blanched, and the skin is generally covered with a cold, clammy sweat. The extremities are especially cold.

Circulation.—The heart is quick, pulse feeble and fluttering. Very often the pulse can not be detected in the extremities. It may not be appreciable in the radials.

Temperature.—The temperature is generally subnormal.

Eyes.—The eyes are half-closed, lusterless, and glazed. The pupils are dilated and react slightly to light.

Respiration.—The respiration is shallow, quiet, and slow and may be of the Cheyne-Stokes character.

Muscular System.—The muscles are usually relaxed. There may be more or less muscular tremor. The sphincters yield and there may be involuntary actions of the bowels and bladder. There may be nausea and vomiting. In severe forms of shock, the urine may be suppressed and the patient subsequently die of uremia. The symptoms

may come on with such sudden onset that the patient will die of syncope, or if the shock is prolonged, the patient will go into a semiconscious or delirious state, followed by collapse. Reaction may be established. This will be attended by the color returning, the skin becoming hot, face flushed, and the temperature rising to normal, or perhaps slightly elevated. The bowels will be confined, the urine scanty and high-colored and the patient will feel feverish. The pulse becomes full and strong. The secretions will be established slowly.

Treatment.—The treatment of shock is to first remove the cause. If it is hemorrhage, this should be at once arrested. If it is due to an anesthetic, it should be withdrawn and the patient given plenty of fresh air. If it is due to exposure the person should be protected. Often in cases of operation the shock may be brought about partly by exposure of the patient, the surface of the body becoming chilled. If the shock is due to the presence of a dead limb, which may sometimes occur, the limb should be amputated. If due to the presence of a fracture or dislocation, this should be reduced and the member put in an easy position as soon as possible. Never administer morphine in case of shock, even if the shock is largely brought about by pain. Bandage the limbs with hot flannels; especially should this be done if the shock is brought about by hemorrhage. Wrap the patient in hot blankets. Hot water bottles should be applied over the heart and generally about the body. If the shock is severe, hot fluids, such as hot coffee, etc., may be given. Artificial respiration should be kept up. The head should be lowered to allow the blood to get to the centers. Enemata of hot normal saline solutions may be given. The solutions should be heated to 110 degrees F.

Osteopathic Measures.—It is of the greatest importance that a good circulation be secured to the nerve centers in the medulla and brain. This can be done by stimulating the superior cervical ganglion. The vasomotors to the general body should be stimulated so as to equalize the general circulation. The heart itself, if weak, will require stimulation. This can be successfully done by manipulation in the upper dorsal and upper cervical regions. Raising the ribs—especially the upper ribs on the left side—will be of service.

Prevention of Shock.—Shock may be prevented by protecting the patient, seeing that he is properly covered and the surface of the body not too much exposed. Prolonged operations are sometimes the source of shock, hence it is a great and important factor. Operations should be done rapidly. Do not allow purging of the patient previous to undergoing an operation. In shock, hot, strong, black coffee will be found useful. It is perhaps of advantage before the operation. Where the shock is from pain, relief may be obtained by pressure upon the nerve involved. In case of injury to the eye, or at a point where it is impossible to reach the injured nerve, morphine may be given hypo-

dermically or opium administered per os. However, there are but few instances where such remedies are necessary. Osteopathic methods are sufficient in almost all cases.

Hemorrhage.

Hemorrhage is frequently spoken of as (1) arterial, (2) venous, (3) capillary, (4) parenchymatous, (5) interstitial, and (6) internal.

By **Arterial Hemorrhage** is meant bleeding from an artery. This can usually be told by the bright red color of the blood and the pulsation or irregularity of the stream, the blood escaping in jets.

In **Venous Hemorrhage** the blood, while flowing rapidly, is a continuous stream and is blue or purplish-red in color.

In **Capillary Hemorrhage** the blood oozes from the tissues and seems to come from all points in the wound and not from any distinct locality. There are conditions, though, in which venous and arterial hemorrhage can not be distinguished. In case of prolonged anesthesia, the blood is generally purplish, or if the blood has flowed some little distance and is directly exposed to the air, it may become oxygenated and very bright red, even though it has come from a vein. Where bleeding takes place from cavernous tissues or tissue spaces, such as occurs in the corpora cavernosa or from the spleen, it is called *parenchymatous hemorrhage.* Where the hemorrhage takes place in the tissues of a limb between the muscles and along the fascia, it is called *interstitial hemorrhage.* This interstitial hemorrhage may be sufficiently severe to cause a large puffy tumor and to so press upon the blood-vessels of a limb as to obstruct the circulation below.

Internal Hemorrhage is a condition where there is bleeding into one of the large cavities of the body, as the peritoneal or pleural cavity.

Symptoms.—The symptoms of hemorrhage are both local and general. The local effects are the presence of large quantities of blood. When it occurs in the subcutaneous tissues it forms a puffy tumor, or in a cavity of the body an evidence of fluid. The extravasation of blood takes place along the tendon and muscle-sheaths, or underneath planes of fascia, and after a time causes considerable discoloration of the tissues. The general effects of hemorrhage are the following: If the hemorrhage is rapid, death may follow from syncope. If it is not so rapid, the pulse will be found weak, at first rapid and then slow and fluttering. The skin becomes covered with a clammy sweat and it may often have a greenish tinge. The face becomes pale and the lips blanched. The patient will often complain of vertigo and the eyes will have a fixed and glassy stare and the pupils are dilated. In less severe cases one of the first symptoms is defective sight. The patient complains of objects moving in the room and of everything suddenly turning black, or there may be little objects dancing before the eyes (muscae volitantes). The hear-

ing will be defective and the patient may complain of tinnitus aurium. The more severe the hemorrhage, the harder the hearing of the patient. Thirst is inordinate and it is not relieved by frequent draughts of water. The patient is restless and sometimes there is muscular tremor. Especially is this true if there is considerable blood lost. Convulsions generally precede death. Vomiting and regurgitation of the contents of the stomach are not uncommon. Where the hemorrhage is severe and rapid, dyspnea is a marked symptom and the patient ofttimes gasps for air and clutches his chest. A loss of one-half the blood of the body is usually fatal. This amount will vary according to the individual. It is said from four to six pounds is fatal. Ofttimes in cases of concealed hemorrhage, the first evidence may be yawning. The patient complains of a close feeling—not sufficient air and of thirst. An examination should at once be made to determine if there is hemorrhage.

General Treatment of Primary Hemorrhage.

Position.—To prevent syncope and collapse from hemorrhage, it is essential to keep the head low and the centers supplied with blood, hence the affected part should be elevated and the head lowered. In case of uterine hemorrhage, or hemorrhage from the bowels in typhoid fever and in similar conditions, the foot of the bed should be elevated six inches and the pillows taken from under the head of the patient and absolute quiet enjoined.

Bandaging.—The limbs should be closely bandaged with hot flannel bandages. This is of the greatest value in that it renders the circulatory system smaller in size until the quantity of the blood may be increased.

Increase of Blood to the Medulla and Other Manipulative Measures.

Manipulation in case of hemorrhage should not be directed toward increasing the heart's action, since it may cause a greater loss of blood. The blood flow to the nerve centers may be increased by securing dilation of the carotids and vertebrals and their branches. This can be accomplished by stimulating the vasomotors in the neck. Any manipulation should be gentle and not sufficient to disturb the patient.

Heat should be applied to the body by means of hot blankets and hot water bottles. This should be kept up to relieve the shock incident to the hemorrhage and to restore the heat which the loss of blood has taken away.

Hot Saline Enemata are of the greatest advantage. In some cases intravenous injections of hot saline solutions are used. This is unnecessary if the enemata are used sufficiently early. A quart of normal salt solution should be allowed to run into the bowel and must be retained. If it is voided by the patient, more should be introduced by means of a fountain syringe.

Diet.—The subsequent effects of hemorrhage may be best treated by the administration of highly concentrated and digestible foods. Give water, beef broth or beef juice, eggs, milk, and such other nourishment in small quantities, frequently repeated.

Methods of Arresting Hemorrhage.

Nature's Method.—Nature's method of arresting hemorrhage is to bring about a lowering of the blood pressure. This is accomplished by dilating the blood-vessels in the splanchnic area so that the blood pressure is markedly lowered in the bleeding artery. Then the flow of blood from the artery becomes less rapid. Furthermore, the inner coat of the artery is made up of elastic tissue and when this is torn or injured it has the property of contracting and curling up. As it contracts it more or less obstructs the lumen of the vessel and furnishes numerous points which are favorable to the coagulation of the blood. As the blood flows more slowly and as it is brought in contact with the atmosphere, the lumen of the vessel being reduced, the end of the artery may become plugged by a clot. This clot will form in the vessel extending back to where the first branch is given off. In this way nature endeavors to arrest the hemorrhage. It is not unusual that the hemorrhage may become arrested, and then by means of the contractions of muscles or movements, these clots may become disturbed. With the rise of blood pressure, as the heart becomes stronger, these plugs are forced out of the ends of the arteries and a subsequent hemorrhage occurs. Repeated hemorrhage of this kind may continue until the patient dies, so that it is necessary to enjoin the strictest quietude where the methods are not at hand to stop the hemorrhage and we must rely upon nature's effort. Where hemorrhage takes place into a cavity, such as the pleural cavity, it will continue until the pressure within the cavity is equal to that within the vessels. This, it can be readily seen, would require a considerable amount of blood. There are two chief factors which have to do with the formation of clots within the vessels in the operation of nature's method for the control of the bleeding vessels. They are (1) enfeeblement of the heart and (2) the absorption of the watery fluids from the tissues. These seem to assist the coagulation process. Should the clot remain within the artery, it will most likely undergo reorganization and the artery will become permanently plugged. Coagulation of the blood in the wound and around the sheath of the artery, and its subsequent contraction, prevent the artery from dilating, consequently the clot is not readily dislodged. The internal clot, because of its adherence to the vessel wall, prevents the escape of blood. Leukocytes migrate from the clot. Proliferation of the connective-tissue cells occurs and the clot becomes organized. After a short time inflammatory exudates occupy the place of the clot until finally it becomes changed into granulation tissue and then into fibrous tissue, forming a hard, fibrous plug. This description

of the method of arresting hemorrhage applies to injury of small arteries. When an artery is punctured or when the aorta or one of the larger vessels is injured, this process may not take place. The hemorrhage is likely to be fatal. If the artery is divided in its course, the distal end heals in the manner described. The proximal end will heal in this manner, providing the conditions are favorable and the artery is not too large, so that hemorrhage will destroy life.

The methods employed by the older surgeons in the treatment of hemorrhage were in some cases terribly barbarous, as, for instance, in the amputation of a limb, a redhot knife was used. It was the common practice, until the days of Ambrose Pare, to pour boiling oil over an amputation stump to check the hemorrhage. Sometimes the stump, after amputation, was immersed in boiling pitch, but after nature's method of arresting hemorrhage became better understood, the methods of the surgeons were made to comply with and to imitate it. Nature's method depends upon these conditions:—The fall of the blood pressure, the contraction of the arterioles brought about by the action of the muscular coat, the curling up of the internal coat with the terminal plugging of the vessel, together with the increase of the coagulability of the blood. This increase of the coagulability, as before mentioned, is brought about by the slowing of the blood and the increase of its watery elements and by being brought in contact with the air.

Surgical Methods.—(A) Temporary. The temporary methods of controlling hemorrhage are (1) direct pressure on the bleeding artery, which can be at once accomplished by placing the thumb or finger over the bleeding point and holding it, or pressure may be made upon the bleeding point by means of surgical dressings and a suitably applied bandage. (2) Pressure between the bleeding point and the heart, which may be accomplished in the following ways:—digital pressure, forced flexion, and the tourniquet. The femoral artery may be compressed where it passes underneath Poupart's ligament. The dorsalis pedis artery may be compressed on top of the foot. The popliteal artery may be compressed by forced flexion. The posterior tibial artery may be compressed above the internal malleolus. In severe hemorrhage from the palmar arch, the brachial artery may be compressed at the insertion of the coraco-brachialis muscle. The axillary artery may be compressed by pressing it against the head of the humerus. The subclavian artery may be compressed where it comes over the first rib. The temporal artery may be compressed anywhere upon the side of the face and head. The occipital artery may be compressed as it passes up behind the ear. In this manner hemorrhage can be arrested until other means can be used. Where a limb is torn and mangled and there are numerous arteries injured, a tourniquet may be necessary. This can be applied by taking a handkerchief or piece of cloth and tying it loosely around the limb, then inserting a stick and twisting it. The knot in the cloth should be placed over the leading vessel. The tourni-

quet may be twisted sufficiently tight to arrest the hemorrhage. It must not be twisted sufficiently tight as to entirely cut off the circulation, or gangrene of the stump will take place, providing the tourniquet is allowed to remain for any length of time. Even a few hours may be fatal to the tissue beyond the point of compression. Morton's elastic bandage or an elastic tourniquet is often very valuable where it is at hand.

(B) Permanent methods. The permanent surgical methods of controlling hemorrhage are the following:—(1) Cold, (2) Heat, (3) Pressure, (4) Ligature, (5) Torsion, (6) Acupressure, (7) Forcipressure, (8) Cautery, and (9) Styptics.

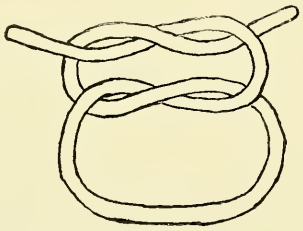
Cold may be applied in the form of a cold water coil or ice-pack, preferably in the form of ice. It seems to cause the muscular coat of the artery to contract and drives the blood out of the part. Severe cold favors coagulation of the blood in the smaller vessels. Ice-pack to the right iliac fossa is of advantage in hemorrhage in typhoid fever. Ice applied directly to the bleeding surface is of benefit.

Heat.—In the control of venous and capillary hemorrhage, heat is the most valuable agent, next to ligature, that we have. Water should be used as hot as can be borne. The water should be at least 120 degrees F. and in many instances water of greater heat is of great advantage. The best method of application is by sponges wrung from hot water and applied to the bleeding surface. This causes the contraction of the arterioles and coagulation of the blood in the mouths of the vessels. By rapid and constant changing of the sponges, together with the local pressure, hemorrhage may be quickly staunched. The success of the method depends upon its rigid application.

Pressure has been mentioned as one of the temporary methods of controlling hemorrhage. It likewise can be considered as one of the permanent methods. In injuries where the arteries may be compressed between the dressing and bone, as in wounds of the temporal or occipital artery, a mass of gauze and cotton may be placed over the artery and a tight bandage placed about the head. Here pressure is made directly upon the artery by the bandage which is sufficient to control the hemorrhage and yet will not interfere with the nutrition of the tissues and the healing of the wound. Pressure can be applied in a similar manner, by a tight bandage, to stumps. Care should be used in the application of the bandage, not to interfere with the return circulation. In hemorrhage from a varicose ulcer or injury to an artery or vein of the lower leg, the part may be bandaged snugly from below up. The bandage may be allowed to remain until nature completes the work by causing coagulation in the mouths of the vessels, thereby arresting the hemorrhage. In case of hemorrhage from the uterus, tamponing the vagina is a valuable method. In hemorrhage from the nose, tamponing the posterior and anterior nares is of the utmost value and many times will save life when all other efforts are futile. The posterior nares

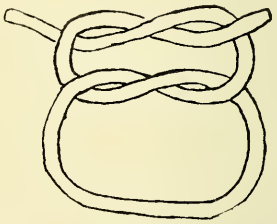
may be best tamponed in the following manner:—Take a small rubber catheter and tie to it a string several feet in length. The catheter may then be pushed back through the nose until it enters the pharynx, where it may be grasped with forceps and pulled through the mouth. We now have a string coming out of the mouth and nose. A pledget of cotton of sufficient size, which when compressed will be about as large as the patient's thumb, should be used. This is tied to the string coming out of the mouth, when by means of the string coming out of the anterior nares, the cotton may be pulled back up into the posterior nares. This will successfully cut off the hemorrhage in that direction. The anterior nares may be readily plugged by inserting cotton. The plug in the posterior nares may be allowed to remain thirty-six hours or longer, or until the physician is sure that the mouths of the vessels have been closed by nature. An instrument may then be pushed in through the nares and the plug pushed out in the pharynx and removed.

FIG. 18.



A reef knot, the kind used in the ligature of an artery.

FIG. 19.



A granny knot, the kind not to use in ligaturing a vessel.

Ligature is the most reliable of all the methods of permanently arresting hemorrhage and it is one which is frequently used. Material used for the ligature are chromicized and asepticized catgut, sterilized silk, and kangaroo-tendon. Of these ligatures, silk is most generally used because it is more readily rendered aseptic. Before asepsis and antisepsis were thoroughly understood, it was customary in ligature of an artery to allow the ends of the ligatures to hang out of the wound. Each day as the surgeon visited his patient he would pull the ligature slightly until finally the end of the artery was pulled off and the ligature pulled out. The wound was then allowed to heal by second intention. It has now been shown by experience that silk, if aseptic, under reasonably favorable circumstances, will remain as an inert body within the tissues and will not occasion any mischief, but will become encapsulated, perhaps partly absorbed. Kangaroo-tendon and chromicized catgut have the advantage that they will after a while become absorbed, but they have the disadvantage that they can not be so successfully sterilized as silk. In the application of a ligature it should be tied sufficiently tight to prevent its slipping, and none of the tissues surrounding the artery should be enclosed with it. The artery should be tied by

means of a reef knot or a friction knot. When the ligature is applied, the internal coat is broken, the end retracts and curls up and becomes crumpled, coagulation of the blood readily takes place and secondary changes, organization of the clot and encapsulation of the ligature, follow in sequence.

Torsion consists in seizing the end of a bleeding artery with an artery forceps, drawing it from its sheath and twisting it several times until it is felt to partly yield. Four or five complete turns will be sufficient. Where the artery is large it should be pulled out a half inch and grasped by one artery forceps, while another grasps the end of the artery. The one forceps holds the artery firm, while with the second forceps, or the one grasping the end of the artery, torsion is made. This method of arresting hemorrhage is applicable to arteries the size of the radials, brachials, and even the superficial femoral. In this method no foreign body is left in the wound, hence there is less danger in the wound healing, likewise less danger of scar. This method can not be used if the artery is diseased. It is said that in some cases necrosis of the artery has taken place. This method was employed even by ancient surgeons. In small arteries or where suppuration would be especially disastrous, this method is valuable.

Acupressure is controlling hemorrhage by means of pins. It was devised by J. Y. Simpson. The pin passes underneath the vessel, leaving as little tissue on either side and between the pin and the vessel as possible. Silk is then twisted in a figure-of-8 over the ends of the needle. There are other means of applying acupressure needles, but they need not be mentioned, as they are obsolete.

Forcipressure consists simply of using a hemostatic forceps to grasp the end of the artery. It is the means used during an operation to control hemorrhage and in many cases will be permanent. It is occasionally used to arrest hemorrhage where the artery is deep and it is impractical to further operate, or where the artery can not be ligated. Apply the forceps and allow them to remain for twenty-four hours, when they can be quietly removed, the patient being kept very quiet and the wound afterwards closely watched. By this time nature has formed a clot within the artery and the subsequent changes, as occur in nature's method of arresting hemorrhage, will take place.

Cautery arrests hemorrhage by the coagulation of the blood and partly by charring the tissues, which form an eschar, preventing further flow from the vessels. It is best applied by means of the Paquelin cautery or the Galvano-cautery. The wound or bleeding surface is dried by the application of surgeon's lint or cotton, and the cautery, which is at a full red heat, should be immediately applied. Where these cauteries are not at hand a cautery iron which is heated in the fire may be used. The chief objection to the use of the cautery is that the charred tissues will separate and subsequent hemorrhage

result. It is useful to arrest hemorrhage in the nasal mucous membranes or the tonsils or in some location which is not readily accessible.

Styptics should never be used to arrest hemorrhage until all other methods have been exhausted. Personally the writer considers them of little value. The drugs produce coagulation of the blood in the mouths of the bleeding vessels. The agents most frequently used are the tincture of the chloride of iron, in fairly strong solutions, one-half to one dram to an ounce of water; tannic or gallic acid, either in a dry powder or a strong solution. Sloughing of the tissues is often brought about by the application of these styptics and they should be used with the utmost care.

Recurrent or Reactionary Hemorrhage.

Recurrent or reactionary hemorrhage occurs because of the slipping of a ligature or because the clot has been washed out of the mouth of the vessel. It calls for immediate treatment, some permanent means being used and the wound redressed. The blood soaked dressings must be removed or infection will take place. Where there is oozing from a stump, it is hardly reactionary hemorrhage. The part should be redressed and perhaps more firmly bandaged.

Secondary Hemorrhage.

Secondary hemorrhage is that which occurs after twenty-four or thirty-six hours and which is generally the result of defective formation of the clot within the vessel, or perhaps the result of faulty surgical means. In some cases it may be because of disease of the vessel wall. Infection may lead to ulceration; this, extending into the blood-vessels, may bring about secondary hemorrhage.

Cause.—The causes of secondary hemorrhage may be summarized as follows: (1) Bad treatment. This bad treatment may consist of failure to maintain cleanliness and asepsis or ligature improperly applied.

(2) Infection. When infection follows, necrosis of the end of the bleeding vessels may occur. The application of modern methods will prevent infection and secondary hemorrhage.

(3) Disease of the vessel wall. Thrombosis and degeneration of the vessel walls may be such that the ligature will not hold or the artery will break, secondary hemorrhage occurring.

(4) Certain constitutional conditions, as in hemorrhagic diathesis, and in conditions where the patient has a tendency to bleed.

Treatment of Wounds.

The treatment of wounds may be conveniently grouped under the following heads:—

1. Arrest of hemorrhage, prevention of shock, and relief of pain.
2. Cleansing the wound.
3. Closing the wound and providing proper drainage.
4. Prevention of sepsis by proper care and the proper dressings rightly applied.
5. Attention to the general health.

Arrest of hemorrhage, prevention of shock, and relief of pain have been discussed.

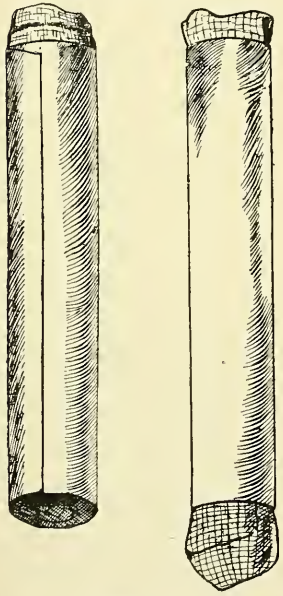
The cleansing of the wound consists in the removal of foreign bodies and irritants of any kind. If the wound has been made by a septic object it is presumed that the wound is septic. If the opening is sufficiently large, as in the case of an incised or lacerated wound, in fact, any wound in which there is an opening sufficient for drainage, the wound should be washed out with an antiseptic solution, either a 1:1000 solution of bichloride of mercury or 1:20 carbolic acid solution. After the wound is thoroughly washed out and cleansed in every part, all foreign bodies removed, such as splinters, bullets, dirt, pieces of glass, etc., provisions may be made to establish drainage and to close the wound. In some wounds where it is believed that the wound tract is not very septic and the opening is small, as happens in a gunshot wound or punctured wound, the surface of the wound only should be cleansed and hemorrhage should be encouraged by compression and all the blood expressed out of the wound, if possible. After washing the surface with an antiseptic solution the wound should be dressed antiseptically by means of cotton and gauze properly applied. It is the best policy not to introduce fluids into these wounds unless in the judgment of the physician they are distinctly septic. It is a well known fact that the tissues of the body may take care of a considerable quantity of septic material under favorable circumstances so that it is well enough to temporize with these wounds and permit nature to handle the case. If evidences of undue inflammation arise, the tract of the wound may be laid open, disinfected, and drained, and allowed to heal from the bottom up by granulation.

The establishing of drainage is perhaps, next to asepsis, the most important factor in the treatment of wounds. Where the wound is large and there is liable to be much exudation, it is of the utmost importance to establish drainage. Drainage should always be established at the most dependent part of the wound. If the wound is on the head and the person will be lying down during the time the wound is healing, the drainage should be at the most dependent point, but if the patient will be in an erect posture most of the time, drainage would perhaps be best established at some other point. At all events it should be so arranged that it will take place in the easiest manner possible.

The materials used for drainage may be strips of antiseptic gauze.

which are laid in the bottom of the wound, or a fenestrated rubber tube, which has been previously sterilized, may be introduced. If the wound is large, the drainage tube should be transfixed with a safety pin to prevent it from dropping into the wound beyond reach. The rubber tube furnishes an additional advantage in that, if the wound is septic, it affords a means of irrigating the interior of the wound with antiseptic solutions. In operations upon the abdomen a cigarette drain is best. The drainage tube or other material should be covered over with a good sized mass of surgeon's cotton to prevent infection and to absorb the wound secretions. In ordinary wounds, especially small wounds, gauze drainage is, perhaps, best. The chief object of drainage is to permit the free escape of serum and other materials which may exude into the wound and which, being retained, would furnish a good pabulum for the growth and development of micro-organisms. Furthermore, the exudation of the serum into the wound prevents union and renders sepsis more likely, inasmuch as it causes great tension of the flaps and interferes with the circulation in the tissues.

FIG. 20.



Cigarette drains.

Closure of Wounds.—The surfaces of the divided tissues must be accurately coaptated, or brought together, and permanently held in that position until the tissues have had time to establish firm union. Where the wound involves different layers of tissues, as fascia, skin, muscle, nerve, etc., if a good result is obtained the nerves should be brought in apposition, also muscle to muscle, fascia to fascia, skin to skin, so that, when union takes place, the tissues are in as nearly a normal position as is possible for them to be. There are numerous methods of wound closure. The method which is of the greatest value and most universally used, and in fact is absolutely necessary, is by some kind of a suture. The materials used for sutures are silver wire, silk, horse-hair, silkworm-gut, catgut, and kangaroo tendon. The qualities, which these different forms of sutures possess, vary. An ideal suture should be one which is, first of all, aseptic, secondly, that it must be of sufficient strength to hold the tissues in position, and thirdly, that it is not absorbent, that is, that it will not absorb the fluids from the tissues nor from the surface of the body. Silver wire has this advantage, that it is very easily sterilized, is non-irritating and is not absorbent, but on the other hand, it is not so easily applied and, after union takes place, it is more difficult to remove. It causes pain and irritation upon

removal. Silkworm-gut is, in many respects, the ideal suture and is suitable for closing the abdomen or for use in perineal operations or in very large wounds, but it is not absorbable and of course must be removed. It is an animal suture and is best sterilized by boiling for at least an hour, when afterwards it may be kept in strong alcohol until used. Sometimes it becomes more or less brittle and breaks easily. This is one objection to its use. But as a superficial suture, in many respects, it is superior to any other form. In superficial sutures, horsehair is not irritating, is readily removed, and being fine, is of advantage where a small suture is demanded. It is suitable for superficial suture in closing wounds on the face. Silk suture is the most universally used. It can be readily sterilized by boiling or by the use of antiseptics. Its chief objection is that it is absorbent and when used on the surface, a stitch-abscess may result. But with all its defects, silk is a most excellent suture material. It was formerly believed that silk could not be used in the tissues where it was allowed to remain, but it has been shown that if it is sterile it will not act as an irritant, but will become encapsulated and be harmless. Silk may be sterilized by boiling, or by immersing in a superheated strong solution of mercuric chloride, or 1:20 solution of carbolic acid. The carbolic solution may be heated to boiling, and when the suture material is immersed in it, in a short time it will become sterile. After the sutures are sterilized, they should be kept in an air-tight, thoroughly sterile jar or container made for the purpose. *Catgut* has the advantage over the sutures before mentioned in that it is absorbable, being liquefied by the fluids from the tissues. The suture is made from the submucosa of the intestine of the sheep. The method by which it is made is as follows: The mucous membrane is first rubbed or scraped off, and then the muscular coat is scraped off until only a thin submucosa is left. This is cut into strips and rolled and dried. Afterwards it is rendered aseptic by various methods, boiling in cumol or by heating to a certain degree at stated intervals, for several days, or a week or more. Several of these methods are now known to be reliable and catgut can be obtained which is aseptic; but with all that, it is not a suitable superficial suture. Healing of the wound will not take place readily, since, when the suture becomes liquefied, it furnishes a pabulum upon which the bacteria will develop, and infection at the stitch-holes is common; in fact, it may lead to general infection of the wound. It is useful as a buried suture where the wound is closed and subsequent removal of the suture would be impossible without a secondary operation. It is put up in several forms, carbolated, chromicized, etc. Chromicized gut is rendered harder by the action of the chromic acid and therefore becomes liquefied much less rapidly, remaining in the tissues for a long time. Chromicized gut is used for the ligation of arteries. It will generally become liquefied within ten days or two weeks. Three or four days is sufficient for the liquefaction of the ordinary catgut. Kangaroo tendon is used to a considerable extent for subcutaneous sutures; it is not used on the

surface. It has the advantage that it is readily absorbed and is not irritating. The methods by which these sutures can be sterilized are various and are only successful when they are thoroughly carried out. Reliable suture material can be obtained from certain supply houses. Unless the surgeon is equipped to do his own sterilizing thoroughly and successfully, it is better to get the sterilized sutures already prepared.

According to the manner of their application, sutures may be classified into buried and superficial. By buried suture is meant a suture which has been placed in the tissues for the purpose of coaptating some of the deeper structures and which is allowed to remain in situ and not afterwards removed. Superficial sutures may be readily removed at any time. Of the method of application, the following are some of the varieties in use:

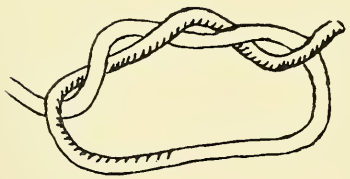


FIG. 21.

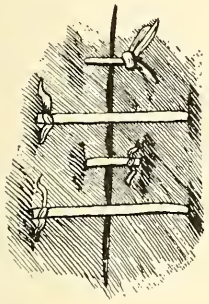
Friction knot, the kind used in tying sutures.

1. Superficial or coaptation.
2. Deep or relaxation.
3. Interrupted.
4. Continuous.
5. Quilled.
6. Figure-of-8.
7. Halsted's.
8. Lembert's.
9. Button.

The needles in use for the application of these sutures should have a sharp point and may be either curved or straight. There are two needles which are in most general use. These are Peaslee's and Hagedorn's. The Hagedorn needle has the advantage that the slight cut made by the needle entering the tissues is parallel with the direction of the suture or is transverse to the wound, whereas the cut made by the Peaslee needle is parallel with the wound. In tying a suture introduced by a Peaslee's needle, the little cut made by the needle is pulled open. Troublesome hemorrhage has followed such application of suture. This is not true of the Hagedorn needle, as the thread pulls in the end of the cut, and the more tightly the suture is drawn the more closely do the cut surfaces of the needle-hole press against each other and thus hemorrhage is avoided. The needle, having been previously sterilized, is threaded with the kind of suture material best suited for the occasion in question and should be introduced, wherever possible, with the fingers. Numerous needle holders have been invented by mechanics and by operative surgeons, but no needle holder is so good as deft fingers. Then, too, the best needle holder is liable to break. Where the needle is small and where the surgeon is operating in a cavity, it may be necessary to use a needle holder. A suitable automatic one should be at hand. Unless a surgeon has a number of assistants, the needle holder may entail useless delay. In the closing of an ordinary wound, the suture should be introduced down to the bottom of the wound, so that when

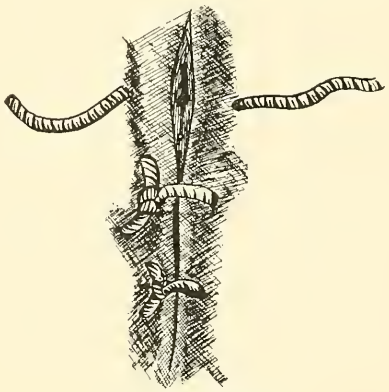
it is drawn up snugly and tied, all parts of the wound-margins are brought in apposition. If this is not done, serum will exude into the lower part of the wound. A cavity is thus formed, filled with serum, which furnishes an excellent nidus for the development of bacteria.

FIG. 22.



Coaptation and relaxation sutures.

FIG. 23.

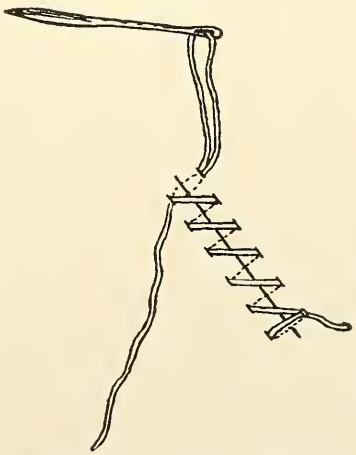


Interrupted suture.

Suppuration is almost sure to occur unless the wound is closed in all its parts.

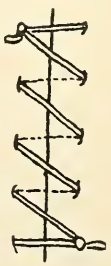
The method of application may be an interrupted or continuous suture. The interrupted suture is the one most frequently used and has the advantage that it can be applied evenly. A moderate amount of swelling will not interfere seriously with the suture. A continuous suture will not so readily accomodate itself to other conditions than those present at its introduction. It is not so easily removed. It is useful for closing large wounds quickly where the wounds are upon the surface, or it is suitable for use in buried suture in apposing fascia. Halsted's continuous subcuticular suture is an excellent superficial suture of silk, which need not be removed.

FIG. 24.



Method of ending a continuous suture.

FIG. 25.

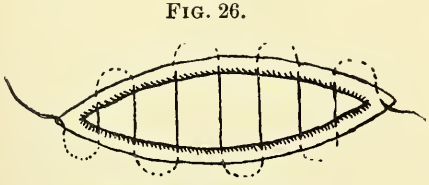


A continuous suture applied.

By deep or relaxation sutures are meant sutures which are introduced a distance back from the edge of the wound, including all the deep tissues, and are for the purpose of lessening the tension upon the

sutures which are at the margins of the wound. Coaptation sutures are those which are put in at the margin of the wound and are for the purpose of accurately apposing the surfaces. The quilled suture is no longer used. The figure-of-8 suture is still popular in plastic surgery, especially in harelip. It is applied by the insertion of silver harelip pins (an ordinary commercial iron pin may be used). The pins are first sterilized and then inserted, and a sterilized thread is placed in a figure-of-8 manner over the ends of the needle. It has the advantage that there is but little scarring of the skin and it holds the superficial tissues in position. Halsted's suture is a valuable suture under some circumstances. By the use of this suture, the scars, the result of the wounds made by the needle, are avoided. The button or shot suture is still sometimes used. Lembert's suture is useful in suturing wounds in the small intestines or any of the hollow viscera. Other forms, such as the mattress suture or Ford suture, may be used if the occasion demands, but these occasions are few, if they ever arise. In the use of needles and suture material for the closure of wounds, it is the best policy to use as small a needle as possible, the finest silk for coaptation sutures, and for retention sutures, the larger silk. The twisted silk is the stronger. In tying sutures the knot should not be drawn too tightly. If the suture is drawn tightly it will more or less arrest the circulation to the tissues underneath it and sloughing of the skin, or stitch abscess may follow. If the suture is aseptic, it will not operate as an irritant unless it interferes with the physiological process of repair. There are a few other means of wound closure which should be understood, and which are useful in small wounds where other methods are not available. These consist of adhesive plaster, collodion, etc., which have the property of adhering closely to the skin, and if the wound is small, holding the edges in apposition. Tear the adhesive plaster in very small strips, dry the surfaces of the wound, heat the adhesive plaster and as the tissues are held together, the adhesive plaster is applied. Collodion may be used in a similar manner. Little strips of iodoform or borated gauze may be laid over the wound, which has been dried, and the whole painted thoroughly with collodion. Another fairly successful method of closing a wound, where sutures are not at hand, is to stick firmly to the skin strips of adhesive plaster which extend parallel with, and not too far distant from the wound. Then by means of a needle and ordinary thread, apposition can be secured by bringing the thread through the strips of adhesive plaster and then tying it. This will be found successful in small wounds or where suture material is not at hand. After a suture is applied, if the tension becomes so great on the flaps that there is

FIG. 26.



Halsted's sub-cuticular suture.

indication of the suture cutting the tissues, some of the sutures should be removed.

To remove a suture successfully, it must be done in the following manner: The part of the suture which is without the tissues is more than likely septic, so in removal the suture should be cut off below the skin. While the suture is lifted up with a dressing forceps, the tissues may be pressed down so that a margin of a quarter of an inch of the suture, which was formerly within the tissues, may be pulled out and the suture can be cut off at this point. This will prevent stitch-abscesses. The length of time sutures are allowed to remain in the tissues will vary according to the nature of the wound and the nature of the tissues. In the face, coaptation sutures should not be allowed to remain longer than thirty-six to forty-eight hours. A retention suture should be allowed to remain longer, until there is no danger of the wound being pulled apart. In case of lacerated perineum, the suture should be allowed to remain ten to fourteen days, providing evidences of inflammation do not appear, for the reason that the motions of the body and the evacuation of the bowels may cause the newly united structures to separate. Ordinarily in a vascular area like the hand, the suture may be removed on the third, fourth, or fifth day. In an area, as over the back, or on the thigh, union will not take place as quickly and the suture should be removed on the sixth or seventh day.

Prevention of Sepsis.—Providing the wound has been thoroughly cleansed, no drainage being necessary, the wound is coaptated and lastly washed thoroughly to get rid of all materials which might remain. The wound may be dressed with or without antiseptics. The object of the dressings is to prevent sepsis and protect the wound. Dressings then should be sterilized and should be of a material which will readily soak up any wound-secretion or discharge. An antiseptic or aseptic gauze is found to be the most serviceable. Outside of these gauzes may be placed a considerable amount of aseptic cotton. The cotton prevents any micro-organisms getting into the wound and will, at the same time, absorb any of the secretions which are discharged.

Removal of Dressings.—Providing there is but little discharge, the dressings should not be disturbed until it is necessary to remove the sutures. If drainage has been established, the dressings should be looked into within the first twenty-four hours, or sooner. Under no circumstances should the dressing be allowed to become saturated. Should this happen, infection quickly travels into the wound from the outside. The drainage tube should be removed in from twenty-four to thirty-six hours, for the reason, if it remains there too long, it will act as an irritant and cause inflammation in the tissues round about and prevent the wound healing. The idea which the surgeon should have in mind is that the wound should not, under any circumstances, be disturbed unless he feels that it is not doing well, or that it requires change of dressing because of its having been disturbed or because of an excess of

secretions. The wound should be properly dressed in a manner according with the principles of modern surgery, and when once dressed should be allowed to remain quiet until conditions have arisen which demand intervention. If there is evidence of sepsis upon removal of the dressing, an antiseptic solution may be thoroughly used. Under *clean* conditions, considering that the surface has been thoroughly irrigated with an antiseptic solution, several thicknesses of sterilized gauze may be applied to the surface. On top of this is placed a considerable mass of absorbent cotton. If conditions are not very clean, the surgeon may apply boracic acid, iodoform, equal parts of boric acid and acetanilid, salicylic acid, aristol, protonuclein, etc., in fact, any antiseptic drug which prevents fermentation. The gauze may be carbolated five per cent., boracic acid ten per cent., iodoform ten per cent., bichloride of mercury 1:5000 or 1:1000. Any of these gauzes are excellent. Bichloride of mercury is the strongest antiseptic, but is irritating. The borated gauze secures mild antisepsis and asepsis and is, perhaps, the best of all the gauzes. Where there is abundant discharge from the wound, a dressing quickly becomes saturated and should be renewed sufficiently often to keep the wound dry. It will then heal more rapidly. If the dressings are sodden with secretions of the wound, instead of operating as a protection, they furnish a bed for the micro-organisms in the same manner as a flax-seed poultice.

Rest.—Functional and mechanical rest is of the greatest importance in the treatment of wounds. The process of repair is accomplished by the reproduction of new cells. These granulation-tissue cells are very delicate and easily destroyed. Every movement of the injured part will destroy some cells and call upon the tissues for renewed activity to produce others. In fact, if the irritation is great, it may either prevent the wound healing or may cause a considerable formation of fibrous tissues, which is always detrimental in any location in the body. At best, the process of repair is difficult, and the tissues have an added burden in order to properly repair the injury.

Constitutional Treatment.—In the healing of wounds, much depends upon judicious constitutional treatment. It is necessary that the bowels act daily, unless there are circumstances which require their quiescence. The urine should be voided at stated intervals. The person should be fed properly and should get the proper amount of sleep and rest. After the shock has been combated and the patient has rallied from the operation or from the wound, he should be placed in the most comfortable position, so that he is as nearly at ease as possible. The room should be sufficiently ventilated, the patient should not be exposed to drafts. In the sick room a temperature of 60 degrees F. is necessary. Many cases will require 70 degrees F. The room should be kept scrupulously clean and especially should the patient's bed be kept clean and his clothing changed daily. The bowels should be kept regular by proper treatment. This treatment will vary accord-

ing to the condition. Sometimes it may be necessary to resort to the use of an enema. In the administration of an enema, a little castile soap diffused in a quart of boiled water should be used. Where the strength of the patient has been markedly reduced, either by shock, injury, or operation, or severe loss of blood, a stimulating diet will be found necessary. Where there is suppuration, it is of the utmost importance that cleanliness be obtained; furthermore, that the patient be given a nourishing diet. The pulse and temperature should be carefully watched, in case of severe wounds, and where there is not a rise of temperature and the patient feels well, it will not be necessary to investigate the wound at the end of the first twenty-four hours, nor may it be necessary even at the end of forty-eight hours. In recovery from old wounds or wounds in the ill-nourished, diabetic, or syphilitic cases, or conditions of tuberculosis and Bright's disease, proper treatment should be administered tending towards the support of the patient and the relief of the exisiting conditions.

Kinds of Open Wounds.

1. Incised.
2. Contused.
3. Lacerated.
4. Punctured.
5. Poisoned.
6. Gunshot.
7. Fracture.

Incised Wound.—An incised wound is one having an evenly divided edge and smooth surface and generally made by a sharp instrument. A wound quite similar to an incised wound may be made with the edge of a hard object, as a brick on the scalp. Often the hemorrhage is very severe in an incised wound, in fact, it is the chief danger. Providing the wound is properly cleansed and good apposition secured, healing takes place by first intention. There is nothing special in the treatment of this form of wound.

Contused Wound.—A contused wound is one in which the wound area and edges are severely bruised and injured. It is made by objects which distribute the wounding force over a considerable area. It is usually attended by an extravasation of blood within the tissues. External hemorrhage is slight, the reason being that the mashing of an artery renders the conditions for coagulation of the blood more favorable, hence nature arrests the hemorrhage more quickly. The dangers of this wound are sloughing of the tissues, together with infection. The bruising of the tissues may so devitalize them that it renders infection easy. Under all circumstances, if the skin is not broken, the wound should be handled with the greatest care, so that the skin may not be broken. Any parts of the skin which may have become more or less detached should always be preserved. Contused wounds require more careful measures than incised wounds because of the devitalization of the tissues as the result of the injury.

Lacerated Wound.—A lacerated wound is one which is torn. Lacerated wounds are in many respects more harmful than others. Certain of the tissues will be torn and perhaps killed, while others will

have become so devitalized as to be unable to resist the onset of the invading bacteria. Furthermore, lacerated wounds contain many crevices and nooks in which septic material may lodge, so that the probabilities are the wound will not be thoroughly cleansed. Apposition can not be so readily obtained, therefore scar formation is common. The wounds will frequently heal by second intention. The primary hemorrhage is not so great and, as a rule, it should be encouraged. The dangers in lacerated wounds are infection and deformity from scar formation. The edges of the wound should be closed and drainage provided for. Sutures can not be applied as closely as in an incised wound.

Punctured Wound.—A punctured wound is one made by a long sharp instrument. The margins of the wound are not contused. The depth of the wound is much greater than its breadth. The chief dangers of these wounds are hemorrhage and infection. Puncture of the viscera or large vessels is liable to be fatal. Suppuration is common in punctured wounds and very often leads to general sepsis. The wound heals on the surface and the infected secretions being retained, pus is formed. Punctured wounds in the body-cavity (thoracic and abdominal) are generally fatal. As a rule these wounds should be caused to unite by second intention. If the wound gives evidence of sepsis, it should be thoroughly cleansed with an antiseptic solution and a piece of gauze introduced to the bottom. Where it is made with a septic instrument, it is advisable to introduce a drainage tube to the bottom of the wound, and each day as the wound is dressed, the drainage tube may be drawn out a half inch or more, until it is finally removed, allowing the wound to heal from the bottom.

Poisoned Wound.—A poisoned wound is one in which some poisonous product is introduced. These poisonous products may be classified as bacteria, bacterial toxins, and chemical poisons, such as are present in the bite of snakes, sting of bees, etc. Wounds containing bacteria are called septic and infective. A septic wound should be washed with peroxid of hydrogen, providing the opening from the wound is sufficiently large, and then washed with a solution of bichloride of mercury (1:1000). If infection is arrested, the wound should be kept at rest and the most rigid cleanliness maintained. In post-mortem or dissection wounds we have an example of poisoned wounds. The result will largely depend upon the treatment, the amount of poison introduced, and the condition of the health of the person sustaining the injury. As soon as the wound is infected, it should be washed and treated with suction. Every effort should be made to have the wound bleed freely. Afterward, the wound may be cauterized with pure carbolic acid or strong acetic acid. The hands may then be cleansed with a strong solution of bichloride of mercury. There is, perhaps, the most danger in holding a post-mortem on patients who have died of typhoid fever, septicemia, pyemia, peritonitis, erysipelas, etc. The changes which take place following

infection are, a pustule may be formed and evidences of lymphangitis and phlebitis. Antiseptic lotions should be applied to the wound at once. If the wound is located in the upper extremity, the axillary glands will enlarge and may suppurate. As soon as there is evidence of suppuration these should be removed. Where the infection is rapid and severe, and nature shows an effort at limiting it, an amputation should be performed. The prognosis, in these wounds, is not favorable when one can not prevent general infection. Where severe constitutional symptoms set in, death usually occurs in from ten days to two weeks, or if recovery takes place, it is only after a long, tedious illness. The nature of the inflammation is that of a cellulitis or a condition resembling cellulo-cutaneous erysipelas. As soon as infection is evident at the wound, incisions may be made in the tissues about, bleeding encouraged, and the wound thoroughly cleansed with a strong corrosive sublimate solution (1:500).

Snake-Bite.—The venom of certain reptiles introduces into the circulation, through the wound, substances which may produce alarmingly fatal results. These poisons, in some cases, are extremely rapid in their action, depending upon whether the poison is introduced into the circulation or whether it reaches the circulatory system through the connective tissues and the lymphatics. Snake-bite may be likened to a hypodermic injection of a chemical poison. The poison acts directly upon the muscular and connective tissues, and when it enters into the circulation, it affects the nervous tissues generally. Many of the reptiles reputed to be poisonous, have no special poison. On the other hand, bites of animals, such as rats, or even the bite of a person, may at times be poisonous, depending upon the materials carried into the tissues by the teeth. The poisonous snakes in this country are the rattlesnake (of which there are perhaps eighteen different species), the water moccasin, copperhead, and, perhaps, the viper, although the ordinary spreading viper or puffing adder is believed to be harmless. There are also said to be some poisonous lizards. The exact nature of the poison is not definitely known. It seems to be a collection of compounds containing peptones, globulins, and, perhaps, toxic alkaloids, which act like ferments, inducing wide-spread chemical reactions. The effect of the poison upon the body varies according to the dose and according to the animal from which the poison was extracted. The poisons of the various reptiles differ not only in their chemistry, but in their toxicity. The poison in almost all seems to have a paralyzing effect upon the wall of the artery, while it brings about disorganization of the blood. Most of the poisons apparently have an affinity for the nervous tissues, uniformly bringing about paralytic changes. The poison of the serpent is introduced by means of a hollow fang, and is produced by a special gland. The duct of the gland leads to the hollow tooth, and in the working of the jaws, the poison is compressed out of the gland through the hollow tooth, and in this manner introduced into

the tissues. If the poison-bag and the fangs are removed, the snake will be harmless.

The **Symptoms** of poisoning are as follows: The pain is excruciating, coming on very rapidly after the bite. The part of the limb swells rapidly and becomes mottled because of the effect of the poison upon the blood. It is not unusual that the swelling of the member is enormous. Consciousness is more or less affected. This varies in degree from slight lethargy and stupor, to complete unconsciousness. The symptoms are those of profound shock, which may be attended with delirium. Death may come on within an hour or it may be delayed several hours. Where death does not occur during the first twenty-four to forty-eight hours, gangrene and sepsis frequently arise.

The **Treatment** for snake-bite is to at once tie a tight band about the member, above the wound. Several of these bands should be placed around so as to restrict the return circulation. The wound should be treated with suction, either by the person himself, when possible, or by some friend or relative who is not afraid to take the risk. Care should be taken that the person performing this suction has no wounds on the lips or mouth, as they likewise may become poisoned. A crucial incision should be made at the bite and hemorrhage encouraged. As soon as the wound is thoroughly sucked, it should be cauterized. Hunters frequently cover the bite with powder, which, upon being ignited, chars the skin. A hot iron may be used for a cautery or pure carbolic acid may be applied. A strong solution of permanganate of potassium is excellent, inasmuch as it seems to have the property of destroying the poison. A two per cent. solution is sometimes injected into the tissues about the wound. The wound and member should be kept soaked in alcohol. It is said to be more efficient if the alcohol contains one-third of camphor. Where a surgeon is at hand, amputation of the member is advised if the bite of the reptile is very poisonous. Strong ammonia-water applied to the wound seems to be an excellent method of destroying the poisons.

Bites and Stings of Insects and Certain Animals.—There are certain lizards whose bites are said to be poisonous. These bites should be treated in the same manner as a snake-bite. The bites of certain spiders are productive of severe inflammation, great prostration, and, in some cases, death. These spider-bites should be treated similarly to snake-bites. As soon as the bite is made, suction should at once be applied. If this can not be done, enlarge the wound and encourage bleeding. Tie a fillet around the member, if it is possible, and cauterize the wound with strong carbolic acid or strong ammonia and use alcohol as a local application. The bite of the centipede is not so fatal as is popularly believed. The effects are, generally, only local. The bite of the scorpion produces much severer symptoms. Very often there is great prostration, vomiting, delirium, with local swelling rapidly extending, and severe burning pain. There may be vertigo or severe head-

ache, together with great sweating and diarrhea. Bee-stings, if multiple, may cause severe symptoms or even death. A bee-sting is in the nature of a poisoned wound, being made by two little lancets which are pushed out and the poison is squeezed in between them and then inserted into the wound. When the wound is over the cellular tissues of the body, swelling is sometimes very rapid and great. Sometimes the pain is extremely excruciating. Where there are several stings, constitutional symptoms, such as delirium, vomiting, diarrhea, and considerable shock, may be manifest. Where death follows these severe symptoms, it is usually from heart failure. Stings in the mouth may, without causing these symptoms, bring about edema of the glottis which may be fatal. Such stings should be looked upon with fear.

Treatment.—Wash the part with a strong solution of soda or salt and apply ammonia-water. Ice applied is very grateful, as it lessens the inflammation.

Gunshot Wound.—A gunshot wound is peculiar, in that the opening is very often small, surrounded by a contused area, and the tract of the bullet very often long, giving an example of a deep wound with a small opening. Drainage is difficult to obtain. The wounds arising in military and civil practice vary greatly, inasmuch as projectiles vary and are discharged in one case with much more force than in the other. Bullets may sometimes cause fracture of a long bone or they may cut off a nerve to a part or may button-hole a large artery. They very often glance around these structures unless hurled with terrific force.

Injury to the Soft Parts.—The course of the bullet in the tissues varies according to the velocity and nature of the bullet. The bullets may be deflected by fascia, bones, and ligaments. If the skin be struck at the proper angle, and the bullet be "spent", it will be only grazed, or merely a streak left. The opening made by the bullet is very often, unless fired at close range, accompanied by laceration of the soft parts. The exit of the ball is in some cases marked by much more extensive laceration than in the entrance. Especially is this true of the soft-nosed bullets. There the core projects out and forms a mushroom-like mass and is terrifically destructive. Ordinary pistol-balls are not nearly so destructive. They may bury themselves in the ends of the long bones, but rarely pass entirely through the bone, while the injury to the bone is generally not so great. In civil practice the injury to the joints is usually not very extensive. The chief element of danger seems to be sepsis. The results of gunshot wounds may be summarized as (1) hemorrhage. Hemorrhage may be very severe, but it is usually speedily arrested by natural processes. Gunshot wounds, even of the internal jugular, may not prove fatal. Especially is this true if there is contusion. The contusion causes the middle and inner coats to curl up and plug the ends of the arteries and veins. Secondary hemorrhage is not uncommon, and is usually due to sepsis. Where the wound is aseptic, secondary hemorrhage is not likely to occur.

(2) Pain. The pain is variable, depending upon whether a large nerve is injured. In case the injury is within the explosive action of the ball, the part may be anesthetized more or less because of the contusion. It may be that the anesthesia due to the contusion is great and, if occurring during mental excitement, a person may not know that he is struck. In such cases infection is more likely. Where fracture is caused by the bullet, the pain is very often excruciating. Shock attending bullet injuries varies greatly. A small wound of the extremity, although trivial in nature, may be accompanied by general shock. Perhaps the effect is largely due to mental emotion. On the other hand, penetrating wounds of the abdomen in many cases occasion but comparatively little disturbance. Often pistol wounds of the brain may cause less disturbance than would be expected.

Treatment.—In civil practice, the treatment of gunshot wounds will differ from that of military practice. Where the patient can have the advantage of a hospital and of a clean operating room, in fact, where asepsis can be secured, it may be the best policy to uniformly investigate these wounds; but it must be kept in mind that the presence of the bullet and the little material which the bullet may have carried into the wound, are in no wise as serious a menace as will be the septic materials introduced by unclean hands and instruments, in the effort to locate the ball. Too many physicians, in treating the bullet wound, seem to feel that they must get the bullet regardless of the effect of their operations or methods upon the life of the individual. Miscellaneous probing of bullet wounds is extremely bad. Of all the objects introduced into the wound, a clean finger is the least harmful. Where the wound is too small to permit of the introduction of the finger, and none of the large cavities of the body has been entered or viscera perforated, the best treatment seems to be to cleanse the surface thoroughly by means of antiseptic solutions, encourage bleeding and dress the wound with antiseptic dressings and await developments. If the bullet causes subsequent trouble it may be removed by operation. The truth of the maxim, that "when a bullet has ceased to move it has ceased to do harm," has but few exceptions. These are perhaps where the bullet may ulcerate into a large cavity, or when present in the brain, by gravity may cause pressure symptoms, but generally when located within the tissues, unless especially septic, it will not occasion any very considerable trouble. The probe used to investigate the wound should be metal and as large as can be conveniently introduced into the wound. It should be blunt-pointed so as not to injure the tissues in any way. Nelaton's porcelain-pointed probe is valuable in some cases in locating a bullet, inasmuch as the lead will leave a mark on the point. Girdner's telephonic probe is, perhaps, the best of the various electrical devices, but its virtues are questionable. Where the bullet is superficial it should be removed, but if deep and not readily reached and it is believed to be in a part of the body where it will not occasion much

harm, the surface of the body should be cleansed and the wound treated in an antiseptic manner and allowed to heal of itself. If it is believed that a patch of the clothing is carried in with the bullet, an effort should be made to remove such material. Where it is possible to use it, the x-rays should be utilized in locating the bullet. A bullet forceps may be used in the extraction of the bullet, or the wound may be enlarged, when it may be seized with forceps or a scoop, or a Volkmann spoon may be of advantage.

Other Foreign Bodies in Wounds.—Bits of glass, needles, and other objects may be blown, hurled or driven into the tissues and their presence occasion great harm. Glass can be located by the x-ray, as can most of the other objects. Universally these foreign bodies should be removed. A needle is perhaps the worst of these penetrating foreign bodies. Especially is this true where the needle enters the palm of the hand or sole of the foot. The needle should be removed at once. Muscular contractions will often cause the needle to follow along the tendon-sheaths or planes of fascia or along through the muscles, so that each contraction drives the needle farther distant. In removing a needle it should first be accurately located and a sufficiently large incision made, so that it can be successfully reached. Under no circumstances should a little wound be made and the tissues separated in an attempt to reach the needle, as the efforts of the surgeon may push the foreign body further in. After the needle is removed, the wound may be given ordinary treatment.

Contusions.—Contusions, not attended by an open wound, may, in some cases, cause considerable damage to the soft-parts and may require special attention. Where a contusion is small it is commonly called a bruise. If this bruise breaks blood-vessels beneath the skin, subcutaneous hemorrhage will occur among the tissues, causing the surface to become black, as in the case of a blacked eye. These ecchymoses may be extensive in some cases. Coagulation of the blood will follow and afterwards the coagula will break down as the serum and other elements are removed. The surface changes into a blue-black or purplish or reddish-black color, while later the skin may assume a greenish tinge. This extravasation of blood may sometimes extend, where it occurs at the shoulder, even to the tips of the fingers, following the fascia. Muscular action is responsible for this. In muscle-bruises, very often the extravasation of the blood is quite severe. These extensive contusions are best treated by rest and a suitably applied woolen bandage, and later, manipulation to assist in breaking up the clot and securing absorption of the fluids. Even though a large tumor be formed by the extravasation of blood, on no account should it be opened, for if once opened and air admitted an abscess will result. If allowed to remain, nature will take care of the effused material and the part will finally return to its normal condition.

Burns and Scalds.—Burns and scalds are merely wounds from thermal causes, but deserve special mention because of the difference in

the symptoms and treatment. Burns differ from scalds in that they are more destructive. If a burn has been produced by boiling oil or by molten metal, the destruction of the tissues is sometimes very great. The effects of burns are both local and constitutional. These depend sometimes upon the severity of the burn, that is, whether it is attended by extensive destruction of the tissues in any part, or if the burn is slight and extends over a large area. Burns of the trunk are more serious than burns of the extremities. Burns and scalds have been classified by Dupuytren in the following manner:

1. A burn of the first degree consists of an erythema of the surface which is not attended by any destruction of tissues and leaves no scar. This burn is usually not serious unless it affects a large area of the body, when it may be fatal.

2. A burn of the second degree is where the cuticle is raised from the cutis and blisters result. Should the blisters burst and the cuticle be removed, it leaves a red and inflamed true skin. This burn is more painful and more serious. If it affects a considerable part of the body, it may seriously interfere with the functions of the skin. These blisters may become infected and later, ulceration take place.

3. A burn of the third degree is where the cuticle is entirely destroyed and also part of the true skin is affected. Inasmuch as the true skin contains the tips of the nerves and capillary tufts, these are affected. The terminal nerves may be injured or even destroyed, and the congestion and inflammation which follow, occasion severe pain, and sometimes, destruction of the tissues.

4. In burns of the fourth degree the cuticle and true skin are entirely destroyed, with perhaps some little of the subcutaneous tissues.

5. In burns of the fifth degree, muscles, connective tissues, and fascia, together with the skin and subcutaneous tissues, are destroyed.

6. In burns of the sixth degree an entire member is destroyed.

Slight burns involving a limited area, and which do not extend beyond the skin, while they occasion considerable pain, are not serious. They may be immersed in cold water, which will relieve the nervous chill or rigors and the excruciating pain, or some oil, as sweet oil, may be applied so as to protect the surface from the air. Where these burns, simply of the surface, affect a large area, the shock to the nervous system may be so great as to bring about collapse and death. In burns of the first degree, where only the cuticle is involved, if a fatal result should follow, it will occur within thirty-six hours. Where the effect upon the nervous system is great, it calls for immediate treatment to prevent this fatal termination. Within twenty-four hours the patient enters into the stage of reaction; and subsequent trouble, providing sepsis does not occur, will not be serious unless ulceration should follow in the duodenum, which complication occurs in some burns. This ulceration may extend through the wall of the duodenum into the peritoneum, causing peritonitis. There are other burns of the mucous

membrane, as scalding of the respiratory tract from inhaling steam. In some cases this will set up edema of the glottis and, in other cases, bronchitis or pneumonia. These may be fatal.

The first symptoms of burns of any considerable extent are those of shock. Later there are symptoms of reaction and inflammation, while lastly there are those of sepis because of infection.

Treatment of Burns.—If the burn is extensive, the clothing should be removed with great care. The burned area should be cleansed with a warm, normal salt solution. It may be thoroughly dusted with flour in emergencies. White lead, ready mixed for house painting, has been extensively used. The part may be coated over with the lead mixture. Linseed oil and lime water, equal parts, called carron oil, is more generally used than any other application. Absorbent cotton saturated with this mixture is applied after cleansing the surface. It is a filthy application and results in much pus formation. Surgeon's lint dipped in a two per cent. solution of carbolic acid in olive oil is an excellent preparation.

Where the burn is small, an ointment of benzoated oxid of zinc may be used. Picric acid has a great reputation in burns. It is used in the strength of one per cent. in water. Lint saturated with the solution, is applied with a thick layer of absorbent cotton over it. The dressing is reapplied in three or four days and not again until recovery. Later if there is sloughing and pus formation, the sore must be cleansed daily with a mercurial solution (1:5000) and then dusted with a powder composed of three parts of boric acid to one part of salicylic acid. Healing may be hastened and scar formation lessened by skin grafting. Exuberant granulations will require cauterizing with nitrate of silver. Later the cicatricial contractions must be overcome by manipulation.

PART II.

DISEASES AND INJURIES OF SPECIAL TISSUES.

Diseases and Injuries of the Blood Vascular System, Heart and Pericardium.

There are cases of persisting pericardial effusion which may require removal. Paracentesis of the pericardial sac may be performed with an ordinary aspirating apparatus. The surface should be thoroughly cleansed before the introduction of the needle. The fluid may then be pumped out and the opening dressed antiseptically. An aspirating needle should be inserted an inch and a half from the left border of the sternum in the fourth or fifth intercostal space. This is done to avoid the internal mammary artery. Wounds of the heart and great vessels are so quickly fatal that it is hardly necessary to discuss the injury. Injuries to the pericardium, whether they are by knife or bullet, are attended by hemorrhage into the pericardial sac and this blood, clotting around the heart, so interferes with its action, that death occurs. Very often, where this hemorrhage is not great enough to produce death, infection and suppurative pericarditis, which is generally fatal, will follow. Little can be done in the way of operative treatment. The most essential thing is to keep the person quiet, with his head low. The wound should be cleansed, but during the stage of shock, no operative means should be attempted. If the patient recovers from the shock, the wound in the pericardium may be closed.

DISEASES OF THE ARTERIES.

Arteries are subject to acute or chronic inflammation, the result of injury, sepsis, or constitutional disorders.

Acute Arteritis is extremely rare, but is said to be occasionally met with in septic and infective inflammations, where infective emboli lodge in the artery and create ulcerative inflammation. Of course, plastic arteritis occurs in the healing of an artery in an open wound, but the changes attending infection of the artery from infective emboli are different in that they are destructive.

Chronic Arteritis is frequently spoken of as atheroma, endarteritis, or sclero-endarteritis. The tunica intima and media only, are involved. It is the most common disease of the artery and is present in many people over forty years of age. It is most common in the large arteries, especially those of the lower extremities. It is the result of increased intra-arterial pressure, the arteries becoming overtaxed. It is very

much more common in men than in women. Excitement, alcoholism, syphilis, Bright's disease, plethora, gout, together with lesions affecting the integrity of the artery-wall, may be set down as among the causes of the disease.

The *pathology* of the disease is that of a chronic inflammation. The middle coat and the tunica intima become infiltrated with round cells. These may break down and ulcerate (ulcerative endarteritis), or the inflamed part may undergo calcification (pipe-stem artery), or the round cells may form fibrous tissue. Soft inflamed areas may fuse together, making a hard artery (sclerosis). Sclerosis of the arteries may become general. The artery feels like a hard, fibrous cord, and at certain places, the artery-wall may become thickened and calcareous, when it will feel knotty or beaded. In some cases, the degeneration is so great that the artery can not be tied and, being grasped with an artery forceps, it will be found brittle and will break off. The elastic tissue in the tunica intima is most affected, likewise the large arteries which are made up largely of elastic tissues, are affected to a greater extent than the medium sized or smaller arteries. But the inflammation nearly always extends into the tunica media and impairs the integrity of the muscular coat, so that the arteries are unable to dilate to answer the call of the tissues for nutrition.

The degenerative changes which come on later are (1) fatty, (2) calcareous, and (3) fibrous. The effect of this condition in the arteries is that the limb below is cold, congested, and often ill-nourished. The artery becomes tortuous. Aneurysm frequently results because of a weakening of the artery. This occurs when the tissues of the tunica intima break down and ulcerate. Thrombosis may be caused by the debris from the ulcer within the artery, being carried to other parts of the body, also, coagulation of blood at this roughened area may occur. This clot may be detached and carried elsewhere and result in the plugging up of an artery (See Thrombosis and Embolism), or rupture of the artery sometimes occurs because of fatty or calcareous changes, which so weaken the artery that muscular effort or excitement results in apoplexy. Gangrene is not an infrequent result of this endarteritis. (See Gangrene).

The *symptoms* of chronic endarteritis are:—

1. Evidences of degeneration generally, arcus senilis, the person is prematurely aged.
2. History of syphilis, tuberculosis, alcoholism, or Bright's disease, etc.
3. The presence of atheroma of the superficial vessels.
4. Lesions affecting the integrity of the vessel walls.

Obliterative endarteritis sometimes follows in small arteries where thrombosis occurs, or if the inflammation is more violent, it results in the obliteration of the artery and occasions great pain and suffering. It is fortunate that the disease is rare. Chronic endarteritis may con-

tinue for years, and if a person leads a quiet life, he may never know that his arterial system is fragile and may at any time rupture, causing his death. Degenerative changes will continue until the larger arteries are affected, when in excitement, or because of the weakened artery, at a certain point it dilates and an aneurysm results.

ANEURYSM.

An aneurysm is an abnormal dilatation of the living artery, or a pulsating tumor filled with blood, connected either directly or indirectly with an artery. Aneurysms are either spontaneous or traumatic. The spontaneous aneurysms result from disease, while a traumatic aneurysm results from an injury of the artery. Spontaneous aneurysms are the result of obstructions to the circulation, endarteritis, atheroma, arterio-sclerosis, or any diseased condition which makes the artery weaker at one point than another.

Aneurysms are further classified into *false* and *true.* A *false* aneurysm is one having no coat of the artery intact. A *true* aneurysm is one which has one or more coats of the artery intact.

Varieties.—Besides (1) *false,* (2) *true,* (3) *spontaneous,* and (4) *traumatic* aneurysm, there are (5) *fusiform,* in which there is a long, spindle-shaped dilatation of the artery, (6) *sacculated,* where it is in the shape of a saccular dilatation of the artery, (7) *circumscribed,* where it is outlined by a wall of resisting tissue, (8) *diffuse,* where it has not such a definite outline, (9) *artero-venous,* where the aneurysm occurs in connection with a vein (See traumatic aneurysm), (10) *cirsoid,* where a number of arteries are dilated and pulsatile, and (11) *cylindrical,* where the dilated artery has the same dimensions for some distance.

Causes.—The causes of aneurysm are, predisposing and exciting.

The *predisposing causes* are male sex, occupation, excitement, and the presence of certain diseases, as alcoholism, Bright's disease, syphilis, etc. It happens more frequently in laborers, inasmuch as during violent muscular contraction, which to some extent will obstruct the circulation, or during the time when the heart's action is increased because of stimulants, the artery may give way at a weak point. Diseases of the arteries, as atheroma and the formation of emboli, also operate as predisposing causes.

The *exciting causes* are obstructions to the circulation, mechanical violence or injury to the artery, abnormal heart action, muscular contractions, blows, strains, etc.

Formation.—Aneurysms are formed in several different ways. When due to atheroma or to an ulcerative endarteritis, the middle and inner coats usually give way. These diseases do not affect the external coat, therefore, it only, forms a covering for the artery. The dilatation may be medium or may be quite great. As the artery dilates, inflammatory tissues form which prevent the sa rupturing. Sometimes it may

be the result of a weakened condition of the artery or embolism of the vasa vasorum and there may be a general dilatation of a piece of the artery when none of the coats is absent. The vessel may rupture at the point of ulceration in the artery, and the flow of blood into the tissues be slow and may excite inflammation and the formation of fibrous tissue, limiting the diffusion of the blood by a distinct sac formed of this inflammatory tissue. In other cases, the blood may extravasate in the middle coat separating the internal and a part of the middle coat from the external coat, with dilatation of the external coat following. This form of aneurysm is called dissecting or consecutive aneurysm. It may happen that from ulceration or injury, the external coat may be weakened so that the middle or internal coat is pushed out through the opening in the external coat, this forming the wall of the sacculated aneurysm. This is rare. In structure the sac may be made up of:—

1. All the coats of the artery.
2. It may be the condensed tissues external to the artery, none of the coats being intact over the tumor.
3. The walls of the sac may consist of the external coat only.
4. The walls of the sac may be the external and part of the middle coat (rare). In other cases, still more rare, the inner wall of the sac may consist of the middle coat, as in dissecting aneurysm.

Contents.—The contents of the aneurysm consists more or less of clot. Coagulation and organization of the blood within the aneurysm, seems to be nature's method of obtaining a cure. The blood flows less swiftly inside the sac, the inner surface of the aneurysm is rough and the conditions are favorable to coagulation. The clot in the aneurysm may be white, or it may be partly white and partly red, or it may be entirely red when it forms quickly. It depends upon how rapidly the clot forms and under what conditions.

Results.—*Spontaneous recovery* in an aneurysm occurs because of the deposit of fibrin in the aneurysmal sac, layer after layer being formed until, after a time, the entire sac is filled up. This may become organized, forming a hard fibrous mass. The artery beyond the aneurysm may be pervious because of collateral circulation having been established, or it may become obliterated, the tissues to which this artery was originally distributed, being nourished from other channels, when a fibrous cord would be the remains of the artery. In other cases, a hard, nodular mass the size of the aneurysm, somewhat shrunken, will remain. The artery above and below being plugged up, an abscess forms and burrows towards the surface and ruptures, the disintegrated blood being discharged, and finally, the wound healing, leaves a mass of fibrous tissue which is the result of the inflammatory process. The arrest of the circulation in the aneurysmal sac is brought about by pressure upon the artery between the aneurysm and the heart, or pressure upon the artery beyond the aneurysm. In other cases, the cir-

culation in the artery is slowed and coagulation may set in. If it sets up, it may continue until the coagula fill up the entire aneurysmal sac. The clots which are formed are classified by some writers as active and passive, but whether some of the clots may be more productive of favorable reults than others is, perhaps, not known. Coagulation of the blood in the sac seems to be the end sought for in almost all the operations for aneurysm.

Rupture of the Sac may lead to very disastrous results in the case of aneurysm. Rupture within a joint or the tissues of a member, followed by hemorrhage, will result in the obstruction of the circulation to the limb below and gangrene will occur. Rupture of a popliteal aneurysm within the knee-joint, is an indication for amputation. In aneurysm of the superficial femoral artery which ruptures within the tissues, the blood extravasating along the fascia and muscle-planes will sooner or later obstruct the circulation to the leg, and gangrene will result. Rupture of an aneurysm within the chest, or on a mucous membrane, or in the peritoneal cavity, or externally, will result fatally.

Sloughing during suppuration, following inflammation in the aneurysmal sac, may result in serious secondary hemorrhage.

Destructive changes may follow the pressure of the aneurysm upon other tissues. It is a curious fact that the pressure of an aneurysm upon hard bone will result in the wearing away, erosion, and absorption of the bone. Elastic tissues are less affected by the pressure of the aneurysm than any other. It may result in the paralysis of nerves and the obstruction of veins. Aneurysm of the arch of the aorta may cause absorption and erosion of the sternum and it may appear beneath the skin on the front of the chest. Aneurysm of the descending portion of the arch of the aorta will cause erosion of the bodies of the vertebrae and finally, paralysis, due to pressure upon the nerves. In such cases the intervertebral discs are less affected than the bone, because of the fact that cartilagenous tissues do not yield to the pressure of the aneurysm as does bone. It may press upon the artery, of which the aneurysm is itself a part, causing obstruction to the circulation through the aneurysm, or at least an interference with it, to that extent that coagulation of the blood may occur within the aneurysm, a spontaneous cure resulting. One of the serious results of the pressure of the aneurysmal sac is pressure upon the accompanying veins of the artery, thus obstructing the circulation.

Gangrene is one of the serious terminations of an aneurysm. It is caused by pressure on the main artery, vein, or nerve of a member, or by rupture of the aneurysm, thus interfering with the nutrition.

The effects upon the general health are various, depending largely upon the local conditions. The presence of a diseased condition of the artery affects the nutrition to the tissues generally, and the person is found to be in a condition of bad health.

Symptoms.—The symptoms of aneurysm are (1) pulsation. This pulsation is synchronous with the heart-beat. Aneurysm may be mistaken for a tumor which lies immediately over the artery and which raises up at each heart-beat because of the distension of the artery. The aneurysm not only raises up, but enlarges in all directions, a point which must be kept in mind. The pulsation of the tumor is arrested by pressure on the artery between the aneurysm and the heart. The pulsation in the tumor is markedly increased by pressure on the artery beyond the tumor. After a little time, because of pressure on the artery beyond the tumor, the pulsation in the aneurysm will disappear.

2. Pulse. The pulse beyond the aneurysm is very small, weak, or even absent, while, on the proximal side of the aneurysm, the pulse is equally as strong as it is in corresponding parts of the body.

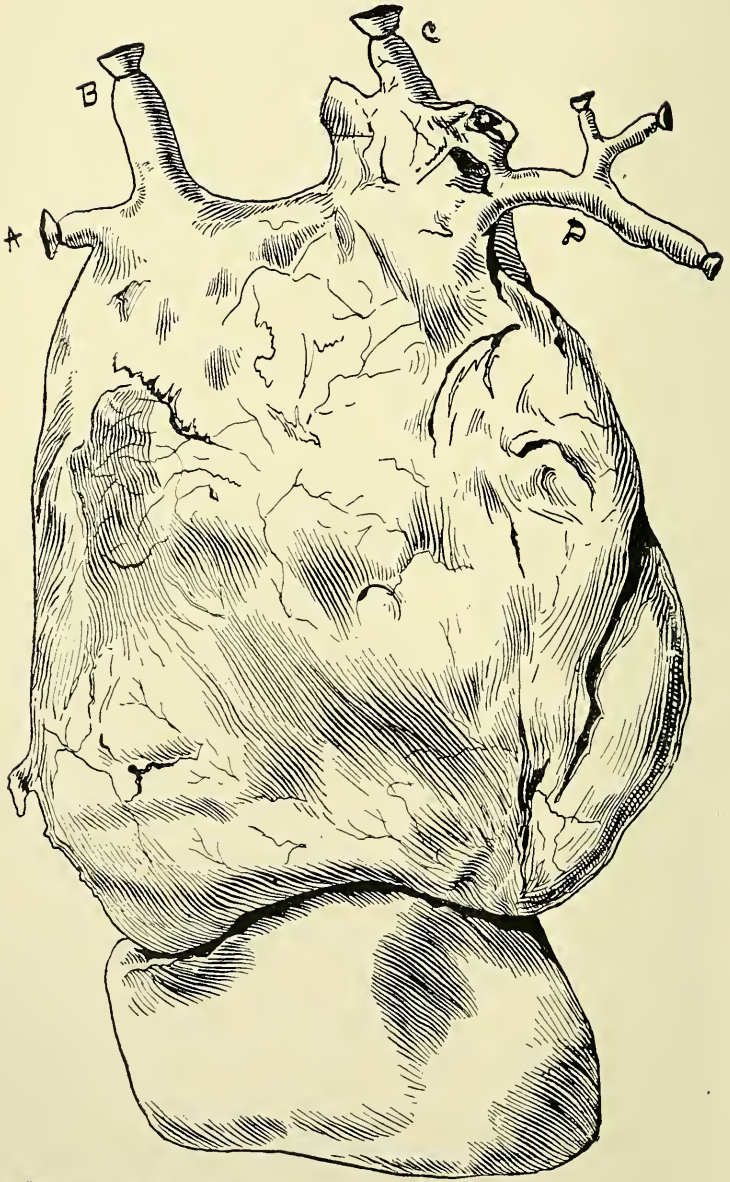
3. Bruit. Upon auscultation, an abnormal sound may be heard over the tumor. It is a swishing sound produced by the liquid rushing from a smaller into a larger space. This is synchronous with the heart-beat.

4. Circulatory disturbances are often very marked. In consequence of pressure upon the venae comites of the artery, there is edema of the part below or beyond the tumor, and there may be even a varicosity of the superficial veins in some cases. The pulse beyond the tumor is less, and if the limb is raised, it may be absent. Upon elevating the limb in which the aneurysm is located, the tumor will be found less tense and the circulation to the limb almost arrested, whereas, on lowering the limb, the tumor becomes more turgid and the return circulation of the limb is affected. Sphygmographic tracings show that the dicrotic wave has disappeared and that the pulse beyond the tumor is somewhat delayed.

5. Changes in arteries and other degenerative changes. The presence of arcus senilis and degenerative changes in the arteries generally (atheroma), and a history of the case, of diabetes, syphilis, Bright's disease, etc., will be sufficient, when taken with the symptoms present, to make a diagnosis of aneurysm.

Internal Aneurysm.—Internal aneurysm is more difficult to recognize. There is no tumor which can be palpated and the signs are often obscure. It may be mistaken for valvular heart disease. Pressure upon the thoracic viscera, producing dyspnea, violent cough, obstruction to the circulation upon the side of the neck and head, or dilatation of the pupil, or evidence of pressure upon the large nerves of the neck, will be important evidences of thoracic aneurysm. When taken into consideration with the interference with the general circulation, or the interference in the circulation upon one side of the body and not the other, together with the abnormal sounds of the heart upon auscultation, the diagnosis of thoracic aneurysm may be made. Aneurysm of the abdominal aorta is more easily diagnosed, inasmuch as the tumor is more readily accessible. The evidences of rupture of an aneurysm

FIG. 27.



Specimen showing the heart and an aneurysm of the arch of the aorta. *a*, right subclavian; *b*, right common carotid; *c*, left common carotid; *d*, left subclavian branches.—From laboratory of anatomy, American School of Osteopathy.

into one of the serous cavities of the body, are those of internal hemorrhage with rapid collapse. Where the rupture takes place within the tissues of a limb, there will be rapid distension of the tissues, together with an obstruction to the return circulation. The pressure in the tissues occasions great pain. Oftentimes there will be, from escape of blood in the tissues, a loss of the pulse beyond and a disappearance of the bruit. The rapid and intense swelling ends in edema and coldness below. Where the loss of blood in the tissues is not sufficiently great to immediately bring on death, gangrene in the member below will follow. Where the rupture of the aneurysm is in one of the large cavities, death results quickly from hemorrhage. The rupture of a carotid aneurysm may result in almost instant death, whether in the tissues of the neck or in the pharynx. Rupture of an aneurysm externally, is so rare, and the symptoms so evident, that it merits no description. Sometimes an aneurysm is spontaneously cured. Evidence of spontaneous cure will be the increased hardness of the tumor and the fact that it diminishes in size. There is loss of pulsation and the disappearance of the bruit. Sometimes, where the aneurysm involves a nerve by the formation of fibrous tissue, because of cicatricial contraction occasioned by the plugging of the aneurysm, great pain will be experienced.

Diagnosis.—The diagnosis of aneurysm is sometimes difficult. It may be mistaken, under certain circumstances, for (1) tumor over the artery, (2) an abscess about an artery, (3) enlarged thyroid, and (4) valvular heart disease. The diagnosis between aneurysm and tumor can be made upon careful examination. The tumor, while it raises up with each pulse beat, is not *expansile*. There is no bruit heard over the tumor. Very frequently the tumor may be raised up away from the artery. The history of the case and the absence of atheroma will be sufficient to form the diagnosis. Furthermore, the pulse beyond the tumor is not seriously affected.

In abscess, the inflammation is more severe. Traumatic aneurysm, the result of injury of one or more coats of the artery where inflammation is excited, may be puzzling. As for instance, a lady in ironing, while turning around to face the table upon which an ironing board lay, struck the inside of her leg in Scarpa's triangle, against the side of the table. She experienced some pain from the injury, but gave it little thought and continued with her duties. Swelling followed and within four or five days, an acute inflammation set up. There was considerable interference with the return circulation. Upon examination it was found that the tumefaction, which had been diagnosed as an abscess, was an aneurysm of the superficial femoral artery. The inflammation was not severe enough for an abscess, and an abscess would not have occasioned the interference with the return circulation. The bruit heard over the tumor was distinct and upon operation the diagnosis was confirmed. The aneurysm was removed and the case recovered without untoward symptoms.

Aneurysm of the common carotid artery and an enlarged thyroid gland, are frequently confounded. In exophthalmic goitre, where the exophthalmos is not very great and where there is a bruit or abnormal sound over the gland, together with a cardiac murmur and tumefaction in the neck, the case is often called aneurysm of the carotid artery. In these cases the pulse beyond the tumor is found not to be affected. If the case is inquired into carefully, this mistake need not be made. In goitre there is tachycardia and Graves's sign is present, that is, widening of the palpebral fissure. The pulse in the temporal arteries on either side is alike. This would not be true of aneurysm. Furthermore, the enlarged thyroid gland will move with the larynx on deglutition, the aneurysm will not. In cases where there is no pulsation in the aneurysm, the diagnosis is extremely difficult. At all events, where the diagnosis is in doubt, an opinion should be withheld until every means of obtaining knowledge of the case is exhausted.

The diagnosis of aortic aneurysm will ofttimes depend upon one's knowledge of, and skill in, physical diagnosis.

Treatment.—The treatment of aneurysm is (A) Osteopathic, (B) Operative, and (C) Dietetic and General.

Osteopathic Treatment has for its purpose, to decrease the intra-arterial tension and to favor coagulation of the blood within the sac. Should such coagulation take place, the tumor will become organized and harmless. In brief, it simulates nature's method of spontaneous cure. When the obliteration of the aneurysm is not possible, as where the aorta is involved, the sac wall may be strengthened by removing lesions affecting the trophic and vasomotor nerves distributed to the arterial wall. For a full discussion of the osteopathic methods of treatment, lesions, etc, a text book on the Practice of Osteopathy should be consulted.

The *operative treatment* consists of (1) pressure. Pressure may be administered in several ways:—(a) Digital pressure, which is made by the thumbs, assisted by a shot-bag. Pressure is kept up by means of intelligent assistants. Pressure is made on the proximal side of the tumor in order to lessen the circulation in the tumor, with the hope that coagulation of the blood will follow. Cases of good results from this treatment are reported to have taken place within a few hours. The aneurysm having filled up with a clot, the clot later becomes organized and the aneurysm cured. This method is not practicable in certain parts of the body, as in the neck, but it is practicable in the gluteal region or in the femoral, popliteal, or tibial aneurysms. (b) Flexion. Pressure by flexion may be made in cases of popliteal aneurysm, or a hollow ball of rubber may be used in case of axillary or subclavian aneurysm, the arm being held to the side, while pressure is exercised directly upon the tumor. (c) Direct pressure by tourniquet. This was formerly used quite extensively, the object being to excite inflammation in the sac and adhesion of its walls or the formation of clot.

This method is now rarely used. (d) Pressure by bandage is of service and might be tried in aneurysms in the extremities. This consists of applying snugly to the limb an Esmarch's elastic bandage, (in case of the lower extremity, from the toes up to above the aneurysm. The bandage must be loosely applied over the aneurysm and rather tightly above it. This cuts off the blood supply to the aneurysm somewhat, making the flow of blood through it slower, rendering coagulation more likely. This method is said to be quite successful. In all these forms, the pressure should not be kept up continuously. In digital pressure, the operator may press for a period of ten minutes, when the assistant takes up the duty and keeps up pressure for the same length of time. This may be kept up for four or five hours during the day, on successive days, and should be left off at night. Esmarch's bandage may be applied so long as it can be borne by the patient, or so as not to seriously interfere with the circulation to the limb, or so as not to cause excruciating pain. It can be applied during the day time and removed at night. This method, or the method of digital pressure, may be used before operative means are begun.

(2) Ligature. Ligation of the artery is, perhaps, the best method of treatment. It should be tried where the aneurysm is a menace, especially after other methods have failed. Operation for ligature of the artery varies according to the part of the body in which the aneurysm is located. Of the methods in use, the following may be mentioned as being of interest, if not the safest to follow: (a) Hunter's method. This method consists in ligating the artery at a distance from the aneurysm. It was devised by the illustrious John Hunter, recognizing the fact that the artery adjacent to the aneurysm, is often diseased, and that ligation some distance above is safer. If the operation is done within the healthy tissues, it does not entirely interfere with the circulation to the part below. Pulsation does not return in the tumor. Secondary hemorrhage is not so common. Collateral branches finally distend and take up the function of the artery below, the inflammation disappears, and the aneurysm becomes more or less absorbed. Occasionally it is found that after Hunter's operation, an abscess, or symptoms like those of an abscess, follow. Should this happen, as soon as pus is evident, the abscess is opened and drained and the cavity packed with gauze.

(b) Anel's method. Anel's method was to ligate the artery immediately above the aneurysm. This operation is no longer used except in special locations. Furthermore, it has no advantage over the Hunterian operation.

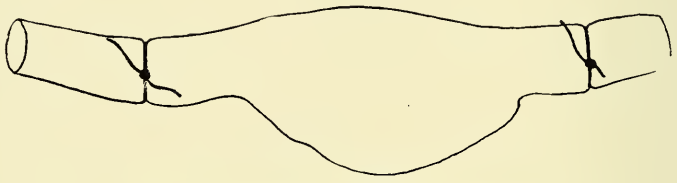
(c) Antyllus's method. The old operation of Antyllus is no longer used, inasmuch as abscess or suppuration is likely to occur. This method consists of ligation of the artery immediately above and below the aneurysm. It is perhaps valuable for traumatic aneurysms, but is not a good method for the treatment of a spontaneous aneurysm where

there is disease of the artery. This method has given way to extirpation.

(d) Basdor's method. Basdor's method consists of ligation of the artery beyond the aneurysm. This prevents blood going from the aneurysm, but allows it to go in. It arrests pulsation in the tumor, favors coagulation and the formation of a clot. The clot, of course, may become organized and the aneurysm disappear.

(e) Wardrop's operation. This consists in ligating the main branch

FIG. 28.

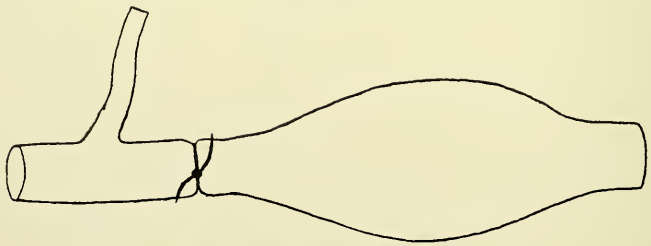


Method of Antyllus for treatment of aneurysm.

of the artery beyond the aneurysm, in an effort to arrest the rapidity of the circulation through the tumor. These operations are hardly advisable.

(3) Excision. Of late years excision has grown into favor. The objection to excision is that it is a prolonged and difficult operation, and that it is frequently necessary to remove the venae comites with the aneurysm. Where this occurs it may so interfere with the return

FIG. 29.



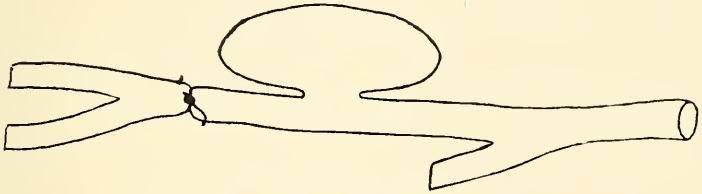
Anel's method of ligaturing an aneurysm.

circulation through the limb that gangrene will follow. With improved technic and a knowledge of the tissues in which the aneurysm is located, together with a careful consideration of the condition of the artery, it is perhaps the safest operation. Should the patient be feeble and aged, a prolonged operation should not be undertaken. Then the Hunterian operation is, perhaps, the best, or Wardrop's or Basdor's operation may be undertaken. These operations are not so difficult nor are they attended with such danger. But where the patient is in good physical condition, excision may be undertaken. The

argument that the artery near the sac is diseased, is not of sufficient weight to warrant going higher than the end of the aneurysmal sac, since, if there is a condition of general atheroma, it will be at all points. In an excision under approved surgical conditions where the ligatures are absolutely sterile, suppuration will be less likely than by ligation above and below the tumor.

(4) Galvano-puncture or Electrolysis and Injections are all now obsolete. They are attended with too much danger and should never,

FIG. 30.

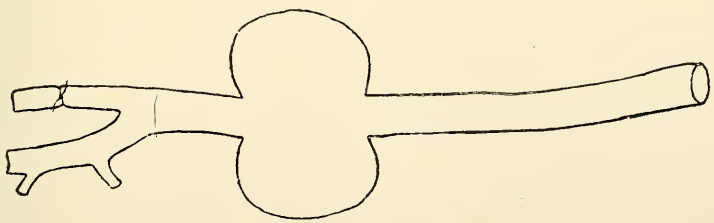


Basdor's method of operation.

under any circumstances, be undertaken. None of them has been attended with sufficient success to warrant any such procedure. Irritation of the inside of the sac by McEwen's method, is of no value.

(5) Manipulation is one of the operative methods which may be undertaken in the treatment of aneurysm. It consists in manipulating the aneurysm, with the idea that a piece of the clot may be dislodged and plug up the mouth of the sac. This method is not unattended with danger. In case of aneurysm of the common or external carotid artery,

FIG. 31.



Wardrop's method of operation.

a piece of clot may be dislodged; embolism of one of the cerebral arteries results, producing hemiplegia. It may be undertaken in an aneurysm of the lower extremity. Here it would not likely be attended by any such serious results.

Dietetic and General Treatment.—Absolute physical and mental rest should be enjoined. The person should be free from excitement and mental worry. All muscular effort in the member should be stopped. The patient should be confined to his room, and, at least a part of the time, in bed. Where it is an unfavorable case, it should be explained to

the patient, that he carries his life in his own hands and that a sudden rupture of the aneurysm would be serious. The diet should be simple and only sufficient to nourish the body, and should consist of plain food well cooked and not a great variety.

Cirsoid Aneurysm.—The treatment of cirsoid aneurysm is somewhat different from the treatment of ordinary aneurysm. This variety of aneurysm consists of a general dilatation and pouching and lengthening of one artery, or several arteries, with their branches. After the disease continues for some length of time, it involves even the veins and capillaries in the same area. The walls of the vessels become thin, lose their contractility and there seems to be absorption of the muscular and elastic coats, only the outer coat remaining. Rupture is not unusual. Their location is on the face and scalp. In some cases, they may embrace the whole of one side of the head. They are more common in the temporal artery. The diagnosis is easy, but differs somewhat from ordinary cases of aneurysm. The thrill and bruit are somewhat differ-

FIG. 32.

Hunter's method of ligation of an artery for aneurysm.

ent. Ligation of the larger arteries which supply the tumor, is a failure. Subcutaneous ligation seems to be successful in some cases. Direct pressure is also successful in certain cases and should be tried in all cases at first. Ligation en masse is the only successful method of treatment. Where the veins and capillaries are involved, the treatment is somewhat different. (See Nevus.)

Traumatic Aneurysm.—In this condition, there has been puncture or rupture of the artery, which results, either in the formation of a sac with part of the artery for its wall, or an effusion of blood within the tissues sets up an inflammation and the resulting tissues become condensed and form a wall for the slowly flowing blood. In traumatic aneurysm, there is a large, and somewhat oblong, fluctuating tumor. In the limb below the aneurysm, there is no pulse, and it is cold and perhaps swollen. The skin is purple, and if the vein is also ruptured, the obstruction to the circulation may be complete or, if there is rupture in a joint, an amputation is indicated.

The most frequent aneurysm produced by injury is the artero-venous or Pott's aneurysm. This aneurysm is now rare. In former times, when bleeding was common, an aneurysm was frequently seen on the front of the elbow. It was produced by wounds of both the vein and artery, the two healing together. There are two forms of this aneurysm, one the

varicose aneurysm, in which the communication between the artery and vein is through an intervening sac. The second variety is aneurysmal varix, a condition in which there is no such intervening tumor between the connecting vein and artery, but the vein dilates and forms a tumefaction, the blood flowing directly from the artery into the vein. Conditions may still arise in civil practice, in case of punctured wounds, where the artery and vein are both wounded, the blood flowing from the artery directly into the vein. Where the opening into the vein is not so large as that in the artery, more blood will perhaps get out of the artery than goes into the vein, under which condition the varicose aneurysm will result, that is, a considerable sac will exist between the artery and the vein. The vein will not be so dilated.

Symptoms of Artero-Venous Aneurysm.—The symptoms of this form of aneurysm are a large swelling, with pulsation. On auscultation, a loud bruit is heard which is transmitted along the veins. The veins above and below the tumor, are tortuous and pulsatile. The limb is swollen and congested and the parts painful. There is a distinct thrill in the tumor, which is lessened on pressure. The diagnosis between aneurysmal varix and varicose aneurysm is often very difficult. When the pressure upon the main artery causes a disappearance of the tumor, it is said to be one of aneurysmal varix, but when such disappearance does not occur, it is said to be varicose aneurysm. Varicose aneurysm may be emptied by direct pressure. Palliative measures should be used. The vein does not tend to rupture, but becomes thickened and, after a time, cease to enlarge. Usually some form of support is necessary. The part is much swollen and very painful. The artery should be tied above and below the tumor. Both vessels may be ligated, providing they can be separated with ease. Ordinary pressure treatment for aneurysm should be used here before any other kind of treatment is applied. If this fails, the artery should be tied. It is a good plan in these cases, to excise the mass if it can be readily done.

Indications for Amputation.

Amputation is frequently required in case of aneurysm. The conditions which demand amputation may be summarized as follows:

1. When gangrene of the limb is imminent.
2. Suppuration of the aneurysm after other methods have been tried.
3. Where severe secondary hemorrhage follows and threatens life.
4. Recurrence of the aneurysm. When it recurs it often becomes much worse.
5. Rupture of the aneurysm into a joint, or the erosion of bones.
6. Rupture of the aneurysm subcutaneously, causing rapid effusion of blood, may call for amputation.

INJURIES TO ARTERIES.

Wounds of arteries may be classified as wounds of other tissues, or incised, contused, punctured, gunshot, etc.

Contused Wounds.—A contused wound of an artery may entirely destroy the vitality of the coats, and sloughing, followed by hemorrhage,

result, or the contusion may rupture the blood-vessel, which will be evidenced by the effusion of blood among the tissues. The evidence of rupture of the artery will be plain—a rapidly forming, fluctuating tumor and absence of the pulse beyond the injury. There will be no bruit and likely no pulsation over the swelling. The limb will become cold from effusion of blood causing obstruction to the return circulation. If collateral circulation is more or less set up and there is not too much obstruction to the return circulation, swelling will occur only at the site of injury. The swelling may extend to other parts of the limb. If there is rupture of a large vein, a tumor occurs at the point of rupture, and if the obstruction to the return circulation is very great, which happens if the main vein of the part becomes ruptured, edema of the member will be one of the chief signs. In contusions of an artery, unless it is of a very large artery, nature will arrest the hemorrhage. The internal coat curls up and favors coagulation. If collateral circulation is not sufficient after the formation of the clot which may involve some of the branches of the artery, gangrene of the member will follow. The results of contusion might be summed up as gangrene from thrombosis and secondary hemorrhage.

Incised Wounds.—Incised wounds of an artery are more apt to be serious. Hemorrhage is rapidly profuse, but contraction of the middle coat and a curling of the inner coat will, after a time, occur. A transverse wound causes profuse bleeding, but is not so serious as an oblique wound. The clot which forms within the artery is called the internal clot. That which forms on the outside is called the external clot. The place of the internal clot will be taken up by fibrous tissue. The external clot will be absorbed. Circulation will take place around this area. The small arteries will become enlarged and if the circulation is sufficient, the vitality of the member will be only temporarily held in abeyance. If the circulation is almost entirely cut off, necrosis will likely follow.

Lacerated Wounds.—A lacerated wound of an artery causes little primary hemorrhage, as a rule, since the conditions present favor coagulation. Secondary hemorrhage may come on, which will give considerable trouble sometimes. This should be looked for in all cases of lacerated wounds affecting arteries.

Punctured Wounds.—Punctured wounds are not immediately serious, but traumatic aneurysm often follows.

Gunshot Wounds.—Gunshot wounds may, because of contusion a the artery wall, result in thrombosis, hemorrhage, gangrene, etc., or may cut the artery entirely off, serious hemorrhage resulting. In some cases, the wound will be clean-cut, in other cases it will be in the nature of a contusion. When the wound is adjacent to an artery, in some cases it may cause laceration. The results of these wounds are similar to others.

LIGATION OF ARTERIES.

The ligature of an artery in continuity is sometimes required in the treatment of aneurysm, as it may be the only method, other than amputation, which will give relief. The operation consists in dividing all the tissues evenly, parallel to the vessel in question, and opening the sheath of the artery, without disturbing the neighboring structures, then passing a ligature of silk, chromicised catgut, or some other suitable ligature material about the artery and tying it so as to obstruct the flow of blood along the artery. The ligature should be tied sufficiently tight to entirely constrict the lumen of the artery.

Instruments.—The instruments needed are a scalpel and dissecting forceps, a grooved director, artery forceps (a half dozen or more), retractors, aneurysm-needles, blunt hooks, ligature material, and ordinary needles for the closure of the wound.

Operation.—In general, the operation consists of the following procedure. The strictest asepsis must be maintained in every particular. The ligature material must be not only properly prepared, but it must be known to be aseptic. After every preparation has been made, the line of the artery marked out, the muscular guide located, an incision is made, generally parallel with the artery, and all of the structures divided in equal length down to the sheath of the artery. The skin and fascia may be divided with a scalpel. A dissecting forceps may then be used and the fascia lifted up and divided until the sheath of the artery presents itself, then the sheath of the artery must be lifted up and divided and the artery itself entirely separated from the surrounding structures. Where it is deep seated, a double curved aneurysm-needle is necessary. The aneurysm-needle may be threaded with a very fine strand of catgut or silk and passed around the artery. To the end of this fine strand of silk is attached the ligature material proper, which is then pulled through, bringing the ligature beneath the artery. It is said this subjects the artery to less irritation. Under most circumstances the artery can be so exposed and the needle so readily passed around the artery to be ligated, that the above procedure is hardly necessary. In making the incision in the sheath of the vessel, the back of the knife should be kept towards the artery. The sheath should be picked up, a delicate incision longitudinal to the artery should be made, when the sheath may be stripped off by means of dissecting forceps. The opening in the sheath should be from three-fourths to one inch in length. The sheath of the artery may then be grasped in forceps and held steady while the operator passes an aneurysm-needle around the artery. He should note that he has no other structures engaged than the artery itself. The ligature may then be passed through the eye of the needle around the vessel. It is tied in a direction exactly at right angles to the longitudinal axis of the artery. Under no circumstances should the artery be dragged out of the wound, but it should be tied in the position in which it is

found. A reef knot is the one used. It is better than a friction knot and is not so complicated as other knots. It is a general rule that, when passing the needle around the artery, it should be directed away from the other important structures which may lie adjacent to the artery. If, by accident, the accompanying vein to the artery is punctured, the needle must be withdrawn and the opening in the vein ligatured before further procedure. In case of small arteries, no trouble will arise from the ligation of the accompanying vein along with the artery, but this should not be done in case of the brachial or femoral, inasmuch as it will interfere quite seriously with the return circulation.

The ligature used should be a specially prepared form of chromicized catgut and should be at least a foot or more in length to permit of the ends being sufficiently long that tying may take place easily and rapidly. No one should attempt the operation until he is thoroughly familiar with the location of the artery and the landmarks or muscular guides. Both deep and superficial guides should be kept in mind at all times. Every structure divided in continuity by the surgeon should be recognized. When the artery is reached, it can be told by pulsation. It is more easily recognizable in the living subject than in the dead.

After Treatment.—The after treatment of the operation consists in maintaining the strictest asepsis and cleanliness. Under ordinary circumstances, the wound should be healed and the stitches removed in from seven to ten days. A limb must be elevated and kept quiet. It should be bandaged snugly with a woolen bandage to keep the limb warm, and if it is necessary, hot water bottles should be applied. In debilitated conditions, or in elderly people, the patient should be kept quiet a longer period than ten days, to allow the tissues to consolidate, so that subsequent inflammation will not arise. Should the operator be afraid of gangrene, for some little time before the operation, the limb should be thoroughly washed several times with antiseptics, while the limb may be elevated and enveloped in aseptic lamb's wool.

Dangers of Ligation.—The dangers of ligation of an artery are secondary hemorrhage and gangrene.

Secondary hemorrhage from the ligation of an artery occurs in septic conditions, where the artery sloughs and the clot formed within the artery is not sufficient to entirely plug it up, or where the ulceration extends into the accompanying vein. This secondary hemorrhage, if it is severe, may necessitate amputation unless the artery can be ligated a second time higher up.

Gangrene may arise from several different conditions; usually it is simply from a loss of vitality. The maximum amount of blood distributed to the limb by means of collateral circulation is not sufficient to keep the tissues alive. Collateral circulation will depend upon the

condition of the artery and the location. If arterio-sclerosis or atheroma is present, collateral circulation will not likely be sufficient. In any case where gangrene occurs, it will begin in the terminal structures, e. g., in the ends of the fingers, ends of the toes, or the structures near the cortex of the brain.

Should primary or secondary hemorrhage occur, the gangrene is then of the dry form. Gangrene occurs also where there is an obstruction to the venous return. It frequently happens that, in the removal of an aneurysm or the ligature of an artery, the accompanying vein is caught up with the artery, or because of some other condition existing, there are inflammatory tissues thrown out. These form an obstruction to the return circulation. A sufficient amount of blood enters the limb, but after getting in, it can not get out, therefore the tissues die from a lack of nutrition. The kind of gangrene occurring under such circumstances, is moist. Bandages, too tightly applied, may operate as an obstruction to the return circulation with similar effect. Gangrene may also occur because of an attack of erysipelas, or because of injudicious after-treatment, in the use of ice-bags, or in not keeping the limb warm, or in too high elevation. Every precaution should be taken to prevent the occurrence of gangrene and when it does appear, every precaution should be taken to limit it. It is not unusual that in ligating the femoral artery there will be death of the toes. Gangrene may extend no farther if the patient is well nourished and the limb is properly treated. Such parts, after having dried, may be removed by a secondary operation, when the circulation seems to have been thoroughly established to the limb.

Position of the Patient During an Operation.—The position of the patient during the operation should be that which makes the artery most easily accessible and exaggerates the outline of the muscular guides.

Ligation of Special Arteries.—Arteria Innominata.—To ligate the innominate artery, an incision should be made along the lower one-third of the anterior border of the sterno-cleido-mastoid. The incision is usually extended down across the suprasternal notch. The inner tendon of the sterno-mastoid should be divided and the anterior jugular veins secured. The sterno-hyoid and sterno-thyroid muscles should be successively divided. The carotid sheath should be located and followed and opened, and the artery traced down to where it is given off from the arteria innominata. At this point the innominate artery may be ligated. It has been ligated six times successfully out of thirty or more operations. The tissues to be avoided are the internal jugular and innominate veins which lie to the outer side of the vessel. The vagus nerve and the pleura also, are to the outer side, and these should be carefully separated from the artery. The aneurysm-needle should be passed from without in. Collateral circulation is established by means of the vertebral, basilar, circle of Willis, branches of external

carotid, superior intercostal, aortic intercostals, deep epigastric, internal mammary, and phrenic arteries.

Carotid.—The carotid artery is ligated below the omo-hyoid in the inferior carotid triangle or above the omo-hyoid in the superior carotid triangle. It should always be ligated in the superior triangle if possible. The superficial muscular guide is the sterno-mastoid, the deep muscular guide, the omo-hyoid. The vessel should be uncovered at a point where this muscle crosses the artery and it may then be ligated above or below. The course of the artery may be indicated by a line drawn from the sterno-clavicular articulation, to a point midway between the angle of the jaw and the mastoid process. An incision, two and one-half inches long, should be made along the anterior border of the sterno-mastoid. The edge of the muscle should be uncovered and pulled back, which exposes the common sheath, including the common carotid artery, the jugular vein and pneumogastric nerve. The artery is on the inner side, the vein on the outer side, and the nerve between the two, but on a plane posterior to both, while in front of the sheath will be found the filaments from the loop of communication between the descendens and communicans noni nerves. The sheath should be opened with care not to destroy these nerves. Preliminary hemorrhage, incident to uncovering the sheath, should be staunched. After the sheath is opened, the sheath of the carotid itself should be opened and separated and the needle passed around the artery. The needle should be passed from without inward. The sheath should be opened sufficiently, so it will be plain that the pneumogastric nerve is not included in the ligature. The operation above the omo-hyoid does not differ in any way from that below, except it may be necessary to pull the depressors of the os-hyoid inward, while the sterno-mastoid may be pulled outward. It may be necessary to divide the anterior fibres of the sterno-mastoid. The effect of the ligature of the common carotid artery is curious and interesting. Either soon after, or in a few days, brain symptoms manifest themselves in about twenty-five per cent of the cases. These symptoms are in the nature of syncope, because of anemia, and in a few days there are evidences of cerebral softening, convulsions, coma, and death. In the cases thus affected, about one-half will terminate fatally. In some cases there may be congestion of the lungs, perhaps due to irritation of the pneumogastric nerve. In other cases, the sympathetic nerves seem to be affected; perhaps inflammatory tissue involves the sympathetic trunk. Collateral circulation is then established chiefly by means of the vertebrals, profunda cervicis, arteria princeps cervicis, inferior thyroid, superficial cervical, and occipital arteries.

Internal Carotid.—Ligature of the internal carotid artery may be demanded, under rare circumstances, for aneurysm and hemorrhage. It may be done in any part of its course, but preferably, just after the bifurcation of the common carotid. The operation is similar to that

for ligation of the common carotid, but a trifle higher up. A three-inch incision along the anterior border of the sterno-mastoid muscle, (which is the muscular guide), opposite the greater cornu of the os-hyoid, should be made. The aneurysm-needle is passed toward the middle line, away from the internal jugular vein. Collateral circulation is established chiefly through the circle of Willis.

External Carotid.—The external carotid artery may be ligated in any part of its course, but the operation seems easiest above the point where the superior thyroid branch is given off. A three-inch incision is made along the anterior margin of the sterno-mastoid, when the muscle is uncovered and drawn backward and the digastric muscle is exposed. Care should be taken not to injure the hypoglossal nerve. The sheath should be opened below the hypoglossal nerve, where it winds around the occipital artery. The ligature is applied below the cornu of the os-hyoid, and the aneurysm-needle should be passed under the artery toward the middle line of the neck. Enlarged glands make the operation difficult. Furthermore, any irregularity in the position of the anterior branches of the artery, will make the operation more difficult. It is also necessary to avoid the loop of communication between the descendens and communicans noni and the superior laryngeal nerve which lie in close connection with the external carotid.

Superior Thyroid.—An incision is made as in ligating the external carotid. The superior thyroid is tied just where it is given off.

Lingual.—Ligature of the lingual artery is sometimes done for malignant disease or injury of the tongue. The operation is difficult and requires the utmost care. The artery is preferably ligated beneath the hyo-glossus in the submaxillary triangle of the neck. It may be ligated just at its origin in a manner similar to the ligation of the external carotid. For the technic of the operation, larger works should be consulted.

Facial.—The facial artery is best ligated where it crosses the lower jaw in front of the masseter muscle. A vertical incision, an inch long, dividing the skin and deep fascia, will uncover the artery, when it may be readily tied.

Temporal.—The temporal artery is best tied where it crosses the zygoma. At this point it is quite superficial and is covered only by skin and fascia. Sometimes the auriculo-temporal nerve is in relation with the temporal artery and care should be taken not to wound it or to engage it within the ligature.

Occipital.—An incision, two inches long, backward and upward from the mastoid process of the temporal bone, should be made, uncovering the posterior fibres of the sterno-mastoid. The fibres of the trachelo-mastoid and the splenius capitis are divided. This will expose the artery as it emerges from behind the mastoid process, when the ligature may be readily applied.

Subclavian.—This artery is most frequently ligated in the third part of its course, between the scalenus anticus muscle and the lower border of the first rib. The operation may be done for the purpose of controlling hemorrhage after wound of the brachial, or aneurysm of the subclavian, or because of injury. The patient should be placed in a recumbent posture and the face turned to the opposite side. The arm should be depressed and the shoulders drawn close to the edge of the table. A four-inch incision is made over the clavicle after the skin has been drawn down, so that on relaxation, the skin is returned over the clavicle. The deep structures are exposed beneath the sterno-mastoid and trapezius in the subclavian triangle. The external jugular and communicating veins are drawn to one side. The connective tissues are divided, care being taken to avoid severing the suprascapular and the transversalis cervicis arteries. If the posterior belly of the omo-hyoid muscle presents itself, it should be drawn upward. The connective tissues are separated, when the finger may be introduced and the scalenus tubercle on the first rib located. The artery should then be isolated from the vein, and the cords of the brachial plexus may be pulled to one side. Great care is necessary to avoid wounding, injuring, or including any of the cords of the brachial plexus, inasmuch as one cord is on the inside, one posterior, and one on the outside of the artery. Serious injury may be done to the veins in the neck, also the pleura may be wounded. These are the chief dangers of the operation. Collateral circulation is set up through the branches of the thyroid axis and subclavian, axillary, and external carotid.

Internal Mammary.—The internal mammary artery is best ligated on the front of the chest, by removal of a costal cartilage. The costal cartilage is either incised or removed and the artery exposed without opening the pleura. It lies a half-inch to an inch from the margin of the sternum. In case of hemorrhage, it may be necessary to secure both ends of the artery.

Vertebral.—The vertebral artery can readily be ligated just before it enters the foramen at the base of the transverse process of the sixth cervical vertebra. A three and a half-inch incision is made along the posterior border of the sterno-mastoid. The scalenus anticus muscle must be located and the phrenic nerve by all means avoided. The interval between the scalenus anticus and longus colli muscle, should be noted. It is in this interval in which the vertebral artery is found. If a few sympathetic nerve branches are included in the ligature, contraction of the pupil results.

Inferior Thyroid.—The inferior thyroid artery must be tied by an operation in the inferior carotid triangle. The operation is difficult. An incision three inches long is made along the anterior border of the lower part of the sterno-mastoid muscle, the muscle is drawn backward and the sheath of the carotid vessels drawn upward. It may be necessary to divide the sterno-hyoid and the sterno-thyroid. Behind

the sheath of the common carotid artery, the inferior thyroid is found as it arches upward and inward. Care should be taken not to injure the sympathetic trunk. The middle cervical ganglion lies directly on the artery.

Axillary.—The axillary artery is tied, in preference to the brachial, when injury or aneurysm require ligature high up. There are two operations which are practiced, either one of which is good. The arm should be fully abducted and the operation performed from the axilla, if possible. The surgeon should stand between the patient's arm and his body. An incision is made along the course of the vessel, which is at the junction of the anterior and middle third of the space between the two folds of the axilla. The coraco-brachialis muscle should be clearly defined, as it is the muscular guide to the artery. The muscle should be drawn outward, which exposes the median and external cutaneous nerves, which are drawn inward. This exposes the artery. The needle should be passed from the vein accompanying the artery, after the nerves have been thoroughly separated from it. The anastomosis about the shoulder is free.

Brachial.—The brachial artery requires ligature in wounds of the palmar arch or for aneurysm or artero-venous wounds at the bicipital space. The arm should be held away from the side and not supported on the table, but rather held by an assistant. The surgeon may stand between the arm and the trunk. The biceps muscle is the muscular guide. A two-inch incision is made along its border and the skin and fascia divided, when the biceps is drawn slightly outward and the median nerve exposed. As the nerve, which crosses the artery in the middle part of its course, is brought into view, it should be drawn inward. The artery should be separated from its venae comites, care being taken not to inclose any other structures within the ligature. Collateral circulation takes place through the free anastomosis of the profunda, anastomotica magna, and recurrent arteries about the elbow.

Ulnar.—The ulnar artery may be tied in the middle of the forearm or at the wrist. The muscular guide is the tendon of the flexor carpi ulnaris. An inch incision is made, the flexor carpi ulnaris drawn inward, and the artery exposed. The venae comites should be separated. The ulnar nerve will be found on the inner side of the artery, which should be avoided in passing the ligature. In the middle of the forearm, a line drawn from the inner condyle to the pisiform bone, will mark the line of incision. The incision should be made at the intermuscular septum between the flexor carpi ulnaris and the flexor sublimis digitorum muscles. The artery lies under cover of the flexor carpi ulnaris, and if one succeeds in finding this intermuscular septum, the artery is easily discovered and tied. It is said that the most common mistake which happens is, that the operator will separate portions of the flexor sublimis digitorum, or that he will get too far to the radial side between the flexor sublimis digitorum and the palmaris longus.

Radial.—The radial artery may be tied at three points, in the upper one-third of the arm, above the wrist, and at the back of the wrist. The supinator longus is the muscular guide. An incision is made along the inner border of this muscle, when it is raised up, exposing the artery. The radial nerve is on the outer side and separated by a small interval. The artery may be readily tied at this point.

Above the wrist, the artery lies between the tendons of the flexor carpi radialis and the supinator longus and is subcutaneous. An incision is made between these two tendons. The artery is readily exposed.

On the back of the wrist, the radial artery is ligated in what is known as the anatomical snuff-box, or inter-tendinous hollow, below the styloid process of the radius. The artery is here found directed towards the first interosseous space underneath the extensor tendons.

Abdominal Aorta.—Ligation of the abdominal aorta, according to Tillaux, has been done fourteen times. Death is reported in all cases, although a patient operated upon by Keene lived until the forty-eighth day. The operation is both difficult and dangerous. Patients usually die of sepsis. For a description of the operation, the student is referred to large works on operative surgery.

Common Iliac.—The common iliac arteries may be ligatured by two methods, one by an extraperitoneal method, where the peritoneum is not opened, similar to operation for ligation of the external iliac, and by the trans-peritoneal operation, where the artery is ligated through the peritoneum. The operation is rather difficult and requires a thorough knowledge of the technic. With strictest asepsis the operation is not necessarily fatal. The method of procedure will be found discussed at length in more extensive texts.

Internal Iliac.—Occasionally, the internal iliac artery is ligated for hernia, hemorrhage, or aneurysm. The trunk is short, hence ligation is done just after the bifurcation of the common iliac.

Gluteal.—Ligation is necessary in case of gluteal aneurysm. The gluteal artery emerges from the pelvis through the great sacro-sciatic notch above the pyriformis muscle. A line drawn from the great trochanter to the posterior superior iliac spine at the junction of the upper one-third of this line with the middle one-third, will mark the point of incision. An incision is made along this line just mentioned, and the fibres of the gluteal muscles are separated and held apart. Through the space between the gluteus medius and minimus, the pyriformis muscle is located. The artery may now be ligated. Some believe that it is wiser to deal with the trunk of the internal iliac, inasmuch as the operation is difficult.

Sciatic and Pudic.—The sciatic and pudic arteries are rarely ever tied, but are best located opposite the sciatic spine.

External Iliac.—The external iliac artery is accessible in any part of its course. It has but two branches, the deep epigastric and deep circumflex iliac, and these come off in the lower portion. A line drawn from the bifurcation of the aorta to the middle of Poupart's ligament, will indicate the course of the artery. The following operation is one of the various operations described, which is generally utilized: An incision four inches in length extends from a point one and a half inches above the anterior superior spine, to one-half inch below the middle of Poupart's ligament. The muscles are successively divided until the fascia transversalis is reached. At this point, if the transversalis fascia is thick, it should be opened. Sometimes it is not well developed, when, unless care is taken, the peritoneum may be opened. The peritoneum and its contents are now stripped from the pelvic wall with the hand by careful dissection. The incision should be large enough and the peritoneum separated sufficiently far back to uncover the psoas muscle; the artery lies on the inner border of this muscle. It can be readily found enveloped in fascia, while lying over it is the genito crural nerve, the vein being on the inner side of the artery. The sheath is opened and the artery separated from the vein and the genito crural nerve. The aneurysm needle is passed from within out. This is Abernathy's method of operation. Collateral circulation is established through the internal mammary, superficial and deep epigastric, lumbar arteries, lower intercostals, also by means of the crucial anastomosis on the back of the leg; also, by the anastomosis of the ilio-lumbar and gluteal with the circumflex iliac and external circumflex artery, and with the anastomosis of the obturator artery.

Common Femoral.—This artery is rarely ever ligated, except in hip amputation. The superficial femoral is usually ligated because it permits of much better collateral circulation. The artery is located by a line drawn from the mid point of a line extending from the anterior superior spine to the symphysis, to the internal condyle of the femur. If the limb is flexed and abducted, the artery may be readily picked up at the apex of Scarpa's triangle or in Hunter's canal.

In Scarpa's triangle an incision is made over the direction of the artery, about a hand's breadth below Poupart's ligament. The incision should be about three or four inches long. The border of the sartorius muscle is the muscular guide. The middle cutaneous nerve presents, lying over the sheath of the artery. The muscle is drawn aside and the sheath may be opened and the artery exposed. The needle may be passed in either direction, especial care being taken not to enclose any other structures.

When possible, the artery should be ligated in Hunter's canal. A four-inch incision is made over the line of the artery and after the fascia lata is divided, the sartorius muscle is exposed. The outer border of the muscle is located and the muscle drawn inward. As it is drawn inward it discloses the aponeurotic covering of Hunter's canal. This

canal is opened, which exposes the femoral artery and vein and long saphenous nerve. The nerve to the vastus internus lies on the outer side of the artery. The long saphenous nerve crosses the artery from without inward, while the vein lies to the inner side and behind. The needle may be passed in either direction, but with great care. No mistake need be made in locating Hunter's canal, if it is borne in mind that it is directly beneath the sartorius muscle, and as the sartorius muscle is raised up in its sheath, the glistening surface of the aponeurotic covering of the canal may be seen.

Popliteal.—The popliteal artery may be ligated just after the femoral artery has passed through the opening in the adductor magnus, but the operation is more troublesome and has no advantage over the ligation of the femoral. The artery may also be tied in the lower part of its course where it lies on the popliteus muscle in the popliteal space. But this operation has no advantage over the ligation of the superficial femoral in Hunter's canal.

Posterior Tibial.—Ligature of the posterior tibial artery may be required in case of hemorrhage. It may be ligated in the calf, in the lower one-third of the leg, or just behind the internal malleolus. An incision should be made an inch behind the inner border of the tibia. The incision should be at least four inches long. The internal saphenous nerve is met with and should be pulled to one side. The artery lies just underneath the soleus muscle. The incision should expose the tibial origin of the soleus which is severed at the oblique line of the tibia. The muscle is pulled up and the artery exposed. If possible, the venae comites should be separated. The nerve should be distinguished from the artery, which is easily done, and the aneurysm-needle passed around the artery away from the nerve.

In the lower one-third of the leg, an incision is made midway between the border of the Achilles tendon and the inner border of the tibia. The artery is found lying on the flexor longus digitorum muscle. The nerve is on the outer side and behind. In passing the needle this nerve should be avoided.

Behind the malleolus the incision is made a finger's breadth behind the internal malleolus. The deep fascia is divided between the extensor longus digitorum and the flexor longus hallucis, and the artery is exposed. The sheaths of the tendons should not be opened.

Anterior Tibial.—The anterior tibial artery is located by a line drawn from a point midway between the outer tuberosity of the tibia and the head of the fibula, to a point midway between the two malleoli. It may be tied either in the upper, middle, or lower third of the leg. In the upper third of the leg the artery lies between the tibialis anticus and the extensor longus digitorum muscles, on the interosseous membrane. The anterior tibial nerve is on the outer side.

In the middle one-third of the leg it lies between the tibialis anticus

and the extensor propius hallucis. The nerve generally lies on the artery.

In the lower one-third of the leg the artery lies between the tendons of the tibialis anticus and the extensor propius hallucis. The nerve is on the outer side.

Dorsalis Pedis.—This artery extends from a point midway between the two malleoli and the interval between the first two metatarsal bones. An incision made along this line will uncover the artery which is found lying between the tendons of the extensor propius hallucis and the extensor brevis digitorum. Sometimes it is said the artery is rather difficult to tie, and it will be best to cut the artery and then ligate the cut ends.

Peroneal.—The peroneal artery will be found lying on the inner side of the fibula on its postero-internal border. It is in an osseo-aponeurotic canal and is rather difficult to tie.

DISEASES OF VEINS.

Phlebitis is an inflammation of a vein. Two forms are recognized, (1) plastic and (2) infective.

Plastic Phlebitis usually results from a wound and often arises from the reparative inflammation extending into the vein. It may also result from injury. It is a localized inflammation of the vein, and is often attended by thrombosis. Continued pressure or irritation of the vein may set up a plastic phlebitis, thrombosis resulting. It is also said that inflammation of the perivascular tissues, as occurs in septic conditions, may induce plastic phlebitis within a vein.

Infective Phlebitis is a much more serious condition, inasmuch as the thrombus formed is infected and may become a means whereby the micro-organisms are disseminated through the body. This septic or infective phlebitis was the source of trouble among the older surgeons, as infection was introduced directly into the veins, and rapid sepsis resulted. Septic phlebitis never occurs now as the result of a surgical operation. In neglected wounds or in suppurating diseases, it may arise, forming a serious complication. It follows mastoid disease, the infection traveling through the bone into the lateral sinus. Localized phlebitis often arises around foul ulcers or in cases of gonorrhea, but where the infection gets directly into the vein, as occurs in septic phlebitis, general edema will result.

Symptoms.—The vessels are swollen and hard, forming red and painful cords underneath the skin. Nodular enlargements corresponding to the valves may be felt. The skin is edematous and there are areas which are dusky and congested. When the deeper veins are involved, the diagnosis is more difficult. It is accompanied by a peculiar white edema of the tissues. In case the deep veins of the leg are involved, a condition called "milk leg" follows. In this condition per-

haps, lymphatic obstruction operates as a part of the cause of the condition. The onset of septic phlebitis is attended by a chill with rapid extension of the inflammation, unless but a small area is affected, and it is usually followed by sepsis and rapid invasion of the general system. Diffuse suppuration sometimes follows. Repetition of the chills and acceleration of the temperature would indicate pyemia.

Treatment.—The treatment of phlebitis is absolute rest and elevation of the part. In the case of a limb, it should be enveloped in lamb's wool or cotton and well bandaged. The limb should be kept hot by means of hot water bottles. The limb may be manipulated to assist the return circulation. Vigorous local manipulation should be avoided since coagulation may occur in the veins. Dislodging of the clot would be followed by embolism. The circulation to the affected part must be assisted by relieving any obstruction and encouraging the flow of blood through the agency of the vasomotors. Any spinal or other lesions affecting the nerves to the inflamed vessels should receive especial attention. The diet of the patient should be non-stimulating and nutritious. Septic phlebitis, with the formation of pus, should be treated the same as an abscess. As soon as pus formation is made evident by means of fluctuation, the abscess should be opened and freely drained. In some cases it is possible to ligate the vein above the septic area and scrape out the inflamed mass. This is very often attended by sepsis. This method of treatment could only be used where a single trunk is involved; it is rarely ever feasible.

Varicose Veins, or Varix.

This disease is sometimes called phlebectasis. The vein becomes very prominently dilated and lengthened and more or less tortuous. It is said to occur in twenty per cent of adults, more frequently in men than in women. The locations where they are usually found are the internal and external saphenous veins (generally the internal); the spermatic veins which surround the spermatic cord (varicocele) and in the veins of the rectum, where a condition of hemorrhoids or piles is produced. Varicocele and hemorrhoids will be considered elsewhere. Other veins may be affected, as, for instance, the veins over the abdomen may be dilated in conditions of cirrhosis of the liver. Sometimes varicosities of the veins of the viscera happen, and rarely they occur in the deep veins of the extremities. Sometimes congenital varicose veins occur.

Pathology.—It need hardly be mentioned that the cause of varicose veins is an obstruction to the return circulation at some point. The cure of the condition depends upon the physician determining the point of obstruction. Changes take place within the vein-wall. It becomes thickened by the formation of inflammatory tissue and when the vein is cut it will remain distended. Pouch-like dilatations occur

along the course of the vein at the location of the valves. After some length of time, fibrous changes occurring in the veins, entirely displace the normal tissues of the intima and media. Superficial varicose veins are evident on inspection. They appear enlarged, thickened, distended, and tortuous.

Results.—The results of varicose veins in the leg, as these are the most common, consist of a general impairment of the circulation. In severe cases, edema of the limb is common. The tissues of the limb often become debilitated because of the bad circulation and at the least possible injury, ulcers result. These varicose ulcers are difficult to treat and sometimes seriously affect the general health. Where the skin is subject to irritation, eczema sometimes develops. This eczema oftentimes results in ulceration, and after the ulceration is established, the secretions flowing over the tissues may again cause eczema. Inflammations of the vein frequently occur in this ill-nourished and distended condition. This phlebitis may result in the formation of thrombus or it may result in the partial occlusion of the vein or the formation of an abscess. Where the injury to the vein results in the coagulation of the blood and the formation of thrombus, later the vein may be more or less absorbed, only a fibrous cord being left. Sometimes calcareous degeneration of the thrombus occurs, when a phlebolith results. Persons of rheumatic and gouty tendency who have varicose veins are very liable to phlebitis. Varicose veins are accelerated by the formation of what is known as the "vicious circulation." Sometimes blood from the internal saphenous vein empties into the external or short saphenous vein and thence into the deep veins, whereas the blood from the deep veins flows from the femoral vein into the saphenous, so that a certain amount of blood would, as it were, go round and round this vicious circuit. Whether this is true is questionable, but it is said to sometimes occur.

Treatment.—The treatment of varicose veins depends on recognizing the cause. The obstruction in the leg may be caused by enlarged lymphatic glands at the saphenous opening. Muscular contractions may produce tension of the fascia lata and cause impingement of the return circulation. Partial and complete dislocations of the hip will, in like manner, directly or indirectly interfere with the return circulation. Prolapsus of the abdominal viscera will produce obstructions in the pelvis. Pressure on the ascending cava where it passes through the diaphragm may be the cause. Where there is a general lack of tone, lesions affecting the vasomotor nerve supply to the vessels of the legs will be found. These lesions may be at the sacro-iliac joint, between the sacrum and lumbar spine, or in the lower dorsal or lumbar regions. Luxations of the lower ribs may operate similarly. A cure in any case depends upon removing the cause and securing the proper nerve supply by removing the lesions found, and also in stimulating the vasomotors to the veins affected.

Nevus.

Nevus is a condition of dilation of the veins, venules and arterioles and is classified as one of the tumors. (See Angioma.) The capillaries are dilated and this dilation may extend into the small veins and arteries, and large cavernous spaces may be formed. Considerable pigmentation of the tissues about may occur, since the blood may flow in cavernous spaces, and the circulation being weak at this point, it may be partially obstructed. The disease is very often congenital. It may wither and disappear after a time or it may enlarge and spread over a considerable area. Two varieties are usually described.

1. Capillary nevus, or mother's mark, occurs usually as a bright red or purplish colored mass, slightly elevated above the skin. It consists of a mass of capillaries lined with endothelium. They are small and often do not extend over a space of more than an inch or two in diameter, but they may, in some cases, cover the side of the head and face. Where a certain amount of pigmentation occurs, it is called the "port wine" stain. If they are injured, hemorrhage is usually very free, but is readily stopped by pressure.

2. Cavernous angioma is a condition where the veins are largely involved. They lie in the skin and subcutaneous tissues. They are soft to the touch, easily compressible, but return to their dilated condition so soon as the pressure is removed. They are often lobulated, and when the blood is pressed from them, they give evidence of sinuses beneath the skin. They are generally situated beneath the skin and show as a blue lobulated mass. In the mucous form, where the capillary and venous angiomata are mixed, it is usually of a dark red color. Venous nevi are really masses of venous sinuses lined with endothelium. They may be associated with injury, may occur spontaneously, because of local weakness and obstructions, and may be congenital.

Treatment.—The treatment of nevus, where it can be accomplished, especially the venous form, is (1) excision. The veins are ligated, separated from the subcutaneous tissues and the skin, and removed. (2) Subcutaneous ligation may be used with advantage in some cases, and if excision cannot be done, it should be tried. (3) Injection of coagulating fluids into the tumor, such as perchloride of iron or a strong solution of carbolic acid, is no longer practiced. (4) Electrolysis. Where excision and subcutaneous ligation are impossible, electrolysis forms an excellent method of treatment of nevus. This treatment is especially valuable where the nevus occurs upon the face or where it is necessary to avoid cicatrization. It consists in the passing of a strong current of electricity through the mass. This produces chemical and physical changes and brings about coagulation and organization of the tissues. Both poles of the battery may be introduced into the tumor, but this is not the wisest plan. It is better to employ a one or two needled positive electrode and introduce it into the tumor while the negative pole is applied to a different part of the body. The needle

should be made of steel, inasmuch as the treatment corrodes the needle, which has an advantageous effect upon the tumor. The use of the negative pole in the tumor is more liable to cause scar. A current equal to about two-hundred milliamperes should be passed through the tumor for about fifteen minutes. Should both poles be applied to the tumor, a current of only about half this strength is necessary. General anesthesia is required. The immediate effect on the tumor is to cause it to become hard through the coagulation of the blood. In some cases the treatment is not successful. It is best to deal with the periphery of the nevus first. Some scarring will be inevitable. It is wise not to do too much at one sitting. If the nevus be treated at several sittings, there will be less scar formation. The nevus should be treated sufficiently long to permit of complete cicatrization.

Embolism.

An embolus is any floating object in the blood. It may be composed of the following materials:

1. Thrombi. (2) Parasites. (3) Fat. (4) Air. (5) Glandular Cells.

The method by which thrombi become emboli can best be seen in forms of valvular heart disease or endocarditis. In valvular heart disease the valves become roughened and clots are readily formed, when, because of the action of the heart, these clots become detached and are whirled away along the blood-stream and finally plug up some artery. This is the most frequent origin of emboli. Emboli may contain parasites and wherever they lodge, an abscess results. In case of fracture, especially of long bones, particles of fat may be dislodged, and finally entering the veins, are carried back to the heart. This will cause dyspnea by plugging up the branches of the pulmonary artery. Air embolism sometimes occurs where there is a wound of a large vein and where the intravenous pressure is negative, or it sometimes happens after giving a hypodermic injection of a drug, where the syringe contains some quantity of air. Embolism by other cells sometimes occurs in cases of cancer and sarcoma. The cells enter the circulation and are carried elsewhere, and a secondary tumor results.

Effects of Embolism.—The effect of embolism is to cut off the circulation to the part. If it occurs in the brain, paralysis results. If it happens in other organs, other symptoms. These effects may depend somewhat upon the nature of the clot. They may be classified as follows:

1. Changes in the clot. Subsequent changes in the clot may occur. Becoming organized, as in case of thrombi, the artery is permanently obliterated. Collateral circulation may be established and the function of the part restored.

2. Anemia. Where collateral circulation is fairly good, the part may give evidence only of anemia. This will be recovered from in due time.

3. Necrosis. In terminal arteries, necrosis will occur, as in case of

gastric ulcer. In terminal arteries of the brain, necrosis of a portion of the brain very often happens. This necrosed area becomes liquefied, afterwards forming either an abscess or cyst, depending upon whether the clot is infective.

4. Infarction. Where the embolism is of an organ like the kidney or spleen, infarcts are formed. This infarct consists in the plugging of a terminal artery in some such organ as mentioned, and a subsequent engorgement or swelling in the area to which the artery is distributed. Inflammatory changes and fibrous tissue changes very often take place in these infarcted areas. There are two kinds of infarcts—the white, in which there is no obstruction to the return circulation, and red infarcts, where there is more or less obstruction to the return circulation, or where there is at least some collateral circulation.

Evidences of Embolism.—The evidences of embolism are similar to those of thrombosis, with the exception that they come on more suddenly. The effect on the brain is sudden and complete paralysis of the area affected. Embolism of the arteria centralis retinae and its branches would destroy sight in the eye affected. It at once destroys the function of the area to which the artery, which is plugged, is distributed. In the organs where infarction takes place, there will be evidences of congestion and edema. Should the blood supply be entirely cut off, necrosis of a mass of tissue will occur. If the embolus is infective an abscess results. In any case the symptoms will be obscure and diagnosis difficult, and it can only be made, in many cases, by eliminating other conditions.

Thrombosis.

Thrombosis is the formation of a clot in a living blood-vessel.

Causes.—The causes of thrombosis may be classified as follows:

1. Disease or injury to the vessel wall. Any disease or injury to the vessel wall, whereby it becomes roughened or thickened or a portion is removed, may furnish more favorable conditions for coagulation. Atheroma, sclero-endarteritis, etc., are conditions which bring about thrombosis.

2. Certain changes in the blood. Changes in the blood, whereby it becomes more coagulable, favor thrombosis. These changes are, perhaps, problematical and theoretical, but that the blood is more coagulable under some circumstances than in others, is likely true.

3. Foreign bodies or the presence of micro-organisms. These foreign bodies furnish a point upon which the coagula may be deposited or to which the leukocytes may cling, thereby assisting the formation of a clot.

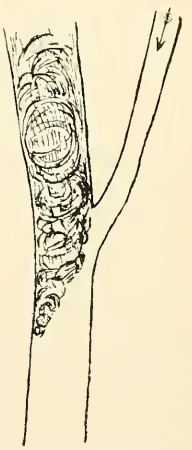
4. Retardation of the blood stream. Retardation or slowing of the blood stream may occur under several conditions. It occurs after (a) ligature of the artery in operations for thrombosis, or from injury to the artery or vein, from aneurysm, or in any operation where the artery is tied.

(b) From tight bandage. Pressure of a tight bandage may lead to such obstruction to the circulation that coagulation will occur.

(c) Diminished force and frequency of the heart-beat, lessening the vis a tergo, perhaps assist in the formation of the clot.

(d) The pressure of a tumor or luxated bones or other objects upon the vessel above, may lead to coagulation and the formation of thrombi. This occurs, perhaps, in cases of phlegmasia alba dolens or milk leg. When the clot is formed, it may extend in both directions from the point of origin, but it usually extends in the direction of the blood current. If it entirely fills up a branch of the artery it will extend back only so far as the main trunk. At this point it may stick out and form a projection into the blood stream of the larger artery. It will extend in the direction of the blood stream as far as where branches are given off, or where the blood flow is influenced by collateral circulation. The thrombi may be occluding where they entirely fill up the vessels or they may be only partial. The effects they produce and the symptoms of thrombosis will depend upon the subsequent changes which take place in the thrombus, or upon whether it is *occluding*.

FIG. 33.



Venous thrombus.

Changes in Thrombosis.—1. Organization. A thrombus may become organized; this takes place in the following manner: As soon as a clot forms in any vessel, it becomes infiltrated with leukocytes and proliferated endothelial cells and connective-tissue cells—in other words, round cell infiltration occurs. Subsequently the clot becomes displaced by means of this new formation. Small blood vessels may extend from the vasa vasorum through the vessel wall out into the clot. The artery becomes organized and forms a hard fibrous cord.

2. Softening. Softening of the clot may occur because of fatty degeneration of its elements. Fatty degeneration may be because of the limited nutrition of the infiltrated tissue cells or the softening may be the result of bacteria. The clot may become softened and a portion of it dislodged and carried into the general circulation, embolism resulting. It may break down, the elements become liquefied and a small cyst result, or, on the other hand, fatty degeneration and liquefaction and absorption of the elements may occur.

3. Calcification. Sometimes the fatty material which is formed as the result of fatty degeneration of the clot, will become displaced by means of calcareous material, when the remains of the thrombus and the artery will be a calcified mass.

4. Absorption and tunnelling of the clot may sometimes occur. This is accomplished by means of the clot apparently opening up because of the blood pressure or the liquefying effects of the blood, or perhaps be-

cause of fatty degeneration. The clot becomes tunnelled out and a sinuous or tortuous tract is made through the clot and it becomes pervious to the extent that it will permit of regular circulation taking place through it.

Effects of Thrombosis.—The effects of thrombosis depend upon whether it occurs in an artery or vein, or whether it is in a terminal artery, or upon the extent to which the circulation is cut off from the tissues to which the vessel is distributed.

1. Swelling and edema. The swelling and edema are usually great. It will depend upon whether the obstruction is in the vein or artery. If the obstruction is in the vein, the swelling will be enormous. If the clot becomes organized in the vein and the collateral circulation is poorly established, this edema may remain and become hard (solid edema). This sometimes occurs in phlegmasia alba dolens.

2. Gangrene. It is not unusual for gangrene to result from obstruction to the return circulation or from the formation of a thrombus in an artery or vein. The gangrene following is of a moist variety, especially where the thrombus is in the vein. The extent of the gangrene will depend upon the extent to which the circulation is cut off.

3. Phlebitis. Inflammation of the vein walls will very likely occur, especially if the clot is infected or if the patient is in a debilitated condition. It may take on a suppurative form. If it does, it more than likely arises from an infected clot.

4. Embolism. Embolism consists in the plugging up of an artery by means of a floating clot or other material which has become detached and loose in the blood. If the material forming the embolus is not infective, the results are not so serious, but if it is infective, pyemia will likely result.

Symptoms of Thrombosis.—The symptoms of thrombosis depend upon the location of the clot. In case it occurs in a vein, it will be attended by marked edema and dilatation of the veins, together with phlebitis. Blood extravasations are not uncommon. The pain is severe and the part to which the artery is distributed, or from which the vein comes, will lose its function. Thrombosis of one of the cerebral arteries would be attended by paralytic or mental symptoms. If it should occur in the lower limb, paralysis and edema of the member will follow, together with more or less pain. In case the vein is affected the symptoms of phlebitis will supervene.

Treatment.—The treatment depends upon the conditions present. In general, it is directed toward securing resorption of the clot and stimulating collateral circulation. Vigorous manipulation to dislodge the clot is not advisable. Often the clot can be absorbed if the case is seen early. When gangrene results, operation is necessary. In paralysis, the result of thrombosis and embolism, an effort should be made to establish collateral circulation. In this, nature can be assisted. If the part

can be prevented from dying, the integrity of the tissues will be restored in time.

INJURIES TO VEINS.

Injury to veins should be treated in much the same manner as injury to arteries. It demands prompt methods to arrest the hemorrhage, and later, the bleeding points may be ligated. In all cases the proximal and distal ends of the veins should be ligated, as hemorrhage may occur from either end Especially is this true of the external jugular, inasmuch as the valves are imperfect and do not entirely close the vessel. Operations on veins are done with the same precautions as are taken in the ligature of arteries. (See Ligature of Arteries.)

DISEASES AND INJURIES OF THE LYMPHATICS.

Lymphangitis.

There are two forms of lymphangitis, acute and chronic.

Acute Lymphangitis is a rapid invasion of the lymphatics by septic material or the products absorbed from poisoned wounds.

Cause.—The cause is micro-organisms or other toxic material associated with obstruction to the lymph stream.

Pathology.—The wall of the lymphatic is infiltrated and inflamed as in an ordinary acute inflammation. The tissues round about are more or less involved. It is said by some that the lymph within the vessels coagulates and forms a pink clot.

Symptoms.—The symptoms of an acute lymphangitis are fine red lines, edematous swelling and a violent inflammation closely resembling erysipelas. There seems to be two forms, one in which the larger lymphatics are involved, a tubular form, and the other in which the smaller lymphatics are involved. Where the small lymphatics only are involved, it may closely resemble erysipelas. The disease may be attended by chill, vomiting, and sweats. The pulse is rapid and the fever ranges from 102 degrees to 104 degrees F. The diagnosis is sometimes difficult, but it is not so essential. Erysipelas itself is a lymphangitis due to a special micro-organism. It has more of a rose-red color, the skin is more brawny, and the onset of the disease more marked than in acute lymphangitis.

Treatment.—It is essentially that of erysipelas. (See treatment of Erysipelas.)

Chronic Lymphangitis.—A chronic inflammation of the lymphatics resembles a chronic inflammation in any of the connective tissues. It follows the acute form where recovery is not entire, or it happens in cases of syphilis and tuberculosis. There are people who seem to have a tendency to the proliferation of connective tissue elements. In these subjects, chronic lymphangitis often develops. There are enlargements of the lymphatic glands and thickening of the connective tissues generally.

Treatment.—The treatment is the same as the acute form. Remove the obstruction to the lymphatic circulation.

Lymphangiectasis or Lymphangioma.

This is a condition of chronic dilatation of the lymphatic vessels. It is sometimes congenital and other times acquired. It may be localized to small areas or involve a considerable part of a member. Chronic distension of the lymphatics is oftentimes accompanied by overgrowth of the connective tissue elements of the part, leading to chronic hypertrophy, as seen in macroglossia. Distension of the lymphatics may be shown by small vesicles which persist and which are not accompanied by evidences of inflammation. When these vesicles or lymph spaces are opened, there is a considerable flow of fluid (lymphorrhea). They are found most frequently on the inner side of the thigh and the genitalia of the male.

Treatment.—Remove the fascial obstruction to the lymphatic circulation. This will drain the sodden tissues and give relief.

Lymphatic Obstruction.

Lymphatic obstruction may take place in any of the large lymphatics, as the thoracic duct or any of its branches. The obstruction may be due to muscular contraction, contraction of the fascia, abnormal position of the bony structures, and to chronic lymphatic obstruction arising from the deposit of tuberculous material, as occurs in long standing inflammations of the fascia or connective tissues generally. Repeated attacks of eczema may cause enlargement of the lymphatic glands, which operates as an obstruction to the lymphatic circulation and will sometimes finally result in a thickening of a member. This lymphatic obstruction and enlargement of the part is called elephantiasis.

Elephantiasis.

There are two forms of elephantiasis: (1) Elephantiasis Arabum and (2) Pseudo-elephantiasis. It may affect the foot, leg, genitalia, etc., where it is known as elephantiasis pedis, elephantiasis cruris, elephantiasis labium, etc. The phenomena of elephantiasis consist of (1) edema. This edema is lymphatic in origin and solid. The fluid cannot be pressed out of the tissues and the part appears to be permanently thickened. (2) Hyperplasia. Hyperplasia of the connective tissues takes place. The subcutaneous connective tissues become infiltrated and thickened and increased in amount. The skin becomes coarse and warty in appearance and ulcers are common. Where injuries or ulcerations occur in the enlarged part, the lymph will seep out (lymph fistula). This continual discharge of lymph is called lymphorrhea.

Pseudo-elephantiasis arises from tuberculous conditions and ulcers. It is sometimes called Barbados leg. It is a disease of the tropics and need not be discussed here. It affects the leg, scrotum, vulva, face, and breast. The disease may persist for years.

Lymphadenitis or Adenitis of the Lymphatic Glands.

Cause.—Inflammation of the lymphatic glands is produced by the absorption of toxic materials and obstruction to the return circulation. This material is carried back through the lymph channel into the lymphatic glands where tissue changes are produced. This inflammation in the lymphatic glands operates as an obstruction to the flow of lymph. As soon as the source of the irritating products and the obstructions are removed, the swelling and inflammation of the gland disappear. If pyogenic micro-organisms get in, suppuration is very likely to follow. Suppurative adenitis is a slow process and may be prolonged over a considerable period. Some writers look upon the lymphatic glands as filters whereby poisonous products are kept from entering the general circulation. This perhaps accounts for the fact that when a considerable amount of poisonous material finally gets into these glands, suppuration is very apt to occur. Occasionally, acute lymphangitis occurs. In these cases it is believed that muscular injury, irregularities in the circulation, and bony lesions, etc., may be set down as the cause.

Pathology.—The pathology of the disease is simply that of an inflammation in any of the tissues. If suppuration occurs, it is usually localized, rarely diffuse. If it becomes diffuse, it may persist for a considerable length of time.

Symptoms.—The evidences of acute lymphangitis are the symptoms of inflammation, together with the enlargements of the glands. They are extremely painful and hard, and the tissues about are sometimes edematous. As soon as suppuration is evident, the lymphatic gland should be freely opened and drained. Sometimes the suppurative process may extend into the neighboring glands and each one in succession breaks down and ulcerates. The absorption of toxins and disturbance of the digestion and secretions will follow and the patient becomes debilitated, and a chronic abscess results, if the disease is not properly treated at once. Any obstruction to the nerve or blood supply, or the lymph stream, should be relieved at once and any anatomical lesions accounting for the condition, should be corrected. As soon as suppuration is evident, the abscess should be opened and freely drained. Not only should there be free drainage, but the abscess should be frequently dressed, each time being washed with an antiseptic solution. Before suppuration takes place, hot fomentations are valuable. The glands most frequently involved are the axillary, inguinal, and cervical. Where suppuration occurs, they should be treated as acute abscesses. It is worthy of note that the osteopathic treatment, which will be indicated in each individual case, is of the utmost importance. Next to this should be cleanliness, proper diet, and hygiene.

Chronic Lymphadenitis.

Chronic lymphadenitis is a chronic inflammation of the lymphatic glands and may result from acute inflammation or from constitutional conditions, but, in all events, the chief underlying cause is anatomical

derangement. The disease is most common in the neck in scrofulous children. Sometimes the disease can be traced to exciting causes, such as carious teeth, chronically inflamed tonsils, sore mouth, and is said to be produced in some cases by lice. In every case syphilis and tuberculosis should be eliminated. The glands usually enlarge slowly and become infiltrated with round cells, as in chronic inflammation of other tissues. The enlargement is first fleshy in nature and usually not painful. The person may improve in health and the enlargement disappear, or the inflammation may continue for some length of time. The inflammatory reaction becomes apparent, slowly accelerated and may or may not be painful. Finally the gland undergoes caseation, or it may even break down and ulcerate. Other times, the liquid elements of the caseous mass may be absorbed, leaving a hard mass, which finally atrophies and disappears. It is claimed by some that general tuberculosis may be derived from these chronically enlarged glands. The glands, which are at first singly enlarged and movable, often become adhered into a mass. Evidence of suppuration will be shown by the fact that the skin over the gland becomes red and adherent. After a lymphatic gland breaks down and suppurates, it leaves a purplish, foul, undermined, and indolent ulcer. After awhile this may heal. They leave a peculiar, puckered, white scar. After suppuration has occurred and fluctuation is distinctly felt, the abscess cavity should be opened and well drained. If the opening is large enough for the finger to be introduced, all loculi of the cavity should be dug out. A Volkmann's spoon is an excellent instrument with which to scrape out the dead parts of the gland. Strictest asepsis should be maintained to prevent scarring. The scars are peculiar in these cases, in that they retain their pink color much longer than ordinary scars. In treating acute and chronic lymphangitis, painting the glands with belladonna and glycerin, the application of the tincture of iodine, or the oleate of mercury, or other such drugs, is of no value. The treatment should be first directed towards restoring the circulation and relieving the obstruction to the return circulation, not only the lymphatic, but the venous as well. Besides the *cause* must be removed, whether it is carious teeth, anatomical lesions, or a sore. Some surgeons advise a radical treatment for enlarged lymphatic glands, but this is unwise. This treatment is to enucleate the gland as soon as it enlarges. If proper attention is paid to the *cause* of the disease, the treatment will be plain.

Lymphadenoma.

A non-inflammatory enlargement of lymphatic glands may occur sometimes; this is called a condition of lymphadenoma. Two forms are described by various writers, (1) benign or the simple form, which consists in the enlargement of a single lymphatic gland or the lymphatic glands of a small area, viz., the groin, neck, or axilla. The cause of the disease is due to lymphatic obstruction or to errors of the nerve and

blood supply. (2) Malignant lymphadenoma, or Hodgkin's disease, or pseudo-leukemia, is usually met with in adults and consists in an overgrowth of all the lymphoid tissues of the body—spleen, lymphatic glands, and the lymphoid tissues in the bowels. The proportion of white corpuscles is much greater than should be, but not so great as exists in true leukemia. The subject has one white, to fifty or seventy-five red, corpuscles. The disease is said to be incurable.

Lymphosarcoma.

This is a condition of sarcoma of the lymphatic glands. (See Sarcomata.) The disease occurs more often in the tonsil than any place in the body. It grows rapidly and is painless. It seriously affects the health and rapidly becomes fatal. The disease usually occurs in adults. The dissemination of the growth to the viscera results fatally.

Secondary growths of the lymphatic glands and *tubercular enlargements* of the lymphatic glands or *syphilis* of the lymphatic glands, are discussed elsewhere in the text.

DISEASES OF THE SKIN AND ITS APPENDAGES.

Dermatitis.

One of the most common inflammations of the skin is the toxic form, the result of poison sumach. There are three forms of the poison sumach more especially toxic, the poison oak, poison ash, and poison ivy. Contact with the plant is not always necessary to bring on the inflammation. The symptoms are a papillary or vesicular inflammation of the skin. Edema may result. In bad cases there is fever.

Treatment.—Apply sweet spirits of nitre to moisten the surface of the skin. Oxid of zinc ointment containing ten drops of carbolic acid to the ounce of ointment is an excellent application. Extract of witch hazel applied several times daily is of great service many times. A 1:5000 solution of bichloride of mercury will relieve some cases.

Furuncle.

A furuncle, or boil, is a circumscribed inflammation of the true skin and the connective tissues beneath it. The cause of a boil is infection of a hair follicle by the pus germs, generally the staphylococcus pyogenes aurus, sometimes the albus. Conditions making inoculation possible are the same as those operating in other infections. They are common in disorders of digestion, in constipation, diabetes, Bright's disease, and conditions of general debility.

Symptoms.—The symptoms of a boil are too well known to require description. Sometimes boils apparently come in crops or they may be scattered over the body. In such instances the pus is usually expressed by the hand and gets onto the body in other locations and infection occurs.

Treatment.—As soon as pus is evident, the boil may be lanced or allowed to rupture itself. The cavity must be thoroughly cleansed with an antiseptic solution, as peroxid of hydrogen. Where the boils come in crops, scrubbing the skin with soap and water and afterwards thoroughly washing it with an antiseptic solution, or fomentations of a weak solution of bichloride of mercury, or a saturated solution of boracic acid, is of great service.

Carbuncle.

A carbuncle is really a condition similar to a boil, but which is attended by extensive infiltration of the skin in the neighborhood of the pus formation. The cause is the staphylococcus pyogenes aurus, coupled with certain conditions of the body or a devitalized condition locally. It differs from a boil in that the constitutional symptoms are severer and the base is hard, indurated, and boggy. Instead of the pus pointing at one place, several pustules will form with a bloody serum contained in them. It is not unusual that a considerable mass of tissue will necrose, pus forming in below this, will burrow out through it. Where the patient is debilitated and the absorption of pus is very great, general sepsis may follow, when it may result in phlebitis or lymphangitis. The most usual location for carbuncles is the neck, back, and buttock.

Treatment.—The treatment is to relieve local lesions and whatever general ailment the patient may have. The carbuncle should be freely incised and cauterized with pure carbolic acid. It should then be treated as a simple sore by washing with antiseptics and sprinkling with Senn's powder (one-third salicylic acid to two-thirds boric acid). Sometimes a hot saturated solution of boracic acid accomplishes much. This treatment should be kept up until the sloughs are separated. The sore should then be dressed with dry antiseptic gauzes.

Clavus or Corn.

A corn is a thickening of the epidermis, due to inflammation of the skin, brought about by irregular pressure of ill-fitting boots. The treatment is to remove the pressure by the use of plasters and then subsequently to remove the corn by scraping. In old persons the corn should not be cut, but should be soaked in hot water and scraped, care being taken not to injure the skin. In painful feet, the result of corns, direct the patient to soak the feet in hot water and afterwards wrap them in cloths saturated with a mixture of equal parts of linseed oil and lime water. Suitable plasters to remove the pressure from the corn, will relieve the inflammation, when the corn can be removed. The following formula will be found useful in removing corns: Paint the corn each night with a mixture of salicylic acid, one and one-half drams, extract of cannabis indica ten grains, and flexible collodion one dram.

Chilblains.

Chilblains are circumscribed congestions and inflammations of the skin, the result of excessive cold. They are more common in young persons. They consist of localized reddish or bluish-red erythematous areas. They give rise to intolerable itching and burning. In some cases the skin may be a purplish-red and so congested as to cause rupture—broken chilblain.

Treatment.—The application of equal parts of spirits of turpentine and olive oil, or the oxid of zinc ointment, or the tincture of cantharides and soap liniment in the proportion of one to six, will give relief.

Onychia.

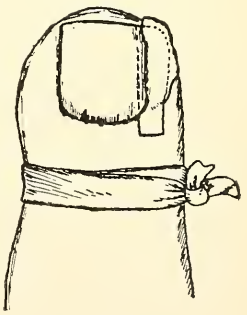
Onychia is an inflammation of the nail and seems to be due always to the infection of the matrix with pyogenic organisms. The inflammation usually starts at the side or base. The common form is perionychia or ungual whitlow. Pus forms beneath the nail and the affection is extremely persistent and painful.

Treatment.—The treatment consists in removing the nail with fine scissors and cleansing the sore thoroughly with antiseptics. The patient is usually run down in health. Strictest antisepsis and care of the nail is necessary. When suppuration is taking place, hot lotions of 1:50 carbolic solution are most comforting. All parts of the diseased nail should be trimmed away with fine scissors and all exuberant granulations touched with lunar caustic.

Ingrowing Nail.

Ingrowing nail is an ulcerative condition of the side of the toe (generally the great toe) produced by the curling up of, and pressure on, the nail, caused by pressure of ill-fitting boots and neglect of the feet. Extensive inflammation and thickening of the tissues alongside of the nail may result, so that the flesh will, in some cases, extend out over half the nail.

FIG. 34.



Method of operation for ingrown toe-nail. Tie a fillet around the toe and excise part of the nail.

Treatment.—The treatment is to take the condition in hand early and prevent pressure by correcting the footwear. Then insert a piece of surgeon's cotton underneath the edge of the nail to prevent the sharp edge from cutting into the flesh, also, the middle of the nail should be scraped thin so as to permit it to bend; also, in trimming the nail, it should be cut straight across and the corners allowed to grow out. These should be turned up. The disease seems to be produced by the nail being thick and the corners having been cut off on the sides. As the nail grows out the flesh is pushed by the boot against the sharp edge of the nail, which causes the inflammation.

Of the various operations for relief of ingrowing toenail, there is but one that gives permanent relief. The redundant tissues on the side of the toe should be cut off and one-fourth of the nail should be removed, care being taken to destroy the matrix so the nail will not return. After the operation the wound should be treated antiseptically and allowed to heal.

Molluscum Contagiosum.

This is an affection which shows itself by small, hemispherical nodules, about the size of a split pea. They are yellowish-white in color and umbilicated. These masses undergo hyaline or waxy degeneration. The depression in the center is usually occupied by dried material. They are common on the face, especially of a child, and may appear upon the breast of the mother. The nature of the affection is unknown. The origin seems to be in a hair follicle.

Treatment.—The treatment is to incise the mass, express out the contents and touch the capsule with a stick of nitrate of silver.

DISEASES AND INJURIES OF NERVES.

Injuries to the nerves consist of:

1. Contusions.
2. Strains.
3. Rupture.
4. Compression.
5. Puncture.
6. Division.

Contusions.

Contusions may be transitory in their effect, but in persons subject to gout, syphilis, rheumatism, or in neurotic individuals, neuritis may result. Simple contusions cause a tingling sensation as of a pin pricking the skin. This may wear off in a few hours. In severe cases there may be complete loss of motion and sensation.

Treatment.—The treatment consists in securing the proper nerve and blood supply to the affected nerve trunk. Massage and friction will be found serviceable.

Strains.

Strains are produced by extraordinary muscular efforts during times of excitement, and the results are similar to contusions. The treatment is likewise similar.

Rupture.

Rupture of a nerve rarely occurs except in connection with fractures where there is considerable laceration of the soft parts, or in connection with dislocations. Entire division of a nerve is very rare. All of the axis cylinders may be ruptured, with the sheath of the nerve still intact. The symptoms of the affection are immediate paralysis of motion and sensation. In case the rupture is complete, the paralysis

of motion and sensation may be permanent, but usually a considerable amount of repair will take place; sometimes it is complete.

Treatment.—The treatment consists in relieving the congestion and securing the proper blood supply to the injured nerve. Where the paralysis exists for some length of time, the part should be thoroughly manipulated to prevent atrophy, until regeneration of the nerve takes place. Even in old standing cases much improvement may be obtained.

Compression.

Compression of the nerve may result in partial or complete loss of function. The pressure may serve as an irritation and cause the inflammation and a neuralgic condition. Pressure may be exercised upon a nerve in the following conditions:

1. Aneurysm.
2. Tumor.
3. Fracture.
4. Callus, where it envelops a nerve some weeks after the fracture.
5. Pressure of a crutch, causing crutch-paralysis.
6. Pressure of a splint.
7. Chronic osteitis.
8. Syphilitic diseases of bones.
9. Displacement of bones.

Displacement of bones consists in partial or complete dislocations. Partial dislocations, the result of injury or muscular contractions, are more frequently the cause of compression than all other agencies. These should be looked for in any given case. When the compression can be readily removed, recovery will be complete. If secondary changes have taken place in the nerve and muscles, the prognosis is not so favorable. Recovery will be slow.

Puncture.

Puncture of a nerve is usually associated with inflammation and followed by neuralgic pains. Sometimes the pain is very intense. Especially is this true in neurotic individuals. The pain will radiate along up the nerve trunk and cause muscular spasms.

Division.

The immediate effects of division of a nerve are:

1. Paralysis of motion, providing the nerve contains motor filaments.

2. Paralysis of sensation in the part to which the nerve is distributed. The area of sensation destroyed becomes smaller through the development of collateral nerve distribution.

3. Vasomotor paralysis will be evident by congestion of the part at first, followed later by the part becoming colder and not sufficiently supplied with blood.

4. The secretions may be arrested because of secretory fibres having been destroyed.

5. Trophic changes may take place in the tissues, as ulcerations, degenerations, etc., because of paralysis of the trophic nerves.

Secondary Effects.—The secondary effects consist in (1) inflammation and (2) degeneration of the nerve trunk and (3) the reparative efforts of nature. Immediately upon division of a nerve, the space between the divided ends becomes filled with blood. After several days this is absorbed. Round-celled infiltration takes place, so that the spaces finally become filled up with granulation tissue. If there is not approximation of the nerve ends, the two stumps become united by means of cicatricial tissue. From the proximal extremity of the nerve, the axis cylinders will grow out through the connective tissue, and some of the fibres will seek out the axis cylinders of the distal end of the nerve, and will grow down through the myelin sheaths. This results in the partial restoration of the nerve-function. It is said that such outgrowing of the nerve trunks may take place through one and a half inches of cicatricial tissue. Sometimes such regeneration does not occur. Even a small scar may result in the complete loss of the nerve-function. In case of amputation of a limb, the divided end of the nerve sometimes develops a tumefaction (amputation neuroma). This consists of a thickening of the connective tissues of the nerve, together with the outgrowth of the axis cylinders of the trunk of the nerve. These axis cylinders coil up and sometimes form a bulbous extremity. These bulbs may be the cause of severe neuralgias, and may necessitate the removal of the end of the nerve trunk. After division of the nerve, in the peripheral extremity, Wallerian degeneration occurs. This is set up about the fourth day. It is said to be caused by a separation of the nerve trunk from its source of nutrition, the nerve cell. The changes which occur are such as are described under "Repair of Nerves." The changes which take place in muscles consist of more or less complete paralysis of motion. This paralysis is later followed by more or less slowly developing atrophy, and finally, the muscle undergoes degeneration. Deformity may result because of the paralysis, atrophy, and degeneration; especially is this true where the opposing muscles are disturbed. Certain electrical changes take place in the muscle. These electrical changes are summed up in the reactions of degeneration. As long as the reactions of degeneration are present, there is hope for recovery of the muscle, providing the nerve can be restored. This is of little practical use inasmuch as the history of the case, together with the anatomical conditions present, will enable the physician to determine the amount of recovery which may be expected. The sensation which has been destroyed as the result of the nerve division, will be more or less restored. The area of anesthesia will be lessened as anastomosis and collateral nerve supply is established. The blood supply to the part is lessened. The part looks bluish and may appear congested. Sometimes the skin has a peculiar, shiny appearance, while at other times it is rough and covered with scales, or even edematous. Wounds heal badly in a paralytic limb. Exposure to heat and cold may cause chilblains or vesication. Slight irritants excite ulceration, and these ulcers persist for a considerable length of time. In paralysis of

the fifth nerve, corneal ulceration is common, whereas in hemiplegia, perforating ulcers arise on the bottom of the foot. The appendages of the skin may become involved, the hair falling out, or the nails become brittle and rough. The sebaceous glands may become functionless or may secrete an over abundance of sebaceous material. Atrophy of some of the smaller bones, as the phalanges, and ankylosis of the terminal joints, may occur in old cases. When the paralysis occurs in young people, the development of the member paralyzed is arrested. Occasionally the division of a nerve is attended by certain changes in the cortical area. This may result in epileptiform seizures or in severe cases of dementia. This is not so common unless a foreign body is in relation with the stump of the nerve. Regeneration of the nerve will take place according to the method described under "Regeneration of Nerve Tissue."

Treatment.—In case of division of a nerve, the treatment is nerve suture. The needle best suited for the purpose is a round one, not having cutting edges. A fine Hagedorn needle may be used. The operation of uniting the nerve ends should be done under the strictest asepsis. The suture, which should be of catgut, must be aseptic and only one or two applied, sufficient to hold the ends of the nerve in position.

Secondary nerve suture has, of late years, given some promise. Even where a considerable cicatrix has formed between the ends of the nerve, it can be removed, the nerve ends approximated, and a good result obtained.

Nerve grafting has been done successfully. It consists in removing a piece of nerve from a lower animal (preferably from the spinal cord), and grafting it in between the divided ends of the nerve. This operation has been done successfully in several instances. It requires the strictest asepsis and a thorough acquaintance with operative technic. After the injury, the parts should be manipulated and massaged in order to encourage the circulation to the injured part and prevent degeneration of the muscles. Ankylosis and contractions of any muscles or ligaments should be prevented. If sepsis has complicated the original wound, the prognosis of the case is rather unfavorable.

Neuritis.

Neuritis, or inflammation of a nerve, is not a common condition, but may occur from subluxations, injury, gout, or rheumatism. It sometimes attends necrosis of bone, carious teeth, etc.

The *symptoms* vary according to whether the inflammation is acute or chronic, and according to the nerve affected. The inflammatory condition may be sufficient to lead to degeneration of the nerve. Usually it results in the formation of fibrous tissue, the slow contraction of which so impinges upon the nerve that persistent neuralgic pains result.

The *causes* are due to injury, gout, rheumatism, and subluxations.

The *treatment* consists in relieving the congestion, improving the circulation to the nerve, and removing the cause. If it is rheumatism,

the rheumatism should be treated; if it is gout, the gout should be treated; or if it is a dislocated bone, the luxation should be reduced.

Neuralgia.

Neuralgia means "nerve pain." The term is applied to persistent pain in a part along the course of a certain nerve. The pain is usually paroxysmal, intermittent, darting, and stabbing in character. It is most common in the trigeminus or fifth nerve. The attacks may last a few minutes, or several days, or even longer. It may be periodical. The pains may extend over a certain part of the nerve, or all of it. Trophic changes will take place in the skin. Sensation and motion may be more or less affected. Frequently the circulation is impaired. It may be brought on apparently by a draft of air. Pressure on certain points may relieve or increase the pain. Muscles frequently become contracted and there may be excessive secretions. Over the area of the distribution of the nerve, an herpetic eruption may break out. Neuralgic pains may occur in any mixed or sensory nerve or in any of the organs, such as the breast, ovary, or testis.

Causes and Treatment.—Osteopathy in this affection does what medicine and surgery have failed to do—accomplishes a cure. The cause of this troublesome affection is pressure on a nerve by contractions of the muscles and connective tissues, but more especially by bony displacements. As for instance, trifacial neuralgia is produced by luxation of the atlas affecting the medulla and sympathetic nerves. Intercostal neuralgia is produced by a luxated rib or contractions of the intercostal muscles which hold the ribs in abnormal position. Operative interference is never warranted in view of the results obtained by osteopathic treatment. These operations consist of nerve section and nerve stretching.

DISEASES AND INJURIES OF BONES AND JOINTS.

Diseases of Bones.

Inflammation of Bone.—Inflammation of bone has for its causes the same agencies which produce inflammation of any other tissue. The reaction to injury in bone is quite similar to the reaction in other tissues. Only the soft tissue of the bone is affected. The inflammation usually begins in the periosteum or endosteum and then extends along the Haversian canals, lymphatics, and blood stream into the bone itself.

The results of inflammation of bone are suppuration, caries, necrosis, and sclerosis, which are similar to the terminations of inflammation in other tissues. When the inflammation occurs chiefly in the periosteum, it is a periostitis; if the chief changes take place within the bone itself, it is an osteitis; or within the medulla of the bone, osteomyelitis. The inflammation may be simple or septic. Simple inflammations attend fractures and bruises of the bone and are reparative in nature and terminate in resolution, whereas the septic variety

very often terminates in destructive changes. The septic variety is brought about by the absorption of micro-organisms. These are carried through the body and finally lodge in the connective tissue spaces of the bone, setting up inflammation.

Periostitis.

Periostitis, or inflammation of the periosteum, occurs in three forms, (1) acute simple periostitis, (2) acute infective periostitis, and (3) chronic periostitis.

Acute Simple Periostitis.

This is usually the result of injury and occurs in the exposed parts of the body. Its pathology is that of simple inflammation. It terminates in resolution.

Treatment.—The treatment consists in rest, elevation of the part, and the application of cold. Manipulation to assist the return circulation and to secure a good, free flow of arterial blood, will be found of great advantage. Pus formation is rare. The disease usually terminates in resolution. Should evidence of suppuration appear, hot boracic acid fomentations should be applied, and as soon as the pus is formed, a free incision should be made and the pus evacuated. Rigid antisepsis should be employed to prevent ulceration of the bone.

Acute Infective Periostitis

Is sometimes called diffuse periostitis. It is of a grave nature and leads to death of a considerable portion of bone, or the disease may terminate fatally in pyemia or septicemia.

Pathology.—The disease usually occurs in young people who are debilitated. It often follows an injury, although the injury may be slight. The most probable causes are constitutional conditions and certain bony lesions affecting the nutrition, which render infection possible. The disease is often the sequel of a continued fever. The exciting cause of the affection is, perhaps, the staphylococci or streptococci which have gained entrance into the system at some point made weak by a deficient nerve and blood supply, the result of subluxations or muscular contractions. The disease begins as a rapidly spreading inflammation, which quickly extends into the bone and reaches the medulla. The pus is formed beneath the periosteum in the cancellous part of the bone, also in the medulla. In some cases the entire shaft of the bone may be destroyed. The epiphysis of the bone escapes injury, as the blood supply to this part is through another source and is perhaps better. There is no direct connection between the blood-vessels which supply the epiphysis and those which supply the diaphysis until after ossification is complete, and for this reason, neither the epiphysis nor the joint become affected. It is possible

for the inflammation to spread to the joint, only through the connection between the capsule of the joint and the periosteum.

Symptoms.—The onset of the disease is usually announced by a chill and an inflammatory fever, which is sometimes attended by delirium. The shafts of the long bones, such as the humerus, femur, and tibia, are more frequently affected. This disease may be overlooked. It begins as a pain, deep-seated, intense, and agonizing. The limb can not be handled, which makes it probable that the periosteum is affected. The soft-parts over the bone become swollen, edematous, and dusky red (indicating a deep-seated inflammation). It can not always be differentiated from an abscess, except by incision. If the joints become involved, the symptoms are more urgent. After suppuration occurs and the pus burrows towards the surface, it will be found, after rupture or opening of the abscess, that a considerable mass of the bone has died. If the joint becomes involved, bony ankylosis will frequently result. As soon as the diagnosis is made, an incision should be made through the periosteum, free drainage established, and the wound washed with corrosive sublimate solution (1:2000). Should this not serve to arrest the process, and if small particles of pus seem to come through the nutrient foramina, an opening should be made, by means of a bone chisel or trephine, into the middle of the bone, where, some surgeons believe, is the primary seat of the trouble. The wound should be washed out twice daily with a 1:2000 corrosive sublimate solution. At least a gallon of antiseptic solution should be thrown into all parts of the abscess each time. The limb should be kept quiet. Liquid nourishment should be given regularly at stated intervals. Should a joint become involved, suppuration occurring, it should be laid open and freely irrigated with some antiseptic solution. If there is evidence of general sepsis intervening, amputation should be considered. An early incision can not be too strongly emphasized, since by this means the shaft of the bone may be saved. Should necrosis of bone occur, the dead bone must be removed as soon as it becomes loose. If the shaft of the bone dies, a short longitudinal incision should be made, the shaft divided and pulled loose from either epiphysis. If this is done early, it will save deformity, suppuration, and sepsis. Furthermore, by applying an extension apparatus, new bone will be formed in place of the old shaft, providing pus has not been present a sufficient length of time to destroy the vitality of the periosteum.

Chronic Periostitis.

It is associated with changes in the connective tissues about the bone. It is usually limited and is almost always due to syphilis, tuberculosis, or rheumatism. When it is caused by trauma, it arises from a long continued irritation, or perhaps from the extension of an ulcer into bone. As in acute periostitis, it may result from continued fevers, such as typhoid.

Pathology.—The pathology is similar to that of acute periostitis, except the tissue changes are not so rapid. Round cell infiltration takes place in the periosteum, extending finally into the bone. The inflammatory material will, with proper treatment, be absorbed or may become ossified, or a condition of fibrosis may occur. In another case it may break down, forming pus, caries resulting. The ossifying variety of the disease forms a hard node of bone. Suppurating chronic periostitis of the long bones is usually due to tuberculosis or typhoid fever, whereas, that occurring in the skull is often the result of syphilis.

Symptoms.—Dull, deep-seated, boring pains, which are worse at night than by day. Upon examination it will be found that the bone is thickened, presenting hard, irregular nodules along its surface. On the head, the tumor is usually soft and fluctuating and looks like a sebaceous cyst, but there is always a history of syphilis.

Treatment.—The treatment is to lay open the soft mass and clean out the abscess. If the case is syphilitic, the general condition should be treated. Where a mass of bone dies, it should be removed. If the inflammation extends into the medullary cavity, the bone should be trephined.

Osteomyelitis.

There are three forms of osteomyelitis, (1) Acute simple osteomyelitis, (2) Acute diffuse osteomyelitis, and (3) Chronic osteomyelitis.

Acute Simple Osteomyelitis is a localized inflammation of the medulla of the bone and is believed to be of traumatic origin. It arises from fractures or from sawing of the bone in an amputation. There may be a localized necrosis, when the sequestrum is small and conical, because of the spread of the inflammation along up the medullary canal.

The *treatment* is to keep the wound aseptic and to remove the sequestrum, if one forms.

Acute Diffuse or Infective Osteomyelitis is a more grave affliction. It is said to be often spontaneous in its origin, while in some cases there may be a distinct history of trauma. It occurs in debilitated and strumous subjects, especially in children.

Cause.—The cause of the disease is the streptococci and the staphylococci, which have gained entrance into the system, because of the lessened resistance of the tissues at some point, or because of the presence of ulcers. It follows, or attends, attacks of acute infectious diseases or suppurating wounds. It sometimes follows abrasions where more or less sepsis complicates the condition.

Pathology.—The disease is grave. It usually begins with a chill, the fever rises rather rapidly, and delirium is common. In children, after wounds, the disease comes on suddenly and at night. Where there is no evidence of injury, the patient may give a history of becoming chilled after being apparently over-heated. Locally, there are vio-

lent aching pains and acute tenderness over the seat of the inflammation. The entire medulla of the bone becomes infiltrated and there is rapid diffusion of the pus germs. The toxins absorbed give symptoms of sapremia, septicemia, or pyemia. It is not unusual that infective osteomyelitis is the gravest of the staphylococci infections. The disease can probably be prevented in many instances, but in others not. The entire diaphysis of the bone may be destroyed and sometimes the neighboring joints are involved. In some cases, only a central mass of bone is destroyed.

Symptoms.—The symptoms are similar to those of periostitis, except that the local signs are not evidenced so soon. The systemic disturbances are usually greater and more sudden, but as soon as the inflammation extends through the bone to the periosteum, the local symptoms are the same, and perhaps the two diseases can not be differentiated. High fever, rigors, and edematous swelling of the limb are present. In cases of fractures or amputation, the periosteum recedes, leaving the dead end of the bone protruding. The granulations about the dead bone are fungating in character.

Treatment.—In osteomyelitis, not the result of wounds, an early free incision seems to be the best treatment. Even before pus is formed, the medulla of the bone should be exposed. In cases, the result of operation or injury, the wound should be thoroughly cleansed with an antiseptic solution. Some operators scrape out the medulla of the bone and follow this curetting process with antiseptic washes. The treatment is similar to that of sapremia or septicemia. Should general sepsis supervene, a high amputation is necessary. When septicemia and pyemia seem to have been established, amputation will be of no use.

Chronic Osteomyelitis can not be differentiated from chronic periostitis. It may end, as other chronic inflammations, in the formation of fibrous tissue in the medullary canal, or it may end in the formation of pus. The disease is believed to be tubercular. The abscess following is called Brodie's abscess. The disease may be the result of syphilis or typhoid fever. The medulla of the bone and the tissues within the Haversian canals, seem to be equally affected. The cancellous part of the bone suffers most. It is difficult to differentiate this disease from osteitis until after the diseased tissues have been exposed by operation.

Osteitis.

Osteitis means inflammation of the bone tissues, but this is said to occur rarely, if ever, without involving the medulla or periosteum, hence it is difficult to differentiate between it, periostitis and osteomyelitis.

Cause.—The cause seems to be the same as in other disease of bone.

Pathology.—The pathology is likewise about the same. There is usually a history of injury, together with lesions affecting the tissues locally, or certain constitutional conditions. The tissue changes

occurring in osteitis, are similar to those occurring in inflammations of other tissues. The Haversian canals and other spaces in the bone become infiltrated with proliferated bone cells. There are certain large bone corpuscles formed which bring about a rarification, or thinning, of the bone. By this process all of the bony spaces are enlarged and by destroying the septa between the spaces, larger spaces are formed. The periosteum will become more or less inflamed and perhaps separated by exudations from the bone itself. When the periosteum becomes separated, the nutrition is cut off to a portion of the bone mass. Death of this mass occurs (necrosis). In some cases, resolution of the inflammation may take place, while in other cases, fibrous tissue and bone formation will result, the bone becoming permanently thickened and hardened (sclerosis). In other cases suppuration may follow and abscess of the bone occur. This abscess of the bone is attended with molecular death or caries. Sometimes caseation may take place in the abscess. It is said that osteitis will sometimes occur in connection with periostitis, as the result of strains or traumatism, or will follow any of the acute infectious diseases. Periostitis, and sometimes osteitis, will occur at the attachment of the patellar tendon to the tubercle on the front of the tibia in football players, causing a football knee.

Osteitis may terminate in destruction and absorption of part of the bone, the process being similar to abscess formation with absorption of pus. This is called "rarefied osteitis."

Symptoms.—Osteitis can not be differentiated from periostitis. The signs vary according to the intensity of the inflammation. Pains are deep-seated and boring, and they are worse at night, and increase on moving about. The œdema is slight, with little redness. If the periosteum is involved, the redness will be considerable. There may be no swelling at first, although subsequently, the limb may become considerably enlarged. The deep-seated character of the pain, the fact that it has continued for a long time, and that pressure relieves the pain, together with the absence of much redness and swelling, indicate osteitis. Pain of a more superficial character, and which is increased upon pressure, would indicate that the periosteum and superficial tissues are affected. In the chronic form of the disease, the diagnosis can not always be made.

Treatment.—The treatment should be directed towards increasing the arterial blood flow, relieving the return circulation, and any general or systemic ailment which may be present. Relief may not be obtained until the bone is laid bare and a piece chiseled out. This will let out the engorged blood and pus. If gout, rheumatism, or tuberculosis exist, special treatment will be required.

Abscess of Bone.

Abscess of bone is always chronic. Acute inflammation of bone causes necrosis rather than abscess formation. After enteric fever, an area of suppuration may slowly form at the end of one of the long

bones. This is said to be due to the action of the typhoid bacilli. It may occur after tuberculosis, the end of the bone being the point of least resistance. The disease is more commonly found in the tibia than any other bone. Often great thickening of the bone covering the abscess occurs. The pus may burrow into the joint, inasmuch as there is no periosteum there to form a shell of bone to act as a barrier. Inasmuch as this abscess of the bone may be the result of any chronic inflammation of the bone, it may be located within the medullary canal, within the bone itself, or beneath the periosteum. The process by which pus is formed in bone, is similar to that occurring in suppuration in the soft tissues. After the central portion of the inflamed area dies, caries of the surrounding bone follows until a distinct abscess cavity is formed. This is lined with a thick, tough, pyogenic membrane. The abscess may be latent in the bone for years. After the abscess cavity forms, it may burrow through the periosteum to the surface and discharge most of its contents. The opening through the outside shell of bone may close up and the abscess remain quiescent for a considerable period of time, and when the system again becomes debilitated, or because of injury or exposure, the abscess takes on renewed activity and pus is again formed. At the second formation of pus it may burrow through a new sinus, making an additional opening.

Symptoms.—The symptoms are somewhat obscure and frequently lead to the diagnosis of chronic rheumatism. The pain is rather a dull ache and is described by the patient as giving a sensation like boring into the bone with a gimlet. The pain is said to be worse at night. Previous to the discharge of pus through the small sinuses leading down to the cavity, the pain will be intense; afterwards the patient may be able to get up and about and suffer no very great inconvenience. As the abscess approaches the surface, there will be edema and other evidences of pus formation. The enlargement of the bone, the redness of the skin, and the character of the pain, will be sufficient to make the diagnosis. It may be impossible to distinguish whether it is a case of osteitis, periostitis, or osteomyelitis, but it does not matter with which of these ailments we have to deal, the treatment is practically the same. Where there is doubt, exposure of the limb to the *x*-rays will indicate the nature of the affection. In a case operated upon by the author in the clinics of the American School of Osteopathy, an abscess in the lower part of the tibia was opened. The history of the case extended over a period of seventeen years. There were two openings leading through the thick, hard shell of bone which surrounded the abscess cavity. The cavity itself was perhaps the size of a walnut. The tibia was several times its natural size. A button of bone was taken out by a trephine and the abscess cavity well curetted out and then packed with gauze and afterwards treated antiseptically. Appropriate osteopathic treatment afterwards, to restore the general health, resulted in complete recovery.

Caries.

Caries in bone is a process similar to ulceration in the soft-parts. It means a limited molecular death of the bone substance. The general tendency is to inflammatory exudates which are prone to suppurate and afterwards, perhaps, to cascate.

Cause.—The cause of the disease is deficient nutrition from abnormal blood supply and obstruction to the return circulation. Syphilis and a general debilitated state of the system are also causes. Conditions of caries usually give a history of an injury and a period of failing health. Like abscess, caries is one of the terminations of chronic inflammations of bone. The process may be tubercular.

Pathology.—The pathological changes taking place are similar to those of abscess formation, except that the condition is more chronic and takes place slowly. The bone and periosteum become infiltrated with granulation-tissue cells, the circulation becomes more or less arrested at a certain point and coagulation necrosis of a small mass results. This mass may break down and form pus, or it may undergo caseation and absorption. Liquefaction necrosis may occur. Sometimes the adjacent trabeculae of bone become absorbed because of the destructive process, and a considerable cavity in the bone results. It is said that the granulation-tissue cells may form distinct masses sometimes. These masses will increase or extend through the soft tissues. This is called *fungating caries*. There are cases where these granulation tissue cells seem to break down and afterwards dry up, or the fluids are absorbed, but the bone has already been destroyed by their action, so that there is no pus formation and little evidence of inflammatory tissue. This is a condition of *dry caries* (caries sicca). Should a considerable mass die so as to form a sequestrum of bone, and afterwards the caries follow, as in other instances, the condition is called *caries necrotica*. In some instances, it is claimed the tubercle bacilli and giant cells have been found in among the granulation tissue. This has led to the claim that all these cases are tubercular. Caries occurs in cancellous bone, and more often in the vertebrae than in any other part of the body, whereas necrosis happens in compact bone and more often in the long bones. The tuberculous variety more frequently undergoes caseation and is attended by a crumbling away of the bone, with but little tendency to repair, and the destructive process is more widespread. There seems to be no method of determining whether or not these cases are tubercular. It matters little, since the treatment is the same in all cases.

Symptoms.—The symptoms are pain, more or less swelling (sometimes not evident), contraction and rigidity of muscles about the inflamed area, redness, and other evidences of inflammation when the process becomes superficial. If pus forms, it will burrow along the direction of least resistance until rupturing. The discharge is a peculiar, foul-smelling material which contains a considerable number of bone

cells. Around the opening of the sinus there is a mass of granulation tissue which is more or less exuberant and puckered. At the point where caries occurs, the bone is found to be friable, rough, and yielding.

Treatment.—The surgical treatment is to enlarge the sinus and cleanse the cavity. If it is possible to reach the carious bone, it should be scraped out and a healthy ulcerating surface produced. Afterwards, antiseptics, as boroglyceride solution, may be applied.

Necrosis.

Necrosis is the death of bone en masse, and with reference to bone, it means the same as gangrene of the soft-parts. Necrosis of bone is rather frequent and is more common, as before mentioned, in compact than in cancellous bone. It more frequently follows acute inflammation. Necrosis is always due to an arrest of the nutrition to a mass of bone, therefore, any inflammatory process which would interfere with the nutrition to compact bone, will result in its death.

Cause.—The cause in all cases is arrest of nutrition, that is, the blood supply is cut off. This may be due to inflammation, injury, tissue-contractions, or luxations. The cause of the inflammation may be injury or constitutional disease, or, perhaps, acute, specific febrile processes. Fracture of bone and injury of the nutrient artery may result in death of the bone, or necrosis. Injury of the main artery to the part, or the main nerve, or vein, or extensive laceration of the soft parts, or phosphorous or mercurial poisoning, may result in death of the bone.

Pathology.—The pathological changes, which occur in the death of bone, consist, for the most part, in depriving the bone of its membrane (periosteum), and in plugging up the blood-vessels which enter the bone through the Haversian canals. If undue inflammation occurs, it will interfere with the nutrition and result in death. In necrosis, from various causes, different parts of the bone will be affected. In simple periostitis, the outer lamellae of the bone are usually affected, whereas, in osteomyelitis, the layers of bone surrounding the medulla are mostly affected. If, in acute osteomyelitis, the entire bone is affected, the whole diaphysis will die. If the necrosis is due to osteitis or simple periostitis, it is very often attended with, and followed by, caries. A piece of dead bone is called a sequestrum. This piece of bone is devoid of periosteum, and is usually white, hard and bloodless. Sometimes, after it has been exposed for a length of time to decomposing discharges, it may turn black. The resonance of dead bone and live bone is different. If the bone has been inflamed, the surface of the sequestrum will be rough and irregular. Usually, the surface next the periosteum is smooth and the margins are ragged and serrated. In inflammations, where caries has occurred, the sequestrum will be porous and friable, but where there is more or less fibrosis, the mass will be found hard and unyielding. After a piece of bone has died it

may, of itself, act as a source of inflammation, as it becomes a foreign body and is therefore irritating. Nature endeavors to get rid of it by an ulcerating process. In some cases, the ulcerating process may continue for some considerable length of time and the mass of bone may be discharged (exfoliation). Often there is caries of the bone around a sequestrum, forming a cavity. After the discharge of a piece of bone or after its removal by surgical methods, the cavity fills up with fibrous tissue, which undergoes ossification. It may happen that, as the mass of bone dies and becomes separated, the periosteum, not being destroyed, forms new bone around the outside of it, so that the sequestrum lies in a mass of pus walled in by bone on all sides. The sequestrum is then said to be invaginated. Sometimes this cavity containing a sequestrum and pus, surrounded by a shell of bone, is called an involucrum. Occasionally, the pus may burrow through this shell of bone and discharge on the surface. The opening of the sinus has a drawn appearance and is called a cloaca.

Diagnosis.—The diagnosis between caries and necrosis can not always be made, nor is it essential. The pus is usually foul smelling, and the appearance of the opening of the sinus is characteristic. A probe may be introduced to the bottom of the sinus and the roughened or loose bone detected. There are cases of necrosis without the formation of pus. These somewhat resemble new growths. This form of the disease can not be diagnosed unless an incision is made. The dead bone exfoliated in carious conditions is soft and crumbles, whereas that derived from conditions of necrosis is thick and hard. The skin over necrosis is more edematous and inflamed. The discharge in caries may be thin and more or less watery, whereas in the case of necrosis, it is thick and purulent. In case of necrosis, there may be great thickening of bone, while in caries, there may not be. In abscess of the bone there likewise may be found great thickening of the bone and a discharge of pus. The diagnosis can be correctly made only by exploratory incision.

Treatment.—The treatment in diseased bone is to extirpate the diseased area when it is possible. In case of necrosis, as soon as the diseased bone is found, it should be removed. The inflammation should be treated as any acute inflammation. In chronic conditions, an operation, uncovering the sequestrum and removing it will be found necessary. The presence of several cloacae and a thickened condition of the bone will be sufficient to warrant a diagnosis of involucrum. A bone chisel or trephine should be brought into use, the abscess cavity opened and the sequestrum removed, and all of the dead or diseased bone scraped out. The abscess cavity may then be cleansed thoroughly and a boroglyceride solution applied once or twice daily. In case the abscess cavity is large, and severe hemorrhage follows the operation, the cavity from which the diseased bone has been removed should be packed with borated gauze. Cleanliness, together with supporting

treatment and a correction of any local lesions, malposition of the limbs, bones, muscles, and contractions of fascia, will effect a cure.

Atrophy of Bone.

Atrophy of bone is often an accompaniment of old age. It results because of pressure or non-use. It may occur about joints, because of disease or non-use, or in the stumps of amputated limbs. This atrophy may be attended by a friable condition of the bone, or the bone may become considerably smaller, rendering it more liable to fracture. Fatty degeneration, more or less, attends atrophy of the bone.

Hypertrophy of Bone.

Hypertrophy, as the term indicates, is an overgrowth of the osseous structures. The general causes of hypertrophy operate. It is the result of an increased blood supply, excessive use, etc. In case of the removal of the radius, the companion bone, the ulna, will become enlarged and hypertrophied. In such cases it depends upon an increased demand upon the bone. The term "hypertrophy" should not be applied to fibroid thickening, the result of inflammation.

Syphilis of Bone.

In tertiary syphilis, certain pathological changes take place in the bones. The nature of these changes are gummatous formations occurring usually in the periosteum. They are nodes of inflammatory thickening or infiltration. These extend into the bone itself. Ofttimes they lead to caries, necrosis, or sclerosis. Ulceration and destruction of bone may occur because of this low-grade inflammation set up, and because of the general condition of malnutrition existing in syphilis.

Tuberculosis of Bone.

Tubercular disease of bone refers to that variety of osteitis set up by the deposit of the tubercle bacillus.

Pathology.—The pathology of the affection is the pathology of the deposit of the tubercle anywhere, except that it occurs in bone. The deposit of the tubercle always takes place at a point in the bone where there is the least blood supply and where the bone is the weakest. It develops after an injury has set up an inflammation. In the largest per cent of the cases, tuberculosis of other organs does not occur. Patients suffering from Pott's disease of the spine, which results in the formation of psoas or lumbar abscess, may live out a long life, after apparently extensive destruction of the tissues. There seems to be no way by which we can determine whether or not a given case is tubercular, therefore the same treatment should be applied in all cases, viz., to increase the general nutrition, relieve any constitutional conditions, support the patient by proper diet, hygiene, and habits, and above all, correct any lesions which may be found, which might be the cause of the ailment by interfering with the circulation and nutrition of parts of the bone.

Mollities Ossium, or Osteomalacia.

Mollities Ossium is a disease in which the earthy salts are absorbed, leaving the bone soft so that it will bend. There may be numerous bones involved. Usually it comes on late in life, and is said to be more frequent in women than in men. It may occur during pregnancy. The medullary structures of the bone increase in size and become more fatty.

Cause.—The cause of the disease is unknown. Some writers maintain that it is produced by the development of lactic acid in the system, but this is only theory. In some cases the medulla of the bone seems to be filled with material much resembling spleen pulp.

Symptoms.—The symptoms of the disease are those of rheumatism. There is a general weakness and obscure pains. This is followed by a sudden fracture or perhaps a bending and distortion of the bones. The long bones become misshapen, as do the pelvis and thorax. The urine is said to contain albumen, phosphates, and lactic acid. Death usually comes on from exhaustion. If it occurs during pregnancy, the patient may die during parturition.

Treatment.—Inasmuch as the cause of the disease is unknown, the treatment is likewise not definite. It is reasonable to suppose, when we consider the many affections in which Osteopathic treatment has been eminently successful, where other methods failed, that in these cases there will be found lesions accounting for the conditions present. Where this is true, the removal of these lesions and the abatement of the symptoms would indicate to the physician that he had found the source of the trouble. At all events, whatever lesions are found, they should be removed with the hope that a specific treatment may be found.

Acromegaly.

In this disease there is general, symmetrical enlargement of the bones and connective tissues of the hands, feet, head, and face. The nasal and inferior maxillary bones are the most affected. Prognathism of the lower jaw and prominence and thickening of the nose and supra-orbital ridges are marked symptoms. The larynx, bones of the shoulder-girdle, ribs, and vertebrae may also become affected. The cause of the disease is obscure. It can, most likely, be attributed to some lesion of the nervous system.

Virchow's Disease, or Leontiasis Ossium.

This disease consists of hypertrophy of the facial and cranial bones. It is symmetrical and usually involves the superior maxillary bone. The hypertrophy is progressive, symmetrical, and causes persistent headaches. Great deformity results. Where the disease has continued for some length of time, the removal of a mass of bone may give some relief.

Tumors of Bone.

The tumors of bone are:

1. Osteomata. 2. Enchondromata. 3 Fibromata. 4. Sarcomata. 5. Carcinomata.

Osteomata.—These tumors are reproductions of true bone. They are circumscribed and diffuse. The diagnosis of the tumor can be made by eliminating the other forms.

The *treatment* consists in removing the tumor by means of a chisel.

Enchondromata.—These are reproductions of cartilage in connection with bone. They occur more frequently in the bones of the fingers or at the end of the long bones. They are multiple and often congenital. Sometimes, in developing within a bone, they expand it into a thin shell, maybe rupturing it. They are thought to arise from periosteum. They may grow in any direction in the bone, or out towards the surface. They rarely ossify, but calcification or mucoid softening may occur.

Diagnosis.—They may be diagnosed by great hardness and their even attachment to the bone, slow growth, and no glandular enlargements attending.

Fibromata.—These sometimes occur in connection with the bones at the base of the skull or lower jaw. They are said to constitute the nasal polypi and epulis, and rise from the periosteum of the bones of the naso-pharynx.

The *treatment* is to remove the tumor.

Sarcomata.—Sarcomata of bone are common. They are of the myeloid variety, occasionally the round and mix-celled. They are derived from the deeper layers of the periosteum and may surround the bone or extend to the bony tissues.

Symptoms.—The symptoms of sarcoma are the symptoms of a sarcoma anywhere on the body. They grow slowly and occasion considerable pain, but do not affect the lymphatic glands. Some forms of sarcomata may grow rapidly. The pain may not be severe, or it may be absent. The tumor occurs more frequently in young people and is attended by great loss of weight and strength. In some cases the tumor is pulsating and there is considerable redness and edema of the soft-parts. If possible, the tumor should be removed. Some forms of the tumor are very malignant.

Carcinomata.—Cancer of bone never occurs primarily. It may spread to the bone from any of the organs or from any of the surfaces of the body. Amputation seems to be the only relief.

INJURIES OF BONES.

Fractures—A fracture is a broken bone, or a sudden and forcible solution of the continuity of bone.

Causes.—A. Predisposing.

1. Age.
2. Sex.
3. Occupation.
4. Certain diseased conditions.

Age.—Fractures are more common after the age of forty-five, because of the fragile condition of the bones, and less common in small children on account of the elasticity of the bones and because the subject is less liable to injury. Fractures increase in frequency from six years upward, being more frequent in very old people.

Sex.—The male sex is more liable to fracture, because of greater exposure to violence and injury.

Occupation.—Laborers, because of the greater risks they are compelled to take in life, are more liable to fractures.

Certain diseased conditions, which render fractures more likely, may be enumerated as follows: Atrophy, either senile or from pressure or disuse; rickets; fatty degeneration; fragilitas ossium; osteomalacia; nervous disorders; tuberculosis and syphilis; caries and necrosis; malignant growths, and in fact, any condition which impairs the strength of the bone renders it more liable to fracture.

B. Exciting causes.

1. External violence.
   a. Direct.
   b. Indirect.
2. Internal violence.

Direct Violence.—By direct violence we mean violence applied to the spot where the fracture occurs. It is evident that in cases of this kind there will be more or less contusion of the soft-parts at the site of fracture. The fragments are more liable to be comminuted and the injury to the soft-parts is likely to be greater in fractures from direct than from indirect violence.

Indirect Violence.—Fractures from indirect violence take place where the force is transmitted through the axis of the bone or through other structures, as for instance, intra-capsular fracture of the femur takes place in twisting the leg from catching the toe; fracture of the clavicle may occur from falling on the hand; fractures of certain vertebrae or the base of the skull may be produced by falls upon the buttocks; fractures on the back part of the skull may take place because of injury upon the front of the skull (fractures by *contre coup*).

Internal Violence.—Internal violence consists of muscular action. Fractures from muscular action may take place in the long bones in diseased conditions, as in the case of spastic paralysis. Under ordinary circumstances, they are more common in the patella.

Varieties of Fracture.

All fractures are divided into simple and compound, depending upon whether there is an open wound leading to the site of fracture.

1. **Simple Fracture** is one in which air is not admitted to the site of fracture.

2. **Compound Fracture** is one in which air is admitted to the site of fracture or the wound leads to the surface. A flesh-wound attending a

fracture does not necessarily mean that the fracture is compound. The wound may not lead to the site of fracture.

All fractures may also be divided into complete and incomplete.

3. **Complete Fracture** is one in which the bone is separated into two or more fragments.

4. **Incomplete Fracture** is one in which the bone is not separated into fragments, but is only partially fractured. The most common form of incomplete fracture is green-stick fracture, where the bone is partially bent and partially broken.

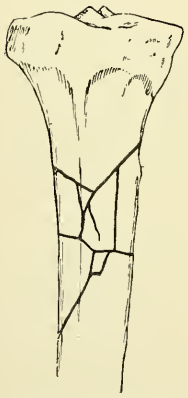
Other forms of fracture may be described as:—

5. **Multiple Fracture,** a condition where there is a fracture at more than one point in the bone.

6. **Comminuted Fracture,** where the bone is fractured at two points and these lines of fracture unite.

7. **Impacted Fracture,** a condition where one fragment telescopes the other, or the ends of the bones are driven into each other.

FIG. 35.



Comminuted fracture of upper extremity of tibia.

FIG. 36.

An impacted fracture of the upper extremity of the femur.

FIG 37.

Transverse fracture of the tibia.

8. **Fissured Fracture,** a condition where the bone is simply fissured, not entirely broken off, and there is no displacement. This variety occurs most frequently in flat bones.

9. **Depressed Fracture** occurs in bones of the skull most frequently. One edge of the broken bone is driven below its opposing edge.

10. **Punctured Fracture** is one which is produced by a pointed instrument without displacement of the fragments.

11. **Splintered Fracture** is a condition where the ends of the bones are splintered and separated into numerous fragments.

Other forms, described according to the line of fracture, may be:

12. **Transverse**, where the line of fracture is transverse to the long axis of the bone.

13. **Oblique**, where the line of fracture extends obliquely to the shaft of the bone.

14. **Longitudinal**, where the line of fracture extends lengthwise in the bone.

15. **Spiral**, where the line of fracture extends spirally around the bone.

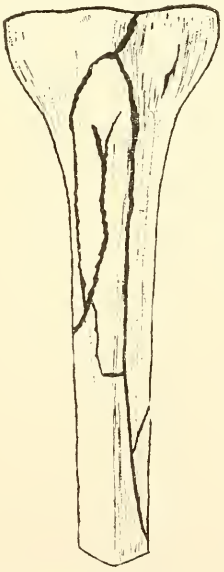
16. **Y or T Fractures** are those occurring at the end of bones, as in the lower end of the humerus or femur, the line of fracture resembling the letter Y or T.

17. **Stellate Fracture** is one occurring in the skull where several lines of fracture radiate from a single point.

FIG. 38.

Example of oblique fracture of the tibia.

FIG. 39.

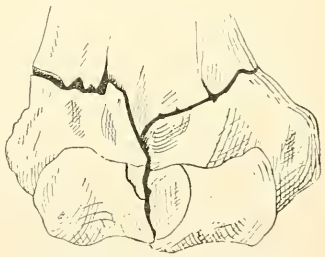


Longitudinal fracture of the tibia.

18. **Epiphyseal Fracture** is one extending through the epiphyseal cartilage which unites the epiphysis and diaphysis. It consists in the separation of the epiphysis from the diaphysis.

19. **Complicated Fracture** is one which is associated with extensive injury to the soft-parts, or is attended by rupture of the main artery of the part, or by concomitant dislocation or other severe injury which interferes with treatment and union of the fracture.

FIG. 40.



Y fracture of the lower extremity of the humerus.

20. **Ununited Fracture** is one in which union has not taken place within a reasonable length of time after the injury.

Signs of Fracture.—The signs of fracture are, in general, those of local injury and may be enumerated as:

1. Pain.
2. Swelling.
3. Deformity.
4. Impaired function.
5. Preternatural mobility.
6. Crepitus.
7. Shortening.
8. Sensation of sudden snap.
9. History of the accident.

The **pain** of a fracture is not diagnostic. It may be severe, or slight. Sometimes it is so severe as to cause great shock; especially is this true where a large nerve, such as the sciatic, is pressed upon by the jagged end of the bone.

The **swelling** may be slight, or it may be severe, depending largely upon the amount of injury to the soft-parts, and the amount of effusion of blood amongst the tissues.

The **deformity** varies. It may be simply an enormous swelling or it may be angular, such as to indicate at a glance that there is a broken bone. Deformity, crepitus, shortening, and other signs will depend largely upon the displacement of the fragments. The displacement of the fragments depends upon three things, viz.:

1. Continuation of the fracturing force.
2. Muscular action.
3. Weight of the limb.

Sometimes, because of these agencies acting, the deformity will depend upon the amount of the swelling, the degree and nature of the displacement of the fragments.

Impairment of the Function will depend largely upon the nature of the fracture. Sometimes the function will be only slightly impaired, at other times the function may be entirely lost.

Preternatural Mobility means mobility at a point where there should be none. The mobility may sometimes be increased and at other times diminished. In case of fracture of the shaft of a bone, there is mobility at an abnormal location. In case of fracture at the end of a bone, the mobility may be decreased. Preternatural mobility may be absent in fissured fractures, in incomplete or green-stick fractures, or in impacted fractures. When it can be obtained, preternatural mobility is proof positive of fracture.

Crepitus is the sensation imparted to the surgeon's hands by the scraping together of the roughened ends of the broken bone. This scraping together of the ends of the bone may be sufficient that a grating sound can be heard, but the crepitus refers to the sensation which is obtained by touch. There are two kinds of crepitus, false and true. *False crepitus* is obtained at joints where there are roughened tendon-sheaths or articular cartilages, or where fibrous adhesions have been formed between the ends of the bones, so that motion of the joint causes grating. In some cases this so closely resembles crepitus as to make the sign of but little value. True crepitus is of great importance. It is sufficient evidence upon which to base the diagnosis where there is proof that it came from the bone, and not from other structures.

Shortening varies according to the fracture and according to the condition of the member. It is produced by muscular contraction, the muscles normally being slightly contracted, and when the bone is

broken the ends are pulled past each other. Sometimes the weight of the member, with no other agencies acting, may overcome this muscular contraction, when the shortening may not be so great.

Sensation of Sudden Snap and History of the Accident.—A history of the accident, and the fact that the patient felt a cracking of the bone, may be of some value. Subjective symptoms are often of not much value.

Diagnosis of Fracture.—The diagnosis of fracture is made by weighing the symptoms and evidences obtained. Sometimes the fracture will be extremely difficult to make out. The diagnosis may be clouded under the following circumstances:

1. When the fracture occurs in the neighborhood of a joint.
2. When there is much fluid effusion and extravasation of blood and serum about the site of fracture, so as to render it impossible to make suitable examination.
3. In conditions where there is no displacement of the bones, or where the fragments are held together by a companion bone.
4. Subperiosteal fractures or fissured fractures of the skull.

The signs of fracture may be so meager and difficult to obtain that a diagnosis is impossible. Where it is possible, in doubtful cases, the injured member should be exposed to the x-rays. The diagnosis can be made by successfully obtaining the various signs of fracture. Crepitus can be obtained by making extension and counter-extension where the fracture occurs in a long bone, thus bringing the ends of the bone in apposition. Crepitus may be gotten by grasping the limb above the site of fracture and rotating the limb below. Sometimes effort at muscular action by the patient will develop crepitus. Where crepitus can not be obtained without the use of force, other signs must be looked for. Shortening is an important sign in many fractures and is obtained by measuring, after placing the body in a normal position. Measurements should be taken from fixed points. In case of fracture of the humerus, the shortening is determined by measuring from the acromion process to the external condyle. Preternatural mobility is one of the most important of the signs and is obtained, in some instances, by grasping the limb above and below the fracture, and an effort at motion will determine whether there is mobility at a point where there should be none.

How Fractures Heal.—As a rule, a broken bone heals, under favorable circumstances, much better than any other tissue. The way in which union takes place is of the greatest importance, and should be thoroughly understood in order to appreciate the importance of the methods of treatment. As soon as the fracture occurs, extravasation of blood takes place in the soft parts and between the ends of the broken bones. This extravasation may be great or it may be small. Sometimes it is so great as to form a complication of the fracture, but under average circumstances the hemorrhage into the site of fracture will cease when

the pressure becomes equal to that within the blood-vessels. The tissue changes and inflammation which follow will be sufficient only to repair the injury in case of simple fracture. In case of compound fracture, the inflammation will likely be greater because of the introduction of a certain amount of septic material. The periosteum, Haversian canals, medulla of the bone, and soft tissues about, all become infiltrated with leukocytes and round cells. These new cells are derived from the endothelial cells in the Haversian canals, from the endosteum (membrane lining the medullary cavity) and periosteum. The blood which has extravasated between the ends of the bones, becomes absorbed within four or five days in ordinary fractures. In case of green-stick fracture, perhaps earlier, while if there is extensive injury to the soft parts, the absorption might not be completed before the sixth or eighth day. In young persons the reaction of the tissues to injury is quicker and greater than in old people, so that the absorption takes place more quickly. The formation of granulation tissues at the site of fracture takes place just as soon as the clot is sufficiently absorbed. When the diffused blood disappears, its place is occupied by granulation-tissue cells which comprise the soft callus. The formation of this soft callus begins, in children, as early as the third or fourth day; in very old people as late as the tenth or twelfth day, but ordinarily it begins by the fifth or sixth day, so that the fracture should be *set* before that time. This soft callus becomes penetrated by delicate capillary loops which are derived from the vessels in the Haversian canals and periosteum. The soft callus which fills up the spaces between the ends of the bones is the permanent or definitive callus. Within the medullary cavity the endosteal callus is formed, whereas on the outside of the bone and derived from the periosteum is formed the periosteal, or ensheathing callus. This new tissue becomes firm and hard and highly organized until it is converted into a fibrous or cartilagenous mass. Over the ensheathing callus new periosteum forms because of a growing out of the periosteum from either side of the fracture. All this has occurred, under average circumstances, by the fourteenth day after the fracture. At this time ossification of the callus begins, usually at the point where the ensheathing callus meets the periosteum. The ossifying process extends over either edge of the ensheathing callus until it meets in the middle line and also extends down in through the definitive callus into the endosteal callus. Ossification in the definitive callus begins at the edges next to the healthy bone, while ossification of the endosteal callus starts where it is in contact with the endosteum and takes place in the same manner as ossification from the periosteal callus. When ossification is complete, the endosteal and periosteal callus become absorbed and disappear, leaving the permanent callus sufficiently strong to maintain the integrity of the bone. The new callus is vascular in the beginning, but becomes solid by the process of ossification. The large vascular spaces are filled up by layers of bone successively

built in. In cases where the fragments overlap, the space is filled up by the ensheathing callus, and under such circumstances the ensheathing callus will not be absorbed. When the fragments are in good apposition and kept at rest, all the ensheathing and endosteal callus will disappear. Where there is much motion, or not good apposition, none of the ensheathing callus may be absorbed and a large knot will always remain as an evidence of fracture. It is the rule in children, for a considerable amount of ensheathing callus to be developed because of the energy of the tissues.

Treatment.—The indications in the treatment of fractures are:

1. Reduction.
2. Maintaining apposition.
3. Restoration of function.
4. Attention to the general health.

Reduction of fracture consists in bringing the ends of the bones in apposition in as nearly normal position as possible.

Temporary Methods.—When a fracture is first seen, the member should be put in the best position possible to prevent injury. Effort at reduction should not be made until the proper materials for splints and bandages are at hand. In case of a fractured femur, the limb may be tied to the opposite one, or it may be bound to an umbrella or stick, so that further manipulation of the member will not injure the soft-parts. Where the patient is already in bed, sand-bags or pillows may be propped about the limb. Before efforts at reduction are made, the clothing, shoes, etc., should be cut off and the limb exposed, so that a careful examination can be made to determine the nature of the fracture and amount of displacement. The conditions preventing reduction are:

1. Swelling. The swelling may be such as to interfere with the setting of the fracture or the application of the proper dressings. Under such circumstances anti-inflammatory measures, such as cold and rest, should be employed for the first twenty-four or thirty-six hours, the part having been kept immovable during this time. When the swelling has sufficiently subsided, efforts at reduction may be made.

2. Contraction of muscles may be such as to interfere with the reduction. When this occurs, a pulley and weight should be secured, so when reduction is once made, the fragments may be kept in position by means of extension and counter-extension.

3. Interposition of fascia, muscle, tendon, etc. The interposition of some of the soft structures, as a piece of periosteum, tendon, muscle, etc., may prevent the surgeon from securing apposition of the fragments. It is necessary to get rid of this interposing tissue or union will not take place.

4. Impaction of fragments will also prevent reduction; in fact, in cases of impacted fracture, reduction should not be made. The fractured bones should be allowed to heal in that position. Before efforts are made at reduction of a fracture, a suitable splint, such as the surgeon believes to be the best for the condition at hand, should be selected,

and all materials prepared before a reduction of the fracture is attempted. The nature of the dressing will depend largely upon the choice of the surgeon, inasmuch as there are many suitable dressings that are known and tried, and if properly applied will bring about good results.

Methods of Reduction of Fracture.—The reduction is usually accomplished by extension and counter-extension. This overcomes muscular contraction, when the pressure of the soft-parts will push the ends of the bone in the proper position. This is not always true. In case of fracture of the upper extremity of the femur, extension and counter-extension will not bring about relaxation of the contractured muscles. In this case the psoas and iliacus muscles tip the lower end of the upper fragment forward and prevent the operator from securing the desired apposition of the fragments. In such cases it is necessary to partially flex the thigh upon the abdomen. In case of fracture of the lower extremity of the femur, contraction of the muscles of the calf turns the lower fragment backward, preventing apposition, and no amount of extension and counter-extension will secure apposition. Here, by flexing the leg at the knee, the limb may be properly manipulated and apposition secured. In general, to secure reduction, extension and counter-extension, rotation and flexion, and manipulation should be made to mould the parts in position, and when once the bones are gotten in good apposition, every effort should be made to maintain them in such position.

Position of the Limb.—The limb must be put in such position as to secure the greatest muscular relaxation and greatest ease to the patient. Opposing muscles rarely act with equal force and it is necessary to determine the muscles which are contracted. The limb must be placed in such position as to secure relaxation of the contracted muscles.

Position of the Fragments.—When the fragments are impacted, they should be allowed to remain in this condition. The reasons are, that because of the injury to the ends of the fragments, one being driven into the other, the effort at union will not be sufficient and therefore a bad result may be obtained; whereas, if the impaction is allowed to remain, good union may be obtained, but there may be some deformity. It is better to have the slight deformity attending an impacted fracture than lose the use of the member, which might occur providing the impaction is broken up.

Maintaining Apposition.—In the treatment of fracture it is necessary to maintain apposition in order that nature may, by the reparative process, heal the injury. This apposition must be maintained at all times until union is complete, when the apparatus used for the purpose may be dispensed with. To maintain the fragments in apposition, it is necessary to use splints, bandages, strappings, etc., such means as are known to be reliable. These splints, bandages, and strappings vary according to the location of the fracture and its nature.

Rules for Applying Splints.— Rules for applying splints may be best considered under the following heads:

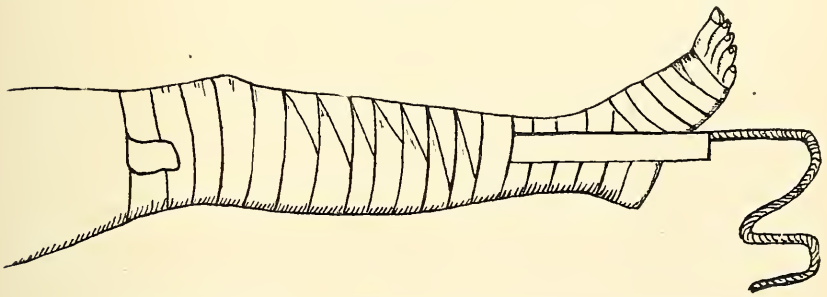
1. The splint must be well padded. The padding is best made by means of aseptic lamb's-wool, borated lint, or surgeon's cotton. The splint should be thoroughly padded to give the member a nice, soft, easy bed in which to rest.

2. The splint should not press upon bony points. This should be observed for fear a pressure-sore might result. Also unequal pressure would result in displacing the fragments.

3. The bandage must not be applied too tightly, so that constriction of the limb will take place. It may be possible, in the application of the bandage, that it will so obstruct the return circulation that gangrene will result, or it may so interfere with the nutrition of the limb as to cause non-union.

4. Splints, in general, must render immovable the joints above and below the fracture. Inasmuch as the muscles which move the member

FIG. 41.



Extension apparatus applied, suitable for fractures of the femur. It consists of a long strip of adhesive plaster extending up on either side of the leg. The adhesive plaster is held in place by a roller bandage.

have their origins from above the joint, and their insertion is frequently beyond the joint below, it is necessary to render both immovable in order to secure immobility of the fragments.

5. The splint must not cover the wound, in case of compound fracture. This is necessary, inasmuch as the wound must be treated. In case of severe simple fracture, the site of fracture should be left exposed in order to observe any changes which may take place.

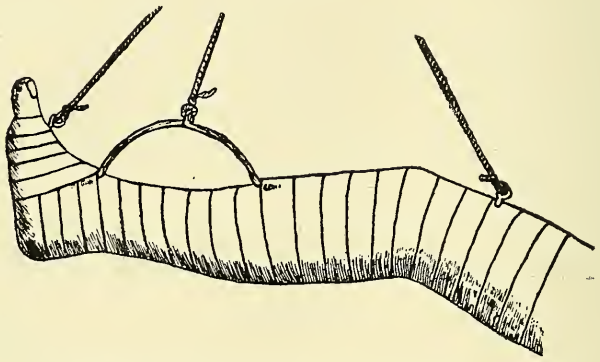
6. The patient must be seen within twenty-four hours after applying the first dressing. This is necessary, inasmuch as the swelling which follows fracture, may be such as to operate as an obstruction to the return circulation. The bandage may become too tight.

7. Should the circulation not be disturbed and the fragments held in apposition, the dressing should be left alone. This rule should be followed conscientiously. It is not necessary to look at the site of fracture every day, but it is necessary to see that the dressings accomplish the desired purpose.

8. Where the splints will not maintain apposition, an extension

apparatus must be applied to overcome muscular contraction. This is preferably done by a weight and pulley, the extension being made on the lower fragment. On the lower extremity in strong men, the weight should be five to ten pounds; in persons less strong the weight should be less.

FIG. 42.

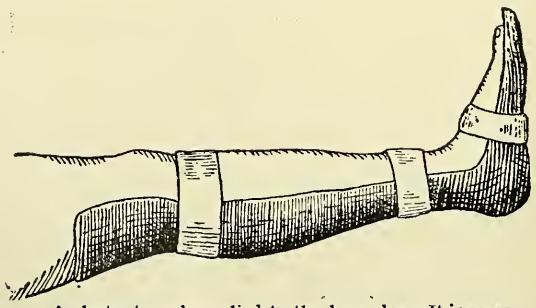


A plaster cast which encloses a rod by which the member may be suspended.

Dressings.—There are many forms of dressings. Some surgeons prefer one kind and some another. Some have secured better results with one kind of dressing and, perhaps, are more adept at applying that dressing. Dr. A. T. Still prefers a starch-paste dressing made with starch-paste, pasteboard, and a many-tailed bandage.

Other forms of dressing consist of splints made of thin board, pasteboard, gutta percha, or a plaster-of-Paris dressing. At pres-

FIG. 43.



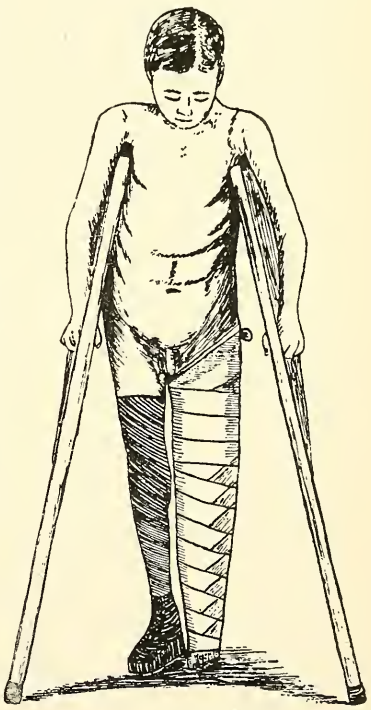
A plaster trough applied to the lower leg. It is an excellent dressing for fractures of the tibia or fibula.

ent the plaster-of-Paris dressing is the most popular. It has many advantages, viz., great strength and durability. A plaster-of-Paris dressing is often applied at once, in case of fracture, where there is not much injury to the soft parts, or much swelling, or where the case is in a hospital and can be watched

by an intelligent attendant. In private practice this is not best, inasmuch as it may obstruct the return circulation. It is best to put on a temporary dressing until the swelling reaches its maximum intensity, when the gypsum splint may be applied.

Restoration of Function.—Restoration of function is accomplished, in the greater part, by manipulation. This manipulation assists the return circulation, prevents adhesion among the soft-parts and maintains the integrity of the joint. This manipulation should be begun at the end of the second week in almost all cases. Some fractures in old people may form exceptions to the rule. The former method of treating fracture by not manipulating them until after four or five weeks has been found to be bad, inasmuch as by manipulation you can assist the circulation and secure union in many cases where otherwise non-union would occur. Where the fracture is in the neighborhood of a joint, or involves the joint, just as soon as the inflammation and swelling disappear, which will be in four or five days, manipulation to assist the return circulation, to prevent the formation of adhesions, will be found of the greatest advantage. This manipulation should be gentle and not vigorous and destructive, but should be regularly kept up. The manipulation consists in pronating and supinating, extending and counter-extending, rotating and circumducting the member, and in loosening up the soft-parts in the neighborhood of the fracture in a mild way.

FIG. 44.



The ambulatory method of treating fractures of the leg.

Attention to the General Health.—This can best be subserved by placing the person upon a suitable bed. In general, the bed should be smooth. Where there is a tendency to bed-sores, a water-bed or air-cushion should be provided, while the skin should be treated with lotions of alcohol and an ointment of benzoated oxid of zinc. If available, a fracture bed may be supplied. The patient should be placed upon a suitable diet, consisting of substantial food which will sustain the strength. The bowels should be kept acting daily. Old people should not be kept in bed too long, as edema of the lung is liable to arise.

Time Within Which a Fracture Should Heal.—Complete union

takes place in fractures, in the average case, in from four to six weeks. In a child, good union may take place within three weeks, whereas, in an old person, it may be considerably longer. If union has not taken place in eight weeks, it may be considered a condition of delayed union, but delayed union is liable to occur under many circumstances.

Ununited Fracture.—An ununited fracture is a condition in which, within a reasonable time, the fractured ends of the bones are not united with sufficiently strong callus to enable the restoration of the function of the member. There are various conditions of ununited fracture, which may be classified as follows:

1. Delayed Union. This is a condition where, because of debility or disease, or because of the treatment, the union is delayed beyond the time when it should have taken place.

2. Fibrous Union. Fibrous union is a condition which may occur, even under favorable circumstances, as in fractures of the patella, intracapsular fractures of the neck of the femur in old people, or fractures of the anatomical neck of the humerus, where the parts of the bone at the site of fracture are poorly supplied with blood. It occurs at other locations, where the parts are not kept strictly immovable.

3. False Joint (Pseudo-arthrosis). A condition of false joint occurs where the fracture has not been kept immovable, and the ends of the bones become worn off; a thin covering of cartilage forms, and a capsule is developed.

4. No Effort at Union Whatever. There are conditions of malnutrition, where there is no effort at union whatever. The causes of nonunion or ununited fracture are local and general. The *local* causes may be enumerated in this manner:

(a) Failure to maintain immobility, which may be because of improper dressings, or because the patient did not properly follow the instructions of the physician.

(b) Failure to secure apposition, not from the bungling work of the operator, but from (1) muscular contractions which will cause overlapping of the fragments; (2) interposition of muscle, tendon, fascia, periosteum, etc.; (3) the loss of a piece of bone. Where there is comminution, a piece of the bone may be destroyed. This loose piece of bone may act as a foreign body, preventing apposition.

(c) Defective nutrition to the injured bone may be brought about by the following conditions: (1) injury to the nutrient artery of the bone: (2) injury to the main artery of the limb; (3) defective nerve influence, because of injury or rupture of the main nerve to the limb, or because of injury to the spine, so that the trophic and vasomotor impulses to the injured area are either interfered with or destroyed; (4) poor blood supply to the site of fracture. This occurs in case of fracture through the ends of the bone, as in the upper extremity of the humerus or femur. (5) Necrosis of a fragment of bone may occur,

where it has been detached from the soft tissues and from the shaft of the bone, its source of nutrition being thereby cut off.

The *general* causes of non-union are the following: Old age, general debility, malnutrition, or sudden alteration of the patient's habits. If the patient has been addicted to the use of stimulants, the sudden withdrawal of them, may markedly interfere with the nutrition. General diseases, as Bright's disease, diabetes, syphilis, gout, tuberculosis, rickets, and scurvy, certain forms of paralysis, such as tabes dorsalis, or paralysis agitans, will interfere with the general nutrition of the body to that extent that there will be little or no effort at union.

Disunited Fracture.—A disunited fracture is a condition where the fracture has once healed and, because of acute fevers or some general disease, the callus is absorbed, and the fracture left ununited.

Treatment of Delayed Union.—The treatment of delayed union should be taken up methodically. The first thing to determine is the cause, and this should be corrected. In general, the following procedure should be strictly adhered to:

1. Reapply and fix a dressing, correct in every detail, which will maintain the fragments in apposition and immovable. The general health should then be corrected. If there are any local or spinal lesions, or any condition which would interfere with the nutrition to a certain area, these conditions must be relieved. At this same time, thorough manipulation of the soft-parts, and of the member should be kept up, to secure a good blood supply to the site of the fracture. If this fails, the following should be tried:

2. Friction of the fragments should be made under anesthesia. When the muscles are thoroughly relaxed, the two fragments should be grasped and raked together vigorously and thoroughly, in order to excite the reparative process. Then a fixed dressing should be applied and the parts kept in apposition, until the fracture has had an opportunity to heal. In the meantime, any constitutional defect should be corrected. Any lesion interfering with the circulation, general nutrition, or the secretion of any organs, such as the kidneys, liver, etc., should be treated and removed. If this method fails, the following should be tried:

3. Operative Procedure. The operative procedure, to unite an old fracture, consists in drilling through the ends of the fragments with a bone drill, and fastening the fragments together by means of aseptic ivory pegs or steel nails, or the ends of the bones may be wired together. Where the bones are subcutaneous, as in the case of the tibia, instead of friction, the bone drill may be introduced through the skin, and a hole bored through the ends of the fractured bone to excite inflammation and union. Senn's bone-ferrules may be used. These are serviceable in the treatment of non-union, especially in case of the humerus or femur.

Vicious Union.—Vicious union is a condition which sometimes occurs in improperly adjusted fractures, or where the condition has

had bad treatment. An enormous amount of callus will be thrown out, which will involve a nerve or a companion bone and interfere with the use of the member.

Complications of Fractures.—Fractures may be complicated by the following conditions, which must receive appropriate treatment:

1. General conditions, such as shock, delirium, retention of urine, etc., brought about by the effects of the injury upon the general system.

2. Infection. Infections, such as erysipelas, tetanus, sepsis, etc., may complicate fracture and interfere with union. Sepsis is rare, except in compound fractures, but erysipelas and tetanus may occur in simple fractures. These infections will likely bring about non-union and death, unless they are successfully combated.

3. Dislocations. When a concomitant dislocation occurs, the healing of the fracture may be markedly interfered with, inasmuch as it will be more difficult to secure apposition of the fragments and maintain immobility.

4. Injury to Other Structures. Injury to a joint, main artery to the limb, or the nutrient artery to the bone, or to the nerve to the part, may form a serious complication and prevent union, or, in some cases, even demand amputation. Extensive extravasation of blood may form a serious complication in the healing of a fracture.

5. Fat Embolism. Fat embolism may occur in case of fracture of the long bones. This fat embolism is serious, but may be recovered from. The fat gets into the deep veins, and, after passing through the heart, will not circulate through the capillaries of the lung, causing obstruction in the branches of the pulmonary artery.

6. Gangrene from tight bandage. Dr. A. T. Still advises the use of his dressing, because the nutrition to the part below is not interfered with, and the tightness of the bandage can be readily regulated. A fixed dressing, as of plaster-of-Paris, may bring about gangrene of the extremity, if it interferes with the return circulation.

7. Bed-sores and Pressure-sores. Unless guarded against, bed-sores and pressure-sores may form such a serious complication of the fracture, as to interfere with the general health of the patient and bring about non-union. The attendant should be cautioned to watch for any indication of such sore.

8. Hypostatic pneumonia is a serious complication, in case of old people, and should be avoided, if possible. If an old person is kept in bed too long, the circulation being weak, the fluids settle in the lower and back part of the lung, hypostatic pneumonia resulting. When once set up, it is fatal.

9. Paralysis may occur under at least two conditions. Crutch paralysis, because of the pressure of the crutch, or the nerve may become involved in the callus, where the nerve is in relation with the bone, as the musculo-spiral in the upper arm.

10. Suppuration may occur, where the circulation is cut off, or arrested to a certain portion of the tissues at the site of fracture, or

it may occur because of infection. This will interfere with the formation of the callus.

The combating of these conditions of fracture can best be accomplished by a strict watch of the case and by relieving the conditions, as they arise, by approved methods. An old person should be propped up in bed, pressure should be kept from pressure-sores, and the bandage must be properly applied. If an injury to the other structures, such as the artery, nerve, or extravasation of blood, it may demand amputation. Suppuration can be prevented by aseptic treatment. Infections may be prevented, and if they arise, should at once be combated by appropriate methods. Shock, delirium, and the retention of urine, should be relieved by proper manipulation. If the shock is from loss of blood, the patient's health should be restored by appropriate treatment.

Epiphyseal Fracture.—Forcible removal of the epiphysis from the diaphysis, consists of a fracture through the film of cartilage which unites them. Obviously this fracture occurs before the age of twenty or twenty-one. The signs of the fracture are not so pronounced as those of ordinary fracture. Crepitus is moist, and being so near the joint, it may be difficult to obtain. Inasmuch as the bone grows long from the epiphyseal cartilage, permanent shortening will result, because of this injury. It is easy enough to get union, but the patient should be made to understand that deformity will result. The treatment is the same as in other kinds of fractures.

Compound Fracture.

Compound fractures are those which are attended by a wound of the soft parts which lead to the site of fracture.

How Produced.—1. By the fracturing force. The fracturing force may, in addition to breaking the bone, destroy the soft-parts down to the site of the fracture. This wound, produced by the fracturing force, may be incised, contused, lacerated, or punctured, as the case may be, therefore a bullet might produce a compound fracture, being made compound by the fracturing agent.

2. Muscular action of the patient. Sometimes in the effort of the patient to move about or perform some physical act, the sharp end of one of the fragments may be forced through the skin.

3. Later, fractures may become compound by sloughing of the soft-parts down to the site of fracture. This is unusual.

Dangers in Compound Fractures.—(1) Hemorrhage, (2) shock, and (3) sepsis.

Hemorrhage may be arrested by ligation of the ends of the artery or by proper dressing. The shock may be relieved by appropriate means. Sepsis may be guarded against by means of cleanliness.

Union in Compound Fracture.—Union in compound fracture, takes place in the same manner as in simple fracture, but is longer delayed,

and accompanied by the formation of more callus. This callus sometimes involves the soft parts to a considerable extent.

The *treatment of compound fracture* consists in the following:

1. The wound should be rendered aseptic. All foreign bodies should be removed, loose fragments of bone, if detached, should be removed.

2. The fracture should be set and the wound dressed with suitable antiseptic dressings. Splints should be applied which must maintain immobility and at the same time allow the wound to be free from pressure, and so it can be readily exposed.

3. The wound should be treated, from day to day, in an antiseptic manner, to prevent sepsis and other complications.

Indications for Amputation.—One of the most troublesome questions arising from compound fractures, or even from a bad simple fracture, is whether or not the member can be saved. The older surgeons held that the following conditions demanded amputation:

1. Extensive injury to the soft-parts.
2. Where there is great comminution of bone.
3. Where there is involvement of a large joint.
4. Rupture of the main artery of the limb.
5. Old Age. In case the patient is very old, and his strength believed not sufficient to heal the fracture, the member might be amputated with advantage. The procedure adopted by the surgeon, in any case, will be that which, in his judgment, is best. Where he is doubt about what should be done, a consultation should be held. The patient should be apprised of the condition, and under no circumstances should amputation be performed without the consent of the patient or his next friend. If the patient is unconscious, it is the duty of the physician to do that which he believes best. With modern aseptic and antiseptic methods, wounds of the soft parts should be rendered aseptic and, if the circulation to the part below is not too seriously interfered with, gangrene may be avoided. Should the case be doubtful, it should be put in suitable dressing and closely watched. Should evidence of gangrene appear, amputation must be performed at once. Every attempt must be made to save the member, but the patient's life must not be sacrificed in so doing.

SPECIAL FRACTURES.

Fractures of the Nasal Bones.

Fracture of the nasal bone is produced by direct violence. The injury is severe. The line of fracture is usually transverse, but may be longitudinal and comminuted, also may be complicated by emphysema of the tissues. The fracture may extend into the cribriform plate of the ethmoid. The diagnosis is readily made by evidences of severe injury and crepitus. There is often considerable deformity. Union takes place quickly, and is, as a rule, good.

Treatment.—The bones may be manipulated into position with the fingers externally, or by covered probe or director internally. If the

bones will not remain in position of themselves, a tampon, made by wrapping a section of a linen catheter with gauze, may be introduced. This will assist in holding the fragments in position until the soft callus is formed, which will be in five or six days. Should the treatment not be successful in maintaining the bones in proper position, a Mason's pin may be used. Should the fracture be compound, the wound must be treated as an ordinary wound by antiseptic methods.

Fracture of the Lachrymal Bone.

Fractures of the lachrymal bones are produced by direct violence and attended by severe injury of the soft-parts. The chief trouble is, that the fracture may result in obstruction of the nasal duct, and in treatment, this should be looked after.

Fracture of the Superior Maxillary Bone.

The superior maxilla is rarely fractured. The break is the result of direct violence. The diagnosis is readily made by mobility and crepitus. Deformity, the result of this fracture, is usually very great and is exaggerated upon the production of callus. The fracture through the alveolar process will result in inability to chew. This fracture may be produced in extracting teeth. Fracture of the nasal process may interfere with the nasal duct. If the antrum is fractured, emphysema of the soft-parts may occur, or it may result in considerable depression in the cheek. The infra-orbital nerve may be involved, frequently causing great pain. To manipulate the bone into position, put a finger of one hand in the mouth and apply the other hand externally, when the fragments may be approximated. Where the malar bone is driven into the antrum, the antrum should be opened and the bone lifted out. Loose teeth should be extracted. If the fracture is compound, the wound should be kept aseptic. The mouth should be frequently washed to keep it clean and the patient supported by liquid diet. Where the teeth are irregular and out of line, they should be put in regular position and held together by thongs.

Fracture of the Malar Bone.

The malar bone is rarely fractured. Where fracture occurs it is the result of direct violence. If the bones are in abnormal position, they should be put immediately in correct position. If chewing exaggerates the deformity the fragments should be wired. Fractures of the zygomatic arch may be similarly treated.

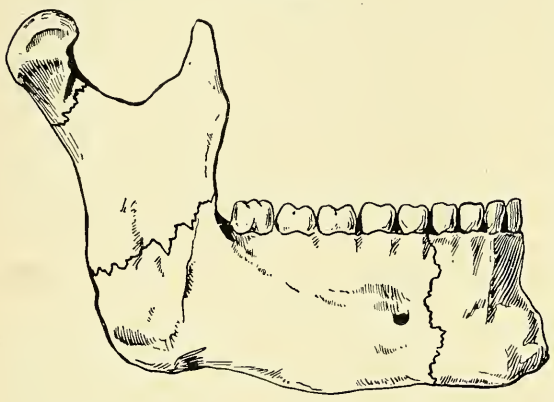
Fractures of the Inferior Maxillary Bone.

Fracture of the lower jaw usually occurs at, or near, the symphysis, but may occur anywhere on the body or ramus. The coronoid process may be broken off or the line of fracture may extend through the neck.

The fracture is very liable to be compound in the mouth. The fracture may be bilateral. The cause of the fracture is usually direct violence.

Diagnosis.—Laceration of the gums, blood-stained saliva, and the irregular line of the teeth, together with pain and crepitus, will be sufficient upon which to base the diagnosis. Where the fracture is through the neck or the coronoid process, the signs are more obscure. When the fracture occurs far back, the anterior fragment is pulled down, while the posterior fragment is pulled up and may override the anterior. This is caused by the opposing action of the supra-hyoid muscles and the muscles of mastication.

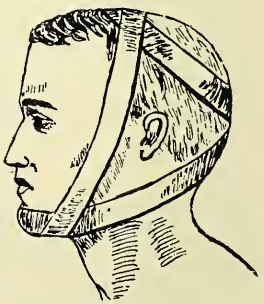
FIG. 45.



Illustrating the locations of fractures of the inferior maxilla.

Treatment.—A splint of gutta-percha, leather or perforated tin is made to fit over the chin. A Barton's bandage is then applied which holds the jaws together. The patient should be instructed to avoid talking and chewing. The diet should be liquid and should be passed between the teeth or the gap beyond the last molar. Where the fracture is compound within the mouth, suppuration may occur. It is necessary to exercise the strictest cleanliness; after taking food, the mouth should be rinsed with an antiseptic lotion—a saturated solution of boric acid or Listerine. Union will take place in four or five weeks. Where there is much displacement and the patient is unruly, the fragments may be held in apposition by means of thongs passed between the teeth. Where this method fails, wiring of the fragments may be advised. Where the suppurative process is active, the site of fracture should be cleansed and maintained aseptic until the inflammation subsides, when apposition of the fragments can be secured.

FIG. 46.



Barton's bandage applied in fracture of the inferior maxilla.

Fracture of the Hyoid Bone.

Fracture of the hyoid bone is rare and is produced by compression of the throat. The fragments are pulled apart by the supra—and infra-

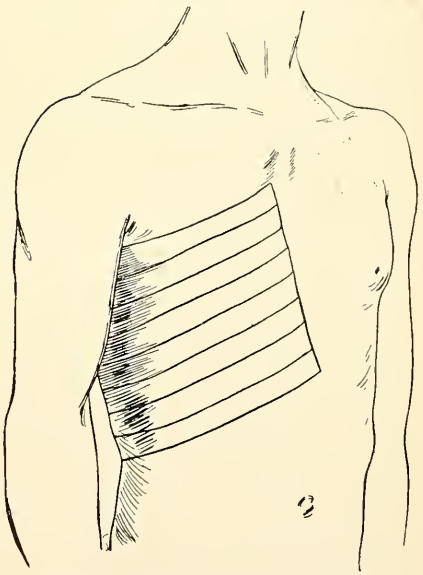
hyoid muscles. The bones may be manipulated into position, and the neck strapped with adhesive plaster to keep the bones in apposition, while the person should avoid talking or using the throat as much as possible.

Fracture of the Ribs.

Fractures of the ribs are fairly common. They arise in two different ways, by direct violence, as a blow upon them, or by compression of the chest. The fifth to the eighth ribs are those usually injured. There may be contusion and laceration of the viscera, caused by driving the sharp end of the fractured bone into the underlying structures. The fracture may be compound from within.

Signs.—The signs are evident. There is localized pain, which is stabbing in character, and is increased on effort at breathing or coughing. If there is much displacement of the fragments, there will be considerable local extravasation of blood and swelling. Crepitus may be obtained. Emphysema of the tissues is an indication of perforation of the lung. If the patient is fleshy, the diagnosis may be difficult. Emphysema of the tissues over the thorax without external wound, is evidence of fracture.

FIG. 47.



Method strapping side with adhesive plaster in fracture of the ribs.

Treatment.—The treatment of fractured ribs is to strap the side with adhesive plaster. The strips of plaster should be two inches wide and extend from the spine to the middle of the sternum, around the portion of the rib broken. The ribs above and below should be immobilized, so that several strips, each overlapping the other, are necessary. The strips must be applied at the end of a forced expiration. A figure-of-8 bandage may then be applied over the plaster. When the lower ribs are broken, tight bandages around the chest are, as a rule, contra-indicated; troublesome hiccough may result. Union takes place within two or three weeks. The mobility between the ends of the floating ribs is so great that only fibrous union is obtained.

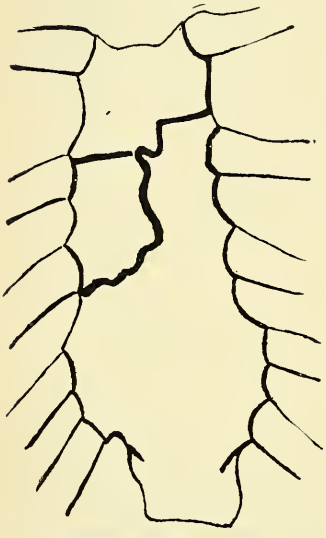
Fracture of the Costal Cartilages.

The costal cartilages are liable to fracture. The treatment is the same as in fracture of the ribs.

Fracture of the Sternum.

Fracture of the sternum is produced by direct violence. The line of fracture is usually transverse. The fragments generally remain in situ. Where there is displacement of the fragments, great dyspnea may result.

FIG. 48.



Fracture of the sternum.

Treatment.—The patient should be kept in bed with a small pillow between the shoulders and the chest strapped, as in case of fracture of the ribs.

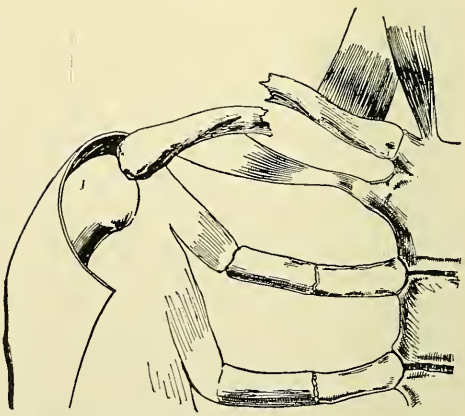
Fractures of the Clavicle.

The clavicle is one of the most frequently fractured bones. The only other bone so often fractured is the radius. The clavicle is broken by direct and indirect violence, by blows directly upon the clavicle, and by falls upon the shoulder or arm. The injury is common in children and the fracture may be green-stick. The bone may be broken in three different locations, at the sternal extremity (least often), in the middle third (most often) and in the outer third.

Sternal End.—This fracture is rare, usually transverse, and the displacement slight.

Middle One-third.—This is the common site for fractures of this bone. The line of fracture is usually oblique. The deformity is characteristic, the shoulder falls downward and inward, due to the weight of the arm and the action of the chest muscles. The outer extremity of the inner fragment projects prominently against the skin and appears to be drawn up, but is not. It is held in position by the sterno-mastoid muscle, and by the rhomboid ligament. The falling of the shoulder stretches the skin over the sharp outer end of the inner fragment. The head is inclined to the affected side and the arm is useless. There is a history of a fall.

FIG. 49.



Fracture of the clavicle, showing how deformity takes place.

Outer One-third.—This fracture is produced by direct violence, falls upon the shoulder, or a blow upon the acromion. The deformity is not great, the clavicle being held in relation with the scapula by means of the coraco-clavicular ligament.

Signs of Fracture of the Clavicle.—The deformity is characteristic. Pain, crepitus, deformity, evidences of injury, and history of accident.

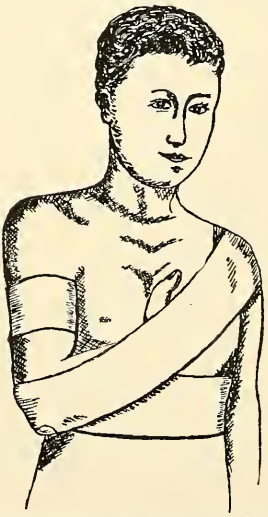
Treatment.—Fracture of the clavicle is best treated by one of the following methods:

1. A posterior figure-of-8 bandage serves the purpose of drawing the shoulders backward, and a sling will sustain the weight of the arm. Sufficient padding should be put in the axilla so as to prevent the arm from falling against the chest. Velpeau's bandage, as far as appearance is concerned, makes an excellent dressing, but it is believed that it exaggerates the deformity.

FIG. 50.

Sayre's Dressing. Method of applying the first strip of adhesive plaster, which extends around the body.

FIG. 51.



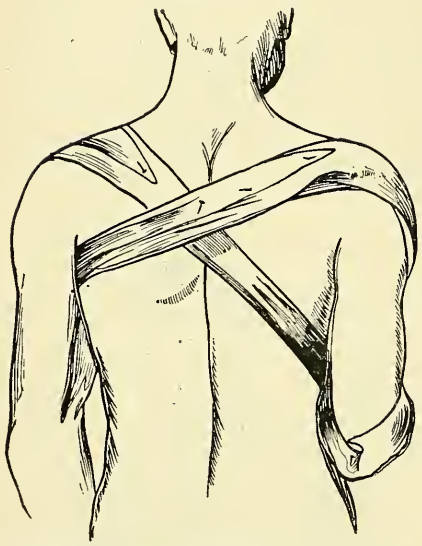
Sayre's Dressing. Method of applying the second strip of adhesive plaster, which extends over the shoulder and under the elbow.

2. Sayre's dressing is very successful, especially in children, as it serves the purpose of holding the arm immovable. Two strips of adhesive plaster, two to four inches wide, are necessary. A suitable pad should be placed in the axilla. A strip of adhesive plaster of sufficient length is fastened around the arm at the insertion of the deltoid. It is then carried entirely around the body, and fastened on the back. Another strip is started on the scapula of the sound side, passed across the back, down the back of the arm, over the elbow, and up over the shoulder of the sound side. Where the plaster passes over the elbow a slit should be made to prevent pressure on the olecranon. This second plaster

should be drawn sufficiently tight to raise up the arm. The hand should be placed across the chest on the shoulder of the sound side, so that the plaster extends along up the forearm and over the hand. In children this serves the purpose of maintaining immobility of the entire arm.

3. Moore's dressing consists of a figure-of-8 bandage around the elbow, and over the arm and shoulder, to the shoulder of the opposite side.

FIG. 52.



Moore's dressing for fracture of the clavicle. The arm is carried in a sling.

4. Where even the slightest deformity is undesirable, the patient should lie on a smooth bed, with a small pad between the scapulae, for at least three weeks. A small sand-bag can be placed over the shoulder and the arm may be strapped to the side, the patient being cautioned to avoid all unnecessary motion. A considerable callus is the rule in these fractures. When the fracture is properly attended to, a good result can be obtained. In fractures where there is violent injury, the outer fragment may be driven downward until it perforates the apex of the lung. Emphysema of the tissues will follow and complicate the condition.

Fractures of the Scapula.

The scapula may be fractured in the following locations:

1. Acromion process.
2. Coracoid process.
3. Body.
4. Neck
5. Glenoid cavity.

The *acromion process* may be broken by direct violence. The arm and hand are helpless and there is evidence of local injury. The bone is subcutaneous, and if seen early, there will be no difficulty in making out the condition. *Treatment.*—It may be strapped in position and the arm carried in a sling.

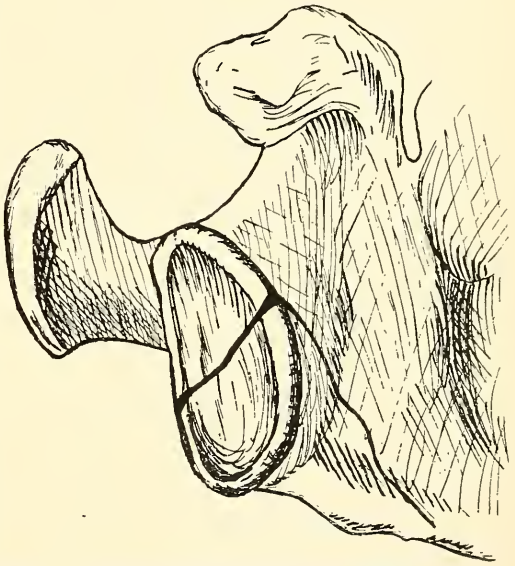
The *coracoid process* is rarely broken and then only from direct violence. There is little displacement. The arm should be raised and put in a sling and the fragment of bone drawn up as far as possible.

The *body* of the scapula is rarely broken and then only from direct violence. The fracture may be longitudinal or transverse. It is a result of injury to the spine of the scapula. The diagnosis can be made

by obtaining crepitus and preternatural mobility. The fragments may be held together by strapping and by supporting the arm.

Fracture of the *neck* of the scapula is produced by great violence to the shoulder. It may occur in two locations, through the neck, or through the suprascapular notch back of the coracoid process. The deformity resulting resembles a dislocation of the humerus downward. These conditions are readily differentiated, since when the shoulder is pushed up, as the arm is lifted, crepitus is obtained. On allowing the arm to hang by the side, the deformity returns. The arm should be bandaged to the side and kept immovable.

FIG. 53.



Fracture through the glenoid cavity of the scapula.

Fracture of the *glenoid cavity* is extremely rare. The prognosis of the injury is good. It should be treated as a fracture of the neck of the scapula.

Fractures of the Humerus.

These are divided into:—

1. Fractures of the upper extremity.
2. Fractures of the shaft.
3. Fractures of the lower extremity.

Fractures of the upper extremity are:—

A. Fractures of the anatomical neck (Intracapsular).
B. Fractures of the surgical neck (Extracapsular).
C. Fracture of the greater tuberosity.
D. Fracture of the epiphysis.

Fractures of the anatomical neck are:—

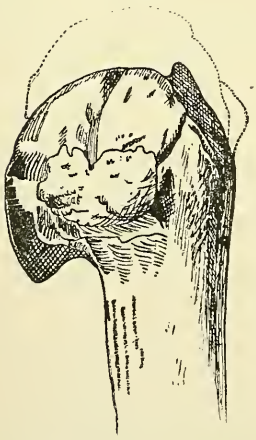
a. Non-impacted.
b Impacted.

A **non-impacted** fracture of the anatomical neck is extremely rare, but is more frequent than the impacted form. The line of fracture is partly within and partly without the capsule of the joint. The signs of the fracture are obscure, and consist of pain, swelling, loss of function, deformity (loss of rotundity of shoulder), crepitus, and absence

of the signs of dislocation and other injury. The fracture occurs in old people. The prognosis is not very good, inasmuch as only fibrous union may be obtained; furthermore, the upper fragment may become turned in its position so that the fractured ends of the bone can not be brought into position. Perhaps this can only be made out by an x-ray examination. Should such a condition occur, an operation will be necessary to remove the upper fragment. Where there is not much displacement of the fragments, and the patient has good general health, the prognosis is fairly good.

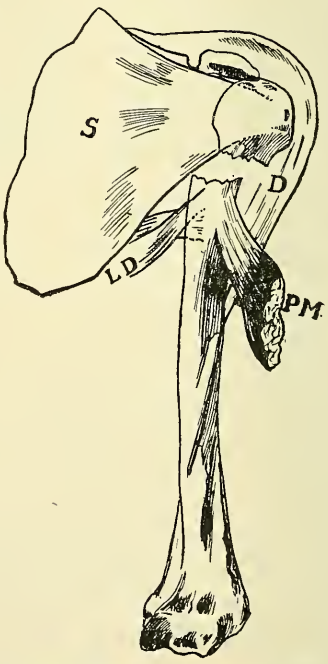
In **impacted** fracture of the neck of the humerus, the head is driven into the lower fragment. The cause is from direct violence. The signs are even more obscure than in the non-impacted variety of fracture. There is shortening, which is determined by measuring from the acromion process to the external condyle, and a slight prominence of the acromion process. There is loss

FIG. 54.



Impacted fracture of the anatomical neck of the humerus.

FIG. 55.



Fracture of the surgical neck of the humerus. S, scapula; D, deltoid; P. M., pectoralis major; L. D., latissimus dorsi.

of rotundity of the shoulder, and later the head of the bone can not be felt in an abnormal position, and there is no crepitus. There is absence of the signs of dislocation. The signs of this fracture are chiefly negative.

Treatment.—A shoulder-cap, extending down as far as the insertion of the deltoid, should be made of a starch-paste dressing, leather, or gutta-percha. The axilla should be well padded and the shoulder enveloped in cotton, and a figure-of-8 bandage applied from the fingers up, to prevent edema. Obstruction to the circulation is produced by

the callus compressing the deep veins in the axilla. Manipulation of the soft-parts should be begun early, within ten days, and kept up regularly, in order to prevent a stiff joint.

Fracture of the Surgical Neck.—This fracture may be impacted or non-impacted, but the impacted form is extremely rare, and when it occurs, the lower fragment is driven into the upper one. The non-impacted form, which is the most common, is caused by direct violence.

Displacement.—The upper fragment is rotated out by the muscles which are attached to the greater tuberosity, while the deltoid, biceps, and triceps, together with the pectoral muscles, draw the lower fragment upward and forward, so that the roughened end of the lower fragment makes a prominence against the anterior fold of the axilla. The arm is helpless and is supported by the hand of the opposite side.

Signs.—There is marked pain, swelling, and some shortening. The roughened upper end of the lower fragment makes a prominence against the anterior fold of the axilla. Preternatural mobility is very evident as the operator grasps the head of the humerus. The arm may be rotated while the upper fragment remains stationary. There is increased mobility upon manipulation by the surgeon, also loss of function. Upon extension of the arm and approximation of the fragments, crepitus is obtained.

Union.—In fracture of the surgical neck, union is bony, and the result good. The only complication arising may be paralysis of the deltoid, because of the involvement of the circumflex nerve in the callus. Where fracture is not attended by other injury, a good result can be assured.

Treatment.—The treatment consists in reducing the fracture by extension and counter-extension. A firm pad should then be placed in the axilla. A shoulder-cap, covering the outer, anterior, and posterior surfaces of the shoulder and upper arm, extending down below the insertion of the deltoid, should be applied. Previous to the application of the shoulder-cap, a moderate film of surgeon's cotton may be placed over the shoulder. A figure-of-8 bandage should be applied from the hand up and carried entirely over the shoulder. The arm is put in a sling, and in a muscular person a one or two pound weight is hung on the elbow to overcome muscular contraction. This is unnecessary in weak people.

Fracture of the Greater Tuberosity is rare, and is the result of direct violence. There is evidence of great local injury; sometimes the bone may be split.

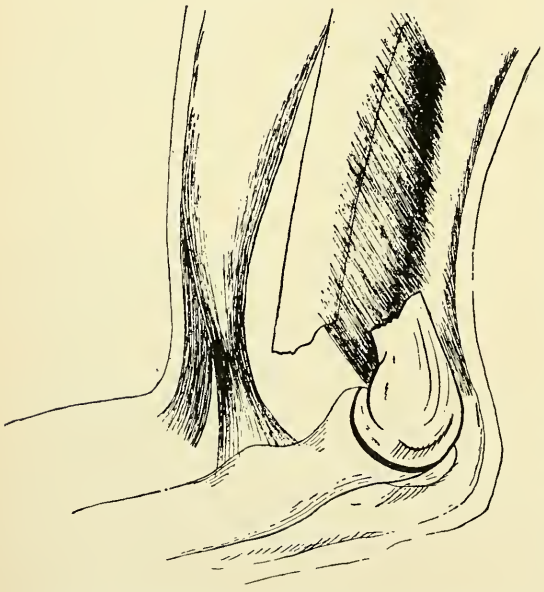
Treatment.—The treatment must be modified according to the requirements of the condition. If the tuberosity is drawn away from the bone, it should be brought back and held there by adhesive strips. The arm should be bandaged from the hand up and carried in a sling.

Epiphyseal Fracture of the upper extremity of the humerus is rare. It happens before the age of twenty and resembles a fracture of the sur-

gical neck. The upper fragment carries with it the greater tuberosity. The *signs* of the fracture are the same as the signs of fracture of the surgical neck, with the exception that crepitus is moist, and the projection made against the anterior fold of the axilla is from a smooth, rather than a roughened, end of the bone. The *treatment* is the same as treatment of the surgical neck.

Fractures of the Shaft.—The shaft of the humerus is broken by direct violence, while, in some rare cases, it may be by indirect violence. In case of softening of the bone, muscular contraction has been said to produce the fracture. The displacement of the fragments will depend upon the location of the fracture. Where the line of fracture is above the insertion of the deltoid, the upper fragment is rotated outward by means of the muscles attached to the greater tuberosity, while the deltoid, biceps, and triceps, pull the lower fragment upward and lift it outward. The upper fragment is drawn inward towards the chest by the muscles attached to the bicipital ridges. Where the fracture occurs below the insertion of the deltoid, the upper fragment is drawn outward and forward by the action of the pectoralis major and deltoid, and shortening is produced by the biceps and triceps.

FIG. 56.



Oblique fracture of the lower extremity of the shaft of the humerus, showing the displacement of the fragments.

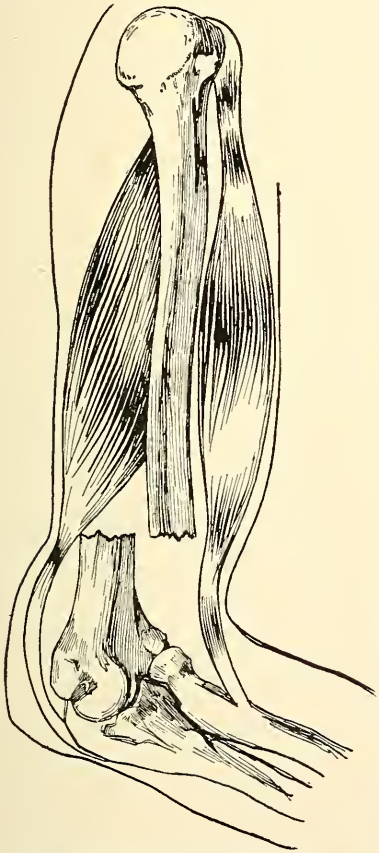
Signs.—The signs of the fracture are very evident and may be enumerated as pain, swelling, preternatural mobility, crepitus, deformity, and loss of function.

Union.—Good union may be obtained in treatment of fracture of the shaft of the humerus, but it must be borne in mind that non-union more often happens in this fracture than in any other. The chief reason seems to be that the fragments are not maintained immovable and in apposition. Complications may arise which consist of paralysis of the extensor muscles because of the involvement of the musculospiral nerve in the callus.

Treatment.—The treatment of fracture of the shaft of the humerus is simple, but whatever method is used, it should be attended to thoroughly. The splints used are the following:

1. A posterior trough, which is perhaps the best splint to use, is made of perforated metal, or of pasteboard and starch-paste, and extends from the shoulder to the hand. It should be well padded, so as to make a nice bed for the arm.

FIG. 57.



Transverse fracture of the humerus, showing little displacement of the fragments.

2. An internal angular splint, which should extend from the shoulder to beyond the wrist, so as to immobilize the hand. This may be reinforced by three simple splints, one on the front of the arm, one on the outer side, and one on the posterior surface. These should extend from the axilla to the elbow. The arm should be well enveloped in cotton and the splints, which are made of heavy pasteboard or thin boards, are then applied. A figure-of-8 bandage should be applied from the hand entirely over the arm and enveloping the shoulder. The splint should maintain extension and counter-extension. The dressing devised by Dr. A. T. Still is the most suitable dressing after the preparation has dried. Extension and counter-extension may be made after twenty-four hours and the bandage readjusted.

3. A plaster-of-Paris dressing is advocated by some physicians, but it is not satisfactory.

Fractures of the Lower Extremity of the humerus consist of the following:

A. Transverse.
B. T- or Y-shaped.
C. Internal condyle.
D. External condyle.
E. Epiphyseal.

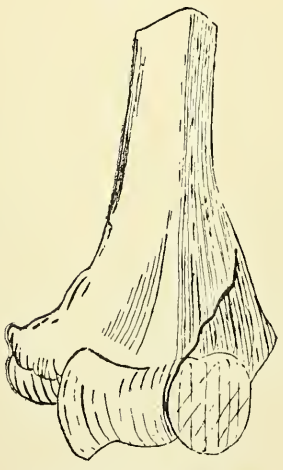
A **transverse fracture** of the lower extremity of the humerus may occur in two locations, one above the condyle, and the other below. Transverse fracture below the condyles, taking off a portion of the lower epiphysis, is an extremely rare condition. Transverse fracture above the condyles is the common fracture.

Cause.—Direct violence, as falls on the elbow.

Displacement of Fragments.—The triceps, acting upon the olecranon, draws the forearm backward; the biceps, brachialis anticus, triceps, and other muscles, draw the forearm upward, while the lower end of the upper fragment is carried forward and makes a prominence above the crease at the bend of the elbow.

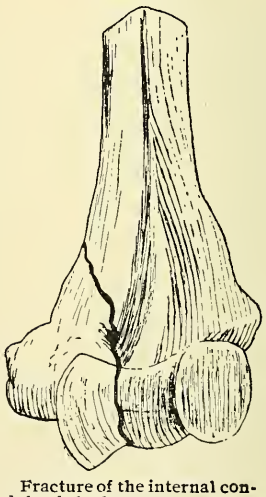
Signs.—Deformity in this fracture resembles the deformity in dislocations of both bones of the forearm backward. A diagnosis can be made by careful examination. In fracture, the relation of the condyles and the olecranon is unchanged, whereas in dislocations, the relation of these bony points is changed. In case of fracture, upon reduction of the deformity, crepitus is obtained, while in dislocations, no crepitus is obtained. In case of fracture, the deformity will return after reduction;

FIG. 58.



Fracture of the outer condyle of the humerus.

FIG. 59.



Fracture of the internal condyle of the humerus.

in dislocations the deformity will not return. In fracture there is shortening, the distance from the external condyle to the acromion process is shorter on the injured side, while in dislocation, there is no shortening. In fracture, the lower end of the upper fragment makes a prominence above the crease at the bend of the elbow, while in dislocation, the prominence is below the crease at the end of the elbow.

In **T-shaped fracture** there is not only a transverse fracture, but the line of fracture extends into the joint. The signs are similar to those of transverse fracture, with the exception that upon motion of the condyles of the humerus, crepitus is obtained. Where the case is seen early, crepitus may be obtained by compressing the condyles. Where great fluid effusion has taken place in the joint, this sign may be absent.

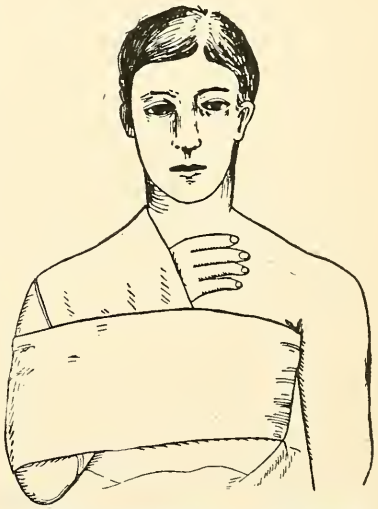
Fracture of the condyles is the result of direct violence. The line of fracture may, or may not, invade the joint. In case the internal

condyle is fractured, the fragment is drawn downward by the pronator radii teres and the flexor muscles of the arm, whereas in fracture of the external condyle, it is drawn downward underneath the fibres of the supinator longus. The loose fragment is readily manipulated, and when drawn into position, crepitus can be obtained.

Epiphyseal fracture is the same as transverse fracture, with the exception that moist crepitus is obtained. The fracture occurs in young persons.

Diagnosis.—The diagnosis in all these fractures is difficult; furthermore, great swelling is the rule. The best treatment, where the case is not seen early, and before the swelling is intense, is to place the arm on a pillow, keep it in an immovable position, and apply cold to combat the swelling, after which, a correct diagnosis can be made. Furthermore, the bones may be manipulated in the proper position and a permanent dressing better applied. Where the diagnosis is uncertain, an x-ray examination should be made, if possible. It is of the greatest importance to correctly determine the condition. The prognosis should be guarded. Fractures extending into the elbow-joint are always serious, and it is difficult to obtain good union without deformity, or without interference in some of the functions.

FIG. 60.



Method of dressing the arm in acute flexion for T-fractures or for fracture of the internal and external condyles of the humerus.

Union.—Union takes place with more or less deformity. In epiphyseal fractures, or fractures within the capsule of the joint, the union is fibrous. In transverse fractures, and in fractures of the condyles, the union is bony.

Treatment.—As before mentioned, where there is much swelling, the arm should be placed upon a rubber cushion and cold applied. When the swelling has been reduced sufficiently, the diagnosis may be made, and a suitable dressing applied. A posterior trough, or an external or internal angular splint, may be applied. The internal angular splint is preferable in all cases, with the exception of fractures of the internal condyle. Manipulation should be made early in all cases, with the exception of transverse fracture, where the line of fracture does not invade the joint. In all cases where the fracture invades the joint, manipulation should be begun at the end of the first week. In case it does not invade the joint, it may be delayed until the end of

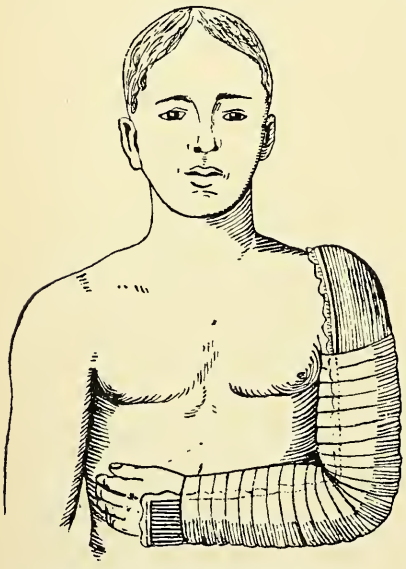
the second week. The success in the treatment of these fractures will depend upon the proper management of the case.

Fractures of the Forearm—Both Bones.

Fracture of both bones of the forearm is the result of direct violence, when both bones are broken at the same level. Where the bones are not broken at the same level, it is the result of indirect violence, the bones breaking at the weakest point. In the latter condition, the radius breaks in the upper one-third, while the ulna breaks in the lower one-third.

Displacement.—The upper fragment of the radius is drawn toward the upper fragment of the ulna by the pronator radii teres, while the lower fragment of the ulna is drawn toward the lower fragment of the radius by the pronator quadratus, and in this manner the interosseous space is more or less obliterated.

FIG. 61.



Posterior trough, suitable for fractures of the humerus and both bones of the forearm.

Signs.—Deformity, crepitus, history of accident, pain, swelling, preternatural mobility, etc. The signs are very evident.

Treatment.—Flex the elbow to a right angle and place the forearm midway between pronation and supination. In this position, the thumb is directed upward. A well-padded internal and external splint should be applied. The internal splint should extend from the axilla to the tips of the fingers, while the external splint need only extend from the elbow to beyond the wrist. Both splints should be broader than the forearm, so that the bandage may not compress the bones towards each other, thus lessening the interosseous space. Manipulation of the hand, fingers, and muscles of the forearm should be begun within two weeks. If either the elbow-joint or wrist joint is involved, manipulation should be begun earlier. Pronation and supination may be lost if this manipulation is not begun early, and kept up regularly. The patient should be seen within twenty-four hours after the accident, because of the liability to constriction of the return circulation by the bandage. Here, again, the dressing advised by Dr. Still will be found to be of the greatest advantage. The fracture may be green-stick, in a child.

Fractures of the Radius.—Fractures of the radius are of the (1) neck, (2) shaft, and (3) lower extremity.

Fracture of the *neck* of the radius is the result of direct, or indirect, violence. The diagnosis is sometimes difficult. The signs are crepitus, obtained by extension and manipulation; preternatural mobility, obtained by grasping the head of the bone and pronating and supinating the arm. The head does not move. Occasionally, in young persons, the upper epiphysis may be separated. This condition is difficult to diagnose. It gives moist crepitus, and evidence of a foreign body in the joint.

Treatment.—The treatment of fracture of the neck of the radius consists in flexing the arm at right angles, to relax the biceps, when a posterior angular trough, or internal angular splint, may be used. Mild manipulation should be begun at the end of the second week.

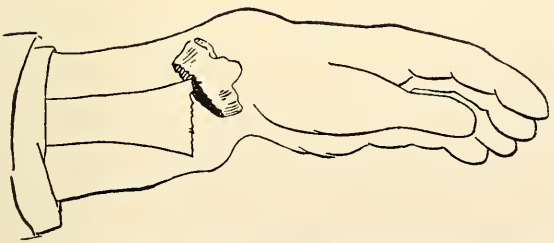
The *shaft* of the radius is broken by direct, or indirect, violence, such as blows upon the arm, or falls upon the palm. Displacement of the fragments varies, depending upon whether the fracture is above or below the insertion of the pronator radii teres. Should it be above, the upper fragment will be flexed and supinated, while the lower fragment will be pronated and drawn towards the ulna. When the fracture is below the insertion of the pronator radii teres, the upper fragment is flexed and drawn inward, while the lower fragment is approximated to the ulna.

FIG. 62.

Fracture of the lower extremity of the shaft of the radius showing deformity.

Treatment.—The forearm should be placed midway between pronation and supination, and flexed at right angles at the elbow. A posterior, or internal, angular splint may be used, with sufficient interosseous pad to prevent the approximation of the bones. The splints should be carried from below the wrist to above the middle of the arm. Manipulation should be begun at the end of the second week.

FIG. 63.



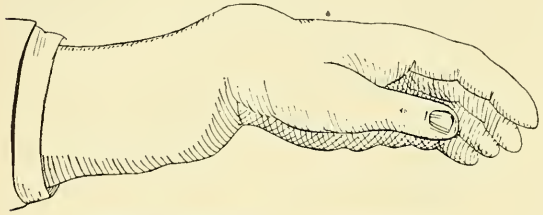
Colles's fracture, showing displacement of the fragments.

Fracture of the *lower extremity* of the radius is called **Colles's fracture.** This injury occurs most frequently in elderly women, and is produced by falls upon the outstretched palm, while the hand is completely pronated and extended. The fracture may be an inch from the wrist-joint, but is usually less. The deformity is characteristic, and is described as

"silver-fork," because of the position of the hand resembling a dinner fork.

Displacement.—The lower fragment of the bone is carried backward and upward, because of the direction of the application of the violence. Often there is some impaction of the fragments. This impaction, together with the action of the extensor carpi radialis longior and brevior muscles, maintain the deformity. Because the main violence is directed on the ball of the thumb, the outer side of the lower fragment is displaced more than the inner side. This causes a prominence of the styloid process of the ulna, which will be found in this injury on a lower level than the styloid process of the radius. The upper fragment is pronated and approximated to the ulna. These forces acting, likely produce the characteristic deformity.

FIG. 64.

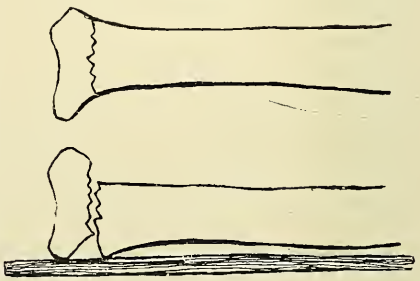


Silver-fork deformity in Colles's fracture.

Signs.—The characteristic deformity is a prominence on the back of the wrist, while there is a corresponding depression on the front of the wrist. The styloid process of the radius is on a higher level than that of the ulna. In case the fracture is not impacted, there is crepitus. The history of the accident and the age of the patient may be considered. It may be confounded with dislocation of the wrist, but this dislocation is rare, and the deformity different. The styloid process of the radius is on a lower level than that of the ulna, while there is no crepitus. If the deformity is reduced, it will not return.

Treatment.—The treatment of Colles's fracture is, first, to set the fracture, providing it is not impacted. Where there is impaction, without much deformity, the member should be treated in that position. There are numerous splints which are of excellent service in the treatment of this fracture. The chief objection to all of them seems to be that a stiff joint is liable to result. Levis's splint is, perhaps, the most popular. A splint similar to Levis's may be made of Dr. Still's dressing. Bond's splint is an excellent dressing. This splint has a pad which fits over the lower end of the upper fragment, and a dorsal pad which fits

FIG. 65.



Deformity liable to result in the treatment of Colles's fracture with a straight splint.

over the lower fragment. It tends to correct the deformity. The fingers and thumb are allowed to be free. Passive motion should be begun in four or five days, and kept up until cured.

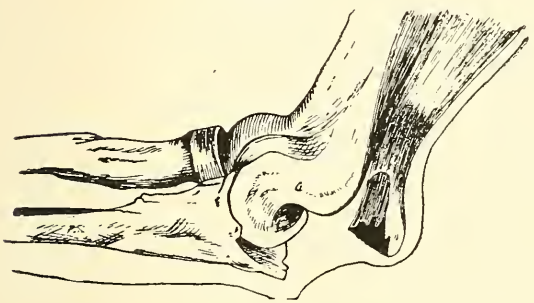
Fracture of the Ulna.

Fractures of the ulna consist of fractures of the:

1. Olecranon.
2. Coronoid Process.
3. Shaft.
4. Styloid Process.

Fractures of the *olecranon* are produced by direct violence, as by falls upon the elbow, and by muscular contraction, in conditions of disease of the bone.

FIG. 66.



Fracture of the olecranon process, showing upper fragment pulled up by the triceps muscle.

Nature of the Injury.—Usually there is considerable contusion of the tissues over the olecranon, while the loosened fragment is drawn upward by the tendon of the triceps and can be readily felt beneath the skin, an inch or more above the joint. The diagnosis is easy, inasmuch as it cannot be mistaken for any other injury.

Union.—The union is sometimes fibrous, but in young and middle-aged people, in good health, the union is good.

Treatment.—The arm is best treated in complete extension and by strapping the olecranon in its normal position by means of adhesive strips. Some surgeons advise the use of a right-angle splint and strapping the bone in position. In case of non-union, the olecranon may be wired in position. The arm should be kept in an extended position for three weeks, when slight flexion should be made. Manipulation should be instituted late.

Fractures of the *coronoid process* occur most frequently at the time of dislocation of the ulna. It is said that contraction of the brachialis anticus may produce this fracture. The fracture is attended by considerable injury. Where it complicates a dislocation, a bad result is liable to follow. It is best treated in flexion, with an internal angular splint. Manipulation should be begun early, in order to prevent a stiff joint.

Fractures of the *shaft* are caused by direct violence. The line of fracture may be transverse, or oblique. The upper fragment is held in position while the lower fragment is approximated to the radius by the pronator radii teres. The diagnosis is easy, inas-

much as the posterior border of the ulna is subcutaneous. A finger run along the posterior border would discover an offset in the bone. Union is good.

Treatment.—It is best treated in a manner similar to fractures of the shaft of the humerus. A splint, the length of the forearm and hand, slightly wider than the forearm, applied to the inner side, will be sufficient. The splint should be well padded, and held in position by a figure-of-8 bandage. If extension and counter-extension are kept up while the splint is applied, the bones will be held in apposition.

Fractures of the Carpus.

Fractures of the carpus are produced by severe, direct violence, and very often the fracture is compound.

The *diagnosis* is readily made by crepitus. The injury is more serious than is indicated at first glance. Because of the limited blood supply to the carpal bones, one of the fragments may die, and suppuration and abscess result. Should this occur, it will produce ankylosis.

Treatment.—The bone should be manipulated into position, and held by a well padded anterior splint, extending beyond the middle of the forearm.

Fractures of the Metacarpus.

Fracture of the metacarpal bones is produced by direct violence. The signs are evident, and consist of deformity and crepitus.

Treatment.—The bones may be readily manipulated into position, while an anterior splint, extending beyond the wrist, should be applied. In fractures of both the carpus and metacarpus, manipulation should be begun early, in order to prevent fibrous adhesions of tendons and the involvement of the joints.

Fractures of the Phalanges.

Fracture of one of the phalanges may take place because of direct violence. The diagnosis is easy. It is best treated by a palmar splint immobilizing the metacarpo-phalangeal, as well as the phalangeal joints. The hand should be carried in a sling during the first two weeks.

Fractures of the Pelvis.

Fractures of the pelvis are caused by heavy, direct violence, such as the wheels of a loaded wagon passing over the body, or by falls from a considerable distance. The nature of the injury depends upon the line of fracture. If the line of fracture extends through the crest of the ilium, it may not involve any of the pelvic viscera, but it may extend through the ramus or body of the pubes and ischium, thus separating the two sides of the pelvis. Such fractures of the true

pelvis are usually attended by lacerations of the pelvic viscera, of the rectum, vagina, urethra, and bladder.

Signs.—The signs will vary, depending upon the viscera injured. There is severe contusion of the soft-parts. Crepitus is obtained by pressing upon the ilia, or upon the pelvis antero-posteriorly. Bloody urine will indicate that the fracture extends into the bladder, or blood may be voided from the bowel. A history of the accident may lead to a suspicion of fracture. If any of the viscera are involved, the prognosis of the fracture is grave. Infection, abscess formation, and non-union, will bring about exhaustion and death. Where there is laceration of the viscera, the patient may be kept quiet with sand-bags at the side, and with proper care and attention, may recover. The acetabulum may be fractured because of blows upon the hip. This injury is rare, and the diagnosis can be made by eliminating fractures and dislocations of the hip, and by the presence of pain and crepitus. In fractures of the pelvis, little dressing, beyond keeping the patient quiet, will be required. A flannel roller may be applied around the pelvis and the patient not allowed to move.

Fractures of the Femur.

Fractures of the femur are divided into:—

I. Fracture of the upper extremity.
II. Fracture of the shaft.
III. Fractures of the lower extremity.

Fractures of the upper extremity are divided into:—

A. Intracapsular.
B. Extracapsular.
C. Fractures of the greater tuberosity.
D. Epiphyseal.

Intracapsular fractures are divided into:

1. Impacted.
2. Non-Impacted.

The **non-impacted** fracture is the most common.

Cause.—The causes of non-impacted fracture of the neck of the femur are:

1. The fragile condition of the bone.
2. Fatty degeneration of the neck.
3. Indirect violence.

The fracture happens in old people, and is produced by slipping on cobble-stones, etc., or catching the toe. The limb is wrenched, and the neck of the bone easily breaks off

Nature of the Injury.—The fracture may be transverse, or oblique, and the displacement will depend somewhat upon the line of fracture. In some cases, the fracture is subperiosteal. In other cases, where the periosteum is torn, or lacerated, greater displacement of the fragments takes place.

FIG. 67.

Non-impacted intra-capsular fracture of the neck of the femur.

Signs.—1. Shortening—three-fourths of an inch, to one inch.

2. Eversion of the foot, which is produced by the weight of the limb as it lies in a helpless condition.

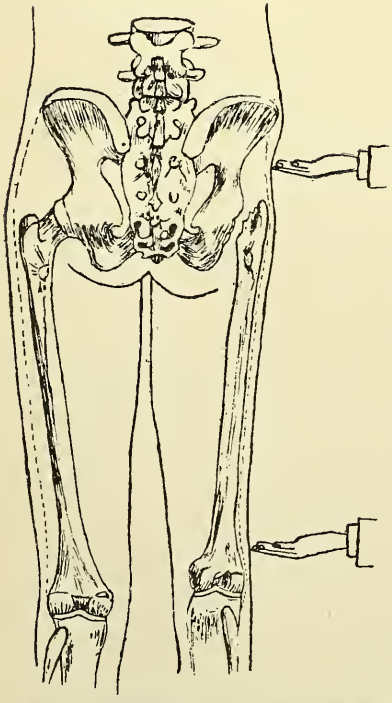
3. Lessened arc of rotation of the great trochanter. This sign is obtained by grasping the great trochanter and rotating the limb outward and inward.

4. Crepitus.

5. The great trochanter is nearer the anterior superior spine. This may be determined by accurate measurements. These measurements may be made in one of two ways. First, by Nelaton's line, which is a line drawn from the anterior superior spine of the ilium to the most prominent part of the tuberosity of the ischium. Under normal conditions it crosses the upper edge of the great trochanter.

It may also be made by Bryant's line, which consists of a line drawn around the body at the level of the anterior superior spines. A second line is drawn upward from the great trochanter to this line. This second line is shorter on the injured side than on the sound side, in case of displacement of the great trochanter upward.

FIG. 68.



Method of determining Allis's sign in fracture of the neck of the femur.

6. A history of the accident.

7. Age of the patient. The fracture happens in old people, and from slight injury, by catching the foot, or in slipping. It should be noted that there is no injury to the tissues over the trochanter.

Allis's Sign.—This is the relaxation of the fascia lata. The relaxation is caused by shortening, lessening the tension on the iliotibial band.

Impacted Intracapsular Fracture of the neck of the femur is rare.

Signs.—

1. No crepitus.
2. Very slight shortening.
3. Absence of the signs of other injury or dislocation.
4. History of the accident and age of the patient.
5. Eversion of the limb.

Occasionally in these fractures the limb is not helpless, and the patient may even attempt to walk.

The diagnosis is sometimes very difficult, inasmuch as the signs are chiefly negative.

Extracapsular Fracture of the neck of the femur occurs in young, or middle-aged people, and is either impacted, or non-impacted, but is usually impacted. It is caused by direct violence, as heavy falls on, or severe injury over, the trochanter. In the impacted variety, the upper fragment is driven into the lower one.

Nature of the Injury.—The injury is brought about by severe direct violence, therefore there is evidence of bruising of the skin and soft tissues. The trochanter is considerably thickened. There is shortening of at least one inch, and is greater than in the intracapsular fracture. There is a lessened arc of rotation of the trochanter, no crepitus, eversion of the foot, while the trochanter is displaced above Nelaton's line.

In the **non-impacted** extracapsular fracture of the neck of the femur, it is believed that the impaction is broken up by the extension of the fracturing force, or by the efforts of the patient to move, or by subsequent manipulation. The cause of the injury is, great direct violence over the trochanter.

Nature of the Injury.—The injury is very severe. There is intense contusion of the skin and soft-parts. The line of fracture may even extend through the base of the great trochanter, or may extend through the line of union of the neck with the great trochanter.

Signs.—1. Crepitus, which is pronounced, and is evidenced by grasping the trochanter.

2. Shortening (one or two inches).

3. Evidence of great injury to the soft-parts over the trochanter.

4. History of the accident, and age of the patient.

5. Eversion of the limb.

Treatment.—Non-impacted Intracapsular Fracture.—As this fracture occurs in old people, long confinement in the recumbent posture is liable to result in hypostatic congestion of the lungs, and in bed-sores, either of which may destroy life; therefore, it is best to keep the patient in bed the shortest time possible. The patient may be put to bed, and an extension apparatus applied, with sand-bags along the side of the femur, and the limb kept immovable until the preliminary soreness disappears. At the end of the first week, and not later than the second week, the patient should be allowed to sit up, or, if possible, to get up and about on crutches. Where it is deemed advisable, and the condition of the patient's health will permit it, a fixed-dressing should be applied, which will immobilize the hip and knee. In the majority of cases, this dressing can not be used. Fibrous union is the rule. Sometimes, because of the limited blood supply, and the enfeebled condition of the patient, no union takes place, and the end of the bone may become worn off. Sometimes the limb is left helpless. In order to secure a good result, confinement in bed for six or eight weeks is usually neces-

sary, and where the patient is young, this may be permitted. A stiff apparatus applied over the hip is necessary, even after a considerable length of time in bed. This stiff dressing over the hip may be in the nature of a leather casing, or a pasteboard and starch-paste dressing, and so constructed as to fit closely over the hip and thigh.

In the **impacted** form, a similar treatment should be followed, except that the extension apparatus is unnecessary. No attempt should be made to break up the impaction. Generally a good result can be obtained, but the hip should be rendered immovable by some fixed dressing. A plaster dressing in old people is bad.

Extracapsular Fracture.—In the **impacted** variety, it is only necessary to keep the limb at rest. No extension apparatus is necessary. Sand-bags should be placed along the side of the hip, and the limb kept at rest until the soreness and swelling have disappeared, and then the patient may get up and go about on crutches. Subsequent manipulation may obtain a good result.

In the **non-impacted** variety, an extension apparatus will be necessary. An eight or ten pound weight, sufficient to overcome the muscular contractions, should be applied, and the patient kept quiet in bed, and the limb kept immovable, by sand-bags, until the preliminary swelling and inflammation have subsided, when a plaster dressing, encasing the leg and pelvis, may be applied. This plaster dressing is kept on for two weeks, when the patient is gotten up on crutches. The plaster dressing should be removed at the end of four weeks. Some surgeons advise, in the impacted variety, if the person is in good general health, to pull the impaction apart and apply a plaster dressing, but this method of procedure is questionable. Deformity, following this fracture, is the rule. While the extension apparatus is used, the foot of the bed should be raised from four to six inches, so that the weight of the patient will operate as a counter-extending force.

Fractures of the **greater tuberosity** are very rare, and are accompanied by extensive local injury. The diagnosis is usually not difficult. The broken fragments should be strapped into position, and the patient kept at rest in bed until fibrous union, at least, has taken place.

Epiphyseal fracture is also rare, and occurs in young people.

Signs.—The signs are the same as non-impacted extracapsular fracture, with the exception that there is moist crepitus. A history of the case, and the age of the patient, indicate the nature of the injury.

Fractures of the Shaft.

Fractures of the shaft of the femur are best considered in fractures of the upper, middle, and lower one-third. The *cause* is usually direct violence, but may be due to indirect violence, especially when occurring in the upper one-third of the shaft. The line of fracture is usually oblique. Muscular contracture may produce the fracture, in conditions

of softening of the bone, or in fragile conditions of the bone attending paralysis agitans.

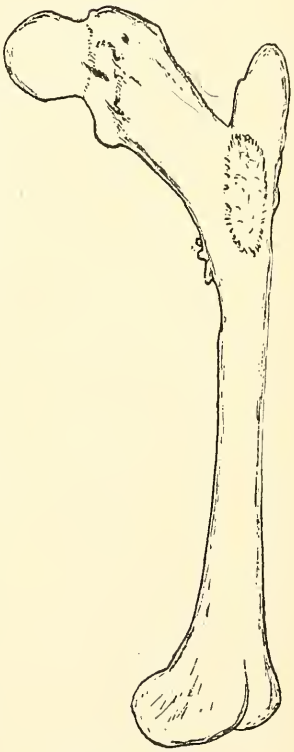
Upper One-third.—Displacement of the Fragments.—In the upper one-third, the upper fragment is tilted forward by the action of the iliacus and psoas muscles, while the quadriceps extensors, biceps, semitendenosus, semimembranosus and the adductors draw the lower fragment upward, so there is marked shortening, the upper end of the lower fragment slipping past the upper fragment. Extension made upon the limb in an extended position, will not bring about apposition of the fragments. The limb must be treated in a semi-flexed position, in order to relax the psoas and iliacus muscles.

FIG. 69.

Fracture of the upper extremity of the shaft of the femur, showing displacement of the upper fragment by the psoas and iliacus.

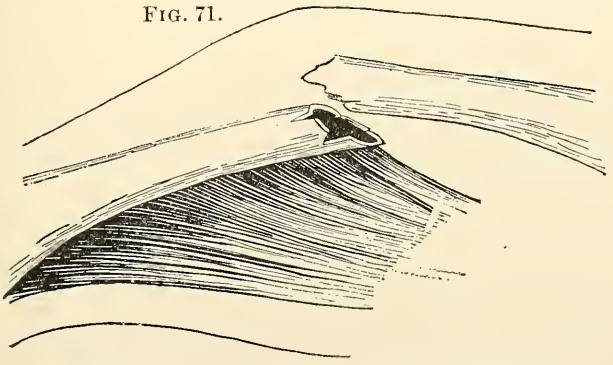
In fractures of the **middle one-third**, a similar displacement of the fragments may occur, but it is not so pronounced. In fracture of the **lower one-third** of the femur, the upper end of the lower fragment is usually turned back-

FIG. 70.



Union with angular deformity in fracture of the upper one-third of the shaft of the femur.

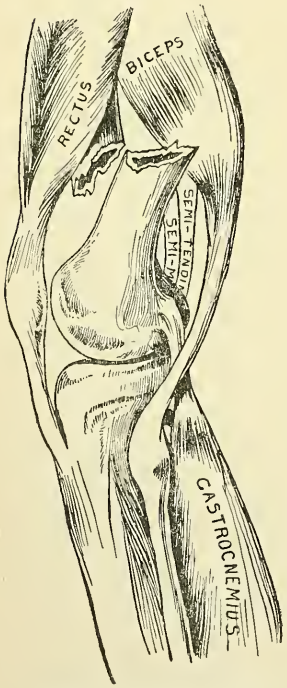
FIG. 71.



Deformity in fracture of the middle of the shaft of the femur.

ward, because of the action of the calf muscles on the upper and back part of the condyles, whereas, the upper fragment is usually tilted more or less forward, and there is marked shortening. This deformity may not occur where the fracture is caused by direct violence and the line of fracture is transverse. In fractures of the middle one-third of the shaft, extension will bring about apposition of the fragments, and the limb may be treated in a fixed dressing in an extended position, but in fractures of the upper and lower one-third, the thigh should be flexed on the abdomen, and the leg partially flexed on the thigh. In fractures of the upper extremity, union with angular deformity may occur, when good apposition has not been obtained and the fragments are not kept immovable.

FIG. 72.



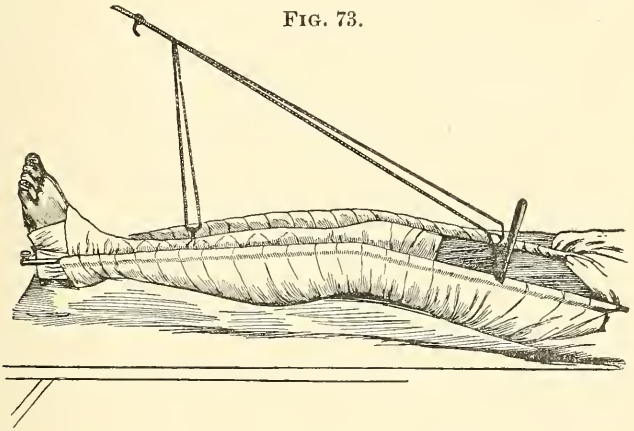
Fracture of the lower extremity of the shaft of the femur, showing the deformity produced by the action of the calf muscles.

Signs.—The signs in fracture of the shaft of the femur are so obvious that a diagnosis is easy. The limb below the fracture is helpless, and any effort at motion causes great pain. There is shortening to the extent of two or three inches. Preternatural mobility and crepitus, with deformity, will be sufficient to enable the operator to determine the injury. The foot is everted and helpless. Sometimes this fracture is attended by great shock and intense pain, because of injury to the sciatic nerve. Fat embolism forms a rare complication.

Dressing.—Numerous dressings, splints, extension apparatus, and other forms of dressings, have been devised for these fractures. Whatever is used, the operator must keep in mind the condition of the limb to be treated. Dr. Still advises the use of a dressing made of starch-paste, pasteboard, and a many-tailed bandage, which is applied to the thigh and leg. Each day the physician visits the case, to see that the bones are kept in good apposition, and the dressing does not interfere with the return circulation. He has never had a failure with this method of treatment. For fractures of the upper and lower thirds of the femur, Hodgen's dressing is of great value. This dressing consists of a cradle made of muslin, fastened to two iron bars, which are bent at the knee. Two cross pieces, which can be readily detached, hold the two bars a certain distance apart. Fastened to these bars is a suspension apparatus, which is attached to a hook in the ceiling. By this means the limb is swung in the cradle, which will accommodate itself to the shape of the thigh, and by regulating the suspension appa-

ratus, any degree of extension can be obtained. For hospital use, this dressing has no superior. The splint in most common use, both in the hospital and private practice, is the double inclined plane. This, in case of fracture of the upper one-third of the femur, relaxes the psoas and iliacus muscles; in case of the lower one-third, it relaxes the calf muscles. Extension is made

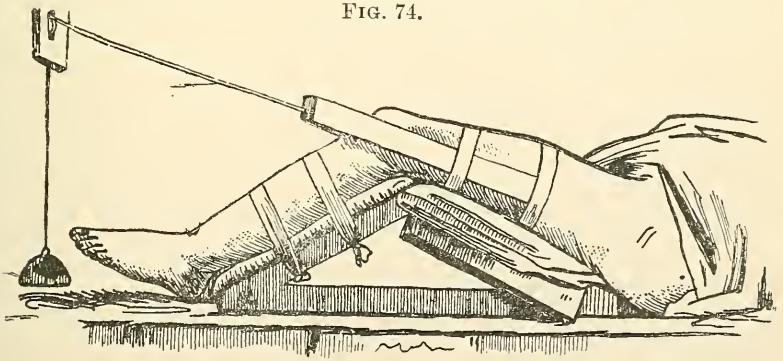
FIG. 73.



Hodgen's dressing for fractures of the shaft of the femur.

in the direction of the lower fragment. The difficulty in the treatment of this fracture in small children is to maintain immobility. Perhaps the dressing which yields the best result is a vertical suspension of the limbs in a plaster dressing. This enables the attendant to easily reach the excretories, so that cleanliness can be

FIG. 74.

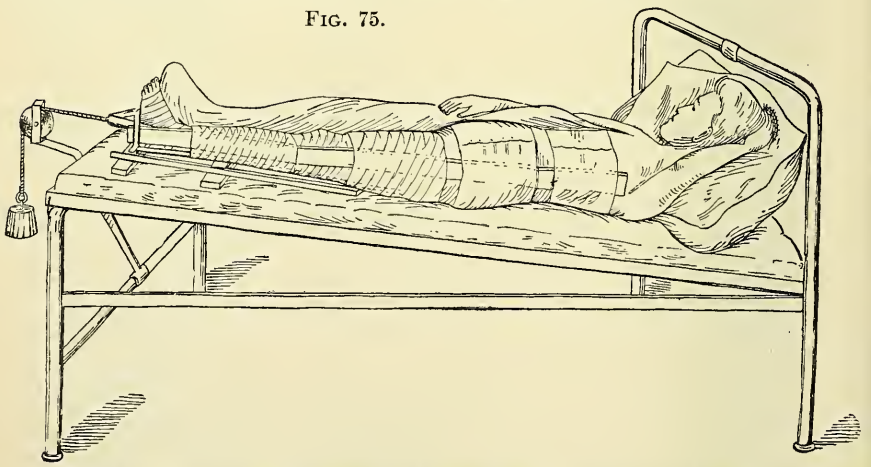


Double inclined plane and extension apparatus for fracture of the upper extremity of the shaft of the femur.

maintained. Fracture of the middle third of the shaft can be treated successfully with a plaster-of-Paris dressing, which is applied from the foot up the thigh and around the pelvis, in the form of a spica bandage, as high as the tenth rib. It does not matter how successfully this dress-

ing is applied, it will soon become loose, so if a good cast is originally put on, and along the site of fracture, the bandage, reinforced by two or three narrow wooden strips, the plaster may be incised, and a roller bandage applied over all, and the splint drawn snugly to the thigh. If this splint is used, the patient should be gotten up at the end of two weeks and made to go about on crutches. The reason for this is that considerable atrophy of the muscles will take place, unless some such method is used. In hospitals, a plaster-of-Paris bandage is applied immediately. This is not wise in private practice. The best method would be to put on an extension apparatus, keep the limb immovable between sand-bags until the preliminary swelling has disappeared, and then the plaster bandage can be put on, and in ten days, or two weeks, the patient may get about on crutches. In fractures of any part of the thigh, the hip-, knee-, and ankle-joints should be rendered immovable. The knee and ankle may easily be rendered immovable, but the hip-joint only with great difficulty. The reason is, that it is necessary for the bowels to move daily, and the inserting of the bed-pan, and care of the patient, will cause more or less motion at the hip-joint. Where it can be obtained, a fracture-bed will be found of great service. If a

FIG. 75.



Long splint, fracture bed and extension apparatus used in fractures of the femur.

fracture-bed can be secured, only an extension apparatus will be required. The function of the fracture-bed is to raise the patient, by means of canvas stretched on a frame. A hole through the sheet and canvas, in the neighborhood of the buttocks, will allow the contents of the bowel to be evacuated without motion of the body.

Fractures of the Lower Extremity.

Fractures of the lower extremity of the femur are:—

A. Transverse.

B. Y or T.

C. Internal or external condyle.

Transverse.—The diagnosis of a transverse fracture is fairly easy, when it is produced by direct violence. There may not be much displacement. Where it is produced both by direct and indirect violence, there may be considerable displacement. The upper end of the lower fragment may be turned directly backward. When this occurs, some difficulty may be experienced in setting the fracture. Cases are on record where it was necessary to tenotomize the tendo Achilles in order to effect relaxation of the calf muscles, so as to permit of manipulating the lower fragment into position. When once in proper position, the limb should be treated in a semi-flexed position by a double inclined splint. The diagnosis is made by means of preternatural mobility, deformity, crepitus, history of the accident, and the nature of the injury. Generally a good result is obtained in the treatment of the fracture. The fracture may be kept immovable for three weeks in a young person, and in older persons four weeks, when they may be gotten up on crutches. Care should be taken in the preliminary use of the limb, that the soft callus is not broken up. There is no danger of ankylosis at the knee, inasmuch as the line of fracture does not invade the joint.

T or Y fracture is an extremely serious injury. It is produced by direct and indirect violence, and the violence is usually of such nature that it produces contusion and injury of the soft-parts, as well as the fracture. This adds to the gravity of the case. Inasmuch as the fracture invades the joint, effusion of blood will take place within the joint cavity, and the swelling will be intense. Where the case is not seen early, it had best be treated by antiphlogistic measures until the swelling disappears, when an accurate diagnosis can be made. Where it is possible, the limb should be exposed to the x-rays, in order to determine the exact nature of the fracture, then a fairly accurate prognosis may be made. Bony union takes place between the condyles and the shaft of the bone. Only fibrous union will take place between the two condyles. The space between the condyles is widened, and they will no longer fit the articular surfaces of the tibia, nor will the patella fit in between the condyles, so that the joint will be permanently enlarged, and other deformity may result. The *diagnosis* of the fracture is easily made. Crepitus is marked. There is effusion in the joint. Motion of the patella will occasion crepitus. More or less evidence of dislocation will be present. These, together with the history of the accident, and evidences of severe injury of the knee, will be sufficient to make the diagnosis.

Treatment.—The limb should be kept immovable for a period of ten days or two weeks. The parts adjacent to the injury may be manipulated, to assist the return circulation. The patient should be kept in the best possible condition and every effort made to get rid of the inflammation. At the end of two weeks, slight manipulation of the joint may be begun. This manipulation will prevent the formation of adhesions. Where there is not much contusion of the parts, the

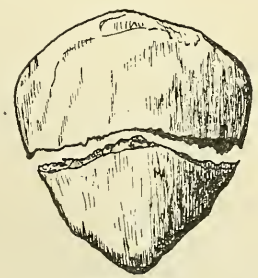
joint may be manipulated as early as the twelfth day. This manipulation is kept up lightly for two weeks, when the person may be gotten about on crutches, and a leather knee-boot constructed, which can be laced up closely to the limb, and which will hold the fragments in position. This splint may be removed daily, to permit of manipulation of the joint. If this treatment is followed out with care, the integrity of the joint will be maintained and a fairly good result obtained.

Fracture of Either Condyle is produced by direct and indirect violence, either or both. The signs of fractures are the mobility of the condyle and crepitus, together with evidence of injury. Usually a good result will be obtained. Even if the union is but fibrous at first, it will become bony, especially if the fracture occurs in a young person. Such a fracture happening in an old person, is more grave, and the integrity of the joint will be permanently lost. Deformity is the rule in this kind of a fracture, inasmuch as more or less callus must form between the condyle and the end of the bone. This slice of callus so inserted, as it were, elongates the condyle, and in case of fracture of the inner condyle, the person will have knock-knee, whereas, if it happens in the external condyle, by lengthening it, a bowed condition of the leg will result. This fracture should be treated with a double inclined plane and motion begun early (within two weeks) and kept up until the freedom of the motion of the joint is not impaired.

Epiphyseal Fracture of the lower extremity of the femur is extremely rare. Moist crepitus, history of the accident, age of the patient, evidence of a foreign body in the joint, and other signs of fracture, will enable the physician to make the diagnosis.

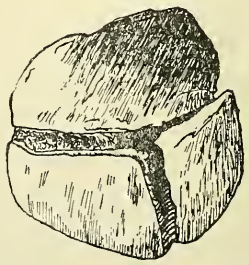
Treatment.—The treatment is the same as in the other forms of fracture. The family should be notified that considerable deformity results from this fracture. Destruction of the lower epiphysis will result in marked shortening of the limb, since the limb will no longer grow from this joint.

FIG. 76.



Transverse fracture of the patella.

FIG. 77.



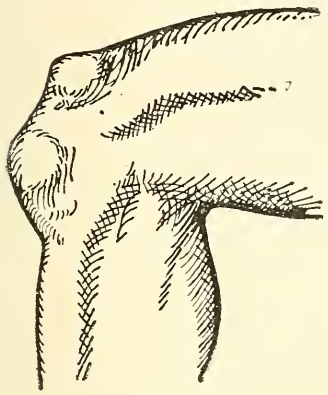
Fracture of the patella with separation of the bone into three fragments.

Fractures of the Patella.

The patella is fractured by direct violence. The line of fracture may be vertical or transverse, but is usually transverse. The trans-

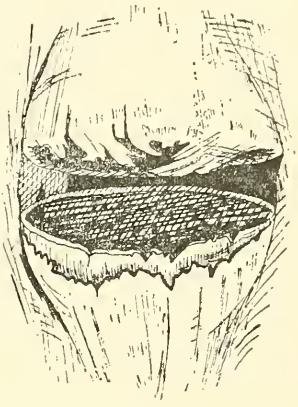
verse fracture is said to occur sometimes from muscular contraction, by vigorous and forced action of the quadriceps extensors. The diagnosis of the transverse fracture is easy. The upper fragment is pulled

FIG. 78.



Fracture of the patella, showing displacement of the upper fragment.

FIG. 79.



Fracture of the patella, showing the nature of the injury.

up above the knee, by the action of the quadriceps muscles, while the lower fragment remains in situ. There is a gap between the fragments. In the vertical fracture, the diagnosis is equally easy. It is so rare that it scarcely merits description.

Treatment.—The treatment in case of a transverse fracture of the patella is not followed by a very good result. Fibrous union is the rule, although bony union may occur. The blood supply to the bone is insufficient to secure strong union. In elderly people, it is perhaps best to wire the bones together at the outset. Under aseptic conditions this operation may be done without impairing the integrity of the joint. In young or middle-aged healthy people, the limb may be dressed in extension, while the upper fragment is drawn downward by means of adhesive strips. The limb should be kept in an extended position for at least six weeks, and then manipulation and passive motion should be begun, but only mildly. The reason for not permitting motion of the limb earlier is that the callus, which is yet only fibrous, will stretch and allow the fragments to be pulled apart. This will lengthen the distance between the origin and insertion of the quadriceps extensor muscles and thereby impair their usefulness, and deformity will result. Should fibrous union occur an operation may be advised. A slice of callus may be sawed out and the ends of the bones united. It may be treated by means of McBurney's hooks, but this treatment is not often used.

Compound Fracture of the Femur and Patella should be treated in the same manner as a simple fracture, with the exception that the wound

should be cleansed and asepticized at once and thereafter dressed antiseptically. Should a plaster bandage be applied, a window may be cut in the plaster over the site of the wound, so as to permit of daily treatment and cleansing of the wound and provision for drainage.

Fracture of the Lower Leg.

Fractures of the lower leg may be divided into:

I. Fractures of the tibia and fibula.
II. Fractures of the tibia.
III. Fractures of the fibula.

Fracture of Both Bones is most common, with the exception, perhaps, of fractures of the lower extremity of the fibula. The cause is direct and indirect violence. If both bones are fractured at the same level, and the line of fracture is transverse, the cause is direct violence. If the bones break at their weakest point, because of falls on the foot, and more or less force distributed to the leg at the same time, the line of fracture will be oblique. In the latter case, the tibia breaks in its lower third, while the fibula breaks in its upper third. In the transverse fracture, which is the result of direct violence, there is not much deformity. The diagnosis is easy. The tibia is subcutaneous and fracture can readily be determined in it. It may not be so easy to determine whether the fibula is broken, but in case only the tibia is broken, preternatural mobility would not be very marked, because of the presence of the companion bone, whereas if both bones were broken, the preternatural mobility would be more marked. In the oblique fracture, which is a much more serious condition, there is great danger of the fracture becoming compound. The reason is, because the lower end of the upper fragment projects forward against the skin, while the action of the muscles pulls the lower fragment past the upper. The lower end of the upper fragment usually makes a sharp projection against the skin, and unless great care is exercised in handling the member, the skin may be broken.

FIG. 80.

Transverse fracture of both bones of the leg as results from direct violence.

Signs.—The signs of fracture are obvious. Evidences of injury, preternatural mobility, crepitus, deformity, loss of motion, etc., are present.

Treatment.—In treating fractures of the tibia and fibula, it is important to keep in mind that both the ankle- and knee-joints should be rendered immovable. Furthermore, in setting the fracture, it is of the greatest importance that the physician sees that he does not have union with deformity. Eversion of the foot is the rule. The contraction of the tibial muscles will be greater than the peroneal,

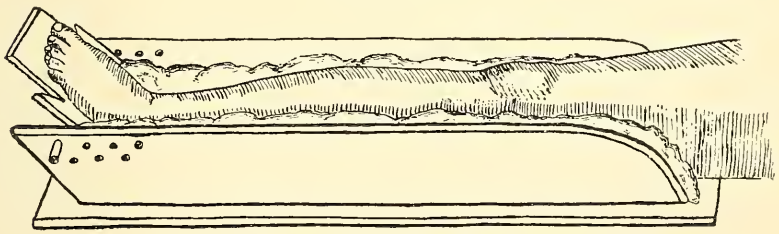
Radiograph by George M. Laughlin, D. O.

PLATE I.

Radiograph of a compound fracture of both bones of the lower leg six weeks after the injury. Note that the bones are fragmented and that there is non-union. There is a multiple fracture of the fibula. The wound became infected and inflammatory tissue shows on the fibular side of the leg.

and a condition of varus, especially if the fracture is low down, may occur. This can be prevented by making extension and having the inner side of the great toe, the inner malleolus, and the inner border of the patella in the same plane. As long as these points are kept in the same plane and extension and counter-extension is maintained, a good result will follow. The best dressing, and the one easiest to apply, is the one advised by Dr. Still. The dressing used in hospitals, where there is not too much injury to the soft-parts, or where there is no comminution of the bones, is a plaster-of-Paris dressing. It is carried to just beyond the middle of the thigh, sufficiently high to render the knee immovable. Should the dressing become loose, it can be cut in front and a roller bandage applied over the plaster splint, so as to draw it tight to the leg. Extension is made on the lower fragments by weight and pulley, in the same manner as for fractures of the thigh. It is not necessary to keep this extension up if the bandage is properly applied.

FIG. 81.



Fracture box for fractures of either or both bones of the leg.

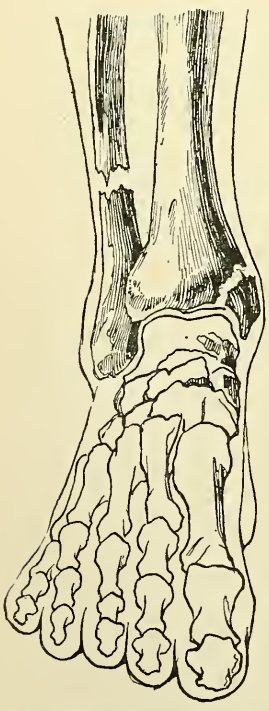
Fractures of the Tibia.—Fractures of the tibia may occur in any part of the bone, but fractures in the upper one-third are rare, except as the result of great direct violence, when the fracture may be multiple and comminuted. This is a very severe form of fracture, and may demand amputation. Where the vitality of the patient is good, and there is fairly good circulation, the limb may be put in a fracture-box for a few days and watched. Where the fracture is not compound, this procedure should always be followed. Amputation may be deferred until there is evidence of deficient circulation, or gangrene appears. Fracture of the middle or lower third of the shaft is caused by direct and indirect violence—blows directly upon the bone or falls upon the foot, either or both. Usually there is but little displacement, because the companion bone, the fibula, is uninjured. The diagnosis of the injury is easy, inasmuch as the bone is subcutaneous. As the finger is passed along the anterior border of the tibia, at the site of the fracture preternatural mobility and crepitus will be obtained, and there will be evidences of local injury. Fractures of the upper and lower third of the tibia may be treated similarly. It is necessary to carry the splint only to the tuberosity of the tibia. Where there seems to be a consid-

erable wrenching of the ligamentous attachments between the tibia and fibula at the time of the injury, and where it appears to the physician that there is mobility between the ends of the bones, it may be necessary to carry the splint or dressing up to the middle of the thigh. In all these fractures of the lower leg, the patient should be gotten up within two weeks after the fracture. A plaster dressing may be applied over the foot and up to the tuberosity of the tibia. In this fracture, Dr. Still's dressing is of the greatest service. It is easy to apply, and is light, and if applied with care, will maintain the bones in apposition, and will permit the patient to go about on crutches. The objection to the plaster-of-Paris dressing is, that it is weighty and cumbersome and in numerous ways troublesome.

Fractures of the Fibula.

Fractures of the fibula are more common than fractures of the tibia. The cause is direct violence, as blows directly upon the fibula, and indirect violence, such as wrenches of the foot. There is not much displacement of the bones in fractures of the fibula. The diagnosis is easy. The lower part of the bone is subcutaneous. There will not be much preternatural mobility, but the normal springiness between the tibia and fibula will be destroyed and there will be crepitus. The fracture most common in the fibula, and the one which merits the best description, is that which occurs in the lower one-fifth of the bone, or two or three inches above the malleolus. This fracture was first described by Percival Pott, and has since borne his name. It is usually caused by the patient slipping on the foot, as in stepping from a car or cab upon a cobblestone. The astragalus is driven against the lower extremity of the fibula, the force is transmitted up along the bone, the fracture occurring two or three inches above

FIG. 82.



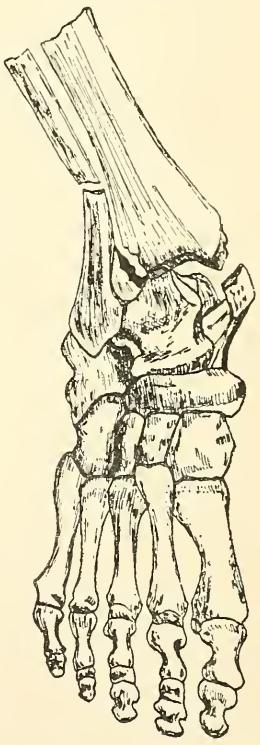
Pott's fracture with the deformity reduced.

FIG. 83.

Pott's fracture, showing the characteristic deformity.

the malleolus. The upper end of the lower fragment is directed in towards the tibia, while the astragalus is dislocated outward. The internal lateral ligament is ruptured, or the tip of the internal malleolus is broken off. The deformity in this fracture is characteristic. The inner side of the sole of the foot is directed downward, while the sole itself is directed downward and outward. The foot is displaced outward, and at the same time everted. The internal malleolus stretches the skin and is markedly prominent. There is a depression on the outer side of the leg above the external malleolus. This is by far the most common fracture. There are two or three similar fractures described, one of which is Dupuytren's. In this fracture, the fibula is broken, as before mentioned, the tip of the internal malleolus is broken off, while the tibio-fibular ligaments are likewise torn, i. e., there is a separation of the lower articulation of the tibia and fibula. In the third variety of fracture, the fibula is broken in the same situation, and the tibia is broken transversely just above the articulation. In these last two fractures, the deformity is very similar to that of a Pott's fracture, but the internal malleolus does not form such a sharp prominence on the inner side of the foot. Should the tip of the internal malleolus be broken off in Pott's fracture, the fragment of bone will be felt beneath the skin. Fracture of the internal malleolus does not occur in the majority of cases. In mild cases of Pott's fracture, with but little injury to the soft-parts, the patient may be able to walk some distance, or may not discover that he has a fracture, believing it is a sprain. There is a rare form of this fracture described by some authors, in which the foot is displaced inward, instead of outward. In this case, the upper end of the lower fragment projects outward against the skin, instead of inward. The diagnosis in Pott's fracture is fairly easy. Where the characteristic deformity is present, it is only necessary to determine the nature and amount of injury. If the surgeon grasps the ankle, the natural springiness of the fibula is absent. Crepitus will be obtained upon extension. Eversion or inversion of the foot will disclose preternatural mobility. In cases where the physician is in doubt, it should be treated as a fracture. This is equally true of all injuries to bones.

FIG. 84.



Dupuytren's fracture, which closely simulates a Pott's fracture.

Treatment.—The treatment is to correct the deformity by traction and manipulate the foot in proper position. When the inner side of

the great toe, the inner malleolus, and the patella are in the same plane, a suitable fixed dressing may be applied. Dr. Still's dressing is preferable. An external splint, with a vertical foot-piece, or a plaster-of-Paris dressing may be used. In any case, the patient should be gotten up, so that he can get about on crutches, within two weeks after the injury. The foot may be manipulated and the integrity of the joint restored. It is necessary, in all cases, to maintain immobility of the fracture. If this is not done, eversion of the foot may take place and a condition of talipes valgus, or flat-foot, will result.

Fractures of the Tarsus.

Fracture of the tarsus is rare, except as a result of great direct violence. The diagnosis is usually easy. Preternatural mobility and crepitus are easily obtained. In cases where there is great swelling, the diagnosis cannot be readily made. The foot should be kept immovable and at rest, and antiphlogistic measures applied until the swelling is so reduced that a diagnosis may be readily made. An x-ray examination should be made when possible. The prognosis should be guarded in these fractures, inasmuch as death of one of the fragments may occur. Union is good. The fracture may result in the letting down of the arch of the foot. The person should not be allowed to walk until after good union has been obtained.

Fractures of the Metatarsus.

The metatarsal bones are fractured by direct violence, blows on top of the foot, or by weighty objects falling upon the foot. The diagnosis is easy. A stiff splint moulded to the sole of the foot and the member snugly bandaged to assist the return circulation, will be all that is necessary. The foot should be allowed rest for three or four weeks. In the meantime, the parts may be manipulated.

Fractures of the Phalanges.

Fractures of the phalanges are common, and the diagnosis is made without difficulty. The treatment is similar to treatment of the metatarsal bones.

DISEASES OF JOINTS.

Synovitis.

Synovitis is an inflammation of the synovial membrane of a joint. These inflammations may be divided into (1) acute, and (2) chronic.

Acute Synovitis is caused from injury, such as contusions, sprains, wrenches, exposure to wet and cold, and to the deposit of certain inflammatory products, or micro-organisms, about the synovial membrane. The abnormal relation of the articular surfaces of the joint, or partial dislocations and contractions of fascia and muscles interfering with the

return circulation, operate, as the most usual causes, in a large number of cases.

Pathology.—The synovial membrane becomes congested and red; following this there is an exudation of fluid into the synovial sac, which prevents the inflamed surfaces of the membrane coming in contact. This effusion may be very great, or may be only slight. There is always more or less inflammation about the joint, sometimes the congestion of the periarticular structures is considerable. Where the activity of the cause is not too great, and the case is properly treated, resolution may take place without any organic changes occurring in any of the joint structures. On the other hand, the inflammation may extend into the cartilages, the connective tissues about the joint, or into the bone. Suppuration and abscess may follow, and the cartilages and bones become eroded and destroyed, resulting in osteo-arthritis and bony ankylosis.

Symptoms.—The joint is swollen and painful; movements are impeded. Spasms of the muscles and a *"fixed"* condition of the ligaments serve to hold the joint in a position (generally a flexed one) of the greatest ease. In septic cases, congestion and inflammation are much greater and the case is attended by considerable fever, while in the milder cases, the fever may not rise to more than 100 degrees or 101 degrees F., or in very mild cases there may be no febrile reaction whatever. In the severer forms a chill may occur, together with a rise in temperature, sordes, loss of appetite, coated tongue, confined bowels—indications of the absorption of pus. If the joint is not covered with too many surrounding tissues the swelling is quite manifest. The outline of the distended synovial sac can be mapped out with ease. In the case of a *knee-joint* the greatest distension takes place on either side of the ligamentum patellae and just above the joint underneath the quadriceps extensor muscles. In some cases, this distension may be enormous. If pus forms within the joint, it burrows in the direction of least resistance, which may be along the sheath of some muscle, a distance away from the joint. In case of the *elbow,* the distension of the membrane takes place upward underneath the triceps. In the *ankle,* there is puffiness behind the malleoli and underneath the extensor tendons. Sometimes the fluid effusion is so small that it is difficult to detect it. In conditions of the hip and shoulder, it may be overlooked. In the knee-joint, the patella may even be lifted away from the condyles (riding of the patella). In other cases, it may be necessary for the person to bend at the hips in a standing position, with the legs extended, and the hands resting on the front of the thighs (Fisk's method), when fluctuation may be felt on the inner side of the patella. The severer forms of septic synovitis will be indicated by the evidence of sepsis, the increased pain, and redness about the joint, together with the general systemic conditions already mentioned.

Treatment.—The treatment of acute synovitis is distinctly osteo-

pathic, until pus forms, when surgical interference may be necessary to evacuate the pus, and prevent erosion of the articular cartilages, and subsequent involvement of the ends of the bones. Destruction of the joint tissues to any extent means ankylosis, which will more than likely permanently interfere with the integrity of the joint. If the synovitis arises from a penetrating wound, by which infectious materials have been introduced, it is imperative to at once wash out the wound and joint with an antiseptic solution, as a saturated solution of boric acid, or 1:50 solution of carbolic acid in boiled water. Drainage must be provided and the wound washed and dressed twice daily until all danger of infection of the synovial membrane has passed. When the inflammation is set up by bruising the joint, and not by an open wound, cold should be applied during the first twenty-four hours, then manipulative measures, to secure normal circulation.

If the synovitis is the result of the deposit of germs in the joint, and of obstructions to the circulation, or from subluxations or malposition of the bones, only manipulative measures will afford relief. Where the joint is a point of least resistance, lesions will be found directly affecting the blood supply, or spinal lesions affecting the nerves to the joint. The treatment consists of removing these lesions, releasing the nerves, and in stimulating the circulation. Slight passive motion must be kept up, to prevent ankylosis. Obstructions to the circulation, and local congestion, may be relieved by appropriate methods. When pus forms, which will be evidenced by chills and fever, loss of appetite, confined bowels, etc., a free incision should be made at the most convenient point and the pus evacuated. The joint may then be washed out daily with an antiseptic solution. Even though pus forms in the joint, and the synovial fluid drains out for weeks, there is no danger of ankylosis, unless the cartilages become eroded and destroyed. As the inflammation subsides, more vigorous manipulation of the joint should be made. Should any adhesions form, they may be readily broken up and the inflammatory tissues absorbed.

Chronic Synovitis, or subacute synovitis, frequently follows an attack of acute inflammation of the synovial membrane, or it may be subacute from the beginning. It is stated by excellent authors that many of these cases of chronic synovitis are tubercular inflammations. The opposite of this might be stated with perhaps equal truth, that many cases diagnosed as tubercular synovitis are nothing more than simple cases of subacute synovitis, the result of lesions, subluxations, and contractions of fascia or muscles, which interfere with the circulation and bring about the inflammatory conditions. The habit of calling these prolonged cases of chronic synovitis which do not yield to the treatment administered, "tubercular," is nothing short of vicious. Without doubt, many cases are due to the deposit of the tubercle bacillus outside of the membrane, or within the membrane, and this low-grade inflammation results, but there are other causes more important than these bacilli, and those

causes might be summed up in the interference with the circulation to the joint and bad general health.

Pathology.—The synovial membrane may be congested, but the villus-like projections around the edges of the articular surfaces become hypertrophied and edematous. A considerable amount of fluid may exude into the joint. This may be so great as to give rise to a condition called "hydrops articuli." The nature of the fluid effused into the joint may be that of ordinary serum. The joint may remain in this condition for years without change, while on the other hand, absorption may take place and the disease disappear. The synovial membrane may become thickened and hypertrophied, and as it becomes distended, it may extend along sheaths of muscles in pouch-like dilations (Baker's cysts). The cartilages of the joints may become inflamed and thickened. Sometimes degenerations of the thickened portions of the synovial membrane may take place.

Symptoms.—Evidences of effusion in the joint, together with a history of acute synovitis or lesions, indicating interference with the return circulation, or a history of injury, together with the presence of fluid in the joint. In some cases there may be false crepitus in the joint, occasioned by the formation of weak fibrous adhesions. On motion these are broken up. If the joint is aspirated, a viscid, straw-colored fluid will be obtained.

Treatment.—In the treatment of chronic, as in acute, synovitis, osteopathic methods have accomplished wonderful results. If these manipulative measures are persisted in, good results will be obtained, and amputation rendered unnecessary. It does not matter whether the case is tubercular or not, the same methods should be employed, while uniformly good results may be expected. Even in cases of long standing, where surgical authorities have advised amputation as the only means of relief, good results have been obtained in many cases. It is in this class of cases that osteopathic practitioners have achieved some of their most brilliant results.

The treatment consists in securing the proper blood supply, removing obstructions to the circulation, and reducing subluxations. Certain spinal lesions, affecting the nutrition to the joint, may be the cause of the disease. These should be removed at once. Resorption of the inflammatory thickenings and fibrous tissues about the joint may be secured by obtaining the proper circulation.

Acute Arthritis.

Arthritis is an inflammation of all the tissues of a joint. In synovitis, the inflammation is limited to the synovial membrane. In arthritis, the synovial membrane also may be involved, but the inflammation extends into the connective tissues about the joint. The origin of the disease may be within the synovial membrane, as synovitis, or it may

be within the bone, as osteitis, but at all events, the inflammation involves all of the articular structures.

Cause.—The causes are the same as in synovitis. In arthritis, there is usually a history of greater injury, often penetrating wounds, or a history of osteitis, periostitis, osteomyelitis, or abscess in the soft-parts which may have involved the joint, or there may have been the absorption of septic poisons from certain acute fevers, which have lodged in and about the joint, setting up a general inflammation.

Pathology.—The changes occurring in the joint vary according to the course of the disease, and according to its origin. It usually begins as an acute inflammation of the synovial membrane, which spreads into the surrounding tissues, the cartilages become eroded and softened, and may be entirely destroyed. The ligaments become infiltrated with inflammatory elements, softening may take place, with marked increase in the connective tissue elements. Because of the muscular spasm, and the weakened condition of the ligaments, luxation of the articular ends of the bones follows, while because of the interference in the circulation, and the partial arrest of the nutrition to the tissues about the joint, disorganization is followed by the formation of pus and further destruction of the articular structures. The pus will burrow in the direction of least resistance, finally rupturing, perhaps, some distance from the joint. It will continue discharging pus for a considerable length of time, afterward the abscess may heal and fibrous tissues form between the articular ends of the bones, producing true ankylosis. This ankylosis may, in some cases, be bony, leaving a permanently stiff joint. The cartilages are destroyed by the process of infiltration and degeneration. The ends of the bones may often be greatly eroded or destroyed by a process of caries. Sometimes, before the epiphysis has been united to the diaphysis, the entire epiphysis may be destroyed, because of interference to the circulation. There is a certain class of these cases in which the pus burrows in many directions into the muscles and along the bones, giving rise to a general septic condition. In such cases, the pus may even get into the medullary cavity, setting up an osteomyelitis. Such cases end unfavorably. In most cases, the pus will rupture in the neighborhood of the joint, afterward healing by third intention. After prolonged suppuration in the worst cases, lardaceous disease and affections of the viscera may occur.

Symptoms.—The symptoms may be those of an ordinary attack of synovitis, but as soon as the structures about the synovial membrane begin to be involved, the symptoms are more intense, greater swelling, edema about the joint, and a bluish-red color, will serve to distinguish it from synovitis. The temperature is higher, and the pulse more rapid. Where pus develops in the septic forms of the disease, there will be chills, followed by rigors, a quiet condition of the bowels, and a loss of appetite. The patient is often considerably debilitated.

The pain in the joint is usually very severe, and the reflex irritation of the muscles gives rise to painful startings. After rupture of the abscess, the condition heals slowly.

Treatment.—In general, the treatment is the same as in synovitis. The pus must be evacuated early and good drainage obtained. The patient must be given a nourishing diet, while the secretions should be made as nearly normal as possible. Where there is extensive destruction of bone, and the case continues a considerable length of time, resection of the joint and scraping away of all the necrosed bone may be necessary to save the limb. Even in bad cases, if good drainage is secured, manipulative methods will obtain good results. Obstructions to the return circulation must be removed, spinal lesions corrected, and the general health built up. The prognosis should always be guarded, although a fair result can usually be obtained.

Epiphysitis.

Epiphysitis is an inflammation of the epiphysis of the bone in young persons. It may be acute, subacute, or chronic, and arises from injury or lesions affecting the blood supply, or the abnormal relations of the bones. It may, or may not, involve a joint.

Cause.—The causes are the same as those of synovitis and arthritis. The changes taking place in the epiphysis are such as to terminate quickly in suppuration. Should the pus and inflammation extend into the joint, arthritis may result. Sometimes the epiphysis may be separated from the diaphysis of the bone, forming a sequestrum, when by a process of suppuration, ulceration, and a burrowing of the pus, the sequestrum may be dislodged, or even exfoliated by nature. In most cases, the injury and destruction of the epiphysis result in a shortened limb. There are cases in which the limb even grows longer, because of the formation of new tissues within the epiphysis. At all events, stiffness and fixidity of the joint are the rule. Sometimes a large abscess results.

Treatment.—The treatment is essentially the same as for arthritis and synovitis. The prognosis should be guarded. Should the case be seen before there is destruction of bone, relief may be given almost at once. The reduction of the subluxation and the relaxation of the contracted muscles, thus removing obstructions to the circulation, will prevent destructive changes.

Gonorrheal Arthritis, or Gonorrheal Rheumatism.

Not infrequently during the course of gonorrhea, the patient may be attacked with inflammation of the joints. Cases have been reported where these inflammations attended gonorrheal opthalmia. These arthritic inflammations vary in intensity; some are very mild, while others are severe, furnishing a mental picture of the ordinary case of acute rheumatism. Not all the rheumatic attacks taking place during gonorrheal arthritis are the result of this disease, but many are.

Cause.—The cause of the joint-inflammation seems to be the absorption of the products of inflammation. It may be, in some cases, the streptococci; in rare instances, the gonococci may be the exciting cause of the inflammation. It is really not a form of rheumatism, but a form of arthritis, due to the absorption of the inflammatory products from the ulcer found in the urethra, or upon the mucous membrane of the vagina. The inflammations are rather intractable, but yield to treatment. The inflammations usually end in resolution, but may end in ankylosis, fibrosis about the joint, and in suppuration. The disease occurs during the later stages of gonorrhea, or after the discharge has disappeared. It is usually confined to one joint, most often the knee; the next most frequently affected are the tarsal-joints, which is often followed by flat-foot. It may affect the hands or wrists. The disease frequently recurs.

Symptoms.—The symptoms of the disease are those of acute and chronic arthritis and synovitis. The presence of chronic gonorrhea, together with evidences of rheumatism, will determine the diagnosis.

Treatment.—In the treatment of gonorrheal arthritis, the organs of elimination, especially the kidneys, must be kept active, and the circulation *through* the affected joint should be improved. Since the disease is produced by the absorption of toxic products from the gonorrheal ulcer, it is plain that these elements would lodge and excite an inflammation at a weak point. Stimulation of the spinal origin of the nerves to the joint, together with local treatment about the joint, improving the circulation, and assisting resorption of the inflammatory elements, will be necessary. Any subluxation existing must be reduced, as these are regarded as responsible for the inflammation.

Tubercular Arthritis.

There is a large per cent of cases of chronic arthritis which are either tubercular, almost from the incipiency, or become tubercular some time within the history of the disease. The disease occurs more frequently in the spine than any other part of the body (See tuberculosis of the spine). In order of frequency, the following joints and bones are affected: Knee, hip, ankle, tarsus, elbow, wrist, hand, skull, face, sternum, clavicle, ribs, pelvis, femur, tibia, fibula, shoulder, scapula, ulna, radius, humerus, and patella. The disease is much more common in young people. It is claimed that the imperfect structure and the irregular contour of the vessels in the epiphyses of the bones entering into the formation of the joints involved, constitute an important factor in the development of tubercular disease. This is hardly true. The presence of spinal lesions, together with partial dislocations, muscular contractions, contractions of fascia, etc., all assist in bringing about a condition in which there is an abnormal blood supply and abnormal nerve influence to the joint or bone, and under these circumstances, the tubercle bacilli are deposited and the disease arises. The deposit of the

germ takes place more frequently in the epiphysis in children, but in adults the disease starts in the synovial membrane, or joint-capsule.

Changes Occurring In.—The pathological changes occurring in tuberculosis of joints are, in general, as follows:

1. The formation of granulation tissue. This is characteristic of all tubercular inflammations. Sometimes it is fungating in character. At other times there will be but few tubercles and but little granulation tissue, but the rule is that a considerable amount is formed.

2. Caseation and softening of the granulation tissue is sometimes termed gelatiniform degeneration. This takes place according to whether there is sufficient interference to the nutrition of certain areas of the affected tissues. In some cases, no caseation and softening follow, while in other cases the degenerative changes are extensive.

3. Joint-effusion. Effusion into the joint is the rule. Sometimes there is but little joint-effusion, while at other times it is extensive. There is a certain class of cases in which there is a considerable amount of granulation tissue, with no effusion and no tendency to caseate. In such cases there will be but few tubercles formed.

4. The contour of the joint is changed. The joint becomes spindle-shaped, and the tissues are more or less glued together, and the motions of the joint become limited. There may be considerable redness of the joint, or there may be none. The veins about are often considerably enlarged, due to the interference in the return circulation. Especially is this true where the granulation tissue involves the deep veins, in case of tuberculosis of the knee-joint.

5. Deformity is one of the most important changes occurring in joint-tuberculosis. This deformity arises, many times, before the deposit of the tubercle. Primary injury is an important factor in the cause of tubercular disease. This primary injury may be contusions of the ends of bones, or it may be a subluxation. The injury of the joint may produce spasm of the muscles, holding the bones in an abnormal position. This initial deformity is exaggerated in the later stages of the disease by muscular spasms, erosions of the bones, destruction of the cartilages, and relaxation of certain of the ligaments, and contraction of others, producing partial or complete dislocations. Furthermore, the position of the limb assumed by the patient in obtaining relief from pain, oftentimes results in deformity.

6. Abscess formation. In a certain proportion of cases, degeneration and softening occur, resulting in the formation of a fluid similar to pus. This fluid burrows along the sheaths of muscles, or fascia-planes, and finally reaches the surface and ruptures, forming a sinus. Occasionally infection will take place along back this sinus, which leads to pyogenic infection of the joint. Fever and other evidences of the septic process will be present. This acute suppuration is very often perilous to life, so it should be avoided under all circumstances.

7. Ankylosis. By the old method of treatment, ankylosis was the

rule, and in only a very few cases was the disease recognized sufficiently early, nor was the treatment sufficiently successful, to permit of a cure without limited motion. Osteopathic treatment has improved upon the older methods, from the fact that it not only secures an arrest of the tuberculous process, but likewise prevents ankylosis in a large number of cases. Sometimes ankylosis cannot be prevented. The disease may sometimes remain quiescent for several years, and again break out anew.

Treatment.—The treatment of tuberculosis of joints may be followed out on the same principles as of tuberculosis of any other structure. The deposit of the tubercle bacilli will not occur unless there is a diminished resistance of the tissues. This condition may be overcome by building up the system and increasing the nutrition of the tissues at the point of least resistance, or those affected. It is conceded that our only protection against the onslaughts of the tubercle bacilli is normal, healthy blood, and a free circulation. These may be best obtained by osteopathic methods.

The manipulation employed should be at the spinal origin of the nerves to the affected part or directly over the vessels carrying the blood to and from the diseased area, always working in the direction of the circulation; also local manipulation, to prevent stasis and to increase the local nutrition. Lesions directly, or reflexly, affecting the circulation, or nerve supply, must be removed as soon as possible. Motion must be kept up in the joint, to prevent ankylosis. There is no danger of disseminating the tubercle bacilli. Very vigorous manipulation will do mechanical injury. When abscesses occur, the necrosed tissues should be washed away by antiseptic solutions, and rigid cleanliness enforced. Antisepsis will not heal the sore—only good, fresh blood can accomplish it.

Tuberculosis of Special Joints.

Hip Disease.—This affection has a variety of names, such as Morbus Coxarius, Morbus Coxae, Coxitis, or Hip-joint disease.

Causes.—The causes of hip disease are (A) Contributory and (B) Exciting.

The contributory causes consist of luxations and subluxations of the hip, or conditions affecting the circulation and nerve supply to the joint and surrounding tissues. The nerve supply of the hip-joint comes from the anterior crural, obturator, great sciatic nerves, and filaments from the sacral plexus. These nerves may be pressed upon by luxations, curvatures in the lumbar spine, subluxations at the sacro-iliac joint, usually a twisted condition, or at the hip itself, or by contractions of the psoas magnus, pyriformis, and other muscles. The blood supply comes from the internal circumflex, sciatic, gluteal and obturator arteries. These arteries and their accompanying veins may be obstructed by contractions of the internal femoral, gluteal, obturator, psoas, and other muscles, also by certain bony lesions. By the operation

PLATE II. Radiograph by George M. Laughlin, D. O.

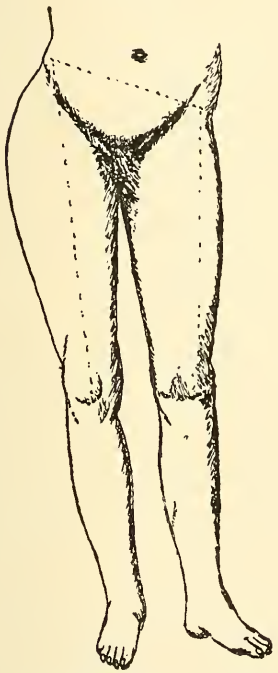
Radiograph of a condition of hip disease of the left hip (posterior view) in a girl aged five years. The disease is quiescent and the hip is ankylosed. Treatment will do no good.

of these lesions, the joint becomes a weak point, when, because of a slight injury, or the deposit of the bacilli, degenerative changes are set up.

The exciting causes are injury and deposit of the tubercle bacilli.

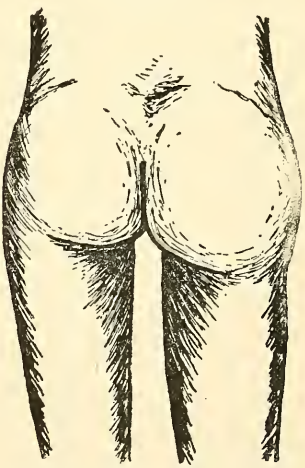
Occurrence.—The disease occurs more frequently in children. It is claimed that between sixty and sixty-five per cent of all cases occur in children under ten years of age, while eighty per cent. of the cases are found in individuals under twenty.

FIG. 85.



Early hip disease, showing obliquity of the pelvis.

FIG. 86.



Obliteration of the gluteal fold as occurs in hip disease.

Point of Origin.—In the largest number of cases, the disease arises from the deposit of the tubercle in the acetabulum. In a certain proportion of cases, it first begins in the head of the femur, while other times it may arise in the great trochanter. In cases developing in adults, the deposit of the tubercle will be in the synovial membrane, or in the connective tissues outside.

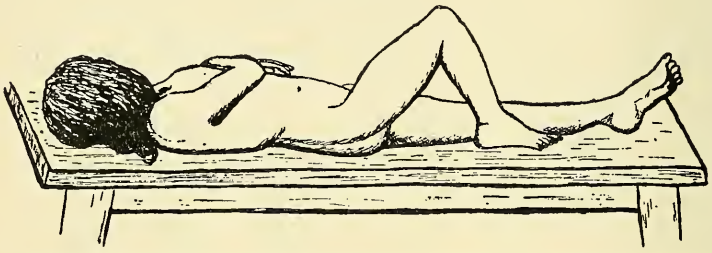
Symptoms.—The symptoms of hip-joint disease vary with the nature of the changes taking place in the joint. They may, perhaps, be best understood by classifying them in the following manner:

1. Sympathetic pain in the knee-joint, which is most likely due to the involvement, either directly or reflexly, of the obturator nerve. It may be due to pressure upon the obturator nerve, or to an irritation of the filaments within the hip-joint itself. The pain is usually localized on the inner side of the knee-joint. It may be on the front of the leg, or extend along down the inner side of the thigh, leg, and foot.

2. Faulty position of the limb. The abnormal position of the leg

early in the disease consists of flexion, external rotation, and abduction. The flexion may be slight and the abduction not great, depending upon the severity of the symptoms. The cause of this position seems to be the tension of the ilio-femoral, or Y-ligament. The fluid effusion in the joint apparently lifts the head of the bone out of the socket. This produces a greater tension upon the Y-ligament, causing the flexion.

FIG. 87.

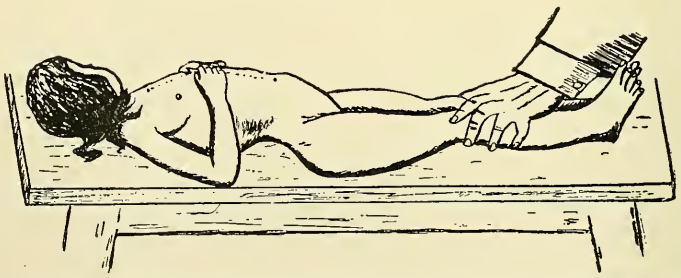


Flexion of the thigh produced by tension of the Y-ligament as happens in coxitis.

This flexion gives rise to one of the earliest symptoms, viz., inability of the patient to completely extend the limb, or should the limb be completely extended, it produces lordosis of the spine.

3. Later deformity. Later in the disease, because of the muscular spasm and contracted fascia, and because of the changes taking place in the head of the bone, or in the acetabulum, the limb becomes ad-

FIG. 88.



Lordosis of the spine, produced by extension of the legs, as occurs in hip disease.

ducted, rotated inward, and flexed. Should the epiphysis become separated from the shaft of the bone, it may resemble a fracture of the neck of the femur, while in other cases, the head of the femur is drawn against the upper rim of the acetabulum. Here it presses against the upper and back part of the capsule, which gives way, and the muscular contraction produces a dorsal dislocation. This is the most common and the characteristic position of old cases of hip-joint disease. From early in the disease, extending through its clinical course, there is a marked adductor spasm. Following fluid effusion in the joint, there may be extensive erosion of the bones, ligaments, and cartilages.

The fluid effusions may be so great that fluctuation can be made out. Where erosion of the bones and destruction of the cartilages, with formation of pus, follow, this pus will burrow through the muscles of the thigh, underneath the fascia lata, to the point where the tensor fascia femoris muscle is inserted, where it ruptures. In other cases, the pus may reach Scarpa's triangle, by passing through the cotyloid notch, or by passing through the bursa underneath the psoas muscle. In other cases, it may burrow upward underneath the glutei muscles.

4. Pain is produced in the hip-joint by pressure on the sole of the foot and great trochanter. While pain is present in hip-joint disease, it is markedly increased by pressure in these localities.

5. Marked atrophy of the muscles attends hip disease. There is flattening of the buttock, and the gluteal crease, or fold, is lessened, or absent, and is lower down on the affected side.

Early Signs.—The early symptoms of coxitis may be entirely overlooked. Usually there is evidence of malnutrition, the child has night terrors, and on arising in the morning, shows lameness, which wears off during the day. The child easily tires at play, and should he lie down to rest, the lameness is evident in the hip, which will, perhaps, wear off again shortly. Pain may, or may not, occur in the hip, upon tapping the sole of the foot, or upon pressure upon the trochanters. There is slight adductor spasm, and as the disease grows worse, the little patient complains of pain in the hip-joint and on the inside of the knee, while there may be more or less tilting of the pelvis to allow the foot to touch the ground in walking.

Diagnosis.—The diagnosis of early hip disease is very difficult. In making an examination, the pelvis should be placed in normal relation with the spine, the anterior superior spines of the ilia should be on the same level, when shortening of the limb can be detected. If the limb is flexed, with the ilia in normal position, and then extended, lordosis of the spine will be produced. There is usually limitation of motion in the joint in some direction.

This disease may be confounded with lumbar or psoas abscess from caries of the spine, sacro-iliac disease, congenital dislocations of the hip, lordosis from rickets, infantile paralysis, gluteal bursitis, or gluteal abscess. In psoas or lumbar abscess from caries of the spine, there will be evidence of disease of the vertebrae, whereas, the abscess appears below Poupart's ligament, external to the femoral vessels, at a point where hip abscess rarely, if ever, appears. In sacro-iliac disease, pressure upon the iliac crests will produce pain, whereas tapping of the sole of the foot will not produce pain. There will be no limitation of motion in the hip-joint. In congenital dislocations, a history of the case, and absence of inflammatory signs, together with an x-ray examination, will enable the physician to make a correct diagnosis. In rickets, there will be evidence of the rachitic rosary, and the involvement of other bones and joints than the hip. In infantile paralysis,

there are no inflammatory symptoms. There is progressive muscular atrophy, which takes place rather rapidly. In gluteal bursitis, the symptoms are continuous and unremitting. Exercise aggravates the pain, which is moderate. The location of the pain is behind the hip and behind the knee.

Treatment.—The treatment of hip disease consists in removing the lesions found. Twists in the pelvis and curvature of the spine call for attention at once. It is not necessary, in many cases, to manipulate the thigh at all. If the thigh is manipulated, it should be done gently, and not so as to do injury. Treatment to correct the position of the spine and the pelvic lesions will be followed by good results in from two to six months. In bad cases, treatment may be required longer—a year or more.

The methods employed in surgical practice are, fixation and extension for a long period (six months to a year). By this treatment, ankylosis is the rule. Ankylosis rarely, if ever, follows osteopathic treatment. In fact, the ankylosis already present is often cured by the treatment. When pus forms, it should be evacuated and the cavity well drained and cleansed. No local application of medicine is needed. If the strictly osteopathic methods are relied upon, good results will follow. Where luxations, or subluxations, of the hip result from the disease (which will nearly always occur in cases not treated), they should be reduced at once, and the limb kept in an easy normal position until the use is recovered and pain ceases.

Sacro-Iliac Disease.

Sacro-iliac disease is rare, and comes on after the age of fifteen. It may arise from the tubercle bacilli being deposited within the joint, or the adjacent bones, or through tuberculous pus burrowing into the joint from caries of the spine. It may be associated with extensive disease of the pelvic bones. The symptoms of the disease are obscure. It may be confounded with vertebral caries, sciatica, or coxitis. There is considerable limp on walking, subluxation of the ilium, and pain upon pressing the ilia together. The pain may be reflected down the leg, because of the close proximity of the obturator nerve. If iliac abscess results, there may be some fluctuation, otherwise there is none.

Diagnosis.—The tenderness and soreness over the iliac-joint, together with the absence of caries of the spine and hip-joint disease, and evidence of inflammatory exudates about the joint, will determine the diagnosis.

Treatment.—In sacro-iliac disease, there is a condition of curvature of the lumbar spine. This directly affects the nutrition to the joint. There is a subluxation at the sacro-iliac joint. Treatment should be directed to these conditions only. When abscess occurs, the pus should be evacuated, and the treatment directed toward improving the circulation and nutrition to the affected area.

Radiograph by George M. Laughlin, D. O.

PLATE III.

Radiograph (posterior view) showing the condition of the hip in an old quiescent case of morbus coxarius in a boy aged ten years. There is entire destruction of the head and neck of the femur. There was no abscess formation. There is good motion and about two inches of shortening. Treatment is of no value.

Knee-joint.—(White Swelling).—The knee-joint is more frequently involved than any other of the joints, except in the spine. It is said that the disease begins, in case of the knee, in the femoral epiphysis most often, but may begin in the synovial sac, or joint-capsule. It is most common in young adults. It may follow an acute synovitis. In many cases there is but little swelling, while at other times there may be enormous swelling, with gelatiniform degeneration. There is great muscular spasm. The tissues become glued together and the tibia is dislocated backward. The disease may exist for years. Pain is rarely severe, and the lameness is usually the result of deformity. The sudden spasmodic muscular contraction is one of the peculiarities of the disease. In some cases, there may be rapid destruction of the joint, whereas, in others, it may become quiescent and thus continue for years.

Treatment.—The cause of the disease is a posterior condition of the ilium at the sacro-iliac joint. In many cases, there will be lumbar lesions. Muscular contractions, also, may directly affect the circulation. Subluxations of the hip may be responsible for the ailment. In a case, in a young lady, of one and one-half year's standing, after treatment with plaster cast and iodoform emulsion injections and various other methods, amputation was advised by eminent surgeons. An osteopath was consulted. He cut off the plaster cast, reduced the luxation at the hip, corrected the lumbar spine, encouraged the circulation to the inflamed joint, and obtained a complete cure within a month. The lady had been compelled to use crutches for nearly two years. It has been four years since the case was discharged cured. There has been no evidence of return of the trouble.

It is not necessary to manipulate the joint itself, but all attention should be directed to correcting the lesions, and securing a good blood supply. If seen early, or there is not too much destruction of bone, a cure may be expected in from one to six months. Ankylosis can usually be prevented. By medical or surgical treatment, ankylosis is the rule; in fact, what is looked for. Osteopathic treatment avoids ankylosis, secures good use of the affected joint, and cures the disease.

Ankle-joint.—The evidences of disease in the ankle-joint are simply the evidences of tuberculosis anywhere—more or less fluid effusion, pain in the joint, lameness and limitation of motion. Caseation and sinus may follow, with destruction of some of the bones of the tarsus. The disease is caused by luxations of one or more of the tarsal bones, coupled with injury and deposit of the germs. The treatment is directed to replacing the bones and securing the proper nerve and blood supply. If there is any abnormality at the hip, it should be corrected. Should abscess occur, the treatment must still be directed to assisting and encouraging the circulation. Uniformly good results will follow the treatment. Where the patient is in bad general health, and there is a condition of malnutrition, attention must be directed to any spinal lesions likely causing the mischief.

Elbow-joint.—The disease may arise in the humerus, ulna, or radius. The pain is never great, but is attended by great muscular wasting and limitation of motion. It is produced by subluxations at the elbow and shoulder and by lesions in the cervical spine. The treatment in general is that of synovitis. If a good circulation can be secured, the disease will subside and the inflammatory exudates will be absorbed. The prognosis is favorable.

Wrist-joint.—Tuberculosis of the wrist is rare, and may occur at any age. The joint presents signs of chronic inflammation, and it is fusiform in shape. All the motions of the wrist are impaired, as are also pronation and supination. The tubercular inflammation may begin in the joint-capsule or within the carpal bones. It is caused by luxations of the carpal bones and by lesions in the cervical and upper dorsal spine. The disease will extend over a considerable period. By judicious treatment, attention to the general health, and with the proper diet and hygienic surroundings, a good result may be obtained.

Shoulder-joint.—The disease usually begins at the head of the humerus. There is more or less destruction of the bone by process of dry caries (caries sicca). The disease is said to be more common in adults. In some cases, there may be no swelling, simply a shrinking and destruction of the joint, because of muscular spasm and caries. Pus formation is rare. The disease is occasioned by cervical lesions affecting the circumflex or suprascapular nerves. The blood supply may be affected by muscular contractions and subluxations of the humerus. The treatment is directed toward correcting these lesions.

Hysterical-joint.—Hysterical-joint, sometimes called Brodie's joint, is an affection occurring chiefly in young women. The knee- and hip-joints are the ones involved. There are always evidences of latent hysteria. The disease may be brought on by an injury, while sometimes it may arise almost from suggestion, without apparently any cause. It may follow cases of synovitis, or inflammation of the joints. The patient complains of pain, stiffness, and soreness. It is easy to discover that the patient resists efforts at motion. Muscular atrophy is not great, and is because of non-use. There is hyperesthesia of the skin, so that a slight touch causes more pain than deep pressure. The stiffness of the joint is produced by muscular rigidity. This muscular rigidity is apparently involuntarily produced, and the limb may be in any position of extension or flexion. The position of the thigh is changed at different times. The skin is usually cool, but may become hot at certain periods, when the pain is more excruciating. The pain is more in the nature of a neuralgia. The phenomena attending this disease are not all confined to the affected joint. There are other conditions which indicate that the subject is neurotic. There is evidence of neurasthenia, convulsions, globus hystericus, or other nervous disorders. On the whole, the general health of the patient is good. The hysterical joint simulates, correctly or incorrectly, a certain

Radiograph by George M. Laughlin, D. O.

PLATE IV.

Radiograph showing white swelling of the knee joint. Infection followed vaccination. The case is of one year's standing in a boy fourteen years of age. Abscesses formed and the tibia, patella and the femur are affected. The prognosis is good.

affection, only as the patient understands the symptoms of the disease so simulated. The physician will likely observe that the symptoms disappear when the attention of the attendant is attracted elsewhere. This may not always be true.

Treatment.—The treatment consists in reducing whatever lesion may be found along the spine. Where partial dislocations are present, the reduction of these relieve the impinged nerves and will give instant relief, and the patient may be permanently cured. The application of local remedies and treatment will do no good.

Neuralgia of Joints.—The term "Neuralgia of a joint" applies to those conditions described in texts as "obscure pains within the joint." Pains do not arise *de novo*. The presence of neuralgia simply indicates that there is a nerve impinged somewhere. The location of this pressure upon the nerve can be accurately determined by proper physical examination. There is no excuse for labeling a case of subluxation which may give rise to a terrific pain, idiopathic neuralgia of the joint. Neuralgia of the joint is an impingement of the nerve of the joint without inflammatory reaction. Reduction of the subluxation relieves the condition.

Acute Rheumatic Arthritis, or Acute Rheumatism.

This is an acute febrile reaction, characterized by an inflammation and a fluid effusion in the joints, together with acid sweats and a general interference in the metabolism of the body. The disease begins with malaise and fever, when one or more joints may be affected. Where joints are simultaneously affected, they are apt to be symmetrical, or after the inflammation subsides in one joint, it is apt to reappear in another (metastasis). When the inflammation begins it is evidenced by a burning and pricking pain within the joint. The swelling is often considerable. The joint is hot, red, and stiff, and there may be considerable effusion. As soon as the fluid effusion is sufficient to separate the inflamed surfaces of the synovial membrane, the pain more or less disappears, when in several days inflammation subsides, and finally disappears. Suppuration rarely, if ever, takes place. The disease is attended by pronounced anemia, and the exhaustion is very great. The sweat is markedly acid, the urine scanty, highly colored, and highly acid. Diseases of the heart, such as endocarditis, pericarditis, or myocarditis, frequently result from the circulation of this changed condition of the blood, apparently brought about by the presence of the rheumatism. Occasionally cases are found in which there is a condition of hyperpyrexia.

Treatment.—The treatment consists in removing lesions affecting the kidneys and liver, or in stimulating the function of these organs, thus eliminating the poisons retained in the system. Other bony lesions directly affecting the joints inflamed must be removed. The contractions of the fascia, ligaments, and connective tissues about the joints, must

be relaxed. The lesions are not constant and should be searched for in any given case. The most essential point is to keep the eliminative organs active and the patient well nourished.

Chronic Rheumatic Arthritis.

Occasionally this disease is the result of an acute attack, but more often it arises from other conditions. Associated with this disease are exposure to cold and damp weather, poverty, and hardships. It seems that the tendon-sheaths and the joint-capsules are more or less congested and inflamed, and there may be effusions into the joint. Conditions simulating chronic rheumatism, such as painful joints, are frequently due to spinal lesions, subluxations, muscular contractions, partial dislocations of the hip, involvement of the peripheral nerves, etc. In pronounced cases of chronic rheumatism, affecting several joints, there is a general tendency to the formation of fibrous tissue. The joints become thickened and enlarged, and the muscles atrophy. The contraction of these inflammatory tissues which form about the joint, results in erosions of the articular ends of the bones and in great deformity. Sometimes this deformity may be frightful.

Symptoms.—The joints are enlarged, painful, and stiff. Changes of the weather, dampness, cold, etc., seem to aggravate the condition. Only one joint may be involved, but usually several are implicated. Effort at motion causes crackling in the joint and false crepitus. This may be within the joint itself, or along the tendon-sheaths, and is produced by the roughened condition of the tendons gliding in the sheaths or the roughened ends of the bones scraping over each other. Complete ankylosis may take place in the joints. There is great wasting of the muscles, with profound anemia. There is little tendency to pus formation, although suppuration and caseation sometimes form a disagreeable complication. There is little or no tendency towards recovery.

Treatment.—In this disease, bony lesions are the rule. The removal of these lesions will be attended by a cessation of the pain. Where fibrous tissues have formed extensively, and there is persistent contraction of muscles, not much can be done, especially if the case is of old standing. Nature does not have sufficient recuperative power. Resorption of the fibrous tissues will not take place, and degenerative changes are apt to occur in the tendons, muscles, and ligaments.

Gouty Arthritis, Rheumatic Gout.

This disease arises in the tarsal and metatarso-phalangeal articulations of the feet and hands. It is maintained that the disease is caused by the deposit of the urates of sodium in the periarticular structures. This chemical irritant excites the inflammation leading to the infiltration of the connective tissues about the joint by granulation tissue. This afterward is converted

into fibrous tissues, when contraction, with consequent deformity, arises. The mobility of the joint is lessened. Sometimes the deposit of the urates may be sufficiently large as to cause chalk-stones. Premonitory signs are not the rule, but in some cases they may be observed. The seizure is acute and occurs in the morning when the patient is asleep. He is aroused by excruciating pains in the metatarso-phalangeal articulations (usually the great toe), the joint becomes swollen, painful, and hot to the touch. There may be considerable fever. The intensity of the seizure usually abates within a short time, whereas a recurrence, often with renewed violence, happens the following morning. These attacks recur with varied intensity for several days (six to ten), when the disease subsides. Unless the person gets entirely rid of the cause of the disease, and the system is more or less regenerated, subsequent attacks will lead to a chronic condition, in which there may be great deformity and stiffness of the joint. In some cases, ulceration takes place, and these chalk-stone deposits may be exfoliated. The disease arises in people who eat highly concentrated and highly seasoned foods, and who have been addicted to the use of stimulants. It is attended by hypertrophy of the heart and increased arterial tension.

Treatment.—The treatment is directed toward removing lesions, causing a retention of these urates and to reducing subluxations of the affected joints. Lesions affecting the kidneys are responsible for most of the mischief. When these are removed, and the kidneys act normally, the irritating deposits are absorbed and eliminated. The subluxations of the bones forming the affected joints, as the phalanges and metatarsal, and tarsal, should be adjusted. The circulation to the affected part must be improved and the inflammatory products absorbed. Relief may be given almost at once by this means. The prognosis is favorable. The system must be renovated and the patient placed on a plain, wholesome diet, and stimulants must be avoided.

Osteo-Arthritis, Rheumatoid Arthritis, or Arthritis Deformans (Paget's Disease).

This is a progressive disease, which leads to great deformity, and, oftentimes, to complete impairment of the function of the joint. One of the marked peculiarities of the disease is that it is attended by a great deal of destruction of the cartilages, enlargement and alteration in the articular ends of the bones, and the formation of osteophytes in the fibrous tissue about the joint. Because of the formation of the fibrous tissue and the erosions of the ends of the bones, great shortening of certain bones, such as the phalanges and metacarpal bones of the thumb, may occur. The joints of the extremities are most frequently involved, although it may affect the spine or lower jaw.

Causes.—Exposure to cold, lesions affecting the central nervous system, or the roots of the spinal nerves, and a general depressed condition of the nervous system, are believed to be the causes of the disease.

Pathology.—Inflammatory changes take place in and about the joints, cartilages, ligaments, synovial membranes, etc., leading to fibrosis. The cartilages become eroded and cracked, and by friction on each other, gradually wear away. The pathological process is essentially that of fibrosis, together with a softening of the matrix of the cartilage and the absorption of its elements. It is claimed by some that the process is one of ulceration, but this is hardly true. The changes taking place in the synovial membrane are similar to those which occur in chronic synovitis. Some fluid effusion takes place in the joint. This comes from the congestion of the synovial membrane and the edematous condition of the villus-like processes and fringes of the synovial sac. Sometimes these processes become detached and form loose bodies within the joint. Occasionally cartilages entirely disappear, and because of the ends of the bones rubbing together, they become hard and polished (eburnated) and look like porcelain. This solid condition of the bone is likely due to the development of bony lesions within the Haversian canals and the cavities within the bone. In some cases, erosions take place before the development of such osseous tissues can take place, when the end of the bone presents a honey-combed appearance. Ossification may take place in the tendons and the connective tissues about the joint.

Symptoms.—The following symptoms will be sufficient to determine the disease early. First, a rapid action of the heart, together with vasomotor disturbances, resulting in an increased arterial tension. Second, trophic conditions, due to the affection of the central nervous system, together with a clamminess of the skin and a bronzing of certain areas. Pain is especially marked along the inside of the wrist and over the ball of the thumb. There is characteristic creaking of the joints as in rheumatism, and the pain is increased upon motion of the affected parts. Loose bodies are detected outside of the joints. The margins of the joints are not only thickened, but bulge out; the center of the bone is absorbed, while the margins of the articular surfaces become thickened, because of ossific deposit. Motion is limited and deformity is usually great.

Treatment.—The treatment is directed first to removing the spinal lesions affecting the nerve roots supplying the affected joint. Any lesions affecting the central nervous system must be removed. The treatment of the joint itself is directed toward encouraging the circulation and nutrition. Resorption of the fibrous tissue must be secured before a cure is obtained. The prognosis, especially in old cases, should be guarded.

Charcot's Disease, or Neuropathic Arthritis.

This disease is a peculiar affection of the joints attending the course of certain nervous diseases, especially locomotor ataxia. The exciting cause of the disease may be injury, but the chief cause seems to be cer-

tain lesions of the spine or certain diseases of the nervous system, which bring about the changes in the joint. The disease seems to be characterized by lightning-like pains, and with more or less effusion into the joint of light colored serum, which may diffuse into the surrounding bursae, causing marked enlargements and deformity. It is said, in some cases, that the distension of the joint may be so rapid as to cause dislocation. The joints most frequently affected are the hip, shoulder, and knee. In some cases, the fluid effusion is entirely absorbed, and the joint returns to its normal size, although, apparently, it is considerably weakened. Sometimes the attacks recur, and the patient becomes still more crippled. In certain cases, it may so weaken the ligaments and perivascular structures as to leave a condition of flail-joint. Osseous outgrowths are not unusual, and, in continued cases, this will lead to stiffness of the joint. Where the disease runs a chronic course, hypertrophy of the periarticular structures, and erosion of the ends of the bones, is the rule. Some cases resemble osteo-arthritis, but the rapidity of the onset, together with but one joint being affected, the general absence of pain, subsequent atrophy of the ends of the bones, and the presence of flail-joints, will serve to enable one to make the diagnosis.

Treatment.—The treatment is directed towards removing the spinal lesions affecting the cord and nerve roots supplying the joint. Unless further pathological change in the nervous system can be arrested, and a better nerve supply to the joint can be secured, the prognosis will be unfavorable. If seen early, the locomotor ataxia can be cured. In bad cases, it may be arrested. Usually this will serve to arrest further joint involvement.

Loose Bodies in Joints.

Loose bodies in joints consist of several varieties, which may be classified as follows:

1. Masses of articular cartilages, which have been broken off by violence, and which, by friction, have been worn off into rounded, smooth masses. There may be a nucleus of bone within the center.

2. "Melon seed-like" bodies, the result of fibrinous exudates.

3. Occasionally the villus-like fringes of the synovial membrane become detached, or worn off, and form loose bodies, which have been described by some as being fetal residue.

4. Certain portions of bone may become detached from the surrounding bone, and become covered with cartilage, and exist as foreign bodies. These foreign bodies are nourished by nutritious fluids, by which they are surrounded. The diagnosis of these loose bodies may occasionally be difficult. In the knee-joint, they must be differentiated from displaced semilunar cartilages. The fact that the joint locks in certain positions, would indicate a loose body.

Treatment.—If the foreign body is a serious obstacle to the mobility of the joint, it should be removed by a surgical operation.

Ankylosis.

Ankylosis is a condition of immobility, partial or complete, of a joint. It usually results from inflammation.

Varieties.—(1) false, (2) true, (3) fibrous, and (4) bony.

False Ankylosis is a term applied to that form of stiff joint or ankylosis which arises from changes without the capsule and among the ligaments, tendons, etc., around the joint. Cicatricial contraction in the skin, and formations of fibrous tissue between the tendons and their sheaths, as occur in palmar abscess, are examples of false ankylosis.

True Ankylosis is caused by changes within the joint-capsule, and is the result of inflammation or injury. It is the result of the formation of fibrous tissue, or because of osseous deposits, which bind together the articular ends of otherwise movable bones.

Fibrous Ankylosis (incomplete) may be either false or true, and is the result of thickening or contraction of the ligaments (as happens in rheumatic conditions), or of the formation of fibrous bands, or adhesions, between the ends of the bones (as occurs in synovitis), or in erosion of the cartilages, the result of inflammation, and the subsequent formation of fibrous bands between the cartilages. Some motion is possible in the majority of the cases, although the joints may be entirely fixed.

Bony Ankylosis (complete), sometimes called synostosis, is developed from the union of the whole, or part of the opposing surfaces of two bones, from which the cartilages have become eroded and destroyed. The union is at first fibrous, but afterwards ossification takes place.

Causes.—The causes of ankylosis are various, but may be enumerated as follows:

1. Injury involving the articular surfaces of a joint, the injury being sufficient to destroy the cartilages.

2. Rheumatic or gouty inflammations, which result in the progressive formation of fibrous tissue about the joints.

3. Erosions of the articular surfaces, the result of acute or chronic suppurative conditions.

4. Certain nervous disorders, such as spina bifida, locomotor ataxia, peripheral neuritis, Raynaud's disease, or operations on nerves.

5. Subluxations. The abnormal relations of the bones operate as a source of irritation. Subsequent formation of fibrous tissues may occasion more or less fibrous ankylosis.

Diagnosis.—It is of the utmost importance to determine whether the case is one of true, or bony, ankylosis. The history of the case will determine whether the ankylosis is the result of extensive injury, such as fracture in the joint, or if it is the result of suppuration within the joint. In such cases, the ankylosis will be bony. It is of importance to determine whether there was much abnormality of position or relation of the bones at the time ankylosis occurred. The more abnormal

the position, the greater will be the irritation, and the worse the ankylosis. Dislocations, complicating fractures, will often lead to extensive callus formation and the ankylosis will most likely be complete.

Treatment.—When the inflammatory reaction has not been severe, or within the joint, the prognosis is favorable, even though there is no motion whatever in the joint. All cases, except bony ankylosis, may be benefited. If not *entirely* cured, very great improvement may be obtained.

The treatment consists of persistent manipulative efforts to break up the old adhesions, and secure resorption of the connective tissue elements forming the adhesions and thickening the joint structures. Vigorous efforts once or twice a week, kept up for a period of from one month to two years, should cure all cases. Bony ankylosis is incurable. A surgical operation will do no good. Anesthesia is not necessary to break up the adhesions in false ankylosis, unless it is done at one treatment. It is better to break up the adhesions gradually, as less pain results, and there is no danger to the joint. The patient should be instructed to use the joint as much as possible, consistent with comfort and good health.

DISLOCATIONS.

A dislocation is a partial or complete separation of the articular surfaces of two bones which normally should be in apposition. In fact, any displacement, however slight, whether or not accompanied by injury to the ligaments or other articular structures, constitutes a dislocation. Without doubt, in many cases, such abnormality of relation exists. This abnormality of relation comes under the head of partial dislocations.

Varieties.—Dislocations are divided with reference to degree into partial and complete.

1. **Partial or Incomplete dislocation** is a condition in which the articular surfaces of two bones, which should normally be in relation, are partly separated, but not sufficiently, as a rule, to rupture the ligaments. This variety of dislocation is more common than any other. They are caused by slight external violence and muscular action. The effects of the dislocation are often overlooked, inasmuch as they may be slight at first. Where the bones continue in abnormal relation, structural and functional changes are set up. Dr. A. T. Still discovered the relation between these subluxations and disease. He proved beyond question that subluxations will affect nerve and blood supply directly, or reflexly through the vasomotors. The nutrition of some structure is interfered with, when inflammation, degeneration, atrophy, tumefaction, etc., result. A reduction of these subluxations is attended by a cessation of the diseased symptoms and a return to health. This has formed the foundation of the science of osteopathy. These subluxations are more common in the spine than in any other part of the body. Subluxation of a vertebra may be anterior, posterior,

lateral, or it may consist of a twisting of the bone on the axis of its body. Any of these lesions will cause pressure on the spinal nerve roots, or interfere with the blood supply to the cord itself. This constitutes the most important causative agent in the production of disease. Similar luxations of other bones, as the ribs, bones of the pelvis, thigh, leg, ankle, foot, clavicle, humerus, forearm, wrist and hand, may occur. In any case, disease production will depend upon whether a nerve, artery, or vein is compressed, or if there is an obstruction to the flow of the fluids in the tissues, thereby partially, or completely, arresting the nutrition. Therefore, certain lesions will be found uniformly associated with certain diseases. They constitute the underlying cause, rendering bacterial action, fermentative, and other destructive processes possible.

2. **Complete dislocation** is one in which the articular surfaces of two bones are entirely separated from each other.

3. **Simple dislocation** is one in which there is no wound leading to the surface.

4. **Compound dislocation** is one in which there is a wound leading into the joint, in addition to the articular surfaces of the bones being separated.

5. **Complicated dislocation** is one which is attended by fracture or laceration of the soft-parts, rupture of an artery, great injury to a nerve, etc.

6. **Recent dislocation** is one which is not sufficiently old to permit of the formation of fibrous adhesions which bind the ends of the bones down in an abnormal position.

7. **Old dislocation** is one which has been standing for some months. The inflammatory signs have disappeared, and fibrous adhesions have formed about the head of the bone, binding it down in an abnormal position.

8. **Habitual dislocation** is one occurring in a joint in which the conditions are such as to predispose to a dislocation, as a rent in the capsule not having healed, and the joint cavity being shallow, dislocation takes place readily.

9. **Congenital dislocation** is one which happens because of a lack of development of the joint cavity, or the articular end of the bone, or because luxations have occurred in utero.

10. **Spontaneous dislocation**, or pathological dislocation, is one resulting from slight injury or disease of the joint.

11. **Traumatic dislocation** is one which is caused by injury.

Congenital Dislocations.

Congenital dislocations should not be confounded with those occurring at delivery, as they are not properly congenital.

The *causes* of congenital dislocations are:—

1. Malformation of the joint.

Radiograph by George M. Laughlin, D. O.

PLATE V.

Radiograph (posterior view) of a congenital dislocation of the left hip in a girl aged ten years. Note the malformation of the acetabulum and the smallness of the femur. To effect reduction a radical operation is required. The prognosis is doubtful. Several months' treatment established good motion.

2. Violence in Utero. These dislocations nearly always take place at the hip, but may occur in the shoulder. The causes are obscure. Without doubt, they sometimes follow injury. Because of the fact that sometimes the head of the bone is too large for the cavity, i. e., the head of the bone develops and the cavity does not, or that the cavity is poorly developed, or the head of the bone malformed, leads to the belief that it is one of the results of lesions of the nervous system. Quite likely lesions of the spine bring about this condition, these lesions having been produced by certain positions or injuries in utero.

Condition of the Joint.—The most universally present condition is that the head of the bone is malformed, or, if the head is of proper size and shape, the joint cavity is too small. There is marked atrophy of the muscles, and if the child has attained some age, a new cavity has formed where the head of the bone rests, which, in case of the hip, is on the dorsum of the ilium. The patient has a waddling gait, and if only one hip is involved, there is marked shortening, and when both are affected, there is marked lordosis of the spine. In a grown person, a new capsule has been formed, a new articular surface, and the head of the bone is rounded off so as to fit the abnormal conditions.

Treatment.—The treatment of congenital dislocation varies according to the age of the patient and the conditions present. Usually the case can be successfully treated before the age of ten years, but after that, not much can be done. In some cases, even afterward, the condition of the limb may be greatly improved by treatment, but the dislocation can not, as a rule, be reduced. The methods of reduction are the same as used in recent dislocations. Where shortening of the muscles has occurred, they will require stretching, and perhaps rupturing. to permit of reduction. Some months of energetic treatment may be required to prepare the muscles and other structures for the operation of reduction. The hip should be manipulated twice a week until such time as it is believed reduction may be made. In some cases, the dislocation may be reduced by the ordinary methods and a good result obtained. In these cases, there is a good socket, and the head of the femur is nearly normal. Where there is a malformed saucer-shaped socket, even if reduction can be made, the dislocation will recur. It is necessary to hold the femur in place by a stiff dressing, such as a plaster cast. In many of these older cases, it will be necessary to rupture the adductors before reduction can be made. As little injury to the soft parts should be done as is compatible with reduction. In general, a modification of the Lorenz method is best. An essential feature of the treatment is to secure a good blood and nerve supply to the joint, so that development of the muscles, ligaments, and joint structures, may be encouraged.

Lorenz's Method.—Lorenz devised what he has styled a bloodless method of reducing congenital dislocations of the hip, in contradistinction to the open method of division of the muscles, tendons, ligaments, etc., with the knife, and subsequently replacing the bone. It is

far from a bloodless method, and is condemned by many surgeons as brutal and in many cases harmful. The limb is forcibly abducted and the shortened adductors are torn asunder. All ligaments, or other structures, are torn or stretched by forcibly dragging down the limb. In some cases, a block is used as a fulcrum above and the thigh forcibly abducted, thus compelling the head of the bone to enter the cotyloid cavity. The limb is then fixed in extreme abduction by a plaster cast. After several months a new cast is applied and the limb put in about 50 degrees of abduction and 45 degrees of flexion. The patient is then encouraged to walk. After several months more, this cast is taken off and the limb straightened. The treatment, when modified and supplemented by osteopathic methods, is less harmful and more successful.

Pathological or Spontaneous Dislocations

Are those which occur with slight force, insufficient in the average case to bring about dislocation. The conditions which render these dislocations possible are:—1. A weak condition of the ligaments and a relaxed capsule. 2. Nature of the joint, which may not be thoroughly developed. 3. Chronic synovitis. 4. Tubercular disease. 5. Rheumatoid arthritis. 6. Typhoid fever. 7. Charcot's joint. 8. Locomotor ataxia. 9. Any irregularity in the cavity or head of the bone.

Dislocations, especially in typhoid fever, may take place (usually on the dorsum of the ilium) without the attending physician knowing anything about it, unless examination especially for this condition be made. A careful examination should occasionally be made during the course of this disease, to determine if a dislocation has occurred. A reduction is usually easy, if attempted early. Later, a reduction may be extremely difficult. Fluid effusions in the joint may lift the head of the bone out, or so relax the capsule that dislocations follow. Tubercular disease brings about fluid effusion in the joint, and by thickening of the ends of the bones, muscular contractions in certain positions will draw the head of the bone from its articular surface. In most cases of tubercular disease, dislocation, either partial or complete, is the rule. In rheumatoid arthritis, because of the formation of fibrous adhesions and a consequent contraction, dislocations occur.

Traumatic Dislocations

Are those following injury. The causes are, predisposing, and exciting.

The *predisposing causes* are: (1) Age. (2) Sex. (3) Muscular development. (4) Occupation. (5) Kind of joint. (6) Location of the joint. (7) Diseases of bone, joint, and ligaments. (8) Weakness of ligaments, etc.

Dislocations are most common in middle life, and more common in men than women, because of their occupations. Persons of great mus-

PLATE VI.

Radiograph by George M. Laughlin, D. O.

Radiograph showing a congenital dislocation of the left hip (posterior view) in a boy aged five years. The head and neck of the femur, also the acetabulum, are malformed. Forcible reduction and fixation in a plaster cast are the only means of relief.

cular development are more liable to dislocations, because of the vigorous muscular action. People of certain occupations are more liable to dislocation than those of others, it being necessary for them to take greater risks. Dislocations are more common in ball-and-socket joints than in hinge-joints. Diseases, because they affect the integrity of the ligaments, the amount of fluid within the joint, and sometimes the contour of the articular ends, predispose to dislocations. Some joints, because of their exposed position, are more liable to luxation. In atonic conditions, and in certain spinal lesions, the integrity of the ligaments may be affected to that extent that dislocation may occur. The ligaments require a nerve supply as well as do muscles, skin, arteries, and other structures, and any interference in the nerve or blood supply of these ligaments will necessarily interfere with their integrity. Weakness of the ligaments is a predisposing cause to traumatic dislocations, but more especially to partial dislocations.

The *exciting causes* are external violence and muscular contraction. External violence may be direct, or indirect. All of the causes may operate at the same time to produce dislocation. Deformity is the result of muscular contraction, tension upon the ligaments, and extension of the dislocating force.

State of the Parts in Dislocation.—Usually there is more or less laceration of the ligaments and of the capsule of the joint. There may be no laceration of the capsule, or the opening may be small, or large. When the opening in the capsule is small, it may operate as an impediment to reduction. When there is no laceration of the capsule, reduction is easy. It is only in conditions of lax capsule that will permit of complete dislocation without laceration of the capsule. There may be extensive injury to the soft-parts, such as rupture of muscles, tendons, nerves, or of large vessels. This injury sometimes operates as a complication, and may be of such severity as to demand operative interference.

Later Changes.—Should the dislocation not be reduced soon after its occurrence, inflammation will arise because of the irritation. This inflammation results in the formation of fibrous tissue. This fibrous tissue will be in the nature of adhesions about the ends of the bones. The inflammation may be sufficient to fill the socket which the bone normally occupied. The joint cavity will not be obliterated unless the inflammation is suppurative, when there may be erosion and destruction of the cartilages. Sometimes this inflammation and the pressure of the surrounding tissues cause the formation of a compact capsule, which will hold the bone in abnormal position. In very old cases, a new socket may be formed, while the old socket may still be good, but be filled with fibrous tissue, which of itself will operate as an obstacle to reduction. The muscles about the joint will atrophy because of non-use, and will be bound down because of the inflammation and the formation of the adhesions. Because of the

spasms which result from irritation, the muscles become permanently contracted and shortened. The ligaments undergo changes and become shortened, and in some cases weakened, and in other cases thickened. It may be that a fairly good joint will be formed in the new situation of the head of the bone. In old standing cases where a fairly good new joint is formed, and the history of the case indicates that there has been severe inflammation which would likely obliterate the joint structures, or at least interfere with their integrity, it may be advisable to not attempt reduction. In the treatment of all these old standing dislocations, even if the dislocation is not reduced, treatment will always be followed by benefit.

Signs.—The signs of dislocation may be classified as follows: (1) Pain of a nauseating or sickening nature. (2) Alteration in the general outline of the joint. (3) Rigidity of the muscles about the joint, which is increased on effort of the surgeon to manipulate the limb. (4) Change in relation of the bony prominences about the joint, as in dislocations of the humerus, the greater tuberosity is not found a little below and external to the acromion, as occurs normally. (5) Alteration in the length of the limb. In some cases there may be shortening, in other cases, lengthening of the limb. (6) Alteration in the axis of the limb. (7) The head of the bone may be felt in an abnormal position. (8) The head of the bone can not be felt in its normal cavity. (9) Loss of function, which is more or less complete. Where the diagnosis is impossible, or the signs are obscure, an x-ray examination should be made to determine, if possible, the nature of the injury.

Methods of Examination.—To determine whether or not a dislocation exists, or to definitely make out the pathological condition in the joint, an accurate knowledge of the anatomy of the part and the relation of the structures is necessary. The relation of the bony prominences and of the tendons, muscles, etc., must be observed. The examination should be complete and methodical. All available signs should be taken into consideration, and an effort should be made to determine the relation of each structure in turn. An accurate history of the injury should be obtained. The nature of the deformity should be considered, and whether or not it has recurred. A dislocation may be mistaken for a sprain, for effusions in the joint, or for fracture. Where the condition can not be made out, and there is too much swelling, antiphlogistic measures may be used to get rid of the inflammation and swelling, so an accurate diagnosis can be made. Where the parts are painful, it is better to administer an anesthetic and make a complete and careful examination. If a dislocation exists, it should be reduced at once. When it is possible, an x-ray examination should be made, which may lead to a diagnosis. Furthermore, when luxations occur, if they are reduced, usually they will not recur. Deformity from other injuries may recur.

Treatment.—(1) The luxation should be reduced. (2) The bones

PLATE VII. Radiograph by George M. Laughlin, D. O.

Radiograph (posterior view) of a congenital dislocation of both hips in a girl aged nine years. Note that the cotyloid cavities are malformed. Treatment was slightly beneficial.

should be maintained in a normal position until the capsule of the joint heals and the ligaments return to their normal condition.

Methods of Reduction.—A. Manipulation.—In general, this consists of:—

1. Adduction.
2. Abduction.
3. Flexion.
4. Extension.
5. Rotation.
6. Circumduction.

Or any combination of these movements which have for their purpose:

(a) To relax tense muscles, tendons, ligaments, etc.

(b) To disengage any bony prominence or the head of the bone.

(c) To direct the luxated bone so that it will return to its articulation over the same route by which it got out. That this manipulation may be properly executed, it is very necessary that the anatomical relation of the structures be understood; furthermore, what muscles or ligaments are put on a stretch, or what structures operate against reduction. The reasons why manipulative methods are more successful in the hands of some operators than others, is because they more thoroughly understand the condition of the parts. This method is by all means best, because it is attended by little or no injury. That it will be successful in all cases, if attempted within a reasonable length of time, is proven by osteopathic methods and results.

B. Extension and Counter-extension. Extension and counter-extension should be used only as a *dernier* resort. This contemplates forcibly dragging the bone into the normal position, regardless of the way in which it got out. Great harm has been caused by this method of reducing dislocations, and as we better understand the anatomy of the joints, and the morbid conditions of dislocations, the more we will use manipulative methods. The old method of reducing a dislocation of the humerus under the coracoid process was to put the unbooted foot in the axilla and make traction on the arm, forcibly dragging the bone into the socket. Now we have better methods, although this method may be used with great advantage sometimes. Ofttimes extension and counter-extension can be used with great advantage with manipulation. It is of service many times in breaking up adhesions in old standing dislocations. Extension and counter-extension is made by the hands or by a clove-hitch, by weight and pulley, or by hooks. The hooks are fastened into one of the fragments, in case of fracture, and by this means traction can be made.

After Treatment.—The limb should be kept quiet until the opening in the capsule has had an opportunity to heal. A suitable bandage should be applied and the parts allowed rest.

Compound Dislocations.

Compound dislocations are those in which not only the bone is dislocated from its normal cavity, but there is a penetrating wound into the joint. The treatment depends largely upon the state of the

parts. Operative interference may be necessary. It may require amputation or excision, depending largely upon the amount of destruction of the bone. Should there be extensive destruction of the bone, and a stiff joint would render the limb useless, amputation may be advised. The wound should be treated as an ordinary wound, by the strictest asepsis, and provision for drainage. Manipulation should be begun early and kept up regularly in order to prevent fibrous adhesion. Sometimes fairly good results can be obtained in children after extensive injury to a joint, especially if manipulation is begun early and kept up. As a rule, in elderly people, true ankylosis of a permanent nature will develop if there is extensive injury.

Old Dislocations.

When a dislocation has existed for from four to eight weeks, fibrous adhesions form around the ends of the bones, the opening in the joint capsule closes, while other periarticular structures, such as tendons, arteries, veins, nerves, etc., become bound down in abnormal positions. By old methods, the reduction of these dislocations was often attended by frightful injury, as evulsion of the limb, or fracture. An open cutting method was advised, whereby all impediments to reduction were cut and the bone put back in its proper position. This operation is also unsuccessful. Hence the question, "How long after the dislocation happens may reduction be safely attempted," was a most important one. Here, as in many other instances, the results obtained by osteopathic methods are such as to revolutionize the science of surgery. Dr. Still has reduced dislocations of the hip of seventeen years' standing. Because of his great skill in reducing old dislocations of years' standing, when the most eminent practitioners of other schools had failed, he has earned a wide and enviable reputation. The methods are simple, but require a thorough knowledge of the anatomy of the joint and periarticular structures. The adhesions should be gradually broken up and the ligaments and muscles stretched to permit of reduction without injury. In some cases it may require some time to thoroughly prepare the joint. In other cases, reduction may be effected at once. In general, the manipulative methods are similar to those used in recent dislocations. It will be necessary in many cases to promote a healthy circulation and nerve supply to the joint to secure resorption of the inflammatory tissues before reduction may be safely attempted. No definite time may be set down as to when dislocations become irreducible. It all depends upon the condition of the tissues about the joint and the joint itself. Where too extensive injury has taken place, and the tissues will not yield readily to treatment, the prognosis is unfavorable.

Injuries Attending Reduction.—Sometimes, because of the vigorous methods used, injury to the articular or periarticular structures will occur. These may be classed as:—

1. Fracture. This is sometimes the result of using the bones as levers, or where too great force is used.

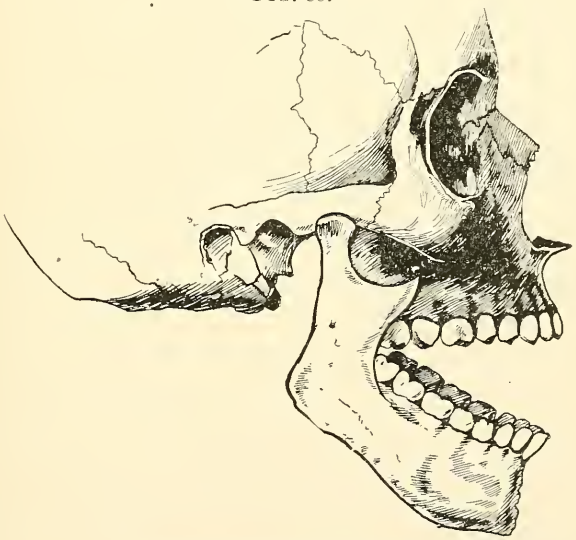
2. Extensive injury of the soft-parts, i. e., injury to nerve, vein, artery, muscle, or tendon.

3. An adhesive or suppurative inflammation may be excited, which may bring about ankylosis.

4. Rupture of the skin and soft-parts, producing a compound condition, will render sepsis possible.

5. Evulsion of the limb. Cases have occurred where such great force has been used in traction that a limb has been torn from the body. There is no need of any of the above injuries being produced. Dislocations may be reduced without such barbarous methods.

FIG. 89.



Dislocation of the lower jaw forward.

Special Dislocations.

Lower Jaw.—The lower jaw may be dislocated forward or backward (very rare). The forward dislocations may be unilateral or bilateral. They occur more frequently in women in middle life, and seem to be brought on by vigorous efforts at yawning, laughing, and vomiting. The condyle is drawn from its normal position, chiefly by the external pterygoid muscle. The condyle is usually luxated into the zygomatic fossa, while the temporal, masseter, and internal pterygoid muscles hold the bone fixed in the abnormal position.

Signs.—There is a hollow behind the luxated condyle. The mouth is permanently wide open, and the saliva dribbles away. The person attempts to talk, or to explain the condition, and is unable to because of inability to close the mouth. In the unilateral dislocation, there is a hollow on but one side of the head and the teeth are out of line.

Unilateral dislocations are rare. Backward dislocation is questionable, and the symptoms are not worth considering.

Treatment.—The reduction of dislocation of the jaw is best accomplished by wrapping the thumbs with a handkerchief, so as to protect them, and inserting them in the mouth, one on either side. Strong pressure is made downward upon the molar teeth, while at the same time the operator should lift up on the symphysis by means of the fingers. In this manner, the condyles are moved back into the glenoid fossa. Should this fail, a cork may be placed between the molar teeth. This acts as a fulcrum when pressure is made upward on the symphysis, and as the bone is lifted from its position, it may be carried backward into the articulation. As a rule, unless the thumbs are wrapped, because of the contraction of the muscles when the reduction is accomplished, the operator may have his thumbs wounded.

Subluxation of the Lower Jaw.

Subluxation or partial dislocation of the lower jaw may refer to one of two conditions. There may be a partial dislocation of the condyle from the interarticular fibro-cartilage, or there may be a subluxation of the fibro-cartilage from the eminentia articularis. In either case, it may interfere markedly in chewing, so that the person may, on effort to close the mouth, find motions of the jaw suddenly arrested. In several months, perhaps, this will disappear of itself, or there may be permanent difficulty in closing the mouth. The luxation can readily be relieved by the proper manipulation.

Dislocation of the Clavicle.

The clavicle may be dislocated both at its sternal and acromial extremity.

Sternal Extremity.—Dislocations of the sternal extremity are: 1. Forward. 2. Upward. 3. Backward.

Forward dislocations are produced by falls and blows upon the shoulder. Usually the blows are directed backward and the falls forward, so that the shoulder is driven backward. The sternal extremity is tilted forward and is driven on the front of the sternum.

Signs.—The symptoms are plain. The clavicle makes a marked prominence on the front of the sternum. Its relation with the sternum is impaired. The head of the bone lies over towards the middle line of the body. The distance to the acromion process is less than on the sound side. The sterno-mastoid and other muscles of the neck are put violently upon a stretch. The method of reduction is to place the knee in the interscapular space over the spine, and to make traction outward and backward on the two shoulders. In this manner, the head of the bone is drawn into its normal position. Should this not be successful, while an assistant makes traction outward and backward on the

shoulders, the operator may manipulate the bone and push it into place. This injury is best treated by means of a posterior figure-of-8 bandage. While the bone is held in position, a gutta-percha splint may be moulded to the surface of the body. This, when lightly padded with lint, may be bandaged into position. This, in addition to the figure-of-8 bandage, will be sufficient to maintain the bone in its normal position. A Velpeau's bandage may also be used. Where there is complete rupture of the ligaments, it is difficult to maintain the bone in position, so that more or less deformity will result. The original dressing to hold the bone in position should be kept on for a period of three or four weeks. After that, a dressing which will draw the shoulders backward will assist in keeping the bone in position.

Upward dislocation of the clavicle is very rare. The cause is a fall upon the shoulder, which drives the acromial end downward and inward, tilting the clavicle upward and inward. The diagnosis is easily made. The shoulder falls down and in, and the clavicle makes a marked prominence in the suprasternal notch. It may be possible that the head of the clavicle presses so much upon the trachea that dyspnea will result. The dislocation is easily reduced. Extension can be made upon the arm outward from the body, and the counter-extending force may be made by a sheet passed around the body beneath the arm. As the bone is dragged into position, it may be held in situ by means of a Velpeau's bandage. A firm pad, or gutta-percha splint, is placed over the sterno-clavicular joint. In some cases it may be advisable to wire the bone in position. Usually, if the case is seen sufficiently early, a good result may be obtained by the application of proper dressings.

Backward dislocation of the clavicle is rare. The causes are severe direct violence. The symptoms are pronounced and urgent. There is marked pain, interference in breathing, and dysphagia. The shoulder has fallen downward and inward, while there is a depression over the point where the head of the clavicle should normally be felt. Occasionally there may be obliteration of the pulse in the arm, because of pressure on the subclavian artery, or there may be great venous congestion of the head, because of pressure upon the external jugular, and to some extent, upon the internal jugular. The dislocation may be reduced by means of traction outward and backward upon the shoulders, with pressure by the knee between the scapulae. In some cases this method of reduction is said to have failed. Still more vigorous traction may be made upward and backward upon the affected side. In other rare instances it is said that an operation may be necessary to remove the end of the clavicle. After reduction, the head of the bone may be held in position by a posterior figure-of-8 bandage.

Acromial Extremity.—Dislocations of the acromial end of the clavicle may be upward or downward. If upward, the clavicle may lie on top of the acromion, and if downward, it may lie beneath it. These dislocations are produced by blows forcing the scapula forward, or by blows on top of the clavicle, forcing it downward.

Signs.—The signs in case of dislocation of the clavicle *upward* are a prominence of the clavicle on top of the acromion; more or less impaired function of the arm, as inability to raise the arm. The head is usually inclined to the affected side, and there is more or less contraction of the trapezius muscle with an outlining of its clavicular border. The arm is apparently lengthened. This dislocation upward is reduced by pulling the scapula backward, which can be done by traction on the arm and by pressing downward upon the clavicle. By former methods considerable deformity often resulted from this dislocation. A strip of adhesive plaster, carried around underneath the elbow and over the top of the clavicle, may be sufficient to hold the bone in proper position. Rhoads's dressing consists of a strap passing underneath the elbow and over the top of the clavicle, with a second strap extending around the chest underneath the axilla, and which is fastened to the perpendicular strap, thus preventing it from slipping off. This may be buckled sufficiently tight to hold the clavicle in position. In reducing a dislocation *downward*, the clavicle is raised, while the scapula is pushed outward and backward. Not much difficulty will be experienced in effecting reduction. The same kind of dressing is used as in dislocation upward.

Dislocation of both ends of the clavicle may occur in rare instances simultaneously. The treatment would be a combination of the methods used in reducing dislocations of the outer and inner extremity.

Dislocation of the Scapula.

A condition which was formerly called a dislocation of the scapula, as when the lower angle was believed to slip out from underneath the latissimus dorsi muscle, is now considered to be a condition of paralysis of the posterior thoracic nerve. Attending this condition will be found a vertebral lesion, which if reduced, will result in restoring the integrity of the serratus magnus muscle and the apparently luxated condition of the scapula will disappear. There are some cases where the latissimus dorsi muscle takes a portion of its attachment from the scapula, and because of injury, this attachment may be torn loose. In this condition, no vertebral lesion will be found.

Dislocations of the Shoulder-joint.

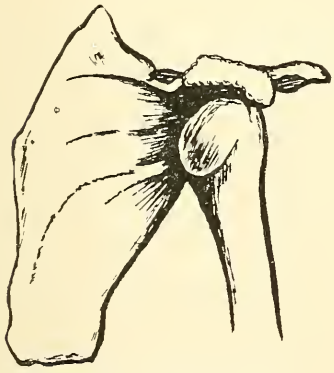
Dislocations of the Humerus, both partial and complete, are common, because of the exposed condition of the joint, shallowness of the glenoid cavity, and, in some cases, because of a relaxed or weakened condition of the ligaments. These dislocations are most frequently found in muscular adults.

Cause.—Falls on the extended arm or elbow, or directly upon the shoulder. It may result from twists of the arm, or from muscular action.

Varieties.—1. Subcoracoid. 2. Subglenoid. 3. Subclavicular. 4. Subspinous.

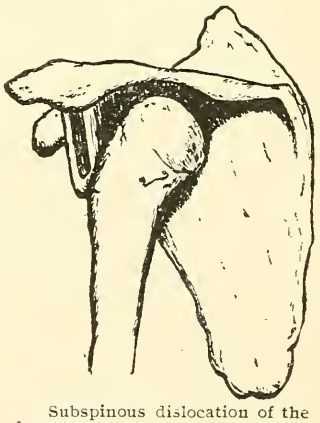
Symptoms.—In addition to the general symptoms of dislocation, there are certain signs in connection with dislocations of the shoulder, which are of great importance, and merit careful consideration. (1) Perhaps the most prominent symptom is prominence of the acromion process, together with (2) flattening of the shoulder. This will contrast sharply, when compared with the sound side and the normal rotundity of the shoulder. Sometimes this flattening of the shoulder will even be exaggerated into a depression beneath the acromion process. It is increased by raising the arm. (3) Change in the axis of the bone. (4)Alteration in the length of the limb when compared with the sound side. (5) Absence of the greater tuberosity from a little below and

FIG. 90.



Subcoracoid dislocation of the humerus.

FIG. 91.



Subspinous dislocation of the humerus.

external to the acromion process. In all cases, unless the condition is obvious, the examination should be taken up methodically.

Tests.—The following tests will be of use in determining the nature of the condition in question:

1. The circumference of the luxated shoulder is at least two inches greater than on the sound side. This is determined by passing a tape-line underneath the axilla and over the top of the acromion.

2. Straight edge test (Hamilton's). A straight edge, which touches the external condyle and the acromion process, proves that there is a dislocation. Normally, it will not touch these two points, because of the presence of the greater tuberosity a little below and external to the acromion.

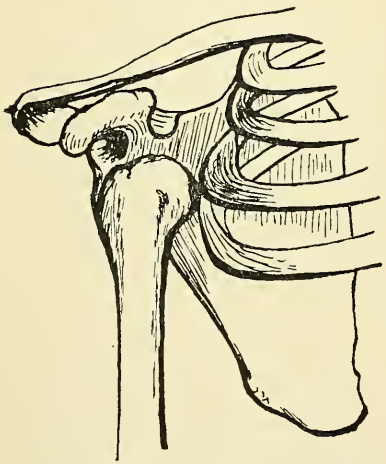
3. Change in the axis of the bone. With the hand on the opposite shoulder, the elbow can not be brought in relation with the chest.

4. In a thin subject, the greater tuberosity may be felt a little below and external to the acromion process.

In doubtful cases, the shoulder should be exposed to the x-rays.

Subcoracoid Dislocation is more frequent than all other dislocations of the shoulder. In this injury the head of the bone is displaced forward, downward, and inward under the coracoid process. The head of the bone rests on the anterior surface of the neck of the scapula, just beneath the coracoid process, while the groove just back of the head of the humerus rests on the anterior margin of the glenoid cavity. The capsular ligament is torn at its lower and inner portion. It may be detached from the glenoid cavity. The subscapularis muscle is often raised up, or partially torn loose, from the anterior surface of the scapula, while the muscles which are attached to the greater tuberosity (supraspinatus, infraspinatus, and teres minor) are put tightly

FIG. 92.



Subglenoid dislocation of the humerus.

FIG. 93.

Subclavicular dislocation of the humerus.

on a stretch. The subscapularis may be torn at its insertion, as may also happen with the muscles attached to the greater tuberosity. In rare instances, it is said that the greater tuberosity may be detached. This dislocation is described by the old writers as intracoracoid, inasmuch as the head of the bone rolls underneath the coracoid process. In this dislocation, the signs are distinctive; the head of the bone may be seen making a marked prominence on the front of the chest; the elbow projects outward and backward; there is shortening of the humerus, depending upon how far the head of the bone is displaced inward. All the other signs of dislocation of the humerus are present.

Subglenoid Dislocation.—Next to the subcoracoid, the subglenoid dislocation is the most common. In this dislocation, the head of the bone rests upon the anterior border of the scapula, below the glenoid cavity. The capsular ligament

is ruptured in its lower portion, while the muscles attached to the greater tuberosity are put violently on a stretch. The deltoid muscle may be paralyzed, because of pressure or injury to the circumflex nerve. The symptoms of this dislocation are distinctive. In general, all the evidences of dislocation of the shoulder are present. There is lengthening of the arm, i. e., the distance between the external condyle and the acromion process is greater than on the sound side, and, in addition, there is a marked depression beneath the acromion process. The head of the bone can be felt in the axilla. In a moderately thin subject, a marked space of two inches can be felt between the head of the bone and the acromion. The elbow is carried away from the side; in some cases, it may be directed backward, and in others, forward, depending upon the position of the bone. In exaggerated conditions, it is said that the elbow will be raised on a level with the head, being neither abducted nor adducted—this was formerly called *luxatio erecta.*

Subclavicular Dislocation.—Subclavicular dislocation is rather rare, and it seems to be but an exaggerated form of the subcoracoid dislocation. The head of the bone is carried inward beyond the coracoid process, underneath the clavicle. The capsule is ruptured in the lower and inner part. The head of the bone plows up the pectoral muscles and rests on the ribs, beneath the clavicle. The subscapularis muscle is torn from its attachment to the anterior surface of the scapula; it is detached from the humerus. The attachments of the muscles to the greater tuberosity are more or less torn, but they retain their attachments, as a rule, to the capsular ligament. The head of the bone may be seen, making a marked prominence, beneath the clavicle. The shaft can be felt in the axilla, and there is marked shortening of the arm. It lies in close relation with the chest. The elbow usually projects backward, and a little outward.

Subspinous Dislocation.—Subspinous dislocation is very rare. The head of the bone is forced out of the glenoid cavity, between the infraspinatus and teres minor muscles, and rests on the dorsum of the scapula, just beneath the spine, in the infraspinous fossa. In some cases, the head of the bone will be found just behind, or resting upon the edge of the glenoid cavity. The elbow is directed forward and outward. The humerus is rotated inward. The head of the bone makes a marked prominence on the dorsum of the scapula, while the other signs of dislocation are present. In addition to the signs already mentioned, there may be evidences of injury to the soft tissues. These are evidences of injury to the brachial plexus, intense pain or numbness, and even paralysis in some cases, or the pressure upon the axillary vein causes intense edema of the arm. The axillary artery may be compressed to such an extent as to obliterate the pulse at the wrist. There may be great effusion of blood, especially where there is considerable laceration of the capsule and other soft tissues about the joint. These severe symptoms

and the signs of dislocation before mentioned, are not present in conditions of subluxation or partial dislocation at the shoulder-joint. These conditions are common, and are produced by pushing the head of the humerus underneath the coracoid process, without rupturing the capsule, but with injury to the long head of the biceps, or the long head of the biceps may be luxated from its tendinous groove.

FIG. 94.

First step in Kocher's method of reducing anterior dislocations of the humerus.

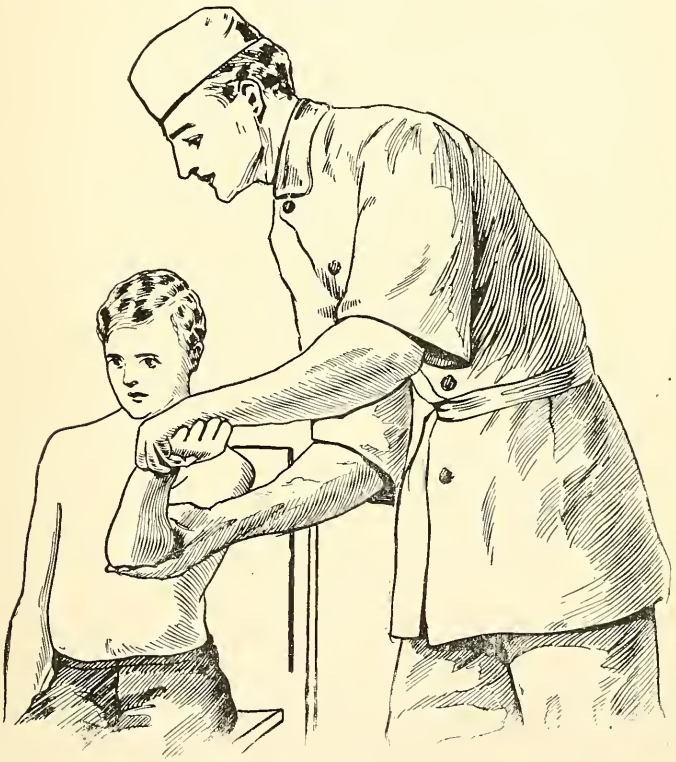
Treatment.—1. Kocher's method, suitable for anterior dislocations, consists of external rotation, adduction, and internal rotation. External rotation should be complete, and is performed in order to relax the muscles attached to the greater tuberosity. The elbow is then carried to the middle line of the body in order to bring the head in relation with the opening in the capsule, and, as internal rotation is accomplished, the head of the bone will slip through the rent in the capsule without difficulty.

2. Other manipulative methods are as follows: If the dislocation is in the right shoulder, the head of the bone is grasped by the left

hand, while the elbow is seized with the right hand; the arm, in case of an anterior dislocation, is rotated outward, with more or less extension from the body. The knee, against the chest wall, may be used as a counter-extending force. The head of the bone may be dragged by the left hand into the cavity. This manipulation may be modified to suit all the dislocations.

3. Manipulative methods, with extension, may be made with the patient sitting in a chair, when the operator's foot is placed on the edge

FIG. 95.



Second step in Kocher's method of reducing anterior dislocations of the humerus.

of the chair, with the knee in the axilla. The knee is used as a fulcrum, while the arm is seized above the elbow, the humerus being used as a lever, when the head of the bone is lifted into the socket.

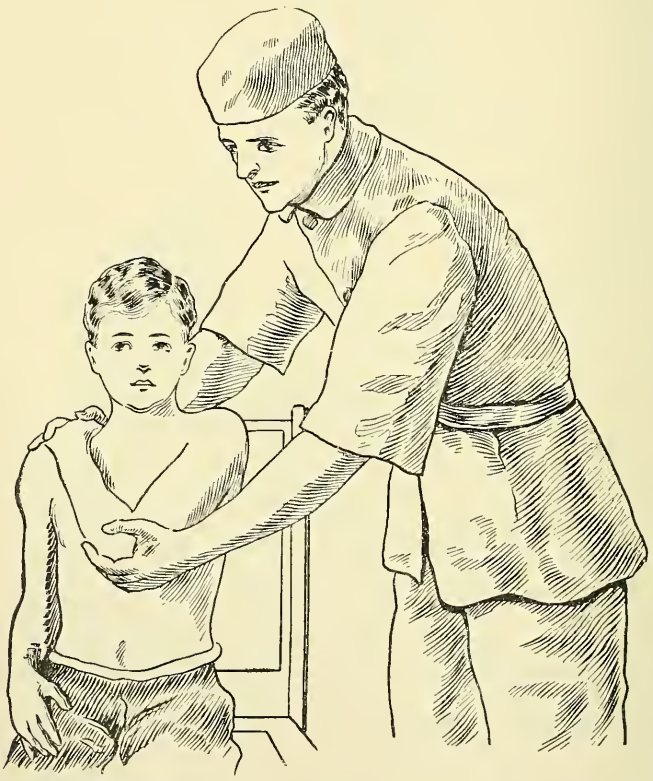
4. Extension may be made from the body with counter-extension by means of a towel or sheet passed underneath the axilla. This method may be successful when other methods have failed.

5. Forcible extension downward. The unbooted foot may be placed in the axilla, so as to rest against the lower border of the glenoid cavity, and strong traction is made on the arm. Where sufficient grasp can

not be gotten on the arm, a clove-hitch may be used around the arm. By this means the head of the bone may be forcibly dragged into the socket.

6. Air-cushion in the axilla. Where the dislocation can not be reduced, an excellent treatment is to place an air-cushion in the axilla, and bind the arm to the side. This air-cushion may lift the head of the bone out of its position, when reduction can easily be effected. In

FIG. 96.



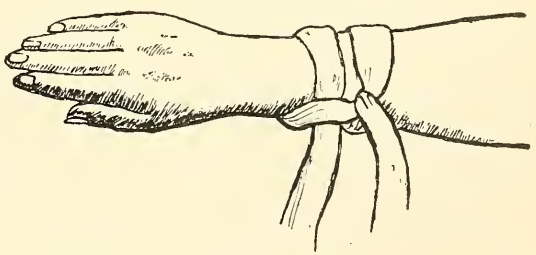
Completion of the manipulation in Kocher's method of reducing anterior dislocations of the humerus.

reducing a dislocation of the shoulder, care should be taken not to injure the axillary vessels, the brachial plexus, or to fracture the bone. The old method of placing the foot against the chest wall, and making traction on the arm, has resulted in fracture of the upper ribs. These methods are barbarous. Extension by means of pulley and tackle should not be used, as it has resulted in severe and extensive injury. Milder methods are more successful. All recent dislocations should be reduced by manipulative methods. Anesthesia may be necessary, but, in nearly all cases, the dislocation may be reduced without it. After the dislocation is reduced, a Velpeau's bandage may be applied or the

arm may be bound to the chest, for a period of three weeks. After the first week, manipulation will assist the return of the tissues to their normal condition, and, after the third week, the bandage may be removed.

Reduction of old dislocations of the shoulder is best effected by means of manipulation. Extension under ether is a bad procedure. The great mortality of anesthesia, in the reduction of shoulder dislocations, is brought about by the fact that the chest is compressed and respiration interfered with, together with the fact that profound anesthesia is necessary to effect the entire relaxation of the muscles. Such vigorous methods are unwarranted. Milder methods will be found successful, if persisted in. Manipulation might not be successful at first, but it may be successful later. Continued manipulation, breaking up of adhesions, relaxing contracted muscles, releasing bony prominences, and securing a better circulation to the injured tissues, all tend to make reduction easier. If the dislocation is complicated by fracture, an effort at reduction should be made by traction and manipulation of the head of the bone. This should be done very cautiously. If reduction is impossible, McBurney advises an open incision and a hook attached to the scapula, with another hook fastened to the humerus; by these, traction is made, and the dislocation reduced, when the fragments are subsequently wired together. Usually, there is sufficient periosteum, which unites the fragments, and the muscular attachments are such that the dislocation can be reduced without operative procedure. In emergency cases, gimlets have been used to bore into the bones and traction made from them. This is hardly warranted.

FIG. 97.



The clove-hitch applied as a means of making extension.

Subluxations are reduced by methods similar to those used in complete dislocations. The condition may return, when subsequent reduction is necessary. If the nerve and blood supply to the joint and other structures are properly improved, a cure will be effected.

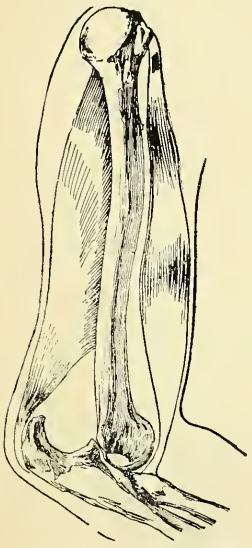
Dislocations of the Elbow.

Varieties:

1. Dislocation of both bones (ulna and radius).
   a. Backward. b. Inward. c. Outward.
   d Forward (with fracture of olecranon.)
   e. Ulna backward and radius forward.
2. Dislocation of the ulna backward.
3. Dislocation of the radius.
   a. Forward. b. Outward. c. Backward.

Dislocation of Ulna and Radius Backward.—Causes.—The causes are direct and indirect violence, operating together, as falls upon the hand or wrenches of the arm. The injury is more frequent in young people, and is often accompanied by laceration of the soft-parts. The injury to the tissues depends somewhat upon the nature of the dislocation.

FIG. 98.



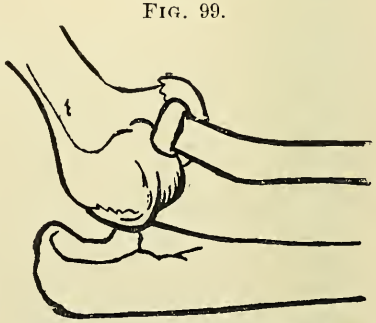
Dislocation of both bones of the forearm backward.

Condition of the Parts.—In dislocation backward, (which is the most common dislocation at the elbow) there may be, at the same time, more or less displacement of the bones inward or outward. As a rule, the coronoid process will be found in the olecranon fossa. If the coronoid process is not broken off, the attachment of the brachialis anticus muscle is, more or less, torn loose. The neck of the radius will be found in relation with the articular surface of the humerus. The anterior ligament is nearly always torn, while sometimes the lateral ligaments are ruptured. The olecranon and the head of the radius form a marked prominence on the back of the arm, while the lower end of the humerus makes a marked prominence below the crease at the bend of the elbow. The relation between the condyles and the olecranon will be found changed. The forearm is *fixed, flexed* and *shortened.*

Dislocation of Both Bones Inward is produced by falls upon the elbow and forearm. The internal and external lateral ligaments are ruptured unless the dislocation is but slight. The relation of the condyles and the olecranon will be found changed. The outer condyle stands out prominently, while the inner condyle is obscured by the upper extremity of the ulna lifting up the flexor muscles. The upper extremity of the ulna will be found to stand out prominently on the inner side of the arm, while the head of the radius can not be felt. The deformity resulting may be twisted or angular.

Dislocation of Both Bones Outward will be evidenced by the marked prominence of the inner condyle of the humerus, and the prominence of the head of the radius beneath the supinator longus on the outside of the arm. The relation between the

FIG. 99.



Dislocation of the radius forward and the ulna backward at the elbow.

condyles and the olecranon is altered. There is loss of function, and the swelling and elevated muscles more or less obliterate the external condyle.

Dislocation of Both Bones Forward.—In this dislocation, fracture of the olecranon process usually takes place, although rare cases have occurred where there is no fracture, the dislocation having been produced by dragging down both bones, and, at the same time, forcing them forward. In either case, a marked lengthening of the limb, the absence of the olecranon process on the back of the humerus, and alteration in the relation between the condyles and the olecranon, will serve to make the diagnosis.

Treatment.—Reduction of the backward dislocation is best accomplished by the following methods:

1. Dr. Still makes traction on the forearm in exaggerated extension, the object being to lift the coronoid process out of the olecranon fossa. This method will be found successful in all recent cases.

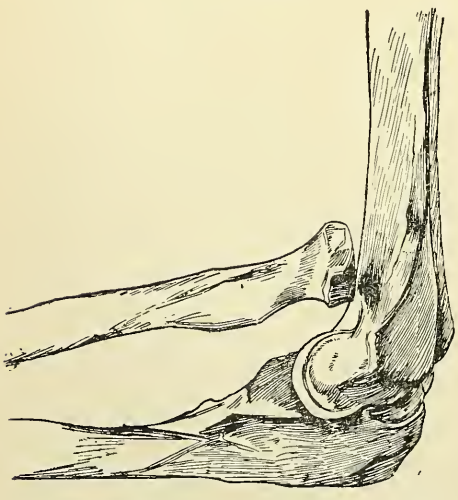
2. Some operators use the following method: The front of the knee is placed against the front of the elbow-joint; this operates as a fulcrum against the upper extremity of the forearm. Traction and flexion are made simultaneously, the forearm being used purely as a lever. In this way, the coronoid process is lifted out of the olecranon fossa and reduction is accomplished. In dislocations inward, outward, or forward, extension and counter-extension are made to overcome the rigidity of the muscles and the contracted ligaments, while the operator molds the bones into position. The same course should be pursued in dislocations of the ulna backward and the radius forward. Where the diagnosis can not be made, an *x*-ray examination should be made, if possible. Great swelling is the rule. This swelling obliterates the landmarks about the elbow-joint. Sometimes the elbow is so painful that even a superficial examination can hardly be made. Under no circumstances should the patient be treated, except, perhaps, for a few days, to combat the swelling, unless an accurate diagnosis has been made. The reasons for this are that old dislocations of the elbow are difficult to reduce, and the great liability of fibrous adhesions impairing the integrity of the joint. Perhaps in no other location of the body are injuries attended by worse results; still, there are many cases where the severest forms of injury have been attended by the most remarkable results, but these cases are unusual. In old cases, the family or friends of the patient should be notified of its gravity. A too favorable prognosis should not be made. The treatment will depend upon the nature of the injury. In old dislocations of both bones backward, the prognosis is not favorable, especially if there has been extensive inflammation following the injury. The coronoid process will become, as it were, glued into the olecranon fossa. Fibrous adhesions will prevent reduction. In dislocations inward, or outward, and both bones forward, or the ulna backward and the radius forward, reduction can be accomplished better, and

more readily, and the results are better. In reducing these old dislocations, it is necessary to prepare the joint for the operation of reduction. This means that the fibrous tissue must be gotten rid of. While the bones may not be gotten into absolutely normal relation, the treatment by manipulative methods will be attended by improvement of the condition of the joint. Not only the range of motion will be increased, but the pain will be lessened, and the deformity more or less removed, so that the prognosis in old cases is much more favorable where osteopathic methods prevail.

Dislocation of the Ulna Backward.—This injury is rare and occurs because of force directed upon the ulna itself. The most common dislocation of the ulna is a condition of subluxation of the upper extremity brought about by falls upon the hand, where more or less force is directed against the inner side of the arm. The head of the radius is used as a fulcrum, while the forearm is adducted. Partial dislocation of the upper extremity of the ulna may take place without rupture of any of the ligaments. This injury is often overlooked. Reduction is accomplished by exaggeration of the deformity, the thumb being placed against the inner border of the coronoid process. While extension with abduction and adduction is made, the ulna will be returned to its normal position.

Dislocation of the Radius Forward is said to be the most common dislocation at the elbow, and is caused by falls upon the hand with the arm extended, and the forearm pronated. Some writers have maintained that forced pronation and muscular contraction will produce the dislocation. The head of the radius rests against the front of the humerus, the arm is in a semi-flexed position, while the head of the bone can no longer be felt beneath the external condyle. The arm may be flexed voluntarily, but will come to a sudden stop, because the head of the bone, being drawn upward by the biceps muscle, will be brought forcibly against the anterior surface of the lower extremity of the humerus. At the point beneath the external condyle, where the head of the radius should be, there is more or less of a hollow. The arm can not be fully supinated, but can be pronated.

FIG. 100.



Dislocation of the radius forward at the elbow.

The diagnosis of the dislocation is difficult, especially in muscular or fleshy subjects. The injury may be confounded with fracture of the neck of the radius or an epiphyseal separation.

Differential Diagnosis.—1. Crepitus. In fracture, crepitus may be obtained, while in dislocation, crepitus will be absent, except in case of adhesions or roughened conditions of the ends of the bones, when false crepitus only will be obtained.

2. Preternatural mobility. In fracture, preternatural mobility may be obtained, by grasping the head of the bone and pronating and supinating the arm; the head of the bone will be found not to move. In dislocation, if the head of the bone can be grasped, it will be found to rotate with the shaft of the bone, upon pronation and supination.

3. Reduction of the fracture will be followed by a return of the deformity, whereas, in dislocation, if it is reduced, the deformity will not return. In epiphyseal separation, where there is not much swelling, a sensation as of a foreign body in the joint may be obtained and moist crepitus is present. Where the diagnosis is clouded, an x-ray examination should be made. Where this is not possible, the prognosis should be guarded. Where the diagnosis can not be made, the deformity should be reduced and treated as a fracture.

Reduction of the dislocation is accomplished by extension applied more particularly to the radius, while the bone is manipulated into position, or the knee may be used as a fulcrum against the upper part of the forearm, as the forearm itself is used as a lever, at the same time, more or less extension is made.

Dislocation of the Radius Backward is produced by falls upon the hand in supination. The head of the bone can be readily felt beside the olecranon back of the external condyle. The forearm is flexed and pronated. The diagnosis is usually easy. While extension is being made, the bone is manipulated into position. The knee may be used as a fulcrum, as the head of the bone is drawn into position.

Dislocation of the Radius Outward is rare. The head of the bone is displaced to the outer side of the outer condyle, where it makes a marked prominence. The head of the bone can be readily felt rotating in this position, upon pronation and supination. Rotation of the radius, together with forced extension, will easily effect reduction.

Subluxation of the Radius.—Subluxation of the head of the radius is a common injury, more frequent in children. It is the result of muscular action, twisting or traction of the forearm. Various explanations have been offered for the injury. Some operators say that extension and adduction produce the injury, while others say that only extension is necessary. In a child, the injury is called "pulled-elbow," and usually occurs between two and four years of age. Complete supination or falls produce subluxation. The symptoms are various, depending upon the amount of displacement and the extent of injury to the ligaments. There is not much deformity at the elbow. Pressure over the upper extremity of the radius will cause severe pain. The arm is usually

flexed at an angle of about sixty degrees. Some movements of the arm are painless, while complete extension of the arm causes great pain. Complete pronation and supination also cause pain. Forced supination will cause a distinct clicking sound. The subluxation can be reduced by completely flexing the arm with supination and pronation, together with abduction and extension. In some cases the edge of the fibro-cartilage will be displaced or slip between the head of the bone and the articular surface of the humerus. After reduction has been accomplished, it is necessary to put a figure-of-8 bandage around the elbow and carry the arm in a sling for a few days until the ligaments return to a normal condition. In all dislocations at the elbow starch-paste dressing may be put over the joint by means of paste-board and a four-tailed bandage and the arm carried in a sling. After the preliminary inflammation has disappeared, which will take place within a week, the joint may be manipulated every few days, so as to prevent ankylosis. Recovery is complete in uncomplicated cases.

Other **peculiar conditions** which may occur at the elbow, and which may cause pronounced symptoms are:

1. Slight posterior displacement.
2. Slight anterior displacement of the head of the radius.
3. Luxations of the interarticular cartilages.
4. Locking of the tuberosity of the radius with the inner edge of the ulna.
5. Intracapsular fracture of the head of the radius.
6. Paralysis or neuritis of one of the large nerves of the arm brought about by injury.

The conditions may be made out only by careful physical examination by one who has an accurate knowledge of anatomical relations.

Dislocations of the Wrist are common and may be classified as:

1. Dislocations forward. 2. Dislocations backward.
3. Backward luxation of the ulna from the radius.
4. Forward luxations of the ulna from the radius.
5. Subluxations.

Dislocations Backward.—This dislocation is produced by falls upon the hands. The carpus stands out prominently on the back of the wrist, while the fingers are flexed and the lower extremity of the radius and ulna project prominently in front of the forearm. It must be noted that the styloid process of the radius is upon a lower level than that of the ulna.

Fracture through the base of the styloid process of the radius (Colles's fracture) simulates dislocation of the wrist, but the styloid process of the radius is on the same level or higher than that of the ulna. There is muscular rigidity and an absence of crepitus. Extension and manipulation usually reduce the deformity.

Dislocations Forward.—In dislocations forward the carpus makes a prominence on the front of the wrist, while the ulna stands out prom-

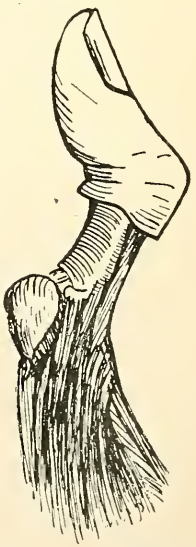
inently on the back of the forearm. This injury is very rare. Reduction is accomplished by extension and counter-extension.

Dislocation of the Ulna from the Radius, either forward or backward, is accomplished by forced supination or pronation, as occurs in violent twisting of the hand. In the backward dislocation, the forearm is pronated and the space between the styloid processes of the ulna and radius is diminished. The ulna stands out prominently on the back of the wrist. In the forward dislocation, the ulna projects in front, while the distance between the two styloid processes may be found lessened. The arm is supinated. Reduction is accomplished by traction, exaggeration of the deformity, and pressure upon the head of the bone with flexion or extension, as the case may be, when it may be readily forced into position.

Dislocation of the Carpus.—Dislocation of one of the carpal bones may take place because of injury or forced movements of the wrist. The deformity may not be great, but the involvement of the nerve filaments causes great pain. The diagnosis can be made by a careful examination. The weakest point in the wrist is between the scaphoid, os magnum, and semilunar bones. Reduction is accomplished by exaggeration of the deformity, and pressure upon the projecting bone, with forced flexion or extension as the case may require.

Dislocation of the Metacarpus.—Dislocation of the metacarpal bones in their articulation with the carpus is rare. Subluxations are fairly common, and when any nerve structures are involved, severe pain is the chief symptom. The deformity is not great. The first metacarpal bone is the one most frequently dislocated. The diagnosis is usually readily made upon careful examination. Flexion and extension with adduction and abduction, while compression is made by the thumb upon the end of the dislocated bone, will accomplish reduction.

FIG. 101.



Dislocation of the first phalanx of the thumb.

Dislocations of the Metacarpo-phalangeal Articulations are rare. The dislocation usually takes place backward, and is caused by falls on the outstretched hand. The diagnosis is made without difficulty. Reduction is accomplished by manipulation as extension is being made. In only one of these dislocations will any difficulty be found in making reduction, i. e., dislocation of the first phalanx of the thumb. This dislocation takes place backward. The obstacles to reduction are the margin of the capsular ligament, together with a stretched condition of the flexor longus pollicis and the sesamoid bones developed in the tendons of the flexor brevis pollicis. Reduction is accomplished by forced extension and lifting the head of the bone into place. Extension should be made until the phalanx is at right angles

with the head of the metacarpal bone. This enlarges the opening through which the dislocation took place. In some cases tenotomy may be necessary.

Dislocations of the Phalanges are fairly common. The diagnosis is easy and reduction is accomplished by extension and counter-extension. Where sufficient extension can not be made by grasping the finger, a Levis's splint may be used. This splint is made by means of a narrow board, having two rows of holes the width of the finger. Tape is passed through the holes so as to form loops upon one side of the splint. The finger is inserted into these loops and the tape is drawn tightly to the finger. Traction can be made by means of the splint.

Dislocations of the Ribs.—Clinical experience shows that traumatic dislocations of the ribs often take place. These may accompany fractures of the spine, or the luxation may take place without other injury, being caused by direct or indirect violence. The displacement of the head of the rib may be forward or backward, upward or downward. The signs are:

1. Elevation or prominence of the luxated rib.
2. Depression or lessened prominence of the luxated rib.
3. Widening or narrowing of the intercostal space.

A history of the accident, together with the deformity present, will easily enable the physician to make the diagnosis. Conditions of subluxations are more thoroughly described in works on Osteopathic Practice, to which the reader is referred.

Reduction is accomplished by manipulation. These are elaborated upon in works on osteopathic methods.

Dislocation of the rib from its costal cartilage may be produced by direct or indirect violence. Inasmuch as the bone is subcutaneous, the condition can readily be made out. Pain will be a prominent symptom, together with an offset in the rib at that point. Reduction is accomplished by manipulation. It may be held in position by strapping. In severe conditions of luxation of the head of the rib from its articulation with the spine, strapping of the rib, as in case of fracture, may be required.

Dislocation of the Costal Cartilages at their articulation with the sternum may also take place and is the result of direct violence. The symptoms are pain and deformity. If the ribs are raised, and that part of the chest kept immovable by strapping, complete recovery will take place without any troublesome symptoms.

Dislocation of the Sternum.—Inasmuch as bony union takes place between the three portions of the sternum late in life, dislocations of these parts of the bone may take place in children. Dislocation of the **gladiolus from the manubrium** may take place because of great direct violence. The symptoms are usually evidences of severe local injury, together with a ridge at the point of union of the two bones. Where the injury is very severe, there may be marked dyspnea, and irregular heart action. Dorsal flexion, with pressure over the manu-

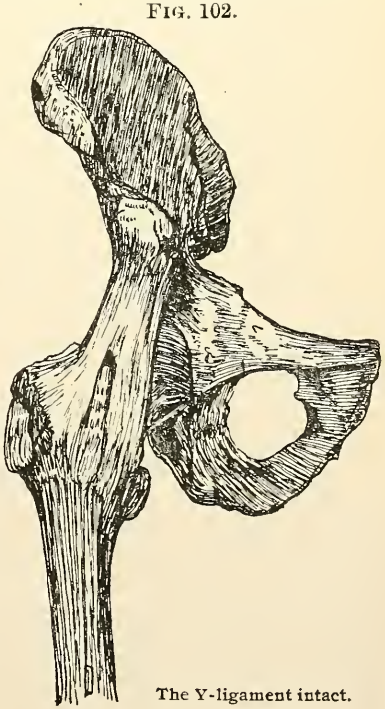
brium and a raising of the ribs, will draw the bone into position. A figure-of-8 bandage about the chest, to limit motion, will relieve the pain and hasten recovery.

The **Ensiform Cartilage** may be dislocated by means of pressure, or blows received. The displacement may be slight, or the deformity may even be angular, and it may interfere with taking food. Cases are reported where persistent vomiting followed such injury. The symptoms are usually plain; a history of the injury and pressure upon the cartilage are indicative; also there is a marked depression at the lower end of the sternum. Raising the ribs will lift out the cartilage. Operative treatment is necessary.

Dislocation of the Sacro-iliac Joint.—Sacro-iliac dislocations partake of the nature of subluxations. They are common and consist of displacements backward, forward, upward, or downward, or of combinations of these, as a luxation upward and backward. One or both sides may be affected. It will produce inequality in the length of the limbs and tilting or twisting of the pelvis. The posterior superior iliac spines may be more prominent, or less so, and may be higher up, or lower down, than normally. It may be evidenced by pain at the symphysis pubis, in the back, down the thigh, or within the joint. It may cause hip-joint disease, white swelling, sciatica, pelvic disease, neuralgic conditions, and various other diseases. A careful examination will reveal the condition. The luxations are reduced by manipulation, or well known osteopathic methods.

Dislocations of the Hip.—Dislocations of the hip are more common than dislocations of many other joints, although the nature of the anatomy of the joint is such as to rather protect it from injury. The cotyloid cavity is deep and the head of the femur fits in with such nicety and the ligaments are sufficiently strong to render dislocations unlikely. They form, perhaps, ten per cent. of all dislocations. They are more common between the ages of twenty and thirty, but may occur at any age. It is important to thoroughly understand the anatomy of the hip-joint to understand the dislocations. The most important of the ligaments is the Y-ligament, which is the form of an inverted Y, whose upper attachment is the anterior inferior spine of the ilium, and the lower

FIG. 102.



The Y-ligament intact.

attachment, the outer limb, at the upper extremity of the anterior intertrochanteric line, and the inner limb to the inner extremity of the anterior intertrochanteric line. This Y-ligament is really a thickened anterior portion of the capsular ligament. It is this ligament which determines the position of the thigh in what are understood as the regular dislocations. Regular dislocations are those in which the Y-ligament is intact. The irregular dislocations are those in which the Y-ligament, either the inner or outer limb, is ruptured.

The *causes* of the dislocations are those of dislocations of other joints, but the luxations may happen in typhoid fever or they may be produced by the assumption of habitual attitudes. The exciting cause of the dislocation in certain abnormal conditions may be slight force, as turning in bed. Muscular contractions play a great part in some of the dislocations. In eighty per cent. the head of the bone gets out of the capsule at its posterior portion. In other cases, the head of the bone may rupture the lower or the inner portion of the capsule. It is believed that the dislocation takes place largely by leverage. This may not always be true. Many different classifications will be found, but it is more important to understand the nature of these dislocations than the particular classification. They may be best understood as follows:

FIG. 103.

A drawing illustrating dorsal dislocations of the hip.

A. **Regular.** 1. Iliac, where the head of the bone rests on the dorsum of the ilium. 2. Sciatic, where the head of the bone is dislocated beneath the obturator internus muscle. 3. Obturator or thyroid, where the head of the bone is displaced in the thyroid foramen. 4. Pubic, where the head of the bone is displaced inward on the front of the pubes.

B. **Irregular.** 1. Anterior oblique. 2. Everted dorsal. 3. Perineal. 4. Supracotyloid. 5. Ischial.

Both **iliac** and **sciatic** dislocations are backward displacements of the bone. The bone gets out of the lower or upper part of the capsule during flexion, adduction, and internal rotation of the thigh. There are cases where a thyroid dislocation may be transformed into a dorsal, but this is unusual. The Y-ligament is intact and stretched, producing flexion of the thigh. The ligamentum teres is usually ruptured. The quadratus femoris, the gemelli, and perhaps the obturatur internus and pyriformis muscles, are injured. The head of the bone dissects up the glutei muscles, and in fairly thin subjects, can often be felt imperfectly on the dorsum of the ilium.

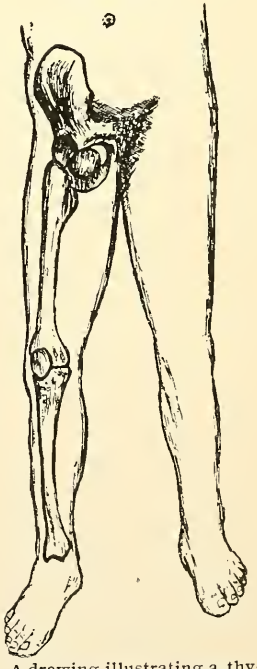
PLATE VIII. Radiograph by George M. Laughlin, D. O.

Radiograph (posterior view) of a normal pelvis in a girl five years of age. Note a partial arrest of the development of the right thigh as the result of infantile paralysis.

In the **sciatic** dislocation, the head of the bone gets out at the lower and posterior part of the capsule. The head of the bone becomes engaged beneath the tendon of the obturator internus muscle and usually lies between it and the pyriformis. Sometimes it may rest upon the pyriformis muscle. It seldom ever reaches the sciatic notch. As a rule, if the head of the bone leaves the cavity at the lower and posterior part of the capsule, a sciatic dislocation will result. If it leaves at a higher point, the iliac dislocation results. The rim of the acetabulum may be chipped off, or the head of the femur may be broken. Fifty per cent. of all dislocations of the hip are dorsal; thirty per cent. are sciatic.

The *symptoms* of these dislocations are adduction, internal rotation, and flexion. There may be considerable tilting of the pelvis, causing marked lordosis of the spine. The lower extremity of the femur on the injured side, if projected, would cross the lower extremity of the femur on the sound side, while in the erect position, the foot rests on the top of the foot of the sound side. The hip is broadened, the trochanter is elevated above Nelaton's line, while Bryant's line is shortened, also indicating the ascent of the trochanter. The voluntary movements are for the most part lost. Passive movements are possible in flexion and adduction, but are impossible in extension and external rotation or abduction. Much shortening is the rule, but this comes largely from the adduction and flexion of the thigh. The adduction and flexion are produced by the tension on the Y-ligament and the adductor muscles. The signs of a sciatic dislocation are similar to those of an iliac dislocation, but are not so pronounced. The shortening is less upon extension of the thigh and greater upon flexion of the thigh.

FIG. 104.

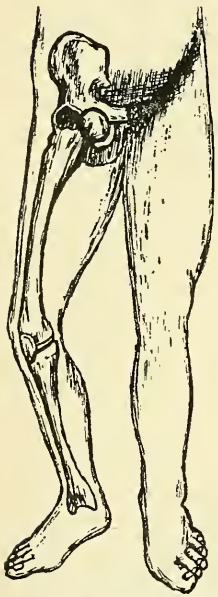


A drawing illustrating a thyroid dislocation of the hip.

Obturator or **Thyroid Dislocations** constitute eleven per cent. of the hip dislocations, and may be produced by blows on the back part of the pelvis. The head of the bone is displaced downward and inward. The Y-ligament is intact and holds the limb in abduction and flexion. The limb can not be extended or adducted. Because of the tilting of the pelvis forward, due to the tension upon the Y-ligament, the limb is apparently lengthened, but is shortened to some extent. While the patient stands erect the limb is held forward in abduction by the Y-ligament. In the obturator dislocation the head of the bone gets out of the cavity through the lower, or lower and inner part of the capsule.

In **Pubic** dislocations, the head of the bone rests on the front of the pubes. It may be a transformed obturator dislocation, or the bone may get out through the upper and inner part of the capsule. The injury is produced by hyper-extension, or by forced abduction and external rotation.

FIG. 105.



A drawing showing the position of the limb in public dislocations of the hip.

The head of the bone rests on the ilio-pectineal eminence most often, but it may be displaced farther inward. The limb is markedly abducted and everted. The hip is flattened, and there is considerable shortening.

Irregular Dislocations constitute about two per cent. of all the dislocations of the hip. One or both limbs of the Y-ligament are ruptured.

The **Everted Dorsal** dislocation is the same as the dorsal, with the exception that the head of the bone is displaced forward and inward, while the limb is abducted and extended. The outer limb of the Y-ligament is broken.

In the **Anterior Oblique** dislocation there is outward rotation and marked flexion and abduction. The head of the bone rests just above the acetabulum. The Y-ligament is broken.

Perineal dislocation is the same as the thyroid dislocation, with the exception that the head of the bone is displaced farther inward, while flexion and abduction are more marked. Sometimes the head of the bone may be felt in the perineum.

In the **Supracotyloid** dislocation, the head of the bone is just above the acetabulum. There is eversion and abduction.

A **Suprapubic** dislocation, which is an anterior dislocation displaced upward, may resemble the supracotyloid, or an everted dorsal luxation.

Ischial dislocations are rare. The head of the bone is displaced downward and backward, and rests upon the tuberosity of the ischium. The limb is everted, abducted, and flexed.

Methods of Reduction.

In the **backward dislocations**, the dorsal and sciatic, the manip-

FIG. 106.

A drawing showing the method of reduction in dorsal and sciatic dislocations. In pubic and thyroid luxations the limb is adducted instead of abducted and also rotated inward.

ulation should be directed towards relaxing the Y-ligament and directing the head of the bone toward the opening in the capsular ligament. The patient should lie flat on his back, while the pelvis is held fixed by an assistant. Flex the knee at right angles and rotate the thigh a little further inward, then lift up or make traction upon the femur with considerable force, at the same time rotating the limb outward. This is followed by abduction and extension. Dr. Charles Still prefers to lift the thigh in position by grasping the trochanter. He is very successful with this method. Some operators have the patient lie upon the floor, while the pelvis is held fixed, believing that more traction can be made upon the thigh during the manipulation. Stimson places the patient with the face down, with the hips projecting just beyond the end of the table. An assistant holds the sound thigh, while the operator grasps the foot on the injured side and allows the weight of the limb to pull the thigh in position. Ten or fifteen pounds of weight may be added to overcome the tension of the muscles, when the hip may be dropped in position. This manipulation is suitable for the reduction of backward dislocations. Leverage is, perhaps, one of the most important forces to be utilized in the reduction of hip dislocations.

In **Obturator** dislocations, the thigh should be flexed at right angles, while traction should be made upon the femur. The limb should then be adducted and extended. It may be necessary to rotate the thigh farther outward in order to secure relaxation of the Y-ligament.

In the **Pubic** dislocations, traction is made in flexion, while an assistant makes pressure against the upper extremity of the thigh, on the inner side, thus preventing the head of the bone returning on the front of the pubes while internal rotation is performed by the operator. In some cases, reduction may not be accomplished, but the skill of the physician will depend upon his experience and his knowledge of the anatomical relations.

Compound Dislocations.—Compound dislocations are very rare, and are usually fatal; but a few cases are on record. There is generally such extensive injury to the soft-parts, and bone, that sepsis results.

Old Dislocations.—Unreduced dislocations are treated in the same manner as recent dislocations. Should the operator fail to reduce the dislocation at the first attempt, he should not be discouraged. Many times, by breaking up the adhesions and relaxing the muscles, the head of the bone may be made to retrace its steps. If there is no injury to the cotyloid cavity, and the inflammatory reaction about has not been too severe, reduction may be accomplished after a number of years. Dr. A. T. Still has reduced a large number of these dislocations, even after they had existed many years. Reduction, in many cases, may be accomplished only after months of treatment preparing the parts for reduction. After reduction has been accomplished, treatment may still be required for some length of time to prevent the dislocation returning.

Pathological Dislocations.—Pathological dislocations are very com-

mon in inflammations of the joint, paralysis, in conditions of rickets, and septic fevers, especially in conditions where the person assumes a certain position for a considerable length of time. These pathological dislocations are reduced by methods similar to those used in recent dislocations. The joint must first be prepared for reduction. The ligaments must be relaxed, the tonicity of the muscles improved, and the adhesions broken up. After this has been done, the pelvis must be held securely by an assistant while the operator makes traction on the thigh. Too much force should not be applied to the limb. It is unnecessary and may do harm. The old method of Sir Ashley Cooper of forcibly dragging the head of the bone into the socket is bad, inasmuch as it may do a vast deal of harm. Reduction can be made by manipulative means much more readily, even in old dislocations. If the femur is dislocated inward or downward, the pelvis should be held securely to the table or floor, while the physician makes traction on the thigh. Pressure may be made on the inner side of the neck of the femur, while at the same time the physician performs adduction, thus using the femur as a lever. This may force the bone in the socket. Similar methods may be used if the femur is dislocated backward. In this case, the assistant may press upon the back part of the femur while abduction and extension are made.

Dislocations of the Knee-Joint may be classified as:

1. Dislocations of the patella.
2. Dislocations of the tibia.
3. Dislocations of the semilunar cartilages.

Dislocations of the Patella.—The patella may be dislocated (a) outward, (b) inward (very rare), and (c) edgewise (vertical rotation).

Dislocation Outward is the most common, on account of the obliquity of the femur. It occurs in subjects suffering with genu valgum, and is produced by direct violence. It occurs while the limb is extended. If the luxation is complete, the patella will be felt lying entirely on the outside of the external condyle. The knee will be flattened, while the intracondylar space will be marked by a depression. Where the luxation is incomplete, the inner half of the articular surface of the patella lies in relation with the articular surface of the outer condyle. Reduction is accomplished by means of extension and manipulation, the thigh at the same time being flexed upon the abdomen, which thoroughly relaxes the quadriceps extensors, when the bone may readily be moved into position.

Inward Dislocation is extremely rare, and is due to direct violence. The diagnosis is easy. The treatment is similar to that of dislocation outward.

Dislocation edgewise, or vertical rotation, is a rare condition produced by twisting the patella on its own axis. Cases are on record where the patella has been turned completely over. Partial rotation of the bone is similar to an incomplete dislocation, either inward or out-

ward, and reduction is accomplished in the same manner as reduction of a dislocation either inward or outward. Complete rotation may be reduced by relaxing the quadriceps extensors and rotating the bone into position.

Dislocations of the Tibia.—Dislocations of the tibia may occur (a) inward, (b) outward, (c) backward, or (d) forward. When the dislocation is caused by disease it is *backward,* but when caused by traumatism, it is nearly always *lateral.* Dislocation either *inward* or *outward* is rarely ever complete, and is accompanied by more or less twisting of the leg. One or the other of the lateral ligaments will be ruptured. The diagnosis of the dislocation can be readily made, as the symptoms are prominent. Reduction of the dislocation is easy. While extension is made, the limb is abducted or adducted as required and rotated either inward or outward, or, while an assistant makes extension, the bone may be lifted into position by the operator.

Dislocation of the tibia *forward* is more common than dislocation backward, when the result of trauma. The dislocation may be complete. The lower extremity of the femur will project into the popliteal space and obstruct the femoral vessels, while the tuberosity of the tibia will stand out prominently on the front of the leg. There may be considerable shortening. Usually, the dislocation is incomplete and the symptoms are not so prominent. Reduction is accomplished by extension and manipulation.

Dislocation of the tibia *backward* is usually not complete. The cause of the injury is direct and indirect violence. The signs are so constant and prominent as to be characteristic. The tibia is more or less displaced into the popliteal space, and operates as an obstruction to the return circulation through the femoral vessels. There will be engorgement of the short saphenous vein. A depression beneath the condyles of the femur in front will be prominent and the nature of the dislocation is evident upon inspection. Like other dislocations of the tibia, reduction can readily be accomplished in recent dislocations by traction and manipulation. Under no circumstances should this dislocation be allowed to continue for any length of time, not even a few days, before reduction is made. The limb should be kept at rest for a few days until the swelling and inflammation have subsided, when a knee-boot can be applied, which is drawn tightly to the knee, and which prevents a recurrence of the condition. Where there is rupture of the ligaments of the knee, it is best to keep the knee at rest for a period of two or three weeks, to permit union of the torn ends of the ligaments.

Dislocation of the Semilunar Cartilages is sometimes called a subluxation of the knee. The injury is frequent and happens during flexion with rotary motion at the knee. Pressure of the condyles, under certain circumstances, tends to displace the cartilages. In a condition of flexion, these cartilages are more movable upon the surface of the

tibia than upon extension, so that in a flexed condition a sudden wrenching or spraining of the joint may lead to a displacement of the cartilage. The internal cartilage is more frequently displaced than the external. The extent of the displacement varies, and the coronary ligament may, or may not, be ruptured. Displacement of the cartilage usually takes place anteriorly, but may take place laterally. In certain cases, it is said to have been displaced into the intra-condyloid notch, or to have been doubled upon itself.

Signs.—The first sign of the injury is a cracking sound, as if something gives way in the joint, which is accompanied by an intense sickening sensation. The joint remains fixed in a position of flexion. The limb can not be forcibly extended, because of the obstruction afforded by the cartilage. Efforts at manipulation cause a sickening pain. It may be that more or less twisting of the leg in a position of flexion will result in spontaneous recovery. The disarticulated cartilage forms a prominence on the front of the joint. A history of the accident, together with the absence of other injury, will serve to complete the diagnosis.

Methods of Reduction.—The flexion should be exaggerated. Should it be the internal cartilage which is dislocated, the operator places his two thumbs upon the dislocated cartilage, while his hands grasp the hamstring tendons, and an assistant makes extension and abduction. The extension and abduction should be forcibly made, while at the same time vigorous pressure is made upon the luxated cartilage. Where the external cartilage is dislocated, the same procedure is adopted, with the exception that at the time of extension the lower leg is adducted. This manipulation should be successful in all cases. Operative treatment is recommended in various texts for the removal of the cartilage where there has been a failure in the attempts at reduction. This operative treatment consists in removing the cartilage under the strictest aseptic conditions, or by fixation of the cartilage by means of aseptic chromicized catgut sutures. In case of such operation, it is necessary to drain the joint for a day or two after the operation. Manipulative methods, if kept up some length of time, and judiciously applied, will be successful in restoring the integrity of the joint in all cases.

Dislocations of the Ankle-joint.—Dislocations of the ankle are (a) outward, (b) inward, (c) backward, (d) forward, and (e) upward. Because of the peculiar relation of the astragalus with the tibia and fibula, fractures not unusually complicate these dislocations. Dislocations laterally rarely occur without fracture, therefore in reality they are fracture-dislocations, as is the case in Pott's fracture of the lower one-fifth of the fibula, or Dupuytren's fracture. The diagnosis may be difficult, and will require a careful examination, perhaps with the assistance of the x-rays, to make an accurate diagnosis. The luxation is usually readily reduced.

Dislocation Backward is more common than dislocation forward, and usually takes place in jumping. Both malleoli may be fractured, while

the astragalus is driven behind the lower extremity of the tibia. The heel protrudes prominently. The lower extremity of the tibia may rest upon the scaphoid or cuneiform bones.

Dislocation Forward is very common, and is not associated with fracture of the bones of the leg. Apparently the foot is lengthened. The tibia stands out prominently on the upper surface of the os calcis. The heel is not so prominent as normally, and a depression exists over the top of the astragalus.

Dislocation Upward.—In this dislocation, the astragalus, with perhaps other bones of the foot, is driven upward between the tibia and fibula, after the ligamentous attachments of these bones have been forcibly divided. At first glance it may be denied that this dislocation is possible, but competent observers attest to the fact that the dislocation does occur. Widening of the malleoli, together with a shortening of the foot and leg, make the diagnosis easy. There is a history of violent injury.

Treatment.—Dislocation of the ankle may be reduced by means of extension, together with rotation, abduction, adduction, and flexion. By extension and counter-extension the tense muscles are relaxed, and the bones may be manipulated into position. In some cases, it is said that it is necessary to divide the tendo Achillis in muscular subjects. In fracture-dislocations, the fracture requires special treatment. Where there is dislocation pure and simple, it is necessary to keep the foot immovable, and to apply antiphlogistic measures, such as assisting the return circulation, relaxing the tissues, and keeping the foot immovable for ten days. After that time, manipulation of the joint, to prevent adhesions and to reduce inflammation, will be found necessary. The person should go about on crutches within a week, but for a considerable part of the day the foot should be elevated, to assist the return circulation.

Dislocation of the Astragalus.—Dislocations of the astragalus alone deserve special consideration. They consist of a partial or complete detachment of the bone from its normal connection. It may be luxated either anteriorly or posteriorly.

Anterior Dislocation is usually associated with more or less rotation, which may be outward or inward. If the dislocation should be complete, the bone will be found lying in front of the ankle loose and readily movable upon the scaphoid. The skin over the dorsum of the foot is tightly drawn over the bone. The limb is shortened, while the malleoli approximate the bottom of the foot. The lower extremity of the tibia usually rests upon the articular surface of the os calcis, instead of the astragalus. In the incomplete variety, the head of the bone simply presses upon the scaphoid or cuboid. Only about half of the articular surface is displaced from the tibia. Prominence of the bone may be felt in front of the ankle.

Backward Dislocation may also be complete or incomplete. Rotation of the bone may attend the injury. The bone may be readily felt making a marked prominence above the os calcis, the degree of prominence depending upon the degree of luxation of the bone. The diagnosis in either dislocation, forward or backward, with or without rotation, complete or incomplete, is usually easy, providing the swelling is not too extensive. It may be confounded with a sprain, and until the swelling is gotten rid of, the diagnosis may not be accurately made.

Treatment.—Reduction is accomplished in the incomplete form of dislocation by exaggerating the deformity, while the operator presses upon the bone with his thumbs, extension being made at the same time. In this manner the bone is forced into its normal location. More or less rotation may be necessary. Not a great deal of force will be required, except in muscular subjects, or where the bone is tightly wedged in. In complete dislocations an anesthetic may be required. If the case is seen early, a reduction can be accomplished without great difficulty. In all dislocations, after some hours, great swelling obliterates the characteristic evidences of the injury, while the pain, because of the pressure of the effused fluids, is intense. The joint-reflexes are exaggerated and muscular spasms occur, so that reduction of the dislocation may be difficult. Where there is violent inflammation, an anesthetic may be necessary for a thorough examination. In cases where the diagnosis can not be made, an x-ray examination may assist in clearing up the diagnosis.

Subastragaloid Dislocations.—These dislocations refer to the forcible separation of the other bones of the tarsus from the astragalus. Generally the astragalus maintains its normal relation with the malleoli, while the ligaments which attach the astragalus to the other tarsal bones have been either considerably stretched, or ruptured. The dislocations are produced by violent wrenching of the foot. The displacement of the bones may be inward, outward, or backward, but is usually backward and outward, or backward and inward. The luxation is incomplete, and while being classified under traumatic dislocations, it properly belongs to partial dislocations. The dislocation may even be compound, and yet not be complete. The scaphoid is sometimes completely separated from the head of the astragalus. Great deformity is the rule. The heel projects prominently, while the anterior part of the foot is apparently shortened. As a rule, the toes point downward, the heel being drawn upward by contraction of the calf muscles. The tendo Achillis is put violently upon a stretch, while beneath the skin on the front of the foot the astragalus projects prominently. The anterior tibial vessels and nerves are usually severely injured. The extensor tendons may be so engaged about the head of the astragalus as to operate against reduction. When the bones are dislocated inward, the foot is everted so that the outer malleolus stands out prominently, and the

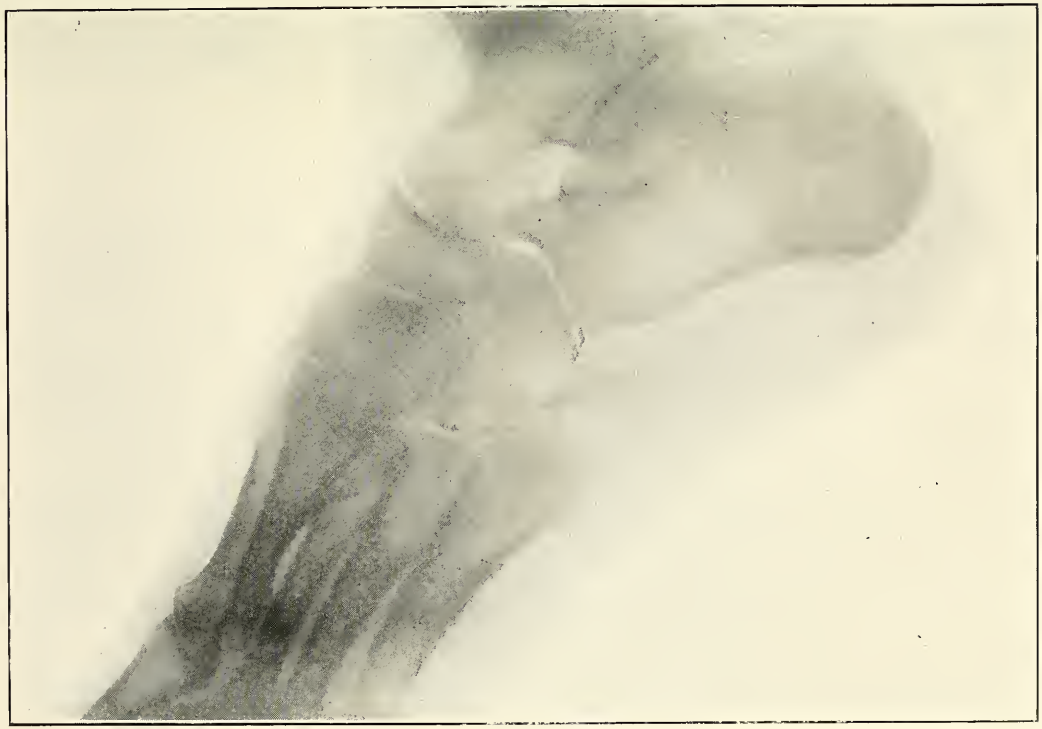


PLATE IX. Radiograph by George M. Laughlin, D. O.

Radiograph showing a subluxation at the calcaneo-cuboid and astragalo-scaphoid articulations, as occurs in gouty conditions.

normal projection of the internal malleolus is lost. The position of the foot resembles that of equino-varus. When the tarsus is displaced outward, the foot is everted, while the inner malleolus is prominent and a depression marks the position of the external malleolus. The position of the foot is that of equino-valgus. In either variety, the tendo Achillis is put violently upon a stretch and is somewhat curved, depending upon the degree and nature of the displacement. Tenotomy may be necessary before reduction of the dislocation can be made. Extension and rotation and an exaggeration of the deformity, with pressure upon the projecting bone, will enable the operator to force the luxated bones into position.

Dislocations of Other Tarsal Bones, as the cuneiform, scaphoid, or cuboid, occur but rarely, and are the result of severe direct violence and twisting of the foot. The diagnosis is usually easy. The treatment is to reduce the dislocation and to keep the foot quiet, to give it rest until the ligaments may be restored, since there may be a sinking down of the arch of the foot, because of a giving way of the ligaments. This condition of subluxation in the tarsal bones will result in a deformity which interferes greatly in walking.

Dislocations of the Metatarso-Phalangeal, or the Phalangeal Articulations, occasionally occur, but are easily recognized and readily reduced by extension and counter-extension. They are not sufficiently serious to merit description. Subluxations may cause bunions, Morton's disease, or other affections.

DISEASES AND INJURIES OF THE SPINE.

Spina Bifida.

Spina bifida is a congenital condition due to maldevelopment of the dorsal plates in embryo. The dorsal plates not having properly closed, the lamina, pedicles, spinous processes, and sometimes part of the membranes of the brain and cord, fail to develop. The tension of the fluid within the neural canal is such as to form a tumor. The only structures lying over the spinal cord are the skin, and perhaps a little connective tissue, or the membranes may lie directly in connection with the skin. The tumor presenting is produced by a collection of fluid in the subdural spaces, or subarachnoidal spaces, or from within the spinal canal. Three forms of tumor are usually described.

A. **Meningocele,** which consists of a protrusion of the dura mater and arachnoid, but contains no part of the cord or spinal nerves. The posterior portion of one, two, or more vertebrae may be absent. The tumor may be of considerable size.

B. **Meningo-myelocele** is a condition where the fluid distension is beneath the arachnoid and dura mater, the wall of the tumor containing these two membranes, together with the cord and spinal nerves. The cord may be spread out over the side of the tumor.

C. **Syringo-myelocele** is a condition where the fluid distension is within the central canal of the spinal cord, so that the spinal cord is spread out around the tumor. Certain spinal nerves which run down some distance within the spinal canal before making their exit may be included in the tumor, providing it is located in the lumbar region.

Signs.—The location of the tumor is in the middle line of the back, over the lower part of the spine. It may be covered with healthy skin, but very often it is apparently scarred. The vessels often are obliterated and the tumor is translucent. In infants, if the tumor is compressed, it will be noticed that the fontanels raise up. On coughing, or crying, there will be a distinct impulse over the tumor. The edges of the bones, which are the imperfectly developed lamina or pedicles, may be felt. There is more or less paralysis and imperfect development below the tumor, because of the pressure upon the nervous tissues. There may be talipes, perforating ulcers of the foot, or more or less complete anesthesia. The child may be the subject of hydrocephalus. The prognosis is not good.

Treatment.—When the tumor is small, an elastic band may be applied, which will, perhaps, prevent its development. Treatment of the parts below will be found of service. The circulation to the atrophied muscles and partially paralyzed nerves may be increased, but by no known methods can the ill-developed vertebrae be restored. Tapping has been advised. Where the wall of the tumor is not very thick, as it enlarges, which may happen in some cases, spontaneous rupture may take place. If this occurs, the contents will escape from the tumor and the meningeal fluid will continue flowing for some days, when the opening will heal up. The tumor will reappear in a short time. Tapping has been advised, but it will do but little good, as the tumor will quickly return. Enucleation of the sac has been advised by some surgeons, but it is not known whether the operation is attended by good results or not. The best that osteopathic treatment can do for the affection is to prevent the atrophy of the muscles, and to increase the blood supply to the areas of paralysis, or paresis, and to increase the nerve impulses to the weakened structures. Where perforating ulcers are present, usually osteopathic treatment will cause these to heal up, but the condition can not be cured.

Tumors of the Spine.—New growths are of rare occurrence in the spine. They may consist of **gummata,** because of tuberculosis, or syphilis, or **fibromata, lipomata,** or **gliomata,** may develop. Rarely secondary cancers of the spinal cord occur. Spinal tumor will not cause any difficulty until it attains the size of a medium sized marble. The symptoms are pain, more or less localized, followed by progressive anesthesia, usually ending in paraplegia, monoplegia, or evidences of ataxia. The symptoms are those of compression and irritation of the spinal cord. The reflexes are at first exaggerated, afterwards paralyzed. Following exaggeration of the reflexes, there is paresis

of the muscles, followed by paralysis. Sometimes spasms of the muscles form a prominent symptom, because of irritation. Occasionally, instead of paralysis, there is a condition of contracted muscles, due to irritation of the motor cells. Different locations of the tumor will occasion different symptoms. The diagnosis is usually made by eliminating other conditions which might cause the same symptoms. These other conditions are hemorrhage within the spinal canal, compression from inflammatory products, and luxations. Should the diagnosis be accurately made, which in most cases can be done, the tumor should be removed by a surgical operation. The technic of the operation is that of laminectomy.

Osteomyelitis of the Vertebrae.—Osteomyelitis is a rare, acute, suppurative disease of the vertebral bodies. It is caused by infection from the pus cocci, and is often associated with osteomyelitis of other bones, or by infection of the viscera. The symptoms, in general, are those of osteomyelitis of other parts of the body, with the exception that the disease involves the spine, causing, perhaps, paralysis, also sequestration of the bodies of the vertebrae and abscess formation.

Treatment.—The treatment is similar to that for osteomyelitis. This disease does not include the chronic suppuration of the bodies of the vertebrae, a condition which arises from other causes. Acute osteomyelitis of the vertebrae occurs in ill-fed and ill-nourished children, and is a very difficult disease to treat. As soon as pus is evident, a free incision and good drainage, with antisepsis, should be made. Likely, in each of these individual cases, a certain spinal lesion will be found, which will account for the origin of the disease. The general condition of the patient will demand treatment, as well as the specific inflammatory process.

Spinal Curvature.

The more common curvatures of the spine are scoliosis, kyphosis, and lordosis. **Scoliosis**, or lateral curvature, is most common in the upper dorsal region. The curvature usually extends to the right. A compensatory curve occurs in the lumbar region, while a second compensatory curve may occur in the neck. There are cases where even more curves are found in the spine. The intervertebral discs are unequally compressed, while the ribs form a great convexity upon one side, and as a rule, are widely separated. They are more horizontal, and the scapula is crowded forward with them. As a general rule, with the lateral curvature there exists considerable rotation. This rotation may be so marked that the side of the body of the vertebra may look directly backward, while the angles of the ribs upon one side may occupy the position of the spinous processes. While the ribs are greatly projected upon one side, they are markedly depressed upon the opposite side, and in some cases the thorax may be so distorted that the lower ribs upon one side may touch the iliac crest. One breast is usually much more prominent than the other.

Cause.—The causes of spinal curvature are: A. Lesions of the spinal column (bones and cartilages). B. Lesions of the muscles. C. Lesions of other tissues.

A. **Lesions of the Spinal Column** are: 1. Subluxations of the vertebrae and ribs interfering with the nutrition to the intervertebral discs, or parts of the body of the vertebrae, thus causing maldevelopment. 2. Luxations of the vertebrae and ribs affecting directly the blood and nerve supply to the bones. 3. Fractures of the vertebrae. 4. Destructive osteitis or Pott's disease of the spine. 5. Spina bifida, etc.

B. **Lesions of the Muscles** are: 1. Muscular spasm, producing subluxations, or luxations, as happens in torticollis. 2. Muscular contractions, as occur in muscular rheumatism. 3. Muscular atrophy, whereby the muscles upon one side of the spine are rendered weak, when those acting upon the opposite side produce curvature. 4. Muscular hypertrophy, where the muscles upon one side of the spine become hypertrophied and stronger than those upon the opposite side. 5. Contractions from burns.

C. **Lesions of Other Tissues** are: 1. Collapse of the lung. 2. Pleuritic adhesions. 3. Habitual one-sided position of the body. 4. Strauma, rickets, etc. 5. Weakness and ill health.

Kyphosis, or posterior curvature, is produced by: 1. Relaxed condition of the ligaments. 2. Failure of development of the anterior parts of the bodies of the vertebrae. 3. Rickets and ill-nourished conditions. 4. Certain occupations and bad hygienic surroundings. 5. Caries of the anterior portions of the bodies of the vertebrae.

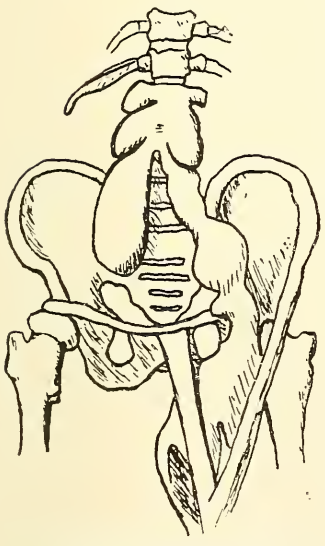
Lordosis, or anterior curvature, is often congenital. It may be secondary to Pott's disease, hip-joint disease, or sacro-iliac disease. This curvature is usually found in the lumbo-dorsal region.

Pathology.—In general, pronounced cases of spinal curvature are found in persons whose general health is more or less affected. There may be lesions accounting for this condition. The curvature is the result of subluxations, or luxations of the vertebrae. These are really pathological dislocations. Curvature of the spine will affect the integrity of the spinal nerve roots. These nerve roots will be more or less impinged upon and the blood supply to the spinal cord more or less arrested. The trophic influence of these nerves to certain of the tissues will be withdrawn. This results in paralysis, and in disease of organs.

Treatment.—The treatment of curvature of the spine has been revolutionized in recent years, and especially by osteopathic methods. Formerly braces, plaster casts, the jurymast and other apparatus were used to correct curvature, while no attempt was made to increase the nutrition of the weak and diseased structures. The results from such treatment were unfavorable. Some authors now advise against the use of what Dr. Still condemned years ago. An instance is as follows: "Perhaps the most important advice to be given to the general practitioner in relation to the treatment of this condition is caution against

the use of braces, corsets, jackets, and other mechanical appliances, which by confining the movements of the chest and supplying all artificial support in place of the muscle which it is desired to develop, *actually do great harm to many patients instead of good"* (American Text Book of Surgery, page 632). The curvature may be cured by means of manipulation. Whatever cause exists, this should be removed. Luxated vertebrae should be reduced; tense ligaments should be stretched, while spastic conditions of the muscles must be relieved by proper manipulative measures, such as rotating the vertebra upon its axis and removing pressure on certain nerves. By securing a better blood and nerve supply to the structures outside of the spine, the curvature may be cured. Many times the spinal curvature is looked upon as secondary to other ailments, when, on the other hand, it is primary, or, if secondary, it serves to keep up the disease process. If the spinal curvature is relieved, the disease usually abates. If manipulative means are kept up, the most obstinate cases may be cured. Cases of complete paraplegia and of the worst forms of paralysis have been entirely cured and the patient restored to health by correcting the spinal curvature.

FIG. 107.



Pott's disease of the spine with abscess formation.

Caries of the Spine, or Pott's Disease is sometimes called tuberculosis of the spine. It is claimed by the majority of authors that this disease is tubercular. The ground for calling this affection a tubercular process is its clinical course. The pathological conditions do not warrant the statement that the disease is always tubercular. There are some cases which undoubtedly are tubercular.

The **exciting cause** of the disease consists of blows, wrenches, or strains which excite inflammation.

The **predisposing causes** to this affection are spinal curvature, subluxations of the vertebrae, such as spinal lesions, which may consist of lateral, rotary, or antero-posterior displacement, subluxations of the ribs, and muscular contractions. These interfere, more or less, with the nutrition of the parts where the disease arises. This interference in the nutrition may be in the shape of an obstruction to the return circulation and an impingement of the arterial circulation, or a more or less interference with the normal flow of nerve force.

Other Causes are tuberculosis, syphilis, acute infectious fevers, or infection by the pus germs.

Situation of the Disease.—Any part of the spine may be affected, but usually the dorsal and lumbar portions are the parts involved.

The disease nearly always starts in the anterior portion of the body of the vertebra, and may result in the destruction of the vertebral body and the intervertebral substance, but the vertebral body is destroyed before the intervertebral substance. The reason why the anterior part of the bodies of the vertebrae is affected is because of the anatomical relations. The blood supply to this part of the vertebral body is more liable to interference because of displacement of the body of the vertebra, or because of rib lesions.

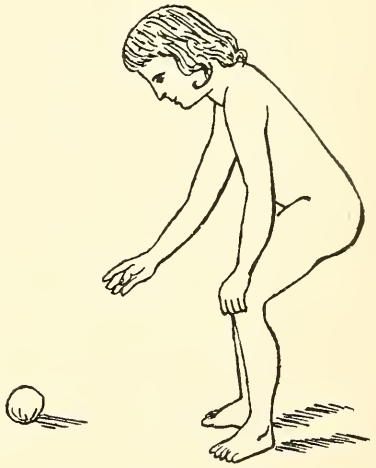
Pathology.—The tissue changes occurring in this disease are the same as those occurring in caries of bone elsewhere, or in formation of chronic abscess. For the pathology of which see Caries of Bone and Chronic Abscess. Because of the habits of the person, contractures of the muscles, rib lesions, and a more or less debilitated state, the circulation to the anterior portions of the bodies of the vertebrae become so affected that sprains, wrenches, bruises, or other injuries, cause an inflammation which results in some form of caries. This may be caries sicca, caries necrotica, or caries suppurativa (usually caries suppurativa). In Pott's disease of the spine, pus is the rule. When the disease occurs in the cervical region, a postpharyngeal abscess arises. When in the lower cervical region, the abscess may burrow laterally between the scaleni muscles and open above the clavicle. If the disease is in the dorsal region, a dorsal abscess may occur, when the pus may burrow into the viscera. When the abscess occurs in the lumbar region, in the neighborhood of the attachments of the psoas muscle, a psoas abscess arises. In some cases sequestration of the bodies of the vertebrae may occur. In other cases, the pus may form a distinct abscess, and caseation, and absorption of the pus taking place, the active symptoms disappear. The lamina, pedicles, and posterior portions of the bodies of the vertebrae are rarely affected. The cord membranes are never affected. They may be compressed because of luxations of the vertebrae, or the developing of inflammatory products, or pus formation, but the disease process does not invade the spinal cord. It more often affects certain nerves as they come off from the spinal cord, so that the symptoms are localized and refer to the compression or irritation of certain nerves. The cord may be compressed to some extent, giving evidences of spinal irritation, shown by contracture of the muscles, or exaggeration, or interferences with reflexes, but paralysis is rare.

Signs.—The signs of the disease are: 1. Pain. 2. Rigidity of the spine. 3. Deformity. 4. Abscess. 5. Muscular spasm. 6. Paralysis. The pain manifests itself variously. There is always a localized spot over the diseased bone which is painful. Other pains are neuralgic in character, and may be in the nature of referred pains—those produced by the pressure or irritation upon a nerve. The pain is referred to the distribution of the nerve, as, for instance, the genito-crural nerve may

be affected, or the anterior crural, or some other of the lumbar nerves. If the second and third cervical vertebrae are affected, the auricularis magnus, occipitalis major and minor nerves will be affected, causing pain behind the ear on the back of the head. The pain may be in the nature of bilateral cramps. In grown people, the pain is in the nature of headache, backache, and girdle-pains.

Rigidity of the Spine is a constant accompaniment of Pott's disease, and is one of the earliest symptoms. It is produced by contracture of the muscles and ligaments, brought about by irritation. This of itself operates against recovery, inasmuch as it interferes with a proper circulation of the fluids. When the lower part of the spine is affected, the back is held stiff and causes a peculiar gait, while the movements of the body in sitting or stooping are greatly modified. The patient often becomes weak and supports himself by extended arms upon his legs. In a little child, this rigidity of the spine can be tested by having the patient lie prone while the legs are lifted. Under normal conditions the spine is fairly flexible. It is hardly necessary for the benefit of the osteopathic practitioner to describe the methods of determining the rigid condition of certain portions of the spine, inasmuch as his teachings include all such conditions. Stiffness in the neck, caused by caries, will be evident upon forced movements.

FIG. 108.



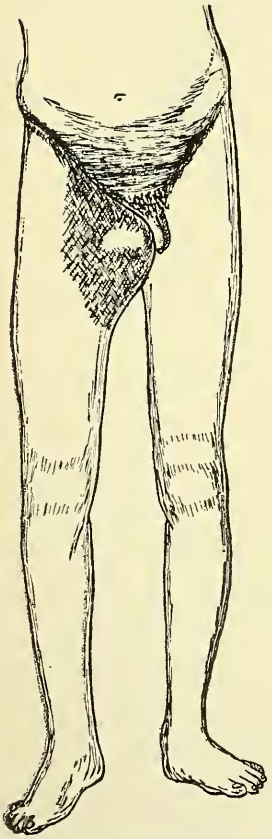
Method of testing the rigidity of the spine, as occurs in spinal caries.

The **deformity** depends upon the part of the spine involved and the extent of such involvement. In the lumbar region, when but one or two vertebrae are involved, there may be no deformity appreciable upon inspection, but palpation will reveal a lesion. This lesion may be of a single vertebra, or three or four, and may be displaced laterally, antero-posteriorly, or twisted. When several of the vertebrae are affected, and there is extensive destruction of the bodies, there may be angular deformity, or a considerable area may be markedly curved. In the cervical region, much curvature is not common, but the lesion is apparent. The most profound curvature is found in caries of the dorsal region. In the cervical region, the deformity present may manifest itself as a twisting of the vertebra and a partial dislocation of the articular surfaces.

Abscess in Pott's disease occurs in the majority of cases. The abscess may reach large proportions, or it may be small. The direction which the pus may take will depend largely upon the part of the spine affected.

Retropharyngeal or Postpharyngeal Abscess arises in caries of the cervical vertebrae. It forms a soft, fluctuating mass in the back part of the pharynx, and may cause difficulty in swallowing and breathing. The pus may rupture into the pharynx, or it may burrow down behind the esophagus into the chest and posterior mediastinum. It may burrow laterally, opening above the clavicle, or passing beneath the clavicle behind the axillary vessels. If it ruptures within the pharynx, and the opening becomes septic, the disease may terminate fatally.

FIG. 109.



Psoas Abscess, pointing in Scarpa's triangle.

Dorsal Abscess.—The pus which forms in caries of the dorsal vertebrae passes backward between the vertebral ends of the ribs underneath the erector spinae mass, forming an abscess four or five inches from the spinous processes. This abscess *yields an impulse upon coughing.* There are cases where the abscess burrows along the vessels and nerves and appears where the lateral cutaneous branches are given off on the side. In some cases, it may pass down the spine, going underneath the ligamentum arcuatum internum and into the sheath of the psoas muscle, forming a psoas abscess.

Lumbar Abscess is due to the pus passing backward along the posterior branches of the lumbar vessels and nerves. It appears on the surface of the outer border of the erector spinae mass and usually points in Petit's triangle. Psoas abscess forms in the sheath of the psoas muscle, passes underneath Poupart's ligament, forming a tumefaction on the front and inner side of the thigh. It may then burrow underneath the fascia lata, but usually ruptures in Scarpa's triangle. The pus appears at a point at the junction of the middle and inner one-third of Poupart's ligament and to the outer side of the femoral vessels. The constitutional symptoms attending the formation of these abscesses are like those attending the formation of any chronic abscess. The pain depends entirely upon whether the trunk of a sensory nerve is affected.

Paralysis and Muscular Spasm do not, as a rule, occur in the course of spinal caries. The cause is often due to the formation of a mass of inflammatory tissue beneath the posterior common ligament. This, if the irritation is slight, will cause muscular spasm and pain, or if the pressure is considerable, cause areas of anesthesia, or localized

muscular paralysis. The effect will depend largely upon the rapidity of the development of the pressure. Where the pressure comes on very gradually, the symptoms are those of sclerosis. Where it comes on rapidly, the symptoms indicate inflammatory softening. Where the paralysis is sudden, it is due to hemorrhage, or luxations. In conditions of paralysis, the disease is usually located in the upper dorsal region. Paraplegia, or paralysis of the body below, happens only in about one case in fifteen. Paraplegic symptoms must be differentiated from those of pressure upon nerve roots. The pressure upon nerve roots causes neuralgic pains, or paresis, or paralysis of a limited area. In compression of the cord, motor and sensory symptoms are combined, but the motor symptoms usually predominate. At first there is a dragging of the toes, a loss of power in the legs, weakness of the sphincters, and an exaggeration of the reflexes. Later on paralysis becomes complete, because of degeneration of the cord. Afterward, *rigidity of the muscles* and a loss of the reflexes occur. In sacral caries there may be no deformity and but little pain. An abscess may form on the buttock, or in the groin, and may be bilateral. Where the abscess ruptures of itself, mixed infection usually occurs, which is followed by hectic symptoms, and should the patient's resistance be low, the case will likely terminate fatally. Long continued suppuration is of itself exhausting, while at the same time lardaceous disease, together with degenerations in the organs, may set up, which terminate the case fatally. The pus may burrow into the viscera and cause death by rupture, or meningitis may be set up, or a condition of pyemia or multiple abscess formation may develop upon the absorption of pus germs. In paraplegic cases, bed sores often operate as a complication, while septic cystitis may bring about a fatal termination from exhaustion.

Diagnosis.—The diagnosis of the disease is easy. A psoas abscess may be differentiated from an abscess of the hip by the fact that if it ruptures in Scarpa's triangle the sinus extends back up the psoas muscle, while in a hip abscess, should it rupture in the groin, the sinus will extend backward and downward. It may be differentiated from an iliac abscess by the presence of spinal disease. Occasionally abscess of the appendix, in chronic appendicitis, ruptures in this same neighborhood. A careful examination will enable the physician to distinguish between them. It may be confounded with femoral hernia (see femoral hernia).

Treatment.—A. Osteopathic.—Like chronic abscess, or chronic bone disease, this affection has its origin in the fact that the tissues of the anterior parts of the bodies of the vertebrae have been partly deprived of their nutrition because of luxated ribs, or subluxated or twisted vertebrae. These displacements cause direct pressure on the small arteries, depriving the diseased part of its proper blood supply. The question as to whether the diseased process is tubercular or a degenerative one does not in any way modify the treatment, since the deposit

of the tubercle is dependent upon the lesions. It is not possible to introduce into the diseased area any drug which will destroy the germ, if present. The only treatment is to build up the tissues so that they may, after a time, resist the ravages of the germs, or destroy them. Where the disease depends partly upon a general nutritive disorder, the removal of the lesions directly responsible for the carious process will not effect a cure. Other lesions in these cases will be found responsible for the general depraved condition of the system. Where the cases are seen early, no deformity apparatus will be found necessary, but the lesions should be corrected and the blood supply encouraged through the vasomotors. In cases seen late, after abscess forms, the same treatment must be followed out. The abscess may be opened after it points and rupture is imminent. Good drainage must be established and the abscess cavity must be washed out daily with an antiseptic solution 1:2000 bichloride of mercury, or 1:40 carbolic acid solution. This will not always be necessary. Only where streptococcic infection seems likely will it be demanded. Where great deformity and paralysis have occurred, the disease will require treatment for from six months to two years. Many cases will get well in four or five months after abscess has formed. The patient must have the benefit of a good substantial diet, fresh air, and sunshine. As far as can be done, apparatus to limit the use of the spine, as the jurymast, plaster casts, etc., should be avoided. The results of the treatment are uniformly good. As a rule, the deformity and paralysis can be overcome in time. Hopeless cripples of years' standing have been entirely cured by the above methods.

B. Surgical.—In view of the very favorable results obtained by osteopathic treatment in spinal caries, operative measures such as advised by Treves and Halsted are not necessary. In the case of a psoas or lumbar abscess, before much pus is formed, aspiration of the abscess may be done under aseptic conditions, while osteopathic treatment is regularly kept up. Usually this will be successful. Where it is not successful, the abscess should be allowed to point. After pointing it should be freely opened, the cavity thoroughly washed out, and good drainage established. The abscess cavity should be washed daily with an antiseptic solution until the discharge has apparently ceased. Drainage should be provided for, while the osteopathic treatment is continued. Favorable results will be obtained. The application of plaster jackets, or extension of the spine, are methods not advisable. Formerly, many surgeons advised forcibly straightening the spine to overcome the deformity, but this is not needed. Operations for the removal of the carious bone and all of the diseased tissues have not been attended by results sufficiently favorable to warrant such procedure. More or less ankylosis of the spine will take place because of the formation of inflammatory tissues and a gluing together of the lamina and articular processes, the ligaments of the spine remaining intact. The deformity and ankylosis resulting may be more or less relieved by appropriate treatment. The patient should have the benefit of out-door

air and a nourishing diet. The secretions should be attended to, while pressure symptoms may be relieved by a correction of the deformity and relief of the inflammation. Septic cystitis developing demands irrigation of the bladder by an antiseptic solution.

Osteo-arthritis.—Arthritis deformans of the spine is a rare affection. The margins of the bodies of the vertebrae become thickened and enlarged, resulting in more or less ankylosis of the spine. This ankylosis may extend even to the ribs, so as to render them almost entirely immovable. The cause of the disease is obscure. The symptoms will depend upon the amount of involvement of the spinal nerves. Paralysis and neuralgic pains are the rule.

Treatment.—Heretofore no favorable results have been reported in the treatment. The osteopath should remove whatever lesions he finds. Whether or not these will be attended by good results will depend upon how early the case is seen.

Dislocations of the Spine may be complete, or incomplete. They are more common in the cervical region, but may occur in the dorsal and lumbar regions. It has been disputed by many that complete dislocations of the lumbar spine may take place without fracture, but unquestioned cases have been found upon autopsy (See American Text Book Surgery, p. 646). Dorsal dislocations occur in the lower part of the dorsal region most frequently. Partial dislocations of the spine are the rule, and are believed many times to play a great part in disease production, sometimes operating as the direct cause of disease, at other times as the indirect cause. The luxations may be bilateral, or unilateral. Bilateral dislocations may be produced by forced flexion, or extension, and the dislocation may be forward, or backward. It is the rule to speak of the upper vertebra as the one dislocated. In complete forward dislocations, the inferior articular process will rest on the pedicle of the vertebra below at a point between the articular process and the body. In backward dislocations, the superior articular process will rest between the inferior articular process and the body of the vertebra above. In this condition there may be little or no pressure upon the spinal cord, but there will be pressure upon the nerve roots as they leave the spine, hence the paralysis may be only limited. In some cases, the paralysis may be extensive, depending upon the amount of injury to the spinal cord. Unilateral luxations are produced by extreme lateral motions of the spine, with or without rotation. In such cases, it is much less likely that there will be pressure upon the spinal cord. There may be pressure only upon a single nerve as it passes out of the intervertebral foramen. This pressure may be evidenced by pain, or by paralysis.

The causes of the dislocations are the same as dislocations in other parts of the body, forced movements, muscular contractions, direct and indirect violence, and wrenching or twisting of the spine. In incomplete dislocations, more or less pressure is made upon the roots of the

spinal nerves, cutting off the nerve supply to certain structures, making a weak point, thus permitting the development of disease.

The **diagnosis** of these conditions may be made by palpating the articular processes and by noticing the general alignment of the spine. The transverse or articular process may be palpated and luxations can be made out. The spinous processes will not always give an accurate idea of the positions of the bodies of the vertebrae, inasmuch as they may often be absent, twisted, or deformed, indicating that there might be curvature, or luxation, when there is none. Usually the symptoms, direct or reflex, are sufficiently pronounced to lead one to investigate a certain part of the spine. Upon close examination, a subluxation, or complete luxation, may be made out.

Reduction.—These luxations are reduced by manipulation. The manipulation consists, in the main, of exaggerating the deformity, then catching the luxated bone with the thumb, or finger, the body is rotated, and the bone pushed into place by firm pressure. In general, this applies to all of the vertebrae. Reduction can easily be accomplished without injury to the spinal cord. It was the former practice of physicians of other schools to allow these luxations to remain, for fear death would be produced by attempts to effect reduction. Complete dislocations of the atlas and axis have occurred, reduction has been made, the person afterward continuing in good health. Subluxations of these vertebrae are much more common, and by the osteopathic practitioner will bear an exhaustive study.

Fractures of the Spine are usually in the nature of a fracture-dislocation; that is, a fracture accompanied by dislocation. The most common site is in the dorsal and lumbar regions. Dislocations of the spine are more common in the upper part of the column.

Cause.—The cause of the fracture is direct and indirect violence. Direct violence, by blows, or heavy falls, where the force is transmitted from behind directly upon the spinal column, or by falls upon the buttocks or extended legs. The nature of the fracture varies with the kind of violence producing it.

Nature of the Injury.—When the fracture is produced by direct violence, the inferior articular processes may be broken off and the vertebrae displaced forward. This results in rupturing of the anterior common ligament. The spinous processes, laminae, or pedicles, may be broken without fracturing the bodies of the vertebrae. This is the rule in fractures from direct violence. In fractures from indirect violence, one or two vertebrae may be fissured, the bodies usually being affected, inasmuch as the chief force is directed upon them. As a rule, the transverse, articular, or spinous processes are not affected, nor are the laminae or pedicles. The displacement of the vertebrae may be much, or little.

Nature of the Injury to the Cord.—*The importance of a condition of fractured spine is not so much the injury to the vertebrae as it is the injury*

to the cord. The cord may be torn asunder, which will result in complete and permanent paralysis of the structures below that point. It may be compressed so that its conductivity is only temporarily suspended. In other cases, fractures of the spine may occur without any paralytic symptoms, nor is the primary injury to the spinal cord always of the greatest importance. The nature of the inflammatory reaction which follows is, perhaps, of greater importance. The functioning of the spinal cord is usually destroyed by inflammatory softening. If the injury is extensive, this inflammatory softening is more likely to occur. Absolute paralysis of motion, sensation, and the reflexes below may be followed by a complete recovery with proper treatment, providing the inflammation is not too great.

Symptoms.—The symptoms of fracture of the spine vary, according to the region injured, and according to the degree of compression of the cord. The clearest mental picture may be obtained from considering a fracture at a single location. In fracture of the upper or mid-dorsal region the symptoms are, in the main, as follows: There is paralysis below, more or less complete—paraplegia. Immediately above the site of injury, there quickly appears a zone of hyperesthesia. The intercostal and abdominal muscles are more or less paralyzed, so that respiration is carried on chiefly by the diaphragm and the elastic and involuntary muscular tissues of the lung, the abdomen rising and falling with the action of the diaphragm. There is paralysis of the sphincters, the urine at first being retained, but after the bladder becomes distended, it dribbles away. There is incontinence of feces. In the male, priapisms are liable to occur, especially upon using a catheter. There may be a spastic condition of some certain groups of muscles, while others may be completely paralyzed. Some of the deep reflexes may be present. Evidences of the reflexes returning, is a sign of the conductivity of the cord returning. After a few days, bronchial troubles will arise, or, if the fracture is high up, cardiac symptoms may appear, because of injury to the vasomotor fibres in the upper dorsal region. The bronchitis will end fatally in a few days. If the patient escapes these troubles, he may live two or three weeks, when secondary complications, such as bed-sores, cystitis, etc., will cause the case to terminate fatally. Bed-sores are the result of the dribbling away of the urine, the bed-clothing being continually saturated with the urine, which decomposes and brings about a foul condition. A little scratch, or slight irritation of the skin, will result in bed-sores which are very difficult to heal. The bed-sores are partially the result of the irritation of the urine, and partially the result of vasomotor disturbances and interference in the nerve influence to the tissues.

Cystitis.—Because the bladder is deprived of the proper nerve and blood supply, and because micro-organisms are likely introduced into the bladder with a catheter, decomposition of the urine may take place. It becomes ammoniacal and will contain ropy mucus and pus. The absorption of this pus brings about a septic condition. This in-

flammation may extend up the ureters and produce pyonephrosis or a suppurative condition of the kidneys. This cystitis is usually fatal. Sometimes bed-sores and cystitis will occur conjointly. The bed-sores are best treated before the sore appears, by sponging the tissues off with strong alcohol once or twice daily and dusting talcum over the parts so as to keep them dry, or, as each small pimple appears, apply oxide of zinc ointment. After the sore appears, it should be dressed once or twice daily with antiseptics. A solution of 1:20 carbolic acid for a time, then 1:2000 corrosive sublimate. After the sores are thoroughly washed, boracic acid may be dusted in them, or aristol, or a little balsam of Peru applied on cotton. Gauze and cotton may be applied to the sore and held in place by adhesive strips. A water-bed is the most useful appliance in the treatment of these cases. Cystitis is best treated by washing out the bladder with a solution of boracic acid (ten grains to the ounce) once or twice daily.

Terminations.—A. In the cervical region. If the fracture is of any of the four upper cervical vertebrae, death is liable to occur, because of paralysis of respiration.

B. Lower cervical and upper dorsal region. Hemorrhage into the cord may extravasate upward, pressing upon the roots of the phrenic nerve and producing death, or a low bronchitis may develop in a few days. Bed-sores, cystitis, etc., usually cause the case to terminate fatally within three or four weeks.

C. Middle and lower dorsal region. If the person survives the inflammatory reaction which follows the injury, he will partially recover, and in some cases, almost complete recovery may occur, leaving only some deformity of the spine as an evidence of the fracture.

D. Lumbar region. In the lumbar region, a fracture with dislocation may occur without any paralytic symptoms. Below the second lumbar there will be no injury to the cord, but the cauda equina will suffer. There may be partial or complete paralysis of a group, or groups, of muscles.

Prognosis.—The prognosis will entirely depend upon the nature of the treatment. Osteopathic methods are superior to those of any system of treatment.

Treatment.—A. First, rest until fibrous and bony union has occurred.

B. Manipulative measures to increase the blood supply to the parts affected.

C. Guard against cystitis and bed-sores, with attention to the secretions. In the treatment of bed-sores above mentioned only surgical treatment has been given. The osteopathic treatment is of greater importance. Even with the strictest asepsis, a good recovery can not be obtained unless nature herself can produce it. Osteopathic treatment means to assist nature in that it increases the blood and nerve supply to the affected areas. Congestion of the inflamed area of the cord should be

relieved, and the relieving of this congestion of the inflamed cord brings about the recovery of its conductivity. This is followed by a better nerve and blood supply to the tissues generally, so that bed-sores are avoided. Extensive bed-sores, attended by necrosis of large masses of the tissues involving the erector spinae mass, denuding the iliac bones and the lumbar spine, in fact, extending over the entire lower back, have been successfully treated by osteopathic methods after all hope had been given up by eminent surgeons. This but illustrates the osteopathic principle. In almost all cases of bed-sores, unless there is absolute paralysis of the tissues below, the sore may be readily healed, if simple cleanliness is maintained and appropriate osteopathic treatment is administered. This osteopathic treatment consists in increasing the blood supply to the sore, and in gently manipulating the spine, so as to increase its blood supply if required, or to relieve the congestion, as the case may be, or to reduce any luxation present. Where the case is seen early during inflammatory softening, appropriate osteopathic treatment will prevent the appearance of the bed-sore.

Concussion of the Spine consists of a molecular displacement of the anatomical elements of the spine. It is a disarrangement of the cells because of severe jarring, as occurs in railway accidents. In some cases, there may be punctuate hemorrhages, or even lacerations, attended by paralysis, or the injury may be simply a partial dislocation, more or less interfering with the blood supply to the spinal cord itself, rendering it anemic, resulting in paresis. Where paralysis occurs, it is likely due to hemorrhage, or laceration. The condition of railway spine is the result of certain spinal lesions. The symptoms vary in the different cases, according to the lesions present and to their length of standing.

Treatment.—In concussion of the spinal cord, or in conditions of railway spine, the treatment is to remove the lesions present. If the lesions are not of too long standing, the prognosis is favorable.

Compression of the Cord.—Compression of the cord is produced by (1) dislocations, (2) hemorrhages, (3) inflammatory products, pus, etc., (4) tumors, (5) fractures. The differential diagnosis between these conditions is usually easy. The evidences of inflammation and pus are sufficiently plain and have been discussed elsewhere. The presence of the fracture, or dislocation, may be determined by the deformity. In the case of dislocation, the diagnosis is made by the alteration of the alignment of the vertebrae and by crepitus, in case of fracture of the spine. The symptoms of compression vary according to the degree of compression and the part of the spine affected.

Traumatic Hysteria.—Traumatic hysteria, or a hysterical condition the result of injury, always bears with it the element of suggestion; furthermore, the stigmata of hysteria will be found present. There are evidences of a neurosis. There are numbers of these cases where the removal of a lesion will cure the case, but the prognosis should be

guarded. Many times the patient will be apparently helpless and the removal of the lesion will produce remarkable recovery. As to whether or not the lesion will produce the symptoms in question, will be evident to the observer. Inasmuch as the patient has no knowledge of the anatomy, the symptoms which are simulated will not be in accordance with the anatomy.

Operations on the Spine consist in operations for tumor, or laminectomy, for the removal of pieces of bone or foreign bodies pressing upon the spinal cord.

DISEASES AND INJURIES OF THE HEAD.

Contusions of the Scalp.—Contusions of the scalp, if sufficiently severe, will cause extravasation of blood. This extravasation may take place between the aponeurosis of the occipito-frontalis and the periosteum, or may take place beneath the periosteum. In any case, it forms a puffy tumor. The blood may coagulate, afterward liquefaction may follow, and a sort of cystic tumor result. The tumor will disappear by absorption. A hematoma may be produced by the blade of the forceps in instrumental delivery of a child. The diagnosis can be made without difficulty by running the finger around along the edge of the tumor, gradually encroaching upon it. The blood will be felt to give way, and there will be no erosion of the bone. In the formation of a cold abscess, there will be erosion of the bone and a ridge of inflammatory tissue around the edge of the tumor. If suppuration of the tumor occurs, it should be opened and freely drained. Where the tumor persists, the contents may be aspirated. Manipulation, such as loosening the tissues about the tumor, relieving contracted muscles and fascia of the neck, to assist the return circulation, will secure absorption of the fluid.

Wounds of the Scalp.—Wounds of the scalp are of the varieties of wounds in other soft tissues. Two dangers beset wounds of the scalp which may not be present in wounds of other parts of the body. These dangers are:

1. Hemorrhage, because of the extensive blood supply.

2. Sepsis, inasmuch as the scalp is an unclean part of the body. Sharp hemorrhage will occur from wounding the anterior or posterior divisions of the temporal artery, or branches of the occipital artery. This hemorrhage can be readily arrested by compression, but where it is very severe, the artery should be caught up with hemostatic forceps and the end of the vessel tied. If the wound is extensive, it is necessary to provide for drainage, which should be at the most dependent portion of the wound. Small scalp abrasions will require no suturing, but extensive wounds will require a few sutures. The number of sutures should be few, and the distance between them greater than in other parts of the body. A small cicatrix will do no harm, unless it is on a part of the scalp where there is no hair. The wound should be

rendered aseptic by thoroughly washing with antiseptic solutions, the hair along the margins of the wound should be shaved off, and the skin approximated. The wound may then be dressed with boracic acid, borated gauze and cotton. A compress may be applied by means of layers of gauze and a mass of cotton, the bandage being applied sufficiently tight about the head to keep the dressing in position. These wounds usually heal very quickly, providing there is no sepsis, since there is a luxuriant blood supply. Should the wound become unhealthy, it must be freely opened by removing the sutures and every part thoroughly washed with an antiseptic solution.

Contusions of the Bones of the Skull.—Contusions of the bones of the skull are not serious in the ordinary healthy individual, but in persons the subject of tuberculosis, or syphilis, necrosis of the bone may occur. This may be serious. These contusions will require no special treatment.

Fractures of the Skull.—Fractures of the skull may conveniently be divided into:

A. Fractures of the vault.

B. Fractures of the base.

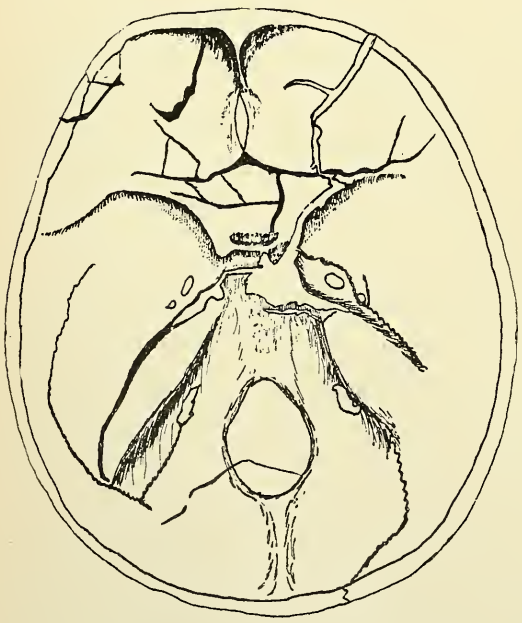
Fractures of the Vault of the skull are nearly always produced by direct violence. Fractures by indirect violence may occur, as by contrecoup. The varieties of fractures are, in general, those of other bones. The most common are fissured, stellate, depressed, and punctured. Elevated fractures may occur in military, but rarely in civil, practice. The fracture may be simple, or compound, depending upon whether there is a wound extending into the site of fracture.

Condition of the Parts.—This will vary according to the nature of the fracture. A simple fissured fracture of the skull may be attended by no signs whatever save that of a bruise of the soft tissues. In stellate fractures, several lines of fracture extend out in different directions from the same point. These irregularities may be felt. In depressed fractures, the depression may be round, or oblong, the "pond and gutter" fracture of the old writers. The fracture may be fissured, with one fragment depressed, or both sides of the fissure may be depressed. The fracture may be extensive, traversing the parietal, frontal, and temporal bones. Where the fracture is compound, the diagnosis is easy, but where it is simple, unless the fracture is elevated, depressed, or punctured, it is difficult to determine. The only other symptoms indicating fracture may be evidences of compression. Where the case is doubtful, it should be carefully watched, and if secondary symptoms, such as headache, epilepsy, evidences of neuritis, etc., develop, a flap should be raised and the skull trephined at the point of injury. In general, where there are evidences of depressed bone, the chisel, or trephine, should be brought into use. The case should not be allowed to continue until traumatic epilepsy develops. After epileptiform seizures have developed, the operation may not be attended by

good results. In some cases of compound or depressed fracture, there may be extensive destruction of the brain substance, or a fragment of the fractured bone may extend down through the dura mater, lacerating or puncturing the brain. In these cases, a flap should be raised, the loose pieces of bone removed, the lacerated tissues placed in normal position, the dura mater sutured, and the periosteum having been separated from the loose fragments of bone, should be sutured over the opening and drainage established. If the wound is extensive, the strictest asepsis should be maintained, inasmuch as septic meningitis may develop. If possible, drainage should be dispensed with, as it renders infection more liable. In any case, it should be removed early. Every possible attempt should be made to have the wound heal by first intention.

Fractures of the Base of the skull may result from direct, or indirect, violence. Fractures from direct violence are caused by blows or falls directly upon the skull. Fractures from indirect violence occur where a person falling from a great height alights on the feet or buttocks; the force is transmitted through the spinal column to the base of the skull, which is fractured.

FIG. 110.



Fracture at the base of the skull.

Site of Fracture.— The fracture may extend in any direction, through the (a) anterior, (b) middle, or (c) posterior fossa, or two of the fossae may be implicated in the same line of fracture.

Anterior Fossa.—The line of fracture may extend through the orbital plates, or through the cribriform plate of the ethmoid, so that hemorrhage may take place through the nose, or effusions of blood may take place within the orbit and appear beneath the conjunctiva. Paralysis of some of the nerves which enter the orbit may occur.

Middle Fossa.— Fracture of the middle fossa usually involves the middle part of the petrous portion of the temporal bone, or may involve

all of the bones. The fracture may extend into the tympanum by lacerating the membrana tympani, and may open into the meatus auditorius externus. The lateral sinus may be implicated, or branches of the middle meningeal artery being ruptured, blood may effuse into the middle ear and come out of the external ear. Blood extravasations within the skull, or pressure of fragments of the bone may involve some of the cranial nerves at their exit.

Posterior Fossa.—The fracture usually extends through the foramen magnum. It may extend into the petrous portion of the temporal bone, or the fracture may take place through the basilar portion of the occipital bone and by rupturing the mucous membrane beneath, hemorrhage will take place into the pharynx. Certain of the cranial nerves will also be affected.

Symptoms.—The symptoms may be divided into (A) General and (B) Local.

The **general symptoms** of fracture at the base of the skull are those of *compression* of the brain.

The **local symptoms** are:

1. The escape of cerebrospinal fluid. The most characteristic feature of this symptom is the large quantity of the fluid escaping. The quantity is variously estimated by different writers at from one to three or four pints in twenty-four hours, so that numerous dressings will be required to absorb the flow. The fluid is clear and somewhat resembles serum. A chemical analysis is hardly necessary to determine whether the fluid is cerebrospinal or not. The points from which the escape of this fluid may be made, are wounds, the nose, mouth, and ear. The escape of fluid may take place from wounds when the fracture at the base of the skull is compound. It may take place through the nose, when the fracture extends through the cribriform plate of the ethmoid. It may take place through the mouth, when the fracture extends into the vault of the pharynx. It may take place through the ear, when the fracture extends entirely into the middle ear and the membrana tympani is lacerated.

2. Blood Symptoms. These consist of hemorrhage and blood effusions. Hemorrhage is of little value as an indication of fracture at the base of the skull, inasmuch as the flow of blood is no more severe than when there is but a wound in the soft tissues, but blood effusion is of more value. Blood effusions may be subconjunctival in fractures through the orbital plates, and the effusion of blood takes place in the orbit, or they may be about the mastoid process in fractures of the posterior fossa, or the blood effusions may take place in the suboccipital region. Blood effusions in these localities, without evidence of local injury, are an indication of fracture of the base of the skull.

3. Paralysis of the Cranial Nerves. These may be manifest in strabismus, ptosis, Bell's paralysis (where the facial nerve is implicated), the pupils may be irregular and dilated, there may be diplopia, or there

may be paralysis of accommodation. Where the patient is not unconscious, the latter symptoms are of importance, but where the patient is unconscious, they may not be of as much value.

Treatment.—The treatment of fracture at the base of the skull is rest and attention to the secretions, together with local treatment of the wound and manipulation, in general, to assist the return circulation. No drugs will be found of any advantage. There are cases where the patient is delirious and more or less irritable, but under no circumstances should morphine, alcoholic stimulants or other drugs be allowed. If the person survives the early compression, absorption of the fluids may be secured, and the paralytic and other symptoms will gradually disappear. The prognosis is unfavorable, but many cases recover.

Concussion of the Brain.—Injury to the brain itself is manifest by certain symptoms which are classified, as a rule, under two conditions, concussion and compression. The difference in the pathology of these two affections is not always well defined, and the symptoms vary.

Concussion is a condition of extensive jarring of the brain. The tissue elements of the brain are shaken up and the connections between the cells and groups of cells are for a time suspended. It may be described as a molecular displacement of the brain elements. In some cases there may be punctuate hemorrhages; others describe the conditions as a vasomotor disturbance. A person suffering from concussion is popularly said to have been "knocked silly," or "stunned." The severity of the symptoms varies with the severity of the injury to the brain. There may be cases where the person is temporarily "queer," and may stagger about and be unable to speak for a little time, and will appear as if drunk, but consciousness will quickly return and the queer feeling disappear. Pronounced cases are attended with severe symptoms, which may be classified as follows:

1. State of Mind. The person is more or less unconscious of his surroundings. In mild cases, he may know something of what is going on about him, but in severe cases, he knows nothing. Under all circumstances, he may be aroused to make an intelligent answer in monosyllables, as "yes" or "no."

2. Skin. The skin is pale and cold, and the extremities are cold. The body-temperature may be subnormal.

3. Muscular Symptoms. There may only be a giddiness, or a giving-way of the muscles, or there may be complete muscular relaxation.

4. Respiration. Respirations are shallow, quiet, and a little more rapid.

5. Pulse. The pulse is small, soft, irregular, and more rapid. The heart is fluttering.

6. Pupils. The pupils react to light. They may be dilated, or contracted, but are unequal.

7. Paralysis. Paralysis of any part is rare, and if it occurs, is only temporary. There may be muscular twitchings in certain muscles.

There are severe cases of profound concussion in which there is evidence of great cortical irritation. This is manifest by the person shunning light and curling up in bed, and by more or less rigidity and twitching of the muscles. It may be almost impossible to open the person's eyes, as it causes pain.

8. Urine and Feces. The urine and feces may both be voided involuntarily.

9. Nausea and Vomiting. Nausea and vomiting appear late, and are favorable signs, as they are an evidence of reaction which they precede.

Reactionary Signs.—Reactionary signs are, as indicated, vomiting, followed by headache, lassitude, insomnia, low spirits, perhaps hysteria, and in severe cases, epilepsy and insanity. The longer the person remains unconscious, the more likely is the mentality to be seriously affected.

Treatment.—The treatment of concussion consists of equalizing the circulation and the proper restoration of the vasomotor impulse. In conditions of congestion of the brain, this congestion should be relieved. Cases may be brought out of concussion by manipulation of the bowels, which attracts the blood to the splanchnic area. Under no circumstances should alcohol be given. The application of hot water bottles to the abdomen and legs and restoring the circulation by treatment in the neck and upper dorsal region, together with rest and quiet, are all that is required. Enemata of hot water, or hot milk, after the lower bowel has been evacuated, is advised. A few drops of ammonia on a handkerchief may be of some service. Even if obstinate wakefulness and cortical irritation are manifest, no opiates should be allowed. Sleep can be produced by equalizing the circulation. It is believed, in concussion, that the chief difficulty is the suspension of the vasomotor function to the cerebral vessels. Undoubtedly in many of these cases, cervical lesions will be found, and if these are reduced, the concussion will disappear. It is believed that many of the cases which are described as concussion are the result of displacement of the atlas or some of the cervical vertebrae obstructing the return circulation.

Compression of the Brain.—Compression of the brain is produced by the following conditions:

1. Fractures, as depressed fractures of the vault, or fractures at the base of the skull. 2. Intracranial hemorrhage. 3. Tumor. 4. Pus, as in abscess formation. 5. Inflammatory exudates. 6. Foreign bodies.

Symptoms.—1. State of the Mind. The state of mind in compression of the brain is usually coma. The person may emit articulate sounds, but they are not intelligent, in contradistinction to concussion in which a reply can be obtained by speaking loudly in the ear.

2. Skin. The skin is hot and perspiring, while the face is flushed. The temperature may be elevated, or may be subnormal.

3. Muscular System. In general, there is a loss of all voluntary motion.

4. Respiration. Respirations are slow, deep, and noisy, because of paralysis of the soft palate, which flaps back and forth during respiration, and the buccinator muscles being paralyzed, the cheeks flap in and out.

5. Pulse. The pulse is full and bounding. It may be slow, or rapid, but is usually strong. It may be irregular.

6. Pupils. The pupils are fixed, and will not react to light. They may be regular, or irregular, dilated, or contracted.

7. Paralysis. Paralysis exists and may be extensive, involving one entire side—hemiplegia—or it may be limited to a member —monoplegia. There may be paralysis of some one of the cranial nerves, producing strabismus, ptosis, Bell's paralysis, etc.

8. Urine and Bowels. There is incontinence of feces and urine.

9. Nausea and Vomiting. Nausea and vomiting are unfavorable signs, indicating involvement of the base of the brain or medulla.

Differential Diagnosis.—Coma, present in compression of the brain, may be simulated by comatose conditions arising in:

1. Apoplexy. 2. Uremia. 3. Diabetes. 4. Opium poisoning.
5. Alcoholic intoxication. 6 Epilepsy. 7. Hysteria.

Confusion in the diagnosis is not so liable in private practice as in hospital practice.

Apoplexy.—Apoplexy may be ushered in by convulsive movements. Hemiplegia is the rule. The temperature may be subnormal. It is more liable in conditions of arterio-sclerosis during excitement, or in a person the subject of syphilitic disease.

Uremia.—In uremia, albuminuria is one of the chief symptoms. In a doubtful case, the urine should be withdrawn and tested. The presence of albumen and tube casts indicates Bright's disease. The skin is sallow. Puffiness of the eyes and edema about the ankles are present.

Diabetes.—In diabetes, the quantity of urine is greatly increased and has a sweetish odor. The patient also has a sweetish breath. There is sugar in the urine. The pupils react to light.

Opium Poisoning.—In opium poisoning, there is a pin-point pupil, and it will not react to light. The respirations are slow and shallow, and there may be a history of the drug. In doubtful cases, the urine may be withdrawn and tested for the drug.

Epilepsy.—In epilepsy, the person can be aroused The attitude of the person simulates that of natural sleep. The presence of bloody and frothy saliva is also indicative. There may be paralytic symptoms, but these are usually temporary.

Hysteria.—In hysteria the coma apparently is the result of choice. The patient can not be aroused, but can readily swal-

low articles put in the mouth. The pupils are normal. The disease occurs in neurotic individuals.

Treatment.—The treatment of compression will depend upon the cause. Where there is a depressed fracture, it should be elevated. Where it is the result of a tumor, and the case is operable, the tumor should be removed. If caused by pus formation, a button of bone should be removed over the site of the abscess and the pus evacuated. If from foreign bodies, these should be removed, if possible. Where the cerebral compression is caused by hemorrhage, if the hemorrhage is extradural, or subdural, operative treatment may give relief. Where operative treatment is questionable, the patient should be kept quiet in bed and all efforts made to assist the return circulation.

Extravasation of Blood Within the Cranium.

Extravasations of blood within the cranium may be classified as follows:

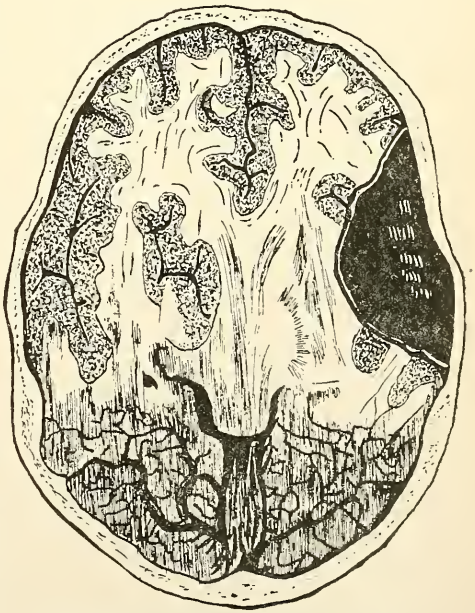
A. Extradural, where the effusion of blood is between the bone and the dura mater.

B. Subdural, where the effusion of blood is below the dura mater and between it and the brain.

C. Subarachnoid, when the effusion of blood takes place in the subarachnoid spaces.

D. Intracerebral, when the hemorrhage takes place within the brain substance.

FIG. 111.



Extradural hemorrhage from rupture of the middle meningeal artery.

Extradural.—Extradural hemorrhage results from rupture of the middle cerebral artery — usually the anterior branch. It is frequently associated with fracture of the skull. It may also be caused by wounds of the lateral sinus, superior longitudinal sinus, or small vessels passing through the inner table of the skull going to the diploe.

Symptoms.—While there may be symptoms of concussion, still a distinct period of consciousness, as a rule, intervenes before evidences of compression. As the extravasated blood dissects up the dura from the skull and presses upon the brain, the symptoms

will increase in severity, depending upon the amount of the effusion. Usually there is paralysis of one side, which gradually increases, involving the face, arm and perhaps the leg. The temperature of the affected side is elevated. The paralysis is on the opposite side to the injury. At first it is limited. The coma gradually deepens, until death may occur within a few days. In some cases the blood may force the brain substance out of the site of fracture.

Subdural.—In subdural hemorrhage, there is no interval of consciousness between the injury and the pressure symptoms, but paralysis comes on at once and is soon complete. As a rule, it cannot be diagnosed from hemorrhage within the brain.

Subarachnoid.—Subarachnoid hemorrhage, when of any quantity, attends lacerations of the brain, hence the symptoms of compression are immediate.

Intracerebral.—Intracerebral hemorrhage in nearly all cases comes from the rupture of the lenticulo-striate artery of Charcot. It is this artery which is ruptured in cerebral apoplexy. For the symptoms and diagnosis, text-books on The Practice of Osteopathy should be consulted.

Treatment of Cerebral Hemorrhage.—When the symptoms show that the hemorrhage is extradural, operation should at once be performed and the bleeding sinus or artery ligated. In subdural hemorrhage, if operation is done early, it will be of use. Where the rupture of the artery attends fracture, this is the only method of treatment which will give relief. All other methods will result in permanent paralysis, or death. Other forms of hemorrhage must be treated by other means. No drugs administered will lessen the amount of effused blood. An ice-cap may be applied, the person kept quiet in bed, and when the hemorrhage is arrested, treatment to encourage the return circulation from the brain and the absorption of the fluid may be administered.

Contusions and Lacerations of the Brain.

These injuries, like injuries of other soft-tissues, are attended by extravasations of blood, subsequent congestion, and inflammation sufficient to repair the injury. The symptoms, in general, are those of compression and concussion. They will vary from cerebral irritability, restlessness, lassitude, headache, and spasms of muscles, to paralysis, and perhaps coma. The symptoms vary according to the severity of the injury, and also according to its location. If Broca's convolution is affected, motor aphasia will result. If the lower part of the motor area is affected, the lower part of the face will be paralyzed. Where the tissues on either side of the upper part of the fissure of Rolando are affected, the leg will be paralyzed. The paralysis may be incomplete, localized, and delayed, and involve the entire limb, or but a group of muscles. When the laceration is within the brain, the paralysis is immediate, complete, and extensive.

Treatment of Cerebral Injuries.—If possible, foreign bodies within the brain should be located by means of the x-rays, the aluminium probe, or gravity probe, and an operation at once performed and the foreign body removed. To determine the site of the injury, or the location of a foreign body, tumor, or other object pressing upon the brain tissue, it is necessary to understand cerebral localization. The most pronounced symptoms attend pressure upon the motor area. To locate this part of the brain is of the greatest importance. In general, it is situated in the paracentral and postcentral lobules on either side of the fissure of Rolando. Inasmuch as extradural hemorrhage is from rupture of the branches of the meningeal artery, to locate this artery is of importance. The **anterior branch** of the middle meningeal artery may be uncovered by a button of bone removed at a point one and one-half inches directly behind the external angular process of the frontal bone. Providing the hemorrhage does not occur from rupture of this artery, a button of bone may be taken out on the same line, just below the parietal eminences. This will uncover the **posterior branch** of the middle meningeal artery. To locate the **fissure of Rolando**, first locate the bregma, which is found by drawing a line from one external auditory meatus to the other. The upper end of the fissure of Rolando is two inches behind the bregma. The fissure extends downward and forward from the bregma a distance of three and three-eighths inches. It makes an angle of 67½ degrees, with a line drawn from the glabella to the external occipital protuberance. The lower extremity of the fissure of Rolando will then be found two and three-fourths inches behind the external angular process and one inch above it. It will be found that pressure upon the tissues on either side of the upper part of the fissure of Rolando results in paralysis of the leg, while pressure behind the middle part, the arm, and pressure upon the lower extremity produces paralysis of the face. For an exhaustive discussion of this subject, larger texts should be consulted.

Intracranial Inflammation.—Intracranial inflammation consists of:

A. Meningitis, or inflammation of the coverings of the brain.

B. Encephalitis, or inflammation of the brain substance.

Cause.—The causes of these inflammations are acute, general diseases of an infectious nature, middle ear disease, syphilis, tuberculosis, injury, lacerations, bone disease, contusions, fracture, rheumatism, and sunstroke.

Pachymeningitis is an inflammation of the dura mater, usually circumscribed, and is caused by inflammation extending from without, in.

Leptomeningitis is an inflammation of the pia mater and arachnoid, and may be localized because of infection from without. It is extensive, when the inflammation spreads throughout the membranes of the brain and cord.

Pathology.—The pathology of these inflammations is similar to the

pathology of inflammations of other like membranes. The extent of the inflammation depends upon the nature of the cause and the condition of the tissues.

Symptoms.—The symptoms are fever, pain in the head, which is greatest over the site of the severest inflammation, intolerance to light and sound. There is more or less nausea and retching, while the tongue does not indicate any trouble with the intestinal tract. The pulse is quick and full, the face is flushed, the pupils usually contract. There is restlessness and insomnia, and perhaps delirium. Later, serous effusions, inflammatory exudates, or pus formation, etc., press on the brain substance, and symptoms of compression supervene. These will be recognized by a fixed and dilated pupil on the affected side, slow pulse, stertorous breathing, paralysis, and coma. There may be rigors, indicating pus formation. In chronic inflammations, the symptoms are less severe and the onset sudden. There are localized evidences of sepsis. If the abscess is between the dura mater and the skull, puffiness of the skin, and the presence of pus, or a foul wound, would indicate abscess. Where there is no injury to the scalp, the symptoms arising may be due to the vascularity of the membranes, produced by a concussion or shaking up of the brain. After four or five days, the pia mater and the brain substance may be affected. In bruises and lacerations of the pia mater and brain, inflammatory symptoms may supervene several days after the injury.

Cerebral Abscess.—In the formation of a cerebral abscess, the symptoms are often delayed and are more or less obscure. There is evidence of optic neuritis and paralytic disturbance in the motor area. Rigors may, or may not, occur. The temperature may be primarily elevated, but as the inflammatory reaction continues, it is usually subnormal. Later along in the disease there may be an elevated temperature of 101 or 102 degrees F. There is persistent headache, which is more or less localized, and persists throughout the delirium, in contradistinction to headaches from any other cause. The pulse is slow, respirations are shallow, or may be of the Cheyne-Stokes variety. Vomiting of a retching character is a frequent symptom of cerebral abscess. The symptoms are those of irritation; spasmodic action of the muscles, followed by paralysis; the pupil on the affected side becomes fixed; choke-disc may be present; later, one or more of the cranial nerves may become involved. It is said that more than one-half of all the cases of cerebral abscess come from middle ear disease. Cases are caused by fractures of the skull, tubercular disease, and by infections through the mouth and nose.

Intracranial Tumor.

New growths in the brain are tumors, such as gliomata, psammomata, gummata (tubercular and syphilitic formations), cysts, and malignant neoplasms.

Symptoms.—The symptoms of new growth of the brain are, vomit-

ing, headache, optic neuritis, spasms, and paralysis. Epileptiform seizures, in the nature of Jacksonian epilepsy, are a more or less constant accompaniment of the development of intracranial tumor. Localization is more or less indicated by these symptoms: (1) The beginning of the epileptiform seizures may indicate the part of the brain affected. (2) Pain. (3) The exaggerated contraction of the flexor or extensor muscles proceeds from a certain area of the brain. (4) Paralysis of muscles, as of the face, monoplegia, etc.; the affection of sensation or the special senses, as of sight, hearing, etc. (5) The involvement of certain cranial nerves. These symptoms may indicate the location of the new growth.

Treatment.—The treatment of the new growth will somewhat depend upon its nature and location. Some of these tumors are inoperable and can best be treated by the ordinary methods in the treatment of tumors. In tuberculosis and syphilis of the brain, the general treatment for these affections will be required.

Hernia Cerebri.—Hernia cerebri is a condition where there is pouting of the brain substance from a wound. It looks like a reddish-brown, blood stained fungus mass. It pulsates with the brain. It usually overhangs an opening in the skull bone. It may slough off and the wound cicatrize and heal, with more or less interference of function, or the mass may recede and the patient recover. In other cases, paralysis, coma, and death will occur.

Trephining.—For the treatment of extradural and subdural hemorrhage, cerebral abscess, intracranial tumor, depressed and punctured fractures, bullet wounds, etc., and the removal of foreign bodies, the operation of trephining is often required. It consists of the following procedure: If the patient is in a state of unconsciousness, an anesthetic may not be required, but where there is more or less consciousness, an anesthetic should be given. Preparatory to the operation, the head should be shaved, the scalp thoroughly scrubbed, and rendered as nearly aseptic as possible. A semi-circular flap, including all the structures to the bone, should be raised. The flap should be so constructed as to receive the maximum blood supply and to give the best opportunity for drainage. The instruments necessary for opening the skull are the Galt's trephine, or a good bone chisel and mallet. It is necessary to have a small brush for removing the saw-dust, or this may be removed by means of irrigation. The trephine should be set upon solid bone. A rongeur forceps should be at hand for the purpose of enlarging the opening if necessary. Care should be taken not to puncture the dura mater. In case of extradural hemorrhage, the dura will not need to be opened. In depressed fracture, after the button is removed, the chisel may be used as a lever and the depressed bone elevated. In case of cerebral abscess, the dura mater may be opened, the abscess incised, thoroughly drained, and washed out with a saturated solution of boracic acid. The strictest asepsis is necessary throughout the operation

to prevent the development of meningitis. Before the operation, the fissure of Rolando and the anterior and posterior branches of the middle meningeal artery, or the lateral sinus, or any part of the brain upon which the operation is to be made, must be outlined with an anilin pencil. This will serve as a guide to the operator. The pin of the trephine should protrude perhaps one-tenth of an inch beyond the saw's edge, and as soon as the diploe is reached, this pin should be withdrawn. If it is necessary to open the dura mater, the greatest care should be taken not to injure the cerebral vessels. After the removal of the foreign body, the dura mater may again be closed by means of sterile catgut or tendon sutures. Some surgeons make an osteoplastic flap by raising the scalp and skull by means of an incision through the scalp and chiseling through the bone. The operation, when the technic has been carefully observed in every detail, is eminently successful in the removal of many brain tumors, in draining abscesses, and in the removal of foreign bodies and other conditions before mentioned.

Epilepsy.

By traumatic epilepsy is here meant that form of epilepsy which is usually considered operable. This kind of epilepsy may be due to the following conditions:

1. Fragments or outgrowth of bones.
2. Tumors.
3. Scars or cicatrices of the meninges.
4. Thickening of the meninges from chronic meningitis.
5. Hemorrhagic cysts or aneurysms.

The time to operate in cases of depressed bone, or injuries of the brain, is at the time of the injury, and not after the development of epilepsy. Too often the epilepsy becomes much worse after the operation. Some cases of cure by operation for epilepsy are reported in the non-traumatic form, but almost all cases are not benefited, while some may be made much worse. It is questionable whether operation in either form of epilepsy is of any use. The removal of any object pressing upon the cortex of the brain would be attended by benefit, if not by actual relief of the epileptiform seizures.

Treatment.—The treatment of epilepsy must be considered from other standpoints. Osteopathic methods offer more hope than other forms of treatment.

Mastoid Disease.—Mastoid disease is an inflammation of the mastoid cells caused by the extension of the inflammation from the tympanum (in cases of otitis media). The symptoms vary according to the severity of the inflammation. The inflammation may be slight and terminate in resolution, or it may become chronic and be followed by fibroid changes, with subsequent ossification of the inflammatory products, thus converting the antrum into bone. Often suppura-

tion results. Pus may open at the tip of the mastoid process, or burrow down the neck. In other cases, the infection may extend into the lateral sinus and an infected thrombus result, while in other cases cerebral abscess may develop.

Symptoms.—Where the abscess makes its way into the cranial cavity, there will be symptoms of cerebral abscess. Over the mastoid process there is deep seated pain upon pressure. Where the periosteum over the mastoid is involved, there will be great redness and swelling and inflammation of the tissues behind the ear. Sometimes the abscess is but superficial and will point, and after rupturing, discharge its contents spontaneously, but after pus forms, many cases will require some operative interference.

Treatment.—The treatment of the disease is anti-inflammatory. Hot fomentations should be applied, to attract the pus towards the surface. As soon as fluctuation is felt, the abscess should be thoroughly opened and cleansed. It should then be treated by hot borated poultices and any cervical lesions removed, while the contracted fascia and muscles of the neck should be relaxed. Suppuration is the rule. No measures are entirely successful, inasmuch as the blood supply to the middle ear and the mastoid cells must come through bony canals, which will not permit of sufficient nutrition to enable the tissues to combat the infection. Where the inflammation is deep seated, and the pus does not show a tendency to burrow towards the surface, and there are evidences of meningitis, the operation for trephining the mastoid should be done. To open the mastoid antrum, the trephine should be set a half-inch behind and one-fourth inch above the middle of the external auditory meatus. In case the anterior surface of the petrous bone and the roof of the tympanum are to be excised, the operation should be seven-eighths of an inch above the middle of the auditory meatus, while if the lateral sinus is to be operated upon, the point of operation is one and one-eighth inches behind and one-fourth inch above the middle of the auditory meatus. Abscess in the cerebellar region is opened at a point one and one-fourth inches behind and a half inch below the middle of the auditory meatus.

Abscess of the Scalp.—Abscess of the scalp, if it occurs beneath the aponeurosis of the occipito-frontalis, may be spread over a large area. It will require free incision and good drainage. It should be washed out twice daily and thoroughly cleansed.

Microcephalus is a condition of abnormally small head, due to maldevelopment. The skull frequently becomes ossified early. Operations for the removal of sections of bone have been performed with the hope of the brain developing, but this operation has not been attended with any success. These patients should be sent to a home for the feeble-minded. It is not known that any treatment will accomplish much good.

Meningocele is a congenital tumor of the membranes of the brain

which contains fluid. The tumor is translucent, and does not pulsate. It is usually located in the occipital region. It is small and pedunculated. It may occur at the root of the nose. At this point, it is small and sessile.

Encephalocele is a congenital tumor which is made up not only of the membranes, but of the brain tissues. These tumors are small, opaque, and pulsatile. They have a broad base, and compression gives pressure symptoms. Operative treatment is advised in some cases. In meningocele, the tumor may be excised by plastic operation. In encephalocele, no treatment is known to be of any use.

Hydrencephalus is a condition similar to encephalocele, but differs from it in that the cavity of the tumor communicates with the ventricle The tumor is larger than an encephalocele.

Hydrocephalus may be acute, or chronic, external, or internal.

Acute Hydrencephalus is caused by meningitis, and usually results in tubercular meningitis. For the symptoms and treatment, texts on osteopathic practice should be consulted.

Chronic Hydrencephalus is a congenital condition. The cranium enlarges enormously, and the forehead is broad and overhangs the eyes. Sometimes the skull bones are widely separated. The case is usually apparent upon inspection. The child is often an idiot, and may not be able to learn to walk, or talk. It usually dies young.

In **External Hydrocephalus** the fluid is between the membranes and the brain, while in **Internal Hydrocephalus** the increase in the fluid takes place within the ventricles.

Injuries and Diseases of Muscles, Tendons, Fascia, and Bursae.

Contusion of Muscles.—Contusion of muscles is a common and painful injury, and is usually associated with considerable extravasation of blood within the tissues.

Treatment.—Apply cold water the first twenty-four hours; subsequent manipulation to diffuse the blood-clot will be of advantage. Sometimes intense discoloration of the subcutaneous tissues and skin will take place. Unless abscess occurs, no other treatment will be necessary, even though the condition is quite painful. If abscess occurs, applications of heat should be made. As soon as fluctuation is felt, the abscess should be opened. However extensive the blood extravasation, it should not be opened unless pus forms. Contusion of the muscles may result in temporary paralysis, but manipulation and encouraging the circulation and nerve force will result in recovery of function.

Strain and Rupture of Muscles.—Strain and rupture of muscles may take place in violent exercise, or while performing athletic feats, or from spasmodic action of muscles, such as happen in vomiting, delirium, tetanus, and parturition. The muscles most often affected are the biceps in raising weights, supinator longus, gastrocnemius, and rectus

femoris in tennis, quadriceps extensor cruris in sprinters, and rectus abdominus in parturition, etc.

Signs.—Often there is a giving-way of the muscle, with a sudden snap and severe pain, while a gap forms between the ruptured ends. The ruptured ends of the muscle form hard knots on either side of the gap.

Treatment.—The ends of the muscle should be approximated as nearly as possible by position and relaxation. Keep the limb at rest and apply cold water for the first twenty-four hours, then daily manipulation, together with rest, will bring about recovery. The integrity of the muscle may be somewhat impaired.

Open Wounds of Muscles and Tendons.—The division of muscles and tendons requires approximation of the structures by special suture, to re-establish their function. This should be done in the manner described in the treatment under "Closure of Wounds." It is best done with aseptic catgut, or kangaroo tendon suture.

Dislocation of Muscles and Tendons.—Displacement of muscles and tendons takes place more frequently than is generally supposed. Sudden and violent contractions, spasmodic efforts, etc., are the cause. Perhaps the long head of the biceps is more frequently dislocated than any other individual muscle. The signs somewhat resemble dislocation of the shoulder. Where the tendon is not returned to its normal position, it may become absorbed. The peroneus longus and brevis may be dislocated from behind the external malleolus. They will stand out prominently beneath the skin over the lower extremity of the fibula. The tibialis posticus may be dislocated from behind the internal malleolus. Muscles of the calf, thigh, back, neck, arm, and forearm are all liable to dislocation. The diagnosis can only be made by understanding the anatomical relations.

Treatment.—The treatment is to manipulate the parts into position and enjoin rest and quiet until the ruptured sheaths heal. Operations to place a halter about luxated tendons may sometimes be necessary, where the dislocation becomes habitual. This operation is, if properly done, successful.

Rupture of Tendons.—Tendon-rupture occurs because of violent muscular contraction or violence to the tendon itself. The ends of the ruptured tendon should be approximated and the limb flexed or extended, abducted or adducted, as the case may be, to thoroughly relax the muscle. The member should be put in a splint until the tendon heals, which will be within two or three weeks.

Myalgia.—Myalgia, or muscular rheumatism, so-called, is a painful affection of voluntary muscles, or of the periosteum and fascia to which these muscles are attached and by which they are surrounded. The disease is properly not a rheumatism, but is more in the nature of a neuralgia. The cause of the disease is a specific bony lesion pressing

upon the vessels and nerves to the part affected, or congestion of the muscles brought about by cold, damp, exposure, and climatic conditions. These congestions bring about muscular contractions, producing bony lesions, which of themselves serve to prolong the ailment. When it affects the muscles of the back, it is termed lumbago; the intercostal muscles, pleurodynia; the muscles of the scalp, cephalodynia. Myalgia of the muscles of the neck is called rheumatic torticollis. A certain class of these diseases is produced by mercury and lead poisoning, syphilis, alcoholic excesses, gouty and rheumatic conditions.

Treatment.—The treatment is distinctly osteopathic. Certain lesions are responsible for the affection. Sometimes these are bony, and sometimes muscular. Occasionally, bony lesions will irritate certain nerve filaments, when spasm of some muscle, or group of muscles, results. This serves to perpetuate the lesion and to increase the pain and congestion. Sometimes congestion of muscles and fascia will produce sufficient irritation to bring about muscular contraction and thus cause lesions. Wherever myalgia occurs, certain lesions may be found to which the disease can be traced. The removal of these lesions will be attended by a cessation of pain and recovery. Manipulation directed toward relieving contracted and congested muscles, fascia, and ligaments, will be necessary, as well as the removal of bony lesions. In the largest number of cases, spinal lesions, causing pressure upon the roots of the nerves as they leave the spinal canal through the intervertebral foramina, are the direct cause of the ailment. These may be found upon careful examination. In any case, the appropriate treatment of the lesions present will give relief.

Myositis.—Myositis is an inflammation of muscles produced by injury and infection. The course it runs is not unlike that of inflammations of other structures, and the treatment is similar. Should an abscess develop, it should be freely opened and drained.

Gummata.—Syphilitic gummata may occur as local swellings in muscles in tertiary syphilis. History of the disease and the absence of other causes will serve to make the diagnosis. The treatment is antisyphilitic.

Atrophy and Degeneration.—Atrophy of the muscles may be simple, or numerical. **Simple atrophy** is usually due to non-use. This happens in the case of fractures. The muscles do not lose their striations, and appropriate treatment, or use, brings about the entire recovery and development. **Numerical atrophy** often attends critical joint disease, with long disuse of the limb. It may be impossible to secure complete recovery of the muscles affected.

Degeneration of Muscle takes place in acute fevers, progressive muscular trophy, infantile palsy, and other paralysis. The prognosis is only fair, if the case is of long standing. The degenerations are fatty, waxy, and albuminoid in nature. The integrity of the muscle may be more or less permanently impaired.

Treatment.—The condition of atrophied or degenerated muscles may always be improved. The extent of improvement depends upon the amount of pressure on, or injury to, the nerves, and as to whether these nerves may be regenerated. Much depends on the condition of the circulation, and to what extent the tissues respond to the treatment. In many instances, withered limbs, or paralyzed members of years' standing, have been relieved in a few months, the muscles being restored to their normal strength and tonicity. In other instances, not much relief can be given. Where there is disease of the nerve cells governing the muscles, the prognosis is not favorable. In all other instances manipulation directed toward assisting the circulation, nerve supply, and to removing lesions affecting the nerve and blood supply directly, will secure regeneration of the affected parts.

Ossification of Muscles.—Ossification of muscles may arise from certain diseased conditions, chronic irritation, or occupations. The most frequent examples met with are the rider's bone in the adductor muscles, or ossification of the deltoid in soldiers, the result of carrying arms. Ossification of the quadriceps extensor is said to take place in cases of Charcot's disease.

Tenosynovitis, or Thecitis.—This disease may occur in the form of a simple inflammation of tendon-sheaths, as the result of injury or overexertion. It often affects the common extensor tendons of the thumb. It is accompanied by a globular or elongated swelling over the tendon. It is painful until after the swelling takes place. The swelling is more or less fluctuating and movable. After the swelling disappears, or in chronic forms of the disease, movement will produce a characteristic creaking sensation (false crepitus).

Treatment.—Strapping, as a strap buckled tightly around the wrist, will give relief from pain. Local manipulation will assist the circulation and may secure resorption of the inflammatory products. The treatment must be persisted in, since the case yields but slowly. The tendons should be given sufficient rest to permit the reparative process to take place when there has been injury.

Thecal Abscess.—(Paronychia tendinosa). This is a suppurative form of inflammation occurring in tendon-sheaths. The non-suppurative form may occur in gonorrhea, rheumatism, and influenza. It is attended by fluid effusions, crepitus, etc. Thecal abscess is one of the forms of whitlow, or felon. It occurs in persons who are debilitated. Constipation exists, or the urinary secretions are abnormal. In addition, there are bony or muscular lesions affecting the circulation or nerve supply to the part. This renders infection possible. Bacterial invasion takes place in a finger or toe. The disease is more common in the hand, where it is in the form of a palmar abscess. Thecal abscess of the little finger and thumb is more serious than of the middle, index, and ring fingers, inasmuch as the effusion of pus may take place along back the tendon-sheath which communicates with the sheath of the common

flexors in the hand. The pus may burrow underneath the annular ligament and in some cases may extend up the arm. Such extension of the pus is not possible in abscess of the index, middle, and ring fingers, inasmuch as the tendon-sheaths do not communicate directly with the tendon-sheaths in the palm. The abscess may extend into the palm, pass between the heads of the interossei muscles, and open on the back of the hand, or may burrow underneath the annular ligament, producing a swelling above the wrist, or may even extend up the sheath of the muscles into the forearm. Sepsis may result. Necrosis of the bone may occur, or a considerable amount of fibrous tissue may form and the sheaths of the tendons become glued to the tendon itself, producing contractions and deformity, or it may involve the carpal, phalangeal, metacarpo-phalangeal, or wrist-joints, producing ankylosis.

Symptoms.—Severe throbbing pain, extreme tenderness upon pressure, swelling, and a dusky redness. Oftentimes there is swelling, edema, and redness of the back of the hand. The lymphatics in the axilla are enlarged and painful; constitutional symptoms, as rise of temperature, are present; the appetite is lost; there is constipation; the urine is less in amount and highly colored. Only one other affection resembles this disease, and that is acute septic inflammation of the connective tissues of the fingers and not involving the tendon-sheaths. Care should be taken when the abscess is opened, which will nearly always be necessary, not to make an incision into the tendon-sheath, unless it is necessary.

Treatment.—The treatment is manipulative and anti-inflammatory. The manipulation consists of removing local lesions, increasing the circulation and nerve supply to the part, together with correcting the constipation and urinary secretions. Attention should be paid to any constitutional defect found. Should suppuration be imminent, an early incision is necessary. The incision should be made just a little to one side of the middle line of the finger. The abscess should be thoroughly washed out once or twice daily with antiseptic solutions (1:20 carbolic acid, or 1:2000 bichloride of mercury). In the meantime, hot borated poultices should be applied. This facilitates the flow of pus, loosens the tissues and maintains mild antisepsis. As the inflammation disappears, a dry dressing may be substituted and manipulation of the hand be made to prevent adhesions. If the treatment is instituted early, before the pus has extended beyond the annular ligament, even though a palmar abscess has formed, no deformity of the hand will follow. In opening a palmar abscess, an incision should not be made above the web of the thumb, but beyond that point. If made beyond a line on the level with the web of the thumb, there is no danger of wounding the palmar arch, which would occasion severe hemorrhage. Efforts to ligate the palmar arch may be futile, and it may be necessary to ligate the brachial.

Whitlow, or Felon.—Whitlow is a pyogenic invasion of a finger or

toe. The cause is the same as that mentioned in thecitis. The location of whitlow may be: 1. In the superficial connective tissues, which, when it occurs at the root of the nail, is popularly termed a "run-around." 2. When within a tendon-sheath "thecitis." 3. Beneath the periosteum it is called a bone felon.

The symptoms vary according to the location of the infection. Manipulation to assist the circulation, the application of hot poultices to secure the relaxation of the tissues, together with an early incision to let out the stagnated blood and pus, and rigid antisepsis afterward, form the best treatment.

Dupuytren's Contraction takes place in the palmar fascia. The disease begins as a small, round, fibrous nodule in the process of fascia extending from the palm to the fingers. Generally two or three fingers are affected. The skin is drawn and puckered because of its attachment to the fascia. In this manner it may be told from contractions of the tendons. Local manipulation does but little good. The disease may be attended by a cervical lesion, which is indirectly responsible for the fascial contraction. Perhaps it is due to chronic inflammation of the fascia, or to rheumatic conditions. Incisions between the puckered portions and the use of splints to straighten the fingers will be found to be successful. An open incision should be made under strictest asepsis.

Ganglia.—Ganglia are of two varieties, simple and compound. **Simple ganglia** are cysts in connection with the tendon-sheaths. They develop from the synovial fringes in connection with the extensor tendons, but may occur on the front of the wrist, palm, or about the ankle. They vary in size from a small pea to a guinea-egg, and contain a viscid, semi-viscid, or jelly-like material. They impair the action of the tendon and produce some deformity. The disease is quite common in piano players.

Treatment.—Rupture by pressure of the thumbs. If this is not successful, the tumor may be struck a smart blow with a piece of shingle. Failing in this, the skin should be asepticized, a tenotome introduced, the inside of the sac cut in several places, the contents expressed, and the wound afterwards dressed antiseptically. The ganglion will likely not return, nor will it affect the use of the part, providing proper manipulation is used to prevent adhesion. Compound ganglia usually appear on the front of the wrist in connection with the flexor tendons. They are oblong, or oval, sometimes containing a dark fluid, or they may be filled with melon seed-like bodies, or the bits may resemble rice-grains. Often there is some constitutional defect attending these conditions, which should be treated. These ganglia can not be ruptured by the methods mentioned before, but on the other hand, a valvular incision should be made, the contents expressed and drained out, while antiseptic dressings should be strapped on tightly.

Bursitis.—Bursitis is an inflammation of bursae, which may lie be-

tween the skin and the tendons or bone, or between tendons and other structures. There are two forms, acute and chronic. Acute inflammation is the result of injury, and anti-inflammatory treatment is necessary. Rest and manipulation will usually relieve the fluid effusion. The chronic form arises where the bursa is subject to chronic irritation. Fluid effusions into the bursae seem to be more common in persons of rheumatic tendency. The contents may be a clear fluid, or may be rice-grain or melon seed-like bodies, or may be a fibrinous mass. The most common site of this bursal inflammation is the bursa of the patella, where it forms a condition called "housemaid's knee;" or it may occur in the bursa beneath the semimembranosus and form an enlargement in the popliteal space, which more or less disappears upon flexion. (Baker's cyst.) Enlargement of the bursa over the ischial tuberosity is called "weaver's bottom." Inflammation and enlargement of the bursa over the olecranon is called "miner's elbow," while inflammation of the bursa over the head of the first metatarsal bone occasions a condition called "bunion." In other cases, adventitious bursae may form and produce corns. These bursae may produce dislocations of bones. Absorption of the fluid in these bursae will not, as a rule, take place of itself, unless the part is permitted rest and the irritation and cause removed. Manipulative methods may be tried, and failing in this, antiseptic draining of the bursae will be found successful.

Torticollis.—Torticollis, or wry-neck, is a condition of contraction of the sterno-mastoid and trapezius muscles. There are two forms, congenital and acquired. The *congenital form* is produced by malposition in utero, or injury at birth. These produce specific lesions in the cervical vertebrae from the first to the fifth, inclusive. The *acquired form* is produced by rheumatism, inflamed lymphatic glands, producing contractions of the muscles, hysteria, and by traumatic lesions of the first to the fifth cervical vertebrae. These lesions affect the external division of the spinal accessory nerve, which is the motor supply to the trapezius and sterno-mastoid, or it affects filaments of the cervical plexus, which sometimes also supply these muscles. In cases where the lesion was the first cause, reduction of the lesion will accomplish a cure. In old cases, congestion and chronic inflammation take place within the muscles. This is accompanied by the formation of fibrous tissue, which displaces the striated fibres and impairs the integrity of the muscles, and subsequent contraction produces permanent shortening, so that a cure may not be accomplished by the correction of the lesion. All cases may be markedly benefited by treatment. Cases have been cured by osteopathic treatment after section of the muscle and resection of the nerve had failed. The *treatment* consists of correcting the neck lesions and improving the general health.

Tenotomy.—Tenotomy consists in the division of a tendon, or muscle, the contraction of which produces deformity. Two methods are in use, the open, and closed. The closed method is preferred, since it eliminates

the danger of sepsis. The tendo Achillis is frequently tenotomized for correcting conditions of club-foot, as equino-varus. This operation is best performed by having the patient lie upon his back, inclined towards the affected side. The part is rendered thoroughly aseptic. The instruments used are a blunt and sharp-pointed tenotome. A knife is inserted flatwise along the anterior border of the tendon until the point of the knife may be felt on the opposite side of the leg just beneath the skin. Care should be taken not to split the tendon. After this incision is made, a blunt-pointed tenotome is introduced. After introduction, the sharp edge of the tenotome is turned towards the tendon and brought against it and held in that position firmly, while the tendon is thoroughly stretched by flexing the foot. The tendon will snap in two. The operation is done one and a half inches above the insertion of the tendo Achillis into the tuberosity of the os calcis. The tibialis anticus is tenotomized one and one-half inches above its insertion for conditions of talipes varus. The peroneus longus and brevis may be tenotomized one and one-half inches above the external malleolus. The tibialis posticus is divided one and a half inches above the anterior annular ligament. Fasciotomy of the plantar fascia is sometimes performed by passing the knife flatwise between the skin and fascia and cutting inward, dividing the fascia or the structures which are producing the abnormal arching of the foot. Sometimes instead of tenotomy, tendon lengthening is performed. This is a plastic operation done by splitting the tendon and sliding the two portions a distance apart. The operation of tendon lengthening is also sometimes necessary where sections of the tendons have been lost because of injury. In case of injury, it may sometimes be necessary to attach the ruptured tendon to adjacent muscles or tendons in order to not entirely lose the use of the muscle. For more exhaustive descriptions of these operative procedures, an operative surgery should be consulted.

Syndactylism, or **Web Finger**, is a congenital condition and is relieved by operation. Some such operation as Diday's should be done in dividing the fingers.

Polydactylism is a condition of supernumerary digits. The extra finger should be amputated while the child is young, to prevent deformity.

Trigger-finger is a condition in which one or more of the fingers are held in a flexed condition, but when forcibly extended they will open with a snap, as in opening a knife. The hand may be readily closed. It is said to be produced by contraction of the transverse ligament of the palm. It may be produced by cartilagenous tumors, or ganglia. Some maintain it is due to enlargement or an inflamed condition of the flexor tendons.

Mallet-finger is a condition due to the rupture of the extensor tendon, where it forms the posterior ligament of the phalangeal articulation. A similar condition is found in base-ball players, and is due to a

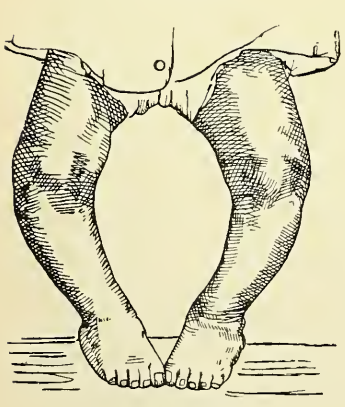
dislocation backward of the first phalanx. The condition may be cured by reducing the dislocation which often exists and putting the finger in a splint.

Club-hand is a deformity of the hand due to absence of one of the carpal bones.

Genu Valgum, or Knock-knee, is an abnormal growth of the inner condyle of the femur. This condition is brought about by an interference in the nutrition to the outer condyle and outer part of the bone. Spinal lesions interfere with the nerve supply to that part of the bone, or interference with the blood supply may also cause the deformity, or it may be brought about by a general condition of malnutrition. The improvement of the general nutrition of the body and the correction of local lesions will be attended by the correction of the deformity, providing this treatment is commenced reasonably early. Where this fails, which may happen in long standing cases, an osteoplastic operation, such as removing a wedge-shaped piece of bone from the internal condyle, will be found to give relief.

Genu Varum, or Bow-legs, may be an inherited condition, or it may be brought about by encouraging the child to stand before the bones of the legs have properly ossified. It may occur in rickety children, or conditions of malnutrition. Bony lesions likely account for some cases. These bony lesions either act directly upon the nerve and blood supply, or bring about a contraction of the muscles, which interferes with the nutrition to the inner side of the bones of the upper and lower leg. The external condyle often grows too long, or there may be bowing of the femur and tibia. Improvement in the general health often markedly benefits the condition. The correction of any bony lesions, reduction of dislocations, or improvement of the general health, will be attended by lessening of the deformity.

FIG. 112.



Genu Varum.

Club-foot is a condition where the bones of the tarsus assume an abnormal relation with the bones of the leg. It is accompanied by contractions of the ligaments, fascia, and muscles of the foot and leg, together with distortion and twisting of the bones of the tarsus. It may be congenital, or acquired.

A. **Congenital Club-foot** may be produced by one of the following conditions: 1. Spastic contractions of the muscles, due to lesions affecting the nerve centers governing the foot. 2. Malposition in utero. 3. Alteration of the tarsal bones, due to interference in the blood supply.

B. The **acquired form** is produced by the following conditions: 1. Infantile paralysis—nearly all of the cases of acquired talipes, or club-foot, are produced by infantile paralysis. 2. Injury. 3. Spinal lesions which bring about weak ligaments, disease, and fascial contraction.

Varieties.—The varieties of club-foot are:

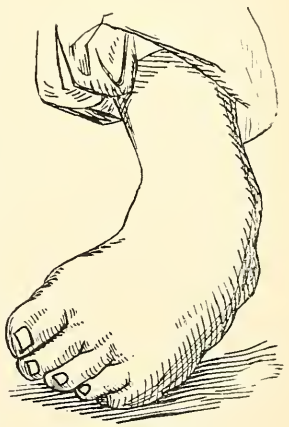
1. Talipes varus.
2. Talipes equinus.
3. Talipes calcaneus.
4. Talipes valgus.
5. Talipes cavus.

Combinations of these may occur in the form of:

1. Talipes equino-varus.
2. Talipes equino-valgus.
3. Talipes calcaneo-valgus.

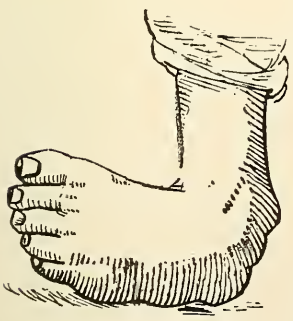
Talipes Varus is the most common form of club-foot. In this condition the tibialis posticus and anticus muscles, together with the tendo Achillis, are found contracted, while the peronei muscles are correspondingly relaxed. The foot is twisted so that in walking the outer border of the foot first comes in contact with the floor. The sole of the foot looks, in mild cases, downward and inward, but in pronounced cases the foot may be turned so that the sole looks directly upward, while the back of the foot is directed downward. If the condition persists, the abnormal position of the foot affects the blood supply to the bones, and pressure upon the bones in an abnormal position results in their irregular development, so that they become deformed. The ligaments become contracted, and these often form the chief obstacle to reduction, even if the muscles could be readily relaxed. In the congenital variety, the deformity is readily reduced. If allowed to persist, it will result in extreme deformity. Talipes varus *per se* is not common, but is very common when associated with equinus, so that equino-varus is the common condition. The acquired equino-varus is nearly always the result of infantile paralysis, and that amount of recovery can be expected commensurate with the recovery of the part of the spinal cord affected. The withdrawal of the nerve supply and the interference in the blood supply prevent the proper development of the foot.

FIG. 113.



Acquired Talipes Varus.

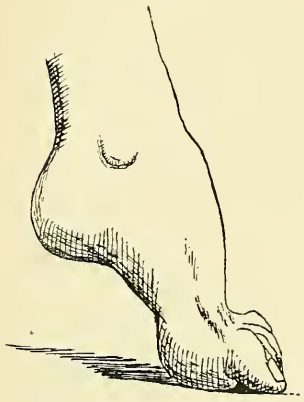
FIG. 114.



Congenital Talipes Varus.

Talipes Equinus is rare, and is either due to paralysis of the extensor tendons or to a spasm of the muscles forming the tendo Achillis. The heel is drawn up, while the foot is extended.

FIG. 115.



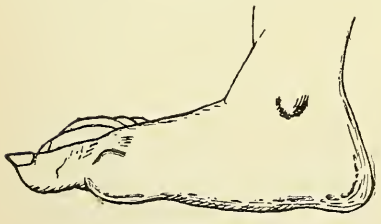
Talipes Equinus.

FIG. 116.

Talipes Equino-calcaneus.

Talipes Calcaneus may be congenital, or acquired. When congenital, it is due to contraction of the extensor tendons, and when acquired it is due to infantile paralysis of the calf muscles. In this condition the foot is abnormally flexed upon the leg and the patient walks upon the heel.

FIG. 117.



Talipes Valgus.

Talipes Valgus, or flat-foot, may be due to several conditions: 1. Weakening and yielding of the ligaments of the bottom of the tarsus. 2. Supporting heavy weights for some length of time. 3. Rheumatism and gonorrheal affections of the ligaments, together with sprains and rachitic conditions. 4. Paralysis of the tibialis anticus and posticus muscles. 5. Badly set Pott's fracture. The arch of the foot sinks down and is lost. In the acquired form, the patient is badly crippled and the foot is longer and broader than normally. The astragalus and scaphoid bones form projections on the inner side of the foot.

Talipes Cavus or Equino-calcaneus is a condition of abnormal increase of the arch of the foot and is produced in some cases by contractions of the plantar fascia, while in other cases by spastic conditions of the peroneal muscles.

Treatment.—Manipulation, begun early, will cure a large number of the cases of club-foot. In congenital club-foot, the treatment should be instituted immediately after birth. Whatever dislocation is found

should be reduced. This is important. The blood and nerve supply to the weak muscles should be encouraged. If the condition is due to a spasm of certain muscles, this spasm can be relieved by removing the spinal lesions irritating certain nerve roots causing such spasm. If the condition has persisted for a long time, and the spasm of the muscles can not be relieved, tenotomy of these muscles may be done with advantage. Applying a plaster cast, with or without tenotomy, in all cases, and holding the foot in normal position, is bad practice. Where the deformity persists *in spite of manipulation,* a plaster cast may be applied, or the foot may be held in normal position by means of some apparatus which can be adjusted as required and can be removed for the purpose of treatment. Strips of adhesive plaster, passed across the sole of the foot and carried up along the side of the leg, will suffice to hold the foot in normal position in some cases of talipes varus. These may be removed at the time of treatment. Many cases may be cured without application of any deformity apparatus. In old cases, where the patient has walked on the foot and it is believed that the bones are malformed, the prognosis should be guarded. The case may be improved, but may not be cured. Operative treatment is likely necessary. Where tenotomy will not correct the deformity, the fascia and ligaments should be divided so as to permit the foot to be returned to its normal position. Where the foot can not be returned to its normal position after subcutaneous division of tendons and fascia, tarsotomy may be performed with advantage. This operation, if properly done, offers hope of fair recovery of the deformity. Even in old cases, after several unsuccessful operations, manipulative treatment will be found of great benefit. It must not be expected that the deformed bones can be cured by manipulative methods, but further deformity can be prevented by proper treatment. In talipes cavus, the subcutaneous division of the plantar fascia may give relief. In flat-foot, or **pes planus**, the fitting into the sole of the shoe of a steel spring which will assist in raising the arch of the foot, will be found of advantage. In equino-varus, tenotomy of the tendo Achillis, together with both tibial muscles, should be done, while in talipes equinus, tenotomy of the tendo Achillis will be sufficient.

FIG. 118.

Imprint of a normal foot.

FIG. 119.

Imprint of the foot in pes planus.

Hallux Valgus, or **Varus**, is a partial dislocation of the great toe outward, or inward. It most often occurs in old men. The cause is from wearing narrow shoes, or wearing a shoe which presses against the end of the toe and weakens the inner metatarso-phalangeal ligament. The bone is usually displaced inward, and because of pressure upon the

head of the first metatarsal bone, bursitis follows. This bunion is frequently an extremely painful condition. It may be successfully treated by reduction of the dislocation. It may be necessary to hold the dislocated toe in position by means of an apparatus for straightening the toe. Continued reduction and manipulation, together with properly fitting shoes, will cure the ailment, unless in very old people.

Fig. 120.

Hallux valgus, with the formation of a bunion.

Hammer-toe is a condition of contraction of the plantar fibres of the lateral ligaments. A bunion forms on top of the toe. Probably amputation of the toe is the best treatment.

Metatarsalgia (Morton's Disease).—This disease is a partial dislocation of one or more of the metatarsal bones, implicating certain nerve fibres, which cause intense pain. The disease may be diagnosed by grasping the foot and compressing it transversely. This occasions great pain. The disease may be associated with flat-foot, and is produced by wearing a shoe that is too narrow. The pain is on the outer and inner side of the little, or fourth toe, or about the neck of the fourth metatarsal bone. Manipulation for reduction of the subluxation and a properly fitting shoe will give relief.

Coxa Vara is a disease in which there is abnormal bending of the neck of the femur, usually laterally. It is said to occur most frequently between twelve and twenty years of age. Likely the disease is rachitic. The disease is frequently diagnosed as dislocation. The neck of the femur gives way and the trochanter ascends above Nelaton's line. The condition is frequently greatly improved by treatment, indicating that it is due to an interference in the nutrition of the neck of the femur. It may be brought about, more or less, by partial dislocation, or the existence of certain spinal lesions. It may require the assistance of the x-rays to determine the condition.

Flail-Joints.—Abnormal looseness of joints following infantile paralysis, or prolonged pressure upon a nerve to the joint, is called flail-joint. The condition is most common in the hip, knee, and ankle. When the condition is produced by dislocations, or spinal lesions, the dislocation should be reduced and the spinal lesions corrected, together with encouraging the blood supply and increasing the tonicity of the ligaments and muscles. Where cases have persisted for years, there is not much hope of recovery.

PART III.

DISEASES AND INJURIES OF REGIONS.

Face, Lips, Tongue, Mouth, and Throat.

Cracks and Fissures of the Lip.—**Cause.**—Exposure, cold, dyspepsia, and neglect may lead to fissures of the lip, which obstinately refuse to heal. These will require treatment. Compound tincture of benzoin should be applied once daily or the fissure cauterized with a stick of silver nitrate. If the sore is kept up by a foul condition of the mouth, a boroglyceride solution should be used as a mouth wash after each meal. If the sores are syphilitic, they should be at once cauterized, since they may easily be a source of infection.

Papillomata or Warty Growths of the Lip should be removed with a knife or curved scissors.

Ulcers of the Lip may be dyspeptic, syphilitic, or tubercular. In dyspeptic ulcers, boroglyceride solution should be used as a wash several times daily. These ulcers should not be cauterized. Syphilitic ulcers occur in secondary syphilis. They should be cauterized with nitrate of silver and afterwards treated as a simple sore.

Nevi or Angiomata may occur on the lips. They may be removed by electrolysis or subcutaneous ligature.

Hypertrophy of the Lip may occur in strumous conditions, or in syphilis. Constitutional treatment for these conditions may relieve the thickness of the lip. Where the condition persists, a V-shaped mass of tissues may be removed by operation.

Chancre of the Lip.—Chancre of the lips and tongue, and even of the tonsil, has been reported in young persons in lower classes. Such suspicious sores should be immediately cauterized to prevent spreading of the disease.

Tumors of the Lip are both benign and malignant. The malignant tumors are of the nature of cancer and rodent ulcer, and may be diagnosed by the ordinary signs of malignant tumor, together with later enlargement of the lymphatic glands. The enlargement of the lymphatic glands does not appear before six months. After the cancer ulcerates, the best treatment is a V-shaped incision, removing all vestiges of the growth. This is more successful than cauterization. Cases of persistent ulcer may be cauterized with chloride of zinc or arsenious acid, or sulphuric acid paste. This causes extensive sloughing of the tissues and may get rid of the malignant sore.

Harelip.—Harelip is a congenital malformation of the upper lip, caused by failure of the fronto-nasal plates to close. It may be a mere cleft in the lip, or it may extend into the nostril, or even to the inner

canthus of the eye. Very rarely it may be bilateral. The most common form is a mere clefting of the lip. In some cases, the intermaxillary bone and the septum of the nose are absent, or are partially developed. Frequently, there coexists cleft palate, spina bifida, club-foot, etc.

Treatment.—The edges of the cleft should be pared, approximated and held by harelip pins and appropriate sutures to secure union. The operation should be done between the third and fifth months, since a very small child withstands hemorrhage badly. The object of the operation should be to secure primary union, without scar, and to prevent a post-operative notch in the lip, and keep the margins of the lip in line. It is almost the universal practice to use pins and sutures. The incision will depend upon the nature of the cleft. The success of the operation frequently depends upon the ingenuity of the operator. It requires more skill to secure an elegant result and thorough correction of the deformity in many cases of harelip than it does to perform many of the major operations. A nice approximation of the wound must be secured. The pins should be removed within thirty-six hours after the operation, otherwise scarring will result. The sutures between the pins should be allowed to remain until union has taken place. After the removal of the pins, the lip should be thoroughly strapped, in order to prevent the wound being torn asunder.

Stomatitis.—The more frequent and mild forms of stomatitis come within the province of the physician, and not the surgeon. There are two forms in which surgical measures are sometimes necessary. These are the toxic stomatitis, mercurial stomatitis, or ptyalism, and the gangrenous stomatitis, or noma. In mercurial stomatitis, or ptyalism, there is ulceration and edema of the gums, profuse secretion of saliva, the breath is foul, and the person is in great pain. The disease is produced by the administration of some form of mercury, usually calomel. The indications in the treatment are to at once remove the drug and put the patient upon a nourishing liquid diet. See that the other secretions, such as urine and stools, are free. Antiseptic mouth washes should be used several times daily. Chlorate of potassium in saturated solution, will be found of great service. Peroxid of hydrogen is also useful, diluted with equal parts of water. Boroglyceride solution may be used with advantage. The mouth should be thoroughly cleansed with an antiseptic solution each time after taking food.

Gangrenous Stomatitis.—See Gangrene.

Ranula.—Ranula is a bluish-white, semi-translucent, ovoid tumor growing in the floor of the mouth. It is produced by closure of Wharton's duct, or by distension of a mucous follicle. The operation is to clip out a part of the tumor with curved scissors and cauterize the sac with a stick of nitrate of silver.

Dermoid Cysts.—Dermoid cysts occur in the middle line of the neck, and sometimes project into the mouth. They are the result of fetal inclusions. They may extend up into the mouth, where they may be

shelled out, or they may develop in the neighborhood of the hyoid bone. Where they develop lower down, they should be dissected out, otherwise a fistula is liable to result.

Tongue-tie.—In the treatment of tongue-tie, a little notch should be clipped in the margin of the frenum linguae soon after birth. Care should be taken not to clip too much of the frenum, or to cut the ranine artery.

Macroglossia is a condition of obstruction of the lymphatics leading from the tongue. The tongue develops in some cases to enormous size, and may enlarge so as to fill the mouth and to distend it, keeping it permanently open. It is congenital, or acquired. It is sometimes associated with a similar condition of elephantiasis of other parts of the body. Where manipulative methods do not give relief, an operation should be advised, and a wedge-shaped piece of the tongue removed.

Acute Glossitis.—Acute inflammations of the tongue result from bee-stings and infections, from mercurial poisoning, as in mercurial stomatitis, and injury, or acute fevers. Where manipulative methods will not give relief by assisting the return circulation and relieving the obstruction to the circulation, an incision should be made to provide for drainage of the fluids, or pus.

Ulcers of the Tongue are simple, dyspeptic, syphilitic, tubercular, and gangrenous. Simple ulcers may be cauterized with nitrate of silver, or the mouth may be rinsed with borax and honey, or boroglyceride solution. Dyspeptic ulcers should not be cauterized, but should be treated antiseptically. Syphilitic and tubercular ulcers should be cauterized, but the conditions may return unless systemic treatment is administered to get rid of the general poison. Cancer of the tongue may be removed by excision of a considerable portion of the tongue, providing the diagnosis is made early.

Cleft Palate.—Cleft palate is failure in the development of the hard or soft palate. and is due to the arrest of development of the processes which normally form the superior maxillary and palate bones, which processes subsequently form the vomer. Various degrees of this condition may exist. Simply the uvula may be absent, or the cleft may be in the soft palate only, or there may be entire absence of the intermaxillary processes, vomer and nasal septum. The cleft may be so extensive as to prevent the child nursing. The operation for relief of cleft palate is staphylorrhaphy.

Staphylorrhaphy.—This operation is advised for the relief of cleft palate. **Uranoplasty** may be necessary where the intermaxillary processes are absent. These operations should, as a rule, be undertaken after the end of the second year. The operation consists in paring the margins of the cleft and uniting them by means of interrupted suture. Relaxation sutures are often necessary. It may be necessary to make a second incision, near the gums, through the soft tissues in order to secure sufficient relaxation, that the pared edges may be united. For

the technic of the operation of staphylorrhaphy and uranoplasty, larger texts should be consulted.

Elongated Uvula is a condition in which the uvula becomes abnormally long, because of chronic inflammation, or because of certain relaxed conditions. It may hang down on the back of the tongue and act as a source of irritation. Where securing a better nerve supply to the uvula does not give relief, and where it is a source of persistent trouble, it may be amputated. This is readily done under cocaine, or local anesthesia. The end of the uvula may be grasped by forceps and clipped off with curved or straight scissors. No hemorrhage is likely to result.

Tonsilitis.—Inflammation of the tonsils is considered by texts on the Practice of Osteopathy, and the methods there advocated will be sufficient to relieve almost all cases. Exceptionally abscesses of the tonsils occur, or occasionally the tonsils, after several attacks of acute tonsilitis, may become hypertrophied. Abscess of the tonsil should be treated in the following manner: Hot poultices should be applied to the neck, until suppuration is evidenced by fluctuation, which may be determined by bi-manual manipulation. The abscess should then be opened. A small straight bistoury, or scalpel, should be wrapped within half an inch of its point. This is inserted on the line of the molar teeth. The knife is introduced, with the sharp edge towards the median line of the throat, and pushed directly into the tonsil, and the incision is made towards the median line. This is done to avoid the carotid artery, which has been cut in lancing abscesses of the tonsil. Such an accident would be immediately fatal.

Hypertrophy of the Tonsil may occasionally require operation. The electro-cautery should be used by all means. Removing a small portion of the upper part of the tonsil projecting will suffice to secure atrophy of the organ.

Ulceration of the Tonsil may be simple, gangrenous, syphilitic, tubercular, or malignant. It should be treated in the same manner as ulcer of the mouth.

Tumors of the Tonsil are benign and malignant. The benign tumors are papilloma and adenoma. These should be removed, but sarcoma and carcinoma of the tonsil can not be successfully removed. Manipulative treatment may give relief.

Alveolar Abscess results from caries, or periostitis of the teeth and alveolar process. The superficial form is known as gum-boil. The abscess may expand the alveolus burrowing into the bone and appearing on the face, cheek, angle of the jaw, or may lead to necrosis of the bone. In some cases the pus may burrow into the pharynx. The symptoms are pain, evidence of carious teeth, inflammation, and swelling.

The **treatment** is to remove the carious teeth. Sometimes this will not arrest the disease. Application of poultice should be made to hasten pointing of the abscess. When pointing occurs, it should be

opened and thoroughly washed with an antiseptic solution several times daily. After the pus has been removed, the abscess will readily heal. In old cases, it may be necessary to scrape out the sinus and remove the carious bone before the condition will heal.

Epulis may exist in two forms; one a fibrous tumor which projects from between the teeth, and the other a malignant growth developing from a fibroma of the periosteum. Complete removal of the tumor will give relief.

Abscess of the Antrum usually arises from carious teeth, or from the extension of inflammations of the nose into the antrum. The tissues of the cavity are rendered more liable to disease because of the existence of certain lesions affecting the nerve and blood supply. The chief symptoms of the disease are pain and an edematous swelling of the face, which is brought about by the filling up of the antrum with pus. Pressure over the front of the superior maxillary bone will elicit crepitation. If the patient's head is held between his knees, the pus flows into the nose. A small electric light held in the mouth shows lessened transillumination of the affected side.

Treatment.—The treatment is at first manipulative, to encourage the circulation, and to relieve any venous obstruction. Failing in this, the carious teeth should be removed, and a trochar inserted through the root of the tooth into the antrum, with the hope that drainage can be secured in this way. Failing in this, a trocar should be introduced through the nose, opening the antrum at the lower anterior part. The normal opening of the antrum is the upper and back portion, hence the pus which accumulates within the cavity can not be discharged. If there is no abatement of the symptoms, a bone drill should be set just above the second bicuspid tooth and the opening made directly into the antrum. The antrum should then be thoroughly irrigated several times daily with an antiseptic solution. Where this fails, the bone may be trephined at this same point and a drainage tube inserted to secure free drainage.

INJURIES OF THE FACE AND NECK.

The most frequent injury to the face is in the form of contusion, and when about the eye, is accompanied by effusion of blood in the loose connective tissue, which is popularly called a **black-eye**. This can be prevented by pressure and the application of ice shortly after the injury, and later manipulation to diffuse the effused blood.

Open Wounds of the Face occasion sharp hemorrhage, which should be attended to at once, Scarring and deformity will result unless the wound is properly closed. Part of the sutures should be removed on the second day; the remainder may be removed as soon as possible.

Wounds in the Neck may involve the superior thyroid, lingual, or facial arteries, or the external jugular vein. In efforts at self-destruction, some one of these vessels is severed. The hemorrhage

will be severe, but may not occasion death. Where the internal jugular, or the common or external carotid arteries are cut, death will be almost immediate, or before help can be secured. The method of treatment of wounds in general should be followed in the treatment of injuries of this region. The special dangers in these wounds are the entrance of air into the veins, edema of the glottis, dyspnea, loss of voice, fistula, bronchitis, and scar formation. Where the wounds enter the trachea, or larynx, bronchitis and broncho-pneumonia may develop because of the septic condition.

Contusion of the Larynx sometimes occurs. It causes great pain, edema glottidis, loss of voice, and hemoptysis. Ice should be applied and the patient kept quiet and impediments to the return circulation removed.

Rupture of the Larynx and Trachea is the result of severe local injury. It is usually fatal.

Fracture of the Laryngeal Cartilages occurs because of direct violence, compression, etc., and occasions great pain, spitting of blood, swelling and ecchymosis in the connective tissues, dyspnea, crepitus, and irregularity of the cartilages, which are evident upon examination. The **treatment** is to manipulate the cartilages into position, where they may be held by strapping. The person should avoid talking, and should be kept at rest until healing takes place.

Foreign Bodies in the Nose.—Foreign bodies, such as beans, beads, buttons, or the seeds of fruit, may be pushed into the nose by small children. Under certain conditions, foreign bodies may get into the nose from behind during vomiting. Usually there are signs of catarrh. Cases are on record where foreign bodies have remained in the nose for a long time, occasioning an inflammation, and ofttimes a purulent discharge, as in ozena. A careful examination will reveal the foreign body. It may be engaged by mouse-toothed forceps and drawn out. Failing in this, the nose may be anesthetized by a four per cent. solution of cocaine and a scoop introduced, which may assist in pulling the body out. If this fails, a nasal douche should be used. Where all these efforts are unsuccessful, the patient should be anesthetized, when the object may be readily grasped and removed.

Foreign Bodies in the Pharynx and Esophagus.—Foreign bodies, such as portions of food, onions, beans, etc., may lodge in the pharynx, either cross-wise, or become engaged underneath a fold of mucous membrane, or they may lodge within the esophagus. In the pharynx, the foreign body may be grasped by means of dressing forceps and removed. A radioscopic mirror will assist in locating the foreign body. Where it is near enough, it may be pulled out with the fingers. In case the pharyngeal reflexes are excited, the mucous membrane may be swabbed or sprayed with a four per cent. solution of cocaine, then the finger may be introduced sufficiently far into the pharynx to pull out the foreign body. If these methods fail, a probang may be introduced, then ex-

panded and withdrawn. The hairs usually engage the foreign body and withdraw it. This same instrument may be used with advantage in the esophagus. To introduce the instrument the patient should be seated in a straight-backed chair, with the head well thrown back so as to bring the mouth, pharynx, and esophagus on the same line. The instrument is coated with glycerine, or white of egg, and then slowly introduced over the back of the tongue. A long bullet forceps may be of advantage to secure hard objects, such as coins. If these methods fail to secure the foreign body, esophagotomy may be performed. Before this is done, the foreign body should be accurately located by means of the x-rays.

Foreign Bodies in the Larynx, Trachea, and Bronchi.—Foreign bodies may lodge in the larynx above the vocal cords, in the chink between the vocal cords, or in the ventricle of the larynx. They may also lodge at the entrance of the larynx, or they may pass farther on, falling into the trachea, and perhaps, in some cases, entering the bronchi. The symptoms depend upon the extent of interference in the ingress and egress of air. Sometimes the symptoms are rapidly urgent, but at other times they cause but an irritation of the throat. If the foreign body falls into the trachea, it excites violent spasms of coughing and dyspnea, providing the body is of sufficient size to more or less obstruct the tube. Where the foreign body is small, and falls down into the bronchus, it may occasion great dyspnea, or the patient may be able to tell by subjective sensation the location of the foreign body. The foreign body is usually gotten in during forced inspiration, and while the head is thrown back, rendering it easy for the object to enter.

Treatment.—The patient should immediately be swung by his heels to prevent the foreign body from falling into the lung. Snuff may be administered, with the hope that the body may be expelled without operative interference. This usually does no good. With the aid of a laryngeal mirror, and a good light, the foreign body may be reached with a forceps, if it is in the larynx. If not, a probang introduced may engage the foreign body. Where this fails, laryngotomy or tracheotomy may be performed. Laryngotomy should never be performed in a child under thirteen years of age. In older persons, laryngotomy is an excellent operation. In young children, tracheotomy is the rule. There are two operations for tracheotomy, the high and the low operation. The high operation is done above the isthmus of the thyroid cartilage. At this point the trachea is more superficial and there is less danger of hemorrhage. It should be performed at this point under all circumstances if possible. The trachea should be carefully opened, and the foreign body having been previously located, if it exists in the larynx, it may be pushed into the pharynx by introducing the little finger into the trachea. The foreign body should be recovered. The lower operation should only be done when the foreign body is low down in the trachea, and when the high operation is not feasible. For the technic of the operation, the

student is referred to an operative surgery. Quick laryngotomy is done through the crico-thyroid membrane just above the cricoid cartilage, avoiding the crico-thyroid artery, care being taken not to injure the vocal cords.

Intubation.—Intubation may be performed with advantage in laryngeal croup, diphtheria, or in edema glottidis. For the technic of the operation, the student is referred to more extensive texts.

Examination of the Nose.—In examination of the nose, the cavity should be thoroughly illuminated by means of an electric light, or rhinoscopic mirror, while the alae are distended by means of a suitable speculum. This examination, if thoroughly made, will reveal the presence, or absence, of foreign bodies, polypi, inflammation, growths, or ulcerations.

Polypi.—Nasal polypi are of three forms:

1. Myxomatous, or gelatiniform tumors.
2. Fibrous, or forms of soft fibromata.
3. Malignant, which may be either sarcomatous, or carcinomatous.

The tumors are of various shapes, oval, pedunculated, or sessile. The most common forms are either pink, grayish-white, or semi-translucent. There may be one, or a number. Polypi should be removed by electric snare, or they may be pulled off by a polypus snare and the base cauterized. This cauterization of the base is necessary, since tumors will return in two or three weeks if it is not done.

Catarrh.—There are various forms of inflammations of the mucous membrane of the nose. These are attended by symptoms depending upon the nature and severity of the disease. The disease may be successfully combated in all ordinary forms by manipulative methods described in texts on Osteopathic Practice. In bad cases, where there is a foul discharge and an ulcerated condition of the mucous membrane, an alkaline antiseptic may be of advantage. For this purpose, Dobell's solution is perhaps best. Peroxid of hydrogen may do equally as well when diluted one part of the peroxid and two parts of distilled or boiled water. In tubercular and syphilitic diseases of the nose, local treatment may do some good, but a cure can be effected only by constitutional measures.

Ozena.—Ozena is a condition of purulent inflammation of the nose. It is accompanied by a very foul discharge. The condition is produced by atrophic nasal catarrh, caries, and necrosis of the bones, and by syphilitic and lupoid ulcerations. Sometimes foreign bodies may occasion a condition much like this in debilitated children. The treatment is to cleanse the cavity.

Deflection of the Septum occurs as a congenital malformation, or is the result of injury. Where the deformity is but slight, it may occasion no symptoms, but where it forms a distinct projection into one nasal cavity, with a corresponding depression in the other, it may affect the voice, occasion headaches, partial deafness, and various nervous symp-

toms. The treatment is to forcibly straighten the septum by means of appropriate forceps. It may be necessary in some cases to insert a hollow plug to maintain the septum in its normal position until reparative tissues will develop to permanently anchor it.

Adenoid Vegetations.—Some subjects are apparently disposed to the development of adenoid tissues. In these cases, the adenoid tissues may enlarge and develop in the upper and back part of the nose and in the upper part of the pharynx. These vegetations may often produce a condition of mouth-breathing. The child is a dullard, the voice is changed, and the nostrils widened and thickened. Soft tumefactions may be felt behind the nose in the upper part of the pharynx, or they may be readily seen by the aid of a laryngoscopic mirror. Where manipulative treatment fails, they should be cut or burned out.

Tumors of the Pharynx are extremely rare. Only the benign tumors are operable. Malignant tumors should be treated by other methods.

Edema of the Glottis is produced by congestion and exudation of serum beneath the mucous membrane of the epiglottis and the upper part of the larynx. It is produced by inflammations, injuries, bee-stings, erysipelas, fevers. small-pox, etc. The symptoms may come on rapidly, attended by hoarseness, loss of voice, dyspnea, etc. Every effort should be made to relax the tissues and relieve the return circulation. Inhalations of steam may be of advantage, or just when it is appearing, the application of ice to the throat. If this fails, the epiglottis may be punctured in several places with a small instrument to permit the exudation of serum, thus relieving the urgent symptoms. Intubation, or operative treatment, may be necessary.

Laryngeal Tuberculosis and Syphilis.—In these diseases, no local treatment is effective. Only constitutional treatment gives relief.

Tumors of the Larynx.—The symptoms of tumor are hoarseness, loss of voice, and dyspnea, which may, or may not, be paroxysmal, depending upon whether or not the tumor is pedunculated. The tumor may be of various shapes. The diagnosis can be readily made by means of the laryngoscope. The tumor may be removed from within while yet small by an electro-cautery snare.

Tumors of the Parotid Gland.—Only benign tumors of the parotid gland can be removed by operation. Sarcoma or carcinoma of this organ cannot be successfully removed, and therefore should not be operated upon.

Thyroid Gland.—Operations for ligations of the superior, or inferior, thyroid artery, and extirpation of the gland for the relief of goitre, are not warranted. The disease yields to appropriate osteopathic treatment.

INJURIES AND DISEASES OF THE CHEST.

Wounds of the Chest Wall.—Non-penetrating wounds and contusions of the chest wall may result in a localized pneumonia, or

pleurisy, or they may cause pain, cough, and the expectoration of bloody mucus, but are not serious. They should be treated as ordinary wounds.

Punctured Wounds of the Pleura.—Punctured wounds of the pleura may, or may not, involve the lung. Where the lung is not involved, the wound is not so serious, and if hemorrhage is not severe, healing may take place with but little difficulty, but if the lung is involved, the wound is at once grave. It will be attended by great shock, pain, and severe coughing, with more or less dyspnea, depending upon the size of the wound. Air will escape from the wound into the pleural sac, causing a condition of pneumothorax, while pulmonary collapse may take place. The air in conditions of penetrating wounds of the lung will be sucked into the wound during inspiration. If the wound is of sufficient size, as occurs in stab-wounds of the chest, hernia of the lung may follow. Where the hernia can not be restored within the cavity, the part should be ligated and excised.

Incised wounds of the chest are usually fatal, because of rapid hemorrhage and sudden collapse. Bullet wounds are not so serious. This hemorrhage is treated in various ways. Where the intercostal artery is wounded, two layers of antiseptic gauze may be placed over the wound, and absorbent cotton pushed, with the gauze around it, into the pleural sac. Enough cotton should be introduced to prevent its extraction upon traction on the gauze. This will compress the intercostal arteries so as to arrest the hemorrhage. It likewise will assist in arresting the hemorrhage within the pleural cavity. Some surgeons advise enlarging the wound and packing the lung with gauze. Emphysema of the chest wall is not always an evidence of lung puncture. Where the case is doubtful, the hemorrhage should be checked and the part strapped and rendered more or less immovable, while the patient is kept quiet in bed.

Pleuritic Effusions.—Serous effusions will take place within the pleural cavity in debilitated conditions. These pleuritic effusions often are allowed to remain for some length of time. The mouths of the lymphatics becoming agglutinated, or pressed together, and efforts toward absorption failing, aspiration of the effusion will be required. The diagnosis of pleuritic effusion may be made by physical examination.

Empyema.—Empyema is a condition of pus within the pleural cavity. This pus is the result of an infection of the effusion which follows inflammations of the lung and pleura. The pus in the pleural cavity may be the result of acute, or chronic, inflammation. In so-called empyema, while the material looks like pus, it contains no microorganisms. In some cases, empyema is the result of the activity of the tubercle bacillus. A bacteriological examination will determine whether pus cocci are present. The diagnosis is made by the signs of abscess, the absorption of pus, hectic fever, and the evidence of pleuritic

effusion manifest upon physical examination. In pleuritic effusions, and in empyema, where the symptoms are urgent, the lung should be aspirated. Simple puncturing of the pleural cavity is no longer done. There is too much danger of infection, in fact, many cases of pleuritic effusion, at first sterile, have been rendered septic, and perhaps tubercular, by the use of an unclean trocar. The side of the patient, the hands of the operator, and the instruments, should be rendered thoroughly aseptic. In the axillary line, in the fifth intercostal space, the aspirating needle should be introduced. The fore-finger of the operator should be pressed against the upper border of the sixth rib so as to prevent introducing the aseptic needle too close to the rib and thereby puncturing the intercostal artery. A tiny incision may be made in the skin, to make the puncture more easy. An instrument similar to Potain's aspirator may be used and the fluid sucked out of the cavity, no air being allowed to enter. This aspiration may be repeated if occasion demands, but in most cases, if the proper treatment is instituted at once, succeeding aspirations will not be required. In case of empyema, where it is necessary to establish drainage, resection of the ribs will be necessary. One or more ribs may be resected, likewise resection of a rib may be done in cases of pneumonotomy, or pneumonectomy, for abscess of the lung. For the technic of the operation of resection of a rib, texts on operative surgery should be consulted.

Pneumothorax.—In case of puncture of the lung from fractured ribs, effusions of air may take place within the tissues. If the pneumothorax is pronounced, or the emphysema of the tissues is very great, puncture by means of an aspirating needle may be performed, but strapping of the emphysematous area will usually suffice. Occasionally, however, abscess is produced by such effusion of air, but this is rare.

DISEASES AND INJURIES OF THE DIGESTIVE TRACT, ABDOMEN AND PELVIS.

Diverticula of the Esophagus.—Diverticula of the esophagus are of infrequent occurrence, and may be congenital, or acquired. As a rule, they occur on the posterior wall of the esophagus at its junction with the pharynx. The causes are malformations and degenerations of the muscular fibres of the esophageal wall and stricture. Each of these conditions is responsible for pouch-like dilations, or diverticula. The *symptoms* are dysphagia, more or less dyspnea, because of pressure on the trachea, with the presence of tumor in the neck and regurgitation of undigested food some hours after eating. The *treatment* is palliative. Where the condition is congenital, it may be removed by operation.

Stricture of the Esophagus.—Stricture of the esophagus is either spasmodic or organic, the spasmodic form being due to spasms of the circular muscle fibres. Organic strictures are the result of the formation of fibrous tissue and cicatricial contraction, because of the erosion of the esophagus by chemicals, or superheated fluids, or because of

injury. Malignant strictures form a certain class, and are due to the development of cancer. Stricture of the esophagus may be simulated by pressure upon the esophagus from aneurysm, enlarged thyroid gland, mediastinal tumor, and foreign bodies.

Spasmodic Stricture usually occurs in nervous women, and there are evidences of hysteria. The patient can swallow at times, but if a bougie is passed, the presence of the stricture is readily determined. If the patient is given chloroform, the stricture disappears.

Organic Stricture occurs in two forms, fibrous and malignant. Fibrous stricture may, in rare instances, be syphilitic; usually it affects the upper half of the esophagus. Pouch-like dilatations will occur above the stricture. The history of the case, together with the presence of the stricture, will determine the diagnosis.

Malignant Stricture is often due to the development of an epithelioma within the tube. The upper and lower ends are usually affected. It may ulcerate into the trachea, or externally. The symptoms are very often obscure; there is difficulty in swallowing, pain, exhaustion, hemorrhage, a foul discharge, and the patient is of advanced age. On auscultation, a trickling sound may be heard over the esophagus. In some cases, no symptoms may be evident until ulceration takes place into the trachea, when the patient may die in an effort at drinking liquids.

Treatment.—In hysterical stricture, whatever osteopathic lesion is found must be removed. In the **fibrous form,** gradual dilatation with a bougie is the proper treatment. In the **malignant form,** a soft tube should be passed, either through the nose, or mouth, and left in situ. Objectionable as this may seem, patients often apparently gradually improve after passing the tube, by which they may be given a sufficient amount of liquid nourishment. At best, it is a disagreeable method of prolonging life. Gastrotomy may be performed in some cases, but this hardly seems justifiable.

Contusions of the Abdominal Wall.—Contusions of the abdominal wall are always grave, inasmuch as they may be attended by injury, or rupture of the viscera. Very often there is great shock. The patient should be put to bed, with the legs flexed on the abdomen, and carefully watched. If there is no evidence of internal injury, as soon as the shock is relieved, an ice bag should be placed over the injury, to lessen the amount of blood effusion. The shock should be treated by an equalization of the circulation and the application of heat. Sometimes considerable effusion of blood will take place in the muscle planes, or the rectus muscle may be ruptured. Should the injury demand it, which may be determined upon recovery, the integrity of the abdominal wall may be restored by means of operation, but this is rarely necessary. Under no circumstances should the blood, which has effused, be let out. When there is evidence of abscess, it may be treated as such. Manipulation will diffuse the effused blood and replace the viscera. The bowels

should be moved by appropriate treatment. A binder should be applied until the integrity of the abdominal wall is established. Where abscess develops from the extravasation of blood or urine, early incision and drainage will be necessary.

Rupture of the Peritoneum.—The peritoneum may be lacerated by injury. It is always attended by grave symptoms of shock and internal hemorrhage. The patient rapidly sinks and faints away, while the surface becomes cold and blanched. There is absence of vomiting, and in some cases, pain may be absent, but usually there is **marked rigidity of the muscles.** Unless the rupture is closed, peritonitis quickly supervenes. If there is great shock, localized pain, evidences of internal hemorrhage, shown by rapid, weak pulse, together with dullness over the injured area, with great rigidity of the abdominal muscles, an operation should be performed and the abdominal cavity explored, and if there is a rent, it should be closed by suture. Where the operation is not performed, the treatment should be rest, quiet, etc., practically the same as in acute peritonitis.

Rupture of the Viscera.—Any of the abdominal viscera, with the exception, perhaps, of the pancreas, are liable to injury, and sometimes the pancreas may be injured in stab or gun-shot wounds. Rupture of the viscera is the result of great violence, such as a heavily loaded wagon passing over the body, or severe blows. The liver, stomach, gall-bladder, and intestines are more frequently injured.

Liver.—Injury to the liver is attended by severe hemorrhage, by great pain, which is localized, an increasing area of dullness, due to the effusion of blood, profound shock, and later, peritonitis. In some cases, jaundice follows in a few days, or more rarely, diabetes. An examination should be made for fractured rib over the liver. Rupture of the liver is usually fatal, although some mild cases may get well of themselves. Severe rupture of the organ is attended by fatal internal hemorrhage, inasmuch as the vessels remain open because of the structure of the organ, and will not close, as occurs in other soft tissues. Nature's method of controlling hemorrhage is of no avail.

Spleen.—Injury to the spleen is evident because of severe local pain, increased area of splenic dullness, and, perhaps, fracture of the ribs on the left side. Hemorrhage is very severe, and may be fatal. Shock and collapse usually come on quickly. The injury will be fatal unless there is operative intervention.

Stomach.—Extreme collapse attends rupture of the stomach. Usually the injury is rapidly fatal. There is severe general pain, which is more severe in the epigastric region, and extreme localized tenderness. There is free gas in the abdominal cavity, which brings about a lessened area of liver dullness. Usually there is vomiting, the contents having more or less blood intermingled. The stomach can not be inflated with hydrogen. The contents of the stomach will effuse into the peritoneal cavity, setting up a rapidly spreading, fatal inflammation.

Gall-bladder.—The gall-bladder is sometimes ruptured, which causes great pain and shock, together with a rapidly developing peritonitis. There is great emaciation and distention of the cavity, with a bile stained fluid.

Intestines.—Rupture of the intestines is attended by intense pain and rigidity over the abdomen, but more severe at the point of the injury. Vomiting is usually present, first of the contents of the stomach, and second of bile, and perhaps blood. Very often there are bloody stools. Tympanites is present, while there is dullness along the sides of the abdomen. Fatal peritonitis usually follows. If rupture is small, and the effusion of the contents of the abdomen but little, the rupture may become glued to some part of the viscera and but a local inflammation result.

Kidney.—Injury of the kidney is attended by more or less injury to the back. There is increased frequency of micturition and bloody urine. Urine extravasations may take place in the loin. There are evidences of bruising and lumbar pains. There is more or less retraction of the testicle. In case of extravasation of the urine about the kidney, a perinephritic abscess will likely follow. There may be pus in the urine. A diagnosis of the perinephritic abscess can be made without difficulty.

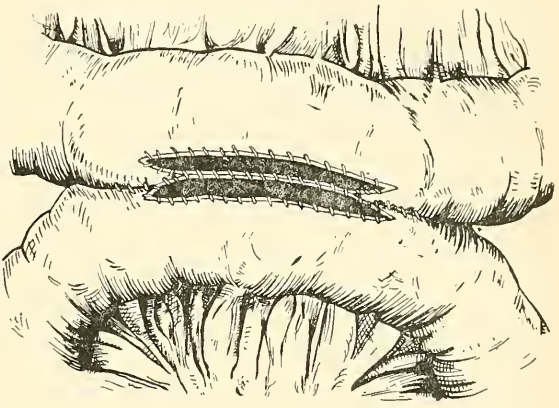
Ureter.—Rupture of the ureter gives rise to a fluctuating retro-peritoneal swelling, together with bloody urine. This occurs after a few days.

Injury to the abdominal viscera is attended by great shock and collapse, but there are cases where marked rigidity of the abdominal muscles, together with a rapid pulse, are about the only symptoms of the injury. Evidences of internal hemorrhage which can be localized by the symptoms should be treated by laparotomy and the bleeding vessels secured. In case of the liver, where it is possible, the organ should be sutured with sterilized gut sutures, but as a rule this can not be done, the best treatment being to pack the rupture liberally with gauze, one end of which is brought out of the wound, and which may be removed when danger of hemorrhage has ceased. The same treatment may be advised in case of the spleen, but usually splenectomy is performed, inasmuch as this organ may be safely removed, and yet the patient enjoy good health. Where the injury is of the gall-cyst, or in any of the hollow viscera, where it is possible, the rent should be closed by means of Lembert sutures placed one-eighth or one-sixteenth of an inch apart. If the injury to the intestines is such that after closure, more than one-half of the lumen of the intestines will be cut off, intestinal anastomosis is advisable, or where there is severe injury to the duodenum, the gall-cyst may be united to the intestine at another point. The abdominal wall should be closed by means of a through-and-through silkworm-gut suture—that is, the suture extends entirely through all of the structures of the abdominal wall. It may be neces-

sary in some cases to inflate the intestines, or stomach, with hydrogen gas (Senn's method), in order to find the injury. Rectal or intra-venous injections of hot normal salt solutions, may be necessary to save the patient's life.

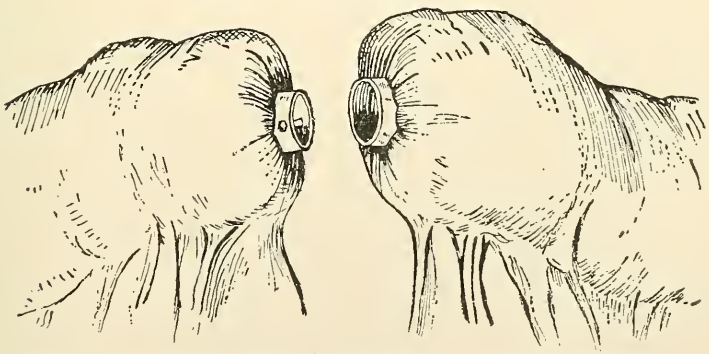
Intestinal Anastomosis.—Intestinal anastomosis is most quickly performed by means of Murphy's button, and this is often the safest method. The button is made of various sizes, suitable to any part of the intestinal tract and the gall-cyst. It consists of a male and female portion which fit snugly together. By means of this button the divided and inverted ends of the gut are securely held together, the peritoneal coats being held in contact. The operation consists of the following: After removing the portion of the intestines, the portion of the button is inserted into the lumen of each end of the intestine, while the edge of the cut end of the gut is drawn around the button by means of a purse-string suture, a double turn being necessary at the mesenteric attachment. After both the male and female portions are inserted, the parts are pushed together. The slit in the mesentery is closed by means of continuous sutures. Before the button is pushed together, the peritoneal surfaces may be gently scratched with a needle. These peritoneal surfaces unite, the edges of the bowel slough off, and the

FIG. 121.



Method of performing lateral anastomosis.

FIG. 122.

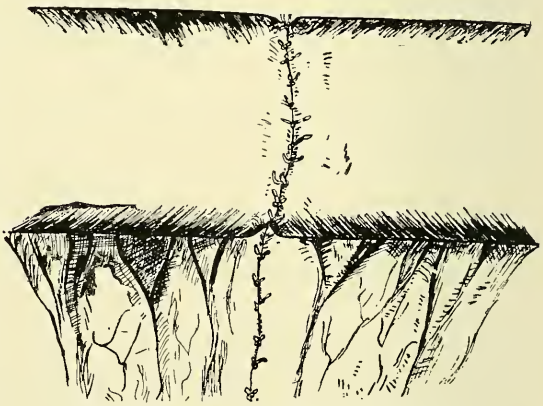


Method of performing intestinal anastomosis by means of Murphy's button.

button will pass within ten days, or two weeks. Before the bowel is returned to the abdominal cavity, it should be washed and cleansed and any part of the contents of the gut removed from the abdominal cavity. If the button does not pass within four weeks, a rectal examination should be made. Liquid nourishment should be given as soon as the patient recovers from the shock of the operation. The bowels should be moved early (second day) and thereafter kept open. There are other methods of perforating lateral anastomosis and circular enterorrhaphy, but these operations are most successful in the hands of those who devised them. The end-to-end anastomosis by means of Murphy's button has the advantage that it is most rapid, and there is less shock.

Open Wounds of the Abdomen.—Open wounds of the abdomen may be divided into penetrating, and non-penetrating. In the **non-penetrating** wounds, care should be taken to secure apposition of the different layers of fascia and muscles after the wound has been thoroughly cleansed. The chief danger of non-penetrating wounds of the abdominal parietes is that the wall may be so weakened that hernia may result. Otherwise these wounds will require no special attention different from other wounds.

FIG. 123.



Halsted's method of performing enterorrhaphy.

Penetrating wounds of the abdomen are always grave. They vary in gravity, depending upon whether there is any wound or injury to the viscera, or whether any of the viscera protrude. Protrusion of the viscera renders sepsis more likely. The peritoneal cavity must be regarded as a large lymph space which communicates directly with the connective tissue spaces of all the surrounding tissues and organs, so that septic material once gaining access to this cavity, is quickly absorbed, producing a condition of general poisoning. Punctured wounds may be divided into three classes:

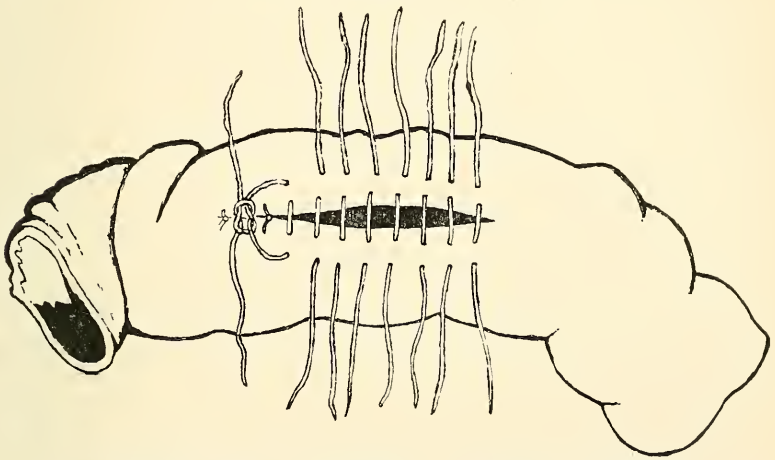
1. Wounds with no injury to the viscera.
2. Wounds with protrusion of the viscera.
3. Wounds complicated by injuries of the viscera.

Wounds With No Injury to the Viscera.—Penetrating wounds of the abdomen should be explored, even when there is no injury or protrusion of the viscera, and there is no evidence of septic material having entered the cavity. The wound should be closed, with the layers of the

abdominal wall nicely approximated by means of a through-and-through silkworm-gut suture.

Wounds With Protrusion of the Viscera.—The treatment of these wounds will depend upon the condition of the viscus protruding. If the viscus is healthy, all it will require is thorough cleansing, when it may be returned. If the circulation has been cut off to the part and it is gangrenous, intestinal anastomosis should be done, the gut thoroughly washed and cleansed and returned. The wound may then be closed by means of a through-and-through abdominal suture.

FIG. 124.



Method of closing wounds of the stomach or intestines by Lembert's suture.

Wounds Complicated by Injuries of the Viscera.—When the stomach or intestines have been injured, as from a stab or gunshot wound, the opening in the viscus should be closed by means of a Lembert or Halsted suture. After the openings have been closed, the peritoneal cavity must be thoroughly washed out in all its parts with several gallons of sterile salt solution. Where it is imperative to operate immediately, and the means are not at hand to accomplish intestinal anastomosis, the gut may be fixed in the wound in the abdominal wall and an artificial anus made. Intestinal anastomosis should be performed when there is gangrene or sloughing of the bowel, or when there is such injury that the closing of the bowel would obstruct more than half its lumen. Anastomosis may be done by the lateral or end-to-end method.

Traumatic Peritonitis.—This disease is considered here only in its surgical aspect. A large per cent. of the cases of peritonitis may be treated very successfully by osteopathic methods. For the treatment of other forms of peritonitis, the student is referred to works on Osteopathic Practice.

Traumatic peritonitis may be (A) Local and (B) General. The causes of this form of peritonitis are injury and infection, associated

with lesions of the lower ribs and any spinal lesions which may affect the visceral rami of the sympathetic, bringing about vasomotor disturbances, or pelvic lesions affecting the nerve and blood supply of the peritoneum, pelvis, and lower bowel, or any lesions affecting any of the abdominal viscera. The exciting causes may be specified as penetrating wounds, rupture, and disease of the hollow abdominal viscera, septic diseases of the viscera, and rupture into the peritoneal cavity of an abscess. The inflammation may be only local, or may involve the entire membrane.

Local Peritonitis is caused by penetrating wounds, appendicitis, salpingitis, cholecystitis, or small perforations of the stomach or intestines. In other conditions, there is low virulence of the micro-organisms, or a rapid formation of the inflammatory exudates, which glue the tissues round about, and may localize the process.

Symptoms.—The symptoms are more or less pain, local tenderness, nausea, slight fever, and a rapid pulse. The muscles are rigid over the part inflamed. Later, the inflamed part will form a hard mass, within which there may be an abscess cavity. Should the abscess form, it may enlarge to considerable size. This abscess may rupture into the viscera, onto the surface of the body, or it may rupture into the peritoneal cavity, causing acute diffuse peritonitis and death. The general symptoms of such localized abscess formation are chills, fever, and sweats, together with more or less emaciation and evidences of a fluctuating tumor.

Treatment.—Under all circumstances, when the abscess has been determined, an operation should be performed to evacuate its contents.

General Peritonitis.—Causes.—It may result from a local peritonitis, or from a high grade of virulence of the infection, or of a large number of germs. It may come from perforation of the stomach, intestines, or appendix. It may result from puerperal inflammations extending through the uterus and its appendages. There are no adhesions in this disease, or if any are formed, the inflammation quickly spreads beyond them. The peritoneum is red, congested, and thickened. On autopsy, it is found covered with a fibrinous exudate, or there may be masses of coagulated fibrin scattered through the cavity and over the viscera. Usually a foul odor emanates on opening the cavity. In some cases, there may be general diffusion of pus.

Symptoms.—At first the symptoms are those of a local inflammation. There may be local or general pain over the abdomen, and a feeling of weakness, exhaustion, and general malaise. Nausea and vomiting appear early. There is an elevation of temperature and acceleration of the pulse, while the patient appears anxious and is flushed. Muscular rigidity is more or less general over the abdomen, but greatest over the point of infection. As the disease progresses, the abdomen becomes distended and tender, while rigidity of the muscles becomes greater. The temperature rises, while the pulse becomes more

frequent; in short, the patient seems prostrated with sepsis. The bowels are confined, and are more or less paralyzed, because of which there is considerable distension from gas, although some gas may at first be expelled. Pain and tenderness apparently become lessened, because of the action of the septic poisoning upon the brain and nerve centers. The patient lies upon his back, with his legs drawn up, while the abdomen is greatly distended and the respirations are shallow. The face is drawn, the mouth and tongue dry, and the teeth are covered with sordes. Delirium, as a rule, is present. Vomiting is the rule, although the patient may be able to swallow and retain fluids. The vomited matter consists first of the contents of the stomach, afterwards that of the intestines. The temperature in some cases may be very high, while in others it may be subnormal. The pulse becomes rapid, feeble, compressible, and intermittent. Usually, efforts towards moving the bowels are futile when the case becomes pronounced.

Prognosis and Treatment.—The prognosis of the disease depends upon the cause and the severity of the infection. Where the disease arises from rupture of the stomach, or gall-bladder, or a ruptured abscess of the appendix, it is fatal. Cases arising from puerperal infection extending through the uterus and Fallopian tubes are especially grave. Where the disease arises from perforation of the hollow viscera, or from rupture of an abscess within the peritoneal cavity, only prompt surgical interference gives any hope of recovery. A moderate opening should be made through the abdominal wall and all parts of the peritoneal cavity washed out by means of irrigation with a large quantity of sterile normal salt solution. After this is done, the wound should be closed and drainage established by means of a cigarette drain. The bowel should be moved by means of enemata of glycerine, soapsuds, turpentine or castor-oil. The patient should be given fluids in large quantities, to encourage action of the kidneys in eliminating as much of the poison as possible. Salines are said to have a beneficial effect.

Foreign Bodies in the Stomach and Intestines.—Foreign bodies which can pass through the œsophagus can pass through the intestinal canal, but they may lodge in any part of the tract. The symptoms vary according to the location and the inflammation arising. These foreign bodies are usually swallowed by children, drunkards, or the weak minded. Foreign bodies, such as pieces of glass, needles, and fish bones, may occasion serious trouble by being caught in the folds of the mucous membrane. Museum freaks often eat glass, tacks, nails, etc., without occasioning very serious trouble. A purgative should never be administered to hasten the passage of the foreign body, but a diet should be given which leaves considerable residue and which may encase the foreign body and insure a safer passage. Many foreign bodies may be skiagraphed and accurately located. It is sometimes possible to feel the foreign body. If the foreign body lodges, the symptoms will be largely those of intestinal obstruction. In such cases, an operation will be required.

Cancer of the Stomach.—Cancer of the stomach may occur in either curvature, the cardiac or pyloric end, or on the anterior or posterior surface. In the majority of cases, the cancer is in the pyloric extremity. When it occurs in the pyloric extremity, there is constriction of the pyloric orifice, and the symptoms will be those of advanced age, indigestion, progressive emaciation, weakness, and cachexia. A dragging pain, which is increased upon eating, is present. Vomiting is frequent, but is usually not very early. When the cardiac end is involved, the vomiting is soon after eating, but when the pyloric extremity is affected, the vomiting is usually an hour or more after eating. The vomitus is in the nature of coffee grounds, due to the action of the fluids of the stomach. The presence of blood in the vomitus occurs in only about 40 per cent. of the cases. As a general rule, there is no free hydrochloric acid found in the gastric juice. Later in the disease, there is formation of a tumor, which can frequently be felt by distending the stomach with gas or fluid. To distend the stomach with gas, have the patient take a Seidlitz powder in the following manner: The bicarbonate should be mixed in a half-cup of water, and may be all drunk at once. The tartaric acid is dissolved in the same amount of water and gradually sipped. The gas forms quickly and will distend the stomach, when the tumor may be made out upon careful examination. To determine the presence or absence of free acid, a test meal may be given, and later the stomach washed out and the vomitus examined. The diagnosis is difficult. The *prognosis* is unfavorable. Death usually occurs in five or six months, but may be delayed two years.

Treatment.—The correction of rib or spinal lesions may relieve the symptoms. Improvement of the circulation and blood supply to the stomach should be kept up during the entire course of the disease. The symptoms should be treated as they arise. The measures are palliative and consist in limiting the diet to milk, gruels, and predigested foods. Lavage of the stomach should be advised. After the tumor is made out, in some cases, operation may be advised. The operation consists in removing the cancerous area, and it has been successfully done in a number of cases. Almost the entire stomach has been successfully removed by a number of operators in this country and abroad. The operation usually done is gastro-enterostomy, where the small intestine is brought up and attached to a healthy part of the stomach.

Ulcer of the Stomach.—Causes.—Rib or spinal lesions affecting, either directly or indirectly, the nerve and blood supply to the stomach. "The condition of the 8th and 9th ribs anteriorly, and the 5th to 8th ribs posteriorly, must be looked to" (Hazzard). It occurs in young women. The ulcer is usually located in the pyloric region; only two per cent. perforate. Only rarely may the ulcer be located on the anterior wall, when perforation may occur. The disease often attends menstrual disorders or chlorosis, and seems to be influenced to some extent by tight lacing, or by bending over, and thus compressing the

stomach. Alcoholism, anxiety, and dyspepsia are, if not exciting, contributing causes.

Symptoms.—The symptoms of ulcer of the stomach are those of acid dyspepsia and flatulency. Vomiting occurs two hours after eating. The vomitus contains a considerable quantity of free hydrochloric acid. Blood is often vomited and the stools may be tarry, owing to the presence of blood. There are violent paroxysmal pains, which are aggravated by the taking of food. The pain is boring in character and extends back to between the 8th and 9th dorsal vertebrae. Usually there is considerable local tenderness upon pressure. Perforation of the ulcer is evidenced by rapid collapse, muscular rigidity, and violent pains, which are increased upon the drinking of liquids. Where the diagnosis can be made, a surgical operation should be performed, and the edges of the ulcer united, and the effused contents of the stomach washed out of the peritoneal cavity.

Treatment.—Osteopathic treatment should be relied upon in the treatment of ulcer of the stomach. For a full description of the treatment, texts on Osteopathic Practice should be consulted. Surgical measures should be used only after perforation.

Stenosis of the Pyloric Orifice.—Stenosis of the pyloric orifice may be made out by the following symptoms. The vomiting of food, which has been taken several days previously; dyspepsia, and gradual distension of the stomach, with more or less pain. The dilated stomach can be made out by a careful physical examination after distention with gas. There is an absence of cachexia, which attends cancer, and no free hydrochloric acid. Where the stenosis is produced by a malignant growth, the symptoms will be the same as those of cancer of the stomach.

Intestinal Obstruction.—Intestinal obstruction is a condition where there is partial or complete obstruction to the flow of the contents of the bowel. Where there is obstruction to the circulation also, it constitutes strangulation. It may arise from the following conditions:

1. Fecal Impactions, Foreign Bodies, Gall-Stones, Etc.—Fecal impaction is the result of habitual or acute constipation, and usually takes place in the large bowel, in the cecum, sigmoid flexure, or rectum. Foreign bodies are rare, inasmuch as they can usually pass through the canal of themselves. They may lodge in the ileum, cecum, or rectum. Gall-stones and enteroliths sometimes produce obstruction by fecal matter accumulating upon them. This may take place in the small intestines. In some cases, there is a sort of paresis of the muscular wall of the bowel, which brings about the obstruction.

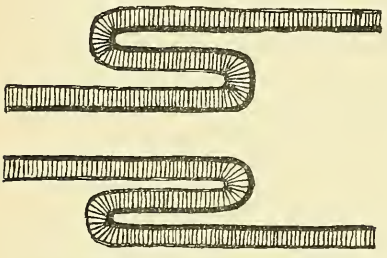
2. Volvulus.—Volvulus is a twisting of the bowel, either on its own axis or upon the axis of the mesentery. It usually occurs in the sigmoid flexure. It may occur in a hernia.

3. Intussusception is a telescoping or invaginating of the bowel. The varieties are: (a) Ileocecal, where the ileum and ileocecal valve

are prolapsed into the ascending colon. (b) Colic, where it occurs in the colon. (c) Ileocolic, where the ileum is driven through the ileocecal valve into the cecum and ascending colon. (d) Ileal, where only the ileum is involved.

4. BANDS.—Obstruction by bands is brought about by peritoneal adhesions, omentum and Meckel's diverticulum (the persistence of the vitellin duct, which comes off about three feet above the ilocecal valve). Obstruction by bands often takes place in appendicular inflammations, or in disease of the Fallopian tubes.

FIG. 125.



Intussusception or telescoping of the bowel.

5. Tumors of the Bowel.—The development of benign and malignant tumors of the bowel may bring about obstruction.

6. Tumors or Other Abnormalities Outside of the Bowel, such as malposition of the womb, retroflection or pregnancy, cysts and tumors of the viscera, may cause obstruction.

7. Stricture of the Intestine, from injury or malignant growths, may be the source of obstruction.

Symptoms.—The obstruction of the bowel may be partial or complete, acute or chronic, or there may be strangulation. When strangulation exists, the blood supply has been cut off to a certain part of the bowel. The symptoms in **acute obstruction** are shock and severe colicky pains, which are never absent, but there are frequent exacerbations. The constipation soon becomes absolute, not even gas passing. There is vomiting, first of the contents of the stomach, then bile, and finally stercoraceous material. The abdomen is distended and tender. Usually there is some fever, although the temperature may be subnormal. The face expresses pain, is anxious and shows great shock. The pulse is rapid and feeble. When the obstruction is high, there will be neither vomiting nor tympanites. There may be no great muscular cramping. The tongue is dry and the mind clear. Peristalsis is very often vigorous and visible, and if not visible, the case is likely to develop peritonitis. Digital explorations of the rectum may reveal the condition. As a rule, early vomiting means a tightly constricted condition of the intestines. In **chronic obstruction,** the attacks of pain are only at intervals, but they become more severe with vomiting and constipation. Unless the obstruction is acute, there is no stercoraceous vomiting. The constipation is not absolute. There is a history of alternate diarrhea and constipation. Abdominal distension is present. The patient gives a history of dyspepsia, with loss of appetite, uneasiness, etc. Acute obstruction may follow chronic obstruction.

Diagnosis.—The diagnosis may be made in the following manner: Obstruction of the bowel by **fecal accumulations** gives a history of chronic obstruction developing into acute. Constipation has preceded the case. Very often a doughy-like mass may be made out in the sigmoid flexure, cecum, or rectum. Pain and vomiting come on late. In **gall-stones,** there is a history of the stone having passed. In case of a **foreign body,** usually a history can be obtained. An x-ray examination may locate the foreign body. **Volvulus** is preceded by constipation, and comes on with explosive suddenness; the constipation is absolute, not even gas passing. It quickly attains great severity. There is no tumor, and rectal examination is negative. The vomiting comes on late, and is rarely stercoraceous. The abdominal distension and tenderness are great, while peristalsis is very vigorous. The collapse is not rapid. **Intussusception** occurs in children, usually in the iliac fossa. A sausage-shaped tumor is present, tenesmus exists and bloody mucus is passed from the bowel. The abdomen is not distended or tender. The vomiting is not stercoraceous. The invaginated bowel may be felt in the rectum. **Bands** are very often post-operative, or there is a history of peritonitis. It usually comes on after violent exertion and the attacks are like those of strangulated hernia—sudden and the onset fierce. Vomiting is intractable and soon becomes stercoraceous. The pain is violent, while the peristalsis above the obstruction is very vigorous. Collapse is early and muscular rigidity is pronounced. Obstruction is usually complete, and there is tympanites and distension because of the accumulation of gas in the bowel above the obstruction; tenderness is very great. In **tumor** the examination or history of the case will disclose the tumor. The symptoms are those of a chronic obstruction engrafted upon acute.

Treatment.—The physician should first carefully examine all the locations where hernia may occur. He should then determine whether the case is one of appendicitis, peritonitis, or poisoning. The case should be closely watched until the diagnosis is made. If it is one of gall-stones or impacted feces, high enemata and manipulation will give relief. Strangulation of the bowel, intussusception or volvulus demand laparotomy. In no case should treatment be begun until an accurate diagnosis is made.

Ulcer of the Bowel is said to sometimes follow burns. No surgical treatment is required for these ulcers unless there is rupture, then operative interference is the only hope of saving life.

Malignant Tumors of the Bowel are sarcomata and carcinomata. Sarcomata are very rare, while cancers are located at the ileocecal valve, in the sigmoid flexure or rectum.

Appendicitis.—Appendicitis is an inflammation of the appendix vermiformis of the cecum. Other inflammations, such as typhilitis, perityphilitis, etc., which occur in this region, are believed to arise from inflammations of the appendix. The appendix is attached

to the lower, inner, and posterior part of the cecum, at which point the pain and inflammation are greatest. It is indicated by McBurney's point, which is located two and one-half inches up on a line from the anterior superior spine of the ilium to the umbilicus. The position and relation of the appendix has been the subject of great study. In two-thirds of all cases, it has a well-developed mesentery, while in one-third of the cases, it is more or less fixed in the iliac fossa, and there is no mesentery, or one but partially developed. Its position in the abdominal cavity is variable and will hardly be found in two cases exactly alike. Its length may be from one to twelve inches, but is usually about four and one-half. It has four coats similar to those of the large intestine. The lumen is small and its opening into the intestine is guarded by the valve of Gerlach.

Cause.—Appendicitis is a bacterial disease. In some cases, the germs present are the pus cocci, while in others, the bacillus coli communis. Infection is rendered possible by the diminished resistance of the tissues of the appendix. This diminished resistance of the tissues is brought about by interference in the blood supply, perhaps also interference in the nerve supply may be a contributing cause. This seems to be supported by the fact that two-thirds of all cases are found in young males, where the only blood supply to the appendix is from a small branch of the ileocolic artery, while in the female an additional blood supply is received by a small branch of the ovarian artery. Other conditions contributing are the dependent position, the narrow mouth and the short mesentery. Foreign bodies are not so frequently the cause of this disease as was formerly believed. McBurney has stated that he never saw but one grape-seed in the appendix, and that was by accident, in performing an operation for another ailment. There were no evidences of appendicitis. Four hundred and fifty-nine autopsies show that in one hundred and seventy-nine cases, fecal concretions existed, while in sixteen, foreign bodies were found. In none of these were there evidences of appendicitis. Interference in the blood supply is brought about by twists, bruises, concretions, pressure, adhesions, and perhaps, in some cases, the contraction of the psoas muscle may play an important part. Da Costa says the disease is rare in women, because the appendix has a larger blood supply. Without doubt, osteopathic lesions, which affect the integrity of the lower bowel, will especially affect the appendix, diminishing its resistance to the onslaughts of the bacteria. Furthermore, that the disease is due to the interference in the circulation, is proven by the fact that 70 per cent. of all cases will recover without treatment. In a record of five hundred autopsies, 36 per cent. showed evidences of appendicitis. In none of these cases was there any treatment administered for this ailment. This would indicate that nature had overcome the pathological process by an increase in the blood supply. In the combating of all inflammations, the freedom of the blood supply is of the most vital importance. It is by means of a good free blood supply that nature resists the onset of acute inflamma-

tions and acute infections. Recognizing this fact, the osteopath may relieve a large number of cases where operation would otherwise seem imperative.

Varieties.—The disease may manifest itself in the following varieties:

1. Catarrhal, where only the mucous and submucous tissues are involved.

2. Obliterative, where the violence and extension of the inflammation have resulted in the obliteration of the lumen of the appendix.

3. Suppurative, where the tissues of the appendix become infiltrated with pus and an abscess forms.

4. Gangrenous, where the appendix dies because of the arrest of the circulation.

5. Relapsing or recurrent, where the disease relapses or recurs at various intervals.

Symptoms.—The symptoms of the disease are pain, more or less general over the abdomen, or perhaps radiating about the umbilicus. It finally becomes localized in the right iliac fossa, and at McBurney's point the pain and tenderness are greatest. There is general malaise, nausea, and vomiting, but in many cases this may not occur. At first, there is little or no muscular rigidity over the area, but as the symptoms become more severe, the lower half of the rectus, the muscles over the right iliac fossa, and other muscles, become rigid. The pulse is rapid, while the temperature may not be elevated more than a degree. In some cases, it soon runs to 102 or 103 degrees F., while in very bad cases, the temperature may be higher. The disease may come on after inflammations of some other part of the intestinal tract. It may come on after injury, or in many cases, arise spontaneously. Perhaps, in some cases, the presence of the fecal matter in the appendix is a contributing cause of the disease, and may excite more or less of a catarrhal inflammation. The effort of the appendix to rid itself of these materials may occasion colicy pains—appendicular colic.

Treatment.—The treatment of appendicular inflammation is the same as the treatment of other inflammations, and of abscess thereof, the same as the treatment of other abscesses. As is indicated above, this disease is usually the result of bacterial invasion. This bacterial invasion is rendered possible by disturbances of the circulation, either vasomotor or direct obstructions by pressure on the vessels. Where the disease is produced by fecal concretions, atonic conditions of the bowels are the cause. Spinal or rib lesions will be found in the splanchnic area, from the fifth dorsal to the second lumbar, to which the vasomotor disturbance and the atonic condition of the viscera are due. With this in view, the treatment consists in correcting these lesions and then stimulating the blood and nerve supply to the inflamed area. Manipulation over the inflamed appendix should be avoided, since it might cause rupture of the adhesions formed to limit the diffusion of

the poison. Treatments should be given to evacuate the bowels. The alimentary tract should be kept well cleaned out. When the temperature is elevated, treatment may be necessary to relieve it, but as a rule not. During paroxysms of pain, when the appendix is endeavoring to free itself of its contents, inhibitory treatment may be given in the splanchnic region to cause the opening into the bowel to relax. Should an abscess form, which is evidenced by a circumscribed tumefaction, fever, and an accelerated pulse, or should the pulse suddenly become rapid, and great depression follow, an operation should be advised. In this operation the appendix is removed, if possible, without opening the peritoneal cavity. During the course of the disease the patient should be kept on a nutritious liquid diet. The urinary secretions should be kept free. If these methods are followed out, surgical interference will rarely be necessary.

Enteroptosis (Glenard's Disease).—This is a condition of displacement downward of the abdominal viscera. All of the viscera, with the exception of the pancreas, rarely the kidneys, may be involved.

Cause.—Various rib and spinal lesions affecting the nerve and blood supply, and thus weakening the ligaments of the viscera, the mesentery, and the muscle of Treitz. Contributing causes may be mentioned, such as constipation, causing a dragging down of the transverse colon, stomach, spleen, and perhaps the right kidney. The patient is usually dyspeptic, anemic, and neurasthenic.

Treatment.—The treatment is entirely osteopathic. In some instances, the kidney, liver, and spleen may be anchored by operation.

Abscess of the Liver.—Abscess of the liver is due to pyogenic invasion in a condition of weakness brought about by lesions affecting the circulation and nerve supply. The abscess may be pyemic, or may be the result of other infection, as in case of abscess of the liver occurring in inhabitants of hot countries.

Symptoms.—The symptoms are those of a septic fever. There is enlargement and inflammation of the liver. The course of the disease, in many instances, resembles enteric fever, while in others it resembles malaria. The chills which occur in abscess of the liver are irregular. The fever is remittent, and higher in the evening than in the morning. Usually there is jaundice, cough, with diarrhea, and constipation alternating. Fluctuation is rare, unless the pus burrows near the surface.

Treatment.—When it is perfectly clear that an abscess is located in the liver, an exploratory incision should be made and the pus evacuated.

Osteopathic Measures.—In the treatment of abscess of the liver, other lesions than those directly affecting the organ itself will be found. Lesions will be found causing weakened areas and permitting the absorption of pus cocci. These enter the circulation and lodge in the liver, producing abscess formation. Any existing suppurating surface or abscess cavity must be cleansed, while the lesions directly affect-

ing the integrity of the liver must be treated. These lesions are found in the splanchnic area and the lower ribs on the right side. By increasing the circulation to the liver, abscess formation may be arrested, or the inflammatory products absorbed. Should the abscess attain considerable size, and give evidence of burrowing, an incision should be made, the cavity opened, and the pus evacuated. The circulation should be especially stimulated. This will prevent stasis and hasten absorption.

Hepatoptosis.—Displacement of the liver may occur in Glenard's disease. A history of the case, together with a careful physical examination, will determine the condition. Osteopathic treatment may give relief.

Gall-stones.—The condition of cholelithiasis is brought about by the precipitation of certain materials from the bile. This precipitation, which is usually around a nucleus of bacteria, shreds of epithelium, or blood-clot, consists of crystals of cholesterin, or lime salts. The causes of the disease are lesions of the left ribs, from the 8th to the 12th (Dr. Still). Experience seems to show that lesions affecting the splanchnic area, and in general, the lower ribs, deprive the chylopoetic viscera of the proper nerve force and blood supply, and inflammations arising may extend up the ducts into the gall-cyst, which will assist in bringing about the condition of cholelithiasis. The quality of the bile becomes changed and the salts are precipitated.

Symptoms.—The attack may come on gradually, being attended by flatulency, but more often it makes its appearance suddenly, as a violent colic. It usually occurs about three hours after a meal. The pains are violent, spasmodic, and paroxysmal. They radiate over the epigastric and hepatic regions, and finally extend up over the right half of the thorax. The patient is nauseated and often vomits, while the abdomen frequently becomes distended. Sometimes the condition of the patient much resembles that of collapse. The attacks last a variable time. The stone may pass on into the intestines, may regurgitate into the gall-cyst, or may become encysted in the cystic or common duct. Where the stone lodges in the common duct, jaundice will soon appear. It will not be present if the cystic duct is obstructed. If the stone lodges, it will cause repeated fierce attacks, the patient becomes more and more exhausted, while jaundice is pronounced and continued. Occasionally the stone may be large enough to be palpated. As the stone passes into the intestine, there is complete relief from pain. Usually the stone will pass from the bowel in several days, but this may not be true. It may remain in the intestinal tract for some length of time, or it may have been crushed within the duct, and afterwards dissolved by the intestinal secretions.

Treatment.—Osteopathy has almost wrested this ailment from the surgeon's hands. Stones of large size have been removed by manipulative measures. It is only in cases where the gall-stone becomes encysted in one of the ducts that an operation should be performed, and

then only when it is determined that relief can not be given by other means. Cholecystotomy should be performed, the stone removed, and the case treated as the condition requires. In some instances, it may be necessary to make a new communication between the intestines and gall-cyst, attaching the gall-cyst to the intestine—cholecystenterostomy. Where the cystic duct is obstructed, the disease may gradually wear off, and the contents of the gall-cyst become absorbed, or an abscess may result.

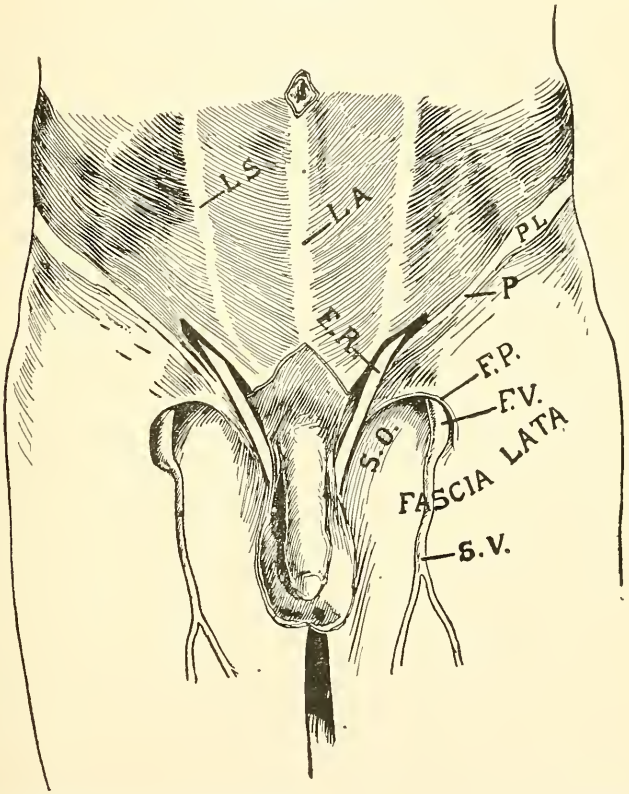
The treatment consists in removing lesions affecting the integrity of the gall-cyst and its ducts, and in stimulating the functions of the liver, thus obtaining a normal biliary secretion. Even after calculi have lodged in one of the ducts, they may be readily removed. The following case well illustrates the treatment: Mrs. S., the wife of a Justice of a United States Court, applied to the A. T. Still Infirmary for treatment. She had been advised by eminent surgeons to submit to an operation for the removal of the calculi, since all treatment had failed to remove them. Upon examination, spinal lesions from the fourth to the eighth dorsal were found. The corresponding ribs on either side were also affected. Treatment was instituted. Within two weeks she began passing the calculi per rectum. More than three hundred were gotten rid of in this manner. Within three months she was discharged, cured, and has not since had a recurrence of the trouble. The treatment was directed towards relieving the engorged duct, and to stimulating the unstriped muscle in the duct wall. During the paroxysms of pain, inhibitive treatment was given in the dorsal region on the right side, from the sixth to tenth dorsal. Manipulation was also made along the course of the duct from the ninth costal cartilage downward, and inward toward the umbilicus, to assist the progress of the stone. This case can not be viewed as an accident, since many osteopathic physicians have, by similar treatment, cured numerous cases suffering from gall-stones, after all other treatment had failed, and surgical procedures were considered the only means of relief. After the removal of the calculi, the general system may be toned up, and the liver secretion restored to its normal condition. This is most essential, since there may be a recurrence of the trouble if the lesions are not corrected.

Pancreatitis.—A sudden, acute, hemorrhagic inflammation of the pancreas may occur in drinkers. The pain is violent, and there is nausea and vomiting. Constipation is always present, with more or less fever and abdominal distension. Collapse usually comes on early. The symptoms are obscure. The causes are the subject of dispute among surgeons and authors. Undoubtedly certain lesions of the spine, affecting the nerve supply to the organ, are chiefly responsible for the disease. The treatment is osteopathic, and consists in removing any pressure on the nerve roots (at their spinal origin), or in increasing the blood supply through the vasomotors.

Tumors of the Pancreas.—Tumors of the pancreas are cysts and

malignant disease. Where the diagnosis can be made, the cyst may be attached to the abdominal wall, opened and drained, providing it does not yield to osteopathic measures. In malignant disease, the treatment is palliative. Surgery does no good.

FIG. 126.



Drawing showing the spermatic cord, external abdominal ring and the saphenous opening in the fascia lata.

Hernia.—Hernia is a protrusion of a viscus from its normal cavity, hence the term may be applied to the lung or brain, as well as to any of the abdominal viscera. As the term is ordinarily used, it applies to the escape of the contents of the abdomen. Abdominal hernias get out at the umbilicus, along the spermatic cord, round ligament, along the crural sheath of the femoral vessels, or through the diaphragm.

Causes.—The causes of hernia are congenital and acquired. The congenital causes are: 1. The continuous persistence of the pouch of peritoneum covering the testicle and cord. 2. The late descent of the testicle seems to predispose to the development of hernia. 3. Congenital phimosis, causing straining in the effort to void urine. 4. The abnormal length of the mesentery will render hernia more likely. 5. Inherited weakness of the parietes of the abdomen.

Acquired Causes.—Any condition which increases the intra-abdominal pressure, and weakens the abdominal walls, will bring on hernia. These are violent exertion, pregnancy, coughing in prolonged cases of bronchitis, straining in the erect position, constipation, urethral stricture, etc.

Structure of Hernia.—The hernial contents are always enclosed within a sac, called the hernial sac. This is made up of peritoneum, which covers over and is about the opening through which the viscus protrudes. This sac may be reduced when the viscus is restored to its normal cavity, but usually when the hernia appears subsequently, the sac becomes adherent to the surrounding tissues, and therefore is irreducible, although the contents of the sac may be returned to the abdominal cavity with ease. Sometimes this hernial sac may be the situation of a localized peritonitis, due to irritation, or injury. This inflammation may result in the obliteration of the neck of the sac, resulting in a spontaneous cure. Effusions of serum, or blood, may occur in the sac. When the sac is made up of a neck and fundus, the fundus, or body, may be of any size or shape. In some cases it is very large, while in other cases quite small. The neck may be small, or quite large, easily permitting the intestine or epiploon to insinuate itself. In general, there are present the different structures forming the abdominal wall at the point where the hernia escapes. In some cases, a portion of them may be absent, while in other cases, the parietes may be represented by other structures. These may be anatomically considered with benefit, but are of no practical value, since they are never recognized during operation, with the exception of the cremaster muscle, which forms a useful guide to the operator.

Contents of Hernia.—The contents of a hernia may be of any of the viscera of the abdomen, but usually is made up of some portion of the intestine or omentum.

Enterocele is a form of hernia which has for its contents intestine.

Epiplocele is a hernia which has for its contents omentum.

Entero-epiplocele is a form of hernia in which there is present both omentum and intestine.

The cecum and appendix vermiformis may in rare instances form a part of the hernial contents. In old cases, the bladder has been dragged into the sac. Sometimes loose bodies are found in the hernial sac. They are produced by cutting off of the appendices epiploicae.

Symptoms.—The symptoms of hernia are: 1. A pear-shaped swelling. 2. The swelling is increased in size when the patient stands, or decreased in size when he is in a recumbent posture. 3. There is an impulse on coughing. 4. It reduces with a gurgle. 5. When the contents of the hernial sac is omentum, it gives a doughy-like mass. 6. There is more or less pain of a colicky nature. 7. Occasionally, when the bowel is distended with gas, there will be tympanites on percussion.

Condition of the Hernia.—The condition of the hernia may be: 1.

Reducible. 2. Irreducible. 3. Incarcerated or obstructed. 4. Inflamed. 5. Strangulated.

Reducible Hernia.—A reducible hernia is one which may be readily returned to the abdominal cavity. The treatment of this hernia is either by the application of a truss, or operation. (See treatment of hernia).

Irreducible Hernia.—In this variety there exists some impediment to reduction. The causes are:

1. Structures outside of the sac, such as inflammatory thickening, etc., which may so constrict the neck as to render reduction impossible.

2. Thickening of the sac-wall. The sac-wall may become inflamed, and this lessens the lumen of the neck, rendering reduction impossible.

3. Certain conditions within the sac. These conditions may be the great amount of the contents of the sac, or it may be because of the omentum or gut which forms a part of the hernial contents, or it may be because of the adhesions between the parts of the hernial contents and the sac, or there may be an effusion of fluid within the sac which will prevent reduction.

Symptoms.—The symptoms of irreducible hernia consist of a dragging down sensation, with colicky pains; there is impulse on coughing, and the tumor is non-translucent. It may gurgle some on handling. The symptoms are not alarming, but the hernia will be the source of great annoyance, both to the patient and the physician. Likewise the patient is constantly in danger of strangulation occurring, which might prove fatal.

Treatment.—The treatment of irreducible hernia is palliative and operative. Palliative treatment consists in the application of heat for the relaxation of the tissues, or in other conditions, the application of ice to lessen the congestion, or high enemata of castor oil or salines, with manipulation along the spine to relax the contracted fascia and muscles, and finally the application of gentle taxis. Should the hernia become strangulated, an operation should be done immediately, to effect reduction and radical cure. Where the hernia has existed for some length of time, and where the inflammatory symptoms have receded and the hernia is still irreducible, it is fair to assume there are such adhesions that reduction is impossible. A bag, or laced-up truss, may be worn to prevent the hernia from becoming larger. They are often difficult to apply, and it may be better to take a plaster cast of the condition, so that the instrument maker may properly fit the truss. Where the patient will submit, an operation should be performed for the radical cure of the hernia.

Incarcerated Hernia.—This is brought about by the accumulation of hardened feces, fruit-stones, or other objects within the bowel in the hernial sac, or it may occur in old people where the contents become more or less inflamed. The inflammation may lead to strangulation of the bowel. There is constipation, which is not absolute, colicky pains, and more or less nausea. There may be vom

iting. A hard fecal mass can be felt, and likewise a slight impulse on coughing. In this form of hernia, high enemata of castor oil, or salines, together with heat and manipulation judiciously applied, will relieve the condition. If strangulation develops, an operation should be performed at once.

Inflamed Hernia.—Inflamed hernia is a condition where the hernial sac and its contents have become inflamed. It is most common in small and irreducible hernias of the omentum (epiploceles). It may be because of excessive manipulation, or injury, or a badly fitting truss. Many times, even though a truss is fairly well applied, the omentum may insinuate itself through the neck underneath the truss into the sac. The truss will more or less obstruct the return circulation and cause the viscus to inflame and thicken.

Symptoms.—The hernia is hot, inflamed, and very often edematous. There is vomiting, but it is not fecal. Usually there is constipation, but it is not absolute. Gas seems to pass readily. There is an impulse on coughing.

Treatment.—The treatment of inflamed hernia is the application of heat, or in some cases, an ice-bag. The patient should be placed in the recumbent posture and given high enemata. Heat will be found of the greatest advantage. It may be applied by woolen cloths, wrung from hot water every five minutes. Where gentle manipulation of the hernia itself, together with appropriate spinal treatment, does not give relief from the inflammation, and the symptoms become more severe, herniotomy should be performed.

Strangulated Hernia.—Strangulated hernia is a condition in which the circulation is more or less arrested to the hernial sac and its contents.

Cause.—1. There is contraction at the neck of the sac, because of the small aperture.

2. It may be brought about by increase in the bulk of the hernia by fresh portions of the abdominal contents being forced into the sac, obstructing the return circulation.

3. Catarrhal inflammations of the mucous membrane, together with fecal accumulations in the bowel, may arrest the circulation.

4. Congestion of the omentum, as may occur in inflamed or irreducible hernia, may bring about strangulation.

Pathology.—There may be an obstruction to the return circulation, or there may be a direct obstruction to the arterial blood flow, which is sufficiently complete to result in death of the hernial contents within a few hours. The changes taking place within the intestine largely depend upon the amount of irritation and the extent to which the blood supply is cut off. The intestine becomes dark and turgid, or edematous. It loses its shiny appearance and becomes lusterless and doughy. It may slough and a fecal fistula form and the patient survive, but usually intestinal obstruction supervenes and the patient dies in collapse.

Symptoms.—The symptoms are (A) Local and (B) General.

Local Symptoms.—1. The hernia is irreducible. 2. It is tender, painful, and stony-hard. It may be tympanitic. 3. There is no impulse on coughing. 4. Pain radiating about the umbilicus. As soon as strangulation comes on, the pain radiates about the umbilicus. 5. The skin and subcutaneous tissues over the hernia become a brick-dust red, and may be emphysematous and have a fecal odor.

General Symptoms.—The general symptoms are those of intestinal obstruction, as vomiting, first of the contents of the stomach, and then afterwards fecal matter. The constipation is absolute. The face becomes pinched and drawn, the pulse small and wiry, and the tongue furred and brown. Death ensues from collapse and general peritonitis.

Treatment.—In the treatment of strangulated hernia, the following considerations should be kept in mind:

1. Purgatives are terribly injurious and should never be allowed.

2. Prolonged taxis is very harmful and must be condemned.

3. Not a moment's delay should be tolerated, as every hour adds greatly to the danger. Necrosis of the bowel in some cases may occur within a few hours.

4. Employ taxis gently for a few minutes, and if this is unsuccessful,

5. Put the patient in a hot bath for twenty minutes and for a few minutes apply hot cloths over the hernia, and then try taxis again for a short interval. Failing in this, if the symptoms are urgent, preparations should be made for an operation. The patient's consent to operate should be obtained. The patient should then be given ether, and after thoroughly anesthetized, the hernia should be gently manipulated in an effort to effect reduction. If this fails, an operation should be performed.

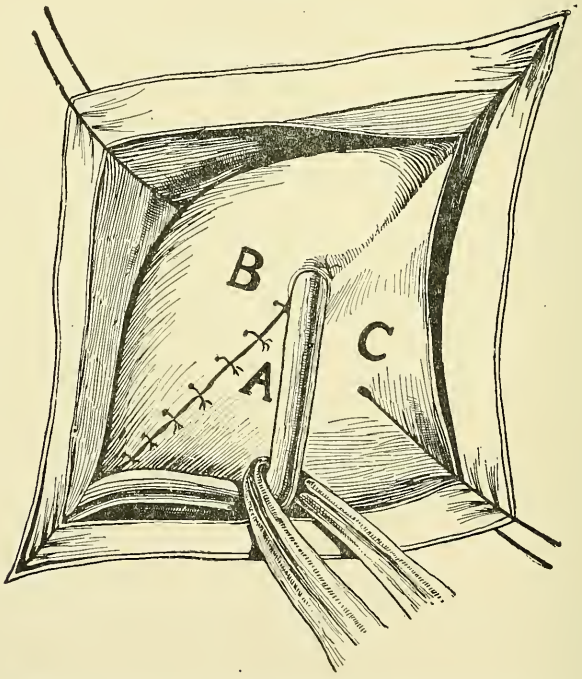
Taxis.—This is the manipulation which is employed for the purpose of reducing a hernia, and it is made in the direction from which the hernia came. In inguinal or femoral hernia, the hips should be elevated, the legs flexed upon the abdomen, so as to relax the abdominal muscles, while the tumor is grasped and gently manipulated, not with the intention of forcing the hernia back, but with the intention of assisting its return.

How long should taxis be employed? This is a question of the utmost importance. The application of taxis too long and too severely may of itself bring about necrosis of the bowel. In the ordinary hernia, taxis should not be applied longer than ten minutes, while in a tense femoral or inguinal hernia, with symptoms of obstruction, taxis should not be employed longer than five minutes. There are certain conditions under which taxis should not be employed, and these are, first, when there is evidence that vigorous and unsuccessful efforts have been made by other physicians, and second, when the hernia is very tense and tender, no manipulation should be made, but means to counteract the inflammation should be used. Manipulation is useless in a small, tender,

and inflamed femoral hernia, where there is fecal vomiting. Little can be expected from manipulation in femoral hernia. An operation is usually necessary. A hot bath is most successful in young and muscular subjects, but should not be given to old people.

Herniotomy.—Bassini's and Halsted's operations for inguinal hernia are most successful, and if carefully performed will permanently cure the rupture. Bassini's operation consists in making an incision from above the internal abdominal ring to the spine of the pubes, uncovering the

FIG. 127.

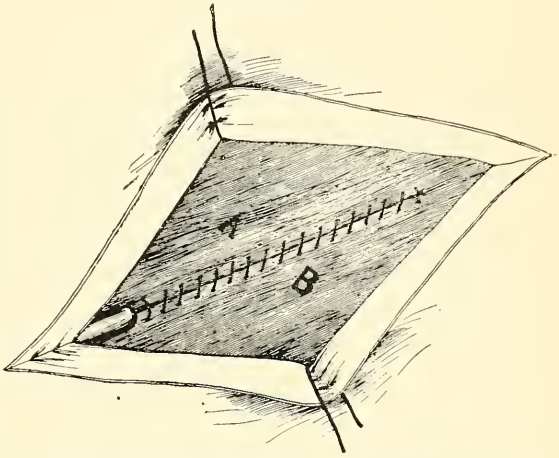


Bassini's operation for the radical cure of inguinal hernia. This drawing shows the internal oblique muscle drawn down and sutured to Poupart's ligament to form the floor of the inguinal canal.

external abdominal ring. The external oblique aponeurosis is then divided up to the internal ring and retracted. The various tunics covering the hernia are then separated and drawn aside, while the hernia is separated from the spermatic cord. The cord is picked up and drawn aside. The hernial contents are then restored to the abdominal cavity and the sac ligated with catgut and removed, while the stump is allowed to sink back into the cavity. While the cord is still retracted, the inferior border of the internal oblique muscle is drawn down and sutured to Poupart's ligament underneath the external oblique. In this manner a good floor is made for the inguinal canal. The roof is made by suturing the aponeurosis of the external oblique muscle over the cord.

Chromicized catgut sutures are used. A continuous suture may be used for the external oblique, and it should be carried down to the external ring, not so close as to produce a constriction. The wound is then closed by interrupted silkworm-gut sutures. Halsted attaches all the structures to Poupart's ligament and leaves the cord beneath the skin. The cord is brought out through the aponeurosis of the external oblique above the internal ring. Other operations have been devised, but are not so successful as the above.

FIG. 128.



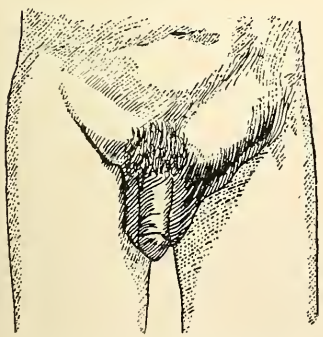
Bassini's operation for radical cure of hernia. This shows the external oblique muscle sutured over the spermatic cord to form the roof of the inguinal canal.

Varieties of Hernia.—The most common forms of hernia are **inguinal** and **femoral**, but other forms, such as **ventral, epigastric, diaphragmatic obturator, lumbar, ischiatic, perineal, vaginal,** and **rectal,** may occur.

Inguinal Hernia.—Inguinal hernia may be (A) Direct, and (B) Indirect or oblique. It is a direct hernia when it passes through the external abdominal ring only, and indirect when it comes through the internal abdominal ring, traverses the inguinal canal, coming out the external abdominal ring.

Direct Inguinal Hernia.—This variety of hernia escapes directly through the external abdominal ring without passing through the inguinal canal. It is situated internal to the epigastric artery. Inasmuch as the conjoined tendon of the internal oblique and transversalis muscles are attached immediately behind the external abdominal ring, it either pushes this conjoined tendon along with it, or it passes around it. The coverings of this hernia from without in, are skin, superficial fascia, intercolumnar fascia, conjoined tendon, transversalis fascia, subserous areolar tissue, and peritoneum which forms the sac. In some cases where there are three fossae on the inside of the front of the abdominal cavity instead of two, in which condition

FIG. 129.

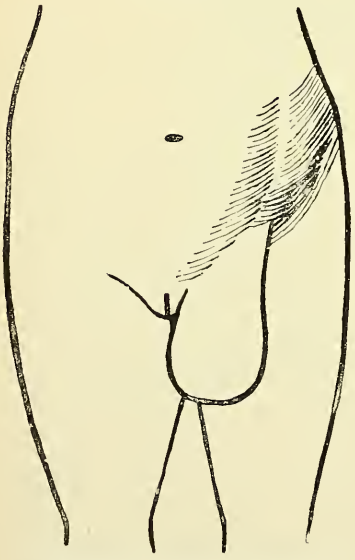


Double incomplete inguinal hernia.

the fibrous cord of the obliterated hypogastric artery does not accompany the deep epigastric artery, the direct inguinal hernia may come out external to the conjoined tendon, appearing within the inguinal canal, then passing out the external abdominal ring. Under such circumstances it would have as a covering, instead of the conjoined tendon, fibres of the internal oblique and transversalis muscles. This hernia always comes out through Hesselbach's triangle, which has as its base Poupart's ligament, one leg being the outer border of the rectus muscle, while the other is formed by the deep epigastric artery, so that the artery is on the outer side of the neck of the sac. Strangulation in this variety of hernia is situated in the external ring, or in the conjoined tendon.

Oblique Inguinal Hernia.—There are several varieties of oblique inguinal hernia, the most common of which are: 1. Acquired. 2. Congenital. 3. Infantile, or encysted.

FIG. 130.



Labial hernia or inguinal hernia in the female.

Acquired Indirect Inguinal Hernia makes its appearance at the internal abdominal ring. In some cases, the hernia may remain in the inguinal canal, never coming out the external abdominal ring. This is called **incomplete hernia**, or **bubonocele.** When it passes through the external abdominal ring, it will descend into the scrotum (scrotal hernia), or when along the round ligament into the labia majora (labial hernia).

The **coverings** of the oblique inguinal hernia in the male are, from without inward, skin, superficial fascia, intercolumnar fascia, cremaster muscle, infundibuliform fascia, subserous areolar tissue, and peritoneum. In the female, the cremaster muscle is wanting.

Congenital Hernia.—In this variety, the pouch of peritoneum which has been pushed down in front of the testicle remains patulous. The abdominal contents readily descend into this sac. The testicle is more or less surrounded by the hernia.

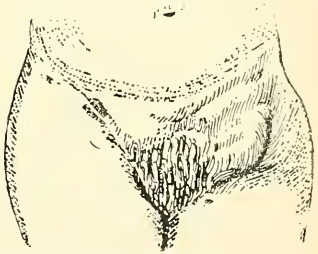
Infantile or Encysted Hernia.—This is a form of hernia arising in a condition where the pouch of peritoneum pushed down by the testicle is closed at the internal ring, but remains patent below so that the cavity of the tunica vaginalis testis communicates with the pouch extending along up in front of the cord. The hernia then has a distinct sac which passes down behind this pouch, so that in operating, the cavity of the tunica vaginalis would be opened before the hernial sac could

be reached. There are three coverings of peritoneum in front of the hernia, two being connected with the tunica vaginalis, while one forms the hernial sac. The sac of the hernia could not be reached without pushing aside this process. In some cases the fluid within this cavity will entirely obliterate any evidence of hernia.

Diagnosis.—Inguinal hernia may be confounded with: 1. Enlarged lymphatic glands in the groin. 2. Femoral hernia. 3. An encysted hydrocele of the cord. 4. A retained testicle. 5. Hydrocele of the tunica vaginalis. 6. Varicocele. 7. Psoas abscess.

A careful examination usually renders the diagnosis easy. In incomplete inguinal hernia, the swelling is a round, hard tumor, and is painful and not movable, while in **enlarged lymphatic glands**, more than one gland will be enlarged, and they are more or less movable, also some sore on the genitalia, or some venereal disease, which is the cause of the lymphatic enlargement, will be present. In complete inguinal hernia, the contents descend into the scrotum. In **femoral hernia**, the enlargement is below Poupart's ligament. In **encysted hydrocele**, there is a translucent tumor, which is usually tense, ovoid, and well defined, having no connection above or below, while it gives no impulse upon coughing. In **retained testicle**, the absence of the organ in the scrotum, together with the fact that it gives no impulse on coughing, will serve to distinguish it. Usually it is quite movable within the inguinal canal. If it has become inflamed, the nausea and vomiting are not of the intense character that occurs in strangulated hernia. In **hydrocele of the tunica vaginalis**, there is a translucent tumor, with a history of its gradual appearance. It is irreducible, and the testicle may be felt in the back part of the tumefaction. In children, sometimes translucency can be obtained in the hernia, and, too, a **hydrocele** may be more or less reducible, but the hydrocele is not reducible with a gurgle, as is hernia. **Varicocele** will disappear when the patient assumes a recumbent posture, and while standing it feels like a mass of earth worms, or the intestines of a chicken. There is no impulse upon coughing. If the external abdominal ring is compressed, the hydrocele will not disappear upon lying down. It is nearly always on the left side. **Pott's Abscess** appears below Poupart's ligament, and is more liable to be mistaken for a femoral hernia. There is evidence of spinal trouble. Pott's abscess is not reducible with a gurgle, and gives no impulse upon coughing.

FIG. 131.



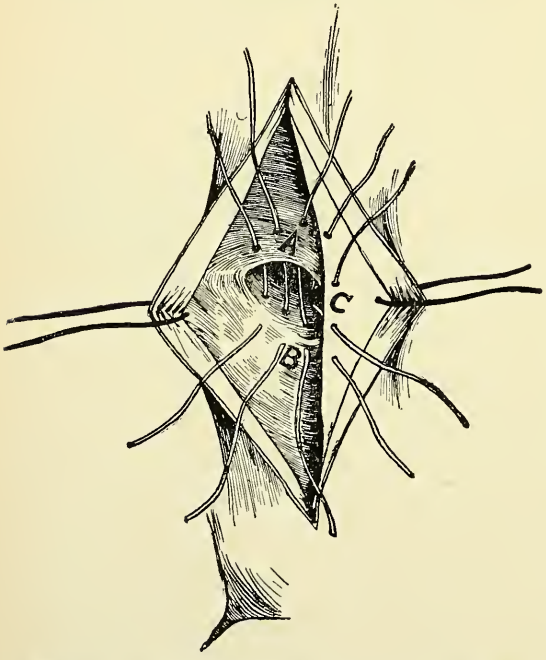
Femoral hernia showing the enlargement upward and outward below Poupart's ligament.

Femoral Hernia.—Femoral hernia is one which escapes through the femoral canal internal to the femoral vessels, making its appearance through the deep fascia at the saphenous opening. The neck of the sac

is situated at the femoral ring. This ring is bounded above by Poupart's ligament, internally by Gimbernat's ligament, below by the pubes, and externally by the femoral vessels. The course of the hernia is through the femoral ring, along down the femoral canal, and out the saphenous opening. It then turns upward and outward. In some cases, where it is very large, it may ascend above Poupart's ligament on the abdomen.

The **coverings** of femoral hernia are, from without inward, skin superficial fascia, cribriform fascia, femoral sheath, or fascia propria, septum crurale, subserous areolar tissue, and peritoneum which forms the sac. This form of hernia is rarely ever congenital. It is much more common in women than in men. When strangulation of the hernia takes place, the stricture is at the saphenous opening, or in the femoral opening.

FIG. 132.



Bassini's method of operation for radical cure of femoral hernia.

Diagnosis.—It may be mistaken for an inguinal hernia, enlarged lymphatic glands, for a small lipoma, or Psoas abscess. Careful examination should render the diagnosis not difficult.

Umbilical Hernia.—There are three forms of umbilical hernia usually described, congenital, infantile, and acquired. **Congenital** is an exceedingly rare form, due to imperfect closure of the abdominal walls. The intestines escape into the sac which is beneath the umbilical cord. The cord may be large and bulbous, so that the hernia may be included in the ligature and fatal strangulation result, if care is not taken. **Infantile umbilical hernia** is the result of weakness of the umbilical scar which yields to intra-abdominal pressure. Chronic constipation, phimosis, or pertussis, may bring it about. Regulation of the bowels, together with strapping on a properly fitting band, will be found sufficient to effect a cure. The acquired form usually occurs in women who have borne children, or from injury producing rupture of the linea

alba. Obstruction or strangulation of this hernia is rare. **The treatment** is either by truss, or operation.

Ventral Hernia.—Ventral hernia is rare, except following operations whereby the abdominal parietes are divided. These hernias may be very large. In view of improved surgical methods, they are very rare. The **treatment** should be to open the sac and freshen the edges of the muscles and fascia and reunite them.

Lumbar Hernia.—Lumbar hernia is a rare condition where the abdominal viscera protrude by the side of the erector spinae mass coming to the surface between the latissimus dorsi and the external oblique, in the space commonly known as Petit's triangle. The ordinary signs of hernia are present. It can be readily distinguished from lumbar abscess. The **treatment** is, as in other hernias, bandage, or operation.

Diaphragmatic Hernia.—This hernia is rarely recognized before death. It is usually congenital, and arises from imperfect development of one half of the diaphragm. The transverse colon, or stomach, is forced into the thorax. There is no peritoneal sac.

Obturator Hernia.—This is a condition where there is protrusion of the intestines through the obturator foramen. It usually occurs in females. It is not often recognized in life, except in strangulation. Fortunately it is rare.

Other forms or hernia, such as **epigastric, ischiatic, perineal, visceral, rectal,** etc, are too rare to merit description here.

DISEASES OF THE RECTUM.

Malformations of the Rectum.—Imperforate Anus.—This is a congenital condition in which the process of development of the rectum has been arrested. The rectum is formed by the invagination of the epiblast and the absorption of the tissues between this invagination and the intestinal canal. There may be no invagination, or there may be but a thin membrane between the rectum and the bowel above.

Treatment.—The treatment is operative. A vertical incision is made in the middle line and carefully extended to the gut. The wound should be kept open with a bougie, to prevent union of the sides.

Proctitis.—Proctitis, or inflammation of the rectum, is rare. The cause is a prolapsed condition of the viscera, injury, gonorrhea, dysentery, luxations of the coccyx, or at the sacro-iliac joint, or of the dorsal and lumbar spine affecting the blood and nerve supply, either directly or reflexly. The lesions are usually low down.

Treatment.—The bowels should be kept loose, and a liquid diet administered. The bowels should be washed out, to relieve the mucous membrane of any irritants. Lesions affecting the blood and nerve supply to the rectum should be removed, also the secretions of the remainder of the intestines should be looked after.

Pruritis Ani.—This is a condition of obstinate and terrible itching of the skin and mucous membrane about the anus. In some conditions there may be disease of the epithelium, or the superficial skin about the anus. In most cases there seems to be a lesion affecting the nervous system. The lesions will be for the most part found in the lumbar region, also there may be deflections of the coccyx. If these lesions are corrected and the coccyx straightened, the disease will disappear. Contributing factors to the disease are constipation, vermes, pediculi, eczema marginatum, piles, condylomata, digestive disorders, etc.

Treatment.—The treatment is osteopathic. Being due to lesions irritating nerve trunks, it can be cured by removing these lesions and by taking proper care of the affected skin. The parts must be kept dry and free from irritation. Where the itching is terrible, and immediate relief can not be given by treatment, the following solution will be found of advantage, simply as a palliative measure: Bathe the parts with hot water and then apply a solution made of one dram of camphophenique, stirred into one ounce of water. Should this not give relief, or should the itching persist, an application of the following ointment will be found of advantage:

Oleate of cocain.....one part
Lanolin.....three parts
Vaselin.....two parts
Olive oil.....two parts

This should be made into an ointment and applied once or twice daily as is needed.

Fissure of the Rectum is produced by the passage of hard fecal masses, or irritating substances, or foreign bodies, within the stool. It usually occurs in constipation when there is excessive straining at stool. The symptoms are pain, which may radiate to other parts of the body, and spasm of the sphincter muscle. The stool is streaked with blood. Very often above the fissure there is a little pile, or it may be the fissure consists of a small, inflamed, valve-like nodule of the mucous membrane.

Treatment.—The treatment consists in relaxing the sphincter muscle, correcting any bony lesions present, and touching the fissure with equal parts of glycerine and carbolic acid. The use of carbolized vaselin will frequently give relief. The sphincter muscle should be dilated and the stool softened and kept free. Correcting the lesions of the lumbosacral spine will relieve the spasm of the sphincter muscle.

Prolapsus of the Rectum and Anus.—This consists of a prolapsing of the mucous membrane, occasionally the muscular coat, of the rectum and anus. It usually happens in children, but may occur at any age. The causes are certain spinal lesions affecting the rectum, together with straining at stool, stricture of the urethra, phimosis, ascarides, stone in the bladder, constipation, piles, polypi, etc. The *diagnosis* is evident. The prolapsus can readily be reduced by gentle pressure. In some old cases, the prolapsed bowel may be difficult to reduce. In these old cases, the mucous membrane becomes gradually thickened and the prolapsed

mass may be of very large size. In children, the disease usually results from constipation and relaxed and atonic conditions of the elastic tissues which unite the mucous membrane to the muscular coat. Any pelvic or spinal lesions should be removed. The stools should be kept loose, the bowels moved in a reclining posture, or while the patient is lying upon his side. It will require several months to effect a cure. In children, cases yield readily to simple treatment. In grown people, the disease may be difficult to cure without an operation. The habit of voiding stool in a squatting posture is vicious. In severe cases, the actual cautery may be necessary. Two or three scars are made with the cautery through the mucous membrane. This causes adhesion to the muscular coat and effects a cure. Astringents, or the local application of any medicines, are worthless. Osteopathy will cure most of the cases, providing the patient will follow the physician's instructions.

Hemorrhoids.—Hemorrhoids are varicosities of the veins of the rectum and anus. The cause of hemorrhoids in the large majority of cases is malposition of the coccyx. Deflection of the coccyx interferes directly and reflexly with the blood supply to the bowel. Atonic conditions of the bowels occur from dorsal, lumbar, or rib lesions affecting the circulation and nerve supply, causing straining at stool, prolapsus of the viscera, etc., which lead to constipation and the use of purgatives. These purgatives are irritating to the mucous membrane of the bowel, and cause congestion and inflammation and predispose to the formation of hemorrhoids. The pressure of a tumor, gravid uterus, or obstruction to the portal circulation, may be the active causes. In general, any lesions affecting the circulation or nerve supply, either directly or reflexly, may be said to operate as causative agents. The piles may be external, or internal. **External piles** are situated without the sphincter muscle. They are soft, globular, pinkish-blue swellings. They may be soft and fleshy or moderately firm. They may be due to the rupture of a vein, or they may consist simply of hypertrophied tags of skin. **Internal piles** are reddish-blue masses, situated within the sphincter muscles. They may, or may not, prolapse at stool. If they prolapse at stool, they may return voluntarily, or they may be so large as to require assistance in returning them. They may become ulcerated and bleed (bleeding piles), or they may become inflamed (inflamed piles). The tumor may be pedunculated, may be large or small, or may be globular, or sessile. There may be one, or many. They may be so plentiful and large that prolapsus at stool resembles prolapsus of the rectum. The *diagnosis* can be readily made by having the patient lie prone across a table or bed and require him to bear down as in defecation, at the same time the buttocks should be retracted. The tumor will appear at the anus, where it may be seen. Examination with the finger is deceptive, as the pile can not be readily felt unless inflamed or ulcerated. Where the spasm of the sphincter is very great and the piles come down and can not be returned, a hot poultice of bread and milk may be ap-

plied, which will soften the tissues and usually brings about their return without much difficulty. Where the parts are very sore, the application of the benzoated oxide of zinc ointment as a protective, or of carbolated vaselin, will be found excellent as palliative measures.

Treatment.—The treatment of hemorrhoids, as in other diseases, consists in removing the cause. It is especially important, since piles are nearly always the result of obstructions to the circulation. **Lesions** responsible for them consist of deviations of the coccyx affecting the circulation directly, or lower dorsal and lumbar lesions affecting the circulation indirectly. Lesions affecting the heart, lungs, and liver may interfere with the circulation to the lower bowel and cause the tumefactions. Treatment directed toward repairing the diseased condition of these viscera will in these cases cure piles. Piles may be caused by pregnancy, a prolapsed condition of the bowels, tumors, or by a loss of tonicity of the tissues comprising the submucous coat of the bowel. Constipation and hard fecal masses, causing straining at stool, may cause the obstruction producing the pile. In any case, the obstruction, if possible, must be removed, the blood vessels toned up, and the fecal mass softened by rendering the passing of the stool easy. Where the piles are ulcerated, carbolized vaselin or benzoated oxide of zinc ointment may be applied after voiding stool. Each time after defecation the piles should be washed clean with warm water. Often the application of *cold* cloths will markedly benefit inflamed piles. Operations will sometimes be found necessary for the removal of the piles. These operations consist of ligation of the piles, or removing them by the clamp and cautery.

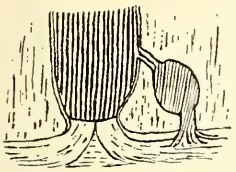
Ischiorectal Abscess is an abscess in the ischiorectal fossa. It must not be confounded with perineal abscess. The causes are lesions affecting the circulation in the ischiorectal fossa. Circulation through this loose connective tissue is often not good. Pressure of a hard fecal mass, and the wounding of the mucous membrane, permit the entrance of bacteria. If then the tissues are deprived of their proper amount of blood, an abscess results. The *symptoms* are pain, heat, redness, swelling, and fluctuation.

Treatment.—An early incision should be made and the pus evacuated and the abscess treated as an ordinary abscess until it heals.

Fistula in Ano is a communication between the bowel and the surface tissues by means of a small tract, which is the result of the burrowing of pus. The walls around the opening of the fistula are hard and indurated, and there is a watery or purulent secretion appearing. Fistulae are divided into complete and blind. Blind fistulae are rare, and finally develop into complete fistulae. They may be blind externally, or internally, that is, a sinus may extend from the cavity in the tissues to the outside, or extend from the bowel a short distance into the tissues. Complete fistula is where the tract extends entirely through from the bowel to the surface of the tissues. The

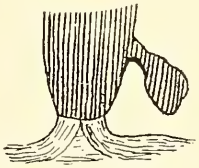
opening may be at the margin of the anus, on the buttocks, or in the perineum. The cause is burrowing of the pus of an ischiorectal abscess, or the burrowing of pus from an ulcerated tract in the rectum. The *symptoms* are pain, increased upon voiding stool, discharge of pus, and the escape of feces. A correct diagnosis may be made with a probe, which can be readily introduced into the fistula and its course and extent determined.

FIG. 133.



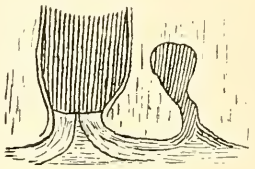
A complete fistula.

FIG. 134.



An incomplete internal or "blind" fistula.

FIG. 135.



An incomplete external fistula.

Treatment.—The treatment is manipulative, and operative. By keeping the fistulous tract clean, and increasing the blood supply to the area and correcting the constipation, many of them may be cured. Where this treatment fails, the patient may be anesthetized, the sphincter dilated, and a probe introduced at the external opening of the fistula through to the internal opening and the end of the probe within the bowel hooked up and brought out of the anus. Then the tissues over the probe should be divided with a bistoury. The fistulous tract will be found cartilagenous and hard. It should be scraped out with a curette, the wound packed with gauze, and made to heal from within out. Where the fistulae are small, the sphincter may not require dilatation.

Tumors of the Rectum.—Polypi of the rectum are pedunculated tumors, which may reach the size of a cherry. They are vascular, or fibrous. They may be the cause of bleeding, especially in children. The best treatment is to ligature the base of the polypus with a stout silk ligature.

Papillomatous Tumors of the rectum are rare, and may easily be recognized upon examination.

Cancer of the Rectum occurs between thirty and thirty-five years of life. It may occur later. It usually ulcerates and makes a hard ring around the anus. It occasions severe burning pain, hemorrhage, and stricture, and is attended by cachexia. Where the diagnosis can not be made by inspection externally, a speculum, or the finger introduced, will disclose a cauliflower excrescence.

Treatment.—Unless the tumor can be completely removed, no operation should be attempted, as it will excite the growth of the cancer, causing it to bring about death much more quickly. Palliative measures

should be used. There is no specific treatment. Excision is practiced in some cases.

Ulcers of the Rectum are simple, specific, tubercular, and malignant. **Simple ulcers** are produced from passing hard fecal masses and are made possible by the debilitated state of the general health, or lesions affecting the nerve and blood supply. A diagnosis of the ulcer may be made by means of a speculum. It is essential to determine the nature of the ulcer. If it is simple, cauterizing the ulcer with a stick of nitrate of silver and washing out the bowel will soon effect a cure. Some cases may be treated successfully by correcting the coccyx, or any spinal or other lesion present. If the ulcer is syphilitic, malignant, or tubercular, the treatment must be modified accordingly. In case of syphilitic and tubercular ulcer, cauterization will be of service.

Stricture of the Rectum may be caused by the growth of a tumor from without the bowel, or by primary narrowing of the bowel from growth of tumors within. It may be caused by malignant disease, syphilis, or ulceration and sloughing, the result of injury and debilitated states. It may be caused by tubercle and injury.

Treatment.—The treatment of stricture is many times questionable. Where the tumor can be conveniently removed, it should be done. In syphilitic stricture, the syphilis should be treated. In tubercular stricture, the tubercle should be treated. In traumatic stricture, or stricture the result of ulceration, not from tubercular or syphilitic disease, gradual dilatation by means of a bougie, or speculum, is good treatment. It may be possible, by increasing the circulation, to secure absorption of a considerable part of the stricture.

DISEASES OF THE URINARY ORGANS.

Hematuria.—Hematuria may occur in hemorrhagic diathesis, scurvy, or in fevers, or it may be due to injury or disease of the urinary organs. The color of the urine may be bright red, dark, or smoky. The presence of blood may be determined by microscopical and chemical tests.

Cause.—The blood may come from the kidney, ureter, bladder, prostate, or urethra. When the hemorrhage comes from the ureter or kidney, it may be the result of the formation of calculus or injury, congestion, inflammation, Bright's disease, ingestion of turpentine, or the application of cantharides. The blood is intimately mixed with the urine, which is of smoky color. When the blood is derived from the bladder or prostate gland, it may come from injury, or the formation of calculus, cystitis, tubercle, or morbid growths. The urine contains more blood towards the end of urination, and it is usually of a bright red color. Whatever condition is the cause of the bloody urine, this should be treated. In hemorrhage from the urethra, arising because of injury, urethritis, chancre, rupture of the corpus spongiosum, or morbid growths, the hemorrhage follows urination, or occurs during the interim.

Micturition may be painful or frequent. It is painful in hyperacidity of the urine, or in irritated or diseased conditions of the genito-urinary tract. The following points will be useful for the purpose of diagnosis.

In **stone in the bladder**, the pain is in the head of the penis behind the meatus, and is greatest at the end of urination. It is aggravated by exercise.

In **stone in the kidney**, the pain is in the back, thigh, groin, and testicle.

In **orchitis**, the pain is along the cord in the groin.

In cystitis, the pain is before micturition, and is often relieved by the act.

In **urethritis**, the pain is intense during micturition.

In inflammation of the **neck of the bladder**, the pain is intense during, and just after urination, and is associated with bloody urine and tenesmus.

In inflammation of the **prostate**, there is intense pain during micturition and soreness in the gland. Defecation is painful.

Frequency of Micturition.—Micturition is increased in frequency by spinal lesions, phimosis, a narrow meatus urinarius externus, inflammation of the kidney, etc., very acid urine, calculi, sexual excess, mental worry, fear, diabetes, Bright's disease, tumors, and neuroses. It may be increased by atony of the bladder with residual urine, stricture, or by enlarged prostate. Urination may be increased in frequency without an increase in the amount, so that it is necessary to determine the force of the stream and the frequency of micturition. A small stream denotes stricture of the urethra. Slow urination denotes enlarged prostate, stricture, or atony of the bladder. Frequent micturition, with less force in the stream, denotes atony of the bladder, enlarged prostate, or stricture. In making a diagnosis, it is essential to determine the following points:

1. **The frequency of urination**, and the conditions affecting it.

2. **Pain.** Its nature and location. Is it paroxysmal, transitory, or constant, and the conditions affecting the pain.

3. **Character of the stream.** The size and force.

4. **Character of the urine.** The amount, whether it contains sugar, albumin, pus, blood, etc.

Tumors of the Kidney.—Tumors of the kidney are benign and malignant. Benign tumors are fibroma, lipoma, and adenoma. Malignant tumors are sarcoma (rare) and carcinoma. The signs of malignant tumors are pain, tube casts, casts of the pelvis of the kidney and ureter, cachexia, and the presence of the tumor, which can be made out on palpation.

The **treatment** is operative. When the non-malignant tumors can be made out, they may be removed, providing they do not yield to appropriate osteopathic treatment over the kidney areas.

Movable Kidney (Nephroptosis).—This sometimes occurs in Glenard's disease. The diagnosis can usually be made without difficulty. A pad should be worn, to hold the organ in place, or the treatment for enteroptosis given. The operations for anchoring the organ have not been very successful.

Renal Calculus.—Renal calculus is brought about by lesions affecting the suprarenal capsule of the kidney, or spinal lesions from the tenth dorsal to the first lumbar, affecting the lower ribs.

Composition of the Stone.—It usually consists of the urates of ammonia or uric acid. More rarely, it may be made up of lime salts—the oxalate or acid phosphate. The stone excites pyelitis.. If it is small and round, it may pass to the bladder without difficulty, or it may ulcerate through the pelvis of the kidney, forming an abscess and appear externally. It may form a complete obstruction to the flow of urine to the bladder, causing a condition of hydronephrosis, or pus may be formed in the pelvis of the kidney, causing pyonephrosis. The **symptoms** are persistent pain in the loin, which is increased upon exercise. The pain is usually along the genito-crural nerve. There is retraction of the testicle in the male, labium majus in the female. Very often the pain is down in the buttock, the thigh, or the heel. Hematuria and pyuria are present and are increased upon exercise. There is frequent micturition, and the patient lies upon the affected side. The kidney is enlarged, and the passage of the stone gives rise to renal colic.

Renal Colic comes on as a sudden excruciating, paroxysmal pain. It is referred to the loin or along the genito-crural nerve. There is vomiting and shock. The patient writhes in agony, while he is covered with cold perspiration. The temperature is often subnormal, the pulse rapid and weak. The patient has strangury. The attack lasts a variable time, when the stone may be regurgitated into the pelvis of the kidney, or it may pass into the bladder.

Treatment.—The treatment is osteopathic and consists in relaxing the ureter to permit the stone to pass. In severe cases nephrectomy may be performed.

Pyelitis.—Pyelitis is inflammation of the pelvis of the kidney. It is caused by spinal or rib lesions, by injury, or the extension of inflammations from the bladder up the ureter to the kidney, or the formation of calculi, or by tubercle or cancer of the kidney, the ingestion of drugs and by foreign bodies.

The **treatment** is to remove the cause. This can be successfully done osteopathically. Providing the disease does not end in pyonephrosis or abscess of the kidney, operations will not be required.

Pyonephrosis.—Cause.—Pyonephrosis is the result of inflammations of the pelvis of the kidney, or hydronephrosis.

Symptoms.—The kidney is enlarged and tender, and there is more or less sudden pain with an elevation of temperature. The urine is scanty and contains pus. There is loss of appetite and emaciation.

Abscess of the Kidney.—Abscess of the kidney may follow infarcts, pyogenic infection, pyelitis, and pyonephrosis. The abscess may be single or multiple. It may be the result of interstitial nephritis from injury. The symptoms are pyuria, enlarged kidney, fluctuation, pus, and a nephritic abscess. In pyonephrosis or abscess of the kidney nephrotomy may be necessary.

Perinephritic Abscess.—There are lesions affecting the connective tissues surrounding the kidney, or it is because of rupture of the kidney or ureter, or the extension of inflammation through the peritoneal cavity or pleural cavities, or it may be produced by ulceration through the pelvis of the kidney. In perinephritic abscess, there is evidence of deep suppuration, chill with septic fever, swelling, and perhaps fluctuation. If the abscess ruptures of itself, it may open alongside of the erector spinae mass or through the side of the abdomen, or it may break into the peritoneal cavity. The **treatment** is to open the abscess and drain it.

Tubercular Kidney.—The symptoms are obscure and the diagnosis difficult. Not too much stress should be placed upon the presence of the tubercle bacillus in the urine. Removal of the lesions should effect a cure. An exploratory operation is not advisable.

Rupture of the Bladder.—The bladder may be ruptured by direct violence to the lower part of the abdomen, when the viscus is distended, or by penetrating wounds, or from fractures of the pelvis, or it may be ruptured from over-distension. When rupture takes place, it occurs either within or without the peritoneal cavity. **Intraperitoneal** rupture produces severe shock and a burning pain in the hypogastrium. There is a constant desire to micturate. Muscular rigidity is marked. Bloody urine may be passed. If the bladder is catheterized, it will be found empty. Attempts may be made to distend the bladder with sterile water, which will prove the rupture. Immediate laparotomy is demanded, or fatal peritonitis will result. In **extraperitoneal** rupture, the urine extravasates into the pelvic cellular tissues. It may extend up over the front of the abdomen or around the perineum. If the urine is not septic, urgent symptoms will not follow so quickly, but if the urine is septic, abscesses will immediately follow. These abscesses may be fatal. Incisions should be made early and the tissues drained. Where the urine is not septic, the prognosis is fairly good.

Cystitis.—Cystitis is an inflammation of the bladder wall. It usually involves the mucous coat, but may involve all the coats. It may be acute, or chronic.

Acute Cystitis.—Cause.—Spinal and pelvic lesions and irritation to the vesical plexus, thereby diminishing the integrity of the viscus. Other causes are, injury from operation, or the passage of instruments, irritation of calculi, or the extension of urethral and pelvic inflamma-

tions. Pressure of other organs and tumors may cause the disease, as in case of a gravid uterus. Exposure to cold and damp, especially in the spring, will produce a mild cystitis.

Symptoms.—Pain and strangury (straining and passing urine drop by drop), with a continuous desire to void urine. The onset of the disease is often announced by a chill. The fever may be very high, or it may assume a typhoid nature. There is increased pain with the accumulation of urine, because of the stretching of the inflamed walls. The urine is scanty and high colored, and may contain pus or blood. In mild cases the fever may be high, but transitory, while in the severe forms, destruction of the mucous, submucous, and even the muscular coats, may occur. The case may take on a typhoid nature, with delirium and symptoms of general sepsis.

Pathology.—In mild cases the inflammation is limited to the neck of the bladder and the mucosa, while in severe cases the whole bladder may be affected, or all the coats. It may terminate in resolution, or in a fibroid thickening of the coats, or in chronic cystitis. Ulcerations of the mucous coat may occur, while in other cases the inflammation may extend on up the ureter to the pelvis of the kidneys, causing pyelitis, or into the kidney itself, setting up nephritis or pyelonephritis. In other cases the absorption of pus may lead to multiple abscess formation and pyemia.

Treatment.—The treatment is osteopathic and surgical. The osteopathic treatment consists in relieving the pain and improving the circulation to the bladder wall, whereby it may be able to resist the invasion of the germs. Surgical treatment calls for the removal of the cause—if a retained catheter, it should be removed; if a stone, it should be removed, either by crushing or cystotomy. The bladder may be washed out with a boracic acid solution once or twice daily, in order to get rid of the decomposing urine and pus. Cystitis is very often produced by an unclean catheter. It is necessary to observe the strictest cleanliness about the use of a catheter, and especially so when the bladder is diseased. If this is done, many cases may be prevented.

In washing out the bladder, the following simple method will be found highly satisfactory: A clean fountain syringe is filled with a warm solution of boracic acid, ten grains to the ounce of boiled water. The nozzle of the syringe should be replaced by the glass portion of a medicine dropper. The air should now be exhausted from the syringe by unfastening the catch and allowing the solution to flow out until it flows a free stream, when the catch may then be snapped down and a soft rubber catheter inserted in the bladder and the urine withdrawn. When the urine is withdrawn, the medicine dropper may be inserted into the end of the catheter and the bladder allowed to run full of the solution. When full, the syringe may be detached from the catheter and the solution in the bladder allowed to flow into a vessel. The bladder may again be filled and emptied in a similar manner. Several times

filling will soon be followed by the solution coming clear from the bladder. The catheter should then be pinched together and withdrawn so as to bring out that solution still remaining within the catheter. If the strictest cleanliness is observed in this operation, it will have a very beneficial effect upon the inflammation of the bladder. It may be done once or twice daily, as the case may require.

Chronic Cystitis.—This is much more common. It may be the result of acute cystitis, or it may be subacute from the beginning.

Cause.—The causes of chronic cystitis are acute cystitis, calculi, foreign bodies, morbid growths, obstructions to the urine, as in stricture, enlarged prostate, paralysis, gonorrhea, and bony lesions.

Symptoms.—Frequent micturition, the urine being passed every half-hour to hour. The desire is urgent and spasmodic. The pain is usually relieved on passing the urine. The urine contains ropy mucus, or muco-pus. It is alkaline in reaction, often strongly ammoniacal, and may be very offensive. Decomposition of the urea is brought about by the action of the micrococcus ureae.

Pathology.—The mucous membrane is dark and engorged. It is much thickened and covered with muco-pus, and sometimes with a precipitation of phosphates. The mucosa may become sacculated, because of the hypertrophy of the villus-like processes.

Treatment.—In this disease the osteopathic treatment may be relied upon to effect a cure. Whatever lesions are found affecting the nerve and blood supply to the bladder should be removed. The diet should be non-stimulating, light, and of good quality. The other secretions should be kept good, the bowels regular, the patient well clothed, and he should pursue an even life. No alcoholics or coffee should be allowed. The bladder may be washed out, where the urine is foul, with hot water or a boracic acid solution, in the manner above mentioned. The catheter should be kept scrupulously clean. The lesions usually found are at the lumbo-sacral articulation affecting the visceral rami of the sympathetic, thus interfering with the nutrition of the viscus; and also, subluxation of the lower dorsal and the lumbar vertebrae affecting the vasomotors to the bladder, thereby diminishing the blood supply. These lesions must be corrected, the blood supply encouraged, and the viscus toned up. Usually the disease yields readily to treatment.

Irritability of the Bladder is a condition described in texts as a peculiar condition of the viscus in which it is affected by changes in the water and by articles of food, etc. It is most likely that in all these cases there are lesions which directly affect the nerve supply of the bladder. The removal of these lesions will effect a cure.

Atony of the Bladder is a condition where the bladder wall is not sufficiently strong to expel all of the urine.

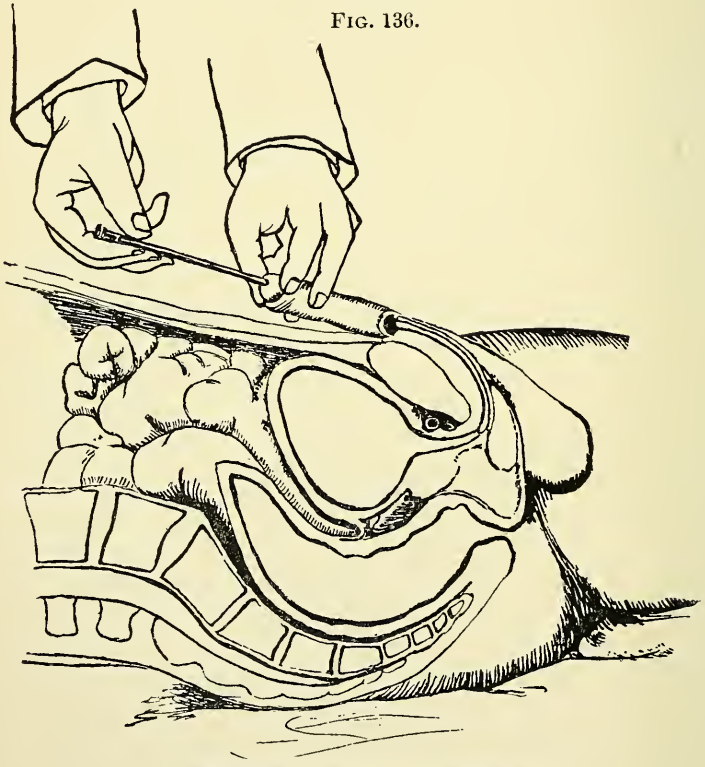
Causes.—1. Over-distension, because of holding the urine too long.

2. It may become gradually distended, since it is not able to entirely empty itself, because of stricture or enlarged prostate.

3. Certain diseases of the bladder wall, as fibroid and other changes, diminishing the integrity of the coats, as occurs in chronic cystitis.

Symptoms.—The symptoms are those of retention. There is frequent urination, or the urine dribbles away, the patient being unable to retain it. There may be involuntary flow during sleep, or upon exertion. The disease is the result of certain lesions affecting the bladder, or obstruction to the flow of urine. These lesions should be treated, or the obstruction to the flow of urine removed.

FIG. 136.



Drawing showing method of catheterization.

Retention of Urine.—This should not be confounded with suppression. It is symptomatic, being the result of obstruction, or a lack of sufficient nerve and muscular power to empty the bladder. It occurs in:

1. The aged, because of enlarged prostate, or because of atony of the bladder from over distension.

2. Middle-aged, because of organic, spasmodic, or congestive stricture.

3. In women with hysteria, or enlarged uterus, or it may be because of the pressure of the head in parturition.

4. In children, from calculus or phimosis.

5. It may, at all ages, be due to shock from injury or operation, or from tumors of the neck of the bladder, or abscess of the urethra, or paralysis from brain or cord injury.

Symptoms.—Retention of urine can be distinguished by the fact that the urine dribbles away, while a large amount of urine still remains within the bladder (residual urine). In some cases, in old men, the patient may give a history of frequent micturition and may insist that all the urine is passed. Palpation and percussion will reveal a full bladder, when passing of the catheter will demonstrate to the patient that he is deceived. In these cases it comes on slowly, and is manifest by the **residual urine.** If the retention of urine is produced suddenly, it may be followed by pain, constitutional symptoms, a small pulse, dry tongue, and delirium. The bladder may rise out of the pelvis even as far as the ensiform cartilage. Where the disease is the result of atony, there will be a history of a slow stream, with less force, cystitis, and painful micturition. It may come on in nephritis, or from rupture of the urethra behind a stricture.

Treatment.—1. From stricture.—In spasmodic and congestive strictures, appropriate treatment will relieve the spasm and congestion. In organic stricture, treatment to relax the stricture, together with hot sitz baths, may give relief. Where a small catheter can not be passed, an anesthetic should be given. If this fails, the bladder should be aspirated above the pubes; afterwards the organic stricture may be appropriately treated by internal or external urethrotomy, or by cystotomy, draining the bladder through another channel.

2. Enlarged Prostate.—This usually occurs in alcoholism, and it is necessary to have the patient correct his habits at once. A gum elastic catheter, with stilet, should be secured. This may usually be passed without difficulty. Sometimes tunnelling of the prostate may occur from the passing of a hard catheter. Often the irritability of the prostatic portion of the urethra causes a spasm of its muscular structure which will form a barrier to the passing of the catheter. Aspiration of the bladder may be demanded. As a rule, in these conditions, where the patient may be controlled, proper osteopathic treatment will relieve the spasm of the organ.

3. Hysteria.—Where retention of urine is from this cause, the disease should be recognized and appropriate treatment administered. The case should not be catheterized.

Tumors of the Bladder are benign and malignant. The benign are fibromata, papillomata (villosities), myxomatous, or gelatiniform tumors. The malignant growths are carcinomata and sarcomata (rare). Fibromata and myxomata are rare tumors and are in the nature of polypoid growths. Villosities are more common. They develop from the mucous membrane, and may be extensive. Malignant tumors are chiefly carcinomata.

Symptoms.—The symptoms are urinary obstruction, together with pain and increased frequency of micturition. In malignant tumors, there may be hematuria, together with other signs of malignancy. It may be possible to palpate the tumor. It may require a cystoscopic examination to make the diagnosis. In malignant tumors, as a rule, there are symptoms of cystitis with foul urine containing muco-pus, pus, or blood.

Treatment.—A suprapubic cystotomy should be done and the tumor removed by the galvano-cautery, or cautery loop. If the malignant tumor is extensive, no operation should be performed.

Urinary Fistula.—Urinary Fistula follows abscess in case of stricture, wounds, or it may be produced by the ulcerations from calculi. They may be perineal, scrotal, or penile. A perineal fistula should be scraped out, while the bladder is drained with a catheter held in situ. Should this fail, an operation may be required. A scrotal fistula will usually require an operation. The bladder must be drained, while the fistulous tract is laid open and scraped. In urinary fistula in the penile portion of the urethra a plastic operation will usually suffice.

Tubercular Bladder.—This disease is rarely primary. The evidences are those of chronic cystitis, and there are signs of tubercle elsewhere. The treatment is the same as in tuberculosis of other regions.

Exstrophy of the Bladder (Ectopia Vesicae).—This is a congenital malformation in which there is failure of the abdominal walls to close and there is absence of the anterior part of the bladder wall, so that the viscera push the posterior wall into the cleft and the mucous membrane is exposed. A plastic operation may be necessary. Where the symphysis is not united, a primary operation to separate the sacro-iliac joints may be necessary before the symphysis may be united.

Enuresis or Incontinence of Urine is a condition which may arise from paralysis of the bladder outlet (true enuresis), or there may be a condition of nocturnal enuresis, or the condition may result from retention with incontinence.

Cause.—True enuresis is produced by paralysis of the sphincter vesicae. This may be brought about by lumbar lesions, or there may be conditions of malformation of the prostate, permitting of enuresis. It may be occasioned by over dilatation of the urethra in lithotrity, or it may be produced by injury to the neck of the bladder during parturition. Nocturnal enuresis is brought about by lumbar lesions, thread worms, calculi, or by a long prepuce or morbid growths. In this condition, osteopathic treatment will give relief, except when caused by a redundant prepuce or tumor.

Stone in the Bladder occurs most commonly between the ages of fifteen and twenty, or in old men. It may come on in children. It appears in poor children, and in old men of gouty habits. The stone may be made up of one or more salts. The uric acid calculus is the most common. The next in frequency is the oxalate of calcium and the

phosphatic calculi. The others consist of the ammonium magnesium phosphate and phosphate of iron.

Cause.—Residence seems to have something to do with the production of stone in the bladder. In certain parts of our country, as Kentucky and Tennessee, the disease is quite common, while in other parts of the country it is rarely, if ever, known. Certain conditions of the system, such as gout and rheumatism, seem to predispose to the disease. Without doubt, certain lesions predispose, if they are not the active factors, in producing the calculi.

Symptoms.—The symptoms of stone in the bladder are those of inflammation of the viscus. There is cystitis, with frequent micturition, burning pain at the end of the penis, and the pain is increased upon exercise, or jolting. Tenesmus is marked at the end of urination, when the stone is grasped by the muscular contraction of the bladder. Pus and blood will be found in the urine. The person may be of gouty habit. The symptoms will vary in different cases. Some cases give no symptoms, while in others the symptoms are exaggerated. There is but one way of making sure of the diagnosis, and that is by passing a searcher. An ordinary steel sound will be sufficient for the purpose. With this the stone may be felt.

Treatment.—Osteopathic treatment will not always dissolve the stone after it has once formed, but it will arrest the stone formation, tone up the viscus, cure the attendant cystitis, correct the urine, and prevent the subsequent formation of calculi after they have been removed by lithotrity or cystotomy. The treatment is directed toward removing whatever lesions are found and to stimulating the blood supply by treatment in the lower dorsal and lumbar regions.

The operative treatment consists in cystotomy, either above the pubes or a median or lateral lithotomy or lithotrity. By lithotrity is meant crushing the stone within the bladder, afterwards by suitable evacuating apparatus the crushed stone may be washed out.

Prostatitis.—Prostatitis may be acute or chronic. **Acute prostatitis** usually results from gonorrhea. It occasions painful and frequent micturition and pain on defecation. There is a throbbing pain in the perineum, together with slight fever, which may be ushered in by chilly feelings. Sitz baths should be given and the bladder catheterized if urine is retained. The bowels should be kept loose by appropriate treatment, while the circulation to the prostate may be reached by treatment over the lumbar spine. Any lesions present should be removed. The circulation can be improved by stimulating the vasomotors to the inflamed organ. These come off from the spine in the lower dorsal or upper lumbar region. When an abscess results it will be evidenced by a chill and violent inflammation. As soon as pus is detected, a free incision should be made in the median line of the perineum.

Chronic prostatitis may follow the acute, or may be chronic from the outset. The gland is painful and enlarged, and is attended by nocturnal

emissions. There is more or less pus in the urine or there may be some discharge of mucus and blood. Micturition is more or less painful and interfered with.

Treatment.—The treatment consists in determining the cause, then correcting it. If due to excessive venery, or to the use of alcohol, the habits of the individual should be corrected. If due to irritating conditions of the urine, lesions affecting the kidney may be the cause. Where the organ becomes enlarged, and the disease persists, lesions anywhere from the ninth dorsal down to the lumbo-sacral articulation may be found. Sacro-iliac subluxations are sometimes present. Correcting these lesions, will prevent the further enlargement of the organ, but it may not secure resorption of the fibrous tissue formed in the gland.

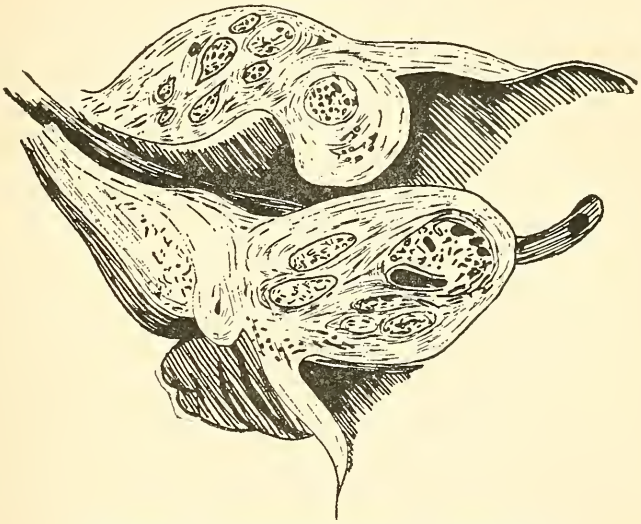
Vesiculitis.—Inflammation of the vesiculae seminales is the result of the backward extension of gonorrheal inflammation. The symptoms are pain in the back, hip-joint, anus, rectum, or perineum. Defecation and urination are painful, while micturition is frequent. The disease is often caused by injections. There may be painful and bloody emissions. In the chronic form, there will be nocturnal emissions and seminal weakness, together with a discharge of mucus. The treatment consists in improving the circulation and nerve supply to the seminal vesicles by means of spinal treatment. Stripping of the seminal vesicles once in seven days is practiced by many specialists. This operation is performed by the person standing bent over a chair, the finger is introduced into the rectum above the prostate gland, while, with strong and firm pressure, the finger is drawn downward and the contents of the seminal vesicles expressed. The posterior urethra may then be washed out and irrigated, as in the treatment of chronic urethritis.

Hypertrophy of the Prostate.—Enlarged prostate is produced by lesions of the sacral and innominate bones and of the tenth, eleventh, and twelfth dorsal and any of the lumbar vertebrae, affecting the visceral rami to the organ. It occurs in old men. There is hypertrophy of the muscular and glandular structure of the organ, so that it impedes the flow of urine. It comes on slowly and causes increased frequency of micturition, at first at night. The stream voided is smaller and discharged with less force. The lumen of the urethra is more and more impinged upon until finally the bladder is unable to entirely empty itself, when **residual urine** will be present. This retained urine gives rise to cystitis and the formation of calculi. A diagnosis of the disease is easy. There is obstruction to passing the catheter and the presence of residual urine, together with the fact that upon palpation one or more lobes of the prostate gland are found enlarged.

Treatment.—The lesions present must be corrected at once, and the patient directed to pursue a quiet life. No stimulants should be allowed. The general health should be built up. The circulation to the organ should be stimulated. If constipation exists, this must be overcome,

since the hard fecal mass in the rectum will produce irritation sufficient to keep up the disease. In hypertrophy of the prostate or in cases of chronic prostatitis, when there is obstruction to the flow of urine, after other methods have failed Bottini's operation, burning out the prostate with an electro-cautery, is often successful.

FIG. 137.



Enlargement of the Prostate Gland with a Catheter in situ.

Tubercle of the Prostate is a rare condition, and gives rise to the same symptoms as chronic prostatitis, together with the evidence of tubercle elsewhere. The treatment is the same as chronic prostatitis.

Malignant Disease of the Prostate Gland is rare. With the enlargement of the gland, there are general evidences of malignancy. The treatment, in general, is that of chronic inflammations of the gland. Many cases may be benefited, but as a rule the disease runs an unfavorable course.

INJURIES TO THE PERINEUM, PENIS, URETHRA, ETC.

Injuries to the Perineum.—Open wounds leading to the urethra may cause fistulae. Contusions causing effusions of blood beneath the skin and mucous membrane, may cause interference in urination and require catheterization. Open wounds leading into the urethra should be closed as other wounds, and a catheter left in situ until the wound heals. Injuries to the female perineum may lead to impairment and irregularity and require immediate attention.

Fracture of the Penis.—This injury occurs at the time of erection, from blows or injury in coitus. The organ remains erect and is crooked. A dorsal padded splint and bandage should be applied. Recovery is usually good.

Rupture of the Urethra.—This is attended by extravasation of the urine. It may occur behind a stricture. Rupture of the urethra with extravasation of urine demands cystotomy. A suprapubic operation should be done, while a catheter may be passed outward from the posterior extremity of the urethra, and the mucous membrane of the urethral tract united with gut suture.

Foreign Bodies in the Urethra.—Foreign bodies of all kinds may be introduced into the urethra in both sexes. A history of the case, with palpation, will determine the diagnosis. In case of small foreign bodies, the penis may be distended while the patient strains down, and the foreign body may be dislodged and expelled. It may be recovered by means of forceps, or it may be expelled by rubber ligature. In some cases, urethrotomy may be required; the urethra is opened, the foreign body removed and the mucous membrane sutured with a catheter in situ.

Chronic Urethritis.—The treatment of chronic urethritis consists in overcoming the stricture often present and in removing the spinal lesions. There may be some systemic defect responsible for the chronic condition, but usually it is due to the presence of lumbar lesions. No alcohol, tobacco, coffee, or any stimulants should be tolerated. Injections are contra-indicated. If constipation or urinary defects are present, they must be attended to, or a cure may not be effected. Sexual excitement must be avoided and the patient should be directed to pursue an even life.

The prognosis is good if the patient can be controlled. The blood supply to the inflamed area must be encouraged through the medium of the vasomotors.

Urethral Stricture may be spasmodic, congestive, or organic.

Spasmodic Stricture is due to a spasm of the unstriped muscle fibres situated within the muscular wall of the urethra. It is only temporary, and is due to peripheral or spinal irritation .

Congestive Stricture is due to congestion of the mucous membrane, brought about by local injury or spinal lesion.

Organic Stricture is usually the result of a chronic or neglected case of gonorrhea. In these cases, the inflammation and ulceration extend through the mucous into the submucous coat and considerable fibrous tissue is formed, which afterwards contracts and narrows the lumen of the urethra. The anatomical appearance of the stricture may be irregular, tortuous, or it may be linear or annular. Sometimes these organic strictures become very sensitive, and in addition we have engrafted upon the organic stricture a spasmodic one. In old cases, the stricture may be cartilagenous or hard. It may occur in any part of the urethra, except in the prostatic portion. It is most common in the bulbous portion. When a stricture occurs, the urethra behind becomes distended and ulcerates. It may lead to perforation and

urinary abscess, causing fistulae, this being the result of straining in the effort at urination. The bladder becomes thickened and hypertrophied, and the mucous membrane inflamed. The ureters become dilated and the kidneys may become more or less diseased, because of a backward extension of the urine, which is more or less infected. The symptoms are those of a chronic discharge, a stream smaller than normal and voided with less force. Passing of a bougie, or catheter, will usually locate the stricture. There may be one or several.

Treatment.—The treatment of stricture may be considered as (A) Osteopathic and (B) Operative.

Osteopathic Treatment.—The object of the treatment is to relax the stricture and resorb the organized inflammatory products. If the urine is irritating, it should be corrected by proper treatment over the kidney areas. By promoting the blood supply, the chronic inflammation which is present may be overcome. In the majority of these cases, the habits of the individual are harmful to his condition. No alcohol, tobacco, or coffee should be allowed. The patient should retire early at night and avoid sexual excitement. The treatment consists in removing the spinal lesions which attend stricture and in promoting resorption of the inflammatory products.

Operative Treatment consists in either slow dilatation, by means of graduated sounds, or rapid dilatation, by means of an Otis's dilator, or internal urethrotomy, by division within the urethra, or external urethrotomy, a division of the stricture from without. Strictures of large caliber, interfering but little with the stream, may be successfully treated by means of electrolysis.

Urethral Fever follows operation, the introduction of sounds, catheterization in case of stricture, or injury to the urethra or bladder. It is attended by considerable nervous shock and followed by septic fever. It is said that cleanliness will prevent the disease. It is especially fatal in old people, as there is a marked tendency to the suppression of urine. The disease is ushered in by a chill and high fever. Equalization of the circulation by means of osteopathic treatment, together with irrigation of the bladder, will give relief.

Urinary Fever is believed to be a sudden infection of the urine and that it occurs after the withdrawal of residual urine. The patient has chilly feelings, low fever, and a quick, feeble pulse, the tongue is dry, and there is a loss of appetite. It occurs in old people. Delirium, coma, and death may appear within a week. It will be found that cystitis has developed, and this extending to the kidneys, causes a ovelonephritis.

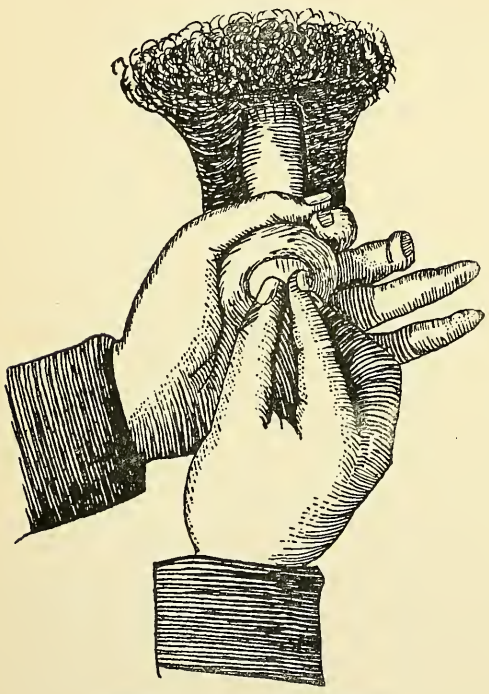
Malformations of the Urethra.—Hypospadias.—It may be partial, or complete. The partial form is a congenital absence of some part of the floor of the urethra. The meatus usually opens in front of the scrotum. Beyond the opening, the urethra is but a gutter on the under side of

the penis, instead of a tube as normally. In the complete form, the urethra opens back of the perineum. The penis is frequently small, distorted, and bound down, and much resembles the clitoris. The cases are liable to urethral inflammations. Plastic operations may do some good in some cases.

Epispadias.—This is a congenital absence of the roof of the urethra in part or whole. There is clefting of the corpora cavernosa. If partial a plastic operation will do good.

Chancroid or Venereal Sore is a local sore sharply defined, with undermined edges. It looks "punched out." It is not elevated, and has a gray and sloughing base. There is profuse ulceration and the discharge of foul pus, which will inoculate the healthy tissues over which it flows. Thirty per cent. of the cases have buboes on the same side upon which the sore is situated. If the sore is in the middle line, buboes may be on both sides. The sore is multiple, painful, and appears early. It may be situated on any part of the glans penis, prepuce, labia majora or minora, or ostium vaginae.

FIG. 138.



Method of reducing paraphimosis.

Treatment.—Cauterize the sore with carbolic acid, or nitric acid. Afterwards, wash twice daily with peroxid of hydrogen and carbolated water, while calomel, aristol, or other drying powder, may be dusted on the sore, and antiseptic gauze and cotton applied as in the treatment of other sores.

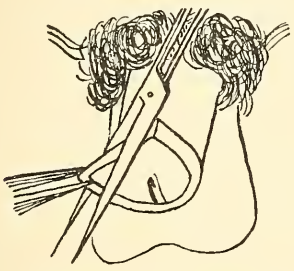
Cancer of the Penis demands amputation and removal of the enlarged glands in the groin.

Phimosis is a condition where the prepuce can not be retracted behind the glans. It gives rise to nervous symptoms, urinary incontinence, and inflammation. The prepuce may be adhered to the glans. It demands circumcision. Some cases may be cured by means of daily attempts at pushing the prepuce over the glans, or small forceps may be introduced into the lumen and the skin gradually stretched. In the majority of cases this will not be successful.

Paraphimosis is a more or less strangulation of the glans penis, caused by the constriction of a too narrow prepuce. It occurs most frequently in boys where the prepuce is pushed back and allowed to remain, forming an obstruction. In adults, it is the result of gonorrheal inflammation.

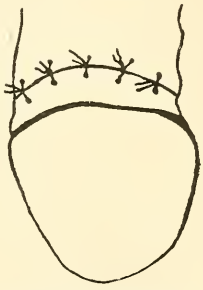
The **Treatment** of the condition is to grasp the penis between the thumb and first finger of one hand, behind the constriction, then with

FIG. 139.



Circumcision. Removing the prepuce.

FIG. 140.

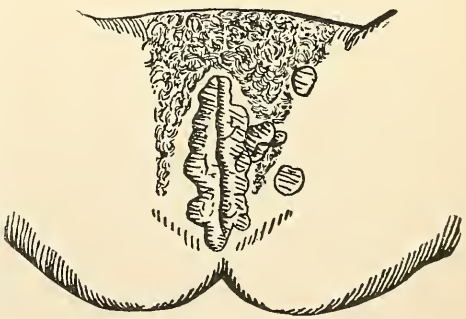


The skin and mucous membrane sutured together in circumcision.

gentle and continuous pressure by the thumb and first finger of the other hand upon the glans, the constricted portion may be pulled over, when circumcision may be performed. Where this does not succeed, anoint the glans penis, take strips of old washed linen and lay over the glans, while with a small catheter the glans may be wrapped from the tip backward, which drives the blood out of the glans back under the constriction, when reduction is easy. If this operation is not successful, an incision should be made on the dorsum of the penis, relieving the constriction. Care should be observed to avoid the dorsal veins.

Circumcision.—The operation of circumcision is necessary in case of redundant or inflamed prepuce or in case of phimosis or paraphimosis. The operation may be done under local or general anesthesia. The prepuce is grasped by forceps close up to the glans and the redundant portion beyond the forceps is then cut off. The mucous membrane is slit up the back and trimmed off; about one-eighth of an inch is allowed to remain. This is then sutured to the skin, while the patient is instructed to urinate through a bottle neck until the wound heals. The

FIG. 141.



Venereal warts on the female genitalia.

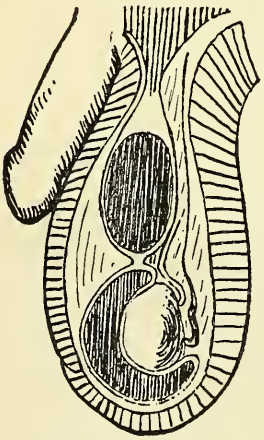
sutures may be removed in five or six days. Slitting the prepuce on the dorsum may be practiced on children. Suture will not be necessary if the operation is done shortly after birth.

Venereal Warts.—Many cases may be cured by washing daily with peroxid of hydrogen and dusting the parts with boracic acid. In other cases they may be clipped off. Where this will not be allowed, paint them with a solution of corrosive sublimate one dram, collodion fifteen drams.

Amputation of the Penis is performed for malignant disease. Treve's or Ricord's operation should be performed.

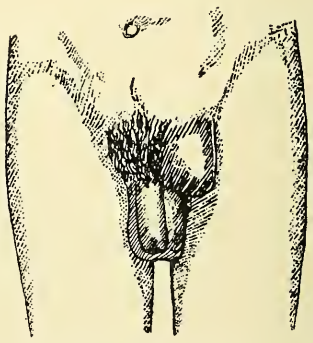
Edema of the Scrotum occurs in conditions of ascites or general dropsy. It may follow operations for hernia and varicocele. Supporting

FIG. 142.



An encysted hydrocele.

FIG. 143.



Encysted hydrocele of the cord.

the scrotum, and removing the cause, will be sufficient. Aspiration is rarely called for.

Eczema and Prurigo of the Scrotum.—These diseases occasion an intolerable itching of the scrotum, brought about by unclean conditions and spinal lesions. It may be produced by the habit of scratching. Spinal treatment, together with the application of local sedatives, will give relief. The local sedatives should be mentholated oil, solutions of menthol, or carbolized vaselin.

Elephantiasis of the Scrotum and Penis consists of an obstruction to the lymphatic circulation, and is similar to elephantiasis cruris and pedis.

Hydrocele is an accumulation of fluid within the tunica vaginalis testis. It may be congenital, infantile, encysted, or vaginal. In the congenital form, the tunica vaginalis communicates with the general peritoneal cavity, whereas in the infantile and encysted forms, the part

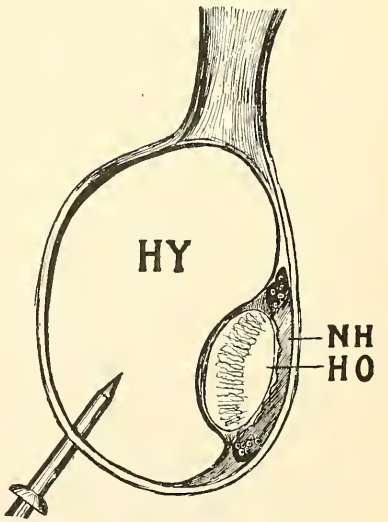
of the peritoneum covering the cord is open, but is cut off from the general peritoneal cavity.

Cause.—There is usually an anterior condition of the fifth lumbar. Other lumbar lesions may be present.

The **Diagnosis** can be made by the presence of a translucent tumor, no impulse on coughing, and by the fact that it is not reducible. A history of the case will be a valuable aid in diagnosis. The testicle may be felt in the back part of the sac.

Treatment.—The fluid of a hydrocele may be evacuated by means of a trocar and canula, or an aspirating needle. The trocar should be directed upward and backward, to avoid the testicle which is at the lower and back part of the tumor. After the evacuation of the fluid, the lesions in the lumbar region may be corrected. A cure is readily effected.

FIG. 144.



Method of tapping a hydrocele.
HY, Hydrocele; NH, Epididymis; HO, Testicle.

Varicocele is a condition of enlargement of the veins of the testicle. It usually is found on the left side, because of the relation of the veins to other structures, and because of the circuitous route of the return circulation.

Cause.—Lumbar lesions, obstruction to the return circulation, and atony of the vessel walls.

Symptoms.—Usually the enlarged veins may be seen within the scrotum. While the patient is standing the enlargement feels like a mass of earth worms; upon lying down the veins diminish in size. There is no impulse upon coughing, and there is a history of a chronic condition.

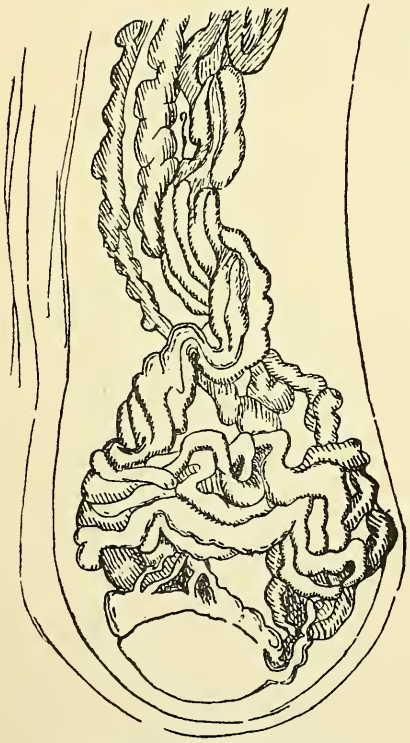
Treatment.—The treatment is to remove the obstruction and improve the circulation by improving the muscular tone of the vessel walls. Proper spinal treatment, the application of cold and the correction of constipation, will usually effect a cure. In old cases, where the veins are thickened and are like fibrous cords, they may be removed by operation.

Hematocle of the Scrotum.—Effusions of blood within the scrotum may be parenchymatous, vaginal, or encysted. In any case, the patient should be put to bed in the recumbent posture and ice applied. Where inflammation sets in, indicating the formation of pus, a free incision should be made and the effusion evacuated.

Orchitis, or inflammation of the testicle, may be acute or chronic. Acute orchitis results from injury, exposure to cold and wet, from epididymitis, or mumps, rheumatism, acute and septic fevers, as typhoid, etc. The testicle becomes enlarged, swollen, and extremely painful and tender. The skin is red, while the tunica vaginalis and subcutaneous tissues are infiltrated with fluid. There is a painful dragging down sensation.

The chronic form may arise from the acute, from syphilis, or tuberculosis.

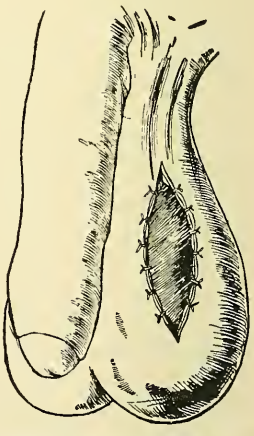
FIG. 145.



Varicocele, showing the dilated veins.

Treatment.—The treatment is support of the testicle and improvement of the circulation. Often lower dorsal, lumbar, or lumbo-sacral lesions will be found. These may be corrected. The most essential part of the treatment is to encourage the circulation through the medium

FIG. 146.



Method of operation for the radical cure of varicocele.

of the vasomotors. The bowels and kidneys must be kept free and active. The person should be kept in a recumbent posture, or after the inflammation partially subsides, the testicle may be carried in a suspensory bandage. Strapping of the testicle will frequently do good.

Tumors of the Testicle are sarcomata, carcinomata, cysts, and cartilagenous tumors. Of the malignant tumors, the sarcoma is the most common. When it has not yet involved other tissues and the inguinal glands, it should be removed. Some years ago the writer removed a sarcoma of the left testicle of a physician from the Indian Territory. The operation was successful, and the tumor did not recur.

Epididymitis.—Inflammation of the epididymis is the result of the extension of the urethral inflammations. It is very often the result of the use of injections. The testicle should be supported by a suspensory bandage. If constipation is present, it should be relieved. The circulation must be promoted by treatment in the lower dorsal and upper lumbar regions. Whatever lesions exist—lumbo-sacral, ilio-sacral, lumbar or dorsal—must be corrected before the inflammation will subside. It usually extends over a period of two to four weeks.

Retained Testicle.—In 80 per cent of cases, the testicle descends before birth. It may remain in the lumbar region, or may be arrested in any part of its course of descent. Cases are reported where it has descended into the scrotum as late as the thirteenth year. Repeated efforts at pulling it down into the scrotum will be attended by good results. Where it gives trouble, it may be removed, providing the other testicle is healthy.

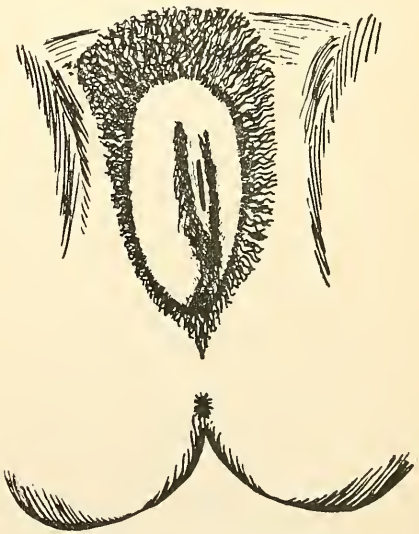
DISEASES AND INJURIES OF THE FEMALE GENITALIA.

Vulvitis.—Inflammation of the vulva may arise in children where they are ill-fed and unclean, or it may be caused by cold, exposure, injury, parasites, irritating discharges, etc.

Lesions.—Subluxations at the sacro-iliac joint, or displaced lumbar vertebrae affecting the vasomotors and viscero-motors, are often responsible for the disease. The vulva is red, swollen, edematous, and there is an offensive discharge. In adults, the disease is usually the result of gonorrhea.

Treatment. — The treatment consists in removing whatever lesions are regarded as the cause, or are keeping up the disease process. The blood supply may be promoted, and any obstruction to the return circulation, such as a displaced uterus, or prolapsed bowel, must be corrected. The parts must be protected from irritating discharges. In addition to this, a mild astringent, such as a teaspoonful of the acetate of zinc to a quart of water, is often useful, or a 1:5000 solution of bichloride of mercury where the conditions are foul.

FIG. 147.



Abscess of the vulvo-vaginal glands.

Abscess of the Vulvo-vaginal Glands.—This abscess is due either to

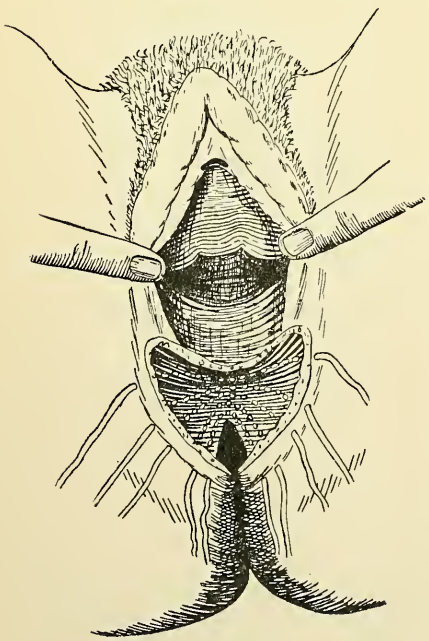
an infection of the ducts of Bartholin, or to an irritation and inflammation being set up which cause closure of the ducts and retention of secretions, resulting in abscess formation. The *treatment* is an early incision, to evacuate the pus. The abscess should be washed out with an antiseptic solution.

Cysts are produced by the closure of the ducts of Bartholin from irritation. The proper treatment is to clip out a little piece of the wall of the cyst and evacuate its contents, then scrape the wall within the sac so as to set up an adhesive inflammation.

Tumors of the external genitalia are benign and malignant. The benign tumors are fibromata, myxomata, and lipomata. The malignant tumors are cancer and sarcoma. The tumors are rare and easily distinguished. In malignant disease, a history of the case, lymphatic enlargement, the age of the patient, and the signs of the tumor, will suffice to make the diagnosis. The same treatment should be administered here as in tumors of other locations.

Injuries of the Perineum.—Lacerations of the perineum frequently occur during labor. The laceration may be of the fourchette only, or it may be of any part of the perineum, or it may extend through the sphincter muscle into the bowel, or even destroy the septum between the vagina and rectum. The *treatment* is the thorough approximation of the rupture by means of suture. This should be done immediately after labor. Should the operation not be done, and the case is seen several days after the rupture, a secondary operation will be necessary. These operations are various, all looking toward restoring the integrity of the perineal body. Should this body not be restored, there will probably be incontinence of feces and flatus. In the incomplete laceration of the perineum, the operation is simple and uniformly successful, but the secondary operation for complete laceration of the perineum is difficult and requires the utmost care and attention, likewise a thorough knowledge of the technic of the operation. In general, the stumps of the muscles of the perineum should be pared, all the scar tissue raised, the

FIG. 148.



Method of restoring the perineum in case of laceration.

two denuded surfaces nicely approximated and held together by silkworm-gut sutures. These sutures should be allowed to remain from seven to fourteen days. The bowels should be kept confined for a week after the operation. The stool should then be softened up with enemata to prevent the hard fecal mass from separating the surfaces of the wound. With the proper attention, considering that the operation has been properly done, it should be successful in all cases.

Vaginitis (Gonorrheal).—This disease is the result of the infection of the vagina with the diplococcus Neiseri. The inflammation of itself is not serious, but the extension of the inflammation is frequently dangerous to health, if not to life. It is apt to be followed by urethritis, endometritis, and salpingitis. Salpingitis will frequently result in pyosalpinx, and a pelvic or general peritonitis. The treatment of gonorrhea in the female is much easier than in the male. Frequent douching with hot water, or a weak solution, one grain to four or six ounces of water, of permanganate of potassium, to get rid of the foul discharge, together with an antiseptic plug of gauze, to maintain thorough drainage, will be found effective. A mercurial solution (1:5000) may be used, but will hardly be attended by better success than simply very hot water. Osteopathic treatment, looking toward assisting the return circulation, will be found sufficient in all cases, if supplemented by cleanliness and antiseptics. Whatever lesions are present must be removed, since these will affect the circulation and nerve supply to the mucous surface.

Fistula.—Vesicovaginal and rectovaginal fistulae are frequently established, either by injury or by pressure of the head of the child during parturition. This pressure of the head may cause rupture of the membrane, or the continued pressure cause sloughing, which results in the fistulous opening. The condition is very troublesome, and can only be relieved by plastic operation, which consists in denuding the margins of the wound and nicely approximating them under aseptic conditions.

Rectocele is a protrusion downward through the vagina of the anterior wall of the rectum. It is the result of a giving way of the perineal body, lacerations of the perineum, and a relaxation of the muscular tissues of the bowel. Most of these cases will demand perineorrhaphy.

Cystocele is a prolapsus of the posterior wall of the bladder into the vagina. It is usually the result of pressure of the head during parturition. A suitable plastic operation may be of benefit. Oftentimes this condition is due to a lax condition of the muscles, which may be better reached by appropriate spinal treatment, encouraging the nerve supply to the part, and the removal of certain lesions, than by an operation.

Ovarian Tumor.—Tumors of the ovary may be cystomata, carcinomata, sarcomata, and fibromata. Cysts are more common, and may arise from the ovary or parovarium. The cysts may be unilocular, or multilocular. Those appearing early in life are likely to be dermoid in character. Those cysts arising from the ovary are probably the result of changes taking place in the Graafian follicles, while the parovarian

cysts are the result of the accumulation of fluid within Gartner's ducts. The contents of the tumor may be of a high, or low, specific gravity, and may consist of a thin clear fluid, or it may be thick like tenacious mucus. A portion of the tumor may sometimes resemble glandular tissue. The tumors may attain enormous size. Recently Dr. Charles Still delivered a woman of a normal child, who had during pregnancy developed an ovarian cyst. The cyst contained more than fifty pounds of liquid at the time of delivery. The author successfully removed the tumor by laparotomy, although there were very extensive adhesions. The patient was able to sit up on the fourteenth day after the operation. Subsequently she made a complete recovery. The diagnosis is not always easy. Sometimes the case will require careful study before an accurate conclusion may be reached. At first it may be mistaken for tubal pregnancy, or inflammatory conditions; later, when the tumor distends the abdomen, as it may, it may be mistaken for ascites. A patient was treated at the A. T. Still Infirmary who had been tapped every two weeks for two years. An average of nearly five gallons of fluid was removed at each tapping. The case had been treated as one of ascites, whereas the trouble was an ovarian cyst. If a careful history of the case is obtained and a thorough physical examination made, a mistake need not be made. Often the pedicle of the tumor may be made out. After the tumor becomes large, it will distend the abdomen most in the lower segment, while fluctuation and dullness is evident over the central area of the abdomen when the patient is in a recumbent posture, whereas in ascites, the dullness and fluctuation are about the flanks. The presence of the other tumors of the ovary may be made out by a careful examination.

Treatment.—The treatment of any of these tumors depends somewhat upon the conditions present. Luxation of the ilium, lesions at the lumbo-sacral articulation, or in the lumbar region, must be corrected. The general nutrition of the system must be improved. Tumors are the result of an abnormal blood supply and defective nerve influence, or to some obstruction to the flow of the fluids from the parts. When these conditions can be corrected, the tumors will be absorbed. Osteopathic treatment will relieve many cases, unless of too long standing, or unless the tissues will not respond to treatment. Under such circumstances, laparotomy should be advised. In simple cases the mortality is ten per cent., while in complicated cases it may be twenty-five per cent., or even higher.

Salpingitis (Pyosalpinx).—Inflammation of the Fallopian tube is the result of the extension of inflammation from the endometrium or ovary. Nearly all of the cases are the result of the extension of gonorrheal inflammation. Even though an abscess results, its contents are often discharged into the uterus, and a spontaneous cure effected. Adhesions usually form about the inflamed organ, binding together the pelvic viscera. Upon vaginal and rectal examination, the tubes are found in-

flamed and thickened, while the uterus is more or less fixed. Formerly all these cases were operated upon at once and the diseased tube removed. Only when an abscess of some size has formed is this necessary. A large number of the cases may be relieved by correcting the lesions present and by promoting the blood supply through the agency of the vasomotors.

Paget's Disease of the Nipple.—This is an intractable form of ulceration of the nipple. It often appears eczematous. It is said that it may often lead to cancer. Some observers have claimed that the disease is parasitic, but it is more than likely due to a luxated rib, and should be treated with that in view.

Acute Mastitis.—Inflammations of the breast arise from obstruction to the return circulation. This obstruction is usually in the axilla, or between the ribs, and comes from subluxations of the clavicle, or of the second, third, or fourth ribs, and muscular contractions, producing impingement upon the internal mammary and axillary veins. The abscess may occur in three locations, superficial to the gland, within the gland, or beneath the gland. If proper osteopathic treatment is not instituted sufficiently early, abscess will result. When this occurs, a free incision should be made on a line radiating from the nipple. Rigid cleanliness must be observed in the after-treatment. The breast and the wound may be washed out with a saturated solution of boracic acid several times daily. The obstructions to the circulation must be removed and the blood flow promoted.

Tumors of the Breast are benign and malignant. The benign tumors are usually fibromata. The malignant tumors are cancers and sarcomata. The cause of these tumors comes primarily from a long established interference in the circulation of the fluids from the breast. This is either due to a rib lesion, or subluxation of the clavicle, and muscular contractions. The benign tumors usually occur early in life. They are round, hard, and sometimes globular, very freely movable, and not very large. They never become adherent, and are not serious. They can be relieved by the proper osteopathic treatment. Cancer of the breast is usually scirrhus or hard, but may be encephaloid. It begins as a small, hard lump within the gland and soon involves the skin and pectoral muscles beneath. It ulcerates early and the lymphatic glands in the axilla are enlarged. When near the center of the breast, the nipple is retracted. As the case continues, it is attended by pronounced cachexia and exhaustion. The skin over the tumor is drawn, "bacon rind." From the ulcer there is a foul discharge, while the growth is often fungating and nodular.

Sarcoma arises from the connective tissues between the acini, in contra-distinction to the cancer which arises from the epithelium of the gland tubules. It is usually of the large spindle-celled or round-celled variety. The veins over the tumor are enlarged and tortuous. The tumor is smooth and elastic, may be lobulated, and grows rapidly.

It occurs between twenty and forty years of age, and does not infiltrate the skin, nor does it cause retraction of the nipple. It may perforate the skin and protrude as a fungiform mass. It can not be successfully removed by the knife. Cancers of the breast are operable early.

Osteopathic Treatment.—Appropriate osteopathic treatment in tumors of the breast is attended by the most unusual and pronounced beneficial results. A lady, aged forty-five, suffering from a scirrhus cancer of the breast which involved both mammae, extending into the axilla and down over the epigastrium, applied to Dr. Charles Still for treatment. Upon examination, an ulcerating tumor the size of a child's head was found in the left breast. The patient was cachectic and much depressed. Because of the extensive involvement of other tissues, the case was declared inoperable by several eminent surgeons. The patient applied for osteopathic treatment as a drowning person grasps at a straw. After a month's treatment the extensive ulcerated surface healed. Within four months the case was apparently cured. This case is most remarkable. Not all cases can be so successfully handled. In the above case the ribs were adjusted (third and fourth) and the circulation of the fluids stimulated. Treatment should be advised in all cases of benign or malignant tumors. Where the tumor does not show signs of yielding after three or four months' treatment, and it affects the general health, or is malignant, the breast should be amputated.

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