

Appendicitis.

Thesis for the degree of M.D.  
(old regulations)

Presented by

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## APPENDICITIS.

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I wish in this thesis to enter into a consideration of the varieties of inflammation localised to the region of the coecum and appendix. No subject in abdominal surgery has received more attention than this during recent years and among those to whom we are largely indebted for our increased knowledge concerning inflammatory affections of this region may be mentioned Treves, Hawkins and Kelynack, Fitz, Bull of New York and Fowler of Brooklyn.

The term Appendicitis is of comparatively recent birth having originated in America, and it is now applied to all these affections which are comprised under the names of typhlitis, perityphlitis, paratyphlitis etc. Professor Shepherd in his article on Appendix Vermiformis in the Encyclopaedia Medica Vol. 1. says that all have their origin in the appendix and it is very questionable whether a case of inflammation about the coecum not due to tubercular or cancerous disease ever occurs without being secondary to disease of the appendix.

Mr. Treves in a monograph on the Surgical Treatment of Typhlitis says "It is unfortunate that the term typhlitis directs special attention to the coecum and still more unfortunate that the appreciation

of this variety of peritonitis should have been encumbered by mere terms and obscured by classification; for such classifications were not founded on a correct anatomical or pathological basis." Even at the present day it is a matter of controversy whether the symptoms of appendicitis - using the term as the name for inflammatory attacks in the Right Iliac region - may or may not be due to disease of the coecum apart from the appendix. In this connection it is interesting to notice that as our knowledge concerning this subject has increased the coecum has come to occupy a very subsidiary place in the minds of surgeons.

#### HISTORICAL REVIEW.

It has long been recognised that the parts lying in the right iliac fossa are above all other abdominal structures liable to an inflammatory attack, which is generally marked by the appearance of a tumour in this region and is sometimes followed by the formation of an abscess. This affection is seldom fatal and consequently the post-mortem observations which are necessary to explain its site and origin are to a great extent wanting.

The pathology of the severe cases that are operated upon and of those that terminate fatally is tolerably clear and points very strongly to the appendix as the root of the mischief; but the point where opinion is divided is as to the pathology of the



class of case - and it is a numerous one - where the patient recovers without surgical aid. Knowing that the appendix is nearly always the starting point in the severe forms one is justified to some extent at least in assuming that in all probability the appendix is the cause of the mild cases also. For the first forty years of this century all the localised inflammatory affections in this region were attributed to disease in the coecum and although for a hundred years or more it has been known that disease of the vermiform appendix is capable of exciting an inflammation of the whole peritoneum, yet the theory of a coecal origin for all local inflammations in the right iliac fossa has been unquestioned until recent times.

The Coecal theory has however recently been the subject of gradual modification and is now nearly, if not quite, extinct.

It was not till 1800 that Bichat in his "Treatise on Membranes" recognised the peritoneum as a continuous structure distinct from the organs which it invests. Still less had "peritonitis" any place in the field of practical medicine. In the literature of the early part of this century descriptions of "Phlegmon of the iliac fossa" are abundant, its symptoms and course being set forth with great accuracy. Few writers, however, ventured upon an explanation of its origin. In 1831 Ferrall published a paper



on "Phlegmonous tumours in the Right Iliac region" in which the coecum was held without question to be the organ primarily diseased. In 1833 Dupuytren expressed similar views and for the next fifty years the coecal theory was still uppermost in the minds of writers.

In 1837 John Burne speaks of "ulceration of the appendix" set up by the presence of foreign bodies and concretions and he is familiar with the results; for he says "So long as the ulceration is limited to the mucous membrane it is of little consequence, but immediately the peritoneum is perforated inflammation ensues and then there is general peritonitis or local peritonitis with abscess." He throws doubt on the alleged frequency of perforation of the coecum and states his belief that all Dupuytren's cases were due to disease of the appendix.

In 1838 Albers fully recognised the possibility of disease in this region taking origin in the appendix but gave it a subsidiary place beside the Coecum.

In 1840 Villerme published some cases of rapidly fatal inflammation and gangrene of the appendix.

Every few years now brought fresh information on the subject of the appendix while the coecum fell more and more into the background and this change was directly related to the growing habit of making post-mortem examinations.

In 1843 appeared a paper by Voltz entitled "Ulcer-

-ation and perforation of the appendix occasioned by foreign bodies."

In 1856 appeared a paper by Lewis in which he collected a large number of cases where a foecal concretion or a foreign body had originated such disease in the appendix as to lead to general or local peritonitis by means of a perforation, but he did not suspect that similar conditions could result from catarrhal inflammation of the mucous membrane of the appendix.

His view was that if the inflammation was virulent and fatal the disease originated in the appendix but if it was a mild attack the coecum was the seat of the original mischief, and this view is still held by some at the present day.

In 1886 appeared an exhaustive treatise by Fitz. The appearance of this work has done more than any other to place the whole matter on a clear basis. He showed the extreme rarity of primary perforation of the coecum. Treves has shown that the mild cases may be due to mischief in the appendix.

Finally Shepherd in the Encyclopoedia Medica Vol. I. is of opinion that every case is due to mischief in the appendix.

The pathological grounds for the belief that many of the milder cases of appendicitis occur independently of mischief in the appendix are necessarily scanty for the disease almost always ends in recovery.

The coecum is often found to be extensively affected

in cases of appendicitis, and this explains why the coecum was regarded as the starting point of the disease by old writers. More precise observation has proved that these changes in the coecum are in the majority of cases secondary to disease in the appendix.

It is no uncommon thing to find a perforation of the coecum. In one of the cases I record such a perforation was found at the operation; but the appendix was also extensively diseased. Such perforations are manifestly due to an abscess in this region bursting into the bowel just as it may burst externally. Primary perforation of the coecum does occur. Osler records two cases of perforation of a coecal ulcer.

Fitz in 466 cases found only three instances, two of which were due to impaction of a foreign body and the third was some form of "strangulation" of bowel.

Treves records one case of primary perforation of the coecum, preceded by few abdominal symptoms in a case of tubercular ulceration of the Colon in a patient the subject of Phthisis. Ulcer of the coecum may undoubtedly perforate but the history of such a case is one of prolonged foecal obstruction and does not present the clinical picture of appendicitis.

Stercoral ulcer of the coecum has long been familiar to clinicians but post mortem records maintain an absolute silence regarding it. The fact that



perforation of such an ulcer is so very rare serves to throw doubt on the existence of stercoral ulcer.

Ulceration of the coecum so long as it remains limited to the mucous membrane may cause no symptoms, and if it does cause symptoms they are not those of appendicitis.

But when such an ulcer spreads to the peritoneum all the phenomena of appendicitis may be manifested (Treves). Ulceration of the coecum occurs also from tubercle, dysentery, typhoid fever, and actinomycosis.

Catarrhal inflammation of the coecum has long been recognised by clinicians but here again the clinical picture is not that of a case of appendicitis.

It is manifested by pain which is trifling, by slight tenderness over the region of the coecum, by the presence of a distinct doughy mass in the lumbar region and by the absence or late occurrence of slight fever.

Possibly even in these cases the starting point is in the appendix and the tumour felt is composed of faeces that have accumulated secondarily to paralytic distention of the coecum; so that on pathological grounds one is driven to the belief that a primary affection of the appendix underlies all degrees of the affection.

Treves in a monograph published in 1890 entitled "The Surgical Treatment of Typhlitis" says "the milder varieties of typhlitis - using the term as the

name for inflammatory affections in the right iliac fossa - are usually due to a peritonitis over the coecum which has been set up by the spreading of a stercoral ulcer. The severer forms and notably those which induce suppuration usually depend upon troubles in the appendix." This differentiation is, I think, unwarranted for evidences of old appendicular disease are very often observed in the post mortem room and it seems unreasonable to conclude that the appendix is not at fault in the mild cases that recover without operation.

#### ANATOMY.

The anatomy of this region has of late years been very fully considered by Treves and others. Treves has proved that the ideas of older anatomists were wrong in regard to the distribution of the peritoneum in this region.

THE COECUM is that part of the large intestine which lies below the level of the ileo-coecal valve i.e. below the level of the point of entrance of the ileum.

The average breadth of the coecum is 3 inches and the average length is  $2\frac{1}{4}$  inches. The shape and outline of the coecum are liable to considerable variations.

It usually lies on the psoas muscle and is so placed that its apex or lowest point is just projecting beyond the inner border of that muscle or less

frequently it is found in relation with the Iliacus chiefly. In the majority of cases the apex of the coecum corresponds with a point a little to the inner side of Poupart's ligament.

In the foetus it is higher and more central in position and this foetal condition may persist. In three cases it was found to lie under the umbilicus. It is not uncommon to find it in the right loin having no relation with the iliac fossa. It has been found lying against the spleen. It may be entirely clear of the psoas and iliacus and hang over the pelvic brim. In 18 per cent of cases examined by Treves the coecum was wholly in the pelvis. These anomalies of position may serve to explain some mysterious cases of pelvic peritonitis in males.

#### RELATION OF THE COECUM TO THE PERITONEUM.

Treves has proved beyond all doubt that the coecum is always entirely covered by peritoneum on all sides and that it is never found to be attached by areolar tissue to the iliac fossa. There is no fold to represent the meso-coecum of old anatomists.

The line of reflection of the peritoneum from the posterior wall of the coecum on to the posterior abdominal parietes varies somewhat.

When an ascending meso-colon exists this reflection will correspond with the origin of such meso-colon. In any case it is continuous with the left or under layer of the mesentery. This reflection is usually



transverse and is usually placed between a line on a level with the summit of the iliac crest and another on a level with the anterior superior spine. In the great majority of cases this reflection takes place from the posterior surface of the ascending colon and not from the coecum at all - thus showing that the coecum is entirely covered by peritoneum.

The distribution of the peritoneum in the right iliac region gives rise to various fossae. The ileo-colic fossa is bounded on the outer side by the ascending colon and on the inner or lower side by the ileum and has the mesentery for its floor. It has very little importance in regard to disease of the appendix.

The ileo-coecal fossa is situated behind the angle of junction of the ileum and coecum being bounded on the right by the meso-colon and on the left by the mesentery. It is not an uncommon situation for the appendix.

The mobility of the coecum is often considerable and the degree of mobility depends on one of two conditions (1) upon the length of intestine that extends between the tip of the coecum and the reflection of peritoneum alluded to, or (2) upon the presence of the ascending meso-colon.

#### COMPARATIVE ANATOMY OF THE COECUM.

The coecum varies in different species. In some marsupials and herbivorous rodents it is nearly double

the length of the entire body and its capacity is nearly equal to the rest of the alimentary canal. It is one of nature's methods of increasing the digestive surface.

Flower has shown that it varies inversely as the stomach. In carnivora, rodents, and bats it is small and imperfect in most species and in a few, such as bears and badgers, it is absent. As the coecum is generally better developed in the more primitive members of the great mammalian orders than in the more highly specialised forms morphologists think that the carnivorous coecum is an extremely reduced form of an ancestral type.

#### THE APPENDIX VERMIFORMIS.

The appendix starts from the posterior and lower part of the coecum and has an average length of 4 inches - the extreme being 1 inch and 8 or 9 inches. Its width is pretty constant being about  $\frac{1}{4}$  inch. Bryant has shown that the diameter of the appendix in the male is one tenth greater than in the female. He noticed that the greater the diameter within apparently normal limits, the greater is the probability of the presence in it of foecal and other matters. He further observed that in males 70 per cent of appendices contain foecal matter with or without mucus, in females only 35 per cent.

H. P. Hawkins in 100 bodies examined in the post-mortem room of St. Thomas' Hospital found the lumen

of the appendix obliterated locally in 4 cases and completely in 1 case.

Treves in 100 cases found local obliteration in 2 and complete obliteration in 1 case.

Kelynack found local obliteration in 21 per cent and complete obliteration in 2 per cent of cases examined.

Ribbert states that the lumen of the appendix becomes either partially or totally obliterated in about 25 per cent of all cases before the 35 year. After the 40th year this percentage rises rapidly till at 45 it is more or less excluded in 50 per cent of cases and by the 70th year in 60 per cent. From these facts one is inclined to regard the appendix as an ancestral relic.

Treves in a monograph entitled "The Surgical Treatment of Typhlitis" (1890) says, "The appendix is useless and functionless and its anatomical elimination is aided by pathological processes. It is quite common to find in post-mortems that the appendix is wanting - traces of its existence being found in a mass of inflammatory adhesions. The appendix has in such instances been obliterated by a morbid process."

He says further "It is safe to predict that in the intestine of the man of the future there will be no such structure found hanging from the coecum."

The appendix is much twisted upon itself, this



special form being dependent on the shortness of its mesentery.

THE POSITION OF THE APPENDIX is very variable. It usually lies behind the ileum and its mesentery and pointing upwards and to the left i.e. towards the spleen. This is the position in 38 per cent of cases. The next position in frequency is behind the coecum in a vertical position. This obtains in 26 per cent of cases. In 17 per cent of cases the appendix dips into the pelvis.

But it may be anywhere in the abdominal cavity. It may lie in contact with the sigmoid, rectum, uterus or bladder.

THE STRUCTURE OF THE APPENDIX differs but little from that of the coecum.

The general substance of the mucous membrane is composed of a delicate retiform tissue. This holds in its meshes a varying number of lymphoid cells, which may here and there be aggregated into small dense masses. Running up in this retiform tissue towards the surface may be seen numerous parallel rows of elongated nuclei, representing capillaries and lymphatics. This retiform tissue is bounded towards the lumen of the tube by a definite basement membrane, and on this membrane is seated a columnar epithelium. Dipping into this retiform tissue are the tubular glands of Lieberkühn. Under the mucous membrane and often embedding the lymphoid follicles

lies the submucous coat.

The muscular coat is in two layers - the inner being disposed in a circular manner and much thicker than the outer layer which is longitudinal. Outside this is the peritoneal coat which does not call for special description. There is as a rule a slight duplicature of the mucous membrane at the orifice of the appendix known as the valve of Gerlach.

#### MESO-APPENDIX.

The appendix has a mesentery which is formed by a fold of peritoneum which comes off from the left or under layer of the mesentery of the ileum. Its origin from this layer is along a straight line which is not quite parallel with the margin of the bowel.

By pulling the appendix away from the caecum its mesentery is fully displayed and it appears to come off at right angles to the enteric mesentery. At one extremity this fold runs right up to the ileo-caecal junction, while at the other end it form a free concave margin.

In its general outline the meso-appendix is triangular. In the foetus it may extend right up to the tip of the organ but in the adult it usually only reaches half way or may get to the junction of the first two thirds with the distal third. Its shortness accounts for the twisted condition of the appendix.

In the free margin of the meso-appendix runs the

artery to the appendix - a terminal branch of the ileo-colic artery. In the female a twig is sometimes also derived from the ovarian artery.

The meso-appendix is liable to extreme variations, the most usual of which depend on shortening of the fold in all directions and in this way bringing about kinking of the lumen and so interfering with the entrance and exit of its contents.

#### DEVELOPMENT OF THE APPENDIX.

In the human foetus the coecum appears as a well developed tubular prolongation from the gut of nearly three times the relative length in the adult and with equal calibre to the rest of the gut to its extreme tip.

As growth proceeds this relation rapidly changes. The distal two thirds of the diverticulum is arrested in its development or even atrophies and at about the sixth month the coeco-appendix has become reduced to a structure of about the shape of an old fashioned tobacco pipe - the stem of which represents the appendix and the bowl the coecum.

From this point the disproportion between the two parts steadily increases; the anterior aspect of the coecum bulges downwards and outwards pushing the appendix portion upwards and backwards until finally the appendix, instead of being directly continuous with the lumen of the coecum, comes to occupy its adult position at the upper and inner aspect of the



posterior wall of the coecum. That it was originally a direct continuation of the larger cavity of the coecum is shown by the fact that the three longitudinal muscular bands can be traced on to the base of the appendix, and this serves as a guide in operations upon the appendix.

The adult relation is attained at birth or shortly after.

#### AETIOLOGY.

Being rudimentary and so to speak functionless the vitality of the appendix is low.

It is in communication with the bowel by a narrow orifice which is more or less valvular and which prevents free exit of its contents.

Indiscretions in diet and prolonged mal-digestion seem to predispose to an attack. Often enough the patient dates his trouble from a hearty meal or something which has disagreed.

Numerous instances of this are recorded, and I have met with one instance of it myself. The disease is more common in males than in females. I have already mentioned that the lumen of the tube is greater in males than females and that foecal matter is more apt to accumulate in the appendix in males. Also traumatism may account for this special proclivity, for males are more liable to traumata of all sorts.

The age of the individual also plays a part, for the majority of cases occur in young adults. This

is perhaps to be explained by the fact that as age advances the appendix becomes more or less obliterated.

The majority of cases occur between the ages of 20 and 30 years though many occur between the ages of 10 and 12. But the disease has been met with in infants and old people over 80. Foecal concretions are very commonly met with in the appendix and they may be the cause of the trouble. Such concretions are also met with in the appendices of persons who have died from other causes so that it does not follow that a concretion necessarily produces an attack of appendicitis. The exact pathology of these concretions is not yet clearly understood. They often resemble foreign bodies such as pips and often fruit seeds and were formerly regarded as such. How they arise is not quite clear. The mucous membrane of the appendix is very commonly the seat of catarrhal inflammation and these concretions may be the result of that. They are usually oval in shape and this particular form is probably the result of peristaltic action. The composition of these concretions is not easily determined. They consist of foecal matter mixed with inspissated mucus and often they have an outer covering of salts, usually phosphates. Whether micro-organisms play any part in their production is not determined. A blow over the region of the appendix may cause an attack and it is all the

more likely to do so if, at the time, the appendix is the seat of one of these concretions.

Similarly a sudden movement or a strain may precipitate the attack.

Being the seat of lymphoid tissue some authorities think that the appendix is liable to follicular inflammations like the tonsil. This may explain the part that a chill sometimes plays in the production of an attack.

From some cause the appendix may become twisted upon itself suddenly and become gangrenous; or from some stenosis of the lumen the appendix may become distended and this may end in an attack of appendicitis.

Foreign bodies are sometimes met with in the appendix but they are rare compared with concretions. I met with one case in a man who developed an abscess in the right iliac region. It was incised and drained but the appendix was not removed. On the third day after the operation I packed the wound with gauze and next morning I found an ordinary household pin entangled in the gauze when I removed it. The pin was blackened and eroded and here and there was a deposit of salts. Other foreign bodies in the shape of fruit seeds, bristles, small shot, and bits of bone have been observed. With regard to the relative frequency of enteroliths and foreign bodies Fitz, Bull and others have shown that enteroliths



or concretions exist in nearly one half of cases operated on and an actual foreign body in one eighth of cases. The appendix may be the seat of acute ulceration either of a tubercular or typhoid nature and in that way lead to an attack. But this is very rare. Also the appendix has been known to be the seat of actinomycosis. Such a case was recorded in the Med. Chir. Trans. 1892 by Ransom. In this case there was a retro-coecal abscess. Threadworms have also been found in the appendix. Geo. F. Still is of opinion that the appendix is the chief habitat of threadworms.

Micro-organisms play an important part in the causation of appendicitis.

The appendix is normally the seat of all the usual micro-organisms found in the intestines, the most constant being the bacillus colicomunis. But the streptococcus pyogenes, staphylococcus pyogenes aureus, the proteus and bacillus pyocyaneus are also found. The Bacillus Coli Communis was first described by Escherich in 1886.

Larnelle in 1889 first showed its pathogenic powers. Pure cultures of the Bacillus Coli injected into the circulation of guinea pigs produce death in one to three days. Post-mortem one finds catarrhal lesions of the intestines, swollen Peyer's patches, and usually intense congestion of the peritoneum with bloody fluid in its cavity and the bacillus can be

recovered from the blood and solid viscera (Escherich). Pure cultures taken from healthy bowel are not harmful to the peritoneum, but they are virulent when taken from an unhealthy bowel e.g. in inflamed, strangulated, or oedematous conditions. In conditions of diarrhoea and constipation the virulence increases.

When taken from suppurative peritonitis it produces the same result if injected into the abdomen of animals.

Thus it will be seen that in a state of health the Bacillus Coli is harmless, but it has this notable feature that it varies greatly in its virulence. Should the mucosa of the bowel become the seat of any morbid condition then the bacillus becomes at once virulent.

Of 23 cases examined by Tavel and Lanz, in 3 cases no micro-organisms were found. In 19 examples the colon bacillus was found either alone or in association with other Pathogenic organisms. The Streptococcus was found in several cases. The pneumococcus was met in two cases.

#### PATHOLOGY AND MORBID ANATOMY.

In describing the pathology of appendicitis most of my facts and the methods of description have been derived from H. P. Hawkin's monograph on "Disease of the Vermiform appendix."

One must first of all realise that the appendix

may be extremely diseased and yet give rise to few or no symptoms. Till the peritoneum becomes involved we do not get the clinical manifestations of appendicitis.

#### CATARRH OF THE APPENDIX .

Like other mucous surfaces the mucous lining of the appendix is often the seat of a catarrhal inflammation which gives rise to changes similar to those seen in other situations.

Such a catarrhal condition of the appendix is often seen in the general post mortem room.

It is characterised by shedding of the epithelium with detachment and extrusion of the epithelial lining of the crypts of Lieberkühn. With this occurs a leuco-cyatal infiltration of the mucosa causing swelling and pressure on and even obliteration of many of the crypts. The lumen of the appendix is found to contain abundance of leucocytes, granular debris, mucus, and casts of the crypts, and the whole of this material may be moulded in a definite central mass by the peristaltic movements of the tube.

As the process continues the basement membrane is destroyed and the leuco-cyatal infiltration becomes more marked so that the mucosa comes to consist of a dense cellular layer having a ragged raw internal surface, or in other words it has assumed the characters of a granulating surface.

Hawkins is strongly of opinion that this is a very



fertile source of local peritonitis.

If by pressure of surrounding parts the opposed surfaces of this granulation tissue are brought in contact for any length of time, union may take place and so the appendix may become more or less obliterated and so may effect a natural cure. In many cases however the condition lapses into one of chronic appendicular inflammation leading to thickening and stiffening of the wall of the tube. The obliteration may take place only at one point and so give rise to a stricture of the tube. This generally occurs near the coecal end, and following this a cystic condition of the appendix may arise. Treves is of opinion that this is very often the pathology of Relapsing Appendicitis. Sometimes the cyst bursts and leads to peritonitis either local or general.

Hawkins mentions two cases of fatal general peritonitis resulting from rupture of such a cyst. Another cause of cystic distension of the appendix is kinking of the tube by an acute bend.

#### ULCERATIVE APPENDICITIS.

Under this title Hawkins describes a primary local ulceration of the appendix which is not preceded by a general catarrh; but it is due either to a foecal concretion or a foreign body. Foecal matter in the appendix does not necessarily produce ulceration. Ulceration does not occur until the foecal mass has

acquired a degree of firmness and so by pressure causes erosion of the mucous membrane. The hardness of the concretion and its resultant pressure depend on the peristalsis of the tube. The concretion as a rule tapers at each end giving it the appearance of an orange pip and this peculiarity of shape is in all probability also due to the peristaltic action.

The first thing to suffer from this pressure is the epithelial lining of the tube which disappears opposite the site of the concretion. How far this is just a process of pressure atrophy or whether there is added to this the action of micro-organisms is somewhat difficult to determine.

Taking fatal cases that have been operated upon, a foecal concretion is found to be the cause in from 35 to 50 per cent of cases.

Ribbert found foecal concretion in 10 per cent of 400 general autopsies,

I have already alluded to the relative frequency of actual foreign bodies in the appendix compared with foecal concretions.

As the process goes on the epithelium completely disappears and successively the whole mucous membrane, submucous tissue and finally the muscular coats. The peritoneal coat may prove to be very tolerant of this distending process.

#### INFECTIVE APPENDICITIS

Under this title Hawkins describes a condition

that may arise quite independently of a catarrh or a concretion but which may also follow either of these conditions.

It is of comparatively frequent occurrence and almost of necessity is followed by a virulent degree of local suppuration or general peritonitis. Most of these cases are accompanied by sloughing or necrosis of part of the appendix wall. But it may give rise to a general peritonitis even when there is no perforation or necrosis visible. The area of necrosis may be at a distance from the seat of the concretion. This was so in one case I examined post mortem. I found the appendix in a big abscess cavity behind the coecum. There was a concretion near the coecal end of the tube and the distal end was in a sloughing condition with a perforation at one point. To the naked eye the appendix usually presents an area of necrosis involving the peritoneal surface. This may involve a considerable part of the circumference of the tube and may even cause the separation of the distal end. Such a condition has been recorded by Stephen Paget in which almost the entire appendix floated out in the pus on opening a large abscess. In all cases there is first a shedding of the epithelial lining of the tube or in other words there is a raw surface capable of invasion by micro-organisms. But still it is not a mere extension of gross disease from the mucous membrane to the



deeper tissues by continuity of tissue. The destructive necrotic process arises ab initio in the deeper structures of the wall.

One can observe all the stages of formation of an abscess in the muscular coats and eventually this microscopic abscess in the wall may burst through the peritoneal covering and so give rise to a perforation which, though it communicates with the peritoneum, does not open into the lumen of the appendix but merely into this focus of softened material in the wall. Such an infective character may be assumed at any moment in the course of a chronic catarrh of the appendix and it is always followed by a virulent form of peritonitis either local or general. The bacillus coli communis is invariably found in such cases. They can readily be demonstrated in the tissues of the wall. Probably the bacillus finds its way in from the lumen of the appendix at a point where the epithelium is deficient i.e. an abrasion of the mucosa followed by invasion of micro-organisms. Whether or not the organisms find their way to the tissues of the wall by the circulation is not determined.

The bacillus coli is also found in the peritoneal exudation around a diseased appendix.

The reason why the appendix is so prone to invasion by micro-organisms is probably owing to the peculiarity of its structure compared with the rest of the intestine and to the fact that it is an organ

which is more or less degenerate and probably functionless and therefore not endowed with great powers of resistance.

Considering the frequency of catarrhal conditions of the appendix one would almost expect such invasion by micro-organisms to happen oftener; but it would appear that the bacillus coli varies greatly in its virulence. This can be proved experimentally. The bacillus may retain its virulence on artificial media for months; but on agar it loses it more quickly than on broth, and cultures may be attenuated in this way until virulence is lost.

Ekehorn has found in experimenting on animals that the bacillus coli obtained from mild forms of appendicitis is less virulent than that obtained from acute severe appendicitis.

Macaigne has shown that a culture taken from a healthy intestine and injected into the peritoneum is harmless. Why we should get such invasion of the wall by micro-organisms in one case and not in another is a point difficult to determine. It may depend on this variable virulence or upon diminished power of resistance or such a condition within the bowel as will enable these organisms to become virulent. Others have ascribed this necrotic process to interference with the circulation either by thrombosis of the vessels or by pressure on them by a concretion. But in all probability it is due to

micro-organisms or to the effect of toxins produced by these organisms.

#### CLINICAL MANIFESTATIONS.

In considering the clinical manifestations of appendicitis one has to recognise several varieties:-

1. The simple nonsuppurative or catarrhal form.
2. The local suppurative form.
3. The fulminating form of appendicitis.
4. Relapsing appendicitis.

#### THE SIMPLE OR CATARRHAL FORM OF APPENDICITIS

This is the commonest form of the disease and yet our knowledge of it is not so precise as in the other forms; for it never terminates fatally and therefore the exact pathology of it is wanting to a great degree.

Whether foecal concretions play any part in its causation has not been determined. Probably there has in these cases been an old standing catarrhal inflammation of the tube and from some cause the peritoneum one day becomes invaded. It must always be remembered that the appendix may be the seat of a catarrhal inflammation and yet cause no symptoms until the peritoneum becomes involved.

Often enough there is a history of indiscretion in diet immediately preceding the attack or some other exciting cause in the form of an injury or strain. In the case that I record no such exciting cause could be ascertained. Hawkins relates 12



cases in which an exciting cause could be traced.

The first indication is invariably the onset of pain in the abdomen. It comes on quite suddenly and is usually severe and generally localised in the right iliac fossa, but in some cases it is more general over the abdomen or perhaps more marked around the umbilicus. Very soon, however, the pain becomes localised in the region of the appendix. The patient will usually tell you that it is worst at one spot midway between the umbilicus and the anterior superior spine of the ilium - McBurney's point. In a few cases the pain is not of this severe character so that the patient may continue to walk about. I have met with one instance in which a man was able to walk about until a definite tumour formed in the right iliac fossa.

Very soon after the onset of pain the patient experiences a feeling of nausea and usually vomits though in this form of the disease the vomiting is not an urgent symptom.

The temperature goes up from the beginning of the illness reaching 102 degrees or 103 degrees in the first few hours. It may reach higher than this but as a rule it does not attain to any high degree. The patient presents the symptoms of the febrile state. The tongue is furred but not very dry. Appetite is gone and constipation is a marked feature of the illness. The patient may present the facies of

peritonitis in a slight degree. The urine is scanty and high coloured.

The pain is at its worst during the first two or three days of the illness but with rest in bed and suitable palliative measures the pain usually disappears by the end of 4 or 5 days.

On examination of the abdomen one notices that the patient instinctively lies on the back with the right thigh slightly flexed on the abdomen. On palpation there is marked tenderness in the right iliac fossa - the point of maximum intensity being at McBurney's point which is midway between the umbilicus and the anterior superior spine. The area of tenderness varies in different cases but is usually confined to the right iliac fossa. It may extend right up to the costal margin and round to the loin. Over this area of tenderness one notices rigidity of the abdominal wall, but after a time this gives way and one encounters a feeling of resistance in the right iliac fossa in the form of a definite inflammatory mass which is dull on percussion. It may be somewhat soft and difficult to define or it may be firmer and well defined especially towards its inner and upper margins. This mass is inflammatory in character being made up of oedematous loops of gut matted together by inflammatory exudation causing fixation.

In cases where the appendix occupies a retro-

caecal position this mass may not be felt but instead the percussion note over the caecum may be unduly resonant - even tympanitic - doubtless owing to paralytic distension of the gut by the inflammatory process. I saw a case about 3 weeks ago where this was very marked in a boy age 5. The illness began with severe pain in the right iliac fossa with fever and vomiting. He made a good recovery without operation.

#### THE COURSE OF THE ILLNESS.

The tenderness persists after the acute pain has subsided but gets less and less marked as the case goes on. Should the tenderness persist or become more marked after the first few days one begins to suspect pus formation.

The temperature is always an important indication of the behaviour of the case. As a rule there is a steady fall of temperature from the first day until the last (Hawkins). There are exceptions to this. Hawkins at p. 80 says "In some instances a steady rise of temperature sets in during the course of the illness, strongly suggestive of the formation of pus, and yet the illness may be as uneventful as usual." He quotes cases to prove this. One would naturally think that these were cases in which the abscess had evacuated itself by opening into the bowel, but he excludes the possibility of this having happened in his cases.



About the end of the first week the fever subsides and the tongue cleans and the appetite returns. The inflammatory mass grows less and less daily and the tenderness is no longer marked.

As a general rule all acute symptoms are at an end in 10 or 14 days. Eventually all trace of the inflammatory mass disappears, but in a few the appendix remains thickened and tender for weeks or even months after the illness.

#### CASE I.

##### SIMPLE OR CATARRHAL APPENDICITIS ENDING IN RESOLUTION.

A. B. a girl aet. 14 was seized with sudden pain in the right iliac region accompanied with pyrexia, nausea and vomiting about a week before admission to hospital on October 12th 1899. She had had no previous attack. On admission she looked ill, her tongue was furred and a distinct mass could be felt in the right iliac fossa. Pain was not severe though tenderness was very marked.

She did not show any pyrexia during her stay in hospital and with rest in bed, liquid diet, hot fomentations and simple enemata all signs had vanished by the end of 10 day's stay in hospital.

It is now six months since the illness and she has not had any symptoms of return.

##### LOCAL SUPPURATIVE APPENDICITIS.

This form is not so frequent as the nonsuppurative variety. Hawkins at p. 83 says - "It has been

shown that the conditions of the appendix, with which a local suppurative appendicitis is associated are mainly (1) ulceration due to the presence of a concretion often culminating in necrosis of the appendix wall. (2) an acute necrosis of the wall consequent upon a chronic catarrh of the appendix. Less commonly a simple catarrh may prove sufficient to excite the local formation of pus."

It is very remarkable how apparently a similar cause produces suppuration in one case and not in another.

Perhaps this is due to a variation in the powers of resistance on the part of the individual, or to a variable virulence of the Bacterium Coli. Certainly in the early stages of the disease it is often quite impossible to tell whether the case will suppurate or not as the clinical picture of the two conditions <sup>is</sup> so similar. This identity of the manner of onset is strongly suggestive of a common origin.

Sometimes there is a history of previous simple attacks of appendicitis. In one of the cases that I record there was a history of several such attacks prior to the one that ended in suppuration.

As in the case of the simple form there may be a history of some exciting cause in the form of indiscretion in diet, or a direct injury, or a violent muscular effort. One can well understand that a blow in the region of the appendix is all the more

likely to precipitate an attack if, at the same time, the appendix is the seat of a concretion.

But there are many cases where no such exciting cause can be ascertained.

The mode of onset is in all respects similar to the simple form except that the symptoms are apt to be more severe and to progress more rapidly.

But on the other hand it is impossible to say definitely from the severity of onset whether the case will end in suppuration or not.

Hawkins at page 85 says - "I am confident that in a great majority of these cases of perityphlitic abscess we must rest our diagnosis of the presence of pus entirely upon a 'continuance or increase of symptoms' and not upon any 'specific difference in the symptoms' of the two forms of the trouble."

Again he says "Considering the much greater frequency of the nonsuppurative form, the occurrence of suppuration might almost be regarded as a complication of the simple form and not as a separate type of the disease."

Treves in a monograph entitled "The Surgical Treatment of Typhlitis" published in 1890 says, "The pain is more severe and there is sometimes an initial chill or rigor, the pain is apt to radiate to the thigh, perinaeum and testis and to be associated with tenesmus and disturbance of micturition."

Of course later on the local swelling or area of



dulness takes on the phenomena attending suppuration.

A continued increase of temperature after the second day is one of the most important indications of suppuration but even in this there are exceptions as Hawkins has pointed out. He mentions cases where fever persisted for a long time and yet the case ended in resolution. He excludes in these cases the possibility of the abscess having evacuated itself through the bowel.

The behaviour of the inflammatory mass is another important indication.

It has been shown conclusively that an abscess may be fully formed as early as the third day.

As an illustration I might mention the case of a boy, aged 8, who was seized with pain in the early morning of Wednesday and when operated on on the following Friday afternoon a large collection of pus was evacuated.

The larger the inflammatory mass is the more likely it is to suppurate, and the more rapidly it is formed the more likely is it to suppurate(Hawkins).

But in most cases events are much slower. If the mass, having remained more or less stationary for a day or two, shows an increase in area with increased tenderness then we may be fairly confident that suppuration has ensued.

In a few cases the symptoms may be latent or unaccountably delayed.

Buck reports that a sailor was at work rolling barrels of flour till the day of his admission to hospital. He then had a prominent fluctuating iliac tumour, extending along the outer half of Poupart's ligament.

In one case that I record the patient, a man age 48, walked about till a distinct tumour formed which, a few days after admission to hospital, suppurated.

#### POSITION AND SIZE OF THE ABSCESS.

It varies much in size. Fitz mentions a case that contained more than a gallon of pus, liquid faeces and scybala.

The average quantity of pus is about 3 or 4 ounces. Rarely it is only about a teaspoonful and in these cases it may be difficult to find.

The pus as a rule forms in the right iliac fossa and if left to itself shows signs of pointing just above Poupart's ligament. But it may point at the top of the thigh.

In other cases where the appendix occupies a vertical position behind the coecum the abscess is really more manifest as a lumbar abscess. However extensive the abscess may be it is certain that in all cases the pus formation is intra-peritoneal not extra-peritoneal as has been held by some writers. It is shut off from the general peritoneal cavity by an adhesive inflammation between the coils of gut and mesentery in the immediate neighbourhood.

It is however quite possible for an extraperitoneal suppuration to arise in the course of appendicitis. Fitz says - "With perforation of the parietal peritoneum, may occur extensive necrosis, purulent and foecal infiltration of the abdominal walls. Within three weeks the iliacus may be destroyed and the ilium be bared. The course of the psoas and iliacus may be followed into the thigh and extensive and deep seated destruction of tissue with foecal infiltration be present in this region."

I have met with one case of such extra-peritoneal rupture of the abscess with consequent burrowing in the extra-peritoneal tissue. It was in the case of a young adult man whom I saw in private practice and therefore I am unable to furnish a chart of the case. He had a severe attack of local suppurative appendicitis and the mass presented all the phenomena of suppuration viz. redness and oedema over the area. He would not consent to operation and a day or two later he developed a fluctuating swelling in the left iliac region. At this stage he consented to operation and on incision over the right iliac fossa pus flowed out freely and at the same time the swelling in the left fossa disappeared. He went on to an uninterrupted recovery. The appendix was not removed.

In cases where the appendix occupies a retro-coecal position with the appendix pointing upwards



towards the right kidney I have had my attention drawn to an important sign in the early stages of the disease by Thomas of Liverpool. He has observed in such cases that one can elicit a splashing sound over the coecum. There is no mass to be felt in the right iliac fossa. It is entirely absent. Instead of a dull note one observes some degree of tympanites in the right iliac fossa, and by a rapid dipping movement with the hand one can often elicit a splashing sound similar to what can be obtained in dilated conditions of the stomach. He has on two occasions recently operated on such cases and in both he found an abscess behind the coecum.

The distended condition of the coecum is most probably due to an inflammatory paresis of the wall. Quite recently I met with a case in which this sign was very easily elicited. It was in the case of a boy aged 8 who had been seized with severe pain in the right iliac region 48 hours previously. This was attended with pyrexia and vomiting. There was considerable abdominal distension on admission to hospital, and no area of resistance or dulness could be ascertained in the right iliac region, but this splashing over the coecum could be elicited quite distinctly. He was put on the table and an incision was made in the right iliac fossa just above the outer half of Poupart's ligament; but no trace of the appendix was seen and no pus was evacuated till the

coecum was lifted forwards somewhat forcibly and then a free flow of very foetid pus followed. Attempts were made to reach the appendix, but the gut was so bound down by adhesions that it was not considered advisable to continue the search. The primary incision was extended vertically upwards and as there appeared to be a very large abscess cavity extending upwards behind the colon a counter-opening was made in the loin just above the crest of the ilium and a drainage tube was inserted. But the peritonitic symptoms of vomiting and abdominal distension persisted after operation and he died 48 hours after operation.

Post mortem I found the coecum firmly bound down by adhesions and behind it and extending vertically upwards behind the ascending colon I found the appendix also firmly bound down by adhesions. The appendix was unusually long being quite  $4\frac{1}{2}$  inches in length and at the junction of the proximal with the middle third I found a foecal concretion, and curiously the distal third of the appendix was in a sloughing condition with a small perforation at one point. The abscess cavity was unusually large extending right up to the under surface of the liver, and it was interesting to notice how efficiently it was drained through the opening behind.

When this appendix occupies a position in the pelvis examination of the abdomen may reveal very

little beyond some tenderness in the groin. There is no resistance in the right iliac fossa, but on examination per rectum definite evidence of pelvic peritonitis is obtained.

When this appendix occupies one of its anomalous positions in the abdomen, the abscess may be found in equally anomalous situations. Three such cases have been recorded by Fowler of Brooklyn.

#### COMPLICATIONS AND SEQUELAE

Hawkins at page 94 says "Of all the complications and after effects of perityphlitis and perityphlitic abscess, obstruction of the bowels stands in the front rank. In some cases it is the actual causation of death and in many cases it persists in slight degree through a long period of convalescence."

He mentions 4 cases terminating fatally.

#### HEPATIC ABSCESS.

This is another important complication of appendicular abscess. It is fortunately a rare complication as it is usually fatal. It is due to spread of the bacterium coli by the portal circulation. Fitz in 257 cases of perforative appendicitis found this occur in eleven cases.

In the Medical Review of Reviews, January 1899 a case is published. It is characterised by jaundice, fever and rigors, and hepatic pain. The extent of liver dulness increases. M. Berthelin has collected 28 cases.



The abscesses are nearly always multiple and therefore beyond surgical aid.

More rarely a single large hepatic abscess forms usually due to Infective Embolism, and when this is the case surgical measures may avail.

Gendron records three cases of hepatic abscess bursting upwards through the diaphragm. In the Lancet March 24th 1900 a case of suppurative appendicitis with secondary liver abscesses is recorded by Gifford Nash. In this case the abscess of the liver was due to direct extension of the suppurative process.

Post mortem a large abscess cavity was found extending upwards behind the coecum and colon between the layers of the meso-colon. The meso-colon at the hepatic flexure was adherent to the liver and on separating these adhesions the under surface of the liver was found to be rough and ulcerated. A section through the portion of the liver in the neighbourhood showed numerous abscess cavities, the largest having a diameter of about half an inch.

I have already referred to a case of retro-coecal abscess in a boy age 8. In his case the abscess cavity extended right up to the under surface of the liver in a similar way but unfortunately I am unable to furnish a complete post mortem report as I had to be content with an examination through the incision that had been made at the time of operation. More

rarely the infection spreads from the portal trunk down the splenic vein giving rise to a splenic abscess as well.

Instead of the infective process being limited to the liver a general pyaemia may supervene.

Duckworth records three such cases. It is very rare for the abscess to burst into the general peritoneal cavity, and in that way set up a general peritonitis.

It is by no means uncommon to find that the abscess has burst into the bowel.

Many instances of this are on record, and in this way a cure has come about.

From the frequency with which perforation of the caecum has been observed it was at one time thought that this was the cause of the trouble.

The abscess may burst into any part of the bowel ~~and~~ in the immediate neighbourhood. More rarely the abscess bursts into the bladder. Fifteen cases have been recorded (Medical Review, January 1899) and of these 10 recovered by spontaneous closure of the vesical communication.

Sometimes a definite right sided pleurisy develops in the course of appendicitis. Hawkins met with two instances of this in 190 cases.

#### HAEMORRHAGE.

Fowler records a case where a man age 57 had an attack of local suppurative appendicitis consequent

# SOUTHPORT INFIRMARY.

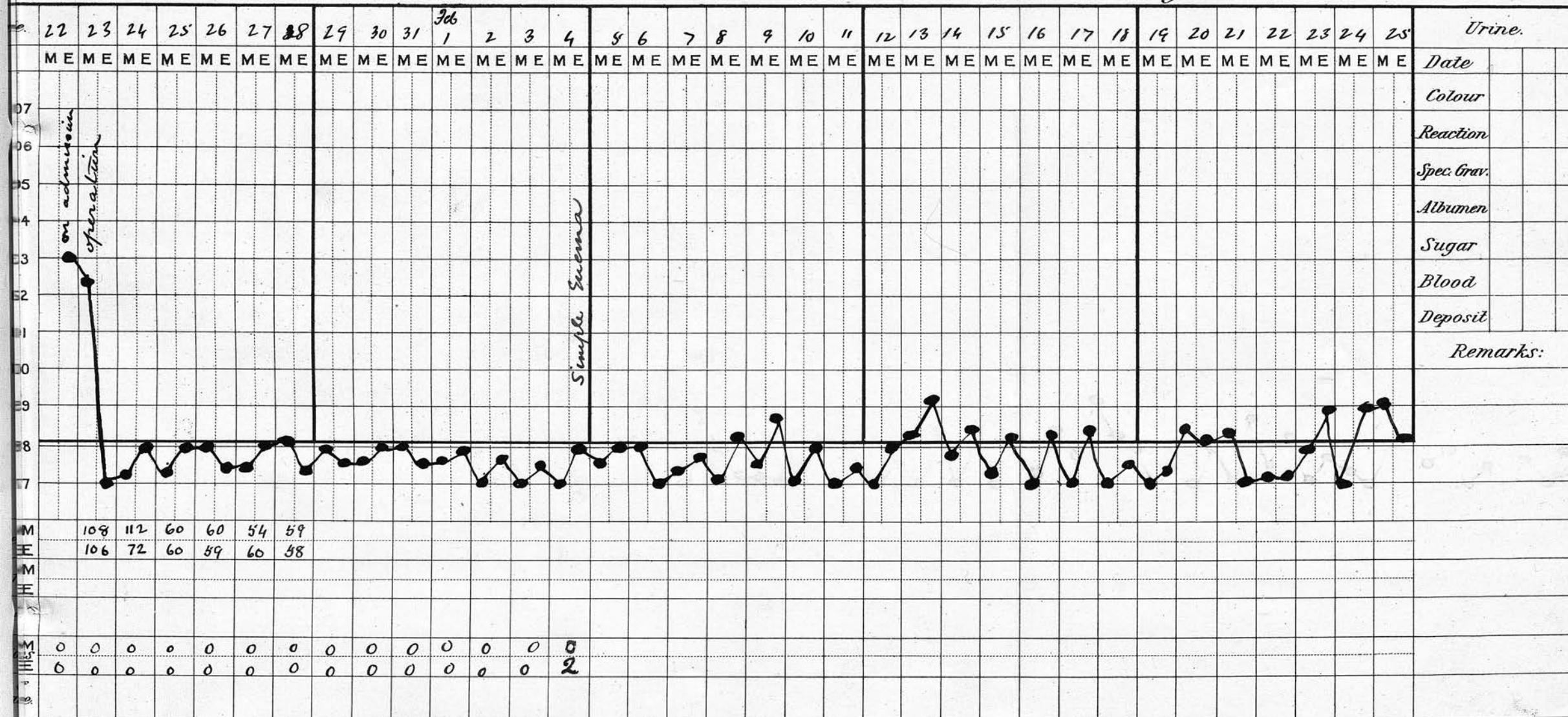
Name A.W.

Age 23

Residence \_\_\_\_\_

Admitted Jan'y. 22. 1900

Case Suppurative Appendicitis Discharged March 3<sup>rd</sup>





upon a gangrenous condition of the appendix. Laparotomy was performed and the abscess cavity was drained. Two days later while the wound was being dressed a gush of blood followed the withdrawal of the gauze drain. Though the haemorrhage was controlled he never rallied from the loss of blood. Such an accident is in all probability due to invasion of the wall of a vessel by the inflammatory process.

Bryant records a case of fatal haemorrhage from ulceration of the deep circumflex artery. In one of the cases I record severe haemorrhage per rectum was observed on the 11th day after operation and again on the following day blood was passed three times per rectum in considerable quantity.

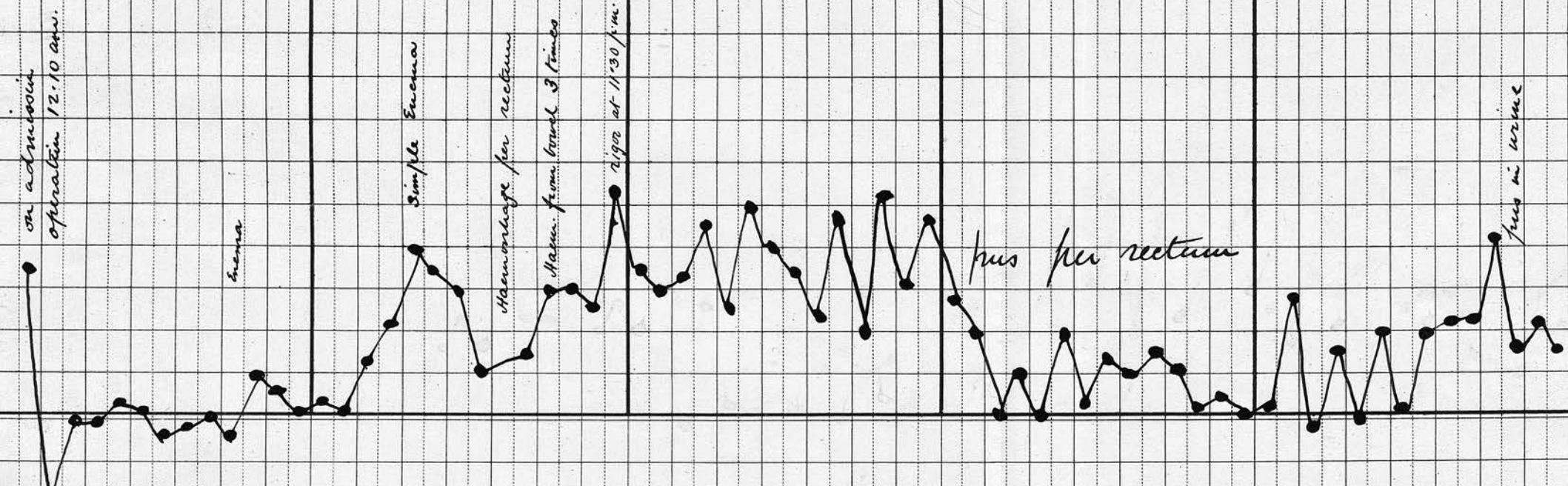
CASE OF SUPPURATIVE APPENDICITIS ENDING IN RECOVERY.

A. W. age 25, a tailor was admitted to hospital on January 22nd 1900, with severe pain in the right iliac region accompanied by vomiting. Temperature on admission was 103 degrees F. There was a large inflammatory mass to be felt in the right iliac fossa, which on incision over the most prominent part was found to contain a large collection of very foetid pus. The appendix was not removed as it was firmly bound down by adhesions. A drainage tube was inserted and next evening the temperature was normal and he went on to an uninterrupted recovery and was discharged March 3rd. For about a week prior to admission he had pain in the right iliac region which

# SOUTHPORT INFIRMARY.

Name A. G. Age 17. Residence \_\_\_\_\_  
 Admitted Jan. 2. 1900 Case Appendicitis Discharged Mar. 30.

Date.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Feb 1	2	3	4	5	Urine.			
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Pulse	M	114	110	108	106	100	102	100	98	110	102	112	102	100	106	106	102	108	102	96	100	100	90	90	94	94	94	96											
	E	140	120	112	100	92	92	98	100	108	100	102	100	104	104	104	106	108	108	100	102	100	90	96	96	94	96	92	96										
Respn.	M																																						
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Urine	M																																						
	E																																						
Motions	M	0	0	0	0	2	1	0	0	1	0	0	0	0	0	0	1	2	2	1	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0			
	E	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	3	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1	1	1			
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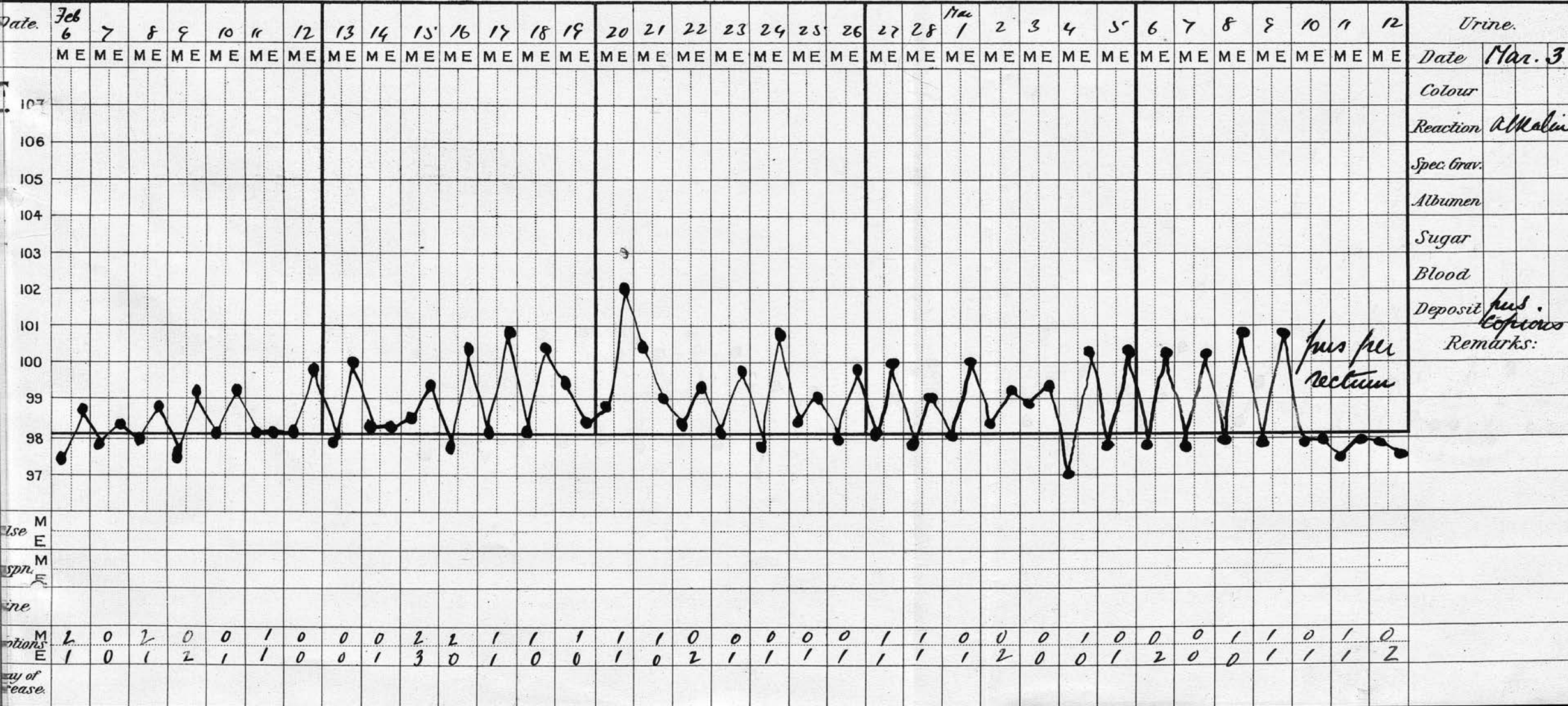


# SOUTHPORT INFIRMARY.

Continued

Name A. G. Age 17 Residence \_\_\_\_\_

Admitted \_\_\_\_\_ Case \_\_\_\_\_ Discharged \_\_\_\_\_





was not very severe at first, but towards the end of the week it became severe.

No cause could be ascertained and there had been no previous attack.

CASE OF SUPPURATIVE APPENDICITIS WITH HISTORY OF SEVERAL PREVIOUS SIMPLE ATTACKS, ENDING IN RECOVERY.

A. G. age 17, a domestic servant, was admitted to hospital on January 2nd 1900 with vomiting pyrexia and pain in the right iliac fossa. On examination an inflammatory mass was discovered in the right iliac fossa. She had been seized with sudden severe pain in the region of the appendix on the previous morning as she was in the act of dressing and she had had an unusually large supper the night before.

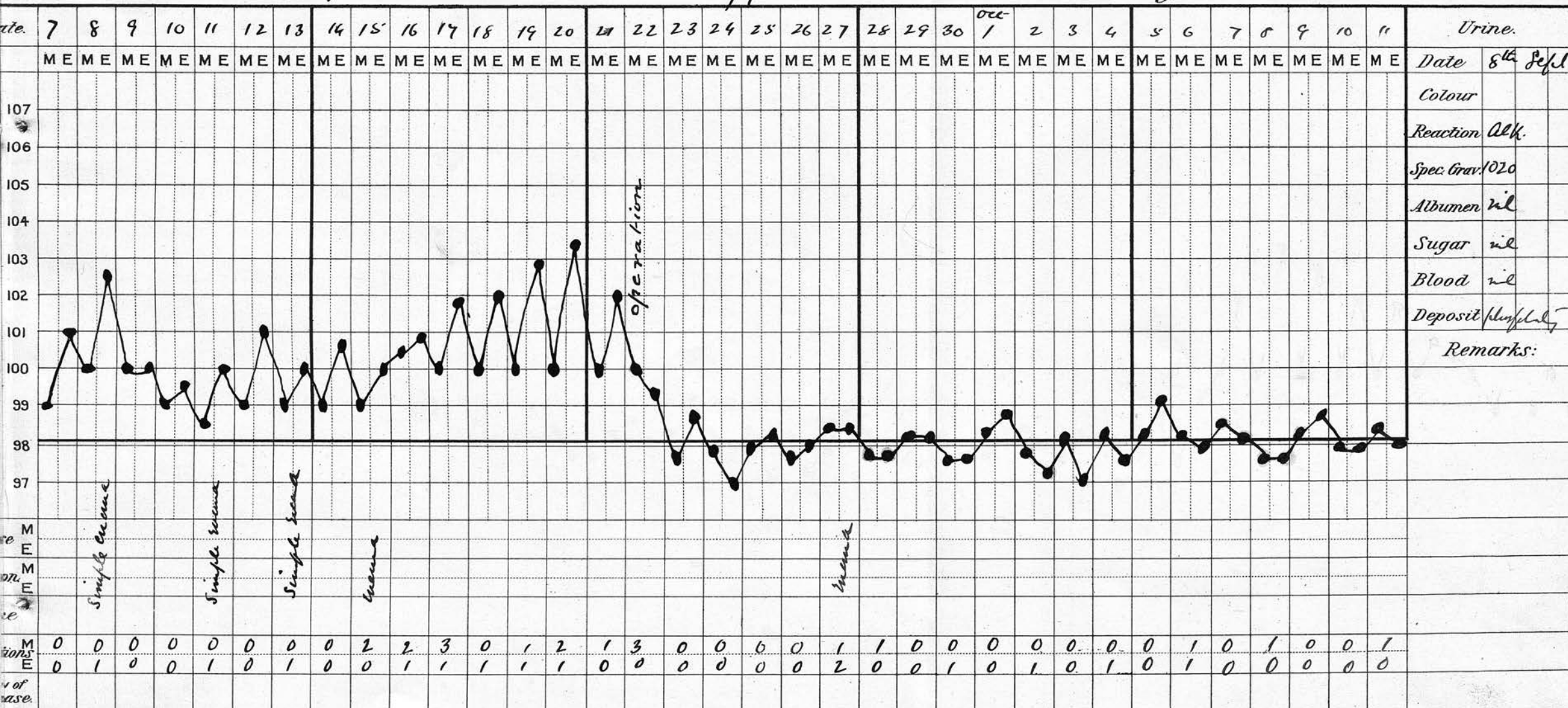
There was a history of 3 previous attacks.

Her temperature on admission was 101.6 degrees with a pulse of 140. An incision was made above the outer half of Poupart's ligament that evening and a considerable quantity of pus was evacuated after which the appendix was searched for and was found with the tip pointing towards the bladder. A perforation of the caecum also existed. The appendix was ligatured and cut away, and attempts were made to close the aperture in the caecum by suturing. A drainage tube was inserted and the patient was sent back to bed. Next morning the temperature was subnormal and the temperature remained normal till

# SOUTHPORT INFIRMARY.

Name R. F. M. Age 48 Residence \_\_\_\_\_

Admitted Sep. 7. 99. Case Appendicular Abscess Discharged Nov. 7. 99.



about 10 days after operation when it rose to 102 degrees but nothing could be discovered to account for the rise. On the 12th day she passed a considerable quantity of blood by the rectum and again on the 13th day. The blood was bright red in colour. After this the temperature kept fluctuating between 99 degrees and 102 degrees till three weeks after admission when she began to pass pus per rectum in large quantity and this went on for over a week and the temperature improved; but the temperature began to rise again in the 5th week and then it was discovered that pus was present in the urine. There were no symptoms of cystitis at any time, so that I think an abscess must have evacuated itself by opening into the bladder. She made a good recovery eventually and was discharged on March 30th.

CASE OF APPENDICULAR ABSCESS IN WHICH AN ORDINARY DOMESTIC PIN WAS FOUND TO BE THE CAUSE (with chart)

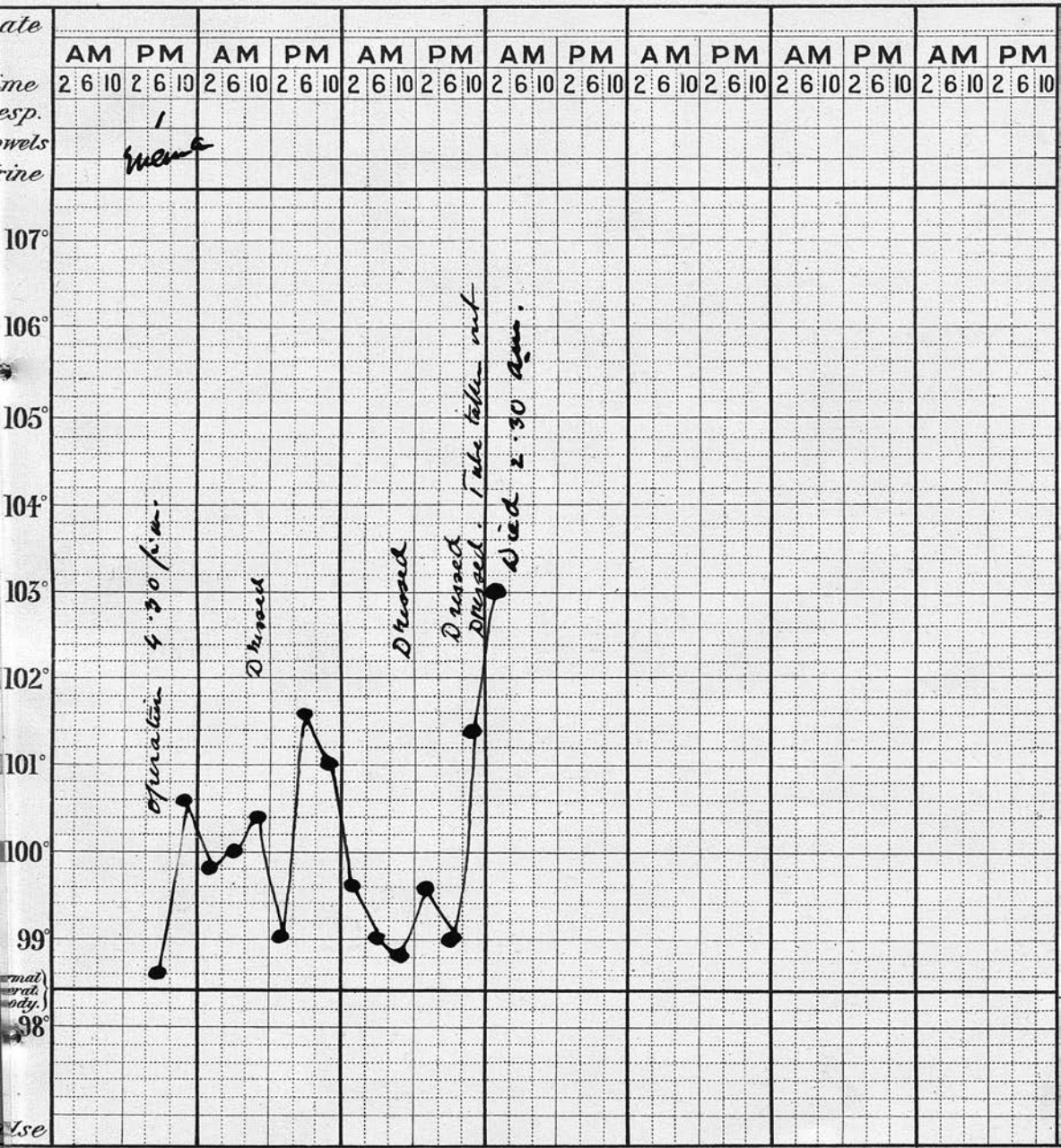
R. F. M. age 48, a gardener, was admitted to hospital September 7th 1899 with a large inflammatory mass in the right iliac region accompanied with severe pain in that region and slight pyrexia. There had not been any vomiting at any period of the illness. About six months before admission he had had pain in the right iliac region "just like a needle pricking him" as he described it. He noticed this pain after riding or walking or at the end of his day's work. After admission the temperature con-



# SOUTHPOR

Name J. H.

Age 8



tinued to rise and assumed a suppurative character and along with this one noticed the signs of suppuration in the right iliac region. He would not consent to operation till a fortnight after admission when an incision was made over the swelling and a large abscess was evacuated. No attempt was made to remove the appendix, but the cavity was irrigated and a large rubber drainage tube was inserted. Four days after operation an ordinary pin was fished out entangled in the gauze that had been used to pack the cavity. The pin was blackened and eroded and here and there was a deposit of salts. After this he soon recovered.

CASE OF LARGE RETRO-COECAL ABSCESS EXTENDING UP  
BEHIND THE COLON TO THE UNDER SURFACE OF THE LIVER,  
TERMINATING FATALLY.

J. H. age 8 was admitted to hospital on March 23rd 1900 with a history of sudden severe pain in the right iliac region commencing 48 hours previously accompanied by vomiting which had continued.

Temperature after admission was 101.6. There was considerable abdominal distension on admission and great tenderness in the right iliac region but no inflammatory mass could be felt. On opening the abdomen by the usual incision for appendicitis no pus was discovered till the caecum, which was fixed by adhesions, was pulled somewhat forcibly forward, then a large quantity of very foetid pus was evacuated.

Attempts were made to bring the appendix into view but it was so firmly bound down by adhesions behind the coecum and colon that it was left in situ. A counter-opening was made in the loin just above the iliac crest and a large rubber drainage tube was inserted. However the vomiting and abdominal distension became aggravated after he was put back to bed and he died about 48 hours after operation. The post mortem appearances I have already described in an earlier part of this thesis.

#### FULMINATING APPENDICITIS.

This variety of appendicitis fortunately forms only a small proportion of cases for it is very often fatal.

Hawkins found 36 cases in a series of 264. Of these 36 cases 9 recovered, and all of these, as the general abdominal distension subsided, revealed a localised mass in the right iliac region. The remaining 27 died whether the abdomen was opened and washed out or not.

Hawkins is of opinion that in cases where there is a history of previous attacks of appendicitis the patient stands a better chance of recovery. Of the 9 cases that recovered in his series 4 had had a previous attack, whereas in the 27 cases that died only 3 had had a previous attack. This, he thinks, is to be explained not so much because adhesions have formed as owing to a change in the peritoneum rendering



it less absorbent.

Greig Smith says he has never known a case recover; and of the few cases of recorded recovery at least one third ought to be placed in the category of diffusion of peri-appendicular abscess. Another third were not truly general, and in the remaining third slow onset of symptoms proved slow extravasation rather than sudden diffusion.

This form of appendicitis is usually associated with a sudden perforation of the appendix from the presence of a concretion or with rapid and extensive sloughing of the organ.

The patient is suddenly seized with agonising pain in the abdomen. The pain is felt all over the abdomen but is usually worst in the neighbourhood of the umbilicus. Very rarely is it localised to the right iliac fossa at the commencement. Within a few minutes the patient begins to vomit and the vomiting may continue throughout the illness; and as the case progresses the vomit is often of a dark colour being evidence of severe blood changes from toxæmic absorption. The pulse is very rapid and soon assumes a peritonitic character. There is pyrexia but the temperature does not reach a very high degree - usually 102 degrees or 103 degrees and this after a time usually gives way to a normal or nearly normal standard; but it may again rise to 104 or 105 just before death.

There is extreme tenderness all over the abdomen and very soon abdominal distension sets in. The patient has the anxious look with pinched features so characteristic of general peritonitis. The mouth is dry, thirst is marked, and the tongue becomes dry and furred.

There is marked constipation throughout the illness though in a few the illness is ushered in with two or three evacuations of the bowel and in some cases diarrhoea continues throughout the illness. Towards the end the extremities become cold from collapse of the circulation, the skin is clammy and the restless anxiety gives place to apathy which soon ends in death. I have met with only one instance of this form of the disease. It was the case of a woman, aged 33 whom I saw in private practice in Sunderland. She had just recovered from an attack of quinsy and was seized one morning as she was walking about the house with sudden severe pain in the abdomen which was at first in the region of the appendix but when I saw her the pain was general over the abdomen and was accompanied by vomiting and pyrexia. She refused operation and died 48 hours later. An interesting feature about the case was its association with quinsy.

#### RELAPSING OR RECURRENT APPENDICITIS.

Relapse or recurrence of the disease may be looked for in a certain proportion of cases. The great

majority of the cases that have passed through the stage of suppuration are thereby rendered free from any further attacks; so that it is in the mild forms of appendicitis that we are to expect recurrence.

Roughly recurrence may be expected in about every third case.

Hawkins found it recurring in 23.6 per cent of cases in a series of 250.

Krafft found recurrence in 23 per cent of 106 cases. Fitz has recently placed it as high as 44 per cent.

#### FREQUENCY OF RECURRENCE IN AN INDIVIDUAL CASE .

In many instances the attacks are limited to one or two in the year and the period of liability extends to 3 or 4 years. But in the most severe form of the disease, to which the term relapsing is particularly applicable, the interval of comparative health between the attacks does not amount to more than two or three weeks and the total result is then a nearly continuous illness.

As many as twelve attacks have been known to occur within twelve months.

As to the morbid conditions associated with recurrent forms of the disease Hawkins says, "The condition above all others which is associated with a relapsing form of appendicitis is a chronic catarrh in which either the wall of the tube is immensely thickened, or obliteration of the lumen has occurred



at some point with cystic dilatation on the distal side."

Treves in a paper published in the British Medical Journal 1895 says, "The lumen is in some places narrowed or occluded and the contents of the little tube are unable to escape. Such occlusion may result from a twisting of the organ, or from an acute bending of it, due to the contraction of adhesions, or from a cicatrix in its interior due to extensive ulceration. In other examples a quantity of inflammatory material, amongst which may be found the gangrenous tip of the appendix, is embedded within a mass of firm adhesions as an explosive within a bomb. In a third series the organ shows a condition well adapted for volvulus, or there is lodged within it a calculus or concretion.

THE SYMPTOMS OF RECURRENT APPENDICITIS do not call for special mention as they are those of simple appendicitis.

Each attack is complete in itself and runs the same course, though there is a tendency towards a diminution of severity as time goes on (Hawkins). But in others the attacks return with renewed vigour each time; or the attacks may vary greatly in severity and often grave attacks will alternate with others of comparatively trifling character. When local symptoms, such as discomfort in the groin and tenderness, persist between the attacks, there is

a probability that pus is present (Treves).

In 14 cases of relapsing appendicitis operated on by Treves pus was discovered in 9 instances and was absent in 5.

#### DIAGNOSIS OF APPENDICITIS.

It is the rare exception that peritonitis in the male is due to anything else than appendicitis. According to Krafft only 2 per cent of peritoneal inflammations in the male are not due to appendicitis. The diagnosis of appendicitis as a rule presents little difficulty. The mode of onset is an important point in forming a diagnosis.

Any affection which sets in with sudden and severe pain in the abdomen, shortly afterwards, if not from the commencement, localised to the right iliac fossa, accompanied with nausea, vomiting and pyrexia is most likely due to appendicitis.

#### TYPHOID FEVER .

In the Lancet November 1899 Moizard mentions two cases of enteric fever in which acute abdominal pain localised to McBurney's point was an early symptom; but as a rule it is not difficult to exclude typhoid from the facts, in appendicitis the onset is more sudden, the pain, <sup>that</sup> <sup>is</sup> more severe, and there is abdominal resistance, and the patient sooner reaches an acutely ill condition.

#### RENAL COLIC AND OTHER KIDNEY CONDITIONS.

In this connection I might mention the case of



A. J. age 46 who was admitted to hospital complaining of severe pain in the right iliac region with pyrexia, and great tenderness in this region, and marked constipation. On more careful examination it was found that the pain and tenderness were rather higher than one finds in appendicitis and a definite tumour could be felt by kidney palpation, which proved to be a case of pyelo-nephritis.

INFLAMED AND DISTENDED GALL-BLADDER may simulate appendicitis. Shepherd in Encyclopaedia Medica vol. 1. mentions a case where the patient was seized with sudden and severe pain, tenderness in the right iliac region, fever and vomiting, and a tumour was found in a line between the umbilicus and anterior superior spine. On opening the abdomen in the usual way an inflamed distended gall bladder presented itself, which was opened and some stones removed and patient recovered rapidly.

NEURALGIA of the lumbo-abdominal muscles has been mistaken for appendicitis.

INTESTINAL OBSTRUCTION due to twists or bands is excluded by the presence of pyrexia and the localising signs and symptoms in the right iliac fossa.

PELVIC INFLAMMATION in females has often been mistaken for appendicitis and vice versa.

This is especially apt to be the case in cases of tubal inflammation. Just at present I have a case in the wards that presented this difficulty in



diagnosis.

It is the case of a woman age 27, who about a month ago was seized with severe pain in the right iliac region accompanied with vomiting and pyrexia and constipation. She referred the pain to a point rather lower than McBurney's point. There was marked tenderness on palpation and more resistance on the right than on the left iliac region.

Per rectum a large inflammatory mass is now to be felt in the pelvis and per vaginam this is found to be associated with the right broad ligament.

#### PERFORATING GASTRIC ULCER,

May simulate appendicitis but the absence of fever and the history of gastric trouble will help to clear up the diagnosis, though it must be remembered that perforation may be the first symptom of gastric ulcer.

#### PLUMBISM.

Quite recently attention has been drawn to the possibility of mistaking plumbism for appendicitis and vice versa. Attention has been called to this in the Medical Review of Reviews vol. II Nos. 9, 11, 12 and in the Lancet May 20th, July 15th and July 22nd 1899.

J. P. Lord published a case in the American Medical Journal April 15th 1899, in which a diagnosis of appendicitis had been made and it was not till the abdomen was opened that it was discovered to be

a case of Plumbism. The jejunum and ileum were found contracted to the diameter of the little finger.

Lord has met with constriction of the colon for 10 inches at the splenic flexure in another case of plumbism.

In the same Journal 1896 Murphy describes a case in which obstructive symptoms showed in a subject of plumbism.

On the other hand Le Gendre brings forward evidence of appendicitis having been mistaken for lead colic.

#### PROGNOSIS OF APPENDICITIS.

I. As to the various varieties, the simple nonsuppurative form uniformly recovers. The local suppurative form recovers as a rule if operated upon. As to the Fulminating form of Appendicitis it is almost uniformly fatal.

II. As to the prognosis in any individual case, this must be considered from the clinical standpoint. In this connection an important paper read before the London Medical Society by H. A. Caley was published in the Lancet December 2nd 1899. Here the prognosis is considered from four standpoints -

1. As regards local symptoms with special reference to pain and vomiting.
2. As to general symptoms with special reference to pulse, respirations, temperature and general condition.

3. As to local signs on physical examination.

4. As to the progress of the case.

1. AS REGARDS LOCAL SYMPTOMS.

The distribution severity and duration of pain vary greatly. In mild cases the pain tends to become localised whereas in perforative cases it is sudden, severe and more generalised. Persistent severe pain is suggestive of a severe lesion and sudden increase of pain is an unfavourable omen.

Vomiting as a single symptom is more significant than pain. In mild cases the vomiting is only present in the initial stage. It subsides when the patient is kept at rest in bed and dieted carefully. Severe and persistent vomiting suggests a severe lesion, as also does vomiting which has recurred after a definite interval. Gangrenous appendicitis may however pursue a fatal course without much pain or vomiting.

2. AS REGARDS GENERAL SYMPTOMS.

The temperature, pulse, and respiration must be considered jointly and the aspect and general condition noted carefully.

The temperature by itself is apt to be fallacious. A very quick pulse suggests severe lesion, but the converse is not necessarily true. If the pulse is persistently 120 or more we may look for local suppuration or general peritonitis. Severe initial



collapse is a bad omen.

### 3. IN REGARD TO LOCAL SIGNS.

The degree of abdominal rigidity, the presence of abdominal distension and the extent of local tenderness help to estimate the degree of peritoneal invasion.

### 4. THE PROGRESS OF THE CASE.

This is always an important factor in forming a prognosis for it is often only by watching further developments that we are able to pronounce upon a case.

Recurrence may be looked for in every third case.

## TREATMENT OF APPENDICITIS.

### THE SIMPLE FORM OF APPENDICITIS.

Some surgeons hold that appendicitis cases ought never to find a place in the medical wards of a hospital. Considering that this variety of the disease is the most common form and that palliative measures so often effect a cure I think the physician may well claim that appendicitis does belong to his field. The treatment in this class of case consists in the relief of symptoms and in the avoidance of causes which might tend to convert a local peritonitis into a general one.

To this end he must ensure perfect rest in bed throughout the course of the illness.

For the relief of pain warm applications in the

form of poultices or hot fomentations applied to the abdomen will be found useful. Or cold applications in the form of an ice-bag may serve the same purpose. Similarly the use of leeches over the affected part has been attended with great relief of pain. As a rule one finds it necessary to supplement these measures by the use of opium in the form of hypodermic injection. This will relieve pain and allay any peristalsis, and when these two objects have been attained it is important to discontinue the use of opium. For the relief of sickness it will be found that this tends to disappear when the patient is kept in bed and put on a liquid spare diet. The administration of a simple enema is often attended with considerable relief to the abdominal symptoms. The question of the management of the bowels in the early stages of appendicitis is one that has created some difference of opinion in recent times.

Hawkins says, "As regards the management of the bowels it is best to err on the safe side of constipation. No purgative, saline or otherwise should be given until the patient is well enough to leave his bed." This is the method of treatment adopted by most at the present day. Recently, however, the use of purgatives has been advocated by some surgeons including Maylard of Glasgow and Terry of New York.

In the Glasgow Medical Journal, March 1899,

Maylard advocates the use of saline aperients in the early stages of the disease. He restricts this treatment to selected cases. If the patient is seized with sudden acute pain accompanied by pyrexia, nausea, vomiting, and tenderness in the right iliac region, and if such a case is seen within the first 24 hours with no more serious symptoms than those described, the first duty is to empty the bowels and relieve the pain. A copious soap and water enema is given, followed by small teaspoonful doses of sulphate of magnesium dissolved in a couple of wine glassfuls of warm water. This is given hourly until the bowels are moved, from six to eight doses being required as a rule.

Terry's method consists in first giving cathartic doses of castor oil with olive oil, followed by hot water until the bowels are thoroughly emptied. This is followed by enemata of glycerine with olive oil. He claims good results from this form of treatment. Out of 51 cases under his personal supervision 44 were successfully treated without operation. (From extract in the Medical Review of Reviews vol. II page 39.) If we may suppose that the exciting cause of the inflammation is the irritating contents of the bowel, then this treatment would appear to be quite rational.

Maylard further says that even if the bowel contents are not at fault no treatment of a septic



process is so important as stimulating the excretory organs and nothing effects this better than purgation. Maylard claims that since he adopted this mode of treatment in the early stage of the disease he has not had one case where the symptoms did not subside. This does not imply a cure for if the acute onset is due to a foecal concretion cure can only be effected by removal of it along with the appendix. But he claims that by these means he is able to operate under much more favourable conditions.

Until the fever has subsided the patient must be kept on a liquid diet, and milk will be found most serviceable.

Throughout the illness simple enemata may be given at intervals. After all acute symptoms have subsided one may give Epsom salt or some form of mineral water with advantage. In the after-treatment careful attention must be paid to the diet and digestion and constipation must be avoided.

#### TREATMENT OF THE LOCAL SUPPURATIVE FORM.

The same care in regard to rest in bed and a spare fluid diet with palliative measures for the relief of pain must be observed from the commencement of the disease.

It is in this class of case that surgical treatment has been attended with such good results.

The operative treatment of appendicitis still provokes a good deal of discussion. On the one

hand there are those who advocate an early and more extensive operation with removal of the appendix in every instance. This I shall call the Radical operation. Then again there are those who delay operating till adhesions have had time to form in order that they may avoid any risk of infecting the general peritoneal cavity. In this operation the appendix is removed if it presents itself or is easily dealt with and not otherwise. This I shall call the Conservative Operation.

#### THE RADICAL OPERATION.

This operation has been practised more widely in America than anywhere else. American surgeons are in favour of operation and removal of the appendix at the earliest possible moment after the onset of any peritonitic symptoms - mild or severe. In Germany and France the same opinion is held by many, but in this country the operation has met with almost universal opposition until quite recently when Mansell Moullin has been advocating it with some reservations. It is claimed by the advocates of the radical plan (1) that many lives will be saved and much suffering avoided by the prevention of future attacks and (2) that by such early excision the attack of peritonitis which is beginning at the time of the operation will be cut short, and that, as some of these cases if left alone terminate in general peritonitis, a number of lives will be thereby saved.

As to the first claim it is by no means certain that many will die if left without operation for a few days. The case that gives rise to a general peritonitis forms a very small proportion of all cases of appendicitis. Hawkins puts it at 13 per cent and not all of these necessarily die. Again the operation itself is a more serious one and not so safe an operation in the hands of the ordinary surgeon as the more conservative method of operating.

In the radical operation the peritoneal cavity is opened irrespective of any limiting adhesions for it is undertaken before these can be formed, and the operation cannot be undertaken after the second day of the disease. It has this advantage that in all cases the cause of the disease is removed and so the possibility of a second attack is nil. But results prove that an appendix that has once caused suppuration, seldom causes any trouble afterwards as it becomes so bound down by adhesions. In the Lancet December 16th 1899 appears a paper by Mansell Moullin advocating the early and extensive operation.

His procedure is to operate in all cases that show no improvement at the end of 36 hours. Quite recently I had a case illustrative of the difficulty one has in coming to a decision after 36 hours. It was in the case of a little boy, age 5, I first saw him 24 hours after the onset of symptoms when he had severe pain in the region of the appendix accompanied



by vomiting and pyrexia. It was agreed to wait for further developments but the condition was much the same at the end of the 36 hours. He did not show signs of being any worse nor was there any distinct improvement; but by the end of 48 hours there was distinct evidence of improvement and he eventually got quite well without operation. It seems to me that Mansell Moullin's time limit is open to serious objection from both stand points. He seems to me to miss the virtues of both methods of operating. If the case is a severe one and he waits till the end of 36 hours definite peritonitis will have set in and this is the object the early operation aims at preventing; and on the other hand if he operates at the end of 36 hours he is operating before adhesions have had time to form and therefore there is an objection from this side. As Grieg Smith remarks, "It is impossible to be definite, and it would be wrong to be dogmatic. To lay down rules as to operation on the first, second, or third day is to override the values of such facts and figures as are available. There might be some reason, on the one hand, in operating on every case of appendicitis the moment it is diagnosed; and on the other, in refusing operation till pus has formed. But rules for any sort of compromise are useless."

Mansell Moullin quotes statistics by Fowler to show that the mortality attending operation rises

the longer the operation is delayed. Fowler has shown that of 127 cases 83 per cent recovered of those who were operated on by the third day.

60 %	recovered	of those	done	on the	4th day.
58 %	"	"	"	"	on the 5th or 6th day.
50 %	"	"	"	"	on the 7th or 8th day.
33 %	"	"	"	"	on the 9th or 10th day.

But it must be remembered, as Dr. Berry points out in the Lancet December 30th 1899 that these statistics refer to the more extensive operation of opening the uninfected portion of the peritoneum. Such a mortality does not attend the more limited operation of opening the abscess respective of the limiting adhesions. He quotes statistics from Bart's Hospital Reports 1895 - 97 to prove this. Of 24 acute cases treated by free incision without regard to the area of adhesions 5 recovered and 19 died; whereas of 21 cases treated by expectant methods and then operated on by a limited incision 19 recovered and 2 died. The groups of cases were strictly comparable and only differed in the time and method of operating. The extensive operation has given very good results in the hands of Bull, McBurney, Senn and others, but it must be confessed that the risks attending the operation except in the hands of the most skilful surgeons are great, while the dangers attending delay in operating for a few days are very small. Of course where one

has reason to suppose a general peritonitis from the beginning of the case every one is agreed that it is impossible to operate too early. It is urged in favour of the early operation that a large number of recorded cases afford examples of an operation performed too late or of a fatal issue which could have been averted by operation. Such cases afford an argument for earlier interference but do not necessarily imply that the opening of the abdomen within the first 48 hours should be the routine treatment of appendicitis.

#### THE CONSERVATIVE OPERATION

Treves in the System of Surgery says that operation is seldom called for before the 5th day. Shepherd in the Encyclopaedia Medica Vol. 1. says, "If at the end of 48 hours the case does not improve and the pulse be over 120 with increasing rigidity of the muscles and an anxious expression of the face, then the question of operation should be seriously entertained."

The site of the incision cannot be laid down in any arbitrary manner. It should be placed over that part of the inflamed area which appears to cover the seat of the suppuration, and this will usually be found to be an inch and half to two inches to the inner side of the anterior superior spine and having a direction nearly parallel to Poupart's ligament. The chief objects one has to keep in view are to



open the abscess, to secure efficient drainage, and to avoid as far as possible interfering with the limiting adhesions. As Treves says, the less that is done after the abscess has been evacuated the better. Should the appendix present itself, or be easily got at, it ought to be removed; but it is not wise to attempt removal of an appendix that is firmly bound down by adhesions or otherwise difficult of attainment. Shepherd advocates removal of the appendix on all possible occasions. He says it is always better to remove an appendix if its removal does not involve too much dissection or too much disturbance of the limiting wall which separates it from the general peritoneal cavity.

As to the treatment of the stump after removal of the appendix many methods have been employed. Treves simply ligatures at a healthy spot near the proximal end and then cuts the distal portion off. If the appendix be entirely gangrenous or be perforated close to its point of origin from the coecum he thinks it better left untouched.

Shepherd's method consists in tying off with cat-gut and removing with scissors and then cauterising the cut surface and lumen freely with the thermocautery.

Some invert the stump into the coecum and then apply Lembert sutures to the coecum but the simpler the methods adopted the better.

Some surgeons douche the cavity with a weak warm antiseptic solution and others think it is better not to wash out the cavity.

No attempts ought to be made to remove the flakes of lymph from the bowel in the neighbourhood. In cases where the abscess is retro-coecal and extending upwards behind the colon it is good procedure to make a counter-opening in the loin just above the iliac crest. This is easily done by thrusting a pair of sinus forceps through the soft tissues of the posterior wall of the abdomen and cutting down on them through the skin. This method was adopted in one of the cases I record and a drainage tube inserted with very good result.

Instead of using a tube the cavity may be packed with gauze. Should a perforation of the coecum be found it is not wise to attempt to suture it as its edges are inflammatory and friable and altogether unsuited for this; and besides it has been shown that these perforations tend to close naturally provided efficient drainage is secured.

#### TREATMENT OF FULMINATING APPENDICITIS.

It must be confessed that the treatment of this form of appendicitis has so far been attended with very little success. A few cases of recovery after operation have been recorded in this country and in America.

Hawkins mentions 9 cases of recovery out of a

series of 36 cases but in none of these was a laparotomy performed. Of the cases that were operated on in his series all died. The patient's only chance lies in early opening of the abdomen followed by cleansing, and removal of the offending organ.

To this end a free incision is made preferably over the region of the appendix. The ordinary oblique incision midway between the umbilicus and the anterior superior spine on the right side answers best. As a rule the appendix is found lying quite free in the abdomen and is easily removed. The patient is turned over on the right side slightly to allow any pus to flow away and then the whole abdomen is freely irrigated with a warm douche of normal saline solution or Barff's Boroglyceride (half an ounce to the pint). It is quantity rather than any particular quality of lotion that is required. The douche must be directed in various directions - down into the pelvis and up into the right flank and kept going as long as the patient can tolerate it. In some cases the patient soon shows signs of collapse during this process and in others they seem to revive with the douching. Free drainage is secured either by large rubber drainage tubes or by strips of sterilized gauze. As soon as the operation is completed it is well to give a  $\frac{1}{4}$  grain of morphia along with  $\frac{1}{100}$  of a grain of Atropine hypodermically. It is important to secure an action



of the bowels as soon as possible after operation. For this purpose Shepherd in the Encyclopoedia Medica Vol. 1. advocates the use of calomel. M'Cosh injects into the intestines during operation one ounce of sulphate of magnesium in a saturated solution followed by the administration of 10 grains of calomel as soon as the patient recovers from the anaesthetic. M'Cosh reports 9 cases of general peritonitis with 3 recoveries treated by this method.

Should vomiting continue after the operation washing out the stomach with warm water sometimes checks it; or sips of hot water may serve the same purpose. Stimulant and nutrient enemata must be given per rectum. A useful form of enema is Brandy and egg albumen and water to which a little salt has been added.

#### TREATMENT OF RELAPSING APPENDICITIS.

To Mr. Treves belongs the credit of having placed the treatment of this form of appendicitis on a rational basis.

He first advocated removal of the appendix during the quiescent period in 1877, and for a time the operation was practised very generally. Recently however more careful observation has led Treves to consider that "cases adapted for operation are comparatively few." He emphatically states that in a fair proportion of instances in which the trouble has relapsed no surgical interference is called for.

In many cases much can be done by medical means, by diet, and by attention to the bowels. Any mal-digestion must be corrected. By seeing that the teeth are in a proper state for mastication much good may be done. The patient must have his meals at regular intervals, and he must eat slowly and rest after each meal. The diet must be simple and easily digested and assimilated.

Constipation must be avoided. For this purpose some mineral water must be taken first thing in the morning. Also the administration of cascara in tonic doses twice or thrice daily will be found useful.

Massage of the abdomen is often attended with very good results by stimulating peristalsis and promoting absorption of any inflammatory products. The patient should be encouraged to take suitable exercise. Some form of intestinal antiseptic may be given - the best perhaps being salol in doses of 10 grains given in milk or in cachets night and morning.

#### CONDITIONS JUSTIFYING OPERATIONS.

Treves says, in a paper published in 1895, "Cases where there is abiding tenderness and some swelling in the coecal region with very frequent attacks of pain and fever, are amenable to no other measure short of operation; for in such cases pus will usually be found."

Where the patient is reduced to the condition of a chronic invalid owing to constant relapses one is justified in operating.

Again where the attacks recur with renewed vigour it is well to urge operation.

Most surgeons think that after the second attack operation should be urged, and I think, with good reason; for the longer the case is left the more difficulty is one likely to meet with from old adhesions. The whole difficulty in the operation consists in dealing with the adhesions. In many cases the appendix is removed without any difficulty and one meets with all grades from this condition up to such a state that the appendix is so firmly bound down by adhesions that removal is impossible.

Treves says he has never operated in any case where he has not been able to make out the enlarged appendix still in evidence after the acute symptoms have passed off.

#### THE OPERATION.

Determine the position of the appendix as far as possible and make the incision accordingly. Usually the incision will be at right angles to a line drawn from the umbilicus to the right anterior superior spine, and about two inches from the Antr. Supr. Spine. The incision should be about two inches long and its centre should correspond with the line.

The peritoneum must be opened carefully for the



coecum may be adherent to it.

The appendix is freed from any adhesions and ligatured and cut away, the cut end being touched with the thermocautery or with pure carbolic acid.

Treves dissects up the peritoneum from the appendix for a short distance, just as one dissects back the flaps in an amputation; and then cuts away the appendix and scrapes away the presenting mucous membrane and then sutures the muscular coats and over this he stitches the flaps of peritoneum with Lembert sutures. The abdominal wound is closed by first stitching the two edges of the peritoneum with a continuous silk suture and then the rest of the wound is closed with silkworm gut sutures that include everything down to the peritoneum. The patient must be kept in bed for quite three weeks after the operation to ensure good cicatrisation in the parietal wound.

The mortality attending this operation is not more than 1 per cent and in the hands of Treves it is lower, for he has had only one death in all the cases he has done and in that case it would appear that the death was not due to the operation directly.