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Rest

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REST

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CONTENTS

"Six hours sleep is enough for a man, seven for a woman, eight for a fool".

King George III

"Rast' ich, so rost' ich".

(If I rest, I rust.)

M. Luther

"Better to hunt in fields for health unbought than fee the doctor for a nausi-draught. The wise, fore cure, on exercise depend..."

Dryden

"What is the first business of one who studies philosophy? To part with self conceit. For it is impossible for anyone to begin to learn what he thinks that he already knows".

Epictetus

INTRODUCTION

Rest in bed is the most widely employed remedial measure. As most therapeutic measures, it can do harm as well as good. One hardly ever thinks of using a drug without some consideration of its dangers. But the bed as a therapeutic device, as a means of providing rest, is usually taken for granted. We often debate the question whether or not the patient will profit by going to bed, but the decision as a rule does not consider the danger of going to bed. The recumbent posture is unphysiologic; it is when long maintained, hazardous to the psyche, the physical well-being, and even the lives of adult patients. Since it is widely used, it claims more lives than do all other therapeutic agents put together (Dock 1944 a).

Traditions and long established habits are generally followed blindly and without question. This has been true up to comparatively recently of the various clinical aspects of rest. Even today many practitioners are still clinging to the old traditional methods in the employment of rest as a therapeutic agent. It should be the duty of every physician, in the interest of progress, to submit these

traditions to criticism, to continue what is good, to cast aside what is useless and harmful, and to evolve better and more humane methods. It is the purpose of this thesis to analyze the progress that has been made in the study of rest from both its physiological and clinical aspects.

Up to the present century and to some extent in this century, a large portion of the literature has been purely discoursive in character, as for example that of Lewes (1860) and Hilton (1891). Many advances have been made in the study of rest since 1900, but comparatively little actual research work has been done on such an important therapeutic agent as "rest" up to the present time, and many of the newly discovered facts need to have confirmation.

PHYSIOLOGICAL ASPECTS OF REST

In all living things there occur periods of rest, alternating with periods of activity. During periods of activity, fatigue of the various body structures takes place. The onset of fatigue is earliest in the mind, next in the nerve fibers themselves, and finally, in the muscle (Owen 1942). Rest is the basic treatment for all types of fatigue, but the duration and frequency varies. Rest is but a relative degree of exercise, i.e. there is no such thing as absolute rest of the human organism. We cannot rest the vegetative or visceral system for it is active from birth to death, but its activity can be reduced to the lowest possible point. Rest, then, is a relative inactivity in the voluntary muscular system and a reduction of the demands upon the vegetative system to a low point. One of the goals of human living should be to find the best equilibrium of energizing and rest, resulting in maximum achievement.

According to Jacobson (1930 a) the following changes occur during rest: repairs fatigue or exhaustion, thereby increasing the general resistance of the organism to infection and other noxious agents; decreases the strain on the heart and blood vessels;

diminishes the energy output and thus also the required caloric intake; quiets the nervous system, thus tending to relieve excitement; heightens reflexes and often spastic states; diminishes the motion of the affected part or parts, thereby averting possible strain and injury.

Effect of Prolonged Rest on Muscle.

It has been long observed that muscular wasting associated with bone or joint disease is more rapid and extreme than that which occurs with simple disease of a limb. In the former, visible loss of substance may be seen in a day or two. It is quite definite also that there is a more rapid and extreme wasting in limbs immobilized to correct a deformity.

The oxygen consumption of muscles, according to Harding (1926), wasted as a result of arthritis is definitely increased above normal; whereas that of muscles wasted from pure disease is unaltered. Further, that to produce the first type of atrophy experimentally, there must be complete integrity of the efferent nervous paths, and that the atrophy of pure disuse can be still produced even after de-afferentation at the posterior columns. There appear then

to be two quite distinct types of atrophy--one which is mainly of reflex origin, and one which is probably entirely due to imposed rest. Cuthbertson, McGirr, and Robertson (1939) believe that the reason for the rapid and extreme wasting in limbs immobilized for some inflammation or traumatic lesion, than in limbs immobilized to correct a deformity, is not in the degree of immobilization, but in a reflex trophic effect affecting certain groups of muscles more than others in the same region. Such a reflex atrophy is dependent on the integrity of the afferent paths.

Effect of Prolonged Rest of Bone.

Albright and his co-workers (1941) considers bone atrophy of disuse a special form of osteoporosis in which there is a deficiency of the normal stimulus of stress and strain for osteoblastic activity. In the studies of Allison and Brooks (1921, 1922), the amount of bony change varied with the degree of disuse, the cause of the disuse being immaterial. The effects of prolonged rest on bone, as shown by the studies of Allison and Brooks (1921, 1922), are as follows: The changes in bone which result from lack of use during adult life are such that the general

shape and contour of the bone as a whole are only slightly modified. The diameter of the shaft may be very slightly decreased. The length is not changed. The medullary canal is increased in diameter, producing a corresponding diminutions in the thickness of the cortex, which, after a long period of non-use, is reduced to a thin bone shell. The cancellous bone becomes much more porous, with fewer and thinner trabeculae after a long period of non-use; the compact bone of the shaft becomes porous.

If the onset of non-use occurs during the growing period, the process of growth will be inhibited but not arrested along with the process of bone atrophy, resulting in a marked change in the shape and contour of the whole bone. The bone is smaller both in length and thickness; the decrease in thickness is more noticeable than that in length. There may also be a difference in the shape of the cross section of the bones, comparing used with non-used; for example, the cross section of a normal used tibia is triangular in outline, while the cross section of a tibia which has not been used during the growing period more nearly approaches a circle. The lack of use of an extremity during the period of growth

results both in inhibition of growth and in an abnormally early cessation of growth in bones.

Bone atrophy has no effect on the process of bone regeneration, but the reestablishment of use during the period of growth will not result in a sufficiently increased rate of growth to make up for the loss which has occurred during the period of non-use, resulting in permanent changes in the size and shape of the affected bones. If the lack of use is during the adult period, the reestablishment of use results in only an increase in the thickness of the existing parts of the bone. Lack of use results in a complete disappearance of parts of the trabeculae of the cancellous bone, but on reestablishment of use become thicker.

Effect of Prolonged Rest on Metabolism

In the series of experiments by Cuthbertson (1929) he demonstrated that subjects in nitrogenous equilibrium show within a day or two from the commencement of a period of muscle rest, a rise in the excretion of sulfur, nitrogen, phosphorus, and calcium, in that order of priority. This loss is maintained fairly steadily for a varying period, after which it gradually declines. Cuthbertson further showed that the rise in

excretion of nitrogen is mainly due to a proportionate increase in the amount of urea. Ammonia excretion also rises, but more slowly. Creatinine and uric acid are practically unaltered. These changes are due to non-use of the body generally, and most probably to non-use of muscle and bone in particular. He concludes that when one alters the level of functional activity, there is a lag period before nitrogen equilibrium is again obtained. During this period, there is a loss of the essentially active substances, which persists until, in the case of increased muscle work, the anabolic response is equal and opposite to or even greater than the increased catabolism. In the case of decreased muscular activity, it persists until the amount of functioning metabolic substance is reduced to such a level that the catabolism is equal and opposite to the diminished anabolism. Such a change does not appear to alter appreciably the endogenous metabolism as represented by uric acid and creatinine.

It is of interest to note that Albright and his co-workers (1941) found that hypercalcinuria occurs in the early stages of disuse and may lead to renal complications, i.e. immobilization of a large part

of the skeleton in adolescent individuals may result in hypercalcinemia associated with a rapidly developing osteoporosis; this hypercalcinemia may not only lead to the erroneous diagnosis of hypoparathyroidism, but may also produce a fatal issue because of kidney damage or because of the symptoms from the hypercalcinemia per se.

In order to counteract these losses of minerals, Cuthbertson, McGirr, and Robertson (1939) fed their subjects a high caloric diet (up to 5000 calories) and of very high first-class protein content, but this failed to prevent a negative N-balance at the height of the disturbance. This suggests that part of the rise in the urinary excretion of these catabolites is probably caused by autolytic processes. These are presumably localized to the site of the injury. Following the peak of the metabolic disturbance, which is about the sixth day, the various processes declined in intensity, and in those cases receiving adequate nourishment, nitrogen, etc., retention occurred. The increased metabolic processes are more general than local, and presumably also involve loss of body carbohydrate and fat. Since certain of them can be allayed to a considerable extent

by raising the food intake, it would appear to be good clinical practice to feed subjects with fractures the maximum intake of energy-providing material which they are capable of ingesting. In addition, there are several indications for maintaining a high protein diet during the convalescent period.

The increase in calcium excretion in bed rest is perfectly enormous and it cannot be influenced by diet (Dock 1944 a). Putting the patients on a calcium free diet results in no decrease whatsoever from a level of 300 to 400 percent of the basal calcium excretion. A very favorable situation exists for the production of renal stones. At the same time, bed rest is an active mechanism for depriving the rest of the bony skeleton of calcium, therefore the patients should be made ambulatory as early as possible.

Rest and Sleep

A great deal of the work on rest has been done in conjunction with the work on sleep, which is an important form of rest, and since the various concomitants and characteristics of sleep can all (with the notable exception of the positive Babinski response and certain types of electroencephalogram

patterns) can be obtained in a waking subject under certain conditions of horizontal body position, rest, and muscular relaxation, a brief review of sleep will be given.

Requirements of Sleep

The sleep requirement of different persons varies widely. According to Kleitman (193), there is no more "normal" duration of sleep, for either children or adults, than there is a normal heart rate and height or weight. The average figure given by Best and Taylor (1943) for the amount of sleep required at different periods of life are similar to those given by other investigators:

Newborn infant---------18-20 hours
Growing children-------12-14 hours
Adults-----------------7-9 hours
Old persons------------5-7 hours

These figures have been arrived at for the most part empirically, i.e. there are the approximate averages of composite values. There is a great deal of variation as to the amount of sleep necessary for each individual. Proper care of the body, or general hygienic and dietetic measures, is all that is required

to insure the baby as much sleep as it needs (Kleitman 1939). There seems to be some difference in the amount of sleep needed by a child and depending upon his or her intelligence; for example, White (1931) states that pre-school children with higher intelligence quotients get less sleep than children that are not so bright. In older children, i.e. of school age, Terman (1925) found that gifted children slept longer on the average. It is possible that superior mental ability in younger children permits them to remain awake longer, whereas the increased mental activity of older gifted children produces greater fatigue and, therefore, greater need for recuperation at the end of a waking period.

As to a common complaint concerning undersleeping of older children, Reynolds and Mallay (1933) observed that in spite of large daily fluctuations in the amount of sleep taken by individual children, the weekly, bi-weekly, and tri-weekly averages for a child were in close agreement. In other words, over long periods, each child seems to find its own norm for the duration of sleep.

As to the amount of sleep needed by adults, that varies according to the individual differences in the

ability of the cortex to maintain wakefulness of choice (Kleitman 1939). When one says that he needs nine hours of sleep, it means that the wakefulness-maintaining power of his cortex is limited to 15 hours out of 24; and when one says that he can get along on five or six hours of sleep, his cortex can keep up wakefulness of choice for 18-19 hours. Even the same individual may at times lengthen or shorten his wakefulness of choice according to circumstances, and some people go into "sleep debt" during the week, paying it off after several days, i.e. individuals who are capable of accumulating such a deficit of rest usually find that they can return to "par" by allowing themselves one night of considerably lengthened sleep. As in all cortical activities, there are all sorts of idiosyncrasies with respect to wakefulness of choice. Sleep, as an escape phenomenon, is simply the result of boredom or too great a limitation of interests. A particular individual may be wide awake one evening and maintain a high level of sensorimotor activity on an interesting event, and uncontrollably drowsy some other evening when struggling through some uninteresting activity. There is also another important factor, that of the individual's temperament.

Lewes (1860) states that it is not the persons of active and excitable temperaments who are the greatest sleepers; it is infants, very old people, and people of sluggish, indolent, lymphatic temperaments. Laird and Wheeler (1926), in their series of experiments on the effect of six hours of sleep and eight hours of sleep, each for a duration of one week, on mental multiplication, found no significant difference in performance. If anything, the subjects showed a greater tendency to do better after six hours of sleep than after eight hours.

Effect of Prolonged Wakefulness

The effects of prolonged wakefulness have been studies on both man and animals. In an experiment by Okazaki (1925), dogs were kept continuously awake for a minimum survival of 14 days and a maximum of 77 days. The chief histological findings were changes in the cells of the cerebral cortex, producing a picture somewhat similar to that of a psychotic brain. Evans and Hartridge (1936) state that animals deprived of sleep for several days show marked changes in the nerve cells of the brain and spinal cord in that the cells stain badly, there is chromatolysis, and the dendritic processes of the cells are retracted and

knobby. The results of Weiskotten (1925) experiments on man show that loss of sleep does not seem to affect either the mental or the physical powers to any appreciable degree, unless continued to a greath length. In Kleitman's (1939) human experiments the effects of prolonged wakefulness is a poorer performance of those highest centers. The subject is more irritable and unreasonable, less reliable, less honest, and as the wakefulness continues, he may suffer from hallucinations or dreams with his eyes open. The subject may make efforts, but they are short lasting. He may do as well as normally in psychological tests that take a minute or so to perform, but breaks down in so simple a task as color naming if it has to be carried on for 10 to 15 minutes. Lee and Kleitman (1923) found a marked deterioration of the ability to stand upright after a period of prolonged wakefulness. All of these experiments involved extreme neuromuscular fatigue, calling insistently for relief through relaxation; also, staying awake was accomplished only through continued muscular activity. Sitting down made it very hard to keep awake; lying down, impossible to do so.

Experimenters are not in complete agreement concerning the time needed for recuperation after a period of prolonged wakefulness. There is a general agreement among the various workers that eight to ten hours is sufficient.

Physiological Changes during Sleep

During sleep most bodily functions are reduced to their basal levels, but all investigators do not agree to the extent to which they occur and when they occur. As to the heart rate, Wiechmann and Bamberger (1924) state that the decrease in heart rate may be as great in day sleep as in sleep during the night, and accompanied by a parallel decrease in blood pressure. Kleitman (1939) claims that heart rate is markedly slowed during sleep, more so during the night than during the daytime naps.

The lowest blood pressure is reached from one to two hours after the onset of sleep. Mueller (1921) made observations on 50 patients, men, women and children. In men, the average drop in systolic pressure was 26 mm., in women, 21 mm.; and in children 3-14 years of age, it was 6 mm. less than in adults. Brooks and Carroll (1912) conclude from their experiments that in individuals kept in bed at night, but

not allowed to sleep, the fall in blood pressure was not so pronounced, nor was it marked in sleep disturbed by pain, noise, or disagreeable dreams. Once the maximum drop had taken place, no similar drop occurred even if the individual was aroused and permitted to fall asleep again, and no matter how sound the subsequent sleep seemed to be.

There is a tendency to expansion of the intracranial contents during sleep and this tendency manifests itself in greater pressure and, when possible, in greater volume (Shepard 1914).

The blood picture shows some change after a 14-day rest period, as demonstrated by Kaufman (1926), in that there was an increase in hemoglobin, red blood cells, and lymphocytes, i.e. the shift to the left was decreased. Cooperman (1936) demonstrated a decrease in red blood cells, hemoglobin after 1½ to 2 hours of rest, and an increase in the NaCl content of the plasma. He also found that during sleep and during rest without sleep (5-7 hours), both total serum calcium and serum protein decreased with a resultant slight but consistent increase in the calcium ion-concentration of the serum. During sleep and rest for shorter periods (1½-2 hours), there is a more marked

decrease in total serum calcium but the ionized calcium remains the same. The changes found in the shorter periods of sleep were correlated with an increase in circulating plasma volume. Kleitman (1939) believes that nearly all the changes in the composition of the blood during sleep are explainable by the effect of alteration of posture. In the upright position, with an increase in capillary filtration pressure, there is an oozing-out of blood plasma devoid of protein. In the horizontal position, with a decreased filtration pressure, the fluid can return to the blood vessels, and thus increase the blood volume, at the same time diluting the constituents that cannot move freely in and out of the circulatory system. Gollwitzer-Meier and Kroetz (1924) demonstrated that blood drawn two hours after the beginning of sleep was thinner than blood drawn during the waking hours.

Slow heart action and low blood pressure could be expected to result in the production of a smaller volume of urine per unit of time during sleep and that is found to be the case. Campbell and Webster (1921, 1922) report a decrease of excretion of total nitrogen at night and a greater excretion of acid and

of phosphates. They found this to be true for sleep at any time during the day. Kleitman (1925) also found that more phosphorus is excreted in the urine per hour during sleep than during wakefulness, independently of the volume of urine secreted. This was also true for total acidity. The increase in excretion of phosphorus during sleep is due to more complete muscular relaxation and to a corresponding decrease in carbohydrate metabolism.

Basal heat production is usually decreased during sleep, concomitantly with muscular relaxation and low body temperature. It appears that assumption of the horizontal position induces a decrease in body temperature, particularly when the individual experiences muscular fatigue and is inclined to relax. Most of the temperature changes occurring during sleep may be due to muscular relaxation, vasomotor adjustments following the assumption of the horizontal position, and the diurnal body temperature curve.

The diurnal body temperature curve is highest in wakefulness and lowest in sleep. The nature of the temperature rhythm is not yet understood, but is is probably linked with changes in muscle tonus, themselves depending on activity of the cerebral cortex.

We may be dealing here with an autogenous vicious cycle, repeated every day according to Kleitman (1944). Muscular action on getting up in the morning awakens the subject and thus increases the cortical activity, which in turn augments muscle tonus, raising the body temperature and further stimulating the cerebral cortex. This goes on until muscular fatigue favoring relaxation reverses the process and sends the body temperature on its downward course.

Other changes that occur are increased thresholds for somatic reflexes, constriction of pupils, and the eyeballs are turned upwards and outwards. The knee jerk is abolished, and a positive Babinski is present due to a functional break between the cerebral cortex and the other parts of the nervous system (Kleitman 1939). The secretion of sweat glands is considerably increased; lacrymal and salivary secretions are reduced. As to the effect on the gastro-intestinal tract, the concensus of opinion seems to be that there is a normal or greater gastric motility, a greater acidity, and a smaller secretion during sleep. The intestinal movements do not seem to be changed in sleep. They are absent in sleep if absent in the waking state, and vice versa.

Motility during Sleep

Most individuals change their position dozens of times during a single night's sleep. There is no best position in which one should sleep. In changing his position, the sleeper is half-awake, although he usually does not recall the fact. Too frequent changes in posture may have a disturbing effect on sleep, while maintaining the same posture for too long a time may lead to discomfort or pain from pressure effects on various parts of the body. Experiments at Mellan Institute also demonstrated that restful sleep occurred when the subject moved quite frequently during the night. The type of sleep in which, for some reason, such as experimental stupor or unusual fatigue, the subject hardly moved, was not usually followed by the sense of refreshment in the morning. The business of moving the legs about every seven minutes or so, as many of the normal subjects do, may not only relate to the maintenance of vascular flow but also to the carrying away of products, such as lactic acid, which might accumulate in muscle and which, if long continued, might lead to mild degenrative changes. Gidding (1934), on his work on the child's sleep, found that no two children have the same sleep curve.

The first hour in bed is the most active hour, and the next most active hour is the last regular hour of sleep. In a vast majority of children, the quietest sleep is reached the second 30 to 60 minutes after going to bed. Also, females are sounder sleepers than males; not only do they get to sleep more quickly, but they sleep more quietly throughout the night.

Relaxation as a Means of Obtaining More Complete Physical and Mental Rest

Many patients do not know how to rest. In consequence of repeated but futile efforts to get relief through the doctor from restlessness which is usually brought on by distress, tense muscles, worry, impatient or otherwise active mind, the individual will often turn to pseudo-religious cults, medical quacks or charlatans. Measures that are employed to promote sleep and relaxation are prolonged tepid baths, general massage, warm drinks, quiet, fresh air, suggestion and persuasion. By far, the most general and popular agents employed by physicians to induce rest are the various drug sedatives. Jacobson (1930 a) has shown that relaxation can be cultivated and has demonstrated a method, which he calls progressive relaxation, that

will result in differential and more complete relaxation. This method consists of the cultivation of voluntary continued reduction of contraction or tonus, or activity of muscle groups, and of motor or associated portions of the nervous system. This will result in differential relaxation, i.e. the absence of an undue degree of contraction in the muscles employed for an act, while other muscles not as needed remain flaccid.

Various differences exist between complete rest which can be cultivated and the more common forms of incomplete rest, called ordinary rest. Some of these differences are: the metabolic rate is lower in the same individual under otherwise identical conditions, if the skeletal system is approximately at zero tension; the knee jerk (as well as any other reflex) is decreased or altogether absent during the time when relaxation is approximately complete; the organism is quieter as a whole and in its parts; mental activity, including emotional states, dwindles or disappears with advanced general relaxation.

Progressive relaxation (Jacobson 1930 a) is indicated as a specific form of treatment in the following conditions: acute neuromuscular hypertension

(nervousness or emotional disturbance); chronic neuromuscular hypertension (neurasthenia and functional neuroses, i.e. phobias, tics, habit spasm, insomnia, stammering and stuttering, emotional unbalance, and heightened reflexes without organic derangement); psychic phases of neuromuscular hypertension including worry, anxiety, hypochrondria, and psychasthenia; states of fatigue and exhaustion; states of debility; sundry preoperative and postoperative conditions; toxic goiter; disturbances of sleep; alimentary spasm including mucous colitis, colonic spasm, cardiospasm, and other esophagospasm; chronic pulmonary tuberculosis; and vascular hypertension. Since relaxation is the intensive form of rest, we may assume that it will be indicated as a rule where rest is indicated.

Muscular rest, if complete, necessarily includes mental rest. Mental rest is most important in the accomplishment of local rest and healing. Mental tension from fear, excitement, anger, and resentment may make local rest or muscular relaxation impossible. Under appropriate conditions of laboratory investigation, Jacobson (1930 b,c) found that in every instance of transient imagination, reflection and other mental activity, it involves specific acts in one or another

group or groups of muscle. Mental activities, including emotional states, evidently depend on presence of residual and other forms of slight contractions in the skeletal musculature, particularly including the muscles of the ocular and speech apparatus. As relaxation of these points advances, it is found clinically that rest apparently becomes most effective. Mental rest accompanies physiologic rest according to this physiologic procedure and this may be one reason why general advanced relaxation proves restorative.

Relative Rest

Relative rest is obtained by mere change of occupation as by introduction of diversity into the occupation or activity. Change and diversity give rest to faculties that are exhausted and stimulation to others that are insufficiently used. The greater the contrast between the kinds of work, the greater is the advantage gained.

CLINICAL ASPECTS OF REST

Rest has been used by man in medical and surgical treatment since history began. It was nature's method for relief of pain and continued trauma when other methods of treatment for the promotion of healing were unknown.

The principles of rest have been more extensively studied and practiced since the time of John Hunter (1728-1793), who prescribed rest as a routine measure in the treatment of disablements of the motor system of the human body. John Hilton (1807-1878) regarded rest as the most powerful aid which the surgeon could bring to the aid of disordered tissues. Hugh Owen Thomas (1834-1891) made rest his creed and ritual.

As previously mentioned, the writings up to the present century have been largely discoursive in nature, and relatively little research work has been done up to the present time on such an important therapeutic agent as rest.

The various clinical aspects of rest will be discussed but just in those branches of medicine in which the use of rest has been studied. When the medical profession as a whole grasps the significance of these studies, more intensive work will be done

and the use of it in all branches of medicine will be made.

SURGERY

In the early period of abdominal surgery, great attention was paid to the physical quiet of the patient and rigid measures were adapted to insure immobility, both active and passive, as essential to the best result. Experiments since have demonstrated the needlessness and injury of such extreme restriction. Then, and too often now, no latitude was given to the inclinations of the patient, but rigid immobility was ruthlessly enforced. After the operation, the patient was placed flat on the back, the hands kept under the blankets, the head lowered to the level of the body, and the legs were maintained fully extended. This was a refined specimen of cruelty, needless and injurious, and only equalled by Treve's deadly thirst considered as essential to the highest changes of recovery after abdominal section (Chase 1908). In these early days of modern surgery, patients were kept in bed after clean celiotomies and herniorrhaphies for periods of three weeks or more. Immobility of the wound was felt to be so important

that plaster spicas were applied after herniorrhaphies (Bloodgood 1898). Even today, such prolonged periods of enforced bed rest are not unheard of; in fact, it is still very common (Henriksen 1941). Billroth unquestionably held to prolonged bed rest as essential to wound healing, and it was probably he who most greatly influenced modern American and European surgeons. The present attitude of the majority toward this problem is shown by a statement by Pool (1913) that a fairly prolonged stay in bed after celiotomy usually from one to two weeks is recommended by most surgeons, largely that the coapted tissues may unite firmly before considerable strain is allowed to bear on them. This traditional period of prolonged rest after operations in our present day is also reflected by the writings of Cutting (1932) who recommends 12 to 14 days in bed in uncomplicated cases, and longer in elderly patients and in complicated cases.

The most violent break in traditional postoperative care had its inception in the chance observation of Emil Ries (1899) in Morrisoni's clinic of a patient who had a wound which healed well in spite of the patient's having walked across the room the night of

operation. Ries began to get patients up out of bed in 24 to 48 hours after vaginal hysterectomies and soon extended the method to celiotomies.

About this time, Kümmell (1908, 1909) of Hamburg was practicing and strongly advocating early postoperative walking. The method received rather general acclaim in Central Europe. The use of the method spread throughout all Europe, and was reported from Africa (Marty 1934) and South America. Except for the Central European Clinics (1908 to 1912), and with notable exception of Paul Claremont's (1922) clinic in Zürich and Schumacker's at Giessen, university clinics have had no part in the development or evaluation of early postoperative walking.

Andre' Chalier (1934) of Lyon has done much to popularize early postoperative walking in Latin countries. He considers this to mean getting patients out of bed from the second to the fifth day postoperatively. In contrast to him, Havlicek (1935), Mermingas (1930, 1939), and Paschoud (1938) among others have, by their example and publications, advocated what is called immediate arising, that is, walking from the operating table back to the room and continued activity out of bed until discharged.

This method now has a fairly wide following (Ricci 1936, Gautier 1937).

It is of more than passing interest that this method of early mobilization of patients after operation was forced on one surgeon (Backer-Grondahl 1939) by lack of adequate bed space in his hospital, and on another (Marty 1934) by the spontaneous adoption of it by his patients.

In this country, Kelly reported in 1911 that Ries' example had been followed by others too numerous to mention. A reaction away from and disillusionment with the method of early rising were inherent in the prevalent gross technique involving the use of coarse catgut and running sutures. Many surgeons are still keeping the tradition alive in our present day even though the trend is towards acceptance of this method in general.

Definition

An arbitrary temporal limit for early postoperative walking may be said to mean walking within the first 24 hours postoperatively. The rationale for this time limit lies in Henle's demonstration, in 1900, that pulmonary complications occur largely within 48 hours (Tondeur 1937) after operation, and the

belief that other complications appear or have their silent inception within a few hours after the operation, if not during the actual operation itself, and other observations which will be given under advantages of rest. The daily postoperative continuation of bodily activity, including walking, self-care in matters of toilet, dressing, and feeding, and even actual gymnastics according to some investigators is considered an integral part of a regimen directed toward an uncomplicated and rapid convalescence. In those cases, in which early postoperative walking was contraindicated, deep breathing and leg exercises in bed are substituted for it by most of those who have written on the subject.

Procedures and Results

Few of the procedures used by the various investigators and the results will be given.

Claremont (1922) in Zürich worked on the principle that the patient should be out of bed at the earliest possible moment after operation. The routine that he used in most of his cases is as follows:

1. Seat the patient out of bed in a chair for one-half hour on the day following operation.

2. On the second day have the patient walk the length of the room and sit out for a longer period, or it may be for a short period twice a day.

3. Thereafter, the daily distance walked and the length of time out of bed are increased.

4. Stitches come out on the sixth to seventh day and the patient walks out of the hospital on the tenth day.

This routine was employed irrespective of the size of the operation wound or the nature of operation. The abdominal wounds were sutured very thoroughly. With the exception of the peritoneum, all layers were sutured with very closely placed interrupted stitches, catgut being the material usually employed.

Representing conservative procedure is that of Rowland (1922) who depended a great deal on the inclinations of his patients, but he would left them move as much as they liked in bed from the first, have the freedom of the room after four days, of the bath after seven days, and take short walks or drives in the open air after ten days. In gastro-jejunostomy and active duodenal ulcer, Rowland believes that prolonged convalescence and dieting for two to three

months are necessary to ensure permanent healing of the ulcer and stoma, but only the first few days of this period need be spent in bed. The greater part can be passed more profitably in the open air, taking gradually increasing exercises, just short of fatigue, so that the patient becomes strong and well before he returns to work, about three months after the operation.

In the methods employed by Robertson (1927), patients hardly knew that they had been ill because of the rapid convalescence. According to him, the majority of appendectomies can safely be out of bed in 24 hours, walk with comfort on the second day, and go home on the third day. Many of his gastroenterostomies and ulcer perforation cases leave the hospital fit and walking well on the tenth day following the operation.

The studies of Leithauser and Bergo (1941) show that patients who were active on the first postoperative day had the most favorable convalescence. The procedure he used is as follows: After the operation the patients were turned frequently in bed and were instructed to be active and to take deep breathing exercises at regular intervals. On the first

postoperative day, provided conditions were satisfactory, they were assisted in sitting on the edge of the bed (after assuming the right lateral position) and then in standing beside the bed for deep breathing exercises. While in each position, they were instructed to take several deep inhalations and were urged to cough. This procedure seldom failed promptly to clear lungs of accumulation of mucus. After this was accomplished, they were permitted to walk about the room and to sit in a chair for a few moments, and then they returned to bed. On returning they sat on the edge of the bed and reclined on the right shoulder. These sitting-up and ambulatory exercises were always first carried out under supervision. Such exercises were then repeated during the first postoperative day with the assistance of a nurse, and thereafter the patients were encouraged to increase their activities voluntarily. They left the hospital by automobile and routinely presented themselves at the office for the first dressing on the sixth postoperative day, light work on the eighth day, and heavy manual labor on the fourteenth day. In his 370 cases of appendectomies, the average period of confinement was 1.5 days and the average period of hospitalization was 2.3 days.

In 66 other major surgical procedures, the average period of confinement to bed was 1.9 days and average postoperative hospitalization was 8.9 days. All abdominal incisions were closed with continuous double 0 chromic catgut for the peritoneum and the posterior fascia, and one or more interrupted buried sutures of steel wire with a continuous suture of double 0 chromic catgut were used for the anterior sheath.

In a recent investigation by Powers (1944), he observed the postoperative convalescence of 100 consecutive patients who were allowed to sit in a chair and to walk on the first day after major operations, and compared these studies with similar observations of an equal number of consecutive unselected patients who remained in bed for the traditional period of ten to fifteen days after operations of the same type and magnitude, such as hernioplasty, appendectomy, cholecystectomy, choledochostomy, and abdominopelvic surgery. The mean age of the total group of 100 patients who were permitted to sit in a chair and to walk on the first day after operation was 43.4 years. The age of an equal number of control patients was 38.7 years; this group averaged 12.7 postoperative days in bed. The ambulatory patients spent

10.3 days in the hospital, while those who followed the traditional convalescent program averaged 16.1 days. The average period of convalescence after early activity was 5.7 weeks; after traditional postoperative management, 10.3 weeks. These figures indicate that, by the elimination of deconditioning secondary to a period of ten to fifteen days of recumbency following major surgery, the patient may return with comfort and safety to his usual occupation four and one-half weeks earlier than has been customary when traditional routine is followed. As to postoperative complications, there were 17 among the hundred patients who were out of bed on the first day and 46 among the same number in the unselected control group. There were no apparent contraindications in this study for early rising.

Nelson and Collins (1942), in their cases of hysterectomies, appendectomies, and umbilical herniaplasty, allowed the patients bathroom privileges within the first 24 hours after surgery. Those patients who did not walk on the evening of the operation were escorted to the bathroom the following morning, remaining ambulatory thereafter. They used early ambulation due to previous incidents of pulmonary

embolism and thrombophlebitis. As with all the other careful investigators, they had no wound infection, or wound disruption, or incisional hernia.

In the present war, early ambulation is being forced upon many surgeons due to circumstances as seen in the report of Sparkman and Williams (1942), who had their patients out of bed on the second and third day following operation because of their fear of increased incidence of postoperative pulmonary complications arising from the nature of the accomodations. An analogous situation exists when it is necessary for soldiers who have been operated upon in the field of combat to be evacuated considerable distances by motor over rough terrain to hospitals in the rear echelons. No ill effects of any sort were observed from early ambulation.

It is gratifying to note that our hospital will not be the last in making advances in the use of rest as a therapeutic agent. The Gynecological Department within the last year has cast aside the traditional rest period after operations and are allowing their patients to dangle their feet on the second postoperative day, sit on the third, and walk on the fourth. This still does not conform to Newburger's definition

of early rising but they have a modified form of it, and are having excellent results. As far as the other departments are concerned, it is tragic to see in this day of modern medicine adult patients and especially elderly patients forced to bed along with all the evils of bed rest when they could be comfortable in convalescent chairs or up and around and occupied with useful things to do in order to maintain the normal physiological fundtions and a healthy mental attitude.

Advantages of Early Walking

The controversy relative to the advantage and alleged dangers of early postoperative walking, inaugurated by the publication of Ries' paper in 1899, continues. Since then an evolution in the regimen has resulted in emphasis being placed on getting the patient out of bed and walking within one to twenty-four hours after celiotomy or herniorrhaphy. This change is due to the gradual realization that bed rest, especially in the first few days, is a veritable breeding place for complications.

It is recognized that the mere fact of lying in bed for any considerable number of days produces in itself an illness, both mentally and physically, even in a normal individual, without any such complication

as the addition of an operation. The mentality of the patient becomes impaired by the monotomy of the existence and by the complete dependence on others, while on the physical side degeneration of function rapidly follows as the wasting of muscle and the disturbance of intestinal and other activities.

The various specific advantages are as follows:

1. Asthenia is avoided. This has impressed all who have used the method. A representative statement is that by Boldt (1907) who states that there is less weakening of the general physical condition of the patient and a more rapid recovery to working ability. The need of massage and passive exercise will be eliminated as getting up early prevents loss of power and wasting of muscles (Rowland 1922).

2. Morale of the patient is greatly lifted by the feeling that since he is up and leading a relatively normal life, the dangers of the operation and the discomforts of the postoperative period are over or have been unduly exaggerated.

3. Economy, both to patient and hospital, is attained through the more rapid convalescence, discharge, and return to work and through reduction of the needed nursing personnel and the more efficient

use of bed space, all resulting in simplication of postoperative care.

4. Pulmonary complications are reduced four to five-fold (Salischen and Aisiks 1936). Leithauser and Bergo (1941) suggest the possibility that certain pathologic reflexes originate from the area of mechanical and chemical injury and impair respiration by limiting the excursions of the thoracic cage. This in turn delays the capillary circulation in the lungs and the return flow in the vena cava and the portal system, and also favors the accumulation and the retention of bronchial secretion. McMichael and McGibbon (1939), on the basis of their work on respiration, estimated that in the recumbent position, the total volume of air in the lung is decreased by 340 c.c. on the average, and the total volume of blood in pulmonary vessels is materially increased. Khromav (1936) reported that those of his patients who were confined to bed for four to six days after appendectomies had a temporary reduction of vital capacity of from 38 to 48%. Further, Coryllos (1930) believed that recumbent position decreased the efficiency of the cough reflex. All the above mentioned conditions play some role in the etiology

of postoperative atelectasis and pneumonia. The volume of tidal air, tension of oxygen in the alveolar spaces, oxygen saturation of arterial blood, and the depth and rate of respiratory movements are increased by exercise. Hence, early postoperative walking is of definite therapeutic value in the prevention of pulmonary complications.

5. Demineralization of bones and atrophy of muscles, so common after prolonged periods of rest in bed, are entirely obviated.

6. There is a reduction of adhesions (Polichetti 1933). Boldt (1907) states that there is earlier peristalsis which makes intestinal adhesions less likely than in patients who are kept in the recumbent position. Ries (1899) believes that a well filled intestinal canal and regular peristaltic motion, far from being detrimental, are really the only reliable means of breaking up old and preventing new adhesions from forming postoperatively. Rowland (1922) states that undue adhesions of the viscera to each other and to the parietes, and of the various layers of the abdominal wall to each other, can be very largely prevented by early voluntary movements.

7. Postoperative dysfunction of the gastrointestinal tract is uncommon when early convalescent activity is permitted. There is absence of hollow viscus atony, abdominal distention, nausea and vomiting, and early occurrence of spontaneous action of the bowels, making the use of laxatives, enemas and rectal tubes seldom necessary. Likewise, the bladder function is restored early, thereby avoiding the use of catheterization. Liberal diets can be allowed within 24 hours if the patient is up and has regular bowel movements (Ries 1899). According to Powers (1944), regular diet may be accepted on the fourth and fifth postoperative days.

8. Celiotomy and herniorrhaphy wounds heal more benignly and rapidly with the motion of early postoperative walking than with immobilization (Newburger 1943). The findings of Newburger confirmed the early views as to the stimulating effect of functions on healing. An explanation of the increased tensile strength of the wound caused by exercise at so early a period as the fifth day must be based on a shortened lag period or, conversely, a more rapid initiation of the period of fibroplasia. There is a latent period of about four days before the growth of

fibroblasts becomes appreciable in terms of tensile strength. Howes (1933) found new fibrils of collagen within two days in wounds sewed with silk and in three days with catgut. Immature collagen fibers are the only available agent for increased strength as early as the fifth day. Cathcart (1929), in his experiments, obtained good evidence to a definitely enhanced metabolism of protein as the result of muscular activity. Rowland (1922) claims that complete rest is unnecessary and even harmful by interfering with general and local circulation and nutrition. Gentle movements of wounded soft parts do not hinder but help the process of healing.

The tragic experiences of some of the early surgeons, as described by Koenig (Madelug 1905), in that they had a high incidence of incisional hernia and evisceration after early ambulation, was undoubtedly due to inaccurate suturing of, or drainage through, the wound. This era lasted roughly till the beginning of the Eighties. Since that time, those who have used early postoperative walking have found no resulting deleterious effects such as increase in incisional pain, dehiscence, or incisional hernia. But these surgeons all stress the importance of

secure, accurate apposition without tension, and the need of scrupulous attention to hemostasis as well as to other surgical fundamentals.

9. A reduction of thrombosis and embolism is claimed by a vast majority of the investigators. The most important factor in the formation of thrombosis is felt by many to be the decreased rate of venous return, and this is affected by early postoperative walking.

According to the experiments of Smith, Allen, and Craig (194), exercise of the legs decreases the circulation time in the legs, and it is approximately twice as effective as elevation of the extremities.

After operation, the circulation time from the foot to the carotid sinus is usually increased after the fourth postoperative day, i.e. blood flows more slowly (Smith and Allen 1944). Leithauser and Bergo (1941) believes that pathological reflexes originating from the area of mechanical and chemical injury initiate a delay in peripheral circulation by producing vasospasm and capillary dilatation which lends to complications, and that strict confinement to bed favors the development of such complications. Ochsner and DeBakey (1939) have demonstrated by means

of plethysmographic tracings that vasospasm is present in cases of thrombophlebitis and that it can be relieved by infiltration of the paravertebral ganglions with procaine hydrochloride.

Various blood changes take place after operations that influence intravascular coagulation (Allen 1927). The sharp constant increase of fibronogen following operations is probably the most important change. There is also a postoperative increase in the number of leukocytes and a prolongation of the prothrombin time, the interpretation of which is obscure. The change in the number of erythrocytes may indicate widespread vasomotor disturbances, which definitely influence intravascular clotting. Curiously enough, the number of platelets, the cholesteral, the bleeding time, and the coagulation time do not show definite changes.

The previous mentioned conditions which are conducive to thrombus formation can be obviated and shortened by early ambulation. Other methods to decrease venous stasis and the incidence of thrombosis by position and exercises in bed have not been universally successful, as illustrated by the results of Barnes (1937), who found that after the use of measures

directed at the prophylaxis of thrombosis and embolism, such as active and passive leg exercises in bed, massage of lower extremities, and deep breathing, pulmonary embolism, over a ten-year period, still accounted for 5.8 percent of surgical deaths despite efforts at prevention. Early postoperative walking does not entirely circumvent the occurrences of thrombi and consequent emboli in all cases. In these fatal cases, the preoperative existence of thrombi cannot be excluded, nor the fact that the embolism might not have as readily occurred on the operating table as after early postoperative walking. In most of these cases, early ambulation would obviate the liberation of emboli of sufficient size to precipitate a fatal postoperative catastrophe. A thrombus of this magnitude does not usually develop in an active venous circulation.

According to Dock (1944 a), Swiss and German pathologists have given us excellent data on the etiology of these accidents and their relation to bed rest. Autopsies with complete dissections show that 30 percent of all hospital cases, ages 17 to 90 years, have thrombi in the veins of the calf of the leg; in adults who have been in bed two weeks or

longer, the incidence reaches 60 percent, while nearly all show necroses and inflammatory reaction in the calf muscles, which apparently initiate the process. In 10 percent, thrombi are found only in the veins of the foot, and none are ever found in the dorsum of the foot. Only two percent have thrombi in the hypergastric or iliac veins without clots in the legs. The incidence of thrombi goes up with age, doubling after 40 and again after 60. Von Jaschke (1926), with an extensive statistical background, claimed that postponement of early postoperative walking from the second to the third postoperative day increased the incidence of thrombosis. All things considered, early ambulation is of definite prophylactic value and is worth extensive adoption.

Early rising and ambulatory activity after surgical operations on the abdomen are contraindicated if there is undue rigidity of the abdomen, undue intestinal distention, or severe shock, severe anemia or cachexia, hemorrhages, suppurative conditions, or an insecure wound, as well as prolonged preoperative bed confinement. Paralytic ileus and severe shock as a rule occur early, usually within 24 hours after operation. It is usually after this 24-hour period

that atelectasis, pneumonia, thrombophlebitis, embolism, and the detrimental effects of anoxia and toxic-retention in the vital organs occur; it is during this intermediate period that early rising and graduated ambulatory activity should be instituted. The patient may be ambulatory with a Wangensteen tube in position or even a stab wound with a drain, such as is commonly practiced after cholecystectomy (Newburger 1942).

HEART DISEASES

Within the past three decades, there has been developed a tendency to regard prolonged rest in bed and complete abstinence from normal economic activity as the sine qua non of the proper management of the more serious forms of heart disease. During the eighteenth and nineteenth centuries, while the basic framework for our present understanding of heart disease was being fashioned, little emphasis was placed on the desirability of rest as it is now employed. Heberden, in 1802, cites in his writings a patient with angina pectoris who set himself the task of sawing wood for half an hour every day and was nearly cured. Similarly, Stokes in 1854 utilized

graduated exercise for patients with various cardiac disabilities. John Hunter, a famous physician in the eighteenth century, had myocardial infarction for approximately 20 years, during which time he continued to be active, did much of his best work, and apparently never remained in bed for any long period of time. Sir James Mackenzie, the father of modern cardiology, had angina of effort and myocardial infarction for approximately 18 years during which time he led an active and useful life and never spent more than a few days in bed at any time. Since that time, and especially within the past 30 years, there has developed a strong tendency for prolonged rest in bed for the various cardiac diseases. Evidence will be presented under the various heart conditions to show that rest as a therapeutic agent should be used only as long as it is absolutely indicated.

Congestive Failure

At the present time, there is no agreement in the literature as to the length of time patients should rest after evidence of congestive failure has disappeared, or as to the advisability of exercise in convalescence. Pratt (1920) advocates prolonged rest in

bed for heart failure; likewise, Davis (1938) recommends prolonged bed rest, the length of which depends upon the duration of cardiac failure. Other investigators and especially those of the present time as Levine (1944), White (1944) are recommending a reduced period of bed rest because of the harmful effects of recumbency. Williams and Rainey (1938) suggest that the initial period of complete rest should be reduced because in a large number of their cardiac patients, pulmonary infarction and pneumonia were found to be the cause of death, and according to Dock (1944), pulmonary emboli are very common.

In general, rest obtained by putting a cardiac patient to bed decreases the basal metabolis, slows the heart rate, and may lower blood pressure. All this decreases the work on the heart. Recumbency encourages venous return, increasing rather than decreasing the work of the right side of the heart, giving rise to pulmonary congestion and resultant breathlessness if the left ventricle can not keep pace. In other words, bed rest, for a while, may impose greater rather than less work on the heart.

It is known that normally (McMichael and McGibbon 1939) there is a decrease in total lung volume

of over 300 cc. and a decrease on the vital capacity of the lungs of about 200 cc. in the recumbent position. Very likely these figures are greater for patients already suffering from pulmonary congestion. These changes must indicate an increased congestion of the pulmonary vessels. Not only is the limited breathing space further reduced, but the congestion of the lungs acts as a trigger mechanism through reflexes in the production of paroxysm of dyspnea.

On assumption of the horizontal position in normal individuals and patients with cardiac asthma, there is a decrease in serum concentration and slight increase in venous pressure. This flow of fluid from the tissue spaces into the blood stream is obviously deleterious to cardiac patients, and when there is a tendency to dyspnea from left ventricular weakness as from serious mechanical obstruction of mitral stenosis, serious pulmonary edema may result. The serum protein was also found to rise toward the normal levels in patients about 15 minutes after the attacks of dyspnea were over.(Perera and Berliner 1943).

In placing an ambulatory cardiac patient to bed, pulmonary rales and hydrothorax previously absent quickly appear. Fluids in the legs may be unsightly

but does comparatively little harm, whereas fluid in the lungs is a dangerous handicap. There is also a shift of fluid to the upper portions in recumbency, resulting in extensive edema of the lower part of the back. The reason that harmful results from strict bed rest are not encountered more frequently is that in most cases the beneficial effects of rest, diet, and medication outweigh the harmful effect of posture (Levine 1940). In peripheral edema, engorged liver, and no threat of pulmonary congestion or dyspnea, recumbency will aid in diminishing right-sided failure.

Other difficulties that may follow prolonged bed rest, both in cardiac and in non-cardiac patients (Levine 1944), are as follows:

1. In elderly men, urinary retention from atonic bladder and prostatic obstruction may first develop after confinement to bed. This may necessitate catheterization, resulting in infections and other complications.

2. Hypostatic pneumonia.

3. Thrombophlebitis of legs, with subsequent pulmonary embolism.

4. Pulmonary embolism following venous thrombosis in obese and orthopneic individuals.

The various therapeutic implications that follow from the above known facts are that severe cardiac patients, especially those with nocturnal dyspnea, should not be kept flat in bed until active cardiac treatment has been well advanced in improving the circulation. During these early days, they may sit in a chair and should be urged to exercise their legs or take short walks in their rooms several times daily. The bed in which they sleep should slant downwards from head to foot. This can be accomplished by placing nine-inch wooden blocks under the headpost of the bed. At times, it is even wise to take a critically sick cardiac patient with severe pulmonary edema deliberately out of bed and place him in a chair with his feet hanging down. The purpose is to shift the fluid from the lungs to the legs. Also, cardiac as well as non-cardiac patients, who are confined to bed for any appreciable length of time should be instructed to exercise their legs frequently or to have massage of the legs to prevent venous thrombosis of the legs and pulmonary emboli.

The present day treatment which takes into account all the evils of bed rest is reflected in the principle used by White (1944)--it is important to

allow a patient with heart disease but without failure to take as much exercise as he reasonably and safely can, with periods of rest as needed, because it is physical exercise that helps to maintain a state of general good health; undoubtedly, the proper functioning of the peripheral circulation and of the diaphragm resulting from reasonable exercise aids the heart in its work. The most practical exercise is walking, and this is also uniformly satisfactory; it can be graded easily by three factors: distance, speed, and slope (hill climbing). Other mild exercises, like easy golf and croquet, may be encouraged at times.

Angina Pectoris

Rest in bed has long been advised as a treatment for severe angina. There is general agreement that rest is of first importance in angina of myocardial infarctions, but its effects in angina of effort have never been closely investigated, and the literature is vague about the results achieved. Osler, in 1910, stated that ordinary high-pressure business or professional men suffering from angina pectoris may find relief, or even cure, in the simple process of slowing the engines. He also advised absolute rest in

bed when attacks recurred often and were severe. Allbutt (1915) further stressed its value in obstinate cases and cited one of his own patients whose attacks ceased after resting in bed for five months. Gabergritz (1927) advised that rest in bed should be reserved especially for those patients in whom angina was associated with high blood pressure, though he did not give supportive evidence. Romberg (1929) mentioned the importance of complete rest in bed whenever the attacks were severe and that exertion should only be resumed gradually one or two weeks after the attacks ceased. Saca (1915) said that although most authors advised one to two weeks of absolute rest, this was necessary only in severe cases. Brooks (1930) recommended that severe cases should remain at complete rest until they were able to sit up without enduring pain. Sutton and Lueth (1932) say that rest in bed is not indicated in angina pectoris and that it may be harmful. Hoyle and Evans (1934) recommend complete rest in bed for two to six weeks for patients with angina of effort, when the attacks have not improved or are becoming worse in spite of treatment. The modern treatment of angina is seen in Harrison's (1944) statement that rest in bed for more than a day

or two at a time probably has no place in the treatment of angina pectoris except in those patients who are especially liable to develop in the immediate future myocardial infarction, as indicated by increasingly frequent and prolonged attacks at rest. Dock (1944 a) claims that some patients with angina have attacks chiefly when recumbent. When sitting up leads to accumulation of much edema in the legs, it may also predispose to such attacks on lying down when the fluid shifts back into the blood stream, resulting in pulmonary edema; also, these attacks occur when night brings on its normal antidiuresis, acidosis, fall in blood pressure and possibly in coronary flow. In these cases, the longest periods of sitting should be in the morning.

Myocardial Infarction

In many places it is the custom, whenever the diagnosis of myocardial infarct is made, to order the patient to bed for six weeks. Such a custom, according to Dock (1944 a), is almost as illogical as the bleedings and purgings of previous generations. If a patient is afebrile, and if he enjoys sitting up, there is no physiological basis for having him lie in

the most unphysiologic posture known, namely, the recumbent for six weeks.

The view of Bradley (1942) that the healing process of coronary infarction is not complete in one or two months, the usual period of bed rest advised, and in the absence of infallibility in determining the severity of the infarction, a minimum of three months' bed rest is recommended; and the view of Master (1935) that six weeks of bed rest, which lowers the basal metabolism and decreases the work on the heart, is necessary to form adequate collateral circulation around the infarcted region, can be questioned because the cardiac work per beat is probably no greater and may be somewhat less in the sitting than in the recumbent posture. The decline in blood pressure in the recumbent position is usually counterbalanced by the increased stroke volume. Also, rigid restriction of activity reduces flow of blood to a minimum and may tend to favor development of thrombi, either in the venous system with subsequently pulmonary infarction or in the arteries, and more especially in branches of the coronary system other than the ones originally affected. Hence, both pulmonary infarction and a second myocardial infarction are frequently

observed in patients subjected to unusually prolonged and rigid rest. Harrison (1944) observed that the incidence of postinfarctional cardiac neurosis is decidedly greater in those subjects who have been kept in bed for several months, and therefore from the psyche standpoint, there is a definite disadvantage in the enforcement of a rigid regimen after the acute phase of the illness has subsided. He suggests that following myocardial infarction, recumbency should not be prescribed for a longer period than two to three weeks after the more acute and alarming symptoms have subsided. The recumbent position should not be enforced on patients who are more comfortable sitting. Other things being equal, it would appear wise to allow elderly patients out of bed sooner than younger ones.

Essential Hypertension

The high blood pressure in essential hypertension can be reduced by cultivated relaxation (Jacobson 1940). Blood pressure generally increases during moments of emotion and is attributed to generalized increase of skeletal and visceral muscular tension, which are definitely measurable in action-potentials. When action-potentials from skeletal and other muscles

characteristically exceed the normal, the term neuromuscular hypertension has seemed appropriate. Excessive neuromuscular tension tends to maintain an elevated blood pressure even in normal individuals. Action-potential studies have indicated that both systolic and diastolic pressure are functions which vary within limits with the magnitude of contraction voltages in the skeletal musculature.

Relaxation is not only profitable in this type of essential hypertension but also useful as a therapeutic measure for relative high blood pressures.

In all patients with severe forms of heart disease, activity should be kept below the symptomatic threshhold, i.e. should be less than that amount which induces dyspnea or pain.

PULMONARY TUBERCULOSIS

Rest is to the tuberculosis patient as oil is to the waves of the storm-lashed sea. It not only keeps them flat, but is a compelling force for quietness, bodily and mental relaxation. Deittweiler was the first to keep the febrile consumptive on absolute rest and to prescribe rest on reclining chairs in the open air. Kretzschmar of Brooklyn (1888), Trudeau

(1895), and Minor, inspired by Deittweiler's works, introduced his method in this country; but the foremost advocate of intensive and prolonged bed rest is Pratt of Boston. At the present time, most investigators are agreed that the best results are obtained by the use of strict bed rest and a supplementary form of rest, as collapse therapy at the onset followed later by graduated exercise and proper adjustment to their condition.

Rest is the most important single factor in the treatment of pulmonary tuberculosis. By resting, metabolism is slowed down, circulation is slowed down, absorption is lessened, toxemia is decreased, body resistance is built up, healing of the affected part is encouraged, and cure of the patient is certainly more likely; but rest is the important measure to be utilized when the patient is suffering from active tuberculosis only. Rest may be secured by voluntary body and mental relaxation on the part of the patient, or by the associated pathological processes such as pleurisy and adhesions, or by surgical procedures such as pneumothorax, phrenicectomy, and thoracoplastics (Madonna 1942). Pneumothorax or compression and relaxation of the lung, when

successfully established, enhances the influence of rest on the lung pathology in that it increases the tendency to the formation of fibrosis or healing and the localization of the disease process. In addition, it tends mechanically to bring the walls of cavities into close apposition so that they can and will heal. Pneumothorax also redeems the general toxemia by reducing the circulation through the diseased areas of the lung. In all but early and less extensively involved cases, continued rest for patients without the assistance of collapse therapy is not only wasting time but inviting certain complications such as: (Hayes 1938)

1. Bronchiogenic and hematogenous extensions of the disease and, in the less fibrotic cases, increase in the size of the cavity and the occurrence of hemorrhage.

2. Where lesions are predominantly fibrotic in type, the walls of the cavities, as well as the lung tissue around them, may become so dense that closing them satisfactorily is difficult or impossible by any procedure.

3. The fibrosis of the lung may increase and involve more or less the whole in a marked contraction

with displacement of the vertebrae, creating a definite posture and, very often, distressing pain.

4. In the presence of dense fibrosis, kinking and distortion of the bronchi take place, resulting in retention of purulent secretions.

Patients who have gone through a neglected period of bed rest only, and are later subjected to collapse therapy, are far from being well individuals. Because of the retention of pus, they are in a chronic state of toxemia and developing amyloidosis; and because of their discomfort, they are mentally depressed and discouraged. There is also a marked reduction of their vital and working capacity and they have a definitely limited endurance and fall easy prey to the acute respiratory infection.

As to the length or duration of bed rest, Madonna (1942) recommends that rest should be continued until evidences of toxemia, for example, tachycardia, temperature, anorexia and debility, have subsided for at least six weeks, followed by carefully prescribed exercises. Lynch and Howlett (1942) state that bed rest for a period of from two months to one year should be a routine procedure in every patient who has just had a diagnosis made, regardless of the mildness or even absence of symptoms.

In general, most investigators are agreed that bed rest along with a supplementary form of bed rest such as collapse therapy, etc. should be used in the majority of cases as they present themselves for treatment at the present time, but with the subsidence of the activity of the tuberculosis, a gradual increase of privileges followed by graduated exercises, and finally by adjustment of his life so as to minimize physical and mental strain. It is important that exercise be instituted as early as possible so as to increase the efficiency of the physiologic response.

Rest is not a natural status of man, although few do seem to assume such a condition with ease and flaccidity, yet there are those who to assume such a status means great exercise of will, and it becomes extremely irksome to put it mildly, especially in its inception, necessitating mental diversions for the release of energy in excess of a physiological balance. The indications for modified rest with exercise are those derived not from any one particular bit of evidence but deducted from all the evidence obtainable as to the disease status. Rest modified with exercise is of great importance

in the treatment of pulmonary tuberculosis, but according to the different period or phases in the retrogression of pathology. The various methods employed are: first, by the use of mental and cultural muscle exercise, cultural muscles including lingual, laryngeal, facial, and small muscles of the fingers, hands and possibly forearms in bedside occupational therapy, and in additional exposure in sunsuits to the air; second, in addition to the methods just mentioned, by graduated exercises of the large skeletal muscles, arms, legs, back, and so on; third, with continuation of the methods already enumerated, is added graduated occupational bedside and shop work, as well as utilizable employment; fourth, by the use of established industrial colonies, gradual increase in hours of work, and rehabilitation training activities. Graduated exercise under proper supervision is an essential and potent remedial measure, and any reaction thereto is a barometer of the patient's success in healing and localization of his lesions (Smart 1933). It is also known that one long sanatorium residence is better than repeated short ones.

COMMON COLD

In an experiment by LeBlanc and Welborn (1936) in determining the effect of rest in bed on the common cold and its course, they found that rest in bed instituted with relative promptness seemed to have some effect in decreasing the incidence of complications, i.e. complications were more than five times as frequent in the group in which a delay of 120 hours occurred before instituting bed rest.

SUBACUTE COMBINED DEGENERATION OF THE CORD

Here again not enough work had been done as to the study of rest on these patients. Farquharson (1935) has found definite improvement with prolonged rest for at least three months, accompanied by adequate liver therapy in those whose neurological symptoms are of relatively short duration and severe. Patrick (1937) also has found that the patient improves by rest, because increased tone of muscles, which gives rise to spasticity, is increased by fatigue and lessened by rest.

Here, as elsewhere, the alternating periods of rest and exercise, which is a basic behavior of life, should be instituted as early as possible, and

with gradual increase in activity but always short of fatigue.

MULTIPLE SCLEROSIS

Relapses in multiple sclerosis are intimately associated with untoward happenings in the lives of these patients, also by neglected head colds. Freeman (1944) believes that prolonged rest is one of the most important factors in the early treatment of the condition and that a warm climate with freedom from upper respiratory infection is the best insurance against another crippling recrudescence of the disease. Prolonged rest, according to Freeman, will build up the immunity mechanisms and hold the disease in check and that these patients should be treated as other chronic and relapsing conditions, as tuberculosis.

Rest, here, is again of importance but within limits, alternating with activity the extent of which depends upon the course and severity of the condition.

According to Dock (1944 a), multiple sclerosis and tabes are seriously affected by being put to bed as they have great difficulty in walking on getting up. Since the energy cost of sitting in a comfortable

chair as against that of lying in bed is of no significant difference, these patients should be in comfortable chairs part of the time.

CEREBRAL THROMBOSIS WITH RESULTING HEMIPLEGIA

It is recommended by Patrick (1937) that these patients should be up in a few days, preferably in less than a week after the occurrence, resulting in a definite benefit to the general health. The risk of a pulmonary complication as of a bed sore is lessened, and the difficulties with balance are reduced to a minimum.

NEPHRITIS

Relative rest of the kidney is obtained by prescribing diets low in protein as the fate of an injured kidney is largely dependent on the work that is imposed upon it (Addis 1940). The minimum protein requirement varies as to the individual: 0.4 to 0.6 grams per kilogram. If the caloric intake is adequate and the body weight nevertheless slowly decreases, protein must be increased. Patrick (1937) believes that the patient should be up if the symptoms are favorable even though he still has some albuminuria.

SCARLET FEVER

At one time, it was the rule that a patient with scarlet fever should remain in bed from four to six weeks, but since then it has been demonstrated that the shortening of the rest period has hastened recovery. It is Patrick's (1937) belief that the time in bed should not exceed three weeks.

INFANTILE PARALYSIS

In infantile paralysis, periods of complete rest with supervised and controlled activity seem to give best results in the early stages when the muscles are painful and sore (Swaim 1944). This again is in accord with the fundamental principle of alternating periods of rest with activity.

SYPHILIS

In the pre-arsphenamine era, the non-specific treatment consisted of vacation at spas, hot water, steam and sulfur baths, and stimulation via the gastro-intestinal tract. It is known that primitive people, as the African Negroes in Assnan, have been treating syphilis with symptomatic success by burying the patient for several days in the hot desert and administering decoctions. At the advent of the

arsphenamine era, all empirical achievements of additional non-specific treatment of syphilis were momentarily forgotten. In 1936, Obermayer stated that an important increase in the mechanism of defense is secured by non-specific physical or chemical therapy. Resistant cases of syphilis have been successfully treated with autohemic injections and systemic ultraviolet irradiation. Rest and relaxation is of paramount necessity for obtaining the most satisfactory results from anti-syphilitic treatment, and it is often a life-saving factor.

MALNUTRITION IN CHILDREN

Malnutrition is too widespread in this country to reflect credit on our child welfare; about one-third to one-fourth of the total number of children are malnourished (Bier 1933). Seham and Seham (1929) have pointed out that rest slows general metabolism and decreases functional activity. Proper feeding and the enforced rest cure for malnutrition reduces the nervous symptoms, increases the functional capacity and hastens the gain in weight. Wiseman (1930), reporting the results of preventorium cure, states that rest is more important than fresh air; regularity

of living next in importance, and feeding practically secondary. In his institution, the majority of the children regained their normal weight in six months. Lucas and Pryor (1931) suggested that enforced rest overcame problems of behavior as well as malnutrition. Full bed rest of 10 to 15 days followed by semi-bed rest was recommended. According to Bier (1933), those children who are markedly underweight or who do not gain as ambulatory patients are given full bed rest. This means that the patient remains in bed all day, with toilet privileges. Semi-bed rest, which usually follows full bed rest (or is used in the place of it) consists of having the child remain in bed until 10:00 A.M.; the child returns to bed from 1:00 to 4:00 P.M., and then is allowed up until 7:00 P.M., the usual bed time.

In general, bed rest in varying amounts produces excellent results in the treatment of malnutrition and its accompanying conditions.

ARTHRITIS

Many patients fall victim to true arthritis by reason of exhaustion, both physical and mental (Buckley 1936). Rest is of vital importance during acute

stages of rheumatoid arthritis when affected joint capsules and synovial membranes are inflamed. Many unnecessary contractions with resulting flexion deformities occur as a result of the lack of protection and artificial immobilization at this time (Swaim 1944). On subsidence of inflammatory process, daily exercises short of fatigue should be instituted. Maclure (1934) gives the following rules:

1. Nature's danger signal is pain, and within the limits of pain, active movement never does any harm and is the method of choice in the treatment of aseptic traumatic lesions of joints, such as recent sprains and dislocations.

2. The other safeguard: that if the range of movement of a joint increases daily, then the treatment is correct; but if the range decreases, it is a warning that rest is indicated.

Ghormley (1944) has observed that patients obviously suffering from severe and disabling arthritis, who by sheer force of circumstances have been prevented from giving up and going to bed, usually came through their ordeal with much better joints than those who have been put to bed, even though the rest in bed may be accompanied by the best available treatment.

HEAD INJURIES

According to the old teaching, a man ought to stay in bed for a week for every hour of unconsciousness that he sustained following a blow on the head. As a matter of fact, patients have been kept in bed eight, nine, or ten weeks and then have had a very hard time adjusting themselves to the upright position, both physiologically and symbolically. They have a hard job getting back to work. The practice in the Army and Navy at present is to get a man on his feet just as soon as possible following a head injury, i.e. when he expresses the inclination. The results are far better with regard to the post-traumatic sequelae, the dizziness, and confusion states that used to be common after prolonged rest in bed.(Dock 1944 a).

ORTHOPEDICS

The creed prescribed for orthopedic surgeons of a generation or more ago called for rest in considerable quantities. This has been carried to an extreme, although in the treatment of tuberculosis of bone, rest was the best means of combating that disease in the human body. Splinting of joints, supporting dietary regimens, heliotherapy, and other things were

supposed to add to the efficacy of the treatment, but the main feature was rest.

For the past thirty years, the fact that more perfect rest to diseased joints could be brought about by internal fixation of the spinal column and major joints by means of operative fixation with bone grafts or by a fusion operation has become to be recognized. This has not only brought improvement in the results, but also has reduced the bad effects of long rest in bed.

The various deleterious effects of long rest in bed, especially from the standpoint of the orthopedic surgeon, are atrophy of muscles, articular structures, bone, and skin, and the formation of thrombi with resultant embolism. Ghormley (1944) has observed that when one opens a thigh that has been at rest either in a cast or in a splint or as a result of rest in bed, one finds quite often that the fascial surface, as well as the surface of the underlying muscle, is dull and does not glide; oftentimes, many small adhesions have formed between the muscle and fascia. Bone atrophy may become symptomatic and even progress to the point where pathologic fractures may take place. A similar condition may take place in the skin, and

the dangers of decubitus ulcers in bedridden patients are well known.

There is scarcely any form of disease or injury of the spinal column, pelvis, hip, or femur in which efforts to reduce the period of rest in bed have not produced good results. One of the outstanding examples is the introduction of the Smith-Peterson three-flanged nail for the fixation of fractures of the neck of the femur (Smith-Peterson 1931). Although many similar methods and instruments have been devised, the principle of internal fixation of such fractures has undoubtedly come to stay and with it a definite shortening of the period of rest in bed, from months to three to five weeks.

In late years, many efforts have been made by various methods of pin fixation to get patients with a fractured femur ambulatory at an earlier date. Such methods as those of Roger Anderson (1938), Stader and Hagnes (Shaar and Krenz 1942) all point toward this. In many instances, open reduction for internal fixation and the subsequent application of a spica cast in order that the patient may be turned and even gotten up so as to avoid the deleterious effects of continued rest in bed in a supine position, such as

is necessary when most traction methods are employed, will tend to cause less strain on the general condition of the patient.

Likewise, lesions of the spinal column and especially those accompanied by paraplegia were of necessity required to remain bedfast for a long time. For the treatment of simple compression fractures and fractures without paraplegia, there are available methods of reduction and control which will greatly shorten the period of rest in bed, which is desirable. Rest in bed for four to six weeks is adequate in practically all cases, provided adequate fixation of the spinal column with plaster is employed after reduction by means of a hyperextension frame or by hyperextension manipulation under anesthesia. Elderly persons with a compression fracture of moderate severity are fit with an adequate spinal support, and they are up within a few days in order to avoid the almost inevitable complications that arise because of prolonged and continuous rest in bed (Ghormley 1944).

Another example in which an advancement has been made is in the operations for fusion of the spinal column. Formerly, it was not uncommon for patients to be kept in bed, and sometimes in casts, for twelve weeks

after such an operation. At the present time, at the Mayo Clinic, Ghormley (1944) allows the patients to be up and about for a short period daily at the end of three weeks after operation. He permits these patients to turn themselves from side to side and even to turn on the face three days after the operation. No ill results have been noticed, and the patients have had an easier convalescence and are able to resume activity with greater ease and comfort.

In general, most of the orthopedic surgeons are realizing the detrimental effects of complete rest in bed and have succeeded in shortening the periods of such confinement. In the future, more advances will be made along this line.

OBSTETRICS

Advances in this field have been made along various lines, as early ambulation after delivery, amount of rest needed during pregnancy, particularly pregnant women in industry, and rest of the female reproductive organ as it pertains to so-called "child spacing".

Early Ambulation after Delivery

It has been the custom and still is in a great many places to keep the patient in bed for ten days

or more after delivery. For example, DeLee (1925) allowed his patients to sit up in bed on the sixth or seventh day, get out of bed into a large chair for an hour on the ninth or tenth day, for three hours on the eleventh day, and before the end of the second week, she has the freedom of the floor. He recommended some active movement in bed, and not absolute quiet in bed as formerly. Beck (1935) states that patients do better if they remain in bed a week or ten days after labor.

This time-honored custom of keeping the woman in bed nine days or more has been assailed by late writers. Küstner, in 1899, and White, as far back as 1775, advocated the practice of allowing the women to leave the bed as soon as they felt able to do so, and claimed that no evil results followed, but, on the contrary, the women recovered strength quicker, had less fever, less frequent thrombophlebitis, less coprastasis, less necessity for catheterization, better lactation, and no greater frequency of prolapse of the uterus and vagina. Since the time of Küstner and White, there was a period in which various investigators allowed their patients to be up on the second day and go back to their work. This resulted in a greater incidence

of prolapse of the uterus. For that reason, early ambulation was condemned for a long period of time until the present. Early ambulation is being practiced in our University Hospital and apparently with good results. They allow the patients to sit up on the second day and be up on the third day.

There are no contraindications for early ambulation except for sepsis, exhaustion, henorrhage, and other pathological conditions which require special attention and restoration of the patient's resistance to infection. By instituting early alternating periods of rest and activity, which is a fundamental biological principle, one not only avoids the evils of bed rest, but also restores the normal functions of the body earlier with a resultant rapid convalescence and a minimum loss of strength.

Pregnant Women in Industry

A conservative estimate of the number of women engaged in industrial work and becoming pregnant is approximately a quarter of a million per year. According to the Children's Bureau and the Women's Bureau of the U.S. Department of Labor (1942), ideally, the pregnant woman should not be employed, but

they believe that the employment of pregnant women in industrial plants is entirely feasible and safe, provided certain safeguards could be thrown about them. Among the safeguards are facilities for adequate antepartum care; avoidance of work on the night shift, two to ten-minute rest periods; the avoidance of occupations which demand heavy lifting, continuous standing, or a good sense of bodily balance and, finally, a minimum of six weeks' leave before delivery and two months' leave after delivery; also a maximum of 48 hours of work per week with eight hours per day. A sedentary unoccupied life is not conducive to the health of the expectant mother (Eastman 1944 a).

In England it was found that a five to ten-minute rest in the middle of the work spell increased the output by five to ten percent (Kronenberg 1944). Rest periods cannot in themselves offset fatigue but are only one of the several measures for its control. Hesseltine (1944) advised adequate rest facilities for women with dysmenorrhea during menstruation, along with other supportive measures.

In general, most of the investigators are agreed that a pregnant woman should have leave six weeks

prior to delivery and from two to three months after delivery. O'Sullivan and Bourne (1944) recommended three months after delivery, particularly if the baby is breast-fed. It is of interest to note that in 1919 a proposal was adopted at the General Conference of National Labor Organization of the League of Nations that pregnant women should be allowed a period of six weeks before and after childbirth and that provisions should be made for their maintenance.

Child Spacing

Based on an observation made by Woodbury (1925) in 1915, this teaching, that babies are less likely to survive if born at intervals of less than two years, has had wide circulation and has become both to the physician and to the public almost an axiom of maternity. In a recent extensive study by Eastman (1944 b), he has shown that:

1. Infants born from 12 to 24 months after a previous viable delivery, i.e. during the second year, have at least as low a stillbirth and neonatal mortality as do infants born after longer intervals.

2. The longer the interval between births, the more likely the mother is to suffer from some form of hypertensive toxemia of pregnancy. The incidence

of this complication is lowest when the interval is 12 to 24 months, significantly higher when it is 24 to 48 months, and much higher when it exceeds four years. This is true of colored and white races alike.

3. In patients who have had a previous hypertensive toxemia of pregnancy, the likelihood of repetition becomes progressively greater as the interval becomes longer.

4. The incidence of the following conditions is no greater when the interval is 12 to 24 months than when it is longer; premature labor, anemia, postpartum hemorrhage, and puerperal infection; nor are mothers in this brief interval group less able to nurse their babies. The weight of the mature babies was approximately the same regardless of the interval.

These findings contradict the old, deep rooted technique that frequent childbearing is dangerous. Many of these findings have been confirmed by the experience of many of the present-day specialists.

There is suggestive evidence that pregnancies which are conceived within five months after a previous delivery show a slightly higher incidence of premature termination.

Child spacing by definition means maternal aging; and after a certain optimum period, probably in the early twenties, maternal aging means inevitably somewhat higher risks both to mother and to child (Eastman 1944 a). All experience and all statistics support this statement. Whatever advantage is gained by a rest period of several years between births seems to be offset and in some respects more than counterbalanced by the aging factor, for it must never be forgotten that the most important talisman which a childbearing woman can possess is youth. For the best maternal and fetal outlook, we are inclined to believe that youth is a better ally than child spacing.

Rest and Nutrition of Breast Feeding

In the observations of Darner and Hunter (1943), undisturbed mothers after delivery had a more abundant supply of breast milk, and infants of these mothers regained their birth weight at discharge from the hospital and suffered a smaller initial weight loss. Physical and mental fatigue induced by the efforts of the patient to entertain her visitors has the result of reducing the breast supply below the point of adequacy.

PSYCHIATRY

The concept of rest as a form of treatment in psychiatry arose in an era characterized by the total neglect of the consideration of psychologic factors in the study of human beings. As the mechanistic conception of personality has given way to the dynamic organismic conception, the fallacy of curing psychologic symptoms by merely decreasing muscular activity has become apparent. In the sense of physical inactivity, rest has ceased to be of any importance in psychiatric phenomena. Indeed, the tendency is in precisely the other direction, namely, to utilize rather than to blockade further the available energy of the neurotic or psychotic patient.

Towards the end of the last century, Weir Mitchell advocated a "rest cure" for certain forms of neuroasthenia and hysteria, and especially for nervous women who as a rule are thin, lack blood, and are exhausted. It consisted of the combined use of absolute rest of body and mind, high caloric feeding with regular diet at fixed hours, isolation, passive exercise by massage, the use of electricity, graduated activities, and the supervision of a trained nurse. The purpose of isolation or seclusion was

to free the patient from influences of their habitual surroundings. Massage was used to deprive rest of its evils along with the use of electricity, which was used to exercise the muscles with the least amount of pain and annoyance. He did warn his followers that rest is a remedy with the capacity to hurt as well as to help, and should never be used without the advice of the physician, nor persistently kept up without medical observation of its temporary and more permanent effects; for he well knew the evils of bed rest: lessened the appetite, weakened the digestion in many cases, constipated the bowels, enfeebled the circulation, muscles became undernourished, and vessels lost their tone. He also stated that his plan was used only in well-chosen cases, which did not respond to exercise, outdoor life, or change; and he also predicted, "This treatment runs, indeed, the risk of being employed in cases which do not need it and by persons who are not competent, and of being thus in a measure brought into disrepute." The great success which Mitchell attained was in large part due not only to the physiologic benefits resulting from the treatment, but also to his ability to understand and adjust social and

mental problems, which nearly always underlie nervous phenomena. Mitchell's prestige, influence and persuasiveness were such that his "rest cure" for the treatment of neuroses influenced American medicine for nearly fifty years. Since his time, the rest cure treatment has been used by physicians in other diseases without giving much thought whether or not it was definitely indicated; also diagnoses of nervous exhaustion, nervous fatigue, fatigue neurosis, nervous breakdowns from overwork, nervous weakness, neurasthenia, and so on, continued to fill the records of hospitals, clinics, and private practitioners. Treatment based on these diagnoses and Weir Mitchell's example were developed, exploited and popularized: modified rest cures, relaxation treatment, and vacation treatment. In 1903, Dercum also advocated a form of rest treatment for neurasthenia and hypochondria. He also used exercise and food combined with rest in his treatment; for according to him, in health there must be a due proportion between functional activity and rest, and that work, mental and physical, means the active stimulation of function. Black, in 1917, used enforced rest on the various psychiatric patients and especially those who

are constantly in a state of unrest, the hyperirritable, and overworked business or professional man or woman. He told his patients that they would simulate hibernation for three to four days, i.e. he placed his patients in a semi-stuporous state with bromides and paraldehyde for four days during which time the diet consisted of milk and water.

There is no question but that nervous patients show evidences of fatigue and easy fatigability; this fatigue is a symptom of neurosis. Overstudy, overapplication, overexertion, and all other excess expenditures of energy do not cause psychiatric syndromes; they are often the expression of psychiatric illness. The cure of the psychiatric illness--the neurosis, the nervousness--is the removal of that which impels the individual to make such depletions of his own strength, to waste so much of his energy, or to require so much of it to hold himself in check against explosions or collapse (Menninger 1944). The neuroses and psychoses and other evidences of maladjustment on the part of a patient are a result of misdirected energy rather than lack of sufficient energy; and the treatment is aimed at the redirection of the wasted energy, the removal of interfering

inhibitions and the setting up of requisite inhibitions. A finding that is common in psychiatric patients is that they cannot work, they cannot play, and they cannot rest. They have to be taught to do all three of these things. This is the function of occupational therapy, recreational therapy, educational therapy, and psychotherapy as they are employed in the modern psychiatric hospital (Menninger 1940). All this is in a contrary direction to that of the old plan of enforced rest whereby the patient through moral, physical, or chemical restraint was obliged to surrender to illness and passivity, resulting in further deterioration.

Rest does play a definite role in certain phases of these diseases. Many are not able to rest adequately and this capacity must then be developed. Also, through the use of sedatives, one is able to modify consciousness and the psychologic architecture as to permit the emergence of what might be described as the indigestible toxic material of the mind (Murray 1943). It has been found in this present war that in some instances, exposure to prodigious stress, both physical and mental, has so depleted the energy reserves of combat troops that psychiatric

syndromes have emerged. A few nights of sound, protected sleep under quiet, pleasant surroundings with good food and manifested friendliness are often sufficient to restore these individuals to active duty within one to three weeks (Kubic 1943). Even in these cases, important as is the element of rest, the importance of the psychologic factors of safety, sympathy and admiration are probably equally great. Companionship and planned activities are prescribed as soon as the men are up.

In general, the psychiatric patient must be treated not only from the physical standpoint and the chemical standpoint, but also from the psychologic standpoint, using each with skill, and delicately adjusted to the needs of the individual.

REST IN INDUSTRIAL WORK

Through relative recent investigations in industrial plants, the use of short rest periods has been found to be of great value in increasing the output in industrial work. According to Wyatt (1927) and Vernon (1927), the introduction of rest pauses varying from five to ten minutes generally increases the output in industrial work. This duration of five

to ten minutes is sufficient to abolish 75 to 100 percent of oxygen debt in most types of industrial work. Simonson (1926) states that since the oxidative recovery speed is higher in the sitting than in the standing position, the former position is to be recommended, where possible, for all types of work which are performed in the standing position. Similar results were obtained by Simonson and Euzer (1941) and they believed that the introduction of regular and short rest pauses cuts off the last period of each working interval, where fatigue begins to develop; it enables the worker to work at a steady state of oxygen consumption, not only with greatly increased endurance, but also with better effieiency.

A pleasant environment, adequate diet, and interesting social activities, are essential parts of the rest period. As more is learned of the psychologic aspects of fatigue, it is being recognized that such factors as rest periods, the taking of food during working hours, and a variety of other changes in working conditions, operate in a substantial measure through psychologic rather than direct physiologic mechanisms (Hoff 1943). Dill (1936) in his study of the output of a group of skilled persons

working under carefully controlled conditions, noted that practically every alteration led to an increased output; even returning to earlier conditions resulted in an increase. The above studies show that optimal working conditions are determined by factors other than purely physiologic, and that the psychologic factor plays a very definite role.

EVILS OF BED REST

Many of the evils of bed rest have been discussed throughout this thesis. Most of these hazards will again be enumerated and some of them emphasized.

Thousands are confined to absolute bed rest, not by necessity or choice, but by the doctor's orders. While bed rest has little hazard to life in childhood, it becomes increasingly dangerous with advancing years. Absolute bed rest kills more patients than anesthesia and all the drugs in the pharmacopacia added together (Dock 1944 a). In most cases, the evil effects of complete bed rest are potentiated by anesthesia, narcotics or other medication, or by the results of the original illness. Obviously, such a hazardous agent must be used only for precise indications, and then its value should be weighed against its risks.

As a means of securing absolute rest, lying in the bed is sometimes inferior to sitting quietly in a chair, for many patients are much more restless in bed than they are in a chair. The energy exchange of the patient while sitting in a chair is not materially higher than it is when he is lying in bed, as shown by basal metabolism rate. Lying in bed,

furthermore, involves unphysiologic postures and adjustments which give rise to many disturbances. It leads to bone atrophy, muscular wasting, vasomotor instability, constipation, cathartic habituation, backache, distention, urinary retention, prostatism, impairment of appetite, depression of morale, bed sores, cramps, persistent muscle spasm, and loss of calcium from the skeleton with calcinuria and renal stones. Another serious consequence of lying flat in bed occurs in failure of the left side of the heart, in which the greater filling of the heart promotes edema of the lungs. In elderly persons, especially, it leads to pulmonary congestion and hypostatic pneumonia. Protracted bed rest prolongs the period of convalescence and makes more difficult the final adjustment to an erect posture and a normal mode of life. The disabling effect of confinement to bed is reflected in this rule, that every week spent in bed takes a month to get over the incapacitating effects (Patrick 1937).

There is a more serious consequence of bed rest; namely, pulmonary embolism. This results from the compression of the veins in the calves of the legs, slowing the venous circulation, with resulting

thrombosis. Thrombosis in the feet, calves, and thighs begins in the dependent parts, where prolonged pressure and ischemia cause tissue damage (Voegt 1937). Among middle aged and elderly patients, dying after days or weeks of bed rest, thrombosis in the veins of the dorsal part of the legs and feet were demonstrable in one-fourth to one-half of the cases in a large series studied in Germany, in Sweden, and in Oregon (Rossle 1937; Frykholm 1940; Hunter, Sneeden, Robertson, Robertson, and Snyder 1941). Also fatal pulmonary emboli were present in about four percent of the cases with thrombi in the legs, and non-fatal emboli in about 20 percent more.

It was formerly taught that pulmonary infarcts occur only in patients with passive hyperemia of the lungs, but now it is known that they follow pulmonary embolism in 60 percent of surgical and medical cases without heart failure, and in 90 percent of the cardiac (White 1940). Here again, the combination of dorsal decubitus with sedatives, which depress respiration, serves to pave the way for trouble, and young men, previously in excellent health, may have pulmonary infarction within a week of an otherwise uncomplicated celiotomy or herniorrhaphy,

if they have been kept comfortable and quiet by skillful nursing and constant medication.

As to the traditional confinement of the patient with coronary thrombosis for a period of six weeks in bed, there seems to be a great deal of doubt that this is necessary, as well as a belief that greater freedom of motion and sitting in a chair, except possibly for the most acute phase of the disorder, would materially improve the treatment of the condition.

A discussion of the hazards of bed rest would be incomplete without emphasizing the tremendous strain put on the heart and circulation by a maneuver which patients in bed frequently perform and against which many are never warned. Whenever one takes a deep breath, closes the glottis, and tightens the thoracic and abdominal muscles (Valsalva experiment), there follows a series of extreme fluctuation in thoracic pressure, cardiac output, blood pressure, and vagal and vasomotor tone (Dock 1944 b). After myocardial infarction, sudden death is far more likely to occur when the patient performs this effort than from any other cause, and it is a common incitant of pulmonary embolism. This

may occur on the bedpan or even when passing flatus or trying to push oneself higher on the pillows. Patients with difficulty in urination or defecation probably undergo less risk if warned against this procedure and allowed to get out of bed to use a commode, than when left to struggle in a supine position. Every physician should be acutely aware of the fact that simple ordering complete bed rest does not protect the patient from severe periodic stress on the heart and circulation, while it does expose him to definite danger.

There are, of course, many situations in which bed rest may be essential, such as pulmonary tuberculosis, acute prostration and shock, and after certain operative procedures. Short periods of rest alternated with activity will prove to be of great beneficial help in the majority of disease but the length of each adjusted to each individual case. Many conditions in which bed rest was commonly regarded as essential are treated more satisfactorily with the patient for the most part sitting in a comfortable chair. In the future, more patients will be treated almost from the beginning of their illness to its end by comfortable rest in a chair

rather than by debilitating rest in bed. Also much more often will the commode take the place of the bedpan. Patients who need to be confined to bed will be encouraged to move with reasonable frequency in order to avoid the formation of thrombi in the veins of the legs. Less depressant medication will be used. The morbidity from protracted illness will be reduced. The convalescence from protracted illness will be shortened. The mortality from bed rest alone will be largely eliminated.

COMMENT

At the present time, we are in a period of transition as to the use of rest as a therapeutic agent. At the end of the last century and at the beginning of this century, physicians began to realize the evils of bed rest. The natural reaction was to the other extreme, as is the case in so many of the new findings, eliminating bed rest as much as possible. This occurred in several branches of medicine, particularly that of surgery. Since many of the surgeons and phsyicians had disasterous results in the way they employed bed rest, there was a swing back to the more conservative measures. At the present time, the tendency in the various branches of medicine is to use rest as long as it is indicated and discontinue it as early as possible because of the many hazards of bed rest, especially to elderly patients.

The study of bed rest is being and will be extended into all branches of medicine where many questions still remain unanswered as to when and how much of bed rest should be used in each disease. There is also the need for more work to be done on the various physiological reactions that occur during rest and also what occurs when rest is employed

in the various diseases. Many of the present day findings need confirmation as, for example, the decrease in serum protein during rest or sleep.

The one fundamental principle that can be used as a basis in the employment of rest as a therapeutic agent is that in all living things there occur periods of rest, alternating with periods of activity. The amount of each used in the various conditions and diseases would depend upon the indications that the patient presents. This alternation of rest and activity has a stimulating effect upon the various physiological functions of the body, resulting in a more rapid restoration to normality from the various diseases. In general, some activity should be instituted from the very beginning in the majority of the patients, and gradually increased as the patient improves. Complete bed rest should never be used unless it is definitely indicated, for it is highly unphysiologic and definitely a hazardous form of therapy, and should be discontinued as early as possible.

Rest is just one form of therapy, and in most cases it will be used as an adjuvant to the other forms of therapy; and if properly used, it can be of utmost value and be very beneficial.

SUMMARY

1. In all living things there occur periods of rest, alternating with activity, which is a fundamental biological fact.

2. Rest is the basic treatment for all types of fatigue.

3. Prolonged rest results in atrophy of muscle and bone; and in metabolism, rise in the excretion of sulfur, nitrogen, phosphorus, and calcium, in that order of priority.

4. On altering the level of functional activity, there is a lag period before nitrogen equilibrium is again obtained, i.e. it persists until the amount of functioning metabolic substances is reduced to such a level that the catabolism is equal and opposite to the diminished anabolism. High protein diet failed to prevent a negative nitrogen balance at the height of the metabolic disturbance; also a calcium-free diet does not decrease the increased calcium excretion.

5. The various concomitants and characteristics of sleep can all (with the notable exception of the positive Babinski response, and certain types of electroencephalogram patterns) be obtained in a

waking subject under certain conditions of horizontal body position, rest, and muscular relaxation.

6. Prolonged wakefulness results in extreme neuromuscular fatigue and poorer performance of the higher centers.

7. There is substantial evidence that during sleep and during rest without sleep, there is a decrease both in total serum calcium and serum protein.

8. Most investigators are agreed that restful sleep occurs when an individual moves quite frequently during the night, while too frequent changes or maintaining the same posture too long has a disturbing effect.

9. Muscular rest, if complete, necessarily includes mental rest.

10. Overwhelming evidence exists to show that the traditional rest period employed after operations is a practice of the past, and has been replaced by early ambulation. Early ambulation results in a rapid convalescence, reduction of adhesions, rapid healing of the wound, and avoidance of the many hazards of bed rest. In order that the maximum benefit is secured from early ambulation, patients must get up within 24 hours after operation, followed by

increasing activity and alternating with periods of rest.

11. Patients with congestive failure and especially those with nocturnal dyspnea should not be kept flat in bed until active cardiac treatment has been well advanced in improving the circulation.

12. Patients with heart disease, but without failure, should be allowed to take as much exercise as they reasonably and safely can, with periods of rest as needed, as it is physical exercise that helps to maintain a state of general good health.

13. Patients with angina pectoris should not rest in bed for more than a day or two, except in those patients who are especially liable to develop in the immediate future myocardial infarction.

14. The traditional confinement of the patient with myocardial infarction for a period of six weeks to bed is not necessary, as greater freedom of motion and sitting in a chair, except for the acute phases, materially improves the treatment of the condition.

15. High blood pressure in essential hypertension can be reduced by cultivated relaxation.

16. In all patients with severe forms of heart disease, activity should be kept below the symptomatic threshhold, i.e. should be less than the amount which induces dyspnea or pain.

17. In pulmonary tuberculosis, bed rest accompanied by a supplementary form of bed rest as collapse therapy should be used at the onset in the majority of cases, but with subsidence of the activity of tuberculosis, a gradual increase of privileges and exercises should be instituted, and, finally, be adjustment of his life so as to minimize physical and mental strain. It is important that exercise should be instituted as early as possible so as to increase the efficiency of the physiologic response.

18. Disease and injuries of the spinal column, pelvis, hip, or femur are being treated by internal fixation, adequate fixation with plaster, and fusion operations, thereby shortening the period of bed rest and avoiding the deleterious effects of continued rest.

19. The time-honored custom of keeping women in bed nine days or more after deliveries is being replaced with early ambulation (alternating periods of rest with activity), resulting in early restoration

of the normal conditions of the body and avoidance of the hazards of bed rest.

20. Pregnant women in industry should have leave six weeks prior to delivery and from two to three months after delivery.

21. Substantial evidence exists that the old, deep rooted principle that frequent childbearing is dangerous is false. No advantage is gained by a rest period of several years between births.

22. Psychiatric patients must be treated not only from the physical standpoint (including rest), the chemical standpoint, but also from the psychologic standpoint, using each with skill as to the needs of the individual case.

23. The introduction of rest pauses varying from five to ten minutes will generally increase the output in industrial work.

24. Some of the various hazards of bed rest are bone atrophy, muscular wasting, vasomotor instability, constipation, cathartic habituation, backache, distention, urinary retention, prostatism, impairment of appetite, depression of morale, bed sores, hypostatic pneumonia, thrombophlebitis, thrombus formation, pulmonary embolism, and the present day bedpan.

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