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THE IMPORTANCE OF REST IN THE TREATMENT OF TUBERCULOSIS*

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Rest is one of the most important measures in the treatment of tuberculosis. Important as it is, simple as it seems, it is but poorly understood and usually improperly applied. Comparatively few men, even those who limit their practice to the treatment of tuberculosis, seem to understand the therapeutic value of rest, and grasp the importance of a carefully arranged régime for its application. This term should include mental relaxation as well as physical repose.

Brehmer, the founder of the modern treatment of tuberculosis, was an advocate of exercise, believing that an important predisposing cause of the disease was a small heart, and that this supposed predisposing factor could be overcome by graduated exercise, particularly hill climbing, which would have an influence in strengthening that organ. While he used care and judgment in prescribing these exercises yet it was his opinion that each patient should exercise and climb gradual ascents as an important part of the therapy. The harm that was done by this measure was not readily determined, because this was the first systematic effort that was ever made to segregate tuberculous patients in an institution and give them the advantange of systematic treatment. The general improvement was so much greater than that obtained by treatment in the home that whatever ill effects were produced by the exercise were hidden by the general improvement.

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Dettweiler, a patient and later an assistant of Brehmer, became convinced that ill effects resulted from exercise and adopted rest as the important factor in a systematic treatment which he instituted. He is the founder of the *Liegekur,* or rest treatment. It was a long step from the exercise and hill climbing of Brehmer to the rest treatment of Dettweiler, in which patients were forced to spend many hours each day reclining in chairs on piazzas. Such a wide divergence of view held by two men of such earnestness for the good of the tuberculous patient naturally resulted in the founding of two schools of thought—the followers of Brehmer, who emphasized the importance of exercise, and the followers of Dettweiler, who emphasized the importance of rest.

When I became interested in the treatment of tuberculosis in the year 1895, an attitude of compromise toward these two principles was prevalent, with a leaning toward the necessity of exercise. This leaning toward exercise was particularly prevalent among the rank and file of the medical profession.

Having a member of my own family afflicted with the disease I had occasion to consult some of the men who were most interested in treating tuberculosis at that time, and without exception they advised exercise in the open air. The fact that the patient was weak, had fever, and was gradually losing strength made no difference. I endeavored to follow this advice, but after urging exercise upon the patient for a time I came to the conclusion that good could not come from a measure which resulted in exhausting what little strength the patient had, and substituted rest in the open air in its stead. At that time, I did not know of the work of either Brehmer or Dettweiler, but unknowingly adopted the principles of the latter. Shortly after this a colleague from Toronto consulted me after a long journey through our eastern and southern cities.

He had stopped at each medical centre and each health resort on the way and had consulted one or more specialists in each place, and had been advised by all "to exercise in the open air, if he would regain his health." When he consulted me I remarked, after completing my physical examination, that I was going to give him advice which was contrary to the usual teaching, but believed that it was rational. I then told him that I wanted him to rest and not exercise. He reached out his hand and grasped mine and said, "Thank God that I have at last found a man who understands my feelings."

Further study of the tuberculous patient as well as the disease led me to favor the teachings of Dettweiler rather than those of Brehmer. At first, however, I grasped the meaning of rest but imperfectly. I thought it was sufficient for the patient to remain quiet when the temperature was up to 100°. When I began my sanatorium experience the plan which I adopted was to keep all patients in bed with temperatures of 100° or over, and not to allow them to get up until the temperature had been below 100° for three days. This was the accepted teaching at that time. What ignorance both of tuberculosis and of the tuberculous patient is manifested in such advice! It carries with it no conception of a reason for either the rest or the exercise.

If one would understand the indications for rest and exercise he must understand the rationale of the cure of tuberculosis. He must understand that, as yet, there has not been found any one thing upon which we may depend for a healing of this disease; but that cure, if it comes, is brought about by conserving the natural defensive forces of the individual on the one hand and stimulating specific reaction against the disease processes on the other.

The healing of tuberculosis then resolves itself into, 1, a process of building up and making the patient strong, and keeping him so for a long period of time until he becomes master of the invading bacilli, and, 2, a stimulation of the pa-

tient's specific defensive powers. The former may be brought about by such measures as open air, suitable food, carefully directed rest and exercise, a helpful mental attitude, hydrotherapy, heliotherapy, and such measures as relieve symptoms and complications; the latter may be brought about by products made from the tubercle bacillus or the culture fluid in which it has grown. It is impossible to place a percentage value on any one of these measures. It is also evident that their relative value differs with different patients and under different circumstances.

One reason why rest and exercise are so abused in therapy is because most of the other measures may be employed either while the patient rests or while he exercises; another reason is that those who prescribe often fail to appreciate the difference in application, or at least fail to make a careful distinction. Both rest and exercise are applicable in the treatment of tuberculosis; both have their influence for cure. The indications for their employment are so different, however, that they should be understood by all who prescribe for tuberculous patients. The indications are based on physiological principles. Rest conserves energy; exercise calls for an increased energy output. Rest is the condition which makes the least demand upon the body forces, consequently it is the condition which leaves the patient with the greatest amount of reserve force. There are times in the treatment of most cases of tuberculosis, more particularly those of active tuberculosis, when, unless all possible strength is conserved, the tide will be turned against the patient. It requires a given amount of energy to meet the demands of ordinary metabolism; it requires an extra amount to meet the extra demands made by a disease like tuberculosis; and it requires still more to fight the infection and bring about a healing. Whether or not treatment will be successful and the progress of the disease will be checked depends on whether or not a suffi-

cient energy output can be maintained. If all available energy is used up (as it is in certain persons) in caring for the ordinary wear and tear of the body, patients can not fight a chronic infection like tuberculosis. Some way of conserving their strength must be found. The demand must either be made less or the supply of energy greater, or both. In some, the margin of conservation is very slight. No doubt could we only raise it five or ten per cent. we might be able to save some lives.

In order to appreciate the manner in which exercise calls for the expenditure of energy, I will quote from Joslin the observation on normal individuals at the Carnegie Laboratory (1): "It is convenient to remember that one calorie per kilogram body weight per hour was eliminated while in bed, and 1.21 calories per kilogram were eliminated while sitting in a chair. In other words, twenty per cent. more energy was required by these individuals to sit in a chair than to lie on a couch. If the subject is asleep lying down and awake sitting up the difference may be thirty-five to forty per cent. On the other hand, if the greatest possible care is taken to be as quiet when erect as horizontal, the difference may be only eight per cent."

The disease fighting power of a patient will depend on his ability to maintain an excess of energy after meeting the natural metabolic requirements of the body. If it requires twenty per cent. more energy to sit in a chair than it does to lie at rest in bed, it is plain that lives may be saved by the conserving force of rest in bed.

Energy is produced by food; not the eating of food, but the assimilation of food. The requirements of food under conditions of rest and various degrees of exercise are about as follows:

Condition.	*Total calories.*
At rest	1750-2100
Light work	2450-2800
Moderate work	2800-3150
Hard work	3150-4200

In tuberculosis nutrition suffers greatly at times, partly on account of an inability to eat sufficient food, again on account of faulty assimilation. Sometimes the energy output can be readily met when the patient is at rest, but not on exertion. Again there are times when, with large intake and absolute rest, the energy requirements cannot be met, except at the expense of the patient's own tissues.

Therefore, the rule for rest as far as the expenditure of energy is concerned, may be stated thus: The patient should always rest when exercise will make demands upon his energy output so great that he is unable to meet them fully and still have a surplus for fighting the disease.

In tuberculosis a condition of suboxygenation is often present. This leads to incomplete metabolism and favors the storage of hydrogen ions in the tissues, with a resultant lessened alkalinity. This condition favors necrosis and autolytic action which result in the breaking down of the tuberculous tissue. During the stage of activity exercise increases the toxemia and provokes cough; conditions which lessen energy production on the one hand and call for an increase of energy output on the other. Rest, then, seems to be essential in conditions of low energy production and in the presence of active disease. In this connection, I wish to call attention to the difference between clinical and pathological activity.

Recently I listened to an address on the use of exercise in the treatment of tuberculosis. The speaker wisely stated that exercise should not be prescribed while the disease was still active, but made the mistake of giving as the indications for the absence of activity, the absence of clinical symptoms, such as cough, expectoration, malaise and fever. Such a conception is wholly wrong. How often do we see patients walking with symptoms of malaise, cough, expectoration, and temperature, the

latter sometimes as high as 101° and 102°, who lose all these symptoms after a few days or weeks in bed. Yet no one would say that this disease process has become inactive in so short a time. Many patients have a tuberculous process which is clinically inactive although they continue to cough and expectorate bacillus bearing sputa from cavities which have failed to heal. Many patients suffer from malaise from causes other than tuberculosis and may still suffer from it after all activity from tuberculosis has disappeared. The temperature is too often taken as being the guide to the degree of activity. The temperature curve is an index of the ratio of heat dissipation to heat production; and while a rise of temperature is associated with an increased heat production which takes place when an active infection is present in the body, a temperature rise may be caused by excessive muscular exercise, or by remaining in a superheated atmosphere, or by certain nervous reactions which interfere with heat elimination. There are two important elements, then, to be considered in the production of rises in temperature: the increased heat production and the decreased heat elimination. Heat elimination takes place to the extent of eighty-five per cent., through the blood vessels of the skin. Therefore the nerve control of these vessels is a very important factor in the control of the body temperature. A patient may have active tuberculosis and yet the control of the blood vessels of the skin may be such that he is able to eliminate a little more than an average amount of heat; under such circumstances the body temperature might be kept at the normal.

So it is evident that one cannot rely on the disappearance of the common symptoms which accompany tuberculosis as meaning that the disease is no longer active, nor is it necessary that they all be absent before the process is inactive. One must recognize that tuberculosis is a chronic infectious disease in which pathological changes take place

very slowly. The same cycle of changes, from infection to the development of the disease and resolution, which takes place in an ordinary boil in a week, in pneumonia in two or three weeks, in typhoid fever in six or eight weeks, takes place in tuberculosis in months or years. From the time of implantation of bacilli with formation of the tubercle in a lung until the time of its producing active tuberculosis or healing may be months or years. Under conditions most favorable for healing it is my opinion that changes continue to take place in the lung of patients suffering from early clinical tuberculosis for a period of one and one-half or two years. This opinion is based on results obtained from watching contractions which occur in the lung, the data elicited on auscultation, and the time required for the muscles (sternocleido-mastoideus, scaleni, pectoralis, trapezius, levator anguli scapulæ and rhomboidei) which are reflexly thrown into spasm by the inflammation in the lung to lose their rigidity.

I endorse the statement that exercise should not be used in the treatment of tuberculosis during the period of clinical activity, but would suggest that it is not sufficiently definite. This does not mean that exercise should be prescribed as soon as a patient loses his cough, expectoration, fever, and toxic symptoms. Rest, in my opinion, should be employed until such a time as exercise will not cause an increase or a return of clinical symptoms; and until such a time as the patient has secured a degree of resistance and reserve force which is capable of supplying the extra demand made upon him by the exercise without lowering his reserve for fighting the infection. When the patient has reached this condition may be judged by observing him carefully and by careful examination. Rest is preferable as long as signs of active necrosis are present and until the breath sounds have assumed the harsh quality characteristic of scar formation.

It has taken me many years to develop the program which I now follow in the treatment of tuberculosis In no other line of therapy do I feel that I have made greater advances in treating the tuberculous patient than in the application of rest and exercise It is my invariable rule to put patients to bed on entering the sanatorium regardless of the degree of illness. My purpose is first to relieve the patient of all extra and avoidable demands upon his physical body that his energy may be directed toward fighting his infection. I also endeavor to secure as high a degree of nerve relaxation as is possible; so that by the time the disease process is inactive and it is time to build up a strong physical state, the nerve balance will be restored to such a degree as to be able to do its part. In this connection it must be remembered that tuberculosis is a chronic infectious disease and that the diagnosis is rarely made until the disease has existed for a long time. During this time toxins have been exerting their harmful influence upon the nerve cells which result in rendering them unstable. As we endeavor to rest and exercise the physical body in order to restore physical strength, applying each measure when it is indicated, so do we through mental relaxation and psychotherapy endeavor to rest and exercise the nerve centres and psychical being so as to restore the nerve and psychic equilibrium.

The success of a measure depends much upon its technic. The technic must be adapted to the individual patient, to the physician who employs it, and to the conditions under which it is operative. What I consider the ideal technic for applying rest and exercise to the treatment of tuberculosis is the one that I follow in the sanatorium. The patient upon entering the institution is put to bed. If his maximum daily temperature is near or only a degree or so above the normal and there is no other condition to contraindicate it, he is allowed to get up to wash and go to the toilet, and to sit up while his bed is

being made. His baths, however, are at first given by the nurse. If toxemia, as indicated by fever, or other contraindicating conditions are present, then the wash bowl is brought to the patient while in bed; if severely ill, the urinal and bed pan are used and the bed is made without the patient getting up. Patients are treated with this degree of rest and care until signs of activity lessen and until such a degree of physical and nerve stability has been reached as to warrant the opinion that increased exercise will be beneficial, or at least not harmful.

This long period of rest, in my experience, is borne well by more than ninety-five per cent. of patients. The first few days are the most difficult. Lying in bed relieves certain muscles and brings strain upon others. These latter ache, the same as muscles which are not accustomed to being used in walking ache after a long tramp. This should be explained to the patient. This discomfort disappears in a few days. The patient needs sympathetic encouragement during this first period, and if properly guided at this time will usually co-operate satisfactorily. This enforced rest and care is, as a rule, a new idea to the patient; it often impresses him with his first idea of the seriousness of his disease, and thus affords him the basis for a wholehearted necessary co-operation. The few who will not co-operate usually make unsatisfactory patients and obtain unfavorable results. Fortunately this régime is usually quickly followed by some improvement and often by a very striking one. This shows the patient the value of the rest, and, if he is intelligent, usually calls forth an earnest co-operation.

Those patients who remain at home usually fail to secure the advantages that such a program insures. They are living among the well who, as a rule, are untrained in carrying out the program; so the benefits derived are usually much below that obtained in an institution. There is a desire on the part of the patient to eat at the table, to go to the

bath room whether able to or not, to visit at various times and often with those who remain too long and tire the patient. The extra demands made upon the patient are often sufficient to turn the balance against him.

If the patient and those who care for him could only realize that whether or not healing will take place is largely a matter of whether the patient can provide sufficient energy to carry on the ordinary processes of metabolism, meet the demands made by the amount of exercise taken, and still have a surplus for fighting the disease, the necessity for rest would be better understood. If they would then further realize that the act of sitting quietly in a chair requires twenty per cent. more energy than lying quietly in bed; and that sitting up, walking or engaging in active conversation requires probably forty per cent. more than lying quietly in bed, the necessity for rest would be better comprehended.

When the time comes to put the patient on exercise caution should guide each movement. I usually allow the patient to sit up only ten minutes the first day, and then increase by five or ten minutes a day, according to the particular condition of the patient. My idea is to increase the exercise so gradually that no possibility of tiring can exist. When one-half hour is reached, I have the patient divide the time and sit up at two periods, one in the morning and the other in the evening. When one hour is attained, it is repeated for several days; so is two hours, and three, before advancing. The length of time taken to advance to two or three hours sitting up varies greatly according to the patient. The stronger patients are allowed considerable freedom about their rooms during the time when they are sitting up two or three hours. This is preparatory to walking.

When a patient is able to sit up three hours without tiring he is ready, providing there are no other contraindications, to begin walking. On the

first day I order fifty or one hundred feet, according to the patient, and have it increased by the same amount each day, stopping and repeating for several days when half a mile, one mile and two miles have been attained. The ultimate distance to be reached depends upon the patient; so does the rapidity of attaining it. The maximum of some patients will be one-half mile, but that of others ten miles. When possible, I attempt to have the average patient walking at least two or three miles a day and the stronger ones five or ten miles before discharging them from the institution. Such a program should then be followed for a long period of time. If the patient starts work of any kind, however, the amount of walking must be reduced so as to bring his expenditure of energy within his production, otherwise disaster will result. Patients who can walk ten miles a day without tiring will usually stand an ordinary day's work without harm, providing they begin by working a few hours a day and gradually increase the amount.

The success of this program depends first upon thorough rest, dropping the patient's energy expenditure below the point of energy production; and then, when the patient is relieved of the extra demands made upon him by the disease process, increasing his ability to meet larger demands for increased energy by gradually accustoming him to an increased amount of exercise.

Time is the essence of this program. It cannot be carried out quickly; only as rapidly as tuberculosis heals. The successful healing of tuberculosis requires a long time. It can not be cut short with safety. There is a time when nearly all cases of clinical tuberculosis can be successfully combated by intelligent therapy carried out for a sufficiently long period of time. There is no definite set period of time, when the disease should heal or be considered incurable. One patient will respond much quicker than another; one will be more conscientious in his treatment than another; and still one

will have a different tuberculous process from the other. The patient must be guided by the physician who knows, and keep fighting until the result has been attained.

The program here outlined is only that for the application of rest and exercise. It alone is not to be considered sufficient. Everything that will aid should be added. Open air, good food, psychotherapy, aerotherapy, heliotherapy, hydrotherapy, tuberculin, attention to symptoms and complications, should each be employed for the five or ten per cent., that it will add to the chances of healing.

Too much of our effort in the treatment of tuberculosis is poorly directed. We must draw our minds away from the narrow conception of an infiltration in the lung, and make our conception include the patient with all the effects which this disease has produced upon him, either directly or indirectly. Then and not until then will we grasp the serious problems which this disease produces, and understand that the treatment of tuberculosis is a re-education and a rehabilitation of one whose physical, nervous, and psychical equilibrium has been destroyed by the long continued action of a chronic infectious disease. When this point of view has been attained, the necessity for physical rest and nervous relaxation in the program for the treatment of chronic clinical tuberculosis and the necessity for early diagnosis and prompt energetic treatment before these serious changes have taken place will be more fully recognized.

REFERENCES.

1. JOSLIN: *Treatment of Diabetes Mellitus,* Lea & Febiger, Philadelphia, 1916, p. 199.