Work Capacity: Its Role in the Treatment of Tuberculosis*

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The treatment of tuberculosis, based as it is upon the concept of bed rest, has as its ultimate objective the restoration of the patient to a state of relative well-being and a capacity for participating in a program of work which is consistent with his handicap. For the physician who treats the tuberculous patient, for the others who are interested in the other aspects of his rehabilitation, and for the patient himself, the problem of absolute bed rest has been a vexing one. Countless papers have been written dealing with the factors which prompt patients to leave tuberculosis hospitals against medical advice, and not a few have referred to the inability of patients to adjust to the bed rest regimen.

The physician must rely for the most part upon his experience and empirical judgment to determine at what time the patient may begin his activity and how much activity he may undertake. Neither qualitative nor quantitative yardsticks have yet been developed by which the amount of activity in which a tuberculosis patient participates may be measured, with perhaps the possible exception of the time factor. Thus a patient for whom activity is prescribed is told that he may devote a half hour twice each day to reading, studying, occupational therapy, or related work.

With the development of rehabilitation programs for tuberculous patients during recent years, it has become increasingly apparent that evaluation of their work capacity constitutes a significant factor in assisting them to evolve vocational readjustment plans consistent with their physical limitations. The ability of the patient to sustain, without untoward effects, an activity program when his pulmonary lesion has become stabilized enters into the evaluation of his clinical status. Thus the patient

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with an unstable pulmonary lesion is classified as "active" clinically or pathologically, and is generally kept at absolute bed rest until the lesion stabilizes. Activity, in most instances, is permitted only after a lesion has become stable. The patient then progresses through graduated levels of activity, more or less following a "time table," unless a flare-up occurs. At the time of discharge, the patient who has reached the classification "arrested" has a work capacity for one hour of walking exercise twice daily, or its equivalent, having shown that he has been able to sustain such a program for a period of two months without reactivation of his symptoms of his lesion. For some time now, it has been obvious to many of us that this activity level is insufficient to meet the conditions which the patient must encounter in the work-a-day world. Furthermore, the physician is unable to predict with any assurance just how well the patient will tolerate a given work experience because in most instances it has not been possible in the hospital to observe the patient's reaction to activity similar to that which he will be subjected to in the job of his choice.

Recent studies have yielded information which may contribute to a better understanding of the physiology of bed rest and exercise and may possibly suggest useful techniques which may be applied in the management of pulmonary tuberculosis. In a series of carefully controlled observations, using conscientious objectors, Keys¹ found that, following a six week period of absolute bed rest, otherwise normal subjects demonstrated significant signs of physical and mental deconditioning. He reports that, while there is relatively little loss in simple muscular coordination; endurance, postural coordination, and adjustment are quickly impaired. Cardiocirculatory capacity and efficiency are reduced, the blood volume diminishes, the heart becomes smaller, and a relative tachycardia develops even in basal rest. He also has found rather clear indications that tissue metabolism is affected. The body goes into negative nitrogen balance, requiring an appreciable increase in protein intake to restore normal balance. A negative calcium and potassium balance is also observed, further suggesting that tissue disintegration is taking place. Thiamine, vitamin C, and riboflavin appear in the urine in unusual amounts. These observations are especially interesting since similar phenomena are not uncommonly associated with the clinical findings in tuberculosis. Barr and his co-workers² have reported substantially similar data and, in addition, a marked hyper-reaction to the tilt table. These findings become even more significant when related to the observations of Bray³ who questions the value of absolute bed rest in treating pulmonary tuberculosis in patients who show good nutrition and are symptom free or practically so. Bray cites the paucity
of published studies which contain strong evidence that strict bed rest is significantly more effective than prescribed and graduated activity. He further observes that curtailment of activity has a definitely deleterious effect upon muscle tone and mental attitude.

Recognition of the fact that patients, subjected to strictly limited opportunities for exercise or related activity during their illness, developed tangible evidence of both physical and mental degeneration, prompted the development by the Army and the Navy of reconditioning programs in the various service hospitals during the recent World War. This type of therapy materially helped to restore thousands of men to maximum levels of efficiency and, simultaneously, shortened the length of their hospital treatment. Patients were brought to a peak of physical fitness through a reconditioning process which included physical therapy, occupational therapy together with competitive team play, supervised and graduated calisthenics, and active recreation. The mental aspect was not neglected. Patients were encouraged to enroll in a variety of study courses which were developed by the United States Armed Forces Institute. Many patients in Army and Navy hospitals were thereby able, successfully, to complete and receive academic credit for the educational work which they took. The rehabilitation value of this reconditioning program has been adequately demonstrated.

These observations suggest that basal physiologic rest should be prescribed with as much care as is an activity regimen. It should be noted that none of the studies which have been cited discounted the value of bed rest as a therapeutic measure. If any conclusion may be drawn, it would suggest that greater consideration be given in prescribing basal physiologic rest, to the amount required and for what length of time. Furthermore, the effects of too much rest should be considered. This concept does not seem to be inconsistent with the present principles of bed rest therapy in the treatment of pulmonary tuberculosis.

It therefore seems quite clear that to be effective, a work capacity program for tuberculosis patients should be predicated upon a consideration of the following: the factors which determine how soon a patient may be permitted to begin an activity program; the factors which determine the amount and type of activity prescribed; and the factors which determine when and by how much, activity may be increased.

There is no doubt regarding the necessity for restricting the activity of the patient who is toxic and shows the characteristic elevated temperature, pulse, and erythrocyte sedimentation rate, is in poor nutrition, or whose pulmonary lesions are in any way
suggestive of an acute tuberculous process. At such time, however, as the toxicity has subsided, the patient has improved nutritionally, and there is evidence that the pulmonary lesion is regressive, it would appear that an activity prescription may be considered.

Based upon the studies which have been cited and some work done by Covalt and Covalt, we are presently studying a program of mild, graduated exercises which are to be given by physical therapists under medical supervision. These exercises are particularly designed to teach the patient how to relax and thereby enable him to tolerate a bed rest regimen which will still constitute the major portion of his therapy. At the same time, however, it is intended that these exercises will initiate the restoration and maintenance of muscle tone. An indication of the type of exercise which will be employed may be obtained from a brief description of the first series which will be prescribed for the patient who has been on complete bed rest and has reached the point of being able to sustain a minimum of activity. The exercises are demonstrated to the patient by the physical therapist to insure that he understands the procedures.

(The following exercises are done by the patient while lying flat on his back. They are repeated four times each day at prescribed times):

1. Curl the toes downward and at the same time bend the foot upward at the ankle. Relax and repeat three times. Exercise one foot at a time.

2. Repeat exercise number 1, but this time rotate the foot upward and inward so that the sole of the foot may be seen. Relax and repeat three times.

3. Keep the leg straight. Tighten the muscle on the upper surface of the thigh, pulling the kneecap upwards. Relax and repeat three times.

4. With the legs flat on the bed and about twelve inches apart, rotate the legs inward keeping the knees straight. Relax and repeat three times.

5. Clench the fingers of your hand to make a fist. Relax, stretching the fingers open and apart. Relax and repeat three times. Do this exercise one hand at a time.

The patient's reaction to this exercise program will be closely observed. If it is found that he is able to sustain the preliminary series, the second set of exercises will be prescribed and his reaction similarly noted. In this manner, we propose to increase the amount of activity and simultaneously the length of time. Integrated with this exercise program and depending upon the patient's interests, he will be permitted to read and sit up for
his meals. The total amount of such activity will be kept within the time limit specified by the physician. As the patient demonstrates continued progress in dealing with his disease, the activity prescription will be increased and occupational therapy and educational therapy facilities will be introduced. These will be determined by evaluating the patient's interests and aptitudes.

It should be evident that the only criteria which we now have are those which indicate that the patient shows no untoward elevation of temperature, pulse rate, or sedimentation rate of the red blood cells; and, further, that roentgenologically his lesion shows continued retrogression. However, as patients progress to ambulatory status and their activity program becomes diversified, the problem of evaluation becomes more complicated. The physical demands of different types of activity vary. Consequently, walking along level ground does not require as much energy output as climbing a hill. Similarly walking may logically be expected to require more effort than work at a desk or a work bench. The effect of these factors on fatigue must also be considered. The determination of activity equivalence is therefore a problem which will require special study. We propose to study our patients as they perform at their various activities and record the effects of measured amounts of work upon body temperature, pulse rate, erythrocyte sedimentation rate and similar physiologic reactions. It may be particularly interesting to observe the effect which such a program of graduated exercise and work will have upon calcium and potassium balance, and also upon the thiamine, vitamin C and riboflavin output. It would also be of particular interest to make these determinations in individuals with active pulmonary tuberculosis who have not as yet begun their bed rest regimen. Because our program is just now being developed, we have not been able to obtain data for inclusion in this paper. We are hopeful that this will be possible in the near future and that this discussion will stimulate investigation of this question by others. It seems possible that such study may yield some information which may serve as the basis for a better understanding of the problem of bed rest and work capacity.

While seemingly unrelated to the question of work capacity, the deformity which not uncommonly follows thoracoplasty does have associated with it limitation of arm and shoulder function and, of course, the mental reaction of the patient. It may consequently be of interest to report on the program which is being developed at the Veterans Administration Hospital at Oteen, which we expect will prevent the deformities and other functional defects which have been referred to. The success of similar programs which were employed by British workers and later in our Army
hospitals has recommended this approach to us. By individual preoperative and postoperative treatment and instruction given the patient by the physical therapist under the supervision of the surgeon and the physician-in-charge of Medical Rehabilitation, the patient is taught the principles of correct posture. Following surgery a series of mild, graduated exercises is prescribed and the patient is encouraged to use the arm on the operated side rather than keep it splinted to his side and inactive.

The work capacity program which we are developing is the principal mission of the Medical Rehabilitation Service, following the pattern so successfully demonstrated by the convalescent programs developed by the Armed Forces. As established by the Veterans Administration, the Medical Rehabilitation Service at our hospital at Oteen, North Carolina, which is almost wholly devoted to the treatment of tuberculosis, consists of four component units: Physical Therapy, Occupational Therapy, Educational Therapy, and Manual Arts Therapy. Under medical supervision, the work of each is coordinated to provide the patients diversified yet regulated activity which is both therapeutic and purposeful. As early as is consistent with his physical condition and his intellectual interests, each patient is permitted to participate in work, study and recreation designed both to enable him to explore his interests and aptitudes in a variety of vocational pursuits and also to enable the patient's physician to observe his ability to sustain such a program of activity.

SUMMARY

The concept of work capacity as applied in the treatment of pulmonary tuberculosis has been reviewed in the light of several recent studies of deconditioning phenomena. The question has been raised as to whether prescribed and carefully graded exercises may be effective in minimizing physical deconditioning of tuberculous patients if employed prior to ambulation. The need for more objective criteria for evaluating work capacity is suggested and a work capacity program outlined.

It is the hope of the authors that the views presented here will stimulate further study of these problems.

RESUMEN

A la luz de varios estudios recientes sobre los fenómenos del reacondicionamiento se ha analizado el concepto de la tolerancia al trabajo, en su aplicación al tratamiento de la tuberculosis pulmonar. Se ha discutido el problema de si los ejercicios prescritos y cuidadosamente graduados podrían ser eficaces para reducir al mínimo el reacondicionamiento físico de pacientes tuberculosos,
si se practicaran antes del período ambulante. Se indica la necesidad de emplear criterios más objetivos para evaluar la capacidad para el trabajo, y se bosqueja un plan de tolerancia al trabajo.

Los autores abrigan la esperanza de que las opiniones aquí presentadas sirvan de estímulo para que se emprendan estudios adicionales sobre estos problemas.

REFERENCES