Rehabilitation in Congestive Heart Failure

By Howard A. Rusk, M.D., and Menard M. Gertler, M.D.

The philosophical concept of rehabilitation has gained wide recognition over the past 10 years. One of the reasons for the rapid advance in this comparatively new discipline is that numerous studies have begun to define scientifically the meaning and practice of rehabilitation. The scientific knowledge thus attained in concepts of rehabilitation coupled with the increased physiologic and biochemical knowledge of congestive heart failure and a better understanding of the meaning of cardiac functional classification in terms of ergometry and ergonomics has at long last permitted a more scientific as well as clinical basis for rehabilitation.

The projected population in the United States in 1980 is estimated to be about 200,000,000. There appears to be no doubt that by 1980, 45 per cent of the individuals in this population will be over the age of 45. Accordingly, nearly 90,000,000 individuals will be in an age group where cardiac disease will be the most prevalent. At the present time, the cost of heart disease to the nation in terms of merely dollars and cents exceeds 4 billion dollars annually. This does not include, of course, the intangible loss in happiness, comfort, and equanimity to the individual and his family. It is therefore imperative to recognize the present as well as the future needs for rehabilitation of the patient with cardiac disease.

The technic and practice of rehabilitation procedures have proved to be of inestimable value in the hemiplegic patient and the patient with coronary heart disease. Results in various industries prove conclusively that patients with coronary heart disease not only resume their original occupation but continue their duties with less absentee days and with at least as much efficiency as do the healthy, noncardiac group. In addition it has been demonstrated in a group of industrial cardiac patients in functional classes I and II that over 70 per cent returned to their former occupations and maintained an equal work status with their noncardiac colleagues.

Rehabilitation of the patient with congestive heart failure involves the same team approach, cooperation, and principles established in other areas of rehabilitation. Specifically, for the patient with cardiac heart failure the physician either alone or in cooperation with the other disciplines must endeavor to obtain the maximal cardiac function with minimal risk to the individual patient so that he can perform his role with the most efficiency and acceptability in the environment in which he lives and works.

Eventually all cardiac patients, whether hypertensive, arteriosclerotic, rheumatic, or congenital, are more likely to develop the syndrome of congestive heart failure than any other complication. The exact number of individuals who are hospitalized or who are ambulatory with congestive heart failure is unknown, for the statistics on this problem are unsatisfactory and have not been considered in great detail. For diverse reasons, it is difficult to know at the present time the exact incidence of congestive heart failure. A survey of a hospital ward and a survey of 1,000 consecutive private patients indicated (a) 31 cases of grades 3 to 4 congestive failure in 180 ward beds and (b) 93 private cases with grades 1 to 2 congestive failure. (No attempt was made to classify the etiologic type of heart disease.)

Congestive Heart Failure as Related to Rehabilitation

The syndrome of congestive heart failure may be looked upon in simple terms as a bodily state wherein there is a failure of bio-

From the Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center.

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chemical energy within cardiac muscle to be converted into mechanical energy for propulsion of blood to meet the requirements of various organs. Accordingly, there are 3 areas in which failure may develop: (a) failure in energy production or substrate availability, (b) failure in energy transportation, and (c) failure in energy utilization.\textsuperscript{13, 14} According to this enlightened and biochemical concept of congestive heart failure, the correction of failure is basically the correction of bioenergetics in the areas described. The heart must be placed in a condition in which it meets its demands easily. This is the first basic principle of cardiac rehabilitation, i.e., know the exact diagnosis and evaluate the treatment from the viewpoint of the whole patient. There are 5 other basic principles of cardiac rehabilitation:\textsuperscript{15}

1. Evaluate the patient's medical, psychological, social, and vocational status.
2. Individualize management, including diet, drugs, physical activity, emotional stress, environmental stress, etc.
3. Discuss with the patient the nature of his disease and the prognosis and treatment, as well as the assessment of his capacities and how he can best arrange his life to fit his needs.
4. Make every effort to eliminate the patient's fear of heart disease.
5. Encourage the patient to live the best life possible within the limits (if any) imposed by his disease.

Energy measurements of cardiac work have been calculated directly and indirectly. The direct measurement exceeds the indirect by far in accuracy but cannot be employed routinely or continually. These measurements consist of bioenergetic studies of mitochondrial systems prepared from animals in experimental heart failure\textsuperscript{15} and coronary sinus catheterization.\textsuperscript{16} The indirect measurements are not without criticism but are practical and useful for the evaluation of the patient for cardiac rehabilitation. The methods employed most frequently for the evaluation of energy costs of myocardial work are based upon indirect calculation from oxygen consumption of the total individual during a standard sustained exercise, dye-dilution studies, and balistocardiogram.\textsuperscript{17, 18} The results obtained by Kottke,\textsuperscript{2} Bruce,\textsuperscript{18} Jones,\textsuperscript{19} Benton and Rusk,\textsuperscript{20} and Hellerstein and Ford\textsuperscript{21} have contributed much to our knowledge concerning the functional capacity of the heart during and following illness. This information coupled with the classic information of Passmore and Durbin\textsuperscript{4} on the energy cost of various human endeavors has placed cardiac rehabilitation on a human, scientific, and practical basis.

Special Rehabilitation Procedures

One of the most important phases in the rehabilitation of patients with congestive heart failure is a proper diagnosis both as to functional and therapeutic classification. With the proper diagnosis, specific medical treatment for the particular type and degree of heart disease may be instituted. In addition to the general supportive and therapeutic measures given to the patient with congestive heart failure such as digitalis, low-sodium diet, diuretics, and vitamins, specific measures for (a) coronary disease may include anticoagulants and an isocaloric diet low in short-chain fatty acids, (b) for hypertensive cardiovascular disease the use of one or more of the many antihypertensive drugs, and (c) in rheumatic heart disease, the use of salicylates and steroids during the early phase of failure may be mandatory. In addition prevention of further rheumatic episodes is in order with the use of antibiotics.

A further word may be said in favor of calculated exercise in coronary heart disease. Exercise has been shown recently to be effective as a protection against coronary heart disease in 3 areas: (1) it increases collateral circulation in the myocardium;\textsuperscript{22} (2) it increases the plasmin serum levels thus aiding in the dissolution of blood clots;\textsuperscript{23} (3) it decreases the incidence of atherosclerosis in rabbits fed high-cholesterol diets.\textsuperscript{24} The exercise should not be sustained but rather intermittent with an output of not more than 4.0 calories per minute.

Jones\textsuperscript{19} has classified cardiac patients with
Table 1
The Interrelationships Between Cardiac Functional Classification, Physiologic Symptoms, and Ergometrics

<table>
<thead>
<tr>
<th>Cardiac functional classification</th>
<th>Physiologic symptoms</th>
<th>Maximum calories per minute sustained</th>
<th>Intermittent</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Patients with a cardiac disorder without limitation of physical activity. Ordinary physical activity causes no discomfort</td>
<td>5.0 6.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Patients with a cardiac disorder with slight to moderate limitation of physical activity. Ordinary physical activity causes discomfort</td>
<td>2.5 4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. Patients with a cardiac disorder with moderate to great limitation of physical activity. Less than ordinary physical activity causes discomfort</td>
<td>2.0 2.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV. Patients with a cardiac disorder unable to carry on any physical activity without discomfort</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Modified from Jones.*

Congestive failure into the functional classification of the American Heart Association and determined the output in terms of calories per minute. These are summarized in Table 1. It is very important in assaying the performance of work for the cardiac subject to note the effect of peak sustained effort in comparison with intermittent effort, because the same amount of calorie output may be accomplished by a cardiac subject working intermittently over a longer period without danger while at peak sustained effort the work may be done in a shorter period but the cost could be devastating, e.g., in coronary heart disease.

Choice of Occupation
The choice of occupation may require more than just a casual glance at occupations and ergometrics. There are, in addition, intangible factors which are very specific for each individual and the type of cardiac disorder. An individual, for example, who has had a myocardial infarction should not be permitted to engage in an occupation which may endanger the lives of the public, i.e., bus driver, train engineer, or pilot.

The ergometric and ergonomic studies of Passmore and Durnin and others have permitted the removal of the guess work from a physician's instructions to patients. Instead of saying to a bed ridden patient, "Do a little more" the patient may be told to shave in bed (1.0 cal./min.); sit up in bed for an hour (3.0 cal./min.); walk down the hall for 15 minutes (4.0 cal./min.). Thus, by giving specific instructions, the patients progress may be gauged, e.g., if symptoms of angina or dyspnea or signs of tachycardia or increased venous pressure do not appear with low cal./min. activities, then activities of increased cal./min. are instituted until patient is completely ambulatory and self sufficient according to the scheme of activities of daily living.

A few of these activities are summarized in Table 2.

Table 2
Energy Costs of Various Activities and Occupations

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cal./min</th>
<th>Activity</th>
<th>Cal./min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing &amp; dressing</td>
<td>2.6</td>
<td>Inspector</td>
<td>1.2</td>
</tr>
<tr>
<td>Washing face &amp; combing hair</td>
<td>2.5</td>
<td>Shoe repairing</td>
<td>3.0</td>
</tr>
<tr>
<td>Sitting</td>
<td>1.6</td>
<td>Shoveling</td>
<td>10.0</td>
</tr>
<tr>
<td>Standing</td>
<td>2.0</td>
<td>Postman</td>
<td>10.0</td>
</tr>
<tr>
<td>Sewing, 30</td>
<td></td>
<td>Planning</td>
<td></td>
</tr>
<tr>
<td>Peeling potatoes</td>
<td>2.4</td>
<td>hardwood</td>
<td>9.1</td>
</tr>
<tr>
<td>Polishing floor</td>
<td>4.5</td>
<td>Gardening</td>
<td>4.4-5.6</td>
</tr>
<tr>
<td>Bed making</td>
<td>5.4</td>
<td>Hoeing</td>
<td>4.4</td>
</tr>
<tr>
<td>Beating and</td>
<td>2.8</td>
<td>Driving a car</td>
<td></td>
</tr>
<tr>
<td>brushing carpets</td>
<td>7.8</td>
<td>Golfing</td>
<td>5.0</td>
</tr>
<tr>
<td>Climbing stairs</td>
<td>6.0-10.0</td>
<td>Tennis</td>
<td>7.1</td>
</tr>
<tr>
<td>Walking 3.0 m.p.h.</td>
<td>5.6</td>
<td>Cycling</td>
<td>5.0-10.0</td>
</tr>
<tr>
<td>Typing</td>
<td>1.5</td>
<td>Dancing</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Conclusions
In addition to the necessity for meticulous diagnosis, physical evaluation, and prescription the psychologic and emotional factors are of primary importance. Confidence based on gradually increased work experience and a
close patient-physician relationship are fundamental in establishing the milieu necessary for successful rehabilitation. As Spiller has so aptly said, “Action absorbs anxiety.” In congestive heart disease, action is an invaluable therapeutic tool but like all potent remedies, it requires all of the skills of the dedicated clinician to prescribe it safely and effectively.

**Summario in Interlingua**

A parte le necessitate del plus meticulose attention in diagnos, evaluation physique, e prescription, factores psychologic e emotional es de importantia primari in le rehabilitation de patientes con congestive disfallimento cardiaco. Confidentia basate super un gradualmente aumentate carga de labor e un intime relation inter le patiente e le medico es de importantia fundamental in establir le milieu que es necessari pro successo in le rehabilitation. Como Spiller lo ha si ben exprimite: “Action absorbe anxietate.” In casos de congestive morbo cardiaco, action es de inestimabile valor therapeutico, sed—como omne potente remedios—pro esser salve e efficace, illo debe esser prescribite con omne le habilitate de un dedicate clinico.

**References**

1. **Purdue Farm-Cardiac Seminar**: Purdue University, Indiana, September, 1958.

12. **Gertler, M. M.**: Personal observations.