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PHYSICAL EXERCISE AND REHABILITATION AFTER MYOCARDIAL INFARCTION

Experience from a General Hospital

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ABSTRACT. The methods used in a general hospital for graded physical training after myocardial infarction are briefly described. The training is physician-supervised and its purpose is to alleviate symptoms, improve physical capacity and speed vocational rehabilitation. No adverse effects have occurred. Of 22 patients who had difficulty in readjusting to work, 11 have resumed full-time and 6 part-time work. As a result of this favourable experience, a programme of graded physical exercise has been introduced for use in the early phase of recovery from myocardial infarction.

The treatment of myocardial infarction has essentially changed in the past decade. Special hospital units have increased the survival rates in the acute phase. The previously prevailing restriction of physical activity during convalescence has been supplanted by a considerably more active attitude towards rehabilitation of the patient. The favourable results of activation during early stages of infarction have been reported in a number of papers (1, 3, 10, 11, 12). Physical training during later convalescence (1, 2, 6, 7, 8, 12) and vocational rehabilitation (10) have likewise given encouraging results. The physiologic basis of this positive experience is not yet clear, but the most important factor is now thought to be more economical use of the cardiac work due to better adjustment of the peripheral circulation (4, 5, 13). Improved collateral circulation is among the other factors that have been discussed (1).

At the rehabilitation department of Eskilstuna Central Hospital, physical training after myocardial infarction in patients whose difficulties included vocational readjustment has been practised since 1964. When necessary the training is followed by measures to aid re-employment. Since an acute infarction unit was established at the hospital in 1967, the staff of the rehabilitation department have collaborated also in the early mobilization of the patients.

The purpose of the present paper is to describe the routine procedure during the phases of mobilization and reconditioning after myocardial infarction and to present conclusions permitted by experience from the past 5 years of this work.

Aims of the rehabilitation programme

The main aims are as follows.

1. Alleviation, or if possible elimination, of cardiac symptoms such as angina pectoris, dyspnoea and palpitations,
2. increase of the patient's self-confidence concerning cardiac capacity, so that he may fully utilize that capacity,
3. improvement of physical working capacity,
4. readjustment to work in optimal conditions.

METHODS AND ORGANISATION

A. *Phase of mobilization*

A specially trained physiotherapist assists in the early stages of rehabilitation. The principles of treatment are essentially those practised at Sahlgrenska Hospital in Göteborg (10), i.e., a supervised, graded programme of activity, from breathing exercises and thrombosis-counteracting movements to stair climbing.

The physiotherapist is notified of all admissions to the infarction unit and begins immediately

Table I. *Subjective effects of physical training after myocardial infarction*

Effect	General opinion of benefit	Confidence in regard to cardiac capacity	Alleviation of angina pectoris	Physical fitness
Positive	18	17	9	15
Neutral	3	5	11[a]	7
Negative	1		2	

[a] Including 7 patients who had never had angina pectoris.

with supervision of breathing. As soon as the internist judges that the acute phase has passed, a referral note is sent to the rehabilitation department, with information on the clinical course, especially on any complications such as arrhythmia and cardiac failure. The medical staff of the rehabilitation unit assess the case and together with the physiotherapist plan the programme of mobilization. Until the patient is ready for discharge, any problems that arise are discussed at weekly conferences between the medical staff of the infarction and rehabilitation units and the physiotherapist.

About a week before the patient is discharged from hospital, he is again seen by the medical rehabilitation staff, when special attention is paid to vocational rehabilitation. Patients who before their illness had heavy or otherwise unsuitable work are now referred to the disablement resettlement department of the Labour Market Board, so as to avoid unnecessary delays.

Follow-up after myocardial infarction is usually done by the medical internists. Patients who 1 to 3 months after discharge still have difficulties such as cardiac distress, lack of self-confidence, poor physical capacity and defective vocational readjustment are again referred to the rehabilitation department, if no contraindications exist.

Table II. *Results of physical training after myocardial infarction in regard to working capacity*

	No. of patients
Returned to previous occupation, full-time	9
Returned to previous occupation, part-time	4
Retrained for other work, full-time	2
Retrained for other work, part-time	2
Disablement pension	5

B. *Phase of reconditioning*

The selection of these patients is made from the mentioned pre-discharge contacts and by referrals from internists who observe that readjustment is not proceeding satisfactorily. Phase of reconditioning is then conducted along two lines—physical training and vocational rehabilitation.

1. *Physical training.* All physical training in rehabilitation after myocardial infarction has hitherto been done under close medical supervision. We have not accepted patients who have had severely disturbed cardiac rhythm, such as ventricular tachycardia or ventricular fibrillation, or who currently show clustered and/or multifocal ventricular premature beats particularly if these are accentuated by effort. Cardiac decompensation and/or pronounced cardiac enlargement (as a rule more than 600 ml/m^2 body surface) are also regarded as contraindications to physical training. After the age of 65 years the indications for training decline, though we have not set any fixed age limit.

A bicycle ergometer test *ad modum* Sjöstrand is done before the physical training programme is embarked upon. The test is done in the presence of the physician who will be responsible for the patient's treatment. It is stopped if the patient experiences angina pectoris or severe dyspnoea, if cardiac arrhythmia occurs, or at the latest when the maximum permitted pulse rate of 150 beats per minute is reached.

The intensity of training is adjusted according to the results of the bicycle ergometer test. The upper limit for permitted pulse rate during training is set at about 20 beats less than the rate during the patient's maximum effort on the ergometer.

The apparatus presently used for physical training (Salud) involves a form of cycling, but using arms as well as legs. The work load can be varied

as desired, e.g. with the guidance of the pulse rate. Since our goal is primarily *to teach the patient to undertake activity without risk on his own initiative,* the training programme has not been standardized in regard to number of sessions and work load and duration for each session. All these factors are adjusted to suit the individual. The physician-supervised training is repeated daily or several times weekly. From the patient's point of view, the most obvious indication of progress is increased length of training sessions. In many cases the sessions are begun with 5 to 10 min and increase by only one or a few minutes per session up to 45 to 60 min. With this cautious time lengthening and a low initial work load, it is rarely necessary to cut short a session and return to an earlier phase of the programme. The resistance in the training apparatus is slowly increased during each session, keeping in view the permitted maximum pulse rate of 20 beats per minute below the highest rate during the bicycle ergometer test. The total length of the training programme frequently is 4 weeks, but may range from 1 to 8 weeks, depending upon the desired result. Now that a specially trained physiotherapist has been engaged for these patients, we plan to vary the training programme more. Along with the exercises in the Salud apparatus, some of the patients have received further training in the occupational therapy department.

During the period of training the patients may live at home or in a special rehabilitation ward of the hospital, or they may attend the day centre of the rehabilitation department. Advice on diet and general health is given, with special emphasis on the undesirability of obesity and of heavy smoking. We try to utilize this period also to instruct the patients concerning the long-term advantages of physical training, which probably are more important than the directly observable effects after a few weeks of the programme.

2. *Vocational rehabilitation.* With the aim of facilitating vocational rehabilitation, the department has collaborated since its establishment in 1962 with the local labour authorities. Conferences are held every fortnight at the department with the disablement resettlement officer.

Referrals for formal vocational assessment are unusual in this county, which as yet lacks a special unit for such assessment. Vocational training or re-training has relatively seldom been undertaken in persons with heart disorders, though presumably some of the patients who have undergone work training have subsequently been trained for more suitable work. About 5 % of the persons referred to the county's workshop (for work training) are handicapped by cardiac disorder.

In this connection it is pertinent that in a small follow-up survey in 1965 (9), about half of the cardiac patients who had undergone work training were found to be in economically satisfactory employment and another quarter of the patients were waiting for work or were partially employed. This series included 11 patients who had had cardiac infarction, none of whom had recurrence of infarction during or after the training period. Their total observation time after the last episode of infarction was 41 years, which was considered to indicate the suitability of the chosen occupations.

FOLLOW-UP

The effect of late rehabilitation after myocardial infarction, in the form of physical training as practised at the rehabilitation department since 1964, was assessed by a follow-up study at the end of 1968. We wished to see how far the aims mentioned earlier in this paper had been realised. The selection of patients for rehabilitation was based essentially on difficulties in vocational readjustment. Some patients had been afraid to work because of lack of confidence in their cardiac capacity. Others were prevented from working by anginal pain. Only patients who were known definitely to have had myocardial infarction, i.e. with classic ECG and enzyme reactions in the acute phase, were accepted for the follow-up study. Their medical and social histories, physical status and ECG patterns were recorded.

There were 22 patients, all men, with ages ranging from 33 to 64 years. Persons with strenuous manual occupations and with sedentary occupations were fairly equally represented in the series. All attended the follow-up examination.

There were no deaths during the observation period, which ranged from 15 to 52 months, with a mean of 26 months. Two patients had a second infarction during this period.

The great majority of the patients considered that they had benefited from the physical training (Table I). One patient had to give up because of

anginal pain. No complications occurred in connection with the training. Seven of the patients had not had angina pectoris when the programme was begun, but are nevertheless classified as "neutral" in this respect in Table I. Improvement in physical health was objectively checked in only a few cases in which bicycle ergometry was done both before and after the training programme.

The duration of sick-listing when the training began ranged from 3 to 40 months, with a mean of 12 months. The situation in regard to work at the time of follow-up is shown in Table II.

DISCUSSION

We have found no risk in this training régime, provided that the contraindications are observed, that the patients are expertly supervised and that there is good communication between staff and patients.

Since the follow-up study was concluded in 1968, the early rehabilitation during the phase of mobilization conducted by the physiotherapist has been extended. By September of the following year 77 patients with myocardial infarction had received such treatment without complications.

One of the most important factors in the rehabilitation of patients after myocardial infarction is a well-organised, continuous collaboration with the disablement resettlement authorities, in order to establish continuity between the physical training in the hospital rehabilitation department and vocational rehabilitation. Our patients have had access to a workshop for work training, and sheltered workshops, but further measures are necessary—in particular ergonomic research—to adjust work to the capacity of cardiac patients. In addition, the problem of transport to and from work is often unsolved.

Collaboration with some organised form of sport for the physically handicapped has recently been recommended for cardiac patients by the Swedish Association against Diseases of the Heart and Chest. In this recommendation we concur.

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