

CARDIAC REHABILITATION: EVALUATION OF A LONG-TERM PROGRAMME OF PHYSICAL TRAINING FOR OUT-PATIENTS

J. Perk, B. Hedbäck and S. Jutterdal

*From the Departments of Internal Medicine and Physiotherapy,
Oskarshamn Hospital, Sweden*

ABSTRACT. A community-based long-term cardiac rehabilitation programme (LTP) has been designed for patients who had completed a two-year hospital-based physical training programme after myocardial infarction (MI) and wished to continue with community-based group training sessions. Since the start of LTP 20% of all patients in a consecutive MI population <65 yrs have participated. The programme operates on a low-cost base. Its feasibility is supported by a high attendance rate and by the absence of adverse effects during more than 2000 patient training hours. In order to evaluate LTP 20 participating MI patients were compared with 20 matched control patients, who had completed the hospital-based training, but did not participate in LTP. The main reason for participation was the need for continued group support and social contact (15/20). Reasons for not participating were preference to exercise at home (10/20), long distance (6/20) and working hours (4/20). When compared with the data of the hospital-based programme one year post MI, both groups showed 4 years (average) post MI a slight but significant increase of systolic blood pressure of 12 vs. 18 mmHg. Work performance levels had been maintained (132 vs. 136 W). No patients had started smoking and there were no differences between the groups as to leisure time activities. It is concluded that a long-term training programme can be provided safely and at low cost for those MI patients who need continued support in order to maintain the effectiveness of the hospital-based cardiac rehabilitation.

Key words: myocardial infarction, cardiac rehabilitation, physical training, long-term follow-up.

Cardiac rehabilitation after myocardial infarction (MI) can be divided into three phases (1, 2). WHO phase I comprises the in-hospital mobilisation, phase II the first 2-6 months after discharge, during which rehabilitation consists of physical training, vocational counselling and advice on non-smoking and diet. WHO phase III is the long-term maintenance phase of cardiac rehabilitation. Physical training is an important part of the phase II cardiac rehabilitation but the role of physical training in secondary prevention remains under debate (3). Even the problem of encouraging and enabling pa-

tients to continue physical training needs to be solved if long-term rehabilitation is to be effective (4).

In an earlier survey we reported that all Swedish hospitals provide phase I programmes, and that approx. 50% of the hospitals even offer phase II rehabilitation (5). Three Swedish phase II programmes (6-8), and two combined phase II and III have been presented (9-11).

At present a minority of the hospitals are engaged in long-term programmes (LTP), but patient organisations in Sweden have argued for an increase of phase III programmes. The economic situation of many hospitals does not allow unrestrained expansion into new areas of health care. Therefore data on long-term cardiac rehabilitation programmes are needed. Several questions remain to be answered: Can patients be motivated to participate; which patients may benefit; is the adherence satisfactory; does LTP influence risk factors; are the results of the early intervention maintained; can it be provided on a safe and low-cost base?

The aims of this report are: (i) To describe the design, feasibility, compliance and safety of a phase III physical training programme provided to a non-selected consecutive group of MI survivors and (ii) to compare the effect of the programme on smoking, blood pressure, medication, exercise performance, return to work and leisure time activity with a matched control group of patients not participating in the long term training.

MATERIAL AND METHODS

In the Oskarshamn District Hospital a two-year comprehensive cardiac rehabilitation programme, consisting of health education, follow-up at a post MI clinic, and physical training in groups, is provided for all MI-patients <65 years. The results of the programme on mortality, morbidity, risk factors and return to work have earlier been presented (10, 11).

Table I. *Material*

	Study group <i>n</i> =20	Control group <i>n</i> =20	Rate of participation
			90–95%
Males/females	18/2	18/2	
Age at MI	58.2 (45–64)	58.5 (47–64)	
Months after MI	51.4 (26–91)	53 (22–94)	65–70%
Smoking ^a	0	0	
Systolic blood pressure, mmHg ^a	137 (100–160)	137 (105–160)	60–65%
Diastolic blood pressure, mmHg ^a	80 (60–90)	81 (60–95)	
Returned to work ^a	12	12	20%
Beta-blockade therapy ^a	12	10	

^a Data one year post MI.

From the start of the programme in August 1977 until the end of 1984 all 265 patients <65 years who had survived an MI were enrolled into the programme. Initially no efforts were made to provide further training facilities after conclusion of the two year training programme. However, many patients felt a need for continued training under supervision of a physiotherapist as they lacked the physiosocial support they had enjoyed in the training groups.

Therefore we designed a long-term programme for those patients who wished to continue: Once a month a 45 min group training session consisting of jogging, calisthenics, stretching and relaxation is offered at the department of physiotherapy. The sessions are held after working hours in order not to interfere with the working hours of the participants or with the daily activities at the department of physiotherapy. Two groups of patients participate with approx. 10–15 patients in each group. Necessary safety and resuscitation equipment is available. Occasionally physicians from the rehabilitation team join the training, which gives a good opportunity for informal health education, encouraging the patients to keep up an active way of living and to abstain from smoking. The patients are regularly informed that training once a month does not substitute the individual training at home, but that it is a valuable way of keeping up their level of fitness. Patients who wish to participate may continue to do so, as long as they wish. The programme has no time limit.

By using the available training facilities the programme operates on a low cost base. The salary of the supervising physiotherapist is paid by the Swedish Heart Patients Association (RHL).

In December 1985 we performed a controlled study in order to evaluate the long term programme. The study group consisted of 20 patients participating regularly in LTP (defined as attending at least 3 out of 5 training sessions during a 5-month period). They were compared with a control group of 20 matched patients. The patients in the control group were chosen among those, who had completed the first two years of the programme but who had not participated in LTP.

The patients were matched for sex, age (± 5 yrs), and

Fig. 1. Flow chart cardiac rehabilitation.

date of MI (± 1 yr). We included the following data from the medical examination one year post MI: Maximal work performance at the exercise test (± 50 w), smoking habits, therapy with beta-blocking drugs, return to work.

At one year post MI the groups were comparable as to heart rate, systolic blood pressure, heart-rate-pressure product and ST-segment depression at maximal work load during exercise testing (Tables I and II).

Ten patients in the study group had an observation period of 2–4 years after MI, 10 patients ≥ 4 years (av. 51.4 months, 26–91 months). Eight patients in the control group had an observation period of 2–4 years, 12 patients ≥ 4 years (av. 53.0 months, 24–94 months).

The groups were assessed by physical examination, exercise test on a bicycle ergometer, and a standardized questionnaire. Blood pressure, smoking habits, return to work and the results of the exercise testing were compared. The data on risk factors, return to work, medication and exercise testing were based upon an average observation period of more than four years post MI.

The attitudes towards physical activity and the individual training habits were studied with a questionnaire (Table III) and were further analysed in personal structured interviews between the patients and their physicians. The differences between the study group and their matched controls were calculated, using two-sided Student's *t*-test and χ^2 -tests in the statistical procedure (12).

RESULTS

Attendance rate and safety (Fig. 1)

Since the start 20% of all MI patients <65 yrs have participated, attending in average 80% of the monthly training sessions; even an increasing number of patients who have undergone coronary artery bypass grafting have joined. Yearly 300–350 patient-training sessions are being performed; no

Table II. Exercise test data at one year post MI

W = Watt, BP = blood pressure, bpm = beats per minute

	Study group n=20	Control group n=20
Max work load, W	142 (110-180)	145 (100-200)
Max heart rate, bpm	130 (98-160)	129 (100-158)
BP-max during work, mmHg	177 (150-220)	176 (130-240)
Heart-rate-pressure product/1000	23.2 (15.7-32.8)	23.0 (13.0-31.7)
Max ST-segment depression >1 mm	5/20	3/20

No differences are statistically significant.

cardiovascular complications or other adverse effects, such as orthopedic injuries, have occurred during more than 2000 hours of exercise training.

Risk factors, medication, return to work (Table IV)

In making a comparison between the results of the phase II rehabilitation one year post MI and the results 24-94 months later we observed in both groups a slight, but statistically significant rise of the systolic blood pressure. During the observation period none of the 40 patients reported that he/she had taken up smoking. Likewise there were no differences in the use of cardiovascular drugs. In both groups there were less patients in active employment, mainly due to age retirement.

On comparison between the groups there were no statistically significant differences with regard to smoking, hypertension, medication and rate of employment at the end of the observation period of 24-94 months.

Exercise testing (Table V)

The maximal exercise performance showed no statistically significant difference between the groups, when compared with the exercise test one year post

MI. Neither did we observe differences in blood pressure data and heart-rate-pressure product. However, in both groups the amount of patients with ST-segment depression >1 mm had increased.

Attitudes and training habits

All patients, even those who did not participate in LTP, considered physical training to be valuable in the prevention of reoccurrence of their coronary heart disease. The patients in the study group had continued regular physical training at home; they exercised 1-2 hours weekly (average 112 min/week). In the control group 3 patients had discontinued regular physical exercise, the remaining 17 patients trained 103 min/week on average. The most common types of exercise were cycling and jogging. Seven patients in the study group and eight in the control group wished to train more often at home, but had not done so due to working schedules or other various reasons.

Based upon the findings in the personal interviews the main reasons for participation were the need for continued social contact and group support (15/20), or maintenance of the level of fitness (5/20). In the control group 10 patients preferred individual home training, 6 patients experienced

Table III. Questionnaire

1. What is your opinion about the role of physical training in preventing coronary heart disease?
2. a: Are you training regularly?
b: If yes, how many hours per week?
c: Do you consider your training activities to be sufficient?
3. Which are your main activities during leisure time?
4. Why did you/didn't you join the long-term training programme?
5. What has participation in the long-term programme meant to you?

Table IV. Results on risk factors, return to work, medication

BP = blood pressure

	Study group n=20	Control group n=20
Systolic BP, mmHg	150 (120-195)	155 (125-200)
Diastolic BP, mmHg	80 (70-95)	81 (65-95)
Smoking	0	0
Return to work	7	8
Beta-blockade therapy	13	6

Table V. Exercise test data

bpm = beats per minute, BP = blood pressure

	Study group n=20	Control group n=20
Max work load, Watt	132 (90-180)	136 (80-220)
Max heart rate, bpm	122 (100-153)	129 (98-180)
BP-max during work, mmHg	178 (130-240)	191 (125-270)
Heart-rate-pressure product/1000	21.8 (15.3-33.1)	24.6 (13.8-36.5)
Max ST segment depression >1 mm	8/20	5/20

distance as an obstacle and the remaining 4 patients could not participate due to their working schedule.

DISCUSSION

Cardiac rehabilitation programmes play an important role in helping MI-patients to return to normal activities of daily life. Therefore patient organisations put increasing demands on health facilities to provide cardiac rehabilitation, including long-term programmes. Our study shows that the responsibility for such programmes might well be handed over from hospital health services to these organisations, if they can provide trained staff and adequate training facilities.

The organisation of cardiac rehabilitation varies considerably throughout the world. Comprehensive programmes consisting of health education for the patients and their families, medical follow-up at post-MI clinics and physical training in out-patient groups are used in many Western-European and American hospitals; whereas in central and Eastern Europe post-MI patients are more often referred to special rehabilitation clinics. The design varies from home programmes to hospital-based efforts and gymnasium exercise. Low-cost at-home rehabilitation has been described as a method to increase the availability of cardiac rehabilitation (13).

Three controlled exercise trials starting early after discharge (14-16) and two late intervention trials (17, 18) have indicated a lowering of the cardiac mortality, but the results on recurrent myocardial infarctions, lipoproteins, blood pressure and smoking differ. Several long-term follow-up studies of exercise programmes have failed to show positive results on risk factors, e.g. the cessation of smoking (19-21).

The comparison in this study between partici-

pants in the long-term training and matched controls has the methodological disadvantage of preselection. Randomisation of participation in the long-term training programme could not be performed for practical reasons.

According to our study the results of the phase II risk factor intervention, i.e. hypertension and smoking, and on medication, return to work, performance during exercise testing and leisure time activities are maintained in both groups during an average observation period of more than four years, independent of participation in the long-term programme. The lack of an additive effect on risk factors of the long-term programme can be compared with the findings in several other long-term studies e.g. (20, 21). The modest rise of the systolic blood pressure could be due to increasing age during the observation period, or withdrawal of beta-blocking therapy.

The long-term training, sponsored by the Heart Patients Organisation has attracted approximately 20% of the total group of MI-survivors (Fig. 1), which can be compared with the experiences from the Federal Republic of Germany, where 72% of the MI patients participate in phase II, whereas only 30% of the men and 18% of the women become members of a phase III heart group (22).

However, for this minority of MI patients the long-term training appears to play an important role. The need for continued group support and regular contact with the rehabilitation team among the participants was underlined by a high rate of attendance to the monthly training sessions.

The absence of adverse cardiac effects and orthopedic complications, the low-cost profile of the programme and the compliance of the patients showed that such projects may well be feasible in post-MI rehabilitation.

CONCLUSION

Based upon our earlier and present findings we suggest that hospital-based cardiac rehabilitation schemes as part of comprehensive post-MI care could be restricted mainly to WHO phase I and II rehabilitation; even the early part of phase III may be included as to support vocational rehabilitation and return to work. Thereafter a community-based rehabilitation programme can be provided safely and at low cost for the minority of the MI patients that needs continued group support in order to maintain the positive results of the hospital-based cardiac rehabilitation.

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Address for offprints:

Dr J. Perk
Department of Internal Medicine
Oskarshamn Hospital
57201 Oskarshamn
Sweden