Benefits and weaknesses of a cardiac rehabilitation programme

ABSTRACT—The British Heart Foundation and the Chest, Heart and Stroke Association have allocated funds to develop cardiac rehabilitation programmes. We have recently completed and now evaluate an exercise-based rehabilitation course reinforced with advice about return to normal activity for 110 patients who had suffered acute myocardial infarction. Patients admitted to the Plymouth cardiac care unit were randomised into groups: a control group to receive standard hospital care, and a rehabilitation group who, in addition, received an exercise programme reinforced with advice. Patients were assessed at entry to the study and at intervals thereafter. Assessment was by questionnaire and objective tests consisting of a 12-minute walking test and weekly outpatient pedometry. In the rehabilitation group patients were able to walk further and faster, return to work earlier, undertake more housework, and resume normal sexual activity; they were less short of breath and did not experience more angina. However, the rehabilitation course brought little benefit to the patients' perception of well-being and their anxiety about health or their outlook on life. Exercise and advice are important components of a rehabilitation programme, but more attention needs to be given to the psychological aspects of recovery from a heart attack.

A heart attack is often a devastating experience, particularly for people who had previously considered themselves fit. Most patients do make a satisfactory cardiological recovery but, despite this, many studies confirm a disappointing level of return to work, hobbies, social activities, and usual sexual activity. Once invalidism is established it becomes hard to alter. Thus there is a current interest in the development of good rehabilitation programmes to restore patients to as full a life as possible.

JEAN BERTIE, MCSP, *Senior Physiotherapist*
ANGELA KING, BSc., *Research Assistant*
NORMAN REED, MCSP, *District Physiotherapist*
ANDREW J. MARSHALL, MD, FRCP, *Consultant Cardiologist, Derriford Hospital, Plymouth*
CHRIS RICKETTS, PhD, *Senior Lecturer in Statistics, Polytechnic South West, Plymouth*

Patients and methods

On their final hospital day, 110 patients who had suffered acute myocardial infarction and had been admitted to the Plymouth coronary care unit were randomised into two groups: one for experimental rehabilitation, and a control group to receive standard hospital care. The diagnosis of acute myocardial infarction was confirmed by typical symptoms, electrocardiographic changes, and a rise in cardiac creatinine kinase isoenzyme.

Patients were excluded from the study:

(i) if they were visitors or lived too far from the hospital;

(ii) if they were in uncontrolled heart failure;

(iii) if they had serious rhythm disturbances which persisted and they required treatment at the time of discharge, or required pacing or needed treatment with anti-arrhythmic drugs for atrial fibrillation;

(iv) if they had another disabling illness, eg severe diabetes, peripheral vascular disease, renal failure.

All patients were asked to stop smoking and given dietary advice either for weight reduction or because of elevated serum cholesterol. To boost confidence each patient was asked to walk up two flights of stairs under supervision, and was given advice on mobilisation on discharge. Patients were told it would be safe to resume marital sexual intercourse within two weeks of discharge if normal exercise did not cause angina.

Rehabilitation programme

Patients in the exercise group were placed in a formal rehabilitation programme extending over four weeks and attended at the hospital twice a week during this period. The programme concentrated mainly on standard pulse-monitored group exercise commonly used in the physiotherapy of cardiac patients, supervised by a physiotherapist. The patient's pulse was monitored before and after each circuit of 12 exercises, and after a five-minute interval the patient repeated the circuit up to a maximum of four circuits. Further reinforcement about health measures such as not smoking and dietary advice was given at these sessions, together with a relaxation technique. Relatives were not actively encouraged to attend with the patient, nor were they discouraged from attending if they wished to do so.

Rehabilitation in the gymnasium started in the third week after discharge from the coronary care unit.

Each patient received a video recording of the exercise programme and was encouraged to undertake daily exercises at home while following the instruction on the recording.

Assessments

Assessment 1 (on the day of discharge)

On entry to the study, the assessment included a questionnaire to determine pre-illness status; patients were questioned about their occupation, their ability to do household chores, about driving, smoking, chest pain, shortness of breath, and sexual intercourse. Patients were asked to mark on a linear scale of ten their general feeling of well-being and enjoyment of life as it was at that moment. This was marked: not at all well, quite poorly, not too bad, well, very well indeed. A similar scale was used to assess anxiety about health, marking appropriately: very anxious, worried a lot, quite a lot, worried a bit, not at all anxious. We also listed eight statements about outlook on life; patients were asked to tick the columns that most described how they felt about themselves. The columns were headed: strongly agree, agree, uncertain, disagree, strongly disagree; and the statements were: (1) on the whole I felt well before admission; (2) I got pleasure from my social life; (3) I was enjoying life; (4) on the whole I was a relaxed person; (5) things used to bother me a lot; (6) I had energy to follow my interests; (7) I had an active interest in the world around me; (8) my capacity for work was satisfactory.

Assessment 2 (in the third week after discharge)

All patients were assessed with a questionnaire similar to assessment 1, with additional questions relating to visits to the GP.

Objective tests to assess the patient's exercise capability were a 12-minute walking test and an assessment of the mean daily mileage walked, calculated from seven days of recordings with a pedometer.

Assessment 3 (after rehabilitation)

This applied only to the exercise group. It included a questionnaire similar to assessment 2, a 12-minute walking test, and pedometry.

Assessment 4 (four months after the infarct)

All patients were assessed as in assessment 2.

Assessment 5 (12–24 months after the infarct)

As a follow-up, all patients were sent a final questionnaire, similar to that of assessment 2 but omitting questions on outlook on life.

Where possible, questionnaires were completed by the patients themselves, but if necessary they had help from the physiotherapist.

A random urine sample was tested [1] for the presence of cotinine, a metabolite of nicotine, in patients who had been smokers before their myocardial infarct. Cotinine can be detected up to 24 hours after smoking, and this test was used to check answers regarding smoking. Patients did not know that the urine sample was being used for this purpose.

Withdrawals

Patients were withdrawn from the study because of death, increasing angina, coronary artery surgery, reinfarction, at their own request, and failure to complete assessments 2 or 4.

Statistical analysis

Comparisons of means between the control and experimental groups were made using Z tests because of the large number of patients; frequencies were compared using χ^2 tests. For both tests, a probability of less than 0.05 was considered to show a significant effect.

Table 1. Reasons for withdrawal from the study

Reason	Control	Exercise
No reason	9	8
Died	3	–
Myocardial infarct	1	–
Angina	1	1
Coronary artery bypass graft	–	1
Arrhythmia	1	1
Deep vein thrombosis	–	1
Arthritis	–	1
Moved away	–	1
Total	*15*	*14*

Table 2. Mean age (in years) and employment status of patients, just before their myocardial infarction (in numbers)

	Control	Exercise
Average age	52.7 ± 1.3	52.1 ± 1.3
Age range	32–64	40–64
Employment status		
Employed	21	26
Self-employed	5	5
Unemployed	7	4
Retired	3	8
Housewife	2	–
Total	*38*	*43*

Results

A total of 110 patients was entered into the study, 53 in the control group and 57 in the exercise group. A number of patients were withdrawn for reasons stated in Table 1. The total number remaining in the study was 81, 38 in the control group and 43 in the exercise rehabilitation group.

The average age of patients in each group is shown in Table 2, as is their employment status just before their myocardial infarct. In the exercise group nine of the 31 patients in employment described their work as heavy, compared with 11 of the 26 patients in the control group. The differences in age and employment between the two groups were not significant.

Table 3 shows results of the objective tests at assessments 2, 3 and 4. Before rehabilitation there was no significant difference in these tests between the groups after discharge from hospital. Both groups subsequently showed an improvement in distance walked in 12 minutes, but in this test patients in the exercise group could walk significantly further than those in the control group: 929 metres compared with 747 ($p<0.01$).

The greatest improvement in distance walked in 12 minutes in the exercise group was attained on completion of four weeks rehabilitation (assessment 3), followed by a further but smaller improvement by assessment 4. Similarly, patients in the exercise group walked farther during the day than those in the control group: 8.2 km compared with 6.6 km ($p<0.05$). The greatest improvement in the patients' daily walking distance did not occur until assessment 4.

Table 4 shows the number of patients in each group (and percentage in each group where more clarity is required) returning to activities in which they had engaged prior to their myocardial infarct. The total number of patients in each group is in brackets and varies according to whether or not patients were engaged in these activities before their myocardial infarct.

Four months after the infarct significantly more patients ($p<0.05$) had returned to work in the exercise group than in the control group. There was a significant difference between groups in the number of patients returning to their usual pre-infarct sexual activity. At the end of the study fewer patients were smoking in the exercise group, but this difference was not significant. By assessment 4, 98% of the exercise group were able to do household chores compared with 85% of the control group ($p<0.05$), but there was no difference between the groups of patients starting to drive after their myocardial infarct (97% v 95%).

Significantly fewer patients in the exercise group were short of breath on exercise at assessment 4—44% v 82% in the control group ($p<0.01$)—but there was no significant difference between the groups in their experience of chest pain (51% v 61%). The patients' own assessment of feelings of well-being and of anxiety about health showed no statistically significant difference between the two groups, even though 70% of the

Table 3. Distances walked in 12 minutes and average daily mileage from pedometry

Objective tests	Control (n=27)	Exercise (n=30)	p values
A. Walking in 12 minutes (in metres)			
Assessment 2	665±35	723±16	NS
Assessment 3		960±20	
Assessment 4	747±38	929±21	$p<0.001$
B. Pedometry: average daily mileage (km)			
Assessment 2	4.5±0.5	5.1±0.3	NS
Assessment 3		6.0±0.3	
Assessment 4	6.6±0.5	8.2±0.6	$p<0.05$

Table 4. Patients returning to pre-myocardial infarction activities

Objective tests	Control	Exercise	p values
Return to work of patients previously employed or self-employed			
Assessment 3		3 (28) 11%	
Assessment 4	10 (26) 38%	20 (29) 69%	$p<0.05$
Assessment 5	10 (23) 43%	10 (29) 69%	NS
Sexual activity the same as or greater than before myocardial infarction			
Assessment 2	11 (29)	8 (29)	NS
Assessment 3		19 (27) 70%	$p<0.05$
Assessment 4	13 (29) 45%	22 (29) 76%	$p<0.05$
Assessment 5	11 (29) 38%	22 (29) 76%	$p<0.05$
Smoking Had been smokers at some time in their lives	32 (38)	38 (43)	
Smokers up to their myocardial infarction	21	20	
Admit to smoking post-myocardial infarction	9 +6 +ve cotinines	4 +5 +ve cotinines	

patients in the exercise group indicated there was an improvement compared with 55% of the control group; and 51% of the exercise group compared with 53% of the controls became less anxious about their health.

There was no difference between groups in how many patients consulted their GP. By the time of assessment 4, 97% of patients in the exercise group had visited their GP compared with 100% of the controls. In both groups 62% of patients had requested the consultation, while the remaining 38% had been called in or been visited by the GP.

Some statistical differences were noted in patients' replies to statements regarding their outlook on life. Before admission to the coronary care unit, 79% of patients in the exercise group compared with 57% of the control group ($p<0.05$) agreed with the statement 'On the whole I feel well these days'; by assessment 4 the percentage of patients who agreed with the statement 'I get pleasure from my social life' was 91% of the exercise group and 70% of the control group ($p<0.05$). Before admission, more patients (58%) in the exercise group agreed with the statement 'On the whole I am a relaxed person' than in the control group (32%, $p<0.05$).

Discussion

Patients derived significant benefits from being given exercise-based rehabilitation reinforced with advice. After four months they were able to walk faster and farther than a control group who had not undergone a rehabilitation programme. They were less breathless and, despite the greater amount of exertion, did not experience more angina. The improvement in physical activity was similar to findings of Mayou *et al.* [2] whose study included three groups of patients: control, exercise, and advice groups. They assessed exercise capability by submaximal treadmill testing. We chose a 12-minute walking test [3] and pedometry [4] as more closely resembling the patient's normal activity. The patients in the control group also improved their exercise capacity over the study period. This has been noted and discussed by others [5,6] and probably reflects general reconditioning following illness and a period of bed-rest and physical inactivity.

We have also shown that patients in the exercise group were more likely to be doing household chores and to have resumed normal sexual activity, and 69% had returned to work compared with 43% in the control group. Mayou *et al.* [2] did not find these benefits in their exercise group, but in their advice group there was an improvement in work hours and frequency of sexual intercourse. Danchin *et al.* [7] were similarly unable to show a difference in return to work between their control and rehabilitation groups. In return to work, only half the patients who had entered an uncontrolled rehabilitation programme returned to work. However, we were unable to achieve the 80%

and 85% return to work quoted by others [6,9]. The recommendation from a doctor is a major determinant of the speed of the patient's return to work, coupled with a patient's optimism about his or her present health [8]. Return to normal sexual activity was also greater in the exercise group in our study: 76% compared to 33% or 25% previously reported. As Goodman [10] explains, this is probably a reflection of patients' reluctance to ask about sex and the failure of some doctors to discuss the subject.

We failed to stop some smokers in the rehabilitation group from continuing to smoke, despite repetitive advice. Exercise training alone has no effect on giving up smoking. Taylor *et al.* [11] found no difference between the groups in the number of patients who smoked, although they did find that those in the exercise group smoked fewer cigarettes. Since it appears that continual smoking is an important psychosocial risk factor after myocardial infarction, this is an area of rehabilitation that requires more attention. Higher smoking cessation rates have been obtained in programmes where patients are given firm instructions and help to stop [6].

In both groups, some patients who denied smoking had positive urinary cotinine tests, showing that an objective measurement is essential to assess smoking habits [1]. Taylor *et al.* [11] also found that 20% of patients who were still smoking after myocardial infarction failed to report that they were doing so. Rehabilitation did not influence the time when patients started to drive again: one patient in the exercise group started driving less than four weeks after discharge from hospital although he had been advised not to drive for two months.

Despite the fact that patients in the exercise-and-advice group performed better than the control group, formal assessment showed no differences between the groups in their perception of well-being and anxiety about their health, and there was little difference in their outlook on life. Had a more complex psychological assessment been used, subtle improvements in the subjective status of the patients may have been detected; but on the basis of our simple questionnaire these were not evident.

The reasons why patients did not show a clear difference in outlook on life or feelings of well-being in the exercise group are unclear. Possibly returning to the hospital environment where the patients had been admitted following their myocardial infarct served as a reminder of the event and promoted unease. We speculate that changing the environment of a cardiac rehabilitation programme from hospital to a more recreational setting, such as a local sports centre, might result in more obvious improvements. Visits to the GP were also not reduced by rehabilitation, which does suggest that the perception of well-being and anxiety had not been improved.

While results from rehabilitation show encouraging trends in better exercise capability and early return to

work and to normal activities, the patients' perceptions of well-being, anxiety about health, and outlook on life have not been greatly improved. Our rehabilitation programme which included both exercise and advice produced greater improvement than just exercise alone [2]; it is suitable for use in any district general hospital and requires little in the way of equipment.

Clearly, exercise and advice are important components of a rehabilitation programme. We suggest that both should be offered to most patients and that more attention should be given to the psychological aspects to help patients towards a full recovery from a heart attack.

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Address for correspondence: Dr A. J. Marshall, Consultant Cardiologist, Cardiology Department, Derriford Hospital, Derriford Road, Plymouth PL6 8DH

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