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The effects of stress management on the quality of life of patients following acute myocardial infarction or coronary bypass surgery

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The objective of this study was to assess the impact of group-based stress management training on emotional well-being, functional status, social activity and chest pain in cardiac patients, within a randomized controlled trial.

Fifty acute myocardial infarction and 50 coronary artery bypass patients were randomized to experimental (27 myocardial infarction and 23 coronary artery bypass) and control (23 myocardial infarction and 27 coronary artery bypass) groups 3 months after infarction or surgery. Experimental patients underwent a 10-week relaxation-based stress management programme, while the controls received normal care. Following assessment at the end of the treatment period, controls were offered the stress management programme. Follow-up data were collected 6 months post-treatment from both groups.

Significantly greater improvements in emotional well-being as assessed on the Hospital Anxiety and Depression scale ($P<0.005$) and the Psychological General Well-being Index ($P<0.001$) were found in the experimental than control groups, and improvements were maintained at 6 month follow-up. Greater improvements were also recorded in experimental than control groups in activities of daily living ($P<0.005$), satisfaction with health ($P<0.025$), reports from spouses or relatives of patients' emotional state ($P<0.001$), and in disruption due to chest pain ($P<0.001$). Similar responses to stress management were observed in myocardial infarction and coronary artery bypass patients. When controls underwent treatment, they too showed significant reductions in anxiety and depression, but no changes in social or functional status.

We conclude that stress management training may lead to improvements in the quality of life of myocardial infarction and coronary artery bypass patients. Such programmes might usefully be made available even to patients who have participated in formal rehabilitation.
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Key Words: Cardiac rehabilitation, stress management, coronary artery bypass surgery, quality of life.

Introduction

There is considerable evidence of severe emotional distress among patients following acute myocardial infarction or coronary bypass surgery[1–4]. Although psychological well-being typically improves over the first few months of recovery, anxiety and depression remain elevated in comparison with levels in healthy populations, and emotional distress is a serious problem in a minority of patients[5]. Early emotional reactions have been shown to predict psychosocial adjustment and return to work at one year[6]. The incorporation of psychosocial counselling and stress-management into cardiac rehabilitation programmes has been widely recommended[7,8].

The impact on emotional well-being and quality of life of counselling, educational and stress-management programmes has been evaluated in several studies, but with variable results[9]. We have previously reported results of a preliminary trial of relaxation-based stress management administered to patients at 3 months after their acute myocardial infarction or coronary artery bypass surgery[10]. Significant reductions in anxiety, depression and chest pain, and improvements in psychological well-being, activities of daily living and quality of social interactions were recorded post-treatment and were largely maintained at 6 months follow-up. The present study describes a trial in which patients were randomized to a modified version of this programme or a waiting list (delayed treatment) control condition. The objectives were to determine whether the improvements in quality of life resulting from this

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programme were greater than those arising through normal recovery processes in the control condition, and whether similar responses would be observed in patients following myocardial infarction and bypass surgery.

Methods

Subjects

The participants in this study were 87 men and 13 women aged less than 70 years admitted to St George's or St Helier Hospitals for acute myocardial infarction (WHO criteria) or coronary artery bypass surgery with adequate command of English, and not suffering from serious psychiatric disorder or disability. Patients were recruited 2 to 3 months following myocardial infarction or coronary artery bypass, so as to allow a degree of emotional and physical stabilization after discharge from hospital. Patients were randomized to the experimental condition (43 men and seven women) or to the waiting list control condition (44 men and six women). The experimental group took part in a 10-week stress management programme. Measures of disability and emotional well-being were administered before and after the treatment period (approximately 3 and 6 months after infarction or surgery), and at 6 months follow-up (one year after infarction or surgery). Participants in the control group were offered the treatment after the 10 week waiting period, and were subsequently reassessed post-treatment and at 6 months follow-up (15 months after infarction or surgery).

Measures

Emotional state

Emotional distress was assessed using the Hospital Anxiety and Depression scale (HAD)[11], and the Psychological Well-Being Schedule (GWB)[12]. The HAD consists of 14 items, each of which is rated on a 4-point scale, and was developed to detect states of anxiety and depression in medical out-patients. It has been validated against interview measures, and used extensively with cardiac patients[13]. The GWB schedule is a well-validated broad-ranging indicator of subjective feelings of distress and well-being, and has also been widely used in cardiovascular studies[14]. The 18-item version developed for the US Health and Nutrition Examination Survey was employed in this study[15]. The total GWB score could range from 0 to 110.

Functional status and social activity

Functional level and social activity were assessed using the Functional Status Questionnaire (FSQ)[16]. This inventory has been tested extensively on out-patient and healthy samples, and has an acceptable reliability and factor structure[17]. The following measures were derived: Intermediate activities of daily living (ADL), assessed with six items on 5-point Likert scales, concerning day-to-day activities, shopping, climbing stairs and doing housework; Social activity, assessed with three items concerning difficulty in visiting friends or participating in community activities; Quality of personal interaction, assessed with five items concerning getting on well with others, being irritable or affectionate, etc. Scores on these inventories were scaled to a maximum of 100 and a minimum of 0. The FSQ was also used to measure the number of days of restricted activity over the past month, satisfaction with sexual relationships and satisfaction with health (both on 5-point scale where 5=very satisfied).

Spouse/relative reports

Spouses or relatives provide important supplementary information about each patient's state. Spouses or relatives were asked about the frequency of signs of depression, fatigue, anxiety or impatience in the patient, making ratings on a series of 5-point scales. These were later combined into a single scale with scores ranging from 4 to 20, with lower scores indicating a more favourable profile. The internal consistency of this scale, assessed using Cronbach's α, was 0·76.

Chest pain

The WHO (Rose) angina questionnaire[18] was administered, with responses to the chest pain section of this questionnaire being scored in four symptom categories: no chest pain, angina grade 1 (where the exertion required to produce chest pain involved walking up hill or hurrying), angina grade 2 (where walking on the level at an ordinary pace induced chest pain) and 'other' chest pain. In addition, three scales concerning the frequency and severity of chest pain and level of restriction were utilized. Frequency was assessed on a 5-point scale (where 1='less than once a week' and 5='several times a day'). Severity was rated on a 4-point scale (from 'slight discomfort or pain' to 'extremely severe discomfort or pain'), and restriction on a 5-point scale (from 1='not restricted at all' to 5='severely restricted').

Demographic and clinical data

This information was obtained by interview and from patient notes, and included age, sex, marital status, work status, time between event/surgery and entering the stress management programme, changes in medication, hospital readmissions and General Practice consultations. Return to work was not used as an outcome measure in view of the age profile of the sample and the unfavourable employment pattern of the community from which patients were drawn.

Treatment programme

The treatment programme was developed on the principle that many patients believe that stress is important to heart disease. However, in contrast with other risk factors, little information is provided about how to understand stress, to monitor signs of stress, or how

Table 1 Background characteristics of study participants. Means (standard deviations in parentheses) and percentages

	Experimental group	Control group
Number	50	50
Men/women	43/7	44/6
Age (years)	59·4 (7·7)	61·0 (6·7)
Time since event/surgery (days)	85·4 (20·4)	86·9 (20·3)
Marital status (% married)	76·0	76·0
Occupational status (%)		
Employed	30·0	36·0
Retired	46·0	52·0
Not employed	24·0	12·0
Socioeconomic status (% non-manual)	66·0	72·0
Clinical group (%)		
Myocardial infarction	54·0	46·0
CABG	46 0	54·0
Previous history (%)		
Myocardial infarction	40·0	32·0
CABG	6·0	10·0
High blood pressure	38·0	52·0
Co-morbidity (%)	28·0	36·0
Family history of coronary artery disease (%)	50·0	52·0
Smoking prior to surgery/event (%)	28·0	26 0
Previous attendance at cardiac rehabilitation (%)	46·0	36·0

to cope in day to day settings. In addition, patients frequently complain about loss of self-confidence and lack of control over their lives following infarction and surgery. While in hospital, patients may feel safe under the care of skilled clinical staff, but their insecurity can increase on discharge. Therapist-guided relaxation and stress management was intended to provide the support necessary to help patients become independent again. The programme involved 10 group-based weekly sessions with a clinical research psychologist. The relaxation method was developed based on autogenic training, emphasizing increasing control over bodily function. A visual metaphor to help the subject's own efforts to improve his or her circulation, and personal 'key' words to be used in stress day-to-day situations, were also selected. A relaxation cassette was prepared and given to each patient with instructions to play it twice a day at home. In addition to relaxation, the weekly sessions focused on specific topics relevant to stress-management, including avoidance of aggravation and irritation, coping with time urgency, emotional expression, social support and coping with pain and sleeping difficulties. Patients' spouses were invited to one session to air their concerns.

Procedure

A letter of invitation was sent to patients 2 to 3 months after they had been discharged from St George's or St Helier Hospitals following myocardial infarction or coronary artery bypass. Those who agreed to participate completed pre-treatment measures before the programme commenced. The principles of the programme were explained in detail, and ethical consent was obtained. The control group were told that there would be a delay before they could take part, while the experimental group began treatment immediately. The HAD, GWB, FSQ, SSQ, spouse/relative ratings and chest pain questionnaires were re-administered after ten weeks to both groups, and at 6 months post-training (follow-up) to the experimental group. Patients in the control condition who still wished to be treated were reassessed with the same measures after they had completed treatment.

Results

Table 1 summarises the background characteristics of patients in the experimental and control groups. There were 27 myocardial infarction and 23 coronary artery bypass patients in the experimental condition, and 23 myocardial infarction and 27 coronary artery bypass patients in the control group. Twelve (52%) of the coronary artery bypass patients in the experimental group had three arterial grafts, while five (21·7%) had two grafts and six (26·1%) had four grafts. Among controls, 13 (48·1%) underwent three grafts, with five patients (18·5%) having two grafts and nine (33·3%) having four grafts. These proportions did not differ between groups. The levels of co-morbidity (chiefly diabetes) were also comparable. The groups did not differ significantly on demographic or clinical characteristics.

Table 2 Characteristics of study participants. Means and standard deviations in parentheses

	Experimental group	Control group
HAD		
Anxiety	7·5 (3·3)	7·4 (4·0)
Depression	4·3 (2·5)	4 7 (3·6)
Psychological GWB	68·5 (12·6)	74·7 (17·4)
FSQ		
Intermediate ADL	68·5 (18·6)	68·2 (25·0)
Social activity	51·8 (35·1)	55·2 (37·7)
Number of restricted days	9·4 (11·2)	8·6 (12 2)
Quality of interactions	74·1 (11·4)	74·7 (15·0)
Sexual relationship	1·5 (1·8)	1·6 (1·8)
Satisfaction with health	3·2 (0·9)	3 5 (1·0)
Chest pain questionnaire (%)		
None	36·0	50·0
Grade 1	28·0	24·0
Grade 2	16·0	14·0
Other chest pain	20·0	12·0
Chest pain ratings		
Frequency	3·0 (1·3)	2·6 (1·1)
Severity	1·5 (0·6)	1 3 (0·5)
Restriction	2·1 (1·0)	1·8 (0·8)

The initial values on the measures of functional and social status in the two groups were comparable (Table 2). One difference was present in the emotional domain, since scores on the GWB index were lower in the experimental than control group ($P<0·05$), indicating greater emotional well-being among the latter. Spouse/relative ratings were available from 43 patients in each group. The levels of anxiety and depression suggest that patients who participated in this trial were moderately emotionally distressed. Using the cut-off of 8 on the HAD as an indicator of moderate disturbance or 'caseness', the proportion of participants who attained this criterion for anxiety or depression was 52% in each group.

Responses to psychological treatment

Patients in the experimental group attended an average of 8·5 (± 1·3) stress management sessions. Mean scores on the emotional, functional and social activity scales before and after treatment are summarised in Table 3. The experimental group showed significant improvements from pre to post-treatment in anxiety, depression and psychological well-being, the six FCQ scales (activities of daily living, social activity, the number of restricted days over the past month, quality of interactions, sexual relationships and satisfaction with health), and in spouse/relative ratings (all $P<0·05$). Significant improvements were observed on only one measure (number of restricted days over the past month) in controls. In repeated measures analysis of variance with group as the between-subject factor and time (pre/post) as the within-subject factor, significant group by time interactions were observed for HAD anxiety ($P<0·005$), GWB ($P<0·001$), intermediate ADL ($P<0·005$), satisfaction with health ($P<0·025$), and spouse/relative ratings ($P<0·001$). These effects are shown in Fig. 1, where it is apparent that greater improvements in emotional well-being, functional level and in observers' ratings of emotional state were observed in the experimental than control groups over

Table 3 Emotional and functional well-being in experimental and control groups. Means and standard deviations in parentheses

		Pre-treatment	Post-treatment	Follow-up
HAD-Anxiety	Experimental	7·50 (3·3)[a]	5·94 (3·3)[b]**	5·73 (3·1)[b]
	Control	7·38 (4·0)	7·60 (4·2)	
HAD-Depression	Experimental	4·32 (2·5)[a]	3·36 (3·0) [b]	2·98 (2·4)[b]
	Control	4·70 (3·6)	4·68 (3·7)	
Psychological GWB	Experimental	68·5 (12·6)[a]	76·4 (16·9) [b]**	78·1 (15·4)[b]
	Control	74·7 (17·4)	72·6 (18·0)	
Intermediate ADL	Experimental	68·5 (18·6)[a]	83·9 (15·9) [b]**	82·5 (23·4)[b]
	Control	68·2 (25·0)	72·7 (25·1)	
Social activity	Experimental	51 8 (35·1)[a]	66·2 (34·4) [b]	68·7 (36·3)[b]
	Control	55·2 (37·7)	56·0 (36·0)	
Restricted days	Experimental	9·42 (11·2)[a]	2·18 (5·6) [b]	2·12 (6·6)[b]
	Control	8·60 (12·2)[a]	2·90 (6·2) [b]	
Quality of interactions	Experimental	74·1 (11·4)[a]	77·9 (13·2) [b]	78·1 (11·9)[b]
	Control	74·7 (15 0)	74·3 (15·8)	
Sexual relationships	Experimental	1·5 (1·8)[a]	2·3 (2·1) [b]	2·4 (1·9)[b]
	Control	1·6 (1·8)	1·9 (2·0)	
Satisfaction with health	Experimental	3·20 (0·9)[a]	3 58 (0·9) [b]**	3·84 (0·9)[c]
	Control	3·47 (1·0)	3·47 (1·1)	
Spouse/relative ratings	Experimental	9·86 (2·4)[a]	8·16 (2·6) [b]**	8·21 (2 5)[b]
	Control	9·30 (3 0)	9·79 (3·6)	

Means on each line with different superscripts are significantly different.
**indicates significant treatment by time interaction.

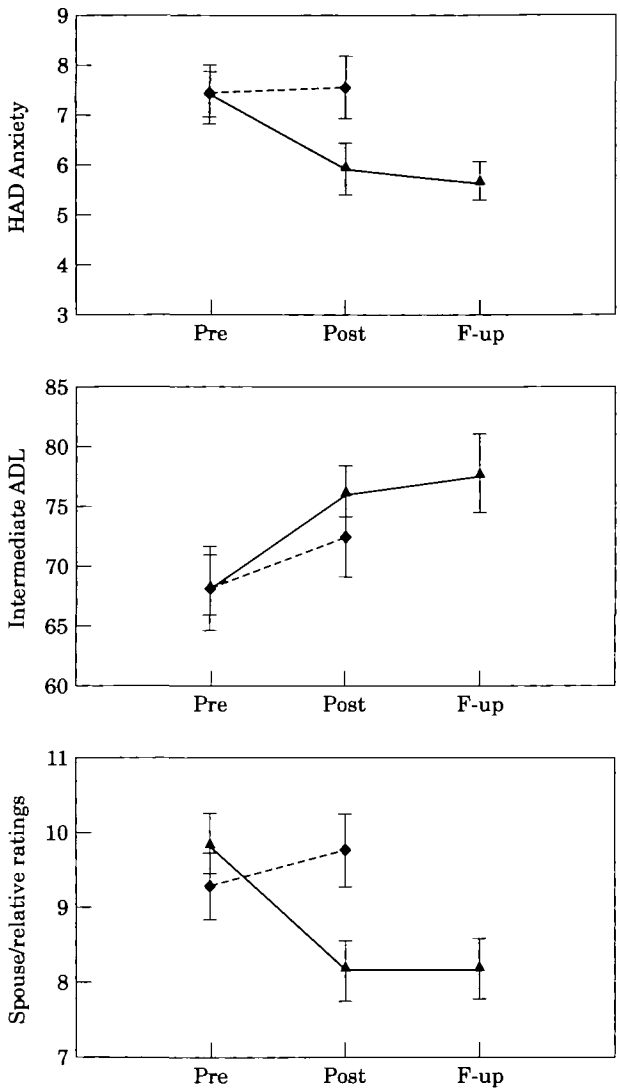

Figure 1 **Mean levels of anxiety (top panel), intermediate activities of daily living from the FSQ (centre panel), and spouse/relative ratings (lower panel) in the experimental (▲) and control (◆) groups before treatment (Pre), after treatment or an equivalent 10 week waiting period (Post) and at 6 months follow-up (F-up). Error bars represent SEM.**

the treatment period, and that effects were sustained for the following 6 months. Comparison of patients who had and had not previously participated in cardiac rehabilitation showed no differences in response to stress management.

Responses to the angina questionnaire showed that the proportion of patients in the experimental group who reported no chest pain increased from 36% (18 patients) to 50% (25 patients) over the treatment period. The proportion who reported severe (grade 2 angina) was reduced from 16% (eight patients) to 8% (four patients). Analysis using the binomial test confirmed that a greater proportion of patients showed an improvement than deterioration in chest pain in the experimental group ($P<0.05$). In contrast, 56% (28 patients) in the control group reported an absence of chest pain after the waiting period as opposed to 50% (25 patients) previously. This difference was not significant. The analysis of ratings of chest pain quality was confined to the 22 patients in the experimental group and 19 in the control group who reported chest pain at both assessment points. In the analyses of ratings of frequency of chest pain, the group by time interaction was significant ($P<0.001$). Patients in the experimental group showed a reduction in ratings of the frequency of pain episodes from 3.00 ± 1.4 to 2.27 ± 1.3 over the treatment period, compared with an increase from 2.63 ± 1.1 to 3.32 ± 1.0 in controls. There was also a significant interaction between group and time in the analysis of ratings of restriction due to pain ($P<0.005$). Ratings decreased in the experimental group (means 2.09 ± 1.1 to 1.68 ± 1.0), but increased in controls (means 1.84 ± 0.8 to 2.47 ± 1.4). These effects suggest that the experimental treatment led to a diminution in the disruption associated with chest pain. There were no differences in the frequency of general practice consultation or in hospital readmissions between the groups.

The 6 month post-treatment follow-up results for 49 of the 50 patients in the experimental group are also shown in Table 3. The changes that were observed in measures post-treatment were maintained on follow-up in all domains of quality of life. Only one variable, satisfaction with health, showed further gains between post-treatment and follow-up.

Twenty-two of the 50 waiting list control patients (11 myocardial infarction and 11 coronary artery bypass) elected to undergo stress management at the end of the 10-week waiting period, and their results are summarised in Table 4. Significant improvements were apparent in HAD anxiety ($P<0.01$), HAD depression ($P<0.005$) and GWB ($P<0.001$), and benefits were maintained at follow-up ($P<0.05$). However, no changes were present in intermediate ADL, ratings of sexual relationships, satisfaction with health or spouse/relative ratings, as were seen for the experimental group. The number of restricted days showed no further improvement, but was already extremely low prior to treatment. Ratings of social activity and quality of social interactions improved significantly between pre-treatment and follow-up ($P<0.05$). Prior to treatment, four patients reported grade 2 and four grade 1 angina. The number with grade 2 angina was reduced to one post-treatment, but this effect was not statistically significant. The ratings of frequency, severity and restriction due to chest pain did not change in the eight patients with grade 1 and 2 angina across the treatment period.

Differences between infarction and surgery patients

A major objective of this study was to determine whether myocardial infarction and coronary artery bypass patients differed in their response to the stress

Table 4 Response to treatment in waiting-list controls. Means and standard deviations in parentheses

	Pre-treatment	Post-treatment	Follow-up
HAD — Anxiety	8·09 (3·5)[a]	6·46 (3·1)[b]	6·80 (3·2)[b]
HAD — Depression	4·27 (2·9)[a]	2 96 (2·6)[b]	3·01 (2·6)[b]
Psychological GWB	71·2 (17·5)[a]	89·1 (14·5)[b]	82·1 (13·7)[b]
Intermediate ADL	73·7 (19·1)	76 3 (16·2)	73·3 (21·7)
Social activity	61·1 (33·9)[a]	66 2 (38 3)[ab]	73·3 (36 3)[bc]
Restricted days	0·73 (1·6)	1·13 (4·3)	3·00 (6·8)
Quality of interactions	74·4 (14·2)[a]	79·8 (12·6)[ab]	81·8 (12·1)[bc]
Sexual relationship	2·6 (2·1)	2·6 (1·9)	2·5 (1·9)
Satisfaction with health	3·73 (0·9)	3 82 (0·8)	3·75 (0·9)
Spouse/relative ratings	9·78 (3·0)	8·78 (3·0)	8·47 (3·2)

Means on each line with different superscripts are significantly different.

management programme. Analysis of variance was therefore carried out on the pre vs post-treatment data from experimental and control groups, including patient category (myocardial infarction, coronary artery bypass) as an additional factor. The results indicated that for all three measures of emotional well-being, the difference between patient categories was significant ($P<0·01$), since the myocardial infarction patients were more impaired than coronary artery bypass patients. However, both patient categories responded similarly to the treatment, so there were no significant interactions between patient category, experimental group and time. The data for HAD anxiety illustrated in Fig. 2 is representative of this pattern; it is apparent that comparable reductions were reported by both myocardial infarction and coronary artery bypass patients in the experimental group, albeit from different initial levels, while no improvement was recorded among controls. In the case of intermediate ADL, the interactions between patient category and time ($P<0·005$) and experimental group ($P<0·001$) were both reliable, and are summarised in Fig. 2. In the experimental group, both myocardial infarction and coronary artery bypass patients increased their capacity for activities of daily living. Gains were also reported among coronary artery bypass patients in the control group, although not to the extent seen in the experimental group ($P=0·07$). Control patients suffering from myocardial infarction failed to show any improvements in ADL over the treatment period. No other variables showed important differential responses between patients in these two clinical groups.

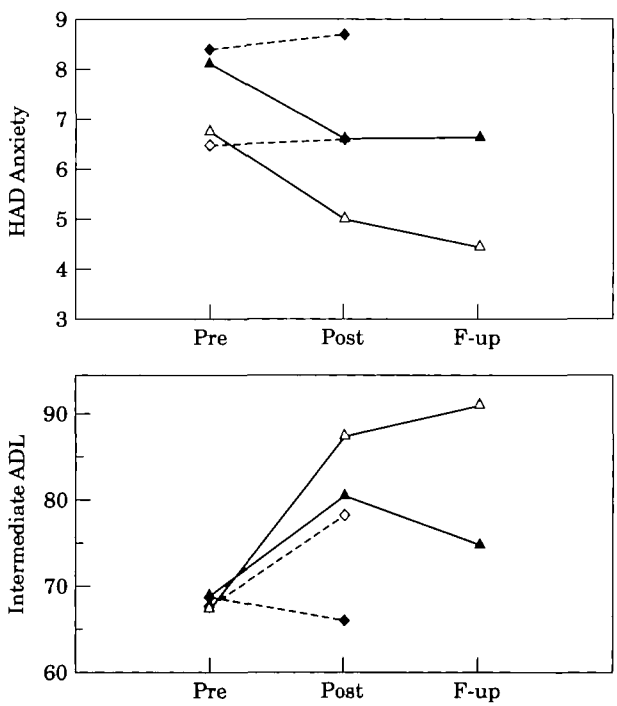

Figure 2 **Mean levels of anxiety (upper panel) and intermediate activities of daily living from the FSQ (lower panel) in the experimental and control groups before treatment (Pre), after treatment or an equivalent 10 week waiting period (Post) and at 6 months follow-up (F-up). Error bars represent SEM. ▲=experimental group myocardial infarction patients; △=experimental group coronary artery bypass patients; ◆=control group myocardial infarction patients; ◇=control group coronary artery bypass patients.**

Discussion

A number of controlled trials have shown that patients benefit from psychosocial counselling and stress management following acute myocardial infarction by improving emotional well-being[13,19,20]. Other programmes have failed to produce psychological improvements despite substantial clinical output[21,22]. Few attempts to apply stress management procedures to patients following bypass surgery have yet been reported, although high levels of distress and uncertainty are commonly experienced by patients[4,23].

Stress management was not initiated in this study until 3 months following infarction or surgery. Emotional well-being and functional status show marked improvement in the first few weeks following

infarction or surgery, but subsequently stabilize[5,24]. Superimposing stress management on this changing state might confuse interpretation. In addition, many patients are attending cardiac rehabilitation classes in 3 months after discharge, so might become confused about the care being offered to them. Emotional well-being and other aspects of quality of life are not consistently predicted by clinical variables in infarction patients or by surgical parameters following coronary bypass[25,26]. However, persistent emotional distress at 2 to 3 months predicts long-term psychosocial morbidity[27]. Psychosocial factors such as severe depression, social isolation and life stress are also associated with poor survival following myocardial infarction[28,29].

The comparison of the experimental group with waiting-list controls made it possible to determine whether changes following stress management were direct effects of the programme, or non-specific improvements due to passage of time and recuperation. Non-specific responses were responsible for some of the changes observed. For example, the number of days over the past month during which patients reported being restricted in their activities due to their health decreased by an average of 76·9% in the experimental group and by 66·3% in controls. Differences between groups were not significant, indicating this response was not attributable to treatment. Nevertheless, in two major domains of quality of life, emotional well-being and activities of daily living, the gains were significantly greater in experimental than control groups, suggesting direct benefits from stress management. Levels of social activity and the reported quality of social interactions also improved in the experimental but not control groups. This may be important since lack of social participation predicts early mortality following infarction[30] and cardiac surgery[31]. Stress management was also associated with reductions in the disruption caused by chest pain.

The mechanisms underlying these responses are unclear. It is notable that nearly half the patients had previously attended cardiac rehabilitation classes in which relaxation had been taught. The stress management programme was designed not only to provide patients with a range of skills in coping with stress, but advice about how to apply these in everyday life conditions. Anecdotally, patients reported increased confidence in being able to manage difficult situations in their lives, and this may have stimulated them to extend their range of activities. Pain and emotional distress are intimately associated, and a vicious circle of tension leading to maladaptive pain behaviour may develop. Reducing anxiety and depression may disrupt this connection, allowing patients to cope with chest pain more effectively.

The waiting list controls who underwent stress management showed more limited improvements in quality of life than did the experimental group. Significant changes were recorded in the measures of emotional well-being, but not in activities of daily living, satisfaction with health or spouse/relative ratings. The reasons for this difference in response are not clear. Fewer than half of the waiting list controls elected to undergo stress management, and those who made this decision may have been especially resistant to change. The smaller number also reduced the power of the study to identify significant differences. Alternatively, there may be a sensitive period for interventions of this kind, so that initiation of treatment 6 rather than 3 months after infarction or surgery may be less effective. Nevertheless, replication in waiting list controls of the reductions in anxiety and depression and improvements in psychological well-being observed in the experimental group indicates that the effects of stress management on emotional state were robust.

Comparison of infarction and bypass patients identified relatively few differences in response. Poorer emotional well-being was recorded prior to treatment in infarction patients, but both clinical groups showed a similar response to stress management. This result is encouraging, in that it implies that the same programme can be used for different groups of cardiac patients.

In conclusion, the results of this controlled trial confirm the observations reported in our earlier cohort study in showing benefits to emotional well-being and functional and social activity with stress management. The group format of the programme considerably reduced the costs of the intervention in comparison with the individual case format used previously[10], without marked deterioration in effectiveness. Programmes of this type may be particularly beneficial for patients showing persistent emotional distress following hospital discharge and early-phase rehabilitation.

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