Management after Coronary By-Pass Graft Surgery: A Rehabilitation Course Induces Life Style Changes which may improve Long Term Graft Survival

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SUMMARY: Too many coronary artery by-pass grafts block within 10 years. Smoking, one risk factor is well managed with over 80% giving up peri-operatively, but hyperlipidaemia is not. Only 27% of such patients on a rehabilitation course knew their cholesterol and 32% had received no dietary advice. As baseline mean cholesterol was high (7.03mmol/l) this may be a serious omission.

After rehabilitation patients have complied for a mean 16.6 months with recommendations on diet (97% remain on a low fat diet) and exercise (now over 3 sessions per week, a level at which long term cardiovascular benefit may be expected). Within 4 months a significant (14%) fall in total cholesterol was achieved. Rehabilitation after by-pass grafting induces life style changes which may improve long term graft survival and should be made more available.

Introduction

How should patients be managed in the long term after coronary artery by-pass grafting (CABPG)? The ideal cannot yet have been achieved because studies have shown that up to 50% of saphenous vein grafts have occluded after 10 years^{1,2}, with unsatisfactory consequences especially for those who had surgery at a young age. Secondary preventive measures may help to delay disease progression, but as the Coronary Artery Surgery Study (CASS) showed that surgery per se does not persuade patients to adopt a healthier life style³, the Consensus Development Conference on CABPG suggested that the full benefits of surgery could not be achieved without rehabilitation and counselling measures⁴.

At the Queen Elizabeth Military Hospital a cardiac rehabilitation course has been running for 10 years, and an increasing proportion of patients have undergone CABPG. The aims of this study were to see how much advice on secondary prevention is normally received after CABPG, and whether participation on a rehabilitation course can persuade patients to begin and maintain a healthier life style. Changes in serum lipids were measured to assess whether objective benefit was achieved, in the hope that this might improve long term graft survival.

Patients and Methods

Between September 1986 and May 1988 seventy nine males who had recently undergone CABPG commenced a three week residential cardiac rehabilitation course at this hospital. They had been referred from several cardiac surgical units, and our only exclusion criteria were age >65 and significant non-cardiovascular disability. Patients were usually accepted 8-10 weeks post operatively to allow good sternal healing.

After initial history and examination all underwent a

maximal exercise test on the treadmill, using the standard Bruce protocol. Those unable to complete 3 minutes, for any reason, were not permitted to continue and neither were those who developed complex arrhythmias or chest pain associated with significant ST segment depression. The maximum heart rate achieved was used as a baseline for the exercise training programme.

The course itself consists of 3 x 5 day blocks. During each block the patients exercised to an increasing percentage of their maximum heart rate, from 70% in block 1 to 85% in block 3. This is achieved during sessions lasting between 20-30 minutes of high intensity aerobic exercise such as circuit training, swimming and jogging. In between there are longer sessions of lower intensity endurance exercise such as walking and cycling.

The exercise programme is combined with educational and counselling sessions, including group discussions with dietician, psychologist, physiotherapist and physician. The patients are taught the aetiology and pathogenesis of coronary artery disease, the role of the various medical and surgical treatments, and how by risk factor modification they might prevent or at least delay disease progression. They all are given a diet low in saturated fat and high in fibre which they are encouraged to continue after the course. At the end each patient, ideally with their partner, is interviewed by the staff and is then encouraged to continue with a modified exercise programme of 3 or more sessions per week, and to persevere with the other life style changes that have been recommended. After one review 3 months later the patient returns to the care of the referring hospital.

A questionnaire was sent to all the above patients who completed the course. It included a series of questions about whether effective advice on lipid management had been received prior to rehabilitation, and a smoking and exercise history. They were also asked whether their symptoms had recurred.

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Lipid changes were assessed by comparing total cholesterol and triglyceride levels from fasting blood samples taken on arrival here with those taken at review 3 months after the end of the course. No lipid lowering drugs were introduced during this interval.

Results

Of the original 79 patients, 3 (3.8%) did not commence the exercise programme because of an abnormal stress test. Four (5.3%) dropped out of the course because of musculo-skeletal injuries and 1 (1.3%) because of ventricular arrhythmias. The study population therefore consisted of 71 men, mean age 48.4 (SD 7.0) of whom 51 (71%) had had a preceding myocardial infarction. Sixty-four (90%) had their lipids checked at the 3 month review. Sixty replies to the questionnaire were received, a response rate of 85%, from patients who had attended the course a mean 16.6 (SD 7.0) months beforehand.

Advice Pre Rehabilitation

From Tables 1 and 2 it is clear that good anti-smoking advice had been received, as almost 80% of the smokers had given up before the start of the rehabilitation course. The remainder have continued to smoke, but none of the ex-smokers have since relapsed. Lipid management has not been good, as only 27% had been told their cholesterol level and 32% had not received any dietary advice.

Exercise

By the start of the rehabilitation course these patients were doing as much exercise as they were before their symptoms began (Table 3). After rehabilitation they were recommended to continue with 3 sessions per week, and this they have managed to achieve and maintain in the medium term. The increase is highly statistically significant.

Lipid Changes

In less than 4 months a highly significant fall in total cholesterol from 7.03 mmol/l to 6.05 mmol/l, and a significant fall in triglycerides from 2.46 mmol/l to 1.99 mmol/l has been seen (Table 4).

Recurrence of Symptoms

One patient has had a myocardial infarction, and angina has developed in two others, a recurrence rate of 4.2%. One patient has died of non-cardiovascular disease. A study of the hospital notes of those who failed to reply to the questionnaire did not reveal any further information.

Overall

Virtually all (97%) of the patients have complied with our dietary advice (Table 2). On average they continue to do the recommended amount of exercise, and a significant improvement in lipid profiles has been seen. A few continue to smoke but overall these patients have complied extremely well with our advice on risk factor modification.

Discussion

Cardiac rehabilitation, although popular in America and some parts of Europe^{5,6}, has received less support in this country⁷. However CABPG, although known to prolong life in certain anatomical patterns of coronary artery disease and very effective in relieving angina, is a palliative procedure not a cure⁸ and without education on risk factor modification the disease process will continue, as shown by the high rates of graft attrition after 10 years.

A successful rehabilitation programme after CABPG should combine education with physical training. The main aim of such training has been to restore patients to their pre-morbid level of fitness and enable them to return to work. This is especially necessary in this

Table 1
General Advice on Lipids

Did you:	Yes	No
Know your Cholesterol Level before Rehab?	16 (27%)	44 (73%)
Receive Dietary Advice before Rehab?	41 (68%)	19 (32%)
Do You:		
Continue with our Dietary Recommendations?	58 (97%)	2 (3%)
Have your Family on a similar diet	45 (75%)	15 (25%)

Table 2
Smoking Habits

	PRE INFARCT	PRE CABPG	PRE REHAB	NOW
Smokers	17 (40%)	13 (22%)	5 (9%)	4 (7%)
≥ 20/Day	14 (82%)	5 (38%)	0 (0%)	1 (25%)
TOTAL	40	59	56	57

Table 3
Exercise Habits

		Pre Infarct	Pre Rehab	Now
Exercise Sessions Per Week	Mean (SD)	1.58 (1.57)	1.56 (1.64)	3.15 (1.63)
	n	40	52	54
(30 mins intensive or 60 mins endurance)	Change	–	↓ 1.3%	↑ 102%
	p value	–	NS	<0.1%

Table 4
Lipid Changes

	Cholesterol		Triglyceride	
	Baseline	Review	Baseline	Review
Mean (SD)	mmol/l 7.03 (1.40)	mmol/l 6.05 (1.17)	mmol/l 2.46 (1.16)	mmol/l 1.99 (0.90)
n	64			63
Reduction	13.9%			19.1%
p value	<0.1%			<5%

country where long surgical waiting lists often result in a prolonged period of pre-operative disability⁷ which is known to be a poor prognostic factor for future employment⁸. In the context of this study, physical training, if continued after the end of formal rehabilitation may also give longer term cardiovascular benefits, including improved myocardial efficiency and possibly myocardial perfusion⁵, a decrease in coagulability and favourable alterations to lipids^{9,10}.

While it is generally accepted that smoking will accelerate the progression of coronary artery disease¹¹, there has until recently been less interest in the role of hyperlipidaemia¹². In those who have had CABPG however, good evidence is now available that links late graft occlusion with high cholesterol levels^{1,2}. Further work has shown that effective lipid control can delay the onset of graft atheroma, and may also reduce the rate of disease progression in the native coronary arteries¹³. Reviews now stress the importance of lipid control in patients after CABPG^{14,15}. A combination of diet and exercise should give added benefit.

Our results illustrate some of the above comments. They are based on an 85% questionnaire response and a 90% follow-up lipid estimation, which allows valid generalisations to be made. Advice on smoking had obviously been given, and with good effect, with 80% of smokers having stopped before attending the course. As in another study, rehabilitation was unable to influence the remainder⁹. The assessment and management of hyperlipidaemia was very different. Few had been told their cholesterol level, and a substantial minority had

received no dietary advice. Their baseline cholesterol was subsequently shown to be in the 'substantially elevated' range, as defined by Lewis¹⁶, which makes this a serious omission.

Subsequent compliance with the recommended low saturated fat, high fibre diet has been excellent, as also has been compliance with the exercise regime. Three sessions per week of either high intensity aerobic exercise for up to 30 minutes or endurance exercise for at least 60 minutes were chosen as being the types and frequency of exercise thought to give the best cardiovascular benefit¹⁰. With this combination of diet and exercise a mean fall in total cholesterol of 14% was achieved in less than 4 months, almost down to the mean level in healthy British men of this age group¹⁶. Such a fall compares well with the maximum calculated effects from diet alone¹⁶.

The follow-up period of this study is too short to assess whether the patients will have improved long term graft patency, and this group of patients will continue to be studied for some years. It appears, however, that a cardiac rehabilitation course does persuade patients to practise effective secondary prevention for some time as those who attended over two years ago still comply as well as those who attended more recently.

Cardiac rehabilitation has been shown to be safe¹⁰ and should be made more available. Cost and facilities need not be a problem, as Bethell¹⁷ has recently shown. The real need is for physicians and cardiac surgeons to understand the benefits that rehabilitation may give patients who have undergone CABPG.

REFERENCES

1. CAMPEAU L, *et al.* The relation of risk factors to the development of atherosclerosis in saphenous vein by-pass grafts and the progression of disease in the native circulation. *NEJM* 1984; **311**: 1329-32.
2. SOLYMOSS B C, *et al.* Late thrombosis of saphenous vein coronary by-pass grafts related to risk factors. *Circulation* 1988; **78** (suppl I): 140-143.
3. Coronary Artery Surgery Study (CASS): a randomized trial of coronary artery by-pass surgery. *Circulation* 1983; **68**: 951-960.
4. Consensus development conference: coronary artery by-pass grafting. *Br Med J* 1984; **289**: 1527-29.
5. FROELICHER V, *et al.* A randomized trial of exercise training in patients with coronary heart disease. *JAMA* 1984; **252**: 1291-97.
6. GLEICHMANN U. Will there be less need for cardiac rehabilitation programmes when acute treatment is intensified and shortened? *Eur Heart J* 1987; **8** (suppl F): 29-33.
7. MAYOU R and BRYANT B. Quality of life after coronary artery surgery. *Q J Med* 1987; **239**: 239-248.
8. HOFFMEISTER J M, GRUNTZIG A R and WENGER N K. Long term management of patients following successful coronary artery by-pass grafting. *Cardiology* 1986; **73**: 323-332.
9. VERMEULAN A, LIE K I and DURRER D. Effects of cardiac rehabilitation after myocardial infarction: changes in coronary risk factors and long term prognosis. *Am Heart J* 1983; **105**: 798-801.
10. KAVANAGH T. Exercise for the post-coronary patient I. In Exercise, Heart, Health. *The Coronary Prevention Group* 1987: 47-58.
11. VLIETSTRA R E. Effect of cigarette smoking on survival of patients with angiographically proven coronary artery disease. *JAMA* 1986; **255**: 1023-27.
12. ANON. Secondary prevention of coronary disease with lipid lowering drugs. *Lancet* 1989; **I**: 473-474.
13. BLANKENHORN D H, *et al.* Beneficial effects of combined colestipol-niacin therapy on coronary atherosclerosis and coronary venous by-pass grafts. *JAMA* 1987; **257**: 3233-40.
14. BOURASSA M G, *et al.* Atherosclerosis after coronary artery by-pass surgery: results of recent studies and recommendations regarding prevention. *Cardiology* 1986; **73**: 259-268.
15. CHATTERJEE K. Is there any long term benefit from coronary artery by-pass surgery. *JACC* 1988; **12**: 881-882.
16. LEWIS B, MANN J I and MANCINI M. Reducing the risks of coronary heart disease in individuals and in the population. *Lancet* 1986; **I**: 956-959.
17. BETHELL H J N. How to do it: Set up a coronary rehabilitation programme. *Br Med J* 1988; **297**: 120-121.