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ORIGINAL ARTICLE

Rehabilitation of elderly with coronary heart disease – Improvement in quality of life at a low cost

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Abstract

The aim of this randomized controlled study was to evaluate healthcare consumption, self-reported health-related quality of life and to calculate the costs of the training programme, in a cohort of 101 consecutive elderly patients ≥65 years admitted to the Coronary Care Unit at Karolinska University Hospital, Stockholm, Sweden due to an acute coronary event. The patients in the intervention group ($n = 50$) participated in a 3-month aerobic group training programme 3 times a week. The control group were encouraged to take daily walks and to restart their previous physical activity when they felt fit enough for it. Significant improvements ($p \leq 0.05$) were seen over time in the intervention group in health-related quality of life, measured with EuroQol and Time Trade Off, as well as in physical activity level and self-estimated well-being ($p \leq 0.05$). No significant differences were found between the two groups in healthcare consumption or morbidity. The actual cost for the training programme was low, both for the healthcare system and for each single patient. The main findings in this study were low costs and a high compliance to the training programme. The intervention group also increased their level of physical activity and scored a higher quality of life than the control group – two important factors for a healthy lifestyle when elderly.

Key words: *Angina pectoris, compliance, health-economy, morbidity, myocardial infarction, old, physiotherapy, training*

Introduction

Cardiovascular disease is one of the major causes of death and disability in the elderly population, contributing substantially to an escalating cost for the healthcare system. One reason for this is the increasing population of elderly patients. Even though physical and mental manifestations of ageing are inevitable, an intervention such as exercise training can improve and maintain functional capacity, prolong an active lifestyle and, thereby, decrease dependence and disability (1–3).

For countries in the developed world, treatment of coronary heart disease poses a major demand on the healthcare budget. In 1995, about 200,000 patients with coronary heart disease spent about one million days in hospitals in Sweden to a total cost of 460 million Euro. Indirect costs – such as costs for lost production and invalidity benefits – were estimated at 850 million Euro, which is more than the total costs for the whole healthcare. The total socio-economic costs caused by cardiac disease were estimated at 1.6 billion Euro in 1995 (4).

An increase in patients with cardiovascular disease is also expected, which will influence the use and costs of the healthcare system (5).

While comprehensive cardiac rehabilitation has been shown to be an effective intervention for patients with documented coronary heart disease, data from economic evaluations to determine the efficiency are limited. Available economic evaluations shows, however, that it is a cost-effective intervention following an acute coronary event and can even be cost saving (4) and therefore economically justified (6).

The calculated cost-effectiveness based on a 1-year-follow-up in Sweden is a prevention of 217 deaths to a cost of 34 million Euro, i.e. 160,000 Euro per prevented death (4).

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Coronary heart disease imposes restrictions not only in physical terms, but also in psychological and social functioning. This may influence activities in daily life negatively, as well as the possibility to stay independent. Depression, especially in elderly patients, has a negative influence on recovery and in patients participating in cardiac rehabilitation (7). All these factors may cause a reduction in quality of life (QoL) (8). This is especially common during the initial recovery phase, and is worsened with increasing severity of the disease, stratified by angina pectoris class, while asymptomatic patients reports a better profile (9,10). QoL is defined as "a generic concept reflecting concern with the modification and enhancement of life attributes, e.g. physical, political, moral and social environment: the overall condition of a human life" (11).

Participating in cardiac rehabilitation programmes improves QoL in younger patients, when measuring the effects directly after the training period, as well as in elderly patients and very old patients following 12 weeks of exercise based cardiac rehabilitation (12,13).

The aim of this study was to evaluate self-reported health-related QoL (HRQoL) and healthcare consumption and to calculate the costs of the training programme, in a group of elderly patients participating in a 3-month aerobic group training programme, 1 year after the acute event, and compare this with a control group.

Methods

Study patients

One hundred and one consecutive patients over 65 years admitted to the Coronary Care Unit at the Karolinska University Hospital, Stockholm, due to an acute coronary event during a period of 2½ years, were randomly allocated into one of two groups: Group I, the intervention group, and Group C, the control group.

To be included in the study, the patients had to perform a pre-discharge exercise test with a workload of $\geq$70 watts in males and $\geq$50 watts in females. Patients with neurological sequels, memory dysfunction such as dementia, orthopaedic disability, inability to speak and/or understand Swedish, and a planned coronary intervention within 3 months were excluded.

Morbidity was measured as angina pectoris or congestive heart failure, and classified by the Canadian Cardiovascular System (CCS) (14) for angina pectoris and the New York Heart Association classification system (NYHA) (15) for congestive heart failure.

All patients received verbal and written information about the importance of regular physical activity after an acute coronary event. They were recommended to take a daily walk at a comfortable speed, and to gradually increase the time, length and speed. The recommendations for walking were based on the individual perceived exertion, according to Borg's Ratings of Perceived Exertion-scale (RPE-scale) (16,17), and subjects were encouraged to reach an exertion of 12–13/20 while walking, with a warming-up and cool-down period at an exertion level of 9–10/20.

All patients were also invited to monthly information meetings at the hospital, where they had the possibility to ask questions about their disease, receive information on pharmacological therapy, and discuss their problems with a professional team specialized in cardiac rehabilitation. The medical follow-up at the outpatient clinic was the same for all patients, and they were all encouraged to contact the team at any time during the study period.

The patients were evaluated at baseline, at 3 and 12 months after inclusion by an independent, blinded to group allocation, researcher.

Training programme

The patients in Group I participated in a 50-min aerobic group training programme three times a week for 3 months, with a voluntary step-down period once a week for another 3 months. A specialized physiotherapist supervised all training sessions.

The complete programme was supported by music, which guided the intensity of the performance during the session. The training sessions were followed by 10 min of relaxation, also supported by music (18).

Leaving the programme, all patients were encouraged to contact training facilities outside the hospital, such as those offered by the local National Association for Heart and Lung Patients.

The patients in Group C received instructions as already outlined and were encouraged to restart their prior physical activity as soon as they felt fit enough for this. After the 3-month follow-up, they were also encouraged to contact the local National Association for Heart and Lung Patients concerning taking part in its training programme for heart patients.

Healthcare consumption

Information about hospital visits and visits to other healthcare facilities were collected from the study-protocol at 3 and 12 months follow-up.

HRQoL

To evaluate QoL, the EuroQol (19–24) and Time Trade Off (25–28) questionnaires were used. These instruments are often used in economical studies (29,30).

EuroQol is divided in two parts. The first part contains questions about physical activity, activities of daily living function, pain/disability and fear/depression. The other part, the thermometer, consists of a 100-degree vertical scale, with zero indicating the worst possible health and 100 indicating the best possible health. The patient puts a mark on the scale where he/she is at that particular moment.

In Time Trade Off (TTO), the patient is asked to choose between living 1 year with best possible health or up to 10 years with present health status. The closer to 10 the patient answers, the "healthier" he is assumed to be.

Quality-adjusted life-years (QALYs) were used as a marker of gain in QoL measured in Euro. To estimate the gain in QoL, every 0.01 increase in Euro-Qol and TTO corresponds to a gain of 500 Euro. Every year with full health (1 QALY), is worth 50,000 Euro (0.01 × 500 Euro) (31).

Self-estimated physical activity and well-being

Before randomization, and after 3 and 12 months, the patients estimated their level of physical activity according to a six-point scale where one corresponds to sedentary and six to strenuous exercise at least 3 h a week such as jogging, skiing, tennis, swimming or aerobic training (29).

Self-graded well-being was assessed using a scale from 0 to 100 mm with the extremes "not good at all" to "very good" at the 3-month follow-up (32).

Calculating costs of the training programme

Information about costs for outpatient care was received from the economic department at Karolinska University Hospital (33).

Cost for a physiotherapist including overhead costs were received from the head of the Department of Physiotherapy, Karolinska University Hospital (34).

Travel time costs to and from the training sessions and costs for travelling by car were calculated according to instructions from Swedish Authority, which is 1.6 Euro per 10 km after tax (35,36).

Statistical methods

Results are presented as mean (M), standard deviation (SD), median (Md) and/or range depending on data. Statistically significant differences were assumed when $p \leq 0.05$. Analyses were performed using two-sided Student's t-test and Wilcoxon's signed ranks test between groups and Friedman's ANOVA (analyses of variance) for changes over time.

Ethical considerations

The local Ethic Committee at the Karolinska University Hospital approved the study protocol, and all patients gave their informed consent to participate after verbal and written information.

Results

Study patients

One hundred and one patients were included. Fifty were randomized to the intervention group (Group I; 41 men and nine women) and 51 to the control group (Group C; 40 men and 11 women). The median age were 71 years in both groups, range 64–84 in Group I and 65–83 in Group C. The total initial hospital stay before including in the study were 6 days in Group I and 5 days in Group C.

Characteristics of the patients are presented in Table I. There were neither demographic nor medical differences between the two groups at baseline.

Six patients, two in Group I and four in Group C, underwent coronary artery by-pass graft surgery (CABG) during the follow-up period between 3 and 12 months. Two patients in Group I and one

Table I. Characteristics of the patients, divided in intervention group and control group.

	Intervention group ($n=50$)	Control group ($n=51$)
Male/female ratio	41/9	40/11
Married/single	43/4	39/6
Widow/widower	3	6
Time of hospital treatment in days, Md (range)	6 (1–16)	5 (1–12)
Other diseases		
Diabetes mellitus	10	6
Hyperlipidaemia	9	8
Hypertension	18	14
Congestive heart failure	2	5
Previous AMI	18	11
Angina pectoris	20	21
Previous PTCA	7	5
Previous CABG	9	9

AMI, acute myocardial infarction; PTCA, percutaneous transluminal coronary angioplasty; CABG, coronary artery by-pass graft surgery.
Data are presented as numbers of patients (n), unless indicated otherwise.

patient in Group C underwent percutaneous transluminal coronary angioplasty (PTCA) during baseline and 3 months, and two additional patients in Group I between the 3- and 12-month follow-up.

The average compliance (actually performed training sessions divided by possible sessions) in the intervention group was 87% (range 64–100). There were no complications of any kind during the training sessions. Forty-seven patients of the 50 in Group I continued the training programme once a week for the second 3-month period.

Healthcare consumption

There was a significant difference between the two groups at the 1-year-follow-up regarding number of days in hospital with a decrease in Group I and an increase in Group C (Table II). There were no significant differences between the two groups in health consumption.

HRQoL

Morbidity, measured as angina pectoris or congestive heart failure and classified by the CCS for angina pectoris and the NYHA for congestive heart failure, showed no significant differences between the two groups neither at baseline, nor at 3- or 12-month follow-up.

Analysis over time showed significant improvements in QoL in Group I measured with the TTO, the thermometer and the first part of the EuroQol compared to Group C. There were no significant differences between the two groups in QoL nor at baseline, or after 3 or 12 months (Table III).

When calculating QALYs, i.e. gains in QoL, both groups improved. TTO and EuroQol (first part, the questionnaire) showed the same gain in Group I and Group C. EuroQol part two (the thermometer) showed a larger gain in Group I (54,000 Euro) compared to Group C (31,500 Euro).

Self-estimated physical activity and well-being

Self-estimated level of well-being was 9 in Group I (Md; range 1.75–10) ($p \leq 0.05$) compared to 7.8 in Group C (Md; range 2.5–10) at the 3-month follow-up. Group I scored a significant higher level ($p \leq 0.05$) of self-estimated physical activity on the six-graded scale.

Calculating costs of the training programme

The proceeds received from the training programme varied from 10 to 12 Euro per patient. The more patients per group, the larger the proceeds. The fee for each patient was 7 Euró for each session.

The costs for 1 h of physiotherapy in a group session with 10 patients were 170 Euro plus patient fee. About 2 h work was estimated for the physiotherapist in charge of each session with time for administration and preparation included.

The costs for one single physiotherapist, working full time, were 52,800 Euro per year in 2003, including overhead costs.

The patients had an average about 13 km of travelling to the hospital where training sessions took place. Time for travelling was estimated at about 30 min (one way). Most of the patients travelled with bus or by their own car. Total costs for training, travelling time and costs for travelling with own car were summarized to about 470 Euro for the whole training period for each patient.

Table II. Healthcare consumption at 3 and 12 months in the intervention group and control group.

	3 months		12 months	
	Intervention ($n=50$)	Control ($n=51$)	Intervention ($n=50$)	Control ($n=51$)
Non-institutional care				
Visits	24	23	32	27
Acute visits	2	2	4	2
Appointments				
Mean (range)	1 (1–3)	1 (1–10)	2 (1–9)	2 (1–20)
Hospital stay				
Visits	15	9	18	16
Acute visits (range)	13 (1–5)	8 (1–4)	7 (2–3)	7 (1–2)
Appointments (range)	12 (1–3)	5 (1–5)	20 (1–5)	26 (1–9)
Admitted to hospital	10	6	11	11
Days (range)	43 (1–14)	23 (1–8)	24 (1–7)	99 (4–30)

Data are presented as number of visits (n) or days at hospital, unless indicated otherwise.

Table III. Quality of life measured with EuroQol and Time Trade Off (TTO; the numbers for TTO and EuroQol part two divided by 10).

	Baseline			3 months			12 months		
	Group I $n=50$	Group C $n=51$	p $n=50$	Group I $n=51$	Group C $n=50$	p $n=51$	Group I	Group C	p
TTO			ns			ns			ns
Md	0.8	0.9		1.0	1.0		1.0	1.0	
Range	0.1–1.0	0.1–1.0		0.2–1.0	0.1–1.0		0.2–1.0	0.1–1.0	
M	0.78	0.77		0.84	0.85		0.86	0.85	
SD	0.23	0.26		0.24	0.21		0.23	0.21	
EuroQol; part two			ns			ns			ns
Md	6.78	7.0		8.0	7.5		7.9	7.1	
Range	3.0–9.9	0.5–10		3.5–10	3.0–10		3.0–10	4.2–10	
M	6.52	6.8		7.72	7.51		7.6	7.43	
SD	1.56	1.61		1.61	1.71		1.46	1.4	
EuroQol; part one			ns			ns			ns
Md	0.80	0.80		0.85	0.80		1	0.81	
Range	0.09–1	0.12–1		0.09–1	0.12–1		0.42–1	0.17–1	
M	0.79	0.81		0.85	0.84		0.87	0.86	
SD	0.24	0.2		0.17	0.17		0.15	0.16	

Md, median; M, mean; SD, standard deviation; ns, not significant.

Discussion

The main findings in this study were low costs and a high compliance to the training programme. The intervention group also increased their physical activity level and scored a higher QoL than the control group – two important factors for a healthy lifestyle even when elderly.

Cardiac rehabilitation, like any therapeutic intervention, should be subjected to an economic evaluation. However, it is not sufficient to focus only on effectiveness measures without taking into consideration issues such as HRQoL. Too much attention has been focused on survival following cardiac rehabilitation, when improved HRQoL is the expected main benefit (37). Assessment of HRQoL is important and aspects of QoL should be included in a comprehensive evaluation of cardiac rehabilitation programmes designed for elderly subjects (38).

To make informed and appropriate decisions about the allocation of limited resources to various cardiovascular care services, comparative economic evaluation must be performed (39–41). In economic analysis, additional costs must also be included. With respect to cardiac rehabilitation direct costs, such as exercise clothing and shoes, are minimal. However, indirect costs such as loss of payment and time spent in rehabilitation could be considerable high (12).

The intervention group had a higher (but not statistical significant) healthcare consumption during the follow-up period. One reason for this could be that the intervention group often met healthcare professionals and had opportunities to bring up questions and problems, and might therefore more often be advised to see a doctor than the control group. However, no differences were seen between the two groups in hospital visits for cardiological reasons.

Costs for travelling to and from training sessions were low, even if most of the patients used their own car or travelled by bus. One reason for the low costs could be that the patients estimated the costs lower than reality, or that they were travelling together with someone else and not paying by themselves. Using season tickets could also be a reason for low costs travelling by bus.

Because so many of the patients estimated such low costs for travelling, we chose to calculate the costs of travelling by car using numbers fixed by law (1.6 Euro per 10 km). The same method was used for calculating costs for travelling time, with the time changed from minutes to Euro (36).

The instruments used for measuring QoL were TTO and EuroQol. These are generic instruments and are often used in economic studies (29,30), and as the purpose of the present study was to do an economical analysis and to calculate the cost for the programme we chose these instruments. The problem with generic instruments is the low sensitivity for changes over time. Taylor et al. (42) tested three different instruments on cardiac patients, evaluating QoL – the Sickness Impact Profile (SIP), Nottingham Health Profile (NHP) and McMaster Health Inventory Questionnaire (MHIQ) – and concluded that generic instruments should not be used to evaluate rehabilitation, but rather disease-specific instruments.

For everyday use in cardiac rehabilitation, it might be more meaningful to use questions such as "How do you feel right now?" when evaluating patients in QoL and well-being, before and after an intervention such as a period of exercise training.

Patients included in this study are representative for those who can take a brisk walk, but they are not representative for the whole group of cardiac patients older than 65 years. Some selection in rehabilitation is common, e.g. patients had to be able to do an exercise test, and, due to this, we probably reached only the "healthiest" patients.

Even though there were no gains in returning to work in this study, as the study population was elderly and already retired, we think that it is important to include elderly patients in cardiac rehabilitation programmes based on exercise training, and that the gains in QoL compared with the costs for the training programme are so low that differences in QoL, even if they are not statistically significant, are gains for every single patient (18,43–46).

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