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Improvement in Quality of Life, Functional Capacity, and Depression Level after Cardiac Rehabilitation

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Abstract

Objective: In cardiac rehabilitation program (CRP), patients are supported to achieve and maintain optimal physical and psychosocial health following a recent cardiac event or procedure. In this study, we aimed to retrospectively assess the effects of CRP in our cardiopulmonary rehabilitation unit.
Material and Methods: Records of 40 patients with a diagnosis of coronary artery disease (CAD) and 10 patients who had undergone coronary artery bypass graft surgery (CABG) and who completed 30 sessions were evaluated. CRP comprised aerobic exercise with cycle ergometer and the upper and lower extremity strengthening exercises. The patients' vital signs were monitored during the cycle ergometer exercise. The quality of life of the patients were evaluated with the Short Form-36 (SF-36), aerobic exercise capacity and metabolic equivalent (MET) levels were assessed with the effort test using the Bruce protocol, their functional capacity was assessed with a 6-min walk test, and depression levels were assessed with the Beck Depression Inventory.
Results: After CRP, there were statistically significant differences in all subunits of SF-36 except social function, emotional role, and mental component in patients with CAD ($p \leq 0.05$). In patients with CABG, physical function, physical role, social function, and mental health subunits of SF-36 significantly improved ($p \leq 0.05$). The patients' mean MET values significantly increased in both the groups ($p \leq 0.05$). The mean 6-MWT distances significantly increased from 455.3±66.4 to 522.7±68.5 m after CRP in patients with CAD ($p < 0.001$). Furthermore, in patients with CABG, the mean 6-MWT distances significantly increased from 389.1±88.5 to 495.0±99.1 m ($p \leq 0.05$). There was significant decrease in BDI score from 4.3±7.1 to 2.9±4.3 in patients with CAD ($p \leq 0.05$). However, no significant change in mean BDI score was observed in patients with CABG.
Conclusion: In our cardiopulmonary rehabilitation unit, CRP, comprising endurance exercise using cycle ergometer, improved the quality of life and functional capacity in patients with CAD and CABG. However, the improvement in depression level was observed only in patients with CAD.
Keywords: Cardiac rehabilitation, endurance exercise, cycle ergometer

Introduction

Physical exercise is an important component of the standard therapy for patients after a cardiac event (1). The World Health Organization has defined secondary prevention cardiac rehabilitation (CR) as "the sum of activities required to favorably influence the underlying cause of the disease as well as the best possible physical, mental, and social conditions so that they may, by their own efforts, preserve or resume as normal a place as possible in the community (WHO, 1993.p.3). Rehabilitation cannot be regarded as an isolated form of therapy but must be integrated with the whole treatment of which it forms only one facet (2). Clinical trials demonstrate significant reductions in all-cause and cardiovascular mortality for patients with coronary artery disease (CAD) who are enrolled in exercise-based cardiac rehabilitation programs (3,4).

However, quality of life (QoL) outcomes of CR have attracted less attention. Health-related QoL (HRQoL) represents the

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patient's own evaluation of the impact of a disease on his/her physical function and wellbeing (5).

Several instruments for assessing HRQoL have been developed, both generic and disease specific. HRQoL assessments have been evaluated in a recent review, and the results suggest that the Short Form 36 (SF-36) is the most appropriate generic measure of HRQoL among people with ischemic heart disease (6,7).

The positive effect of CR on functional capacity has long been revealed (8,9). The 6-min walk test is widely used to assess functional capacity and prognosis (10).

Depression is common after coronary artery bypass graft (CABG) surgery, in patients with CAD and chronic heart failure and is associated with poor QoL, increased morbidity, frequency of hospitalizations, and mortality. Research suggests that depression in populations with CABG and CAD improves during exercise training rehabilitation programs (11).

In our retrospective study, we aimed to determine changes in QoL, depression level, and functional capacity of patients with CAD and CABG who attended an outpatient rehabilitation program.

Material and Methods

A retrospective analysis was performed for 50 outpatients enrolled in the cardiac rehabilitation program (CRP) from November 2011 to May 2013 in Afyon Kocatepe University Hospital Department of Physical Medicine and Rehabilitation. We obtained the ethics committee's approval and informed consent from the patients. The charts of patients who had completed 30 sessions of CR were reviewed. Forty patients with a diagnosis of CAD and 10 patients who had undergone CABG were included in the study. CRP comprised 5 min of warm-up, 10 min of range of motion, 10 min of strengthening, 30 min of aerobic exercise with cycle ergometer, and 5 min of cool-down exercises. The patients' vital signs, including pulse, tension arterial, heart rhythm, and oxygen saturation, were monitored during the cycle ergometer exercise (Ergoselect 200, Ergoline GmbH, Bitz, Germany). All patients exercised with a constant heart rate training program.

The QoL was assessed using SF-36, a generic HRQoL questionnaire. It comprises 36 questions grouped in eight separate multi-item scales, covering the following domains: physical functioning (10 items), role limitations due to physical problems (four items), body pain (four items), general health perception (five items), vitality (four items), social functioning (two items), role limitations due to emotional problems (three items), and mental health (five items). Majority of the scales are scored on three- to six-point categorical scales with different anchor points, whereas the response choices in the role functioning scales are dichotomous (6). The questions were summated and transformed to eight 0–100 scales with higher scores indicating better HRQoL. The Turkish version has been proved to be valid and reliable (12).

The 6-min walk test (6-MWT) is a practical simple test that requires a 100-ft hallway but no exercise equipment or advanced training for technicians. This test measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 min. It evaluates the global and integrated responses of all the systems involved during exercise, including the pulmonary and cardiovascular systems, systemic circulation, peripheral circulation, blood, neuromuscular units, and muscle metabolism. Functional capacity of patients was assessed with 6-MWT (13).

Table 1. Demographics of patients with CAD and CABG undergoing CRP

	CAD (n=40)	CABG (n=10)
Age (years) (Mean±SD)	55.9±8.4	58.7±4.7
Male/Female (n)	35/5	9/1
Diagnosis duration (months)	17.6±23.4	59.1±53.7

CAD: coronary artery disease; CABG: coronary artery bypass graft; CRP: cardiac rehabilitation program; SD: standard deviation

Table 2. Pre-CR and Post-CR SF-36 subunit values of patients with CAD

	Pre-CR (Mean±SD)	Post-CR (Mean±SD)	p value
Physical function	61.9±26.1	75.7±20.8	0.00
Physical role	48.0±39.8	65.1±38.7	0.002
Pain	63.7±24.8	73.8±21.6	0.007
General health	55.8±17.5	69.7±19.8	0.00
Vitality	59.5±21.5	69.4±20.9	0.002
Social function	71.2±23.2	77.9±21.4	0.061
Emotional role	53.3±40.5	64.9±35.4	0.066
Mental health	63.9±21.2	71.9±19.4	0.003
Physical component	42.4±9.8	47.5±8.6	0.00
Mental component	45.8±9.9	48.4±8.8	0.057

Pre-CR: pre-cardiac rehabilitation; Post-CR: post-cardiac rehabilitation; CAD: coronary artery disease; SF-36: Short form 36; SD: standard deviation

Table 3. Pre-CR and Post-CR SF-36 subunit values of patients with CABG

	Pre-CR (Mean±SD)	Post-CR (Mean±SD)	p value
Physical function	45.2±19.1	61.5±20.6	0.028
Physical role	18.5±23.1	60.0±35.7	0.011
Pain	52.4±19.7	60.9±27.2	0.343
General health	35.6±21.5	46.3±26.2	0.206
Vitality	47.0±19.0	55.0±24.0	0.076
Social function	70.0±23.7	81.2±12.1	0.038
Emotional role	39.3±30.1	46.6±39.1	0.273
Mental health	53.0±17.3	62.8±19.4	0.011
Physical component	35.5±6.2	40.8±9.2	0.114
Mental component	40.7±8.6	44.3±6.6	0.241

Pre-CR: pre-cardiac rehabilitation; Post-CR: post-cardiac rehabilitation; SD: standard deviation

Table 4. Pre-CR and Post-CR MET values, 6-MWT distances and BDI scores of patients with CAD and CABG

	Pre-CR (Mean±SD)	Post-CR (Mean±SD)	*p value	Pre-CR (Mean±SD)	Post-CR (Mean±SD)	**p value
MET value	9.9±2.1	10.9±1.9	0.000	7.9±1.1	9.3±1.8	0.007
6-MWT (m)	455.3±66.4	522.7±68.5	0.000	389.1±88.5	495.0±99.1	0.005
BDI score	4.3±7.1	2.9±4.3	0.021	6.0±5.6	5.7±7.8	0.344

*p value for patients with CAD

**p value for patients with CABG

6-MWT: six-min walk test; BDI: Beck Depression Inventory; Pre-CR: pre-cardiac rehabilitation; Post-CR: post-cardiac rehabilitation; CAD: coronary artery disease; CABG: coronary artery bypass graft surgery; MET: metabolic equivalent; SD: standard deviation

It is convenient to express the oxygen uptake in multiples of resting requirement. The metabolic equivalent (MET) is a unit of resting oxygen uptake. Rather than using each the patient's own value, one MET is designated as the average value (3.5 mL O_2 uptake/kg/min). A mean exercise capacity of 10 METs has been observed in nonathletic, healthy, middle-aged men (14).

Effort stress tests of patients were performed before and after the rehabilitation program to determine the changes in MET values.

Beck Depression Inventory (BDI) was used to determine depression level. BDI is a 21-question multiple-choice self-reported inventory, one of the most widely used method, for measuring depression severity. When the test is scored, a value of 0–3 is assigned for each answer and then the total score is compared with a key to determine the depression's severity. The standard cut-offs are as follows: 0–9, indicates minimal depression; 10–18, indicates mild depression; 19–29, indicates moderate depression; and 30–63, indicates severe depression. Higher total scores indicate more severe depressive symptoms (15).

Statistical Analysis

Statistical analyses were performed using SPSS version 15.0 (Statistical Package for the Social Sciences Inc., Chicago, IL, USA). Descriptive statistics and means were used to describe the features of the data. The normality of the distribution of continuous variables was assessed with the Kolmogorov–Simirnov test. To compare the outcome measures obtained before and after CR, Wilcoxon signed rank test or paired samples T-test were used where appropriate. A p value of <0.05 was considered to demonstrate a statistically significant result.

Results

The demographics of patients are depicted in Table 1. The mean age of patients with CAD and CABG were 55.9±8.4 and 58.7±4.7 years, respectively. Seven (17.5%) patients with CAD and two (20%) patients with CABG never smoked.

There were statistically significant differences in all subunits of SF-36 except social function, emotional role, and mental component after CRP in patients with CAD (p≤0.05) (Table 2). In patients with CABG, physical function, physical role, social function, and mental health subunits of SF-36 significantly improved (p≤0.05) (Table 3).

The mean 6-MWT distances significantly increased from 455.3±66.4 to 522.7±68.5 m after CRP in patients with CAD (p<0.001). Moreover, in patients with CABG, the mean 6-MWT distances significantly increased from 389.1±88.5 to 495.0±99.1 m after CRP (p≤ 0.05) (Table 4).

The mean MET value significantly changed after CRP in both patients with CAD and CABG (p<0.05) (Table 3).

There was significant decrease in BDI score from 4.3±7.1 to 2.9±4.3 after CRP in patients with CAD (p≤0.05). However, we did not observe significant change in the mean BDI score in patients with CABG (p>0.05) (Table 3).

Discussion

In this study, we demonstrated that cardiac rehabilitation program, comprising 30 sessions of exercise training, is associated with significant improvements in the QoL and functional capacity for outpatients with CAD and CABG. However, the depression level significantly improved only in patients with CAD.

As an outcome in an intervention like CR where the objective is for patients "by their own efforts, to preserve or resume as normal a place as possible in the community," physical and psychological well-being; that is, HRQoL may be as important to a patient as survival (2). Hsu et al. (16) reported an effect of outpatient CR on HRQoL among patients who underwent aortic coronary bypass. After the end of rehabilitation, there were significant improvements in physical functioning, physical role, bodily pain, and social function among these patients. Karapolat et al. (17) compared the effects of hospital-supervised exercise vs. home-based exercise in patients after orthotopic heart transplantation on functional capacity, QoL, and psychological symptoms and reported significant improvements in pVO2 and most SF-36 subgroups in the hospital-based exercise group. In accordance with these findings, we observed significant improvement in QoL in patients with CABG. Furthermore, Stauber et al. (18) reported significant improvements in all subunits of SF-36 in 520 patients with coronary artery after a comprehensive 12-week outpatient CRP. Moreover, in our study, the QoL of patients with CAD significantly improved after 30 sessions of outpatient CRP.

Many patients in contemporary cardiac rehabilitation programs are quite deconditioned on entry. Using the 6-MWT to assess submaximal exercise capacity, for example, patients walked an average of only 76±21% of the 6-min walk distance predicted for their age, sex, height, and weight; mean distance walked at the completion of CR was 90±22% predicted and the proportions of patients performing at ≥80% of predicted walk distance increased from 44% to 69% (19,20). Stahle et al. (21) reported 15% improvement that was observed in the 6-MWT distances in elderly patients with post-myocardial infarction after an aerobic-based exercise intervention. Karapolat et al. (22) compared hospital-based vs. home-based exercise training in patients with heart failure and reported significant improvement in pVO_2 and 6-MWT in both the groups. Freyssin et al. (23) observed significant increase in the distance walked during the 6MWT in 26 patients with chronic heart failure after both continuous and interval training cardiac rehabilitation program lasting for 8 weeks. Jelinek et al. (24) reported that a 6-week cardiac rehabilitation program improves 6-MWT in both patients who had undergone CABG and percutaneous coronary revascularization. In this study, they compared 6-MWT distances before and after 6-week of CRP and found improvements in both the groups. In accordance with the literature, we determined improvement in 6-MWT distances for patients with CABG and CAD in our study.

Improving depression was not a specific target of cardiac rehabilitation. However, the rehabilitation program confers a high amount of physical exercise that may be expected to alleviate depressive symptoms in its own right (25). Stauber et al. (18) reported significant improvements in depression and anxiety levels after a 12-week cardiac rehabilitation program, comprising aerobic endurance, strength training and relaxation sessions, for patients with CAD. In a study by Milani and Lavie (26), depressive symptoms were assessed by a questionnaire, and mortality was evaluated at 40 months in over 500 consecutive coronary patients completing vs. not completing rehabilitation. Decreased depressive symptoms and decreased mortality were associated with improved fitness with only the modest improvement in fitness levels required to produce these benefits. In our study, we also observed significant improvement in depression levels of patients with CAD after 30 sessions of outpatient CRP. In another study by Karapolat et al. (27), the efficacy of the cardiac rehabilitation program in patients with end-stage heart failure, heart transplant patients and left ventricular assist device recipients, they demonstrated significant improvement in functional capacity, pulmonary function test, QoL, and depression after an 8-week supervised exercise program. Kulcu et al. (28) assessed the effect of cardiac rehabilitation on depression in patients with congestive heart failure and reported significant improvement in BDI scores in the treatment group in the short term. Sharif et al. (29) observed significant decreases in BDI scores in 80 patients with CABG at the end of and 2 months after the 32 sessions of cardiac rehabilitation exercise program. However, in this study, we could not demonstrate improvement in the depression level of CABG after the 30 sessions of outpatient CRP. This may be because of the small number of patients with CABG attending this program.

The exercise tolerance test (ETT) can provide important prognostic information. Cardiac rehabilitative exercise training improves these ETT-derived prognostic variables and decrease predicted cardiovascular risk scores that incorporate these variables (30). Among men with and without cardiovascular disease who were referred for treadmill exercise testing, peak exercise capacity measured in METS was the strongest predictor of the risk of death, during an average of 6.2 years follow-up (14). For each MET increase in exercise capacity, there was a 12% improvement in survival.

Adams et al. (30) reported significant increase in MET values after a supervised CR program in 210 patients with CAD in a retrospective study. Rechcinski et al. (31) demonstrated significant increase in MET values after early cardiac rehabilitation program for patients following complete revascularization and incomplete revascularization by PCI. In a study, the effect of CRP on exercise capacity in women undergoing CABG was investigated, and significant increases of estimated exercise capacity in terms of MET values were reported (32). In our study, we observed improvement in MET values after CRP in patients with CAD in accordance with the literature.

This study had several limitations. First, the number of patients with CABG and CAD were relatively low. Second, because the study was retrospective and did not include a control group, we were unable to compare the effectiveness of CRP over home-based exercise. Furthermore, as spontaneous improvement may occur in aerobic capacity in the following several weeks in patients with CHD who have not received an exercise-based CR, the lack of control group in our study limits us to make assertive conclusions regarding our results.

Therefore, to our knowledge, our study is among the first retrospective studies reporting the effect of 30 sessions of CRP comprising 30 sessions of endurance training using only the cycle ergometer with constant heart rate program in our country.

Conclusion

This retrospective study, involving 40 patients with CAD and 10 patients with CABG, demonstrated that outpatient CR program, comprising 30 sessions of endurance and strengthening exercises, provides improvements in the QoL and functional capacity of both patients with CAD and CABG. Therefore, with this CRP, only patients with CAD could gain improvement in depression level. This may be because of the small number of patients with CABG. However, feature prospective and controlled studies with longer follow-up and large sample size are required to support our findings.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Afyonkarahisar Medical Research Ethics Committee (Number: 2014/16).

Informed Consent: Verbal informed consent was obtained from patients who participated in this study.

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