

The relationship of exercise-based cardiac rehabilitation and the quality of life of patients after myocardial infarction

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Abstract

Background: The aim of the present review is to identify the relationship of an exercise-based cardiac rehabilitation program (exCR) and quality of life in patients after myocardial infarction.

Design: The following databases were searched: Medline databases (via PubMed), and Scopus /Elsevier. Additional relevant research was also identified by direct search in scientific journals available online. The review included studies designed to primary evaluate the quality of life of an exCR program with no limitation about the publication date. Case reports and case series were excluded. Data were extracted by one reviewer and checked by a second reviewer.

Results: The results are presented as per the PRISMA reporting guideline. The articles that finally met all the inclusion criteria and were analyzed, after the screening of the title, the summary and the whole text, were 6. A total of 694 patients who received exCR were examined in this review.

Discussion: The present review indicates that an exCR program improves the quality of life for the patients with myocardial infarction and that quality of life improvements have a bidirectional relationship with increased physical activity and vocational status.

Keywords: Cardiac rehabilitation program; Quality of life; QoL; Myocardial infraction; Exercise

1. Introduction

Cardiac rehabilitation (CR) is a promising emerging multidisciplinary treatment [1] in the reduction of depression, anxiety [2], and enhancement of quality of life in patients with coronary heart disease [3-4]. It is a secondary prevention treatment modality that aims to reduce mortality and morbidity among patients with coronary heart disease, with objectives to improve symptoms, functional capacity, metabolic status, and depression, to ensure that cardiac patients achieve optimal physical, mental, and social conditions, so that they may resume as normal a place as possible in the community [5]. CR has been shown to be clinically effective as secondary prevention following myocardial infarction (MI) in developed countries [6-8]. CR has been shown to reduce total mortality, cardiovascular mortality and hospitalizations, while simultaneously improving physical function [9-10]. Exercise-based cardiac rehabilitation (exCR) is the most widely recognized CR strategy [11] because of known dose-response benefit for mortality from all causes including CVD [12-13], and a strong potential to improve health-related quality of life (HRQoL) [14]. ExCR is consistently and strongly recommended in international clinical practice guidelines, particularly for ACS [15-19].

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The quality of life (QoL) of patients after MI is negatively affected [20-23] due to functional and psychosocial limitations as health professionals know [24] and is confirmed in most research [25-26]. The QoL level seems to have predictive value for the short- and long-term disease outcome, since according to research, lower quality of life is associated with increased rates of mortality and rehospitalization after OME [27-30]. Improving patients' QoL is by definition the goal of secondary prevention in CR, and therefore its measurement is a criterion for its effectiveness. The aim of the present review is to identify the safety of an exCR program in patients after myocardial infarction.

2. Methods

2.1. Review design

The results are presented as per the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) reporting guideline (supporting checklist/diagram) [31].

2.2. Data Sources and Search Strategy

A search strategy was developed based on the intersection of 2 search themes: cardiac rehabilitation program and quality of life. The following databases were searched: Medline databases (via PubMed), and Scopus /Elsevier. Additional relevant research was also identified by direct search in scientific journals available online. Prisma methodology was used, and 6 unique studies were included in the review.

2.3. Inclusion Criteria

The review included studies designed to primary evaluate the QoL of an exCR program with no limitation about the publication date. Case reports and case series were excluded.

2.4. Study selection

Eligibility screening of the studies was conducted in a blinded standardized way by one independent reviewer (Ev.T.). Titles and abstracts were screened using and duplicate articles were excluded. After screening titles and abstracts, full paper copies were retrieved. Full text screening was also performed blinded by the same reviewer (Ev.T.). The whole review process was conducted under the supervision of a second reviewer (Em.T.).

3. Results

The articles that finally met all the inclusion criteria and were analyzed, after the screening of the title, the summary, and the whole text, were 6. (Table 1)

In March 2015, Peixoto et al. [32] conducted a study that aimed to evaluate the effectiveness of early CR in improving health-related QoL and functional capacity, in patients who have recently experienced an episode of acute MI. The sample involved 88 patients who started a supervised early mobilization program twice daily 12 hours after MI. The exercise's intensity was initially 2 METs and progressively increased up to 4 METs. During this exercise phase, patients were taught to exercise at low-moderate intensity using the speech test. Low cardiac risk patients were randomly assigned to the intervention group consisting of 43 subjects with a mean age of 56.0 ± 9.6 years (67% male) and in the control group with 45 patients with a mean age of 56.8 ± 10.8 years (73% male). Patients in the control group were instructed to participate after discharge in an unsupervised 4-week moderate-intensity exercise program. The program was conducted 4 times a week and consisted of a 5' warm-up, walking on a flat surface for gradually increasing time (20' in the 1st week, 25' in the 2nd, 30-35' in the 3rd and 35-40' in the last week), and 5' warm-up. The MacNew Heart Disease HRQL questionnaire results showed significantly higher scores for patients in the intervention group in the domain of physical and emotional functioning compared to patients in the control group. While there were no statistically significant differences in the domain of social functioning? According to the 6/minute walk distance test, patients in the intervention group showed a significant improvement in the distance they covered (85m - 20%) compared to the initial test, while patients in the control group only increased the distance by 13m (3%).

In 2010, Trevlakakis [33] study examined, in an experimental-research environment, the results of a complex therapeutic program of aerobic exercise, i.e. a comprehensive treatment of patients after MI, which has secondary prevention value as part of the general rapid and effective rehabilitation program. The research sample included 64 patients who suffered from coronary artery disease. They were separated by the cardiologist, based on their own preference and their consent to participate in special tests, into two groups. The experimental group consisted of 34 patients with MI (30 male and 4 female) and the control group consisted of the remaining 30 patients with the same MI clinical image, who received the

usual medication (B-blockers, nitrites, antagonist's calcium, and diuretics) that remained stable throughout the program period. The experimental group underwent 50 sessions, 3 times a week, lasting 30-45 minutes until the 20th session. The remaining 30 sessions lasted 45-60 minutes. The intensity of exercise was at 60-80% of the maximum heart rate reached during the fatigue test, for the entire application of the physical therapy program. The control group with coronary disease showed neutral changes. Compared to the control group, the experimental group presented from the beginning to the completion of the program, significant improvements, both in the health status of the patients and in their functional capacity. The comparative analysis finds a significant improvement in the Improving health status, an improvement and stabilization of the psychological state, and a recovery of a good level of functional capacity.

Lavie & Milani [34] conducted a cohort study that aimed to determine the baseline psychological characteristics as well as the overall risk profile in young coronary patients and compare them with those of older patients after a coronary episode. Evaluated detailed information on 104 young patients with a mean age of 48 ± 6 years (73.1% male) compared with 260 elderly patients with a mean age of 75 ± 3 years (75.4% male) were collected before and after completion of the 2nd exCR Phase (2-6 weeks after the heart attack and 1 week after the end of Phase 2. All patients completed weighted questionnaires at the beginning and end of the program to assess behavioral characteristics (The Kellner Symptom Questionnaire) as well as quality of life (The Medical Outcomes Study 36 – Item Short-Form Health Survey). The exercise protocol generally consisted of 12 weeks of 36 teaching and training sessions, where exercise sessions included 10' of warm-up, calisthenics and stretching, followed by 30-45' of continuous aerobic and dynamic exercise as well as light isometric exercise and approximately 5 up to 10' recovery. Exercise intensity was predicted to be close to the anaerobic or respiratory threshold, defined through the baseline value of a cardiorespiratory exercise test, and 10 to 15 beats/min below the level at which any exercise can induce silent myocardial ischemia. After completing the program significant improvements were seen in the score regarding depression (-58.5%), anxiety (-46.0%), hostility (-45.7%), psychosomatic disorder (somatization) (-33.8 %), and quality of life (15.8%) ($P < 0.001$ for all these parameters).

In 2007, Choo et al. [35] published research to evaluate the effects of an 8-week exCR program on exercise capacity and health-related QoL in patients with MI in Korea. A total of 60 patients with acute MI, mean age 56 ± 11 years with a left ventricular ejection fraction $\geq 35\%$, participated. The sample were divided into the exercise group, consisting of 31 subjects, and the control group, consisting of 29 patients who could not participate in the exercise program at the hospital rehabilitation center due to distance from it or professional obligations. For the exercise group, the exCR program started 3 weeks after the onset of the infarction, it included 8 weeks of in-hospital supervised physical exercise, with 3 training sessions per week (24 sessions). The control group was instructed on a home-based exercise regimen without contact during the 8 weeks. At baseline and 8 weeks, HRQoL was assessed by the Quality of Life Index (QLI)-cardiac version III; exercise capacity by a treadmill test. After adjusting for education level, the overall QLI, health/functioning and psycho/spiritual scores showed greater increases in the CRP group than the Control group ($p=.014$, $p=.016$, and $p=.036$, respectively). We observed significant improvements in VO (2peak) ($p<.0001$), anaerobic threshold ($p<.0001$), and maximal exercise duration ($p<.0001$) in the CRP group, compared to the Control group.

In August 2010, Aamot et al. [36] conducted a study in order to evaluate the results of phase b exCR according to its initiation time as well as its effect on the QoL of patients after MI. The clinical trial included 39 low-risk patients, after taking part in a maximal exercise test 14 days after MI (range 8-21 days) were randomly allocated to the exercise group consisting of 20 patients with a mean age of 60.9 years (75% male), and the control group consisted of 19 patients (73.7% male) with a mean age of 57.7 years. To measure the QoL, the MacNew Quality of Life after MI was used in combination with the SF-16. HRQL improved significantly in both groups in every domain but one, physical functioning, though the difference between groups was not significant.

Garcia et al. [37] conducted a study to measure the effects of a comprehensive CR program based on a sport modification (tennis), on QoL, metabolic syndrome factors and exercise test results, and to compare to those of traditional exercise programs. The study sample consisted of 79 male patients with a mean age of 55.23 years (range: 9.6 years), at low risk (LVEF $> 45\%$) after an acute coronary event. These patients were divided into 3 groups: two experimental groups, in which their placement was done randomly, and a control group. The first experimental group ($n=27$) used the ergometric bicycle as a dominant physical exercise, while the second experimental group ($n=27$) took part in a program with a modified form of tennis. At the end of this three-month program in terms of QoL, significant differences were observed in the total score in favor of the exercise groups compared to the control group.

Table 1 Studies included in the review

Authors, year	Design	Sample (n, mean age)	Intervention		Conclusion
			(Follow-up)	Type	
Peixoto et al. 2015	RCT	88 Therapy group: 43 (56 ± 9,6) Control group: 45 (56.8 ± 10.8)	2 m	Phase I: Early mobilization - 12 hours after OEM Exercise 2-4 METs Phase II: 4 weeks unsupervised moderate-intensity walking program at home	Improving health-related quality of life and functional capacity of low cardiac risk patients.
Trevlakis 2010	RCT	64 (56.4 ± 4.16) Therapy group: 34 Control group: 30	4-5 m	Exercise 4-5 months, 50 reps-3f/week. The first 20 reps. 30 – 45' Aerobic, light dynamic exercise and use of medicine balls & weights. The 30 sessions 45-60 minutes. Intensity 60-80% of MKS	Improving health status. Improvement and stabilization of the psychological state. Recovery of a good level of functional capacity.
Lavie & Milani 2006	Prospective cohort study	364 Therapy group: 104 (48 ± 6) Elderly group: 260 (75 ± 3)	13 w	II Phase/2-6 weeks after OEM 12 weeks, 36 plus, 10' warm-up 30-45' continuous aerobic & dynamic, & light isometric 5-10' recovery with Intensity near the anaerobic or respiratory threshold. Additional 1-3 sessions/wk at home	Young patients with CHD are characterized by a higher degree of psychological distress (anxiety, aggression, depression, psychosomatic disorder). The above unfavorable characteristics improve significantly after completing exercise programs.
Choo et al. 2007	CRT	60 Therapy group: 31 (53,9) Control group: 29 (57,2)	8 w	exCR 3 weeks after MI, 8 weeks – 3 times/week 60' with pre- and warm-up on a treadmill, cycle ergometer arm ergometric instrument and stairmaster increasing intensity as 70 -85% VO2peak	After adjusting for education level, the overall QLI, health/functioning and psycho/spiritual scores showed greater increases in the CRP group than the Control group (p=.014, p=.016, and p=.036, respectively).
Aamot et al. 2010	RCT	39 Therapy group: 20 (60.9) Control group: 19 (57.7)	16 w	Therapy group: Exercise 1-3 weeks after MI Control group: Exercise 4 weeks after MI. 16 weeks aerobics & strength training Intensity initially low then moderate – intense.	(In 16 weeks, similar increase in VO2max in both groups). Program initiation time did not affect VO2max improvement.
Garcia et al. 2013	RCT	79 Tennis group: 27 (56,4) Bicycle group: 27 (53,5) Control group: 25 (55,8)	3 m	Exercise 2 weeks after MI. In the 1st month common program with aerobic, endurance & muscle strengthening. For 2 months, 3 times/week, 60' modified tennis program / ergometric bike intensity 70 -85% MKS	Significant improvement in exercise capacity and exercise duration in both experimental groups compared to control group.

4. Discussion

A total of 694 patients who received exCR were examined in this review. Peixoto et al. study concluded that an exCR program starting immediately after MI with in-hospital supervised exercise of progressively increasing intensity, and continuing with an out-of-hospital unsupervised walking exercise program, improves health-related quality of life as well as functional capacity in patients with reduced cardiovascular risk factors, who have had an acute myocardial infarction [32].

According to Trevlakis et al. study, aerobic exercise in combination with a medicine ball and portable weights (0.3-0.5 kg in each upper extremity) and the enrichment of the program with ergometric training, therapeutic hiking, static strength games with an aerobic background, leisure trips as well as various sports (swimming, cycling, ping-pong, etc.) at a controlled intensity has an important role in improving the health status of patients with MI, the improvement and stabilization of their psychological state and finally the recovery of a good level of functional capacity, with the creation of motor habits and abilities, for unsupervised implementation of daily activities [33].

There were 3 important findings from the research of Lavie & Milani 2006 [34]. First, young patients constitute a significant portion of the coronary heart disease population participating in exCR. Second, young patients with CHD are characterized by a higher degree of psychological distress (anxiety, aggression, depression, and psychosomatic disorder), obesity and dyslipidemia. Third, the above adverse characteristics were significantly improved after the completion of Phase 2 exCR, which is why it is important, despite the various obstacles encountered by younger patients, such as returning to work and family obligations, to refer for CHD and be strongly encouraged to participate in and especially complete such programs.

The Choo et al. study findings lead to the conclusion that an 8-week inpatient CR can lead to significant improvements in exercise capacity and health-related quality of life in patients with acute myocardial infarction [35]. As far as the second phase of the exCR is concerned, Aamot et al. concluded that the health-related quality of life increased in every domain, while an early start of the second phase of the exercise program did not increase maximal oxygen consumption, compared to starting exercise 4 weeks later. For patients with a low risk factor, who are highly motivated to exercise, walking is an option for a moderate start of cardiac rehabilitation in the first weeks after myocardial infarction [36].

The Garcia et al. study led to the conclusion that CR of low-risk patients after acute coronary syndrome based on a modified tennis program improves exercise endurance, quality of life, lipid profile and brings about favorable changes in various anthropometric parameters related to reduction of cardiovascular risk [37]. The development and creation of CR programs based on various modified sports to suit different motivations and tastes would complement the available options of traditional programs and benefit patient participation and adherence to physical exercise. In 2016 Anderson et al. published a systematic review and meta-analysis of studies on the effect of exercise on mortality and morbidity, to update the Cochrane database which is internationally recognized as the most reliable source of high-quality evidence on Medical Issues [38]. The study included 63 randomized trials, 49 of which were published between 2000 and 2014, mostly in Europe and North America. Most studies showed higher levels of health-related quality of life compared to non-exercising patients. All the studies in this review agree that exercise in patients after MI leads to a significant improvement in their functional capacity and health-related QoL [34-38].

5. Conclusion

The present review indicates that an exCR program improves the QoL for the patients with MI. QoL improvements present a bidirectional relationship with increased physical activity and vocational status. Regardless of the starting period and the type of program, positive results are shown in the QoL of these patients. The development and creation of CR programs based on various modified sports to suit different motivations and tastes would complement the available options of traditional programs and benefit patient participation and adherence to physical exercise. However, further research is needed to explore the relationship of QoL outcomes to the relationship between improved physical well-being and anxiety, and the QoL and physical exercise program parameters.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

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