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The role of cardiac rehabilitation in patients with heart disease

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ABSTRACT

Cardiac rehabilitation is a valuable treatment for patients with a broad spectrum of cardiac disease. Current guidelines support its use in patients after acute coronary syndrome, coronary artery bypass grafting, coronary stent placement, valve surgery, and stable chronic systolic heart failure. Its use in these conditions is supported by a robust body of research demonstrating improved clinical outcomes. Despite this evidence, cardiac rehabilitation referral and attendance remains low and interventions to increase its use need to be developed.

Key words: Cardiac rehabilitation, Cardiovascular disease.

Introduction

Cardiac rehabilitation (CR) has evolved from exercise only into a comprehensive program that also addresses other cardiovascular disease risk factors and provides education and social support [1]. CR classically consists of three phases. Phase I refers to inpatient rehabilitation during the index hospitalization. Due to the increasingly shorter durations of hospital stay, phase I CR has become less formalized. Phase II refers to physician supervised, outpatient monitored physical activity during the 4 months after discharge. Patients usually undergo up to 36 sessions in a graduated exercise program. Thereafter, patients may continue into phase III, which is an enduring unmonitored exercise program. CR programs also provide nutritional, psychological and smoking cessation counseling, as well as lipid and blood pressure management. Medicare and most insurance carriers provide coverage for this service after acute coronary syndrome, percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG), valve surgery, and chronic stable heart failure with reduced ejection fraction (HFrEF) [2]. The American Heart Association (AHA) and American College of Cardiology (ACC) consider CR a Class I indication for these conditions [3,4].

The exercise prescription at CR centers optimally starts with a pre-exercise-training, symptom limited, exercise tolerance test. Thereafter, workouts typically consist of a brief warm up period, followed by supervised individualized aerobic exercise, and a brief cool down phase. The aerobic exercise consists of 20–60 min workouts 3–5 days a week at 50–80% of maximal exercise capacity [1]. Relatively recent data suggest that high intensity interval training (HIIT) produces larger and more rapid increases in exercise capacity [5–7]. A trial of 27 patients with stable ischemic cardiomyopathy randomized to either moderate continuous training at

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70% of their max predicted heart rate or to HIIT at 95% peak heart rate or to a exercise–advise-only control group demonstrated a 46 vs 14% ($p<0.001$) increase in peak oxygen consumption (VO_{2MAX}) in the HIIT vs continuous training group [5]. Higher VO_{2MAX} has been associated with lower mortality rates in patients with coronary artery disease (CAD) [8]. HIIT also improved endothelial function, reversed left ventricular remodeling, and increased ejection fraction more than continuous training [5]. Similar superior improvements have been noted in other studies [6,7]. Yet it should not be forgotten that the favorable meta-analyses of CR showing reductions in total mortality and rehospitalizations were based upon the utilization of moderate intensity exercise [9].

The role of exercise training

Many of the benefits of CR are derived from exercise training. Exercise training increases VO_{2MAX} and endurance capacity or the ability to maintain physical activity for extended periods of time [5]. Exercise training has multiple other potentially beneficial effects including improving endothelial function [5,10], myocardial flow reserve [11] reducing smoking, body weight, blood lipids, and blood pressure [12]. Exercise training has even been shown to reduce the progression of coronary atherosclerosis in patients with known CAD [11].

CR also reduces depression and anxiety and increases quality of life in cardiac patients [13]. Depression is associated with higher mortality, up to fourfold higher in one study of depressed cardiac patients [14]. Depression symptoms and mortality decreased by 63% and 73% among depressed patients after CR compared to non-participants ($p<0.001$) [14].

Coronary artery disease (CAD)

CAD is the most common referral diagnosis to CR centers. Exercise training or CR in patients with CAD increases exercise tolerance and quality of life [5,6,15–17], decreases angina [18], ischemia [19], subsequent hospitalizations [15,17], and mortality [9,15].

The AHA/ACC recommends the referral of patients after myocardial infarction (MI) or coronary revascularization and those with stable angina to CR [4] because multiple meta-analysis have demonstrated that CR reduces mortality in patients with CAD [9,15,20,21]. A meta-analysis of 63 randomized clinical trials dating from 1974 through 2014 including 14,486 patients documented that CR, compared to no-exercise control reduced cardiovascular mortality (10.4 vs 7.6%, CI 0.64–0.86, number needed to treat (NNT): 37) in patients with CAD. Hospital admissions were also reduced at one year (31 vs 26%, CI 0.70–0.96, NNT: 22). Health related quality of life increased and the cost of heath care resources decreased [15].

CR benefits patients with CAD regardless of the referral diagnosis. Exercise training has long been known to reduce symptoms in patients with angina pectoris and CR may be as effective as PCI at least in the short term. Selected male patients with stable angina (n=101) randomized to PCI or CR demonstrated increased exercise capacity and reduced coronary events at 12 months in the CR vs control group [17]. Exercise training was associated with a higher event free survival (88% vs 70%, p=0.023), increased VO_{2MAX} (+16%, $p<0.001$), and lower cost ($3429 vs $6956 Canadian currency).

CR also benefits patients after emergent, urgent or elective PCI. Patients (n=2395) referred to CR after emergent (32%), urgent (42%), or elective (26%) PCI and followed for a mean of 6.3 years experienced a 46% relative reduction in all-cause mortality (CI 0.41–0.71, NNT: 34) (Fig. 1) [22]. This was independent of age, sex, or PCI setting (elective vs non-elective). Recurrent MI and repeat PCI, however, were not different between the groups. Similarly, 118 patients randomized to CR or usual care after PCI increased their VO_{2MAX} (+26%, $p<0.001$) and quality of life (+26.8%, p=0.001) and experienced lower rates of cardiac events (11.9 vs 32.2%, p=0.008), and hospital readmissions rates (18.6 vs 46%, $p<0.001$) after six months. The rate of angiographic restenosis was similar, but the CR patients had less stenosis (29.7%, p=0.045) and less evidence of myocardial ischemia by nuclear imaging (19%, $p<0.001$), although this study did precede the widespread use of drug eluting stents [19].

CR has been evaluated extensively in patients referred after acute MI. A meta-analysis of 36 randomized control trials including 6111 patients after MI demonstrated a 36% reduction in cardiac deaths (confidence interval (CI) 0.46–0.88), 26% reduction in total mortality (CI 0.85–0.95), and a 47% reduction in reinfarction (CI 0.38–0.76) [12].

CR also reduces cardiac events, hospital readmissions and mortality after CABG. An observational trial of 846 patients after CABG, 69% of whom attended CR, evaluated after a mean follow-up of 9 years reported a 46% relative risk reduction (RRR) and 12.7% absolute risk reduction of all-cause mortality with a number needed to treat of 8 (CI 0.40–0.74) [23]. These findings were independent of age, sex, prior

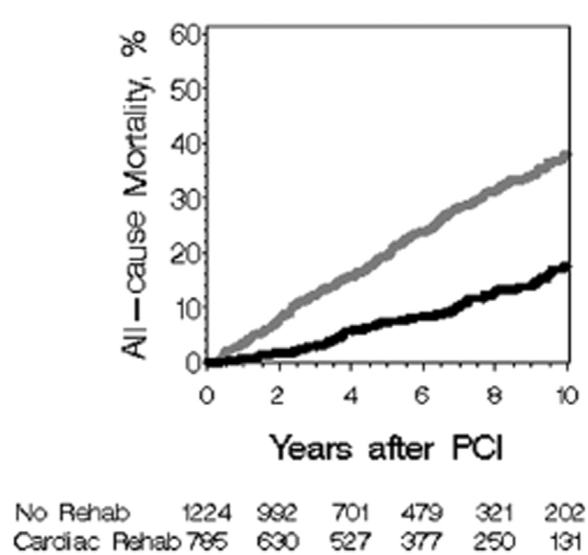

Fig. 1 – Effect of cardiac rehabilitation on mortality after percutaneous intervention. (Kaplan-Meier curve showing the association between cardiac rehabilitation (dark line) and all-cause mortality in patients after elective (26%), urgent (42%), or emergent (32%) percutaneous coronary intervention. Reproduced from [22].)