Weight Loss And Fitness In Patients With Coronary Artery Disease Through Cardiac Rehabilitation – A Long Term Follow-Up.

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Citation

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Abstract

Background and rationale: excess body weight is an established cardiovascular risk factor. Current literature on the effects of cardiac rehabilitation (CR) in weight reduction has been inconclusive and none has provided results for an ongoing long term supervised exercise program beyond 3 months. We therefore undertake to determine the relationship of CR with ongoing supervised exercise program for over two years on weight reduction and fitness. Method: This is an observational study of 47 CR patients who were followed up for ≥24 months. Patients were assessed at their entry and exit of Phase II CR and at 12 and 24 months of Phase III programs. Results: No significant weight change occurred during either phase of CR for all pre-defined weight ranges in either Phase II or Phase III while exercise capacity increased by 3.3±1.1 METs (P<0.0001) and 0.6±1.24 METs, (p=0.1) respectively. Conclusion: The study demonstrates that CR even in a long-term setting does not significantly reduce weight amongst participants. To reduce excess weight as a risk factor, further interventions such as more exercise sessions or longer, more strenuous sessions, or dietary interventions should be considered.
Condensed Abstract: We conducted a retrospective observational study into the affect of long term CR on weight loss and fitness levels. No weight loss was observed after a 2 years exercise program, while fitness levels improved markedly and were maintained over the study duration.

BACKGROUND AND RATIONALE

Cardiac rehabilitation (CR) following a cardiac event has been shown to reduce risk of mortality by 25% over three years[1].

While CR was originally centered around exercise and improving physical function, the current guidelines recommend that assessment and targeting of risk factors should be an integral part of CR[1].

Obesity is an established cardiovascular risk factor (CRF), and even patients who are overweight (BMI 25-29.9) are shown to be at an increased risk of cardiovascular events[2].

The majority of CR patients are overweight or obese[3], and over half of CR patients are thought to have metabolic syndrome[4,5]. Therefore, weight reduction and maintenance in an ideal weight range would seem a natural and prognostically relevant objective of CR.

Recent literature on the effects of CR in weight reduction has been inconclusive. While a few studies showed CR resulted in body weight reduction[1,6,7], others have not been able to demonstrate this[8]. None has provided ongoing long term supervised exercise program beyond 3 months.

Peak exercise capacity has been found to be the strongest predictor of mortality in men with cardiovascular disease[9]. While CR has been shown to markedly improve exercise capacity for patients of all weight ranges[3,10], the maintenance of fitness with long term CR is yet to be established.

We therefore undertake to determine the relationship of CR including an ongoing exercise program for over two years on weight reduction and fitness.

METHOD

STUDY POPULATION

The study population comprised 47 consecutive outpatients who completed ≥24 months of an outpatient based CR program. Reasons for entry into CR are shown in table 1. For the purpose of this study, patients in CR who only had valve surgery were excluded.

MEASUREMENTS

Weight, height, exercise capacity, cardiac workload, resting blood pressure and heart rate were assessed at entry into CR and again at exit of Phase II, then at 12 months after entry into CR and ≥24 months after entry. Weight range was defined as normal range (BMI: <25), overweight (BMI: 25-29.9), or obese (BMI: ≥30).

Exercise capacity was assessed using peak vO_2 consumption during a symptom limited treadmill stress test, from which maximum metabolic equivalents (METs) were calculated.

Cardiac workload was assessed by measuring peak blood pressure and heart rate during stress test (cardiac workload = peak systolic blood pressure x peak exercise heart rate).

INTERVENTION

All patients participated in a six-week Phase II followed by an ongoing Phase III CR program.

In Phase II, exercise sessions were offered 2 times a week for 45 minutes per session, supervised by CR trained nurses and exercise physiologists. Symptoms, haemodynamics, and ECG were monitored during exercise. Education was given on 'heart healthy living', including life style, diet, stress reduction, peer group support, professional coaching, and counseling by nursing staff and exercise physiotherapists.

For overweight and obese patients, recommendation of weight loss towards a healthy range employing life style modification measures was given. Smoking cessation sessions were offered where applicable.

In Phase III Program, weekly one-hour exercise sessions were offered and supervised by exercise physiotherapists and CR nurses.

STATISTICAL ANALYSES

Pairs of data were tested for significance using paired Students t-tests, with a two-tailed value >0.05 considered non-significant. Change in BMI across the four sampling points was tested for significance using a Kruskal-Wallis test.

RESULTS

The weight change experienced by patients during the Phase II program is shown in Table 2. The results showed no significant weight loss for overall population, nor for those who began the study with a BMI ≥30.

Similarly, no weight loss was found between entry and at 24 months of Phase III for the overall and obese populations (table 3).

When patients were categorized into three weight range groups (normal, overweight, and obese), there was no significant trend towards a lesser proportion of the study's population being obese over the 24 months CR period (table 3).

Exercise capacity measured in maximum METs (Fig. 1) increased by 3.3±1.1 METs (P<0.0001) during Phase II CR, representing a relative increase of 66 percent. No significant change in exercise capacity was noted thereafter throughout the phase III program (phase II to phase III: +0.6 METs, p=0.1).

Cardiac workload significantly improved during Phase II, increasing by 4921±4757 (table 2), representing a relative increase of 26 percent. No significant change was observed thereafter throughout the subsequent phase III program.

Resting heart rate and resting blood pressure did not change significantly throughout the Phase II or Phase III programs (table 2).

Figure 1

Table 1. Baseline Characteristics

Gender (M/F)	38/9
Age	69.4 ±7.8
Weight (kg)	83.1 ±12.3
BMI	27.6 ±4.2
Resting Heart Rate	71.8 ±14.2
MET	5.0 ±1.3
Reason for CR	
Coronary Artery Surgery %	57.4
Myocardial Infarct %	19.1
Stent %	17
CRF %	2.1
Medical Management of CHD%	2.1
PTCA %	2.1
History	
Coronary Artery Disease %	98.9
Diabetes %	10.6
Hypertension (above 140??) %	55.3
Smoker %	6.4
Alcohol Consumption %	76.6
Regular Exercise (≥30min, 3 x weekly) %	47.7
Systolic BP	138 ±20
Diastolic BP	78 ±10
Resting Heart Rate	72 ±14

Figure 2

Table 2. Results through phase II and phase III cardiac rehabilitation

	Entry Phase II	Exit Phase II	Phase III 12 months	Phase III 2 Years
Average Weight (kg)	83.1 ± 12.3	83.0 ± 12.4 (-1.4%)	81.6 ± 12.1 (-1.7%)	84.1 ± 11.8 (1.3%)
BMI (kg/m²)	27.6 ± 4.2	27.7 ± 4.0 (-0.1%)	27.0 ± 3.4 (-2.4%)	27.8 ± 3.8 (0.6%)
Weight (kg) of obese patients	101.7 ± 10.2	100.27 ± 10.0 (-1.4%)	101.4 ± 9.3 (-0.3%)	97.9 ± 8.6 (-3.8%)
Cardiac Workload (HRxBP)	18862 ± 4539	23795 ± 4676 (26.2%)*	23587 ± 4470 (25.1%)*	23620 ± 4821 (25.2%)*
Exercise Capacity (METs)	5.0 ± 1.3	8.2 ± 1.6 (64.7%)*	8.9 ± 1.7 (78.4%)*	8.9 ± 1.7 (78.1%)*
Resting systolic BP (mmHg)	138 ± 20	138 ± 16 (0.7%)	135 ± 15 (-2.1%)	141 ± 14 (2.8%)
Resting diastolic BP (mmHg)	78 ± 10	76 ± 8 (-2.3%)	75 ± 10 (-3.7%)	77 ± 11 (-1.3%)
Resting Heart Rate (beats/min)	72 ± 14	71 ± 14 (-0.8%)	70 ± 12 (-3.1%)	69 ± 12 (-3.2%)

(percentage change from entry)

No significant change was found in weight, BMI, BP and HR throughout phase II and II.

*p<0.0001 vs. entry Phase II.

Figure 3

Table 3. Patients' BMI throughout cardiac rehabilitation

BMI Range	Entry Phase II	Exit Phase II	Phase III 12 months	Phase III 2 Years	Probability Value
Normal Range, %	25.5	26.7	25.6	19.5	NS
Overweight, %	59.6	55.5	56.5	63.5	NS
Obese, %	14.9	17.8	17.9	17.0	NS

DISCUSSIONS

In this study, supervised long-term CR (phase II followed by phase III) was associated with an improvement in physical fitness but did not result in significant weight loss.

In concordance with previous studies[3,4,5], most (75%) of our patients were overweight or obese at entry into the study (table 2). Among those who were obese at study entry there was a trend of 1.4% or 1.5 kg weight reduction at the completion of phase II program, although the loss was not statistically significant (p=0.79), possibly do to the small number of patients in this group (n:7). However, the group did show a greater trend of weight loss of close to 4% or 3.9 kg (p=0.46) between entry and ≥24 months. Other studies, employing a CR program of up to 3 months, have found obese patients tend to lose a greater percentage of their weight than non-obese patients[3,6,11], although not to the degree that satisfies recommendations for a 10% reduction of body weight over 6 months[12].

The literature on the influence of CR on weight loss remains inconclusive. While a few studies[1,6,7] found a modest weight loss (0-2% of total body weight), others have not found significant weight reduction following Phase II CR programs of up to 3 months[6,7,8,13]. None, however, provided data on long-term supervised CR.

The failure of achieving significant weight loss by our patients and by patients in other studies may be related to inadequate energy expenditure during the exercise sessions. Savage, Brochu, Scott and Ades measured the energy expenditure by 112 patients during two Phase II CR sessions and found the average energy expenditure was 270±112 kcal per session[14], below the recommended expenditure for cardiorespiratory benefits[15].

Similar findings on patients attending maintenance CR program were reported by Schairer et al[15]. They found that despite most patients exercising at 60-80% of their maximum heart rate for an average of 47 minutes, the energy expenditure was only modest, at 230 kcal per session.

A recent study has also found that amongst patients 1 year after a coronary event, overall diet was poor[16], suggesting a need for further dietary intervention.

Exercise capacity increased during Phase II, and plateaued throughout continuation of CR in Phase III. The findings indicate the effectiveness of the once per week supervised group exercise program per se, and possibly through its pleiotropic benefits (eg. keeping up with motivation to exercise, ability to discuss exercise routines with peers and exercise physiologists etc) in maintaining exercise capacity or physical fitness over 2 or more years of being in the program.

Cardiac workload improved in parallel with exercise capacity following phase II, and was maintained throughout Phase III (table 2).

Fitness has been found to be protective against all-cause mortality despite the presence of other risk factors[9], and improved physical fitness has been found to reduce mortality by up to 44%[17]. Thus, the observed improvement in exercise capacity as a proxy of physical fitness following phase II and subsequent maintenance in phase III, establishes potential prognostic benefit of supervised long term CR.

STUDY LIMITATION.

This is a retrospective study without a control group. Attendance rate throughout the CR program was not recorded. Thus variability in the frequency of session attendance may exist and dilute the effectiveness of the programs. Furthermore, the exercise capacity at entry does not necessarily reflect the patients' physical fitness prior to cardiac events prompting enrollment into CR.

It would have been beneficial to measure the percent change in body fat throughout CR. Studies have found that CR can decrease body fat mass at a greater percentage than total weight[7,8]. It is possible patients in our study experienced a change in body composition without a significant change in body weight.

A selection bias may exist in that only patients who had completed 2 or more years of CR were included, as their progress during Phase II may differ from those who chose not to continue into Phase III (eg. patients who successfully lost weight in Phase II may have chosen not to continue with Phase III). The selection bias questions the validity of the study's findings on Phase II CR results more than the long term findings.

CONCLUSION

Our study results suggest that Phase II CR followed by 2 or more year long-term phase III CR program in its current model is not sufficient to produce significant weight loss, and further interventions, such as more exercise sessions or longer, more strenuous sessions, or dietary interventions should be considered. Out study did show benefits of Phase II CR in improving physical fitness, which is maintained throughout the long term Phase III CR. A long-term, prospective, controlled trial incorporating ongoing dietary guidance and surveillance with additional exercise sessions seems to be warranted.

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