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Aerobic Exercise Training Improves Physical Fitness in Patients with Ischemic Heart Disease

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Abstract: This study was designed to determine changes in physical fitness in patients with ischemic heart disease after aerobic exercise training program. Thirty male patients with coronary heart disease, their age ranged between 42 to 51 years old . Patients were included into 2 equal groups; group (A) received treadmill walking exercise training for 3 months in addition to medical treatment . The second group (B) received only medical treatment. The mean values of VO_2 max., anaerobic threshold and work capacity were significantly higher in group (A), while the results of group (B) were not significant .There was a significant difference between both groups after treatment. Aerobic exercise training on treadmill can improve physical fitness in patients with ischemic heart disease.

Key words: Aerobic exercise · Physical fitness · Ischemic heart disease

INTRODUCTION

Impaired exercise tolerance represents a major problem in some patients with coronary heart disease and often results in functional disabilities. Skeletal muscle fatigue occurs sooner in coronary heart disease patients than in normal patients and is associated with exercise intolerance [1].

A hospital-based supervised exercise program for 18 weeks significantly improves exercise tolerance and hemodynamic parameters in severe chronic heart failure diseased patients with a relatively safe profile [2]. Exercise training, as part of cardiac rehabilitation, is in routine clinical use for secondary prevention of coronary heart disease improved functional capacity and greater event-free survival in the exercise group[3].

In patients with heart disease, training can lead to a mean increase of 20% in maximal aerobic capacity by having a predominant impact on muscle oxidative metabolism: an increase in the activity of mitochondrial oxidative enzymes and in the density of the capillary network around the striated muscle fibers. In such patients, this result leads to improved physical capacity and quality of life [4].

The aim of this study was to detect changes in physical fitness in patients with ischemic heart disease after aerobic exercises training program.

MATERIALS AND METHODS

Subjects: Thirty male patients with coronary heart disease their age ranged from 42 to 51 years with a history of anginal chest discomfort that was proved by angiographic documentation of equal or lesser than 50% stenosis of a major epicardial coronary artery. Patients with uncontrolled hypertension, body mass index (BMI)≥ 30 kg/m^2,osteoarthritis, diabetes mellitus, smokers, heart failure, cardiomyopathy, valvular disease or bundle branch block were excluded. Patients were included into 2 equal groups; group (A) received treadmill walking exercise training for 3 months in addition to medical treatment. The second group (B) received only medical treatment. All participants were free to withdraw from the study at any time. If any adverse effects had occurred, the experiment would have been stopped, with this being announced to the Human Subjects Review Board. However, no adverse effects occurred and so the data of all the participants were available for analysis. The authors confirm that the study was approved by the ethics committee and that the patients gave their informed consent.

Methods

Cardiopulmonary Exercise Test Procedure: Before conducting the exercise tolerance test, all subjects had to

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visit the laboratory to be familiarized with the equipment in order to be cooperative during conducting the test. Treadmill (Track master 400E, gas fitness system, England) it was used in exercise stress test with other exercise test equipment to estimate exercise capacity and in aerobic exercise training. The treadmill has front and side rails to aid in subject stability. Each subject underwent continuous progressive exercise tolerance test according to Bruce standard protocol which consists of warming up phase and five active phases and recovery phase. Measurements which were recorded included VO_2 max., anaerobic threshold and work capacity.

The Aerobic Exercise Training Program: The aerobic treadmill-based training program (Track master 400E, gas fitness system, England) was set at 60% to 80% of the maximum heart rate (HRmax) achieved in a reference ST performed according to a modified Bruce protocol. This rate was defined as the training heart rate (THR). After an initial, 5-minute warm-up phase performed on the treadmill at a low load, each endurance training session lasted 30 minutes and ended with 5-minute recovery and relaxation phase. All patients performed three sessions/ week (i.e. a total of 36 sessions per patient over a 3-month period).

Statistical Analysis: The mean values of VO_2 max., anaerobic threshold and work capacity obtained before and after three months in both groups were compared using paired "t" test. Independent "t" test was used for the comparison between the two groups ($P<0.05$).

RESULTS

The mean values of VO_2 max., anaerobic threshold and work capacity were significantly higher in group (A) received aerobic treadmill-based training program in addition to medical treatment, while the results of group (B) received only the medical treatment were not significant (Tables 1 and 2). There was a significant difference between both groups after treatment (Table 3).

DISCUSSION

This study was designed to detect changes in physical fitness in patients with ischemic heart disease after aerobic exercises training program. Results of this study indicated that aerobic exercise training on treadmill improves physical fitness in patients with ischemic heart disease. Results of this study confirmed and agreed with many previous studies.

Exercise capacity improved by 30-50% after three months of aerobic conditioning at an intensity of 70% to 85% of target heart rate. The possible physiological mechanism of aerobic conditioning in patients by central (cardiac) and peripheral (skeletal muscles and vascular) adaptations that increases capacity to deliver substrate to skeletal and cardiac muscles [5,6,7]. The peripheral vascular adaptation may arise from structural modifications of the vasculature and alterations in the control of vascular tone. An increase in the capillary density of muscle has also been shown after training. Both capillary density and blood flow increase in

Table 1: Mean value and significance of VO_2 max., anaerobic threshold and work capacity in group (A) before and after treatment

	Mean±SD			
	Before	After	T-value	Significance
VO_2 max. (L./min./Kg)	3.07±0.16	3.39±0.15	5.11	P <0.05
Anaerobic threshold	50.81±2.67	56.32±3.12	4.33	P <0.05
work capacity (ml./min./Kg)	8.67±1.16	11.49±1.14	4.12	P <0.05

Table 2: Mean value and significance of VO_2 max., anaerobic threshold and work capacity in group (B) before and after treatment

	Mean ±SD			
	Before	After	T-value	Significance
VO_2 max. (L./min./Kg)	3.06±0.17	3.09±0.16	1.01	P >0.05
Anaerobic threshold	50.14±2.98	51.11±3.15	1.13	P >0.05
work capacity (ml./min./Kg)	8.23±1.11	8.78±1.12	0.87	P>0.05

Table 3: Mean value and significance of VO_2 max., anaerobic threshold and work capacity in group (A) and group (B) after treatment

	Mean ±SD			
	Group (A)	Group (B)	T-value	Significance
VO_2 max. (L./min./Kg)	3.39±0.15	3.09±0.16	3.79	P <0.05
Anaerobic threshold	56.32±3.12	51.11±3.15	3.22	P <0.05
work capacity (ml./min./Kg)	11.49±1.14	8.78±1.12	4.75	P <0.05

VO_2 max.= Maximal oxygen consumption; L. = liter Min.= minute Kg= kilogram

proportion to the rise in maximal aerobic power during long-term aerobic training [8].

There was a significant improvement in VO_2 max and minute ventilation after moderate and severe exercise program [9]. Regular aerobic training induces significant adaptations both at resting and during maximum exercise in a variety of dimensional and functional capacities related to the cardiovascular and respiratory regulation system; enhancing the delivery of oxygen into active muscles these changes include decreases in resting and maximal exercise heart rate, enhanced stroke volume and cardiac output and as a result increase VO_2 max. [10,11,12].

Endurance training may improve the relative balance between myocardial oxygen supply and demands and thereby result in an anti-ischemic effect. Increased metabolic capacity and improved mechanical performance of myocardium are well-substantiated adaptation to endurance training. Lowered heart rate and systolic blood pressure during submaximal exertion reduce myocardial work, its oxygen demands and coronary blood flow needed. Among patients with coronary heart disease, this allows a greater absolute workload to Accomplish before reaching the ischemic threshold. In addition, heart rate slowing with training allows more time during diastole for coronary flow to perfuse the myocardium [13,14].

CONCLUSION

Aerobic exercise training on treadmill can improve physical fitness in patients with ischemic heart disease.

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