

Influence of an Uncontrolled Strength and Aerobic Exercise on Clinical and Echocardiographic Parameters in a Patient Following Anterior Myocardial Infarction

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Abstract

Cardiac rehabilitation has been strongly recommended as a major therapeutic measure for coronary artery disease. Exercises, including resistance training, Ti-chi and yoga surprisingly show various and promising outcomes. We present an unusual case which certain aerobic techniques over a period of 5 weeks have improved a patient's myocardial contractility and overall function after sustaining an anterior myocardial infarction.

Keywords

Anterior MI, Strength Exercise, Resistance Training, Aerobic Training, Cardiac Rehabilitation

1. Introduction

Cardiac rehabilitation (CR), according to the WHO guidelines is defined as “the comprehensive and coordinated use of medical, social, educational and professional resources to accommodate patients to a new lifestyle, and enable them to achieve the best performance.” [1]. Long-term follow-up study of patients after coronary incidents carried out by the Mayo Clinic Institution proved that properly conducted CR program in patients after myocardial infarction is able to reduce all-cause mortality by 45% - 47% [2]. Cardiac rehabilitation program generally includes physical exercise, diet counseling, educational classes on lifestyle changes and disease management as well as psychosocial support to the patients and their families. The main scope of CR programs includes supervised physical

activities, focusing mainly on aerobic and resistance training techniques. Strength exercise, requiring Valsalva maneuver, such as pushing or lifting heavy objects, is contraindicated in post-myocardial infarction.

2. Case Report

A 45-year-old male was diagnosed with an anterior myocardial infarction (MI) involving left anterior descending artery (LAD). Angioplastic drug eluting stent (DES) was implanted into the culprit artery. He was discharged from the cardiology department with moderate left ventricular (LV) systolic dysfunction-(left ventricular ejection fraction LVEF = 40%. LVEF is the fraction of the blood contained in the ventricle at the end of diastole that is expelled during its contraction, that is, the stroke volume divided by end-diastolic volume, normally 55% - 80%. Patient received post-MI pharmacotherapy. Directly after his discharge, he returned to his professional activities as a builder carrying heavy objects (20 - 30 kg) on a 40 repetition basis and lifting around 20 kg of ballast while placing them on site. Aside from work, the patient was performing 40 push-ups, cycling (15 - 20 km) and was lifting free weights reaching up to 25 kg on a daily basis. All these activities were not associated with heart rate (HR) or blood pressure (BP) monitoring. He also did not consult his physical activity with primary physician or specialist cardiologist so performed all these activities in completely uncontrolled manner.

After a month he was admitted to stationary Cardiac Rehabilitation department. Upon admission to the department, his heart rate and blood pressure measurements were within normal limits. He complained of shortness of breath NYHA II-III. Physical examination was significant for bilateral bas crackles on auscultation of the lungs, Routine laboratory values were normal whereas screening echocardiography revealed severely impaired global LV systolic function with EF of 25% - 30% with apical dyskinesia and akinesia of the mid-segments of anterior and lateral left ventricular walls. Based on the clinical status and an echocardiographic findings, his medications were adequately adjusted and physical exercise program was postponed for a couple of days until his clinical status was optimized.

Then the patient underwent a symptoms-limited ramp exercise test on cycle ergometer utilizing the 10 Watts per minute protocol. The exercise test was discontinued because of dyspnea with 3.0 MET result obtained, which corresponds to a very low functional capacity according to the American Association of Cardiovascular and Pulmonary Rehabilitation guidelines [3]. His CR program included gradual cardiorespiratory endurance (aerobic), flexibility and stretching exercises as well as relaxation sessions utilizing yoga and tai-chi. Low-intensity resistance (muscular strength) training was included after three weeks of well tolerated aerobic training.

Following the 5 weeks program, both physical capacity and echocardiographic parameters of LV systolic function significantly improved (vide graph).. Echo-

cardiogram revealed significant improvement in LV systolic function with EF of 38%. Control ramp exercise test was terminated because the patient complained of moderate-level dyspnea upon reaching 4.0 MET.

3. Discussion

Current ESC guidelines recommend an early resumption of physical activity in clinically stable patients after myocardial infarctions [4]. The daily target is at least 30 minutes of moderate-intensity aerobic physical activity such as walking or cycling. Both time and intensity of this effort should be gradually increased, starting with 5 - 10 minute exercise bouts. For individuals with sedentary lifestyle, initial efforts should be done with precaution. The aim is to gradually lengthen the duration of exercise, and mainly focus towards the uncontrolled increase in heart rate. Peak exercise heart rate should not exceed 120 beats per min. The intensity of exercise should not interfere with casual conversation that is so-called "conversational pace". The aerobic exercise program initially reflects light-to-moderate intensity of exercises (*i.e.* 3 - 6 METs). Transition to vigorous exercises (above 6 METs) takes least 2 - 3 week time. According to cardiac rehabilitation guidelines published in 2004 by the Polish Cardiac Society, resistance (muscle strength) training is allowed in patients after myocardial infarction after a few weeks of well tolerated aerobic (cardiorespiratory) training and only for rehabilitation models A and B *i.e.* for low- and intermediate-risk patients [5]. Resistance training involving different major muscle groups should be conducted 2 - 3 times per week with appropriate load, involving initially about 30% - 50% of the maximum muscle strength and should include adequate rest periods between exercise sets. Exercises utilizing a Valsalva maneuver (pronounced breathing with a closed glottis, causing an increased pressure in the chest) should be avoided. Unfortunately, adherence to guidelines is still poor and large majority of post-MI patients do not achieve the guideline standards for secondary prevention with a high prevalence of physical inactivity according to EUROASPIRE IV study results (only about 33% of patients undertook the recommended physical activity) [6] [7]. Lack of strict discharge physical activity recommendations in this case combined with an immediate resumption of inadequate and uncontrolled physical activities by the patient disproportionately impacted both clinical state and echocardiographic LV systolic function parameters. This was clearly visualized by a low physical capacity and LV EF deterioration by about 15%. Individually-tailored five weeks Cardiac Rehabilitation program was able to reverse partially these adverse effects of LV dysfunction (cardiac rehabilitation hospitalization in Poland is for maximum five weeks, then patients are referred to outpatient cardiac rehabilitation centers).

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