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High Interval Intensity Training in Patients with Left Atrial Myxoma

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Abstract: Myxomas are common benign cardiac tumors that can cause life-threatening events. A case of left atrial myxoma, which induces acute myocardial infarction (AMI) and stroke, is very rare. Patients with concomitant cardiac disease and stroke have lower aerobic capacity than patients with cardiac disease or stroke alone. A case was reported on a 41-year-old male with a fatigue complaint who underwent phase II cardiac rehabilitation (CR) after surgery for left atrial myxoma, which had caused acute myocardial infarction (AMI) and ischemic stroke (IS). Fatigue impaired his work and hobbies. Initial assessments showed moderate fatigue and reduced functional capacity (FC). A four-week comprehensive CR was given to this patient, and supervised high-intensity interval training (HIIT) was administered thrice a week. This report showed that HIIT can improve FC and quality of life in patients who suffered left atrial myxoma, which induced AMI and IS.

Keywords: High Intensity Interval Training; Cardiac Rehabilitation; Left Atrial Myxoma

INTRODUCTION

The incidence of primary tumors of the heart ranges between 0.001% and 0.3%, and cardiac myxomas are the most common pathology in 80% of the cases.[1] Myxomas are most typically found in the left atrium, where they develop from a stalk linked to the atrial septum.[2] System embolization is a common complication of myxoma, in which the incidence of stroke is between 10% and 30%, and the incidence of myocardial infarction is relatively low, at approximately 0.06%. The occurrence of concurrent between the two cases is very rare.[3] Patients after acute myocardial infarction (AMI) entering CR often have a low exercise capacity (EC).[4] Stroke patients are also predisposed to a sedentary lifestyle because of the muscle weakness that leads to cardiorespiratory deconditioning. Patients with concomitant cardiac disease and stroke have lower aerobic capacity than patients with cardiac disease or stroke alone. Individuals with a history of stroke (primary or secondary) demonstrate lower baseline peak oxygen uptake (VO_2 peak) compared to those with only cardiac diagnoses. This difference indicates reduced aerobic capacity due to compounded effects of neurological and cardiovascular impairments.[5] Therefore, comprehensive CR, including exercise training and patient education, is needed for this group of patients.

Cardiac rehabilitation programs are usually performed over a 12-week period.[6] This case reported a patient attending phase II CR after undergoing surgery for left atrial myxoma, which induced AMI and IS by giving comprehensive CR, including high-intensity interval training (HIIT) combined with resistance, flexibility, and breathing exercises in just 4 weeks because his work issues.

CASES

A 41-year-old male patient with a fatigue complaint came for phase II cardiac rehabilitation (CR) six weeks after hospitalization. He felt fatigued, mostly when he walked more than 500 meters or when he walked on stairs. Previously, he was diagnosed with acute myocardial infarction (AMI) and ischemic stroke

(IS), which were induced by cardiac myxoma. He has no history of hypertension. He underwent cardiac surgery for tumor resection.

One year before his surgery, he had complained of being easily fatigued. The symptoms worsened with time until he was only able to walk less than 200 meters. It restrains him from doing his work and his hobby. He worked at a company as a TV service worker. He usually repairs 5–6 units of TV per day. On the weekend, he usually cycles with his club over a minimum distance of 13 km.

Two weeks after surgery, he returned to work, but he could only repair 2-3 units of TV per day due to fatigue. He has also not been able to return to his hobby of cycling.

On physical examination, blood pressure was 108/79 mmHg, pulse rate 85 beats per minute, respiratory rate 20 times/minute, temperature 36.6 °C, and oxygen saturation was 98% on room air. His BMI was 25.1 kg/m2. The internal status and neuromusculoskeletal examinations were normal. Chest expansion was 2cm/2.5 cm/3 cm (limited). The functional capacity (FC) was assessed with 6 minutes walking test (6MWT). The distance was 490 meters with an FC of 5,33 metabolic equivalents (METs). Quality of life was assessed with Fatigue Severity Scale (FSS) and Short Form (SF)-36. The result of FSS was 39/63 (moderate fatigue), and the SF-36 score is 90/100.

We established a CR program that included aerobic, resistance, and flexibility exercises in the hospital, and breathing exercises were done at home for four weeks. We gave the CR program a short-term due to his fear of being fired from his job because he had to attend a rehabilitation program during working hours. Education on exercise and a healthy diet was also given to increase patient adherence. The prescription of exercises is shown in Table 1.

Table 1. The Prescription of Exercises

Component of Exercise	Aerobic	Resistance	Flexibility	Breathing
Frequency	Supervised-hospital-based: 3 times a week	Supervised-hospital-based: 2 times a week	Supervised-hospital-based: 3 times a week	Home-based: 2 times a day
Intensity	Supervised-hospital-based: high-intensity intervals training (HITT) at an exercise intensity between 85–95% peak heart rate (HR) and rating of perceived exertion (RPE) between 15–17 (Borg) and low-intensity intervals at 50–75% peak HR and RPE between 12–14 (Borg)	Supervised-hospital-based: 50% of 1-repetition maximum (RM)	Supervised-hospital-based: hold muscle contraction for 1 minute at the point of slight discomfort	Home-based: Not applicable
Time	Supervised-hospital-based: 35 minutes in the form of 4 sets of high-intensity intervals, each lasting 4 minutes, interspersed with 3 sets of low-intensity intervals, each lasting 3 minutes, with warm-up and cool-down activities of 5 minutes	Supervised-hospital-based: 15 repetitions/set, 2 sets, with resting of 1-3 minutes between sets	Supervised-hospital-based: 2 sets of 6-8 times	3 sets of 10 repetitions, 3-minutes rest between sets
Type	Supervised-hospital based cardiorespiratory endurance exercise using a treadmill	Supervised-hospital-based: isotonic knee extension using NK-table	Supervised-hospital-based: static stretching of the head and neck, shoulder girdle, chest wall, quadriceps, hamstring and calf muscles	Deep breathing
Precaution	Knee pain	Knee pain Valsalva maneuver	Not applicable	Not applicable
Education	Exercise preparations Symptoms and signs of intolerance Adverse events	Exercise preparations Adverse events	Exercise preparations Adverse events	Exercise preparations Adverse events

After the CR program, he showed improvement in functional capacity (8,08 METs). His quality of life, which was assessed with FSS (12/63) and SF-36 (100/100), was also improved. The outcomes are shown in Table 2. He returned to previous performances in his work (5-6 TVs per day) and his hobby of cycling.

Table 2. Increasing of Functional Capacity and Quality of Life After Rehabilitation Program

Test	Baseline	After 4 Weeks Program
6MWT	490 meters/5,33 METs	810 meters/ 8,08 METs
Fatigue Severity Scale	39/63 (moderate fatigue)	12/63 (no fatigue)
Short Form-36	90/100	100/100

DISCUSSION

This patient was diagnosed with AMI and IS after he suddenly felt chest pain, weakness in the left side, and visual loss. Left atrial myxomas are associated with an increased risk of embolization, particularly in the central nervous system and retinal arteries.[7] Coronary artery embolism from a myxoma that causes AMI is rare.[3] Although it is very rare for a myxoma to cause AMI and IS, the possibility of multiple emboli due to cardiac myxoma should be considered when the clinical and vascular conditions do not match in young patients with no risk factors.[3] This explains the incidence of AMI and IS experienced by the patient.

The incidence of myocardial infarction and stroke reduces the heart's ability to supply oxygen to meet tissue demands. This is causing a decrease in cardiorespiratory fitness.[8,9] Decreased blood flow to tissues also causes oxidative stress, which causes skeletal muscle dysfunction, including the respiratory muscles. Skeletal muscle dysfunction and decreased cardiorespiratory fitness lead to activity intolerance.[8] After being discharged, he still complained of easily fatigued and could only repair 2-3 TVs per day. He also has not been able to return to his hobby of cycling.

A comprehensive CR program, which combined exercise training and education, helped this patient return to his work and his hobby. It also had a beneficial approach, along with the long-term follow-up of this patient.

He was given 3 sessions of HIIT per week (hospital-based) with high-intensity intervals at 85–95% peak HR and RPE between 15–17 (Borg) and low-intensity intervals at 50–75% peak HR and RPE between 12–14 (Borg), consisting of 4 sets of high-intensity intervals, each lasting 4 minutes, interspersed with 3 sets of low-intensity intervals, each lasting 3 minutes. The exercise prescription in these patients followed the protocol from the study by Dun et al. and Taylor et al.[10, 11]

He was given HIIT with several considerations: 1.) Availability of time to participate in a short-term cardiac rehabilitation program because he had returned to work; 2.) following the principle of dose-response relationship where the higher the intensity the greater enhancements in cardiorespiratory fitness[12]; 3.) the exercise is carried out under supervision[11]; 4.) evidence from previous studies showing that HIIT is safe for improving cardiorespiratory fitness in patients with cardiovascular disease (CVD).[13]

Deka et al.'s study showed that a combination of HIIT and resistance exercise improved functional capacity and quality of life in older patients with coronary disease. It is recommended to provide resistance training 2-3x per week, low-to-moderate intensity (30–50% of 1 maximum repetition (RM), 2 sets of 15 repetitions).[14] Resistance exercise had positive effects on physiological, clinical, and risk factors in patients with CVD, besides improving and maintaining muscle mass and strength.[15]

Flexibility or stretching exercises such as head and neck, shoulder girdle, chest wall, quadriceps, hamstring, and calf muscles stretching, which are performed 2 sets of 6-8 times on each side, is also given as warm-up and cooling down in this patient. According to current guidelines, flexibility exercise increases the range of motion in joints and thus protects against injury to muscles and joints. The Hotta et al. study showed that flexibility exercise enhanced vascular endothelial function, resulting in improved peripheral circulation in patients with AMI.[16]

Postoperative sternotomy can cause pulmonary complications, which lead to a decrease in respiratory capacity, muscle oxygen transmission, and worsening exercise tolerance. Therefore, it is important to do breathing exercises to improve lung function. Deep breathing exercises were given in this patient with 3 sets of 10 repetitions, 1-3 minutes rest between sets, two times a day.[17]

Education about a balanced diet, physical activity, and the impact of an unhealthy diet on the development of the disease is also given to the patient. The reason for providing education to this patient is because it is assumed that the patient does not understand all of this because he has never received

education before. Besides that, the level of education and the motivation to take part in the CR program, which is quite good, are also considerations for providing an educational program.

Based on a study of 72 patients by Norazlin et al., patients diagnosed with MI who received the one-on-one education program showed an improvement in control risk factors.[18]

Overall, the CR program, which includes a supervised HIIT in four weeks, was effective in improving the patient's FC and decreasing the symptoms so the quality of his life becomes better. A secondary prevention program through lifelong healthy behavior is needed, considering the patient has experienced MI, stroke, and a history of cardiac tumors. Previous studies have shown that regular exercise, increased physical activity, and a healthy diet reduce cardiovascular disease mortality and morbidity.[19] This patient was given a continued program with unsupervised home-based moderate-intensity exercise (70–75% peak HR) three to five times a week for 30 minutes.

CONCLUSION

A four-week cardiac rehabilitation program (short-term) with HIIT seems to be sufficient for improving functional capacity and quality of life in patients who suffer from left atrial myxoma, which induces AMI and IS.

CONFLICT OF INTEREST

The authors report no conflicts of interest in this work.

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