PHYSICAL EXERCISE ON THE RECOVERY OF OBESITY MYOCARDIAL INFARCTION

O EXERCÍCIO FÍSICO NA RECUPERAÇÃO DE INFARTO DO MIOCÁRDIO POR OBESIDADE

EL EJERCICIO FÍSICO EN LA RECUPERACIÓN DEL INFARTO DE MIOCARDIO POR OBESIDAD

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ABSTRACT

Introduction: Myocardial infarction caused by human obesity can cause a decline in mobility and a decline in the quality of a healthy life. Sports training is beneficial to maintain early physical functions after myocardial infarction. Objective: This article deals with the effect of applying walking aerobic exercise in the rehabilitation treatment of patients with myocardial infarction. Methods: We enrolled 91 patients with myocardial infarction in the early exercise group and 90 patients in the control group. The control group received the routine nursing intervention, and the early exercise group received early physical exercise rehabilitation therapy. Results: The actual quality of life of the early exercise group was higher than that of the control group. The incidence of cardiovascular adverse events was lower than that of the control group. Conclusion: Physical exercise therapy used in acute myocardial infarction can reduce adverse cardiovascular events and improve the quality of life of patients. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Anterior wall myocardial infarction; Obesity; Exercise therapy; Exercise.

RESUMO

Introdução: O infarto do miocárdio causado por obesidade pode levar a um declínio de mobilidade e na qualidade de uma vida saudável. O treinamento esportivo é benéfico para a manutenção precoce da função física após o infarto do miocárdio. Objetivo: Este estudo trata do efeito de exercícios aeróbicos de caminhada no tratamento de reabilitação de pacientes que sofreram infarto do miocárdio. Métodos: Recrutamos 91 pacientes que sofreram infarto do miocárdio no grupo de exercícios precoce e 90 pacientes no grupo de controle. O grupo de controle recebeu a intervenção de enfermagem de rotina, enquanto o grupo de exercícios precoce recebeu terapia de reabilitação com exercícios precoces. Resultados: A qualidade de vida efetiva do grupo de exercício precoce foi mais alta do que aquela do grupo de controle. Conclusão: A terapia de exercícios físicos usada no infarto agudo do miocárdio pode reduzir incidências cardiovasculares adversas e melhorar a qualidade de vida dos pacientes. ***Nível de evidência II; estudos terapêuticos – investigação de resultados de tratamento.***

Descritores: *Infarto miocárdico de parede anterior; Obesidade; Terapia por exercício; Exercício físico.*

RESUMEN

Introducción: El infarto de miocardio causado por obesidad puede ocasionar una caída de movilidad y de la calidad de una vida saludable. El entrenamiento deportivo es benéfico para la manutención temprana de la función física tras el infarto de miocardio. Objetivo: Este estudio trata del efecto de ejercicios aeróbicos de caminata en el tratamiento de rehabilitación de pacientes que sufrieron infarto de miocardio. Métodos: Reclutamos 91 pacientes que sufrieron infarto de miocardio en el grupo de ejercicios temprano y 90 pacientes en el grupo de control. El grupo de control recibió la intervención de enfermería de rutina, mientras el grupo de ejercicios tempranos recibió terapia de rehabilitación con ejercicios tempranos. Resultados: La calidad de vida efectiva del grupo de ejercicio temprano fue más alta que aquella del grupo de control. Conclusión: La terapia de ejercicios físicos usada en el infarto agudo de miocardio puede reducir incidencias cardiovasculares adversas y mejorar la calidad de vida de los pacientes. ***Nivel de evidencia II; Estudios terapéuticos – investigación de resultados de tratamiento.***

Descriptores: *Infarto de la pared anterior del miocardio; Obesidad; Terapia por ejercicio; Ejercicio físico.*

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INTRODUCTION

Coronary heart disease, especially myocardial infarction, can cause a decline in mobility and a decline in the quality of healthy life. Exercise training has been widely carried out abroad as part of cardiac rehabilitation after myocardial infarction. It has a good effect in reducing mortality, improving exercise capacity and quality of life. It has been proven to be beneficial for maintaining early body function after myocardial infarction.[1] Following the current sports training guidelines, we divide the rehabilitation training into three different stages. The first phase usually starts within 24 hours of admission and continues until the patient is discharged. The goal of this stage is to reduce patient anxiety and bed-related dysfunction through health education. The second phase begins within three weeks of discharge and lasts for 4 to 12 weeks. This stage aims to help patients adapt to the knowledge and skills needed for lifestyle changes and gradually recover their physical strength. Sports rehabilitation can be divided into the initial low-intensity exercise training (2a) and the subsequent medium-intensity exercise training (2b). The third stage is called the maintenance stage.[2] This stage aims to encourage lifestyle changes, adhere to long-term exercise training, and focus on self-care. Although exercise rehabilitation has proven to reduce the risk of adverse events, it is not clear how early low-intensity exercise training affects the prognosis of patients with MI. This study aims to investigate the effect of exercise rehabilitation starting 2 weeks after myocardial infarction due to obesity.

METHOD

Included objects

The enrolled patients came from patients admitted to the Department of Cardiology due to acute ST-segment elevation myocardial infarction from September 2017 to May 2019. Inclusion criteria: The patient had chest pain less than 6 hours and underwent emergency interventional surgery to open the occluded blood vessel and restore normal blood flow.[3] The patient is in stable condition without heart failure manifestations and can regularly take secondary prevention drugs for coronary heart disease. Exclusion criteria: age> 75 years old. The patient still had severe coronary artery stenosis without revascularization treatment. Examination of the patient found that the left ventricular myocardium was bulging, and the left ventricular ejection fraction (EF) was <50%. The patient has severe heart valve disease, respiratory system disease, and malignant tumors with a life expectancy of less than 1 year. The patient may have a hemodynamically unstable malignant arrhythmia. The patient was unable to exercise or follow up as required or refused to participate in the trial. Participants were randomly assigned to the early exercise and control groups and signed an informed consent form.

Intervention measures

Both groups of patients received health education and exercise training methods from the responsible nurse during their hospitalization. Inform patients that they should stop exercising immediately if they have the following symptoms: chest pain, dizziness, overwork, shortness of breath, excessive sweating, nausea and vomiting, and irregular pulse.[4] The early exercise group was mainly bedridden on that day. On the first day after surgery, passive and active limb training in bed began under the guidance of nurses. The patient can sit up in bed for 15 to 30 minutes, 2 to 3 times a day. If there is no discomfort, you can hang your feet on the side of the bed. On the second day after surgery, stand at the bedside for 5-10 minutes, step on the spot ten times, 2-3 times a day. From the 3rd postoperative day to discharge period (physical recovery training accompanied by the responsible nurse (stage 1). Warm-up exercises every day, walking 50-150m, up and down stairs 1-2 floors. Slow walking every day after discharge, Twice a day, 30 minutes each time. After two weeks, start sports training (2a). Do three times a week without training days for a total of 2 weeks. Each training lasts 50 minutes, including 10 minutes of warm-up. Yes, Walk at an average oxygen speed for 30 minutes.

The exercise intensity should be mild to moderate according to the voluntary fatigue level (PRE) value. The patients must exercise not to affect the conversation and do not induce chest tightness and palpitations. The control group patients are required to 2 weeks after the operation. Start self-activity.[5] Each time no more than 15 minutes, as long as there is no discomfort. 4 weeks after the operation, the patient's exercise planning enters stage 2a. The researchers asked the two groups of patients to record their exercise tolerance and discomfort response in diaries. All participants After two weeks, the 2a stage will enter the 2b stage exercise training. The 2b stage exercise adds 10 minutes of upper limb strength training based on the 2a stage. The exercise intensity is increased to moderate, and the exercise method is fast walking (5~6km/h). 2b stage It lasts until 12 months after surgery. Those who have no exceptional circumstances will enter the third phase of rehabilitation training after one year.

Follow-up

Assist patients in completing the evaluation of the Self-Rating Depression Scale (SDS) and Seattle Coronary Heart Disease Patients' Quality of Life Evaluation Scale (SAQ). After that, the hospital communicated with patients by telephone every month.[6] According to the patient's different stages and physical recovery, it is recommended to give corresponding exercise intensity and type recommendations and record the patient's medication status simultaneously. One year later, the endpoint follow-up of death, myocardial infarction, and rehospitalization rate was completed.

Statistical methods

The experiment uses SPSS15.0 statistical software for data processing. Continuous variables are expressed as mean ± standard deviation. Discrete variables are expressed in absolute numbers and percentages.[7]

To predict the position of the moving target in the video sequence, we assume a sample $s = \{x, y, x', y', h\}$. Where x, y represents the center position of the moving target. x', y' represents the speed of the moving target in the horizontal and vertical directions, respectively. h represents the size of the moving target. The target's motion model represents the propagation of the sample set:

$$s_t = As_{t-1} + w_{t-1} \qquad (1)$$

A represents the moving speed of the moving target. w_{t-1} represents that system noise generally obeys Gaussian distribution.[8] The formula (1) describes the similarity between each sample point and the target model. The greater the similarity, the greater the probability weight π^n of the sample point. Therefore, the probability weight of each sample point:

$$\pi^n = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{d^2}{2\sigma^2}} = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(1-\rho[p',q'(s^n)])}{2\sigma^2}} \qquad (2)$$

The flow of the particle filter algorithm in this paper is as follows:

(1) From the sample set $S_{t-1} = \{s_{t-1}^{(n)}\}_{n=1,\cdots,N}$, select N samples that obey the probability distribution π_{t-1}.

1. Calculate the cumulative probability distribution C'_{t-1}

$$\begin{aligned} c_{t-1}^{(0)} &= 0 \\ c_{t-1}^{(n)} &= c_{t-1}^{(n-1)} + \pi_{t-1}^{n} \\ c'^{(n)}_{t-1} &= \frac{c_{t-1}^{(n)}}{c_{t-1}^{(N)}} \end{aligned} \qquad (3)$$

2. Generate N random numbers $r_n \in [0,1]$ that obey a uniform distribution.

3. Choose the smallest j that satisfies the condition $c'^{(j)}_{t-1} \geq r_n$ in the set $\{c'^{(j)}_{t-1}\}$ and let $S'^{(n)}_{t-1} = s_{t-1}^{(j)}, 0 \leq n \leq N$.

(2) From the set $S'_{t-1} = \{S'^{(n)}_{t-1}\}_{n=1,\cdots,N}$, use the motion equation (3) to generate the sample set $S_t = \{S_{t-1}^{(n)}\}_{n=1,\cdots,N}$; $s_t^{(n)} = As'^{(n)}_{t-1} + w_t^{(n)}$ ($w_{t-1}^{(n)}$ in the next frame of the image; it is the system noise and conforms to the Gaussian distribution).

(3) Predict the position of the target in the next frame of the image:

1. Calculate the similarity $\rho[p', q'(s_t^{(n)})]$ between each sample point and the target model;

2. Calculate the probability weight π^n_t of each sample point:

$$\pi_t^n = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(1-\rho[p',q'(s_t^{(n)})])}{2\sigma^2}} \qquad (4)$$

3. Estimate the expected value of the target location:

$$E[S_t] = \sum_{n=1}^{N} \pi_t^n s_t^{(n)} \quad (5)$$

RESULTS

From September 2017 to May 2019, 91 patients with myocardial infarction were enrolled in the early exercise group, and 90 patients were enrolled in the control group. One person in each group withdrew from the group at stage 2b due to physical intolerance.[9] There were no significant differences in age, gender, angiographic characteristics, hypertension, diabetes, liver and kidney function, and drug treatment between the two groups (Table 1).

In the one-month postoperative follow-up of Holter's 24-hour early ventricular number, the incidence of short bursts of ventricular tachycardia, and the 6-minute walk test, the Seattle Evaluation Scale early exercise group was significantly better than the control group. In the early exercise group, those who reached the diagnostic criteria for depression were significantly less than those in the control group. There was no significant difference between EF and left ventricular end-diastolic diameter (Table 2).

One year after the operation, the EF value of the early exercise group and the control group increased compared with that at discharge. There was no significant difference between the two groups. The average number of 24h room mornings in the early exercise and control groups were significantly reduced compares to The Seattle scores of the early exercise group, and the control group also improved compared to before November.[10]

Table 1. Baseline data of patients in the early exercise group and control group.

Grouping	Early exercise group (n=91)	Control group (n=90)	P value
Male [n(%)]	65(71.4)	62(68.9)	0.71
age)	61.4±9.1	62.2±9.5	0.38
body mass index	26.3±4.2	27.5±4.8	0.49
Hypertension [n(%)]	60(65.9)	56(62.2)	0.6
Diabetes [n(%)]	30(33.0)	32(35.6)	0.71
Current smokers [n(%)]	22(24.2)	18(20.0)	0.5
Anterior wall myocardial infarction [n(%)]	37(40.7)	40(44.4)	0.61
Multivessel disease [n(%)]	24(26.4)	27(30.0)	0.59
Creatine Kinase Isoenzyme Peak	243.3±108.4	239.6±110.1	0.68
Left ventricular ejection fraction (%)	50.3±11.8	49.7±12.2	0.65
Alanine aminotransferase (mmol/L)	28.2±19.4	29.5±21.6	0.41
Serum creatinine (mmol/L)	72.7±18.9	74.8±23.6	0.26
Low-density lipoprotein cholesterol (mmol/L)	3.2±0.9	3.1±1.1	0.59
Aspirin [n(%)]	88(96.7)	87(96.7)	0.99
Clopidogrel [n(%)]	89(97.8)	90(100)	0.1
Statins [n(%)]	89(97.8)	89(98.9)	0.56
Angiotensin converting enzyme inhibitor [n(%)]	85(93.4)	83(92.2)	0.76
Beta blockers [n(%)]	81(89.0)	79(87.8)	0.8

Table 2. 1-month follow-up results of patients in the early exercise group and the control group.

Grouping	Early exercise group (n=91)	Control group (n=90)	P
Average 24h room morning number (n)	1323±647	2074±1285	0.018
24h short burst rate of ventricular tachycardia	12.40%	18.90%	0.036
Left ventricular end diastolic diameter (mm)	46.6±7.3	48.5±8.1	0.33
Left ventricular ejection fraction (%)	53.5±9.2	50.7±8.8	0.15
6-minute walk test (m)	378±64	302±73	0.037
Incidence of decreased libido [n(%)]	18 (19.8%)	40 (44.4%)	0.0003
Seattle score	82.5±17.2	70.6±16.3	0.042
Depression scale score ≥53 points [n(%)]	22(24.2)	39(43.3)	0.01

DISCUSSION

Exercise can inhibit the occurrence and development of coronary heart disease. The risk of cardiovascular death for people without physical activity is more than five times that of those who exercise diligently, and 30 minutes of moderate-intensity exercise every day can reduce cardiovascular risk. There are many reasons why exercise can slow down the progression of atherosclerosis. Exercise can help reduce abdominal obesity and control blood pressure, lower triacylglycerol, and low-density lipoprotein cholesterol (LDL-C). It can raise high-density lipoprotein cholesterol (HDL-C), increase insulin sensitivity and blood sugar utilization to reduce the occurrence of diabetes. The body's oxygen uptake capacity decreases by 25% after three weeks of bed rest, and exercise can improve the oxygen uptake capacity of patients with acute myocardial infarction. We confirmed it by the 6-minute walk test and the improvement in left ventricular ejection fraction. Experiments have shown that exercise can reduce the t-wave alternation (TWA) of the electrocardiogram. TWA is recognized as the most predictive non-invasive electrophysiological index for sudden cardiac death caused by malignant arrhythmia.

CONCLUSION

Exercise is beneficial and safe for the recovery of patients with coronary heart disease. Early exercise rehabilitation for patients with stable conditions after acute myocardial infarction emergency surgery is conducive to improving physical function as soon as possible. It can help patients improve their quality of life.

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