Research Progress of Aerobic Endurance Training on Cardiac Rehabilitation in Patients with Chronic Heart Failure

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Abstract. Heart failure is due to any abnormal cardiac structure or function of the ventricular filling and (or) ejection ability damage caused by a group of clinical syndromes, the main symptoms were dyspnea, fatigue and fluid retention, chronic heart failure (CHF) is the final destination of most cardiovascular disease, also is the main cause of death[1]. In 2016, the Chinese cardiovascular disease report mentioned 4.5 million patients with heart failure in China, and the death rate of 5.4% in 30 days [2]. Patients with CHF had poor prognosis, high mortality and poor quality of life due to their long duration, multiple complications and poor compliance with medication. The prescription of cardiac rehabilitation exercise is important for the improvement and prognosis of CHF symptoms. Cardiac rehabilitation includes aerobic endurance training, flexibility training, resistance training, and aerobic endurance training as the basis for a heart rehabilitation program. This paper will summarize the clinical evidence of aerobic endurance training to improve the prognosis of CHF patients, and aim to help the development of aerobic endurance training in China.

The Content of Cardiac Rehabilitation

The mode of cardiac rehabilitation provides “five prescription” for patients, including drug prescriptions and sports prescriptions, nutrition prescriptions, psychological prescription and smoking cessation prescription. It is a multidisciplinary cooperative rehabilitation program; exercise rehabilitation is an important part of the cardiac rehabilitation program, which accounts for about 30%-50% of the cardiac rehabilitation program. Evidence-based medicine shows that exercise training has reduced the mortality of cardiovascular disease by 31%[3]. Motor recovery in patients with CHF is on the basis of comprehensive evaluation for exercise prescription or exercise guidance, making exercise prescription or exercise guidance, and using proper body movement to help patients to restore life ability and promote physical and mental health[4].

Aerobic Endurance Training

Types of Aerobic Endurance Training

Aerobic endurance exercise is a sport with low intensity and rhythmicity, the movement for a long time (about 30 minutes or more), and the intensity of exercise is in the middle or upper (60% to 80% of maximum heart rate). Aerobic endurance training can greatly increase
VO\textsubscript{2}\text{max}, such as walking, climbing, cycling, swimming, boating, climbing stairs, elliptical trainer, aerobics, nordic walking, Traditional Chinese medicine forms such as Taijiquan, Qigong, and wuqinxi, etc. The core exercise in cardiac rehabilitation is regular medication, regulation and proper change of exercise intensity, heart rate and blood pressure and ECG monitoring. In addition, the general characteristics of the patients (such as sex, age, exercise tolerance, etc) should also pay attention to the motivation and preference.

**Assessment of Aerobic Endurance Training**

At any stage, CHF patients should develop effective rehabilitation strategies based on their professional assessment, and exercise rehabilitation under hemodynamic stability and stable symptoms. Clinical assessment includes risk stratification, the motion experiment of symptom restriction, the complication of restricted movement, the functional status and behavioral characteristics of patients, personal goals and sports preferences\textsuperscript{[3]}. The Heart Failure Association and the European Association suggests that patients with heart failure I-III level should take into consideration accepting exercise rehabilitation patients with stable heart failure\textsuperscript{[5]}. Regardless of the level of cardiac function, CHF patients need to risk assessment and exercise rehabilitation under the guidance of professional rehabilitation instructor, to avoid exercise by leaps and bounds to increase or change without evaluating movement way.

**Duration and Intensity of Aerobic Endurance Training**

Exercise intensity should include maximum heart rate (HR\text{max}), maximum exercise load (with watts as a unit), changes of blood pressure during the training, and possible ischemic threshold. During the rehabilitation process, the training heart rate is 60\% to 75\% of HR\text{max}, and the intensity of exercise should be 40\% to 60\% of the maximum load in the restrictive exercise of the symptom\textsuperscript{[3]}. VO\textsubscript{2}\text{max} (maximum oxygen uptake) reaches 50\%-80\% during exercise(walking, mountain climbing, cycling, swimming, rowing, climbing stairs, elliptical trainer, aerobics), and HR\text{peak} reaches 50\%-80\% or HRR (Heart Rate Reserve) 40\%-60\%. The duration of the project is 2-16weeks,\textgreater3 times a week, and the duration of each time is 20-30min \textsuperscript{[6]}.

**Monitoring during Exercise Training Sessions**

Heart rate and Borg Rating of Perceived Exertion Scale were used to monitor heart rate, blood pressure and symptoms and signs during exercise. Respiratory symptoms such as rapid breathing, fatigue, chest pain and mild headache can also be used as monitoring index\textsuperscript{[7]} Closely monitor the patient’s response and tolerance, the patient is encouraged to try as much as possible during exercise, and any discomfort can be stopped at any time. Before exercise, the patients may be informed of possible discomfort and risk, such as the feeling of precordial compression, lumbago and leg pain, or dyspnea.

**The Effect on Cardiac Rehabilitation in CHF Patients**

Long-term aerobic exercise produces physiological changes that are beneficial to the body, and effectively prevents the development of heart failure \textsuperscript{[8]}, and reduce cardiovascular death\textsuperscript{[10-11]} or related hospitalization risk in CHF patients, improve the quality of live. Improve cardiopulmonary function, reduce the risk factors of disease associated with disease and coronary arteries, and reduce the mortality of patients with myocardial infarction. It can improve skeletal muscle strength and exercise endurance, improve the activity of skeletal
muscle oxidase and endothelial cell function, and reduce the motor reserve capacity caused by sympathetic nerve disorder.

**Summary**

Although the effect of cardiac rehabilitation exercise has been widely confirmed, it is still not optimistic about the current situation in our country. How to solve the problem of patient awareness and low participation rate is an important key to the development of cardiac rehabilitation. For all patients with CHF stability, they should actively participate in and adhere to the exercise plan formulated by the rehabilitation staff. During the implementation process, patients’ anxiety and uncertainty, tensions between nurses and patients prevent the rehabilitation exercise being carried out smoothly. Therefore, we should also pay attention to in the process of campaigning to rehabilitation in patients with mental intervention. CHF patients are short in hospital time. Sports rehabilitation should take into account the continuity of the community. How to gradually build a rehabilitation mode suitable for our hospital-community-family integration movement mode to promote the rehabilitation of CHF patients’ needs further exploration.

**References**


