

Progress in the Application of Resistance Exercise in Patients with Sarcopenia

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Abstract:

Resistance exercise is a non-pharmacological intervention method, referring to active movements of muscles against external resistance, which is used to restore and enhance muscle strength and endurance. Sarcopenia is associated with various adverse outcomes in the elderly, and resistance exercise is the standard non-pharmacological treatment for sarcopenia. This article reviews the development of resistance exercise, the application of different resistance training, nutritional combination, concurrent other diseases, and improvement effects, with the aim of providing references for the rehabilitation of elderly patients with chronic diseases.

Keywords: Resistance exercise, Senile sarcopenia, Rehabilitation, Review Nursing

1. Introduction

Sarcopenia, abbreviated as sarcopenia, is a degenerative loss of skeletal muscle mass, strength, and function associated with aging[1]. It mainly affects the elderly population, but it can also occur in younger individuals due to long-term inactivity, malnutrition, or chronic diseases. In 2010, the European Working Group on Sarcopenia in the Elderly (EWGSOP) first defined sarcopenia as a geriatric syndrome, emphasizing its characteristics as reduced muscle mass, decreased muscle strength, and/or reduced physical function. In 2018, the EWGSOP updated the definition, further emphasizing that the loss of muscle strength is the main indicator of sarcopenia. With the increasingly severe form of population aging in China, the number of sarcopenia patients has also been increasing year by year. Studies [2-3] show that in recent years, the proportion of elderly sarcopenia patients in China has reached 6.8-18.5%, and the proportion of sarcopenia patients in elderly care in-

stitutions has reached 28.8%. Study[4] indicates that resistance exercise is the standard non-pharmacological treatment for sarcopenia, with significant positive evidence. Study[5] points out that since muscle mass, muscle strength, bone density, and cartilage function may play an important role in daily activities, resistance training may have a positive and significant impact on the elderly. This article mainly discusses the progress in the application of resistance exercise in elderly sarcopenia patients, reviewing from the development of resistance exercise, nutrition combination, the application of different resistance training, concurrent other diseases, and improvement effects, in order to provide a reference for the rehabilitation of elderly patients with chronic diseases.

2. The evolution process of resistance training

In the 1940s, Thomas L. DeLorme, a military doctor of the United States Army, first proposed the concept

of “Progressive Resistance Training”. In the 1950s, the research on resistance training gradually increased. For instance, scientists such as Dr. Richard A. Berger began to study the impact of different training programs on strength development. At the same time, Bob Hoffman, through his publications such as the “Strength and Health” magazine, vigorously promoted resistance training. The 1970s was an important turning point in the research of resistance training. During this period, scientists began to deeply study the physiological mechanisms of resistance training, including the molecular mechanisms of muscle contraction (such as the sliding filament theory). At the same time, resistance training gradually became incorporated into the regular programs of fitness and rehabilitation. From the late 20th century to the early 21st century, resistance training was widely applied in the fields of fitness, rehabilitation and sports training. For example, the American College of Sports Medicine (ACSM) released guidelines on resistance training in 1998, recommending regular resistance training for healthy adults. In recent years, the research on resistance training has continued to deepen, including its health benefits for different populations (such as the elderly, women, and athletes) and the optimization of training methods.

3. The application of different resistance training methods

After nearly a decade of literature review, the combined application forms of resistance exercise in elderly patients with sarcopenia mainly include the following types: aerobic exercise, blood flow restriction, elastic band, Baduanjin, and electrical stimulation. Fang Meng et al. [6] conducted a 12-week aerobic combined resistance exercise program for 60 elderly patients over 60 years old with obesity-related sarcopenia undergoing maintenance hemodialysis. Yang Wenjie et al. [7] carried out a 3-month sequential aerobic-resistance training program for 120 stroke patients. Chen Xuemei and Yu Guanglan [8] conducted a 12-week blood flow restriction combined with low-intensity resistance exercise program for 71 elderly patients with cerebral infarction and sarcopenia. Wang Guanghui et al. [9] conducted a 12-week elastic band resistance exercise training program for 60 elderly patients with sarcopenia in the community. Zhai Yuting et al. [10] conducted a 12-week elastic band resistance exercise combined with respiratory function training for elderly patients with stable chronic obstructive pulmonary disease and sarcopenia. Xu Xuechen et al. [11] conducted a 12-week Baduanjin combined resistance exercise program for 60 elderly patients over 65 years old with sarcopenia. Luo Junting et al. [12] conducted a 12-week resistance

training combined with electrical stimulation program for 60 elderly patients over 60 years old with sarcopenia. All these studies have played a positive role in improving the quality of life of elderly patients with sarcopenia, indicating that different resistance exercise combined with different forms have a positive impact on improving muscle strength, and it can also be seen that the intervention exercise for sarcopenia usually lasts for 12 weeks, suggesting that conducting an intervention program for 12 weeks can lead to more ideal conclusions.

4. Resistance exercise combined with nutritional intervention

After nearly a decade of literature review, there are various applications of nutritional components and single nutritional components in the treatment of elderly sarcopenia patients through resistance exercise combined with nutrition intervention, with the research on single nutritional components being the most extensive. Study [13] indicates that vitamin D3 combined with low-intensity resistance exercise has a significant effect in increasing the skeletal muscle of elderly patients with sarcopenia. Li Baijuan et al. [14] found that the intake of essential amino acids and vitamin D, etc., has a positive effect on improving the quality of life of elderly patients with sarcopenia. Study [15] shows that supplementation of whey protein combined with resistance exercise can effectively improve the muscle content of elderly patients with sarcopenia. Li Yao and Zhong Ping [16] conducted a 12-week study on 110 elderly patients with chronic heart failure and muscle atrophy, and found that enhanced nutrition not only improves cardiac function but also increases the muscle mass. Chen Shu et al. [17] studied that protein powder combined with resistance exercise has a positive impact on improving the quality of life of elderly patients with sarcopenia compared to simple resistance exercise. Similarly, a review [18] indicates that supplementation of whey protein combined with resistance exercise is more effective than simple resistance exercise in improving muscle quality, but this effectiveness is relatively low. There is also a review on muscle atrophy in patients with chronic kidney disease [19] stating that the optimal resistance exercise prescription needs to be verified, and the safety and effectiveness of nutritional measures still need to be determined.

5. Sarcopenia combined with other diseases

Other diseases can often trigger sarcopenia, such as dis-

eases of the circulatory system, respiratory system, urinary system, and endocrine system. These diseases usually have a high mortality rate and disability rate. Resistance exercise has a good effect on promoting the prognosis of these diseases and improving the concurrent sarcopenia. Research [15] found that resistance exercise training was significantly effective in improving indicators related to cardiac function and indicators related to skeletal muscle function (all $P < 0.05$). Zhai Yuting et al. [10] found that resistance exercise training could significantly improve the lung function of patients and increase the skeletal muscle mass. Research [6] found that resistance exercise had a positive effect on the reduction of albumin in patients with chronic kidney disease and the improvement of muscle strength status. Li Ming et al. [20] pointed out that resistance exercise could improve the serum nutritional indicators and muscle quality of patients with maintenance hemodialysis with sarcopenia. A review [21] pointed out that resistance exercise had a good effect on improving the limb circumference and muscle strength of patients with sarcopenia combined with maintenance hemodialysis. Zhang Bo et al. [22] found that resistance exercise could improve the skeletal muscle mass, muscle strength and motor function of elderly patients with chronic kidney disease and sarcopenia, but had no significant effect on renal function improvement. Wang Ji et al. [23] found that resistance exercise could effectively improve the muscle mass and strength performance of patients with type 2 diabetes with sarcopenia. A review [24] pointed out that resistance exercise could promote muscle protein synthesis, reduce protein breakdown, increase muscle mass, strength and function, and improve glucose clearance rate, reduce visceral fat tissue, increase insulin sensitivity, and prevent and control insulin resistance. Wang Yanan et al. [25] found that resistance exercise could improve the skeletal muscle mass and index of the limbs and the fasting blood glucose and glycated hemoglobin of elderly patients with type 2 diabetes (all $P < 0.001$). Zhou Chunxia's research [26] found that after implementing resistance exercise compared to before, the blood glucose indicators and sarcopenia indicators of patients with type 2 diabetes with sarcopenia were significantly improved.

6.The improvement effect of resistance training

Resistance training is a type of exercise that enhances muscle strength, endurance and volume by opposing resistance. The core of resistance training lies in stimulating muscle contraction by applying external resistance, thereby achieving the goal of strengthening muscle strength and endurance. A review [27] states that resistance training can increase the activation level of the insulin signaling pathway in skeletal muscles, increase the glycogen content and basal glycogen synthase activity in skeletal

muscles, improve the antioxidant capacity of skeletal muscles, prevent the shortening of telomere length in aged skeletal muscles, and promote mitochondrial remodeling, etc. Another review [28] indicates that resistance training can improve neuromuscular function, regulate endocrine function, and enhance muscle strength and function.

7.Conclusion

This study summarizes the development process of resistance training, the effects of different forms of resistance training applications, the improvement effect of resistance training combined with nutritional intervention on the quality of life of elderly patients with sarcopenia, the improvement effect of applying resistance training after concurrent occurrence of other diseases, and the specific aspects of the improvement effect of resistance training. It provides a basis for healthcare professionals to understand resistance training, apply it, and understand its effects. The search terms used in this study were few, the databases searched were relatively limited, and the number of English literatures included was small. The research is not yet sufficient and needs to be continuously enriched.

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