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PUBTEXTO

Adequate Exercise for Frailty in Patients with Chronic Kidney Disease (CKD) and Hemodialysis (HD)

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Abstract

For patients with chronic kidney disease (CKD) and hemodialysis (HD), there was formerly concern that exercise might exacerbate urinary dysfunction, and then exercise restriction was conducted. Sarcopenia and frailty have been often observed, leading increased risk of dialysis induction and death. The guideline of Kidney Disease Outcome Quality initiative (K/DOQI) shows the recommendations of increased exercise level. They include 3-4 times a week on non-dialysis days, 30-60 minutes of walking, medium-intensity aerobic exercise, low-intensity strength training, some stretching and range of motion (ROM) maintenance training before and after exercise. Such comprehensive program will be hopefully prevalent in the future.

Keywords: Chronic Kidney Disease (CKD); Hemodialysis (HD); Kidney Disease Outcome Quality Initiative (K/DOQI); American College of Sports Medicine (ACSM); Frailty; Exercise

Mini-Review

For patients with chronic kidney disease (CKD), urgent need is found for measures to prevent progression and delay the dialysis. With advancing age, renal and physical functions decline, and sarcopenia and frailty syndrome increase [1]. Since these factors influence the prognosis much, the rehabilitation for conservative CKD and dialysis have attracted attention for years [2]. In other words, the purpose is to adjust physical and psychological effects and symptoms, and to improve life prognosis and psychosocial conditions. A comprehensive program includes exercise therapy, diet and water management, medication, education, and psychological support [3].

For CKD patients during the conservative period, walking speed and distance for 6 minutes are 30% lower than those in healthy subjects, and timed up and go time is extended by 40%. These exacerbations bring the risk of death after 3 years more predictable than exacerbations of blood data. Furthermore, they show 7-24% higher prevalence of frailty. In CKD stage 3-5, the death risk becomes 3 times due to frailty. When eGFR is <30 mL/min/1.73m^2, the frailty risk becomes 3.7 times with the combination of diabetes and hypertension. With the presence of frailty, the risk of dialysis induction and death increased 2.5 times [4].

Hemodialysis (HD) patients are more likely to have sarcopenia and frailty, and maximal oxygen uptake (VO2max) is about 60% of the predicted age [5]. Sarcopenia is present in 34-40% of HD patients with high prevalence due to complications of depression and diabetes. A study of prognosis in HD showed higher mortality rate of 35% for muscle mass loss, 182% for grip strength loss, and 194% for sarcopenia complications.

For CKD patients, moderate exercise improved exercise tolerance, muscle strength, and health-related QOL without exacerbating renal function [6]. Exercise prevents protein catabolism, even under a low protein diet [7]. Consequently, the activities of CKD patients should not be excessively restricted. Resistance exercise did not worsen eGFR and significantly improved compared to the non-exercise group. When both aerobic and resistance exercises were continued 3 times a week for 12 months, the decrease in eGFR was significantly lower than non-intervention group. Ordinary walking alone reduced 10-year overall mortality risk by 33% and the risk of transition to HD by 22%.

Most HD patients do not continue exercise or physical activity [8]. Compared to active group, inactive group has a 1.6-fold higher risk of death for one year. Taking about 1,000 steps/day for 10 minutes on non-dialysis days reduces death risk by 20%. The guideline of Kidney Disease Outcome Quality Initiative (K/DOQI) shows the recommendations of increased exercise level and reassessment for short form (SF)-36 and athletic performance every 6 months. The standard menu includes exercise 3-4 times/week on non-dialysis days, walking 30-60 minutes, and medium-intensity aerobic exercise using ergometer. As low-intensity strength training, some stretching and range of motion (ROM) maintenance training before and after exercise. Exercise therapy can be performed during dialysis, using lower limb exercises by variable load ergometers or electrically power-assisted ergometers, and resistance exercises by rubber belt and ball [9].

The effects of exercise therapy on dialysis include various medical

changes. They are improved QOL, psychological state, cardiac function, lipids profile, increased VO2max and skeletal muscle fibers, decreased blood pressure, and reduced depression state, and so on [10]. Further, some reports showed that malnutrition and inflammatory complex syndrome and dialysis efficiency were improved. Regarding the exercise effect of HD patients on the prognosis of life, there were apparent evidence until now. However, there are multicenter, randomized clinical trials (RCT) examining the effects of exercise programs on 6-minute walking distance [11]. As a result, the cumulative non-hospitalization rate during that period was lower in dialysis patients who had completed exercise therapy for 6 months than those who did not receive exercise therapy.

Formerly, there was concern that exercise in CKD patients exacerbated urinary protein and dysfunction, and exercise restriction was considered necessary. However, such clinical evidences were not found. The guideline of "Evidence-based CKD Practice" was presented by Japanese Society of Nephrology [12]. Among them, decreased physical activity poses a risk of death due to cardiovascular disease, and exercise therapy may be important [13]. According to the Rehabilitation Guideline for CKD, it is suggested that CKD patients should be given exercise therapy to the extent possible while considering their age and physical function, which was estimated to be recommendation level 2, evidence level C [14].

As standard concept of renal disease, K/DOQI have announced the management of CKD [15]. According to the guideline of K/DOQI, adequate exercise was recommended to be at least 30 minute, 5 times a week, which is also effective for improving cardiovascular health and exercise tolerance [16]. Furthermore, another standard has been presented by American College of Sports Medicine (ACSM) [17]. Among them, exercise prescriptions for CKD patients were set based on the general public [18]. The initial exercise intensity is from mild (<40% of the oxygen intake reserve) to moderate intensity (40-60%). The intensity should be gradually increased based on the patient's exercise tolerance. Resistance exercise has been also important for overall health of CKD patients.

There is no established exercise prescription for patients with conservative CKD [12]. On the other hand, renal rehabilitation guideline showed both propose of supervised and unsupervised exercise therapy [14]. Short-term exercise may increase urinary protein excretion and decrease renal blood flow and GFR. Therefore, the exacerbation risk of renal dysfunction may be supposed by performing high-intensity exercise. As to the evaluation of renal function, measurement of creatinine and cystatin may be used from now [19]. No conclusions have yet been shown on these issues. This will be a challenging issue in the future.

In summary, exercise was previously thought to exacerbate renal function. Then, social life and school activities were restricted for CKD patients. At present, aging society has come, and CKD patients are also increasing [20]. In this situation, exercise therapy is expected to improve exercise tolerance, strength and health-related QOL and become an intervention for maintaining renal function [21]. Various mechanism and efficacy will be clarified, including acute/chronic phase, optimal intensity, frequency, duration, and others. Further research and evidence for renal rehabilitation will be expected.

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