



The Effect of Intradialytic Exercise on Fatigue-Related Chronic Kidney Disease: A Case Study of Patient Undergoing Hemodialysis

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Abstract

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BACKGROUND: Fatigue is one of the most common problems experienced by chronic kidney disease (CKD) patients undergoing hemodialysis. The application of intradialytic exercises can be the best solutions to overcome fatigue related to CKD.

CASE PRESENTATION: A 50-year-old male patient with CKD, who complained of severe fatigue, was selected in case study. The FACIT fatigue scale questionnaire and clinical indicators were measured before and after intervention. The intradialytic exercise was administered at 3rd h of hemodialysis for 4 sessions in 2 weeks. Each session required 30 min, containing warming up, main exercise, and cooling down. After 2 weeks intervention, there was an improvement of fatigue score (16–29) and reduction of weakness, tiredness, washout feeling, sleepy, and tiredness on eating. Moreover, the clinical indicators showed positive improvement after the intervention.

CONCLUSION: Thus, intradialytic exercise is practically promising to minimize fatigue related to CKD among patients undergoing hemodialysis. Hemodialysis nurses or other health-care providers could utilize this evidence as a program to reduce the fatigue related to CKD.

Introduction

Fatigue, one of the most common problems experienced by CKD patients undergoing hemodialysis, is problematic. Fatigue related to CKD significantly affects patients' quality of life and their health outcomes [1]. This symptom is manifested as a subjective sense of weakness, loss of energy, tiredness, and discomfort that occur as a biological warning when health is threatened [2]. About 60–97% of adult patients undergoing hemodialysis report fatigue related to CKD and indicate that it seriously affects their daily life.

The previous research identified the leading factors of fatigue related to CKD among hemodialysis patients. These included treatment-related factors (i.e., dialysis frequency and adequacy of dialysis), psychosocial and lifestyle factors (i.e. depression, physical activity, and poor sleep quality), and physiological factors (i.e., anemia, malnutrition, and uremia) [2], [3]. Anemia occurs in almost half of patients with CKD in Stages III and IV and its prevalence increases up to 75% in patients suffering end-stage

renal disease [4]. Mostly, anemia in CKD patients is due to reducing the erythropoietin production, which causes a decrease in red blood cells [3]. Iron deficiency, folic acid deficiency, decreased ability of red blood cells to live, inhibition of erythropoiesis in the bone marrow, especially by parathyroid hormone, interstitial blood loss, and infection are also able to cause the anemia in CKD patients [5].

Physical exercise, an easy and cheap intervention, is able to reduce depression and fatigue related to CKD among patients undergoing hemodialysis. There are three alternatives of physical exercise for hemodialysis patients, including intradialytic exercise (during the hemodialysis therapy), exercise on non-dialysis schedule, and home-based exercise [6]. Among the three alternatives, intradialytic exercise is the most feasible, applicable, and common choice for hemodialysis patients. The intradialytic exercise does not require extra time for doing it during the hemodialysis time, which leads to higher compliance [7]. During the hemodialysis therapy, most patients are usually waiting for 3–5 h and it is good to be more active during the therapy. In addition, exercise during the

dialysis is monitored by health-care professionals. Any complications can be detected, anticipated, and well treated. Moreover, intradialytic exercise potentially increases the solute removal, improves the blood flow to the muscles, and pushes a greater removing of toxic agents by the dialyzers [8].

This study aimed to explore a feasible intradialytic exercise based on the current evidence to reduce the fatigue complaints of patients undergoing hemodialysis. The formatted questions were constructed as below: (a) What is the intradialytic exercise to minimize the fatigue related to CKD based on the available evidence? and (b) how is the effect of the intradialytic exercise on fatigue related to CKD for the patient undergoing hemodialysis?

Case Report

LM was a 50-year-old male diagnosed with CKD stage V due to hypertension on August 2020. He lives with his family in an urban area, non-working, and graduated from high school. Due to the CKD, the patient was referred to Dr. Sardjito General Hospital to undergo hemodialysis therapy twice a week. During the initial assessment, the patient complained about feeling tired and weak, and family members assisted most of his self-care activities. He also could not sleep well at night due to restlessness and anxiety. The patient said that, currently, he felt a lack of appetite and was often nauseous without vomiting. He was usually eating 3 times with small portions and consumed fluid about 1800–3000 cc/day. The results of physical examination (October 1, 2020) showed that the generally the patient looked weak, *compos mentis*, and with no shortness of breath. His blood pressure, pulse, respiration, and temperature were 151/85 mmHg, 72 x/min, 18 x/min, and 37.2°C, respectively, with height 160 cm and dry weight 45 kg. The conjunctivas looked anemic, but not icteric. The rests indicated normal finding of physical examination.

Therapeutic Intervention

LM routinely consumes osteocal 3 × 500 mg, cefixime 2 × 100 mg, folic acid 3 × 1 mg, and candesartan 1 × 8 mg. He had received packed red cell transfusion (PRC) for two bags while hemodialysis (September 14, 2020).

Intradialytic exercise is administered twice a week according to the patient's hemodialysis schedule. The duration is about 30 min between 2nd or 3rd h of hemodialysis procedure. Clinical indicators, such as heart rate, respiratory rate, oxygen saturation, and

blood pressure, should be monitored before and after intradialytic exercise [9]. The intradialytic exercise procedures according to Mahrova and Svagrova consist of warming up, main exercise, and cooling down [10]. The implementation of intradialytic exercises in this case study was 4 sessions in 2 weeks. The patient was encouraged and instructed to follow the intradialytic exercise as recommended. Vital sign measurements were taken before and after exercise in each session. Exercise was done for 30 min at the 3rd h of hemodialysis. Fatigue related to CKD was measured using the FACIT fatigue scale twice, at the first session before the exercise and the after the exercise in the fourth session.

Patient outcomes

At the baseline (October 12, 2020), the fatigue score was 16, which indicated severe fatigue level. After 2 weeks of intradialytic exercise intervention (October 20, 2020), the results of fatigue score showed a change. There was an increasing score of fatigue from 16 to 29. Although the level of fatigue was still indicated severe fatigue, an increase in the score indicated an improvement in the patient's quality of life and less fatigue symptoms. After intervention, the complaining about weakness, tiredness, washout feeling, sleepy, and tiredness on eating was improved (Table 1).

Table 1: Results of fatigue scale measurement using FACIT fatigue scale

Serial number	Statement	Scoring		
		Pre	Post	Delta
1	I feel fatigued	1	2	1
2	I feel weak all over	0	3	3
3	I feel listless or "washed out"	1	3	2
4	I feel tired	0	3	3
5	I have trouble starting things because I am tired	1	1	0
6	I have trouble finishing things because I am tired	1	1	0
7	I have energy	1	1	0
8	I am able to do my usual activities	2	1	-1
9	I need to sleep during the day	2	4	2
10	I am too tired to eat	1	3	2
11	I need help doing my usual activities	2	3	1
12	I am frustrated by being too tired to do the things I want to do	2	1	-1
13	I have to limit my social activity because I am tired	2	3	1
Total score		16	29	13

The measurement results of the vital sign before and after the intervention showed a positive change (Table 2). The intradialytic exercise could improve the BP, HR, RR, and SpO₂, which were remarkable improvements after the exercise.

Table 2: Results of measurement of patients' vital signs

Date	Indicators	Pre	Post
October 12	Blood pressure	145/90 mmHg	203/115 mmHg
	Heart rate	63 x/min	78 x/min
	Respiratory rate	22 x/min	22 x/min
	Oxygen saturation	97%	99%
October 15	Blood pressure	182/112 mmHg	189/121 mmHg
	Heart rate	77 x/min	93 x/min
	Respiratory rate	20 x/min	22 x/min
	Oxygen saturation	97%	98%
October 19	Blood pressure	123/92 mmHg	158/100 mmHg
	Heart rate	108 x/min	105 x/min
	Respiratory rate	18 x/min	20 x/min
	Oxygen saturation	98%	98%
October 22	Blood pressure	92/57 mmHg	105/61 mmHg
	Heart rate	70 x/min	104 x/min
	Respiratory rate	18 x/min	22 x/min
	Oxygen saturation	99%	99%

Discussion

Fatigue is known as the main complaint of patients undergoing long-term hemodialysis. The prevalence of fatigue related to CKD on patients undergoing hemodialysis ranges from 60% to 97% [11]. Assessment and management of fatigue related to CKD are important to improve clinical outcomes and quality of life for patients undergoing hemodialysis, pre-dialysis, and post kidney transplantation [12]. The application of intradialytic exercise can be the best solution to overcome fatigue complaints during the hemodialysis process [1]. Intradialytic exercise potentially increases hemodialysis adequacy, solute removal, intradialytic protein synthesis, muscle strength, oxygen consumption, nutritional status, and quality of life [13].

The results, in this case study, showed that there was a change in patient fatigue scores after 2 weeks of intradialytic exercise intervention. The previous research described that physical exercise was a particular promising way to curb the progression of fatigue among hemodialysis patients [14]. A significant reduction was monitored in fatigue and electrolyte levels such as serum phosphate, potassium, calcium, urea, and creatinine in CKD patients undergoing hemodialysis after 8 weeks of an intradialytic exercise program [15]. Another review showed that there was a significant difference in the level of fatigue in the experimental group before and after intradialytic exercise intervention. The duration of the intervention varied from 4 weeks to 24 weeks [16]. Berry *et al.* [17] declared that the longer the exercise program for patients with chronic disease could show better improvement than the shorter exercise program. In this case study, intradialytic exercise was only done for 2 weeks, so it had not shown significant results yet on the patient's fatigue severity. However, the current results indicated a promising result with an improvement in outcomes and it was similar with the previous researches.

Intradialytic exercise has beneficial effects on the cardiorespiratory capacity of patients undergoing hemodialysis. In the cardiovascular system, the exercise will increase cardiac output, improve venous return, and myocardial contraction which result in adequacy on the cardiovascular system and blood vessels during hemodialysis and facilitating adaptation and compensation [18]. Significant improvements were found in physical capacity, physical performance and physical function. Appropriate physical exercise during the hemodialysis process is able to improve cellular metabolic activities from anaerobic to aerobic, without the side effect of fatigue [19]. The previous research showed that routine intradialytic exercise could help achieving adequate cellular oxygenation and increasing cellular energy [20].

Routine intradialytic exercise can increase blood flow to the muscles and capillary surface area

by increasing the movement of urea and toxic from the tissues to the blood vessels, which are then flowed to the dialyzer [21]. Patients who are practicing physical exercise during hemodialysis are known to experience less CKD complication. When exercising, the blood flow through the tissues increases, the use of the muscles of the lower leg allows the capillaries to open more and provides a larger surface area for the exchange of substances from the tissues to the blood. Physical exercise can expand muscular arteries, improve perfusion, and alleviate diseases affecting blood circulation in muscles [22].

Intradialytic exercise can be an option for patients during the hemodialysis process, because it is feasible, cost-effective, and promising to improve their quality of life. Intradialytic exercise is considered safe and effective in the rehabilitation program and complementary treatment for patients undergoing hemodialysis [14].

Conclusion

This case study showed that intradialytic exercise could provide benefits to reduce the symptoms of fatigue related to CKD experienced by patients undergoing hemodialysis. Although the results indicated no change in the level of fatigue, the score and symptoms of fatigue showed improvement. The intervention should be delivered for 30 min between 2nd and 3rd h of hemodialysis procedure with frequency twice a week and the clinical indicators should be well monitored before and after the exercise. Hemodialysis nurses or other health care providers could utilize this evidence as a program to reduce the fatigue related CKD.

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