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Investigating the Effects of Physical Activity on the Amount of Muscle Cramp Pain in Hemodialysis Patients

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Abstract

Due to the physical weakness and low level of physical endurance in chronic kidney failure patients and also because most patients are dialyzed through the veins of the hand, exercise using the legs is the best option for improving muscle cramps and improving their quality of life. Therefore, this study was conducted to determine the effect of physical activity on muscle cramps in patients referred to the hemodialysis department. The current study is a semi-experimental type and the sample size was determined by using previous studies and the sample size formula, 34 people. Sampling was done using available sampling, and then the samples were divided into intervention and control groups by drawing cards. The implementation of the physical activity program was such that for the patients of the intervention group, the walking program was carried out for 30 minutes, 3 times a week immediately after the end of the hemodialysis session or with the prior coordination of the patient. The visual analog scale for muscle cramp pain intensity was completed at the beginning and end of the intervention in two groups. The obtained data were statistically analyzed using SPSS23 software. The results of this study showed that there was no significant difference between the average muscle cramp pain before the intervention in the control and intervention groups ($P > 0.05$). However, there was a significant difference between the average muscle cramp pain scores after the intervention in the control and intervention groups ($P < 0.05$), so after the intervention, the average muscle cramp pain score in the intervention group was reduced compared to the control group. The present study showed that physical activity was effective in muscle cramp pain.

Keywords: Hemodialysis patients, Physical activity, Muscle cramp, Pain

Introduction

Hemodialysis is a treatment method in end-stage chronic kidney failure patients. Chronic renal failure refers to the irreversible failure of kidney function from a clinical point of view, which has a progressive course, and most patients need alternative treatment, either permanent hemodialysis or kidney transplantation [1-4]. Chronic renal failure is defined as any damage to the kidney or a decrease in glomerular filtration rate to less than 60 ml per minute, per 1.73 square meters of body surface, lasting more than three months [1].

The incidence and prevalence of chronic kidney failure have increased dramatically throughout the world during the past few decades, and the incidence of this disease in most countries is more than 200 cases per one million people per year [5, 6]. Among the possible causes the disease can be attributed to diabetes, low physical activity, blood pressure, high cholesterol and other blood lipids, smoking, gender, environmental factors, alcohol consumption, noise and mental stress, air pollution, use of certain drugs, kidney and urinary tract infections, cysts and congenital disorders, anatomical disorders, and defects, as well as regional and geographical issues [2, 7, 8]. When the glomerular filtration of the kidneys reaches 10-15% of the normal level, there will be a need to use

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alternative methods to compensate for the lost normal function of the kidneys. These methods include hemodialysis, peritoneal dialysis, and kidney transplant, the most common of these methods being hemodialysis [3].

According to researchers' reports, muscle structure abnormalities are more evident in patients who are undergoing dialysis than in patients who have chronic kidney failure but have not yet undergone dialysis [9-11]. The cause of skeletal muscle breakdown in hemodialysis patients is not yet fully understood; but factors such as acidosis, oxidative stress, hyperparathyroidism, neuropathy, restriction of protein diet, anorexia, cytokinin, abnormalities in vitamin D metabolism or calcium concentration, insufficient dialysis and dialysis treatment are involved in this [12-14]. Hemodialysis patients are prone to muscle cramps during dialysis and between dialysis sessions. These cramps are often very painful and destructive and have harmful effects on the patient's quality of life [15]. Reports have shown that 24-86% of hemodialysis patients experience muscle cramps [16].

Quinine sulfate has been used for four decades to treat hemodialysis-related muscle cramps, but concerns about quinine use have been raised for many years [17]. The answer to this question is unknown, to what extent are limitations in physical performance as an inevitable result of renal failure or dialysis treatment? And to what extent is it the result of poor mobility? Therefore, the question that arises is what the beneficial effects of regular physical activity are for hemodialysis patients. Considering the physical weakness and low level of physical endurance of hemodialysis patients, and also because most of the patients are dialyzed through the veins of the hand, and taking into account past research, sports exercises using the legs are the best option for these patients [18-20]. Therefore, this study was conducted to determine the effect of physical activity on muscle cramps in patients referred to the dialysis department.

Materials and Methods

This study is a semi-experimental research, with a pre-test-post-test design, with two intervention and control groups. In this research, considering the power of 85%, $\alpha = 0.05$ (significance level) according to the objectives of the study and previous studies, $d = 3$ (difference in the average quality of life score of the intervention and control groups at the end of the study) and $s = 87.3$ (standard deviation of the quality of life score), the sample size was 30, and taking into account the drop of 10%, a total of 34 people were determined, using the card drawing method, 17 people in the intervention group and 17 people in the group was controlled.

It should be noted that all patients were identical in terms of the type of dialysis machine and equipment used, the type of strainers used, the type of dialysis fluid, etc., and also the relative homogeneity of the research samples in terms of culture and society through the demographic characteristics questionnaire before the start of the research. The participants were assured that the present study does not interfere with the treatment process of the patients. It was also explained that participation in this study is completely voluntary and they have the right to withdraw from the study at any stage of the research, and the results obtained are completely confidential and will be published without mentioning their names and surnames. Then, the demographic information questionnaire was completed in both groups before the intervention. Demographic profile questionnaire including gender, age, marital status, level of education, employment status, place of residence, income, high blood pressure, the primary cause of kidney disease, diabetes, glomerulonephritis, etc., duration of dialysis, duration of kidney disease, number of times Dialysis per week is the amount of hemoglobin, albumin and dialysis adequacy. Also, the visual analog scale for muscle cramp pain intensity was completed at the beginning and end of the intervention in two groups. This scale is horizontally graded as a line between 0 and 10, and the two sides of its range are enclosed on the left side of the phrase no pain and the right side of the phrase the worst imaginable pain = 10. The patient is asked to select only one number from 0 to 10 according to the level of pain in the last 48 hours and draw a circle around it. A score of 1-3 indicates mild pain, 4-7 moderate pain, and 8-10 severe pain [21]. The study of Alghadir *et al*. [22] in Saudi Arabia showed the internal consistency of the visual pain scale to be 0.97.

The implementation of the intervention program was that for the patients of the intervention group, a walking program was carried out for 30 minutes, 3 times a week immediately after the end of the hemodialysis session or with the prior arrangement of the patient in the open area of the hospital. Before implementing the physical activity program, in each session, the vital signs, blood pressure, pulse, and breathing of the patients were controlled by the researcher, and if the vital signs were abnormal, the patients were verbally asked if there was a problem from the company's point of view. If the patient expressed discomfort and intolerance to the exercise program, physical activity was not performed for the person on that day and was postponed to another day with the coordination of the patient. In this study, none of the research units had any problem in participating in the physical activity program. The program included four stages warming up and preparing the body (5 minutes), brisk walking based on the patient's tolerance (10 minutes), walking at a slow speed and cooling the body (5 minutes), and 10 minutes of rest. The 5-minute warm-up was such that the patients first walked very slowly to prepare their bodies. Then they entered the main walking program and had a fast walk for 10 minutes. At this stage, the patients were told to go as fast as they could to feel their heart rate increase. Then, to cool down the body, they slowed down their walking speed and walked at a slow speed for 5 minutes. Then, to relax the body, they sat on a chair and took

deep breaths with closed eyes for 10 minutes. The walking exercise program was carried out for 8 weeks. It should be noted that the program of physical activity and relaxation, which lasted 30 minutes in total, did not interfere with the schedule and duration of the hemodialysis routine.
Data analysis using SPSS version 23 statistical software in the form of descriptive statistics (tables, average, and standard deviation) and inferential statistics methods and statistical tests including Kolmogorov–Smirnov test, paired t-test, independent t-test, exact test Fisher, and chi-square test analysis was performed.

Results and Discussion

18 patients (52.9%) were male and 16 patients (47.1%) were female. The age of the participants was between 35 and 65 years. 22 patients (64.7%) were married and 11 patients (32.3%) were single. About 7 of the patients (20.5%) were illiterate and the rest of the participants had primary education or higher. About 30 people (88.2%) of the participants were unemployed or did not have a fixed job.

Table 1. Distribution of qualitative demographic variables between two groups without physical activity and with physical activity in patients referred to the hemodialysis department.

Variable		Group				Significant level
		No physical activity		With physical activity		
		N	%	N	%	
Gender	Female	9	52.9	7	41.2	$X^2 = 0.472$ P = 0.492
	Male	8	47.1	10	58.8	
Education level	Illiterate	2	11.8	5	29.4	$X^2 = 4.225$ P = 0.238
	Elementary	2	11.8	4	23.5	
	Diploma	5	29.4	5	29.4	
	Bachelor and above	8	47.1	3	17.6	
Marital status	Single	7	41.2	4	23.5	$X^2 = 2.443$ P = 0.282
	Married	9	52.9	13	76.5	
	Etc.	1	5.9	0	0	
Place of residence	City	9	52.9	8	47.1	$X^2 = 0.118$ P = 0.732
	Village	8	47.1	9	52.9	
Way of life	Alone	2	11.8	0	0	P = 0.485
	With family	15	88.2	17	100	
Employment status	Employed	2	11.8	2	11.8	$X^2 < 0.001$ P > 0.999
	Unemployed	15	88.2	15	88.2	
Primary cause of kidney disease	high blood pressure	5	29.4	6	35.3	F = 0.319 P = 0.999
	diabetes	3	17.6	4	23.5	
	Glomerulonephritis	1	5.9	0	0	
	Etc.	8	47.1	7	41.2	
Duration of hemodialysis	Less than 25 months	4	23.5	6	35.3	$X^2 = 4.944$ P = 0.176
	Between 25 and 50 months	7	41.2	6	35.3	
	Between 50 and 70 months	5	29.4	1	5.9	
	More than 75 months	1	5.9	4	23.5	
Number of hemodialysis	Twice a week	2	11.8	1	5.9	$X^2 = 0.366$ P = 0.545
	Three times a week	15	88.2	16	94.1	
Duration of hemodialysis	3 hours	0	0	3	17.6	P = 0.227
	More than 3 hours	17	100	14	82.4	

From Chi-Square and Fisher's exact test, the frequency distribution of the variables between the two control and intervention groups is almost similar and not significant, and they have a homogeneous distribution between the two groups.

Table 2. Comparison of the mean of quantitative demographic variables between two groups without physical activity and with physical activity in patients referred to the hemodialysis department.

Variable	Group		Significant level
	No physical activity	With physical activity	
Age	46.88 ± 10.47	46.88 ± 12.33	P > 0.999, t < 0.001
Number of children	1.24 ± 1.2	2.53 ± 2.48	P = 0.061, t = -1.938
Systolic blood pressure	117.94 ± 10.67	117.06 ± 20.85	P = 0.878, t = 0.155
Diastolic blood pressure	75.29 ± 10.07	71.76 ± 11.31	P = 0.344, t = 0.961
Pulse	78.58 ± 3.69	75.29 ± 5.64	P = 0.052, t = 2.014
Breathing	17.65 ± 0.79	16.94 ± 1.34	P = 0.071, t = 1.868
Temperature	35.24 ± 0.28	36.75 ± 0.4	P = 0.399, t = -0.855
Hemodialysis adequacy (K/tv)	1.15 ± 0.25	1.08 ± 0.18	P = 0.311, t = 1.029
Hemodialysis adequacy (URR)	0.68 ± 0.15	0.63 ± 0.1	P = 0.217, t = 1.258
Hemoglobin level	9.31 ± 1.88	10.82 ± 2.23	P = 0.04, t = -2.14
Albumin level	3.79 ± 0.34	3.67 ± 0.68	P = 0.536, t = 0.626

Table 2 showed that according to the results of the independent t-test, the average variables of age, number of children, systolic and diastolic blood pressure, pulse, breathing, temperature, adequacy of hemodialysis, and albumin level between the two intervention and control groups are almost equal and was not statistically significant. This is while the variable of the average amount of hemoglobin between the two control and intervention groups was statistically significant and was included as a confounding effect in the study results to adjust its effect.

Table 3. Comparison of the average pain visual analog scale score before and after the intervention between without physical activity and with physical activity in patients referred to the hemodialysis department.

Variable		Group		Significant level
		No physical activity	With physical activity	
Muscle cramp pain	Before intervention	5.41 ± 0.62	6.47 ± 1.38	t = -2.896 P = 0.007
	After intervention	5.88 ± 0.485	5 ± 1.23	F = 65.28 P < 0.001
Significant level		t = 3.108 P = 0.007	t = -11.785 P < 0.001	-

Table 3 shows that according to the results of the independent t-test, the average muscle cramp pain score between the two groups without physical activity and with physical activity, before the start of the intervention, is statistically significant. Therefore, comparing the mean score of muscle cramp pain after the intervention of the two effects of confounding the hemoglobin level and the visual analog pain scale before the controlled intervention, and according to the results of the analysis of covariance, the mean score of muscle cramp pain between the two groups is significant. Also, the average score of muscle cramp pain in the group without physical activity and with physical activity according to the results of the paired t-test were significant, that in the group without physical activity, the score of muscle cramp pain increased and in the group with physical activity, the score of cramp pain decreased.

This study was conducted to determine the effect of physical activity on muscle cramp pain in patients referred to the dialysis department. The results of the present study showed that the mean scores of muscle cramp pain in the group without physical activity and with physical activity were significant according to the results of the paired t-test. In the group without physical activity, the increase in the average muscle cramp pain score, and the group with physical activity, the decrease in the average muscle cramp pain score is statistically significant. In line with these results, a review study by Elsedawy *et al*. [23], Albadr *et al*. [24], and Dhudum and Bhore [25].

In this way, Elsedawy *et al*. [23] in Egypt taught 50 patients in the age range of 60-65 years to perform stretching exercises during dialysis, and after one month, the patients were examined for muscle cramps. According to the findings, the amount of muscle cramps before and after performing stretching exercises during dialysis was

statistically significant, and a significant decrease in the amount of muscle cramps was observed after performing intradialysis stretching exercises. Therefore, stretching exercises during dialysis should be combined with routine nursing care for hemodialysis patients [23]. The results of the study by Dhudum and Bhore [25] also indicated the effectiveness of stretching exercises during dialysis. In addition, Albadr *et al*. [24], in a study examined hemodialysis patients who are dialyzed with fistula after performing sports exercises for 2 months in the form of stretching exercises, range of motion exercises, and isometric exercises. The results showed that intradialysis exercise can improve muscle strength and reduce muscle cramps caused by hemodialysis [24].
According to the results obtained from different studies, most of the studies conducted were consistent with the results of the present study, which means that the use of this non-invasive treatment plan as one of the non-pharmacological nursing interventions is valuable, cheap, applicable, and effective can reduce the pain of muscle cramps in these patients. The findings of the current research, while confirming and supporting the research hypotheses, showed that physical activity has a positive effect on muscle cramp pain in hemodialysis patients. Therefore, it is necessary for nurses to effectively provide advice and training appropriate to the condition of the disease to perform physical activities in hemodialysis patients. In addition, managers and officials of the health system should improve their health by adopting new measures and policies, as well as by holding educational programs and workshops related to the key role of physical activity in patients. These conditions can create an optimistic view over time in patients and their families.

Conclusion

This study was conducted to determine the effect of physical activity on muscle cramps in patients referred to the hemodialysis department. The results of this study showed that there was no significant difference between the average muscle cramp pain before the intervention in the control and intervention groups. However, there was a significant difference between the average muscle cramp pain scores after the intervention in the control and intervention groups, so after the intervention, the average muscle cramp pain score in the intervention group was reduced compared to the control group. The present study showed that physical activity was effective in muscle cramp pain. Therefore, considering the importance of the role of educational interventions in improving the health of patients and their caregivers, the managers of medical and health centers can improve the health of patients by adopting measures and educational programs and workshops related to teaching the key role of physical activity.

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