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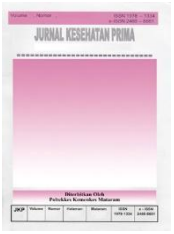

The Combination of Ankle Pumping Exercise and 30˚ Leg Elevation on Foot Edema in Chronic Kidney Disease

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Abstract
Chronic kidney disease is a condition in which progressive and irreversible kidney function disorders occur that the body fails to maintain metabolism, fluid, and electrolyte balance. Excess fluids and electrolytes in the body can cause circulation overload and edema. Edema not handled properly can cause complications in various body systems. Treatment that can be to reduce edema can be pharmacology and non-pharmacological. One of the non-pharmacological methods is ankle pumping exercise therapy with a combination of 30˚ leg elevation. To find the effectiveness of giving ankle pumping exercise therapy with a combination of 30° leg elevation to reduce the degree of edema in chronic kidney disease patients. This study used a randomized controlled trial (RCT) research design with a pre-posttest design with a control group. The number of samples is 58. Sampling uses probability sampling with a simple random sampling technique. The results of the Wilcoxon statistical test in the control group obtained significant results of 0.083 (p-value> 0.05), and the intervention group obtained significant results of 0.000 (p-value <0.05). The Mann-Whitney test found a difference between the two groups with a significance result of 0.000 (p-value <0.05). Ankle pumping exercise therapy with a combination of 30° leg elevation effectively reduces the degree of edema in chronic kidney disease patients.

Keywords: Ankle Pumping Exercise; Chronic Kidney Disease; Edema; 30° Leg Elevation

INTRODUCTION

In patients with chronic kidney failure (CKD) renal function is impaired which is progressive and irreversible so the body cannot maintain metabolism and fluid and electrolyte balance. According to Kovesdy, (2022), chronic kidney disease is one of several diseases that can be the biggest cause of death in 21 countries. The prevalence of CRF reaches > 10% of the world's population, which is estimated at around 843.6 million people, with 13.4% CRF stages 1-5 and 10.6% CRF stages 3-5. The global death rate associated with CRF increased by 41.5% between 1990 and 2017.

The fluid requirement is a basic need that must be met in patients with chronic kidney failure. When the body experiences excess fluid and electrolyte volume due to not paying attention to the amount of fluid consumed, it can cause the body's circulation to be overloaded, one of which is edema (Nurlina, 2018). Patients with chronic renal failure often develop edema caused by the inability of the body to excrete fluids (nephritic syndrome, associated with hypertension and low urine output). Untreated edema will affect the patient's quality of life and will cause complications in various body systems (Prastika et al., 2019).

Research by Hein et al., (2019) states that excess fluid in the body will worsen the body's condition and cause complications such as heart failure, pulmonary edema, and venous edema which can lead to death if not handled properly.

The role of nurses to prevent the occurrence of complications of edema in CRF patients is needed as a

form of comprehensive nursing care. Complementary nursing interventions are one of the nursing care provided by nurses to be carried out by patients at home independently. Ankle pumping exercise therapy combined with 30° leg elevation is a simple therapy that is easy to do, even patients can do therapy independently at home or in the hospital (Prastika et al., 2019).

In this case, the intervention was given as a complementary therapy as well to find out whether the administration of ankle pumping exercise therapy combined with 30° leg elevation therapy is effective in reducing the level of leg edema in patients with chronic kidney failure.

METHOD

This study used a randomized controlled trial (RCT) research design with a pre-post-test design with a control group. The research was conducted for 7 weeks from January to March 2023 at the respondent's house. The sample of this study was 58 respondents with chronic renal failure with leg edema, with 29 patients in the control group and 29 patients in the intervention group. The sampling technique uses probability sampling with a simple random sampling technique and meets the criteria.

Therapy ankle pumping exercise combined with a foot elevation 30˚ is given by lifting the leg 30˚ degrees and pushing the ankle in a position of flexion and extension. This therapy is carried out in 6 sessions within 3 days and takes 10 minutes for each session. This research has met ethical clearance with the ethical approval number: LB. 1.667/XII/HREC/2022.

RESULTS AND DISCUSSION

The most age group is the respondents aged 45-59 years. According to WHO, the age group of respondents in this study was in the middle age category. Faqih Fatchur et al., (2020), also mention that the increase in edema that occurs is due to the diameter of the patient's veins which is affected by age. The small diameter of the vein causes retention of blood flow and will increase rapidly, but if there is edema, it will take a long time for the edema to decrease.

1. Characteristics Respondent

Table 1. Characteristics Respondent

Characteristics	Frequence	Percentage (%)
Age		
<44 years	10	17.2
45-59 years	42	72.4
>60 years	6	10.3
Gender		
Man	35	60.3
Woman	23	39.7
Work		
Doesn't work	41	70.7
Employee	11	19.0
PNS/TNI/Polri	4	6.9
Self-employed	2	3.4
Education		
SD	8	13.8
SMP	20	34.5
SMA	24	41.4
Diploma/S1/S2/S3	6	10.3
Dietary History		
No	21	36.2
Liquid Diet	32	55.2
Liquid and Sodium Diet	5	8.6
Blood Pressure		
Normal	4	6.9
Pre-Hypertension	20	34.5
Grade 1 hypertension	27	46.6
Grade 2 hypertension	7	12.1
Drug Consumption		
No	39	67.2
Yes	19	32.8
Smoke		
No	54	93.1
Yes	4	6.9
Alcohol Consumption		
No	58	100.0
Yes	0	0

Clinically those who are more than 40 years old will lose certainly nephrons. The average age-related decline in renal blood flow (RBF) and glomerular filtration rate (GFR) per decade is 10 ml/min/1.73 m² from the age of 40 years.

Table 1 above shows that there are more men than women. With these data, it is assumed that men tend to be more at risk of experiencing edema when compared to women in CKD patients. In a study by

Arifa et al., (2017), it was explained that when viewed clinically, men have a 2x greater risk of developing chronic kidney disease than women. This happens maybe because women are considered to be able to pay more attention to their health and lifestyle than men, women are also considered to be able to take care of themselves and can manage the use of drugs.

The average respondent does not work after undergoing hemodialysis treatment and experiencing leg edema. Work that has a controlled level of activity is possible to help reduce the degree of edema experienced by patients. Patients with CRF are strongly encouraged to do activities or exercises that suit their body condition regularly. Arifa et al., (2017), stated that there is no significant relationship between work and chronic kidney failure.

As many as 41.4% of respondents have high school/vocational school education. In Sulistiyanto W..S & Prasetyaningrum, (2022), regarding the quality of life of CRF patients undergoing hemodialysis, it was stated that patients with a history of education at tertiary institutions showed lifestyle behaviors and work activities that were different from elementary, junior high and high school education. It can be concluded that the level of education can affect many aspects of life, including the health aspect.

The average respondent underwent a liquid diet after edema occurred according to the doctor's orders. Limiting the amount of fluid, sodium, and protein that is not controlled in patients with chronic kidney failure can exacerbate the edema experienced by patients. According to Arifrianto et al in Cholifah et al., (2021), it is explained that providing a good diet and nutrition in patients with kidney disease aims to achieve and maintain a good nutritional status of patients, prevent cardiovascular and vascular complications, and avoid uremic poisoning and other metabolic disorders that can be affected by nutrition, and cannot be overcome by hemodialysis measures.

The incidence of hypertension and chronic kidney failure has a significant relationship as evidenced by the fact that most respondents suffer from grade I hypertension. Uncontrolled hypertension can be a cause of chronic kidney disease, this is because the kidneys help filter waste and extra fluid from the blood during the filtering process. When blood vessels are damaged, the nephrons that filter blood do not receive enough oxygen and nutrients, which causes the nephrons to not function properly (Narsa et al., 2022).

According to Dhrik & Prasetya, (2019), uncontrolled hypertension will increase severe cardiovascular disease in patients with CRF undergoing hemodialysis. These cardiovascular complications are the main cause of mortality and morbidity in patients with chronic kidney failure.

The average patient consumes diuretic drugs and antihypertensive drugs. According to Dipiro in Habibi, (2022), diuretic drugs are indicated for conditions such as hypertension, edema, heart failure, certain kidney disorders, liver disorders and so on. Antihypertensive drugs are given to patients with chronic kidney failure to reduce blood pressure and slow down the course of kidney disease with or without hypertension. Giving the wrong drug dose can further injure the kidneys, but giving the right drug dosage for the right conditions can provide great benefits.

Table 1 also shows that the average respondent said he did not smoke, in line with research conducted by Harahap, (2018), where the incidence of chronic kidney failure tends to occur more in people who do not have smoking habits. In contrast to a study conducted by Hidayati et al., (2008), which showed that active and passive smoking were equally significant in increasing the incidence of terminal chronic kidney disease. Light smokers who consume one pack of cigarettes or less than one pack per day have a 2x greater chance when compared to non-smokers to experience albuminuria, while heavy smokers who consume one pack more per

day have a 2x greater chance of experiencing this. Albuminuria is a protein found in the urine that indicates decreased kidney function.

In this study, most of the respondents did not consume alcohol. Webster et al., (2017), stated that alcohol consumption will damage many organs in the body, especially the kidneys. Consuming alcohol will increase the risk of albuminuria and decrease the GFR rate < 60 mL/min/1.73 m² within 5 years. Alcohol or ethanol if consumed will undergo a series of biochemical processes. Approximately 90% of alcohol that is drunk will be metabolized by the body in the liver and the rest is excreted into the kidneys, including its metabolism. Alcohol metabolism will cause hypoxia in the liver and the formation of molecules containing reactive oxygen which can damage other components of body cells (Sandoval et al., 2017).

2. Edema Levels Before and After Giving Ankle Pumping Exercises with a Combination of Leg Elevation 30° in the Intervention Group

Table 2. Wilcoxon Test Results in the Control Group and Intervention Group

Degree of Edema	Variable	N	*Mean*	*Z*	*Sig. (2-tailed)*
Control Group	Pretest	29	*2,21*	*-1.732*	*0,083*
	Posttest	29	*2,31*		
Intervention Groub	Pretest	29	*2,34*	*-4.796*	*0,000*
	Posttest	29	*1,55*		

In the control group, the average difference in the degree of edema increased by 0.10 and the p-value was 0.083 which indicated that there was no effect of reducing the degree of edema before and after therapy. According to the researcher, the measurement of the degree of edema that experienced an increase in the control group was caused by external factors that could not be controlled directly by the researcher, for example, in patients who did not undergo a diet of fluids, sodium, protein, and different patient activity levels, which could cause different degrees of edema among respondents.

According to Aisara et al., (2018), in patients with chronic renal failure, the high degree of edema is due to reduced plasma osmotic pressure, sodium and water retention resulting from fluid accumulation. Due to the gravitational force, the excess fluid that occurs will accumulate in the peripheral parts such as the feet, making it easier for peripheral edema to occur than other symptoms of excess fluid.

The research conducted by Budiono & Rini Slamet Ristanti, (2019), also showed the results of the average degree of edema in the control group before grade II with a mean of 0.505 and the average after grade II with a mean of 3.50 with a p-value = 0.317. Research conducted by Kasron & Susilowati, (2020), regarding the effect of leg elevation in CHF patients also showed that in general there was no significant decrease in leg edema on the first day and third day in the control group.

In the intervention group, the difference in the average degree of edema decreased by 0.79 and the p-value was 0.000, which means that the intervention group experienced a decrease in the degree of edema. After being given action in the form of ankle pumping exercise therapy combined with 30° leg elevation, it was found that the degree of respondent's edema decreased in the intervention group. The decrease in the degree of edema is due to the extracellular fluid being pushed back to the heart through the blood vessels.

Ankle pumping exercise therapy is done when the patient's position is comfortable and ready, then taught how to push the ankle backward and forwards alternately, so that there will be muscle contractions that suppress fluid and veins which cause edema will be carried into the blood circulation and there will be an increase in regulation of the central nervous system, oxidation processes and the amount of potassium and sodium, oxygen transport capacity.

Ankle pumping therapy is carried out simultaneously with the provision of a foot elevation position by elevating the foot position as high as 30°, this elevation of the leg position uses the principle of earth's gravity so that it causes increased venous return and decreased edema because the pressure in the veins decreases when the leg position is at a higher elevation than the heart.

3. Analysis of the Effect of Ankle Pumping Exercise with a combination of 30° Leg Elevation on Edema Levels in the Control Group and the Intervention Group

Table 3. Mann Whitney test in the control and intervention groups

Karakteristik	Variable	N	Mean rank	*Asymp. Sig (2-tailed)*
Degree of Edema	Control	29	43,48	*0,000*
	Intervention	29	15,52	
Difference			27,96	

Between the control group and the intervention group, there was a difference of 27.96 with a p-value of 0.000 which indicated that there was a significant difference between the two groups. The results of the Mann-Whitney test showed that giving ankle pumping exercise therapy combined with 30° leg elevation had an effect on reducing the degree of edema compared to the group that received standard therapy from the hospital.

Analysis of differences in the degree of edema before and after being given treatment in the intervention group showed that there was a decrease in the degree of edema, whereas, in the control group, there was no decrease in the degree of edema but an increase in the degree of edema. The results of the analysis in the two groups showed that there were differences between the two so the result was that ankle pumping exercise therapy combined with a 30° leg elevation angle was effective in reducing leg edema in patients with chronic kidney failure. The ankle pumping exercise therapy combined with 30° foot elevation is carried out in 6 sessions over 3 days and takes 10 minutes for each session.

The average difference in the difference between pre and post-edema reduction in the intervention group was 0.79 while in the control group, it increased by 0.10. In a study conducted by Kang et al., (2016), regarding the edema index in peritoneal dialysis (PD) patients with 1-year mortality, the highest AUROC cut-off value was 0.372 in women and 0.371 in men. Another study conducted by Sukackiene et al., (2020), regarding the edema index (ECW/TWB), obtained a cut-off value of 0.4055. Based on the description above, if there is a decrease in edema> 0.405, it can be said to be significant.

According to Zuj et al., (2018), ankle pumping therapy is carried out by utilizing muscle contractions. Muscle contraction is part of blood circulation and this therapy will cause the flow from the blood vessels to return to the heart, through the blood vessels which can cause an increase in blood circulation through the muscles due to exercise. Blood flow to the muscles has increased due to vasodilation which causes stimulation of the nervous system, chemical reactions and chemical mechanisms will be directly related to the body's metabolism.

Elevation of the feet causes lymphatic flow and venous return from the lower extremities to the heart to increase. Gravity can affect peripheral arterial and venous pressure, so if the position of the feet is higher than the heart it will help reduce and increase the pressure in the periphery so that leg edema will decrease (Budiono & Rini Slamet Ristanti, 2019).

The combination of ankle pumping exercise therapy with 30° leg elevation will cause the veins to experience pressure due to muscle contractions and then an increase in regulation of the nervous system will increase the rate of the oxidation process of sodium, and potassium and be pushed to the maximum

into the blood vessels, and flowed throughout the blood vessels to reduce edema (Sukmana et al., 2020).

Research conducted by Bae & Kim, (2014), shows that ankle pumping exercises have a positive effect on lower extremity edema and lower extremity pain in nurses who are in the operating room. It is supported by the research of Prastika et al., (2019), that the analysis of the Wilcoxon Test shows that there is an effect of reducing edema in patients with kidney failure before and after the ankle pumping exercise therapy and 30° leg elevation in 2019 in Mojokerto with a p-value = 0.001.

Patients with kidney disease, including those who depend on dialysis or transplantation, should feel actively supported in their symptom management through the identification and targeting of unpleasant symptoms via a tailored palliative care approach. Such an ankle pumping exercise therapy and leg elevation as a non-pharmacological intervention may help minimize the burden and consequences of kidney disease, and lead to improved patient outcomes including health-related quality of life and better life participation. Nurse should know the unpleasant symptoms especially oedema and applied the procedure of ankle pumping exercise and leg elevation to the patients.

This study has some limitations. First, this sample size was small for intervention study. Second, this study did not control other therapies that may affect the results of the study such as liquid diets, low-salt diets, and drugs consumed by respondents. Therefore, it is recommended that future research on effectiveness of ankle pumping exercise therapy and leg elevation in managing edema in chronic kidney disease patients conducted in larger-scale studies to get the proper validation.

CONCLUSION

The results of this study indicate that ankle pumping exercise therapy combined with 30° leg elevation is effective in reducing leg edema in chronic kidney failure patients. It was proven by the fact that in the intervention group, there was a decrease in the degree of edema with an average decrease in the degree of edema of 0.79 and the control group the degree of edema did not decrease but increased with an average of 0.10.

Based on the results of data processing and research above, giving ankle pumping exercise therapy combined with 30° leg elevation in the intervention group was more effective in reducing edema in chronic kidney failure patients than the control group who only received therapy from the hospital.

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