Babali Nursing Research
2023, Vol. 4, No. 1, 161-169
https://doi.org/10.37363/bnr.2023.41222

Original Research

The Effect of Using Fluid Balance Application on Interdialytic Weight Gain in Stage V Chronic Kidney Disease Patients Undergoing Hemodialysis

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Article Info

Article history:
Received:
13 December 2022
Accepted:
28 January 2023

Keywords:
fluid balance, interdialytic weight gain, hemodialysis

Abstract

Introduction: Stage V Chronic Kidney Disease (CKD) is a condition that requires the patient to undergo hemodialysis for the rest of his life. Often hypervolemia occurs between two times of dialysis. Hypervolemia can lead to emergency conditions such as pulmonary edema and cardiac arrest. Interdialytic Weight Gain (IDWG) is an indicator of fluid intake during the interdialytic period. Calculating fluid balance per 24 hours helps patients with stage V CKD in controlling fluid intake. The purpose of this study was to identify the effect of using a fluid balance application on IDWG status in stage V CKD patients undergoing hemodialysis.
Methods: This study used a quasi-experimental design, with one group pre-test and post-test design. 24 respondents were selected by consecutive sampling technique.
Results: Statistical analysis using a paired t-test showed that there was an effect of using a fluid balance application on IDWG status in stage V CKD patients undergoing hemodialysis (p value = 0.000).
Conclusion: The application of fluid balance can be applied to patients with stage V CKD because it is effective in controlling hypervolemia.

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INTRODUCTION

Stage V Chronic Kidney Disease (CKD) is functional kidney damage with an estimated glomerular filtration rate of less than 15 ml/minute/1.73 m2 [1]. This condition requires patients with stage V CKD to undergo lifelong renal replacement therapy. One of the most widely used renal replacement therapy is hemodialysis. Hemodialysis is a substitute for the role of the kidneys in filtering blood to remove excess water, solutes, and toxins with the help of a dialyser [2].

The incidence of stage V CKD in 2018 was 131,636 patients, an increase of 2.3% since 2017 [3]. At the end of 2018, there were 554,038 (70.7%) patients undergoing hemodialysis. Meanwhile, the Indonesian Renal Registry reports that the number of new patients undergoing hemodialysis has doubled compared to 2017, namely 66,433 patients [4]. In Central Java alone, the number of hemodialysis patients is 7,906 patients [4]. Even though hemodialysis is a therapy that is in great demand, it still causes problems, especially with fluids.

Patients with stage V CKD must control fluid intake to prevent complications. Excess fluid causes edema of the extremities, cramps, hypertension, heart failure, and even an emergency condition, namely pulmonary edema [5]. Bouchard et al. in Claure-Del & Mehta explained that patients with a weight gain of more than 10% had significantly more respiratory failure, required mechanical ventilation, and sepsis [6]. Meanwhile, Ekinci et al. explained that excess fluid results in emergency cardiovascular conditions such as arrhythmias and cardiac arrest due to left ventricular hypertrophy [7]. Byod et al. in Claure-Del & Mehta added that excess fluid correlated significantly with increased mortality [6].

Often excess fluid conditions occur between two times of dialysis. Interdialytic Weight Gain (IDWG) is an indicator of the patient's fluid intake during the interdialytic period which can affect the patient's health status while undergoing hemodialysis therapy [8]. This condition can be monitored by calculating the patient's fluid balance per 24 hours. Fluid balance is a balance between expenditure and fluid intake in the body that allows the body's metabolic functions to work properly. Currently, one of the easiest and most frequently carried communication tools is a smartphone. The Google Play Store feature which is equipped with a fluid balance application can be accessed easily by everyone without paying. This of course can help patients with stage V CKD in controlling fluid intake.

Klinik Ginjal dan Hipertensi Lestari is one of the clinics in the city of Semarang, Central Java, which provides hemodialysis facilities. Based on the results of observations and interviews, 4 out of 5 hemodialysis nurses said that hemodialysis patients often come with excess fluid. Some patients say that this is usually done because they often feel thirsty, and their complaints have decreased after repeated hemodialysis. Based on the description above, the authors are interested in conducting research with the title "The Effect of Using Fluid Balance Applications on Interdialytic Weight Gain in Stage V Chronic Kidney Disease Patients Undergoing Hemodialysis".

METHODS

This study used a quasi-experimental design, with a one group pre-test and post-test design. The sample of this research was 24 respondents using non-probability sampling method with consecutive sampling technique. The inclusion criteria: aged 25-70 years, compos mentis, able to read and write, willing to be a respondent, undergo routine hemodialysis 2 times a week for at least 4 hours, have a smartphone. While the exclusion criteria: patients with hemodynamic disorders characterized by blood pressure ≤ 110/70 mmHg or ≥ 150/90 mmHg, pulse frequency ≤ 60 or ≥ 100 times per minute, respiration ≤ 16 or ≥ 20 times per minute, and temperature ≤ 365 0C or ≥ 375 0C.

The research instrument used weight observation sheets, general perceived self-efficacy questionnaires (validity test obtained r results 0.462 - 0.810 > 0.444, while the reliability test obtained Cronbach's alpha coefficient value 0.760 > 0.60), family support questionnaires, and fluid balance applications. Researchers teach how to use the fluid balance application to be applied for 24 hours. Then measure the patient's weight after the first hemodialysis session and before the second hemodialysis session. Then it is calculated in the IDWG formula. The data normality test was performed using the Shapiro-Wilk test. While statistical analysis using paired t-test.

This research has gone through a feasibility assessment from the ethics committee team of the Research and Community Service Unit of the Telogorejo College of Health Sciences with no 056/VII.KE/STIKES/2022. The ethical principles in this study include respecting human dignity by giving informed consent, maintaining the confidentiality of respondents by using coding as a substitute for identity, openness and fairness by ensuring that respondents receive the same treatment and benefits regardless of gender, religion, ethnicity, and others, as well as explaining the possible losses that arise.

RESULTS

Table 1 shows the mean age of the respondents in table 1 is 46.88 years (standard deviation 13.179) with a range of 25-70 years and an estimate of 95% believe that the mean age is between 41.31-52.44 years.

Table 2 shows that the proportion of sex in most respondents is male at 54.2% (13 respondents). The proportion of family support for the most respondents was good at 62.5% (15 respondents). While the proportion of self-efficacy in the most respondents was high at 62.5% (15 respondents).

Table 3 shows that the pre IDWG data (p = 0.577) and post IDWG data (p = 0.182) so that it can be concluded that the data is normally distributed (p> 0.05).

Table 4 shows that there is an effect of the use of fluid balance applications on interdialytic weight gain status in stage V chronic kidney disease patients undergoing hemodialysis (p <0.05).

Table 1

Distribution of respondent characteristics based on age at the Kidney Clinic and Sustainable Hypertension October 2022 (n=24)

Variable	N	Mean ± SD	Median	Min – Max	CI 95% (Min, Max)	
Age	24	46.88 ± 13.179	45.00	25 – 70	41.31	52.44

Table 2

Distribution of respondent characteristics based on gender, family support, and self-efficacy at the Kidney and Sustainable Hypertension Clinic October 2022 (n=24)

Variable	Category	Total	
		n	%
Sex	Men	13	54.2
	Female	11	45.8
	Total	24	100.0
Family Support	Low	3	12.5
	Moderate	6	25.0
	Good	15	62.5
	Total	24	100.0
Self Efficacy	Moderate	9	37.5
	High	15	62.5
	Total	24	100.0

Table 3

Data Normality Test

	Statistic	df	Sig.
IDWG Pre	0.966	24	0.577
IDWG Post	0.942	24	0.182

Table 4

The Effect of Using the Fluid Balance Application on Interdialytic Weight Gain Status in Chronic Kidney Disease Grade V Patients Undergoing Hemodialysis at the Kidney and Sustainable Hypertension Clinic October 2022 (n=24)

	Mean (s.b)	Difference (s.b)	IK 95%	P value
IDWG Pre	3.34 (1.81)	1.14 (1.28)	0.59 – 1.68	0.000
IDWG Post	2.20 (1.44)			

DISCUSSION

The results showed that the mean age of the respondents was 46.88 years with a range of 25 – 70 years. The results of this study are in line with IRR which states that the highest number of hemodialysis patients in Indonesia is in the age range of 45-54 years (30.82%) [4]. The results of the study by Somji et al. stated that the majority of hemodialysis patients in Tanzania were over 40 years old (81.1%) [9]. While the results of this study were also almost similar to the study of Isnaini et al. which stated that the highest number of hemodialysis patients at RSI Purwokerto was in the age range of 40-65 years (65.6%) [10].

Glomerular Filtration Rate (GFR) will decrease at the age of 30-40 years [11]. The aging process is also often associated with changes in kidney structure (glomerulus, tubules, including renal vascularization) and a decrease in the number of nephrons. This is supported by the research of Wang et al. which stated that over the age of 50 years there was a decrease in total kidney volume due to nephrosclerosis [12]. Denic et al. added that the aging process results in hypertrophy to compensate for the remaining nephrons [11]. In addition, old age is associated with risk factors such as hypertension and Diabetes Mellitus [13].

The results showed that the proportion of sex was mostly male. The results of this study are in line with URSDS that the incidence of stage V CKD in 2020 is more in males, namely 64.4% [3]. IRR also stated the same thing, that the incidence of stage V CKD in Indonesia in 2018 was more in males, namely 57% [4]. The results of this study are also in line with the research of Cahyani et al. which stated that the incidence of stage V CKD in males was higher than in females, which was 68.1% [14].

Stage V CKD in men is often associated with smoking status [12]. Smoking causes vascular disorders, one of which is atherosclerosis. This results in decreased blood supply to the kidneys and the occurrence of stage V CKD which is characterized by a GFR of less than 15 ml/min/1.73m2 [15]. Meanwhile, in women, the hormone estrogen is protective because it can control mitochondrial biogenesis and inhibit the growth of endothelial cells in the kidneys [16].

The results showed that the proportion of family support was mostly good. The results of this study are in line with the research of Rusiawati et al. which states that most family support for hemodialysis patients is good family support [17]. Hemodialysis patients have physical, psychological and social limitations so they will depend on their families including accompanying them during the dialysis schedule, reminding them to take medication, and even limiting fluids [18]. In addition, family support can have a positive effect because patients feel they have better self-esteem, better moods, and life becomes more meaningful [19]. This is supported by research by Winata et al. which states that to get a good quality of life, good family support is also needed [20].

The results of the study show that the proportion of self-efficacy is mostly high. The results of this study are in line with the research which stated that the most self-efficacy in hemodialysis patients is high self-efficacy [21] [22]. Self-efficacy is associated with the ability of hemodialysis patients to control behavior and determine the success of the therapy undertaken [23]. Hemodialysis is a treatment that is continuously carried out by stage V CKD patients so they must be actively involved in self-management [24]. This is supported by research by Wright & Wilson which states that stage V CKD patients with a high level of self-efficacy correlated with a high degree of independence in decision making [25].

The results of this study indicated that there was an effect of the use of fluid balance applications on interdialytic weight gain status in stage V chronic kidney disease patients undergoing hemodialysis ($p<0.05$). Stage V CKD is a progressive loss of kidney function and results in dependence on renal replacement therapy for the rest of his life [1]. Dialyser is an artificial tool as a substitute for the role of the kidney which functions to filter blood, remove excess fluids and toxins [2]. Non-compliance with fluid restrictions is a major problem in hemodialysis patients which can result in hypervolemia [26].

The increase in fluid volume in hemodialysis patients can be assessed by calculating body weight through the interdialytic weight gain (IDWG) parameter. Assessing fluid status periodically is one of the efforts to overcome the increase in IDWG by emphasizing the concept of dry weight [27]. The fluid balance application is a digital application that is easy to download and operate without having to pay in the Google Play Store feature. This application is aimed at hemodialysis patients to introduce the importance of limiting fluids, identifying fluids that enter and leave the body, and find out complications if they experience fluid overload.

Melianna's research said that the greater the patient's adherence to fluid restrictions, the smaller the occurrence of hypervolemia. Family support is one of the determining factors for behavior change [28]. Family support can provide motivation and attention to always remind dialysis patients to limit fluids [29]. In addition, self-efficacy also affects patients' self-confidence while undergoing hemodialysis in increasing motivation in complying with therapy and controlling fluids and preventing an increase in IDWG [30]. Self-efficacy is a belief that

comes from within a person who is able to provide positive energy.

STUDY LIMITATION

The limitations in this study are other variables that were not studied, for example, the length of time undergoing hemodialysis and level of education. In addition, a larger number of respondents is required.

CONCLUSION

The results of this study indicated that there was an effect of the use of fluid balance applications on interdialytic weight gain status in stage V chronic kidney disease patients undergoing hemodialysis ($p<0.05$). Furthermore, the application of fluid balance can be used to apply to patients with stage V CKD because it is effective in controlling hypervolemic conditions.

ACKNOWLEDGMENTS

The researcher would like to thank STIKES Telogorejo for providing funding for this research.

CONFLICTS OF INTEREST

In this study, no conflicts were found.

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