

Original Article

DURATION OF HEMODIALYSIS THERAPY CORRELATES WITH COGNITIVE FUNCTION OF CHRONIC KIDNEY DISEASE PATIENTS

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ABSTRACT

Background. When the kidneys are unable to eliminate waste and fluid from the body, hemodialysis is a treatment that is employed. Hemodialysis patients with kidney failure experience a reduction in cerebral perfusion and blood flow velocity, which leads to a cerebral edema, a decrease in intracerebral blood pressure, and a change in the brain's oxygen metabolism, all of which impair cognitive function. Numerous investigations on people with chronic renal disease have extensively documented cognitive impairments and dementia. This study purpose to determine cognitive function related to the duration of hemodialysis in chronic kidney disease patients.

Research Methods. This cross-sectional, correlative analytical investigation was carried out in January 2024 using a sample of around 26 participants who satisfied the inclusion requirements using complete sampling methodologies. Mini Mental State Examination (MMSE) questionnaires were used in this investigation. The Spearman's rho statistical test was used to assess the collected data.

Findings. There was no relationship between the two factors examined in patients with chronic renal disease, the length of hemodialysis treatment, and the cognitive function ($p = 0.311$).

Conclusion. Hospital would be able to maintain or reduce cognitive impairment in hemodialysis patients by offering education or conversation using a variety of techniques or media, particularly with relation to understanding about chronic kidney disease patients.

Keywords: Chronic Kidney Disease, Cognitive Function, Duration of Hemodialysis Therapy

BACKGROUND

The clinical condition known as kidney failure is defined by an irreversible deterioration in kidney function to the point that dialysis or kidney transplantation are necessary forms of permanent kidney replacement therapy [1]. When the kidneys are unable to eliminate waste and fluid from the body, hemodialysis is a treatment that is employed [2]. Patients with renal failure receiving hemodialysis may have cerebral edema, a reduction in cerebral perfusion and blood flow velocity, which lowers oxygen metabolism to the brain, and blood pressure reduction Intracerebral leading to a decline in cognitive function. The decline in cognitive function in hemodialysis patients occurs one year earlier compared to

the general elderly population [3]. The study showed that severe cognitive impairment occurred in 37% of 336 patients after undergoing routine hemodialysis for 2 years [4]. Cognitive impairments that may occur include declines in attention (awareness and concentration), memory and information storage, language disorders such as sensory and motor aphasia, visuospatial (inability to recognize direction), executive function disorders such as decreased calculation or counting ability, decision-making, and thinking. The diagnosis of cognitive impairment is very important as it is associated with an increased risk of mortality in dialysis patients and decreases their quality of life.

Worldwide, the number of individuals receiving renal replacement therapy is estimated to exceed 1.4 million, with an incidence growing at around 8%. The prevalence of Chronic Kidney Disease (CKD) in 2013 was 2,997,680 people, but in 2014 it increased to 3,091,240 people [5]. Medical record data from a private hospital in Driyorejo showed that the number of patients undergoing hemodialysis has also increased. At the beginning of its opening in October 2023, there were only 10 patients, which increased to 26 patients within 10 months. Of the 26 patients undergoing hemodialysis, nearly 84% had been undergoing the process for less than 12 months.

Cognitive impairment and Numerous investigations on people with chronic renal disease have extensively documented cases of dementia. Factors that may be involved in the decrease of cognitive function in people with chronic renal disease include the high prevalence of cardiovascular risk factors that cause subclinical damage, uremia, and its relationship with the accompanying metabolic disorders [6]. Neuropathological changes in the brain that occur in parallel with the kidneys have been identified as mechanisms explaining the relationship between CKD and cognitive function impairment. This includes atherosclerosis, microvascular disease, stroke, silent stroke, oxidative stress, and white matter lesions.

The cumulative impact of many vascular risk factors may be the mechanism behind cognitive abnormalities in small artery disease in individuals with chronic renal disease [2]. Increased asymmetric dimethyl-L-arginine inhibits the generation of nitric oxide when renal function deteriorates. Nitric oxide is a potent vasodilator and an inhibitor of platelet aggregation and vascular smooth muscle cell growth. Chronic ischemia damage to subcortical tissues may arise as a result of endothelial dysfunction brought on by decreased nitric oxide generation in the brain's tiny capillaries [7]. Based on the background presented above, the author is interested in researching the relationship between the duration of hemodialysis therapy and cognitive function in chronic kidney disease patients.

RESEARCH METHODS

This study was a correlational analytical study with a cross-sectional design conducted in January 2024 at a Private hospital in Driyorejo. The population of this study consists of all chronic kidney failure patients undergoing hemodialysis wards totaling 26 patients. Sampling was conducted using total sampling technique that met the inclusion criteria, which is 26 patients. The independent variable in this study is the duration of hemodialysis therapy, while the dependent variable is cognitive function. This study conducted interviews and the Mini Mental State Examination (MMSE) questionnaire [5]. The data obtained were analyzed using Spearman's rho statistical test through SPSS 16.0, with the test results indicating a significant correlation if the p-value < 0.05.

FINDINGS

The results are presented in the form of univariate analysis, which includes the distribution of respondents based on age, gender, education, occupation, marital status, duration of hemodialysis therapy, and cognitive function. Meanwhile, the bivariate analysis includes descriptive results of the cross-tabulation below.

Table 1. Distribution of respondents based on age, gender, education, occupation, marital status, duration of hemodialysis therapy, and cognitive function

Respondent Characteristics		n	%
Age	21-20 years	1	4
	31-40 years	4	15
	41-50 years	11	42
	51-60 years	10	39
Total		26	100
Gender	Male	14	54
	Female	12	46
Total		26	100
Education	No schooling	2	8
	Elementary	2	8
	Middle School	3	11
	High School	17	65
	Bachelor's Degree	2	8
Total		26	100
Occupation	Trader	3	15
	Not working	13	50
	Private sector	9	31
	Civil servant	1	4

		Total	26	100
Status Marriage		Married	25	96
		Single	1	4
		Total	26	100
Duration HD	Less than 12 months		15	58
	12-24 months		7	27
	>24 months		4	15
		Total	26	100
Function Cognitive	Normal cognitive		18	70
	Mild cognitive		8	30
	Moderate cognitive		0	0
	Severe cognitive		0	0
	Total		26	100

Table 1 shows the characteristics of the study respondents. The results of the data analysis indicate on the age characteristic. Some respondents aged 41 – 50 years That is, as many as 11 people (42%). In terms of gender characteristics, the majority of respondents were 14 people (54%) who were male. In terms of education characteristics, most respondents were 17 people (65%) with a high school education. In terms of employment characteristics, the majority of respondents, namely 13 people (50%), were housewives/unemployed. In terms of marital status characteristics, 25 people or almost all respondents (96%) were married. In terms of the duration of hemodialysis therapy, the majority of respondents, namely 15 people (58%), had undergone hemodialysis therapy for less than 12 months. In terms of cognitive function characteristics of hemodialysis patients, the majority of respondents, namely 18 respondents (70%), had normal cognitive status.

Table 2. Cross-tabulation of duration and cognitive function

Duration	Cognitive Function				Total	
	Normal Cognitive Function		Mild Cognitive Impairment			
<12	12	80%	3	20%	15	100%
12-	3	43%	4	57%	7	100%
>24	3	75%	1	25%	4	100%
Total	18	70%	8	30%	26	100%

Spearman test, Correlation Coefficient (r) = 0.207, Significance (p) = 0.311

Table 2, results of the calculations obtained a p-value of 0.311 where $p > 0.05$ which means there is no correlation between the two variables tested. The strength of the correlation value (r)= 0.207, which means the strength of the correlation is weak and the direction of the correlation is negative.

DISCUSSIONS

The duration of hemodialysis is closely related to the efficiency and adequacy of hemodialysis, so the duration of hemodialysis is also influenced by the level of uremia due to the progressive deterioration of kidney function and its comorbid factors, as well as the acceleration of blood flow and the speed of dialysate flow [6]. However, the longer the hemodialysis process, the longer the blood remains outside the body, thus requiring more anticoagulants, with the consequence of more frequent side effects [7].

A prolonged hemodialysis process generally causes physical stress; patients will experience fatigue, headaches, and cold sweats due to low blood pressure. But this will also affect the psychological state of the patients. Patients will experience disturbances in thinking and concentration as well as disturbances in social relationships. All these conditions will lead to a decrease in the quality of life of patients with chronic kidney disease undergoing hemodialysis [8]. Decreased kidney function begins to occur at the age of 30 and above. Then at the age of 60, physiological changes occur with a decrease in the population of nephrons and the absence of regenerative ability, leading to a decrease in kidney function to 50% of that at age 30 [4].

From the above research, it can be concluded that the majority of respondents have undergone hemodialysis therapy for less than 12 months, which means that more respondents have just started hemodialysis therapy. Among the 58% of respondents who have undergone hemodialysis therapy for less than 12 months, there is 1 patient in the age group of 21-30 years, and in the age group of 31-40 years, there are 4 people, with 8 people in the age group of 41-50 years and 2 people in the age group of 51-60 years [5].

The cognitive function examination using the MMSE questionnaire includes orientation function, registration, attention and calculation, recall, and language. In this study, it was found that 70% of respondents experienced mild cognitive impairment, showing deficiencies in attention and calculation functions. More than half (50-80%) of patients with mild cognitive impairment will suffer from dementia within the next 5-7 years. This is why early detection is necessary to prevent further decline in cognitive function [9]. In addition, cognitive function is influenced by factors such as age, gender, education level, and physical activity.

The results of the Spearman test indicate that there is no relationship between the duration of hemodialysis therapy and the cognitive function of patients with chronic kidney disease at RS Petrokimia Gresik Driyorejo, where the p-value is 0.311 and > 0.05 . In this study, patients undergoing hemodialysis therapy for less than 12 months with normal

cognitive function numbered 12, patients with mild cognitive impairment numbered 3, patients undergoing hemodialysis therapy for 12-24 months with normal cognitive function numbered 3 and with mild cognitive impairment numbered 4, while patients undergoing therapy Three patients undergoing hemodialysis for more than 24 months had normal cognitive function, while one patient had mild cognitive impairment.

The mechanism of cognitive deficit in small vessel disease in patients with chronic kidney disease may involve the cumulative effects of several vascular risk factors [10]. As with the decline in kidney function, increased asymmetric dimethyl-L-arginine suppresses nitric oxide synthesis. Nitric oxide is an inhibitor of vascular smooth muscle cell proliferation, platelet aggregation, and a strong vasodilator [11]. Endothelial dysfunction due to reduced nitric oxide production in the small vessels of the brain may contribute to the development of chronic ischemic damage to subcortical structures. In patients receiving hemodialysis, recurrent episodes of hypotension during treatment can lead to further damage to the ischemic circuits sensitive to frontal-subcortical areas due to arteriosclerosis of small vessels, calcification, and a deficiency of nitric oxide, which may tend to disrupt the normal autoregulation mechanisms and blood flow to the anterior brain structures [12].

The factors that may contribute to cognitive function impairment in patients with chronic kidney disease include the high prevalence of cardiovascular risk factors that cause subclinical damage, uremia, and its relationship with abnormalities. metabolic disorders that follow it [13,14]. Other factors that may play a role in the occurrence of cognitive function disturbances in CKD are anemia, which usually occurs in advanced stages of CKD [15].

Based on the results of the research that has been conducted, it is intended for; The First is, Hemodialysis Patients, Both patients and their families should enhance their information about preventing cognitive function decline, which is expected to motivate and provide support as well as increase awareness to engage in activities that can minimize cognitive function decline. The Second is for Health Institutions, this research can provide suggestions for health institutions to enhance efforts to prevent cognitive function decline in hemodialysis patients through various methods or media, especially regarding knowledge related to chronic kidney disease to maintain or minimize cognitive function disturbances in hemodialysis patients. And last, is for Other Researchers that It is recommended for fellow nurses to conduct further research with a larger sample size, so that cognitive function can be compared between patients with hemodialysis therapy duration of <12 months and >24 months.

CONCLUSIONS

From the results of the research and discussion, conclusions can be drawn to answer the objectives of the study as follows; Firstly, the duration of hemodialysis therapy in patients with chronic kidney disease is less than 12 months (58%). Secondly, the cognitive function in patients with chronic kidney disease is mostly normal cognitive function (73%). Last but not least, there is no relationship between the duration of hemodialysis therapy and the cognitive function of patients with chronic kidney disease.

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