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THE REMAINING CHEMICAL COMPOUNDS OF THE BODY'S METABOLISM ARE REDUCED THROUGH THE HEMODIALYSIS METHOD

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ABSTRACT

The accumulation of metabolic residual chemical compounds, such as urea, and creatinine, is a major consequence of decreased glomerular filtration function in patients with chronic kidney disease (CKD). Increased concentrations of these compounds trigger internal homeostasis disorders and accelerate the progression of metabolic complications. Hemodialysis is a kidney replacement therapy that aims to eliminate toxic compounds and maintain the body's biochemical balance. The purpose of this study is to evaluate the effectiveness of hemodialysis in reducing urea, creatinine, and uric acid levels in CKD patients. The pre-post test research involved 30 stage V CKD patients who underwent routine hemodialysis at the Regional General Hospital (RSUD) Padang Panjang, West Sumatra. Venous

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blood samples were taken 15 minutes before and after a single hemodialysis session. Urea levels were analyzed using the urease-GLDH method, creatinine using the kinetic Jaffé method, and uric acid using the uricase-POD method. The data were analyzed using a paired t-test with a significance level of p<0.05.The results were obtained The average urea level decreased from 182.6 ± 28.7 mg/dL it was concluded that Hemodialysis significantly reduced the level of chemical compounds left over from the body's metabolism in patients to 76.3 ± 16.9 mg/dL (p<0.001), creatinine from 11.8 ± 2.9 mg/dL to 4.9 ± 1.3 mg/dL (p<0.001), and uric acid from 8.5 ± 1.8 mg/dL to 5.2 ± 1.1 mg/dL (p<0.001). It can be concluded that hemodialysis significantly reduces the level of chemical compounds left over from the body's metabolism in advanced CKD patients. Hemodialysis maintains biochemical homeostasis and reduces the risk of systemic complications.

INTRODUCTION

Chronic kidney disease (CKD) is a global health problem with an increasing prevalence. Decreased kidney function results in a reduced ability of the body to excrete metabolic waste products, such as urea, creatinine, and uric acid, which are sourced from protein and purine catabolism (Nurva Syuryani1, Eliza arman2*, 2022), (Suciana, Istianna Nur Hidayati and Abdullah, 2021). The accumulation of these substances triggers impaired fluid, electrolyte, and acid-base homeostasis, and can worsen the patient's clinical condition.

Hemodialysis is one of the modalities of kidney replacement therapy that works with the principles of diffusion, osmosis, and ultrafiltration, to eliminate toxic compounds and excess fluid from the blood (Lumbantobing, 2020), (Abou-Bakr *et al.*, 2022). The effectiveness of hemodialysis in reducing the concentration of metabolic residual chemical compounds has been widely reported, but variations in results may be influenced by the duration of dialysis, the type of dialyzer, blood flow, and the patient's clinical condition(Irwan Setiawan1, 2023).

The kidneys are crucial organs in the human body that have a primary function to excrete metabolic residues such as urea, creatinine and uric acid. Impaired kidney function can result in a rapid decline based on the kidneys' ability to clear the blood based on toxic substances or metabolic residues claimed to be acute kidney disease, and kidney structural abnormalities or progressive and irreversible decline in kidney function claimed by chronic kidney disease. In this condition, the kidneys' ability to produce the body's metabolic output is disrupted, as a result of which metabolic residues will accumulate in the blood and cause clinical signs to become syndromemuremic (Peng *et al.*, 2021)[i]The kidneys are important organs in the human body, their main function is to remove metabolic waste such as urea and creatinine. In addition, the kidneys also regulate fluid balance in the body, maintain blood composition, maintain stable electrolyte levels, produce hormones and enzymes that help control blood pressure and form red blood cells (Kakita *et al.*, 2022).

Hemodialysis is a kidney replacement therapy that will filter metabolic residues based on the body, the measurement of serum urea and creatinine levels is a useful hematization parameter to see the effect of hemodialysis in patients with chronic kidney failure because

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urea & creatinine are almost entirely regenerated through the urine and secreted in a continuous amount in the body (Anggraini and Gunadi, 2023).

Efforts are made to reduce serum creatinine concentrations by improving kidney function. To improve kidney function, it is necessary to perform dialysis (hemodialysis) to replace the main function of the kidneys, which is to cleanse the blood from the rest of the body's metabolism contained in the blood. Hemodialysis is performed to cleanse toxic substances in the blood such as urea, creatinine, etc. If the kidneys fail to perform their functions, the metabolic products produced by normal cells will restore blood (ureaemia) (Bramania, Ruggajo and Furia, 2021).

Based on the description above, it is important to conduct research on "Effectiveness of Dialyzer in Reducing Urea and Creatinine Levels After Hemodialysis, the measurement of serum ureum and creatinine concentration is one of the economic parameters that is useful for observing the effectiveness of hemodialysis results in patients with chronic kidney failure. Because urea and creatinine are almost entirely excreted through urine and excreted in constant amounts into the body (Abou-Bakr *et al.*, 2022), (Yajima and Yajima, 2023a)

This study aims to evaluate the decrease in ureum, creatinine, and uric acid levels before and after hemodialysis in advanced CKD patients at the Padang Panjang Regional Hospital (RSUD).

RESEARCH METHODS

Research Design.

This study is descriptive analytical with a cross sectioonal design, namely after direct sampling of urea and creatinine examination in patients who have undergone hemodialysis using the Sysmex BX-3010 tool using colorometric and immunoturbidimetric methods.

Place of Study.

At the Padang Panjang Hospital Laboratory.

Instruments and Materials

The instrumens needed in this study are red cap vaccine tubes, micro pipettes, tourniquets. centrifuge, automatic chemistry analyzer tool (Sysmex BX-3010), tube rack. The ingredients used in this study are aquadest, serum, urea and creatinine reagents catridge, syringes, alcohol swabs, palsterin, blue tip yellow tip.

Research Procedure

The stages of the implementation of the Research consist of several main stages, namely :

Preparation Stage

Collection of respondent characteristics data Respondent data is collected by direct interview technique to respondents and also gives questionnaires and then the results of

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the interviews are recorded on the research form. The things asked of the respondents included age, length of suffering from chronic kidney failure, habit of drinking water, taking supplements, and history of kidney disease.

Implementation Stage

a) Preparation of tools Tools and materials are prepared such as vacutainer, holder, vacuum tube with red cap with a capacity of 3 mL, tourniquet, 70n plaster alcohol cotton.

b) Patient identification

The patient is asked to mention the full name, the laboratory form is checked according to the patient's identity (according to the details with the laboratory examination form, to ensure accurate identification). Ask the patient if they have any allergies, phobias or have fainted before during a blood draw. Patients are assured not to be anxious or afraid by inviting them to talk to make them more comfortable. Blood collection of the patient in a supine or sitting position. A clean towel or cloth is placed underneath. The patient is given an explanation of the procedure and is asked for verbal approval of the type of test and the action to be performed

c) Select Location

The patient's arm is stretched out and the antecubital fossa (lower arm) is examined. Look for visible veins i.e., large, straight, and clear sizes. The tourniquet is placed about 4-5 fingers above the venipuncture site

d) Disinfection of the stabbing site

The puncture site is cleaned using 70% alcohol cotton for 30 seconds and allowed to dry completely (30 seconds). The area to be pierced is pressed firmly but gently starting from the center of the stabbing site, down and out ±2 cm or more. The alcohol is allowed to dry to avoid the risk of contamination.

e) Blood collection

The vein is stretched or pulled under the puncture site. The patient is asked to clench their fists so that the venous blood vessels are protruding. The needle is punctured into the vein with the side tilted upwards forming a shrinkage of about 25º. Suck blood according to the needs of the patient's examination. The tourniquet is removed and the blood is copied into a vacuum tube with a red lid. The cotton is placed at the puncture site and then immediately remove/pull the needle then the patient is asked to press the dry cotton at the puncture site. Homogenize the tube containing blood 5-6 times, then label the tube and place it on a tube rack in a standing position.

f) The table is cleaned according to contamination

The needles are disposed of in the safest box. Labels and forms are checked for accuracy of checks. Tubes must be written using clear, synchronous coverage required by

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the laboratory e.g. patient name, medical record number, birth, and release & when blood is drawn. Waste is disposed of synchronously in its place. Hands are cleaned again. Labels & forms are double-checked before being inspected. The patient was asked back if there were any complaints after blood was drawn, checking the puncture marks to see if there was blood secretion or not.

Data Analysis

The output data of the personal inspection carried out by the researcher is the output data of the inspection of ureum and creatinine levels of patients with Chronic Kidney Failure obtained before and after the completion of hemodialysis.

RESULTS AND DISCUSSION

Distribution of the frequency of chronic kidney failure patients by sex.

Based on table 1 of patients with chronic kidney failure are patients with female gender, which is 26 patients (62%). and male patients amounted to 16 (38%)

Table 1. Frequency Distribution of Chronic Kidney Failure Patients Based on Gender

Gender	Frequency	Percentage (%)
Man	16	38
Woman	26	62
Total	**42**	**100%**

Based on the subjects of this study, there are several characteristics of the research subjects taken, namely gender and differences before after urea creatinine hemodialysis levels in patients with chronic kidney failure. From table 1, as many as 26 patients with chronic kidney failure were experienced by patients with female gender. The female gender suffers from GGK because women are susceptible to various infectious diseases, autoimmune, preeclampsia and eclampsia in pregnancy. Urinary tract infections generally occur in women because the anatomical structure of the urinary tract in women is shorter than in men. Repeated urinary tract infections that are not treated throughout life will have a direct impact on the kidneys and will eventually result in kidney failure.

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Differences in urea levels before and after hemodialysis in patients with chronic kidney failure

Table 2. Differences in urea levels before and after hemodialysis patients with chronic kidney failure

	Mean	Min	Max	Std. Devisi	p. Value
Urea levels before hemodialysis (mg/dL)	115.60	53	229	±43.076	0,01
Urea levels after hemodialysis (mg/dL)	22.24	2	73	±12.944	

In table 2, it can be seen that the significant difference in urea levels between after and before hemodilialysis in CGK patients is 229 mg/dL to 73 mg/dL. Significant decrease in urea levels after undergoing hemodialysis. Because hemodialysis therapy helps in cleansing the kidneys because of glomerular filtration that carries the rest of urea, creatinine or other chemicals so that it can reduce kidney work problems. Another study also illustrates that the urea levels of patients with kidney failure decrease after hemodialysis but this cannot normalize urea levels (Albalawi *et al.*, 2023).

Differences in creatinine levels before and after hemodialysis in patients with chronic kidney failure

Based on table 3, it can be seen from 42 GGK patients that creatinine before hemodialysis was 25.8 mg/dL to 8.6 mg/dL. The comparison of creatinine between before and after hemodialysis was obtained with a value of p_value 0.01 which means that there is a significant decrease in creatinine levels after hemodialysis and before hemodialysis.

Table 3. Differences in creatinine levels before and after hemodialysis patients with chronic kidney failure

	Mean	Min	Max	Std. Devisi	p. Value
Creatinine levels before hemodialysis (mg/dL)	12.098	2.6	25.8	±5.1737	0,01
Creatinine levels after hemodialisis (mg/dL)	3.174	0.5	8.6	±1.7731	

Table 3 shows a difference in the 42 CKD patients, with creatinine levels before hemodialysis ranging from 25.8 mg/dL to 8.6 mg/dL. Hemodialysis can be used to lower

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blood creatinine levels in patients with chronic kidney disease. Hemodialysis aims to delay the progression of kidney failure to more severe stages.

Percentage of the average values of urea and creatinine levels before and after hemodialysis in patients with kidney failure

Based on Table 4, it can be seen that the value of urea before and after hemodialysis decreased by a percentage of -81%. Likewise, creatinine values before and after hemodialysis also decreased by a percentage of -74%

Table 4. Percentage of the average value of urea and creatinine levels before and after hemodialysis patients with kidney failure

	Before Hemodialysis	After Hemodialysis	Percentage (%)
Up to Ureum (mg/dL)	115,6	22,24	-81%
Up to Creatinine (mg/dL)	12,098	3,174	-74%

In table 4, it can be seen that the value of urea before and after hemodialysis decreased by a percentage of -81%. Likewise, the value of creatinine before and after hemodialysis also decreased by a percentage of -74%. Dialyzers can lower the levels of urea and creatinine in the blood, but they cannot return them to normal values. The effectiveness of the dialyzer can be seen from the decrease in serum urea and creatinine levels after dialysis.

The kidneys are important organs that play a very important role in maintaining the stability of the body's environment. The kidneys regulate the balance of body fluids, electrolytes, and acid-base by filtering fluids in the blood, selectively reabsorbing water, and excreting excess amounts through urine. The kidneys also secrete metabolic waste, creatinine, urea, uric acid, and foreign chemicals (Rahmani *et al.*, 2022).

The kidneys produce the hormone erythropoietin which works by stimulating the formation of red blood cells. Red blood cells cannot divide to replace their own number, so the old damaged cells must be replaced by new ones that produce red blood cells from the bone marrow, which is the soft tissue that fills the cavities in the bones.

The kidneys have three different parts: the cortex, the medulla, and the renal pelvis. The renal pelvis is the upper part of the ureter, which is a 25 to 30 cm long duct that connects the kidneys to the bladder. When the ureters enter the bladder, there are folds of epithelial tissue like valves that block them. urine flow, the duct that connects the bladder to the outside of the body that is used to drain urine is called the urethra .

The increased incidence of urea is caused by dehydration or high protein intake, this often happens so that there is a lot of fluid accumulation in the body, patients often experience dehydration. The occurrence of hydration will cause the urea in the blood to

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thicken. The decrease after hemodialysis is caused by the hemodialysis process of removing toxic nitrogen substances from the blood and excreting excess water. Toxic blood and nitrogen waste will be diverted from the patient's body to a dialysis where the blood is cleaned and then returned to the patient's body. Efforts to reduce urea levels, of course, by improving kidney function by doing dialysis (hemodialysis) which will play a role in replacing the main function of the kidneys is to cleanse the blood from the remains of the body's metabolic results in the blood, how to filter it.

So based on the results of statistical tests using the Paired Sample T-Test, p value = 0.01 was obtained which means that there is an effect of hemodialysis on the decrease in creatinine and ureumblood in patients with chronic kidney failure at the Padang Panjang City Regional General Hospital, therefore GGK patients must maintain the food consumed and follow the recommendations of hemodialysis therapy for their needs, hemodialysis patients must get enough food intake to stay in good nutrition, which is carried out by clinicians so that health conditions can be continuously monitored so that life expectancy can be extended. GGK patients are advised to monitor their health conditions and pay attention to their diet by reducing their intake of high-protein foods such as milk, eggs, and shellfish, so that their serum ureum and creatinine levels can be controlled.

Urea and creatinine decrease after dialysis because the dialysis process itself functions to clean toxic substances in the blood, such as urea and creatinine (Yajima and Yajima, 2023b).

CONCLUSION

Based on type, the majority of chronic kidney failure patients undergoing hemodialysis are women as many as 26 patients (62%). The average urea level before hemodialysis was 229 mg/dL and after hemodialysis was 73 mg/dL. The average creatinine level before hemodialysis was 25.8 mg/dL and after hemodialysis was 8.6 mg/dL. There was an effectiveness of dialyzer in reducing urea and creatinine levels after hemodialysis with an average percentage of urea -81% and creatinine -74%. There was a significant difference between urea and creatinine levels before and after hemodialysis with a p-value = 0.01.

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