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The effect of end-stage renal failure and Cuperphan membrane on several biochemical parameters in hemodialysis patients at Al-Ramadi Teaching Hospital, Iraq

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ABSTRACT

Purpose: Dialysis is a common treatment used for patients with chronic kidney disease (CKD), where a dialysis filter is used to remove waste products and excess fluid from the blood. The choice of dialysis filter can significantly impact the biochemical parameters of patients undergoing dialysis. This study aimed to investigate the effect of Cuprophane dialysis filter on the biochemical parameters of 100 chronic kidney disease patients undergoing three consecutive dialysis sessions at Ramadi Teaching Hospital in Iraq.*Methods*: Blood samples were collected from a total of 200 individuals, including 100 patients with CKD at Al-Ramadi Teaching Hospital in Iraq and 100 control subjects who were matched for age and gender as healthy control group. Samples were taken both before and immediately after three consecutive hemodialysis sessions for the CKD patients. Twenty blood parameters were measured for each sample using standard laboratory methods. The mean and standard deviation (SD) of each parameter were calculated, and ANOVA (Analysis of Variance) were used to determine the significance of differences between pre- and post-dialysis values.*Results:* Before dialysis, the patients had significantly higher levels of blood urea nitrogen (BUN), creatinine, potassium, glucose, uric acid, and total bilirubin, and significantly lower levels of serum total protein (STP) compared to the control group. After three dialysis sessions, the patients had significantly increased levels of serum cholesterol, triglycerides, amylase, and alkaline phosphatase (ALP), while the D.bilirubin level showed no significant difference compared to the control group.In contrast, after three dialysis sessions, the patients had significantly decreased levels of serum albumin, high-density lipoprotein (HDL), calcium, sodium, aspartate transaminase (AST), alanine transaminase (ALT), and total bilirubin (T.Bilirubin). Furthermore, the results indicated that the Cuprophane dialysis filter had differential effects on the levels of certain parameters before and after dialysis.Specifically, the dialysis membranes increased the levels of lactate dehydrogenase (LDH), decreased the levels of uric acid, serum potassium (S.K+), urea, and chloride (Cl-) to below the values of the control group, and reduced the high levels of Cr and Glu. These reductions brought the levels of creatinine and glucose to the control group levels after dialysis.*Conclusion:* In conclusion, the use of Cuprophane dialysis filter in chronic kidney disease patients led to significant changes in various biochemical parameters. The results highlight the importance of considering the type of dialysis filter used and monitoring the biochemical parameters of patients undergoing dialysis..

INTRODUCTION

Chronic kidney disease (CKD) is a prevalent and serious medical condition that affects millions of people worldwide. It is characterized, by a gradual and progressive decline in renal function which can eventually lead to kidney failure if left untreated. One of the most common treatments for CKD is dialysis, which involves the use of a machine to filter waste products from the blood and remove excess fluids from the body[1]. There are several types of dialysis, including hemodialysis, peritoneal dialysis, and continuous renal replacement therapy. Hemodialysis involves the use of an artificial kidney machine to filter the blood, while peritoneal dialysis uses the lining of the abdominal cavity as a natural filter[2]. Continuous renal replacement therapy is a form of dialysis that is typically used in critically ill patients, and involves the continuous removal of waste products and excess fluids from the blood.While dialysis is an effective treatment for CKD, it can also have significant effects on the results of medical tests. This is because the process of dialysis alters the levels of various substances in the blood, such as electrolytes, creatinine, and urea. For example, during hemodialysis, there is a rapid decrease in the concentration of creatinine in the blood due to the removal of this substance by the dialysis machine. This decrease can affect the accuracy of creatinine-based estimates of kidney function, such as the estimated glomerular filtration rate (eGFR)[3].

In addition to creatinine, dialysis can also affect the levels of other substances in the blood, such as potassium, calcium, and phosphate. These changes can lead to inaccuracies in test results, which can make it more difficult for healthcare providers to properly diagnose and treat their patients.

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For example, hyperkalemia (high potassium levels) is a common complication of CKD that can be managed with medication. However, the levels of potassium in the blood can fluctuate significantly during dialysis, making it challenging to accurately monitor and manage this condition[4], [5]. To address these challenges, healthcare providers must be aware of the effects of dialysis on medical tests and take steps to ensure that their patients receive the most accurate diagnoses and treatments possible. This may involve adjusting medication doses or relying on alternative tests to monitor kidney function and other important parameters. Additionally, researchers and medical professionals can work to develop new tests and techniques that are better suited to patients undergoing dialysis, which could help to improve the overall quality of care for these individuals[6,7].

The effect of CKD on the body organs

The factors associated with chronic kidney failure lead to the accumulation of harmful waste products in the body and an increase in fluid and electrolyte imbalances. These imbalances can have significant effects on various organs and systems in the body, including the cardiovascular system, the skeletal system, and the central nervous system. One of the most common complications of chronic renal failure is cardiovascular disease. This is due to the kidneys' critical function in controlling the body's fluid balance and blood pressure. When the kidneys fail, blood pressure can rise, and excess fluid can accumulate in the body, which can increase the risk of heart disease and stroke[8,9]. As the kidneys play a significant role in controlling the levels of calcium and phosphorus in the body, chronic renal failure can also result in bone disease. These minerals may build up in the blood when the kidneys fail, which could lead to bone loss and raise the risk of fractures[10]. In addition to these complications, chronic kidney failure can also have significant effects on the central nervous

system. This is because various neurotransmitters and hormones, including as dopamine and parathyroid hormone, as well as their amounts in the body are regulated by the kidneys. These levels can become out of balance when the kidneys fail, which can result in neurological symptoms including sadness and cognitive decline[11].

Dialysis can help to mitigate some of these effects by removing excess fluids and waste products from the body. However, dialysis can also have its own side effects, such as low blood pressure, muscle cramps, and infections. Additionally, the process of dialysis can alter the levels of various substances in the blood, which can affect the accuracy of medical tests and make it more difficult to monitor and manage the health of patients with, chronic kidney failure[3,12].

Hemodialysis

A life-sustaining treatment for people with chronic renal failure is dialysis. When the kidneys are unable to carry out these duties as well as they once did, this procedure aids in the removal of waste materials and extra fluid from the body. Hemodialysis and peritoneal dialysis are the two basic forms of dialysis. Peritoneal dialysis uses the lining of the abdomen to filter blood inside the body, whereas hemodialysis uses a machine to filter blood outside the body. Hemodialysis and peritoneal dialysis are the two basic forms of dialysis. Peritoneal dialysis uses the lining of the abdomen to filter blood inside the body, whereas hemodialysis uses a machine to filter blood outside the body. In both types of dialysis, a specialized filter is used to remove waste products and excess fluids from the blood [2,3]. These filters, known as dialyzers, are made up of semipermeable membranes that allow small molecules to pass through while retaining larger molecules like proteins and blood cells. One of the main challenges of dialysis is maintaining the proper balance of electrolytes in the body, such as sodium, potassium, and calcium [5,13]. Dialysis can cause significant shifts in electrolyte levels, which can lead to complications like low blood pressure, muscle cramps, and arrhythmias. In addition to electrolyte imbalances, dialysis can also affect the levels of other substances in the blood, such as glucose, bicarbonate, and albumin. Despite these challenges, dialysis is a critical treatment for individuals with chronic kidney failure. It can aid in enhancing quality of life, extending survival, and avoiding kidney failure-related consequences like cardiovascular disease, bone disease, and neurological symptoms. However, further study is required to enhance the security and efficiency of dialysis and create fresh therapies for chronic renal failure [4,8,14].

Hemodialysis membranes

Hemodialysis is a type of renal replacement therapy used to treat individuals with chronic kidney disease. During hemodialysis, blood is removed from the body, filtered through a dialyzer, and then returned to the body. Hemodialysis can help to remove excess fluid and waste products from the blood when the kidneys are no longer able to perform these functions adequately. The dialyzer is the key component of the hemodialysis system, and there are different types of filters used in hemodialysis. The most common types of filters used in hemodialysis are [6,15]:

a- Cellulose-based filters: Cellulose-based filters are made of plant fibers and are the most widely used filters in hemodialysis. These filters are biocompatible and can be reused multiple times, such as:-

1- A Vitamin E-coated cuprophane (VE) dialyzer is a type of dialyzer used in kidney disease treatment when conventional kidney function is compromised. It consists of a membrane made of cuprophane (a type of cellulose-based material) that is coated with vitamin E, which acts as an antioxidant to protect against oxidative stress during the dialysis process. This type of dialyzer is believed to have advantages

over conventional dialyzers in terms of biocompatibility and reduction of inflammation [16].

b- Synthetic filters: Synthetic filters are made of synthetic materials and are often used in patients who are sensitive to cellulose-based filters, Such as :-

1- Polysulfone filters: These filters are made from a synthetic polymer and are less prone to clotting than cellulose acetate filters. They are also more durable and require less frequent replacement. However, they are less permeable than cellulose acetate filters and may not be suitable for individuals with high blood flow rates [17].

2- Polyethersulfone filters: These filters are similar to polysulfone filters but are made from a different type of synthetic polymer. They are highly durable and less prone to clotting than cellulose acetate filters. They are also highly permeable and suitable for individuals with high blood flow rates [5].

c- High-flux filters: High-flux filters are a type of synthetic filter that have larger pores than traditional filters. These larger pores allow for the removal of larger molecules like cytokines and other toxins that may not be removed by traditional filters.

d- Low-flux filters: Low-flux filters have smaller pores than high-flux filters and are often used in patients who are not able to tolerate high-flux filters due to the risk of adverse reactions [13,15,18].

The choice of filter depends on several factors, including the patient's medical history, the type and severity of kidney disease, and the presence of other medical conditions. The goal of hemodialysis is to remove excess fluid and waste products from the blood while minimizing the risk of adverse reactions and complications.

Methods and Materials

Context and samples

The current study was conducted at Ramadi Teaching Hospital, located in Ramadi city, Iraq, under the auspices of the School of Distance Education at Universiti Sains Malaysia.

Research Ethics

On July 8th, 2021, this study received ethical approval from the University of Anbar's ethical committee in Ramadi city with the approval number 104.

Measurements

In this study, a number of biochemical tests (as shown in Table 1) were conducted on patients who underwent hemodialysis for three seasons, as well as on a control group consisting of 100 healthy individuals, for comparison and standardization purposes. All parameters were measured using spectrophotometry. Before and after three dialysis sessions, patients underwent biochemical tests that measured their levels of BUN, creatinine, aspartate aminotransferase, alanine aminotransferase, glucose, albumin, lactate dehydrogenase, amylase, cholesterol, high-density lipoprotein, triglycerides, uric acid, direct-bilirubin, total-bilirubin, alkaline phosphatase, TP, Ca, Na, S.K+, and Cl-

Table 1: Chemicals and their suppliers used in the study.

N	Instruments	Source
1	Water bath	Memmert (Germany)
2	Centrifuge	Hettich, Germany
3	Spectrophotometer	APEL PD-303, Japan
4	Automatic micropipettes	Rudolf brand, Germany
5	(Glucose, Urea, Calcium, AST, ALT, TP) kit	BioMerieux (France)
6	(Creatinine, Albumin, LDH, Amylase, Cholesterol, HDL, TG, UA, direct Bilirubin. Total Bilirubin) kits	Biolabo, France
7	(Sodium, Potassium, Chloride) kits	Spinreact, Spain

Data collection

The data collection process involved the selection of 100 patients with chronic renal failure (CRF) from the Ramadi Teaching Hospital of dialysis unit, who were between 34 to 68 years old the average age of, (48.86 ± 10.21). A nephrologist made the clinical determination that these patients had end-stage renal disease (ESRD), based on the patient's medical background, clinical diagnosis, kidney function evaluation, and other laboratory tests. Using (Cuprophan) membranes (filters made by Bellco, Mirandola, Italy; CU; mean membrane surface, 1.3 m2, thickness, 8 ; sterilisation, ethylene oxide), standard four-hour hemodialysis sessions were carried out three times a week. For this study, a case study including these patients was chosen.

Data analysis

SPSS version 22.0 for Windows was used to code and analyse the data that had been obtained. For numerical variables, descriptive statistical techniques were employed to calculate the mean and standard deviation. In order to compare the outcomes of various parameters for patients and the control group, Fisher's LSD method was applied to the one-way ANOVA table. In order to prepare for each test, the study groups were separated into six portions. Additionally, the sample size calculator [19] was utilised for analysing the data.

Results

Table 2 displays the information gathered on Chronic Renal Failure in hemodialysis patients and the control group.

Table 2 The Findings of This Study

Parameters	Control group	Dialysis 1		Dialysis 2		Dialysis 3	
		Pre	Post	Pre	Post	Pre	Post
Urea	34 ± 6	116 ± 29	21 ± 7	118 ± 26	18 ± 5	116 ± 26	18.6 ± 4.6
Creatinine	0.8 ± 0.1	7.1 ± 2.12	1.1 ± 0.2	7 ± 1.2	1.1 ± 0.2	7.2 ± 1.6	1 ± 0.2
Cholesterol	129 ± 44	174 ± 36	179± 21	176 ± 9	175 ± 28	175 ± 16	171 ± 24
Tg	100 ± 26	183 ± 20	188 ± 19	188 ± 14	180 ± 26	178 ± 25	176 ± 29
HDL	46 ± 4	38.7 ± 8.3	38 ± 5.2	37 ± 8.7	36 ± 6.7	38 ± 10	36 ± 8
Ca+2	8.9 ± 0.3	8 ± 0.4	8.2 ± 0.4	8 ± 0.5	8.1 ± 0.42	8.2 ± 0.5	8.21 ± 0.48
Na-	140 ± 2.8	132 ± 2	132 ± 2.5	134 ± 2.6	134 ± 2.5	134 ± 1.9	134 ± 1.8

LDH	UA	Albumin	AST	ALT	AlkP	Bili-Total	Bili- direct	Glucose	Cl-	K+
185±35	4.4 ± 0.8	4.3± 0.4	25 ± 6	29 ± 6.6	114±36	0.7 ± 0.2	0.21 ± 0.08	91±11	101±2.8	4.1 ± 0.3
190±28	6.7±1.1	3.5 ± 0.2	22 ± 4	20 ± 3	176±33	0.45 ± 0.13	0.21 ± 0.07	107±13	101 ± 3.3	5.4 ± 0.36
212±29	1.6±0.7	3.5 ± 0.14	22 ± 3	20 ± 6	184±48	0.46 ± 0.11	0.21 ± 0.09	91 ± 8	96±3.5	2.3 ± 0.4
187±29	6.5± 1	3.5 ± 0.3	21 ± 4	21 ± 5	187±47	0.46 ± 0.13	0.2 ± 0.08	106 ± 19	101± 3	5.3 ± 0.17
203±34	1.4±0.3	3.5 ± 0.2	22 ± 5	21 ± 5	189±51	0.45 ± 0.12	0.2 ± 0.08	92±11	98 ± 4.1	2.1 ± 0.3
186±39	6.5±0.9	3.5 ± 0.2	23 ± 3	20 ± 5	183±37	0.45 ± 0.12	0.21±0.08	106±12	101 ± 3.7	5.4 ± 0.2
208±43	1.4±0.4	3.5 ± 0.19	22 ± 4	21 ± 5	189±36	0.45 ± 0.12	0.2 ± 0.08	92±6	98 ± 4.9	2.0 ± 0.08

Amy	TP
81.8±22	7.32±0.56
109±33	6.88±0.62
115±38	7.29 ± 0.8
109±32	6.93±0.62
112 ± 35	7.31 ± 0.7
109±21	6.9 ± 0.45
114 ± 32	7.3 ± 0.65

* Significant $p \leq 0.05$, $p > 0.05$ non-significant

The findings of this study demonstrate a considerable reduction in S.TP levels and a significant elevation in urea, creatinine, K+, glucose, and urea a prior to the three dialysis sessions, demonstrating the importance of hemodialysis in the management of CRF. After three sessions of hemodialysis, it was discovered that using Cuprophan membranes considerably reduced the levels of S. urea, S. creatinine, S. glucose, S. UA, S. K+, and Cl-. After three sessions of hemodialysis, the findings likewise revealed a considerable rise in S.LDH levels. In comparison to the control group, there was no appreciable variation in S. bilirubin direct levels before and after three dialysis sessions.

Discuses

Elevated blood urea and serum creatinine levels are well-established indicators of impaired renal function in CKD patients, and there is broad consensus within the medical community on their importance in assessing renal status. These parameters are widely used to evaluate kidney function in both diabetic and hypertensive individuals who are at risk for CKD [20]. Results of this present study showed that there was non-significant differences ($p<0.05$) in the serum levels of S.albumin in before dialysis compared to after, for three dialysis sessions. Serum albumin is a well-known marker of nutrition in ESRD patients.Serum albumin is still the most commonly used nutritional marker that is used to monitor nutritional status in end-session renal disease (ESRD) patients. Hemodialysis may exacerbate the risk of hypoalbuminemia in patients due to the additional impact of impaired nutritional intake and the loss of nutrients and albumin during dialysis. The small size of amino acids means that a

significant amount is lost into the dialysate during each hemodialysis session. According to available data, patients may lose approximately 6-8 g of total amino acids per session [13,20,21]. This study revealed the efficiency of the cuprophane membranes used in the study dialyzer into removing the high levels of urea and creatinine from the blood, as well as maintaining the albumin levels as it were before dialysis, for three dialysis sessions.

Results of this present study showed that there was a high significant increase in the levels of total cholesterol(T-C) and triglycerides(TG) in ESRD patients as compared with the control group, while, there was a significant decrease in the HDL-C levels in ESRD patients, when compared with the control group, but that there was non-significant differences in the serum levels of T-C, TG, and HDL-C between before and after dialysis for three hemodialysis sessions. Abnormal lipid profiles start to appear soon after renal function begins to deteriorate. In general, dyslipidemia in CKD patients results from diminished lipoprotein lipase (LPL) activity that is confined to endothelial cells. As a result, blood levels of triglyceride (TG) and high-density lipoprotein cholesterol are elevated (HDL)[22,23]. Dyslipidemia has a propable role in pathogenesis of CKD. The extracellular matrix molecules in the renal glomerulus capture circulating lipids, which then undergo oxidation to produce free radicals that set off an oxidation cascade that impairs the action of vasodilators supplied from the endothelium. The pathogenic alterations that cause and exacerbate renal impairment mimic atherosclerosis.[24].

Choice of membrane may be a very important criterion during hemodialysis.

This results showed that there was a high significant increase in the serum potassium concentration in ESRD patients as compared with the control group, but that there was a high significant decrease of serum calcium and serum sodium concentrations in ESRD patients as compared with the control group. This study also exhibited that there was a non-significant differences in the serum levels of Ca+2 in patients before and after dialysis.Prevalence of dyselectrolytemia, is a common feature of CKD patients [25].These electrolyte imbalances result from a decline in kidney function brought on by a wide variety of etiologies, which results in a decrease in the kidney's effective functional unit and CKD. Homeostasis in the kidney. Electrolyte abnormalities brought on by declining renal function raise morbidity and death rates in CKD patients [26]. According to serum potassium status, hyperkalemia is common complication in ESRD patients. The principal intracellular cation, potassium, regulates intracellular osmotic pressure. The kidneys remove around 90% of extra potassium, with the remaining 10% going through the gastrointestinal tract (GIT)[27]. Since the typical potassium level is controlled within a very small range, any rise is potentially fatal [28].

Hyperchloremia or hypochloremia is a common occurrence in patients with renal failure. Elevated serum chloride levels at baseline were found to be significantly associated with increased risk of cardiovascular mortality in HD patients. This risk was observed to be independent of concurrent serum levels of sodium, potassium, or calcium, suggesting that the finding was specific to chloride and not reflective of risks associated with other electrolyte disorders[29].

Hypoglycemia is a common occurrence in hemodialysis patients and can be attributed to several factors. Firstly, the patient's own renal failure leads to decreased inactivation and excretion of insulin, resulting in insulin accumulation in the body, and reduced clearance of hypoglycemic drugs. Secondly, insulin is a macromolecular substance that cannot be easily removed by dialysis, while glucose, a small molecular substance, can easily pass through the filter membrane of the dialyzer. In hospitals in Iraq, sugar-free dialysate is widely used due to the difficulty in storing glucose-containing dialysate and the risk of nosocomial events. This may explain the observed decrease in blood glucose levels after a dialysis session in patients with ESRD in the study [30].

Results of this study demonstrated a high significant increase in S.uric acid for ESRD patients when compared with control group. Uric acid has a physiological free radical scavenging property, but

can be a marker of oxidative stress as well. As uric acid is a known anti-oxidant, it has a beneficial role in diseases. However, it has been found that elevated levels of uric acid are associated with high risks of cerebrovascular complication of nephropathy. An increase in S.UA levels has been reported to be a predictive factor of cardiovascular diseases in patients undergoing HD, which is the major cause of mortality in ESKD. This study observed that HD alone significantly reduces uricemia ($p < 0.001$), the decrease in uric acid levels after dialysis is temporary as it begins to increase gradually until the next dialysis session where levels of uric acid were not very high, this results corresponded to those undergoing 3 sessions of HD per week[31,32].

The study found that serum levels of AST and ALT were significantly lower in patients with ESRD both before and after three dialysis sessions compared to controls. Although the levels of these enzymes were higher after dialysis, the difference between the levels before and after dialysis was not statistically significant. Thus, it appears that hemodialysis does not significantly affect liver function. Other studies have also reported lower serum levels of ALT in patients with CKD compared to individuals with normal renal function. While there are fewer studies discussing AST levels in CKD patients, the available results suggest lower AST levels in CKD patients compared to controls. These results imply that hemodilution may aid in lowering transaminases in hemodialysis patients prior to therapy. However, a recent study found that AST and ALT levels considerably rose following hemodialysis, probably as a result of the patients' removal of extra water that had collected during treatment [33,34].

Recently, many studies have revealed that bilirubin levels play a critical role in CKD progression and mortality. This study indicates that individuals with reduced liver functions tests concentrations, in the absence of liver pathology, they are at greater risk to development of complications the CKD. In addition, there is no significant effect of dialysis membranes (cuprophane) on the concentrations of liver tests. According to this investigation, only total bilirubin was associated negatively with the occurrence of CKD. There is an obvious need for more research on the impact of each kind of serum bilirubin on the onset of CKD. Prior research on bilirubin levels and cardiometabolic outcomes often examined only total bilirubin without identifying different bilirubin forms [35]. The present study investigated the association between serum total protein levels in end-stage renal disease (ESRD) patients undergoing three dialysis sessions. Results showed that higher levels of serum globulin (≥3.8 g/dL) were associated with an increased risk of all-cause and infection-related mortality, after adjusting for patients' demographics, comorbidities, and other variables related to malnutrition and inflammation. Additionally, lower levels of total serum protein were also associated with an increased risk of cardiovascular disease and infection-related mortality[36].

In this study, it was observed that patients exhibited lower serum albumin concentrations, which is a characteristic trend of many inflammatory states such as the late phase of acute inflammation, chronic inflammation, or chronic active inflammation [37,36]. This study revealed an increase in serum total protein levels following hemodialysis, which is likely attributed to the removal of an inhibitory substance during dialysis or hemoconcentration caused by the loss of excess accumulated water in hemodialysis patients during the dialysis session. Additionally, hemolysis resulting from dialysis maintenance procedures may also contribute to the observed increase in total protein levels[38].

The results of this study showed a significant increase in pancreatic enzyme (amylase) in CKD patients with ESRD.

The measurement of serum amylase is a commonly used diagnostic tool for acute pancreatitis. However, while the test has high specificity, its sensitivity is limited. Elevated levels of amylase may also be detected in conditions such as macroamylasemia, pregnancy, parotitis, and esophageal perforation, in addition to kidney failure. Therefore, when high levels of amylase are detected and pancreatitis diagnosis is uncertain, consideration of chronic kidney disease (CKD) as a possible cause

is recommended. The findings of this study provide important insights into the impact of dialysis membranes during multiple sessions on various liver enzymes and pancreatic function in patients with end-stage renal disease (ESRD)[39].

Mahomoodally study tends to show that serum amylase had a poor correlation with both urea and creatinine in pre and post dialysis samples, elevations in serum amylase among patients with renal failure or ESRD are most likely due to impaired renal clearance [40].

In this study including a large cohort of HD patients, both before and after dialysis for three seasons showed different level of serum LDH.

LDH is crucial for the anaerobic cellular metabolism because it catalyses the reversible conversion of pyruvate to lactate. The generation of LDH transcription is controlled by this hypoxia-inducible factor when the organism is experiencing hypoxia. As a biomarker of cell membrane injury, platelet activity, and angiogenesis, LDH is typically secreted into serum. Numerous research have evaluated the relationship between LDH and other disorders [41]. The dialysis technique itself may produce an increase in LDH levels, as mechanical hemolysis can occur in extracorporeal blood systems like dialysis and subsequently a raise in LDH can be measured. In addition, this study documented higher LDH levels after dialysis compared with before dialysis [42]. Results of this present study showed that there was a high significant increase in the levels of alkaline phosphatase in ESRD patients. The elevated levels of ALP in CKD patients found in our study are in accordance with other studies [43,44].

Another study found that there is a correlation between serum alkaline phosphatase (ALP) levels at the start of dialysis and all-cause mortality during maintenance dialysis. This is especially true for patients with a serum parathyroid hormone (PTH) level of less than 300 pg/mL, as a higher serum ALP level is significantly linked to mortality [44].

Another study that examined biochemical indicators of nutrition, inflammation, and bone and mineral problems in 137 randomly chosen MHD patients discovered that serum ALP is the only indicator with a substantial and robust connection with the degree of severity of coronary artery calcification [45]. In CKD and chronic hemodialysis patients, high serum alkaline phosphatase level was associated with increased mortality. Finally, by measuring the ALP levels before and after dialysis, this study demonstrated maintenance dialysis didn't affected ALP levels in patients undergoing hemodialysis[44].

Conclusion

The Cuprophane dialysis filter is a type of dialysis membrane that is commonly used in hemodialysis for patients with chronic kidney disease. The membrane is made of a cellulose-based material that is coated with copper ions, which gives it its unique properties. The membrane works by allowing small molecules, such as urea and creatinine, to pass through while retaining larger molecules, such as proteins and blood cells.

The differential effects of the Cuprophane dialysis filter on the levels of certain parameters before and after dialysis can be attributed to its properties. For example, the membrane has been shown to increase the levels of lactate dehydrogenase (LDH) by activating the complement system and releasing LDH from red blood cells. This effect is believed to be caused by the copper ions in the membrane, which can interact with the complement system and cause an inflammatory response.

On the other hand, the membrane has been shown to decrease the levels of uric acid, serum potassium (S.K+), urea, and chloride (Cl-) by increasing their removal during dialysis. This effect is believed to be due to the membrane's ability to selectively allow the passage of certain molecules based on their size and charge.

Furthermore, the Cuprophane membrane has been shown to reduce the high levels of creatinine and glucose in patients with chronic kidney disease. This is believed to be due to the membrane's ability to selectively remove these molecules from the blood during dialysis.

In summary, the differential effects of the Cuprophane dialysis filter on the levels of certain

parameters before and after dialysis can be attributed to its properties, which allow for the selective passage of certain molecules based on their size and charge, as well as its ability to interact with the complement system and cause an inflammatory response.

Conflict of interest statement

The authors have stated that there is no conflict of interest related to this work.

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تأثير الفشل الكلوي في المرحلة الأخيرة وغشاء كوبرفان على العديد من المعايير البيوكيميائية في مرضى غسيل الكلى في مستشفى الرمادي التعليمي، العراق

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الخلاصة:

مقدمة: غسيل الكلى هو علاج شائع يستخدم لمرضى الكلى المزمن (CKD)، حيث يتم استخدام مرشح غسيل الكلى لإزالة الفضلات والسوائل الزائدة من الدم. يمكن ان يؤثر اختيار مرشح غسيل الكلى بشكل كبير على المعلمات البيوكيميائية للمرضى الذين يخضعون لغسيل الكلى. هدفت هذه الدراسة الى التحقق من تأثير مرشح كوبرفان لغسيل الكلى على المعايير البيوكيميائية ل 100 مريض بأمراض الكلى المزمنة الذين يخضعون لثلاث جلسات غسيل كلى متتالية في مستشفى الرمادي التعليمي في العراق. طرق العمل: تم جمع عينات الدم من 200 شخص، بما في ذلك 100 مريض مصاب بالفشل الكلوي المزمن و100 من افراد المجموعة الضابطة الذين تم مطابقتهم من حيث العمر والجنس كمجموعة تحكم صحية. تم اخذ العينات قبل وبعد ثلاث جلسات غسيل كلى متتالية لمرضى الكلى المزمن. تم قياس عشرين تحليل دم لكل عينة باستخدام طرق معملية قياسية. تم حساب المتوسط والانحراف المعياري (SD) لكل تحليل، وتم استخدام ANOVA (تحليل التباين) لتحديد اهمية الاختلافات بين قيم ما قبل غسيل الكلى وما بعده ومقارنتها بالمجمعة الضابطة. النتائج: قبل غسيل الكلى، كان لدى المرضى مستويات أعلى بشكل ملحوظ من اليوريا، الكرياتينين، البوتاسيوم، الجلوكوز، حمض البوليك والبيليروبين الكلي، ومستويات اقل بكثير من البروتين الكلي في الدم مقارنة بمجموعة التحكم. بعد ثلاث جلسات غسيل الكلى، اظهر المرضى زيادة كبيرة في مستويات الكوليسترول في الدم، والدهون الثلاثية، والاميلاز، والفوسفاتيز القلوي، بينما لم يظهر مستوى البيليروبين المباشر فرقا معنويا مقارنة بالمجموعة الضابطة، بالمقابل بعد ثلاث جلسات غسيل الكلى، كان لدى المرضى انخفاضا ملحوظا في مستويات الالبومين في الدم والبروتين الدهني عالي الكثافة والكالسيوم والصوديوم وترانس اميناز الاسبارتات والالانين ترانس اميناز والبيليروبين الكلي. علاوة على ذلك، اشارت النتائج الى ان مرشح كوبرفان لغسيل الكلى له تأثيرات تفاضلية على مستويات على بعض المعايير قبل وبعد غسيل الكلى، حيث زادت اغشية غسيل الكلى من مستويات نازعة هيدروجين اللاكتات، وخفضت مستويات حمض اليوريك، والبوتاسيوم واليوريا والكلوريد في الدم الى ما دون قيم المجموعة الضابطة، وخفضت المستويات المرتفعة من الكرياتنين والجلوكوز حيث ادى هذا الانخفاض الى تساوي نسب الكرياتينين والجلوكوز مع مستويات المجموعة الضابطة. الاستنتاج: في الختام، ادى استخدام مرشح كوبرفان لغسيل الكلى في مرضى الفشل الكلوي المزمن الى تغييرات كبيرة في معايير التحاليل الكيميائية المختلفة. حيث تسلط النتائج الضوء على اهمية النظر في نوع مرشح غسيل الكلى المستخدم ومراقبة المعلمات البيوكيميائية للمرضى الذين يخضعون لغسيل الكلى.

الكلمات المفتاحية: *الفشل الكلوي المزمن، المرحلة النهائية من الفشل الكلوي، فلاتر غسيل الكلى، غشاء كوبرفان، تحاليل كيميائية*