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ASSESSMENT OF BLOOD UREA AND SERUM CREATININE IN CHRONIC KIDNEY DISEASE PATIENTS BEFORE AND AFTER HEMODIALYSIS VISITING TO REHMAN MEDICAL INSTITUTE HAYATABAD PESHAWAR

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Abstract

The is descriptive cross-sectional study was carried out at Rahman Medical Institute Peshawar. This Research Project was carried out in 6 months after approval of research Proposal from Departmental Research Board DRB), starting from April 2025 to September 2025. During the said period all the steps of research thesis was completed. Blood was obtained from each patient before and after dialysis. All the estimations were done on cobas 501 analyser uses spectrophotometry technology the blood urea, creatinine and eGFR levels dropped after dialysis, which is expected, as dialysis removes waste products like urea and creatinine from the blood. All the collected data is analyzed by using SPSS (Statistical Package for the Social Science) software, version 22, and statistical result taken.

Among 100 individuals Male respondents made up 46.6% of the sample, followed by female respondents with 53.4%. There are 100 peoples, less than 25 years are 15 (15%) between the ages of 25– 34 years where 6 (6 %), 35–44 years were 11 (11%), 45-54 years were 10 (10%), and 55years or older were 61 (61%).

INTRODUCTION

In a healthy individual, the kidneys each weighing approximately 4 ounces filter around 200 liters of blood daily to eliminate waste products and excess water. They also convert 25-hydroxy-vitamin D into its active form, 1,25-dihydroxy-vitamin D (calcitriol), which is essential for calcium absorption and bone health. Additionally, the kidneys produce erythropoietin, a hormone that stimulates the production of red blood cells, and regulate renin, which plays a key role in controlling blood volume and blood pressure. Serving excretory, metabolic, and biosynthetic functions, the kidneys are essential for maintaining overall physiological balance. (St. Peter, 2007)

Two bean-shaped organs located on either side of the spine responsible for filtering blood, producing urine, and regulating fluid and acid balance in the body. Kidney disease encompasses any condition that harms the kidneys It can be classified as acute, which develops rapidly and is often severe, or chronic, which progresses gradually over time and persists long term (Kalantar-Zadeh, et al, 2021).

Acute kidney injury (AKI) is a type of kidney condition that can be severe but is often reversible with proper treatment. In contrast, chronic kidney disease (CKD) usually develops gradually, is generally irreversible, and often shows no symptoms for years until significant

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kidney damage leads to failure (Kalantar-Zadeh, et al, 2021).

Chronic kidney disease (CKD) is a long-term condition marked by structural and functional damage to the kidneys caused by various underlying factors. It is commonly defined by a decline in kidney function, often as a complication of another serious health issue. Unlike acute kidney failure, which develops suddenly, CKD progresses slowly over weeks, months, or even years, eventually leading to end-stage renal disease (ESRD) if left untreated. This gradual loss of kidney function is reflected in a continuous decline in renal clearance or glomerular filtration rate (GFR), resulting in the accumulation of

waste products like urea and creatinine in the blood. According to the Kidney

1Disease: Improving Global Outcomes (KDIGO) guidelines, a GFR below 60 mL/min/1.73 m^2 is an indicator of CKD (Pethő, et al, 2024).

Chronic kidney disease is a pathophysiological condition with multiple causes, leading to the irreversible loss of both nephron number and function. Over time, this often progresses to end-stage renal disease (ESRD), a clinical state in which kidney function is permanently lost to a degree that the patient requires renal replacement therapy such as dialysis or kidney transplantation to survive and prevent life-threatening uremia. Uremia is a clinical and laboratory-defined syndrome that reflects widespread organ dysfunction due to untreated or inadequately treated chronic kidney failure. Notably, by the time plasma creatinine levels show even a slight increase, significant and lasting damage to the nephrons has usually already occurred. The pathophysiology of the uremic syndrome can be categorized into two main types of abnormalities (Gulavani, et al, 2020).

Chronic kidney disease (CKD) can be difficult to detect in its early stages because symptoms often appear only after significant kidney damage has occurred. For this reason, CKD is sometimes referred to as a "silent" condition many individuals with early-stage CKD are unaware they have it. When symptoms do develop, they may include changes in urination, fatigue, persistent itching, swelling in the hands, legs, or feet, shortness of breath, lower back pain, reduced appetite, nausea or vomiting, and abnormalities in calcium, phosphate, or vitamin D levels. Abnormal results in urine tests can also indicate CKD (Gulavani, et al, 2020).

Biochemical markers are essential for accurately diagnosing kidney conditions, evaluating risk, and guiding treatment to improve patient outcomes. In clinical practice, blood tests analyzing renal function markers such as urea, creatinine, uric acid, and electrolytes are routinely used for prognosis. Blood Urea Nitrogen (BUN) and creatinine are key indicators in this assessment. BUN reflects the amount of urea nitrogen a major waste productfrom protein and amino acid breakdown present in the blood and provides an indirect measure of the kidneys' excretory function. Creatinine, a byproduct of creatinine phosphate metabolism in muscles, is also filtered by the kidneys, and its levels in the blood are used to evaluate renal function. Elevated levels of urea and creatinine in the serum suggest impaired kidney function. Among all renal function tests, BUN and serum creatinine are the most commonly used and widely accepted indicators of kidney health (Rehman Medical Institute, 2025).

The definition and classification of chronic kidney disease (CKD) have progressed over the years. According to current international guidelines, CKD is defined as either a reduction in kidney function—indicated by a glomerular filtration rate (GFR) below 60 mL/min/1.73 m^2—or the presence of markers of kidney damage, or both, lasting for at least three months, regardless of the underlying cause. The leading causes of CKD are diabetes and hypertension (Webster, et al, 2016).

The incidence and prevalence of end-stage kidney disease (ESKD) differ across the globe. Over 80% of individuals undergoing treatment for ESKD live in countries with aging populations and access to affordable healthcare services. In contrast, global patterns of chronic kidney disease (CKD) are less well-defined, as most available data come from cohort studies, which may not

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capture the full picture (Webster, et al, 2016).

Chronic kidney disease (CKD) is a significant global public health issue. Hemodialysis is one form of renal replacement therapy used when the kidneys can no longer effectively remove waste products such as urea, creatinine, and excess water from the blood. This process works on the principle of solute diffusion across a semi-permeable membrane. While kidney transplantation is an alternative, it is often not feasible for many patients due to its high cost and the potential risk of organ rejection. As a result, the ongoing expense of dialysis can be challenging for the average patient to afford (Pethő, et al, 2024).

The dialysis process presents two specific physiological challenges for patients:

1. A decrease in intravascular volume due to ultrafiltration, and
2. A drop in extracellular osmolarity as solutes move from the blood into the dialysate along concentration gradients.

These changes often lead to a drop in blood pressure during treatment. However, individual responses can vary, as patients activate different paracrine and neurohormonal mechanisms to help stabilize their blood pressure and maintain hemodynamic balance (Van Buren, 2017).

In the United States, approximately 26 million adults have kidney disease that does not require dialysis, and over 4 million adults suffer from chronic renal disease, affecting more than 13% of the population. It is projected that the burden of CKD will continue to grow, with over 2 million people expected to be receiving renal replacement therapy either dialysis or kidney transplantation by 2030. Similarly, in Pakistan, the number of patients with chronic renal failure is steadily rising, with recent reports indicating more than 100 new cases per million people (Van Buren, 2017).

Study Design

METHODOLOGY

The descriptive cross-sectional study was carried out at Rahman Medical Institute Peshawar.

Study Population

The target population is the chronic kidney disease patient RMI Peshawar.

Study Duration

This Research Project was carried out in 6 months after approval of research Proposal from Departmental Research Board DRB), starting from April 2025 to September 2025. During the said period all the steps of research thesis was completed i.e.

Study Settings

The study was conducted in Rehman Medical Institute Hayatabad Peshawar, KP.

Sample Size

All the patients of chronic kidney disease Registered with Rehman Medical Institute Peshawar was included in the sample. A randomly 100 sample size of CKD patient there in the RMI for taking care them.

Sampling Techniques

Non Probability Convenient Sampling Technique was used for study design.

SAMPLE SELECTION

Inclusion Criteria

a. Patients who have been diagnosed with chronic kidney failure for at least 3 months and have been on hemodialysis for ≥1 month

b. Patients who are admitted in the wards diagnosed with CKD.

Exclusion Criteria

c. These patient who are not available at the time of data collection.

d. Patients with immune-compromised diseases (HIV/AIDS, Cancer, and chronic infections)

Ethical consideration

This study was approved by the INU, Research Institutional Review Board with a Letter of Authorization (Ethical no.920) from RMI Peshawar. The purpose and significance of the

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study were explained to the participants. Verbal informed consent was obtained from patient in accordance with the Declaration of Helsinki. Furthermore, it was declared that there was no relationship between the research and their services, and participation was completely voluntary. Additionally, research participant confidentiality was maintained and personal identification of research participants was avoided.

DATA COLLECTION PROCEDURE:

First, we get approval from the Institute and the concerned supervisor. After authorization from the head of HR department of the concern RMI and the verbal consent form in the native language from the full participants before enrolling them to the study. The Data was obtained by using a pre-designed Performa. In addition to the consent form and baseline demographic information, the questions covered the influence of hemodialysis on RFTs; personal and family history of CKD as well as the acceptance of screening test before CKD occur. The question was translated into the local language, Urdu. The same inquiries are closed-ended. Some are unrestricted.

DATA ANALYSIS PROCEDURE:

All the data collected is analyzed by using SPSS (Statistical Package for the Social Science) software, version 22, and statistical result taken.

RESULTS

Participant Demographics

Figure 1 and 2 displayed our study population's demographic information. Among 100 individuals Male respondents made up 46% of the sample, followed by female respondents with 54%.

There are 100 peoples, Figure 3 shows less than 25 years are 15 (15%) between

the ages of 25– 34 years where 6 (6 %), 35–44 years were 11 (11%), 45-54

years were 10 (10%), and 55years or older were 61 (61%).

Blood was obtained from each patient before and after dialysis. All the estimations were done on sys cobas 501 analyzer uses spectrophotometry technology. Assessment of the results were done with SPSS software. Mean comparison, Paired Samples Statistics, Paired Samples Correlations, Paired Samples Test were used for the assessment of level of significance.

A total of 100 patients were analyzed. These patients were randomly selected and their serum urea level, serum creatinine level, eGFR were estimated pre and post hemodialysis. Renal failure is a gradual, progressive and irreversible loss of normal kidney functioning. A total of 100 patients who were diagnosed for renal failure at RMI. Creatinine is a resultant of muscle metabolism and its elevated level indicate kidney disease. Hemodialysis portrayed an effective impact on serum creatinine levels which reduced to near normal levels.

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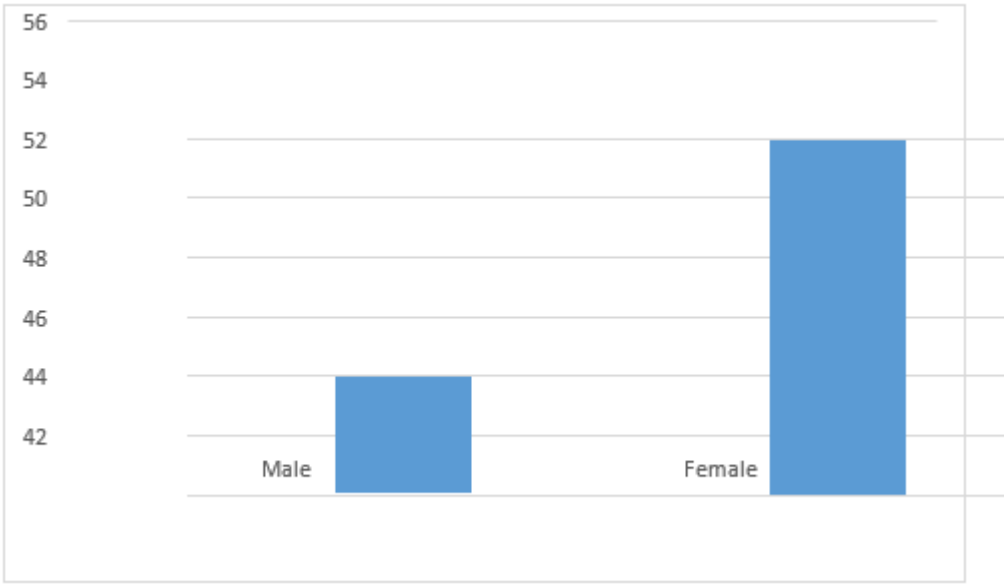

Figure 1: Gender Wise Distribution

Figure 1 displayed the gender of the Responder of 100 patients. Among 100 individuals Male respondents made up 46% of the sample, followed by female respondents with 54%.

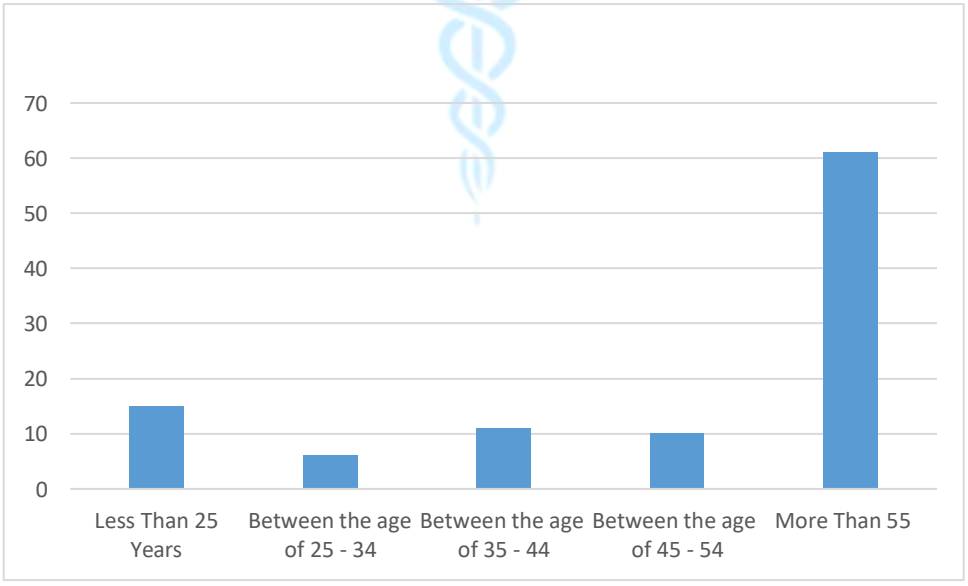

Figure 2: Age Wise distribution

Figure 2: There are 100 people, less than 25 years are 15 (15%) between the ages of 25– 34 years where 6 (6 %), 35–44 years were 11 (11%), 45-54 years were 10 (10%), and 55years or older were 61 (61%).

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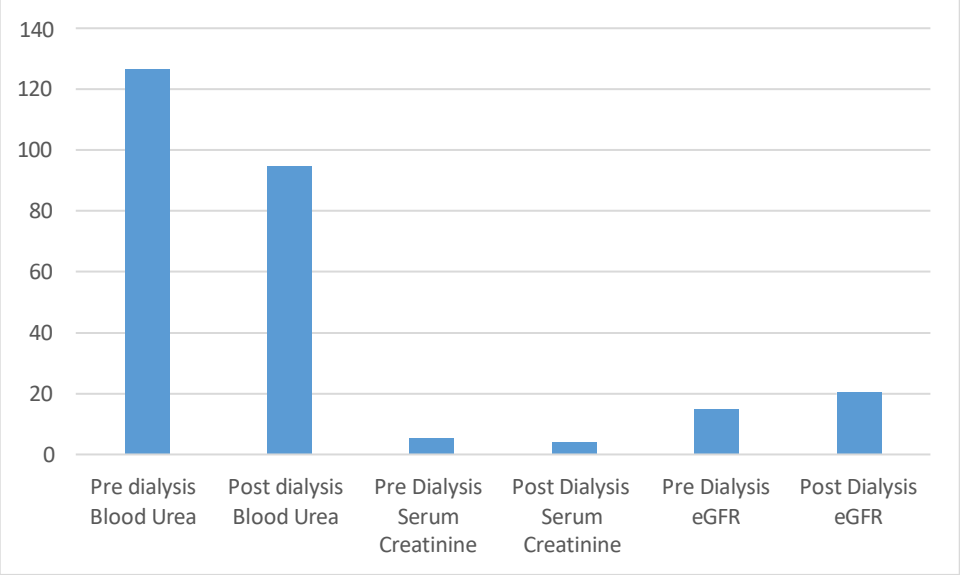

Figure 3: Shown Mean Comparison of RFT's Before and after Hemodialysis.

Paired Samples Statistics

In the Table 4, statistical test (Paired Samples Statistics) was done to compare two related sets of data — usually before and after a treatment — taken on the same subjects.

Comparing RFT values before and after dialysis for the same patients.

Table 4 Shown Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE DIALYSIS BLOOD UREA	126.7379	103	52.26553	5.14988
	POST DIALYSIS BLOOD UREA	94.8252	103	47.51747	4.68204
Pair 2	PRE DIALYSIS SERUM CREATININE	5.3385	103	3.11914	.30734
	POST DIALYSIS SERUM CREATININE	3.8917	103	2.15921	.21275
Pair 3	PRE DIALYSIS EGFR	14.8932	103	11.20041	1.10361
	POST DIALYSIS EGFR	20.5340	103	14.48381	1.42713

Paired Samples Correlations

In the table 5 shown, the statistical test (Paired Samples Correlation) was used to measure how strongly the before and after RFT values are related for the same patients.

It shows whether changes in RFTs before and after dialysis move together.

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Table 5 shown Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PRE DIALYSIS BLOOD UREA & POST DIALYSIS BLOOD UREA	103	.847	.000
Pair 2	PRE DIALYSIS SERUM CREATININE & POST DIALYSIS SERUM CREATININE	103	.822	.000
Pair 3	PRE DIALYSIS EGFR & POST DIALYSIS EGFR	103	.904	.000

Paired Samples Test

In the table 6, the statistical test (Paired Samples Test) was done to check if there is a significant difference in RFT values before and after dialysis for the same patients

Table 6 shown Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PRE DIALYSIS BLOOD UREA – POST DIALYSIS BLOOD UREA	31.91262	27.99584	2.75851	26.44113	37.38412	11.569	102	.000
Pair 2	PRE DIALYSIS SERUM CREATININE - POST DIALYSIS SERUM CREATININE	1.44680	1.82162	.17949	1.09078	1.80281	8.061	102	.000
Pair 3	PRE DIALYSIS EGFR – POST DIALYSIS EGFR	-5.64078	6.48203	.63869	-6.90762	-4.37393	-8.832	102	.000

Discussion

Chronic renal failure, also known as chronic kidney disease (CKD), is a long-term condition in which the kidneys gradually lose their ability to perform their normal functions. One of the key indicators of kidney function is the glomerular filtration rate (GFR)—the rate at which the kidneys filter waste and excess fluids from the blood. In chronic renal failure, the nephrons (the functional units of the kidneys) become damaged over time due to various causes such as diabetes, hypertension, or infections.

As the GFR declines, the kidneys become less efficient at removing waste products like creatinine and urea from the bloodstream. Serum creatinine is a byproduct of muscle metabolism, and blood urea nitrogen (BUN) comes from the breakdown of proteins. Under normal conditions, both substances are filtered out by healthy kidneys and excreted in the urine. When kidney function declines, these waste products accumulate in the blood, leading to elevated

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levels of serum creatinine and BUN.

Therefore, high levels of serum creatinine and BUN are important clinical indicators of impaired kidney function. Monitoring these parameters helps in assessing the severity of kidney disease and determining the effectiveness of treatments such as hemodialysis.

Chronic renal failure (CRF), or chronic kidney disease (CKD), develops gradually over time as a result of long-standing conditions that damage the kidneys. The most common causes are hypertension (high blood pressure), diabetes mellitus, and autoimmune disorders such as lupus nephritis.

As these conditions progress, the glomerular filtration rate (GFR) — which measures how well the kidneys are cleaning the blood — steadily declines. In advanced stages of CRF, the GFR can fall to 5–10% of normal, meaning the kidneys are barely functioning. This leads to the accumulation of toxic waste products in the blood, a condition known as uremia. Uremia causes severe symptoms such as fatigue, nausea, swelling, confusion, and can be life- threatening if not treated with dialysis or kidney transplantation.

In chronic renal failure (CRF), the kidneys lose their ability to effectively filter and remove waste products, toxins, and excess fluids from the blood. As a result, various biochemical changes occur such as elevated levels of urea, creatinine, potassium, and phosphate, and reduced levels of calcium and bicarbonate. These imbalances disrupt the normal internal environment of the body, leading to many of the signs and symptoms seen in kidney disease.

In this study we investigated if RFTSs profile (Creatinine, urea, eGFR) are different pre and post Dialysis. Serum sodium: Serum creatinine and blood urea in post-Hemodialysis patients were lower in comparison with the pre-hemodialysis. While a similar study conduct at Maharashtra, India which show hemodialysis reduce the creatinine and blood urea. Both study are in line with the given result.

Conclusion

A strong correlation is observed between serum creatinine and serum urea levels in patients with renal failure. Hemodialysis serves as an effective and essential method for removing unwanted metabolites such as creatinine and urea, while also improving estimated glomerular filtration rate (eGFR) within a significant range. This process helps to reduce the overall burden on the kidneys.

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