

Research Article

Study of Serum Electrolyte Abnormalities in Patients with Chronic Kidney Disease

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ABSTRACT

Background: Chronic kidney disease (CKD) is a long-term illness that becomes worse over time and causes the kidneys to stop working properly, which throws off the balance of fluids, electrolytes, and acid-base. People with CKD often have electrolyte problems such hyponatremia, hyperkalemia, and hypocalcaemia, which can make them more likely to get sick and die. For good care of CKD patients, it is important to keep an eye on these problems.

Aim: To study serum electrolyte abnormalities in patients with chronic kidney disease.

Materials and Methods: The Department of Physiology at Jaipur National University in Rajasthan did a cross-sectional observational study in a hospital. The study comprised 100 participants who had been diagnosed with chronic renal disease. They wrote down information on the person's age and gender. We took blood samples in a clean environment and used standard biochemical methods to assess the amounts of sodium, potassium, and calcium in the serum. We used the right statistical tools to look at the data we collected. We thought that p values less than 0.05 were statistically significant.

Results: Most of the patients (27%) were between the ages of 51 and 60. There were 62% males and 38% females in the study group. Forty-four percent of the patients had hyponatremia, forty-one percent had normal sodium levels, and fifteen percent had hypernatremia. Forty-two percent of the patients had hyperkalemia, while forty-six percent had normal potassium levels and twelve percent had hypokalemia. Hypocalcaemia was the most frequent calcium problem, seen in 53% of patients. 37% had normal calcium levels, and 10% had hypercalcemia.

Conclusion: Most of the patients (27%) were between the ages of 51 and 60. There were 62% men and 38% women in the study. There were 44% of patients with hyponatremia, 41% with normal sodium levels, and 15% with hypernatremia. Forty-two percent of patients had hyperkalemia, whereas forty-six percent had normal potassium levels and twelve percent had hypokalemia. Hypocalcemia was the predominant calcium anomaly, identified in 53% of patients, whereas 37% exhibited normal calcium levels and 10% presented with hypercalcemia.

Keywords: Chronic Kidney Disease, Electrolyte Imbalance, Hypernatremia, Hyperkalemia, Hypocalcaemia.

INTRODUCTION

Chronic kidney disease (CKD) is an illness that becomes worse over time and can't be fixed. It causes the kidneys to stop working over the course of months to years. It is characterized by kidney damage or a diminished glomerular filtration rate (GFR) of less than 60 mL/min/1.73 m² for a minimum of three months, regardless of the underlying etiology. Chronic kidney disease (CKD) is becoming a big public health concern across the world because it is becoming more common, causes a lot of illness, and costs a lot of money to treat. Diabetes mellitus and hypertension are the primary causes of chronic kidney disease (CKD) globally; however, additional factors, including chronic glomerulonephritis, obstructive uropathy, and genetic kidney

abnormalities, also play a substantial role in the course of the illness. As kidney function becomes worse, the kidneys can't maintain the right balance of fluids, electrolytes, and acids and bases. This causes several metabolic problems that have a big impact on how well patients do [1, 2].

One of the most important problems that might happen with CKD is the development of electrolyte imbalances. The kidneys are very important for keeping the levels of electrolytes like sodium, potassium, calcium, phosphorus, and magnesium in the blood at the right levels. In CKD, the kidneys don't work as well as they should, and they can't filter as much, which changes how they handle electrolytes and maintain homeostasis. These problems can show up as metabolic acidosis,

hyponatremia, hyperkalemia, hypocalcemia, and hyperphosphatemia. Patients with advanced CKD often have these kinds of problems, but they can also happen earlier in the disease, depending on the underlying cause and any other health problems the patient has [3, 4].

Hyperkalemia is one of the electrolyte problems that can happen in CKD that is most serious since it can lead to heart arrhythmias that could kill you. In CKD patients, high serum potassium levels are caused by a combination of variables, including less potassium being excreted by the kidneys, metabolic acidosis, drugs (such as ACE inhibitors or potassium-sparing diuretics), and dietary intake. In the same way, sodium levels can become out of whack if the kidneys don't handle water well, which can lead to dilutional hyponatremia or, less often, hypernatremia. The metabolism of calcium and phosphorus is also greatly influenced by less vitamin D activation in the kidneys and less phosphate excretion. This leads to secondary hyperparathyroidism and renal osteodystrophy [5, 6].

Abnormal electrolytes in CKD have big effects on how the body works. They lead to problems like heart disease, bone mineral abnormalities, neuromuscular dysfunction, and higher death rates. Researchers have found that CKD patients with aberrant levels of potassium and salt in their blood are more likely to be hospitalized and have bad heart problems. Also, problems with the balance of calcium and phosphorus are very important for the development of vascular calcification and bone disease, which make this population even more sick [7,8]. Early diagnosis and monitoring of electrolyte abnormalities are crucial aspects of CKD therapy. Regular biochemical testing helps doctors find abnormalities quickly and start the right treatments, such changing the patient's diet, giving them medication, or starting dialysis if needed. It is vital to know the pattern and frequency of serum electrolyte problems in people with CKD so that treatment plans may be made and clinical outcomes can be improved. Consequently, the current investigation seeks to examine serum electrolyte anomalies in individuals with

chronic renal disease and to evaluate their therapeutic relevance in the therapy of this condition [9, 10].

The study's goal is to look at changes in serum electrolytes in people with chronic renal disease. The goals are to find out how often and what kinds of electrolyte disturbances are, to look at changes in sodium, potassium, calcium, and phosphorus levels, and to figure out how important they are clinically and how they relate to the severity of kidney dysfunction.

MATERIALS AND METHODS

Study Design: Hospital-based cross-sectional observational study.

Study Place: Department of Physiology, Jaipur National University, Rajasthan.

Study Population: Patients diagnosed with chronic kidney disease (CKD).

Sample Size: A total of 100 patients were included in the study.

Study Duration: Conducted over a defined study period after institutional approval.

Inclusion Criteria: Patients having a clinical diagnosis of CKD who consent to participate in the trial.

Exclusion Criteria: Patients exhibiting acute renal injury, significant systemic disease, or those on electrolyte-modifying drugs unrelated to CKD therapy.

Statistical Analysis: We put the data into Microsoft Excel and then used SPSS software version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5 to look at it. For continuous variables, the mean and standard deviation were used, while for categorical variables, the frequencies and percentages were used. The unpaired t-test was used to compare continuous variables between groups that were not related, and the paired t-test was used to compare variables within the same group. The Chi-square test or Fisher's exact test were used to look at categorical variables. It was thought that a p-value of less than 0.05 was statistically significant.

RESULT

Table 1: Age Distribution of Study Participants

Age Group (Years)	Number of Patients	Percentage (%)	P Value
21–30	12	12%	0.042
31–40	18	18%	

41–50	25	25%
51–60	27	27%
>60	18	18%
Total	100	100%

Table 2: Gender Distribution

Gender	Number of Patients	Percentage (%)	P Value
Male	62	62%	0.031
Female	38	38%	
Total	100	100%	

Table 3: Serum Sodium Levels in CKD Patients

Serum Sodium Level	Number of Patients	Percentage (%)	P Value
Hyponatremia (<135 mEq/L)	44	44%	0.018
Normal (135–145 mEq/L)	41	41%	
Hypernatremia (>145 mEq/L)	15	15%	
Total	100	100%	

Table 4: Serum Potassium Levels

Serum Potassium Level	Number of Patients	Percentage (%)	P Value
Hypokalemia (<3.5 mEq/L)	12	12%	0.009
Normal (3.5–5.0 mEq/L)	46	46%	
Hyperkalemia (>5.0 mEq/L)	42	42%	
Total	100	100%	

Table 5: Serum Calcium Levels

Serum Calcium Level	Number of Patients	Percentage (%)	P Value
Hypocalcemia (<8.5 mg/dL)	53	53%	0.014
Normal (8.5–10.5 mg/dL)	37	37%	
Hypercalcemia (>10.5 mg/dL)	10	10%	
Total	100	100%	

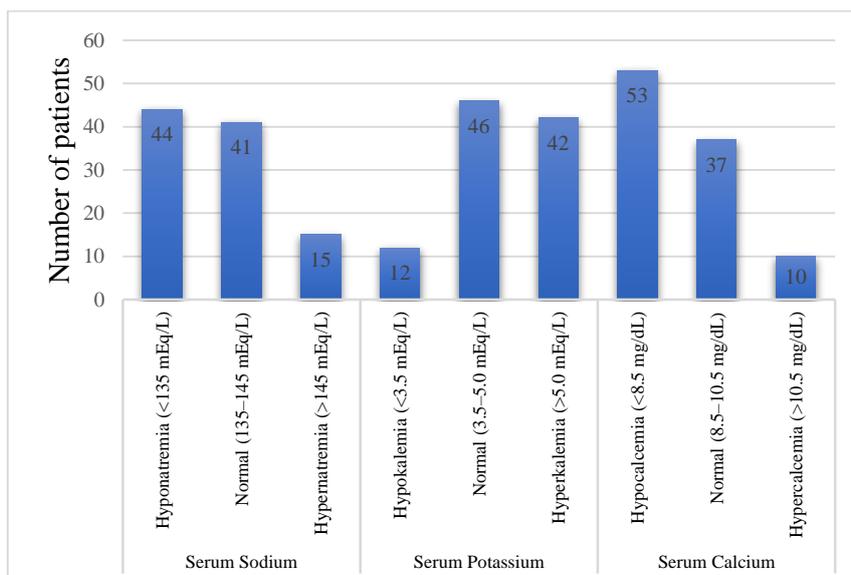


Figure: 1 Distribution of Serum Electrolyte Abnormalities among Patients with Chronic Kidney Disease

Table 1: The Ages of the People Who Took Part in the Study

In this study, the 100 patients with chronic renal disease were mostly between the ages of 51 and 60 (27%) and 41 and 50 (25%). Patients aged 31 to 40 made up 18% of the total, while those aged 21 to 30 and over 60 made up 12% and 18%, respectively. The prevalence of patients in the middle-aged and elderly cohorts suggests that CKD is more prevalent with advancing age. There was a statistically significant link between the age distribution and the number of people with CKD in the study population ($p = 0.042$).

Table 2: Distribution of Gender

The study found that 62 patients (62%) were male and 38 patients (38%) were female. This shows that CKD is more common in men than in women. The study found that more men than women had CKD, which could mean that men are more likely to have it or to seek medical attention for it. The difference in the number of men and women was determined to be statistically significant ($p = 0.031$).

Table 3: Levels of Sodium in the Blood of People with CKD

44 of the study subjects (44%) had low sodium levels, while 41 (41%) had normal sodium levels. Fifteen people (15%) had hypernatremia. Hyponatremia was the predominant sodium anomaly identified in CKD individuals within the research. The distribution of sodium anomalies was statistically significant ($p = 0.018$), demonstrating a robust correlation between CKD and sodium balance problems.

Table 4: Levels of Potassium in the Blood

An assessment of serum potassium levels indicated that 42 patients (42%) exhibited hyperkalemia, 46 patients (46%) presented with normal potassium levels, and 12 patients (12%) had hypokalemia. Hyperkalemia was the most common potassium problem among the people in the study. This is in line with CKD patients having trouble getting rid of potassium through their kidneys. Statistically significant was the variation in potassium level distribution across patients ($p = 0.009$).

Table 5: Levels of Calcium in Serum

The evaluation of serum calcium concentrations indicated that 53 patients (53%) exhibited hypocalcemia, 37 patients (37%) demonstrated normal calcium levels, and 10 patients (10%) presented with

hypercalcemia. Hypocalcemia was the most common calcium problem seen in CKD patients in the study. This is because their kidneys were not working as well, which affected how their bodies processed calcium and phosphate. The correlation between CKD and modified calcium levels was statistically significant ($p = 0.014$).

DISCUSSION

In this study, the age distribution showed that most of the people with chronic kidney disease (CKD) were between the ages of 51 and 60 (27%), followed by those between the ages of 41 and 50 (25%). This suggests that CKD is more common in older adults and middle-aged people. As people get older, the number of people with CKD rises. This may be because they have had other health problems for a long time, like diabetes, high blood pressure, and vascular disorders, which slowly damage the kidneys. Singh et al. [11] reported similar findings, noting that most CKD patients were aged 50 to 60 years. Agarwal et al. [12] also found that CKD was much more common in people over 40, which shows how closely aging and kidney problems are related.

The gender distribution in this study indicated a male predominance (62%) relative to females (38%), suggesting that CKD may be more prevalent among males. This result is in line with what other studies have found, which is that there are more male patients with CKD than female patients. Kumar et al. [13] found that almost 60% of people with CKD were men. They said this was because men were more likely to be exposed to lifestyle risk factors such as smoking, high blood pressure, and stress at work. Ibrahim et al. [14] also observed that men were more likely than women to have CKD. They thought this might be because of biological causes and differences in how people seek medical care.

The current investigation revealed a significant prevalence of hyponatremia (44%) among CKD patients, with 41% exhibiting normal sodium levels and 15% presenting with hypernatremia. Hyponatremia frequently occurs in chronic kidney disease (CKD) due to compromised renal water excretion and dilutional effects resulting from fluid retention. The results of this study are in line with those of Kovesdy et al. [15], who found that hyponatremia was a common electrolyte problem in CKD patients and was linked to more illness and hospitalizations. Palmer et al. [16] have said that individuals with advanced

renal illness often have problems with salt balance because their tubular reabsorption and water management are not working properly.

The current investigation revealed that 42% of patients exhibited hyperkalaemia, 46% demonstrated normal potassium levels, and 12% presented with hypokalaemia. Hyperkalaemia is a well-known problem that can happen with CKD because the kidneys don't get rid of enough potassium and the body becomes too acidic. These results are similar to what Einhorn et al. [17] found, which was that about 40% of patients with moderate to severe CKD had hyperkalemia. In a similar vein, Sarafidis et al. [18] noted that heightened serum potassium concentrations were markedly correlated with a diminishing glomerular filtration rate and an augmented risk of cardiac problems.

Hypocalcemia was the most frequent calcium problem in this study, with 53% of people having it. Normal calcium levels were next (37%), while hypercalcemia was last (10%). Hypocalcemia in CKD happens mostly because the kidneys don't make as much active vitamin D (calcitriol) and keep phosphate, which causes secondary hyperparathyroidism. These results are in line with the study by Block et al. [19], which found that many people with CKD had an imbalance of calcium and phosphate, which can lead to mineral bone problems. In the same way, Moe et al. [20] said that problems with calcium metabolism are widespread in CKD and are a primary cause of renal osteodystrophy and vascular calcification. Overall, the results of this study show that individuals with chronic kidney illness often have electrolyte problems such hyponatremia, hyperkalemia, and hypocalcemia. These changes are closely associated with compromised renal function and underscore the necessity of routine monitoring of serum electrolytes in CKD patients to avert consequences and enhance clinical outcomes.

CONCLUSION

We conclude that this study looked at electrolyte problems in the blood of people with chronic renal disease and showed that these problems are widespread in CKD patients. Most of the patients were middle-aged or older, and more men than women were impacted. Hyponatremia was the most common sodium problem found, which means that the kidneys were not able to control water and sodium levels as well as they should have

been. Hyperkalaemia was also often seen, which means that the kidneys weren't getting rid of enough potassium. This shows how CKD patients are at risk for major heart problems. Also, more than half of the people in the research had low calcium levels, which may have been caused by renal failure, which leads to less vitamin D activation and greater phosphate retention. The results of this study show that electrolyte imbalance is a serious medical issue for people with chronic kidney disease. To avoid problems and enhance the overall clinical management and prognosis of patients with CKD, it is important to check their serum electrolytes regularly and give them immediate treatment.

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