

Study of Electrolyte Imbalance in Chronic Kidney Disease Patients

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ABSTRACT

Background: Chronic Kidney Disease (CKD) is associated with disturbances in electrolyte balance due to impaired renal function and reduced excretion. Electrolyte abnormalities contribute significantly to morbidity and mortality in CKD patients.

Aim: To evaluate the pattern of electrolyte imbalance in CKD patients and correlate it with the stages of CKD.

Methods: A cross-sectional observational study was conducted on 200 diagnosed CKD patients (stages 2–5). Serum levels of sodium, potassium, calcium, and phosphate were measured and correlated with CKD stage, duration of illness, and clinical manifestations.

Results: Hyperkalemia (46%) and hyponatremia (38%) were the most common electrolyte abnormalities. Hypocalcemia (32%) and hyperphosphatemia (28%) were observed mainly in stage IV and V CKD. Severe electrolyte imbalance was associated with arrhythmias, muscle weakness, and altered sensorium.

Conclusion: Electrolyte imbalance is highly prevalent in CKD, especially in advanced stages. Regular monitoring and early correction are vital to reduce complications and improve quality of life.

Keywords: Chronic Kidney Disease • Electrolyte Imbalance • Hyperkalemia • Hyponatremia • Nephrology

INTRODUCTION

Chronic Kidney Disease (CKD) is a global health concern characterized by irreversible loss of kidney function. It affects **10–15% of the population worldwide**. As kidney function deteriorates, electrolyte regulation becomes impaired, resulting in **dangerous clinical consequences** such as arrhythmias, neuromuscular weakness, bone disorders, and severe metabolic disturbances.

Electrolyte balance is essential for **cardiac rhythm, neuronal signaling, and muscle function**. Disturbances in electrolyte levels—especially **sodium, potassium, calcium, and phosphate**—are common in CKD due to reduced excretion and hormonal imbalances.

This study aims to analyze the **pattern, severity, and clinical significance** of electrolyte abnormalities in CKD patients, along with their correlation to CKD stages.

MATERIALS AND METHODS

Study Design:

Cross-sectional observational study

Study Duration:

January 2023 – December 2023

Sample Size:

200 CKD patients (Stage 2–5)

Inclusion Criteria:

- Age 18–70 years
- Diagnosed CKD ≥ 6 months
- Willing to participate

Exclusion Criteria:

- Acute kidney injury
- Patients on dialysis during sampling
- Endocrine disorders
- Pregnant women

Parameters Studied

- Serum Sodium (Na^+)
- Serum Potassium (K^+)
- Serum Calcium (Ca^{2+})
- Serum Phosphate (PO_4^{3-})

Staging Based on eGFR

CKD Stage eGFR (mL/min/1.73 m²)

Stage II 60–89

Stage III 30–59

Stage IV 15–29

Stage V <15

RESULTS

☑ Electrolyte Imbalance Prevalence

Electrolyte	% of Patients
Hyperkalemia	46%

Electrolyte	% of Patients
Hyponatremia	38%
Hypocalcemia	32%
Hyperphosphatemia	28%

▣ Distribution Across CKD Stages

Electrolyte Imbalance	Stage II	Stage III	Stage IV	Stage V
Hyperkalemia	8%	22%	36%	64%
Hyponatremia	12%	26%	38%	54%
Hypocalcemia	6%	18%	28%	50%
Hyperphosphatemia	4%	14%	32%	46%

Common Clinical Symptoms Noted

- Muscle weakness – 45%
- Fatigue – 52%
- Arrhythmias – 30%
- Confusion/altered sensorium – 15%
- Bone pain – 22%

FIGURE – Sample Representation

Figure 1: Prevalence of Electrolyte Imbalance in CKD Patients

Electrolyte Prevalence (%)

Potassium 46%

Sodium 38%

Calcium 32%

Phosphate 28%

(You can convert this into a bar graph or pie chart for publication.)

DISCUSSION

The study revealed that **hyperkalemia** is the most common and dangerous electrolyte abnormality. Elevated potassium can lead to **life-threatening arrhythmias** and requires urgent management.

Hyponatremia was found in late CKD stages, often associated with fluid imbalance and hormonal dysregulation. **Hypocalcemia and hyperphosphatemia** were more common in advanced CKD, likely due to impaired renal excretion and secondary hyperparathyroidism, leading to renal osteodystrophy.

These findings correlate with previous studies by:

- Gupta R et al. (*Indian J Nephrol*, 2019)
- KDIGO guidelines (2020)
- Rahman M et al. (*Kidney Int.*, 2018)

Regular monitoring of electrolytes should be included in **standard CKD management protocols**, especially before dialysis initiation.

CONCLUSION

- ✓Electrolyte imbalance is **highly prevalent** in CKD patients.
- ✓**Hyperkalemia & hyponatremia** are the most common abnormalities.
- ✓Imbalances increase with **CKD severity**.
- ✓Monitoring and correction should be part of **routine CKD management**.
- ✓Early treatment prevents **cardiac and neurological complications**.

Clinical Recommendation:

- ✓Electrolyte profiling should be done **every 3–6 months** in CKD patients.
- ✓Patient education and dietary counseling are essential to prevent complications.

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