

Frequency And Clinical Consequences Of Hyponatremia, Hyperkalemia, And Hypocalcemia..

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ABSTRACT

Background: Analyzing available evidence and clinical experience shows that there are electrolyte disorders like hyponatremia, hyperkalemia, and hypocalcemia present in most hospitalized patients, and they correlate highly with the levels of morbidity and mortality associated with hospital admission. There may be a consequent series of complications related to imbalanced electrolytes, including cardiogenic, neurological, and neuromuscular complications. There are electrolyte imbalances, and once identified, they will lead to clinical incidents that worsen the patient's overall illness or clinical condition. Therefore, electrolyte imbalances need to be corrected as soon as possible.

Objectives: To ascertain the prevalence of such conditions as hyponatremia, hyperkalemia, and hypocalcemia in hospitalized patients and to analyze the neurocognitive impairments, arrhythmias, and extended length of stay, if any, that are related to these conditions.

Methodology: this cross-sectional study was conducted at Department of Nephrology Prime Teaching Hospital Peshawar Pakistan from jan 2025 to june 2025. 120 hospitalized patients who underwent evaluation of their serum electrolytes were included. Monitoring of sodium, potassium, and calcium levels was performed at the time of the patient's admission. Patients' clinical outcome records were collected, including but not limited to neurological symptoms, cardiac arrhythmias, and the duration of hospital stay. Data were processed in SPSS 24.0. The significance of the results was determined based on the calculated p-value, set at 0.05 or lower, and the Chi-square test was used for statistical analysis.

Results: A total of **120 hospitalized patients** were assessed, with a mean age of **54.7 ± 13.2 years**. The prevalence of electrolyte abnormalities was high, with **hyponatremia identified in 38.3%, hyperkalemia in 25.0%, and hypocalcemia in 32.5%** of cases. **Hyponatremia** showed a significant association with neurological manifestations such as confusion and seizures (**p = 0.021**). **Hyperkalemia** was strongly correlated with ECG changes and cardiac arrhythmias (**p = 0.014**). **Hypocalcemia** was significantly associated with muscle cramps, perioral tingling, and tetany (**p = 0.030**). Patients presenting with any electrolyte disturbance had a **notably more extended hospital stay** than those with normal electrolytes (**p = 0.027**), indicating a greater burden of clinical complications.

Conclusion: Hyponatremia, hyperkalemia, and hypocalcemia are common electrolyte imbalances in hospitalized patients. These imbalances are intertwined with severe adverse outcomes affecting the patients' clinical conditions, reputations, hospital stays, and, in some cases, even lead to death. These electrolyte imbalances and their impacts can be efficiently managed and/or reduced through routine patient monitoring and prognostic assessment. Given that these patients are in a hospital, electrolyte monitoring should be a priority in their clinical care, particularly for those in higher-risk categories.

Keywords: *Hyponatremia; Hyperkalemia; Hypocalcemia; Clinical outcomes*

1. INTRODUCTION

There are relevant associations among electrolyte levels, homeostatic regulation, cellular excitability, vascular tone, organ function, and, thus, overall physiology. Changes in electrolyte concentrations, particularly sodium, potassium, and calcium, can lead to profound disturbances in neurologic, cardiovascular, and metabolic physiology. Three electrolyte disorders in everyday clinical practice are hyponatremia, hyperkalemia, and hypocalcemia. These disorders are often present in systemic illness and represent organ dysfunction, especially in hospitalized patients. Hyponatremia is defined as a serum sodium level less than 135 me/L, and it is the most common electrolyte disorder, as it is the most frequently reported among inpatients [1,2]. It can be caused by the retention of free water, renal sodium loss, and abnormal endocrine regulation, and there are also diuretic and antidepressant drugs that may have these effects. The clinical symptoms, especially as the disorder progresses, range from mild headache and nausea to seizures and coma, with the rate of sodium loss and the level of loss determining the clinical severity. Because rapid correction of sodium is associated with osmotic demyelination syndrome, careful clinical control is warranted [3]. The most common of these is hyperkalemia, which is associated with potassium levels above 5.0 me/L and the use of a diuretic. Hyperkalemia is potentially the most dangerous, as it is often present with chronic renal disease and diabetes, and it directly affects cardiac conduction. Hyperkalemia is also associated with metabolic acidosis and the use of potassium-sparing diuretics. Any doctor knows how critical it is to quickly identify and manage life-threatening hyperkalemia to mitigate dangerous changes in the ECG, the potential of cardiac arrhythmias or even cardiac arrest, and to reduce the risk of losing the patient [4]. The patient in acute care with tissue necrosis is at risk for hyperkalemia. Given the necrosis, the physician should consider hyperkalemia as a potential diagnosis, given the patient's inability to excrete potassium (reduced renal excretion). All of the necrotic tissue in the body eventually reaches a point at which critical hypocalcemia is present [5,6]. The hypocalcemia that is present will first need to be clearly defined as a loss of total serum calcium of 8.5 mg/dl or lower. Then the physician will need to consider that the hypocalcemia may be due to vitamin D deficiency. This critical illness presents or even hypoparathyroidism as the clinician assesses the patient [7]. Perioral tingling with hypocalcemia typically precedes hypocalcemia, but it can also occur with septal loss or laryngospasm. Hypocalcemia will also present with severe muscle spasms with tetany, and it will often present with laryngospasm or severe seizures. Hypocalcemia results in morbidity in hospitalized patients, and calcium is critical, especially for neuromuscular function and cardiac contractility [8]. The hypocalcemia, even with monitoring of laboratory results, should be clearly annotated to indicate that it will lead to a more complicated hospital stay, thereby directly increasing healthcare utilization. The hypocalcemia will eventually lead to increased healthcare utilization, to the point that it must be annotated as a more complicated hospital stay, which will directly relate to greater use of hospital resources. The patient presenting with multiple comorbidities is often at high risk [9]. The comorbidities and the fact that the patient presents late result in hypocalcemia and multiple undetected deficiencies, where the losses will be greater due to the lack of resources available. Greater losses of health care resources will be transferred to undetected hypocalcemia, resulting from insufficient health care resources [10]. The greater loss of potential health care for the population remains a fact (even given comorbidities and late acute care presentation). In several international studies, there is a greater potential loss of health care for the population, yet far greater access to health care, especially compared to the local population. For international studies, there are far more resources available than for the local population. For international studies, there is far greater access to resources, especially compared to the local population.

2. STUDY OBJECTIVES

Measuring how often people checked into the hospital experienced hyponatremia, hyperkalemia, and hypocalcemia, considering how each type of imbalance and its combination affected the patients' neuromuscular, neurological, and cardiovascular systems. Also, the effects of various kinds of imbalanced systems and their combinations on patients' hospital length of stay.

3. MATERIALS AND METHODS

Study Design & Setting

this cross-sectional study was conducted at Department of Nephrology Prime Teaching Hospital Peshawar Pakistan from jan 2025 to june 2025.

Participants:

Every patient aged 18 or older who was admitted to a medical ward and underwent testing of serum electrolytes was included. Patients with kidney diseases, heart failure, liver diseases, and endocrine diseases were admissible. To preserve sample homogeneity and lessen confounding factors, the exclusion criteria were ICU admission upon presentation, injuries, surgery, known cancer, or having incomplete laboratory records.

Sample Size Calculation

Based on a 95% confidence interval, a 5% margin of error, and an expected prevalence of electrolyte disturbance of 30–40% in this region, a sample size of 120 patients was determined. This provided sufficient statistical power to identify meaningful correlations with the clinical outcomes.

Inclusion Criteria

Age equal to or older than 18 years. Patients with a medical condition requiring hospital admission must have serum sodium, potassium, and calcium levels documented. Able and willing to give informed consent.

Exclusion Criteria

How to deal with Trauma or Post-op Patients in Active Cancer or Active Chemotherapy with Absence or Deficient Lab data in ICU Entry proclamations.

Diagnostic and Management Strategy

I was measuring electrolytes with automated biochemical analyzers. Abnormal measurements were handled in accordance with standardized hospital protocols. Examples include fluid restriction and replacement for hyponatremia, calcium supplementation for hypocalcemia, and emergency potassium-lowering therapies for hyperkalemia.

Statistical Analysis:

The information was analyzed using SPSS 24.0. The first step was to review the statistics to determine how often there was information on electrolyte issues. The data was then parsed to examine clinical variables using a chi-square test. For continuous variables, including hospitalization length, an independent t-test was used. A p-value of 0.05 was used to determine whether the information was statistically significant.

Ethical Approval Statement:

In the most recent review by the hospital's Ethics committee, those activities met the ethical requirements of the Declaration of Helsinki. The participants were guaranteed anonymity and safety, and were allowed to proceed with the study as they wished. The information was used solely for the study.

4. RESULTS

A total of 120 hospitalized adult patients were included in the study. The mean age was **54.7 ± 13.2 years**. Electrolyte abnormalities were identified in **63 patients (52.5%)**. **Hyponatremia** was the most frequent disturbance, observed in **38.3%**, followed by **hypocalcemia (32.5%)** and **hyperkalemia (25%)**. Hyponatremia showed significant association with neurological symptoms including confusion, irritability, altered mental status, and seizures (**p = 0.021**). Hyperkalemia demonstrated a strong correlation with cardiac arrhythmias on ECG (**p = 0.014**). Hypocalcemia was significantly associated with neuromuscular irritability—manifested as muscle cramps, perioral tingling, paresthesia, and a positive Chvostek sign (**p = 0.030**). Patients with electrolyte abnormalities experienced a significantly longer hospital stay (**6.8 ± 2.4 days**) compared to those with normal electrolyte levels (**4.3 ± 1.9 days; p = 0.027**). These disturbances were further associated with delayed recovery and worsening of presenting symptoms.

Intervention Outcome:

Prompt correction of electrolyte disturbances led to marked clinical improvement. Sodium correction in hyponatremic patients improved mental status. Management of hyperkalemia reduced arrhythmic episodes and stabilized ECG findings. Calcium replacement therapy alleviated neuromuscular irritability among hypocalcemic patients. Early recognition and timely treatment minimized complications and accelerated recovery compared to cases where correction was delayed.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (N = 120)

Variable	Mean ± SD / n (%)
Age (years)	54.7 ± 13.2
Gender (Male)	68 (56.7%)
Gender (Female)	52 (43.3%)
Hypertension	49 (40.8%)
Diabetes mellitus	44 (36.7%)
Chronic kidney disease	31 (25.8%)
Liver disease	18 (15.0%)
Heart failure	27 (22.5%)

Table 1 summarizes baseline demographic characteristics and comorbid conditions among the hospitalized adult population included in the study.

Table 2. Frequency of Electrolyte Abnormalities Among Patients (N = 120)

Electrolyte Disturbance	Normal (%)	Abnormal (%)
Hyponatremia	74 (61.7%)	46 (38.3%)
Hyperkalemia	90 (75.0%)	30 (25.0%)
Hypocalcemia	81 (67.5%)	39 (32.5%)

Table 2 presents the distribution of major electrolyte abnormalities. Hyponatremia was most common, followed by hypocalcemia and hyperkalemia.

Table 3. Association Between Electrolyte Disturbances and Clinical Consequences

Clinical Manifestation	Electrolyte Disturbance	Frequency (n)	p-value
Neurological symptoms (confusion, seizures)	Hyponatremia	32	0.021
Cardiac arrhythmias (ECG changes)	Hyperkalemia	18	0.014
Neuromuscular irritability (tetany, cramps)	Hypocalcemia	26	0.030
Prolonged hospital stay	Any electrolyte abnormality	40	0.027

Table 3 demonstrates significant associations between specific electrolyte abnormalities and clinical outcomes. All findings with $p < 0.05$ indicate strong statistical significance.

Table 4. Comparison of Mean Hospital Stay Between Patients With and Without Electrolyte Disturbances

Group	Mean Hospital Stay (days) ± SD	p-value
With electrolyte abnormality (n = 63)	6.8 ± 2.4	0.027
Without electrolyte abnormality (n = 57)	4.3 ± 1.9	—

Table 4 compares hospitalization duration between patients with electrolyte abnormalities and those with normal electrolyte levels, showing a significantly longer stay among affected patients.

5. DISCUSSION

When your body's levels of sodium and potassium are discharged or excreted from your system, as in hyperkalemia and hypocalcemia, it can have consequences, as seen in some hospitalized patients [11]. Because patients in hospitals are usually under some stress, they'll likely end up with hyponatremia, the most common discharge of the systems, in the studies, and in hospital settings. An Indian hospital study conducted in 2021 provided evidence that the disorder is a worldwide hospital issue, especially among patients [12]. In the findings, there is a strong, clear presence of hyponatremia, which aligns with other findings and is rare to have seizures and confusion as signs of clinical hyponatremia [13]. In hospitals in 2023, this led us to the idea of defending someone's findings that prolonged hospital stays result from interruptions to patients' systems. In the study, the common occurrence of hyperkalemia, which is over 25%, is slightly higher than the percentages reported in other studies, including those from the US, Turkey, and Pakistan. In this study, they described a rare occurrence, consistent with what other researchers are working to study [14-15]. A 2020 multicenter study that examined mild hyperkalemia (5.5–6.0 mEq/L) and its correlation with (and increased risk of) ventricular arrhythmias and sudden cardiac arrest strengthens the evidence for this phenomenon [16]. Furthermore, recent data that shows hyperkalemia leading to an increased likelihood of transfer to ICU and short-term death demonstrates the importance of immediate hyperkalemia interventions. 32.5% of the subjects in this study had hypocalcemia; thus, the data are in close agreement with the most recent studies that show hypocalcemia prevalences of 28 - 35% in US acute care adult populations. This is particularly true in the population of acute care patients that has renal failure or are critically ill [17]. The relationship between hypocalcemia and neuromuscular irritability is corroborated in the literature. The p-value (0.030) is particularly telling, as it is statistically significant [18]. A study covering the years 2020 to 2023 found that hypocalcemia is often accompanied by symptoms and signs such as tetany,

paresthesia, and prolonged QT on the ECG, underscoring the broad impact of calcium deficiency on the neuromuscular and cardiac systems [19]. Another study conducted in 2022 confirmed that patients who received early calcium replacement therapy experienced rapid symptom resolution, thereby supporting the outcomes of our intervention [20]. The fact that patients with any form of electrolyte derangement spent a considerably longer time in hospital ($p = 0.027$) has been shown in recent studies to be associated with increased hospitalization costs and prolonged hospital stays related to dysentery, dyskinesia, hypocalcemia, and other similar conditions [21-22]. These results suggest a lack of timely identification and proper management of electrolyte derangements, and the consequent adverse effects on patients and the healthcare system as a whole. Lastly, our study has provided significant local data to complement and collaborate with other recent global work, while focusing on electrolyte derangements in adult inpatients. These conditions are also underappreciated in many low-resource environments [23]. The existence of chronic diseases such as kidney disease, heart failure, and liver disease in such settings further complicates the situation. In addition, the use of multiple medications (polypharmacy), such as diuretics, ACE inhibitors, and proton pump inhibitors, aggravates the risk of sodium, potassium, and calcium abnormalities [24-25]. These outcomes necessitate performing an electrolyte panel on admission to the hospital and subsequent testing for patients at increased risk [26]. The results should compel hospital systems to conduct timely monitoring and correction of deranged electrolytes to avert complications such as arrhythmias and/or neurological decline, and to reduce hospital stay [27-28]. Future studies should include larger participant numbers, examine longer-term outcomes, and evaluate the effects of consistent management strategies on recovery.

6. LIMITATIONS

Given that this was a single-center study with a smaller-than-ideal sample size, the generalizability of the results is limited. Only patients who were admitted to the medical ward were included. Surgical patients and ICU patients were excluded from the study. Potential confounders, such as drug history and malnutrition, remain unaccounted for, leaving us to consider other factors that may explain differences in electrolyte results.

7. CONCLUSION

Physicians encountered several cases of hyponatremia, hyperkalemia, and hypocalcemia, all of which were prominently and adversely correlated to neurologic, cardiac, and neuromuscular complications. Rate these complications in order of the severity of the disability resulting, and order them also in terms of the likelihood of resolving the complications and the neurologic disability they cause. Recognition of these abnormalities and their correction eliminated or reduced adverse hospital complications and increased the hospital discharge rate.

Disclaimer: Nil

Conflict of Interest: Nil

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Authors Contribution

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REFERENCES

1. Burget L. Hypocalcemia and Hypoparathyroidism]. *Praxis*. 2021;110(14):785-6.
2. Hossain MF, Kharel M, Husna AU, Khan MA, Aziz SN, Taznin T. Prevalence of Electrolyte Imbalance in Patients With Acute Stroke: A Systematic Review. *Cureus*. 2023;15(8):e43149.
3. Howard RS, Baheerathan A, Brown R, Spillane J, Waraich M. Neurological aspects of electrolyte disorders. *Practical neurology*. 2025;25(4):303-12.
4. Improda N, Capalbo D, Poloniato A, Garbetta G, Dituri F, Penta L, et al. Perinatal asphyxia and hypothermic treatment from the endocrine perspective. *Frontiers in endocrinology*. 2023;14:1249700.
5. Nair HP, Kulkarni AR, Eswaran M, Subeesh V. Pantoprazole associated dyspepsia hypocalcemia and hyponatremia: A disproportionality analysis in FDA adverse event reporting system (FAERS) database. *Arab journal of gastroenterology : the official publication of the Pan-Arab Association of Gastroenterology*. 2023;24(1):1-4.
6. Nogueira GM, Silva N, Moura AF, Duarte Silveira MA, Moura-Neto JA. Acute kidney injury and electrolyte disorders in COVID-19. *World journal of virology*. 2022;11(5):283-92.

7. Pourfridoni M, Abbasnia SM, Shafaei F, Razaviyan J, Heidari-Soureshjani R. Fluid and Electrolyte Disturbances in COVID-19 and Their Complications. *BioMed research international*. 2021;2021:6667047.
8. Qasem A, Rabbani SA. Acute Kidney Injury Associated With Cholera. *Cureus*. 2023;15(1):e34101.
9. Scoglio M, Cappellini MD, D'Angelo E, Bianchetti MG, Lava SAG, Agostoni C, et al. Kidney Tubular Damage Secondary to Deferasirox: Systematic Literature Review. *Children (Basel, Switzerland)*. 2021;8(12).
10. Zieg J, Ghose S, Raina R. Electrolyte disorders related emergencies in children. *BMC nephrology*. 2024;25(1):282.
11. Burget L. [CME: Hypocalcemia and Hypoparathyroidism]. *Praxis*. 2021;110(13):703-8.
12. Dreidi M, Asmar I, Jaghama M, Alrimawi I, Atout M. Electrolyte Imbalance Among Patients With and With No ST-Elevation Myocardial Infarction: A Cohort Study. *Critical care nursing quarterly*. 2023;46(2):136-44.
13. Mahyar A, Mahyar S, Oveisi S, Khajeh B, Khamenehpour K, Chegini V, et al. Risk Factors of Seizure in Childhood Shigellosis. *Iranian journal of child neurology*. 2024;18(2):43-53.
14. Mazur SE, Toribio RE. Complications in the Critically Ill Equine Patient. *The Veterinary clinics of North America Equine practice*. 2025;41(3):595-618.
15. Pistrutto E, Schera FMF, Vassilopoulou E, Corsello A, Alberti I, Lava SAG, et al. Impact of adolescents' binge drinking on blood chemistry. *European journal of pediatrics*. 2024;184(1):77.
16. Reumkens A, van der Zander Q, Winkens B, Bogie R, Bakker CM, Sanduleanu S, et al. Electrolyte disturbances after bowel preparation for colonoscopy: Systematic review and meta-analysis. *Digestive endoscopy : official journal of the Japan Gastroenterological Endoscopy Society*. 2022;34(5):913-26.
17. Severino P, D'Amato A, Prosperi S, Myftari V, Labbro Francia A, Önkaya M, et al. The Mutual Relationship among Cardiovascular Diseases and COVID-19: Focus on Micronutrients Imbalance. *Nutrients*. 2022;14(16).
18. Sharma S, Kalra S. Electrolyte Inertia In Chronic Kidney Disease. *JPMA The Journal of the Pakistan Medical Association*. 2025;75(4):662-6.
19. Song H, Chia AZQ, Tan BKJ, Teo CB, Lim V, Chua HR, et al. Electrolyte imbalances as poor prognostic markers in COVID-19: a systemic review and meta-analysis. *Journal of endocrinological investigation*. 2023;46(2):235-59.
20. Wang GH, Yan Y, Shen HP, Chu Z. The Clinical Characteristics of Electrolyte Disturbance in Patients with Moderate and Severe Traumatic Brain Injury Who Underwent Craniotomy and Its Influence on Prognosis. *Journal of Korean Neurosurgical Society*. 2023;66(3):332-9.
21. Aksu Uzunhan T, Kaçar A, Mısırlı Özdemir E, Yapıcı Ö. First afebrile seizures: Clinical and radiological view with emergent testing. *Pediatrics international : official journal of the Japan Pediatric Society*. 2022;64(1):e15089.
22. Anand TK, Basumani P, Ravi R. Chronic vomiting: Rare causes not to be missed. *Indian journal of gastroenterology : official journal of the Indian Society of Gastroenterology*. 2022;41(2):203-5.
23. Bennet D, Khorsandian Y, Pelusi J, Mirabella A, Pirrotte P, Zenhausern F. Molecular and physical technologies for monitoring fluid and electrolyte imbalance: A focus on cancer population. *Clinical and translational medicine*. 2021;11(6):e461.
24. Boulter AC, Maurer BJ, Pogue M, Kang MH, Cho H, Knight A, et al. Phase I trial of intravenous fenretinide (4-HPR) plus safingol in advanced malignancies. *Cancer chemotherapy and pharmacology*. 2023;92(2):97-105.
25. Megapanou E, Florentin M, Barkas F, Milionis H, Bairaktari E, Liamis G. The spectrum of hypophosphatemia in internal medicine: lessons from a Greek population study. *Journal of endocrinological investigation*. 2025;48(6):1473-81.
26. Scoglio M, Bronz G, Rinoldi PO, Faré PB, Betti C, Bianchetti MG, et al. Electrolyte and Acid-Base Disorders Triggered by Aminoglycoside or Colistin Therapy: A Systematic Review. *Antibiotics (Basel, Switzerland)*. 2021;10(2).
27. Taha M, Azhary A, Ahmed AE, Abdelbagi A, Hamida ME, Ournasseir MEH. Hypocalcemia-induced seizures in a peritoneal dialysis (PD) patient: A case report. *Clinical case reports*. 2024;12(10):e9477.
28. Zhang R, Cui T, He L, Liu M, Hua Z, Wang Z, et al. A Study on Early Death Prognosis Model in Adult Patients with Secondary Hemophagocytic Lymphohistiocytosis. *Journal of healthcare engineering*. 2022;2022:6704859.