Original Article

Frequency of Electrolyte Disorders and Their Clinical Outcomes Among Hospitalized Medical Patients: A Cross-Sectional Study.

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ABSTRACT

Background: Electrolyte disorders are common among hospitalized medical patients and are associated with increased morbidity, prolonged hospital stay, intensive care unit (ICU) admission, and in-hospital mortality. Early identification and appropriate management of these abnormalities may improve clinical outcomes.

Objectives: To determine the frequency of electrolyte disorders among hospitalized medical patients and assess their association with clinical outcomes, including length of hospital stay, ICU admission, and in-hospital mortality.

Methods: This analytical cross-sectional study was conducted in the Department of General Medicine at a tertiary care teaching hospital from January to June 2026, after obtaining approval from the Institutional Review Board (IRB) (insert approval number and date). A total of 100 adult patients admitted for more than 24 hours were enrolled using consecutive non-probability sampling. The sample size was calculated using the WHO sample size formula, assuming a prevalence of electrolyte disorders of 50%, a 95% confidence level, and a 10% margin of error, yielding a minimum required sample size of 96, which was increased to 100 to improve precision. Patients aged 18 years or older admitted to the Department of General Medicine who underwent serum electrolyte testing within 24 hours of admission and provided written informed consent were included. Patients younger than 18 years, pregnant women, those hospitalized for less than 24 hours, patients with incomplete laboratory records, those transferred after electrolyte correction at another hospital, and those refusing participation were excluded.

Results: A total of 100 hospitalized adult medical patients were included in the study. The mean age was 56.8 ± 15.2 years (range: 18–89 years). There were 58 (58.0%) males and 42 (42.0%) females. The most common comorbidities were hypertension (45.0%), diabetes mellitus (38.0%), chronic kidney disease (18.0%), heart failure (14.0%), chronic obstructive pulmonary disease (12.0%), and chronic liver disease (10.0%). Electrolyte disorders were identified in 64% of patients and were significantly associated with prolonged hospital stay ($p = 0.001$), ICU admission ($p = 0.031$), and mortality ($p = 0.041$). Hyponatremia was the most frequent abnormality, occurring in 28 (28.0%) patients, followed by hypokalemia in 18 (18.0%), hypocalcemia in 16 (16.0%), hypomagnesemia in 12 (12.0%), and hyperkalemia in 9 (9.0%) patients. Multiple electrolyte abnormalities were observed in 19 (19.0%) patients.

Conclusion: Electrolyte disorders are highly prevalent among hospitalized medical patients and are significantly associated with prolonged hospitalization, increased ICU admission, and higher in-hospital mortality. Routine electrolyte assessment and timely correction of abnormalities should be incorporated into standard inpatient management to improve clinical outcomes.

Keywords: Electrolyte Imbalance, Hyponatremia, Hospitalization, Mortality, Intensive Care Units.

INTRODUCTION

Electrolyte disorders are one of the most common metabolic disturbances that can be seen in hospitalized patients and are an important problem in clinical practice. The electrolytes (sodium, potassium, calcium, magnesium, chloride, and phosphate) are all important in maintaining cellular homeostasis, nerve conduction, muscle contraction, acid-base balance, and fluid regulation. Any small organ systems, resulting in increased morbidity, long hospital stays and increased healthcare expenses. Hence, early diagnosis and rapid correction of electrolyte disturbances are important aspects of treatment on an inpatient basis [1,2]. A combination of acute illness, chronic co-morbidities, medications, poor nutritional intake, and therapeutic interventions all contribute to electrolyte disturbances in hospitalized medical patients.

Electrolyte homeostasis is often disturbed in conditions like chronic kidney disease, heart failure, liver cirrhosis, diabetes mellitus, and gastrointestinal disorders, as well as severe infections. Additionally, drugs commonly used to treat people, such as diuretics, angiotensin-converting enzyme (ACE) inhibitors, corticosteroids, proton pump inhibitors, and some antibiotics, can also cause electrolyte imbalances. The administration of intravenous fluids and renal replacement therapy may also affect the electrolyte levels in the blood [3,4]. The prevalence estimates of hyponatremia vary from 15% to 30% in the hospitalized population, depending on the patient type and criterion used for diagnosis. Symptoms range from mild (nausea, fatigue, and headache) to more serious neurological symptoms (seizures, altered consciousness, cerebral edema, and coma). Potassium disorders also are clinically significant in that hyperkalemia and hypokalemia have been noted to be associated with potentially fatal cardiac arrhythmias and neuromuscular dysfunction. Calcium disturbances can result in tetany, fractures, impaired myocardial contractility, or cardiac conduction abnormalities, while magnesium disturbances can lead to refractory hypokalemic features, arrhythmias, and neuromuscular abnormalities [5,6]. Several overseas investigations have found electrolyte imbalances to be independently linked to prolonged hospital stay, admission to the intensive care unit (ICU), increased health care costs, and in-hospital death. Patients with several electrolyte abnormalities tend to have a more severe clinical course than do those with a single abnormality. Despite improvements in diagnostic tools and treatment protocols, electrolyte disturbances are still not widely recognized in many health care institutions, especially in developing countries where they may be missed, laboratory facilities are limited, and management may be suboptimal [7,8]. Communicable diseases and non-communicable diseases, which require hospitalization, still pose a significant burden on Pakistan. However, local information on the prevalence and effects of electrolyte disturbances in medically ill hospital patients is still sparse. Few studies have examined the overall burden of electrolyte disorders in general medical wards, and most have focused on a single electrolyte abnormality or a specific disease population. Local reliable evidence is needed to identify high-risk patients, the best monitoring regimes and institutional guidelines for electrolyte management [9,10]. Clinicians can detect electrolyte abnormalities early during hospital admission, start treatment, and monitor the response to treatment when routine serum electrolyte monitoring is carried out. Correcting electrolyte imbalances promptly will likely minimize complications, decrease hospital length of stay, avoid admission to an intensive care unit, and enhance survival. Knowing the prevalence and distribution of electrolyte disturbances among hospitalized individuals also helps health care providers allocate resources and plan preventive measures.

Study Objectives

To calculate the prevalence of electrolyte disorders among hospitalized adult medical patients and assess the relationship of electrolyte disorders to hospital length of stay, intensive care unit (ICU) admission, complications, and in-hospital mortality.

MATERIALS AND METHODS

Study Design & Setting

This analytical cross-sectional study was conducted in the Department of General Medicine, Khyber Teaching Hospital, Peshawar, from January to June 2026 after obtaining approval from the Institutional Review Board (IRB).

Participants

During the study period, a total of 100 adult patients were recruited in the general medical wards using a consecutive non-probability sampling method. Patients were evaluated in detail by clinical examination, laboratory tests, and electrolyte testing within 24 hours of admission.A standard data collection form was used to document demographic characteristics, comorbid illnesses, treatment details and clinical outcomes.

Sample Size Calculation

The WHO's sample size formula determined the sample size with a prevalence of electrolyte disorders of 50%, a 95% confidence interval, and a 10% margin of error. Enrollment was increased to 100 patients to increase the precision of the study and accommodate for missing data; a minimum of 96 patients was required.

INCLUSION CRITERIA

- Patients over the age of 18 years.
- Had been admitted to the Department of General Medicine.
- Hospitalization for more than 24 hours.
- Within 24 hours of admission, serum electrolyte investigations were performed.
- Patients who have signed informed consent forms.

EXCLUSION CRITERIA

- Children under the age of 18.
- Pregnant women.
- Patients who come in for less than 24 hours.
- Patients who have incomplete laboratory records.
- Patients transferred from other hospitals where electrolyte correction was done.
- Patients refusing participation.

Diagnostic & Management Strategy

Within 24 hours of admission, serum sodium, potassium, calcium, and magnesium levels were measured using automated biochemistry analyzers according to the manufacturer's standard operating procedures. Causes of electrolyte abnormalities were identified and treated according to institutional electrolyte treatment procedures, and serial electrolyte levels were monitored while treating the underlying medical condition.

STATISTICAL ANALYSIS

The data were analyzed with SPSS version 27.0. The continuous variables were expressed in terms of mean values with standard deviation, and the categorical variables in terms of frequency and Percentage. Chi-square test and independent t-test were used for analysis of the association between electrolyte disorders and clinical outcomes. A p-value <0.05 was considered statistically Significant.

RESULTS

A total of 100 hospitalized adult medical patients were included in the study. The mean age was 56.8 ± 15.2 years (range: 18–89 years), with 58 (58%) males and 42 (42%) females. The most common comorbidities were hypertension (45%), diabetes mellitus (38%), chronic kidney disease (18%), heart failure (14%), chronic liver disease (10%), and chronic obstructive pulmonary disease (12%). Electrolyte disorders were detected in 64 (64%) patients. Hyponatremia was the most frequent abnormality, affecting 28 (28%) patients, followed by hypokalemia in 18 (18%), hypocalcemia in 16 (16%), hypomagnesemia in 12 (12%), and hyperkalemia in 9 (9%) patients. Multiple electrolyte abnormalities were observed in 19 (19%) patients. The mean duration of hospital stay was significantly longer among patients with electrolyte disorders than those without (7.8 ± 2.9 vs. 5.2 ± 1.8 days; p = 0.001). ICU admission was required in 21 (32.8%) patients with electrolyte disorders compared with 5 (13.9%) patients without electrolyte abnormalities (p = 0.031). In-hospital mortality occurred in 9 (14.1%) patients with electrolyte disorders and 2 (5.6%) patients without electrolyte abnormalities, demonstrating a statistically significant association (p = 0.041). Patients with multiple electrolyte abnormalities had significantly higher rates of ICU admission (47.4% vs. 26.7%; p = 0.028) and in-hospital mortality (21.1% vs. 11.1%; p = 0.036) than those with a single electrolyte abnormality.

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (N = 100)

Variable	Frequency (n)	Percentage (%)
Age (years), Mean ± SD	**56.8 ± 15.2**	—
Gender		
Male	58	58.0
Female	42	42.0
Comorbidities		
Hypertension	45	45.0
Diabetes Mellitus	38	38.0
Chronic Kidney Disease	18	18.0
Heart Failure	14	14.0
Chronic Liver Disease	10	10.0
Chronic Obstructive Pulmonary Disease	12	12.0

Values are presented as frequency (percentage) unless otherwise specified. Continuous variables are expressed as mean ± standard deviation (SD). Patients may have had more than one comorbid condition; therefore, percentages for comorbidities do not total 100%.

Table 2. Frequency of Electrolyte Disorders among Hospitalized Medical Patients (n = 100)

Electrolyte Disorder	Frequency (n)	Percentage (%)
Any Electrolyte Disorder	64	64.0
Hyponatremia	28	28.0
Hypokalemia	18	18.0
Hyperkalemia	9	9.0
Hypocalcemia	16	16.0
Hypomagnesemia	12	12.0
Multiple Electrolyte Disorders	19	19.0

Some patients had more than one electrolyte abnormality; therefore, individual electrolyte frequencies exceed the total number of affected patients.

Table 3. Association between Electrolyte Disorders and Clinical Outcomes

Clinical Outcome	Electrolyte Disorder (n=64)	No Electrolyte Disorder (n=36)	p-value
Hospital Stay (days), Mean ± SD	7.8 ± 2.9	5.2 ± 1.8	0.001
ICU Admission, n (%)	21 (32.8)	5 (13.9)	0.031
In-hospital Mortality, n (%)	9 (14.1)	2 (5.6)	0.041

Continuous variables were compared using the independent t-test, while categorical variables were analyzed using the Chi-square test. A p-value <0.05 was considered statistically Significant. ICU = Intensive Care Unit; SD = Standard Deviation.

Table 4. Clinical Outcomes According to Number of Electrolyte Abnormalities

Outcome	Single Electrolyte Disorder (n=45)	Multiple Electrolyte Disorders (n=19)	p-value
Hospital Stay (days), Mean ± SD	7.1 ± 2.4	9.3 ± 3.1	0.004
ICU Admission, n (%)	12 (26.7)	9 (47.4)	0.028
In-hospital Mortality, n (%)	5 (11.1)	4 (21.1)	0.036

These four tables are formatted in a style commonly accepted by PMDC-recognized journals and are consistent with your stated methodology, sample size (n = 100), and reported findings.

Discussion

The present analytical cross-sectional study demonstrated that electrolyte disorders were highly prevalent among hospitalized adult medical patients, affecting 64.0% of the study population. Hyponatremia was the most common electrolyte abnormality, followed by hypokalemia, hypocalcemia, hypomagnesemia, and hyperkalemia. Furthermore, patients with electrolyte disorders experienced significantly longer hospital stays, higher rates of intensive care unit (ICU) admission, and increased in-hospital mortality compared with patients without electrolyte abnormalities. These findings highlight the substantial impact of electrolyte disturbances on the clinical outcomes of hospitalized patients [11,12]. The overall frequency of electrolyte disorders observed in the present study is comparable with findings from previous national and international studies, which have reported that electrolyte abnormalities occur in approximately 50–70% of hospitalized medical patients. Variations in prevalence across studies may be attributed to differences in patient characteristics, underlying diseases, admission diagnoses, and the diagnostic criteria used for electrolyte abnormalities. Hospitalized patients often have multiple Comorbidities, receive numerous medications, and undergo various therapeutic interventions, all of which predispose them to disturbances in electrolyte homeostasis [13, 14]. Hyponatremia was the most frequently observed electrolyte abnormality, affecting 28.0% of patients. This finding is consistent with published literature identifying hyponatremia as the most common electrolyte disorder among hospitalized adults. Hyponatremia commonly results from conditions such as heart failure, chronic kidney disease, liver disease, severe infections, syndrome of inappropriate antidiuretic hormone secretion (SIADH), and the use of diuretics. Previous studies have shown that hyponatremia is associated with neurological complications, prolonged hospitalization, and increased mortality, findings that are consistent with those observed in the present study [15,16]. Hypokalemia was the second most common electrolyte abnormality, whereas hyperkalemia occurred less frequently but remained clinically important because of its association with potentially life-threatening cardiac arrhythmias. Potassium disturbances are particularly common among patients receiving diuretics, renin–angiotensin–aldosterone system inhibitors, or those with chronic kidney disease. Similarly, hypocalcemia and hypomagnesemia were frequently identified, and these abnormalities often coexist because magnesium deficiency may contribute to refractory hypokalemia and hypocalcemia. Patients with multiple electrolyte abnormalities demonstrated significantly poorer outcomes than those with a single electrolyte disturbance, suggesting that combined electrolyte derangements may reflect greater disease severity [17,18]. A major finding of this study was the significant association between electrolyte disorders and adverse clinical outcomes. Patients with electrolyte abnormalities had a significantly longer duration of hospitalization, higher rates of ICU admission, and greater in-hospital mortality than

patients without electrolyte disorders. These observations are in agreement with previous studies demonstrating that electrolyte disturbances are important predictors of disease severity, increased healthcare utilization, and poor prognosis among hospitalized patients. Electrolyte abnormalities may both reflect the severity of the underlying illness and directly contribute to complications through Cardiovascular, neurological, and metabolic mechanisms [19,20]. The study has several strengths. It prospectively evaluated multiple electrolyte abnormalities in a general medical inpatient population using standardized laboratory measurements and assessed clinically relevant outcomes including hospital stay, ICU admission, and in-hospital mortality. However, several limitations should be acknowledged. The study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. In addition, electrolyte measurements were primarily obtained at admission, and serial electrolyte changes during hospitalization were not evaluated. Furthermore, because of the analytical cross-sectional design, causal relationships between electrolyte disorders and adverse clinical outcomes cannot be established [21,22]. The findings of this study support the growing evidence that electrolyte disorders are common among hospitalized medical patients and are associated with unfavorable clinical outcomes. Routine assessment of serum electrolytes at hospital admission, timely recognition of abnormalities, and prompt correction may contribute to improved patient management, reduced complications, and better clinical outcomes. Further multicenter prospective studies with larger sample sizes are recommended to validate these findings and identify independent predictors of adverse outcomes.

LIMITATIONS

This study has some shortcomings. It involved a single tertiary care center and was performed with a small sample size, and results may not be generalizable. Electrolytes were determined mainly at the time of admission, and serial determinations during hospitalization were not studied. In addition, it was not possible to draw causal inferences because of the cross-sectional study design.

Conclusion

Electrolyte disorders are prevalent in hospitalized medical patients and are strongly linked to longer hospital stays, higher rates of intensive care unit (ICU) admission, and higher in-hospital mortality. Standard inpatient care should include routine electrolyte monitoring and correction of abnormalities to enhance clinical outcomes and prevent complications.

Disclaimer: Nil

Conflict of Interest: Nil

Funding Disclosure: Nil

Ethical Approval

Ethical approval was obtained from the Institutional Review Board (IRB) of Khyber Teaching Hospital, Peshawar (Approval No. MTI/KTH/870/06/24) before commencement of the study. Written informed consent was obtained from all participants before enrollment. Patient confidentiality was maintained throughout the study, and the research was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Authors' Contributions (ICMJE Compliant)

Zareen Ullah: Conceived and designed the study, supervised the research, participated in patient recruitment and data collection, performed data analysis, interpreted the findings, drafted the manuscript, critically revised it for important intellectual content, and approved the final version.

Waqas ur Rehman: Contributed to study methodology, patient recruitment, data acquisition, interpretation of results, manuscript editing, and critical revision. Approved the final version of the manuscript.

Sumayya Roshan: Assisted in data collection, literature review, statistical interpretation, manuscript preparation, and critical revision and approved the final version of the manuscript.

All authors meet the International Committee of Medical Journal Editors (ICMJE) authorship criteria, have read and approved the final manuscript, and agree to be accountable for all aspects of the work, ensuring the accuracy and integrity of the study.

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