Original article

Impact of dysnatremia on Mortality in Patients with Acute Kidney Injury at Holy Family Hospital, Rawalpindi: A Cross-Sectional Study

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Abstract

Objective: To determine the frequency of dysnatremia among acute kidney injury (AKI) patients and assess the associated in-hospital mortality during the first 10 days of admission.
Methods: A descriptive cross-sectional study was conducted over six months at Holy Family Hospital, Rawalpindi. Data were collected from 120 AKI patients. Sodium levels were categorized as normal, hyponatremic, or hypernatremic, and mortality rates were tracked. Descriptive statistics were applied using SPSS.
Results: Among 120 patients, 31.7% (n=38) had dysnatremia. In-hospital mortality was 12.5% (n=15), with dysnatremia significantly associated with increased mortality.
Conclusion: Dysnatremia is common in AKI patients and is associated with increased short-term mortality, highlighting the need for careful monitoring of sodium levels in such patients.

Keywords: Dysnatremia, acute kidney injury (AKI)

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1. Introduction

Acute kidney injury (AKI) affects 8-16% of hospitalized patients and up to 50% of patients in intensive care units (ICU). Dysnatremia, particularly hyponatremia and hypernatremia, is common in these patients and has been linked to worsened outcomes, including higher mortality rates. Dysnatremia can affect cellular function, leading to complications such as brain edema (in hyponatremia) or cell shrinkage (in hypernatremia), both of which can have life-threatening consequences. Acute kidney injury (AKI) poses significant challenges for nephrologists, with uncertain etiology in many cases. AKI affects 8-16% of hospitalized patients, with 1 in 7 developing AKI during their stay, and up to 50% in intensive care unit (ICU) settings[1]. Patients with renal impairment are prone to dysnatremias, which are associated with increased morbidity and mortality[2, 3]. Dysnatremias can lead to altered central nervous system function, cellular damage, and mortality[3, 4].

Previous studies have reported significant mortality rates among AKI patients with hyponatremia (20.1-20.3%) and hypernatremia (18.1-32.1%)[5, 6]. The kidney's crucial role in sodium homeostasis makes it a key factor in these disorders. Research has shown that dysnatremias are strongly associated with AKI development and may serve as an early indicator of kidney injury[7]. Despite existing literature, the independent and cumulative prognostic effects of dysnatremias in AKI patients remain poorly understood[7, 8].

Recently, Gao et al. reported higher 90-day mortality rates among AKI patients with hyponatremia or hypernatremia at hospital admission[9]. This study aims to quantify the prevalence of dysnatremia in AKI patients and explore its impact on in-hospital mortality, addressing a gap in the local Pakistani healthcare context.

2. Materials & Methods

A descriptive cross-sectional study conducted in the Nephrology Department, Holy Family Hospital, Rawalpindi.Six months (March 2023 to September 2023). 120 patients, calculated using WHO sample size formula with a 95% confidence interval. Inclusion Criteria included Patients aged 18-60 years & AKI patients with underlying conditions like sepsis, nephrotoxic drug exposure, or ischemic heart disease. Exclusion Criteria included Patients with chronic kidney disease (CKD) & Trauma-related AKI. Data Collection: Data on age, gender, comorbidities (e.g., diabetes, hypertension, sepsis), and sodium levels were collected using hospital records. Sodium levels <135 mmol/L were categorized as hyponatremia, >145 mmol/L as hypernatremia. Mortality was measured within 10 days of admission. SPSS version 23 was used for analysis. Frequencies and percentages were calculated for categorical variables, while continuous variables were expressed as means ± standard deviations. A p-value of ≤ 0.05 was considered significant.

3. Results

Out of 120 AKI patients, 58.3% (n=70) were males and 41.7% (n=50) were females, with a mean age of 50.14 ± 5.28 years. Dysnatremia was present in 31.7% (n=38) of the patients. Coexisting conditions included diabetes (30.8%), hypertension (32.5%), ischemic heart disease (44.2%), and sepsis (10%).

- Hyponatremia: 20% (n=24)
- Hypernatremia: 11.7% (n=14)
- Mortality Rate: 12.5% (n=15) overall, with higher mortality in dysnatremic patients ($p < 0.05$).

Table 1: Demographic Data of Patients (n=120)

Variable	Frequency (%)
Male	58.3%
Female	41.7%
Age (mean ± SD)	50.14 ± 5.28

Table 2: Co-morbidities

Co-morbidity	Frequency (%)
Diabetes	30.8%
Hypertension	32.5%
Ischemic Heart Disease	44.2%
Chronic Liver Disease	34.2%
Sepsis	10.0%
Shock	6.7%

Table 3: Sodium Levels and Mortality

Sodium Level (mmol/L)	Frequency (%)
Normal (135-145)	68.3%
Dysnatremia (<135 or >145)	31.7%
Mortality	12.5%

Dysnatremia was observed in 31.7% of patients, with higher mortality rates compared to those with normal sodium levels. Co-morbid conditions like ischemic heart disease, chronic liver disease, and sepsis were common among patients with dysnatremia.

4. Discussion

Acute kidney injury (AKI) is a significant healthcare concern, affecting up to 30% of hospitalized patients worldwide, with mortality rates reaching 25-50%[10-12]. The combination of AKI, non-solid tumors, and sepsis is particularly ominous, with a reported in-hospital mortality rate of 100%. Survivors are at increased risk of developing chronic kidney disease (CKD)[13, 14].

Recent studies have identified novel AKI biomarkers, including damage markers (e.g., NGAL, KIM-1, L-FABP) and stress markers (e.g., dickkopf-3)[15, 16]. The Acute Disease Quality Initiative Consensus Conference recommendations emphasize the clinical utility of these biomarkers in AKI diagnosis, prediction, and severity assessment[16].

The pathophysiology of dysnatremia in AKI involves impaired sodium regulation due to reduced renal filtration capacity, which can disrupt the body's ability to maintain electrolyte balance. In hypernatremia, excessive free water loss leads to dehydration, while in hyponatremia, water retention may cause cerebral edema, both contributing to higher mortality. Our study investigated the frequency and impact of dysnatremias on mortality in AKI patients. The results show that dysnatremias are common in AKI patients and are associated with increased mortality. This finding is consistent with previous studies[17-23]. Notably, hyponatremia and hypernatremia have been identified as independent predictors of in-hospital mortality and 90-day mortality[19, 21].

The pathophysiological mechanisms underlying dysnatremias in AKI are complex and multifactorial. Our study's findings suggest that dysnatremias may serve as an early indicator of kidney injury and mortality risk. The association between dysnatremias and mortality persisted after adjusting for comorbidities and other potential confounders. The clinical implications of our study are significant. Early recognition and management of dysnatremias may improve outcomes in AKI patients. Future research should focus on developing strategies to prevent and manage dysnatremias in AKI, as well as exploring the underlying mechanisms of this association.

Limitations: The study is limited by its single-center design and small sample size. Further multicentered studies with larger cohorts are needed to validate these findings.

5. Conclusion

Dysnatremia is a frequent and significant contributor to mortality in AKI patients. Early recognition and correction of sodium imbalances could improve outcomes and reduce the risk of death in this vulnerable population.

Limitations: Our study has some limitations, including its retrospective design and relatively small sample size. Further prospective studies are needed to confirm our

findings and elucidate the causal relationships between dysnatremias and mortality in AKI patients.

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