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Clinical Significance of Admission Dysnatremia in Critically Ill Children at Benha University Hospital

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Abstract: Purpose: To evaluate the incidence of dysnatremia at the time of admission to a tertiary medical pediatric intensive care unit (PICU) and its relationship to underlying diseases and demographic factors.

Methods: This observational prospective study was conducted over six months and included 327 patients aged 1 month to 18 years admitted to PICU. Patients were categorized into three groups based on their serum sodium levels on admission: isonatremia group (n=275) (serum sodium 135-145 mEq/L), hyponatremia group (n=71) (serum sodium <135 mEq/L), and hypernatremia group (26) (serum sodium >145 mEq/L). Comprehensive data collection included demographic information, clinical histories, physical examinations, and laboratory investigations.

Results: Body math index (BMI) was significantly lower in the hyponatremic group (15 ± 1.8) compared to the isonatremic (16 ± 1.3) and hypernatremic (15.9 ± 1.4) groups. K+ levels, urea, serum and urine osmolality, and urine sodium were highest in the hypernatremic group. White blood cells (WBC) and hemoglobin were highest in the hyponatremic group. Bicarbonate was highest in the isonatremic group, and PCO_2 was highest in the hypernatremic group. Mortality rates were 22.5% in hyponatremic, 15.4% in hypernatremic, and 8% in isonatremic patients. Low sodium levels were associated with increased mortality (OR = 0.952, 95% CI = 0.913 - 0.994, P = 0.024).

Conclusions: Dysnatremia upon admission to the PICU is prevalent and significantly impacts patient outcomes. Hyponatremic patients had the highest mortality rates and complications, detecting the critical need for immediate management of serum sodium levels upon PICU admission.

Keywords: *Admission Dysnatremia, Critically Ill Children, Isonatremia, Hyponatremia, Hypernatremia, PICU*

Introduction

Electrolyte disturbances, particularly dysnatremia, pose significant challenges in pediatric intensive care [1]. Early recognition and understanding are crucial for reducing morbidity and mortality [2].

Sodium, the major extracellular cation, affects serum osmolality and is influenced by body water balance, Antidiuretic Hormone (ADH) secretion, and diseases [3]. Normal serum sodium in children is 135-145 mEq/L, with hypernatremia above 145 mEq/L and hyponatremia below 135 mEq/L [4].

Rapid sodium changes can cause brain edema due to the blood-brain barrier [5]. ADH increases water reabsorption, potentially causing hyponatremia, common in hospitalized children due to Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH) and medical interventions [6].

Hyponatremia, often exacerbated by iatrogenic factors, has prompted changes in IV fluid administration to prevent brain damage [7,8]. Hypernatremia is less common but carries high mortality in debilitated patients [9].

Electrolyte abnormalities often merge with underlying diseases, complicating recognition and treatment. Close monitoring and correction are essential to reduce mortality [10]. Electrolyte balance is crucial for critically ill patients, and accurate measurement at admission is a key prognostic indicator in the Pediatric Intensive Care unit (PICU) [11].

In this study, we aimed to evaluate the incidence of dysnatremia at the time of admission to a tertiary medical PICU and its relationship to underlying diseases and demographic factors in Benha university hospital.

Patients and methods

Design and population:

This was an observational prospective study that included 327 patients aged 1 month to 18 years admitted to the PICU who developed dysnatremia on admission (either hyponatremia, hypernatremia or isonatremia). They were selected from PICU in Benha university hospital during the period from 1st July 2023 to 31st December 2023 (6 months).

Patients were divided regarding natremia status into 3 groups; **group 1** included 275 patients with isonatremia, **group 2** included 71 patients with hyponatremia and g**roup 3** included 26 patients with hypernatremia.

Inclusion criteria were patients aged 1 month to 18 years and admitted to the PICU who developed hyponatremia or hypernatremia.

Exclusion criteria were patients who received intravenous fluid more than half of maintenance fluid needs within 24 hours before admission.

Methodology:

All studied cases were subjected to the following:

Full history taking included demographic characteristics (age, sex and weight) and detailed patient histories focusing on pre-existing conditions, medications, and any factors potentially affecting sodium balance.

Physical examination included anthropometric measurements (weight, height, BMI) to assess nutritional and hydration status. System-specific examinations of the chest, cardiac, abdominal, and neurological systems were conducted to identify any underlying conditions contributing to dysnatremia.

Laboratory investigations included Complete Blood Count (CBC), serum electrolytes (Na, K, Ca), Venous Blood Gases (VBG), kidney function tests (urea, creatinine), and liver function tests (AST, ALT). Specific tests for sodium balance included serum osmolality, urine osmolality, and urine sodium. Serum sodium levels on admission were used to categorize patients as hyponatremic, hypernatremic, or isonatremic.

Upon admission to PICU, serum sodium levels are measured to classify patients into three categories reflecting their natremic status [12]. Hyponatremia is defined as a serum sodium concentration of less than 135 mEq/L and is further subclassified into mild (130-134 mEq/L), moderate (120-129 mEq/L), and severe (<120 mEq/L) levels [13]. Hypernatremia is defined as a serum sodium concentration greater than 145 mEq/L, with further categorization into mild (146-150 mEq/L), moderate (151-160 mEq/L), and severe (>160

mEq/L) levels [14]. Isonatremia (normonatremia) is defined as serum sodium concentrations within the normal range of 135 to 145 mEq/L [15].

Documentation and Classification: Categories of admission diagnosis, and admission serum sodium levels were documented for each patient. Patients with dysnatremia were further classified according to the underlying causes, such as pulmonary diseases, renal diseases, CNS diseases, diabetic ketoacidosis (DKA), gastrointestinal (GI) diseases, cardiovascular and hematologic diseases, among others.

Statistical methods

Data were managed and analyzed using SPSS version 28. Normality of quantitative data was assessed using the Shapiro-Wilk test and visual methods. Data were summarized as means and standard deviations or medians and ranges for quantitative data, and as numbers and percentages for categorical data. One-way ANOVA or Kruskal-Wallis tests were used to compare quantitative data by natremic status, with post-hoc analyses for significant effects. Categorical data were compared using Chi-square or Fisher's exact test. Serum sodium was compared by mortality using the independent t-test. ROC analysis was performed to predict mortality, calculating the area under the curve, cutoff points, and diagnostic indices. Correlations were done using Pearson's or Spearman's correlation. Multivariate logistic regression predicted mortality, with odds ratios and confidence intervals calculated. A nomogram analysis generated a mortality risk score. All tests were two-sided with $P < 0.05$ considered significant.

Ethical approval: Before the children were enrolled in the study, the parents gave parental agreement, and the study was granted ethical authorization. The parents were fully informed about all study procedures. The Ethics Committee of Faculty of Medicine, Benha University Hospital's gave its approval to this investigation.

Results

This observational prospective study was conducted over six months in the PICU of Benha University Hospital. Patients aged 1 month to 18 years with hyponatremia or hypernatremia on admission were included. The patients were classified according to the natremic status into three groups: Isonatremia, hyponatremia and hypernatremia groups.

BMI differed significantly according to natremic status, being lower in the hyponatremic group (15 ± 1.8) compared to the isonatremic (16 ± 1.3) and hypernatremic (15.9 ± 1.4) groups, with no significant difference between the isonatremic and hypernatremic groups. However, age and weight showed no significant differences based on natremic status ($P = 0.44$ and 0.285, respectively).**Table 1**

K+ levels differed significantly among the groups ($P = 0.025$), being higher in the hypernatremic group (4.7 ± 0.7) than in the iso (4.3 ± 0.6) and hyponatremic (4.3 ± 0.4) groups. Urea was significantly higher in the hypernatremic group (median = 47) compared to iso (median = 35) and hyponatremic (median = 38) groups ($P = 0.04$). Serum osmolality was highest in the hypernatremic group (319.3 ± 14.4), followed by iso (292.9 ± 8.6) and hyponatremic (275.7 ± 17.4) groups ($P < 0.001$). Urine osmolality and sodium were also highest in the hypernatremic group, followed by the iso and hyponatremic groups ($P < 0.001$). WBCs were highest in the hyponatremic group (median = 16.3) compared to iso (median = 13.2) and hypernatremic (median = 13.1) groups ($P < 0.001$). Hemoglobin was highest in the hyponatremic group (12.4 ± 1.6) compared to iso (10.8 ± 2.6) and hypernatremic (11.1 ± 2.1) groups ($P < 0.001$). Bicarbonate levels were highest in the isonatremic group (25 ± 6) compared to hypo (23 ± 7) and hypernatremic (21 ± 7) groups ($P = 0.003$). PCO2 was highest in the hypernatremic group (41 ± 8) compared to the isonatremic group (35 ± 7) ($P = 0.002$). **Table 1**

Mortality rates were significantly different, with higher percentage among hyponatremic patients (22.5%), followed by hypernatremic (15.4%), and isonatremic patients (8%). Length of hospital stay, use of inotropes, mechanical ventilation and ventilation time revealed no significant differences according to the natremic status ($P = 0.519$, 0.210, 0.09, and 0.086, respectively). **Error! Reference source not found.**

Table 1: General, laboratory and clinical findings according to natremic status.

	Isonatremia (n = 275)	Hyponatremia (n = 71)	Hypernatremia (n = 26)	Total	P-value
Age (years)	0.83 (0.08 - 10.58)	0.92 (0.08 - 12.83)	0.83 (0.08 - 10.67)	0.83 (0.08 - 12.83)	0.44
Weight (kg)	9.2 (4.4 - 35.2)	14 (2.5 - 43)	9.6 (4.7 - 40.1)	9.3 (2.5 - 43)	0.285
BMI	16 ±1.3 [2]	15 ±1.8 [1, 3]	15.9 ±1.4 [2]	15.8 ±1.5	**<0.001***
K^+(mmol/L)	4.3 ±0.6 [3]	4.3 ±0.4 [3]	4.7 ±0.7 [1,2]	4.3 ±0.6	**0.025***
Ca (mmol/L)	1.2 ±0.2	1.2 ±0.2	1.1 ±0.2	1.2 ±0.2	0.149
Glucose (mg/dL)	94 (69 - 482)	93 (69 - 488)	83 (74 - 419)	93 (69 - 488)	0.303
Urea (mg/dL)	35 (11 - 134) [3]	38 (11 - 76) [3]	47 (15 - 145) [1, 2]	35 (11 - 145)	**0.04***
Serum osmolality (mOsm/kgH2O)	292.9 ±8.6 [2,3]	275.7 ±17.4 [1, 3]	319.3 ±14.4 [1, 2]	291.5 ±15.1	**<0.001***
Urine osmolality (mOsm/kgH2O)	180.7 (92.4 - 449.9) [2, 3]	145.4 (74.9 - 280.2) [1, 3]	239.4 (139.8 - 508) [1, 2]	171.3 (74.9 - 508)	**<0.001***
Urine Sodium (mmol/L)	32 ±5 2, 3	15 ±2 1, 3	45 ±3 1, 2	29 ±9	**<0.001***
WBC (10^3/uL)	13.2 (4.1 - 21) [2]	16.3 (8.7 - 20.8) [1, 3]	13.1 (4.3 - 19.7) [2]	14.1 (4.1 - 21)	**<0.001***
Hemoglobin (g/dL)	10.8 ±2.6 [2]	12.4 ±1.6 [1,3]	11.1 ±2.1 [2]	11.1 ±2.5	**<0.001***
Platelets (10^3/uL)	296.1 (82.9 - 520)	292.7 (151.8 - 558)	296.4 (80.3 - 595)	296.1 (80.3 - 595)	0.489
Bicarb (mmol/L)	25 ±6 [2, 3]	23 ±7 [1]	21 ±7 [1]	7.4 ±0.1	**0.003***
PCO^2 (mmHg)	35 ±7 [3]	38 ±9	41 ±8 [1]	25 ±6	**0.002***
Positive CRP	144 (52.4)	43 (60.6)	12 (46.2)	36 ±7	0.345
Length of hospital stay (days)	8 (1 - 14)	7 (1 - 14)	8 (1 - 14)	8 (1 - 14)	0.519
Use of inotropes	49 (17.8)	11 (15.5)	8 (30.8)	68 (18.3)	0.210
Use of mechanical ventilation	63 (22.9)	25 (35.2)	8 (30.8)	54 (14.5)	0.09
Ventilation time (days)	2 (1 - 6)	4 (1 - 7)	2 (1 - 5)	96 (25.8)	0.086
Mortality	22 (8)	16 (22.5)	4 (15.4)	3 (1 - 7)	**0.002***

Data are presented as mean ±SD, median (min-max), or number (percentage). *Significant P-value; BMI: Body mass index; K: Potassium; Ca: Calcium; WBC: White blood cells; CRP: C-reactive protein; PH: Potential hydrogen; PCO2: Partial pressure of carbon dioxide; SD: Standard deviation. 1: Significantly different from isonatremic group; 2: Significantly different from hyponatremic group; 3: Significantly different from hypernatremic group.

Serum sodium showed significant positive correlations with BMI (r = .242, P < 0.001), serum osmolality (r = .838, P < 0.001), urine osmolality (r = .190, P < 0.001), urine sodium (r = .704, P < 0.001), pH (r = .119, P = 0.022), bicarbonate (r = .144, P = 0.005), and length of hospital stay (r = .129, P = 0.013). Conversely, it had significant negative correlations with WBC (r = -.218, P < 0.001), hemoglobin (r = -.292, P < 0.001), and PCO2 (r = -.150, P = 0.005). No significant correlations were found with age (P = 0.214), weight (P = 0.38), K (P = 0.056), Ca (P = 0.597), urea (P = 0.506), platelets (P = 0.766), and ventilation time (P = 0.473). **Table 2**

Table 2: Correlation between serum sodium and other parameters.

	Serum Sodium (mmol/L)	
	r	**P**
Age (years)	-0.065	0.214
Weight (kg)	-0.046	0.38
BMI	.242	**<0.001***
K (mmol/L)	0.099	0.056
Ca (mmol/L)	0.028	0.597
Glucose (mg/dL)	-0.081	0.119
Urea (mg/dL)	0.035	0.506
Serum osmolality (mOsm/kgH2O)	.838	**<0.001***
Urine osmolality (mOsm/kgH2O)	.190	**< 0.001***
Urine Sodium (mmol/L)	.704	**<0.001***
WBC (10^3/uL)	-.218	**< 0.001***
Hemoglobin (g/dL)	-.292	**<0.001***
Platelet (10^3/uL)	0.015	0.766
PH	.119	**0.022***
Bicarb (mmol/L)	.144	**0.005***
PCO_2 (mmHg)	-.150**	**0.004***
Length of hospital stay (days)	.129*	**0.013***
Ventilation time (days)	0.074	0.473

*Significant P-value; r: Correlation coefficient; BMI: Body mass index; K: Potassium; Ca: Calcium; WBC: White blood cells; HGB: Hemoglobin; PH: Potential hydrogen; PCO2: Partial pressure of carbon dioxide.

In patients with hyponatremia, ventilation time significantly differed by dysnatremia classification (P = 0.026), with median times of 5 days for mild, 2 days for moderate, and 4 days for severe cases. However, the use of inotropes (P = 0.581), mechanical ventilation (P = 0.410), and mortality (P = 0.442) were not significantly associated with dysnatremia classification. In hypernatremic patients, the use of inotropes (P = 0.123), mechanical ventilation (P = 0.123), ventilation time (P = 0.343), and mortality (P = 0.726) did not significantly differ by dysnatremia classification. **Table 3**

Table 3: Outcomes according to the degree of hyponatremia and hypernatremia.

		Hponatremia classification			
		Mild	**Moderate**	**Severe**	**P-value**
Use of inotropes	n (%)	5 (15.2)	2 (10.0)	4 (22.2)	0.581
Use of mechanical ventilation	n (%)	9 (27.3)	8 (40.0)	8 (44.4)	0.410
Ventilation time (days)	Median (range)	5 (1 – 7) [2]	2 (1- 4) [1]	4 (1 – 6)	**0.026***
Mortality	n (%)	6 (18.2)	4 (20.0)	6 (33.3)	0.442
		Hypernatremia classification			
		Mild	**Moderate**	**Severe**	**P-value**
Use of inotropes	n (%)	4 (26.7)	2 (22.2)	2 (100.0)	0.123
Use of mechanical ventilation	n (%)	4 (26.7)	2 (22.2)	2 (100.0)	0.123
Ventilation time (days)	Median (range)	3 (1 – 5)	2 (2 – 2)	1 (1 – 1)	0.343

Mortality	n (%)	2 (13.3)	2 (22.2)	0 (0.0)	0.726

*Significant P-value; 1: Significantly different from mild; 2: Significantly different from moderate.

A borderline significance was observed in the serum sodium level between survivors and non-survivors' patients; it was lower in the non-survivors' patients than survivors (135 ±10 vs. 139 ±7, respectively, P = 055). **Figure 1**

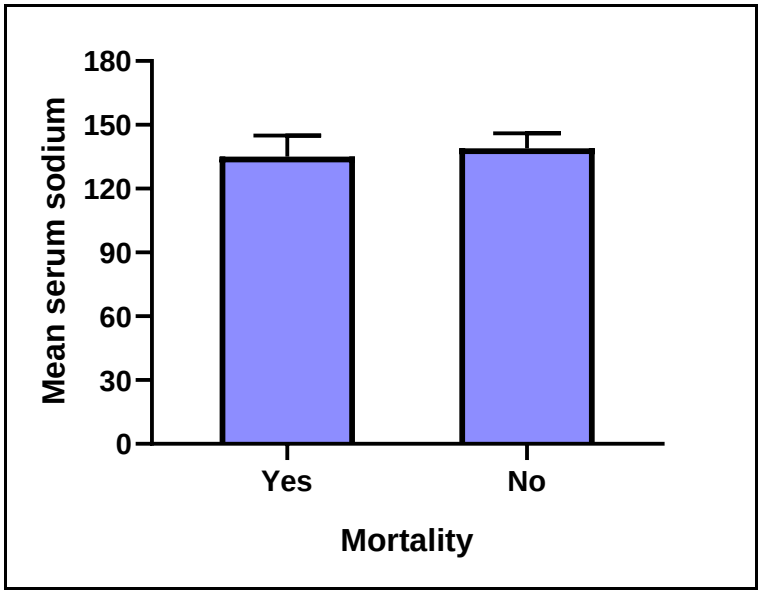

Figure 1: Serum sodium level according to mortality.

Multivariate logistic regression analysis was done for serum sodium to predict mortality. The model revealed that low sodium level was associated with increased mortality; one unit increase in serum sodium was associated with about 5% reduced risk of mortality, controlling for age and BMI (OR = 0.952, 95%CI = 0.913 - 0.994, P = 0.024). **Table**

Table 4: Multivariate logistic regression analysis of serum sodium to predict mortality.

	B	S.E.	Wald	OR (95% CI)	P-value
Age (years)	0.057	0.05	1.318	1.059 (0.96 - 1.168)	0.251
BMI	0.082	0.116	0.503	1.086 (0.865 - 1.363)	0.478
Serum Sodium (mmol/L)	-0.049	0.022	5.082	0.952 (0.913 - 0.994)	**0.024***

*Significant P-value; B: Regression coefficient; S.E.: Standard error; Wald: Wald statistic; OR: Odds ratio; CI: Confidence interval; BMI: Body mass index.

Discussion

Electrolyte disturbances, particularly dysnatremia, pose significant challenges in pediatric intensive care, affecting morbidity and mortality. Sodium, a major extracellular cation, influences serum osmolality and is impacted by body water balance, ADH secretion, and diseases [10]. The current study aimed to evaluate the incidence and impact of dysnatremia in critically ill children admitted to the PICU at Benha University Hospital. We included 327 patients, categorizing them based on their serum sodium levels and analyzing demographic, clinical, and laboratory data to assess outcomes and complications associated with dysnatremia.

Regarding our work, the patients were classified according to the natremic status into three groups: Isonatremia, hyponatremia and hypernatremia groups. In our study, the incidence of hyponatremia upon admission to the PICU at Benha University Hospital was 19.1%.

In a similar vein, Hasegawa et al. found that approximately 17% of hospitalized patients had hyponatremia [serum sodium (Na) < 135 mEq/L] [16].

This prevalence is considerably lower compared to the 67.2% reported by Al-Sofyani in a Saudi tertiary hospital [1]. Subba and Thomas studied 305 children admitted to the PICU for electrolyte abnormalities. Of these, 99 (32.45%) developed electrolyte issues. Hyponatremia was observed in 9.5% of the cases, which was less frequent than in this study [17]. The variations in these rates might be due to differences in regional healthcare practices, the prevalence of underlying diseases that affect electrolyte balance, or specific admission criteria and protocols at different hospitals.

In the current study, the prevalence of hypernatremia among pediatric patients admitted to the PICU at Benha University Hospital was 7%. This is higher compared to findings from other studies. For instance, Navaifar et al. reported a frequency of admission hypernatremia (serum sodium above 145 mEq/L) of 5.1% [18]. Similarly, a retrospective, single-center study conducted by Lindner et al. included 981 patients, found that only 2% of patients had hypernatremia on admission to the ICU [19].

In the current study, BMI varied significantly according to natremic status, with lower values in the hyponatremic group compared to the isonatremic and hypernatremic groups. There was no statistically significant difference in BMI between the isonatremic and hypernatremic groups. In contrast, age and weight did not show significant differences based on natremic status.

The significantly lower BMI in the hyponatremic patients can be attributed to severe underlying illnesses and hypovolemic states, which lead to poor nutritional status, weight loss, and reduced body fluid volume and muscle mass [13].

Another factor is Syndrome of SIADH, common in patients with CNS disorders, which causes reduced appetite and poor intake, leading to lower BMI. Chronic diseases like gastrointestinal disorders cause malnutrition and lower BMI due to impaired nutrient absorption. Additionally, medications and treatments for underlying diseases, such as diuretics, can cause hyponatremia and weight loss, further lowering BMI [20].

Regarding laboratory findings, the observed differences in biochemical parameters among the natremic groups can be scientifically justified by considering the underlying pathophysiological mechanisms associated with each condition: Elevated K+ and urea levels in hypernatremic patients indicate dehydration and kidney dysfunction [21]. Increased serum and urine osmolality reflect water retention efforts [22], while high urine sodium shows active sodium excretion. Higher WBC counts and hemoglobin in hyponatremic patients suggest underlying inflammation and mild dehydration [23]. Isonatremic patients have better acid-base balance, and elevated PCO2 in hypernatremic patients suggests respiratory compensation for metabolic disturbances [24].

In the present work, mortality rates differed significantly, with the highest percentage among hyponatremic patients, followed by hypernatremic patients, and the lowest among isonatremic patients.

Compatibly, Al-Sofyani reported that there was a trend of increased LOS in association with hyponatremia severity ($p = 0.04$, Kruskal–Walli's test). Mortality rate increased with hyponatremia severity: mild hyponatremia (15.3%), < moderate (29.0%), and < severe (35.0%) [1].

According to this study findings, the length of hospital stays, use of inotropes, mechanical ventilation, and ventilation time did not differ significantly based on natremic status.

This contrasts with the findings of Omar et al., where hyponatremic patients had a significantly prolonged hospital stay compared to isonatremic patients, with a median (IQR) of 5 (3-8) days and a range of 1 to 27 days ($p=0.007$). Similarly, Omar et al. reported that hypernatremic patients had a prolonged hospital stay compared to isonatremic patients, with a median of 4.5 (3-6) days and a range of 1 to 19 days, which was also statistically significant ($p=0.007$) [25]. These differences highlight the variability in how natremic status can influence the length of PICU stay in different patient populations and settings.

Furthermore, Jayakumar et al., who observed that morbidity, as determined by PICU stay, was significantly higher in patients with hyponatremia compared to isonatremic patients [26]. Additionally, Ontenda et al. concluded that dysnatremia was associated with increased hospital stay and mortality [27]. This study findings differ in that we did not observe a statistically significant impact of natremic status on the duration of PICU stay, highlighting potential differences in patient populations, underlying conditions, and healthcare practices across studies.

Regarding this study results, in patients with hyponatremia, ventilation time significantly differed by dysnatremia classification, with median times of 5 days for mild, 2 days for moderate, and 4 days for severe dysnatremia. However, the use of inotropes, mechanical ventilation, and mortality rates did not significantly differ according to dysnatremia classification.

In contrast, Al-Sofyani's findings indicate that children with severe hyponatremia typically require careful monitoring, potentially need mechanical ventilation (MV), and experience increased healthcare costs, longer periods of hospital stay, and a higher risk of mortality. They observed a trend showing that increased severity of hyponatremia correlates with longer length of stay (LOS) and higher mortality rates in the PICU [1].

Contrariwise, Seifert et al. reported an association between increased hyponatremia severity and a higher frequency of intubation, as well as longer LOS in the PICU for children with bronchiolitis [28]. Similarly, Luu et al. found that children with bronchitis and hyponatremia experienced worse outcomes, including longer PICU stays and increased mortality, within two hours of admission compared to their normonatremic counterparts [29]. Price et al. showed that hyponatremia in children with heart failure was significantly associated with higher rates of heart transplantation, use of mechanical circulatory support, and death [30]. These findings highlight how increased plasma concentrations of antidiuretic, correlated with hyponatremia severity, can significantly impair cerebral and vascular functions, reducing the brain's capacity to adapt to hyponatremia [31,32].

Interestingly, in the present study, while moderate-to-severe hyponatremia was associated with significantly longer ventilation times, it did not show a significant correlation with increased mortality or the use of inotropes and mechanical ventilation. This suggests that hyponatremia severity was not considered an independent risk factor for mortality in our pediatric population, as the correlation was not statistically significant. These findings align with those by Bindu and Beeregowda, who observed higher mortality rates in hyponatremic children but did not attribute pediatric deaths directly to hyponatremia due to confounding factors [33]. Baran and Hutchinson similarly found that patients with CNS symptoms due to hyponatremia had similar mortality rates to those without CNS symptoms [34].

Conversely, other studies, such as Singhi et al., reported significantly increased mortality risks—up to 3.5-fold—in hyponatremic children compared to normonatremic counterparts [35]. These mixed results suggest that while hyponatremia may serve as a marker for severe underlying conditions with poor prognosis, its role as an independent risk factor for mortality may vary depending on specific etiologies and patient populations.

In patients with hypernatremia, the use of inotropes, use of mechanical ventilation, ventilation time, and mortaltiy did not significantly differ according to dysnatremia classification.

In the current work, multivariate logistic regression analysis was done for serum sodium to predict mortality. The model revealed that one unit increase in serum sodium was associated with about 5% reduced risk of mortality, controlling for age and BMI.

In the study by Al-Sofyani, the predictive value of hyponatremia severity for mortality in a PICU was analyzed, with the findings showing that moderate or severe hyponatremia significantly increased the odds of mortality (OR = 2.53; p = 0.021). Additionally, the presence of diseases categorized as having relatively high mortality (CNS, cardiology, and shock) also correlated with increased mortality risks (OR = 2.65; p = 0.020) [1]. These findings are somewhat echoed in our study, where we observed different degrees of hyponatremia and correlated them with patient outcomes in the PICU.

The study's limitations include its single-hospital data, limiting generalizability, and a small number of hypernatremia and severe dysnatremia cases, reducing statistical power. It only considers in-hospital outcomes without long-term follow-up, missing insights into enduring health impacts. Additionally, excluding patients based on pre-admission intravenous fluid intake may have omitted critically ill children, reducing the understanding of pre-admission fluid management effects on dysnatremia and outcomes.

Conclusions

Dysnatremia upon admission to the PICU is prevalent and significantly impacts patient outcomes. Hyponatremic patients had the highest mortality rates and complications, underscoring the critical need for immediate management of serum sodium levels upon PICU admission.

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