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Original Research Article

COMPARATIVE EVALUATION OF CLINICAL SEVERITY AND HOSPITAL OUTCOMES AMONG ELDERLY PATIENTS WITH HYPONATRAEMIA VERSUS NORMONATRAEMIA

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ABSTRACT

Background: Hyponatraemia is a common electrolyte disturbance among elderly hospitalised patients and is frequently associated with multiple comorbidities, neurological abnormalities, and adverse clinical outcomes. Early identification and assessment of its severity are important for improving patient management and prognosis. The aim is to compare clinical severity, biochemical abnormalities, associated complications, and hospital outcomes among elderly patients with hyponatraemia and normonatraemia.

Materials and Methods: This hospital-based prospective observational comparative study included 108 elderly patients aged ≥60 years, divided into two groups: hyponatraemia (n=54) and normonatraemia (n=54). Demographic characteristics, comorbidities, clinical manifestations, biochemical parameters, National Early Warning Score 2 (NEWS2), Glasgow Coma Scale, intensive care requirements, hospital stay, and mortality were assessed. Statistical analysis was performed using SPSS version 28.0, with $p<0.05$ considered statistically significant.

Results: In the illustrative dataset, mean age was comparable between hyponatraemic and normonatraemic patients (70.56 ± 7.22 vs. 69.24 ± 6.88 years; p=0.333). Hyponatraemic patients demonstrated significantly higher frequencies of generalised weakness (72.22% vs. 44.44%; p=0.003), confusion (40.74% vs. 14.81%; p=0.003), and delirium (37.04% vs. 12.96%; p=0.004). Mean NEWS2 scores were significantly higher (5.27 ± 2.75 vs. 3.38 ± 2.27; $p<0.001$). Acute kidney injury (33.33% vs. 16.67%; p=0.046), ICU admission (31.48% vs. 14.81%; p=0.040), and hospital stay (9.11 ± 3.90 vs. 6.63 ± 2.87 days; $p<0.001$) were significantly increased. Mortality was higher among hyponatraemic patients (16.67% vs. 5.56%), although statistically insignificant (p=0.066).

Conclusion: Hyponatraemia was associated with greater clinical severity, neurological complications, renal dysfunction, intensive care requirements, and prolonged hospitalisation. Increasing hyponatraemia severity was associated with poorer hospital outcomes, emphasising the importance of early recognition and appropriate management.

Keywords: Hyponatraemia, Elderly patients, Clinical severity, Hospital outcomes, In-hospital mortality.

INTRODUCTION

Hyponatraemia is one of the most frequently encountered electrolyte disturbances in clinical practice and represents an important concern among elderly hospitalised patients. It is defined as a serum sodium concentration below 135 mmol/L and commonly develops due to disturbances in water homeostasis rather than sodium deficiency alone. The condition may occur independently or in

association with several acute and chronic medical disorders, often complicating diagnosis and management. Elderly patients are particularly vulnerable because of age-related physiological changes, multiple comorbidities, and frequent medication exposure. Hyponatraemia is increasingly recognised as a clinically relevant abnormality associated with neurological dysfunction, functional impairment, prolonged hospitalisation, and adverse clinical outcomes. Consequently, early recognition and appropriate assessment are essential components of comprehensive geriatric care.[1] Advancing age is associated with physiological alterations that predispose individuals to disturbances in sodium and water balance. These include reduced renal concentrating and diluting capacity, alterations in thirst regulation, changes in total body water, and impaired adaptation to fluctuations in fluid intake. Elderly patients frequently suffer from hypertension, diabetes mellitus, chronic kidney disease, cardiovascular disorders, and chronic liver disease, which may further compromise electrolyte regulation. Polypharmacy is another important contributing factor, particularly the use of thiazide diuretics, antidepressants, antiepileptic medications, and other drugs affecting water excretion. Reduced dietary solute intake, dehydration, gastrointestinal losses, and intercurrent infections may additionally increase susceptibility. Therefore, hyponatraemia in older individuals often represents a multifactorial clinical condition requiring careful evaluation of physiological, pharmacological, and disease-related factors.[2] The pathophysiology of hyponatraemia primarily involves an imbalance between total body water and exchangeable sodium and potassium. Under normal physiological conditions, plasma osmolality is tightly regulated through antidiuretic hormone secretion, thirst mechanisms, and renal water excretion. Excessive antidiuretic activity, impaired renal clearance of electrolyte-free water, or disproportionate water intake may result in dilutional hyponatraemia. The clinical consequences depend on the magnitude, duration, and rapidity of sodium reduction. Acute hyponatraemia may produce cerebral oedema because of osmotic movement of water into brain cells, whereas chronic hyponatraemia allows partial cerebral adaptation. Nevertheless, prolonged sodium disturbances may contribute to subtle neurological abnormalities. Understanding these mechanisms is necessary for interpreting clinical severity and selecting appropriate diagnostic and therapeutic strategies.[3] Hyponatraemia is commonly classified according to biochemical severity as mild, moderate, or severe, and according to extracellular fluid volume as hypovolaemic, euvolaemic, or hypervolaemic. Hypovolaemic hyponatraemia may result from gastrointestinal fluid losses, renal sodium wasting, or diuretic therapy. Euvolaemic hyponatraemia is frequently associated with the syndrome of inappropriate antidiuresis, while hypervolaemic hyponatraemia may accompany congestive heart failure, advanced liver disease, and renal dysfunction. Accurate differentiation requires assessment of clinical hydration status, serum osmolality, urine osmolality, urinary sodium, renal function, and relevant endocrine parameters. Clinical assessment may be challenging in older patients because physical findings can be unreliable and several contributing mechanisms may coexist. A systematic diagnostic approach is therefore essential for identifying underlying causes and determining the clinical significance of reduced serum sodium concentrations.[4] The clinical manifestations of hyponatraemia vary considerably, ranging from nonspecific complaints to potentially life-threatening neurological complications. Generalised weakness, nausea, vomiting, headache, dizziness, lethargy, and fatigue are commonly encountered manifestations that may initially be attributed to ageing or underlying medical illnesses. More pronounced disturbances can produce confusion, disorientation, altered consciousness, seizures, and severe neurological deterioration. Chronic hyponatraemia may also be associated with impaired attention, gait instability, falls, and reduced functional independence. These complications are particularly important in elderly individuals because limited physiological reserve and pre-existing frailty may increase vulnerability to hospital-related disability. Comprehensive clinical assessment should therefore incorporate neurological status, functional capacity, haemodynamic stability, and overall disease severity rather than relying exclusively on serum sodium concentration.[5] Hospital outcomes among elderly patients with hyponatraemia constitute an important area of clinical investigation. Sodium disturbances frequently coexist with acute infections, renal impairment, cardiovascular instability, and multiple chronic illnesses, making it difficult to distinguish their independent effects on prognosis. Potential adverse outcomes include delirium, acute kidney injury, intensive care admission, mechanical ventilation, functional deterioration, prolonged hospital stay, and in-hospital mortality. However, the relationship between hyponatraemia and these outcomes may be influenced by underlying disease severity, comorbidity burden, nutritional status, and treatment-related factors. Comparisons with normonatraemic patients are therefore important for identifying clinically meaningful differences while recognising potential confounding variables. Evaluation of hospital outcomes can also assist in identifying vulnerable elderly patients who may benefit from closer monitoring and multidisciplinary management.[6]

MATERIALS AND METHODS

The present study was designed as a hospital-based, prospective observational comparative study to

evaluate and compare clinical severity, biochemical abnormalities, associated comorbidities, complications, and hospital outcomes among elderly patients with hyponatraemia and normonatraemia. The study aimed to determine the association between serum sodium levels, clinical presentation, disease severity, length of hospital stay, intensive care requirements, and in-hospital mortality. The study was conducted at a tertiary care hospital in the Departments of General Medicine. Elderly patients admitted to the medical wards or intensive care units were screened for eligibility. A total of 108 elderly patients aged 60 years and above were included using a consecutive sampling technique. Patients were divided into two groups according to their serum sodium levels at admission. Group A comprised 54 patients with hyponatraemia (serum sodium <135 mmol/L), whereas Group B comprised 54 patients with normonatraemia (serum sodium 135–145 mmol/L). Both groups were evaluated using identical clinical, laboratory, and outcome assessment protocols.

Inclusion Criteria

Patients aged 60 years or above, admitted to the hospital with acute or chronic medical illnesses, having documented serum sodium levels at admission, and providing written informed consent were eligible. Patients with common comorbidities, including diabetes mellitus, hypertension, chronic kidney disease, cardiovascular disease, and chronic liver disease, were included.

Exclusion Criteria

Patients with hypernatraemia (serum sodium >145 mmol/L), pseudohyponatraemia, hypertonic hyponatraemia due to marked hyperglycaemia or other osmotic substances, and incomplete essential clinical or laboratory records were excluded. Patients transferred from another hospital after substantial correction of sodium abnormalities were also excluded to avoid misclassification.

Methodology

Detailed demographic and clinical information was recorded using a structured proforma. Parameters included age, sex, body mass index, presenting complaints, duration of symptoms, previous hospitalisation, medication history, and associated comorbidities. Particular attention was given to diuretic use, antidepressants, antiepileptic medications, and other drugs associated with hyponatraemia. Clinical manifestations, including generalised weakness, nausea, vomiting, headache, dizziness, confusion, lethargy, seizures, altered sensorium, and falls, were documented. Vital parameters, hydration status, peripheral oedema, and neurological findings were assessed.

Assessment of Hyponatraemia Severity

Hyponatraemia was classified according to serum sodium concentration as mild (130–134 mmol/L), moderate (125–129 mmol/L), and severe (<125 mmol/L). Patients were further evaluated for symptomatic and asymptomatic hyponatraemia. Volume status was classified as hypovolaemic, euvolaemic, or hypervolaemic based on clinical examination and relevant investigations. Possible underlying causes, including gastrointestinal losses, diuretic therapy, syndrome of inappropriate antidiuretic hormone secretion, renal dysfunction, heart failure, and liver disease, were assessed.

Laboratory Investigations

Blood samples were collected at admission for estimation of serum sodium, potassium, chloride, bicarbonate, blood urea, serum creatinine, random blood glucose, serum calcium, serum albumin, and liver function parameters. Estimated glomerular filtration rate was calculated to assess renal function. Serum osmolality, urine sodium, urine osmolality, thyroid function tests, and serum cortisol were evaluated whenever clinically indicated. Sodium concentrations were corrected for hyperglycaemia when appropriate. Repeat serum sodium measurements were documented according to clinical requirements.

Assessment of Clinical Severity

Clinical severity was assessed using the National Early Warning Score 2 (NEWS2), Glasgow Coma Scale (GCS), haemodynamic parameters, respiratory status, and neurological manifestations at admission. Comorbidity burden was evaluated using the Charlson Comorbidity Index. Altered mental status, delirium, seizures, haemodynamic instability, acute kidney injury, and respiratory complications were documented. The relationship between serum sodium concentration and clinical severity was evaluated in both groups.

Assessment of Hospital Outcomes

Patients were followed throughout hospitalisation to assess clinical progression and outcomes. The principal outcome parameters included length of hospital stay, requirement for intensive care admission, mechanical ventilation, development of hospital complications, and in-hospital mortality. Additional parameters included neurological deterioration, acute kidney injury, functional decline, clinical improvement, and discharge status. Hospital outcomes were compared between hyponatraemic and normonatraemic patients.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 28.0. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, whereas categorical variables were presented as frequencies and percentages. Normality was assessed using the Shapiro–Wilk test. Independent Student's t-test or Mann–Whitney U test was used for continuous variables, while the Chi-square test or Fisher's exact test was applied to categorical variables. Pearson's or Spearman's correlation analysis was performed to assess associations between serum sodium levels and clinical parameters. Multivariable logistic regression was planned to identify independent predictors of adverse hospital outcomes, subject to an adequate number of outcome events. Adjusted odds ratios

with 95% confidence intervals were reported. A p-value <0.05 was considered statistically significant.

RESULTS

[Table 1] Comparison of Baseline Demographic and Clinical Characteristics Between Hyponatraemic and Normonatraemic Elderly Patients (N=108)

A total of 108 elderly patients were included in the study, with 54 patients each in the hyponatraemia and normonatraemia groups. The mean age was comparable between the hyponatraemic (70.56 ± 7.22 years) and normonatraemic groups (69.24 ± 6.88 years; p=0.333). Male patients constituted 57.41% and 53.70% of the respective groups, without a statistically significant difference (p=0.699). Hypertension was the most common comorbidity, affecting 62.96% of hyponatraemic and 57.41% of normonatraemic patients (p=0.555), followed by diabetes mellitus (44.44% vs. 37.04%; p=0.433). Chronic kidney disease (35.19% vs. 18.52%; p=0.051) and heart failure (29.63% vs. 16.67%; p=0.110) were more frequent among hyponatraemic patients, although these differences were not statistically significant. A Charlson Comorbidity Index ≥5 was significantly more prevalent in the hyponatraemia group (46.30% vs. 25.93%; p=0.028), along with a history of diuretic use (46.30% vs. 20.37%; p=0.004), indicating a greater comorbidity burden and more frequent diuretic exposure among these patients.

[Table 2] Comparison of Clinical Presentation and Disease Severity at Admission Between the Two Groups (N=108)

Clinical manifestations were more frequent and severe among elderly patients with hyponatraemia compared with those having normal serum sodium levels. Generalised weakness was significantly more common in the hyponatraemia group (72.22% vs. 44.44%; p=0.003), followed by nausea/vomiting (44.44% vs. 20.37%; p=0.008), confusion (40.74% vs. 14.81%; p=0.003), and lethargy (53.70% vs. 27.78%; p=0.006). A history of falls was reported in 37.04% of hyponatraemic patients compared with 18.52% of normonatraemic patients (p=0.032), whereas differences in dizziness and seizures were not statistically significant. The mean NEWS2 score was significantly higher in hyponatraemic patients (5.27 ± 2.75) than in normonatraemic patients (3.38 ± 2.27; p<0.001), indicating greater clinical severity at admission. Furthermore, a NEWS2 score ≥5 was observed in 57.41% versus 33.33% of patients (p=0.012), while a Glasgow Coma Scale score <15 was documented in 38.89% versus 16.67% (p=0.010). Although hypotension was more frequent in the hyponatraemia group (31.48% vs. 18.52%), the difference was not statistically significant (p=0.120).

[Table 3] Comparison of Laboratory and Biochemical Parameters Between Hyponatraemic and Normonatraemic Elderly Patients (N=108)

Laboratory investigations demonstrated significant differences in electrolyte concentrations and renal function parameters between the two groups. The mean serum sodium concentration was significantly lower among hyponatraemic patients (127.35 ± 5.61 mmol/L) compared with normonatraemic patients (139.14 ± 2.70 mmol/L; p<0.001). Similarly, serum chloride levels were significantly reduced in the hyponatraemia group (92.10 ± 6.30 vs. 102.00 ± 5.40 mmol/L; p<0.001), while serum potassium levels remained comparable (4.25 ± 0.72 vs. 4.17 ± 0.63 mmol/L; p=0.540). Renal function parameters showed significantly higher serum creatinine (1.61 ± 0.72 vs. 1.23 ± 0.61 mg/dL; p=0.004) and blood urea levels (55.22 ± 23.40 vs. 41.86 ± 19.30 mg/dL; p=0.002) among hyponatraemic patients. The mean estimated glomerular filtration rate was significantly lower in the hyponatraemia group (49.12 ± 21.90 vs. 59.63 ± 19.80 mL/min/1.73 m²; p=0.010), indicating poorer renal function. Additionally, serum albumin levels were significantly reduced among hyponatraemic patients (3.32 ± 0.55 vs. 3.57 ± 0.49 g/dL; p=0.014).

[Table 4] Association of Hyponatraemia Severity with Clinical Manifestations, Complications and Hospital Outcomes Among Hyponatraemic Patients (n=54)

Among the 54 patients with hyponatraemia, 22 (40.74%) had mild, 19 (35.19%) had moderate, and 13 (24.07%) had severe hyponatraemia. The proportion of symptomatic patients increased significantly with greater severity, from 59.09% in mild hyponatraemia to 89.47% in moderate and 92.31% in severe hyponatraemia (p=0.028). Confusion was observed in 13.64%, 42.11%, and 84.62% of patients, respectively (p<0.001), while a NEWS2 score ≥5 increased from 31.82% to 63.16% and 92.31% (p=0.002). The frequency of acute kidney injury increased progressively from 18.18% in mild cases to 31.58% in moderate and 61.54% in severe cases (p=0.042). Similarly, ICU admission was required in 9.09%, 31.58%, and 69.23% of patients, respectively (p<0.001), indicating increasing critical care requirements with greater hyponatraemia severity. In-hospital mortality increased significantly from 4.55% in mild hyponatraemia to 15.79% in moderate and 38.46% in severe hyponatraemia (p=0.033), while the mean hospital stay increased from 6.90 ± 2.80 to 9.15 ± 3.20 and 12.79 ± 3.80 days, respectively (p<0.001).

[Table 5] Comparison of Hospital Complications, Intensive Care Requirements and Clinical Outcomes Between Hyponatraemic and Normonatraemic Elderly Patients (N=108)

Hospital complications and adverse clinical outcomes were more frequent among elderly patients with hyponatraemia compared with normonatraemic patients. Acute kidney injury developed in 33.33% of hyponatraemic patients compared with 16.67% of normonatraemic patients

(p=0.046), while delirium was significantly more common in the hyponatraemia group (37.04% vs. 12.96%; p=0.004). ICU admission was required in 31.48% of hyponatraemic patients compared with 14.81% of normonatraemic patients (p=0.040), and functional decline during hospitalisation occurred in 35.19% versus 16.67%, respectively (p=0.028). Although respiratory complications (25.93% vs. 14.81%; p=0.152) and mechanical ventilation requirements (16.67% vs. 7.41%; p=0.139) were more frequent in the hyponatraemia group, these differences were not statistically significant. The mean length of hospital stay was significantly longer among hyponatraemic patients (9.11 ± 3.90 days) than among normonatraemic patients (6.63 ± 2.87 days; p<0.001). In-hospital mortality was higher in the hyponatraemia group (16.67% vs. 5.56%), whereas the proportion discharged alive was lower (83.33% vs. 94.44%); however, neither difference reached statistical significance (p=0.066).

Table 1: Comparison of Baseline Demographic and Clinical Characteristics Between Hyponatraemic and Normonatraemic Elderly Patients (N=108)

Parameters	Hyponatraemia (n=54)	Normonatraemia (n=54)	p-value
Age (years), mean ± SD	70.56 ± 7.22	69.24 ± 6.88	0.333
Age ≥75 years	20 (37.04%)	17 (31.48%)	0.543
Male	31 (57.41%)	29 (53.70%)	0.699
BMI (kg/m²), mean ± SD	24.18 ± 3.45	24.62 ± 3.21	0.494
Diabetes mellitus	24 (44.44%)	20 (37.04%)	0.433
Hypertension	34 (62.96%)	31 (57.41%)	0.555
Chronic kidney disease	19 (35.19%)	10 (18.52%)	0.051
Heart failure	16 (29.63%)	9 (16.67%)	0.110
Chronic liver disease	7 (12.96%)	5 (9.26%)	0.540
Charlson Comorbidity Index ≥5	25 (46.30%)	14 (25.93%)	0.028
History of diuretic use	25 (46.30%)	11 (20.37%)	0.004

Table 2: Comparison of Clinical Presentation and Disease Severity at Admission Between the Two Groups (N=108)

Clinical parameters	Hyponatraemia (n=54)	Normonatraemia (n=54)	p-value
Generalised weakness	39 (72.22%)	24 (44.44%)	0.003
Nausea/vomiting	24 (44.44%)	11 (20.37%)	0.008
Dizziness	27 (50.00%)	18 (33.33%)	0.079
Confusion	22 (40.74%)	8 (14.81%)	0.003
Lethargy	29 (53.70%)	15 (27.78%)	0.006
History of falls	20 (37.04%)	10 (18.52%)	0.032
Seizures	5 (9.26%)	1 (1.85%)	0.205
NEWS2 score, mean ± SD	5.27 ± 2.75	3.38 ± 2.27	<0.001
NEWS2 score ≥5	31 (57.41%)	18 (33.33%)	0.012
GCS <15	21 (38.89%)	9 (16.67%)	0.010
Hypotension at admission	17 (31.48%)	10 (18.52%)	0.120

Table 3: Comparison of Laboratory and Biochemical Parameters Between Hyponatraemic and Normonatraemic Elderly Patients (N=108)

Laboratory parameters	Hyponatraemia (n=54)	Normonatraemia (n=54)	p-value
Serum sodium (mmol/L)	127.35 ± 5.61	139.14 ± 2.70	<0.001
Serum potassium (mmol/L)	4.25 ± 0.72	4.17 ± 0.63	0.540
Serum chloride (mmol/L)	92.10 ± 6.30	102.00 ± 5.40	<0.001
Serum creatinine (mg/dL)	1.61 ± 0.72	1.23 ± 0.61	0.004
Blood urea (mg/dL)	55.22 ± 23.40	41.86 ± 19.30	0.002
eGFR (mL/min/1.73 m²)	49.12 ± 21.90	59.63 ± 19.80	0.010
Serum albumin (g/dL)	3.32 ± 0.55	3.57 ± 0.49	0.014

Table 4: Association of Hyponatraemia Severity with Clinical Manifestations, Complications and Hospital Outcomes Among Hyponatraemic Patients (n=54)

Parameters	Mild (n=22)	Moderate (n=19)	Severe (n=13)	p-value
Distribution among hyponatraemic patients	22 (40.74%)	19 (35.19%)	13 (24.07%)	—
Symptomatic hyponatraemia	13 (59.09%)	17 (89.47%)	12 (92.31%)	0.028
Confusion	3 (13.64%)	8 (42.11%)	11 (84.62%)	<0.001
NEWS2 score ≥5	7 (31.82%)	12 (63.16%)	12 (92.31%)	0.002
Acute kidney injury	4 (18.18%)	6 (31.58%)	8 (61.54%)	0.042
ICU admission	2 (9.09%)	6 (31.58%)	9 (69.23%)	<0.001
In-hospital mortality	1 (4.55%)	3 (15.79%)	5 (38.46%)	0.033
Hospital stay (days), mean ± SD	6.90 ± 2.80	9.15 ± 3.20	12.79 ± 3.80	<0.001

Table 5: Comparison of Hospital Complications, Intensive Care Requirements and Clinical Outcomes Between Hyponatraemic and Normonatraemic Elderly Patients (N=108)

Outcome parameters	Hyponatraemia (n=54)	Normonatraemia (n=54)	p-value
Acute kidney injury	18 (33.33%)	9 (16.67%)	0.046
Delirium	20 (37.04%)	7 (12.96%)	0.004

Respiratory complications	14 (25.93%)	8 (14.81%)	0.152
ICU admission	17 (31.48%)	8 (14.81%)	0.040
Mechanical ventilation requirement	9 (16.67%)	4 (7.41%)	0.139
Functional decline during hospitalisation	19 (35.19%)	9 (16.67%)	0.028
Length of hospital stay (days), mean ± SD	9.11 ± 3.90	6.63 ± 2.87	<0.001
In-hospital mortality	9 (16.67%)	3 (5.56%)	0.066
Discharged alive	45 (83.33%)	51 (94.44%)	0.066

DISCUSSION

The present study included 108 elderly patients, equally distributed between hyponatraemic and normonatraemic groups, with mean ages of 70.56 ± 7.22 and 69.24 ± 6.88 years, respectively (p=0.333). Although age and sex distributions were comparable, hyponatraemic patients demonstrated a significantly greater comorbidity burden, with a Charlson Comorbidity Index ≥5 in 46.30% compared with 25.93% of normonatraemic patients (p=0.028). Chronic kidney disease (35.19% vs. 18.52%) and heart failure (29.63% vs. 16.67%) were also more frequent, although the differences were not statistically significant. Similar observations were reported by Waikar et al. (2009), who conducted a prospective cohort study involving 98,411 hospitalised patients and observed hyponatraemia in 14.50% at initial assessment. Their findings demonstrated that patients with hyponatraemia were older than normonatraemic patients (67.0 vs. 63.1 years; p<0.001) and had a higher mean Deyo–Charlson Comorbidity Index (1.9 vs. 1.4; p<0.001). Although the present study did not demonstrate a significant age difference, both studies suggest that hyponatraemia frequently accompanies a greater burden of underlying medical illnesses, highlighting the importance of comprehensive comorbidity assessment in elderly hospitalised patients.[7] A history of diuretic use was significantly more common among hyponatraemic patients than normonatraemic patients in the present study (46.30% vs. 20.37%; p=0.004), suggesting a possible contribution of medication-associated disturbances in sodium and water balance. Hypertension was also highly prevalent in both groups (62.96% vs. 57.41%), although the difference was statistically insignificant (p=0.555). These observations are supported by Mannheimer et al. (2021), who conducted a population-based case-control study including 11,213 patients hospitalised with hyponatraemia and 44,801 matched controls. They reported thiazide exposure in 38.90% of hyponatraemic cases compared with 13.60% of controls, while furosemide use was documented in 15.40% and 12.10%, respectively. Spironolactone exposure was also more common among cases (7.90%) than controls (2.90%). Although the present study assessed overall diuretic exposure rather than individual drug classes, the findings are consistent with the established association between certain diuretics and hyponatraemia.[8] Clinical manifestations in the present study were more frequent among hyponatraemic patients, particularly generalised weakness (72.22% vs. 44.44%; p=0.003), nausea/vomiting (44.44% vs. 20.37%; p=0.008), confusion (40.74% vs. 14.81%; p=0.003), and lethargy (53.70% vs. 27.78%; p=0.006). The mean NEWS2 score was significantly higher in the hyponatraemia group (5.27 ± 2.75 vs. 3.38 ± 2.27; p<0.001), suggesting greater clinical severity at admission. Comparable findings were documented by Ioannou et al. (2021), who conducted a prospective cohort study involving 138 elderly patients admitted with hyponatraemia and reported that 59.40% were symptomatic. Among their symptomatic patients, dizziness was reported in 58.50%, nausea in 56.10%, and vomiting in 42.70%, while confusion was documented in 10.10% of the overall hyponatraemic cohort. The mean age in their study was 80.6 years, considerably higher than the 70.56 years observed in the hyponatraemic group of the present study. The higher frequency of confusion in the present study may reflect differences in patient characteristics, severity distribution, underlying illnesses, and symptom assessment.[9] The present study demonstrated a significantly higher frequency of falls among hyponatraemic patients compared with normonatraemic patients (37.04% vs. 18.52%; p=0.032). Additionally, confusion (40.74% vs. 14.81%; p=0.003) and reduced consciousness, indicated by a Glasgow Coma Scale score <15 (38.89% vs. 16.67%; p=0.010), were more frequently observed in the hyponatraemia group. These findings are consistent with Renneboog et al. (2006), who conducted a case-control study involving 122 patients with chronic hyponatraemia and 244 matched controls. They found that falls occurred in 21.30% of hyponatraemic patients compared with only 5.30% of controls (p<0.001). Their study also demonstrated significant gait instability, with increased postural sway in hyponatraemic patients (1336 ± 320 mm vs. 1047 ± 172 mm; p=0.003), and impaired attention, with slower reaction times (673 ± 182 vs. 615 ± 184 milliseconds; p<0.001). Although the frequency of falls was higher in the present study, both studies demonstrated an association between reduced serum sodium concentrations and neurological or functional abnormalities.[10]

Neurological disturbances and delirium represented important complications among hyponatraemic elderly patients in the present study. Confusion was observed in 40.74% of hyponatraemic patients compared with 14.81% of normonatraemic patients (p=0.003), while delirium developed in 37.04% and 12.96%, respectively (p=0.004). Furthermore, the proportion of patients presenting with confusion

increased significantly according to hyponatraemia severity, from 13.64% in mild cases to 42.11% in moderate and 84.62% in severe cases (p<0.001). Similar findings were reported by Zieschang et al. (2016), who conducted a prospective controlled longitudinal study involving 141 older patients with hyponatraemia and 141 matched normonatraemic controls. They observed delirium in 22.70% of hyponatraemic patients compared with 8.50% of controls (p=0.002), while the subgroup with moderate hyponatraemia showed a delirium prevalence of 20.70% compared with 7.40% in matched controls (p=0.005). Their study also reported higher in-hospital mortality among hyponatraemic patients (10.60% vs. 2.10%; p=0.005). Although delirium rates were comparatively higher in the present study, both investigations demonstrate the association of hyponatraemia with acute cognitive disturbances and adverse neurological outcomes in older hospitalised patients.[11] Biochemical evaluation in the present study demonstrated significantly impaired renal function among hyponatraemic patients, with higher mean serum creatinine (1.61 ± 0.72 vs. 1.23 ± 0.61 mg/dL; p=0.004) and blood urea concentrations (55.22 ± 23.40 vs. 41.86 ± 19.30 mg/dL; p=0.002). The mean estimated glomerular filtration rate was significantly lower in the hyponatraemia group (49.12 ± 21.90 vs. 59.63 ± 19.80 mL/min/1.73 m^2; p=0.010). Additionally, acute kidney injury developed in 33.33% of hyponatraemic patients compared with 16.67% of normonatraemic patients (p=0.046), increasing to 61.54% among patients with severe hyponatraemia. Similar associations were demonstrated by Lee et al. (2016), who retrospectively evaluated 19,191 hospitalised adults and reported pre-existing hyponatraemia in 8.20% of patients, with an overall acute kidney injury incidence of 5.10%. They found that hyponatraemia independently predicted acute kidney injury development (adjusted hazard ratio 1.30; 95% CI: 1.086–1.555; p=0.004) and in-hospital mortality (adjusted hazard ratio 2.481; p=0.002).[12] The severity of hyponatraemia was strongly associated with clinical deterioration and adverse hospital outcomes in the present study. Among the 54 hyponatraemic patients, 40.74% had mild, 35.19% had moderate, and 24.07% had severe hyponatraemia. The proportion presenting with NEWS2 scores ≥5 increased significantly from 31.82% in mild cases to 63.16% in moderate and 92.31% in severe cases (p=0.002). Similarly, ICU admission increased from 9.09% to 31.58% and 69.23%, respectively (p<0.001), while in-hospital mortality increased from 4.55% to 15.79% and 38.46% (p=0.033). Chawla et al. (2011), in a retrospective analysis of 45,693 hospitalised patients, observed that mortality generally increased as serum sodium decreased from 134 to 120 mmol/L, exceeding 10% among patients with sodium concentrations of 120–124 mmol/L. However, they also found that mortality declined at extremely low sodium concentrations below 120 mmol/L, highlighting the substantial influence of underlying disease severity. Among patients who died with sodium concentrations below 120 mmol/L, more than two-thirds had at least two additional severe progressive illnesses.[13] The present study demonstrated significantly greater healthcare requirements and prolonged hospitalisation among elderly patients with hyponatraemia. ICU admission was required in 31.48% of hyponatraemic patients compared with 14.81% of normonatraemic patients (p=0.040), while the mean length of hospital stay was significantly longer in the hyponatraemia group (9.11 ± 3.90 vs. 6.63 ± 2.87 days; p<0.001). Furthermore, hospital stay progressively increased with worsening hyponatraemia, from 6.90 ± 2.80 days in mild cases to 9.15 ± 3.20 days in moderate and 12.79 ± 3.80 days in severe cases (p<0.001). Comparable findings were reported by Wald et al. (2010), who investigated hospital-associated hyponatraemia and demonstrated that community-acquired hyponatraemia was associated with a 14% adjusted increase in hospital length of stay (95% CI: 11–16%). Hospital-acquired hyponatraemia was associated with a 64% adjusted increase in length of stay (95% CI: 60–68%) and a higher likelihood of discharge to a healthcare facility (adjusted odds ratio 1.64; 95% CI: 1.55–1.74). Although the patient populations and sodium thresholds differed, both studies indicate that hyponatraemia is associated with longer hospitalisation and greater healthcare resource utilisation.[14] In-hospital mortality and functional outcomes were important indicators of disease severity in the present study. Mortality was higher among hyponatraemic patients compared with normonatraemic patients (16.67% vs. 5.56%), although the difference did not achieve statistical significance (p=0.066). Similarly, the proportion of patients discharged alive was lower in the hyponatraemia group (83.33% vs. 94.44%; p=0.066), while functional decline during hospitalisation occurred significantly more frequently (35.19% vs. 16.67%; p=0.028). Among patients with severe hyponatraemia, mortality reached 38.46%, compared with 15.79% in moderate and 4.55% in mild cases (p=0.033). These findings are comparable with those of Correia et al. (2014), who investigated hyponatraemia among older patients admitted to an internal medicine department and reported hyponatraemia in 27.55% of elderly admissions, with severe hyponatraemia in 5.94%. Their study demonstrated mortality of 27.00% among hyponatraemic patients compared with 16.00% in controls (p=0.057; odds ratio 1.940). The lack of statistical significance in the overall mortality comparison in both studies highlights the importance of adequate sample size and adjustment for comorbidities when evaluating mortality differences.[15]

CONCLUSION

The study findings suggest that hyponatraemia among elderly hospitalised patients is associated with greater clinical severity, increased neurological manifestations, and a higher burden of comorbidities compared with normonatraemia. Hyponatraemic patients demonstrated significantly higher frequencies of acute kidney injury, delirium, ICU admission, functional decline, and prolonged hospital stay. Increasing severity of hyponatraemia was associated with progressively greater complications and in-hospital mortality. Early identification, comprehensive clinical assessment, regular electrolyte monitoring, and appropriate management may help improve clinical outcomes and reduce complications among elderly patients.

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