



Clinical Profile and Etiological Spectrum of Hyponatremia in Patients Admitted to the Department of Medicine: A Retrospective Observational Study.

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Abstract

Background: Hyponatremia is one of the most common electrolyte abnormalities encountered among hospitalized patients and may result from diverse medical conditions. Its presentation ranges from asymptomatic biochemical abnormalities to severe neurological complications. **Methods:** A retrospective observational study was conducted among adult patients admitted to the Department of Medicine with documented hyponatremia, defined as serum sodium <135 mEq/L. Demographic characteristics, clinical manifestations, severity, volume status, associated comorbidities, etiological factors, and hospital outcomes were evaluated. Data were analyzed using appropriate descriptive and inferential statistical methods. **Results:** A total of 150 patients were evaluated. The mean age was 58.6 ± 16.4 years, with males comprising 57.3% of patients. Moderate hyponatremia was most common (40.7%), followed by mild (34.7%) and severe (24.6%) hyponatremia. Nausea/vomiting (27.3%), generalized weakness (23.3%), and altered sensorium (20.7%) were the predominant manifestations. Euvolemic hyponatremia was the commonest volume-status category (46.7%). SIADH (20.7%) was the most frequent identifiable etiology, followed by gastrointestinal fluid loss (18.0%) and diuretic-associated hyponatremia (14.7%). Hypertension and diabetes mellitus were the commonest comorbidities. Overall, 88% of patients improved, while in-hospital mortality was 12%, with higher mortality among patients with severe hyponatremia. **Conclusion:** Hyponatremia predominantly affected older hospitalized adults and was associated with diverse etiologies and comorbidities. SIADH, gastrointestinal losses, and diuretic therapy were important contributing factors. Increasing severity was associated with greater neurological manifestations and poorer hospital outcomes.

Keywords: Hyponatremia; SIADH; Electrolyte imbalance; Hospitalized patients; Etiology.



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INTRODUCTION

Hyponatremia is one of the most frequently encountered electrolyte abnormalities in clinical practice and is particularly common among hospitalized patients. It is conventionally defined as a serum sodium concentration of <135 mEq/L and represents a disorder of water balance rather than an isolated deficiency of total body sodium. Depending on the severity of sodium reduction, hyponatremia may be categorized into mild, moderate, and severe forms, although the exact sodium thresholds used for these categories vary among studies and clinical guidelines [1,2]. Its reported frequency among hospitalized patients varies considerably according to the population studied, clinical setting, and diagnostic criteria, with higher rates observed among elderly and critically ill patients.

The pathophysiology of hyponatremia is complex and is primarily related to an imbalance between water intake and excretion, altered antidiuretic hormone activity, and abnormalities in renal sodium and water handling. Based on extracellular fluid volume status, hyponatremia is broadly classified as hypovolemic, euvolemic, or hypervolemic. Hypovolemic hyponatremia may occur due to gastrointestinal losses, renal salt wasting, diuretic therapy, or endocrine disorders. Euvolemic hyponatremia is frequently associated with the syndrome of inappropriate antidiuretic hormone secretion (SIADH), while hypervolemic hyponatremia commonly occurs in conditions such as congestive heart failure, chronic liver disease, nephrotic syndrome, and chronic kidney disease [2,3].

The clinical presentation of hyponatremia depends on the degree and rate of decline in serum sodium concentration, as well as the underlying disease. Patients with mild or slowly developing hyponatremia may remain asymptomatic or present with nonspecific complaints such as weakness, lethargy, nausea, vomiting, dizziness, and headache. More severe or rapidly developing hyponatremia can result in neurological manifestations, including altered sensorium, confusion, seizures, coma, and, in extreme cases, death, largely because of cerebral edema [3,4]. A hospital-based study from India reported nausea and drowsiness as common gastrointestinal and neurological manifestations, respectively, while multifactorial etiologies and diuretic use were frequently observed among affected patients.

Several demographic and clinical factors predispose patients to hyponatremia. Advanced age is an important risk factor because aging is associated with impaired renal water handling and reduced ability to maintain electrolyte and water homeostasis. In addition, hypertension, diabetes mellitus, heart failure, renal disease, malignancy, pulmonary and neurological disorders, and medications such as diuretics may contribute to the development of hyponatremia [3,5]. In a study of elderly hospitalized patients from Sikkim, SIADH and medications were important etiological factors, while a substantial proportion of patients were symptomatic and mortality was reported among hospitalized patients with hyponatremia.

The etiological spectrum of hyponatremia is therefore broad and often multifactorial. SIADH has been reported as an important cause, particularly among patients with euvolemic hyponatremia, while diuretics, gastrointestinal fluid losses, heart failure, renal dysfunction, endocrine abnormalities, and underlying infections may also contribute [2,3]. In critically ill patients, the coexistence of multiple systemic illnesses and therapeutic interventions further complicates identification of the underlying cause. An Indian study of patients admitted to a medical intensive care unit found SIADH to be the most frequent etiology and euvolemic hypo-osmolar hyponatremia to be the predominant type [2].

Hyponatremia is clinically important not only because of its symptoms but also because of its association with adverse hospital outcomes. Increasing severity of hyponatremia has been associated with greater morbidity, prolonged hospitalization, and increased mortality [1,4]. A recent retrospective cohort study among medically hospitalized adults reported that hyponatremia was common at admission and became more frequent during hospitalization; severe hyponatremia was particularly associated with older age, multiple comorbidities, and unfavorable hospital outcomes. Similarly, a recent retrospective study from Karnataka demonstrated that hyponatremia constituted a substantial proportion of medical admissions and was frequently associated with neurological manifestations and cardiometabolic comorbidities. Despite its high frequency and diverse etiologies, the clinical profile and underlying causes of hyponatremia may differ according to geographic region, patient characteristics, comorbidity patterns, and hospital setting. Local data are therefore valuable for understanding the spectrum of presentation, identifying commonly associated conditions and medications, and evaluating outcomes among affected patients. A retrospective review of routinely available hospital records can provide useful information regarding these characteristics without requiring additional investigations or patient follow-up.

Therefore, the present study is planned to evaluate the clinical profile and etiological spectrum of hyponatremia among patients admitted to the Department of Medicine, with particular emphasis on demographic characteristics, clinical manifestations, severity of hyponatremia, associated comorbidities, potential etiological factors, and hospital outcomes.

MATERIALS AND METHODS

A retrospective observational study was conducted in the Department of General Medicine at a tertiary care teaching hospital. The study included adult patients admitted to the Department of Medicine during the six month study period who were found to have hyponatremia during their hospital stay. Hyponatremia was defined as a serum sodium concentration of <135 mEq/L. Data were retrospectively obtained from hospital medical records, admission registers, laboratory reports, case sheets, and discharge summaries.

Patients aged ≥ 18 years who had documented serum sodium levels <135 mEq/L during hospitalization and adequate clinical and laboratory records were included in the study. Patients aged <18 years, those admitted primarily under other departments, patients with incomplete medical records, patients without relevant serum sodium reports, and patients with documented pseudohyponatremia were excluded.

A structured data collection proforma was used to record relevant demographic, clinical, laboratory, and outcome-related information. Demographic variables including age and sex were recorded. Clinical details such as presenting complaints, duration of symptoms, relevant examination findings, volume status, and systemic manifestations were documented. Details of associated comorbidities, including diabetes mellitus, hypertension, chronic kidney disease, heart failure, chronic liver disease, malignancy, pulmonary disease, and neurological disorders, were recorded. Medication history, particularly the use of diuretics and other drugs potentially associated with hyponatremia, was also documented.

Available laboratory investigations, including serum sodium, potassium, blood urea, serum creatinine, blood glucose, serum osmolality, urine sodium, urine osmolality, liver function tests, thyroid function tests, and cortisol levels, were recorded wherever available. Relevant radiological and other investigations performed to determine the underlying cause were also noted. Patients were categorized according to the severity of hyponatremia based on their recorded serum sodium concentration. Where adequate clinical and laboratory information was available, patients were further classified according to volume status as hypovolemic, euvoletic, or hypervolemic. The probable etiology was determined from the documented clinical and laboratory findings and was categorized as gastrointestinal losses, renal losses or diuretic-associated causes, syndrome of inappropriate antidiuretic hormone secretion (SIADH), heart failure, liver disease, kidney disease, endocrine causes, infections, malignancy, or other identifiable causes. Cases with more than one documented contributing factor were considered to have a multifactorial etiology.

The primary outcome of the study was the clinical and etiological profile of hyponatremia among hospitalized medical patients. Secondary outcomes included the association of hyponatremia severity and etiological factors with duration of hospital stay, intensive care unit admission, complications, and in-hospital mortality.

The collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean $\pm$ standard deviation or median with interquartile range, as appropriate, while categorical variables were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was used to assess associations between categorical variables. For comparison of continuous variables between two groups, the Student's t-test or Mann-Whitney U test was applied according to the distribution of the data. A p-value <0.05 was considered statistically significant.

The study was conducted after obtaining approval from the Institutional Ethics Committee. Since the study was retrospective and record-based, only previously documented clinical information was utilized. Patient confidentiality and privacy were maintained throughout the study, and identifying information was not disclosed in the study report.

RESULTS

A total of 150 patients with hyponatremia were considered for the present retrospective analysis. The mean age of the patients was 58.6 ± 16.4 years, with a slight male predominance. There were 86 (57.3%) males and 64 (42.7%) females, giving a male-to-female ratio of approximately 1.34:1. The majority of patients belonged to the older age groups, with patients aged >60 years constituting approximately one-third of the study population.

Table 1. Age and sex distribution of patients with hyponatremia (N=150)

Age group (years)	Male, n (%)	Female, n (%)	Total, n (%)
18–30	7 (4.7)	6 (4.0)	13 (8.7)
31–40	11 (7.3)	9 (6.0)	20 (13.3)
41–50	16 (10.7)	12 (8.0)	28 (18.7)
51–60	20 (13.3)	15 (10.0)	35 (23.3)
>60	32 (21.3)	22 (14.7)	54 (36.0)
Total	86 (57.3)	64 (42.7)	150 (100)

The mean serum sodium concentration at the time of detection was 124.8 ± 6.8 mEq/L. Based on severity, 52 (34.7%) patients had mild hyponatremia, 61 (40.7%) had moderate hyponatremia, and 37 (24.6%) had severe hyponatremia. Thus, moderate hyponatremia constituted the largest proportion of cases.

Table 2. Distribution according to severity of hyponatremia

Severity	Serum sodium (mEq/L)	No. of patients	Percentage
Mild	130–134	52	34.7
Moderate	125–129	61	40.7
Severe	<125	37	24.6

Regarding clinical presentation, 41 (27.3%) patients presented with nausea/vomiting, 35 (23.3%) had generalized weakness or lethargy, 31 (20.7%) had altered sensorium or confusion, 18 (12.0%) had headache or dizziness, and 9 (6.0%) experienced seizures. Approximately 34 (22.7%) patients were asymptomatic at the time of identification of hyponatremia. Neurological manifestations were more frequently observed among patients with moderate-to-severe hyponatremia. Similar studies have reported vomiting, confusion, headache, malaise, altered sensorium, and seizures among the principal clinical manifestations.

Table 3. Clinical manifestations among patients with hyponatremia

Clinical manifestation	No. of patients	Percentage
Nausea/vomiting	41	27.3
Generalized weakness/lethargy	35	23.3
Altered sensorium/confusion	31	20.7
Headache/dizziness	18	12.0
Seizures	9	6.0
Other symptoms	16	10.7

Assessment of volume status showed that 70 (46.7%) patients were euvolemic, 45 (30.0%) were hypovolemic, and 35 (23.3%) were hypervolemic. Euvolemic hyponatremia was therefore the predominant pattern, followed by hypovolemic and hypervolemic forms.

Table 4. Distribution according to volume status

Volume status	No. of patients	Percentage
Euvolemic	70	46.7
Hypovolemic	45	30.0
Hypervolemic	35	23.3

Table 5. Etiological spectrum of hyponatremia

Etiology	No. of patients	Percentage
SIADH	31	20.7
Gastrointestinal fluid loss	27	18.0
Diuretic-associated	22	14.7
Chronic kidney disease	14	9.3
Heart failure	12	8.0
Pulmonary infection	10	6.7
Neurological/CNS disorders	9	6.0
Chronic liver disease	7	4.7
Endocrine causes	5	3.3
Other causes	13	8.7

Among the identified etiological factors, SIADH was the most frequent single etiology, accounting for 31 (20.7%) patients, followed by gastrointestinal fluid losses in 27 (18.0%), diuretic-associated hyponatremia in 22 (14.7%), chronic kidney disease in 14 (9.3%), heart failure in 12 (8.0%), pulmonary infections in 10 (6.7%), cerebrovascular/neurological disorders in 9 (6.0%), chronic liver disease in 7 (4.7%), endocrine causes in 5 (3.3%), and other causes in 13 (8.7%) patients. In approximately 18 (12.0%) patients, more than one contributing factor was identified.

Table 6. Distribution of major comorbidities

Comorbidity	No. of patients	Percentage
Hypertension	61	40.7
Diabetes mellitus	48	32.0
Chronic kidney disease	25	16.7
Heart failure	20	13.3
Chronic liver disease	15	10.0
Chronic pulmonary disease	14	9.3
Cerebrovascular disease	13	8.7
Other comorbidities	21	14.0

Among patients with euvolemic hyponatremia, SIADH was the predominant cause. Infectious diseases, particularly pulmonary and central nervous system infections, constituted important underlying conditions among patients with SIADH.

Table 7. Association between severity of hyponatremia and altered sensorium

Severity	Altered sensorium, n (%)	No altered sensorium, n (%)	Total
Mild	4 (7.7)	48 (92.3)	52
Moderate	10 (16.4)	51 (83.6)	61
Severe	17 (45.9)	20 (54.1)	37
Total	31 (20.7)	119 (79.3)	150

Among patients with hypovolemic hyponatremia, gastrointestinal losses, particularly vomiting and diarrhea, represented the predominant identifiable cause. Diuretic therapy and inadequate oral intake were additional contributing factors.

Table 8. Etiology according to volume status

Etiology	Hypovolemic (n=45)	Euvolemic (n=70)	Hypervolemic (n=35)
SIADH	2	28	1
GI fluid loss	23	3	1
Diuretic-associated	10	7	5
Chronic kidney disease	2	5	7
Heart failure	1	2	9
Pulmonary infection	1	8	1
CNS disorder	1	7	1
Chronic liver disease	0	1	6
Endocrine causes	2	3	0
Other causes	3	6	4
Total	45	70	35

The commonest associated comorbidities were hypertension in 61 (40.7%) patients, followed by diabetes mellitus in 48 (32.0%), chronic kidney disease in 25 (16.7%), chronic heart failure in 20 (13.3%), chronic liver disease in 15 (10.0%), chronic pulmonary disease in 14 (9.3%), and cerebrovascular disease in 13 (8.7%). Multiple comorbidities were present in a considerable proportion of patients.

Table 9. Hospital outcome according to severity of hyponatremia

Severity	Improved, n (%)	Death, n (%)	Total
Mild	50 (96.2)	2 (3.8)	52
Moderate	55 (90.2)	6 (9.8)	61
Severe	27 (73.0)	10 (27.0)	37
Total	132 (88.0)	18 (12.0)	150
P value	0.002		

A history of diuretic use was documented in 29 (19.3%) patients. Among these, thiazide and loop diuretics were the commonly documented medications. Diuretic therapy was more frequently associated with hypovolemic or multifactorial hyponatremia.

Table 10. Association of major risk factors with mortality

Risk factor	Survivors n (%)	Deaths n (%)	p-value
Age >60 years	43 (32.6)	11 (61.1)	0.02
Severe hyponatremia	27 (20.5)	10 (55.6)	<0.001
Altered sensorium	21 (15.9)	10 (55.6)	<0.001
Heart failure	14 (10.6)	6 (33.3)	0.01
Chronic kidney disease	19 (14.4)	6 (33.3)	0.04
Diuretic use	23 (17.4)	6 (33.3)	0.10

Regarding hospital outcome, 132 (88.0%) patients showed clinical improvement, whereas 18 (12.0%) patients died during hospitalization. Mortality was relatively higher among patients with severe hyponatremia, altered sensorium, multiple comorbidities, and hypervolemic hyponatremia.

Overall, the findings demonstrated that hyponatremia predominantly affected older hospitalized adults and was commonly associated with multiple comorbid conditions. Euvolemic hyponatremia was the predominant volume-status category, while SIADH, gastrointestinal fluid loss, and diuretic therapy represented important etiological factors. Clinical manifestations ranged from asymptomatic biochemical abnormalities to significant neurological symptoms, and severe hyponatremia was associated with poorer hospital outcomes.

DISCUSSION

Hyponatremia is a common electrolyte abnormality among hospitalized patients, with clinical manifestations ranging from nonspecific symptoms to severe neurological complications. In the present study, patients were predominantly older adults, with a mean age of 58.6 ± 16.4 years, and males constituted 57.3% of cases. Similar findings were reported by Sood et al., who observed a mean age of 62.25 ± 17.7 years with male predominance, while Baji and Borkar also reported greater occurrence among older patients [4,6]. Jain and Nandy highlighted the increased susceptibility of elderly individuals due to impaired water and electrolyte regulation and frequent comorbidities [3].

The mean serum sodium level was 124.8 ± 6.8 mEq/L, with moderate hyponatremia being the most common severity category (40.7%). This differed somewhat from studies involving more severely ill populations, where severe hyponatremia was more frequent [2,6]. Such variation may reflect differences in patient selection and clinical setting.

The common clinical manifestations in the present study were nausea/vomiting (27.3%), weakness (23.3%), and altered sensorium (20.7%). These findings were comparable with Babaliche et al., who reported vomiting and confusion as common presentations, and with Baji and Borkar, who observed nausea and drowsiness frequently [2,5]. Altered sensorium was significantly more frequent in severe hyponatremia in the present study (45.9%; $p < 0.001$), consistent with the findings of Babaliche et al. [2].

Euvolemic hyponatremia (46.7%) was the predominant volume-status category, followed by hypovolemic (30.0%) and hypervolemic (23.3%) forms. Similar predominance of euvolemic hyponatremia was reported by Chatterjee et al. and Babaliche et al., whereas Sood et al. reported a relatively similar distribution among the three categories [2,6,7].

SIADH (20.7%) was the most common identifiable etiology, followed by gastrointestinal fluid loss (18.0%) and diuretic-associated hyponatremia (14.7%). Babaliche et al. also identified SIADH as the leading cause, although their proportion was higher (46%) because their study included patients with moderate-to-severe hyponatremia admitted to the medical ICU [2]. Gastrointestinal losses were also important in the present study, consistent with Sood et al., who identified acute gastroenteritis as the commonest cause of hypovolemic hyponatremia [6].

Hypertension (40.7%) and diabetes mellitus (32.0%) were the most frequent comorbidities. Comparable findings were reported by Babaliche et al. and Baji and Borkar, who observed high frequencies of hypertension and diabetes among patients with hyponatremia [2,5]. Diuretic use was also an important contributing factor, particularly among older patients, consistent with previous reports [3,5].

The overall in-hospital mortality was 12.0%, increasing from 3.8% in mild to 27.0% in severe hyponatremia. This was comparable with mortality reported by Sood et al. (10.38%), Babaliche et al. (6%), and Chatterjee et al. (13.5%) [2,3,6]. The higher mortality associated with severe hyponatremia may reflect both the physiological effects of severe sodium reduction and the severity of underlying illnesses.

Overall, the present findings were broadly consistent with previous Indian studies, particularly regarding older age, male predominance, neurological and gastrointestinal manifestations, predominance of euvolemic hyponatremia, SIADH as an important etiology, and poorer outcomes with increasing severity [2-4,6,7]. Differences between studies may be explained by variations in patient population, disease severity, study setting, and etiological profile.

CONCLUSION

The present study demonstrated that hyponatremia was predominantly observed among older hospitalized adults and was commonly associated with multiple comorbidities. Euvolemic hyponatremia and SIADH represented important components of the etiological spectrum, while gastrointestinal losses and diuretic therapy were also frequent contributors. Increasing severity of hyponatremia was associated with a greater frequency of neurological manifestations and poorer hospital outcomes. The overall findings were broadly consistent with previously reported Indian studies, while differences in etiological and severity patterns highlighted the influence of patient characteristics and clinical setting on the presentation of hyponatremia.

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