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A STUDY OF CLINICAL AND BIOCHEMICAL PROFILE OF HYPONATREMIA IN HOSPITALIZED PATIENTS

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Abstract

Background: Hyponatremia represents the most prevalent electrolyte disorder, constituting approximately 22% of all such cases. It is a significant contributor to morbidity and mortality within intensive care units in India, although comprehensive data are scarce. This study aims to assess the causes and in-hospital outcomes of admitted ward patients with hyponatremia.

Methods: A detailed standard proforma was employed to document each patient's current complaints and past medical history, including conditions like diabetes mellitus, systemic hypertension, ischemic heart disease, dyslipidemia, neurological issues, chronic kidney or renal disease, and any regulatory or endocrine disorders.

Results: The most common treatment approach involved a combination of Normal Saline (NS) and Diuretics (33 patients, 41.3%). This suggests that correcting volume depletion and promoting fluid excretion were crucial aspects of therapy in many cases. 3% saline administration, either alone (24 patients) or combined with diuretics (1 patient), represents another frequently used strategy (31.25% of patients). This indicates a need for more aggressive sodium level correction in some patients.

Conclusion: This study demonstrates a significant burden of symptomatic hyponatremia in hospitalized patients, frequently manifesting with neurological symptoms. Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH) emerged as the predominant etiology, typically presenting with euvolemic hyponatremia. Diuretic use and endocrine dysfunction were identified as recurrent contributory factors.

Keywords: Hyponatremia, Syndrome of Inappropriate ADH, Euvolemia, Hypovolemia.

Introduction

Hyponatremia, defined as a serum sodium concentration below 135 mmol/L, is a prevalent electrolyte abnormality encountered in hospitalized settings. This simple imbalance has emerged as a significant concern due to its association with adverse patient outcomes. Studies report that hyponatremia affects up to 15% of hospitalized patients, with a particularly high prevalence among the elderly population residing in long-term care facilities [1-5]. This vulnerability in older adults is likely due to a combination of factors, including age-related physiological changes, polypharmacy (using multiple medications), and underlying chronic medical conditions. The clinical presentation of hyponatremia can be highly variable, ranging from asymptomatic in mild cases to severe neurological manifestations including confusion, seizures, and coma in more rapid or severe presentations. The severity of symptoms often depends on the rate of decrease in serum sodium concentration. Hyponatremia can also contribute to complications like falls, hospital readmissions, and even mortality [6]. Hyponatremia is the most frequently encountered electrolyte imbalance in hospitalized patients [7-9] and is linked to a mortality rate ranging from 5% to 50% [10], which varies based on the condition's

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severity and the rapidity of its onset [11]. Its occurrence in non-hospitalized elderly patients is estimated to be between 7% and 11.4%, with rates rising to 11% - 22.5% among hospitalized individuals [12]. The clinical manifestations of hyponatremia can range from no symptoms at all to severe outcomes such as seizures and coma [13]. If not carefully managed, the prognosis can be dire and have long-lasting effects [14]. Symptoms of hyponatremia include restlessness, altered consciousness, lethargy, seizures, and coma. Due to the wide variability in symptoms, diagnosing hyponatremia can be challenging. However, prompt and effective management of hyponatremia in the hospital setting can lead to reduced mortality, diminished severity of symptoms, less intensive care needs, shorter hospital stays, lower associated costs, and enhanced management of comorbid conditions, thus improving patient quality of life. Therefore, clinicians must maintain a high level of suspicion to effectively diagnose hyponatremia.

Hyponatremia is also associated with serious neurological complications. Identifying the potential causes of hyponatremia is essential in each case. The symptoms present and the duration of the hyponatremia inform the approach to treatment. A thorough evaluation for hyponatremia requires accurate history taking, clinical examination, and various diagnostic tests. This study was conducted to investigate the incidence, etiology, and clinical manifestations of hyponatremia in adult patients in the medical wards of a hospital.

Material and methods

This prospective study was conducted in the Department of General Medicine, Prathima Institute of Medical Sciences, Nagunur, Karimnagar. Institutional ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Inclusion Criteria

1. Cases with serum sodium levels below 130mMol/L
2. Aged 20 and above
3. Males and Females
4. Admitted to the wards of the Hospital
5. Willing to participate in the study voluntarily

Exclusion criteria

1. Patients on treatment with osmotic diuretics
2. Pregnant and lactating females
3. Not as per the inclusion criteria

Clinical examination: A detailed standard proforma was employed to document each patient's current complaints and past medical history, including conditions like diabetes mellitus, systemic hypertension, ischemic heart disease, dyslipidemia, neurological issues, chronic kidney or renal disease, and any regulatory or endocrine disorders. A comprehensive medication history was also gathered. Clinical examinations, particularly assessing the volume status of the patients, were meticulously documented.

Sample collection: In the hospital, blood samples were routinely drawn from all patients, and serum electrolytes were measured in the central biochemistry laboratory. Records of patients diagnosed with hyponatremia were closely monitored, and their sodium levels were tested again for confirmation.

Data collected included initial serum sodium, final sodium at discharge or death, calculated serum osmolality, urine osmolality, spot urine sodium, and any necessary endocrine evaluations. The treatment regimens, including fluid management and medications, were noted. The probable causes of hyponatremia were identified and correlated with patient outcomes at the end of the hospital stay.

Statistical Analysis Data were organized in an MS Excel spreadsheet and analyzed using SPSS software version 21. Quantitative and qualitative variables were presented using descriptive statistics (mean + standard deviation), frequencies, and percentages. The Chi-square test, a non-parametric statistic, was utilized to determine statistically significant differences between variables. A p-value of <0.05 was deemed statistically significant for this study.

Results

A total of 80 cases of hyponatremia were detected and included in the study. Table 1 shows the distribution of cases of hyponatremia. A critical analysis of Table 1 shows No cases of hyponatremia were identified in the 21-30 age group. The prevalence of hyponatremia appears to increase with age. The highest proportion of cases (42.5%) falls within the 61-70 age group. The second highest proportion (25.0%) is in the over 70 age group. The mean age of the cohort was 60.25 years. Overall, females (56.25%) make up a slightly larger portion of the study population compared to males (43.75%). However, within most age groups, there are more males than females.

Table 1: showing the distribution of cases of hyponatremia included in the study

Age group	*Male*	*Female*	*Total*	*Percentage*
21 - 30	0	0	0	0.00
31 - 40	1	2	3	3.75
41 - 50	5	6	11	13.75
51 - 60	5	7	12	15.00
61 - 70	15	19	34	42.5
> 70	9	11	20	25.00
Total	35	45	80	100.0

A significant proportion of patients (55 out of 80, or 68.75%) exhibited neurological symptoms associated with hyponatremia. Altered sensorium, which could include confusion, disorientation, or drowsiness, appears to be the most frequent neurological manifestation (38/80 = 47.5% of patients). Seizures were reported in a smaller subset of patients (12/80 = 15%).

Table 2: showing the symptoms and levels of hyponatremia in cases with neurological symptoms included in the study

Serum sodium levels in (mMol/L)	*Severity*	*Symptomatic*	*Asymptomatic*	*P value*
< 110	Severe	7 (20.6%)	0 (00.0%)	0.001
110 – 120	Moderate	22 (64.7%)	13 (61.9%)	0.03
120 – 130	Mild	5 (14.7%)	8 (38.1%)	0.224
Total	----	34 (100.0%)	21 (100.0%)	---

Table 2 analyzes the relationship between serum sodium levels (indicating hyponatremia severity) and neurological symptoms in 55 patients. There's a trend towards more severe neurological symptoms with lower serum sodium levels (greater hyponatremia severity). All patients (7, 100%) with severe hyponatremia (< 110 mmol/L) exhibited neurological symptoms. The majority of patients (22, 64.7%) with moderate hyponatremia (110-120 mmol/L) also had neurological symptoms. A smaller proportion (5, 14.7%) of patients with mild hyponatremia (120-130 mmol/L) experienced neurological symptoms. The P-values (0.001 for severe, 0.03 for moderate) indicate statistically significant differences in symptom prevalence between symptomatic and asymptomatic groups within those severity categories. There isn't a statistically significant difference for mild hyponatremia (p=0.224).

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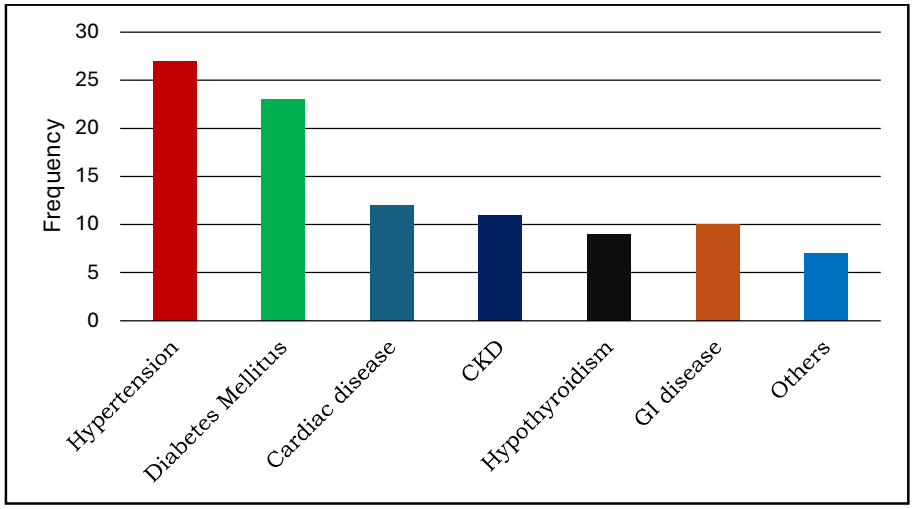

Figure 1: showing the comorbidities in the cases of hyponatremia included in the study

Figure 1 provides an overview of the various comorbidities (pre-existing medical conditions) identified among the 80 patients with hyponatremia included in the study. Hypertension is the most common comorbidity, affecting 27 (33.75%) patients. Diabetes Mellitus (23 patients, 28.75%) and Cardiac disease (12 patients, 15%) are also frequently reported comorbidities. Other conditions like chronic kidney disease (CKD), Hypothyroidism, and Gastrointestinal diseases are present in a smaller but notable portion of the study population. This suggests that several underlying medical conditions might predispose individuals to hyponatremia. Conditions like hypertension, diabetes, and heart disease can contribute to electrolyte imbalances and fluid management issues, potentially leading to hyponatremia.

Table 3: Volume status of hyponatremia cases included in the study

Volume status	*Symptomatic*	*Asymptomatic*	*P value*
Euvolemia	35 (43.7%)	21 (26.3%)	0.022
Hypovolemia	8 (10.0%)	7 (8.75%)	0.891
Hypervolemia	7 (8.75%)	2 (2.5%)	0.194

Table 3 shows the relationship between volume status (blood volume) and the presence of neurological symptoms in the 80 patients with hyponatremia from the study. Euvolemia is the most common volume status (35 patients, 43.7%), followed by Euvolemia in the symptomatic group (21 patients, 26.3%). There seems to be a weak association between euvolemia and hyponatremia symptoms. The P-value (0.022) suggests a statistically significant difference, but the percentages are relatively close. Hypovolemia and Hypervolemia are less frequent. The P-values for these categories (0.891 and 0.194, respectively) indicate no statistically significant difference in symptom prevalence between symptomatic and asymptomatic groups. Euvolemia appears to be the most common volume status in both symptomatic and asymptomatic hyponatremia patients. While there might be a weak association between euvolemia and symptoms, the cause of hyponatremia in these cases likely stems from factors other than blood volume abnormalities.

Table 4: Treatment done in cases of hyponatremia included in the study

Treatment	Frequency	Percentage
Normal saline + Diuretics	33	41.3
NS + Insulin	1	1.25
NS + 3% saline	4	5.0
Fluid restriction diuretics	3	3.75
Fluid restriction alone	1	1.25
3% saline	24	30.0
3% saline + diuretics	1	1.25
Diuretics	9	11.25
Steroids + NS	4	5.0
Total	80	100.0

A critical analysis of Table 4 shows the details of the various treatment approaches used to manage hyponatremia in the 80 patients included in the study. The most common treatment approach involved a combination of Normal Saline (NS) and Diuretics (33 patients, 41.3%). This suggests that correcting volume depletion and promoting fluid excretion were crucial aspects of therapy in many cases. 3% saline administration, either alone (24 patients) or combined with diuretics (1 patient), represents another frequently used strategy (31.25% of patients). This indicates a need for more aggressive sodium level correction in some patients. Other treatment combinations like fluid restriction with or without diuretics, and regimens including steroids, were used in a smaller proportion of cases. The treatment was a tailored approach to hyponatremia treatment, considering factors like volume status and severity of sodium depletion. The frequent use of normal saline with diuretics indicates that euvolemic or hypervolemic hyponatremia (normal or excess blood volume) might be common in this patient population. The use of 3% saline suggests a need for faster sodium level correction in some cases, due to severe hyponatremia or rapid symptom onset.

Discussion

A total of 80 hyponatremia patients admitted to wards of our hospital were included in the study during the duration of the study period. The mean age of participants in our study was 60.25 ± 5.5 years, with a female predominance (56.25% Female, 43.75% male). This patient demographic is similar to a hospital-based study by Rao MY et al. [15], where the mean age was 73.87 years (± 6.54) and the male-to-female ratio was 1:0.96. The prevalence of hyponatremia in our elderly patient population was 20%. This finding aligns with the study by Rao MY et al. [15], which reported a prevalence of 25.98% among elderly patients. Our study identified hypertension (33.75%) and diabetes mellitus (28.75%) as the most prevalent pre-existing conditions (comorbidities) among patients with hyponatremia. Cardiac problems (15%), and renal problems (13.75%) were also present. While studies haven't established a direct link between hyponatremia and hypertension, an association with age and diuretic use is evident [16, 17]. Similar to our findings, Shanmugasundaram et al. [18] reported hypertension followed by diabetes as the most common comorbidities in their hyponatremia patient population. The most common cause of hyponatremia in our study was the Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH) at 27.5%. This aligns with findings from Rao MY et al. [15] (31% SIADH) and contrasts with Vurghese et al. [19] who reported a lower prevalence (4.8%). Single causes were identified in 59% of patients, while multifactorial causes were observed in 37% and the cause remained unclear in 4%. These findings are consistent with reported percentages: 34.8% multiple etiologies by Vurghese et al. [19] and 75% by Clayton et al. [17]. These studies highlight the importance of pinpointing the specific factors contributing to hyponatremia in each patient to guide appropriate treatment strategies.

In our study, 70% of patients were euvolemic (normal blood volume), 18.75 % were hypovolemic (decreased blood volume), and 11.25% were hypervolemic (increased blood volume). Interestingly, among euvolemic patients, 43.7% were symptomatic (experienced neurological symptoms) while only 26.3% were asymptomatic. A similar trend was observed in the hypervolemic

group (10% symptomatic vs. 8.75% asymptomatic) and the hypovolemic group (8.75% symptomatic vs. 2.5% asymptomatic). A statistically significant difference was found, with most euvolemic patients presenting symptoms ($p < 0.022$). This aligns with Bhattacharjee et al.'s study [20] where euvolemic patients exhibited more severe hyponatremia symptoms compared to other groups. Baji et al. [21] reported distribution of 43% euvolemic, 38% hypervolemic, and 19% hypovolemic patients in their study. Our study employed various treatment methods, with most patients receiving a combination of approaches. Notably, 3% saline solution was used for correction in 36.25% of patients (Table 4). In Rao MY et al.'s study [15], treatment included normal saline (71% of patients), oral sodium chloride supplementation (44%), hypertonic (3%) saline (41%), fluid restriction (37%), and loop diuretics (26%). The mortality rate in our study was 5%, and it did not correlate with hyponatremia severity (p-value = 0.125). In contrast, Rao MY et al. [15] reported a higher overall mortality of 20% among hyponatremia patients, with 23.5% mortality in the most severe cases. Shanmugasundaram et al. [18] observed a mortality rate of 2.1% in patients with severe hyponatremia. These findings suggest that mortality is likely linked more to the severity of underlying medical conditions rather than hyponatremia itself.

Conclusion

This study demonstrates a significant burden of symptomatic hyponatremia in hospitalized patients, frequently manifesting with neurological symptoms. Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH) emerged as the predominant etiology, typically presenting with euvolemic hyponatremia. Diuretic use and endocrine dysfunction were identified as recurrent contributory factors. While a lower mortality rate was observed, it primarily correlated with pre-existing comorbidities rather than hyponatremia severity. Notably, the incidence of hyponatremia exhibited a positive association with age, and symptom severity intensified with greater degrees of hyponatremia. These findings underscore the importance of early identification and prompt management of hyponatremia in hospitalized patients, particularly among older adults, to mitigate potential neurological complications.

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