

Clinical Profile of Euvolemic Hyponatremia and its Outcome in Elderly Hospitalized Patients

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Abstract:

Background: Euvolemic hyponatremia is a common electrolyte imbalance observed in hospitalized elderly patients. It is often associated with conditions like Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH), medications, and chronic illnesses. Given the complexities of its diagnosis and management, understanding the clinical profile of elderly patients with euvolemic hyponatremia is crucial for improving patient outcomes. This study aims to evaluate the clinical characteristics, underlying etiologies, and outcomes of euvolemic hyponatremia in a sample of 50 elderly hospitalized patients.

Methodology: A prospective observational study was conducted in a tertiary care hospital over six months. Fifty elderly patients (aged ≥ 60 years) with confirmed euvolemic hyponatremia (serum sodium < 135 mEq/L, normal total body water) were included. Patients with hypervolemic or hypovolemic hyponatremia were excluded. Detailed medical histories, including medication use, comorbidities, and clinical presentations, were recorded. Laboratory parameters, including serum sodium, osmolality, and urine sodium, were analysed. Data was statistically analyzed to identify significant trends and correlations.

Results: The current study observed a male predominance (62%) among elderly patients with euvolemic hyponatremia. A significant proportion of patients presented with severe (42%) and moderate (40%) hyponatremia, which aligns with similar studies reporting delayed diagnosis due to masked symptoms in the elderly. SIADH was identified as the leading cause (48%), often linked to medications and comorbidities. Lethargy (56%) and postural dizziness (36%) were the most common symptoms, with severe cases exhibiting CNS complications like confusion and seizures. Severe hyponatremia significantly increased the risk of mortality (20%, $p=0.01$), emphasizing the need for early intervention.

Discussion: This study highlights that euvolemic hyponatremia in elderly hospitalized patients is predominantly linked to SIADH and medication use. The clinical presentation is often nonspecific, emphasizing the importance of careful evaluation to prevent misdiagnosis. Timely intervention with fluid restriction and management of the underlying cause can lead to favourable outcomes, although comorbid conditions continue to pose significant challenges. Further research is needed to explore preventive strategies and optimize treatment protocols in this vulnerable population.

Conclusion: Euvolemic hyponatremia in the elderly is a multifaceted condition with diverse etiologies and presentations. Early identification and targeted therapy are essential to minimize hospital stays and complications.

Keywords: SIADH, hyponatremia, sodium, elderly.

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Introduction

Hyponatremia is a very common condition observed in hospitalized patients. Serum Na^+ concentration disorders are caused by anomalies in water homeostasis, resulting in alterations in the Na^+ to body water ratio. Water intake and circulating AVP are the two main factors which can lead to both hyponatremia and hypernatremia.[1] Hyponatremia is defined as serum sodium concentration less than 135 mmol/L, which can

occur Upto 22 to 23 % of hospitalized patients.[1] Sodium concentration is key molecule in determining extracellular volume and maintaining blood pressures and osmotic equilibrium.[2] The symptoms related to hyponatremia is mainly due to osmotic disequilibrium which can lead to cerebral edema. [1,3] Incidence of hyponatremia in elderly is very high which is due to age related physiological changes in the body, renal

dysregulation and other comorbid conditions. [4] It increases the morbidity and mortality of the patients, prolongs hospitalization and with the severity it also increases the poor disease outcome.[2,3,4] Diagnostic evaluation of hyponatremia in elderly patients is difficult because of underlying comorbidities like heart failure, chronic kidney disease etc., use of various drugs which may cause hyponatremia.[5] hyponatremia can be divided into hypovolemic, euvolemic and hypervolemic depending on upon the volume status of the patient. [1,2]

Euvolemic hyponatremia occurs when total body water increases without increase in total body sodium. The various causes of euvolemic hyponatremia includes : adrenal insufficiency, hypothyroidism , SIADH, cerebral salt wasting, drug induced , primary polydipsia, poor solute containing fluid intake (beer potomania), etc. [1] One of the leading cause of hyponatremia in elderly population is syndrome of inappropriate antidiuresis (SIADH), which is can be due to malignancies , pulmonary diseases , central nervous system disorder or drug induced.[1,4] The clinical manifestations hyponatremia includes lethargy, nausea, postural dizziness, nausea, vomiting, altered behaviours ,seizures, coma or even death.[4,5,6] These signs and symptoms can vary depending upon the serum sodium level. Death rates may increase up to 1.5 to 60 times in hyponatraemic patients when compared to those having normal levels.

Management of euvolemic hyponatremia is very different from management of hypovolemic hyponatremia, so careful evaluation is necessary. [6] Patients may present with acutely < 48 hours where symptoms are more severe as compared to chronic hyponatremia where symptoms are less severe due adaptation made by brain cells. [1,6,7] An accurate clinical assessment that focuses on fluid status, chronicity, and possible aetiology, together with the necessary diagnostics, is necessary to initiate the proper treatment.[8] Depending upon the clinical scenario, patients are managed with fluid restriction, hypertonic saline infusion or even with vasopressin antagonists.[9]

In our country, there is scarce data regarding the impact of hyponatremia in disease outcomes in elderly populations which is sometimes underestimated, and early recognition and prompt treatment can decrease the disease burden in these age group. In this study, we are going to analyse the various etiologies of euvolemic hyponatremia, clinical manifestations, disease outcome depending upon the severity and various treatment modalities used to treat the disease.

Materials and Methods

Study design and setting: Our study was conducted at a tertiary care teaching hospital located in northeastern India. It was a single-centre, prospective observational study, with clinical data collected from patients between January 2024 and June 2024. Data collection commenced after receiving approval from the Institutional Ethics Committee (MC. No.: 190/2007/pt-II/Dec 2023/35). A convenience sampling method was employed. The study adhered to the principles outlined in the Declaration of Helsinki (2008), and this manuscript follows the STROBE guidelines for reporting.

Sample Size: A total of 50 patients who presented with euvolemic hyponatremia who fulfilled the inclusion criteria were taken up for the study.

Inclusion criteria: Subjects aged 60 years and above with serum sodium <135 mEq/L.

Exclusion criteria

1. Patients with hypovolemic and hypervolemic state.
2. Patients who refused to give informed consent.

Data collection and analysis: The study was conducted in the Department of General Medicine at Gauhati Medical College and Hospital. Participants included individuals aged 60 years and above with serum sodium levels below 135 mEq/L. Patients with hypovolemic or hypervolemic hyponatremia, including conditions such as congestive heart failure (CCF), chronic kidney disease (CKD), and chronic liver disease (CLD), were excluded.

A thorough history was taken for each patient, including symptoms of hyponatremia, potential risk factors, and any pre-existing conditions. Symptoms evaluated included altered sensorium, postural dizziness, lethargy, and seizures. Changes in sensorium encompassed confusion, memory impairment, stupor, delirium, and coma.

A comprehensive clinical examination was performed on all patients to assess their hydration status, allowing them to be categorized as hypervolemic, hypovolemic, or euvolemic. At the time of hyponatremia diagnosis, a detailed central nervous system (CNS) examination was conducted to document mental status and identify any neurological deficits. The CNS exam was repeated after hyponatremia correction, and symptoms such as dizziness, lethargy, altered sensorium, and seizures were attributed to hyponatremia unless another medical condition or medication could explain them.

The investigations included complete blood count, serum sodium, osmolality, blood urea nitrogen, glucose levels, urine osmolality, specific gravity, sodium concentration, microscopic analysis, serum

proteins, lipid profile, thyroid function tests, brain imaging, and cerebrospinal fluid analysis.

The various data were collected on a standard data collection proforma and then entered in Microsoft excel spreadsheet. The analysis was done using GraphPad prism 8.0.

Results

A hospital based observational study was conducted on 50 elderly patients who came to Gauhati Medical College and Hospital between January 2024 to July 2024. The study included the

patients who were admitted in the medicine ward department, GMCH with a diagnosis of hyponatremia due to various etiology above 60 years of age.

Majority of the participants were male (62%) as compared to females (38%). Out of which, 21 had severe hyponatremia (42%), 20 had moderate hyponatremia (40%) and 9 had mild hyponatremia (18%). 28 patients were of age group 60-70 years, 16 were between 71-80 years and 6 patients were above 80 years.

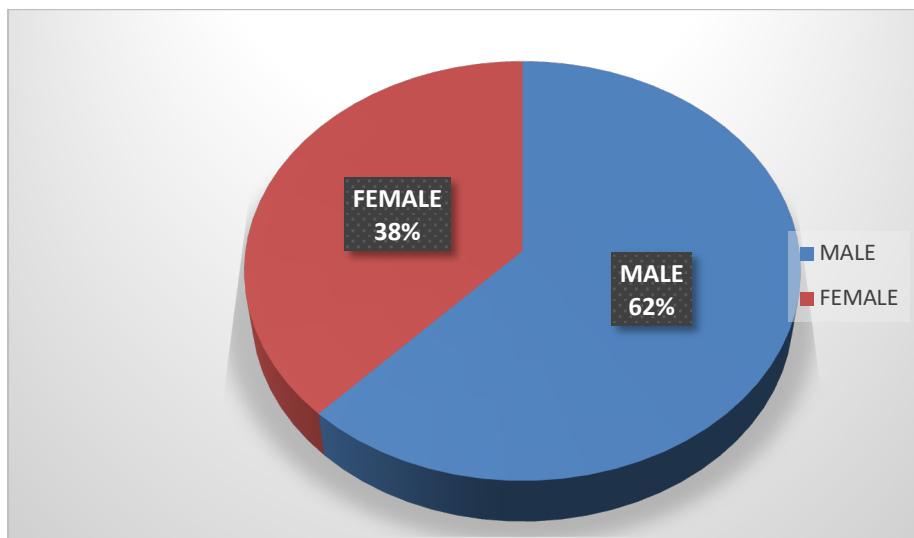


Figure 1: Gender Distribution

Table 1: Table Showing Distribution According To Severity

| Severity | Sodium Level | Total NOS. of Patient |
|-------------|--------------|-----------------------|
| Severe | <125 | 21 |
| Moderate | 125-129 | 20 |
| Mild | 130-134 | 9 |
| Grand Total | | 50 |

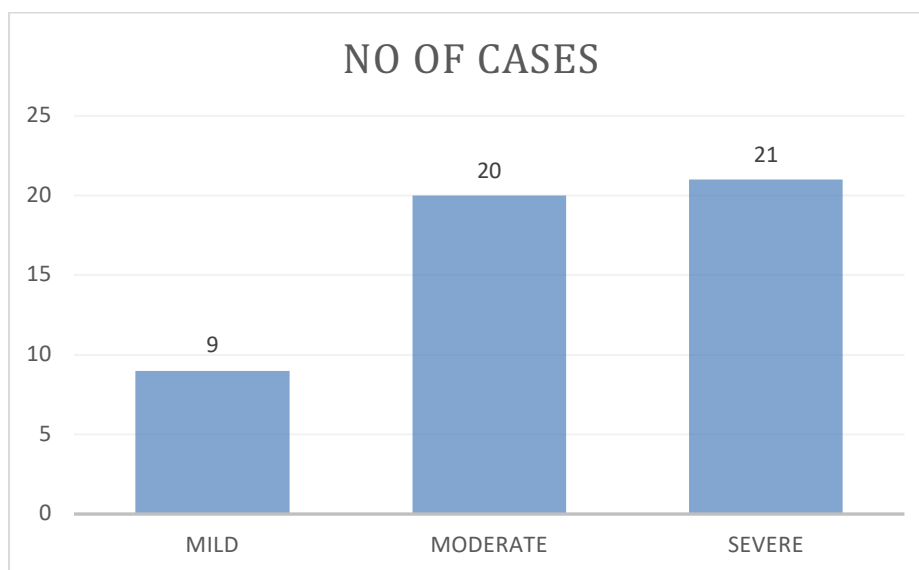


Figure 2: Bar Diagram Showing Distribution According To Severity

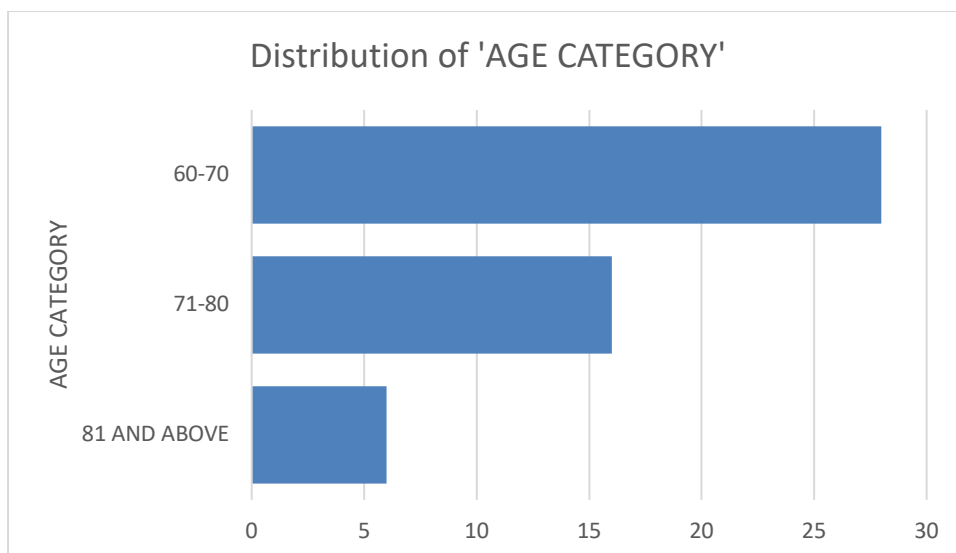


Figure 3: Bar Diagram Showing Distribution According To Age

Most common cause for hyponatremia was found to be SIADH (48%) followed by hypothyroidism (16%), others cause like drug induced (8%), adrenal insufficiency (4%), cerebral salt wasting (4%) and others (20%).

Table 2: Etiologies of Hyponatremia

| Etiology | No of Cases |
|-----------------------|-------------|
| Hypothyroidism | 8 |
| Siadh | 24 |
| Drugs | 4 |
| Adrenal Insufficiency | 2 |
| Cerebral Salt Wasting | 2 |
| Others | 10 |
| Total | 50 |

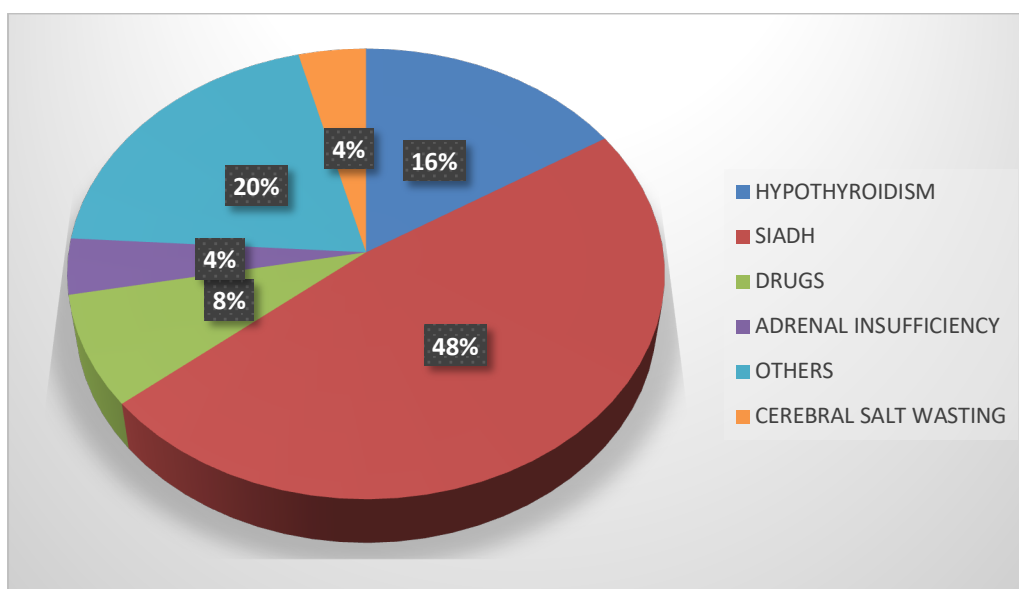
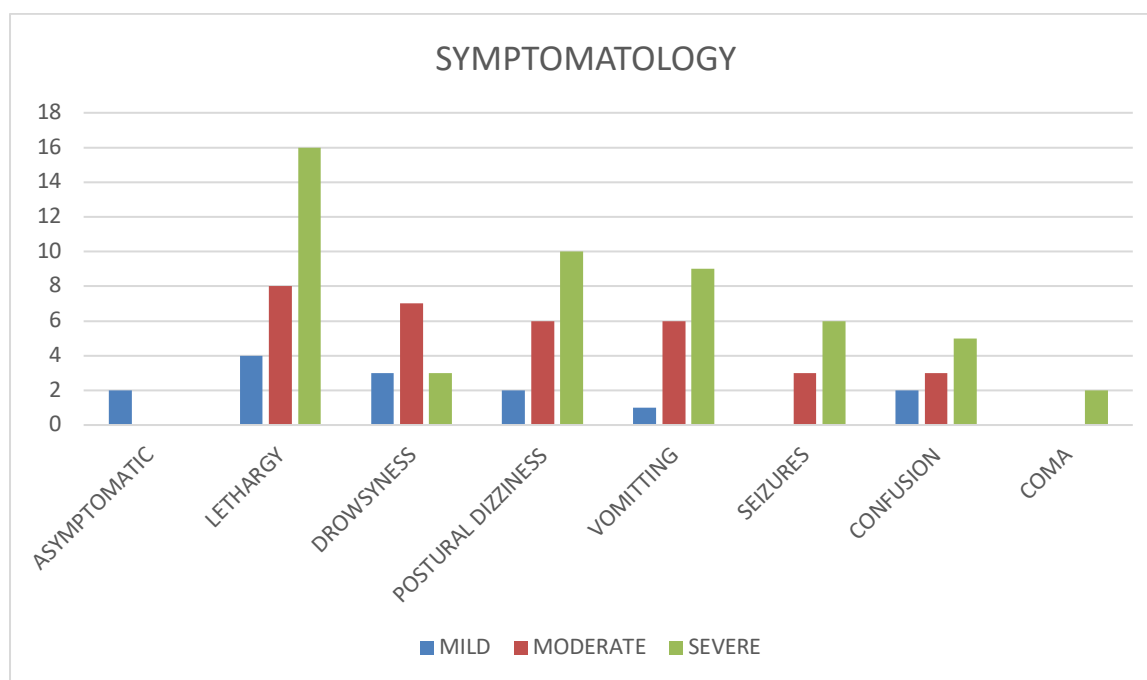


Figure 4: Pie Chart Showing Etiologies of Hyponatremia

Most predominant symptoms of hyponatremia were found to be lethargy in 33 patients (56%) followed by postural dizziness in 18 patients (36%), 16 patients (32%) have GI symptoms like nausea and vomiting. CNS symptoms like confusion, seizures and coma presented in 10 (20%), 9 (18%) and 2 (4%) patients respectively. The patients with severe hyponatremia were more likely to develop CNS symptoms which was found significant in in our study ($p < 0.0001$, $r = -0.80$, 95% of CI -0.8845 to -0.6774).

Table 3: Symptoms of Hyponatremia According To Severity

| Symptoms | Mild | Moderate | Severe | Total |
|--------------------|------|----------|--------|-------|
| Asypmtomatic | 2 | 0 | 0 | 2 |
| Lethargy | 4 | 8 | 16 | 28 |
| Drowsyness | 3 | 7 | 3 | 13 |
| Postural Dizziness | 2 | 6 | 10 | 18 |
| Vomiting | 1 | 6 | 9 | 16 |
| Confusion | 2 | 3 | 5 | 10 |
| Seizures | 0 | 3 | 6 | 9 |
| Coma | 0 | 0 | 2 | 2 |

**Figure 5: Bar Diagram Showing Symptoms According To Severity**

Out of 50 patients, 40 patients were discharged out of which 6 patients had residual defect, and 10 patients died. Patients with severe hyponatremia had an 8-fold increased risk of mortality compared to those with mild and moderate episodes, which was found statistically significant. ($p=0.01$, 95% of CI= 1.489 to 41.31).

Discussion

The clinical profile of euvolemic hyponatremia in elderly patients have been a focus of numerous studies, given its frequent occurrence in hospitalized patients and its potential for serious outcomes. The present study conducted at Gauhati Medical College and Hospital provides valuable insights into the demographic distribution, etiologies, symptomatology, and outcomes associated with hyponatremia in the elderly, complementing existing literature on the topic. The study observed a male predominance (62%), which aligns with findings from other research, where male elderly patients were reported to have a higher incidence of hyponatremia. Some studies have suggested that this may be linked to greater comorbidities and medication usage in elderly men

compared to women, although this pattern is not universally observed. For instance, a study conducted by A Senthamarai et al. [2] also demonstrated a male predominance (60%) in their cohort of elderly patients with hyponatremia.

The distribution of hyponatremia severity in this study shows a significant number of patients with severe (42%) and moderate (40%) hyponatremia. This finding is comparable to that of a study by Nikhil Sood et al., [10] which also reported a higher proportion of elderly patients with severe hyponatremia (42.6%). The higher incidence of severe cases may be attributable to the delayed presentation or recognition of the condition in elderly populations, often masked by comorbidities.

SIADH was identified as the leading cause (48%), consistent with findings from other hospital-based studies, where SIADH frequently emerges as a prominent contributor to euvolemic hyponatremia. SIADH in the elderly is often multifactorial, associated with medications (e.g., diuretics, SSRIs), malignancies, and pulmonary or central nervous system disorders. A study by Mahesan Anpalahan

[11], also highlighted SIADH as a common etiology, particularly in elderly patients with malignancies and chronic lung diseases.

Lethargy (56%) and postural dizziness (36%) were the most common presenting symptoms, mirroring findings in the broader literature. A study by Shyam Kumar Shah et al. [12] noted that non-specific symptoms such as lethargy and dizziness are often the initial manifestations of hyponatremia in the elderly, making early diagnosis challenging. CNS symptoms like confusion (20%), seizures (18%), and coma (4%) were more frequently observed in patients with severe hyponatremia, consistent with other studies that have identified a direct correlation between serum sodium levels and neurological symptoms. This relationship is significant in the current study ($p < 0.0001$), confirming the association between lower sodium levels and a higher risk of CNS complications.

The study reported a high mortality rate (20%), with severe hyponatremia significantly increasing the risk of death ($p = 0.01$). This is consistent with findings from studies such as that by Amit K Jain et al., [13] who reported an increased mortality risk in elderly patients with severe hyponatremia. The 8-fold increase in mortality risk for severe cases emphasizes the need for early recognition and aggressive management of hyponatremia in this population.

Residual neurological deficits were observed in 6 patients, like findings in studies where chronic or severe hyponatremia led to lasting cognitive or motor impairments. This highlights the importance of long-term follow-up for elderly patients who survive an episode of severe hyponatremia.

Conclusion

The study conducted at Gauhati Medical College and Hospital offers significant insights into the clinical profile of euvolemic hyponatremia in elderly hospitalized patients. A male predominance (62%) was noted, consistent with existing literature, possibly due to higher comorbidities and medication use among elderly men. Most patients presented with moderate to severe hyponatremia, underscoring the delayed recognition of the condition, which is often masked by comorbidities in this population. SIADH emerged as the most common cause, responsible for 48% of cases, aligning with previous research that highlights its multifactorial nature, especially in relation to some medications, malignancies, and chronic pulmonary or neurological conditions in the elderly.

The study also highlighted the high mortality rate (20%), particularly in patients with severe hyponatremia, emphasizing the critical need for early diagnosis and prompt management. Moreover, the presence of residual neurological

deficits in some survivors of severe hyponatremia stresses the importance of long-term follow-up to address cognitive and motor impairments. Overall, this study reinforces the importance of vigilant monitoring and comprehensive management strategies for elderly patients at risk of hyponatremia, given the potentially severe outcomes.

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