**Original research article**

# Clinico-etiological profile of hyponatremia among elderly patients admitted in medical ward of rural tertiary care hospital Dr.RPGMC Kangra at Tanda Himachal Pradesh.

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**Abstract**

**Background:** Hyponatremia, defined as a serum sodium concentration <135 mmol/l. It may be asymptomatic or present with symptoms ranging from nausea, lethargy to seizure and coma or even life threatening. Timely diagnosis can result in appropriate interventions to reduce these symptoms and mortalities. **Aims and Objective:** To study the incidence, etiology, clinical features and treatment outcomes of hyponatremia at a tertiary care centre.

**Material and Methods:** Study was conducted at a Rural tertiary care centre DRPGMC Kangra at Tanda, H.P, from the period 01 August 2019 to 01 August 2020. Present study was observational study. Elderly Patient with serum $Na^+ \leq 135$ meq/l were included in study. Based on history and clinical examination patients were classified as hypovolemic hyponatremia, hypervolemic hyponatremia and euvolemic hyponatremia**.** Patients with clinical euvolemia, Urine $Na^+ > 20$ mmol/l, Serum uric acid ≤4 mg/dl, normal renal function (serum creatinine and blood urea) and absence of thyroid or pituitary insufficiency were classified as having Syndrome of inappropriate antidiuresis (SIADH). The sodium estimation was done in the randox automated analyser which measures sodium by ion selective electrode technology. **Result:** Total of 100 patients with hyponatremia (serum sodium chloride < 135mEq/L) .Mean age of the patients was 73.87 ± 6.54 years with a male to female ratio of 1.04:1. About 82% of patients were symptomatic among which lethargy (50%), drowsiness (42%), and abnormal behavior (35%) were common symptoms. Most patients (49%) had profound hyponatremia and Syndrome of inappropriate anti-diuretic hormone secretion (SIADH) (39%) and drugs (26%) were the most common cause of hyponatremia in this study. The common treatment given in this study was 0.9% NaCl (68%) and 3% NaCl and Mortality of patients in this study was 17%. **Conclusion**: Commonest age group for hyponatremia was 70–74 years. Majority of the patients fell in euvolemic group followed by hypervolemic. Most common presentation of hyponatremia was altered sensorium, lethargy; vomiting and one patient had seizure. The possible cause of hyponatremia should always be sought as outcome in severe hyponatremia is governed by etiology, and not by the serum sodium level. Treatment of severe symptomatic hyponatremia with hypertonic saline is safe if recommendation for the rate of correction of hyponatremia is strictly followed.

**Key words:** Hyponatremia; Syndrome of Inappropriate Ant-diuretic hormone; Altered Sensorium.



## Introduction

Electrolyte Disorders of sodium and water metabolism are common in clinical practice. Both hyponatremia and hypernatremia can cause substantial morbidity and mortality and incorrect treatment can add to the problem.

It is defined as a serum sodium concentration <135 mmol/l, it can lead to a wide spectrum of clinical symptom. It may be asymptomatic or present with symptoms ranging from nausea, lethargy to seizure and

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coma or even life threatening.[1-2] The incidence is much more in the elderly mainly owing to the impaired ability to maintain water and electrolyte homeostasis in response to dietary and environmental changes.[3] The management of these cases needs modification due to physiological changes with age affecting the renal and other systems. Clinical management of the patients with hyponatremia is based on correcting the serum sodium level and treating the underlying cause.[3] Diagnosis of the electrolyte abnormality is depends crucially on the correct assessment of volume status which is some time difficult to determine, especially in the elderly patients.[4,5] Syndrome of inappropriate antidiuresis (SIADH) is widely assumed the commonest cause of euvolumic hyponatremia, but some time it may be over diagnosed particularly in dehydrated elderly patients.[4,6,7] Due to incorrect diagnosis these patients may be mismanaged because the management of the euvolumic hyponatremia (SIADH) is exact opposite to the management of hypovolemic hyponatremia. Data regarding the incidence of hyponatremia in the elderlyin India is limited. This study was conducted to evaluate the common clinical features and etiology of hyponatremia in the elderly hospitalized patients and to correlate the hyponatremia with co morbid conditions.

**Material and Methods**

The present study was observational study. Elderly patients with serum $Na^+ \leq 135$ meq/l were included in study.

**Exclusion criteria**:

Uncontrolled diabetes, hyperlipidemia (TG>500 mg/dl), multiple myeloma, receiving mannitol, suspected ethylene glycol or methanol poisoning.

All selected patient were evaluated by history and clinical examination using a preformed proforma. Special emphasis was made on duration of hyponatremia and symptoms/signs related to hyponatremia. All the patients were subjected to base line investigations: Arterial blood gas, complete blood counts, random blood glucose, blood urea and serum creatinine, serum electrolytes ($Na^+$, $K^+$, Cl), serum uric acid, urine electrolytes, liver function test, serum TFT, serum cortisol level (wherever indicated). Chest radiograph and imaging studies-ultrasonography abdomen, two-dimensional (2D) ECHO and colour Doppler (wherever indicated). Since the osmometer was not available for measurement of osmolality. serum osmolality was calculated in all patients using the formula: Serum osmolality= $(2Na^+ + (BUN/2.8) + (glucose/18)$. Based on serum $Na^+$level patients were classified into mild (131–135 mg/dl), moderate (121–130 mg/dl) and severe hyponatremia (≤120 mg/dl). Data were recorded on a predesigned proforma and managed in a Microsoft Excel spreadsheet. Data are presented as frequency distribution and simple percentages.

**Result:**

Total of 100 patients were enrolled in the study with a mean age of 73.87 ± 6.54 years and male to female ratio of 1.14:1 Age and gender distribution of the study patients is mentioned in Table 1. The severity of hyponatremia is given in Table 2. In this study, majority of the patients had profound hyponatremia. Symptoms of hyponatremia and its association with the severity of hyponatremia are given in Table 3. Majority of patients (82%) were symptomatic with most of the patients (62%) having more than 1 symptom. Lethargy (50%), drowsiness (42%), and abnormal behavior (35%) were common symptoms and seizure was the least commonly observed symptom (1%) with profound hyponatremia. About 18% of patients were asymptomatic with most of them having mild hyponatremia. Hypertension (68%) and diabetes mellitus (46%) were common pre-existing diseases, while drugs (26%), vomiting (32%), and poor intake (31%) were common predisposing factors observed among the study patients. Causes of hyponatremia are given in Table 4. Majority of the patients had single etiology (86%). SIADH (39%) and drugs (26%) were the most common causes and hypothyroidism (3%) and renal loss (5%) being the least. Common Causes of SIADH are neurological like stroke in (14) patients meningitis (3) and SOL(3). Other are pulmonary cause like Pneumonia (13) tuberculosis (3), carcinoma lung (3). Most common drugs which causes hypernatremia were diuretics. Among diuretics most common was Thiazide, Loop diuretics, Loop diuretics+spironolactone caused hyponatremia in 09,06and 04 patients respectively shown in table 5. Other drugs were antidepressants and ATT and chemotherapy in our study. Majority of the patients had euvolemia (54%) followed by hypervolemia (26%) and the least common being hypovolemia (20%). The common treatment given in this study was 0.9% normal saline (NS) (68%). Twenty patients had associated hypokalemia, which was treated with intravenous and/or oral potassium supplement.

Treatment given for correction of hyponatremia was 3% sodium chloride, 0.9% NaCl, Diuretics, Restricted water intake and increased oral salt

intake. In our study mortality of patients was 17%. Outcome of the patients in different age groups, gender, hyponatremia level given in table 6. There is no co-relation between age and mortality. Maximum death occurred in age group 74 to 79 years i.e (6) patients. In profound hyponatremia there were ten deaths. In mild and moderate hyponatremia mortality were one and six respectively.

**Table 1: Age and Sex distribution**

| Age Group | Female (*n*) | Male (*n*) | Grand Total (*n*) |
|---|---|---|---|
| 65-69 | 8 | 15 | 23 |
| 70-74 | 17 | 13 | 30 |
| 75-79 | 12 | 10 | 22 |
| 80-84 | 8 | 9 | 17 |
| 85-89 | 4 | 4 | 8 |
| Total | 49 | 51 | 100 |

**Table:2 Severity of Hyponatremia.**

| Severity of hyponatremia | Patients |
|---|---|
| Mild | **23** |
| Moderate | **28** |
| Profound | **49** |

**Table:3 Association of symptoms with severity of hyponatrmia.**

| Symptoms | Mild | Moderate | Severe |
|---|---|---|---|
| Asymptomatic | 15 | 3 | 0 |
| Nausea | 2 | 8 | 25 |
| Headache | 2 | 5 | 21 |
| Dizziness | 2 | 4 | 17 |
| Lethargy | 5 | 15 | 30 |
| Muscle cramps | 2 | 5 | 7 |
| Abnormal behavior | 1 | 11 | 23 |
| Drowsiness | 2 | 12 | 28 |
| Seizures | 0 | 0 | 3 |

**Table: 4 Aetiology of Hyponatremia**

| Aetiology of Hyponatremia | Patients (*n*) |
|---|---|
| SIADH | **39** |
| Drugs | **26** |
| Dilution | **22** |
| GI Loss | **14** |
| Poor Intake | **7** |
| Renal loss | **5** |
| Hypothyroidism | **3** |

**Table 5: Drugs which caused Hyponatremia Patients (*n*)**

| | |
|---|---|
| Diuretics | |
| Thiazide | 9 |
| Loop diuretics | 5 |
| Loop diuretics & Spironolactone | 4 |
| Antidepressants | 3 |
| Anticonvulsants | 2 |
| Chemotherapeutic agents | 2 |
| Antitubercular agents | 1 |

**Table 6: Level of Biochemistry parameter in different Level of Hyponatremia**

| **Parameters** | | **Hyponatremia** | | |
|---|---|---|---|---|
| | **Mild (*n*=23)** | **Moderate (*n*=28)** | **Profound (*n*=49)** | **Total(n)100** |
| Serum Sodium (mEq/L) | 131.23±20.9 | 126.24±19.62 | 118.58 | 125.05±6.58 |
| Random Blood sugar (mg/dl) | 146.50±76.4 | 164.00±71.36 | 139.24±51.18 | 149.77±62.58 |
| Blood Urea (mg/dl) | 22.49±19.05 | 26.57±15.58 | 32.22±23.02 | 26.66±20.54 |
| Serum Creatinine (mg/dl) | 1.36±1.04 | 1.86±1.67 | 1.58±1.52 | 1.6o±1.44 |
| Serum Osmolality (Osm/L) | 277.20±9.33 | 261.70±11.03 | 248.37±22.35 | 262.10±21.36 |
| Urine Sodium (mEq/L) | 43.07±27.63 | 66.95±55.00 | 83.90±64.18 | 71.19±56.96 |

**Table 6: Outcome in different demographic group.**

| Characteristics | | Outcome | |
|---|---|---|---|
| | | Death (*n*) | Discharge (*n*) |
| Age Group (years) | 65-69 | 3 | 20 |
| | 70-74 | 6 | 25 |
| | 75-79 | 3 | 20 |
| | 80-84 | 3 | 13 |
| | 85-89 | 2 | 8 |
| Gender | Female | 10 | 42 |
| | Male | 7 | 44 |
| Levels of | Mild | 1 | 22 |
| Hyponatremia | Moderate | 6 | 24 |
| | Profound | 10 | 40 |

## Discussion

Hyponatremia is the most common electrolyte disturbance seen in hospital practice. It is more common in the elderly patients with multiple medical comorbidities.[9] Hyponatremia has been associated with considerable morbidity and mortality in many chronic diseases, most notably in patients with congestive heart failure [10] and cirrhosis of liver.[11] Hyponatremia also leads to increased health care cost and the majority of these costs are attributable to the incremental resource utilization for patients who were not admitted specifically for hyponatremia, but whose hospitalization was prolonged due to hyponatremia. In our study, the mean age of the patients was 73.87 ± 6.54 years, which was comparable to a hospital based study by Rao et al. where the mean age was 72 years.[12] Decreased glomerular filtration rate, impaired ability of the kidney to conserve sodium, increased release of antidiuretic hormone (ADH) to a given osmotic stimulus, various drugs taken by them, and concomitant illnesses predisposes an elderly patient to hyponatremia. Hawkins et al. noted that increasing age, after adjusting for sex, was independently associated with both hyponatremia at presentation and hospital acquired hyponatremia.[12] In our study, the prevalence of hyponatremia was almost equal in male and female patients comparable to study by Rao *et al.*[11] Symptoms of hyponatremia varied among study patient with 18% of the patients being asymptomatic. Most (82%) Symptoms of hyponatremia varied among study patients with 18% of the patients being asymptomatic. Most asymptomatic patients had mild hyponatremia. Lethargy (50%) was the most common symptom. Most patients with serum sodium <125 mEq/L had neurological symptoms, such as drowsiness; however, patients with serum sodium ≤110 mEq/L showed severe neurological symptoms, such as seizures and unconsciousness. These findings are consistent with the available literature and previous studies.[12,13] The major pre-existing illnesses present among the patients, in our study, were hypertension (68%), diabetes mellitus (46%), and chronic kidney disease (CKD) (19%). In our study, hypertension was a second major risk factor for hyponatremia due to diuretic use. The studies on hyponatremia have not demonstrated a direct correlation between hyponatremia and hypertension, although the correlation of hyponatremia with the age and diuretic use is evident.[4,9] In our study, 26% of the patients had pre-existing renal disorder, heart failure, or CLD. Twenty one out of these 26 patients were admitted to the hospital due to noncompliance with treatment. In majority of these patients, loop diuretics and fluid restriction were sufficient to correct hyponatremia. In a

study by Saeed et al.[13] 37% of the patients had hyponatremia due to similar disorders (renal disorders 21%, liver disorders 7%, and CHF 9%). In our study, 6% of patients had pre-existing hypothyroidism, which is higher compared to reported 3.7% by Clayton et al.[4] SIADH was the most common cause of hyponatremia, in our study, representing 39% of cases, which is in line with reported 34.8% by Vurgese et al.[14] Drugs was the second most common cause for hyponatremia, in our study, accounted for 26% of the study patients, out of which 18 patients were on diuretics (9 patients on thiazide diuretics, 5 patients on loop diuretics, and 4 patients on a combination of loop diuretic and spironolactone). It is reported that 14% of patients prescribed a thiazide diuretic in primary care, have sodium level below the normal range and this incidence is up to 33% in elderly patients.[14] Thiazide is reported to be known cause of profound hyponatremia.[15] In our study, 26 out of 49 patients of profound hyponatremia were on diuretics. Saeed et al. reported 33.3%. While Huda et al. reported 63.6% hyponatremia cases associated with diuretic usage.[16] Though JNC 8 recommends diuretics as the first line drug for treatment of hypertension, a word of caution should be maintained while prescribing diuretics in the elderly and when required doses should be modified according to the body weight and should begin with the lowest dose. In our study, 2 patients had selective serotonin reuptake inhibitors (SSRIs) induced hyponatremia, which is much lower than 11.1% reported by Clayton et al.[4] This is possibly because SSRIs are not usually prescribed for the patients in general medical wards. In our study, 14% of the patient had multiple etiological factors for hyponatremia, which is in line with reported 10.9% by Nzerue et al.[17] These studies emphasize the importance of establishing the various factors responsible for hyponatremia in the patient so that relevant corrective measures can be considered during the treatment. Vomiting is one of the strongest known stimuli for ADH release.[18] In our study, vomiting was associated with infective/inflammatory illnesses. Poor nutritional intake secondary to various other co morbidities was a major risk factor in this study. Total 31% of patients had a history of poor intake, which was associated with various causes, such as anorexia (14 patients; uremia-5, malignancy-2, CLD-2, and tuberculosis-2) and acute illnesses (6 patients). The conventionally fed fluids in India, orally or through Ryle's tube, are sugar based, such as fresh fruit juices, milk, tea and coffee, glucose water, and tender coconut water. Soups and canned juices with salt are not a part of our traditional meal, which may lead to the development of in hospital hyponatremia. This is in line with the causes of hospital acquired hyponatremia as reported earlier.[19] In our study, 54% of patients were euvolemic, 26% of patients were hypovolemic and 20% of patients were hypervolemic, which is line with reported by Bhattacharjee et al.[19] In our study, 68% patients received NS, 44% patients were given oral sodium chloride supplementation, 41% patients were given hypertonic (3%) saline, 34% patients were on fluid restriction, and 26% patients received loop diuretics. Study by Nzerue et al, 82% patients received NS, 9% patients were given fluid restriction, 3% patients were given 3% Saline while 6% patients were treated with other treatment modalities, such as withdrawal of drug causing hyponatremia.[17,19] The overall mortality among patients of hyponatremia, in our study, was 17% which is comparable to the mortality between 20% and 27%, as in the literature in patients with hyponatremia.[16,17] When the mortality outcomes were compared with respect to age, sex, and hydration status, there was no statistically significant difference.

## Conclusions

Clinicians need to be aware of the common occurrence of hyponatremia in the elderly, especially acutely sick elderly. A systematic approach with the application of simple standardized diagnostic algorithms and establish mechanism of hyponatremia can significantly improve the assessment and management of hyponatremia as the outcome in profound hyponatremia is governed by etiology, and not by the serum sodium level. Second most common cause of hyponatremia in elderly is diuretic (Thiazide) or its combination with anti hypertensives. Studying the aetiology, risk factors and management of hyponatremia in hospitalized patients will help in reducing its incidence and minimize the complications associated with hyponatremia. Caution should be exercised in prescribing diuretics/diuretic combination in elderly hypertensive or diabetic and also while advising strict salt restriction.

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