Study of Clinical Profile of Hyponatremia in Elderly Hospitalised Subjects from Bagalkot, Karnataka

Gopal Bajaj[1], Shashidhar Khanapure[2], Udit Aggarwal[3], Saurabh Suhas Patil[4]

[1, 2, 3, 4] Department of General Medicine, S. Nijalingappa Medical College and H.S.K Hospital, Bagalkot, Karnataka, India.

ABSTRACT

BACKGROUND

Hyponatremia is one of the most commonly encountered electrolyte disturbances in the hospital setting especially in elderly patients. The plasma sodium level of less than 135 mEq/l is called as hyponatremia, but it may vary to a small extent in different laboratories. It is associated with increased morbidity and mortality. The purpose of this study was to assess clinical profile of hyponatremia in elderly hospitalized patients, the aetiologic factors involved, as well as treatment and outcome of the patients using a prospective case series. The normal serum sodium concentration is 135 - 145 mEq/L.

METHODS

This hospital-based case series study was conducted at HSK Hospital, Bagalkot from 01 January 2018 to 30 June 2019. All admitted patients whose serum sodium was less than 135 mEq/L at any point during the admission were included in the study.

RESULTS

241 patients were included in study, out of which 200 (83 %) were symptomatic. 128 (53.1 %) and 113 (46.9 %) were males and females respectively. Recovery was seen in 224 (92.9 %) patients whereas mortality was seen in 17 (7.1 %) patients. In this study, mortality was seen in 8 (3.31 %) patients with severe hyponatremia and 9 (3.73 %) patients with moderate hyponatremia, no mortality was seen in mild hyponatremia group.

CONCLUSIONS

Hyponatremia is a common electrolyte abnormality found in elderly hospitalized critically ill patients. Altered consciousness and thought disturbance were the most common neurological symptoms. Hyponatremia was seen in significantly a greater number of patients on diuretic therapy. Severe hyponatremia was associated with considerably high morbidity and mortality compared to patients having mild to moderate hyponatremia.

KEYWORDS

Hyponatremia, Elderly, Altered Sensorium

Corresponding Author:
Dr. Shashidhar Khanapure,
Associate Professor,
Department of General Medicine,
S. Nijalingappa Medical College and H.S.K Hospital, Bagalkot,
Karnataka, India.
E-mail: drbajaj.05@gmail.com

DOI: 10.18410/jebmh/2021/615

How to Cite This Article:
Bajaj G, Khanapure S, Aggarwal U, et al. Study of clinical profile of hyponatremia in elderly hospitalised subjects from Bagalkot, Karnataka. J Evid Based Med Healthc 2021;8(38):3390-3394. DOI: 10.18410/jebmh/2021/615

Submission 26-03-2021,
Peer Review 02-04-2021,
Acceptance 03-09-2021,
Published 20-09-2021.

BACKGROUND

The serum sodium level of less than 135 mEq/l is called as hyponatremia. It is one of the most commonly encountered electrolyte disturbances in the hospital setting especially in elderly patients.[1] Analysis of serum sodium values in healthy individuals has shown an age-related decrease of approximately 1 mEq/L per decade from a mean value of 141 ± 4 mEq/L in young subjects. Serum sodium concentration does not depend on total body sodium but on the ratio of total body solutes (e.g., total body sodium and total body potassium) to total body water. A deranged sodium level does not necessarily mean abnormal sodium balance, but may be secondary to abnormal water balance as well.

The normal serum sodium concentration is 135 - 145 mEq/L. Hyponatremia in elderly is classified according to serum sodium concentration, as follows:

Mild: 130 - 134 mEq/L, Moderate: 125 - 129 mEq/L, Severe: < 125 mEq/L

It bears significant effect on the morbidity and mortality of the patient and thus is having a direct impact on the healthcare expenditure by prolonging the duration of hospital stay and increasing the risk of disability and death in the patients.[2,3,4] Identifying the potential risk factors and clinical features of hyponatremia will help in early recognition of a potentially life-threatening condition and reducing its incidence in hospitalized patients and thereby reducing the overall morbidity, mortality and hence cost of health care.

Objectives

- To study clinical profile of hyponatremia in elderly hospitalized patients.
- To assess the morbidity and mortality due to hyponatremia.

METHODS

This hospital based, case series study was conducted at HSK Hospital, Bagalkot from 01 January 2018 to 30 June 2019. All admitted patients whose serum sodium less than 135 mEq/L at any point during the admission were included in the study.

Inclusion Criteria

Adult patients (age > 60 years) with hyponatremia

Exclusion Criteria

Known case of hyponatremia on sodium replacement therapy (Vaptans).

Methodology

Clinical Assessment

a) Detailed history - This includes symptoms of hyponatremia and history of co-morbidities. Symptoms of hyponatremia include the presence of altered sensorium, postural dizziness, lethargy and seizures. Altered sensorium includes acute onset of confusion, memory disturbances, stupor, delirium and/or coma. History of drug intake that can increase the release of antidiuretic hormone (ADH) or potentiate its renal action were recorded. Other history of illnesses causing hyponatremia such as congestive heart failure (CHF), chronic liver disease, hypothyroidism, chronic kidney disease (CKD), and other conditions which are associated with syndrome of inappropriate secretion of antidiuretic hormone (SIADH) such as central nervous system (CNS) disease, pulmonary diseases like small cell carcinoma were taken and recorded. History of vomiting, diarrhoea, diuretic use, excessive sweating should be taken in all patients to rule out fluid loss.

b) Physical examination – Detailed clinical examination of every patient should be done. Clinical examination should include hydration status of the patient. The signs of hypovolemia are tachycardia, orthostatic hypotension, decreased skin turgor, dry mucous membranes and decreased peripheral perfusion with delayed capillary refill more than three seconds. Anasarca, ascites, symmetrical and pitting pedal oedema and raised jugular venous pressure (JVP) are the signs of hypervolemia. Accordingly, patients were divided into hypervolemic, hypovolemic and euvolemic states.

Detailed CNS examination was done to look for the signs of raised intracranial pressure, mental status and other focal neurological deficit was done at the time of diagnosis of hyponatremia. After correction of hyponatremia, CNS examination was repeated and the persistence of symptoms such as dizziness, lethargy, altered sensorium and seizures were attributed to hyponatremia unless there was a coexisting medical condition or medication effect to account for these symptoms.

Investigations

a. Complete blood count – Haemoglobin (Hb), total leukocyte count (TLC), differential leukocyte count (DLC) and platelet count.
b. Urine routine examination (RE) and microscopic examination (ME).
c. Serum sodium – Serum sodium was done 8th hourly in patients with severe hyponatremia on 3 % saline infusion. In symptomatic patients who are not on hypertonic saline, serum sodium was done daily till the correction of hyponatremia.
d. Serum blood urea nitrogen (BUN) and glucose levels – for calculation of serum osmolality
e. Serum osmolality = 2([Na^+] + [K^+]) + RBS/18 + BUN/2.8 mOsm/L (RBS in mg/dL, BUN in mg/dL)
f. Urine spot sodium - In patients with hypo-osmolar hyponatremia (serum osmolality < 270 mOsm/L)

Management and Outcome Assessment

Hyponatremia is classified into following categories based on serum sodium levels:

1. Mild hyponatremia - 130 - 134 mEq/L
2. Moderate hyponatremia - 125 - 129 mEq/L
3. Severe hyponatremia - < 125 mEq/L

Treatment Strategy

Treatment strategy for hyponatremia was based on the aetiology and severity of hyponatremia and presence of neurological symptoms of hyponatremia.

1. Fluid restriction – Total fluid intake in 24 hours equal to the volume of urine output of previous 24 hours. Fluid restriction was advised in patients with hypervolemic hyponatremia as caused by CHF, renal disorders and chronic liver disease and patients with SIADH.
2. Oral sodium supplementation- This is advised in patients with asymptomatic euvolemic and hypovolemic hyponatremia with history of poor intake in past. Patients receiving hypertonic saline after symptomatic improvement should receive oral sodium chloride supplementation. Supplemental sodium chloride was added to daily dietary intake in the dose of 15 - 20 g/day in 3 - 4 divided doses.
3. Normal saline (0.9 % NaCl) – In hypovolemic patients, normal saline was advised. In cases of febrile illnesses, vomiting and diarrhoea, it is advised as part fluid therapy.
4. Loop diuretic - Loop diuretic was given for excretion of free water in cases of SIADH and hypervolemic hyponatremia.
5. Hypertonic (3 %) saline - In severe hyponatremia patients with neurological symptoms of hyponatremia and hypovolemic or euvolemic status with aim to increase serum sodium level by 8 mEq/L in 24 hours this hypertonic saline was advised.

Statistical Analysis

Data were recorded on a predesigned proforma and managed in a Microsoft Excel. All the entries were cross-verified for any possible keyboard error. Data so collected was systematically analyzed in Statistical Package for Social Sciences (SPSS V21) and is presented as simple percentages and frequency distribution. Descriptive statistics i.e. mean and standard deviation has been calculated for the continuous variables. Categorical variables were expressed as percentages. Chi-square test was applied to find significance. P < 0.05 was considered as statistically significant.

RESULTS

In the study group of 241 participants, 144 (59.8 %) participants were in the age group of 60 - 70 years, 86 (35.7 %) in the age group of 70 - 80 years and 11 (4.5 %) in more than 80 years age group. Out of which, 128 (53.1 %) and 113 (46.9 %) were males and females respectively.

Study showed 52 (36.1 %), 67 (46.5 %) and 25 (17.4 %) participants of 60 - 70 years age group had mild, moderate, and severe hyponatremia respectively, whereas it was 31 (36.0 %), 35 (40.7 %) and 20 (23.3 %) in the age group of 70 - 80 years and 5 (45.5 %), 3 (27.3 %) and 3 (27.3 %) in more than 80 years age group had mild, moderate and severe hyponatremia respectively.

In our study of 241 patients, 41 (17 %) were asymptomatic and 200 (83 %) were symptomatic. Out of the 241 patients included in the study, 101 (41.9 %) had altered consciousness at presentation. 116 (48.1 %) patients had fever. Thought disturbance, seizures and focal neurological deficit (FND) was seen in 76 (31.5 %), 22 (9.1 %) and 18 (7 %) patients respectively.

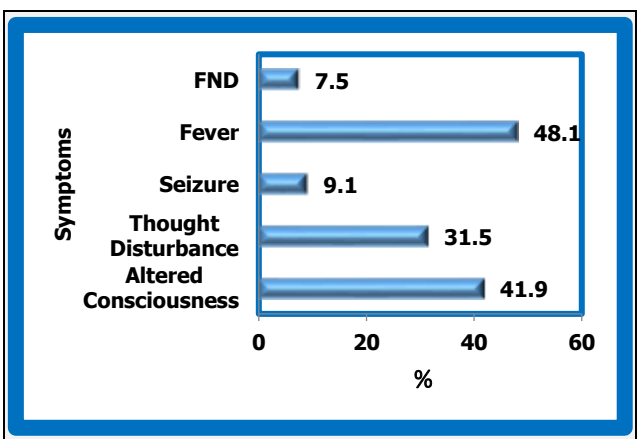

Figure 1. Clinical Profile in Patients with Hyponatremia

Variable	Category	Serum Na: Severe Count	Severe %	Moderate Count	Moderate %	Mild Count	Mild %	P-Value
DM	Yes	13	16.9 %	38	49.4 %	26	33.8 %	0.44
	No	35	21.3 %	67	40.9 %	62	37.8 %	
HTN	Yes	21	25.3 %	35	42.2 %	27	32.5 %	0.29
	No	27	17.1 %	70	44.3 %	61	38.6 %	
CKD	Yes	4	28.6 %	7	50.0 %	3	21.4 %	0.44
	No	44	19.4 %	98	43.2 %	85	37.4 %	
COPD	Yes	10	25.0 %	13	32.5 %	17	42.5 %	0.29
	No	38	18.9 %	92	45.8 %	71	35.3 %	
Cirrhosis	Yes	1	5.9 %	12	70.6 %	4	23.5 %	0.06
	No	47	21.0 %	93	41.5 %	84	37.5 %	

Table 1. Statistical Analysis of Comorbidities in Hyponatraemic Patients

In present study out of the 77 (31.95 %) patients who had diabetes mellitus (DM), 13 (5.3 %), 38 (15.76 %) and 26 (10.78 %) had severe, moderate and mild hyponatremia respectively. 83 (34.43 %) patients had hypertension of which 21 (25.3 %), 35 (42.2 %) and 27 (32.5 %) had severe, moderate and mild hyponatremia respectively. The results were statistically not significant (P = 0.29). 4 (1.65 %) patients of CKD had severe hyponatremia, 7 (2.90 %) had moderate and 3 (1.24 %) had mild hyponatremia (P =

0.44). Chronic obstructive pulmonary disease was seen in 10 (4.14 %) patients of severe, 13 (5.39 %) patients of moderate and 17 (7.05 %) patients of mild hyponatremia (P = 0.29). Cirrhosis was seen in 1 (0.41 %) patient with severe, 12 (4.97 %) patients of moderate and 4 (1.65 %) patients of mild hyponatremia. (P = 0.06).

Sixteen patients (6.63 %) with mild hyponatremia were on diuretics. 25 (10.37 %) patients with moderate and 2 (0.82 %) patients with severe hyponatremia were on diuretics. The results were found to be statistically significant (p=0.013).

Out of 241 patients, 48 (19.91 %) had severe hyponatremia, 105 (43.56 %) had moderate and 88 (36.51 %) had mild hyponatremia.

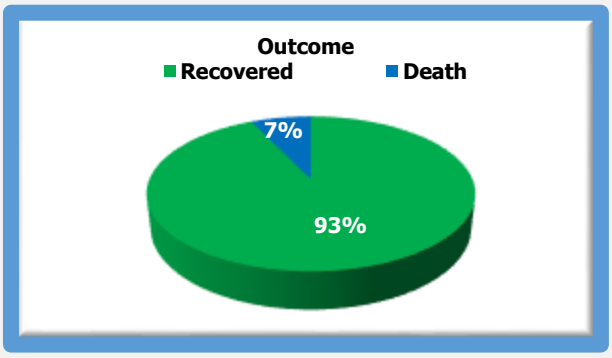

Figure 2. Recovery and Mortality in Patients

Recovery was seen in 224 (92.9 %) patients whereas mortality was seen in 17 (7.1 %) patients. In our study, mortality was seen in 8 (3.31 %) patients with severe and 9 (3.73 %) patients with moderate hypernatremia, no mortality was seen in mild hyponatremia group.

Hospital stay was less than 5 days in 31 (12.86 %), whereas 184 (76.34 %) and 26 (10.78 %) patients stayed for 6 - 10 days and more than 10 days respectively.

Six patients with severe hyponatremia stayed in hospital for less than 5 days, 37 stayed for 6 - 10 days and 5 patients stayed for more than 10 days. In patient with moderate hyponatremia, 10 stayed in hospital for less than 5 days, 82 for 6 - 10 days and 13 for more than 10 days. In patients with mild hyponatremia, 15 stayed for < 5 days, 65 for 6 - 10 days and 8 stayed in hospital for more than 10 days. In the study, mean duration of hospital stay was 7.57 ± 4.89 days.

DISCUSSION

This study was done as there is increased prevalence of hyponatremia in the elderly patients who are at high risk of developing electrolyte disturbance as these people have age related physiological changes in the function of kidney and other co-morbid conditions. 5-year retrospective study of 2,188 patients, Bennani et al.[5] found the incidence of hyponatremia to be 14 % at the time of admission to the intensive care unit while DeVita et al.[6] found the incidence of hyponatremia in intensive care unit (ICU) to be 29.6 %.

In our study of 241 elderly hospitalized patients (> 60 years), 128 (53.1 %) were males and 113 (46.9 %) were females. Sex distribution had no significant correlation with the severity of hyponatremia, in our study 25 (19.5 %) and 23 (20.4 %) of males and females had severe hyponatremia respectively. In the study done by Rao et al.[7] 55 were females and 45 were male, whereas in a study by Mahavir et al.[8] 64.3 % were males and 53.7 % were females. In study by Rubio et al.[9] 52.7 % were females and 47.3 % were males.

Incidence of hyponatremia has been shown to have direct correlation with age.[10] In our study, the mean population age was 70.99 ± 5.58 years, in another study by Amit et al.[11] the mean age was 73.87 ± 6.54 years. 60 % of the patients were 60 to 70 years, another 35 % were in the group 70 - 80 years and only 5 % were more than 80 years which is in contrast to Hawkins et al.[10] where it was noted that increasing age, after adjusting for sex, was independently associated with both hyponatremia at presentation and hospital-acquired hyponatremia which can be due to a small sample size of the study.

Majority of the cases (83 %) were symptomatic at time of presentation, out of which 41.9 % (101) patients had altered conscious level, 31.5 % (76) of patients had thought disturbance and 9.1 % (22) had seizures (GTCS) and 17 % were asymptomatic. In a study by Amit et al.[11] majority of patients (81 %) were symptomatic with lethargy (50 %), drowsiness (40 %) and abnormal behaviour (39 %) being the common symptoms and about 19 % of patients were asymptomatic with most of them having mild hyponatremia.

The patients may be asymptomatic or have minimal symptoms at presentation in gradual onset of hyponatremia as cerebral neurons have time to respond by reducing the intracellular osmolality.

In the present study, 48 (19.9 %) had severe hyponatremia, 105 (43.6 %) had moderate hyponatremia and 88 (36.5 %) had mild hyponatremia, with mean serum sodium level of 125.74 ± 9.99 mEq/l, mean sodium level was found to be 118.2 mEq/l and 113.89 mEq/l in the study conducted by Rai et al.[12] and Rao et al.[7] respectively.

The major pre-existing illnesses present among the patients in our study were hypertension (34.4 %), diabetes mellitus (32.0 %), chronic kidney disease (5.8 %) and chronic liver diseases (7.1 %). In our study, hypertension and diabetes were the major risk factor for hyponatremia, in elderly patients. In a study by Amit et al.[11] hypertension was seen in 68 % and diabetes mellitus is 46 % of the cases. The studies have not shown any direct correlation between hyponatremia and hypertension, although correlation of hyponatremia with diuretic use[13] and age[10] is evident.

In this study, 43 (17.8 %) patients were on diuretics therapy who had hyponatremia, nearly a third of elderly patients taking a thiazide at hospital admission are hyponatraemic and 14 % of patients who were prescribed with a thiazide group of diuretic in primary care center have sodium less the normal range.[13,14] Severe hyponatremia occurs almost exclusively with thiazide diuretics rather than loop diuretics.[15] Hyponatraemic hypertensive syndrome is a well-known entity wherein the most common association is in patients with essential hypertension receiving diuretics, which interfere with the metabolism of a variety of electrolytes and cause electrolyte imbalance. Thiazide

diuretics influence the sodium chloride cotransporter channel and also result in the non-osmotic release of vasopressin leading to water retention.[16]

The time required for normalizing sodium were noted in the present study. For 31 cases, less than 5 days were needed, 184 cases needed 6 - 10 days whereas 26 cases had prolonged stay requiring more than 10 days. In our study, average duration of hospital stay was 7.57 ± 4.89 days and in hospital, mortality was seen in 7.1 % (N = 17) of subjects, in 15 subjects it was directly related to co-morbid conditions whereas only in 2 subjects it was directly linked to hyponatremia. In study by Mahavir et al.[8] time taken for recovery was 3.7 ± 2.4 days and no mortality was observed. In a study by Rubios et al.[9] in-hospital mortality due to hyponatremia was 12.9 %. In study by Chua et al.[17] mean length of hospital stay was 13 days. Mortality rate was 8 % out of 103 cases. There is significant association between serum sodium levels and symptoms and with outcome of the patients.

CONCLUSIONS

Hyponatremia is a common electrolyte abnormality found in elderly hospitalized patients. It is more commonly seen in critically ill patients. One fifth of the patients were asymptomatic at presentation, altered consciousness and thought disturbance were the most common neurological symptoms. Hypertension and diabetes mellitus were the two most common pre-existing comorbid conditions. Hyponatremia was seen in significantly a greater number of patients on diuretic therapy. Severe hyponatremia was associated with considerably high morbidity and mortality in patients with underlying medical diseases, hence patient outcome is directly related to symptoms and serum sodium level.

Limitations of the Study

1. The study group was smaller.
2. Only short-term mortality and morbidity was assessed, and long term was not assessed.
3. In comparison with other studies, male to female ratio was not similar.
4. The causes for hyponatremia in elderly patients is predominantly multifactorial, which was not studied.
5. As the study was conducted in a tertiary care centre, patients may not represent the general population.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
Financial or other competing interests: None.
Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

REFERENCES

[1] Ellison DH, Berl T. The syndrome of inappropriate antidiuresis. N Engl J Med 2007;356(20):2064-72.
[2] Nzerue CM, Baffoe-Bonnie H, You W, et al. Predictors of outcome in hospitalized patients with severe hyponatremia. J Natl Med Assoc 2003;95(5):335-343.
[3] Drummond M. Cost-of-illness studies. Pharmacoeconomics 1992;2(1):1-4.
[4] Drummond MF, Sculpher MJ, Claxton K, et al. Methods for the economic evaluation of health care programmes. Oxford University Press 2015.
[5] Bennani SL, Abouqal R, Zeggwagh AA, et al. Incidence, causes and prognostic factors of hyponatremia in intensive care. Rev Med interne 2003;24(4):224-229.
[6] DeVita MV, Gardenswartz MH, Konecky A, et al. Incidence and etiology of hyponatremia in an intensive care unit. Clin Nephrol 1990;34(4):163-166.
[7] Rao MY, Sudhir U, Kumar TA, et al. Hospital-based descriptive study of symptomatic hyponatremia in elderly patients. J Assoc Physicians India 2010;58:667-669.
[8] Agarwal SM, Agrawal A. A comparative study of the clinico-aetiological profile of hyponatremia at presentation with that developing in the hospital. Indian J Med Res 2011;134(1):118- 122.
[9] Rubio-Rivas M, Formiga F, Cuerpo S, et al. Hyponatremia in elderly patients admitted in an acute geriatric care unit prevalence and prognosis. Med Clin (Barc) 2012;139(3):93-97.
[10] Hawkins RC. Age and gender as risk factors for hyponatremia and hypernatremia. Clin Chim Acta 2003;337(1-2):169-172.
[11] Jain AK, Nandy P. Clinico-etiological profile of hyponatremia among elderly age group patients in a tertiary care hospital in Sikkim. J Fam Med Prim Care 2019;8(3):988-994.
[12] Rai NK, Meena LP, Chakravarty J, et al. A study to assess the etiology and clinical profile of patients with hyponatremia at a tertiary care hospital. Natl J Physiol Pharm Pharmacol 2018;8(4):497-500.
[13] Clayton JA, Rodgers S, Blakey J, et al. Thiazide diuretic prescription and electrolyte abnormalities in primary care. Br J Clin Pharmacol 2006;61(1):87-95.
[14] Byatt CM, Millard PH, Levin GE. Diuretics and electrolyte disturbances in 1000 consecutive geriatric admissions. J R Soc Med 1990;83(11):704–708.
[15] Robertson GL, Berl T. Pathophysiology of water metabolism: water retaining disorders. In: Brenner BM, ed. The kidney. 5th edn. Philadelphia, PA: W.B. Saunders 1996: p. 899.
[16] Freda BJ, Davidson MB, Hall PM. Evaluation of hyponatremia: a little physiology goes a long way. Cleve Clin J Med 2004;71(8):639–650.
[17] Chua M, Hoyle GE, Soiza RL. Prognostic implications of hyponatremia in elderly hospitalized patients. Arch Gerontol Geriatr 2007;45(3):253-258.