



Study of clinico-etiological profile and outcome of hyponatremia in patients admitted in critical care

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Aim: To study clinico-etiological profile and outcome of hyponatremia in patients admitted in critical care.

Material and Methods: It was an observational study and included all patients admitted in ICU/HDU with hyponatremia from January 2020 to June 2021 in Mahatma Gandhi Medical College and Hospital, Jaipur. The inclusion criteria comprised of all patients admitted in critical care (ICU/HDU) with a serum sodium concentration <135 meq/l. The selected socio-demographic profile, various causes and symptoms, clinical presentation and recovery pattern and outcome of hyponatremia was analyzed statistically and types of hyponatremia was determined with assessment of Serum osmolality, Urinary osmolality and urinary Na^+ levels.

Results: Euvolemia, hypervolemia and hypovolemia was reported in 58%, 24% and 18% of the subjects respectively. Most common etiology was SIADH (48%) followed by renal disorders (16%). Most common cause of SIADH was cerebrovascular accident followed by pneumonia. Most of the patients had SIADH as the etiology of hyponatremia and all of these patients had euvolemic hypoosmolar hyponatraemia. Mortality was reported more in Hypervolemic (25%) followed by Hypovolemic (22.22%) and Euvolemic subjects (13.79%). Management of patients viz. 3% NaCl, diuretics, 0.9% NaCl, oral salt and water restriction was done in 39%, 24%, 64%, 47% and 26% of the subjects respectively.

Conclusion: Symptomatic hyponatremia is common among the hospitalized patients. Neurological symptoms are common in hyponatremia patients. SIADH and euvolemic hyponatremia formed the largest subgroup in the study. The mortality was mainly due to underlying primary diseases.

Keywords: Elder, Euvolemia, Hypervolemia, Hypovolemia, SIADH, Hyponatremia

Introduction: Electrolyte Disorders of sodium and water metabolism are common in clinical practice. Hyponatremia is very common in hospitalized patients. Incidence varies from 1% to 40%. Despite the awareness on hyponatremia since mid-20th century, this common disorder is still incompletely understood in many basic areas, due to its association with a wide range of underlying causes, multiple etiologies and

differing pathophysiological mechanisms.(1) Hyponatremia is defined as serum sodium concentration of less than 135mmol/L. It can be sub divided into mild hyponatremia (130-134mmol/L), moderate hyponatremia (120-129mmol/L) and severe hyponatremia (<120 mmol/L).(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. The management of hyponatremia in elderly patients needs more attention due to age affecting the kidneys and other systems and also presence of multiple comorbid risk factors that can accelerate the mortality rate. Clinical management of the patients with hyponatremia is based on correcting the serum sodium level and treating the underlying cause. Diagnosis of the electrolyte abnormality depends crucially on the correct assessment of volume status which is some time difficult to determine, especially in the elderly patients.(3)

Syndrome of inappropriate antidiuresis (SIADH) is widely assumed the commonest cause of euvolemic hyponatremia. Since the management of euvolemic hyponatremia (SIADH) is exactly opposite to management of hypovolemic hyponatremia, it is important to distinguish between these types and incorrect diagnosis of dehydrated elderly patients as SIADH may lead to mismanagement and add to the mortality. Data regarding the incidence of hyponatremia in the elderly in India is limited.(4,5)

Determining the cause of hyponatremia is challenging in clinical practice. The clinical presentation of severe hyponatremia ranges from mild, nonspecific symptoms, such as nausea, headache, and lethargy, to severe neurological symptoms such as seizure and coma. The data available on clinical presentation and etiology are scarce in ICU settings, especially in those patients who develop moderate-to-severe hyponatremia, Hence this study was undertaken to know the incidence, presentation, common etiologies, comorbid and clinical outcomes of hyponatremia in patients admitted in Medical ICU and critical care, not only to aid in the treatment of patients but also to prevent further morbidity and mortality.

Material and Methods: It was an observational study and included all patients admitted in ICU/HDU with hyponatremia from January 2020 to June 2021 in Mahatma Gandhi Medical College and Hospital, Jaipur. The inclusion criteria comprised of all patients admitted in critical care (ICU/HDU) with a serum sodium concentration <135 meq/l. The selected socio-demographic, various causes and symptoms, clinical presentation and recovery pattern and outcome of hyponatremia was analyzed statistically and types of hyponatremia may be associated with assessment of Serum osmolality, Urinary osmolality and urinary Na⁺ levels, and recovery pattern and outcome among patients with hyponatremia was carried out.

Inclusion criteria:

- All patients admitted in medical ICU/ HDU with serum Na⁺ <135 meq /l
- Patients who developed hyponatremia during hospitalization will also be included in the study
- Patients of both genders will be included in the study,
- Patients of age 18 year and above will be studied.

Exclusion criteria:

- Patients age <18 years
- Hyponatremia only on 1 reading
- Patients not willing to give consent for study

Investigations

- Serum Na⁺ levels
- Urinary Na⁺ levels
- Urine osmolality
- Serum osmolality as per ABG

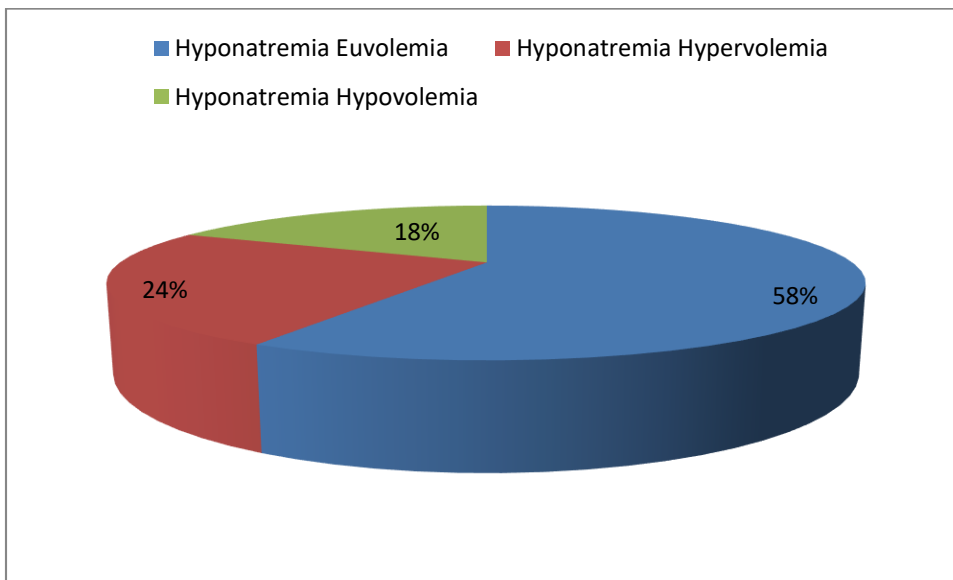
Statistical analysis: Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Difference between two groups was determined using chi square test and the level of significance was set at $p < 0.05$.

Results: Out of 100 subjects, males (64%) were comparatively more as compared to females (36%). Out of 100 subjects, maximum subjects were from the age group of 41-60 years (48%) followed by 60-80 years (27%) and >80 years (14%). Minimum subjects were from age group of 20-40 years (11%) as shown in table 1.

Table 1: Gender and age distribution among the study subjects

Gender	N	%
Male	64	64
Female	36	36
Age Group		
20-40	11	11
41-60	48	48
60-80	27	27
>80	14	14
Total	100	100

Euvoemia, hypervolemia and hypovolemia was reported in 58%, 24% and 18% of the subjects respectively (table 2).



Graph 1: Level of hyponatremia (Hydration status) among the study subjects

Most common etiology was SIADH (48%) followed by renal disorders (16%), CLD (12%), GI loss (8%) and CCF as well as sepsis (6%). Hyponatremia due to drugs and hypothyroidism was revealed in 2 (4%) subject each. Most common cause of SIADH was cerebrovascular accident followed by pneumonia (table 2).

Hypervolemia was revealed more in asymptomatic subjects while Euvolemia and Hypervolemia in symptomatic subjects. When hydration status was compared according to symptoms using chi square test, it was found to be statistically significant as $p < 0.05$ (table 3).

Table 3: Level of Hydration status among the study subjects according to symptoms

Hyponatremia	N	Symptomatic		Asymptomatic		p value
		N=68	%	N=32	%	
Euvolemia	58	48	82.76	10	17.24	0.006*
Hypervolemia	24	8	33.33	16	66.67	
Hypovolemia	18	12	66.67	6	33.33	

*: statistically significant

In the present study most of the patients had SIADH as the etiology of hyponatremia and all of these patients had euvolemic hypoosmolar hyponatraemia. Similarly most of the patients with cirrhosis (66.67%), cardiac, renal causes had hypervolemic hypoosmolar hyponatremia while most of the patients with GI loss had hypovolemic hypoosmolar/iso osmolar hyponatremia and this difference was statistically significant ($p < 0.001$) as shown in table 4.

Table 4: Cause among the study subjects according to Hydration status

Cause	N	Euvoemia		Hypervolemia		Hypovolemia		p value
		N=58	%	N=24	%	N=18	%	
CCF	6	0	0	6	100	0	0	<0.01*
CLD	12	2	16.67	8	66.67	2	16.67	
Drugs	2	1	50	0	0	1	50	
GI Loss	8	1	12.5	0	0	7	87.5	
Hypothyroidism	2	2	100	0	0	0	0	
AKI	16	4	25	10	62.5	2	12.5	
Sepsis	6	0	0	0	0	6	100	
SIADH	48	48	100	0	0	0	0	

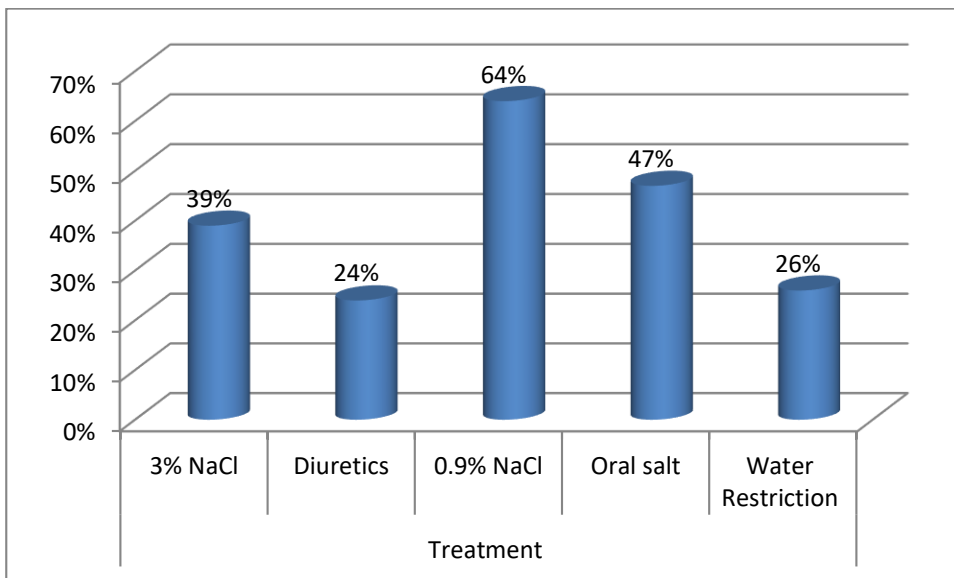
*: statistically significant

In our study, mortality was reported in 18% of the subjects. Mortality was reported more in Hypervolemic (25%) followed by Hypovolemic (22.22%) and Euvoemic subjects (13.79%). When mortality was compared according to Hydration status using chi square test, insignificant difference was found as $p>0.05$ (table 5).

Table 5: Outcome among the study subjects according to Hydration status

Outcome	N	Euvoemia		Hypervolemia		Hypovolemia		p value
		N=58	%	N=24	%	N=18	%	
Survivor	82	50	86.21	18	75	14	77.78	0.27
Non-survivor	18	8	13.79	6	25	4	22.22	

Management of patients viz. 3% NaCl, diuretics, 0.9% NaCl, oral salt and water restriction was done in 39%, 24%, 64%, 47% and 26% of the subjects respectively (graph 2).



Graph 2: Management

Discussion: Hyponatremia is thought to affect 15%–30% of patients in long-term care, according to studies (6). The elderly are more likely to develop the condition, owing to their reduced ability to maintain water and electrolyte homeostasis in response to dietary and environmental changes (7). Due to physiological changes impacting the renal and other systems as people age, the management of these situations must be modified. In India, there is a scarcity of information on the prevalence of hyponatremia. Hence the present hospital based descriptive study was conducted in the department of General Medicine among 100 patients admitted in ICU/HDU with hyponatremia from January 2020 to June 2021 in Mahatma Gandhi Medical College and Hospital, Jaipur.

In this study, males (64%) were comparatively more as compared to females (36%) in this study. Amit K. Jain et al (8) and Parijat P. Baji et al (9) in their study too revealed more males as compared to females.

Out of 100 subjects, maximum subjects were from the age group of 41-60 years (48%) followed by 60-80 years (27%) and >80 years (14%) in the present study. Similar trend was observed by Hochman (10) and Vurgese (11) in their study and they had shown that elderly patients were more prone to hyponatremia. According to Amit K. Jain et al (8), mean age among the study subjects was 73.87 ± 6.54 years. An aged patient is predisposed to hyponatremia due to a decreased glomerular filtration rate, diminished ability of the kidney to preserve salt, increased production of antidiuretic hormone (ADH) in response to a given osmotic stimulation, numerous medicines taken by them, and concomitant disorders.

Most common etiology was SIADH (48%) followed by renal disorders (16%), CLD (12%), GI loss (8%) and CCF as well as sepsis (6%). Hyponatremia due to drugs and hypothyroidism was revealed in 2 (4%) subject each. Most common cause of SIADH was cerebrovascular accident followed by pneumonia. In our study, 28% 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 (12), 37% of the

patients had hyponatremia due to similar disorders (renal disorders 21%, liver disorders 7%, and CHF 9%). Similar findings were revealed by Amit K. Jain et al (8) in their study. Vurgese et al (11) in their study too showed that SIADH was the most common cause of hyponatremia.

Mean Sodium Level (mEq/L) among the study subjects was 116.71 ± 6.08 . Euvolemia, hypervolemia and hypovolemia was reported in 58%, 24% and 18% of the subjects respectively. Hypervolemia was revealed more in asymptomatic subjects while Euvolemia and Hypervolemia in symptomatic subjects. Bhattacharjee et al (13) in their study revealed similar findings too. Patients with euvolemia were observed to have more severe symptoms of hyponatremia compared to the other groups. Parijat P. Baji et al (9) in their study similarly reported that Euvolemic hyponatremia (43%) is the most common type of hyponatremia followed by hypervolemic (38%) and hypovolemic hyponatremia (19%). Thus the present study emphasizes the importance of establishing the various factors responsible for hyponatremia in the patient so that relevant corrective measures can be considered during the treatment.

In our study, mortality was reported in 18% of the subjects. Mortality was reported more in Hypervolemic (25%) followed by Hypovolemic (22.22%) and Euvolemic subjects (13.79%). When mortality was compared according to Hydration status using chi square test, insignificant difference was found as $p > 0.05$. Scott MG et al (14) revealed mortality in 9% of the subjects, which is approximately similar to our study. According to Parijat P. Baji et al (9), 21% of the subjects died. There is no statistical difference between the serum sodium of those who survived and those who died which is similar to our study. Huda MS (15) and Nzerue CM et al (16) in their study reported mortality between 20% and 27% which is higher than the present study. Mortality was not directly related to hyponatremia but to the severity of the underlying medical condition in the patients. However, the extent of contribution to death is debatable as even those patients who succumbed to their illness had received the correction of hyponatremia as per the standardized regimen of treatment followed in our study.

The limitations of the present study was that it was a single arm, monocentric study with limited sample size, it is difficult to conclude precise clinico-etiological profile and its association with different characteristics and hence, multicenter, 2 arms with the control group, study with a large population is suggested for further evaluation.

Conclusion: Symptomatic hyponatremia is common among the hospitalized patients. Neurological symptoms are common in hyponatremia patients. SIADH and euvolemic hyponatremia formed the largest subgroup in the study. The mortality was mainly due to underlying primary diseases. Hence clinicians need to be aware of the common occurrence of hyponatremia, especially in 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 severe hyponatremia is governed by etiology, and not by the serum sodium level.

References

1. Reddy P, Mooradian AD. Diagnosis and management of hyponatremia in hospitalized patients. *Int J Clin Pract.* 2009;63:494-508
2. Heinrich S, Wagner A, Gross P. Hyponatremia. *Med Klin Intensiv Med* 2013;108:53-8.
3. Soiza RL, Hoyle GE, Chua MP. Electrolyte and salt disturbances in older people: Causes, management and implications. *Rev Clin Gerontol* 2008; 18:143-58.
4. Renneboog B, Musch W, Vandemergel X, Manto MU, Decaux G. Mild chronic hyponatremia is associated with falls, unsteadiness, and attention deficits. *Am J Med* 2006;119:e1-8
5. Soiza RL, Hoyle GE. Syndrome of appropriate antidiuretic hormone: Difficulties with diagnosing syndrome of inappropriate antidiuretic hormone in older people. *Intern Med J* 2011;41:295.
6. Chandregowda, Mahesh K, Unnikrishnan A. Study of clinical profile of hyponatremia in elderly patients admitted to medical wards at Mandya institute of medical sciences, Mandya. *Int Surg J* 2021;8:390-4.
7. Adroque H, Madias N. Hyponatremia. *N Engl J Med* 2000;342:1581-9.
8. Jain AK, Nandy P. Clinico-etiological profile of hyponatremia among elderly age group patients in a tertiary care hospital in Sikkim. *J Family Med Prim Care.* 2019;8(3):988-994.
9. Baji PP, Borkar SS. Clinico-etiological profile and outcome of hyponatremia in hospitalised adult patients. *IJSR* 2015; 1 (7).
10. Hochman I, Cabili S, Peer G. Hyponatremia in internal medicine ward patients: causes, treatment and prognosis. *Isr J Med Sci.*1989;25(2):73-6.
11. Vurgese TA, Radhakrishnan SB, Mapkar OA. Frequency and etiology of hyponatremia in adult hospitalized patients in medical wards of a general hospital in Kuwait. *Kuwait Medical Journal.* 2006;38(3):211-3.
12. Saeed BO, Beaumont D, Handley GH, Weaver JU. Severe hyponatraemia: Investigation and management in a district general hospital. *J Clin Pathol* 2002;55:893-6.
13. Bhattacharjee P, Das P, Das D, Jog A, Jain M. Clinical and etiological profile of patients presenting with hyponatremia in a tertiary care teaching hospital of North Eastern India. *International Journal of Contemporary Medical Research* 2017;4(5):1038-1041.
14. Scott MG, LeGrys VA, Klutts JS. Electrolytes and blood gases. In: clinical chemistry and molecular diagnostics Teitz s. 3rd ed. Saunders WB, Philadelphia. 2007;983-1018.
15. Huda MS, Boyd A, Skagen K, Wile D, van Heyningen C, Watson I, et al. Investigation and management of severe hyponatraemia in a hospital setting. *Postgrad Med J* 2006;82:216-9.
16. Nzerue CM, Baffoe-Bonnie H, You W, Falana B, Dai S. Predictors of outcome in hospitalized patients with severe hyponatremia. *J Natl Med Assoc* 2003;95:335-43.