

STUDY OF SEVERITY OF HYPONATRAEMIA AND ITS CLINICAL OUTCOME IN PATIENTS ADMITTED TO TERTIARY CARE ICU

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ABSTRACT

BACKGROUND OF THE STUDY

Hyponatraemia is a commonly encountered plasma electrolyte abnormality noticed in the patients admitted to ICU, which has a diverse variety of manifestations. It can lead to a wide spectrum of clinical symptoms, from subtle to severe or even life-threatening and is associated with increased mortality and morbidity.

OBJECTIVES

To study the clinical profile at different levels of hyponatraemia in ICU patients and its clinical outcome at different levels.

METHODOLOGY

A retrospective descriptive study was done at Intensive Care Unit of Dr. B.R. Ambedkar Medical College and Hospital during the period from April 2015 to March 2016 among the patients having serum sodium levels less than 135 mEq/L.

RESULTS

Commonly involved age group is between 50 to 70 years. Severe form of Hyponatraemia is seen in elderly males. The most common underlying predisposing factor for hyponatraemia in our case series was sepsis (26%) followed by gastrointestinal fluid loss (15.5%), diabetic ketoacidosis (10%) and cirrhosis of liver (10%). Mortality was highest with severe hyponatraemia (10.5%) who had pulmonary sepsis, metabolic encephalopathy, diabetic ketoacidosis and cirrhosis of liver.

CONCLUSIONS

Hyponatraemia is one of the good predictor of ICU mortality in association with wide variety of systemic diseases and wide spectrum of clinical profile.

KEYWORDS

Hyponatraemia, Serum Sodium Levels, ICU.

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INTRODUCTION

Disorders of serum Na⁺ concentration are caused by abnormalities in water homeostasis that lead to changes in the relative ratio of Na⁺ to body water. Water intake and circulating AVP constitute the two key effectors in the defense of serum osmolality; defects in one or both of these defense mechanisms cause most cases of hyponatraemia and hypernatremia. Hyponatraemia, which is defined as a plasma Na⁺ concentration <135 mm is a very common disorder, occurring in up to 22% of hospitalized patients. This disorder is almost always the result of an increase in circulating AVP and/or increased renal sensitivity to AVP, combined with any intake of free water; a notable exception is hyponatraemia due to low solute intake.¹

Despite the awareness on hyponatraemia 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 disease states multiple aetiologies and differing pathophysiological mechanisms.² Hyponatraemia can be classified according to the volume status of the patient as Hypovolemic, Hypervolemic or Euvolemic.^{1,3} Hypervolemic Hyponatraemia may be caused by congestive cardiac failure, liver cirrhosis and renal disease.³

Acute symptomatic hyponatraemia is a medical emergency that occurs in a number of specific settings. 1. Iatrogenic: Postoperative: Premenopausal women, hypotonic fluids with cause of increased vasopressin, glycine irrigation; TURP, uterine surgery, colonoscopy preparation, recent institution of thiazides; 2. Polydipsia; 3. MDMA ingestion; 4. Exercise-induced; 5. Multifactorial, e.g. thiazide and polydipsia.¹

The symptoms of hyponatraemia are primarily neurologic, reflecting the development of cerebral oedema within a rigid skull. The initial CNS response to acute hyponatraemia is an increase in interstitial pressure, leading to shunting of ECF and solutes from the interstitial space into the cerebrospinal fluid and then into the systemic circulation.¹ The clinical presentation has a wide spectrum varying from asymptomatic patients to ones having seizures and coma.^{4,5}

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Early symptoms can include nausea, headache and vomiting. However, severe complications can evolve rapidly including seizure activity, brainstem herniation, coma and death. A key complication of acute hyponatraemia is normocapnic or hypercapnic respiratory failure; the associated hypoxaemia may amplify the neurologic injury.¹ In chronic hyponatraemia cerebral adaptation helps the patient to be asymptomatic, though the plasma sodium is as low as 115-120 mEq/L. Clinically, hyponatraemia is often unrecognized when it is mild or when it develops slowly.

But severe hyponatraemia (plasma sodium < 120 mmol/l), particularly of rapid onset is associated with substantial morbidity and can be life-threatening. Also moderate-to-severe hyponatraemia bears a substantial associated morbidity and mortality.^{6,7,8} It is known that hyponatraemia is associated with longer hospital days, medical costs and higher mortality compared to eunatremia.^{9,10} Although, it is hypothesized that long-term hyponatraemia might disturb the metabolic and genetic balance in cells, resulting in higher mortality, pathophysiologic effect of hyponatraemia on clinical outcome has not yet clearly been identified.¹¹

Acute or symptomatic hyponatraemia can lead to significant rates of morbidity and mortality.^{12,13} Mortality rates as high as 17.9% have been quoted, but this extreme rate usually occurs in the context of hospitalized ICU patients.^{3,14} Morbidity also can result from rapid correction of hyponatraemia.³

Treatment was individualized. Overtly symptomatic patients were treated with hypertonic saline intravenously by proper dose and rate calculation followed by oral salt supplementation.⁴ Evaluation of other disease associated with the hyponatraemia is vital, as they are involved in the pathogenesis of the disease. Hence, the physician should have suspicion of hyponatraemia in patients with pneumonia, pulmonary tuberculosis, pulmonary abscess, bronchiectasis, malignancies and chronic obstructive pulmonary disease.^{15,16} Data regarding the incidence of hyponatraemia in our country is limited. This study was done to know the common clinical features and aetiology of hyponatraemia in hospitalized (ICU) patients and to correlate the outcome of these patients with admission serum sodium levels.

MATERIALS AND METHODS

This retrospective descriptive study was conducted from April 2015 to March 2016 in ICU of Dr. B.R. Ambedkar Medical College and Hospital, Bangalore. Patients with serum sodium levels less than 135 mEq/L at the time of admission with or without symptoms of hyponatraemia were selected and treated with 3% saline (Hypertonic saline) according to severity of symptoms and serum sodium levels. Patients with age group below 18 years and above 80 years and severe renal dysfunction and post-operative patients were excluded from the study. Data was collected retrospectively from all the patients with hyponatraemia fulfilling the Inclusion and Exclusion Criteria. Excel and SPSS software packages were used for data entry and analysis.

RESULTS

This study clinical data was taken retrospectively from ICU patients of a tertiary care hospital from April 2015 to March 2016. The total number of admissions to ICU during the above period was 708 patients. Compared to other electrolyte

disturbances, we found that hyponatraemia on admission was most prevalent.

Out of them 200 patients (28.25%) had Serum Sodium levels <135 mEq/L. There were 123 (61.5%) male patients and 77 (38.5%) female patients. [Figure 1]

Age- Sex Distribution

123 male patients and 77 female patients.

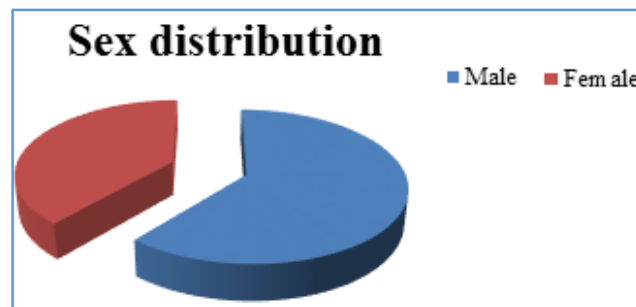


Fig. 1: Age-Sex Distribution

Commonly involved age group was between 51 to 70 years. Mild and Moderate hyponatraemia was common in age group between 51 to 60 years [Figure 2], whereas severe hyponatraemia was common between the age group of 61 to 70 years [Figure 3].

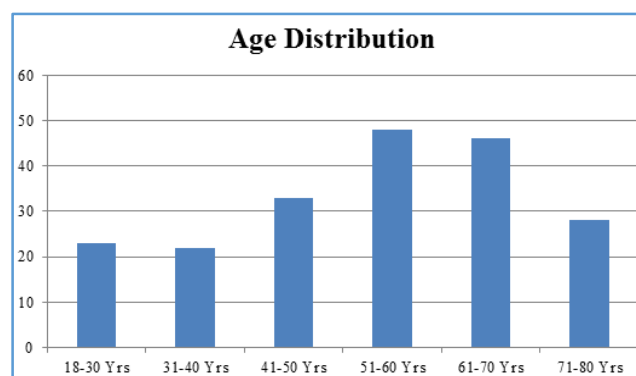


Fig. 2: Age Distribution Comparison

Age Distribution	No. of Patients
18-30 Yrs.	23
31-40 Yrs.	22
41-50 Yrs.	33
51-60 Yrs.	48
61-70 Yrs.	46
71-80 Yrs.	28

Age Distribution	Mild and Moderate	Severe Hyponatraemia
18-30 Yrs.	16	7
31-40 Yrs.	16	6
41-50 Yrs.	24	9
51-60 Yrs.	31	17
61-70 Yrs.	26	20
71-80 Yrs.	15	13

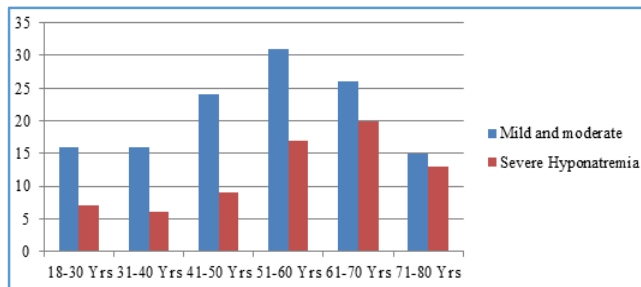
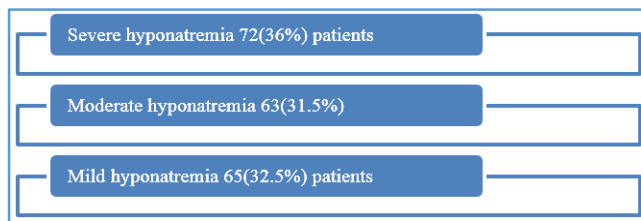


Fig. 3: Age Distribution Comparison

Severe hyponatraemia was detected in 72 (36%) patients. Mild hyponatraemia and moderate hyponatraemia was seen in 65 (32.5%) and 63 (31.5%) patients respectively. Severe hyponatraemia was commonly seen in patients with sepsis 36 (50%), metabolic encephalopathy 26 (34.72%), cirrhosis of liver 6 (8.33%) and diabetic ketoacidosis 5 (6.9%).



The most common underlying predisposing factor for hyponatraemia in our case series was sepsis (26%) followed by gastrointestinal fluid loss (15.5%), diabetic ketoacidosis (10%) and cirrhosis of liver (10%). Other causes of hyponatraemia were cerebrovascular accidents (9%), meningitis (5%), acute pancreatitis (4.5%), viral fever (3%), chronic obstructive pulmonary disease (2.5%) and hypertensive encephalopathy (1%) [Figure 4].

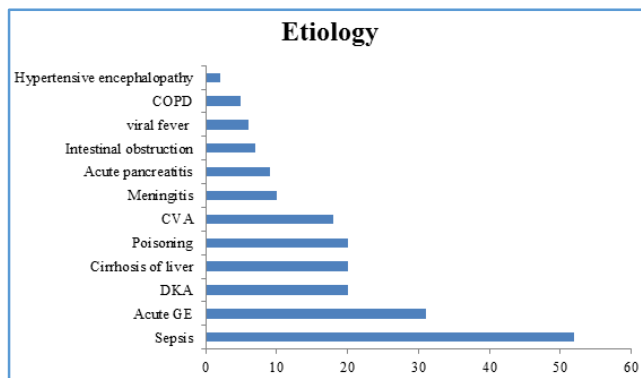


Fig. 4: Aetiological Distribution of Hyponatremic Patients

	Aetiology
Sepsis	52 (26%)
Acute GE	31 (15.5%)
DKA	20 (10%)
Cirrhosis of liver	20 (10%)
Poisoning	20 (10%)
CVA	18 (9%)
Meningitis	10 (5%)
Acute pancreatitis	9 (4.5%)
Intestinal obstruction	7 (3.5%)
viral fever	6 (3%)
COPD	5 (2.5%)
Hypertensive encephalopathy	2 (1%)

Clinical Profile Comparison

The major symptoms seen in mild and moderate hyponatraemia were nausea and dyspnoea, whereas altered sensorium and seizures were common in severe hyponatraemia.

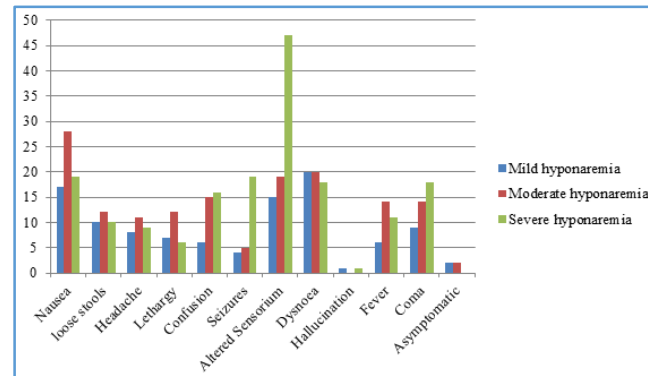


Fig. 5: Clinical Profile of Hyponatremia

Symptoms	Mild Hyponatremia	Moderate Hyponatremia	Severe Hyponatremia
Nausea	17	28	19
Loose stools	10	12	10
Headache	8	11	9
Lethargy	7	12	6
Confusion	6	15	16
Seizures	4	5	19
Altered Sensorium	15	19	47
Dyspnoea	20	20	18
Hallucination	1	0	1
Fever	6	14	11
Coma	9	14	18
Asymptomatic	2	2	0

Associated Comorbid Conditions (Diabetes, Hypertension, etc.) in Hyponatremia

Out of 200 patients with hyponatraemia, 141 patients (70.5%) had co-morbid conditions like diabetes mellitus (35%), hypertension (28.5%), renal failure (2%) and ischaemic heart disease (5%) [Figure 6].

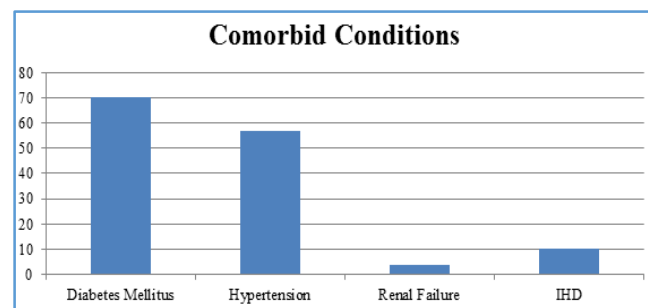
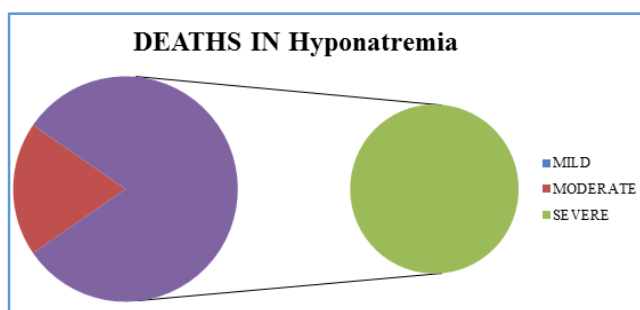
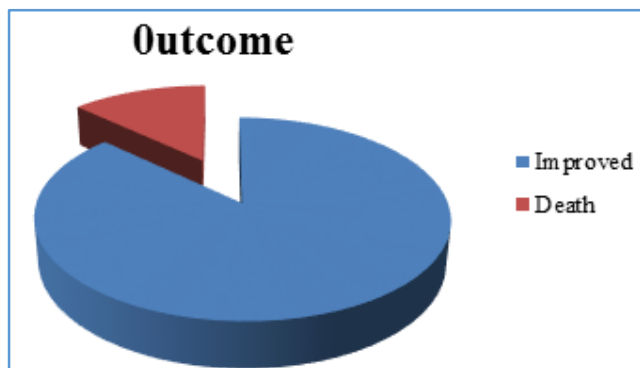


Fig. 6: Associated Co-Morbid Conditions in Hyponatremic Patients

Outcome

Among 200 patients with hyponatraemia, 174 patients were improved and 26 patients died during the course of treatment. Mortality was highest with severe hyponatraemia patients (10.5%) who had sepsis, metabolic encephalopathy, cirrhosis of liver and diabetic ketoacidosis.



DISCUSSION

Hyponatraemia is associated with substantial morbidity and mortality. The identification of risk factors associated with the development of symptomatic hyponatraemia is important in determining preventive strategies. The occurrence of severe hyponatraemia seen in elderly sick patients with other multiple co-morbidities was found to be 28%. In other studies like Chatterji et al, the incidence was 16.4% and in Pandey and Pandey et al it was 9%.¹⁷ In our study, 61.5% were males and 38.5% were females which was similar in other studies like Pandey and Pandey et al (Males: 65%, Females: 35%).¹⁷ and Agarwal and Agrawal et al (Males: 64.3%, Females: 35.7%).¹⁸ The commonly involved age group was between 51 to 70 years in our study. Mild and moderate hyponatraemia was common in age group between 51 to 60 years, whereas severe hyponatraemia was common in age group between 61 to 70 years. The population predominantly belonged to the age groups 51 to 70 years in a study done by Paniker and Joseph et al and it was 60 to 80 years in Chatterji et al.

Confusion followed by altered sensorium were major symptoms in patients with severe hyponatraemia in Agarwal and Agarwal et al.¹⁸ But, in our study, altered sensorium followed by seizures were the major symptoms.

Analysis of the causes of hyponatraemia in our patients revealed that most patients had multiple predisposing factors. The most common underlying predisposing factor for hyponatraemia in our case series was sepsis (26%) followed by gastrointestinal fluid loss (15.5%) followed by Diabetic ketoacidosis (10%) and cirrhosis of liver (10%). In a study done by Paniker and Joseph et al, the incidence of congestive

heart failure was 24% which was the most common cause of hyponatraemia followed by gastrointestinal loss (18%) and cirrhosis of liver (7%). Analysis of the causes of hyponatraemia in study done by Agarwal and Agrawal et al revealed that most patients (94.3%) had multiple precipitating factors. Increased loss of sodium from the body was seen in 65.7% patients, most commonly via gastrointestinal route. Volume overload due to cardiac, renal and hepatic disease was a factor in 48% patients.

Diuretics as a precipitating factor for hyponatraemia was found in 37.1% of patients in this study.¹⁸ In a study done by Chatterji et al, gastrointestinal fluid loss, cerebrovascular accident and pulmonary sepsis were the most frequent predisposing risk factors.

Among 200 Hyponatraemic patients, mortality was seen with severe form of hyponatraemia (10.5%) followed by moderate hyponatraemia (2.5%). This above mortality correlates with comorbid diseases like sepsis, metabolic encephalopathy, cirrhosis of liver and diabetic ketoacidosis. Most of the patients in our study had multiple underlying diseases like sepsis, gastrointestinal loss of fluids, cerebrovascular accidents with hypertensive encephalopathy, cirrhosis of liver, diabetic ketoacidosis, neuro-infections, chronic obstructive pulmonary disease, acute febrile illness and congestive heart failure.

CONCLUSION

Hyponatraemia must be actively looked for and corrected early, as delay in starting treatment worsens the hyponatraemia and prolongs the hospital stay. The severity of symptoms and signs are generally more prominent in elderly patients due to their failure of homeostatic mechanisms. It is also important to evaluate the aetiology of hyponatraemia, so that specific underlying cause can be treated. The mortality depends not only with severity of hyponatraemia even with underlying diseases, and also patient's presenting symptoms like confusion, altered sensorium, seizures and coma. So that serum sodium levels and clinical profile are the good predictors of mortality.

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