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Clinico-Etiological Profile of Hyponatremia in Patients Admitted in Intensive Care Unit of Tertiary Health Care Rural Center

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Abstract

Introduction: *Hyponatremia is one of the most common electrolyte disturbances of encountered in medical wards, Dialysis unit, and medical intensive care unit (ICU). It is defi ned as sodium ion concentration <135 mmol. ICU in patients with various comorbid conditions such as congestive heart failure (CHF), chronic kidney disease (CKD), liver cirrhosis, and diarrhea and vomiting. This contributes to substantial morbidity and mortality. However, early recognition and management drastically alters the prognosis.*

Objective: *This study was conducted to explore the clinical profile of hyponatremia in medically ill patients.*

Materials and Methods: *Study was conducted on 100 patients admitted in the medical unit from October 2011 to October 2013.All patients underwent clinical examination, routine hemogram, blood urea, sugar, creatinine, serum electrolytes and necessary investigations.*

Patients were divided as per their osmolarity. SIADH was diagnosed on the basis of diagnostic criteria by Verbalis.

Results: *The commonest age group of presentation of hyponatremia was older age group (>56 years). Hyponatremia was more common in males than in females. SIADH was the single most important etiology of hyponatremia. Diuretics and salt wasting nephropathy were also significant causes of hyponatremia in this study. Other causes of hyponatremia were CCF, Cirrhosis of liver, Hypothroidism and gastro- Intestinal loss. Among the various diuretics causing hyponatremia thiazides were the most frequent cause. Drowsiness was the single most important symptom of hyponatremia followed by vomitting, hiccups and seizures were also significant symptoms in this study. However one fifth of patients of hyponatremia had no symptoms of hyponatremia. Majority of the patients had mild hyponatremia. Majority of the patients had euvolemic hyponatremia.Mortality was more in patients with severe hyponatremia.*

Conclusion: *Hyponatremia is fairly common in patients admitted in medical wards, ICU, dialysis unit as patients with CHF, CKD, Liver cirrhosis, and diarrhea and vomiting hence early recognition and prompt treatment are of supreme importance in such patients.*

INTRODUCTION

Hyponatremia is defined as a serum sodium level less than 135 meq/L. An abnormal sodium level does not necessarily imply abnormal sodium balance, but can be due to abnormal water balance as well. Hyponatremia, an excess of water in relation to the sodium in the extracellular fluid, is the most common electrolyte disorder in hospitalized patients and particularly so in the elderly.[1]

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

disease states, multiple etiologies and differing pathophysiological mechanisms.[2]

Data on the clinical features and exact etiologies in patients in hyponatremia is lacking, this study aims to describe the clinical feature as well as etiological factors of hyponatremia in patients admitted in ICU at tertiary health care Rural Centre.

MATERIALS AND METHODS

The study was conducted from October 2011 to October2013. All admitted patients whose serum electrolytes (serum sodium) had been estimated, were identified from the biochemistry laboratory records. Those patients with a serum sodium concentration less than 135meq/L at any point during the admission were included in the study. All adult (age >15 years) patients admitted to medicine ICU with documented hyponatremia, defined as serum sodium concentration [Na+] less than 135 meq/L, were included in the study.

METHODOLOGY

Clinical Assessment

Detailed history - This included history of symptoms of hyponatremia, predisposing factors and pre-existing illnesses if present. The definition of symptomatic hyponatremia was based on a clinical assessment of symptomatology including the presence of altered sensorium, postural dizziness, lethargy and seizures. Sensorium changes comprised acute confusional states, memory disturbances, stupor, delirium and/or coma in the absence of dementia, psychiatric illness and substance abuse. Drugs that can increase the non-osmotic release of antidiuretic hormone (ADH) or potentiate its renal action (ADH-stimulating drugs) were recorded. History of illnesses causing hyponatremia such as congestive heart failure, chronic kidney disease, chronic liver disease, hypothyroidism and other conditions which are associated with SIADH such as small cell lung carcinoma, CNS disease, pulmonary disease were taken and recorded. History of fluid loss as in vomiting, diarrhea, diuretic use, excessive sweating was taken in all patients.

Physical examination - Detailed clinical evaluation was done in every patient. Hydration status of the patient was determined by clinical examination. The signs of hypovolemia included tachycardia, orthostatic fall in blood pressure, decreased skin turgor, dry mucous membranes and decreased peripheral perfusion with a delayed capillary refill more than three seconds. Hypervolemic state was defined by the presence of anasarca, ascites, symmetrical and pitting pedal edema and raised jugular venous pressure (JVP). Accordingly patients were divided into hypervolemic, hypovolemic and euvolemic states.

Investigations:

Complete blood count, serum sodium , BUN, glucose, sr. osmolality .

Serum osmolality - was calculated by the formula:

Serum osmolality = 2([Na+] + [K+]) + RBS/18 + BUN/2.8 mOsm/L

(RBS in mg/dl, BUN in mg/dl)

Patients were divided in following groups depending on their serum

Osmolarity[4] -

I. Normal osmolarity - 270-290mOsm/L

II. Hyperosmolar - >290 mOsm/L

III. Hypoosmolar - <270mOsm/L

SIADH diagnostic criteria - The diagnostic criteria used were as described by Verbalis[5]-

Essential criteria

Extracellular fluid (ECF) effective osmolality below 270 mOsm/kg water.

Inappropriate urinary concentration (>100mOsm/kg).

Clinical euvolemia (absence of signs of hypovolemia and hypervolemia)

Increased urinary [Na+] while on a normal salt and water intake.

Absence of adrenal, thyroid, pituitary or renal insufficiency or diuretic use.

Supplemental criteria

Abnormal water load test (inability to excrete at least 90% of 20ml/kg water load in 4 hr and/or failure to dilute urinary osmolality to below 100mOsm/kg).

Plasma AVP level inappropriately raised relative to plasma osmolality and AVP level done as whenever required.

No significant correction of plasma [Na+] with volume expansion but improvement after fluid restriction.

The data on demographic parameters like age, sex and pathological parameters like serum sodium, potassium, creatinine levels, blood urea, urine sodium along with presenting symptoms and final diagnosis was obtained on 100 patients. The demographic parameters were expressed in terms of numbers and frequencies. Further, the measurable pathological parameters were also transformed into categories like mild, moderate and severe respectively. The number and proportion of cases in each category for respective parameters was obtained. Their association with demographic, type of symptoms and diagnosis was studied using *Chi-square test*. For contingency tables with expected cell values less than 5, *Monte-Carlo simulation* was carried out by creating large number of samples (1000) with the given proportion followed by applying re-sampling procedures to the generated samples. The algorithm is built-in one of the functions *R*-package and has been used for contingency tables with above condition. In addition, all frequencies and percentages were computed in R-package by writing validated scripts and the statistical significance was evaluated at 5% level.

RESULTS

In the present study prevalence of hyponatremia was more in male patients i.e. 74 males and 26 females (FIGURE 1). Majority, i.e. 48 (48 %) patients were beyond 55 years of age, followed by 34 (34%) of the patients belonged to age group of 35 – 55 years and 18 (18%) of the patients belonged to the age group of 16 – 35 years (TABLE 1)

Table 1: Age distribution among patients with hyponatremia

Age groups	No. (%)
16-35	18 (18)
36-55	34 (34)
>= 56	48 (48)
Total	100

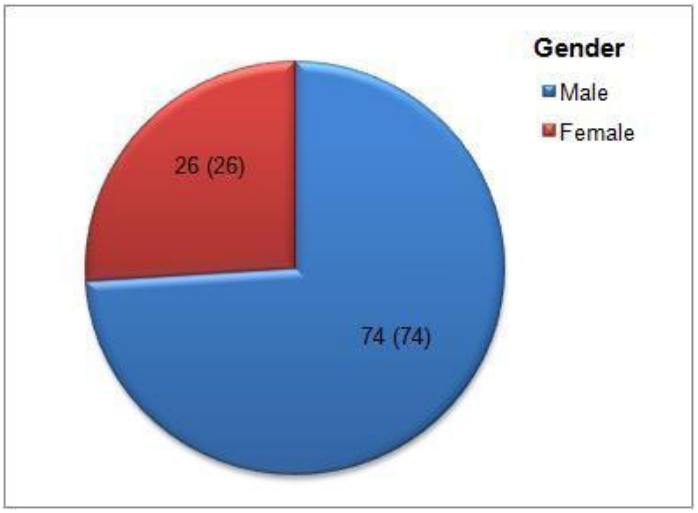

FIGURE 1 : Gender Distribution

In this study 81% of the patients had manifestations of hyponatremia at presentation. A major proportion (19%) of the patients in the study did not have evident clinical manifestations of hyponatremia. This can be possibly due to the reason that acute hyponatremia (hyponatremia of <48 hr duration) is less frequent than chronic hyponatremia.

Present study shows that, Drowsiness was the commonest symptom in the current study. It was present in half 51 (51%) of the cases. One fifth of the cases were asymptomatic whereas, There were 14 (14%) patients who had vomiting, 10 (10%) of

the patients had hiccups and 6 (6%) patients had seizures (TABLE 2).

Table 2: Distribution of patients with symptoms among patients with hyponatremia

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Symptoms	No. (%)
Asymptomatic	19 (19)
Drowsiness	51 (51)
Vomiting	14 (14)
Hiccups	10 (10)
Seizures	6 (6)
Total	100

Table 3 provides the distribution of patients as per symptoms and serum sodium (Na+). Asymptomatic patients showed serum sodium levels in the moderate and mild range (9 [47%] each). Amongst those presenting with drowsiness, 27 (53%) had sodium levels above 125 mMol/L, while 15 (29%) had levels in the moderate range. Amongst those who had vomiting, 8 (57%) had sodium levels above 125 mMol/L. There were 6 (60%) cases of mild sodium levels who presented with hiccups, and 4 (67%) cases of mild levels having seizures. Table shows that 9 cases with low sodium levels had drowsiness as the prominent symptom. The association between symptoms and serum sodium (Na+) was statistically insignificant with *P*-value of 0.5562 ($P > 0.05$) according to *chi-square test with simulated p-value*.

Table 3: Correlation between symptoms and severity of hyponatremia

Symptoms	Serum Na+ (mMol/L)			Total (%)
	Severe (≤ 114)	Moderate (115-124)	Mild (≥ 125)	
Asymptomatic	1(6)	9 (47)	9 (47)	19 (19)
Drowsiness	9 (18)	15 (29)	27 (53)	51 (51)
Vomiting	2 (14)	4 (29)	8 (57)	14 (14)
Hiccups	1 (10)	3 (30)	6 (60)	10 (10)
Seizures	2 (33)	0	4 (67)	6 (6)
Total (%)	15 (15)	31 (31)	54 (54)	100

Majority, i.e. 50 (50%) patients had pallor as observed during physical examination, followed by 15 (15%) of the patients with edema feet. There were 11 (11%) cases with dry tongue. A graphical representation of patient distribution according to physical examination is given through bar chart in Figure 2

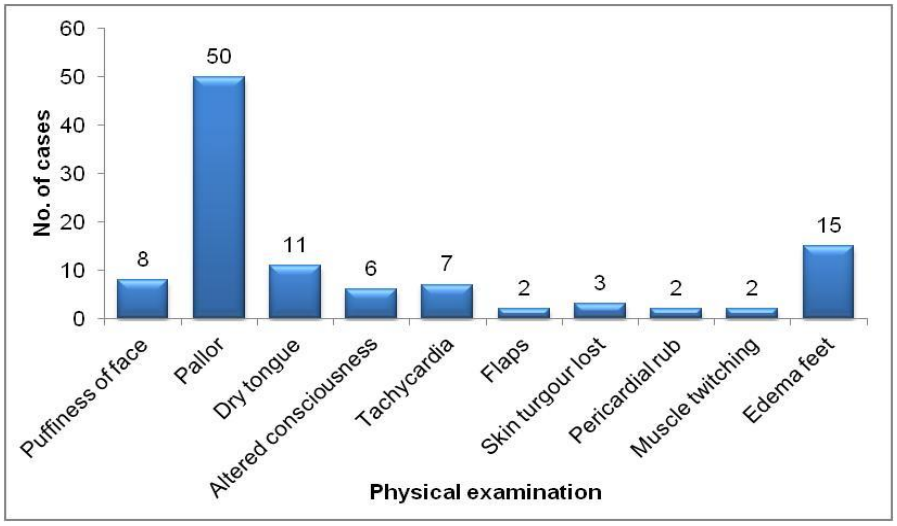

Figure 2: Bar chart showing the distribution of patients according to physical examination

TABLE 4: Distribution Of Patients According To Volume Status

Volume status	No. (%)
Euvolemia	49 (49)
Hypovolemia	36 (36)
Hypervolemia	15 (15)
Total	100

Table 4 gives the distribution of patients according to volume status. It is evident that majority i.e. 49 (49%) patients had Euvolemia volume status, 36 (36%) had Hypovolemia and 15 (15%) patients had Hypervolemia.

Majority, i.e. 44 (44%) cases were diagnosed with SIADH, followed by 31(31%) cases diagnosed with Salt wasting nephropathy. There were 10 (10%) cases of CCF. Further, there were 5 (5%) cases of Cirrhosis of liver, Endocrine and GI loss each. Amongst these patients, 39 had more than one etiology. A graphical representation of patient distribution with reference to diagnosis is given through bar chart in Figure3

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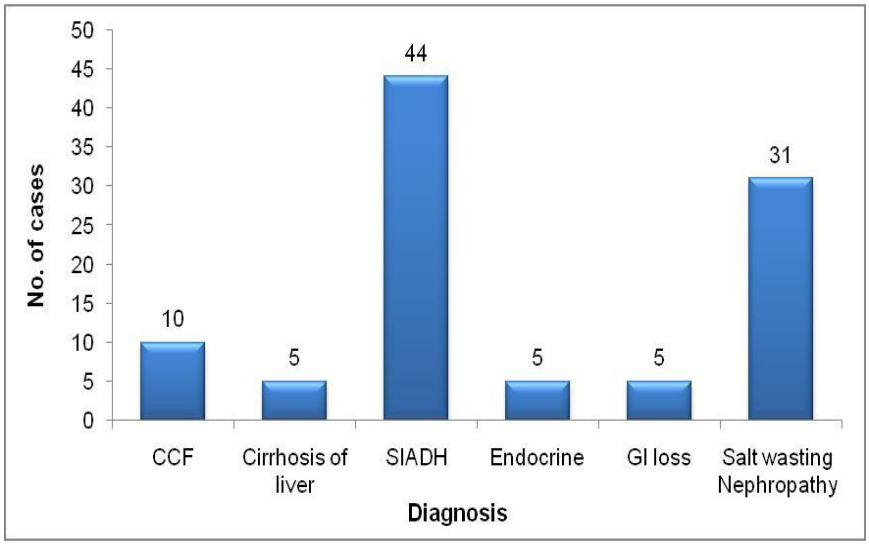

Figure 3 Bar chart showing the distribution of patients according to diagnosis

Table 5 gives the distribution of cases as per diagnosis and urine sodium (Na+) levels. In patients diagnosed with CCF or Cirrhosis of liver, 14 (93%) had urine sodium level above 20 meq/L. Similarly, those diagnosed with SIADH, 42 (95%) had sodium levels above 20 meq/L. In patients diagnosed with Salt wasting nephropathy, 27 (87%) had level above 20 meq/L. The significance of association between diagnosis and urine sodium levels was evaluated using *chi-square test*, which resulted into a simulated *P*-value of 0.1084 ($P > 0.05$) indicating insignificant association

Table 5: Correlation between different aetiologies and urine sodium among patients with hyponatremia

Diagnosis	Urine Na+		Total
	≤ 20 meq/L	> 20 meq/L	
Dilutional (CCF + Cirrhosis of liver)	1 (7)	14 (93)	15 (14)
SIADH	2 (5)	42 (95)	44 (44)
Endocrine	2 (40)	3 (60)	5 (5)
GI loss	1 (20)	4 (80)	5 (4)
Salt wasting nephropathy	4 (13)	27 (87)	31 (31)
Total	10 (10)	90 (90)	100

Table 6 shows the distribution of patients according to degree of Hyponatremia/Serum Na+ Level. The degree of Hyponatremia was mild in 54 (54%) cases, followed moderate in 31 (31%) cases and severe in 15 (15%) cases. A graphical representation of the distribution of patients as per degree of Hyponatremia (Serum Na+ Level) is given through a pie chart in Figure 4.

Table 6: Distribution of patients as per degree of Hyponatremia/Serum Na+ Level (mMol/L)

Degree of Hyponatremia (Serum Na+ Level)	No. (%)
Mild (≥ 125)	54 (54)
Moderate (115 - 124)	31 (31)
Severe (≤ 114)	15 (15)
Total	100

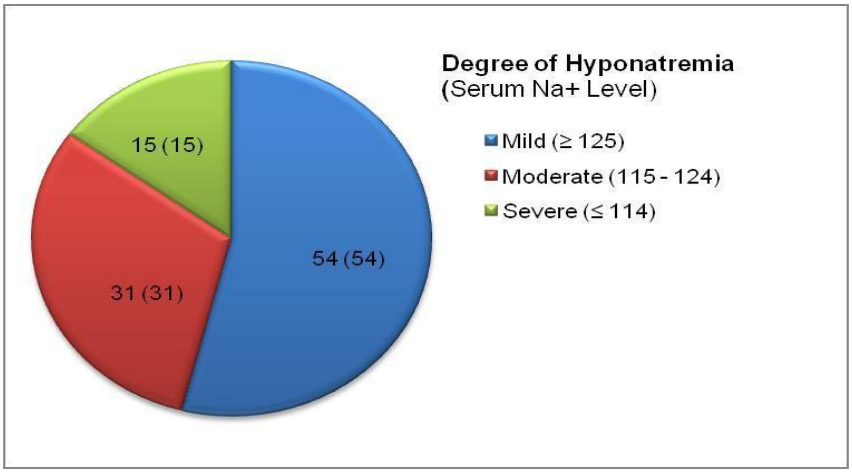

Figure 4: Pie chart showing the distribution of patients as per degree of Hyponatremia

Table 7 gives the distribution of patients according to urinary sodium (Na+) level. Majority i.e. 90 (90%) patients had level above 20 meq/L and only 10 (10%) patients had it below 20 meq/L.

Table 7: Distribution of patients as per urinary sodium (Na+)

Urinary Sodium (Na+)	No. (%)
≤ 20 meq/L	10 (10)
> 20 meq/L	90 (90)
Total	100

Table 8 provides the number of occurrences of deaths as per the degree of hyponatremia. It shows that maximum number of deaths i.e. 7 (46.6%) were in the severe hyponatremia category. There was one death in each moderate and mild hyponatremia categories.

Table 8: Number of deaths according to degree of severity of hyponatremia

Degree of hyponatremia (Serum Na+ levels)	No. of patients survived	No. of patients expired	Total (%)
Mild (□□ 125 mM/L)	53 (98.14)	1 (1.86)	54 (54)
Moderate (115-124 mM/L)	30 (96.77)	1 (3.23)	31 (31)
Severe (□ 114 mM/L)	8 (53.33)	7 (46.67)	15 (15)
Total	91 (91)	9 (9)	100

CONCLUSION

Hyponatremia is a common electrolyte abnormality found in hospitalized patients in general medical and surgical wards[6]. It is more common in elderly patients and critically ill patients admitted to the ICU. The commonest age group of presentation of hyponatremia was older age group (>56 years). Hyponatremia was more common in males than in females. SIADH was the single most important etiology of hyponatremia. Diuretics and salt wasting nephropathy were also significant causes of hyponatremia in this study. Other causes of hyponatremia were CCF, Cirrhosis of liver, Hypothroidism and gastro-Intestinal loss.Among the various diuretics causing hyponatremia thiazides were the most frequent cause. Drowsiness was the single most important symptom of hyponatremia followed by vomitting, hiccups and seizures were also significant symptoms in this study. However one fifth of patients of hyponatremia had no symptoms of hyponatremia. Majority of the patients had mild hyponatremia. Majority of the patients had euvolemic hyponatremia. Mortality was more in patients with severe hyponatremia.

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SUMMARY

Hyponatremia is the most common electrolyte disorder in hospitalized patients particularly in elderly. Hyponatremia is important to recognize because of the potential morbidity, mortality and the economic impact on the patient and the health care. Studying the etiology, risk factors and clinical profile of hyponatremia in hospitalized patients will help in reducing its incidence and minimize the complications associated with hyponatremia[7].

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