



Original Article

Profile of Hyponatremia in Patients admitted into Medical ICU

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Abstract

Background: Hyponatremia is a common metabolic disorder in all subsets of patients including critically ill medical patients. Hyponatremia is caused by a diverse set of causes and evaluation at times can be challenging. The symptomatology of Hyponatremia is a spectrum and at times patients can be asymptomatic. The symptomatology depends on the rapidity of the onset of Hyponatremia and symptoms are decided by the rapidity of Astrocyte adaptation to decreasing serum tonicity.

Methods: This retrospective study which included patients admitted into Medical Intensive care Unit (ICU) between September 2016 to August 2018 is aimed at the analysis of hyponatremia admitted into Medical ICU. This study is based on the evaluation of etiology based on standard clinical and laboratory tools and focusses on the clinical and laboratory profiles of patients with Hyponatremia in Medical ICU.

Results: A total of 142 patients with Hyponatremia were identified. There was a male preponderance with males constituting 62 % of the study population. The mean age of the study population was 54.8 +/- 12.8. Hyponatremia was acute in 42.2 % of patients (60 patients) while it is chronic in 57.8 %. Vomiting was the most common manifestation was reported in 57 % of patients while altered Sensorium and Seizures were documented in 29.5 % and 12 % of patients. Euvolemia, Hypovolemia and Hypervolemia was noted in 46%, 33% and 21 % of patients. Syndrome of Inappropriate Anti Diuretic Hormone Secretion (SIADH) is the most common form of euvolemic hyponatremia and it accounted for 91 % of cases of Euvolemic Hyponatremia. Thiazide induced hyponatremia was noted in 18.3% of the total study population and was the most common type of Hypovolemic Hyponatremia. The therapy correct Hyponatremia was well tolerated and none had Osmotic Demyelination Syndrome (ODS). 18 patients died during their hospital stay (12.6 %).

Conclusions: The most common form of Hyponatremia is Euvolemic pattern of Hyponatremia. SIADH is the major type of euvolemic hyponatremia. Thiazides induced hyponatremia is noted in 18.3 % of total patients and is the most common form of Hypovolemic Hyponatremia. None of the patients experienced ODS. Mortality was recorded in 12.6 % of study population.

Keywords: Hyponatremia, Syndrome of Inappropriate Anti Diuretic Hormone Secretion (SIADH), Thiazide induced Hyponatremia, Osmotic Demyelination Syndrome (ODS).

Introduction

Hyponatremia is a common electrolyte disorder in critically ill patients and is associated with prolongation of hospital stay and adverse outcomes. Hyponatremia is defined as serum sodium of less than 135 meq/L¹. The reported prevalence of hyponatremia in critically ill patients ranges from 30-40 % while it is noted in around 14 % of patients at the time of hospitalization into ICU^{2,3}. The prevalence of Hyponatremia in the general population is around 1.72 %³. Hyponatremia is caused by a variety of causes and could be of multi factorial etiology in few⁴. Hyponatremia is a disorder whose symptomatology is a spectrum and not all patients do exhibit symptoms. Further, hyponatremia is usually confounded by the primary clinical condition⁵. Hyponatremia can also contribute to the increased mortality in all subset of patients complicated by hyponatremia^{6,7}.

The identification of hyponatremia warrants a high degree of suspicion. Hyponatremia can complicate the course of all subsets of patients including medical and surgical patients. Hyponatremia management can be challenging in Intensive Care Unit patients in whom Hyponatremia results from a plethora of overlapping etiologies. The workup of Hyponatremia includes clinical tools in addition to the standard set of laboratory investigations⁸.

Hyponatremia is one of the clinical condition which mandates against rapid correction as such rapid correction of hyponatremia could result in catastrophic Pontine demyelination Syndrome⁹.

Hyponatremia is classified in various ways and each classification is tagged with clinical relevance. Hyponatremia is classified as acute verses chronic hyponatremia with 48 hour time frame as the differentiating feature amongst these two types. Hyponatremia can also be classified basing on Volume status as Hypovolemic, Hypervolemic and Euvolemic Hyponatremia.

The current study is aimed at the analysis of hyponatremia admitted into Medical ICU. This study is based on the evaluation of etiology based

on standard clinical and laboratory tools and focusses on the clinical and laboratory profiles of patients with Hyponatremia in Medical ICU.

Material and Methods

This is a retrospective study included patients admitted into Medical ICU who had Hyponatremia at the time of hospitalization. The records of such patients admitted between September 2016 to August 2018 were analyzed. The inclusion criteria included patients admitted into Medical ICU and who had serum Sodium of less than 135 meq/L. Patients who were admitted into Surgical ICU and those patients in whom the detailed workup could not be completed were excluded. Hyponatremia was defined as Serum Sodium concentration of less than 135 mEq/L. Serum Sodium was measured using the ion Electrode method. Detailed History including the preexisting comorbidities, Symptomatology, Past History of dyselectrolytemia, Medication details were collected. Further, the basic laboratory investigations (Renal Function tests, Liver Function Tests, Lipid profile) were performed. In all the cases, Serum Osmolality, Urine Osmolality, Spot Urine Sodium, Serum Uric acid, Blood Urea Nitrogen (BUN), Thyroid Profile were tested. Volume Status was evaluated clinically and with IVC collapsibility parameter. Depending on the clinical indication, in few cases further work up was ordered Viz. CT scan Chest X Ray, chest imaging, Neuroimaging of Brain and CSF analysis and Serum Cortisol levels. IBM SPSS version 22 was used for statistical analysis. Descriptive analysis was carried out by the mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. Data was also represented using appropriate diagrams.

Results

A total of 142 patients were included in the study. Males and females were 88 and 54 respectively. The mean age was 54.8 +/- 12.8. Hyponatremia was acute in 42.2 % of patients (60 patients) while

it is chronic in 57.8 %. The various symptoms relevant to Hyponatremia recorded at the time of admission were elaborated in the Table 1. Almost one third of the individuals were asymptomatic with regard to Hyponatremia. Vomiting was reported in 53 %. Gait disorders were the prominent complaint in 5 % of patients. Altered Sensorium and Seizures were documented in 29.5 % and 12 % of patients and all these patients were of Acute Hyponatremia subtype. Volume status as assessed by clinical examination revealed euvolemia in 46 %, Hypovolemia in 33 % and Hypervolemia in 21 %. 16 % had mild Hyponatremia, 62 % had Moderate Hyponatremia and Severe Hyponatremia in 22 %.

All patients had true hyponatremia as denoted by a low serum osmolality value. All patients of Euvolemic hyponatremia had Urine osmolality of more than 100 and Spot Urine Sodium of more than 40. Twenty Six out of forty seven (55 %) patients with Hypovolemic Hyponatremia had Urine Sodium of >20 meq/L while 21 patients (44.7%) had Urine sodium of < 20 meq/L. Urine Osmolality was more than 100 in 28 out of 30 patients (93.4%) with Hypervolemic Hyponatremia while 5 out of 30 patients had Urine Sodium of less than 100. Spot Urine Sodium was less than 20 meq/l in 20 out of 30 patients (67%) And it was more than 20 meq/L in 10 out of 30 patients (33%) of Hypervolemia.

59 out of 65 patients (91%) with euvolemic hyponatremia had Syndrome of Inappropriate Anti Diuretic Hormone Secretion (SIADH) while the 6 out of 65 patients had Hypothyroidism induced Euvolemic Hyponatremia. Central nervous system disorders were the major trigger for SIADH (63%) (37 out of 59 cases of SIADH) while Pulmonary causes were the contributing causes in others (37%) (22 out of 59 cases). Stroke contributed for Seventy Three percent (27 out of 37) of CNS causes causing SIADH while the rest were caused by Head trauma and CNS infections.(five cases had axonal Brain injury, three had Subdural haematoma and two had TB meningitis) There were no drug induced causes of

SIADH in the current study. The major causes of Hypovolemic hyponatremia were Thiazide diuretics (18.3% of the total patients), diarrhoea (12.6 % of the total cases) (18 cases) and third space fluid losses (2.11% of total cases) (3 cases). Congestive Heart Failure was the cause for Hyponatremia in 13 patients (9.15 % of total cases) while Cirrosis of liver was the culprit in 7 cases (4.9% of total cases). Renal failure was noted in 22.53 % of patients.(22.53 % of total cases).

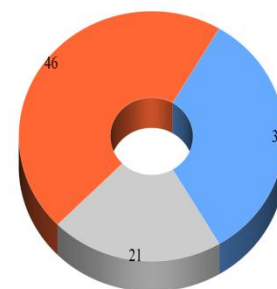
18 patients died during their hospital stay (12.6 %). Out of these patients 4 had severe hyponatremia, 8 had moderate hyponatremia and 6 had mild hyponatremia.

Table 1 Symptoms of patients with Hyponatremia

S.No	Symptom	Number	Percentage
1.	Asymptomatic	45	32
2	Vomiting	75	53
3	Gait Abnormalities	7	05
4	Altered Sensorium	42	29.5
5	Seizures	17	12

Percentage of Volume status in Hyponatraemia

■ Euvolemia ■ Hypovolemia ■ Hypervolemia



Discussion

The incidence of Hyponatremia increases with age. This could be because of the overlapping multiple risk factors as the age increases^{3,10}. In the current study also depicted the similar trend as there is preponderance of middle aged and elderly population with a mean age of 54.8 +/- 12.8. There is conflicting literature on the gender

preponderance though majority of the studies projected female preponderance^{10,11,12}. However, there is male preponderance in this current study with a male and female contribution as 62 % and 38 % respectively. This male preponderance can be explained by the well-known inter region variation in the profiles of Hyponatremia.

Hyponatremia is classified as Acute and chronic basing on a time frame of 48 hours. Such a time frame was affixed as 48 hours is the time period needed for the Brain cells to adopt to Hyponatremia¹. Patients of acute Hyponatremia present with severe symptoms while the patients with chronic hyponatremia are prone for neurological complications if the correction of Hyponatremia is undertaken at a rapid pace. In the present study, Hyponatremia was acute in 42.2 % of patients (60 patients) while it is chronic in 57.8 %. The higher incidence of Chronic Hyponatremia is in concurrence with other studies¹³.

The manifestations of hyponatremia are diverse in nature and the primary brunt is manifested on Central Nervous System. The symptomatology is directly proportional to the duration of Hyponatremia with acute hyponatremia patients being more symptomatic when compared to chronic hyponatremia patients. The severity of manifestations is decided by the adaptation of astrocytes to the hyponatremia¹⁴. The manifestations would be stormy if the sodium falls at a rapid pace on the backdrop of severe water retention in hitherto euvolemic individuals. This is usually the case with immediate post-operative patients and primary polydipsia¹⁵.

In the current study patients manifested a wide range of symptoms ranging from head ache to seizures and Encephalopathy. Vomiting was the most common manifestation was reported in 57 % of patients while altered Sensorium and Seizures were documented in 29.5 % and 12 % of patients. All patients with Seizures and hyponatremia belonged to the category of acute hyponatremia. Vomiting is a particularly uniform manifestation across various studies and is the consistent clinical feature in various patient subsets¹¹.

Establishing the volume status is of pivotal importance in the approach and evaluation of Hyponatremia. All the major workup protocols incorporated Volume assessment and trifurcation of patients into Hypovolemia, Hypervolemia and Euvolemia¹. Euvolemic Hyponatremia is the most common form of Hyponatremia in various subsets of patients^{8,16}. In a study from France where in 300 patients of ICU patients with Hyponatremia were studied, Euvolemic Hyponatremia was the dominant type (50.6%) with hypovolemic hyponatremia and Hypervolemic hyponatremia in 25.7% and 23.7% patients¹⁷. In the present study, majority were Euvolemic (46%), while Hypovolemia and Hypervolemia was observed in 33 % and 21 % respectively.

Globally, SIADH is the most common form of Euvolemic Hyponatremia¹⁶. This denotes the culmination of multiple etiologies as SIADH and majority of such disorders are intra cranial , pulmonary and drug induced causes. In the current study also SIADH is the most common form of euvolemic hyponatremia and it accounted for 91 % of cases of Euvolemic Hyponatremia. Central Nervous systems disorders were the leading identified causes of SIADH in the current series.

Another important etiology of Hyponatremia in the current study is Thiazide induced Hyponatremia. Various studies have reported the prevalence of Thiazide induced Hyponatremia up to 30 % of individuals receiving Thiazides¹⁸. Barring few exceptions, all most all cases of Diuretic induced Hyponatremia are attributable to Thiazides¹⁹. It usually manifests within first three months of treatment. In the current study, Thiazide induced hyponatremia was noted in 18.3% of the total study population and was the most common type of Hypovolemic Hyponatremia. None of these patients had severe neurological manifestations. In this series all cases of diuretic induced hyponatremia are due to Thiazides only.

One of the cornerstones in the treatment of Hyponatremia lies in measures of mitigating the side effects of therapy. Such side effects can be at times catastrophic and usually occur when rapid

correction of Hyponatremia is contemplated. Central Pontine Myelinolysis is an entity which makes the treatment of Hyponatremia complex. It manifests when the hyponatremia is corrected at a rapid pace. Central Pontine myelinolysis arising due to rapid correction of Hyponatremia contributes to 21 % of total Central Pontine Myelinolysis in the world²⁰. The common risk factors for the development of Osmotic demyelination syndrome include Beer Potomania, hypovolemia, malnutrition, Serum sodium at presentation of less than 105 meq/L, Severe Liver disease, Hypothyroidism, alcoholism, woman of child bearing age, chronic hyponatremia, and Hypokalemia^{9,21}. However, Osmotic demyelination is documented in none of our subjects. This could be the result of the strict adherence to the protocol of not increasing serum sodium of not more than 8 meq/Day.

It is an undisputed fact that Hyponatremia is associated with increased mortality, though it is not clear that whether hyponatremia is a direct contributor of mortality or the projected mortality denotes the severity of the primary systemic disease which led to hyponatremia^{22,23}. In the current study, 18 patients died during their hospital stay (12.6 %). Out of these patients 4 had severe hyponatremia, 8 had moderate hyponatremia and 6 had severe hyponatremia. Such nonlinear trend of serum sodium and mortality was systematically established in other studies²⁴. However, it is not possible to establish whether hyponatremia is a silent bystander or the core culprit with regard to mortality in these patients.

Conclusion

Hyponatremia is a commonly encountered electrolyte disorder in critically ill patients admitted into Medical ICU. The most common form of Hyponatremia is Euvolemic pattern of Hyponatremia. SIADH is the major type of euvolemic hyponatremia. Thiazides induced hyponatremia is noted in 18.3 % of total patients and it is the most common type of hypovolemic

hyponatremia. None of the patients with Thiazide induced hyponatremia were symptomatic. Congestive Heart failure contributed to the majority of Hypervolemic Hyponatremia. If the protocol of not raising serum potassium above 8 meq/L is strictly adhered, neurological sequelae of hyponatremia correction can be mitigated. The mortality documented in Hyponatremia patients in the current study was 12.6, though the casual association could not be ascertained.

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