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Study of Hyponatremia among Patients Admitted InIcu Of A Tertiary Care Hospital

Dr. Pritam Debnath [1]
Department of Medicine,AGMC & GBP Hospital
/Tripura University, Tripura, India,

Dr. Rajesh Kishore Debbarma [2]
Professor, Department of Medicine, AGMC &GBPHospital, Agartala,

Dr. Durlabh Debbarma [3]
Department of Medicine,AGMC & GBP Hospital
/Tripura University, Tripura, India

Dr. Swapan Sarkar [4]
Associate Professor, Department of Medicine,AGMC &GBP Hospital, Agartala,

Abstract:
Introduction: *. Hyponatremia, a very common electrolyte abnormality in hospitalized patients and is defined as a serum sodium level <135 mEq/L. Acute hyponatremia poses an immediate danger to the central nervous system. Hyponatremia can eventually lead to seizure and death depending on magnitude and severity of onset[2,3]. Hyponatremia can be classified on the basis of serum osmolality, volume status and urinary sodium into hypertonic, isotonic and hypotonic types. Hyponatremia may also be classified into Hypervolemic, euvolemic and hypovolemic.* ***Materials and Methods****:This prospective observational study was done on 344 nos of patients in ICU of Agartala Government Medical College & GBP Hospital.****Results****: The proportion of patients having hyponatremia among ICUadmitted patients in this study was found to be 27.9%. Majority of the patients (62.7%) were in the age group of 41- 60 years.Out of the cases of hyponatremia, 61.5% were male and 38.5% were female. In patients of hypernatremia admitted in ICU, there were more number of patients had End Stage Renal disease(ESRD) under Haemo Dialysis, Chronic Liver disease, Cirrhosis of Liver and Septicemia.By assessing the volume status we found that there were more number of hyponatremia among Hypervolemic patients (51%) followed by Hypovolemia (26%) and Euvolemia (22.9%).****Conclusion:*** *Hyponatremia is a very common clinical manifestation in patients admitted in icu.When we assess the clinical features among the hyponatremic patients we found that hyponatremia is maximally associated withdrowsiness (62.50%) followed by nausea (59.40%), confusion (41.66%), altered sensorium / behaviour (31.25%) and convulsion (5.20%).*

Key Words: *Hyponatremia,Serum Osmolality,Hypervolemic,Euvolemic,Hypovolemic,ESRD.*

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I. Introduction:

Hyponatremia, a very common electrolyte abnormality in hospitalized patients andis defined as a serum sodium level <135 mEq/L.Both total body sodium and total body water determine the serum sodium concentration. Acute hyponatremia poses an immediate danger tothe central nervous system. The rapid shift of fluidsassociated with this condition frequentlyresults in brain edema. Administration of hypotonic maintenance fluids may worsen this edema.Hyponatremia can eventually lead to seizure and death depending on magnitude and severity of onset[2,3]. Hyponatremia can be classified on the basis of serum osmolality, volume status and urinary sodium into hypertonic, isotonic and hypotonic types. Hyponatremia may also be classified into Hypervolemic, euvolemic and hypovolemic as follows [4]: Hypovolemic hyponatremia: Decreased total body sodium and decreased total body water. The sodium deficit exceeding water deficit. Euvolemic hyponatremia: Normal body sodium with increase in total body water. Hypervolemic hyponatremia: Increase in total body sodium with greater increase in total body water. The treatment ofhyponatremia depends on the duration of hyponatremia and volume status of the patients. There is serious neurologic sequel if hyponatremia is inappropriately treated. Hyponatremia is one of the commonest electrolyte disturbances plaguing hospital

admitted patient's at any point of time[5,6].It is a common problem encountered in patients presenting with non specific symptoms[7]. It is defined as a serum sodium concentration less than 135mEq/L. Hyponatremia is subdivided diagnostically into 3 groups depending on clinical history and volume status, i.e.; hypovolemic, euvolemic and hypervolemic[8].This disorder is almost always the result of an increase in circulating AVP and/or increased renal sensitivity to AVP, combined with an intake of free water. The clinical presentation has a wide spectrum, varying from asymptomatic patients to oneshaving seizures and coma[9]. This study is done to know the common clinical features and etiology of hyponatremia in ICU patients and study the outcome of such patients. Unless addressed meticulously, the prognostic implications aregrave and far reaching[10]. It is particularly common in intensive care unit (ICU) where both access to water and renal handling are impaired incritically ill patients often afflicted with multi organ system failure, contributing to substantial morbidity and mortality [11]. As both hyponatremia and hypernatremia can cause substantial morbidity andmortality, ironically incorrect diagnosis and treatment can add to the problem [12]. However early detection and management alters prognosis drastically [13]. This type of study is not undertaken in our hospital, so this study is done to know the impact of hyponatremia in health and its etiology.Sodium- related disorders (both hyponatremia and hypernatremia) are extremely common and are associated with considerable morbidity and mortality [14].Hyponatremia is the most common electrolyte disorder, reported in up to 6% of hospitalized patients. Mild hyponatremia(plasma sodium 125–135 mmol/l) is found in as many as 15%–30% of hospitalized patients, with an average of about 25% of Intensive Care Unit (ICU) patients experiencing this disorder [15]. Moderate to severe hyponatremia, especially which is rapid in onset, is associated withconsiderable morbidity and mortality. Despite the awareness on hyponatremia since long time, this common disorder remains an enigma due to its association with a plethora of underlying disease states and its multiple etiologies with different pathophysiological mechanisms[16].Hyponatremia, which is defined as the plasma sodium concentration of <135 mEq/L, occurs primarily due to imbalance in water homeostasis, antidiuretic hormone (ADH) regulation, and renal handling of filtered sodium. Syndrome of inappropriate ADH secretion (SIADH), a common cause of hyponatremia, is associated with many clinical conditions. These include neoplasia, central nervous system (CNS) disorders, drugs andpulmonary diseases [16].Timely diagnosis andtreatment is the key to improved neurological status and reduced hospitalstay. 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.

Aim & Objectives: To detect hyponatremia among patients admitted in medical ICU of Agartala Government Medical College & GBP Hospital.and to study its etiology. To find out the proportion of patients admitted in ICU having hyponatremia and to study the etiology of hyponatremia among these patients.

Inclusion and Exclusion Criteria: Patients admitted in the ICU; age more than 18 years. Patients were followed up during their ICU stay.Post operative patients.Patients who maynot give consent.

II. Materials and Methods:

Methodology: Patients admitted in ICU fulfilling the Inclusion and ExclusionCriteriawere selected. The study group was informed regarding the aim of study and informed consent was taken.

a. Among all fresh admitted patients of last 24 hours (from 12 pm to 12pm) in ICU one was selected by lottery method.
b. Informed consent was taken through the prepared proforma from each patient/attendants.
c. The data was analyzed using appropriate statistical tests.
d. This is an observational study conducted on a series of randomly selected patients admitted in ICU with Hyponatremia and Non- Hyponatremia during one and half years period.
e. Finally the clinical evaluation of volume status was observed and classified as hypovolemic hyponatremia, euvolemic hyponatremia and hypervolemichypernatremia.
f. Parameters for the presence of acute renal failure, ventilator support with days duration of ICU present was recorded as observationaldata.
g. Male female ratio, complication was analysed.

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed bySPSS (version 25.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests. One- way analysis of variance (one-way ANOVA) was a technique used to compare means of three or more samples for numerical data (using the F distribution). A chi-squared test ($\chi 2$ test) was anystatistical hypothesis test wherein the sampling distribution of

the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. Explicit expressions that can be used to carry out various t-tests are given below. In each case,the formula for a test statistic that either exactly follows or closely approximates a t-distribution under the null hypothesis is given. Also, the appropriate degrees of freedom are given in each case. Each of these statistics can be used to carry out either a one-tailed test or a two-tailed test. Once a t value is determined, a p-value can be found using a table of values from Student's t- distribution. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis.p-value ≤ 0.05 was considered for statistically significant.

III. Sampling Method:

STUDYDESIGN: Cross-sectionalStudy.
TYPE OF STUDY: Observational Study. **STUDY SETTING:** Study was conducted in the ICU of Agartala Govt. Medical College& GBP Hospital.
STUDY DURATION: One and halfyears, with effect from January 2018 to June 2019. **SAMPLE SIZE CALCULATION:**
N= 4pq / L 2N= Sample Size.
P= Prevalence of hyponatremia among ICU patient's is 22.5% [10]. Q= 100- P=77.5%
L=Allowable error = 20% of P = 4.5% Here L= Allowable error = 20 % of P = 4.5 So, N = 4 x 22.5 x 77.5 / (4.5)2 = 344.
So, total sample size = 344 (Minimum sample size)
SAMPLING METHOD: Simple random sampling (by lottery method)

IV. Results & Observations:

Age in Years	Frequency	Percent
≤30	12	3.5%
31 to 40	54	15.7%
41 to 50	103	29.9%
51 to 60	113	32.8%
61 to 70	52	15.1%
71 to 80	10	2.9%
Total	344	100.0%

Table 1: Distribution of Age in Years

Group	Frequency	Percent
Hyponatremia	96	27.9%
Non- Hyponatremia	248	72.1%
Total	344	100.0%

Table 2: Distribution of Group

Hyponatremic Group	Frequency	Percent
Euvolemia	22	6.4%
Hypervolemia	49	14.2%
Hypovolemia	25	7.3%
Non- Hyponatremic Group	248	72.1%
Total	344	100.0%

Table 3: Distribution of Hyponatremia Group

Sex	Frequency	Percent
Female	160	46.5%
Male	184	53.5%
Total	344	100.0%

Table 4: Distribution of Sex

Clinical Features	Frequency	Percent
Nausea	75	59.40%
Drowsiness	60	62.50%
Confusion	40	41.66%
Convulsions	5	5.20%
Altered Sensorium	30	31.25%
Asymptomatic	15	15.62%
Total Hyponatremic patients	**96**	

Table 5: Distribution of Clinical Features among Hyponatrimia Patients

	StudyGroup	Number	Mean	SD	Minimum	Maximum	Median	p- value
S. Na +	Hyponatremia	96	122.2500	6.7543	107.0000	131.0000	122.5000	<0.0001
	Non- Hyponatremia	248	137.9597	2.6355	135.0000	145.0000	137.0000	

Table 6: Distribution of mean S. Na+ in hyponatremia

	Study Group	Number	Mean	SD	Minimum	Maximum	Median	p-value
Serum Osmolality	Hyponatremia	96	265.1363	16.9449	224.0000	296.5000	264.4150	<0.0001
	Non-Hyponatremia	248	288.4284	5.5887	280.1000	304.2000	287.0000	

Table 7: Distribution of mean SerumOsmolality in hyponatremia

	Study Group	Number	Mean	SD	Minimum	Maximum	Median	p-value
S. Albumin	Hyponatremia	96	3.6868	.6314	2.1000	4.6800	8000	0.0001
	emia	231	3.8952	.2878	2.8000	4.4000	0000	

Table 8: Distribution of mean S. Albuminin hyponatremia

V. Discussions:

Observations have been made in 344 ICU admitted patients. After obtaininghistoryand investigations cases are discussed, findingsare analysed and compared with similar studies. The proportion of patients having hyponatremia among ICU admitted patients in this study was found to be 27.9%. This is similar to the results obtained in the study conducted by Babaliche Pet al (22%), Vora CS et al (22%).

After comparing the baseline characteristics of patients with Hyponatremia it was found that age of the patient was significantly associated with hyponatremia ($p<0.001$). Majority of the patients(62.7%) were in the age group of 41-60 years. This is similar to the results obtained in thestudyconducted by Vora CS et. Al, Patni M et al.

Out of the cases of hyponatremia, 61.5% were male and 38.5% were female. However sex of patient had no statistically significant association with hyponatremia in this study ($P=0.0652$).In patients of hypernatremia admitted in ICU, there were more number of patients had End Stage Renal disease under Haemo Dialysis, Chronic Liver disease, Cirrhosis of Liver and Septicemia. Similar result has been obtained in the study conducted by Vora CS et. al, PatniM et. al, Patnis et. al.

By assessing the volume status we found that there were more number of hyponatremia among Hypervolemic patients (51%) followed byHypovolemia (26%) and Euvolemia (22.9%).

It was found that in hyponatremia, the mean serum sodium (mean± s.d.) of patients was 122.2500 ± 6.7543. In normal, the mean serum sodium (mean± s.d.) of patients was 137.9597 ± 2.6355. Distribution of mean serum sodium amonghyponatremic patientswas statistically significant($p<0.0001$).

We found that in hyponatremia, the mean serum osmolality (mean± s.d.) of patients was 265.1363± 16.9449. In normal, the mean serum osmolality (mean± s.d.) of patients was 288.4284

± 5.5887. Distribution of mean serum osmolality among hyponatremic patients was statistically significant ($p<0.0001$).

It was found that in hyponatremia, the mean serum albumin (mean± s.d.) of patients was 3.6868 ± 0.6314. In normal, the mean serum albumin (mean± s.d.) of patients was 3.8952

±0.2878. Distribution of mean serum albuminamonghyponatremic patients was statistically significant ($p=0.0001$).

When we assess the clinical features among the hyponatremic patients we found that hyponatremia is maximally associated with drowsiness (62.50%) followed by nausea (59.40%), confusion (41.66%), altered sensorium

/ behaviour (31.25%) and convulsion (5.20%). Similar results obtained in the study conducted by Padhi R et. al, Patnim et. al.

VI. Conclusion:

To conclude, within a period from January 2018 to June 2019, a total number of 344 patients were enrolled and studied. After obtaining a complete history and physical examination, they were subjected to CBC, KFT, LFT Lipid Profile, S. Electrolytes. BUN and serum osmolality were calculated. All the values were analysed and following results were obtained. Among 344 subject 27.9% were found to have hyponatremia. People between the age of 41 - 60 years are mostly affected with hyponatremia, although there is no significant association with sex seen. Disease prevalent in hyponatremic groups are CLD, Cirrhosis, ESRD, Septicemia, Drug induced hypontremia and Diuretic induced hyponatremia. Among hyponatremicpatients

22.9 % are Euvolemic , 51 % are Hypervolemic and 26% are Hypovolemic. So, in my study maximum numbers of patients are found to haveHypervolemic Hypernatremia.

Serum uric Acid, Serum K+, TLC, Platelet count, S. Bilirubin, TGS, LDL Cholesterol also taken into consideration, but they are unable to show any statistically significant association.

Blood urea, Serum Creatinine, Serum Na+, Blood Glucose, Serum Osmolality, Hb%, Total Protein, Serum Albumin are also taken into considerationand statistical analysis shows significant association with hyponatremicgroups.

The most common etiology of hyponatremia in the present study was Hypervolemic hyponatremia mostly related to CLD, Cirrhosis and ESRD. Evaluating the cause of hyponatremia is veryimportant, as treating the underlying cause would prevent considerable morbidity and mortality associated with this enigmatic electrolyte disorder.

VII. Limitations:

This cross sectional study was unable to find out hyponatremia in surgical patients aspost- operative patients are excluded from this study. Urine Sodium (Na+) and urine osmolality also used to evaluate hyponatremia but due to lack offacilities, these tests were not undertaken in thisstudy.
Hypernatremic patients were not evaluated in thisstudy.

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