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Clinical Profile Of Patients With Hyponatremia Admitted In Medical ICU.

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Abstract:
BACKGROUND: Hyponatraemia is the most common electrolyte disorder among hospitalised patients occurring in upto 22% of them and has been associated with increased mortality. There is scarce data about the clinical
profile of hyponatraemia in Indian ICU settings. David B Mount defined hyponatraemia as a serum sodium concentration (Na+) less than 135 mEq/L. MATERIALS AND METHODS
This prospective observational hospital-based study was conducted from September 2015-March2017 at Sri Aurobindo Medical College & Post Graduate Institute, Indore (M.P.). A total of 100 cases with serum sodium level <135mEq/L were studied. History and clinical examinations were recorded in all patients. Necessary laboratory and radiological investigations were done.
Results:
The incidence of hyponatraemia in our study was 7.1 percent, 60 cases were males and 40 cases were females. Hyponatraemia was commonly observed in the age group of 35-50 years in both the groups.
Two-third (61.0%) patients with hyponatremia were diagnosed with specific diseases of which chronic liver diseases was commonest whereas one-third (39.0%) patients of hyponatremia were found with non- specific disease. 38 patients had euvolemia, 35 patients had hypervolemia and 27 patients had hypovolemia. The mortality was found to be 6% in this study and was found to be higher in hypovolemic hyponatraemia group.
Conclusion:
Hyponatremia was more common in the age group 20-80 years. Most of the patients in the present study were found to have euvolemic hyponatremia (38%).The majority of the patients in the present study were noticed to have underlying neurological causes. Among neurological causes, cerebrovascular episode and seizure disorder were commonest. The mortality associated with hyponatremia in the present study was 6%. The mortality was higher in Hypovolemic hyponatremia. The type of hyponatremia among patients may be considered as the significant indices of recovery pattern and outcome.
Keywords*: Hyponatraemia, Euvolemia,Hypovolemia, Hypervolemia.*

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I. Introduction

Sodium-related disorders (both hyponatremia and hypernatremia) are extremely common and are associated with considerable morbidity and mortality.[1]Hyponatraemia is the most common electrolyte disorder among hospitalised patients occurring in upto 22% of them.[1]Mild hyponatremia (plasma sodium 125–135 mEq/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.[2] Moderate-to-severe hyponatremia, especially which is rapid in onset, is associated with considerable 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.[3]

David B Mount defined hyponatremia as a electrolyte disorder in which serum sodium concentration becomes (Na+)less than 135mEq/L .[4]It 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 and pulmonary diseases.[3]

Hyponatraemia is subdivided diagnostically into three groups on clinical history and volume status.[5]

1. Hypovolemic hyponatraemia.
2. Euvolemichyponatraemia.
3. Hypervolemichyponatraemia.

II. Why This Study

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, the present study was undertaken to assess the clinical profile and etiology of clinically significant hyponatremia, not only to aid in the treatment of patients but also to prevent further morbidity and mortality.

The study isanalysedon the following parameters:

1) Incidence of hyponatraemia in Medical ICU settings.
2) Hyponatraemia in relation to age and sex of patients.
3) Causes and presenting symptoms of patients withhyponatraemia.
4) Recovery pattern and outcome of hyponatremia.

III. Sampling And Study Design

It was a prospective observational study included 100 patients admitted in ICU with hyponatremia. This study was conducted from September 2015 to March 2017 at Department of Medicine, Sri Aurobindo Medical College & Post Graduate Institute, Indore (M.P.).

The inclusion criteria comprised of all diagnosed cases of hyponatremia without symptoms of peripheral vascular disease, patients admitted with serum Na levels <135 mEq/L, patients who developed hyponatremia during hospitalization were also included in the study, patients of both genders were included in the study, patients of age 18 year and above were studied. The exclusion criteria comprised of cases of age < 18 years.

InstrumentationThe selected socio-demographic, various causes and symptoms, and recovery pattern and outcome of hyponatremia were analyzed statistically and types of hyponatremia may be associated with assessment of liver function test, and recovery pattern and outcome among patients with hyponatremia were carried out. However, these socio-demographic and other factors had analyzed in order to evaluate the causes, symptoms and recovery pattern and outcome among studied patients suffered from hyponatremia.

Overall, the study group had analyzed for hyponatremia in order to evaluate the prevalence of types of hyponatremia, clinical significance and the association of types of hyponatremia with liver function test, and recovery pattern and outcome

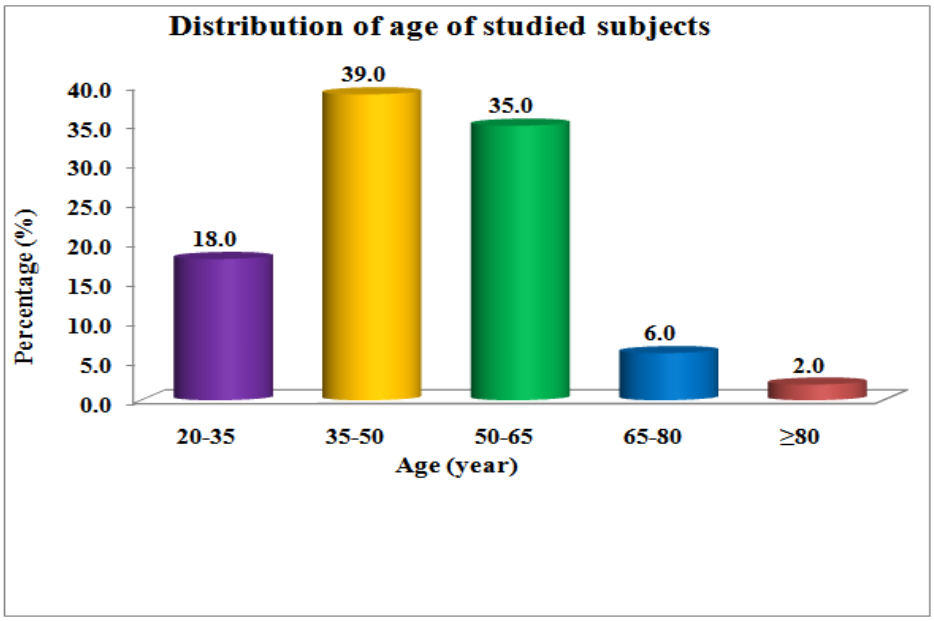
IV. Statistics And Data Analysis

Ethical clearance was obtained from the Institutional Ethical Committee. After explaining the purpose of the study, written consent was obtained from the patients before data collection. Data were recorded in a predesigned and pretested proforma. The data were coded and entered into Microsoft Excel Worksheet. The categorical data were expressed as rates, ratios, and proportions and the continuous data were expressed as mean ± standard deviation but results on categoricalmeasurements are presented in numbers (%). The comparison of categorical data was performed using Non-parametric test, Pearson's Chi-Square test. Statistical software, SPSS version 17.0 Trial was used for analysis. Prevalence of an outcome variable along with 95% confidence limits was calculated.

V. Observations And Results

The incidence of hyponatraemia in our study was 7.1%. The mean age of patients was 46.57±13.23 years. The spread of mean age (mean ± standard deviation) of male patients with hyponatremia was found to be 49.63±11.97 years with a range from 23 to 85 years found to be little greater as compared to age of female patients (41.98±13.83 years) noted within range from 20 to 75 years. The age wise distribution of subjects is depicted in following table.

Table 1:- Age wise distribution of subjects:



Analysis indicates that more than one-third (39, 39.0%) of the patients with hyponatremia belonged to age group of 35-40 years and that was followed by 35 (35.0%) patients noticed within age group of 50-65 years. The lower age group of 20-35 years comprised of 18 (18.0%) patients who had hyponatremia while the upper second age group of 65-80 was observed with few (6, 6.0%) patients with hyponatremia. The higher age group of more than or equal to 80 years included very few (2 2.0%) patients with hyponatremia who participated in the present study.

Table 2: Gender wise distribution of subjects:

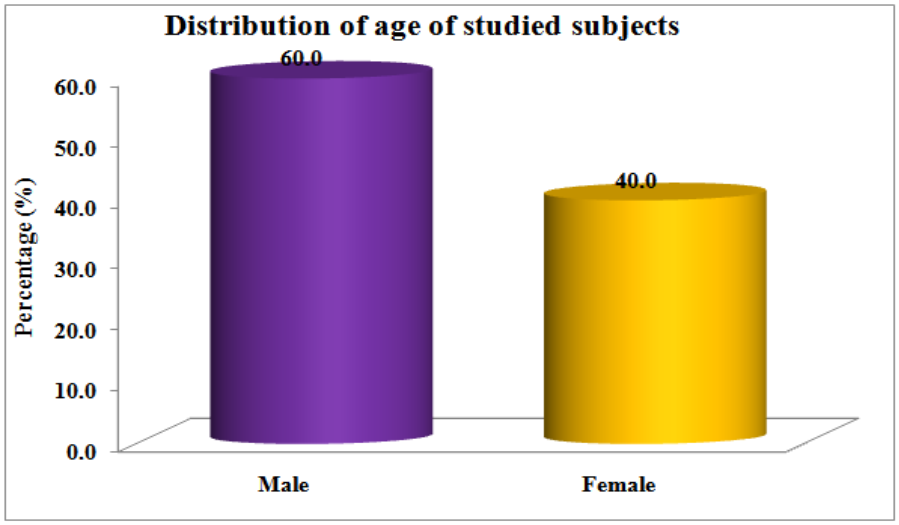
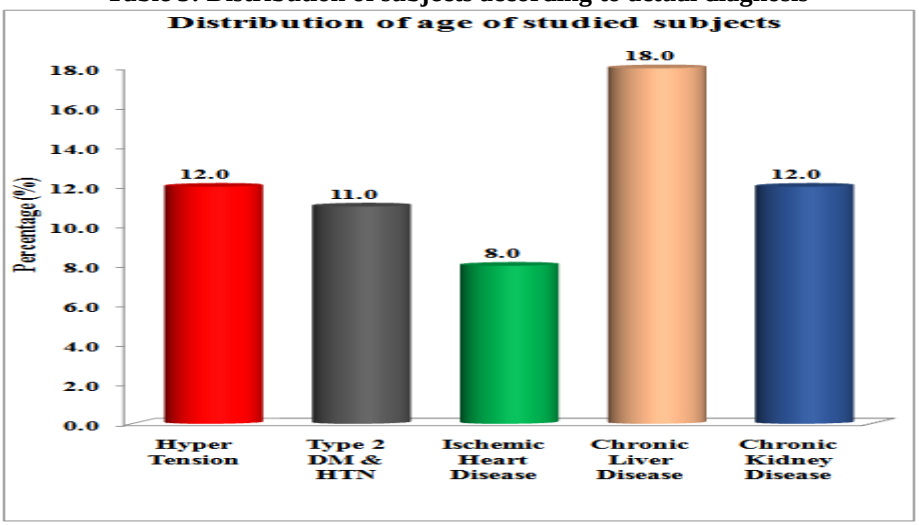


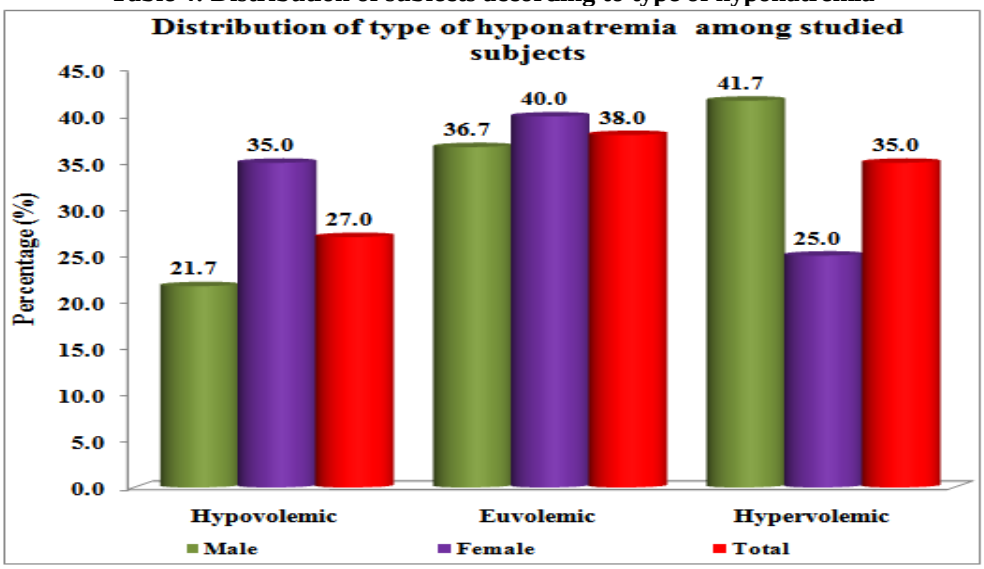
Table showed that approximately two-third (60.0%) of the patients were males who were screened for hyponatremia. Rest more than one-third (40.0%) patients were females.

Table 3: Distribution of subjects according to actual diagnosis



Analysis show that approximately two-third (61.0%) patients with hyponatremia were diagnosed with specific diseases such as hyper tension, type 2 diabetes mellitus, ischemic heart disease, chronic liver disease and chronic kidney disease.It was noticed that more than one third patients who had hyponatremia were diagnosed with non-specific diseases. Major proportion (18.0%) of population of hyponatremia patients had chronic liver diseases and that followed by each 12 (12.0%) patients diagnosed with specific disease was considered. Larger proportion (39.0%) of hyponatremia patients were found to have nonspecific disease such as MVP/AF (recovered)/COPD, PUO/Lt supraclavicular lymphadenopathy/Sensory Motor Neuropathy, Dilated Cardiomyopathy/Severe MR/Severe TR/Mild Pericardial Effusion, Drug Induced Lupus, Severe Acute Pancreatitis/ALI, UTI, AKI/Septicemia, etc.

Table 4: Distribution of sublects according to type of hyponatremia



The analysis indicates that 14 (35.0%) female patients were diagnosed with hypovolemia as compared to 13 (21.7%) male patient's from a total of 27 (27.0%) patients with hyponatremia. A total of 38 (38.0%) patients were categorized as euvolemic. Twenty two (36.7%) patients were males as compared to 16 (40.0%) patients who were females. Hypervolemichyponatremia was found to be more common among male (25, 41.7%) as compared to female (10, 25.0%) patients. Hypervolemichyponatremia was found to be prevalent among 35 (35.0%) of total studied cases.

Table 7: Association of type of hyponatremia of patients with assessment of liver function test

Type of Hyponatremia	Liver Function Test		Total
	Deranged	Normal	
Hypovolemic	1 4.8%	26 32.9%	**27** **27.0%**
Euvolemic	0 0.0%	38 48.1%	**38** **38.0%**
Hypervolemic	20 95.2%	15 19.0%	**35** **35.0%**
Total	**21** **100.0%**	**79** **100.0%**	**100** **100.0%**

$\chi_2^2 = 42.53$ and p<0.001 #

Statistical analysis shows that the LFT's of patients has a strong relation with categories of hyponatremia. Moreover, LFT's was found to be more deranged in hypervolemic patient as compared to hypovolemic and euvolemic. Overall, the association of type of hyponatremia with assessment of liver function test was found to be statistically significant (P<0.001).

Table 9: Association of type of hyponatremia of patients with recovery pattern and outcome

Type of Hyponatremia	Recovery Pattern and Outcome		Total
	Discharged	Died	
Hypovolemic	22 23.4%	5 83.3%	**27** **27.0%**
Euvolemic	38 40.4%	0 0.0%	**38** **38.0%**
Hypervolemic	34 36.2%	1 16.7%	**35** **35.0%**
Total	**94** **100.0%**	**6** **100.0%**	**100** **100.0%**

$\chi_2^2 = 10.54$ and p<0.005 #

Recovery pattern and outcome showed that the all patients who developed euvolemichyponatremia were discharged (38, 40.4%) as compared to hypervolemic (34, 36.2%) and hypovolemic (22, 23.4%). Death was observed amongst 5 (83.3%) cases of hyponatremia that developed hypovolemia as compared to 1 (16.7%) case of hyponatremia who developed hypervolemia while no death was observed amongst euvolemic patients. However, the differences in proportion to judge the association of type of hyponatremia with recovery pattern and outcome test was found to be statistically significant (p<0.001). Further, the statistical analysis indicates that the type of hyponatremia in patient's was found to be the statistically significant factor that impacted strongly the recovery pattern and outcome. Overall, the type of hyponatremia among patients may be considered as the significant indices of recovery pattern and outcome.

VI. Discussion

Despite being a commonly observed electrolyte imbalance, hyponatremia is incompletely understood. Its association with a plethora of underlying disease states and its multiple etiologies with differing pathophysiological mechanisms makes diagnosis challenging.[6] This study was as an attempt to describe the clinical profile of patients with hyponatremia in medical ICU.

In our study,100 patients admitted in ICU with hyponatremiawere evaluated for various causes, symptoms, and recovery pattern and outcome while the collected data for this observational study was further analyzed statistically.

Distribution of cases, according to baseline characteristics:

The most commonly observed characteristics were altered sensorium and chronic liver disease which were statistically significant. Chronic liver disease was commonly observed in patients of severe hyponatremia.[7]**However Panicker, Georgy Itty, S. Joseph et al(2014)** stated that once the level ofserum sodium goes below 125 mEq/L, neurologic symptoms occur.Clinical signs such as altered sensorium are seen in patients with serum sodium levels below 125 mEq/L[8]

Distribution of cases of according to type of hyponatremia:

The hydration status of the patients was diagnosed on the basis of clinical examination and was subdivided into euvolemic, hypovolemic and hypervolemic states. 38 patients had euvolemia, 35 patients had hypervolemia, & 27 patients had hypervolemia. Thus, as is evident, euvolemichyponatremia was most

common.**Similarly Nandakumar, Hiremath P. B et al (2010)**, stated that the most common type of hyponatremia was euvolemichyponatremia , found in 54 % cases most common cause was SIADH.[9]**However,AqeelRaheem,AL-Barqawi et al (2007)**, found that euvolemichyponatremia was the most common comprising (52%) of total cases. This correlates well with our study.[10]These findings correlates well with our study.

Age wise distribution:

Age group of cases was between 20-80 years. The underlying systemic diseases like diabetes mellitus, CVA, liver cirrhosis are common in this age group. Hyponatremia was noted at all ages. **Whereas, AqeelRaheem,AL-Barqawi et al (2007)**, in their study observed age group of 16-90 years and the age group most affected was 46-60 years. [10]**RAHIL A I, KHAN F Y et al (2009)** in their study observed age group of 17-93 years.[11]Thiscorrelates well with our study.

Gender wise distribution :

Of total 100 cases, males constituted 60 cases & females constituted 40 cases. Male to Female ratio was 1.5:1. In general, in our hospital population, there were more males than females. Hence, this increase in males was not very significant. This ratio was more or less constant in all age groups.**Similarly, Nandakumar, Hiremath P.B et al (2010)**, stated 44 cases (36.7%) were females and 76 cases (63.3%) were males.[9]**However,AqeelRaheem,ALBarqawi et al (2007)**reported 56% were female, while 44% were male patients.[10]**NandiniChatterjee, NilanjanSengupta et al (2012)**, reported 126 cases (62.69%) were male patients and 75 (37.31%) were female patients.[12]**Rahil A I, Khan F Y et al (2009)** reported 33 cases were males (62.3%) and 20 cases were females (37.7%).[11]Our study correlates well with all these studies.

Distribution of cases according to comorbid conditions of patients:

In our study, Hypertension (12%) and diabetes mellitus (11%) were commonest comorbid conditions in cases of hyponatremia which was statistically significant as compared to other comorbid conditions.**Similarly, J. R. Rawal 1, H. S. Joshi et al (2013)** observed the common comorbidities asHypertension (64.22%), Diabetes mellitus (32.41%), Ischemic Heart Disease (67.42%) and Valvular Heart Disease (10.5%).[13]The comorbid conditions were higher in this study as it was conducted in critical care unit only.The study was limited to heart failure patients admitted in ICU. **However, Nandakumar, HiremathP.B et al (2010)**, observed that the elderly cases were more likely to have comorbid conditions such as diabetes, hypertension and ischemic heart disease.Thiscorrelates well with our study.[9]

SumitMohan , Sue Guet al (2013) noted that hyponatremia was more common in subjects with hypertension, diabetes, coronary artery disease, stroke, chronic obstructive pulmonary disease, cancer, and psychiatric disorders, and less common in those with no comorbidities. ($P<0.001$)[14] Our study correlates well with these studies.

Distribution of cases according to urinary sodium in types of hyponatremia:

The mean Urinary Sodium in Hypovolemic Hyponatremia came out to be 60± 34.01. In cases of EuvolemicHyponatremia it came out to be 118.92 ±20.60 while that of HypervolemicHyponatremia came out to be 311.97±112.48.

Distribution of cases according to mortality associated with severity of hyponatremia:

In this present study, the mortality was 6%. Among 27 patients of Hypovolemic Hyponatremia 5 patients died. Among HypervolemicHyponatremia death was observed in 1 patient only. In EuvolemicHyponatremia no death was observed

Similarly, Rahil A I , Khan F Y et al (2009) reported mortality as 11.3%, which correlates with our study[11]**However, Liviu Klein, Christopher M. O'Connor et al(2005)**found that lower serum sodium was associated with higher inhospital and 60-day mortality. However we studied only in hospital mortality. Follow up of discharged cases was not done[15]

VII. Conclusion

Hyponatremia is the commonest electrolyte abnormality in hospitalized patients. Hyponatremia was more common in the age group 20-80 years. The majority of the patients in the present study were noticed to have underlying neurological causes. Among neurological causes, cerebrovascular accident was the commonest. Other comorbid conditions noted, were diabetes mellitus, systemic hypertension

Most of the patients in the present study were found to have euvolemichyponatremia (38%). Among neurological causes cerebrovascular episode and seizure disorder were commonest. The mortality associated with hyponatremia in the present study was 6%. The mortality was higher in Hypovolemic hyponatremia

Of total 100 cases, male constituted 60 cases & female constituted 40 cases. Male to Female ratio was 1.5:1. This was attributed to proportionate admissions of male and female cases. This ratio was more or less constant in all age groups. Most of the patients in the present study had underlying neurological disease. Euvolemichyponatremia was commonest which was followed by Hypervolemichyponatremiaand Hypovolemic hyponatremia .

Out of 100 cases of Hyponatremia 94 patient got discharged/recovered and 6 patient died. Liver Function tests were deranged in 21 while it was normal in 79 cases.

Hence, to conclude, a thorough understanding of the pathophysiological process of hyponatremia and its associated risk factors is of great importance in prompt and effective treatment of this potentially life-threatening condition. The type of hyponatremia among patients may be considered as the significant indices of recovery pattern and outcome.

VIII. Recommendation

Clinicians need to be aware about the common occurrence of hyponatremia, its early identification, and its association with a large variety of diseases. In developing nations, like India, TB is still a common health hazard, remains latent, and can often present only as symptomatic hyponatremia. Therefore, evaluating for the cause of hyponatremia is equally important, as treating the underlying cause would prevent considerable morbidity and mortality associated with this enigmatic electrolyte disorder.

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Conflicts of interest
There are no conflicts of interest.

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