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Hyponatraemia – A Camouflaged Killer in Critically Ill Patients

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Abstract

Background: Hyponatraemia is the commonest electrolyte abnormality encountered in hospitalised patients. It is classified into euvolaemic, hypovolaemic, and hypervolaemic hyponatraemia.

Aim: The present study was designed to determine the presence of hyponatraemia, its subtype and also the outcome associated with each type mentioned above.

Materials and methods: A prospective observational hospital-based study which included 150 admitted patients who had hyponatraemia, was undertaken after ethical clearance and with informed consent. The study period was for 1.5 years from December, 2015, to April, 2017.

Results: In this study 150 patients of hyponatraemia were enrolled, irrespective of the cause of admission and diagnosis. 62 (41.3%) patients were diagnosed to have hypovolaemia, 42 (28%) patients were diagnosed to have hypervolaemia, 46 (30.6%) out of 150 patients were classified to have euvolaemic hyponatraemia. Mortality rate was higher in patients with hypervolaemic hyponatraemia as compared to hypovolaemic and euvolaemic hyponatraemia (p - value < 0.005). Most patients with euvolaemic hyponatraemia had a shorter duration of hospital stay, as compared to patients with hypovolaemic and hypervolaemic hyponatraemia (p - value < 0.005).

Conclusion: There is a significant association of hyponatraemia and its type with increased duration of hospital stay and mortality in admitted patients. Hence, timely recognition of hyponatraemia and volume status of the patient helps significantly in reducing the morbidity and mortality in admitted patients.

Key words: Hyponatraemia, hypovolaemic, hypervolaemic, euvolaemic.

Introduction

Hyponatraemia is defined as plasma sodium concentration < 135 meq/l and it is the most common electrolyte disturbance encountered in hospitalised patients as it occurs in 22% of hospitalised patients[1]. The incidence of hyponatraemia in the Indian setup has been found to be much more than mentioned in western literature[2]. Hyponatraemia has a wide clinical spectrum varying from absence of symptoms to seizures, coma and death. Nausea and malaise are the earliest findings and may be seen when the plasma sodium concentration falls below 125 to 130 mmol/l. This may be followed by headache, lethargy, obtundation, and eventually seizure, coma and respiratory arrest if the plasma sodium concentration falls below 115 to 120 mmol/l. Thus hyponatraemia is called severe when the serum sodium level falls below 125 mmol/l[3]. Hyponatraemia is subdivided diagnostically into hypovolaemic hyponatraemia, euvolaemic hyponatraemia and hypervolaemic hyponatraemia[1].

As the health care needs of the population are increasing day by day, the number of hospital admissions have increased considerably in the past few decades. Electrolyte abnormalities, though often neglected, have been important causes that influence morbidity and mortality in patients who have been admitted with various disorders. Since, it is an easily detectable and correctible electrolyte abnormality, its causes in the individual patient need to be ascertained carefully, and it should be managed appropriately to prevent morbidity as well as mortality.

Methods

The present study was designed after taking approval from the institutional ethics committee. It was a prospective observational hospital based study conducted at the department of Medicine, Smt Sucheta Kripalani Hospital and LHMC, New Delhi from November 2015 to March 2017. After taking informed consent, 150 consecutive subjects of age more than 18 years, with a serum sodium level less

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than 135 meq/l were included from among the indoor patient department, irrespective of the cause of admission and diagnosis (Table I). Patients who did not consent were excluded from the study.

Serum sodium levels were measured on a daily basis using potentiometric method with an ion sensitive electrode.

Normal sodium levels: 135 - 145 meq/l.

Mild hypnoatraemia: 130 - 135 meq/l.

Moderate hyponatraemia: 125 - 130 meq/l.

Severe hyponatraemia: < 125 meq/l.

Acute hyponatraemia: Hyponatraemia lasting for < 2 days (48 hours)[1].

Chronic hyponatraemia: Hyponatraemia lasting for more than 2 days (48 hours)[1].

Hypovolaemic hyponatraemia was considered by the presence of symptoms and signs of dehydration, i.e., dry skin and tongue, increased thirst, oliguria, tachycardia, decreased JVP, cyanosis, altered mental status[1].

Hypervolaemic hyponatraemia was considered by the presence of symptoms and signs of volume overload, i.e., dyspnoea, orthopnoea, sudden increase in weight, swelling in the face, legs and arms, fluid in the abdomen (ascites), crepitations on chest auscultation (pulmonary oedema), raised JVP, and elevated pulse pressure[1].

Euvolaemic hyponatraemia was diagnosed if there were no signs of hypervolaemia and hypovolaemia[1].

Statistical analysis

Statistical analysis was done after entering Data in Microsoft Excel and then using SPSS 16.0 Version. Descriptive Data were expressed as mean ± Standard deviation for quantitative variables and percentages for qualitative variables. The correlationof hyponatraemia with morbidity and mortality was calculated using Pearson's correlation co-efficient and was considered significant if p - value < 0.05. Chi square analysis was done to find out association between the independent variables and outcome variable.

Results

Out of 150 patients, most belonged to 30 - 50 years age group. Mean age was calculated as 48.93 years. 88 (58.6%) were female and 62 (41.33%) males. Mean sodium concentration in males was 128.32 ± 5.127 meq/l while it was 126.94 ± 6.10 meq/l in female, again the difference between two sex groups in terms of mean sodium concentration on day 1 was not significant (p value 0.14 (> 0.05). Mean sodium concentration observed in this study was 127.51 ± 5.744 meq/l. 77 (51.3%) of the patients had a BMI between 18 - 22.9 kg/m^2 with a mean sodium concentration of 126.48 ± 5.81 meq/l , 39 (26%) patients had BMI between 23 - 24.9 kg/m^2 with a mean sodium concentration of 128.775 ± 5.42 meq/l and 34 (22.6%) patients had high BMI of more than 25 kg/m^2 with a mean sodium concentration of 128.28 ± 5.706 meq/l. However, Pearson's co-efficient was calculated to be 0.058 which was showed a very weak co-relation between BMI and mean sodium levels. Mean sodium levels in each sub group of BMI was, hypovolaemic – 127.68 ± 7.23 meq/l, euvolaemic – 127.32 ± 6.81 meq/l, hypervolaemic – 127.61 ± 8.22 meq/l, there was no statistical difference.

62 (41.3%) patients were diagnosed to have hypovolaemia, 42 (28%) patients were diagnosed to have hypervolaemia, 46 (30.6%) out of 150 patients were classified to have euvolaemic hyponatraemia. Headache (81%), vomiting (63%), altered sensorium (34%), seizures (10.6%), coma (6%) were amongst the common symptoms encountered in the study group. Also, there was a strong significant statistical association between vomiting and aetiology of hyponatraemia as 57 out of 62 hypovolaemic patients had vomiting. There was also a significance noted between altered sensorium and type of hyponatraemia where majority of patients who had altered sensorium had hypervolaemic hyponatraemia.

Most patients with euvolaemic hyponatraemia had a shorter duration of hospital stay, as compared to patients with hypovolaemic and hypervolaemic hyponatraemia. A strong association was found between aetiology of hyponatraemia and hospital stay (p value of < 0.005) (Fig. 1 and Table I). Mortality rate was higher in patients with hypervolaemic hyponatraemia as compared to hypovolaemic and euvolaemic hyponatraemia with p value of < 0.005 significant suggesting a strong association (Fig. 2 and Table II). Euvolaemic hypovolaemia is less severe (had a higher mean sodium levels) compared to hypovolaemic and hypervolaemic group (Table III).

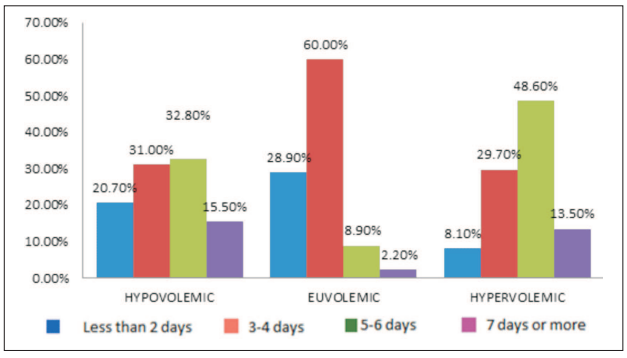
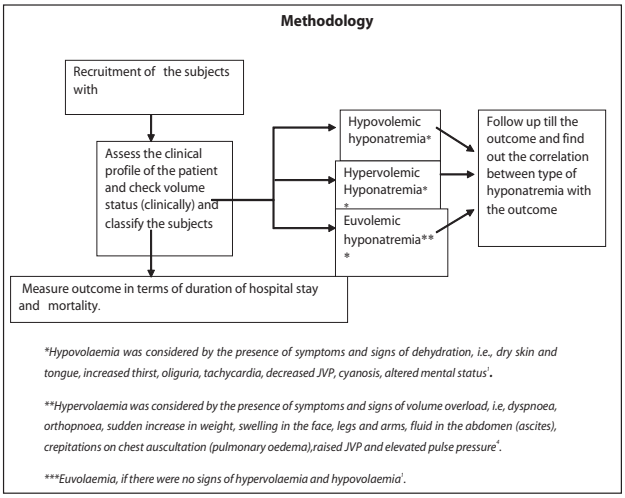


Fig. 1: *Showing association between aetiology and duration of hospital stay.*

Table I: Flow chart showing the methodology of present study.



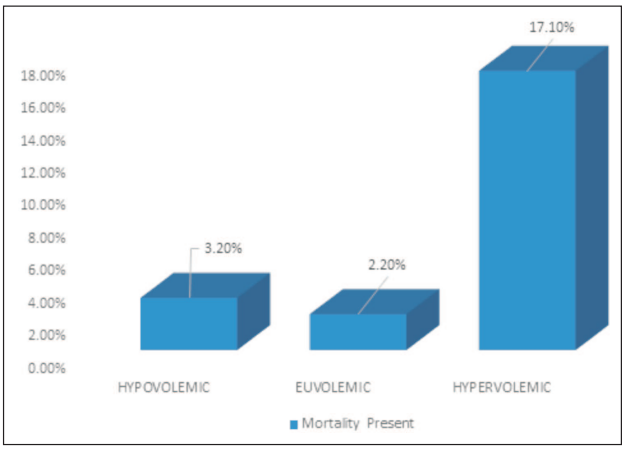


Fig. 2: *Showing association between subtypes of hyponatraemia with mortality.*

Table II: Association between aetiology, mortality, and duration of hospital stay.

Aetiology	Duration of hospitalisation				Mortality	Total
	< 2 days	3 - 4 days	5 - 6 days	>7 days		
Hypovolaemic	12	18	19	9	4	62
	19.3%	29.8%	30.68%	14.5%	6.4 %	100.0%
Euvolaemic	13	27	4	1	1	46
	28.2%	58.6%	8.6%	2.1%	2.1%	100.0%
Hypervolaemic	3	11	18	5	5	42
	7.1%	26.1%	42.8%	11.9%	11.9%	100.0%
Total	28	56	41	15	10	150
	20.0%	40.0%	29.3%	10.7%	6.7%	100.0%

Chi-square = 26.97, df = 6, p < 0.01significant.

Table III: Comprehensive summary of mean sodium concentrations (in meq/l) with type, duration, and aetiology of hyponatraemia.

Aetiology	Acute	Chronic	Mild	Moderate	Severe
Hypovolaemic	127.79 ± 6.304	126.59 ± 9.14	132.05 ± 1.23	127 ± 1.73.	117.78 ± 7.82
Hypervolaemic	127.70 ± 5.86	126.5.87 ± 5.52	131.6 ± 1.15	126.4 ± 1.51.	119.33 ± 2.67
Euvolaemic	127.81 ± 2.48	127.5.42 ± 2.36	131.75 ± 0.955	127.6 ± 1.48	120.5 ± 2.12

Discussion

The present study population consisted mainly of patients with hypovolaemic hyponatraemia. 62 (41.3%) out of 150 patients. This is in contrast with the already available studies by Nandini Chatterjee *et al*[2], Mahim Mittal *et al*[5], and Panickeret *et al*[6], where in euvolaemic hyponatraemia was more common. This could be attributed to:-

1. The increased incidence of dehydration present in hospitalised patients in New Delhi, since it has an average daily temperature of 33° C throughout the year and the maximum temperature recorded during the year 2015 - 2016 (study period) was 47.2° C.
2. Decreased appetite and reduced oral fluid intake, especially significant during critical illness contributing to dehydration. So, a multifactorial causation for hypovolaemia can be present in hospitalised patients.

Data regarding the association between hyponatraemia and hospital stay is scarce. In a study conducted by Berardi *et al*[8], On 105 patients with hyponatraemia a statistically significant correlation was found between hyponatraemia and duration of hospital stay which was also comparable in the present study.Patients with euvolaemic hyponatraemia had a shorter duration of hospital stay compared to patients with hypervolaemic and hypovolaemic hyponatraemia. 14.5% patients with hypovolaemia and 11.9% of them with hypervolaemia stayed for more than 7 days as compared to 2.2% of patients with euvolaemic hyponatraemia. Majority of the patients with euvolaemic hyponatraemia were discharged within 4 days after admission irrespective of the primary diagnosis where as majority of patients with hypovolaemia and hypervolaemia were discharged after 5 days. 50% of the patients who expired had hypervolaemia which was slightly comparable to study done by Mahim Mittal *et al*[5] (62.5% were due to hypervolaemia), 40% of the deaths (4 out of 10 patients were due to severe hypovolaemia and 1 patient was euvolaemic). Fluid overload is related to increased mortality and also leads to several complications like pulmonary edema, cardiac failure,

delayed wound healing, tissue breakdown, impaired bowel function[9] and dehydration in admitted patients is associated with poor outcome as well[10]. Our study found also a significant statistical association between the type of hyponatraemia, duration of hospital stay and mortality rate as well, hence proving that the volume status of hyponatraemic patients is extremely important to determine the prognosis irrespective of the primary disease they have been admitted with.

Limitations of the present study

1. Multifactorial aetiology – The present study divided the aetiological factors broadly into 3 groups; however, multiple factors may be associated with the development of hyponatraemia in a single patient, a factor that was not addressed by the study.
2. The study may have been better if it could have included asymptomatic matched controls with hyponatraemia. However, this group was not considered due to difficulties associated in recognising patients with hyponatraemia.

Conclusion

A strong association was found between aetiology of hyponatraemia, hospital stay, and mortality. Patients with euvolaemic hyponatraemia had a shorter duration of hospital stay and low mortality rate as compared to patients with hypovolaemic and hypervolaemic hyponatraemia. Hence, timely recognition of hyponatraemia and volume status of the patient helps significantly in reducing the morbidity and mortality in admitted patients.

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