

Original Research Article

A study of dysnatremia in patients admitted in medical intensive care unit of a tertiary care teaching hospital

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ABSTRACT

Background: Both dysnatremia at admission and that acquired in the intensive care unit (ICU) have been shown to have a direct influence on prognosis. The present was planned to study dysnatremia in adult patients admitting in medical intensive care unit (MICU).

Methods: The present prospective observational study was conducted on patients admitted in medical ICU over a period of 1 year who developed dysnatremia during ICU stay. Patient's age, sex, diagnosis at the time of diagnosis, comorbidities, serum sodium levels, risk factors, length of ICU stay, and survival status were noted.

Results: Out of total 798 patients during the study period; 207 (25.94%) were found to have hypernatremia and 87 (10.9%) were hyponatremic. In hypernatremic group male/ female ratio was 125/82 and it was 50/37 in hyponatremic group. The mean ICU stay was significantly more in hypernatremic patients (4.76 ± 3.57) compared to hyponatremic group (4.06 ± 2.80). ($p < 0.05$) Mortality in both hypernatremic patients and hyponatremic patients was found significantly more in hypervolemic group which was 84.38% and 53.84% respectively. ($p < 0.05$)

Conclusions: This study concluded that nowadays hypernatremia is more common with longer ICU stay. In both hypernatremia and hyponatremia mortality was found similar without any significant difference.

Keywords: Hypernatremia, Hyonatremia, Hypervolemic, Mortality

INTRODUCTION

Sodium plays an important role as the predominant extracellular cation found in the body and its concentrations are tightly regulated by a number of homeostatic biological mechanisms.¹ Despite great variations in salt and water intake, the body finely maintains the serum sodium between 135 and 145 mmol/L and readings outside this range (hyponatremias or hypernatremias) are termed dysnatremias.¹ This value is a reflection of total sodium is in the body compared to the total body water content.

Serum sodium abnormalities are a common finding within the intensive care setting.² Dysnatremia can affect a number of physiological functions and has been shown to

negatively impact upon prognosis for patients in intensive care. Both dysnatremia at admission and that acquired in the intensive care unit (ICU) have been shown to have a direct influence on prognosis.³ Dysnatremias are common in the ICU patients due to the severity and complexity of the admitted patients and have been associated with an increase in mortality rate in both instances in which the patient was admitted with dysnatremia or developed dysnatremia during their ICU stay.

Studies have shown that dysnatremias seen in the ICU are largely preventable and reflect largely upon the quality of care given. Although both forms of dysnatremia development have been linked to increased mortality but dysnatremia presented upon admission has been linked to higher mortality rates as compared to dysnatremia

development during the ICU stay.^{4,5} Fast correction of serum sodium levels in hypernatremic patients has a deleterious effect on survival of the patients, which have been reported in many studies and more death in surgical cardiac patients were also noted with rapid changes in serum sodium concentration.⁶ Several studies have investigated the epidemiology of dysnatremia and its possible impact on adverse outcomes in critically ill patients. However, these studies were mostly performed in mixed medical and surgical ICU populations and evaluated sodium levels either at admission to the ICU or during the ICU stays. Whether the time of onset of dysnatremia can influence outcomes after major surgical interventions is still unknown. In addition, although a strong association between the rate of correction of hypernatremia and outcome has been reported, the possible impact on outcome of fluctuations in serum sodium concentrations during the ICU stay has not been adequately investigated.

Sakr et al in their study found an independent association between sodium fluctuations and mortality, even in patients who remained within the reference range throughout their ICU stay.⁷ Current studies have mostly been conducted in unselected general hospital populations and mixed ICU populations of both medical and surgical patients.^{5,7,8} One study has investigated the link between dysnatremia and mortality specifically in ICU surgical patients.⁷ The association of sodium fluctuations and mortality has been validated in another study in a subgroup of paediatric population requiring externalized ventricular drains.⁶ So, the present study was aimed to study dysnatremia in adult patients admitting in medical intensive care unit (MICU).

METHODS

The present prospective observational study was conducted on patients admitted in medical ICU over a period of 1 year who developed Dysnatremia in Geetanjali Medical College and Hospital, Udaipur. Permission from institutional ethics committee was taken before commencing the study. Purposive consecutive sampling was done to include patients in study during the study period. Patients age more than 18 year admitted in MICU with eunatremia with at least 24 hours of stay in MICU were included in the study. Informed consent for the study was taken from patient and/or relative/legal guardian. Patients with evidence of decreased or increased sodium level before admission in MICU, discharged against advice, pregnant patient, with strong evidence of End Stage Renal Disease and use of investigational drug, or device during the study period were excluded out from the study.

History and clinical examination were done in all the patients. GCS scoring and laboratory investigations (complete blood count (CBC), Random blood sugar (RBS), liver function test (LFT), kidney function test (KFT), prothrombin time /international normalized ratio

(PT/INR), activated partial pro-thromboplastin test (APTT), thyroid stimulating test (TSH)) were done in all the patients. Venous sample was sent for serum sodium level along with other blood investigations. Hyponatremia defined as when the level of sodium in blood was below 135 mEq, hypernatremia defined as when the level of sodium in blood was above 145 mEq and between 135-145 mEq was defined as eunatremia.

Patient's age, sex, diagnosis at the time of diagnosis, comorbidities, serum sodium levels, risk factors, length of ICU stay, and survival status were noted in a case record form. Data was represented as mean, standard deviation, ratio and proportion with percentage. Data was entered in Microsoft excel Windows 10 and analysis was done using Statistical package for social sciences (SPSS) IBM version 21. For categorical data Chi-squared and Fischer exact test were used. For quantitative data student's t-test was used. P value less than 0.05 was considered significant.

RESULTS

Total 798 patients were admitted in ICU during the study period of 1 year. Out of these 798 patients; 207 (25.94%) were found to have hypernatremia and 87 (10.9%) were hyponatremic. (Figure 1)

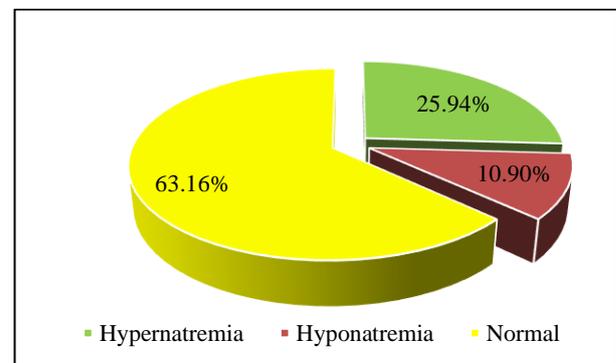


Figure 1: Prevalence of dysnatremia in ICU patients (n=798).

In hypernatremic group male/ female ratio was 125/82 and it was 50/37 in hyponatremic group. 38 (18.36%) hypernatremic patients and 20 (22.99%) hyponatremic patients were found non-significantly more in 60-69 years age group. Out of 207 hypernatremic patients, 114 (55.07%) were found in hypervolemic group. (Table 1)

Overall ICU stay ranged from 2 days to 27 days for all patients in the study. The mean ICU stay was significantly more in hypernatremic patients (4.76±3.57) compared to hyponatremic group (4.06±2.80). In hypernatremic patients it was 4.04±1.73 days, 4.54±3.86 days, and 5.42±7.89 days in euvolemic, hypervolemic and hypovolemic group respectively. (Table 2 and Table 3)

Out of total 207 patients of hypernatremia 32 (15.45%) died and out of 87 patients of hyponatremia 13(14.94%) died. Difference was found non-significant.

Table 1: Demographic distribution of dysnatremia patients in ICU.

	Hypernatremia (n=207) N (%)	Hyponatremia (n=87) N (%)	P value
Sex			
Female	82 (39.61%)	37 (42.53%)	0.738
Male	125 (60.39%)	50 (57.47%)	
Age range (years)			
<20	8 (3.86%)	1 (1.15%)	0.388
20-29	22 (10.63%)	5 (5.75%)	0.271
30-39	23 (11.11%)	15 (17.24%)	0.215
40-49	26 (12.56%)	11 (12.64%)	0.863
50-59	31 (14.98%)	13 (14.94%)	0.864
60-69	38 (18.36%)	20 (22.99%)	0.453
70-79	37 (17.87%)	14 (16.09%)	0.842
80-90	20 (9.66%)	7 (8.05%)	0.828
>90	2 (0.97%)	1 (1.15%)	0.622
Types of hypo and hypernatremia			
Euvolemic	26 (12.56%)	24 (27.59%)	0.000
Hypervolemic	114 (55.07%)	27 (31.03%)	
Hypovolemic	67 (32.37%)	36 (41.38%)	

Table 2: Overall ICU stay of all the admitted patients.

	ICU stay (days) Mean±SD
Hyponatremia Patients	4.06±2.80
Hypernatremia Patients	4.76±3.57

p<0.01

Table 3: Overall ICU stay of all the hypernatremia and hyponatremia patients.

ICU Stay (days)	Euvolemic (Mean±SD)	Hypervolemic (Mean±SD)	Hypovolemic (Mean±SD)	P value
Hyponatremia	4.75±3.93	4.48±2.79	3.31±1.53	0.098
Hypernatremia	4.04±1.73	4.54±3.86	5.42±7.89	0.434

Table 4: Mortality in hypernatremia and hyponatremia patients.

	Euvolemic N (%)	Hypervolemic N (%)	Hypovolemic N (%)	P value
Hypernatremia(n=32)	0	27 (84.38%)	5 (15.63%)	0.000
Hyponatremia (n=13)	1 (7.69%)	7 (53.84%)	5 (38.46%)	0.03
P value	0.056			

Mortality in both hypernatremic patients and hyponatremic patients was found significantly more in hypervolemic group which was 84.38% and 53.84% respectively (Table 4).

DISCUSSION

Dysnatremias in both forms either hyponatremia or hypernatremia have been associated with an increase incidence of morbidity as well as in mortality in critically ill patients who are admitted to intensive care unit.⁹ This morbidity and mortality lead to extensive burden on healthcare resources which can be decreased and prevented by giving proper quality care in these patients.⁶ The present study was conducted to assess ICU-acquired hyponatremia or hypernatremia in medical ICU.

In present study, hyponatremia was found in 10.9% patients. Few studies have reported development of hyponatremia from 18%-40% of patients in intensive care unit.⁹⁻¹¹ Although in present study it was found less but this difference may be due to the different level of severity and co-morbidities in ICU patients of different centres and also due to the variations in fluid and electrolyte treatment.

In present study 24.94% patients developed hypernatremia. This incidence was found more as compared to other studies which had reported from 3 to 10% incidence of hypernatremia.^{9,12} The reason of variations can be same like hyponatremia and this also support the results of one study in which they have mentioned that now a days hypernatremia is more common as compared to hyponatremia.⁶

Although in both hyponatremia and hypernatremia patients, more patients were male but there was no significant difference in both the group. Many studies have reported that dysnatremia is common in female due to more muscle mass.¹³ But Goh et al has reported that there is no sexual predilection exists in incidence of hyponatremia.¹⁴ In hypernatremia significant numbers of patients were hypervolemic. This may due to the fact that many patients were of neurological disorders and acute kidney injury which lead to hypervolemic condition.¹⁵

In present study ICU stay was significantly more in hyponatremic patients. Dysnatremia lead to prolonged ICU stay as compared to other normal patients in ICU. Many other studies have also reported similar results.^{16,17} This may be due presence of more comorbidities as well as old age of these patients.

In present study mortality rate was same in both in hyponatremic group and hypernatremic group which was around 15%. Many other studies have reported 32% - 55% mortality in dysnatremia patients. In our study this rate was found quite less as compared to others. This may be due to that fact that in our centre good quality of care is given with the help of experienced intensivists and other health care team in the form of aggressive approach in treatment.¹⁷⁻¹⁹

CONCLUSION

This study concluded that now a days hypernatremia is more common with longer ICU stay. In both hypernatremia and hyponatremia mortality was found similar without any significant difference. Quality care given through expert intensivist can significantly decreases the morbidity and mortality in dysnatremic patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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