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FREQUENCY OF HYPONATREMIA IN PATIENTS WITH TRAUMATIC BRAIN INJURY

Dr. Tayyeba Afzal[1], Dr. Muhammad Naeem[2] and Dr. Abdul Basit Maqbool*[3]

[2](PMDC # 86027-p).
[3](PMDC # 87724-p).

***Corresponding Author: Dr. Abdul Basit Maqbool**

(PMDC # 87724-p).

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ABSTRACT

Objective: To find out the frequency of hyponatremia in patients of traumatic brain injury. **Material and methods:** This cross sectional study was conducted at Department of Neurosurgery, Nishtar Hospital Multan from January 2018 to May 2018 over the period of 5 months. Total 150 patients with traumatic brain injury having age from 20-60 years either male or female were selected. Hyponatremia was assessed in selected patients. **Results:** Mean age of the patients with traumatic brain injury was 37.85 ± 13.15 years. Out 150 patients, hyponatremia was found in 50 (33%) patients. Hyponatremia was found in 36 (40.45%) patients and in 14 (22.95%) patients of age groups 20-40 years and age group 41-60 years respectively. Hyponatremia was significantly associated with age groups with p value 0.034. Hyponatremia was found in 34 (36.96%) male patients and in 16 (27.59%) female patients. Statistically insignificant association between hyponatremia and gender was observed with p value 0.287. **Conclusion:** Results of this study showed a higher percentage of hypernatremia in cases of traumatic brain injury. Development of hyponatremia was significantly associated with age groups. Male gender was more victim of traumatic brain injury as compared to female gender but development of hyponatremia was not significantly associated with gender. There were also insignificant association of hyponatremia with hypertension and diabetes mellitus was noted.

KEYWORDS: Hyponatremia, TBI, ICU, mortality.

INTRODUCTION

Traumatic brain injury (TBI) is the major cause of disability, morbidity, and mortality among individuals younger than 45 years and is responsible for a significant proportion of all traumatic deaths in the United States (US) and other developed nations.[1-2] Traumatic brain injury is a critical public health and socio-economic problem throughout the world.[3] Although high-quality prevalence data are scarce, it is estimated that in the US, around 5.3 million people are living with a TBI-related disability and in the European Union, approximately 7.7 million people who have experienced a TBI have disabilities.[4-5] Hyponatremia is a common electrolyte abnormality in hospitalized patients.1,2 Incidence varies from 1% to 40%.[6] Despite the awareness on hyponatremia since mid-20thcentury, this common disorder is still incompletely understood in many basic areas, due to its association with a wide range of underlying causes, multiple etiologies and differing pathophysiological mechanisms.[7] Hyponatremia is defined as serum sodium concentration of less than 135mmol/L. It can be sub divided into mild hyponatremia (130134mmol/L), moderate hyponatremia (120129mmol/L) and severe hyponatremia (<120 mmol/L).[8] Mild hyponatremia is found in as many as 15-30% of hospitalized patients or in the institutionalized elderly.[9] Clinically, hyponatremia is often unrecognized when it is mild or when it develops gradually. But severe hyponatremia (serum sodium <120 mmol/L), particularly of rapid onset, is associated with substantial morbidity and can be life threatening.[10] Also, moderate to severe hyponatremia bears a substantial associated morbidity and mortality.[11] It is common in the elderly, mainly owing to impaired water and electrolyte balance in response to diet, drugs and environmental changes.[12-13] Hyponatremia occurs due to disruption of sodium and water homeostasis, normally maintained by complex multisystem physiological mechanisms.[14] Hyponatremia is subdivided diagnostically into three groups, depending on clinical history and volume status, like hypovolemic, euvolemic, and hypervolemic.[15]

Hypernatremia is a common electrolyte disturbance in patients with TBI. Patients with severe TBI has a high risk of developing hypernatremia over the course of their ICU stay, due to insensible water losses, inadequate provision of free water, excess sodium administration, the development of central diabetes insipidus and other

coexisting predisposing neurological conditions.[16] The relationship between hypernatremia and TBI is complex, and there is considerable heterogeneity in prior studies evaluating hypernatremia in patients with TBI.[10] The aim of this study was to assess the frequency of hypernatremia TBI. Results of this study may help us to early screen and manage the hyponatremia in cases of TBI and may helpful to reduce the mortality and morbidity related to it.

MATERIAL AND METHODS

This cross sectional study was conducted at Department of Neurosurgery, Nishtar Hospital Multan from January 2018 to May 2018 over the period of 5 months. An approval was taken from ethical committee of the hospital and written informed consent was taken from patients/attendants. Total 150 patients with traumatic brain injury having age from 20-60 years either male or female were selected. Exclusion criteria consisted of patients with underlying renal diseases, patients admitted to the emergency unit for more than 48 hours, and patients companions not willing to participate in the study. In addition, patients that presented other potential causes of sodium disorders and systemic trauma (especially abdominal and orthopedic trauma because of that these lesions often involve blood loss and need resuscitation with saline solution) were excluded from the study. All patients underwent neurosurgical examination, cervical spine and plain chest radiography, and cerebral computed tomography (CT). Patients underwent CT scans on two occasions: on hospital admission after resuscitation and within 12 hours after the first tomography. 5ml blood sample of all the selected patients were drawn and send to laboratory for analysis of serum sodium levels. Findings were noted in predesigned proforma in term of hyponatremia (Yes/No). Demographic profile of all the patients was also noted on proforma. Collected data was entered in SPSS version 20 and analyzed. Mean and SD was calculated for age. Frequencies were calculated for gender and hyponatremia. Stratification for age and gender was done. Post stratification chi-square test was applied to see the effect of these on outcome variable i.e. hyponatremia.

RESULTS

Mean age of the patients with traumatic brain injury was 37.85 ± 13.15 years. Out 150 patients, hyponatremia was found in 50 (33%) patients (Fig. 1). Patients were divided into two equal groups i.e. age group 20-40 years and age group 41-60 years. Total 89 (59.33%) patients belonged to age group 20-40 years and 61 (40.67%) patients belonged to age group 41-60 years. Hyponatremia was found in 36 (40.45%) patients and in 14 (22.95%) patients of age groups 20-40 years and age group 41-60 years respectively. Hyponatremia was significantly associated with age groups with p value 0.034 (Table 1). Total 92 (61.33%) patients were male and 58 (38.67%) patients were female. Hyponatremia was found in 34 (36.96%) male patients and in 16 (27.59%) female patients. Statistically insignificant association between hyponatremia and gender was observed with p value 0.287 (Table 2). Out of 105 (70%) hypertensive patients 45 (30%) normotensive patients, hyponatremia was seen in 34 (32.38%) patients and 16 (35.56%) patients respectively in hypertensive and normotensive patients. No association (P = 0.709) between hyponatremia and hypertension was found (Table 3). There were 94 (62.67%) diabetics and 56 (37.33%) non-diabetics. Total 37 (39.36%) diabetics and 13 (23.21%) non-diabetics were found with hyponatremia. Hypernatremia was significantly associated with diabetes mellitus with p value 0.050 (Table 4).

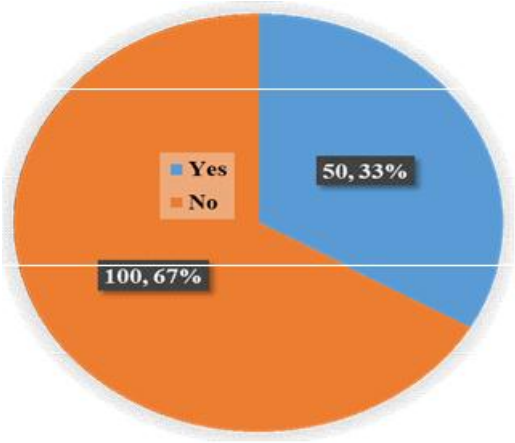

Fig. 1: Frequency of hyponatremia.

Table 1: Association of Hyponatremia with age group.

Age (years)	Hyponatremia		Total	P-value
	Yes	No		
20-40	36 (40.45%)	53 (59.55%)	89 (59.33%)	0.034
41-60	14 (22.95%)	47 (77.05%)	61 (40.67%)	
Total	50 (33.33%)	100 (66.67%)	150	

Table 2: Association of Hyponatremia with gender.

Gender	Hyponatremia		Total	P-value
	Yes	No		
Male	34 (36.96%)	58 (63.04%)	92 (61.33%)	0.287
Female	16 (27.59%)	42 (72.41%)	58 (38.67%)	
Total	50 (33.33%)	100 (66.67%)	150	

Table 3: Association of Hyponatremia with hypertension.

Hypertension	Hyponatremia		Total	P-value
	Yes	No		
Hypertensive	34 (32.38%)	71 (67.62%)	105 (70%)	**0.709**
Normotensive	16 (35.56%)	29 (64.44%)	45 (30%)	
Total	50 (33.33%)	100 (66.67%)	150	

Table 4: Association of Hyponatremia with diabetes mellitus.

Diabetes Mellitus	Hyponatremia		Total	P-value
	Yes	No		
Diabetics	37 (39.36%)	57 (60.64%)	94 (62.67%)	**0.050**
No-diabetics	13 (23.21%)	43 (76.79%)	56 (37.33%)	
Total	50 (33.33%)	100 (66.67%)	150	

DISCUSSION

Traumatic brain injury occurs when a traumatic event causes the brain to move rapidly within the skull, leading to damage.[17] A TBI occurs every 15 seconds in the US, generating 1.7 million new head injury victims per year.[17] Primary brain damage and secondary brain damage are the main two types of TBI.[18] Moreover, TBI is a major cause of mortality and disability in Europe and the US, as well as in under developing countries as 2.5 million of people in the US is suffering from the bad outcome. Many head-injured patients die or survive with severe brain damage, even after mild or moderate head injury.[17] The objective of present study was to assess the hyponatremia in cases of traumatic brain injury. Mean age of the patients with traumatic brain injury was 37.85 ± 13.15 years. Out 150 patients, hyponatremia was found in 50 (33%) patients. In one study by Chitsazian et al,[19] mean age of patients with traumatic brain injury was 42.85 ± 22.59 years. In same study hyponatremia was noted 31.6% patients which is comparable with our study. In a study conducted on 26 brain injury patients, authors observed a 34.6% prevalence of hyponatremia in the patients, which was quite consistent with that of ours.[20] Sherlock et al.[21] directed a study on 1695 patients undergoing brain surgery in Beaumont hospital, Ireland, in 2009 in which 11% of the patients with brain tumor, hemorrhage, and brain tumor had sodium excretion of less than 130. This rate of prevalence was somewhat lower than that obtained by us which may be due to the different definitions for hyponatremia in both studies. Our study considers a patient with sodium less than 135 as hyponatremic, while Sherlock and colleagues states that an excretion of sodium less than 130 is enough for a patient to be considered as hyponatremic which justifies the higher prevalence of hyponatremia in our study. Another cause for this high prevalence in our study can be because of the severity of brain injury in our patients which were all referred to the ICU, whereas Sherlock covered only those brain injury patients received by the hospital. Born et al,[22] reported that out of 109 patients with severe trauma, 36 (33%) were hyponatremic which was consistent with the prevalence found by our study (31.6%). In a study that Upadhyay and colleagues,[23] performed on some hospitalized patients, it was revealed that in 28.2% of the patients at least one patient had hyponatremia. This rate was higher for those who stayed in the ICU (18 - 30%), which was in line with our study. Cerda et al.[24] in a research done in 2010, titled as "Prevalence and Causes of Hyponatremia in the Neurologic Patients" showed that from the 130 patients under study, 14.6% were hyponatremic.

CONCLUSION

Results of this study showed a higher percentage of hypernatremia in cases of traumatic brain injury. Development of hyponatremia was significantly associated with age groups. Male gender was more victim of traumatic brain injury as compared to female gender but development of hyponatremia was not significantly associated with gender. There were also insignificant association of hyponatremia with hypertension and diabetes mellitus was noted.

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