



Electrolyte Disturbance in Patients with Head Injury in Neuro ICU, EMCH, Savar, Dhaka, Bangladesh

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Abstract: Background: A head injury is a broad term that describes a vast array of injuries that occur to the scalp, skull, brain, and underlying tissue and blood vessels in the head. Head injuries are also commonly referred to as brain injury or traumatic brain injury (TBI), depending on the extent of the head trauma. Serum electrolyte abnormalities (SEAs) may occur due to the initiation of destructive inflammatory and biochemical cascades of primary brain injury or as a result of interventions such as hyperosmolar therapy. **Objective:** To evaluate the electrolyte disturbance in patients with head injury in Neuro ICU, Enam Medical College & Hospital, Savar, Dhaka, Bangladesh. **Methodology:** It was cross sectional observational study carried out by Department of Neuro ICU, Dhaka during the period of 2017-2021. Total 37 head injury patients were included. Data were collected using a structured questionnaire containing all the variables of interest. Data was processed and analyzed with the help of computer program SPSS for windows version 25. **Results:** This study shows maximum (45.9%) were 15-35 years. The mean age was 30.97±18.49 years (range 2 years-71 years). Majority (94.6%) were male and only 5.4% were female. Most common head injury were due to road traffic accident (75.7%), followed by fall from height which contributes 56 (18.9%). Among 37 patients 28 (75.7%) patients normal serum sodium level, hyponatremia seen in 7 (18.9%) patients and 2 (5.4%) had hypernatremia. Hypokalemia observed in 21 (56.8%) patients, hyperkalemia in 7 (18.9%) patients and 9 (24.3%) patients had normal potassium level. Hypochloremia were present in 21 (56.8%) patients, hyperchloremia in 7 (18.9%) patients and in 9 (24.3%) patients no change in serum chloride. **Conclusion:** Serum sodium, potassium and chloride abnormalities are common in head injury patients in this study. They are associated with higher risk of mortality and can be expected to occur in patients with abnormalities in specific clinical, radiological and acid-based parameters.

Keywords: Electrolyte Disturbance, Head Injury, Hyperosmolar Therapy, Traumatic Brain Injury.

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INTRODUCTION

Traumatic brain injury (TBI) is among the most significant one manifesting high morbidity and mortality. The consequences of TBI results in

disability with lifelong financial, medical, emotional, family trauma. TBI is a foremost important cause of death and disability entire the world and is the leading cause of brain damage in children and young

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adults [1]. Traumatic brain injury (TBI) - a silent epidemic, has emerged as a leading cause of mortality, morbidity and fiscal loss in developing countries like Bangladesh. Road traffic accidents (RTA) the leading cause of TBI (around 60%), hits the most intellectual and economic class of 15-29 years [2]. Electrolyte imbalance in cases of TBI is associated with the pathology of the brain itself or is iatrogenic in causation. Unknown pre-existing conditions such as renal failure, cirrhosis, or congestive heart failure share the cause. It is common and considered as one of several preventable secondary injuries. The risk to the development of electrolyte disturbance in TBI patients depends on the severity of head injury, underlying disease age and primary therapeutic strategy such as the choice of resuscitation fluid, administration of mannitol or diuretics and hyperventilation. Of all serum electrolytes, the most common electrolyte subject to imbalance in TBI patients is serum sodium [3, 4]. Suman *et al.*, [5] and Rafiq *et al.*, [6] reported the most common electrolyte imbalance condition in TBI was hyponatremia followed by hyponatremia and hypokalemia. Serum electrolyte abnormalities (SEAs) are common in severe TBI and are associated with poor outcomes such as increased mortality, prolonged Intensive Care Unit (ICU) admission and

poor outcome scores. (Commonly reported SEA includes sodium, potassium, calcium, magnesium and phosphate ions). These abnormalities may arise as a result of brain injury or interventions such as the use of hyperosmolar therapy. In addition, these abnormalities may coexist and therefore worsen the outcome [5]. Electrolyte abnormalities may be one of the factors that can contribute to the high mortality. The objective of this study was to determine the electrolyte disturbance in Patients With Head Injury in Neuro ICU, Enam Medical College Hospital (EMCH), Savar, Dhaka, Bangladesh.

MATERIALS AND METHODS

It was descriptive type of observational study carried out by Department of Neuro ICU, EMCH, Dhaka during the period of 2019-2021. Total 37 head injury patients were included. Data collection included patient demographics, pre-hospital interventions, clinical examination and findings, CT Scan head findings, serum electrolyte findings. Data were collected using a structured questionnaire containing all the variables of interest. Data was processed and analyzed with the help of computer program SPSS for windows version 25.

RESULTS

Table I: Demographic characteristics of the study subject (n=37)

Characteristics	Frequency	Percentage (%)
Age in years		
≤15	7	18.9
15-35	17	45.9
36-50	6	16.2
>50	7	18.9
Mean±SD	30.97±18.49	
Sex		
Male	35	94.6
Female	2	5.4

Table II: Mode of injury of the study subjects (n=37)

Mode injury	Frequency	Percentage (%)
Fall from height	7	18.9
RTA	28	75.7
Physical assault	1	2.7
Deliberate self harm	1	2.7

Table III: Diagnosis of the study subjects (n=37)

Diagnosis	Frequency	Percentage (%)
Lt fronto-parietal SDH	1	2.7
Multiple contusion due to TBI	2	5.4
Significant brain edema due to TBI	1	2.7
Head injury with Multiple Rib fracture (Rt)	1	2.7
Bi frontal Lt temporal contusion	7	18.9
ICH due to TBI	7	18.9

Diagnosis	Frequency	Percentage (%)
SAH due to TBI	7	18.9
Post traumatic ventricular bleeding	20	54.1
Severe TBI with Splenic contusion	20	54.1
TBI with depressed parietal bone fracture	20	54.1
TBI with Haemothorax	20	54.1
Diffuse axonal injury	3	8.1
Mild DAI	1	2.7
Linear occipital and temporal bone fracture	2	5.4
Head injury due to fall down	1	2.7
Putaminal haemorrhage due to TBI	1	2.7
ICH in right parieto temporal region due to TBI	1	2.7
Depressed fracture parietal bone with underlying- contusion due to TBI	1	2.7
TBI with Aspiration pneumonia	1	2.7
Multiple haemorrhagic contusion in brain due to RTA	1	2.7

Table IV: Associated injury of the study subjects (n=37)

Associated injury	Frequency	Percentage (%)
Spleen injury	1	2.7
Rt. sided haemothorax	1	2.7
Aspiration pneumonia	2	5.4
Mandible fracture	1	2.7
Acromio clavicular subluxation	1	2.7
Compartment syndrome of Rt leg	1	2.7
Volkamann ischaemia of Rt Tibia	1	2.7
Shaft of Lt. femur fracture	1	2.7
Rt radius fracture	1	2.7
Lt Ulna fracture	1	2.7

Table V: Findings on electrolyte (N=37)

Finding	Frequency	Percentage (%)
Sodium		
Hypo (<136 mmol/L)	7	18.9
Normal (136-145)	28	75.7
Hyper (>145 mmol/L)	2	5.4
Potassium		
Hypo (<3.5 mmol/L)	13	35.1
Normal (3.5-5 mmol/L)	24	64.9
Hyper (>5 mmol/L)	0	00
Chloride		
Hypo (<98 mmol/L)	21	56.8
Normal (98-106 mmol/L)	9	24.3
Hyper (>106 mmol/L)	7	18.9

DISCUSSION

Electrolyte imbalances are common in traumatic brain injury. It shares the cause of perioperative morbidity and mortality. Types of intravenous fluid resuscitation, osmotic diuretics, massive blood loss and intracranial pathology were considered as the potential factors to worsen electrolyte abnormalities in these patients. In this study shows maximum (45.9%) were 15-35 years, 18.9% were >50 years, 18.9% were ≤15 years and 16.2% were 36-50 years. The mean age was

30.97±18.49 years (range 2 years-71 years) which is similar Jha *et al.*, [1] they found 58 (27.61%) patients belong to age less than 18 years, 122 (58.09%) patients were from age 20 to 50 years and 30 (14.28%) patients belong to age >50 years. Another study Gupta *et al.*, [8] they found mean age in group 1 was 37.78 (range 15-73) year. In this study shows majority (94.6%) were male and only 5.4% were female. This findings consistent with Gupta *et al.*, [7]. Another study Jha *et al.*, [1] also found higher in male than female which was 157

(74.76%) patients were male and 53 (25.23%) were female. Previous study Rafiq *et al.*, [6] reported Out of which 127 (59.1%) were male and 88 (40.9%) were female. This study shows most common head injury were due to road traffic accident (75.7%), followed by fall from height which contributes 56 (18.9%), others like physical assault contributes 1 (2.7%) and deliberate self harm 1 (2.7%). Most common diagnosis finding in this study were post traumatic ventricular bleeding 20 (54.1%) patients, Severe TBI with splenic contusion 20 (54.1%) patients, TBI with depressed parietal bone 20 (54.1%) patients, TBI with Haemothorax 20 (54.1%) patients, bi frontal Lt temporal contusion 7 (18.9%), ICH due to TBI (18.9%) and SAH due to TBI 7(18.9%). Similar study Jha *et al.*, [1] reported most common mechanism of TBI in their study were due to road traffic accident (56.67%), followed by fall from height which contributes 56 (26.67%), others like assault contributes 31 (14.76%) and sports related injuries in 4 (1.90%). Most common CT scan finding in our study were fracture of skull 44 (21%) patients, followed by extradural hematoma 43 (20.47%) patients, subdural hematoma 39 (18.57%) patients, subarachnoid hemorrhage 31 (14.76%) patients, diffuse axonal injuries 30 (14.28%), and 23 (10.95%) patients had brain contusions. In this study among 37 patients 28 (75.7%) patients with normal serum sodium level, hyponatremia seen in 7 (18.9%) patients and 2 (5.4%) had hypernatremia. Hypokalemia observed in 21 (56.8%) patients, hyperkalemia in 7 (18.9) patients and 9 (24.3%) patients had normal potassium level. Hypochloremia were present in 21 (56.8%) patients, hyperchloremia in 7 (18.9%) patients and in 9 (24.3%) patients no change in serum chloride. This was consistent with the findings by Jain *et al.*, [9] and Dey *et al.*, [10] Similar study Jha *et al.*, they reported among 210 patients 128 (60.95%) patients normal serum sodium level, hyponatremia seen in 53 (25.23%) patients and 29 (13.80%) had hypernatremia. Hypokalemia observed in 44 (20.95%) patients, hyperkalemia in 23 (10.95) patients and 143 (68.09%) patients had normal potassium level. Out of 48 severe injured patients 46 (95.83%) had abnormal sodium level, 33 (68.75%) patients had abnormal potassium level and 19 (39.58%) had abnormal calcium level. Other studies reported the most common electrolyte imbalance in patients with traumatic brain injury was hyponatremia followed by hypokalaemia Gupta *et al.*, [8], Adiga *et al.*, [11] Other important electrolyte deficiencies noted were hypocalcemia, hypophosphatemia and hypomagnesemia Suman S *et al.*⁵ A shift of electrolytes from extracellular compartment to intracellular compartment and electrolyte loss in head injury plays a role in

electrolyte imbalances. The levels of sodium, potassium and chlorine should be measured routinely in all patients with head injury and especially in patients with severe head injury because imbalances in level of these electrolytes are likely to remain undetected for a longer time.

CONCLUSIONS

This study shows head injury patients have a very strong propensity to develop electrolyte imbalance, particularly hyponatremia and hypokalemia. They are also prone to develop hypochloremia and hyperchloremia. Hence it would be wise to choose appropriate fluid in head injury patients to prevent or treat any electrolyte imbalance at its earliest while keeping a wise watch over nitrogen balance and stop its fall down the ladder of protein catabolism as much as feasible. The effect of therapeutic intervention/correction of specific ion abnormalities on the outcome (e.g. duration of ICU stay.) needs to be studied.

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