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STUDY OF PATTERN OF HEAD INJURY WITH SPECIAL REFERENCE TO ELECTROLYTE IMBALANCE IN TRAUMATIC BRAIN INJURY [TBI]

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ABSTRACT

INTRODUCTION: TBI is most commonly occur in road traffic accident which is most common cause of death in TBI patient which is 2/3 of accidental death in hospital. TBI is a leading reason behind mortality in patients younger than forty five years accounting for over a 3rd of all injury connected deaths in U.S. annually fifty two folks die and another eighty suffer morbidity though additional severe injuries square measure related to poorer outcomes, the moderately black-and-blue patients are also in danger. Brain injury is that the commonest reason behind death in trauma victims accounting for regarding 1/2 deaths at the accident. Brain death determination is sometimes not possible within the emergency department (ED). The primary outcomes are the incidence of electrolyte imbalance and relation between prognosis of head injury and electrolyte imbalance in TBI patients. To aim of the study electrolyte imbalances in traumatic brain injury patient, relation between prognosis and severity of the head injury with electrolyte imbalance. **MATERIAL AND METHODS:** Approximate 109 cases, above 18-60 years of age, irrespective of sex, getting admitted through SOPD, casualty or transferred from other department diagnosed as electrolyte imbalance. TBI [Traumatic Brain Injury] patients during the period of study are included in the study. **RESULTS:** 109 patients due to RTA, assault, & fall, on admission patients were briefly interrogated, clinically examined and resuscitation started according to priority i.e. patency of airway, breathing and circulation were restored. the incident of head injury are more common in younger age group than elderly patient. Head injury is more common in male patient as compared to female patient. the prognosis /severity is more in patient group that is brought by relatives it indicate the severity of head injury. Among 109 patients hypernatremia seen in 33 patients, hyponatremia seen in 19 patients, hypokalaemia seen in 15 patients, hyperkalaemia 9 patients hypocalcaemia 5 patients, hypercalcemia 2 patients.
CONCLUSION- As soon as possible adequately hydrate the patients. As soon as possible maintain adequate oxygenation, maintain blood glucose level. Monitor patents vital regularly, control ICP, control bleeding etc.

KEYWORDS

TBI, RTA, Electrolyte imbalance, hematoma etc.

INTRODUCTION:

TBI [traumatic brain injury] is taken into account as a significant unhealthiness that's a frequent reason behind death and incapacity and makes extensive demands on health services. In developing countries accident rates generally and TBI specially square measure increasing as traffic will increase besides alternative factors like industrial enterprise, falls and trajectory trauma.[1] Closed head injury is that the results of type of mechanisms together with motorcar and motor cycle accidents, falls from heights, assaults and pedestrians being smitten by motorized vehicles traumatic brain injury happens within the presence of further injuries to alternative major organ systems however it may also occur in isolation[2]. As several as 2 thirds of all motorcar accident victims sustain some head injury.[3] Death of the patient is that the elementary medical and legal commonplace for decease. Permanent halt of heartbeat and respiratory produces death while not resuscitative, efforts, destruction of the entire brain happens.[4,5] Any therapeutic inadequacies could lead to any increase in morbidity and mortality thence management of head injury is additionally a responsibility, requiring perspicacity and awareness of a chance of injury to alternative systems which can complicate the issues. The bulk of patients need conservative management and solely 10–20% of patients would like surgical intervention.[6] Automobile, motorcycle, and bicycle collisions were liable for half all TBIs, whereas one third resulted from falls, and rest from recreational injuries/sports(10%), firearms etc.[7] Since primary injury is irreversible, all doable efforts square measure required to attenuate the secondary brain injury. Post traumatic endocrine complications create a good challenge within the management of TBI.[8] Early recognition of those delicate issues will turn out a major impact on the electrolytes imbalance in Traumatic Brain Injury twelve progress and outcome around 30-50% of patients.

Solution [electrolyte] imbalance are common in traumatic brain injury patient it shares the cause of perioperative morbidity and mortality types of iv fluid resuscitation,osmotic diuresis, massive blood loss and intracranial pathology are consider as potential factor to worsen solution imbalance. The aim of this study is to report the incidence of solution imbalance and their relation to prognosis of head injury at 24,48 and 72 hour of admission.[9-10] Risk to the development of then electrolyte imbalance dependants on the severity of head injury age and therapeutic strategy.[11-12] The primary outcome are the incidence of electrolyte imbalance and relation between prognosis of head injury and electrolyte imbalance in TBI patients. To aim of the study electrolyte imbalances in traumatic brain injury patient, relation between prognosis and severity of the head injury with electrolyte imbalance.

MATERIALS AND METHODS:

This present study is conducted prospectively from 1st June 2019 to 31st May 2020. 109 patients of traumatic head injury with intra cerebral hematoma/contusions fulfilling the inclusion criteria were selected for the study. And carefully take history, positive clinical findings, GCS scores and positive CT scan findings. Approximate 109 cases, above 18-60 years of age, irrespective of sex, getting admitted through SOPD, casualty or transferred from other department diagnosed as electrolyte imbalance. TBI patients during the period of study are included in the study.

INCLUSION CRITERIA:

- All TBI [Traumatic Brain Injury] patients will be admitted in emergency ward during this period are all included in the study.
- Diagnosed by CT/MRI head.

EXCLUSION CRITERIA:

- TBI [Traumatic Brain Injury] patients with ventilator support.
- Associated blunt trauma chest and abdomen other then head injury.
- Associated other comorbid conditions.

On admission patients were briefly interrogated, clinically examined and resuscitation started according to priority i.e. patency of airway, breathing and circulation were restored by ET intubation, Oxygen

supplementation and intravenous fluids supplementation. Bleeding surface wounds (scalp or any other body part), were stitched and fracture site if any, splinted. Thorough clinical examination was conducted to evaluate the nature and severity of injury. All efforts were made to diagnose other associated injuries. All patients were examined for other associated injuries like spine trauma, trauma chest, abdomen, pelvic trauma and any other major bone fractures.

General examination like respiration, pulse rate, BP, oxygen saturation, urine output, were noted regularly. GCS scoring was noted regularly. Based on clinical assessment, initial GCS and NCCT reports (size/location of hematoma/Midline shift) line of management was decided. Patients considered for the study had a computed tomography. Several imaging study are used for diagnosis like CT head, MRI head but CT are more useful, more sensitive and more suitable approach and available easily and size as well as volume and areas of the brain like hematoma. Patients who presented within 24 hours of TBI and had evidence of a traumatic ICH on CT can diagnose volume appox. 20 mL or more were included. Further repeat NCCT head was conducted as per need in patients who were deteriorating after initial conservative management to see any delayed increase in size of hematomas. Early surgery for initial intervention for operative head injury can salvage the patient .i.e. craniotomy and removal of intra cerebral hematoma along with surrounding contused brain tissue, combined with appropriate drug therapy and non-operative treatment was the standard medical treatment. Best medical treatment included monitoring of renal function, liver function, serum electrolytes, serum osmotic pressure, temperature, and arterial blood.

GOS* ScoreFunctional Status

1Acquiring daily activity, adequate lifestyles, with minimal neuropsychological problems.2Disabled but independent, able to work in a sheltered environment3This category pts don't acquire normal activity by reason of neuro or psychological problems or both.4Vegetative State5Death*

Glasgow Outcome Scale

After all necessary resuscitative measure, after stabilizing patients, we measures serum electrolyte which are included in our study like ;

a. Serum sodium
b. Serum potassium
c. Serum calcium

At different time interval;

At 24 hour.
At 48 hour.
At 72 hour.

RESULTS:

The results of my observation data study of 109 patients, carried out at SSMC associated SGM hospital Rewa M.P. according to the statistical tools.

Table no.1 Demographic and Clinical Characteristic

AGE GROUP	Condition on Discharge				Chi square	P value
	Discharged		Expired			
	N	%	N	%		
19-20 Years	9	10.8	3	11.5	0.54	0.991
21-30 Years	32	38.6	9	34.6		
31-40 Years	20	24.1	7	26.9		
41-50 Years	10	12.0	3	11.5		
51-60 Years	11	13.3	4	15.4		
SEX						
Female	14	16.9	4	15.4	0.03	0.859
Male	69	83.1	22	84.6		
OCCUPATION						
Driver	4	4.8	1	3.8	17.29	0.044
Cleaner	0	0.0	1	3.8		
Farmer	7	8.4	3	11.5		
Job	20	24.1	4	15.4		
Labourer	5	6.0	3	11.5		
Business	4	4.8	0	0.0		
Student	30	36.1	8	30.8		
Housewife	9	10.8	1	3.8		
Others	4	4.8	5	19.2		
BROUGHT BY						
Self	8	9.6	3	11.5	0.87	0.647
Relative	74	89.2	22	84.6		
Others	1	1.2	1	3.8		
EVM						
3-5	0	0.0	16	61.5	88.28	<0.0001
6-8	0	0.0	6	23.1		
9-12	21	25.3	2	7.7		
13-15	62	74.7	2	7.7		
DURATION						
0-4 hrs	59	71.1	16	61.5	8.51	0.075
4-8 hrs	10	12.0	0	0.0		
8-24 hrs	4	4.8	2	7.7		
24-48 hrs	4	4.8	2	7.7		
48-72 hrs	6	7.2	6	23.1		
TIME OF ACCIDENT						
Morning	23	27.7	7	26.9	2.84	0.417
after noon	11	13.3	7	26.9		
Evening	36	43.4	9	34.6		
Night	13	15.7	3	11.5		
FIRST AID RECEIVED						
Not received	52	62.7	20	76.9		
First aid received	31	37.3	6	23.1	1.80	0.18

Out of 109 patients 12 patients are belongs to age group of 12-20 year of age. And 41 patients are belongs to age group of 21-30 year of age .and 27 patients belongs to age group of 31-40 year of age .and 13 patients are in 41-50 year of age and 14 patients are in age group of 51-60 year of age. Incident of head injury is more common in male patient as compared to female patient. Head injuries are more common in student due to younger age and lack of responsibility and proper precaution. The prognosis /severity is more in patient group that is brought by relatives it indicate the severity of head injury. Association between inverse proportion of EVM and prognosis of patient. If there is low EVM prognosis is poor in that patient group. Traumatic brain injury and prognosis is more common in evening period. Evidence that the prognosis of traumatic brain injury patient is less in patient who received first aid. And prognosis is poor in patient who not received first aid. (Table 1)

Table no. 2

MODE OF INJURY	Condition on Discharge				Chi square	P value
	Discharged		Expired			
	N	%	N	%		
RTA	59	71.1	16	61.5	2.39	0.496
Fall	11	13.3	3	11.5		
Assault	12	14.5	7	26.9		
Fall of Heavy Object {Other}	1	1.2	0	0.0		
CT/MRI						
EDH-extradural hematoma	8	9.8	2	7.7	36.69	<0.0001
SDH-subdural hematoma	12	14.6	10	38.5		
SAH-subarachnoid haemorrhage	15	18.3	3	11.5		
Contusion	45	54.9	3	11.5		
DAI-diffuse axonal injury	0	0.0	6	23.1		
Concussion	2	2.4	1	3.8		
Others	0	0.0	1	3.8		
Treatment						
conservative	78	94.0	22	84.6	2.29	0.13
operative	5	6.0	4	16.6		

Traumatic brain injury are more common in RTA patient. So prognosis is also more in RTA group. Hematoma a pattern of head injury are more common than other pattern of head injury. The prognosis is poor in severe type of head injury that is diffuse axonal injury. (Table 2)

Table -3

Sr. Na+ at 24 hours	Condition on Discharge				Chi square	P value
	Discharged		Expired			
	N	%	N	%		
Hyponatremia (Na+ <136MEq/L)	21	25.3	1	3.8	7.99	0.018
Normal (Na+ 136-146MEq/L	25	30.1	6	23.1		

Hypernatremia (Na+ >146MEq/L)	37	44.6	19	73.1		
Sr. Na+ at 48 hours						
Hyponatremia (Na+ <136MEq/L)	27	32.5	5	19.2	7.67	0.022
Normal (Na+ 136-146MEq/L	24	28.9	3	11.5		
Hypernatremia (Na+ >146MEq/L)	32	38.6	18	69.2		
Sr. Na+ at 72 hours						
Hyponatremia (Na+ <136MEq/L)	26	31.3	7	26.9	14.42	0.001
Normal (Na+ 136-146MEq/L	34	41.0	2	7.7		
Hypernatremia (Na+ >146MEq/L)	23	27.7	17	65.4		
Sr. K+ at 24 hours						
Hypokalaemia (K+ <3.5MEq/L)	29	34.9	13	50.0		
Normal (K+ 3.5-5.5MEq/L	49	59.0	8	30.8		
hyperkalaemia (K+ >5.5MEq/L)	5	6.0	5	19.2		
Sr. K+ at 48 hours						
Hypokalaemia (K+ <3.5MEq/L)	40	48.2	13	50.0	6.32	0.042
Normal (K+ 3.5-5.5MEq/L	23	27.7	12	46.2		
Hyperkalaemia (K+ >5.5MEq/L)	20	24.1	1	3.8		
Sr. K+ at 72 hours						
Hypokalaemia (K+ <3.5MEq/L)	40	48.2	11	42.3	6.88	0.032
Normal (K+ 3.5-5.5MEq/L	25	30.1	14	53.9		
Hyperkalaemia (K+ >5.5MEq/L)	18	21.7	1	3.8		
Sr. Ca+ at 24 hours						
Hypocalcemia (Ca+ <8MEq/L)	38	51.7	14	71.2	3.83	0.04
Normal (Ca+ 8-10MEq/L	45	62.3	06	74.6		
Hypercalcemia (Ca+ >10MEq/L)	12	16.2	04	9.7		
Sr. Ca+ at 48 hours						
Hypocalcaemia (Ca+ <8MEq/L)	30	49.2	11	39.8	4.07	0.004
Normal (Ca+ 8-10MEq/L	45	51.03	11	43.2		
Hypercalcemia (Ca+ >10MEq/L)	08	05.01	05	03.02		
Sr. Ca+ at 72 hours						
Hypocalcemia (Ca+ <8MEq/L)	30	29.4	10	49.1	4.49	0.034
Normal (Ca+ 8-10MEq/L	42	50.6	7	26.9		
Hypercalcemia (Ca+ >10MEq/L)	11	8.2	9	5.0		

1. The most common electrolyte imbalance that occur in patients with traumatic brain injury [TBI] as with sodium.
2. The second most common electrolyte imbalance was associated with potassium.
3. Calcium salt imbalance was also associated with traumatic brain injury [TBI] but 3rd in the series.
4. With the sodium salt imbalance hypernatremia was more common as compared to hyponatremia.
5. Patients with hypokalemic imbalance were less as compared to that of hyponatremic imbalance.
6. And hypocacemia was found to be least associated with traumatic brain injury. [TBI]

Among 109 patients hypernatremia seen in 33 patients, hyponatremia seen in 19 patients, hypokalaemia seen in 15 patients, hyperkalaemia 9 patients hypocalcaemia 5 patients, hypercalcemia 2 patients.

1. Most commonly occur electrolyte imbalance is sodium.
2. Followed by sodium there is most commonly occur electrolyte imbalance are potassium.
3. Followed by potassium, calcium has minimal change occur.
4. Out of all these most commonly occur electrolyte imbalance; hypernatremia is most common electrolyte imbalance.

DISCUSSION

Discussion with several other studies on electrolyte imbalance in traumatic brain injury patients.

Maggiore et al reported that hypernatremia was associated with a the refold increase in an adjusted hazard ratio of ICU death in severe traumatic brain injury[13]

Li et al reported severe hypernatremia as being an independent risk factor with an extremely odds ratio for death in traumatic brain injury patients admitted to intensive care unit. [60]

Lindsey et al demonstrate that the trauma patients with traumatic brain injury require electrolyte supplement at a greater level than non traumatic brain injury patients.[14]

Suman et al and **Rafiq et al** reported that the most common electrolyte imbalance in the traumatic brain injury patients was hypernatremia followed by hyponatremia and hypokalemia.[16]

Salma H Elhassan et al : This study was done on total 210 patients with Traumatic brain injury and their sodium level was measured.[17]

Sanjay K. Gupta et al: This study was done on 100 patients which were divided into 2 groups. In group 1 patients with head injury were taken and in group 2 patients without head injury were taken.[18]

M M Taha et al: This study was done on 80 patients with severe (GCS 8 or below) traumatic closed head injury.[19]

Aiyagiri V, Deibert E, et al: Hypernatremia is common following traumatic brain injury and occurs from variety of mechanism including hyperosmolar fluids, limitation of free waters, diabetes insipidus. The purpose of this study was to assess the relationship between hypernatremia and mortality in patients with traumatic brain injury.[20]

A comparative discussion from all above mentioned studies, the following discussion similarities are included in my studies.

Among 109 patients hypernatremia seen most commonly followed by hyponatremia, hypokalemia, hyperkalemia, hypocalcemia and hypercalcemia.

Head injury constitutes a problem of increasing magnitude. Traumatic brain injuries (TBIs) unit selection one clarification for morbidity, mortality, incapacity and socioeconomic losses in republic of state and wholly completely different developing countries.

Road traffic accidents (RTA) are the leading cause (60%) of TBIs followed by falls (20%-25%) and violence (10%). It affects all ages; but majority of road traffic injuries (RTI) happens in young adults of productive life.

Traumatic brain injury is also a very important clarification for death and incapacity, significantly amongst individuals below the age of forty five years. Traumatic brain injury (TBI) is also a international standing that has hurtful consequences for the people with the brain injury, their families and therefore the society.

As a result RTAs became the leading cause for head injury. Electrolyte imbalance happens in further than quantity of traumatic brain injury patients unit of measurement usually clinically, imaging, subdural, intra cerebral, subarachnoid or intra-ventricular haemorrhages.

Prompt correction of electrolytes imbalance can significantly improve the prognosis and survival outcome in Traumatic brain injury patients. Electrolytes imbalance is most important abnormality occur in traumatic brain injury patients. Its timely correction significantly improves the mortality and morbidity of the patients. The present study was conducted on 109 cases of traumatic brain injury.

Our results demonstrate that patients with severe head injury are at a high risk for the event of hypernatremia, hyponatremia, hypokalaemia, symptom.

Brain symptom chemical compound brain natriuretic product (BNP) activities could responsible for symptom. Brain symptom chemical compound is associate economical drug, symptom, vasodilating agent, and associate substance of the secretion of sex hormone, renin, and ADH.

Patients with severe head injury unit at high risk for the event of symptom, low part levels in these patients are because of a rise in their urinary loss, caused by medical specialty trauma.

However, the fundamental quantity among that stuff volumes were fashioned is unknown, as a results of we have a tendency to tend to tend to were unable to check the last time that the patients had urinated before the prevalence of head injury. Additionally, spontaneous stuff loss may have occurred in patients at the scene of their accident. This may result in a true statement of residual stuff levels.

Although this doesn't establish that polyuria was the rationale for answer deficit it looks on the face of it that top stuff production and viscus excretion of resolutions contributed to the prevalence of solution disorders. It's sturdy to check to what extent outcome in our

patients was laid low with the presence of answer disorders. Serum sodium and serum potassium unit measured habitually at admission altogether patients, likewise as those with cerebral injury.

So, deficiencies in levels of those electrolytes unit on the face of it to stay unseen for a extended amount of some time. In my study it is demonstrate that hypernatremia is the most commonly found electrolyte imbalance. Hypernatremia significantly increase the odds of post-operative death in the first 24 hours.

Present study supported the hypothesis that the incidence of electrolyte imbalance is affected by the severity of TBI. The clinical significant of finding is twofold. Such electrolyte imbalance are immediately identified and rapidly corrected. There is also correlation between the GCS of the patient on admission and prognosis of patients and incidence of electrolyte imbalance.

CONCLUSION:

With the resuscitation of patients with head injury and timely detection of electrolyte imbalance, that is within 24 hour of head injury and with the timely correction of electrolyte imbalance both the morbidity and mortality of patients with traumatic brain injury decreases.

Sodium is the most common electrolyte affected.Serum potassium, serum calcium must also be looked as they play an important role in prevention of secondary brain insults, preservation of cerebral perfusion pressure (CPP),and improvement of cerebral natural process if correction electrolyte imbalance done within 24 hours following resuscitation.

In our study there's several pattern of head injury with many types of electrolyte imbalance. like EDH, SDH, SAH, Contusion etc.

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