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Effectiveness of Mannitol Therapy in Patients of Cerebral Oedema Caused by Traumatic Brain Injury"- A Retrospective Study

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ABSTRACT

Truamatic Brain Injury: It occurs when sudden trauma causes damage to brain, can result when head suddenly and violently hits objects or when objects pierces the skull .In India estimated 16 lacks persons sustain head injury each year with 2 lacks deaths. Estimated Prevalence in India is 9.7 million, out of which 16% sustain sever TBI. Contributing to leading cause of morbidity, mortality, disability and socioeconomic losses in India and other developing countries. As a result of TBI brain function is temporarily or permanently impaired leading to cerebral oedema in 85% cases. Mannitol: Mannitol, an osmotic diuretic is the mainstay of treatment for cerebral oedema. Rapid iv Mannitol reduces intra-cranial pressure and cerebral edema by reducing brain mass. Considering its *cost-effectiveness and rapid action* to decrease the intra-cranial pressure in critical conditions like traumatic brain injury it is fabricated to assess the efficacy of mannitol therapy in trumatic brain injury. To find out optimal duration of mannitol therapy according to grading of severity of TBI. 1 Grading patients according to severity of the brain injury based on Glassglow coma scale 2. Assessing optimal use of mannitol by considering duration of mannitol therapy TYPE OF STUDY: It is a retrospective study. STUDY SETTING**:** Case records of patients admitted from Aug 2014 to Aug 2015, in AVBRH Hospital sawangi who received Mannitol therapy SAMPLE SIZE: 40 patients. DATA COLLECTION: Data was collected from case papers available at medical report department of AVBRH hospital in structured format STUDY DESIGN: 1. Case records of patients admitted from Aug 2014 to Aug 2015, in AVBRH Hospital sawangi who received Mannitol therapy were assessed at medical report department of AVBRH hospital 2. Depending upon GCS scale written on case paper at time of admission patients were graded as mild, moderate and sever grades of severity 3. With the start of mannitol therapy till the day when GCS scale scored 15/15 was considered to be the total duration of mannitol therapy required to reduce edema effectively. This study suggest stage wise or severity wise treatment regimen of mannitol should be followed to decrease mortality as well as morbidity.Categorization of the patients with TBI is very important as per the severity of TBI with the help of GCS which is a clinical tool designed to assess severity of TBI. This study has certain limitations as it is Retrospective study with less sample size, more Prospective studies with large sample size is required to make this study more evident.

Keywords: TBI – Traumatic brain injury, GCS – Glasglow coma scale, ICT –intracranial tension

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INTRODUCTION

Traumatic brain injury is damage to the brain as a consequence of a focal impact upon the head, from external mechanical force, by a sudden acceleration/deceleration within the cranium or by a complex combination of both movement and sudden impact.

In India estimated 16 lacks persons sustain head injury each year with 2 lacks deaths. Estimated Prevalence in India is 9.7 million, out of which 16% sustain sever TBI. [1].Contributing to leading cause of morbidity, mortality, disability and socioeconomic losses in India and other developing countries [2,3] showing a peak incidence between 15-24 years of age. Males sustain traumatic brain injuries more frequently than do females. Causes include falls, vehicle accidents, and violence. As a result of TBI brain function is temporarily or permanently impaired leading to cerebral oedema in 85% cases. 20th century saw critical developments in diagnosis and treatment that decreased death rates and improved outcome.

Primary brain injury include damage that occurs at the moment of trauma when tissues and blood vessels are stretched, compressed, and torn that occur in the minutes to days following the trauma.

secondary injury events include damage to the blood–brain barrier, release of factors that cause inflammation, free radical overload, excessive release of the neurotransmitter glutamate (excitotoxicity), influx of calcium and sodium ions into neurons, and dysfunction of mitochondria. Other factors in secondary injury are changes in the blood flow to the brain; ischemia (insufficient blood flow); cerebral hypoxia (insufficient oxygen in the brain); cerebral oedema (swelling of the brain); and raised intracranial pressure (the pressure within the skull). Intracranial pressure may rise due to swelling or a mass effect from a lesion, such as a haemorrhage, direct tissue damage and impaired regulation of cerebral blood flow and metabolism leads to ischemia which further leads to accumulation of lactic acid due to anaerobic glycolysis, increased membrane permeability, and consecutive oedema formation.

Therefore role of diuretics in decreasing blood volume thereby decreasing Intra Cranial Tension is very important. **Mannitol, an osmotic diuretic is** the mainstay of treatment for cerebral oedema. Rapid iv Mannitol reduces intra-cranial pressure and cerebral edema by reducing brain mass. [4]. It elevates blood plasma osmolality, resulting in enhanced flow from tissues, including brain and cerebrospinal fluid, into interstitial fluid and plasma. As a result, cerebral oedema , elevated ict and cerebrospinal fluid volume is reduced. By its immediate plasma expanding property and by reducing viscosity it increases cerebral perfusion pressure (cpp) and microcirculation perfusion. This leads to increased flow, increased in cerebral blood flow and cerebral o2 delivery. Grades of severity of head injury are determined by glasglow coma scale and accordingly required dose of mannitol can be calculated. Mannitol in dosages of 0.5 to 1 gm/kg may be used intravenously at 6 hourly intervals as a standard dose.

Mannitol osmotherapy has proved to be lifesaving in patients of cerebral haemorrhage and cerebral oedema. Considering its ***cost-effectiveness and rapid action*** to decrease the intra-cranial pressure in critical conditions like traumatic brain injury it is fabricated to assess the efficacy of mannitol therapy in traumatic brain injury.20th century saw critical developments in diagnosis and treatment that decreased death rates and improved outcome.

Aims and Objectives

Aim

To find out optimal duration of mannitol therapy according to grading of severity of TBI

Objectives

1 Grading patients according to severity of the brain injury based on Glassglow coma scale 2. Assessing optimal use of mannitol by considering duration of mannitol therapy

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MATERIALS AND METHODS:

- TYPE OF STUDY: It is a retrospective study.
- STUDY SETTING : Case records of patients admitted from Aug 2014 to Aug 2015, in AVBRH Hospital sawangi who received Mannitol therapy
- SAMPLE SIZE: 40 patients.
- DATA COLLECTION : Data was collected from case papers available at medical report department of AVBRH hospital in structured format
- ETHICAL CONSIDERATION: study design was approved by ethical committee.

INCLUSION CRITERIA:

Patients with Traumatic Brain Injury with CT scan report showing cerebral oedema and who had received mannitol therapy.

EXCLUSION CRITERIA:

Patients of cerebral oedema due to some another reason who had not received mannitol therapy.

STUDY DESIGN:

- Case records of patients admitted from Aug 2014 to Aug 2015, in AVBRH Hospital sawangi who received Mannitol therapy were assessed at medical report department of AVBRH hospital
- Depending upon GCS scale written on case paper at time of admission patients were graded as mild, moderate and sever grades of severity
- With the start of mannitol therapy till the day when GCS scale scored 15/15 was considered to be the total duration of mannitol therapy required to reduce oedema effectively.

GRADING OF TBI: It has mentioned score in the range of 3-15.

Table 1. Glasslow coma scale

eye opening response	spontaneous - open with blinking at baseline	4 points
	opens to verbal command, speech, or shout	3 points
	opens to pain, not applied to face	2 points
	None	1 point
verbal response	Oriented	5 points
	confused conversation, but able to answer questions	4 points
	inappropriate responses, words discernible	3 points
	incomprehensible speech	2 points
	None	1 point
motor response	obeys commands for movement	6ponits
	purposeful movement to painful stimulus	5 points
	withdraws from pain	4 points
	abnormal (spastic) flexion, decorticate posture	3 points
	extensor (rigid) response, decerebrate posture	2 points
	None	1 Point

Table 2. Severity of traumatic brain injury based on glasgow coma scale [5, 6, 7]

SEVERITY	GCS SCORE
1. mild	13-15
2. moderate	9-12
3. severe	3-8

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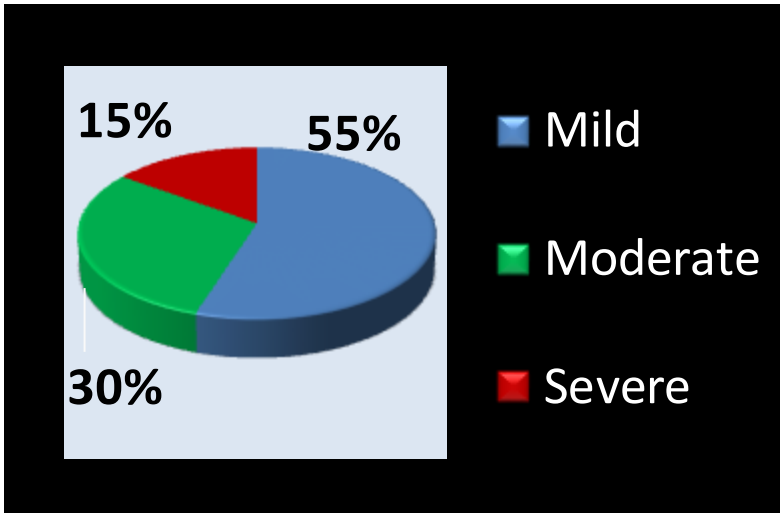
OBSERVATIONS AND RESULT

SEVERITY GRADING: Among 40 patients of TBI 22 patients (55%) of mild grade of severity, 12 patients (30%) of moderate grade and 6 (15%) of sever grade were found during study, as shown in chart 1.



Severity Grading- Chart 1

Average time taken by mannitol to effectively reduce cerebral edema varied according to the severity of TBI: for Severe cases it took 11days, for Moderate cases - 7 days, for Mild cases - 3 days were required ,shown in figure 2.

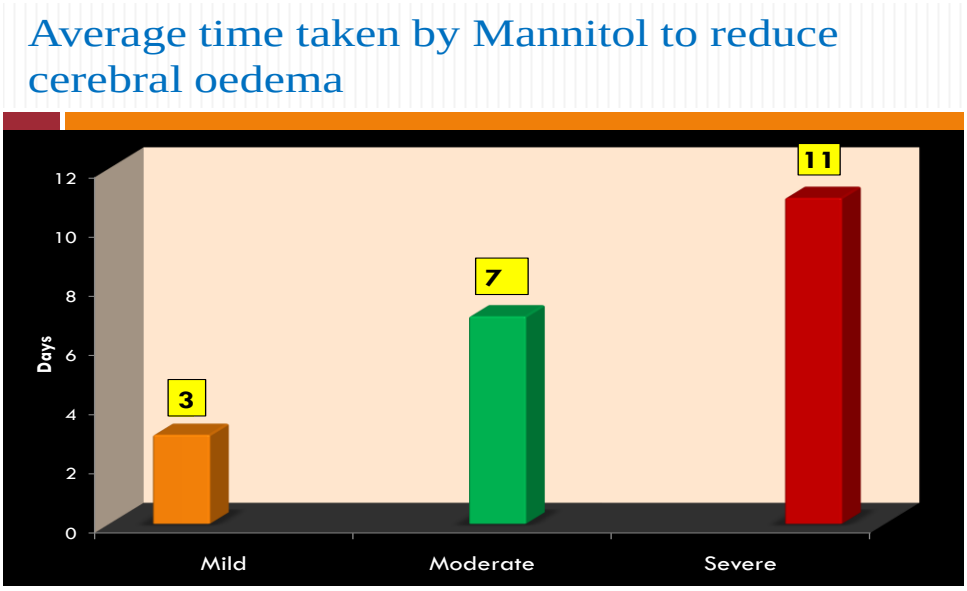


Chart 2

DISCUSSION

In this study, we found that time taken by mannitol to reduce cerebral edema effectively were different for different grades of severity of TBI. And therefore severity grading of TBI will help in management of cerebral oedema which is a very frequent presentation of patient with TBI. Also this study help treating doctors to predict time required to reduce the cerebral edema by mannitol in different grades of TBI which will help to improve prognosis of patients of TBI. Our findings are similar to **Abel Wakai et al**.

CONCLUSION

This study suggest stage wise or severity wise treatment regimen of mannitol should be followed to decrease mortality as well as morbidity.Categorization of the patients with TBI before initiation of mannitol therapy is very important as per the severity of TBI with the help of GCS which is a clinical tool designed to assess severity of TBI. And also daily CGS score record should be maintained for the patient of cerebral edema which is important for assessing effectiveness of mannitol therapy.This study has certain limitations as it is Retrospective study with less sample size. More Prospective studies with large sample size are required to make this study more evident.

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