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"ROLE OF 3% HYPERTONIC SALINE AND 20% MANNITOL AS ANTIEDEMA MEASURE IN MANAGEMENT OF MODERATE TO SEVERE HEAD INJURY: A PROSPECTIVE STUDY"

Surgery

Deepti Dhodi* Senior Resident *Corresponding Author

A.K. Chaurasia Associate Professor

Pushpendra Gehlod Senior Resident

ABSTRACT

Traumatic Brain Injuries cause substantial morbidity and mortality. At tissue level brain injuries are a result of damage to the brain parenchyma and/or collection of blood in the within the cranium due to rupture of the blood vessels. As a result there is increase in the intracranial pressure due to increase in the volume of intracranial contents (from blood or edema). Hyperosmolar therapy with mannitol or hypertonic saline is used to reduce cerebral edema.

AIMS & OBJECTIVES: To study the efficacy and safety of 3% hypertonic saline as compared with 20% mannitol in the management of moderate to severe head injury.

METHODS: Comparative prospective study design with random distribution. Group A (patients treated with Mannitol) n=30. Group B (patients treated with 3% hypertonic saline) n=30.

INCLUSION CRITERIA: 60 patients admitted to the Department of Surgery with moderate to severe head injury over. 18 years of age from March 2017 to March 2018, whose attendants also gave consent.

EXCLUSION CRITERIA: Age 18 years

RESULT & CONCLUSION: In our comparative prospective study, we concluded that the efficiency of 20% Mannitol and 3% Hypertonic Saline for the treatment of cerebral edema in patients with moderate to severe head injury is almost equal. Hypertonic saline (3%) therapy in case of moderate to severe head injury was found to be as safe & as efficacious as mannitol.

KEYWORDS

Mannitol, 3% hypertonic saline, Head injury.

INTRODUCTION-

Traumatic brain injury (TBI), also known as intracranial injury, occurs when an external force injures the brain. Brain trauma occurs as a consequence of a sudden acceleration or deceleration within the cranium or by a complex combination of both movement and sudden impact. In addition to the damage caused at the moment of injury, a variety of events in the minutes to days following the injury may result in secondary injury. These processes include alterations in cerebral blood flow and the pressure within the skull. Treatment depends on severity of the injury like minimal or may include interventions such as medications, emergency surgery or surgery years later.

In medical interventions, Mannitol, Urea, Glycerol and 3% Hypertonic Saline was used, due to complications urea and glycerol were abandoned and these days, we use mannitol and hypertoic saline as anti-edema measure. Operation is definitive therapy in reducing ICP by evacuating hematoma[1].

Conservative treatment can be carried out immediately prior to the operative procedure or if the operative procedure cannot be conducted[2].

Conservative treatment such as the
- 30° head-up position.
- hyperventilation, hypothermia .
- the use of hyperosmolar fluid[3].

MANNITOL-

Mannitol is a type of sugar alcohol which is also used as a medication[2]. As a medication, it is used to decrease pressure in the eyes, as in glaucoma and to lower increased intracranial pressure[4,5].

Effect after injection typically begin within 15 minutes and last up to 8 hours[6]. Common side effects from medical use include electrolyte imbalance and dehydration[4]. Other serious side effects may include worsening heart failure and nephrotoxicity[4,6].

SALINE:

Saline or saline solution, is a mixture of sodium chloride in water and has many uses[2]. Saline is in the crystalloid family of medications[5]. Saline has a pH of 5.5 making it highly acidic[6].Large amounts may result in fluid overload, swelling, acidosis, and high blood sodium[2,4]. Hyperosmolar treatment is one of the important method of treating cerebral edema and has been employed since 1960. Side effect such as rebound edema, hypovolemia and nephrotoxicity have lead to search for new agents one of them being hypertonic saline.

AIMS AND OBJECTIVES-

To study the efficacy and safety of 3% hypertonic saline and compare with 20% mannitol in the management of moderate to severe head injury.

To observe untoward effects if any.

MATERIALS AND METHODS-

Present study was carried out in the Department of General Surgery, Gandhi Medical College and Associated Hamidia Hospital, Bhopal (m.p.) after obtaining approval from the ethical committee.

Study design: A comparative prospective study

Setting: Department of Surgery, Hamidia Hospital, Bhopal

INCLUSION CRITERIA:

60 patients with moderate to severe head injury over 18 years of age from March 2017 to March 2018, whose attendant also gave consent.

EXCLUSION CRITERIA

Patients with age <18 years

Groups and method of randomization-

Group A (patients treated with Mannitol) n=30
Group B (patients treated with 3% hypertonic saline) n=30.

Intervention protocol

Dose of Mannitol 20% 2ml/Kg infused over 20 minutes 6 or 8 hourly for the group A. Group B infused with 3% 2ml/Kg Hypertonic Saline over 20 minutes.

MEASUREMENTS TAKEN

Blood pressure: pre and post drug after 30 minutes administration 3 measured for 5 consecutive days.

S. creatinine: First day and 4th day.
Serum electrolytes: Initial five days.

MAP (Mean Arterial Pressure): As per the recordings of the BP pre drug and post drug administration for five consecutive days.

Duration of Coma hours:
Measured during the period of hospitalization

OBSERVATIONS AND DISCUSSION-
TABLE-1

SERIAL No.	MEASURES	GROUP A (MANNITOL)	GROUP B(HYPERTONIC SALINE)
1	AGE	37.06+10.63	37.90+10.20
2	SEX(male)	88.3%	70%
3	SEX(female)	16.6%	30%
4	OUTCOME (improved)	24(80%)	22(973.3)
5	OUTCOME (death)	6(20%)	8(26.6%)
6	DURATION OF COMA (hrs)	73.6±38.8	77.25±33.8

In present study, mean age, sex ratio, blood investigation results and duration of coma was comparable in both the study groups and results obtained were statistically insignificant ($p<0.05$).[TABLE-1]

Also the outcome of surgery in terms of improvement in condition or death was comparable and statistically insignificant ($p<0.05$) in two study groups.

Table -2 Serum Electrolyte Level In Two Groups-

SERUM NA+	GROUP A MANITOL (N=30)	GROUP B HYPERTONIC SALINE (N=30)
Day 1	126.6 ± 1.5	125.3 ± 1.5
Day 2	124.3 ± 1.5	127.1 ± 1.8
Day 3	122.8 ± 1.7	129.2 ± 2.2
Day 4	121.5 ± 1.3	129.5 ± 2.6
Day 5	123.8 ± 2.2	127.8 ± 1.9

Serum Na+ levels were on lower side in both groups but more lower levels were seen in mannitol group. Hypernatremia was seen in one patient only in study group with hypertonic saline.

Table- 3 Serum Creatinine Level In Two Groups

S. CREATININE	GROUP A MANNITOL (N=30)	GROUP B HYPERTONIC SALINE (N=30)
Day 1	1.04 ± 0.9	1.06 ± 0.9
Day 4	1.16 ± 1.02	0.98 ± 0.5

Serum creatinine value on day 1 and day 4 is almost similar in both the group.

Table-4 Mean Arterial Pressure And Gcs Of Patients In Mannitol Group

DAY	PREDRUG MAP	PREDRUG GCS	POSTDRUG MAP	POSTDRUG GCS
1	92.84	9	88.5	9
2	90.01	8	86.5	8
3	87.65	9	84	9
4	88.67	10	86.5	10
5	90.21	12	89.40	12

MAP measurement pre drug (mannitol) and half hour after mannitol which was significantly decreased in initially 3 days & later its effect decreases.

Table-5 Mean Arterial Pressure And Gcs In Patients Of Hypertonic Saline Group

DAY	PREDRUG MAP	PREDRUG GCS	POST DRUG MAP	POSTDRUG GCS
1	90.86	8	89.5	8
2	89.94	9	88.68	9
3	90.01	9	88.72	9
4	88.52	10	87.42	10
5	89.20	12	88.41	12

Changes in MAP after hypertonic saline was relatively less but constant throughout in initial 5 days.

Table-6 Gcs Score Of The Patients In Mannitol And Hypertonic Saline Group

	GCS SCORE OF THE PATIENTS IN MANNITOL (GROUP A)			GCS SCORE OF THE PATIENTS IN HYPERTONIC SALINE GROUP (GROUP B)		
GCS	ON ADMISSION	IMPROVED	DEATH	ON ADMISSION	IMPROVED	DEATH
3-5	8	1	7	5	1	4
6-8	8	8	0	12	9	3
9-12	14	14	0	13	13	0

Mortality was very high in very severe head injury patients with GCS score less than 8 & this was almost same in both the groups.

Mannitol and hypertonic saline were found equally effective as anti-edema agents in our study. Vialet et al[7]. Conducted a randomised controlled trial with hypertonic saline and mannitol and found no difference In mortality And Neurological Improvement.

Battison et Al[8] conducted a prospective, cross-over, controlled study on 9 TBI Patients (N=6) And SAH (N=3) with 200 Ml 20% Mannitol (249 Mosm) Or 100 Ml Of 7.5% Saline And 6% Dextran- 70 (250 Mosm). They found that hypertonic saline gave More significant reduction in ICP and longer duration effect than mannitol. Oddo et al[9] conducted a prospective, non-randomized, cross-over study with12 patients of severe TBI with mannitol vs hypertonic saline and they found that hypertonic saline had effects in decreasing ICP, increasing CPP and brain tissue oxygenation which was better than mannitol.

Cottenceau et al[10] conducted a study with 47 patients of severe TBI with mannitol or saline hypertonic and concluded that hypertonic saline provided more powerful effect on the improvement of CPP. There was no difference in neurological outcome in both groups.

Sakellarindis et al[11] conducted a study with mannitol and hypertonic saline and found no significant difference either in decreasing ICP and duration of the action of the two solutions.

Mangat et al[12] studied 50 patients with severe TBI with mannitol and hypertonic saline and found that hypertonic saline provided lower daily and cumulative increased ICP and shorter period of ICU hospitalization than mannitol

CONCLUSION

In our comparative prospective study, we concluded that the efficiency of 20% Mannitol and 3% Hypertonic Saline for the treatment of cerebral edema in patients with moderate to severe head injury is almost equal.

There was no significant difference in mortality. The duration of coma hours were also not very different.

There was no difference in neurological outcomes of both the groups. No significant untoward complication observed in both the groups which were found to be related to drug.

Hypertonic saline (3%) therapy in case of moderate to severe head injury is found to be as safe & as efficacious as mannitol .

No significant hypernatremia is seen in 97% of our patients of hypertonic saline (3%) group.

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