Resuscitation of traumatic brain injured Sudanese patients

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ABSTRACT

This prospective study was carried out in Khartoum Teaching Hospital Casualty to improve the awareness of proper resuscitation and to minimize mortality and post-traumatic disability. In addition, to evaluate the resuscitation of traumatic brain injured patients by using different methods of resuscitation. Despite the general conditions of 67 patients in lack of medevac; the time factor was included in the study. Regarding clinical examinations that include systemic blood pressure, Glasgow Coma Scale, Pupillary and other general examination of the chest, abdomen and extremities. All patients were resuscitated with Intra-venous fluids regardless the circulatory situation, 64 patients were resuscitated with normal saline in a percentage of 95.5%, one patient was resuscitated with colloid solution (Hemagel) in a percentage of 1.5% and two patients received blood in a percentage of 3.0%. The total number of patients who received frusmide were 38 patients in a percentage of 56.7%. The number of patients who received mannitol were 14 patients in a percentage of 20.9%. Failure of resuscitation was behind the high mortality, which was 46 patients in a percentage of 68.7%. While the living patients were 21 in a percentage of 31.3%.

Keywords: Brain injured, Frusemide, Hypotension, Mannitol, Resuscitation, Sudan

INTRODUCTION:

Traumatic brain injury is characterized by direct tissue damage and impaired regulation of cerebral blood flow and metabolism. This ischemia like pattern leads to accumulation of lactic acid due to anaerobic glycolysis. The first priority for the head-injured patient is complete and rapid physiologic resuscitation. The administration of mannitol is desirable but only under conditions of adequate volume resuscitation. However, in multitrauma patients with head injury, Scalea demonstrated a lack of relationship between amount of fluid or blood infused and ICP, (Scalea, et al, 1994). Hypertonic saline and mannitol have been advocated as resuscitation fluids in addition to the reduction of intracranial hypertension. Clinically, mannitol is routinely used to reduce ICP in TBI patients with intracranial hypertension. The prehospital administration of mannitol versus placebo in TBI patients showed no difference in mortality; however, in the treatment group SBP fell significantly two hours after hospital arrival, but comparing all time periods there was no substantial difference,(Sayre, et al,1996). The importance of mean arterial pressure, as opposed to systolic pressure, should also be stressed, not only because of its role in calculating CPP, but because the lack of a consistent relationship between systolic and mean pressures makes calculations based on systolic values unreliable. It may be valuable to maintain mean arterial pressures considerably above those represented by systolic pressures of 90 mm Hg throughout the patient’s course. The incidence of morbidity and mortality resulting from severe head injury is strongly related to ICP and hypotension measured during the course of ICP management, (Miller and Becker 1982). A strong statistical relationship exists between early hypotension and increased morbidity and mortality in patients with severe head injury, (Miller, et al, 1978). This is the first prospective report implicating early hypotension as a major predictor of increased morbidity and mortality from severe head injury ICP control using a threshold of 20 mm Hg as a part of an overall aggressive treatment approach to severe head injury may be associated with improved outcome, (Narayan, et al/ 1982). Early surgery with intraoperative hypotension is significantly correlated with increased mortality from severe head injury in a duration-dependent fashion, (Pigula, et al, 1993). The detrimental effects of hypotension (SBP < 90
mm Hg) on outcome appear to extend to children, (Rose, et al 1977). Hypotension is a major avoidable cause of increased mortality in patients with moderate head injury, (Sayre, et al, 1996). Early hypotension is significantly correlated with increased incidence and severity of intracranial hypertension and increased mortality, (Silverston, 1989). Raising the blood pressure in the hypotensive, severe head injury patient improves outcome in proportion to the efficacy of the resuscitation. Prehospital administration of 7.5% sodium chloride to hypotensive trauma patients was associated with a significant increase in blood pressure compared with infusion of Lactated Ringer’s (LR) solution. The survivors in the LR and hypertonic saline (HS) groups had significantly higher blood pressures than the non-survivors. There was no significant increase in the overall survival of patients with severe brain injuries; however, the survival rate in the HS group was higher than that in the LR group for the cohort with a baseline GCS score of 8 or less, (Vassar, et al, 1993). Logistic regression analysis was performed on patients with TBI showing an odds ratio of 1.92 for 24-hour survival, and 2:12 for survival until discharge. Thus, patients with TBI in the presence of hypotension who received HSD were approximately twice as likely to survive as those who received saline. This was statistically significant (p = 0.048). Pre-hospital endotracheal intubation was associated with a statistically significant improved survival, (Winchell and Hoyt, 1997).

PATIENTS AND METHODS:
This study was conducted in Khartoum Teaching Hospital Casualty of neurosurgery and Alshaab Teaching Hospital (since the casualty is the same for both hospitals), in the period from February 2008 to February 2009. Patients with severe traumatic head injury, and who were received within 6 hours of trauma in the casualty with GCS of 3-8. Baseline vital signs and investigations were taken from the admission sheet. Patients without baseline vital signs and investigations were registered separately.

RESULTS AND DISCUSSION:
Hypertonic saline has been demonstrated to reduce ICP in patients with TBI and intracranial hypertension. Subgroup, post-hoc analysis of severe TBI patients in a prospective, randomized, placebo-controlled, multicenter trial demonstrated both a higher SBP and enhanced survival in trauma patients resuscitated with hypertonic saline instead of crystalloid. This data strongly suggests that elevating the blood pressure in hypotensive, severe head injured patients improves outcome. Meta-analysis of TBI patients who received hypertonic saline/dextran are about twice as likely to survive as those who receive standard therapy, (Wade, et al, 1997).

Management and patient resuscitation: The number of patients who were resuscitated with Intra venous fluids regardless the circulatory situation were 67 patients , 64 patients were resuscitated with normal saline in a percentage of 95.5%, one patient was resuscitated with colloid solution ( Hemagel) in a percentage of 1.5% and two patients received blood in a percentage of 3.0% (table 15).

Table 1: Fluid resuscitation

<table>
<thead>
<tr>
<th>Type of fluids</th>
<th>Number of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal saline</td>
<td>64</td>
<td>95.5</td>
</tr>
<tr>
<td>Normal saline and Hemagel</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Blood</td>
<td>2</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>100%</td>
</tr>
</tbody>
</table>

Baseline blood pressure was recorded for 57 patients in a percentage of 85.1% whereas 10 patients in a percentage of 14.9% had no blood pressure recorded. Patients with low systolic pressure (<90 mm Hg) were 9 patients, 8 of them died, (table1). This agree with (Miller, 1978, 1982) who reported that hypertension has a strong statistical relationship in increasing the morbidity and mortality in patients with severe traumatic head injury. Poor resuscitation and those patients whose blood pressure was not recorded were behind the high mortality, this indicates poor resuscitation and the possibility to improve outcome if they were managed properly (Jeffrey and Jones, 1981) and (Hill et al, 1993). Improving pre-hospital management decreased the incidence of hypotension but its impact on outcome in patients suffering hypotensive insults maintained as a statistically significant, independent predictor of poor outcome (Gentleman, 1992). Management strategies that prevent or minimize hypotension in the prehospital, improving the management of hypovolemic hypotension is a major potential mechanism for improving the outcome from severe head injury (Hill, et al, 1993).
Baseline blood pressure | Number of patients
---|---
Systole <90 | 9
Stable | 19
Unstable | 3
Very high | 3
<100/60 – 140/90 | 16
Diastole<60 | 7
Not done | 10
Total | 67

A single episode of hypotension during this period doubled mortality and also increased morbidity. Patients whose hypotension was not corrected in the field had a worse outcome than those whose hypotension was corrected by time of ED arrival (Chesnut, et al, 1993). Hypotension (SBP < 90 mm Hg) occurring at any time during a patient’s course, independently predicts worse outcome (Cooke, et al, 1995). Early hypotension appears to be a common and avoidable cause of death in severe head injury patients (Jeffreys and Jones 1981). Early hypotension increases the mortality and worsens the prognosis of survivors in severe head injury.

Clinical trials of mannitol management versus frusemide: An attempt was made to lower down the intracranial pressure in fourteen patients who received mannitol in a percentage of 20.9% and thirty eight patients who received frusemide in a percentage of 56.7% this agreed with (Cold, 1990) who said mannitol increased blood flow, central venous pressure, cardiac output and cerebral metabolic rate.

Table 3: Mannitol and Lasix management

<table>
<thead>
<tr>
<th>Mannitol</th>
<th>Frequency</th>
<th>%</th>
<th>Lasix</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>14</td>
<td>20.9</td>
<td>Yes</td>
<td>38</td>
<td>56.7</td>
</tr>
<tr>
<td>No</td>
<td>53</td>
<td>79.1</td>
<td>No</td>
<td>29</td>
<td>43.3</td>
</tr>
</tbody>
</table>

Mannitol at a dose of 0.25-1 g/kg body weight has been shown to be effective for control of raised intracranial pressure in TBI patients. The BTF guidelines recommend that mannitol should not be used without ICP monitoring unless the patient demonstrates signs of transtentorial herniation or progressive neurologic deterioration. In a 1985 retrospective analysis by (Kohi, et al, 1984) , mannitol improved MAP, CPP, cerebral blood flow, and lowered ICP. In 2007 Sakowitz et al. studied the effects of a 0.5 g/kg bolus of mannitol on ICP in six male TBI patients (GCS <9) with an ICP exceeding 20 mm Hg.

Mannitol was administered in 14 instances of elevated ICP, and it successfully reduced ICP in all cases. Maximal effect was seen 40 minutes after the start of the 20 minutes infusion, and effects last up to
100 minutes this agreed with (Sakowitz, et al 2007). Francony et al, reported in 2008 a comparison of equimolar doses of mannitol and 7.45% HSS in increased ICP in 20 patients, 17 of which had TBI. Patients were stable (including a MAP > 80 mmHg) with a sustained ICP of > 20 mmHg for 10 minutes or greater. Both groups had a significant reduction of ICP. Only the mannitol group had a significant increase in CPP. Changes in serum sodium, chloride and osmolality were not different between the two groups. The authors concluded that both mannitol and HSS exhibit comparable effectiveness in reducing ICP in stable patients. Factors such as serum sodium and systemic and brain hemodynamics should be considered in the choice between the two. HSS can be recommended in patients who are hypotensive (MAP <80 mmHg), hypovolemic or hyponatremic.

Proper fluid resuscitation: Fluid resuscitation must be with isotonic fluids only, e.g. normal saline. Hartmann’s solution is hypotonic and should not be used. The only place for colloids is when there is a need to deliver large volumes of fluid and blood is not available (but only because one ml for ml basis colloids are better at volume restoration than crystalloids). Glucose containing fluids are usually hypotonic, lead to hyperglycaemia and should be avoided. If, after 2 units of crystalloids and/or colloids, the blood pressure is not rapidly restored then blood should be given if blood loss is assumed to be the cause of the hypotension; either 0-ve or group specific. Anaemia should be corrected and some evidence exists to suggest that the optimal haemoglobin is 100gms/l. No adverse effects of rapid infusion of 7.5% NaCl or 7.5% NaCl/6% dextran 70 were noted. The survival rate of severely head-injured patients to hospital discharge was significantly higher for those who received hypertonic saline/dextran (HSD) (32% of patients with HSD vs 16% in patients with LR) when using logistic regression analysis (Vassar, et al, 1993). Following adequate fluid resuscitation, phenylephrine (10–100 mg/minute) was administered when CPP was 60 mm Hg or less for longer than 15 minutes. If ICP remained elevated despite mannitol infusions, an external ventricular drain was placed for cerebrospinal fluid drainage and the patient was paralyzed using pancuronium. Additional mannitol boluses were administered if ICP remained elevated despite these strategies, until a maximal serum osmolarity of 320 mOsm was measured. Optimized hyperventilation guided by a jugular bulb catheter was initiated as a second-tier therapy when sedation, paralysis, osmotherapy, and external ventricular drain placement failed to reduce ICP. Hyperventilation was increased to a PaCO2 of 25 mm Hg while maintaining a jugular venous O2 saturation greater than 55%. When hyperventilation was required for more than 12 hours or did not reduce ICP, barbiturate agents (a bolus dose followed by continuous infusion) were administered to induce electroencephalogram monitored burst suppression. In these patients vasopressor agents were administered to maintain adequate CPP if there was barbiturate-associated hypotension. A large decompressive hemicranieectomy was performed using previously reported techniques42, 44 when ICP was persistently greater than 20 mm Hg despite maximal medical management. The administration of 7.5% NaCl (HS) and 7.5% NaCl/6% dextran 70 (HSD) caused no neurologic abnormalities. On the contrary, their use was associated with improvement in survival (as compared with predicted survival) in the patients with low initial GCS score (< 8) and in patients with anatomic confirmation of severe cerebral damage. It appeared that the dextran added little to improvement in survival when compared with HS alone. HS solutions did increase the blood pressure response in all patients, (Wade, et al, 1997). There was no statistically significant difference in overall survival when HS was retrospectively compared with normal saline.

CONCLUSION

Failure of resuscitation is associated with poor outcome; frusemide shouldn't be used to relief brain edema in severe brain injured patients. Since CT scan helps in proper management of certain intracranial lesions and the follow up for the long run, the Initial GCS and CT brain findings were found to be useful predictors; they provided proper resuscitation that was commenced beforehand. The surgical intervention in cases of acute SDH was not shown to improve outcome. Mortality in patients with severe traumatic brain injury occurred within the first 24 hours of trauma such as in road traffic accidents, which is increasingly becoming a medical problem which targeting the youth of the nation.

RECOMMENDATIONS:

It is needed to establish a national protocol for management of severe traumatic brain injured patients. It is to be included in the curriculum of neurosurgery course for medical students and residents. Resuscitation should be the prime responsibility of the trauma team and should be
started as soon as possible after accidents. CT brain in emergency situations should be available around the 24 hours. Portable X-R and CT machines are of great importance for both casualty and Intensive Care Unit together with increased number of Intensive Care Unit beds. Interdepartmental cooperation with neurosurgery and other departments is a corner stone in management of severely injured patients. Traffic laws should be strictly implemented to reduce the numbers of accidents.

REFERENCES


