Hyperosmolar therapy for children

Intravenous administration of hyperosmolar solutions was shown to reduce ICP in 1919 [1].

Mannitol has become the most widely used hyperosmolar solution to treat elevated intracranial pressure. Increasingly, hypertonic saline solutions are being used as an adjunct to mannitol in basic science research and clinical studies. Hyperosmolar solutions are effective in reducing elevated intracranial pressure through 2 distinct mechanisms: plasma expansion with a resultant decrease in blood hematocrit, reduced blood viscosity, and decreased cerebral blood volume; and the creation of an osmotic gradient that draws cerebral edema fluid from brain tissue into the circulation.

7.5% HTS infusion as a second-tier osmotic therapy was associated with significant reduction of ICP and increase of CPP in children with severe TBI [2].

There were no comparative studies available for hyperosmolar therapy in children.

A prospective open label randomized control trial compared the effect of equiosmolar doses of mannitol and hypertonic saline in reducing intracranial pressure in children who sustained severe traumatic brain injury.

Thirty children aged less than or equal to 16 years with severe traumatic brain injury and raised intracranial pressure as measured by ventricular catheter insertion were enrolled. Sixteen children received 20% mannitol, and 14 children received 3% saline as 2.5 ml/kg bolus for episodes of intracranial pressure above cutoff value for age. The mean reduction in intracranial pressure and Glasgow outcome scale at 6 months after injury was measured.

The mean reduction in intracranial pressure in mannitol group was 7.13 mmHg and in hypertonic saline group was 5.67 mmHg, and the difference was not statistically significant, $p = 0.33$. The incidence of death or survival in vegetative state was 23.07% in mannitol group and 16.66% in hypertonic saline group, and the difference was not statistically significant, $p = 0.69$.

Both mannitol and hypertonic saline were equally effective for treatment of raised intracranial pressure in children with severe traumatic brain injury [3].

In pediatric TBI with intracranial hypertension, mannitol and 3 % hypertonic saline are commonly used, but dose and therapeutic threshold for use vary without clear indications for one versus another. Controlled trials are warranted, but several barriers were identified, including high exclusion rate, multiple co-interventions, and care variability [4].

The pediatric section of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies adapted previously published guidelines for the treatment of adult brain injury into guidelines for the treatment of children with traumatic brain injury. These guidelines offer recommendations for the management of children with severe head injury, including the use of mannitol and hypertonic saline to treat intracranial hypertension. Acute and critical care pediatric advanced practice nurses caring for children with severe head injury should be familiar with management guidelines and the use of hyperosmolar solutions [5].

1)
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