

NPICU

Hypertonic Saline Administration

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Goal:

Hyponatremia decreases the seizure threshold, especially in patients already prone to seizures, or in patients with brain injury or increased ICP.

Traumatic Brain Injury's (TBI) devastating effects on the brain are exacerbated by the secondary brain injury, which happens after (hours to days) the initial trauma from edema, fluid shifts, immunologic and excitotoxic reactions, and electrolyte imbalances. Hypertonic Saline Solution (**HTS**) may decrease the secondary brain injury cascade by improving patient hemodynamics, modulating the cellular and excitotoxic response, regulating the vascular endothelium, and decreasing the cerebral edema.

HTS has been widely used for Intracranial Pressure (ICP) control.

Goal Range for HTS therapy in **TBI 145-155 mmol/L. In refractory cases target can be increased to 160**

Patient Eligibility:

1. TBI associated with elevated ICP or hyponatremia
2. Stroke associated with elevated ICP or hyponatremia
3. Status epilepticus associated with elevated ICP or hyponatremia

Contraindications:

1. Congestive Heart Failure and Pulmonary Edema
2. Relative contraindications: Hyper Osmolality (Serum Osmolality > 320), metabolic acidosis, electrolyte abnormalities (Hyperchloremia), renal failure.
3. Chronic Longstanding Hyponatremia (would change goal sodium level, and slow rate of rise of Na⁺ level)

4. Central Pontine Myelinolysis
5. Inadequate access: Patient must have stable peripheral intravenous (PIV) access in larger veins, or Central access. 23.4% high concentration sodium chloride to be infused ONLY through central lines.
6. Sodium >155
7. < 1y/o of age (23.4% high concentration sodium chloride)

General Procedure:

1. Adequate Peripheral or Central intravenous access will be obtained.
2. Target serum sodium goal will be identified by NP/MD team. Initial target of 145 to 155 mmol/L. If ICP is not controlled after this level is achieved, the target may be increased to a max. of 160 mmol/L.
3. Bag of 3% will be obtained from Omnicell. An order is required, it is not available on override
4. **Sodium Bicarbonate may be obtained from Crash Cart in an emergency outside the PICU.**
5. Initial bolus dose of HTS: **2-5** ml/kg, over 10-20 min IV. (max 300 mls)
6. Follow up level will be sent to Lab STAT. Avoid different modalities of sodium measurements (GEM vs laboratory run serum sodium)
7. HTS boluses may be scheduled every 6 hours or an infusion may follow the initial bolus to keep serum sodium within range. Increases of **0.5-1** ml/kg hour every 2 -4 hours will be made to increase serum sodium by 0.5-1 meq to achieve goal range of 150-155. Infusion will be titrated to the minimum rate that will achieve the target Sodium level and ICP < 20mmHg. Bolus of HTS may be repeated while on continuous infusion to reach therapy goal. Infusion is recommended for maintenance of sodium level within range.
8. Monitor serum Sodium levels every 2-4 hours until stable, then every 6 hours while on HTS infusion or on schedule HTS doses. Maintenance levels may be sent "routine" not STAT.
9. Daily assessment of continuation of protocol will be made by the team.
10. After patient ICP has stabilized < 20 mmHg for at least 24 hrs: HTS will be weaned every 6 hours by 20 % to maintain Sodium level within normal limit, while maintaining ICP < 20 mmHg. If patient ICP monitor is removed while the patient is receiving HTS, weaning schedule will be also every 6 hours by 20 % to maintain normal sodium level.
11. Bolus of 23.4% high concentration sodium chloride (Over 10 min) is suggested for refractory ICP. The suggested dose is 0.5mL/kg with maximum of 30mL.

In the context of multiple ICP related therapies, avoiding sustained (>72 h) serum sodium >170 mEq/L is suggested to avoid complications of thrombocytopenia and anemia, whereas avoiding a sustained serum sodium >160 mEq/L is suggested to avoid the complication of deep vein thrombosis.

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