NEUROICU Guideline:
Osmotherapy for Treatment of Intracranial Hypertension

Hypertonic Saline- 3% NaCl

Goal: To maintain therapeutic serum osmolality in severely brain-injured patients refractory to 5%NaCl

Patient Eligibility:
1. Patient must be in the NeuroICU and administration of therapy must be per protocol.
2. Patient must have severe intracranial hypertension (ICP > 20mmHg)
3. At least one of the following criteria must be met (see NeuroICU Mannitol algorithm)
   a. Mannitol failure: mannitol has failed to lower ICP to less than 20mmHg within 20 minutes of administration
   b. Mannitol is contraindicated:
      i. Serum osmolar gap > 20
      ii. Mannitol has been administered within the past 6 hrs
      iii. Mannitol is associated with a drop in CPP < 70mmHg
      iv. Significant intravascular volume depletion exists:
         ▪ Based on a clinical assessment by the NeuroCritical Care Service which synthesizes exam findings, laboratory results, and other pertinent clinical data
         ▪ For example: CVP < 6; net negative fluid balance; elevated BUN/creatinine ratio
4. There must be a failure of 5%NaCl to lower ICP:
   a. 20 minutes after administration of 5%NaCl- ICP remains above 20mmHg OR
   b. Severe intracranial hypertension (ICP > 20mmHg) recurs within 4 hrs of administration of 5%NaCl

Contraindications:
1. ICP < 20 mmHg
2. Severe CHF
   a. Hypoxia due to pulmonary edema
   b. Pink, frothy secretions
   c. Severe pulmonary edema on CXR
3. Significant volume overload:
   a. Based on a clinical assessment by the NeuroCritical Care Service which synthesizes exam findings, laboratory results, and other pertinent clinical data
   b. Use caution if CVP ≥ 15 mmHg or PAOP ≥ 12 mmHg
4. Serum Na⁺ ≥ 160mmol/L
5. Chronic hyponatremia
6. Diabetes Insipidus (DI)
7. Relative Contraindication: Primary intracerebral hemorrhage
Monitoring:
All patient receiving HTS for the treatment of intracranial hypertension must have the following parameters monitored and documented:
1. Central venous pressure via a central venous catheter OR pulmonary artery occlusion pressure via a pulmonary artery catheter
2. Intracranial pressure monitoring
3. Serum Na⁺ every 2 hrs
4. All other monitoring and documentation per NeuroICU protocol

Protocol:
** Use must be approved by Neurocritical Care Attending
** HTS must be infused into a central venous catheter.

1. STAT serum Na⁺ must be checked and recorded under the following conditions:
   a. Last serum Na⁺ value was obtained > 2 hrs prior to planned HTS administration OR
   b. Mannitol or 5%NaCl has been administered since the last serum Na⁺ value was obtained.

2. If ICP>20mmHg AND Na⁺<160 mmol/L AND all of the above criteria are met, patient is eligible to receive 3%NaCl

3. Start infusion of 3%NaCl:
   a. MD will order a continuous 3%NaCl infusion to be started at a rate of 10-50ml/hr and titrated q2hrs per sliding scale to achieve a target serum sodium level that will be ≤160mmol/L
   b. Serum Na⁺ levels must be checked every 2 hours during infusion
   c. Neither boluses of mannitol nor 5%NaCl should be administered during therapy with 3%NaCl

d. Sliding Scale:

<table>
<thead>
<tr>
<th>Serum Na⁺</th>
<th>ICP</th>
<th>3% NaCl Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;140</td>
<td>&gt;20</td>
<td>Increase rate by 20ml/hr not to exceed 100ml/hr.</td>
</tr>
<tr>
<td></td>
<td>&lt;20</td>
<td>Continue current rate</td>
</tr>
<tr>
<td>141-150</td>
<td>&gt;20</td>
<td>Increase rate by 10ml/hr not to exceed 100ml/hr.</td>
</tr>
<tr>
<td></td>
<td>&lt;20</td>
<td>Continue current rate</td>
</tr>
<tr>
<td>151-160</td>
<td>&gt;20</td>
<td>Increase rate by 5ml/hr not to exceed 100ml/hr.</td>
</tr>
<tr>
<td></td>
<td>&lt;20</td>
<td>Continue current rate</td>
</tr>
<tr>
<td>&gt; 160</td>
<td></td>
<td>Stop infusion; recheck serum Na⁺ in 2 hrs. Call MD.</td>
</tr>
</tbody>
</table>

e. Treatment endpoints: Treatment should continue until either
   i. Causes of intracranial hypertension have been resolved or have been more definitively treated
   ii. Signs/Symptoms of volume overload or CHF. Daily assessment and documentation regarding the necessity of ongoing treatment is necessary.

f. Infusion must be discontinued if serum Na⁺ ≥160 mmol/L

g. Infusion must be stopped if signs/symptoms of volume overload develop.