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Hypertonic Saline for Management of Symptomatic Hyponatremia

Case Presentation

- MJ is a 56 year-old female, presents to the ED with a chief complaint of progressively worsening weakness and fatigue over the past week, associated with a loss of appetite, nausea, and occasional confusion.
  - MJ denies shortness of breath, chest or abdominal pain, cough, pain or swelling in her legs, other neurological symptoms, fever, vomiting, or diarrhea.
  - Her medical history is significant for hypothyroidism, hypercholesterolemia, and hypertension.
  - According to family, she was hospitalized for three days a few months ago due to "dehydration", at which time she was given "fluids".
  - While transporting MJ to the CT scanner, she has a witnessed prolonged tonic-clonic seizure
  - POC labs are unremarkable except a serum sodium of 118 mEq/L

- How would you manage this patient?
  - 3% Hypertonic Saline STAT!

Pharmacology

	3% Hypertonic Saline (NaCl)
Dose*	• 2 ml/kg or 50-150 ml ○ Max of 3 boluses of 3% NaCl preferably over 10-30 minutes apart • Option to dose based on calculated sodium deficit

Administration*	• IV bolus
	  ○ Recommended administration for symptomatic hyponatremia
	  ○ Administered over 10-60 minutes
	  ○ May be given through peripheral access while central access obtained

PK/PD	• Onset: Minutes • Duration: Varies based on infusion or bolus dosing
Adverse Effects	• Hypernatremia • Fluid or solute overload • Hypokalemia • Acidosis • Overcorrection of hyponatremia
Monitoring	• BMP (Na^+, K^+, Cl^-) • Symptoms of hyponatremia • Serum osmolality • Volume status • Neurological Exam
Compatibility	• Not compatible with blood products or drugs incompatible with normal saline
Comments	• Critical to establish IV access with largest bore at most proximal access • During emergencies it may be acceptable to administer through peripheral IV

*Check institutional guidelines

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Keys to Managing Symptomatic Hyponatremia	
Indications for Emergency Treatment	• Confusion, agitation, coma, or seizures secondary to low serum sodium levels

Goal Na+	• Symptoms of severe hyponatremia
	  ○ Goal of 5 – 6 mEq/L increase in serum sodium in first 1 – 2 hours
	  ○ Goal of 120 mEq/L initially followed by slower correction to approximately 130 mEq/L over the following 24-48 hours
	  ▪ Initial goal serum sodium level should be lower if the baseline serum sodium is < 100 mEq/L

Pharmacologic Agent	Osmolality
• **3% NaCl** • **7.5% NaCl** • **8.4% Sodium Bicarbonate** • **23.4% NaCl**	• 1027 mOsml/L • 2,567 mOsm/L • 2000 mOsm/L • 8011 mOsm/L

Overview of Evidence			
Author, year	Design/ sample size	Intervention & Comparison	Outcome
Dillion, 2018	Observational, N=66	3% NaCl through PIV	• Max rate= 50 ml/hr • Mean duration infusion= 14 hrs (IQR 4–30) • **Infusion-related phlebitis= 3%**
Perez 2017	Observational, N=28	3% NaCl through PIV	• Max rate= 50 ml/hr • Mean duration infusion= 36 hrs (range 1–124) • **Infusion-related phlebitis= 3%**
Jones, 2016	Observational, N=213	3% NaCl through PIV	• Max rate= 30 ml/hr • Mean duration infusion= 0.85 hr (IQR 0.4–1.3) • **Infusion-related phlebitis= 4%**
Ayus, 2015	Case Series, N=47	3% NaCl 500mL over 6 hrs via PIV	• ↑ serum sodium level by **1.26 mEq/L/hr** • Improvement in symptoms in **97% of cases**
Hew-Butler, 2015	Exercise-Induce Hyponatremia Guideline (EAH)	**Recommendation for Severe EAH** • "100 mL bolus of 3% NaCl, repeated twice if there is no clinical improvement (10 min intervals have been recommended)"	
Spasovski G, 2014	European Renal Best Practice (ERBP) Hyponatremia Guidelines	**Recommendation for Severe Hyponatremia** • "We recommend prompt intravenous infusion of 150 mL 3% hypertonic saline or equivalent over 20 minutes. (1D)"	
Verbalis JG, 2013	Expert Panel Recommendations for Hyponatremia	**Recommendation for Symptomatic Acute Hyponatremia** • "For severe symptoms, 100 mL of 3% NaCl infused IV over 10 minutes x 3 as needed."	

References

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