Exercise-Associated Hyponatremia: Practice Considerations for the Athletic Trainer

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- I have authored a book chapter related to this topic; it is in press with Slack Inc. and will be published in 2020.

- The views expressed in these slides are mine. My views may not be the same as the views of Duquesne University, affiliated clients, or colleagues. Participants should use discretion when using the information contained in this presentation.
Session Objectives

- Differentiate between **signs and symptoms** of dehydration and **hyponatremia**
- Identify fluid ingestion, maintenance, and replacement practices effective in the **prevention and treatment of EAH**
- Incorporate appropriate considerations for **return to play** following EAH
Consider...

- Antoine
- 15 y/o HS wrestler
- Winter break, 5 days
- Spent 3 of these 5 days with fever, HA, loss appetite, and lethargy
- Feeling better now and ready to wrestle
- *What are we thinking?*
<table>
<thead>
<tr>
<th>Hypohydration</th>
<th>Dehydration</th>
</tr>
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<tbody>
<tr>
<td>Loss of body water</td>
<td>Deficient body water</td>
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### A Starting Point

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<td>Loss of body water</td>
<td>Deficient body water</td>
<td>Decrease in electrolyte content, primarily sodium</td>
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It is possible to be both hypohydrated and hyponatremic
Exercise-Associated Hyponatremia

Simplest Form

How does one get to this point?
Finding the Balance

Dietary Intake
- Water
- Beverages
- Food moisture
- Sodium
- Total solutes

Fluid-Electrolyte Variables
- Total body water
- Extracellular Na⁺, volume, & concentration
- Intracellular K⁺, volume, & concentration
- Blood pressure
- Plasma volume

Excretion & Secretion
- Urine
- Sweat
- Transdermal water
- Respiratory water
- Stool water
Is it Possible to Drink too Much?

- Excessive fluid consumption and inappropriate fluid retention
- Sodium levels drop below 130 – 135 mmol/L
- If untreated may lead to death
  - Requires emergency referral
  - Do not give fluids
Hyponatremia

SODIUM LOSS
(Sweating)
Greater than water loss

EXCESSIVE ORAL
FLUID INTAKE
(Hypotonic fluids)

IMPAIRED
RENAL WATER
EXCRETION

EXCESSIVE ORAL
FLUID INTAKE
(Hypotonic fluids)

METABOLIC WATER
PRODUCTION

Increased AVP
--Exercise
--Non-specific stress
--Volume depletion
--Heat
--Cytokines

Impaired Diluting Capacity
Decreased
--GFR
--Distal filtrate delivery
--Renal blood flow

INABILITY TO
MOBILIZE SODIUM
Stores and/or osmotic
Inactivation of sodium
HYponatremia

"ALL RIGHT...WHERE DID ALL THE SODIUM GO?"

**Signs and Symptoms**
- Lethargy
- Headache
- Confusion
- Apprehension
- Seizures
- Coma

Hyponatremia occurs when serum sodium is less than 135 mEq/L.

↓ Na is caused by dilution as a result of excess H\textsubscript{2}O or ↑ Na loss.

These are some of the situations.

- Gastrointestinal suctioning
- Vomiting
- Diarrhea
- Diuretics
- Fluid shift from ICF to ECF by hypertonic solutions, which leads to dilutional hyponatremia
- Inadequate salt intake
- Mannitol
EXERTIONAL HYponATREMIA

Exertional, or exercise-associated, hyponatremia refers to a low serum, plasma, or blood sodium concentration (below 135 milliequivalents/liter) that develops during or up to 24 hours following prolonged physical activity.

DURING 2018,

THERE WERE 82 incident diagnoses of exertional hyponatremia among active component service members, for a crude overall incidence rate of 6.3 per 100,000 person-years (p-yrs).

70 of these diagnoses were among males.

INCIDENCE RATES WERE HIGHEST AMONG

SERVICE MEMBERS LESS THAN 20 YEARS OLD
(13.8 PER 100,000 P-YRS)

MALES
(6.5 PER 100,000 P-YRS)

RECRUIT TRAINEES
(39.1 PER 100,000 P-YRS)

MARINE CORPS MEMBERS
(10.8 PER 100,000 P-YRS)

Access the full report in the April 2019 MSMR (Vol. 26 No. 4).
Go to www.Health.mil/MSMR
Risk Factors for EAH
Signs / Symptoms & Diagnosis EAH

Mild
- Dizziness
- Weakness
- Headache
- Nausea/Vomiting
- Lethargy

< 135 mmol/L

Severe
- Altered mental status
- Seizure
- Extremity swelling
- Pulmonary edema
- Cerebral edema
- Coma*

< 125 mmol/L

* Likely < 120 mmol/L
Adapted from Korey Stringer Institute
General Treatment of EAH

**Mild**
- Cease fluid intake
- Rapid sodium replacement via foods containing high sodium content

**Severe**
- IV hypertonic saline (3-5%)
- Measure serum sodium levels during tx
- Transport to ED

Adapted from Korey Stringer Institute
## Specific Treatment Notes of EAH

<table>
<thead>
<tr>
<th>Mild EAH</th>
<th>Severe EAH</th>
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<tbody>
<tr>
<td>--No IV fluids</td>
<td>--Check core temp—treat result</td>
</tr>
<tr>
<td>--Limit oral fluids without salt until patient can urinate freely</td>
<td>--Administer 100 mL 3% hypertonic saline bolus</td>
</tr>
<tr>
<td>--Drink salty oral fluids</td>
<td>--Up to 2 additional 100ml 3% may be given at 10 minute intervals if no change s/s</td>
</tr>
<tr>
<td>--Monitor until urination</td>
<td>--Recheck Na⁺ levels</td>
</tr>
<tr>
<td>--Discharge to home</td>
<td>--Stop Na⁺ reaches 128-130 mEq/L</td>
</tr>
<tr>
<td>--Monitor for EAH symptoms</td>
<td>--Transfer to ER for ongoing treatment/monitor/recovery</td>
</tr>
<tr>
<td>--Emergency referral is s/s worsen/develop</td>
<td></td>
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CONSIDER DIFFERENTIAL DIAGNOSIS

MILD HYponATREMIA & SIGNS OF VOLUME DEPLETION

MILD HYponATREMIA & SIGNS OF VOLUME DEPLETION

MILD TO MODERATE (weakness, dizziness, headache, nausea/vomiting)

FLUID RESTRICTION or oral hypertonic solution (if tolerated)

OBSERVATION until the onset of spontaneous diuresis

RESOLUTION of the symptoms

WORSENING

Intravenous bolus of 100 mL of 3% HTS

LACK OF IMPROVEMENT

ANALYSIS OF PLASMA SODIUM CONCENTRATION IF AVAILABLE

SIGNS & SYMPTOMS OF EAH

SEVERE (seizure, confusion, coma, ataxia)

BOLUS of 100 mL of 3% HTS

IMMEDIATE TRANSFER TO THE HOSPITAL

Up to three repeat boluses can be given at ten minute intervals if the plasma sodium has been measured to confirm hyponatremia
Return to Activity

- S/S resolved
  - Normal serum Na⁺ level between 135 – 145 mmol/L
- Clearance by physician
- Individualized hydration plan
- Re-acclimatize
- Hydration education
Maintain proper sodium levels
Electrolyte drinks or other sources
Event Preparation

- Educate participants and all event staff on hydration
- Appropriate number of water stops
  - Education on using them
- Ensure availability of Na⁺ containing items
- Recognition and management of EAH
- Think like Ed Strapp would!
  - If you can think of it, you can prepare for it!
Gatorade Sports Science Recommendations

Do
- Start well-hydrated
- Monitor weight
- Drink during exercise
- Ingest sodium during exercise
- Follow individual plan
- Drink plenty during meals

Do Not
- Rely solely on water
- Overdrink
- Restrict salt in diet
- Use dehydration to lose weight
- Don’t delay drinking
Back to Antoine...

- 15 y/o HS wrestler
- Winter break, 5 days
- Spent 3 of these 5 days with fever, HA, loss appetite, and lethargy
- Feeling better now and ready to wrestle
Back to Antoine...

- What further conversation would you have with him today?
- What would you monitor for during practice?
- What could you do during practice to protect him from potential hyponatremia?
- Would you consider contacting his family/care takers?
- What might you need to emphasize to him over the next few days?
PEANUTS
featuring
“Good ol’ Charlie Brown”
by Schulz

“Bonk!”

Here’s the team doctor trotting out onto the field to aid a distressed player...

Hmm...

Obviously a simple case of hyponatremia.

All he needs is a little water and a little salt...

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People will stop asking you questions if you answer back in interpretive dance.


Symptoms of Severe EAH
(any of: altered mental state, coma, seizures)

Blood (Na+) < 135 mmol/L
IV 100 mL 3 - 5 % saline
Repeat every 10 min up to 3 doses or
Until neuro s/s subside

Blood (Na+) > 135 mmol/L
Seek DDX: Heat stroke, hypernatremia, Hypoglycemia, high altitude sickness

No blood electrolyte Measurement available

Blood (Na+) < 135 mmol/L
IV Lock only
Oral hypertonic saline (avoid hypotonic fluids)
Administer O2

Transport

Adapted from Wilderness Medicine Society Practice Guidelines for EAH