

# Syndrome of Inappropriate Antidiuretic Hormone Secretion

*Inappropriately elevated ADH secretion in response to diverse pathologic processes, resulting in the inappropriate reabsorption of free water; resulting in expanded intravascular volume and associated hyponatremia and decreased serum osmolality, with increased urinary osmolality and urinary sodium concentration*

## ANESTHETIC CONSIDERATIONS:

- Underlying etiology of SIADH / Co-morbid Disease
  - Neoplasm, CNS disease, Pulmonary disease, Stress, Surgery, Pain, Medications
- Hyponatremia
  - Cerebral edema, seizures, coma
  - DDX: Cerebral salt wasting (inappropriate renal salt wasting and volume depletion vs. inappropriate free water resorption)
- Complications associated with treatment
  - Rapid correction of Na ( $>0.5\text{mEq/h}$ ) and central pontine myelinolysis
  - Iatrogenic DI with demeclocycline

## ANESTHETIC GOALS:

- Preoperative optimization and correction of hypoNa
  - Hypertonic saline would be indicated if patient has neurological sequelae and is HypoNa
  - If asymptomatic, gradual correction with free H<sub>2</sub>O restriction +/- NS is indicated.
- Maintain hemodynamic stability and frequent monitoring of Na until stable.

## HISTORY

- Surgical history (esp. neurosurgical)
- Volume overload
- Findings associated with hyponatremia (water intoxication)
  - CNS → cerebral edema, lethargy, weakness, confusion, altered reflexes, seizures, coma
  - Fluid retention → weight gain, rarely hypertension

## PHYSICAL

- **CVS:** Peripheral edema, gallop, JVD, weight gain (CHF)
- **RESP:** Rales (CHF)
- **CNS:** Areflexia, weakness, altered LOC, pseudobulbar palsy, asterixis, Babinski (cerebral edema)
- **MSK:** Skeletal muscle weakness (hyponatremia)

## INVESTIGATIONS

- **Labs**
  - Urine and serum electrolytes and osmolality
    - Urinary sodium  $> 25\text{-}30\text{ mEq/L}$
    - Low serum levels of BUN, creatinine, uric acid, and albumin
    - Plasma sodium  $< 130\text{ mEq/L}$  (worry about cerebral edema)
    - Plasma osmolality  $< 270\text{ mOsm/L}$
    - Urine hypertonic relative to plasma ( $> 300\text{-}400\text{ mOsm/L}$ )
  - Serum ADH assay
- **Imaging**
  - CXR (failure)
  - CT head → brain edema, hemorrhage

## OPTIMIZATION

- Correct symptomatic hyponatremia
- Slow normalization of serum Na:  $< \text{or} = 1\text{ mEq/h}$
- Fluid restriction: 500-100 mL/d
- Demeclocycline (300-600 mg/d): induces reversible nephrogenic DI
- Treat underlying cause: d/c drugs, resection of tumors, treat infections / inflammation, adrenal / thyroid supplementation

## ANESTHETIC OPTIONS

- Local, regional, neuraxial, general – depending on neurological status and stability

## ANESTHETIC SETUP

- **Drugs**
  - Hypertonic / isotonic NaCl available
  - Furosemide
  - Demeclocycline
- **Equipment**
  - Usual CAS + 5-lead
  - CVP, PAC, TEE as needed to monitor volume status
  - Arterial line for frequent sampling
  - Foley to urometer

## MANAGEMENT OF ANESTHESIA

- **Induction**

- May develop volume overload with fluid administration
- Avoid drugs known to lower seizure threshold
- **Maintenance**
  - Avoid hypotonic fluids
  - Limit stress response, which may increase ADH secretion
  - Limit drugs that induce ADH release (morphine, barbiturates, beta-adrenergics)
  - Limit total fluids if patient has received DDAVP or other ADH analogues
- **Emergence**
  - Period or risk for patients who have CHF

#### DISPOSITION & MONITORING

- Monitor urine output and serum Na
- Fluid restriction 500-1000 mL/d
- Hypertonic NaCl for symptomatic hyponatremia
- SIADH with SAH may contraindicate fluid restriction (cerebral vasospasm) – may necessitate salt supplementation +/- diuresis for volume overload
- Differentiate SIADH from Cerebral salt wasting in the Neurosurgical population

#### COMPLICATIONS

- Symptoms of acute hyponatremia are more severe than those of chronic hyponatremia for same plasma Na concentration
- Free water losses (renal, skin, GI) must exceed free water intake to increase serum Na concentration
- Acute water intoxication is a medical emergency

#### PATHOPHYSIOLOGY

- ADH promotes resorption of solute-free water by increasing cell membrane permeability to water
- The target site for ADH is the collecting tubules of the kidneys
- A decrease in free water clearance causes a decrease in serum osmolality and a corresponding increase in circulating blood volume
- Distinguish between SIADH and CSW
  - In patients with SAH and hyponatremia 69% were due to SIADH, and only 7% were due to CSW
- **SIADH**
  - Hyponatremia (serum sodium < 130 mEq/L)
  - Urinary sodium > 25 mEq/L
  - Plasma Osmolality < 280 mOsm/L
  - Urine hypertonic relative to plasma
  - Low serum levels of BUN, creatinine, uric acid, albumin
  - Cerebral edema causing:
    - Weight gain
    - Weakness
    - Lethargy
    - Mental confusion
    - Obtundation
    - Disordered reflexes
    - Convulsions
    - Coma
  - **Causes**

NEOPLASMS	CNS DISEASES	PULMONARY DISEASES	MEDICATIONS	MISCELLANEOUS
<ul style="list-style-type: none"> <li>• Bronchogenic carcinoma</li> <li>• Pancreatic carcinoma</li> <li>• Cancer of duodenum</li> <li>• Prostate carcinoma</li> <li>• Thymoma</li> <li>• Lymphoma</li> <li>• Mesothelioma</li> </ul>	<ul style="list-style-type: none"> <li>• Head trauma</li> <li>• Subdural hematoma</li> <li>• SAH</li> <li>• CVA</li> <li>• Meningitis</li> <li>• Encephalitis</li> <li>• Brain abscess</li> <li>• Hydrocephalus</li> <li>• Brain tumor</li> <li>• GBS</li> <li>• Acute intermittent porphyria</li> <li>• Delirium tremens</li> </ul>	<ul style="list-style-type: none"> <li>• TB</li> <li>• Pneumonia</li> <li>• Bronchiectasis</li> <li>• Aspergillosis</li> <li>• CF</li> <li>• Positive pressure ventilation</li> </ul>	<ul style="list-style-type: none"> <li>• Opiates</li> <li>• Chlorpropamide</li> <li>• Carbamazepine</li> <li>• Phenothiazines</li> <li>• TCA</li> <li>• Clofibrate</li> <li>• Vincristine</li> <li>• Cyclophosphamide</li> <li>• Oxytocin</li> </ul>	<ul style="list-style-type: none"> <li>• General surgery</li> <li>• Pain</li> <li>• Nausea</li> <li>• Psychosis</li> </ul>

- **Cerebral Salt Wasting**
  - Hyponatremia, inappropriately concentrated urine
  - CSW associated with volume depletion, where SIADH associated with normo- or hypervolemia
  - CSW seen most often in SAH patients
  - CSW onset in 1<sup>st</sup> 10 days post-op or post-event, resolution within 3-4 weeks
  - Management of CSW is volume repletion with NaCl → increase in blood volume will suppress ADH and further improve hyponatremia
  - Underlying pathophysiology related to impaired Na reabsorption, as opposed to uncontrolled free water reabsorption in SIADH

#### REFERENCES

- Miller 6th Ed. pp 1052 – 1053, p. 1105,
- Stoelting, Co-Existing Disease pp. 437 – 438
- Up To Date – SIADH, Cerebral Salt Wasting
- Roizen & Fleisher – Essence of Anesthesia Practice – p314