

Assessment Points				
System	Effect	Assessment by Hx	PE	Test
CNS	Cerebral edema	Headache, confusion, coma, seizures, difficulty concentrating, lethargy	Decerebrate posturing, altered level of consciousness	CT (brain) MRI (brain) EEG
GI	Increased free water intake	N/V, anorexia		
RENAL	Free water retention	Concentrated urine	No edema	Serum Na ⁺ <130 mEq/L, serum Osm <275 mOsm/L, urine Osm >100 mOsm/L, urine Na ⁺ >40 mEq/L
NM	Fatigue, lethargy	Muscle cramps, falls	Motor weakness	

Key References: Ellison DH, Berl T: Clinical practice. The syndrome of inappropriate antidiuresis, *N Engl J Med* 356(20):2064–2072, 2007; Cornforth BM: SIADH following laparoscopic cholecystectomy, *Can J Anaesth* 45(3):223–225, 1998.

Perioperative Implications

Preoperative Preparation

- Medical evaluation for duration and other causes of hyponatremia.
- Neurologic assessment for symptomatic hyponatremia.

Monitoring

- Periop measurement of serum Na⁺
- CVP or pulm artery cath if necessary to maintain euvoolemia

Induction

- Avoid drugs that may potentiate SIADH.

Maintenance

- Hyponatremia reduces MAC.
- Avoid hypotonic IV fluids.

Extubation

- Symptomatic hyponatremia may contribute to delayed emergence from anesthesia.
- Hyponatremia can cause obtundation and diminished ability to protect the airway.

Adjuvants

- Normal saline (0.9%, 154 mEq/L) and furosemide to maintain euvoolemia and normal Na⁺.

Postoperative Period

- Free water restriction, and avoid hypotonic fluids.

- Monitor serum Na⁺.
- Assess for CNS signs of hyponatremia: Lethargy, confusion, and seizures.

Anticipated Problems/Concerns

- Major surgery causes increased ADH release.
- Acute symptomatic postop hyponatremia is a medical emergency.
- The practice of using hypotonic maintenance fluids in pediatrics is controversial.
- Most reported cases of ODS were assoc with rapid correction of hyponatremia at rates over 12 mEq/L per day but may occur at slower rates of correction.

Syndrome X

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Risk

- True incidence unknown
- Postmenopausal or posthysterectomy women most often at risk
- Common cause of chest pain in women with angiographically normal coronary arteries
- Linked to adverse cardiovascular outcomes and a poor quality of life
- No diagnostic test

Overview

- Characterized by angina with or without ST-segment changes, with or without reversible perfusion defects on stress test, and with normal coronary arteriograms.
- Poorly understood multifactorial etiology makes specific treatment difficult.
- Some studies have found an increased risk of other vasospastic disorders in pts with cardiac syndrome X, such as migraine and Raynaud phenomenon.
- A multimodal approach to reducing oxidative stress and improving endothelial function may be beneficial.

nociception, with systemic inflammation (increased CRP) playing a role.

- Bioavailability of NO plays a role.
- Acute withdrawal of estrogen appears to be a more significant factor than chronic withdrawal.

Perioperative Risks

- Acute withdrawal of sex hormone replacement can potentially lead to symptoms.
- Preop angina can delay procedures.

Usual Treatment

- Treatment includes lifestyle modification, anti-anginal, antiatherosclerotic, and antiischemic medications.
- Nonpharmacologic options include cognitive behavioral therapy, enhanced external counterpulsation, neurostimulation, and stellate ganglionectomy.
- Estrogen patch has been found to significantly improve exercise tolerance and alleviate chest pain.

Worry About

- Discontinuation of medications (HRT) can precipitate symptoms

Etiology

- Etiology unproved but thought to be due to endothelial dysfunction, ± vasospasm and abnormal cardiac

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CV	Angina (chest pain) Inflammation	Hx of exertional angina Hx of evaluations leading to catheterization Hx of hormone replacement therapy		Normal coronary angiogram in presence of chest pain Elevated CRP

Key References: Lim TK, Choy AJ, Khan F, et al.: Therapeutic development in cardiac syndrome X: a need to target the underlying pathophysiology, *Cardiovasc Ther* 27(1):49–58, 2009; Agrawal S, Mehta PK, Bairey Merz CN: Cardiac syndrome X: update, *Heart Fail Clin* 12(1):141–156, 2016.

Perioperative Implications

Preoperative Preparation

- Estrogens are withdrawn owing to the threat of pro-coagulant activity. Pts with this syndrome may experience significant angina upon such withdrawal.
- Distinguish chest pain due to this syndrome from chest pain due to coronary insufficiency from other causes.
- Continue preop medications with appropriate thromboembolic prophylaxis.

Monitoring

- ST-segment analysis, usual ASA monitors
- Invasive as appropriate for procedure

Preinduction/Induction

- Contingent upon type of surgery; may consider maintaining usual medications with use of beta-blockers as appropriate.
- No data as to preferred anesthetic technique or agents.

Anticipated Problems/Concerns

- Angina preop or periop in a pt with known clear coronary arteries.
- Continuation of HRT can increase coagulability.
- Continuation of beta-blockers and CCBs can lead to expected use of vasopressors.