

Volume Assessment

Assessment for HYPERvolemia:

No single finding confirms hypervolemia
Look for supporting findings for hypervolemia
Review pitfalls in volume assessment

Assessment for HYPOvolemia:

1. Check HR and BP lying and standing for 1 minute
2. If patient cannot stand due to preexisting conditions, try to dangle legs over side of bed for 1 minute
3. Look for supporting findings for hypovolemia
4. Review pitfalls in the diagnosis of hypovolemia

Interpretation and Management:

1. If supine HR more than 100 and systolic BP less than 100 mm HG, patient may be in hypovolemic shock
 - a. Initiate emergency management for shock
 - b. Call senior resident or rapid response team for help
2. If patient unable to stand due to lightheadedness OR systolic BP drops more than 20 mmHg OR heart rate rises by 20 bpm on standing, patient is moderately hypovolemic
 - a. Give IV NS 250 ml bolus over 10 minutes
 - b. Recheck postural vitals, O2 sats, JVP, and listen to lungs for crackles
 - c. If postural drop persists, and there are no crackles and O2 sats are unchanged repeat IV NS 250 ml bolus
 - d. Further boluses will depend on repeated vital signs, volume assessments, and oxygen saturations
 - e. Consider foley catheter to monitoring urine output every 4 hours for 24 hours (goal is urine output of at least 150ml every 4 hours)
 - f. Determine cause(s) of hypovolemia. Order laboratory tests to assess hypovolemia
3. If patient has other supporting findings for hypovolemia, but no postural drop or postural tachycardia, then patient may have mild HYPOvolemia
 - a. Determine causes of HYPOvolemia
 - b. There is no urgent need for boluses of normal saline, but if the patient has poor oral intake and/or increased losses, then maintenance IV fluids may be needed to prevent worsening HYPOvolemia

Laboratory tests to confirm hypovolemia:

1. Order renal profile, random urine urea, creatinine and sodium
2. Make sure the units are the same for the urine and plasma creatinine, or your calculations will be off.
3. Laboratory evidence of hypovolemia
 - a. blood urea/plasma creatinine ratio is 1:10 or less (For example, a ratio of 1:5 would suggest hypovolemia)

- b. Urine sodium concentration is less than 20 mmol/L
 - False negative (high urine sodium) with diuretics, vomiting, high rate of water resorption
 - False positive in contrast nephropathy, pigment nephropathy, severe glomerular or tubulointerstitial disease
- c. Fractional excretion of sodium is less than 1%
 - Calculation: $[(\text{urine sodium} / \text{plasma sodium}) / (\text{urine creatinine} / \text{plasma creatinine})] \times 100\%$.
 - Same limitations as urine sodium concentration
- d. Fractional excretion of urea is less than 35%
 - Calculation: $[(\text{urine urea} / \text{blood urea}) / (\text{urine creatinine} / \text{plasma creatinine})] \times 100\%$.
 - Useful even if patient has been on diuretics.

Supporting findings for HYPOvolemia:

None of these are sufficiently accurate to rule-in or rule-out HYPOvolemia, but can be used in conjunction with other findings to support your diagnosis.

1. Historical features supporting HYPOvolemia:
 - b. Diuretics
 - c. Poor oral intake
 - a. c.. GI losses (vomiting, diarrhea)
 - d. Overt bleeding
2. Physical findings supporting diagnosis of HYPOvolemia
 - a. Low JVP
 - b. No edema
 - c. Dry axilla
 - d. Dry underneath tongue
 - e. Furrowed tongue

Supporting findings for HYPERvolemia:

1. Physical findings:
 - a. Sacral pitting edema
 - b. Leg pitting edema
 - c. Crackles in lung bases
 - d. High JVP
 - e. Ascites
 Radiologic data:
2. a. Pulmonary edema on CXR

Pitfalls in Assessment of Volume Status:

1. Patient with tricuspid regurgitation can be hypovolemic despite a very high JVP. The clues are minimal edema, a postural drop, and the low fractional excretion of urea and sodium.
2. Patients with severe hypoalbuminemia can be hypovolemic despite significant pitting edema. The clues will be low JVP, postural drop, and the low fractional excretion of urea and sodium

3. Urine output can be above 30 ml/hour despite hypovolemia in patients with:

- any cause of tubulointerstitial kidney disease
- diuretics
- osmotic diuresis (diabetes mellitus, hypercalcemia, mannitol, diabetes insipidus)
- postobstructive diuresis

Patients on anticholinergics (such as dimenhydrinate (gravol), antihistamines (such as benadryl), neuroleptics, and tricyclic antidepressants) can have dry axillae and dry tongues due to drug side effects.

4. There are other causes of postural hypotension, including deconditioning, drugs, autonomic dysfunction.