**Shock Review & Vasopressors**

<table>
<thead>
<tr>
<th>Type of Shock</th>
<th>Common Examples</th>
<th>Right heart filling</th>
<th>Left heart filling</th>
<th>Cardiac output</th>
<th>Afterload</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypovolemic</td>
<td>Hemorrhage, Intravascular volume loss</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↑↑</td>
<td>Fluids +/- vasopressors to temporize</td>
</tr>
<tr>
<td>Cardiogenic</td>
<td>Cardiomyopathy, MI/ischemia, Valvular lesions, Arrhythmia</td>
<td>↑</td>
<td>↑</td>
<td>↓</td>
<td>↑↑</td>
<td>Inotropes +/- vasopressors</td>
</tr>
<tr>
<td>Distributive</td>
<td>Sepsis, Anaphylaxis, Adrenal insuff., Neurogenic shock</td>
<td>↓</td>
<td>↓</td>
<td>↓ vs. ↑*</td>
<td>↓</td>
<td>Fluids + vasopressors (rarely inotropes)</td>
</tr>
<tr>
<td>Obstructive</td>
<td>PE**, Cardiac tamponade, Tension PTX</td>
<td>↑</td>
<td>PCWP ↑</td>
<td>↓</td>
<td>↑↑</td>
<td>Fluids + vasopressors (occasionally inotropes for R heart failure)</td>
</tr>
</tbody>
</table>

*Hypovolemic shock often presents with low cardiac output at the onset, but may become a high cardiac output state once adequately fluid resuscitated*

**PE’s is the most common example of an obstructive shock and is used to fill out the hemodynamic table.**

**Shock definition:** insufficient blood flow to the tissues

- First: try and identify the type of shock
- Second: tailor your treatment to the PRIMARY PROBLEM (black box) of that particular shock state
  - **hypovolemic** shock = treat with **fluids**
    - **Crystalloids** (Ringer’s Lactate is preferred)
      - SMART-MED and SMART-SURG 2018 → Ringer’s Lactate reduced rate of death, need for dialysis, lower rates of AKI when compared to Normal Saline
    - **Colloids**
      - **Albumin 5% 500 mL** → results in an increase in intravascular volume of ~500 mL x 12-24h (1:1) → more immediate effect
      - **Albumin 25% 100 mL** → results in an increase in intravascular volume of ~450 mL x 12-24h (1:4.5) → slower effect, use if fluid overloaded but intravascularly dry
      - Blood → typically reserved for anemia; transfusion trigger of 70 g/L in a stable, non-bleeding patient
      - AVOID starches → increased risk of AKI + need for dialysis
  - **cardiogenic** shock = **increase cardiac output** with inotropes (may need vasopressors to support BP)
    - **inotropes**
• dobutamine 0-20 ug/kg/min
• milrinone 0.25-0.75 ug/kg/min → slow onset, 6hr duration, more likely to cause hypotension, use with caution in renal failure
• epinephrine 0-10 ug/min
• digoxin load
  o **distributive** shock = *hypovolemia* due to vasodilation + vasopressors to counter *vasodilation*
    ▪ if using CVP, aim for 8-12 mm Hg if not intubated, 12-15 mm Hg if intubated
    ▪ remember that vasopressors also raise CVP, so if the patient is in their “CVP target” but on vasopressors, they may still benefit from more fluid
  o **obstructive** shock (PE) = fluids (CVP is high, but LV is under filled), vasopressors to support BP, inotropes if RV is failing, consider *thrombolysis* if:
    ▪ hemodynamically UNSTABLE
    ▪ stable patients IF:
      • severe or worsening RV dysfunction
      • cardiac arrest due to PE
      • extensive clot burden
      • free-floating RA or RV thrombus

### Vasopressors

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norepinephrine</td>
<td>0-30 ug/kg/min</td>
<td>• often <strong>1st line</strong> vasopressor&lt;br&gt;• can go up to 1 ug/kg/min in refractory shock</td>
</tr>
<tr>
<td>Vasopressin</td>
<td>0-2.4 u/hr</td>
<td>• often added as a <strong>2nd vasopressor</strong> if on high doses of Norepinephrine&lt;br&gt;• still effective when acidotic and hypothermic whereas other vasopressors may not be</td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>0-360 ug/min</td>
<td>• <strong>useful</strong> when you want to avoid b-agonism, e.g. rapid a-fib/flutter and hypotensive&lt;br&gt;• not as potent → can be a significant volume load when running at high doses&lt;br&gt;• watch for hyponatremia when mixed in D5W and running at high doses</td>
</tr>
<tr>
<td>Dopamine</td>
<td>0-20 ug/kg/min</td>
<td>• 0-3 ug/kg/min = “renal dose”, doesn’t prevent AKI&lt;br&gt;• 3-10 ug/kg/min = primarily b-agonism (inotropy)&lt;br&gt;• &gt; 10 ug/kg/min = progressive alpha-effect (vasoconstriction)</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>0-10 ug/min</td>
<td>• Drug of choice for <em>anaphylaxis</em>&lt;br&gt;• Watch for tachycardia/arrhythmias</td>
</tr>
</tbody>
</table>