Definition and Classification of Shock

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Definition of Shock

- Shock is an acute clinical syndrome initiated by ineffective perfusion, resulting in severe dysfunction of organs vital to survival
Ineffective perfusion

- Organ perfusion compromised by an overall decrease or maldistribution in cardiac output
- Worsened by abnormalities of distribution of blood flow within the organs
Syndrome

• Relatively constant set of signs and symptoms that predictably result from pathophysiologic events

• Clinical presentation can be variable
  – Severity of the perfusion defect
  – Underlying cause
  – Prior organ dysfunction
Symptoms/Signs

• Related to decreased tissue perfusion
  – Pale, cool, clammy skin
  – ↓ cap refill
  – ↓ urine output
  – ↓ mental status
Classification

- Hypovolemic
- Cardiogenic
- Extracardiac obstructive
- Distributive
Hypovolemic

- Primary defect is a decrease in intravascular volume
  - Bleeding
  - GI losses
  - Urinary
  - “Third spacing”
Mechanisms

- ↓ in cardiac diastolic filling pressures
- ↓ stroke volume
- CO partially maintained by ↑ HR
- ↑ PVR, myocardial contractility
- Brain, heart protected through autoregulation
- Failure of compensation 20-25%
Clinical manifestations

- Tachycardia
- Tachypnea
- Flat veins
- Signs of hypoperfusion
Effects of $\downarrow$ CO

- Decreased oxygen delivery
  - Tissues initially compensate through increased oxygen extraction
  - Eventual tissue hypoxia and lactic acidosis
- Diversion of flow to brain, heart
  - Eventually fails worsening CO
Cardiogenic Shock

• Primary defect is ↓ CO with elevated cardiac chamber filling pressures
  – Pulmonary edema
  – ↑ JVP
  – Presentation otherwise similar to hypovolemia

• Can be confused by underlying hypovolemia
  – CI <2L/min/m²
  – PAOP >17-20 mmHg
Causes of ↓ CO

• Contractile failure
  – Ischemia/infarction
  – Cardiomyopathy
  – myocarditis
• Arrhythmias
• Conduction disturbances
• Valve lesions
• AMI complications
Left ventricular MI

- >40% of LV infarcted
  - 10-20% of Q-wave AMI
- Mortality >75% unless surgically correctable lesion
- Mortality associated with level of acidosis
Right Ventricular AMI

- RV involved in 50% of inferior infarcts
  - 10-20% results in cardiogenic shock
- Clear lungs
- ↑ JVP
- Kussmaul’s sign
  - Prominent venous distention with inspiration
Extracardiac Obstructive Shock

- Impaired diastolic filling
  - Cardiac tamponade
  - Tension pneumothorax
  - Constrictive pericarditis
  - Compression of great vessels by mediastinal masses

- Increase the R or L ventricular afterload
  - PE
  - Acute pulmonary hypertension
  - Aortic dissection
  - Systemic embolization
Varied Clinical Presentation

- Signs of decreased perfusion
- Symptoms/signs related to cause
  - Neck veins may be present or absent
  - Muffled heart sounds
  - Pulses paradoxus
  - Symptoms of underlying cause
- Varied hemodynamic patterns
Distributive Shock

- SIRS
  - Sepsis
  - Pancreatitis
  - Multitrauma
  - Burns
  - Late hemorrhage
- Neurogenic
- Anaphylaxis
- Adrenal
Hemodynamic pattern

- Hyperdynamic pattern
- Primary defect is a ↓ in SVR secondary to NO production
  - ↑ in CO
  - Normal to low filling pressures
  - Normal to ↑ mixed venous O₂ tension
    - ? AV shunt
Sepsis/SIRS

• Two or more of the following
  – Temp > 38°C, < 36°C
  – Tachycardia
  – Tachypnea or respiratory alkalosis
  – WBC >12, <4, or >10% bands

• Severe sepsis
  – Hypotension or hypoperfusion

• Shock
  – Vasopressors or ionotropes
### Summary

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<th>Type</th>
<th>CO</th>
<th>SVR</th>
<th>PAOP</th>
<th>CVP</th>
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