Shock: Recognition and Resuscitation
What is Shock?

*Inadequate tissue perfusion*

*Hypoperfusion*
What is Shock?

- Shock is when the body’s need for glucose and oxygen are not met.

- This causes impaired energy production which can ultimately lead to cellular death.
Cells receive inadequate oxygen and glucose

Hypoperfusion

Energy Deficit

Anaerobic Metabolism

Accumulation of lactic acid and fall in pH

Metabolic Acidosis

Cell Membrane Dysfunction and Sodium Pump Failure

Toxic Substances Released into Circulation

Cellular Dysfunction and Cell Death
Understanding the Changes that Occur in Shock

- Shock is ultimately a state where a number of different systems attempt to compensate for the HYPOPERFUSION.
- This causes changes primarily in the cardiovascular system.
- Let’s review......
The Cardiovascular System
Cardiovascular System

- Cardiac Output (CO)
- Systemic Vascular Resistance (SVR)
- Blood Pressure (BP)
Cardiac Output

- The amount of blood pumped by the heart in one minute

\[ CO = HR \times SV \]
Systemic Vascular Resistance

- The tone of the vascular system
  - Tone = size of the vessel and the resistance created within it
  - The sympathetic nervous system is responsible for maintaining tone
Blood Pressure

- Blood pressures is a product of both Cardiac Output and Systemic Vascular Resistance
- A fall in either CO or SVR results in a decrease in BP
3 Types of Shock

1. Hypovolemic
   - Inadequate volume
2. Cardiogenic
   - Inadequate pump function
3. Distributive
   - Inadequate vessel tone
Hypovolemic Shock

Just not enough blood
Hypovolemic: Inadequate Volume
Hypovolemic: Inadequate Volume

- A decrease in blood **volume** may result from the loss of whole blood or from loss of plasma volume alone.
Examples of Hypovolemic Shock

- Bleeding
  - Causes whole blood loss
- Vomiting, Diarrhea, Burns
  - Causes loss of plasma volume only
Response to Hypovolemic Shock

Blood Loss

Venous System

BP ↓

CO ↓

HR ↑

SVR ↑

Skin Temp ↓

VITAL ORGANS
Hypovolemic Shock Changes

- Blood Pressure ↓
- Cardiac Output ↓
- Heart Rate ↑
- Systemic Vascular Resistance ↑
- Skin Temperature ↓ (blood shunted to vital organs)
Cardiogenic Shock

Just not enough squeeze
Cardiogenic: Inadequate Pump Function
If the **pump** fails, regardless of the blood volume, the delivery of oxygen and glucose to cells will be decreased.
Examples of Cardiogenic Shock

- Heart damage
  - Myocardial Infarction
  - CHF
- Mechanical Obstruction
  - Cardiac Tamponade
  - Tension Pneumothorax
  - Pulmonary Embolism
  - Aortic Stenosis
Response to Cardiogenic Shock

- Pump Failure
- BP ↓
- CO ↓
- HR ↑
- SVR ↑
- Skin Temp ↓
Cardiogenic Shock Changes

- Cardiac Output ↓
- Blood Pressure ↓
- Heart Rate ↑
- Systemic Vascular Resistance ↑
- Skin Temperature ↓ (blood shunted to vital organs)
Distributive: Inadequate Vessel Tone

Normal-sized vessel full of blood.

Dilated vessel only partially filled with blood.
Distributive: Inadequate Vessel Tone

- In order to have an adequate blood pressure, the tone of the vessels must be maintained.
- The tone is related to the size of the vessel and the resistance created within it. This is referred to as the systemic vascular resistance or peripheral vascular resistance.
- The sympathetic nervous system provides tone by keeping the vessel size regulated to a certain size to maintain the resistance and pressure.
Examples of Distributive Shock

- **Anaphylaxis**
  - Causes vasodilation due to allergic mediators
- **Septic Shock (infection)**
  - Causes vasodilation due to massive inflammatory response
- **Neurogenic (high spinal cord injury)**
  - Causes vasodilation due to loss of sympathetic tone
Response to Distributive Shock

BP ↓

Venous System

CO ↑

HR ↑

ASODILATION

SVR ↓

VITAL ORGANS

Skin Temp ↑
Anaphylactic Shock: SEVERE allergic reaction

- Affects all systems
  - Cardiovascular
    - Massive vasodilation → low BP
  - Respiratory
    - Bronchial constriction → respiratory distress
  - Skin
    - Hives, angioedema, flushing
  - Gastrointestinal
    - Nausea, vomiting, diarrhea, abdominal pain
  - CNS
    - Confusion, altered mental status
Causes of Anaphylactic Shock

- Venom (Bee Stings)
- Medications (antibiotics)
- Food (shellfish, peanuts)
Septic Shock

- Bacterial toxins causes massive vasodilation
- Most commonly gram negative bacteria
- Precipitating illnesses
  - Pneumonia
  - UTI
  - Bacteremia (bacteria in the blood stream)
Neurogenic Shock

- Injury to the brain/spinal cord causes a loss of sympathetic stimulation (fight or flight)
  - Loss of blood vessel tone
  - Unopposed vagal tone $\rightarrow$ bradycardia

- Unique due to HYPOtension and BRADYcardia (all other will have compensatory tachycardia)
Distributive Shock Changes

- Systemic Vascular Resistance ↓
- Blood Pressure ↓
- Cardiac Output ↑
- Heart Rate ↑ (↓ in neurogenic)
- Skin Temperature ↑
Recognizing Shock
You’ve got to recognize
## Shocks Affects on the CV System

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<thead>
<tr>
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<th>Hypovolemic</th>
<th>Cardiogenic</th>
<th>Distributive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure</td>
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<td>Cardiac Output</td>
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Hypovolemic vs. Cardiogenic

- **History Clues**
  - Hx Chest Pain → Cardiogenic
  - Hx Trauma → Hypovolemic
  - Hx CHF with new weight gain and leg swelling → Cardiogenic
  - Hx Vomiting or Diarrhea → Hypovolemic

- **Physical Exam Clues**
  - Patient with large cut with active bleeding → Hypovolemic
  - Patient clutching chest with rapid respiratory rate → Cardiogenic
  - Patient with burns to arms and chest → Hypovolemic
  - Patient with significant leg swelling → Cardiogenic
Treatment of Shock

- Most important to recognize a shock state, start appropriate emergency care and initiate rapid transport

- ALWAYS remember ABC’s
  - Secure Airway
  - Optimize respiratory effort including supplemental oxygen
  - Support Circulation

- Advanced life support includes
  - IV Fluids
  - Medications
  - Procedures
Treatment of Hypovolemic Shock

- Remember: primary issue is loss of blood volume
- So…… REPLACE IT!
- Start 2 large bore IVs and start IV fluids
- IF bleeding…..control the bleeding
  - Direct pressure
  - Tourniquet
Treatment of Cardiogenic Shock

• Depends on etiology .....
STEMI
Treatment of Cardiogenic Shock: Myocardial Infarction

- ASA
- IV Fluids
- Inotropic Meds: Dopamine
- Don’t give nitroglycerin if hypotensive (especially inferior MIs)
- Ultimately, treatment is re-vascularization in the Cath Lab
Treatment of Cardiogenic Shock due to Tension Pneumothorax

- Needle decompression
- Oxygen
- Intubation
Needle Decompression

- 2nd or 3rd intercostal space, midclavicular line
- 14 or 16 gauge needle
Treatment of Distributive Shock

- Depends on etiology ….
Treatment of Anaphylactic Shock

- **First Line Treatment**
  - ABC’s
  - Epinephrine (0.3 mg IM of 1:1000), may repeat
  - IV Fluids
  - Oxygen

- **Second Line Treatment**
  - Corticosteroids: 125 mg methylprednisolone IV
  - Antihistamine: 25-50 mg Benadryl IV
  - Bronchodilator: Albuterol nebulizer, Magnesium Sulfate 2 g IV
Treatment of Septic Shock

- Optimize ABC’s
  - Supplemental Oxygen
  - Intubate if necessary
  - Fluid resuscitation

- Fluids, Fluids, Fluids !!!!!!!
Treatment of Neurogenic Shock

- Should be suspected in trauma patient with hypotension and bradycardia
- HOWEVER, cannot exclude hemorrhagic shock and therefore treat aggressively with IV Fluids
Overview of Shock

- A state of **Hypoperfusion**

- 3 Main Types
  - Hypovolemic
  - Cardiogenic
  - Distributive

- Important to recognize shock
  - Primary change occurs in BP, HR, and SVR
  - Clues in history and physical exam

- Treatment and Resuscitation
  - ABC’s
  - IV Fluids
  - Rapid Transport
Thank you!