**Shock**

**Perfusion Needs of Tissues:**
- The heart demands a constant supply of blood.
- The brain and spinal cord can survive for 4 to 6 minutes without perfusion.
- The kidneys may survive 45 minutes.
- The skeletal muscles may last 2 hours.

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**Anatomy & Physiology**

- Heart
- Blood Vessels
- Blood
- Sensors (Carotid & Aorta)
- Catecholamines
- Aerobic vs. Anerobic Metabolism

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**What is shock?**

A state of widespread inadequate tissue perfusion.

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**Fick Principle**

- On loading of oxygen to red blood cells in lungs
- Delivery of red blood cells to tissue cells
- Off-loading of oxygen from red blood cells to tissue cells

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**Failed Components in Shock**

- Pump
- Pipe
- Fluid

**Failed Components in Shock**

- **Pump Failure**
  - Causes: Heart attack, trauma to heart, obstructive causes
- **Low fluid volume**
  - Causes: Loss of blood, fluid in tissues, fluid loss from skin, extreme sweating, diarrhea, vomiting, fluid loss from gastrointestinal tract
- **Poor vessel function**
  - Causes: Infection, drug, hypotension, embolism, dehydration, shock
Signs & Symptoms of Shock
- Altered LOC
- Cool, Clammy/Diaphoretic, Pale Skin
- Capillary Refill > 2 Seconds
- Weak, Thready, or Absent Peripheral Pulses
- Increased Pulse Rate
- Increased Respiratory Rate
- Decreased Blood Pressure
- Nausea/Vomiting
- Decreased Urinary Output

Problem Patients
- Infants & Children
- Patients taking medications that don’t allow for compensation.

Categories of Shock
- Three stages in the progression of shock:
  - **Compensated shock**: early stage when the body can still compensate for blood loss
  - **Decompensated shock**: late stage when blood pressure falls
  - **Irreversible shock**: terminal stage when transfusion is not enough to save patient

Table 10-3  Progression of Shock
- Compensated Shock
  - Palor
  - Coolness
  - Tachycardia
  - Sleepiness
  - Altered mental status
  - Weak, rapid (thready), or absent pulse
  - Clammy (pale, cool, moist) skin
  - Pallor, with cyanosis about the lips
  - Shallow, rapid breathing
  - Air hunger (shortness of breath), especially if there is a chest injury
  - Nausea or vomiting
  - Capillary refill of longer than 2 seconds in infants and children

- Decompensated Shock
  - Falling blood pressure (systolic blood pressure of 90 mm Hg or lower in an adult)
  - Labored or irregular breathing
  - Ashen, mottled, or cyanotic skin
  - Threaded or absent peripheral pulses
  - Dull eyes, dilated pupils
  - Poor urinary output

Types of Shock

Table 10-1  Causes of Shock
- **Pump Failure**
  - Cardiogenic shock
  - Obstructive shock

- **Poor Vessel Function**
  - Distributive shock
    - Septic shock
    - Neurogenic shock
    - Anaphylactic shock
    - Psychogenic shock

- **Low Fluid Volume**
  - Hypovolemic shock
    - Hemorrhagic shock
    - Nonhemorrhagic shock

Cardiogenic Shock
- Pump Problem
- Signs/Symptoms similar to Hypovolemic Shock
Cardiogenic Shock

- Caused by inadequate function of the heart
- A major effect is the backup of blood into the lungs.
- Resulting buildup of pulmonary fluid is called pulmonary edema.

Obstructive/Mechanical Shock

- Obstructive shock occurs when conditions that cause mechanical obstruction of the cardiac muscle also affect the pump function.
- Common examples include cardiac tamponade and tension pneumothorax.

Mechanical Shock

- Tension Pneumothorax
- Cardiac Tamponade
- Myocardial Contusion with Shock

Tension Pneumothorax

- Caused by damage to lung tissue
- The air normally held within the lung escapes into the chest cavity.
- This air applies pressure to the organs, including the heart.
Cardiac Tamponade
- Collection of fluid between the pericardial sac and the myocardium
- Caused by blunt or penetrating trauma
- Can progress rapidly

Distributive Shock
- Results from widespread dilation of small arterioles, venules, or both
- The circulating blood volume pools in the expanded vascular beds.
- Tissue perfusion decreases

Septic Shock
- Pipe Problem
- Caused by Bacterial Infection (Endotoxins)
- Signs/Symptoms:
  - Increased Pulse Rate
  - Pale/Hot Skin
  - Low BP
  - Sick Appearance

Neurogenic/Spinal Shock
- Pipe Problem
- Associated with Cervical Spine Injuries
- Signs/Symptoms:
  - Capillary Refill less than 2 Seconds
  - Warm/Dry/Pink Skin
  - Low BP
  - Normal Pulse Rate

Anaphylactic Shock
- Pipe Problem
- Caused by an Allergic Reaction
- Signs/Symptoms:
  - Hives
  - Low BP
  - Swelling Airway
  - Cool, Clammy, Pale Skin
  - Increased Pulse Rate
  - Nausea/Vomiting

Psychogenic Shock
- Caused by a sudden reaction of the nervous system
- Produces temporary vascular dilation
- Results in fainting (syncope)
- Serious causes include irregular heartbeat and brain aneurysm.
Psychogenic Shock

- Pipe Problem
- Caused by Sudden Vasospasm
- Signs/Symptoms:
  - Syncope
  - Low BP
  - Pale/Cool/Clammy Skin

Psychogenic Shock

Hypovolemic Shock

- Fluid Problem
- Associated with the classic presentation of shock.

Hypovolemic Shock

- Result of an inadequate amount of fluid or volume in the system
- Hemorrhagic causes and nonhemorrhagic causes
- Occurs with severe thermal burns
  - Intravascular plasma is lost.

Hypovolemic Shock

- Dehydration, the loss of water or fluid from body tissues, can cause or aggravate shock.
  - Fluid loss may be a result of severe vomiting and/or diarrhea.

Questions?