Shock

- Syndrome = decreased tissue perfusion and impaired cellular metabolism
- Imbalance in supply/demand for $O_2$ and nutrients
Diagnostic Studies

- Thorough H & P
- No single study
  - Blood studies
    - Elevation of lactate
    - Base deficit
  - 12-lead ECG
  - Chest x-ray
  - Hemodynamic monitoring
Shock

- Classification of shock
  - Cardiogenic
  - Hypovolemic
  - Distributive
  - Obstructive
Low Blood Flow
Cardiogenic Shock

- Definition
  - Systolic or diastolic dysfunction
  - Compromised cardiac output (CO)
Low Blood Flow
Cardiogenic Shock

- Precipitating causes
  - Myocardial infarction
  - Cardiomyopathy
  - Blunt cardiac injury
  - Severe systemic or pulmonary hypertension
  - Cardiac tamponade
  - Myocardial depression from metabolic problems
Pathophysiology of Cardiogenic Shock

Shock:
- Cardiogenic shock
- Hypovolemic shock
  - Absolute hypovolemia
  - Relative hypovolemia
- Distributive shock
- Neurogenic shock
- Anaphylactic shock
- Septic shock
- Obstructive shock

Systemic Inflammatory Response Syndrome (SIRS)
- Mediator excess: cytokines (e.g., tumor necrosis factor, interleukins), oxygen free radicals, etc.
- Widespread endothelial injury and dysfunction
- Vasodilation and increased capillary permeability
- Tissue edema
- Neutrophil entrapment in microcirculation

Multiple Organ Dysfunction Syndrome (MODS)

- Cardiovascular dysfunction
- Lung dysfunction
- Gastrointestinal dysfunction
- Liver dysfunction
- CNS dysfunction
- Renal dysfunction
- Skin dysfunction
Low Blood Flow
Cardiogenic Shock

- Early manifestations
  - Tachycardia
  - Hypotension
  - Narrowed pulse pressure
  - ↑ Myocardial O₂ consumption
Low Blood Flow
Cardiogenic Shock

- Physical assessment
  - Tachypnea, pulmonary congestion
  - Pallor and cool, clammy skin
  - Decreased capillary refill time
  - Anxiety, confusion, agitation

- ↑ In pulmonary artery wedge pressure

- Decreased renal perfusion and UO
Collaborative Care
Cardiogenic Shock

- Restore blood flow to the myocardium by restoring the balance between O$_2$ supply and demand
- Thrombolytic therapy
- Angioplasty with stenting
- Emergency revascularization
- Valve replacement
Collaborative Care
Cardiogenic Shock

- Hemodynamic monitoring
- Drug therapy (e.g., diuretics to reduce preload)
- Circulatory assist devices (e.g., intraaortic balloon pump, ventricular assist device)
Low Blood Flow
Hypovolemic Shock

- **Absolute hypovolemia**: loss of intravascular fluid volume
  - Hemorrhage
  - GI loss (e.g., vomiting, diarrhea)
  - Fistula drainage
  - Diabetes insipidus
  - Hyperglycemia
  - Diuresis
Low Blood Flow
Hypovolemic Shock

- Relative hypovolemia
  - Results when fluid volume moves out of the vascular space into extravascular space (e.g., intracavitary space)
  - Termed third spacing
Pathophysiology of Hypovolemic Shock

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Low Blood Flow
Hypovolemic Shock

- Response to acute volume loss depends on:
  - Extent of injury
  - Age
  - General state of health
Low Blood Flow
Hypovolemic Shock

- Clinical manifestations
  - Anxiety
  - Tachypnea
  - Increase in CO, heart rate
  - Decrease in stroke volume, PAWP, urinary output

- If loss is >30%, blood volume is replaced
Collaborative Care

Hypovolemic Shock

- Stop loss of fluid and restoring the circulating volume
- Fluid replacement: 3:1 rule (3 mL of isotonic crystalloid for every 1 mL of estimated blood loss)

Type of fluid?
Distributive Shock
Neurogenic Shock

- Hemodynamic phenomenon
- S/P 30 minutes of a spinal cord injury at the fifth thoracic (T₅) vertebra or above
- Response to spinal anesthesia
- Massive vasodilation, leading to pooling of blood in vessels
Pathophysiology of Neurogenic Shock

PATHOPHYSIOLOGY MAP

Disruption of sympathetic nervous system
- Loss of sympathetic tone
  - Venous and arterial vasodilation
    - ↓ BP
      - ↓ Venous return
        - ↓ Stroke volume
          - ↓ Cardiac output
            - ↓ Heart rate
              - ↓ Cellular oxygen supply
                - ↓ Tissue perfusion
                  - Impaired cellular metabolism


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Distributive Shock

Neurogenic Shock

- Clinical manifestations
  - Hypotension
  - Bradycardia
  - Temperature dysregulation (resulting in heat loss)
  - Dry skin
  - Poikilothermia (taking on the temperature of the environment)
Collaborative Care
Neurogenic Shock

- In spinal cord injury: spinal stability
  - Vasopressors
  - Atropine
  - Fluids cautiously
  - Monitor for hypothermia
Distributive Shock
Anaphylactic Shock

- Acute, life-threatening hypersensitivity (allergic) reaction
  - Massive vasodilation
  - Release of vasoactive mediators
  - ↑ Capillary permeability
Distributive Shock
Anaphylactic Shock

Clinical manifestations
- Anxiety, confusion, dizziness
- Sense of impending doom
- Chest pain
- Incontinence
- Swelling of the lips and tongue, angioedema
- Wheezing, stridor
- Flushing, pruritus, urticaria
- Respiratory distress and circulatory failure
Collaborative Care
Anaphylactic Shock

- Epinephrine
- Diphenhydramine
- Maintain a patent airway
  - Nebulized bronchodilators
  - Aerosolized epinephrine
  - Endotracheal intubation or cricothyroidotomy may be necessary
Collaborative Care
Anaphylactic Shock

- Aggressive fluid replacement
- IV corticosteroids
Distributive Shock
Septic Shock

- Sepsis: *systemic inflammatory response to documented or suspected infection*

- Severe sepsis = sepsis + organ dysfunction
Distributive Shock

Septic Shock

- Septic shock
  - hypotension despite fluid resuscitation
  - hypoxia
Pathophysiology of Septic Shock

PATHOPHYSIOLOGY MAP

- Invading microorganisms
- Endothelial damage
- Activation of CNS and endocrine systems
- Maldistribution of circulating blood volume
- Impaired cellular metabolism
- Tissue perfusion
- Cellular oxygen supply
- Hypermetabolic state
- Capillary membrane permeability
- Peripheral vasodilation
- Myocardial depression
- Release of proinflammatory cytokines
  - Tumor necrosis factor (TNF)
  - Interleukin-1 (IL-1)
  - Other proinflammatory cytokines


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Distributive Shock
Septic Shock

- Clinical manifestations
  - ↑ Coagulation and inflammation
  - ↓ Fibrinolysis
    - Formation of microthrombi
    - Obstruction of microvasculature
  - Hyperdynamic state: increased CO and decreased SVR
Distributive Shock
Septic Shock

- Three major pathophysiologic effects
  - Vasodilation
  - Maldistribution of blood flow
  - Myocardial depression
    - Decreased ejection fraction
    - Ventricular dilation
Distributive Shock

Septic Shock

- Clinical manifestations
  - Tachypnea/hyperventilation
  - Temperature dysregulation
  - ↓ Urine output
  - Altered neurologic status
  - GI dysfunction
  - Respiratory failure is common
Collaborative Care
Septic Shock

- Code Sepsis - Protocol
- Fluid replacement
  - Hemodynamic monitoring - Target CVP (8-12 mm Hg)
- Vasopressor drug therapy (CVP >8mm hg)
- Vasopressin for patients refractory to vasopressor therapy
- IV corticosteroids if vasopressor therapy not able to maintain BP
Collaborative Care
Septic Shock

- Antibiotics after cultures are obtained (e.g., blood, wound exudate, urine, stool, sputum)
- 1st Broad-spectrum antibiotics
- More specific antibiotics are then given based on the organism identified
Collaborative Care
Septic Shock

- Glucose levels <180 mg/dL
- Stress ulcer prophylaxis with histamine (H$_2$)-receptor blockers
- DVT prophylaxis with low-dose unfractionated heparin or low-molecular-weight heparin
Collaborative Care

- Cornerstone of therapy for septic, hypovolemic, and anaphylactic shock = volume expansion
  - Isotonic crystalloids (e.g., normal saline) for initial resuscitation of shock
Collaborative Care

- Volume expansion - If no response to 2–3 L of crystalloids
  - blood administration
  - CVP

- Monitor for Complications of fluid resuscitation
  - Hypothermia
  - Coagulopathy
Collaborative Care

- Primary goal of drug therapy = correction of decreased tissue perfusion
  - Vasopressor drugs (e.g., norepinephrine)
    - Achieve/maintain MAP >60 to 65 mm Hg
    - unresponsive to fluid resuscitation
    - Continuously monitor end-organ perfusion
Primary goal of drug therapy = correction of decreased tissue perfusion

- Vasodilator therapy (e.g., nitroglycerin, nitroprusside)
  - Achieve/maintain MAP >65 mm Hg
Collaborative Care

- Nutrition is vital to decreasing morbidity
  - Initiate enteral nutrition within the first 24 hours
  - Initiate parenteral nutrition if enteral nutrition contraindicated or fails to meet at least 80% of caloric requirements
  - Monitor protein, nitrogen balance, BUN, glucose, electrolytes
Nursing Assessment

- ABCs
  - Airway
  - Breathing
  - Circulation
When assessing a patient in shock, the nurse recognizes that the hemodynamics of shock include:

a. Normal cardiac output in cardiogenic shock.

b. Increase in central venous pressure in hypovolemic shock.

c. Increase in systemic vascular resistance in all types of shock.

d. Variations in cardiac output and decreased systemic vascular resistance in septic shock.
The nurse is caring for a critically ill patient. The nurse suspects that the patient has progressed beyond the compensatory stage of shock if what occurs?

a. Increased blood glucose levels
b. Increased serum sodium levels
c. Increased serum calcium levels
d. Increased serum potassium levels
The nurse is caring for a patient in septic shock. Which hemodynamic change would the nurse expect?

a. Increased ejection fraction.
b. Increased mean arterial pressure.
c. Decreased central venous pressure.
d. Decreased systemic vascular resistance.