



# Chapter 10

## Shock

# Introduction (1 of 3)

- Shock (hypoperfusion) means a state of collapse and failure of the cardiovascular system.
  - In the early stages, the body attempts to maintain homeostasis.
  - As shock progresses, blood circulation slows and eventually ceases.

# Introduction (2 of 3)

- Shock can occur because of medical or traumatic events.
  - Heart attack
  - Severe allergic reaction
  - Automobile crash
  - Gunshot wound

# Introduction (3 of 3)

- As an EMT, you cannot go wrong assuming that every patient is in shock or may go into shock.

# Pathophysiology (1 of 9)

- Perfusion is the circulation of an adequate amount of blood to meet the cells' current needs.
  - The body is perfused via the circulatory system.
  - Organs, tissues, and cells must have adequate oxygenation or they may die.

# Pathophysiology (2 of 9)

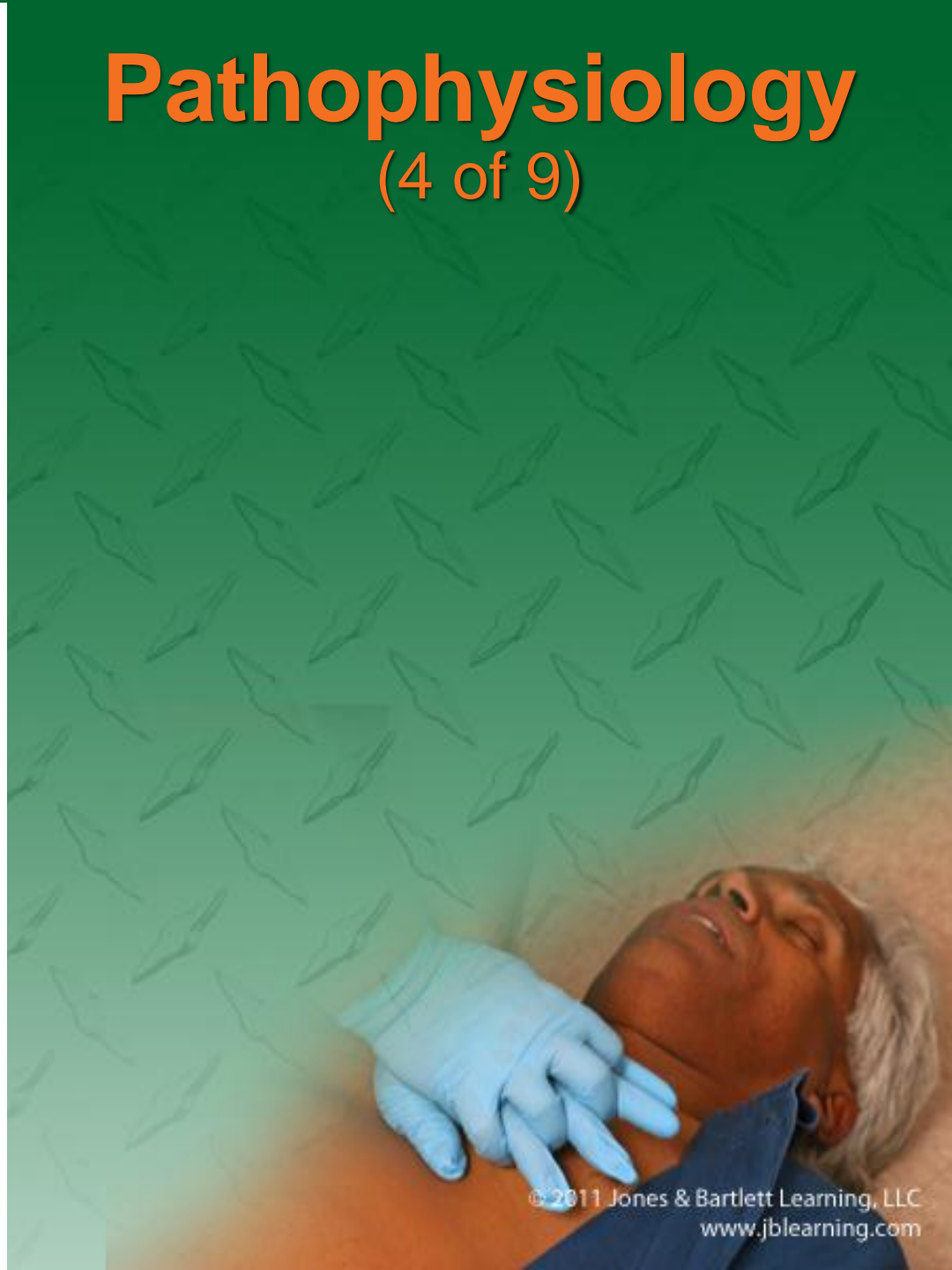
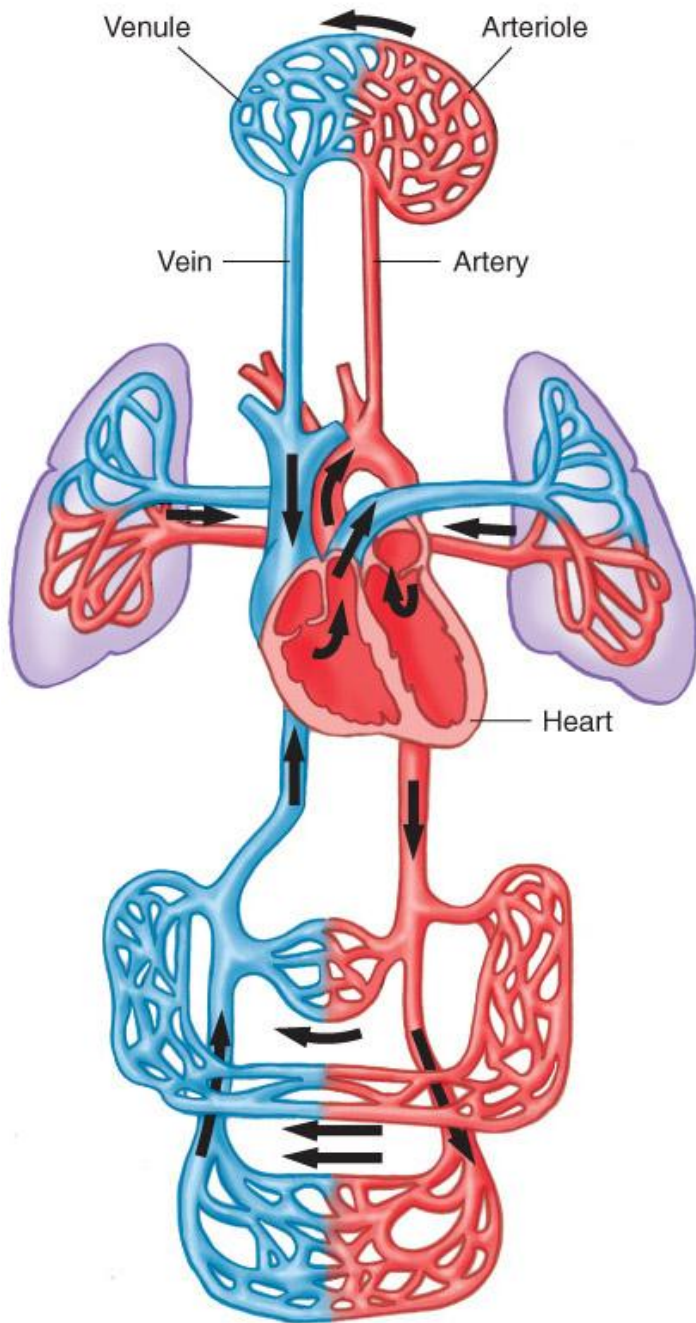
- Shock refers to a state of collapse and failure of the cardiovascular system that leads to inadequate circulation.
  - Shock is an unseen life threat caused by a medical disorder or traumatic injury.
  - If the symptoms of shock are not promptly addressed, the patient will soon die.

# Pathophysiology (3 of 9)

- Cardiovascular system has three parts:
  - Pump (heart)
  - Set of pipes (blood vessels and arteries)
  - Contents (the blood)

# Pathophysiology

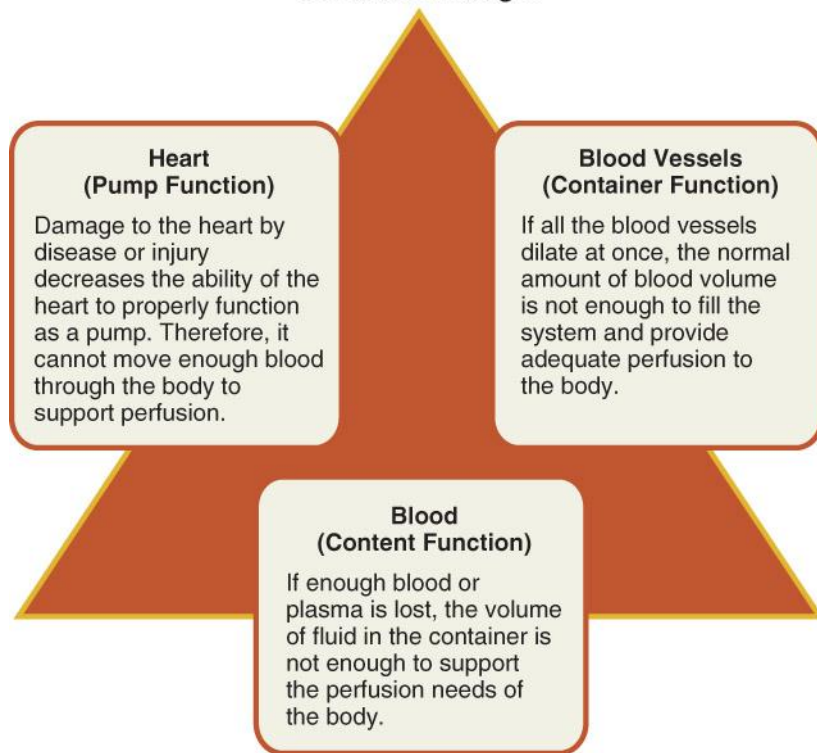
(4 of 9)





# Pathophysiology (5 of 9)

## Perfusion Triangle



- These three parts can be called the “perfusion triangle.”
  - When a patient is in shock, one or more of the three parts is not working properly.

# Pathophysiology (6 of 9)

- Blood pressure is the pressure of blood within the vessels at any one time.
  - Systolic: peak arterial pressure
  - Diastolic: pressure in the arteries while the heart rests between heartbeats

# Pathophysiology (7 of 9)

- Blood flow through the capillary beds is regulated by the capillary sphincters.
  - Under the control of the autonomic nervous system
  - Sphincters respond to other stimuli:
    - Heat
    - Cold
    - The need for oxygen and waste removal

# Pathophysiology (8 of 9)

- Perfusion requires more than just having a working cardiovascular system.
  - Adequate oxygen exchange in the lungs
  - Adequate nutrients in the form of glucose in the blood
  - Adequate waste removal, primarily through the lungs

# Pathophysiology (9 of 9)

- Mechanisms are in place to help support the respiratory and cardiovascular systems when the need for perfusion of vital organs is increased.
  - Mechanisms include the autonomic nervous system and hormones.

# Causes of Shock (1 of 2)

- Shock can result from bleeding, respiratory failure, acute allergic reactions, and overwhelming infection.
  - Damage occurs because of insufficient perfusion of organs and tissues.



# Causes of Shock (2 of 2)



- A Pump failure**  
Causes: Heart attack, trauma to heart, obstructive causes



- B Low fluid volume**  
Causes: Trauma to vessels or tissues, fluid loss from GI tract (vomiting/diarrhea can also lower the fluid component of blood)



- C Poor vessel function**  
Causes: Infection, drug overdose (narcotic), spinal cord injury, anaphylaxis

## 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

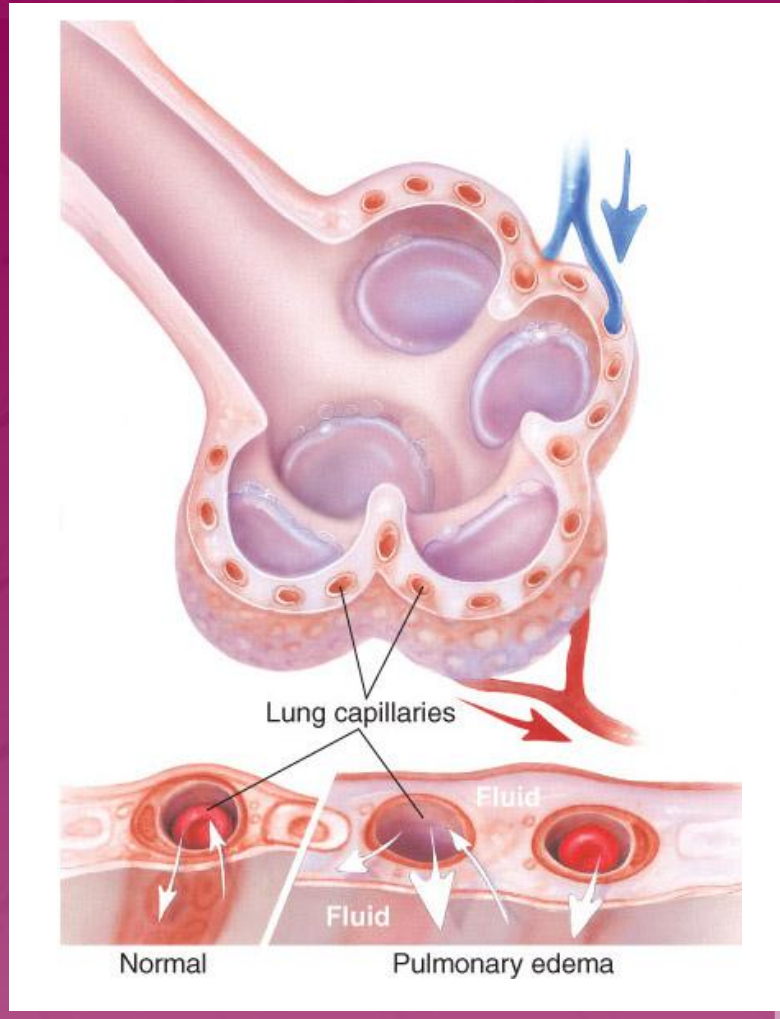
# Cardiogenic Shock (1 of 3)

- 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





# Cardiogenic Shock (2 of 3)



- Edema is the presence of abnormally large amounts of fluid between cells in body tissues, causing swelling.

# Cardiogenic Shock (3 of 3)

- Cardiogenic shock develops when the heart cannot maintain sufficient output to meet the demands of the body.

# Obstructive Shock (1 of 3)

- 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.

# Obstructive Shock (2 of 3)

- Cardiac tamponade
  - Collection of fluid between the pericardial sac and the myocardium
  - Caused by blunt or penetrating trauma
  - Can progress rapidly
  - Signs and symptoms are referred to as Beck's triad.

# Obstructive Shock (3 of 3)

- 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.

A man in a light blue shirt is looking down at a document held by a woman with blonde hair. The background is a purple gradient with a repeating pattern of white, stylized, leaf-like shapes.

# Distributive Shock (1 of 11)

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

# Distributive Shock (2 of 11)

- Septic shock
  - Occurs as a result of severe infections in which toxins are generated by bacteria or by infected body tissues
  - Toxins damage vessel walls, causing increased cellular permeability.
  - Vessel walls leak and are unable to contract well.

# Distributive Shock (3 of 11)

- Septic shock (cont'd)
  - Almost always a complication of a very serious illness, injury, or surgery.

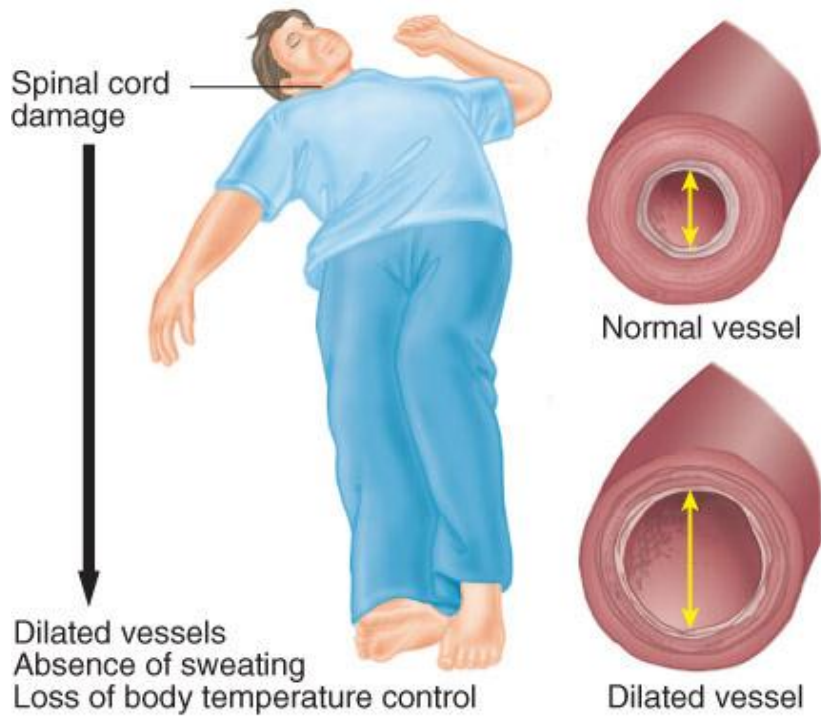


# Distributive Shock (4 of 11)

- Neurogenic shock
  - Usually a result of injury to the part of the nervous system that controls the size and muscle tone of the blood vessels
  - Causes include damage to the spinal cord, brain conditions, tumors, pressure on the spinal cord, and spina bifida.

# Distributive Shock (5 of 11)

- Neurogenic shock (cont'd)
  - Muscles in the blood vessel walls are cut off from nerve impulses that cause them to contract.





# Distributive Shock (6 of 11)

- Anaphylactic shock
  - Occurs when a person reacts violently to a substance to which he or she has been sensitized
  - Sensitization means becoming sensitive to a substance that did not initially cause a reaction.
  - Each subsequent exposure tends to produce a more severe reaction.

# Distributive Shock (7 of 11)

- Anaphylactic shock (cont'd)
  - Common causes:
    - Injections (tetanus antitoxin, penicillin)
    - Stings (honeybee, wasp, yellow jacket, hornet)
    - Ingestion (shellfish, fruit, medication)
    - Inhalation (dust, pollen)

# Distributive Shock (8 of 11)

- Anaphylactic shock (cont'd)
  - Develops within minutes or even seconds of contact with substance
  - Signs are very distinct.
  - Cyanosis (bluish color of skin) is a late sign.

# Distributive Shock (9 of 11)



**Table 10-2** Signs of Anaphylactic Shock

## Skin

- Flushing, itching, or burning, especially over the face and upper part of the chest
- Urticaria (hives), which may spread over large areas of the body
- Edema, especially of the face, tongue, and lips
- Pallor
- Cyanosis (a bluish cast to the skin resulting from poor oxygenation of circulating blood) about the lips

## Circulatory System

- Dilation of peripheral blood vessels
- Increased vessel permeability
- A drop in blood pressure
- A weak, barely palpable pulse
- Dizziness
- Fainting and coma

## Respiratory System

- Sneezing or itching in the nasal passages
- Tightness in the chest, with a persistent dry cough
- Wheezing and dyspnea (difficulty breathing)
- Secretions of fluid and mucus into the bronchial passages, alveoli, and lung tissue, causing coughing
- Constriction of the bronchi; difficulty drawing air into the lungs
- Forced expiration, requiring exertion and accompanied by wheezing
- Cessation of breathing

# Distributive Shock (10 of 11)

- 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.

# Distributive Shock (11 of 11)

- Psychogenic shock (cont'd)
  - Non-life-threatening causes include receiving bad news or seeing something unpleasant such as blood.



# Hypovolemic Shock (1 of 2)

- 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 (2 of 2)

- 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.

# Respiratory Insufficiency (1 of 2)

- A patient with a severe chest injury may be unable to breathe in an adequate amount of oxygen.
  - An insufficient concentration of oxygen in the blood can produce shock as rapidly as vascular causes.

# Respiratory Insufficiency (2 of 2)

- Certain types of poisoning may affect the ability of cells to metabolize or carry oxygen:
  - Carbon monoxide poisoning
  - Cyanide poisoning
- Anemia occurs when there is an abnormally low number of red blood cells.

# The Progression of Shock (1 of 5)

- 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

- Agitation
- Anxiety
- Restlessness
- Feeling of impending doom
- 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
- Marked thirst

### 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
- Thready or absent peripheral pulses
- Dull eyes, dilated pupils
- Poor urinary output

# The Progression of Shock (2 of 5)

- Signs and symptoms

# The Progression of Shock (3 of 5)

- Blood pressure may be the last measureable factor to change in shock.
  - When a drop in blood pressure is evident, shock is well developed.
  - Particularly true in infants and children

# The Progression of Shock (4 of 5)

- Use caution when caring for elderly patients.
- Treating a pediatric or geriatric patient in shock is no different than treating other shock patients.
- Expect shock in many emergency medical situations.



# The Progression of Shock (5 of 5)

- Also expect shock if a patient has any one of the following conditions:
  - Multiple severe fractures
  - Abdominal or chest injury
  - Spinal injury
  - Severe infection
  - Major heart attack or anaphylaxis

# Patient Assessment for Shock

- Patient assessment steps
  - Scene size-up
  - Primary assessment
  - History taking
  - Secondary assessment
  - Reassessment



# Scene Size-Up

- Scene size-up
  - Ensure the scene is safe for you, your partner, your patient, and bystanders.
  - Determine the necessary standard precautions and whether you will need additional resources.
  - Observe the scene and patient for clues to determine the MOI/NOI.



# Primary Assessment (1 of 3)

- Primary assessment
  - Perform a rapid scan.
  - Treat according to the ABCs.
  - Significant bleeding, internal or external, is an immediate life threat.
  - Provide high-flow oxygen to assist in perfusion of damaged tissues.



# Primary Assessment (2 of 3)

- Primary assessment (cont'd)
  - Form a general impression.
  - Assess the airway to ensure it is patent.
  - Assess breathing.
  - An increased respiratory rate is often an early sign of impending shock.
  - Check for a distal pulse.



# Primary Assessment (3 of 3)

- Primary assessment (cont'd)
  - A rapid pulse suggests compensated shock.
  - In compensated shock, the skin may be cool, clammy, or ashen.
  - Trauma patients with shock, or a suspicious MOI, generally should go to a trauma center.

# History Taking

- History taking
  - Investigate the chief complaint.
  - Obtain a SAMPLE history.

# Secondary Assessment

- Secondary assessment
  - Physical examination with a full-body scan
  - Assess the respiratory system, neurologic system, musculoskeletal system, and all anatomic regions.
  - Obtain a complete set of baseline vital signs.
  - Use monitoring devices.



# Reassessment

- Reassessment
  - Determine what interventions are needed.
  - Patients who are in decompensated shock will need rapid interventions to restore adequate perfusion.
  - Determine whether your patient is in compensated or decompensated shock.
  - Document these findings.

# Emergency Medical Care for Shock

- As soon as you recognize shock, begin treatment.
  - See **Skill Drill 10-1**.
  - Do not give the patient anything by mouth, no matter how urgently you are asked.
  - Accurately record the patient's vital signs approximately every 5 minutes throughout treatment and transport.



# Treating Cardiogenic Shock

(1 of 3)

- Patient does not require a transfusion of blood, IV fluids, or elevation of legs.
- Chronic lung disease will aggravate cardiogenic shock.
- Patient is able to breathe better in a sitting or semisitting position.



# Treating Cardiogenic Shock

(2 of 3)



- Before administering nitroglycerin, consult with medical control.
- Patients usually have a low blood pressure, weak/irregular pulse, cyanosis, anxiety, and nausea.
- Place the patient in a position that eases breathing as you give high-flow oxygen.

# Treating Cardiogenic Shock

(3 of 3)

- Assist ventilations as necessary and have suction nearby in case the patient vomits.
- Provide prompt transport.
- Approach a patient with a suspected heart attack with calm reassurance.



# Treating Obstructive Shock

## (1 of 2)

- In cardiac tamponade:
  - Increasing cardiac output is the priority.
  - Surgery is the only definitive treatment.
  - Apply high-flow oxygen.
  - The key treatment is rapid transport or ALS management.

# Treating Obstructive Shock

## (2 of 2)

- In tension pneumothorax:
  - Apply high-flow oxygen to prevent hypoxia.
  - Decompress the injured side of the chest
  - The key treatment is rapid transport or ALS management.

# Treating Septic Shock

- Hospital management is required.
- Use standard precautions.
- Transport as promptly as possible.
- Use high-flow oxygen during transport.
- Ventilatory support may be necessary.
- Use blankets to conserve body heat.



# Treating Neurogenic Shock

## (1 of 2)

- For the spinal cord injury patient, use a combination of all known supportive measures.
- Hospitalization will be required for a long time.
- Keep the patient as warm as possible.

# Treating Neurogenic Shock

## (2 of 2)

- Emergency treatment:
  - Obtain and maintain a proper airway.
  - Provide spinal immobilization.
  - Assist inadequate breathing.
  - Conserve body heat.
  - Provide the most effective circulation.
  - Transport promptly.

# Treating Anaphylactic Shock

- Administer epinephrine.
- Promptly transport the patient.
- Provide supplemental oxygen and ventilatory assistance en route.
- A mild reaction may worsen suddenly.
- Consider requesting ALS backup, if available.

# Treating Psychogenic Shock

## (1 of 2)



- In uncomplicated fainting, once the patient collapses, circulation to the brain is restored.
- Psychogenic shock can worsen other types of shock.
- If the patient falls, check for injuries.

# Treating Psychogenic Shock

## (2 of 2)

- If after regaining consciousness, the patient is unable to walk normally, suspect head injury.
  - Transport the patient promptly.
  - Record all initial observations of vital signs and level of consciousness.

# Treating Hypovolemic Shock

- Control all obvious external bleeding.
- Splint any bone and joint injuries.
- Secure and maintain an airway, and provide respiratory support.
- Transport as rapidly as possible.

# Treating Respiratory Insufficiency

- Secure and maintain the airway.
- Clear the mouth and throat of obstructions.
- If necessary, provide ventilations with a bag-mask device.
- Give supplemental oxygen.
- Transport the patient promptly.

# Summary (1 of 5)

- Perfusion requires an intact cardiovascular system and a functioning respiratory system.
- Most types of shock are caused by dysfunction in the heart, blood vessels, or volume of blood.



# Summary (2 of 5)

- Shock is the collapse and failure of the cardiovascular system, when blood circulation slows and eventually stops.
- Blood is the vehicle for carrying oxygen and nutrients through the vessels to the capillary beds to tissue cells, where these supplies are exchanged for waste products.

# Summary (3 of 5)

- Blood contains red blood cells, white blood cells, platelets, and a liquid called plasma.
- The *systolic* pressure is the peak arterial pressure.
- The *diastolic* pressure is the pressure maintained within the arteries while the heart rests between heartbeats.

# Summary (4 of 5)

- The various types of shock are cardiogenic, obstructive, septic, neurogenic, anaphylactic, psychogenic, and hypovolemic.
- If there is any question on your part, treat for shock. It is never wrong to treat for shock.

# Summary (5 of 5)

- Remember, by the time a drop in blood pressure is detected, shock is usually in an advanced stage.
- Treating a pediatric or geriatric patient in shock is no different than treating any other shock patient.