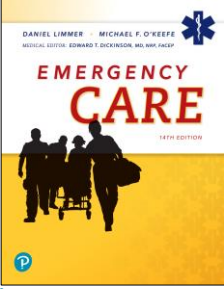



Emergency Care
Fourteenth Edition




Chapter 31
Chest and Abdominal Trauma

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Topics

- [Anatomy and Physiology of the Chest and Abdomen](#)
- [Chest Injuries](#)
- [Abdominal Injuries](#)

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Anatomy and Physiology of the Chest and Abdomen

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Anatomy and Physiology of the Chest (1 of 3)

- Chest cavity
 - Extends from collarbones to diaphragm
 - Dynamic because it depends on respiratory cycle
 - Packed with organs, major blood vessels, and lung tissue

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Anatomy and Physiology of the Chest (2 of 3)

- Organs of the chest are well protected
 - 12 sets of ribs
 - Sternum
 - Thoracic spine vertebrae
 - Scapula

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Anatomy and Physiology of the Chest (3 of 3)

- Physiologic functions of the chest
 - Heart beats to provide blood flow
 - Large blood vessels enter and exit the heart
 - Respiratory function

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Anatomy of the Chest



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The Mechanism of Breathing (1 of 2)

- Chest wall, diaphragm, and lungs work together
 - Change pressure within the chest cavity
 - Cause air to be moved in and out

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The Mechanism of Breathing (2 of 2)

- Inhalation
 - Active process that uses negative pressure to draw air into the lungs
- Exhalation
 - Passive process that uses positive pressure to push air out of the lungs

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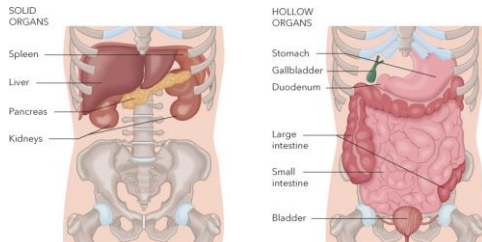
Anatomy and Physiology of the Abdomen (1 of 3)

- Superior border is diaphragm
- Abdominal organs extend to the lower regions of the pelvis
 - Described in context of location relative to four abdominal quadrants

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Anatomy of the Abdomen



[For long description, see slide 83: Appendix 1](#)

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Anatomy and Physiology of the Abdomen (2 of 3)

- Trauma assessment and care takes into consideration placement and function of abdominal organs.
- Differentiate between hollow and solid organs
 - Hollow organs tolerate trauma well.
 - Solid organs do not tolerate trauma well.

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Anatomy and Physiology of the Abdomen (3 of 3)

- Physiology of abdominal organs is dependent on individual function.
- Abdominal cavity is dynamic depending on location of diaphragm.
- There is always a large volume of blood in the abdomen.



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Pathophysiology of the Chest and Abdomen

- Disruption of breathing
- Hemorrhage and shock
- Disruption of organ function
- Infection



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Chest Injuries

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Chest Injuries (1 of 2)

- Blunt trauma
 - Can fracture ribs, sternum, and costal (rib) cartilages
- Penetrating trauma
 - Bullets, knives, pieces of metal or glass, steel rods, pipes, other objects
 - Can damage internal organs and impair respiration



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Chest Injuries (2 of 2)

- Compression and shearing injuries
 - Occurs when severe blunt trauma causes the chest to rapidly compress
 - Shearing can damage the aorta and vena cava
- Chest injuries are classified as either closed or open.



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Blunt Chest Injuries (1 of 4)

- Rib fractures
 - Painful but usually not life-threatening
 - Can make breathing difficult
 - Can lacerate blood vessels or lung tissue



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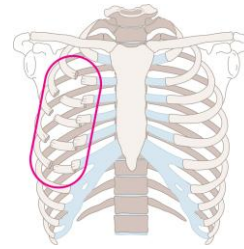
Blunt Chest Injuries (2 of 4)

- Flail chest
 - Fracture of two or more consecutive ribs in two or more places
 - Leaves a portion of the chest wall unstable
 - Leads to inadequate breathing and hypoventilation
- Paradoxical motion
 - Movement of flail segment is opposite to movement of the remainder of the chest cavities.



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Blunt Chest Injuries (3 of 4)

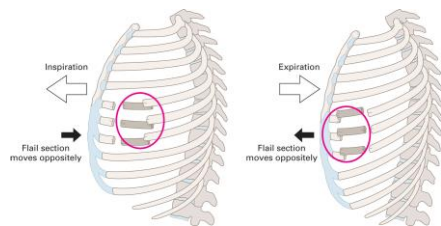


Flail chest occurs when blunt trauma creates a fracture of two or more ribs in two or more places.



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Blunt Chest Injuries (4 of 4)



[For long description, see slide 84: Appendix 2](#)

Paradoxical motion.



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Patient Assessment (1 of 13)

- Rib fracture
 - Consider mechanism of injury
 - Pain at the site of injury that increases with breathing
 - Tenderness
 - Redness, swelling, or bruising of skin
 - Respiratory distress, hypoxia, or respiratory failure
 - Self-splinting



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Patient Assessment (2 of 13)

- Flail chest
 - Mechanism of injury capable of causing injury
 - Difficulty breathing
 - Pain at injury site
 - Likely signs of shock and hypoxia
 - Chest wall muscle contraction



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Patient Care (1 of 10)

- Rib Fracture
 - Consider need for ALS
 - Allow patient to remain in position of comfort
 - Unless spinal precautions are needed
 - Treat hypoxia
 - Allow patient to hold pillow or cushion against chest



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Patient Care (2 of 10)

- Flail chest
 - Primary assessment for life threats
 - Administer oxygen.
 - If patient is breathing inadequately, assist ventilation.
 - Follow local protocols regarding using noninvasive positive pressure ventilations.



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Patient Care (3 of 10)

- Flail chest
 - Request ALS for pain management.
 - Monitor patient carefully.
 - Watch respiratory rate and depth.
 - Do not restrict chest wall movement.



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Penetrating Chest Injuries

- Difficult to tell what is injured from entrance wound
- Assume all wounds are life-threatening.
- Open wounds allow air into chest.
 - Sets imbalance in pressure
 - Causes lung to collapse



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Patient Assessment (3 of 13)

- Determine description of object that penetrated
- If one penetrating wound is found, look for others.
- Visualize entire chest during assessment
- Listen to lung sounds
 - Identify pneumothorax or hemothorax



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Patient Assessment (4 of 13)

- Lung damage signs and symptoms
 - Difficulty breathing
 - Absent or unequal lung sounds
 - Hemoptysis
 - Hypoxia



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Patient Assessment (5 of 13)

- Other signs and symptoms
 - Shock
 - Tachycardia
 - Tachypnea
 - Pale skin
 - Low blood pressure



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Patient Assessment (6 of 13)

- “Sucking chest wound”
 - Air drawn in through hole
 - Wound to the chest
 - Sucking sound
 - Small air bubbles within wound
 - Patient may gasp for air

Patient Care (4 of 10)

- Allow law enforcement to render scene safe.
- Consider ALS.
- Maintain open airway.
- Seal wound.
- Apply occlusive dressing.

Patient Care (5 of 10)

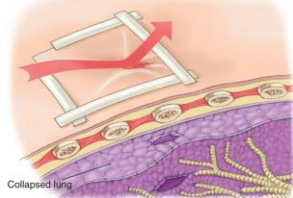
- Allow patient to remain in position of comfort if possible.
- Administer high-concentration oxygen.
- Treat for shock.
- Immediate transport.

Occlusive and Flutter-Valve Dressings (1 of 3)

- Occlusive dressing seals wound to stop movement of air.
- Flutter valve dressings involve taping dressing in place and leaving a side or corner of dressing unsealed
 - As patient inhales, dressing will seal wound.
 - As patient exhales, free corner or edge acts as flutter valve to release air trapped in chest cavity.

Occlusive and Flutter-Valve Dressings (2 of 3)

On inspiration, dressing seals wound, preventing air entry

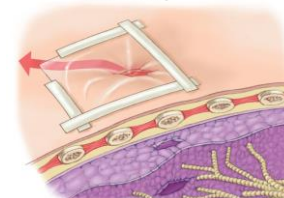


Collapsed lung

Creating a flutter valve to allow air to escape from the chest cavity.

Occlusive and Flutter-Valve Dressings (3 of 3)

Expiration allows trapped air to escape through untaped section of dressing



Creating a flutter valve to allow air to escape from the chest cavity.

Think About It

- Does the patient's chest injury need to be treated during the primary assessment?
- Does the open chest injury require an occlusive dressing?
- Does the patient's injury necessitate immediate transport to a trauma center?



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Injuries Within the Chest Cavity (1 of 12)

- Pneumothorax and tension pneumothorax
- Hemothorax and hemopneumothorax
- Traumatic asphyxia
- Cardiac tamponade
- Aortic injury



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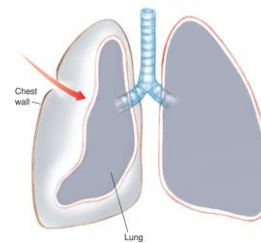
Injuries Within the Chest Cavity (2 of 12)

- Pneumothorax and tension pneumothorax
 - Pneumothorax
 - When air accumulates in chest cavity, possibly causing lung collapse
 - Tension pneumothorax
 - Pressure from air in chest cavity puts pressure on the heart and vena cava



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Injuries Within the Chest Cavity (3 of 12)



Air can enter the chest cavity through a puncture in the chest wall. This can cause the collapse of a lung and impaired breathing.



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Injuries Within the Chest Cavity (4 of 12)

- Pneumothorax and tension pneumothorax
 - Patients typically have diminished or absent lung sounds on affected side.
 - Jugular veins may be distended.
 - Trachea may shift to opposite side.



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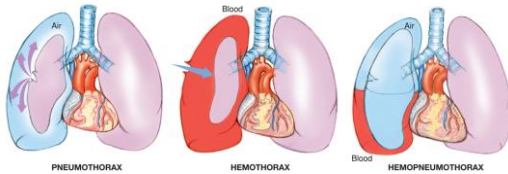
Injuries Within the Chest Cavity (5 of 12)

- Hemothorax and hemopneumothorax
 - Hemothorax
 - Chest cavity fills with blood.
 - Hemopneumothorax
 - Chest cavity fills with both blood and air.



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Hemothorax and Hemopneumothorax



[For long description, see slide 85: Appendix 3](#)

Pneumothorax, hemothorax, and hemopneumothorax.



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Injuries Within the Chest Cavity (6 of 12)

- Traumatic asphyxia
 - Sudden compression of chest forcing blood out of organs and rupturing blood vessels
 - Neck and face are a darker color than rest of the body
 - May cause bulging eyes, distended neck veins, broken blood vessels in face



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Injuries Within the Chest Cavity (7 of 12)

- Cardiac tamponade
 - Direct injury to heart causing blood to flow into the pericardial sac around the heart
 - Pericardium is a tough sac that rarely leaks.
 - Increased pressure on heart so chambers cannot fill



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Injuries Within the Chest Cavity (8 of 12)

- Cardiac tamponade
 - Blood backs up into veins.
 - Usually a result of penetrating trauma
 - Distended neck veins
 - Shock and narrowed pulse pressure



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Injuries Within the Chest Cavity (9 of 12)

- Aortic injury
 - Aorta is the largest artery in the body.
 - Penetrating trauma can cause direct damage.
 - Blunt trauma can sever or tear the aorta.



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Injuries Within the Chest Cavity (10 of 12)

- Aortic injury
 - Aortic dissection
 - Inner layer of aorta begins to tear
 - Blood flows between layers of aorta's wall
 - Often rapidly fatal
 - Aneurysm
 - Balloon-like protrusion of aorta
 - Rupture leads to patient death



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Injuries Within the Chest Cavity (11 of 12)

- Aortic injury
 - Patient complains of pain in chest, abdomen, or back.
 - Signs of shock
 - Differences in pulse or blood pressure between right and left arms or differences in pulses between arms and legs or the legs themselves



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Injuries Within the Chest Cavity (12 of 12)

- Commotio cordis
 - Uncommon condition
 - Trauma to chest when heart is vulnerable
 - If untreated, patient will go into ventricular fibrillation (VF).
 - Treat like a VF patient.
 - CPR, defibrillation



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Patient Assessment (7 of 13)

- Pneumothorax
 - Respiratory difficulty
 - Uneven chest wall movement
 - Reduction or absence of breath sounds on affected side



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Patient Assessment (8 of 13)

- Tension pneumothorax
 - Increased respiratory difficulty and signs of hypoxia
 - Shock
 - Distended neck veins
 - Tracheal deviation
- Hemothorax
 - Signs of pneumothorax
 - Coughing up frothy-red blood



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Patient Assessment (9 of 13)

- Traumatic asphyxia
 - Distended neck veins
 - Head, neck, and shoulders appear dark blue or purple
 - Bloodshot and bulging eyes
 - Swollen and blue tongue and lips
 - Chest deformity or tenderness



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Patient Assessment (10 of 13)

- Cardiac tamponade
 - Distended neck veins
 - Very weak pulse
 - Low blood pressure
 - Steadily decreasing pulse pressure



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Patient Assessment (11 of 13)

- Aortic injury or dissection
 - Tearing chest pain radiating to the back
 - Differences in pulse or blood pressure between right and left extremities or between arms and legs
 - Palpable pulsating mass
 - Cardiac arrest



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Patient Care (6 of 10)

- Pneumothorax or tension pneumothorax
 - Contact ALS.
 - Seal all open chest wounds.
 - Allow air to be expelled for tension pneumothorax.
 - Manage patient's airway.
 - Administer oxygen to treat hypoxia.
 - Allow patient to remain in position of comfort.



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Patient Care (7 of 10)

- Other injuries within the chest cavity
 - Maintain open airway. Be prepared to apply suction.
 - Administer supplemental oxygen.
 - Follow local protocols for type of dressing.
 - Care for shock.
 - Transport as soon as possible.
 - Consider ALS intercept.



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Abdominal Injuries

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Abdominal Injuries (1 of 3)

- Can be open or closed
- Internal bleeding can be severe if organs or blood vessels are damaged or ruptured.
- Evisceration may occur.
 - Organs protruding through wound opening



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Abdominal Injuries (2 of 3)



An abdominal evisceration from a stab wound.



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Abdominal Injuries (3 of 3)

- Blunt trauma to solid organs can cause life-threatening blood loss.
- Injury to the diaphragm can cause detachment, allowing abdominal contents to enter thoracic cavity.
- If hollow organs are injured, they can spill contents into the abdominal cavity
 - Severe irritation and peritonitis



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Patient Assessment (12 of 13)

- Pain, initially mild but rapidly becoming intolerable
- Cramps
- Nausea
- Weakness
- Thirst
- Obvious lacerations and puncture wounds to abdomen



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Patient Assessment (13 of 13)

- Lacerations and puncture wounds to pelvis, and middle and lower back
- Indications of blunt trauma
- Indications of developing shock
- Coughing up or vomiting blood
- Rigid and/or tender abdomen
- Distended abdomen
- Patient tries to lie very still.



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The Path of the Bullet

- Patient with gunshot wound to lower ribs and same level in back should be treated for both chest wound and abdominal wound.
- Bullets often do not take straight paths.



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Patient Care (8 of 10)

- Both closed and open abdominal injuries
 - Stay alert for vomiting; keep airway open.
 - Place patient on back with legs flexed at knees to reduce tension on abdominal muscles.
 - Administer supplemental oxygen.
 - Treat for shock.
 - Give nothing to patient by mouth.
 - Continuously monitor vital signs.
 - Transport as soon as possible.



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Patient Care (9 of 10)

- Additional steps for open abdominal injuries
 - Control external bleeding and dress all wounds.
 - Do not touch or replace eviscerated organs.
 - Apply sterile dressing moistened with sterile saline over wound site.
 - For large evisceration, maintain warmth by placing layers of bulky dressing over occlusive dressing.



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Patient Care (10 of 10)

- Additional steps for open abdominal injuries
 - Do not remove any impaled object.
 - Stabilize with bulky dressings bandaged in place.
 - Leave patient's legs in position found to avoid muscular movement that may move impaled object.



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Chapter Review



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Chapter Review (1 of 6)

- An open chest or abdominal wound is considered to be one that penetrates not only the skin but also the chest or abdominal wall to expose internal organs. Open chest and abdominal wounds are life-threatening. For both open and closed injuries, take appropriate Standard Precautions, note the mechanism of injury, protect the patient's airway and breathing, treat for shock, and transport. If there are signs of hypoxia, or the patient's vital signs indicate or suggest the potential for shock, administer oxygen.



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Chapter Review (2 of 6)

- A flail chest is characterized by paradoxical motion. If the patient is unable to adequately breathe, assist the patient's ventilations.



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Chapter Review (3 of 6)

- Seal a penetrating chest wound with an occlusive dressing. Monitor the patient for changes, and be prepared to manually relieve any pressure in the chest.



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Chapter Review (4 of 6)

- Closed chest wounds are sometimes difficult to distinguish or may occur together. Assess the patient, including breath sounds, and maintain ventilation, oxygenation, and perfusion.



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Chapter Review (5 of 6)

- A patient who collapses in cardiac arrest after a force is applied to the center of the chest should receive CPR and defibrillation like any other patient in arrest from a cardiac cause.
- If a patient develops signs of tension pneumothorax, arrange immediately for ALS intercept or transport promptly to a facility that can treat this injury.



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Chapter Review (6 of 6)

- When solid abdominal organs are injured, life-threatening amounts of blood loss can occur.
- When hollow abdominal organs are injured, their contents spill into the abdominal cavity and cause irritation and peritonitis.



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Remember (1 of 3)

- Blunt trauma, penetrating trauma, and compression are mechanisms that can injure the chest and abdomen.
- Open or closed pertains to the integrity of the chest or abdominal wall after injury.
- Seal open chest wounds to prevent air from entering the chest cavity.



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Remember (2 of 3)

- Closed chest and abdominal wounds bear a high risk for underlying organ system damage and internal bleeding. Use mechanism of injury and patient assessment to recognize the signs and symptoms of shock.



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Remember (3 of 3)

- EMTs should learn signs and symptoms, and treatment procedures for specific chest and abdominal injuries.



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Questions to Consider (1 of 2)

- Is the patient's breathing adequate, inadequate, or absent?
- Is the patient displaying signs of shock?
- Is there an open wound in the chest that needs to be sealed?



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Questions to Consider (2 of 2)

- Is the patient displaying signs of a tension pneumothorax?
- Is there an open wound in the abdomen that needs to be dressed and covered?



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Critical Thinking (1 of 2)

- You are caring for a patient who was shot in the chest with a nail gun. You applied an occlusive dressing around the wound. The patient is suddenly deteriorating. He is having extreme difficulty breathing and his color has worsened.



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Critical Thinking (2 of 2)

- Breath sounds have become almost totally absent on the side with the impaled nail. What complication might you suspect is causing his worsening condition? How could this be corrected?



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Appendix 1

The chart on the left depicts the placement of the solid organs in the human body including the spleen, liver, pancreas, and kidneys. The chart on the right depicts the hollow organs in the human body including the stomach, gallbladder, duodenum, large and small intestines, and bladder.

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Appendix 2

The first graphic shows a rib cage with three ribs broken at two ends. An arrow labeled, Inspiration points outward from the chest. Another arrow points in toward the chest and is labeled, Flail section moves oppositely. The second graphic shows a rib cage with three ribs broken at two ends. An arrow labeled, expiration points in toward the chest. Another arrow points outward from the chest and is labeled, Flail section moves oppositely.

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Appendix 3

With pneumothorax, air enters a chest cavity and collapses one of the lungs. With hemothorax, blood enters a chest cavity and collapses one of the lungs. With hemopneumothorax, blood and air enter a chest cavity and collapse one of the lungs.

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