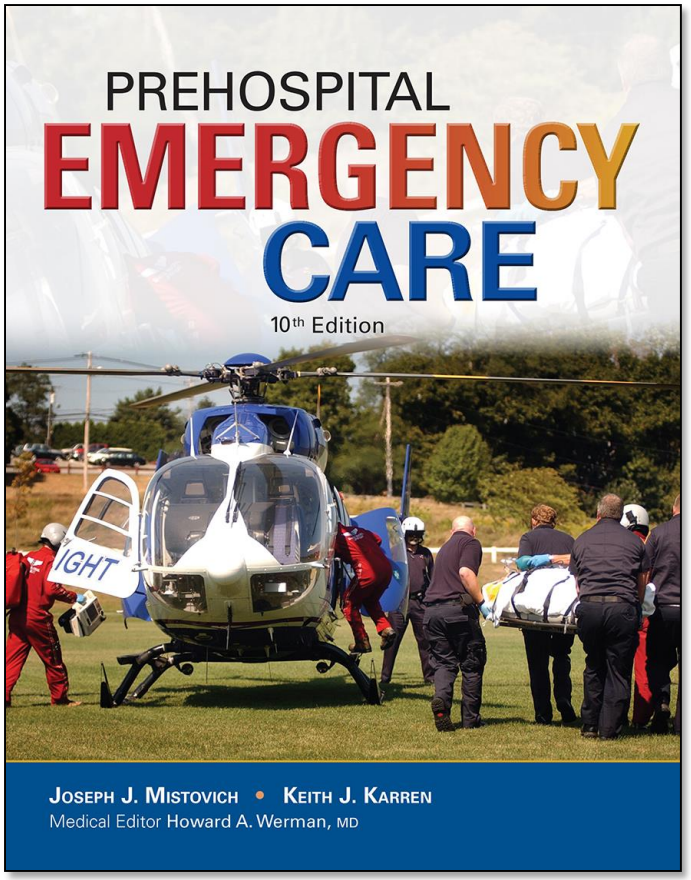
PREHOSPITAL EMERGENCY CARE

TENTH EDITION



CHAPTER 34

Chest Trauma

Learning Readiness

- EMS Education Standards, text p. 945

Learning Readiness Objectives

- Please refer to page 945 of your text to view the objectives for this chapter.

Learning Readiness Key Terms

- Please refer to page 945 of your text to view the key terms for this chapter.

Setting the Stage

- Overview of Lesson Topics
  - Anatomy of the Chest
  - Types of Chest Injuries
  - Assessment-Based Management of Chest Injuries

Case Study Introduction

EMTs Roxanne Freidman and Laura Cahill are on the scene of a patient who was ejected from the driver's seat of a vehicle that rolled multiple times after leaving the roadway at high speed. As Roxanne maintains in-line stabilization of the spine while opening the airway with a jaw-thrust maneuver, Laura quickly exposes the chest and listens for breath sounds.

"No breath sounds on the right. There is jugular vein distention," says Laura.

Case Study

- What injuries are suggested by the mechanism of injury and the EMTs' findings so far?
- What immediate interventions are required?

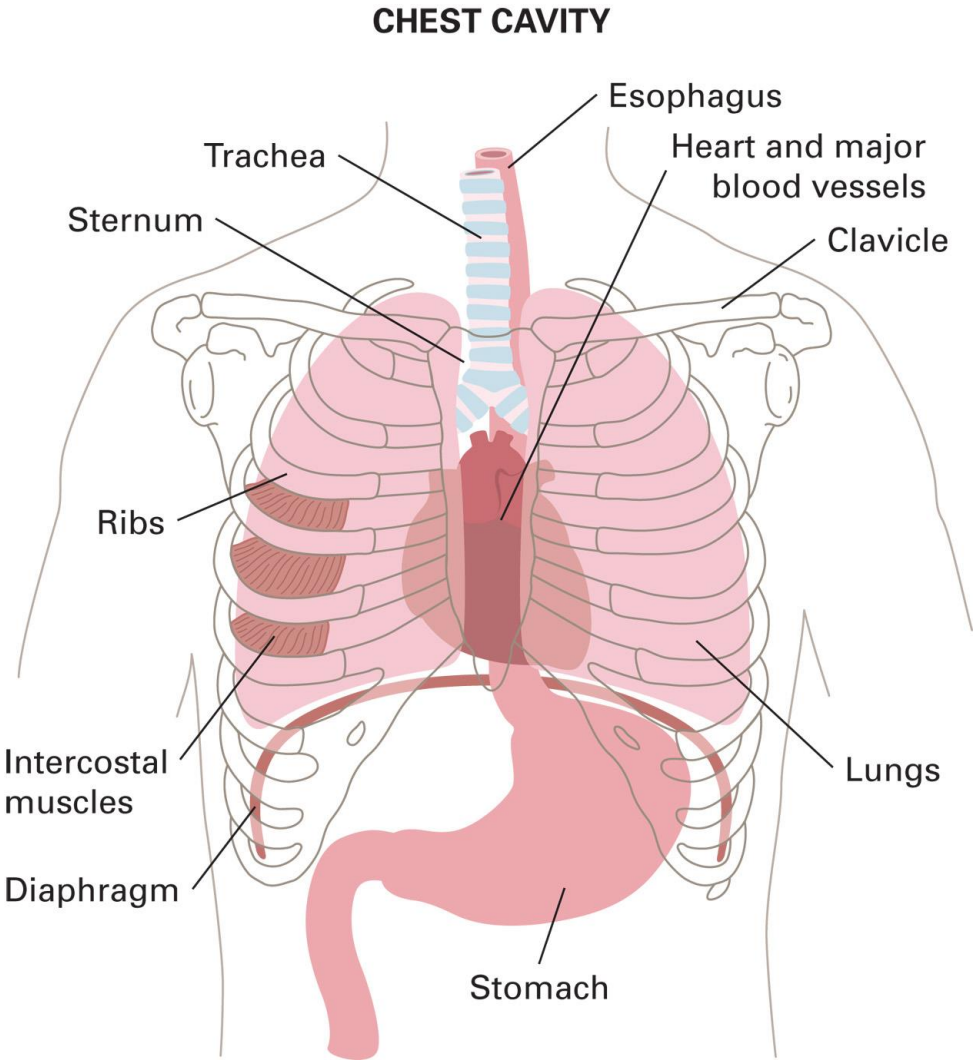
Introduction

- Chest injuries may not have a dramatic appearance and can be overlooked.
- Chest injuries can be lethal.
- Maintain a high index of suspicion based on mechanism of injury.

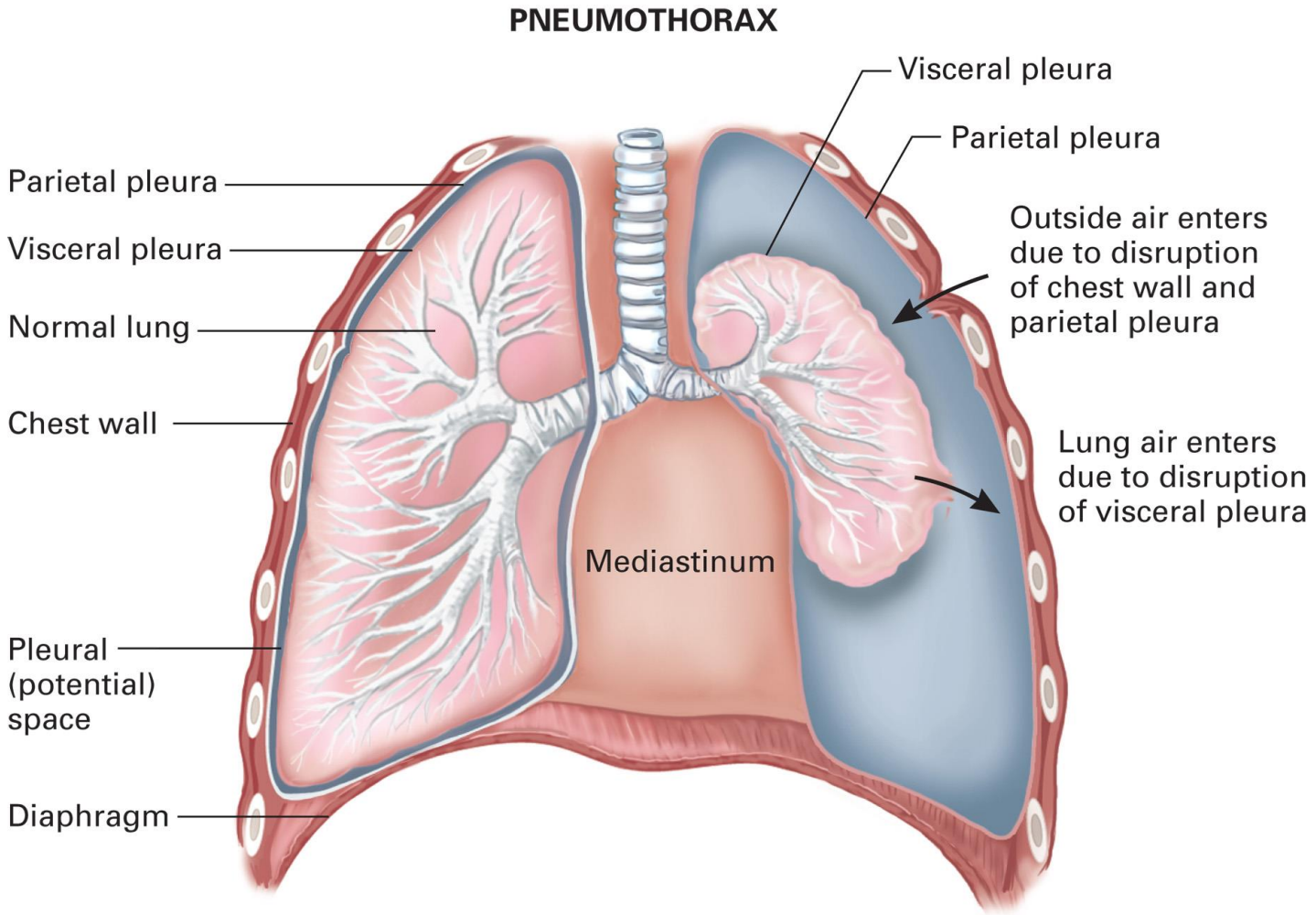
Anatomy of the Chest

- The thoracic cavity
  - Contains vital organs
  - Vital organs are protected by the ribs.
  - The thoracic cavity is lined by two layers of pleura.

The chest cavity.



Normally, negative pressure acts like a vacuum, holding the visceral pleura that covers the lung to the parietal pleura that lines the chest wall and keeping the lung expanded. When either the lung and its visceral pleura are punctured or the chest wall and its parietal pleura are punctured, air enters the space between the pleura, creating positive pressure on the lung and causing it to collapse.

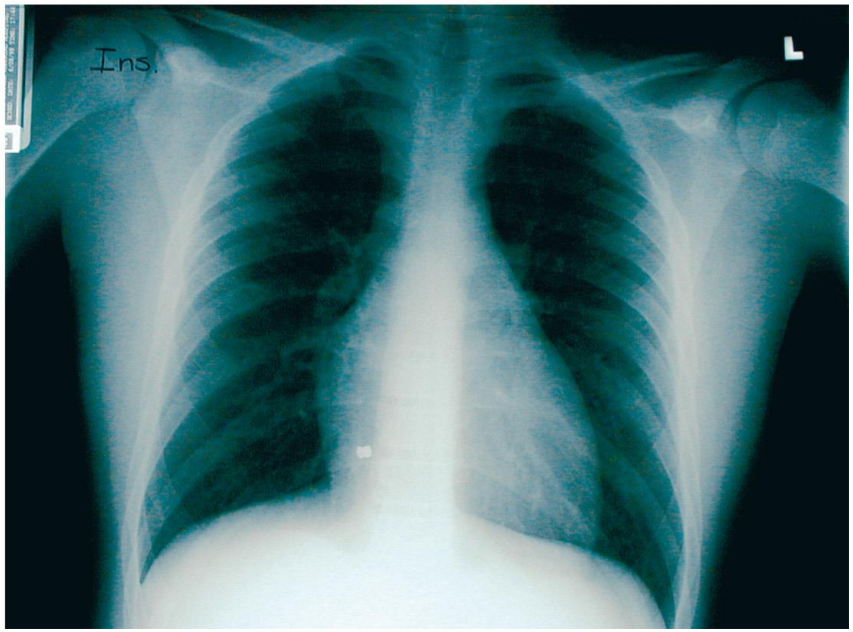


Categories of Chest Injuries

- Open chest injury
  - Caused by penetration injury
  - Cavitation occurs with gunshot wounds.

continued on next slide

A pellet fired from an air gun creates an extremely small entrance wound. Although a pellet wound may be very small, a pellet can penetrate the thoracic cavity, ricochet around, and potentially cause lethal injuries. When you suspect trauma, you must expose and closely inspect the chest to avoid missing potentially lethal injuries. (Both photos: © Charles Stewart, MD, FACEP)



continued on next slide

Categories of Chest Injuries

- Open chest injury
  - May involve injury of the heart, major blood vessels.
  - Pneumothorax
    - Penetrating trauma can interfere with the negative pressure needed for inhalation by allowing air to enter through the wound.

continued on next slide

Categories of Chest Injuries

- Open chest injury
  - Sucking chest wound
    - Air enters through the wound with each inhalation.
    - Must be covered with an occlusive dressing taped on three sides.
    - Taping the dressing on four sides can lead to tension pneumothorax.

continued on next slide

Categories of Chest Injuries

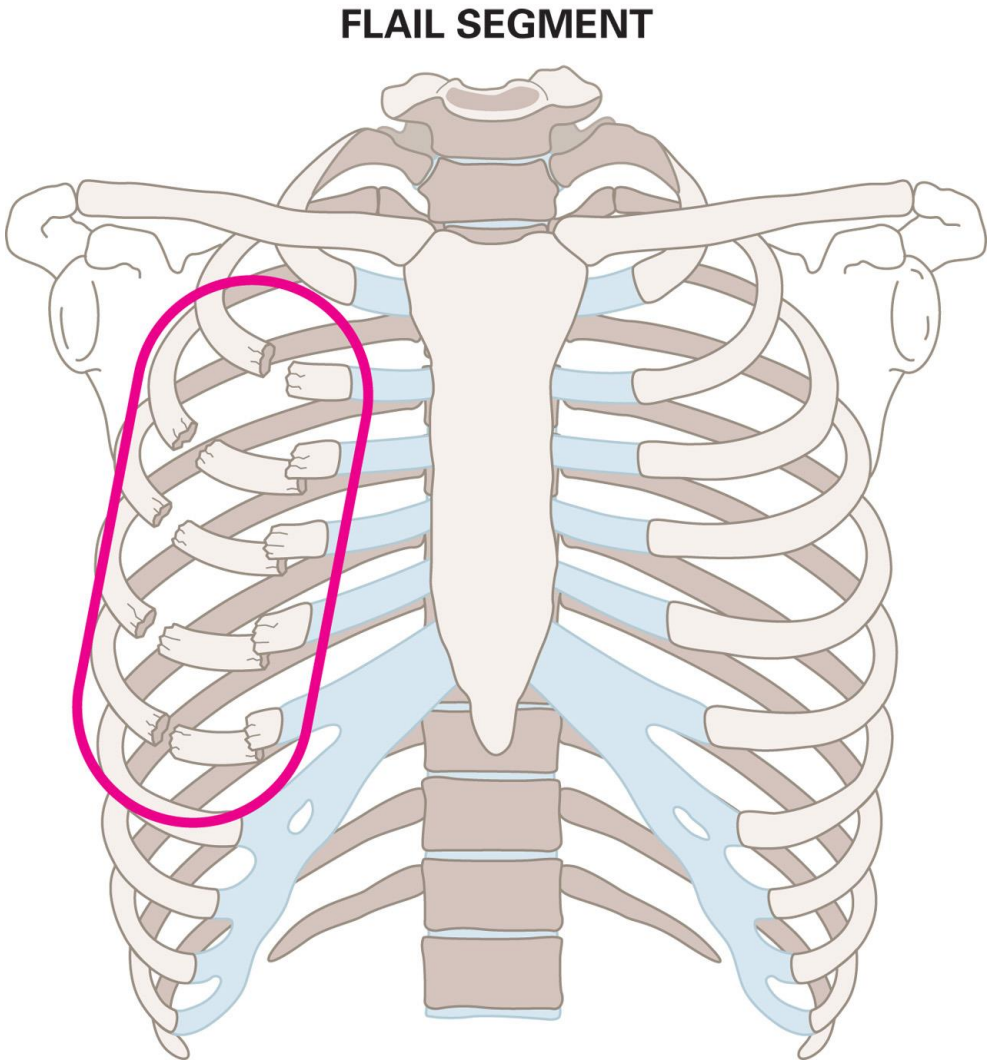
- Closed chest injury
  - Results from blunt trauma
  - Can injure the heart, lung, great vessels, and other structures

continued on next slide

Categories of Chest Injuries

- Closed chest injury
  - Flail chest results when two or more adjacent ribs are each fractured in two or more places, creating a segment of the rib cage that is not attached to the rest of the rib cage.
  - The flail segment interferes with chest expansion and changes in intrathoracic pressure.

Flail segment occurs when blunt trauma causes fracture of two or more ribs, each in two or more places.

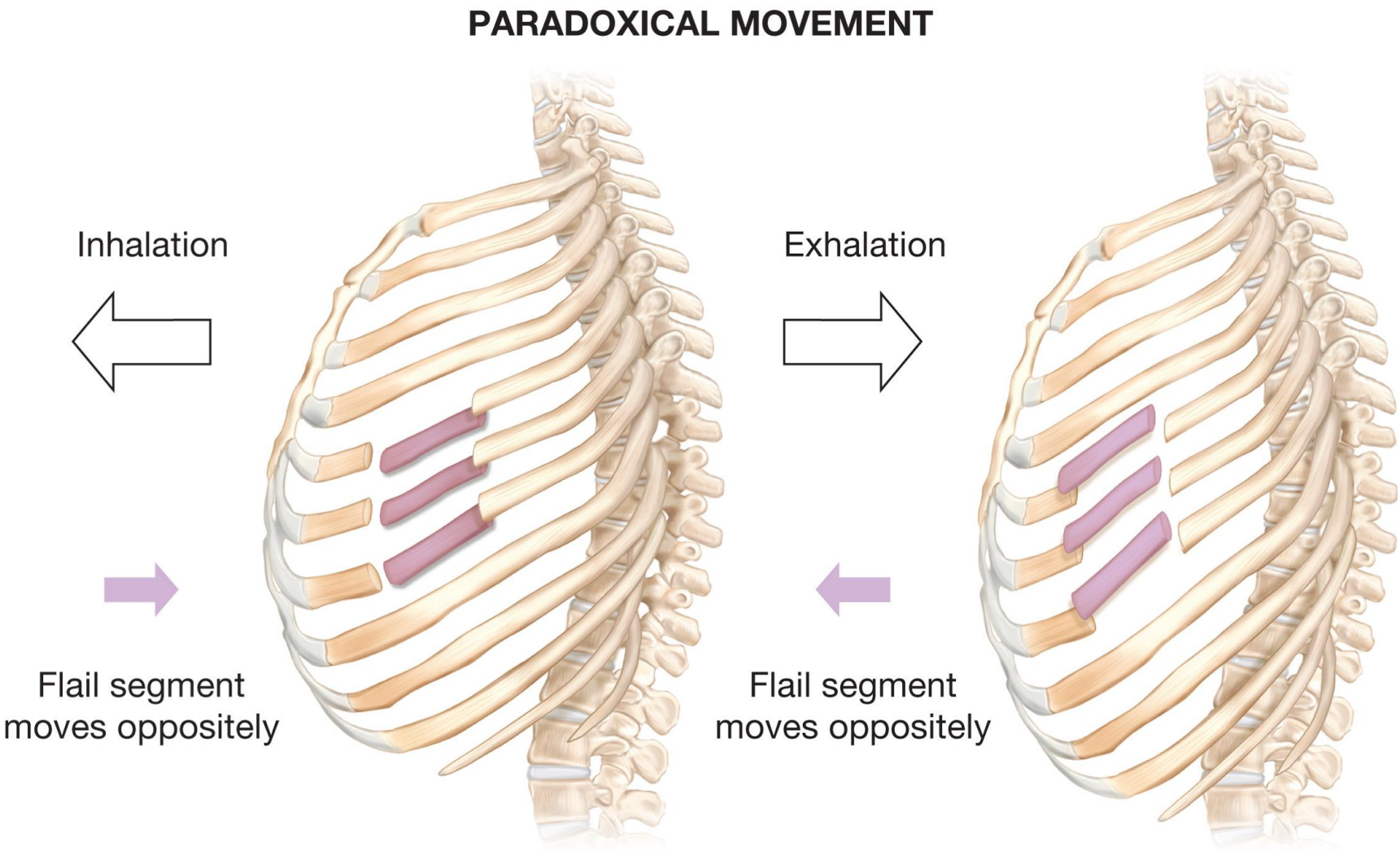


Specific Injuries: Flail Segment

- Two or more ribs fractured in two or more places.
- The flail segment may produce paradoxical motion.

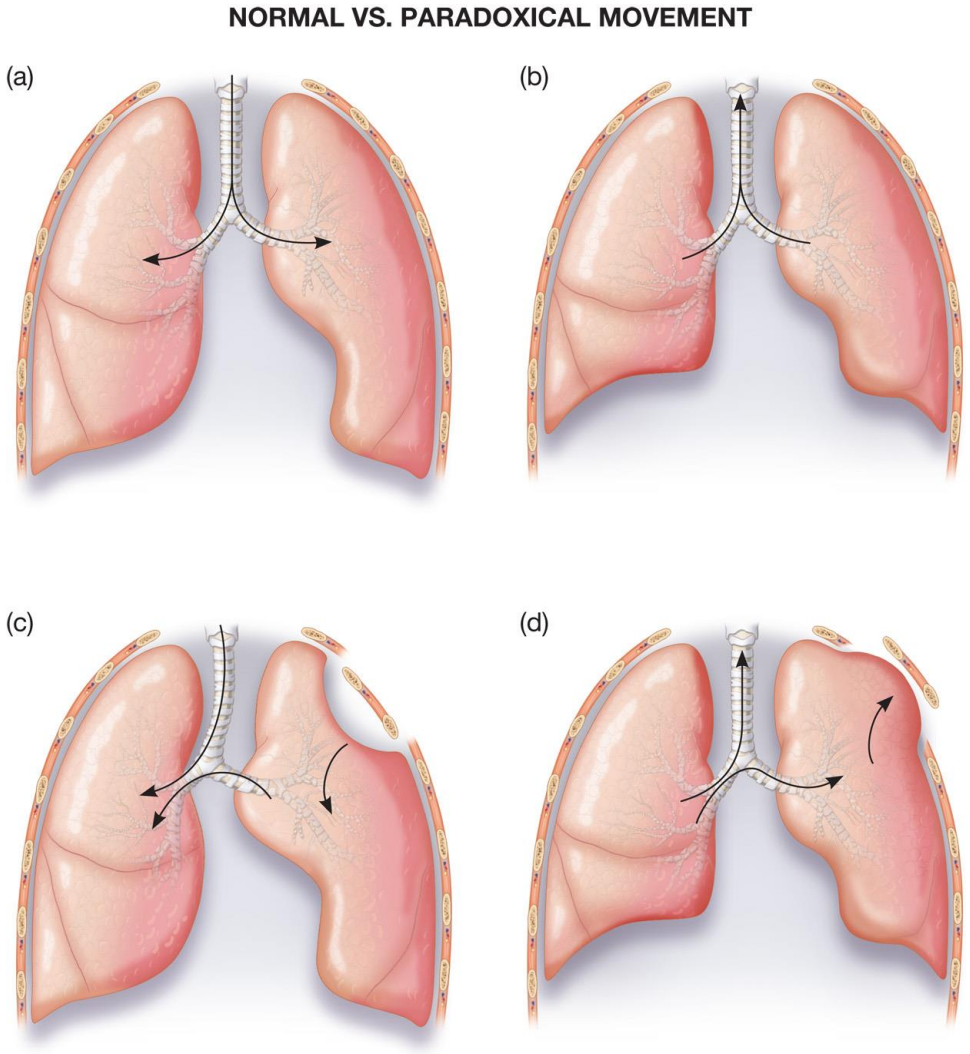
continued on next slide

Paradoxical movement.



continued on next slide

Normal versus paradoxical movement caused by flail segment. (a) Normal inhalation. (b) Normal exhalation. (c) Flail segment drawn inward as the rest of the lung expands with inhalation. (d) Flail segment pushed outward as the rest of the lung contracts with exhalation.



continued on next slide

Specific Injuries: Flail Segment

- The flail segment interferes with ventilation and must be stabilized.
- Also suspect underlying pulmonary contusion, which interferes with gas exchange.

continued on next slide

Specific Injuries: Flail Segment

- To avoid further compromise of chest movement:
  - Do not place the patient on the injured side.
  - Do not stabilize the chest wall with objects that restrict chest wall motion.

continued on next slide

Specific Injuries: Flail Segment

- CPAP or positive pressure ventilation may be indicated to improve ventilation and oxygenation.

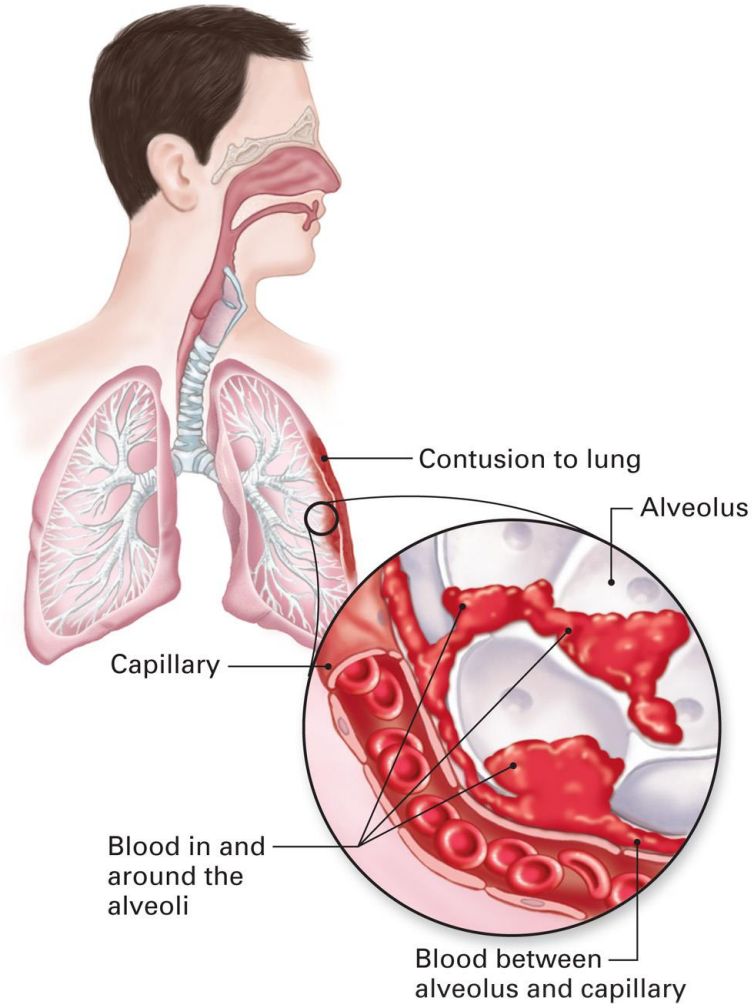
Specific Injuries: Pulmonary Contusion

- Bleeding occurs in the lung tissue in and around the alveoli and in the interstitial space.
- Gas exchange is severely impaired.

continued on next slide

When the lung is bruised (pulmonary contusion), there is bleeding into and around the alveoli and the space between the alveoli and the capillaries, greatly reducing the exchange of oxygen and carbon dioxide in the affected area.

PULMONARY CONTUSION



continued on next slide

Specific Injuries: Pulmonary Contusion

- Treatment is directed toward supporting oxygenation and ventilation.
  - Maintain an SpO_2 greater than or equal to 94%.
  - CPAP or positive pressure ventilation may be required.

Specific Injuries: Pneumothorax

- An accumulation of air in the pleural space resulting in collapse of a portion of the lung.
- Causes
  - A "paper bag" effect may occur upon sudden compression of the chest.
  - Penetrating trauma

continued on next slide

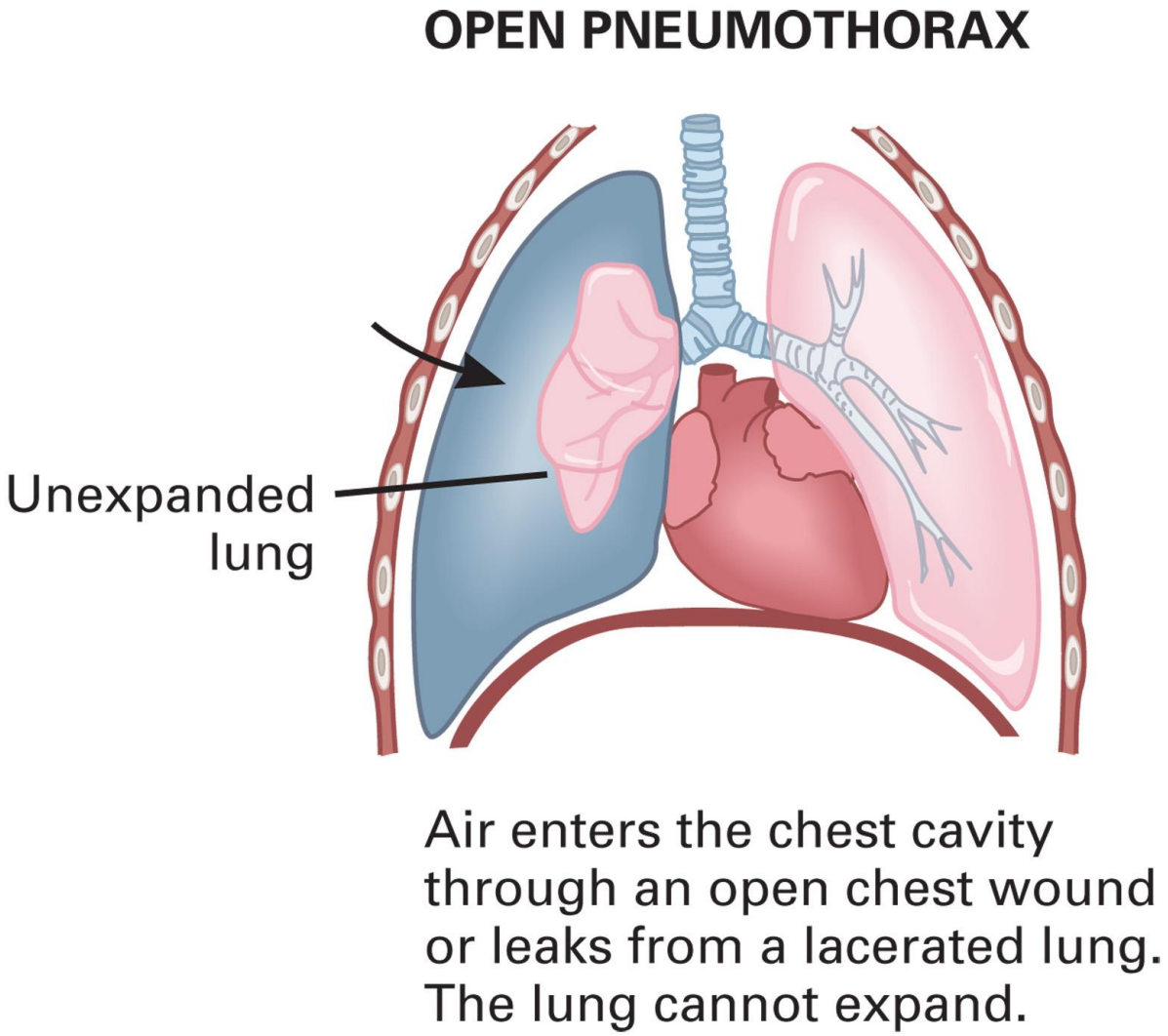
Specific Injuries: Pneumothorax

- Signs and symptoms include:
  - Chest pain, worse with inspiration
  - Dyspnea
  - Tachypnea
  - Decreased or absent breath sounds on affected side

Specific Injuries: Open Pneumothorax

- Caused by an open chest wound that allows air to enter the pleural space with inspiration.
- The open wound must immediately be occluded, first by your gloved hand, and then by an occlusive dressing.

Open pneumothorax is a possible complication of chest injury.



Specific Injuries: Tension Pneumothorax

- Immediately life threatening
- Air accumulates in the pleural space with no route of escape, increasing pressure in the thoracic cavity.

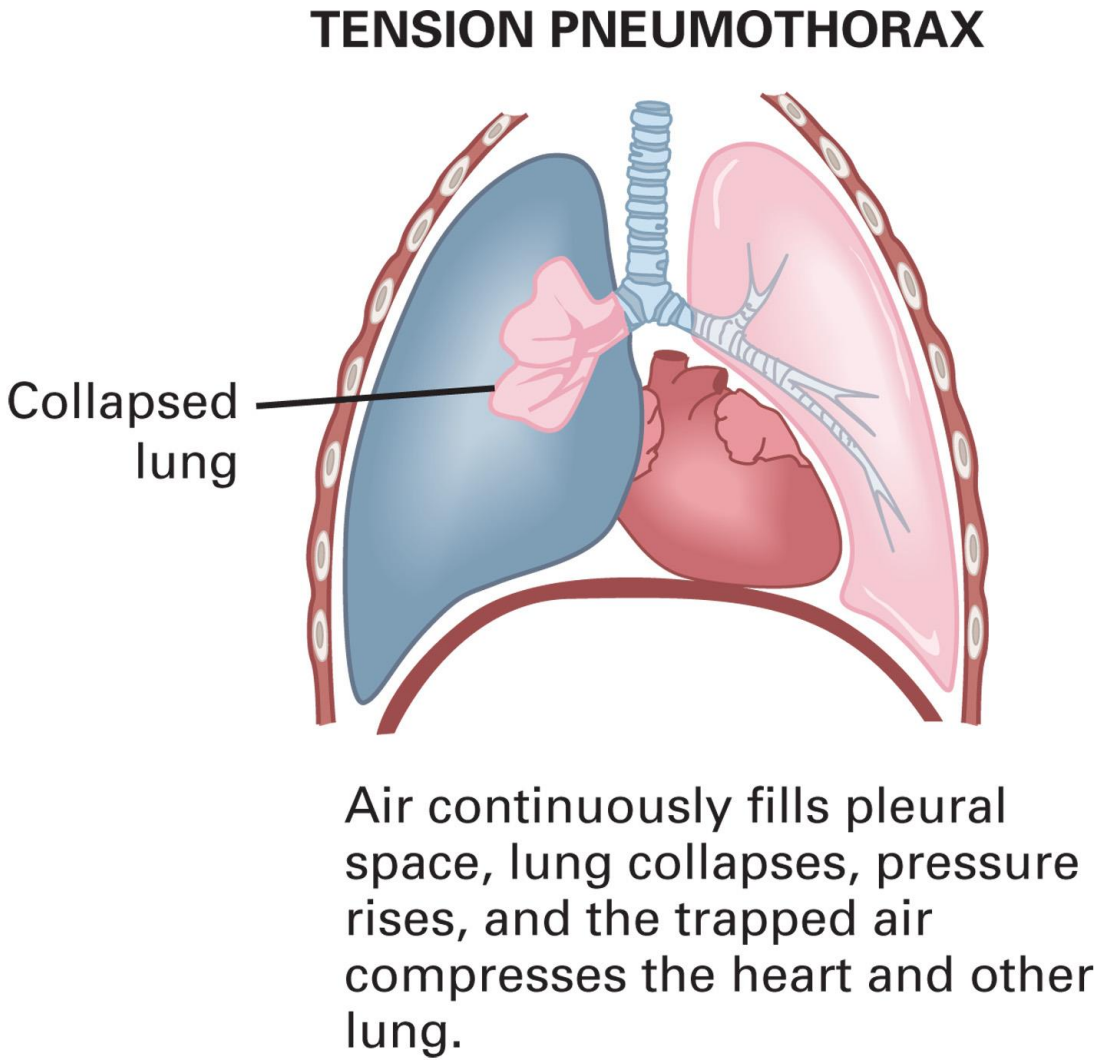
continued on next slide

Specific Injuries: Tension Pneumothorax

- The pressure shifts the structures within the chest and reduces blood return to the heart.
- Death can occur rapidly from from respiratory failure and hypotension.

continued on next slide

Tension pneumothorax is a possible complication of chest injury.



continued on next slide

Specific Injuries: Tension Pneumothorax

- Signs and symptoms
  - Rapid deterioration
  - Severe respiratory distress
  - Signs of shock
  - Absent breath sounds on one side

continued on next slide

Specific Injuries: Tension Pneumothorax

- Signs and symptoms
  - Unequal chest movement
  - Distended neck veins
  - Diminishing breath sounds on the opposite side
  - Deviation of the trachea

continued on next slide

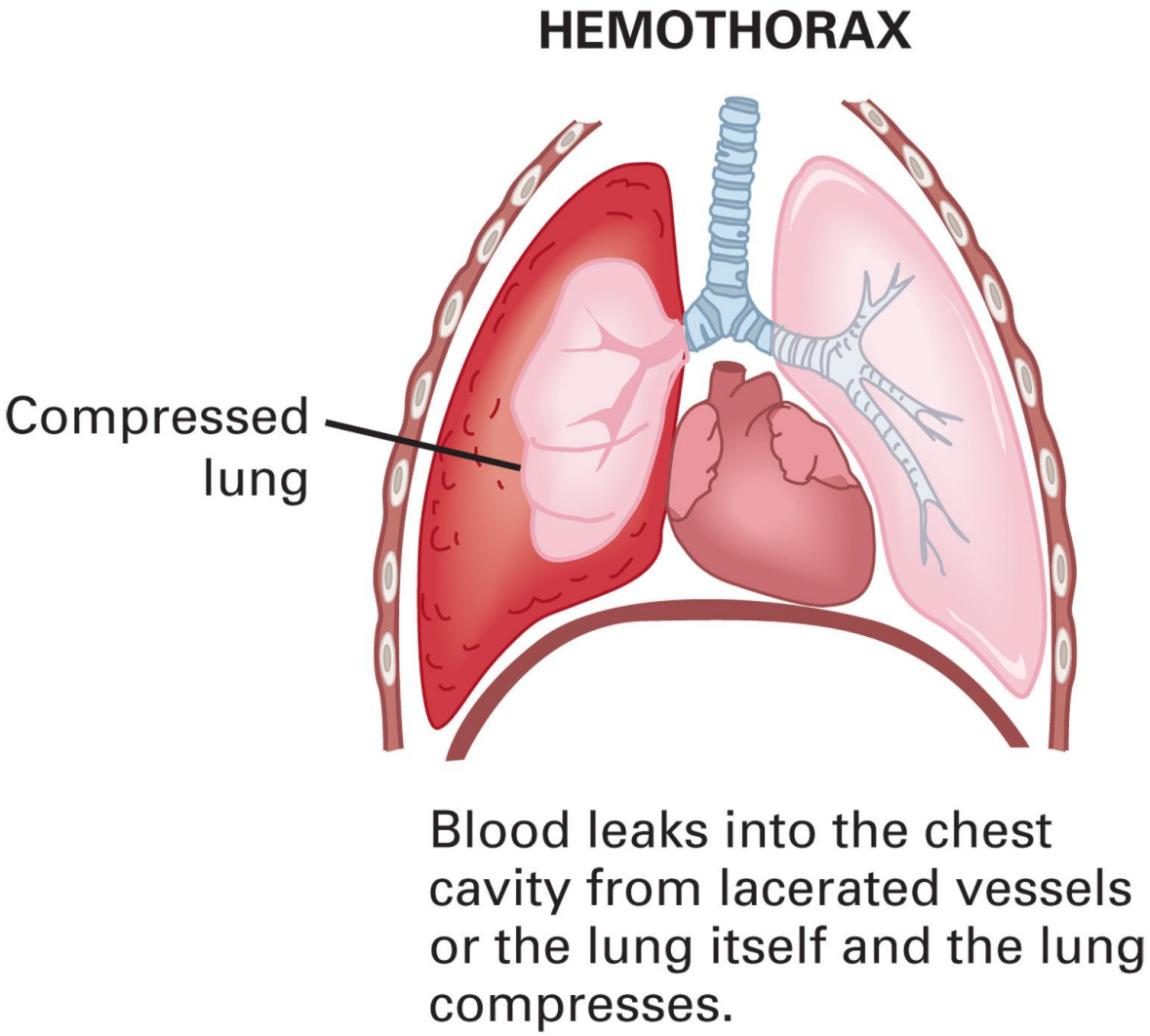
Specific Injuries: Tension Pneumothorax

- If tension pneumothorax results from application of an occlusive dressing, lift the dressing on expiration.
- Immediate transport is critical.

Specific Injuries: Hemothorax

- A collection of blood in the pleural space compresses the lung.
- May occur in open and closed injuries.
- The amount of blood loss can result in shock.

Hemothorax is a possible complication of chest injury.

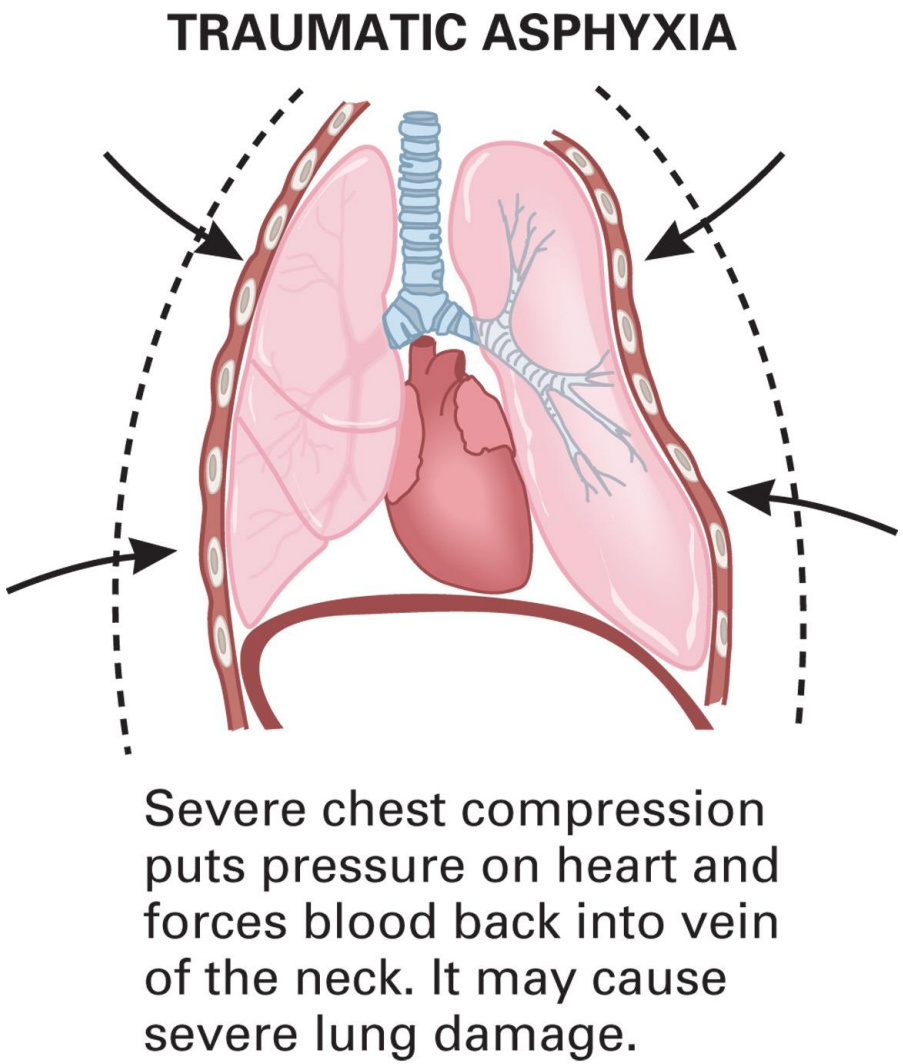


Specific Injuries: Traumatic Asphyxia

- Sudden, severe compression of the thorax causes a rapid increase in intrathoracic pressure.
- There is a backflow of blood out of the right ventricle into the upper body.

continued on next slide

Traumatic asphyxia is a possible complication of chest injury.



Specific Injuries: Traumatic Asphyxia

- Signs and symptoms
  - Bluish or purple discoloration of the face, head, neck, and shoulders
  - Jugular vein distention
  - Bloodshot eyes that are protruding from the socket
  - Cyanotic and swollen tongue and lips
  - Bleeding of the conjunctiva

Specific Injuries: Cardiac Contusion

- Associated with blunt trauma from violent compression of the chest.
- A bruise to the heart wall may form, or the heart may ruptured; disruption in electrical conduction may occur.

continued on next slide

Specific Injuries: Cardiac Contusion

- Signs and symptoms
  - Chest pain or discomfort
  - Signs of blunt trauma to the chest, including bruises, swelling, crepitation, and deformity
  - Tachycardia
  - Irregular pulse

Specific Injuries: Commotio Cordis

- Sudden cardiac arrest from blunt force to the precordial area
- A blow to the chest during a vulnerable period of the cardiac cycle can lead to a lethal dysrhythmia.
- Start CPR and apply the AED.

Specific Injuries: Pericardial Tamponade

- Bleeding into the fibrous sac around the heart from blunt or penetrating trauma
- Compression of the ventricles results in inadequate ventricular filling and reduced cardiac output.

continued on next slide

Specific Injuries: Pericardial Tamponade

- Signs and symptoms
  - Jugular vein distention
  - Signs of shock
  - Tachycardia
  - Decreased blood pressure
  - Narrow pulse pressure
  - Weak pulses
  - Radial pulse diminishes on inhalation

continued on next slide

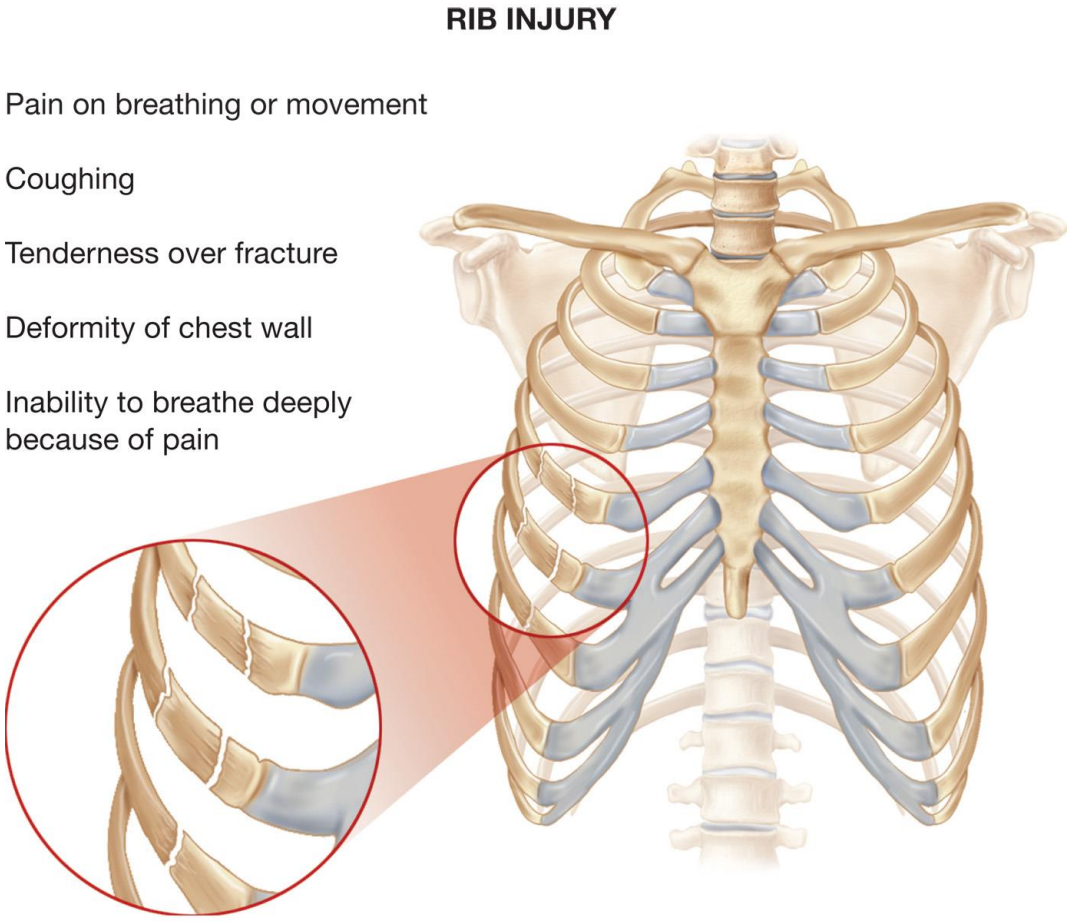
Specific Injuries: Pericardial Tamponade

- Rapidly life threatening
- Early recognition and rapid transport are critical.
- Manage the airway, breathing, and oxygenation.

Specific Injuries: Rib Injury

- The fractured rib may cause damage to the lung or intercostal vessels.
- Rib fracture is less common in children.

Rib injury.



continued on next slide

Click on the injury that is characterized by air trapped in the pleural space under pressure, resulting in compression of the structures of the affected side, mediastinum, and opposite side of the chest.

A. Hemothorax

B. Tension pneumothorax

C. Pericardial tamponade

D. Sucking chest wound

Assessment-Based Approach: Chest Trauma

- Scene size-up
  - If violence was involved, be especially careful with the scene size-up.
  - Do not enter a scene that is not safe to enter.
  - Use Standard Precautions.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Mechanisms of injury
  - Sports accidents
  - Falls
  - Fights
  - Gunshot
  - Vehicle collision
  - Crushing injury
  - Explosion

continued on next slide

Assessment-Based Approach: Chest Trauma

- Primary assessment
  - Use spinal stabilization, if indicated.
  - Form a general impression.
  - Expose and examine the chest.
  - Assess the mental status.
  - Assess the airway.
  - Look for signs of respiratory distress.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Primary assessment
  - If breathing is adequate, apply oxygen, as needed, to maintain an SpO_2 greater than or equal to 94%.
  - Consider CPAP for flail segment or pulmonary contusion.
  - Do not use CPAP if pneumothorax is suspected.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Primary assessment
  - If breathing is inadequate, provide positive pressure ventilation.
  - Tension pneumothorax results in increasing difficulty ventilating the patient.
  - Cyanosis is an indicator of poor oxygenation and ventilation.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Primary assessment
  - Pallor can indicate early hypoxia, poor pumping function of the heart, or blood loss.
  - A weak, rapid pulse can indicate bleeding or compression of the heart.
  - Chest injury patients are a high priority for transport.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Secondary assessment
  - Perform a rapid secondary assessment.
  - Assess the neck for subcutaneous emphysema, jugular vein distention, and tracheal deviation.
  - If indicated, apply a cervical collar after examination of the neck.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Secondary assessment
  - Expose the chest, if not already done.
  - Include examination of the lateral and posterior chest.
  - Immediately seal any open wounds to the chest.
  - For signs of flail segment with inadequate breathing, use positive pressure ventilation.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Secondary assessment
  - Look for chest symmetry, paradoxical movement, swelling, deformities, crepitation, and guarding of injured ribs.
  - Auscultate the lung sounds.
  - Assess baseline vital signs.
  - Obtain a history.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Signs and symptoms
  - Cyanosis
  - Dyspnea
  - Tachypnea or bradypnea
  - Obvious signs of injury
  - Hemoptysis
  - Signs of shock

continued on next slide

Assessment-Based Approach: Chest Trauma

- Signs and symptoms
  - Tracheal deviation
  - Paradoxical movement
  - Open wounds
  - Subcutaneous emphysema
  - Jugular vein distention

continued on next slide

Assessment-Based Approach: Chest Trauma

- Signs and symptoms
  - Absent or decreased breath sounds
  - Pain at the site of injury, especially with inhalation
  - Failure of the chest to expand normally
  - Weak or absent peripheral pulses
  - Drop in systolic BP of ≥10 mmHg on inhalation

continued on next slide

Assessment-Based Approach: Chest Trauma

- General care
  - Maintain an open airway, use in-line spinal stabilization if indicated.
  - Maintain adequate oxygenation.
  - Re-evaluate breathing status; avoid forceful ventilation.

continued on next slide

Provide positive pressure ventilation with supplemental oxygen if breathing is inadequate.

continued on next slide

Assessment-Based Approach: Chest Trauma

- General care
  - Stabilize an impaled object in place.
  - Completely immobilize the patient if spinal injury is suspected.
  - Treat for shock.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Emergency medical care: open chest wound
  - Immediately seal the wound with a gloved hand.
  - Apply an occlusive dressing.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Emergency medical care: open chest wound
  - Continuously assess the respiratory status; be alert to signs of developing tension pneumothorax.
    - Increased respiratory distress
    - Tachypnea
    - Severely decreased or absent breath sounds on the injured side

continued on next slide

Assessment-Based Approach: Chest Trauma

- Emergency medical care: open chest wound
  - If an occlusive dressing has been applied and there are signs of developing tension pneumothorax, lift the dressing on exhalation.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Emergency medical care: flail segment
  - Do not splint the chest wall in any way that interferes with chest movement.
  - Maintain oxygenation.
  - Consider CPAP.
  - Positive pressure ventilation if breathing is inadequate.

continued on next slide

Apply a sling and swathe to stabilize the area of rib injury.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Reassessment
  - Be alert for signs of deterioration such as increased difficulty breathing, decreasing mental status, decreased breath sounds, worsening cyanosis, and shock.

continued on next slide

Assessment-Based Approach: Chest Trauma

- Reassessment
  - Reassess for missed injuries
  - Assess interventions
  - Reassess vital signs

Case Study Conclusion

In the primary assessment, the EMTs find the patient responsive to pain, with rapid, shallow respirations and a weak, rapid pulse that disappears on inspiration.

Roxanne begins positive pressure ventilation as Laura requests ALS backup. With the assistance of other responders on the scene, the EMTs perform a rapid secondary assessment and package the patient for transport.

continued on next slide

Case Study Conclusion

The EMTs meet the ALS unit at the agreed-upon point. Roxanne reports that ventilations are very difficult. After a quick assessment, the paramedic performs a needle chest decompression, which immediately improves the patient's ventilatory status and circulation.

continued on next slide

Case Study Conclusion

The crew transports the patient to a trauma center, where she undergoes surgery for chest and abdominal injuries, as well as for multiple fractures.

Lesson Summary

- Chest injuries can lead to respiratory compromise, poor ventilation, and poor oxygenation.
- An open wound to the chest can allow air into the pleural space.
- A flail chest interferes with ventilation and oxygenation.

continued on next slide

Lesson Summary

- Immediately cover an open chest wound with a gloved hand, followed by an occlusive dressing.
- Patients with flail chest or pulmonary contusion may require CPAP or positive pressure ventilation.
- Do not use CPAP for patients with pneumothorax.