National EMS Education Standard Competencies (1 of 5)
Trauma
Applies fundamental knowledge to provide basic emergency care and transportation based on assessment findings for an acutely injured patient.

National EMS Education Standard Competencies (2 of 5)
Chest Trauma
• Recognition and management of
  – Blunt versus penetrating mechanisms
  – Open chest wound
  – Impaled object

National EMS Education Standard Competencies (3 of 5)
Chest Trauma (cont’d):
• Pathophysiology, assessment, and management of
  – Blunt versus penetrating mechanisms
  – Hemothorax

National EMS Education Standard Competencies (4 of 5)
Chest Trauma (cont’d)
• Pathophysiology, assessment, and management of:
  – Pneumothorax
    • Open
    • Simple
    • Tension

National EMS Education Standard Competencies (5 of 5)
Chest Trauma (cont’d)
• Pathophysiology, assessment, and management of:
  – Cardiac tamponade
  – Rib fractures
  – Flail chest
  – Commotio cordis

Introduction (1 of 2)
• Each year in the United States, chest trauma causes more than:
  – 700,000 emergency department visits
  – 18,000 deaths
• Chest injuries can involve the heart, lungs, and great blood vessels.
  – May be the result of blunt trauma, penetrating trauma, or both

Introduction (2 of 2)
• Immediately treat injuries that interfere with normal breathing function.
  – Internal bleeding can compress the lungs and heart.
  – Air may collect in the chest, preventing lung expansion.

Anatomy and Physiology (1 of 5)
• Remember the difference between ventilation and oxygenation.
  – Ventilation: the body’s ability to move air in and out of the chest and lung tissue
Oxygenation: the process of delivering oxygen to the blood by diffusion from the alveoli following inhalation into the lungs

- The chest (thoracic cage) extends from the lower end of the neck to the diaphragm.

Anatomy and Physiology (2 of 5)

- Thoracic skin, muscle, and bones
  - Similarities to other regions
  - Also unique features to allow for ventilation, such as striated muscle

Anatomy and Physiology (3 of 5)

- The neurovascular bundle lies closely along the lowest margin of each rib.
- The pleura covers each lung and the thoracic cavity.
  - A small amount of pleural fluid between the parietal and visceral pleura allows the lungs to move freely against the inner chest wall during respiration.

Anatomy and Physiology (4 of 5)

- The mediastinum contains the heart, great vessels, esophagus, and trachea.
  - A thoracic aortic dissection can develop in this area of the chest.
- The diaphragm is a muscle that separates the thoracic cavity from the abdominal cavity.

Mechanics of Ventilation (1 of 4)

- The intercostal muscles (between the ribs) contract during inhalation.
  - The diaphragm contracts at the same time.
- The intercostal muscles and the diaphragm relax during exhalation.
- The body should not have to work to breathe when in a resting state.

Mechanics of Ventilation (2 of 4)

Mechanics of Ventilation (3 of 4)

- Patients with a spinal injury below C5 can still breathe from the diaphragm.
- Patients with a spinal injury above C3 may lose the ability to breathe.

Mechanics of Ventilation (4 of 4)

- Minute ventilation (minute volume)
  - Amount of air moved through the lungs in 1 minute
  - Normal tidal volume × respiratory rate
  - Patients with a decreased tidal volume will have an increased respiratory rate.

Injuries of the Chest (1 of 7)

- Two types: open and closed
- In a closed chest injury, the skin is not broken.
  - Generally caused by blunt trauma

Injuries of the Chest (2 of 7)

- Closed chest injury
  - Can cause significant cardiac and pulmonary contusion
  - If the heart is damaged, it may not be able to refill with blood or blood may not be pumped with enough force out of the heart.
  - Lung tissue bruising can result in exponential loss of surface area.
  - Rib fractures may cause further damage.
Injuries of the Chest (3 of 7)
• In an open chest injury, an object penetrates the chest wall itself.
  – Knife, bullet, piece of metal, or broken end of fractured rib
  – Do not attempt to move or remove the object.

Injuries of the Chest (4 of 7)
• Blunt trauma to the chest may cause:
  – Rib, sternum, and chest wall fractures
  – Bruising of the lungs and heart
  – Damage to the aorta
  – Vital organs to be torn from their attachment in the chest cavity

Injuries of the Chest (5 of 7)
• Signs and symptoms:
  – Pain at the site of injury
  – Localized pain aggravated or increased with breathing
  – Bruising to the chest wall
  – Crepitus with palpation of the chest
  – Penetrating injury to the chest
  – Dyspnea

Injuries of the Chest (6 of 7)
• Signs and symptoms: (cont’d)
  – Hemoptysis
  – Failure of one or both sides of the chest to expand normally with inspiration
  – Rapid, weak pulse and low blood pressure
  – Cyanosis around the lips or fingernails

Injuries of the Chest (7 of 7)
• Chest injury patients often have rapid and shallow respirations.
  – Hurts to take a deep breath
  – Patient may not be moving air
  – Auscultate multiple locations to assess for adequate breath sounds.

Scene Size-up (1 of 2)
• Scene safety
  – Ensure the scene is safe for you, your partner, your patient, and bystanders.
  – If the area is a crime scene, do not disturb evidence if possible.
  – Request law enforcement for scenes involving violence.
  – Use gloves and eye protection.

Scene Size-up (2 of 2)
• Mechanism of injury
  – Chest injuries are common in motor vehicle crashes, falls, industrial accidents, and assaults.
  – Determine the number of patients.
  – Consider spinal immobilization.

Primary Assessment (1 of 8)
• Form a general impression.
  – Address life-threatening hemorrhage immediately.
– Note the patient’s level of consciousness.
– Perform a rapid physical examination.
  • Obvious injuries
  • Appearance of blood
  • Difficulty and irregular breathing
  • Cyanosis

28 Primary Assessment (2 of 8)
  • Form a general impression. (cont’d)
    – Perform a rapid scan. (cont’d)
      • Chest rise and fall on only one side
      • Accessory muscle use
      • Extended or engorged jugular veins
      • Assess the ABCs.
      • Assess overall appearance.

29 Primary Assessment (3 of 8)
  • Airway and breathing
    – Ensure that the patient has a clear and patent airway.
    – Consider early cervical spine stabilization if appropriate.
    – Are jugular veins distended?
    – Is breathing present and adequate?
    – Inspect for DCAP-BTLS.

30 Primary Assessment (4 of 8)
  • Airway and breathing (cont’d)
    – Look for equal expansion of the chest wall.
    – Check for paradoxical motion.
    – Apply occlusive dressings to all penetrating injuries.
    – Support ventilations.

31 Primary Assessment (5 of 8)
  • Airway and breathing (cont’d)
    – Reassess the effectiveness of ventilatory support.
    – Be alert for decreasing oxygen saturation.
    – Be alert for impending tension pneumothorax.

32 Primary Assessment (6 of 8)
  • Circulation
    – Pulse rate and quality
    – Skin color and temperature
    – Address life-threatening bleeding immediately, using direct pressure and a bulky dressing.

33 Primary Assessment (7 of 8)
  • Transport decision
    – Priority patients are those with a problem with their ABCs.
    – Pay attention to subtle clues:
      • Appearance of the skin
      • Level of consciousness
      • A sense of impending doom in the patient
Chapter 29 - Chest Injuries

34 Primary Assessment (8 of 8)

35 History Taking

- Investigate the chief complaint.
  - Further investigate the MOI.
  - Identify signs, symptoms, and pertinent negatives.
- SAMPLE history
  - A basic evaluation should be completed
  - Focus on the MOI.

36 Secondary Assessment (1 of 3)

- Physical examinations
  - For an isolated injury, focus on:
    - Isolated injury
    - Patient’s complaint
    - Body region affected
    - Location and extent of injury
    - Anterior and posterior aspects of the chest wall
    - Changes in respirations

37 Secondary Assessment (2 of 3)

- Physical examinations (cont’d)
  - For significant trauma likely affecting multiple systems, start with a rapid physical examination.
  - Use DCAP-BTLS to determine the nature and extent of the injury.

38 Secondary Assessment (3 of 3)

- Vital signs
  - Assess pulse, respirations, blood pressure, skin condition, and pupils.
  - Reevaluate every 5 minutes or less.
  - Pulse and respiratory rates may decrease in later stages of the chest injury.

39 Reassessment (1 of 3)

- Repeat the primary assessment.
- Reassess the chief complaint.
- Reevaluate:
  - Airway
  - Breathing
  - Pulse
  - Perfusion
  - Bleeding

40 Reassessment (2 of 3)

- Interventions
  - Reassess vital signs and observe trends.
  - Provide appropriate spinal stabilization when indicated
  - Maintain an open airway.
  - Control significant, visible bleeding.
  - Place an occlusive dressing over penetrating trauma to the chest wall.

41 Reassessment (3 of 3)
Chapter 29 - Chest Injuries

- Interventions (cont’d)
  - For patients with signs of hypoperfusion:
    - Provide aggressive treatment for shock and rapid transport.
  - Do not delay transport to complete non-life-saving treatments.
  - Communicate all relevant information to the staff at the receiving hospital.

### Pneumothorax (1 of 7)
- Commonly called a collapsed lung
- Accumulation of air in the pleural space
  - Blood passing through the collapsed portion of the lung is not oxygenated.
  - You may hear diminished, absent, or abnormal breath sounds.

### Pneumothorax (2 of 7)
- Open chest wound
  - Often called an open pneumothorax or a sucking chest wound
  - Wounds must be rapidly sealed with an occlusive dressing.
  - A flutter valve is a one-way valve.
  - Carefully monitor the patient for tension pneumothorax.

### Pneumothorax (3 of 7)
- Simple pneumothorax
  - Does not result in major changes in the patient’s cardiac physiology
  - Commonly due to blunt trauma that results in fractured ribs
  - Can often worsen, deteriorate into tension pneumothorax, or develop complications

### Pneumothorax (4 of 7)
- Tension pneumothorax
  - Results from ongoing air accumulation in the pleural space
  - Increased pressure in the chest:
    - Causes complete collapse of the unaffected lung
    - Mediastinum is pushed into the opposite pleural cavity
  - Commonly caused by a blunt injury where a fractured rib lacerates a lung or bronchus

### Hemothorax (1 of 3)
- Blood collects in the pleural space from bleeding around the rib cage or from a lung or great vessel.

### Hemothorax (2 of 3)

### Hemothorax (3 of 3)
- Signs and symptoms
  - Shock without any obvious external bleeding or apparent reason for shock
  - Decreased breath sounds on the affected side
- Prehospital treatment:
  - Rapid transport
- Hemopneumothorax: the presence of air and blood in the pleural space
Chapter 29 - Chest Injuries

52 Cardiac Tamponade (1 of 3)
- Protective membrane (pericardium) around the heart fills with blood or fluid
- The heart cannot pump an adequate amount of blood.

53 Cardiac Tamponade (2 of 3)

54 Cardiac Tamponade (3 of 3)
- Signs and symptoms
  - Beck’s triad
  - Altered mental status
- Prehospital treatment
  - Support ventilations.
  - Rapidly transport.

55 Rib Fractures (1 of 2)
- Common, particularly in older people
- A fracture of one of the upper four ribs is a sign of a very substantial MOI.
- A fractured rib may cause a pneumothorax, hemothorax, or hemopneumothorax.

56 Rib Fractures (2 of 2)
- Signs and symptoms
  - Localized tenderness and pain when breathing
  - Rapid, shallow respirations
  - Patient holding the affected portion of the rib cage
- Prehospital treatment includes supplemental oxygen.

57 Flail Chest (1 of 3)
- Caused by compound rib fractures that detach a segment of the chest wall
- Detached portion moves opposite of normal

58 Flail Chest (2 of 3)
- Prehospital treatment
  - Maintain the airway.
  - Provide respiratory support, if needed.
  - Give supplemental oxygen.
  - Perform ongoing assessments for complications.

59 Flail Chest (3 of 3)
- Treatment may include positive-pressure ventilation with a bag-valve mask.
- Restricting chest wall movement is no longer recommended.
- Flail chest may indicate serious internal damage or spinal injury.

60 Other Chest Injuries (1 of 8)
- Pulmonary contusion
  - Should always be suspected in a patient with a flail chest
  - Pulmonary alveoli become filled with blood, leading to hypoxia
- Prehospital treatment:
  - Supplemental oxygen and positive-pressure ventilation as needed

61 Other Chest Injuries (2 of 8)
- Other fractures
  - Sternal fractures
• Create an increased index of suspicion for organ injury
  – Clavicle fractures
• Possible damage to neurovascular bundle
• Suspect upper rib fractures in medial clavicle fractures.
• Be alert to pneumothorax development.

62 Other Chest Injuries (3 of 8)
• Traumatic asphyxia
  – Characterized by distended neck veins, cyanosis in the face and neck, and hemorrhage in the sclera of the eye

63 Other Chest Injuries (4 of 8)
• Traumatic asphyxia (cont’d)
  – A sudden, severe compression of the chest
  – Suggests an underlying injury to the heart and possibly a pulmonary contusion
  – Prehospital treatment:
    • Ventilatory support and supplemental oxygen
    • Monitor vital signs during immediate transport.

64 Other Chest Injuries (5 of 8)
• Blunt myocardial injury
  – Bruising of the heart muscle
  – The heart may be unable to maintain adequate blood pressure.
  – Signs and symptoms
    • Irregular pulse rate
    • Chest pain or discomfort

65 Other Chest Injuries (6 of 8)
• Blunt myocardial injury (cont’d)
  – Suspect it in all cases of severe blunt injury to the chest.
  – Prehospital treatment
    • Carefully monitor the pulse.
    • Note changes in blood pressure.
    • Provide supplemental oxygen and transport immediately.

66 Other Chest Injuries (7 of 8)
• Commotio cordis
  – Injury caused by a sudden, direct blow to the chest during a critical portion of the heartbeat
  – May result in immediate cardiac arrest
  – Ventricular fibrillation responds positively to defibrillation within the first 2 minutes of the injury.

67 Other Chest Injuries (8 of 8)
• Laceration of the great vessels
  – May result in rapidly fatal hemorrhage
  – Prehospital treatment:
    • Cardiopulmonary resuscitation
    • Ventilatory support and supplemental oxygen, if needed
    • Immediate transport
    • Be alert for shock.
• Monitor for changes in baseline vital signs.

68 Review
1. When the chest impacts the steering wheel during a motor vehicle crash with rapid deceleration, the resulting injury that kills almost one third of patients, usually within seconds, is:
   A. a hemothorax.
   B. aortic shearing.
   C. a pneumothorax.
   D. a ruptured myocardium.

Answer: B
Rationale: When the chest impacts the steering wheel following rapid forward deceleration, aortic injuries (shearing or rupture) are the cause of death in nearly two thirds of patients. The aorta is the largest artery in the body; when it is sheared from its supporting structures or ruptures outright, exsanguination (bleeding to death) occurs—usually within a matter of seconds.

69 Review
Answer: B
Rationale: When the chest impacts the steering wheel following rapid forward deceleration, aortic injuries (shearing or rupture) are the cause of death in nearly two thirds of patients. The aorta is the largest artery in the body; when it is sheared from its supporting structures or ruptures outright, exsanguination (bleeding to death) occurs—usually within a matter of seconds.

70 Review (1 of 2)
1. When the chest impacts the steering wheel during a motor vehicle crash with rapid deceleration, the resulting injury that kills almost one third of patients, usually within seconds, is:
   A. a hemothorax.
      Rationale: This is a serious injury, but is not fatal in seconds.
   B. aortic shearing.
      Rationale: Correct answer
   C. a pneumothorax.
      Rationale: This is a serious injury, but is not fatal in seconds.
   D. a ruptured myocardium.
      Rationale: This is a serious injury, but is not common.

71 Review (2 of 2)
1. When the chest impacts the steering wheel during a motor vehicle crash with rapid deceleration, the resulting injury that kills almost one third of patients, usually within seconds, is:
   C. a pneumothorax.
      Rationale: This is a serious injury, but is not fatal in seconds.
   D. a ruptured myocardium.
      Rationale: This is a serious injury, but is not common.

72 Review
2. Signs and symptoms of a chest injury include all of the following, EXCEPT:
   A. hemoptysis.
   B. hematemesis.
   C. asymmetrical chest movement.
   D. increased pain with breathing.

Answer: B
Rationale: Signs and symptoms of a chest injury include bruising to the chest, chest wall instability, increased pain with breathing, asymmetrical (unequal) chest movement if a pneumothorax is present, and hemoptysis (coughing up blood) if intrapulmonary bleeding is occurring. Hematemesis (vomiting blood) indicates bleeding in the gastrointestinal tract—usually the esophagus or stomach—not the chest cavity.

74 Review (1 of 2)
2. Signs and symptoms of a chest injury include all of the following, EXCEPT:
   A. hemoptysis.
      Rationale: Hemoptysis is coughing up blood or blood-tinged sputum.
   B. hematemesis.
      Rationale: Correct answer

75  Review (2 of 2)
2. Signs and symptoms of a chest injury include all of the following, EXCEPT:
   C. asymmetrical chest movement.
      Rationale: This may indicate a flail chest or pneumothorax.
   D. increased pain with breathing.
      Rationale: A chest injury will cause the presence of pain during inspiratory or
      expiratory chest wall movement.

76  Review
3. During your assessment of a patient who was stabbed, you see an open wound to the left
   anterior chest. Your MOST immediate action should be to:
   A. position the patient on the affected side.
   B. transport immediately.
   C. assess the patient for a tension pneumothorax.
   D. cover the wound with an occlusive dressing.

77  Review
   Answer: D
   Rationale: If you encounter an open chest wound, you must cover it with an occlusive
   dressing. This will prevent air from moving in and out of the wound. After the dressing is
   applied, you must monitor the patient for signs of a developing tension pneumothorax.

78  Review (1 of 2)
3. During your assessment of a patient who was stabbed, you see an open wound to the left
   anterior chest. Your MOST immediate action should be to:
   A. position the patient on the affected side.
      Rationale: This is not the most immediate action.
   B. transport immediately.
      Rationale: Transport should take place once life threats have been managed.

79  Review (2 of 2)
3. During your assessment of a patient who was stabbed, you see an open wound to the left
   anterior chest. Your MOST immediate action should be to:
   C. assess the patient for a tension pneumothorax.
      Rationale: You must monitor for signs of a developing pneumothorax.
   D. cover the wound with an occlusive dressing.
      Rationale: Correct answer

80  Review
4. When caring for a patient with signs of a pneumothorax, your MOST immediate concern
   should be:
   A. hypovolemia.
   B. intrathoracic bleeding.
   C. ventilatory inadequacy.
   D. associated myocardial injury.
Answer: C
Rationale: A pneumothorax occurs when air enters the pleural space and progressively collapses the lung. This impairs the ability of the lung to move air in and out (ventilate). As the lung collapses further, ventilatory efficiency decreases, resulting in hypoxemia; this should be your most immediate concern. Some patients with a pneumothorax may also experience intrathoracic bleeding and associated myocardial injury, depending on the mechanism of injury and the force of the trauma.

Review (1 of 2)
4. When caring for a patient with signs of a pneumothorax, your most immediate concern should be:
   A. hypovolemia.
      Rationale: This may be indicated by the signs and symptoms of shock.
   B. intrathoracic bleeding.
      Rationale: The patient may experience this, but inadequate ventilation is your immediate concern.

Review (2 of 2)
4. When caring for a patient with signs of a pneumothorax, your most immediate concern should be:
   C. ventilatory inadequacy.
      Rationale: Correct answer
   D. associated myocardial injury.
      Rationale: The patient may experience this, but inadequate ventilation is your immediate concern.

Review
5. What purpose does a one-way “flutter valve” serve when used on a patient with an open pneumothorax?
   A. It prevents air escape from within the chest cavity.
   B. It allows the release of air trapped in the pleural space.
   C. It only prevents air from entering an open chest wound.
   D. It allows air to freely move in and out of the chest cavity.

Review
Answer: B
Rationale: A one-way flutter valve is used to treat patients with an open pneumothorax (sucking chest wound), and serves two purposes: it allows air trapped in the pleural space to escape during exhalation, and it prevents air from entering the pleural space during inhalation. These combined effects alleviate pressure on the affected lung, which allows it to reexpand.

Review (1 of 2)
5. What purpose does a one-way “flutter valve” serve when used on a patient with an open pneumothorax?
   A. It prevents air escape from within the chest cavity
      Rationale: It allows air to exit the chest.
   B. It allows the release of air trapped in the pleural space
      Rationale: Correct answer

Review (2 of 2)
5. What purpose does a one-way “flutter valve” serve when used on a patient with an open pneumothorax?
C. It only prevents air from entering an open chest wound  
   Rationale: It prevents air from entering and allows air to exit the chest.
D. It allows air to freely move in and out of the chest cavity  
   Rationale: It allows air to move out freely and prevents air from entering.

88 Review

6. Signs of a cardiac tamponade include all of the following, EXCEPT:
   A. muffled heart tones.
   B. a weak, rapid pulse.
   C. collapsed jugular veins.
   D. narrowing pulse pressure.

89 Review

Answer: C
   Rationale: Cardiac tamponade, which is almost always caused by penetrating chest trauma, 
   occurs when blood accumulates in the pericardial sac. This impairs the heart’s ability to 
   contract and relax; as a result, the systolic blood pressure decreases and the diastolic blood 
   pressure increases (narrowing pulse pressure). Because the heart cannot adequately eject 
   blood, blood backs up beyond the right atrium, resulting in jugular venous distention. In 
   some cases, heart tones may be muffled or distant. Other signs include a weak, rapid pulse 
   and hypotension.

90 Review (1 of 2)

6. Signs of a cardiac tamponade include all of the following, EXCEPT:
   A. muffled heart tones. 
      Rationale: This is an assessment finding with cardiac tamponade.
   B. a weak, rapid pulse. 
      Rationale: This is an assessment finding with cardiac tamponade.

91 Review (2 of 2)

6. Signs of a cardiac tamponade include all of the following, EXCEPT:
   C. collapsed jugular veins. 
      Rationale: Correct answer
   D. narrowing pulse pressure. 
      Rationale: This is an assessment finding with cardiac tamponade.

92 Review

7. A patient experienced a severe compression to the chest when trapped between a vehicle 
   and a brick wall. You suspect traumatic asphyxia due to the hemorrhage into the sclera of 
   his eyes and which other sign?
   A. Flat neck veins
   B. Cyanosis in the face and neck
   C. Asymmetrical chest movement
   D. Irregular heart rate

93 Review

Answer: B
   Rationale: The sudden increase in intrathoracic pressure results in a characteristic 
   appearance, including distended neck veins, and hemorrhage into the sclera of the eyes, 
   signaling the bursting of small blood vessels.

94 Review (1 of 2)

7. A patient experienced a severe compression to the chest when trapped between a vehicle
and a brick wall. You suspect traumatic asphyxia due to the hemorrhage into the sclera of his eyes and which other sign?
A. Flat neck veins
   Rationale: The neck veins would be distended. Flat neck veins may indicate a hemothorax.
B. Cyanosis in the face and neck
   Rationale: Correct answer

Review (2 of 2)
7. A patient experienced a severe compression to the chest when trapped between a vehicle and a brick wall. You suspect traumatic asphyxia due to the hemorrhage into the sclera of his eyes and which other sign?
C. Asymmetrical chest movement
   Rationale: This is seen with a flail segment.
D. Irregular heart rate
   Rationale: This may be seen with a myocardial contusion.

Review
8. A 14-year-old baseball player was hit in the chest with a line drive. He is in cardiac arrest. Which of the following is the most likely explanation?
   A. Myocardial contusion
   B. Traumatic asphyxia
   C. Commotio cordis
   D. Hemothorax
Answer: C
Rationale: Commotio cordis is a blunt chest injury caused by a sudden, direct blow to the chest that occurs only during the critical portion of a person’s heartbeat. The result may be immediate cardiac arrest. The blunt force causes ventricular fibrillation that responds positively to defibrillation within the first 2 minutes after the injury.

Review (1 of 2)
8. A 14-year-old baseball player was hit in the chest with a line drive. He is in cardiac arrest. Which of the following is the most likely explanation?
   A. Myocardial contusion
      Rationale: This may cause an irregular heartbeat, but rarely causes cardiac arrest.
   B. Traumatic asphyxia
      Rationale: This is the result of a crushing injury, not a direct hit.

Review (2 of 2)
8. A 14-year-old baseball player was hit in the chest with a line drive. He is in cardiac arrest. Which of the following is the most likely explanation?
   C. Commotio cordis
      Rationale: Correct answer
   D. Hemothorax
      Rationale: This comes from bleeding around the rib cage or from a lung or great vessel, rather than from a direct hit.

Review
9. Paradoxical chest movement is typically seen in patients with:
   A. a flail chest.
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B. a pneumothorax.
C. isolated rib fractures.
D. a ruptured diaphragm.

Review

Answer: A
Rationale: Paradoxical chest movement occurs when an area of the chest wall bulges out during exhalation and collapses during inhalation. This type of abnormal chest movement is seen in patients with a flail chest—a condition in which several adjacent ribs are fractured in more than one place, resulting in a free-floating segment of fractured ribs.

Review (1 of 2)

9. Paradoxical chest movement is typically seen in patients with:
   A. a flail chest.
      Rationale: Correct answer
   B. a pneumothorax.
      Rationale: This will produce unilateral chest wall movement.

Review (2 of 2)

9. Paradoxical chest movement is typically seen in patients with:
   C. isolated rib fractures.
      Rationale: This will produce pain, but not irregular chest wall movement.
   D. a ruptured diaphragm.
      Rationale: This typically occurs on the left side. You may hear bowel sounds over the lower chest area.

Review

10. A 40-year-old man, who was the unrestrained driver of a car that hit a tree at a high rate of speed, struck the steering wheel with his chest. He has a large bruise over the sternum and an irregular pulse rate of 120 beats/min. You should be MOST concerned that he:
   A. has injured his myocardium.
   B. has a collapsed lung and severe hypoxia.
   C. has extensive bleeding into the pericardial sac.
   D. is at extremely high risk for ventricular fibrillation.

Review

Answer: A
Rationale: A myocardial contusion, or bruising of the heart muscle, is usually the result of blunt trauma—specifically to the center of the chest. In some cases, the injury may be so severe that it renders the heart unable to maintain adequate cardiac output; as a result, blood pressure falls. The pulse rate is often irregular; however, lethal cardiac dysrhythmias such as ventricular tachycardia and ventricular fibrillation are uncommon.

Review (1 of 2)

10. A 40-year-old man, who was the unrestrained driver of a car that hit a tree at a high rate of speed, struck the steering wheel with his chest. He has a large bruise over the sternum and an irregular pulse rate of 120 beats/min. You should be MOST concerned that he:
   A. has injured his myocardium.
      Rationale: Correct answer
   B. has a collapsed lung and severe hypoxia.
      Rationale: This will produce an absence or decrease of breath sounds and unilateral chest wall expansion.
10. A 40-year-old man, who was the unrestrained driver of a car that hit a tree at a high rate of speed, struck the steering wheel with his chest. He has a large bruise over the sternum and an irregular pulse rate of 120 beats/min. You should be MOST concerned that he:

C. has extensive bleeding into the pericardial sac.
   Rationale: This will produce muffled heart sounds and decreased cardiac output.
D. is at extremely high risk for ventricular fibrillation.
   Rationale: Lethal dysrhythmias are uncommon.