

Chapter 2: The Lungs and Chest Wall

Test Bank

MULTIPLE CHOICE

1. Which of the following are explanations for the left hemidiaphragmatic surface being slightly lower than the right?
 - I. The heart rests on the left half of the diaphragm, pushing it downward.
 - II. The presence of air in the stomach acts as a vacuum, pulling the diaphragm downward.
 - III. The liver, directly below the right half of the diaphragm, props up this area.
 - a. I, II
 - b. III
 - c. I, II, III
 - d. I, III

ANS: D

The left diaphragmatic surface is slightly lower than the right because (1) the heart rests on the left half of the diaphragm, pushing it downward, and (2) the liver, directly below the right half of the diaphragm, props up this area (see Figure 2-1).

DIF: Application REF: 25

2. What is the term that describes the presence of fluid in the pleural space as a result of inflammation?
 - a. Pleural effusion
 - b. Thoracentesis
 - c. Pleural rub
 - d. Pneumothorax

ANS: A

If the pleural membranes become inflamed by disease, fluid may form in the pleural space, creating what is called a pleural effusion.

DIF: Recall REF: 26

3. Which of the following best describes the impact of anatomic shunt?
 - a. Systemic arterial blood can never have the same partial pressure of oxygen as the alveolar gas.
 - b. Systemic venous blood will have the same partial pressure of oxygen as the alveolar gas.
 - c. Systemic arterial blood will have the same partial pressure of oxygen as the alveolar gas.
 - d. Systemic arterial blood will have a higher partial pressure of oxygen than the alveolar gas.

ANS: A

The normal process of anatomical shunting means that systemic arterial blood can never have the same partial pressure of oxygen as the alveolar gas; this gives rise to the normal alveolar-to-arterial oxygen pressure difference, or $P(A - a)O_2$.

DIF: Application REF: 28

4. Which of the following is the source of innervation for the lung?
- Somatic nervous system
 - Cranial nerves
 - Autonomic nervous system
 - Visceral nerves

ANS: C

The somatic system provides only motor innervation to the ventilatory muscles; the autonomic system supplies both motor (efferent) and sensory (afferent) nerves to the lung.

DIF: Recall REF: 28

5. Which of the following statements are true of the phrenic nerves?
- They originate from spinal nerves C3 to C5.
 - They enter the chest in front of the scalenus muscle.
 - They are sandwiched between subclavian arteries and veins.
 - Nerve injury is associated with paralysis of the diaphragm.
- I, II
 - III, IV
 - I, II, III
 - I, II, III, IV

ANS: D

The paired phrenic nerves supply motor innervation to the diaphragm. They originate from the right and left cervical nerve plexuses as branches of cervical spinal nerves C3 to C5 (Figure 2-5). Phrenic nerves cross in front of the scalenus anterior muscles of the neck and enter the chest, sandwiched between subclavian arteries and veins. Thoracic surgery, neck trauma, and cancerous tumors sometimes injure or compress the phrenic nerve, causing paralysis of the diaphragm. However, breathing may still be possible if intercostal nerves and muscles are intact.

DIF: Recall REF: 28-29

6. Which of the following are the main neurotransmitters of the autonomic system?
- Norepinephrine
 - Acetylcholine
 - Dopamine
 - Adrenaline
- I, II
 - III, IV
 - I, II, III
 - I, II, III, IV

ANS: A

The two main neurotransmitters of the autonomic system are acetylcholine and norepinephrine.

DIF: Recall REF: 29

7. A 25-year-old is brought to the emergency department after a car versus pedestrian accident. She suffered fractures of vertebrae C2 and C3. Which of the following respiratory muscles will be compromised by this cervical injury?
- I. Diaphragm
 - II. Intercostal muscles
 - III. Abdominals
 - IV. Accessory muscles
- a. I, II
 - b. III, IV
 - c. I, II, III
 - d. I, II, III, IV

ANS: C

Spinal cord injury at the levels of C2 and C3 impairs respiratory muscle function because respiratory muscles receive nerve input from the spinal cord at or below these cervical vertebrae. This includes the major muscles involved in inspiration and expiration: the diaphragm, external and internal intercostals, and abdominals.

DIF: Recall

REF: 30

8. Approximately three-fourths of all parasympathetic fibers are in which cranial nerve?
- a. IX
 - b. X
 - c. XI
 - d. XII

ANS: B

Approximately three-fourths of all parasympathetic fibers are in the vagus nerve, which sends out many branches to the visceral organs.

DIF: Recall

REF: 30

9. What substance is responsible for the only natural mechanism for sympathetic bronchodilation in humans?
- a. Norepinephrine
 - b. Epinephrine
 - c. Acetylcholine
 - d. Dopamine

ANS: A

Circulating epinephrine is the only natural mechanism for sympathetic bronchodilation in humans.

DIF: Recall

REF: 30

10. Which of the following structures in the lung are innervated by the parasympathetic postganglionic fibers?
- I. Smooth airway muscle
 - II. Mucous glands
 - III. Pulmonary blood vessels
 - IV. Lung parenchyma

- a. I, II
- b. III, IV
- c. I, II, III
- d. I, III, IV

ANS: C

Parasympathetic postganglionic fibers innervate the lung's smooth airway muscle, mucous glands, and pulmonary blood vessels.

DIF: Recall

REF: 30

11. What is the effect of parasympathetic stimulation on airway secretions?
- a. Increased production and viscosity
 - b. Thin watery secretions
 - c. Decreased production
 - d. No change

ANS: A

Parasympathetic stimulation increases the production of mucous glycoproteins, raising the viscosity of airway secretions. In contrast, sympathetic stimulation produces thin, watery secretions.

DIF: Recall

REF: 31

12. What is the best explanation for the anticholinergics being less useful than adrenergic bronchodilators in treating small airway constriction?
- a. Cholinergic innervation is greatest in the large airways.
 - b. Adrenergic innervation is greatest in the large airways.
 - c. Cholinergic innervation is greatest in the small airways.
 - d. Cholinergics require a higher dose than the adrenergics to elicit the same effect.

ANS: A

Cholinergic innervation is greatest in the large airways, diminishing peripherally as airways become smaller. This may explain why anticholinergic bronchodilator drugs are less useful than adrenergic bronchodilator drugs when bronchoconstriction involves mostly small airways; in contrast, sympathetic receptors are more uniformly distributed, and adrenergic bronchodilators are equally effective in large and small airways.

DIF: Application

REF: 31

13. Which of the following are typical locations for the pulmonary β_2 receptors?
- I. Airway smooth muscle
 - II. Alveolar interstitium
 - III. Vascular smooth muscle
 - IV. Submucosal glands
- a. II, III, IV
 - b. I, II
 - c. I, III, IV
 - d. I, II, III, IV

ANS: B

Pulmonary β_2 receptors are concentrated in airway smooth muscle, airway epithelium, vascular smooth muscle, and submucosal glands, whereas the smaller number of β_1 receptors are restricted to alveolar walls and submucosal glands.

DIF: Recall

REF: 34

14. A well-known asthmatic individual has been admitted to the ED complaining of difficulty breathing. The physician is asking for a bronchodilator. Which of the following agents should be considered?
- I. β_2 agonists
 - II. Anticholinergics
 - III. Parasympathomimetics
 - IV. Sympathomimetics
- a. I, II
 - b. II, IV
 - c. I, II, IV
 - d. II, III, IV

ANS: C

Sympathomimetic drugs, specifically β_2 agonists, are most commonly inhaled directly into the lungs to reverse the bronchoconstriction associated with asthma. A common example of such a drug is albuterol (Proventil).

Parasympathetic or cholinergic stimulation is the major cause of bronchoconstriction; therefore, drugs that block cholinergic receptors (cholinergic antagonists or, more specifically, muscarinic antagonists) cause bronchodilation.

DIF: Recall

REF: 35

15. A patient is being evaluated for postextubation laryngeal edema. A dose of racemic epinephrine has been ordered. What type of agent is this medication?
- a. β_2 agonist
 - b. Alpha-adrenergic
 - c. Anticholinergic
 - d. Parasympathomimetic

ANS: B

An alpha-adrenergic drug, such as racemic epinephrine, causes the small arterioles that bring blood to the laryngeal epithelium to constrict; this limits the blood flow and pressure that can reach the capillaries. Consequently, capillary blood volume decreases, epithelial tissues shrink, and edema subsides. For this reason, aerosolized racemic epinephrine is the drug of choice for quick relief of postextubation laryngeal edema.

DIF: Recall

REF: 36

16. Which of the following forms of nitric oxide (NO_2) is useful in identifying early stages of asthma exacerbation?
- a. b NO_2
 - b. n NO_2
 - c. i NO_2
 - d. e NO_2

ANS: D

Because asthma is an inflammatory disease of the airways, increased $i\text{NO}_2$ s would be expected to elevate the concentration of NO_2 in the exhaled gas of asthmatics. Indeed, asthmatics do have higher concentrations of exhaled NO_2 than normal individuals, especially during exacerbations of the disease. Thus, monitoring exhaled NO_2 has been proposed as a way to identify early stages of asthma exacerbations.

DIF: Recall

REF: 35-36

17. Which of the following reflexes causes smooth muscle relaxation and bronchodilation after a deep inspiration?
- Herring-Breuer reflex
 - Gag reflex
 - Corneal reflex
 - Brudzinski reflex

ANS: A

These stretch receptors are stimulated by a deep inspiration, which is part of the Herring-Breuer reflex. A deep inspiration inhibits vagal discharge and thus causes smooth muscle relaxation and bronchodilation.

DIF: Recall

REF: 36

18. The presence of irritants such as noxious gases elicits reflex bronchoconstriction to limit penetration of injurious substances into the lungs. This reflex is produced by stimulation of which of the following structures?
- Bronchial smooth muscle
 - Gag receptors
 - Rapidly adapting receptors
 - Cough receptors

ANS: C

Stimulation of RARs causes reflex bronchoconstriction, expiratory narrowing of the larynx, cough, deep inspiration, and mucous secretion. These receptors are protective mechanisms in healthy humans because they elicit bronchospasm, limiting penetration of injurious substances into the lung.

DIF: Recall

REF: 36

19. Which of the following is the right sequence of events for generating a cough?
- The glottis suddenly opens, explosively releasing compressed gas.
 - The diaphragm contracts, causing a deep inspiration.
 - The muscles in the larynx close the glottis, sealing the upper airway.
 - A slight inspiratory pause occurs.
 - The abdominal expiratory muscles contract forcefully.
- I, II, III, IV, V
 - II, IV, III, I, V
 - II, IV, III, V, I
 - II, IV, V, III, I

ANS: C

The cough is produced from the following sequence: 1. The diaphragm contracts, causing a deep inspiration. 2. A slight inspiratory pause occurs. 3. The muscles in the larynx close the glottis, sealing the upper airway. 4. The abdominal expiratory muscles contract forcefully, generating a high intrapulmonary pressure against the closed glottis (as high as 100 to 200 cm H₂O in healthy adults). 5. The glottis suddenly opens, explosively releasing compressed gas.

DIF: Recall REF: 36

20. How many ribs articulate with thoracic vertebrae?
- 12
 - 11
 - 7
 - 2

ANS: A

The 12 thoracic vertebrae articulate with all 12 ribs, but not all ribs connect directly with the sternum anteriorly. The first 7 ribs connect directly with the sternum via cartilages and are called vertebrosteral ribs. Ribs 8 to 10 are connected to the lower sternum by a common cartilage and are called vertebrochondral ribs. Ribs 11 and 12 do not connect with the sternum and are called floating ribs.

DIF: Recall REF: 37

21. The junction of the manubrium, the body of the sternum, and the second rib is known as an anatomical landmark for the level of the carina. What is the name of this part of the sternum?
- Manubrium
 - Xiphoid process
 - Angle of Louis
 - Body

ANS: C

The angle of Louis marks the level of the carina in the lung and is adjacent to the second rib; thus it is a reference point for counting ribs.

DIF: Recall REF: 38

22. During cardiopulmonary resuscitation involving cardiac compressions, care must be taken not to compress which part of the sternum because its fracture may damage underlying organs?
- Manubrium
 - Xiphoid process
 - Angle of Louis
 - Body

ANS: B

During cardiopulmonary resuscitation involving cardiac compressions, care must be taken not to compress the xiphoid process because its fracture may damage underlying organs.

DIF: Recall REF: 38

23. Which of the following is the primary muscle of respiration that is active during quiet breathing?
- Diaphragm

- b. Intercostal muscle
- c. Pectoralis major
- d. Abdominal muscle

ANS: A

The major primary muscle active in quiet breathing is the diaphragm.

DIF: Recall REF: 40

24. Which of the following are considered accessory muscles of respiration?

- I. Sternomastoids
 - II. Pectoralis major
 - III. Trapezius
 - IV. Abdominals
- a. I, II
 - b. II, III, IV
 - c. I, II, III
 - d. I, II, IV

ANS: D

Accessory muscles, used only when the work of breathing or ventilatory demand increases, include the sternomastoids, pectoralis major, and abdominals.

DIF: Recall REF: 40

25. Which of the following are the only accessory muscles of expiration?

- a. Diaphragm
- b. Intercostal muscles
- c. Pectoralis major
- d. Abdominal muscles

ANS: D

The abdominals are the only accessory muscles of expiration.

DIF: Recall REF: 40

26. Which of the following mechanisms is by far the most significant cause of thoracic cavity enlargement during inspiration?

- a. Downward movement of the diaphragm
- b. Upward movement of the diaphragm
- c. Abdominal muscle contraction
- d. Abdominal muscle relaxation

ANS: A

The downward movement of the diaphragm is by far the most significant cause of thoracic cavity enlargement and is therefore the action most responsible for generating subatmospheric pressure in the thoracic cavity during inspiration.

DIF: Recall REF: 41

27. If the lungs fail to empty normally during exhalation, because of either weakened elastic recoil forces or high resistance to airflow, the retained volume causes what change in the chest radiograph?
- Flattening of the diaphragm
 - Bullae formation
 - Pneumothorax
 - Pleural effusion

ANS: A

If the lungs fail to empty normally during exhalation, because of either weakened elastic recoil forces or high resistance to airflow, the retained volume abnormally flattens the diaphragm at the end of exhalation.

DIF: Recall

REF: 41

28. Strong inspiratory efforts may create enough subatmospheric pressure in the thoracic cavity to suck the intercostals muscles inward. This physical finding is called:
- Paradoxical breathing
 - Intercostal retractions
 - Flail chest
 - Rigid chest

ANS: B

Strong inspiratory efforts may create enough subatmospheric pressure in the thoracic cavity to suck the intercostals muscles inward, clearly outlining the individual ribs. Such intercostal retractions are a sign of intense respiratory efforts and reflect a high work of breathing.

DIF: Recall

REF: 41