Assessing Thorax and Lungs

By

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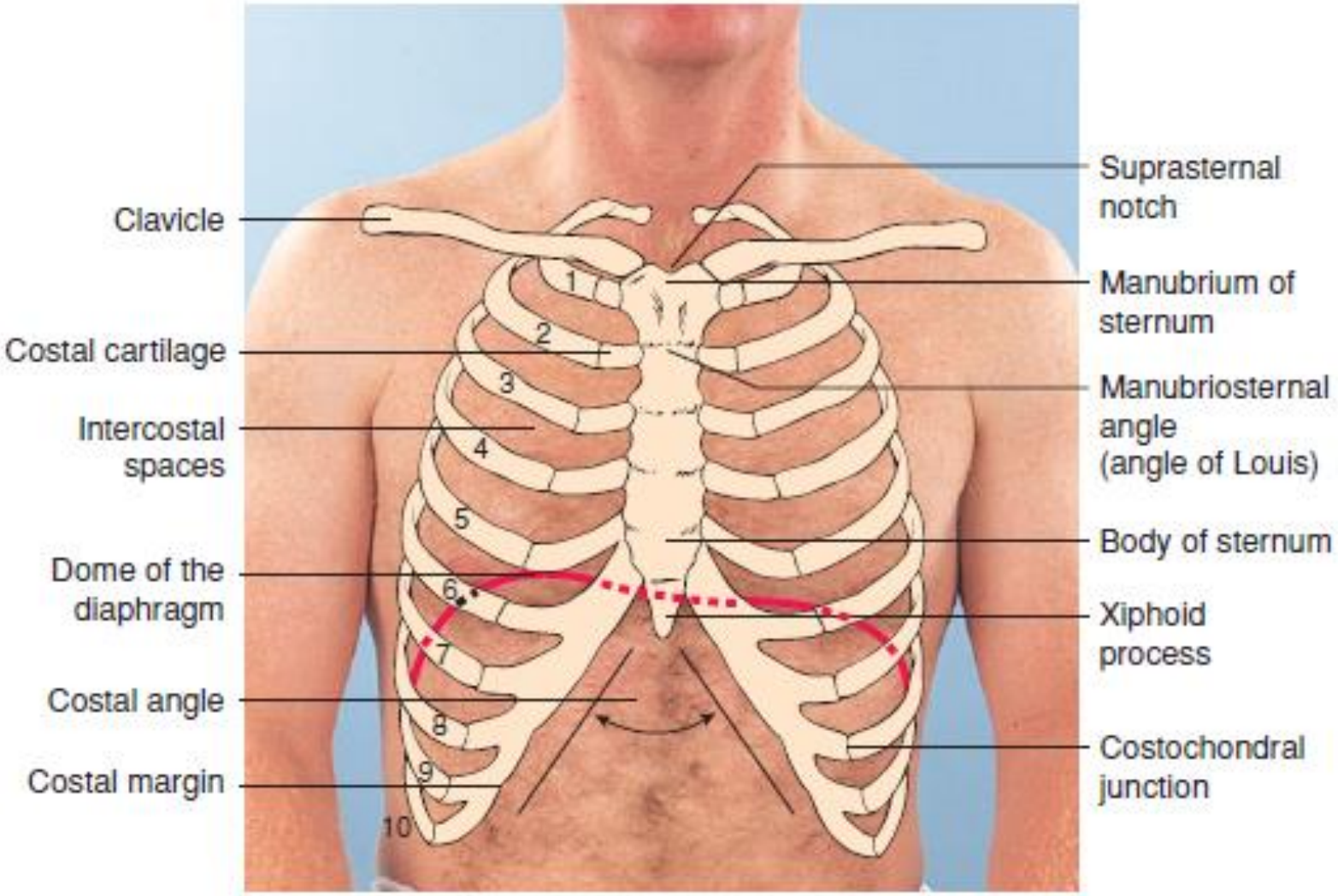
Structure and Function

- The term *thorax* identifies the portion of the body extending from the base of the neck superiorly to the level of the diaphragm inferiorly.
- The lungs, distal portion of the trachea, and the bronchi are located in the thorax and constitute the *lower respiratory system.*
- The outer structure of the thorax is referred to as the *thoracic cage.*
- The *thoracic cavity* contains the respiratory components.


Clavicle
Costal cartilage
Intercostal spaces
Dome of the diaphragm
Costal angle
Costal margin
Suprasternal notch
Manubrium of sternum
Manubriosternal angle (angle of Louis)
Body of sternum
Xiphoid process
Costochondral junction
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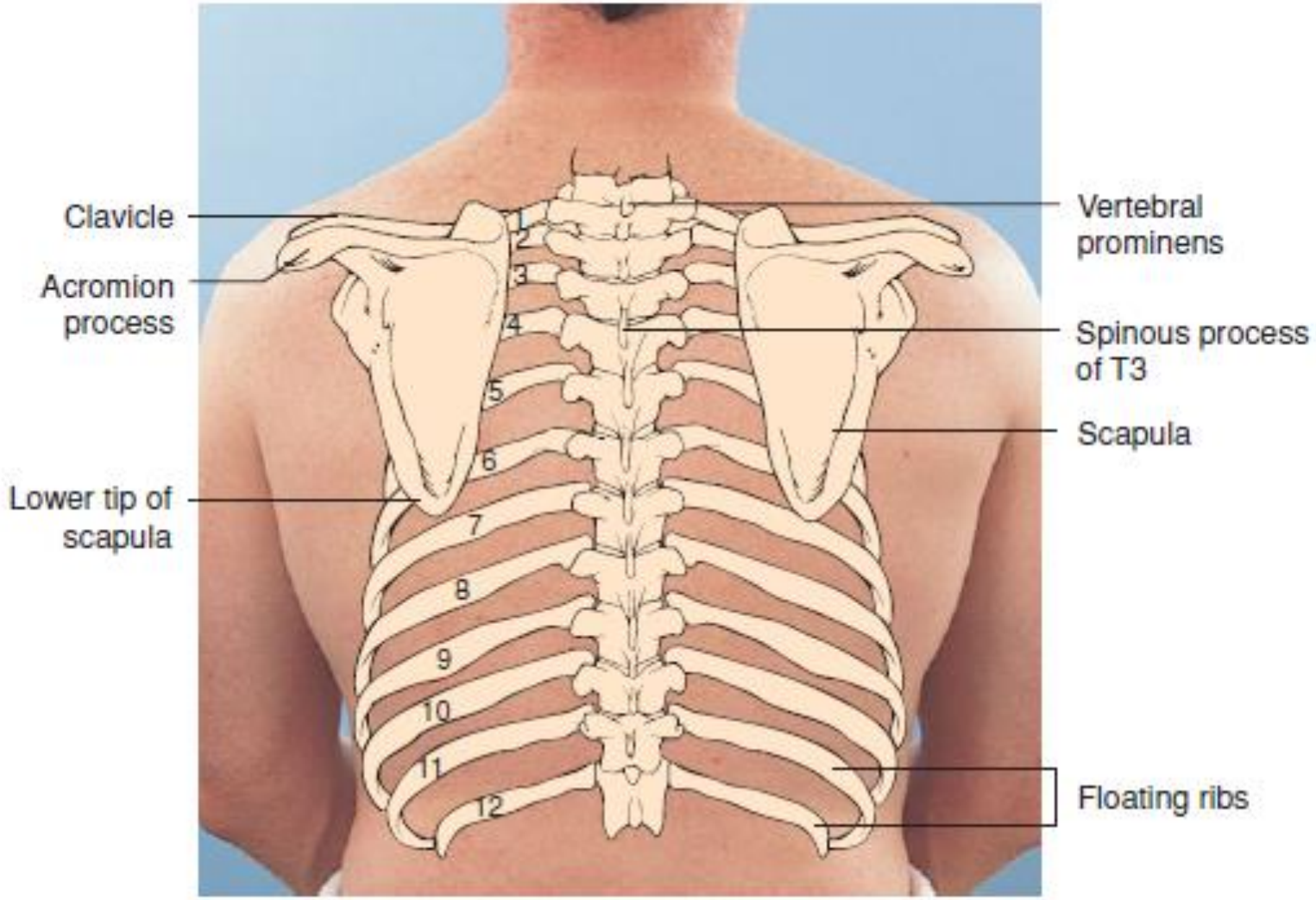
Clavicle
Acromion process
Lower tip of scapula
Vertebral prominens
Spinous process of T3
Scapula
Floating ribs
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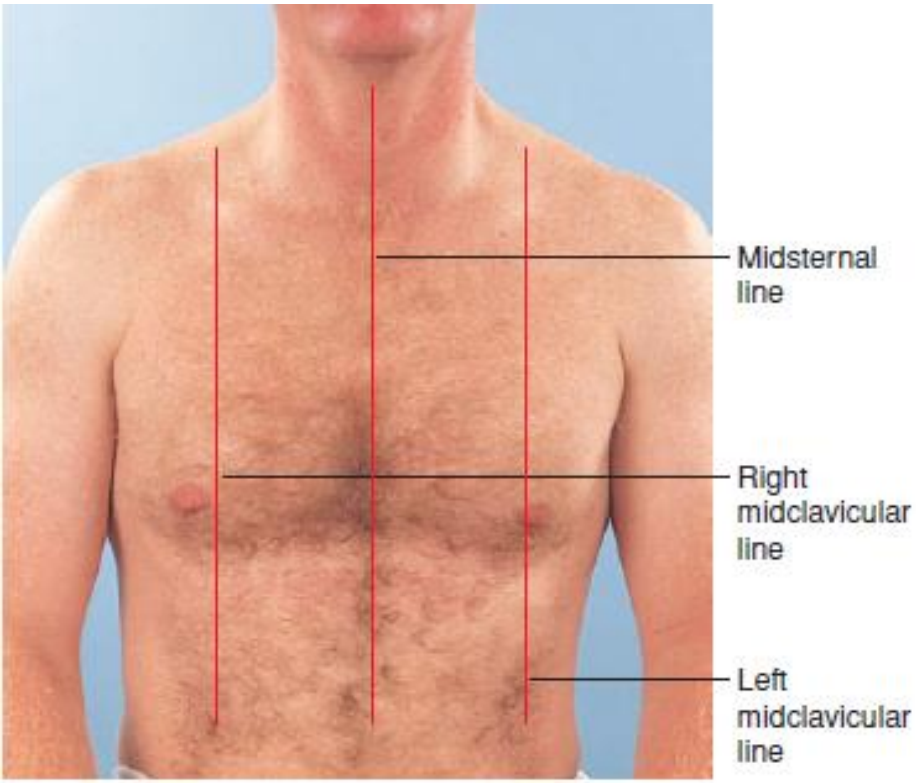


FIGURE 19-3 Anterior vertical lines (imaginary landmarks).

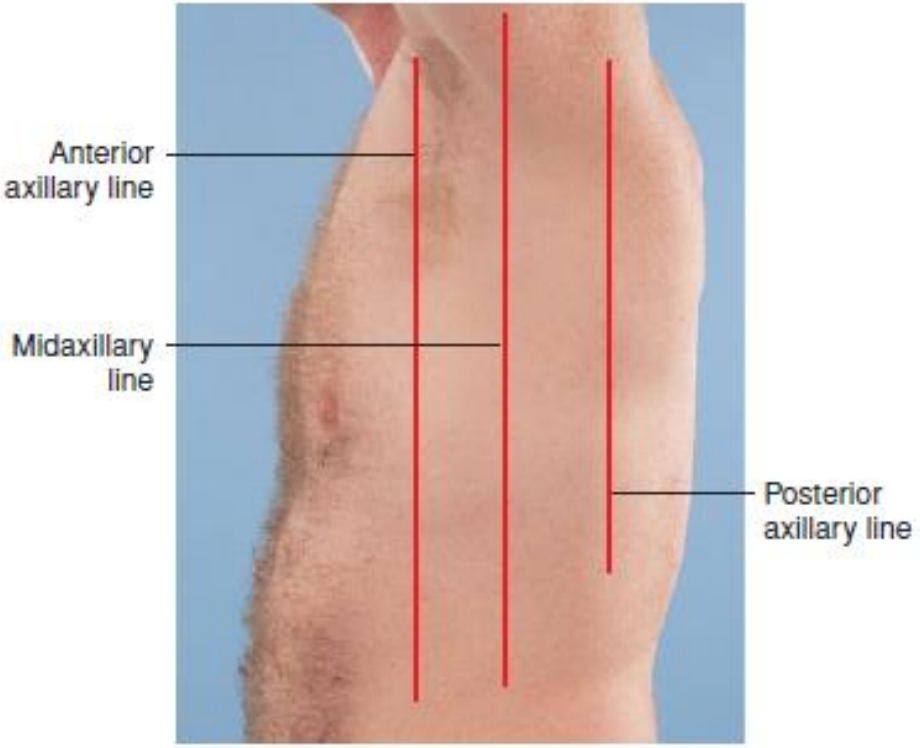


FIGURE 19-5 Lateral vertical lines (imaginary landmarks).

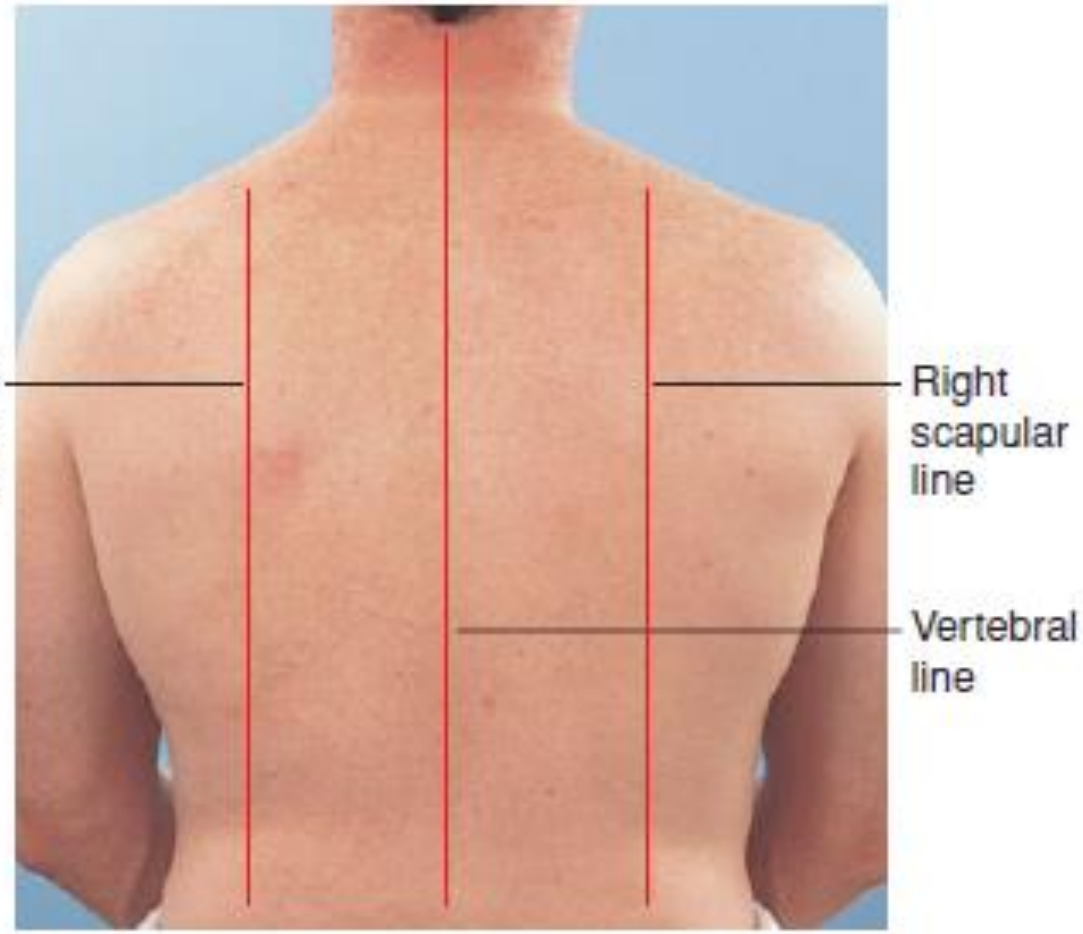


FIGURE 19-4 Posterior vertical lines (imaginary landmarks).

THORACIC CAVITY

- The thoracic cavity consists of the *mediastinum* and the lungs, and it is lined by the pleural membranes.

- The mediastinum refers to a central area in the thoracic cavity that contains the trachea, bronchi, esophagus, heart, and great vessels.

Trachea and Bronchi

- The *trachea* is a flexible structure that lies anterior to the esophagus, begins at the level of the cricoid cartilage in the neck, and is approximately 10 to 12 cm long in an adult.

- C-shaped rings of *hyaline cartilage* compose the trachea; they help to maintain its shape and prevent its collapse during respiration.

- At the level of the sternal angle, the trachea bifurcates into the right and left main *bronchi.*

- The bronchi and trachea represent “dead space” in the respiratory system

Lungs

- The *lungs* are two cone-shaped, elastic structures suspended within the thoracic cavity.
- The *apex* of each lung extends slightly above the clavicle.
- The *base* is at the level of the *diaphragm.*
- At the point of the mid-clavicular line on the anterior surface of the thorax, the lung extends to approximately the sixth rib.
- Laterally lung tissue reaches the level of the eighth rib.
- Posteriorly the lung base lies at about the tenth rib.

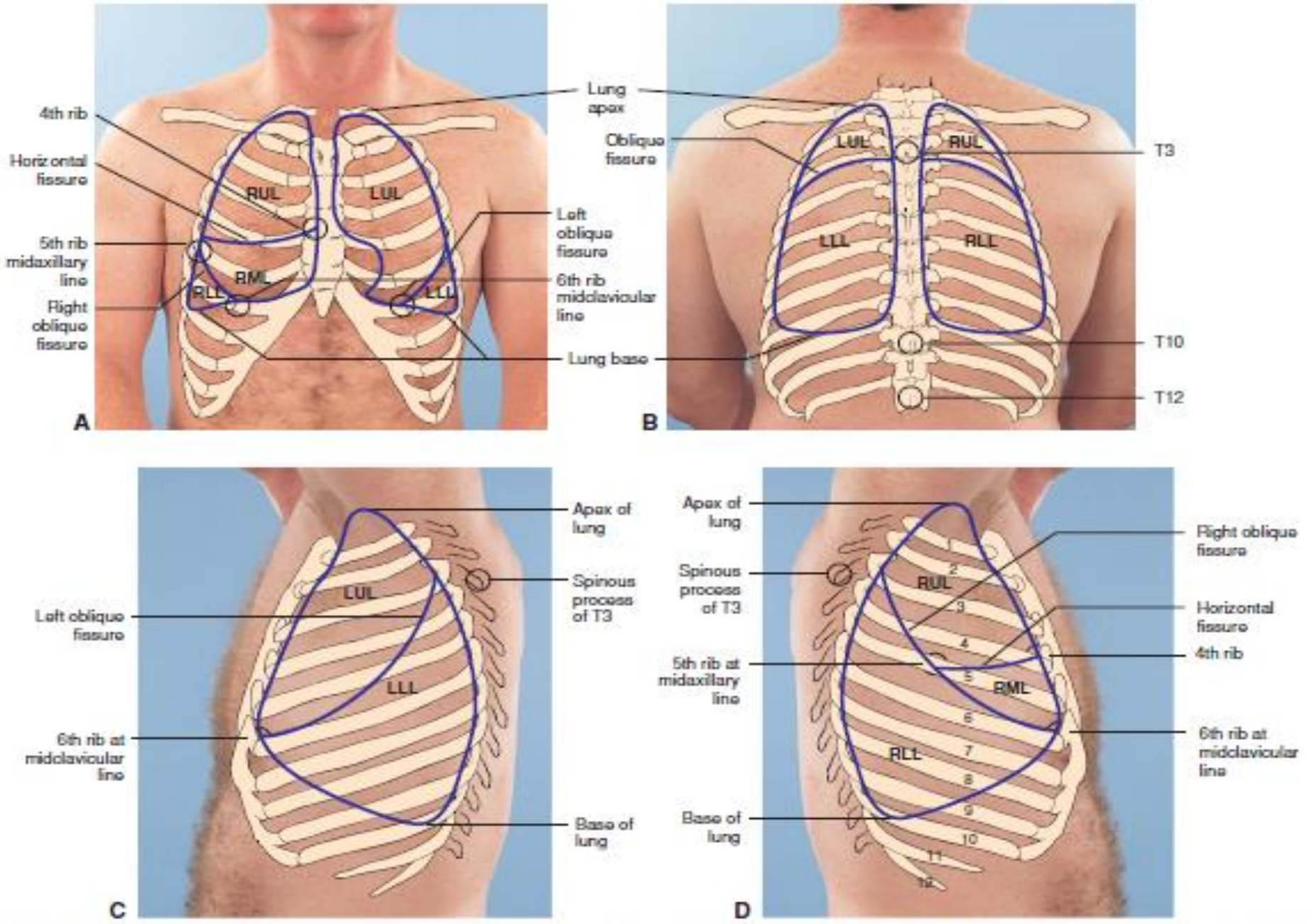
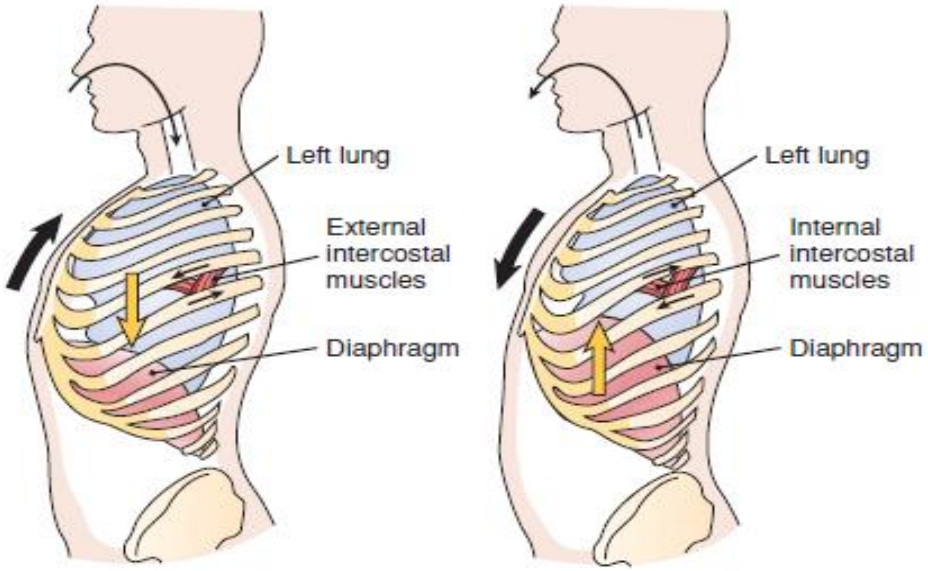


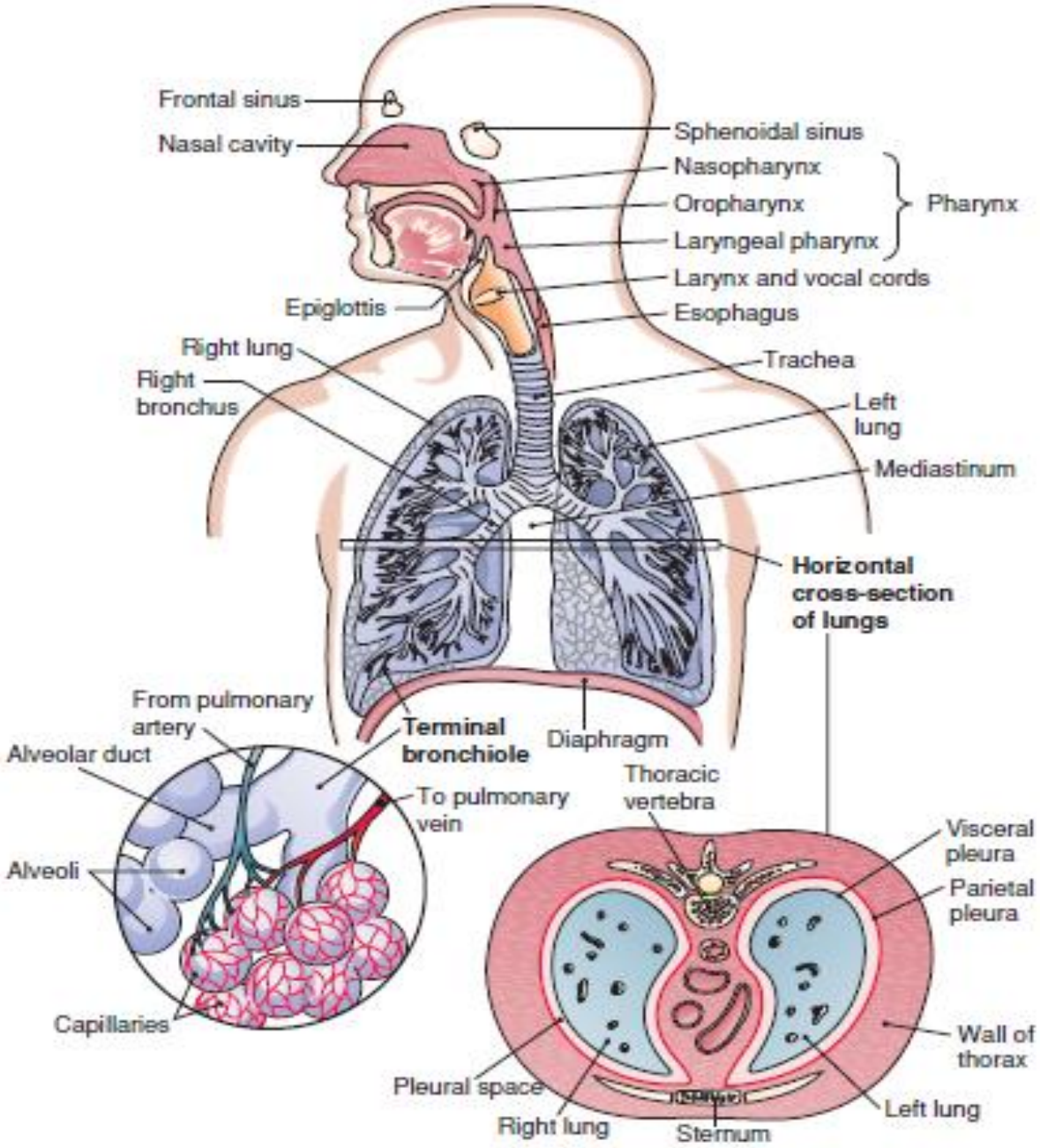
FIGURE 19-7 (**A**) Anterior view of lung position. (**B**) Posterior view of lung position. (**C**) Lateral view of left lung position. (**D**) Lateral view of right lung position.

- The right lung is made up of three lobes.
- The left lung contains only two lobes.
- In the healthy adult, during deep inspiration the lungs extend down to about the eighth intercostal space anteriorly and the twelfth intercostal space posteriorly.
- During expiration, the lungs rise to the fifth or sixth intercostal space anteriorly and tenth posteriorly.



During inhalation the diaphragm presses the abdominal organs downward and forward.

During exhalation the diaphragm rises and recoils to the resting position.


Frontal sinus
Nasal cavity
Sphenoidal sinus
Nasopharynx
Oropharynx
Laryngeal pharynx
Pharynx
Larynx and vocal cords
Epiglottis
Esophagus
Right lung
Right bronchus
Trachea
Left lung
Mediastinum
Horizontal cross-section of lungs
From pulmonary artery
Alveolar duct
Terminal bronchiole
Diaphragm
To pulmonary vein
Thoracic vertebra
Visceral pleura
Alveoli
Parietal pleura
Capillaries
Wall of thorax
Pleural space
Left lung
Right lung
Sternum

COLLECTING SUBJECTIVE DATA: THE NURSING HEALTH HISTORY

History of Present Health Concern

- **Difficulty Breathing**

Ask: Do you ever experience difficulty breathing or a loss of breath? If the client answers yes, use COLDSPA to explore the symptom.

- **Characteristics:** Describe the difficulty breathing.
- **Onset:** When did it begin?
- **Location:** Non-applicable
- **Duration:** How long did the dyspnea last?
- **Severity:**
- **Palliative/Aggravating factors**
- **Associated Factors**

Chest Pain:

- Do you have chest pain? Is the pain associated with a cold, fever, or deep breathing?

Cough:

- Do you have a cough? When and how often does it occur?
- Do you produce any sputum when you cough? If so, what color is the sputum? How much sputum do you cough up? Has this amount increased or decreased recently? Does the sputum have an odor?
- Do you wheeze when you cough or when you are active?

Gastrointestinal symptoms:

- Do you have any gastrointestinal symptoms such as heartburn, frequent hiccups (تقطيع), or chronic cough?

Personal Health History

Questions:

- Have you had prior respiratory problems?
- Have you ever had any thoracic surgery, biopsy, or trauma?
- Have you been tested for or diagnosed with allergies?
- Are you currently taking medications for breathing problems or other medications (prescription or over the counter [OTC]) that affect your breathing?
- Do you use any other treatments at home for your respiratory problems?
- Have you ever had a chest x-ray, tuberculosis (TB) skin test, or influenza immunization? Have you had any other pulmonary studies in the past?

Family History

QUESTIONS:

- Is there a history of lung disease in your family?
- Did any family members in your home smoke when you were growing up?
- Is there a history of other pulmonary illnesses/disorders in the family, e.g., asthma?

Lifestyle and Health Practices

Questions:

- Describe your usual dietary intake.
- Have you ever smoked cigarettes or other tobacco products? Do you currently smoke? At what age did you start? How much do you smoke and how much have you smoked in the past?
- Are you exposed to any environmental conditions that affect your breathing? Where do you work? Are you around smokers?
- Do you have difficulty performing your usual daily activities? Describe any difficulties.
- What kind of stress are you experiencing at this time? How does it affect your breathing?
- Have you used any herbal medicines or alternative therapies to manage colds or other respiratory problems?

PHYSICAL EXAMINATION

Preparing the Client:

- Have the client remove all clothing from the waist up and put on an examination gown or drape. The gown should open down the back
- Ask the client to sit in an upright position with arms relaxed at the sides.

Equipment

- Gloves
- Stethescope
- Light source
- Mask
- Skin marker
- Metric ruler
- Gown and drape

INSPECTION

Inspect for nasal flaring and pursed lip breathing.

- Normal: Nasal flaring is not observed.

- Abnormal: Nasal flaring is seen with labored respirations (especially in small children) and is indicative of hypoxia.

- Pursed lip breathing may be seen in asthma, emphysema, or CHF as a physiologic response to help slow down expiration and keep alveoli open longer.

- **Observe color of face, lips, and chest.**
- Normal: The client has evenly colored skin tone, without unusual or prominent discoloration.
- Abnormal: Ruddy (red) to purple complexion may be seen in clients with COPD or CHF as a result of polycythemia. Cyanosis may be seen if client is cold or hypoxic.

Inspect color and shape of nails.

- Normal: Pink tones should be seen in the nailbeds. There is normally a 160-degree angle between the nail base and the skin.
- Abnormal: Pale or cyanotic nails may indicate hypoxia. Clubbing occur from hypoxia.

Posterior Thorax: Inspection

- **Inspect configuration.** While the client sits with arms at the sides, stand behind the client and observe the position of scapulae and the shape and configuration of the chest wall.

- Normal: Scapulae are symmetric and nonprotruding. Shoulders and scapulae are at equal horizontal positions. The ratio of anteroposterior to transverse diameter is 1:2.

- Abnormal: Spinous processes that deviate laterally in the thoracic area may indicate scoliosis.

Tripod position

Observe use of accessory muscles.

- Watch as the client breathes and note use of muscles.

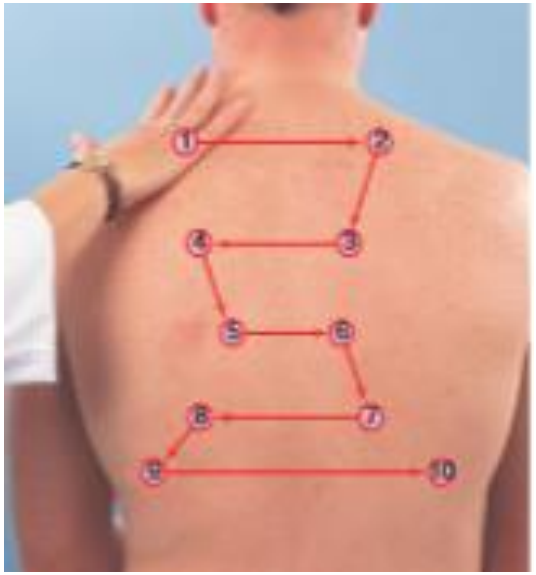
- Normal: The client does not use accessory (trapezius/ shoulder) muscles to assist breathing. The diaphragm is the major muscle at work. This is evidenced by expansion of the lower chest during inspiration.

- Abnormal: Client leans forward and uses arms to support weight and lift chest to increase breathing capacity, referred to as the tripod position (see previous slide).

PALPATION

Palpate for tenderness and sensation.

- Palpation may be performed with one or both hands, but the sequence of palpation is established (see the Fig.).
- Normal: Client reports no tenderness, pain, or unusual sensations. Temperature should be equal bilaterally.
- Abnormal: Muscle soreness from exercise or the excessive work of breathing (as in COPD) may be palpated as tenderness.



Palpate for crepitus.

- Crepitus, also called subcutaneous emphysema, is a crackling sensation (like bones or hairs rubbing against each other) that occurs when air passes through fluid or exudate. (see previous Fig).
- Normal: The examiner finds no palpable crepitus.
- Abnormal: Crepitus can be palpated if air escapes from the lung or other airways into the subcutaneous tissue, as occurs after an open thoracic injury, around a chest tube, or tracheostomy. It also may be palpated in areas of extreme congestion or consolidation.

Palpate surface characteristics.

- Put on gloves and use your fingers to palpate any lesions or unusual masses.

Palpate for fremitus.

- Use the ball or ulnar edge of one hand to assess for fremitus (vibrations of air in the bronchial tubes transmitted to the chest wall). Ask the client to say “ninety-nine.” Assess all areas for symmetry and intensity of vibration.

- Normal: Fremitus is symmetric and easily identified in the upper regions of the lungs.

- Abnormal: Unequal fremitus is a result of consolidation (which increases fremitus) or bronchial obstruction, air trapping in emphysema, pleural effusion, or pneumothorax (which all decrease fremitus).
- Diminished fremitus even with a loud spoken voice may indicate an obstruction of the tracheobronchial tree.

Assess chest expansion.

- Place your hands on the posterior chest wall with your thumbs at the level of T9 or T10 and pressing together a small skin fold. As the client takes a deep breath, observe the movement of your thumbs.

- Normal: When the client takes a deep breath, the examiner's thumbs should move 5 to 10 cm apart symmetrically.

- Abnormal: Unequal chest expansion can occur with severe atelectasis (collapse or incomplete expansion), pneumonia, chest trauma, or pneumothorax (air in the pleural space).
- Decreased chest excursion at the base of the lungs is characteristic of COPD.

PERCUSSION

Percuss for tone.

- Start at the apices of the scapulae and percuss across the tops of both shoulders. Then percuss the intercostal spaces across and down, comparing sides. Percuss to the lateral aspects at the bases of the lungs, comparing sides.

- Normal: Resonance is the percussion tone elicited over normal lung tissue. Percussion elicits flat tones over the scapula.

- Abnormal: Hyperresonance is elicited in cases of trapped air such as in emphysema or pneumothorax.

FIGURE 19-13 Sequence for percussing the posterior thorax.

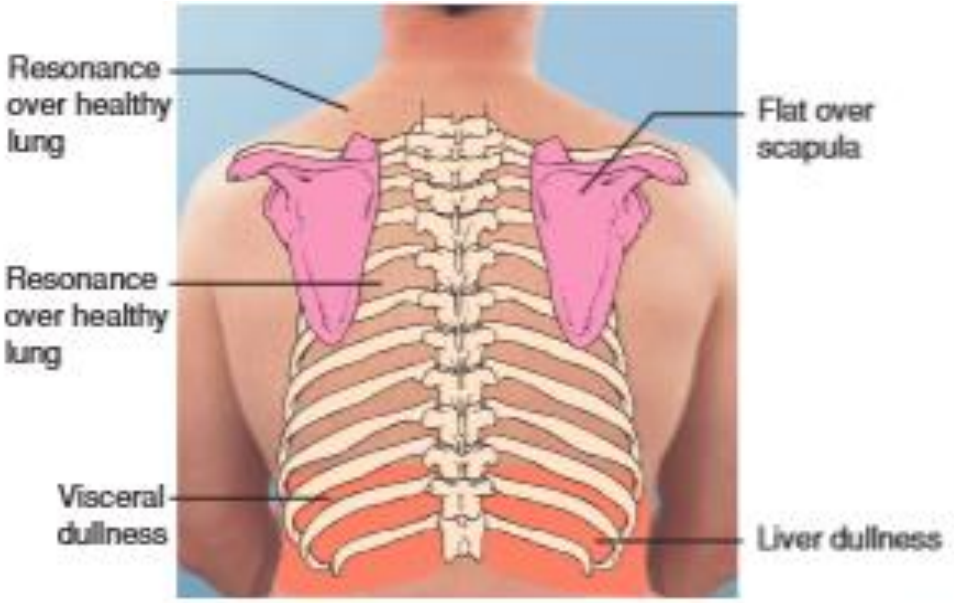


FIGURE 19-14 Normal percussion tones heard from the posterior thorax.

Percuss for diaphragmatic excursion.

- Ask the client to exhale forcefully and hold the breath. Beginning at the scapular line (T7), percuss the intercostal spaces of the right posterior chest wall. Percuss downward until the tone changes from resonance to dullness. Mark this level and allow the client to breathe.
- Next ask the client to inhale deeply and hold it. Percuss the intercostal spaces from the mark downward until resonance changes to dullness. Mark the level and allow the client to breathe. Measure the distance between the two marks.

- Normal: Excursion should be equal bilaterally and measure 3–5 cm in adults (up to 7 or 8 cm In well-conditioned clients).
- The level of the diaphragm may be higher on the right because of the position of the liver.

- Abnormal: Dullness is present when fluid or solid tissue replaces air in the lung or occupies the pleural space, such as in lobar pneumonia, pleural effusion, or tumor.
- Diaphragmatic descent may be limited by atelectasis of the lower lobes or by emphysema.
- Other possible causes for limited descent can be pain or abdominal changes such as extreme ascites, tumors, or pregnancy.
- Uneven excursion may be seen with inflammation from unilateral pneumonia, damage to the phrenic nerve, or splenomegaly.

Auscultate for breath sounds (posterior thorax).

- Do not attempt to listen through clothing or a drape. To begin, place the diaphragm of the stethoscope firmly and directly on the posterior chest wall at the apex of the lung at C7. Ask the client to breathe deeply through the mouth for each area of auscultation. Be alert to the client's comfort and offer times for rest and normal breathing if fatigue is a problem.

- Normal: Three types of normal breath sounds may be auscultated—bronchial, bronchovesicular, and vesicular.

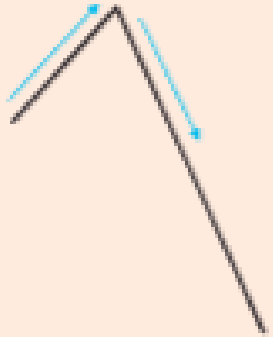
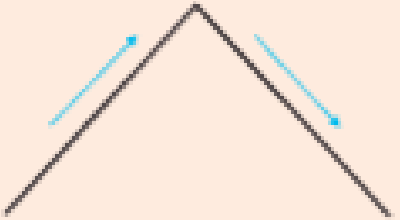
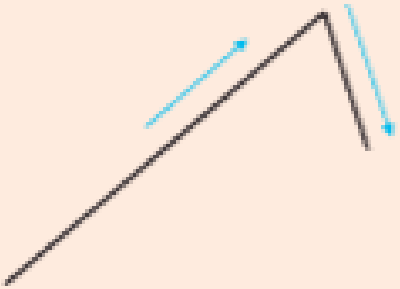
- Abnormal: Diminished or absent breath sounds often indicate that little or no air as a result of obstruction, secretions, mucus plug, or a foreign object.
- It may also indicate pleural space abnormalities such as pleural thickening, pleural effusion, or pneumothorax.

- In cases of emphysema, the hyperinflated nature result in diminished inspiratory breath sounds. Increased (louder) breath sounds often occur when consolidation or compression results in a denser lung area that enhances the transmission of sound.

FIGURE 19-16 Location of breath sounds for the posterior thorax. V, vesicular sounds; BV, bronchovesicular sounds.

FIGURE 19-17 Sequence for auscultating the posterior thorax.

Normal Breath Sounds

Type	Pitch	Quality	Amplitude	Duration	Location	Illustration
Bronchial	High	Harsh or hollow	Loud	Short during inspiration, long in expiration	Trachea and thorax	
Bronchovesicular	Moderate	Mixed	Moderate	Same during inspiration and expiration	Over the major bronchi—*posterior*: between the scapulae; *anterior*: around the upper sternum in the first and second intercostal spaces	
Vesicular	Low	Breezy	Soft	Long in inspiration, short in expiration	Peripheral lung fields	

Auscultate for adventitious sounds.

- Adventitious sounds are sounds added or superimposed over normal breath sounds and heard during auscultation. Be careful to note the location on the chest wall and the sounds within the respiratory cycle.

- Normal: No adventitious sounds, such as crackles (discrete and discontinuous sounds) or wheezes (musical and continuous), are auscultated.

- Abnormal: Adventitious lung sounds, such as crackles (formerly called rales) and wheezes (formerly called rhonchi) are evident.

Abnormal Sound	Characteristics	Source	Associated Conditions
Discontinuous Sounds Crackles (fine) 	High-pitched, short, popping sounds heard during inspiration and not cleared with coughing; sounds are discontinuous and can be simulated by rolling a strand of hair between your fingers near your ear.	Inhaled air suddenly opens the small, deflated air passages that are coated and sticky with exudate.	Crackles occurring late in inspiration are associated with restrictive diseases such as pneumonia and congestive heart failure. Crackles occurring early in inspiration are associated with obstructive disorders such as bronchitis, asthma, or emphysema.
Crackles (coarse) 	Low-pitched, bubbling, moist sounds that may persist from early inspiration to early expiration; also described as softly separating Velcro.	Inhaled air comes into contact with secretions in the large bronchi and trachea.	May indicate pneumonia, pulmonary edema, and pulmonary fibrosis. "Velcro rales" of pulmonary fibrosis are heard louder and closer to stethoscope, usually do not change location, and are more common in clients with long-term COPD.
Continuous Sounds Pleural friction rub 	Low-pitched, dry, grating sound; sound is much like crackles, only more superficial and occurring during both inspiration and expiration.	Sound is the result of rubbing of two inflamed pleural surfaces.	Pleuritis
Wheeze (sibilant) 	High-pitched, musical sounds heard primarily during expiration but may also be heard on inspiration.	Air passes through constricted passages (caused by swelling, secretions, or tumor).	Sibilant wheezes are often heard in cases of acute asthma or chronic emphysema.
Wheeze (sonorous) 	Low-pitched snoring or moaning sounds heard primarily during expiration but may be heard throughout the respiratory cycle. These wheezes may clear with coughing.	Same as sibilant wheeze. The pitch of the wheeze cannot be correlated to the size of the passageway that generates it.	Sonorous wheezes are often heard in cases of bronchitis or single obstructions and snoring before an episode of sleep apnea. *Stridor* is a harsh, honking wheeze with severe broncholaryngospasm, such as occurs with croup.

Auscultate voice sounds.

- Bronchophony: Ask the client to repeat the phrase “ninety-nine” while you auscultate the chest wall.
- Egophony: Ask the client to repeat the letter “E” while you listen over the chest wall.

- Normal: Voice transmission is soft, muffled, and indistinct. The sound of the voice may be heard but the actual phrase cannot be distinguished.

- Abnormal: The words are easily understood and louder over areas of increased density (consolidation, atelectasis, or tumor.

Anterior Thorax: Inspection

Inspect for shape and configuration.

- Have the client sit with arms at the sides. Stand in front of the client and assess shape and configuration.

- Normal: The anteroposterior diameter is less than the transverse diameter (Ratio 1:2).

- Abnormal: Anteroposterior equals transverse diameter, resulting in a barrel chest often seen in emphysema.

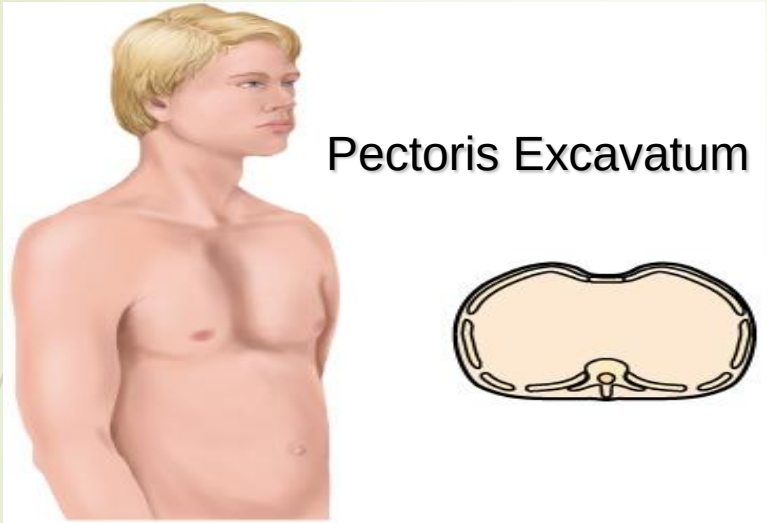
Inspect position of the sternum.

- Observe the sternum from an anterior and lateral viewpoint.

- Normal: Sternum is positioned at midline and straight.

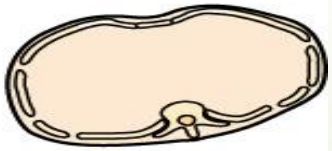
- Abnormal: Pectus excavatum is a markedly sunken sternum and adjacent cartilages (often referred to as funnel chest).
- Pectus carinatum is a forward protrusion of the sternum causing the adjacent ribs to slope backward (often referred to as pigeon chest.

Abnormal Chest Configurations

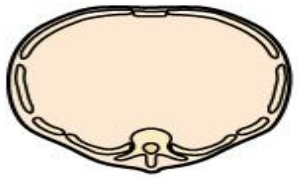


Pectoris Excavatum

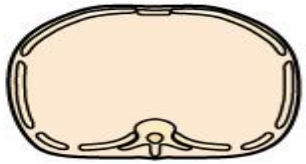
Scoliosis



Kyphosis



Barrel Chest



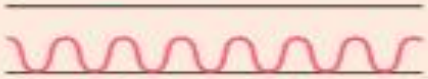
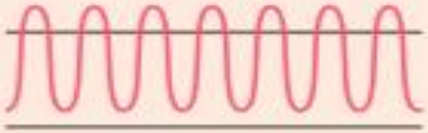
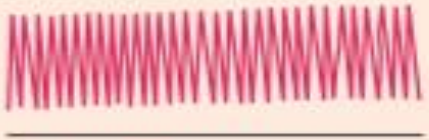
Observe quality and pattern of respiration.

- Note breathing characteristics as well as rate, rhythm, and depth.

- Normal: Respirations are relaxed, effortless, and quiet. They are of a regular rhythm and normal depth at a rate of 10–20 per minute in adults. Tachypnea and bradypnea may be normal in some clients.

- Abnormal: Labored and noisy breathing is often seen with severe asthma or chronic bronchitis.
- Abnormal breathing patterns include tachypnea, bradypnea, hyperventilation, hypoventilation, Cheyne-Stokes respiration, and Biot's respiration.

Respiration Patterns

Type	Description	Pattern	Clinical Indication
Normal	12–20 breaths/min and regular		Normal breathing pattern
Tachypnea	More than 24 breaths/min and shallow		May be a normal response to fever, anxiety, or exercise Can occur with respiratory insufficiency, alkalosis, pneumonia, or pleurisy
Bradypnea	Less than 10 breaths/min and regular		May be normal in well-conditioned athletes Can occur with medication-induced depression of the respiratory center, diabetic coma, neurologic damage
Hyperventilation	Increased rate and increased depth		Usually occurs with extreme exercise, fear, or anxiety. Causes of hyperventilation include disorders of the central nervous system, an overdose of the drug salicylate, or severe anxiety.
Kussmaul	Rapid, deep, labored		A type of hyperventilation associated with diabetic ketoacidosis
Hypoventilation	Decreased rate, decreased depth, irregular pattern		Usually associated with overdose of narcotics or anesthetics
Cheyne-Stokes respiration	Regular pattern characterized by alternating periods of deep, rapid breathing followed by periods of apnea		May result from severe congestive heart failure, drug overdose, increased intracranial pressure, or renal failure May be noted in elderly persons during sleep, not related to any disease process
Biot's respiration	Irregular pattern characterized by varying depth and rate of respirations followed by periods of apnea		May be seen with meningitis or severe brain damage
Ataxic	Significant disorganization with irregular and varying depths of respiration		A more extreme expression of Biot's respirations indicating respiratory compromise
Air trapping	Increasing difficulty in getting breath out		In chronic obstructive pulmonary disease, air is trapped in the lungs during forced expiration

Observe for use of accessory muscles.

- Ask the client to breathe normally and observe for use of accessory muscles.

- Normal: Use of accessory muscles (sternomastoid and rectus abdominis) is not seen with normal respiratory effort (except after strenuous exercise).

- Abnormal: Neck muscles (sternomastoid, scalene, and trapezius) are used to facilitate inspiration in cases of acute or chronic airway obstruction or atelectasis.
- The abdominal muscles and the internal intercostal muscles are used to facilitate expiration in COPD.

PALPATION

Palpate for tenderness, sensation, and surface masses.

- Use your fingers to palpate for tenderness and sensation. Move your hand systematically downward toward the midline at the level of the breasts and outward at the base to include the lateral aspect of the lung.
- Normal: No tenderness or pain is palpated over the lung area with respirations.
- Abnormal: Tenderness over thoracic muscles can result from exercising (e.g., pushups) especially in a previously sedentary client.

- **Palpate for crepitus as you would on the posterior thorax (described previously).**

- **Palpate for any surface masses or lesions.**

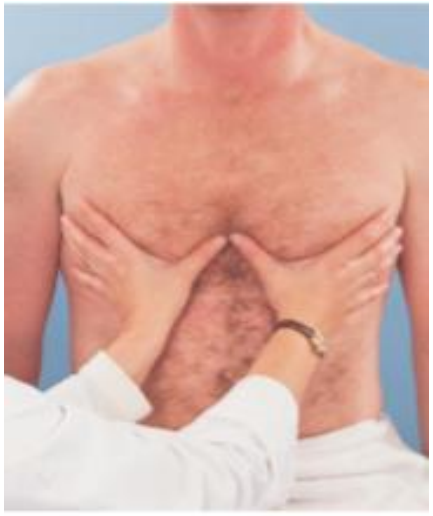
- **Palpate for fremitus.**

Using the sequence for the anterior chest described previously, palpate for fremitus using the same technique as for the posterior thorax.

  - Fremitus is symmetric and easily identified in the upper regions of the lungs. A decreased intensity of fremitus is expected toward the base of the lungs.
  - Diminished vibrations, even with a loud spoken voice, may indicate an obstruction of the tracheobronchial tree. Clients with emphysema may have considerably decreased fremitus as a result of air trapping.

Palpate anterior chest expansion.

- Place your hands on the client's anterolateral wall with your thumbs along the costal margins and pointing toward the xiphoid process (See Fig.). As the client takes a deep breath, observe the movement of your thumbs.
- Normal: Thumbs move outward in a symmetric fashion from the midline.
- Abnormal: Unequal chest expansion can occur with severe atelectasis, pneumonia, chest trauma, pleural effusion, or pneumothorax. Decreased chest excursion at the bases of the lungs is seen with COPD.



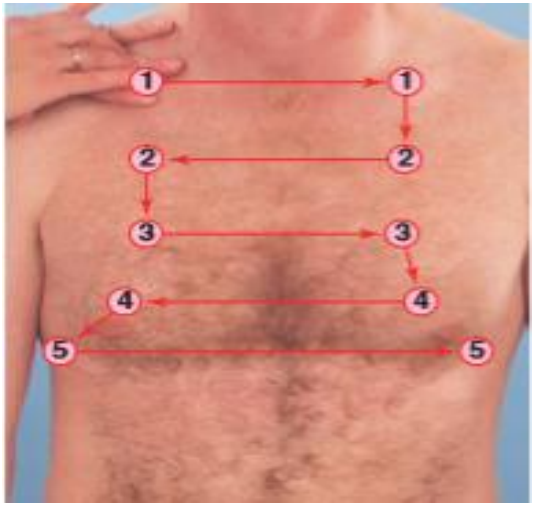
PERCUSSION

Percuss for tone.

- Percuss the apices above the clavicles. Then percuss the intercostal spaces across and down, comparing sides.

- Normal: Resonance is the percussion tone elicited over normal lung tissue, dullness over breast tissue, the heart, and the liver, tympany over the stomach, and flatness over the muscles and bones.

- Abnormal: Hyperresonance is elicited in cases of trapped air such as in emphysema or pneumothorax. Dullness may characterize areas of increased density such as consolidation, pleural effusion, or tumor.



Sequence for percussing the anterior thorax

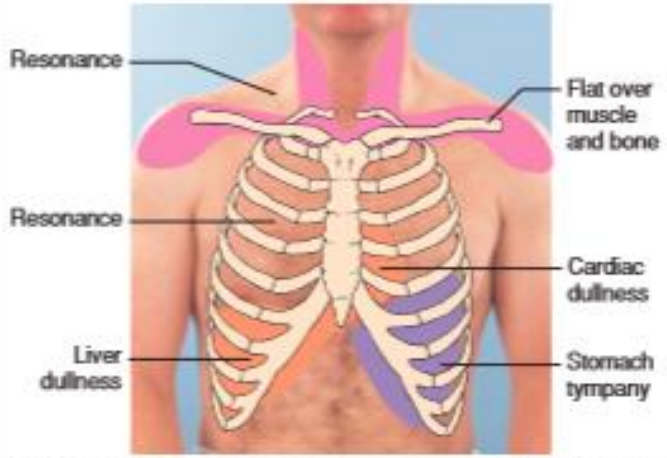


FIGURE 19-21 Normal percussion tones heard from the anterior thorax.

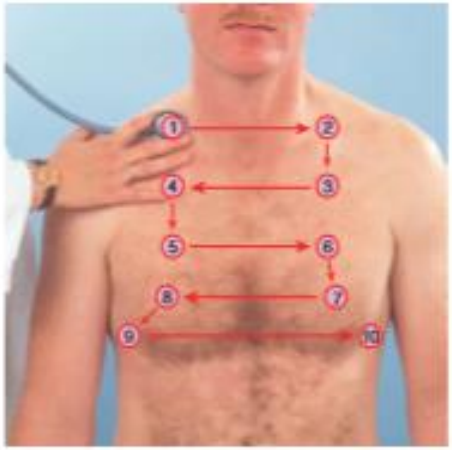


FIGURE 19-23 Sequence for auscultating the anterior thorax.

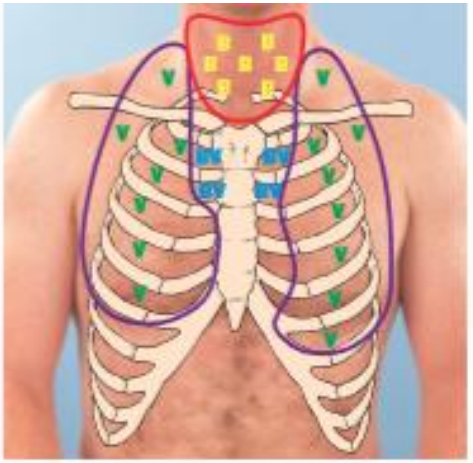


FIGURE 19-22 Location of breath sounds for the anterior thorax. B, bronchial sounds; V, vesicular sounds; BV, bronchovesicular sounds.

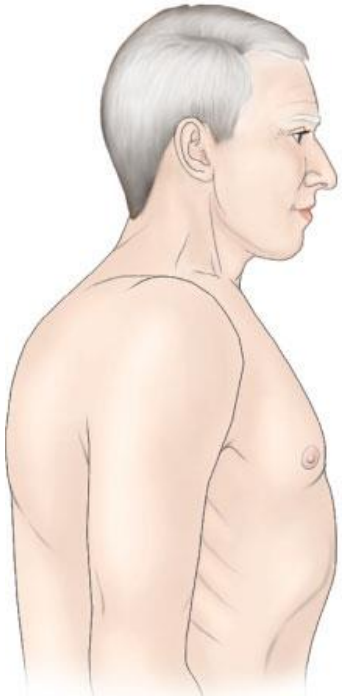
AUSCULTATION

Auscultate for anterior breath sounds, adventitious sounds, and voice sounds.

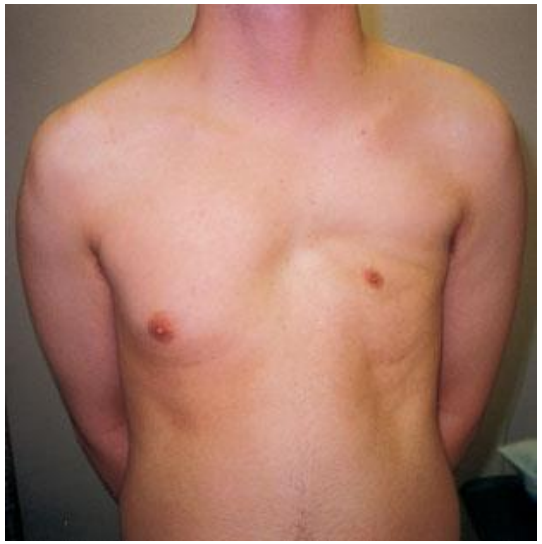
- Place the diaphragm of the stethoscope firmly and directly on the anterior chest wall. Auscultate from the apices of the lungs slightly above the clavicles to the bases of the lungs at the sixth rib. Ask the client to breathe deeply through the mouth in an effort to avoid transmission of sounds that may occur with nasal breathing. Listen at each site for at least one complete respiratory cycle.
- Normal: Refer to text in the posterior thorax section for normal voice sounds.
- Abnormal: Refer to adventitious breath sounds (previous table).

MEDICAL PROBLEMS

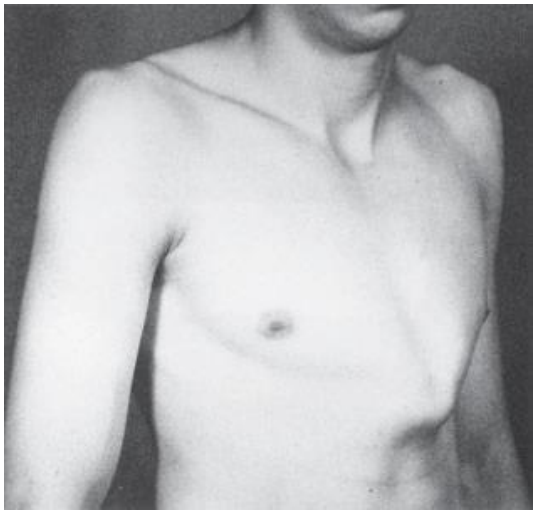
Normal chest configuration



Barrel chest



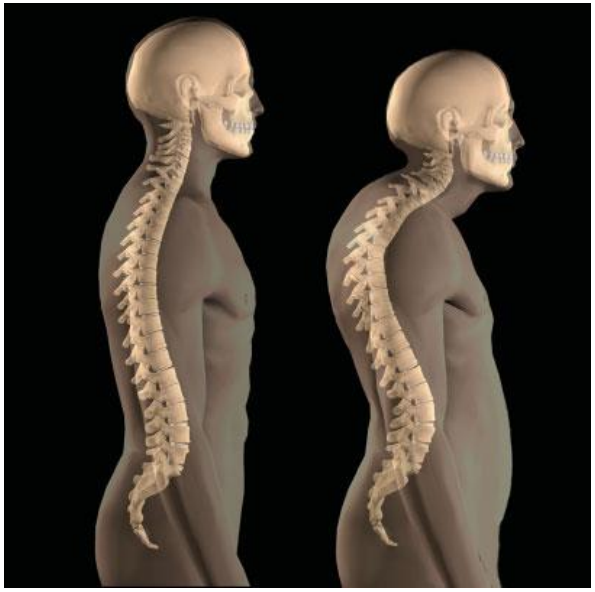
Pectus excavatum (funnel chest)



Pectus carinatum
(pigeon chest)

Scoliosis

Scoliosis



Kyphosis

THANK YOU