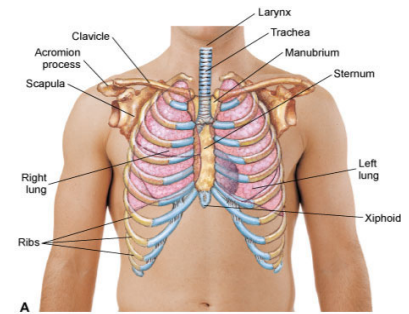


Condensed Chapter Material

Chapter 13: Chest and Lungs

Borders of the chest: (Normally: lateral diameter > AP diameter)

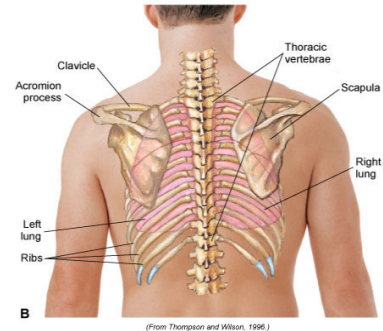
- Anterior-Sternum, manubrium, xiphoid process, and costal cartilages
- Lateral- 12 pairs of ribs (all connect to vertebrae posteriorly. Ribs 1-7 connect to the sternum anteriorly while 8,9, and 10 connect to costal cartilage. Ribs 11 and 12 are floating ribs.
- Posteriorly-12 thoracic vertebrae



Muscles of respiration:

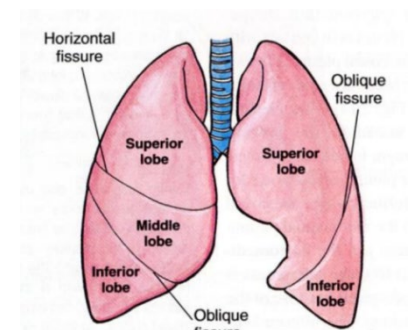
- 1) Diaphragm: Primary muscle; Moves downward with contraction (inspiration), increasing the intrathoracic space
- 2) Intercostals: Primary muscle; Include both internal and external intercostal muscles
- 3) Sternocleidomastoid and Trapezius: Accessory muscles (assist in respiration during exercise or in certain disease states.

The inside of the chest consists of two pleural cavities (incase the lungs) separated by the mediastinum (contains the heart)



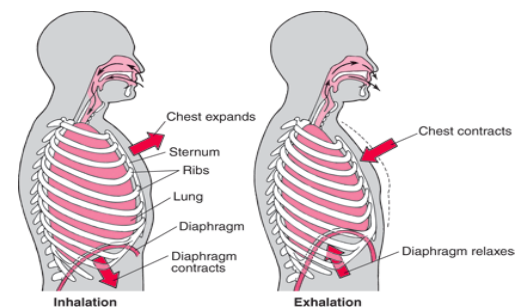
Lungs:

- Right lung has three lobes
- Left lung has two lobes (the upper lobe has a tongue like projection inferiorly called the lingula which is a counterpart of the right middle lobe)
- Both lungs have an oblique fissure separating upper and lower lobes while only the right lung has a lesser horizontal fissure separating the upper and middle lobes



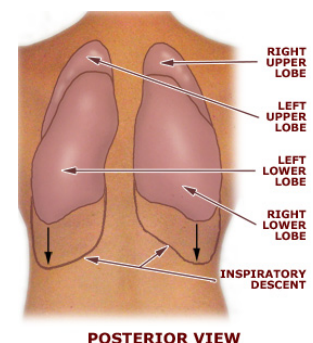
Borders of the lungs:

- Apex is rounded and extends 4cm above the first rib into the base of neck.
- Base: T9 (forced expiration) to T12 (deep inspiration). The base is concave and rests on the convex diaphragm.



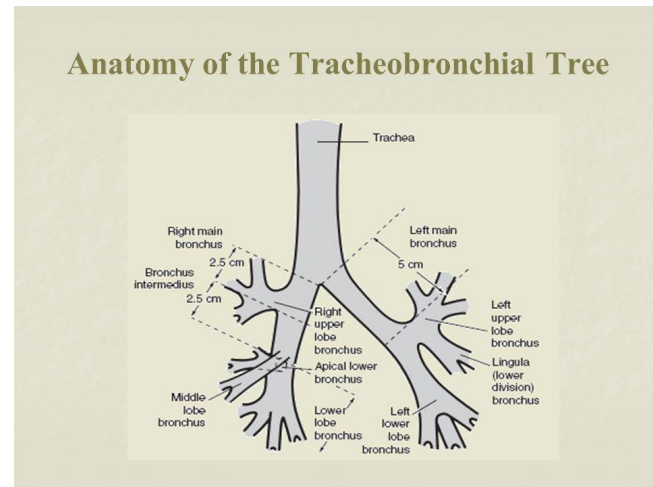
Visualizing Lungs from Surface

- Anteriorly: Right lung rides higher because of the liver; Anterior view on right is mostly upper and middle lobes which are separated by horizontal fissure (fissure at the level of 5th rib in midaxillary region to 4th rib at the sternum). The oblique fissure on both the right and left extends from fifth rib at axilla to the sixth at the midclavicular line
- Posteriorly: Mostly the lower lobe which extends from T3 to T10-12 depending on point of respiratory cycle.
- Right lateral: Lung extends from peak of axilla to 7/8th rib. Upper lobe is demarcated at level of 5th rib at midaxillary line
- Left lateral: Lung extends from peak of axilla to 7/8th rib.



Tracheobronchial Tree

- a) Functions as a conduit for air to travel from the upper airway to alveoli as well as filtering, humidifying and warming air.
- b) Pathway: Trachea (Anterior to esophagus and posterior to thyroid)->divides into right and left main bronchi (at T4-T5 level just below manubriosternal joint)->divide into three branches on right and two on left (each supplying a lobe)->further subdivision into terminal bronchioles->respiratory bronchioles.
- c) Right bronchus is wider, shorter and more vertical than left bronchus therefore, more susceptible to aspiration of foreign body.

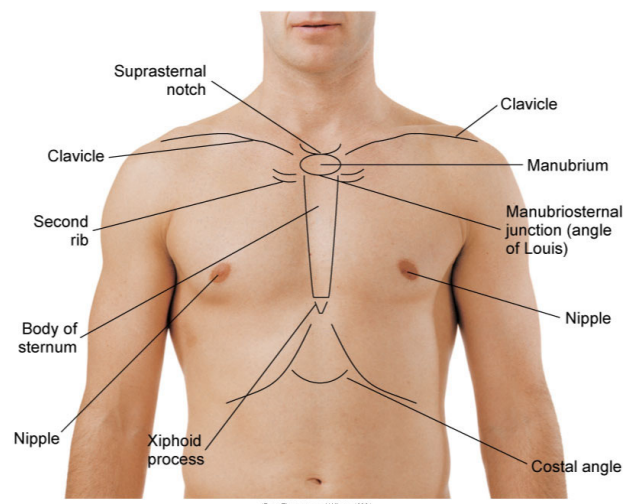


Blood Supply:

- a) Arterial supply: Bronchial arteries (from the anterior thoracic aorta) and intercostal arteries.
- b) Venous: Most blood returned via pulmonary veins but some blood returns from the bronchial vein.

Pertinent Anatomic Landmarks:

- 1) Nipples
- 2) Manubriosternal Junction (angle of Louis)-Visible/palpable angulation of sternum at the level of second rib-sternal articulation. Can be used as landmark to count ribs and intercostal spaces (each intercostal space corresponds to rib immediately above it)
- 3) Suprasternal notch-Palpable/often visible depression superior to manubriosternal junction at the ventral base of the neck
- 4) Costal angle-Angle formed by costal margins at sternum; Usually not greater than 90 degrees
- 5) Vertebrae prominens-Spinous process of C7 (most easily palpated when patient's head is bent forward). If two prominences are palpated, the upper is C7 and lower is T1.
- 6) Clavicles



Physical examination: The inspection, percussion and auscultation should all be done on the skin and not on clothing.

Inspection:

- Patient should be upright.
- Note for shape and symmetry of chest from both the front and back. In normal state the lateral diameter of chest is greater than the anterior-posterior diameter (except newborns in which diameters are similar in size). In older individuals and certain disease states barrel chesting may occur, in which AP chest diameter is increased due to decreased lung elasticity, dorsal curvature of thoracic spine and weakening of muscles in thorax.
- Other findings include posteriorly deviated spine (kyphosis) or laterally (scoliosis), prominent sternal protrusion (pigeon chest aka pectus carinatum), indentation lower sternum (funnel chest aka pectus excavatum).
- Chest asymmetry can be associated with unequal expansion and respiratory compromise caused by collapsed lung or limitations of expansion by extrapleural air, fluid or mass.

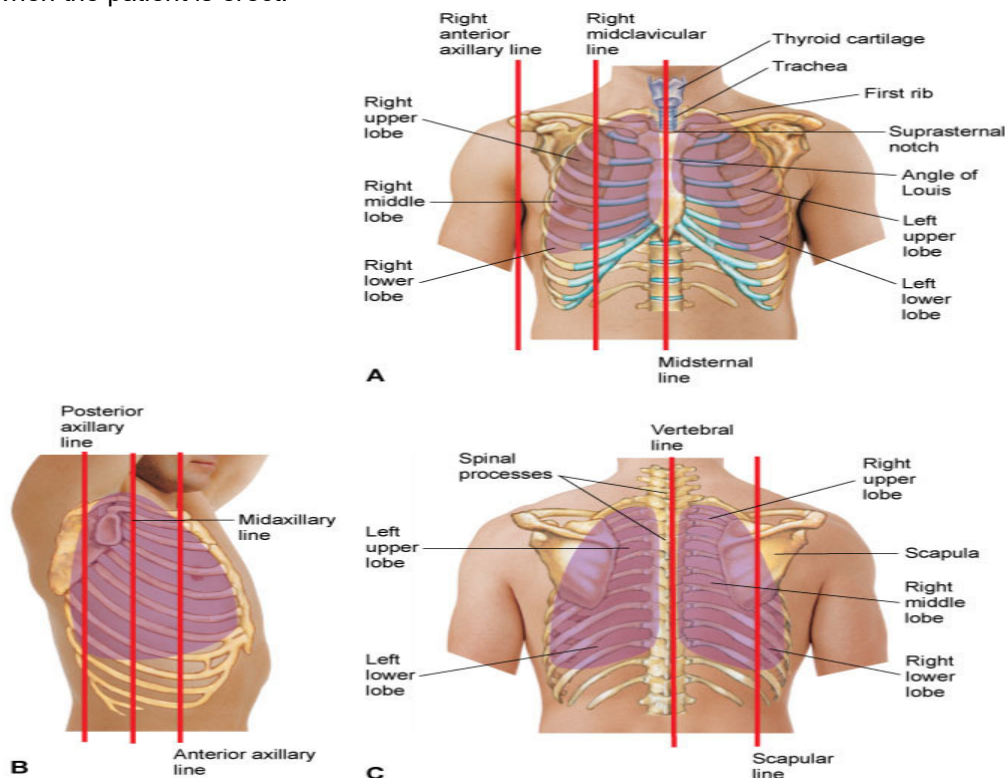
Observing Respirations: Normal respiratory rate is 12-20 breaths per minute. Tachypnea is an elevated rate and bradypnea is a slower rate. Without telling the patient, determine rate after palpating pulse (as if you were counting the pulse for a longer time to avoid the patient from altering the rate).

-Note the pattern of breathing and the chest movement.

-Observe the lips and nails for cyanosis, the lips for pursing, the fingers for clubbing and the alae nasi for flaring all which can signify pulmonary or cardiac difficulty.

Thoracic Landmarks: Use of imaginary lines to help localize findings during examination

- 1) Midsternal line: vertically down midline of sternum
- 2) Right and left midclavicular lines: Vertically down from the midclavicle. The inferior borders of the lungs cross the sixth rib at the midclavicular line
- 3) Right and left anterior axillary lines: parallel to the midsternal line, beginning at the anterior axillary folds.
- 4) Right and left midaxillary lines: Parallel to midsternal line, beginning at the midaxilla.
- 5) Right and left posterior axillary lines: Parallel to the midsternal line, beginning at the posterior axillary folds
- 6) Vertebral line: Vertically down the spinal processes.
- 7) Right and left scapular lines: Parallel to the vertebral line, through the inferior angle of the scapula when the patient is erect.

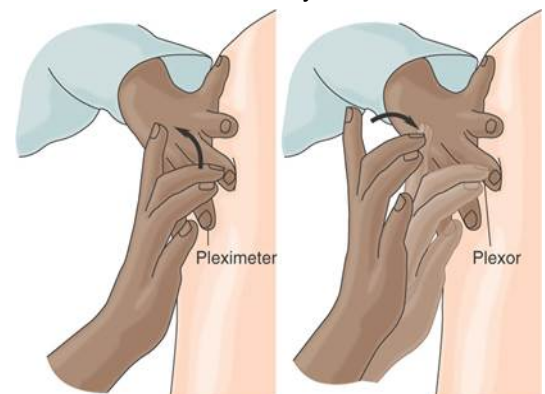


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Percussion:

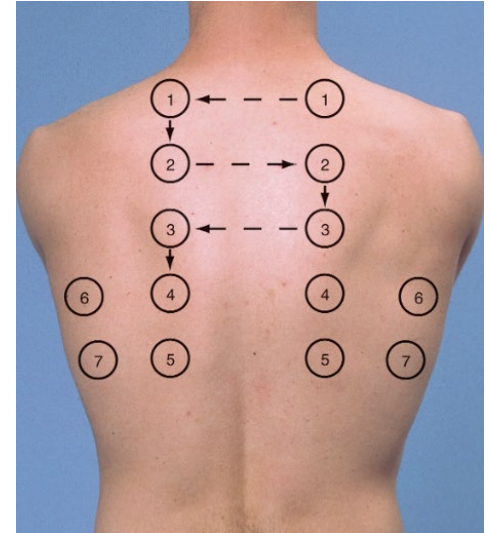
Indirect percussion is performed by placing one's nondominant hand on the surface of the body with fingers slightly separated. Place the distal phalanx of the middle finger firmly on the body surface with other fingers slightly elevated off the surface. Snap the wrist of the other hand downward, striking the tip of the middle finger on the interphalangeal joint of the finger on the body surface.

- 1) Have patient bend his/her head forward and fold their arms in front which moves the scapula laterally to maximize exposure of lungs.



- 2) Percuss at 4 to 5 cm intervals over the intercostal spaces moving superior to inferior alternating from side to side after each percussion.

Resonance is the expected sound. Hyperresonance is associated with hyperinflation (e.g. emphysema, pneumothorax) while dullness/flatness is associated with conditions such as pneumonia, atelectasis (collapse of lung) and pleural effusion (fluid buildup around lung).



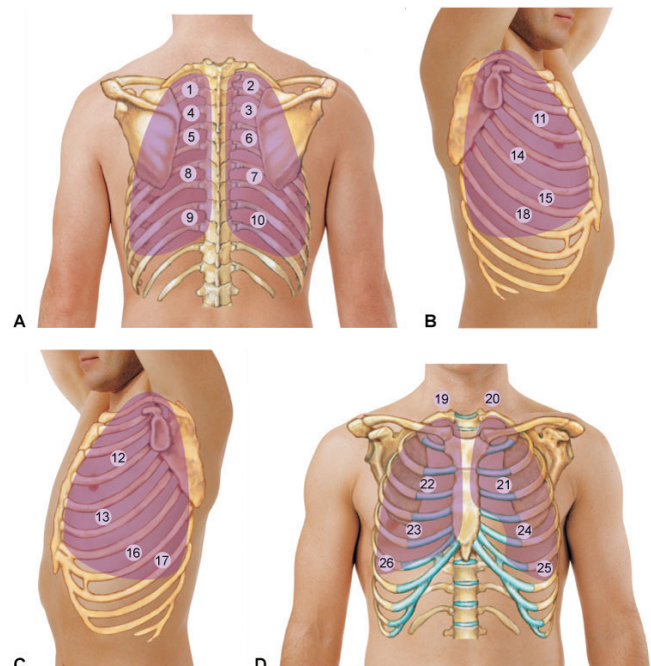
Type of Tone	Intensity	Pitch	Duration	Quality
Resonant	Loud	Low	Long	Hollow
Flat	Soft	High	Short	Very dull
Dull	Medium	Medium to high	Medium	Dull thud
Tympanic	Loud	High	Medium	Drumlike
Hyperresonant	Very loud	Very low	Longer	Booming

Auscultation:

- a) Patient should be sitting upright, if possible.
- b) Have patient breathe deeply and slowly through their mouth while the diaphragm of the stethoscope is placed firmly on the patient's skin.
- c) Listen at each location throughout a complete cycle (inspiration and expiration) and do a side to side comparison as you move down.
- d) If you suspect this process will be difficult for the patient (may cause faintness or tiring) examine the lung bases first due to the fact that most pathologic conditions occur here.
- e) The sounds of the middle lobe of the right lung and the lingula on the left are best heard in the respective axillae.

Locations: (picture on right)

- 1) Back: Have patient sit upright with head bent forward and arms folded.
- 2) Lateral chest: Patient sit more erect with shoulders overhead
- 3) Anterior chest: Patient sit erect with shoulders back



Description of normal breath sounds:

Characterize sounds in similar fashion as percussion (intensity, pitch, quality and duration)

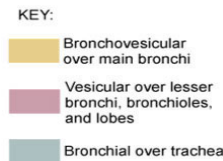
Classify sounds as either:

-Vesicular: Heard over most lung fields; low pitch, low intensity; soft and short expirations. (More prominent in thin patients)

-Bronchovesicular: Heard over major bronchi and over upper right posterior lung field: medium pitch; expiration equals inspiration

-Bronchial/tracheal: Heard only over the trachea; highest pitch and intensity; loud and long expirations, sometimes a bit longer than inspiration.

-Abnormal to hear bronchovesicular and bronchial breath sounds over the peripheral lung tissue



A

B

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Terms for adventitious breath sounds:

- 1) Crackles (rales): Abnormal "popping" sound heard often during inspiration and described as a discrete discontinuous sound often caused by disruptive passage of air through small airways
- 2) Rhonchi (sonorous wheeze)-Loud, low, coarse sounds like a snore most often heard continuously during inspiration and expiration (more pronounced during expiration); may be cleared with cough because often caused by mucus accumulation. Sibilant, higher pitched rhonchi originate in smaller bronchi (ex. asthma) while the more sonorous, lower-pitched rhonchi arise from larger bronchi (ex. tracheobronchitis).
- 3) Wheeze (sibilant wheeze)-Continuous, high-pitched, musical sound (similar to a whistle or squeak) heard during inspiration or expiration caused by high-velocity airflow through a narrowed or obstructed airway. Unilateral wheeze most likely caused by foreign object or tumor while bilateral wheeze is caused by bronchospasm of asthma or bronchitis.
- 4) Pleural friction rub: Dry, rubbing, or grating sound heard outside of the respiratory tree usually caused by inflammation of pleural surfaces with roughened surfaces rubbing together. Heard during inspiration or expiration, loudest over lower lateral anterior surface.

The volume of the breath sounds depends on the speed with which air enters and leaves mouth. They are more difficult to hear in situations such as fluid/pus accumulation in pleural space, hyperinflated lungs, shallow breathing due to pain, and secretions or foreign body obstructing the bronchi. The breath sounds are easier to hear when lungs are consolidated (mass of the respiratory tree promotes sound transmission better than air-filled alveoli).

There are several websites with lung sounds to reference. Some examples:

www.easyauscultation.com

www.practicalclinicalskills.com