

ANATOMY AND PHYSIOLOGY OF THE PULMONARY SYSTEM

Section 1 Part C

Reading Assignment: Des Jardins - Chapter 1, pp.

THE THORAX, MEDIASTINUM

I. Lymphatic System

- A. Lymphatic vessels are found on the surface around the lungs and beneath the visceral pleura
 - 1. found in dense connective tissue -
 - 2. primary function is to remove excess fluid from tissue -
- B. Lymphatic vessels arise from loose space of the interstitium
 - 1. vessels follow bronchial airways, arteries, and veins to hilum
 - 2. unicuspid, funnel shaped valves direct fluid toward hilum
 - 3. large lymph channels have smooth muscle bands that actively produce peristaltic movement regulated by the autonomic nervous system
 - 4. vessels end in pulmonary and bronchopulmonary lymph nodes -
- C. Lymph nodes are located along lymph vessels
 - 1. produce lymphocytes and monocytes
 - 2. act as filters -

II. Neural Control

- A. Autonomic nervous system helps to balance the tone of bronchial and arteriolar muscles of the lung
 - 1. regulates involuntary vital functions -
 - 2. contain two divisions
 - a. sympathetic nervous system
 - b. parasympathetic nervous system
- B. Sympathetic nervous system -
 - 1. stimulation can cause epinephrine or norepinephrine to be released
 - a. stimulates the beta2 (B2) receptors -
 - 2. alpha stimulation produces pulmonary vascular constriction
- C. Parasympathetic nervous system -
 - 1. releases acetylcholine -
 - 2. inactivity of one system allow the other system to dominate the bronchial smooth muscles

III. Lungs/Mediastinum

- A. Morphology of the lungs
 - 1. pointed upper portion forms the APEX -
 - 2. BASES are broad and concave
 - a. anterior -
 - b. posterior -
 - 3. mediastinal border of each lung is concave -
 - a. hilum is located at center of mediastinal border
 - 4. right lung is larger and heavier than left
 - a. three lobes are located on the right, lobes are divided by oblique and horizontal fissure
 - b. two lobe are located on left side and are divided by the oblique fissure
- B. Mediastinum
 - 1. cavity contains organs of the thorax between the right and left lung -
 - 2. bordered anteriorly by sternum and posteriorly by vertebrae

3. changes in shape of the mediastinum can compromise the cardiopulmonary system
 4. arteries
 - a. aortic arch and branches
 - b. subclavian (r. and l.), left common carotid
 - c. thoracic aorta -
 5. veins
 - a. brachiocephalic (r. and l.)
 - b. superior vena cava
 - c. azygous v.
 - d. hemiazygous v.
 6. nerves
 - a. vagus n.
 - b. recurrent laryngeal n.
 - c. phrenic (C3-C5)
 7. thoracic duct -
- C. Plural membranes
1. visceral pleura attaches to outer surface -
 2. parietal pleura lines the inside of the thoracic wall -
 3. thin serous fluid holds the two surfaces together
 - a. surfaces glide over each other during respiratory maneuvers
 - b. inspiration -
 4. subatmospheric pressure is created between two pleura -
 - a. lungs tend to collapse
 - b. thorax tends to expand
 5. if air is allowed to enter thorax between pleurae, lungs will collapse - *pneumothorax*

IV. Thorax

- A. Bones of the thorax
1. 12 thoracic vertebrae
 2. 12 pair of ribs
 - a. pairs 1-7 are true ribs, vertebral sternal ribs
 - b. pairs 8-12 are false ribs, vertebral costal ribs
 - c. pairs 11-12 are floating ribs
 3. sternum
 - a. *manubrium sterni* -
 - b. sternum or body -
 - c. xyphoid process
 - d. sternal angle (angle of Louis) is the junction between the manubrium and sternum
- B. Boundaries of thorax
1. suprasternal angle or jugular notch T2-T3
 2. sternal angle T4-T5
 3. subcostal or infrasternal angle T9
 4. costal margins, ribs 7-10 T8-L2
 5. scapula
 - a. superior angle T2
 - b. spine T3
 - c. inferior angle T7
 6. nipple, male or immature female 4th ICS
- C. Muscles of inspiration (See Muscles of Respiration, page 4)
1. *diaphragm* - major muscle of respiration (inspiration)
 - a. dome shaped musculofibrous partition located between thoracic cavity and abdominal cavity
 - b. composed of two hemidiaphragms -

- c. contraction or movement is downward -
 2. accessory muscles of inspiration
 - a. *scalene muscle (m.)* - flexes neck, elevates ribs 1-2, dec. intrapleural pressure
 - b. *sternocleidomastoid m.* - with head and neck fixed it elevates sternum
 - c. *pectoralis major m.* - increases anteroposterior diameter of chest
 - d. *trapezius m.* - helps to elevate the thoracic cage
 - e. *external intercostal m.* - pulls ribs upward and outward
 3. accessory muscles of expiration - muscles recruited to help with exhalation
 - a. *rectus abdominis m.* - compresses abdomen pushing diaphragm up
 - b. *internal abdominis oblique m.* - compresses abdomen
 - c. *transverse abdominis m.* - compresses abdomen
 - d. *internal intercostal m.* - pulls ribs inward and downward
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VOCABULARY

1. costodiaphragmatic sinus -
2. costomediastinal sinus -
3. cupula -
4. epinephrine -
5. fossa -
6. insertion (muscle) -
7. hiatus -
8. intrapleural pressure -
9. jugular notch -
10. linea alba
11. lymphocytes -
12. monocytes -
13. norepinephrine
14. occipital bone -
15. origin (muscle) -
16. peristaltic -
17. phrenic nerve -
18. pneumothorax -
19. thoracic duct -

MUSCLES OF RESPIRATION

MUSCLES OF INSPIRATION				
<u>MUSCLE</u>	<u>ORIGIN</u>	<u>INSERTION</u>	<u>ACTION</u>	<u>INNERVATION</u>
Diaphragm m.	sternum, costal cartilages, ribs 7-12	central tendon	contraction flattens diaphragm and enlarges thorax	Phrenic nerve
Scalenus medius m.	transverse process of C2-C7 cervical vertebrae 1-2,	1st rib	flexes and rotates head, elevates ribs flexes vert. column laterally	C3-C4
Sternocleidomastoid m.	head of sternum, head of clavicle	mastoid process nuchal line of occipital bone	rotates head pulls head upward elevates sternum	C1-C4
Pectoralis major m.	clavicle, sternum	crest of greater tubercle of humerus	draws ribs toward arms during forced inspiration	C5-C8, T1
Trapezius m.	occipital bone, ligamentum nuchae,	clavicle, scapula	raises shoulder, adducts scapula, elevates thoracic cage	C3-C4
External intercostal m.	11 on each side, inferior border of rib	superior border of rib below	pull ribs up and out	T1-T11

MUSCLES OF EXPIRATION				
<u>MUSCLE</u>	<u>ORIGIN</u>	<u>INSERTION</u>	<u>ACTION</u>	<u>INNERVATION</u>
Rectus abdominis m.	crest of pubis, interpubic ligament	cartilages of ribs 5-7, xiphoid process	compresses abdomen, flexes spine	T6-T11
Internal abdominis oblique m.	inguinal ligament, iliac crest, lumbar aponeurosis	lower costal cartilages, linea alba	flexes and rotates vertebral column, compresses abdominal viscera	T4-T12
Transverse abdominis m.	1) inner surface of costal cartilages of lower 6 ribs, 2) middle layer of lumbar fascia, 3) anterior 2/3 of iliac crest, 4) lateral 1/3 of inguinal ligament	aponeurotic sheath to linea alba	compresses abdomen, depresses ribs	T7-T12
Internal intercostal m.	11 on each side, inferior border of rib and costal cartilage	superior border of rib and costal cartilage below	pull ribs down and in	T1-T11