وَقُل رَّبِّ زِدْنِي عِلْمًا

النادي الطبي

RESPIRATORY SYSTEM

HAYAT BATCH

SUBJECT : Summary for physiology

LEC NO. : one

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Review the physiological anatomy of the pulmonary system and define conducting and respiratory zones.

The lung is made up of 2 trees ① vascular tree ② airway tree → the air way tree start at trachea then generate (divide) to 2 bronchus which enter the lung and generate to many branches → bronchioles typically the lung has 23 generation on average → first 16 are the conducting zone that doesn't have alveoli No gas exchange. called the anatomic dead zone. start at trachea & end at terminal bronchioles their functions are' ① warm & humidify the air ② distribute the air evenly to all lung parts ③ act as body defense system while the respiratory zone start at the transitional/respiratory bronchioles which contain alveoli on their wall gas exchange occur this zone is featured by the large surface area ~75 m^2 wich makes the forward gas flow slow & laminar

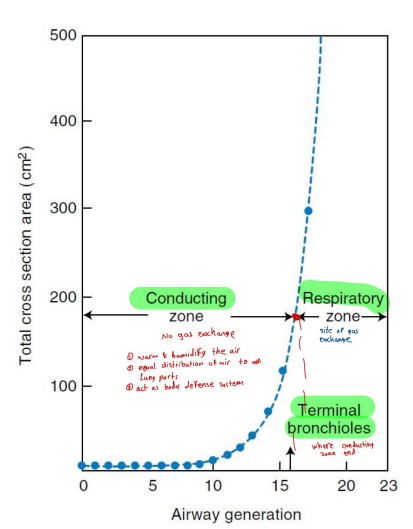
Zones of the respiratory system

① conducting zone

* No gas exchange
* No alveoli
* start at trachea & end at terminal bronchioles
* 150 ml → volume

② Respiratory zone

* site of gas exchange
* alveoli are present
* start at transitional bronchioles and end at alveolis
* 2.5 - 3 L



dentify the major functions of the lungs (the respiratory and non-respiratory functions) and Define cellular respiration and external respiration

Functions of the Respiratory system

A) main role: maintain constant internal environment by providing the oxygen needed for metaholism & excretion of CO_2

① external respiration carried out by pulmonary ventilation (inhalation & expiration), gas exchange through respiratory membrane and transport gases by blood to and from cells

② internal respiration: intracellular oxygen utalization

B) secondary roles (+) 1) non respiratory functions

1) aiding in acid-base balance
2) enabling voice production
3) Nose → smell & immune function
4) filter blood to prevent clots entering to the systematic circulation
5) reservoir to the blood
6) regulate hormonal & humoral concentration by pulmonary capillary epithelium
7) generate enough pressure for vomiting, defection, child birth → carried by the respiratory muscles

understand the steps of external respiration.

same as pulmonary ventilation which is the process of entering the air to the lung & excrete the air to the atmosphere

inspiration " it's an active process "

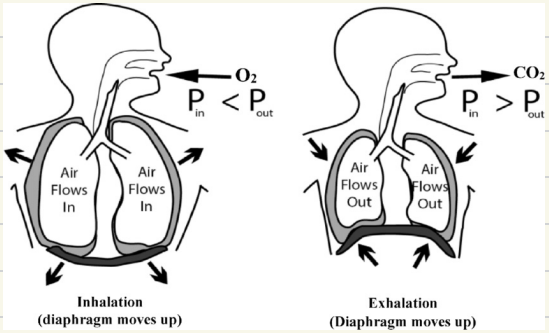
① contraction of diaphragm leading to increase in the vertical dimension
② contraction of external intra costal masdes leading to increase in transverse dimension
③ decrease the plural & alveolar pressure as result in increasing the volume
④ entering the air to the lung by passing the conducting & respiratory zones

expiration " it's a passive process "

① relaxation of diaphragm leading to decrease in the vertical dimension
② relaxation of external intra costal masdes leading to decrease in transverse dimension
③ increase the plural & alveolar pressure as result in decreasing the volume
④ excreting the air to the atmosphere by passing the conducting & respiratory zones

Note that in sever respiratory diseases or exercise we use muscles

which are ① abdominal recti
② internal intercostal muscles



Describe the generation of a pressure gradient between the atmospheres and the alveoli

- Air, like other fluids, moves from a region of higher pressure to one of lower pressure.
  - For air to flow into or out of the lungs, a pressure difference between the atmosphere and the alveoli must be created.
  - During normal inspiration, the alveolar pressure is made lower than atmospheric pressure.
  - This is achieved by contracting the muscles of inspiration, which increases the volume of the alveoli.
  - According to Boyle's law, when the volume of a gas increases, its pressure decreases.
  - Thus, lowering alveolar pressure below atmospheric pressure allows air to flow into the lungs1.

1 Intra-Alveolar Pressure and Airflow:

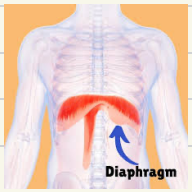
- When the pressure difference is sufficient to overcome the resistance offered by the conducting airways, air flows into the lungs.
- Intra-alveolar pressure eventually equalizes with atmospheric pressure.
- The pressure gradient drives airflow from a space of higher pressure (atmosphere) to a space of lower pressure (alveoli)

List the major muscles involved in respiration and state the role of each.

muscles of the respiratory system (main muscles)

① diaphragm *major

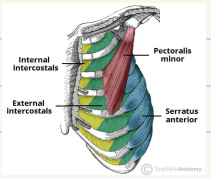
- upward: decrease vertical dimension
- downwords: increase vertical dimension



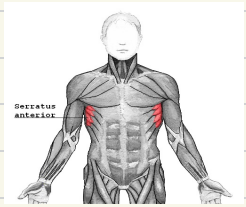
② External intercostal

- upwards: increase transverse dimension
- down words: decrease transverse dimension

"Bucket handle effect"



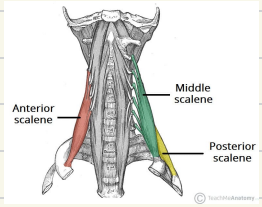
③ anterior serrati



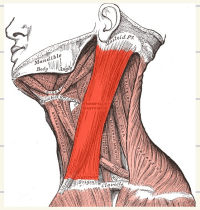
left the ribs assist with respiration

④ Scalene

Lefting the first two ribs during respiration



⑤ sternocleidomastoid



left the sternum

Define intrapleural pressure, alveolar pressure, transpulmonary pressure, and elastic recoil pressure

intrapleural pressure it is the pressure of the fluid in the narrow space between the lung pleura & the chest wall. it's around -5 to -7 cm-H2O and its negative due to the chest wall force (increase lung volume during inspiration) & lung (tend to shrink due to the elastic tissue.

alveolar pressure its the pressure of the air inside the alveoli, which is = to zero when there is no air in or out. and it's equal to -2 to +1 during respiration (in sever obstructive patients it is many times that.

transpulmonary pressure: it's the difference between the alveolar pressure & the intrapleural pressure, which is used to measure the force of the lung elastic tissue which tend to collapse the lung

elastic recoil pressure: it is the pressure that measure the difference in pressure between to side of an elastic tissue

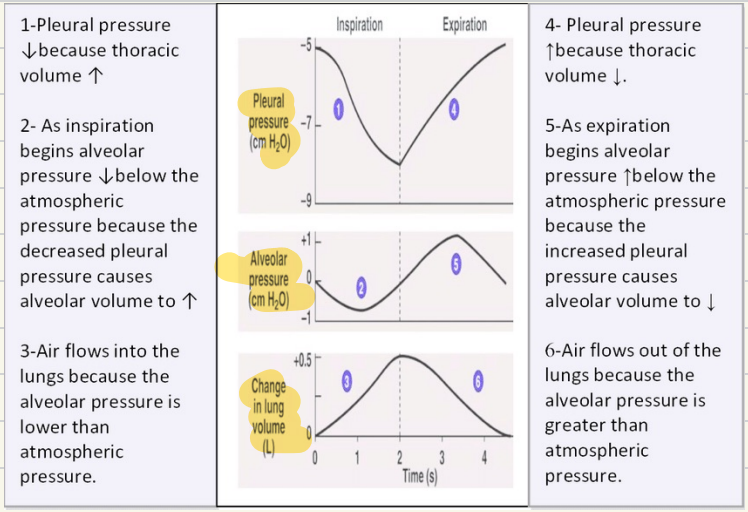
Notes

$$\text{pressure} = \frac{\Sigma P_{gases}}{\text{volume}}$$ ∝ ↑ volume ↓ pressure

* the air tend to move from high pressure area to low pressure area
* the negative pressure according to atmospheric pressure (it's no actually (-) the (-) mean it's less than the atmospheric pressure by that amount

Diagram how pleural pressure, alveolar pressure, airflow, and lung volume change during a normal quiet breathing cycle.
Identify on the figure the onset of inspiration, cessation of inspiration, and cessation of expiration.

1. **Cessation of Inspiration:**
   - **After inhalation, the diaphragm and external intercostal muscles relax.**
   - **The thoracic cavity decreases in size, causing the lungs to recoil.**
   - **Pleural pressure becomes less negative.**
   - **Alveolar pressure gradually increases and approaches atmospheric pressure.**
   - **Airflow into the alveoli stops.**
   - **Lung volume remains constant at the end of inspiration.**
2. **Cessation of Expiration:**
   - **After exhalation, the diaphragm and external intercostal muscles continue to relax.**
   - **The thoracic cavity further decreases in size.**
   - **Pleural pressure becomes less negative.**
   - **Alveolar pressure becomes higher than atmospheric pressure.**
   - **Airflow out of the alveoli stops.**
   - **Lung volume remains constant at the end of expiration.**



TEST QUESTION:

Q. Concerning the airways of the human lung:

A. The volume of the conducting zone is about 50 ml. No 150ml

B. The volume of the lung at the end of quite expiration is about 5 liters. No 2.5 – 3 L

C. A respiratory bronchiole can be distinguished from a terminal bronchiole because the latter has alveoli in its walls. opposite the respiratory bronchioles has alveoli on its wall

D. On the average, there are about three branchings (i.e. generations) of the conducting airways before the first alveoli appear in their walls. No 16

E. In the alveolar ducts, the predominant mode of gas flow is laminar rather than turbulent. true due to the large surface area