PASSION ACADEMIC TEAM

YU - MEDICINE

Sheet# 3 physiology

Lec. Date :

Lec. Title :

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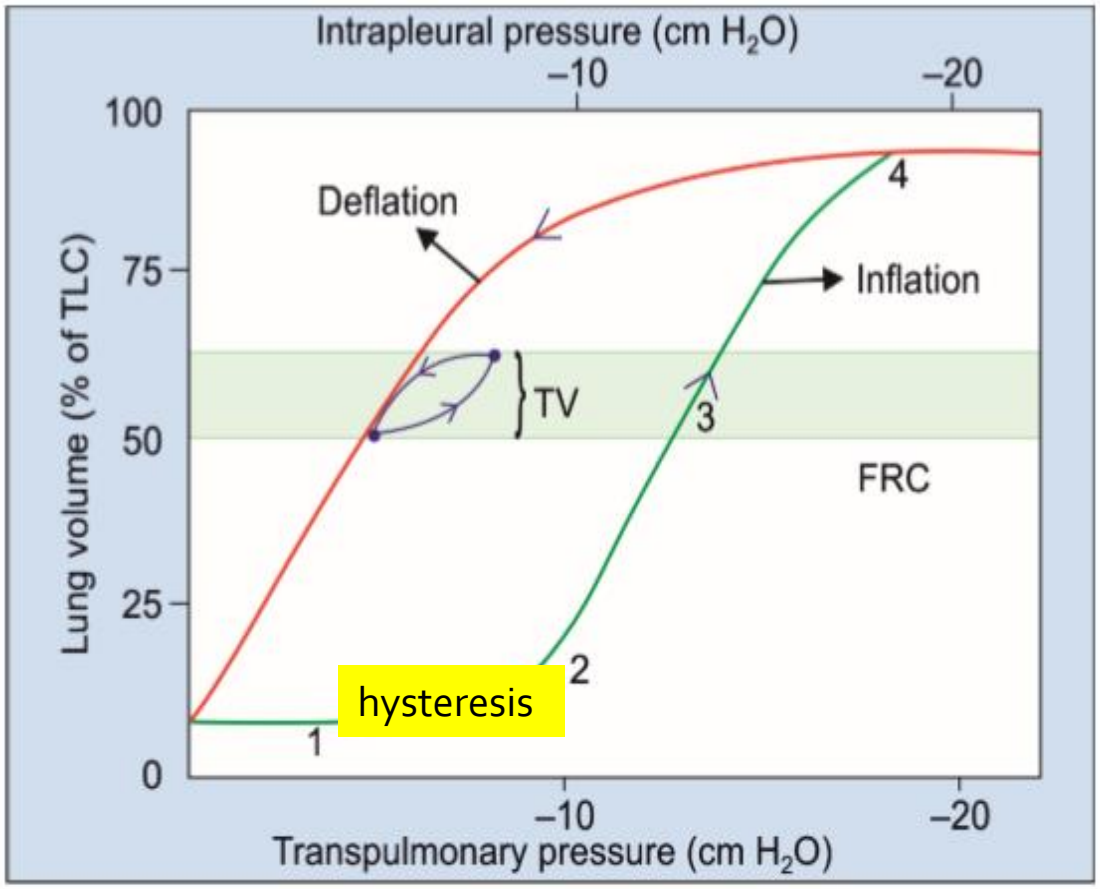
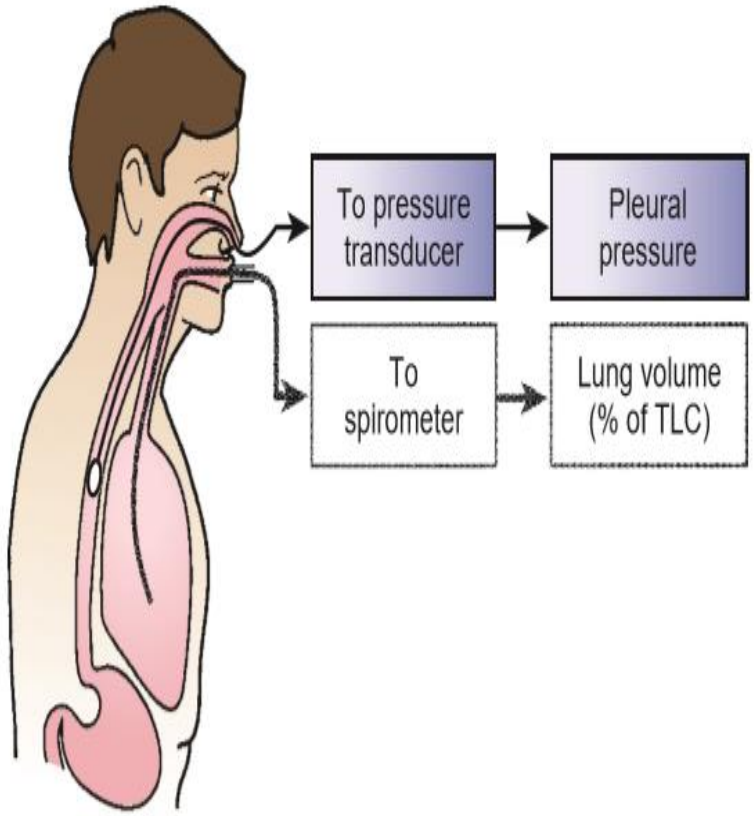
RESPIRATORY SYSTEM

Measurement of Lung Compliance

Static Lung Compliance Measurement



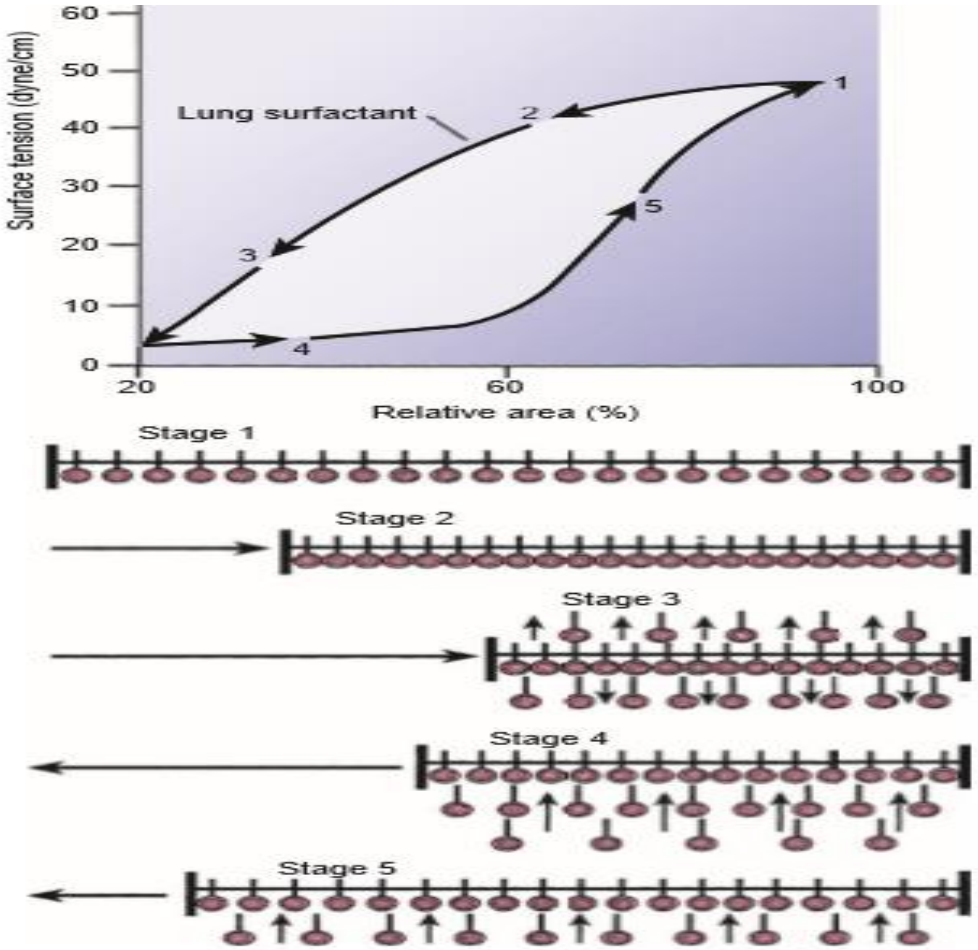


Hysteresis: difference in the compliance between inspiration and expiration

Role of Surfactant in Pulmonary Mechanics

- Turnover of lung surfactant is high because of continual replacement of surfactant during lung expansion.

Atelectasis following surgery??

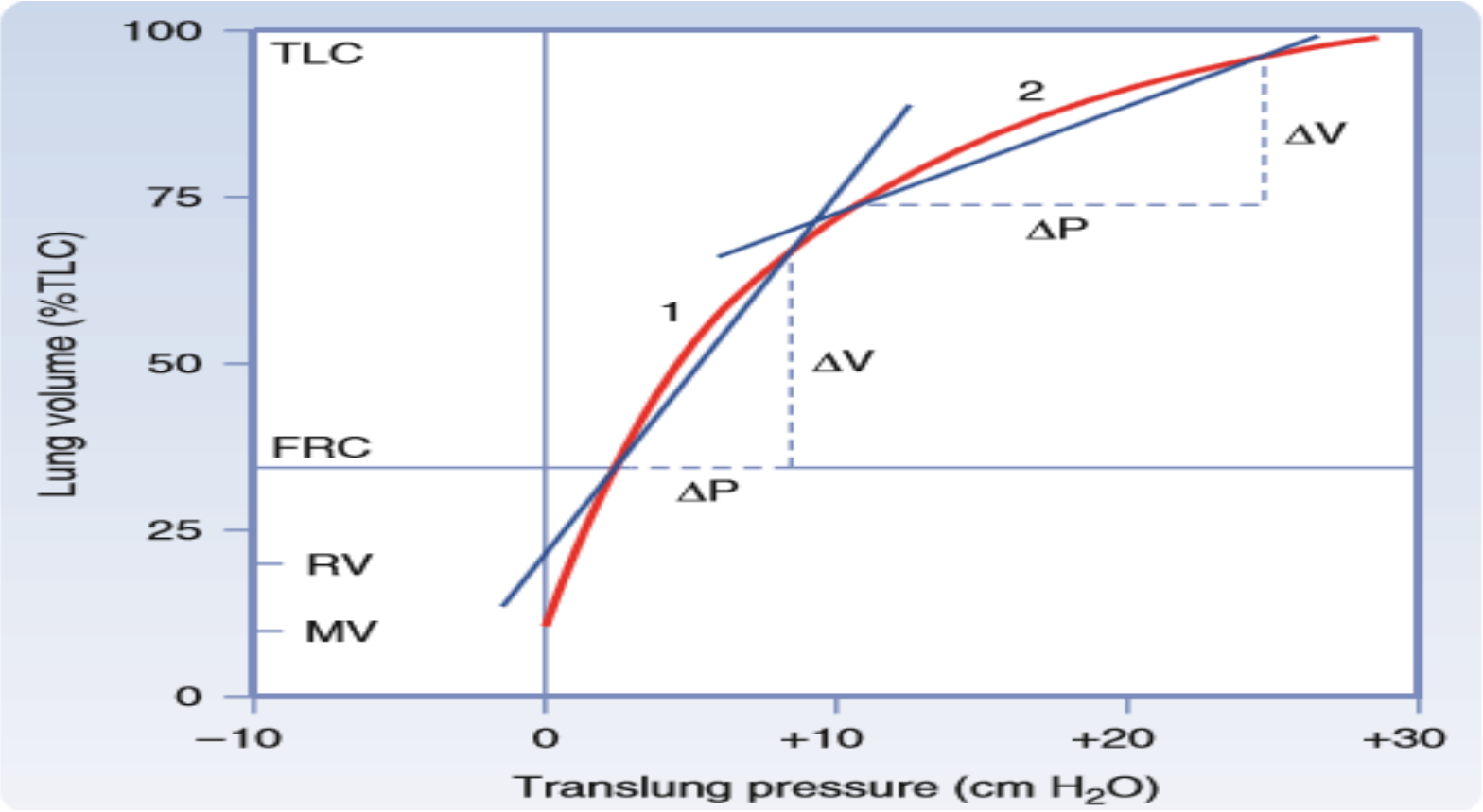


- Turn over of surfactant is high because its continually changed by lung. It is squeezed out and reformed. It is a fatty substance.
- Inspiration reforms it. New addition of surfactant is between air and water.
- At stage 1: there is high lung volume (at end of inspiration beginning of expiration). There is compression because there is expression now. The compression is due to elastic recoil.
- Muscle relaxation → reduction in negativity of pleural cavity. (transpulmonary pressure is less than elastic recoil).

- Stage 3 : area decreases, concentration of surfactant is high→ more efficient→ reduction in surface tension. This is important to stop lung collapse.
- The end of expiration→ surfactant is squeezed out so its reproduced in stage 4.
- Surface area increases faster than the addition of new surfactant. So surfactant is still in low concentration and it is not highly efficient yet increase in surface tension. Alveolar expansion is impaired.

- After thoracic/abdominal surgery, aletectasis can happen due to:
- 1)Anaesthesia relaxing muscles
- 2)Expansion.
- Stage 4→ surfactant replacement. If a person is doing slow shallow breathing= no re synthesis in surfactant= very high surface tension. So, encourage patient to breathe deeply to encourage surfactant addition between surface of air and fluid = reduction in surface tension.

Factors Affecting Lung Compliance



- **Lung volume**
- **Lung size…..specific compliance.**
- **Surface tension inside the alveoli**

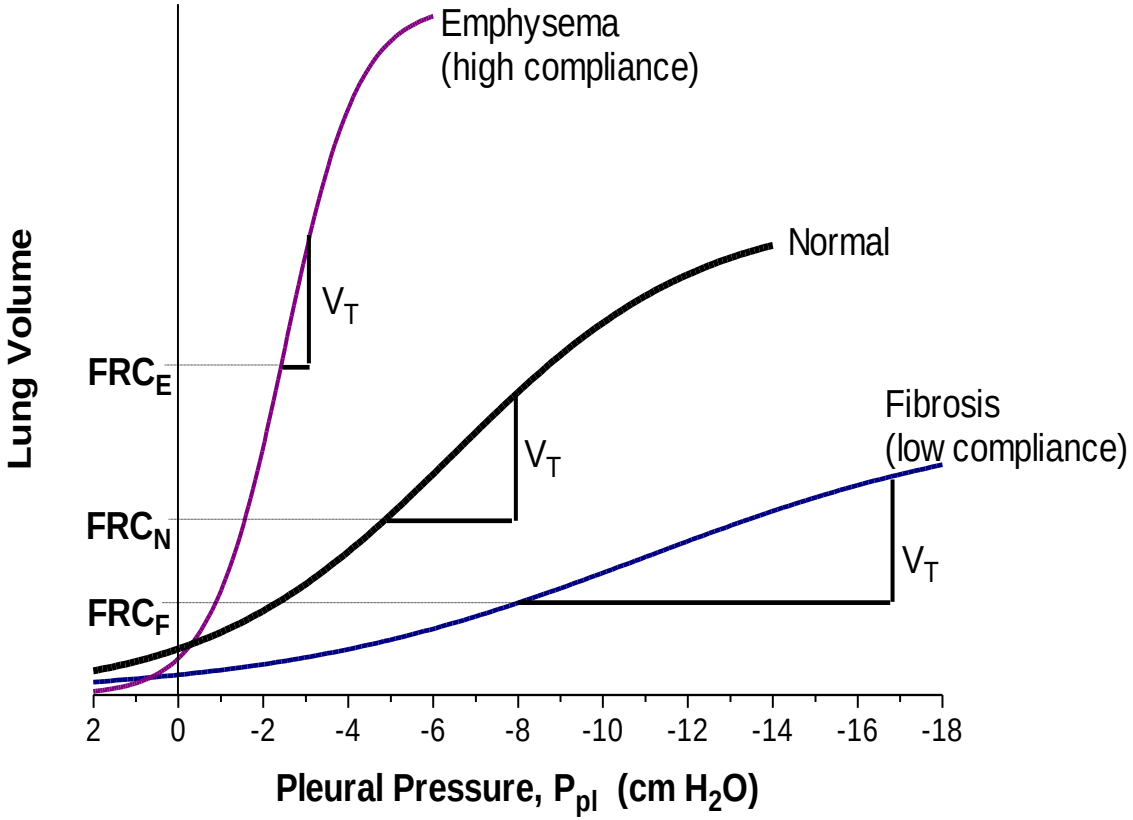
- Volume of lung affects lung compliance due to curve non linearity. So at high lung volumes compliance is low (at inspiration).
- Size of lung effects compliance. Adults lungs have higher compliance compared to children lungs due to their bigger size.
- How can you compare the compliance if the lungs sizes are different?
- Find the specific compliance.

Clinical Significance of Lung Compliance

Diseases of lung alter the lung compliance.

- Low lung compliance is seen in restrictive lung diseases like fibrosis.
- High compliance is seen in obstructive lung diseases like emphysema

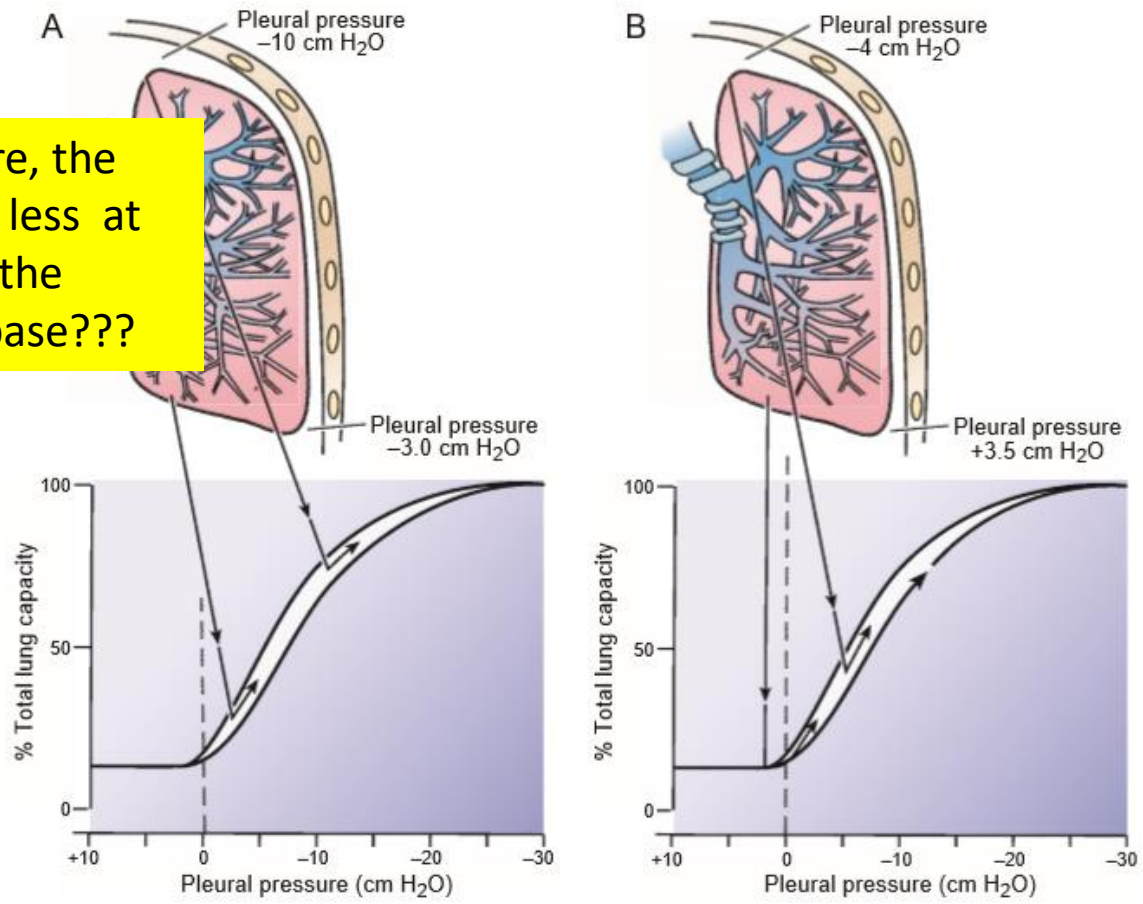
Pneumothorax??
RDS??



- Low compliance can be found in cystic fibrosis due to stiffness of the lungs. It cannot expand as much.
- High compliance can also be found in emphysema due to the high inflation of the lungs. The alveoli are baggy and lack elasticity, The lung has high volume.
- . Respiratory distress syndrome→ downwards→ decrease in compliance.
- More negative= transmural (alveolar minus pleural) pressure is higher at the apex. Pleural pressure increases transmural pressure decreases.

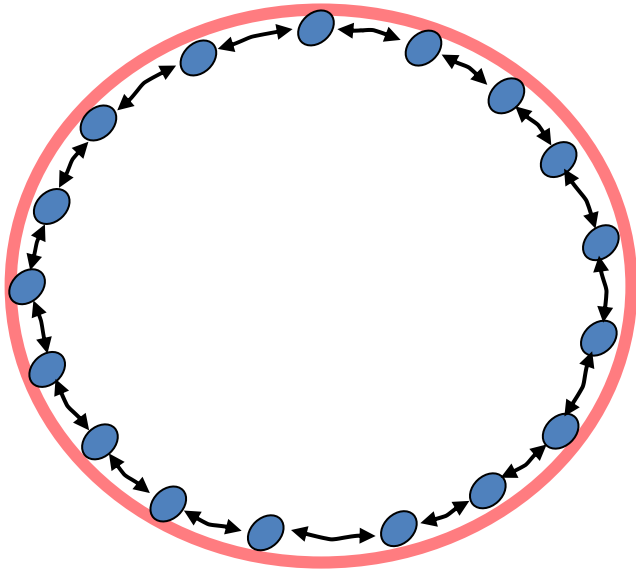
Regional Variation of Lung Compliance

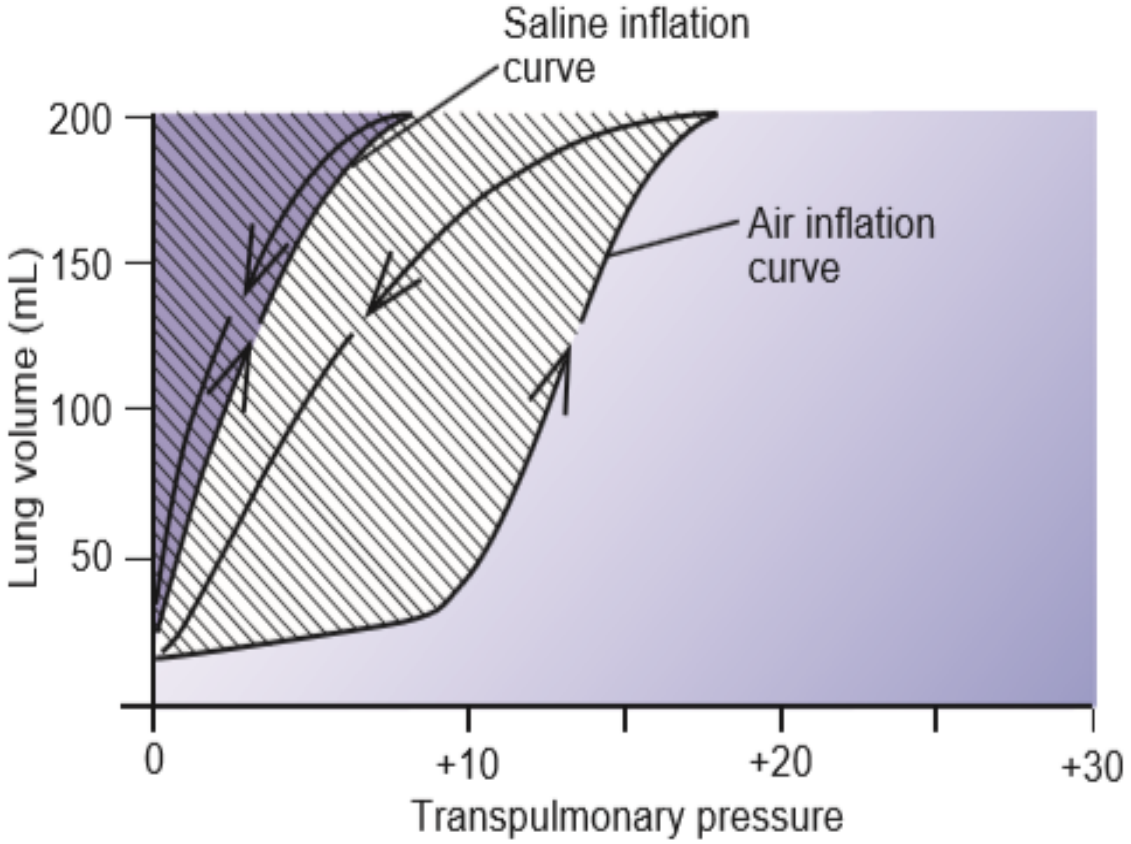
- In upright posture, the lung compliance is less at the top portion of the lungs than at the base???



- Surface tension= internal force in the alveoli that tries to compress the alveoli. Its formed due to the presence of air-fluid interface.
- Compliance changes depending on the gravity. In upright posture lung compliance is less at apex of the lung and higher at the base of the lung.
- The pleural pressure is higher at the apex.
- The gravity pulls the lung tissues downwards. So there is pleural space in the apex.

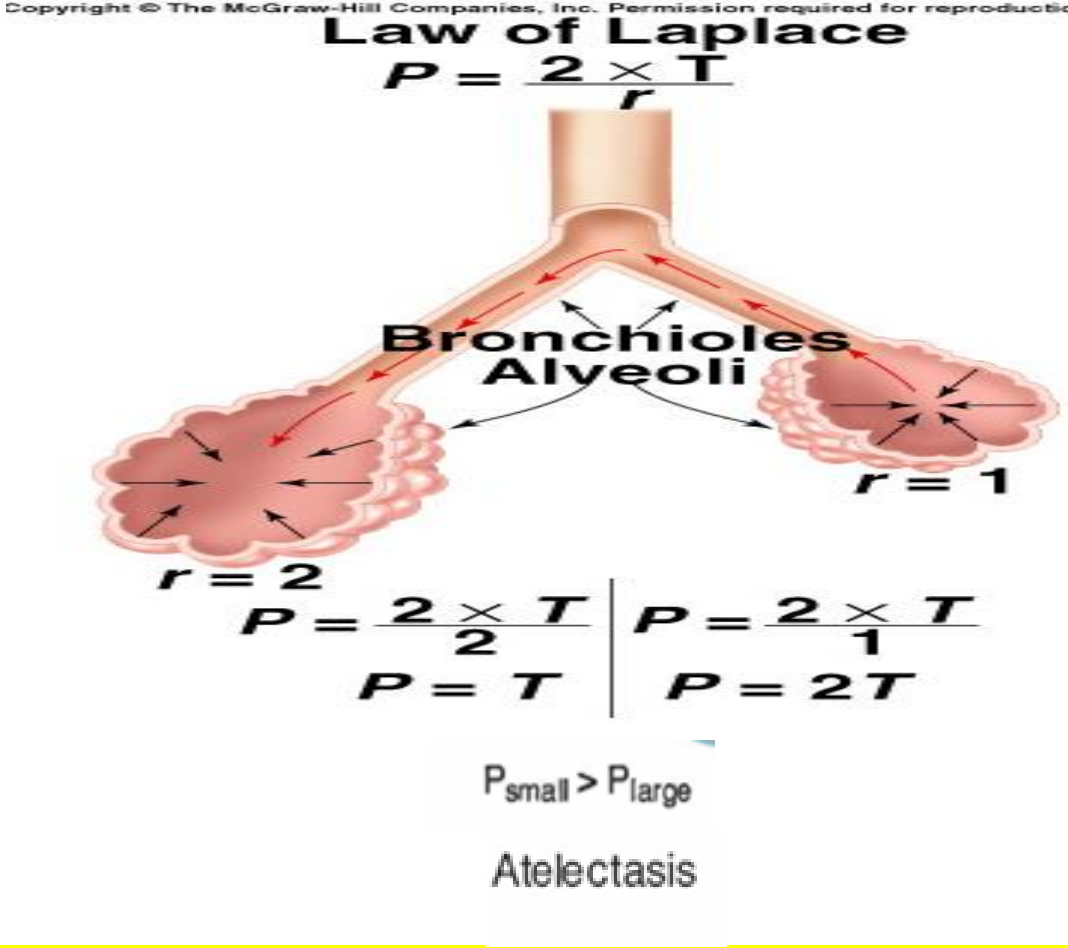
Surface Tension





- water molecules stronger than their attraction to air molecules. So, h2o m. are pulled tightly together due to forces underneath. So during alveolar inflation there are two opposing forces= surface tension and elastic recoil. 2/3 of work goes to overcoming surface tension. 1/3 to overcome elasticity.

Alveolar stability



Where:
p = pressure
T = surface tension
r = radius of alveolus

How do alveoli of different sizes coexist in the intact lung when interconnected? How does the normal lung prevent atelectasis at low lung volumes?

Role of Surfactant in Pulmonary Mechanics

- **pulmonary surfactant, which not only lowers surface tension at the gas–liquid interface but also changes surface tension with changes in alveolar diameter.**
- **Therefore, pulmonary surfactant makes it possible for alveoli of different diameters that are connected to coexist and be stable at low lung volumes, by lowering surface tension proportionately more in the smaller alveoli**