Lung compliance

Pulmonary compliance - is the ratio of the change in volume to the change in interpleural pressure that caused the change.

$$C = \frac{\Delta V}{\Delta P}$$

Interpleural pressure

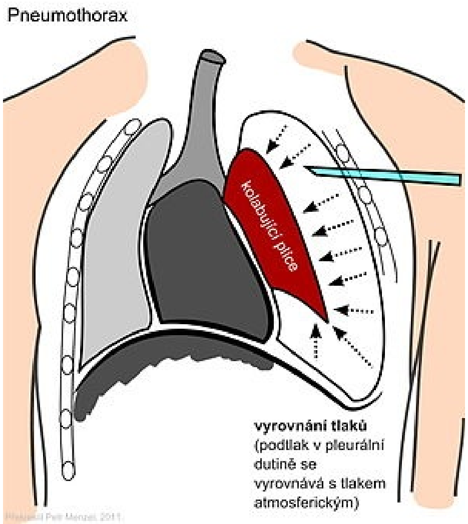
Is the pressure between the pleurae - visceral and parietal.

- It is always negative. On inspiration: -0.8 kPa, on expiration: -0.33 kPa.
- The IPT value at resting expiration is not uniform.
- Standing examinee has IPT more negative in upper parts of lungs than in base of lungs - probably due to weight of lungs. The consequence is different ventilation of the basal and apical parts of the lungs.
- Importance of IPT negativity - keeps lungs expanded - allows chest volume changes to be monitored and thus lung ventilation is secured.

Pneumothorax

Pneumothorax is a disturbance of the pleural cavity - air is present - the lung shrinks, breathing is impaired, and hypoxia is imminent.

1. Enclosed - air enters the pleural cavity from the alveolar space spontaneously or after lung injury.
2. Open - when the chest wall is injured - stab wound.
3. Valvular (tension) - air enters the pleural cavity with each respiratory movement but cannot escape.



Pneumothorax

Factors determining lung compliance

Elasticity of lung tissue

The lung is an elastic organ. The elasticity is due to the reticular arrangement of connective tissue. During exspiration, the fibers contract and bend. The elasticity is 1/3 of the total elasticity of the lung.

Surface tension of alveoli at the interface between alveolar air and alveolar lining

Compliance depends on the surface tension between the gas and fluid - that is, the internal surface area of the alveoli and the exchange of respiratory gases. For example, we have a bubble that is surrounded by a fluid - its surface tension will create an overpressure inside the bubble relative to the external pressure, its value determined by Laplace's law:

$$\Delta p = \frac{2\tau}{r}$$

- If the mouth of the cylinder (ductus alveolaris) is covered by a flat soap bubble, then r is high and P is small.

When we want to increase the volume of the bubble (alveolus) we have to decrease r and thus increase P - a large opening pressure is required. Further inflation increases r and decreases P. Alveoli behave similarly. In interconnected alveoli, the smaller alveolus may shrink in favour of the larger one, but in normal lungs this is prevented by surfactant.

Surfactant

- It reduces surface tension (more in smaller alveoli than in larger alveoli). It also prevents lung collapse.
- In premature infants, the lungs have not had time to develop a functional surfactant.
- Surface tension is therefore high and atelectasis occurs → alveolar collapse → Respiratory Distress Syndrome (RDS). Lung damage also occurs with oxygen poisoning. This is partly due to oxidative destruction of surfactant.
- Compliance decreases, alveoli collapse and **pulmonary edema** develops.

*For more information go to: **Surfactant**.*

References

Related articles

- Respiration and its disorders
- Lungs
- Mechanics of breathing

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