Lecture 2- Normal physiology (extension)

1. ***Describe the compliance of lung, its determinants and effects on distribution of ventilation and ventilation/perfusion (V/Q).***
    - Function residual capacity (FRC)
        - The volume we expire during tidal breathing
        - Determined inward recoil of lung = outward recoil of chest wall
            - Different disorders impact on these 2 parameters

Compliance of lung

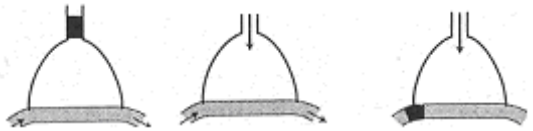
- Determined by elastic tissue of lung

Effects of compliance of lung effects distribution of gas in normal FRC

- Breathe in, generate negative pressure
- Causes volume change as compliance curve
- Gas into alveolus, less gas in alveolus in top part of lung
- Compliance of lung and FRC determines where gas go to -> bottom of lung

Ventilation/perfusion matching (V/Q)

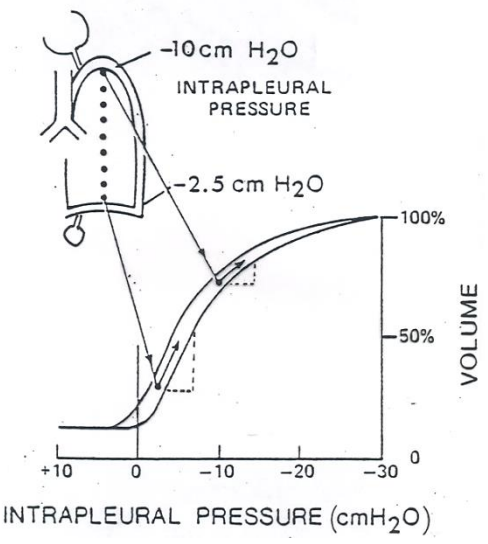
- Perfusion of lung is determined mainly by gravity
- Top of lung, slight V/Q mismatch; V/Q>1
- V/Q<1 at bottom of lung in older individuals
- Ideal V/Q during physical activity; V/Q=1



Modified West (1990)

V/Q<1 V/Q=1 V/Q>1

2. ***Explain the effects of size of tidal breath, FRC and the role of surfactant on compliance of the lung***



- Surfactant
    - Alters elastic recoil
    - Decreases surface tension in alveolus
    - Increases compliance/stiffness
    - Type 2 cells (line alveiol) stretch and surfactant is secreted onto alveolar surface (decreasing surface tension)

3. ***Describe the anatomy and physiology of normal defence mechanisms of the lung at the levels of the upper respiratory tract, lower respiratory tract and alveoli.***

Issues covered include:

- Structure of sputum
- Influence of particle size on site of deposition
- Structure and function of gel and sol mucus
- Airway lining layers
- Ciliary function
- Action of alveolar macrophages
- Role of coughing in mucociliary clearance

Lung defences:

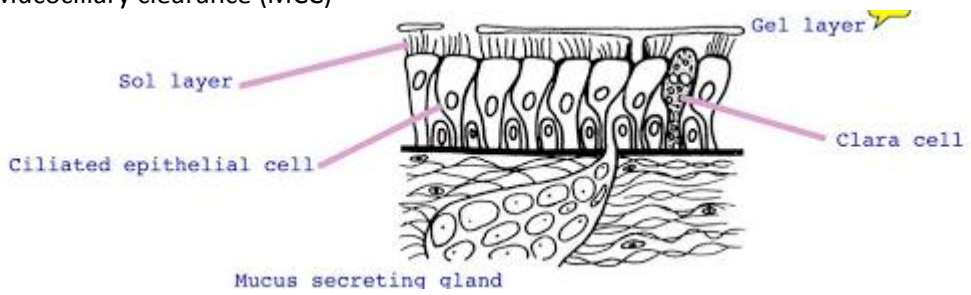
- Anatomical barriers
- Mucocillary defence mechanism
- Humeral response in the alveoli
- Cough

Defence mechanism

Anatomical feature	Size	Defence mechanism
nose	>.10µm	Turbulence in sinus Sneezing
bronchi	10-3 µm	MCC- mucociliary clearance Cough
Alveoli	2-3 µm	Macrophages Lymphocytes
	0.5 µm	Exhaled out

- Size of bacteria determines where it will land and cause infection 1-35 µm
- Virus 0.5-1 µm
- Asbestos 2-3 µm

Mucociliary clearance (MCC)



- Mucus layer
  - Sole layer= lubricating layer for cilia to move
  - Gel layer= bug gets caught in this layer
- Cilia move gel layer up to oropharynx
  - Effective stroke and recovery stroke
  - 12 times per second

- MCC main defence mechanism of lungs
- Drugs, anaesthetics, infections can affect MCC and cause problems

Alveoli clearance

- Slow (24 hours – 3 days)