

# Respiratory failure

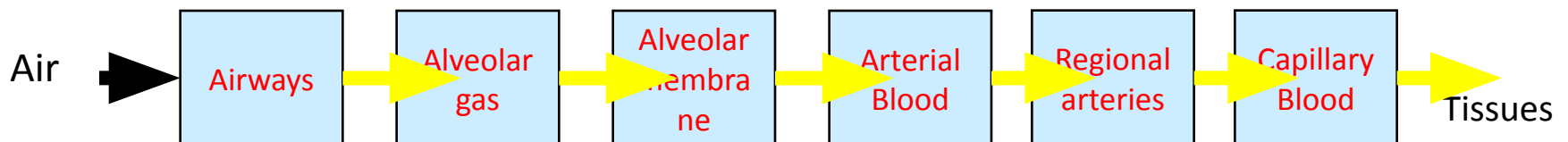
## **Kufa Medical College**

## In Respiratory System Ensures

- Oxygen enters the blood at the same rate as metabolism utilises it
- Carbon Dioxide leaves the blood at the same rate as metabolism produces it

## Oxygen Transport System

### Respiratory Failure



# In Respiratory Failure

- Not enough oxygen enters the blood
- Not enough CO<sub>2</sub> leaves it
- Do not necessarily occur together

## Type 1

- Not enough oxygen enters
- CO<sub>2</sub> loss not compromised
- pO<sub>2</sub> of arterial blood low
- pCO<sub>2</sub> normal or low

*Remind yourself*

- *Normal values*
- *Hb O<sub>2</sub> dissociation curve*

## Type 2 Respiratory Failure

- Not enough oxygen enters the blood
  - Not enough CO<sub>2</sub> leaves it
  - pO<sub>2</sub> low
  - pCO<sub>2</sub> high
- 
- *Remind yourself*
    - *Normal values*
    - *CO<sub>2</sub> transport*
    - *Blood buffers*

# Type 1 Respiratory Failure

- Oxygen cannot get from alveoli to blood
  - Some alveoli
  - Most alveoli

## *Remind yourself*

- *Structure of alveoli*
- *Pulmonary circulation*
- *Barriers to diffusion*

## Symptoms

- Breathlessness
- Exercise intolerance
- Cyanosis

## *Remind yourself*

- *Central & peripheral cyanosis*
- *Assessing exercise tolerance*

- **Some alveoli**
  - Pulmonary embolism
- **Ventilation perfusion matching**
  - Poor O<sub>2</sub> uptake in some alveoli cannot be compensated by increased uptake in others
- *Remind yourself*
  - *Pressures/flow in pulmonary circulation*
  - *Vascular control of pulmonary circulation*
  - *Pulmonary hypertension*

# Type 1 Resp. failure

- Some alveoli
  - Pneumonia
  - consolidation
- Remind yourself
  - Range of infecting organisms
  - Pathological mechanisms
  - Clinical signs
  - investigations

# Type 1 respiratory failure

- Most alveoli
  - Pulmonary oedema
    - Lengthen diffusion pathway
- Remind yourself
  - Mechanism tissue fluid formation
  - Reasons for increased filtration pressure in lung capillaries
  - Left heart failure



# Type 1 respiratory failure

- Most alveoli
  - fibrosis
    - Fibrosing alveolitis
    - Extrinsic allergic alveolitis
    - pneumoconiosis
- Remind yourself
  - Pathological mechanisms
  - Defence mechanisms of the airways

# Hypoxia

- Acute hypoxia
  - $pO_2 < 8.0 \text{ kPa}$
  - Peripheral chemoreceptors
  - Increased ventilation
  - Effects on  $pCO_2$
  - Central chemoreceptors
- Remind yourself
  - Functions of chemoreceptors
  - Respiratory alkalosis and acidosis

# Chronic hypoxia

- Renal correction of acid base balance
- Increased ventilation
- Increased oxygen transport capacity
  - Hb increased
  - DPG
- Remind yourself
  - Mechanism renal excretion  $\text{HCO}_3^-$
  - Assessing acid-base status
  - Control of red cell production
  - Factors affecting unloading of Hb

# Type 2 respiratory failure

- Alveolar  $pO_2$  down
- Alveolar  $pCO_2$  up
- Pump failure
- Remind yourself
  - Muscles of respiration and their control
  - Structure of airways
  - Mechanics of ventilation

# Type 2 respiratory failure

- Ineffective respiratory effort
  - Poor respiratory effort
  - Chest wall problems
  - Hard to ventilate lungs
- Remind yourself
  - Lung compliance
  - Airway resistance
  - Lung function testing

# Type 2 respiratory failure

- Poor respiratory effort
  - Respiratory depression
    - Narcotics
  - Muscle weakness
    - Upper motor neurone
    - Lower motor neurone
- Remind yourself
  - Effects of narcotics
  - Upper/lower mn defects
  - Neuromuscular transmission

# Type 2 respiratory failure

- Chest wall problems

- Scoliosis/ kyphosis
- Trauma
- Pneumothorax

- Remind yourself

- Anatomy of the chest wall
- Role of pleural seal
- Treatment of pneumothorax
  - Chest drains

# Type 2 respiratory failure

- Hard to ventilate lungs

- High airway resistance
- COPD
- Asthma

- Remind yourself

- Factors affecting airway resistance
- Acute/chronic bronchitis
- emphysema
- Pathophysiology of asthma



# Chronic Obstructive Pulmonary Disease

- Role of smoking
- Epidemiology
  - 18% male smokers
  - 14% female smokers
- Chronic bronchitis
  - Productive cough
- remind yourself
  - Histology of mucus production
  - Infecting organisms in acute bronchitis
  - Health behaviours
  - Smoking cessation

# Chronic Obstructive Pulmonary Disease

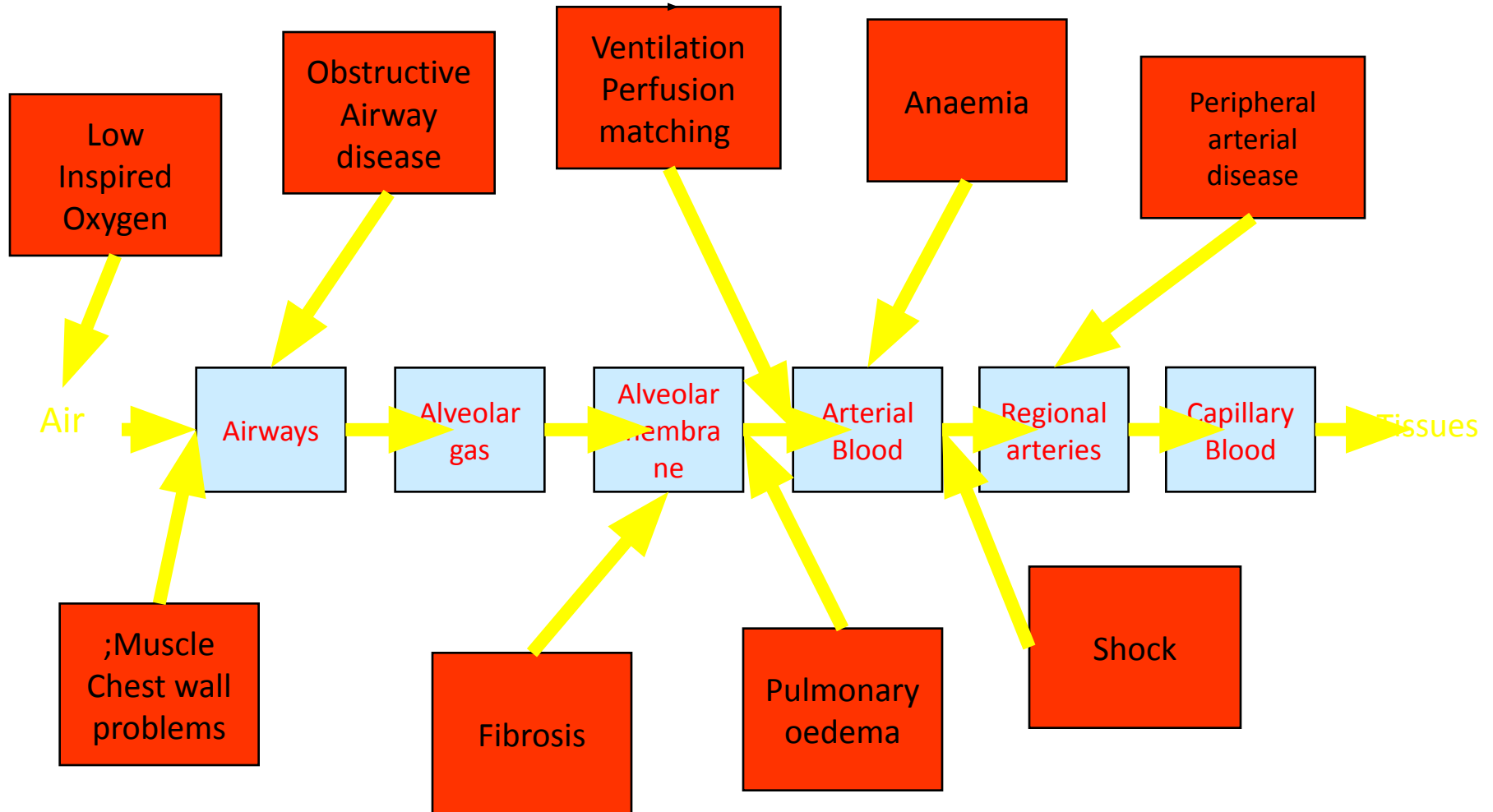
## – Emphysema

- Destruction of lung tissue
- Changes in compliance
- Ventilation perfusion mismatch
- Affects oxygen supply
- Type 1 failure initially

## • Remind yourself

- Antitrypsin deficiency

# Oxygen transport chain



# Acute effects of respiratory failure

- $p\text{CO}_2$  rises,  $p\text{O}_2$  falls
- Central chemoreceptors
- Breathlessness
  - Some compensation
- Remind yourself
  - Central chemoreceptors
  - Role of choroid plexus

# Chronic respiratory failure

- CO<sub>2</sub> retention
  - CSF acidity corrected by choroid plexus
  - Initial acidosis corrected by kidney
  - Reduction of respiratory drive
  - Persisting hypoxia
- Remind yourself
  - Role of central & peripheral chemoreceptors
  - Renal compensation mechanisms
  - Normal values
  - Assessing acid base status

# Chronic respiratory failure

- Pulmonary circulation
  - Effects of hypoxia on pulmonary arterioles
  - Pulmonary hypertension
  - Right heart failure
    - Cor pulmonare
- Remind yourself
  - Pressures in pulmonary circulation
  - Effects of right heart failure
    - Systemic oedema

# Disability

- Chronic respiratory failure severely disabling
  - Assessment
  - Care teams
- Remind yourself
  - Medical/social models of disability
  - Effects on family
  - Health policy issues

# Management of respiratory failure

- Oxygen therapy
- Removal of secretions
- Assisted ventilation
- Treat acute exacerbations
- Remind yourself
  - Techniques of assisted ventilation
  - Antibiotics for acute exacerbations



# At the end

- Intensive care
- Decisions about treatment
  - Ethical issues
  - DNR
- Remind yourself
  - Ethical principles
  - Legal issues
  - Cultural & religious issues around death & dying

# Questions for formative assessment

- 1- what are the compensatory steps occurs in acute type 1 respiratory failure.?
- 2-what are the compensatory steps occurs in acute type 2 respiratory failure
- 3- what do you think?. Is the central chemoreceptor sensitive more to  $H^+$   $CO_2$  or  $O_2$ ?.