

## Oxygen therapy

Discovered by Joseph Priestley and Antoine Lavoisier in 1774

### Oxygen cascade:

Oxygen tension: (1kpa=7.5 mmHg)

Inspired air(160 mmHg). expired air(116). Alveoli(104). Arteries(100). Veins(40). cells(2)

O<sub>2</sub> is carried in blood: Attached to hemoglobin: responsible for O<sub>2</sub> saturation

Dissolved in blood: free; responsible for O<sub>2</sub> tension(PO<sub>2</sub>)

O<sub>2</sub> is metabolized in citric acid cycle: Aerobic 38 ATP, Anaerobic 2ATP + Lactic acid

By mitochondria

**Utilized oxygen** = Arterial PO<sub>2</sub> – Venous PO<sub>2</sub>

Oxygen flux: The amount of oxygen leaving the left ventricle in a minute

= C.O cc/min x Arterial O<sub>2</sub> saturation% x Hb gm/100 x 1.34 ml of O<sub>2</sub> attached to each 1 gm Hb

= 5000 x 97/100 x 16/100 x 1.34 = 1000 cc O<sub>2</sub>/min . Only 250 cc is used by cells

### Oxygen dissociation curve

Gives the relation between PO<sub>2</sub> and Hb saturation with O<sub>2</sub>

Shift to the right : Anemia

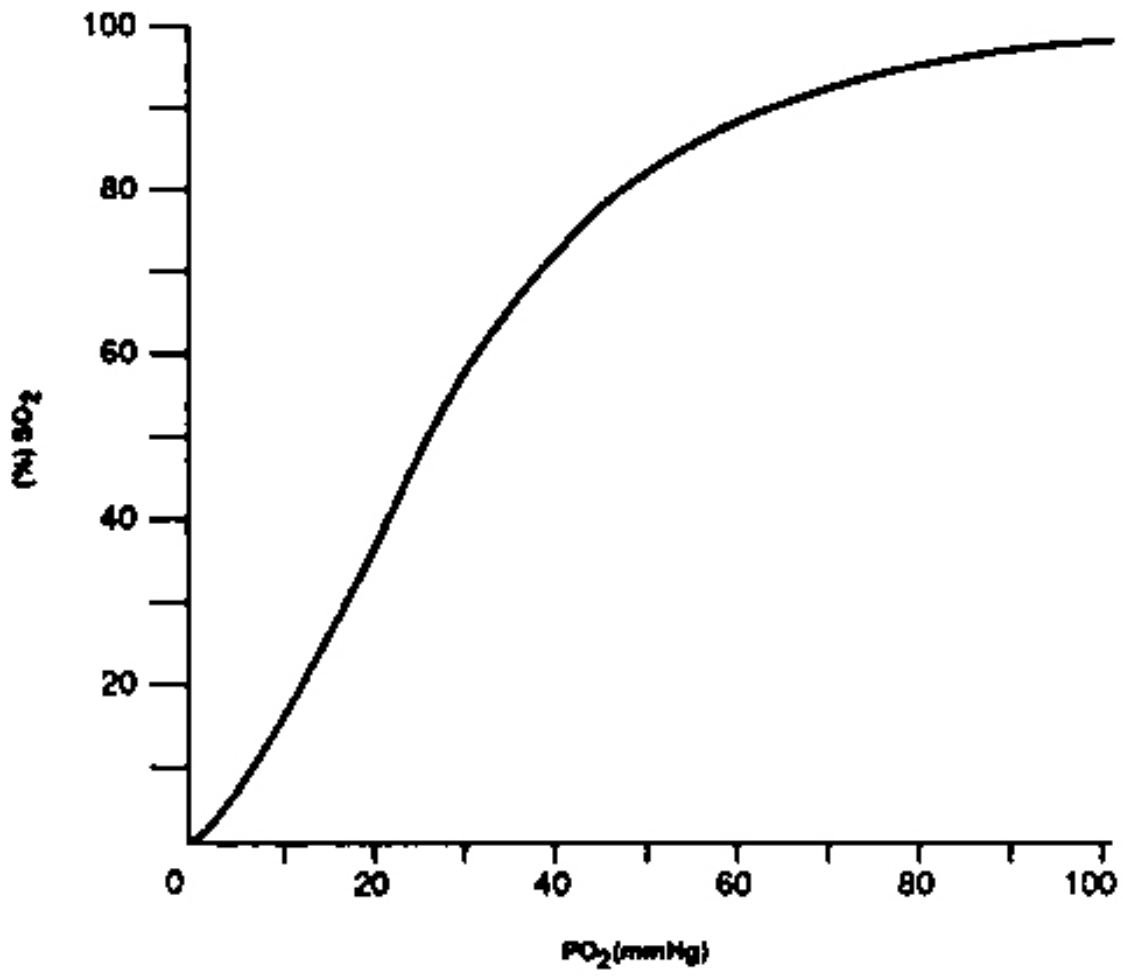
Acidosis

Increase PCO<sub>2</sub>

Increase temp.

Increase 2,3-diphosphoglyceric acid(DPG)

P<sub>50</sub>: the PaO<sub>2</sub> needed to make Hb saturation 50% = 26 mmHg



**Indications of O2 therapy:**

Cyanosis (reduced Hb>5gm)  
Chest injuries  
Shock  
To decompress distended bowel by nitrogen  
CO poisoning  
High metabolic rate

**Hypoxia:** lack of O2

Hypoxic hypoxia: high altitude, diffusion hypoxia  
Anemic hypoxia: decrease Hb, CO poisoning, Sickle, massive blood transfusion  
Stagnant hypoxia: Shock, embolism  
Histotoxic hypoxia: cyanide poisoning, tissue edema

**Methods to overcome hypoxia:**

Measures to increase oxygen availability  
    Raise the arterial oxygen tension  
    Raise the hemoglobin content  
    Remove acidosis  
    Increase the cardiac output  
Measures to reduce oxygen requirement  
    Paralysis and IPPV  
    Digitalization  
    Prevent hyperpyrexia  
    Induce hypothermia ( in 30C O2 requirement is only 40% of normal)

O2 therapy is indicated when PO2 decreases below 60 mmHg

**Delivery of oxygen:**

Nasal cannula: minimal patient discomfort extent 1cm into nares 6L/min  
Face mask: flow 5-8L/min  
Oxygen tent  
Hyperbaric oxygen chamber.....indications

### **Hazards of oxygen therapy:**

-Retrolental fibroplasia: specially in neonates with low birth weight. High O<sub>2</sub> result in vasoconstriction of immature retinal vessels leading to neovascularization and scarring which leads to impaired vision.

-CO<sub>2</sub> retention: In chronic obstructive airway diseases the patient get used to high PCO<sub>2</sub> and low PO<sub>2</sub>. When we remove the low PO<sub>2</sub> they get CO<sub>2</sub> retention.

-Atelectasis: Normally nitrogen in alveoli is in equilibrium with that in the pulmonary capillary blood and its loss is unlikely, this nitrogen act as a splint to alveolar wall. When oxygen is given, it will wash the alveolar nitrogen leading to collapse.

-Pulmonary oxygen toxicity: Prolong exposure of alveoli to O<sub>2</sub> causes pulmonary damage by formation of hyaline(fibrin) membranes with alveolar septal thickening and endothelial destruction, also there will be destruction of mucociliary clearance.

### **Postoperative hypoxia:**

Diffusion hypoxia

Lower functional residual capacity(FRC) than closing volume as in geriatrics and smokers

Decrease cardiac output which will decrease O<sub>2</sub> flux

Hypoventilation: Recurarization: because of vasoconstriction

Opiates such as fentanyl

Obstruction: tongue, secretion, vomiting, foreign bodies

Pain

### **Dry gas harmful effects:**

Ciliary paralysis: Dry gas arrested the activity of mucociliary transport system. If combined with increased musus viscosity(thick) will lead to inspissation and encrustation of mucus leading to inflammation and atelectesis

Decrease mucus flow from tracheobronchial epithelium: In children as they have narrow and small airways so will be easily blocked

### **Hazards of Humidification:**

Overheating leads to hyperpyrexia, it is good in burn patients only as they loss heat

Overhydration: specially in small children

Infection: due to contamination of the chamber with bacteria specially G-ve ...pneumonia

Increased airway resistance, specially if the solution nebulised by ultrasound not heat

Bronchopneumonia-like changes