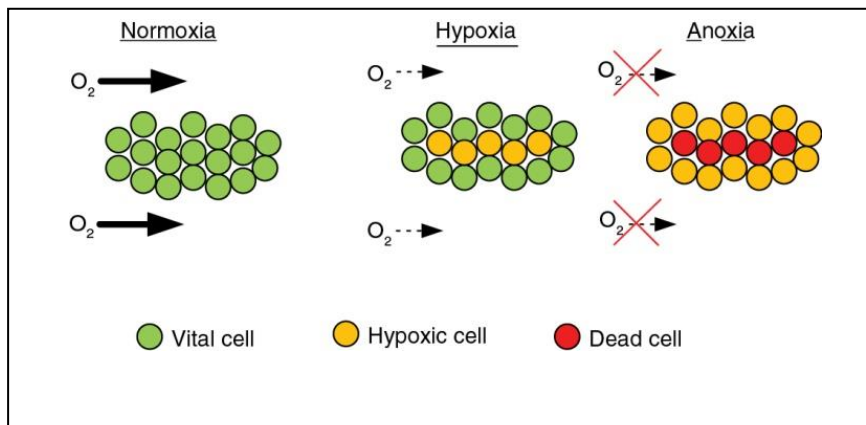




Hypoxia, Anoxia & Hypoxemia

- **Hypoxia** is defined as lack of oxygen at tissue level **or** Supply of O₂ is insufficient for normal life functions.
- **Hypoxemia** Low arterial oxygen supply.
- **Anoxia** is defined as complete absence of oxygen in the tissues



Symptoms of hypoxia

- **Acute symptoms**
Shortness of breath, Rapid breathing, Fast heart rate.
- **Severe Symptoms**
Confusion, Inability to communicate, Coma, death.





Types of hypoxia

A. Hypoxic hypoxia

- ❖ It is characterized by low arterial pO₂ when oxygen carrying capacity of blood and rate of blood flow to tissues are normal or elevated
- ❖ It is characterised by
 - i. Low arterial PO₂
 - ii. Low arterial % O₂ saturation of haemoglobin
 - iii. Low A-V PO₂ difference

Causes of hypoxic hypoxia

- a) Low PO₂ in the inspired air which include :
 - 1) High altitude.
 - 2) Breathing Gas mixture having low PO₂.
 - 3) Breathing in closed space.
- b) Decreased pulmonary ventilation due to respiratory disorder.
 - 1) Obstructive lung diseases (e.g. asthma).
 - 2) Mechanical or nervous disorder (e.g. neuromuscular disorder).
- c) Inadequate oxygenation of blood due to respiratory disorders which included :
 - 1) Impaired alveolar diffusion e.g. Emphysema (destruction of alveoli)
 - 2) Non functioning alveoli e.g. Fibrosis.
 - 3) Pulmonary Edema.
 - 4) Lack of surfactant collapse of lung
- d) Cardiac disorder
 - 1) Congestive Heart Failure
 - 2) Venous-to-arterial shunts ("right-to-left" cardiac shunts)

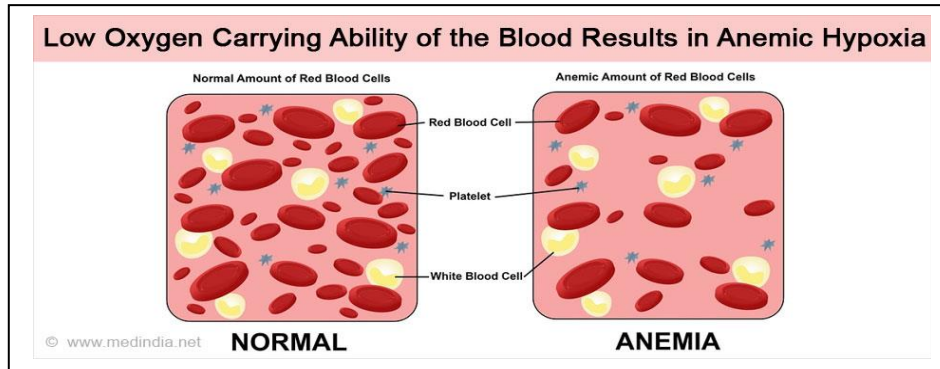
B. Anaemic hypoxia

- ❖ In anaemic hypoxia arterial pO₂ is normal but the amount of haemoglobin available to carry oxygen is reduced.
- ❖ Causes :
 - i. Anemia;
 - ii. Hemorrhage;
 - iii. Conversion of haemoglobin to some abnormal form.



Anaemic hypoxia characterized by:

- i. Normal arterial pO₂
- ii. arterial oxyhemoglobin are reduced
- iii. A-V pO₂ difference is normal



C. Stagnant(ischemic) Hypoxia

- ❖ Blood flow to the tissue is so low that adequate oxygen is not delivered to them .despite normal arterial pO₂ and haemoglobin concentration.
- ❖ Causes :
 - i. Circulatory failure;
 - ii. Haemorrhage via baroreceptors leading to reflex vasoconstriction.

Stagnant Hypoxia Characterized by:

- i. Normal arterial pO₂
- ii. Normal arterial hemoglobin content
- iii. normal arterial % O₂ saturation of haemoglobin
- iv. A-V difference more than normal

D.Histotoxic hypoxia

- ❖ Amount of oxygen delivered to the tissues is adequate but because of the action of toxic agents the tissues cannot make use of the oxygen supplied to them.
- ❖ **Cause** : Cyanide poisoning causing damage to enzyme cytochrome oxidase.
- ❖ **Characterized by:**
 - i. Normal PO₂
 - ii. A-V PO₂ difference is less than normal



Stages of Hypoxia

- 1. Indifferent:
At beginning, depression of eye function.
- 2. Compensatory:
Rise in respiration & heart rates, blood pressure.
- 3. Disturbance:
Obvious symptoms begin (numbness, tingling..etc)
- 4. Critical:
Loss of consciousness.

Adaptation to low Oxygen

1. A great increase in pulmonary ventilation

Up to 4 times that which normally occurs at sea level.

2. Increased number of red blood cells

The hematocrit & Blood volume increase over time.

3. Changes in the oxygen-hemoglobin dissociation curve

At the onset of hypoxia, the curve tends to shift to the left. This helps to oxygenate the blood in the lungs. Over time, production of 2,3-DPG by erythrocytes tends to pull the curve back to the right.

4. Increased efficiency of cellular metabolism

Produce more mitochondria and cellular oxidative enzymes

Treatment of hypoxia

- 1- Treatment of the underlying cause- depending upon the type of hypoxia
- 2. Oxygen therapy
 - i. Inhalation of 100% pure oxygen
 - ii. Hyperbaric oxygen therapy





Asthma

- Definition :
Inflammatory disease of the airways of the lungs.
- Causes:
Genetic or environmental (exposure to air pollutant & allergens).
- Symptoms:
Shortness of breath, Chest tightness , wheezing, Coughing (become worse during night & exercise).

Anesthetic Considerations

- Patients with poorly controlled asthma or wheezing at the time of anesthesia induction have a higher risk of perioperative complications.
- Patients with frequent or chronic bronchospasm should be placed on an optimal bronchodilating regimen.

Intraoperative Management

- Regional anesthesia will circumvent this problem, but some clinicians believe that high spinal or epidural anesthesia may aggravate bronchoconstriction
- Drugs often associated with histamine release (eg, atracurium, morphine, and meperidine) should be avoided or given very slowly when used.

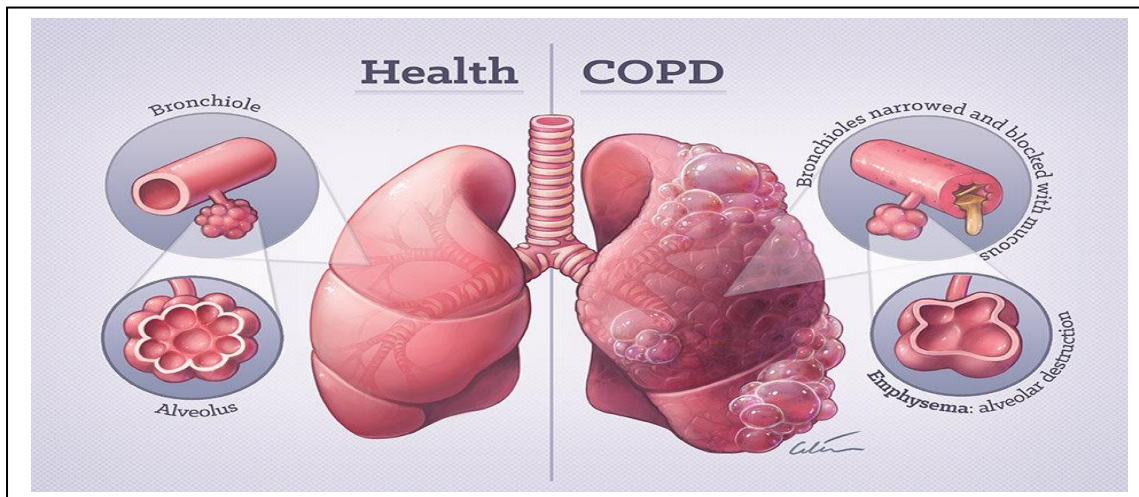
Asphyxia

- ❖ Definition:
It occurred when any obstacle prevents air from entering the passage way or when man inhale the expiratory air (Suffocation).
- ❖ Asphyxia Stages:
 1. Hypernea,
 2. Dyspnea ,
 3. Convulsions,
 4. Exhaustion,
 5. Collapse.

Chronic Obstructive Pulmonary Disease (COPD)

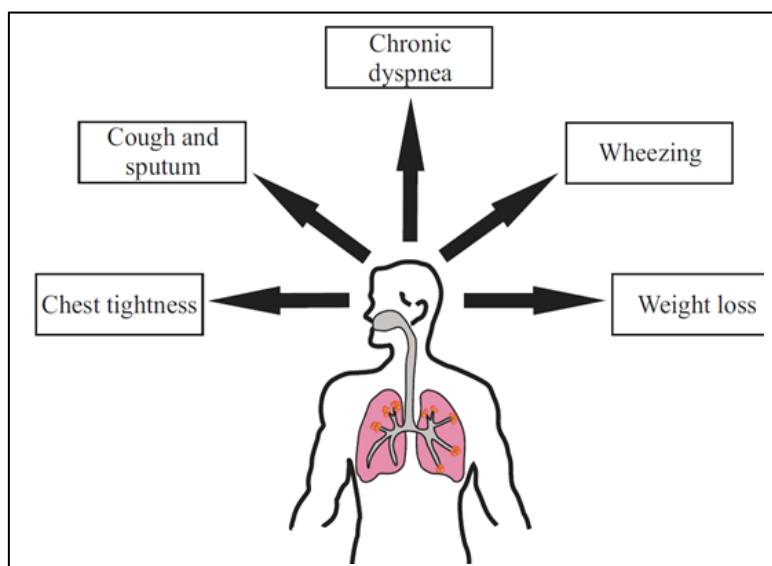
Definition:

Type of obstructive lung disease characterized by long term poor inflow.



Symptoms of COPD

1. Shortness of breath,
2. Cough with sputum production.
3. Walking up stairs and carrying things become difficult.





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Causes of COPD

1. Tobacco smoking,
2. Air pollution (poorly-ventilated heating and cooling places)
3. Genetic