- Pathophysiology of Abnormal Breathing

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- Objectives

At the end of the session the students should be able to:

- Define and classify Hypoxia, List its causes and describe its associated and compensatory changes.
- Define Cyanosis and mention its types and causes

- Define Cheyne- Stokes breathing and describe its pathophysiology

- Definitions

Hypoxia :

Hypoxia is defined as lack of oxygen at tissue level.

Anoxia :

Anoxia is defined as complete absence of oxygen in the tissues

- Types of hypoxia

- Hypoxic hypoxia
- Anaemic hypoxia
- Stagnant(ischaemic) hypoxia
- Histotoxic hypoxia
- A. Hypoxic hypoxia
- It is characterized by low arterial pO_2 when oxygen carrying capacity of blood and rate of blood flow to tissues are normal or elevated
- It is characterised by
- Low arterial pO_2
- Low arterial O_2 content
- Low arterial % O_2 saturation of haemoglobin

- Low A–V pO_2 difference

- Hypoxic hypoxia(contd.)

Causes:

- Low pO_2 of inspired air
- Decreased pulmonary ventilation
- Defect in exchange of gases
- Venous arterial shunts

- B.Anaemic hypoxia

In anaemic hypoxia arterial pO_2 is normal but the amount of haemoglobin available to carry oxygen is reduced.

Causes :

- Anemia
- Haemorrhage
- Conversion of haemoglobin to some abnormal form

• Anaemic hypoxia(contd.)

- Characterized by:
- Normal arterial pO_2
- arterial O_2 content moderately reduced
- A–V pO_2 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 pO_2 and haemoglobin concentration

Causes :

- Circulatory failure
- Haemorrhage via baroreceptors leading to reflex vasoconstriction

- **Stagnant hypoxia (contd.)**

Characterized by:

- Normal arterial pO_2

- Normal arterial O_2 content
- normal arterial % O_2 saturation of haemoglobin
- 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:**

. Normal pO_2

- No difference in O_2 content of arterial and venous blood.

. A-V pO_2 difference is less than normal

- **Clinical features of hypoxia**
- Hyperventilation is seen in all types of hypoxia except anemic hypoxia

- In all types of hypoxia the first symptoms are like that of alcohol overdose(drowsiness, depression/excitement, emotional outburst)

If oxygen saturation of haemoglobin falls below 60% there unconsciousness within 20 seconds, causing death in 4-5 minutes.

- Severe hypoxia(except anaemic) causes increase in heart rate and systemic blood pressure.
- Associated symptoms- nausea, vomiting and anorexia

- Treatment of hypoxia

- Treatment of the underlying cause- depending upon the type of hypoxia
- Oxygen therapy-
- Inhalation of 100% pure oxygen
- Hyperbaric oxygen therapy

- CYANOSIS

Bluish discoloration of skin and/or mucus membrane due to the presence of at least 5gm of reduced haemoglobin per 100ml of blood in capillaries.

Sites to be examined:

- Mucus membrane of undersurface of tongue

- Lips
- Ear lobes
- Nail beds
- Tip of nose

• Types of cyanosis:

- **Central cyanosis**– Due to a circulatory or ventilatory problem that leads to poor blood oxygenation in the lungs.

It develops when arterial saturation of blood with oxygen is ≤85%. Cyanosis may not be detected until saturation is 75% in dark-skinned individuals

- **Peripheral cyanosis**–Due to inadequate circulation.

All factors contributing to central cyanosis can also cause peripheral symptoms to appear, however peripheral cyanosis can be observed without there being heart or lung failures.

- **Causes of cyanosis**
- Hypoxic hypoxia
- Stagnant hypoxia
- Polycythemia
- Exposure to mild cold(approx 20^0 C) produces cyanosis while exposure to severe cold (appprox.

10^0 C or below) does not produce cyanosis.

- Cheyne-Stokes respiration

- Cheyne-Stokes respiration is also known as periodic respiration, with cycles of respiration that are increasingly deeper then shallower with possible periods of apnoea. Typically, over a period of 1 minute, a 10-20 second episode of apnoea or hypopnoea occurs followed by respirations of increasing depth and

frequency. The cycle then repeats itself.

- Causes of Cheyne-Stokes respiration
- Causes include:
  - Brainstem lesions: cerebrovascular event
  - Encephalitis
  - Raised intracranial pressure
  - Heart failure
  - Chronic pulmonary oedema
  - Altitude sickness

- Pathophysiology
- Instability of respiratory control underpins the

development of Cheyne-Stokes respiration and results from hyperventilation, prolonged circulation time, and reduced blood gas buffering capacity

Thanks……..