

Oxygen- its role in normal body function, benefits and potential harms of oxygen therapy

Slide No. 2: Objectives of this webinar

In this webinar we will learn about the following–

- What is oxygen? What is its role in body function?
- How is oxygen transported in the body?
- What is hypoxia and hyperoxia?
- What are the harms / potential toxicities of hypoxia and hyperoxia?

Slide No. 3: Oxygen

- Oxygen is expressed as O₂. It is a colorless / odorless gas which is essential for normal body functions. Oxygen is available to us from the atmospheric air. Normal oxygen concentration in the air is 21%. Oxygen is absorbed in to our body from the air which we breathe in.

Slide No 4: Role of oxygen in normal body function

- Oxygen is essential for normal functioning of each and every cell, the functional unit of our body.
 - Primarily it is required for energy synthesis (ATP)
 - This energy form (ATP) is used for synthesis of proteins / enzymes and to carry out normal cellular functions
 - Lack of oxygen results in inefficient energy synthesis and depletion of ATP eventually leading to cell death

Slide No. 5: Oxygen transport in the body

- Oxygen from the air we breathe enters the lungs and reaches the alveoli, the smaller breathing units of the lung
- From the alveoli oxygen is transported across in to the red blood cells of the blood carried in pulmonary capillaries
- In the RBC, oxygen binds to hemoglobin (Hb).
- Oxygen is carried from the lung to the left side of the heart and subsequently through aorta and its branches to the peripheral capillaries in the tissues.
- Oxygen is released to the tissues from hemoglobin.

- **Slide No 6: Measuring oxygenation**

- Oxygen delivered to baby is expressed as fraction of inspired oxygen concentration (FiO₂)
- Oxygen is transported bound to Hb and in dissolved form
- Oxygenation can be expressed as
 - Partial pressure of oxygen (PO₂) – which is the pressure exerted by the oxygen dissolved in blood. Normal PaO₂ in arterial blood is 50-70 mm Hg in neonates
 - Percentage saturation of oxygen (SpO₂)- which is percentage of oxygenated Hb . Normal SpO₂ is 90-95%.

Slide No 7: Oxygen dissociation curve

- When PO₂ is 27, SpO₂ is 50% i.e. 50% of the Hb is saturated with oxygen. At PO₂ of 50 oxygen saturation is 85% and at PO₂ of 70 it is 95%
- It is important to note that at higher oxygen saturations, PO₂ varies widely and thus may not accurately identify high PO₂ levels

Slide No. 8: Hypoxia and hyperoxia

- Hypoxia and hyperoxia are terms used to describe low or high levels of oxygen in blood.
- It can be defined based on arterial PO₂
 - Normal PaO₂: 50-70 mmHg
 - Hypoxia: PO₂ <50 mmHg from arterial blood sample
 - Hyperoxia: PO₂ >70 mmHg
- It can also be defined based on SpO₂
 - Normal saturation targets: 90-95%
 - Hypoxia: <90%
 - Hyperoxia: >95%

Slide No. 9: Effects of hypoxia

- Severe hypoxia developing over short time (acute hypoxia) affects almost all organ systems immediately particularly brain resulting in poor activity or lethargy progressing to loss of consciousness. Baby also develops shock, decreased urinary output, bradycardia and can progress to cardiac arrest if not attended to.
- Intermittent or prolonged hypoxia increase the risk of death and NEC in preterm infants. Hypoxia also causes periventricular leukomalacia in preterm infants resulting in neurodevelopmental impairment. It also results in pulmonary hypertension

Slide No. 10: Effects of hyperoxia

Hyperoxia causes free radical injury resulting in increased risk of

- Bronchopulmonary dysplasia
- Retinopathy of prematurity
- Brain damage in an infant with birth asphyxia

Slide No. 11: Monitoring oxygen status

- Clinical identification of hypoxia or hyperoxia is not possible. If not identified early will result in complications described earlier
- Continuous monitoring with pulse-oximeter is essential
- Oxygen saturation >95% may correspond to very high PaO₂ values and thus relying only on SpO₂ may fail to detect hyperoxia
- Maintaining strict oxygen saturation targets is advisable to avoid both hypoxia and hyperoxia.
- Desired oxygen saturation target is 90-95%

Slide No. 12: Summary

To conclude

- Oxygen is essential for normal function of the body
- Both hypoxia and hyperoxia are harmful to preterm babies
- Monitoring by pulseoximetry is essential
- Maintaining optimal oxygen saturation targets is essential to prevent harmful effects of hypoxia or hyperoxia