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Multi organ damage of oxygen toxicity: A review article

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Abstract
Introduction: Oxygen is very useful for living things, especially humans. Oxygen functions for the body's metabolism and especially cell metabolism. But oxygen can also be toxic to the human body. This is known as oxygen toxicity. Oxygen toxicity is a condition that results from the harmful effects of inhaling molecular oxygen (O2) at high partial pressures, called as oxygen toxicity syndrome, oxygen intoxication, and oxygen poisoning.
Discussion: Protocols to avoid hyperoxia exist in areas, when high pressure of oxygen is using for condition in medicine, some of emergency cases, some for rehabilitation condition. This protocol has resulted in an increased rarity of seizures due to oxygen poisoning, with lung and eye damage being primarily a problem in the management of preterm infants. This protocol has resulted in an increased rarity of seizures due to oxygen poisoning, with lung and eye damage being primarily a problem in the management of preterm infants. Moreover, oxygen could be toxic. The effects of oxygen poisoning can be classified by the organ affected, classified into three forms. First, The central nervous system, which is characterized by convulsions followed by stupor, occurs in a hyperbaric state. Second, pulmonary (lungs), characterized by difficulty breathing and pain in the chest, occurs when breathing high pressure oxygen for a long time. In the eye (retinopathic condition), characterized by changes in the eyes, occur when breathing high pressure oxygen for a long time.
Conlusion: High concentrations of oxygen also increase the formation of other free radicals, such as nitric oxide, peroxynitrite, and trioxidane, which harm DNA and other biomolecules. Although the body has many antioxidant systems such as glutathione that guard against oxidative stress, these systems are eventually overwhelmed by very high concentrations of free oxygen, and the rate of cellular damage exceeds the capacity of the systems that prevent or repair them. Subsequently, cell damage and death then occurs.

Keywords: oxygen, multi organ, toxicity

Introduction

Oxygen is very useful for living things, especially humans. Oxygen functions for the body's metabolism and especially cell metabolism. But oxygen can also be toxic to the human body. This is known as oxygen toxicity. Oxygen toxicity is a situation breathing oxygen become toxic because of high pressures. It is also known as oxygen toxicity syndrome, oxygen intoxication, and oxygen poisoning [1].
The toxicity of conditions on the central nervous system was discovery and description in the late 19th century. Severe cases can cause cellular damage and death, with the effects most commonly seen in the central nervous system, lungs and eyes. Oxygen toxicity is a problem for divers, those at high concentrations of oxygen, and those undergoing hyperbaric oxygen therapy [2].
When breathing there is an increase in oxygen concentration hyperoxia, excess oxygen in body tissues. Central nervous system toxicity caused by high concentrations of oxygen at might affect more damage if not on right doze. Pulmonary might have damage if got longer exposure with high concentration, along with ocular damage. Symptoms may include disorientation, difficulty breathing, and vision changes such as myopia [1].
High oxygen concentrations can cause membranes damage, lung defect, retinal damage, and seizures. Oxygen toxicity is managed by reducing exposure to high oxygen levels. Studies show that, in the long term, strong recovery from most types of oxygen poisoning is possible [3].
Protocols to avoid hyperoxia exist in areas, when high pressure of oxygen is using for condition in medicine, some of emergency cases, some for rehabilitation condition. This protocol has resulted in an increased rarity of seizures due to oxygen poisoning, with lung and eye damage being primarily a problem in the management of preterm infants [4].

Discussion

In recent years, oxygen has become available for recreational use in oxygen bars. Protocols to avoid hyperoxia exist in areas, when high pressure of oxygen is using for condition in medicine, some of emergency cases, some for rehabilitation condition. This protocol has resulted in an increased rarity of seizures due to oxygen poisoning, with lung and eye damage being primarily a problem in the management of preterm infants. Divers use breathing gases containing up to 100% oxygen, and must have special training in using these gases [4].

Moreover, oxygen could be toxic. The effects of oxygen poisoning can be classified by the organ affected, classified into three forms. First, The central nervous system, which is characterized by convulsions followed by stupor, occurs in a hyperbaric state. Second, pulmonary (lungs), characterized by difficulty breathing and pain in the chest, occurs when breathing high pressure oxygen for a long time. In the eye (retinopathic condition), characterized by changes in the eyes, occur when breathing high pressure oxygen for a long time [5].

Toxicity of Oxygen to the Central Nervous System

Central nervous system oxygen poisoning can cause convulsions, brief periods of rigidity followed by convulsions and fainting, and be of concern to divers who experience greater than atmospheric pressure. Pulmonary toxicity of oxygen results in damage to the lungs, causing pain and difficulty breathing [4].

Oxidative damage can occur in any cell in the body but the effects on the three most vulnerable organs will be of primary concern. It can also be involved in the destruction of red blood cells (hemolysis), damage to the liver (hepatic), heart (myocardial), endocrine glands (adrenal, gonadal, and thyroid), or kidney (kidneys), and general cell damage. Under unusual conditions, effects on other tissues may be observed. It is suspected that during spaceflight, high oxygen concentrations can cause bone destruction [5].

Hyperoxia can also worsening with people who had pulmonary disease due to exchange of oxygen activity in pulmonary tissue resulting central respiratory depression. Hyperoxia in sea level air has an oxygen partial pressure (ppO2) of 0.21 bar (21 kPa) and a lower limit for toxicity of more than 0.3 bar (30 kPa) [4].

Usually oxygen toxicity to the central nervous system occurs in divers. CNS oxygen toxicity, eg headache, difficulty maintain a steady depth, hyperventilation, weakness, and a choking sensation, are also more frequent in the data pool. All these symptoms can serve as a warning sign in diving on CNS oxygen toxicity. There were no cases of loss of consciousness [2].

Toxicity of Oxygen to the Lungs

Free radicals in high pressure of oxygen can damage and develop pulmonary disease, especially in infants. Inflammation of accumulation innate and adaptive immune system result in oxygen toxicity, fibrosis and lung damage [5].

Pulmonary toxicity shows symptoms of inflammation that starts in the airways leading to the lungs and then spreads to the lungs (tracheobronchial tree). Symptoms appear in the upper chest area (substernal and carinal areas). It starts as mild itching on inhalation and progresses to frequent coughing. If partial pressure breathing of increased oxygen not bubbling is stopped, the patient has mild burning on inhalation along with an uncontrollable cough and occasional shortness of breath (dyspnea) [6].

Physical findings related to pulmonary toxicity have included sounds heard through a stethoscope (bubbling rales), fever, and increased blood flow to the nasal lining (hyperemia of the nasal mucosa). Radiological findings of the lungs show inflammation and swelling (pulmonary oedema). Measurements of reduced lung function, as noted by a decrease in the amount of air the lungs can hold (vital capacity) and changes in expiratory function and lung elasticity [7].

Tests in animals have shown variations in tolerance similar to those found in central nervous system toxicity, as well as significant variation between species. Oxygen pressure up to 0.5 bar (50 kPa) or more is consistent, it allows the lungs to recover and delays the onset of toxicity [7].

Toxicity of Oxygen to the Eyes

Oxygen also induces aberrant physiological responses that can damage the eyes in premature infants. Vasoconstriction in the retina could lead to obliteration, vascularization damage, andretinophaty. Increasing knowledge of the mechanisms underlying oxygentoxicity in preterm infants has suggested strategies to minimize tissue injury and to optimize long-term medical outcomes [8].

These include supplemental oxygen and limiting light exposure, use of anti-inflammatory agents or antioxidants, and use of room air in neonatal resuscitation. In addition, in premature infants, signs of retinopathy results because between the vascularized and non areas of the retina of an infant. This level of demarcation is used to designate four stages: (I) demarcation is a line, (II) demarcation is a ridge; (III) growth of new blood vessels occurs around the ridge, (IV) retina begins to detach from the inner wall of the eye (choroid) [9].

The mechanism of oxygen-induced toxicity is the partial reduction of oxygen by one or two electrons to form reactive oxygen species, which are products of normal oxygen metabolism and have an important role in cellular markers. One species is produced by the body, the superoxide anion (O2-), which may be involved in the acquisition of iron. Higher than normal concentrations cause oxygen to increase levels of reactive oxygen species [10].

Oxygen is required for cell metabolism, and supplies blood to all parts of the body. When inhaling oxygen at high partial pressures, the hyperoxic state rapidly spreads, with the most vascularised tissues being the most vulnerable [11].

Conclusion

High concentrations could result free radicals. Free radicals could destroy cells tissue in human body. Damage to amino acids, lipids, bases, carbohydrates, cofactors and neurotransmitters can cause tissue damage if administered consistently and under high pressure. As a result, organ damage, especially the lungs, nerves and eyes is inevitable.

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