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Commentary

Effect of Oxidative Stress in Premature Newborns

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DESCRIPTION

Prematurity is a significant public health issue. Premature birth complications are the main cause of death in children under the age of five. Oxidative stress has been linked to this adverse circumstance as a probable pathophysiological condition. Premature neonates' antioxidant and immunological defense mechanisms are underdeveloped, making them more vulnerable to oxidative stress damages. A hypoxic-hyperoxic challenge, the presence of infections, a weakness in antioxidant defense, and high levels of free iron are the main causes of this sensitivity.

The transfer from the intrauterine to the extrauterine environment boosts free radical generation, which is generally suppressed by the antioxidant defense system. Excessive Reactive Oxygen Species (ROS) are produced when this control is disrupted, resulting in oxidative stress. In oxidative stress, the antioxidant defense system is unable to repair ROS damage due to either excessive ROS production or defective ROS inactivation, or a combination of the two.

Free radicals and oxygenated molecules of non-free radicals are both ROS. Oxidative stress and redox reaction imbalance can be caused by either of them. Oxygen-free radicals are highly reactive chemical species that react with a variety of biological components, including phospholipids, amino acids, and nucleic acids, to cause lipid peroxidation, DNA strand breaks, and other harmful reactions that result in cellular injury.

Several pathogenic processes implicated in newborn disorders are influenced by oxidative stress-induced damage. Most prematurity complications, such as Bronchopulmonary Dysplasia (BPD), Retinopathy of Prematurity (ROP), Necrotizing Enterocolitis (NEC), Intraventricular Haemorrhage (IVH), Periventricular Leukomalacia (PVL), and white matter lesions, appear to be linked to oxidative injury, according to some studies.

Oxidative stress is a physiological phenomenon that occurs in premature neonates during the normal shift from the intrauterine to the extrauterine environment. Free radical production grows dramatically outside of the uterus and must be counter balanced by the antioxidant defense system. Healthy full-term neonates can withstand these rapid alterations; but, tolerance may be compromised if intrauterine development is inadequate or aberrant. To improve newborn care, accurate biomarkers for analyzing the oxidant-antioxidant system dysregulation are needed. Furthermore, assessing oxidative stress in cord blood may be helpful in predicting the prognosis of various diseases.

Increased levels of oxidative stress biomarkers and/or lower levels of antioxidants in cord blood are linked to a higher risk of clinical outcomes such newborn illnesses and morbidity. ROP, Intrauterine Growth Restriction (IUGR), Respiratory Distress Syndrome (RDS), sepsis, and morbidity and mortality were among the diseases that indicated a stronger correlation with increased oxidative stress and/or lower antioxidant levels. The start of the primary diseases of the preterm infant, such as BPD, ROP, NEC, IVH, periventricular leukomalacia, and white matter abnormalities, appears to be linked to an imbalance between the newborn's oxidant and antioxidant components.

The ability to accurately diagnose oxidative damage and the possibility of targeted therapy could help to enhance infant care. None of these biomarkers are currently used in clinical practice. However, more research into the topic may be able to assist overcome the technical and cost constraints, allowing them to be used on a regular basis. In the future, diagnostic tools for identifying the risk of oxidative stress-related diseases may be created, and guidelines for their prevention and treatment may be updated, thereby lowering the morbidity and mortality of premature infants. The measurement of oxidative stress and antioxidant levels in premature neonates' cord blood could aid in the diagnosis and prognosis of a variety of clinically relevant diseases. The pathophysiology of the development of various neonatal disorders involves oxidative stress and antioxidant activity, and the effects are linked to increased short- and long-term morbidity, poor neurodevelopment, and higher mortality.

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