Oxidative Stress Biomarkers in the Preterm Infant

In term infants under physiological conditions, oxidative stress plays an important role in the fetal-to-neonatal transition. However, the antioxidant defense system develops late in gestation. Furthermore, in extremely low gestational age neonates (ELGANs), the onset of respiration often implies exposure to high oxygen and lung trauma which are unequivocally conditioning their mortality, morbidity and long-term outcome.

Free radicals formed by reactive oxygen species (ROS) may react with non-radical molecules in chain reactions causing damage to DNA, proteins, and lipids or by promoting the formation of adducts with DNA and proteins. ROS mediated lipid peroxidation is of special importance due to the high lipid content in the brain, which is the second tissue in lipid content after adipose tissue and hence biomarkers for lipid peroxidation are associated with neuronal damage in ELGANs.

In recent years, experimental and clinical research studies have aimed to define the best approach for reanimation of ELGANs. At the same time, urinary reference ranges of oxidative stress biomarkers have been studied in this target group covering the whole neonatal period. Sample preparation and analytical methods were tailored to the needs of these especially vulnerable patients employing highly sensitive and selective hyphenated tandem mass spectrometric techniques. Validated analytical procedures demonstrated adequate performance in terms of sensitivity, selectivity, accuracy and precision and were successfully applied to the analysis of over 500 urine samples from ELGANs. Different lipid peroxidation byproducts show diverse profiles of urinary elimination, affecting the selection of optimum sampling time points in clinical studies. Results were compared to biomarker levels found in ELGANs suffering from oxidative stress related diseases such as bronchopulmonary disease (BPD) and isofurans have been associated with chronic lung disease independently of the initial FiO_2 used during resuscitation. Hence, isofurans in urine seem to be an early and valuable predictive biomarker of BPD which could be suitable for aiding clinicians to predict development of chronic lung conditions.