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Biomarkers of Oxidative Stress in Acute and Chronic Diseases

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Introduction

Molecular biomarkers allow for individual decisions in the complex management of both acute and chronic diseases and their identification is a critical step toward achieving the important goal of developing personalised therapies. Pathways and molecules involved in the pathophysiological mechanisms of acute or chronic diseases, such as oxidative stress (OS), may be ideal biomarker candidates. Oxidative stress is a key mechanism in the development and progression of many chronic inflammatory diseases, including cardiovascular disease, neurodegenerative disease, infection disease, diabetes and cancer [1].

Description

The breakdown of the physiological balance between pro-oxidant factors and antioxidant defences, which is essential for both the maintenance of low levels of free radicals and the homeostasis of human tissues, results in the overproduction of reactive oxygen species (ROS) and reactive nitrogen species (RNS), both of which are toxic to cells. This determines the accumulation of cell damage, which leads to the destruction of cellular homeostasis and a severe relapse reaching the systemic level. The growing understanding of redox dynamics and the biological mechanisms underlying diseases, as well as the need for increasingly early biomarkers in order to optimise the diagnostic process, has led to the development of new specific and sensitive instruments for measuring OS in various biological materials [2].

Many of these new biomarkers have been proposed as useful tools in the monitoring of various diseases, as well as valuable aids in the evaluation of treatment efficacy. As a result, OS biomarkers are important in assessing disease status and the health-promoting effects of antioxidants. Furthermore, a recent longitudinal study investigated the relationship between blood pressure measurements and CRP and MDA levels determined in dried blood spots (DBS), as well as whether baseline levels of CRP or MDA were associated with changes in BP observed over a 1-year period. They discovered that DBS CRP, a biomarker of chronic inflammation, was significantly associated with systolic blood pressure (SBP) change over a 1-year period in women with incident hypertension living in rural Senegal, while DBS MDA, a biomarker of acute oxidative stress, was significantly associated with concurrent SBP levels [3].

Y59 rats were injected intraperitoneally with iron dextran solution at a dose of 50 mg/kg or exposed to inhaled anaesthetics sevoflurane and isoflurane and their combination for 28 days every other day, resulting in M1 macrophage polarisation. As a result, these findings suggested that iron, in combination with sevoflurane, has a protective effect in tissues exhibiting the M2 phenotype of macrophages, whereas iron dextran and isoflurane in rats determines an increase in the erythropoiesis process via hypoxia induction.

The protective therapeutic effects of Lemna minor extracts on bleomycin-induced pulmonary fibrosis in mouse models (L. minor, Duckweed; a fast-growing freshwater plant used in traditional medicine as an antiscorbutic, depurative diuretic, natural agent effective for colds). They also investigated the mechanism of action of L. minor extract against pulmonary fibrosis. They hypothesised that L. minor prevents bleomycin-induced lung disorders and fibrosis in mice models by regulating protein carbonylation and protein peroxidation levels, inhibiting the production of proinflammatory, pro-fibrous cytokines and reducing oxidative disorders [4,5].

Conclusion

A pilot study using 1H-NMR spectroscopy revealed a typical metabolic profile in Takotsubo syndrome patients, with an increase in circulating KB, ALCAR, glutamate and Phe/Tyr ratio and a decrease in total amino acids, histidine, arginine, alanine and methionine. Based on this finding, they believe that future incorporation of metabolic markers into clinical practice may improve risk stratification in TTS. the critical role of OS in osteomyelitis disease and its implications for the delicate balance of osteoblastogenesis and osteoclastogenesis As a result, they have emphasised the possibility of more accurately measuring the level of OS as a valid support in disease management

Acknowledgement

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Conflict of Interest

There are no conflicts of interest by author.

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