Study of oxidative stress-induced alterations (G6PD, Complex I, 8-OHdG, oxidized proteins) in the blood and tumor tissue of patients with prostate cancer

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It is known that reactive oxygen species (ROS) play a crucial role in various aspects of cellular behavior — from signal transduction to cell death. Activation of ROS and dysregulation of antioxidant mechanisms are frequently observed in cancer processes. ROS perform a dual function: on the one hand, they are essential for normal physiological cellular activity, while on the other, their excessive accumulation leads to cell death. Tumor development is accompanied by increased ROS generation, along with the upregulation of cellular defense mechanisms, ultimately leading to the mobilization of oxidative-antioxidant systems to ensure the survival of cancer cells.

Based on this, our study aimed to assess oxidative stress and oxidative damage-related changes in the tissue and blood of men with benign and malignant prostate tumors. Within the framework of the research, we evaluated the enzymatic activity of mitochondrial Complex I — one of the main sources of ROS production. Levels of malondialdehyde (MDA), a sensitive marker of lipid peroxidation, and 8-hydroxy-2'-deoxyguanosine (8-OHdG), a biomarker of DNA damage, were measured. To evaluate antioxidant status and the influence of oxidative stress, the activity of glucose-6-phosphate dehydrogenase (G6PD) and the extent of protein oxidative damage were also determined.

The results revealed that, in malignant tumor tissue, the activity of Complex I, levels of MDA and 8-OHdG, G6PD activity, and protein oxidation differed significantly compared to both benign tissue and control samples. These changes indicate mitochondrial dysfunction, alterations in antioxidant system activity, and increased oxidative stress, all of which play important roles in tumor progression.

Based on the obtained data, it can be assumed that oxidative stress and related biomolecular damage — including damage to DNA, lipids, and proteins — are closely associated with cancer progression. The combined alteration of these biomarkers reflects the complex features of tumor cell metabolism and adaptation to stress.