Medical staff occupationally exposed to low doses of ionizing radiation. In vivo assessment of the antioxidant-oxidant status and evaluation of the antioxidant response and oxidative stress after an in vitro blood irradiation.


Study Goal: Increase of oxidative stress due to chronic exposure to low-doses of ionizing radiation (IR) is of particular concern since it can lead to pathological conditions. We aim to analyze the antioxidant-oxidant status in a group of hospital staff exposed to long-term low-doses of IR in order to assess the risk of their exposure and improve radiation protection measures if needed. The effect of an in vitro blood irradiation on the antioxidant response and oxidative stress was evaluated as well.

Abstract: Radiation-induced free radicals are considered to initiate and perpetuate the action of ionizing radiation (IR) on living organisms, causing mutations, cell apoptosis or even genetic instability. Oxidative processes play an important role in the pathogenesis of several diseases (e.g. neurodegenerative and cardiovascular diseases or cancer). In contrast, some authors state that a ‘radiation adaptive response’ can be achieved by low-dose radiation exposure. However, there are reports indicating that workers occupationally exposed to ionizing radiation show increased cancer incidence and DNA breakage, as well as dis-regulated oxidative stress status. Hospital staff working in diagnostic or treatment procedures involving IR represents an important collective exposed to low-dose long-term IR. In this study, the response to chronic low-dose IR exposure of occupational workers was analyzed. For this purpose, the antioxidant-oxidant status of four groups of hospital staff occupationally exposed to IR and a control group was measured as well as the variation of several antioxidant and oxidant markers in response to an in vitro irradiation. The total antioxidant capacity (TEAC), extracellular SOD activity (eccSOD), GSH/GSSG ratio, nitrites and nitrates levels (NOx) and lipid peroxidation (TBARS) were measured in peripheral blood samples of the studied workers. Results showed that the Medicine Nuclear workers were the group in which the exposure to low doses of IR induced the most reduced antioxidant capacity and increased oxidative stress. In contrast, subjects from the Radiation Oncology department had a significant higher antioxidant defense, which gives support to the idea of an adaptive response pointed out by some authors. The results from the in vitro assay...
showed that irradiation of cultured blood reduced the cellular antioxidant response and increased the oxidative stress in both exposed and control groups.

**Conclusion:** Analysis of the antioxidant-oxidant status in a group of hospital workers occupationally exposed to ionizing radiation showed that there exists a certain effect on this status due to long-term low-doses exposure to ionizing radiation. *In vitro* irradiation helped to support this idea. Therefore, assessment of the antioxidant-oxidant status might be a useful tool to prevent and treat the radiation-induced oxidative stress and thus other malignancies in which it is involved.

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