

Does Occupational Exposure to Ionizing Radiation Induce Adaptation

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Abstract

Even the most of personnel occupationally exposed (OE) to ionizing radiation (IR) is exposed to very low doses (LD), some harmful effects can be noticed.

IR can affect the cell structure in two ways: directly and indirectly-inducing radiolysis of water and production of reactive oxygen species (ROS) similar to endogenously induced. In the low- LET exposure almost 70% of absorbed energy is spent for ROS production. Over-production of ROS can cause oxidative stress. DNA is the main target of induced ROS. It is also experimentally showed that many important cell protective mechanisms, such is adaptation, are dependent of ROS concentration produced by low doses.

The aim of this paper is to investigate if occupational exposure to LD induce over-production of ROS, and influence the activity of protective enzymes and radiosensitivity as well as induce adaptation.

Our subjects were medical workers occupationally exposed to IR (44) and not-exposed (33), matched in gender, age, habits-daitary, alcohol consumption, smoking. Occupational exposure was calculated on the basis of individual TL-dose records.

Besides the standard medical examination, micronucleus test, superoxide production and lipid peroxidation index, expressed as malondyaldehyde (MDA) production, were performed by standard procedures as well as measurements of activity of the superoxide dismutase (SOD) and glutathione (GSH). Half of each sample were put in a sterile plastic test-tube placed in a plexiglas container 15x15 cm, and irradiated by ⁶⁰Co source of γ -ray at room temperature. Employed radiation dose was 2 Gy, dose-rate 0.45 Gy/min and distance from the source 74 cm. All blood samples were frozen at -70° C, and kept till analyses which were performed at the same time.

Our results confirm: significantly higher incidence of micronuclei in OE (.31±10 vs 17±8, p=0.00) with significant increase after irradiation in each group and lack of differences in radisensitivity between groups (183±22 vs 183±21, p=0.67)

Results also confirmed significantly higher MDA production in OE to IR (0.000028), significant increase in every group after irradiation and the lack of significant difference between groups after (p=0.408). The activity of SOD was also significantly increased in OE (p=0.01), and in each group after irradiation and lack of differences between groups after irradiation ((p=0.35). There is no differences in GSH values between OE and non exposed before as well as after irradiation (p=0.825, p=0.41, respectevlley), and in each group before and after irradiation.

Our results indicated that occupational exposure to LD of IR did not induced adaptive response. The incidence of DNA damage is correlated to the oxidative stress and the activity of anti oxidative enzymes.

KEYWORDS: occupational exposure, low dose, reactive oxygen species, micronuclei