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Study of Oxidative Stress and Antioxidant Status of X-ray Technicians Exposed to Low Radiation Doses During Their Occupational Exposure in Kanchipuram District of Tamil Nadu

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ABSTRACT

Free radicals especially the reactive oxygen species (ROS) implicated in etiology for over hundred diseases. Radiation is one of the major exogenous sources of free radicals in man and it has been proved that ionizing radiation produces ROS in biological system capable of destroying biomolecules. The objective of this study was to measure the serum antioxidant status level in health workers, to estimate the oxidative stress in red blood cells of radiographers by measuring the malondialdehyde (MDA) and percentage hemolysis of RBCs in comparison with controls, to determine the concentrations of antioxidants like vitamin E and catalase in the above groups, to determine the relationship between the levels of oxidative stress, antioxidants and the duration of occupational exposure in radiographers. 5ml of venous blood was collected in heparin. Plasma was used for estimation of vitamin E. The separated cells were used for the assay of oxidative stress parameters - malondialdehyde -oxidative hemolysis of RBS's (or) per cent of hemolysis of RBC, antioxidant status parameters- vitamin E and catalase. Present results show that the percentage of hemolysis of RBC was higher in, radiographers when compared with control group (p=0.0059). The RBC MDA (p=0.690), Catalase (p=0.050) and plasma vitamin 'E' levels (p=0.50) were higher in radiographers than in control group. Finally we can conclude that there is a mild increase in oxidative stress occurring as a result of chronic occupational exposure to low dose ionizing radiation.

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All human beings are constantly exposed to ionizing radiation, the sources of which include both the natural environment and man made products (Halliwell, 2007). In addition to this, the proliferation of radioactivity materials has increased the likelihood of accidental exposure to ionizing radiation (Harman, 1956). X-rays belong to the indirectly ionizing electromagnetic group of radiations (Uma Devi *et al.*, 2000) and they have a very high penetrating power because of their low linear energy transfer (LET) (Dendy and Heaton, 1987). Exposure of eukaryotic cells to ionizing radiation results in the immediate formation of free radicals that last a matter of milliseconds (Spitz *et al.,* 2004) and cause oxidative stress through the radiolysis of body water which is often referred to as the indirect effect of radiation (Uma Devi *et al.*, 2000). This coupled with the 'oxygen effect' (Uma Devi *et al.*, 2000) enhances tissue injury through the process of lipid peroxidation (Cheeseman and Slater, 1994). Both these effects are more pronounced for low LET radiations (Guyton and Kensler, 1993), accounting for more than 70 per cent of molecular damage. Billen (1990) stated that free radical damage induced by low dose ionizing radiation was no greater than the free radical damage caused during routine metabolic chemistry itself, while Ward (1991) argued against this concept. This argument and the paucity of data studying the effects of low dose ionizing radiation in humans *in vivo*, when compared to literature dealing with the different aspects of non-ionizing and high dose ionizing radiations, formed the basis of this work. Studies such as this are important because in developing country like ours, where biological security controls are not strict and extended work days are common, this type of monitoring may be useful as an indicator to detect early damage in order to demand more controls in radiation protection. Oxidative stress in this work has been studied by estimating the levels of malondialdehyde (MDA), percentage hemolysis of RBCs, catalase and vitamin E in medical radiographers and comparing them with those of controls.