NORTHERN HEALTH RESEARCH CONFERENCE

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Investigating Dose Rate Effects in Lens Epithelial Cells to Understand the Risk of Radiation-Induced Cataracts

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ABSTRACT:
Exposure to ionizing radiation has been linked to the formation of cataracts, however direct mechanistic pathways remain to be elucidated. Further, there is a lack of direct evidence of cataract risk in the low-dose range, which comprise the majority of human medical and that occupational exposures. Recently, the International Commission on Radiological Protection (ICRP) drastically lowered occupational dose limits to 20 mSv per year (averaged over 5 years, with no single year exceeding 50 mSv). This recommendation was made discounting any difference between acute and protracted exposures, and was primarily based on epidemiological evidence taken from humans exposed to high, acute exposures. There are therefore limitations with these results as they do not include mechanistic data, specifically following exposures in the low and fractionated dose range. Experiments are currently being conducted using a cultured human lens epithelial cell line (HLE-B3), shown to retain functional characteristics of lens epithelial cells in culture. Dose rate effects were analyzed following acute low dose rate exposures, and multiple fractionated exposures (one exposure per day for 5 consecutive days) looking for several established radiobiological endpoints. DNA damage is being assessed using markers for double stranded breaks, γH2AX and comet assays. Oxidative stress is being quantified using flow cytometry following 8-OHdG (oxidative stress level) and DCFDA (free radical) assays. Cell survival across these ranges was measured using survival curves. Finally, molecular pathways involved in the radiation response will be analyzed using RT-qPCR. Results will contribute to the identification of a threshold dose for ionizing radiation-induced cataracts. Understanding of ionizing radiation is necessary with the increased use of radiation in medical and other occupational fields.