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DNA damage response of haematopoietic stem and progenitor cells to high-LET neutron irradiation.

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The radiosensitivity of haematopoietic stem and progenitor cells (HSPCs) to neutron radiation remains largely underexplored, notwithstanding their role as target cells for radiation-induced leukemogenesis. This is important for radiation protection purposes, particularly for aviation, space missions, nuclear accidents and even particle therapy. In this study, HSPCs (CD34+ cells) were isolated from umbilical cord blood and irradiated with 60Co ɣ-rays (photons) and high energy p(66)/Be(40) neutrons. A significant higher number of DNA DSBs was observed after 0.5 Gy neutrons of 1.277±0.118 foci/cell compared to 0.839±0.141 foci/cell for photons at 2 hours, but decreased to similar levels for both radiation qualities after 18 hours. However, differences in late apoptosis were observed between photons and neutron at 18 hours, 43.17±6.10 % versus 55.55±4.87 % respectively. A significant increase in cytogenetic damage was observed after both 0.5 and 1 Gy neutron irradiation compared to photons. No difference in nuclear division index was observed between both radiation qualities. The results point towards a higher induction of DNA damage after neutron irradiation in HSPCs followed by a fast error-prone DNA repair, which contributes to genomic instability and a higher risk of leukemogenesis.

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