Genotoxicity of I-123-iododeoxyuridine in vitro

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OBJECTIVES: The biological effectiveness of Auger electron emitters (AEE) is attributed to the numerous short-range electrons released during the decay of the radionuclide. Damage on cellular level depends largely on the intracellular distribution of the nuclide. AEE located exclusively in the cytoplasm cause e.g. low-LET type cell survival in the colony-forming-assay, whereas DNA-associated AEE cause high-LET type cell survival. To determine whether DNA-associated AEE induce high-LET type genotoxic effects micronucleus induction and γ-H2AX formation were analyzed after exposure to I-123-iododeoxyuridine (I-123-UdR) in comparison to high- and low-LET radiation in vitro.
MATERIALS AND METHODS: Human T-lymphoma Jurkat cells were either exposed to I-123-UdR (0.5-50 kBq/ml) for 20 h or irradiated with low-LET Cs-137 γ-rays or high-LET Am-241 α-particles. Cells were assayed for micronucleus formation (Cytochalasin B assay) employing automated image analysis (MetaSystems, Germany). The γ-H2AX foci were quantified by measuring the mean signal intensity of γ-H2AX foci per cell using flow cytometry and by counting the number of γ-H2AX foci with a fluorescence microscope.
RESULTS: In contrast to γ- and α-irradiation the numbers of γ-H2AX foci per cell showed a much more pronounced increase after exposure to I-123-UdR. However, the mean intensity of γ-H2AX signals per cell, as measured by flow cytometry, was very similar after exposure to I-123-UdR and α-particles. Single γ-H2AX foci induced by I-123-UdR appear to be smaller and/or less intense stained than those after α-irradiation and resemble γ-H2AX foci induced by γ-rays. Micronucleus induction was almost identical for all three investigated radiation qualities.
CONCLUSIONS: I-123-UdR is a very potent inducer of γ-H2AX foci in comparison to γ- and α-radiation. Taking into account the very low dose rate of I-123-UdR exposure the effect is even more pronounced. Micronucleus induction does not depend on radiation quality in Jurkat cells.

Supported by the Bundesministerium für Bildung und Forschung (BMBF), Kompetenzverbund für Strahlenforschung (KVSF)