Genotoxicity of the Auger electron emitter 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 radionuclides. AEE located exclusively in the cytoplasm produce low-LET type cell survival curves, whereas DNA-associated AEE cause high-LET type survival curves. To determine whether 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.
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 different doses of 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 for 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. Taken 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.

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