Microdosimetry in Biological Cells: A Monte Carlo Method

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Abstract : Purpose: In radionuclide therapy, radioactive atoms are coupled to monoclonal antibodies (mAbs) for treating cancer tumor while limiting radiation to healthy tissues. We know that tumoral and normal tissues are not equally sensitive to radiation. In fact, biological effects such as cellular repair processes or the presence of less radiosensitive cells such as hypoxic cells should be taken account. For this reason, in this paper, we want to calculate biological effect dose (BED) inside tumoral area and healthy cells around tumors. Methods: In this study, deposited doses of a radionuclide, gold-198, inside cells lattice and surrounding healthy tissues were calculated with Monte Carlo method. The elemental compositions and density of malignant and healthy tissues were obtained from ICRU Report 44. For reaching to real condition of oxygen effects, the necrosis and hypoxia area inside tumors has been assessed. Results: With regard to linear-quadratic expression which was defined in Monte Carlo, results showed that a large amount of BED is deposited in the well-oxygenated part of the hypoxia area compared to necrosis area. Moreover, there is a significant difference between the curves of absorbed dose with BED and without BED.

Keywords : biological dose, monte carlo, hypoxia, radionuclide therapy
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