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Assessment of Cell Damage Produced by 161Tb-/177Lu-Somatostatin Analog Radiopharmaceuticals

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The use of 161Tb has been proposed for targeted radionuclide therapy (TRT) because its decay properties are quite similar to those of 177Lu, which is currently the most used radionuclide in TRT. 161Tb emits low-energy photons that are useful for SPECT imaging and relatively low-energy β--particles. However, unlike 177Lu, 161Tb emits a significant number of internal conversion electrons (IE) and Auger electrons (AE) with energies ≤ 40 keV, which could be an advantage to improve the therapeutic efficacy. Moreover, in vitro and in vivo characteristics of 2 somatostatin (SST) analogs labeled with both 161Tb and 177Lu using DOTA as chelating agent demonstrated that both radionuclides produce stable complexes with very similar biodistribution and pharmacokinetics properties.

In this research, the biological damage produced to clusters of AR42J cells by three different SST analog radiopharmaceuticals (RFs) labeled with 161Tb or 177Lu located in different regions within the cells was assessed. For this purpose, the cellular dosimetry and cell surviving fraction assessments using the MIRDcell code were performed.

The results demonstrated that the mean cell absorbed dose is not sufficient to predict cell survival, in this case the most important factors are the localization of the RFs at cellular level and the pattern distribution of the dose within the different cell compartments.

In conclusion, when 161Tb-SST radiopharmaceuticals are internalized in the cells, the emitted IE and AE contribute significantly to the dose absorbed by the cell nucleus. Consequently, the therapeutic efficacy of 161Tb-RFs is higher compared to 177Lu-RFs.