

Radiological properties of Next Generation Theranostics (Cu-64/Cu-67)

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Abstract

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Objectives: To examine the radiological properties of Next Generation Theranostics

Methods: Next generation theranostics can potentially offer improvements on both quality of diagnostic imaging using the PET isotope Cu-64 and therapeutic advantages using Cu-67 for a range of different tumor types. For the case of neuroendocrine tumors (NETS) in adults and neuroblastoma in children, an initial radiological comparisons is made with traditional, emerging, and future theranostic radiopharmaceuticals to examine: The suitability of the different radionuclides for imaging and therapy where comparisons of Cu-64 and Ga-68 for PET imaging and Cu-67 and Lu-177 for therapy using PRRT are made. The practicalities of handling these radionuclides in a clinical setting where a $T_{1/2}$ of 12.7 hours of Cu-64 impacts on radiochemistry, manufacture and logistics. The radiation safety parameters for the different radionuclides where a comparison using Annual Limits of Intake (ALIs) and external dose rates for Cu-64 to Ga-68 and Cu-67 to Lu-177 is made.

Results: Cu-64 for diagnostic PET imaging paired with Cu-67 for therapy provides: advantages for prospective dosimetry in PRRT; practical advantages in manufacture such as centralized GMP manufacture and distribution; and comparable and acceptable radiation safety to the current and popular theranostic isotopes.

Conclusion: The radiological properties of next generation theranostics based on Cu-64 (diagnostic) and Cu-67 (therapeutic) may offer significant advantages for a range of different tumor types. **Research Support:** N/A