

The development of radionuclides towards theragnostic application in nuclear medicine

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The concept of “theragnostics” in nuclear medicine, ideally, involves the diagnosis and treatment of a patient using radioisotopes of the same element, to ensure what you image is what you treat. The concept is currently being followed by means of diagnosis with ^{68}Ga , followed by radionuclide therapy using ^{177}Lu .

Researchers are pursuing the idea utilizing the same element, but different radioisotopes thereof for diagnosis and therapy. Over the last decade, much research has been performed at Paul Scherrer Institute with radioisotopes of scandium and terbium, respectively. The radiotheragnostics principle was demonstrated with the use of cyclotron-produced ^{44}Sc (as well as ^{43}Sc) for tumour diagnosis, while ^{47}Sc was produced for preclinical therapy studies. Four radioisotopes of terbium are deemed interesting for nuclear medical purposes: ^{152}Tb and ^{155}Tb can be used for diagnostic purposes via positron emission tomography (PET) and single photon emission computed tomography (SPECT), respectively, while ^{149}Tb and ^{161}Tb are interesting therapeutic radionuclides due to their α - and β emission, respectively.

The radionuclides in question are in various stages of development, with some in its early stages due to lack of facilities capable of producing them, while terbium-161 is being prepared for clinical trials. An outlook will include possibilities of producing novel radionuclides with new facilities/installations in future.

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