

Estimate of S-values for children due to six positrons emitting radionuclides used in PET examinations

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The positron emission tomography (PET) has revolutionized the diagnosis of cancer since its inception. When combined with computed tomography (CT), PET/CT performed in children produces a diagnosis of high accuracy on the images of regions affected by malignant tumors. Considering the high risk for children when exposed to ionizing radiation, a dosimetric study for PET/CT procedures is necessary. Absorbed specific fractions (SAFs) were determined by monoenergetic photons and positrons, as well as the S-values for six emitting radionuclides (C-11, C-13, F-18, Ga-68, Rb-82, O-15), and 22 source organs. The study was conducted for six pediatric anthropomorphic hybrid models, including the newborn and 1 year hermaphrodite, 5 and 10-year-old male and female, using the code Monte Carlo N-Particle eXtended (MCNPX) version 2.7.0. The results of the SAFs in source organs and S-values for all organs were inversely related to the age of the phantoms, which includes the variation of body weight. The results also show that radionuclides with higher energy peak emission produces S-values self-absorbed higher due to local deposition of doses by positrons decay. The S-values for the source organs are considerably larger due to the interaction of tissue with non-penetrating particles (electrons and positrons) and have a linear relationship with the masses of the bodies. The results of the S-values determined for positron-emitting radionuclides can be used to assess the radiation dose delivered to pediatric patients subjected to PET examination in clinical settings.

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