Monte Carlo simulation of microPET/CT occupational exposure using ^{18}F and ^{68}Ga tracers

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Image techniques are fundamental for the research on diseases and preclinical studies on new pharmacological treatments. The microPET/CT is a noninvasive technique suitable for anatomical and metabolic information by means of X-rays and nuclear tracers [1]. In this scenario, concerns on the stochastic effects on researchers may arise from the long exposure to ionizing radiation. Therefore, this work aims to estimate the occupational doses from an exam performed with the Albira PET/CT [2] system using ^{18}F and ^{68}Ga tracers. The Monte Carlo MCNPX code [3], virtual adult female (FASH3) and male (MASH3) anthropomorphic phantoms [4], and a mouse, represented by a WISTAR, were used in the simulations. The ^{18}F and ^{68}Ga tracers were modeled as isotropic point sources. The simulated microPET/CT X-ray tube is a micro focal 35 μm with 0.5 mmAl beam filtration, operated at 50 kV with tungsten anode (Oxford Instruments XTF5011). The focal distance from the mouse was 25 cm and it was placed on a PMMA table at the FASH3 groin's level in a concrete walled room. The spectra were obtained by applying the F4 *tally* (MeV/cm²). The images were acquired with 8 projections at 45°, 36 at 10° and 720 at 0.5°. The conversion coefficient CC_E(nSv/MBq.s) FASH3 values were 1.11 (13.5%) and 1.14 (14.0%) for MASH3, no significant difference was present regarding ^{18}F and ^{68}Ga except when evaluated at the skin. The $CC_{Hp(10)}$ [nSv/MBq.s] values with ^{18}F was 1.0 (16%) and 1.3 (15%) for ^{68}Ga. The effective risks [CC_H(1/MBq.s)] calculated for 30 years old individuals were 3.1E+04 (20%)-^{18}F and 3.2E+04 (20%)-^{68}Ga regarding the FASH3 and 1.5E+04 (17%)-^{18}F and 1.4E+04 (17%)-^{68}Ga regarding the MASH3 phantom.

Keywords: microPET/CT, Small animal dosimetry, Monte Carlo simulaion

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