

Evaluation of personal external radiation exposure in veterinary nuclear medicine using EGS4

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Abstract

Increasing demand exists to perform veterinary nuclear medicine in Japan. However, prior to start veterinary nuclear medicine in Japan, it is inevitable to evaluate radiation safety or human exposure to make guidelines for the safety use of radiopharmaceuticals in veterinary medicine. In a previous study, we estimated external radiation exposure of human associated with companion animal to which radiopharmaceutical is injected. The estimation was performed by using a computer simulation program based on a method of kerma and fluence rate according to the data published from the Nuclear Safety Technology Center (Tokyo). Although it did not exceed the international permissible dose, it was relatively overestimated. Therefore in this study, calculations were done by using Monte Carlo method (EGS4) in order to achieve the best accuracy. At first, a simple phantom containing common radioisotopes namely ^{99m}Tc or ¹⁸F was measured at assigned distance with fluorescent glass dosimeters (Asahi Techno Glass Ltd.). The simulation calculations in this condition were done by using EGS4 or kerma with fluence rates, to confirm an accuracy of the employed user code. If estimated EGS4 values were comparable to the measured values, it was regarded that the employed user code was accurately described. The obtained EGS4 values were closer to the measured than the values calculated by using kerma and fluence rates. The EGS4 values appeared more accurate in ¹⁸F than in ^{99m}Tc. The reason for the different accuracy based on the EGS4 was thought to be due to the different energy of the gamma ray of the two radioisotopes. Since numbers to hit a target from a low energy source will be so low by EGS4, the statistical accuracy of the obtained results might become lower. Further study is required to improve this statistical precision by selecting a better user code.