Monte Carlo Simulation of In vivo Measurement of the Most Suitable Position of the Knee for the Most Accurate Measurement of the Activity

Majid Khalaf,[1] Richard Brey,[1] Anthony C. James[2]

[1]Idaho State University, Department of Physics/Health Physics, Pocatello, Idaho; [2]United States Transuranium & Uranium Registries, College of Pharmacy, Washington State University, Richland, Washington.

To assess the amount of radioactivity of certain radionuclide whose best indicators are low energy X-rays may be accomplished by a passive radioactive measurement of the knee. A correlation of the activity in the knee to that in the entire skeleton is possible. A question which arises is what is a suitable position of the leg by which all the knee bones contribute to detectable activity. The aim of this study was to create a new and valid model for Monte Carlo simulation of in vivo measurement of the knee to find an optimal position and therefore improve the validity of this measurement technique. CT scan images of the United States Transuranium and Uranium Registries (USTUR) case 0846 leg at different positions were obtained. These images were saved in DICOM format and they were segmented manually prior to voxelization and MCNP input. Monte Carlo modeling was employed to determine an optimized knee position; one that provides the best signal to noise ratio. Four different measurements of the USTUR 0846 leg knee in two different positions using a germanium detector were obtained. We noted that the best signal to noise ratio was observed with the leg in a bent position and the detector close to the patella.

USTUR-0311A-11