Development of EGS-based 3D Brain SPECT Simulator

Takashi Yokoi [1)], Takeyuki Hashimoto [2)], Hiroyuki Shinohara [3)]

1) Bioimaging Laboratory, Inc, Kyoto, Japan, 2) Department of Information Processing, Yokohama Soei College, Yokohama, Japan, 3) Department of Radiological Sciences, Tokyo Metropolitan University of Health Sciences, Tokyo, Japan

We developed the EGS-based Monte Carlo system to simulate a brain SPECT projection data using the 3D digital brain phantom. This system can generate the various radioactivity patterns for human brain using SPECT. In order to investigate the pattern-dependency on the Compton scatter fraction (SF, = number of scatter photon/number of primary photon), we generated three kinds of radioactivity patterns for the cerebral blood flow (CBF: assuming a Tc-99m ECD), the dopaminergic neurotransmission (DP: assuming a Tc-99m TRODAT-1) and the skull bone accumulation (SB: assuming a Tc-99m MDP). Simulation was performed using the ultra-high resolution (UHR), high resolution (HR) and general all purpose (GAP) collimator. The spatial resolution for UHR, HR and GAP collimator was estimated as 6.6 mm FWHM, 8.5 mm FWHM, 12.5 mm FWHM, respectively, using the point source generated from the simulation system. The SF was almost independent of the collimator resolution, whereas it was depended on the radioactivity pattern, namely the SF was 34.6%, 36.8% and 23.6% for CBF, DP and SB, respectively, using HR. This system was useful tool to simulate the human brain imaging using SPECT.