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Dosimetry Calculation for Internal Electron Source Using Korean Adult Stylized Phantom

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In this study, absorbed fraction (AF) and specific absorbed fraction (SAF) of electron were calculated using Korean reference adult stylized phantom. A total of 15 internal organ volumes and external dimension of Korean phantom were designed according to the data of Korean adult male and female. The walls of esophagus, stomach, large intestines and urinary bladder were divided into mucosa and residual wall. The mucosa wall thicknesses were determined by the data presented in the International Commission on Radiological Protection (ICRP) publication 23, 89 and other literature data about wall histology and direct measurements. General pur-pose Monte Carlo transport code MCNPX version 2.5.0 was used for electron dosimetry calculation. The AF and SAF of monoenergetic electrons with the energies ranging from 10 keV to 4 MeV were calculated, and AFs for some organs were compared with the formalism of Medical Internal Radiation Dose (MIRD) committee. According to the MIRD schema, electron, classified into a non-penetrating radiation, is assumed to deposit their entire energy in the source organ or tissues where it is emitted from. However, the results of this study showed this assumption is not applied to electron energy over 100 keV. Since the mucosa wall is more radiosensitive than residual wall, thus the dosimetry for that region is important especially for weak-penetrating particles. Therefore, in the present study, the radiation effect to the mucosa wall was evaluated and whole body electron SAF values were calculated. Until now, tomographic phantoms having mucosa have been rare due to the limit of voxel resolution and the difficulty to segment mucosa wall from medical tomographic image. The ability to simulate very thin mucosa tissues and its dosimetry results showed that stylized phantoms are still useful for that purpose until mucosa-implemented high resolution tomo-graphic phantoms will be available.

Keywords : Internal Dosimetry, Korean Stylized Phantom, Electron Source