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Radiation Dose for Clinical Protocols during CT Transmission Measurement in PET/CT Scan

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The purpose of this study was to evaluate the radiation doses during CT transmission scan by changing tube voltage and current, and to estimate the radiation dose during our clinical whole body high quality CT scan. Radiation doses were evaluated for Philips GEMINI 16 slices PET/CT system. CTDI was measured with standard head and body CT dosimetry phantoms in a variety of CT tube voltage and current over time measurement. A pencil ionization chamber with an active length of 100 mm and electrometer were used for CTDI measurement. The measurement is carried out at the free-in-air, at the center, and at the periphery. The average dose was calculated by the weighted CTDI (CTDIw = 1/3CTDI100,c + 2/3CTDI100,p). Specific organ dose was measured with clinical whole body high quality CT acquisition protocol using TLDs and Alderson phantom. The TLDs used for measurements were selected for an accuracy of ±5% and calibrated in X-ray radiation field. The organ or tissue was selected by the recommendations of ICRP 60. The weighted CT dose index is af-fected by the tube voltage and current over time measurements. For the CTDI head phantom, when tube voltage was fixed to 120 kVp, the CTDIw values were ranged from 6.5 mGy to 97.9 mGy by changing the current values from 35 mAs to 500 mAs. When the current value was fixed to 350 mAs, the CTDIw values were ranged from 27.3 mGy to 85.0 mGy by changing the tube voltage from 90 kVp to 140 kVp. For the CTDI body phantom, when tube voltage was fixed to 120 kVp, the CTDIw values were ranged from 4.8 mGy to 35.8 mGy by changing the tube current from 50 mAs to 400 mAs. When the tube current was fixed to 200 mAs, the CTDIw values were ranged from 8.5 mGy to 27.7 mGy by changing the tube voltage from 90 kVp to 140 kVp. The measured specific organ doses were ranged from 23.9 mGy (bone marrow) to 42.3 mGy (skin). Radiation dose during CT scan in the PET/CT system was measured using CT dosimetry phantom with ion chamber and anthropomorphic phantom with TLDs. Further study need to be performed to find optimal CT acquisition protocols for reducing the patient exposure with same image quality.

Keywords : Radiation Dose, PET/CT