

Purpose: To evaluate the age-dependent CT dosimetry for the Reference Man of ICRP, the Reference Asian Man of IAEA, the mathematical phantoms of MIRD, and the Taiwan reference man established according to the data of weight and height published by the Department of Health in Taiwan. To determine size-dependent technique factors for head and body CT scans using both traditional and novel CT scanners.

Methods and Materials: Five methods were established to investigate the relation between phantom diameters and ages for above references. Five phantom cylinders in 10 to 32 cm diameters represented for the measurements of various CTDI (central, peripheral and weighted) and the cylinder in 5 cm stands for the trend between $CTDI_{air}$ and $CTDI_C$ in 10 cm phantom. All measurements were conducted in one single-row and four multi-row CT scanners across a range of energy (80-140 kVp), and slice collimation (1-40 mm). The noise, SNR and uniformity were estimated using four 2-cm diameter ROIs in CT images.

Results: These phantoms with diameters in 10, 16, 20, 24 and 32 cm represented patients of age groups of newborn, 1-5, 5-10, 10-15 and 18 (adult) years. The calculated ImPACT factor and matching MC data set for each scanner compared with ImPACT library data. The primary and scattered beam percentages were analyzed according to CTDI values. Measured CTDIs and image indicators showed that the $CTDI_W$ per 100 mAs varied with scanner, scan mode, beam quality and depended strongly on phantom size.

Conclusion: Relationship between the phantom diameter and age were found. Tube voltage at 80 kVp was suggested for pediatric body scan in stead of using the same protocol as adults. This adjustment could reduce dose for 69% without sacrificing diagnostic image quality. Measured CTDIs were applied to establish pediatric diagnostic reference dose, and to determine collective effective dose.