

Purpose: This work describes methodologies for determining peak skin dose (PSD) and organ doses in computer tomography (CT) examinations. These methods are demonstrated for the routine adult head protocol. This work allows directly relating the widely used CT dose index parameter, CTDIvol, to actual PSD and organ dose values.

Methods: Values of the CT dose index, CTDIvol, available in all commercially available CT units tested in this work, were derived independently from ionization chamber measurements. Simultaneously, either, PSDs (first method) or organ doses (second method) were measured as well. In the first method, PSDs were measured using radiochromic film placed on the outer surface of the phantom. Optical densities were measured with a transmission densitometer. In the second method doses to the brain, eye lens and face skin were measured using an anthropomorphic head phantom configured with optical stimulated luminescence (OSL) dosimeters. The ionization chamber, films and OSLs used in these measurements were calibrated at NIST in x-ray beams that spectrally approximated those typically produced by CT scanners in clinical use.

Results: The suggested PSD method is reliable, cheap and fast. PSD values of up to 160 mGy were observed in a single scan in some CT scanners. Variations in the PSD values up to a factor of 2 are observed for a fixed value of CTDIvol, which supports characterizing independently each scanner using the proposed methods. Results show a quite homogenous distribution of organ doses inside the head.

Conclusions: Clinical facilities may apply these methods to relate the values of CTDIvol shown on their CT units to actual PSDs and organ doses delivered. Furthermore, this provides a direct method for obtaining PSD and organ dose, as opposed to the more common practice approach of estimating effective dose derived from CT machine parameter values (CTDIvol and scan length).

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