

Purpose: The new 320 slice CT scanners can irradiate x-ray beam widths from 2.0 mm to 160 mm length in one rotation, and they present challenges for the measurement and analysis of radiation doses. Various methods to perform and analyze the radiation dose data were examined.

Methods: These CT scanners have various modes of operation such as: 320 detector axial volume mode, 64 detector axial and helical scan, and scan mode with 4 narrow axial slices ranging from 4*0.5 mm to 4*8 mm. There are many selectable scan parameters such as: four kVp settings (80, 100, 120 and 135), three x-ray beam filters, 50 to 550 mA, several scan time settings of 0.35 to 3.0 seconds, various pitch values and automatic mA modulation. These options complicate the radiation dose measurement and analysis procedures. Longer CT dose phantoms were evaluated. Several ionization chambers (100 mm pencil chamber and 0.6 cc thimble) and OSL dosimeters were utilized to perform the measurements and evaluated.

Results: The radiation dose profiles were measured, and the narrowest beam width resulted in the largest radiation doses. In the 320 slice volume mode, the utilization of 3 radiation dose phantoms stacked together only changes the measured radiation dose by less than 10%. The large amount of data was reduced to a few simple equations and graphs that could be used to estimate the CT radiation dose for any of the clinical procedures. Both thimble ionization and OSL radiation detectors provide useful contributions in CT dosimetry.

Conclusions: Limitations and approaches to CT radiation dosimetry for large cone beam CT scanners are reviewed and guidance is provided. Current dosimetry methods can be employed without significant errors.