AbstractID: 7197 Title: Dosimetry and Image Quality Evaluation of a Dedicated Cone-beam CT System for Sinus and Temporal Bone Applications

Purpose: To evaluate the dose and image quality performance of a dedicated cone-beam CT scanner for sinus and temporal bone applications.

Method and Materials: A low-dose cone-beam CT system with flat-panel detector has recently been introduced for high-contrast applications in the head. Because of the non-uniform dose distribution throughout the volumetric field of view, the dose in the central plane may not accurately represent the overall dose. In this work, we introduce a novel metric, volumetric average dose, to incorporate the spatial variation of radiation dose in a cone-beam scan. The definition and measurement of volumetric average dose are analogous to conventional Weighted CTDI, though conceptually different. Using this metric, we evaluated the dose performance of a cone-beam CT scanner (MiniCAT, Xoran Technologies). Two methods were employed for measurement. One was with a small solid-state detector (RTI CT-SD16), the other was with a conventional CT pencil chamber. Both were measured with a standard CTDI head phantom. The low- and high-contrast spatial resolution, and cone-beam and truncation effects, were also evaluated.

Results: The volumetric average doses for sinus and temporal bone studies measured with CT pencil chamber were 5.02 mGy and 4.33 mGy, respectively. With the RTI CT-SD16 detector, 4.41 mGy and 3.93 mGy were obtained for the two studies. Both are substantially lower than those of conventional adult CT protocols in our practice (58 mGy for sinus and 84 mGy for temporal bone). Isotropic high-contrast spatial resolution of 16 lp/cm was measured for the temporal bone mode. Low contrast resolution, as anticipated, was inferior to conventional CT.

Conclusion: A novel dose metric, volumetric average dose, was used to characterize the dose performance of a cone-beam CT system. The dose and image quality of the dedicated cone-beam CT system appear appropriate for sinus and temporal bone applications.