REPLY:

We thank the authors for their interest and commentary on our study[1] published in *American Journal of Neuroradiology*. We agree with the authors that studies comparing the diagnostic capabilities of conebeam CT (CBCT) and photon-counting detector (PCD) CT are of potential interest. However, there are key advantages of multidetector CT (MDCT) over CBCT that led to its widespread adoption in clinical practice for temporal bone imaging. Here, we will highlight the benefits offered by both MDCT in general and specifically PCDs, which may further enhance the utility of MDCT for temporal bone imaging.

First, modern MDCT systems offer considerable speed benefits. Such systems use conebeam geometry[2] (versus true fan-beam geometry used in older CT systems), multiple detector rows (eg, 120 detector rows, 0.2 mm/row[1]) in a helical configuration, and fast gantry rotation times (0.5–1.0 seconds). These result in a typical temporal bone scan time of ≤5 seconds, with little-to-no motion artifacts and minimal patient discomfort. CBCT, in comparison, requires a scan time of up to 40 seconds.[3] Second, radiation dose comparisons between CBCT and MDCT have been historically challenging due to the lack of standardized dose metrics and reliable measurement techniques for CBCT. The absorbed doses in CBCT and MDCT are reportedly similar if the scan FOV and image-quality parameters are approximately matched.[4,5] The radiation dose in MDCT has continued to decrease with technical advancements in detector technology and reconstruction software (eg, iterative reconstruction). For instance, Leng et al[6] reported a volume CT dose index ($CTDI_{vol}$) of 82 mGy for ultra-high-resolution temporal bone imaging and a further 50% potential dose reduction using *z*-deconvolution and iterative reconstruction algorithms in a second-generation MDCT system without sacrificing diagnostic image quality.

A recent MDCT temporal bone imaging study[7] reported a $CTDI_{vol}$ of 30 mGy and dose-length product (DLP) of 119 mGy × cm. For CBCT, a DLP of 134 mGy × cm for unilateral temporal bone imaging with a small in-plane FOV (8 × 8 cm) has been reported in a cadaveric study.[8] Our study[1] used a mean $CTDI_{vol}$ of 35 mGy and a DLP of 250 mGy × cm without a tin filter for bilateral imaging. By means of PCD-CT with a tin filter, the $CTDI_{vol}$ can be further reduced to ≤10 mGy,[9] and the DLP, to ≤150 mGy × cm, without sacrificing diagnostic image quality. Therefore, the substantial improvement in PCD-CT in spatial resolution relative to non-PCD MDCT could be achieved at doses comparable with those of CBCT for bilateral temporal bone imaging.

Next, the utility of spectral images (such as virtual monoenergetic images) that are routinely available on PCD-CT is yet to be fully explored for temporal bone evaluation. Finally, CBCT has poor CT number uniformity and accuracy, poor soft-tissue contrast, and image artifacts compared with MDCT. Scatter-correction techniques such as antiscatter grids could help reduce artifacts at the cost of increased noise, which consequently warrants an increase in the radiation dose or a reduction in spatial resolution.[5] Unlike MDCT with fixed-source-detector geometry, CBCT uses an open gantry setup with flexible source-to-detector distance configurations, which requires robust and frequent geometric calibrations; residual calibration errors may degrade the spatial resolution in CBCT.

Spatial resolution and radiation dose are 2 of several factors contributing to the diagnostic utility of an x-ray imaging technique, and the limitations of CBCT may hinder its widespread adoption in large medical centers for temporal bone imaging as an alternative to MDCT. Current academic centers using conventional MDCT for temporal bone examinations may find the transition to PCD-based MDCT practical and reliable, with minimal changes to the imaging workflow. As with any technology, CBCT is likely to evolve beyond its current limitations and challenges, and we anticipate that research studies comparing CBCT with PCD-based MDCT for temporal bone imaging may provide insight regarding the strengths and weaknesses of each imaging technique.

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