Purpose: To evaluate multiple methods of localization for stereotactic radiosurgery (SRS) for spatial accuracy and time required for each procedure.

Methods: Multiple phantoms were imaged using a helical diagnostic computed tomography (CT) scanner (Toshiba™ Aquilion) and a linear accelerator mounted cone-beam computed tomography (CBCT). Scans (for both machines) were acquired with a matrix of 512x512 at a field of view of 340 mm. A Varian Medical Systems™ absolute position phantom, in-house created uniformity phantom, LUCY™ phantom, and Catphan phantom were each imaged to compare spatial homogeneity, linearity, spatial resolution, contrast, and uniformity. A final test of localization accuracy was completed by localizing a phantom using three different methods: headring localization using helical CT, headring localization using CBCT, and "anatomical" localization using on-board CBCT.

Results: Average spatial localization errors from absolute phantom spheres were similar for the helical CT scanner (~0.37 mm) compared with the on-board CBCT (~0.35 mm). R2 values for a line fit to the spatial position of the rods in the uniformity phantom scanned with CBCT were > 0.99. Spatial resolution of CBCT and CT were found to be similar using the CTP528 insert of the Catphan phantom (0.071 line pairs/cm). Spatial accuracy of localization by headring for CT and CBCT were similar but "anatomical" localization with CBCT may be less consistent.

Conclusions:The spatial accuracy and linearity of CBCT may be adequate for stereotactic localization using a headring for SRS. Loss of low contrast resolution in CBCT may affect localization and position by CBCT alone. Headring localization using CBCT results in overall time savings without significant loss of spatial information. Localization by CBCT alone may result in increased spatial inaccuracies due to loss of contrast and potential MV radiation and on-board imager isocenter mismatches.