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Localization Accuracy of Cone-Beam CT Guided Radiosurgery as Investigated Utilizing a Geometric Phantom

Introduction: While the advantage of imaging guidance with cone beam CT (CBCT) guided radiosurgery is obvious, the localization accuracy of CBCT guided radiosurgery still remains a concern. This study utilized a geometric phantom with known target positions to investigate the accuracy of CBCT based localization, and to compare its accuracy with conventional frame-based localization.

Methods: Geometric phantom with various target shapes at known positions was scanned with a localizer (Brainlab AG, Germany) attached. Each target was then localized in the treatment room with a target positioning frame. The same target was then localized by using CBCT. The CBCT localized target position was compared with the frame localized position, and also with the known position of the geometric phantom.

Results: The differences of target position between CBCT and frame based localization were listed in Table 1 for targets with various shapes. The mean and standard deviations were 0.8 ± 0.5 mm in AP, 0.3 ± 0.5 mm in IS, 0.8 ± 0.5 mm in RL directions. The differences between CBCT localized target and geometric phantom positions were listed in Table 2 with an average of -0.3 ± 0.5 mm in AP, 0.3 ± 0.5 mm in IS, 0.9 ± 0.6 mm in RL directions.

Conclusion: CBCT can provide comparable localization accuracy as conventional SRS localization frames. Rigorous quality assurance tests are required to maintain its accuracy.