AbstractID: 14222 Title: The Influence of Longitudinal CT Resolution on Target Delineation and Treatment Planning for Stereotactic Radiosurgery

Purpose: To investigate the effect of longitudinal CT resolution on target delineation and treatment planning in stereotactic radiosurgery (SRS) to determine optimal acquisition parameters for SRS simulation.
Method and Materials: CT images for 6 SRS brain patients were acquired and image sets were retrospectively reconstructed with 1, 2 and 3mm slice thicknesses. In total, 9 lesions were contoured 3 times each to quantify intra-observer variability. The volumes contoured on the 2mm scan were the designated reference consistent with current clinical protocol. Variation in GTV with different CT slice thicknesses was evaluated. Additionally, treatment plans were created and optimized using the 2mm scans. Superimposing these plans on the 1mm and 3mm image sets provided a basis for dosimetric comparison—specifically in terms of target coverage.
Results: All of the 3mm GTVs were larger than the 2mm GTVs. However, this consistent overestimation in the GTV was not observed at 1mm, suggesting that the 1mm and 2mm scans produced comparable GTVs. The average % difference in GTV volume when compared to the 2mm scans was 4.6% higher for the 3mm versus 1mm scans. Increasing CT slice thickness from 1 to 3mm caused an increase in the intra-observer variation; volume standard deviations increased up to 51%. The intra-observer variation also increased at larger tumor volumes. Average standard deviations (SD) in GTV extent were 0.14, 0.11 and 0.14cm in the sup-inf, ant-post, and lat dimensions, respectively, implying no directional dependence in target delineation. Dosimetrically, variations in GTV resulted up to a 19% loss in PTV dose coverage.
Conclusion: This study indicates that longitudinal CT resolution causes considerable variation in GTV definition which can potentially compromise SRS treatment plan quality. Therefore, the SRS simulation process may benefit from improvement in scanning parameters in order to yield the most accurate information on the CT dataset.