AbstractID: 12976 Title: Secondary Cancer Risk Characterization of Pediatric Craniospinal Irradiation (CSI) using Helical Tomotherapy and Conventional 3-Field Technique

Purpose: To assess the excess relative risk of developing secondary malignancies in pediatric patients treated with craniospinal irradiation (CSI) using helical tomotherapy and conventional 3-field treatment technique.

Method and Materials: Five previously irradiated patients were replanned using the tomotherapy treatment planning system (TPS) and Pinnacle^3 TPS. For each patient, two plans were generated with thirteen organs at risk (OAR) contoured. Planning target volumes (PTV) were created by expanding the CT-based anatomy with a 0.3 and 1.0cm margin, respectively. All plans were prescribed and normalized so that 95% of the PTV received at least 23.4Gy in 13 fractions. Conventional plans were created using lateral brain fields and single/dual extended SSD spine fields. Dose calculations were performed using 4mm dose voxels. Excess relative risks to each organ and total body were computed by volumetrically weighting the risk. Plans were also compared on the basis of normal tissue sparing, PTV homogeneity, and overall risk.

Results: When using tomotherapy, D_{max} to all the critical structures had a mean reduction of 42.8%. D_{mean} to six critical structures showed a mean reduction of 39%. With conventional techniques, four structures showed a mean dose reduction of 39%. The risk of a secondary malignancy for 50% of the critical structures had a mean reduction of 41.8% with tomotherapy. When using conventional techniques, the other 50% experienced a mean reduction of 44.6%. PTV homogeneity improved by a factor of 3 when using tomotherapy.

Conclusion: Helical tomotherapy, on average, reduces the maximum (~42%) dose to the OARs as well as improves the homogeneity to the PTV by 3x. Though the incidence of secondary malignancy risk is lower in 50% of the OARs when using tomotherapy, a mean reduction of 0.86%/Sv (43.3%) was observed whereas with the other 50%, there is a mean reduction of 0.16%/Sv (35.3%) when using conventional techniques.