

AbstractID: 10680 Title: Effect of Setup Motion and IMRT on the TCP and NTCP for Pediatric Ependymoma

Purpose: Compare the Tumor Control Probability (TCP), Normal Tissue Complication Probability (NTCP) and Conformity Index (CI) of Intensity Modulated Radiation Therapy (IMRT) versus 3D Conformal Radiation Therapy (3D-CRT) for Pediatric Ependymoma patients and quantify the effect of set-up uncertainty (SU) and residual uncertainty (RU) on TCP and NTCP for different PTV margins.

Methods and Materials: 20 Ependymoma patients treated between 1998 and 2002 using 3D-CRT with a 5mm PTV margin were selected for this study. Two IMRT plans for each patient were created, one with identical margins (PTV=5mm) and one with no PTV margin (PTV=0mm). A direct simulation of SU was performed for each plan of each patient based on daily CBCT information obtained from 20 well-matched patients (age, supine/prone, use of GA) on a localization protocol. A direct simulation of RU, based on post-treatment CBCT was performed. TCP; NTCP for the cochlea, spinal cord, and brainstem; and CI were calculated for each plan. Also, a predictive IQ formula was used to compare IMRT vs. 3D-CRT for PTV=5mm.

Results: IMRT improved the TCP by 0.023 ± 0.027 vs. 3D-CRT ($p=0.001$). A TCP loss of 0.004 ± 0.007 ($p=0.02$) due to SU and 0.0003 ± 0.001 ($p=0.14$) due to RU was found for the IMRT with PTV=0mm plan. The NTCP for 3D-CRT, IMRT with PTV=5mm, and IMRT with PTV=0mm was; Cochlea: 0.66 ± 0.40 , 0.29 ± 0.35 , and 0.09 ± 0.17 ; Brainstem: 0.22 ± 0.07 , 0.22 ± 0.04 , 0.19 ± 0.04 ; and Spinal Cord: 0.13 ± 0.06 , 0.09 ± 0.05 , 0.08 ± 0.04 ; respectively. Mean NTCP change due to SU for IMRT with PTV=5mm was; Cochlea 0.02 ± 0.11 , Spinal Cord 0.007 ± 0.01 , and Brainstem 0.003 ± 0.01 . The CI was 0.64 ± 0.12 for IMRT and 0.4 ± 0.14 for 3D-CRT. Predictive IQ formula was 9.98 ± 10.3 points higher for the IMRT plan.

Conclusions: IMRT improves TCP, reduces NTCP and increases the CI versus 3D-CRT for pediatric Ependymoma patients. The setup margin required due to SU may be eliminated if daily localization is performed.