AbstractID: 12729 Title: Dosimetric comparison of Monte Carlo and Ray Tracing of Cyberknife T Spine treatment plans

Purpose: Cyberknife treatment involves many beams passing through lung before reaching the T spine target therefore tissue heterogeneity correction will have major effect on dose distribution. This study compares dose to the target and to critical structure for T Spine treatment plans generated from Multiplan with Monte Carlo and ray tracing for tissue heterogeneity correction.

Method and Materials: Clinical T spine treatment plans based on ray tracing algorithm for tissue density correction were recalculated with Monte Carlo at high resolution with 2% uncertainty. Results including target dose, Conformity Index, target coverage and cord dose based on the two calculation methods are compared.

Results: Based on clinical cases, the ratio of Monte Carlo results to ray tracing results are: target minimum dose 94% +/- 6%, target mean dose 97% +/- 2%, target maximum dose 101% +/- 3%, Conformity Index 93% +/- 3%, coverage 95% +/- 2% and cord maximum dose 96% +/- 3%. Monte Carlo plans tend to have more dose heterogeneity with lower target minimum dose, lower target mean dose and similar target maximum dose. Coverage and Conformity Index are lower for Monte Carlo by 5% to 7% because the optimized ray tracing plans are no longer optimal when recalculated with Monte Carlo.

Conclusion: Ray tracing treatment plan tends to under dose the T spine target and cord by 3% to 4%. At the lung/bone interface, the isodose line tends to pull toward the vertebral body and the target voxels closest to the lung will have the biggest dose drop therefore the lower target minimum dose. It is recommended to start Multiplan optimization with Monte Carlo for T spine treatment plan in order to get realistic dose to target and cord.