AbstractID: 5606 Title: Accounting for Tissue Heterogeneities in Head and Neck IMRT Plans Increases Planning Target Volume and Spinal Cord Doses

Purpose: Using TLD measurements in an anthropomorphic phantom, we previously demonstrated that the presence of heterogeneities causes an average 5.1% dose increase compared to the dose calculated by CORVUS' pencil-beam algorithm without heterogeneity correction. In this treatment planning study, we investigated the dosimetric effects of heterogeneities on clinical head and neck IMRT plans.

Method and Materials: Ten CORVUS plans for five nasopharynx (NP) and five base of tongue (BOT) tumors were recalculated using the convolution/superposition algorithm of Pinnacle^3 6.2b. In contrast to the CORVUS algorithm used in our clinic which assumes a homogeneous water-equivalent patient, the convolution/superposition algorithm accounts for the effects of heterogeneities by converting CT numbers to electron densities. Dose volume histograms were compared for the Pinnacle^3 and CORVUS plans. To characterize tumor coverage, the D_{95} and V_{105} were calculated for the PTV. The maximum doses to the spinal cord were also compared.

Results: The D_{95}, V_{105}, and spinal cord doses calculated by Pinnacle^3 following heterogeneity correction were larger than CORVUS doses for all ten patients. The D_{95} increased by an average of 2.5% (2.9% for NP and 2.2% for BOT tumors). The V_{105} increased by an average of 57.5% (60.2% for NP and 54.8% for BOT tumors). Increases in V_{105} ranged from 28.5% to 71.9%. Spinal cord doses increased by an average of 4.5% (4.5% for NP and 4.6% for BOT tumors) with a range of 0.8% to 8.5%.

Conclusion: PTV coverage was minimally changed but the dose inhomogeneity within the PTV increased. The increased PTV dose inhomogeneity was larger by 5.4% in the NP tumors compared to the BOT tumors. Spinal cord doses were systematically underestimated by CORVUS. Overall, the differences between NP and BOT treatment plans were minimal. This was probably due to the similarity of the initial PTV volumes for the two sites.