AbstractID: 9606 Title: Analysis of Dosimetric Errors for CBCT Based Dose Calculation for IMRT Head and Neck Treatment

Purpose: To evaluate the impact of inhomogeneity correction and image registration on the dosimetric accuracy if online Cone Beam CT (CBCT) is used for IMRT dose verification of head and neck (H&N) patients. **Method and Materials**: (1) The dose deviation induced by CBCT artifacts in CT number-electron density relationship was investigated for ten H&N IMRT plans. To obtain maximum errors associated with inhomogeneity correction, dosimetric parameters for PTV, spinal cord and parotids were calculated with inhomogeneity corrections, and compared with those without inhomogeneity corrections. (2) The effect of image registration on dosimetric error was also examined. Image registrations between CBCT and simulation CT (SimCT) were performed by different planners to transport contoured volumes from SimCT to CBCT. IMRT plans based on SimCT were then applied to CBCT volumes. Deviation of image registration shifted the locations of the CBCT volumes, and its dosimetric impact was quantified. (3) One selected patient with significant shrinkage of tumor mass during treatment was monitored using CBCT, dosimetric parameters were calculated for the anatomy determined by CBCT and the variations were evaluated. **Results**: Without inhomogeneity corrections, dosimetric errors for PTV coverage (D95) were within 1.5%, and within 3% for cord maximum dose and parotid mean dose. Deviation in image registrations generated dosimetric differences of 3.3% for PTV D95, 2.0% for cord maximum dose and 3.5% for parotid mean dose. Changing anatomy due to tumor shrinkage induced dose variations of 4.3% for PTV coverage, 3.2% for maximum cord dose and 3.2% for mean parotid dose. **Conclusions**: The dosimetric errors generated from both CBCT artifacts in inhomogeneity correction and inaccuracy of image registration were of the same magnitude with dose variations caused by patient's changing anatomy. Both accurate CT number - electron density calibration for CBCT and image registration will be necessary for reliable dose calculation using CBCT.