

## AbstractID: 10908 Title: Is Average Fractional Dose Representative of Cumulative Dose for HN-IMRT?

**Purpose:** Use of on-board cone-beam CT (CBCT) imaging during HN-IMRT treatment course allows for calculation and reconstruction of the dose delivered to the patient daily. The purpose of this study was to investigate whether the average fractional dose represents the actual cumulative dose to the patient in fractionated radiotherapy.

**Method and Materials:** The CBCT data from 30 patients and 896 treatment sessions were analyzed and applied to HN-IMRT plans from 12 patients. Dose distribution for each fraction was recalculated based on the actual patient setup error. Two types of analyses and summation were performed for each patient: average of all fractions, AVG, and voxel-by-voxel cumulation for all fractions (CUMU). To illustrate the difference, setup errors were also scaled up by different factors. The evaluation was performed using dosimetric indices for targets and OARs.

**Results:** The mean dose for each structure was the same for AVG and CUMU methods. However, other indices were different. In general, the AVG predicts systematically lower target doses than CUMU for both CTV1 and CTV2, up to 4.5% for  $D_{05}$  and 2.6% for  $D_{90}$ , at proper margins. The AVG also predicts higher OAR doses (up to 8.1%  $D_1$  for cord, brainstem and mandible) than CUMU, except parotid gland in which the  $V_{30}$  and  $V_{20}$  is 11% higher in CUMU than AVG.

**Conclusion:** Significant differences are observed in dose delivered to patients using the average fractional and cumulative dose calculation in the presence of rigid setup error. The differences are smaller at larger margins. The main reason for such differences is that the random setup error is larger than the systematic, and not the same target region gets underdosed at every fraction. Therefore, for fractionated radiotherapy, use of the average fractional dose does not represent the true cumulative dose received by the patient.

**Conflict of Interest:** None.