

AbstractID: 13865 Title: Daily Cone Beam CT (CBCT) Reduces the Setup Margins Needed for External Beam Radiotherapy of Brain Tumors

Purpose: To identify the margin needed to account for setup error in brain tumor radiotherapy based on CBCT data, and quantify the reduction of the required margin with the use of daily CBCT.

Methods and Materials: Patients who underwent EBRT for brain tumors and had daily CBCT imaging were included on this IRB approved study. All patients were immobilized with thermoplastic masks. Prior to each treatment, a CBCT was acquired and the images were co-registered with the planning CT. Positional errors in the three orthogonal directions were recorded. Using Van-Herk's formula, we modeled the necessary setup margin, as a component of the PTV expansion, for all patients. Assuming the use of CBCT corrected for systematic error, we then used data from verification CBCTs taken after the initial shifts were corrected to quantify the margin needed to account for residual random error, and compared these results.

Results: A total of 2008 CBCTs, in 76 patients were included in this analysis. The mean interfraction shifts for all treatments were  $1.2 \pm 1.5$ ,  $1.5 \pm 1.5$  and  $1.7 \pm 1.3$  mm in the medial-lateral, superoinferior, and anteroposterior dimensions, respectively. Without the use of daily CBCT, the necessary setup margins would be 4.0, 4.7, and 5.1 mm in the three dimensions, respectively. Verification CBCTs were acquired for 65 fractions in 21 patients. The standard deviations of the residual errors were 1.1, 1.0 and 0.8 mm, in the three dimensions, respectively. The margin required to account for the residual random error was thereby reduced to 0.8, 0.7 and 0.6 mm, respectively.

Conclusions: Image-guided radiotherapy using daily CBCT for brain tumors significantly reduces the margins needed to account for setup error.