

AbstractID: 6402 Title: A quantitative assessment of treatment setup improvement in TomoTherapy IGRT

Purpose: Image guided radiation therapy (IGRT) is becoming the standard of practice for many treatment sites. Our purpose in this study was to quantify the improvement in setup accuracy with the use of IGRT in TomoTherapy. We have analyzed shifts in the X,Y,Z directions for patients undergoing daily IGRT and treatment with a TomoTherapy Hi-Art unit. Total vector shifts were also calculated. Four distinct patient groups were analyzed: cranial, head and neck, prostate with implanted fiducials, and prostatectomy patients.

Method and Materials: Megavoltage computed tomography (MVCT) was carried out at each treatment fraction. The MVCT was fused to the planning KVCT and the resultant X,Y,Z offsets determined. A total of 1,303 X,Y,Z measurements from 48 patients were collected for this study. The data is presented separately for each of the four groups.

Results: Prostate patients with implanted gold markers had the largest vector shifts with a mean of 9.0 mm. The magnitude of this vector was largely due to vertical shifts (Z direction) with a mean of 7.1 mm. Prostatectomy patients were set up based on bone fusion and had an average vector shift of 7.8 mm, while head and neck and cranial patients had an average shift of 5.0 mm and 4.7 mm respectively. Data for the displacement in each of the X,Y,Z directions is also presented. The variation in shifts between different patients within a group was significant and varied by at least a factor of four.

Conclusion: This study demonstrates quantitatively the potential improvement in radiotherapy accuracy with the use of IGRT in TomoTherapy. Corrections in setup in the Z (vertical) direction account for the largest contribution to the vectors calculated. The use of extremely high dose gradients in IMRT has made patient positioning accuracy even more critical than in previous modalities.