

AbstractID: 7150 Title: Evaluation of patient's setup uncertainties and organ motions using a TomoTherapy Hi-Art system

Purpose: To assess the patient setup uncertainty and internal organ motion using IGRT registration data from a TomoTherapy HI-ART system

Methods and Materials: A TomoTherapy HI-ART system (TomoTherapy Inc., Madison, WI, USA) has been in clinical use at our institution for over one year. For each fractional treatment, patients are scanned and registered to the reference image set. Offsets from registration processes can be analyzed in terms of a systematic component and a random component. For each patient, the systematic component can be calculated by averaging offsets over all treatment fractions; the random component can be assessed by evaluating the standard deviation of offsets over all treatment fractions. In this work, registration data from 25 Head/Neck/Central Nervous System (H&N/CNS) cancer patients and 25 pelvic cancer patients were analyzed. Total number of patient scans involved is approximately 1400.

Results: For H&N/CNS cancer patients, the population mean of random offset component was 1.4 ± 0.6 mm, 1.8 ± 0.5 mm and 1.5 ± 0.5 mm in medio-lateral (M-L), cranio-caudal (C-C) and antero-posterior (A-P) directions. For pelvic cancer patients, results were 4.9 ± 1.7 mm, 3.0 ± 1.9 mm and 3.5 ± 1.0 mm in M-L, C-C and A-P directions. Random offset component for pelvic cancer patients is larger than those of H&N/CNS cancer patients ($p < 0.01$). In both cases, random offset component is different in different spatial directions ($p < 0.01$). The population mean of systematic offset component in A-P direction for pelvic cancer patients is about 6mm.

Conclusions: Large amount of data from IGRT process can be used for many purposes. Our data from patient's daily registration reconfirms that the patient setup uncertainty and internal organ motion should be different for different tumor sites and spatial directions. Our data also shows, for TomoTherapy Hi-Art system, when setting up tattoos for pelvic cancer patients, a 5-6mm offset needs to be considered in A-P direction.