AbstractID: 8638 Title: Analysis of setup and dosimetric errors of kV CBCT guided stereotactic intensity-modulated radiosurgery for spinal lesions

Purpose: To investigate target localization accuracy and dosimetric influences arising from the setup errors and patient motion for an on-board kV CBCT-guided spinal stereotactic intensity-modulated radiosurgery(IMRS).

Methods and Materials: Eight spinal patients treated using CBCT-guided stereotactic IMRS were analyzed for this study. All patients were immobilized using BodyFIX® immobilization system(Medical Intelligence) and set up with the guidance of Varian on-board CBCT. Four sets of images were acquired for each treatment to evaluate patient's intrafraction motion: CBCT and orthogonal kV images before treatment, kV images in the middle of treatment and another CBCT at the end of treatment. Target localization accuracy and intrafraction motion were evaluated by offline analysis of the registrations between planning CT and CBCTs as well as between DRRs and kV images. CBCT images were imported into Eclipse to perform CBCT-based dose calculations using patient's real treatment positions and isocenters. The calculated results represent the delivered dose distributions under the real treatment situations and were used to assess the dosimetric changes arising from setup errors and intrafraction motion.

Results: The results show that the target localization accuracy is 1.4mm and the overall intrafraction target displacement is less than 2.0mm using our IMRS technique. The averaged target coverage reduction is ~5% due to the target localization error and 11% due to both the localization error and the intrafraction motion. The largest increase of the maximum cord dose is 4.8Gy due to the target localization error and 7Gy due to the intrafraction motion.

Conclusions: CBCT-guided stereotactic IMRS can provide a target localization accuracy of less than 1.5mm for spinal treatment. With the BodyFIX® system, the intrafraction displacement can be effectively reduced to 1~2mm. The intrafraction motion at this scale may still have potential influence on the target coverage and the cord dose due to the extreme dose conformity of IMRS.