

AbstractID:8792Title :AssessmentofIntrafractionalMotionforSpinalRadiosurgery PatientsbyMultipleOnboardMegavoltageCTScansduring Treatment

**Purpose:** To assess the intrafractional patient motion during single-fraction spinal radiosurgery using multiple CT scans acquired with onboard megavoltage CT (MVCT) during treatment.

**Method and Materials:** Nineteen patients underwent single-fraction (12 – 24 Gy) spinal radiosurgery on a TomoTherapy HiArt radiotherapy unit with onboard MVCT. Because of the large fractional dose, the treatment was divided into 3 or more sub-fractions. Patients were immobilized with BlueBAG™ BodyFIX® except for C-spine patients who were immobilized with face-and-shoulder masks. To accurately align the patient, an initial MVCT was acquired after patient was setup to skin marks. Image registration between MVCT and planning CT was performed using an auto-registration algorithm followed by manual fine tuning to calculate the couch shifts. Immediately after the alignment, a verification MVCT scan was acquired. The couch was further shifted according to verification CT before the first sub-fraction was delivered. Subsequently, MVCT was reacquired and the patient realigned after each sub-fraction. A total of 67 MVCT-guided intrafractional alignments (excluding initial alignments) were evaluated for the 19 patients. Couch shifts were analyzed to obtain the information of patient intrafractional movements.

**Results:** The mean  $\pm$  standard deviation for the magnitude (and displacement which is expressed in parentheses) of the shift was  $1.0 \pm 0.9$  mm ( $0.16 \pm 1.31$  mm) in the lateral direction,  $1.2 \pm 1.1$  mm ( $0.31 \pm 1.62$  mm) in the anteroposterior direction,  $1.6 \pm 1.2$  mm ( $0.44 \pm 1.97$  mm) in the superior-inferior direction, and  $2.5 \pm 1.4$  for the resultant vector. The respective maximum shifts were 5.0 mm, 5.4 mm, 5.7 mm and 5.9 mm. Majority (73%) of the realignments required shifts less than 3.0 mm. Image resolution and registration errors may have contributed to the observed intrafractional motions.

**Conclusion:** Patient intrafractional motion should be considered in treatment planning for spinal radiosurgery patients. More intensive intrafractional monitoring and better immobilization devices are necessary to reduce intrafractional patient motion.