

## AbstractID: 5081 Title: Frameless Radiosurgery Using Stereoscopic X-ray Guidance: System Characteristics and 2 Year Clinical Experience

**Purpose:** To evaluate targeting capabilities of a system for image guided “frameless” stereotactic irradiation.

**Method and Materials:** System accuracy was investigated using an anthropomorphic head phantom into which a “hidden target” (radio-opaque sphere) was inserted. The target was identified on planning CT images and the phantom was fixed to the treatment couch. To align the target to isocenter, stereoscopic kV x-rays were fused to planning DRRs. AP and lateral verification films were exposed using a 10 mm circular collimator, and the offset of the sphere within the radiation field was recorded. The entire process was repeated 50 times in order to achieve an accurate assessment of positioning capabilities.

Retrospective data was evaluated from patients having undergone nearly 600 x-ray guided single and multi-fraction stereotactic irradiation procedures. From this data the following were investigated: the nature and magnitude of systematic and random positioning errors present in conventional procedures, confidence limits on the reproducibility of the mask immobilization device used for multi-fraction treatments, and the potential for replacing rigid head fixation with image guided positioning.

**Results:** In phantom studies, a vector displacement of  $\sigma = 0.39$  mm relative to the “perfect” isocenter was observed. Based on a sample population of 50, this provides assurance of accuracy at the 95% confidence level.

Improvement in positioning accuracy was observed in multi-fraction procedures; analysis of 565 fractions showed a mean vector deviation  $\sigma = 2.65$  mm relative to traditional methods. The largest component of this discrepancy was in the superior/inferior direction. In comparison, a mean vector deviation  $\sigma = 1.62$  mm was observed in patients for whom rigid fixation was used.

**Conclusions:** Stereoscopic x-ray imaging is an accurate positioning method for cranial stereotactic irradiation. The system is as accurate as rigid frame-based methods and can improve the reproducibility of fractionated delivery.