

## AbstractID: 13751 Title: Retrospective Clinical Data Analysis of Fiducial-Free Lung Tracking

**Purpose:** To present the algorithmic approach used in the Xsight® Lung Tracking System (XLT; Accuray Incorporated, Sunnyvale, CA) of the CyberKnife® Robotic Radiosurgery System (Accuray Incorporated) and to quantify the expected proportion of lung radiosurgery candidates suitable for fiducial-free motion-compensated treatment using orthogonal kV imaging. **Method and Materials:** The XLT system was recently enhanced with the goal of increasing the proportion of lung lesions that can be tracked in orthogonal kV x-ray image pairs without fiducials. These enhancements include digitally reconstructed radiographs generated from local tumor neighborhoods, an automatic preferred projection epipolar constraint, tumor template matching allowing for in-plane rotations, and automatic x-ray image enhancement. An extensive multi-institutional (M=5) cohort of patients (N=103) was retrospectively analyzed to quantify fiducial-free target localization performance for lung tumors spanning a broad range of anatomical locations and sizes (largest dimension ranged from 10 to 100 mm). This analysis evaluated 7,565 x-ray image pairs to quantify the localization performance of the XLT system in comparison to fiducial localization as a gold standard. Clinical cases were categorized as "fiducial-free candidates" when XLT localization satisfied preset accuracy, quality assurance and detection confidence metrics in over 75% of the tested image pairs. **Results:** A total of 57 out of 103 cases (55.3%) were found to be suitable candidates for fiducial-free treatment. The site-specific fiducial-free candidate ratios ranged from 40% to 78% of all lung radiosurgery candidates, reflecting variability in patient population, tumor locations and sizes (algorithm works best for tumors larger than 15 mm in diameter), and x-ray imaging technique. **Conclusion:** This study demonstrates that fiducial-free localization and motion compensation can be achieved in over half of lung radiosurgery candidates using the recently enhanced XLT system, while maintaining tracking accuracy comparable to that obtained using implanted fiducial markers. **Conflict of Interest:** The authors are employed by Accuray Incorporated.