AbstractID: 5302 Title: Image Fusion Reduces Errors for Mobile Tumors and Stereotactic Radiotherapy in IGRT

**Purpose:** To evaluate set-up error for mobile tumors: lung, liver, and prostate under image-guided radiotherapy, and accuracy for cranial stereotactic radiotherapy with fixed (SRS) or removable frame systems (SRT).

**Methods and Materials:** Twenty-six patients with lung, liver or prostate cancer were implanted with 3 gold markers inside in the tumors. Markers and planning isocenter coordinates were transferred to a fusion system. Patients were positioned according to skin tattoos and lasers followed by stereoscopic KV x-ray acquisition. The x-ray sets were then fused with corresponding digital reconstructed radiographs (DRRs) of the plan. New skin tattoos were made after fusion on the first treatment day. For extracranial treatments, markers were manually matched between the x-ray images and DRRs. Auto-fusion matching bone structures was applied for SRS/SRT. Deviations between actual and planning isocenters were determined by the fusion software.

**Results:** Average prostate motions plus setup errors in the lateral, longitudinal and vertical directions were (mean ± one standard deviation): $3.0 \pm 1.5$ mm, $2.4 \pm 1.0$ mm, and $4.2 \pm 1.8$ mm, among 24 patients each treated with 25-45 fractions. Errors >10 mm in one of the three directions was found in 1.9% of the total 1773 measurements. Errors >5mm, occurred in 10.8%, but the rate reduced to 7.5% if 4 patients were excluded from the analysis. Errors for the lung following 32 fractions were: $3.3 \pm 4.4$ mm, $3.3 \pm 2.9$ mm, and $1.7 \pm 1.2$ mm. For liver the errors were: $4.2 \pm 3.1$ mm, $4.6 \pm 4.6$ mm, and $2.6 \pm 2.7$ mm. No error >2.0 mm occurred for SRS, but 15% exceeded 2.0 mm for SRT despite with good immobilization device.

**Conclusions:** Use of image fusion provides a reliable method to evaluate quality of immobilization, verify and increase treatment accuracy. Results from this investigation may have implications for appropriate tumor margins for different sites and techniques.