Tracking Bone and Metal with Xsight-Lung

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Objectives: The Xsight lung tracking algorithm has been widely used to track lung tumors, based on the density difference between the target and surrounding tissue. The ultimate goal of this tracking is to spare patients from invasive fiducial placement. We tested the feasibility of using Xsight lung to track bony structures and metal hardware with a phantom study and report our clinical experience with 8 patients.

Methods: One 2 cm, 4 cm and 8 cm long plastic tubes and 4 cm and 8 cm long biliary stents were placed on top of a 10 cm thick solid water phantom. Gold fiducial markers are also placed around the tube or stent on the phantom as references. The phantom was scanned and test plans were designed to determine the tracking feasibility and precision. Since April 2009, three lung and chest wall patients were treated Xsight lung tracking of the sternum. We also attempted to track stents within the abdomens using Xsight-lung.

Results: Using the default tracking parameters, we could not lock on either the plastic tube or stent in the phantom. After adjust the tracking parameters, especially with low "live contrast factor" and using a smaller tracking range, we successfully and consistently locked on all plastic tubes with the tracking precision of 1 mm or better. These modifications did not allow tracking of the stent in the phantom. However, with manual replacement of the segmental digitally reconstructed radiograph (DRR) with the full DRR as a tracking reference, the 4 cm stent could be tracked, but the 8 cm stent remained untrackable. For the clinical cases, we successfully treated the three patients by tracking the sternum. For those patients with stents we were unable to lock on the stent for tracking.

Conclusions: We achieved tracking of bony structure with Xsight lung, but needed the operator to adjust the tracking parameters. Visual verification is required and special treatment quality control is encouraged with such usage. While tracking of a biliary stent is possible, it was very challenging with the current Xsight lung. Further development of the tracking algorithm is needed.

Outline:

A: Introduction of Xsight-lung

1. **Track Lung tumor**
2. **Possibility of track bone and metal**

B: Design Phantom and test

1. **Plastic tube**
    a. **Adjust tracking parameters needed**
2. **Metal Stent**
    a. **Replace reference DRR**

C: Clinical experience

1. **Successful bone tracking**

2. Failed stent tracking