AbstractID: 3951 Title: Strategies for Respiratory-Compensated Treatment of Lung Lesions

Purpose:
The CyberKnife Synchrony system allows respiratory motion compensated treatment of lung lesions implanted with fiducials, using a model of the relative motion of the fiducials and infrared diodes on the chest. Often implantation of fiducials in the lesion is not feasible because of the potential for pneumothorax. We compare the following two alternative strategies

1. Synchrony treatment with fiducials in the anterior chest wall
2. Non-Synchrony treatment with fiducials in the posterior chest wall

Method and Materials:
The lung lesion patients were scanned using a GE Lightspeed Multi-Slice scanner to obtain 300 1.25mm thick slices through the area of interest during one breath-hold. This was performed three times covering full inspiration, full expiration, and mid-inspiration. Fiducials were implanted percutaneously in the anterior and posterior chest wall. The lesion and position of the fiducials were delineated on all three sets of CT scans. If the motion of the lesion tracked the motion of the anterior chest wall fiducials, then a Synchrony plan was developed to treat the lesion as drawn on the mid-inspiration CT scan. If the lesion motion did not track with the anterior chest wall fiducials then a non-Synchrony plan was developed that treated the lesion as seen on all three sets of CT scans using the fiducials in the posterior chest wall for tracking.

Results:
Using anterior chest wall fiducials, the lesion motion tracked to within 1-2mm in X and Y, and 5-6mm in Z. The target was extended in Z to accommodate this.
For non-Synchrony treatments the target volumes increased by 60 to 75% and the prescription isodose volumes increased by 65 to 90%.

Conclusion:
The treatment of lung lesions presents a difficult challenge especially if fiducials cannot be implanted in the lesion to allow full Synchrony treatment, but the techniques described will still allow treatment.