

AbstractID: 10451 Title: Comparison of lung tumor motion profiles from 4D CT and a treatment tracking system.

**Purposes/Objectives:** Breathing-induced tumor motion is a major challenge in the radiotherapy of lung cancer. 4D CT can be used to define the tumor motion profile in order to create a patient-specific internal target volume (ITV) that can be used for treatment planning. On the other hand, CyberKnife tracking using implanted fiducial markers is used in real time to align a pre-planned treatment volume to the moving anatomy during radiation delivery. This study compares the area of the ITV to the motion of tumors seen during treatment by the CyberKnife.

**Methods/Materials:** One patient who had a 4D CT radiotherapy planning scan were subsequently treated with CyberKnife using fiducial markers. ITVs were drawn based on the gross tumor visualized on all phases of the planning 4D CT. The motion trajectories of the fiducials were recorded during the treatment. A motion profile was generated for each tumor based on the profile of the 0% inhale phase of the CT and the motion trajectory recorded by CyberKnife over 20 second and 10 minute periods. The volume the tumor traversed ( $V_t$ ) and the ITV volume ( $V_i$ ) were compared, to calculate the ratio of the volumes  $V_t/V_i$  and the percent difference  $(V_t - V_i)/(V_i)$  for each 20 second and 10 minute segment.

**Results:** The ratios of the volumes for the patient was 78%. The percentage of  $V_t$  outside of  $V_i$  was 19%. For the 10 minute segments the ratios are 94%.  $V_t - V_i$  is 22%.

**Conclusions:** We developed a method to compare internal target volumes acquired with 4D CT to the actual volume tumors traversed during CyberKnife treatment. The tumor volumes traversed during treatment were usually smaller than the ITV's derived from 4D CT. However, the tumor trajectory was still seen to travel outside of the ITV volumes.