AbstractID: 1790 Title: Predictability of lung tumor motion during normal breathing based on external marker monitoring

This study aims to investigate the relationship between internal lung tumor motion and external chest-wall motion. As part of an IRB approved study, all patients underwent placement of gold fiducial markers directly into the tumor under CT-guidance. The RPM system (Varian Medical Systems, Palo Alto CA) was used to record synchronous fluoroscopic movies of internal fiducial movement during breathing, and movement of an external marker placed on the chest-wall. Several consecutive orthogonal movies were recorded. All measurements were performed during audio breathing instructions customized to a comfortable breathing pattern for each patient. Seven patients have been accrued to this study to date. A diversity of tumor breathing movement patterns was observed, including superior-inferior, lateral, rotational movement and hysteresis. In most cases, a cross correlation coefficient in excess of 0.8 was found between the primary axis of internal motion and external marker movement. The nature of correlation (linear or non-linear) between external and internal marker movement was analyzed, and focus was given to a comparison of correlation to amplitude and phase traces of the external marker. Phase traces in general showed highest degree of correlation in cases where hysteresis in tumor motion was present. In cases where breathing level drifted with time, amplitude traces showed highest correlation. Given high correlation between internal and external motion, a reference correlation trace can reliably be used to base respiratory gated radiotherapy on internal tumor motion prediction from external marker monitoring.
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