

AbstractID: 4612 Title: Correlation between external abdominal and internal liver fiducial motion in 4D-CT

Purpose: to determine how well the anterior-posterior location of a marker, placed on a supine patient's abdominal surface, correlates with the location of a radio-opaque fiducial implanted within the liver. We investigate which respiratory phases exhibit the best correlation between the marker and the fiducial.

Methods and Materials: data was obtained from five patients, each having a fiducial (either an implanted gold pellet or the tip of a stent) in the liver. Each patient received a cine-mode 4D-CT scan of the liver, with the position of an external marker used to associate each cine CT image with a specific respiratory phase. The trace of the anterior-posterior motion of the marker was normalized under the assumption that, among ten phases of a full respiratory cycle (0%, 10%, 20% ... 90%), the marker displacements correlated linearly with the fiducial's superior-inferior displacements. Each cycle of the normalized marker trace was then superimposed upon a plot of the fiducial's displacement; the latter was measured within the 4D-CT data set for each of the ten phases.

Results: comparisons of the marker trace and the fiducial coordinate from 4D-CT indicated that, in general, the marker motion correlated reasonably well with internal liver motion during the process of exhalation (from end-inspiration to end-expiration), with optimum correlation during end-expiration (40% to 60% phase). The correlation tends to be poorer during inhalation, extending from 70% to 90% phase.

Conclusions: a tight correlation near end-expiration suggests that using an external-motion-based respiratory trace, as a guide for gated treatments for liver cancer, should enable reliable and reproducible coverage of the target volume. Poorer correlation during inhalation suggests that the marker's anterior-posterior motion may not adequately characterize the internal motion during those phases, and that gating should be avoided during this stage of the respiratory cycle.