

AbstractID: 11143 Title: Assessment of diaphragm as an internal surrogate for lung tumor motion prediction

Purpose: We have previously assessed the use of diaphragm as a surrogate for predicting real-time tumor position with linear models built with training data extracted from the same treatment fraction. In this study, we evaluate inter-fraction variability of model parameters and the prediction error for different fractions from the model built on the first fraction. **Method and Materials:** 21 fluoroscopic sequences from 5 lung cancer patients were used for this study. Each patient has from 2 to 6 fluoroscopic sequences from at least 2 different treatment fractions. Each sequence consists of 352 to 690 frames at 15 frames per second. Superior-inferior motions of the diaphragm and the tumor were identified in every frame. A model to predict tumor position was built for each sequence, and the parameters from different sequences were compared. Then, the model built from the first fluoroscopic sequence was used to predict tumor position in the subsequent fluoroscopic sets of each patient. Prediction error was calculated for three different ways of registering fluoroscopic sets: manual bony anatomy registration, mean tumor position registration, and mean diaphragm position registration. **Results:** Average variability of the correlation and slope of linear models built from different fluoroscopic sequences are 1.3% and 8.6% respectively. Prediction based on the model built with data from the first sequence leads to an average mean localization error and average error at a 95% confidence level of 1.2mm and 2.9mm respectively for bony registration, 1.5mm and 3.3mm for mean tumor position registration, and 2.5mm and 4.7mm for mean diaphragm position registration. **Conclusion:** For the patients studied, diaphragm has shown to be a good surrogate for tumor motion. Variability of model parameters and prediction error from one sequence to another are small. Bony registration seems the most accurate method for patient setup when using diaphragm as a surrogate.