

AbstractID: 8779 Title: Can Pre- and Post-Imaging Determine Prostate Intrafraction Motion?

Purpose: Recent studies of prostate intrafraction motion have been inconclusive. One cine-MRI study demonstrated that pre-treatment rectal filling status is a significant predictor of intrafraction motion magnitude. However, studies using the Calypso system show that pre- and post-imaging is not an adequate test of prostate intrafraction motion. Our purpose is to determine the effectiveness of pre- and post-imaging in predicting prostate intrafraction motion.

Method and Materials: Pre- and post-CBCT images and intrafraction kV fluoroscopy were used to determine the prostate position via fiducial markers of 15 patients over 279 fractions. For each fraction, rectal filling status was documented and bladder volume estimated on both the pre- and post-CBCTs. Also documented was whether a visible change occurred in rectum shape between CBCTs. The ability of rectal and bladder filling to predict the measured intrafraction motion was evaluated using receiver operator characteristic (ROC) analysis. A model assuming a linear motion pattern during the treatment fraction was applied and the RMS error calculated.

Results: Initial rectal filling status was a significant predictor of large intrafraction motion while effects from bladder filling during treatment were inconclusive. The sensitivity of detecting intrafraction motion above a given threshold using post-imaging was improved when change in rectal filling status was taken into account. For detecting motion >5 mm, the sensitivity increased from 0.88 to 0.93 with a decline in specificity from 0.96 to 0.76. The rms-error decreased from 2.4 mm to 1.4 mm when the linear model was used as opposed to assuming no intrafraction motion ($p < 0.0001$).

Conclusion: Pre- and post-imaging is a significant predictor of intrafraction motion especially when rectal filling status is taken into account. A linear model is more accurate than assuming no intrafraction motion. Effects of bladder filling are inconclusive and require further study.

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