

AbstractID: 6839 Title: A comparison of daily megavoltage CT and ultrasound imaging guided radiation therapy for prostate cancer

Purpose: To compare the prostate localization capabilities of ultrasound imaging and megavoltage CT (MVCT) for on-line daily image-guided radiotherapy (IGRT) of the prostate cancer.

Method and Materials: Daily shifts were analyzed to account for inter-fractional variations collected from a total of 129 prostate cancer patients, 106 with ultrasound-based imaging (BAT, B-mode Acquisition and Targeting) and 23 with MVCT of a TomoTherapy (HiArt) unit. The shifts indicated by the two systems were compared statistically along the right/left (R/L), superior/inferior (S/I), and anterior/posterior (A/P) directions. The systematic and random variations among the daily alignments were calculated. Margins to account for these shifts were estimated. The daily shifts from the first 25 treatment fractions and from the remaining fractions were compared for both systems to examine whether a difference in the prostate motion pattern exists between the first 25 fractions and the rest.

Results: The mean shifts and standard deviations along the R/L, S/I, and A/P directions were -0.11 ± 3.80 mm, 0.67 ± 4.67 mm, and 2.71 ± 6.31 mm for BAT localizations and -0.88 ± 5.36 mm, 0.41 ± 3.38 mm, and 0.91 ± 3.33 mm for MVCT localizations, respectively. It is clear that the systematic and random variations in daily shifts based on MVCT were generally smaller than those based on BAT, especially along the A/P direction. A t-test showed this difference to be statistically significant. The PTV margins estimated to account for daily variations were 6.69 mm and 14.66 mm based on MVCT and BAT data, respectively. There was no statistically significant difference in the daily prostate movement pattern between the first 25 fractions and the remaining.

Conclusion: The MVCT technique results in smaller variations in daily shifts than ultrasound imaging, indicating that MVCT is more reliable and precise for prostate localization. Ultrasound-based localization may overestimate the daily prostate motion, particularly in the A/P direction.

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