Comparison of IGRT shift data between prostate gland and prostate bed obtained from ct-on-rails

Background/Purpose

The daily shifts of prostate gland have been intensively reported in literatures. However, few papers reported the motion of prostate bed (or prostatectomy) due to several practical difficulties. These include limited soft tissue contrast in MVCT and CBCT, inability to use of fiducial markers and significant deformation of prostate cavity. In our department, we have routinely performed IGRT for both prostate gland and bed with ct-on-rails, and the superior diagnostic ct image quality allows us not only to differentiate both bony anatomy, but also the soft tissue contrast of prostate gland/bed from adjacent organs. In this study, we investigated if the daily shift of prostate bed is significant different from that of prostate gland.

Method and Materials

In our treatment protocol for prostate gland, a total dose of 7740cGy is prescribed to the prostate gland and 6660cGy to prostate bed with daily image guidance. Isocenter is shifted whenever daily movement is greater than 3 mm in any directions. We reviewed 50 prostate gland patients who underwent 43 IGRT fractions and 22 patients of prostatectomy underwent 37 IGRT fractions, in total 2150 CT scans were reviewed for prostate gland and 814 scans for prostate bed. The standard deviations of shift for both patient groups were then calculated. For each patient, the shift was separated into systematic/random component and analyzed according to van Herk. F tests of the shift in systematic and random components for both groups were performed.

Results and Statistics

Of the reviewed 814 CT scans from 22 prostate bed patients, the standard deviation of shift was found to be 5.9 mm in AP direction (ranges from -22.4mm to 22mm), 3.2mm in SI direction (ranges from -14mm to 14mm), and 4.1mm in lateral direction (ranges from -15mm to 22mm).

Of the reviewed 2150 daily CT scans of prostate gland from 50 patients, the standard deviations of the shift were found to be 5.4 mm in AP direction (-20mm to 18 mm), 5.0mm in SI direction (-26mm to 20mm), and 4.3mm in lateral direction (range from-15 to 30mm).

F tests of systematic /random shift distribution in three directions (AP, SI and LR) between prostate gland and prostate bed were subsequently performed, it was found that the systematic shift in SI direction for prostate bed is smaller than that for prostate gland (p=0.003).

Discussion/Conclusion

By reviewing a large shift sample of prostate gland and bed, we found that there is no significant difference in daily shift between prostate bed and prostate gland, therefore strategies (e.g. optimized treatment margin) mitigated for prostate gland can be directly applied to prostate bed.