Purpose: To quantitatively characterize the interfractional anatomic variations in post-operative radiation therapy (RT) for prostate bed, so that appropriate strategy that can fully address these variations can be developed.

Methods: A total of 102 daily pre-treatment CT acquired using an in-room CT (CTVision, Siemens) for 10 patients treated with post-operative IG-IMRT of prostate bed. Prior to each fraction, patients were repositioned to correct for interfractional translational shifts based on the alignment of both anterior rectal wall and surgical clips between the daily CT and the planning CT. The PTV was assumed to be the volume enclosed by the 95% prescription isodose surface generated for the conventional four field box. Contours of the PTV, rectum and bladder on each daily CT were generated by populating the planning contours using an auto-segmentation tool based on deformable registration (ABAS, Elekta) with manual editing. Interfractical variations in the volumes, shapes and positions of these contours were obtained. The displacement of the center of mass (DCOM) with respect to the isocenter was used to measure interfractional organ motion, and the maximum overlap rate (MOR) was used to measure organ deformation.

Results: Interfractional variations in the volumes of rectum and bladder were in the range of 50-270% (average 116±41%) and 30-180% (average 67±26%), respectively. The averages of DCOM for rectum are: -0.35±0.46cm (lateral, varying from -1.58 to 1.23cm), -0.33±0.99cm (longitudinal, varying from -2.4 to 1.8cm), and -3.41±1.14cm (vertical, varying from -5.56 to -0.99cm). These values for bladder are: -0.20±0.50cm (lateral, varying from -1.48 to 0.61cm), 3.63±1.10cm (longitudinal, varying from -5.7 to 3.1cm), and -0.31±0.97cm (vertical, varying from -1.68 to 2.77cm).

Conclusions:Large interfractional changes in organ volumes, shapes and positions are seen in post-operative RT for prostate bed. These changes cannot be accounted for by the current standard practice of IGRT repositioning.

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