Purpose: The accuracy of CT-MR imaging fusion plays an important role in both accurate delineation (using MR data) and dose calculation (using CT data) for image-guided radiotherapy (IGRT) of prostate cancer. The purpose of this study was to investigate the accuracy of CT-MRI fusion in target delineation/localization for prostate IGRT.

Methods: Sixty-nine prostate patients were included in this study. Each patient underwent CT/MR simulation prior to the IMRT or RapidArc treatment. Paired CT-MR images were obtained using a GE 4D-CT scanner and a GE 1.5T MR scanner. MR and CT scans were performed within 30min to minimize organ or structure changes except for Calypso patients who received MR scans prior to the Beacon implantation. Prostate, rectum and bladder were delineated on CT and MRI, respectively. The difference of prostate centers and the volume variation between CT and MRI were calculated and used as the index for image fusion accuracy.

Results: With bony structure matching, all bony structures were fused well between CT and MRI. However, the changes in bladder and rectum fillings between CT and MRI dislocate the prostate and the surrounding structures. The maximal shift of the prostate in the AP direction was up to 8mm and about 15.9% of the patients showed a shift >3mm, which was proportional to the difference of the rectum volume. The shift in the SI direction was 0.5-5mm. Of the 11 patients who had >3mm shifts, 6 patients (54.5%) were Calypso patients.

Conclusions: Significant geometrical shifts of the prostate target were observed correlated with large differences in the bladder/rectal volume between CT and MR images especially for large CT-MRI intervals. Attention must be paid to the residual fusion error for the soft tissue target and corrections should be made to ensure target delineation accuracy if necessary.

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None.