

Purpose: Both CT and MR images are used for target delineation in many institutions for prostate IMRT treatment. The uncertainty of prostate registration between these two sets of images caused by the image fusion process will affect the accuracy of the target delineation. The magnitude of image fusion error and its effects on target delineation were investigated.

Materials and Method: For this study, both CT and MR T2 images were taken for prostate patients treated with low dose rate brachytherapy for dosimetry evaluation three weeks after the seed implant. MR images were usually taken within 30 minutes following the CT scan. CT and MR images were fused based on bony structures and some soft tissue land marks that were visible on both images. Image fusion errors were examined by checking the positions of the implanted seeds (two seeds at the prostate base and two at the apex) on both CT and MR images for 30 patients. The differences of seed positions between CT and MR images were analyzed and the mean and the standard deviation were calculated.

Results: The differences of seed positions were clearly visible after the CT and MR images were carefully fused based on bony structures and visible soft tissue land marks. The mean of the difference is 1.6mm and the 1σ standard deviation is 1.4mm for these 30 patients. The median value is 1.5mm and the maximum difference is up to 8.1mm. This error will be transferred to the target delineation if only MR images were used for contouring and the CT images were used for IMRT planning.

Conclusions: Image fusion errors can contribute significantly to the target delineation error that can not be ignored when designing the treatment margin for advanced prostate treatment especially for target localization based on implanted fiducials.