Purpose: Magnetic resonance spectroscopic imaging (MRSI) can identify the dominant intraprostatic lesion, which can then be boosted using high-dose rate (HDR) brachytherapy. MRSI requires the use of an endo-rectal coil, which deforms the prostate. We investigate the performance of deformable registration algorithms to deform MR images acquired with an endo-rectal coil to images acquired without a coil for HDR brachytherapy planning.

Methods: This study utilized MR images of five HDR brachytherapy patients acquired with and without an endo-rectal coil during the same MRSI imaging study. The prostate was contoured on each set of "Coil-In" and "Coil-Out" MR images by an experienced radiation oncologist. The "Coil-In" and "Coil-Out" images were rigidly aligned such that the posterior margins of the prostate were as close as possible without deformation.

Variations on a commercially available deformation algorithm using the B-spline method were applied to a volume of interest that surrounded the prostate and excluded as much of the coil and rectum as possible. The Dice similarity index (DSI) was calculated between rigidly registered contours (DSI1), and compared to the DSI calculated between the "Coil-In" contour and the contour deformed from the "Coil-Out" image to the "Coil-In" image (DSI2). The difference was calculated between DSI2 and DSI1, where a positive change in DSI would indicate an improvement in contour agreement over rigid registration of the prostate in the "Coil-Out" and "Coil-In" images.

Results: The B-spline deformation algorithm designed specifically for MR images was most effective in deforming the "Coil-Out" to the "Coil-In" prostate contour with a mean change in DSI of 0.0124 with contrast correction, and 0.0004 without.

Conclusions: Out of six algorithms tested, only the MR-specific algorithm produced positive changes in DSI. The accuracy of the deformation algorithm on mapping the internal structures of the prostate between "Coil-Out" and "Coil-In" images is under investigation.

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