

AbstractID: 1433 Title: Registering MR with MRS images for HDR prostate treatment using finite element modeling

For targeted HDR prostate brachytherapy treatment, a dose boost can be delivered to dominant intraprostatic lesions (DIL's) identified using MRSI. MRSI data is acquired with an endorectal probe that causes significant nonlinear translation and distortion of the prostate, whereas the probe is removed during HDR therapy. To register MRSI probe-in spectroscopy data to MR probe-out images, we develop a finite element based model that estimates the deformation of the prostate and surrounding tissues due to endorectal probe insertion and balloon inflation. The input is the probe-out MR image with manually segmented tissue types and ROI's and the probe-in MRS image with the inflated balloon outlined. Our model inflates the rectum in the MR image to match the balloon outline in the MRS image and estimates deformations of the prostate and surrounding tissues to produce a deformed MR image and define a mapping between the probe-in/out images. Using this mapping, we warp a regular spectroscopy grid from the deformed MR image to the probe-out MR image that can be used for treatment planning. We verified the method's accuracy by comparing deformed MR images to corresponding MRS images for 5 patients and obtained an average Dice Similarity Coefficient (DSC) of 86% for the prostate. We plan to extend our model and mapping from planar MR/MRS images to 3D volumetric data. The tissue deformation and spectroscopy grid warping requires less than 1 minute of computation time on a standard Pentium-M PC.