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PREDICTION OF PROSTATE MOTION AND DEFORMATION USING FE MODELING FOR BETTER BIOPSY ACCURACY

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Prostate cancer is a major health concern worldwide for aged men and the second leading cause of cancer death of men in the United States. Prostate needle biopsy guided by transrectal ultrasound (TRUS) imaging is the routine clinical standard method of obtaining a tissue sample for histological verification of tumours. Besides, magnetic resonance (MR) imaging prior to the procedure is usually used to assist doctors to localize suspicious regions within a prostate. However, registration between MR-TRUS imaging is complicated because of occurrence of prostate motion and deformation, which may arise from changes of patient position, bladder filling, rectal wall motion and placement of TRUS probe during intervention procedure etc. Here an approach to construct the FE model which mainly encompasses bladder, prostate and rectum from MR images was presented. The influence of biomechanical properties of the organs and constraints from pelvic surroundings on the transformation of prostate upon intervention of TRUS probe or needle insertion was then investigated. Finally, a stand-alone deformable FE model of prostate gland was established with its surrounding organs substituted by mechanical constraints. The study can provide insight into the key factors that determine the prostate motion and deformation. The nonlinear biomechanical FE models will be used to fusion two types of medical images and give guideline for real-time operations to further improve the tissue sampling accuracy.