

Definitive clinical diagnosis of prostate adenocarcinoma (PCa) requires histopathological confirmation of a tissue sample drawn from a 2D transrectal ultrasound (TRUS) guided biopsy. The prostate biopsy procedure, however, is plagued by high false negative rates (up to 34%) as early-stage PCa is generally not visible on ultrasound. As a result, a negative biopsy does not rule out a diagnosis of PCa, as many tumors are missed on initial biopsy. In such circumstances, patients will undergo multiple repeat prostate biopsy (RPBx) to find undetected PCa. In a repeat biopsy, the physician must either avoid previously biopsied tissue (in cases of prior negative biopsy) or target the same anatomical site for patients with non-diagnostic, atypical small acinar proliferations (ASAP). In cases of ASAP, there is a 40-50% chance of finding PCa on RPBx in the same anatomic location, so accurate targeting of prior biopsy locations is essential.

3D TRUS is hypothesized to be superior to 2D TRUS for accurate guidance and recording of the prostate biopsy procedure. Patients undergoing RPBx might benefit most from the hypothesized improvements, as previous Bx core locations can be viewed in 3D and used to guide a RPBx. Accuracy is also important when suspicious findings exist on other diagnostic imaging modalities, such as MRI or PET, are used to direct a TRUS-guided biopsy.

In this paper, we describe a new method to guide prostate biopsy procedures using 3D ultrasound and extend it to prostate therapy. This new approach allows us to guide the biopsy to specific 3D targets in the prostate, record the biopsy locations in 3D, and register the intra-biopsy procedural 3D ultrasound image with an MR image to guide the biopsy to specific locations in the prostate.

Learning Objectives:

1. Understand the limitations of conventional TRUS-guided prostate biopsy
2. Understand the methods that can be used to overcome the limitations of TRUS-guided prostate biopsy
3. Understand the advantages of using MR images fused with 3D ultrasound images to guide prostate biopsy