

MRI-Navigated Stereotactic Prostate Biopsy

Introduction and Objective: A key challenge for prostate cancer therapy is to precisely diagnose tumor lesions. Exact information on tumor grade, stage and site is mandatory to counsel men with prostate cancer. For this purpose we developed a novel prostate biopsy system that combines pre-interventional magnetic resonance imaging with peri-interventional ultrasound for perineal navigated prostate biopsy. This platform integrates imaging, TRUS/MRI-fusion, biopsy planning, perineal targeting and 3D-mapping into a single system.

Materials and Methods: There were 106 men with suspicion of prostate cancer (median age 66yrs, PSA 8.0ng/ml, prostate-volume 47ml) who underwent multiparametric 3T-MRI. Suspicious lesions were marked and the data were transferred to the biopsy system. Using a custom-made biplane TRUS-probe mounted on a stepper, 3D-ultrasound data were gathered and fused with the MRI. As a result, suspicious MRI-lesions were superimposed over the TRUS-data. Next, 3D-biopsy planning was performed including systematic biopsies (median 24 biopsies). Perineal biopsies were taken under live US-imaging and the precise location of each biopsy was documented in 3D. Feasibility, safety, and cancer detection were evaluated.

Results: Prostate cancer was detected in 63 out of 106 patients (59.4%). Of 46 men undergoing initial biopsy cancer was diagnosed in 31 (67.4%). Results in 49 patients undergoing rebiopsy without a previous cancer diagnosis were positive in 22 (44.9%). A positive correlation between MRI-findings and histopathology was found in 68.9%. In MRI-lesions marked as highly suspicious, the detection rate was 95.8% (23/24). Lesion-targeted cores had a significantly higher positivity rate versus nontargeted cores. Procedural targeting error of the first 2461 biopsy cores was 1.7mm. Regarding adverse effects, two patients experienced urinary retention and one patient a perineal hematoma. Urinary tract infections did not occur.

Conclusions: Perineal stereotactic prostate biopsies guided by the combination of magnetic resonance imaging and ultrasound enable effective examination of suspicious MRI- lesions. The higher complexity compared to standard transrectal biopsy is justified by a better detection rate and more comprehensive staging. Each biopsy site is documented accurately for its location in 3D, enabling tailored treatment planning. Also, the resulting data can be used to validate MRI, enabling more precise interpretation of MRI-findings. Procedure morbidity was minimal.

To view this video, please [click here](#)