

Title: Changes in mpMRI and PSA parameters at multiple follow-up time points after whole prostate MRI-guided transurethral prostate ultrasound ablation

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Introduction and objective: The purpose of this study is to evaluate the changes of 3 Tesla (3T) mpMRI and PSA parameters before and during multiple time points after whole gland prostate cancer (PCa) treatment using MRI-guided directional transurethral ultrasound ablation (TULSA).

Specific aims: To describe the volumetric and functional change on serial MR after MR-guided transurethral US-guided whole gland prostate ablation for biopsy-proven prostate cancer.

Rationale and background: Traditional whole gland treatment for prostate cancer, are complicated by urinary incontinence and erectile dysfunction in up to 30-50% of the patients^{1,2}. MR Guided Transurethral US has been previously shown to be safe and effective for whole gland prostate ablation for patients with prostate cancer and might be a novel whole gland ablation technique.

Methods and materials: This IRB approved, HIPAA compliant study included 9 men (45 to 80 years) with biopsy-confirmed PCa, clinical stage <T2b, Gleason score (GS) \leq 3+4, PSA \leq 15 ng/ml and prostate volume \leq 90 cc. The whole prostate was ablated with 3T MRI guided TULSA along with a rectal cooling probe. Patients were followed-up (F/U) at 1, 3, 6, and 12 months after the treatment with measurements of PSA and 3T. mpMRI. The prostate non-perfused volume (NPV) was measured on contrast-enhanced T1-weighted images at each F/U. A paired T-test was used to compare each subjects pre-treatment measurements to their last value F/U measurement ($p < 0.05$ considered significant). TRUS-guided 10-core prostate biopsy was performed at the 12-month (F/U).

Results: In 17 PCa lesions from 9 patients, 8 were GS 3+3, and 9 were 3+4. The mean prostate ablation time was 89 min. (range 30-120 min). There was reported a negative prostate biopsy at the 12-month F/U for all of the patients. There were no immediate intra-procedural or post-procedural complications. Mean prostate volume on T2-weighted MRI decreased from 46cc at baseline to 32cc (29%), 24cc (49%), 21cc (54%) and 13cc (70%) at 3, 6, & 12-month F/U, respectively ($p = 0.01$). The mean prostate NPV decreased from 33.7cc (range 13-83cc) to 21cc (38.3%), 15cc (56.6%), 11cc (68.8%) and 2cc (94.2%) at 1, 3, 6, and 12-month F/U, respectively. The 68.4% difference between mean PSA density=0.19 at baseline and 0.06 at 12-month was significant ($p = 0.041$). The mean ADC value decreased 7.4% from 1460 mm²/s² \pm 117 at baseline to 1351 mm²/s² \pm 130 at 12-month F/U ($p = 0.079$).

Discussion and conclusion: In this study, we have shown that MR guided transurethral ultrasound was safe and resulted in a significant decrease in prostate volume at 1, 3, 6, and 12

months with a corresponding significant decrease in PSAD. Further, ADC decreased in the post ablated prostate, as shown in prior studies. Jakob et al⁹ reported decreases in post-treatment ADC values for non-treated fibroid tissue ($1685\text{mm}^2/\text{sec} \pm 468$) compared to post-treatment ADC values for fibroid tissue ($1078\text{mm}^2/\text{sec} \pm 293$) ($p=0.001$). Kim et al⁴ also reported decreases in ADC values in Canine prostates from baseline ($1630\text{mm}^2/\text{sec} \pm 210$) after treatment ($1030\text{mm}^2/\text{sec} \pm 90$). In conclusion, the new MRI-guided TULSA procedure treated the whole prostate gland in an outpatient setting without significant complications in patients with low-intermediate grade PCa, with a significant, predictable decrease in prostate volume and PSA density, and with considerable changes in mpMRI parameters at multiple F/U time points.

References

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