Transperineal prostate cryoablation under MR-guidance

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Purpose: Cryoablation is a promising minimally invasive therapy to effectively destroy localized tumors. MR guidance is well suited for both accurate cryoprobes placement and monitoring of the ablation zone (ice ball).

We herein report our initial experience and technical feasibility of transperineal prostate cryoablation under MRI.

Methods: Percutaneous MR-guided cryoablation was performed in 11 patients with prostatic adenocarcinoma (mean age: 72 years, mean Gleason-score: 6.45, mean PSA: 6.21 ngr/mL, T1-2c/N0/M0, mean: prostate volume 36.44 mL). All procedures were performed at a 1.5T open bore supra-conductive cylindrical MR scanner (Magnetom-Espree 1.5T, Siemens, Erlangen, Germany), under general anesthesia with an MR-compatible Cryomachine (MR-Seednet System, Galil-Medical, Yokneam, Israel). The patient was positioned in prone positioned (Fig. 1). Body matrix (8 elements) and spine matrix coils were used for signal reception. Free-hand probe positioning was performed under real-time interactive, multi-slice TrueFISP sequence BEAT_IRTTT (TA per plane 0.79 s, TE 2.22 ms, TR 5.4 ms, bandwidth 260 Hz/pixel, flip angle 50°, resolution 1.56 x 1.56 x 4 mm, FOV 350 x 350) (Fig. 2). Multi-planar T2W-Blade imaging (TE 88ms, TR 2200 ms, bandwidth 500 Hz/pixel, flip angle 120°, resolution 1.56 x 1.56 x 4 mm, FOV 400 x 400) was used to confirm final needle position (Fig.3). Four to seven cryoprobes were inserted in the prostate. The ice-ball was monitored using real-time (continuously moved over the treatment area) and high-resolution T2W-Blade imaging (Fig. 4). Urethral warming catheters and rectal thermal monitoring was used to prevent thermal damage to the adjacent organs. Patients were followed at 1, 3, 6, 9 and 12 months after the procedure with serum PSA-level and post-ablation MRI.

Results: Prostate cryoablation was technically feasible in 10 out of 11 patients. The ice-ball was clearly visualized in all cases as a signal-void area in both real time and high-resolution T2-Blade sequences. Mean ice-ball volume was 53.3 mL. Total procedure time ranged from 2 to 4.5h. Mean follow-up was 15 months. Mean PSA-nadir was 0.33 ngr/mL (range: 0.02–0.94 ngr/mL). Complications included a urethra-rectum fistula, urinary infection, transient dysuria and scrotal pain.

Fig. 1

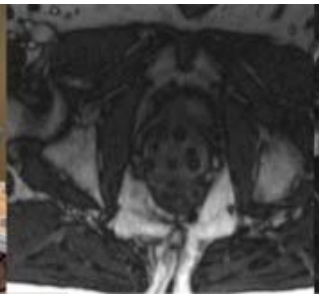

Fig. 2

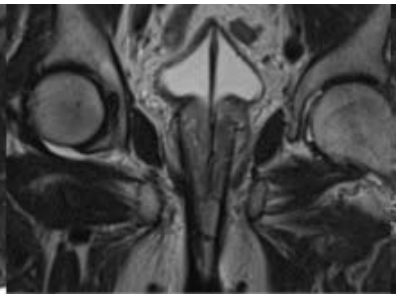

Fig. 3

Fig. 4

Discussion: Percutaneous prostate cryoablation is an effective method for the treatment of localized prostate cancer. Real-time MR-sequences are helpful for both the transperineal cryoprobe positioning and the iceball (ablation zone) monitoring. The introduction of MR compatible templates will reduce procedure time. Future perspectives include the use of MR-guidance for the focal prostate cancer cryotherapy.

Conclusions: MR-guided prostate cryoablation is feasible and promising, with excellent monitoring of the ice-ball.

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