
Histotripsy of ACE-1 implanted prostate tumor: Focal therapy in a canine model

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Introduction: Histotripsy is a non-thermal ablative focused ultrasound technology with possible future applications for prostate cancer focal therapy. We used the ACE-1 prostate tumor model and evaluated the feasibility of treating prostate tumors with histotripsy.

Methods: A total of 10 immunosuppressed (cyclosporine-treated) canine subjects received transrectal ultrasound (TRUS) guided percutaneous intraprostatic injection of ACE-1 canine prostate cancer cells. Prostates were serially imaged with TRUS to monitor tumor growth. Subjects were either treated as shams (3 subjects) or with transabdominal histotripsy of the prostate targeting implanted tumor and adjacent parenchyma using a 750 kHz piezoelectric ultrasound therapy transducer. Prostates were examined histologically to confirm presence of tumor and histotripsy treatment effect.

Results: ACE-1 tumors were visualized on TRUS in all 10 subjects within 2 weeks of tumor injection. Tumors demonstrated growth in the prostatic capsule, glandular lobules, fibrous septa, and periurethral stroma with significant desmoplastic reaction and areas of central necrosis on histology with lymph node and/or pulmonary metastases developing in 4 subjects total. Ultrasound tumor localization and initiation of cavitation during histotripsy therapy was feasible in all treated subjects. Histologically, there was evidence of homogenization of tumor and prostatic parenchyma in all acute subjects (4 total) with necrosis and hemorrhage in chronic subjects (3 total).

Conclusions: This study demonstrates the feasibility of histotripsy destruction of prostate tumors in a canine ACE-1 model, which suggests a potential role for histotripsy-based focal therapy for prostate cancer. Further studies are needed to better characterize the effects of histotripsy on malignant tissues.

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