AbstractID: 13160 Title: MR guided high-intensity focused ultrasound for cancer therapy: a feasibility study using an animal model

Purpose: Ultrasound is a non-invasive agent that has high precision and deep penetration in tissues enabling increased doses to the tumor while sparing nearby normal tissues. MR guided focused ultrasound (MRgFUS) thermal ablation has been applied for cancer surgery and bone palliation clinically. The aim of this work is to explore the feasibility of MRgFUS for prostate cancer therapy.

Method and Materials: An InSightec ExAblate 2000 with a 1.5T GE MR scanner was used in this study. Suitable ultrasound parameters were investigated to perform non-thermal sonications, keeping the temperature below 42°C as measured in real time by MR thermometry. LNCaP cells (10^6) were injected into the prostate of male mice (n=8). When tumors reached the volume of $49\pm3mm^3$ on MRI, the tumor-bearing mice were treated with MRgFUS once a week for two consecutive weeks. Animals were treated with pulsed ultrasound (1MHz; 5W acoustic power; 5Hz frequency; 0.5duty cycle: 0.1sec power on, 0.1sec power off) for 60sec in each sonication. A total of 4-6 sonications were used to cover the entire tumor volume. The animals were allowed to survive for 4 weeks after the last treatment. The tumor growth was monitored on MRI and compared with the control group.

Results: Significant tumor growth delay was observed in the mice treated with MRgFUS. The mean tumor volume for the MRgFUS treated mice was about 30% smaller than that of the control mice 1 week after the MRgFUS treatment and it was about 50% smaller 4 weeks after the MRgFUS treatment.

Conclusions: Our results demonstrated that non-thermal MRgFUS has a great potential for cancer therapy. Further experiments are needed to derive optimal ultrasound parameters and fractionation schemes to maximize the therapeutic effect. This work is supported by Focused Ultrasound Surgery Foundation, DOD PC073127 and Varian Medical Systems. Technical support from InSightec is acknowledged.