

WHITAKER BIOMEDICAL ENGINEERING INSTITUTE

SPECIAL FRIDAY SEMINAR

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“Research in Vascular and Other Interventions with MR”

DATE: October 26, 2007

TIME: 3:00 p.m.

PLACE: Traylor 709

Host: Dr. Elliot McVeigh

Abstract:

Magnetic resonance imaging is well established in diagnostic radiology and has become the method of choice for diagnosing many diseases. The use of MRI during therapeutic procedures, however, is still in its infancy, despite almost two decades of active research. A major reason for the lack of significant progress is the “chicken and egg” situation in which MR scanners are not designed for interventional applications because of the lack of compelling applications, and the inability of compelling applications to arise because of technical limits of existing MR scanners.

To resolve the conundrum, we have been working to develop interventional technologies and potential clinical applications that can be addressed on a minimally-modified MR scanner designed for diagnostic radiology. These technologies include the ability to follow invasive devices in real-time with no latency and minimal acoustic noise. Clinical applications that we have been working towards include MR-guided vascular interventions, with an emphasis on MR-guided electrophysiology, and focused ultrasound ablation in organs such as the prostate.

To address the needs of MR-guided electrophysiology, we have developed a system to both visualize anatomy and to locate catheters in real-time using active MR point-source tracking. Point source MR tracking is acoustically quiet, obtaining catheter locations at rates in excess of 30 frames per second, without employing rapid MR imaging for device localization. Catheter position data is combined with electrical measurements and superimposed on a surface-rendered 3D MR image. One or more catheters can be visualized in real time against pre-acquired images and CINE loops, with synchronization to the cardiac cycle.

We have performed electrical mapping procedures on infarcted (at least three weeks post embolization of the Left Anterior Descending artery) and normal pigs under MR guidance. Voltage maps of the left ventricle have been acquired and compared on the same animal using the current clinical standard, Biosense CARTO EP, and the MR-guided procedure, with excellent agreement. We have also developed system hardware to support rf ablation and cardiac stimulation of the heart while it is in the magnet. We have been able to successfully ablate tissue and pace the heart while MR imaging and tracking, without compromising MR imaging or tracking performance. Therapeutic procedures that we have performed in pigs include ablation of the isthmus (a region ablated to treat atrial flutter), and AV node ablation followed by pacing using a second electrode.

The ultimate role of MR in interventional medicine remains to be seen. Nevertheless, it is becoming increasingly clear that the use of MR imaging systems for interventional procedures offers unique possibilities and that the role of interventional MR imaging can only grow with time.

Any questions, contact 410-955-3132.

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