Real Time 3-D Tracking and Imaging System and Method for MR Guided Endovascular Intervention Therapy

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Technology description

Magnetic resonance (MR) has been utilized largely for medical diagnostic applications, but recent advancements have allowed it to replace many previously performed X-ray examinations. Even more recently, advances have started to permit the use of MR for monitoring and control of therapeutic endovascular interventions. Endovascular therapy is a minimally invasive surgical technique that uses a medical device such as a catheter in the vascular system to access and treat a range of diseases such as vascular disease and tumors.

Using conventional techniques the device tip is tracked and its location is superimposed on a "roadmap" image of the surrounding vasculature/tissue. These techniques are limited to 2-D images and are not capable of simultaneously acquiring the roadmap image and the position of the tracking device. This results in a slight delay, which causes conventional techniques to be limited by patient motion, including heartbeats and general patient movement. UW-Madison researchers have developed a system and method capable of 3-D tracking and imaging in real time for minimally invasive endovascular therapy. The system is comprised of a multi-mode medical device system (see WARF reference number P05330US), which is guided through the patient's vasculature using its tracking and imaging capabilities to produce high quality, localized images. This device is coupled to an MR scanner, which uses the multiple-echo Vastly Under-sampled Imaging with Projections (VIPR) data acquisition sequence to acquire real-time 3-D images of the area of interest using external coils. External imaging, internal tracking and internal imaging are provided simultaneously by this entire system in real time. The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a medical device system and method capable of simultaneously tracking and imaging in 3-D under magnetic resonance (MR) guidance for interventional procedures in real time.

Application area

3-D monitoring and control of endovascular intervention therapy involving patient motion due to heartbeats, general movement, etc.

General interventional MR applications including monitoring ultrasound and laser ablations of tumors, guiding the placement of biopsy needles and monitoring the operative removal of tumors
Monitoring vascular abnormalities such as arterial-venous malformations (AVMs) and aneurysms

Advantages

Able to image in dynamic applications such as a beating heart or a moving patient
Less radiation exposure to patient than in X-ray applications
Less adverse effects to patient from contrast agents than in X-ray applications
Able to acquire 3-D images unlike most X-ray applications
Able to acquire more data with MR, as compared to X-ray, such as temperature, blood flow, tissue perfusion and diffusion, brain activity and glomerular filtration rate (GFR)

Institution

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