MedicalXpress

World's most powerful MRI ready to scan human brain

December 4 2007

The world's most powerful medical magnetic resonance imaging machine, the 9.4 Tesla at the University of Illinois at Chicago, has successfully completed safety trials and may soon offer physicians a real-time view of biological processes in the human brain.

The safety study was published in the November Journal of Magnetic Resonance Imaging in an issue focused on MRI safety.

Researchers and physicians hope that the 9.4T will usher in a new era of brain imaging in which they will be able to observe metabolic processes and customize health care.

Oncologists, for example, may one day be able to tailor radiation therapy based on a brain tumor's real-time response to treatment. Currently, physicians often must wait weeks to see if a tumor is shrinking in response to therapy. With the 9.4T, it will be possible to see if individual cells within the tumor are dying long before the tumor has begun to shrink.

The 9.4T magnet has a field strength more than three times that of state-of-the-art clinical units. UIC's 9.4T is the first such device large enough to scan the head and visualize the human brain.

"Because the more powerful magnet allows us to visualize different types of molecules, we are seeing activity in the brain along a completely different dimension," said Dr. Keith Thulborn, director of UIC's Center

for Magnetic Resonance Research.

Current MRI visualizes water molecules to track biochemical processes. By visualizing the sodium ions involved in those processes instead, the 9.4T permits researchers to directly follow one of the most important energy-consuming processes in the cellular machinery in the brain.

The strength of magnetic resonance scanners has increased from less than 0.5T up to the first 8T in 1998. As human safety data became available, the FDA limits were revised upwards accordingly -- to the current level of 8T in 2003.

In this safety trial, 25 healthy volunteers -- 12 men and 13 women -- were exposed, in random order, to the 9.4T scanner, in which they were exposed to a static magnetic field and to sodium imaging, and to a mock scanner with no magnetic field. An audio recording simulated the sound of a real scanner.

Vital signs and cognitive ability were measured in all volunteers before and after the sodium imaging at 9.4T and the mock scanning. There were no significant changes in heart rate, blood pressure, respiratory rate or other vital signs when volunteers were exposed to either the magnetic field or the imaging. There were no significant differences in the cognitive testing of volunteers following mock vs. real scanning.

The most frequently reported discomfort was lightheadedness or vertigo when being moved into the magnetic field. A few subjects reported a metallic taste, nausea, or a visual effect of seeing sparks. The sensations went away once they were stationary in the magnetic field.

The researchers concluded that exposure to a 9.4T static magnetic field does not present a safety concern.

With the FDA-required safety trials completed, UIC researchers will begin to put the 9.4T to use.

"This initial evaluation of safety is only the first step towards realizing metabolic imaging of the human brain," Thulborn said. "We are now moving towards patient studies of sodium imaging and towards safety testing for oxygen and phosphorus imaging in humans.

"These early metabolic signatures of cellular health have great potential to advance detection and monitoring of diseases in the earliest stages, when treatment can produce the greatest benefit."

Source: University of Illinois at Chicago