

New Brain Helmet Could Detect Stroke Earlier

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Graduate student Brooks Lindsey (standing) demonstrates a prototype 3-D ultrasound "brain helmet" on a healthy volunteer.

(PhysOrg.com) -- A prototype "brain helmet" that provides real-time images of major blood vessels may enable emergency personnel to perform quick scans of potential stroke victims' brains, according to a team of Duke University bioengineers who developed the device.

For patients suspected of having a stroke, the speed of diagnosis and subsequent treatment can make the difference between survival and

death or disability.

Using 3-D ultrasound technology that they had earlier developed, the Duke team built a prototype device that positions ultrasound “wands,” or transducers, against the temples on either side of the head. Duke graduate student Brooks Lindsey designed a system that allows a computer to assemble both streams of ultrasound images into a three-dimensional color movie of the vessels and blood flow within the brain.

“We were able to demonstrate the feasibility of an ultrasound brain helmet producing multiple, simultaneous, real-time, three-dimensional images of the brain’s blood vessel distribution,” Lindsey said. He presented the results of the latest experiments at the Society of Photo-Optical Instrumentation Engineers’ annual Medical Imaging scientific sessions in Orlando, Fla. on Sunday, Feb. 8.

The most common type of stroke is caused by a blockage in a vessel in the brain. The only approved drug for this kind of stroke, a clot-buster known as tPA, must be given shortly after the onset of symptoms. However, before this kind of treatment can begin, physicians must scan the brain in a hospital with time-consuming imaging techniques such as MRI or CT scan to ensure the stroke is not the result of a bleed in the brain, which would be exacerbated by the clot-buster.

“We can foresee a time in the near future when the brain helmet could transmit its images from a remote hospital, or from an ambulance, through cellular networks or the Internet to the neurological team at a stroke center,” said bioengineer Stephen Smith, director of the Duke University Ultrasound Transducer Group and senior member of the research team. “Speed is important because the only approved medical treatment for stroke must be given within three hours of the first symptoms.”

Unfortunately, the researchers said, studies have shown that it takes an average of four hours for a potential stroke patient to receive a CT scan. They estimate that a brain helmet scan can be completed in 15 to 30 minutes.

The latest advance is an extension of the findings of Duke bioengineering graduate student Nikolas Ivancevich, who developed a strategy to overcome what has in the past been a major obstacle to using ultrasound to get clear images of the brain and the structures within -- the skull itself.

The Duke laboratory has a long track record of modifying traditional 2-D ultrasound -- like that used to image babies in utero -- into more advanced 3-D scans, which can provide more detailed information. After inventing the technique in 1991, the team has shown its utility in developing specialized catheters and endoscopes for imaging the heart and blood vessels.

Lindsey tested the brain helmet prototype on two healthy volunteers to assess its ability to accurately provide images of the major vessels of the brain.

“Not only were we able to see in color real-time images of the blood vessels, but we observed the direction of blood flow,” Lindsey said. “Seeing flow is one of our main goals, since it would help clinicians find the location of the stroke.”

According to the American Stroke Association, stroke is the third leading cause of death after heart disease and cancer. More than 780,000 Americans suffer a stroke each year, and it is estimated that it cost the U.S. health care system more than \$65 billion for stroke-related medical care in 2008.

The team is now designing the next generation prototype with an eye toward reducing the size of its components and improving the efficiency of the signal from the transducers.

Smith's laboratory is supported by the National Institutes of Health. Other Duke members of the team were John Whitman, Ned Light, Matthew Fronheiser, Heather Nicoletto and Daniel Laskowitz.

Provided by Duke University

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