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Device Tracks Blood Flow in the Brain

A headset ultrasound monitor could make it easier to detect the dangerous after effects of brain injuries.

By Courtney Humphries

A new ultrasound device could make it easier to detect a potentially life-threatening condition that is common in soldiers with blast-related brain injuries and patients who survive aneurysms.

The condition, called cerebral vasospasm, occurs when blood vessels suddenly constrict. The effect is like squeezing a garden hose: the velocity inside the artery builds as pressure grows, and less blood flows to the brain. The condition can develop several days after an initial injury, and is currently detected using ultrasound, which requires a trained technician to find the relevant blood vessels and hold the ultrasound beam in place.

PhysioSonics, based in Bellevue, Washington, has developed a monitor that makes this process automatic, eliminating the need for a technician. The company is adapting the product for military use, and hopes to expand it to also detect a potentially dangerous buildup of pressure inside the head.

The company's monitor consists of a headset that directs an array of ultrasound beams through the head and uses a proprietary algorithm to automatically detect the mid-cerebral artery, one of the major arteries supplying blood to the brain. The device then locks the relevant beam onto the artery and measures its blood flow. A machine attached to the headset gives an index of flow and peak velocity.

"The point is to give you a variable" that could be read similarly to a heart-rate monitor, says Michel Kliot, company cofounder and a neurosurgeon at University of Washington, where the technology was initially developed.

In November, the company received a military grant of $2.5 million to adapt the device for monitoring vasospasm in soldiers. Nearly half the soldiers who sustain blast injuries develop vasospasm, and the company plans to make a more rugged version of its commercial device for the battlefield.

The device could also be used to monitor patients who survive aneurysm ruptures, a high proportion of whom develop vasospasm. For such patients, a technician would typically measure blood flow with an ultrasound once or twice a day during a hospital stay of several days. Kliot says the new device makes it possible to continuously monitor patients at high risk, and for longer periods of time. "We see putting it on the head and measuring constantly or frequently over two weeks," says Kliot.

Nerissa Ko, a neurologist in the intensive care unit at University of California San Francisco Medical Center, says the device is building on a well-accepted diagnostic technology, with the added innovation of automation. If it proves effective, she says, the device could make it easier to track blood flow over time, which she says is the best way to detect vasospasm.

Brad Harlow, president and CEO of PhysioSonics, says the company has conducted a study comparing the algorithm's accuracy to a technician's and is filing for approval from the U.S. Food and Drug Administration within the month.

The company has also been developing an algorithm that would use the same technology to monitor pressure inside the head. Such monitoring currently requires doctors to drill a hole in the skull. Ko cautions, however, that while the blood-flow changes detected by ultrasound could serve as a surrogate for direct pressure measurements, it's still not clear if the device is sensitive enough to monitor the subtle changes that can signal danger.