

Wearable Seizure Detection Devices Promising

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PHILADELPHIA — Costly in-hospital video electroencephalography (EEG) monitoring for epilepsy may soon be replaced by wearable seizure detection devices — at least that seems to be where the technology is headed.

Some of the new devices, all relatively small and discreet and variously worn on the arm, scalp, and wrist, were highlighted here at the American Epilepsy Society (AES) 69th Annual Meeting.

One of these monitoring units detects generalized tonic-clonic (GTC) seizure activity. The Brain Sentinel GTC Seizure Detection and Warning System appears to have a very low false-positive rate, José Cavazos, MD, PhD, a board-certified epileptologist and cofounder of Brain Sentinel, the company behind the new device, reported.

The portable device, currently under US Food and Drug Administration regulatory review, provides real-time analysis of surface electromyography (sEMG) data to detect GTC seizures. It also has an alarm that alerts caregivers in the event of such a seizure.

The longitudinal clinical data that it captures should help guide treatment, Dr Cavazos said.

The system includes a discreet detection device, base station (laptop), and cellular wireless router. The detection device is attached to the biceps with an adhesive patch that has three pre-gelled sEMG electrodes.

"We have fine-tuned the algorithm to understand the recruiting properties of muscle cells in the biceps muscle," Dr Cavazos told a press briefing. "This is a direct reflection of brain activity; meaning that if you stimulate the brain, muscles are going to contract."

He added that collecting information from muscles, which are connected directed via neurons to the brain, may be less susceptible to artefacts than devices that collect biometric signals through other means.

A new study, funded by the company and presented here, compared the device to "gold standard" video EEG (vEEG) in patients at 11 epilepsy monitoring units across the United States. All parties were blinded to the seizure alert status of the device.

The analysis included 7326 hours of sEMG and vEEG data collected in 142 participants wearing the device. When the device was properly used, its sensitivity to identify GTC seizures was 100% compared with vEEG review. The false-negative rate was 0.48 per 8 hours.

"This device certainly can provide some peace of mind to some patients," said Dr Cavazos.

Asked to comment on Dr Cavazos's device, R. Edward Hogan, MD, professor and director, Adult Epilepsy Center, Washington University, St Louis, Missouri, thought it was promising in helping to track seizures, which can be useful in determining whether treatments are working.

Tracking seizures has traditionally been difficult, said Dr Hogan. "Overall, people remember only about half of their seizures," he said. "So right off the bat, there's a problem with people not remembering just by the nature of what happens to the brain during seizures."

An effective seizure tracker can also improve safety. Because seizures can cause injuries — patients often fall and hurt themselves — a convenient device that alerts caregivers and others of a seizure "would be great," said Dr Hogan.

He was encouraged by the low false-positive rate of this new device. "You don't want a system that goes off all the time."

The study authors, he said, "have looked at the pattern of how the muscle contraction changes," and the false-positive rate they picked up with the device was "pretty good."

He said his "general experience" with seizure detection systems is that "they go off so much that they're not useful."

Waterproof Device

Another device highlighted at the AES meeting is a lightweight, waterproof, matchbox-sized (30 × 30 × 6 mm) EEG recorder that is attached to the scalp (EEG Patch). According to Mark Lehmkuhle, PhD, assistant professor, neurosurgery, University of Utah, Salt Lake City, it's especially useful for children, patients with an intellectual disability, those who experience seizures at night, and those at high risk for sudden unexpected death in epilepsy.

The disposable device collects data for a week. "After 7 days, the thought is that this device would be mailed to a third party to review EEG and become part of the electronic medical records," said Dr Lehmkuhle.

Such a device has advantages over wired devices. For one thing, said Dr Lehmkuhle, movement of the wires "can tug on the electrodes and cause noise in the EEG."

The researchers can produce the device in different hair colors and "themes," such as Batman for kids.

He and his colleagues have started a feasibility trial comparing the device to the EEG system.

"The idea is that if the wire picks up seizure activity and a patch is next to it," it, too, should pick up this activity, said Dr Lehmkuhle. He added that such a well-placed single channel device should be effective at "seizure counting."

Wrist Trackers

A third study looked at two devices worn on the wrist that are designed to detect seizure activity. Researchers at the University of Texas at Dallas, including graduate student Diana Cogan, found that seizure detection using heart rate arterial oxygenation and electrodermal activity is much more accurate than detection by heart rate changes alone.

The focus of this and other related technology is to make devices as small and discreet as possible. Researchers agree that patients are concerned about being "stigmatized" by anything that overtly demonstrates that they have epilepsy.

And the emerging technology is growing at a fast pace. "I'm certain that over the next 10 years, we will see an explosion of wearable devices targeted at people with epilepsy," said Cogan.

Asked to comment on these new data, Michael Privitera, MD, director, Epilepsy Center, University of Cincinnati Neuroscience Institute, Ohio, and president of the American Epilepsy Society, told *Medscape Medical News*, "I am intrigued by these seizure detection devices, but mostly they apply to people with tonic-clonic seizures. I'd like to see some demonstration that they actually translate to improvements in detection or treatment.

"On the other hand," he added, "they are relatively inexpensive and carry no risk, so even if the benefit is modest to a small number of people, they are worthwhile."

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