Seizures in newborns can be detected with small, portable brain activity monitors

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Compact, bedside brain-activity monitors detected most seizures in at-risk infants, researchers at Washington University School of Medicine in St. Louis showed. That means the compact units could assist clinicians in monitoring for electrical seizures until confirmation with conventional EEG (electroencephalography), the researchers assert in an article published in the June issue of *Pediatrics.*

The smaller, more portable units are called amplitude-integrated EEG or aEEG monitors. They use only two or four scalp electrodes to detect the brain's electrical activity, instead of the 12 or 20 used with conventional EEG devices. They also filter and compress the raw signals from the electrodes to provide simpler, shorter readouts than conventional EEG monitors. aEEG machines are easier for staff to manage, and the monitors can more practically be run for longer periods. In addition, more medical facilities can afford aEEG devices because they have lower upfront and operating costs.

But until recently no one had studied whether aEEG was as accurate as conventional EEG for detecting brain seizures in babies. Seizures are episodes of abnormal brain activity that may or may not include involuntary muscle movements. So even if clinical staff members watch a newborn continuously, a seizure might be missed without the use of an EEG device. In newborns, seizures can be an indication that something is wrong in the brain, which might result from a metabolic disorder or a compromised blood supply to the brain before or during birth, for example.

The Washington University researchers conducted a side-by-side comparison of aEEG with conventional EEG. They used both technologies simultaneously for an average of 18 hours per patient to monitor the brain activity of 21 newborns who had experienced seizures. They also compared three different aEEG setups: one that produced a tracing from only one channel, one that produced tracings from two channels, and a third that produced tracings from two channels but also included raw, uncompressed brain-wave tracings.

"We found that we could pick up seizure activity in most of the patients using aEEG monitors that included the raw signals," says lead author Divyen Shah, M.D., a clinical fellow in the Division of Newborn Medicine. "In most medical centers worldwide, conventional EEG isn't available because it's expensive and resource intensive. We've shown that when staff members have training in interpreting aEEG, it can be effective for monitoring electrical seizure activity in newborns."

With conventional EEG, the researchers detected multiple seizures in seven of the infants, and with aEEG plus the raw signals they detected most of those seizures (76 percent) in six of those babies. The seventh baby had only one brief seizure, which was missed by aEEG monitoring.

Although aEEG has the advantage of lower cost and ease of use, the study also showed that its compression of raw brain wave data can make certain types of seizures harder to detect. But, the research also demonstrated that this disadvantage can be largely overcome with the use of aEEG monitors that also output an uncompressed and unfiltered tracing. That raw tracing provides a backup reading to check against any ambiguous reading from the compressed data.

The researchers found that aEEG plus the raw signals yielded better results than unsupplemented aEEG, which missed all of five seizures

experienced by one of the babies. The research team emphasizes that although aEEG monitors can complement conventional EEG, they can't completely replace it for electrical seizure detection.

Next, the research team, headed by senior author Terrie E. Inder, M.D., associate professor of pediatrics and a Washington University pediatrician at St. Louis Children's Hospital, will use aEEG as a tool in a trial of medications for seizures in newborns. They will use different treatment options to determine the optimal therapy for these patients.

Citation: Shah DK, Mackay MT, Lavery S, Watson S, Harvey AS, Zempel J, Mathur A, Inder TE. Accuracy of bedside electroencephalographic monitoring in comparison with simultaneous continuous conventional electroencephalography for seizure detection in term infants. Pediatrics 2008 Jun;121(6):1146-54.

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