Medical Xpress

MRI and EEG could identify children at risk for epilepsy after febrile seizures

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Seizures during childhood fever are usually benign, but when prolonged, they can foreshadow an increased risk of epilepsy later in life. Now a study funded by the National Institutes of Health suggests that brain imaging and recordings of brain activity could help identify the children at highest risk. The study reveals that within days of a prolonged fever-related seizure, some children have signs of acute brain injury, abnormal brain anatomy, altered brain activity, or a combination.

"Our goal has been to develop biomarkers that will tell us whether or not a particular child is at risk for epilepsy. This could in turn help us develop strategies to prevent the disorder," said study investigator Shlomo Shinnar, M.D., Ph.D. Dr. Shinnar is a professor of neurology, pediatrics and epidemiology and the Hyman Climenko Professor of Neuroscience Research at Montefiore Medical Center, Albert Einstein College of Medicine, New York City.

Seizures that occur during the course of a high fever, known as febrile seizures, affect 3 to 4 percent of all children. Most such children recover rapidly and do not suffer long-term health consequences. However, having one or more prolonged febrile seizures in childhood is known to increase the risk of subsequent epilepsy. Some experts estimate that the risk of later epilepsy is 30-40 percent following febrile status epilepticus (FSE), a seizure or series of seizures that can last from 30 minutes to several hours.

"While the majority of children fully recover from febrile status

epilepticus, some will go on to develop epilepsy. We have no way of knowing yet who they will be," Dr. Shinnar said.

The Consequences of Prolonged Febrile Seizures in Childhood (FEBSTAT) study is focused specifically on FSE and the risk of temporal lobe epilepsy. This is one of the most common forms of epilepsy and is characterized by seizures in the temporal lobe, a brain region important for memory.

Within days of FSE, the children in the study underwent magnetic resonance imaging (MRI) and electroencephalography (EEG). The latter technique uses sensors on the scalp to record brain activity, and is often used to diagnose and monitor epilepsy. The MRI findings were reported in July 2012, and the EEG findings were reported today. Both papers were published in *Neurology*.

The MRI scans revealed that FSE is sometimes associated with abnormalities in the hippocampus, a peapod-shaped structure within the temporal lobe. Of 191 children with FSE, 22 (11.5 percent) had signs of hippocampal injury on MRI, and 20 (10.5 percent) had developmental abnormalities of the hippocampus. Abnormal MRI results were rare among children with simple febrile seizures, defined as lasting 10 minutes or less. Out of 96 children with such seizures, only two (2.1 percent) had developmental abnormalities of the hippocampus and none had signs of brain injury.

Nearly half (45.2 percent) of the children with FSE had abnormal EEG findings. There was also a correlation between the MRI and EEG findings. Children with evidence of acute brain injury after FSE were more than twice as likely to have abnormal EEG findings.

The results suggest that for some children, prolonged febrile seizures injure the brain. For others, pre-existing abnormalities could make the

brain susceptible to febrile seizures. Both of these paths could in turn lead to epilepsy, but that will take more time to confirm, Dr. Shinnar said.

Temporal lobe epilepsy can cause memory loss, and brain scans of adults with the disorder sometimes reveal shrinkage and cell loss within the temporal lobe and hippocampus. Many adults with the disorder also report a history of FSE.

FEBSTAT is a unique effort to look forward from FSE in childhood and see if it evolves into temporal lobe epilepsy. "This study may give us insights into how epilepsy develops," said Vicky Whittemore, Ph.D., a program director at NIH's National Institute of Neurological Disorders and Stroke (NINDS), which funds the study.

"If MRI and EEG findings associated with FSE ultimately do correlate with epilepsy, they could be used to identify kids who are at risk and who might benefit from research on preventative therapies for epilepsy," Dr. Whittemore said. "EEG could be especially useful since it is low cost, non-invasive, and readily available at most hospitals."

FEBSTAT began almost 10 years ago. Children with FSE were enrolled from 2003-2010 at five sites: Montefiore Medical Center and Jacobi Hospital in the New York City; Lurie Children's Hospital in Chicago; Duke University Medical Center in Durham, N.C.; Virginia Commonwealth University Hospital in Richmond; and Eastern Virginia Medical School in Norfolk.

The children underwent blood tests, a neurological exam, MRI, and EEG within 72 hours of being seen in the emergency room for FSE. The blood samples are being analyzed for viral infections linked to febrile seizures and for the presence of gene mutations that could contribute to epilepsy. The children continue to receive neurological exams, MRI and

EEG at regular intervals.

More information: Nordli DR et al. "Acute EEG findings in children with febrile status epilepticus: Results of the FEBSTAT study." *Neurology*, published online November 7, 2012. DOI: WNL.0b013e3182759766

Shinnar S et al. "MR imaging abnormalities following febrile status epilepticus in children: The FEBSTAT study." *Neurology*, published online July 25, 2012. DOI: WNL.0b013e318266fcc5

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