Major Advances In Pediatric Epilepsy Surgery

By the age of five Rachel had been struggling with seizures brought on by intractable epilepsy for nearly three years. During these episodes, her body would jerk and shake and then go limp. Her lips would turn blue, her breathing would become shallow and her eyes would move rapidly back and forth. Afterward, she couldn't walk, was temporarily disoriented and confused, and suffered short-term memory loss.

As Rachel's seizures became worse and she continued to lose strength on her left side, imaging tests showed that her brain's right hemisphere was atrophying. Seizure medications failed to work, and her parents felt like they were losing her — both cognitively and physically. Ultimately, Rachel underwent a dramatic surgery at UCLA called a cerebral hemispherectomy, in which half of her brain was removed in the hopes of stopping the seizures and improving her cognitive development.

“We were devastated at first,” said Rachel's mother, Roxanne Cogil. “But after much research, we came to the realization that nothing else was even close to stopping the seizures. We realized that if we were going to protect the healthy side of her brain and her cognitive function while stopping these harsh seizures, then the surgery to disconnect and remove half the brain was the best chance she had at living a life with seizure-freedom.”

Surgery for pediatric epilepsy, UCLA doctors say, not only protects the remaining brain from the damage caused by aggressive seizures, but due to the age of the patients, the remaining brain has the remarkable ability to compensate — a process called developmental neuroplasticity. Now, a new study from the UCLA Pediatric Epilepsy Surgery Program has found that surgery to treat catastrophic pediatric epilepsy – cerebral hemispherectomy being one type &ndash has improved over the past two decades and has led to more successful outcomes, including freedom from seizures. The researchers credit improvements in diagnostic technology and experience in selection and operations as reasons for the program's success.

The study, which appears in the June 1 issue of the journal *Neurology* and is currently available online, is the first to critically compare types of patients and outcomes over a 22-year period at the Pediatric Epilepsy Surgery Program at Mattel Children's Hospital.

“Epileptic seizures have a negative impact on quality of life for children with epilepsy,” said the program's neurosurgical director, Dr. Gary Mathern, a professor of pediatric neurosurgery and senior author of the study. “The goal at the UCLA Pediatric Epilepsy Program is to control the seizures as soon as possible during development so that children can thrive without the burden of epilepsy. The purpose of the study was to determine if changes in practice over time resulted in better care for our young patients.”

Researchers compared types of patients and outcomes during the program's first 11 years (1986-97, 172 patients) with its second 11 years (1998-2008, 253 patients). Approximately one-quarter of all patients had epilepsy surgery within the first two years of life — the most critical time of brain development and the most risky for operative problems. Among the study's findings:

- At all follow-ups after surgery, the percentage of patients who became seizure-free was higher in the 1998-2008 cohort than in the 1986-97 group.
- There were fewer surgery-related complications and fewer follow-up operations among children with recurrent seizures in the 1998-2008 group than among those in the 1986-97 group.
- Improvements were seen with most types of patients and epilepsy operations, especially the most complex cases.
- Improvements in outcomes were accomplished more cost-effectively. For example, the most expensive element of pediatric epilepsy surgery is the implantation of electrodes into the brain to record seizures, which are used in up to 35 percent of children at most centers. UCLA used fewer intracranial electroencephalography electrodes (EEG) in 1998-2008 (less than one percent) than in 1986-97 (nine percent), reducing the cost, time in the hospital for patients, treatment-related risks and the discomfort of the evaluation process for children.

The UCLA team attributed the improvements in surgical outcomes to newer technologies, including advanced MRI scanners, fluoro-deoxyglucose positron emission tomography and magnetoencephalography (MEG) imaging, along with greater experience with EEG and clinical selection of surgical candidates.

“Parents and referring physicians should not see pediatric epilepsy surgery as a treatment of last resort, but the preferred treatment for children who have failed two to three anti-epilepsy medications and who are surgical candidates,” said study co-author Dr. Raman Sankar, professor and chief of pediatric neurology at Mattel Children's Hospital UCLA. “Our experience shows that with earlier and more successful surgery, children can expect a more normal life.” The next stage of research will be to determine if continued experience will show sustained improvements for pediatric epilepsy surgery patients.

A year after Rachel's hemispherectomy at UCLA, her mother reports that she is full of life, interacts with her peers, loves to run (although with a lingering gait) and is simply thriving. And she is finally seizure-free.

“Uncontrolled seizures simply have a negative impact on the brain, which was evident in the three years of cognitive loss that Rachel experienced,” Rachel's mother said. “In her case, by removing the diseased side of her brain, it allowed her remaining side to thrive without being bogged down due to persistent seizures. Knowing what we do now, we wished we would have considered pediatric epilepsy surgery sooner.”

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