



Surgical Treatment in Epilepsy

:: From diagnosis and evaluation in our Comprehensive Epilepsy Center to coordination of care with leading neurosurgeons, epilepsy surgery services at Nationwide Children's Hospital utilizes the expertise of a variety of disciplines and professionals.

Inside this practice tool, look for information about surgical treatment of epilepsy: indications, options and advanced diagnostic, monitoring and therapeutic surgical procedures available at Nationwide Children's.



Epilepsy Surgery: Multidisciplinary Care

Ranked by U.S. News & World Report as one of the best Pediatric Neurology and Neurosurgery centers in the United States, our Neurosciences program is comprised of leading clinical and research expertise in the areas of Neurology, Neurosurgery, Neurodiagnostics, Neuromuscular Disorders, Physical Medicine and Rehabilitation, and Sleep Medicine.

Surgical Epilepsy services at Nationwide Children's involves an array of multidisciplinary specialists to care for the clinical, surgical and psychosocial needs of children with difficult to control epilepsy. From leading pediatric neurologists who specialize in epilepsy evaluation and treatment, and a variety of other professionals, our program provides comprehensive care and employs advanced diagnostic and management techniques to provide the best possible outcomes for successfully curing epilepsy. Services include the following disciplines:

- Anesthesiologists
- Child Life Specialists
- Neurodiagnostic Technicians
- Neurologists, Epileptologists
- Neuropsychologists
- Neuroradiologists
- Neurosurgeons
- Nuclear Medicine Specialists
- Nurse
- Pathologists
- Pediatric Nurse Practitioners



SCHEDULING AND REFERRALS

- Online: www.NationwideChildrens.org/Neurosciences
- Fax: (614) 722-4000
- Phone: (614) 722-6200

Physician Direct Connect Line for urgent physician consultations:

(614) 355-0221 or 1-877-355-0221

surgeryessentials

PARTNERING FOR SUCCESSFUL OUTCOMES

At Nationwide Children's, we understand and respect the needs of physicians and know that the well-being of your patients is your number one concern. No health care professional takes the subject of surgical intervention lightly. That's why we believe in developing a partnership with our referring physicians to support the care you provide for your patients and families before, during and after surgery.

Visit NationwideChildrens.org/Surgery for CME offerings, practice tools, patient and family resources.

Epilepsy Surgery

While seizures for many patients can be controlled effectively with medication, about 25-30 % of children continue to have difficult to control epilepsy. Some of these patients may benefit from surgical intervention. At Nationwide Children's, Neurosurgery works closely with Neurology to provide leading surgical treatments. As part of the Nationwide Children's Comprehensive Epilepsy Center, we have the most up to date EEG monitoring equipment to help us determine the part of the brain that is responsible for the seizures. The video telemetry unit incorporates continuous EEG monitoring with simultaneous digital video recordings to time-lock clinical events to the EEG. Advanced imaging techniques such as SPECT studies, PET scans, and functional MR imaging are also used to help identify where the seizure starts in the brain. For some children with intractable seizures the exact location of seizure onset is difficult to locate, therefore EEG recordings directly from the surface of the brain are necessary to help determine the area of surgical resection.

Curative surgery for seizures includes the resection of the portion of the brain responsible for seizure onset. Other special surgical procedures are often used to improve seizure control. These include corpus callosotomy for drop attacks, and implantation of vagus nerve stimulators for generalized onset or multi-focal onset seizures. Intraoperative monitoring and frameless stereotaxy are routinely used during surgery to assure resection of the seizure focus while sparing critical brain structures.

Patients having surgery will be cared for on the Pediatric Intensive Care Unit and Neuroscience Unit after the surgery.

Diagnostic Studies

- 24-hour, long-term video EEG monitoring in a unit specifically designed for children
- Diffusion tensor imaging
- Functional MRI
- High field, detailed MRI
- Neuropsychological evaluation
- PET (Positron Emission Testing)
- Routine digital/video EEG
- Intra-operative and extra-operative studies to localize language and motor functions
- SPECT (Single Photon Emission Computerized Tomography)



Considerations for Epilepsy Surgery

Although epilepsy in children may spontaneously remit, 30-45% of cases do not. Many are controlled with AEDs (anti-epileptic drugs). However, in 20-30% of patients, seizures are intractable—unable to be controlled with medication. Others are controlled only at the expense of near-unacceptable side effects of medication. Intractable epilepsy is a major risk for personal injury, poor quality of life, and, in some cases, increased mortality. In addition, accumulating evidence suggests that chronic epilepsy results in deterioration of brain function and structure.

Intractable epilepsy is considered to be:

- Failure of an “adequate number” of AEDs—typically, seizures that continue despite maximally tolerated doses of more than two AEDs.
- The occurrence of an average of one seizure per month. However, even less frequent seizures are often associated with significant functional disability.

RISK FACTORS FOR INTRACTABILITY

- Symptomatic seizures associated with an underlying structural brain abnormality
- Specific syndromes:
 - Syndrome of temporal lobe epilepsy
 - Neocortical epilepsy caused by discrete lesions: Rasmussen's syndrome, tuberous sclerosis, focal cortical dysplasia, hemimegalencephaly, hypothalamic hamartoma
- High initial seizure frequency, seizure clustering
- Spasms/tonic seizures
- A history of status epilepticus
- Developmental delay, abnormal neurologic status

WHEN AND WHY SHOULD EPILEPSY SURGERY BE CONSIDERED?

- In cases of intractable partial epilepsy. Conservative estimates are that up to 50% could be successfully treated with surgery.
- If the child has one of the types of epilepsy known to progress to developmental retardation or severe, intractable epilepsy. For instance, children with temporal Complex Partial Seizures show a propensity towards chronic disability.
- When the area of the brain responsible for seizures can be:
 - Accurately defined, and complete resection/disconnection of the epileptogenic zone is possible.
 - Removed without compromising function and with preservation of “eloquent” cortex.
- To improve associated co-morbidities associated with chronic epilepsy including cognitive and behavioral difficulties.
- There is also evidence from some studies of IQ gains of greater than or equal to 15 IQ points.
- Some study outcomes also demonstrate improved behavior (31%) and cognitive function (25%).

EVEN IF SEIZURES ARE NOT COMPLETELY ELIMINATED BY SURGICAL TREATMENT:

- Surgery may offer partial control or a palliative effect and improved quality of life.
- Risk of injury or death may also be decreased, as, for instance, in corpus callosotomies.

Epilepsy Surgery: Recommendations, Types and Outcomes

EVIDENCE IN FAVOR OF EARLY SURGICAL TREATMENT

- Early predictors for intractability
- Poorer development – early seizure onset
- Ongoing seizures in severe epilepsy result in cognitive decline
- Consequences of chronic epilepsy:
 - Decreased school performance/cognitive impairment
 - Behavior problems (aggression, hyperactivity and inattention)

SUGGESTED TIMING OF REFERRAL FOR SURGICAL CONSIDERATION

- Early referral in children < 2 years
- Early referral for newborns and infants with uncontrolled seizures and infantile spasms
- Referral of children with MRI lesion independent of seizure control
- Children with focal epilepsy who have failed 2 medications for efficacy

TYPES OF SURGICAL PROCEDURES

I. RESECTIVE: Considered when seizures arise from a single location

- Temporal
- Extra-temporal
- Lesional vs. non-lesional

Types of Resective Surgery

- Focal cortical resection
 - Involves surgical resection of the specific region of the brain responsible for seizures
- Hemispherectomy
 - Disconnection of the hemisphere responsible for seizures
 - More utilized in children than adults

Indications

- Extensive hemispheric dysplasia
- Hemimegalencephaly
- Sturge-Weber syndrome
- Rasmussen encephalitis
- Stroke

II. FUNCTIONAL: Modification of brain function rather than tissue removal. Generally palliative procedures

- Corpus callosotomy
 - Considered in individuals having frequent drop attacks
 - Epileptic encephalopathies, Peri-Rolandic drops
- Vagus nerve stimulation
 - Programmed electrical pulses sent to the brain via electrodes connected to the vagus nerve from a battery implanted in the chest wall. Pulses can also be activated if a seizure is sensed by the patient. Intended for seizure prevention and/or reduction in frequency. May shorten seizure duration. May also have a palliative effect in that patients report they feel better despite seizures and in the post-seizure state.

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NEUROSCIENCES

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