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Epilepsy Surgery

(*This booklet has been written and compiled by the Epilepsy and Seizure Disorders Divisions within the Departments of Neurology and Neurosurgery at Brigham and Women's Hospital and Massachusetts General Hospital. Eileen Salmanson, LICSW and Deirdre Norris, RN led the team in developing this booklet.)*

What is epilepsy? Epilepsy is a common neurological disorder, characterized by recurrent seizures. A seizure is an electrical discharge from brain cells that disrupts normal function, producing a change in a person's consciousness, movement, and/or sensation. There are many different types of seizures and people with epilepsy may experience more than one type. The kind of seizure a person has depends on which part and how much of the brain is affected by the electrical disturbance that produces seizures.

What are the different types of seizures? Seizures are generally divided into two different types: generalized seizures and partial seizures.

- A generalized seizure occurs when a burst of electrical energy sweeps through the whole brain at once, causing a loss of consciousness, falls, convulsions or muscle spasms.
- Partial seizures occur when the electrical disturbance occurs in just one part of the brain, but occasionally it spreads and can cause a generalized convulsion or fall. This is called a partial seizure that is secondarily generalized. People with partial seizures often describe a warning at the beginning of the seizure. The warning is sometimes called an aura and is a partial seizure. Partial seizures may be called simple partial seizures or complex partial seizures. In simple partial seizures, the person is fully aware of the experience; in complex partial seizures, there is a change in awareness during the seizure.

In the majority of people, seizures can be controlled with appropriate medications. However, it is estimated that 30 to 40 % of patients with epilepsy are not controlled with currently available medical therapy. Patients may be candidates for surgical treatment of their epilepsy in an attempt to achieve better or complete seizure control. Patients whose seizures are caused by specific abnormalities such as tumors or vascular lesions may consider surgery if they feel their quality of life would be significantly improved.

Who are the candidates for epilepsy surgery? There are several factors that must be addressed before surgery is considered:

- Poor control of seizures with more than one medication
- A clear diagnosis of seizure type and syndrome
- Testing to rule out a metabolic, degenerative or structural cause
- Patient and family education to ensure knowledge of medication effects and side effects, as well as alternative treatment options.

Some seizures treated with surgery include:

- Those originating in the temporal lobe
- Any seizure with a focal onset
- Seizures with drop attacks
- Seizures coming from an entirely disordered hemisphere.

Overall, the most important element of a successful surgical outcome is patient selection. Selecting the most appropriate treatment requires a detailed pre-surgical evaluation to identify seizure type, seizure frequency, site of seizure onset, psychological and social functioning, and the degree of disability. This type of evaluation is best carried out in a multi-disciplinary center experienced in the investigation and treatment of epilepsy.

What is Epilepsy Surgery? The goal of epilepsy surgery is to identify an abnormal area of brain tissue from which the seizures originate, and to remove it without causing any significant impairment. The brain is divided into two sides called hemispheres. Each side of the brain is then divided into lobes. The major lobes are temporal (sides of the brain), frontal lobes (front of the brain), parietal lobes (middle of the brain) and occipital lobes (back of the brain). An operation to remove all or part of these areas is called a lobectomy. It is sometimes possible to stop the seizures by removing the part of the brain that produces them. A lobectomy may be performed when a person has seizures that start in the same lobe every time. This surgery is only proposed if it can be safely done without damaging vital functions.

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What are different types of epilepsy surgery?

Temporal lobectomy is the most common type of epilepsy surgery. Success rates of 55 to 70% have been reported.
Extra temporal resection is performed when a clear-cut tumor, vascular malformation or other lesions is present. The brain is removed from areas outside the temporal lobes. It can be particularly difficult to localize seizures in the frontal lobes.
Corpus Callosotomy interrupts the spread of seizures by sectioning or disconnecting the nerve fibers (corpus callosum) that connect one side of the brain to the other. The corpus Callosotomy is indicated in some patients with "drop attacks". The goal is to prevent the spread of seizure discharge to both sides of the brain. It does not stop seizure activity, but may limit the frequency and severity, especially of seizures that cause falls, thus lessening the risk for serious injury.
Hemispherectomy is most commonly performed in children with severe epilepsy and may be the most successful kind of epilepsy surgery.

The Team

The recommendation to consider surgery is initially made by the epilepsy surgery team, a comprehensive group composed of neurologists, neurosurgeons, psychologists, psychiatrists, nurses, social workers, EEG technologists and occupational therapists. Many or all of these specialists will be involved in the care of individuals who are considering epilepsy surgery. The treatment team considers both the medical and emotional needs of the patients and their families during the evaluation process. The decision to recommend surgery can take from several weeks to several months.

What is the role of each member of the care giving team?

Epileptologist: A neurologist specializing in epilepsy. He/she determines the direction of patient care, orders appropriate tests and interprets the test data.
Neurosurgeon: A surgeon specializing in the brain who has expertise in epilepsy surgery. He/she works closely with the neurologist.
Neuropsychologist: Specializes in the brain and behavior, focusing on the impact of memory, insight, and cognition through interview and neuropsychological testing.
Neuropsychiatrist: A psychiatrist specializing in neurological issues and the psychiatric impact of surgery. Treatment focuses on consultation and medication.
Clinical Nurse Specialist: Specializes in psychosocial issues, pre and post-surgical care, medication treatment of epilepsy, and patient education.
Neuro-Clinical Social Worker: Specializes in psychosocial issues of epilepsy, pre and post-surgical care, resources, community programs, and patient education.
EEG Laboratory Technicians: Specializes in inpatient EEG monitoring, and monitoring during Wada tests and surgery.

What is involved in the pre-operative evaluation?

While there are some variations in the evaluation of patients for epilepsy surgery, some general guidelines exist. The evaluations are to classify the different kinds of seizures, as well as the frequency, severity, and duration of each type. The primary components of the pre-surgical evaluation include:

- A detailed clinical history and physical examination
- A high resolution MRI
- Functional imaging. A brain scan to evaluate brain metabolism. A PET scan may be used to identify areas of hypometabolism (decreased glucose uptake), which may be associated with a seizure focus identified by other studies. A single photon emission computer tomography (SPECT scan) may be used to evaluate blood flow.
- Continuous video EEG monitoring. An inpatient hospital stay of three to seven days for 24-hour video and EEG monitoring. The patient's medications may be reduced so a seizure is more likely to occur, with the goal of localizing where the seizures originate.
- Neuropsychological testing. Neuropsychological assessment can provide essential data to help identify specific areas of decreased or altered brain function that may be related to where seizures originate. Language function, memory (verbal and visual) and visio-spatial capability are examined.
- Assessment of psychosocial functioning. A psychological, social and psychiatric assessment is performed. The expectations of surgery and the post-operative adjustment are explored.

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If, after an inpatient stay and video EEG monitoring, a seizure focus is suspected, but the start of the seizures is unclear, some form of implanted (invasive) electrodes may be indicated.

What are intracranial studies?

Intracranial studies are more invasive than scalp EEG studies, and involve a separate surgical procedure. Depth electrodes are used to assist with lateralizing (determining whether the right or left side of the brain is the seizure onset) and localizing (determining where the seizures originate) seizure onset, and are usually placed in both hemispheres using local or general anesthesia. Intracranial electrodes can be placed in areas that are not easily sampled by routine scalp electrodes, and can give more precise EEG information.
The patient usually spends one night in the Intensive Care Unit to monitor for signs and symptoms of increased intracranial pressure, bleeding, and infection, and is usually transferred to the Epilepsy Monitoring Unit the next day. The patient's activity is restricted in the first few days post-operatively, and epilepsy monitoring may take place for seven to nine days.

What is the Wada test?

The Wada test is used to determine which side of the brain is most responsible for language and short-term memory. The study is done in the Radiology Department and is an outpatient day procedure. The patient fasts from midnight the night before, but morning medications may be taken before the procedure. The patient reports to the EEG Lab first and is then brought to the Radiology Suite. A catheter is placed in the artery and an injection of contrast material is given. Next, sodium amytal is injected into one side of the brain. Commands are given to the patient during this period when one hemisphere is essentially asleep, allowing the doctors to determine function of the other side of the brain. Once the patient has returned to baseline following the first injection, sodium amytal is injected into the other internal carotid artery using the same procedure.

The operative procedure: What happens at the hospital?

Medications, including Advil and aspirin, should be avoided before surgery because of their effects on bleeding time. Once the surgery is complete, the patient remains in the Neurology Intensive Care Unit for 24 to 48 hours, continues on his or her seizure medications, and is closely observed for seizure activity. The patient stays in the hospital up to a week and then returns home to recuperate. Post-operative pain varies among patients.
While there are risks in all surgical procedures, including the placement of depth electrodes and grids, most brain surgeries for epilepsy appear to be relatively safe. The success rate is determined either as a percentage of people who are seizure free, or whose seizures have reduced dramatically. Success depends on the type of epilepsy and operation performed. Complications can occur in about 2 out of every 100 of these operations. Depending on the kind of surgery that is performed, possible complications include partial losses of vision, motor ability, memory, or speech. Short-term memory problems after surgery are common; however, this is usually temporary and improves over time.

What happens beyond the hospital?

We recommend that a family member or friend stay at home with the patient for a week to help during recuperation. After three to eight weeks, the patient can usually return to normal activities. If returning to a job, we recommend four to six weeks to return part-time, and two to three months to return to full-time employment. It is usually recommend that patients stay on anti-epileptic medications for one to four years after surgery, though some patients may have to continue medication indefinitely to maintain seizure control.

Following discharge from the hospital, it is important to continue to document seizure occurrence. Talking about the need to continue medication following surgery is an important part of the educational process. Whether or not seizure control is improved, ongoing emotional and psychosocial support is essential. Patients may be reluctant to report symptoms for a variety of reasons, including fear that the surgery was not successful, or a desire to stop taking seizure medications. The nurse and social worker will continue to play a key role in assessing, supporting, and educating the patient and family as they confront the fears and realities of the outcome of the surgery.