REFRACTORY EPILEPSY

A GUIDE FOR PATIENTS & FAMILIES

Mischer
Neuroscience Institute

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The Texas Comprehensive Epilepsy Program at the Mischer Neuroscience Institute is the leading program in the southwestern United States for the diagnosis and treatment of epilepsy in patients of all ages.

We draw upon the combined expertise of affiliated, board-certified neurologists and neurosurgeons with subspecialty training and experience in treating patients with seizures and epilepsy.

Our mission is to help epilepsy patients gain control of their seizures and regain their desired quality of life by applying the latest and most comprehensive diagnostic and treatment methods available.

This brochure provides patients with refractory epilepsy more information about their condition and the available treatment options offered at the Institute. In addition, patients will find clinical details and important resources about the process of recovery.
About Epilepsy

What is refractory epilepsy?

Patients diagnosed with refractory epilepsy, often referred to as medically uncontrolled epilepsy, have seizures that are extremely difficult to control, as medications have proven ineffective or intolerable. After a patient has failed therapy with two medications, the chances that a third drug will work are roughly around 1 percent. Patients should be evaluated to determine the best available treatment option, which may include surgical or non-surgical interventions.

If I have refractory epilepsy, what are my treatment options?

Patients will first undergo a comprehensive evaluation by the epilepsy team to identify the type of epilepsy and localize it. This evaluation may include a variety of tests, such as a video EEG, high-resolution MRI scans, magnetoencephalography (MEG), positron emission tomography (PET) and single-photon emission computed tomography (SPECT). Epilepsy surgery, including minimally invasive laser ablation, is a highly effective and safe treatment for patients with refractory epilepsy. Additionally, in cases where epilepsy surgery is not an option, non-surgical alternatives such as a special diet, hormonal treatment (for women of childbearing age) and experimental trial drugs may be offered.
What is an epileptic focus?

An epileptic focus is an abnormal brain area that produces the abnormal electrical activity (or seizure) that can spread to other more normal areas of the brain within seconds. Removal of this epileptic focus by brain surgery can take away the cause of seizures and possibly cure epilepsy. Not everyone with epilepsy has a removable focus, but for those who do, surgery can be highly effective.

**Diagnosing Epilepsy**

How do you determine who is a candidate for surgery?

Patients will undergo tests and monitoring in a state-of-the-art epilepsy monitoring unit (EMU) before recommendations are made for surgery.

The Institute’s EMU is the largest and most comprehensive unit of its kind in the region. Patients are referred to the EMU for any of the following reasons:

• They have had multiple seizures.
• The cause of their seizures is unknown.
• Their seizures cannot be controlled medically.
• They are being evaluated for surgery.
• They need a definitive diagnosis of epilepsy.

During their stay, patients are monitored 24/7 for even the smallest sign of seizure activity. With one of the only inpatient units in the country with a comprehensive set of diagnostic technologies, the caregiver team in the EMU constantly gathers and records data to help define and locate seizure activity within the brain. The process for identifying a candidate for surgery is divided into three phases.
During a Phase I evaluation, a patient undergoes video EEG continuous monitoring, magnetic resonance imaging (MRI), neuropsychological testing (if applicable) and routine lab work. This generally occurs as part of a three- to five-day admission to the EMU. After a Phase I evaluation, the patient will typically undergo outpatient tests, including MEG, PET, Wada testing and SPECT. Based on results from the Phase I evaluation and outpatient testing, the epilepsy team will develop a specialized plan of care tailored to address the patient’s needs, either moving forward to Phase II of the testing or directly to Phase III, which is the resective, disconnective or ablative surgery.

During Phase II, patients may undergo one of two procedures: a craniotomy with subdural electrode placement or robotic stereoelectroencephalography (SEEG). A craniotomy is a procedure in which a small portion of the skull is opened to place electrodes directly on the brain tissue to allow for more direct measurement of seizure activity. A robotic SEEG is a less invasive procedure that places depth electrodes in targeted brain areas, which are then monitored to locate the seizure source. Once all the data from Phase II is examined, the epilepsy team determines if a resection of the seizure focus is recommended. If so, the process moves to Phase III, in which the brain tissue that is causing the seizures is removed or disconnected. Some patients may undergo stereotactic laser ablation, which is a less invasive procedure that in carefully selected cases can have results similar to traditional surgery.
Pre-Surgical Testing

What is a video EEG?
Video EEG is a noninvasive test used to diagnose epilepsy and determine where seizures originate in the brain. A video EEG involves videotaping patients while scalp electrodes record their brain waves, and is usually performed for several days, up to one week, with the goal of capturing multiple seizures.

What is MEG?
MEG is a noninvasive imaging technique that helps physicians find brain areas that show abnormal electrical activity.

What types of MRIs are used to diagnose epilepsy?
Abnormal brain structures common in patients with epilepsy are best detected with a high-resolution scan called a 3-Tesla MRI, one of the most advanced scanners available. Functional MRI (fMRI) can determine where important functions such as speech and movement are located in the brain. Both types of MRI are used when surgery may be an option.
What is a PET scan?
PET scans produce 3-D images of processes in the brain and are used to help pinpoint the epileptic focus.

What is neuropsychological testing?
These standardized behavioral tests help doctors learn how the brain produces reasoning, language, memory and problem-solving. They also help determine a person’s cognitive strengths and weaknesses, and provide a baseline to measure cognitive function before and after surgery.

What is a Wada test?
By injecting a medication that temporarily puts half of the brain to sleep, a neuropsychologist, working with a neuroradiologist and epileptologist, can assess the function of the right and left sides of the brain separately. The results help preserve vital brain functions during surgery.

What is a SPECT scan?
This imaging study is performed in people whose epileptic seizures are very frequent or predictable. A radioactive substance is injected immediately after a seizure begins, and a special camera detects the substance, revealing the epileptic focus.
Surgical Treatment

What types of surgery are performed to treat epilepsy?

The most effective surgery for epilepsy involves removing the abnormal area, or the epileptogenic focus. People with certain forms of epilepsy can be seizure-free after such a procedure.

One surgical approach, called laser ablation, involves placing a laser probe through a small opening in the skull to destroy a seizure focus through highly focused laser heating. Affiliated physicians routinely use laser ablation techniques to destroy seizure foci located deep in the brain. These techniques target hippocampal and amygdalar seizure foci, deep-seated cortical dysplasias, periventricular nodular heterotopias and tumors that cause seizures.

Focal surgical resections performed include amygdalo-hippocampectomy, lesionectomy and lobectomy. Affiliated surgeons also perform hemispherectomy and focal cortical resection. Another procedure is palliative surgery, which can reduce seizures when the area causing the seizures cannot be identified, or if there is more than one focus. Palliative brain surgery disconnects areas of the brain that cause the spread of seizures, resulting in fewer and less severe seizures.

Some patients may benefit from vagus nerve stimulation (VNS), in which a stimulator is placed to deliver regular, mild pulses of electrical energy to the brain and reduce seizures. The Texas Comprehensive Epilepsy Program also offers responsive neurostimulation therapy with the NeuroPace RNS® System to certain patients who cannot be treated by conventional or laser surgery.
What does surgical implantation of electrodes involve?

If the location of the seizure focus can be estimated within a general region, but cannot be pinpointed because electrical signals from the brain are obscured by the skull and scalp, electrodes may be implanted under the skull to record directly from the brain. This improves the accuracy of defining the focus, which helps to preserve important brain functions. The electrodes come in the form of thin grids and strips or as depth electrodes, and can record signals from very specific brain areas. Before electrode implantation surgery, the patient may undergo another MRI that allows surgeons to use a computer-guided system in the operating room to place the electrodes. The operation generally takes three to five hours and involves an incision behind the hairline so there are no visible scars. After surgery, patients will be admitted to the EMU and an MRI or CT scan will confirm the locations of electrode placement. The patient will be connected to monitoring equipment and anti-epileptic medication levels are gradually lowered and eventually stopped to enable recording of seizures. This is similar to the Phase I video EEG, which uses scalp electrodes.

After enough seizures are recorded, physicians may perform stimulation brain mapping. During this process, the electrodes pass small currents to stimulate the brain, providing the most accurate way to locate important brain functions such as language and movement. After this recording and mapping of brain function, the epilepsy team will devise a surgical plan where the seizure-producing areas are removed and important areas for function are preserved.

Neurosurgeons also use the ROSA™ robot to perform precision epilepsy surgery. An advanced robotized surgical assistant, ROSA allows physicians to create 3-D maps of the patient’s brain and plan the best approach to those areas to implant depth electrodes, place probes for laser ablation or perform brain biopsies. Surgery with the robot is minimally invasive, using needle-thin instruments to place micro-recording depth electrodes into the brain through a tiny hole, which means a shorter surgery. After the electrodes are placed, patients are transferred to the Epilepsy Monitoring Unit where the team records electrical activity from the cerebral cortex. Patients in the EMU are taken off their anticonvulsants to induce seizures in hopes of localizing the focus. If they succeed, some patients are eligible for resective surgery.
Physicians affiliated with the program have adopted other innovative surgical procedures for epilepsy. Among these are robotic stereo-electroencephalography (SEEG) for 3-D investigation of epileptic foci in the brain with stereotactic placement of intracerebral electrodes. The Texas Comprehensive Epilepsy Program was the second in the country to adopt robotic SEEG. Neurosurgeons have performed more than 100 robotic SEEG implantations with zero percent morbidity from the placement of nearly 1,500 electrodes.

What if all these tests do not show a single or clear focus?

Some patients’ tests will show that there is no single epileptic focus – as there may be more than one focus or the seizures may be generalized. Uncontrolled seizures that have more than one focus or are generalized may be treated with other surgeries, such as disconnection or VNS.

What is VNS?

VNS, or vagus nerve stimulation, may be considered for patients who are not surgical candidates. VNS does not require brain surgery and involves implanting a small device similar to a pacemaker to electrically stimulate the left vagus nerve in the neck to help prevent seizures. The device operates automatically, but patients can also activate the device on their own when they feel a seizure coming on.
What is NeuroPace?

The NeuroPace® RNS® Stimulator is an innovative new treatment in which a device is implanted in the skull and connected to two electrodes that target the region of the brain called the hippocampus. The implant detects abnormal brain activity and responds with stimulation to interrupt the signal and help control seizures. It is another option for patients who may not be surgical candidates.

What should I expect during and right after surgery?

Although there are many different types of procedures, patients can have similar expectations during surgery. All of the surgeries will require access to the brain or skull and will be performed under general anesthesia. In some uncommon cases, once access to the brain is achieved the patient may be awakened from anesthesia and a portion of the surgery will be performed while the patient is awake. This is necessary in order to perform functional motor or language mapping for surgery near or within these areas. For the vast majority of operations, patients will remain under general anesthesia throughout the entire operation. Following the operation, patients may experience nausea and/or a headache, which should resolve over the next few days.

The average hospital stay for patients undergoing epilepsy surgery is about three days for those undergoing resection and seven days for those undergoing intracranial electrodes. The first procedure entails implantation of the intracranial electrodes followed by an average period of seven days for thorough video EEG monitoring in the EMU. Most patients are discharged two to three days after the final surgery, returning to work or school about four to six weeks later.

Post-surgery Guidelines

Please adhere to the following guidelines after surgery:

- Do not touch the incision site.
- Keep the incision site clean.
- Be gentle when washing the incision site as the hair follicles begin to grow; they may break easily.
- Use a mild shampoo.
- Do not apply creams, gels, hydrogen peroxide, betadine or scar reduction cream to the incision site.
- Keep the incision open to air.
Additional Resources

Dr. Tandon’s Epilepsy Webinars
Learn about epilepsy diagnosis and treatments by reviewing our webinars: neuro.memorialhermann.org/epilepsy-webinars/

Epilepsy Support Group
First Thursday of every month at 6:00 p.m.
Memorial Hermann Medical Plaza
27th Floor, Suite 2730
Call 713.222.CARE or email supportgroup@memorialhermann.org to register or for more information.

Buddy Program
Through our Buddy Program, post-surgery patient and a pre-surgery patient are paired based on demographics and surgery type, so they may discuss the details of surgery and the physical, emotional and mental changes that are involved. To learn more about the Buddy Program, please ask the clinic staff or call 713.500.5443.