Epilepsy Surgery

by Devin Binder, M.D., Ph.D.

UC Irvine School of Medicine
Neurological Surgery Dept.
714-456-6966
Epilepsy Program
714-456-6203

Epilepsy, from Greek epilambanein, seize or attack, comprises a group of disorders of the brain characterized by the periodic and unpredictable occurrence of seizures. Epilepsy is a common condition, affecting about 1% of the population, and around 50 million people in the world (about 2.5 million in the U.S.). While epilepsy can be adequately controlled by antiepileptic drugs (AEDs) in many patients, a significant proportion, about 30%, remain unresponsive to the drugs. Uncontrolled epilepsy presents a major public health problem in that those affected experience seizures which impair cognitive development, lead to difficulties in completing education, procuring and maintaining steady employment, and also are associated with severe psychosocial morbidity as well as increased mortality. One study estimated the annual direct and indirect costs of epilepsy in the U.S. is at $12.5 billion.

Epilepsy surgery should be considered in carefully selected patients with medically untreatable epilepsy. The goal of epilepsy surgery is to eliminate seizures and interrupt the cycle of progressive morbidity and increased mortality. Prior to consideration for surgery, each patient is evaluated by a multidisciplinary epilepsy team. This evaluation includes a detailed seizure and medication history, inpatient video-electroencephalogram (EEG) monitoring with recording of seizures, high-quality magnetic resonance imaging (MRI) brain scan with dedicated "epilepsy surgery protocol", neuropsychological evaluation, and other tests in specific cases. For example, injecting amobarbital into the carotid artery, which is known as the Wada test. Other studies include magnetoencephalography (MEG), single photon emission computed tomography (SPECT), and positron emission tomography (PET). The goal of this evaluation is to establish the presence of AED resistance, delineate the epileptogenic zone within the brain, and to estimate the risk which might occur for postoperative neurologic or cognitive deficits.

The best candidates for epilepsy surgery are those that demonstrate EEG seizure onset from a focal area concordant with an MRI abnormality in the same region, and the likelihood of being able to remove that region without significant postoperative neurologic or cognitive deficits. In cases of discordant or unclear findings, preoperative evaluation may include invasive intracranial EEG recording with subdural strip and/or grid electrodes ± depth electrodes which localize seizure onset better than scalp EEG and can also be used to map motor and language functions.

In procedures where brain is removed, the abnormal "epileptic focus" responsible for causing the seizures is targeted and eliminated. The most common surgical procedure involves removing a portion of the temporal lobe of the brain; this is referred to as a temporal lobectomy for an abnormality known as a mesial temporal sclerosis. In this group of patients, approximately 70% can achieve prolonged seizure freedom postoperatively, with a surgical mortality close to 0% and less than 5% significant complications including weakness on the opposite side of the body or visual defects. Some patients are candidates for a more limited resection of the temporal lobe which spares the surface of the brain and selectively removes those epileptogenic areas deep within the temporal lobe, this is also known as a selective amygdalohippocampectomy. While distinct approaches to temporal lobectomy have been described, there are potential curative procedures which remove specific pathological sites from the brain. These can include certain types of brain tumors as well as vascular malformations and congenital abnormalities of the brain. In the treatment of epileptogenic tumors and vascular malformations, "epilepsy surgery" overlaps with tumor and vascular neurosurgery. This type of surgery may be very effective in controlling seizures.

In some patients, the epileptic focus cannot be removed either because it is too diffuse or because removal would lead to severe complications. These patients may be candidates for disconnective procedures. In these procedures, the epileptic focus is isolated from surrounding brain areas to prevent seizure spread through the brain. Interrupting the connections between the two halves of the brain is an option for patients with severe generalized epilepsy; particularly those with seizures accompanied by frequent falls and injuries. Multiple small incisions are made in the brain when the epileptogenic lesion cannot be removed due to close proximity to areas of the brain which maintain speech or movement. Removing one hemisphere of the brain is an extensive procedure in which an entire diseased hemisphere is removed, or, more commonly now, disconnected from the opposite hemisphere. In well-selected cases, about 70% of patients become seizure-free following this procedure.

Many studies have now shown that epilepsy surgery may help certain patients with epilepsy that does not respond to medication and allow them to be seizure-free. However, there remain many barriers to effective referral, evaluation, and treatment of these patients. Many patients who could benefit from surgery never reach a specialist. Others are asked to live with their seizures by their healthcare providers. This partially arises from the persistent idea that surgery is a "last resort", whereas studies increasingly suggest that earlier surgery may be more beneficial. There are often socioeconomic obstacles to adequate evaluation.

Since epilepsy surgery techniques are highly specialized, they should only be performed by a fellowship-trained epilepsy neurosurgeon. Early referral to a specialized epilepsy surgery center is essential. Each patient with epilepsy deserves the chance to become free of seizures.

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