

Surgery remains underutilized in patients suffering from epilepsy

by R. Mark Richardson, MD

Epilepsy is the most common serious brain disorder in the world. It affects all ages, ethnicities and socioeconomic classes. Patients and their families suffer an enormous physical, psychological, and social burden that is often related to misunderstanding, fear, and stigma. Likewise, the surgical treatment of epilepsy also suffers from a misunderstanding of its application, safety and potential benefit.

It has been a decade since a landmark randomized controlled trial published in the *New England Journal of Medicine* demonstrated the superiority of surgery for drug-resistant temporal lobe epilepsy over the continuation of medical treatment alone. At that time, it was estimated that although approximately 200,000 patients in the U.S. with temporal lobe epilepsy could benefit from surgery, only 1,500 surgeries were performed each year. Since then, the preponderance of evidence has continued to support the Class I data published in 2001: freedom from significant seizures occurs in approximately 60% of drug-resistant epilepsy alone. More remarkable than these results is the fact that as large a percentage of epilepsy surgical candidates remain untreated today as they did ten years ago.

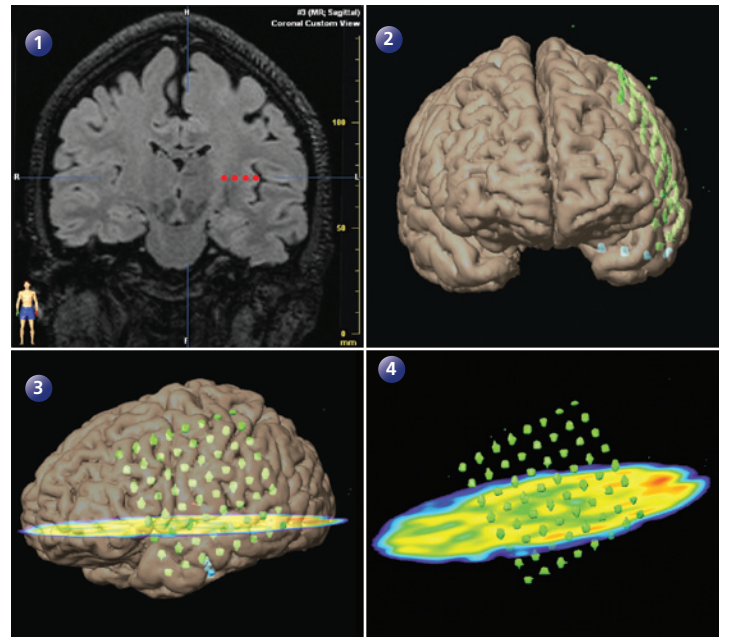
A recent review of data from a national hospital database showed no significant change in the percentage of temporal lobe epilepsy patients receiving temporal lobectomy over time, between 2001 and 2008, despite an increase in the number of hospital admissions for this disease. While up to 15% of patients with epilepsy may benefit from a diagnostic or therapeutic surgical intervention, patients continue to be referred for surgical treatment an average of two decades after onset of seizures, which is much too late to avoid many irreversible disabilities. In fact, greater and more permanent benefits are obtained the earlier surgery occurs in the disease course. The underutilization of surgical treatment is alarming, especially given that seizure surgery is safe: significant morbidity following surgery occurs in only 1-2% of patients, while most patients experience improvement in their quality of life and overall IQ scores. Furthermore, advanced diagnostic and operative techniques continue to improve the safety and efficacy profiles for the surgical treatment of epilepsy.

The philosophy of the Adult Surgical Epilepsy Program is that temporal lobe epilepsy should be viewed as a surgically remediable form of epilepsy from the outset. Through the application of the most advanced imaging techniques, such as PET, MEG and ictal-SPECT, we are able to increase the chances of correctly identifying not only temporal lobe seizure foci, but extra-temporal sites as well. Functional imaging studies such as functional MRI and Magnetic Source Imaging provide preoperative brain mapping data that is useful in surgical planning. The gold standard for the preservation of important brain function—*intraoperative mapping in patients who are awake during a portion of the surgery*—is performed whenever indicated. This expertise in awake brain surgery allows us to take an aggressive stance toward epileptic foci located in eloquent brain areas, including language cortex. In the same way, tumors and other lesions that cause seizures can be resected even if they border the motor cortex and subcortical motor pathways. This is important because there is a direct correlation between the amount of tumor resected and the cessation of seizure activity.

The underutilization of epilepsy surgery indicates the high complexity of epilepsy treatment in general. The Adult Surgical Epilepsy Program

takes a comprehensive, multidisciplinary approach to tackling this problem. The major processes involved in undertaking epilepsy surgery are: (1) a comprehensive presurgical evaluation; (2) determination of surgical candidacy including the timing of surgery; (3) selection of the most appropriate surgical method and approach; (4) preparation for the provision of postsurgical treatment, including rehabilitation and (5) comprehensive evaluation of outcome. The goal of epilepsy surgery is to improve a patient's quality of life by maximizing seizure relief and minimizing adverse effects. At UPMC, adult epilepsy patients that are surgical candidates receive the full spectrum of diagnostic and surgical options. Educating patients and the community about the potential benefits of epilepsy surgery is at the core of our mission. The patient relationship and concurrent management of comorbidities, such as depression, is paramount.

In addition, we are committed to furthering scientific knowledge regarding epilepsy and related brain functions. In fact, the patient-physician relationship is furthered in the Adult Epilepsy Surgery Program by unique opportunities for patients to contribute to brain research. Historically, since the work of Penfield in the 1930's, patients with epilepsy who undergo neurosurgical procedures have arguably contributed more to neuroscience research than any other group. Because an entire armamentarium of diagnostic tools is focused on identifying the causes and effects of seizure activity, a very privileged access for studying brain function exists. This tradition continues at UPMC, where data collected from patients undergoing intracranial electrical recording of brain activity has been applied previously to the development of brain machine interfaces for patients paralyzed by other brain injuries. An additional new research focus in the program will give patients the opportunity to help elucidate neurobiological processes of epilepsy itself that may eventually become therapeutic targets. •



Multiple modalities are used in pre-resection planning in a patient who underwent intracranial monitoring (Stage I) and awake speech mapping resection surgery (Stage II). (1) Coronal MRI scan showing location of left insular depth electrodes (red circles) placed during Stage I surgery; (2) brain reconstruction with navigational software showing location of cortical grid and subtemporal strip electrode placement; (3 & 4) overlay of preoperative PET scan with and without brain surface reconstruction.

Assessing Candidacy for Epilepsy Surgery

- Any individual who continues to have seizures after two first line anti-seizure medications have been administered sequentially should be referred for a surgical evaluation.
- The above rule should be applied to all individuals with epilepsy, whether from a semiological perspective seizures appear to be either focal or generalized.
- Medication trials may take anywhere from three months to two years, after which continued seizures are not a “necessary evil” and should not be tolerated.
- Focal seizures, especially those of the complex partial variety, are more likely to be resistant to medical management than are generalized seizures.
- Patients with complex partial seizures and evidence of a temporal lobe structural lesion or mesial temporal sclerosis are likely to fail medical management.