HHS Public Access

Author manuscript

*Neurologisch (Wien)*. Author manuscript; available in PMC 2017 February 27.

Published in final edited form as:

*Neurologisch (Wien)*. 2013 September ; 2013: 12–14.

# Surgical treatment for epilepsy

**Jerome Engel Jr., MD, PhD**,
UCLA School of Medicine, Los Angeles, CA, USA

**Samuel Wiebe, MSc, MD, FRCPC**,
University of Calgary, Calgary, Alberta, Canada

**Kurupath Radhakrishnan, MD, DM, FAMS, FAAN**, and
Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, Kerala, India

**André Palmini, MD, PhD**
Pontificia Universidade Catolica do Rio Grande do Sol, Porto Alegre, Brazil

## Abstract

Surgical treatment for epilepsy remains highly underutilized: in the United States, there has been no increase in the number of surgical procedures performed annually since 1990[1]; for most patients referred, the average duration of epilepsy is 22 years[2]; and there has been no change in this delay to surgery[3], despite two randomized controlled trials[4, 5] and an American Academy of Neurology practice parameter that recommended surgery as the treatment of choice for medically refractory temporal lobe epilepsy[6]. This session addressed issues relevant to increasing the availability of epilepsy surgery, particularly in countries with limited resources.

## Who should be referred for surgical therapy?

Two-thirds of patients with epilepsy have epileptic seizures that are easily controlled by antiseizure drugs. Of the remainder, causes of apparent pharmacoresistance include noncompliance, seizures that are not epileptic, misdiagnosis of the type of epilepsy condition, prescription of the wrong antiseizure drug or the wrong regimen and dosage, and lifestyle issues that lower seizure threshold or provoke ictal events.

The International League against Epilepsy has proposed that drug-resistant epilepsy should be defined as “failure of adequate drug trials of two tolerated, appropriately chosen and used antiepileptic drugs (whether as monotherapy or in combination) to achieve sustained seizure freedom”[7]. Studies have shown that after failure of two appropriate drug trials, only 3 % of patients eventually become seizure free[8].

It is recommended, therefore, that patients meeting this definition of drug-resistant epilepsy should be referred to an epilepsy center with specialized epileptologists, who can identify specific epilepsy syndromes, distinguish them from psychogenic non-epileptic seizures and other non-epileptic events, diagnose underlying treatable causes, use specialized pharmacologic approaches, address disabling psychosocial problems, and consider alternative treatments such as vagus nerve stimulation, ketogenic diet, behavioral therapies, and surgery. Rather than asking who should be referred for surgical therapy, neurologists

should consider referring all patients with medically refractory seizures to an epilepsy center, and should permit the center's specialists to determine who is a surgical candidate. Surgical treatment for epilepsy is increasingly available in the developing world, and the most cost effective results are obtained when new centers begin with offering surgery to patients with obvious surgically remediable epilepsy syndromes, such as mesial temporal lobe epilepsy[9].

## Benefits of surgical therapy

Patients who fail two appropriately used antiepileptic drugs (AEDs) have a low probability of being controlled with further AED trials, and according to the International League Against Epilepsy (ILAE) they meet the criteria for drug-resistance. These patients should be considered for referral to an epilepsy center where their candidacy for presurgical evaluation should be assessed. Epilepsy surgery is effective and its effects are durable. In long term, about 65 % of patients remain seizure free[10], and of these about one fourth successfully discontinue AEDs. In addition, seizures improve in about 20 % of patients[11]. Randomized controlled trials of temporal lobe epilepsy show that the number of needed treatments with surgery, for one patient to become seizure free, is only 2.0 for chronic epilepsy[4], and even lower (1.4) for recent onset drug-resistant epilepsy[5].

Quality of life (QOL) improves after epilepsy surgery in a sustained manner[12], especially in patients who become seizure free. Although up to 40 % of patients who undergo left temporal lobe surgery experience reliable declines in verbal memory and naming function, these patients still rate their QOL as improved if they are seizure free, and memory improves in 7 % to 14 % of patients following surgery[13]. Studies in several developed countries show that, although the initial costs of epilepsy surgery are higher than medical therapy, after eight years it becomes cheaper than medical therapy[14, 15]. It is likely that in developing countries where epilepsy surgery is substantially less costly than in developed countries, surgery becomes cheaper even earlier. Finally, successful epilepsy surgery significantly decreases the high risk of death in patients with temporal lobe epilepsy surgery[16], and it increases quality-adjusted life expectancy by about 7.5 years[17].

## Minimum requirements for an epilepsy surgery center

The objective of epilepsy surgery is not only to eliminate epileptic seizures without causing any neurological or cognitive deficit, but also to improve the quality of life and make an individual a productive member of society. The surgical candidacy of a patient with drug-resistant epilepsy is favored by focality of the electro-clinical and neuroimaging data. However, not all spells in a patient with suspected drug-resistant epilepsy are epileptic, and not all focal findings are causally related to the epileptic seizures.

Therefore, the first step in presurgical evaluation is to determine whether the habitual spells are indeed focal epileptic seizures. The second step is to localize the epileptogenic zone, which is defined as the region, the resection of which is necessary and sufficient to achieve seizure freedom[18]. Although the anatomical extent of the epileptogenic zone cannot be directly measured, it can be assumed using a multimodality approach comprising clinical,

EEG, MRI, and neuropsychological evaluations. The third step is to delineate, if necessary, the spatial relationship between the presumed epileptogenic zone and eloquent cortical areas by functional mapping studies. The final step is to debate in a patient management conference whether and how the presumed epileptogenic zone can be completely resected without sacrificing essential cortex.

The presurgical evaluation modalities that are required to estimate the epileptogenic zone and its relationship to eloquent cortical areas in an individual patient with drug-resistant epilepsy can vary from simple straightforward to highly complex. Patients considered for focal resections, such as those with mesial temporal lobe sclerosis and low-grade neoplasms, and those with large hemispheric lesions considered for hemispherotomy, could be selected for surgery by MRI and interictal and ictal EEG findings; many of them might not require ictal EEG recordings. In contrast, patients with focal cortical dysplasias located close to eloquent cortical regions, and those with normal/indistinct MRI findings, often require multiple noninvasive and invasive strategies. Especially in resource-poor regions, the success of an epilepsy program depends upon the capacity of the team to select ideal surgical candidates, utilizing the locally available presurgical evaluation technologies and expertise without compromising on patient safety[19].

## The impact of governmentally sponsored epilepsy surgery centers

Although economical and geopolitical changes in the last decade have somewhat blurred the sharp contrasts between developed and developing countries, quality of health care continues to be very poor in the latter. Progress is needed and one way is the establishment of “islands of excellence”, that could set the bar higher, hence improving the whole system.

The establishment of a governmentally sponsored national epilepsy surgery program in Brazil in 1994 may provide a good example. Officials were briefed on the high prevalence of epilepsy in Brazil, and the absolute number of patients whose refractory seizures prevented them and their immediate relatives from working and living properly[20, 21].

At the time, a critical mass of specialists trained abroad had returned to the country, and were organizing centers to care for patients with refractory seizures. The Brazilian program of epilepsy surgery was thus established with internationally-accepted practices for pre-surgical evaluation and surgical procedures. The program has since allocated special funding to accredited centers in the country, and benefited from the fact that Brazil already had a Universal Health Care System (SUS) firmly rooted in society. In the 17 years to 2011, roughly 12,000 pre-surgical evaluations and 6,000 operations were performed. Although the 4 original centers performed more than 75 % of these, over the years the number of centers grew to 12, exactly because these major centers have been providing expert training and support to new centers. The perspective for the coming years is thus favorable as the offer of evaluation and surgical treatment for epilepsy should increase.

Because thousands of patients and their families have been exposed to good epilepsy care, the national epilepsy surgery program in Brazil helped increase awareness about the condition and allowed a better understanding by the lay person and patients of the morbidity,

suffering, and risks involved with recurrent seizures. Furthermore, the positive results in terms of seizure control[22, 23] made epilepsy surgery widely known in the country.

Interest of the media has also been helpful. For instance, a TV program presented the story of a few patients who benefited from epilepsy surgery and shows that surgery may be a very good option to help people with severe epilepsies. Patients and relatives from all over the country immediately empathize, and get interested to be appropriately evaluated. Because the governmentally sponsored epilepsy surgery program is universally available, any patient can then look for evaluation and treatment. This creates a virtuous cycle of awareness about the disease and access to specialized care, with major impact on referring neurologists.

## Conclusions

Surgical treatment for epilepsy is arguably the most underutilized accepted therapy in all of medicine. Approximately two-thirds of appropriately selected patients can expect to become seizure-free. The lives of tens of millions of people with medically refractory epilepsy and their families could be greatly improved by surgery, and the majority of these live in the developing world. It is essential to increase access to surgical treatment for epilepsy, not only in the industrialized world where it has existed for over a century, but in the developing world, where it has become cost effective for many countries with limited resources.

## Biographies

**Jerome Engel Jr., MD, PhD**

**Samuel Wiebe, MSc, MD, FRCPC**

**Kurupath Radhakrishnan, MD, DM, FAMS, FAAN**

**André Palmini, MD, PhD**

## References


1. Englot DJ, et al. Epilepsy surgery trends in the United States, 1990–2008. Neurology. 2012; 78:1200–1206. [PubMed: 22442428]
2. Berg AT, et al. How long does it take for partial epilepsy to become intractable? Neurology. 2003; 60:186–190. [PubMed: 12552028]
3. Haneef Z, et al. Referral pattern for epilepsy surgery after evidence-based recommendations: a retrospective study. Neurology. 2010; 75:699–704. [PubMed: 20733145]
4. Wiebe S, et al. A randomized, controlled trial of surgery for temporal lobe epilepsy. N Engl J Med. 2001; 345:311–318. [PubMed: 11484687]
5. Engel J Jr, et al. Early surgical therapy for drug-resistant temporal lobe epilepsy: A randomized trial. JAMA. 2012; 307:922–930. [PubMed: 22396514]
6. Engel J Jr, et al. Practice parameter: Temporal lobe and localized neocortical resections for epilepsy. Neurology. 2003; 60:538–547. [PubMed: 12601090]
7. Kwan P, et al. Definition of drug resistant epilepsy: Consensus proposal by the ad hoc Task Force of the ILAE Commission on Therapeutic Strategies. Epilepsia. 2010; 51:1069–1077. [PubMed: 19889013]
8. Kwan P, Brodie MJ. Drug treatment of epilepsy: When does it fail and how to optimize its use? CNS Spectrums. 2004; 9:110–119. [PubMed: 14999167]
9. Engel J Jr. Surgery for seizures. N Engl J Med. 1996; 334:647–652. [PubMed: 8592530]
10. Tellez-Zenteno JF, et al. Long-term seizure outcomes following epilepsy surgery: A systematic review and meta-analysis. Brain. 2005; 128:1188–1198. [PubMed: 15758038]
11. Tellez-Zenteno JF, et al. Long-term outcomes in epilepsy surgery: Antiepileptic drugs, mortality, cognitive and psychosocial aspects. Brain. 2007; 130:334–345. [PubMed: 17124190]
12. Langfitt JT, et al. Worsening of quality of life after epilepsy surgery: Effect of seizures and memory decline. Neurology. 2007; 68:1988–1994. [PubMed: 17548548]
13. Sherman EM, et al. Neuropsychological outcomes after epilepsy surgery: Systematic review and pooled estimates. Epilepsia. 2011; 52:857–869. [PubMed: 21426331]
14. Wiebe S, et al. An economic evaluation of surgery for temporal lobe epilepsy. Journal of Epilepsy. 1995; 8:227–235.
15. Picot MC, et al. Cost-effectiveness of epilepsy surgery in a cohort of patients with medically intractable partial epilepsy--Preliminary results. Rev.Neurol.(Paris). 2004; 160(Spec No 1):5S354–5S367. [PubMed: 15331984]
16. Bell GS, et al. Premature mortality in refractory partial epilepsy: does surgical treatment make a difference? J Neurol Neurosurg Psychiatry. 2010; 81(7):716–718. [PubMed: 20478848]
17. Choi H, et al. Epilepsy surgery for pharmacoresistant temporal lobe epilepsy: A decision analysis. JAMA. 2008; 300:2497–2505. 2008. [PubMed: 19050193]
18. Rosenow F, Lüders H. Presurgical evaluation of epilepsy. Brain. 2001; 24:1683–1700.
19. Radhakrishnan K. Challenges in the management of epilepsy in resource-poor countries. Nat Rev Neurol. 2009; 5:323–330. [PubMed: 19455183]
20. Palmini A. Medical and surgical strategies for epilepsy care in developing countries. Epilepsia. 2000; 41(Suppl 4):S10–S17.

21. Palmini, A., Costa da Costa, J., Engel, J, Jr. The challenge represented by epilepsy surgery in developing countries. In: Murthy, JMK., Senanayake, N., editors. Epilepsy in the Tropics. Georgetown, Texas: Landes Bioscience; 2006. p. 174-181.

22. Hemb M, et al. An 18-year follow-up of seizure outcome after surgery for temporal lobe epilepsy and hippocampal sclerosis. J Neurol Neurosurg Psychiatry. 2013; 84:800–805. [PubMed: 23408065]

23. Hamad AP, et al. Hemispheric surgery for refractory epilepsy in children and adolescents: Outcome regarding seizures, motor skills and adaptive functions. Seizure. 2013 (in press).