Epilepsy Surgery Trends in the United States from 1990 to 2008

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Background

Epilepsy is a common, highly morbid disease

Epilepsy is estimated to affect approximately 3 million Americans. The World Health Organization estimates that epilepsy related morbidity is responsible for 1% of the entire global burden of disease in disability adjusted life-years.

In the United States, epilepsy is estimated to cause $12.5 billion in annual direct and indirect costs. Because of its prevalence and high cost to society, there are a variety of pharmacotherapy options used to treat and manage epilepsy. Despite this, pharmacotherapy is unsatisfactory in between 20 – 40% of epilepsy patients.

Anterior temporal lobectomy as a treatment for temporal lobe epilepsy

Figure 2. Kaplan–Meier Event-free Survival Curves Comparing the Cumulative Percentages of Patients in the Two Groups Who Were Free of Seizures Impairing Awareness (Complex Partial or Generalized Seizures) (Panel A) and Free of All Seizures (Including Auras) (Panel B).
In both analyses, more patients in the surgical group were free of seizures (P<0.001 by the log-rank test). Follow-up began 1 day after surgery in the surgical group and 25 days after randomization in the medical group.

One particularly surgically salient type of epilepsy is temporal lobe epilepsy. This class of epilepsies presents with partial complex or partial simple seizures that are initiated from the anterior temporal lobe. Good surgical candidates include medically refractory patients with unilateral seizure foci with limited parasthesia or other neurological signs after inactivation of one temporal lobe.

In 2001, a randomized control trial was able to conclusively prove that anterior temporal lobectomy was a superior option compared continued pharmacotherapy for patients with medically refractory epilepsy – epilepsy that is still not well managed after 2 or more medication regimens.

In 1993, it was estimated that there are approximately 100,000 individuals in the United States with temporal lobe epilepsy, while only 1,500 patients having undergone anterior temporal lobectomy.

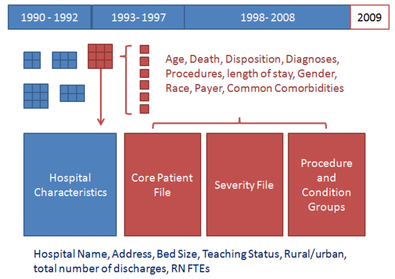
Our Research Question

Has the use of lobectomy for patients with intractable epilepsy increased in light of class I clinical evidence demonstrating efficacy?

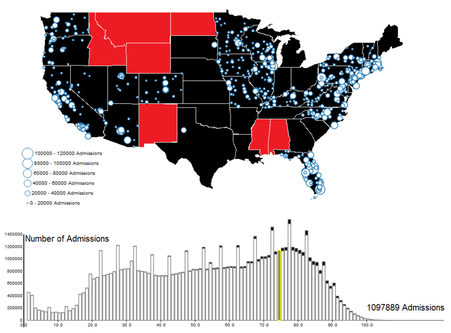
Under the model of translational research, one hopes that advances in medical research would shape community and academic practice. Using a large medical database, we sought explore whether that has happened for anterior temporal lobectomy for temporal lobe epilepsy.

Retrospective Cohort Analysis with the National Inpatient Sample

Database – National Inpatient Sample

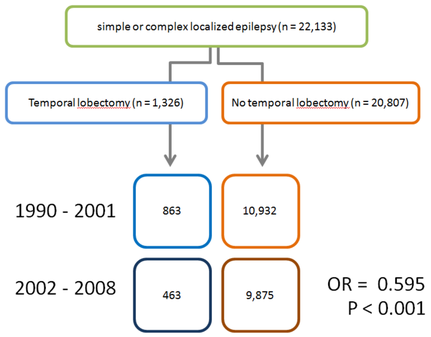


The National Inpatient Sample is a 20% stratified sample of inpatient admissions of US hospitals. Approximately 1000 of the 5000 hospitals in the United States were represented in stratified weighted sample representing 43 states in 2008. The database contained b Data was extracted from non-delimited ASCII files using Python and R.



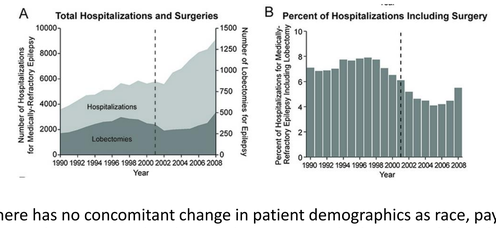
Study Design

Patients with relevant diagnoses and procedures were identified and stratified by ICD9 codes and CPT codes. Contrary to expectation, the usage of temporal lobectomy has decreased in the last twenty years.

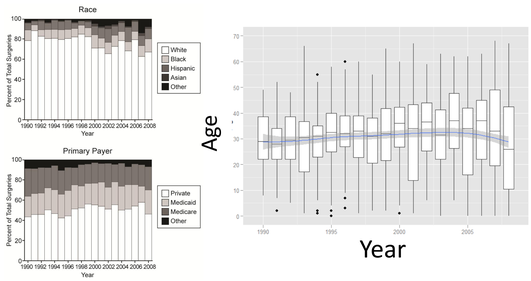


Time Trends in Anterior Temporal Lobectomy

While there has been an increase in the annual number of hospitalizations for partial simple and partial complex seizures in the United States in the last twenty years, there has not been a comparable increase in the number of temporal lobectomies.



There has no concomitant change in patient demographics as race, payer mix, and patient age distributions have remained relatively stable in the twenty years – suggesting few if any diagnostic criteria changes to justify the increase in hospitalizations but not surgeries.



Although patient characteristics have not greatly changed, hospital characteristics have changed in the last twenty years. High volume academic centers are most likely to perform anterior temporal lobectomy, however the number of patients referred to these large hospitals have remained relatively constant over the time period. In contrast, lower volume hospitals have seen a great growth in the number of temporal lobe epilepsy admissions. These hospitals are less likely to perform surgery, and the relative increase in the number of hospitalizations has decreased the ratio of surgeries to hospitalizations.

	1990 - 1994			2004 - 2008		
	Hospitals Admitting for Medically-Refractory Epilepsy, n (%)	Hospitalizations for Medically-Refractory Epilepsy, n (%)	Percent of Hospitalizations Including Lobectomy	Hospitals Admitting for Medically-Refractory Epilepsy, n (%)	Hospitalizations for Medically-Refractory Epilepsy, n (%)	Percent of Hospitalizations Including Lobectomy
Top 20 Hospitals Performing Lobectomy	20 (1.1)	6,450 (30.6)	9.5	20 (0.9)	4,406 (11.0)	9.6
Other Hospitals Performing Lobectomy	140 (7.6)	6,704 (31.8)	9.4	350 (15.6)	27,285 (67.9)	4.5
Hospitals Not Performing Lobectomy	1,685 (91.3)	7,936 (37.6)	0	1,880 (83.6)	8,520 (21.2)	0
Total	**1,845** (100)	**21,090** (100)	**6.9**	**2,250** (100)	**40,210** (100)	**4.3**

Variations in Surgery Utilization and Performance

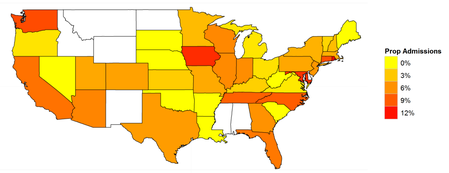
Table: Peri-operative adverse events by center volume

	Low	Middle	High
Stroke/neurological complication	14 (3.8)	33 (1.8)	55 (1.3)
Post-operative infection	10 (2.5)	66 (3.5)	86 (2.0)
Hematoma	10 (2.5)	28 (1.5)	40 (0.9)
Status epilepticus	5 (1.3)	9 (0.5)	10 (0.2)
Ventriculostomy/ Hydrocephalus	0 (0)	9 (0.5)	5 (0.1)
Pulmonary complication	10 (2.5)	28 (1.5)	40 (0.9)
Cardiac complication	0 (0)	5 (0.3)	5 (0.1)
Deep venous thrombosis/Pulmonary embolism	0 (0)	5 (0.3)	20 (0.5)
Death	0 (0)	5 (0.3)	0 (0)
Total	48 (12.5)	190 (10.1)	262 (6.1)

Data are N (%) of each event within each group of centers, 1990-2008.

$X^2 = 13.6$, $p = 0.0002$

Low volume surgical centers are twice as likely to have complications and adverse events compared to high volume centers, in addition to being less likely to refer patients for surgery.



There exists regional, patient, race, and hospital status based disparity in the utilization of lobectomy

Table 2: Predictors of ATL during TLE admission from multivariate analysis

	Odds ratio	95% CI	*P* value
Pediatric (age < 18 y)	1.57	1.30 – 1.89	< 0.001*
White race	1.56	1.28 – 1.90	< 0.001*
Income above 25th percentile	1.02	0.84 – 1.25	0.83
Private insurance	1.73	1.47 – 2.03	< 0.001*
Large hospital	1.51	1.26 – 1.82	< 0.001*
Teaching hospital	1.88	1.51 – 2.34	< 0.001*
Urban hospital	1.12	0.72 – 1.75	0.62
Hospital in South or West	1.74	1.49 – 2.03	< 0.001*

Conclusions

Lobectomy for medically intractable epilepsy is still underutilized, particularly among racial minorities and the underinsured.

Patients with medically refractory epilepsy should be referred to a comprehensive epilepsy center for surgical evaluation by an experienced epilepsy treatment team.

Citations

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