Surgical Treatment of Epilepsy

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Goals
- Recognize refractory epilepsy
- Know when to refer for surgical evaluation
- Become familiar with surgical treatment options

Epilepsy Basics

International League Against Epilepsy Task Force
- “Failure of adequate trials of two tolerated and appropriately chosen and used AED schedules (whether as monotherapies or in combination) to achieve sustained seizure freedom.”

Kwan et al. Epilepsia 2009

Pivotal Study

Kwan & Brodie NEJM 2000

Treatment Options for Refractory Epilepsy
- Further anticonvulsant drug trials
- Dietary
- Devices
- Surgery
**Proposed Treatment Approach**

- Trial of 2 AEDs
- Surgical evaluation
- Surgical Candidate
- Alternative Therapy

**History of Epilepsy Surgery**

- **Late 19th Century**
  - John Hughlings Jackson

- **1886**
  - Victor Horsley

- **1940’s**

- Ideal Semiology
- Early Epilepsy Surgery
- Epilepsy Surgery Programs


**Growth of Epilepsy Surgery in United States**

- 1985: ~ 500 cases/year*
- 1990: ~1500 cases/year**
- Currently >100 specialized epilepsy centers

Based on data collected at 1st and 2nd Palm Desert Conference of Epilepsy Surgery

**Ideal Candidate for Epilepsy Surgery**

- Refractory to treatment (≥ 2 AEDs)
- Well-defined focus of seizure onset
- Epileptogenic zone in “functionally silent” region

**Surgical Evaluation**

- Phase I Investigation
- Phase II Intracranial
- Phase III Surgery

**Case 1 - M.T.**

- Seizure onset at 6 months with complex partial seizure involving left side of the body
- MRI and EEG at 6 months negative
- Phenobarbital started
M.T. (2)
- Changed to Tegretol due to side effects on Phenobarbital
- Continued breakthrough seizures despite increased Tegretol dosage
- EEG - right temporal epileptiform discharges

M.T. (3)
- At 12 y.o. referred to comprehensive epilepsy center with continued seizures
- Trial of combination therapy (Tegretol + Keppra)
- Epilepsy surgery evaluation

Epilepsy Surgery Evaluation - Phase I
- Gather data regarding seizures
- Neuroimaging
- Understand brain function

M.T. (4)
- EMU - Multiple typical seizures; all with right temporal seizure onset. Frequent right temporal epileptiform discharges.

Phase I - Neuroimaging
- Magnetic Resonance Imaging (MRI)
- Positron Emission Tomography (PET)
- Single-Photon Emission Computed Tomography (SPECT)
  - Ictal
  - Interictal

M.T. (5)
- Repeat brain MRI - right mesial temporal sclerosis
<table>
<thead>
<tr>
<th>Case 1: M.T. (6)</th>
<th>Phase I - Understand brain function</th>
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</thead>
<tbody>
<tr>
<td>Brain PET scan - decreased glucose uptake in right temporal region</td>
<td>Neuropsychological testing</td>
</tr>
<tr>
<td>No ictal or interictal SPECT performed</td>
<td>fMRI</td>
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<td></td>
<td>WADA</td>
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<tr>
<th>Case 2: M.T. (7)</th>
<th>M.T. - Case Conference</th>
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<tbody>
<tr>
<td>Neuropsychological testing - difficulties with visual spatial learning and memory</td>
<td>Appropriate candidate for right temporal resection</td>
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<tr>
<td>Consistent with non-dominant temporal lobe dysfunction</td>
<td>To better determine the risks of surgery, a WADA test was recommended</td>
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<th>Case 2: J.C.</th>
<th>J.C. (2)</th>
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<td>15 year-old young man with nocturnal seizures since 8 years old.</td>
<td>PET scan - reduced glucose uptake in the left frontal and temporal regions</td>
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<td>EMU evaluation - frontal lobe seizures; discharge left &gt; right. EEG otherwise normal</td>
<td>SPECT ictal and interictal non-contributory</td>
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<tr>
<td>MRI normal</td>
<td>Neuropsychological testing - inattention, visual &gt; verbal performance suggesting left hemisphere dysfunction</td>
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J.C. - Case Conference
- Suggestive of left frontal > temporal focus
- Further evaluation necessary to determine epileptogenic region
- Intracranial implantation with coverage of left frontal & temporal regions
- Functional MRI

Phase II
- Intracranial Electrode Placement
- Cortical Mapping

J.C. (4)
- Seizure zone identified
- Cortical mapping done to identify eloquent regions

Phase III
- Surgery
  - Removal of mass or tumor
  - Removal of scar tissue
  - Removal of EEG defined seizure focus
  - Disconnection of epileptic region

Hemispherectomy
- Functional versus Classic
Outcomes

- Motor
  - Hemiparesis
  - Spasticity
- Language
- Vision
- Seizures
  - 60-70% Seizure-Free
  - 25-30% Reduction in Seizures

Wyler A. 2nd Ed. The Treatment of Epilepsy 1997

Corpus Callosotomy

- Used for:
  - Drop seizures
  - Prevention of injury
  - Reducing severity
  - Determine focus for rapidly spreading seizures in resective surgery candidate

Neurologic Outcome

- Transient hemiparesis or mutism
- Behavior changes
- Impaired information transfer between hemispheres
- Memory difficulties

Seizure Outcome After Corpus Callosotomy

- 11% Seizure-Free
- 18% Less than 50% Reduction
- 68% With 50% or Greater Reduction

Fuiks K et al. J Neurosurg 1991

Role of Comprehensive Epilepsy Center

- Comprehensive care of epilepsy patient
  - Broad range of AED options
  - Neurostimulation (vagal nerve stimulator)
  - Dietary options
  - Full diagnostic services
  - Surgical treatment of epilepsy
References