Epilepsy Surgery Evaluation
The Epileptologist’s Perspective

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Disclosures

Speaker Bureau: Eisai, Sunovion

No COI related to the content of this talk.
10 Questions you may get asked by your fellow July 1st

1. What’s your Concept of Epilepsy Surgery?
2. What do you do with AED after Surgery?
3. For what do you use Intraoperative ECoG?
4. What do you with NL, dom, high funct. TLE?
5. Why do you use SEEG?
6. When do you offer RNS?
7. Do you need a Social Worker for your Center?
8. Who should treat PNES?
9. How to counsel about Mortality and Surgery?
10. What’s the future of Epilepsy Surgery?
Q: Concept of Epilepsy Surgery

**Symptomatogenic Zone/ Eloquent Cortex**
- Preoperative Anatomy
- Handedness
- Neuropsychology
- fMRI
- Tractography
- MEG

**Intraoperative**
- Wada
- TMS

**Functional Deficit Zone/ Lesion**
- MRI
- FDG PET
- Neuropsychology

**Ictal Onset Zone**
- Semiology
- Scalp Video EEG
- Ictal SPECT
- Extra-operative ECoG
- Stereo-EEG

**Irritative Zone**
- EEG
- MEG
- Intra-operative ECoG
A spatiotemporal model of seizure network dynamics

Region which has activity pre-ictally and/or at ictal onset which is permissive/necessary, facilitatory, or otherwise shapes ictal activity

Region to which seizure spreads but which can NOT sustain autonomous ictal activity

SOZ / Ictogenic Zone (w/ spatial heterogeneity)

Region to which seizure spreads but which can sustain autonomous ictal activity

Sydney Cash, AES, 2015
Epilepsy: Focus vs. Network

**Pro Focus**
- Predictable
- Resectable
- Curative

**Limitations**
- Secondary epileptogenicity
- Poorer outcome in patients with secondarily generalized seizures
- Late relapses
Intelligence Quotient Improves after Antiepileptic Drug Withdrawal following Pediatric Epilepsy Surgery

Kim Boshuisen, MD,1 Monique M. J. van Schooneveld, MSc,2 Cuno S. P. M. Uiterwaal, MD, PhD,3 J. Helen Cross, MD, PhD,4 Sue Harrison, MSc,5 Tilman Polster, MD,6 Marion Daehn, MSc,6 Sarina Djimjadi, MSc,6 Dilek Yalnizoglu, MD,7 Guzide Turanli, MD,7 Robert Sassen, MD,8 Christian Hoppe, MSc, PhD,8 Stefan Kuczaty, MD,8 Carmen Barba, MD, PhD,9 Philippe Kahane, MD, PhD,10 Susanne Schubert-Bast, MD,11 Gitta Reuner, MSc, PhD,11 Thomas Bast, MD, PhD,11,12 Karl Strobl, MD,12 Hans Mayer, PhD,12 Anne de Saint-Martin, MD,13 Caroline Seegmuller, MD,13 Agathe Laurent, MSc,14 Alexis Arzimanoglou, MD, PhD,14,15 and Kees P. J. Braun, MD, PhD1

for the TimeToStop cognitive outcome study group
My Practice

- No change for 6 months
- 6 months postop: 24 hour EEG
- May stop meds causing side effects
- Longterm:
  - Continue in nonlesional patients, FCD
  - Discontinue in lesional patients, complete resection after two years or later.
For what do you use Intraoperative ECoG

- Not for Hippocampal Sclerosis
- Lesional Cases: Extent of resection
- Nonlesional (non-dominant) TLE: prognosis
What do you with non-lesional, (high functioning), dominant TLE

Grids and Strips
A – Lateral temporal (8x4) 210 purple
B – Olfactory (4x5) 740 red
C – Temporal basal (2x6) 213 blue
D – Temporal tip (1x6) 357 blue-purple
E – Anterior temporal (1x6) 426 blue-yellow
F – Posterior temporal (1x6) 153 blue-orange
Ref – Reference (1x4) 400 orange-yellow
**Refs upside down electrode 1x4

Depth Electrodes
AM 158 (8 out)
AH 171
MH 873
PH 884 (8 out)

Total – 114
## Hippocampal Transections

### Table: Multiple hippocampal transections

<table>
<thead>
<tr>
<th>Subject No.</th>
<th>Brain MRI findings</th>
<th>Memory dominance by IAP</th>
<th>Language dominance by IAP</th>
<th>Preoperative seizure frequency</th>
<th>Seizure outcome</th>
<th>Follow-up duration (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Normal</td>
<td>Bilateral</td>
<td>Left</td>
<td>1–2 per month</td>
<td>Seizure-free</td>
<td>31</td>
</tr>
<tr>
<td>#2</td>
<td>Normal</td>
<td>Right</td>
<td>Right</td>
<td>1 per day</td>
<td>Seizure-free</td>
<td>35</td>
</tr>
<tr>
<td>#3</td>
<td>Slight volume loss of the right hippocampus, without signal abnormalities</td>
<td>Not Done</td>
<td>Not Done</td>
<td>1 per month</td>
<td>Seizure-free</td>
<td>42</td>
</tr>
<tr>
<td>#4</td>
<td>Mildly increased T2 signal within the body and tail of the left hippocampus, without volume abnormalities</td>
<td>Bilateral</td>
<td>Left</td>
<td>1–6 per month</td>
<td>Seizure-free</td>
<td>38</td>
</tr>
<tr>
<td>#5</td>
<td>Scattered hypointensities in bilateral white matter</td>
<td>Bilateral R &gt; L</td>
<td>Left</td>
<td>1 every 2 months</td>
<td>Seizure-free</td>
<td>18</td>
</tr>
<tr>
<td>#6</td>
<td>Normal</td>
<td>Left</td>
<td>Left</td>
<td>1 per day</td>
<td>Seizure-free</td>
<td>35</td>
</tr>
<tr>
<td>#7</td>
<td>Decreased volume and increased T2 signal intensity of the left hippocampus</td>
<td>Not Done</td>
<td>Not Done</td>
<td>2 per week</td>
<td>Seizure-free</td>
<td>55</td>
</tr>
<tr>
<td>#8</td>
<td>Small focus of cortical dysplasia involving the posterior left middle temporal gyrus</td>
<td>Bilateral R &gt; L</td>
<td>Right</td>
<td>Up to 6 per day</td>
<td>Seizure-free</td>
<td>65</td>
</tr>
<tr>
<td>#9</td>
<td>Mild asymmetry involving amygdala and head of the hippocampus, which appear slightly larger on the left than the right</td>
<td>Not Done</td>
<td>Not Done</td>
<td>2–3 per week</td>
<td>Seizure-free</td>
<td>21</td>
</tr>
<tr>
<td>#10</td>
<td>Mild asymmetric volume loss of the left hippocampus without signal abnormalities</td>
<td>Bilateral</td>
<td>Left</td>
<td>20 per month</td>
<td>Seizure-free</td>
<td>20</td>
</tr>
<tr>
<td>#11</td>
<td>Normal</td>
<td>Bilateral</td>
<td>Left</td>
<td>1 per month</td>
<td>Seizure-free</td>
<td>20</td>
</tr>
<tr>
<td>#12</td>
<td>Normal</td>
<td>Bilateral</td>
<td>Left</td>
<td>1 per month</td>
<td>Seizure-free</td>
<td>26</td>
</tr>
<tr>
<td>#13</td>
<td>Normal</td>
<td>Bilateral L &gt; R</td>
<td>Left</td>
<td>Multiple times per day then weeks of seizure freedom</td>
<td>Seizure-free</td>
<td>28</td>
</tr>
</tbody>
</table>
Low frequency ES in TLE

FIGURE 1: Preoperative brain magnetic resonance imaging coregistered with postoperative computed tomographic scan showing the location of depth electrodes in the (A) fornodosocommissural tract and (B) body of the fornix at the intersection of vertical and horizontal lines.

FIGURE 4: Scatter plot showing the seizures recorded before and after stimulation. Point 0 corresponds to low-frequency stimulation of the fornix, which consisted of 1 stimulation session for some subjects and >1 for others. The seizure counts included represent the number of seizures in the 48 hours before the first session (−48, 0), and followed the last session (0,48). No seizures occurred during stimulation.
Laserablution

Better object recognition and naming outcome with MRI-guided stereotactic laser amygdalohippocampotomy for temporal lobe epilepsy


_Epilepsia, 56(1):101–113, 2015_

doi: 10.1111/epi.12860

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**Table 1. Demographic, disease-related variables, and surgical characteristics by surgical group**

<table>
<thead>
<tr>
<th>Side of surgery</th>
<th>Standard open resections</th>
<th>Stereotactic laser amygdalohippocampotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22 dominant/17 nondominant</td>
<td>10 dominant/9 nondominant</td>
</tr>
<tr>
<td>Dominant</td>
<td>X</td>
<td>SD</td>
</tr>
<tr>
<td>Age (years)</td>
<td>36.0</td>
<td>11.4</td>
</tr>
<tr>
<td>Education</td>
<td>12.1&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>2.5</td>
</tr>
<tr>
<td>Age of onset</td>
<td>16.7</td>
<td>12.9</td>
</tr>
<tr>
<td>Number of AEDs</td>
<td>2.1</td>
<td>0.8</td>
</tr>
<tr>
<td>MTS</td>
<td>10/22</td>
<td>9/17</td>
</tr>
</tbody>
</table>

MTS, mesial temporal sclerosis; AEDs, antiepileptic drugs.
Standard resections included both standard and tailored anterior TL resections and selective amygdalohippocampectomies. Statistical analysis included Fisher’s exact test comparisons for categorical variables and analysis of variance for continuous data. Matching superscripts indicate that differences between subgroups are significant.

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Kang JY et al. Epilepsia 2016. LiTT for mesial TLE.
Q: Why do you do SEEG?

Table 2. Statistical association between each predictor variable and seizure freedom

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Patients (n)</th>
<th>Seizure free patients (n)</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>23</td>
<td>15</td>
<td>0.697</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>30</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>DOB</td>
<td>Adults</td>
<td>46</td>
<td>31</td>
<td>0.052</td>
</tr>
<tr>
<td></td>
<td>Children</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Side of implantation</td>
<td>Bilateral</td>
<td>16</td>
<td>7</td>
<td>0.077</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>14</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>23</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Side of resection</td>
<td>Left</td>
<td>23</td>
<td>12</td>
<td>0.185</td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>30</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Pathology</td>
<td>Normal</td>
<td>7</td>
<td>1</td>
<td>0.005*</td>
</tr>
<tr>
<td></td>
<td>Abnormal</td>
<td>46</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>MRI</td>
<td>Normal</td>
<td>28</td>
<td>16</td>
<td>0.205</td>
</tr>
<tr>
<td></td>
<td>Abnormal unilateral</td>
<td>22</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abnormal bilateral</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Type of resection</td>
<td>Temporal</td>
<td>13</td>
<td>9</td>
<td>0.717</td>
</tr>
<tr>
<td></td>
<td>Extratemporal unilobar</td>
<td>27</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Extratemporal multilobar</td>
<td>13</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Previous operations</td>
<td>No</td>
<td>38</td>
<td>24</td>
<td>0.831</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>15</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant.
Periventricular nodular heterotopia
Reduced Morbidity
Q: When do you offer RNS?

GK et al. Neurology 2015. Longterm treatment with RNS
In patients who were potential candidates for resection but were found to have localized seizure onset from eloquent cortex after an invasive evaluation.
Secondary benefit of RNS

Table 2. Lateralization of electrographic seizures by inpatient EEG and by chronic ambulatory electrocorticography (ECoG) N = 82

<table>
<thead>
<tr>
<th>Electrographic seizure onsets by inpatient EEG monitoring</th>
<th>Electrographic seizure onset by chronic ambulatory ECoG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bilateral (n = 69)</td>
</tr>
<tr>
<td>Bilateral (n = 71)</td>
<td>75.6% (n = 62)</td>
</tr>
<tr>
<td>Unilateral (n = 11)</td>
<td>8.5% (n = 7)</td>
</tr>
</tbody>
</table>

Lateralization of MTLE with chronic ambulatory ECOG
Why do you need a Social Worker?

- Psychosocial assessment and intervention
  - All Surgical Patients
  - Patient with psychiatric comorbidities
  - Pregnant women with epilepsy

- Support
- Patient Education
- Crisis Intervention and Protective Services
Who should treat PNES?

- A multidisciplinary team
- Including the Epileptologist
- Focus on:
  - 1/3 of patients who improve with diagnosis
  - 1/3 of patients who are amenable to therapy
  - Caution: patient with pre-existing personality disorder
How do you counsel about mortality and surgery

Figure 1: Mortality in patients treated with focal resection or transections compared to nonsurgical patients.

Patients treated with focal resection or subpial transection (8.6 deaths per 1,000 person-years [95% confidence interval (CI) 6.58–11.15]) had a lower mortality rate than nonsurgically treated patients (25.3 deaths per 1,000 person-years [95% CI 14.50–41.17]) (p < 0.0001).

What’s the future of Epilepsy Surgery?