Algorithm for the Treatment of Non-Lesional Epilepsy

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Disclosure

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Learning Objectives

• Provide an evidence-based algorithm for the treatment of non-lesional epilepsy
Key Principles

“Algorithm” definition:
A logical set of rules for solving a specific problem, which assumes that all of the data are objective, that there are a finite number of solutions to the problem, and that there are logical steps that must be performed to arrive at each of those solutions.

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Data

Definition of intractability  
Risks  
Complications

Apply to both lesional and non-lesional epilepsy

31% of patients currently undergoing resective epilepsy surgery have a normal brain MRI vs 21% ten years ago (Jehi et al., 2013).

Non-lesional epilepsy is an undeniable growing proportion of our practice
Key Principles

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Solutions?
Non-resective treatment outcomes

Anti-epileptic drugs:
45-50% new onset
35% 12-mo remission in drug resistant epilepsy
(Callaghan 2011)

Dietary therapies:
38%-48% responder-rate, mostly in non-lesional patients
(Kossof 2013)

Neuro-modulation:
40%-54% responder-rate
(Uthman 2004, Fisher 2010, Morell 2011)

Emerging therapies: radiosurgery, ultrasound, cooling, optogenetics, etc...
## Surgical Outcomes

**Non-lesional Epilepsy**

<table>
<thead>
<tr>
<th>Temporal lobe resections</th>
<th>Extra-temporal lobe resections</th>
</tr>
</thead>
<tbody>
<tr>
<td>48%–67%</td>
<td>34%–55%</td>
</tr>
<tr>
<td>completely seizure-free</td>
<td>completely seizure-free</td>
</tr>
<tr>
<td>at 5-7 years</td>
<td>at 2-5 years</td>
</tr>
</tbody>
</table>

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Steps?
Key investigative steps..

- VEEG
- brain MRI
- Neuropsychiatric evaluation
- PET
- Ictal SPECT
- MEG
- Invasive EEG
Treatment Algorithm

Is epilepsy medically intractable?
- Yes → Is epilepsy focal?
  - No → Anti-epileptic drugs
  - Yes → Is epilepsy "surgical"?
    - No → Neuro-modulation
    - Yes → Resective surgery

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  - Is epilepsy focal?
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      - Yes → Resective surgery

Dietary therapy

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Impact on Clinical Care and Practice
"No two persons ever read the same book."

Edmund Wilson
Medical “person”...
Data

Definition of intractability

Risks

Complications

31% of patients currently undergoing resective epilepsy surgery have a normal brain MRI vs 21% ten years ago (Jehi et al., 2013).

...But there is also the risk of complications from a pre-surgical evaluation (invasive EEG)....
Non-resective treatment outcomes

Anti-epileptic drugs:
45-50% new onset
35% 12-mo remission in drug resistant epilepsy

Dietary therapies:
38%-48% responder-rate, mostly in non-lesional patients

Neuro-modulation:
40%-54% responder-rate

....and we have many successful medical options..

Emerging therapies: radiosurgery, ultrasound, cooling, optogenetics, etc...

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Surgical Outcomes
Non-lesional Epilepsy

Temporal lobe resections
48%- 67%
completely

Extra-temporal lobe resections
34%- 55%
completely

…surgery is far from 100% successful..

Lau et al (2013); Lo-Pinto Khoury (2012); Fong et al (2011); Seo et al (2009);


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The price of epilepsy surgery...

- VEEG (s)
- brain MRI (s)
- Neuropsychiatric evaluation
- PET (s)
- Ictal SPECT (s)
- MEG (s)
- Invasive EEG (s)

....and is VERY costly..
Treatment Algorithm

Is epilepsy medically intractable?

No

Is epilepsy focal?

No

Is epilepsy “surgical”?  

No

Anti-epileptic drugs

Neuro-modulation

Dietary therapy

Yes

Resective surgery
Surgical “person”...
Non-resective treatment outcomes

Anti-epileptic drugs:
- 45-50% new onset
- 35% 12-mo remission in drug resistant epilepsy
  (Callaghan 2011)
- 70% relapse rate

Dietary therapies:
- 38%-48% responder-rate, mostly in non-lesional patients

Neuro-modulation:
- 40%-54% responder-rate

Responder rate is NOT seizure-free

Emerging therapies: radiosurgery, ultrasound, cooling, optogenetics, etc...

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Surgical Outcomes
Non-lesional Epilepsy

Temporal lobe resections

48%-67%
completely seizure-free
at 5-7 years

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Extra-temporal lobe resections

34%-55%
completely seizure-free
at 2-5 years

Pre-surgical evaluation

• Minimum:
  • VEEG
  • brain MRI
  • Neuropsychiatric evaluation

Goal is to identify:
1. Ictal onset
2. Safety of resection

• Other (MRI post-processing, EEG f-MRI, etc)
• Invasive EEG (SDE, SEEG)
Treatment Algorithm

Is epilepsy medically intractable?
- No
- Yes

Is epilepsy focal?
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- Yes

Is epilepsy “surgical”?
- No
- Yes

Resective surgery
Intractable epilepsy is both a “surgical” AND “medical” disease..

So where is the “objective” truth?
From quest for a lesion..

Epilepsy is a NETWORK disease

...to an appreciation of widespread connectivity

From Human Connectome Project
Assessing surgical candidacy requires an appreciation of the electro-clinical picture.
Pre-surgical evaluation

• Minimum:
  • VEEG
  • brain MRI

• Additional:
  • Ictal SPECT
  • MEG
  • Other (MRI post-processing, EEG f-MRI, etc)

Goal is to develop a surgical hypothesis:
  1- extent of network
  2- functional outcomes

Use all that information to guide Invasive EEG planning (SDE or SEEG)
As soon as possible..

..because the “price” of a surgical evaluation needs to be weighed against...
The price of waiting too long...

Lesional FLE

Non-lesional FLE

Self-fulfilling prophecy

Improved Outcomes with Earlier Surgery for Intractable Frontal Lobe Epilepsy

Thitiwan Simasathien, MD,¹ Sumeet Vadera, MD,² Imad Najm, MD,¹ Ajay Gupta, MD,¹ William Bingaman, MD,² and Lara Jehi, MD³

Simasathien et al., Annals of Neurology, 2013
Impact on Clinical Care and Practice

• Determine medical intractability...as soon as possible
• Determine surgical candidacy...as soon as possible
• Perform the appropriate invasive EEG evaluation only if there is a clear hypothesis
• Improving outcomes requires a better understanding of the mechanisms of epilepsy.
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Resective surgery

Anti-epileptic drugs

Neuro-modulation

Dietary therapy

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