While 83% aware that surgery can sometimes be an option for PWE...

PWE Overestimate Risks

How dangerous is epilepsy surgery in carefully selected patients?

Brain surgery should be considered as last resort.

SUDEP

- **Sudden Unexpected Death in Epilepsy Patients**
  - sudden death in a person with epilepsy, who was otherwise healthy, that cannot be explained by an accident, injury or status epilepticus
  - Sudden death = 1:500 to 1:1000 (24X higher than the general population)
  - Risk highest in adults with uncontrolled nocturnal seizures
  - www.epilepsy.com/sudep
  - www.sudepaware.org
Patient Treatment Goals

Objectives

1. To identify who may be a candidate for epilepsy surgery
2. To review the evidence base behind epilepsy surgery
3. To highlight different epilepsy surgical options, the benefits and the risks
4. To explore up and coming surgical treatment options for epilepsy

The Statistics

- Defn: a predisposition to recurrent unprovoked seizures
- Epilepsy affects 0.5-1% of the world population
- Incidence increasing with aging population
- Focal epilepsy/seizures
  - more common
  - may be hard to control with medications

Drug Resistant Epilepsy

- “Failure of adequate trials of two tolerated appropriately chosen and used antiepileptic drug schedules (whether as one agent or in combination) to achieve sustained seizure freedom.”
  ILAE Commission on Therapeutic Strategies, 2010

Illegible text
Adequate Medication trial

- Right drug
- Right dose
- Right duration
- Right drug levels
- Medication not stopped due to side effects alone
- Medication taken as prescribed

French et al., Definition of drug-resistant epilepsy. Epilepsia, 2010 51 (6): 1065-1077

When to go for epilepsy surgery?

"Resective surgery is a consideration in patients with drug-resistant, uncontrolled, disabling focal epilepsy if the seizures originate from a region that can be removed with minimal risk of disabling neurologic or cognitive dysfunction."

Continuum – Epilepsy [June 2013]

Remaining Questions

- What does it mean to have a surgical evaluation?

What does a surgical evaluation entail?

- Almost all cases:
  1. Continuous video EEG
  2. MRI Brain
  3. Neuropsychology testing

Seizure Investigation Unit - Goal #1

Spell analysis: It is important for doctors to see what the event(s) look like on video.
Seizure Investigation Unit - Goal #2

Seizure localization: where on the brain are the seizures coming from?

MRI Brain – Mesiotemporal sclerosis

MRI Brain – Tumor

MRI Brain – May be normal

Neuropsychology Testing

• It is important to perform detailed testing of brain function (e.g. memory and language)
• Paper and pencil tests usually take 1-2 days.

What other tests may be done before surgery?

• Selective cases/center dependent:
  ◦ Psychiatry consultation
  ◦ Wada test (language and memory test)
  ◦ Language MRI
  ◦ PET (positron emission tomography)
  ◦ SPECT (single photon emission computed tomography)
  ◦ Intracranial monitoring (inside the skull)
Psychiatry
- People with epilepsy often struggle with anxiety and mood problems.
- It may be helpful to have a mental health assessment to help optimize your situation.

Wada Test

Language fMRI

CEREBRAL PET
May help localize a seizure focus

CEREBRAL SPECT
- Between seizures: area of low blood flow
- During a seizure: area of high blood flow
- Subtract the two & coregister with MRI

Remaining Questions
- What if it is still unclear where the seizures are coming from?
Intracranial monitoring

1) Subdural monitoring
2) Depth electrode monitoring

Subdural Electrode Placement

Depth Electrodes

Neurosurgeon Consultation

- If you are felt to be a good candidate for epilepsy surgery, you will meet the neurosurgeon beforehand.
Remaining Questions

- What is the evidence behind all of this?

The New England Journal of Medicine

A RANDED, CONTROLLERED TRIAL OF SURGERY FOR TEMPORAL-LOBE EPILEPSY

Surgery is superior to prolonged medical therapy in medically refractory temporal lobe epilepsy.

Study Population

**Inclusion Criteria**
- > 16 yo
- Temporal Lobe Seizures
- Seizures for ≥ 1 year
- Seizures = monthly
- Failed prior trials of ≥ 2 AEDs

**Exclusion Criteria**
- Brain lesions - urgent OR
- Progressive brain disorders
- Active psychosis
- Pseudoseizures
- IQ<70
- Previous epilepsy surgery
- Focal extratemporal EEG/MRI
- Bilateral equally severe TLE

Study Methods

- 80 patients randomized to:
  - 1 year waitlist for surgical evaluation vs.
  - Surgery w/ 4 wks

- Surgical evaluation:
  - Scalp video EEG monitoring +/- subdural
  - MRI
  - Neuropsychology testing
  - +/- Wada test (language test)

Typical surgical resection for temporal lobe epilepsy
No Disabling Seizures at 1 year

Complete Seizure Freedom at 1 year

No Disabling Seizures at 1 year

Complete Seizure Freedom at 1 year

Early Surgical Therapy for Drug-Resistant Temporal Lobe Epilepsy
A Randomized Trial

Remaining Questions

• What are the surgical complications?

Surgical Risks

• Intracranial monitoring
  - Minor or temporary complication = 4.6%
  - Major or permanent complication = 0.6%

Surgical Risks

Resective Surgery

- Medical complications
  - ~5% minor, ~1% major
- Neurologic complications
  - ~10% minor, ~5% major
  - ~1.5% permanent hemiparesis
- Death ~0.4%

http://www.epilepsycases.com/funding_publications.html

http://www.epilepsycases.com/funding_publications.html
Seizure Outcomes after Epilepsy Surgery

Remaining Questions

- What should be expected after surgery?

Recovery Period

- The hospitalization for epilepsy surgery is about 4-6 days
- Recovery usually takes a few weeks.
- You may be advised to take a few months off to recuperate at home.
- Most people resume their usual activities after 2-3 months.
- You will see your epilepsy specialist and surgeon in follow up.

AED Outcomes after Epilepsy Surgery

> 5 years of follow up

Remaining Questions

- What happens with medications use after surgery?
Remaining Questions

- What other outcomes are affected by surgery?

Epilepsy Surgery Outcomes

- Neuropsychological
  - Most do not have significant decline in memory or thinking
  - Risk generally greater if language dominant hemisphere

- Social outcomes
  - Full-time employment, driving, improved lifestyle, relationships, independence, education, finances

- Psychiatric outcomes
  - Improvement or no change overall

- Quality of life
  - 29/32 studies (91%) = positive effect on QOL

Remaining Questions

- Are there other surgical options?

Other Palliative Surgical Options

Vagual Nerve Stimulation

- Exact mechanism?
- Used more commonly in children
  - ~50% reduction in seizure frequency in 50% of patients

Corpus Callosotomy

- Commonly performed in children with drop attacks or disabling convulsions
- Anterior 2/3 vs. complete section of the tract connecting the two hemispheres of the brain
Multiple Subpial Transections

- Reserved for important cortex which can not be resected without high risk of neurologic deficit
- Generally not very effective

Hemispherectomy

- Disconnection of one side of the brain
- Very rarely done in conditions such as:
  - Sturge Weber syndrome
  - Hemimegalecephaly
  - Rasmussen’s encephalitis

Remaining Questions

- Is there anything up and coming?

Hippocampal Stimulation

- Numbers for research recruitment have been low
- Initial data has not been very promising
- Research trials ongoing, although not in Canada

Investigational Procedures

1. Hippocampal stimulation
2. Anterior thalamic nucleus stimulation
3. Responsive neurostimulation system
4. Radiosurgery
5. Laser ablation therapy

Electrical stimulation of the anterior nucleus of thalamus for treatment of refractory epilepsy

By 2 years, there was:
- ~50% reduction in seizure frequency
- 50% of patients had a ≥50% seizure reduction
- 14/100 patients were seizure-free for at least 6 months

Fisher et al, Epilepsy 2010
Responsive Neurostimulation

- RNS administers stimulation only if triggered by seizure activity.
- An investigational treatment for medically refractory epilepsy - currently under review by the FDA.

Radiosurgery

- E.g. gamma knife
- May be useful for areas which are hard to access
- Pilot trials have shown up to 65% response rates in temporal lobe epilepsy
- Exact indications TBD

MRI guided stereotactic guided laser ablation therapy

Remaining Questions

- What is the optimal timing of surgery?

Canadian Statistics

- Delays in undergoing epilepsy surgery average 10 yrs in children; 20 yrs in adults
- 1998-1999: 352 epilepsy surgeries/20,000 potential surgical candidates

Conclusions

- Surgery may offer freedom from disabling seizures in people who have failed medications.
- Various tests are used to help tailor the benefits and risks of surgery on an individual basis.
- One must balance the risks associated with surgery with the risks of ongoing poorly controlled epilepsy.
- Epilepsy surgery should NOT be considered as a ‘last resort.’ Ask your doctor about it!

Questions?