The Surgical Management of Essential Tremor

International Essential Tremor Foundation
“Learning About Essential Tremor: Diagnosis and Treatment Options”
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1. The history of surgery for movement disorders
2. Details of the current surgical procedure (deep brain stimulation),
   – Step-by-step description
   – Results
   – Risks

Overview:

Historical Aspects

Target:
- Pyramidal
- Basal ganglia

Technique:
- Open
- Stereotactic
- Lesioning
- Stimulation
- Ventriculogram/atlas
- CT/MRI computer planning
- Microelectrode rec
Historical Aspects

- Pyramidal era – 1940’s
- Tremor relief at the expense of strength


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Historical Aspects

- Basal ganglia and thalamic era – 1950’s
- Cooper’s “surgical accident” - 1952

- Meyer’s “pallidoansotomy” - 1952
- Relief of tremor, rigidity, bradykinesia without weakness

- Development of stereotactic techniques to make surgery less invasive
  - Horsley and Clarke – animal device (1908)
  - Spiegel and Wycis – human frame (1946)
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Development of stereotactic techniques to make surgery less invasive

- Stereotactic atlases
- Pneumoencephalography

Development of stereotactic techniques

- Lars Leksell
  - Target centered frame
  - Ventral posterior pallidotomy
Development of stereotactic techniques
- Lars Leksell
  - Target centered frame
  - Ventral posterior pallidotomy

Surgical procedures virtually abandoned in 1968 when L-Dopa became available for PD

- Re-discovery of Leksell's ventral posterior pallidotomy
- Significant improvement in bradykinesia, rigidity, dyskinesia

Re-birth of interest in 1990's (Laitenen)
Deep Brain Stimulation

- **History**
  - Initially used for pain control in 1960s
  - Clinical trials for movement disorders 1990s
  - FDA approved for ET in 1997, PD in 2002

- **Advantages over lesioning**
  - Adjustable
  - Reversible
  - Bilateral placement

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Surgical Procedure

1. Frame placement
2. Imaging
3. Treatment planning
4. Operating room

1. Frame placement
2. Imaging
3. Treatment planning
4a. DBS placement
**Surgical Procedure**

**Overview:**
1. Frame placement
2. Imaging
3. Treatment planning
4. Operating room
4b. IPG placement

**Stereotactic frame placement (sedation with IV Versed, local anesthesia)**

**Imaging**
- MRI as outpatient without frame
- CT morning of surgery with frame

**Treatment planning:**
- MRI and CT image sets loaded onto graphic computer workstation in OR
- Images registered to fiducial markers allowing precise translation of brain anatomy into frame coordinates
**Surgical Procedure**

- Treatment planning:
  - Targets (right and left Vim) chosen based on “indirect” and “direct” techniques

- Operating room:
  - Positioning, preparation
  - Arterial line, foley catheter

- Operating room:
  - Frame coordinates set to entry and target
Surgical Procedure

- Operating room:
  - Entry burr hole (nickel size) created

- Operating room:
  - DBS lead securing device placed in burr hole

- Operating room:
  - Microelectrode recording

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- Operating room:
  - DBS implant, test stimulation
Surgical Procedure

• Operating room:
  – DBS implant, test stimulation

Before DBS
L DBS test stimulation

Surgical Procedure

• Repeat the same steps for opposite side

Surgical Procedure

• Second surgery:
  – IPG implant 3 weeks later under general anesthesia

Second surgery

• Either a unilateral IPG (Kinetra) that runs both DBS leads

Admission to Lovelace - Downtown:

• Most patients stay in ICU overnight
  – One-on-one nursing for close neurologic observation
  – Close monitoring of blood pressure
Second surgery
• …or bilateral IPGs (Soletra) that each run a DBS lead

Surgical Procedure
• Second surgery:
  – Discharge home same day
  – Programming of stimulator by Dr. Marjama-Lyons as an outpatient

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Surgical Procedure
• Results
  – 84% tremor suppression

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Surgical Procedure
• Results
  – 85% tremor suppression
Surgical Procedure

- Risks of the procedure:
  - Brain hemorrhage
  - Infection
  - DBS ineffective
  - Mechanical failure
  - Dysarthria
  - Dysequilibrium
- IPG will need replacement in 3 to 5 yrs

Activar Tremor Control Therapy

- Availability and Insurance Coverage
  - Available in Europe and Canada since 1995
  - US FDA approval received in 1997
  - Medicare has policies in all 50 states
  - Most commercial insurers cover the device

Questions?

Dr. Jill Marjama-Lyons

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Thank You!