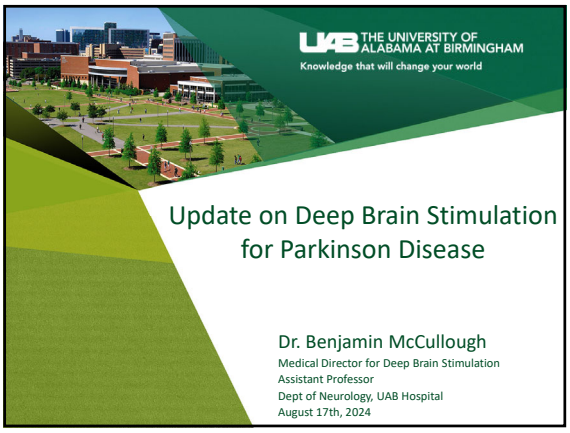


Update on Deep Brain Stimulation for Parkinson Disease

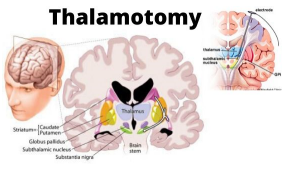
Dr. Benjamin McCullough
Medical Director for Deep Brain Stimulation
Assistant Professor
Dept of Neurology, UAB Hospital
August 17th, 2024

Objectives

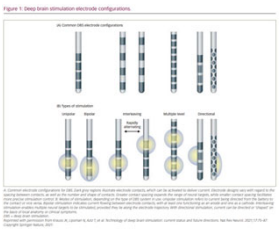
- Review general information on Deep Brain Stimulation
- Discuss when to consider referral for DBS in the treatment of PD
- Review DBS process at UAB Hospital
- Educate on recent patient-centered advancements in DBS for PD

Relevant Disclosures: None

Thalamotomy



DBS Field Effect



Thousands of options
- Location
- Shape/Size
- Power (V/mA)
- Pulse Width
- Frequency

Field Effect is Reversible

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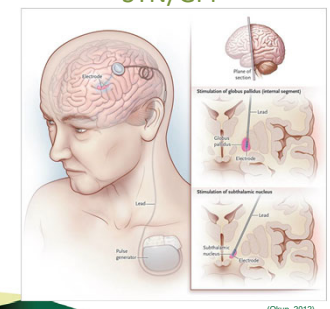
Deep Brain Stimulation STN/GPi



(Okun, 2012)

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Deep Brain Stimulation (DBS)

- FDA Approval 2002 (for PD)
- Improvement in 5 Motor Symptoms
- Decrease in Daily OFF TIME
- Increase in Daily ON TIME
  - i.e. Motor State When Meds Work Best
- Not a Cure
- Adjunctive Therapy in Reducing Levodopa-Responsive Symptoms of PD
  - Exception: Tremor

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Deep Brain Stimulation (DBS)

- Inclusion Criteria
  - Disabling motor symptoms not adequately controlled with medications (at least 600-900 LEDs/day)
    - Tremor
    - Rigidity
    - Bradykinesia/Decreased Hand Dexterity
    - Dyskinesia
    - Dystonia
  - Clear understanding of risks and realistic expectations

Ref: Marks, William J. Deep Brain Stimulation Management. Second Edeition. New York: Cambridge University Press, 2015, Page 5

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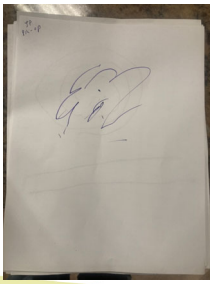
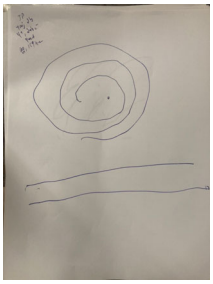
Pre-Op



Stim On



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Deep Brain Stimulation

- Exclusion Criteria
  - Serious surgical comorbidities
  - Levodopa unresponsive (consider levodopa challenge)
  - Uncontrolled psychiatric illness, including anxiety and mood disorder
  - Dementia
  - Preoperative MRI with extensive white matter changes or severe cerebral atrophy

Ref: Marks, William J. Deep Brain Stimulation Management. Second Edeition. New York: Cambridge University Press, 2015, Page 5

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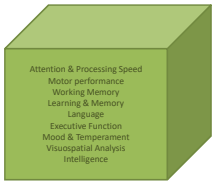
Deep Brain Stimulation (DBS)

- Workup if appropriate candidate
  - MRI Brain (PRISMA)
    - CT allowable if contraindication to MRI
  - Neuropsychological Testing
    - Risk Stratification
      - Verbal Fluency
      - Working Memory/Executive Function



DBS Committee

- In Attendance
  - Movement Disorders Neurology
  - Functional Neurosurgery
  - Neuropsychology
  - Speech Pathology
  - Clinical Care Coordinators
  - Research Staff

Formal Approval

- Side/target selection
- Device Manufacturer
- Awake/Asleep
  Awake Highly preferred
- Unilateral vs. Bilateral
  Default: Unilateral

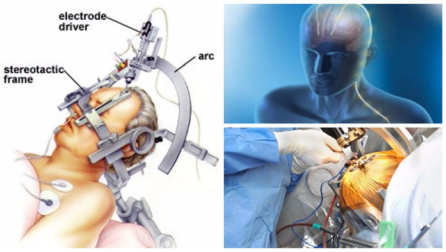
Target Selection in PD

- STN
  - Medication reduction
  - Superior reduction in tremor
  - Generally relieves dyskinesia through medication reduction
- GPi
  - Dystonia
  - Directly blocks dyskinesia through field effect
  - Generally safer in patients with cognitive symptoms and/or significant subcortical atrophy

DBS Surgery

- Stage One
  - Placement of Lead
    - Intraoperative Imaging (CT/O-Arm)
    - Microelectrode recordings
    - Clinical Testing
    - Awake> Overnight monitoring
- Stage Two
  - Placement of Battery (IPG) and Extension Wire
  - Asleep> Home same day
- Programming>>>Follow-up Programming/Optimization

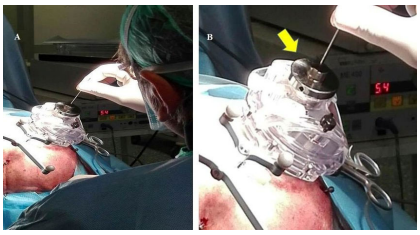
Deep Brain Stimulation: Surgical Frame



https://goo.gl/images/wPxWQn

MBA(1

Frameless (Current)



https://www.researchgate.net/figure/The-Nexframe-modified-technique-A-after-establishing-the-trajec fig6_325162604

Slide 15

MBA(1 McCullough, Benjamin A (Campus), 8/13/2024

Deep Brain Stimulator (DBS)

Lead, Battery, Programmer, Controller

Electrode and Battery

Clinician Programmer

Patient Programmer

http://www.medtronicdbs.com/parkinsons-deep-brain-stimulation/index.htm

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Newer Versions

- https://www.medtronic.com/us-en/patients/treatments-therapies/deep-brain-stimulation-parkinsons-disease/about-dbs-therapy/dbs-products.html
- https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.bostonscientific.com%2Fen-US%2Fmedical-specialties%2Fneurological-surgery%2Fdeep-brain-stimulation-system.html&psig=AOvVaw1dFCxgoaS3XeuGSuCcGewO&ust=1723665013734000&source=images&cd=vfe&opi=89978449&ved=0CBIQjRxqFwoTCKj3zdn8iocDFQAAAAAdAAAAABAE

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Deep Brain Stimulation (DBS)

- Surgical Risks
  - 1% Risk of symptomatic intracranial hemorrhage
  - 2.4% Risk of stroke
  - Many other at low risk: seizure, CSF leak, etc.
- Device Usage Side Effects
  - Anatomically determined

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Deep Brain Stimulation (DBS)

- Device Replacement (UAB)
  - Infection Risk
    - 2% at 1 year
    - 4% at 5 years
  - Lead Repositioning
    - 4% at 5 years
  - All-cause device replacement
    - 10% at 5 years
- Battery Life
  - Average of 3-6 years
  - Rechargeable batteries are available

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Deep Brain Stimulation (DBS)

- Contraindications Afterward
  - Previously: MRI below neck
  - Currently: DBS will need to be set to Bipolar configuration/"MRI Mode" or turned off for MRI (device/manufacturer specific)
  - Activities which involve significant force to the neck
    - Bungee jumping, skydiving
  - Submerging battery in hot tub for longer than 45 minutes
  - Monopolar cautery
    - Bipolar cautery is permitted

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What's New in DBS

- Frameless
- Segmented Leads
- Beam steering
- Virtual Clinic

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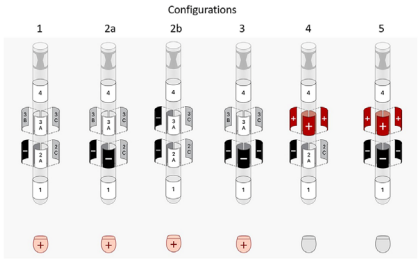
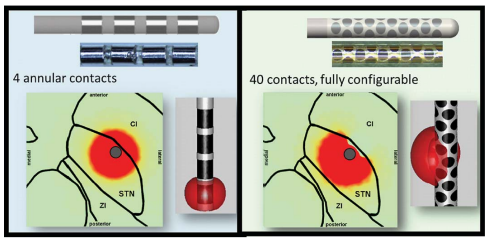
Directional Stimulation: Segmented Leads



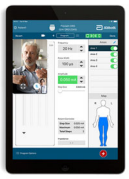
Directional Stimulation: Segmented Leads

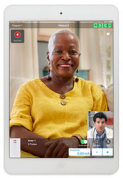


Other New Options

- Beam Steering

- Virtual Clinic

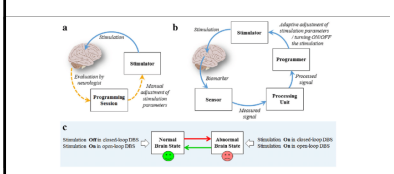


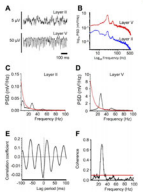


The Future

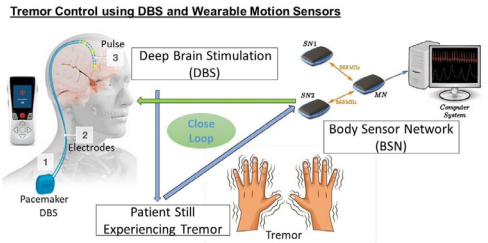
- Closed Loop Systems

Closed Loop (LFP)





Closed Loop (Wearable/External Device)



Overall

- Goals in PD:
  - Treatment of refractory tremor, rigidity, bradykinesia, dyskinesia, dystonia
- Med trial: at least 600-900 LEDs/day
- 1% risk of symptomatic intracranial hemorrhage
- 2.4% risk of stroke

- Never too early to refer!!

Thank you