ASSFN Clinical Case:
Bilateral STN DBS Implant
for Parkinson’s Disease
Parkinson’s Disease

- Cardinal Signs:
  - Resting tremor
  - Rigidity
  - Bradykinesia
  - Postural instability

- Other Symptoms
  - Dystonia
  - Dysphagia
  - Autonomic dysfunction
  - Kyphosis
  - Depression
  - Dementia
  - Masked facies
  - Micrographia
PD Diagnosis

• Medical history and physical examination
  – Primary means of diagnosis

• Medication response
  – 2 month challenge of levodopa or dopamine agonist

• Imaging
  – MRI (may rule out other diagnoses)
  – Dopamine transporter SPECT (DaT scan)
    • Loss of dopamine neurons in PD as well as in atypical Parkinson-like diseases
    • May distinguish between PD and essential tremor
Parkinson’s Pathology

- Loss of pigmented dopaminergic neurons in the substantia nigra pars compacta (SNpc)
- Lewy bodies and neurites
Anti-PD Medications

• Carbidopa/levodopa
  – Levodopa crosses the BBB
  – Carbidopa acts as a peripheral decarboxylase inhibitor

• Entacapone
  – Catechol-o-methyltransferase (COMT) inhibitor
  – Reduces peripheral metabolism of levodopa

• Monoamine oxidase inhibitors
  – Selegiline
  – Rasagiline

• Other dopamine agonists
  – Ropinirole
  – Pramipexole

• Anticholinergic agents
  – Trihexyphenidyl
  – Benztropine
  – Second-line for tremor only
Indication for Surgical Management

• Response to medication worsens with PD progression
  – Medication wears off before next dose
  – Motor fluctuations between “on” and “off” time
  – Dyskinesias
    • Abnormal involuntary movements
    • Side effect of dopamine agonists and levodopa
  – Dystonia
    • Rigid posturing
    • Early morning and during “off” periods
Rationale for Surgical Management

• SNpc dopaminergic degeneration causes improper functioning of direct and indirect pathways
• Modulation of overactive STN or GPi activity to overcome thalamic inhibition and allow for motor functioning
DBS

Advantages

• Reversible
• Non-destructive
• Stimulation titration
  – Maximize therapeutic effects
  – Minimize side effects
• Bilateral implantation
• Superior efficacy compared to best medical management*

Disadvantages

• Surgical risks
• Infection
• Finite battery life
• Disease progression may lessen DBS effect in the long term for some patients

Case Presentation

- 59 year old right-handed female
- CC: Referred for advanced Parkinson’s disease
- Symptoms
  - Takes stalevo 3x a day, wears off between doses
  - During “off” periods, unable to perform ADLs
  - Tremor persists during “on” periods
  - Some balance difficulty – has fallen twice
  - Important rigidity and bradikynesia
  - Clawing of toes in the right foot
  - Irregular jerking torso movements (dyskinesia)
  - Sleepiness (medication side effect)
- PMH: Cholecystectomy, urinary urgency
Management

• Referred for surgical consideration
• Evaluation by multi-disciplinary team including movement disorder specialist, neuropsychiatry, and neurosurgery
• Documented response to levodopa challenge
Preoperative

- 3T MRI scan 1-2 days before surgery
- Anti-PD medications stopped the night before surgery
- Frame placed the morning of surgery
- Head CT obtained in frame
- MRI and CT merged
- Surgical target coordinates calculated and trajectory reviewed
Targeting

Surgical target planning using a planning station.
Intraoperative

- Patient’s head secured in semi-reclined position
- Frame is assembled
- Fluoroscopy prepared
- After prepping and draping, burrhole is made using stereotactic coordinates
- Microelectrode is lowered with electrophysiologic recording and stimulation
Intraoperative

- Surgical target confirmed using coordinates, patient response to microstimulation, and lack of side effects to microstimulation
- Microelectrode removed and DBS lead placed
- Fluoroscopic confirmation of target location
- Lead connected and test stimulation performed
- Lead secured using locking skull cap
- Incision closed with lead coiled under scalp
Intraoperative Fluoroscopy

Fiducials attached to Leksell frame allow for precise targeting of DBS lead.
Postoperative Course

• Confirmatory head CT obtained
• Frame removed
• Patients usually discharged POD 1-2
• Extension and IPG placed during second surgery within 1-2 weeks
• Stimulation begins within several weeks and optimal parameters are gradually derived with testing
Postoperative CT in frame demonstrating lead position.
Postoperative CT

Scout imaging demonstrating leads (no frame).
References


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