



Management of Deep Brain Stimulation

VA PD Consortium Meeting
September 5, 2008

Susan L. Heath, RN, MS
William J. Marks, Jr., MD



National VA Parkinson's Disease
C O N S O R T I U M
Education • Collaboration • Advocacy

Agenda

- Overview of Goals of DBS Programming
- Efficient Approach to DBS Programming
- Troubleshooting



National VA Parkinson's Disease

C O N S O R T I U M

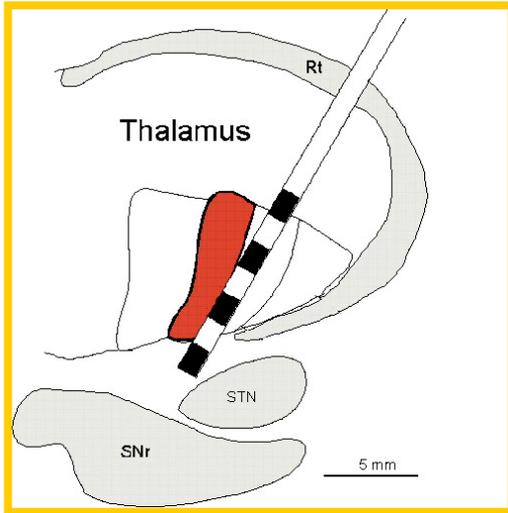
Education • Collaboration • Advocacy

Goal of DBS Programming

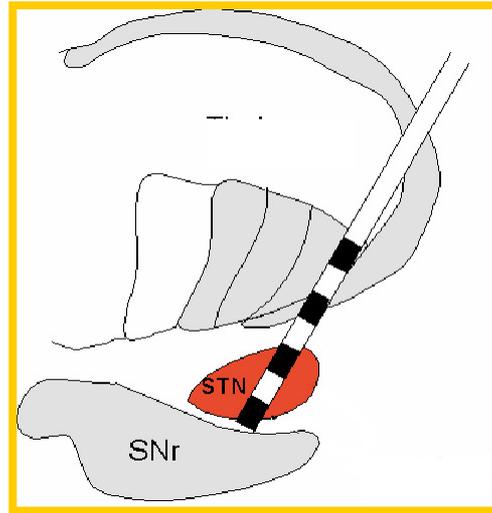
- Goal is to deliver the therapy to the brain target of interest, while minimizing stimulation of surrounding structures
 - Using the electrode closest to the desired target provides maximal benefit and minimizes stimulation-induced adverse effects
 - Setting appropriate stimulation parameters ensures that the desired brain target, but not adjacent structures, receives the stimulation



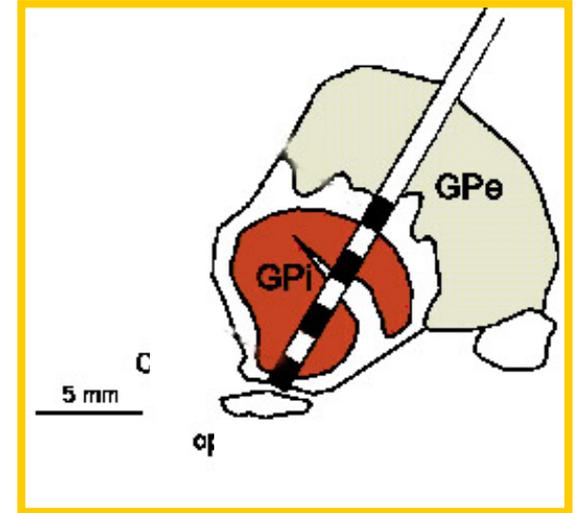
DBS: Targets



Vim Thalamus:
Essential tremor &
other tremor disorders



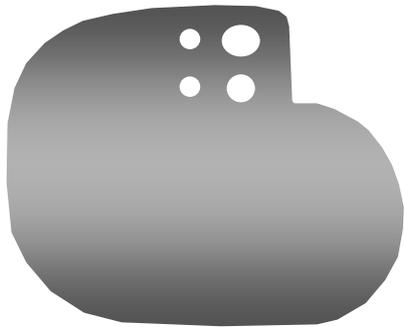
Subthalamic nucleus:
Parkinson's disease



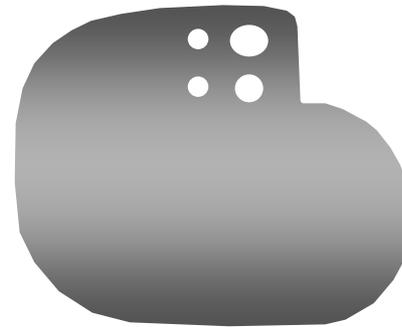
Globus pallidus:
Parkinson's disease &
dystonia



DBS Lead Electrode Selection



Unipolar



Bipolar

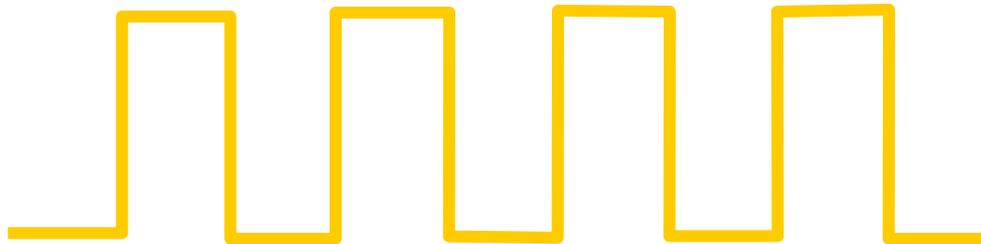


Stimulation Parameters

Pulse Width

(usec)

duration of each stimulus



Amplitude

(Volts)

intensity of stimulation

Rate

(Hertz)

number of pulses
per second



National VA Parkinson's Disease

C O N S O R T I U M

Education • Collaboration • Advocacy

Programming: The 6-Step Process

1. Ensure proper logistics & information on hand
2. Verify device function (impedance checks)
3. Check baseline exam
4. Screen each electrode & find the 1 or 2 best
5. Establish initial parameters
(Repeat for other side)
6. Attend to final tasks



Step 1: Logistics & Info.

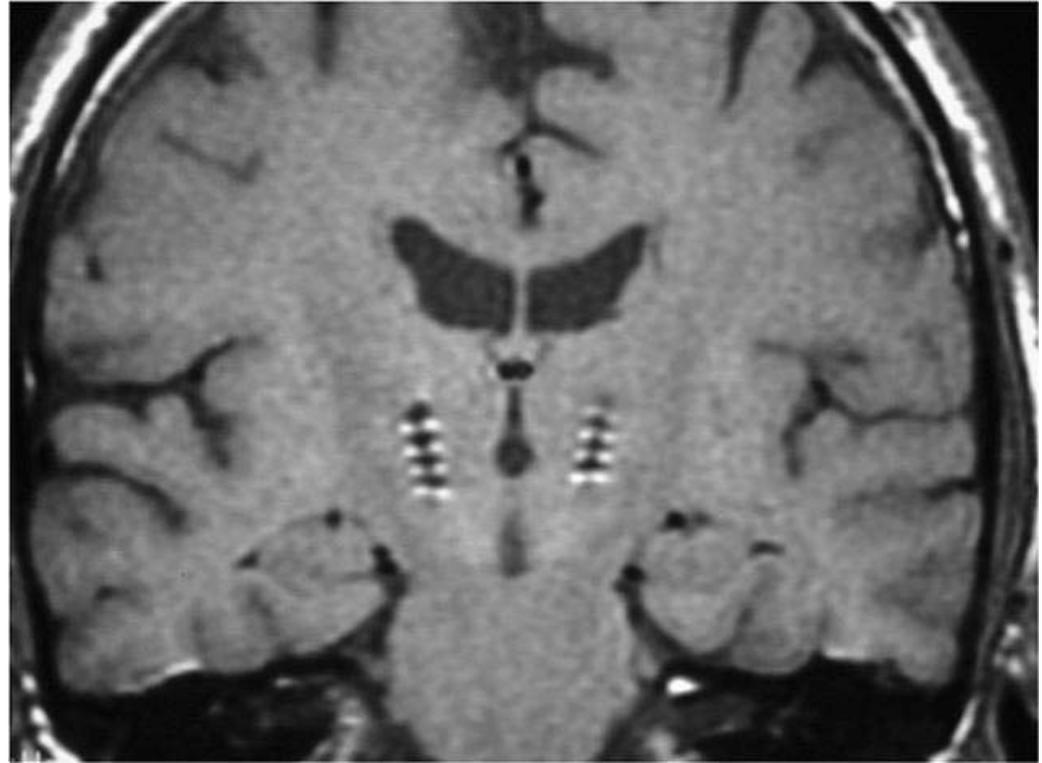
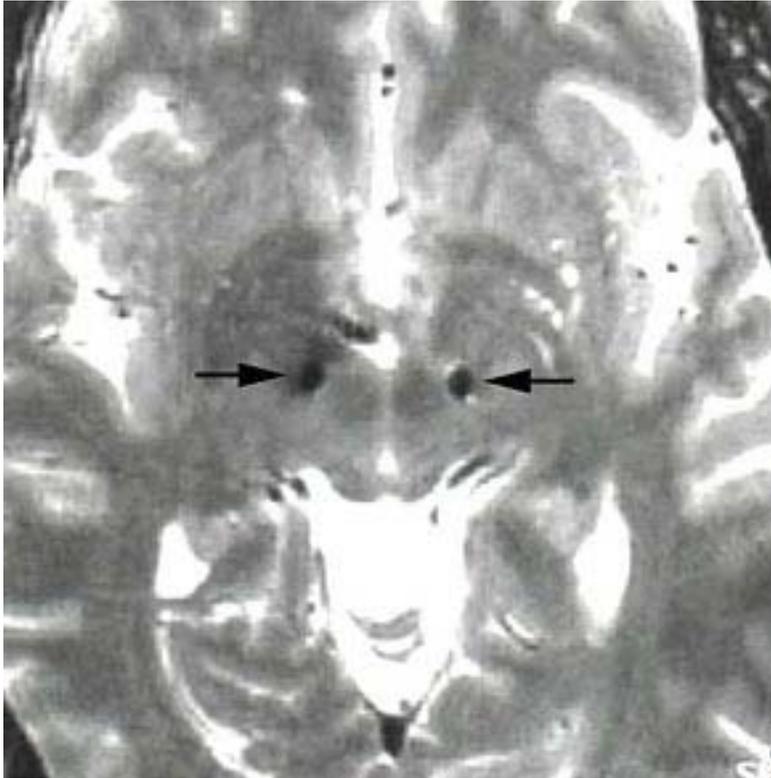
- Postpone programming until micro-lesion effect subsides, in about 2-4 weeks following surgery (although early programming can be performed)
- Schedule patient for morning visit if possible, with medications withheld overnight or longer
- Check surgical incisions to identify signs of infection
- Review operative details: lead type, post-op scan
- Review patient details: most troubling symptom(s)



National VA Parkinson's Disease

C O N S O R T I U M

Education • Collaboration • Advocacy



National VA Parkinson's Disease
CONSORTIUM
Education • Collaboration • Advocacy

Step 2: Verify Device Function

- Check unipolar electrode impedances to verify proper function
 - Soletra
 - Use default parameters on 8840
 - Open circuit if $\text{imp} > 2000 \Omega$ AND current drain $< 12 \mu\text{A}$
 - Short circuit if $\text{imp} < 250 \Omega$ AND current drain $> 75 \mu\text{A}$
 - Kinetra
 - Override parameters on 8840: use 4.0 V
 - Open circuit if $\text{imp} > 4000 \Omega$ AND current drain $< 12 \mu\text{A}$
 - Short circuit if $\text{imp} < 250 \Omega$ AND current drain $> 75 \mu\text{A}$
- If needed electrode(s) are malfunctioning, repair



Step 3: Check Baseline Exam

- You need to know what you're starting with to determine when your programming has made an impact
- Tremor: position & task that bring out tremor
- PD: Check muscle tone for rigidity, evaluate motor speed (hand opening, foot tapping), look for tremor, evaluate rising from chair & gait, listen to speech
- Dystonia: not that helpful, since improvements usually not noted during programming session



National VA Parkinson's Disease

C O N S O R T I U M

Education • Collaboration • Advocacy

Step 4: Screen Each Electrode

- **Goal: Find the 1 or 2 electrodes that improve key symptoms**
- Minimize variables: choose one rate (between 135-185 Hz) & one starting pulse width (60 μ s for STN, 90 μ s for Vim & GPi)
- Perform voltage titration in unipolar mode for each electrode (0, 1, 2, & 3) one at a time
 - Increase voltage until stimulation-induced adverse effects occur
 - Note & record voltage at which persistent adverse effects occur
 - Reduce voltage just until adverse effects abate
 - Assess for efficacy on key contralateral signs/symptoms; record
- Based on screening process, return to electrode that produced most obvious beneficial effects



Step 4: continued

- If a single electrode does not produce optimal effect, try unipolar stimulation using **2 adjacent electrodes**
 - If stimulation is not tolerated in unipolar mode, switch to bipolar mode using most effective single electrode from unipolar exploration as negative and one adjacent electrode as positive
- | | |
|---|--|
| <ul style="list-style-type: none">• Unipolar<ul style="list-style-type: none">Spherical fieldProvides robust effectUseful for well-located lead | <ul style="list-style-type: none">• Bipolar<ul style="list-style-type: none">More focused fieldLess intense effectHelpful in avoiding spread when lead close to other structures |
|---|--|



Step 5: Establish Parameters

- **Goal: identify parameters that provide benefit but produce no unacceptable adverse effects & maximize battery longevity**

Amplitude

The main parameter used to control the intensity of stimulation

Increased amplitude results in increased spread of stimulation

Avoid > 3.6 V with Soletra so as not to invoke doubler circuit

Pulse width

Secondary parameter contributing to total charge density

Increased pulse width accentuates effects of stimulation, since charge lingers in tissue longer and may activate additional elements

Rate

The least important factor in controlling stimulation

Rates between 135-185 Hz seem to exert similar clinical effects for movement disorders; exception may be dystonia, in which some have reported benefit at 60 Hz

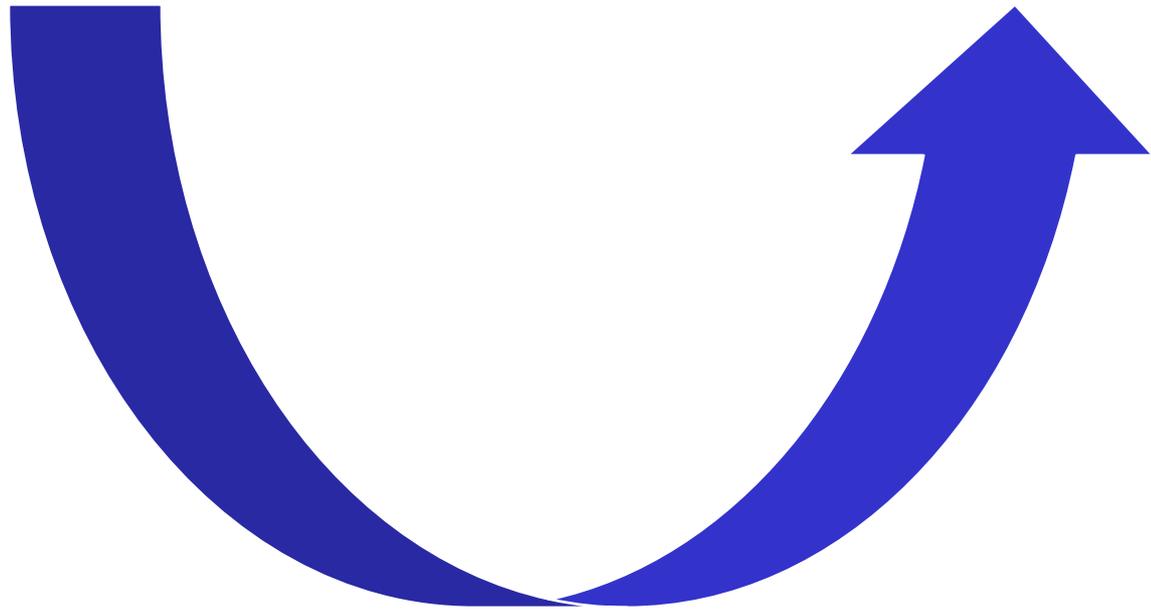


National VA Parkinson's Disease

C O N S O R T I U M

Education • Collaboration • Advocacy

The “U-Shaped” Response Curve



National VA Parkinson's Disease

C O N S O R T I U M

Education • Collaboration • Advocacy

Step 6: Attend to Final Tasks

- Reset usage counter
- Re-interrogate to ensure IPG is ON
- Determine medication regimen
- Print current settings and post in medical chart
- Instruct patient to:
 - Use Patient Therapy Controller or Magnet
 - Track symptoms (consider diary)
 - Be alert for increased dyskinesias (with STN)
 - Be aware of device issues (refer to patient manual), e.g., diathermy
 - Read patient manual thoroughly



Follow-Up Programming

- Review interim changes
 - Symptom response → functional improvements
 - Medication changes
 - Adverse effects
- Interrogate device(s)
- Assess where the stimulation parameters are within the therapeutic range
- Formulate & implement management plan
 - Adjust stimulation
 - Adjust medication
 - Make no adjustments



Reasons Patients May Not Display Optimal Response

- **Sub-optimal**
 - Lead location
 - Programming parameters
 - Medication regimen
- **Device-related issues or malfunction**
- **Unresponsive disease**

