Deep Brain Stimulation and Parkinson’s Disease

The Role of the Speech-Language Pathologist

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Introduction

• Purposes of presentation
  – Explain the role of deep brain stimulation (DBS) in the treatment of Parkinson’s disease (PD)
  – Describe the role of the speech-language pathologist (SLP) on the DBS multidisciplinary team
  – Discuss the pre- and post-DBS SLP protocol
Deep Brain Stimulation
Subthalamic Nucleus
DBS Electrodes
DBS Extensions
Implanted Pulse Generator
Benefits of DBS

• Motoric improvement in cardinal features
  – Tremor
  – Rigidity
  – Bradykinesia

• Decreased need for levodopa

• Less levodopa-induced motor fluctuations and dyskinesia

DBS and Cognition/Language

• Stable global cognitive performance
  Fraraccio et al, 2008

• Specific deficits
  – Verbal fluency
  – Noun and verb generation tasks
  – Verbal memory
  Alberts et al, 2008; Castner et al, 2008; Heo et al, 2008;
  Zangaglia et al, 2009; Zahodne et al, 2009
DBS and Speech/Voice

- **Stimulation induced dysarthria**

- **Improved speech and voice**
  Gentil et al, 2000; Pinto et al, 2004; Simuni et al, 2002

- **Inconsistent changes**
  Dromeys et al, 2000; Rousseaux et al, 2004

- **Equivocal**
DBS and Speech/Voice

• DBS vs Non-DBS
  – More likely to report speech difficulties
  – More likely to rate speech difficulties as “quite a bit” or “extremely” impaired
  – Reported more problems being understood by others
  – Higher ratings of voice disturbance on VHI

Tuchman, 2008
DBS and Speech/Voice

- Hypohonia worsened b/c levadopa is decreased
- Dysarthria worsened b/c of current diffusion to corticobulbar fibers
- Articulation declined after left STN-DBS
  
DBS and Swallowing

• Not described as extensively as speech changes

• Deterioration in swallowing on UPDRS
  Krause et al, 2004

• Improved swallowing
Interim Conclusions

• Contradictory conclusions
  – Different methodologies
  – Heterogeneity of the study populations
• Pre- and post-DBS protocol needed
DBS Multidisciplinary Team

- Review the candidacy of individuals with PD for DBS
- Conduct assessments pre- and post-DBS
- Meet monthly to review and discuss assessments
DBS Multidisciplinary Team

- Evaluation by neurologist
- Referrals to DSB Multidisciplinary Team
- Pre-DBS Team Assessments
- Team Meeting
- Surgery, if appropriate
- Post-DBS Assessments
DBS Multidisciplinary Team

- Neurologist
- Neurosurgeon
- Psychiatrist
- Neuropsychologist
- Research nurse
- Occupational therapist
- Physical therapist
- Speech-language pathologist
Role of the SLP

- Assess cognition/language, speech/voice and swallow
- Conduct diagnostic therapy trial
- Educate patient and family
- Make recommendations and referrals
- Provide therapy as indicated
SLP Assessment

• Cognition/language
  – Montreal Cognitive Assessment
  – Raven’s Coloured Progressive Matrices
  – Revised Boston Naming Test
  – FAS
  – SPTC
  – Animal naming
SLP Assessment

• Montreal Cognitive Assessment
  – A rapid screening instrument for mild cognitive dysfunction
  – Assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculation, and orientation
SLP Assessment

• Montreal Cognitive Assessment
  – Requires 10 minutes to administer
  – Total possible score is 30 points; a score of 26 or above is considered normal
  – Available at http://www.mocatest.org

# Montreal Cognitive Assessment (MOCA)

**Name:**

**Date of Birth:**

**Education:**

**Date:**

## Visual-Spatial/Executive

- **Copy cube:** 
- **Draw clock:** (Ten past eleven) (2 points)

## Naming

- [ ] [ ] [ ] [ ] [ ]

## Memory

- **Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.**
  - **1st trial:** 
  - **2nd trial:**

## Attention

- **Read list of digits (1 digit/sec):** Subject has to repeat them in the forward order
  - [ ] [ ] [ ] [ ] [ ] [ ] [ ]

## Language

- **Repeat: I only know that John is the one to help today.**
- **The cat always sits under the couch when dogs are in the room.**

## Abstraction

- **Similarity between e.g. banana - orange = fruit**
- **Train - bicycle**
- **Watch - ruler**

## Delayed Recall

- **With no cue:**
- **Face**
- **Velvet**
- **Church**
- **Daisy**
- **Red**

## Orientation

- [ ] [ ] [ ] [ ] [ ] [ ]

**Total:** /30

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Administered by: ___________________________

Version 7.1

Normal < 26 / 30

Add 1 point if < 12 years
SLP Assessment

- Raven’s Coloured Progressive Matrices
  - Consists of 36 items in 3 sets (A, Ab, B), with 12 items per set
  - Increases in difficulty within and across sets
  - Arranged to assess cognitive development up to the stage when a person is sufficiently able to reason by analogy and adopt this way of thinking as a consistent method of inference

http://aphasiology/pitt.edu; Raven, 1976
SLP Assessment

- Raven’s Coloured Progressive Matrices
  - Error type analysis
    - Difference
    - Inadequate individuation
    - Repetition of a pattern
    - Incomplete correlate
  - Learning potential
    - Test-Teach-Test format
      Horner & Nailling, 1980; Raven, 1956, 1965
  - Time to administer is 15-30 minutes
SLP Assessment

• Revised Boston Naming Test
  – 60 item test of word retrieval
  – Assesses visual confrontation naming through spontaneous responses and stimulability to cues
  – Arranged in order from high to low frequency

Kaplan, Goodglass & Weintraub, 2001
SLP Assessment

• Phonemic fluency
  – FAS  Spreen & Strauss, 1998
  – SPTC
    • Number of words generated in one minute for each letter

• Semantic fluency
  – Animal naming
    • Number of animals generated in one minute
SLP Assessment

- Speech/oral motor examination
  - Perceptual dimensions
  - Speech intelligibility
  - Stimulability to treatment
    - Maximum loudness
    - Maximum sustained phonation
    - Maximum Fo range
- May administer
  - Voice Handicap Index or VHI-10
  - Communication Effectiveness Survey
SLP Assessment

• Voice Handicap Index
  – Quantifies the psychosocial consequences of voice disorders
  – 30 items
  – Three subscales
    • Emotional
    • Functional
    • Physical
  – Rate each statement on an equal-appearing scale (0 never, 4 always)

Jacobson, Johnson, Grywalski et al, 1997
SLP Assessment

• VHI – 10
  – Abbreviated form of VHI
  F 1. My voice makes it difficult for people to hear me.
  P 2. I run out of air when I talk.
  F 3. People have difficulty understanding me in a noisy room.
  P 4. The sound of my voice varies throughout the day.
  F 5. My family has difficulty hearing me when I call them throughout the house.
  F 6. I use the phone less often than I would like to.
  E 7. I’m tense when talking to others because of my voice.
  F 8. I tend to avoid groups of people because of my voice.
  E 9. People seem irritated with my voice.
  P 10. People ask, “What’s wrong with your voice?”
  Rosen, Lee, Osborne et al, 2004
SLP Assessment

• Communication Effectiveness Survey
  • In this survey we ask you to rate how effective your speech is in different communication situations.
  • Please read each statement. Then rate how effectively you communicate in that situation. If you feel your speech is very effective, mark the 4. If your speech does not allow you to communicate at all in a situation, mark the 1. Feel free to use any number on the scale.
  • 1. Having a conversation with a family member or friends at home.
     Not at all effective 1 2 3 4 Very effective
  • 2. Participating in conversation with strangers in a quiet place.
     Not at all effective 1 2 3 4 Very effective
  • 3. Conversing with a familiar person over the telephone.
     Not at all effective 1 2 3 4 Very effective
Donovan et al, 2007; 2008
SLP Assessment

• Communication Effectiveness Survey
  • 4. Conversing with a stranger over the telephone.
    Not at all effective 1 2 3 4 Very effective
  • 5. Being part of a conversation in a noisy environment (social gathering).
    Not at all effective 1 2 3 4 Very effective
  • 6. Speaking to a friend when you are emotionally upset or you are angry.
    Not at all effective 1 2 3 4 Very effective
  • 7. Having a conversation while traveling in a car.
    Not at all effective 1 2 3 4 Very effective
  • 8. Having a conversation with someone at a distance (across a room).
    Not at all effective 1 2 3 4 Very effective
SLP Assessment

- Swallowing
  - Signs/symptoms of dysphagia
  - History of unintended weight loss
  - History of pneumonia
  - Clinical or “bedside” assessment
  - Videofluoroscopic swallowing study
  - May administer
    - M.D. Anderson Dysphagia Inventory
    - Reflux Severity Index
SLP Assessment

• M.D. Anderson Dysphagia Inventory
  – Assesses impact of dysphagia on quality of life
  – Includes global, emotional, functional, and physical subscales

Chen, Frankowski, Bishop-Leone, 2001
SLP Assessment

- Reflux Severity Index
  - Rate statements as 0 (no problem) to 5 (severe problem)
  - Score greater than 10 indicates significant reflux

Belafsky, Postma, & Koufman, 2001
### SLP Assessment

• **Reflux Severity Index**

<table>
<thead>
<tr>
<th>Within the last month how did the following problems affect you?</th>
<th>0 = no problem</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 = severe problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoarseness or a problem with your voice</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Clearing my throat</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Excess throat mucous or post nasal drip</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Difficulty swallowing food, liquid or pills</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Breathing difficulties or choking episodes</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Troublesome or annoying cough</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Sensations of something sticking in your throat or a lump in your throat</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Heartburn, chest pain, indigestion or stomach acid coming up</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
SLP Assessment

• Patient/family education
  – Role of SLP intervention
  – Test results
  – Recommendations
SLP Assessment

• Patient/family education
  – Recommendations
    • Speech/voice therapy
    • Swallowing
    • Referrals
SLP Treatment

• Speech/voice therapy
  – LSVT
  – “Spacious speech”
  – Amplification
SLP Treatment

• Swallowing
  – “Preventative” exercises
    • Lingual resistance exercise
    • Straw resistance exercise
    • Modified Valsalva
    • Sirening technique
    • Masako maneuver
    • Mendelsohn maneuver
    • Effortful swallow
    • Shaker exercises
SLP Treatment

• Referrals
  – Local and national support contacts
    • JHU PD 101
    • Local support groups
    • National Parkinson Foundation
      – http://www.parkinson.org
  – Otolaryngology
    • Collagen injection
    • Medialization thyroplasty
SLP and the Multi-d Team

- Summarize and present results at the DBS Multidisciplinary Team meeting
  - Characterize dysarthria
    - Perceptual deviations
    - Severity
  - Determine need for VFSS
  - Cognitive/language diagnosis
  - Prognostic statement
  - Referrals

- Cognitive/language, speech/voice, swallowing deficits = relative contraindications
Interim Conclusions

- Cognition/language, speech/voice and swallowing may be affected by DBS
- Limited data justify inclusion of pre- and post-DBS protocol
- Needs
  - Refinement of protocol
  - Correlate protocol use and surgery outcome
Protocol Experience to Date

• N = 17 (9 male, 8 female)
• Mean age = 60.1 years (46 - 80 years)
• 12 diagnosed with idiopathic PD
• 2 diagnosed with essential tremor
• 3 diagnosed with a parkinsonian syndrome
Protocol Experience to Date

- **Montreal Cognitive Assessment**
  - Administered to 12/17 individuals
  - 9/12 individuals scored $\geq 26$, indicating performance within normal limits
  - Subtests from the *Weschler Memory Scale* were administered to three individuals, all of whom scored within normal limits on testing
Protocol Experience to Date

• *Raven’s Coloured Progressive Matrices*
  – Administered to 14/17 individuals
  – 13/14 individuals scored at or above the 50th percentile for their respective age group
Protocol Experience to Date

• *Revised Boston Naming Test*
  – Administered to 14/17 individuals
  – 10/14 scored -/+ 1 standard deviation of the mean for their respective age
Protocol Experience to Date

- **Word Fluency**
  - 17/17 individuals assessed on a word fluency measure
  - 13/17 scored within normal limits on either an animal naming fluency test or the FAS
Protocol Experience to Date

• 16/17 individuals presented with dysarthria
  – 15 presented with mild-moderate dysarthria
  – 1 presented with moderate-severe dysarthria
• Dysarthria was characterized by
  – Reduced vocal intensity
  – Excessive rate
  – Articulatory imprecision
  – Characteristic of hypokinetic dysarthria
• Most were able to increase vocal intensity on command
• Patient with a parkinsonian syndrome presented with intact speech production
Protocol Experience to Date

• 13/17 presented with remarkable findings on the oral motor examination
  – 8 presented with lingual weakness
  – 8 presented with lingual tremor
  – 3 presented with labial tremor
Protocol Experience to Date

- 8/17 presented with signs/symptoms of dysphagia
- Symptoms
  - Oral dryness
  - Sense of pharyngeal retention
  - Occasional coughing after swallowing
- 2 individuals had baseline VFSS
  - Multiple decompensations of the oral and pharyngeal stages of swallowing
Protocol Experience to Date

- 16/17 individuals did not present with any relative contraindications for surgery
- One individual was not judged to be a surgical candidate because of the severity of her dysarthria and history of dysphagia
Protocol Experience to Date

• 10/16 individuals proceed to surgery
  – 7 had bilateral STN-DBS
  – 1 had left STN-DBS
  – 2 underwent left VIM-DBS.
Protocol Experience to Date

- Two individuals were seen for post-operative evaluation
  - Improved his functional status
  - Described as “a mixed bag”
Protocol Experience to Date

• Patient A
  – Two-point decrease on the MoCA
  – No change on the RCPM
  – FAS, 60th percentile (initial testing, above the 80th percentile)
  – No signs/symptoms of dysphagia post-DBS
Protocol Experience to Date

- Patient B
  - Dysarthria was unchanged in perceptual deviations
  - Habitual vocal intensity was judged to be diminished relative to the previous evaluation
  - Ability to increase vocal intensity on command was unchanged
  - No signs/symptoms of dysphagia post-DBS
Protocol Conclusions

• Most had relatively spared cognitive/language abilities and only mild-moderate dysarthria
• Approximately half presented with s/s suggestive of dysphagia, although there were no functional implications
• Most individuals were deemed to be candidates for DBS
Protocol Conclusions

• Most of the candidates proceeded to surgery
• Post-DBS data are limited
• Follow-up evaluations suggested declines in word fluency and vocal intensity
Protocol Conclusions

• Additional post-DBS data are needed
• Individuals may not be returning for post-DBS evaluations because their status is not changed substantially
• More aggressive follow-up is warranted
  – Coordinating post-DBS SLP evaluation with programming sessions with the neurologist
Questions

• Please contact Donna Tippett
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• Thank you!