Deep Brain Stimulation (DBS) Troubleshooting: Reprogramming vs. Revision

Visish M. Srinivasan, MD1, Mary Ann Thenganatt, MD2, Ashwin Viswanathan, MD1, Joohi Jimenez-Shahed, MD2

1Department of Neurosurgery, Baylor College of Medicine
2Parkinson’s Disease Center and Movement Disorders Clinic, Department of Neurology
Baylor College of Medicine, Houston, TX

Objective

- Compare outcomes in DBS patients referred for lead revision to those who were managed by DBS reprogramming alone.
- Identify specific clinical factors that may indicate need for electrode revision.

Introduction

- DBS re-programming strategies with new Medtronic Activa® platform may spare patients from electrode revision procedures.
- Suboptimal lead location can occur due to frame misalignment or shift, brain shift, microelectrode recording interpretation error, or dislocation after successful implantation.
- There are no evidence based guidelines regarding when to refer patients for electrode revision surgery.1,3,4

Methods

- MRIs ordered on DBS patients were identified from a database review.
- Retrospective chart review
  - Reason for MRI, problems with programming, reprogramming strategies, outcomes
- MRIs were analyzed to identify actual electrode location relative to the AC-PC plane (Figure 1)
  - Suboptimal placement was defined as >2mm from target, as with previous studies1

Results

- Of 42 MRIs ordered, 28 were to identify electrode location (Figure 2)
- DBS targets and indications were varied (Table 1)
- Reprogramming was used in 25 patients; before (n=17) and after (n=8) MRI (Figure 3)
- Six patients underwent revision of 10 electrodes (3 STN, 2 GPi, 5 VIM). 9/10 were sub-optimally placed.

Results - continued

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Patients (%)</th>
<th>DBS Target</th>
<th>Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parkinson’s Disease</td>
<td>18 (64%)</td>
<td>STN</td>
<td>15 (54%)</td>
</tr>
<tr>
<td>Essential Tremor</td>
<td>7 (25%)</td>
<td>GPi</td>
<td>3 (11%)</td>
</tr>
<tr>
<td>Dystonia</td>
<td>1 (3.6%)</td>
<td>ViM</td>
<td>7 (25%)</td>
</tr>
<tr>
<td>Tourette’s Syndrome</td>
<td>1 (3.6%)</td>
<td>Unilateral</td>
<td>3 (11%)</td>
</tr>
<tr>
<td>ET+TS</td>
<td>1 (3.6%)</td>
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<td></td>
</tr>
</tbody>
</table>

Table 1: Patient Diagnoses and DBS Targets used in 28 patients with suboptimal electrode placement and insufficient clinical benefit

Conclusions

- Most patients were managed with reprogramming (76%)
- Of patients with insufficient benefit or side effects from reprogramming, 33% may have benefited from revision surgery.
- However, revision only improved outcomes in 33% of referred patients, similar to other studies6
- Of those with suboptimal lead location and not revised, 53% had a good outcome
- Factors other than lead location may affect outcome
- Study Limitations: retrospective study, no uniform reprogramming strategy, no uniform objective clinical assessments.

Future directions:

- Examine side effects in relation to lead position
- Assess lead position in cases without clinical suspicion of suboptimal placement
- Identify relative location of active contact, assess other clinical factors (e.g. disease-related or patient-specific) that may contribute to poor outcome.

Abbreviations used: DBS=deep brain stimulation; PD=Parkinson’s Disease; ET=essential tremor; TS=Tourette’s syndrome.

Selected References