

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

¹ Department of Neurosurgery, Baylor College of Medicine
² Parkinson'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.^{2,3,4}

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

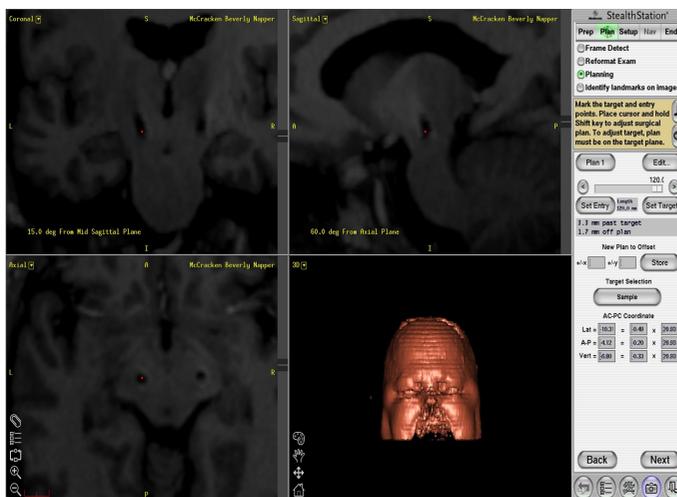


Figure 1: Example of electrode placement measurement on Medtronic StealthStation. Potentially medially placed STN electrode, with laterality of 10.3mm

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.

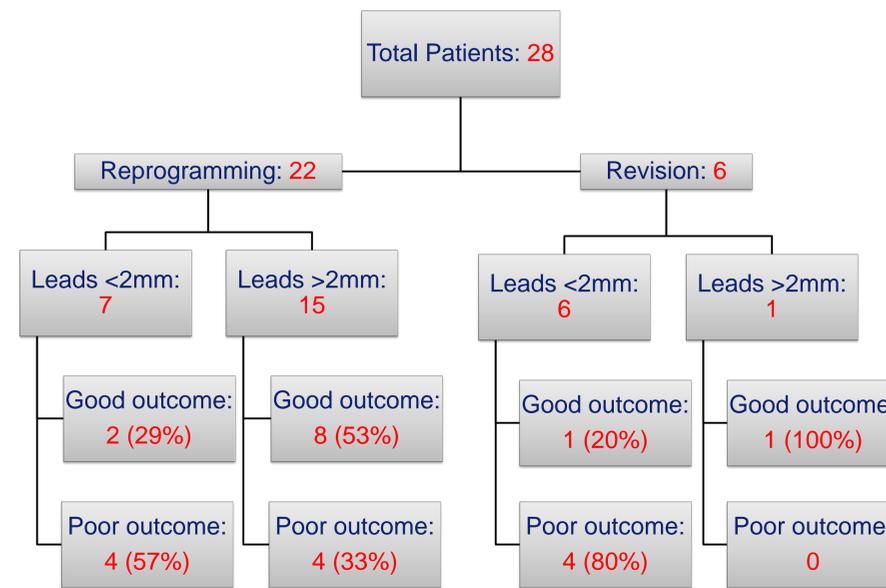


Figure 2: Summary of patients who underwent reprogramming or revision following insufficient benefit from DBS surgery

Results - continued

Diagnosis	Patients (%)	DBS Target	Patients (%)
Parkinson's Disease	18 (64%)	STN	15 (54%)
Essential Tremor	7 (25%)	GPi	3 (11%)
Dystonia	1 (3.6%)	ViM	7 (25%)
Tourette's Syndrome	1 (3.6%)	Unilateral	3 (11%)
ET+TS	1 (3.6%)		

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 (78%)
- ❖ 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 studies⁵
- ❖ 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

- Papavassiliou E, Rau G, et al. Thalamic deep brain stimulation for essential tremor: relation of lead location to outcome. Neurosurgery. Feb 2008;62 Suppl 2:884-894.
- Okun MS, Tagliati M, Pourfar M, et al. Management of referred deep brain stimulation failures: a retrospective analysis from 2 movement disorders centers. Archives of neurology. Aug 2005;62(8):1250-1255.
- Okun MS, Rodriguez RL, Foote KD, et al. A case-based review of troubleshooting deep brain stimulator issues in movement and neuropsychiatric disorders. Parkinsonism & related disorders. Nov 2008;14(7):532-538.
- Farris S, Giroux M. Retrospective review of factors leading to dissatisfaction with subthalamic nucleus deep brain stimulation during long-term management. Surgical neurology international. 2013;4:69.
- Anheim M, Batir A, et al. Improvement in Parkinson Disease by Subthalamic Nucleus Stimulation Based on Electrode Placement. Arch Neurol. May 2008 65(8):612-616

REPROGRAMMING STRATEGIES

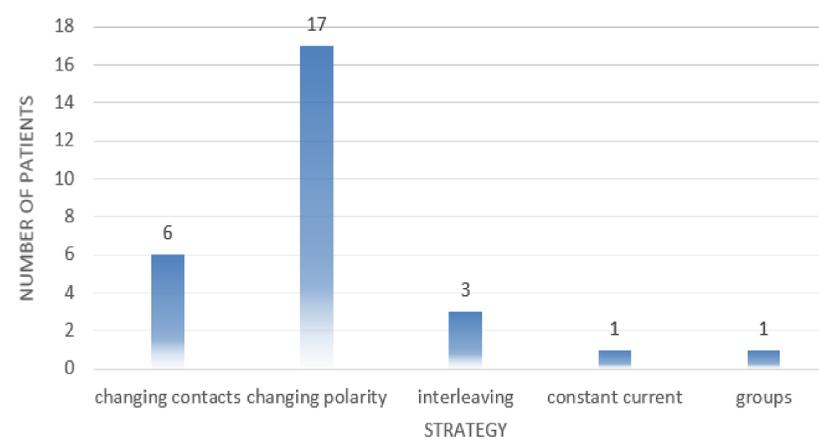


Figure 3: Reprogramming Strategies used. Some patients received reprogramming with multiple strategies.