Optimal Lead Location for Deep Brain Stimulation Treatment of Post-Traumatic Tremor

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BACKGROUND
• Post-traumatic tremor is one of the most common movement disorders resulting from severe head trauma.
• Literature regarding successful deep brain stimulation (DBS) treatment is scarce, resulting in ambiguity regarding the optimal lead location.
• Most cases support the ventral intermediate nucleus (Vim), but there is evidence to defend DBS of the zona incerta (ZI), ventral oralis anterior/posterior (VOA/VOP), and/or a combination of these targets.
• We report six patients with disabling post-traumatic tremor treated with unilateral and bilateral Vim DBS, ipsilateral ZI DBS after unsuccessful Vim DBS, and DBS of the globus pallidus internus (GPI).

METHODS
• Retrospective analysis of all patients with post-traumatic tremor treated by DBS group in the past four years. All patients had been referred to the Vanderbilt Movement Disorders Division.
• Patient work-up included evaluation by a movement disorders neurologist and standardized tremor assessment with the Fahn-Tolosa-Marin (FTM) or WHIGET tremor rating scale.
• After assessment, surgical intervention was determined by a DBS Multidisciplinary Committee. Standard DBS procedure was followed.
• We reviewed all available records of these patients’ trauma histories, presurgical assessments, surgical procedures, and subsequent tremor responses.
• One patient in this group had been treated initially with VIM DBS in May 2000 but suffered ineffective long-term tremor control. His subsequent surgery, performed in November 2011, allowed direct comparison of VIM and ZI DBS but suffered ineffective long-term tremor control.
• We report six patients with disabling post-traumatic tremor treated with unilateral and bilateral Vim DBS, ipsilateral ZI DBS after unsuccessful Vim DBS, and DBS of the globus pallidus internus (GPI).

OBJECTIVE
• Review of the cases of six patients with disabling post-traumatic tremor treated with DBS of the Vim, ZI, and GPI in order to identify the optimal lead location for DBS treatment of post-traumatic tremor.

RESULTS
• All patients sustained significant head trauma with severe diffuse axonal injury.
• Three patients underwent unilateral Vim DBS for contralateral tremor, one underwent bilateral Vim DBS, one underwent bilateral GPI DBS (due to dystonic posturing in addition to tremor), and one benefitted from unilateral ZI DBS after previous VIM DBS had produced ineffective long-term control.
• The patients treated with unilateral Vim and ZI DBS experienced good tremor reduction.
• The patient treated with bilateral Vim DBS experienced moderate tremor reduction, though some dystonic posturing of the hands persisted.
• The patient treated with bilateral GPI DBS showed moderate tremor reduction as well as improvement in his contralateral dystonia.
• Percentage change in tremor ranged from 14.3% to 56.5%, and clinical global impression (CGI) ranged from 2 to 3.

CONCLUSIONS
• Unilateral or bilateral Vim DBS and bilateral GPI DBS are safe and effective treatment modalities for intractable post-traumatic tremor.
• Stimulation of the ZI may have some advantages over the Vim target in this population. Long-term follow-up is required to determine if clinical benefit is maintained without the development of tolerance.
• A randomized controlled trial will be conducted to compare the efficacy of ZI stimulation alone, Vim stimulation alone, and simultaneous stimulation.

SELECTED REFERENCES

Coronal, horizontal, and sagittal images of patient treated with bilateral Vim DBS

Coronal, horizontal, and sagittal images of patient treated with unilateral Vim DBS

Sagittal image of patient treated with unilateral Vim DBS

Horizontal image of patient treated with bilateral GPI DBS