





OPTIMAL CONNECTIONS IN THALAMIC, PALLIDAL & SUBTHALAMIC DBS FOR TOURETTE'S SYNDROME

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Introduction

Gilles de la Tourette syndrome (TS) is a complex neuropsychiatric spectrum disorder, resulting from abnormalities in cortico-basal ganglia-thalamo-cortical loops[1,2]. DBS treatment is an option in severe cases, resistant to more conventional treatments[3]. Studies suggest comparable clinical outcomes for common targets, however, the exact neural pathways responsible for a good clinical outcome remain unclear[4,5]. In this study, we explore the connections associated with improvement of TS patients after DBS across three targets: midline thalamic nuclei (CM/Voi), internal pallidum (GPi) and subthalamic nucleus (STN).

Results

Fiber tracts associated with optimal clinical outcome after stimulation of thalamus, GPi and STN converged in the fasciculus thalamicus. (Fig. 3) Moreover, tracts associated with good clinical outcome after subthalamic stimulation traversed within fasciculus lenticularis, whereas pallidal and thalamic tracts traversed through ansa lenticularis. Peak weights for individual streamlines ranked at R = 0.43 (CM/Voi), R = 0.23 (GPi) and R = 0.70 (STN).



Figure 1: Fiber filtering algorithm. The algorithm iterates through every streamline in the connectome. Each streamline is modulated by each electric field (E-field) with verying magnitudes. By correlating these magnitudes with clinical improvements, we can assign an R-value to each fiber., which is used to filter out and visualize relevant connections.

Methods

43 patients with Tourette's syndrome who previously underwent bilateral deep brain stimulation were included. 15 patients had electrodes placed in thalamus, 14 patients in GPi and 14 patients in STN. (Fig. 2) Preoperative and postoperative images were preprocessed using Lead DBS software[6]. Electrodes were localized, and electrical fields

Voi

GPi

GPe

CM

Pf



Figure 2: Electrode localizations of each cohort.

Conclusion

(E-fields) were calculated for each patient. Each E-field has varying impact onto each streamline of the Basal Ganglia Pathway atlas[7]. These magnitudes were correlated with clinical outcomes measured as the percent improvement in YGTSS using Spearman coefficients, leading to an R-value per streamline. (Fig.1) Top 100 streamlines with highest R-values were retained and visualized in Figure 3.

We visualized connections associated with maximal improvement of TS patients after DBS based on a multi-centric cohort targeting three different structures: CM/Voi, STN and GPi. Our results suggest that a common target in the pallidothalamic projections (fasciculus thalamicus) is key for symptom improvement in TS-DBS.

Optimal stimulation

sites in subthalamic,

pallidal and thalamic DBS for Tourette's Syndrome converge in the fasciculus thalamicus





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