

Introduction

Deep brain stimulation of the subthalamic nucleus (STN) is an effective therapy for patients with Parkinson’s disease (PD). Different regions within the subthalamic area have been correlated with optimal clinical outcomes. In this work, we correlate the motor outcome in PD patients with the electrical field involvement of the nigrofugal and pallidofugal fibers.

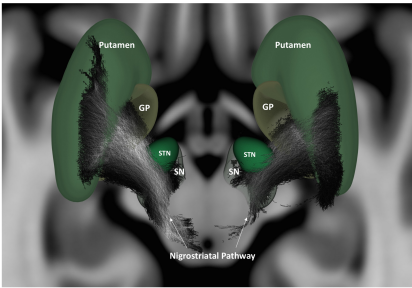
Results

Significant reduction of symptoms was obtained with STN-DBS in our patients ($p<.05$). Nigroputaminal and nigropallidal pathways were traced as described in previous anatomical descriptions.

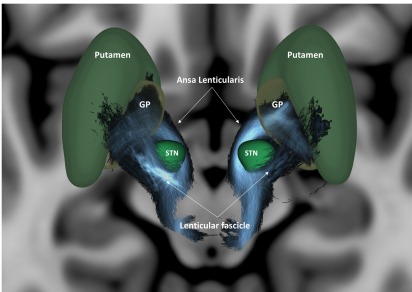
Methods

Forty-three patients with PD treated with STN-DBS were included and their clinical and stimulation parameters were recorded at one-year follow-up. The volume of activated tissue for all patients was modelled using finite element method within the Lead-DBS software. All VATs were summed and analyzed using generalized linear models in FSL software to obtain statistically significant stimulation clusters associated with: greater reduction of dopaminergic medication, improvement in Unified Parkinson's Disease Rating Scale (UPDRS) III, bradykinesia, rigidity, and tremor scores. Nigrofugal and pallidofugal pathways were obtained using constrained spherical deconvolution probabilistic tractography with imaging data from 43 PD matched subjects from the Parkinson's Progression Markers Initiative connectome. Finally, we calculated the overlap of significant clusters with the fiber pathways and the STN.

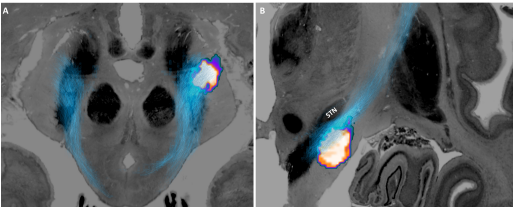
Nigrofugal pathways



Pallidofugal pathways



Cluster associated with the most reduction in dopaminergic medication

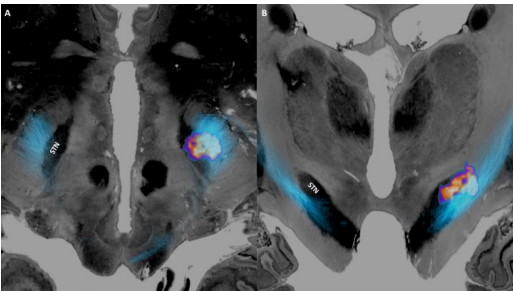


The cluster overlapped with the nigrofugal fibers (coeff0.50) and not with the STN or the pallidofugal pathway.

Conclusions

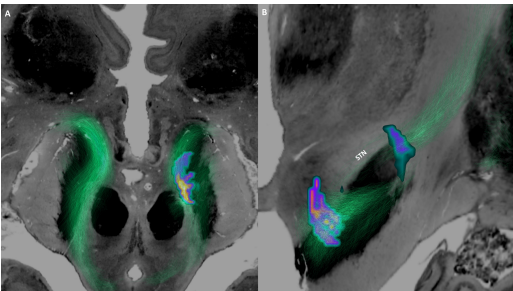
Electrical field involvement of the nigrofugal fibers, more than the STN, appears to produce the most improvement in UPDRS III, and reduction of dopaminergic medications. Similarly, nigropallidal pathways involvement is associated with greater bradykinesia improvement, and the involvement of the nigroputaminal fibers is associated with improvement in rigidity.

Clusters associated with the best improvement of bradykinesia



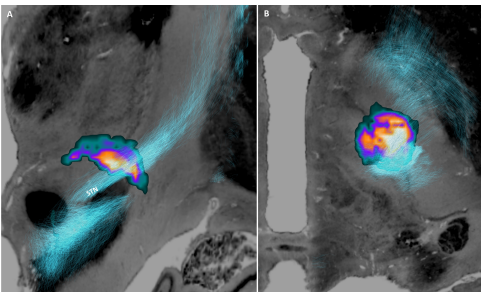
The significant cluster overlapped more with the nigrofugal fibers (coeff0.55) than with the STN(coeff0.19).

Clusters associated with the best improvement in UPDRS



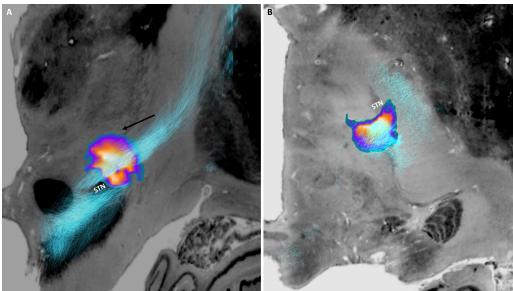
There was more overlap with nigrofugal pathways (coeff0.45) than the STN (coeff0.05).

Clusters associated with the best improvement in rigidity



The clusters overlapped with pallidofugal fibers (coeff0.30).

Clusters associated with the best improvement in tremor



The clusters overlapped with nigroputaminal fibers (coeff0.30) and the STN (coeff0.26). Moreover, this cluster was closely related with the zona incerta

References