

The Role of Diffusion Tensor Imaging Tractography for Gamma Ventral Capsulotomy Bruno Fernandes de Oliveir Santos MD; Alessandra A. Gorgulho MD, CMSc; Antonio A.F. De Salles MD, PhD HCor Neuroscience



Introduction

The role of tractography in Gamma Ventral Capsulotomy (GVC) planning is still unclear. This paper aims to describe the spatial distribution of medial OFC and lateral OFC fibers passing through anterior internal capsule and analyze quantitative tractography parameters that differentiate Obsessive-Compulsive Disorder (OCD) individuals from other functional patients

Methods

Twenty patients undergoing functional stereotactic procedures, between 2013 and 2016 were included in this study. Obsessive-compulsive disorders (OCD) patients underwent GVC (single shot 150 Gy and 4mm collimators). Parkinson's disease (PD) and Morbid Obesity patients were submitted to deep brain stimulation (DBS) implants in the subthalamic nucleus, pallidum internum, or hypothalamus. Diffusion tensor image (DTI) tractography was reconstructed using Brainlab Elements software (Brainlab AG, Feldkirchen, Germany). Deterministic fiber tracking (fractional anisotropy=0.15, minimum fiber length=50 mm, maximal angulation=13) was used in all cases to reconstruct fibers from OFC.

Results

Nine Parkinson disease, six morbid obesity, and five OCD patients were included with a mean age of, respectively, $65.4 \ 9.1, 41.0 \ 8.2$ and $31.2 \ 5.5$, which are statistically different from each other (p<0,001). Fourteen patients (70%) were men. A total of 40 cerebral hemispheres were analyzed. Medial OFC fibers are localized more inferior in the AIC than the lateral OFC fibers in all hemispheres, but the level of intersection and exact topography of fiber bundles are variable among individuals. Both medial and lateral OFC fiber tracts of Parkinson disease and morbid obesity patients have lower volume than, respectively, medial and lateral counterparts of OCD patients (p<0,001).

Segmentation three-dimension (3D) reconstruction of the regions of interest.



Lateral OFC (blue), Medial OFC (orange), brainstem (green), thalamus (red), Lateral OFC fibers (blue), Medial OFC fibers (orange), and ALIC (purple).

Example of a patient with distinct localization of the fibers, lateral OFC bundle cranial to the medial OFC bundle.



Coronal MRI with Lateral (blue) and Medial (yellow) OFC fiber bundle distribution

Coronal MRI of one of the patients pre and post radiosurgery.



Notice the bilateral inferior location of the Gamma Capsulotomy (GVC) and the disappearance of the most inferior fibers (yellow), representing the fibers coming exclusively from the medial left OFC, side that the tractography is represented. Post GK image shows the sparing of the lateral frontal cortex fibers (blue). The internal capsule lesions were done each with 150Gy absolute dose and a 4mm diameter delivery.

Conclusions

Medial and lateral OFC tract fibers have a general standard distribution in anterior internal capsule (lateral OFC higher than medial OFC fibers).

Learning Objectives

There are differences between obesity, Parkinson and OCD patients regarding fiber tracts statistics, what could support OCD fiber tracking singularities that justify additional studies trying to identify specific targets based on DTI tractography.