Using MDEFT MRI Sequences to Target the GPi in DBS Surgery

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OBJECTIVE
Recent advances in different MRI sequences have enabled direct visualization and targeting of the Globus pallidus internus (GPi) for DBS surgery. Modified Driven Equilibrium Fourier Transform (MDEFT) MRI sequences provide high spatial resolution and an excellent contrast of the basal ganglia with low distortion. In this study, we investigate if MDEFT sequences yield accurate and reliable targeting of the GPi and compare direct targeting based on MDEFT sequences with atlas-based targeting.

METHODS
13 consecutive patients considered for bilateral GPi-DBS for dystonia or PD were included in this study. Preoperative targeting of the GPi was performed visually based on MDEFT sequences as well as by using standard atlas coordinates. Postoperative CT imaging was performed to calculate the location of the implanted leads as well as the active electrode(s). The coordinates of both visual and atlas based targets were compared. The stereotactic coordinates of the lead and active electrode(s) were calculated and projected on the segmented GPi.

RESULTS
On MDEFT sequences the GPi was well demarcated in most patients. Compared to atlas-based planning the mean target coordinates were located significantly more posterior. Subgroup analysis showed a significant difference in the lateral coordinate between dystonia (LAT = 19.33 ± 0.90) and PD patients (LAT = 20.67 ± 1.69). Projected on the segmented preoperative GPi the active contacts of the DBS electrode in both dystonia and PD patients were located in the inferior and posterior part of the structure corresponding to the motor part of the GPi.

CONCLUSIONS
MDEFT MRI sequences provide high spatial resolution and an excellent contrast enabling precise identification and direct visual targeting of the GPi. Compared to atlas-based targeting, it resulted in a significantly different mean location of our target. Furthermore, we observed a significant variability of the target.
among the PD and dystonia subpopulation suggesting accurate targeting for each individual patient.

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