Subthalamic stimulation lead coordinates correlate with non-motor effects in Parkinson's disease

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Background

- Subthalamic nucleus (STN) deep brain stimulation (DBS): well-established for patients with Parkinson's disease (PD)[1]
- Beneficial effect of STN-DBS on motor and non-motor symptoms (NMS) in PD[2]
- However, high inter-subject variance of motor and non-motor effects, possibly due to individual lead locations[3]
- In Cologne, DBS surgery planning with visual targeting of STN
- Analytic approach in this study: correlation of lead locations with motor and non-motor outcomes

Methods

- Post-hoc analysis of a cohort of the non-motor symptom study group of the IPMDS
- Assessment of motor functions and NMS: UPDRS-II,-III,-IV and NMS Scale (NMSS) at baseline (MedON) and 6 months follow-up (6MFU, MedON/StimON)
- NMSS: Consisting of nine domains corresponding to specific aspects of NMS
- Wilcoxon signed-rank or t-test, if parametric criteria fulfilled; Bonferroni α-correction
- Measurement of Cartesian coordinates of lead tips using OPTIVISE © (see figure 1)
- Spearman correlation: Cartesian coordinates with change score (baseline-6MFU)

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Table 1

Score	Baseline		6 MFU		Relative change [%]	p
	Mean	SD	Mean	SD		
UPDRS-II	14.7	4.8	10.6	5.1	27.7	0.004**
UPDRS-III ‡	28.1	9.5	19.4	7.5	30.8	0.016*
UPDRS-IV	6.7	4.0	4.0	3.5	39.9	0.032*
NMSS	58.7	34.2	38.7	15.7	34.2	0.040*

* p<0.05, ** p<0.01, ‡ n=19, for all other scales n=20

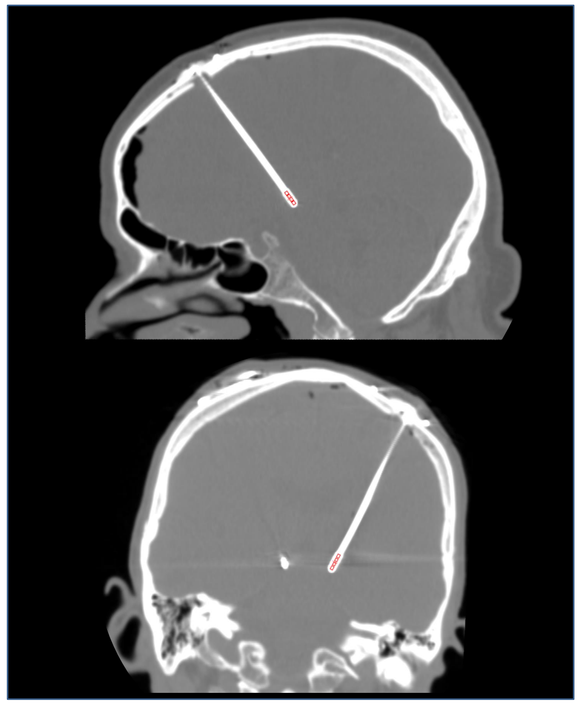

Figure 1: OPTIVISE ©, reconstructed images: both planes aligned to left DBS lead, red squares: contacts 0 to 3

Table 2

Lead location	correlated to improvement of	correlation coefficient	p
Dorsal	UPDRS-II	0.403	0.010*
	UPDRS-III	0.360	0.027*
	NMSS sleep	0.427	0.006**
Posterior	UPDRS-II	0.407	0.009**
	NMSS sleep	0.364	0.021*
Lateral	NMSS cardiovascular	0.358	0.023*

* p<0.05, ** p<0.01

Results

- So far, 20 patients included with bilateral subthalamic stimulation (40 hemispheres)
- Mean lead tip positions in relation to AC: x: 10.9mm (±1.3), y: -18.3mm (±2.2), z: -6.0 (±2.9)
- Significant improvement of all outcomes (see table 1)
- Post-hoc, significant correlations of lead locations with UPDRS-II, -III, NMSS sleep and cardiovascular domains (see table 2)

Conclusion

- Results of our cohort in accordance with broad agreement that DBS outcomes highly dependent on lead locations
- Further studies needed for more sophisticated DBS models also integrating stimulation parameters and patients' individual anatomy
- Perspective: tailoring lead placement and stimulation parameter settings to patients' individual motor and non-motor profiles

References

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