Non-motor outcomes of subthalamic stimulation in Parkinson’s disease depend on location of active contacts

An international, multicentre, multidisciplinary study on surgical therapy outcomes

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OBJECTIVE

To investigate the impact of active contact locations on non-motor symptoms (NMS) in subthalamic nucleus (STN) deep brain stimulation (DBS) in Parkinson’s disease (PD).

BACKGROUND

- Improvement of quality of life (QoL), non-motor,2, and motor symptoms3 by STN-DBS well established
- However, high inter-individual variance of these outcomes4
- Hypothesis: dependency of outcomes on active contact location

METHODS

- Prospective, open-label, multicentre study including 50 patients with PD and bilateral STN-DBS
- Assessments at baseline and 6 months follow-up (6MFU): NMS Scale (NMS), NMS Questionnaire (NMSQ), Hospital Anxiety and Depression Scale (HADS-A/D), PD Questionnaire-8 (PDQ-8), Scales for Outcomes in PD motor examination, activities of daily living, and motor complications (SCOPA-A, -B, and -C)
- Significant changes detected with Wilcoxon signed-rank/t-test and Bonferroni correction
- Although STN targeted visually, exploration of relationship between active contact locations with an atlas-based approach
- Based on fused CT/MRI images (Optivise software) identification of Cartesian coordinates of active contacts referenced to mid-commisural point standardized to the Mai-atlas5 (see fig. 1)
- Computation of linear mixed models (x-/y-/z-coordinates as independent, hemisphere as within-subject, and test change scores as dependent variable)

RESULTS

- Significant improvement of NMSQ, NMSQ, PDQ-8, SCOPA-A and -C, and LEDD at follow-up (see fig. 2)
- Linear mixed-models: Significant dependency of NMS and QoL on more medial (HADS-D, NMSQ), anterior (HADS-D, NMSQ, PDQ-8), and ventral (HADS-A/D, NMSQ, PDQ-8) active contact locations
- More SCOPA-B improvement related to more posterior active contact locations
- No relationship for motor examination and complications with active contact locations in our cohort

CONCLUSION

- Preliminary evidence that more anterior, medial, and ventral STN-DBS significantly related to more beneficial non-motor and QoL outcomes without negative impact on motor examination and complication scores
- Limitation: simplistic approach (atlas-based, only active contact locations)
- However, methods easily accessible and reproducible by most DBS centers
- Need for further studies with more sophisticated models considering patients’ individual anatomy and stimulation parameters based on advanced methods, such as diffusion-tensor imaging and volumes of activated tissue.

ACKNOWLEDGMENTS:
Haidar S. Dafarsi’s work was funded by the Prof. Klaus Thiemann Foundation and the Fulgenhauer Foundation. Jan Niklas Petry-Schmelzer’s work was supported by the Keelin Fortune Program.

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