Deep brain stimulation for Parkinson's disease prognosis

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- Parkinson's Disease, Speech and Neurosurgery
- Olfactory changes in patients with Parkinson's disease undergoing deep brain stimulation in the subthalamic nucleus: a systematic review and meta-analysis
- The Conservative Treatment of a Rare Postoperative Complication of DBS-Brain Abscess: Case Series
- Predicting motor function improvement following deep brain stimulation of the subthalamic nucleus for Parkinson's disease based on STN-T2MRI radiomics
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Deep Brain Stimulation (DBS) is an established treatment for Parkinson's disease (PD), particularly in advanced stages when motor symptoms are inadequately controlled by medication. The prognosis for patients receiving DBS depends on various factors, including patient selection, surgical precision, and postoperative management.

Key Factors

Symptom Response:

DBS significantly improves motor symptoms such as tremors, rigidity, and bradykinesia.

Patients with medication-responsive symptoms generally see the best outcomes.

Non-motor symptoms, like cognitive decline or autonomic dysfunction, are less affected by DBS.

Quality of Life:

DBS can enhance the quality of life by reducing motor fluctuations and dyskinesias caused by long-term dopaminergic therapy.

The procedure allows for a reduction in medication dosage, thereby minimizing side effects like dyskinesias.

Disease Progression:

DBS does not halt disease progression but effectively manages symptoms.

As PD progresses, other symptoms (e.g., speech issues, balance problems, or dementia) may emerge

and become less responsive to DBS.

Target Sites:

Subthalamic nucleus (STN): Commonly used for younger patients, allowing medication reduction.

Globus pallidus internus (GPi): Preferred in cases with severe dyskinesias or in older patients.

The choice of target affects outcomes and side effects.

Cognitive and Psychiatric Effects:

DBS may not be suitable for patients with significant cognitive impairment or psychiatric conditions, as it can exacerbate these issues.

Proper preoperative neuropsychological evaluation is essential.

Surgical and Technical Factors:

Precise electrode placement and programming are critical for optimal results.

Advanced techniques and imaging have improved accuracy, minimizing complications like bleeding or infection.

Postoperative Management:

Regular programming of the DBS device is required to maintain efficacy.

Ongoing collaboration between neurologists, neurosurgeons, and rehabilitation specialists is vital for long-term success.

Prognostic Outcomes

Short-term: Most patients experience substantial improvement in motor symptoms within weeks to months.

Medium-term: Benefits often persist for 5-10 years, though new symptoms related to disease progression may emerge.

Long-term: DBS may continue to provide motor symptom relief, but its efficacy may wane due to disease-related non-motor symptom progression.

Current Research and Innovations

Development of closed-loop DBS systems, which adjust stimulation in real-time based on neural activity, shows promise in improving outcomes. Advances in connectomic approaches are helping refine target selection to maximize efficacy and minimize side effects. Investigations into combining DBS with gene therapy or neuroprotective strategies may offer future avenues for modifying disease progression. In conclusion, DBS offers a significant prognostic benefit for motor symptoms in carefully selected Parkinson's patients. A multidisciplinary approach ensures that patients derive the maximum benefit while addressing the limitations of the treatment.

see Subthalamic Deep brain stimulation for Parkinson's disease outcome.

Observational studies

A study attempted to elucidate whether deep brain stimulation for Parkinson's disease alters the functional connectivity pattern of cognitive networks.

The study obtained fMRI and cognitive scale data from 37 PD patients before and after the DBS surgery. Seed-based FC analysis helped demonstrate the FC changes of the default mode network (DMN), executive control network (ECN), and dorsal attention network (DAN).

PD patients indicated significant network connectivity decline in DMN [such as in right precuneus, left angular gyrus, and left middle frontal gyrus (MFG)], ECN [such as in left inferior parietal gyrus, left MFG, and left supplementary motor area (SMA)], and DAN [such as in left inferior frontal gyrus and left MFG] post-DBS surgery. The phonemic fluency score was positively associated with the FC value of the right precuneus and left angular gyrus in DMN before DBS.

The general reduction in FC in the major cognitive networks after DBS surgery depicted the presence of the corresponding network reorganization. Further research can help explore the mechanism of impaired cognitive function post-DBS [1)]

This study provides meaningful insights into the effects of DBS on cognitive network connectivity in PD, highlighting significant FC declines in major networks during the microlesion period. However, the small sample size, absence of a control group, and limited cognitive assessments constrain its conclusions. Further research with more robust designs and longer follow-ups is essential to deepen our understanding of DBS-induced cognitive changes and their clinical implications.

1)
Luo B, Zou Y, Yan J, Sun J, Wei X, Chang L, Lu Y, Zhao L, Dong W, Qiu C, Yan J, Zhang Y, Zhang W. Altered Cognitive Networks Connectivity in Parkinson's Disease During the Microlesion Period After Deep Brain Stimulation. CNS Neurosci Ther. 2024 Dec;30(12):e70184. doi: 10.1111/cns.70184. PMID: 39722165.