PD-patients in advanced stage of the disease should be referred to a Movement Disorders Clinic where a comprehensive and unbiased evaluation can be made by a neurologist specialized in movement disorders with a vast experience of adjusting peroral medication and in the use of deep brain stimulation (DBS), continuous subcutaneous administration of apomorphine and continuous intestinal administration of levodopa.

**Background**

Patients with Parkinson’s disease, who no longer can be improved by optimising the oral medical treatment, have shown significant benefits from treatment with DBS. DBS has been shown to improve motor function, reduce tremor, motor fluctuations and dyskinesias, decrease use of medication and increase Quality of Life (see reference 1. and references herein).

**Criteria for referral to a specialised Movement Disorder Centre for possible DBS**

Patients with levodopa responsive Parkinson’s disease

- Age < 70 years
- Preferably with a duration of Parkinson’s disease > 5 years
  - *Moderate to severe on-off motor fluctuations* and/or
  - *Moderate to severe dyskinesias* and/or
- Medical refractory *moderate to severe tremor*
  - *Defined as moderate to severe impact on quality of life

**Exclusion criteria**

- Dementia
- Significant medical resistant psychiatric disease (e.g. severe depression)
- Significant medical conditions with limited life expectancy
- Conditions that prevent surgery or MRI
**Patient eligible for DBS**

Patient eligibility for DBS is determined at the Movement Disorder Centre after:

Brain imaging

Neuropsychological assessment of cognitive function and psychiatric symptoms

Levodopa challenge test
**Expected outcome of DBS treatment**

Expected outcome corresponds to the effect of an optimal levodopa dosage on the motor symptoms:
- **Tremor reduction**
- **Significant reduction of motor fluctuations**
- **Decreased use of medication depending on surgical target, see below**
- **Significant reduction of dyskinesias**
- **Levodopa unresponsive symptoms like**
  - Axial symptoms as postural instability
  - Freezing of gait
  - Dysarthria

will not improve

**Surgery in Parkinson´s disease**

**Target**
- The subthalamic nucleus (STN) to treat the cardinal symptoms tremor, rigidity and hypokinesia and reduce motor fluctuations
- The internal part of globus pallidus (GPi) is an alternative target to treat cardinal symptoms and especially dyskinesias, however often results in less reduction of medication
- The ventral intermediate nucleus of thalamus (VIM) to treat tremor only

The electrodes are implanted bilaterally and connected to a subcutaneous lead and impulse generator (IPG) localised beneath the clavicle.

Each electrode has four contacts and stimulation contact and parameters are adjusted by computer telemetry.

**Surgical complications**

Intracranial hemorrhage (appr. ½ -1 %)

Infection
Side effects

Worsening of dysarthria
Sometimes worsening of gait and balance especially patients > 65 years of age
Eyelid apraxia
Dystonia
Psychiatric symptoms (usually transient, treatable and potentially preventable) (7,9)
   Confusion
   Depression
   Mania
   Psychosis
   Apathy
   Increased risk of suicide
Neuropsychological symptoms
   Reduced verbal fluency

Hardware complications

Patient management and follow-up

During the first 3-6 months frequent controls in the outpatient clinic to adjust stimulation parameters and medication to obtain maximum effect of stimulation.
Shared control (referral neurologist and DBS centre) of symptoms and disease development and stimulation effect.
Battery replacement every 3-4 years.
Rechargeable battery available

References


12. The deep-brain stimulation for Parkinson’s disease study group. Deep-brain stimulation of the subthalamic nucleus or the pars interna of the globus pallidus in Parkinson’s disease. NEJM 2001;345:956-963


17. Østergaard K, Sunde NAa, Dupont E. Effects of bilateral stimulation of the subthalamic nucleus in patients with severe Parkinson’s disease and motor fluctuations. Mov Disord 2002;17: 693-700

18. Østergaard K and Sunde N. Evolution of Parkinson’s disease during four years of bilateral stimulation of the subthalamic nucleus. Mov Disord 2006;21:624-631