

## Surgery for patients with Parkinson disease

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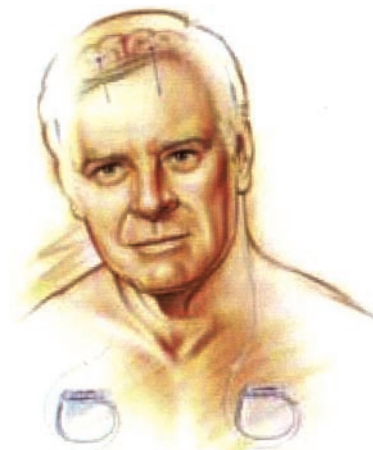
### **What is Parkinson disease?**

Parkinson disease (PD) is a disorder of the nervous system that gets worse over time. Cells in part of the brain die. This leads to the decrease of an important brain chemical called dopamine. The symptoms of PD are caused by not enough dopamine in the brain. The most common signs and symptoms of PD include tremors of the arms, legs, or both when resting, a stiffness of the muscles, slowness of movements, and difficulty with balance, walking, or both. There is no cure for PD, but several therapies are available. These include medications and many kinds of surgical procedures.

### **How is Parkinson disease treated?**

The medications used for PD treat the symptoms, but do not slow the progression of the disease. This means that the medications must be taken over a long period of time. Usually, the dose must be increased with time to achieve the same effect. This can lead to an increase in side effects of the medication that can become disabling.

Surgical treatment for PD can also help decrease some of the symptoms of PD. It may also decrease the disabling side effects caused by long-term use of the medication. However, it is usually not possible to eliminate the use of medication completely. More information about the surgical treatments available for PD can be found on the next page.



*Figure. Bilateral subthalamic nucleus deep brain stimulation. Activa(r) Therapy, used with permission by Medtronic, Inc.*

### **A study comparing two types of surgical treatment for Parkinson disease**

In this issue of *Neurology*, an article by Esselink and colleagues reports the results of a study that compared two of the most common surgical treatments of PD: (1) unilateral pallidotomy and (2) bilateral subthalamic nucleus (STN) deep brain stimulation (DBS). The researchers compared the effectiveness of each surgery in three ways: (1) improving the symptoms of PD, (2) helping the side effects of PD medication, and (3) decreasing the need for PD medication.

The study included patients with PD who were taking high doses of PD medication. These patients were still having PD symptoms, disabling side effects, or both, due to medication. Patients were assigned to get either unilateral pallidotomy or bilateral DBS STN. Patients were evaluated by a neurologist 1 month before surgery

and 6 months following surgery. During the evaluations, these patients were either still taking their medications or off of the medication for at least 12 hours.

The results showed that both surgeries decreased the symptoms of PD while the patients were off medication. However, patients who had the STN DBS surgery had a greater improvement in symptoms. There was a 49% improvement with STN DBS compared to 20% improvement with unilateral pallidotomy. Patients who had the STN DBS surgery had further improvements in symptoms while on medication. The pallidotomy patients actually had a slight worsening in symptoms while on medication.

All patients in this study were able to take less medication after surgery. Those receiving the STN DBS surgery had a greater decrease in medication dose as compared with those patients receiving unilateral pallidotomy. There was a 33% medication decrease for STN DBS as compared to 12% for unilateral pallidotomy. STN DBS patients also showed a decrease in some medication side effects.

### **Why is this study important?**

This study is important because it is the first to directly compare these two types of surgical procedures in a well-done research study. According to the study, STN DBS surgery is better than unilateral pallidotomy surgery because it decreases the symptoms of PD, the amount of medication needed after surgery, and the overall side effects of that medication more.

The surgical treatment of PD is based on the observation that a loss of the dopamine producing cells that occurs with PD somehow causes an imbalance in the activity of the brain. This produces areas of increased activity in several brain areas and decreased activity in others. The goal of surgery for PD is to try to correct this imbalance. The activity in these overactive areas is decreased in one of two ways: (1) making a lesion in the overactive area by destroying the brain tissue or (2) inserting electrodes that produce electrical stimulation that decreases activity without causing damage to the tissue.

### **What types of PD surgical treatments are there?**

The table lists the various types of surgeries available. There are three brain areas that are important in the surgical treatment of PD. These are the thalamus, the globus pallidus, and the subthalamic nucleus. All of these areas are deep within the brain.

The right side of the brain controls the left side of the body, and vice

versa. Making a lesion in the thalamus reduces tremors on the side of the body that is opposite of the side of the surgical lesion. Unfortunately, this approach is not effective in reducing any of the other PD symptoms or medication side effects. It cannot be done on both sides without serious complications. This type of surgery is rarely done.

Making a lesion or using deep brain stimulation in the globus pallidus may greatly reduce or eliminate the medication-induced side effects on the side of the body opposite the lesion or stimulation. There may also be decreases in the motor symptoms of PD (tremor, rigidity, or stiffness and bradykinesia or slow movements).

The most success reported for any site targeted for surgery for PD has been the subthalamic nucleus. The use of deep brain stimulation in this area may produce significant improvement in PD motor symptoms. This approach also allows patients to take less medication following surgery.

### **What is the advantage of deep brain stimulation surgery?**

Deep brain stimulation is a recent development in PD surgery and has several advantages over the use of lesions. The first and most obvious is that brain tissue is not damaged. Producing surgical lesions, especially when done on both sides of the brain, has resulted in many complications. These are listed in the table. Deep brain stimulation has fewer side effects from surgery. Also, electrodes may be placed on both sides of the brain so that both sides of the body can benefit. Some of the problems with deep brain stimulation are listed in the table. Also, there are a limited number of treatment centers that have appropriate expertise in the placement of the electrodes and deep brain stimulation is costly.

### **Who should get surgery?**

These types of PD surgery are best used on patients with the following criteria:

1. A diagnosis of PD with some improvement of PD symptoms with dopamine treatment.
2. Disability due to the failure of PD medication to control the symptoms and disabling medication side effects.
3. Physical condition good enough to undergo the surgical procedure.

Patients who have an associated diagnosis of dementia, depression, or psychiatric illness may not qualify for this surgery. Whether you are a good candidate for this surgery can only be determined by a qualified neurologist.

### **For more information**

The American Academy of Neurology Foundation:  
[www.thebrainmatters.org](http://www.thebrainmatters.org)

The National Institutes of Health:  
[www.nlm.nih.gov/medlineplus/parkinsonsdisease.html](http://www.nlm.nih.gov/medlineplus/parkinsonsdisease.html)

**Table** Types of surgical procedures available for Parkinson disease (PD)

Procedure	Effect	Side effects/problems
Thalamotomy (lesion in thalamus)	Reduction in tremor on the side opposite to the lesion; no effect on other PD motor symptoms	Weakness, difficulty speaking, confusion, seizures, problems walking, and bleeding within the brain
Pallidotomy (lesion in globus pallidus)	Modest improvement in PD motor symptoms	Bleeding within the brain and some postoperative confusion
Deep brain stimulation thalamus	Reduction in tremor on the side opposite to the lesion; no effect on other PD motor symptoms	Bleeding within the brain; infection at implantation site; need to replace battery
Deep brain stimulation globus pallidus	Reduction in all PD motor symptoms, dyskinesia; reduced need for medication and medication-induced side effects	Bleeding within the brain; infection at implantation site; need to replace battery
Deep brain stimulation subthalamic nucleus	Reduction in all PD motor symptoms and medication-induced side effects; reduced need for medication	Bleeding within the brain; infection at implantation site; need to replace battery