Deep Brain Stimulation (DBS)

Deep brain stimulation (DBS) surgery was first approved in 1997 to treat Parkinson's disease (PD) tremor, then in 2002 for the treatment of advanced Parkinson's symptoms. More recently, in 2016, DBS surgery was approved for the earlier stages of PD — for people who have had PD for at least four years and have motor symptoms not adequately controlled with medication.

In DBS surgery, electrodes are inserted into a targeted area of the brain, using MRI (magnetic resonance imaging) and recordings of brain cell activity during the procedure. A second procedure is performed to implant an IPG, impulse generator battery (like a pacemaker). The IPG is placed under the collarbone or in the abdomen. The IPG provides an electrical impulse to a part of the brain involved in motor function. Those who undergo DBS surgery are given a controller to turn the device on or off.

DBS is certainly the most important therapeutic advancement since the development of levodopa. It is most effective for people who experience disabling tremors, wearing-off spells and medication-induced dyskinesias, with studies showing benefits lasting at least five years. That said, it is not a cure and it does not slow PD progression. It is also not right for every person with PD. It is not thought to improve speech or swallow issues, thinking problems or gait freezing.

Like all brain surgeries, DBS carries a small risk of infection, stroke, bleeding or seizures. DBS surgery may be associated with reduced clarity of speech. A small number of people with PD have experienced cognitive decline after DBS surgery.

It is important that a person with PD considering DBS surgery be informed about the procedure and be realistic in his or her expectations.

What Are the Facts?

Surgical procedure used to treat a variety of disabling neurological symptoms — most commonly the debilitating symptoms of Parkinson's, such as tremor, rigidity, stiffness, slowed movement and slowed walking.

Also used to treat essential tremor, a common neurological movement disorder.

Does not damage healthy brain tissue or destroy nerve cells. Instead, the procedure interrupts problematic electrical signals from targeted areas in the brain.

At present, the procedure is used only for patients whose symptoms cannot be adequately controlled with medications.

Uses a surgically implanted, battery-operated medical device called a neurostimulator — similar to a heart pacemaker and approximately the size of a stopwatch — to deliver electrical stimulation to targeted areas in the brain that control movement, blocking the abnormal nerve signals that cause tremor and PD symptoms. Before the procedure, a neurosurgeon uses magnetic resonance imaging

(MRI) or computed tomography (CT) scanning to identify and locate the exact target within the brain where electrical nerve signals generate the PD symptoms.

During surgery, some surgeons may use microelectrode recording — which involves a small wire that monitors the activity of nerve cells in the target area — to more specifically identify the precise brain target that will be stimulated.

Generally, these targets are the thalamus, subthalamic nucleus (STN) and a portion of the globus pallidus.

Once the system is in place, electrical impulses are sent from the neurostimulator up along the extension wire and the active contacts of the lead in the brain. These impulses interfere with and block the electrical signals that cause PD symptoms.

The DBS System Consists of Three Components

The lead (also called an electrode) is a thin, insulated wire inserted through a small opening in the skull and implanted in the brain. The tip of the electrode is positioned within the targeted brain area.

The extension is an insulated wire passed under the skin of the head, neck and shoulder, connecting the lead to the neurostimulator.

The neurostimulator (the battery pack") is the third component and is usually implanted under the skin near the collarbone. In some cases it may be implanted lower in the chest or under the skin over the abdomen.

Which Brain Targets Should Be Used to Implant the DBS Lead?

There are three brain targets that have been FDA approved for use in PD.

The most commonly utilized brain targets include the subthalamic nucleus (STN) and the globus pallidus interna (GPi).

Target choice should be tailored to a patient’s individual needs.

There are many ongoing studies that will help refine target choice for individual patients.

Although the picture is not yet clear on the issue of target choice, the STN does seem to provide more medication reduction, while GPi may be slightly safer for language and cognition.

What Is the Prognosis?

Although most people still need to take medication after undergoing DBS, many people experience considerable reduction of their PD symptoms and can greatly reduce their medications. The amount of reduction varies from person to person.

The reduction in dose of medication leads to decreased risk of side effects such as dyskinesia (involuntary movements of the arms, legs and head). There is a one to three percent chance of infection, stroke, cranial bleeding or other complications associated with anesthesia, per side that is done. It is best to discuss associated risks with your neurologist and neurosurgeon .

Am I a Good Candidate for DBS?

You have had PD symptoms for at least five years.

You have “on/off” fluctuations despite consistent and regular medication dosing.

You have dyskinesias.

You are unable to tolerate anti-parkinson’s medications due to side effects.

You have tremor that is not well controlled with medication (even with medical management by a movement disorders specialist).

You continue to have a good response to PD medications, especially carbidopa/levodopa, although the duration of response may be insufficient.

You have tried different combinations of anti-Parkinson’s medications under the supervision of a movement disorders neurologist.

You have PD symptoms that interfere with daily activities.