

Once the target is defined, the surgeon inserts the electrodes. The wire and stimulator may be implanted at the same time or at a later date. The stimulator is implanted under the collarbone, and the wire is tunneled up the neck, behind the ear, and to the site of the electrode (the patient is now under general anesthesia). The wire is connected to the electrode, and the incisions are closed.

Immediately after the operation, the patient may resume medications. The patient may be discharged the next day.

### **Turning On The Stimulator**

Once the stimulator is implanted, the patient must wait a week or two before the batteries are activated. The electrodes convey electrical pulses into the brain using power produced by the battery in the stimulator. The electrical pulses quiet the brain and reduce symptoms. A series of visits to the hospital are required to adjust the voltage settings to the needs of the individual. It may take several weeks or months to achieve the most beneficial settings.

The individual can check the status of the stimulator using a handheld remote control device. Using this device, he/she can determine if the stimulator is on or off, and can turn it back on in the event that it shuts down unexpectedly.

The expected life span of a battery at a typical voltage is about four years. At a very high voltage, the battery may need to be replaced after a year. At a very low voltage, a battery may last up to seven years. Replacing a battery can be done under general or local anesthesia as an outpatient procedure.

Physical therapy may be recommended to help the individual adjust to new body postures and range of motion.

### **Potential Side Effects**

Serious side effects are minimal, but no procedure is without risks. The main risk in DBS is a fatal hemorrhage. However 99-99.5% of patients do not have significant bleeding. Despite vigorous efforts to avoid it, infection is a risk in approximately 2% of patients. Infection can be serious and warrant the removal of the hardware. If this happens, it may be possible to re-implant the hardware once the infection is treated. Hardware failure is also a concern, though this is rare and precautions are in place in the event of situations such as a battery failure. It is estimated that in 5% of DBS procedures for dystonia some complication may arise, most of which can be addressed without removing the hardware.

### **Benefits**

Dystonia does not respond to DBS in the same way as other movement disorders do. In patients with dystonia, improvement may be delayed for days. Weeks or months may pass before the full extent of the benefit is reached.

DBS may not necessarily eliminate the need for drugs, botulinum toxin, or other therapies.

Although no longer considered “investigational” for dystonia by the United States Food & Drug Administration, DBS is in its relatively early stages as a treatment for this disorder. The preliminary results are quite positive, and the procedure is expected to evolve over time as more patients are treated and more data is collected.



**DYSTONIA  
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- ▶ **Dystonia is a movement disorder that causes the muscles to contract and spasm involuntarily.**
- ▶ **There are more than a dozen forms of dystonia, and many neurological and metabolic diseases include dystonia as a symptom.**
- ▶ **Deep brain stimulation (DBS) is a surgical procedure used to treat some forms of dystonia.**
- ▶ **The goal of DBS is to replicate the benefits of surgeries like pallidotomy and thalamotomy with an adjustable, reversible procedure.**

# **Deep Brain Stimulation**

Deep brain stimulation (DBS) is a medical procedure to treat dystonia that involves surgically implanting electrodes into the brain.

It is estimated that just under 1,000 dystonia patients have been treated with DBS.

DBS has also been performed on individuals with primary generalized dystonia (including DYT1 and non-DYT1) secondary dystonia, cervical dystonia, segmental dystonia, and myoclonic dystonia with encouraging results.

Studies have shown that the average percentage of improvement in symptoms for people with dystonia is about 50-60%. Some individuals, particularly primary generalized patients, are reported to have up to 90% improvement.

## **The Procedure**

The complete DBS apparatus includes the DBS electrode, a connecting wire, and a stimulator (aka "brain pacemaker") that contains a battery. The stimulator is surgically implanted into the chest, near the collarbone.

Most people have bilateral DBS which means there is an electrode on each side of the brain and two corresponding stimulators.

Once a physician has recommended brain surgery, fairly extensive pre-operative screening tests and preparations are necessary.

## **Day of Surgery**

At the time of surgery, the individual is fitted with a head frame under general or local anesthesia. The brain is mapped with imaging technology to create a blueprint for planning and measuring the placement of the electrode.

Under local anesthesia, the electrodes are inserted through a small hole in the skull into the brain. The brain itself does not feel pain, and the patient is usually awake during most of the procedure. The surgical team interacts with the patient throughout the procedure, and the patient provides feedback about symptoms and how he/she feels.

A technique called microelectrode recording is used to confirm the target. The mapping procedure alone may take up to several hours.

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