PROCEDURE

Deep brain stimulation

Deep brain stimulation uses implanted electrodes to reduce certain movement, seizure, or psychiatric symptoms

PURPOSE
Reduce symptoms that medicines do not control well

PROCEDURE TYPE
Therapeutic surgery using implanted brain electrodes and a chest generator

WHERE IT IS DONE
Operating theatre

ANAESTHESIA
Local with sedation or general, based on surgical approach

HOW LONG IT TAKES
About 3-8 hours, sometimes across two operations

PREPARATION
Imaging, medicine review, fasting, and sometimes medication changes

RECOVERY
One to three nights; no driving until cleared

MAIN RISKS
Bleeding, stroke, infection, seizures, and hardware problems

RESULTS
Benefits assessed during programming over weeks to months

Overview

Deep brain stimulation, or DBS, is a type of brain surgery. Thin wires called electrodes are placed in specific areas of your brain. The electrodes deliver controlled electrical signals that change abnormal brain activity.

The electrodes connect through wires under your skin to a battery-powered device, usually placed under the skin of your upper chest. This device is similar to a heart pacemaker. It can be programmed without another operation.

DBS may reduce symptoms and improve daily function, but it does not cure the underlying condition. Its effects can be adjusted, and the system can be turned off or removed if necessary. Removal does not reverse any bleeding or other injury caused by surgery.

Why the procedure is performed

DBS may be considered when symptoms remain difficult to manage despite appropriate medicines and other treatments.

It is most often used for selected people with:

The brain area chosen depends on the condition and the symptoms being treated. DBS may improve tremor, stiffness, slowness, involuntary movements, muscle spasms, or seizure frequency. It usually does not improve every symptom.

- Parkinson's disease, particularly movement symptoms that improve with levodopa but fluctuate during the day
- Essential tremor that seriously affects daily activities
- Dystonia, which causes involuntary muscle contractions and abnormal postures
- Epilepsy that continues despite suitable anti-seizure medicines
- Severe obsessive-compulsive disorder that has not improved with specialist treatment

Who should and should not have it

DBS is generally considered only after a specialist team has confirmed the diagnosis, reviewed previous treatment, and assessed how symptoms affect your life. Testing may include brain imaging, movement or seizure assessments, memory testing, and a mental health evaluation.

For Parkinson's disease, DBS tends to help symptoms that respond to levodopa. Tremor can sometimes improve even when medicine has not helped. Balance, speech, swallowing, memory problems, and symptoms unrelated to movement may respond poorly or can worsen.

DBS may be avoided or delayed if you have:

Age alone does not decide whether DBS is suitable. Your general health, diagnosis, treatment goals, and ability to manage an implanted device are more important.

- An active infection or a wound near the planned surgical area
- A bleeding problem that cannot be corrected
- A medical condition that makes surgery or anaesthesia unsafe
- Significant untreated depression, psychosis, or another unstable psychiatric condition
- Cognitive impairment that would make the risks or follow-up difficult to manage
- Symptoms unlikely to respond to stimulation

- Difficulty attending repeated programming and device checks

How to prepare

Your treating facility's own instructions take priority because surgical methods and medication plans differ.

You will usually have an MRI or CT scan to map the target area in your brain. Blood tests, heart tests, and an anaesthetic assessment may also be needed. Your team will explain whether the operation will be performed while you are awake, asleep, or both.

Give the team a complete list of medicines, supplements, allergies, and implanted devices. Blood thinners and some other medicines may need adjustment, but do not stop them unless the surgical team tells you to.

Follow the facility's fasting instructions. You may also be asked to change the timing of Parkinson's or seizure medicines before surgery. Arrange for someone to take you home and help during the first part of your recovery.

What happens during the procedure

A rigid frame may be attached to your head, or the surgeon may use a frameless navigation system. Imaging helps guide the electrodes to a precise location.

After numbing the scalp, the surgeon makes one or two small openings in the skull. An electrode is passed through each opening into the planned brain target. The brain itself does not feel pain, but the scalp and tissues around the skull do, so anaesthesia is used.

Some operations are performed while you are awake for part of the lead placement. You may be asked to move, speak, or describe changes while the team tests stimulation. Sedation can be reduced during this testing. Other centres use MRI or CT guidance to place the electrodes while you remain under general anaesthesia.

The electrodes are connected to extension wires placed under the skin of your head and neck. These connect to the pulse generator in your upper chest or, less commonly, your abdomen. The leads and generator may be implanted during one operation or on separate days.

The device is often left off initially while the incisions begin to heal.

Recovery and what to expect afterward

Pain is usually greatest around the scalp and chest incisions. Headache, swelling, bruising, and tightness around the generator are common early on. Your team will explain which pain medicines are safe.

You can usually drink and eat once you are awake and not feeling sick. Some people need a temporary lighter diet after anaesthesia.

Walking often begins with assistance soon after surgery. Avoid strenuous activity, heavy lifting, and movements that pull on the chest or neck until your surgical team says the wounds have healed. Follow instructions for bathing and incision care.

Do not drive yourself home. Driving must wait until your surgeon or specialist clears you. This decision takes account of your recovery, symptoms, seizure risk, medicines, and local driving rules.

Time away from work is often measured in weeks rather than days, especially for physical work. Office work may be possible sooner. Your team can give advice based on your operation and job.

Risks and possible complications

DBS involves brain surgery and an implanted electronic system. Important surgical risks include bleeding in or around the brain, stroke, infection, seizures, blood clots, and problems related to anaesthesia. Bleeding may cause weakness, speech problems, confusion, or other lasting effects.

Hardware can move, break, wear through the skin, or stop working. Infection or hardware failure may require antibiotics like amoxicillin or doxycycline , replacement, or removal of part of the system.

Stimulation can cause temporary or persistent side effects, including tingling, muscle tightening, speech or balance problems, double vision, mood changes, or unwanted movements. Many stimulation effects improve when the settings are adjusted.

Future MRI scans and some medical procedures require special safety checks. Always tell healthcare professionals that you have a DBS system and carry your device identification card.

Results and follow up

Programming usually begins after the surgical wounds have started to heal. A clinician uses a wireless programmer to adjust which contacts are active and how much stimulation is

delivered.

Finding the best settings can take several visits over weeks or months. Medicines may also need gradual adjustment. Do not change them on your own.

Follow-up continues long term. Visits check symptom control, side effects, wounds, battery level, and hardware function. Rechargeable generators need regular charging. Non-rechargeable batteries require a minor operation when they run low.

Alternatives

Alternatives depend on the condition being treated and your goals.

Medicines are less invasive and remain the main treatment for many people. Their effects may wear off, fluctuate, or cause side effects. Rehabilitation-including physiotherapy, occupational therapy, and speech therapy-can improve function but does not replace effective symptom treatment.

Focused ultrasound and procedures such as thalamotomy or pallidotomy create a permanent lesion in a specific brain area. They avoid implanted wires and battery changes, but their effect cannot be adjusted or reversed. Treatment may be limited to one side in some situations.

For advanced Parkinson's disease, medicine delivered continuously through a pump may reduce fluctuations. This avoids brain surgery but requires ongoing pump, tubing, or infusion-site care.

For epilepsy, options may include removal or disconnection of a seizure-producing area, vagus nerve stimulation, or responsive neurostimulation. Removal can offer better seizure control when one safe target is found, but it permanently removes brain tissue. Other stimulation systems generally reduce rather than guarantee an end to seizures.

For obsessive-compulsive disorder, specialist exposure and response prevention therapy and medicines remain essential alternatives. They avoid surgery but may not provide enough relief in severe, treatment-resistant illness.

When to call your healthcare team

Seek emergency help for sudden weakness, facial drooping, trouble speaking, loss of consciousness, severe breathing difficulty, or a seizure lasting more than five minutes. Also seek emergency help for repeated seizures without recovery between them.

Contact the surgical team urgently for a worsening severe headache, repeated vomiting, new

confusion, fever, increasing redness or swelling, drainage from an incision, an opening wound, or visible hardware.

Mild stimulation effects that are not rapidly worsening can usually be discussed during office hours. Contact the programming team rather than changing settings unless you have been specifically taught how to use your patient controller.

Common questions

Will I be asleep?

You may be awake for part of the electrode placement, with your scalp numbed and sedation adjusted for testing. Some centres perform the entire placement under general anaesthesia. The chest generator is usually implanted while you are asleep or deeply sedated.

Can I drive home?

No. Someone must take you home. Do not restart driving until your specialist clears you and you meet any local rules related to surgery, seizures, or your underlying condition.

How painful is it?

You should not feel the electrode moving through the brain. Pain and tenderness are more likely around the scalp and chest incisions. Medicines are provided to manage this.

When will I know whether it worked?

Some people notice changes during testing, but the full result is judged after programming and medication adjustments. This commonly takes weeks to months.

Will I still need medicine?

Often, yes. DBS may allow some medicines to be reduced, particularly in Parkinson's disease, but it rarely replaces all treatment. Changes should be supervised.

Can the device be turned off?

Yes. The stimulation can be adjusted or turned off. The implanted parts remain in place unless they are surgically removed.

Sources

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