Deep Brain Stimulation Surgery
Patient Guide

Improving quality of life for those with
Parkinson's disease, essential tremor, and dystonia.

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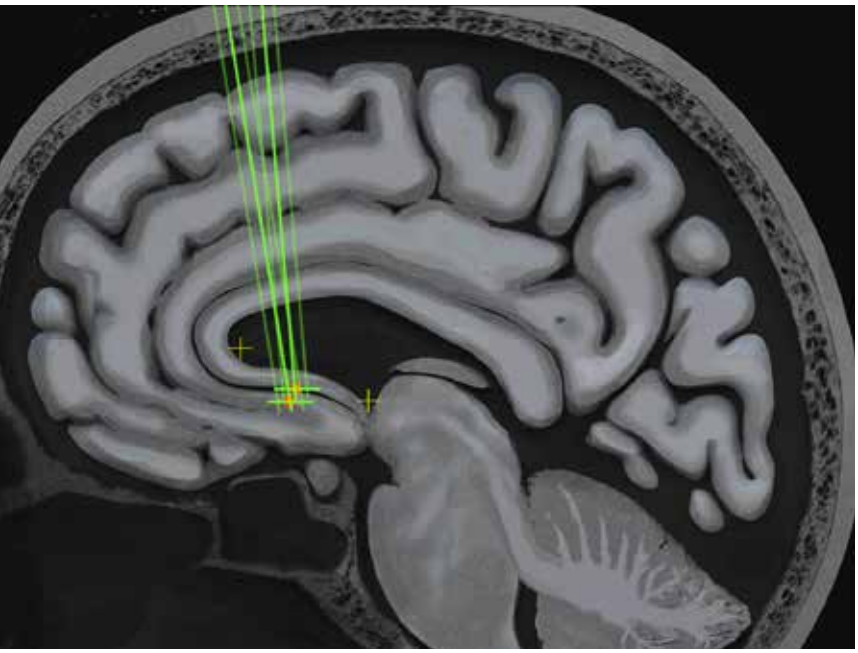

Table of Contents

DBS Overview

Millions of Americans suffer from Parkinson's disease, essential tremor, and dystonia. These disorders are characterized by tremor, muscle rigidity, and/or slowness of movement that make even simple daily activities — like buttoning a coat, signing a check, and holding a cup of coffee — a major challenge.

The good news is there is hope. When medical therapies fail to produce consistent benefits, deep brain stimulation (DBS) has proven to be very effective in letting people gain control of their symptoms and improve their quality of life. Over 100,000 patients across the globe have already been helped by DBS.

The Food and Drug Administration (FDA) approved DBS as a treatment for essential tremor in 1997. In 2002 it was approved for Parkinson's disease. And in 2003 it was approved for dystonia under a special use exemption. DBS has also been approved for use in Canada, Europe, and Australia since 1998. The therapy is completely FDA-approved and non-experimental.

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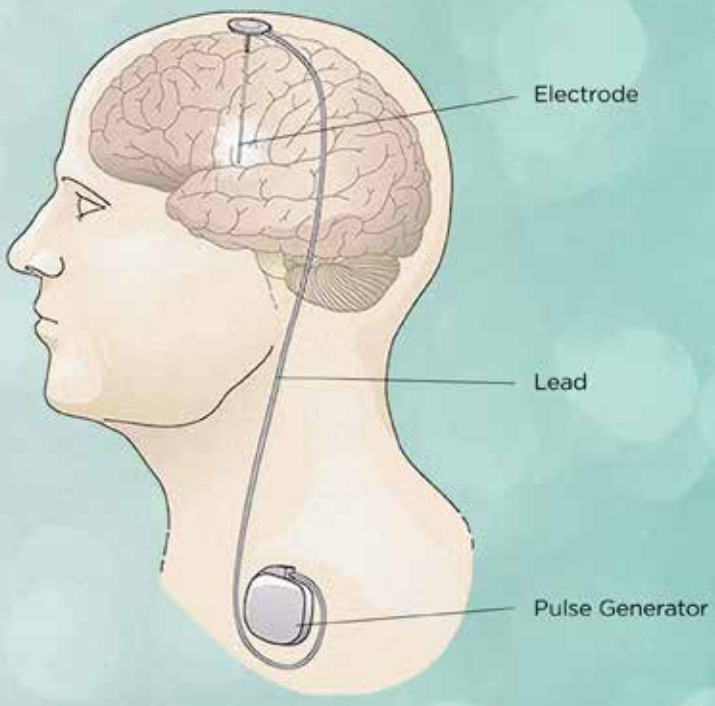

Source: NINDS

What Is Deep Brain Stimulation?

Deep brain stimulation can be thought of as a "brain pacemaker." It is a medical device as well as a clinical therapy. It is composed of two parts. An electrode ("lead") is surgically implanted into deep brain structures involved in movement-related control. The electrode is connected to a pulse generator — similar to a cardiac pacemaker — under the skin and below the collarbone. The pulse generator delivers electrical pulses to the brain tissue through the electrode, blocking the brain signals that cause abnormal movement. In many patients leads are implanted on both sides of the brain. The stimulator is adjusted by the medical team, and patients can use a simple hand-held remote to turn it on or off, and sometimes to control their stimulation. There are no external wires to the devices; the entire system is fully implanted under the skin.

Information for Patients With Parkinson's Disease

Deep brain stimulation (DBS) helps control many symptoms of Parkinson's disease, including shaking, slowed movement, and stiffness. Most commonly, patients become candidates for DBS once medication alone does not effectively control their symptoms.

People with DBS therapy may see improvement in their quality of life and when performing activities like eating, bathing, dressing, toileting, and movement. Depending on the target chosen, patients may be able to somewhat reduce the amount of medication they take. DBS can provide several additional hours of movement control per day when compared to medication alone. With the exception of tremor, it is important to note that symptoms that do not respond to medications such as levodopa do not generally respond to DBS.

When should I have DBS surgery?

People with PD should start DBS at the point when their daily function becomes challenging due to inconsistent medication effect, that is, when medications alone are providing less movement control, and/or causing unwanted movements (dyskinesia). However, DBS is not a last resort and patients should not wait too long because DBS does not help for some of the symptoms of advanced PD, such as frequent falls or dementia.

The best time to maximize benefit from DBS is when medications alone aren't providing enough relief, but still have some effect. Examples of this include:

- Tremor and stiffness are occurring for more hours each day.
- Medication doses take longer to work, and/or the effect is less predictable.
- The medication's effects wear off between doses and you have to take them more often, including during the night.
- You need higher doses of medications to get the same effect.
- Side effects from your medications are worsening.

Information for Patients With Essential Tremor

Deep brain stimulation helps control the symptoms of essential tremor. You may be a candidate for DBS surgery if you have tremor in at least one arm or hand and it keeps you from doing what you want to do. This can include daily tasks like writing or eating. For many people, their tremor causes embarrassment or anxiety when around other people, causing them to reduce their social activity. DBS can be considered when medications have been tried and they didn't work, or their side effects could not be tolerated.

DBS tends to be the most effective for upper extremity (arm or hand) tremors, but can also improve tremor in the head, voice, and legs in certain situations.

When should I have DBS surgery?

Essential tremor tends to get worse over time. Many people expect that DBS is a last resort. However, the best time to maximize benefit from DBS is when your tremor becomes disabling despite trying the best medical therapy directed by a neurologist.

Information for Patients With Dystonia

Deep brain stimulation helps control the symptoms of dystonia, a neurological movement disorder characterized by involuntary muscle contractions. These contractions force certain parts of the body into repetitive, twisting movements or painful postures. Dystonia can cause severe involuntary muscle contractions that often interfere with everyday functions like walking, sleeping, eating, and talking. There are various forms of dystonia that are identified by your neurologist.

When should I have DBS surgery?

The best time to maximize benefit from DBS is when your dystonia becomes disabling despite the best medical therapy directed by a neurologist.

Note that DBS for dystonia is classified as a Humanitarian Device. It is authorized by Federal Law as an aid in the management of chronic, intractable (drug refractory) primary dystonia, including generalized and/or segmental dystonia, hemidystonia, and cervical dystonia (torticollis), in patients seven years of age or above. The effectiveness of the devices for treating these conditions has not been demonstrated.

What To Expect With Deep Brain Stimulation Surgery

The steps before, during, and after DBS surgery are described below. Throughout the process you will be followed by a neurologist and a neurosurgeon who have special training with DBS, as well as several other members of our team.

Preoperative Evaluations

Your neurologist / movement disorders specialist will evaluate you to see if you are a candidate for DBS. The evaluation may include some or all of the following:

- Medical history
- Neurological exam of your movements:
  - **MRI of the brain:** to check for any issues with your brain that would prevent surgery. This scan is also used to plan placement of your DBS electrode wires if you proceed to surgery.
  - **Lab tests:** such as a blood test to make sure your blood clots properly.
  - **Neuropsychological tests:** to test for underlying problems with thinking or talking that need to be considered during your surgery.
  - **Physical, occupational and/or speech therapy:** to evaluate movement issues prior to surgery, including problems walking or taking care of yourself. Some individuals have swallowing problems before surgery that will be carefully evaluated by our speech therapists.
  - **Neurosurgical evaluation:** you will meet with the neurosurgeon to review your exams and tests and discuss how DBS can help with your symptoms.
  - **Medical clearance:** within 4 weeks of the procedure, you will need to have your primary care physician provide clearance from a medical standpoint. This may include EKG, Chest X-ray, or other tests.

Once the preoperative evaluation(s) are complete, your neurologist and neurosurgeon will discuss your case in detail.

What Does Deep Brain Stimulation Involve?

Deep brain stimulation therapy is completed in a series of steps. It involves both surgical and medical management by a team of neurosurgeons and neurologists. It can take up to 3 months to reach optimized therapy.

Stage 1: Fiducial (cranial) marker placement

This stage involves placement of 4 cranial markers on specific points in the head. This will be done using a local anesthetic. The procedure is done in an outpatient procedure room, followed by a CT scan of the head. Patients are sent home after the procedure.

Stage 2: Lead implantation surgery

One to two weeks after stage 1, this stage involves implanting the leads in the brain. This is a precise brain surgery that is partially performed with the patient awake. The surgery takes part of a day, and has multiple steps. At the conclusion of surgery, the lead(s) will be implanted in the brain and tested in the operating room to confirm its location. Most patients spend one or two nights in the hospital after this surgery, then return home for recovery.

Stage 3: Generator implant surgery

One week after stage 2, this stage involves implanting the generator and extension wire to complete the system. The generator, also called the "battery," is similar to a cardiac pacemaker. This procedure is performed under general anesthesia as an outpatient surgery, and most patients go home the same day. A single generator is placed in the chest (outside the rib cage), which can connect to single or bilateral leads.

Stage 4: Programming the neurostimulator

The clinical benefit begins when the system is activated in the office. The first adjustment, or "programming," is typically 1 to 3 weeks after the surgeries, when the patient has recovered and is back to their baseline. In the clinic the stimulator settings are adjusted over multiple visits spanning up to 3 months.

The neurology team also may modify medications while the system is increased and optimized over time. There will also be follow-up visits with neurosurgery to monitor the healing process.

Keep in mind that deep brain stimulation is a process, and it may require weeks of follow-up and adjustments to the stimulator to achieve the maximum benefit. We encourage you to discuss your personal goals and expectations of the surgery with your neurologist or surgeon.

The DBS System Has Several Components

- **Leads:** The lead is an insulated platinum iridium wire, 1.8 mm in diameter, with several electrodes at the tip. The location in the brain for implantation depends on the medical condition. For Parkinson's disease, the electrode is implanted in the subthalamic nucleus (STN) or the globus pallidus interna (GPi); for essential tremor, the tip is implanted in the ventral intermediate (VIM) thalamic nucleus; and for dystonia, the tip of the electrode is usually implanted in the GPi.
- **Extension Wire:** The extension wire connects the lead and the generator. It runs under the skin from the scalp to the chest across the neck. It is rugged and can withstand movement.
- **Generator, "Battery":** The generator is a pacemaker-like device that powers the entire system. It contains a lithium-powered battery that has a computer chip programmed to send electrical pulses through the lead to control movement-disorder symptoms. The battery generally has a two- to five-year life expectancy, depending on how high the parameters are programmed to control your symptoms. Rechargeable batteries are also available; these are rated to last 15 years.
- **Patient Programmer:** You will receive a hand-held device that allows you to turn your stimulators on or off, check your battery life, and (in certain cases) make adjustments. Some essential tremor patients turn off their batteries at night while sleeping. For Parkinson's and dystonia patients, batteries are left on all the time.

Surgical Risks

DBS is a complex brain surgery that has risks. However, potentially serious major complications are uncommon. These risks include:

- Infection of the skin, hardware, and or brain
- Bleeding in the brain (rare)
- Stroke (extremely rare)
- Worsening of neurological symptoms
- Pain
- Stimulation side effects include tingling, slurred speech, and balance difficulties. These can usually be reduced by modifying the DBS stimulation
- Skin erosion over hardware
- Mechanical damage to the DBS system or the stimulator

How Is DBS Surgery Performed?

- The goal of DBS surgery is to precisely implant the DBS electrode in a specific location deep in the brain. The target region is about 3 mm in diameter, so accuracy is critical. If the DBS electrode is placed off target then the therapeutic benefit will be less, and the stimulation side effects may be a problem.
- There are many techniques and tools that are used to improve accuracy that 1) choose the target, 2) guide the electrode through the brain to the target, and 3) confirm the electrode is in the correct location. The techniques used in DBS surgery are rapidly evolving. Each patient has different disease status and preferences. These factors are considered when the patient and surgeon decide together how to perform the surgery. In general, the following are different techniques and options in DBS surgery.

Surgical Targets

There are three common target locations in DBS surgery: subthalamic nucleus (STN), ventrointermedius nucleus of the thalamus (VIM), and posteroventral globus pallidus internus (GPi). The target in your surgery depends on your disease.

- **Essential Tremor:** The target is almost always in the VIM. This is clearly the best location for tremor control, even in Parkinson's disease, and sometimes in dystonia. The VIM target is within 2 mm of the sensory nucleus of the thalamus. Stimulation at high intensity causes paresthesia – tingling. It can also cause slurred speech, particularly common in bilateral surgery.
- **Dystonia:** The GPi is the most common target in dystonia. Typically, DBS electrodes are inserted bilaterally at the same time. This target is effective for nearly all types of dystonia. On occasion, the STN or VIM are used.
- **Parkinson's Disease:** The STN is the most common target, but often the GPi is used. It depends on the symptoms. If tremor is the major symptom the STN is a better target. If dyskinesia is the major symptom, then the GPi is a better target. STN DBS tends to result in greater medication reduction than GPi. Otherwise, either location has a similar benefit. The target in your case is chosen by both the movement disorder neurologist and neurosurgeon, considering your preference as well.

Neurophysiological Testing

The deep structures in the brain including the target region have specific neurophysiological characteristics that can be monitored and tested to confirm the DBS electrode is in the correct location. The following is a list of techniques commonly used. Many of these techniques are combined in one surgery.

- **Microelectrode mapping:** A thin wire called a microelectrode is passed through brain structures including the target. This microelectrode is like a microphone, and it listens to individual neurons. The pattern of neuron activity is different between brain structures. Historically this has been the most widely used technique.
- **Beta-Band:** The DBS electrode can be used to listen for certain patterns and frequencies of activity. The beta-band signal is commonly found at the target region in many patients with PD. It is thought to be a neurophysiological signal of disease. DBS stimulation and medications appear to reduce this signal. The beta-band can be monitored in surgery, and new generation DBS generators are able to monitor this after surgery.
- **Macrostimulation:** Therapeutic stimulation through the DBS electrode can be performed in the operating room. The clinical effect on your disease condition such as tremor, slowness, and stiffness can be determined. This helps to confirm that the DBS electrode is in the correct location. Just as important is the measurement of DBS stimulation side effects, and at what stimulation intensity they occur. These side effects include paresthesia – a tingling sensation, dysarthria – slurred speech, and contractures – muscular pulling of the face or hand. If these side effects occur at too low of a stimulation intensity the DBS electrode may be moved. This is the purpose of the awake stage of the brain surgery.

Mechanical Guidance System

In every case, the surgeon uses a mechanical guidance device to place the DBS electrode. All of these devices attach to the skull and provide mechanical stability and accuracy. Historically DBS has been performed with a "frame." This is a halo device that is attached to the skull, and a system then fastens to the halo and guides the electrode. The frame is connected to the operating table to prevent the patient's head from moving.

At PNI, we instead use customized patient-specific plastic frames to guide the electrode. These systems are termed "frameless" because they do not use a halo, even though they still use a guidance system. This allows the patient's head to move during the procedure, as the guidance system will move with the head. This approach, which we take at PNI, allows for a shorter procedure as both leads can be implanted simultaneously, and has been shown to be as accurate as frame-based procedures.

Imaging

Imaging is playing a more crucial role in DBS surgery. New high-quality MRI scans are used for preoperative targeting.

Frequently Asked Questions About DBS Surgery

Q: What benefits can I expect from DBS? How long do the benefits last?

Every patient's response is different, of course, but on average tremor is reduced 70-80% in patients with essential tremor, and the benefits are sustained for many years. In patients with PD, clinical trials showed an increase of five hours of good response to medication ("on" time) per day, 70% reduction in tremor, and a 75% reduction in dyskinesia. These benefits remained for many years in long-term studies. However, PD is a progressive condition, so symptoms of advanced PD do occur as the years go by, including memory loss, cognitive decline, swallowing problems, and balance issues. These symptoms tend not to be responsive to levodopa, and thus are not responsive to DBS, but are caused by the disease, not the stimulation. DBS is not a cure.

Q: How can I prevent damage to the DBS system?

- Do not allow health care and wellness practitioners (e.g., massage therapists, chiropractors, osteopathic physicians) to treat your head or neck without consulting your health care team first.
- Read and be familiar with the information in the DBS patient manual.
- Don't use your chest to prop or hold things to free up a hand. Set down what you have in your hands if you need to free your hands for another task.

IMPORTANT

Always tell health and dental care providers that you have an implanted neurostimulation system and show them your identification card.

Q: What diagnostic tests can I have?

Always tell your health care providers that you have an implanted neurostimulation system before receiving any of the tests listed below.

- MRI can potentially cause injury to patients with an implanted neurostimulation system. Today's DBS systems are MRI safe, but with certain restrictions such as the type of imaging and the strength of the MRI magnet. We recommend connecting with the DBS company representative when you schedule your MRI, as they can perform the necessary steps to ensure the DBS is in "MRI safe mode" and return you to your settings after the scan.
- Computerized axial tomography (CT or CAT) scans, diagnostic X-rays, electrocardiograms (EKG), fluoroscopy, magnetoencephalography (MEG), and positron emission tomography (PET) are diagnostic tests that are unlikely to interfere with your DBS System. You may need to turn OFF your neurostimulator device before EKGs to keep them from interfering with the scan.
- Diagnostic ultrasound (such as carotid scan or Doppler studies) is unlikely to interfere with your DBS system. To be sure, tell the care provider to keep the transducer 6 inches (15 cm) away from the generator.
- Mammography or other X-rays requiring tight enclosure may damage the neurostimulator if it is pressed too tightly within the enclosure during the procedure. The connectors and extension also could be harmed. Be sure the care provider knows that you have an implanted neurostimulator and takes precautions to limit the pressure on the neurostimulator. Breast MRI or ultrasound may be considered in lieu of mammography if the position of the battery would interfere with mammography.

Q: Can I have diathermy?

Inform anyone treating you that you CANNOT have any shortwave diathermy, microwave diathermy, or therapeutic ultrasound diathermy (all now referred to as diathermy) anywhere on your body because you have an implanted neurostimulation system. Energy from diathermy can be transferred through your implanted system, can cause tissue damage and can result in severe injury or death. Diathermy can also damage parts of your neurostimulation system. This can result in loss of therapy from your neurostimulation system and may require additional surgery to remove or replace parts of your implanted device. Injury or damage can occur during diathermy treatment whether your neurostimulation system is "on" or "off."

Q: After DBS, can I have other types of surgery?

Yes, but notify your surgeon or dental professional depending on the location of the procedure. Your neurosurgeon may need to coordinate regarding surgical planning to avoid injury to the DBS system. Most importantly, unipolar or monopolar cautery should be avoided if possible. Bipolar cautery reduces the area for potential interference but should be used at minimal power settings and only intermittently.

Q: Can I have a pacemaker or an implantable cardioverter defibrillator (ICD)?

For many patients, having a pacemaker or an ICD along with their DBS system is possible. Care must be taken in the testing, placement, and programming of each device to make sure they do not interfere with one another. Because of the many possible combinations of devices and individual patient considerations, your health care team and cardiologist should discuss your situation.

Q: If I get cancer, can I have radiation therapy?

Yes, although care must be taken to protect the DBS System.

Take these precautions:

- Do not use radiation therapy in the vicinity of your neurostimulation system.
- If you require radiation therapy, your radiologist should place lead shielding over the neurostimulator system to help prevent damage.
- Your neurostimulator function and programmed parameters should be checked after each exposure to radiation therapy.

Q: Can I use a hyperbaric chamber?

Hyperbaric chamber therapy is not recommended with a pressure higher than 2.0 atmospheres absolute (ATA) or 29.4 pounds per square inch absolute (psia). Pressures above 2.0 ATA could damage the neurostimulator, which may require surgery to replace it. Discuss with your health care team how the physical effects of hyperbaric chamber therapy may affect you.

Q: Can I have lithotripsy (focused ultrasound or laser to break down stones)?

Nonessential lithotripsy is not recommended. If lithotripsy is essential, physicians should not direct or focus lithotripsy within 6 inches of the neurostimulator. Lithotripsy may damage the neurostimulator, which may require surgery to replace it.

Q: Can I use a transcutaneous electrical nerve stimulation (TENS) unit?

Your DBS system should not be affected by the therapy pulses from the TENS unit. However, because there are many different types of TENS units, and not all have been tested neurostimulators, you should use caution and notify your doctor if you feel that the TENS unit may be interfering with your neurostimulator.

Q: Can I use magnetic therapy products such as wrist and elbow wraps, mattresses, or blankets?

Magnetic therapy products are not recommended. Because a magnetic force cannot be seen, heard, or felt, your neurostimulator could turn from ON to OFF (or OFF to ON) unexpectedly. If you choose to use these products anyway, the magnetic therapy should be kept at least 10 inches from the neurostimulator. Most magnets placed 10 or more inches from the neurostimulator would not be strong enough to activate it. However, magnetic mattresses, blankets, and wrist or elbow wraps would normally be in close contact with the neurostimulator and should not be used. Discuss magnetic therapy products with your health care team before trying them.

Q: Can I use everyday household appliances?

Most of the electrical devices people are around on a normal day will not harm the DBS System. This includes household appliances, microwaves, computers, office machines, cellular phones, and personal radios. If the neurostimulator comes within centimeters (inches) of small permanent magnets (such as stereo speakers, radio, telephones, magnet therapy products, shoe magnets, and magnets that hold the refrigerator door closed) the neurostimulator could be turned ON or OFF.

Q: Can I drive an automobile while the neurostimulator is on?

That depends on the nature of your symptoms and how you respond to DBS therapy. You should avoid activities that could be unsafe to you or others should your symptoms return. Talk with your loved ones and your health care team.

Q: Can I fly and should I be concerned about long-duration airplane flights?

Yes, you can fly, but you cannot pilot your own airplane. Commercial flight is safe. The air pressure in commercial aircraft does not reach levels that are dangerous to your DBS System.

Q: What about airport security gates and metal detectors?

It is best to avoid airport security gates and theft detector/security systems in department stores, pharmacies, shops, libraries, etc. When approaching theft detectors or security gates, show the neurostimulator identification card and multilingual airport/security card to security personnel and ask that a hand search be done to bypass the security device.

If you must pass through the security device, follow these steps:

1. Request a backscatter X-ray device as these are unlikely to affect the neurostimulator device.

2. Approach the center of the device and walk normally. If two security gates are present, walk through the middle, keeping as far away as possible from each gate. If one gate is present, walk as far away as possible from it. Note: Some theft detectors may not be visible.

3. Proceed through the security device. Do not linger near the device.

4. If you suspect that your neurostimulator was turned off, make sure someone is able to turn on your system again. (The person could be you, if your medical condition allows it. Or, it could be someone who has been taught how to use the system.)

Q: How much of my hair will be shaved?

Generally, there are two 2" strips of hair shaved for the lead placement when done bilaterally, plus a 2" strip behind one ear. If there is chest hair, a small patch may need to be shaved for the IPG placement.

Q: Can I go in a hot tub, steam room, or sauna?

Using hot tubs, steam rooms, or saunas is not recommended because they expose your DBS System to higher than normal heat levels.

Q: Can I use a tanning bed?

Using tanning beds is not recommended because they may expose your DBS System to higher than normal levels of energy through your skin.

Q: Can I scuba dive?

Scuba diving below 33 feet (10 meters) of seawater (2.0 atmospheres absolute or 29.4 pounds per square inch absolute) is not recommended. Your neurostimulator will operate normally down to 33 feet of seawater. Neurostimulators begin to deform at depths greater than 33 feet of seawater. Damage to the neurostimulator may require surgery to replace it. Discuss scuba diving with your health care team because there may be health and safety concerns other than possible damage to your neurostimulator.

Q: Can I skydive?

We do not recommend skydiving. While high altitudes should not affect the neurostimulator, the extreme sport of skydiving involves movement and impact that could easily damage your DBS System.

Q: What about other high-altitude activities such as skiing or hiking in the mountains?

High altitudes are unlikely to affect the neurostimulator, but falls and sudden jerks, twists, or stretches could damage your DBS System. Discuss these activities with your health care team before trying them.

Q: Can I be near an electric substation or carrier lines?

Electric power lines, substations, and power transformers should not cause interactions with your neurostimulator system if you stay outside the protective fencing around these installations.

Q: Can I work on an automobile?

Automobiles do not produce strong enough EMI fields to affect DBS therapy. But if you experience any discomfort or problems near your implant while working on an automobile, discontinue the work immediately and call your health care team to have the device checked. Be careful while working on an automobile because excessive or repetitive bending, twisting, or stretching can dislodge or fracture the lead resulting in a change in the intensity of your stimulation.

Q: Can I arc weld?

No. Arc welding is potentially dangerous for patients implanted with DBS systems.

Q: Can I be around industrial equipment?

Your DBS system may turn ON or OFF if exposed to the high amounts of electromagnetic interference commonly found in industrial equipment.

The device could reset to factory settings if interference is too high. As a result, the device will not deliver any stimulation even when turned ON because the amplitude limit will be reset to zero. If this occurs, the device will need to be reprogrammed by your health care team.

Q: Can I use power tools?

Most power tool motors create a weak electrical field. Those that operate from DC electrical power, use batteries, or have permanent magnets may trigger the ON/OFF switch when brought close to the neurostimulator. If you must use power tools, be sure to keep them away from your neurostimulator and check the status of your neurostimulator when you have finished to be sure it is functioning properly.

Q: Do I need to take my medication on the day of DBS surgery?

For the fiducial or cranial markers placement, please do take your usual medications that have been prescribed for your Parkinson's, tremor, or dystonia, with a small sip of water prior to your procedure. For the DBS lead placement, we ask that you do not take your medications for Parkinson's, tremor, or dystonia the morning of the surgery. For the DBS pulse generator placement, please do take your usual medications for Parkinson's, tremor, or dystonia, with a small sip of water prior to your surgery.

Other Medications

The use of other medications prior to surgery, such as those for high blood pressure, heart disease, diabetes, or hormonal therapy, should be discussed with your DBS medical team. They are often continued prior to your anesthesia.

Blood-thinning medications such as aspirin, clopidogrel (Plavix), warfarin (Coumadin), and apixaban (Eliquis), will need to be discussed with your medical team. Vitamins C & E, herbal medications such as ginseng, ginkgo biloba, garlic, turmeric, and Saint John's wort can affect bleeding. We recommend all herbal medications and supplements be stopped SEVEN days prior to surgery. Non-steroidal anti-inflammatory drugs (NSAIDs) should be stopped seven days prior to surgery. Your neurosurgeon will notify you when to restart these medications.



Meet the Team

JEAN-PHILIPPE LANGEVIN, MD

DIRECTOR, RESTORATIVE NEUROSURGERY

Dr. Langevin has extensive experience treating patients at the Restorative Neurosurgery and Deep Brain Stimulation Program at the Pacific Movement Disorders Center. He specializes in the compassionate care and surgical treatment of Parkinson's disease, essential tremor, dystonia, PTSD, epilepsy, and OCD. He employs a variety of advanced treatment modalities including frameless deep brain stimulation. He is the first Providence neurosurgeon to implant the breakthrough Percept™ PC with BrainSense™ technology DBS system. He sees patients in Santa Monica and Torrance. *pacificneuro.org/langevin*

MELITA PETROSSIAN, MD

DIRECTOR, MOVEMENT DISORDERS CENTER

Dr. Petrossian's expertise is in the comprehensive care, treatment, and management of patients with movement disorders including Parkinson's disease, essential tremor, dystonia, gait disorders, ataxia, myoclonus, tics, and Tourette's syndrome. In addition, she uses leading-edge therapies such as botulinum toxin (Botox®) injection for spasticity, blepharospasm, hemifacial spasm, and dystonia; and DBS programming for PD, essential tremor, and dystonia. She sees patients in Santa Monica. *pacificneuro.org/petrossian*

NATALIE DIAZ, MD

MOVEMENT DISORDERS NEUROLOGIST

Dr. Diaz is a board-certified neurologist and fellowship-trained specialist in movement disorders. Her clinical practice focuses on the evaluation and management of patients with Parkinson's disease, atypical parkinsonian disorders, Huntington's disease, dystonia, and ataxia. She also has specialized training in the evaluation and programming of deep brain stimulation as a treatment for Parkinson's disease, essential tremor, and dystonia as well as the therapeutic administration of botulinum toxin injections for non-cosmetic indications such as focal dystonia, hemifacial spasm, and limb spasticity. She sees patients in Torrance. *pacificneuro.org/diaz*

GISELLE TAMULA, MSN, NP-C

NURSE PRACTITIONER
MOVEMENT DISORDERS CENTER

Giselle Tamula is a certified nurse practitioner with extensive clinical experience. She brings her competent and compassionate care of patients to the Pacific Movement Disorders Center. She runs the Life In Motion Parkinson's support group for Parkinson's disease patients and their families, and she helps to moderate the Parkinson's Roadmap for Education and Support Services (PRESS) program, as well as the monthly Everything Parkinson's webinar series. She has specialized training in programming deep brain stimulation for tremor and PD. *pacificneuro.org/tamula*

SHEILA MOORE, MSG, LCSW

SOCIAL WORKER,
MOVEMENT DISORDERS CENTER

Sheila Moore is a licensed clinical social worker (LCSW) and has worked in the field since 1988. She is part of the multidisciplinary team providing psychosocial services in a patient-centered care environment at Pacific Brain Health Center. She is the Information and Referral Coordinator for the American Parkinson Disease Association (APDA), and connects people with Parkinson's disease and their care partners with community resources. *pacificneuro.org/moore*

ANGELICA DE JESUS, BSN, RN

MOVEMENT DISORDERS CENTER

Angelica DeJesus is a registered nurse and the newest member of our team. She has more than 10 years of experience working in multidisciplinary teams caring for patients with chronic conditions. Since joining our team she has been instrumental in the coordination of care before and between clinical visits, maintaining flow in the clinic, preparing patients for scheduled procedures such as botulinum toxin injections and DBS as well as in educating patients about their condition and treatments.

Important Dates

MRI of the brain

_____

Neuropsychological testing

_____

Pre-operative medical clearance

_____

Stage 1

_____

Stage 2

_____

Stage 3

_____

Follow-up with DBS surgeon

_____

Follow-up for first programming

_____

Questions for the DBS Team

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