What is Deep Brain Stimulation (DBS)?

Deep Brain Stimulation (DBS) is a therapy that is used primarily to treat movement disorders such as Parkinson’s disease and essential tremor.

The DBS device works somewhat like a “pacemaker” for the brain to help control abnormal movements such as tremor, stiffness, and slowness of movement. The device uses electrical stimulation through a small electrode implanted in the brain. The stimulation helps diminish abnormal electrical activity in specific locations in brain. Stimulation of these areas improves muscle movements.

Deep brain stimulation cannot cure movement disorders but it has been shown to provide profound quality of life improvement for appropriately selected and managed patients.

Who should get Deep Brain Stimulation (DBS)?

Careful consideration of who is a good candidate for DBS surgery is a crucial step for successful therapy. While DBS implantation surgery is physically a relatively small procedure, patients need to be healthy enough to tolerate general anesthesia and the recovery process. Serious health conditions such as uncontrolled diabetes, heart disease or lung impairment can be reasons not to consider DBS surgery.

Parkinson’s Disease

Parkinson’s disease is a slowly progressive neurologic condition that causes difficulties with movement and coordination. The cardinal symptoms of Parkinson’s disease are resting tremor, slowness of movement (bradykinesia), muscle stiffness (rigidity), and difficulties with gait and balance. Most patients will have a profound response to medication (levodopa). Over time, however, symptoms progress and medication side effects can cause significant disability.

Patients with Parkinson’s disease can have a dramatic improvement in their quality of life from DBS therapy, but it is important to identify which patients are good candidates and which symptoms are likely to improve. Characteristics of individuals with Parkinson’s disease who might be good candidate for DBS therapy include:

- Individuals with clear “idiopathic” Parkinson’s disease and not one of the atypical forms such as Lewy body dementia, progressive supranuclear palsy, multiple systems atrophy or corticobasal degeneration
- Individuals with symptoms that clearly respond to levodopa, but have refractory symptoms in spite of good medication management (including wearing off times, bothersome dyskinesias or medication side effects)
- Individuals without severe cognitive deficits or significant depression
**How do I know if I am a good candidate?**

We work with a multi-disciplinary group of neurologists, neuropsychologists and physical therapists to determine if DBS therapy might be appropriate. Each patient receives a formal neuropsychological evaluation to ensure they have a good cognitive baseline before moving through with surgery (studies have shown that patients with significant dementia or memory problems do not obtain good quality of life benefits from DBS surgery). We also have patients meet with a physical therapist to document how their symptoms respond to levodopa prior to surgery (formal “on-off” testing). Dopamine responsiveness is one indication that DBS therapy should be beneficial.

**What can I expect after DBS surgery?**

It is important to remember that DBS will not cure Parkinson’s disease. However, DBS can significantly reduce the daily burden of movement symptoms. DBS therapy is particularly helpful for patients that fluctuate rapidly between their “ON” times with levodopa (improved slowness, stiffness, tremor) and “OFF” times. Most patients see an average improvement of 6 more hours of “ON” time per day with DBS. It can also be helpful for patients with tremor related to Parkinson’s disease, even tremor that does not fully respond to typical Parkinson’s disease medications.

Deep brain stimulation, in general, cannot improve movement symptoms beyond the best “ON” time produced with medications. The benefit, however, is that this ON time will be much more consistent throughout the day and the “ON” / “OFF” fluctuations will much less dramatic.

DBS does not treat all symptoms of Parkinson’s disease. For example, if a patient’s walking is poor both on levodopa and off levodopa it will not improve with DBS. Certain symptoms such as speech and balance can even worsen slightly after DBS.

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<thead>
<tr>
<th>Symptoms</th>
<th>Expected to Improve</th>
<th>Generally does not Improve</th>
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<tbody>
<tr>
<td>Tremor</td>
<td>+++</td>
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<tr>
<td>Slowness (Bradykinesia)</td>
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<td>Stiffness (Rigidity)</td>
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<td>Dyskinesia</td>
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<tr>
<td>Fluctuations between ON and OFF</td>
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<tr>
<td>Speech</td>
<td>X</td>
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<td>Swallowing</td>
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<td>Handwriting</td>
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<tr>
<td>Freezing of Gait</td>
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<td>Balance</td>
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Essential Tremor

Essential Tremor is the most common adult movement disorder, affecting nearly 10 million people in the United States. Unfortunately, many of the medications used to treat essential tremor only modestly improve the tremor and the side effects from these medications can be difficult to tolerate. These medication limitations leave many patients suffering with debilitating tremors that effect their ability to do normal tasks of living such as eating, drinking or writing.

Deep brain stimulation for essential tremor has been shown to be quite effective, with studies showing reduction of tremor of ~60-70% in most patients with DBS in the thalamic area (VIM)\(^1\). Patients with both postural (holding the hands out in a fixed position) and action (tremor with tasks) hand tremors improve with stimulation. Some patients can even achieve improvements in voice and head tremors. DBS does not cure essential tremor and tremor can progress over time.


How do I know if I am a good candidate?

Good candidates for DBS therapy are those individuals who are experiencing significant interference in their life with tasks such as handwriting, eating, drinking, hygiene, etc. Medications, including beta-blockers and primidone, need to be tried before considering surgery.

To help ensure we are offering DBS to patients that are most likely to have benefit, we work with a team of multidisciplinary specialists including neurologists, neuropsychologists and physical therapists. We recommend a formal neuropsychological evaluation prior to surgery as we don’t recommend DBS surgery in patients with dementia or severe cognitive concerns. We may recommend a formal physical therapy consultation as well, if there are concerns about balance difficulties.
Frequently Asked Questions:

How is the surgery done?

We perform deep brain stimulation in a staged (two-step) process:

- Placement of the electrode(s) into the brain
- Placement of the lead extender(s) that are under the skin and connected to a battery pack under the skin below the clavicle (collarbone)

The first surgery where the electrodes are placed into the brain sometimes requires real-time feedback from the patient and patients are therefore awake during certain parts of the operation. Sometimes the procedure can be performed completely under general anesthesia. Doctor House will discuss with you what is the best approach for your particular situation.

Patients come to the hospital the morning of their procedure and a head CT is performed (x-ray of the head). This brain imaging study is then used in combination with a previous brain MRI to help calculate the exact desired electrode position.

Patients are then brought to the operating room and given a sedating medication through an IV. Sedation allows the surgeon to safely position the patient’s head and completely anesthetize the skin. A small strip of hair is shaved, and the area is cleaned and draped. After the scalp is completely numb, an incision is made on top of the head behind the hairline. A small (nickel-sized) hole is made in the skull while the patient is still sedated. If both sides of the brain are being implanted these bur holes are created on both sides before the patient is brought out of sedation.

To increase the accuracy of electrode positioning, a technique called microelectrode-recording (MER) is also sometimes used. The activity of individual brain cells is noted and used to map the underlying brain anatomy. Patients are gradually woken up and may hear the recordings during this time.

The DBS lead is then placed, and further testing is used to confirm good location. Patients are awake enough to cooperate with simple tasks such as finger tapping, handwriting, and speaking. Although we are looking for benefit to motor symptoms (such as muscle stiffness or tremor reduction), we also focus on testing for stimulation induced side effects. We test this by turning the stimulation up higher than normally used and look for effects such as tingling in the face, arm or leg, slurred speech, facial tightness or vision changes. These effects are not painful and are immediately reversible.

Once the lead location appears to have good effect without limiting side effects then sedation is resumed, and the lead is fixed to the skull with a plastic cap. This cap secures the lead so it does
not move over time. The scalp incision is closed with staples that are removed about 2 weeks later. The wires that connect the DBS lead are coiled under the skin above the ear.

Most patients stay in the hospital one or two nights following this first surgery and are up and walking the same day.

The second surgery is done about 2 weeks after the first surgery and is typically done as a same-day (or “outpatient”) procedure. Patients come in the morning of their procedure and are placed under general anesthesia. The DBS wires that were previously coiled under the scalp are now tunneled under the skin and run down to below the clavicle (collarbone). Here a small pocket is opened and a battery pack is placed. The DBS leads are connected and the system is checked to ensure all the electrical circuits are working well. The pocket is closed with dissolvable sutures with surgical glue. Patients are woken up and typically go home that afternoon.

About two weeks after the second surgery (now four weeks out from the first surgery), patients return to their neurologist for programming of the device. Typically, during the first few months of programming patients return for small adjustments to fine-tune the settings.

**What are the risks of DBS surgery?**

The most common side effect following deep brain stimulation surgery is post-operative headache and chest pain following the battery placement. Rarer, but more serious complications include infection of the leads, extension wires or battery and hemorrhage (bleeding) within the brain. The rates of these serious side effects are dependent upon the surgeon and facility.

Doctor House is the only fellowship trained functional neurosurgeon in the Intermountain West. He has personally performed hundreds of deep brain stimulator surgeries.

**For more information:**

If you have any questions or would like a consultation to see if you are a candidate for deep brain stimulation, please contact our office at (801) 507-9555.