Deep brain stimulation for Parkinson’s disease (PD)

Indications

Parkinson’s disease (PD) is a common movement disorder. The four major findings in PD are: (1) tremor; (2) rigidity; (3) bradykinesia (slowness in movements and gait); and (4) postural instability (trouble with balance and posture). Each patient differs in the severity of each component of PD, and the pace of clinical progression of the disease.

For patients with early PD, levodopa (Sinemet) and other medications are usually effective; however, as PD progresses medication can lose effectiveness or produce disabling side effects. For example, “dyskinesias” are abnormal involuntary movements that can cause the limbs and body to writhe or jump. In addition, the PD medication may no longer work as long as it once did. This can lead to “on-off fluctuations”, a condition in which the ability to control movement changes unpredictably between a mobile (“on”) and an immobile (“off”) state. When patients no longer have an acceptable quality of life due to these shortcomings of medical therapy, deep brain stimulation (DBS) should be considered.

Surgery description and risks

DBS involves placement of a thin metal electrode into a specific target in the brain. The primary targets for PD are either the STN (subthalamic nucleus) or GPi (globus pallidus internus), which are small clusters of nerve cells important for the control of movement. Before the operation, the patient undergoes a specialized “DBS protocol” brain MRI which is then loaded into an intraoperative workstation prior to the procedure. During the operation, the patient is placed under “conscious sedation” with intravenous medication (propofol) and copious local anesthetic is placed. A “stereotactic” head frame is placed which allows extremely precise positioning of the electrode at the brain target. A small opening is made and the electrode is placed to the target. The patient is then awakened during the procedure to test the effect of the electrode on his/her symptoms (such as tremor and rigidity). During testing, the patient is awake and comfortable in a reclined posture. The final electrode position is adjusted to reduce or eliminate the symptoms with no side effects. We get a post-procedural scan to document proper electrode location. The patient is put back to sleep for closure. A sterile dressing is applied. The patient then is monitored overnight in the ICU and is discharged the following morning.

In cases of bilateral (two-sided) DBS, this procedure is repeated one week later on the other side. In cases of unilateral (one-sided) DBS, only one electrode is placed. The right brain controls the left body, the left brain controls the right body, and each DBS procedure is individualized based on the patient’s location and severity of symptoms.

One week after electrode implantation, a separate procedure is performed to implant the DBS battery (“implantable pulse generator”) under the skin of the upper chest. This
procedure is done with the patient completely asleep (under general anesthesia). During this procedure, the DBS electrode(s) are connected via an extension wire (“lead extender”) underneath the skin to the DBS battery. Impedance testing is performed to verify excellent connection from the DBS electrode(s) to the battery. The incisions are closed and dressings are applied.

Postoperative care and outcome

Copious local anesthetic is placed at the end of each procedure to minimize pain and discomfort. After both the DBS electrode and the battery procedures, the patient may shower immediately from the neck down. We ask that the patient sponge bathes the head for two weeks until the cranial incision(s) are fully healed. During the postoperative visit two weeks after surgery, incisions are checked and sutures are removed. DBS settings are adjusted during a routine office visit to the patient’s neurologist to eliminate symptoms while minimizing side effects such as tingling or slurred speech. The neurologist will start to reduce PD medications as well once the DBS is working. Physical therapy is also helpful to optimize outcome after DBS.

DBS for PD is extremely effective at improving movement. DBS eliminates the “on-off fluctuations” and provides better function during more of the day. DBS usually allows reduction in PD medications, thus reducing drug side effects. The benefits of DBS persist indefinitely. Since PD itself is a progressive disease and thus a “moving target”, periodic reprogramming of the DBS is required in the neurologist’s office. Replacement of the DBS battery is performed when necessary as a simple outpatient procedure.