Deep brain stimulation for essential tremor (ET)

Indications

Essential tremor (ET) is a common movement disorder. In most cases, ET is a slowly progressive condition that causes ET patients to develop significant problems with their normal daily functions such as eating, writing, self-care and driving. Severely affected patients are unable to feed or dress themselves. ET tremor is typically a “kinetic” or “action” tremor, meaning that the tremor is greatly increased with movement. First-line therapy for ET with medical treatment with drugs such as primidone and propranolol. However, these drugs often do not work and can cause side effects such as fatigue. Deep brain stimulation (DBS) for ET was FDA-approved in 1999. DBS is indicated for patients with ET who have significant difficulty with activities of daily living due to their tremor and for whom medications have not been effective.

Surgery description and risks

DBS involves placement of a thin metal electrode into a specific target in the brain. The primary target for ET is the thalamus, which is a large, oval cluster of nerve cells important for many functions including 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 tremor. During testing, the patient is awake and comfortable in a reclined posture. The final electrode position is adjusted to reduce or eliminate the tremor 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 tremor.

One week after electrode implantation, there is a separate procedure performed to implant the DBS battery (“implantable pulse generator”) under the skin of the upper chest. This procedure is performed 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 tremor while minimizing side effects such as tingling or slurred speech. Physical therapy is also helpful to optimize outcome after DBS.

DBS for ET is extremely effective at reducing tremor and improving quality of life. The success rate of tremor reduction or elimination is 75-90%. As a result, daily activities such as writing, eating, and dressing are improved significantly. The benefits of DBS persist indefinitely. Replacement of the DBS battery is performed when necessary as a simple outpatient procedure.