

# **SURGICAL THERAPIES FOR PARKINSON'S DISEASE**

Julie H. Carter, R.N., M.S., A.N.P.

Cathi A. Thomas, R.N., M.S.

After many years of medication therapy, some patients may have marked fluctuations in their motor response or severe dyskinesia. For these people, it may be time to consider one of the surgical therapies. There are three types of surgical procedures currently available. *Ablative* procedures (i.e., pallidotomy and thalamotomy) destroy a specific part of the brain to improve function. The other two surgical procedures either 1) *implant* stimulation electrodes which can be programmed to stimulate a specific area of the brain, or 2) *transplant* dopamine-producing cells into areas of the brain that are depleted of dopamine.

All of the available surgeries have advantages and disadvantages, and not all people with Parkinson's disease are appropriate candidates for surgery. It is important that a neurologist experienced in following patients who have had surgical therapies evaluate the potential surgical patient and decide if the benefit of a surgical therapy outweighs the risks. The decision on which type of surgery to perform should be based on several important factors which include the specific symptoms that are most troublesome, the patient's age, and the existence of other symptoms such as thinking problems which may become worse by performing the surgery. The neurologist will work closely with the neurosurgeon who will actually perform the surgery, and following the surgery, the neurologist will continue to manage the ongoing care of the patient.

## **PALLIDOTOMY AND THALAMOTOMY**

### **PALLIDOTOMY**

In Pallidotomy a lesion is made in the part of the brain called the globus pallidus. The destruction of cells in this area may also cause some improvement in the symptoms of rigidity, bradykinesia, and tremor. Pallidotomy can be very effective in decreasing dyskinesia, the involuntary movements associated with too much dopaminergic effect.

Pallidotomy is usually performed on one side of the brain to improve symptoms on the opposite side of the body. For example, a pallidotomy performed on the right side of the brain will lead to a greater relief of symptoms occurring on the left side of the body. During presurgical evaluation, motor tests are done to determine which side of the brain should be lesioned to yield the best results.

Candidates for pallidotomy include patients who have demonstrated a good response to levodopa but are bothered by disabling dyskinesia, as well as patients with motor fluctuations who do not want or are not appropriate candidates for implanted stimulation devices (DBS). Patients should be otherwise healthy and should not have any problems with memory or thinking.

Although pallidotomy has been extensively performed with little side effects, there are risks associated with this procedure as well as any other neurosurgical procedure. There is a two percent risk of stroke or small hemorrhage. Because the brain structures known as the optic tract and internal capsule are located near the pallidum, there is a risk of damage to these structures.

include visually problem

electrode. Many centers will also perform electrical recordings to assist in electrode placement. Once the electrode is in the proper location it is then heated to destroy the cells nearby resulting in the desired lesion.

It is important to note that although the patient is awake during the procedure, pain is minimal and related mainly to the small incision made in the scalp. This pain is essentially prevented by the local application of an anesthetic. The brain tissue itself does not have specific nerves that signal pain.

Patients often experience benefit from the surgery immediately. However, additional time is needed for careful assessment of motor improvements to fine-tune the patient's medications and to optimize final results.

## **THALAMOTOMY**

In thalamotomy, a lesion is made in the brain structure known as the thalamus. Like pallidotomy the lesion is permanent. Patients are candidates for thalamotomy if they experience significant tremor that is disabling and not improved with medication.

Thalamotomy is performed on one side of the brain offering relief of tremor on the opposite side of the body. Thalamotomy is not done on both sides of the brain due to the significant risk of speech and swallowing difficulty. In fact, thalamotomy is more rarely performed than pallidotomy.

Side effects of thalamotomy include a 2-3 percent risk of hemorrhage. Some patients experience parasthesias or tingling sensations of the fingers and mouth, but these generally subside over months.

Although thalamotomy can produce long-term tremor suppression, the other symptoms of Parkinson's disease continue to progress.

## **DEEP BRAIN STIMULATION (DBS)**

In deep brain stimulation, electrodes are permanently implanted in specific areas of the brain and hooked to an electrical generator that is implanted under the skin of the chest or abdomen. A rapid electrical impulse is delivered to the designated area of the brain, which inactivates cells in the area of the electrode. The difference

between DBS and pallidotomy or thalamotomy is that it is reversible. When the stimulator is turned off, the brain cells return to their normal function. Three anatomical areas of the brain are currently chosen, depending on which symptoms need to be treated. If tremor is the major disabling symptom, an electrode is placed in the thalamus. If slowness, stiffness or dyskinesia are the major disabilities, the electrodes are placed in the subthalamic nucleus (STN) or globus pallidus (GPI). Debate continues regarding which of these two sites provides the most benefit. It may also be that one site is better for the management of slowness and stiffness and the other site better for dyskinesia.

An advantage of DBS is that electrodes can be implanted on both sides of the brain because the impulse can be adjusted to produce the best results and minimize side effects. In spite of this major advantage, there are some potential disadvantages; cost, frequent visits to adjust the stimulators, battery changes every 2-5 years, replacement of broken wires, and some potential permanent side effects from implanting the electrode.

Although much hope has been created with the advent of DBS there are still many unanswered questions. A careful scientific comparison of benefits and risks between GPI and STN is still being studied. Both anatomical sites have shown clear benefit. Another important but unanswered question is if DBS alters the response to levodopa. This becomes an important question since most patients continue to need at least some of their medication after the surgery is performed. Because there are so many unanswered questions this procedure should only be done when all medication options have been exhausted. Currently, it is felt that DBS is best done in people with severe dyskinesia, major motor fluctuations or “on/off” phenomena. People who have dementia, freezing, or significant falling and walking problems are not considered good candidates for this surgery.

## **TRANSPLANTATION**

Transplantation surgery in Parkinson’s disease is currently being studied in major centers. It is considered experimental and the understanding of its risks and benefits evolves as new information is obtained. The goal of transplantation surgery is to implant neurons (nerve cells) that are capable of producing dopamine. The neurons that are transplanted are fetal, that is, they are taken from brain tissue in developing embryos. Currently the source of cells are human fetal cells. These fetal cells have been shown to survive and proliferate. The benefit of this in terms of improved motor function is still in question.

Limitations to widespread development of this therapy are many. They include issues involving the source(s) of the transplanted cells. Transplanting any living tissue from one living thing to another carries the basic and essentially similar risks that the cells will be rejected by the “new” host or might carry an infection into the new host. Any patient receiving transplanted cells, regardless of the source, must have their immune systems suppressed to potentially avoid rejection. This usually involves the long-term use of immunosuppressive medications.

The potential benefit of transplant therapies continues to draw more research aimed at avoiding or preventing limitations mentioned above.