Deep Brain Stimulation
Parkinson's Disease

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Parkinson's Disease also known as PD is the second most common degenerative disease that affects the central nervous system throughout the world over the age of 55. It affects approximately 1 in every 250 people over the age of 40, and around 1 in every 100 people over the age of 65. There are as many as 50,000 new cases each year.

Parkinson Disease is progressive neurodegenerative disorder of the central nervous system that most often impairs motor skills and speech. PD belongs to group of conditions called movement disorders. It is characterized by dystonia (tremors and muscle rigidity), slowing of physical movement and in some cases loss of physical movement. Some others effects of PD are dyskinesia, dysphagia (trouble swallowing), depression, cognitive dysfunction, speech problems, and fatigue. PD symptoms have been known since the ancient times. In 1817, the symptoms were documented in *An Essay on the Shaking Palsy* by a British physician James Parkinson. At that time PD was known as paralysis agitans but the term 'Parkinson's Diseases' was coined by Jean-Martin Charcot.

The cause of PD is not truly known, researchers believe that it comes from a defected area deep inside the brain called the basal ganglia. Those nerve cells in the basal ganglia are responsible for the smooth and coordinated movements. The basal ganglia send a signal and transmit a message using the chemical neurotransmitters (dopamine in this case) which is produced in the dopaminergic neurons of the brain. PD occurs when the insufficient formation and action of dopamine decreases the stimulation of the motor cortex by the basal ganglia which then lead to the deterioration of the signals that control the muscle movements. Also, it is believed that the nerve cells can die or become damaged by trauma, infection, toxins found in the environment, or drugs that treat psychosis. Also, for PD there is still no definite genetic link that has been identified. Currently, there are no blood or laboratory tests that have proven to help in diagnosing PD. As a result the diagnosis is based on medical history and a neurological examination.

There is no cure for PD at this time, but with proper treatment, patients with PD can lead a full and productive life. Deep Brain Stimulation (DBS) has become a popular treatment for people with advanced Parkinson's disease. Before DBS surgery, neurosurgeon uses magnetic resonance imaging (MRI) or computed tomography (CT) scanning to identify and locate the exact target within the brain where electrical nerve signals generate the PD symptoms. The DBS system consists of 3 components. The lead or electrode is a thin insulated wire that is inserted through a small opening in the skull and implanted in the blain. The tip of the electrode is positioned within the targeted brain area. The second component is the extension which is an insulated wire that is passed under the skin of the head, neck, and shoulders. This extension connects the lead to the neurostimulator. The last component is the neurostimulator, also known as the battery pack. This is usually implanted under the skin near the collarbone either at the time of the electrode implantation or later which the patient will be under general anesthesia for that part of the procedure. Once the system is in the right place, the electrical impulses are sent from the neurostimulator up to the extension wire and then to the lead and into the brain. The programming of the DBS is easy and painless.

Patients are awake during surgery to allow the surgeon to asses their brain functions. The patient does not feel any pain while the electrode is being advanced through the brain due the human's brains and its inability to generate pain signals. When the skull is being opened a local anesthetic is being administered. Most DBS patients are hospitalized for about three days. The neurostimulator is then turned on for the first time within a few weeks after implantation and can be adjusted as patient's condition changes over time. Also, the battery life is approximately three to seven years. The battery can be changed using local anesthesia in an outpatient procedure that takes only about 15 minutes.

The electrode works by emitting pulses of energy to block the abnormal activity in the brain, which can cause the effects of PD. The success of the surgery is directly related to finding the specific area in the brain for stimulation. DBS surgery is amazingly safe and effective although not completely without risk. On average DBS doubles the amount of "on-time" without dyskinesia for patients with PD, which means patients are mobile and can perform everyday tasks. Also, DBS has shown 50% improvement in their walking and balance, 80% reduction in involuntary movement, decrease in medications.

As with any surgery there are risks involved. There is a 2-3% chance of brain hemorrhage that can cause paralysis, stroke, or other major problems. There is also a 15% chance of a minor/temporary problem. Also, rarely infections occur, while treatment of an infection may require removal of electrode most infections don't cause lasting damage. Generally the electrode and electrical systems are tolerated with no significant changes in brain tissue.

The FDA in January 2002 approved of DBS for treatment of PD. This surgery costs $50,000-$60,000 per patient but usually FDA approved procedure are covered by Medicare. Yet, not all states may allow this but most insurance companies cover the costs of DBS surgery as well. Overall, for advance Parkinson's Disease patients, Deep Brain Stimulation is a great option to have.

References:

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