MEDICAL INNOVATION: DEEP BRAIN STIMULATION (MEDICAL DEVICE: THERAPEUTIC)

Physician: Jean-Louis Benabid
Industry: Medtronic

Situation

Providing hope for Parkinson's patients

If you or someone you know has Parkinson's disease (PD) – a disorder of the brain that leads to shaking (tremors) and difficulty with walking, movement, and coordination – you are not alone. In the United States, 50-60,000 new cases of Parkinson's are diagnosed each year, adding to the one million people who currently have the disease. It is estimated that four to six million people around the world suffer from the condition.

Parkinson's disease has no known cure; instead the goal of current treatment is to control symptoms of the disease. Until recently, medication was the principal way to control symptoms, mostly by increasing levels of dopamine in the brain. However, at certain points during the day, the helpful effects of the medication often wear off, and symptoms can return.

Also, many Parkinson's medications cause severe side effects, including hallucinations, nausea, vomiting, diarrhea, and delirium, and, over time, symptoms may continue to worsen and stop responding well to drug treatment. And the medications can cost $2,500 per year, per patient.

Physician-Industry Collaboration

A "Eureka" moment

Close to a decade ago, Parkinson's sufferers were given new hope, when a therapy known as Deep Brain Stimulation, or DBS therapy, received FDA approval for the treatment of PD symptoms. DBS therapy represents one of the best stories of a medical discovery that led to a unique physician-industry collaboration that benefits patients suffering from a range of neurological diseases, including Parkinson's, Essential Tremor, dystonia and obsessive-compulsive disorder.

In the 1980s, French neurosurgeon Alim-Louis Benabid and neurologist Professor Pierre Pollack were treating patients for essential tremor, a movement disorder that causes a rhythmic, debilitating trembling of the hands. The treatment involved ablating (destroying) the section of the brain that caused the tremors. To find the exact spot to ablate, the surgeons would stimulate various parts of the brain. When the tremors stopped, they knew they had located the correct place.

Professor Benabid described his *Eureka* moment: "I made a serendipitous discovery one day. I was checking by electrical stimulation for the right site to make a lesion, and as I observed the tremors abruptly stop, I realized this could be a new method of treating tremors." In other words, the stimulation could become the therapy itself, not just a tool for identifying locations in the brain.

Shortly thereafter the doctors sought input from a team at Medtronic, Inc., and together they pioneered the world's first DBS system, using thin lead wires with small electrodes that are carefully placed in specific targets within the brain to deliver mild electrical pulses to counteract

or block improper activity in the brain that causes symptoms like tremors. The electrodes are connected to a pacemaker-like device called a neurostimulator that is implanted under the patient's collarbone.

Innovation Benefits

A cost-effective treatment for a range of diseases

DBS has emerged as an innovative and cost-effective treatment for Parkinson's symptoms and other neurological diseases. A recent clinical trial found that a year after implant, DBS increased "on-time" – periods of good motor function and symptom relief – by an average of more than six hours per day in Parkinson's patients. Many patients realize benefits immediately, at a cost of approximately $25,000 per surgery – compared to $2,500 a year for medications that bring with them a host of unwelcome side-effects.

And, although it was first used to treat movement disorders, Medtronic has since developed DBS therapy to treat severe obsessive-compulsive disorder (OCD), and is exploring DBS therapy to treat epilepsy and other psychiatric conditions such as depression.

Patient Benefits

Back in action for the benefit of patients

At age 39, Dr. David H. was on top of the world – a successful neurologist with a wonderful wife and two sons. He never guessed that he would succumb to a disease for which he regularly treated his own patients – Parkinson's.

David first noticed that his right hand seemed weaker than his left. He soon began to suffer from progressive tremors on his right side, and he eventually lost function of his that side of body entirely. He could no longer perform simple tasks like brushing his teeth, buttoning his shirt, writing or driving, and was forced to stop doing public engagements. The tremors, rigidity, slowness of movement and stiffness eventually forced David to leave his neurology practice.

David's own neurologist prescribed a variety of medications that offered some improvement in his condition, but they made him feel tired and nauseous. He soon felt that he had run out of options. Then, in late 2004, he met a woman at a Parkinson's support group who appeared to be unaffected by her disease. He learned that she had undergone the relatively new procedure to receive DBS therapy.

David and his neurologist agreed DBS therapy could work for his condition, as well, and he underwent surgery. Four weeks after the procedure, he had the device turned on and his tremors instantly stopped. He began to regain control of his movements. Since then, he has been able to supplement his therapy with vigorous exercise, good nutrition and stress management.

David is now back in action – resuming his busy life. He works as a scientific advisor to the Parkinson's action network, is practicing medicine again and is back to playing baseball with his sons. "DBS restored my quality of life and allowed me to take charge of my health," he said.