Brain Pacemakers - Deep Brain Stimulation

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Abstract— Brain pacemakers are used in patients suffering from a variety of condition. These pacemakers are implanted deep inside to brain to help stimulate certain areas that no longer get stimulated by normal processes of the body. Parkinson's Disease patients are the main users of this medical device but it also stretches to victims of Alzheimer's Disease as well as many other ones.

I. INTRODUCTION

Brain pacemakers are used as a method to treat

people that suffer from Alzheimer's Disease, Parkinson's Disease, and epilepsy. A pacemaker is a medical device that sends electronic signals into tissue with the purpose of stimulating a certain area. The circadian rhythm, a cluster of neurons, that have a process that has an entrain-able oscillation of 24 hours. A circadian pacemaker is placed inside the pineal gland, where melatonin is produced at night, and only weighs between 100-180mg. The pineal glad is the central structure in the circadian system. The output of melatonin it produces is synchronized with the 24 hour day. Melatonin is linked to being a factor of aging and prevalent in Alzheimer's Disease. Sleep-wake disturbances at night have been linked to the circadian cycle.

II. METHODS

Brain-pacemakers are used in a surgical treatment know as deep brain stimulation. DBS is a process that sends electronic pulses to designated areas of the brain. In the case of mild AD, this device would send continuous electrical impulses to specific "memory" regions that increase neuronal activity. By doing this, it could potentially slow down the progression of the intractable disease. Since its development in France in 1987, DBS has made improvements. Instead of burning the tissue of the affected areas of the brain, small electrodes are now implanted. The DBS electrodes are very small at just a millimeter thick. To place them into the brain, it is a difficult process that requires much precision. First, the surgeon must bore a hole through the patient's parietal bone. Then, a thin electrode is threaded deep into the brain. The spot differs in what area is being treated. For Parkinson's patients, it is the sub-thalamic nucleus. In AD patients it is the pineal glad area. The electrodes are then connected to wires that flow from around the skull, to behind the ear, to a battery-powered pacemaker that is embedded inside the patient's chest. Once inserted, the pacemaker is set by the doctor and patient. This process can take awhile because the device has to be finely tuned from over 60,000 options. When the device is initiated, it delivers a continuous low-voltage charge that stimulates the area



of the brain it was placed in. DBS is still not fully understood by doctors as to how it exactly works.

III. RESULTS

The results for DBS have varied case by case since it is still in the development stages. For AD, the results showed that DBS could slow down the risks of the disease. For dementia caused by PD, it also showed that it could slow down the progression of the disease. The seizures of epileptics were shown to drop significantly after the treatment of DBS.

IV. DISCUSSION

The advantages of DBS clearly outweigh the disadvantages. Further research and tests should continue to be done on patients with PD, AD, and those that have reoccurring seizures. In the future, DBS can hopefully help treat non-motor operations. This would enable DBS to become a more powerful and effective treatment for a wide variety of medical issues people could encounter during their life.

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