

Chapter 19

Neurosurgical Treatments of Neurodegenerative Disorders

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ABSTRACT

Functional neurosurgery consists of procedures that either promotes judicious destruction or chronic stimulation of the nervous system in order to treat disordered behavior or aberrant function, as it is expected in neurodegenerative disorders ([NDs], e.g., movement disorders [Parkinson's disease, Tourette's syndrome, essential tremor, ballism, and dystonia]). Over the past 20 years, approximately 100,000 deep brain stimulation implant procedures have been performed worldwide. Neurosurgery is also a well-established therapeutic option for people with epilepsy whose seizures are not controlled by anti-epilepsy drugs. The most common pathological finding in patients with drug-resistant mesial temporal lobe epilepsy is hippocampal sclerosis. The aim of this chapter is to present the main NDs that can be treated through surgical procedures, and to describe the surgeries with a focus on the pathophysiology of diseases.

INTRODUCTION

Researchers have directed their efforts towards finding effective treatments for neurodegenerative diseases. The concept that neurological diseases are not treatable has been dissipated with the advances of the last decades. There is a great success with clinical therapeutics, genetic findings and immunology.

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This chapter will show movement disorders and epilepsies that had their limiters and disabling results on patients altered by surgical procedures. Examples of diseases that can be treated by functional neurosurgery comprise movement disorders (Parkinson's disease [PD], Tourette's syndrome [TS], essential tremor [ET] and dystonia), spasticity, chronic pain, epilepsy and psychiatric disturbances (obsessive-compulsive disorders [OCD] and depression).

Over the past 20 years, approximately 100,000 deep brain stimulation implant procedures have been performed worldwide (Strauss et al., 2014). The efficacy of these functional procedures in the treatment of Parkinson's disease was verified up to 10 years after surgery (Moro et al., 2010-b). For patients who are compromised by such seizures, referral to an epilepsy surgery center should be strongly considered (Engel et al., 2003). Surgery is a well-established therapeutic option for people with epilepsy whose seizures are not controlled by anti-epilepsy drugs.

The aims of this chapter are to present the main NDs that can be treated through surgical procedures and to describe the surgeries with a focus on the pathophysiology of diseases.

BACKGROUND

The first image about neurosurgery is of a specialty that utilizes surgical techniques aimed at correcting structural / anatomical problems of the nervous system such as aneurysms, brain and spine tumors, fractures and herniated disks. For several years, this type of surgery was the only treatment option available for PD and movement disorders. These procedures were ablative in nature and consisted of surgeries performed on both the peripheral nervous system, including rhizotomies and sympathectomies (Teixeira and Fonoff, 2004), and in the brain, such as corticectomies, trans-ventricular accesses to the basal ganglia nuclei and even section of the cerebral peduncle, procedures that were performed under direct vision and not by a stereotactic approach (Speelman and Bosch, 1998), as the first stereotactic procedures for the treatment of movement disorders would only be performed by Spiegel and Wycis in 1947 (Speelman and Bosch, 1998).

These new perspectives, the "Functional Neurosurgery", are completely different. Functional neurosurgery consist of procedures that either promote judicious, localized destruction of a target area within the central nervous system, or chronic stimulation of specific structures in order to treat disordered behavior or aberrant function of the nervous system, as it is expected in NDs (Teixeira and Fonoff, 2004).

NEURODEGENERATIVE DISEASES WITH POSSIBLE SURGICAL TREATMENT

Movement Disorders

Parkinson's Disease

PD is a ND, characterized by movement disorders and non-motors symptoms (Salat et al., 2016), associated mainly with the death of dopaminergic neurons located in the substantia nigra, leading to progressive depletion of dopaminergic nigrostriatal and mesocorticolimbic neurons (Callesen et al., 2013), but also there is abnormal deposition of α -synuclein in the remaining cells and gliosis in specific areas of the nervous system (Lees et al., 2009; Salat et al., 2016). However, such changes are not restricted to

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