INTRODUCTION

Deep brain stimulation in 2018

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PERHAPS not since Harvey Cushing introduced neurosurgery to the public has there been a therapy that has captured the profession's hopes and the public's imagination as much as deep brain stimulation (DBS). Despite having first been introduced in its modern form 30 years ago, DBS remains futuristic in the eyes of many and is recognized as underutilized. This issue of *Neurosurgical Focus* reviews the state of the art of DBS, including advances in the treatment of old indications, innovative treatment strategies for new indications, and experiences supporting several potential future indications.

Over the past decades, the efficacy of chronic electrical stimulation for movement disorders has provided a unique opportunity to further our understanding of brain anatomy, physiology, and connectivity, as well as the mechanisms by which function is affected in disease states. The evolution from fixed "open-loop" stimulation to more sophisticated and responsive stimulation algorithms represents the next step in advancing how this therapy resets the brain to normalize function. Movement disorders provide an accessible model to test advanced stimulation strategies, although the full benefit of "closed-loop" stimulation may be realized beyond traditional indications.

Indeed, the challenge that "no neuron is safe" reflects an optimism that neuromodulation may provide hope for a host of other neurological conditions, ranging from dementias, obesity, addiction, and chronic pain to psychiatric

disorders. However, the expansion of indications for which DBS is approved has been a slow process. The approval this year by the US FDA of DBS for the treatment of epilepsy follows a decade of clinical trials demonstrating efficacy and adoption of the therapy in Canada and Europe. This approval presents new opportunities to optimize stimulation and targeting strategies.

As progress is being made in implant technology, the operation itself has evolved, and while robotics may be a next step in stereotactic surgery, the ability to have electrodes delivered by endovascular means may not be far off. As neuroscientists make advances in neuromodulation for the treatment of conditions previously managed nonoperatively, we conclude this issue by considering the complex environment and forces in which we work.

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