

## Preface

# Neuroaugmentation for chronic pain



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*Guest Editor*

Pain is perfect miserie, the worst of evils, and excessive, overturns All patience.

—John Milton, from *Paradise Lost*

The treatment of chronic pain has become an increasingly prominent part of medical care. Recognition of chronic pain as a disease state has led to more aggressive treatment, including invasive interventions targeted at the neural circuitry responsible for the perception of pain. Neurosurgeons long ago realized that altering pain transmission pathways can provide relief from pain, initially using this knowledge to design destructive procedures that sometimes provided short-term relief but frequently failed in the long term. As we have learned more about the mechanisms of chronic pain, there has been a shift away from destructive neurosurgical operations and toward augmentative procedures that alter the function of the nervous system by non-destructive electrical or chemical means. In the early part of the twenty-first century, neuroaugmentation has reached a stage of development at which sophisticated technology and refined techniques now offer relief to patients who otherwise would have no remaining treatment options. This issue of the *Neurosurgery Clinics of North America* attempts to outline the current state of the art in neuroaugmentation for chronic pain.

Chronic pain is a complex, multidimensional disorder, encompassing not only nociception (the

transmission and perception of noxious stimuli) but also psychological, social, and behavioral components. When evaluating patients with chronic pain, it is imperative to have a thorough understanding of these contributing factors. Patient selection for neuroaugmentative therapies is such a vital topic that two articles of this issue have been devoted to it, written from differing yet ultimately similar viewpoints. The emphasis on psychosocial aspects underlines what a challenge these patients can present for physicians more accustomed to clear-cut diagnoses and procedure-based thinking.

The use of electrical stimulation as a treatment for pain dates back to ancient times. However, it was not until the 1950s that stimulation of discrete nervous system structures, initially the deep nuclei of the brain, began to be used for the treatment of chronic pain. Electrical stimulation of the spinal cord and intraspinal medication delivery are more recent (and frequently more effective) additions to the armamentarium. Epidural stimulation of the motor cortex is a promising technique that is now being evaluated for the treatment of severely refractory pain states, especially deafferentation pain. Finally, the horizons of neuroaugmentation are being broadened by the introduction of biological therapies such as neurotransplantation and gene therapy.

The contributing authors have done an admirable job outlining the past, present, and future of

neuroaugmentation for chronic pain; however, more work remains to be done. Chronic pain is still poorly understood, despite decades of research. Evaluation of outcomes in chronic pain treatment is frustratingly difficult. The subjective nature of the pain experience makes it difficult to quantify and nearly impossible to compare between any two patients who may have similar complaints. Perhaps with advances in imaging, development of new therapies, and a better understanding of the complex interplay between the numerous systems that contribute to the pain

experience, we may one day find targets for neuroaugmentative therapies that will provide relief for those who suffer from “the worst of evils.”

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