
Preface

The rapid technological advances of the last quarter of a century have dramatically changed surgery. Advances in imaging and technology have made it safer, less invasive, and more effective. In neurosurgery, these advances have been driven by the delicate and complex nature of the nervous system and the need to perform surgical procedures with sufficient precision to leave surrounding neural tissue unharmed. They have culminated in the concept of “minimally invasive neurosurgery.” Colloquially, many have referred to these newer surgical techniques as “bloodless surgery,” but no conventional surgery is truly bloodless and the term is really a misnomer. Minimally invasive surgery attempts to deal with complex problems in a way that minimizes both blood loss and trauma to the normal tissues, including the skull and spine, muscular elements supporting the nervous system, and of course nerves themselves. Minimally invasive techniques are defined by two fundamental prerequisites: a precise definition of the operative anatomy, and a minimally invasive surgical corridor to the target. Minimally invasive techniques are now being used to treat tumors, vascular lesions, hydrocephalus, craniosynostosis, spinal disorders, and many other neurosurgical disorders.

Advances in imaging of the central nervous system have been crucial, and the widespread use of computed tomography (CT) and magnetic resonance imaging (MRI) is one of the primary innovations that allow the application of minimally invasive techniques to neurosurgery. With precise definition of anatomy in the brain and spine, the surgeon can now have more confidence in approaching lesions in the central nervous system while avoiding the normal tissue in the vicinity. Advances in both anatomical and functional MRI permit reliable presurgical and intraoperative brain mapping to resect lesions accurately while sparing eloquent areas. These achievements have made surgery safer and less traumatic and hospital stays shorter. They have also opened the door to novel strategies; for instance, MRI techniques such as spectroscopy offer the possibility of replacing surgery with imaging in the diagnosis of certain brain lesions, and CT and MRI angiography has often replaced intravascular angiograms in the diagnosis of vascular lesions.

Minimally invasive therapy of the brain embodies techniques that achieve results comparable to traditional surgical procedures via small access incisions, penetrating beams, or catheters navigated through the blood stream. The term “minimally invasive surgery” became popular in general surgery with the development of modern endoscopic techniques that allowed procedures such as cholecystectomy to be performed through small access incisions. Endoscopy continues to change our approach to many neurosurgical disorders; however, in neurosurgery there has been a development of many other minimally invasive techniques as well. Image-guided surgery including intraoperative imaging has revolutionized the way we approach many lesions. Conformal radiation, laser hyperthermia, and focused ultrasound are leading to a rethinking of techniques for addressing brain lesions. Interventional radiology often allows an “insider’s” approach to vascular lesions via the arterial or venous system as opposed to a standard craniotomy approach.

In *Minimally Invasive Neurosurgery* we review the impact of these new technologies in creating the contemporary revolution in minimally invasive neurosurgery. We feel honored to have the participation of many of the world's experts in their fields in completing this project. Part I is dedicated to the cutting edge techniques and technology available to neurosurgeons today. This includes a thorough discussion of neurosurgical endoscopic equipment, one of the mainstays of minimally invasive surgery. Experts in the field of radiology discuss magnetic resonance imaging with an emphasis on MR principles, as well as advanced techniques including spectroscopy, functional imaging, and brain mapping. Significant emphasis is also placed on the application of image navigation directly in the operating room, using both preoperative and intraoperative systems. Endovascular approaches to vascular disease, including arteriovenous malformations, aneurysms, and atherosclerotic disease, are extensively reviewed. Next, novel approaches, including radiofrequency, radiosurgery, and thermal therapy, are discussed. Finally, the minimally invasive techniques that allow "molecular neurosurgery," including gene and viral vectors and local delivery systems, are reviewed.

In Part II experts in the neurosurgical fields of pediatrics, vasculature, tumors, spine, peripheral nerves, and trauma discuss how they use minimally invasive techniques in their practice. This two part approach is meant to give both in-depth familiarity with the technologies and then a practical "how to" approach to their uses.

We hope that you will find *Minimally Invasive Neurosurgery* informative, cutting edge, and applicable to your practice as minimally invasive techniques continue to revolutionize neurosurgery. We are grateful to all those who have contributed to this book, in their writing or in other less tangible ways.

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