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Anesthesia for Endovascular Neurosurgery and Interventional Neuroradiology **391**
William L. Young

This review outlines the roles of anesthesiologists in the management of patients undergoing invasive endovascular procedures to treat vascular diseases, primarily of the central nervous system. This practice usually is termed interventional neuroradiology or endovascular neurosurgery. The discussion emphasizes perioperative and anesthetic management strategies to prevent complications and minimize their effects if they occur. Planning anesthetic and perioperative management is predicated on understanding the goals of the therapeutic intervention and anticipating potential problems.

Neuroimaging for the Anesthesiologist **413**
Wibke Müller-Forell and Kristin Engelhard

Neuroimaging is essential in the treatment of cerebral nervous system disorders or in patients in the ICU with deterioration of their neurologic function. Leading clinical symptoms are acute neurologic deficits with different stages of hemisymptomatology, primary or progressing loss of consciousness or vigilance deficit, focal or generalized seizures, sometimes combined with an acute

respiratory or circulatory insufficiency. The resulting questions can be summarized in those of intracranial space occupying hemorrhage; acute infarction; and signs for reduced cerebral blood flow, cerebrovascular vasospasm, or intracranial mass. Recent evolutions in imaging have contributed to an increase in diagnostic sensitivity and specificity along with reduced side effects. This article illustrates typical and atypical differential diagnoses, with some emphasis on traumatic brain injury.

Anesthetic Considerations for Intraoperative Management of Cerebrovascular Disease in Neurovascular Surgical Procedures **441**
Rafi Avitsian and Armin Schubert

Despite new surgical methods and interventions a considerable number of patients who undergo neurovascular procedures emergently or electively have substantial mortality, morbidity, and disability. Sound knowledge of pathophysiology of cerebral hypoperfusion, reliable and timely information from monitoring devices, and appropriate choice of therapeutic intervention is essential for successful anesthetic management of these patients. The management of perioperative vasospasm and temporary ischemia during aneurysm clipping require an understanding of cerebral vascular pathophysiology and neuroprotective measures.

Perioperative Management of Pediatric Patients with Craniosynostosis **465**
Jeffrey L. Koh and Heike Gries

Craniosynostosis, premature closures of the skull sutures, results in dysmorphic features if left untreated. Brain growth and cognitive development may also be impacted. Craniosynostosis repair is usually performed in young infants and has its perioperative challenges. This article provides background information about the different forms of craniosynostosis, with an overview of associated anomalies, genetic influences, and their connection with cognitive function. It also discusses the anesthetic considerations for perioperative management, including blood-loss management and strategies to reduce homologous blood transfusions.

Perioperative Care of Patients with Neuromuscular Disease and Dysfunction **483**
Ansgar M. Brambrink and Jeffrey R. Kirsch

A variety of different pathologies result in disease phenotypes that are summarized as neuromuscular diseases because they share commonalty in their clinical consequences for the patient: a progressive weakening of the skeletal muscles. Distinct caution and appropriate changes to the anesthetic plan are advised when care

is provided during the perioperative period. The choice of anesthetic technique, anesthetic drugs, and neuromuscular blockade always depends on the type of neuromuscular disease and the surgical procedure planned. A clear diagnosis of the underlying disease and sufficient knowledge and understanding of the pathophysiology are of paramount importance to the practitioner and guide optimal perioperative management of affected patients.

Considerations for Airway Management for Cervical Spine Surgery in Adults **511**
Edward T. Crosby

Surgery on the cervical spine runs the gamut from minor interventions done in a minimally invasive fashion on a short-stay or ambulatory basis, to major surgical undertakings of a high-risk, high-threat nature done to stabilize a degraded skeletal structure to preserve and protect neural elements. Planning for optimum airway management and anesthesia care is facilitated by an appreciation of the disease processes that affect the cervical spine and their biomechanical implications and an understanding of the imaging and operative techniques used to evaluate and treat these conditions. This article provides background information and evidence to allow the anesthesia practitioner to develop a conceptual framework within which to develop strategies for care when a patient is presented for surgery on the cervical spine.

Anesthetic Considerations for Awake Craniotomy for Epilepsy **535**
Kirstin M. Erickson and Daniel J. Cole

A variety of anesthetic methods, with and without airway manipulation, are available to facilitate awake intraoperative examinations and cortical stimulation, which allow more aggressive resection of epileptogenic foci in functionally important brain regions. Careful patient selection and preparation combined with attentive cooperation of the medical team are the foundation for a smooth awake procedure. With improved pharmacologic agents and variety of techniques at the neuroanesthesiologist's disposal, awake craniotomy has become an elegant approach to epileptic focus resection in functional cortex.

Perioperative Uses of Transcranial Perfusion Monitoring **557**
Martin Smith

Transcranial perfusion monitoring provides early warning of impending brain ischemia and may be used to guide management of cerebral perfusion and oxygenation. The monitoring options include measurement of intracranial and cerebral perfusion pressures, assessment of cerebral blood flow, and assessment of the

adequacy of perfusion by measurement of cerebral oxygenation and brain tissue biochemistry. Some monitoring techniques are well established, whereas others are relatively new to the clinical arena and their indications are still being evaluated. Currently available monitoring techniques are reviewed and their appropriateness and application to the perioperative period is discussed.

Monitoring and Intraoperative Management of Elevated Intracranial Pressure and Decompressive Craniectomy **579**
W. Andrew Kofke and Michael Stiefel

There are numerous clinical scenarios wherein a critically ill patient may present with neurologic dysfunction. In a general sense these scenarios often involve ischemia, trauma, or neuroexcitation. Each of these may include a period of decreased cerebral perfusion pressure, usually due to elevated intracranial pressure (ICP), eventually compromising cerebral blood flow sufficiently to produce permanent neuronal loss, infarction, and possibly brain death. Elevated ICP is thus a common pathway for neural demise and it may arise from a variety of causes, many of which may result in a neurosurgical procedure intended to ameliorate the impact or etiology of elevated ICP.

Electrophysiologic Monitoring in Neurosurgery **605**
Leslie C. Jameson, Daniel J. Janik, and Tod B. Sloan

Electrophysiologic techniques have become common in the neurosurgical operating room. This article reviews the methods used for mapping neural structures or monitoring during surgery. Mapping methods allow identification of target structures for surgery, or for identifying structures to allow avoidance or plot safe pathways to deeper structures. Monitoring methods allow for surgery on nearby structures to warn of encroachment, thereby reducing unwanted injury.

Risks and Benefits of Patient Positioning During Neurosurgical Care **631**
Irene Rozet and Monica S. Vavilala

Positioning of the surgical patient is an important part of anesthesia care and attention to the physical and physiologic consequences of positioning can help prevent serious adverse events and complications. The general principles of patient positioning of the anesthetized and awake neurosurgical patient are discussed in this article.

Perioperative Pain Management in the Neurosurgical Patient **655**
Jose Ortiz-Cardona and Audrée A. Bendo

The perioperative management of pain in neurosurgical patients is a controversial topic with management decisions based mainly on reports of anecdotal experiences. There is no consensus regarding the standardization of pain control in this patient population. In the last decade, improved awareness and advances in the practice of pain management have resulted in the implementation of diverse techniques to achieve adequate analgesia in this undertreated group of patients. This article provides information about the various techniques and approaches, based on the latest research and clinical trials conducted in this patient population. Specifically, the physiology of pain in patients undergoing brain or spine surgery, the different modalities for pain control, and the diverse choice of drugs, with their associated risks and benefits, are reviewed.

Controversies in Neurosciences Critical Care **675**
J. Ricardo Carhuapoma, Neeraj S. Naval, and Marek A. Mirski

Perhaps the greatest recent controversy in the medical management of complex neurologic and neurosurgical patients has been the defining of the optimal care arena. Despite some early skepticism and measured recognition by the ICU community, neurosciences critical care has grown into a well-recognized subspecialty. Within this environment, the diverse expertise of surgeons, neurologists, and anesthesiologists come together to define best therapeutic strategies. Two neurologic disease states that, in particular, continue to elicit expansive interdisciplinary debate are spontaneous intracerebral hemorrhage and aneurysmal subarachnoid hemorrhage.

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