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Management of Acute Ischemic Stroke 345
Anna Finley Caulfield and Christine A.C. Wijman

Stroke is the third leading cause of death and the leading cause of disability in the United States. This article summarizes the management of acute ischemic stroke, including conventional and novel therapies. The article provides an overview of the initial management, diagnostic work-up, treatment options, and supportive measures that need to be considered in the acute phase of ischemic stroke.

Management of Spontaneous Intracerebral Hemorrhage 373
Neeraj S. Naval, Paul A. Nyquist, and J. Ricardo Carhuapoma

Spontaneous intracerebral hemorrhage (ICH) has the highest mortality of all cerebrovascular events. Thirty-day mortality approaches 50%, and only 20% of survivors achieve meaningful functional recovery at 6 months. Many clinicians believe that effective therapies are lacking; however, this is changing because of new data on the pathophysiology and treatment of ICH, particularly research establishing the role of medical therapies to promote hematoma stabilization. This article provides updates to a recent publication discussing basic principles of ICH management, including initial stabilization, the prevention of hematoma growth, treatment of complications, and identification of the underlying etiology. Minimally invasive surgery (MIS) to reduce clot size is also discussed, with the goal of preserving neurologic function through reduction in parenchymal damage from edema formation.

Updates in the Management of Seizures and Status Epilepticus in Critically Ill Patients

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Karine J. Abou Khaled and Lawrence J. Hirsch

Seizures and status epilepticus are common in critically ill patients. They can be difficult to recognize because most are nonconvulsive and require electroencephalogram monitoring to detect; hence, they are currently underdiagnosed. Early recognition and treatment are essential to obtain maximal response to firstline treatment and to prevent neurologic and systemic sequelae. Antiseizure medication should be combined with management of the underlying cause and reversal of factors that can lower the seizure threshold, including many medications, fever, hypoxia, and metabolic imbalances. This article discusses specific treatments and specific situations, such as hepatic and renal failure patients and organ transplant patients.

Management of Traumatic Brain Injury in the Intensive Care Unit

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Geoffrey S.F. Ling and Scott A. Marshall

Traumatic brain injury is a common and complex clinical entity that deserves better and continued research on interventions and initial treatment postinjury. Current medical management of traumatic brain injury is articulated on minimizing secondary injury by optimizing cerebral perfusion and oxygenation and preventing or treating nonneurologic morbidity. There are major medical research efforts examining the underlying mechanisms of secondary brain injury, which provides hope for effective therapies in the future. Presently, a number of promising therapeutic modalities are undergoing clinical trials, and as new pharmacologic and medical approaches are introduced, there will be increasing opportunity to treat these patients and improve their neurologic outcomes.

Update in the Diagnosis and Management of Central Nervous System Infections

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Wendy C. Ziai and John J. Lewin III

Central nervous system (CNS) infections presenting to the emergency room include meningitis, encephalitis, brain and spinal epidural abscess, subdural empyema, and ventriculitis. These conditions often require admission to an intensive care unit (ICU) and are complications of ICU patients with neurologic injury, contributing significantly to morbidity and mortality. Reducing morbidity and mortality is critically dependent on rapid diagnosis and, perhaps more importantly, on the timely initiation of appropriate antimicrobial therapy. New insights into the role of inflammation and the immune response in CNS infections have contributed to development of new diagnostic strategies using markers of inflammation, and to the study of agents with focused immunomodulatory activity, which may lead to further adjunctive therapy in human disease.

Types of Brain Dysfunction in Critical Illness

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Robert D. Stevens and Paul A. Nyquist

Cerebral dysfunction and injury in the ICU presents as focal neurologic deficits, seizures, coma, and delirium. These syndromes may result from a primary brain insult, such as stroke or trauma, but commonly are a complication of a systemic insult, such as cardiac arrest, hypoxemia, sepsis, metabolic derangements, and pharmacologic exposures. Many survivors of critical illness have cognitive impairment, which is believed to underlie the poor long-term functional status and quality of life observed in many critical illness survivors. Although progress has been made in characterizing the epidemiology of cerebral dysfunction in the ICU, more research is needed to elucidate underlying mechanisms that might represent targets for therapeutic intervention.

Management of Brain Injury After Resuscitation From Cardiac Arrest

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Romertryko G. Geocadin, Matthew A. Koenig, Xiaofeng Jia, Robert D. Stevens, and Mary Ann Peberdy

The devastating neurologic injury in survivors of cardiac arrest has been recognized since the development of modern resuscitation techniques. After numerous failed clinical trials, two trials showed that induced mild hypothermia can ameliorate brain injury and improve survival and functional neurologic outcome in comatose survivors of out-of-hospital cardiac arrest. This article provides a comprehensive review of the advances in the care of brain injury after cardiac arrest, with updates on the process of prognostication, the use of therapeutic hypothermia and adjunctive intensive care unit care for cardiac arrest survivors.

Critical Illness Neuromuscular Syndromes

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Bernard De Jonghe, Jean-Claude Lacherade, Marie-Christine Durand, and Tarek Sharshar

Critical illness neuromyopathy (CINM) is suggested by bilateral diffuse weakness predominant in the proximal part of the limbs after improvement of the acute phase of critical illness. Although muscle and peripheral nerve are often involved in combination, muscle involvement alone is increasingly identified on electrophysiologic investigation, including direct muscle stimulation. CINM frequently involves the respiratory muscles and may result in delayed weaning and prolonged mechanical ventilation. Besides muscle immobilization and prolonged sepsis-induced multiorgan failure, which are risk factors for CINM, hyperglycemia and use of corticosteroids might have a deleterious effect on the neuromuscular system in critically ill patients, suggesting opportunities for preventive interventions.

Management of Intracranial Hypertension

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Leonardo Rangel-Castillo, Shankar Gopinath, and
Claudia S. Robertson

Effective management of intracranial hypertension involves meticulous avoidance of factors that precipitate or aggravate increased intracranial pressure. When intracranial pressure becomes elevated, it is important to rule out new mass lesions that should be surgically evacuated. Medical management of increased intracranial pressure should include sedation, drainage of cerebrospinal fluid, and osmotherapy with either mannitol or hypertonic saline. For intracranial hypertension refractory to initial medical management, barbiturate coma, hypothermia, or decompressive craniectomy should be considered. Steroids are not indicated and may be harmful in the treatment of intracranial hypertension resulting from traumatic brain injury.

The Role of Mechanical Ventilation in Acute Brain Injury

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Robert D. Stevens, Christos Lazaridis and Julio A. Chalela

Mechanical ventilation (MV) is fundamental to the resuscitation of brain injured patients, facilitating tissue oxygen delivery, helping to modulate cerebral vascular reactivity, and ensuring protection of the airway. These benefits come at a cost, which includes a significantly increased risk of pneumonia, delirium, and the complications of sedation and of endotracheal intubation. MV exerts effects on intracranial pressure and cerebral perfusion pressure which may be detrimental in patients with intracranial hypertension. MV can also induce alveolar damage in susceptible individuals, yet changes in ventilation designed to limit this damage may not be tolerated in the setting of brain injury. Recent research has begun to clarify key questions regarding the pathophysiology and management of MV in critically ill neurological patients.

Blood Pressure Management in Acute Stroke

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Victor C. Urrutia and Robert J. Wityk

The optimal management of arterial blood pressure in the setting of an acute stroke has not been defined. Many articles have been published on this topic in the past few years, but definitive evidence from clinical trials continues to be lacking. This situation is complicated further because stroke is a heterogeneous disease. The best management of arterial blood pressure may differ, depending on the type of stroke (ischemic or hemorrhagic) and the subtype of ischemic or hemorrhagic stroke. This article reviews the relationship between arterial blood pressure and the pathophysiology specific to ischemic stroke, primary intracerebral hemorrhage, and aneurysmal subarachnoid hemorrhage, elaborating on the concept of ischemic penumbra and the role of cerebral

autoregulation. The article also examines the impact of blood pressure and its management on outcome. Finally, an agenda for research in this field is outlined.

Temperature Management in Acute Neurologic Disorders

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Yekaterina K. Axelrod and Michael N. Diringer

Temperature management in acute neurologic disorders has received considerable attention in the last 2 decades. Numerous trials of hypothermia have been performed in patients with head injury, stroke, and cardiac arrest. This article reviews the physiology of thermoregulation and mechanisms responsible for hyperpyrexia. Detrimental effects of fever and benefits of normalizing elevated temperature in experimental models are discussed. This article presents a detailed analysis of trials of induced hypothermia in patients with acute neurologic insults and describes methods of fever control.

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