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Deepa Malaiyandi and Lori Shutter

The History of Neurocritical Care as a Subspecialty **1**

Kristi Tempro and Cherylee W.J. Chang

The role of the neurointensivist as a subspecialist has been cemented in modern medicine globally. It was forged through the collaboration of neurologists, neurosurgeons, internists, anesthesiologists, general surgeons, emergency medicine physicians, and pediatricians. As with all critical care areas, it requires a multiprofessional environment. Neurocritical care harnesses knowledge, technology, resources, and research opportunities to embrace a multisystem approach to care for the neurologically critically ill. Although recently formally recognized, its crucial role to serve patients with acute, life-threatening neurologic insults has been well established.

Quality Improvement in Neurocritical Care **17**

Casey Olm-Shipman and Asma M. Moheet

Quality improvement is key to advancing outcomes for neurocritically ill patients. Variation in neurocritical care practice can lead to differences in health outcomes and contribute to health disparities. The implementation of evidence-based best practice standards represents a major opportunity to improve their care. Neurocritical care performance measures have recently been developed and may be used to target high priority areas for improvement. In addition, neurocritical care clinicians should be aware of the heavily weighted pay-for-performance and publicly reported performance measures that are directly relevant to neurocritical care practice.

Neurocritical Care Education in the United States **29**

Angela Hays Shapshak and Lori Shutter

Neurocritical care is a relatively young subspecialty that is rapidly coming into its own. As the neurocritical care community has expanded, the process of training and credentialing physicians in this growing field has undergone a rapid evolution. This article will review the history and current state of neurocritical care training and education, physician certification, and program accreditation in the United States within the larger context of critical care training across subspecialties.

Neurocritical Care Research: Collaborations for Curing Coma **47**

Jose Javier Provencio

One of the most common questions asked by family members of patients with brain injuries who are in a coma is “will my loved one wake up?”.

Despite substantial improvements in the care of patients with neurological diseases, the medical and scientific community struggles to answer this simple question. More importantly, the technology and treatment strategies to improve the trajectory of patients with impaired consciousness in the acute setting are limited. The Curing Coma Campaign was developed by the Neurocritical Care Society as a multispecialty, multi-interest community of researchers and caretakers who are focused on patients with disorders of consciousness (DoC) in the acute phase of care. Over the first few years of the group, several publications have focused on identifying the gaps in our knowledge to encourage research in the area. In this review, the current understanding of DoC is reviewed. The work of the Curing Coma Campaign to identify gaps in our knowledge is highlighted.

Neurocritical Care Aspects of Ischemic Stroke Management 55

Dania Qaryouti and Diana Greene-Chandos

This article reviews the care of patients with ischemic stroke in the intensive care unit, including early general critical care interventions for airway control blood pressure goals according to the type of acute stroke treatment, poststroke cerebral edema management, hemorrhagic conversion in ischemic stroke, fibrinolytic reversal, and management of carotid endarterectomy and infective endocarditis. The importance of preventing common intensive care complications is discussed, including aspiration pneumonia, deep venous thrombosis, urinary tract infections, cardiac arrhythmias, and hyperglycemia.

Advances in Intracranial Hemorrhage: Subarachnoid Hemorrhage and Intracerebral Hemorrhage 71

Salvatore A. D'Amato and Tiffany R. Chang

Aneurysmal subarachnoid hemorrhage and intracerebral hemorrhage are devastating injuries causing significant morbidity and mortality. However, advancements made over decades have improved outcomes. This review summarizes a systematic approach to stabilize and treat these patient populations.

Status Epilepticus: A Neurologic Emergency 87

Patrick J. Coppler and Jonathan Elmer

In this review, we discuss treatment and considerations for status epilepticus in general intensive care unit patients, acquired brain injury, autoimmune conditions, toxidromes, pediatrics, and pregnancy.

Neurotrauma and Intracranial Pressure Management 103

Francis Bernard

Video content accompanies this article at http://www.criticalcare.theclinics.com.

Although intracranial pressure (ICP) monitoring has been the mainstay of traumatic brain injury (TBI) management for decades, new understanding of TBI physiopathology calls for paradigm shifts. The complexity of TBI management precludes ICP being taken as an isolated value with a

specific threshold. Multimodality monitoring is crucial to expanding our comprehension of individualized pathophysiology, allowing for a precise and tailored treatment approach. This article will review keys concepts to interpret and apply published ICP management guidelines and statements.

Neuromuscular Weakness in Intensive Care 123

Deepa Malaiyandi and Elysia James

Diseases of the peripheral nervous system create an additional diagnostic conundrum within the intensive care setting. Causes are vast, presentations are myriad, and symptoms are often ill-defined or misidentified. Care benefits from a multidisciplinary approach including a neuromuscular specialist, rehabilitation services, and a specialty pharmacist in addition to the neurocritical care team. In general, survivors achieve a good functional recovery relative to their preintensive care unit baseline.

Neuroprognostication 139

Victoria Fleming and Susanne Muehlschlegel

Patients with severe acute brain injury are left incapacitated, critically ill, and unable to make their own medical decisions. Surrogate decision-makers must make life-or-death decisions for patients and rely on clinicians' prognostication for guidance. No guidelines currently exist to guide clinicians in how to prognosticate; hence, neuroprognostication is still considered an "art" leaving room for high variability. This review examines the current literature on prognostication in neurocritical care, identifies ongoing challenges that exist in the field, and provides suggestions for future research with the goal to ameliorate variability and focus on scientific and patient-centered, rather than artistic approaches to prognostication.

Neurocritical Care in the General Intensive Care Unit 153

Firas Abdulmajeed, Mohanad Hamandi, Deepa Malaiyandi, and Lori Shutter

Neurologic conditions are often encountered in the general intensive care unit. This article will discuss some of the more common neurologic issues encountered and provide guidance in the assessment and management of these conditions.

Neuropharmacology in the Intensive Care Unit 171

Abdalla Ammar, Mahmoud A. Ammar, and Eljim P. Tesoro

Clinicians must individualize pharmacotherapy for patients with acute neurological injury based on multiple factors, including age, comorbidities, and chronic medication use. Many pharmacokinetic and pharmacodynamic properties are altered during acute illness, particularly absorption, distribution, metabolism, and elimination, which may result in loss of drug effect or toxicity. This article provides clinicians with general pharmacologic knowledge of the following drug regimens commonly prescribed to neurocritically ill adults: sedatives, analgesics, osmotherapy, antiseizure

medications, antishivering agents, vasoactive agents, and antithrombotic reversal agents.

Brain Death/Death by Neurological Criteria: International Standardization and the World Brain Death Project **215**

Gene Sung

This article reviews the criteria for determination of brain death, discusses the importance of protocol development, and reviews the international efforts to standardize clinical testing.

Physiological Monitoring in Patients with Acute Brain Injury: A Multimodal Approach **221**

Tracey H. Fan and Eric S. Rosenthal

Neurocritical care management of acute brain injury (ABI) is focused on identification, prevention, and management of secondary brain injury (SBI). Physiologic monitoring of the brain and other organ systems has a role to predict patient recovery or deterioration, guide individualized therapeutic interventions, and measure response to treatment, with the goal of improving patient outcomes. In this review, we detail how specific physiologic markers of brain injury and neuromonitoring tools are integrated and used in ABI patients to develop therapeutic approaches to prevent SBI.

Artificial Intelligence and Big Data Science in Neurocritical Care **235**

Shraddha Mainali and Soojin Park

In recent years, the volume of digitalized web-based information utilizing modern computer-based technology for data storage, processing, and analysis has grown rapidly. Humans can process a limited number of variables at any given time. Thus, the deluge of clinically useful information in the intensive care unit environment remains untapped. Innovations in machine learning technology with the development of deep neural networks and efficient, cost-effective data archival systems have provided the infrastructure to apply artificial intelligence on big data for determination of clinical events and outcomes. Here, we introduce a few computer-based technologies that have been tested across these domains.