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Shock in the critically ill patient is common and associated with poor outcomes. Categories include distributive, hypovolemic, obstructive, and cardiogenic, of which distributive (and usually septic distributive) shock is by far the most common. Clinical history, physical examination, and hemodynamic assessments & monitoring help differentiate these states. Specific management necessitates interventions to correct the triggering etiology as well as ongoing resuscitation to maintain physiologic milieu. One shock state may convert to another and may have an undifferentiated presentation; therefore, continual re-assessment is essential. This review provides guidance for intensivists for management of all shock states based on available scientific evidence.

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Alisha Bhatia and Jerrad Businger

Acute ischemic stroke is a neurologic emergency that requires precise care due to high likelihood of morbidity and mortality. Current guidelines recommend thrombolytic therapy with alteplase within the first 3 to 4.5 hours of initial stroke symptoms and endovascular mechanical thrombectomy within the first 16 to 24 hours. Anesthesiologists may be involved in the care of these patients perioperatively and in the intensive care unit. Although the optimal anesthetic for these procedures remains under investigation, this article will review how to best optimize and treat these patients to achieve the best outcomes.

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Krassimir Denchev, Jonathan Gomez, Pinxia Chen, and Kathryn Rosenblatt

Traumatic brain injury is a devastating event associated with substantial morbidity. Pathophysiology involves the initial trauma, subsequent inflammatory response, and secondary insults, which worsen brain injury severity. Management entails cardiopulmonary stabilization and diagnostic imaging with targeted interventions, such as decompressive hemicraniectomy,

intracranial monitors or drains, and pharmacological agents to reduce intracranial pressure. Anesthesia and intensive care requires control of multiple physiologic variables and evidence-based practices to reduce secondary brain injury. Advances in biomedical engineering have enhanced assessments of cerebral oxygenation, pressure, metabolism, blood flow, and autoregulation. Many centers employ multimodality neuromonitoring for targeted therapies with the hope to improve recovery.

Update on Mechanical Circulatory Support

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Suzanne Bennett, Lauren Sutherland, Promise Ariyo, and Frank M. O’Connell

Mechanical circulatory support (MCS) devices provide temporary or intermediate- to long-term support for acute cardiopulmonary support. In the last 20 to 30 years, tremendous growth in MCS device usage has been seen. These devices offer support for isolated respiratory failure, isolated cardiac failure, or both. Initiation of MCS devices requires the input from multidisciplinary teams using patient factors and institutional resources to guide decision making, along with a planned “exit strategy” for bridge to decision, bridge to transplant, bridge to recovery, or as destination therapy. Important considerations for MCS use include patient selection, cannulation/insertion strategies, and complications of each device.

Management of Intraoperative Cardiac Arrest

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Aalok K. Kacha, Megan Henley Hicks, Christopher Mahrous, Allison Dalton, and Talia K. Ben-Jacob

Perioperative arrests are both uncommon and heterogeneous and have not been described or studied to the same extent as cardiac arrest in the community. These crises are usually witnessed, frequently anticipated, and involve a rescuer physician with knowledge of the patient’s comorbidities and coexisting anesthetic or surgically related pathophysiology ultimately leading to better outcomes. This article reviews the most probable causes of intraoperative arrest and their management.

Intraoperative Ventilator Management of the Critically Ill Patient

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Erin Hennessey, Edward Bittner, Peggy White, Alan Kovar, and Lucas Meuchel

Strategies for the intraoperative ventilator management of the critically ill patient focus on parameters used for lung protective ventilation with acute respiratory distress syndrome, preventing or limiting the deleterious effects of mechanical ventilation, and optimizing anesthetic and surgical conditions to limit postoperative pulmonary complications for patients at risk. Patient conditions such as obesity, sepsis, the need for laparoscopic surgery, or one-lung ventilation may benefit from intraoperative lung protective ventilation strategies. Anesthesiologists can use risk evaluation and prediction tools, monitor advanced physiologic targets, and incorporate new innovative monitoring techniques to develop an individualized approach for patients.

Postoperative Respiratory Failure and Advanced Ventilator Settings

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Christopher Choi, Gretchen Lemmink, and Jose Humanez

Postoperative respiratory failure has a multifactorial etiology, of which atelectasis is the most common mechanism. Its injurious effects are magnified

by surgical inflammation, high driving pressures, and postoperative pain. Chest physiotherapy and noninvasive ventilation are good options to prevent progression of respiratory failure. Acute respiratory disease syndrome is a late and severe finding, which is associated with high morbidity and mortality. If present, proning is a safe, effective, and underutilized therapy. Extracorporeal membrane oxygenation is an option only when traditional supportive measures have failed.

Patient Blood Management, Anemia, and Transfusion Optimization Across Surgical Specialties 161

Michael E. Kiyatkin, Domagoj Mladinov, Mary L. Jarzebowski, and Matthew A. Warner

Patient blood management (PBM) is a systematic, evidence-based approach to improve patient outcomes by managing and preserving a patient's own blood and minimizing allogenic transfusion need and risk. According to the PBM approach, the goals of perioperative anemia management include early diagnosis, targeted treatment, blood conservation, restrictive transfusion except in cases of acute and massive hemorrhage, and ongoing quality assurance and research efforts to advance overall blood health.

Delirium Prevention and Management in Frail Surgical Patients 175

Kimberly F. Rengel, Lindsay A. Wahl, Archit Sharma, Howard Lee, and Christina J. Hayhurst

Delirium, an acute, fluctuating impairment in cognition and awareness, is one of the most common causes of postoperative brain dysfunction. It is associated with increased hospital length of stay, health care costs, and mortality. There is no FDA-approved treatment of delirium, and management relies on symptomatic control. Several preventative techniques have been proposed, including the choice of anesthetic agent, preoperative testing, and intraoperative monitoring. Frailty, a state of increased vulnerability to adverse events, is an independent and potentially modifiable risk factor for the development of delirium. Diligent preoperative screening techniques and implementation of prevention strategies could help improve outcomes in high-risk patients.

Perioperative Fluid Management and Volume Assessment 191

Jennifer Elia, Murtaza Diwan, Ranjit Deshpande, Jason C. Brainard, and Kunal Karamchandani

Fluid therapy is an integral component of perioperative care and helps maintain or restore effective circulating blood volume. The principal goal of fluid management is to optimize cardiac preload, maximize stroke volume, and maintain adequate organ perfusion. Accurate assessment of volume status and volume responsiveness is necessary for appropriate and judicious utilization of fluid therapy. To accomplish this, static and dynamic indicators of fluid responsiveness have been widely studied. This review discusses the overarching goals of perioperative fluid management, reviews the physiology and parameters used to assess fluid responsiveness, and provides evidence-based recommendations on intraoperative fluid management.

Acute Kidney Injury and Renal Replacement Therapy: A Review and Update for the Perioperative Physician

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Christopher W. Tam, Shreyajit R. Kumar, and Jarva Chow

Post-operative acute kidney injury is a devastating complication with significant morbidity and mortality associated with it. The perioperative anesthesiologist is in a unique position to potentially mitigate the risk of postoperative AKI, however, understanding the pathophysiology, risk factors and preventative strategies is paramount. There are also certain clinical scenarios, where renal replacement therapy may be indicated intraoperatively including severe electrolyte abnormalities, metabolic acidosis and massive volume overload. A multidisciplinary approach including the nephrologist, critical care physician, surgeon and anesthesiologist is necessary to determine the optimal management of these critically ill patients.

Point-of-Care Ultrasound: A Moving Picture Is Worth a Thousand Tests

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Suhas Devangam, Matthew Sigakis, Louisa J. Palmer, Lee Goeddel, and Babar Fiza



Video content accompanies this article at <http://www.anesthesiology.theclinics.com>.

The effective utilization of point-of-care ultrasound may decrease the utilization of conventional diagnostic modalities. This review describes the various pathologies that can be effectively and rapidly identified with point-of-care cardiac, lung, abdominal, vascular airway, and ocular ultrasonography.

Coagulopathy and Emergent Reversal of Anticoagulation

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William John Wallisch, Brent Kidd, Liang Shen, Rachel Hammer, and Jordan Sisco

More patients than ever are presenting for urgent or emergent procedures while therapeutically anticoagulated for various medical indications. Medications including warfarin, antiplatelet agents such as clopidogrel, direct oral anticoagulants such as apixaban, and even heparin or heparinoids may be present. Each of these medication classes presents its own challenges when coagulopathy needs to be quickly corrected. This review article presents evidence-based discussions of monitoring and reversal of these medication-induced coagulopathies. In addition, there will be a brief discussion of other potential coagulopathies that may be encountered in providing acute care anesthesia.

Impact of Intensive Care Unit Nutrition on the Microbiome and Patient Outcomes

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Mara A. Serbanescu, Monica Da Silva, and Ahmed Zaky

The bipartite relationship between nutrition and the intestinal microbiome represents an exciting frontier in critical care medicine. In this review, the authors first address these topics independently, leading with a summary of recent clinical studies assessing intensive care unit nutritional strategies, followed by an exploration of the microbiome in the context of perioperative and intensive care, including recent clinical data implicating

microbial dysbiosis as a key driver of clinical outcomes. Finally, the authors address the intersection of nutrition and the microbiome, exploring the use of supplemental pre-, pro-, and synbiotics to influence microbial composition and improve outcomes in critically ill and postsurgical patients.

Massive Trauma and Resuscitation Strategies

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Carter M. Galbraith, Brant M. Wagener, Athanasios Chalkias, Shahla Siddiqui, and David J. Douin

Massive trauma remains the leading cause of mortality among people aged younger than 45 years. In this review, we discuss the initial care and diagnosis of trauma patients followed by a comparison of resuscitation strategies. We discuss various strategies including use of whole blood and component therapy, examine viscoelastic techniques for management of coagulopathy, and consider the benefits and limitations of the resuscitation strategies and consider a series of questions that will be important for researchers to answer to provide the best and most cost-effective therapy for severely injured patients.

Health and Well-Being of Intensive Care Unit Physicians: How to Ensure the Longevity of a Critical Specialty

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John C. Klick, Madiha Syed, Ron Leong, Haley Miranda, and Elizabeth K. Cotter

A second epidemic of burnout, fatigue, anxiety, and moral distress has emerged concurrently with the coronavirus disease 2019 (COVID-19) pandemic, and critical care physicians are especially affected. This article reviews the history of burnout in health care workers, presents the signs and symptoms, discusses the specific impact of the COVID-19 pandemic on intensive care unit caregivers, and attempts to identify potential strategies to combat the Great Resignation disproportionately affecting health care workers. The article also focuses on how the specialty can amplify the voices and highlight the leadership potential of underrepresented minorities, physicians with disabilities, and the aging physician population.