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Umesh K. Gidwani, Samin K. Sharma, and Annapoorna S. Kini

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Umesh K. Gidwani and Annapoorna S. Kini

This article presents an overview of the evolution of cardiac critical care in the past half century. It tracks the rapid advances in the management of cardiovascular disease and how the intensive care area has kept pace, improving outcomes and incorporating successive innovations. The current multidisciplinary, evidence-based unit is vastly different from the early days and is expected to evolve further in keeping with the concept of “hybrid” care areas where care is delivered by the “heart team”.

## **Hypertensive and Acute Aortic Syndromes** 493

Jack Z. Li, Kim A. Eagle, and Prashant Vaishnava

Acute aortic syndromes are among the most lethal of the cardiovascular diseases. Delays in recognition, diagnosis, and treatment are associated with increases in mortality. Signs and symptoms are sometimes subtle and atypical, and a high index of suspicion is useful to guide the diagnostic evaluation. Uncontrolled hypertension remains the most significant treatable risk factor. Immediate management involves blood pressure reduction.  $\beta$ -Blockers are the first drugs of choice. Although future directions should involve the evolution of operative and endovascular techniques and the development of sophisticated risk prediction tools, risk factor modification by addressing the burden of uncontrolled hypertension cannot be overlooked.

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Narain Moorjani and Susanna Price

Massive pulmonary embolism (PE) is a potentially lethal condition, with death usually caused by right ventricular (RV) failure and cardiogenic shock. Systemic thrombolysis (unless contraindicated) is recommended as the first-line treatment of massive PE to decrease the thromboembolic burden on the RV and increase pulmonary perfusion. Surgical pulmonary embolectomy or catheter-directed thrombectomy should be considered in patients with contraindications to fibrinolysis, or those with persistent hemodynamic compromise or RV dysfunction despite fibrinolytic therapy. Critical care management predominantly involves supporting the RV, by optimizing preload, RV contractility, and coronary perfusion pressure and minimizing afterload. Despite these interventions, mortality remains high.

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Ramesh S. Kutty, Nicola Jones, and Narain Moorjani

Acute myocardial infarction (AMI) can result in ischemic, mechanical, arrhythmic, embolic, or inflammatory complications. The development of mechanical

complications following AMI is associated with a significantly reduced short-term and long-term survival. Since the introduction of primary percutaneous coronary intervention as the principal reperfusion strategy following acute ST-elevation myocardial infarction, the incidence of mechanical complications, including rupture of the left ventricular free wall, papillary muscle, and ventricular septum, has reduced significantly to less than 1%. Despite high operative mortality, the lack of an effective medical alternative makes surgical repair the mainstay of current management for these patients.

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Vaani Panse Garg and Jonathan L. Halperin

This article reviews the pivotal studies of several novel antiplatelet (prasugrel and ticagrelor) and anticoagulant (dabigatran, rivaroxaban, and apixaban) agents. The clinical use of these drugs in cardiac intensive care is discussed, focusing on the management of acute coronary syndromes, ischemic stroke, atrial fibrillation, and venous thromboembolism.

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Umesh K. Gidwani, Bibhu Mohanty, and Kanu Chatterjee

Balloon floatation pulmonary artery catheters (PACs) have been used for hemodynamic monitoring in cardiac, medical, and surgical intensive care units since the 1970s. With the availability of newer noninvasive diagnostic modalities, particularly echocardiography, the frequency of diagnostic pulmonary artery catheterization has declined. In this review, the evolution of PACs, the results of nonrandomized and randomized studies in various clinical conditions, the uses and abuses of bedside hemodynamic monitoring, and current indications for pulmonary artery catheterization are discussed.

### **Cardiogenic Shock** **567**

Howard A. Cooper and Julio A. Panza

Cardiogenic shock (CS) is a condition in which a marked reduction in cardiac output and inadequate end-organ perfusion results from an array of cardiac insults, the most common of which is acute myocardial infarction. CS is a systemic disease involving a vicious cycle of inflammation, ischemia, and progressive myocardial dysfunction, which often results in death. This life-threatening emergency requires intensive monitoring accompanied by aggressive hemodynamic support; other therapies are tailored to the specific pathophysiology. The development of novel therapeutic strategies is urgently required to reduce the unacceptably high mortality rates currently associated with CS.

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Anuradha Lala and Mandeep R. Mehra

Though cardiac transplantation for advanced heart disease patients remains definitive therapy for patients with advanced heart failure, it is challenged by inadequate donor supply, causing durable mechanical circulatory support (MCS) to slowly become a new primary standard. Selecting appropriate patients for MCS involves meeting a number of prespecifications as is required in evaluation for cardiac transplant candidacy. As technology evolves to bring forth more durable smaller devices, selection criteria for appropriate MCS recipients will likely expand to encompass

a broader, less sick population. The “Holy Grail” for MCS will be a focus on clinical recovery and explantation of devices rather than the currently more narrowly defined indications of bridge to transplantation or lifetime device therapy.

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J. William Schleifer and Komandoor Srivathsan

The management of ventricular tachycardia and ventricular fibrillation in the cardiac intensive care unit can be complex. These arrhythmias have many triggers, including ischemia, sympathetic stimulation, and medication toxicities, as well as many different substrates, ranging from ischemic and nonischemic cardiomyopathies to rare genetic conditions such as Brugada syndrome and long QT syndrome. Different settings, such as congenital heart disease, postoperative ventricular arrhythmias, and ventricular assist devices, increase the complexity of management. This article reviews the variety of situations and cardiac conditions that give rise to ventricular arrhythmias, focusing on inpatient management strategies.

**Cardiac Critical Care After Transcatheter Aortic Valve Replacement** 607

Matthew I. Tomey, Umesh K. Gidwani, and Samin K. Sharma

Transcatheter aortic valve replacement (TAVR) is a new therapy for severe aortic stenosis now available in the United States. Initial patients eligible for TAVR are defined by high operative risk, with advanced age and multiple comorbidities. Following TAVR, patients experience acute hemodynamic changes and several possible complications, including hypotension, vascular injury, anemia, stroke, new-onset atrial fibrillation, conduction disturbances and kidney injury, requiring an acute phase of intensive care. Alongside improvements in TAVR technology and technique, improvements in care after TAVR may contribute to improved outcomes. This review presents an approach to post-TAVR critical care and identifies directions for future research.

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Carlos Corredor and Sian I. Jaggar

Patients admitted to the Cardiac Intensive Care Unit (CICU) are of increasing complexity and often require ventilatory support. A deep understanding of respiratory physiology and the interactions between the cardiovascular and respiratory systems is essential. Ventilatory support should be tailored to the specific patient condition, ensuring effective minute ventilation, reducing work of breathing and minimizing adverse hemodynamic effects. The weaning process can stress the cardiovascular system and cardiac failure is a common cause of failure to wean. Identification of patients likely to fail and prompt pre-emptive intervention is crucial for successful weaning and avoiding complications related to prolonged mechanical ventilation.

**Targeted Temperature Management in Survivors of Cardiac Arrest** 637

Ivan Rocha Ferreira Da Silva and Jennifer Ann Frontera

Mild therapeutic hypothermia (MTH) results in a significant decrease in mortality and improvement of neurologic outcomes in cardiac arrest (CA) survivors. Cardiologists and intensivists must be acquainted with the indications and technique because MTH is the only proven neuroprotective therapy for CA survivors. CA involves reinstating meaningful cardiac activity and minimizing secondary neurologic injuries. This article focuses on MTH as the main strategy for post-CA care.

**Ethical Issues and Palliative Care in the Cardiovascular Intensive Care Unit** **657**

Keith M. Swetz and J. Keith Mansel

Medical advances over the past 50 years have helped countless patients with advanced cardiac disease or who are critically ill in the intensive care unit (ICU), but have added to the ethical complexity of the care provided by clinicians, particularly at the end of life. Palliative care has the primary aim of improving symptom burden, quality of life, and the congruence of the medical plan with a patient's goals of care. This article explores ethical issues encountered in the cardiac ICU, discusses key analyses of these issues, and addresses how palliative care might assist medical teams in approaching these challenges.

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