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SPECIFIC FEATURES OF GENERAL ANESTHESIA IN PATIENTS WITH CARDIOVASCULAR FAILURE

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Abstract: Cardiovascular failure significantly increases perioperative risk and represents a major challenge for anesthesiologists. General anesthesia can profoundly affect myocardial contractility, vascular tone, preload, and afterload, potentially leading to hemodynamic instability in patients with limited cardiac reserve. This article provides an in-depth, plagiarism-safe analysis of the specific features of general anesthesia in patients with cardiovascular failure, focusing on pathophysiology, preoperative evaluation, anesthetic management, fluid and ventilatory strategies, and postoperative care.

Keywords: *cardiovascular failure, heart failure, general anesthesia, perioperative management, hemodynamic monitoring*

Introduction

Cardiovascular failure remains one of the leading causes of morbidity and mortality worldwide. With the aging population and increasing prevalence of chronic cardiovascular diseases, anesthesiologists are increasingly required to manage patients with impaired cardiac function undergoing both elective and emergency surgical procedures. Reduced myocardial reserve limits the ability of the cardiovascular system to compensate for anesthetic-induced changes, making perioperative management particularly challenging. Understanding the specific anesthetic considerations in this population is essential to improve surgical outcomes and reduce complications.

General anesthesia induces complex physiological responses involving the cardiovascular, respiratory, and autonomic nervous systems. In patients with cardiovascular failure, these responses may precipitate acute decompensation, emphasizing the need for careful planning.

Pathophysiology of Cardiovascular Failure

Cardiovascular failure may be categorized as systolic, diastolic, or combined dysfunction. Systolic failure is characterized by impaired myocardial contractility and reduced ejection fraction, while diastolic failure involves abnormal ventricular relaxation and filling despite preserved systolic function. Both forms are associated with elevated ventricular filling pressures and reduced cardiac output.

Chronic activation of the sympathetic nervous system and the renin–angiotensin–aldosterone system leads to vasoconstriction, sodium and water retention, and increased myocardial oxygen demand. These compensatory mechanisms initially support circulation but ultimately contribute to disease progression and increase perioperative vulnerability.

Preoperative Assessment and Optimization

Comprehensive preoperative evaluation is a cornerstone of safe anesthetic management in patients with cardiovascular failure. Functional status should be assessed using the New York Heart Association

classification, while echocardiography provides valuable information regarding ventricular function and valvular abnormalities.

Optimization of medical therapy prior to surgery is essential. Beta-blockers, angiotensin-converting enzyme inhibitors, and diuretics should be reviewed and adjusted as necessary. In elective cases, surgery should be postponed until heart failure is adequately compensated.

Choice of Anesthetic Technique and Agents

The selection of anesthetic agents must prioritize cardiovascular stability. Etomidate is frequently used for induction due to its minimal negative inotropic effects. Opioid-based anesthesia reduces sympathetic stress responses, thereby decreasing myocardial oxygen consumption.

Volatile anesthetics such as sevoflurane and isoflurane are preferred for maintenance because they allow controlled depth of anesthesia with relatively predictable hemodynamic effects. Rapid dose escalation and deep anesthesia should be avoided to prevent hypotension.

Intraoperative Monitoring and Hemodynamic Control

Advanced monitoring techniques are strongly recommended in patients with cardiovascular failure. Continuous electrocardiography, invasive arterial blood pressure monitoring, and pulse oximetry enable early detection of hemodynamic instability.

Hemodynamic management aims to maintain adequate preload, avoid tachycardia, and ensure sufficient myocardial oxygen delivery. Inotropic support may be required in cases of reduced cardiac output, while vasopressors should be used cautiously to avoid excessive afterload.

Fluid and Ventilatory Management

Fluid management represents a critical aspect of anesthetic care in heart failure patients. Excessive fluid administration can rapidly lead to pulmonary congestion and edema. Therefore, a restrictive and goal-directed approach is recommended.

Positive-pressure ventilation affects venous return and cardiac output. Lung-protective ventilation strategies using low tidal volumes and minimal effective positive end-expiratory pressure help maintain oxygenation while minimizing cardiovascular compromise.

Postoperative Care and Complications

The postoperative period is associated with an increased risk of cardiac complications, including arrhythmias, myocardial ischemia, and acute heart failure exacerbation. Adequate pain control, oxygen therapy, and careful fluid balance are essential.

Patients with severe cardiovascular failure may benefit from postoperative monitoring in an intensive care unit to ensure early recognition and treatment of complications.

Conclusion

General anesthesia in patients with cardiovascular failure requires meticulous preparation, individualized anesthetic strategies, and close interdisciplinary collaboration. Evidence-based perioperative management significantly reduces morbidity and improves outcomes in this high-risk patient population.

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