

Chapter 16

Cardiovascular System

Wolf Benjamin Kratzert
UCLA, USA

Eva Katherine Boyd
UCLA, USA

ABSTRACT

This chapter addresses underlying physiology, diagnostics, and management of common cardiovascular abnormalities in the patient after cardiac surgery. The goal is to provide insights into daily management, areas of controversy, and future directions in the field. After reviewing basic physiologic principles of cardiac output and circulation; problems affecting the postoperative hemodynamic state will be addressed individually. Specific topics include the low cardiac output syndrome, right ventricular failure, myocardial ischemia, diastolic dysfunction, vasodilatory syndrome, rhythm disturbances, pericardial tamponade, and cardiac arrest. Patients with postoperative open chests, or after orthotopic heart transplantation are also discussed.

INTRODUCTION

Postoperative care of the patient undergoing cardiac surgery presents with unique challenges in the field of critical care medicine. Management of the cardiovascular system plays an essential role, as it addresses the fundamental pathophysiologic state of these patients. Abnormalities in hemodynamics often lead to malfunction of other organs such as the central nervous system, lungs, liver, and kidneys, and achievement of adequate cardiovascular performance is key to recovery. Aberrations in cardiovascular physiology are frequently related to the initial underlying disease state, preexisting comorbidities, surgical procedure performed, and intraoperative events and management. A precise understanding of the preoperative pathophysiology and intraoperative course aids in postoperative management. Additionally, certain physiologic patterns are recognizable during specific phases of the postoperative period. Hemodynamic changes are often predictable to the experienced cardiothoracic intensivist, and subtle deviations from these patterns are detected to prevent adverse events.

This chapter reviews the basic concepts of cardiovascular physiology and pathophysiology specific to the post cardiac surgery patient. After a brief review of basic cardiac physiology, specific changes

DOI: 10.4018/978-1-4666-8603-8.ch016

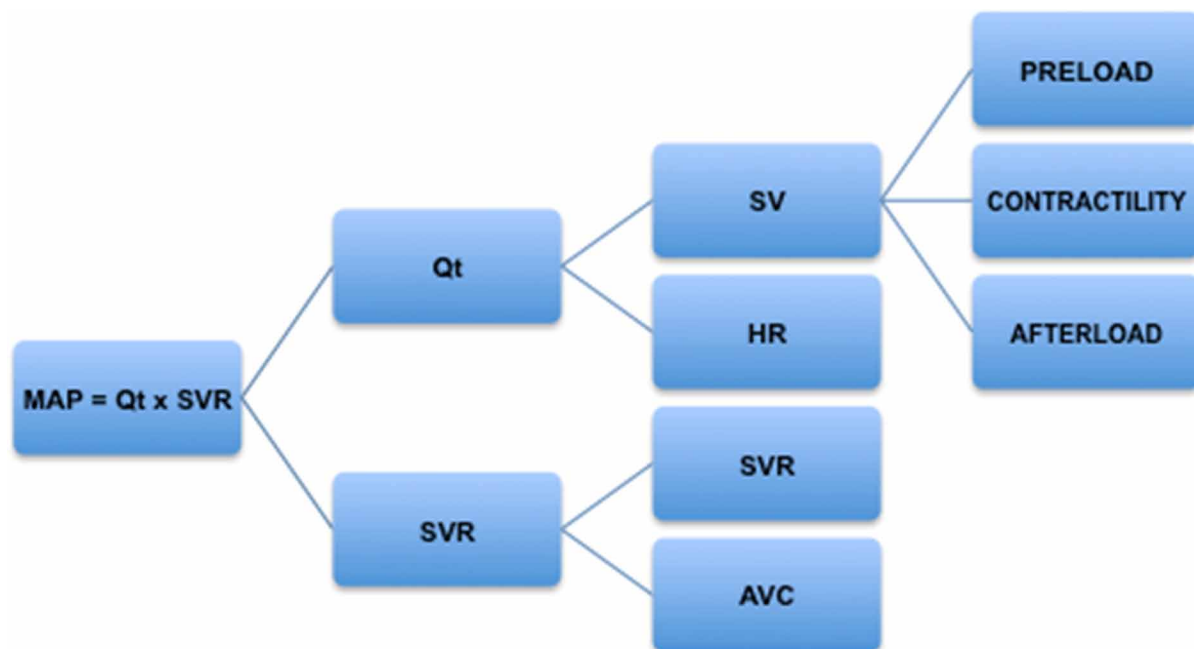
in hemodynamics, and cardiac rhythm disturbances, the pathogenesis, diagnosis, and management of postoperative complications are systematically discussed. The goal of this chapter is to give insights and guidance into prediction, evaluation, and management of acute cardiovascular changes in the post cardiothoracic surgery patient, and offer insights into current controversies in the field.

BASIC PHYSIOLOGIC PRINCIPLES

Achieving adequate oxygen delivery to meet tissue metabolic demands is the primary objective to ensure smooth recovery from cardiac surgery. As systemic blood pressure does not always equal satisfactory organ perfusion, it is imperative to understand the physiologic principles of hemodynamics and tissue oxygenation.

Mean systemic blood pressure (MAP) is the product of cardiac output (CO) and systemic vascular resistance (SVR) added to the central venous pressure (CVP). As CVP is normally low, it is commonly omitted when using the formula for clinical purposes. Cardiac output equals stroke volume (SV) times heart rate (HR). The stroke volume is determined by preload, contractility, and afterload, which themselves are affected by ventricular compliance, interventricular dependence, and cardiac rhythm, among other components (see FIGURE 1). Rhythm disturbances, intrinsic and extrinsic metabolic factors, and postoperative pacing affect heart rate. The cardiac index (CI) is calculated to adjust for the individual patient, and can be derived by dividing CO by the body surface area (BSA). The normal values of the hemodynamic parameters mentioned are seen in Figure 2.

Figure 1. Components determining mean arterial pressure (MAP). Q_t = cardiac output, SVR = systemic vascular resistance; SV = stroke volume; HR = heart rate; AVC = arterial vascular compliance



26 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/cardiovascular-system/136919

Related Content

Advancements in Cardiovascular Diagnostics

Yan Li, Karen L. Fang, Zhi Huang, Yun Lu, Bin Zhang and Yali Yao (2017). *Emerging Applications, Perspectives, and Discoveries in Cardiovascular Research* (pp. 194-211).

www.irma-international.org/chapter/advancements-in-cardiovascular-diagnostics/176217

Recent Innovations in Coronary Stents

Poulomi Sengupta (2017). *Emerging Applications, Perspectives, and Discoveries in Cardiovascular Research* (pp. 233-244).

www.irma-international.org/chapter/recent-innovations-in-coronary-stents/176220

Gastrointestinal Issues in the Cardiothoracic ICU

Carrie Harvey, Katherine Klein and Michael Maile (2015). *Modern Concepts and Practices in Cardiothoracic Critical Care* (pp. 481-516).

www.irma-international.org/chapter/gastrointestinal-issues-in-the-cardiothoracic-icu/136921

Antiarrhythmics, Inotropes, and Vasopressors

Bethany R. Tellor and Keki R. Balsara (2015). *Modern Concepts and Practices in Cardiothoracic Critical Care* (pp. 237-252).

www.irma-international.org/chapter/antiarrhythmics-inotropes-and-vasopressors/136912

Acute Kidney Injury following Cardiac Surgery

Bryan Romito and Joseph Meltzer (2015). *Modern Concepts and Practices in Cardiothoracic Critical Care* (pp. 451-480).

www.irma-international.org/chapter/acute-kidney-injury-following-cardiac-surgery/136920