Contents

Preface: Advances in Hemodynamic Monitoring ix

Michael R. Pinsky

The Interface Between Monitoring and Physiology at the Bedside 1

Eliezer L. Bose, Marilyn Hravnak, and Michael R. Pinsky

Hemodynamic instability as a clinical state represents either a perfusion failure with clinical manifestations of circulatory shock or heart failure or one or more out-of-threshold hemodynamic monitoring values, which may not necessarily be pathologic. Different types of causes of circulatory shock require different types of treatment modalities, making these distinctions important. Diagnostic approaches or therapies based on data derived from hemodynamic monitoring assume that specific patterns of derangements reflect specific disease processes, which respond to appropriate interventions. Hemodynamic monitoring at the bedside improves patient outcomes when used to make treatment decisions at the right time for patients experiencing hemodynamic instability.

Minimally Invasive Monitoring 25

Xavier Monnet and Jean-Louis Teboul

Although use of the classic pulmonary artery catheter has declined, several techniques have emerged to estimate cardiac output. Arterial pressure waveform analysis computes cardiac output from the arterial pressure curve. The method of estimating cardiac output for these devices depends on whether they need to be calibrated by an independent measure of cardiac output. Some newer devices have been developed to estimate cardiac output from an arterial curve obtained noninvasively with photoplethysmography, allowing a noninvasive beat-by-beat estimation of cardiac output. This article describes the different devices that perform pressure waveform analysis.

Bedside Ultrasonography for the Intensivist 43

Jose Cardenas-Garcia and Paul H. Mayo

Videos of a normal parasternal long-axis view, a normal parasternal short-axis view, a normal apical 4-chamber view, a normal subcostal long-axis view, an inferior vena cava long longitudinal axis view, a severely reduced left ventricular systolic function, a moderately reduced left ventricular systolic function, a hyperdynamic left ventricular systolic function, a right ventricular pressure overload, acute cor pulmonale, a pericardial and pleural effusion,a pericardial tamponade, aortic stenosis, valvular vegetation, papillary muscle rupture, pleural effusion, lung sliding and A lines, lung pulse, lung point, B lines, a consolidation pattern, a noncompressible common femoral vein diagnostic of thrombus, a compressible common femoral vein and artery, a compressible common femoral vein at the level of the saphenous vein intake, a femoral vein at common femoral artery bifurcation, a fully

compressible common femoral vein, a fully compressible superficial femoral vein, a fully compressible popliteal vein, FAST study of right side, FAST study of suprapubic area, FAST study of left side accompany this article

Critical care ultrasonography is a bedside technique performed by the frontline clinician at the point of care. Point-of-care ultrasonography is conceptually related to physical examination. The intensivist uses visual assessment, auscultation, and palpation on an ongoing basis to monitor the patient. Ultrasonography adds to traditional physical examination by allowing the intensivist to visualize the anatomy and function of the body in real time. Initial, repeated, and goal-directed ultrasonography is an extension of the physical examination that allows the intensivist to establish a diagnosis and monitor the condition of the patient on a regular basis.

Invasive Hemodynamic Monitoring 67

Sheldon Magder

Although invasive hemodynamic monitoring requires considerable skill, studies have shown a striking lack of knowledge of the measurements obtained with the pulmonary artery catheter (PAC). This article reviews monitoring using a PAC. Issues addressed include basic physiology that determines cardiac output and blood pressure; methodology in the measurement of data obtained from a PAC; use of the PAC in making a diagnosis and for patient management, with emphasis on a responsive approach to management; and uses of the PAC that are not indications by themselves for placing the catheter, but can provide useful information when a PAC is in place.

Functional Hemodynamic Monitoring 89

Michael R. Pinsky

Functional hemodynamic monitoring is the assessment of the dynamic interactions of hemodynamic variables in response to a defined perturbation. Recent interest in functional hemodynamic monitoring for the bedside assessment of cardiovascular insufficiency has heightened with the documentation of its accuracy in predicting volume responsiveness using a wide variety of monitoring devices, both invasive and noninvasive, and across multiple patient groups and clinical conditions. However, volume responsiveness, though important, reflects only part of the overall spectrum of functional physiologic variables that can be measured to define the physiologic state and monitor response to therapy.

Defining Goals of Resuscitation in the Critically Ill Patient 113

Alexandre Joosten, Brenton Alexander, and Maxime Cannesson

There is still no "universal" consensus on an optimal endpoint for goal directed therapy (GDT) in the critically ill patient. As in other areas of medicine, this should help providers to focus on a more "individualized approach" rather than a protocolized approach to ensure proper patient care. Hemodynamic optimization needs more than simply blood pressure, heart rate, central venous pressure and urine output monitoring. It is essential to also monitor flow variables (cardiac output/stroke volume) and

dynamic parameters of fluid responsiveness whenever available. This article will provide a review of current and trending approaches of the goals of resuscitation in the critically ill patient.

Using What You Get: Dynamic Physiologic Signatures of Critical Illness 133

Andre L. Holder and Gilles Clermont

The development and resolution of cardiopulmonary instability take time to become clinically apparent, and the treatments provided take time to have an impact. The characterization of dynamic changes in hemodynamic and metabolic variables is implicit in physiologic signatures. When primary variables are collected with high enough frequency to derive new variables, this data hierarchy can be used to develop physiologic signatures. The creation of physiologic signatures requires no new information; additional knowledge is extracted from data that already exist. It is possible to create physiologic signatures for each stage in the process of clinical decompensation and recovery to improve outcomes.

Organizational Approaches to Improving Resuscitation Effectiveness 165

Ian J. Barbash and Jeremy M. Kahn

Hemodynamic instability and shock are important causes of mortality worldwide. Improving outcomes for these patients through effective resuscitation is a key priority for the health system. This article discusses several organizational approaches to improving resuscitation effectiveness and outlines key areas for future research and development. The discussion is rooted in a conceptual model of effective resuscitation based on three domains: monitoring systems, response teams, and feedback mechanisms. Targeting each of these domains in a unified approach helps clinicians effectively treat deteriorating patients, ultimately improving outcomes for this high-risk patient group.

Index 177