Preface on advances in hemodynamic monitoring in perioperative medicine

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The word monitoring is derived from the Latin word “monere”, which means to warn and to advise. In perioperative medicine, we are facing a flood of information that we need to integrate and take into consideration to come to adequate treatment decisions. In recent years, hemodynamic monitoring has increasingly been used to help perioperative care physicians in the operating room (OR), the intensive care unit (ICU), and the emergency department to provide optimal care for their patients. Technical innovations allowed for better and closer monitoring of patients undergoing surgery, and might thereby help to improve their outcome. It is therefore logical to summarize the recent advances in hemodynamic monitoring in perioperative medicine in this issue of Best Practice & Research Clinical Anaesthesiology.

The first two chapters will look at the current state-of-the art of measuring blood pressure (chapter 1) and blood flow (i.e., cardiac output; chapter 2), two key hemodynamic variables that guarantee adequate organ perfusion. Both chapters discuss the underlying physiology of these hemodynamic variables and describe the currently available measurement methods, showing a trend from invasive towards less or even non-invasive technologies.

More specifically, chapters 3 and 4 look at advanced hemodynamic monitoring techniques. Chapter 3 attempts to answer the question if we still need invasive catheterization techniques to look at cardiac filling pressures (both for the right and the left heart), even in the face of the newer, less-invasive techniques that have been introduced recently. Chapter 4 discusses one of the newer applications of hemodynamic monitoring by looking at heart–lung interactions, and how they can be used to predict fluid responsiveness. A special feature of this chapter is the focus on clinical applications in particular pathologies (including left heart failure, mitral valve insufficiency, aortic stenosis, and right heart failure), with a detailed description of the underlying pathophysiological mechanisms.

The following three chapters (5–7) discuss clinical applications of hemodynamic monitoring techniques for perioperative goal-directed therapy (pGDT; chapter 5), for predicting hypotension (chapter 6), and for closed-loop hemodynamic management (chapter 7). These chapters describe how hemodynamic monitoring techniques can be used to individualize hemodynamic management and eventually improve patient-centered outcomes. The evidence for reducing postoperative morbidity is quite convincing for pGDT, if the therapy is started early, includes a combination of fluids and vaso-active medications, and uses the right hemodynamic targets. The other two concepts (predicting hypotension and closed-loop hemodynamic management) are too new to derive conclusions on patient outcomes yet, but are typical examples how technological advances – including machine learning – are changing our field of practice.

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Chapters 8 and 9 again deal with more complex monitoring issues used for answering specific questions. Cerebral autoregulation (CA) is a physiological mechanism that guarantees a constant blood flow to vital organs (such as brain and kidneys) independent of blood pressure, at least within certain limits. However, we learned in recent years that CA may vary considerably among patients and clinical conditions, so that it is desirable to measure it. How this can be done with our current monitoring technologies is described in detail in chapter 8. Chapter 9 deals with a common condition encountered in many patients having cardiac and non-cardiac surgery, namely diastolic dysfunction. Since diastolic dysfunction is associated with adverse outcome and requires special management, anesthesiologists should be aware of this problem, and know how to assess and quantify it. Diastolic dysfunction is diagnosed by (transesophageal) echocardiography, and chapter 9 explains in detail the different steps and modalities to assess it intraoperatively, and which implications it may have for therapeutic decisions.

The last two chapters cover future applications of hemodynamic monitoring. Chapter 10 discusses postoperative ward monitoring, which is still almost neglected in current clinical practice. This is surprising since almost half of catastrophic cardiocirculatory problems occur on the normal ward. Chapter 11 considers the potential advantages of continuous monitoring on the ward, i.e. dramatically reducing response time of emergency teams activated to treat patients who acutely deteriorate, thus probably markedly improving the outcome of these patients. The closing chapter 11 is a sneak preview in the (nearby) future of hemodynamic monitoring and automation, and elaborates on how these new technologies might be used for decision making in many of the problems discussed in the previous chapters. It also covers the whole perioperative period from preoperative assessment and optimization (days) before surgery, the intraoperative monitoring period, and also continuous ward monitoring.

Taken together, this issue updates the clinician working in perioperative medicine on the latest developments in all aspects of hemodynamic monitoring, described by internationally respected experts in the field.

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