The Year in Cardiothoracic and Vascular Anesthesia: Selected Highlights From 2014

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THIS ARTICLE IS THE SEVENTH in the annual series for the Journal of Cardiothoracic and Vascular Anesthesia.[1] The authors thank the editor-in-chief, Dr. Kaplan, and the editorial board for the opportunity to continue this series; namely, the research highlights of the year that pertain to the specialty of cardiothoracic and vascular anesthesia. The major themes selected for this past year will be outlined in this introduction and then each highlight will be reviewed in detail in the main body of the article.

The literature highlights in the specialty for 2014 begin with the release of the new guidelines about perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery.[2] A pervasive theme throughout this important guideline is the detection and prevention of myocardial injury after noncardiac surgery that is explored in detail in this article because it is a common cause of perioperative mortality. The second major theme in our specialty for 2014 is the explosion of new therapeutic options for the management of atrial fibrillation (AF). The importance of these paradigm shifts for this common arrhythmia is reflected by the recent publication of comprehensive guidelines in both Europe and North America. The third major theme for the specialty is the revolution in adult aortic arch repair due to innovations such as moderate hypothermic circulatory arrest and hybrid aortic arch repair. The themes selected for this seventh highlights article only sample the advances in the specialty for 2014. The patient care processes identified in these highlights will further improve important perioperative outcomes for patients with cardiovascular disease in both cardiac and noncardiac surgery.

MYOCARDIAL INJURY AFTER NONCARDIAC SURGERY

The Detection of Myocardial Injury After Noncardiac Surgery

The recent guidelines from the American College of Cardiology (ACC) and American Heart Association (AHA) on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery have 9 sections, more than 100 pages of text and figures, and 490 references.[2] Although a detailed summary of this landmark document is beyond the scope of this highlights article, the emphasis on myocardial ischemia is pervasive throughout this important document.

A dominant theme in these perioperative guidelines is myocardial ischemia, given that it is a leading cause of perioperative mortality worldwide.[3,4] The importance of perioperative myocardial ischemia in the Journal is evidenced by the fact that more than 150 articles published in the past 2 years are related to this topic (electronic search in ScienceDirect for the Journal of Cardiothoracic and Vascular Anesthesia conducted on September 20, 2014, key word: Myocardial ischemia). Although the universal definition of myocardial infarction typically includes an elevated troponin in combination with an ischemic symptom and/or an ischemic electrocardiographic tracing, defining factors such as symptoms and electrocardiographic changes frequently may not accompany the presentation of myocardial ischemia in the perioperative setting.[5,6] The question is whether there is a better way to detect this life-threatening complication, given these limitations.

A recent analysis (n = 15,065) from the large international prospective Vascular Events In Noncardiac Surgery Patients Cohort Evaluation (VISION) study developed diagnostic criteria for myocardial injury after noncardiac surgery (MINS) as a primary objective.[6] The secondary objectives of this analysis

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were to determine the characteristics, predictors, and perioperative outcomes of MINS at 30 days (full details of the ongoing VISION study are available at www.clincialtrials.gov, trial identifier NCT00512109).[6] The principal finding from the VISION clinical registry was that MINS was diagnosed best by a peak perioperative troponin T level $\geq$0.03 ng/mL that was not attributable to a nonischemc etiology. This definition of MINS does not require an ischemic presentation with respect to clinical symptoms, signs, and electrocardiographic features.[6] In fact, only 41.8% of patients with MINS fulfilled the universal definition of myocardial infarction; the remaining 51.2% who did not rule in for myocardial infarction by classic criteria had a 30-day mortality rate of 7.7%.[5,6] Furthermore, according to this definition, MINS had an incidence of 8.0% and was associated significantly with cardiovascular complications and mortality at 30 days; it explained 34% of all deaths in adults in the first 30 days after noncardiac surgery.[6]

The VISION trial data have highlighted that MINS is common and important. The global impact of these observations is staggering; about 8 million adults suffer MINS worldwide each year, assuming that that the annual volume of adult noncardiac surgery is about 100 million cases.[6] Given this massive caseload, MINS likely accounts for more than 2 million deaths after noncardiac surgery worldwide every year.[6,7]

Further trials are, therefore, essential to identify strategies to prevent and manage the serious complication of MINS.[6,8,9] The consequences of perioperative myocardial ischemia have been realized globally, as evidenced by the recent large trials in Europe and Asia.[8,9] A large single-center analysis from China (n = 117,856: 2003-2011) found that perioperative myocardial infarction after adult noncardiac surgery had an incidence of 5.2 per 10,000, although it significantly increased with age to an incidence of 40.4 per 10,000 for adults aged $\geq$75 years ($p < 0.001$).[9] The mortality rate for patients with myocardial ischemia was 36.1%, which was more than 100 times higher than patients with no perioperative myocardial ischemia (36.1% *v* 0.32%; $p < 0.001$).[9] Furthermore, in this study myocardial infarction typically occurred within 72 hours after surgery without chest pain and with non-ST segment changes on the electrocardiogram.[9]

Taken collectively, these perioperative trials also have highlighted the gaps in the current universal definition of myocardial infarction with respect to perioperative practice; this definition at times may not be clinically relevant. This lack of clinical relevance not only has resulted in the VISION registry but also has led to recent consideration of a new definition of clinically relevant myocardial infarction after coronary revascularization, whether due to percutaneous coronary intervention or coronary artery bypass grafting.[10] Given these gaps in the current definition of myocardial infarction, it is likely that the universal definition of myocardial infarction will be revised in the near future.

The 2014 ACC/AHA guidelines deal with MINS in section 8 entitled "perioperative surveillance."[2] In the setting of signs and symptoms suggestive of perioperative myocardial ischemia, the guidelines strongly recommend the analysis of an electrocardiogram (Class I recommendation; Level of Evidence B) and the measurement of troponins (Class I recommendation; Level of Evidence A).[2] The routine measurement of troponins in patients at high risk for MINS was recommended less strongly in the absence of a defined management strategy with known risks and benefits (Class IIb recommendation; Level of Evidence B).[2] The routine postoperative measurement of troponins in unselected patients was not recommended (Class III recommendation; level of Evidence B).[2]

The VISION trials have, through perioperative surveillance, facilitated the discovery of a gap in perioperative care, namely the detection and management of MINS.[4–6] Although a troponin-based definition has refined the identification of MINS in at-risk patients, the question now becomes what interventions are available to prevent this serious complication.

The Prevention of Myocardial Injury After Noncardiac Surgery

The perioperative therapy for MINS is reviewed in detail in section 6 of the recent ACC/AHA guidelines.[2] The first subsection deals with recommendations for coronary revascularization before noncardiac surgery, including surgical timing in patients who have undergone previous percutaneous coronary intervention.[2] The second subsection deals with perioperative medical therapy, including beta-blockers, alpha$_2$-agonists, and antiplatelet agents.[2]

The recommendations for perioperative beta-blockade in these guidelines are based on a recent systematic review of the evidence that was specially commissioned to address the scientific misconduct in the work by Dr. Poldermans.[2,11] The issue of research misconduct has been reviewed previously in this article series.[12] The key findings of the ACC/AHA systematic review were not affected significantly by the exclusion of the relevant published studies by Dr. Poldermans. Full details of this evidence analysis are provided both in the guidelines and the separately published metaanalysis.[2,12] The first strong recommendation in the new guidelines is that beta-blockers should be continued in patients undergoing surgery who have been on these agents chronically (Class I recommendation; Level of Evidence B).[2] The second strong recommendation is that beta-blockade should not be commenced on the day of surgery (Class III recommendation; Level of Evidence B).[2] The remaining 5 recommendations about beta-blockers in this guideline are Class II and are discussed comprehensively in section 6.2 (subsection 1).[2] The roles of this group of pharmacologic agents, in both cardiac and noncardiac surgery, continue to be explored vigorously and debated in the Journal: 73 articles were devoted to this topic in the Journal within the past 2 years, including a recent meta-analysis (electronic search in ScienceDirect for the Journal of Cardiothoracic and Vascular Anesthesia conducted on September 22, 2014, key word: beta-blockers).[13]

The guidelines also have strongly recommended against apha$_2$-agonists for prevention of myocardial events in patients undergoing noncardiac surgery (Class III recommendation; Level of Evidence B).[2] The recent international randomized Perioperative Ischemic Evaluation-2 (POISE-2) trial evaluated the effects of low-dose clonidine (0.2 mg/day) in patients with or at risk for atherosclerotic disease who underwent noncardiac surgery (n = 10,010: 135 centers in 23 countries).[14,15] In this