

# Implications of Preoperative Heart Failure

## The Next Frontier in Perioperative Medicine?

**CME** This editorial accompanies the article selected for this month's ANESTHESIOLOGY CME Program. After reading the article and editorial, go to <http://www.asahq.org/journal-cme> to take the test and apply for Category 1 credit. Complete instructions may be found in the CME section at the back of this issue.

FOR more than three decades, the presence of signs and symptoms of heart failure has been associated with increased perioperative cardiovascular risk for noncardiac surgery. In the original multifactorial Cardiac Risk Index developed by Goldman *et al.*<sup>1</sup> and published in 1977, the presence of an S3 gallop was associated with 11 points, the highest value assigned to any risk factor. Even as recently as the publication of the Revised Cardiac Risk Index, the presence of heart failure remained one of the independent predictors of adverse cardiac outcomes.<sup>2</sup> Given the wide dissemination of these landmark articles and the inclusion of heart failure as a major clinical predictor in the American Heart Association-American College of Cardiology Guidelines on Perioperative Cardiovascular Care since 1996, is it surprising and somewhat concerning that heart failure is shown to be not only a risk factor but a more important risk factor than coronary artery disease in a study published in this month's Journal by Hammill *et al.*<sup>3-6</sup>

Much of the work related to the study of cardiovascular risk has focused on patients undergoing major vascular surgery.<sup>7,8</sup> The advantage of such an approach is the high rate of adverse cardiovascular outcomes in this surgical group allows the investigators to have sufficient power to find important associations. When studying a more diverse grouping of noncardiac surgeries with lower perioperative risk, it becomes important to obtain larger data sets to assess these associations with more precision. The article published in this month's Journal uses an analysis of large administrative data sets, specifically Medicare data, to accomplish these goals. Analysis of administrative data has its limitations in that it has not

been collected for the purpose of research but does offer the opportunity to analyze large number of patients and generate important hypotheses or observations.<sup>9</sup> By using longitudinal data that allow the investigator to link previous admissions to the noncardiac surgery, the investigative team is able to better assess comorbidities with some degree of confidence.

Given the use of administrative data, it was important to choose outcomes that are robust and would be collected in a similar manner. Hammill *et al.* clearly achieved this goal. Mortality is the most important outcome and can easily and accurately be obtained from the Medicare and Social Security data files. Given the inclusion of all covered medical care for a given individual in the data sets, the second outcome of interest, readmission within 30 days, can also accurately be obtained. A key issue is that the current study reports all-cause mortality and all readmissions. Perioperative mortality and admission within 30 days may be the result of patient disease and surgical and anesthesia etiologies. One approach to linking these outcomes to potential etiologies is the use of billing codes for complications and comorbidities, as the authors have done in the determination of the presence of heart failure or coronary artery disease. However, surveillance for perioperative cardiac events is poor, and the frequency with which any detected event is actually entered into the discharge summary and coded on the Medicare claim form further questions the utility of such an approach. Therefore, the investigators chose to report all-cause outcomes and cannot link patient disease and outcome. Therefore, Hammill *et al.* have presented an extremely important hypothesis-generating study, and much additional work must be done to confirm this link so that the information can be used to inform future research and clinical care.

So, if the hypothesis is correct and heart failure, even in the absence of coronary artery disease, is an important predictor of adverse outcome, the question remains whether focused efforts on reducing the complications of heart failure in the perioperative period would actually result in a reduction in 30-day mortality and subsequent admissions. The past decade has been marked by increasing enthusiasm for perioperative interventions to reduce complications of coronary artery disease. For example, administration of  $\beta$ -blockers had recently been advocated for all patients currently not taking  $\beta$ -blockers but at risk for coronary artery disease.<sup>10</sup> With the recent presentation of the Perioperative Ischemic Evaluation (POISE) study, this enthusiasm has been significantly dampened as investigators attempt to determine whether the

This Editorial View accompanies the following article: Hammill BG, Curtis LH, Bennett-Guerrero E, O'Connor CM, Jollis JG, Schulman KA, Hernandez AF: Impact of heart failure on patients undergoing major noncardiac surgery. ANESTHESIOLOGY 2008; 108:559-67.

Accepted for publication January 3, 2008. The author is not supported by, nor maintains any financial interest in, any commercial activity that may be associated with the topic of this article.

increased mortality and stroke seen in the  $\beta$ -blocker group are a result of dosage, timing of initiation of  $\beta$ -blockers, or any particular patient risk profiles<sup>11</sup> (Philip J. Devereaux, B.Sc., M.D., Assistant Professor, Department of Clinical Epidemiology and Biostatistics, Joint Member, Department of Medicine, McMaster University, Hamilton, Ontario, Canada, verbal communication, November 2007). It may even be possible that the enthusiasm to provide perioperative  $\beta$ -blockers to those currently not taking these agents may have resulted in worsening of heart failure.

The key question is whether we have any perioperative interventions to reduce risk from heart failure or whether we will observe a similar enthusiasm and subsequent caution for these interventions as observed in the  $\beta$ -blocker story. For example, use of pulmonary artery catheters to reduce complications of heart failure and significant coronary artery disease could be extrapolated by the work of Rao *et al.*<sup>12</sup> However, recent large-scale cohort and randomized trials were unable to demonstrate any benefit with potential increased risk of heart failure.<sup>13,14</sup> The one firm conclusion that can be made is that additional studies are needed that focus on patients with heart failure. POISE has taught us that these studies should include large numbers of patients to avoid any potential error from a lack of power to detect any detrimental side effects as opposed to focusing solely on reduction in primary outcomes.

**Lee A. Fleisher, M.D.,** Department of Anesthesiology and Critical Care, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania. lee.fleisher@uphs.upenn.edu

## References

1. Goldman L, Caldera DL, Nussbaum SR, Southwick FS, Krogstad D, Murray B, Burke DS, O'Malley TA, Goroll AH, Caplan CH, Nolan J, Carabello B, Slater EE: Multifactorial index of cardiac risk in noncardiac surgical procedures. *N Engl J Med* 1977; 297:845-50
2. Lee TH, Marcantonio ER, Mangione CM, Thomas EJ, Polanczyk CA, Cook EF, Sugarbaker DJ, Donaldson MC, Poss R, Ho KK, Ludwig LE, Pedan A, Goldman L: Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. *Circulation* 1999; 100:1043-9
3. Eagle K, Brundage B, Chaitman B, Ewy G, Fleisher L, Hertzner N, Leppo L, Ryan T, Schlant R, Spencer W, Spittell J, Twiss R: Guidelines for perioperative cardiovascular evaluation of the noncardiac surgery: A report of the American Heart Association/American College of Cardiology Task Force on Assessment of Diagnostic and Therapeutic Cardiovascular Procedures. *Circulation* 1996; 93: 1278-317
4. Eagle KA, Berger PB, Calkins H, Chaitman BR, Ewy GA, Fleischmann KE, Fleisher LA, Froehlich JB, Gusberg RJ, Leppo JA, Ryan T, Schlant RC, Winters WL Jr, Gibbons RJ, Antman EM, Alpert JS, Faxon DP, Fuster V, Gregoratos G, Jacobs AK, Hiratzka LF, Russell RO, Smith SC Jr: ACC/AHA guideline update for perioperative cardiovascular evaluation for noncardiac surgery—Executive summary: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *Circulation* 2002; 105:1257-67
5. Fleisher LA, Beckman JA, Brown KA, Calkins H, Chaikof E, Fleischmann KE, Freeman WK, Froehlich JB, Kasper EK, Kersten JR, Riegel B, Robb JF, Smith SC Jr, Jacobs AK, Adams CD, Anderson JL, Antman EM, Buller CE, Creager MA, Ettinger SM, Faxon DP, Fuster V, Halperin JL, Hiratzka LF, Hunt SA, Lytle BW, Nishimura R, Ornato JP, Page RL, Tarkington LG, Yancy CW: ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery), developed in collaboration with the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery. *Circulation* 2007; 116:e418-99
6. Hammill BG, Curtis LH, Bennett-Guerrero E, O'Connor CM, Jollis JG, Schulman KA, Hernandez AF: Impact of heart failure on patients undergoing major noncardiac surgery. *ANESTHESIOLOGY* 2008; 108:559-67
7. Fleisher LA, Eagle KA: Clinical practice: Lowering cardiac risk in noncardiac surgery. *N Engl J Med* 2001; 345:1677-82
8. Mangano DT: Perioperative cardiac morbidity. *ANESTHESIOLOGY* 1990; 72: 153-84
9. Fleisher LA, Anderson GF: Perioperative risk: How can we study the influence of provider characteristics? *ANESTHESIOLOGY* 2002; 96:1039-41
10. Auerbach AD, Goldman L:  $\beta$ -Blockers and reduction of cardiac events in noncardiac surgery: Clinical applications. *JAMA* 2002; 287:1445-7
11. Devereaux PJ, Yang H, Guyatt GH, Leslie K, Villar JC, Monteri VM, Choi P, Giles JW, Yusuf S: Rationale, design, and organization of the PeriOperative ISchemic Evaluation (POISE) trial: A randomized controlled trial of metoprolol *versus* placebo in patients undergoing noncardiac surgery. *Am Heart J* 2006; 152:223-30
12. Rao TLK, Jacobs KH, El-Etr AA: Reinfarction following anesthesia in patients with myocardial infarction. *ANESTHESIOLOGY* 1983; 59:499-505
13. Polanczyk CA, Rohde LE, Goldman L, Cook EF, Thomas EJ, Marcantonio ER, Mangione CM, Lee TH: Right heart catheterization and cardiac complications in patients undergoing noncardiac surgery: An observational study. *JAMA* 2001; 286:309-14
14. Sandham JD, Hull RD, Brant RF, Knox L, Pineo GF, Doig CJ, Laporta DP, Viner S, Passerini L, Devitt H, Kirby A, Jacka M: A randomized, controlled trial of the use of pulmonary-artery catheters in high-risk surgical patients. *N Engl J Med* 2003; 348:5-14