STEVEN L. COHN, MD, MACP, SFHM
Professor Emeritus, Department of Medicine, University of Miami Miller School of Medicine, Miami, FL

PAUL J. GRANT, MD, SFHM, FACP
Associate Professor of Medicine, Associate Chief Medical Information Officer, Director, Perioperative and Consultative Medicine, Division of Hospital Medicine, Department of Internal Medicine, University of Michigan, Ann Arbor

BARBARA SLAWSKI, MD, MS, SFHM
Professor of Medicine and Orthopedic Surgery, Chief, Section of Perioperative and Consultative Medicine, Division of General Internal Medicine, Department of Medicine, Medical College of Wisconsin, Milwaukee

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2019 Update in perioperative cardiovascular medicine

ABSTRACT

We performed a MEDLINE search and found 6 studies published February 2018 through January 2019 that should influence perioperative cardiovascular medicine, specifically in preoperative cardiac risk assessment, perioperative medication management, and postoperative cardiac complications.

KEY POINTS

The Duke Activity Status Index is a better tool for assessing cardiopulmonary fitness than subjective assessment, and it should be considered for use in guideline algorithms.

Aspirin should not be given perioperatively in patients undergoing vascular surgery other than carotid endarterectomy.

Angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (ARBs) are associated with intraoperative hypotension if given before surgery. Further study is needed to determined how best to manage ACE inhibitors and ARBs perioperatively.

In a study, dabigatran given to patients with myocardial injury after noncardiac surgery lowered the risk of major vascular complications, with no significant increase in major bleeding. But the study had major limitations.

Postoperative atrial fibrillation is associated with outcomes similar to those of nonsurgical nonvalvular atrial fibrillation. Anticoagulation decreases its stroke and mortality risk.

Perioperative medicine is an evolving field with a rapidly growing body of literature, particularly in cardiology.

In this update, we review 6 articles to answer questions related to preoperative cardiac risk assessment, perioperative medication management, and postoperative cardiac complications. We surveyed perioperative literature from February 2018 through January 2019 and chose the final articles by consensus, based on relevance to clinicians who provide preoperative evaluations and postoperative care to surgical patients.

These summaries are derived from "Updates in Perioperative Medicine" presented at the 14th Annual Perioperative Medicine Summit (Orlando, FL, February 13–16, 2019) and the 2019 Society of Hospital Medicine Annual Meeting (National Harbor, MD, March 24–27, 2019).

■ PREOPERATIVE CARDIAC EVALUATION

How well do measures of functional capacity predict perioperative complications and mortality in noncardiac surgical patients?

Functional capacity is commonly assessed in preoperative evaluations to estimate patients' risks of perioperative complications and death. The American College of Cardiology/American Heart Association[1] and the European Society of Cardiology[2] guidelines both include estimation of cardiopulmonary fitness as a step in preoperative assessment before major noncardiac surgery.

"Subjective assessment" is one way to estimate functional capacity. Simply put, clinicians try to form a rough idea about the fitness of patients by asking questions about routine activities such as walking or climbing stairs. Although commonly used, subjective assessment

TABLE 1

The Duke Activity Status Index

Can you:	Weight
Take care of yourself—eat, dress, bathe, use the toilet?	2.75
Walk indoors, such as around your house?	1.75
Walk a block or two on level ground?	2.75
Climb a flight of stairs or walk up a hill?	5.50
Run a short distance?	8.00
Do light work around the house like dusting or washing dishes?	2.70
Do moderate work around the house like vacuuming, sweeping floors, or carrying groceries?	3.50
Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?	8.00
Do garden work like raking leaves, weeding, or pushing a lawn mower?	4.50
Have sexual relations?	5.25
Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a ball?	6.00
Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?	7.50
Best score	**58.20**

Higher scores correlate with higher functional capacity, but specific cutoffs to predict postoperative risk have not been established.

Reprinted from Hlatky MA, Boineau RE, Higginbotham MB, et al. A brief self-administered questionnaire to determine functional capacity (The Duke Activity Status Index) Am J Cardiol 1989; 64(10):651–654, copyright 1989, with permission from Elsevier.

In a multicenter, prospective cohort study, Wijeysundera et al[4] compared subjective functional capacity assessment, the Duke Activity Status Index, cardiopulmonary exercise testing, and the preoperative N-terminal pro-B-type natriuretic peptide (NT-proBNP) level in their ability to predict complications and death in 1,401 noncardiac surgery patients older than 40 with at least 1 cardiovascular risk factor. After surgery, patients had daily electrocardiograms and troponin measurements until postoperative day 3 or discharge.

The primary outcome was the 30-day incidence of death or myocardial infarction (MI). Additional outcomes included the 30-day incidence of death or myocardial injury after noncardiac surgery (MINS), the 1-year mortality rate, and moderate to severe in-hospital perioperative complications.

Findings. Two percent of patients died or had an MI within 30 days of surgery.[4]

Subjective assessment had only a 19.2% sensitivity (95% confidence interval [CI] 14.2–25) but a 94.7% specificity (95% CI 93.2–95.9) for predicting inability to attain 4 metabolic equivalents during exercise.[4]

A lower Duke Activity Status Index predicted the primary outcome of death or MI within 30 days (adjusted odds ratio [OR] 0.96, 95% CI 0.83–0.99, P = .03), and it was the only measure that did so. Additionally, the Duke index and NT-proBNP level predicted the risk of death or MINS within 30 days.[4]

Only elevated NT-proBNP was associated with death at 1 year.[4]

On exercise testing, low peak oxygen consumption was significantly associated with perioperative complications.

Limitations. The number of primary outcome events (death and MI) was low, potentially affecting the statistical power of the study.

Conclusions. Subjective assessment of functional capacity misclassifies too many patients as being at low risk of perioperative complications and should not be used for preoperative risk stratification. Other tools, such as the Duke Activity Status Index and NT-

of functional capacity lacks strong evidence that it predicts adverse perioperative events.

The Duke Activity Status Index is another method: self-administered in a questionnaire, it consists of 12 questions, which have weighted values (**Table 1**).[3] In its derivation and validation studies, its results were found to correlate with peak oxygen uptake during exercise.

Cardiopulmonary exercise testing is a third option. It measures peak oxygen consumption and anaerobic threshold during exercise. It is probably the best objective measurement of functional capacity, but not necessarily for predicting postoperative cardiac complications, and it is performed relatively infrequently.

proBNP levels, are better predictors of adverse perioperative cardiovascular outcomes and should be considered for use in preoperative cardiac risk assessment.

Although the Duke Activity Status Index is a better predictor of adverse outcomes than subjective functional capacity assessment, a specific perioperative threshold for risk classification has not been established. Its correlate for metabolic equivalents should be considered for use in clinical practice at this point.

■ PERIOPERATIVE MEDICATION MANAGEMENT

Is perioperative aspirin beneficial in patients undergoing vascular surgery?

The Perioperative Ischemic Evaluation 2 (POISE-2) trial,[5] a 2-by-2 factorial randomized controlled trial in which patients received perioperative aspirin, clonidine, both, or neither, demonstrated that perioperative aspirin did not reduce cardiovascular events and increased major bleeding. Patients with recently placed coronary stents and those undergoing carotid endarterectomy were excluded because aspirin is known to have a beneficial effect in these patients.

A subsequent substudy[6] found perioperative aspirin to be beneficial in patients with coronary stents placed more than a year before noncardiac surgery. Whether perioperative aspirin is beneficial in other subgroups was unknown.

Biccard BM, Sigamani A, Chan MTV, et al. Effect of aspirin in vascular surgery in patients from a randomized clinical trial (POISE-2). Br J Surg 2018; 105(12):1591–1597. doi:10.1002/bjs.10925

Biccard et al[7] investigated the effect of perioperative aspirin in the subgroup of patients from the POISE-2 trial who underwent vascular surgery. The primary outcome was death or MI within 30 days. Secondary outcomes in this substudy included vascular occlusive complications (amputation and peripheral arterial thrombosis) and major or life-threatening bleeding.

Findings. In POISE-2, vascular surgery was performed in 603 patients—272 for occlusive disease, 265 for aneurysm, and 66 for both. The results were similar regardless of the type of surgery. Aspirin had little effect (**Table 2**).[7]

TABLE 2

Aspirin has little effect on 30-day outcomes after surgery: The POISE-2 trial

	Aspirin group	Placebo group	Hazard ratio
Primary outcome (death or myocardial infarction)			
Main trial[a]	7.0%	7.1%	0.99
In aneurysm surgery	13.7%	9.0%	1.48
In surgery for occlusive disease	15.8%	13.6%	1.16
In nonvascular surgery	6.4%	6.8%	0.95
Secondary outcomes			
Vascular occlusive complications			
Main trial	0.4%	0.5%	0.82
In aneurysm surgery	0.8%	3.0%	0.25
In surgery for occlusive disease	5.6%	8.8%	0.59
In nonvascular surgery	0.2%	0.2%	1.01
Major or life-threatening bleeding			
Main trial	6.3%	5.1%	1.22[b]
In aneurysm surgery	6.9%	5.2%	1.45
In surgery for occlusive disease	8.9%	8.0%	1.10
In nonvascular surgery	6.1%	5.0%	1.24[b]

[a] N = 10,010, including 265 undergoing aneurysm surgery, 272 undergoing surgery for occlusive disease, and 9,330 undergoing nonvascular surgery.
[b] Statistically significant ($P < .05$).

Data from Biccard et al, reference 7.

Limitations. There were few adverse events, and this substudy was underpowered for the primary and secondary outcomes.

Conclusion. Starting or continuing aspirin did not improve outcomes, and withdrawing it did not increase cardiovascular or occlusive complications.

Do ACE inhibitors affect risk in noncardiac nonvascular surgery?

Angiotensin-converting enzyme (ACE) inhibitors and angiotensin II receptor blockers (ARBs) are some of the most commonly used medications for treating hypertension. But

whether patients should continue receiving them on the day of surgery or whether they should be held remains unclear.

Although current recommendations are inconsistent, the most recent American College of Cardiology/American Heart Association[1] perioperative practice guidelines say that continuing ACE inhibitors or ARBs is reasonable perioperatively. This recommendation, however, acknowledges that published evidence is limited. There is general agreement that preoperative exposure to ACE inhibitors and ARBs is associated with intraoperative hypotension, but whether this increases the risk of adverse clinical outcomes remains unclear. Needed was a study to determine the effect on perioperative morbidity and mortality of continuing vs withholding ACE inhibitors and ARBs before surgery.

Shiffermiller et al[8] performed a randomized controlled trial comparing the effect of 2 preoperative ACE inhibitor management protocols in patients undergoing noncardiac nonvascular surgery. Patients were randomized to either receive or not receive their final preoperative ACE inhibitor dose, whether scheduled on the morning of surgery or the night before.

Exclusion criteria included hypotension or hypertension at their preoperative clinic appointment (defined as systolic blood pressure < 90 or ≥ 160 mm Hg, and diastolic blood pressure < 60 or ≥ 95 mm Hg), moderate to severe heart failure, and end-stage renal disease requiring dialysis. Excluded surgery types were cardiac, vascular, organ transplant, oncologic, and all outpatient procedures. Patients taking ARBs were also excluded.

The primary outcome was intraoperative hypotension defined as any systolic blood pressure less than 80 mm Hg from the time of anesthesia induction until transfer to the postanesthesia care unit. Secondary outcomes were measured until hospital discharge and included postoperative acute kidney injury, postoperative hypotension (systolic pressure < 90 mm Hg) and hypertension (systolic pressure > 180 mm Hg), major cardiac events (composite of acute coronary syndrome, acute heart failure, or new-onset arrhythmia), and death.

Findings. A total of 453 patients were screened for eligibility, and of these, 291 were included for randomization. Their average age was 64, 48% were men, and 87% were white. About 50% underwent general anesthesia, 25% spinal, and 25% regional. Over half of the surgeries were orthopedic, and 20% were spine surgeries.

The primary outcome of intraoperative hypotension occurred significantly less often in patients randomized to ACE inhibitor omission than in the continuation group (55% vs 69%, relative risk [RR] 0.81, 95% CI 0.67–0.97, P = .03). This translates to 1 case of intraoperative hypotension for every 7.5 patients continuing an ACE inhibitor perioperatively (number needed to harm 7.5). Intraoperative hypotension associated with vasopressor administration also occurred significantly less frequently in the ACE inhibitor omission group.

Patients in the ACE inhibitor omission group were also less likely to experience postoperative hypotension, but on the other hand, they were more likely to experience severe postoperative hypertension (defined as any systolic blood pressure > 180 mm Hg). The two groups fared the same in terms of rates of acute kidney injury and major adverse cardiac events (MACE) and hospital length of stay, and no patients died in either group.

Limitations. Several factors limit the generalizability of this single-center study, including the many exclusion criteria, the predominance of orthopedic and spine surgeries, and the low-risk patient population (the average Revised Cardiac Risk Index score was 0, range 0–3). Other limitations include not controlling for the specific ACE inhibitor used and not including the precise timing of the final dose in relation to surgery. Lastly, this study lacked power to measure postoperative outcomes.

Conclusions. Continuing ACE inhibitor treatment before noncardiac nonvascular surgery is associated with a greater frequency and duration of intraoperative hypotension, but it did not increase the incidences of acute kidney injury, MACE, or death nor the hospital length of stay.

There was 1 case of intraoperative hypotension for every 7.5 patients continuing an ACE inhibitor perioperatively

Hollmann C, Fernandes NL, Biccard BM. A systematic review of outcomes associated with withholding or continuing angiotensin-converting enzyme inhibitors and angiotensin receptor blockers before noncardiac surgery. Anesth Analg 2018; 127(3):678–687. doi:10.1213/ANE.0000000000002837

Hollmann et al[9] performed a meta-analysis to determine whether it is better to continue or withhold ACE inhibitors and ARBs before surgery. The patients were adults undergoing noncardiac surgery and receiving an ACE inhibitor or ARB, which was either withheld or continued on the morning of surgery.

Primary outcomes were all-cause mortality and MACE, while secondary outcomes included the incidence of acute kidney injury, heart failure, stroke, intraoperative and postoperative hypotension, and length of hospital stay. Randomized controlled trials and observational studies were included, while case reports and case-control studies were excluded.

Findings. This meta-analysis included 5 randomized controlled trials and 4 cohort studies, with a total of 6,022 patients; 1,816 had their ACE inhibitor or ARB withheld before surgery, while 4,206 continued therapy. It found no difference between the 2 groups in the incidence of death or MACE, and there were not enough data to determine a difference in heart failure, stroke, acute kidney injury, or hospital length of stay.

Seven studies, with 5,414 patients, examined intraoperative hypotension. The overall incidence was 30%, but was significantly lower if the ACE inhibitor or ARB was withheld (OR 0.63, 95% CI 0.47–0.85, P = .002). Findings were similar in an analysis of only the randomized controlled trials. No difference was observed in postoperative hypotension.

Limitations. There was no standard definition of the morbidity outcomes, including hypotension and MACE. The assessment of MACE included data only for MI and not MINS. The specific duration of hypotension was not reported, and this meta-analysis did not take into account different anesthetic techniques. The duration of follow-up varied widely among studies, ranging from the day of hospital discharge to 30 days after surgery. And the randomized controlled trial performed by Shiffermiller et al[8] was not included.

Conclusions. While continuing ACE inhibitors or ARBs before noncardiac surgery was associated with intraoperative hypotension, it did not seem to affect other outcomes, including death and MACE. The authors propose that a large randomized controlled trial is needed to determine whether continuing or withholding ACE inhibitor or ARB therapy before surgery is safer.

■ POSTOPERATIVE CARDIAC COMPLICATIONS

How should we treat MINS?

MINS is associated with an increased risk of cardiovascular events and death in both the short term and long term. MINS is defined as an elevated postoperative troponin level related to an ischemic etiology. However, whether to routinely measure troponin after surgery is unclear, as most patients do not present with ischemic symptoms, and there is no standard of care for treatment of this entity. Limited observational data suggest that starting or intensifying cardiac medications, particularly aspirin and statins, may be beneficial in terms of reducing 30-day mortality rates in patients with MI or cardiac events at 1 year in vascular surgery patients with MINS.

The Management of Myocardial Injury After Noncardiac Surgery (MANAGE) trial was designed to evaluate the potential of the anticoagulant dabigatran to prevent major vascular complications in patients with MINS.

Devereaux PJ, Duceppe E, Guyatt G, et al. Dabigatran in patients with myocardial injury after non-cardiac surgery (MANAGE): an international, randomised, placebo-controlled trial. Lancet 2018; 391(10137):2325–2334. doi:10.1016/S0140-6736(18)30832-8

Devereaux et al[10] randomized patients who were at least 45 years old and had developed MINS within the previous 35 days to receive dabigatran 110 mg orally twice daily or placebo for up to 2 years. Patients not already taking a proton pump inhibitor were also randomized to take either omeprazole 20 mg once daily or placebo.

The primary efficacy outcome initially was major vascular complications, which included vascular mortality, nonfatal MI, nonhemorrhagic stroke, and peripheral arterial thrombosis. However, amputation and symptomatic venous thromboembolism were subsequently added during the study.

Dabigatran lowered the risk of major vascular complications in patients with MINS, with no significant increase in major bleeding

The primary safety outcome was a composite of life-threatening, major, and critical organ bleeding. Major bleeding required a decrease in hemoglobin of at least 4 g/dL, transfusion of at least 3 units of red blood cells within a 24-hour period, or a procedure to stop the bleeding.

Findings. The original goal was to recruit 3,200 patients, but due to slow enrollment and loss of funding, the sample was reduced to 1,754 patients (877 in each group). Approximately 45% of each group stopped taking the study drug prematurely.

The primary efficacy outcome occurred in significantly fewer patients receiving dabigatran (97, 11%) than placebo (133, 15%, HR 0.72, 95% CI 0.55–0.93, P = .0115). The incidence of the primary safety outcome was similar in both groups: 3% with dabigatran and 4% with placebo (HR 0.92, 95% CI 0.55–1.53, P = .76). The only individual efficacy outcome meeting statistical significance was a lower rate of nonhemorrhagic stroke in the dabigatran group. Subgroup analyses showed a trend benefiting patients randomized within 5 days of MINS or with a diagnosis of MI, although it was not statistically significant.

Limitations. The efficacy outcomes were expanded to include venous thromboembolism and others not directly related to MINS, raising questions about the conclusions. Further, as defined by the protocol, bleeding had to be fairly severe to be deemed major. The high number of patients who discontinued the study drug is another limitation of this study.

Conclusion. Dabigatran lowered the risk of major vascular complications with no significant increase in major bleeding in patients with MINS.

What is the risk of thromboembolism in postoperative atrial fibrillation, and what are the benefits of anticoagulation?

Although nonvalvular atrial fibrillation is associated with increased risks of ischemic stroke and systemic embolic events in nonsurgical patients, the association of new-onset postoperative atrial fibrillation with long-term thromboembolic events in the noncardiac surgical population is not well established.

In this retrospective cohort study using a nationwide registry in Denmark, Butt et al[11] assessed the long-term risk of thromboembolic events in noncardiac surgical patients with new postoperative atrial fibrillation. Patients were identified who had no previous history of atrial fibrillation and developed it after noncardiac, nonobstetric surgeries, and were matched in a 1:4 ratio with patients who developed nonvalvular atrial fibrillation during nonsurgical hospitalizations. Matching was based on age, sex, heart failure, hypertension, diabetes, known history of thromboembolic events, ischemic heart disease, and the year patients presented with new atrial fibrillation.

Patients were excluded if they received antiarrhythmic drugs or oral anticoagulants before hospitalization or surgery, had cancer in the year prior, or died in the hospital.

The primary outcome of the study was thromboembolic events—a composite of ischemic stroke, transient cerebral ischemia, and peripheral arterial thrombosis or embolism. Secondary outcomes included rehospitalization for atrial fibrillation and all-cause mortality.

Findings. Overall, 0.4% of patients developed new postoperative atrial fibrillation, of whom 3,380 were matched with 15,320 patients with nonvalvular atrial fibrillation. Over a median follow-up of 3.2 years, the risk of thromboembolic events was similar in both groups (31.7 and 29.9 per 1,000 person-years, HR 0.95, 95% CI 0.85–1.07). The groups did not differ in their CHA_2DS_2-VASc risk scores, HAS-BLED risk scores, or year in which patients were diagnosed.

Anticoagulation lowered the risk of thromboembolic events to a similar extent in both groups compared with no anticoagulation:

- In postoperative atrial fibrillation— HR 0.57, 95% CI 0.40–0.67
- In nonvalvular atrial fibrillation— HR 0.56, 95% CI 0.51–0.62.

Despite the similar reduction in thromboembolic events, only 24.4% of the postoperative atrial fibrillation patients were started on anticoagulation therapy within 30 days of discharge, compared with 41.5% of those with nonvalvular atrial fibrillation.

Substantially fewer patients with post-operative atrial fibrillation receive anticoagulation

Limitations. Although this was a large study with excellent follow-up data, it was observational. It may have underestimated the number of patients who developed postoperative atrial fibrillation because episodes that were judged not to be clinically significant may not have been charted. Many patients are not monitored with continuous telemetry postoperatively, which also may have led to underestimation of the number of atrial fibrillation events.

The study also did not examine the number of atrial fibrillation episodes per patient, the heart rhythm at discharge or long-term, or indication for and duration of anticoagulation. There were no data regarding international normalized ratio levels.

Conclusions. Postoperative atrial fibrillation is associated with outcomes similar to those of nonsurgical nonvalvular atrial fibrillation. Anticoagulation decreases the risks of stroke and death. However, substantially fewer patients with postoperative atrial fibrillation receive anticoagulation. Anticoagulation should be considered in these patients, while noting bleeding risk. ■

■ REFERENCES

1. **Fleisher LA, Fleischmann KE, Auerbach AD, et al**. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. J Am Coll Cardiol 2014; 64(22):e77–137. doi:10.1016/j.jacc.2014.07.944

2. **Kristensen SD, Knuuti J, Saraste A, et al**. 2014 ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management: the Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA). Eur Heart J 2014; 35(35):2383–2431. doi:10.1093/eurheartj/ehu282

3. **Hlatky MA, Boineau RE, Higginbotham MB, et al**. A brief self-administered questionnaire to determine functional capacity (The Duke Activity Status Index). Am J Cardiol 1989; 64(10):651–654. doi:10.1016/0002-9149(89)90496-7

4. **Wijeysundera DN, Pearse RM, Sulman MA, et al**. Assessment of functional capacity before major non-cardiac surgery: an international, prospective cohort study. Lancet 2018; 391(10140):2631–2640. doi:10.1016/S0140-6736(18)31131-0

5. **Devereaux PJ, Mrkobrada M, Sessler DI, et al; POISE-2 Investigators**. Aspirin in patients undergoing noncardiac surgery. N Engl J Med 2014; 370(16):1494–1503. doi:10.1056/NEJMoa1401105

6. **Graham MM, Sessler DI, Parlow JL, et al**. Aspirin in patients with previous percutaneous coronary intervention undergoing noncardiac surgery. Ann Intern Med 2018;168(4):237–244. pmid:29132159

7. **Biccard BM, Sigamani A, Chan MTV, et al**. Effect of aspirin in vascular surgery in patients from a randomized clinical trial (POISE-2). Br J Surg 2018; 105(12):1591–1597. doi:10.1002/bjs.10925

8. **Shiffermiller JF, Monson BJ, Vokoun CW, et al**. Prospective randomized evaluation of preoperative angiotensin-converting enzyme inhibition (PREOP-ACEI). J Hosp Med 2018; 13(10):661–667. doi:10.12788/jhm.3036

9. **Hollmann C, Fernandes NL, Biccard BM**. A systematic review of outcomes associated with withholding or continuing angiotensin-converting enzyme inhibitors and angiotensin receptor blockers before noncardiac surgery. Anesth Analg 2018; 127(3):678–687. doi:10.1213/ANE.0000000000002837

10. **Devereaux PJ, Duceppe E, Guyatt G, et al**. Dabigatran in patients with myocardial injury after non-cardiac surgery (MANAGE): an international, randomised, placebo-controlled trial. Lancet 2018; 391(10137):2325–2334. doi:10.1016/S0140-6736(18)30832-8

11. **Butt JH, Olesen JB, Havers-Borgersen E, et al**. Risk of thromboembolism associated with atrial fibrillation following noncardiac surgery. J Am Coll Cardiol 2018; 72(17):2027–2036. doi:10.1016/j.jacc.2018.07.088

ADDRESS: *Steven L. Cohn, MD, MACP, SFHM, Department of Medicine, University of Miami Miller School of Medicine, 1120 NW 14th Street, Miami, FL 33136; scohn@med.miami.edu*