MORNING REPORT

Cardiac Risk-assessment and Optimization Before Elective Surgery

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A 66-year-old woman is referred for preoperative hospitalist consultation before an elective revision of an L1-ileum fusion and instrumentation. Her orthopedic history is significant for severe thoracolumbar kyphosis with chronic back pain. She has previously undergone posterior T4-pelvic instrumentation and fusion 1.5 years prior to her current presentation. She does well after this surgery aside from an episode of fluid-responsive intraoperative hypotension. Her more recent course is complicated by acute onset back pain; imaging reveals a broken lumbar rod.

At her earlier surgery, hypertension was her only known comorbid condition. Her preoperative EKG revealed a left bundle branch block (LBBB). However, in the interval, she experienced a transient ischemic attack (TIA). She was diagnosed with severe (> 90%) carotid stenosis for which she underwent a carotid endarterectomy. She also developed claudication and an ischemic great toe ulcer. Angiogram revealed severe occlusive ileofemoral popliteal disease, and multiple stents were deployed with resolution of her symptoms.

Perioperative risk is driven by both surgery- and patient-specific risk factors. Rather than being "cleared" for surgery, patients should be risk stratified and deemed stable/optimized or not recommended for a given surgery. As such, the goal of any preoperative evaluation should be a comprehensive assessment of known comorbid medical conditions as well as risk factors for undiagnosed comorbid medical conditions that might increase perioperative risk. Additionally, Medicare requires that a thorough H&P be completed up to 30 days before a surgical procedure. Based on her known medical history, our patient is at least an intermediate-risk candidate for an intermediate-risk surgery.

At the time of her preoperative evaluation, her main complaints are back pain and its associated functional limitations. She denies chest pain, dyspnea, edema, or orthopnea/paroxysmal nocturnal dyspnea. She reports being able to climb two flights of stairs multiple times per day without exertional symptoms but is otherwise sedentary. She has hyperlipidemia but denies a history of diabetes, renal disease, or congestive obstructive pulmonary disease. She has a 10-pack-year tobacco history but has quit smoking. Medications include a baby aspirin, hydrochlorothiazide, and hydrocodone-acetaminophen. She is no longer on clopidogrel, and she is not taking a beta-blocker or a statin.

Vitals signs include a blood pressure of 134/76 mm Hg, heart rate 92 beats per minute (bpm), normal respirations, and oxygen saturation on room air. Her BMI is 23 kg/m^2. Exam is notable for an age-appropriate woman in no distress. Lungs are clear bilaterally without crackles. Heart rate and rhythm are regular without murmurs; her jugular venous pressure is not visible at 90 degrees. She has no peripheral edema and has palpable pedal pulses.

Review of cardiac records includes a current EKG that shows a LBBB, rate 72 bpm, consistent with her prior EKG. Following her episode of intra-operative hypotension during her initial surgery, an ECHO was performed to evaluate for evidence of heart failure or ischemic heart disease. This revealed mild concentric left ventricular hypertrophy (LVH), septal dyssynergy consistent with the LBBB, normal LV systolic function, and no wall motion abnormalities. She has not had additional cardiac testing done prior to her vascular procedures. Because of concern for underlying ischemic heart disease and the likelihood that it will affect her perioperative management, a dobutamine stress ECHO is now ordered.

Certain comorbid medical conditions predict a higher risk of perioperative cardiac complications from non-cardiac surgery. In 2007, the American College of Cardiology/American Heart Association (ACC/AHA) issued updated guidelines for cardiac testing and management before non-cardiac surgeries.[1] Their recommendations include utilization of the Revised Cardiac Risk Index (RCRI), a validated clinical tool to predict perioperative cardiac risk.[1,2] The RCRI scores points for six clinical variables: ischemic heart disease, congestive heart failure, cerebrovascular disease, serum creatinine > 2mg/dL, diabetes requiring insulin therapy, and high-risk surgery (e.g. suprainguinal vascular, thoracic, or intra-abdominal surgeries). Peripheral vascular disease is not included in the algorithm.

Perioperative management recommendations are based on the tallied number of patient variables. For example, with one to two points, the recommendation is to proceed to surgery with heart rate control or to consider additional testing if it will change management. At the time of her preoperative evaluation, this patient receives one point for

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her known cerebrovascular disease. Her chronic LBBB does not award a point for ischemic heart disease. She is not already on a cardiac medication package. There is reasonable clinical suspicion that the results of non-invasive stress testing will influence her perioperative medical management.

A dobutamine stress ECHO reveals newly depressed LVEF at 40% with significant basal and mid-inferior wall motion abnormalities. There is no inducible ischemia, but there is concern for multi-vessel coronary disease. Her surgery is cancelled, and she proceeds to cardiac catheterization. This reveals severe three-vessel disease with a 70% mid-LAD stenosis, 90% OM2 stenosis, and 80% proximal and 99% mid-circumflex stenoses. She undergoes coronary artery bypass grafting (CABG), with a LIMA to the LAD, SVG to the OM2, and SVG to the distal left circumflex. She is discharged on metoprolol, lisinopril, and a statin.

Beta blockers are theoretically beneficial in the perioperative period because they prevent supply-demand mismatch and ischemia in the setting of increased physiologic stress. However, the risks of empiric use of beta blockers include stroke and hypotension; perioperative use of beta-blockade remains an area of controversy.[3-4] The ACC/AHA has issued separate focused guidelines regarding the use of beta blockers.[5]

A Class I recommendation exists to continue beta blockers in patients already receiving them for an independent indication (evidence level C). Class IIa recommendations exist to consider beta blockers for patients undergoing vascular surgery who are at known or high risk of having coronary artery disease (a change from 2006 Class I recommendation) or patients undergoing intermediate-risk surgery with known coronary artery disease or more than one point on the RCRI. Accepted clinical practice is to continue beta blockers in patients already receiving them, given evidence for both their protective effect and concerns for complications in the setting of beta-blocker withdrawal/rebound. The decision to initiate or up-titrate beta-blocker doses before an elective surgery should be a patient-specific risk/benefit decision. If utilized, beta blockers should be titrated to a goal heart rate of less than 65 bpm.

Her post-CABG course is complicated by intermittent heart block requiring a permanent pacemaker. She recovers well and is able to perform < 4 METs at cardiac rehabilitation without cardiac symptoms. She is deemed stable and optimized for her originally planned orthopedic surgery, which is rescheduled. However, she experiences symptomatic fatigue attributed to beta-blocker intolerance, and her metoprolol and lisinopril are stopped within a week of her surgery. She had stopped her statin because of mild myalgias prior.

Statins are also a key component of chronic medical therapy for patients with cardiovascular disease. Until recently, statin therapy was thought to increase perioperative risk with complications such as myopathy. However, there is now data to support that statins may reduce perioperative cardiovascular complications, including fatal myocardial infarctions, by inducing plaque stabilization.[1,6-7] The mortality benefit is even higher for patients undergoing vascular surgery. The ACC/AHA 2007 guidelines find initiation of statin therapy before vascular surgery in patients with/without clinical risk factors, or before intermediate-risk surgery in patients with one or more clinical risk factors, to be reasonable. Patients already taking statins, especially for independent indications, should be instructed to continue them in the perioperative period. Statin cessation needs to be avoided as it can cause a rebound effect associated with increased adverse cardiovascular events.

Moreover, depending on the risk of bleeding complications associated with a specific surgery, one should consider instructing a patient with known ischemic heart disease or cerebrovascular disease to not *stop aspirin therapy before surgery given its protective effect against myocardial infarction and/or stroke and possible aspirin-rebound effect.[8] This is a risk/benefit decision that should be made in conjunction with the patient and the patient's surgeon.*

During anesthesia induction, she becomes hypertensive to the 160s/90s with tachycardia up to 135 bpm. ST segment depressions are observed. The surgery is aborted. Her baseline chronic LBBB remains unchanged on EKG; laboratory data provides clinical evidence of a small NSTEMI with peak troponin I of 0.69 ng/mL (reference range < 0.50 ng/mL). She is deemed to have supply-demand ischemia due to a high double product in the setting of distal small vessel CAD not amenable to revascularization at the time of CABG, exacerbated by her recent and abrupt cessation of beta-blocker therapy. Her beta blocker and a statin are resumed. She remains free of ischemic symptoms with exercise. Since maximizing her medical regimen, she has successfully undergone her spinal surgery with an uneventful intraoperative course.

For patients with independent indications for coronary revascularization (e.g. three-vessel disease, left-main disease), this should be addressed separately.[1] In general, revascularization has not been shown to improve outcomes following non-cardiac surgery.[9-11] However, data exploring the risk/benefit of coronary bypass versus percuta-

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neous interventions is currently lacking. One concern for stent placement preoperatively is in-stent thrombosis, especially if antiplatelets agents are stopped prematurely.[12] Also, microvascular disease, in which the smallest cardiac vessels are narrowed because of intimal/media thickening and plaquing, may persist even after larger coronary vessels are revascularized.

A patient's post-CABG status does not guarantee elimination of perioperativc cardiac risk. Principles of medical management to decrease perioperative cardiac events should remain otherwise unchanged. However, perioperative cardiac risk never disappears. Even a fully optimized and stable patient retains some non-negligible risk of perioperative ischemia and cardiac mortality/morbidity.

Learning Points

1. The Revised Cardiac Risk Index (RCRI) is a validated risk assessment tool for patients undergoing non-cardiac surgery.
2. PVD is not a risk factor included in the RCRI but should/can be taken into account when assessing a patient's risk of CAD.
3. Microvascular coronary artery disease exists and needs to be medically treated even after revascularization.

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