Preoperative Cardiovascular Evaluation in Patients Undergoing Vascular Surgery

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KEYWORDS

• Peripheral vascular disease • Revised cardiac risk index • Perioperative cardiovascular guidelines • Noninvasive stress testing • Coronary revascularization • β-blockers • Statins • Antiplatelet therapy

KEY POINTS

- Vascular surgery is associated with a higher incidence of perioperative cardiovascular morbidity and mortality. The overwhelming perioperative cardiac event is myocardial infarction.
- Patients undergoing vascular surgery represent a higher-risk population. Careful preoperative cardiovascular evaluation involves an assessment of the urgency of surgery, active cardiac conditions, functional capacity, and clinical risk predictors.
- Various cardiac risk indices are available to estimate perioperative cardiovascular risk in the setting of vascular surgery. Awareness of these indices and a careful understanding of their limitations are crucial.
- Noninvasive stress testing in patients undergoing major vascular surgery is often required but not necessary, and knowledge of the appropriate indications is important.
- Although the benefit of coronary revascularization or initiation of β-blockade before vascular surgery on reducing perioperative cardiovascular morbidity is still unproved, there is a reported benefit for the perioperative use of statin therapy.

INTRODUCTION

Major vascular surgery is associated with an increased risk of postoperative major adverse cardiac events (MACE), with the most common being myocardial infarction (MI). Postoperative cardiovascular morbidity and mortality rates for aortic and lower extremity arterial surgeries are reported to be greater than 20%.[1–4] Vascular surgery is associated with the highest 30-day postsurgical Medicare rehospitalization rate at almost 25%.[5] In an analysis of nationwide, surgery-specific, postoperative mortality rates in the Netherlands, vascular surgery was associated with the highest mortality incidence at nearly 6%.[6] The demand for vascular surgery will only increase in parallel with the aging United States population. It is expected that 1 to 2 million such procedures will be performed annually in the United States by the year 2030, resulting in an estimated 18,000 deaths.[7]

There are several key features inherent to vascular surgery, particularly procedures that are open, which account for the increased cardiovascular risk. These include prolonged duration of surgery, large shifts in intravascular and extravascular fluid volumes, cross-clamping of the

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aorta, and hypothermia induction. These factors can lead to a state of high stress and low flow across major vascular beds. The result is increased inflammation, hypercoagulability, catecholamines, and hypoxia, all of which can precipitate the occurrence of acute coronary thrombosis and myocardial ischemia.[8]

In addition to the risks posed by the procedure itself, typical patients undergoing vascular surgery also have certain factors in common that further contribute to the high risk of postoperative cardiovascular complications.[9] Patients with vascular disease already have many of the major risk factors associated with development of coronary artery disease (CAD). The prevalence of significant CAD in patients undergoing elective peripheral vascular surgery is reported to be 25%.[10] In addition, symptoms of CAD are often difficult to assess in this population because of exercise limitations from advanced age, associated comorbidities, and severe lower extremity arterial disease. Patients with flow-limiting lesions or vulnerable lesions in the coronary vasculature are also more susceptible to the significant hemodynamic shifts commonly associated with vascular surgery.

Characteristic features of the patient and the surgical procedure itself contribute to the increased risk of perioperative cardiovascular complications associated with major vascular surgery. A careful preoperative cardiovascular evaluation is crucial in reducing the risk of perioperative events. Such an evaluation includes assessing surgical and patient risk, determining the need for noninvasive stress testing or preoperative coronary revascularization, and implementing appropriate medical therapy.[11] This article offers an approach to preoperative management of patients undergoing vascular surgery in the context of the most recent literature and the most current guidelines and recommendations.

PREOPERATIVE ALGORITHM FOR PATIENTS UNDERGOING VASCULAR SURGERY

The evaluation and management of cardiovascular risk associated with vascular surgery is primarily based on the 2014 American College of Cardiology/American Heart Association (ACC/AHA) guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery.[12] **Fig. 1** is a specific algorithm depicting preoperative cardiovascular management for patients undergoing vascular surgery, whereas recommendations refer to the ACC/AHA guidelines.

Emergency Surgery

A complete preoperative cardiovascular assessment is often impossible in the setting of emergent (<6 hours) or urgent (6–24) vascular surgery, such as aortic dissection, aneurysmal rupture of the aorta, or acute limb ischemia. In such circumstances, the patient requires vascular surgery without delay. A bedside evaluation, including electrocardiogram (EKG) by the cardiology consultant, should be performed if time permits and the focus should be on providing recommendations for postoperative monitoring and medical management.

Active Cardiac Conditions

If a patient is found to have an active cardiac condition (**Box 1**), elective vascular surgery may be postponed. The postoperative cardiovascular event risk is substantially increased in the presence of an active cardiac condition. Treatment of the cardiac condition and maintenance of hemodynamic stability must precede surgery.[13]

Unstable coronary syndromes

In addition to acute coronary syndrome, this category includes patients with severe angina. Severe angina refers to those individuals with Canadian Cardiovascular Society class III or class IV angina. The risk of a recurrent MI is very high if the time between the initial MI and surgery is less than 30 days (32.8%) or between 31 and 60 days (18.7%) and declines to less than 10% after this time frame.[14]

Congestive heart failure

The presence of decompensated or worsening congestive heart failure also elevates perioperative cardiovascular event risk. Among individuals undergoing surgery within 4 weeks of a diagnosed heart failure episode, perioperative mortality exceeds 13%.[15] Preoperative B-type natriuretic peptide levels have also been shown to independently predict the occurrence of cardiovascular events within the first 30 days after vascular surgery; however, further randomized studies are needed to validate the clinical utility of such testing.[16] Treatment should focus on achieving euvolemic status and improving heart failure signs and symptoms before surgery. In cases of new-onset heart failure, a search for underlying cause is also warranted because it may guide perioperative management.

Significant cardiac arrhythmias

Arrhythmias that cause or place the patient at risk for hemodynamic instability should be managed immediately. Examples include high-grade or third-degree atrioventricular block, symptomatic