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Preoperative Evaluation of Patients with CARDIOVASCULAR Disease

- It is estimated that cardiac morbidity will occur in **1% to 5%** of unselected patients undergoing noncardiac surgery.
- Cardiovascular complications are serious perioperative adverse events that account for about 45% of all deaths within 30 days after major noncardiac surgery.
- perioperative interventions have been shown to modify cardiovascular morbidity and mortality.

Hypertension

- Hypertension is defined as a blood pressure greater than 130/80 based on appropriately measured arterial blood pressure.
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- Hypertension leads to significantly increased risks of left ventricular hypertrophy (LVH), heart failure, ischemic heart disease, chronic kidney disease (CKD), ischemic stroke, intracerebral hemorrhage.
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- The degree of end-organ damage and morbidity and mortality correlate with the **duration and severity of hypertension**.
- **Ischemic heart disease** is the most common type of organ damage associated with hypertension.
- These risks appear to increase once blood pressure exceeds 117/75, with each subsequent 20 mm Hg increase in systolic blood pressure and 10 mm Hg increase in diastolic blood pressure being associated with a two-fold increase in the risk of stroke and cardiovascular death.

Goals of preoperative evaluation

- Identify any secondary causes of hypertension
- Presence of other cardiovascular risk factors (e.g., smoking, diabetes mellitus)
- Evidence of end-organ damage
- Treatment

- Paroxysmal hypertension or hypertension in young individuals should prompt a search for causes such as coarctation, hyperthyroidism, pheochromocytoma, or even illicit drug use such as cocaine, amphetamines, or anabolic steroids.
- Physical examination focuses on the cardiovascular system, pulses, vital signs the thyroid gland, and signs of volume overload.
- Asking about episodic tachycardia, palpitations, and syncope, measuring BP in both arms, listening for bruits, and assessing the pulses in both the upper and lower extremities are necessary.

- Patients with long-standing, severe, or poorly controlled hypertension should undergo **an ECG and** blood sampling to measure **creatinine concentration**.
- Individuals **on diuretic** antihypertensives may require evaluation of **electrolytes**.
- Patients with **significant left ventricular hypertrophy** should have a careful assessment of symptoms and other risk factors for CAD.
- In the presence of **heart failure or dyspnea of unknown origina**, an echocardiogram may provide additional information that will modify management.
- Patients with suspected **hyperthyroidism** will require thyroid function tests.

- There is no compelling data that delaying surgery to optimize blood pressure control will result in improved outcomes.
- Some international practice guidelines support proceeding with surgery if the systolic blood pressure is less than 180 mm Hg and diastolic blood pressure is less than 110 mm Hg.
- Usual antihypertensive medication treatment should be continued in these patients during the perioperative period.
- For patients with severe hypertension anesthesiologists should weigh the potential benefits of delaying surgery to optimize antihypertensive treatment against the risks of delaying the procedure.

- All long-term antihypertensive treatment should be continued up to the day of surgery, with the possible exception of angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs).
- Administration of these medications within 24 hours before surgery is consistently associated with increased risks of intraoperative hypotension, and possibly associated with elevated risks of postoperative myocardial injury.
- it is reasonable to withhold these medications for 24 hours before surgery, provided that they are restarted postoperatively once patients are hemodynamically stable.
- Importantly, failure to resume ACEI and ARB therapy postoperatively is itself associated with adverse outcomes.

Ischemic Heart Disease

- In the perioperative setting, IHD is a risk factor for myocardial infarction and a prognostically important myocardial injury after surgery.
- It is also associated with elevated risks of 30-day postoperative mortality, especially if a patient had experienced a myocardial infarction, acute coronary syndrome, or severe angina within the 6 months preceding surgery.
- Surgical patients with IHD may also have important comorbidities with important perioperative implications, such as heart failure and atrial fibrillation

- In the case of patients without known IHD, evaluation of traditional risk factors for IHD (i.e., smoking, hypertension, increased age, male sex, hyperlipidemia, family history) is important when significance of suspicious symptoms (e.g., chest discomfort, dyspnea) or abnormal ECG.
- In patients with known IHD, the anesthesiologist should characterize any history of chest discomfort (i.e., pain, pressure, tightness) with respect to its duration, precipitating factors, associated symptoms, and relieving factors.
- Exertional dyspnea may represent an angina equivalent but is also a nonspecific finding that might be related to physical deconditioning, pulmonary disease, or heart failure.

- Patients with risk factors for IHD or suspicious symptoms **may require an ECG**, especially before intermediate-risk or high-risk surgical procedures.
- Routine preoperative ECGs are not indicated, especially in asymptomatic patients without known cardiovascular disease or risk factors.
- Establishing a baseline for postoperative comparison is often the most important reason to obtain a preoperative ECG; however, this decision should be based on the patient's likely risk of postoperative cardiovascular complications.
- If a previous ECG is available from the **previous 3 months and there has been no intervening change in clinical status**, a repeat ECG is likely not needed.

- Other typical preoperative laboratory tests that may be considered for patients with known or suspected IHD include creatinine and hemoglobin concentrations.
- Both chronic renal insufficiency and anemia are risk factors for perioperative cardiac complications .
- In addition, anemia can modify the effects of β -adrenergic blockade in surgical patients, with evidence of increased harm when used in patients with perioperative anemia or significant bleeding.

Preoperative cardiac risk assessment



- For these individuals, the focus should be on surveillance (e.g., **serial cardiac enzymes, hemodynamic monitoring, serial ECGs**) and early treatment of any postoperative cardiovascular complications.

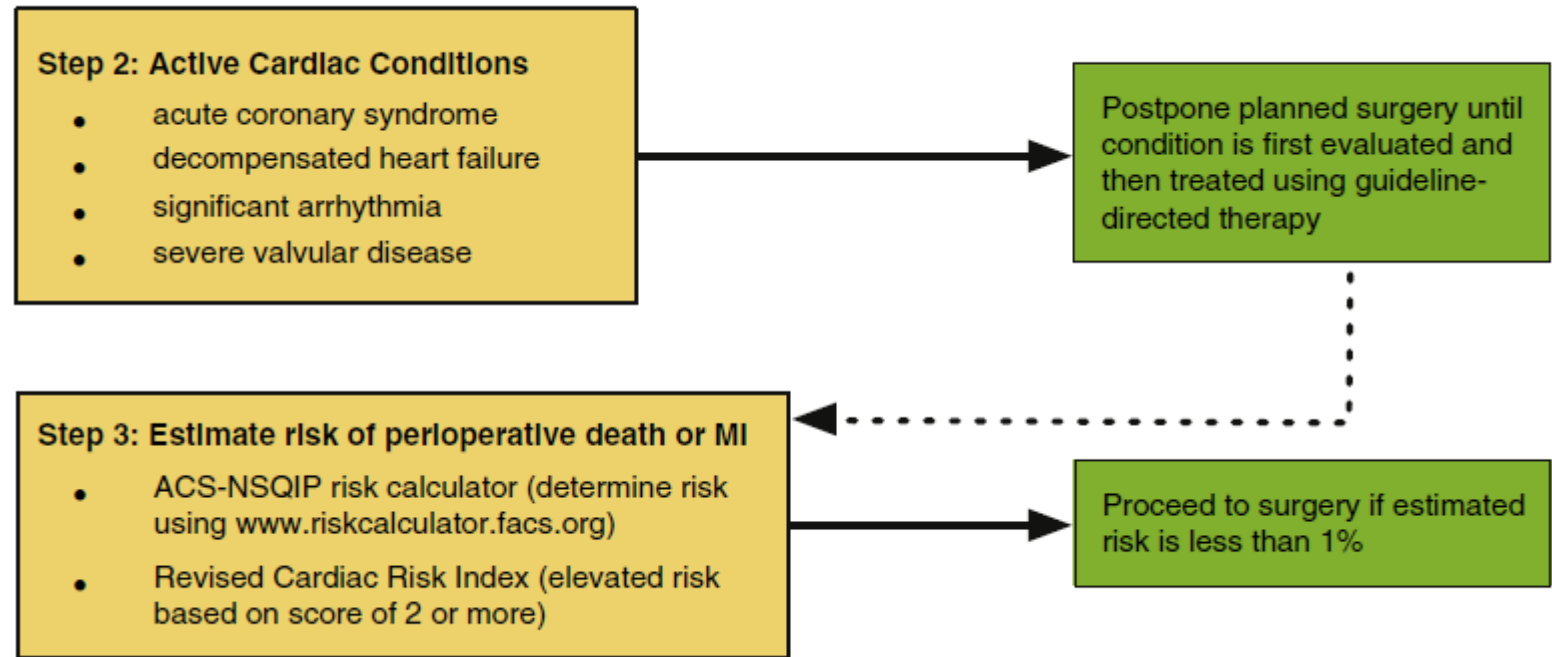


TABLE 31.5 Components of the Revised Cardiac Risk Index and Expected Cardiac Event Risk

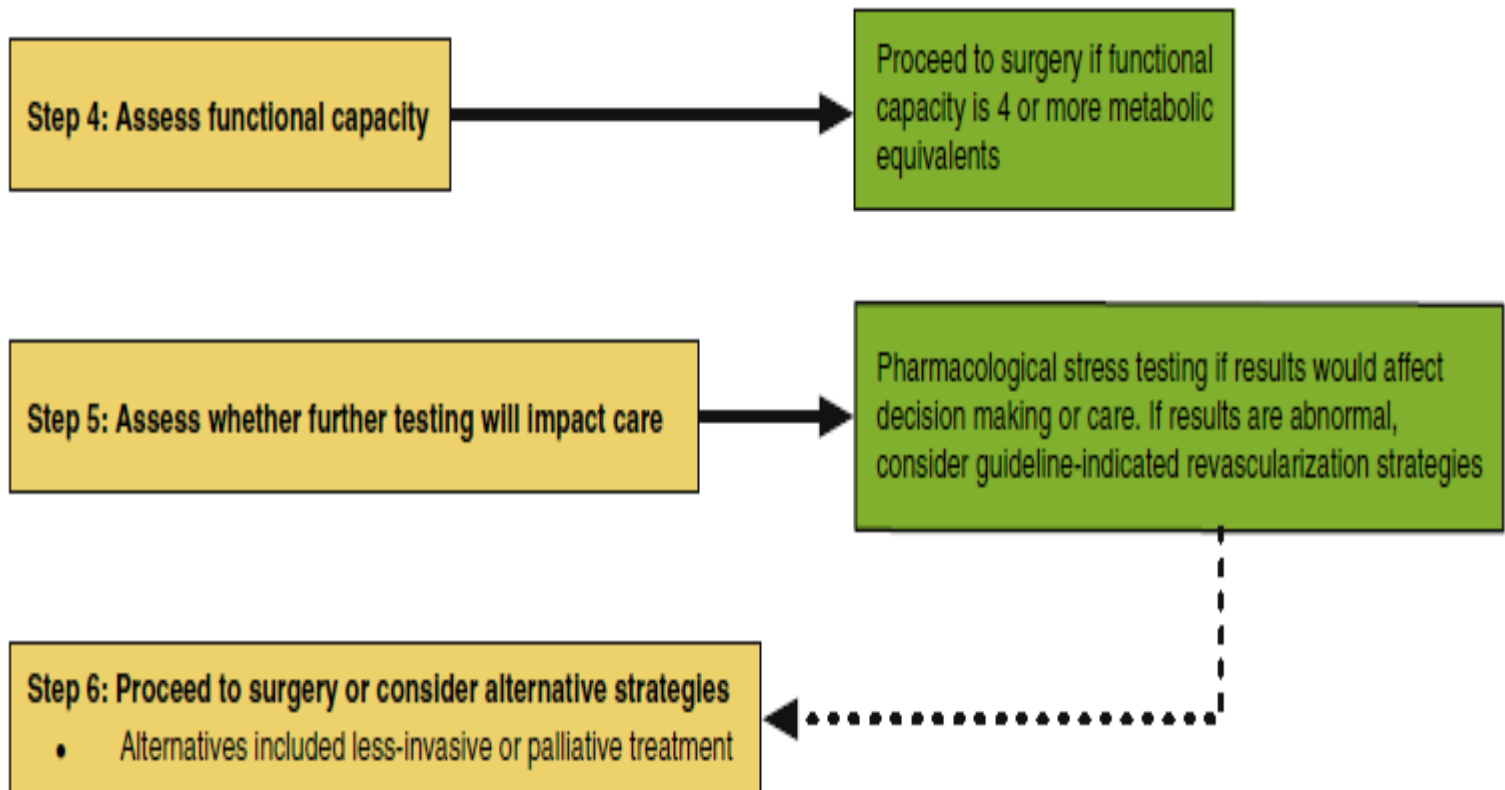
Components of Revised Cardiac Risk Index*	Points Assigned
High-risk surgery (intraperitoneal, intrathoracic, or suprainguinal vascular procedure)	1
Ischemic heart disease (by any diagnostic criteria)	1
History of congestive heart failure	1
History of cerebrovascular disease	1
Diabetes mellitus requiring insulin	1
Creatinine > 2.0 mg/dL (176 μ mol/L)	1
Revised Cardiac Risk Index Score	Risk of Major Cardiac Events^{†,‡}
0	0.4%
1	1.0%
2	2.4%
≥ 3	5.4%

*The Revised Cardiac Risk Index (RCRI) is a validated risk stratification tool for major cardiac events in patients undergoing noncardiac surgery.

[†]Major cardiac events include myocardial infarction, stroke, and death attributable to cardiac causes.

[‡]These risk percentages are based on data from a retrospective analysis of 10,000 patients undergoing noncardiac surgery.

- ACC/AHA guidelines recommend deferring nonurgent surgery until 60 days after a recent myocardial infarction.



- In general, randomized controlled trials have also *not* shown benefit from de novo medical therapy to decrease perioperative cardiac risk, including β -adrenergic blockers, α 2-adrenergic agonists, and low-dose aspirin.
- that perioperative **β -adrenergic blockade reduces the risk of postoperative myocardial infarction, but at the cost of increased risks of acute stroke, hypotension, and death.**
- Most *long-term* cardiovascular medications in patients with IHD should be continued up to surgery, including β -adrenergic blockers, statins, and most other antihypertensive medications.
- ACEI and ARB administration reasonable to withhold these medications for 24 hours before surgery, provided that they are restarted postoperatively.
- A reasonable strategy is to only continue aspirin *selectively* in patients where the risk of cardiac events is felt to exceed the risk of major bleeding it is possible that continuation of aspirin benefits some very high-risk subgroups.

Coronary Stents

- Following PCI with stent implantation, patients require an initial period of dual antiplatelet therapy.
- The purpose of DAPT is to prevent potentially catastrophic stent thrombosis during the vulnerable period preceding stent reendothelialization.
- Temporary preoperative discontinuation of DAPT during this vulnerable period predisposes patients to cardiovascular complications, especially given the prothrombotic state triggered by surgical stress.
- These guidelines recommend that elective noncardiac surgery should be delayed for 30 days or more after BMS implantation. In the case of DES, the ideal recommended minimum delay is 6 months.
- Following surgery, close monitoring for myocardial injury (i.e., serial troponin measurement) should be strongly considered, with any suspected stent thrombosis treated using PCI. High-risk patients are thus ideally best managed in facilities with immediate access to interventional cardiology.
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Heart Failure

- Heart failure has been defined as a clinical syndrome resulting from impaired diastolic filling or systolic ejection of the cardiac ventricles.
- Its major clinical manifestations are dyspnea, fatigue, and fluid retention.
- In the perioperative setting, heart failure is a recognized risk factor for mortality and morbidity after major surgery.

- NYHA class I: no limitation of physical activity; ordinary activity not a cause of fatigue, palpitations, or syncope

- NYHA class II: slight limitation of physical activity; ordinary activity resulting in fatigue, palpitations, or syncope

- NYHA class III: marked limitation of physical activity; less than ordinary activity resulting in fatigue, palpitations, or syncope; comfort at rest

- NYHA class IV: inability to do any physical activity without discomfort; symptoms at rest

- The clinical stability of heart failure symptoms prior to surgery is another important determinant of perioperative risk.
- Decompensated heart failure is considered a high-risk cardiac condition, and elective surgery should be postponed .
- Guidelines recommend that elective intermediate-risk and high-risk noncardiac procedures be deferred for at least 3 months after initiation of medical therapy in patients with newly diagnosed heart failure.

- Decompensated heart failure is a very high-risk condition that warrants postponement of surgery for all except lifesaving emergency procedures.
- No consensus exists on how long nonemergent surgery should be deferred after resolution of acute decompensated heart failure, although a reasonable approach is to delay elective procedures (including most time-sensitive procedures) for 1 month, and urgent procedures for 24 hours.
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BOX 31.3 Recommendations for Preoperative Noninvasive Evaluation of Left Ventricular Function

Class IIa (Reasonable to Perform)

- It is reasonable for patients with dyspnea of unknown origin to undergo preoperative evaluation of LV function.
- It is reasonable for patients with heart failure with worsening dyspnea or other change in clinical status to undergo preoperative evaluation of LV function.

Class IIb (May Be Considered)

- Reassessment of LV function in clinically stable patients with previously documented LV dysfunction may be considered if there has been no assessment within a year.

Class III (Should Not Be Performed Since It Is Not Helpful)

- Routine preoperative evaluation of LV function is not recommended.

- Other tests for patients with heart failure include **ECGs and blood sampling to measure electrolyte and creatinine concentration.**
- **Digoxin levels** are not routinely determined unless toxicity, undertreatment, or noncompliance is suspected.
- Consideration should be given for collaborative perioperative management with a cardiologist or heart failure specialist of severely affected heart failure patients who will undergo intermediate-risk or high-risk procedures.
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- Most medical therapy, including β -adrenergic blockers, hydralazine, nitrates, and digoxin, should be continued preoperatively.
- **Loop diuretics** (e.g., furosemide) can be continued on the day of surgery for most procedures.
- The exception is **lengthy high-risk procedures** with projected significant blood loss or fluid requirements, in which potent diuretics should be held on the morning of surgery.
- it is reasonable to withhold ACEI and ARB administration medications for 24 hours before surgery, provided that they are restarted postoperatively once patients are hemodynamically stable
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- Patients on anticoagulant therapy will likely need these medications temporarily discontinued before surgery .

Aortic Stenosis.

- Aortic stenosis severity is classified based on the valve area and mean transvalvular pressure gradient.
- A limitation of using the pressure gradient alone to assess severity is that the gradient may decrease if the left ventricle systolic function begins to decrease.
- In patients with known aortic stenosis, serial echocardiography is recommended every 6 to 12 months for patients with severe disease, every 1 to 2 years for moderate disease, and every 3 to 5 years for mild disease.
- The cardinal symptoms of severe aortic stenosis are angina, heart failure, and syncope, but patients are much more likely to complain of exertional dyspnea and decreased exercise tolerance.

TABLE 31.9 Grading Severity of Aortic Stenosis

Grade	Transvalvular Jet Velocity (m/s)	Mean Pressure Gradient (mm Hg)	Valve Area (cm²)
Mild	2.0–2.9	<20	≥1.5
Moderate	3–3.9	20–39	1.0–1.5
Severe	≥4	≥40	<1.0

- Aortic stenosis causes a **systolic ejection murmur best heard in the right upper sternal border and often radiating to the neck.**
- Typical ECG abnormalities associated with aortic stenosis include LVH (often with a strain pattern), left axis deviation, and LBBB.
- Moderate to severe aortic stenosis is associated with increased risk of perioperative cardiovascular complications.
- guidelines support proceeding with **major elective noncardiac surgery in patients with asymptomatic severe aortic stenosis**, provided that appropriate intraoperative and postoperative hemodynamic monitoring is available.
- Conversely, for patients with **symptomatic severe aortic stenosis**, aortic valve replacement should be considered before their planned noncardiac surgery

- Patients with moderate to severe aortic stenosis also have an increased risk of bleeding from an *acquired* von Willebrand syndrome, which occurs in 67% to 92% of patients with severe stenosis.
- The underlying pathophysiology is mechanical disruption of von Willebrand multimers during turbulent blood flow through the narrowed valve..
- Of note, prophylaxis for infective endocarditis is not recommended.

