PREOPERATIVE PATIENT ASSESSMENT AND MANAGEMENT

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Outline

- Goals and benefit preoperative evaluation
- Clinical examination
- Preoperative evaluation of patients with coexisting disease
- Investigation and testing
- Preoperative risk assessment
- Preparation

Goals and benefit preoperative evaluation

- The role of an anesthesiologist today encompasses not only the intraoperative period but also preoperative risk assessment.
- The goals of preoperative evaluation are to

  1) ensure that the patient can safely tolerate anesthesia for the planned surgery.

  2) mitigate perioperative risks such as pulmonary or cardiovascular complications.

Clinical examination during preoperative evaluation

Clinical examination =

History

+

Physical examination

Medical history

- planned procedure
- presenting illness
- comorbid conditions
- detailed review of systems
- past anesthetic history with review of complications
- assessment of allergies and medications
- documentation of substance use or abuse
- NPO time

Medical history

- Assessment of functional capacity
  - Used to estimate a patient's risk for major postoperative morbidity or mortality.
  - Lack of exercise may increase the risk of developing cardiopulmonary disease.
  - Poor preoperative functional capacity→ increased perioperative risk.

Assessment of functional capacity

- Functional capacity is typically quantified in using the metabolic equivalent of task (MET)
- One metabolic equivalent of task (MET) is the amount of oxygen consumed while sitting at rest, and is equivalent to an oxygen consumption of 3.5 mL/kg/min
- a metabolic equivalent of task score (METS) of 4 or more predicts a low risk of perioperative complications

TABLE 31.1 Metabolic Equivalents* of Functional Capacity

METs	Equivalent Level of Exercise
1	Eating, working at computer, or dressing
2	Walking down stairs or in your house, or cooking
3	Walking 1 or 2 blocks on level ground
4	Raking leaves, gardening
5	Climbing 1 flight of stairs, dancing, or bicycling
6	Playing golf, or carrying clubs
7	Playing singles tennis
8	Rapidly climbing stairs, or jogging slowly
9	Jumping rope slowly, or moderate cycling
10	Swimming quickly, running or jogging briskly
11	Skiing cross country, or playing full-court basketball
12	Running rapidly for moderate to long distances

*One metabolic equivalent of task (MET) is the amount of oxygen consumed while sitting at rest, and is equivalent to an oxygen consumption of 3.5 mL/min/kg body weight.

Modified from Jette M, Sidney K, Blumchen G. Metabolic equivalents (METS) in exercise testing, exercise prescription, and evaluation of functional capacity. *Clin Cardiol.* 1990;13:555–565.

Assessment of functional capacity

- **Duke Activity Status Index (DASI)** : This 12-item self-administered questionnaire about activities of daily living

$$\text{Estimated METS} = \frac{(0.43 \times \text{DASI score}) + 9.6}{3.5}.$$

TABLE 31.2 Duke Activity Specific Index questionnaire

Can You	Points
1. Take care of yourself, that is, eat dress, bathe, or use the toilet?	2.75
2. Walk indoors, such as around your house?	1.75
3. Walk 200 yards on level ground?	2.75
4. Climb a flight of stairs or walk up a hill?	5.50
5. Run a short distance?	8.00
6. Do light work around the house like dusting or washing dishes?	2.70
7. Do moderate work around the house like vacuuming, sweeping floors, or carrying groceries?	3.50
8. Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?	8.00
9. Do yard work like raking leaves, weeding, or pushing a power mower?	4.50
10. Have sexual relations?	5.25
11. Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a ball?	6.00
12. Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?	7.50
Total score:	

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;64:651–654.

Physical examination

- The preanesthetic examination should include vital signs, height and weight.
- BMI can help identify individuals at risk for difficulties with airway management, and some chronic diseases (e.g., heart disease, diabetes mellitus, OSA)
- IBW should also be calculated

Devine (1974)[1]	men:	50 kg + 2.3 kg/each inch over 5 feet
	women:	45.5 kg + 2.3 kg/each inch over 5 feet

TABLE 31.3 Classification Scheme for Body Mass Index

Body Mass Index	Weight Status
ADULTS OVER 20 YEARS OLD	
BMI < 18.5	Underweight
BMI 18.5–24.9	Normal
BMI 25.0–29.9	Overweight
BMI 30.0 and above	Obese
FOR CHILDREN AND TEENS	
BMI-for-age < 5th percentile	Underweight
BMI-for-age 5th percentile to < 85th percentile	Normal
BMI-for-age 85th percentile to < 95th percentile	At risk of overweight
BMI-for-age ≥ 95th percentile	Overweight

BMI, Body mass index.
From Centers for Disease Control and Prevention. http://www.cdc.gov.

Physical examination

- The most important component of the physical examination is inspection of the airway

Table 13.3 Components of the Airway Examination

Airway Examination Component	Nonreassuring Findings
Length of upper incisors	Relatively long
Relationship of maxillary and mandibular incisors during normal jaw closure	Prominent "overbite" (maxillary incisors anterior to mandibular incisors)
Relationship of maxillary and mandibular incisors during voluntary protrusion of mandible (ability to prognath; upper lip bite test)	Inability to bring mandibular incisors anterior to (in front of) maxillary incisors; unable to bite the upper lip
Interincisor distance	Less than 3 cm
Visibility of uvula	Not visible when tongue is protruded with patient in sitting position (e.g., Mallampati class II)
Compliance of the mandibular/oral space	Highly arched or very narrow; radiation or surgical changes; stiff, indurated, occupied by mass or nonresilient
Thyromental distance	<3 fingerbreadths or <6 cm
Length of neck	Short
Thickness of neck	Thick
Range of motion of head and neck	Cannot touch tip of chin to chest or extend neck

Table 13.2 Preoperative Patient Characteristics Associated With Possible Difficult Airway Management

Difficult Mask Ventilation[a]	Difficult Direct Laryngoscopy
Age > 55 years	Reported history of difficult intubation, aspiration pneumonia after intubation, dental or oral trauma following intubation
Obstructive sleep apnea (OSA) or snoring	OSA or snoring
Previous head/neck radiation, surgery, or trauma	Previous head/neck radiation, surgery, or trauma
Lack of teeth	Congenital disease: Down syndrome, Treacher-Collins syndrome, Pierre Robin syndrome
A beard	Inflammatory/arthritic disease: rheumatoid arthritis, ankylosing spondylitis, scleroderma
Body mass index (BMI) > 26 kg/m^2	Obesity Cervical spine disease or previous surgery

[a]Data from Langeron O, Masso E, Huraux C, et al. Prediction of difficult mask ventilation. *Anesthesiology*. 2000;92:1229-1236.

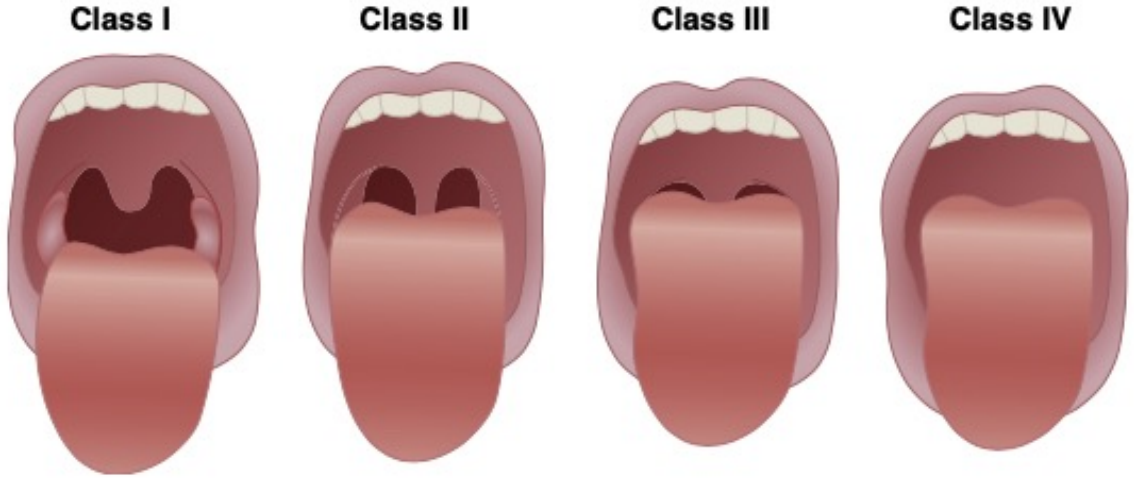

Fig. 31.3 Mallampati classification: class I, soft palate, fauces, entire uvula, pillars; class II, soft palate, fauces, portion of uvula; class III, soft palate, base of uvula; class IV, hard palate only. (From Bair AE, Caravelli R, Tyler K, et al. Feasibility of the preoperative Mallampati airway assessment in emergency department patients. *J Emerg Med*. 2010;38:677–680.)

Mouth opening test

<3 cm

Thyromental distance

<6 cm

Physical examination

- Cardiovascular system
- Respiratory system
- Neurological system
- Skin

Preoperative evaluation of patients with coexisting disease

- Cardiovascular disease
- Pulmonary disorder
- Endocrine disorder
- Kidney disorder
- Hepatic disorder
- Hematologic disorder

Cardiovascular disease

Hypertension

- Hypertension is defined as a blood pressure greater than 130/80 mmHg
- Preoperative hypertension is associated with an increased risk of cardiovascular complication

no evidence for SBP less than 180 mm Hg or DBP less than 110 mm Hg.

Cardiovascular disease

❖ Hypertension

- Physical examination should focus on vital signs, thyroid gland, peripheral pulses, and cardiovascular system (including bruits and signs of intravascular volume overload).
- Patients with long-standing, severe, or poorly controlled hypertension should undergo an ECG and serum for creatinine concentration. ±electrolyte
- Maintaining BP within 20% of the patient's baseline is recommended for adequate organ perfusion.

Cardiovascular disease

Hypertension

- All long-term antihypertensive treatment should be continued up to the day of surgery
- **Exception** of angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs). Administration within 24 hours before surgery is associated with increased risks of **intraoperative hypotension** and possibly associated with elevated risks of postoperative myocardial injury.

Cardiovascular disease

❖ Ischemic heart disease

- IHD is a risk factor for perioperative and postoperative myocardial infarction.
- The goals of preoperative evaluation are to
  - *(1) ascertain whether the patient has previously undiagnosed significant IHD*
  - *(2) characterize any known IHD with respect to severity, functional limitations, therapy, and prior investigations*
  - *(3) determine whether additional preoperative specialized testing or consultations are warranted*
  - *(4) identity opportunities for reducing perioperative risk related to IHD.*

Cardiovascular disease

Ischemic heart disease

- Patients with risk factors for IHD or suspicious symptoms may require an ECG, especially before intermediate-risk or high-risk surgical procedures.

BOX 31.2 Recommendations for Preoperative Resting 12-Lead Electrocardiogram

Class IIa Recommendation: It Is Reasonable to Perform the Procedure

Preoperative resting 12-lead ECG is reasonable for patients with known IHD, significant arrhythmia, PAD, CVD, or other significant structural heart disease (except if undergoing low-risk surgical procedures).

Class IIb Recommendation: The Procedure May Be Considered

Preoperative resting 12-lead ECG may be considered for asymptomatic patients without known coronary heart disease, except for those undergoing low-risk surgical procedures.

Class III Recommendation: The Procedure Should *Not* Be Performed Because It Is Not Helpful

Routine preoperative resting 12-lead ECG is not useful for asymptomatic patients undergoing low-risk surgical procedures.

CVD, Cerebrovascular disease; *ECG*, electrocardiogram; *IHD*, ischemic heart disease; *PAD*, peripheral artery disease.

From 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. *Circulation*. 2014;130:e278–e333.

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Cardiovascular disease

Ischemic heart disease

- Typical preoperative laboratory tests that may be considered for patients with IHD include creatinine and hemoglobin concentrations.
- Most *long-term* cardiovascular medications in patients with IHD should be continued up to surgery.
- ACEI and ARB administration should be hold 24 hours before surgery.

Preoperative cardiac risk assessment algorithms(ACC/AHA)

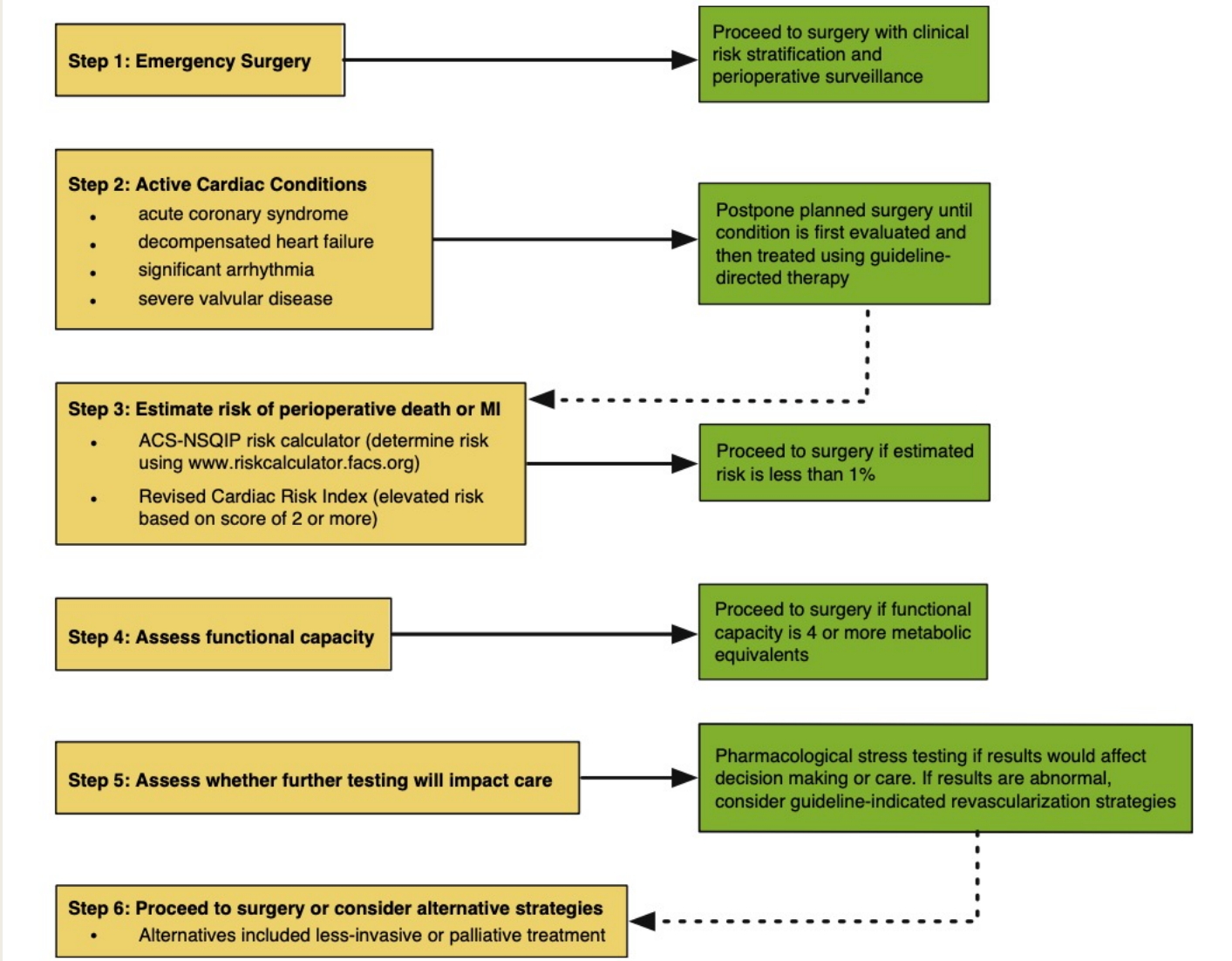

Fig. 31.5 Simplified cardiac evaluation algorithm for noncardiac surgery proposed by the 2014 American Heart Association and American College of Cardiology guidelines. *ACS-NSQIP*, American College of Surgeons National Surgical Quality Improvement Program; *MI*, myocardial infarction. (From Fleisher 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. *Circulation*. 2014;130:e278–e333.)

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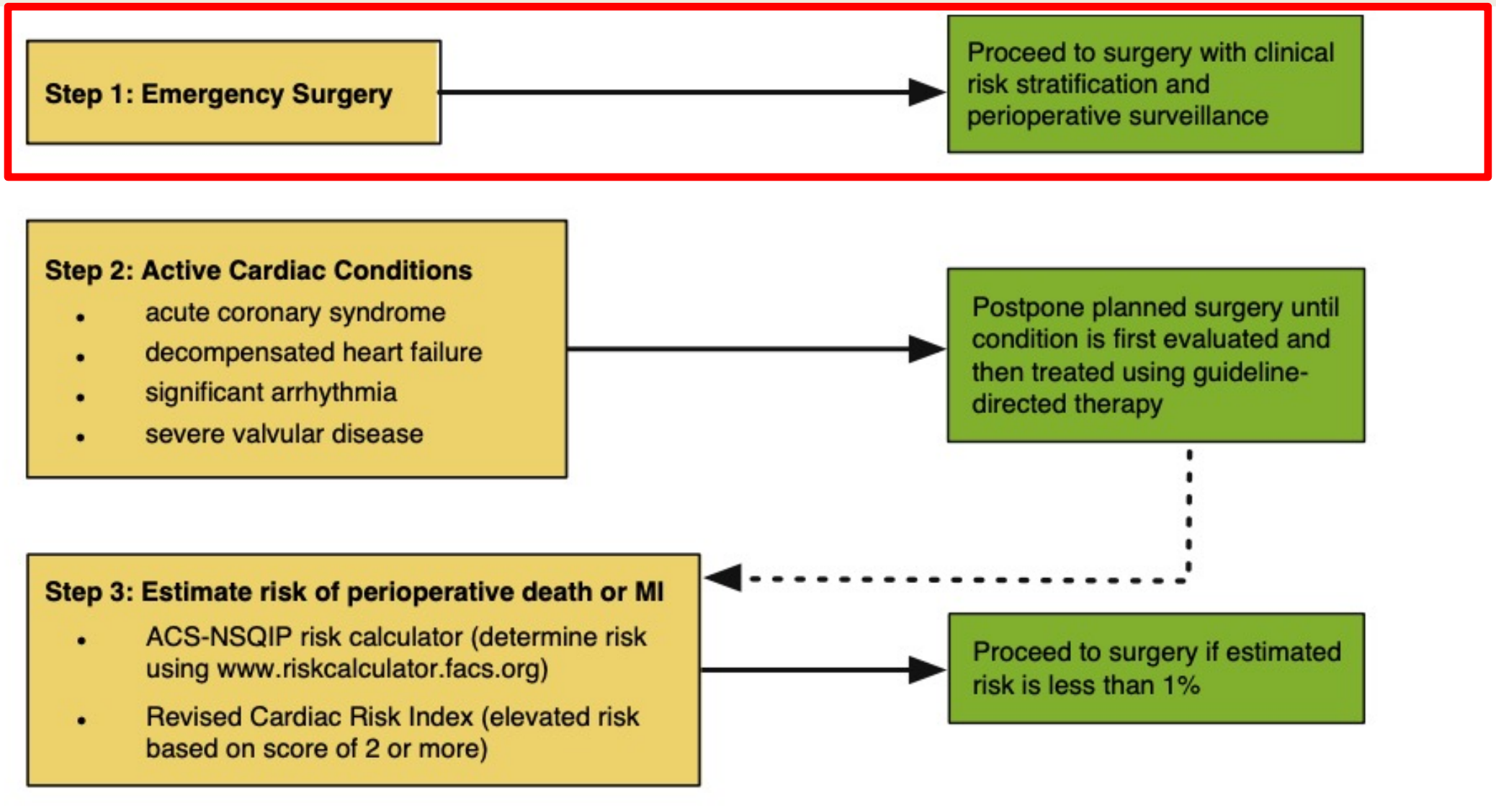

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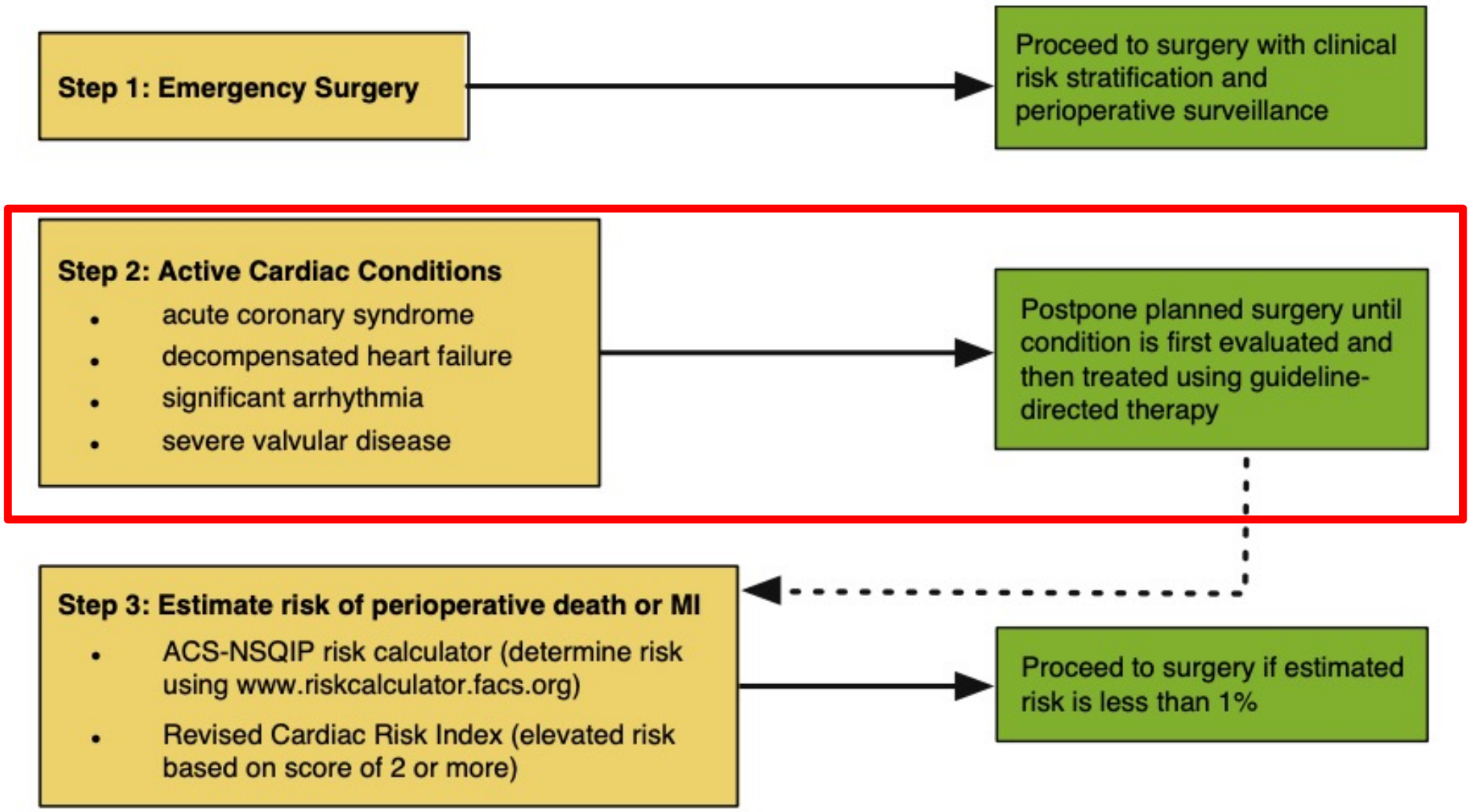

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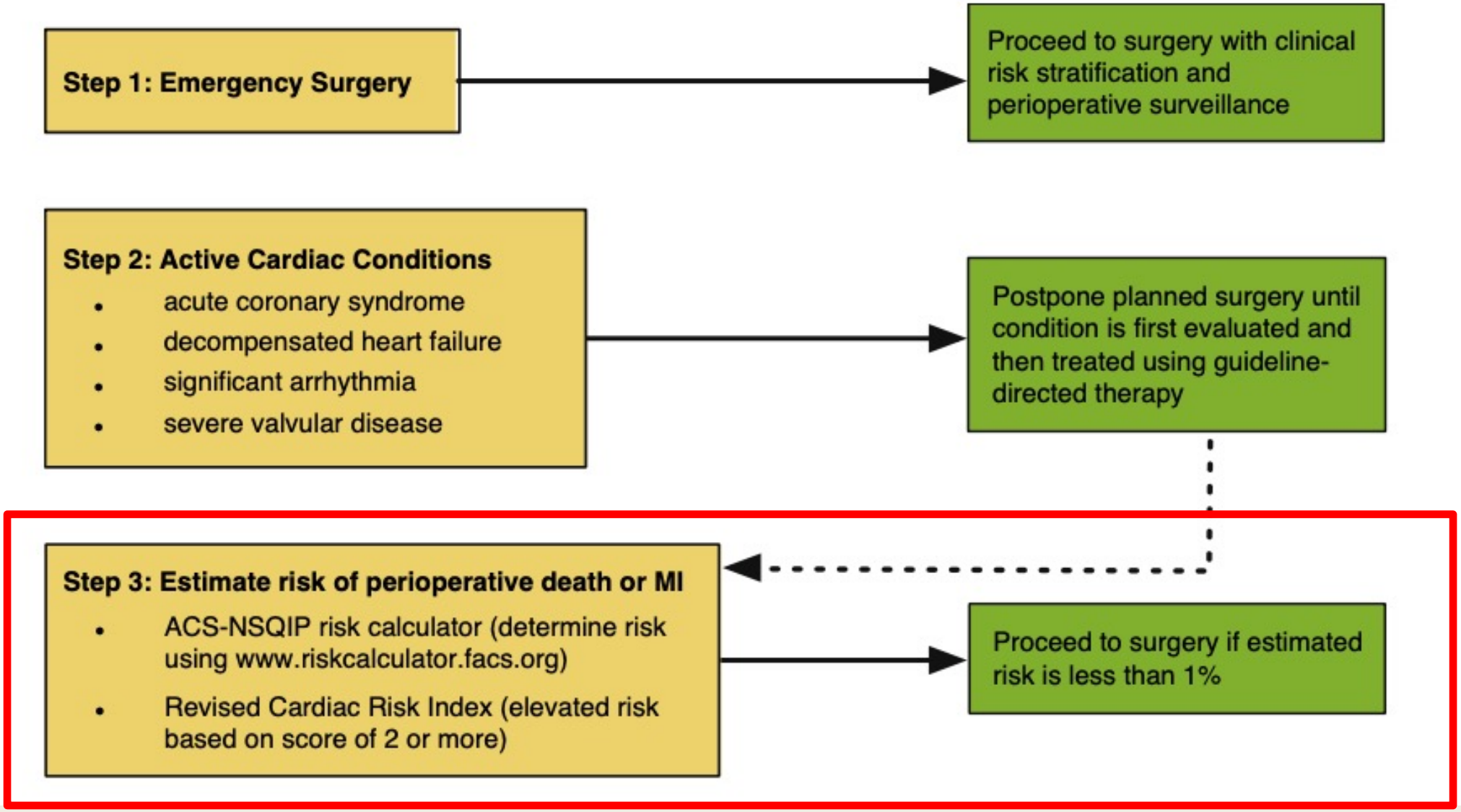

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TABLE 31.5 Components of the Revised Cardiac Risk Index and Expected Cardiac Event Risk

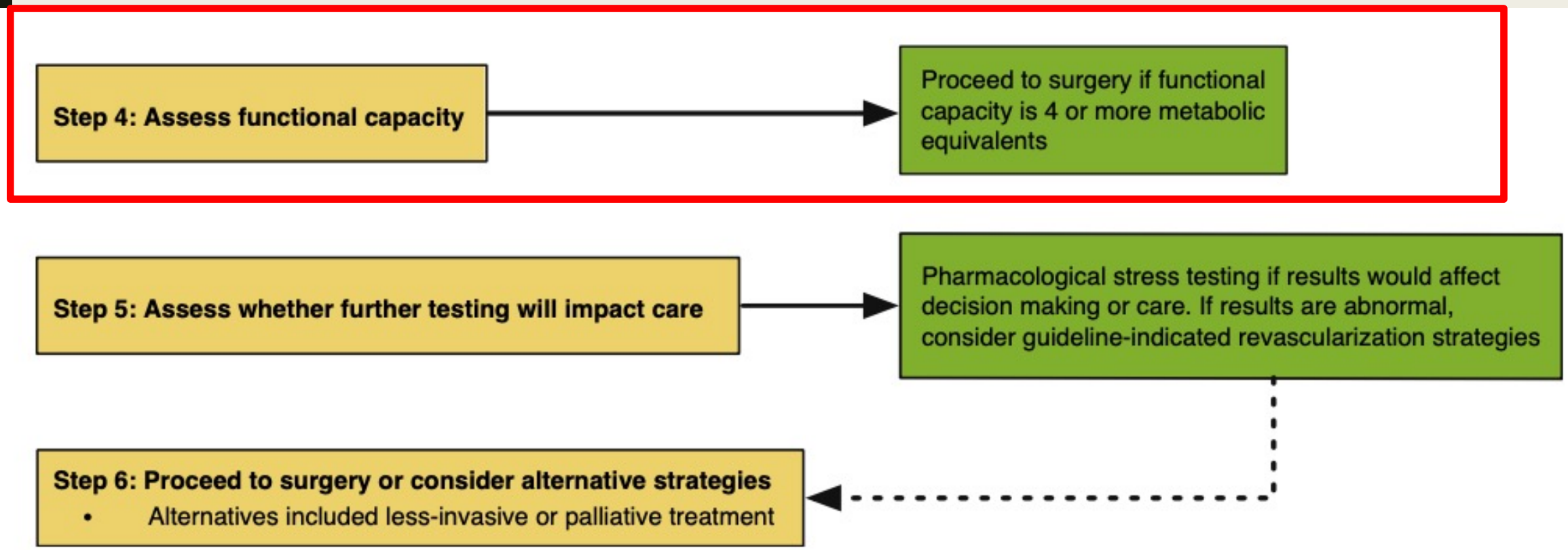
Components of Revised Cardiac Risk Index*	Points Assigned
High-risk surgery (intraperitoneal, intrathoracic, or suprainguinal vascular procedure)	1
Ischemic heart disease (by any diagnostic criteria)	1
History of congestive heart failure	1
History of cerebrovascular disease	1
Diabetes mellitus requiring insulin	1
Creatinine > 2.0 mg/dL (176 μmol/L)	1

Revised Cardiac Risk Index Score	Risk of Major Cardiac Events†,‡
0	0.4%
1	1.0%
2	2.4%
≥3	5.4%

*Data from Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. *Circulation*. 1999;100:1043–1049.

†Data from Devereaux OJ, Goldman L, Cook DJ, et al. Perioperative cardiac events in patients undergoing noncardiac surgery: a review of the magnitude of the problem, the pathophysiology of the events and methods to estimate and communicate risk. *CMAJ*. 2005;173:627–634.

‡Defined as cardiac death, nonfatal myocardial infarction, or nonfatal cardiac arrest.



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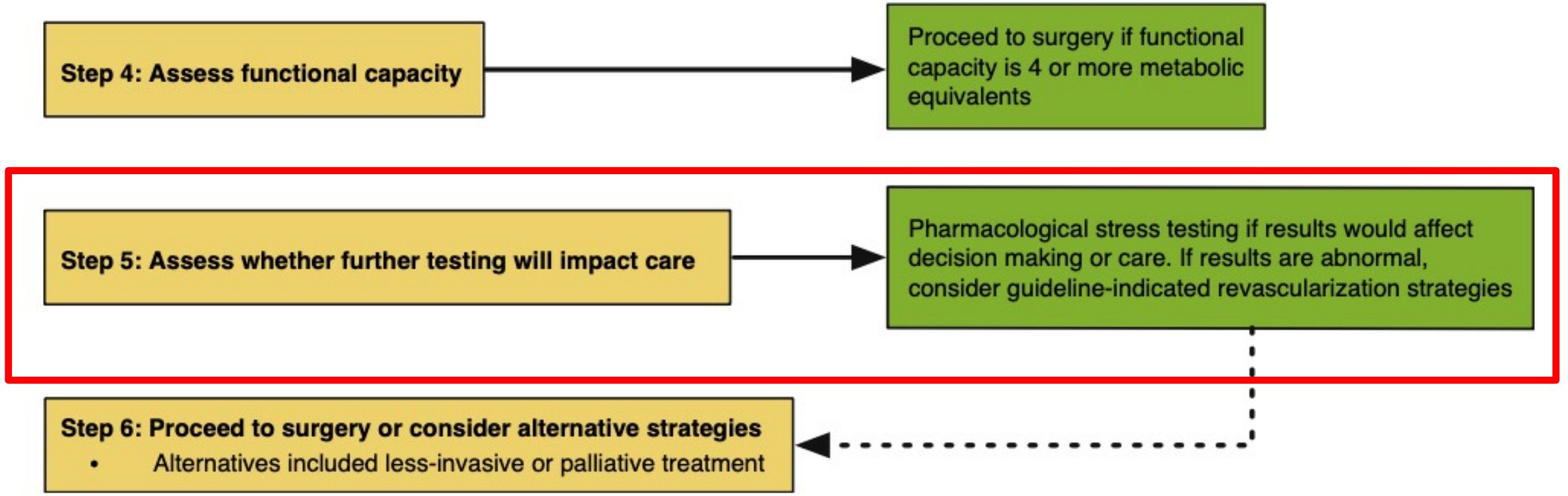

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Cardiovascular disease

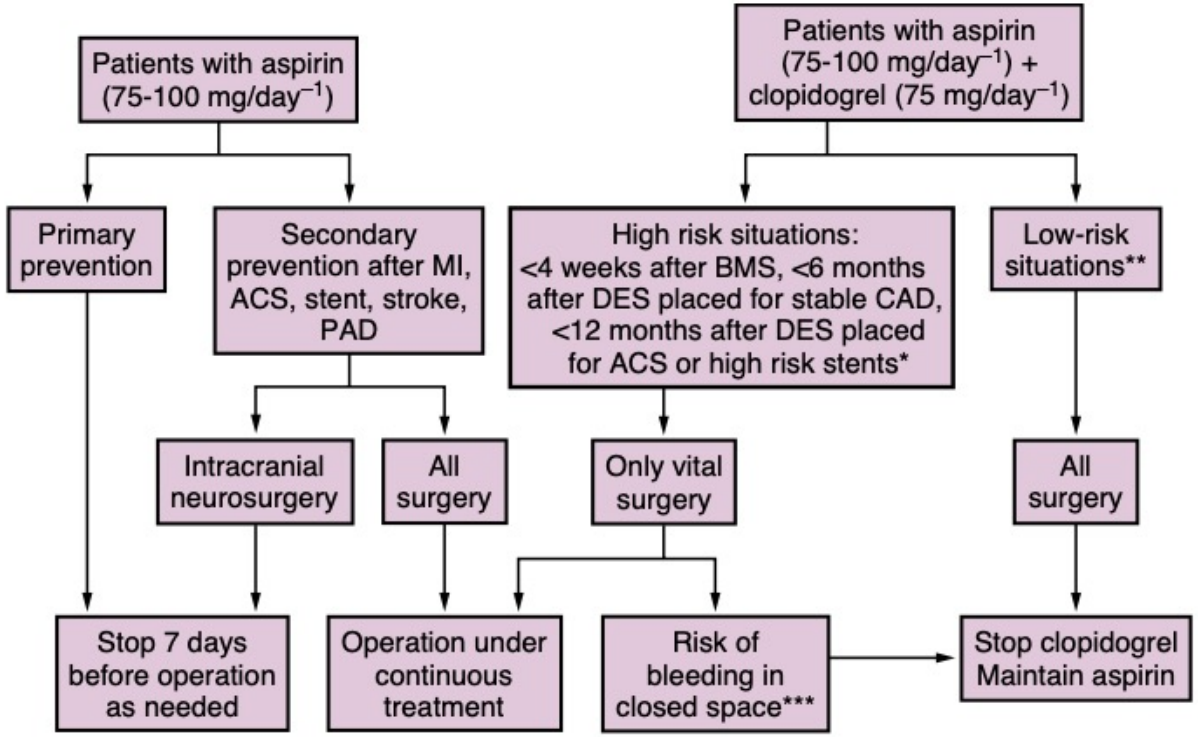
Coronary stent

- Following PCI with stent implantation, patients require an initial period of dual antiplatelet therapy (DAPT) with aspirin and a P2Y12 inhibitor.
- During preoperative evaluation, the anesthesiologist should determine the presence, type (drug-eluting vs. bare-metal), location, and original indication of any coronary stent.
- The guidelines strongly recommend that aspirin be continued, and P2Y12 inhibitor therapy be restarted as soon as possible after surgery

Box 13.4 Recommendations for Perioperative Management of Antiplatelet Drugs in Patients With Coronary Stents

- Premature discontinuation of thienopyridine (e.g., clopidogrel or ticlopidine) therapy has potentially catastrophic consequences. Health care providers should discuss strategies for periprocedural antiplatelet therapy with the patient's cardiologist prior to discontinuation.
- Elective procedures requiring discontinuation of thienopyridine therapy should be deferred until 1 month after placement of bare metal stents (BMS).
- Elective procedures requiring discontinuation of thienopyridine therapy should be deferred until 6 months after placement of a drug-eluting stent (DES) if placed for stable coronary artery disease, or until 12 months after DES if placed for acute coronary syndrome (ACS) or in other high risk situations (e.g., multiple stents, small stents, recent in-stent stenosis).
- Proceeding with urgent surgery within 3 to 6 months following DES placement may be considered if the risk with delayed surgery is greater than the stent thrombosis risk.
- Patients with either a BMS or DES should continue aspirin if at all possible throughout the procedure. The recommended daily dose is 81 mg (range 75-100 mg) as the bleeding risk is lower and with comparable ischemic protection.

Levine GN, Bates ER, Bittl JA, et al. 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients With Coronary Artery Disease. A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines 68(10): 1082-1115.



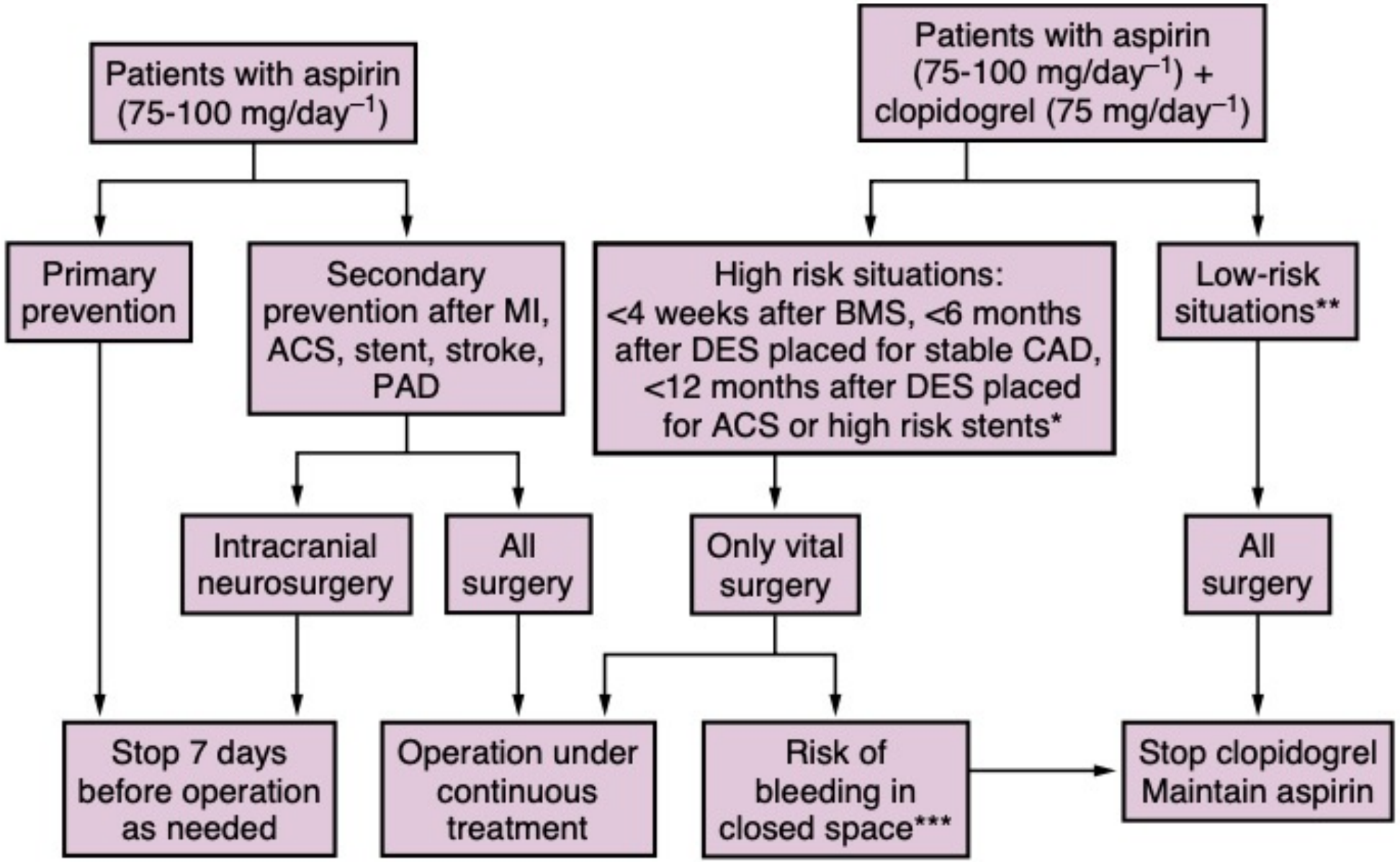
MI, Myocardial infarction; *ACS,* acute coronary syndrome; *PAD,* peripheral arterial disease; *PCI,* percutaneous coronary intervention; *BMS,* bare metal stent; *DES,* drug-eluting stent.

*High-risk stents: long (>36 mm), proximal, overlapping, or multiple stents, stents in chronic total occlusions, or in small vessels or bifurcated lesions.

**Examples of low-risk situations: >1 month after BMS, stroke, uncomplicated MI, PCI without stenting.

***Risk of bleeding in closed space: intracranial neurosurgery, intra-medullary canal surgery, posterior eye chamber ophthalmic surgery. In these situations, the risk/benefit ratio of upholding vs. withdrawing aspirin must be evaluated for each case individually; in case of aspirin upholding, early postoperative re-institution is important.

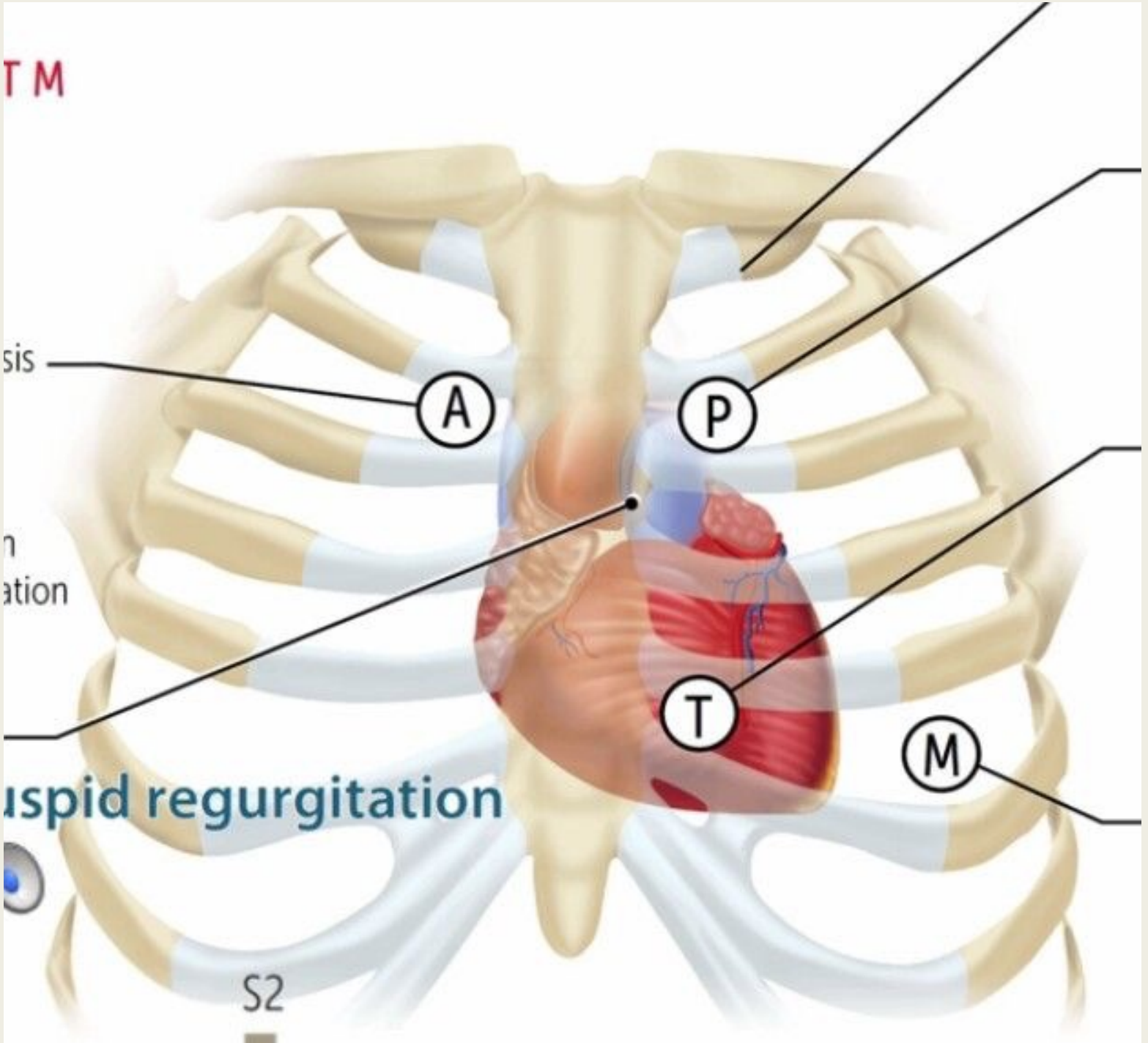
Fig. 13.3 Algorithm for perioperative management of patients taking antiplatelet therapy. (From Chassot PG, Delabays A, Spahn DR. Perioperative antiplatelet therapy: the case for continuing therapy in patients at risk of myocardial infarction. *Br J Anaesth.* 2007;99:316-328. Modified to reflect updates in Levine GN, Bates ER, Bittl JA, et al. 2016 ACC/AHA Guideline focused update on duration of dual antiplatelet therapy in patients with coronary artery disease. A report of the American College of Cardiology/American Heart Association Task Force on clinical practice guidelines. 2016;68[10]: 1082-1115.)


Patients with aspirin (75-100 mg/day^{-1})
Primary prevention
Secondary prevention after MI, ACS, stent, stroke, PAD
Intracranial neurosurgery
All surgery
Stop 7 days before operation as needed
Operation under continuous treatment
Patients with aspirin (75-100 mg/day^{-1}) + clopidogrel (75 mg/day^{-1})
High risk situations: <4 weeks after BMS, <6 months after DES placed for stable CAD, <12 months after DES placed for ACS or high risk stents*
Low-risk situations**
Only vital surgery
All surgery
Risk of bleeding in closed space***
Stop clopidogrel Maintain aspirin

Cardiovascular disease

Murmur and valvular abnormalities

- When a cardiac murmur is identified during preoperative assessment, the subsequent goals are to identify any associated cardiovascular symptoms
- *Diastolic or continuous murmurs* are almost always pathologic.
- Guidelines recommend preoperative echocardiography for any patient who has clinically suspected moderate or severe valvular abnormalities, and no echocardiogram within the previous year.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Cardiovascular disease

Prosthetic heart valves

- The preoperative evaluation should determine the indication that led to valve replacement; type, age, and current status of the valve prosthesis; need for long-term anticoagulation
- The anesthesiologist should review the most recent echocardiogram.
- Current guidelines make recommendations for *bridging therapy* largely based on the location of the mechanical heart valve and nature of planned surgery.

BOX 31.4 Recommendations for Preoperative Bridging Anticoagulation Therapy in Patients With Mechanical Heart Valves

Class I (Recommended)

- Continuation of vitamin K antagonist anticoagulation with a therapeutic INR is recommended in patients with mechanical heart valves undergoing minor procedures (e.g., dental extractions, cataract removal) where bleeding is easily controlled.
- Temporary interruption of vitamin K antagonist anticoagulation, without bridging agents while the INR is subtherapeutic, is recommended in patients with a bileaflet mechanical AVR and no other risk factors* for thrombosis who are undergoing invasive or surgical procedures.

Class IIa (Is Reasonable)

- Bridging anticoagulation therapy during the time interval when the INR is subtherapeutic preoperatively is reasonable on an individualized basis—with the risks of bleeding weighed against the benefits of thromboembolism prevention—for patients who are undergoing invasive or surgical procedures with a (i) mechanical AVR and any thromboembolic risk factor, (ii) older-generation mechanical AVR, or (iii) mechanical MVR.

*Risk factors include atrial fibrillation, previous thromboembolism, hypercoagulable condition, older-generation ball-cage or tilting disc mechanical valve, left ventricular systolic dysfunction, and ≥ 2 mechanical valves.

AVR, Aortic valve replacement; *INR,* international normalized ratio; *MVR,* mitral valve replacement.

From Nishimura RA, Otto CM, Bonow RO, et al. 2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation.* 2017;135:e1159–e1195.

Cardiovascular disease

Atrial fibrillation

- Patients with AF are at elevated risk for death, heart failure, thromboembolic events (e.g. stroke), and hospitalization.
- Treatment : rate control, rhythm control, and prevention of systemic embolization.
- The **CHA2DS2- VASc score** can be used to estimate the long- term systematic embolization risk in patients with atrial fibrillation.

TABLE 31.10 Scoring Scheme for the CHA_2DS_2-VASc Score

Risk Factor	Points
Heart Failure Associated signs and symptoms, or left ventricular systolic dysfunction	1
Hypertension	1
Age ≥ 75 years	2
Diabetes mellitus	1
Previous stroke, transient ischemic attack, or thromboembolism	2
Vascular Disease Myocardial infarction, peripheral artery disease, or aortic plaque	1
Age 65–74 years	1
Female sex	1

CHADS2, Congestive heart failure, hypertension, age > 75, diabetes, prior stroke/transient ischemic attack schema; CHA2DS2-VASc, Birmingham 2009 schema.

From Lip GY, Nieuwlaat R, Pisters R, et al. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the Euro heart survey on atrial fibrillation. *Chest*. 2010;137:263–272.

CHA_2DS_2-VASc

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Cardiovascular disease

❖ Atrial fibrillation

- Current ACC/ AHA guidelines recommend long-term oral anticoagulation for patients with nonvalvular atrial fibrillation and CHA2DS2-VASc scores ≥ 2
- The preoperative evaluation of patients with AF focuses on underlying conditions (e.g., ischemic heart disease), complications (e.g., heart failure, stroke), rate or rhythm control strategies, and anticoagulation strategies.
- Patients with rapid ventricular rates (>100 beats/min) typically require rate control before any elective surgery.

Cardiovascular disease

Atrial fibrillation

- The critical component for preoperative planning for most patients with AF is appropriate perioperative management of long-term anticoagulants.
- There are three overarching issues
  - *(1) whether temporary preoperative discontinuation is needed*
  - *(2) when oral anticoagulants should be discontinued*
  - *(3) whether bridging therapy with LMWH is required*

Cardiovascular disease

Atrial fibrillation

- Low risk procedure and patients no risk factor for bleeding continue vitamin K antagonist.
- If a decision to temporarily discontinue oral anticoagulants is made, vitamin K antagonists should be stopped 5 days before surgery.
- INR should be rechecked within 24 hours before surgery.

Cardiovascular disease

Atrial fibrillation

- ACC published 2017, in the case of vitamin K antagonist therapy, the recommended approach is to omit bridging therapy in low-risk patients who have CHA2DS2-VASc scores of 4 or less and no prior stroke, TIA, or systemic embolization.
- bridging therapy should be considered for high-risk patients with CHA2DS2-VASc scores of 7 or more, recent (i.e., prior 3 months) stroke, TIA, or systemic embolization.

Cardiovascular disease

Atrial fibrillation

- The timing of preoperative discontinuation of DOACs should be guided by the specific drug prescribed, expected procedural bleeding risk, renal function (based on estimated glomerular filtration rate [GFR]), and planned use of neuraxial anesthesia.
- Bridging therapy is generally not needed after preoperative interruption of DOACs because of their relatively short half-lives.

TABLE 31.11 Expert Consensus Recommendations on Preoperative Direct Oral Anticoagulant Discontinuation (Recommended Time Interval from Last Preoperative Dose)

Direct Thrombin Inhibitor (i.e., Dabigatran)	Direct Factor Xa Inhibitor (i.e., Rivaroxaban, Edoxaban, Apixaban)
LOW BLEEDING RISK PROCEDURES (ACC RECOMMENDATIONS)*	
eGFR ≥ 80 mL/min: ≥ 24 h eGFR 50–79 mL/min: ≥ 36 h eGFR 30–49 mL/min: ≥ 48 h eGFR 15–29 mL/min: ≥ 72 h eGFR < 15 mL/min: No data	eGFR ≥ 30 mL/min: ≥ 24 h eGFR 15–29 mL/min: ≥ 36 h eGFR < 15 mL/min: No data (consider ≥ 48 h)
UNCERTAIN, INTERMEDIATE, OR HIGH BLEEDING RISK PROCEDURES (ACC RECOMMENDATIONS)*	
eGFR ≥ 80 mL/min: ≥ 48 h eGFR 50–79 mL/min: ≥ 72 h eGFR 30–49 mL/min: ≥ 96 h eGFR 15–29 mL/min: ≥ 120 h eGFR < 15 mL/min: No data	eGFR ≥ 30 mL/min: ≥ 48 h eGFR < 30 mL/min: No data (consider ≥ 72 h)
PLANNED NEURAXIAL ANESTHESIA (ASRA RECOMMENDATIONS)†	
Uniform approach: 120 h Approach based on eGFR ■ eGFR ≥ 80 mL/min: ≥ 72 h ■ eGFR 50–79 mL/min: ≥ 96 h ■ eGFR 30–49 mL/min: ≥ 120 h ■ eGFR < 30 mL/min: Not recommended	72 h

Cardiovascular disease

Infective endocarditis prophylaxis

- Prophylaxis is required when eligible patients undergo dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth, or perforation of the oral mucosa.

BOX 31.5 Cardiac Conditions for Which Endocarditis Prophylaxis Is Recommended

- Previous infective endocarditis
- Prosthetic cardiac valves, including transcatheter-implanted prostheses, and homografts
- Prosthetic material used for cardiac valve repair, such as annuloplasty rings and chords
- Unrepaired cyanotic congenital heart disease, including palliative shunts and conduits
- Repaired congenital heart disease, with residual shunts or valvular regurgitation at the site of or adjacent to the site of a prosthetic patch or prosthetic device
- Cardiac transplant with valve regurgitation due to a structurally abnormal valve

Prophylaxis is reasonable before dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth, or perforation of the oral mucosa.

From Nishimura RA, Otto CM, Bonow RO, et al. 2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2017;135: e1159–e1195.

Cardiovascular disease

Heart failure

- Heart failure may be caused by *systolic dysfunction (LVEF* $\leq 40\ \%$*)* , *diastolic dysfunction (LVEF* $\geq 50\%$*)* or a combination of the two.
- In the perioperative setting, heart failure is a recognized risk factor for mortality and morbidity after major surgery.

Cardiovascular disease

Heart failure

- The preoperative history pertaining to heart failure should clarify its type, etiology, severity, stability (including prior exacerbations), recent investigations (e.g., echocardiograms), and current therapy (medical and device-based).
- functional status should be classified according to the NYHA categories to determine patient's status :

  compensated heart failure VS decompensated heart failure

Cardiovascular disease

Heart failure

- Physical examination : a third heart sound, jugular venous distension, pulmonary rales, and lower extremity edema
- The current ACC/AHA guidelines discourage routine preoperative assessment of ventricular function

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.

LV, Left ventricle.

From 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. *Circulation.* 2014;130:e278–e333.

Cardiovascular disease

Heart failure

- Tests for patients with heart failure : ECGs , electrolyte and creatinine
- Most medical therapy should be continued preoperatively.
- Diuretics should be held on the morning of surgery.
- ACEI and ARB administration should be hold for 24 hours before surgery

Cardiovascular disease

Cardiovascular implantable electronic devices

- Cardiovascular implantable electronic devices (CIEDs), which include both permanent pacemakers and ICDs
- The preoperative evaluation should characterize the device with respect to type, age, manufacturer, model number, current settings, and timing of recent interrogation, including evaluation of any coexisting cardiac disease
- The function of these devices can be impaired by electromagnetic interference during surgery.

Cardiovascular disease

Cardiovascular implantable electronic devices

- Inappropriate defibrillation may result in unexpected patient movement at a critical moment, such as during ocular surgery or neurosurgery, causing serious patient harm
- Consultation with the device manufacturer or cardiologist may be needed
- Patient with CIED require a preoperative ECG

BOX 31.8 Preoperative Recommendations for Cardiovascular Implantable Electronic Devices

- Inactivation of ICDs is not absolutely necessary for all procedures
- Not all pacemakers need to be altered to pace asynchronously in all patients or for all procedures
- Pacemakers can be reprogrammed or magnets can be used to force pacemakers to pace asynchronously to prevent inhibition
- ICDs can be reprogrammed or magnets can be used to inhibit ICD arrhythmia detection and tachyarrhythmia functions
- Magnets can/will *not* force pacemakers in ICDs to pace asynchronously
- Inactivation of ICDs is recommended for all procedures above the umbilicus involving electrocautery or radiofrequency ablation
- It is preferable to change to asynchronous pacing in pacemaker-dependent patients for procedures involving electrocautery or radiofrequency ablation above the umbilicus

Miller's Anesthesia 9th

Pulmonary disorder

Asthma

- The Global Initiative for Asthma, describes asthma as a "*heterogeneous disease, usually characterized by chronic airway inflammation. It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness, and cough that vary over time and in intensity, together with variable expiratory airflow limitation.*"
- Airflow obstruction are often reversible, either spontaneously or with treatment.

Pulmonary disorder

Asthma

- Spirometry is the preferred diagnostic test for asthma
- History : dyspnea, chest tightness, cough (especially nocturnal), recent exacerbations (with associated triggers), therapy (especially corticosteroids), prior hospitalizations, prior emergency department visits, prior critical care unit admissions, prior need for endotracheal intubation, and recent URI

Pulmonary disorder

Asthma

- Physical examination : quality of breath sounds, quantity of air movement, degree of wheezing, and oxygen saturation by pulse oximetry
- Taking oral corticosteroids should check blood glucose.
- Chest radiography is needed only if an infection or pneumothorax is suspected.
- Bronchodilators, corticosteroids (inhaled and oral), and any antibiotics must be continued on the day of surgery.
- Chronic corticosteroid treatment may need perioperative "*stress dose steroids*"

Pulmonary disorder

Chronic obstructive pulmonary disease

- The Global Initiative for Chronic Obstructive Lung Disease describes COPD as a "*common, preventable, and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases*"
- Persistent airflow obstruction that occasionally is partially reversible
- COPD is a known risk factor for postoperative pulmonary complications

Pulmonary disorder

Chronic obstructive pulmonary disease

- Spirometry is the preferred diagnostic test for COPD
- History : signs of recent infection (e.g., changes in sputum amount or color), smoking.
- Physical examination : barrel chest and pursed-lip breathing also suggest advanced disease.
- Patients who are hypoxic, or require supplemental oxygen, may benefit from further testing, including arterial blood gas

Pulmonary disorder

Chronic obstructive pulmonary disease

- CXR is useful only if infection or bullous disease is suspected
- Smoking cessation should be encouraged for any ongoing smokers
- Inhalers and other long-term medications for COPD should be continued on the day of surgery
- Chronic corticosteroid treatment may need perioperative "*stress dose steroids*"

Pulmonary disorder

Obstructive sleep apnea

- OSA is characterized by recurrent upper airway collapse during sleep that leads to reduced or complete cessation of airflow, despite ongoing breathing efforts.
- Causing in development of intermittent hypercapnia, intermittent hypoxemia and fragmented sleep.
- Patients with OSA are at increased perioperative risk :
  - *More difficult airway*
  - *more sensitive to the respiratory depressant effects of opioids*
  - *Increased risks of perioperative airway obstruction, hypoxemia, atelectasis, pneumonia, cardiovascular complications, and prolonged hospitalizations.*

Pulmonary disorder

Obstructive sleep apnea

- Preoperative evaluation focuses on characterizing all cases of known OSA, and selectively identifying patients at risk for undiagnosed OSA.
- Risk factor : Snoring, daytime sleepiness, hypertension, obesity, and a family history of OSA
- Screening questionnaires : the eight-item STOP-Bang questionnaire
- Patients who use CPAP devices should bring them for their procedures.

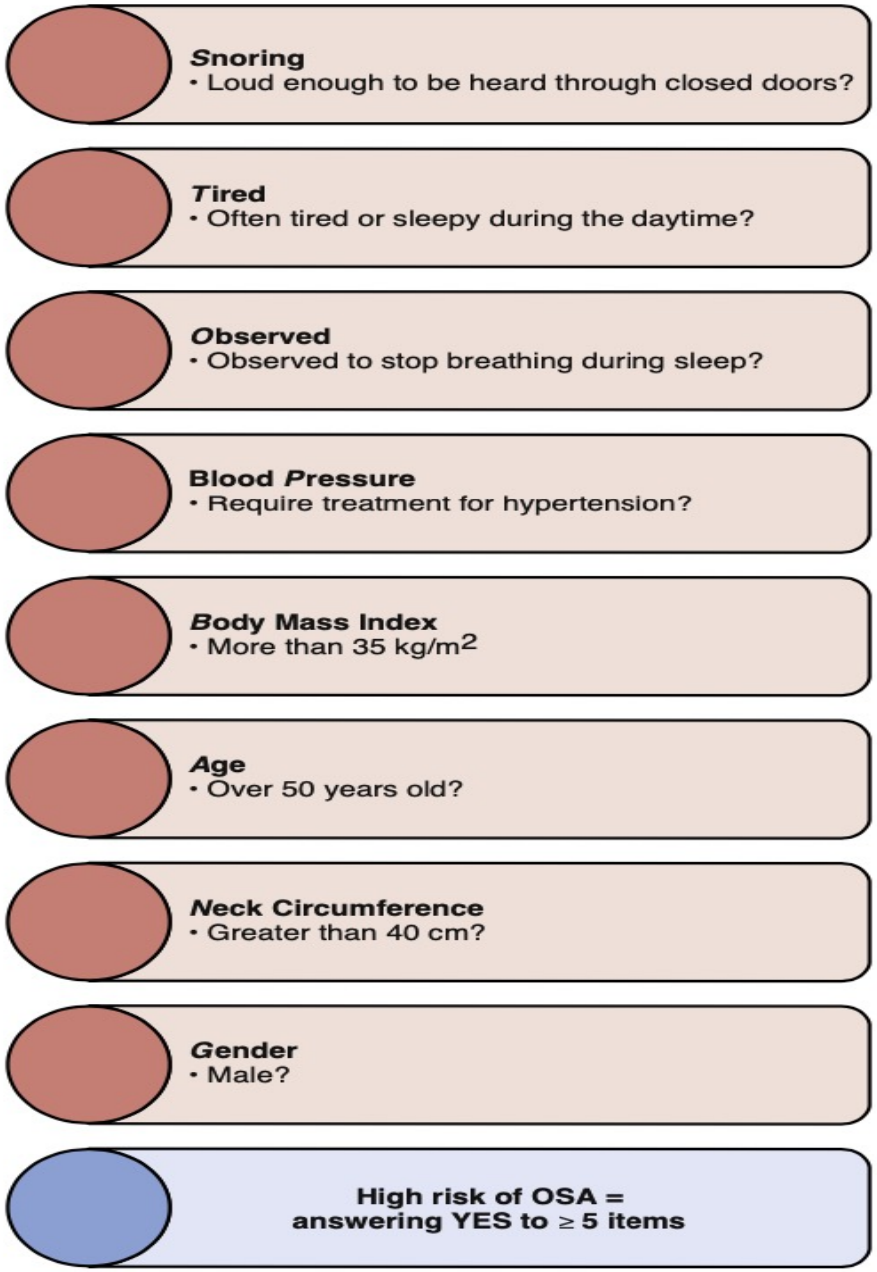


Fig. 13.5 STOP-BANG screening questionnaire for obstructive sleep apnea (OSA). (From Chung F, Yegneswaran B, Liao P, et al. STOP Questionnaire. A tool to screen patients for obstructive sleep apnea. *Anesthesiology.* 2008;108:812-821.)

Pulmonary disorder

❖ Upper respiratory tract infection

- Elective surgical procedures were cancelled when patients, especially **children**, presented with current or recent upper respiratory tract infections → airway hyperreactivity
- For patients with severe symptoms (e.g., high fever), especially in the presence of other health conditions (e.g. significant asthma, heart disease, immunosuppression):

  - elective surgery should be postponed until 4 weeks after resolution of the infection.

Endocrine disorder

Diabetes mellitus

- Two main categories of diabetes mellitus are type 1 diabetes and type 2 diabetes
- In the perioperative setting, diabetes mellitus is a risk factor for postoperative complications, including cardiac events, acute kidney injury (AKI) and surgical site infections.
- During the preoperative evaluation, the anesthesiologist should document the disease type (i.e., type 1 vs. type 2), current usual glycemic control, history of hypoglycemic episodes, current therapy, and the severity of any end-organ complications.

Endocrine disorder

Diabetes mellitus

- Preoperative laboratory tests include an ECG and serum electrolyte, creatinine, and blood glucose concentrations.
- HbA1c concentration can help characterize the average plasma glucose concentration within the prior 3 months.

  (<7.5% for type 1 diabetics and <7% for type 2 diabetics, as recommended by the American Diabetic Association)

Endocrine disorder

Diabetes mellitus

- In the perioperative setting, the goals of glycemic management are to avoid hypoglycemia, prevent ketoacidosis, and avoid marked hyperglycemia
- All diabetic patients should have their surgery as an early morning case
- Most non- insulin diabetic medications should be continued until the day before surgery but held on the morning of surgery.
- SGLT2 inhibitors should be discontinued at least 24 hours before elective surgery.

Endocrine disorder

Diabetes mellitus

- Diabetic patients should discontinue *short- acting* insulin while fasting.
- For patients with T1DM take a small amount (1/3 to 1/2) of their usual morning dose of intermediate-acting or long-acting insulin (e.g., lente, isophane) to avoid diabetic ketoacidosis.
- For patients with T2DM can either take no insulin or up to 1/2 of their usual dose of intermediate-acting, long-acting, or combination (e.g., 70/30 preparations) insulin on the morning of surgery.

Endocrine disorder

Thyroid disease

- Significant hyperthyroidism or hypothyroidism, which appears to increase perioperative risk.
- Surgery, stress, or illness can precipitate myxedema or thyroid storm in patients with untreated or severe thyroid dysfunction.

Table 23-11 Clinical Manifestations of Thyroid and Parathyroid Diseases

	Hyperthyroidism	Hypothyroidism	Hyperparathyroidism
General	Weight loss; heat intolerance; warm, moist skin	Cold intolerance	Weight loss, polydipsia
Cardiovascular	Tachycardia, atrial fibrillation, congestive heart failure	Bradycardia, congestive heart failure, cardiomegaly, pericardial or pleural effusion	Hypertension, heart block
Neurologic	Nervousness, tremor, hyperactive reflexes	Slow mental function, minimal reflexes	Weakness, lethargy, headache, insomnia, apathy, depression
Musculoskeletal	Muscle weakness, bone resorption	Large tongue, amyloidosis	Bone pains, arthritis, pathologic fractures
Gastrointestinal	Diarrhea	Delayed gastric emptying	Anorexia, nausea, vomiting, constipation, epigastric pain
Hematologic	Anemia, thrombocytopenia		
Renal		Impaired free water clearance	Polyuria, hematuria

Adapted from Roizen MF. Anesthesia for the patient with endocrine disease, part 1. *Curr Rev Clin Anesth*. 1987;6:43.

Endocrine disorder

Thyroid disease

- TFT is not needed if the patient is on a stable medication dose and was assessed as being euthyroid within the previous 6 months.
- CXR or CT scans is useful tests to evaluate tracheal or mediastinal involvement by a goiter.
- If a patient has moderate or worse thyroid dysfunction, elective surgery should be postponed until the individual is euthyroid.
- All thyroid replacement therapy and antithyroid drugs should be continued on the day of surgery.

Endocrine disorder

Hypothalamic-pituitary-adrenal disorder

- ACTH regulates cortisol release from the adrenal cortex.
- Physical stressors, surgery is one of the most potent activators of the HPA axis
- Excess adrenal hormones result from *endogenous cortisol* associated with pituitary or adrenal tumors, or *exogenous glucocorticoids* used to treat disorders such as asthma or inflammatory diseases. → Cushing syndrome

Cushing syndrome

Endocrine disorder

Hypothalamic-pituitary-adrenal disorder

- These patients may require an ECG serum electrolytes and glucose.
- An important issue for patients with chronic corticosteroid exposure is whether perioperative “stress-dose steroids” are needed.
- Patients taking prednisone (or its equivalent) in daily doses exceeding 20 mg/day for more than 3 weeks, and patients with Cushing syndrome should have perioperative corticosteroid supplementation.
- Patients should continue their replacement corticosteroid therapy on the day of surgery and may need further supplementation based on the expected surgical stress response.

TABLE 31.15 Recommendations for Perioperative Corticosteroid Coverage

Surgical Stress	Target Hydrocortisone Equivalent	Preoperative Corticosteroid Dose	Perioperative Corticosteroid Dose
Superficial procedure (e.g., biopsy, dental procedure)	8–10 mg/day	Usual daily dose	▪ Then usual daily dose
Minor (e.g., inguinal hernia repair, colonoscopy, hand surgery)	50 mg/day	Usual daily dose	▪ Hydrocortisone 50 mg IV before incision ▪ Hydrocortisone 25 mg IV every 8 h for 24 h ▪ Then usual daily dose
Moderate (e.g., colon resection, total joint replacement, lower extremity revascularization)	75–150 mg/day	Usual daily dose	▪ Hydrocortisone 50 mg IV before incision ▪ Hydrocortisone 25 mg IV every 8 h for 24 h ▪ Then usual daily dose
Major (e.g., esophagectomy, pancreatoduodenectomy, major cardiac, major vascular, trauma)	75–150 mg/day	Usual daily dose	▪ Hydrocortisone 100 mg IV before incision ▪ Continuous IV infusion of 200 mg of hydrocortisone over 24 h ▪ Then usual daily dose OR ▪ Hydrocortisone 50 mg IV every 8 h for 24 h ▪ Taper dose by 50% per day until usual daily dose is reached* ▪ Then usual daily dose

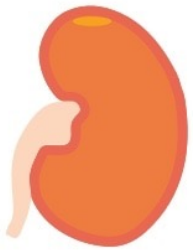
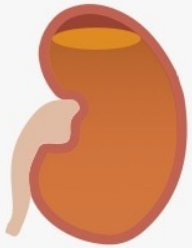
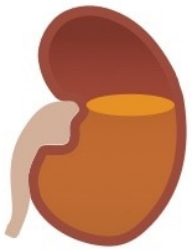
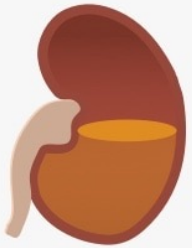
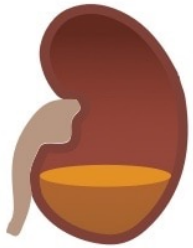
*Administer continuous IV fluids with 5% dextrose and 0.2% to 0.45% sodium chloride (based on degree of hypoglycemia).
IV, Intravenous.
From Liu MM, Reidy AB, Saatee S, et al. Perioperative steroid management: approaches based on current evidence. *Anesthesiology*. 2017;127:166–172.

Kidney disease

Kidney disease

- KDIGO guideline group, CKD is defined as a GFR less than 60 mL/min/1.73 m2 for at least 3 months
- End-stage renal disease generally refers to chronic kidney failure that requires either dialysis or transplantation.
- AKI is a sudden decrease in renal function with the possible decrease in urine output.

- AKI may be reversible if precipitating factors are identified and corrected.

Stage of CKD	STAGE 1	STAGE 2	STAGE 3A	STAGE 3B	STAGE 4	STAGE 5
eGFR	90 or greater	Between 60 and 89	Between 45 and 59	Between 30 and 44	Between 15 and 29	Less than 15
Level of kidney damage	 Mild kidney damage	 Mild kidney damage	 Mild to moderate kidney damage	 Mild to moderate kidney damage	 Moderate to severe kidney damage	 End-stage kidney disease. Kidneys are close to failure or have completely failed. You will need to start dialysis or have a kidney transplant.

Kidney disease

Kidney disease

- CKD is associated with many electrolyte disturbances and chronic metabolic acidosis.
- Preexisting CKD is a risk factor for increased postoperative complications, including cardiac complications, AKI, acute stroke and death.
- During preoperative evaluation, it is important to establish the severity, type, and underlying cause of preoperative renal impairment and volume status.

Kidney disease

Kidney disease

- Patients with CKD need an ECG and serum for electrolyte, calcium, glucose, albumin, and creatinine concentrations.
- A chest radiograph (infection, volume overload), echocardiogram (murmurs, heart failure), and cardiology evaluation may be necessary in some cases.

Kidney disease

Kidney disease

- Patient with CKD should avoid NSAIDs and COX-2 inhibitors
- LMWHs are not removed during dialysis. → prolonged duration
- Ideally, elective surgery should be performed about 24 hours after dialysis.
- **Contrast-induced nephropathy** is defined as AKI that occurs after radiocontrast administration .

- Preventative strategies include avoiding volume depletion, discontinuing NSAIDs for 24 to 48 hours, using a low-risk contrast administration protocol.

Hepatic disorder

Hepatic disorder

- Liver disease is associated with decreased plasma protein production, thereby affecting drug binding, volume of distribution, metabolism and clearance.
- The preoperative history typically reveals the underlying disease etiology, disease severity, therapies, and associated complications.
- The physical examination should assess for weight, vital signs (including oxygen saturation), jaundice, bruising, ascites, pleural effusions, peripheral edema, hepatomegaly, splenomegaly, and altered mental status.

Hepatic disorder

Hepatic disorder

- Baseline testing includes an ECG and serum for CBC, electrolyte, creatinine concentration, liver function tests, albumin concentration, and INR.
- Coagulopathy can be a result of vitamin K deficiency , factor deficiency, or thrombocytopenia.
- Encephalopathy is frequently precipitated by an additional acute insult such as infection, gastrointestinal bleeding, hypovolemia, or sedatives.

Hepatic disorder

Hepatic disorder

- Patients who abuse alcohol may be at risk for neurologic deterioration (i.e., Wernicke-Korsakoff syndrome) if thiamine, folate, and vitamin B12 supplements are not provided
- Patients with severe liver disease have increased perioperative morbidity and mortality.
- Poor perioperative outcome in patients with liver disease is predicted by
  - *Child-Turcotte-Pugh C cirrhosis*
  - *Model for end-stage liver disease (MELD) score of 15 or more*

TABLE 31.16 Child-Turcotte-Pugh Classification

Parameter	1 point	2 points	3 points
Ascites	Absent	Slight	Moderate
Bilirubin (mg/dL)	<2	2–3	>3
Albumin (g/dL)	>3.5	2.8–2.5	<2.8
Prothrombin time (seconds over control)	<4	4–6	>6
Encephalopathy	None	Grade 1–2	Grade 3–4

Class A: <7 points.
Class B: 7-9 points.
Class C: >9 points.

The MELD score can be calculated as shown below (where creatinine and bilirubin concentrations are expressed in mg/dL):

$$\text{MELD} = 6.43 + [3.78 \times \log_e (\text{bilirubin})] + [11.2 \times \log_e (\text{INR})] + [9.57 \times \log_e (\text{creatinine})]$$

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Hematologic disorder

Anemia

- Causes : decreased RBC production, increased RBC destruction, and blood loss.
- Preoperative evaluation should determine its etiology, duration, stability, related symptoms, and therapy.
- The anesthesiologist should also consider the type of surgical procedure, anticipated blood loss, and comorbid conditions that may either affect oxygen delivery or be affected by decreased oxygen delivery.

Hematologic disorder

Thrombocytopenia

- Thrombocytopenia is defined as a platelet count less than 150,000/mm3.
- If a patient has an unexpectedly low platelet count, the initial steps are to repeat the test
- Neuraxial anesthesia is generally considered safe once the platelet count exceeds 50,000 to 80,000/mm3.

Investigation and testing

- Preoperative diagnostic tests should be selectively ordered based on the patient's medical history, planned surgery, and expected degree of intraoperative blood loss.
- Testing does not have to be repeated during the preoperative evaluation of healthy patients (i.e. ASA-PS class 1 or 2) if similar testing has already been performed within the 2 months.

Preoperative testing on patients' medical history

TABLE 31.18 Framework for Preoperative Diagnostic Testing Based on Patients' Medical History

Preoperative Diagnosis	ECG	CXR	CBC	Electrolytes	Creatinine	Glucose	Coagulation	LFTs	Drug Levels	Ca
Cardiac disease										
IHD	X		X	±						
HF	X	±								
HTN	X	±		X*	X					
Chronic atrial fibrillation	X								X†	
PAD	X									
Valvular heart disease	X	±								
Pulmonary disease										
COPD	X	±	X						X‡	
Asthma§										
Diabetes mellitus	X			±	X	X				
Liver disease										
Infectious hepatitis							X	X		
Alcohol/drug induced							X	X		
Tumor infiltration							X	X		
Renal disease			X	X	X					
Hematologic disorders			X							
Coagulopathies			X				X			
CNS Disorders										
Stroke	X		X	X		X			X	
Seizures	X		X	X		X			X	
Tumor	X		X							
Vascular/aneurysms	X		X							
Malignancy			X							

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Preoperative testing on patients' medical history

TABLE 31.18 Framework for Preoperative Diagnostic Testing Based on Patients' Medical History

Preoperative Diagnosis	ECG	CXR	CBC	Electrolytes	Creatinine	Glucose	Coagulation	LFTs	Drug Levels	Ca
Malignancy			X							
Hyperthyroidism	X		X	X						X
Hypothyroidism	X		X	X						
Cushing disease			X	X		X				
Addison disease			X	X		X				
Hyperparathyroidism	X		X	X						X
Hypoparathyroidism	X			X						X
Morbid obesity	X	±				X				
Malabsorption/poor nutrition	X		X	X	X	X				
Select Drug Therapies										
Digoxin	X			±					X	
Anticoagulants			X				X			
Phenytoin									X	
Phenobarbital									X	
Diuretics				X	X					
Corticosteroids			X			X				
Chemotherapy			X		±					
Aspirin/NSAID										
Theophylline									X	

Miller's Anesthesia 9th

Preoperative risk assessment

- Perioperative risk is necessarily a function of both the risk associated with the specific operative procedure and the risk associated with a patient's underlying medical status.
- The most commonly used method by anesthesiologists to assess overall perioperative risk is the ASA-PS classification system

Table 13.1 American Society of Anesthesiologists Physical Status Classification System

ASA PS Classification[a]	Definition	Examples, including, but not limited to
ASA I	A normal healthy patient	Healthy, nonsmoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Examples include (but are not limited to) current smoker, social alcohol drinker, pregnancy, obesity (30 < BMI < 40), well-controlled DM/HTN, mild lung disease
ASA III	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Examples include (but are not limited to) poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥ 40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, premature infant PCA < 60 weeks, history (>3 months) of MI, CVA, TIA, or CAD/stents.
ASA IV	A patient with severe systemic disease that is a constant threat to life	Examples include (but are not limited to) recent (<3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARDS, or ESRD not undergoing regularly scheduled dialysis
ASA V	A moribund patient who is not expected to survive without the operation	Examples include (but are not limited to) ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	

[a]The addition of "E" denotes emergency surgery. (An emergency is defined as existing when delay in treatment of the patient would lead to a significant increase in the threat to life or body part).

ARDS, Acute respiratory disease syndrome; *ASA*, American Society of Anesthesiologists; *ASA PS*, ASA physical status; *BMI*, body mass index; *CAD*, coronary artery disease; *COPD*, chronic obstructive pulmonary disease; *CVA*, cerebral vascular accident; *DIC*, disseminated intravascular coagulopathy; *DM*, diabetes mellitus; *ESRD*, end-stage renal disease; *HTN*, hypertension; *MI*, myocardial infarction; *PCA*, postconceptual age; *TIA*, transient ischemic attack.

From American Society of Anesthesiologists. ASA Physical Status Classification System. www.asahq.org.

Preparation

Smoking cessation

- Encouraging patients to stop smoking
- Current smokers have elevated risks for a range of postoperative complications, including mortality, cardiac complications, pulmonary complications, acute stroke, and surgical site infections.

I Quit	What's getting better for me
20 Minutes Ago	Your heart rate and blood pressure are dropping (normalizing).
8-12 Hours Ago	Your carbon monoxide level is dropping and returns to normal and your oxygen level increases to normal.
48 Hours Ago	Your nerve endings start to regenerate and you can smell and taste things better.
2-3 Months Ago	Your circulation improves and your lung function increases.
1-9 Months Ago	Sinus congestion, fatigue, coughing and shortness of breath decrease. The tiny hair-like structures in your lungs called cilia regain normal function. This increases your lungs ability to handle mucus, clean the lungs and reduce the risk of infection.
1 Year Ago	The added risk of heart disease drops to ½ that of a smoker.
5 Years Ago	Your risk of cancer of the mouth, throat, esophagus and bladder are cut in half. Your risk of cervical cancer falls to that of a non-smoker. Your stroke risk may be reduced to that of a non-smoker.
10 Years Ago	The risk of dying from lung cancer is about half that of a person who is still smoking. The risk of cancer of the larynx (voice box) and pancreas decreases.
15 Years Ago	Your risk of coronary heart disease and smoking related death is now similar to that of someone who never smoked.
CONGRATULATIONS!!! Keep Up The Great Work, Your Body and Your Family Thank You!	

Prevention of perioperative pulmonary aspiration

- Many patients who present for anesthesia are at increased risk for aspiration.
- Today, clinically significant pulmonary aspiration is very rare in healthy patients undergoing general anesthesia.

Table 23-12 Top 10 Factors Predisposing to Aspiration

1	Emergency surgery
2	Inadequate anesthesia
3	Abdominal pathology
4	Obesity
5	Opioid medication
6	Neurologic deficit
7	Lithotomy
8	Difficult intubation/airway
9	Reflux
10	Hiatal hernia

Adapted from Kluger MT, Short TG. Aspiration during anaesthesia: A review of 133 cases from the Australian Anaesthetic Incident Monitoring Study (AIMS). *Anaesthesia*. 1999;54:19–26.

Drugs to reduce the risk of pulmonary aspiration

- Used to decrease the volume and increase the pH of gastric fluid → reduce the risk of aspiration pneumonitis
- not recommend the routine preoperative
- E.g. Histamine-2 receptor antagonists : Cimetidine, Ranitidine, Famotidine

  Proton pump inhibitors (PPIs) : Omeprazole

  Antacids

  Gastrokinetic agents : Metoclopramide

Preoperative medication management

Table 13.7 Preanesthesia Medication Instructions

Continue on Day of Surgery	Discontinue on Day of Surgery Unless Otherwise Indicated
Antidepressant, antianxiety, and psychiatric medications (including monoamine oxidase inhibitors[a])	
Antihypertensives • Generally to be continued	Antihypertensives • May consider discontinuing angiotensin-converting enzyme inhibitors or angiotensin receptor blockers 12-24 h before surgery if taken only for hypertension; especially with lengthy procedures, significant blood loss or fluid shifts, use of general anesthesia, multiple antihypertensive medications, well-controlled blood pressure

Aspirin[b]
• Patients with known vascular disease
• Patients with previous cardiac stents
• Before cataract surgery
• Before vascular surgery
• Taken for secondary prophylaxis (vascular disease of any type)
	Aspirin[b]
	• Discontinue 5-7 days before surgery
	  • If risk of bleeding > risk of thrombosis
	  • For surgeries with serious consequences from bleeding
	  • If taken only for primary prophylaxis (no known vascular disease)

Asthma medications	
Autoimmune medications • Methotrexate (if no risk of renal failure)	Autoimmune medications • Methotrexate (if risk of renal failure) • Entanercept (Enbrel), infliximab (Remicade), adalimumab (Humira): check with prescriber (typically *not* stopped for inflammatory bowel disease)
β-Blockers	
Birth control pills	Birth control pills (if high risk of thrombosis)
Clopidogrel (Plavix)[a] • Patients with drug-eluting stents for <6 months • Patients with bare metal stents for <1 month • Before cataract surgery	Clopidogrel (Plavix)[a] • Patients not included in group recommended for continuation • Patients with drug-eluting stents for 3-6 months if risk of delaying surgery is greater than risk of stent thrombosis
Diuretics • Triamterene, hydrochlorothiazide	Diuretics • Potent loop diuretics
Eye drops	
Estrogen compounds • When used for birth control or cancer therapy (unless high risk of thrombosis)	Estrogen compounds • When used to control menopause symptoms or for osteoporosis
Gastrointestinal reflux medications • Histamine antagonists, proton-pump inhibitors, gastric motility agents	Gastrointestinal reflux medications • Particulate antacids (e.g., Tums)
	Herbals and nonvitamin supplements • 7-14 days before surgery
Insulin • *Type 1 diabetes*: take ~ one third of intermediate to long-acting (NPH, Lente) • *Type 2 diabetes*: take up to one half long-acting (NPH) or combination (70/30) preparations • Glargine (Lantus): decrease only if dose is ≥1 unit/kg • With insulin pump delivery, continue lowest nighttime basal rate • Discontinue if blood sugar level <100	Hypoglycemic agents, oral Insulin • Regular insulin (*exception*: with insulin pump, continue lowest basal rate—generally nighttime dose)

Continued

Table 13.7 Preanesthesia Medication Instructions—cont'd

Continue on Day of Surgery	Discontinue on Day of Surgery Unless Otherwise Indicated
Opioid medications for pain or addiction	
Seizure medications	
	Nonsteroidal antiinflammatory drugs • Discontinue for 5 half-lives of the drug[c]
Statins	
	Topical creams and ointments
Steroids (oral or inhaled)	
Thyroid medications	
	Vitamins, minerals, iron
	Viagra or similar medications • Discontinue 24 h before surgery
Warfarin • Cataract surgery	Warfarin[d] • Discontinue 5 days before surgery if normal INR (international normalized ratio) is required

[a]See text for details.
[b]Except when the risk or consequences of bleeding are severe (generally only with intracranial or posterior eye procedures). If regional anesthesia considered, see Table 13.8.
[c]See Table 13.8.
[d]Bridging may be necessary; see text and Table 13.9 for details.

Table 13.7 Preanesthesia Medication Instructions

Continue on Day of Surgery	Discontinue on Day of Surgery Unless Otherwise Indicated
Antidepressant, antianxiety, and psychiatric medications (including monoamine oxidase inhibitors[a])	
Antihypertensives • Generally to be continued	Antihypertensives • May consider discontinuing angiotensin-converting enzyme inhibitors or angiotensin receptor blockers 12-24 h before surgery if taken only for hypertension; especially with lengthy procedures, significant blood loss or fluid shifts, use of general anesthesia, multiple antihypertensive medications, well-controlled blood pressure

Aspirin[b]
• Patients with known vascular disease
• Patients with previous cardiac stents
• Before cataract surgery
• Before vascular surgery
• Taken for secondary prophylaxis (vascular disease of any type)
	Aspirin[b]
	• Discontinue 5-7 days before surgery
	  • If risk of bleeding > risk of thrombosis
	  • For surgeries with serious consequences from bleeding
	  • If taken only for primary prophylaxis (no known vascular disease)

Asthma medications	
Autoimmune medications • Methotrexate (if no risk of renal failure)	Autoimmune medications • Methotrexate (if risk of renal failure) • Entanercept (Enbrel), infliximab (Remicade), adalimumab (Humira): check with prescriber (typically *not* stopped for inflammatory bowel disease)
β-Blockers	
Birth control pills	Birth control pills (if high risk of thrombosis)

Clopidogrel (Plavix)[a] • Patients with drug-eluting stents for <6 months • Patients with bare metal stents for <1 month • Before cataract surgery	Clopidogrel (Plavix)[a] • Patients not included in group recommended for continuation • Patients with drug-eluting stents for 3-6 months if risk of delaying surgery is greater than risk of stent thrombosis
Diuretics • Triamterene, hydrochlorothiazide	Diuretics • Potent loop diuretics
Eye drops	
Estrogen compounds • When used for birth control or cancer therapy (unless high risk of thrombosis)	Estrogen compounds • When used to control menopause symptoms or for osteoporosis
Gastrointestinal reflux medications • Histamine antagonists, proton-pump inhibitors, gastric motility agents	Gastrointestinal reflux medications • Particulate antacids (e.g., Tums)
	Herbals and nonvitamin supplements • 7-14 days before surgery
Insulin • *Type 1 diabetes*: take ~ one third of intermediate to long-acting (NPH, Lente) • *Type 2 diabetes*: take up to one half long-acting (NPH) or combination (70/30) preparations • Glargine (Lantus): decrease only if dose is ≥1 unit/kg • With insulin pump delivery, continue lowest nighttime basal rate • Discontinue if blood sugar level <100	Hypoglycemic agents, oral Insulin • Regular insulin (*exception*: with insulin pump, continue lowest basal rate—generally nighttime dose)

Continued

Table 13.7 Preanesthesia Medication Instructions—cont'd

Continue on Day of Surgery	Discontinue on Day of Surgery Unless Otherwise Indicated
Opioid medications for pain or addiction	
Seizure medications	
	Nonsteroidal antiinflammatory drugs • Discontinue for 5 half-lives of the drug[c]
Statins	
	Topical creams and ointments
Steroids (oral or inhaled)	
Thyroid medications	
	Vitamins, minerals, iron
	Viagra or similar medications • Discontinue 24 h before surgery
Warfarin • Cataract surgery	Warfarin[d] • Discontinue 5 days before surgery if normal INR (international normalized ratio) is required

[a]See text for details.
[b]Except when the risk or consequences of bleeding are severe (generally only with intracranial or posterior eye procedures). If regional anesthesia considered, see Table 13.8.
[c]See Table 13.8.
[d]Bridging may be necessary; see text and Table 13.9 for details.

Management Recommendations for Selected Antiplatelet/Anticoagulant Medications Before Regional or Neuraxial Procedures

Table 13.8 Management Recommendations for Selected Antiplatelet/Anticoagulant Medications Before Regional or Neuraxial Procedures

Drug	When to Stop: High-Risk Procedure	When to Stop: Intermediate-Risk Procedure	When to Stop: Low-Risk Procedure	When to Restart
Aspirin and combination	Primary prophylaxis: 6 days OR seconday prophylaxis: shared assessment and risk stratification[a]	Shared assessment and risk stratification[a]	No	24 hours
NSAIDs	5 half-lives	No	No	24 hours
Diclofenac	1 day			
Ketorolac	1 day			
Ibuprofen	1 day			
Indomethacin	2 days			
Naproxen	4 days			
Meloxicam	4 days			
Antiplatelets				
Dipyridamole	2 days	No	No	N/A
Clopidogrel	7 days	7 days	No	12-24 hours
Anticoagulants				
Warfarin	5 days, normal INR	5 days, normal INR	No OR shared assessment and risk stratification[a]	24 hours
IV heparin infusion	4 hours	4 hours	4 hours	2 hours[b]
Subcutaneous heparin, bid and tid	8-10 hours	8-10 hours	8-10 hours	2 hours
LMWH: prophylactic	12 hours	12 hours	12 hours	4 hours after low-risk OR 12-24 hours after intermediate- to high-risk procedures
LMWH: therapeutic	24 hours	24 hours	24 hours	
Dabigatran	4-5 days OR 6 days (impaired renal function)	4-5 days OR 6 days (impaired renal function)	Shared assessment and risk stratification[a]	24 hours
Rivaroxaban	3 days	3 days		
Apixaban	3-5 days	3-5 days		
Fibrinolytic agents	48 hours	48 hours	48 hours	48 hours

[a]Case-by-case analysis of risks and benefits of continued therapy recommended.
[b]If an intermediate- or high-risk procedure was bloody, then a 24-hour interval should be observed.
bid, Twice a day; *INR*, international normalized ratio; *IV*, intravenous; *LMWH*, low-molecular-weight heparin; *tid*, three times a day.
Modified from Narouze S, Benzon HT, Provenzano DA, et al. Interventional spine and pain procedures in patients on antiplatelet and anticoagulant medications: guidelines from the American Society of Regional Anesthesia and Pain Medicine, the European Society of Regional Anaesthesia and Pain Therapy, the American Academy of Pain Medicine, the International Neuromodulation Society, the North American Neuromodulation Society, and the World Institute of Pain. *Reg Anesth Pain Med*. 2015;40:182-212.

Table 13.8 Management Recommendations for Selected Antiplatelet/Anticoagulant Medications Before Regional or Neuraxial Procedures

	When to Stop			
Drug	**High-Risk Procedure**	**Intermediate-Risk Procedure**	**Low-Risk Procedure**	**When to Restart**
Aspirin and combination	Primary prophylaxis: 6 days OR seconday prophylaxis: shared assessment and risk stratification[a]	Shared assessment and risk stratification[a]	No	24 hours
NSAIDs	5 half-lives	No	No	24 hours
Diclofenac	1 day			
Ketorolac	1 day			
Ibuprofen	1 day			
Indomethacin	2 days			
Naproxen	4 days			
Meloxicam	4 days			
Antiplatelets				
Dipyridamole	2 days	No	No	N/A
Clopidogrel	7 days	7 days	No	12-24 hours

Table 13.8 Management Recommendations for Selected Antiplatelet/Anticoagulant Medications Before Regional or Neuraxial Procedures

Drug	When to Stop: High-Risk Procedure	When to Stop: Intermediate-Risk Procedure	When to Stop: Low-Risk Procedure	When to Restart
Anticoagulants				
Warfarin	5 days, normal INR	5 days, normal INR	No OR shared assessment and risk stratification[a]	24 hours
IV heparin infusion	4 hours	4 hours	4 hours	2 hours[b]
Subcutaneous heparin, bid and tid	8-10 hours	8-10 hours	8-10 hours	2 hours
LMWH: prophylactic	12 hours	12 hours	12 hours	4 hours after low-risk OR 12-24 hours after intermediate- to high-risk procedures
LMWH: therapeutic	24 hours	24 hours	24 hours	
Dabigatran	4-5 days OR 6 days (impaired renal function)	4-5 days OR 6 days (impaired renal function)	Shared assessment and risk stratification[a]	24 hours
Rivaroxaban	3 days	3 days		
Apixaban	3-5 days	3-5 days		
Fibrinolytic agents	48 hours	48 hours	48 hours	48 hours

[a]Case-by-case analysis of risks and benefits of continued therapy recommended.
[b]If an intermediate- or high-risk procedure was bloody, then a 24-hour interval should be observed.
bid, Twice a day; *INR*, international normalized ratio; *IV*, intravenous; *LMWH*, low-molecular-weight heparin; *tid*, three times a day.
Modified from Narouze S, Benzon HT, Provenzano DA, et al. Interventional spine and pain procedures in patients on antiplatelet and anticoagulant medications: guidelines from the American Society of Regional Anesthesia and Pain Medicine, the European Society of Regional Anaesthesia and Pain Therapy, the American Academy of Pain Medicine, the International Neuromodulation Society, the North American Neuromodulation Society, and the World Institute of Pain. *Reg Anesth Pain Med*. 2015;40:182-212.

Fasting guideline

Table 13.11 Guidelines for Food and Fluid Intake Before Elective Surgery[a] in Healthy Patients[b]

Food or Fluid Intake	Minimum Fasting Period	Examples
Clear liquids	2 h	Water, fruit juices without pulp, sports drinks, carbonated beverages, tea, and coffee (no dairy)
Breast milk	4 h	
Infant formula	6 h	
Nonhuman milk	6 h	Cow, goat, or soy milk
Light meal	6 h	Toast, clear liquids, nonalcoholic beverages
Full meal	>8 h	Fried or fatty foods, meat, alcoholic beverages

THANK YOU