



## Complete Summary

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### GUIDELINE TITLE

Steps to reduce surgical risk. In: I guidelines for perioperative evaluation.

### BIBLIOGRAPHIC SOURCE(S)

Committee on Perioperative Evaluation (CAPO), Brazilian Society of Cardiology. Steps to reduce surgical risk. In: I guidelines for perioperative evaluation. Arq Bras Cardiol 2007;89(6):e197-208.

### GUIDELINE STATUS

This is the current release of the guideline.

## \*\* REGULATORY ALERT \*\*

### FDA WARNING/REGULATORY ALERT

**Note from the National Guideline Clearinghouse:** This guideline references a drug(s) for which important revised regulatory information has been released.

- [August 16, 2007 - Coumadin \(Warfarin\)](#): Updates to the labeling for Coumadin to include pharmacogenomics information to explain that people's genetic makeup may influence how they respond to the drug.
- [August 14, 2007, Thiazolidinedione class of antidiabetic drugs](#): Addition of a boxed warning to the updated label of the entire thiazolidinedione class of antidiabetic drugs to warn of the risks of heart failure.

## COMPLETE SUMMARY CONTENT

\*\* REGULATORY ALERT \*\*

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## SCOPE

### **DISEASE/CONDITION(S)**

Any condition requiring surgery

### **GUIDELINE CATEGORY**

Evaluation  
Management  
Prevention  
Risk Assessment  
Treatment

### **CLINICAL SPECIALTY**

Anesthesiology  
Cardiology  
Critical Care  
Dentistry  
Endocrinology  
Gastroenterology  
Hematology  
Neurology  
Nuclear Medicine  
Obstetrics and Gynecology  
Ophthalmology  
Orthopedic Surgery  
Preventive Medicine  
Pulmonary Medicine  
Surgery  
Thoracic Surgery  
Urology

### **INTENDED USERS**

Physicians

### **GUIDELINE OBJECTIVE(S)**

- To refine and unify the terminology used by the entire multidisciplinary team, including the patients and their family
- To establish new routines, change indication for surgery according to the information obtained during the perioperative evaluation

### **TARGET POPULATION**

Any patient who requires surgery

### **INTERVENTIONS AND PRACTICES CONSIDERED**

## **Perioperative Medication/Prophylaxis/Management**

1. Management of existing medications (beta-blockers, statins, aspirin, anticoagulation therapy)
2. Venous thromboembolism prophylaxis (heparin, warfarin, enoxaparin, compression stockings, intermittent pneumatic compression, mobilization, inferior vena cava filter)
3. Assessment of perioperative risk levels for complications
4. Endocarditis prophylaxis (antibiotics)
5. Glycemic control (hypoglycemic agents and insulin NPH)
6. Choice of anesthetic agent
7. Nitroglycerin during surgery

## **Perioperative Patient Management**

1. Specialist referral
2. Choice of anesthetic technique (regional versus general)
3. Management of body temperature and catheters
4. Use of invasive pressure monitoring
5. Perioperative electrocardiography monitoring
6. Acute myocardial infarction management

## **Management of Type and Timing of Surgery**

1. Myocardial revascularization
2. Elective hip or knee arthroplasty
3. Hip fracture surgery
4. Neurosurgery
5. Trauma
6. Acute spinal cord surgery
7. Gynecologic surgery
8. Urologic surgery

## **MAJOR OUTCOMES CONSIDERED**

- Perioperative cardiovascular complications
- Perioperative cardiovascular mortality
- Venous thromboembolism

## **METHODOLOGY**

### **METHODS USED TO COLLECT/SELECT EVIDENCE**

Searches of Electronic Databases

### **DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE**

Not stated

### **NUMBER OF SOURCE DOCUMENTS**

Not stated

## **METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE**

Weighting According to a Rating Scheme (Scheme Given)

## **RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE**

### **Levels of Evidence**

- A. Sufficient evidence from multiple randomized trials or meta-analyses
- B. Limited evidence from single randomized trial or non-randomized studies
- C. Evidence only from case reports and series
- D. Expert opinion or standard of care

## **METHODS USED TO ANALYZE THE EVIDENCE**

Systematic Review

## **DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

Not stated

## **METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Expert Consensus

## **DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS**

The participants of these guidelines were chosen among health sciences specialists with hands on and academic experience, thus being characterized as clinical researchers.

The adopted methodology and evidence levels were the same as those used in earlier documents by the Brazilian Society of Cardiology.

### **Recommendations**

- The guidelines must be based on evidences.
- Class division must be used when applicable.
- Degrees of recommendation must be used when applicable, according to the levels of evidence.

## **RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

### **Degree or Class of Recommendation**

**Class I:** Conditions for which there is evidence for and/or general agreement that the procedure/therapy is useful and effective

**Class II:** Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of performing the procedure/therapy

**Class IIa:** Weight of evidence/opinion is in favor of usefulness/efficacy

**Class IIb:** Usefulness/efficacy is less well established by evidence/opinion

**Class III:** Conditions for which there is evidence for and/or general agreement that the procedure/therapy is not useful/effective and in some cases may be harmful

## **COST ANALYSIS**

A formal cost analysis was not performed and published cost analyses were not reviewed.

## **METHOD OF GUIDELINE VALIDATION**

Peer Review

## **DESCRIPTION OF METHOD OF GUIDELINE VALIDATION**

Not stated

# **RECOMMENDATIONS**

## **MAJOR RECOMMENDATIONS**

The definitions for levels of evidence (A-D) and classes of recommendation (I-III) are provided at the end of the "Major Recommendations" field.

### **Perioperative Medication Therapy**

#### **Recommendations for Perioperative Beta-Blocker Use**

##### **Class I**

- High-risk (American College of Physicians [ACP] Classes II and III) and coronary artery disease (CAD) patients; **Level of Evidence A.**

##### **Class IIb**

- Two or more cardiovascular risk factors (>65 years, hypertension, smoking, diabetes and total cholesterol >240 mg/dl) (Mangano et al., 1996); **Level of Evidence B.**

### **Class III**

- Patients with contraindication to beta-blockers; **Level of Evidence B.**

### **Recommendations for Perioperative Statin Use**

#### **Class I**

- Patients undergoing vascular surgeries; **Level of Evidence B.**
- Patients with known CAD or those who already use statins; **Level of Evidence D.**

#### **Class IIb**

- High-risk patients (ACP Classes II and III); **Level of Evidence D.**

### **Recommendations for Aspirin Use**

- Patients on lifelong acetylsalicylic acid (AAS) therapy should not discontinue its use before surgery except in cases of neurological surgery or transurethral prostatectomy (Burger et al., 2005); **Class I, Level of Evidence B.**
- Consider reducing the dose of patients taking higher doses of AAS (325 mg); **Class IIa, Level of Evidence D.**

### **Myocardial Revascularization**

#### **Recommendations for Myocardial Revascularization (Surgical or Percutaneous) Before Non-Cardiac Surgeries**

##### **Class I**

- Angioplasty should only be done when there is proof of artery-related ischemia. It should not be done when it is based exclusively on anatomical findings; **Level of Evidence A.**
- Patients with indication of myocardial revascularization, regardless of perioperative context who are scheduled to undergo elective non-cardiac surgeries; **Level of Evidence D.**
- Evidence of extensive ischemic areas, low ischemic threshold and high-risk coronary anatomy (lesion of the left coronary artery and triple-vessel disease with ventricular dysfunction); **Level of Evidence D.**

##### **Class IIa**

- Patients without high-risk functional or anatomical markers for perioperative cardiac complications but with indication of myocardial revascularization before major non-cardiac surgeries (vascular, intraperitoneal or intrathoracic surgeries); **Level of Evidence D.**

##### **Class IIb**

- Patients without high-risk functional or anatomical markers for perioperative cardiac complications but with indication of myocardial revascularization before surgeries other than major vascular, intraperitoneal or intrathoracic surgeries; **Level of Evidence D.**

### **Class III**

- Patients in need of emergency, non-cardiac surgery regardless of symptom severity or degree of coronary artery obstruction; **Level of Evidence D.**
- Patients with diseases that require non-cardiac surgeries and greatly increase the risk of general complications during the perioperative period of myocardial revascularization, such as intestinal neoplasias with considerable bleeding, severe dyspeptic symptoms, intra or extracavitary infections, head injury or brain tumors that may bleed; **Level of Evidence D.**
- Patients with bad prognoses because of severe non-cardiac illness who may be submitted to palliative surgeries such as gastrostomy, gastric/intestinal bypass, tracheotomy, etc.; **Level of Evidence D.**

### **Recommendations Regarding Safe Intervals Between Myocardial Revascularization and Non-Cardiac Surgery**

#### **Class I**

- After surgical myocardial revascularization
  - Ideal interval: 30 days; **Level of Evidence D.**
  - Minimum interval: depends on the clinical condition of the patient; **Level of Evidence D.**
- After balloon angioplasty without stenting
  - Ideal interval: 14 days; **Level of Evidence B**
  - Minimum interval: 7 days; **Level of Evidence B.**
- After angioplasty with stenting
  - Ideal interval: 6 weeks; **Level of Evidence B.**
  - Minimum interval: 14 days; **Level of Evidence B.**
- After angioplasty with drug-eluting stenting
  - Ideal interval: not established; **Level of Evidence D.**
  - Minimum interval: 30 days (Daeman et al., 2007); **Level of Evidence D.**

### **Venous Thromboembolism (VTE) Prophylaxis**

#### **Classification of VTE Risk According to Patient and Surgery Characteristics**

- Low risk: minor surgery, patient under 40 years and without risk factors.
- Moderate risk
  - Minor surgery and patient with risk factors
  - Major surgery, patient between 40 and 60 years and without risk factors
  - Major surgery, patient under 40 years and without risk factors
- High risk
  - Major surgery, patient above 60 years or with risk factors
  - Major surgery, patient above 40 years or with risk factors

- Very high risk
  - Major surgery, patient above 40 years, previous VTE, cancer or hypercoagulation
  - Patient with many risk factors

**Recommendations for the Perioperative Prophylaxis of VTE** (Geerts et al., 2001)

1. *Low Risk*

- Early mobilization; **Class I, Level of Evidence C.**

2. *Moderate Risk*

- Heparin 5000 IU subcutaneously at 12-hour intervals, starting 1 to 2 hours before surgery; **Class I, Level of Evidence A.**
- Enoxaparin 20 mg subcutaneously at 24-hour intervals, starting 1 to 2 hours before surgery; **Class I, Level of Evidence A.**
- Compression stockings: start immediately before surgery until outpatient follow-up or intermittent pneumatic compression (IPC) – start immediately before surgery until hospital discharge; **Class I, Level of Evidence A.**

3. *High Risk*

- Heparin 5000 IU subcutaneously at 8-hour intervals, starting 1 to 2 hours before surgery **Class I, Level of Evidence A.**
- Enoxaparin 40 mg subcutaneously at 24-hour intervals, starting 1 to 2 hours before surgery; **Class I, Level of Evidence A.**
- IPC – start immediately before surgery until hospital discharge **Class I, Level of Evidence A.**

4. *Very High Risk*

- Enoxaparin 40 mg subcutaneously at 24-hour intervals, starting 1 to 2 hours before surgery plus IPC or compression stockings; **Class I, Level of Evidence C.**
- Heparin 5000 IU subcutaneously at 8-hour intervals, starting 1 to 2 hours before surgery plus IPC or compression stockings; **Class I, Level of Evidence C.**
- Warfarin in selected patients -- start with 5 mg/day on the day of surgery or on the next day and adjust the dose to keep international normalized ratio (INR) between 2 and 3. **Class IIa, Level of Evidence C.**

5. *Elective Hip Arthroplasty*

- Enoxaparin 40 mg subcutaneously 12 hours before or 12 to 24 hours after surgery or 20 mg subcutaneously 4 to 6 hours after surgery; then 40 mg/day on the days following surgery; **Class I, Level of Evidence A.**
- Warfarin: adjust dose to keep INR between 2 and 3; start administration before surgery or immediately after surgery; **Class I, Level of Evidence A.**
- Heparin subcutaneously at 8-hour intervals, loading dose of 3500 IU ± 500 IU per dose to keep arterial partial thromboplastin time (aPTT) above normal; **Class IIa, Level of Evidence A.**

- Prophylactic measures associated with IPC or compression stockings **Class IIa, Level of Evidence C.**
- Prophylaxis should last at least 7 days. **Class I, Level of Evidence A.**

#### 6. *Elective Knee Arthroplasty*

- Enoxaparin 40 mg subcutaneously 12 hours before or 12 to 24 hours after surgery, or 20 mg subcutaneously 4 to 6 hours after surgery, then 40 mg/day on the days following surgery; **Class I, Level of Evidence A.**
- Warfarin: adjust dose to keep INR between 2 and 3. Start before surgery or immediately after surgery; **Class I, Level of Evidence A.**
- IPC – start immediately before surgery until hospital discharge; **Class I, Level of Evidence B.**
- Prophylaxis should last at least 7 to 10 days; **Class I, Level of Evidence A.**

#### 7. *Hip Fracture Surgery*

- Enoxaparin 40 mg subcutaneously 12 hours before or 12 to 24 hours after surgery or 20 mg subcutaneously 4 to 6 hours after surgery, then 40 mg/day on the days following surgery; **Class I, Level of Evidence B.**
- Warfarin: adjust dose to keep INR between 2 and 3. Start before surgery or immediately after surgery; **Class I, Level of Evidence B.**
- Heparin 5000 IU subcutaneously at 8-hour intervals, starting 1 to 2 hours before surgery; **Class IIa, Level of Evidence B.**

#### 8. *Neurosurgery*

- IPC with or without compression stockings; **Class I, Level of Evidence A.**
- Heparin 5000 IU subcutaneously at 8-hour intervals starting 1 to 2 hours before surgery; **Class IIa, Level of Evidence A.**
- Enoxaparin 40 mg subcutaneously/day after surgery; **Class IIa, Level of Evidence A.**
- IPC or compression stockings associated with prophylactic enoxaparin or heparin; **Class I, Level of Evidence B.**

#### 9. *Trauma*

- Enoxaparin 30 mg subcutaneously at 12-hour intervals starting 12 to 36 hours after the trauma if the patient is hemodynamically stable; **Class I, Level of Evidence A.**
- IPC or compression stockings if enoxaparin is contraindicated (risk of bleeding); **Class I, Level of Evidence C.**
- Inferior vena cava filter if there is proven deep venous thrombosis (DVT) and contraindication of anticoagulation therapy; **Class I, Level of Evidence C.**

#### 10. *Acute Spinal Cord Injury*

- Enoxaparin 30 mg subcutaneously at 12-hour intervals; **Class I, level of Evidence B.**
- IPC or compression stockings associated with prophylactic enoxaparin or heparin or if anticoagulation therapy is contraindicated right after the lesion; **Class IIa, Level of Evidence B.**

- Continue enoxaparin therapy during rehabilitation or use full anticoagulation with warfarin (INR between 2 and 3); **Class I, Level of Evidence C.**

## 11. Gynecological Surgeries

### 11.A. Small Interventions for Benign Diseases

- Early mobilization; **Class I, Level of Evidence C.**

### 11.B. Major for Benign Diseases Without Risk Factors

- Heparin 5000 IU subcutaneously at 12-hour intervals; **Class I, Level of Evidence A.**
- Enoxaparin 40 mg subcutaneously at 24-hour intervals or IPC before surgery and at least many days after surgery; **Class I, Level of Evidence C.**

### 11.C. Major Cancer Surgeries

- Heparin 5000 IU subcutaneously at 8-hour intervals; **Class I, Level of Evidence A.**
- Heparin 5000 IU subcutaneously at 8-hour intervals associated with IPC or compression stockings to provide additional protection; **Class I, Level of Evidence C.**

## 12. Urological Surgeries

### 12.A. Low-Risk or Transurethral Surgery

- Early mobilization; **Class I, Level of Evidence C.**

### 12.B. Major or Open-Cavity Surgery

- Heparin 5000 IU subcutaneously at 8-hour intervals, 1 to 2 hours before surgery; **Class I, Level of Evidence B.**
- Enoxaparin 40 mg subcutaneously at 24-hour intervals, starting 1 to 2 hours before surgery; **Class I, Level of Evidence B.**
- IPC – start immediately before surgery until hospital discharge; **Class I, Level of Evidence B.**
- Compression stockings – start immediately before surgery until outpatient follow-up; **Class I, Level of Evidence B.**

### 13.C. High-Risk Patients

- IPC or compression stockings associated with prophylactic enoxaparin or heparin; **Class I, Level of Evidence C.**

## **Patients Already Taking Anticoagulation Therapy Because of a Previous VTE**

See Table below.

**Table: Recommendations for the Management of Pre and Postoperative Coagulation Therapy in Patients Taking Oral Anticoagulation Because of a History of VTE** (Kearon & Hirsch, 1997)\*

Indication	Before Surgery	After Surgery
Acute VTE – month 1	IV heparin** (suspend 6h before)	IV heparin** (restart 12h after major surgery or later if there is risk of bleeding)
VTE – month 2 and 3	Prophylactic sub-Q LMWH in inpatients***	IV heparin (until INR=2.0 with warfarin)
VTE – after 3 months	Prophylactic sub-Q LMWH in inpatients***	Sub-Q LMWH
VTE recurrent #	Prophylactic sub-Q LMWH in inpatients***	Sub-Q LMWH

**Class I, Level of Evidence C.**

\*IV heparin refers to intravenous heparin in therapeutic doses and LMWH Sub-Q refers to the use of subcutaneous low-molecular-weight heparin in prophylactic doses to prevent VTE in high-risk patients.

\*\*Consider using an inferior vena cava filter when acute VTE occurred within the previous two weeks or when there is a high risk of bleeding with i.v. heparin.

\*\*\*Hospitalization is not recommended for this reason alone.

#Patients who require long-term oral anticoagulation therapy because of a high risk of recurrence but whose last VTE episode occurred more than 3 months before surgery.

## Perioperative Anticoagulation Therapy

### Patients at Low Risk of Thromboembolism (Ansell et al., 2004)

- Discontinue warfarin 4 days before surgery; wait for INR to return to almost normal values (<1.5); **Class IIa, Level of Evidence C.**
- Non-fractionated (NFH) or low-molecular-weight heparin (LMWH) prophylaxis can be used before surgery if indicated; **Class IIa, Level of Evidence C.**
- NFH or LMWH prophylaxis can be used after surgery if the type of procedure indicates its use and simultaneously reintroduce warfarin; **Class IIa, Level of Evidence C.**

### Patients at High Risk of Thromboembolism

- Discontinue warfarin 4 days before surgery and wait for INR to normalize; **Class IIa, Level of Evidence C.**
- Start full-dose NFH or LMWH when INR <2.0; **Class IIa, Level of Evidence C.**
- Discontinue intravenous NFH 5 hours before surgery and subcutaneous NFH or LMWH 12 to 24 hours before surgery; **Class IIa, Level of Evidence C.**

- Simultaneously reintroduce full-dose NFH or LMWH and warfarin after surgery until INR is within therapeutic range; **Class IIa, Level of Evidence C.**

**Patients at Intermediate Risk of Thromboembolism**

- The management of these patients can follow the recommendations for patients with low or high-risk at the physician's discretion. **Class IIa, Level of Evidence C.**

**Procedures with Low Risk of Bleeding**

- The procedure can be done when INR is around 2.0. Discontinuation of anticoagulation therapy is not necessary; **Class IIa, Level of Evidence C.**
- If INR >3.0, discontinue anticoagulation therapy one or two days before surgery and reintroduce it the night after surgery; **Class IIa, Level of Evidence C.**

**Urgent Procedures** (Machado, 2004)

- Vitamin K and fresh plasma can be used to reverse anticoagulation. Avoid high doses of vitamin K as it may inhibit anticoagulation later on.

**Endocarditis Prophylaxis**

**Recommendations for the Antibiotic Prophylaxis of Infective Endocarditis** (Dajani et al., 1997; Durack, 1995; Dajani, Bawdon, & Berry, 1994)

See Table, below.

**Table: Antibiotic Prophylaxis of Infective Endocarditis**

<b>Dental, Respiratory Tract and Esophageal Procedures</b>		
<b>Situation</b>	<b>Antibiotic</b>	<b>Regimen</b>
General	Amoxicillin or Ampicillin	2 g or 50 mg/kg OA/1 hour before procedure (BP) or  2 g intramuscular (IM)/ intravenous (IV) or 50 mg/kg 30 min BP
Allergic	Clindamycin or Cephalexin	600 mg or 20 mg/Kg OA/1 hour BP or IM 30 min BP
	Azithromycin/clarithromycin	2 g or 50 mg/kg OA/1 hour BP 500 mg 1 hour BP
<b>Gastrointestinal (except Esophagus) and Genitourinary Procedures</b>		
High risk	Ampicillin + Gentamicin	2 g (IM/IV) or 50 mg/kg 30 min BP + 6 hours later 1 g or  25 mg/kg (or Amoxicillin 1 g OA) 1.5

<b>Dental, Respiratory Tract and Esophageal Procedures</b>		
<b>Situation</b>	<b>Antibiotic</b>	<b>Regimen</b>
		mg/kg (up to 120 mg) IM/IV 30 min BP
High risk allergic	Vancomycin + Gentamicin	1 g or 20 mg/kg IV (infusion in 1 hour) 30 min BP + 1.5 mg/kg (up to 120 mg) IM/IV 30 min BP
Moderate risk	Amoxicillin or Ampicillin	2 g or 50 mg/kg AO 1 hour BP or 2 g (IM/IV) or 50 mg/kg 30 min BP
Moderate risk and allergic	Vancomycin	1 g or 20 mg/kg IV (infusion in 1 hour) 30 min BP

### **IE Prophylaxis Is NOT Recommended for**

- Interatrial communication (IAC) alone
- Corrected IAC, interventricular communication (IVC) or patent ductus arteriosus (PDA) and without residual shunt
- Previous myocardial revascularization surgery
- Mitral valve prolapse without regurgitation
- Innocent heart murmurs
- Patients with pacemakers or implantable cardiac devices (ICDs)
- History of Kawasaki disease or rheumatic fever without valvular dysfunction

### **Glycemic Control**

#### **Recommendations for the Preoperative Period**

- Screen all patients and respective medical records for risk factors of diabetes mellitus (DM); **Class I, Level of Evidence D.**
- Patients older than 45 years, overweight or with symptoms that suggest DM should be at least submitted to a fasting glucose test; **Class I, Level of Evidence D.**
- Glycemia <100 mg/dL: Patient can undergo surgery without any special preoperative measure; **Class I, Level of Evidence D.**
- Glycemia between 100 and 125 mg/dL: patient should have a creatinine test done in the previous 12 months, baseline electrocardiogram and be more attentive to blood pressure control. After surgery, consider referring the patient to an endocrinologist; **Class I, Level of Evidence D.**
- Glycemia >125 mg/dL or has diagnosed DM: patient should have a creatinine test done in the previous 12 months, baseline electrocardiogram and be more attentive to blood pressure control including screening for dysautonomia (blood pressure and heart rate while sitting and after standing for 3 minutes). After surgery, consider referring the patient to an endocrinologist; **Class I, Level of Evidence D.**
- Glycemia >220 mg/dL, consider postponing surgery until better glycemic control is achieved. **Class I, Level of Evidence D.**
- Best times to discontinue oral medications before (**Class I, Level of Evidence D**)

Biguanides: 24 to 48 hours before surgery

Sulfonylureas: of 1st generation – 48 to 72 hours before surgery; of 2nd and 3rd generation – on the day of surgery

Glitazones: 24 to 48 hours before surgery

Thiazolidinediones: on the day of surgery

Acarbose: 24 hours before surgery

Glinides: on the day of surgery

Neutral Protamine Hagedorn insulin (insulin NPH): patient may take the normal bedtime dose the night before surgery; on the morning of surgery, administer 1/3 to 2/3 of the normal dose, depending on what time the surgery will be done.

- If glycemic control is too hard to achieve, consider working with an endocrinologist.

### **Recommendations for the Intra and Postoperative Periods**

- If surgery will last more than one hour or if patient is of high risk (ACP Classes II and III), capillary blood glucose level should be determined at induction of anesthesia; **Class IIa, Level of Evidence D.**
- Intravenous insulin infusion to all type I diabetics regardless of surgery classification and to all type II diabetics submitted to surgeries that last more than one hour or when their glycemia is out of control; **Class IIa, Level of Evidence D.**
- Control glycemia strictly with regular insulin in an infusion pump to keep capillary insulin between 80 and 110 mg/dL; determine capillary glucose level as often as needed. If glycemia rises above 110 mg/dL, it is advisable to determine serum potassium level and monitor it at least daily; **Class IIa, Level of Evidence B.**
- Transition from insulin pumps to oral medication can be done outside the intensive care unit (ICU). Target glycemia remains the same (between 80 and 110 mg/dL). Consider endocrinologist follow-up. Capillary blood glucose level should be determined one hour after discontinuation of insulin pump and at least three times per day before meals or at 6-hour intervals in fasting patients; **Class IIa, Level of Evidence B.**

### **Considerations on Anesthesia and Surgery**

#### **Choosing the Anesthetic Technique**

- Whenever possible, prefer neuraxial blockade to general anesthesia. **Class IIa, Level of Evidence A.**

#### **Choosing the Anesthetic Agent**

- Always prefer fast-acting and short-lasting anesthetics and anesthetics whose residual effects are minimal. **Class I, Level of Evidence B.**

### **Management of Body Temperature**

- Maintain normothermia during the perioperative period to prevent cardiac events. **Class I, Level of Evidence A.**

### **Nitroglycerin During Surgery**

- Intraoperative nitroglycerin should only be used to control blood pressure of coronary artery disease patients, not to prevent perioperative ischemia. **Class I, Level of Evidence C.**

### **Catheters**

#### *Pulmonary Artery Catheters*

- Surgery for abdominal aortic aneurysm; **Class IIa, Level of Evidence D.**
- Patients with decompensated heart disease who will undergo major surgery; **Class IIa, Level of Evidence C.**
- Patients with myocardial dysfunction who will undergo major surgery; **Class IIb, Level of Evidence C.**

#### *Invasive Pressure Monitoring*

- Patients with heart disease, hemodynamic instability and/or undergoing major surgery; **Class I, Level of Evidence D.**
- Patients with permanent pacemakers; **Class IIb, Level of Evidence D.**

### **Intra-aortic Balloon Pump**

- Patients at high cardiac risk and high-risk non-cardiac surgeries; **Class IIb, Level of Evidence D.**

### **Perioperative Monitoring**

#### **Monitoring the ST Segment**

- Monitor the ST segment of high-risk patients during the perioperative period; **Class IIB, Level of Evidence C.**

#### **Perioperative Acute Myocardial Infarction**

- Patients with an estimated moderate or high perioperative cardiac risk of ischemic nature must be continuously monitored in semi-intensive or intensive care unit. Electrocardiogram and troponin assay must be done daily until the third day after surgery since most events occur in this period. **Class I, Level of Evidence A.**

- If troponin testing is not available, it should be substituted by a creatine kinase (CK)-myocardial fraction (MB)/CK curve (8/8 hours). **Class I, Level of Evidence B.**

#### **Definitions:**

#### **Levels of Evidence**

- A. Sufficient evidence from multiple randomized trials or meta-analyses
- B. Limited evidence from single randomized trial or non-randomized studies
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- D. Expert opinion or standard of care

#### **Class of Recommendation**

**Class I:** Conditions for which there is evidence for and/or general agreement that the procedure/therapy is useful and effective

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**Class IIa:** Weight of evidence/opinion is in favor of usefulness/efficacy

**Class IIb:** Usefulness/efficacy is less well established by evidence/opinion

**Class III:** Conditions for which there is evidence for and/or general agreement that the procedure/therapy is not useful/effective and in some cases may be harmful

#### **CLINICAL ALGORITHM(S)**

None provided

### **EVIDENCE SUPPORTING THE RECOMMENDATIONS**

#### **REFERENCES SUPPORTING THE RECOMMENDATIONS**

[References open in a new window](#)

#### **TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS**

The type of supporting evidence is identified and graded for most of the recommendations (see the "Major Recommendations" field).

### **BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS**

#### **POTENTIAL BENEFITS**

- Reduction of risk of perioperative complications and mortality

- Prevention of perioperative complications
- Prevention of perioperative mortality

### **POTENTIAL HARMS**

- Risk of hemorrhagic complications from anticoagulants and antiplatelet agents
- Risk of thromboembolism from inadequate anticoagulation
- Risk of hyperglycemia or hypoglycemia due to inadequate glycemic control
- Propofol-induced intraoperative hypotension

## **QUALIFYING STATEMENTS**

### **QUALIFYING STATEMENTS**

- Data or scientific evidences are not always available to allow all the different situations to be analyzed. As customary in medical practice, minute analysis of the patient and problem and the common sense of the team must prevail.
- The surgical intervention does not finish when the patient is bandaged or leaves the operating room. The concept of the word *perioperative* includes the need for a postoperative surveillance whose intensity is determined by the individual level of risk of the patient.

## **IMPLEMENTATION OF THE GUIDELINE**

### **DESCRIPTION OF IMPLEMENTATION STRATEGY**

An implementation strategy was not provided.

## **INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES**

### **IOM CARE NEED**

Getting Better  
Living with Illness  
Staying Healthy

### **IOM DOMAIN**

Effectiveness  
Safety

## **IDENTIFYING INFORMATION AND AVAILABILITY**

### **BIBLIOGRAPHIC SOURCE(S)**

Committee on Perioperative Evaluation (CAPO), Brazilian Society of Cardiology. Steps to reduce surgical risk. In: I guidelines for perioperative evaluation. Arq Bras Cardiol 2007;89(6):e197-208.

**ADAPTATION**

Not applicable: The guideline was not adapted from another source.

**DATE RELEASED**

2007

**GUIDELINE DEVELOPER(S)**

Brazilian Society of Cardiology

**SOURCE(S) OF FUNDING**

Brazilian Society of Cardiology

**GUIDELINE COMMITTEE**

Not stated

**COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE**

*Writing Committee Members:* Danielle Menosi Gualandro; Claudio Pinho; Gilson Feitosa; Bruno Caramelli

*Task Force Members:* Alina Coutinho Rodrigues Feitosa; Beatriz Ayub; Bruno Caramelli; Carisi A. Polanczyk; Carolina L. Zilli Vieira; Claudio Pinho; Daniela Calderaro; Danielle Menosi Gualandro; Denise Iezzi; Dirk Schreen; Dimas T. Ikeoka; Elbio Antonio D'Amico; Elcio Pfeferman; Emerson Quintino de Lima; Emmanuel de Almeida Burdmann; Fábio Santana Machado; Filomena Regina Barbosa Gomes Galas; Gilson Soares Feitosa-Filho; Heno Ferreira Lopes; Henrique Pachón; João César Nunes Sbrano; José Augusto Soares Barreto Filho; José L. Andrade; Roberto Henrique Heinisch; Luciana Moraes dos Santos; Luciana S. Fornari; Ludhmila Abrahão Hajjar; Luis Eduardo P. Rohde; Luiz Francisco Cardoso; Marcelo Luiz Campos Vieira; Maristela C. Monachini; Pai Ching Yu; Paula Ribeiro Villaga; Paulo Grandini; Renato S. Bagnatori; Roseny dos Reis Rodrigues; Sandra F. Menosi Gualandro; Walkiria Samuel Avila; Wilson Mathias Jr.

*Support:* Committee on Perioperative Evaluation (CAPO), Brazilian Society of Cardiology

**FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST**

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This is the current release of the guideline.

**GUIDELINE AVAILABILITY**

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#### **AVAILABILITY OF COMPANION DOCUMENTS**

None available

#### **PATIENT RESOURCES**

None available

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