

Relevant Aspects of Coronary Artery Disease in Candidates for Non-Cardiac Surgery

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Summary: Ramos GC – Relevant Aspects of Coronary Artery Disease in Candidates for Non-Cardiac Surgery.

Background and objectives: Due to its prevalence, coronary artery disease (CAD) represents the main cause of morbidity and mortality in elective surgeries, which justifies this review, whose objective was to establish preoperative conducts based on rules and directive to minimize peri- and postoperative morbidity and mortality of patients with CAD.

Contents: General characteristics of CAD, as well as its physiopathogenic mechanisms, the main variables related to preoperative care of patients with CAD, and the conducts for patients with greater surgical risk are presented.

Conclusions: Patients with CAD who are candidates for non-cardiac surgeries should be evaluated judiciously. Those identified as being at high risk can benefit from preoperative myocardial ischemia-provoking tests, as well as from invasive coronary interventions preceding elective surgeries. In selected patients, one should consider the use of beta-blockers and statins.

Keywords: PREOPERATIVE EVALUATION; RISK FACTORS; SURGERY: Non-cardiac.

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INTRODUCTION

Cardiovascular diseases follow the aging population and represent one of the main comorbidities in patients evaluated for non-cardiac surgeries. Coronary artery disease (CAD) is one of them. Atherosclerotic cardiovascular diseases represent the main cause of death and disability in Brazil and in the world, and it is mainly attributed to CAD. According to the DATASUS (www.datasus.gov.br), approximately 140 thousand deaths/year occur in Brazil due to CAD. This means 250 thousand myocardial infarctions/year. When comparing to the data of other countries, in Brazil the number of patients with angina is, at least, 1.5 million, with approximately 50 thousand new cases/year¹. It has been estimated that approximately 12% of patients who will undergo non-cardiac surgery have or are at risk for coronary artery disease^{2,3}. In this context, the clinician, surgeon, and anesthesiologist are frequently faced with surgical patients with CAD and for this reason some of the aspects related to the management of those patients can be fundamental for the success of the surgery with a reduction in morbidity and mortality.

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General and perioperative considerations

In clinical practice, in 90% of the cases the physiopathogenic substrate of CAD is related to arterial obstruction by atherosclerotic plaques. Concerning perioperative myocardial infarction this mechanism is responsible for approximately 50% of the cases. The other half is related to situations in which O₂ delivery is not enough to meet myocardial demand⁴. Thus, in patients with CAD the surgical-anesthetic stress and other perioperative factors (tachycardia, hypo- and hypertension, hypoxemia, and etc.) that interfere with the cardiorespiratory response can break the balance between O₂ delivery and demand, as well as cause rupture of the vulnerable coronary plaque and, consequently, myocardial ischemia. Infarction without elevation of the ST segment is more common during this period, and elevation of the ST segment and the presence of Q wave are rare⁵.

Coronary artery disease is classified into two clinical types: stable and unstable angina. Angina that maintains its characteristics without alterations for several weeks without worsening is the clinical characteristic of stable angina. On the other hand, unstable angina has three presentations, summarized in Chart I⁶. Due to its high prevalence, CAD constitutes the main cause of morbidity and mortality in elective surgeries⁷. In patients over 40 years of age with CAD, the incidence of myocardial infarction and cardiovascular death can be close to 7% and 3%, respectively⁸. In those cases, it is necessary to determine their functional capability (Chart II)^{9,10} before elective procedures. High-risk patients are not capable of meeting four metabolic equivalents (METs). One metabolic equivalent is equal to the consumption of 3.5 mL.kg⁻¹.min⁻¹ of O₂, which corresponds to a calm individual at rest.

Preoperative planning of those patients is based on the natural history of their cardiac disease and in the risk of the sche-

cluded surgery (Chart III) ¹¹. Regarding to the natural history, the following variables should be characterized:

- Classify angina as stable or unstable.
- Whether the disease is evolutive or not.
- Type of treatment instituted.
- Functional capacity of the patient (ischemic threshold).

Thus, the following patients could benefit from preoperative provocative testing:

- Patients with CAD schedule to undergo high or intermediate risk surgeries or vascular surgeries;
- Patients with CAD and diabetes mellitus, or low functional capacity, or scheduled to undergo high or intermediate risk surgeries or vascular surgery;
- Patients with low functional capacity who require vascular surgery and who present at least three additional risk factors (Chart IV) ¹³.

When the patient has already undergone coronary angiography in some situations such as patients with over 75% obstruction of the left coronary artery; CAD affecting two or more arteries with ventricular dysfunction; or critical stenosis of the anterior descending artery with ischemic provocative test, myocardial revascularization surgery should be done prior to the non-cardiac elective surgery. Several indications for percutaneous coronary interventions (PCI) exist ¹⁴ that are beyond the scope of the present article. However, a few situations apply to patients who underwent PCI with implantation of a coronary stent scheduled for elective surgeries. The type of stent is the main variable to be considered: non-pharmacologic or pharmacologic (drug-eluted). The benefits of the treatment with non-pharmacologic stents were important, but with limitations in some subgroups, among them are diabetic patients with long lesions (> 20 mm) and small diameter vessels (< 3 mm) in whom restenosis is significant in the first six months after the procedure, which can be seen in 15 to 45% of the cases ¹⁵. The initial objective of pharmacologic endo-

Chart I – Clinical Presentations of Unstable Angina ⁶

Presentation	Characteristics
Angina at rest	> 20 minutes for approximately one week
New onset angina	Onset two months ago and, at least, CCS Class III*
Accelerated, increasing, or progressive angina	Angina previously diagnosed, which is more severe, more frequent, and with greater duration

CCS: Canadian Cardiovascular Society.

*Important limitation, pain when walking less than two blocks or when going upstairs in normal situation and speed.

Chart II – Metabolic Equivalent (MET) Classification ^{9,10}

Metabolic equivalent	Type of activity
Excellent (> 10 METs)	Practices sports, such as swimming, tennis, basketball, soccer
Good (7-10 METs)	Moderate recreational activities, such as bowling and dancing, and heavy housework, such as raising furniture
Moderate (4-7 METs)	Running a short distance, going upstairs or climbing a hill, walking at speeds of 4 Mph, and sexual activity
Bad (< 4 METs)	Limited to a few housework activities, short walks with speed of up to 3 Mph

Chart III – Classification of Cardiovascular Risk According to the Type of Surgery ¹¹

High risk (> 5%) *	Intermediate (1% a 5%) **	Low risk (< 1%) ***
Emergency surgeries	Carotid endarterectomy	Endoscopies
Aortic and peripheral revascularization surgeries	Head and neck surgeries	Superficial procedures
Prolonged procedures	Intrathoracic and intraperitoneal surgeries	Cataract surgery
Procedures with large blood loss	Orthopedic and prostate surgeries	Breast surgeries

*More than 5% risk of cardiovascular events.

**Between 1 and 5% risk of cardiovascular events.

***Less than 1% risk of cardiovascular events.

Chart IV – Risk Factors for Myocardial Ischemia ¹³

Morbidities	History
Coronary artery disease	Myocardial infarction, use of nitrates, typical chest pain, inactive region (Q wave) on ECG, positive provocative test, and etc.
Heart failure	Pulmonary edema, third heart sound on auscultation, clinical or radiological signs of pulmonary congestion
Cerebrovascular disease	Stroke or transient ischemic attack
Diabetes mellitus	Diagnosis of diabetes mellitus
Renal failure	Elevated creatinine

prosthesis was to reduce excessive myointimal hyperplasia, the main culprit in coronary restenosis¹⁶. Thus, they reduce cellular division at the site of the implant (target-lesion) promoting lower clinical and angiographic restenosis rates¹⁷, being especially indicated in diabetics. If on the one hand the risk of intrastent restenosis is significantly lower with drug-eluted stents, on the other hand the risk of thrombosis, especially late (> 30 days) and very late (> 1 year) thrombosis, although rare (< 1)¹⁸ is greater with those devices and are related to the lower rate of endothelialization. Thus, the FDA (Food and Drug Administration)¹⁹ and the directives of the European Society of Cardiology²⁰ recommend, formal and indiscriminately, 12 months of antiplatelet therapy combined with aspirin and clopidogrel, especially the latter. Approximately 5% of the patients undergoing PCI will need non-cardiac surgery in the first year after the percutaneous intervention. The surgery itself increases pro-thrombotic factors, increasing the risk of stent thrombosis. Therefore, a conflict is created between the continuity of the antiplatelet treatment in the perioperative period with inherent elevation of the risk of hemorrhage, or its discontinuation with the consequent overexposure to the risk of coronary artery thrombosis^{21,22}. Thus, those patients are exposed to a higher risk of complications. They can have a morbidity and mortality rate five to ten times greater than those undergoing the same surgeries who are on optimized antiplatelet therapy or who have reached the necessary time for re-endothelialization after implantation of stents, and they might achieve a perioperative mortality rate of 30% to 86%^{23,24}. Therefore, the following recommendations should guide the management of patients with CAD, who previously underwent PCI, in elective surgeries¹²:

a) In patients with non-pharmacologic stents, the procedure should be postponed for four to six weeks and they should be operated while on acetylsalicylic acid, and clopidogrel should be discontinued for at least five days prior to the procedure.

b) In patients with pharmacologic stents, the surgery should be postponed for one year and, after this period the patient should be on acetylsalicylic acid for the surgery.

Transfusion of fresh platelets can, at times, be the only way of reestablishing blood coagulation in patients on antiplatelet therapy who need emergency surgery. Six to eight hours after the last dose of clopidogrel, transfused platelets will not be significantly affected by the drug²².

Some beta blockers, especially metoprolol, are administered preoperatively in patients with CAD as cardioprotective agents. Those drugs really reduce coronary ischemic events, but its use has been associated with higher perioperative mortality rate due to sepsis and strokes²⁵, and therefore they should not be indiscriminately used in those patients. They should be continued in those patients with CAD who were already using them.

The use of statins has been associated with several clinical benefits. They are hypolipidemic agents that improve endothelial function, stabilize atherosclerotic plaques, and reduce vascular inflammation. However, some variables such as the ideal time to begin their use are unknown. Thus, only one Class I recommendation exists for their use, i.e., in those patients who were already taking them prior the surgery. Brazilian directives recommend their use in vascular surgeries²⁶.

Patients with CAD who are candidates for non-cardiac surgeries should be evaluated and clinically compensated before any elective surgical procedure. Those patients identified as having a high risk may benefit from preoperative myocardial ischemia-provoking tests, as well as from invasive coronary interventions before elective surgeries. Beta blockers should not be used indiscriminately in those patients. Basic clinical therapeutic actualization of those patients should be known to the entire surgical team whose conducts as a group of clinician, anesthesiologist, and surgeon are decisive for the success of the procedure.

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Resumen: Ramos GC, Gilson Cassem Ramos – Aspectos Relevantes de la Enfermedad Arterial Coronaria en Candidatos a la Cirugía no Cardíaca.

Justificativa y objetivos: Debido a su prevalencia, la enfermedad arterial coronaria (DAC), constituye la principal causa de morbimortalidad en las cirugías por elección, lo que justifica la presente revisión y cuyo objetivo fue principalmente, establecer conductas preoperatorias con base en normas y directrices para minimizar la morbimortalidad peri y postoperatoria de los portadores de DAC.

Contenido: Se presentan características generales de la DAC, como también sus mecanismos fisiopatogénicos, las principales variables relacionadas con la preparación del preoperatorio de pacientes con DAC, como también conductas frente a los enfermos de mayor riesgo quirúrgico.

Conclusiones: Los portadores de DAC candidatos a la cirugía no cardíaca deben ser rigurosamente evaluados. Los identificados como de alto riesgo pueden beneficiarse con los test preoperatorios provocativos de isquemia miocárdica, y de intervenciones coronarias invasivas, precediendo a las operaciones quirúrgicas electivas. En los pacientes seleccionados, debemos considerar el uso de betabloqueantes y de estatinas.