Cardiac complications in vascular surgery

Complicações cardíacas em cirurgia vascular

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Abstract

Background: Approximately 60% of patients with chronic occlusive peripheral arterial disease have severe coronary disease and the principal cause of death during the postoperative period after major vascular surgery is acute myocardial infarction. **Objectives:** To determine the prevalence of coronary disease among patients scheduled for elective major vascular surgery and its relationship with postoperative cardiological complications. **Methods:** A total of 200 patients who underwent elective vascular arterial surgery for obstructive carotid disease, aortoiliac and distal femoropoplíteal disease and aneurysmal disease of the abdominal aorta and iliac arteries were analyzed. These patients were allocated to three groups: group I, free from coronary disease; group II, asymptomatic coronary disease; and group III, symptomatic coronary disease. The cardiological complications analyzed were fatal and nonfatal acute myocardial infarction, congestive heart failure, cardiogenic shock, acute atrial fibrillation and other arrhythmias. **Results:** Cardiac complications occurred in 11 patients (5.5%): three nonfatal acute myocardial infarctions (1.5%), all in patients from group III. The most common cardiac complication was arrhythmia (excluding atrial fibrillation) in five (2.5%) patients, three from group II. Early mortality was nine patients (4.5%). Just one death was caused by a cardiac problem: cardiogenic shock in a patient from group III. **Conclusions:** Coronary disease was not predictive of death among patients who underwent major peripheral vascular surgery. There were no statistical differences in survival between patients with or without coronary disease.

Keywords: vascular peripheral diseases; coronary disease; vascular surgery; postoperative complications.

Resumo

Contexto: Aproximadamente 60% dos pacientes portadores de doença arterial oclusiva crônica periférica têm doença coronariana grave, sendo que a principal causa de morte no pós-operatório de cirurgia vascular de grande porte é o infarto agudo do miocárdio. **Objetivos:** Determinar a prevalência da doença coronariana em pacientes submetidos a cirurgia vascular eletiva de grande porte e sua relação com as complicações cardiológicas pós-operatórias. **Métodos:** Foram analisados 200 pacientes submetidos a cirurgia vascular arterial eletiva: doença obstrutiva carotídea, aortoilíaca e femoropoplítea distal e doença aneurismática de aorta abdominal e de artérias ilíacas. Os pacientes constituíram três grupos: grupo I, sem doença coronariana; grupo II, com doença coronariana assintomática; e grupo III, com doença coronariana sintomática. As complicações cardiológicas consideradas foram infarto agudo do miocárdio fatal e não fatal, insuficiência cardíaca congestiva, choque cardiogênico, fibrilação atrial aguda e outras arritmias. **Resultados:** Complicações cardíacas ocorreram em 11 pacientes (5,5%): três infartos agudos do miocárdio não fatais (1,5%) sempre em pacientes do grupo III. A complicação cardíaca mais frequente foi arritmia (exceto fibrilação atrial) ocorrida em cinco (2,5%) pacientes, sendo três do grupo II. A mortalidade precoce foi de nove pacientes (4,5%). Apenas uma morte foi decorrente de problema cardíaco: choque cardiogênico em paciente do grupo III. **Conclusões:** A doença coronariana não foi preditora de óbito nos pacientes submetidos a cirurgia vascular periférica de grande porte. A sobrevida dos pacientes com ou sem doença coronariana não mostrou diferenças estatísticas.

Palavras-chave: doenças vasculares periféricas; coronariopatia; cirurgia vascular; complicações pós-cirúrgicas.

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The study was carried out at Serviço de Cirurgia Vascular Integrada, Hospital da Beneficência Portuguesa de São Paulo, São Paulo, SP, Brazil, and focused specifically on patients subjected to major arterial vascular surgery before the widespread use of endovascular surgery.

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INTRODUCTION

Atherosclerosis is responsible for one third of deaths in Brazil[1] and is the greatest cause of obstructive coronary artery disease, cerebrovascular disease and peripheral arterial disease, which often coexist.[2] Cardiovascular disease is the leading cause of death globally and is responsible for 17 million deaths per year.[3] Approximately 80% of cases occur in developed countries and the phenomenon is one of the consequences of population aging.[3]

Studies have shown that approximately 60% of patients with peripheral arterial disease (PAD) also have disease in coronary and cerebrovascular territories.[4] Conversely, approximately 40% of patients with coronary disease (CD) or cerebrovascular disease (CVD) also have PAD.[4]

The number one cause of mortality among patients treated with restorative vascular surgery is acute myocardial infarction (AMI). This is why an adequate preoperative cardiological assessment is important, and this is particularly true of people with asymptomatic CD, because of the risk of unsuspected cardiac or coronary disease.[5]

The objective of this study was to determine the prevalence rates of symptomatic and asymptomatic CD in patients scheduled to undergo elective major arterial vascular surgery and their relationship with postoperative cardiological complications.

METHODS

A prospective analysis was conducted of 200 patients who were treated with conventional elective arterial vascular surgery from January 2004 to August 2006 by the vascular surgery service at the Hospital da Beneficência Portuguesa in São Paulo. This period was chosen because there were still a very small number of endovascular procedures, which were not investigated as part of this study. The vascular diseases analyzed were: obstructive disease of the carotid, the aortoiliac and distal femoropopliteal arteries and aneurysmal disease of the abdominal aorta (AAA) and iliac arteries.

All patients underwent basic routine preoperative assessment including history taking, laboratory tests (complete blood count, coagulogram, renal function, electrolytes, lipid profile, arterial blood gas analysis, total and differential proteins, hepatic enzymes, thyroid hormones and glycemia), electrocardiogram, chest X-ray, stress echocardiogram and myocardial scintigraphy.

Patients were allocated to the following groups:

- Group I: free from CD.
- Group II: asymptomatic CD, detected during preoperative assessment by an electrocardiogram suggestive of an area of necrosis (wave Q greater than or equal to 0.03s and/or decrease in the amplitude of the R wave on at least two leads), myocardial scintigraphy, effort test or stress echocardiogram.
- Group III: symptomatic CD, i.e. with a history of typical chest angina, AMI, revascularization of the myocardium and/or previous coronary angioplasty.

The surgical risk assessment protocol followed was based on assessment of clinical predictors (major, intermediate and minor), of functional capacity expressed in metabolic equivalents (> 4 METS and < 4 METS), analyzed using a version of the Duke activity scale modified by American Heart Association (AHA), and of the type of surgery, according to an algorithm created by the American College of Cardiology (ACC)/AHA task force.[6] The cardiological postoperative complications considered were: fatal AMI and non-fatal AMI, congestive heart failure, cardiogenic shock, acute atrial fibrillation (AAF) and other arrhythmias.

For statistical analysis, Student's *t* test was used to compare two means and the chi-square test or Fischer's exact test were used to compare two proportions. Results with $p < 0.05$ were considered significant.

RESULTS

A total of 200 patients were analyzed, 152 (76%) of whom were male and 48 (24%) of whom were female. The average age was 67 years, varying from 44 to 97 years. There were 91 (45.5%) patients with CD, 28 (14%) of whom were asymptomatic (group II) and 63 (31.5%) of whom were symptomatic (group III). None of the other 109 patients (54.5%) had CD (group I).

The most common vascular disease was AAA and aneurysmal disease of the iliac arteries (31.5%), followed, in descending order, by PAD (28.5%), obstructive carotid disease (27%) and obstructive aortoiliac disease (13%). When we compared the groups (I, II and III) in terms of vascular diseases, there were no statistical differences in their relative distributions (Table 1).

The data on previous morbidity showed that ischemic cerebral vascular accidents (ischemic strokes) were the

Table 1. Distribution of vascular diseases in three groups of patients.

Diseases/Groups	I (%)	II (%)	III (%)	Total (%)
Carotid	29 (14.5)	11 (5.5)	14 (7.0)	54 (27.0)
AAA+Iliac	35 (17.5)	6 (3.0)	22 (11.0)	63 (31.5)
Infrainguinal	30 (15.0)	7 (3.5)	20 (10.0)	57 (28.5)
AIOD	15 (7.5)	4 (2.0)	7 (3.5)	26 (13.0)
Total	109 (54.5)	28 (14)	63 (31.5)	200 (110)

AAA = abdominal aortic aneurysm; AIOD = aortoiliac occlusive disease; 0.228 < p < 0.900 (per disease).

Table 2. Distribution of prior cerebral vascular disease and history of cardiac events for patients in three groups.

	I (%)	II (%)	III (%)
Cerebral vascular accident	0 (0.0)	5 (20.0)	7 (11.0)
Coronary failure	0 (0.0)	25 (12.5)	3 (4.7)
Heart failure	1 (0.9)	1 (4.0)	5 (7.9)

Table 3. Cardiac and non-cardiac* postoperative complications.

	n	Frequency (%)
Cardiac complications	11	5.5
Nonfatal AMI†	3	1.5
Heart failure	1	0.5
Acute atrial fibrillation	1	0.5
Other arrhythmias	5	2.5
Cardiogenic shock	1	0.5
Non-cardiac complications	55	27.5
Pulmonary	14	7.0
Renal	2	1.0
Cerebral	2	1.0
Others†	9	4.5
Surgical	28	14.0
Total	66	33.0

AMI = acute myocardial infarction. *One or more patients exhibited more than one type of complication. †Others: sepsis, delirium, septic shock and hypovolemic shock.

Table 4. Causes of postoperative deaths.

Mortality	Cause	n	Frequency (%)
Total		9	4.5
	Cardiogenic shock	1	
	Septic shock	2	
	Hemorrhagic shock	1	
	Acute respiratory failure	1	
	Pulmonary thromboembolism	2	
	Multiple organ failure	1	
	Acute renal failure	1	

most common condition in group II, with five cases (20%), and this was a statistically significant difference with relation to the other groups ($p < 0.001$). Coronary failure was more prevalent in group II than in the other groups, with 25 (12.5%) patients ($p < 0.001$), while heart failure was most common in group III, with five (7.9%) patients ($p = 0.030$) (Table 2).

A total of 206 procedures were conducted, because six patients underwent surgery in two different territories concomitantly. Four of these had occlusive aortoiliac and infrainguinal disease combined and two patients had both AAA and infrainguinal disease.

There were postoperative complications in 46 patients (23%), with cardiac complications in 11 patients (5.5%). The remaining 35 patients (17.5%) had a total of 55 non-cardiac complications, since several had more than one complication (Table 3).

Among the cardiac complications, there were three nonfatal AMI (1.5%), all in patients from group III. The most common cardiac complication was arrhythmia (excluding AAF), in five (2.5%) patients, three of whom were from group II (Table 3).

Total overall early mortality was nine patients (4.5%) who died within 30 days of their operations. The most common causes of death were pulmonary thromboembolism and septic shock, each causing the deaths of two patients. Only one death was the result of a cardiac problem: one patient from group III died from cardiogenic shock (Table 4). The only variable among those analyzed that had a significant association with death was heart failure ($p = 0.04$).

DISCUSSION

Cardiovascular complications are important causes of morbidity in major non-cardiac procedures.[7,8] In our series, the rate of cardiovascular complications was 5.5%, and the highest prevalence (12%) was in the asymptomatic CD group (group II). In a recent study, Bredahl et al.[9] reported a 6% rate of vascular complications during the postoperative period of patients treated for occlusive aortoiliac disease. The overall rate of complications in our series was 33%, among which non-cardiac complications accounted for 27.5%, which is similar to rates observed by other authors.[10]

Lee et al.[11] observed a total of 56 cardiac complications out of 2,893 stable patients (2%) who had undergone elective major non-cardiac surgery and proposed that patients be classified according to the Revised Cardiac Risk Index, which is intended to identify patients at high risk of complications. In our series, this high risk category would correspond to patients

with symptomatic CD: three patients (1.5%) had nonfatal AMI and they were all in group III.

Although Eagle et al.[12] and Bodenheimer[13] have shown that coronary revascularization significantly reduced the number of cardiac events during the postoperative period after non-cardiac surgery, in a more recent series described by McFalls et al.,[14] the incidence of postoperative AMI was not reduced by coronary interventions and coronary interventions also had no effect on long-term survival. These authors concluded that revascularization of the coronary artery before elective vascular surgery was not recommended for stable patients. This was confirmed in the most recent review conducted by the AHA, which continues not to recommend routine use of invasive examinations or routine myocardial revascularization.[15] In view of these data, the patients in group III did not undergo coronary revascularization before surgery, even though they had symptomatic (but stable) disease.

The most common of the cardiac complications was arrhythmia (2.5%), excluding AAF which only occurred in one patient (0.5%). In a series described by Carvalho et al.,[16] the most common cardiac complication was AAF, which occurred in 5.4% of patients treated with conventional surgery for AAA repair.

The association between CD and PAD (38/91 cases) seen in our patient sample coincided with the global literature, in which it is reported in 41.7% of cases. Among the patients with asymptomatic CD, PAD was present in 39.3% (11/28 cases). This highlights the importance of aggressively identifying PAD, since its incidence is elevated and it can lead to high rates of cardiac mortality during the postoperative period after major vascular surgery. Ward et al.[17] described a series showing that patients with PAD had a higher prevalence of significant clinical abnormalities seen on echocardiograms, such as left ventricular dysfunction and aortic stenosis, than patients without infrainguinal disease.

Early mortality was 4.5% in our patient sample, which is similar to the rate reported by Mackey et al.[5] (3.4%), although cardiac ischemia was not the most common cause of death. Cardiac risk is still an important problem among patients undergoing non-cardiac surgery and it is often the most important factor responsible for perioperative results.[6] Recent guidelines have suggested that the moderate risk of AMI or cardiac death in the perioperative period is related to giving priority to recognition of clinical factors, such as heart failure, angina, AMI, advanced age, functional capacity and, for patients subjected to noninvasive tests, ensuring that ischemic territories of the myocardium are identified using challenge tests. The degree of risk conferred by a non-cardiac surgical procedure in addition to the patient-specific risk factors has made their elucidation difficult. However much experience in vascular surgery has been accumulated to date, it is believed that in order to explain increased risk, if not all specific surgical risks, it is necessary to acquire knowledge about the association between PAD and CD.[18-20]

In our series, we observed that although patients with asymptomatic CD only accounted for 5.5% of the patients with CVD, they were the group that had had the greatest proportion of previous ischemic strokes (20%) and were also most likely to have a history of coronary failure (12.5%). While CD was not predictive of death and there were no statistical differences in survival between patients with and without CD, it is still clear that preoperative assessment for early detection of patients with asymptomatic CD is important, since it can contribute to reducing the rates of postoperative complications.

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