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Age influences outcomes in 70-year or older patients undergoing isolated coronary artery bypass graft surgery

A idade influencia os desfechos em pacientes com idade igual ou superior a 70 anos submetidos à cirurgia de revascularização miocárdica isolada

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Abstract

Objective: **To analyze the results of isolated on-pump coronary artery bypass graft surgery (CABG) in patients ≥ 70 years old in comparison to patients <70 years old.**

Methods: **Patients undergoing isolated CABG were selected for the study. The patients were assigned into two groups: G1 (age ≥ 70 years old) and G2 (age <70 years old). The endpoints were in-hospital mortality, acute myocardial infarction (AMI), stroke, re-exploration for bleeding, intraaortic balloon pump for circulatory shock, respiratory complications, acute renal failure, mediastinitis, sepsis, atrial fibrillation, and complete atrioventricular block (CAVB).**

Results: **A total of 1,033 were included in the study: G1 comprised 257 (24.8%) patients G2 776 (75.2%). Patients in G1 were more likely to have in-hospital mortality than in G2 (8.9% vs. 3.6%, respectively; *P*=0.001), while the incidence of AMI was similar (5.8% vs. 5.5%; *P*=0.87) in G2. More patients in G1 had re-exploration for bleeding (12.1% vs. 6.1%; *P*=0.003). Compared to G2, G1 had more incidences of respiratory complications (21.4% vs. 9.1%; *P*<0.001), mediastinitis (5.1% vs. 1.9%; *P*=0.013), stroke (3.9% vs. 1.3%; *P*=0.016), acute renal failure (7.8% vs. 1.3%; *P*<0.001), sepsis (3.9% vs. 1.9%;*P*=0.003), atrial fibrillation (15.6% vs. 9.8%; *P*=0.016), and CAVB (3.5% vs. 1.2%; *P*=0.023). There was no significant difference in the use of the intraaortic balloon pump. In the forward stepwise multivariate logistic**

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Abreviations, acronyms & Symbols

ITA	internal thoracic artery
CVA	stroke
CAVb	complete atrioventricular block
IAB	Intraaortic balloon pump
ECC/	extracorporeal circulation
CABG	coronary artery by-pass graft surgery
CAD	coronary artery disease
DM	diabetes melito
COPD	chronic obstructive pulmonary disease
VD	vascular disease
PVD	peripheral vascular disease
AF	atrial fibrillation
G1	group of patients of age = or > 70 years
G2	group of patients of age < 70 years
SH	systemic hypertension
AMI	acute myocardial infarction
IBGE/BIGS	Brazilian Institute of Geography and Statistics
CI	Confidence interval
AKI	acute kidney injury
CKD	chronic kidney disease
LCATI	left coronary artery trunk injury
RHR	reoperation for hemostasis review
ECCT/CPBT	extracorporeal circulation time
HF	heart failure

regression analysis, age ≥ 70 years was an independent predictive factor for higher in-hospital mortality (*P*=0.004), re-exploration for bleeding (*P*=0.002), sepsis (*P*=0.002), respiratory complications (*P*<0.001), mediastinitis (*P*=0.016), stroke (*P*=0.029), acute renal failure (*P*<0.001), atrial fibrillation (*P*=0.021), and CAVB (*P*=0.031).

***Conclusion:* This study suggests that patients of age ≥ 70 years were at increased risk of death and other complications in the CABG's postoperative period in comparison to younger patients.**

***Descriptors:* Myocardial revascularization. Hospital mortality. Postoperative complications. Aged.**

Resumo

***Objetivo:* Analisar os resultados da cirurgia de revascularização miocárdica (CRVM) isolada com circulação extracorpórea em pacientes com idade ≥ 70 anos em comparação àqueles com < 70 anos.**

***Métodos:* Pacientes submetidos consecutivamente à CRVM isolada. Os pacientes foram agrupados em G1 (idade ≥ 70 anos) e G2 (idade < 70 anos). Os desfechos analisados foram letalidade hospitalar, infarto agudo miocárdio (IAM), acidente vascular encefálico (AVE), reoperação para revisão de hemostasia (RRH), necessidade de balão intra-aórtico (BIA), complicações respiratórias, insuficiência renal aguda (IRA), mediastinite, sepse, fibrilação atrial (FA) e bloqueio atrioventricular total (BAVT).**

***Resultados:* Foram estudados 1033 pacientes, 257 (24,8%) do G1 e 776 (75,2%) do G2. A letalidade hospitalar foi significantemente maior no G1 quando comparado ao G2 (8,9% vs. 3,6%, *P*=0,001), enquanto a incidência de IAM foi semelhante (5,8% vs. 5,5%; *P*=0,87). Maior número de pacientes do G1 necessitou de RRH (12,1% vs. 6,1%; *P*=0,003). Da mesma forma, no G1 houve maior incidência de complicações respiratórias (21,4% vs. 9,1%; *P*<0,001), mediastinite (5,1% vs. 1,9%; *P*=0,013), AVE (3,9% vs. 1,3%; *P*=0,016), IRA (7,8% vs. 1,3%, *P*<0,001), sepse (3,9% *vs.* 1,9%; *P*=0,003), fibrilação atrial (15,6% *vs.* 9,8%; *P*=0,016) e BAVT (3,5% *vs.* 1,2%; *P*=0,023) do que o G2. Não houve diferença significante na necessidade de BIA. Na análise regressão logística multivariada "*forward stepwise*", a idade ≥ 70 anos foi fator preditivo independente para maior letalidade operatória (*P*=0,004) e para RRH (*P*=0,002), sepse (*P*=0,002), complicações respiratórias (*P*<0,001), mediastinite (*P*=0,016), AVE (*P*=0,029), IRA (*P*<0,001), FA (*P*=0,021) e BAVT (*P*=0,031) no pós-operatório.**

***Conclusão:* Este estudo sugere que pacientes com idade ≥ 70 anos estão sob maior risco de morte e outras complicações no pós-operatório de CRVM em comparação aos pacientes mais jovens.**

***Descritores:* Revascularização miocárdica. Mortalidade hospitalar. Complicações pós-operatórias. Idoso.**

INTRODUCTION

The proportion of elderly people in Brazil has increased considerably over recent decades. Between 1980 and 2009, life expectancy of the population has increased more than 10 years ranging from 62.57 years to 73.17 years [1]. In addition, it is estimated that in 2050, over 15% of the Brazilian population will be 70 years or older.

Due to the increased prevalence of coronary artery disease (CAD) with age, it is assumed that an increasing number of elderly patients will become a candidate for coronary artery bypass grafting (CABG) in the coming years. Although this age group is susceptible to the influence of a number of comorbidities (renal, pulmonary, vascular, etc.), CABG has become a procedure with low mortality and morbidity, due to improvements in surgical techniques, anesthetic and postoperative care.

The objective of this study was to analyze the results of isolated CABG in patients of age ≥ 70 years compared with patients < 70 years of age.

METHODS

This is a historical prospective study in which we analyzed all patients who consecutively underwent isolated CABG from October 1, 2001 through August 31, 2005. Exclusion criteria were patients who underwent off-pump CABG or associated with other cardiac surgeries (orovalvar

diseases, ventricular aneurysms, acquired interventricular communications, congenital heart defects) or vascular surgeries. The patients were assigned into two groups: G1 (age ≥ 70 years) and G2 (age < 70 years). Data were retrieved directly from the database of the adult surgery service at the National Institute of Cardiology. The fulfilling of all the fields of the form is mandatory in order to accomplish the administrative process of discharging the patient.

At hospital admission, we collect demographic, clinical, and laboratory data, in addition to medical history and physical examination. We have also gathered the comorbidities for CABG according to the criteria of the American Heart Association and the American College of Cardiology [2], and data relevant to surgery, such as CPB time, number of anastomoses received per patient, and number of internal thoracic artery grafts used. Patients were stratified by surgical risk of death using the European System for cardiac operative risk evaluation (additive EuroSCORE).

Hypertension (HBP) was considered present when blood pressure was ≥ 140/90 mmHg or the patient was under regular antihypertensive medication. Diabetes mellitus (DM) was defined by a record of an abnormal glucose tolerance test, a fasting blood-glucose level ≥ 126 mg/dL on two separate tests, or the regular use of oral hypoglycaemic agents, insulin sensitizer drugs, or insulin either alone or combined. Chronic kidney disease (CKD) was considered present when creatinine clearance was < 60 ml/h, or the patient was undergoing dialysis. Vascular disease (VD) was considered when there was a history of intermittent claudication, ankle/brachial index < 0.9, and peripheral vascular/arterial or cerebrovascular obstruction over 50% on color Doppler, CT angiography or conventional angiography.

As a routine, all patients underwent a two-dimensional echocardiography study with color Doppler to evaluate the cavity dimensions and left ventricle (LV) global and segmental function before both surgery and patient discharge, or at the discretion of the attending physician. The extent and degree of coronary stenoses were evaluated on cineangiocoronariography by at least two highly skilled professional hands.

The following outcomes were analyzed: death from any hospital origin and other postoperative complications occurred during the same hospitalization after CABG, or within the first 30 days postoperatively. The following postoperative complications were analyzed: non-fatal diagnosed acute myocardial infarction (AMI) according to the guidelines of the European Society of Cardiology [3], stroke (cerebrovascular accident/CVA) characterized as any transient or permanent neurological abnormality proven by CT or MRI of the brain, reoperation for hemostasis review, circulatory shock requiring intraaortic balloon pump (IAB), respiratory complications characterized by the use of mechanical ventilation > 24 h, or pulmonary infection requiring postoperative unit stay, acute kidney injury (AKI) requiring dialysis process, mediastinitis, sepsis from any source, atrial fibrillation (AF), and complete atrioventricular block (CAVb) requiring temporary or permanent pacemaker.

Urgent or emergency surgery was defined according to the criteria of the American Heart Association and American College of Cardiology [2].

Continuous variables are expressed as means ± standard deviation (SD), while categorical variables are expressed by proportions. In the statistical analysis, comparisons of means were assessed using the Student's *t*-test. Proportions were compared using the Chi-square or Fisher's exact test. Forward stepwise multivariate logistic regression analysis was used to determine which factors could be independently relevant to the development of the study outcomes. All *P* values are two-tailed, and $P = 0.05$ was considered as significant.

RESULTS

During the study period, 1,033 patients underwent isolated CABG. Of these, 257 (24.8%) comprised G1 and 776 (75.2%) comprised G2.

Table 1 shows that there was no difference between the two groups of patients related to the following: gender, DM, systemic hypertension, routine diagnostic tests of stable or unstable angina, or myocardial infarction less than three months of CABG, chronic obstructive pulmonary disease (COPD), previous stroke (CVA), CKD, VD, or need for urgent or emergency surgery, or previous CABG.

However, compared to patients in G2, patients in G1 had a higher prevalence of peripheral vascular disease (PVD) (18.3% vs. 10.7%, $P = 0.002$), more impairment of the left main coronary artery (37.7% vs 26.8%, $P = 0.001$), and high-risk EuroSCORE (36.2% vs. 8.4%, $P < 0.001$). Table 2 shows that the number of anastomoses per patient was significantly higher in G2 than in G1 [4 (95% CI = 1-5) vs. 2 (95% CI = 1-3), $P = 0.017$]. However, the number of internal thoracic artery grafts used was similar (95.5% vs. 93.0%, respectively, $P = 0.713$).

Table 3 presents the results of surgery. The mortality rate was higher in G1 than in G2 (8.9% vs. 3.6%, $P = 0.001$). The incidence of postoperative AMI was similar between the two groups of patients (5.8% vs 5.5%, $P = 0.876$). Compared to patients in G2, a greater number of patients in G1 required reoperation for hemostasis review (12.1% vs. 6.1%, $P = 0.003$) and developed more respiratory complications (21.4% vs. 9.1%, $P < 0.001$), mediastinitis (5.1% vs. 1.9%, $P = 0.013$), stroke (CVA) (3.9% vs. 1.3%, $P = 0.016$), AKI (7.8% vs. 1.3%, $P < 0.001$), sepsis (3.9% vs. 1.9%, $P = 0.003$), AF (15.6% vs. 9.8%, $P = 0.016$), and CAVb postoperatively (3.5% vs. 1 2%, $P = 0.023$).

Table 1. Demographic and clinical preoperative characteristics distributed through both groups of patients.

	G1 (257)	G2 (776)	*P*
Male gender (%)	68.1	72.8	0.151
Age	74.0 ± 3.2	58.0 ± 7.8	<0.001
DM (%)	29.6	28.6	0.812
SH (%)	83.3	85.6	0.366
CKD (%)	3.1	1.3	0.093
COPD (%)	7.8	7.2	0.783
VD (%)	18.3	10.7	0.002
Stable angina (%)	63.8	66.6	0.448
Unstable angina (%)	28.0	26.5	0.685
AMI ≤ 3 months (%)	13.6	15.1	0.612
HF (%)	2.3	2.6	1.0
Stroke (%)	4.3	2.4	0.136
Reoperation (%)	5.1	7.2	0.252
U/E CABG sugery (%)	28.0	26.7	0.682
Aditive EuroSCORE > or = 6 points(%)	36.2	8.4	<0.001

SH= systemic hypertension; CKD = chronic kidney disease; DM= diabetes mellitus; COPD= chronic obstructive pulmonary disease; VD= vascular disease; AMI= acute myocardial infarction; HF= heart failure; Stroke/CVA cerebrovascular accident; U/E CABG = urgent or emergency coronary artery bypass graft surgery; EuroSCORE = Additive European System for Cardiac Operative Risk Evaluation

Table 2. Cineangiocoronariographic and surgical operation characteristics in both groups of patients

	G1 (257)	G2 (776)	*P*
Lesão de 1 vaso (%)	0,0	0,4	0,007
Lesão de 2 vasos (%)	7,8	8,0	0,007
Lesão de 3 vasos (%)	54,5	64,8	0,007
LTCE (%)	37,7	26,8	0,001
TCEC min	76,2±27,6	73,6±26,9	0,182
Anastomoses/paciente mediana (IC95%)	4 (1 a 5)	3 (1 a 4)	0,017
Enxerto de ATI (%)	93,0	95,5	0,141

LCAD = left main coronary artery disease; ECCT= extracorporeal circulation time // CPBT cardiopulmonary bypass time; CI = confidence interval; ITA = internal thoracic artery

Table 4 shows that the multivariate logistic regression analysis, age ≥ 70 years (P = 0.004), and the presence of PVD (P = 0.007) were factors associated with increased hospital mortality. Age ≥ 70 years was the only factor associated requiring reoperation for hemostasis review (P = 0.002) and postoperative sepsis (P = 0.002). The main variables associated with postoperative respiratory complications after surgeries were as follows: Age ≥ 70 years (P <0.001), PVD (P = 0.006), myocardial infarction < three months after CABG (P = 0.001), and lesion of the left main coronary artery (P = 0.020).

Table 3. Postoperative outcomes in both groups of patients

	G1 (257)	G2 (776)	*P*
Hospital mortality (%)	23(8,9)	28 (3,6)	0,001
Hemostasis review (%)	31 (12,1)	47 (6,1)	0,003
Post-AMI (%)	15 (5,8)	43 (5,5)	0,876
Respiratory Complications (%)	55 (21,4)	71 (9,1)	<0,001
AKI (%)	20 (7,8)	10 (1,3)	<0,001
CVA/Stroke (%)	10 (3,9)	10 (1,3)	0,016
Sepsis (%)	10 (3,9)	7 (0,9)	0,003
Mediastinitis (%)	13 (5,1)	15 (1,9)	0,013
Atrial Fibrillation (%)	40 (15,6)	76 (9,8)	0,016
CAVb (%)	9 (3,5)	9 (1,2)	0,023

AMI = acute myocardial infarction; AKI = acute kidney injury; stroke/CVA = cerebrovascular accident; CAVb = complete atrioventricular block

Table 4. Predictive factors of post-operative complications by logistic regression analysis

	OR	IC95%	*P*
Hospital mortality			
Age ≥ 70 years	2.315	1.296 a 4.136	0.004
VD	2.434	1.263 a 4.689	0.007
Homeostasis review			
Age ≥ 70 years	2.201	1.355 a 3.601	0.002
Sepsis			
Age ≥ 70 years	5.026	1.847 a 13.679	0.002
Respiratory complications			
Age ≥ 70 years	2.537	1.702 a 3.784	<0.001
VD	1.998	1.216 a 3.284	0.006
AMI ≥ 3 months	2.302	1.428 a 3.710	0.001
LACD	1.614	1.079 a 2.414	0.020
Stroke/CVA			
Age ≥ 70 years	2.852	1.116 a 7.290	0.029
DM	2.602	1.007 a 6.724	0.048
COPD	7.020	2.057 a 23.961	0.002
Previous stroke/CVA	20.705	3.560 a 120.433	0.001
Mediastinitis			
Age ≥ 70 years	2.613	1.193 a 5.724	0.016
Unstable angina	3.133	1.418 a 6.922	0.004
CKD	5.247	1.217 a 22.616	0.026
AKI			
Age ≥ 70 years	6.015	2.672 a 13.542	<0.001
IRC	12.918	3.009 a 55.453	0.006
IAM ≥ three months	4.206	1.717 a 10.303	0.001
Atrial fibrillation			
Age ≥ 70 years	1.646	1.075 a 2.522	0.021
DM	2.046	1.355 a 3.089	0.007
VD	1.963	1.181 a 3.264	0.009
CAVb			
Age ≥ 70 years	2.905	1.102 a 7.654	0.031
CKD	9.328	1.561 a 55.739	0.014

VD = vascular disease; AMI = acute myocardialinfarction; LCAD = left main coronary artery disease; Stroke/CVA = cerebrovascular accident; DM=diabetes mellitus; COPD = chronic obstructive pulmonar disease; CKD = chronic kidney disease; AKI = acute kidney injury; CAVb = complete atrioventricular block

The factors associated with mediastinitis were age ≥ 70 years ($P = 0.016$), unstable angina ($P = 0.004$), and CKD ($P = 0.026$). The factors associated with postoperative stroke were age ≥ 70 years ($P = 0.029$), diabetes ($P = 0.048$), COPD ($P = 0.002$), and previous stroke (CVA) ($P = 0.001$). AKI in the postoperative period was associated with age ≥ 70 years ($P < 0.001$), CKD (P = 0.006, OR = 12.91), and MI < three months after CABG ($P = 0.001$). Factors associated with postoperative FA were age ≥ 70 years ($P = 0.021$), DM ($P = 0.006$), and PVD ($P = 0.009$). Factors associated with postoperative CAVb were age ≥ 70 years ($P = 0.031$), and CRF ($P = 0.014$). There was no significant difference between G1 and G2 in relation to the occurrence of circulatory shock requiring IAB pump (13.6% vs. 10.6%, $P = 0.211$).

DISCUSSION

The present study performed at a cardiology center, which is a reference in highly complex procedures, suggests that elderly patients of age ≥ 70 years are at increased risk of hospital mortality and postoperative complications of all sorts as compared to younger patients after CABG. In spite of patients aged ≥ 70 years present more comorbidities preoperatively than younger ones (Table 1), data adjustment by multivariate logistic regression analysis linked them to increased risk of operative mortality and postoperative complications. It was observed that the elderly patients were two times more likely to die during the procedure than patients < 70 years of age (Table 4). Furthermore, compared to younger patients, elderly patients are likely to have more post-operative complications (occurrence of atrial fibrillation = 1.6 times and development of AKI = 6 times) (Table 4).

In this study, the higher mortality of aged patients after CABG is consistent with previous published results, in which the operative outcomes in elderly and younger patients were compared. In the study conducted by Johnson et al. [4], the influence of age alone on the outcome of heart surgery performed in octogenarian patients compared to younger patients was questioned. In a multivariate analysis, Johnson et al. demonstrated that 522 aged 80 years or older undergoing CABG had a higher risk of death, longer length of hospital stay, neurological complications, and need for reoperation to treat bleeding than non-octogenarians. Similarly, Alves, Jr. et al. [5] in a study involving 197 patients septuagenarians or elderly patients undergoing CABG and valve operations observed operative mortality of isolated CABG in septuagenarians compared to younger patients (19% versus 6%, respectively). These authors also demonstrated that septuagenarians had more postoperative bleeding, pulmonary complications, mediastinitis, kidney dysfunction, and stroke (CVA). They also required more vasopressors than patients < 70 years of age [5]. In another study at the Mount Sinai School of Medicine, Mount Sinai, New York, data from 2,985 patients undergoing CABG were prospectively collected. It was found that the operative mortality in patients of age = or > 80 years was 4.6%, in septuagenarians it was 2.2%, and in patients < 70 years of age it was 2.4% [6]. Naughton et al. [7] also compared the results in patients aged ≥ 75 years and aged 60-74 years undergoing CABG. Operative mortality (30 days) in the patients aged > 75 years was 5% compared to 1.8% in the younger patients (aged 60-74 years). The logistic regression analysis showed that an age > 75 years was an independent factor for operative mortality. Peterson et al. [8] have analyzed the outcomes of CABG performed in 24,461 patients registered in the Medicare program in the United States. They found that the operative mortality was 11.5% in patients of age ≥ 80 years versus 4.4% in patients of age 65 to 70 years. On the other hand, Ng et al. [9] found no significant difference in hospital mortality of patients ≥ 70 years of age compared to those < 70 years old undergoing CABG (5.4% vs. 3.8%, respectively).

When analyzing the outcomes of studies that did not compare elderly versus younger patients undergoing on-pump CABG, it appears that the operative mortality varies widely ranging from 1.6% to 27% [10-12]. This implies different levels of preoperative risk of these patients. An analysis of the preoperative characteristics of the elderly patients involved in this study shows the presence of a more severe atherosclerotic damage compared to the younger patients. This is supported by the higher prevalence of vascular disease (cerebrovascular and peripheral) and CKD (Table 1). In Brazil, when considering the predictors of mortality in patients aged > 70 years undergoing CABG or valve replacement with CPB, Anderson et al. [13] reported a mortality rate of 8.3% for those undergoing isolated CABG. Souza et al. [12] found a 30-day hospital mortality rate of 8.5%, when analyzing the outcomes of CABG performed in 492 patients aged 70 years or over. Iglézias et al. [14] reported an operative mortality rate of 8.5% in a retrospective analysis of 47 octogenarians who underwent CABG at the Heart Institute, University of São Paulo (INCOR) between 1978 and 1993.

In a retrospective study on the outcomes of isolated CABG in 144 patients aged ≥ 70 years, Deinninger et al. [15] observed an operative mortality rate of 5.5%. Almeida et al. [16] observed hospital mortality rate of 7.1%, when analyzing the outcomes of 70 patients after the eighth decade of life undergoing CABG. Pivatto et al. [17] described the hospital morbidity and mortality of 140 patients aged ≥ 80 years undergoing isolated or combined CABG. They have found an in-hospital mortality rate of 14.3%, distributed as follows: 10% for isolated CABG and 22% for CABG associated with

other cardiac surgeries. In this study, it was also reported that the most frequent complications were: low output (27.9%), kidney dysfunction (10%), and prolonged ventilatory support (9.6%) [17].

Assuming that off-pump CABG could bring benefits to patients at higher surgical risk for both operative mortality and postoperative complications, some investigators have compared the clinical outcomes of elderly patients undergoing on-pump versus off-pump CABG. Iglézias et al. [18] compared the clinical outcomes in patients aged ≥ 80 years undergoing on-pump versus off-pump CABG. They reported an operative hospital mortality rate much higher in on-pump CABG (38%) than in off-pump CABG (11.7%) [18]. However, other postoperative complications were similar. Thus, the incidence of myocardial infarction was 3.4% vs 2.8%; stroke (CVA) was 0% vs. 4%; assisted ventilation > 24 hours 27.4% vs 21.1% and reoperation 2.9% vs. 1.9%, respectively for on-pump vs. of-pump CABG [18]. In a similar analysis, Lee et al. [19] retrospectively compared the results of on-pump vs. off-pump CABG. They found that on-pump CABG had a higher mortality rate compared to off-pump CABG (11.5% vs. 2.1%, respectively). However, unlike Iglézias et al. [18], they observed a higher incidence of other postoperative complications: stroke (CVA) (11.5% vs. 0%); AF (30.8% vs. 12.8%), AKI (19.2% vs. 0%), respiratory failure (16% vs. 2.1%), dialysis (20% vs. 0%), mechanical ventilation > 24 h (24% vs. 4.3%) and AMI (8% vs. 4.3%) respectively in on-pump vs. off-pump CABG.

In another study in which the in-hospital outcome of 87 patients aged ≥ 70 years that underwent off-pump CABG was analyzed, Silva et al. [20] observed a hospital mortality rate of 4.6%. Of these, the incidence of AF was observed in 32.2% of the patients, bronchopneumonia in 10.3%, sepsis in 3.4%, AMI in 2.3%, mediastinitis in 1.1%, transient ischemic attacks (TIAs) in 1.1%, and pneumothorax in 1.1%. However, contrary to all these studies, Saleh et al. [21] compared retrospectively isolated on-pump and off-pump CABG in 343 octogenarian patients who were matched by the propensity score. They observed no significant differences between on-pump and off-pump patients with regards in-hospital mortality rate, MI, and stroke.

Conceptually speaking, the definition of an elderly individual based on the chronological factor is subject to errors, even though it lacks psychic, organic, and functional evidence [20]. In Brazil, the Brazilian Institute of Geography and Statistics (IBGE) classifies as elderly the individuals aged 60 or older, which obviously does not accurately reflect the biological state of them. This difficulty in the classification of elderly individuals extends to the moment in which they need a high complexity procedure, such as a heart surgery. The scores that assess the operative risk do not take into account the biological factor, which leads us to group patients with the same chronological status but not necessarily with the same biological status [22]. As in this study, we did not assess the frailty [22] in patients undergoing CABG, there is no way to measure how many of them were vulnerable in their psychological and biological conditions, despite not having significant comorbidities.

LIMITATIONS OF THE STUDY

Like any other observational study, this is only a hypothesis generator study. However, depending on the number of patients involved, it is reasonable to assume that the results are representative of current clinical practice in our country. Because all patients underwent on-pump CABG, it is obviously that we could not verify whether off-pump surgery would bring any different result than observed.

CONCLUSIONS

This study suggests that patients age ≥ 70 years are at increased risk of death and other complications after CABG compared with younger patients.

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