

Risk Factors for Mortality in Octogenarians Undergoing Myocardial Revascularization Surgery

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Abstract

Background: Age over 80 years, by itself, is not the only risk factor for mortality in coronary artery bypass grafting.

Objective: To identify risk factors for mortality in octogenarian patients undergoing CABG.

Methods: We studied 164 patients aged 80 years and over. The variables studied were: gender; age (in years); ejection fraction (LVEF); reoperation; emergency surgery; number of revascularized arteries; use of the left internal thoracic artery (LITA); use of cardiopulmonary bypass (CPB); associated surgery; revascularization of the left anterior descending artery (DA); and use of intra-aortic balloon (IAB). Statistical analysis was done using descriptive analysis, univariate and multivariate logistic regression. A p value < 0.05 was considered statistically significant, and multivariate analysis was performed for variables whose value was $p < 0.20$.

Results: Mortality was 11%. Univariate analysis showed that low LVEF ($p = 0.008$), emergency surgery ($p < 0.001$), and use of intra-aortic balloon ($p = 0.049$) were related to higher mortality. When adjusted by logistic regression, age over 85 years was correlated with a 6.31 times greater mortality ($p = 0.012$), and emergency surgery was related to a 55.39 times greater mortality ($p < 0.001$).

Conclusion: In octogenarians undergoing coronary artery bypass surgery, age over 85 years and emergency surgery are important predictors of mortality. (Arq Bras Cardiol 2011; 96(2): 94-98)

Keywords: Myocardial revascularization/mortality; risk factors; aged, 80 years over; risk, assesment.

Introduction

Since CABG started being used, advanced age (> 65 years) has been considered an operative risk factor^{1,2}. This is becoming increasingly relevant due to the increased life expectancy of the population worldwide, including in Brazil³, thus leading to an increasing number of elderly, especially over 80 years, having surgical indication⁴. This group of patients, due to the aging process itself, has comorbidities that increase the operative risk^{5,6}. One of the most widely used risk scores today, the EuroSCORE^{7,8}, applies a significant weight to age over 60 years in the final calculation of mortality risk. However, it seems reasonable to consider all the elderly patients as a homogeneous group, and age, by itself, as a determinant of greater risk^{9,10}.

The objective of this study was to identify other risk factors, besides age, in a group of octogenarians who underwent CABG at the Heart Institute of Pernambuco.

Methods

We reviewed the records of 164 patients, aged 80 years and over, who underwent CABG at the Heart Institute of Pernambuco, between January 1991 and August 2008. The variables studied were: gender; age; left ventricular ejection fraction; reoperation; emergency surgery; number of revascularized arteries; use of the left internal mammary artery; use of cardiopulmonary bypass; associated surgery; revascularization of the left anterior descending artery; and use of intra-aortic balloon (IAB).

Results whose descriptive levels (p values) were lower than 0.05 were considered statistically significant. The following software programs were used in the preparation of the technical report: MSOffice Excel, version 2003, for managing the database; Statistical Package for Social Sciences (SPSS) for Windows, version 12.0, for the execution of statistical calculations; and MSOffice Word, version 2003, for drafting and editing the graphics, as well as for preparing tables and writing the text.

The study was approved by the ethics committee of the Heart Institute of Pernambuco, under Protocol number 0009/09.

Statistical analysis

The statistical analysis was divided into three parts: descriptive analysis, univariate and multivariate analyses by logistic regression model.

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In order to characterize the sample, we presented the total number of patients, the relative (percentage) and the absolute (N) frequencies of the classes for each qualitative variable. For the quantitative variable (age), we used means and medians to summarize the information and the standard deviations, minimum and maximum, to indicate data variability.

In order to identify the main factors (variables) that may alter the risk of death, we performed a univariate analysis. For the qualitative variables, we compared the proportion of deaths in different categories using Pearson's chi-square test¹¹. The Fisher exact test was used in situations in which the expected values were less than five, including: the number of patients in each category; the percentage of deaths in each subgroup; the odds ratio and the respective 95% confidence interval; here the reference category was considered the one in which the lowest risk for mortality was expected, as well as the significance of the association between the variable concerned and death.

For a comprehensive analysis, we used logistic regression¹², so as to assess all factors simultaneously.

All variables with p value < 0.20 in a univariate analysis were included in the regression, i.e. the variables age, LV function, emergency surgery, associated surgery, and use of IAB. The selected variables were evaluated for possible interactions in a correlation matrix, and all interactions with a correlation coefficient greater than or equal to 0.5 were incorporated into the model.

Results

Table 1 shows the absolute and relative values of the ten variables evaluated in the population of 164 patients. These data show that 60% of the patients were female, 12% had EF < 50%, 3% were reoperations, and 8% were emergency surgeries. Three or more arteries were revascularized in 37% of cases, and the left internal mammary artery was used in 57% of patients. The operation was performed with CPB only in 31% of patients, and 3.7% had associated surgery. In most patients, the left anterior descending artery was revascularized, and in only 2.4% an intra-aortic balloon was used.

The patients' ages ranged from 80 to 89 years (average 82.46), median of 82.00, and standard deviation of \pm 2.31. The in-hospital mortality was 11% (18 patients). The causes of death (Table 2) included: respiratory infection and sepsis (eight cases); low cardiac output syndrome (four cases); acute renal failure (three cases); stroke (two cases); and intraoperative aortic dissection (one case). Table 3 shows the details of the univariate analysis performed with the eleven variables involved in the study. The following factors were statistically significant: low LV ejection fraction, emergency surgery, and use of intra-aortic balloon.

Table 4 shows data from the logistic regression with the variables analyzed; both age over 85 years and emergency surgery were statistically significant.

Discussion

The aging population and the increasing number of octogenarian patients with surgical indication for CABG led

Table 1 - Distribution of qualitative variables analyzed with their absolute and relative frequencies for the 164 patients who participated in the study

Variables	n	%
Gender - male	99	60
LVEF <50%	19	12
Reoperation	5	3.0
Emergency surgery	13	8
Number of revascularized arteries (\geq 3)	61	37
LITA use	94	57
Surgery with CPB	51	31
Associated surgery	6	3.7
AIVA revascularization	160	98
IAB use	4	2.4

LVEF - left ventricular ejection fraction, CPB - cardiopulmonary bypass; AIVA - left anterior descending artery; IAB - Intra-aortic balloon, LITA - left internal mammary artery.

Table 2 - Causes of death

Causes of death	Number of patients
Respiratory tract infection/sepsis	08
Acute renal failure	03
Stroke	02
Low cardiac output syndrome	04
Intraoperative aortic dissection	01

us to evaluate retrospectively the results of a series of 164 patients aged over 80 years, operated in our institution over the past 18 years. Of course, this long-term evaluation is a limitation to the study, but analyzing the changes in technique that could eventually change the mortality rate, only two were identified: expanding the use of the internal thoracic artery, and expanding the use of off-pump surgery.

The mortality in our series of cases (11%) was similar to that reported in the literature^{13,14}. The analysis of our case material showed that 61 patients (37%) had three or more revascularized arteries, and that in 97% of cases the left anterior descending artery was involved. However, unlike other reports^{15,16}, in which the left internal mammary artery was used in over 95% of cases, in our series this type of graft was used in 57% of patients. The low percentage is due to the fact that up to 2000, we did not routinely use the LITA in patients over 75 years, and we still do not use it in emergency surgeries with hemodynamic instability. Other variables evaluated in this study, such as reoperation, associated surgery, and use of intra-aortic balloon, showed a low prevalence, which may have possibly influenced the univariate and the multivariate analyses.

Despite the wide confidence interval, probably due to the small number of events, univariate analysis showed that LV ejection fraction greater than 50%, emergency surgery, and use of intra-aortic balloon increased 5, 35 and 9 times the risk

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Table 3 - Factors associated with in-hospital mortality

Variables	n	Deaths n (%)	Univariate analysis	
			OR (95% CI)	p
Age				
< 85 years	137	12 (8.8%)	1.0	0.083
≥ 85 years	27	6 (22.2%)	2.98 (0.99 ; 8.79)	
Gender				
Female	65	7 (10.8%)	1.0	0.945
Male	99	11 (11.1%)	1.04 (0.38 ; 2.83)	
LVEF				
> 50%	145	12 (8.3%)	1.0	0.008 _F
< 50%	19	6 (31.6%)	5.12 (1.65 ; 15.89)	
Reoperation				
No	159	17 (10.7%)	1.0	0.445 _F
Yes	5	1 (20.0%)	2.09 (0.22 – 19.78)	
Emergency surgery				
No	151	9 (6.0%)	1.0	<0.001 _F
Yes	13	9 (69.2%)	35.5 (9.14 ; 137.88)	
Number of revascularized arteries				
1 or 2	103	11 (10.7%)	1.0	0.875
≥ 3	61	7 (11.5%)	1.08 (0.39 ; 2.96)	
LITA use				
No	70	8 (11.4%)	1.0	0.873
Yes	94	10 (10.6%)	0.92 (0.34 ; 2.47)	
CPB				
No	113	11 (9.7%)	1.0	0.449
Yes	51	7 (13.7%)	1.48 (0.54 ; 4.06)	
Associated surgery				
No	158	16 (10.1%)	1.0	0.131 _F
Yes	6	2 (33.3%)	4.44 (0.75 ; 26.17)	
AIVA revascularization				
No	4	0 (0.0%)	-	>0.999 _F
Yes	160	18 (11.3%)		
IAB use				
No	160	16 (10%)	1.0	0.049 _F
Yes	4	2 (50%)	9.02 (1.19 ; 68.31)	

LVEF - ejection fraction of left ventricle; CPB - cardiopulmonary bypass; AIVA - left anterior descending artery; IAB - Intra-aortic balloon; OR - odds ratio; LITA - left internal thoracic artery; F - using the Fisher exact test.

Table 4 - Logistic regression results - enter method

Independent variable	p value	Odds ratio	95% CI OR
Age (≥ 85 years vs < 85 years)	0.012*	6.31	[1.51 ; 26.35]
EF (< 50% vs > 50%)	0.070	4.96	[0.88 ; 27.99]
Emergency surgery (yes vs no)	<0.001*	55.39	[9.85 ; 111.45]
Associated surgery (yes vs no)	0.612	1.86	[0.17 ; 20.53]
IAB (yes vs no)	0.256	0.15	[0.01 ; 3.96]

EF - ejection fraction; IAB - intra-aortic balloon. * Statistically significant.

of death, respectively, and these findings are corroborated by the literature¹⁷.

Multivariate analysis showed that older age is an independent predictor of mortality, as it has been described¹⁸. By dividing our patients into two groups according to age,

we noted that patients aged over 85 years had a six times greater mortality. Another independent finding, despite the wide confidence interval, was the observation that patients undergoing emergency surgery had greater mortality (55 times) than those operated electively. Patients who undergo emergency surgery are a high risk group, with high EuroSCORE, due to poor ventricular function, high creatinine levels, and other risk factors, as demonstrated in a recent Canadian study¹⁹.

In conclusion, the statistical study of our material by multivariate logistic regression analysis showed that only age above 85 years and emergency surgery are really important risk factors in octogenarian patients undergoing coronary artery bypass surgery. Therefore, advanced age by itself should not be considered as the only important risk factor, but other clinical variables must be taken into account.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any post-graduation program.

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