

Morbimortality in Octogenarian Patients Submitted to Myocardial Revascularization Surgery

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Abstract

Background: Given the progressive increase in longevity and the need of an increasingly elderly population to undergo myocardial revascularization surgery (MRS), it becomes necessary to know its risks and benefits.

Objective: To evaluate the in-hospital morbimortality of patients aged 80 and older submitted to MRS and identify its predictor variables.

Methods: A total of 140 consecutive cases were studied between January 2002 and December 2007. The patients' mean age was 82.5 ± 2.2 years (range: 80-89) and 55.7% were males. In the sample, 72.9% had arterial hypertension, 26.4% had diabetes, 65.7% presented severe lesion in three or more vessels and 28.6% presented a severe lesion in the left coronary trunk. An associated surgery was present in 35.7% of the cases, with aortic valve in 26.4% and mitral valve in 5.6%.

Results: The mortality rate was 14.3% (isolated MRS 10.0% vs 22.0% with associated procedure; $p = 0.091$) and the morbidity was 37.9% (isolated MRS 34.4% vs 44.0% with associated procedure; $p = 0.35$). The most frequent complications were low cardiac output (27.9%), renal dysfunction (10.0%) and prolonged ventilatory support (9.6%). At the bivariate analysis, the most important mortality predictors were sepsis (RR 10.2; 95%CI: 6.10-17.7), previous MRS (RR 8.06; 95%CI: 5.16-12.6), postoperative low cardiac output (RR 7.77; 95%CI: 3.03-19.9) and postoperative renal dysfunction (RR 7.36; 95%CI: 3.71-14.6). The morbidity predictors were extracorporeal circulation time ≥ 120 min. (RR: 2.34; 95%CI: 1.62-3.38) and time of ischemia ≥ 90 min. (RR: 2.29 95%CI: 1.56-3.37).

Conclusion: The MRS in octogenarians is associated with a higher morbimortality when compared to younger patients, which, however, does not prevent the procedure if the indication is justified by clinical condition. (Arq Bras Cardiol. 2010; [online]. ahead print, PP.0-0)

Key words: Myocardial revascularization surgery/mortality, morbidity, 80-year-old elderly and older.

Introduction

In recent years, the elderly population has increased considerably, in developed as well as in developing countries¹. The Brazilian demographic data have shown an evident increase in the elderly population, with estimates predicting that Brazil will have the sixth world's elderly population by 2025².

Cardiovascular disease is extremely prevalent at this age range, with approximately 40% of octogenarians presenting symptomatic cardiovascular disease³.

Several models of epidemiological study have predicted that with the current growth rate of the elderly population,

there will be not only an increase in the incidence of coronary artery disease, but also in the total mortality and economic costs, with a probable progressive increase, in the next decades, in the number of elderly patients presenting at the Cardiac Surgery Services⁴.

Currently, the indication for myocardial revascularization surgery (MRS) in septuagenarians is usual, it is becoming increasingly more common in octogenarians and it is not rare in nonagenarians⁵. It has been broadly reported in the literature that advanced age is a factor correlated with operative mortality and throughout time in myocardial revascularization surgery. For several reasons, it can be considered a high-risk factor in major surgical procedures, especially cardiac surgeries⁴.

The operative mortality rate in patients aged 70 years or older varied from 5-20% in the last 20 years in isolated MRS, with a mean of 8.9%⁶. The ACC/AHA guidelines report a mortality rate of 5.28% in patients older than 75 years and 8.38% in those older than 80 years⁶.

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The objective of the present study was to evaluate the in-hospital morbimortality of octogenarian patients submitted to MRS and, secondarily, to identify pre, trans and postoperative variables that constitute the morbidity and/or mortality predictors.

Methods

This retrospective study included all consecutive patients aged 80 years or older submitted to myocardial revascularization surgery from January 2002 to December 2007 at the Institute of Cardiology of Rio Grande do Sul. The variables included in the present study are shown in Table 1.

Renal dysfunction, both pre and postoperative, was defined by a serum creatinine level > 2 mg/ml. The heart failure (HF) classification followed the criteria established by the New York Heart Association (NYHA). A coronary lesion was considered

severe when it was > 70% in the coronary arteries and 50% in the left coronary trunk. Ejection fraction (EF) was considered low when < 50% and normal when >50%. Low cardiac output was considered for all hemodynamic instability with the need for vasoactive drugs or intra-aortic balloon. Localized neurological or consciousness level alterations for period > 24 hours were defined as cerebrovascular accident. In-hospital mortality was defined as any death occurring during the patient's hospitalization, regardless of its duration. The occurrence of one or more of the following events in the postoperative period was defined as operative morbidity: low cardiac output, use of intra-aortic balloon, sepsis, surgical wound or lower-limb infection, renal dysfunction, cerebrovascular accident, reintervention due to bleeding and time of ventilatory support > 48 hours.

Considering the retrospective design of the present study, there was an expected loss of data, which were not found in the patients' files. That occurred more often in relation to the following variables: NYHA functional class, ejection fraction and time of extracorporeal circulation (ECC), ischemia and ventilatory support.

The data were collected directly from patients' files, entered in a database and analyzed using the SPSS 15.0 program package. The descriptive analysis for the qualitative variables was carried out through the distribution of absolute and relative frequencies and through means and standard deviations for the quantitative variables. In order to statistically assess the association between two qualitative variables, the Chi-square or Fisher's exact tests were used when indicated. A level of 5 % was established as the limit for rejection of the null hypothesis. Poisson regression was used to evaluate the association between the risk of mortality and the variables and a 95% confidence interval was also used. Student's *t* test was used to compare the means of the quantitative variables in relation to mortality. Due to the low mortality rate and the presence of several significant variables at Poisson regression analysis, the multivariate analysis was not performed.

Table 1 - Variables included in the present study

Preoperative
Age
Sex
Diabetes
Systemic arterial hypertension
Previous myocardial infarction
Renal dysfunction
Atrial fibrillation
Previous myocardial revascularization surgery
NYHA functional class
Urgency of the operation
Severe lesion ≥ 3 vessels
Severe lesion in the left coronary trunk
Ejection fraction
Transoperative
Use of internal thoracic artery
Time of extracorporeal circulation
Time of ischemia
Associated surgery
Transoperative myocardial infarction
Postoperative
Low cardiac output
Use of intra-aortic balloon
Sepsis
Surgical wound infection
Lower-limb infection
Renal dysfunction
Cerebrovascular accident
Reintervention due to bleeding
Ventilatory support time

Results

The sample consisted of 140 octogenarian patients, among a total of 4,203 myocardial revascularization surgeries (3.3%). The patients' age varied from 80 to 89 years, with a mean age of 82.5 ± 2.2 . The characteristics of the studied population are shown in Table 2.

Regarding the surgical data, all procedures were carried out with ECC. The internal thoracic artery was used in 24.3% of the patients, mean ECC time was 85.4 ± 28.8 minutes and mean myocardial ischemia time was 58.0 ± 22.3 minutes. An associated surgery was performed in 50 (35.7%) patients. The associated procedures are listed in Table 3.

Fifty-three patients (37.9%) presented at least one complication in the postoperative period. In patients submitted to isolated revascularization, the rate of complications was 34.4%, with no statistically significant difference when compared with the group that underwent an associated procedure (44.0%; $p = 0.35$).

Table 4 shows the prevalence of the analyzed morbidity, showing that low cardiac output was the most common complication (27.9%).

Table 2 - Preoperative characteristics of the sample

Demographic characteristics	Patients	%
Systemic arterial hypertension	102	72.9
Severe lesion ≥ 3 vessels	92	65.7
NYHA functional class III/IV	45	57.0
Severe lesion of the LCT	40	28.6
Diabetes	37	26.4
Previous myocardial infarction	37	26.4
Non-elective surgery	22	16.4
Ejection fraction < 50%	14	10.0
Atrial fibrillation	8	5.7
Renal dysfunction	7	5.0
Previous MRS	3	2.1

LCT - left coronary trunk.

Table 3 - Associated surgical procedures

Associated procedure	Patients	%
Aortic bioprosthesis	28	20.0%
Aortic valve plasty	5	3.6%
Carotid endarterectomy	5	3.6%
Mitral bioprosthesis	3	2.1%
Mitral valve plasty	3	2.1%
Aortic bioprosthesis + aortoplasty	2	1.4%
Aortic bioprosthesis + mitral plasty	2	1.4%
Endo-aneurysmorrhaphy	1	0.7%

Table 4 - Prevalence of the analyzed postoperative complications

Complication	Patients	%
Low cardiac output	39	27.9
Renal dysfunction	14	10.0
Prolonged ventilatory support	13	9.6
Use of intra-aortic balloon	10	7.1
Reintervention due to bleeding	8	5.7
Sepsis	7	5.0
Cerebrovascular accident	6	4.3
Surgical wound infection	5	3.6
Lower-limb infection	3	2.1

The observed hospital mortality was 14.3% (20 patients), being 10.0% in patients submitted to isolated revascularization and 22.0% in the presence of an associated procedure. This difference in the mortality rate was not statistically significant ($p = 0.091$). Cardiogenic shock was the main cause of death, being responsible for the death of 11 patients (55.0%).

The risk factors for in-hospital mortality are shown in Table 5. All the other analyzed factors that are absent did not show to be significant at the bivariate analysis.

Regarding the predictors of morbidity, only prolonged ECC and ischemia time were statistically significant (Table 6).

Discussão

The need to decide on the best treatment for coronary artery disease in patients older than 80 years has become increasingly frequent. The aging process promotes the increase of comorbidities, in addition to the higher prevalence of coronary artery disease and its consequences in the elderly⁷.

The surgical indication in octogenarian patients aims chiefly at symptom relief and good quality of life, as the long-term outcome is limited by the life expectancy at this age range and can also be affected by the onset of age-related diseases in other organs¹.

In recent years, the myocardial revascularization surgery (MRS) has been increasingly performed in elderly patients with multi-vessel coronary involvement, left ventricular dysfunction and other associated chronic-degenerative diseases.

The characteristics of this population demonstrate such peculiarities, considering that 65.7% of the patients had severe three-vessel lesion, 26.4% had diabetes and 72.9% had hypertension - frequencies that were similar to data found in the literature⁸⁻¹⁰. Such fact represents an important characteristic of this population, which contributes to its increased surgical risk.

The combination of more advanced coronary disease and worse comorbidities leads to an increased rate of fatal and nonfatal complications, with higher rates of intra or postoperative myocardial infarction, low cardiac output, cerebrovascular accident, gastrointestinal complications, surgical wound infection, kidney failure and use of intra-aortic balloon⁶. In the present study, the most frequent complication was the low cardiac output (27.9%), as seen in other series^{4,11}.

The in-hospital mortality rate of 14.3% in this series is in agreement with the literature. During the same period of this study, 3,530 isolated revascularization surgeries were carried out at the Institute of Cardiology, with a global in-hospital mortality of 3.7% and 673 revascularizations with associated surgeries, of which mortality was 10.3%. The difference between the mortality rates in isolated procedures (10.0%) and when there is an associated surgical procedure (22.0%) is important, as it is known that the concomitant surgical procedure is relevant, considering that the associated surgical procedure increases the risk of mortality. Iglézias et al¹² demonstrated an increase of in-hospital mortality of 25%, with a statistically significant difference ($p = 0.002$) in the group submitted to the isolated surgical procedure, different from what was observed in the present study.

López-Rodríguez et al¹³, in a recent analysis of 140 octogenarians submitted to cardiac surgery, observed a mortality rate of 8.3% in isolated surgeries and 21.4% with associated surgeries; in this study, the ECC was not used by 25% of the patients. Peterson et al¹⁴ have carried out the largest study with octogenarian patients to date, studying 24,461

Table 5 - Risk factor for in-hospital mortality

Variable		Patients	% Mortality	RR (95%CI)	P
Sepsis	Yes	7	100%	10.2 (6.10-17.7)	< 0.001
	No	133	9.8%		
Previous MRS	Yes	3	100%	8.06 (5.16-12.6)	0.003
	No	137	12.4%		
Low cardiac output	Yes	39	38.5%	7.77 (3.03-19.9)	< 0.001
	No	101	5.0%		
Postoperative renal dysfunction	Yes	14	64.3%	7.36 (3.71-14.6)	< 0.001
	No	126	8.7%		
Preoperative renal dysfunction	Yes	7	71.4%	6.33 (3.25-12.4)	0.001
	No	133	11.3%		
Use of intra-aortic balloon	Yes	10	60.0%	5.57 (2.74-11.3)	0.001
	No	130	10.8%		
Reintervention due to bleeding	Yes	8	50.0%	4.12 (1.79-9.47)	0.015
	No	132	12.1%		
Prolonged ventilatory support	Yes	13	46.2%	4.05 (1.88-8.73)	0.004
	No	123	11.4%		
Ischemia time ≥ 90 min.	Yes	13	38.5%	3.43 (1.47-8.01)	0.018
	No	125	11.2%		
ECC time ≥ 120 min.	Yes	14	35.7%	2.98 (1.27-6.95)	0.032
	No	125	12.0%		
Non-elective surgery	Yes	22	27.3%	2.54 (1.07-6.06)	0.035
	No	112	10.7%		

ECC - extra-corporeal circulation.

Table 6 - Risk factors for in-hospital morbidity

Variable		Patients	% Morbidity	RR (95%CI)	p
ECC time ≥ 120 min.	Yes	14	78.6%	2.34 (1.62-3.38)	0.003
	No	125	33.6%		
Ischemia time ≥ 90 min.	Yes	13	76.9%	2.29 (1.56-3.37)	0.005
	No	125	33.6%		

ECC - extra-corporeal circulation.

patients submitted to the isolated surgery, with an in-hospital mortality of 11.5%.

Several groups have reported on the results of MRS in elderly patients, as it is a particular group of patients, mainly related to associations with other preoperative diseases and the complications that can appear after the procedure¹⁵. However, to date, there have been few national studies that assessed octogenarian patients and that is the contribution of the present study.

Iglézias et al⁴ analyzed 361 patients aged ≥ 70 years (mean age = 73.9 ± 3.3 years) submitted to isolated MRS and reported a 30-day mortality of 9.1%. This same group analyzed, in another study¹¹, 100 patients submitted to

isolated MRS, also aged ≥ 70 years; 50% of the patients were submitted to the surgical procedure with extracorporeal circulation (ECC) and the other half, without ECC. Both groups presented a mean age > 75 years. The 30-day survival was 92% for those submitted to surgery with ECC and 96% for those without ECC, with no statistically significant difference.

Regarding the surgical procedures of the present study, as described before, they were all carried out with ECC. The benefits of performing off-pump cardiac surgeries in elderly patients have been the subject of debate for some time. A recent article, of which proposal was to analyze the use of off-pump MRS in octogenarian patients in comparison to the conventional surgery, did not demonstrate a significant

difference in mortality between these two groups (conventional 6.7%, off-pump 3.1%; $p = 0.22$)¹⁶. Li et al¹⁷, in an analysis of 1,191 patients aged > 65 years, observed that the off-pump MRS was associated with more favorable early outcomes, which, however, did not persist at long-term follow-up, with the traditional surgery being associated with better middle and long-term outcomes. This observation was ratified in a recent review article, which observed that current evidence suggests that off-pump MRS can offer lower perioperative morbidity, but at the cost of a lower long-term effectiveness¹⁸. The internal thoracic artery (ITA) is the best graft for myocardial revascularization regarding long-term patency, free from recurrence of angina and late cardiac events. Due to the fact that the apparent benefit of using the ITA has been more emphasized regarding late patency and survival outcomes, many surgeons avoided using it in elderly patients, presuming that no substantial benefit was observed in this population¹⁹. In Brazil, the current life expectancy is 72.4 years; however, individuals who reach the eighth decade of life live on average 9.4 more years²⁰. Therefore, more important than the global life expectancy of the general population is the life expectancy for those individuals who reach their eighth decade. Regarding the survival of octogenarian patients submitted to MRS, studies have demonstrated that those submitted to the isolated surgery have a similar¹⁴ or higher survival²¹ than that of the general population. Thus, the nonuse of the ITA in elderly patients, due to the presumed loss of importance of its late patency, cannot be viewed as a correct approach.

The low rate of the ITA use in the present study (24.3%) is justified by its retrospective nature, which demonstrated the reality of a hospital throughout a long period of time, where the opinion on the use of this graft at the studied age range has changed, with the ITA being currently preferred by most surgeons, even in octogenarian patients.

The predictors of in-hospital mortality shown in Table 4 are similar to those found in other studies with elderly patients. The most significant predictors were sepsis, previous MRS, postoperative low cardiac output and pre and postoperative renal dysfunction. It is worth mentioning again the limitation of the present study, considering that, due to the small sample size and the large number of predictor variables at the bivariate analysis, the multivariate analysis was not performed, which could have provided independent predictor indications of in-hospital mortality.

An analysis carried out by López-Rodríguez et al¹³ of

589 patients aged > 75 years submitted to cardiac surgery showed that prolonged ECC time, i.e., > 120 minutes, is an independent predictor of postoperative morbidity. In the present study, this variable showed to be a predictor at the bivariate analysis, as well as the prolonged time of ischemia.

According to the Guidelines of the Brazilian Society of Cardiology²², age must not be a contraindication for surgery and it is important to assess the patient's actual age vs apparent age, general status and physical and intellectual capacity. According to the ACC/AHA guidelines⁶, the patient and the physician must explore together the potential benefits of quality of life improvement, observing the risks of the procedure in comparison with an alternative therapy, also taking into account the patient's basal functional capacity and wishes.

Age alone must not be a contraindication for the myocardial revascularization surgery, if we consider that the benefits can overcome the risks of the procedure in the long term.

Conclusion

The myocardial revascularization surgery in octogenarian patients is associated with a higher morbimortality when compared to younger patients, which, however, does not prevent the procedure, when indicated by the clinical condition.

The most frequent complications were low cardiac output, renal dysfunction and prolonged ventilatory support. The most important predictors of mortality were sepsis, previous MRS, postoperative low cardiac output and postoperative renal dysfunction. As for the morbidity, its main predictors were ECC time ≥ 120 min and ischemia time ≥ 90 min. Thus, the surgical indication must be carefully assessed and individualized, taking into the account the patient's age and general status, life expectancy, probability of return to social life, the coronary lesion location and severity, the extension of myocardial ischemia, symptom intensity, presence of comorbidities, the surgical team's experience and the comparative results with other forms of pharmacological treatment and percutaneous angioplasty.

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