

Morbidity and Mortality in Patients Aged over 75 Years Undergoing Surgery for Aortic Valve Replacement

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Abstract

Background: The greater longevity observed today has caused an increase in the number of elderly who need surgery. Aortic stenosis is a common condition in this age group.

Objective: To evaluate morbidity and mortality in people aged 75 years or older who have undergone valvuloplasty or valve replacement surgery for aortic stenosis alone or associated with other injuries.

Methods: We studied 230 consecutive cases between Jan/2002-Dec/2007. Patients were 79.5 ± 3.7 years (75 - 94), and 53.9% were men. In the sample, 68.7% had hypertension, 17.9% had atrial fibrillation, 15.9% were obese, and 14.4% had undergone previous heart surgery. At surgery, 87.4% underwent aortic stent placement, and 12.6% underwent aortic valvuloplasty.

Results: The mortality rate was 13.9% (9.4% with isolated aortic stenosis versus 20.9% with an associated procedure, $p = 0.023$) and the morbidity rate was 30.0% (25.2% with aortic stenosis alone versus 37.4% with an associated procedure, $p = 0.068$). The most common complications were: low cardiac output (20.2%), renal dysfunction (9.7%), and prolonged ventilatory support (7.9%). In the bivariate analysis, the main predictors of mortality were low cardiac output (RR 10.1, 95% CI: 5.02-20.3), use of intra-aortic balloon (RR 6.6, 95% CI: 3.83-11.4), sepsis (RR 6.77, 95%: 1.66-9.48) and renal dysfunction after surgery (RR 6.21, 95%: 3.47-11.1). As for morbidity, the predictors were: pre-operative renal dysfunction (RR 2.22, 95%: 1.25-3.95), atrial fibrillation (RR 1.74, 95%: 1.16-2.61), and chronic obstructive pulmonary disease (COPD) (RR 1.93, 95%: 1.25-2.97).

Conclusion: Aortic valve surgery in the elderly is related to a slightly higher mortality rate than in younger patients, and its main risk factors were associated procedures, renal failure, atrial fibrillation, COPD, and sepsis. (Arq Bras Cardiol. 2010; [online]. ahead print, PP.0-0)

Key words: Aortic valve stenosis/surgery/mortality; morbidity; aged.

Introduction

Due to the increase in life expectancy, the prevalence of aortic stenosis of congenital or senile origin has increased remarkably in recent years. In Brazil, the elderly account for 8.6% of the population¹, and approximately 25.0% of them are 75 years or over¹. With advancing age, the normal aortic valve undergoes calcification which is aggravated or accelerated in case of congenital defect, such as a bicuspid valve morphology.

Whilst there may be discrepancy between chronological and physiological age, the ability of the elderly to respond to cardiac surgery is lower, due to comorbidities, limited functional reserve of vital organs, and reduced capacity for defense and adaptation. With the development of improved techniques of myocardial and lung protection, and advances

in the preoperative evaluation, the benefits of cardiac surgery in the elderly are more frequently extended to the eighth and ninth decades^{2,3}. However, the evaluation scores of surgical risk still consider advanced age as a factor associated with increased hospital morbidity⁴. The recent development of devices for percutaneous implantation of an aortic bioprosthesis^{5,6} aims at preventing such risks in elderly patients, although there are no randomized trials comparing this treatment modality with the surgical treatment of aortic stenosis.

The objective of this study was to evaluate hospital morbidity and mortality rates in patients aged 75 years or older who have undergone valvuloplasty or valve replacement surgery for aortic stenosis alone or associated with other injuries.

Methods

Design

This was a retrospective study of a consecutive case series.

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Population

Of a total of 1,873 valve surgeries performed between Jan/2002-Dec/2007, 230 (12.3%) were in patients over 75 years undergoing cardiac surgery for aortic stenosis, consecutively, at the Institute of Cardiology of Rio Grande do Sul. Data were obtained retrospectively through medical records. The study was approved by the local Research Ethics Committee.

In preoperative clinical characteristics, obesity was defined by calculating the body mass index (BMI), and individuals with BMI ≥ 30.0 kg/m² were considered obese. Patients who had a history of hypertension and were in regular use of antihypertensive medication were considered as having hypertension (HBP). Pre- or postoperative renal dysfunction was defined as serum creatinine greater than 2.0 mg/dl. Preoperative atrial fibrillation was defined by the presence of atrial fibrillation on resting electrocardiogram before surgery. The classification of heart failure followed the criteria established by the New York Heart Association (NYHA). Previous cerebrovascular accident (CVA) was defined as the presence of previous history of stroke, associated with localized neurological defects. Low cardiac output was defined as hemodynamic instability and need to use vasoactive drugs, with or without the use of intra-aortic balloon. Post-operative stroke was defined as localized neurological defects, or changes in the level of consciousness for a period exceeding 24 hours. Hospital mortality was defined as death from any cause during the hospitalization of the patient, regardless of its duration.

Operative morbidity was defined as the occurrence of one or more of the following events during the postoperative period: low cardiac output, use of intra-aortic balloon, sepsis, wound or lower limb infection, renal dysfunction, stroke, reoperation for bleeding, and length of ventilatory support (longer than 48 hours).

Considering the retrospective methodology of this study, it would be natural to expect some loss of data, which were missing in the medical records. This occurred most frequently in the following variables: ventricular mass, septal thickness, posterior wall thickness, and NYHA functional class. Such losses, however, were less than 10.0% of the total of possible data.

The present study included the following preoperative variables: age; gender; obesity; hypertension; renal dysfunction; atrial fibrillation; previous cardiac surgery; LV ejection fraction < 60.0%; LV systolic diameter; LV diastolic diameter; LV posterior wall thickness; septal thickness; left ventricular mass; mean aortic gradient; severe lesion of the mitral valve; pulmonary hypertension; previous stroke; current smoking habit; calcification of the ascending aorta; and NYHA functional class III/IV.

The intraoperative variables evaluated were time of cardiopulmonary bypass; ischemia time; surgical procedure (exchange/valvuloplasty); and associated surgery. The postoperative variables analyzed were low cardiac output; use of intra-aortic balloon; sepsis; wound infection; lower limb infection; renal dysfunction; stroke; reoperation for bleeding; time of prolonged ventilatory support.

Statistical analysis

The 95.0% confidence interval was calculated for the percentages when deemed appropriate, and is shown in parentheses. A descriptive analysis for both qualitative variables was conducted using absolute and relative frequency distribution. The analysis for the quantitative variables was conducted using the mean and standard deviation.

In order to statistically assess the association between both qualitative variables, we used the chi-square or Fisher exact test, as indicated. The Student t test or the Mann-Whitney U test was used to compare the mean of the quantitative variables to mortality and morbidity.

The crude Poisson regression was used to evaluate the association between mortality risk and the variables, adopting a confidence interval of 95.0%. The level of significance for all tests was 5.0%.

Results

The patients' ages ranged from 75-94 years, mean age (\pm SD) 79.5 \pm 3.7; 122 (53.0%) of them were male. The characteristics of the sample are shown in Table 1, and the echocardiographic data, in Table 2.

Table 1 - Pre-operative clinical characteristics of the sample (n = 230)

Variable	Frequency	%
Hypertension	156	67.8
NYHA functional class III/IV	103	44.8
Obesity (BMI ≥ 30.0 kg/m ²)	34	14.8
Ejection fraction < 60.0%	62	27.0
Pulmonary arterial hypertension	47	20.4
Atrial fibrillation	41	17.8
Previous heart surgery	32	13.9
COPD	30	13.0
Calcification of the ascending aorta	22	9.6
Severe mitral valve disease	18	7.8
Current smoking habit	17	7.4
Previous stroke	15	6.5
Renal dysfunction (creatinine > 2.0 mg/dl)	8	3.5

Table 2 - Echocardiographic parameters in left ventricular assessment

Variable	Mean (\pm SD)
Systolic diameter (mm)	34.5 \pm 9.6
Diastolic diameter (mm)	52.7 \pm 8.5
Posterior wall (mm)	11.6 \pm 2.4
Septal thickness (mm)	12.2 \pm 2.7
Ventricular mass (g)	193.8 \pm 85.3
Mean LV-AO gradient (mmHg)	51.4 \pm 15.9

As for the surgical procedure, 201 (87.4%) underwent valve replacement, and the remaining 29 (12.6%) underwent valvuloplasty. All 201 patients undergoing valve replacement received implanted bioprostheses. In 91 patients (39.6%), the surgery was associated with other procedures, and in 61 patients (26.52%), the surgery was associated with coronary artery bypass grafting (Table 3). The mean cardiopulmonary bypass time was 84.1 ± 30.1 minutes and the myocardial ischemia time was 62.8 ± 22.1 minutes.

Of all patients (n = 230), 13.9% (32 cases, 95%: 9,3-18,5%) died in the post-operative hospital stay, with a rate of 9.4% (n = 13) among patients undergoing isolated aortic valve surgery (n = 139), and 20.9% (n = 19) among those who underwent another associated procedure, with a statistically significant difference (p = 0.023). Risk factors for hospital mortality are shown in Table 4. All other factors analyzed that are missing in the table were not significant for the bivariate analysis.

At least one of the postoperative complications analyzed

were present in 69 patients (30.0%, 95% CI: 24.0-36.0%). In those who underwent isolated aortic valve surgery, the complication rate was 25.2% (n = 35), with no significant difference (p = 0.068) when compared to the group that underwent an associated procedure, in which the rate of complications was 37.4% (n = 34). Table 5 shows the frequency of the postoperative complications analyzed, and it is noteworthy that low cardiac output was the most frequent complication, occurring in 20.0% of patients (n = 46). Risk factors for postoperative morbidity were atrial fibrillation; COPD; and cardiopulmonary bypass time over 120 minutes (Table 6); there was no observed statistical significance in other variables.

Discussion

Cardiovascular diseases are the leading cause of death

Table 3 - Associated surgical procedures performed

Associated procedure	Frequency	%
Associated CABG	61	26.52
Mitral valve	8	3.47
CABG + other ¹	6	2.60
CABG + mitral valve	3	1.30
CABG + mitral + other ²	1	0.43
Other procedures	12	5.21

¹ - left ventricular aneurysmectomy (2 cases), carotid endarterectomy (2 cases), correction of aneurysms of the ascending aorta (2 cases). ² - carotid endarterectomy.

Table 5 - Frequency of postoperative complications

Variable	Frequency	%
Low cardiac output	46	20.0
Renal dysfunction	22	9.6
Prolonged ventilatory support	18	7.8
Sepsis	13	5.7
Reintervention for bleeding	9	3.9
Use of intra-aortic balloon	8	3.5
Stroke	7	3.0
Wound infection	6	2.6
Lower limb infection	3	1.3

Table 4 - Risk factors for hospital mortality: Relationship between the observed mortality and the variables

Variable	Frequency	Mortality	RR (CI 95%)	P	
Low cardiac output	Yes	46	50.0%	10.1 (5.02-20.3)	<0.001
	No	182	4.9%		
Sepsis	Yes	13	69.2%	6.77 (3.96-11.6)	<0.001
	No	215	10.2%		
Need for intra-aortic balloon	Yes	8	75.0%	6.6 (3.83-11.4)	<0.001
	No	220	11.4%		
Postoperative renal dysfunction	Yes	22	54.5%	6.21 (3.47-11.1)	<0.001
	No	205	8.8%		
Lower limb wound infection	Yes	3	66.7%	5.17 (2.17-12.3)	0.049
	No	225	12.9%		
Reintervention for bleeding	Yes	9	55.6%	4.68 (2.36-9.3)	0.003
	No	219	11.9%		
Chest wound infection	Yes	6	50.0%	3.96 (1.66-9.48)	0.034
	No	222	12.6%		
Associated procedure	Yes	91	20.9%	2.23 (1.16-4.29)	0.023
	No	139	9.4%		

Table 6 - Risk factors for morbidity

Variable	Frequency		Morbidity	RR (95%)	P
CPB time > 120 min	Yes	24	54.2%	1.96 (1.27-3.03)	0.015
	No	192	27.6%		
COPD	Yes	30	50.0%	1.93 (1.25-2.97)	0.013
	No	193	25.9%		
Atrial fibrillation	Yes	41	46.3%	1.74 (1.16-2.61)	0.021
	No	188	26.6%		

in elderly individuals¹. Since aortic stenosis is a prevalent condition among the elderly, the increased life expectancy of the population is leading to an increased need for surgical interventions on the aortic valve in this age group.

The prognosis of severe aortic stenosis, especially when symptomatic, is very reserved. Patients who present severe aortic stenosis associated with syncope or angina have a three-year overlife of about 90.0%. When heart failure supervenes, the two-year survival is 10.0%⁷.

Hospital mortality for aortic valve surgery in the elderly has been declining over the past decades, probably due to better myocardial protection, anesthesia and postoperative care techniques⁸, which encourage the performance of this procedure in elderly patients⁹. Currently, hospital mortality of isolated aortic valve replacement in the elderly ranges from 2.0-10.0%^{3,10-19}. Recently, Kolhe et al¹⁵ described a hospital mortality of 9.0% in 162 octogenarians who underwent isolated aortic valve replacement, a figure similar to those found in the series of Chiappini et al¹² (8.5%) and Collart et al¹⁴ (8.8%).

The mortality found in our study for isolated aortic valve surgery was 9.4%, indicating that the procedure can be performed with an acceptable mortality rate. The association of aortic valve surgery with another surgical procedure resulted in an increase of the mortality rate to 20.9%, statistically significant difference ($p = 0.023$).

Among the surgical procedures associated with aortic valve surgery, the most frequent one was coronary artery bypass surgery (61 cases, 26.52% of procedures). In previous studies conducted by Kolhe et al¹⁵ and Langanay et al²⁰, the mortality rates for the combination of aortic valve replacement surgery and coronary artery bypass surgery were 24.0% and 18.0%, respectively. In our series, of 61 patients who underwent aortic valve surgery associated with CABG, 12 (19.67%) died. This result is similar to those described above.

The association of coronary artery bypass surgery with aortic valve surgery is not related to increased mortality in younger patients, and therefore not considered a contraindication. However, in the elderly, there is a significant increase in mortality. Some authors¹⁵ have suggested that only severe coronary lesions (greater than 80.0%) should be considered for revascularization. This approach could, however, facilitate the occurrence of ischemic episodes during the immediate postoperative period, increasing morbidity and mortality. Another interesting option for these patients is the performance

of a pre-operative percutaneous coronary revascularization, that present risks somewhat lower when compared to surgical revascularization, but with lower long-term durability.

One explanation for the increase in mortality in the association of aortic valve surgery with CABG is that these are more severe cases, due to the presence of comorbidities and the association of aortic stenosis with coronary artery disease.

In univariate analysis, the predictors of hospital mortality were low cardiac output; sepsis; lower limb wound infection; chest wound infection; need to use an intra-aortic balloon; renal dysfunction after surgery; reintervention for bleeding; and association of aortic valve surgery with other surgery procedure. The association of postoperative renal dysfunction and an increase in hospital mortality was observed in the series of Melby et al¹⁹, Urso et al²¹ and Calvo et al²² as well as in our series. Also in the series of Melby et al¹⁹, the use of intra-aortic balloon was a predictor of mortality. The increase in mortality associated with the use of an intra-aortic balloon can certainly be explained by the greater ventricular dysfunction in patients using this device. In a study by Alves Júnior et al²³ a higher probability of postoperative bleeding was observed in elderly patients undergoing cardiac surgery. In the series of Calvo et al²² as well as in ours, reoperation for bleeding was identified as a predictor of hospital mortality.

The rate of postoperative complications observed in this series was 30.0%. This value is lower than those reported by Collart et al¹⁴ and by Kolhe et al¹⁵ (63.0% and 60.0%, respectively). Despite a tendency towards an increased morbidity in the association of valve replacement surgery with another surgical procedure, there was no statistically significant difference in the rate of postoperative complications between the two groups (25.2% for isolated aortic valve surgery, and 37.4 % for associated procedure, $p = 0.068$). In univariate analysis, the variables associated with the increased postoperative morbidity were duration of CPB exceeding 120 minutes; chronic obstructive pulmonary disease; and atrial fibrillation.

Conclusions

In conclusion, valve replacement surgery can be performed with an acceptable morbidity and mortality rates in patients over 75 years.

Given the above, the elderly may be considered as good candidates for aortic valve surgery, and this should be offered whenever the criteria for surgical indication are met.

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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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