Moderate Aortic Stenosis in Coronary Artery Bypass Grafting Patients More Than 70 Years of Age: To Replace or Not to Replace?

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Background. **Moderate aortic stenosis in coronary artery bypass graft surgery (CABG) patients more than 70 years old is not unusual. The risk-benefit of performing a concomitant aortic valve replacement (AVR) is often difficult to assess. To stratify the risk-benefit ratio, we reviewed outcomes of CABG patients more than 70 years old with preoperative moderate aortic stenosis (valve area 1.0 to 1.6 cm^2 or indexed valve area 0.6 to 1.0 cm^2/m^2).**

Methods. **Among 263 CABG patients more than 70 years old with moderate aortic stenosis, 167 patients underwent only CABG and 96 had CABG+AVR.**

Results. **Cross-clamp time ($p < 0.0001$) and perioperative transient ischemic attack–cerebrovascular accident ($p < 0.04$) were significantly higher in the CABG+AVR group. In-hospital mortality was comparable among groups (CABG 6.0% versus CABG+AVR 4.2%; $p = 0.8$). At a mean follow-up of 4.5 ± 3.0 years, 5-year survival (CABG 64.2% ± 4.3% versus CABG+AVR 62.3% ± 5.5%) and freedom from AVR (CABG 97.8% ± 1.2% versus CABG+AVR 98.9% ± 1.1%; $p = 0.13$) were comparable among both groups. Among patients treated with CABG alone, receiver operating characteristic curve analysis identified 26 mm Hg and 15 mm Hg as maximum and mean aortic valve gradients, respectively, for increased risk of reoperation for late AVR. Multivariate analyses for predictors of operative mortality were preoperative renal failure (odds ratio [OR] 7.64, $p < 0.001$) and intubation more than 48 hours (OR 11.10, $p < 0.0002$); for late death, ejection fraction less than 40% (OR 3.35, $p < 0.02$), New York Heart Association functional class III or IV (OR 2.37, $p < 0.002$), chronic obstructive pulmonary disease (OR 2.26, $p < 0.02$), and renal failure (OR 3.03, $p < 0.003$); for perioperative transient ischemic attack–cerebrovascular accident, cross-clamp time (OR 1.02, $p < 0.02$) and Parsonnet score (OR 1.09, $p < 0.05$).**

Conclusions. **For CABG patients more than 70 years old with minimal comorbidities especially in the presence of aortic gradients of 26/15 mm Hg or greater, concomitant AVR for moderate aortic stenosis should be performed during CABG and may be performed with minimal additional operative risk. Patients with significant comorbidities should be managed with CABG alone, owing to an increased perioperative risk, poor midterm survival, and minimal risk of AVR at 5 years.**

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With the aging population, incidental aortic valve disease among patients undergoing coronary artery bypass graft surgery (CABG) is common. While it is widely accepted that severe aortic stenosis should be managed with concomitant aortic valve replacement (AVR), treatment of moderate aortic stenosis remains controversial [1, 2]. The controversy to perform or not perform a concomitant AVR for moderate aortic stenosis in a CABG setting is raised by the difficulty in assessing the rate of progression of the aortic stenosis and whether the patient will outlive the natural progression of the aortic stenosis. This decision-making process is especially difficult for elderly patients.

Concomitant AVR avoids the risk of long-term reoperation for progressive native aortic valve stenosis. However, the patient may be exposed to additional perioperative risks and long-term prosthesis-related complications. Conversely, performing only CABG may expose the patient to a higher risk of late reoperation for AVR. Reoperative AVR after CABG has been reported with acceptable results but still remains a challenging procedure, especially in the elderly [3, 4].

Establishment of risk factors of perioperative mortality and midterm survival may allow to better stratify the decision whether to replace the aortic valve in elderly patients who present for CABG with moderate aortic stenosis. To investigate this issue, we herein reviewed our institutional experience with elderly patients who have moderate aortic stenosis and are undergoing CABG.

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Patients and Methods

Patient Cohort Selection

Study approval was obtained from the review boards of the Institut Universitaire de Cardiologie et de Pneumologie de Québec, Québec, Canada. Patients more than 70 years old undergoing CABG and presenting with a moderate aortic stenosis (defined as aortic valve area 1.0 to 1.6 cm^2 or an indexed valve area 0.6 to 1.0 cm^2/m^2) were identified between 1995 and 2009 within the databank of the Division of Cardiac Surgery, Institut Universitaire de Cardiologie et de Pneumologie de Québec. Data were collected prospectively. No concomitant procedure was included. Decision to replace the aortic valve was based on the surgeon's evaluation at the time of the surgery. Operative techniques were conducted according to the current surgical practices and were standard among surgeons.

Variable Definitions and Follow-Up

Preoperative renal failure was defined as baseline creatinine greater than 150 μmol/L; chronic obstructive pulmonary disease (COPD) by forced expiratory volume of air in 1 second (FEV_1) of less than 75% of the predicted value, or by daily use of a bronchodilator.

Postoperative transient ischemic attack–cerebrovascular accident (TIA-CVA) was diagnosed by the presence of a new focal deficit on neurologic examination as either transient or permanent with or without a new lesion on brain computed tomography; postoperative renal failure was diagnosed by a creatinine increase of 50 μmol/L from baseline value. All patients were followed yearly in a dedicated valve clinic either through a clinic visit or by phone contact. Survival was validated by interrogating the Quebec Provincial Death Registry.

Statistical Analysis

Qualitative data are presented as percentages and quantitative data as mean ± SD. Differences between CABG and AVR+CABG in proportions were tested with the χ^2 test or Fisher's exact test, and continuous variables were compared using Student's *t* test.

The logistic regression analysis was performed to predict death and CVA. Variables with a probability value of less than 0.20 were candidates for the multivariate regression model building. The selection variables were performed using the forward and backward statistical approaches. The selection variable with interaction terms was performed using a forward approach. The survival function was obtained from the Nelson-Aalen estimator of the cumulative hazard rate. The Cox regression model was used to predict the distribution of the time of death from the following variables: Parsonnet score, ejection fraction less than 40%, New York Heart Association (NYHA) functional class, preoperative and postoperative CVA, COPD, preoperative and postoperative renal failure, peripheral vascular disease, reoperation for bleeding, preoperative atrial fibrillation, intubation longer than 48 hours, and septicemia. Variables with a probability value less than 0.20 were candidates for the multivariate Cox regression model building. Martingale's residuals were used to examine the functional form of continuous variables and to conclude that all variables needed no transformation. The graphic representation of the logarithm cumulative hazard rates versus time was used first to assess the proportionality, whereas continuous variables were stratified into four to eight disjoint strata. Second, an artificially time-dependent covariate was added to the model to test the proportionality assumption. The results were considered significant with *p* values less than 0.05. The data were analyzed using the statistical package program SAS version 9.2 (SAS Institute, Cary, NC).

Results

Patient Characteristics

Among 263 patients more than 70 years old operated on for CABG with moderate aortic stenosis since 1995, 167 patients underwent only CABG whereas 96 had a concomitant AVR performed. Groups were comparable for major preoperative variables (Table 1), although higher maximal aortic valve gradients and lower indexed valve area were documented in the CABG+AVR group. Number of distal grafts were significantly higher in the CABG group (CABG 3.4 ± 0.9, CABG+AVR 3.0 ± 1.2; $p < 0.01$). Perioperative outcomes are outlined in Table 2. Cardiopulmonary bypass and cross-clamp times were significantly longer in the CABG+AVR group. Transient ischemic attack-CVA ($p < 0.04$) and postoperative renal failure ($p < 0.03$) were more frequently encountered in the CABG+AVR group as was mediastinitis ($p < 0.03$) and reoperation for bleeding ($p < 0.04$).

Table 1. Patient Characteristics

Variables	CABG n = 167	CABG+AVR n = 96	*p* Value
Male	102 (61.1%)	69 (71.9%)	0.082
Redo	5 (3.0%)	4 (4.2%)	0.73
Peak gradient, mm Hg	20.6 ± 7.0	42.2 ± 14.7	<0.0001
Aortic valve area, cm^2	1.44 ± 0.24	1.15 ± 0.16	<0.0001
Indexed aortic valve area, cm^2/m^2	0.81 ± 0.13	0.65 ± 0.12	<0.0001
Ejection fraction ≥40%	150 (90.9%)	86 (92.5%)	0.82
Angina III or IV	98 (59.0%)	47 (49.0%)	0.12
NYHA class III or IV	71 (43.6%)	36 (37.9%)	0.43
Elective/urgent	165 (99.4%)	96 (100%)	1.0000
Previous CVA	24 (14.4%)	14 (14.6%)	1.0000
Diabetes mellitus	47 (28.1%)	28 (29.2%)	0.89
COPD	36 (21.6%)	17 (17.7%)	0.52
Hypertension	135 (80.8%)	74 (77.9%)	0.63
Renal failure	32 (19.2%)	14 (14.6%)	0.40
Peripheral vascular disease	47 (28.1%)	19 (19.8%)	0.14
Previous atrial fibrillation	21 (12.6%)	9 (9.4%)	0.55

AVR = aortic valve replacement; CABG = coronary artery bypass graft surgery; COPD = chronic obstructive pulmonary disease; CVA = cerebrovascular accident; NYHA = New York Heart Association.