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The impact of coronary artery disease on the quality of life of patients undergoing aortic valve replacement

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Abstract

Of 415 patients, 200 undergoing aortic valve replacement (AVR) and 215 undergoing AVR in combination with myocardial revascularization [coronary artery bypass grafting (CABG)], had complete preoperative health-related quality of life (HRQOL) data. From this group, 224 patients had a follow-up of one year. To assess HRQOL, the EuroQol instrument was used. The EQ-5D index score was calculated, based on separate scores from five health domains, to express the global health status of the patient. The EQ visual analogue scale (VAS) was used to describe patients' subjective HRQOL. At baseline, the EQ-5D showed no significant differences between the two groups. The EQ-VAS score, however, was statistically significantly lower in the AVR+CABG patients (P=0.031). At one year postoperatively, both groups showed a statistically significant increase in the EQ-VAS (P=0.001 and P=0.001, respectively) and the EQ-5D (P=0.001 and P=0.001, respectively). This increase, however, could only be ascertained for the domain 'pain/discomfort' (P=0.001) in the AVR group, and for 'mobility' (P=0.018), 'usual activities' (P=0.001), 'pain/discomfort' (P=0.001) and 'anxiety/depression' (P=0.001) in the AVR+CABG group. At baseline, coronary artery disease had a negative influence on the patients' HRQOL, especially on the EQ-VAS. Postoperatively, all patients experienced significantly better HRQOL. However, the patients undergoing combined surgery experienced more benefit from their operation.

Keywords: Aortic valve replacement; Coronary artery disease; EuroQol; Follow-up; Quality of life

1. Introduction

Improvements in survival and health-related quality of life (HRQOL) are the main goals of cardiac surgery [1, 2]. In patients undergoing aortic valve replacement (AVR), the combination with coronary artery disease (CAD) is known to negatively influence short- and long-term survival [3, 4]. Whether or not CAD influences HRQOL, however, preoperatively as well as postoperatively, is still questionable. This is important because, in several studies concerning HRQOL after valve surgery, patients with isolated or combined procedures were considered as one group [5, 6].

The aim of this study is to evaluate the influence of CAD on HRQOL in patients undergoing AVR. Additionally, if CAD appears to have no effect, both groups can continue to be combined in HRQOL evaluation after AVR surgery.

2. Patients and methods

2.1. Patients

With the aid of our database, the Coronary Surgery Database Radboud Hospital (CORRAD), we first identified 549 consecutive patients aged 55 years or older who underwent either an AVR or a combined aortic valve–coronary artery bypass operation (AVR+CABG) between October 2006 and August 2010. Of this initial group, 415 (76%) patients completed the preoperative HRQOL (the total group). Thirty-nine patients were in New York Heart Association (NYHA) class IV, 286 patients were in NYHA class III, and the other 90 patients were in NYHA class I or II.

Second, a subset of 239 patients was identified for the one-year follow-up (patients operated on before May 2009). (It must be noted that this subgroup was only determined by the date of operation and the resulting possibility of a one-year follow-up.) Hospital mortality was seven (2.9%) patients, and during the first year another eight (3.3%) patients died. Of the remaining 224 patients, 50 were lost to follow-up or had incomplete postoperative data. Therefore, pre- and postoperative data were available for 174 (78%) patients (the follow-up group).

The total group consisted of 215 (52%) AVR+CABG patients, and the follow-up group of 102 (59%) AVR+CABG patients. The EuroSCORE was used for risk stratification [7]. Table 1 presents the studied variables and their definitions.

2.2. Quality of life

For the evaluation of QOL, the EuroQol (EQ-5D) instrument was used [8]. This is a standardized generic instru-

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Table 1. Variables and definitions

Variables	Definitions
Age (years)	Years
BMI	Body mass index
Diabetes	Diet-controlled, oral therapy or insulin-dependent diabetes
Vascular disease	Peripheral, abdominal vascular pathology or operation
Neurological disease	Cerebrovascular accidents and/or transient ischemic attack
Renal disease	Renal failure (creatinine ≥200 μmol/l), preoperative dialysis
Pulmonary disease	Chronic obstructive pulmonary disease and/or history of previous lung disease
Preoperative myocardial infarction (Pre-MI)	History of myocardial infarction before the operation
Hospital mortality	All mortality during the postoperative hospital stay after cardiac surgery

ment to measure QOL, and its validity has been substantially corroborated. The EQ-5D consists of five domains of health (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), each of which is divided into three levels: no problems (1), some or moderate problems (2), and extreme problems (3). Based on the response to this classification, a single index value is estimated by applying a general population-based algorithm [9]. For example, state 21,312 leads to an EQ-5D index score of 0.54. Possible scores span a scale from –0.54 (state 33,333) to 1.0 (state 11,111), the latter representing perfect health. An EQ-5D index score of zero corresponds to a HRQOL state that is all but death.

In addition, patients scaled their health on a visual analogue scale (EQ-VAS) ranging from 0 to 100, with 0 as the worst possible health state and 100 as the best possible health state. Whereas the EQ-5D index can be regarded as a societal-based composite global HRQOL measure, the EQ-VAS is a direct global HRQOL assessment from the patient's perspective. In keeping with our previous work [10], we also evaluated the five domains of health separately by coding them from one (the best) to three (the worst) and by subsequently transposing these values to a metric scale.

2.3. Surgical technique

All patients were operated on using a standard cardiopulmonary bypass technique, aortic and right atrial (two-stage) cannulation, hypothermia (32–34 °C) and myocardial protection using crystalloid cardioplegia. For the patients undergoing only AVR, the mean time on extracorporeal circulation was 97±[standard deviation (S.D.)] 25 min (range 60–189) and the mean duration of aortic cross-clamping was 67±16 min (range 31–135 min). Of these patients, 176 (88%) received a biological and 24 (12%) a mechanical valve. For patients undergoing AVR+CABG, the mean time on extracorporeal circulation was 152±40 min (range 75–272 min) and the mean duration of aortic cross-clamping was 105±27 min (range 55–205 min). In this group, the mean number of grafts was 1.5±0.5 (range 1–2) with 2.5±1.4 (range 1–7) distal anastomoses. Of all patients undergoing AVR+CABG, 65% received at least one arterial graft. In the AVR+CABG group, 191 (89%) patients received a biological and 24 (11%) patients a mechanical valve.

2.4. Follow-up

The HRQOL data resulted from our yearly-organized follow-up, a written survey sent directly to the patients. Both the preoperative and follow-up registration of data were approved by the Local Ethical and Research Council. Participation was on a voluntary basis [11].

2.5. Statistical analysis

Characteristics of patients are presented as percentage for dichotomous variables, and as mean±S.D., and range for numerical variables. Differences in percentages were tested with the χ^2-test and numerical variables were tested with the *t*-test or Mann–Whitney *U*-test when appropriate. Student's *t*-tests were performed to examine the mean differences between pre- and postoperative HRQOL. Statistical significance was assumed at $P \leq 0.05$.

3. Results

The characteristics of the 415 patients in the total group are listed in Table 2. Analysis shows a significant difference in male:female ratio ($P=0.012$), as well as a significantly higher prevalence of diabetes ($P=0.040$), preoperative myocardial infarction (MI) ($P=0.001$) and renal failure ($P=0.010$), additive EuroSCORE ($P=0.011$) and logistic EuroSCORE ($P=0.007$) in the AVR+CABG group. The calculated EQ-5D index is not significantly different between the two groups, but the EQ-VAS score ($P=0.031$) is, being significantly lower for the AVR+CABG group. The calculated means of the EQ-5D and the patient distribution within the five domains show no differences between the two groups (Table 3).

The follow-up group of 174 patients – 72 AVR and 102 AVR+CABG – did not show any statistically significant difference in relation to the baseline characteristics, EQ-5D index and EQ-VAS if compared with the total group (data not shown). At one year postoperatively, however, the EQ-5D index and the EQ-VAS score showed a significant increase for both the AVR group ($P=0.001$ and $P=0.001$, respectively) and the AVR+CABG group ($P=0.001$ and $P=0.001$, respectively) (Table 4). Considering the five domains of the EuroHRQOL, the AVR group only showed significant improvements with regard to the item 'pain/discomfort' ($P=0.001$). In the AVR+CABG group, aspects of 'mobility' ($P=0.018$), 'usual activity' ($P=0.001$) and 'anxiety' (0.001), in addition to that of 'pain/discomfort' ($P=0.001$), achieve statistically significant better scores.

4. Discussion

This study evaluates the influence of combined CAD in patients undergoing AVR surgery on HRQOL before and at

Table 2. Baseline characteristics, EuroSCORE risk and health-related quality of life information for the total group

Variables	Patients n=415 (%)	AVR n=200 (%)	AVR+CABG n=215 (%)	AVR vs. AVR+CABG P-value
Age (years)	71.7±7.3 (55–88)	71.1±7.6 (55–88)	72.3±7.1 (55–87)	0.081
Sex (male)	260 (62.7)	113 (56.5)	147 (68.4)	0.012
Body mass index	27.7±4.6 (15.4–46.7)	27.9±4.7 (15.4–46.7)	27.5±4.5 (18.1–41.7)	0.358
Diabetes	95 (22.9)	37 (18.5)	58 (27.0)	0.040
Preoperative diuretics	112 (26.0)	47 (23.5)	65 (30.2)	0.123
Vascular disease	59 (14.2)	22 (11.0)	37 (17.2)	0.070
Neurological disease	26 (6.3)	8 (4.0)	18 (8.4)	0.066
Pulmonary disease	73 (17.6)	35 (17.5)	38 (17.7)	0.963
Renal failure	7 (1.7)	0 (0.0)	7 (3.3)	0.010
Pre-MI	50 (12.0)	11 (5.5)	39 (18.1)	0.001
Reoperation	16 (3.9)	12 (6.0)	4 (1.9)	0.029
Additive EuroSCORE	6.2±2.2 (2–16)	5.9±2.2 (2–16)	6.4±2.2 (2–13)	0.011
Logistic EuroSCORE	6.9±6.0 (1.51–69.1)	6.4±6.5 (1.51–69.1)	7.3±5.6 (1.51–38.4)	0.007
EQ-5D	0.72±0.26 (–0.13–1.00)	0.72±0.27 (0.0–1.00)	0.71±0.26 (–0.13–1.00)	0.479
EQ-VAS	62.9±19.3 (8–100)	64.8±20.0 (8–100)	61.1±18.5 (10–100)	0.031

AVR, Aortic valve replacement; AVR+CABG, combined aortic valve replacement and coronary artery bypass grafting; MI, myocardial infarction; VAS, visual analogue scale.

one year postoperatively. In the present study, only patients aged 55 or older were included. This age limit is of course arbitrary but was applied because, in the AVR group, most patients under 55 years of age are operated on for congenital aortic valve disease.

As other studies have shown [3, 12] that there is a higher percentage of women undergoing isolated AVR. A possible explanation is the lower prevalence of CAD among women [13], which is probably no different in patients with aortic valve disease. Another variable that reached a significant difference is the incidence of previous cardiac surgery. This corresponds with the studies of Kurlansky et al. [5] and Akins et al. [14]. It might be that these patients have often had prior CABG, yet the fact that they underwent an isolated AVR suggests that at that time there was no need for myocardial revascularization.

The significantly higher prevalence of diabetes, preoperative MI and renal failure highlights the combination of CAD and associated diseases. The fact that the additive and logistic EuroSCOREs are significantly higher in the AVR+CABG group can be explained by the significantly higher prevalence of renal failure, some recent MI, regis-

Table 3. The calculated means of the EQ-5D and the patient distribution within the five domains

Variables	Patients n=415 (%)	AVR n=200 (%)	AVR+CABG n=215 (%)	AVR vs. AVR+CABG P-value
Means±S.D. of the different domains				
Mobility	1.50±0.59	1.45±0.59	1.54±0.59	0.110
Self-care	1.10±0.36	1.10±0.38	1.10±0.36	0.942
Usual activities	1.37±0.57	1.32±0.53	1.42±0.60	0.068
Pain/discomfort	1.69±0.63	1.67±0.64	1.72±0.63	0.463
Anxiety/depression	1.46±0.57	1.48±0.58	1.44±0.57	0.504
Distribution of the patients in the different domains				
Mobility				0.105
1	228 (54.9)	120 (60.0)	108 (50.2)	
2	165 (39.8)	69 (34.5)	96 (44.7)	
3	22 (5.3)	11 (5.5)	11 (5.1)	
Self-care				0.830
1	381 (91.8)	184 (92.0)	197 (91.6)	
2	25 (6.0)	11 (5.5)	14 (6.5)	
3	9 (2.2)	5 (2.5)	4 (1.9)	
Usual activities				0.188
1	280 (67.5)	143 (71.5)	137 (63.7)	
2	115 (27.7)	50 (25.0)	65 (30.2)	
3	20 (4.8)	7 (3.5)	13 (6.0)	
Pain/discomfort				0.660
1	165 (39.8)	84 (42.0)	81 (37.7)	
2	210 (50.6)	97 (48.5)	113 (52.6)	
3	40 (9.6)	19 (9.5)	21 (9.8)	
Anxiety/depression				0.770
1	242 (58.3)	113 (56.5)	129 (60.0)	
2	155 (37.3)	78 (39.0)	77 (35.8)	
3	18 (4.3)	9 (4.5)	9 (4.2)	

AVR, Aortic valve replacement; AVR+CABG, combined aortic valve replacement and coronary artery bypass grafting; S.D., standard deviation.

Table 4. Difference between preoperative and postoperative (one-year) EQ-5D index, EQ visual analogue score (EQ-VAS) and the different domains of the patients undergoing isolated aortic valve replacement and combined aortic valve replacement and coronary artery bypass grafting

Variables	AVR				AVR+CABG			
	Preoperative	Postoperative (one year)	Mean difference	*P*-value	Preoperative	Postoperative (one year)	Mean difference	*P*-value
EQ-5D index	0.71±0.27	0.81±0.23	0.10±0.27	0.001	0.69±0.27	0.82±0.22	0.13±0.29	0.001
EQ-VAS	62.5±20.0	76.0±17.6	13.5±21.8	0.001	62.0±17.8	74.9±16.1	12.9±19.7	0.001
Mobility	1.54±0.60	1.43±0.62	–0.11±0.68	0.172	1.57±0.62	1.42±0.55	–0.15±0.62	0.018
Self-care	1.08±0.33	1.11±0.40	0.03±0.44	0.596	1.12±0.38	1.13±0.46	0.01±0.43	0.820
Usual activity	1.32±0.55	1.21±0.47	–0.11±0.68	0.172	1.44±0.62	1.23±0.47	–0.22±0.65	0.001
Pain/discomfort	1.72±0.66	1.42±0.52	–0.31±0.70	0.001	1.75±0.67	1.40±0.55	–0.35±0.70	0.001
Anxiety/depression	1.46±0.58	1.33±0.53	–0.13±0.63	0.095	1.47±0.58	1.26±0.51	–0.21±0.63	0.001

AVR, Aortic valve replacement; AVR+CABG, combined aortic valve replacement and coronary artery bypass grafting.

tered under MI, and the higher, although not significantly so, incidence of vascular and neurological disease, all risk variables of the EuroSCORE. The higher percentage of women, however, as well as the higher percentage of previous cardiac surgery in the AVR group, reduces the difference in calculated EuroSCORE.

Preoperatively, patients with significant CAD have a significantly lower EQ-VAS score, but the EQ-5D score is in the same region. The calculated means and the distribution of the five domains of the EuroHRQOL registration show no significant differences either. Possible angina as a symptom of coronary atherosclerosis has more influence on the patient's EQ-VAS.

At one year postoperatively, both groups show significant improvements for EQ-5D and EQ-VAS. This finding is in keeping with several other studies concerning AVR [6, 15]. For both groups, the increase in the EQ-5D is statistically significant. The mean score improvement in the AVR group is about 14% (from 0.71 to 0.81), and in the AVR+CABG group about 18% (from 0.69 to 0.82). This suggests that the increase in the EQ-5D is higher in the AVR+CABG group. Regarding the calculated means of the EQ-5D domains, it is clear that the AVR+CABG group has more benefits: four items improve significantly after the operation, compared with only one item in the AVR group. In both groups, there is a significant improvement for the domain 'pain/discomfort'. Only in the AVR+CABG group, however, is there a significant improvement, with a decrease in the mean for the domain anxiety/depression; patients with CAD are probably more concerned they will suffer a MI, and these patients feel more confident after CABG. The significant decrease for 'usual activities' and 'mobility' in the AVR+CABG probably has to do with the higher, although not significantly so, preoperative value for these domains. Which can be explained because of the CAD in these patients. Both groups show a statistically significant increase in the EQ-VAS. For the AVR group, it adds up to about 20% (from 62.5 to 76.0), and for the AVR+CABG group it is 21% (from 62.0 to 74.9).

Before drawing our conclusion, we must realize that the number of patients studied is small. Our total group, however, consists of 415 patients with a registered preoperative HRQOL. This is, to our knowledge, one of the largest groups with a documented preoperative HRQOL registration that has been published. Other work refers only to postoperatively registered HRQOL [5]. The study of Sedrakyan et al. is the only one of our references that compares preoperatively and postoperatively registered HRQOL, but their study group consists of only 220 patients [6]. Our follow-up group is smaller (174 patients) and follow-up is restricted to only one year, but again this is one of the rare studies with pre- and postoperative HRQOL information. Other remarks about the use of the EuroQol and the fact that we evaluate the five domains of health separately, transposing these values to a metric scale, and about the influence of comorbidity during follow-up, have already been discussed in our previous paper [10]. The fact that, in the total group (24%), as in the follow-up group (22%), patients could not be included because of a lack of QOL data has several reasons: participation was on a voluntary basis [15], but also, and this was certainly true in the follow-up group, we analysed only complete cases, so that subjects with missing values were excluded from analysis.

Despite these limitations, we conclude that, at baseline, CAD has a negative influence on the patient's HRQOL, especially the EQ-VAS (the patient's subjective perspective). Postoperatively, both groups experienced a better HRQOL. According to the HRQOL domains, however, patients who underwent AVR+CABG surgery experienced a more comprehensive improvement. Because CAD has a negative influence on the baseline HRQOL of the patients, and because patients who undergo combined surgery experience more benefit from the operation, it does not seem opportune to combine these two groups for the evaluation of HRQOL after AVR. In order to confirm our conclusions, however, further larger studies are necessary.

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