Isolated aortic valve replacement vs. aortic valve replacement with CABG in elderly patients

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Abstract

Introduction: With the advancing age of the population in the western world, more septuagenarians and octogenarians are becoming candidates for cardiac surgery. Age is associated with increased surgical complexity required, e.g. aortic valve replacement with coronary artery bypass grafting. The aim of the study was to evaluate clinical characteristics and outcomes of patients aged 70 years or older undergoing isolated aortic valve replacement vs. aortic valve replacement with CABG and to determine the predictors of adverse outcome.

Method: Between January 2001 and December 2005, 408 patients aged over 70 underwent aortic valve replacement (AVR) with and without coronary revascularisation (CABG). 157 patients (group A) had isolated AVR, 251 patients (group B) AVR+CABG.

Results: There were 82 (49%) females in group A and 77 (33%) in group B (p<0.001). Parsonnet score was higher in group B [24.24 (SD 5.8) vs. 20.3 (SD 5.9) (p<0.001)]. In group B cross-clamp time was longer [118.3 min (SD 30.3) vs. 74.3 min (SD 18.9) (p<0.001)]. Patients with AVR + CABG more frequently had stroke [13 (5.5%) vs. 0 (p<0.01)], had GI complications [26 (10.8%) vs. 9 (5.7%) (p<0.05)] and had blood transfusion [0.2 U pp (SD 0.4) vs. 2.5 (SD 3.9) U pp (p<0.001)]. 30-day mortality was higher in group B, 23 (9.1%) vs. 6 (3.8%) (p<0.05). Multivariable logistic regression identified redo [p=0.043 (95% CI 0.102-0.827)], AF [p=033 (95% CI 1.187-6.187)], urgent operation [p=0.025 (95% CI 0.012-0.738)], CPBT>100 min [p=0.027 (95% CI 1.008-1.124)] in group A and female gender [p=0.033 (95% CI 0.015-0.840)], poor EF [p=0.002 (95% CI 4.475-6.112)], intraoperative IABP [p=0.004 (95% CI 6.702-8.796)] and no. of grafts [p=0.042 (95% CI 1.029-4.596)] in group B as independent predictors of mortality.

Conclusions: Overall mortality in our series is comparable with data from other centres. Redo, preoperative AF, long CPBT and urgent referrals were independent risk factors of mortality in the AVR group. Female gender, poor EF, no. of grafts, long CPBT and intraoperative use of IABP were independent risk factors of mortality in the AVR+CABG group.

Key words: aortic valve replacement, septuagenarians, coronary artery bypass grafting.

Streszczenie

Wstęp: Wraz ze wzrostem średniej długości życia w krajach uprzemysłowionych coraz więcej osób w wieku 70 i 80 lat zgłaszanych jest do leczenia kardiochirurgicznego. Zaawansowany wiek wiąże się ze wzmożoną złożonością zabiegów, jak np. połączenia wymiany zastawki aortalnej z CABG. Celem niniejszej pracy jest ocena przebiegu okresu okołooperacyjnego u chorych powyżej 70. r.ż. poddanych izolowanej wymianie zastawki aortalnej oraz w połączeniu z pomostowaniem wieńcowym; dodatkowo oceniono występowanie czynników ryzyka.

Metodyka: Pomiędzy I 2001 a XII 2005 r. 408 pacjentów >70. r.ż. poddano wymianie zastawki w pozycji aortalnej (AVR) zarówno z CABG, jak i bez niego. 157 chorych (grupa A) przebyło izolowaną AVR, 251 chorych (grupa B) AVR+CABG.

Wyniki: W grupie A znalazły się 82 kobiety (49%), w grupie B 77 (33%) (p<0,001). Przedoperacyjny *Parsonnet score* był wyższy w grupie B 24,24 (SD 5,8) *vs* 20,3 (SD 5,9) (p<0,001). Również w grupie B dłuższy był czas zaklemowania aorty: 118,3 min (SD 30,3) *vs* 74,3 min (SD 18,9) (p<0,001). U pacjentów z AVR+CABG częściej pooperacyjnie wystąpił udar: 13 (5,5%) *vs* 0 (p<0,01) oraz powikłania ze strony jamy brzusznej: 26 (10,8%) *vs* 9 (5,7%; p<0,05), częściej również wymagali przetoczeń: 0,2 U pp (SD 0,4) *vs* 2,5 (SD 3,9) U pp (p<0,001). 30-dniowa śmiertelność była wyższa w grupie B: 23 (9,1%) *vs* 6 (3,8%) (p<0,05). Analiza wieloczynnikowa zidentyfikowała reoperację p=0,043 (95% CI 0,102–0,827), przedoperacyjne migotanie przedsionków p=033 (95% CI 1,187–6,187), pilne wskazanie do operacji p=0,025 (95% CI 0,012–0,738)], CPBT >100 min [p=0,027 (95% CI 1,008– 1,124)] w grupie A oraz płeć żeńską p=0,033 (95% CI 0,015–0,840), EF<30% p=0,002 (95% CI 4,475–6,112)], śródoperacyjne użycie IABP p=0,004 (95% CI 6,702–8,796) oraz ilość pomostów p=0,042 (95% CI 1,029–4,596)] w grupie B jako niezależne czynniki ryzyka zgonu okołooperacyjnego.

Wnioski: Śmiertelność w prezentowanej populacji jest porównywalna z innymi ośrodkami. Reoperacja, przedoperacyjne MP, długi czas krążenia pozaustrojowego oraz pilne wskazanie do operacji były niezależnymi czynnikami ryzyka zgonu w grupie z izolowaną wymianą zastawki aortanej. Płeć żeńska, EF <30% śródoperacyjne użycie IABP oraz liczba pomostów były niezależnymi czynnikami ryzyka zgonu u chorych w grupie AVR+CABG.

Słowa kluczowe: wymiana zastawki aortalnej, siedemdziesięciolatkowie, pomostowanie tętnic wieńcowych.

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Introduction

Over the last few decades a significant increase in the number of people aged over 70 years with good physical and mental health has been observed. Based on statistical data derived from population studies, further life expectancy increase can be expected [1–3].

With this ageing of the population and the greater use of non-invasive diagnostic techniques, particularly echocardiography, the diagnosis of aortic valve disease is becoming increasingly common [2, 4]. The decision between continued medical management and surgical intervention for aortic valve disease in elderly patients is becoming increasingly frequent as the population ages [5]. Moreover, advanced age with higher co-morbidities requires more complex surgery associated with increased risk of mortality and morbidity.

Recent reports reveal that cardiac operation for elderly individuals can improve mortality, morbidity and quality of life [2, 3, 5–15]. However, the outcomes remain not completely defined, especially for combined aortic valve procedure (AVR) with coronary artery bypass grafting (CABG) [15, 16].

After isolated CABG, aortic valve replacement is the second most common cardiac operation in the United Kingdom. In financial year 2003, a total of 3367 isolated AVR and 2292 combined AVR and CABG were performed in the UK [3].

The aim of this study was to evaluate clinical characteristics and outcomes of patients aged 70 years or older undergoing isolated aortic valve replacement vs. aortic valve replacement with CABG and to determine the predictors of adverse outcome.

Methods

Patient population

Between January 2001 and December 2005 in the University Hospital of Wales in Cardiff 408 patients aged over 70 underwent aortic valve replacement with and without coronary revascularisation. 157 patients (group A) had isolated AVR, 251 patients (group B) AVR+CABG. Preoperative and operative information together with postoperative events were prospectively entered and stored in computerized database PATS (Patient Analysis & Tracking System – Dendrite Clinical).

All procedures were done with cardiopulmonary bypass with mild systemic hypothermia (30 to 34°C). The procedures were performed with either a standard or partial median sternotomy. The selection of myocardial protection and valve prosthesis type was at the discretion of the operating surgeon. However, there has been a strong preference for biological valves in this age group. CABG was performed for recognized indications.

Statistical analysis

Normally distributed continuous data are expressed as mean ± standard deviation throughout. Categorical data are expressed as counts and proportions. Unrelated two-group univariate comparisons were performed with paired and independent, two-tailed *t* tests for means of normally distributed continuous variables The χ^2 or Fisher exact univariate tests were used to analyse differences in proportions in the categorical data. Factors found to trend towards significance by univariate testing ($p<0.10$) were entered into a multivariate analysis. Binary logistic regression analysis of predictor variables for 30-day mortality was performed with estimate odds ratios (ORs) and 95% confidence intervals (CIs) for each of the independent variables in the model displayed. Data acquisition was performed using Microsoft Excel version 2003 (Microsoft Corporation, USA). Data analysis was performed using SPSS 11.5 statistical software package (SPSS Inc. Chicago, IL, USA). All values of $p<0.05$ were considered to be statistically significant.

Results

There were no significant changes in the number of performed operations in both groups in different years – Figure 1. Baseline preoperative characteristics of both groups are presented in Table I. There was no difference in standard EuroSCORE, 7.7 (SD 2.4) in group A vs. 8.1 (SD 2.5) in group B, or logistic EuroSCORE, 11.2 (SD 11.4) vs. 12.0 (SD 11.7) (ns). However, Parsonnet score was higher in group B (AVR+CABG), 20.3 (SD 5.9) vs. 24.24 (SD 5.8) ($p<0.001$). The most common indication for surgery was mixed aortic stenosis and regurgitation in group A, 77 (49.0%) vs. 45 (17.9%) ($p<0.001$), and aortic stenosis in group B, 71 (45.2%) vs. 194 (77.3%) ($p<0.001$).

The mean cardiopulmonary bypass time (CPBT) was longer in group B, 99.0 min (SD 33.9) vs. 159.6 min (SD 48.6) ($p<0.001$). Also cross-clamp time (CCT) was longer in the AVR + CABG group, 74.3 min (SD 18.9) vs. 118.3 min (SD 30.3) ($p<0.001$). In both groups mainly tissue valves were used, 107 (68.2%) vs. 212 (84.5%) ($p<0.001$). The mean valve size was 22.5 (SD 2.2) in group A vs. 22.9 (2.1) in group B ($p<0.05$).

Postoperatively, patients with AVR + CABG more frequently had stroke, 13 (5.5%) vs. 0 ($p<0.01$), gastrointestinal (GI) complications, 26 (10.8%) vs. 9 (5.7%) ($p<0.05$), and required blood transfusion, 0.2 U pp (SD 0.4) vs. 2.5 (SD 3.9) U pp ($p<0.001$) (Table II). 30-day mortality was higher in group B, 6 (3.8%) vs. 23 (9.1%) ($p<0.05$).

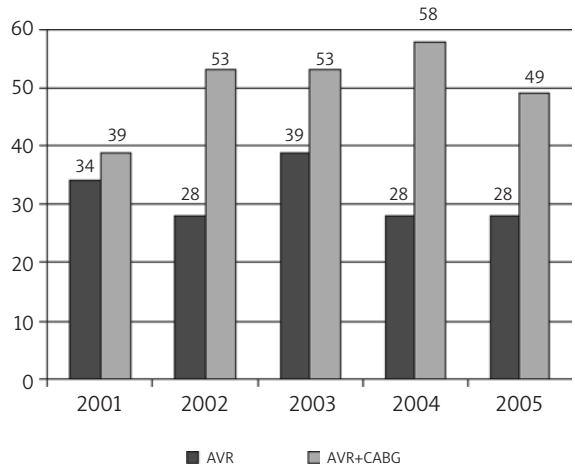

Fig. 1. Number of operations in different years

Tab. I. Baseline characteristics of both groups

	AVR (n=157) Mean/N (SD/%)	AVR+CABG (n=251) Mean/N (SD/%)	p
Female gender	82 (49%)	77 (32.7%)	0.001
Age	75.6 (4.1)	76.2 (4.2)	ns
Previous MI	10 (6.4%)	56 (22.3%)	0.001
Redo operation	16 (10.2%)	10 (4%)	0.01
COPD	17 (10.8%)	30 (11.9%)	ns
Previous stroke	17 (10.8%)	38 (15.1%)	ns
Renal insufficiency	10 (6.4%)	10 (3.9%)	ns
Diabetes mellitus	19 (12.1%)	47 (18.7%)	0.05
Peripheral vascular disease	11 (7.0%)	63 (25.1%)	0.001
Atrial fibrillation	26 (16.6%)	62 (24.7%)	0.05
Poor EF	18 (11.5%)	21 (8.4%)	ns
Preop. IABP	1 (0.6%)	3 (1.2%)	ns
Urgent op.	51 (32.5%)	111 (44.2%)	0.01

Tab. II. Perioperative complications

	AVR (n=157) Mean/N (SD/%)	AVR+CABG (n=251) Mean/N (SD/%)	p
Reopening	12 (7.6%)	29 (11.7%)	ns
Intra-/Postop. IABP	6 (3.8%)	11 (4.2%)	ns
New stroke	2 (1.3%)	13 (5.5%)	0.016
New haemofiltration	11 (7.0%)	29 (12.1)	0.05
GI complications	9 (5.7%)	26 (12.1%)	0.004
Infection	26 (16.6%)	67 (27.9%)	ns
Pulmonary complications	25 (15.9%)	46 (19.0%)	ns
Blood transfusion on ITU	0.2 U pp (0.4)	2.5 U pp (3.9)	0.001
Post op. stay	15.6 (13.3)	17.9 (16.5)	ns

Tab. III. Multivariable logistic regression analysis

AVR group				
	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
			Lower	Upper
Redo	.043	.202	.102	.827
AF	.033	4.791	1.187	6.187
Urgent op.	.025	.093	.012	.738
CPBT>100	.027	1.061	1.008	1.124
AVR + CABG group				
	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
			Lower	Upper
Female	.033	.112	.015	.840
Poor EF	.002	5.636	4.475	6.112
no. grafts	.042	2.174	1.029	4.596
IABP intra	.004	7.465	6.702	8.796
CPBT>150	.009	.958	.927	.989

Multivariable logistic regression analysis identified redo operation [p =0.043 (95% CI 0.102-0.827)], atrial fibrillation (AF) [p=033 (95% CI 1.187-6.187)], urgent operation [p=0.025 (95% CI 0.012-0.738)], CPBT >100 min [p=0.027 (95% CI 1.008-1.124)] in group A (Table III) and female gender [p=0.033 (95% CI 0.015-0.840)], poor ejection fraction (EF <30%) [p=0.002 (95% CI 4.475-6.112)], intraoperative intra-aortic balloon pump (IABP) [p=0.004 (95% CI 6.702-8.796)] and number of grafts [p=0.042 (95% CI 1.029-4.596)] in group B as independent predictors of mortality (Table III).

Discussion

The elderly population continues to expand in western countries and acquired heart disease still will be a leading cause of death among them [1]. Because aortic valve disease remains a common problem in the elderly, increasing numbers of patients are presenting for surgical evaluation of symptomatic valve disease. The natural prognosis of symptomatic severe aortic stenosis is ominous: 90% of patients will die in 2–3 years [1, 17]. Surgical treatment improves survival and provides functional benefits over medical treatment independently of patient age [2, 18]. The number of patients aged over 70 years having valve surgery has been growing over the last decade [1–3]. However, in our study in five years time we did not manage to show an upward trend in the number of performed aortic valve procedures in the elderly population. Early reports of AVR in elderly patients showed high operative mortality rates; however, recent reports have shown mortality rates of 2±10% for isolated AVR [2, 5, 19–21]. The 30-day mortality presented in our series is comparable with other publications. This improvement in surgical outcome has been ascribed to advances in myocardial protection, anaesthesia and postoperative critical care [1].

Higher mortality and morbidity in the combined coronary artery bypass grafting with aortic valve replacement group was not predicted by either logistic or standard EuroSCORE, only by the Parsonnet system. However, only additive EuroSCORE did not over-predict mortality in this group; a similar observation was recently described in other studies.

In 1999, Bouma and colleagues [5, 22] analyzed the records of 205 consecutive patients aged 70 years or older with critical aortic stenoses who were treated either medically or surgically. AVR was performed in 94 patients, with a 30-day operative mortality of 2.2%. In these surgically treated patients, previous CABG, moderately impaired renal function (creatinine, 110 to 250 mol/L), age 80 years or older, and a history of myocardial infarction were associated with an increased risk of death. The 3-year survival was 80% in the surgical group and 49% in the medical group. These results demonstrated that good operative outcomes can be achieved in the elderly with critical aortic stenosis and confirmed the clear survival advantage of surgical intervention versus medical management alone in this elderly population.

In our observation multivariate logistic regression analysis showed that preoperative risk factors associated with operative mortality were redo operation, atrial fibrillation and urgent operation in the group with isolated AVR. In the group with AVR and CABG female gender and poor ejection fraction were independent predictors of mortality. During surgery long cross-clamp time, use of intra-aortic balloon pump and number of grafts, indicating more diffused disease, were harbingers of a poorer outcome.

Poor left ventricular function was also predictive of hospital death in other series, respectively from the Texas Heart Institute [1, 20], from the John Hopkins Hospital [1, 21] and from the Université Pierre et Marie Curie Paris [2]. Elayada et al. [1, 20] also found hypertension and concomitant surgical procedures to be associated with early mortality. Praschker et al. [2] described as risk factors mitral valve replacement, emergency surgery, preoperative low EF, prolonged CPB time, NYHA functional class, and combined procedures (CABG+AVR) for postoperative death. Also, other studies have demonstrated increased risk of mortality with the addition of coronary artery bypass grafting (CABG) to the procedure [5, 15, 16]. Galloway et al. [1, 23] showed emergency operation, isolated aortic regurgitation and previous cardiac operation to be predictive of operative mortality. In other reports, female sex has been an independent predictor of both early and late mortality in the elderly, both for isolated AVR [1, 24] and for AVR with CABG [1, 25]. In contrast Melby et al. reported in their study that patients over 80 years who underwent AVR with concomitant CABG fared better both in the perioperative period and in long-term survival [5].

In our study urgent procedure as a preoperative risk factor may suggest that elderly patients should be referred for operation as early as possible to prevent urgent operations or advanced stage disease.

Conventional practice suggests that revascularization should be performed at the time of aortic valve replacement if major coronary artery stenosis is present, regardless of the presence or absence of angina [1, 26]. Reports [1, 27, 28] in younger patient populations indicate that myocardial revascularization does not increase the operative mortality of valve replacement, and the functional result may be improved by relieving the symptoms of angina and providing improved myocardial protection. Our data may suggest that more complex surgery with longer cross-clamp time may increase risk of mortality and morbidity. However, a more important risk factor is probably concomitant coronary artery disease.

The incidence of postoperative complications such as stroke, GI complications, blood transfusion, or reoperation, was comparable with other reports [1, 19, 21].

Conclusions

In summary, AVR with or without CABG can be performed in patients 70 years or older with acceptable mortality and morbidity. In our population preoperative risk factors associated with early mortality in isolated AVR involve previous surgery, preoperative atrial fibrillation, longer CPBT and urgent referral, whereas female gender, poor EF and number of grafts were predictors of mortality in combined AVR and CABG. We believe older people with aortic valve disease should not be denied the benefits of surgery if they are reasonably good surgical candidates, are physiologically and mentally able to withstand the stress of surgery and have good motivation for an improved lifestyle.

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