

Performance of Bioprostheses and Mechanical Prostheses in Age Group 61-70 Years

Kriengchai Prasongsukarn, W. R. Eric Jamieson, Samuel V. Lichtenstein

University of British Columbia, Vancouver, Canada

Background and aim of the study: The performance of bioprostheses (BP) and mechanical prostheses (MP) from valve-related composites of complications and combined major thromboembolism and hemorrhage were considered in order to facilitate decision-making for the patient age group of 61-70 years.

Methods: The aortic valve replacement (AVR) population (BP, n = 619; MP, n = 303) was differentiated by age, concomitant coronary artery bypass, diabetes mellitus, chronic obstructive pulmonary disease (COPD) and preoperative renal failure. The mitral valve replacement (MVR) population (BP, n = 353; MP, n = 312) was differentiated by valve type, age, concomitant coronary artery bypass, ejection fraction, NYHA and preoperative renal failure.

Results: Actual freedom from reoperation for AVR was $92.1 \pm 1.5\%$ for BP and $98.7 \pm 6.6\%$ for MP, and for MVR was $74.5 \pm 2.6\%$ for BP and $93.8 \pm 2.2\%$ (12 years) for MP. Actual freedom from major thromboembolism and hemorrhage for AVR was $85.1 \pm 1.7\%$ for BP and $76.9 \pm 3.6\%$ for MP, and for MVR was

$82.7 \pm 2.4\%$ for BP and $76.7 \pm 3.8\%$ (12 years) for MP. Linearized rates were undifferentiated for major thromboembolism. The hemorrhage rate for AVR-BP was $0.55\%/pt-yr$ and for AVR-MP was $2.3\%/pt-yr$ ($p < 0.0001$); for MVR-BP, the rate was $0.69\%/pt-yr$ and for MVR-MP was $1.85\%/pt-yr$ ($p = 0.0011$). The only predictor of AVR reoperation was age, and predictors for MVR reoperation were prosthesis type and follow up NYHA class. Predictors of AVR major thromboembolism and hemorrhage were prosthesis type, age, diabetes mellitus and COPD. There were no predictors of MVR major thromboembolism and hemorrhage.

Conclusion: For the age group of 61-70 years, MP are recommended for MVR to protect from BP reoperation, whilst for AVR BP are recommended to protect from anticoagulant hemorrhage. Freedom from reoperation for AVR was undifferentiated for BP and MP at 12-15 years.

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There is lack of clarity of prosthesis choice, either bioprostheses or mechanical prostheses, for the age group of 61-70 years for both aortic and mitral valve replacement. The majority of patients in this age group will advance into the elderly age category, either greater than 70 years of age or equal to or greater than 75 years of age. The information on prostheses-type performance for the age category 61-70 years can only be extrapolated from a limited number of publications,

and primarily for bioprostheses (1-4). During recent decades, the life expectancy of populations in developed countries has extended, and consequently those patients undergoing valve replacement surgery in the 61- to 70-year decade of life are likely to experience valve-related complications as if they had surgery as an elderly member of society.

Since it is unclear which prosthesis-type - either mechanical or bioprosthetic - is most suitable for patients aged 61-70 years, the present authors evaluated their cumulative experience with mechanical prostheses and bioprostheses. For both aortic and mitral valve replacement, the following parameters were considered: patient survival, freedom from major thromboembolism and hemorrhage, and freedom from valve-related composites, in an attempt to provide recommendations for the 61-70-year age group. This was a retrospective study of a prospectively maintained cardiac valve database.

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Address for correspondence:
Dr. W. R. Eric Jamieson, 486 Burrard Bldg., St. Paul's Hospital, 1081 Burrard Street, Vancouver, Canada V6Z 1Y6
Tel: (604) 806-8383
Fax: (604) 806-8384
e-mail: wrej@interchange.ubc.ca

Table I: Details of the patient population.

Parameter	AVR-BP	AVR-MP	MVR-BP	MVR-MP
Patients (n)	619	303	353	312
Age (years)*,†	67.1 ± 2.7	65.9 ± 2.9	66.5 ± 3.0	66.2 ± 2.8
Gender**				
Male	403 (65.1)	193 (63.7)	150 (42.5)	159 (51.0)
Female	216 (34.9)	110 (36.3)	203 (57.5)	153 (49.0)
Procedures (n)	665	308	426	322
Con-CAB***	250 (40.3)	102 (33.8)	175 (49.6)	178 (57.0)
Atrial fibrillation				
Preoperative	47 (7.6)	37 (12.2)	81 (22.9)	148 (47.4)
At follow up	72 (11.6)	30 (9.9)	52 (14.7)	70 (22.4)
Total follow up (years)	5,234.6	1,824.6	2,310.0	1,620.7
Mean follow up (years)+	8.5 ± 4.8	6.0 ± 3.0	6.5 ± 5.0	5.2 ± 3.1

Values in parentheses are percentages.

*Values are mean ± SEM.

*AVR: BP vs. MP, p < 0.0001

MVR: BP vs. MP, p = 0.169

**AVR: BP vs. MP, p = 0.729

MVR: BP vs. MP, p = 0.035

***AVR: BP vs. MP, p = 0.057

MVR: BP vs. MP, p = 0.194

BP: Bioprosthesis; Con-CAB: Concomitant coronary artery bypass; MP: Mechanical prosthesis.

Materials and methods

Patients who entered into the study had undergone initial cardiac surgery between 1982 and 1998. The prostheses used are currently marketed world-wide, namely: Carpentier-Edwards SAV, Carpentier-Edwards PERIMOUNT, Medtronic Mosaic bioprostheses; St. Jude Medical (Standard, HP and Regent) and CarboMedics (Standard and Top-Hat) mechanical prostheses. The closing interval of follow up was 2000 to 2001.

Between 1982 and 1998, a total of 1,587 patients aged 61-70 years underwent primary valve replacement at the authors' institution. Among these patients, 922 had aortic valve replacement (AVR) with either a bioprosthesis (BP) (n = 619) or a mechanical prosthesis (MP) (n

= 303), and 665 had mitral valve replacement (MVR) with either a BP (n = 353) or a MP (n = 312). The patient populations of AVR and MVR are detailed in Table I and Appendices I and II. Patients were censored, and excluded at 31 days after reoperation, when there was a change of prosthesis-type (for AVR, six BP and one MP; for MVR, 31 BP and three MP). The statistical analysis was performed on 649 AVR-BP and 307 AVR-MP, and 390 MVR-BP and 316 MVR-MP. The purpose of the censoring was to exclude those patients who had a change of prosthesis-type from being included in both groups of the study, to enable an evaluation of patient survival for prosthesis types.

Statistical analysis

Patient survival and freedom from valve-related

Table II: Mortality and valve-related complications for aortic valve replacement (AVR).

Variable	AVR-BP	AVR-MP	p-value
Early mortality*	3.4 (21/619)	1.7 (5/303)	0.197
Valve-related	0	0	
Late mortality**	5.50 (288/619)	4.06 (74/303)	0.016
Valve-related	0.97 (51/288)	0.99 (18/74)	0.964
Overall mortality**	5.90 (309/619)	4.33 (79/303)	0.011
Valve-related	0.97 (51/309)	0.99 (18/79)	0.964
Major TE + thrombosis**	1.17 (61)	1.37 (25)	0.500
Mortality	0.34 (18)	0.16 (3)	0.198
Hemorrhage**	0.55 (29)	2.30 (42)	<0.001
Mortality	0.13 (7)	0.60 (11)	0.002

*% (early mortality).

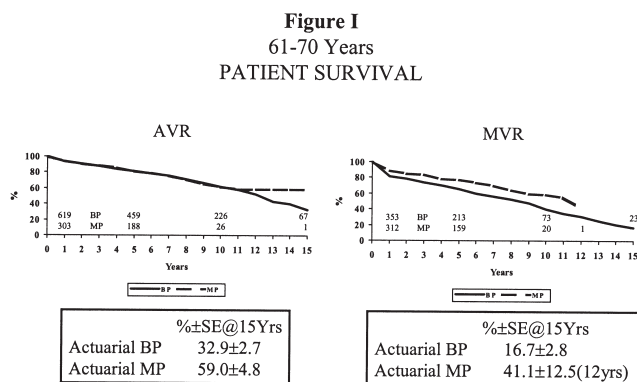
**%/patient-year (linearized occurrence rate).

BP: Bioprosthesis; MP: Mechanical prosthesis; TE: Thromboembolism.

complications were determined by Kaplan-Meier actuarial analysis, and expressed as percentage of patients \pm SEM. The early mortality (30-day) was included in the survival analysis. Late mortality, as percent per patient-year (pt-yr) included mortality beyond 30 days, while overall mortality included early and late mortality combined. The differences were evaluated by log rank statistic. The freedom from valve-related complications and composites of complications were also evaluated by cumulative incidence or actual methodology using modified Kaplan-Meier analysis. The comparison of continuous and categorical variables was evaluated using standard methodology. The testing of two proportions for early mortality was evaluated by the z-test for two-tailed probabilities. The evaluation of performance of prostheses by linearized occurrence rates (%/pt-yr) had the linearized occurrence rates tested by log likelihood ratio statistic. The predictors of performance were evaluated, for AVR and MVR valve positions, by univariate and multivariate Cox proportional regression analysis. The variables considered were: valve type, gender, age, concomitant coronary artery bypass (CAB), valve size, ejection fraction, preoperative NYHA functional class, diabetes mellitus, chronic obstructive pulmonary disease (COPD), preoperative renal failure and follow up NYHA class.

Individual factors potentially predictive of survival and freedom from valve-related complications and composites of complications were initially analyzed with univariate analysis. To determine independent predictors of mortality and valve-related complications, all variables with a p-value <0.1 by univariate analysis were entered as covariates in the multivariate analysis by Cox stepwise logistic regression. A p-value <0.05 was considered to be statistically significant.

The definitions of valve-related complications for-



Actuarial AVR MP>BP p=0.8148(NS); MVR MP>BP p=0.0003

Figure 1: Patient survival after aortic valve replacement (AVR) and mitral valve replacement (MVR). BP: Bioprosthesis; MP: Mechanical prosthesis.

mulate the 'Guidelines for Reporting Morbidity and Mortality after Cardiac Valvular Operation' and were utilized in this study (5). Valve-related reoperation and valve-related mortality were defined as in the guidelines. The valve-related reoperation and valve-related mortality are inclusive of structural valve deterioration (SVD), non-structural dysfunction (NSD), prosthetic valve endocarditis (PVE) and thromboembolism and hemorrhage. Valve-related mortality is also inclusive of sudden, unexplained, unexpected deaths. Valve-related morbidity was defined as permanent neurological or functional impairment.

Results

Aortic valve replacement

The mortality (early, late and overall) and valve-related complications (major thromboembolism and

Table III: Mortality and valve-related complications for mitral valve replacement (MVR).

Variable	MVR-BP	MVR-MP	p-value
Early mortality*	12.2 (43/353)	5.8 (18/312)	0.006
Valve-related	2	0	
Late mortality**	8.18 (189/353)	4.57 (74/312)	0.00001
Valve-related	1.82 (42/189)	0.74 (12/74)	0.0032
Overall mortality**	10.04 (232/353)	5.68 (92/312)	0.000002
Valve-related	1.90 (44/232)	0.99 (16/92)	0.0186
Major TE + thrombosis**	1.90 (44)	1.67 (27)	0.582
Mortality	0.52 (12)	0.31 (5)	0.312
Hemorrhage**	0.69 (16)	1.85 (30)	0.00105
Mortality	0.17 (4)	0.37 (6)	0.2328

*% (early mortality).

**%/patient-year (linearized occurrence rate).

BP: Bioprosthesis; MP: Mechanical prosthesis; TE: Thromboembolism.

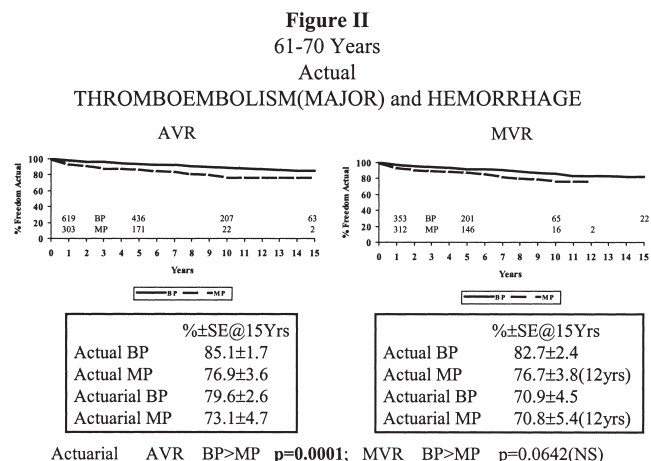


Figure 2: Freedom from thromboembolism (major) and hemorrhage (actual) after AVR and MVR. BP: Bioprosthesis; MP: Mechanical prosthesis.

thrombosis (TE) and hemorrhage (antithrombotic hemorrhage) for AVR are detailed in Table II.

The survival of the prosthetic valve groups for AVR are illustrated in Figure 1. The causes of death for AVR are presented in Table IV.

The freedom from major TE and hemorrhage for AVR is shown in Figure 2. The actuarial freedom for AVR-BP was 79.6 ± 2.6%, and for AVR-MP was 73.1 ± 4.7% at 15 years (p = 0.0001). The actual freedom for BP was 85.1 ± 1.7%, and for MP was 76.9 ± 3.6% at 15 years.

The freedom from reoperation for AVR at 15 years was not differentiated by actuarial analysis: 85.8 ± 3.0% for MP and 82.2 ± 15.0% for BP (p = 0.5029) (Fig. 3). The actual freedom, at 15 years, was 92.1 ± 1.5% for AVR-BP and 98.7 ± 6.6% for AVR-MP. The causes of reoper-

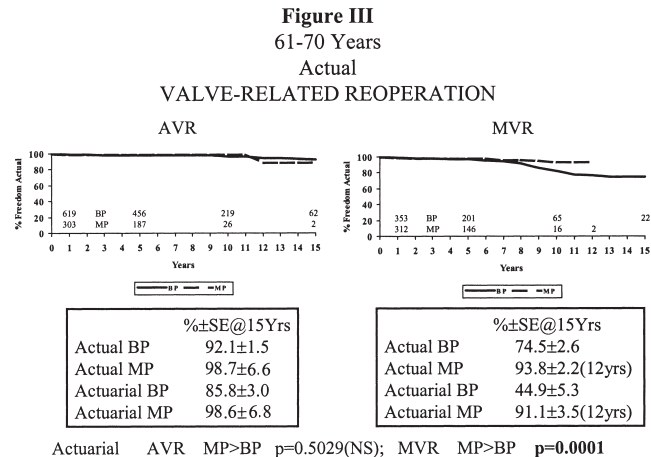


Figure 3: Freedom from valve-related reoperation (actual) after AVR and MVR. BP: Bioprosthesis; MP: Mechanical prosthesis.

ation for AVR are presented in Table IV. The actuarial and actual freedoms from valve-related mortality and valve-related morbidity for AVR are illustrated in Figures 4 and 5.

Mitral valve replacement

The mortality (early, late and overall) and valve-related complications (major thromboembolism and thrombosis (TE) and hemorrhage (antithrombotic hemorrhage) for MVR are detailed in Table III.

The survival of the prosthetic valve groups for MVR is illustrated in Figure 1. The overall survival at 15 years for MVR-BP was 16.7 ± 2.8% and for MVR-MP was 41.1 ± 12.5% (12 years) (p = 0.0003). The causes of death for MVR are detailed in Table IV.

The freedom from major TE and hemorrhage for

Table IV: Causes of mortality and valve-related reoperation for aortic valve replacement (AVR) and mitral valve replacement (MVR).

Cause	Mortality		Reoperation	
	AVR	MVR	AVR	MVR
Cardiac	140	156	-	-
Non-cardiac	179	106	-	-
Valve-related	69	62		
NSD	-	3	14	12
PVE	5	8	5	2
SVD	12	18	20	64
Thromboembolism	23	14	-	-
Hemorrhage	18	10	-	-
Thrombosis	-	3	2	5
Sudden unexpected	11	6	-	-
Total	388	324	41	83

NSD: Non-structural dysfunction; PVE: Prosthetic valve endocarditis; SVD: Structural valve deterioration.

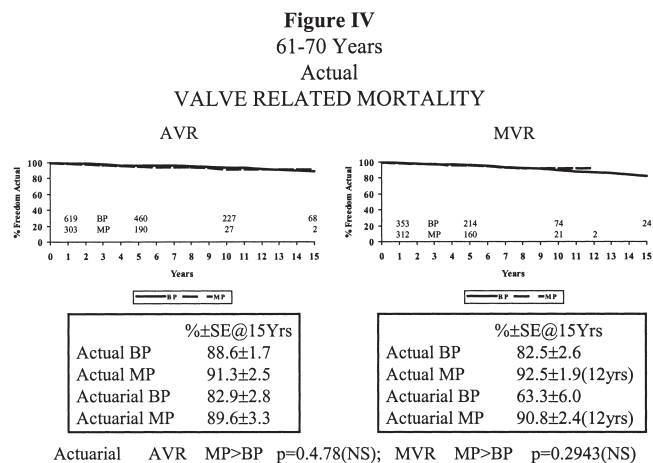


Figure 4: Freedom from valve-related mortality (actual) after AVR and MVR. BP: Bioprosthesis; MP: Mechanical prosthesis.

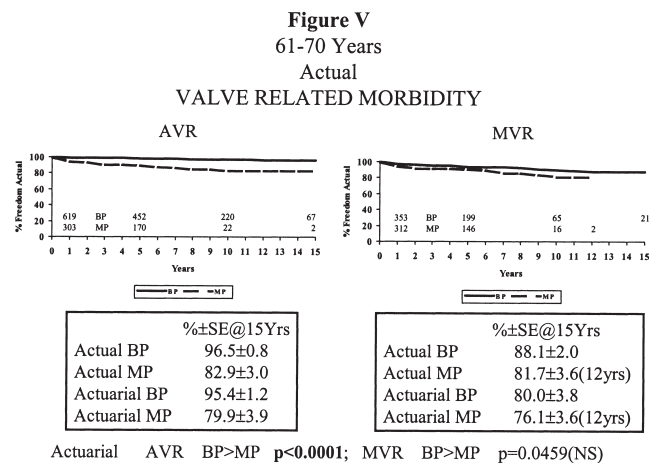


Figure 5: Freedom from valve-related morbidity (actual) after AVR and MVR. BP: Bioprosthesis; MP: Mechanical prosthesis.

MVR is shown in Figure 2. The actuarial freedom for MVR-BP was $70.9 \pm 4.5\%$ at 15 years and for MVR-MP was $70.8 \pm 5.4\%$ at 12 years ($p = 0.0642$). The actual freedom for BP was $82.7 \pm 2.4\%$ at 15 years and for MP was $76.7 \pm 3.8\%$ at 12 years.

The actuarial freedom from reoperation for MVR was $91.1 \pm 3.5\%$ at 12 years for MP and $44.9 \pm 5.3\%$ at 15 years for BP ($p = 0.0001$) (Fig. 3). The actual freedom, at 15 years, was $74.5 \pm 2.6\%$ for MVR-BP and, at 12 years, was $93.8 \pm 2.2\%$ for MVR-MP. The causes of

reoperation for MVR are presented in Table IV. The actuarial and actual freedoms from valve-related mortality and valve-related morbidity for MVR are illustrated in Figures 4 and 5.

Predictors of performance

The predictors of patient survival for AVR and MVR are detailed in Appendices I and II and Table V. The predictors of survival for AVR were age (hazard ratio (HR) 1.06), concomitant CAB (HR 1.32), COPD (HR

Table V: Predictors of overall survival for aortic valve replacement (AVR) and mitral valve replacement (MVR).

Variable	AVR	MVR
Type	-	1.44 1.099-1.89 p = 0.0082 MP>BP
Age	1.06 1.02-1.10 p = 0.0037	1.06 1.02-1.11 p = 0.0029
Concomitant CAB	1.32 1.07-1.63 p = 0.0099	1.45 1.13-1.85 p = 0.0031
Ejection fraction <35%	-	1.92 1.18-3.13 p = 0.0087
35-50%	-	1.48 1.02-2.15 p = 0.0388
NYHA class III/IV	-	1.94 1.19-3.17 p = 0.0082
COPD	2.29 1.38-3.80 p = 0.0014	-
Diabetes mellitus	2.3 1.28-4.20 p = 0.0054	-
Renal failure	2.17 1.36-3.47 p <0.0012	1.50 1.01-2.22 p = 0.0468

CAB: Coronary artery bypass; COPD: Chronic obstructive pulmonary disease.

Table VI: Multivariate predictors of thromboembolism and hemorrhage (TE+H) and composites of complications for aortic valve replacement (AVR).

Variable	AVR _{REOP}	AVR _{MORT}	AVR _{MORB}	TE+H
Type	-	-	7.8 4.2-14.6	2.6 1.7-3.9
	-	-	p <0.001 MP>BP	p <0.001 MP>BP
Age	0.9 0.8-1.0 p = 0.0095	-	1.1 1.0-1.2	1.1 1.0-1.2
Diabetes	-	5.6 1.5-20.7 p = 0.0100	-	4.5 1.6-12.5 p = 0.0218
COPD	-	4.8 1.7-13.9 p = 0.0040	4.7 1.0-22.3 p = 0.0490	4.0 1.2-9.8 p = 0.0028

BP: Bioprosthesis; COPD: Chronic obstructive pulmonary disease; MP: Mechanical prosthesis.

2.29), diabetes mellitus (HR 2.3) and preoperative renal failure (HR 2.17). The predictors of survival for MVR were valve type (MP>BP) (HR 1.44), age (HR 1.06), concomitant CAB (HR 1.45), ejection fraction <35% (HR 1.92) and 35-50% (HR 1.48), NYHA class III/IV (HR 1.94) and postoperative renal failure (HR 1.50).

The predictors of TE and composites of valve-related complications by multivariate analysis are detailed for AVR and MVR in Tables VI and VII. In AVR, valve type influenced valve-related morbidity and major TE and hemorrhage, while in MVR valve type only influenced valve-related reoperation.

Censored population

The methods section documents that 41 patients were censored, and excluded from the analysis at the time of 31 days after reoperation in the total cohort of the population aged 61-70 years. Of the 36 AVR-BP patients, 28 had another BP, six a MP, and two had a reoperation at a remote center. Of the five AVR-MP patients, four had a MP and one patient had a BP. Of the 73 MVR-BP patients, 32 had a BP, 31 had a MP, while five had a reparative procedure and five had a reoperation at a remote center. Of the 10 MVR-MP patients, four had a MP, three a BP, and three a reparative procedure.

Discussion

Traditionally, surgeons, cardiologists and patients weigh the risk of reoperation for the SVD of bioprostheses with the risk of anticoagulant-related complications that occur with mechanical prostheses. The increasing life expectancy of populations in developed countries over the past decades must be given full consideration, especially in choosing the prosthesis type for the age group 61-70 years. It is for this reason that the present authors chose to study their experience in the population of 61-70 years with aortic and mitral valve replacements. There has been no previous specific report comparing long-term follow up of bioprostheses or mechanical prostheses in this patient sub-group.

The authors have documented a limited review of the population in 61-to 70-year age group. In 1997, they reported SVD incorporating this age group (1). In 2001, Jamieson and colleagues (2) reported survival, at 15 years, with AVR of 33% for patients 61-70 years and an actual freedom from SVD of 84%. This compared to survival, at 15 years, of 14% and freedom from SVD of 97% for patients aged >70 years.

Jamieson, Burr and colleagues have reported on three occasions (1989, 1992 and 1995) from the University of British Columbia database on elderly valve experience incorporating the age group 65-69

Table VII: Multivariate predictors of thromboembolism and hemorrhage (TE+H) and composites of complications for mitral valve replacement (MVR).

Variable	MVR _{REOP}	MVR _{MORT}	MVR _{MORB}	TE+H
Type	2.9 1.4-6.1 p = 0.0050 BP>MP	-	-	-
Age	-	-	-	-
F-U NYHA class	2.5 1.5-4.0 p = 0.0002	-	-	-

BP: Bioprosthesis; F-U: Follow up; MP: Mechanical prosthesis.

years, which is part of the current reported population of 61-70 years (6-8). The actuarial freedom from SVD with the combined Carpentier-Edwards standard and SAV bioprostheses in the 65- to 69-year age group was 95% for aortic prostheses and 70% for mitral prostheses at 10 years (3).

This current review has identified that for AVR extending to 15 years, the actual freedom from major thromboembolism and hemorrhage was 85% for bioprostheses and 77% for mechanical prostheses, and for MVR was 83% at 15 years and 77% at 12 years, respectively. The actual freedom from valve-related reoperation was 92% for bioprostheses and 89% for mechanical prostheses with AVR, and 75% and 94% (at 12 years), respectively, for MVR. In 2000 Jamieson and colleagues (4) reported actual freedom from reoperation with bioprostheses for the age group 61-70 years, at 15 years, of 88% for AVR and 71% for MVR.

In 2000, Jamieson and co-investigators (9) reported on a comparison of bioprostheses and mechanical prostheses. The overall freedom from major thromboembolism, and major thromboembolism and hemorrhage was greater for bioprostheses than for mechanical prostheses, but the freedom from valve-related mortality and reoperation was not different. Advancing age was a contributing factor to overall mortality, valve-related mortality (aortic and mitral), major thromboembolism (aortic) and major thromboembolism and hemorrhage (aortic and mitral). Advancing age decreased reoperation in all positions. Coronary artery bypass increased overall mortality but not valve-related mortality, and it decreased reoperations in all positions. Overall mortality was not influenced by valve type (aortic and multiple) but decreased bioprostheses in the mitral position. Prosthesis type did not influence valve-related mortality in all positions. Mechanical prostheses decreased reoperation for AVR, but increased major thromboembolism with or without hemorrhage for the aortic and mitral positions.

The present study has evaluated AVR and MVR separately in the 61- to 70-year age group. Survival was not different between BP and MP for AVR, but was greater with MP than BP for MVR. Valve type was not a predictor for AVR, while age, concomitant CAB, COPD, diabetes mellitus and preoperative renal failure were predictors of survival for AVR. The predictors of survival for MVR were valve type, age, concomitant CAB, ventricular dysfunction, NYHA class and preoperative renal failure. It is clear that bioprostheses were favored in the patient cohort with co-morbidities which were anticipated to have reduced life expectancy, and influenced survival only for MVR, but not AVR. This is evident in AVR-BP, where 40% of the patients had concomitant CAB while only 34% of AVR-

MP patients had concomitant CAB. In the MVR group, where survival was influenced by valve type (MP>BP), 50% of BP and 57% of MP had concomitant CAB. Hanania et al. (10) have reported on a 15-year evaluation of BP and MP in the same age group of 61-70 years. Survival for AVR-BP and AVR-MP was 32% and 46%, respectively, and for MVR-BP and MVR-MP was 33% and 34%, respectively. However, the survival rates of the two studies were not completely comparable because of a lack of knowledge of the co-morbidities.

In AVR, valve type was not an influential factor of valve-related reoperation and valve-related mortality. Valve type (BP>MP) provided a greater freedom from valve-related morbidity and major thromboembolism and hemorrhage for AVR. On the other hand, for MVR, valve type (MP>BP) provided a greater freedom from valve-related reoperation. There were no influential factors of major thromboembolism and hemorrhage, nor of valve-related mortality and valve-related morbidity for MVR.

The present study affords the opportunity to consider how different prosthesis types will perform in elderly patients (whether considered as >70 or ≥ 75 years). There has been considerable documentation on the use of bioprostheses and mechanical prostheses in the elderly, but the definition of elderly is not standardized (6-8,11-18). Borkon et al. (11) reported that in AVR, hemorrhage is more prevalent with anticoagulants for patients aged >70 years with mechanical prostheses. These authors noted a greater freedom from valve-related complications with bioprostheses. Milano et al. (12) reported on elderly patients (aged ≥ 70 years) with BP and MP in AVR, and found that valve-related mortality did not influence overall mortality. These authors also indicated that the higher incidence of anticoagulant hemorrhage limited the use of mechanical prostheses in the elderly. Hanania and colleagues (10) found, in the pre-elderly 61- to 70-year group, thromboembolic rates three times higher with MVR than with AVR. Hemorrhage, on the other hand, was four-fold more frequent for MP than BP. Antunes (13), on the other hand, reported that MP performed well in the elderly. Davis et al. (14) evaluated performance in patients aged ≥ 70 years and found anticoagulation to be low risk; however, these authors expressed concern for a low but significant risk of SVD with bioprostheses, and consequently mechanical prostheses may be under-used in the elderly. Arom and colleagues (15) found anticoagulant hemorrhage in patients aged ≥ 70 years to be acceptable with MP, and recommended their use in selected groups of the elderly.

Several publications have provided more support for the use of bioprostheses in the elderly. Kobayashi et al. (16) studied elderly patients (aged ≥ 65 years), and reported more anticoagulant hemorrhage for both the

65- to 70-year and >70-year age groups. These authors identified SVD as a major problem in the 65- to 70-year age group, and suggested that bioprostheses should only be used in patients aged >70 years, though they did not differentiate valve position. Holper et al. (17) supported bioprosthesis use in the elderly because of a limited risk of SVD, while Logeais et al. (18) stated that, in order to avoid reoperation in the elderly with bioprostheses, the 10-year durability should be matched to life expectancy; that is, bioprostheses should be used after the age of 74 years in men and 78 years in women.

Study limitations

The main limitation of the present study was that consideration was not given to subdividing the 61- to 70-year age group to 61-65 years and 66-70 years. The study was also limited by an inadequate number of mechanical valve patients available for evaluation between 12 and 15 years.

In conclusion, the findings of the present study support the use of mechanical prostheses for MVR in patients aged 61-70 years, and bioprostheses for AVR because of the reduced risk of major thromboembolism and hemorrhage, with no increased risk of reoperation.

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Meeting discussion

DR. KENTON J. ZEHR (Rochester, MN, USA): Dr. Jamieson, as you know, coronary artery disease plays a significant role in our choices in this age group. Did you specifically look at how coronary artery disease was related to this series?

DR. W. R. ERIC JAMIESON (Vancouver, British Columbia, Canada): As you saw from the patient population data, the incidence of concomitant coronary artery bypass did not differ between the bioprosthesis and mechanical prosthesis groups. In the multivariate analysis that was one of the factors, but it did not emerge as a predictor when examining thromboembolism plus hemorrhage or reoperation. However, the incidents were similar and not significant between the utilization and bypass.

DR. J. MICHAEL HASENKAM (Aarhus, Denmark): The complication in terms of bleeding is more a side effect of the anticoagulation treatment. Do you have any recordings or data showing the quality of your anticoagulation treatment in these patients?

DR. JAMIESON: The only thing that we do is to obtain the INR rates of patients if they have an event, or the INR as close to the embolic event or hemorrhagic event as possible. We have not looked into serial recordings of INR over time.

DR. HASENKAM: I think that could improve the outcome and also the quality of the anticoagulation treatment.

DR. JAMIESON: I agree that if we could achieve a patient control anticoagulation, that this would improve treatment significantly.

DR. JOACHIM LAAS (Bad Bevensen, Germany): Why do patients with mechanical valve replacement in the mitral position do better than patients with biological valves? Is this related to the hemodynamics? Can you explain this difference?

DR. JAMIESON: Mechanical prostheses, certainly for patients aged less than 70 years, have always been recommended by our group, especially with regard to durability. The hemodynamic characteristics are probably better with some mechanical valves than with trileaflet biological valves in the mitral position.

Appendix I: Patient population variables and univariate predictors of mortality in aortic valve replacement (AVR).

Variable	Distribution by mortality	Hazard ratio	95% CI	p-value
Valve type				
BP	49.9% (309/619)	1.15	0.9-1.5	0.3130
MP	26.1% (79/303)			
Gender				
Male	45.0% (268/596)	1.09	0.8-1.4	0.4960
Female	36.8% (120/326)			
Age*				
Alive	66.4 ± 2.9 years (534)			
Dead	67.0 ± 2.7 years (388)	1.06	1.0-1.1	0.0037
Con-CAB				
No	38.4% (219/570)			
Yes	48.0% (169/352)	1.32	1.1-1.6	0.0099
Valve size*				
Alive	23.3 ± 2.4 mm (534)			
Dead	23.8 ± 2.5 mm (388)	1.02	1.0-1.1	0.3410
Ejection fraction				
<35%	48.3% (14/29)	0.91	0.5-1.7	0.7541
35-50%	43.3% (26/60)	1.01	0.7-1.6	0.9569
>50%	41.8% (348/833)			
Preop. NYHA class				
I/II	25.6% (54/211)			
III/IV	47.0% (334/711)	1.31	1.0-1.8	0.0743
Diabetes				
No	41.4% (46/111)			
Yes	36.4% (16/44)	2.30	1.3-4.2	0.0054
Unknown	42.5% (326/767)	1.50	1.0-2.2	0.0343
COPD				
Unknown	41.3% (368/890)			
Moderate/severe	62.5% (20/32)	2.29	1.4-3.8	0.0014
Rhythm				
Unknown/SR	41.6% (20/32)			
AF/Fl	45.2% (38/84)	1.23	0.5-3.0	0.6228
HB	50.0% (7/14)	1.24	0.5-3.0	0.6244
Renal failure (preop.)				
No	41.1% (362/881)			
Yes	63.4% (26/41)	2.17	1.4-3.5	0.0012
F/U NYHA class				
I/II	42.1% (368/874)	1.29	0.8-2.0	0.2679
III/IV	41.7% (20/48)			

*Values are mean ± SEM.

HB: Heart block; SR: Sinus rhythm. For other abbreviations, see Tables.

Appendix II: Patient population variables and univariate predictors of mortality in mitral valve replacement (MVR).

Variable	Distribution by mortality	Hazard ratio	95%CI	p-value
Valve type				
BP	65.7% (232/353)	1.44	1.1-1.9	0.0082
MP	29.5% (92/312)			
Gender				
Male	48.5% (150/309)	1.10	0.9-1.4	0.4613
Female	48.9% (174/356)			
Age*				
Alive	66.0 ± 2.8 years (341)			
Dead	66.7 ± 2.9 years (324)	1.06	1.0-1.1	0.0029
Con CAB				
No	40.3% (142/352)			
Yes	58.1% (182/313)	1.45	1.1-1.8	0.0031
Valve size*				
Alive	28.5 ± 2.3 mm (341)			
Dead	28.4 ± 2.4 mm (324)	0.97	0.9-1.0	0.2074
Ejection fraction				
<35%	66.7% (22/33)	1.92	1.2-3.1	0.0087
35-50%	62.9% (39/62)	1.48	1.0-2.1	0.0388
>50%	46.1% (263/570)			
Pre-op. NYHA class				
I/II	19.4% (18/93)			
III/IV	53.5% (306/572)	1.94	1.2-3.2	0.0082
Diabetes				
No	61.3% (49/80)			
Yes	62.2% (23/37)	1.19	0.7-2.0	0.5153
Unknown	46.0% (252/548)	0.94	0.7-1.3	0.6941
COPD				
Unknown	48.6% (312/642)			
Moderate/severe	52.2% (12/23)	1.22	0.6-2.3	0.5434
Rhythm				
Unknown/SR	51.6% (221/428)			
AF/Fl	42.8% (98/229)	1.20	0.5-3.0	0.6997
HB	62.5% (5/8)	1.17	0.5-3.0	0.7448
Renal failure (preop.)				
No	46.9% (284/605)			
Yes	66.7% (40/60)	1.50	1.0-2.2	0.0468
F/U NYHA class				
I/II	49.9% (297/595)	1.81	1.2-2.7	0.0044
III/IV	38.6% (27/70)			

*Values are mean ± SEM.

HB: Heart block; SR: Sinus rhythm. For other abbreviations, see Tables.