

Does Gender Affect the Outcomes of Multiple Valve Heart Surgery?

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ABSTRACT

Background: Multiple valve surgery exposes patients to major morbidity and mortality. Little is known about the effect of gender on the outcomes of multiple valve surgery. **Methods:** In 69 patients who had multiple valve surgery for rheumatic valvular heart disease, 51 patients had mitral and aortic valve replacement, 9 patients had mitral and aortic valve replacement and tricuspid valve repair, 4 patients had mitral valve replacement and tricuspid valve repair, 4 patients had mitral and tricuspid valve repair, and 1 patient had mitral and tricuspid valve replacement. Outcomes were evaluated with univariate analysis. **Results:** Women had significantly smaller body surface area and smaller left ventricular end-systolic area than men. Women and men had similar left ventricular ejection fraction and New York Heart Association functional class. Univariate analysis showed that in women (but not men), older age, atrial fibrillation, lower left ventricular ejection fraction, and New York Heart Association functional class II and III were associated with longer hospital and intensive care unit stay. In men (but not women), longer cardiopulmonary bypass time was associated with increased left ventricular end-systolic area at 12 months after surgery. Longer aortic cross-clamp time was associated with increased left ventricular end-systolic area in men but only weakly in women. **Conclusion:** We concluded that gender is an independent predictor of outcomes after multiple valve heart surgery.

Keywords: Gender; Multiple Valves; Surgery; Outcomes

1. Introduction

During the past 2 decades, improvements have occurred in the clinical outcomes of patients with multiple valvular heart disease. Many studies have examined the effect of gender-related differences and outcomes after isolated valvular heart surgery, isolated coronary artery bypass grafting, and valvular heart surgery with coronary artery bypass grafting [1-10]. However, knowledge about the effects of gender-related differences on the outcomes of multiple valvular heart surgery is limited. The current prospective study aimed to examine the association of gender with the outcomes of multiple valvular heart surgery.

2. Materials and Methods

Multiple valvular heart surgery was performed on 73 consecutive patients from January 1999 to December 2005. Of these 73 patients, 4 women were excluded because of missing data, leaving 69 patients (43 women and 26 men) who were enrolled in the study and were prospectively followed. All 69 patients had rheumatic valvular heart disease and underwent primary multiple valve surgery, defined as a single operation that involved > 1 valve that

included a combination of aortic valve replacement, mitral valve repair or replacement, and/or tricuspid valve repair or replacement (**Table 1**).

The outcomes reviewed included duration of intensive care unit (ICU) stay, hospital stay, and mechanical ventilation; and postoperative atrial fibrillation, left ventricular ejection fraction, left ventricular end-systolic area at 12 months after surgery and mortality at 30 days after surgery.

3. Data Analysis

Two independent samples t-test, Mann-Whitney test, Kruskal-Wallis test, exact chi-square test, and Spearman's correlation coefficient were used to assess the demographic characteristics of the patients and the effects of various risk factors on the different outcomes of men and women separately, wherever appropriate. All the statistical tests were performed using SPSS for Windows (Release 14.0; SPSS Inc., Chicago, Illinois, USA). The level of significance was set at $P \leq 0.05$.

4. Results

Women and men were similar in age, left ventricular

ejection fraction, New York Heart Association functional class, medical comorbidities, valve disease type, and cardiopulmonary bypass and cross-clamp times (**Table 1**). Women had significantly smaller body surface area and smaller left ventricular end-systolic area than men (**Table 1**). Surgery performed in most patients was combined mitral and aortic valve replacement (**Table 1**).

Univariate analysis showed that in women (but not men), older age, atrial fibrillation, lower left ventricular

ejection fraction, and New York Heart Association functional class II and III were associated with longer hospital and ICU stay (**Table 2**). In men (but not women), longer cardiopulmonary bypass time was associated with increased left ventricular end-systolic area at 12 months after surgery (**Table 2**). In addition, longer aortic cross-clamp time was associated with increased left ventricular end-systolic area in men but only weakly in women (**Table 2**).

Table 1. Clinical characteristics of patients who had multiple valve heart surgery*.

Clinical characteristics	Women	Men	P ≤ †
Number of patients	43	26	-
Age (y)	50 ± 11	49 ± 15	NS
Body surface area (m ²)	1.5 ± 0.1	1.7 ± 0.2	0.003
Left ventricular end-systolic area (mm ²)	36 (29, 31)	39 (35, 49)	0.02
Left ventricular ejection fraction (%)			
<40	3 (7%)	2 (8%)	
40 - 60	20 (47%)	14 (56%)	NS
>60	20 (47%)	9 (36%)	
NYHA class			
I	6 (4%)	3 (12%)	
II	23 (53%)	13 (50%)	NS
III	14 (32%)	9 (35%)	
IV	0	1 (4%)	
Comorbidities			
Atrial fibrillation	28 (68%)	15 (63%)	NS
Congestive heart failure	7 (18%)	9 (35%)	NS
Hypertension	4 (10%)	2 (8%)	NS
Diabetes mellitus	7 (16%)	0 (0%)	NS
Stroke	2 (5%)	1 (4%)	NS
COPD	2 (8%)	0 (0%)	NS
Aortic valve disease			
Stenosis	26 (61%)	12 (46%)	NS
Regurgitation	35 (81%)	25 (96%)	NS
Mixed	23 (54%)	12 (46%)	NS
Mitral valve disease			
Stenosis	32 (74%)	18 (69%)	NS
Regurgitation	36 (84%)	21 (81%)	NS
Mixed	25 (58%)	13 (50%)	NS
Tricuspid valve disease			
Stenosis	0 (0%)	1 (4%)	NS
Regurgitation	31 (72%)	18 (69%)	NS
Operations			
MVR + AVR	29 (67%)	22 (85%)	
MVR + AVR + TV repair	6 (14%)	3 (12%)	
MVR + TV repair	3 (7%)	1 (4%)	NS
MV repair + TV repair	4 (9%)	0 (0%)	
MVR + TVR	1 (2%)	0 (0%)	
Cardiopulmonary bypass time (min)	142 (120, 160)	153 (125, 188)	NS
Aortic cross-clamp time (min)	119 (95, 129)	121 (106, 147)	NS
Postoperative mechanical ventilation (>1 d)	58 (43,63)	48 (22,55)	NS

*N = 69 patients. Data reported as mean ± SD; number (percent) patients, or median (interquartile range). Abbreviations: AVR, aortic valve replacement; COPD, chronic obstructive pulmonary disease; MV, mitral valve; MVR, mitral valve replacement; NYHA, New York Heart Association; TV, tricuspid valve; TVR, tricuspid valve replacement; †NS, not significant (P > 0.05).

Table 2. Univariate analysis of postoperative outcomes after multiple valve heart surgery*.

Risk Factor		Length of hospital stay	Intensive care unit stay >1 day	Mechanical ventilation >1 day	Left ventricular end-systolic area at 12 months after surgery
Age					
Women		0.418 ^{#*}	58 (34, 63)	58 (38, 63)	0.169
Men		-0.046	48 (22, 55)	48 (22, 55)	-0.496
All		0.25 [*]	52 (22, 63)	52 (22, 63)	-0.137
Left ventricular ejection fraction (%)					
Women	<40	12 (8, 35)	2 (67%)	0 (0%)	32 (32, 32)
	40 - 60	10 (6, 36)	3 (15%)	3 (15%)	31 (25, 45)
	>60	12 (7, 25)	0 (0%)	0 (0%)	32 (15, 45)
Men	<40	9 (8, 9)	0 (0%)	0 (0%)	0 (0)
	40 - 60	12 (7,27)	1 (7%)	1 (7%)	42 (39, 49)
	>60	13 (8, 30)	1 (11%)	1 (11%)	35 (28,39)
All	<40	9 (8, 35)	2 (40%)	0 (0%)	32 (32, 32)
	40 - 60	10 (6, 36)	4 (12%)	4 (12%)	36 (25, 49)
	>60	12 (7, 30)	1 (3%)	1 (3%)	33 (15, 45)
Atrial fibrillation					
Women	Yes	12 (8, 36)	5 (18%)	3 (11%)	33 (15, 45)
	No	8 (6, 20)	0 (0%)	0 (0%)	28 (25, 33)
Men	Yes	12 (8, 30)	1 (6%)	1 (7%)	37 (30, 43)
	No	12 (9, 27)	1 (11%)	1 (11%)	37 (28, 41)
All	Yes	12 (8, 36)	6 (14%)	4 (9%)	35 (15, 45)
	No	10 (6, 27)	1 (5%)	1 (5%)	29 (25, 41)
Chronic obstructive pulmonary disease					
Women	Yes	13 (8, 18)	2 (100%)	2 (100%)	0 (0)
	No	10 (6, 36)	2 (9%)	1 (5%)	32 (25, 45)
Men	Yes		0 (0%)	0 (0%)	0 (0)
	No	12 (7, 30)	3 (20%)	3 (20%)	41 (39, 49)
All	Yes	13 (8, 18)	2 (100%)	2 (100%)	0 (0)
	No	11 (6, 36)	5 (14%)	4 (11%)	33 (25, 49)
Cardiopulmonary bypass time					
Women		0.247	147 (81, 304)	147 (81, 304)	-0.068
Men		-0.07	219 (122, 324)	219 (122, 324)	0.703
All		0.169	183 (81, 324)	183 (81, 32)	0.263
Left ventricular end-systolic area					
Women		-0.086	34 (24, 52)	34 (30, 38)	0
Men		-0.336	38 (22, 47)	38 (22, 47)	-5.5
All		-0.117	38 (22, 52)	38 (22, 47)	-4
Aortic cross-clamp time					
Women		0.163	122 (51, 219)	122 (51, 187)	-0.125
Men		-0.087	142 (106, 260)	142 (106, 260)	0.527
All		0.096	132 (51, 260)	132 (51, 260)	0.158

Data reported as number (percent) patients, median (interquartile range), or [#]Spearman correlation coefficient, *P < 0.05; ^{**}P < 0.01; ^{***}P < 0.001.

There were 2 deaths within 30 days of surgery, including 1 woman (2%) who died of multiple organ failure after primary aortic and mitral valve replacement and tricuspid valve repair, and 1 man (5%) who died of aortic dissection after primary aortic and mitral valve replacement.

5. Discussion

This study showed that older age, atrial fibrillation, lower ejection fraction, and NYHA functional class II and III were associated with longer hospital and ICU stay in women. In men, longer cardiopulmonary bypass time was associated with greater left ventricular end-systolic area at 12 months after surgery. Other risk factors also may have influenced the outcomes of multiple valve procedures but could not be identified because of the small number of patients included in this study.

Several reports have assessed the effect of gender on isolated coronary artery bypass grafting procedures, with contradictory outcomes [1-6]. Women undergoing combined valvular surgery and coronary artery bypass grafting may be at greater risk of morbidity during the perioperative period, but long-term survival may be similar in woman and men [7]. The association between longer cardiopulmonary bypass duration and left ventricular end-diastolic area at 12 months in men may explain why men have higher levels of gene expression changes in response to cardiopulmonary bypass [8]. Direct comparison of outcomes between men and women may be confounded by differences in disease patterns and technical surgical considerations between men and women [9,10]. Nevertheless, women and men have similar benefits from combined procedures [7].

In summary, the present data suggest that 1) women and men have similar benefits from multiple valve procedures and 2) men experience more negative effects of prolonged cardiopulmonary bypass on left ventricular end-systolic area at 12 months after surgery than women.

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