

Aortic Valve Replacement for Aortic Stenosis in Nonagenarians

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We reviewed certain clinical and morphologic findings in 9 patients who had aortic valve replacement (AVR) for aortic stenosis (AS) when ≥ 90 years of age. All had AVR from February 2000 to April 2006. The aortic valve areas ranged from 0.41 to 1.00 cm², and the transvalvular peak systolic gradients ranged from 20 to 110 mm Hg. The left ventricular ejection fractions were $\geq 50\%$ in 6 of the 9 patients. The aortic valve was congenitally bicuspid in 3 patients, and the operatively excised valves in them weighed 4.20, 5.73, and 9.75 g, respectively (mean 6.56). The other 6 patients had 3-cuspid valves without commissural fusion, and the operatively excised valves in them weighed 0.43, 0.94, 1.08, 1.51, 1.98, and 4.43 g, respectively (median 1.30, mean 1.73). Coronary artery bypass grafting (CABG) was performed at the time of AVR in 8 of the patients. One patient died a day postoperatively and 2 others died 874 and 1,011 days, respectively, after operation. Two were in skilled nursing units postoperatively for several weeks. In conclusion, AS can be severe in nonagenarians and may be superimposed on a congenitally bicuspid aortic valve. © 2006 Elsevier Inc. All rights reserved. (Am J Cardiol 2006;98:1251–1253)

Numerous reports have appeared describing clinical and operative results of aortic valve replacement (AVR) for aortic stenosis (AS) in octogenarians.^{1–9} In contrast, few reports are available describing clinical or other features of nonagenarians having AVR for AS. Such is the purpose of this report.

Methods and Results

Cases having isolated AVR for AS from March 1993 to April 2006 at Baylor University Medical Center (BUMC) were reviewed. A total of 1,157 patients had isolated AVR for AS

during this 13-year period and 9 (0.8%) of them were ≥ 90 years of age at the time of AVR. All 9 had AVR from 2000 to 2006 and none had AVR in the 1990s. This study focuses exclusively on observations in these 9 patients. Certain clinical and morphologic aortic valve findings in them are summarized in Table 1, and the operatively excised aortic valves are illustrated in Figures 1 and 2. Of the 6 men, 3 had congenitally bicuspid aortic valves that weighed 4.20, 5.73, and 9.75 g, respectively (mean 6.56). Each of the 3 women and the 3 other men had 3-cuspid aortic valves ranging in weight from 0.43 to 4.43 g (median 1.30, mean 1.73).

The calculated aortic valve areas ranged preoperatively from 0.41 to 1.00 cm² (mean 0.68). The transvalvular peak systolic gradients (6 patients) ranged from 20 to 110 mm Hg (average 58, median 60) and the transvalvular mean gradients (8 patients) ranged from 15 to 75 mm Hg (average 44). The left ventricular ejection fractions were $\geq 50\%$ in 6 of the 9 patients.

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Table 1
Data in eight nonagenarians having aortic valve replacement for aortic valve stenosis

Case No.	Age at AVR Years/ Sex	LV (s/d) (mm Hg)	Aorta (s/d) (mm Hg)	LV-Aortic PSG (mm Hg)	LV-Aortic MSG (mm Hg)	Aortic Valve Area (cm ²)	EF (%)	No. of Aortic Valve Cusps	Valve Weight (g)	CABG	Date of AVR	Days in Hospital After AVR	Status (days after AVR)
1	91M	—	—	—	40	0.60	75*	2	4.20	+	11/5/2001	9	Died (1,011)
2	90M	207/15	157/60	50	57	0.64	50	2	5.73	0	5/14/2002	8	Alive (1,413)
3	90M	—	146/58	110*	75*	0.55*	65	2	9.75	+	10/10/2003	10	Alive (899)
4	90F	156/19	136/55	20	30	0.82	70	3	0.43	+	2/8/2005	1	Died (1)
5	90F	—	133/76	—	—	0.50*	25*	3	0.94	+	11/12/2002	9	Alive (1,231)
6	91M	—	—	—	15	1.00	50	3	1.08	+	4/3/2006	25	Alive (27 as of 4/30/06)
7	91F	237/32	168/61	69	54	0.66	74*	3	1.51	+	3/19/2004	6	Alive (738)
8	90M	95/14	64/30	31	25	0.91	30	3	1.98	+	2/17/2000	7	Alive (2230)
9	91M	187/28	118/62	69	52	0.41	15	3	4.43	+	7/6/2000	14	Died (874)

* From echocardiogram.

Ao = aorta; AR = aortic regurgitation; AVR = aortic valve replacement; EF = ejection fraction; LV = left ventricular; MSG = mean systolic gradient; PO = postoperation; PSG = peak systolic gradient; s/d = peak systole/end diastole.



Figure 1. Congenitally bicuspid aortic valves (see Table 1). *Left*, case 1; *middle*, case 2; and *right*, case 3.

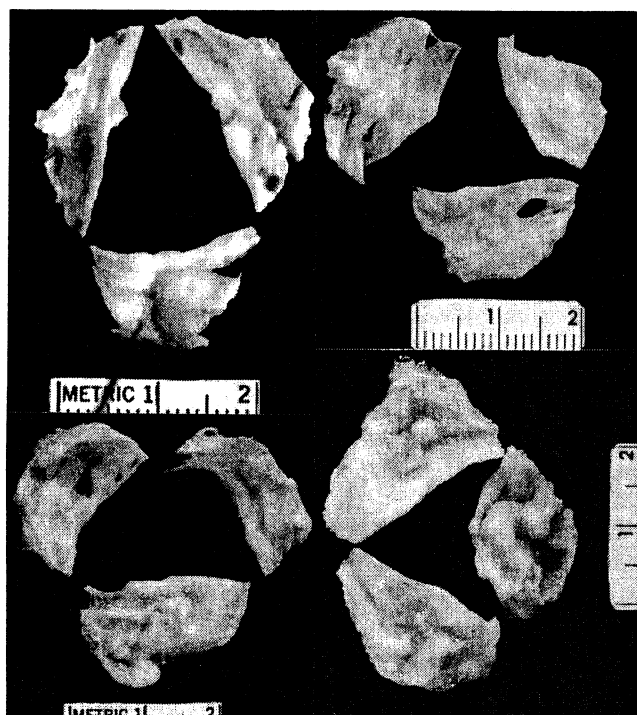


Figure 2. Tricuspid aortic valves (see Table 1). *Upper left*, case 4; *upper right*, case 5; *lower left*, case 6; and *lower right*, case 7.

One patient died 1 day postoperatively and 2 others died 874 and 1,011 days, respectively, after operation. Of the 6 living patients, 5 remain alive from 738 to 2,230 days postoperatively as of March 27, 2006, and the remaining 1 patient is alive 27 days postoperatively as of April 30, 2006. Two patients were in the rehabilitation hospital for several weeks postoperatively.

Eight of the 9 patients had coronary artery bypass grafting (CABG) at the time of AVR.

Discussion

Of the 9 nonagenarians included in this study, all but 1 survived the operative period, another died 874 days postoperatively, and another 1,011 days postoperatively. The

exact cause of death in these patients is unclear and a necropsy was not performed in any of them. The other 6 patients are alive 27, 738, 899, 1,231, 1,413, and 2,230 days, respectively, postoperatively.

A surprise finding in the 9 patients was the presence of a congenitally bicuspid aortic valve in 3 of them. As described previously, the operatively excised stenotic congenitally bicuspid aortic valves are, as a rule, much heavier than are the operatively excised stenotic 3-cuspid aortic valves. All 3 patients with congenitally bicuspid aortic valves were men and 3 of the 6 patients with operatively excised stenotic 3-cuspid aortic valves were men. Men, irrespective of valve structure, tend to have heavier valves than do women of similar age.¹⁰ The valve weight in the stenotic valves is determined primarily by the quantity of calcium on the aortic aspects of the cusps, and men tend to have larger deposits of calcium on their stenotic valves than women. The quantity of calcium in stenotic congenitally bicuspid aortic valves tends to be much larger than in patients with stenotic 3-cuspid aortic valves (when comparing adults of similar age) and that fact accounts for the heavier weights in the patients with bicuspid valves.

Few reports have described patients ≥ 90 years of age having AVR with or without simultaneous CABG. Samuel and colleagues,¹¹ in 1996, described 6 nonagenarians (4 women, 2 men). All survived the perioperative period: 1 died 4 months, another 31 months, and another 73 months postoperatively; the remaining 3 patients were alive 24, 44, and 62 months, respectively, postoperatively. The structure of the operatively excised stenotic aortic valves in these 6 patients was not described.

Blanche and associates,¹² in 1997, briefly described 17 nonagenarians who had AVR, 10 with and 7 without simultaneous CABG. Because these 17 patients were included among 13 others who had CABG without AVR, details of outcomes and other findings in the group having AVR could not be determined. The structure of the operatively excised stenotic aortic valves was not described. The authors noted that the average hospital cost of isolated AVR in their nonagenarians was \$60,000, whereas those having combined AVR and CABG was \$51,000, figures considerably higher than in their younger patients having these proce-

Table 2

Frequency of unicuspid, bicuspid, and tricuspid valves operatively excised at the Baylor University Medical Center (Dallas) from 1993 to 2006 in septuagenarians, octogenarians, and nonagenarians

Age Group (Years)	Mean Age (Years)	Number of Patients	Aortic Valve Structure				Aortic Valve Weight (g)			
			Unicuspid	Bicuspid	Tricuspid	Indeterminate	Unicuspid	Bicuspid	Tricuspid	Indeterminate
70-79										
Men	74.6	259	6 (2%)	113 (44%)	138 (53%)	2 (1%)	2.71-3.40 (2.95)	1.20-11.3 (3.42)	0.76-5.77 (2.40)	—
Women	74.9	182	1 (1%)	71 (39%)	106 (58%)	4 (2%)	1.67	0.98-3.97 (2.27)	0.60-4.81 (1.54)	0.95-2.10 (2.03)
80-89										
Men	82.7	121	0	37 (31%)	82 (68%)	2 (1%)	—	0.81-7.84 (3.69)	1.03-6.60 (2.32)	1.77, 2.89 (2.33)
Women	83.1	87	0	23 (26%)	64 (73%)	0	—	0.79-4.90 (2.58)	0.45-3.14 (1.55)	—
90-99										
Men	90.5	6	0	3 (50%)	3 (50%)	0	—	4.20-9.75 (6.56)	1.08-4.43 (2.50)	—
Women	90.3	3	0	0	3 (100%)	0	—	—	0.43-1.51 (0.96)	—

dures. Bacchetta and colleagues,¹³ in 2003, described findings in 18 nonagenarians who underwent AVR: 5 had isolated AVR, 10 had AVR and CABG, and 3 had AVR, mitral valve replacement, and CABG. All 18 appeared to have survived 30 days postoperatively, but their courses thereafter are unclear. The structure of the operatively excised aortic valves in these 18 patients was not described.

Comparison of the frequency of the congenitally bicuspid aortic valve among septuagenarians, octogenarians, and nonagenarians who had isolated AVR for AS (with or without associated aortic valve regurgitation) at BUMC from 1993 through 2006 are shown in Table 2. The frequency of the congenitally bicuspid aortic valve among patients with isolated AVR for AS was 42% (184 of 441) in the septuagenarians, 29% (60 of 208) in the octogenarians, and 33% (3 of 9) in the nonagenarians.

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