

Table S1 Comparison of patients with preoperative SOV >40 mm and ≤40 mm

Comparison of patients with preoperative SOV >40 mm and ≤40 mm	SOV >40 mm (N=20)	SOV ≤40 mm (N=69)	P value
Preoperative characteristics			
Age (years)	61±13	62±11	0.705
Female sex	2 (10%)	36 (52%)	0.0003
Body surface area (m ²)	1.73±0.16	1.61±0.20	0.017
Hypertension	13 (65%)	42 (61%)	0.737
Chronic obstructive pulmonary disorder	3 (15%)	11 (16%)	0.919
Aortic valve etiology			0.023
Stenosis	11 (55%)	50 (72%)	
Regurgitation	6 (30%)	4 (6%)	
Mixed	3 (15%)	15 (22%)	
Phenotype of bicuspid aortic valve			0.489
Type 0	5 (25%)	27 (39%)	
Type 1 (R-L fusion)	10 (50%)	29 (42%)	
Type 1 (R-N fusion)	5 (25%)	13 (19%)	
Diameter (mm)			
Sinus of Valsalva	43.2±3.0	33.9±3.5	<0.001
Middle ascending aorta	49.2±4.7	46.7±4.5	0.048
Distal ascending aorta	37.7±3.0	37.0±3.7	0.418
EuroSCORE II	2.18±1.54	2.14±2.13	0.343
Intraoperative results			
Operation time (min)	339±76	311±80	0.079
Cardiopulmonary bypass time (min)	165±38	146±38	0.035
Aortic cross-clamp time (min)	117±24	106±26	0.058
Cystic medial necrosis grade			0.591
0	2 (10%)	6 (9%)	
1	10 (53%)	24 (38%)	
2	4 (21%)	23 (36%)	
3	3 (16%)	11 (17%)	
Postoperative outcomes			
In-hospital mortality	0	1 (1%)	0.474
Reoperation for bleeding	1 (5%)	4 (6%)	0.890
Atrial fibrillation	3 (15%)	12 (18%)	0.779
Aortic dissection	0	1 (1%)	0.474
Ventilation time (hour)	14±19	10±8	0.338
ICU stay (day)	3±2	3±2	0.803

Table S1 (continued)

Table S1 (continued)

Comparison of patients with preoperative SOV >40 mm and ≤40 mm	SOV >40 mm (N=20)	SOV ≤40 mm (N=69)	P value
Hospital stay (day)	16±8	15±7	0.880
Follow-up (years)	6.9±2.7	6.0±3.0	0.201
Late mortality	1 (5%)	0	0.082
MACCEs	3 (15%)	11 (16%)	0.919
Reoperation			0.334
Pseudo-aneurysm at sinus of Valsalva	1 (5%)	0 (1%)	
Structural valve deterioration	0	3 (4%)	
Prosthetic valve endocarditis	0	1 (1%)	
Diameter at late follow-up (mm)			
Sinus of Valsalva	43.1±3.4	34.3±3.2 37.5±3.4	<0.0001 0.398
Distal ascending aorta	38.1±3.1		
Expansion rate (mm/year)			
Sinus of Valsalva	-0.11±0.67	0.05±0.41	0.110
Distal ascending aorta	0.11±0.40	0.11±0.42	0.832

ICU, intensive care unit, MACCEs, major adverse cardiac and cerebrovascular events, SOV, sinus of Valsalva.

Table S2 Comparison of patients with preoperative DAAo >40 mm and ≤40 mm

Comparison of patients with preoperative DAAo >40mm and ≤40mm	DAAo >40mm (N=14)	DAAo ≤40mm (N=75)	P-value
Preoperative characteristics			
Age (years)	63±15	62±11	0.600
Female sex	5 (35%)	33 (44%)	0.562
Body surface area (m ²)	1.64±0.26	1.64±0.18	0.714
Hypertension	7 (50%)	48 (64%)	0.328
Chronic obstructive pulmonary disorder	2 (14%)	12 (16%)	0.870
Aortic valve etiology			0.259
Stenosis	7 (50%)	54 (72%)	
Regurgitation	3 (21%)	7 (9%)	
Mixed	4 (29%)	14 (19%)	
Phenotype of bicuspid aortic valve			0.676
Type 0	5 (36%)	27 (36%)	
Type 1 (R-L fusion)	5 (36%)	34 (45%)	
Type 1 (R-N fusion)	4 (29%)	14 (19%)	
Diameter (mm)			
Sinus of Valsalva	36.9±4.7	35.9±5.2	0.478

Table S2 (continued)

Table S2 (continued)

Comparison of patients with preoperative DAAo >40mm and ≤40mm	DAAo >40mm (N=14)	DAAo ≤40mm (N=75)	P-value
Middle ascending aorta	50.1±4.9	46.7±4.5	0.019
Distal ascending aorta	42.7±1.4	36.1±2.8	<0.0001
EuroSCORE II	4.35±4.06	1.85±1.40	0.078
Intraoperative results			
Operation time (min)	339±110	313±73	0.539
Cardiopulmonary bypass time (min)	165±52	148±36	0.255
Aortic cross-clamp time (min)	112±30	108±25	0.521
Cystic medial necrosis grade			0.245
0	0	8 (11%)	
1	7 (58%)	27 (38%)	
2	4 (33%)	23 (32%)	
3	1 (8%)	13 (18%)	
Postoperative outcomes			
In-hospital mortality	0	1 (1%)	0.557
Reoperation for bleeding	1 (7%)	4 (5%)	0.794
Atrial fibrillation	4 (29%)	11 (15%)	0.237
Aortic dissection	1 (7%)	0	0.053
Ventilation time (hour)	9±5	12±13	0.270
ICU stay (day)	3±2	3±2	0.651
Hospital stay (day)	18±10	15±6	0.200
Follow-up (years)	4.7±2.6	6.5±2.9	0.026
Late mortality	0	1 (1%)	0.557
MACCEs	1 (7%)	13 (17%)	0.297
Reoperation			0.334
Pseudo-aneurysm at sinus of Valsalva	0	1 (1%)	
Structural valve deterioration	0	3 (4%)	
Prosthetic valve endocarditis	0	1 (1%)	
Diameter at late follow-up (mm)			
Sinus of Valsalva	37.3±5.6	36.6±5.1	0.752
Distal ascending aorta	42.2±1.5	36.9±2.9	<0.0001
Expansion rate (mm/year)			
Sinus of Valsalva	-0.11±0.51	0.03±0.50	0.917
Distal ascending aorta	-0.11±0.24	0.15±0.42	0.013

DAAo, distal ascending aorta, ICU, intensive care unit, MACCEs, major adverse cardiac and cerebrovascular events.

Table S3 Generalized linear estimate for dilatation of the SOV and DAAo

	Coefficient	SE	P-value
Generalized linear estimate for SOV			
Years	0.039	0.137	0.778
Age	-0.245	0.438	0.577
Female Sex	-6.477	0.868	<0.001
COPD	-0.244	1.481	0.869
Hypertension	-0.109	1.160	0.925
BAV phenotype	0.414	0.756	0.585
CMN grade	-0.791	0.639	0.218
SOV < 40 mm vs. ≥ 40 mm	9.073	0.749	<0.001
Aortic valve etiology	-3.102	0.842	<0.001
Prosthetic valve type	0.666	1.098	0.545
Aortic graft size	0.755	0.195	<0.001
Generalized linear estimate for DAAo			
Years	0.096	0.089	0.283
Age	0.361	0.262	0.170
Female Sex	-0.990	0.682	0.149
COPD	1.185	0.927	0.203
Hypertension	0.308	0.802	0.702
BAV phenotype	0.089	0.466	0.849
CMN grade	0.723	0.394	0.068
DAAo <40 mm vs. ≥40 mm	5.941	0.560	<0.001
Aortic valve etiology	0.211	0.598	0.725
Prosthetic valve type	0.739	0.746	0.324
Aortic graft size	0.245	0.138	0.078

BAV, bicuspid aortic valve, CMN, cystic medial necrosis, COPD, chronic obstructive pulmonary disorder, DAAo, distal ascending aorta, SE, standard error, SOV, sinus of Valsalva.

Table S4 Baseline characteristics according to trajectory groups for the SOV and DAAo

	Class 1	Class 2	Class 3	Class 4
SOV				
Number.at risk	16	36	24	13
Age, years	67.7	61.3	60.8	59.2
Female sex, %	12.5	47.2	87.5	84.6
COPD, %	12.5	13.9	20.8	15.4
Hypertension	53.8	65.2	81.8	64.7
BAV phenotype, %				
Type 0	43.8	36.1	37.5	23.1
Type 1 (R-L)	25.0	50.0	33.3	69.2
Type 1 (R-N)	31.3	13.9	29.2	7.7
CMN grade, %				
Grade 0	6.3	11.8	4.8	16.7
Grade 1	18.8	50.0	33.3	58.3
Grade 2	56.3	23.5	42.9	8.3
Grade 3	18.8	14.7	19.1	16.7
SOV >40 mm, %	0.0	0.0	33.3	100.0
Aortic valve etiology, %				
AS	54.5	65.0	68.4	87.5
AR	18.2	10.0	N.A.	N.A.
ASR	18.2	17.5	31.6	N.A.
Prosthetic valve type, %	90.9	77.5	89.5	87.5
Graft size, %	27.2	27.0	27.3	26.3

Table S4 (continued)

Table S4 (continued)

	Class 1	Class 2	Class 3	Class 4
DAAo				
Number.at risk	13	24	35	17
Age, years	56.2	64.6	61.7	63.3
Female sex, %	38.5	50.0	65.7	64.7
COPD, %	0.0	16.7	20.0	17.6
Hypertension	47.1	60.0	68.8	75.0
BAV phenotype, %				
Type 0	38.5	33.3	37.1	35.3
Type 1 (R-L)	46.2	45.8	42.9	41.2
Type 1 (R-N)	15.4	20.8	20.0	23.5
CMN grade, %				
Grade 0	33.3	4.4	9.1	0.0
Grade 1	33.3	43.5	39.4	46.7
Grade 2	25.0	39.1	33.3	26.7
Grade 3	8.3	13.0	18.2	26.7
DAAo >40 mm, %	0.0	0.0	14.3	100.0
Aortic valve etiology, %				
AS	58.6	85.7	52.9	68.1
AR	20.7	N.A.	11.8	4.3
ASR	13.8	14.3	17.6	23.4
Prosthetic valve type, %				
Graft size, %	27.4	26.0	27.5	26.9

AR, aortic valve regurgitation, AS, aortic valve stenosis, ASR; aortic valve stenosis and regurgitation, BAV, bicuspid aortic valve, CMN, cystic medial necrosis, COPD, chronic obstructive pulmonary disorder, DAAo, distal ascending aorta, N.A., not available, SOV, sinus of Valsalva.

Table S5 Model probabilities for trajectory analysis

	Model probability	SD
SOV		
Class 1	0.95	0.09
Class 2	0.94	0.08
Class 3	0.93	0.08
Class 4	0.95	0.12
DAAo		
Class 1	0.95	0.11
Class 2	0.92	0.10
Class 3	0.91	0.11
Class 4	0.97	0.05

DAAo, distal ascending aorta, SD, standard deviation, SOV, sinus of Valsalva.

Table S6 Comparison of GR of the ascending aorta with clamped and with DHCA in pre-, intra-, and post-operative variables

Comparison of GR of the ascending aorta with clamped and with DHCA	With clamped (N=68)	With DHCA (N=21)	P-value
Preoperative characteristics			
Age (years)	63±10	59±14	0.219
Female sex	34 (50%)	4 (19%)	0.013
Body surface area (m ²)	1.62±0.20	1.70±0.17	0.064
Hypertension	45 (66%)	10 (48%)	0.198
Chronic obstructive pulmonary disorder	9 (13%)	5 (24%)	0.305
Aortic valve etiology			0.396
Stenosis	47 (69%)	14 (67%)	
Regurgitation	15 (22%)	3 (14%)	
Mixed	6 (9%)	4 (19%)	
Phenotype of bicuspid aortic valve			0.190
Type 0	27 (40%)	5 (24%)	
Type 1 (R-L fusion)	30 (44%)	9 (43%)	
Type 1 (R-N fusion)	11 (16%)	7 (33%)	
Diameter (mm)			
Sinus of Valsalva	35.3±5.0	38.3±5.0	0.016
Middle ascending aorta	46.5±4.4	49.9±4.6	0.002
Distal ascending aorta	36.6±3.3	39.0±3.7	0.003
EuroSCORE II	4.16±2.14	3.92±3.58	0.045
Intraoperative results			
Operation time (min)	298±72	379±72	< 0.001
Cardiopulmonary bypass time (min)	136±31	196±26	< 0.001
Aortic cross-clamp time (min)	102±24	131±18	< 0.001
Cerebral perfusion time (min)	–	29±7	NA
Circulatory arrest time (min)	–	31±7	NA
Cystic medial necrosis grade			0.285
0	6 (10%)	2 (10%)	
1	26 (41%)	8 (40%)	
2	23 (36%)	4 (20%)	
3	8 (13%)	6 (30%)	
Postoperative outcomes			
In-hospital mortality	1 (1%)	0	0.578
Reoperation for bleeding	1 (1%)	3 (14%)	0.039
Atrial fibrillation	12 (18%)	3 (14%)	0.756
Aortic dissection	1 (1%)	0	0.980

Table S6 (continued)

Table S6 (continued)

Comparison of GR of the ascending aorta with clamped and with DHCA	With clamped (N=68)	With DHCA (N=21)	P-value
Ventilation time (hour)	10±8	14±19	0.283
ICU stay (day)	3±2	3±1	0.402
Hospital stay (day)	13±4	21±10	< 0.001
Follow-up (years)	5.8±2.9	7.5±2.7	0.014
Late mortality	1 (1%)	0	1.000
MACCEs	8 (12%)	1 (5%)	0.108
Reoperation			0.334
Pseudo-aneurysm at sinus of Valsalva	1 (1%)	0	
Structural valve deterioration	3 (4%)	0	
Prosthetic valve endocarditis	1 (1%)	0	
Diameter at late follow-up (mm)			
Sinus of Valsalva	35.6±4.7	38.5±4.7	0.024
Distal ascending aorta	37.2±3.3	38.7±3.3	0.055
Expansion rate (mm/year)			
Sinus of Valsalva	0.03±0.53	0.03±0.20	0.587
Distal ascending aorta	0.10±0.39	-0.08±0.33	0.062

GR, graft replacement, DHCA, deep hypothermic circulatory arrest, ICU, intensive care unit, MACCEs, major adverse cardiac and cerebrovascular events.