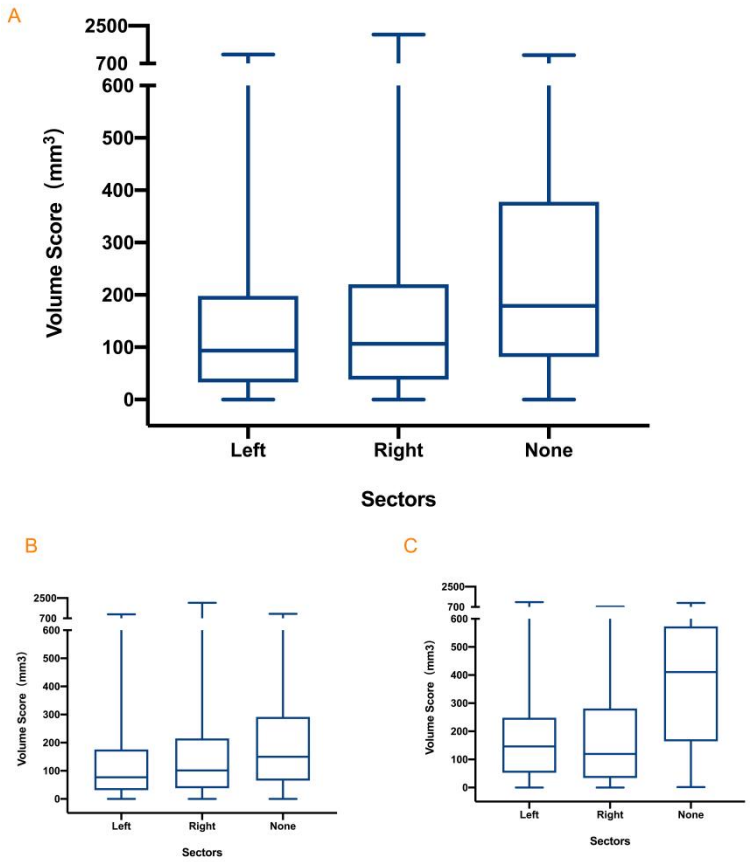
Supplementary Materials

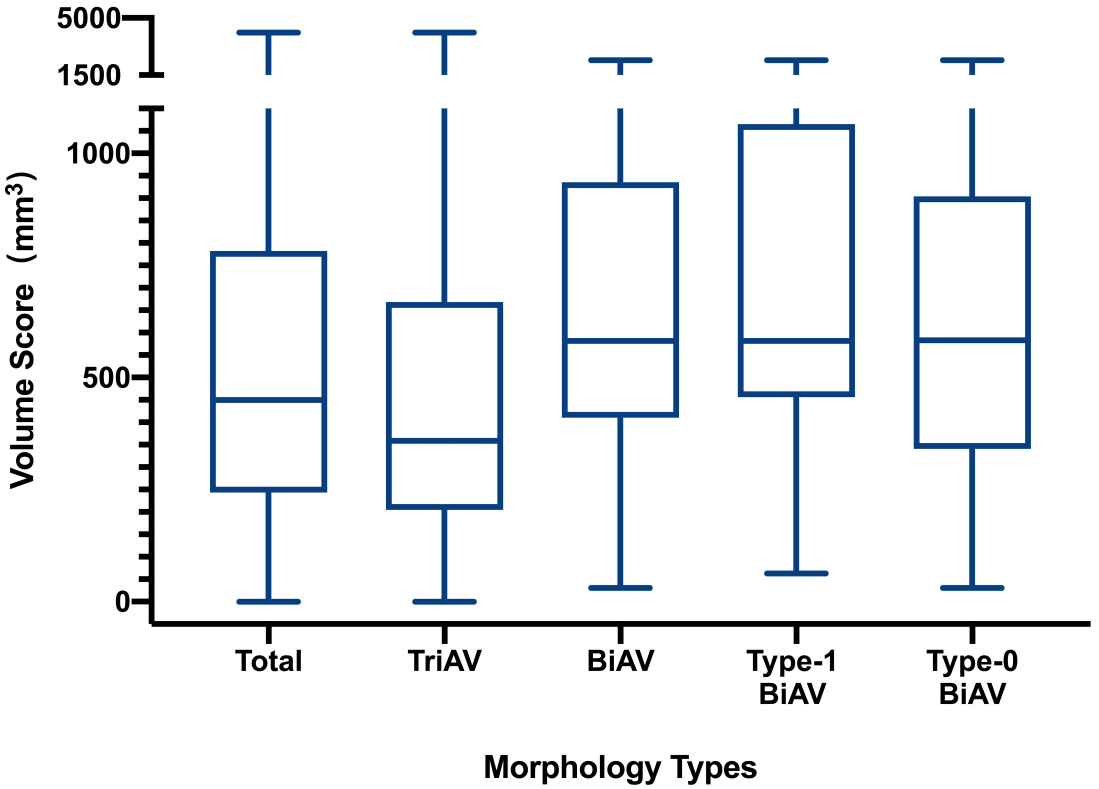
CT image acquisition

All patients underwent a CT scan with retrospective ECG gating technique on a 2nd generation dual-source CT scanner (Somatom Definition Flash, Siemens Healthcare, Forchheim, Germany). Acquisition parameters were: 120 kV tube voltage, 2×64×0.6 mm of detector collimation and 280 ms of gantry rotation time. The CT scan was performed from the tracheal bifurcation to diaphragm, followed by the high-pitch spiral non-ECG-gated CT scanning from the underjaw to the lesser trochanter of the femur. All studies were achieved in a craniocaudal direction in end-inspiration. Attenuation-based tube current modulation (CareDose 4D, Siemens) was applied per default. For contrast medium enhancement, automated bolus tracking was used in a region-of-interest within the ascending aorta, with a signal attenuation trigger threshold of 100 Hounsfield units (HU) and a 6 s scan delay. We used a triple-phase contrast medium injection protocol, which consisted of 50–60 mL of undiluted contrast agent (iopromide; Ultravist 370 mgI/ml, Bayer Healthcare, Berlin, Germany) followed by a 30 mL 3: 7 mixture of contrast medium and saline and a 40 mL saline chaser bolus, all injected with flow rates of 4–5 mL/s. We used iterative reconstruction in all CT images.

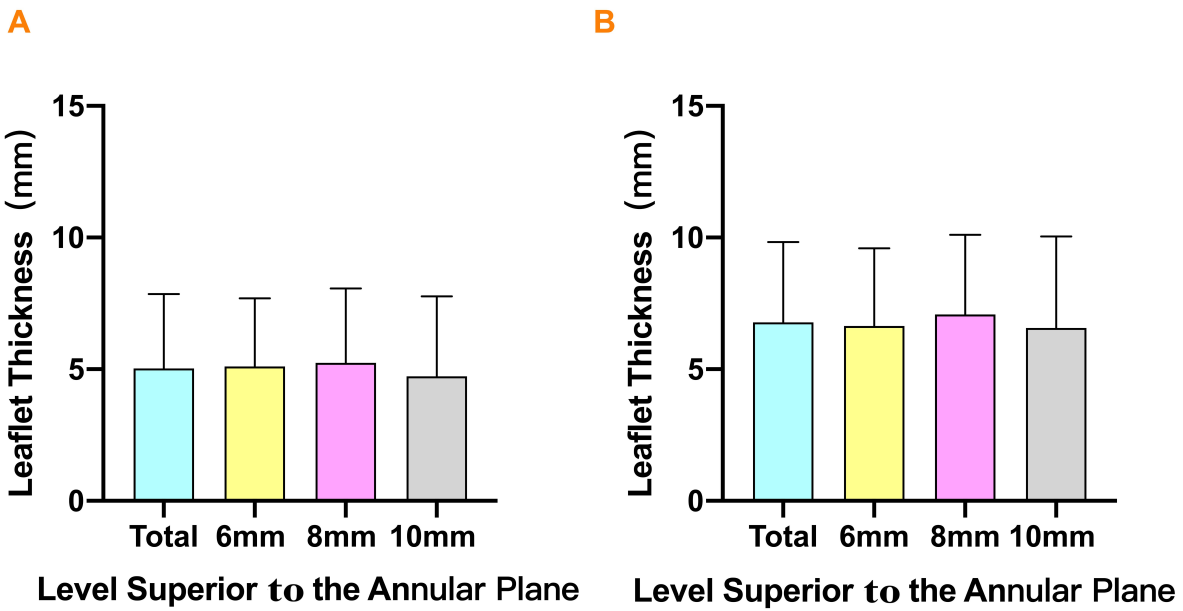
CT imaging quality evaluation was performed according to the following principles: Grade I: Non-contrast CT scan, Grade II: Too low contrast attenuation or excessive image noise or excessive motion artifacts or double contours, Grade III: Low contrast attenuation or mild motion artifacts, double contours or stair-step artifacts, Grade IV: Sharp depiction of the annular contour with sufficient contrast attenuation in the absence of artifacts. Patients with CT imaging of Grade I or II were excluded.



Supplementary Figure 1: Calcium volume scores of each leaflet sectors in aortic stenosis patients. (A) Volume scores in all patients. (B) Volume scores in patients with tricuspid aortic valve. (C) Volume scores in patients with Sievers type-1 bicuspid aortic valve.



Supplementary Figure 2: Calcium volume scores in aortic stenosis patients with different morphological types. BiAV: Bicuspid aortic valve; TriAV: Tricuspid aortic valve; Type-0 BiAV: Sievers type-0 bicuspid aortic valve; Type-1 BiAV: Sievers type-1 bicuspid aortic valve.



Supplementary Figure 3: Leaflet thickness in aortic stenosis patients. (A) Leaflet thickness of patients with tricuspid aortic valve. (B) Leaflet thickness of patients with bicuspid aortic valve. Total: Mean thickness of total thickness; 6, 8 and 10 mm: Leaflet thickness on the level of 6, 8 and 10 mm above the annulus.

Supplementary Table 1: Anatomic analysis of Chinese aortic stenosis patients receiving transcatheter aortic valve replacement.

Item	Total (*n* = 293)	Tricuspid (*n* = 198)	Bicuspid (*n* = 95)	*P*-value	Type 1 BiAV (*n* = 49)	Type 0 BiAV (*n* = 46)	*P*-value
Systolic annular measurements							
Long-axial diameter (mm)	27.00 (25.20–29.20)	26.85 (25.20–29.00)	27.30 (24.95–29.90)	0.16	28.40 (26.20–31.20)	26.55 (24.40–28.80)	0.01
Short-axial diameter (mm)	20.80 (19.10–22.60)	20.35 (18.90–21.90)	21.90 (19.75–23.90)	<0.01	22.40 (20.40–24.20)	21.70 (19.70–22.80)	0.10
Aortic valve annulus perimeter (mm)	75.60 (70.63–81.75)	74.65 (70.00–80.50)	77.50 (72.90–85.00)	<0.01	79.40 (74.30–88.50)	75.15 (70.80–82.40)	0.01
Aortic valve annulus area (mm^2)	436.50 (381.45–513.50)	428.65 (374.10–492.60)	462.60 (404.80–551.00)	<0.01	476.00 (425.70–594.80)	437.85 (387.60–519.90)	0.02
Eccentricity of the aortic valve annulus	0.24 (0.19–0.27)	0.24 (0.21–0.27)	0.21 (0.16–0.27)	<0.01	0.21 (0.17–0.29)	0.21 (0.16–0.25)	0.23
Annulus calcification	125 (42.7)	71 (35.9)	54 (56.8）	<0.01	27 (55.1)	27 (58.7)	0.72
Annulus nodule calcification	26 (8.9)	14 (7.1)	12 (12.6)	0.12	9 (18.4)	3 (6.5)	0.08
Sinotubular junction diameter (mm)	29.50 (26.80–32.20)	28.73 (26.20–30.80)	32.10 (28.90–34.48)	<0.01	31.70 (27.70–33.80)	32.70 (29.95–35.40)	0.09
Ascending aorta (mm)	38.40 (35.00–42.80)	36.65 (34.30–40.00)	43.00 (39.10–47.45)	<0.01	41.80 (38.00–46.60)	44.25 (40.30–48.20)	0.03
LVOT perimeter (mm)	78.00 (70.85–86.80)	75.35 (69.15–84.30)	82.00 (75.10–90.85)	<0.01	82.20 (77.40–91.50)	81.85 (73.30–90.70)	0.27
LVOT area (mm^2)	443.70 (367.70–557.00)	422.40 (348.20–517.30)	506.30 (405.75–604.70)	<0.01	510.50 (440.50–613.00)	501.30 (394.90–604.00)	0.14
LCA ostium (mm)	13.90 (11.50–15.95)	13.40 (11.30–15.30)	15.20 (12.00–17.95)	<0.01	13.50 (11.30–16.00)	16.20 (14.00–20.30)	<0.01

RCA ostium (mm)	16.60 (14.70–18.80)	16.10 (14.70–18.20)	17.70 (15.15–19.35)	0.01	16.50 (13.80–19.00)	18.45 (16.20–19.40)	<0.01
Sinus of Valsalva diameter (mm)							
Left (mm)	31.70 (29.40-34.20)	31.75 (29.35-33.75)	31.70 (29.80-36.50)	0.13	31.70 (29.80-36.50)	–	–
Right (mm)	30.90 (28.50-33.20)	30.85 (28.40-32.85)	31.10 (28.80-33.90)	0.29	31.10 (28.80-33.90)	–	–
None (mm)	32.40 (30.10-35.60)	32.20 (29.55-34.90)	34.90 (32.00-37.10)	<0.01	34.90 (32.00-37.10)	–	–
Inter-commissural length (mm)	–	–	–	–	27.80 (25.10-30.55)	26.75 (24.10-29.10)	0.19
Sinus-sinus length (mm)	–	–	–	–	–	36.75 (34.50-39.90)	–
Sinus of Valsalva height (mm)							
Left (mm)	21.20 (18.90-23.80)	20.60 (18.50-22.30)	23.30 (20.00-25.90)	<0.01	20.60 (18.65-24.05)	25.10 (22.28-28.13)	<0.01
Right (mm)	20.70 (18.60-23.60)	20.70 (18.80-23.45)	20.30 (17.65-23.90)	0.46	20.30 (17.65-23.90)	–	–
None (mm)	19.30 (17.30-21.70)	19.10 (17.20-21.25)	20.80 (17.40-23.00)	0.03	20.80 (17.40-23.00)	–	–
Sinus opposite to left (mm)	–	–	–	–	–	23.55 (20.70-26.00)	–
Leaflet height (mm)							
Left (mm)	14.40 (12.80-16.25)	14.00 (12.60-15.90)	15.30 (13.60-16.90)	<0.01	14.60 (13.40-16.40)	16.05 (14.13-17.65)	0.06
Right (mm)	14.30 (13.00-16.30)	14.30 (13.00-16.25)	14.40 (13.20-16.40)	0.57	14.40 (13.20-16.40)	–	–

None (mm)	14.40 （12.90-16.40）	14.30 （12.70-16.25）	15.20 （13.70-17.20）	0.04	15.20 （13.70-17.20）	–	–
Leaflet opposite to left (mm)	–	–	–	–	–	16.15 （14.20-19.00）	–

BiAV: Bicuspid aortic valve; LCA: Left coronary artery; LVOT: Left ventricular outflow tract; RCA: Right coronary artery; Type-1 BiAV: Sievers type-1 bicuspid aortic valve; Type-0 BiAV: Sievers type-0 bicuspid aortic valve; –: Not available. Sinus-sinus length: The maximum distance between the two sinuses; Inter-commissural length: The distance between commissures of the respective opposing leaflets; Sinus opposite to left: In Type 0 bicuspid aortic valve, the sinus which left coronary is not given out; Leaflet opposite to left: In Type 0 bicuspid aortic valve, the leaflet on the same side with the sinus which left coronary is not given out.

Supplementary Table 2: Calcium volume of Chinese aortic stenosis patients receiving transcatheter aortic valve replacement (mm^3).*

Item	Total *n*=293	TriAV *n*=198	BiAV *n*=95	*P*-value	Type-1 BiAV *n*=49	Type-0 BiAV *n*=46	*P*-value
Total	449.90 (243.15-782.15)	358.45 (206.40-668.40)	581.30 (417.50-934.95)	<0.01	581.30 (457.10-1022.80)	582.90 (349.60-897.80)	0.40
Sectors							
Left	93.70 (32.80-197.90)	75.20 (31.40-175.70)	146.30 (54.70-242.80)	0.02	146.30 (54.70-242.80)	–	–
Right	104.50 (37.90-221.73)	100.90 (39.00-214.50)	119.50 (38.80-275.10)	0.33	119.50 (38.80-275.10)	–	–
None	179.10 (81.30-377.70)	149.80 (66.10-289.80)	410.60 (182.00-567.80)	<0.01	410.60 (182.00-567.80)	–	–
Regions							
LVOT region	0 (0-1.30)	0 (0-0.03)	0 (0-7.30)	0.07	0 (0-5.30)	0 (0-7.80)	0.52
Annulus region	7.50 (0.70-33.30)	3.60 (0.10-22.20)	22.30 (4.20-62.50)	<0.01	25.10 (4.20-82.30)	19.50 (4.20-57.00)	0.49
Lower leaflet region	119.20 (55.60-219.95)	101.20 (44.30-204.00)	160.50 (85.45-229.00)	<0.01	172.60 (103.40-275.30)	152.30 (74.20-199.40)	0.08
Mid leaflet	201.80 (91.40-318.20)	161.95 (66.00-296.30)	246.90 (155.50-359.65)	<0.01	264.30 (177.80-410.20)	246.15 (136.50-302.10)	0.10
Upper leaflet region	70.30 (18.75-206.65)	50.60 (13.70-155.80)	141.30 (50.45-303.35)	<0.01	143.90 (51.60-264.70)	130.70 (49.30-336.70)	0.89

*Based on a contrast scan with an 850-HU threshold for detection. LVOT region: from 6 mm below the annular plane to 2 mm below the annular plane; Annulus region: from 2 mm below the annular plane to 2 mm superior to the annular plane; Lower leaflet region: from 2 mm superior the annular plane to 6 mm superior to the annular plane; Mid leaflet region: from 6 mm superior to the annular plane to 10 mm superior to the annular plane; Upper leaflet region: from 10 mm superior the annular plane to the sinotubular junction level. BiAV: Bicuspid aortic valve; LVOT: Left ventricular outflow tract; TriAV: Tricuspid aortic valve; Type-1 BiAV: Sievers type-1 bicuspid aortic valve; Type-0 BiAV: Sievers type-0 bicuspid aortic valve; –: Not available.

Supplementary Table 3: VARC endpoints of Chinese aortic stenosis patients 30 days after receiving transcatheter aortic valve replacement: annular sizing vs. downsize approaches in TriAV and BiAV patients.

Item	Annular sizing (*n* = 66)	Downsize (*n* = 132)	*P*-value	Annular sizing (*n* = 23)	Downsize (*n* = 72)	*P*-value	*P*-value
	Tricuspid aortic valve			Bicuspid aortic valve			
Technical success	54 (81.8)	112 (84.9)	0.67	19 (82.6)	58 (80.6)	0.83	0.43
Device success	49 (74.2)	100 (75.8)	0.82	15 (65.2)	53 (73.6)	0.44	0.68
Death	2 (3.0)	4 (3.0)	>0.99	0 (0)	0 (0)	–	0.13
Second valve implantation	6 (9.1)	13 (9.9)	0.86	4 (17.4)	10 (13.9)	0.69	0.51
PVL	2 (3.0)	1 (0.8)	0.22	2 (8.7)	3 (4.2)	0.42	0.09
New permanent pacemaker implantation	8 (12.1)	8 (6.1)	0.11	1 (4.4)	5 (6.9)	0.64	0.80
Repeat procedure	7 (10.6)	12 (9.1)	0.73	0 (0)	4 (5.6)	0.13	0.37
Major vascular complication	2 (3.0)	6 (4.6)	0.61	0 (0)	0 (0)	–	0.07
Prosthetic aortic valve stenosis	3 (4.6)	9 (6.8)	0.52	1 (4.4)	4 (5.6)	0.82	0.72

Data are expressed as *n* (%). **P*-value between downsize group of tricuspid aortic valve and downsize group of bicuspid aortic valve. BiAV: Bicuspid aortic valve; PVL: Perivalvular leakage; TriAV: Tricuspid aortic valve; VARC: Valve Academic Research Consortium; –: Not available.

Supplementary Table 4: VARC endpoints of Chinese aortic stenosis patients 30 days after receiving transcatheter aortic valve replacement: annular sizing vs. downsize approaches in BiAV morphology.

Item	Annular sizing (*n* = 10)	Downsize (*n* = 36)	*P*-value	Annular sizing (*n* = 13)	Downsize (*n* = 36)	*P*-value
	Sievers Type 0			Sievers Type 1		
Technical success	8 (80.0)	28 (77.8)	0.88	11 (84.6)	30 (83.3)	0.74
Device success	7 (70.0)	27 (75.0)	0.75	8 (61.5)	26 (72.2)	0.47
Death	0 (0)	0 (0)	–	0 (0)	0 (0)	–
Second valve implantation	2 (20.0)	6 (16.7)	0.81	2 (15.4)	4 (11.1)	0.69
PVL	1 (10.0)	1 (2.8)	0.32	1 (7.7)	2 (5.6)	0.78
New permanent pacemaker implantation	0 (0)	0 (0)	–	1 (7.7)	5 (13.9)	0.56
Repeat procedure	0 (0)	2 (5.6)	0.45	0 (0)	2 (5.6)	0.39
Major vascular complication	0 (0)	0 (0)	–	0 (0)	0 (0)	–
Prosthetic aortic valve stenosis	0 (0)	2 (5.6)	0.45	1 (7.7)	2 (5.6)	0.78

Data are expressed as *n* (%). BiAV: Bicuspid aortic valve; PVL: Perivalvular leakage; VARC: Valve Academic Research Consortium; –: Not available.