

Supplementary data

Supplementary Table 1. *In vitro* neoskirt dimensions for S3-in-Evolut and Evolut-in-Evolut redo-TAVI.

Index Evolut	Second TAV	S3 implant depth	Neoskirt height (mm)	Neoskirt width (mm)	Pinned leaflet length (mm)
26 mm Evolut	23 mm S3	Node 4	17.1	23.4	4
		Node 5	21.0	24.2	8
		Node 6	23.4	23.3	11
29 mm Evolut	26 mm S3	Node 4	18.3	25.8	5
		Node 5	20.6	26.5	7
		Node 6	24.7	25.6	11
34 mm Evolut	29 mm S3	Node 4	19.9	27.4	6
		Node 5	23.0	28.6	9
		Node 6	27.0	28.5	13
26 mm Evolut	26 mm Evolut	NA	26.2	NA	13
29 mm Evolut	29 mm Evolut	NA	27.5	NA	14
34 mm Evolut	34 mm Evolut	NA	28.9	NA	15

Neoskirt height was defined as the distance from the Evolut inflow to the pinned leaflet at the outflow of the S3. For Evolut in Evolut, the neoskirt height was defined as the distance from the Evolut inflow to the fully pinned leaflet height. Neoskirt width is the diameter of the Evolut after the S3 is placed inside. Neoskirt width of the Evolut in Evolut was determined by the post implant diameter of the Evolut on the CT scan. The pinned leaflet length was defined as the amount of first TAV's leaflet that is pinned.

Supplementary Table 2. Post-TAVI CT measurements for S3-in-Evolut and Evolut-in-Evolut redo-TAVI.

Dimensions (mm)	N	Mean ± SD
S3 in Evolut		
LCA average height (midpoint)	204	20.74 ± 3.64
RCA average height (midpoint)	204	22.00 ± 4.31
Node 4 VTC LCA	204	4.15 ± 1.97
Node 4 VTC RCA	194	3.19 ± 1.90
Node 5 VTC LCA	204	3.69 ± 1.94
Node 5 VTC RCA	194	2.73 ± 1.90
Node 6 VTC LCA	204	4.04 ± 1.91
Node 6 VTC RCA	194	3.07 ± 1.91
Evolut inflow to top of left coronary sinus	204	25.61 ± 3.94
Evolut inflow to top of right coronary sinus	204	26.16 ± 4.55
Node 4 VTSTJ LCA	198	1.37 ± 1.75
Node 4 VTSTJ RCA	187	1.68 ± 1.74
Node 5 VTSTJ LCA	198	0.91 ± 1.71
Node 5 VTSTJ RCA	187	1.23 ± 1.73
Node 6 VTSTJ LCA	198	1.22 ± 1.71
Node 6 VTSTJ RCA	187	1.54 ± 1.74
Evolut in Evolut		
VTC middle of LCA	204	5.58 ± 2.13
VTC middle of RCA	194	5.06 ± 2.08
VTSTJ above LCA	198	2.12 ± 1.46
VTSTJ above RCA	187	2.82 ± 1.62
VTA above LCA	94	1.43 ± 0.91
VTA above RCA	94	2.46 ± 1.34

Mean anatomic measurements with a virtual TAV within an Evolut to determine risk of coronary flow compromise and access. Node level refers to the frame of the index Evolut. LCA and RCA average heights (midpoint) were measured from the index Evolut inflow plane. VTSTJ and VTA were only measured if neoskirt was above the STJ. LCA, left coronary artery; RCA, right coronary artery; VTC, valve-to-coronary distance; VTSTJ, valve-to-sinotubular junction distance; VTA, valve-to-aortic wall at neoskirt plane.

Supplementary Table 3. CT-predicted risk of compromised coronary flow and access in patients undergoing S3-in-Evolut redo-TAVI by valve size.

Index Evolut	Second TAV	S3 implant depth	N	Low risk of coronary flow compromise (%)	Low risk of coronary inaccessibility (%)
26 mm Evolut	23 mm S3	Node 4	43		
Left Coronary				86	65
Right Coronary				79	77
Both				74	58
26 mm Evolut	23 mm S3	Node 5	43		
Left Coronary				28	21
Right Coronary				21	12
Both				28	14
26 mm Evolut	23 mm S3	Node 6	43		
Left Coronary				16	2
Right Coronary				21	9
Both				12	2
29 mm Evolut	26 mm S3	Node 4	89		
Left Coronary				84	74
Right Coronary				88	85
Both				79	70
29 mm Evolut	26 mm S3	Node 5	89		
Left Coronary				72	53
Right Coronary				69	63
Both				62	46
29 mm Evolut	26 mm S3	Node 6	89		
Left Coronary				45	11
Right Coronary				44	19
Both				33	6
34 mm Evolut	29 mm S3	Node 4	72		
Left Coronary				89	75
Right Coronary				90	83

Both				85	71
34 mm Evolut	29 mm S3	Node 5	72		
Left Coronary				76	51
Right Coronary				71	67
Both				63	46
34 mm Evolut	29 mm S3	Node 6	72		
Left Coronary				38	7
Right Coronary				38	23
Both				23	3

Supplementary Table 4. CT-predicted risk of compromised coronary flow and access in patients undergoing Evolut-in-Evolut redo-TAVI by valve size.

Index Evolut	Second TAV	N	Low risk of coronary flow compromise (%)	Low risk of coronary inaccessibility (%)
26 mm Evolut	26 mm Evolut	43		
Left Coronary			12	0
Right Coronary			26	2
Both			7	0
29 mm Evolut	29 mm Evolut	89		
Left Coronary			38	2
Right Coronary			62	7
Both			33	1
34 mm Evolut	34 mm Evolut	72		
Left Coronary			56	1
Right Coronary			58	7
Both			39	0

Supplementary Table 5. Univariable pre-TAVI CT predictors of high risk of coronary flow compromise for S3 outflow at Evolut node 4 redo-TAVI by index Evolut valve size.

	26mm Index Evolut (N=43)		29mm Index Evolut (N=89)		34mm Index Evolut (N=72)	
	Odds ratio (95% CI)	P value ¹	Odds ratio (95% CI)	P value ¹	Odds ratio (95% CI)	P value ¹
Aortic annulus perimeter (mm)	0.88 (0.62, 1.25)	0.466	0.79 (0.68, 0.91)	<0.001	0.89 (0.77, 1.01)	0.077
Aortic annulus perimeter- derived diameter (mm)	0.65 (0.21, 2.00)	0.452	0.47 (0.30, 0.73)	<0.001	0.68 (0.45, 1.04)	0.075
Aortic annulus perimeter- derived diameter ≤ 23mm	1.11 (0.13, 9.46)	0.927	6.86 (1.45, 32.38)	0.015	NA	NA
Valve oversizing (%)	1.08 (0.87, 1.34)	0.469	1.16 (1.06, 1.27)	<0.001	1.09 (0.99, 1.20)	0.066
SoV height at right coronary (mm)	0.69 (0.49, 0.97)	0.033	0.75 (0.62, 0.91)	0.003	0.87 (0.74, 1.03)	0.117
SoV height at left coronary (mm)	0.82 (0.60, 1.11)	0.193	0.80 (0.67, 0.96)	0.017	0.78 (0.64, 0.97)	0.022
SoV height at non- coronary (mm)	0.71 (0.50, 1.01)	0.054	0.80 (0.67, 0.96)	0.016	0.89 (0.74, 1.07)	0.209
Average SoV height (mm)	0.60 (0.38, 0.94)	0.027	0.69 (0.55, 0.87)	0.002	0.77 (0.61, 0.98)	0.032
Right coronary ostium height (mm)	0.73 (0.49, 1.08)	0.114	0.75 (0.62, 0.91)	0.003	0.79 (0.63, 0.97)	0.028
Left coronary ostium height (mm)	0.96 (0.71, 1.30)	0.784	0.85 (0.72, 1.00)	0.048	0.92 (0.77, 1.09)	0.338

	26mm Index Evolut (N=43)		29mm Index Evolut (N=89)		34mm Index Evolut (N=72)	
	Odds ratio (95% CI)	P value ¹	Odds ratio (95% CI)	P value ¹	Odds ratio (95% CI)	P value ¹
Average coronary ostium height (mm)	0.72 (0.43, 1.20)	0.208	0.74 (0.60, 0.91)	0.004	0.75 (0.57, 0.98)	0.036
SoV width at right coronary cusp (mm)	0.84 (0.57, 1.23)	0.365	0.52 (0.38, 0.71)	<0.001	0.78 (0.63, 0.97)	0.025
SoV width left coronary cusp (mm)	0.98 (0.67, 1.45)	0.923	0.53 (0.39, 0.72)	<0.001	0.74 (0.59, 0.94)	0.013
SoV width non-coronary cusp (mm)	0.85 (0.56, 1.32)	0.476	0.41 (0.28, 0.61)	<0.001	0.75 (0.59, 0.96)	0.020
Average SoV width (mm)	0.86 (0.55, 1.35)	0.523	0.42 (0.28, 0.61)	<0.001	0.73 (0.56, 0.94)	0.014
Ascending aorta minor diameter (mm)	1.15 (0.86, 1.53)	0.355	0.86 (0.72, 1.02)	0.083	0.86 (0.73, 1.01)	0.072
STJ max diameter (mm)	0.79 (0.55, 1.13)	0.191	0.75 (0.61, 0.93)	0.007	0.83 (0.70, 0.99)	0.044
STJ minor diameter (mm)	0.82 (0.58, 1.15)	0.251	0.81 (0.68, 0.98)	0.029	0.85 (0.70, 1.02)	0.076
Average STJ diameter (mm)	0.79 (0.55, 1.14)	0.208	0.78 (0.63, 0.95)	0.013	0.83 (0.69, 1.00)	0.054
Aortic valve calcium volume (mm ³) ²	0.99 (0.96, 1.02)	0.522	0.99 (0.98, 1.00)	0.199	1.00 (0.99, 1.01)	0.932
Index Evolut depth of implant at NCC (mm) ³	0.43 (0.25, 0.74)	0.002	0.67 (0.53, 0.84)	<0.001	0.73 (0.60, 0.89)	0.002

¹ Wald p value

² OR per 10 mm³ increase in calcium volume

³ CT-measured if available, otherwise fluoroscopy

SoV, sinus of Valsalva; STJ, sinotubular junction; NCC, non-coronary cusp