Asan Medical Center CT Algorithm for TAVR: Pre-TAVR Evaluation

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Disclosure

- I have no disclosures.

ECG-gated Multislice CT in TAVR Planning: A Critical Tool

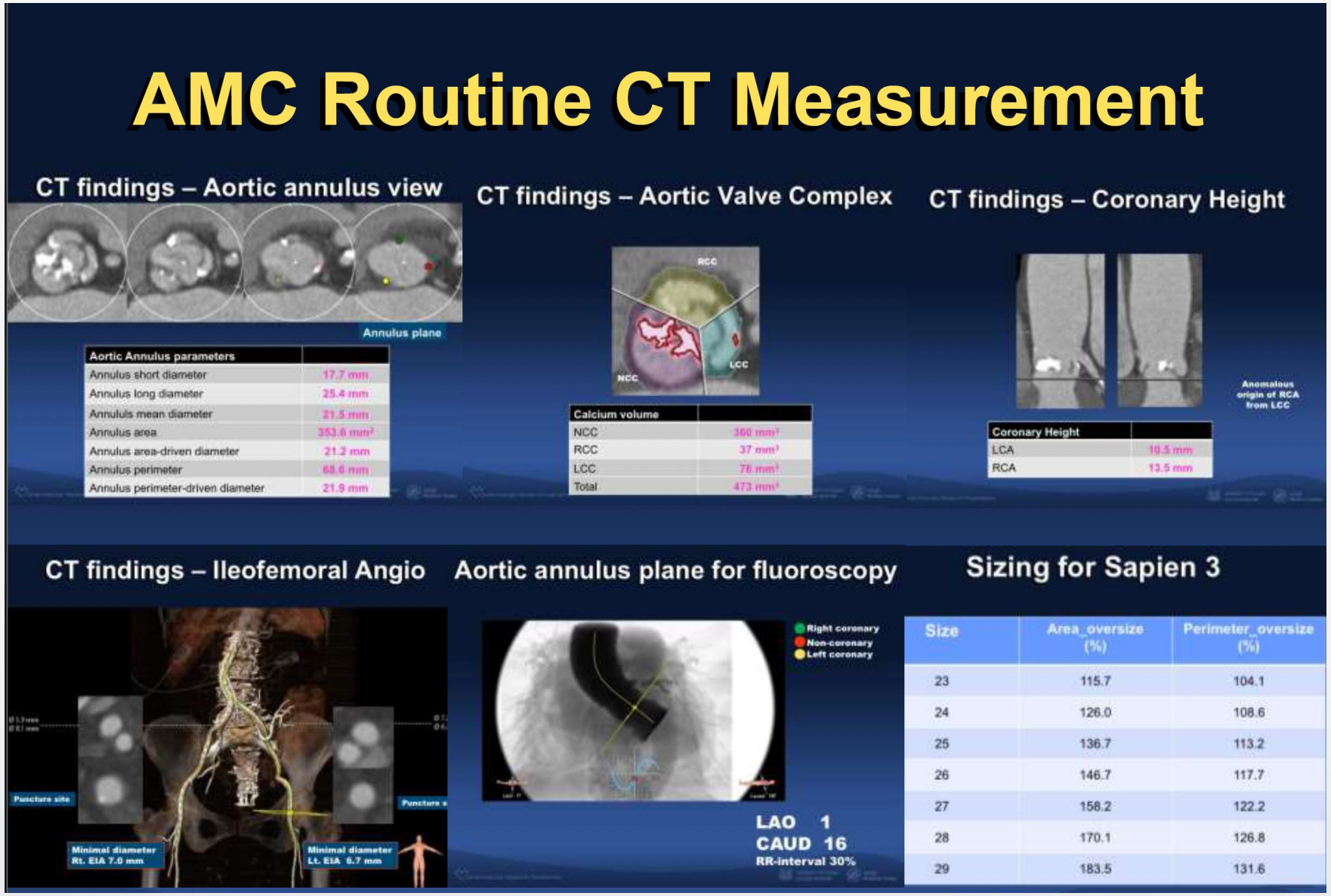
- **Assessment of Coronary Disease**: Streamline patient care by bypassing routine angiography when possible.
- **Anatomical Analysis**: Precise examination of aortic, iliac, and femoral vessels to determine the most suitable access and anticipate complications.
- **Valve Complex Visualization**: Detailed imaging for informed choices on device type and size.
- **Quality Assurance**: Consistently reliable measurements backed by strong intra-reader & inter-reader correlation.

TAVR in AMC

CT Planning Process

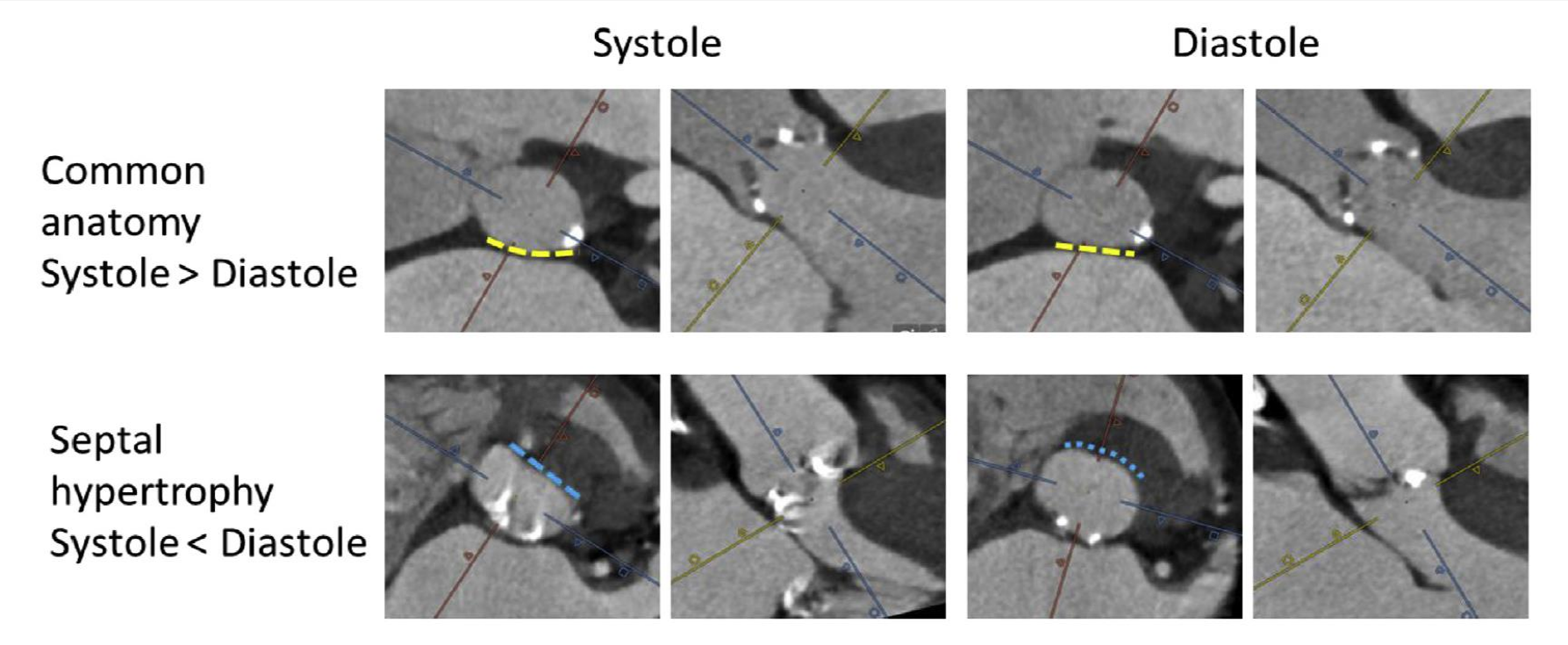
- 1-2 structural fellows & device representative perform separate measurements.
- Measurements are discussed together in real time to reach a consensus.
- Collective findings are discussed in MDT to finalize TAVR strategy.

AMC Routine CT Measurement

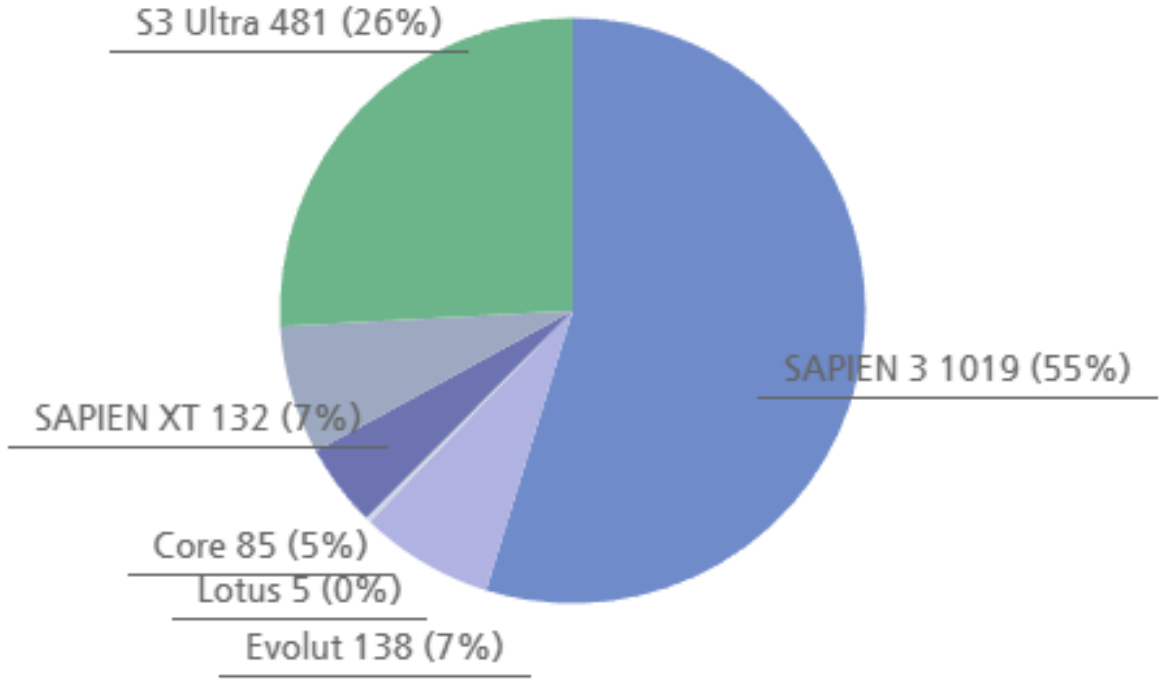


Annular dynamism

- Annulus size changes throughout cardiac cycle.
- Measure end-systolic phase (usually largest annulus phase 20-30%)
- If septal hypertrophy Measure diastolic phases.

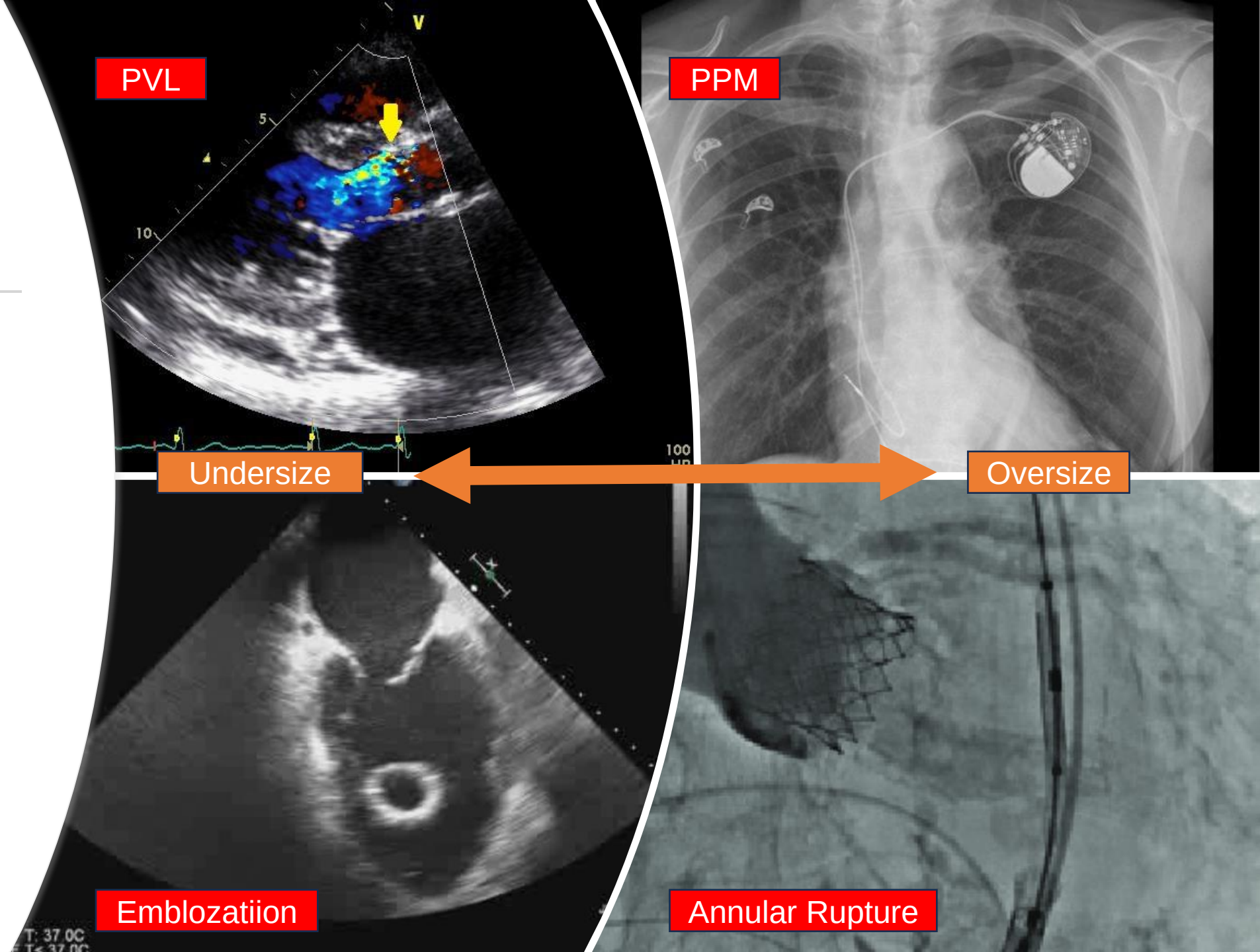


Blanke P et al. JACC Cardiovasc Imaging. 2019;12:1-24.


S3 Ultra 481 (26%)
SAPIEN 3 1019 (55%)
SAPIEN XT 132 (7%)
Core 85 (5%)
Lotus 5 (0%)
Evolut 138 (7%)

Total : 1860

Sizing Matters

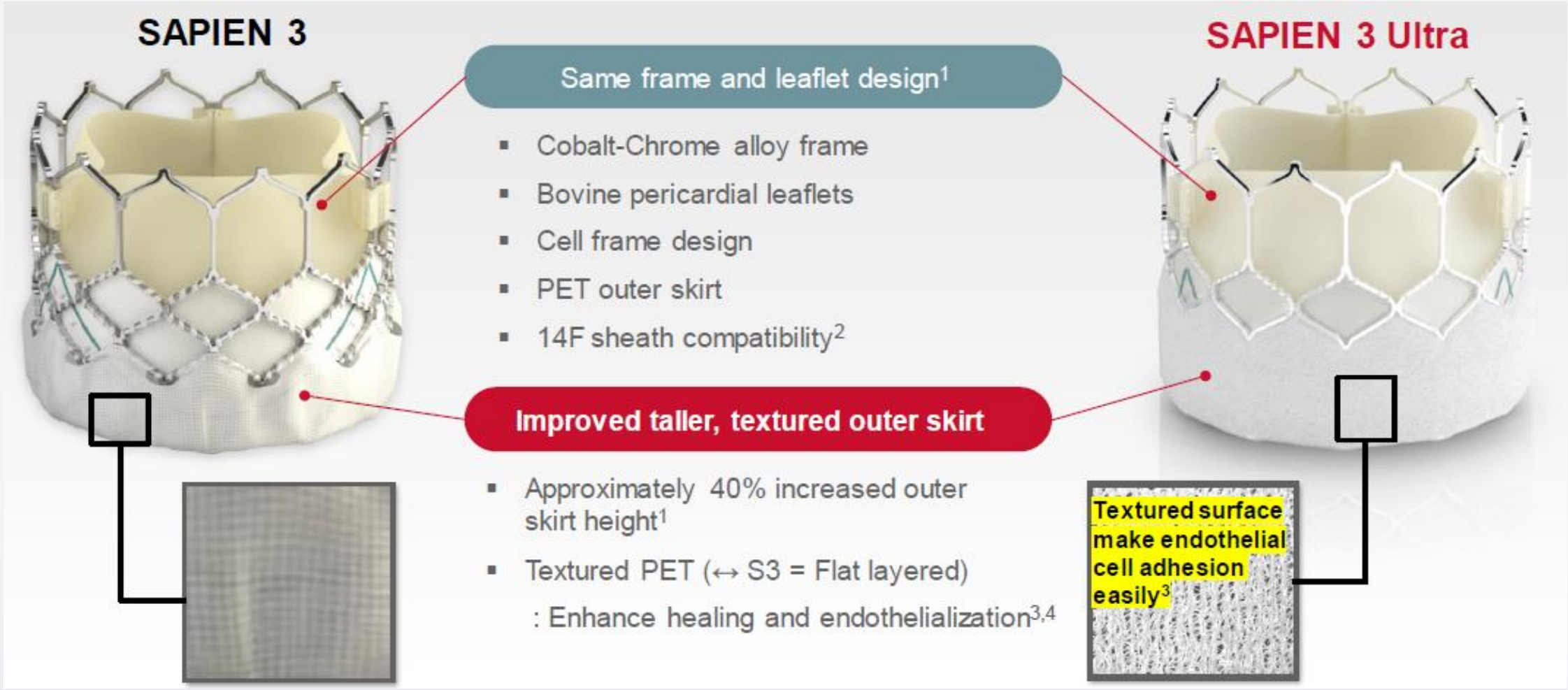


AMC TAVR Registry

	Predictor	Odds Ratio (95% CI)	P-Value
PPM	Annulus area oversizing by CT (per 1%)	1.02 (1.003 - 1.04)	0.024
> Moderate PVL	Total amount of annulus calcium by CT (per 100 mm3)	1.26 (1.10 – 1.45)	0.001

	Cut-off	Outcome	AUC	Sensitivity/specificity
Annulus Area oversizing	115%	PPM	.72	0.85/0.51
Annular calcium	400mm3	PVL	.70	0.50/0.68

Difference btw SAPIEN 3 and SAPIEN 3 Ultra

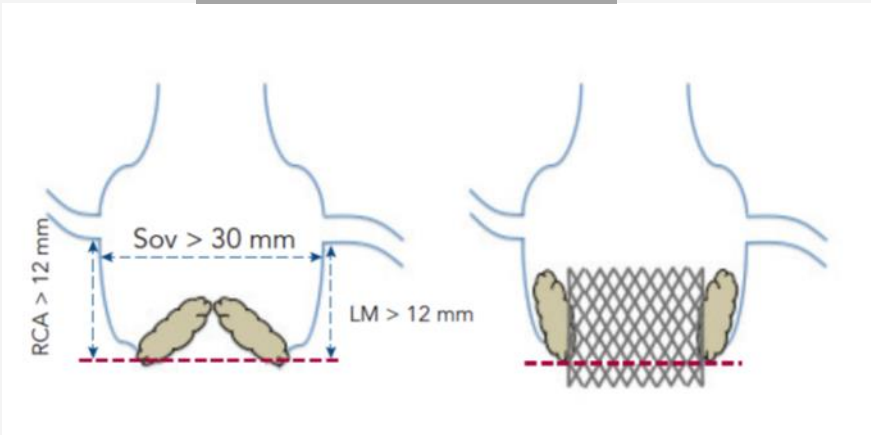


S3U area oversizing based on CT
5% Cutoff

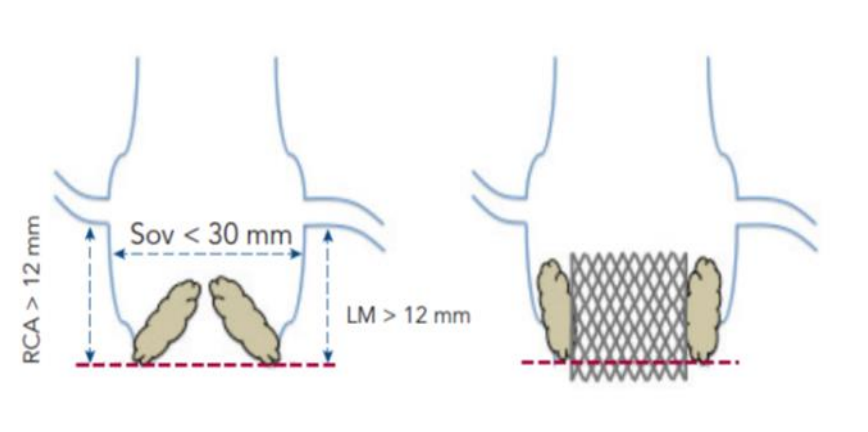
	Oversizing
Low Caclification (Ca Volume < 400m^3)	**5~10%, then overfill**
Heavy calcification (Ca Volume > 400m$^{3)}$	**0~5%, then overfill**
Bicuspid AS and **Low calcification**	**0~5%, then overfill**
Bicuspid AS and **Heavy calcification**	**-5~0%, then overfill**

Risk of Coronary Obstruction

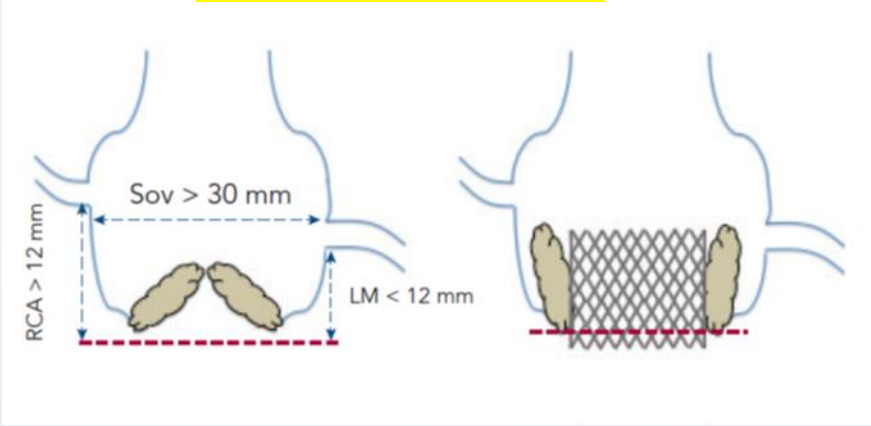
Wide and High



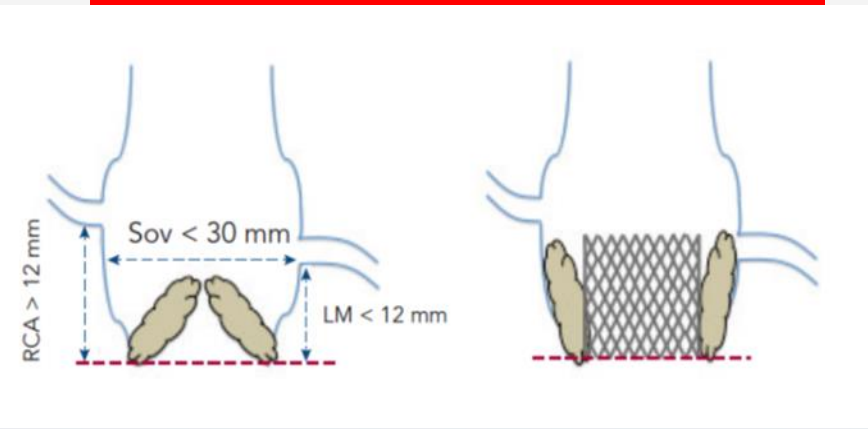
Shallow and High



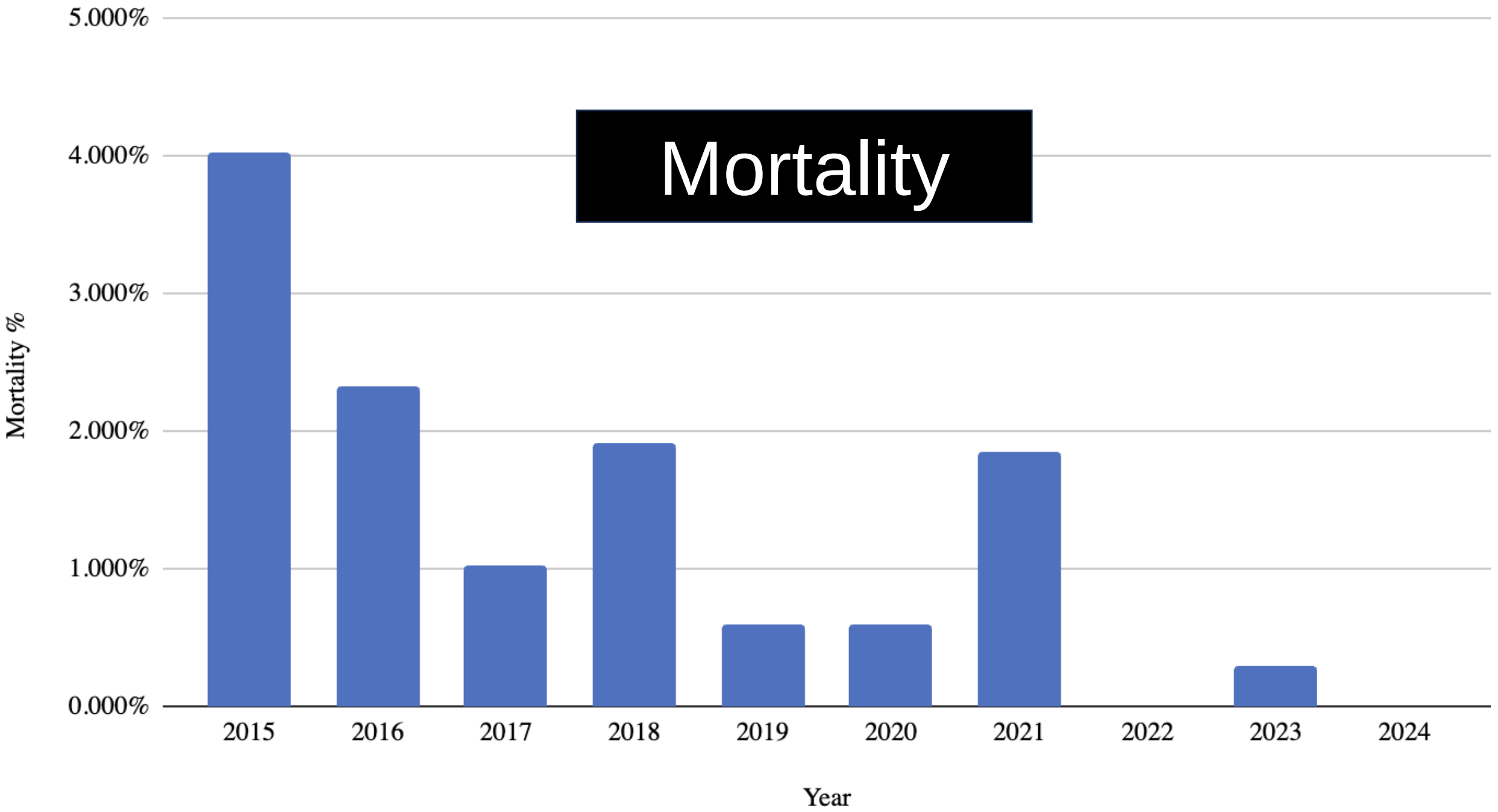
Wide and Low



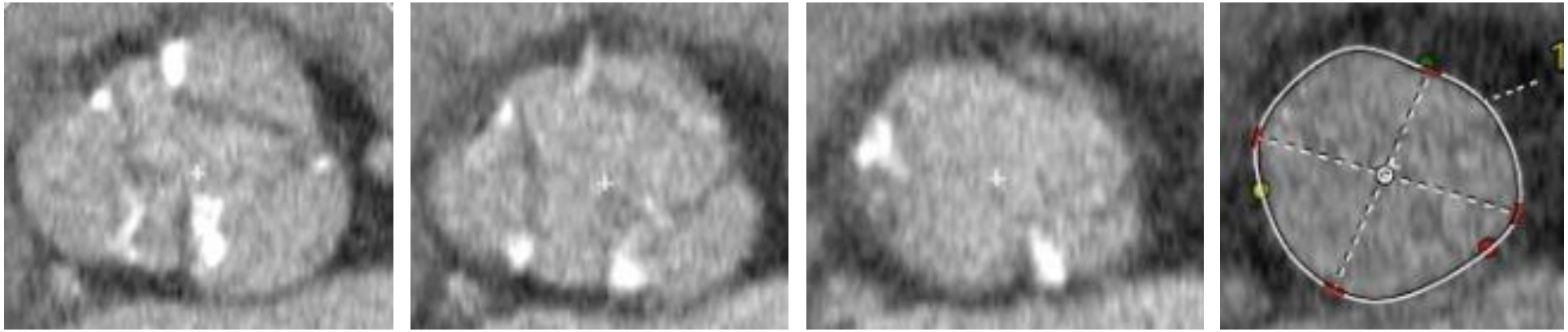
Shallow and Low (<10mm)



Interventional Cardiology Review, 2015;10(2):94–7


Mortality
5.000%
4.000%
3.000%
2.000%
1.000%
0.000%
Mortality %
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year

Case 1

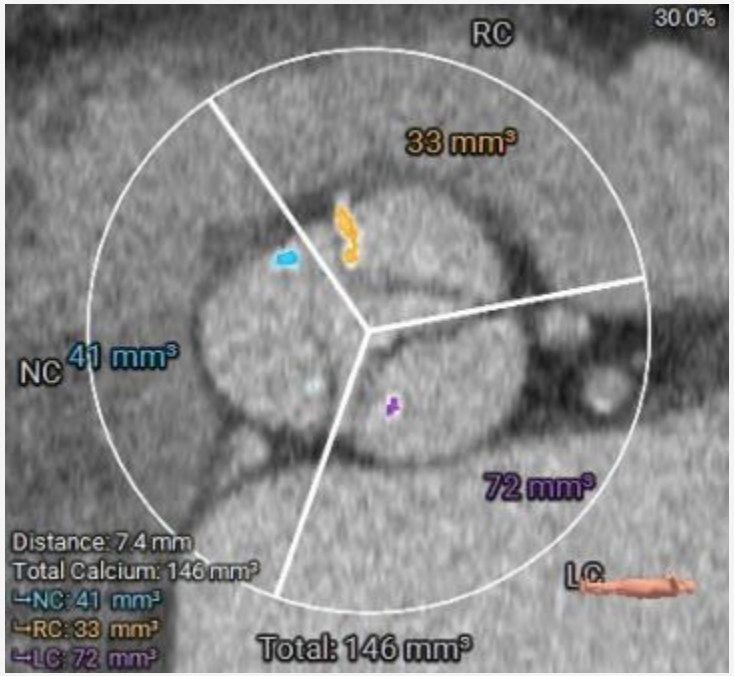


Annulus plane_30%

Aortic Annulus parameters	
Annulus short diameter	**22.3 mm**
Annulus long diameter	**25.3 mm**
Annulus mean diameter	**23.8 mm**
Annulus area	**434 mm^2**
Annulus area-driven diameter	**23.5 mm**
Annulus perimeter	**74.5 mm**
Annulus perimeter-driven diameter	**23.7 mm**

Caclium Volume

Short membranous septum



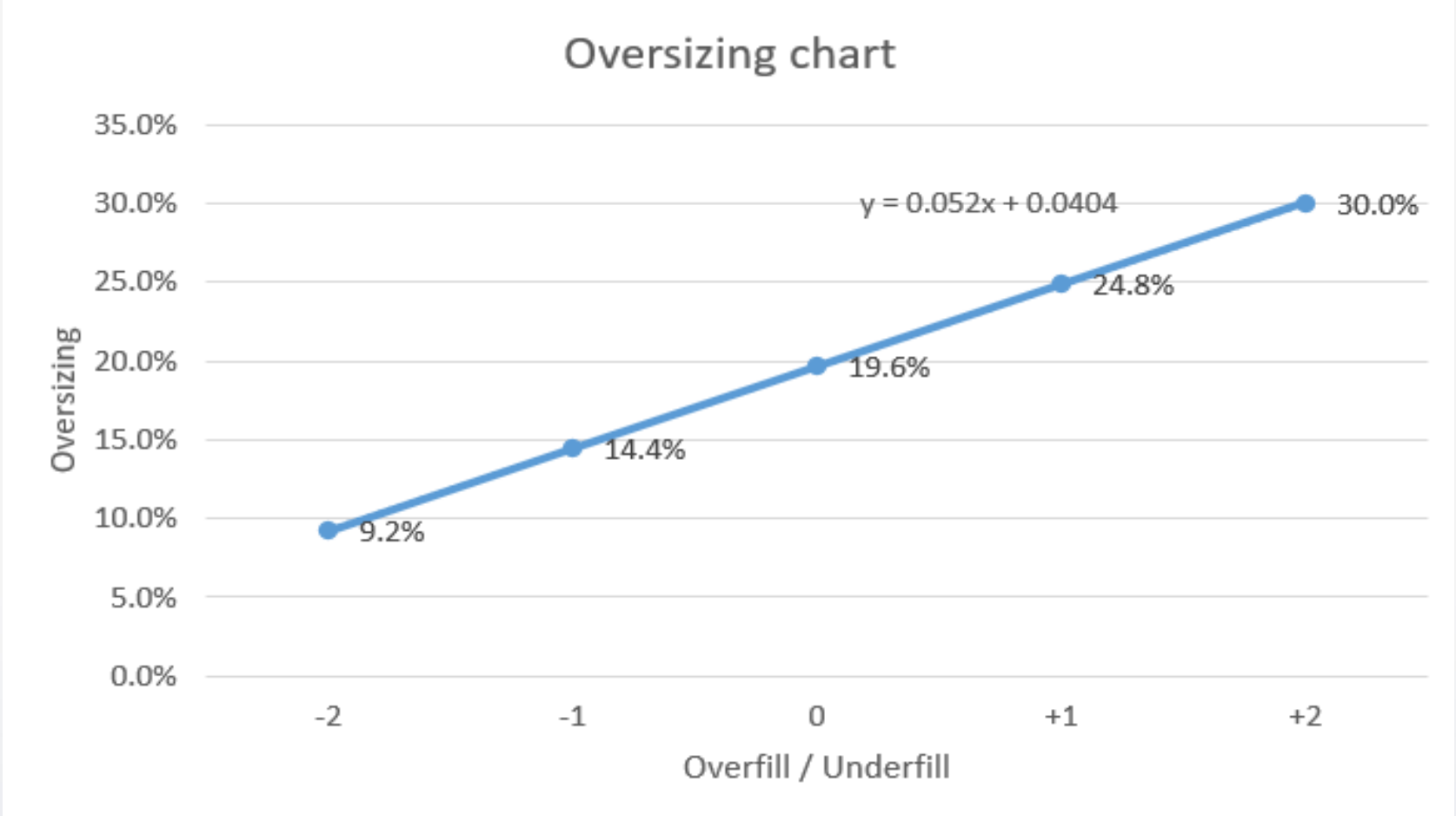
Calcium volume	
NCC	**41 mm³**
RCC	**33 mm³**
LCC	**72 mm³**
Total	**146 mm³**

	Oversizing
Low Caclification (Ca Volume < 400m³)	**5-10%, then overfill**
Heavy calcification (Ca Volume > 400m³)	**0-5%, then overfill**
Bicuspid AS and **Low calcification**	**0-5, then overfill**
Bicuspid AS and **Heavy calcification**	**-5-0%, then overfill**

S3U oversizing table

Size	Area Oversize (%)	Perimeter Oversize (%)
21	83.3	90.4
22	91.5	94.7
23	94.3	95.9
24	102.7	100.1
25	111.4	104.2
26	119.6	108.4
27	129.0	112.6

Oversizing for S3U 26mm Valve

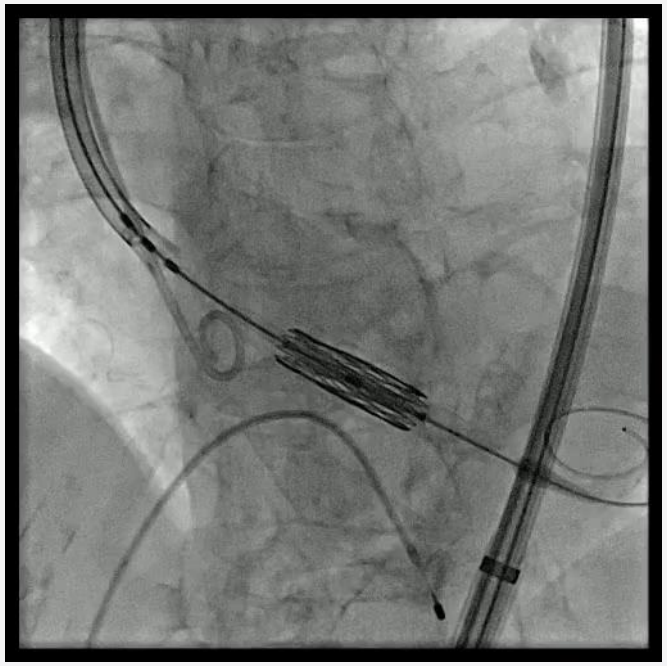


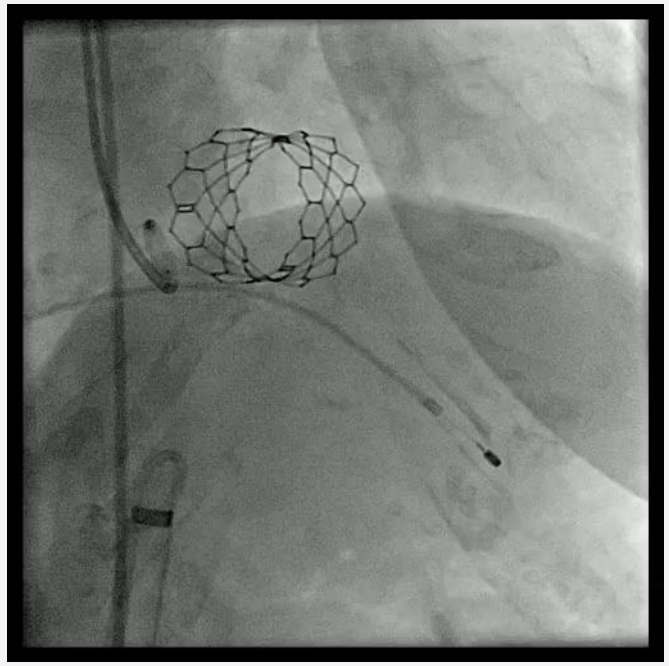
Final decision

We decided on a **26mm S3U valve with -2cc underfill**

9.2% oversize

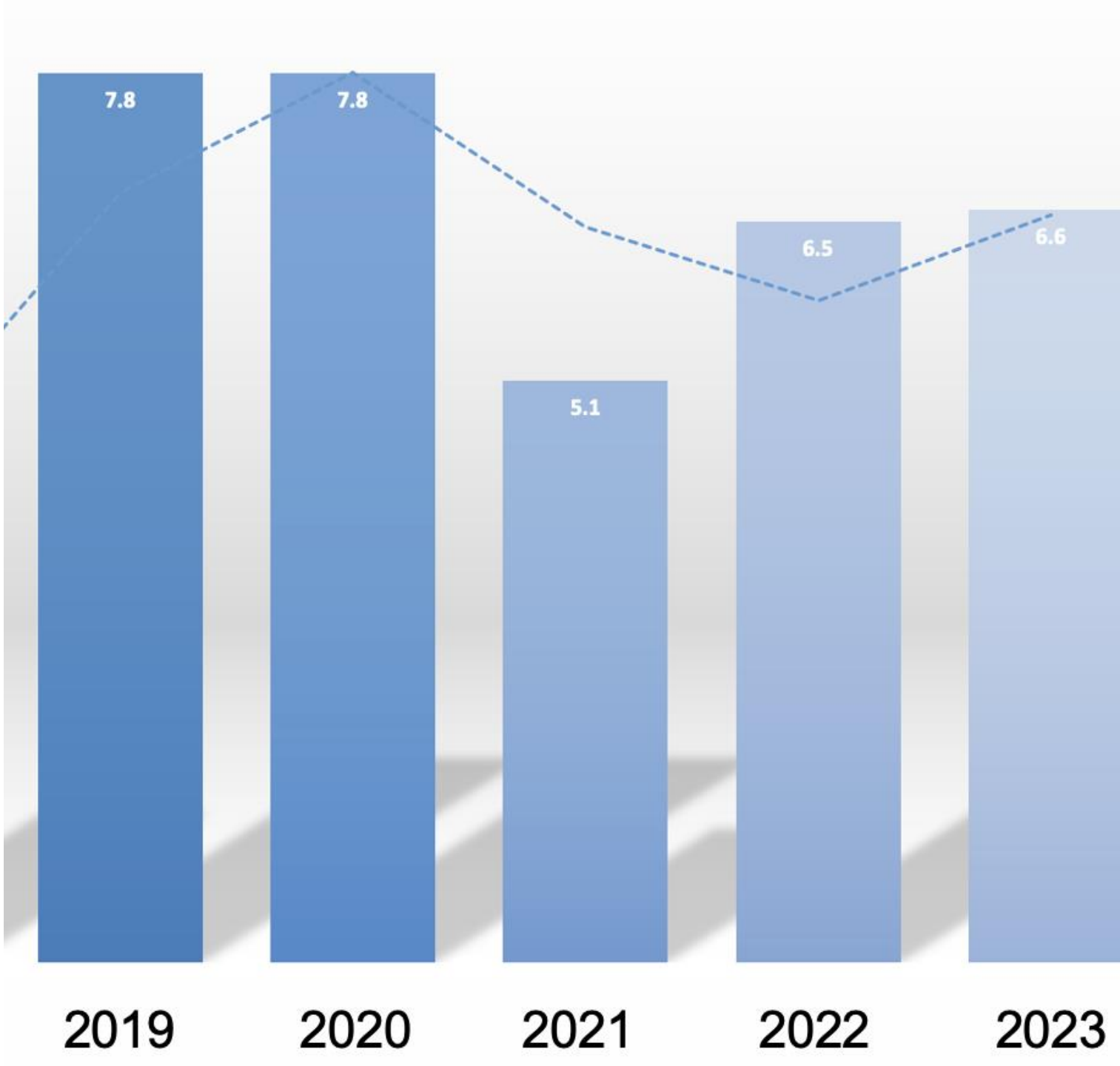
26mm S3U valve with 2cc underfill
9.2% oversize



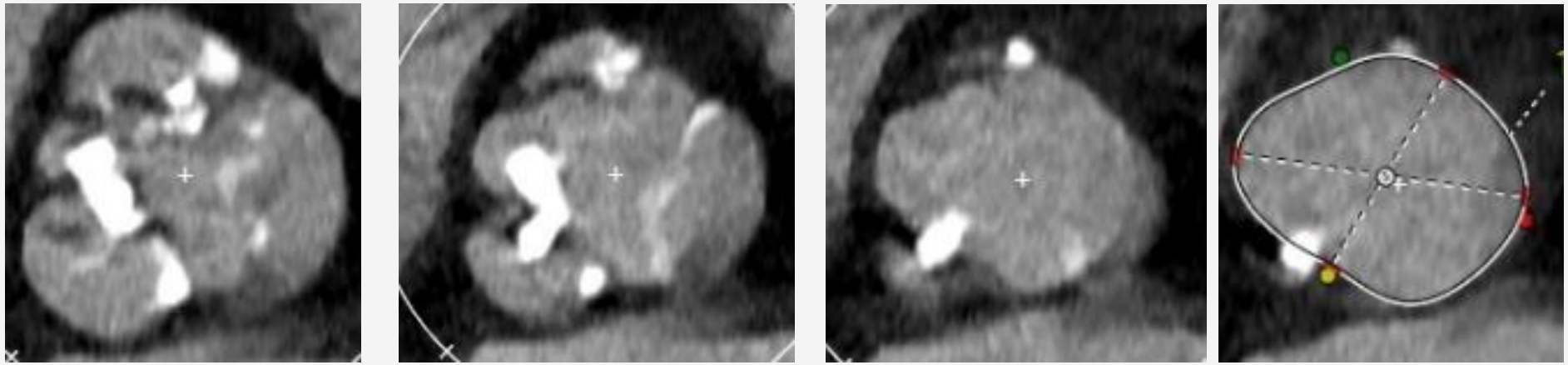


Patient developed CHB
requiring TPM x 24 hours

PPM Incidence after TAVR in AMC



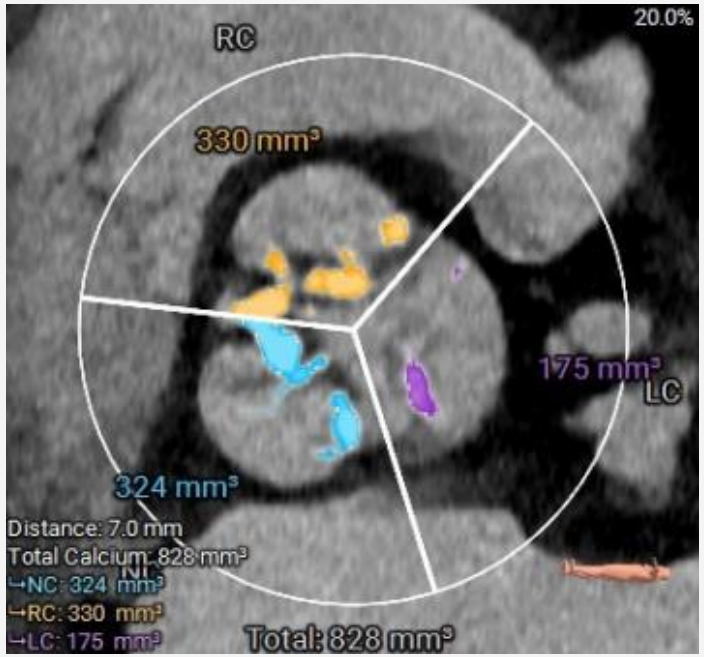
Case 2 (Bicuspid)



Annulus plane_20%

Aortic Annulus parameters	
Annulus short diameter	**21.4 mm**
Annulus long diameter	**28.0 mm**
Annulus mean diameter	**24.7 mm**
Annulus area	**466 mm^2**
Annulus area-driven diameter	**24.3 mm**
Annulus perimeter	**78.2 mm**
Annulus perimeter-driven diameter	**24.9 mm**

Caclium Volume



HU

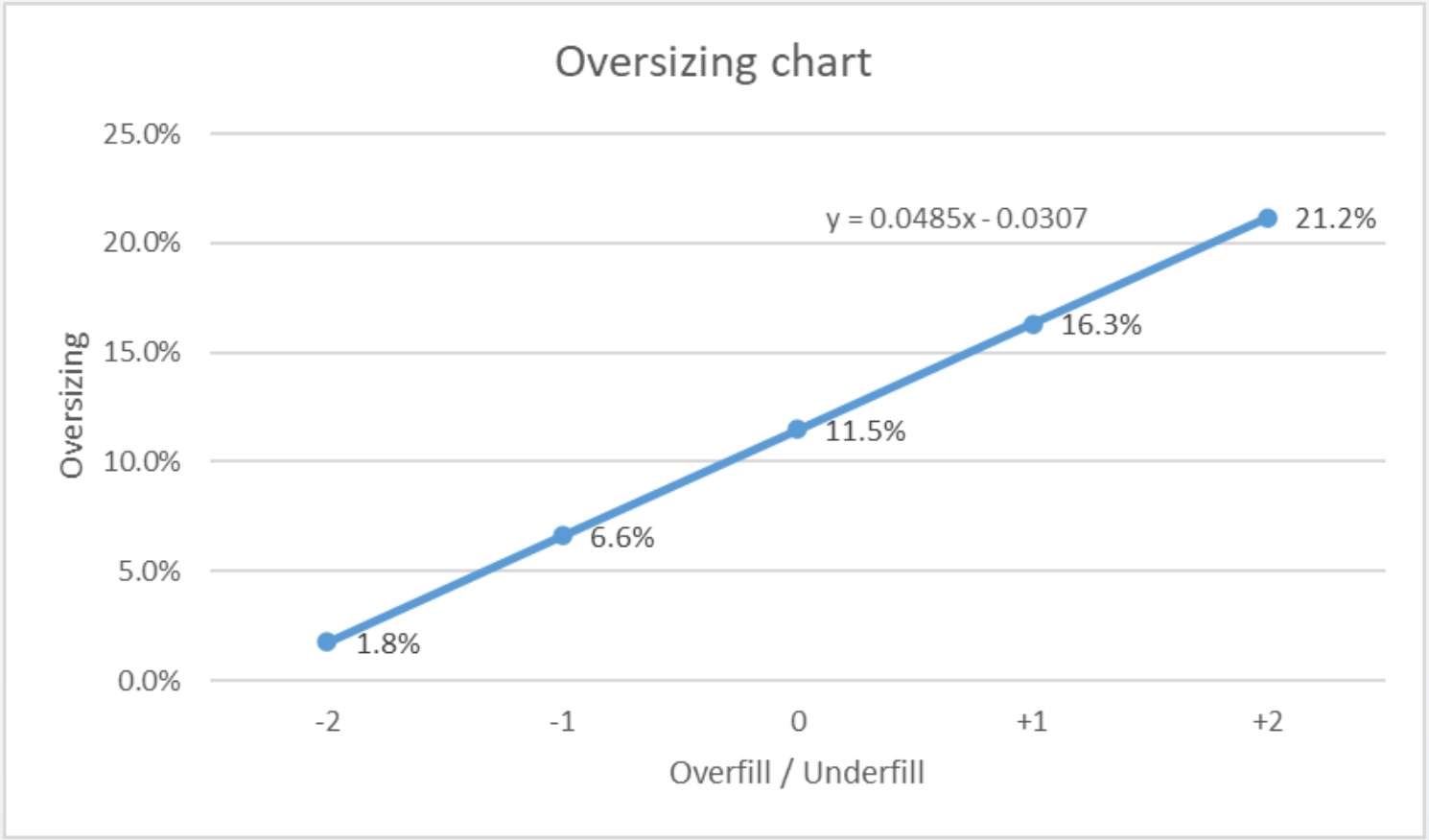
Calcium volume	
NCC	**324 mm³**
RCC	**330 mm³**
LCC	**175 mm³**
Total	**828 mm³**

	Oversizing
Low Caclification (Ca Volume < 400m³)	**5-10%, then overfill**
Heavy calcification (Ca Volume > 400m³)	**0-5%, then overfill**
Bicuspid AS and **Low calcification**	**0-5%, then overfill**
Bicuspid AS and **Heavy calcification**	**-5-0%, then overfill**

Sizing for Sapien 3

Size	Area Oversize (%)	Perimeter Oversize (%)
23	87.8	91.4
24	95.6	95.4
25	103.7	99.3
26	111.4	103.2
27	120.1	107.2
28	129.2	111.1
29	139.4	115.4

Overizing for S3U 26mm Valve

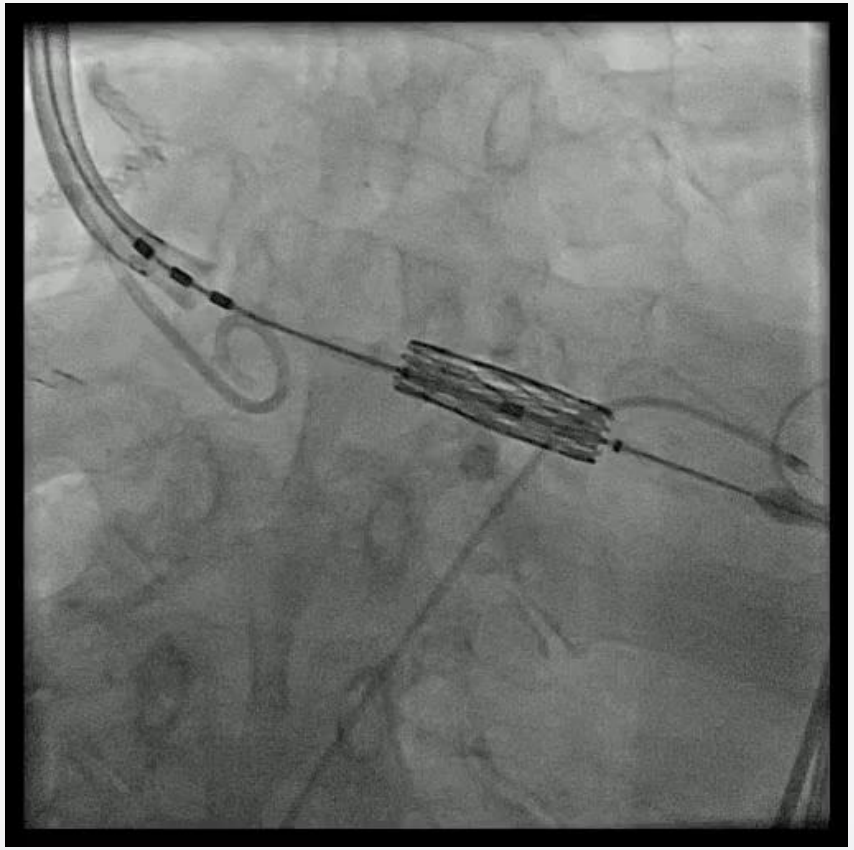


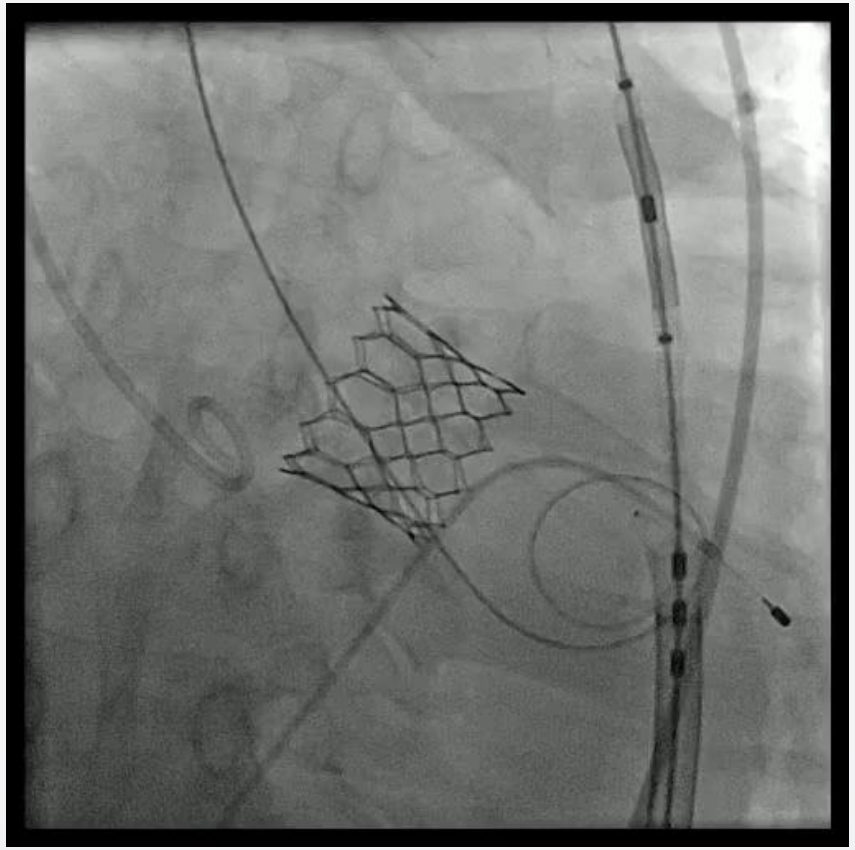
Final decision

We decided on a **26mm S3U valve with -2cc underfill**

1.8% oversize

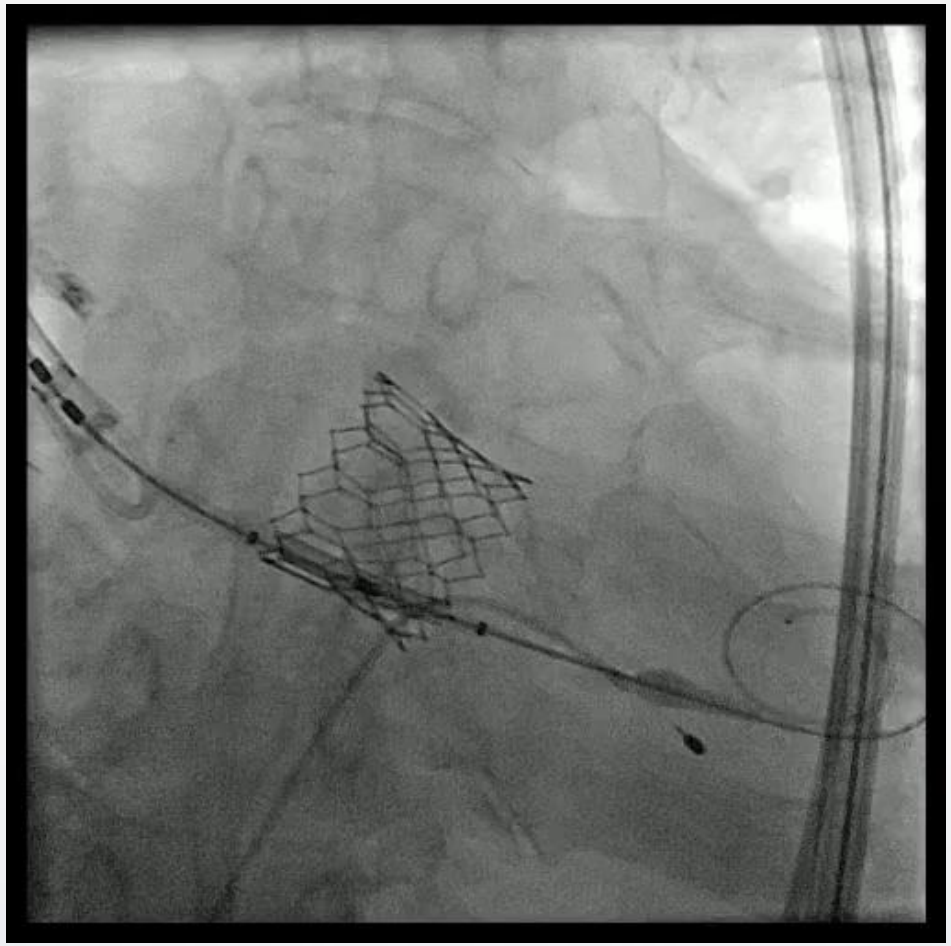
26mm S3U valve with -2cc underfill
1.8% oversize

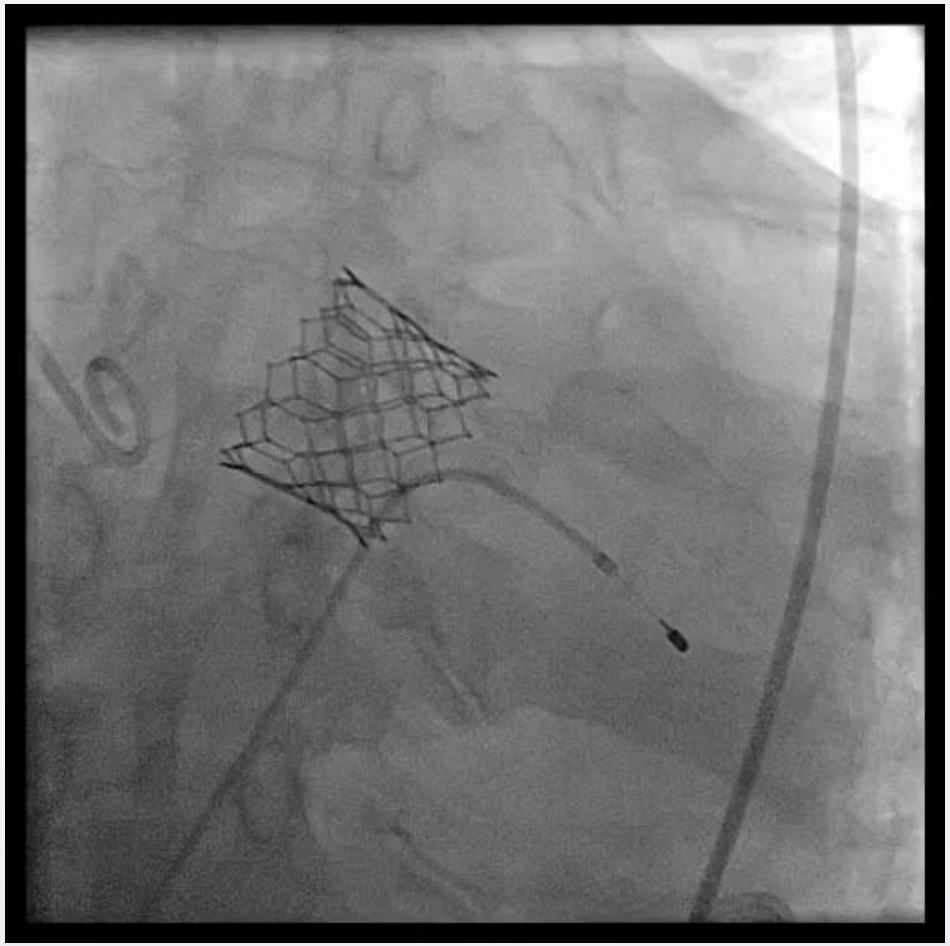




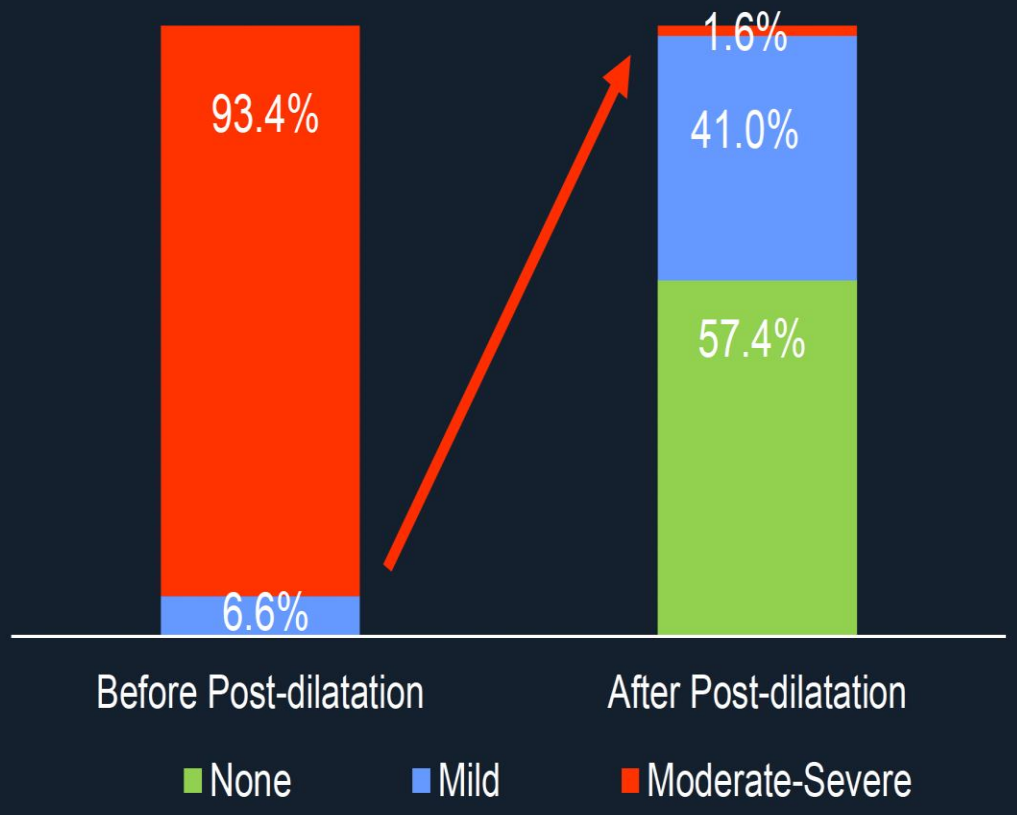
Mild PVL

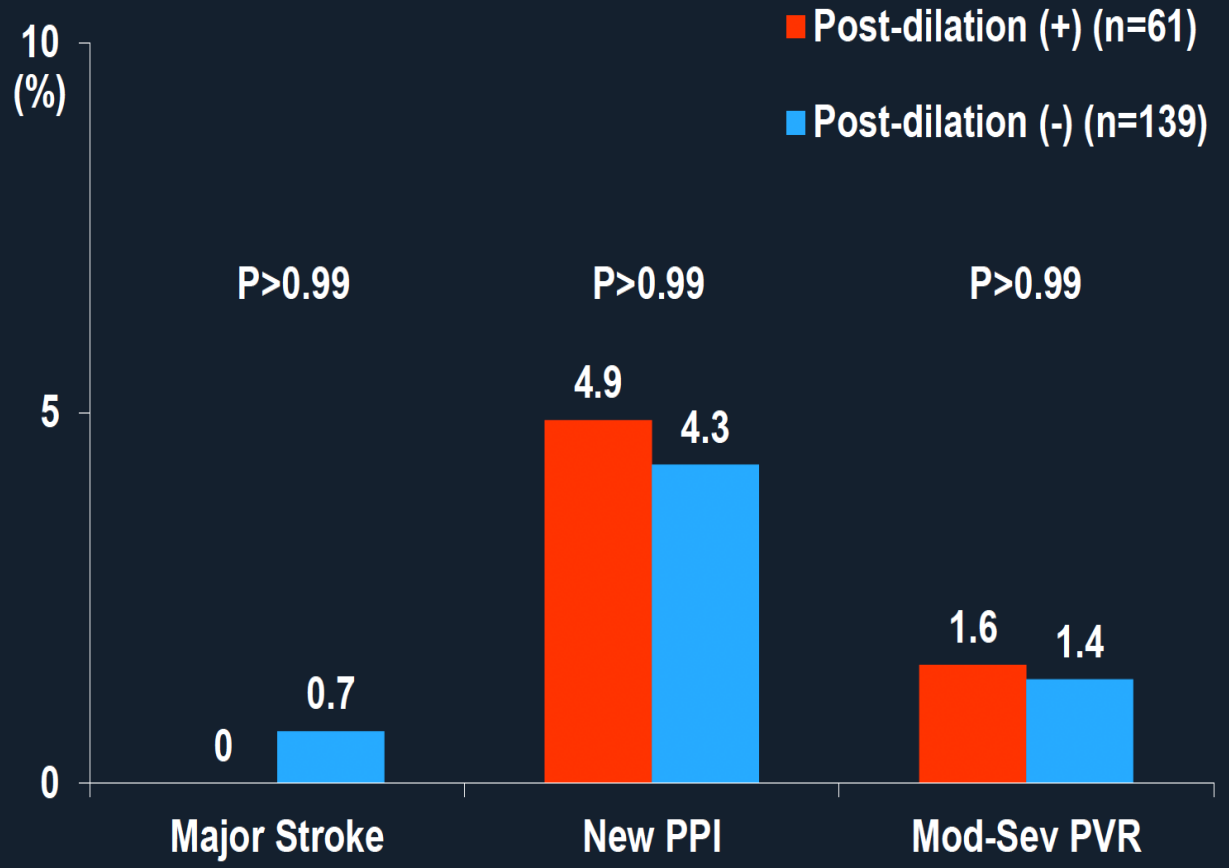
Postdilation at -1cc underfill 6.6% oversize



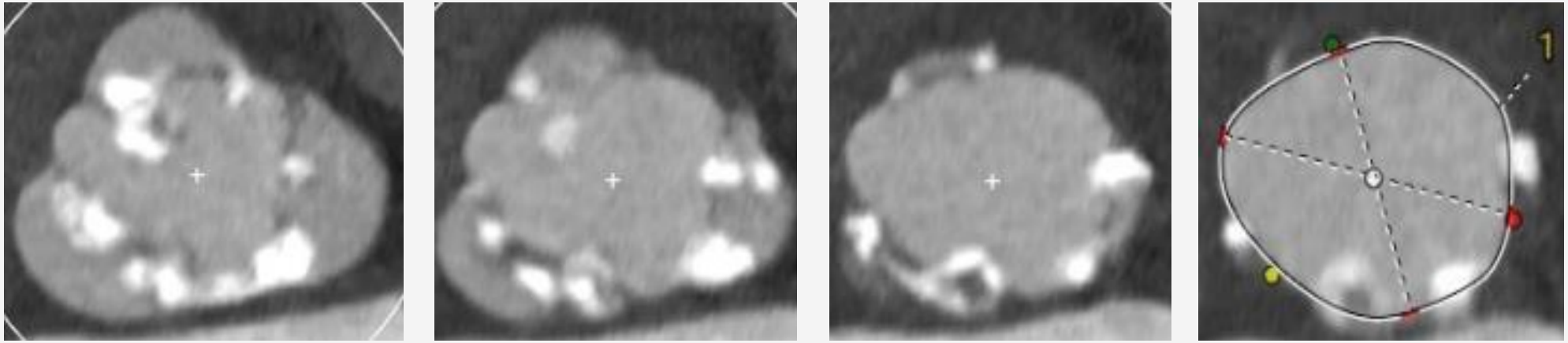


AMC TAVR Registry





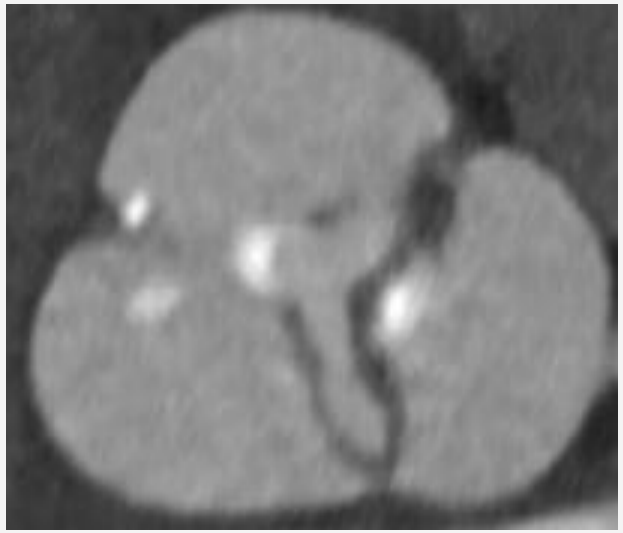
Case 3



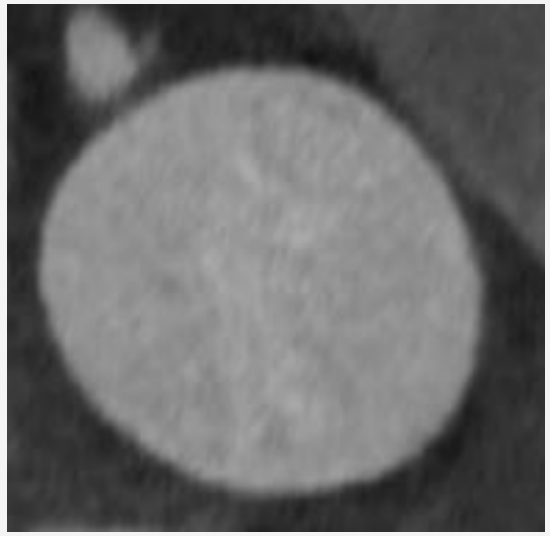
Annulus plane_20%

Aortic Annulus parameters	
Annulus short diameter	**25.4 mm**
Annulus long diameter	**30.6 mm**
Annulus mean diameter	**28.0 mm**
Annulus area	**598 mm^2**
Annulus area-driven diameter	**27.6 mm**
Annulus perimeter	**88.0 mm**
Annulus perimeter-driven diameter	**28.0 mm**

CT findings – Aortic Valve Complex



Sinus of Valsalva

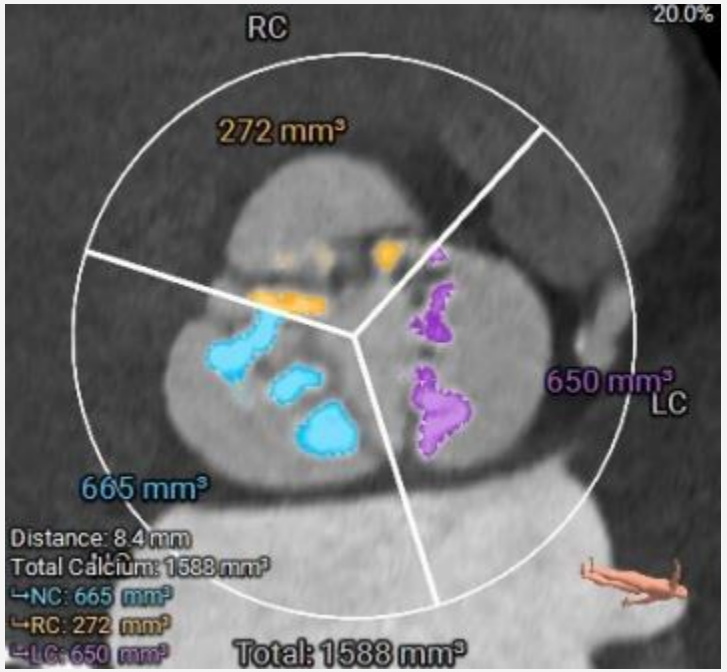


STJ

Sinus of Valsalva		STJ	
Area	**1234.3 mm2**	Area	**951.6 mm2**
Sinus / Annulus Area Ratio	**2.06**	STJ/ Annulus Area Ratio	**1.59**
NCC diameter	**38.5 mm**	Mean diameter	**35.0 mm**
RCC diameter	**37.5 mm**	Height of lowest STJ	**24.1 mm**
LCC diameter	**39.4 mm**		

Mean Sinus / Annulus Area Ratio: 1.87 ± 0.33 **Mean STJ / Annulus Area Ratio:** 1.52 ± 0.36

Calcium Score



HU

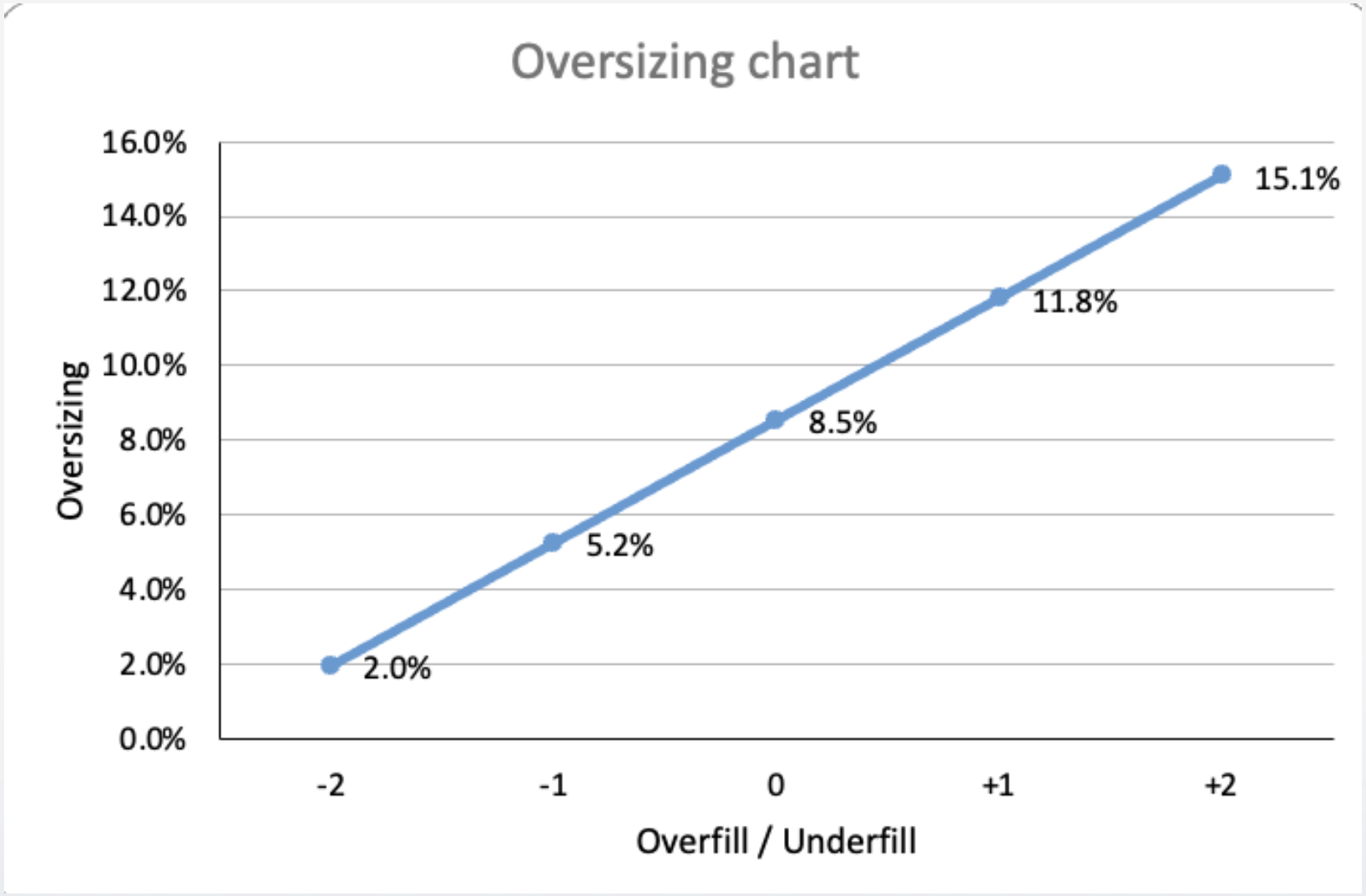
Calcium volume	
NCC	**665 mm³**
RCC	**272 mm³**
LCC	**650 mm³**
Total	**1588 mm³**

	Oversizing
Low Caclification (Ca Volume < 400m³)	**5-10%, then overfill**
Heavy calcification (Ca Volume > 400m³)	**0-5%, then overfill**
Bicuspid AS and **Low calcification**	**0-5%, then overfill**
Bicuspid AS and **Heavy calcification**	**-5-0%, then overfill**

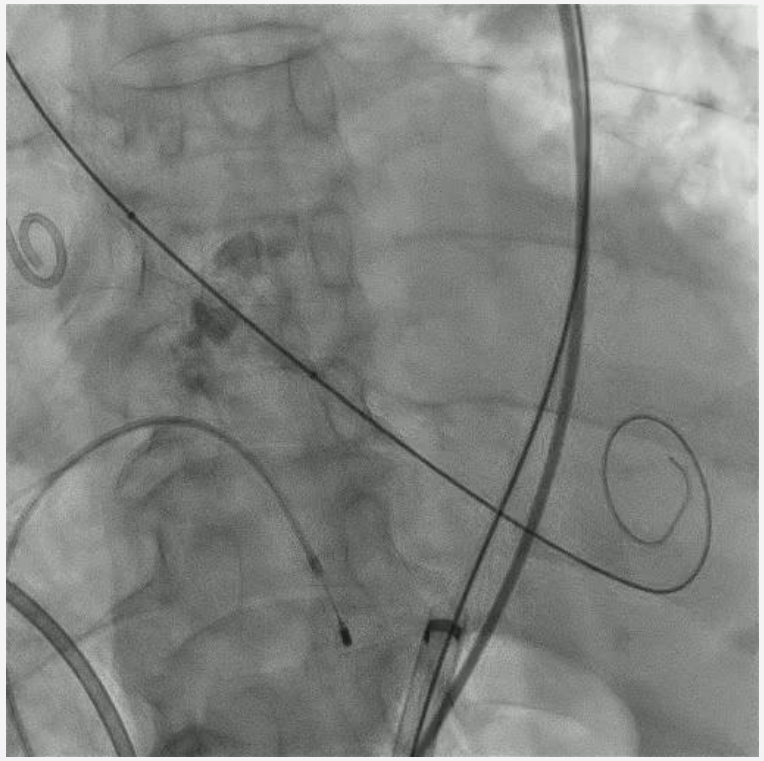
Sizing for Sapien 3

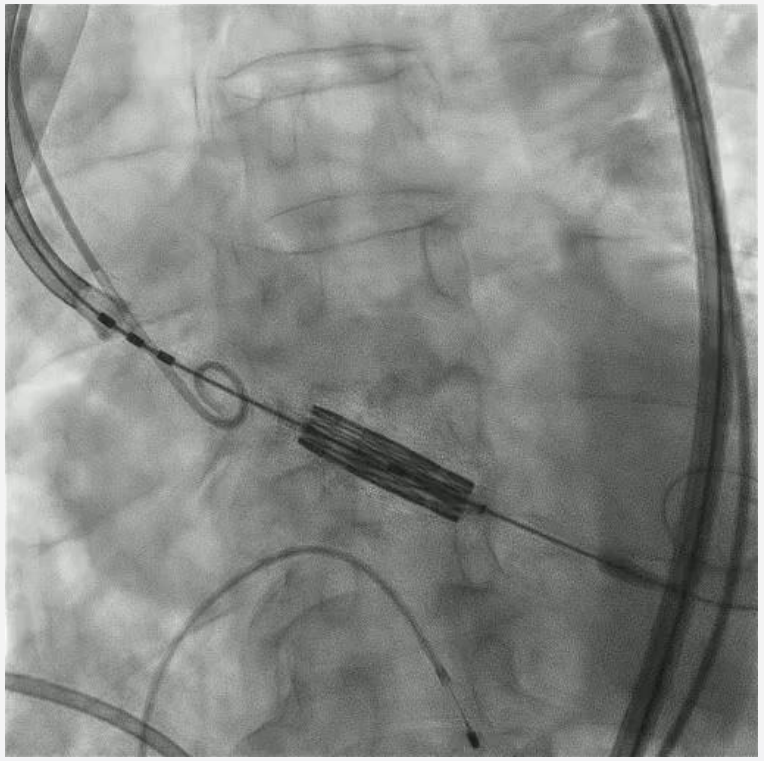
Size	Area Oversize (%)	Perimeter Oversize (%)
25	80.8	88.3
26	86.7	91.7
27	93.5	95.2
28	100.6	98.8
29	108.4	102.6
30	116.0	106.1
31	123.9	109.7

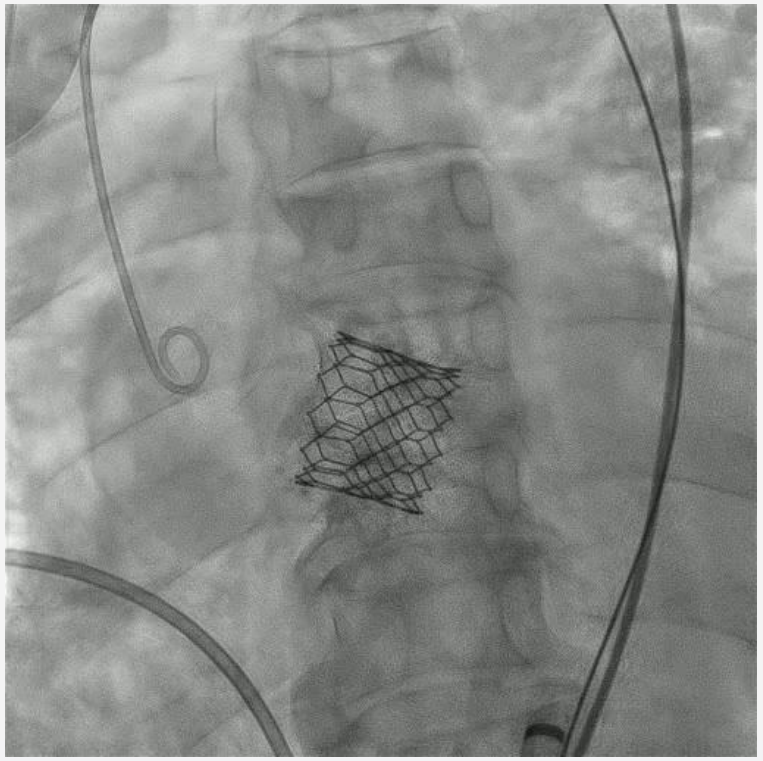
Oversizing for S3U 29mm Valve



29mm S3U valve with -1cc underfill
5.2% oversize







Mild PVL

Conclusion

- CT TAVR planning and MDT collaboration ensure precise valve selection and improved patient outcomes, this can be crucial for navigating complex cases.

- In the era of low surgical risk TAVR, comprehensive CT analysis is critical for optimal valve and patient selection, ensuring enhanced procedural outcomes.

- Employing a CT sizing algorithm with the possibility of provisional post-dilation to achieve the intended oversizing ratio has proven to be both safe and effective.

THANK YOU