

# AMC CT Algorithm for TAVR with SAPIEN 3 Platform

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# MDCT Analysis is Essential for TAVR Anatomic Risk Evaluation

1. Suitable Aortic Root Anatomy
2. Device and Size Selection
3. Coronary Disease Status
4. Aortic, Iliac and Femoral Anatomy
5. Optimal Fluoroscopic Projection Angulation

# Valve Sizing Matters

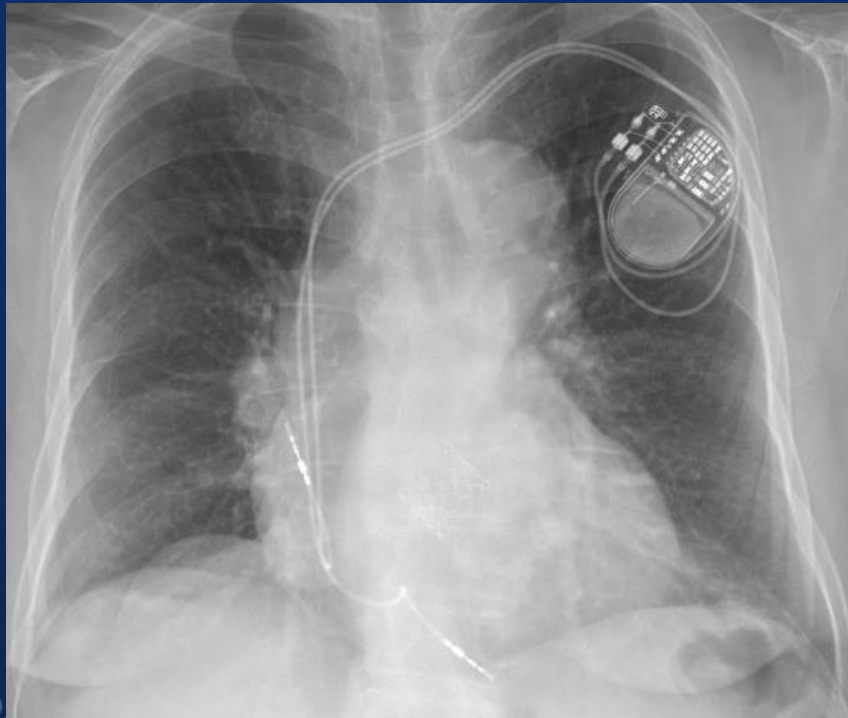
Oversize

Undersize



Permanent Pacemaker  
Annular Rupture

Paravalvular Regurgitation  
Valve Embolization

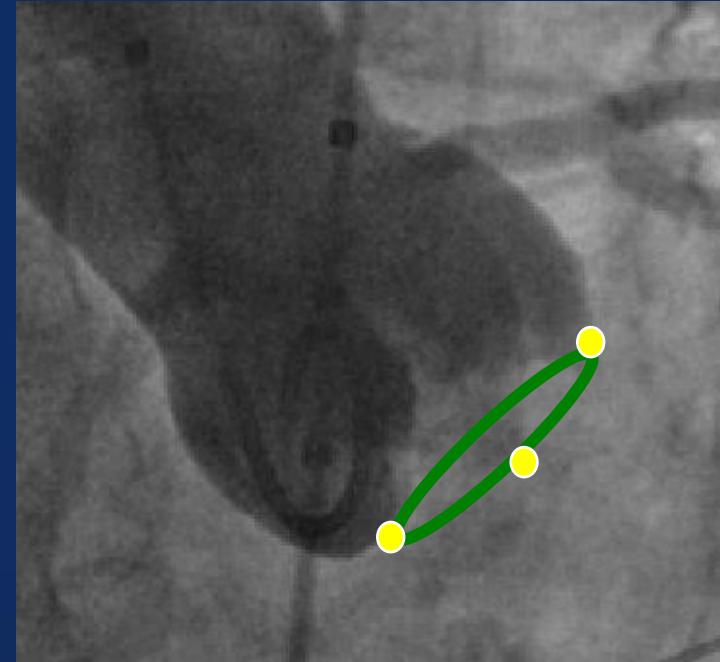
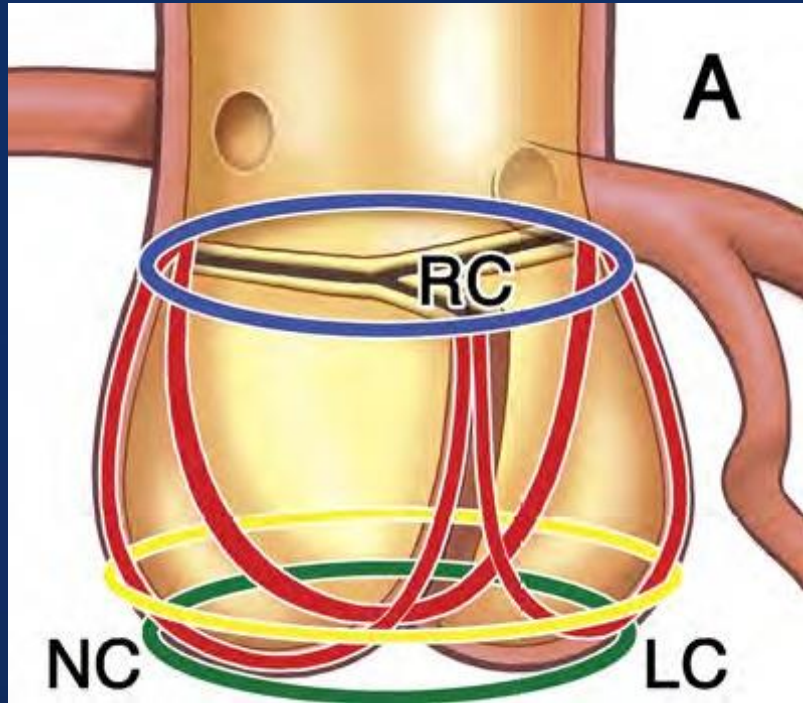


VS.



# Virtual Basal Ring

## Correct Assessment of Annulus Size

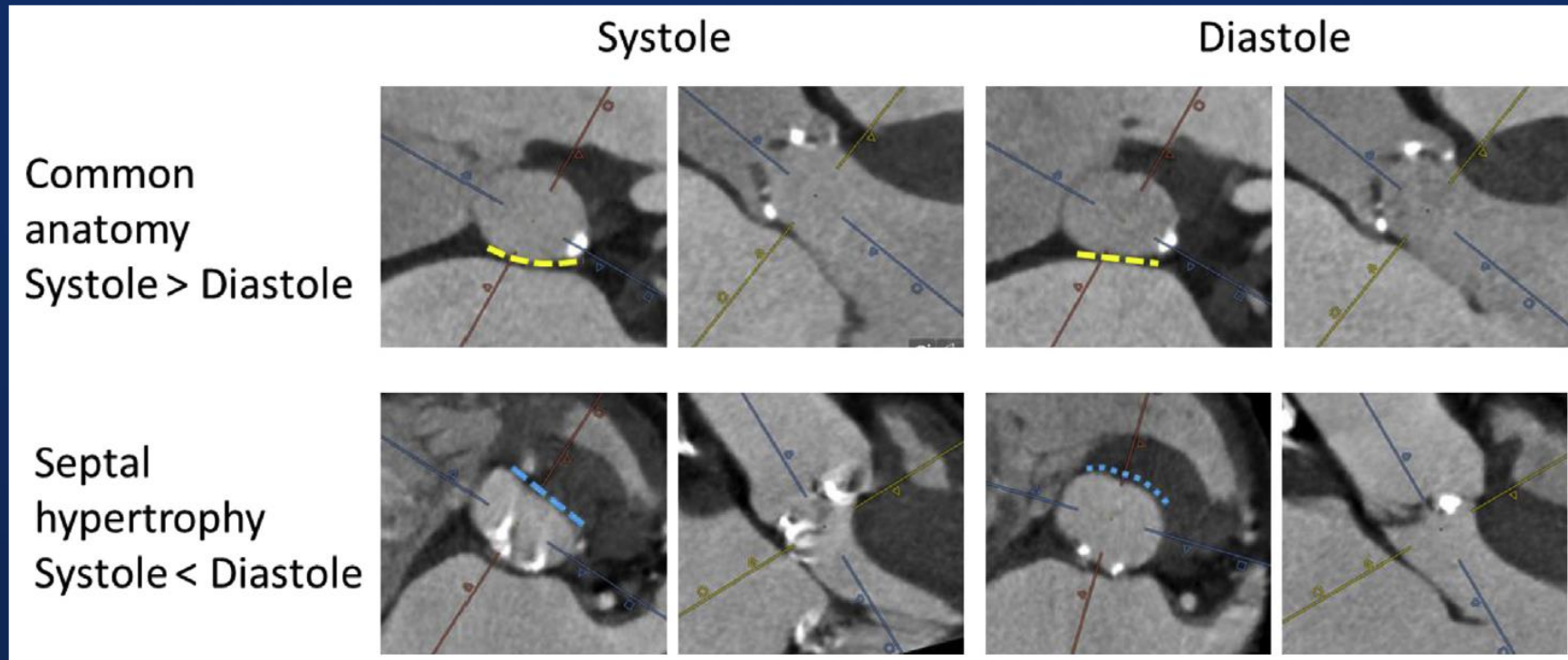


-  Sinotubular junction
-  Aortic leaflets
-  Aortoventricular junction
-  Aortic Annulus : virtual ring formed by base of AV leaflets

RC = Right coronary cusp; NC = Non-coronary cusp; LC = Left coronary cusp

# Valve Sizing Matters

- Annular size changes throughout cardiac cycle  
→ Sizing at end-systolic phase with maximal annular size
- Check the diastolic phase in case of septal hypertrophy

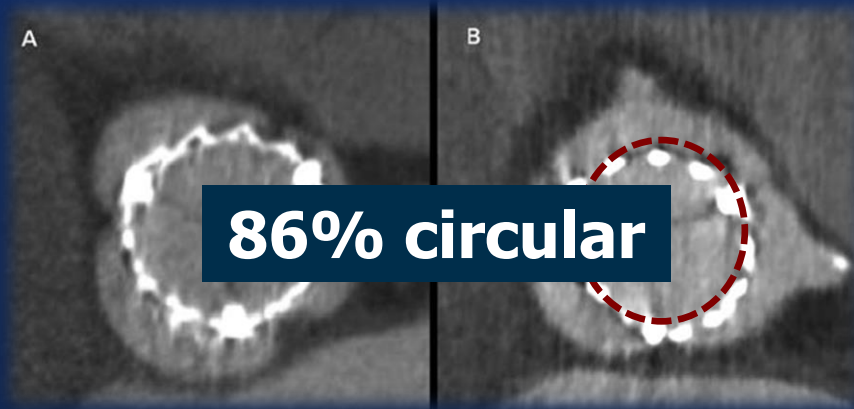


# Circularization of the Annulus

**Balloon-expandable  
prosthesis**



Prosthesis “remodels”  
the annulus

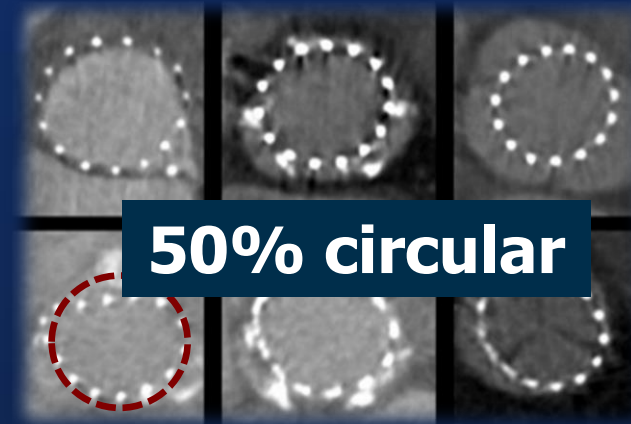


Delgado et al. Eur Heart J 2010;31:1114-1123

**Self-expanding  
prosthesis**



The “annulus”  
remodels the prosthesis



Schultz C et al. JACC 2009; 54:911-8

# Balloon-Expandable SAPIEN 3 Ultra Valve



$$\text{Area Oversizing \%} = \frac{\textit{nominal Sapien 3 area}}{\textit{Systolic annular area}} \times 100$$

# S3 Size is Adjustable By Balloon Volume (Over or Under filled)

22 mm - 1cc

23 mm

24 mm + 1cc

25 mm - 2cc

26 mm

27mm + 2cc

28mm - 3cc

29 mm

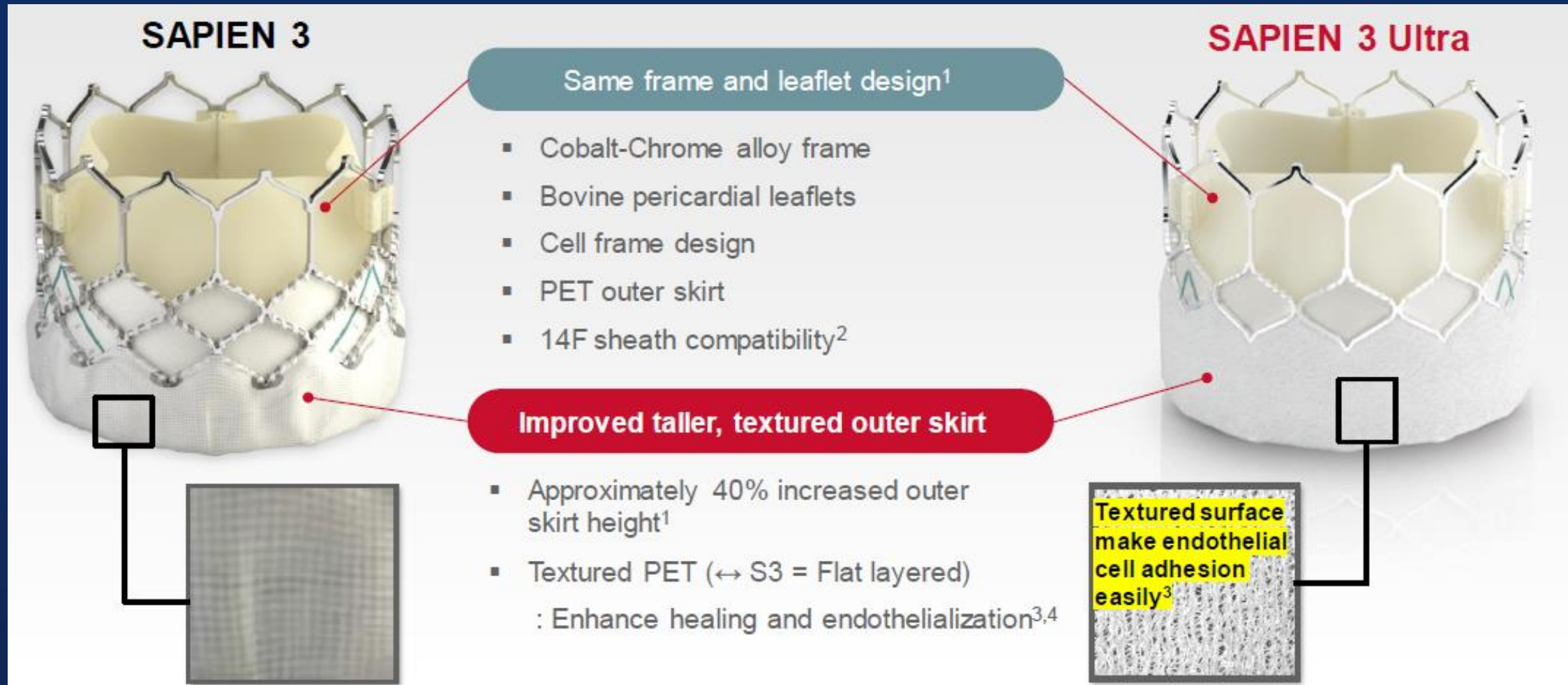
30 mm + 3cc



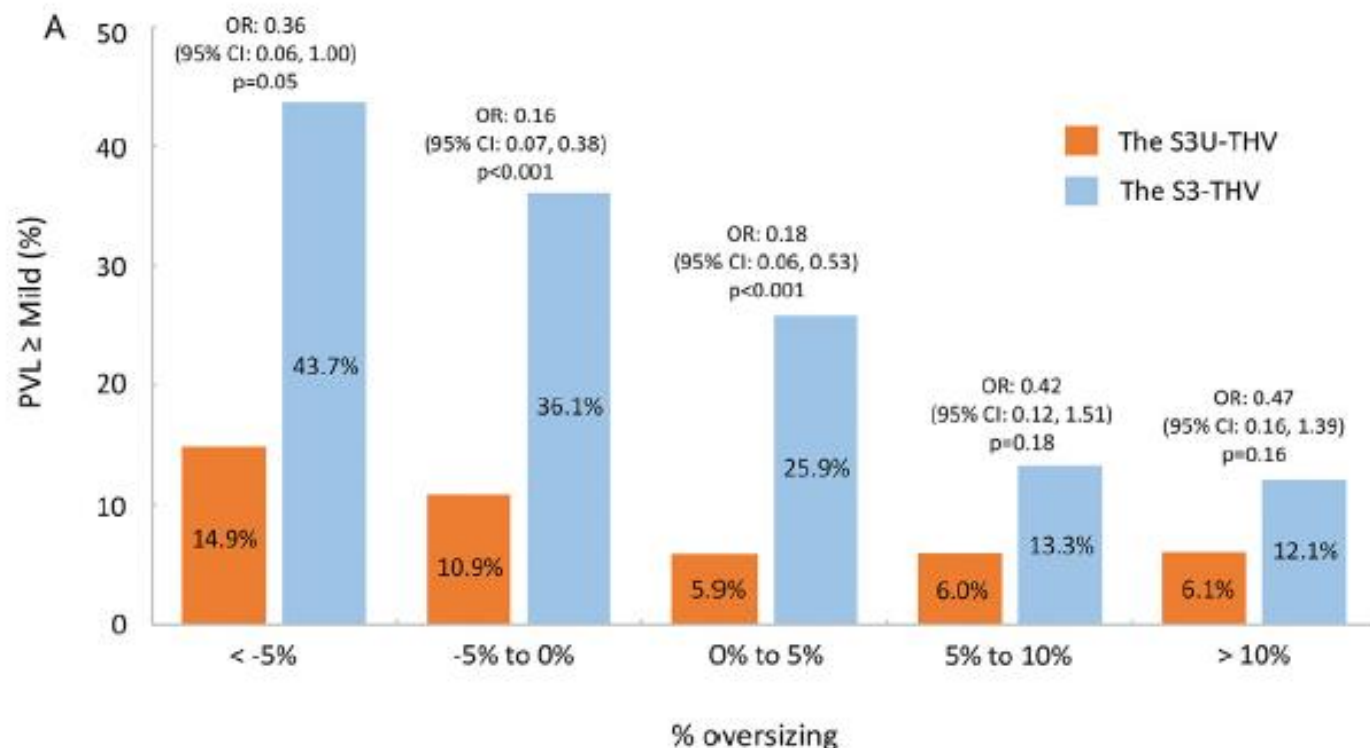
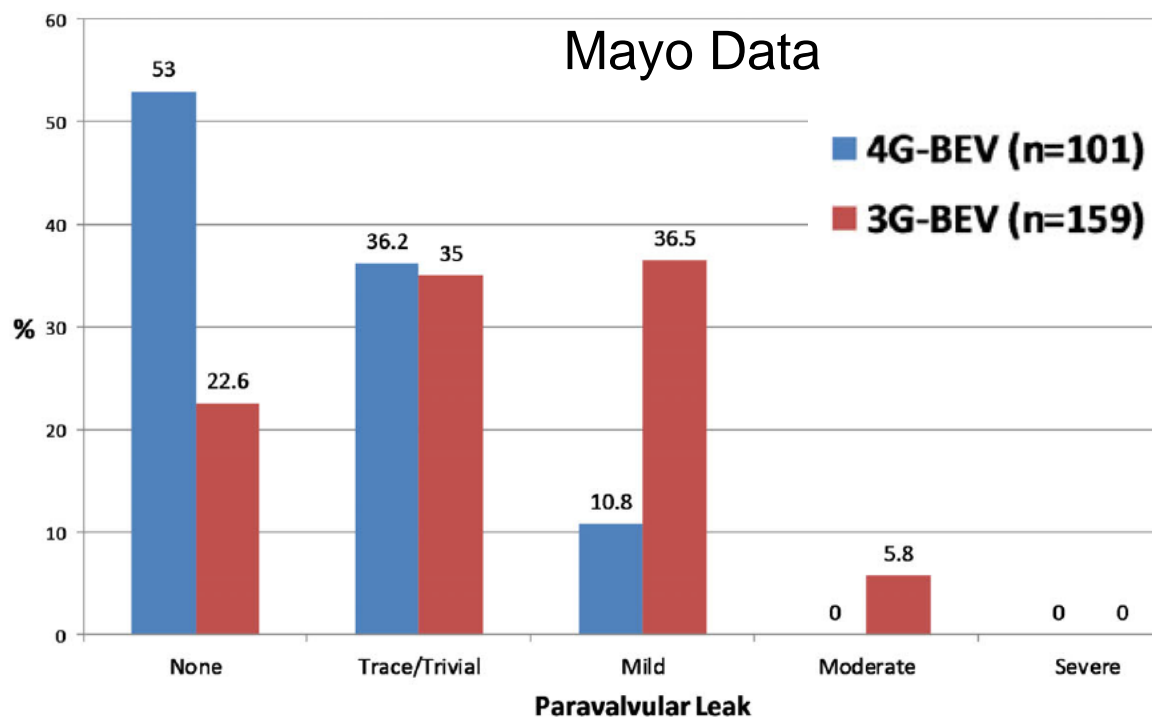
# Important Predictors of TAVR Complications in ASAN-TAVR registry

Complication	Predictor	Odds Ratio (95% CI)	P-Value
Permanent Pacemaker Implantation	Annulus <b>area oversizing</b> by CT (per 1%)	1.02 (1.003 - 1.04)	0.024
> Moderate PVL	Total amount of <b>annulus calcium</b> by CT (per 100 mm <sup>3</sup> )	1.26 (1.10 – 1.45)	0.001

# Difference btw SAPIEN 3 and SAPIEN 3 Ultra



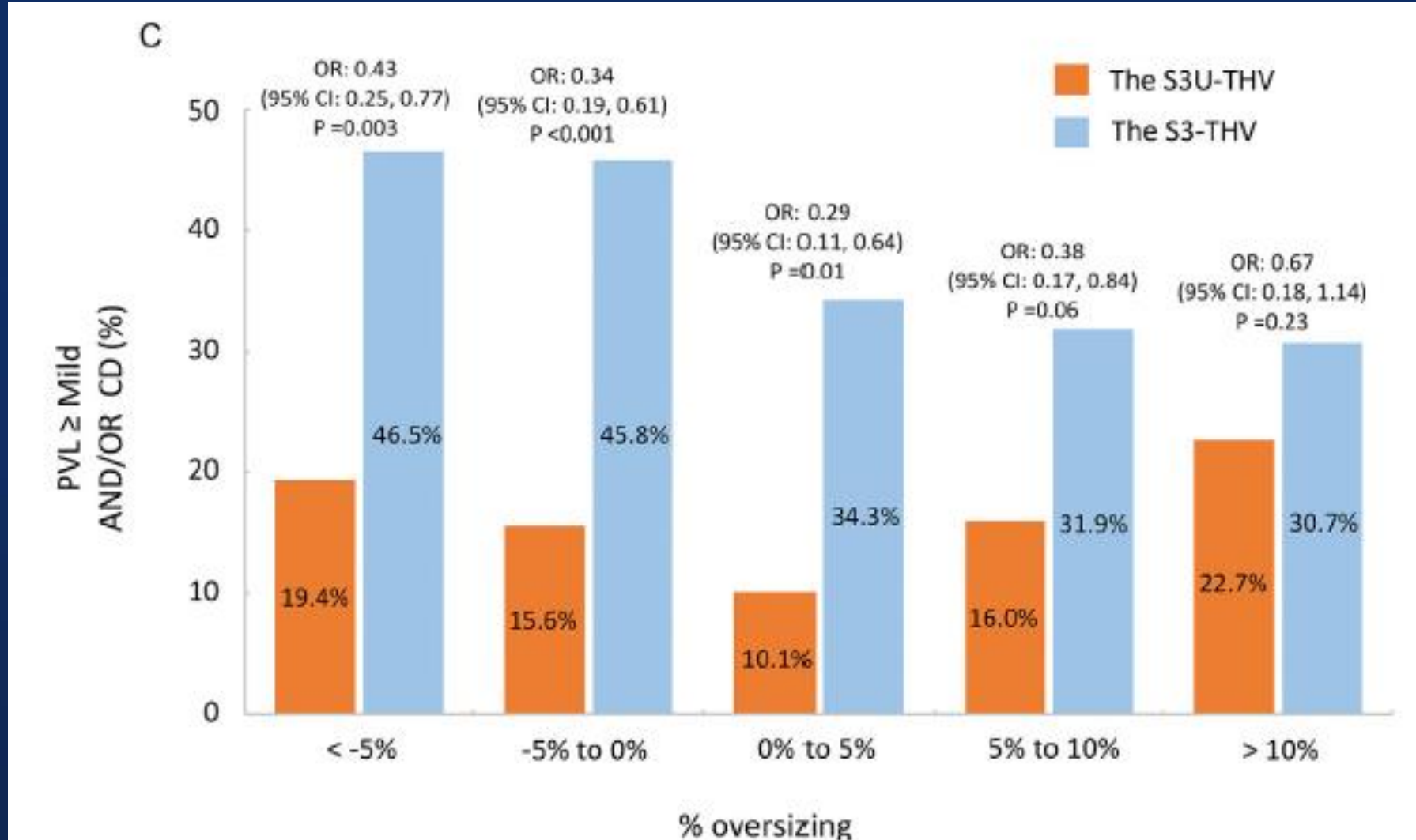
# Decreased PVL with SAPIEN 3 ULTRA



Welle GA et al. Catheter Cardiovasc Interv. 2021;97:895–902.

Moriyama N et al. Am J Cardiol 2023;207:140–149

# A New “Sweet Spot” with SAPIEN 3 ULTRA



# S3U Area Oversizing Based on the Annulus size by CT *5%, Cutoff*

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*Low Calcification  
(Ca volume  $\leq 400 \text{ mm}^3$ )*

*5~10%, then Overfill*

*Heavy Calcification  
(Ca volume  $> 400 \text{ mm}^3$ )*

*0~5%, then Overfill*

*Bicuspid AS with Low Calcification  
(Ca volume  $\leq 400 \text{ mm}^3$ )*

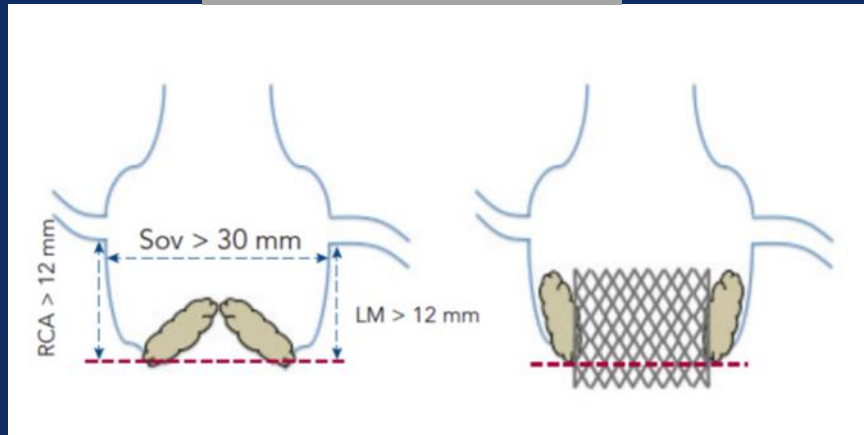
*0~5%, then Overfill*

*Bicuspid AS with Low Calcification  
(Ca volume  $> 400 \text{ mm}^3$ )*

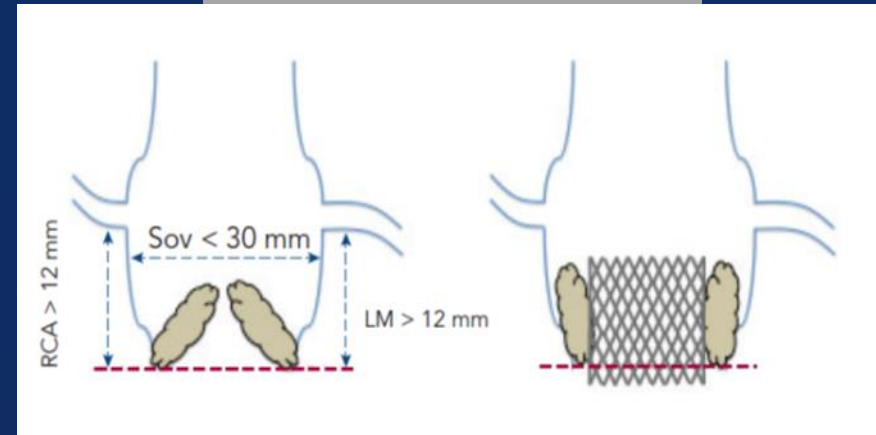
*-5~0%, then Overfill*

# Risk of Coronary Obstruction

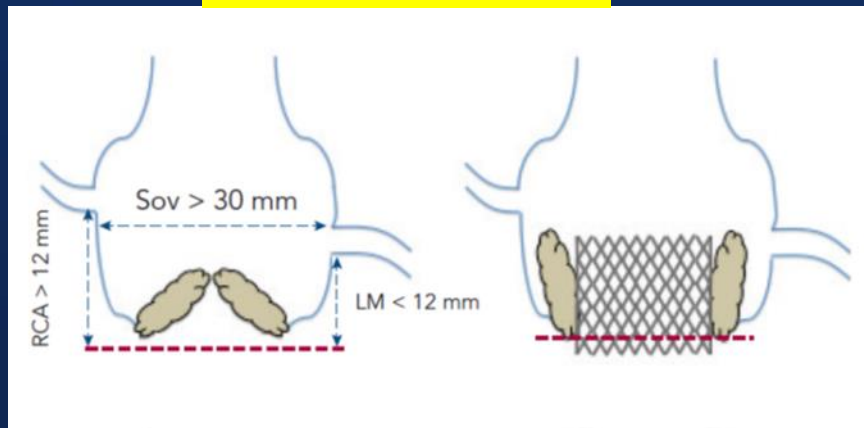
## Wide and High



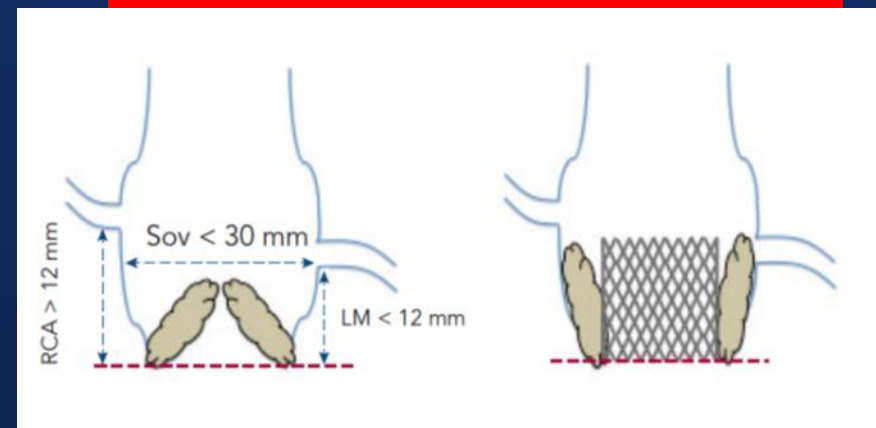
## Shallow and High



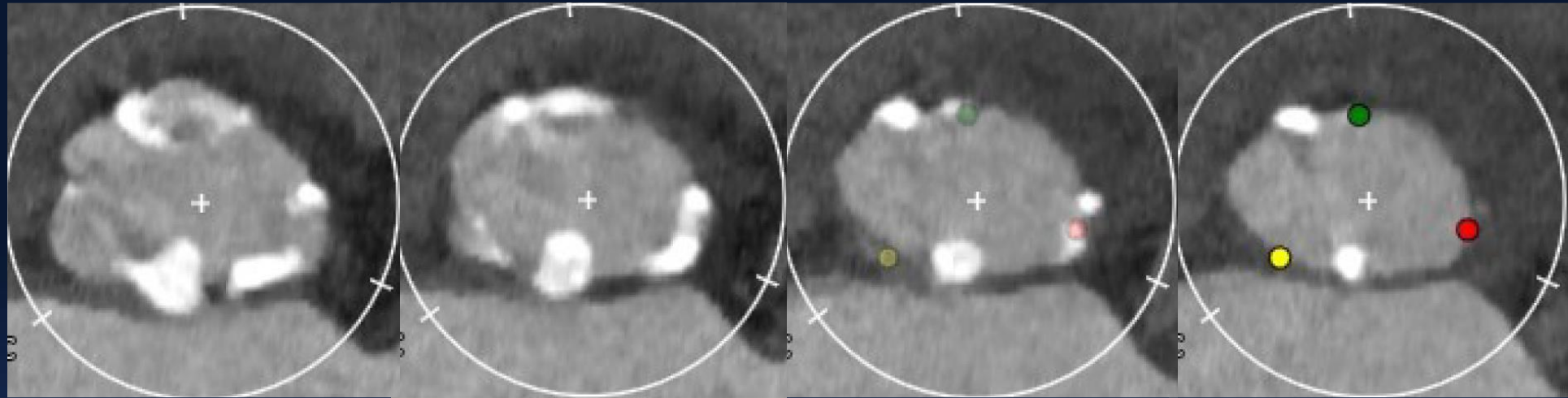
## Wide and Low



## Shallow and Low (<10mm)



# Case #1, 90/M with Severe AS, PCI Hx, AF



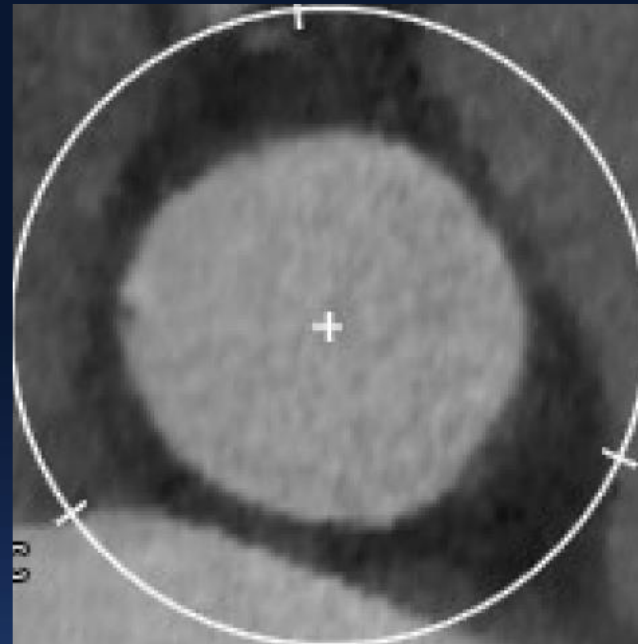
Annulus plane

Aortic Annulus parameters	
Annulus short diameter	20.8 mm
Annulus long diameter	30.8 mm
Annulus mean diameter	25.8 mm
Annulus area	507 mm <sup>2</sup>
Annulus area-driven diameter	25.4 mm
Annulus perimeter	82.8 mm
Annulus perimeter-driven diameter	26.3 mm

# CT findings – Aortic Valve Complex



**Sinus of Valsalva**



**STJ**

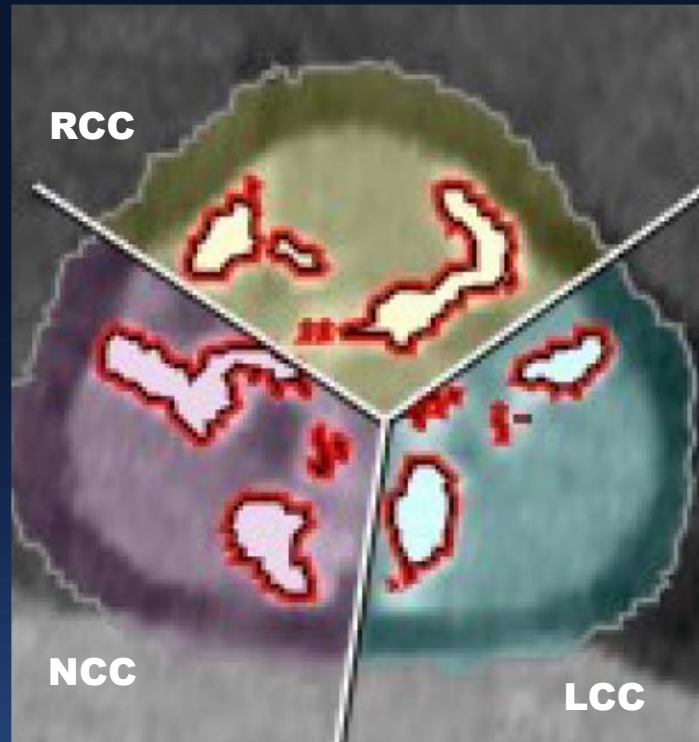
<b>Sinus of Valsalva</b>		<b>STJ</b>	
Area	<b>927 mm<sup>2</sup></b>	Area	<b>750 mm<sup>2</sup></b>
Sinus / Annulus Area Ratio	<b>1.83</b>	STJ/ Annulus Area Ratio	<b>1.48</b>
NCC diameter	<b>35.1 mm</b>	Mean diameter	<b>31.0 mm</b>
LCC diameter	<b>36.7 mm</b>	Height of STJ	<b>24.7 mm</b>
RCC diameter	<b>31.8 mm</b>		

Mean Sinus / Annulus Area Ratio **1.83 ± 0.27**

Mean STJ / Annulus Area Ratio **1.49 ± 0.29**



# Calcium Amount

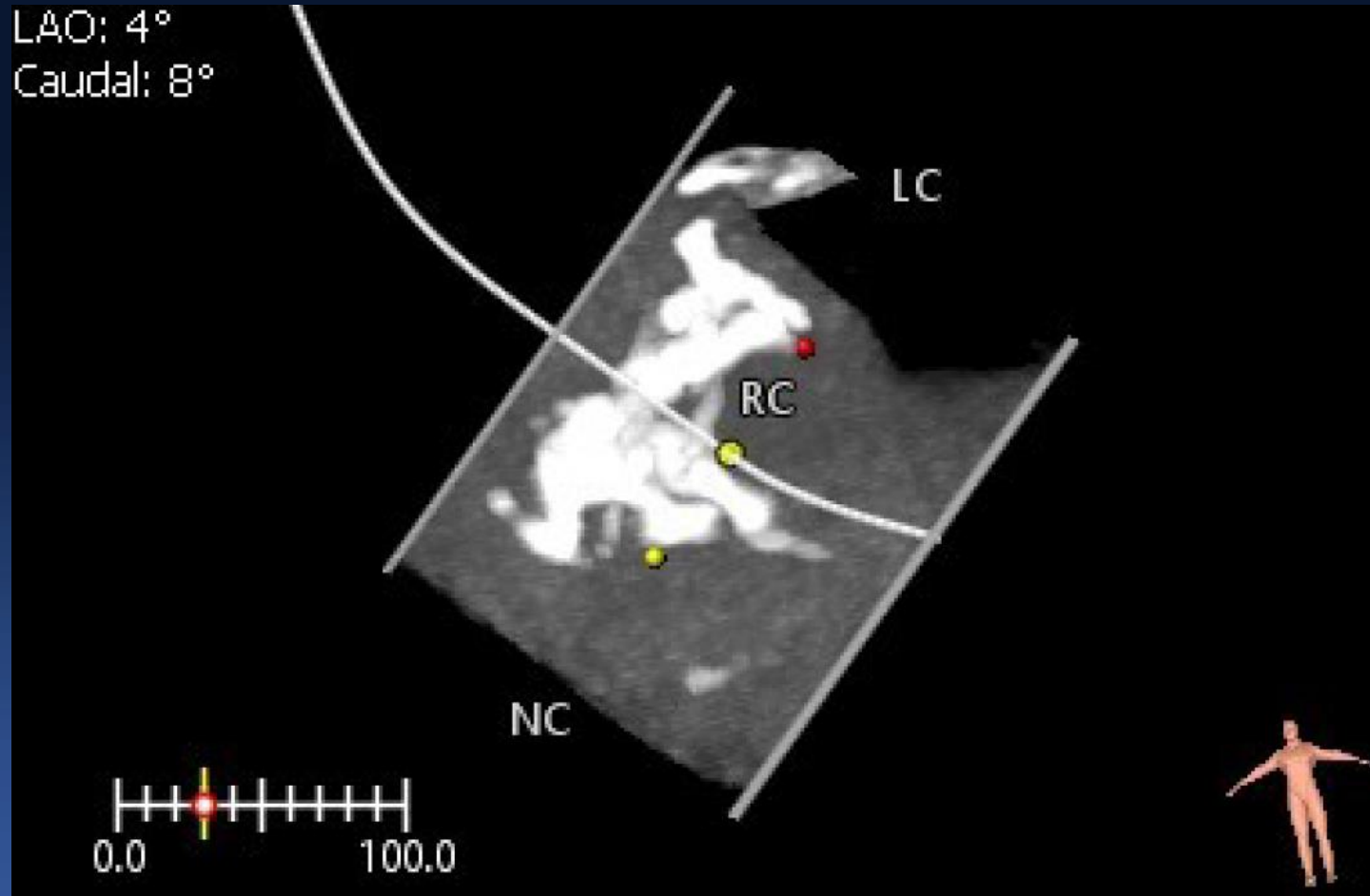


Heavy  
calcification

Calcium volume	
NCC	723 mm <sup>3</sup>
RCC	438 mm <sup>3</sup>
LCC	472 mm <sup>3</sup>
Total	1633 mm <sup>3</sup>

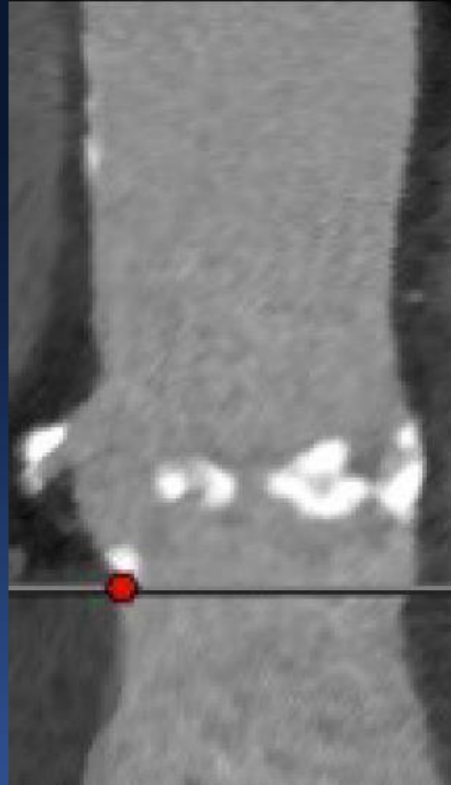
Mean Amount of total Calcium  $355.4 \pm 289.9$

# Calcification of AV complex



# CT findings – Coronary Height

LCA



RCA



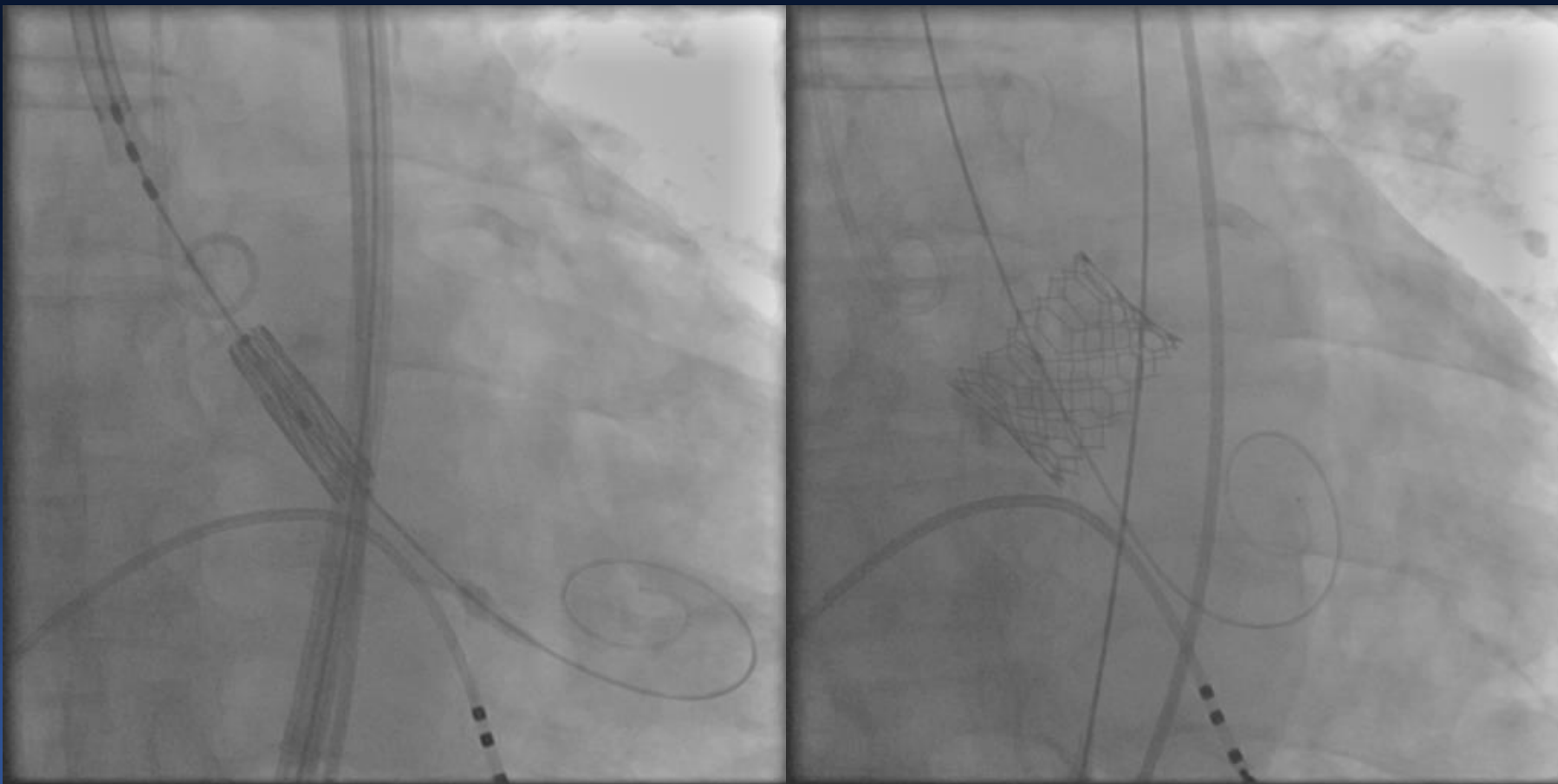
Coronary Height	
LCA	13.5 mm
RCA	17.7 mm

# Begin with Smaller Degree of Oversizing

## S3U 26mm (2.3% Oversizing)

Size	Area_oversize (%)	Perimeter_oversize (%)
24	87.9	90.1
25	95.3	93.8
26	102.3	97.5
27	110.3	101.3
28	118.6	105.0
29	128.0	109.0
30	137.0	112.8

# S3U 26mm (2.3% Oversizing)



Moderate PVL

# Post-dilation with +2cc Overfill (Upto 27mm, 10% Oversizing)

Size	Area_oversize (%)	Perimeter_oversize (%)
24	87.9	90.1
25	95.3	93.8
26	102.3	97.5
27	110.3	101.3
28	118.6	105.0
29	128.0	109.0
30	137.0	112.8

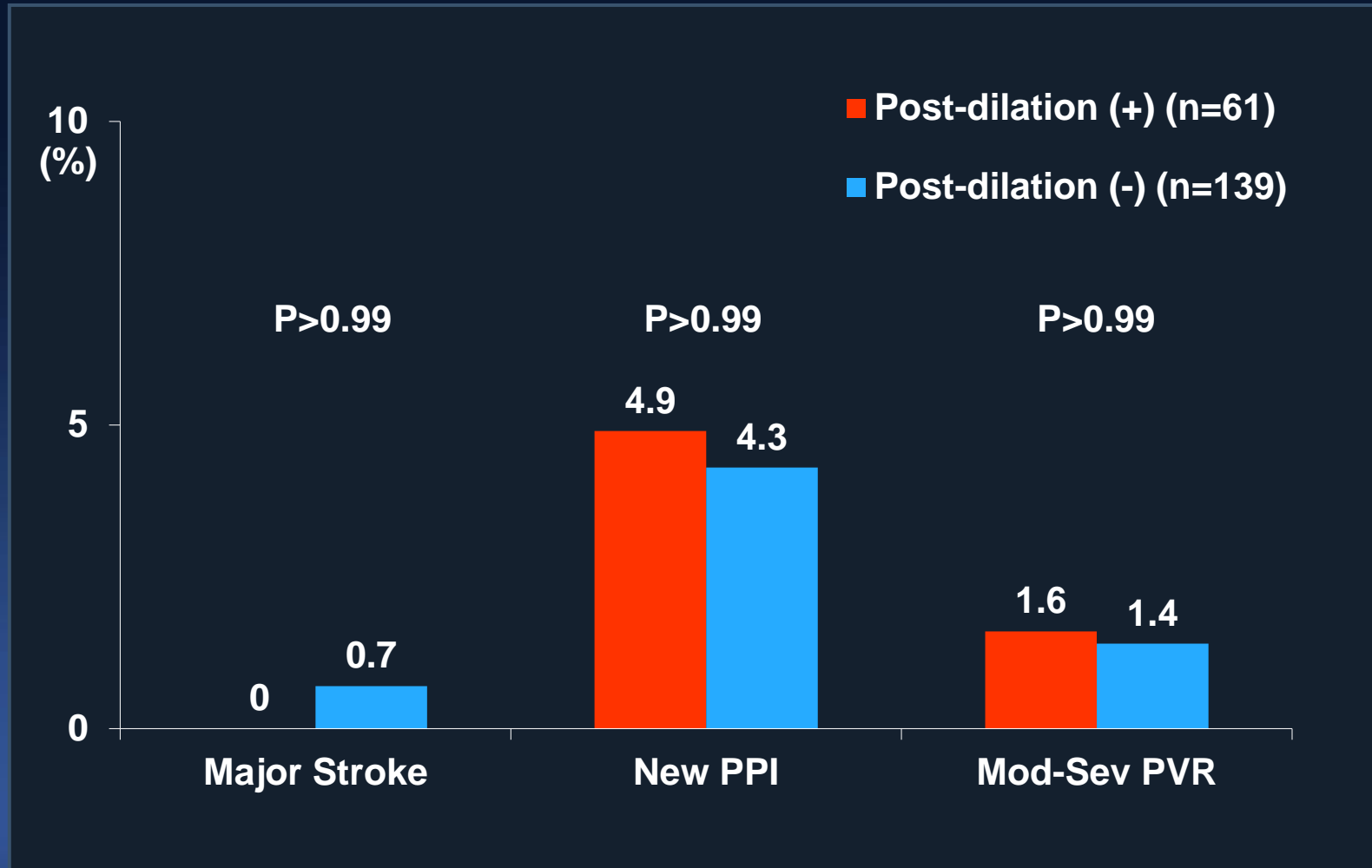
# Post-dilation with +2cc Overfill (10% Oversizing)



Mild PVL

# Post-dilation was safe and effective

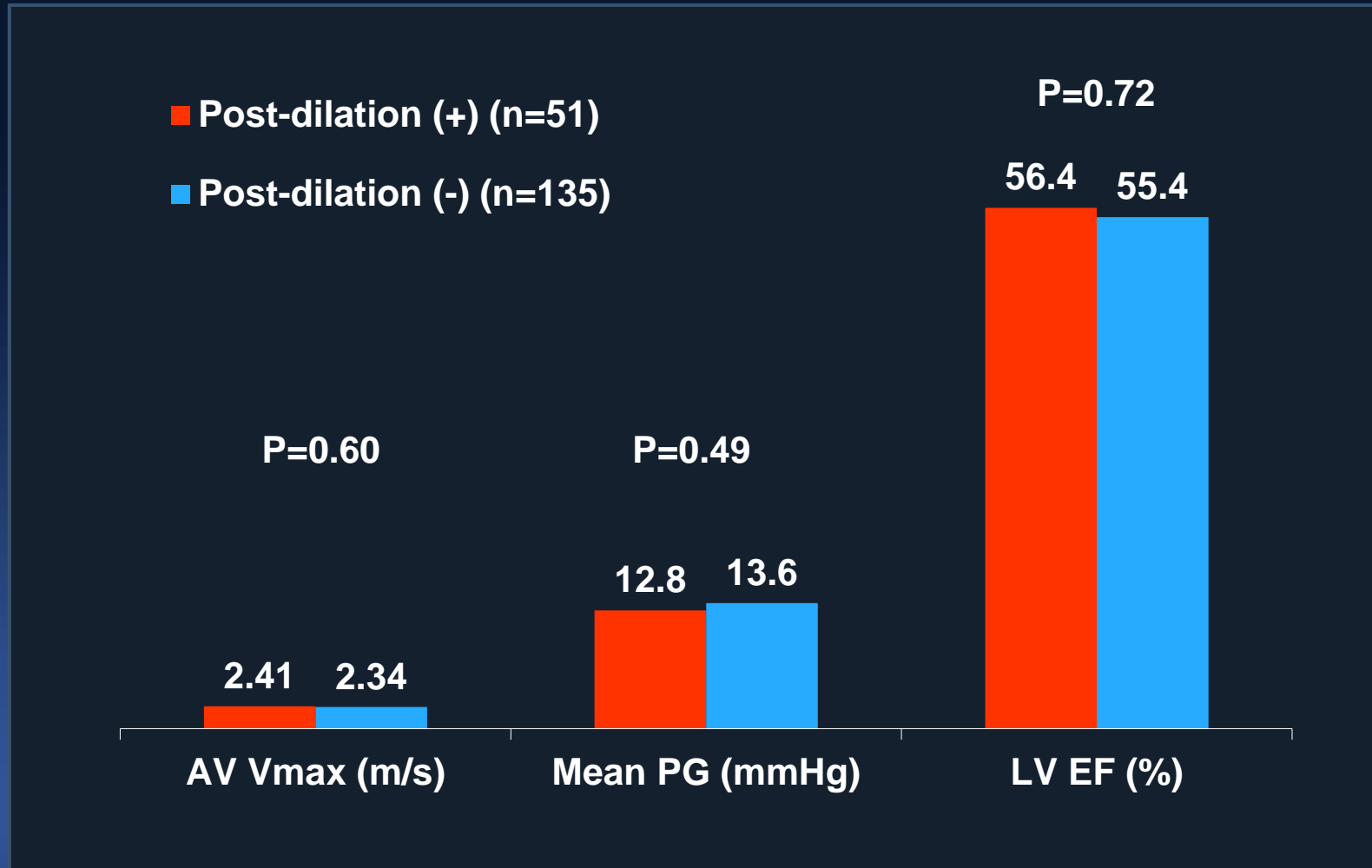
## Clinical Outcomes at 1 month after TAVR



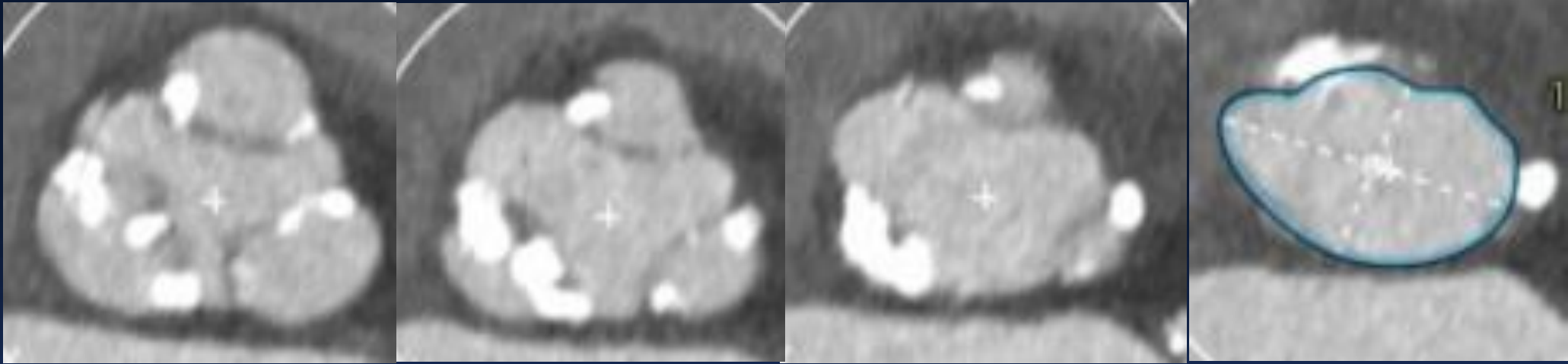


# Post-dilation was safe and effective

## EchoCG at 1 month after TAVR



# Case #2, 85/M with Severe AS, DM, HT, PCI Hx



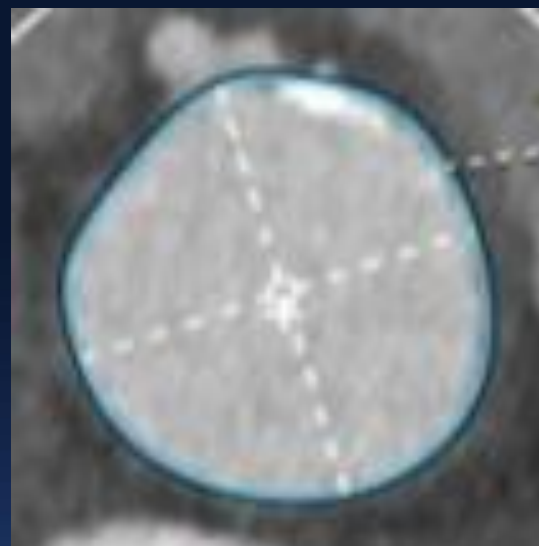
Annulus plane

Aortic Annulus parameters	
Annulus short diameter	17 mm
Annulus long diameter	28.1 mm
Annulus mean diameter	22.6 mm
Annulus area	369 mm <sup>2</sup>
Annulus area-driven diameter	21.7 mm
Annulus perimeter	73 mm
Annulus perimeter-driven diameter	23.2 mm

# CT findings – Aortic Valve Complex



Sinus of Valsalva



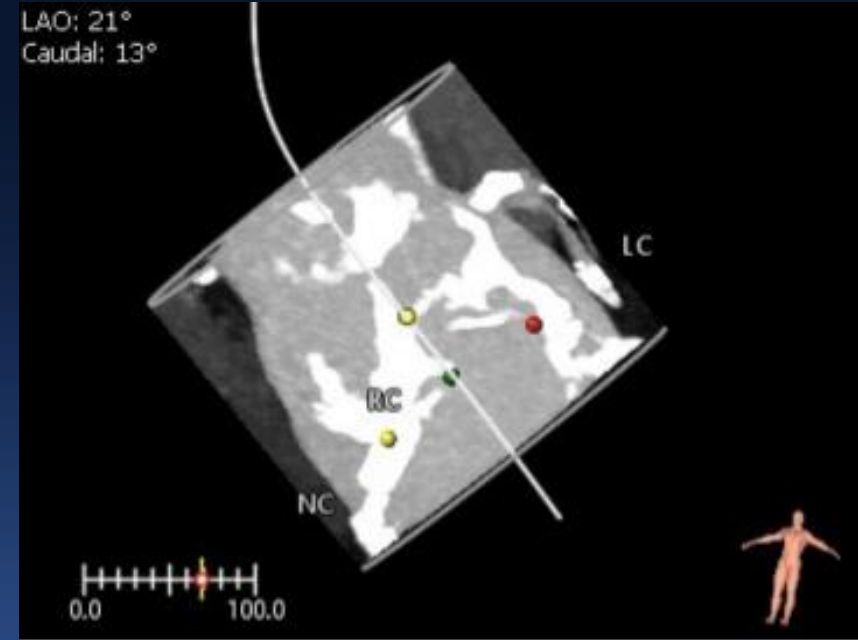
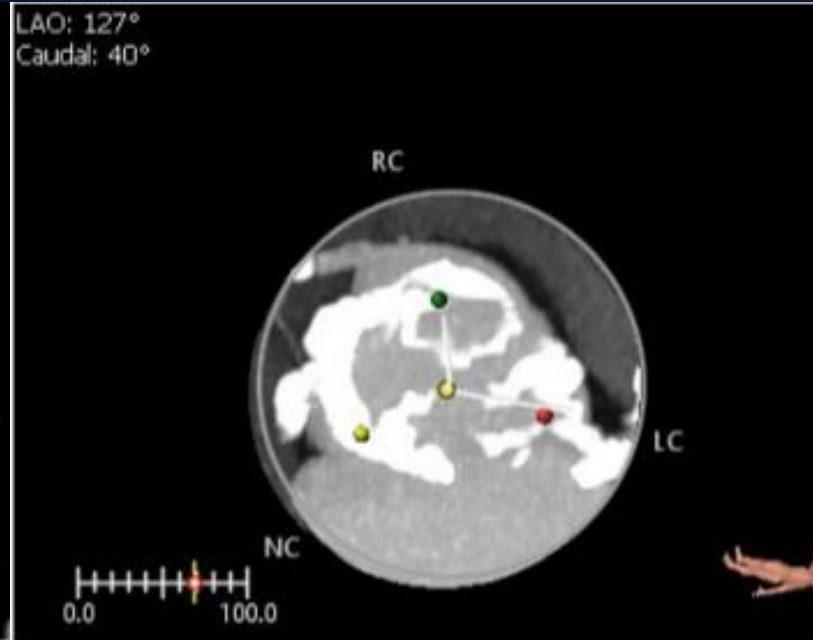
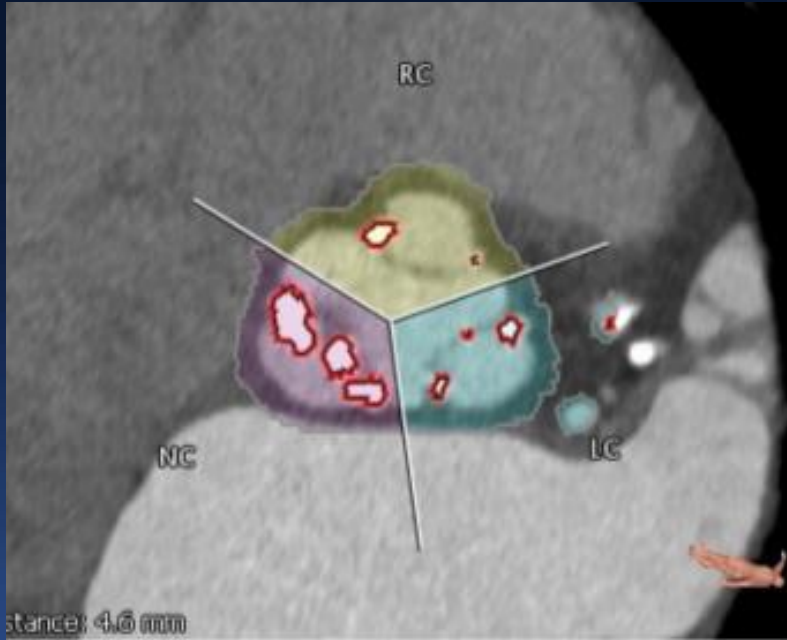
STJ

Sinus of Valsalva		STJ	
Area	<b>703 mm<sup>2</sup></b>	Area	<b>570 mm<sup>2</sup></b>
Sinus / Annulus Area Ratio	<b>1.91</b>	STJ/ Annulus Area Ratio	<b>1.55</b>
NCC diameter	<b>29.5 mm</b>	Mean diameter	<b>26.9 mm</b>
RCC diameter	<b>27.1 mm</b>	Height of lowest STJ	<b>18.2 mm</b>
LCC diameter	<b>31.2 mm</b>		

Mean Sinus / Annulus Area Ratio:  $1.87 \pm 0.33$     Mean STJ / Annulus Area Ratio:  $1.52 \pm 0.36$

# Calcium Amount

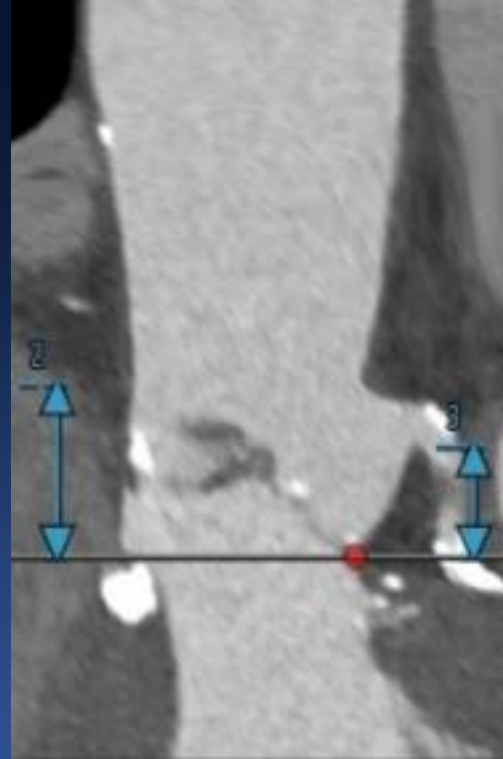
Heavy  
calcification



Calcium volume	
NCC	417 mm <sup>3</sup>
RCC	183.4 mm <sup>3</sup>
LCC	322 mm <sup>3</sup>
Total	922 mm <sup>3</sup>

# CT findings – Coronary Height

LCA



RCA



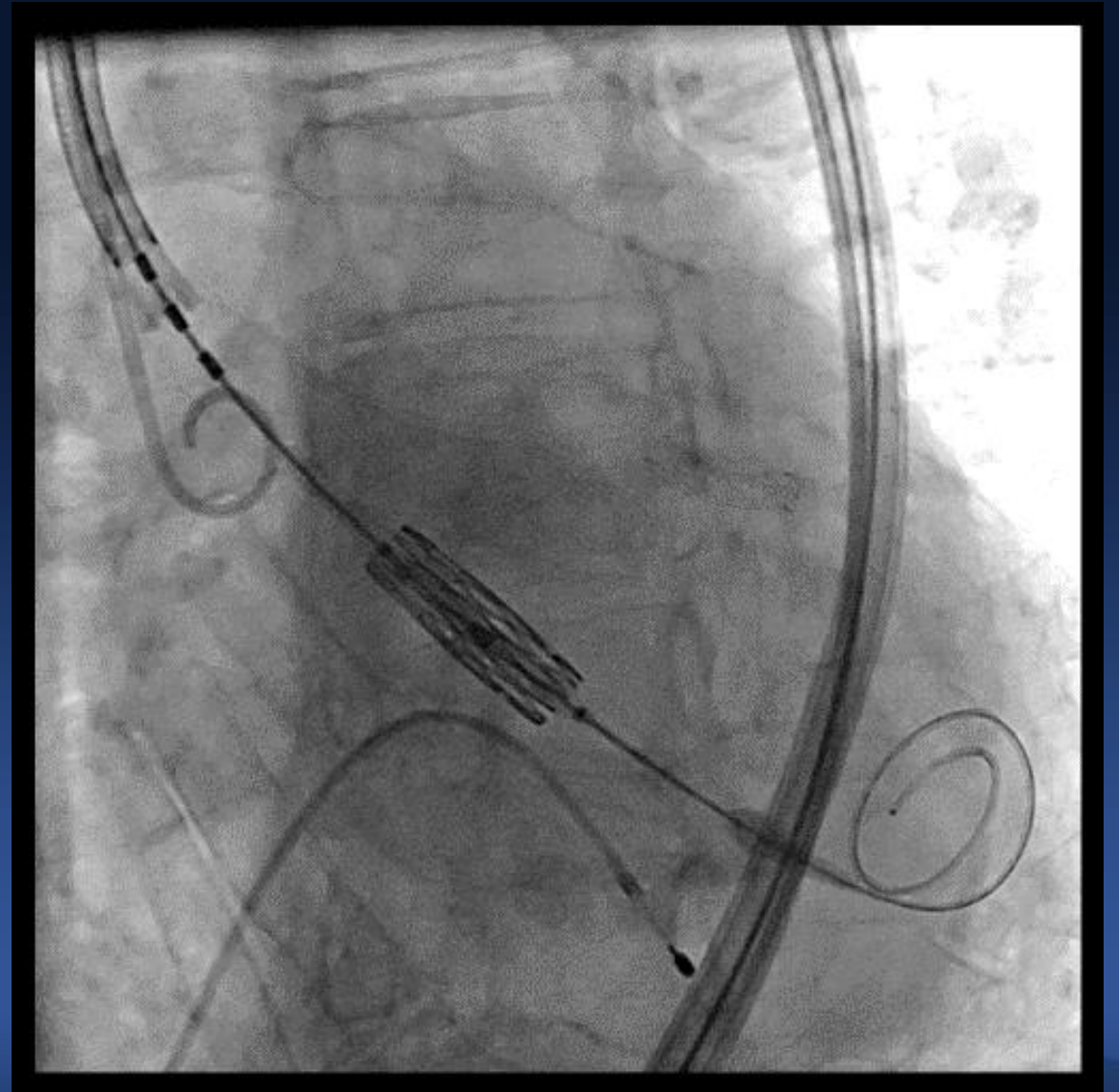
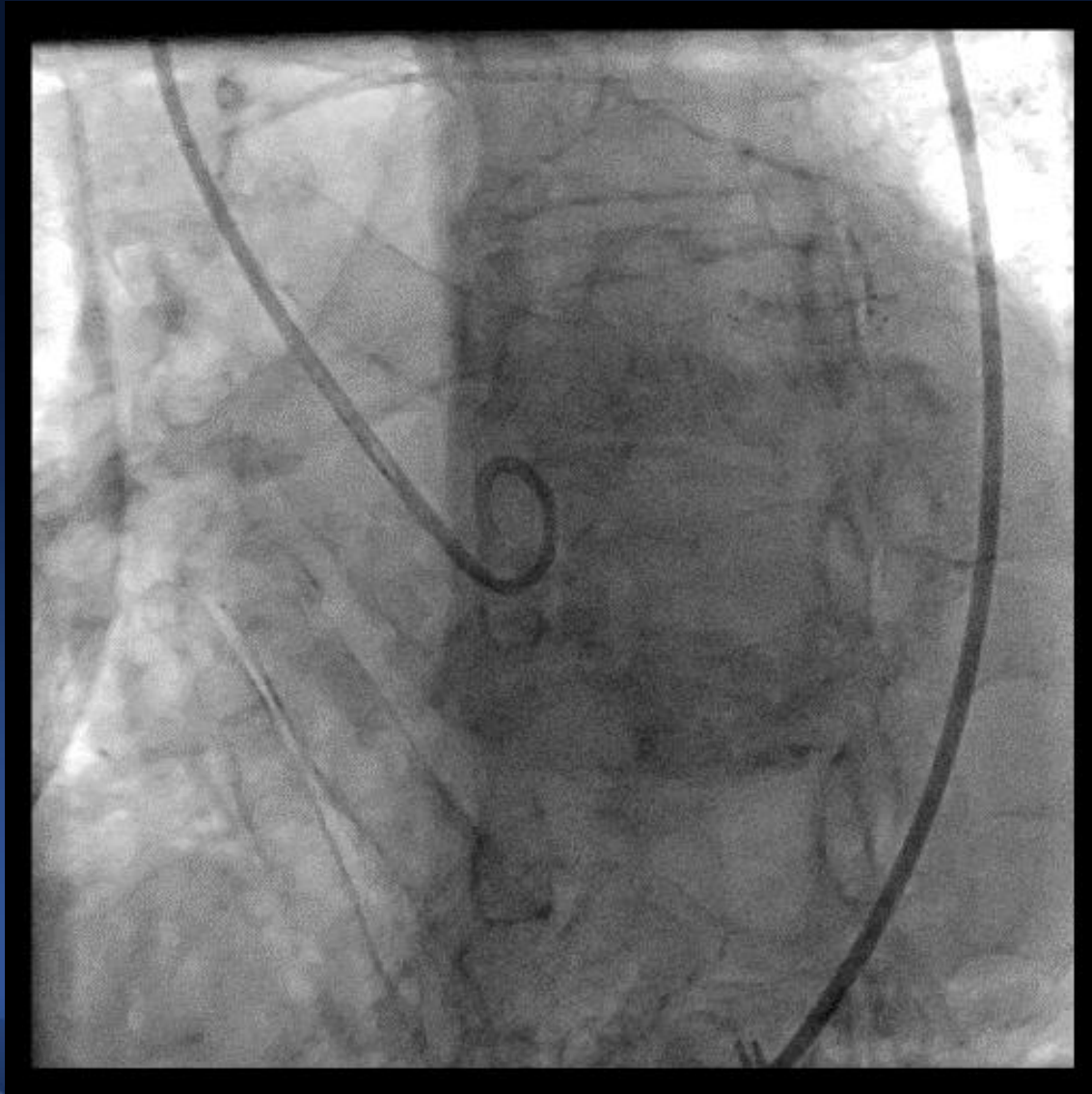
Coronary Height	
LCA	11.7 mm
RCA	16 mm

# Sizing Chart for S3U

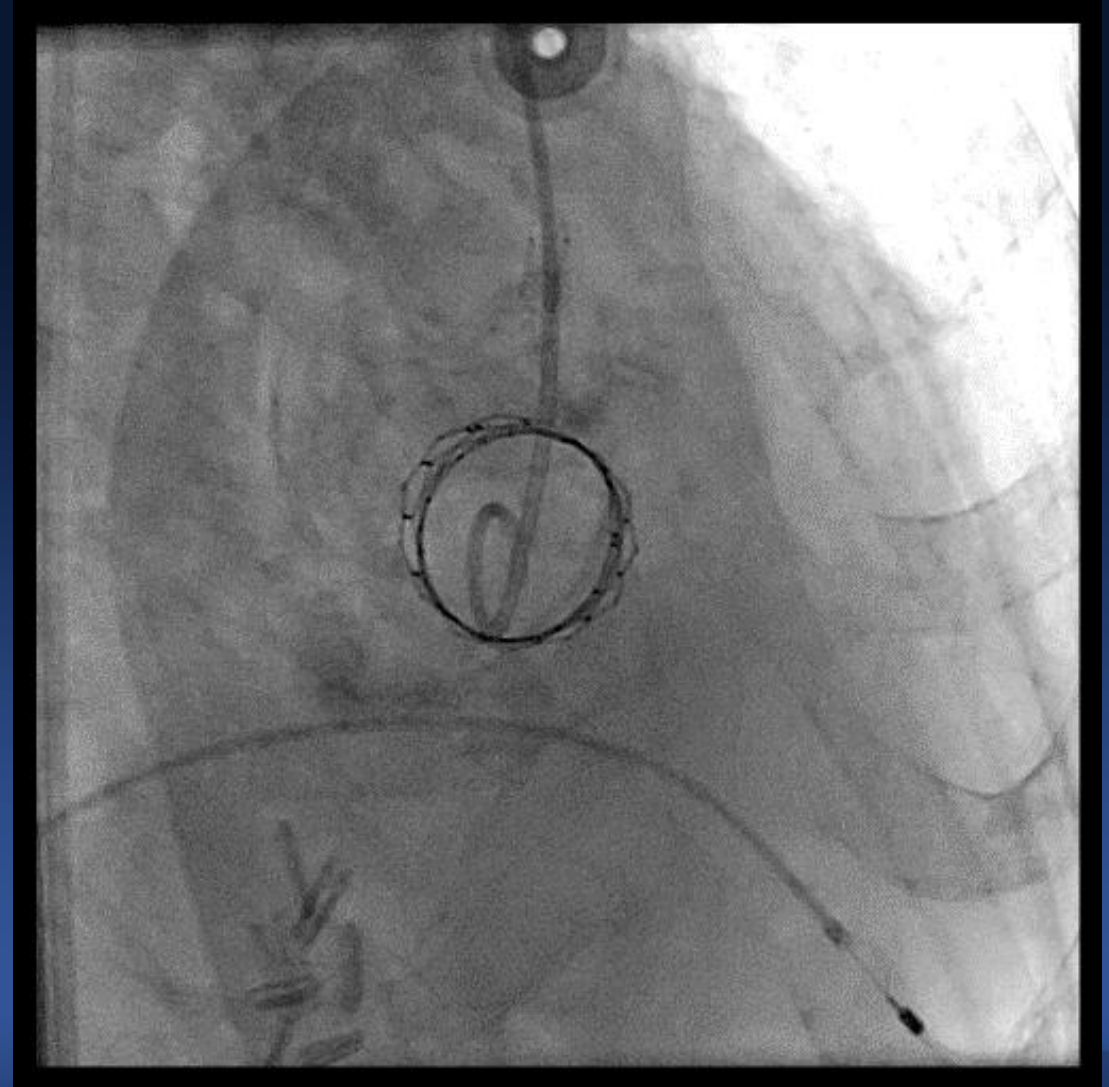
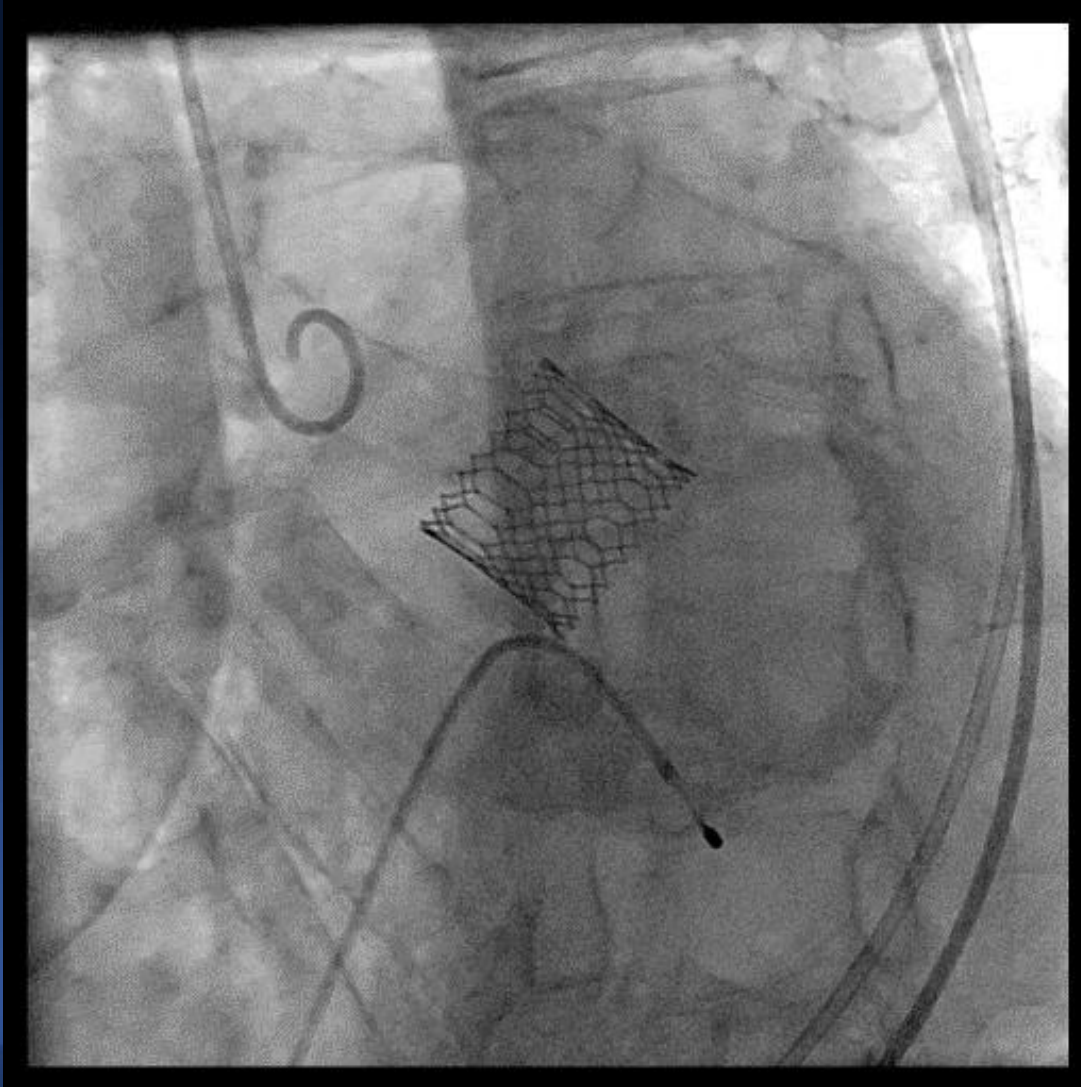
## S3U 23mm-1cc (7.8% Oversizing)

Size	Area_oversize (%)	Perimeter_oversize (%)
20	89.1	87.9
21	98.2	92.3
22	107.8	96.7
23	111.1	97.9
24	121.0	102.2
25	131.3	106.4

# S3 23mm-1cc (7.8% Oversizing)



# S3 23mm-1cc (7.8% Oversizing)

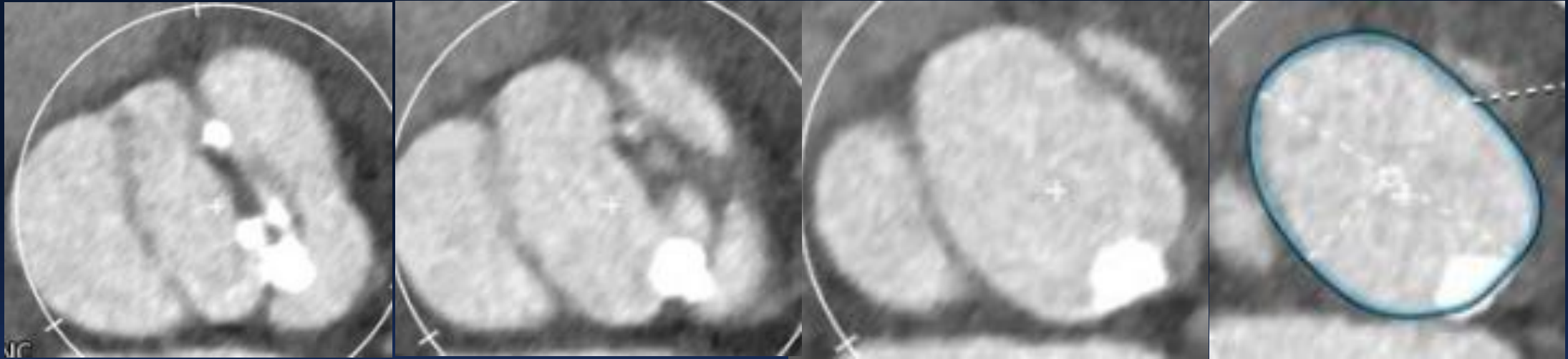




# CAVB s/p Permanent Pacemaker Implantation



# Case #3, M/76 with Bicuspid AS, s/p Hemi-arch replacement



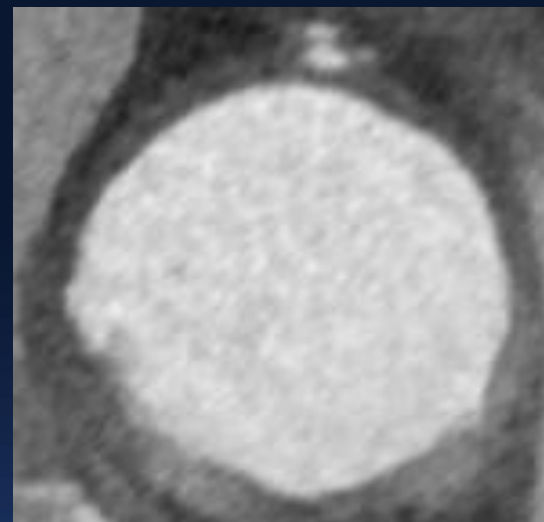
Annulus plane

Aortic Annulus parameters	
Annulus short diameter	22.9 mm
Annulus long diameter	30.5 mm
Annulus mean diameter	26.7 mm
Annulus area	575 mm <sup>2</sup>
Annulus area-driven diameter	27.1 mm
Annulus perimeter	86.8 mm
Annulus perimeter-driven diameter	27.6 mm

# CT findings – Aortic Valve Complex



Sinus of Valsalva

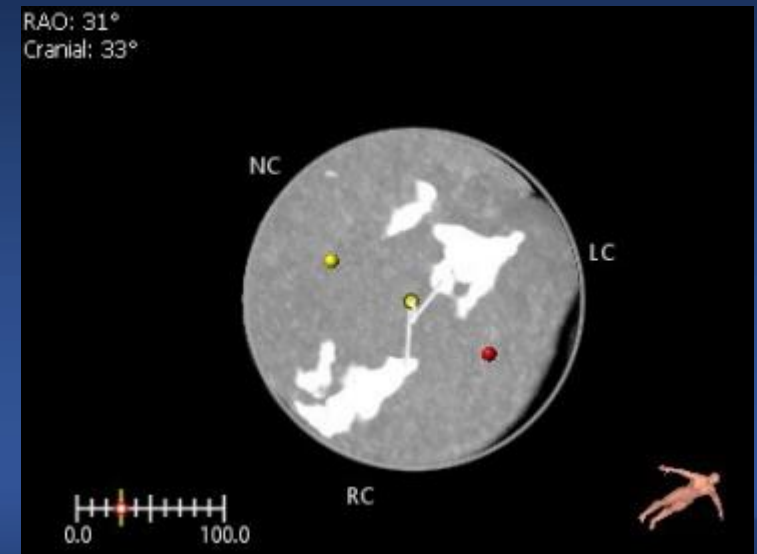
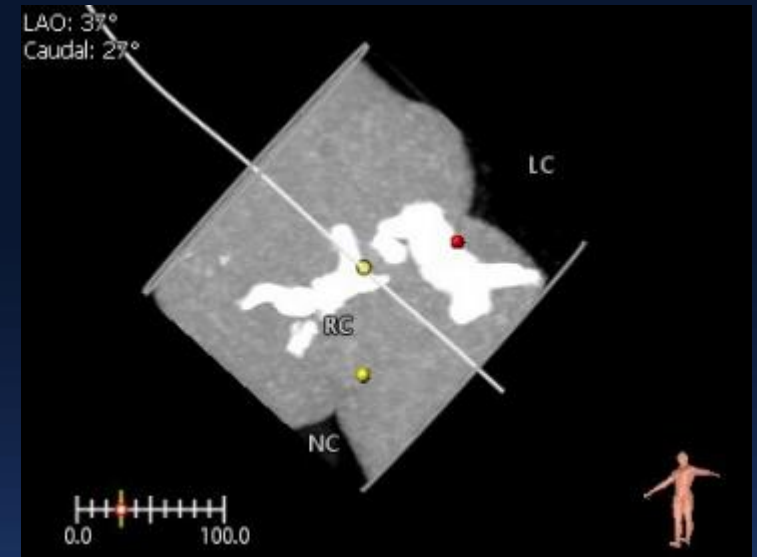
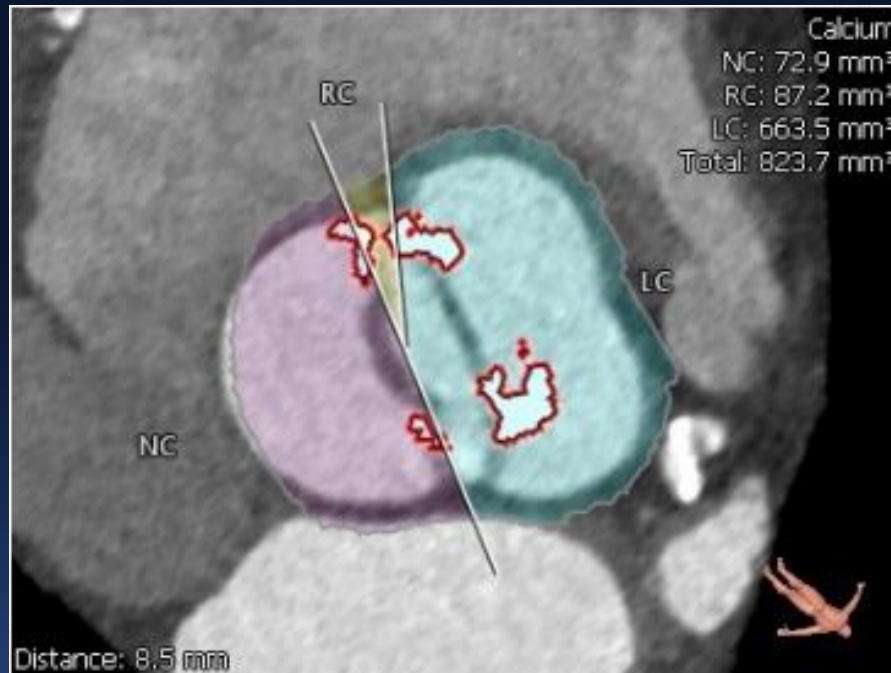


STJ

Sinus of Valsalva		STJ	
Area	<b>1455 mm<sup>2</sup></b>	Area	<b>1224 mm<sup>2</sup></b>
Sinus / Annulus Area Ratio	<b>2.5</b>	STJ/ Annulus Area Ratio	<b>2.12</b>
Min diameter	<b>32.3 mm</b>	Mean diameter	<b>39.4 mm</b>
Max diameter	<b>44 mm</b>	Height of lowest STJ	<b>29.9 mm</b>

Mean Sinus / Annulus Area Ratio:  $1.87 \pm 0.33$     Mean STJ / Annulus Area Ratio:  $1.52 \pm 0.36$

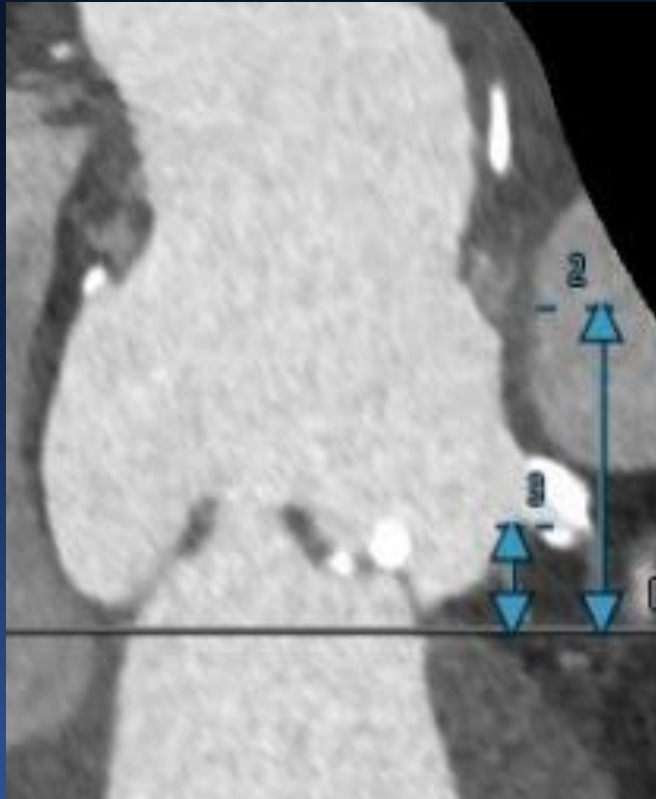
# Calcium Amount



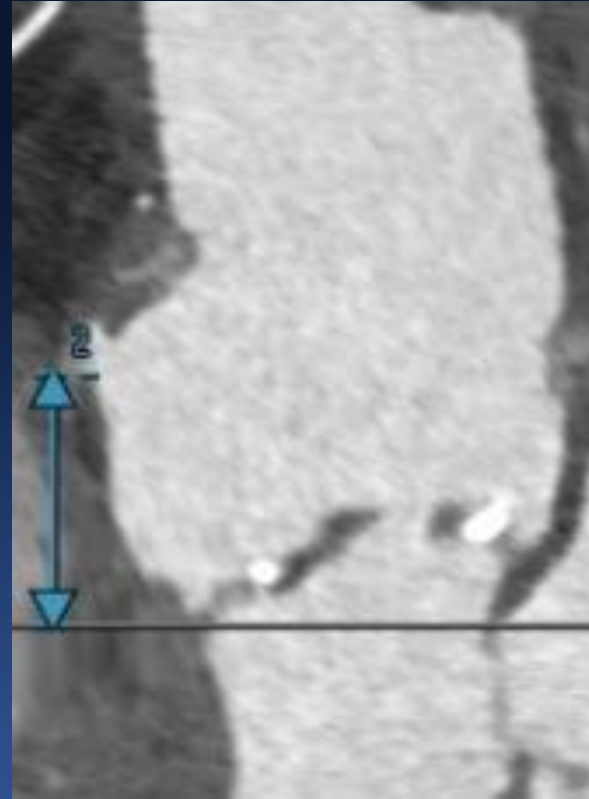
Calcium volume	
NCC	72.9 mm <sup>3</sup>
RCC	
LCC	750.7 mm <sup>3</sup>
Total	823 mm <sup>3</sup>

# CT findings – Coronary Height

LCA

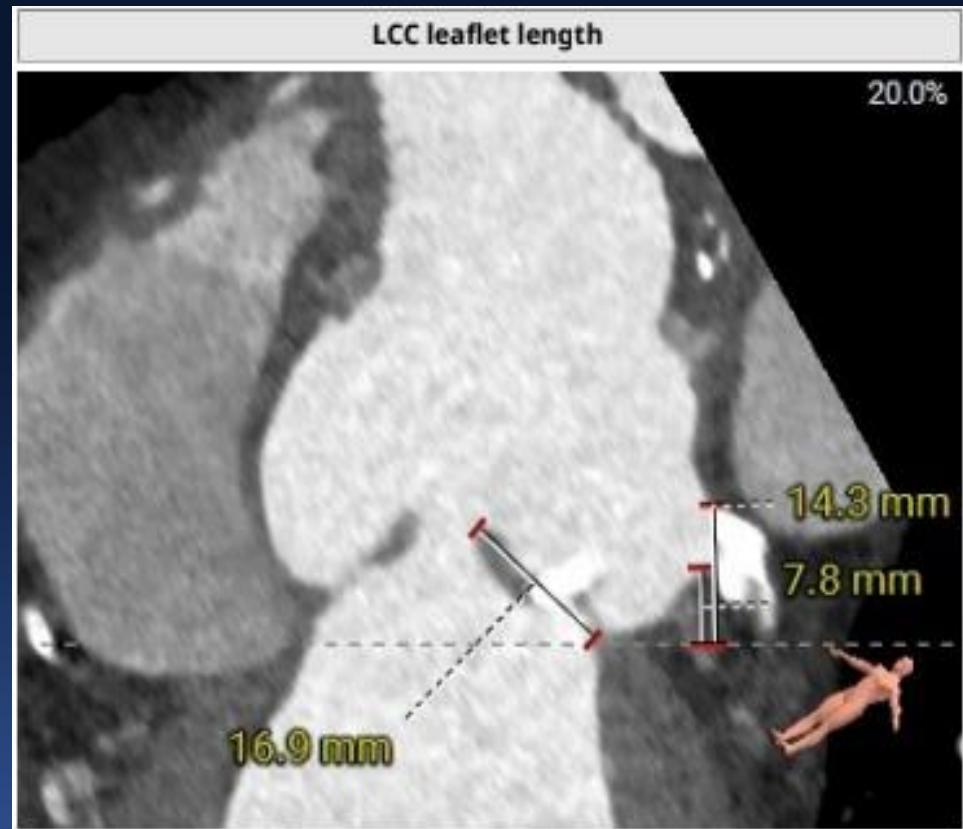
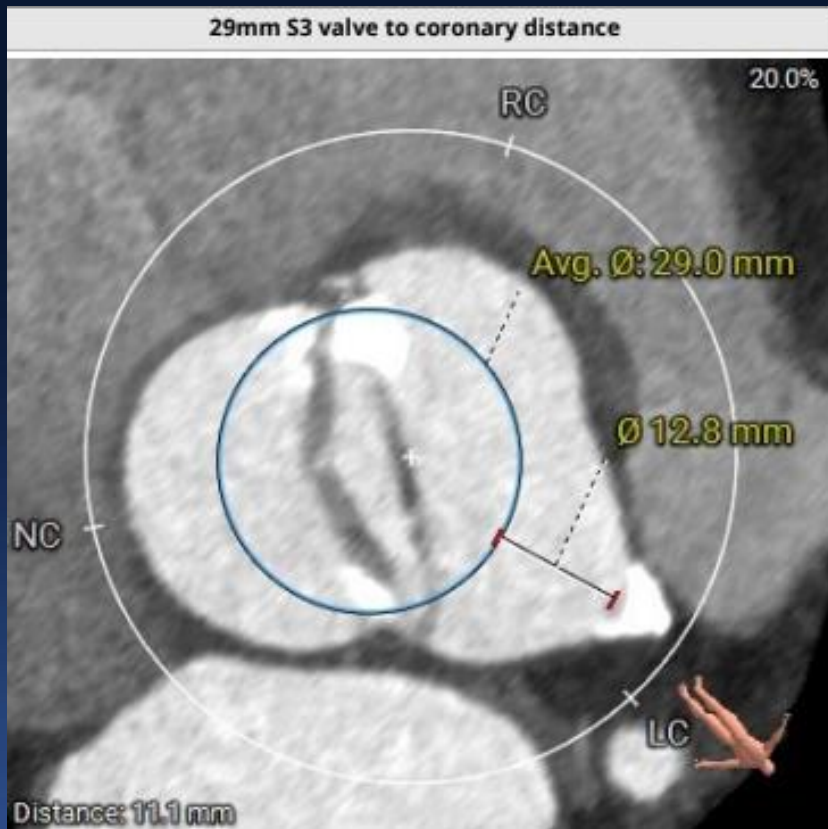


RCA



Coronary Height	
LCA	9.8 mm
RCA	24.9 mm

# CT findings – VTC / LCL length

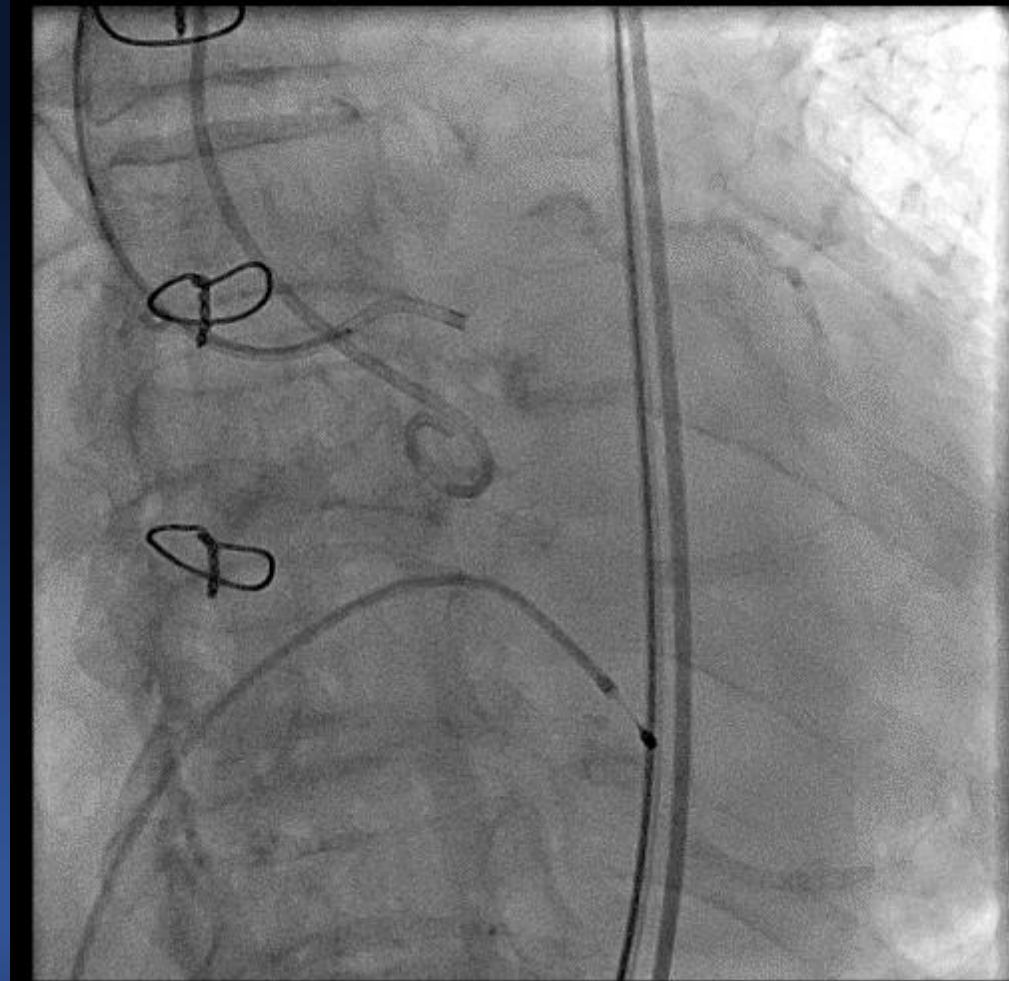
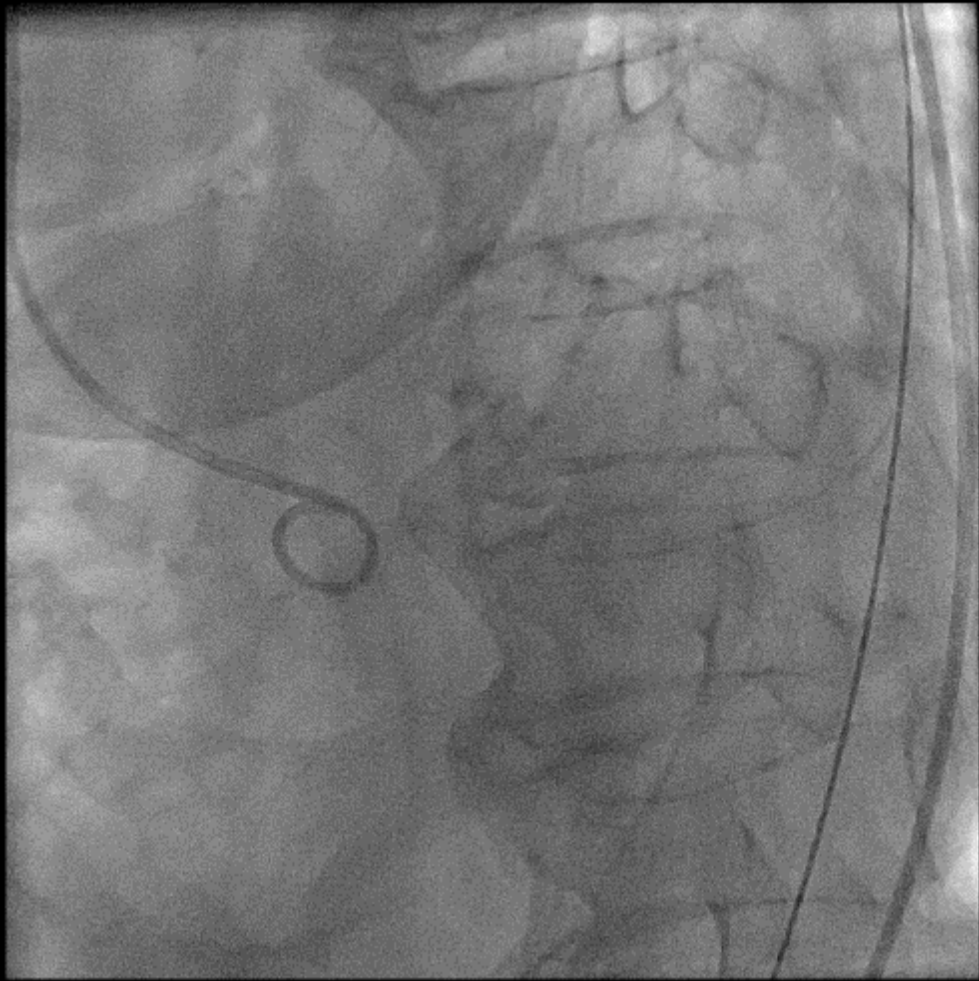
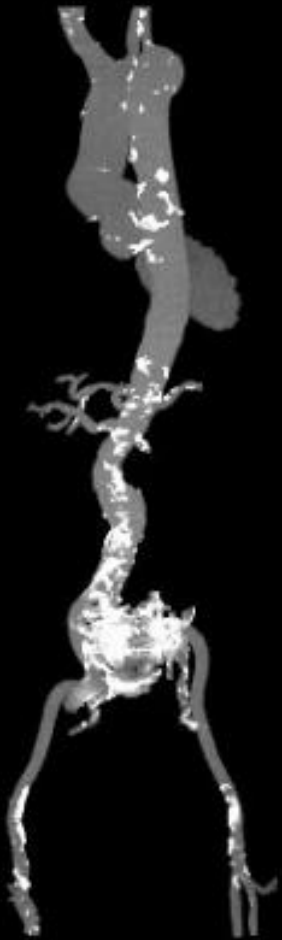


LCL length	16.9 mm
VTC	12.8 mm

# S3 26mm with +2cc Underfill (-3% Oversizing)

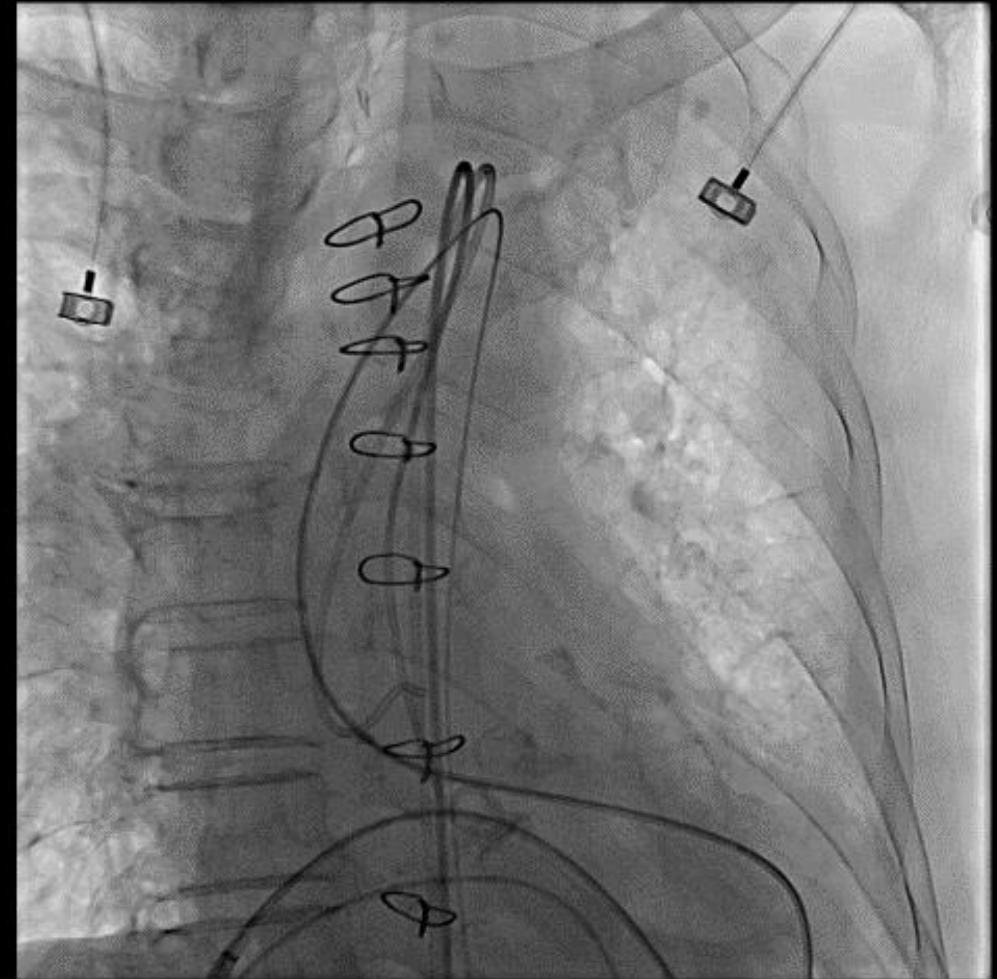
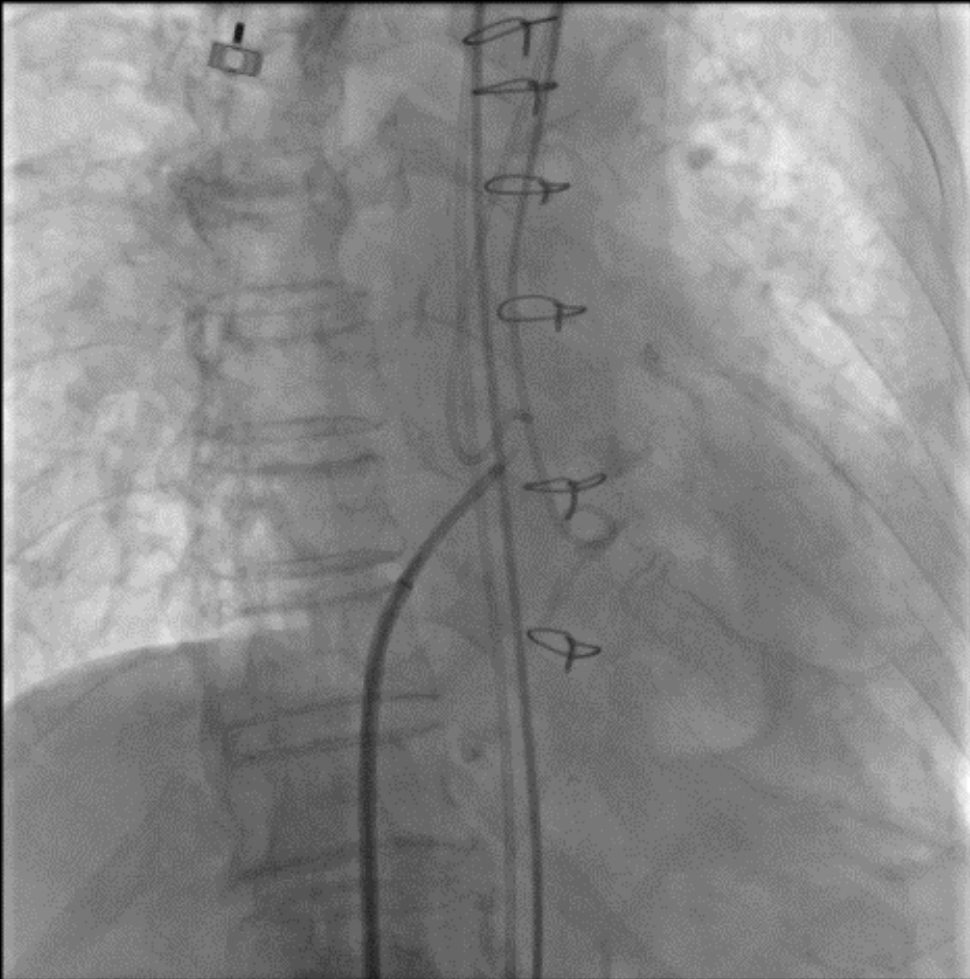
Size	Area_oversize (%)	Perimeter_oversize (%)
24	77.4	86.1
25	84.0	89.7
26	90.2	93.2
<b>27</b>	<b>97.3</b>	<b>96.8</b>
28	104.6	100.4
29	112.8	104.2
30	120.7	107.8

# Difficulty in AV Wiring

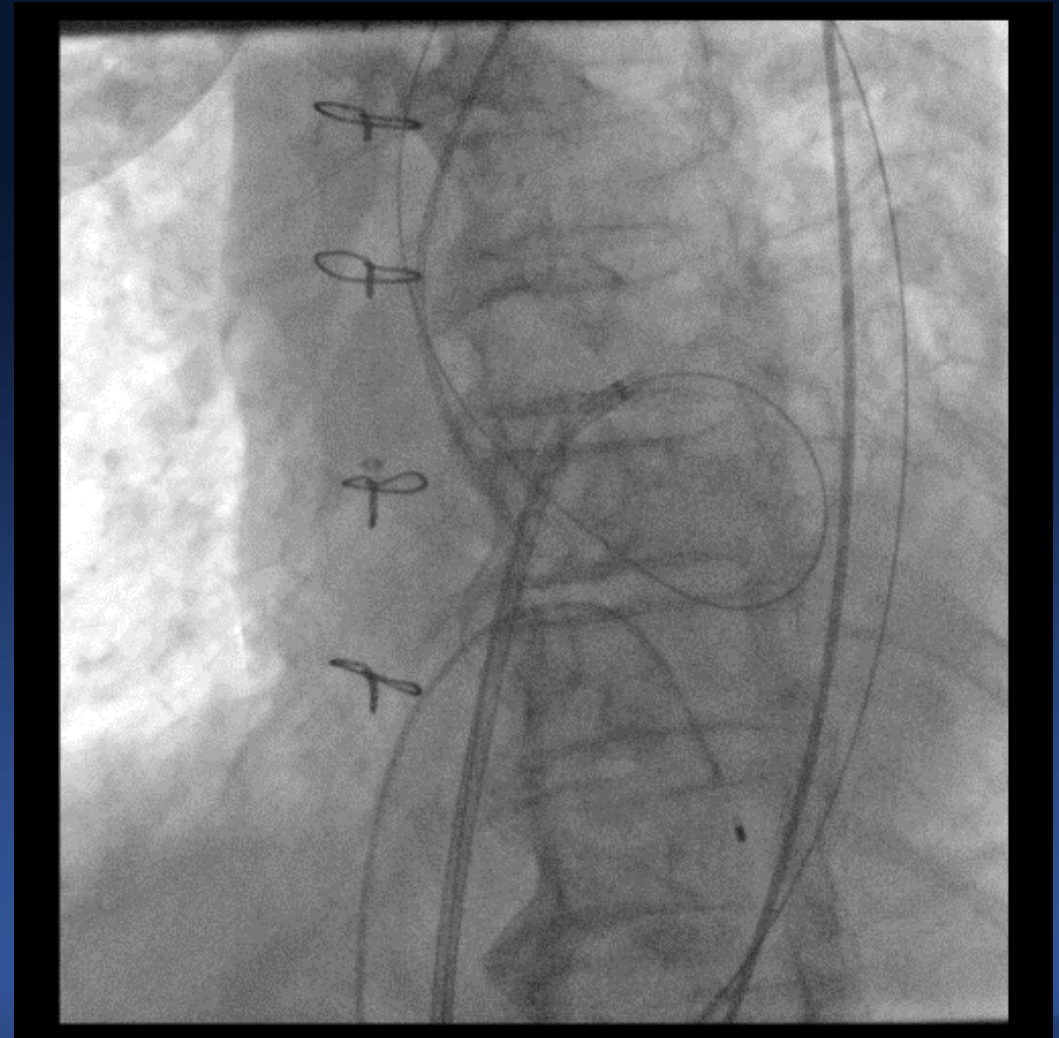
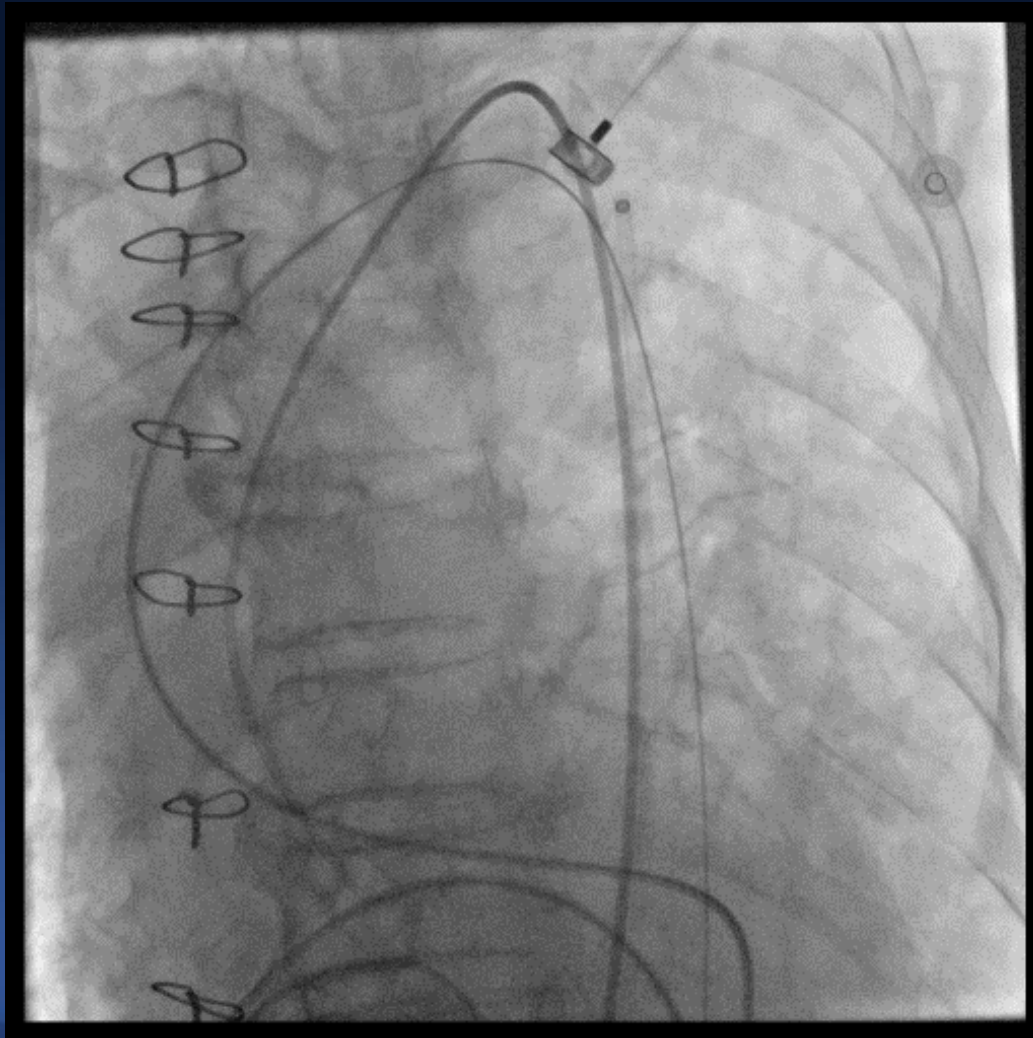




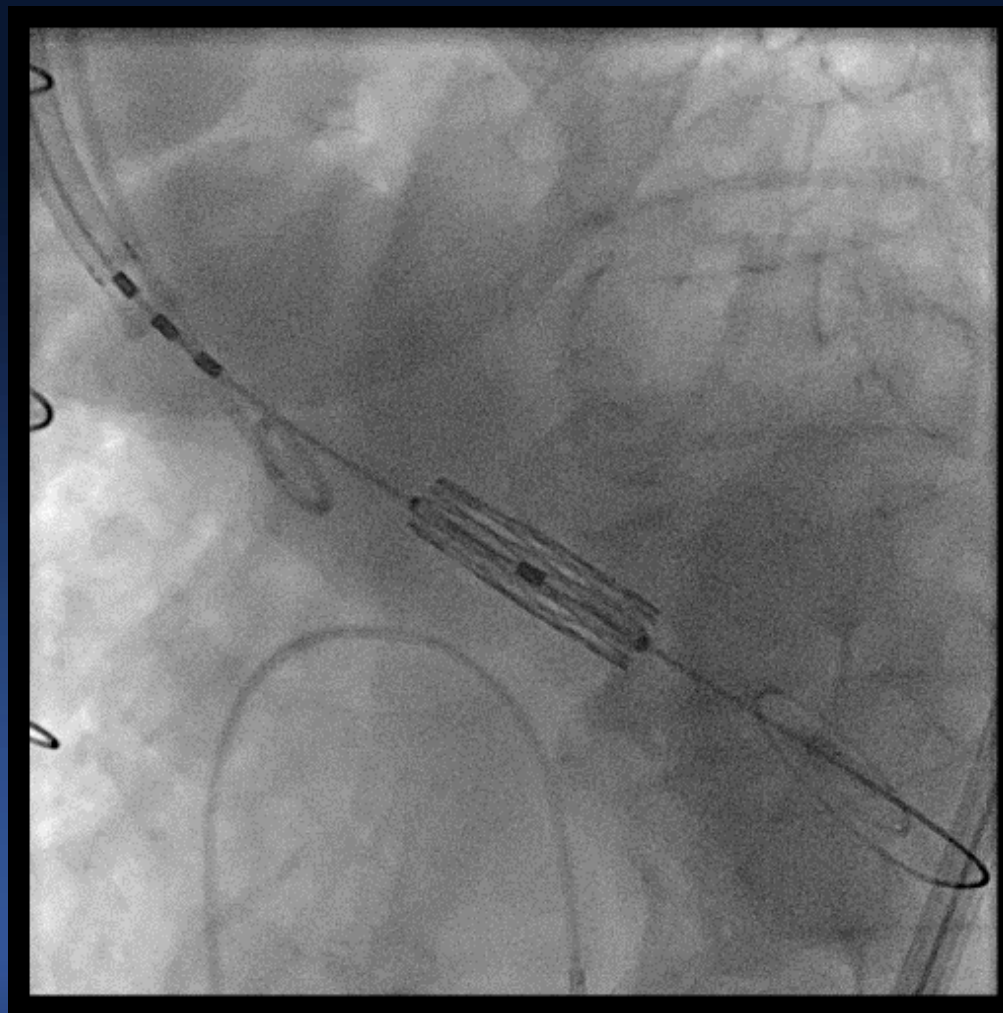
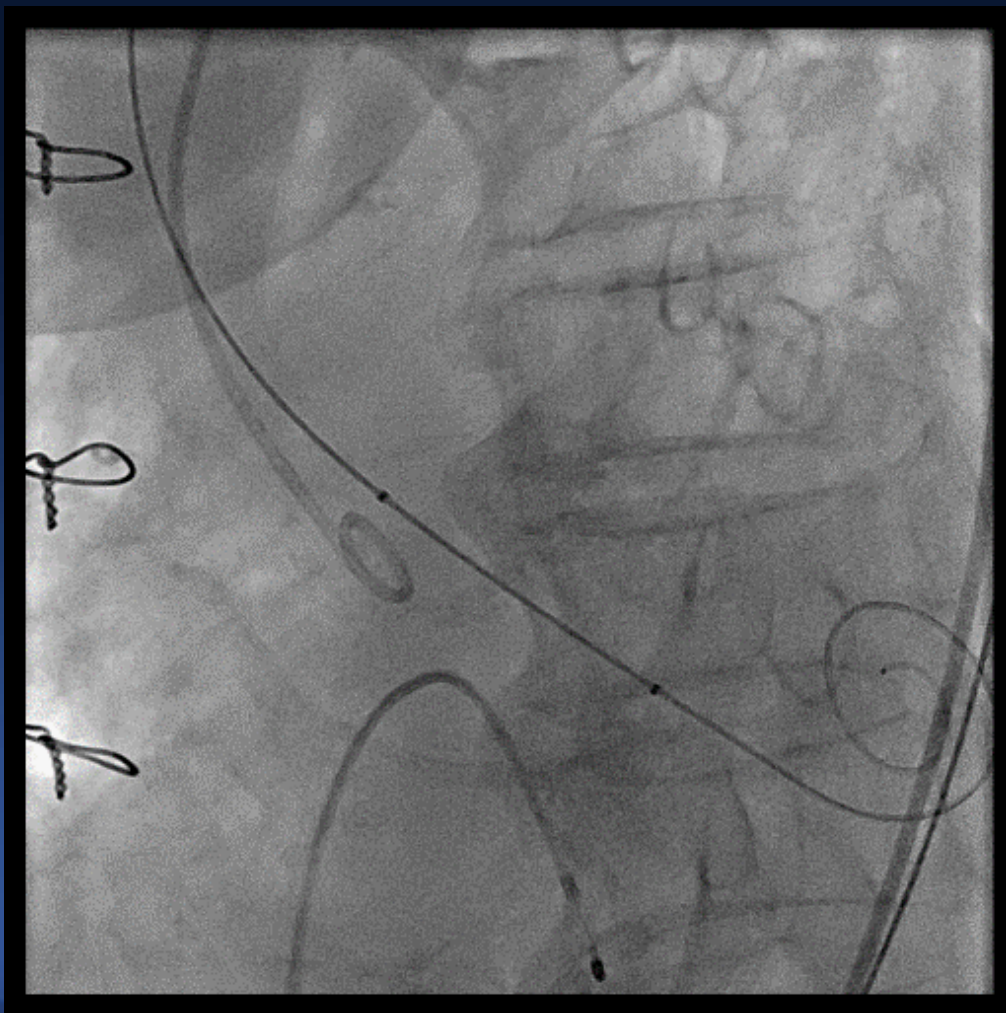
# Antegrade Wiring via Trans-septal Approach (Floating Balloon Technique)



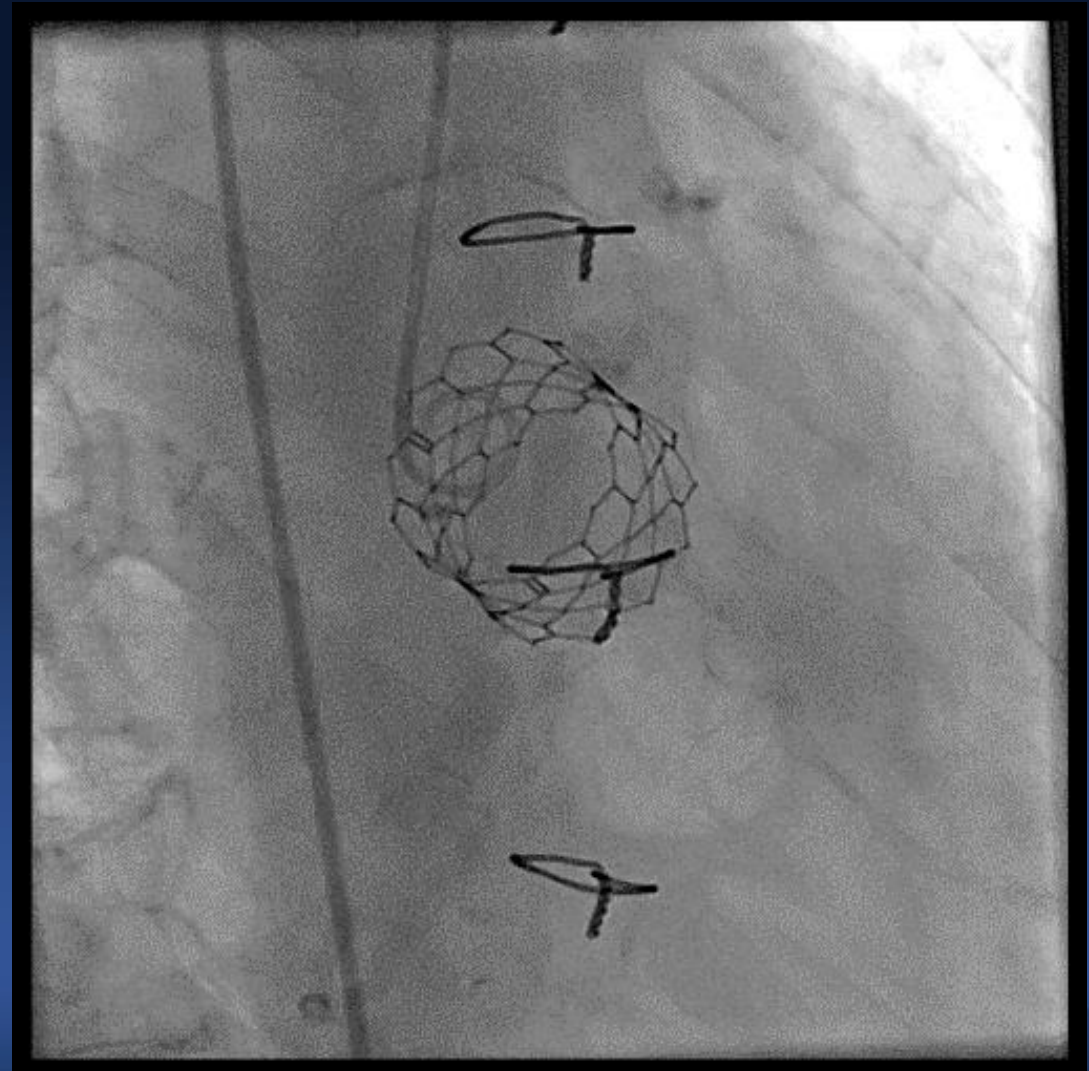
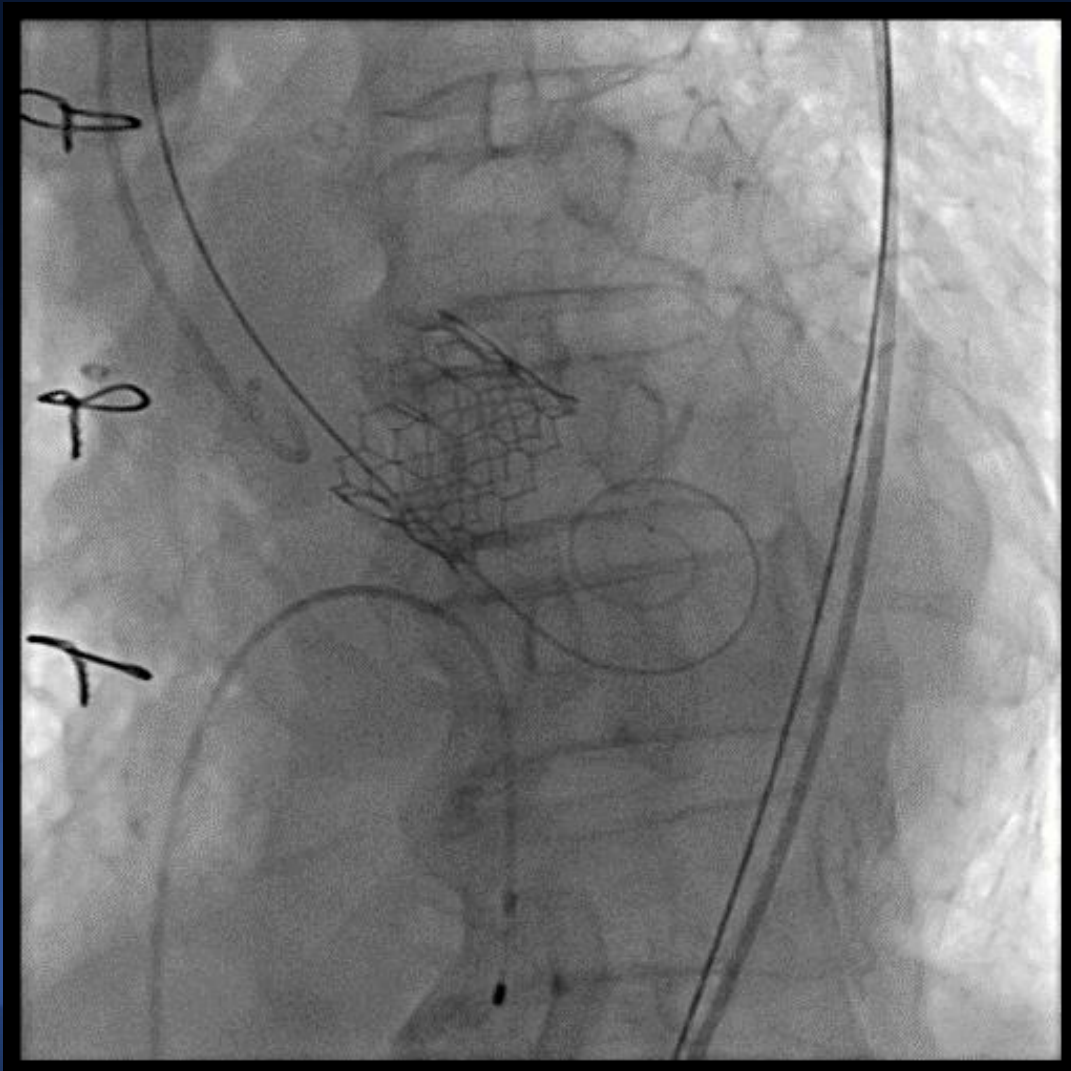
# Catheter Exchange via AV Rail



# S3 26mm with +2cc Underfill (-3% Oversizing)



# Final Aortography



# Conclusion

- Anatomic risk evaluation is important, especially in the era of TAVR for younger patients with lower surgical risk.
- Optimal patient and valve selection by comprehensive MDCT analysis is essential to optimize the procedural outcomes.
- CT sizing algorithm with provisional post-dilation upto intended target oversizing ratio is safe and effective.