

# LVOT CA Cases

**Alan C. Yeung, MD**  
**Li Ka Shing Professor of Medicine**  
**Medical Director, Cardiovascular Health**  
**Stanford University School of Medicine**  
**Stanford Medicine**



# Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

## Affiliation/Financial Relationship

- Grant/Research Support
- Scientific Advisory Board
- Executive Physician Council

## Company

- Edwards Lifesciences, Abbott
- Medtronic
- Boston Scientific Corp



# Case 1

## History:

63 year old male with history of HTN, HLD, and severe symptomatic AS. Currently symptomatic of fatigue and syncope/seizure.

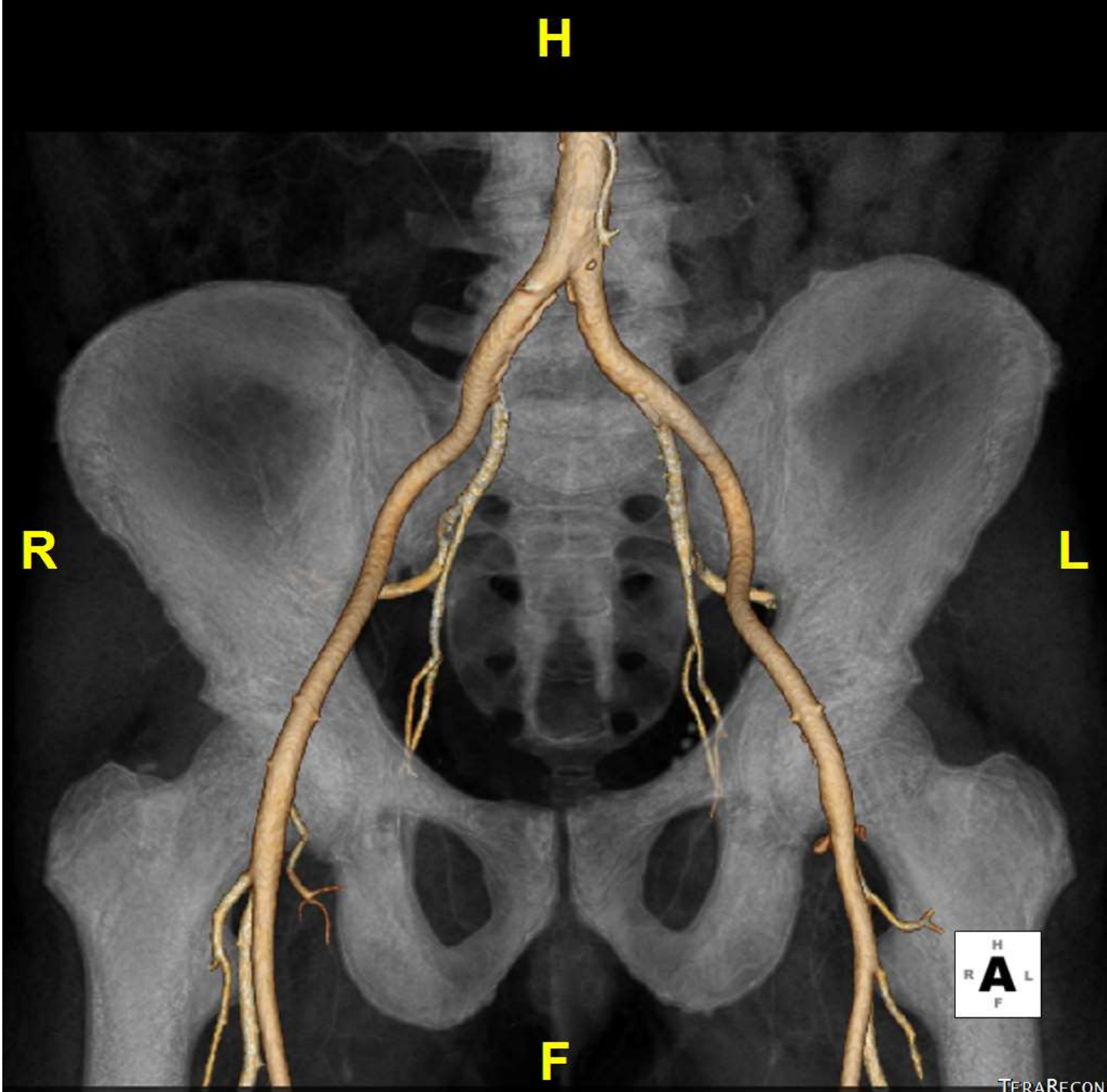
<b>PFTs:</b>	<b>FEV1</b> x.x L (%) <b>DLCO</b> xx.x mL (%)	<b>Frailty:</b>	<b>BMI</b> 31.25 <b>Serum Albumin</b> 4.5 g/dL (-) <b>ADLs</b> 6/6 (-) <b>Grip Strength</b> 40.3 kg (-) <b>5m WT</b> 4.48 sec (-) <b>Score</b> 0/4	<b>STS</b> 0.7%  63 year old, male, Caucasian, 98.8 kg, 177.8 cm (BSA 2.21), Cr 1.0, HTN, NYHA Class II, EF 60%, AS, Trace AI, Trace MR, Mild TR, first op, elective
<b>Anticoagulation History/Regimen:</b>				
ASA				

<b>Echo:</b>	<b>Date</b> 2/11/2020	<b>RHC:</b>	<b>RA</b> 3 01/31/20 <b>RV</b> 26/0 <b>PA</b> 20/8 <b>PCW</b> 7 <b>CO</b> 4.5-6.2 L/min <b>CI</b> 2.1-2.9 L/min/m2	<b>Coronary heights:</b>	<b>LCA</b> 12.2 mm <b>RCA</b> 15.8 mm	<b>SOV Diameters:</b>	<b>RCC</b> 29.4 mm <b>LCC</b> 32.3 mm <b>NCC</b> 30.3 mm
-	<b>AVA</b> 0.50 cm2 <b>AVAI</b> 0.23 cm2/m2 <b>V2 Max</b> 5.0 m/s <b>Gradient</b> 63 mmHg <b>V1/V2</b> - <b>EF</b> 60% <b>RVSP</b> 34 mmHg <b>AI</b> Trace <b>MR</b> Trace <b>TR</b> Mild		<b>Cors:</b>	<b>LM</b> No sig disease 01/31/20 <b>LAD</b> No sig disease <b>LCX</b> No sig disease <b>RCA</b> No sig disease <b>Grafts</b> -	<b>Vascular access:</b> (in mm) <b>RCIA</b> 9.0 x 7.7 <b>REIA #1</b> 7.4 x 7.2 <b>REIA #2</b> 7.1 x 7.0 <b>RCFA</b> 9.2 x 6.9 <b>LCIA</b> 10.0 x 9.5 <b>LEIA #1</b> 7.1 x 7.0 <b>LEIA #2</b> 7.0 x 6.9 <b>LCFA</b> 9.0 x 7.4	<b>SOV heights &gt; 15 mm:</b> Yes <b>Ascending Ao diameter:</b> <b>Annulus:</b>	<b>Long Axis</b> 34.3 mm <b>Short Axis</b> 32.6 mm <b>Diameter</b> ~24.7 mm <b>Long Axis</b> 26.3 mm <b>Short Axis</b> 22.6 mm <b>Area</b> 478 mm <sup>2</sup> <b>Perimeter</b> 78.9 mm

**Notes:** Labs: NT-proBNP 477. CT: partial fusion of the R & L coronary cusps with calcification extending inferiorly from the LC and NC commissure into the LVOT.

<b>Summary:</b>	<b>THV Notes:</b>
<ul style="list-style-type: none"> <li>• 63 year old male</li> <li>• STS 0.7%</li> <li>• LR</li> <li>• Eligible studies:</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial TAVR</li> <li>• 26 mm Sapien 3</li> <li>• Transfemoral approach - Right side</li> <li>• Fast track eligible</li> <li>• OR staff needed: No</li> <li>• Anesthesia Notes: MAC eligible</li> <li>• Planned use of Sentinel device: No</li> </ul>



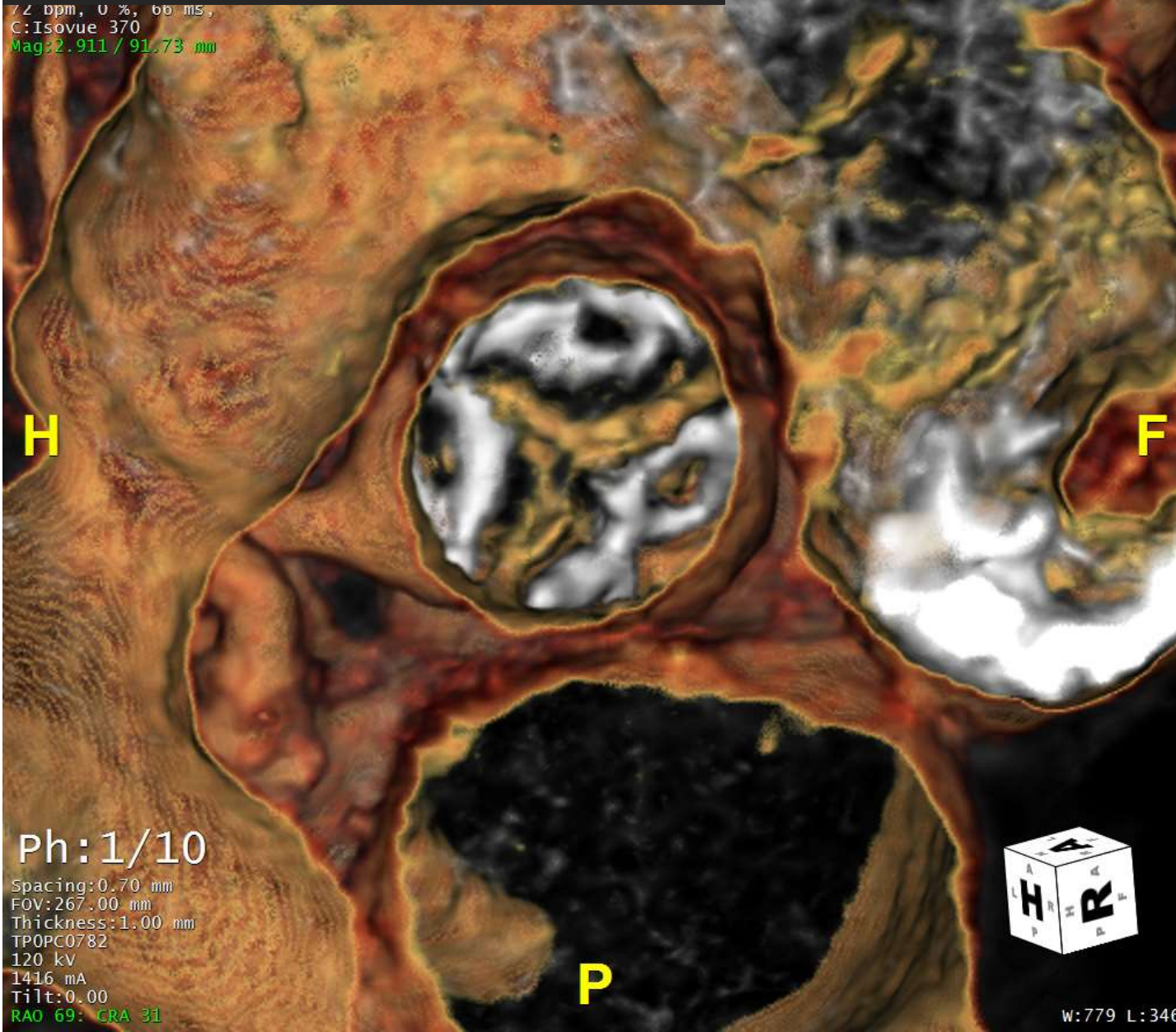




Moderate to severely calcified three commissural aortic valve, partial fusion of Right and Left coronary cusps.

SMICPA  
SOMATOM Force  
CTAWP75513  
512x512  
3D VR  
Slab: 30.00 mm

72 bpm, 0 %, 66 ms,  
C: Isovive 370  
Mag: 2.911 / 91.73 mm



Ph: 1/10

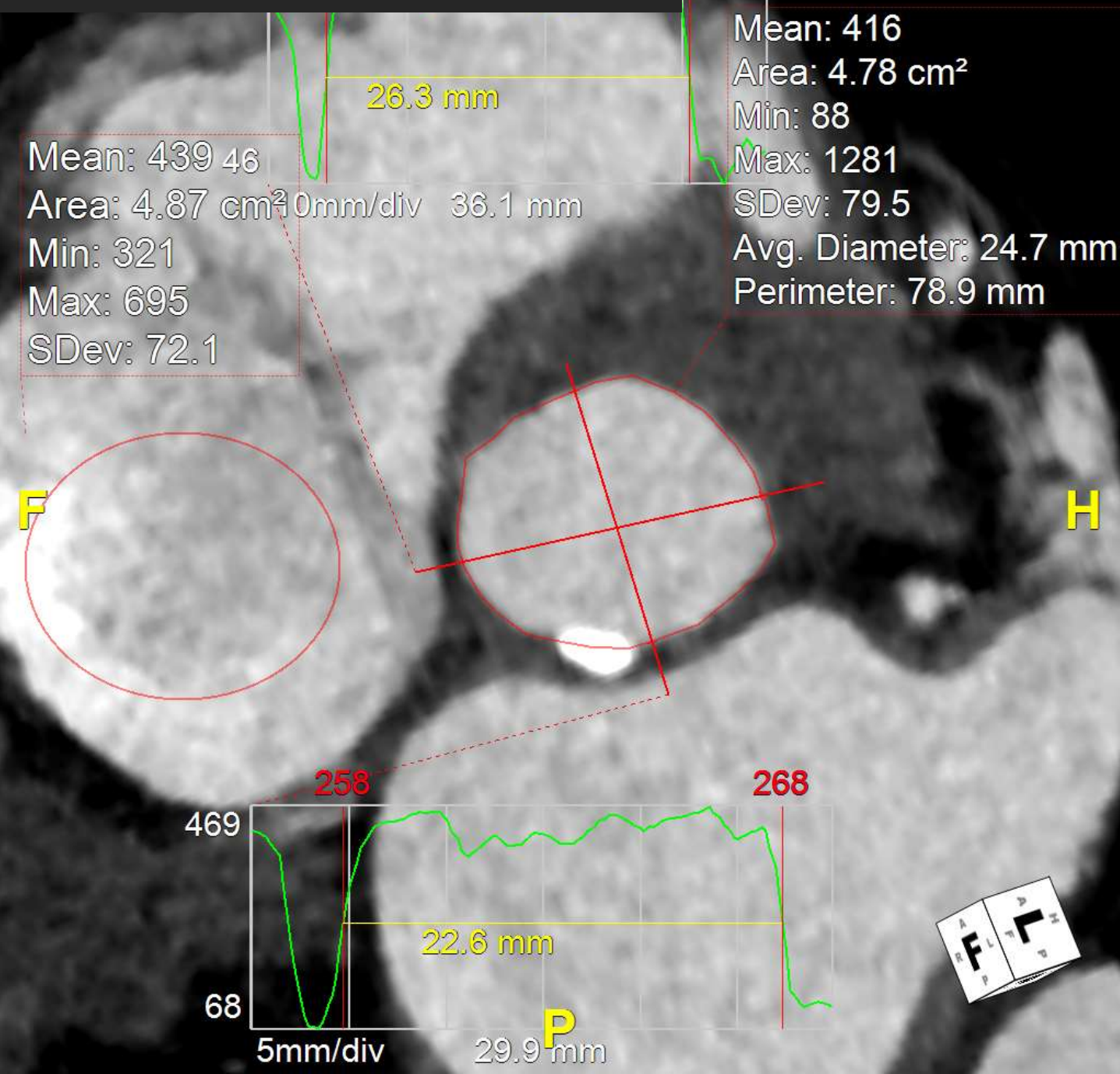
Spacing: 0.70 mm  
FOV: 267.00 mm  
Thickness: 1.00 mm  
TPOPC0782  
120 kV  
1416 mA  
Tilt: 0.00  
RAO 69: CRA 31



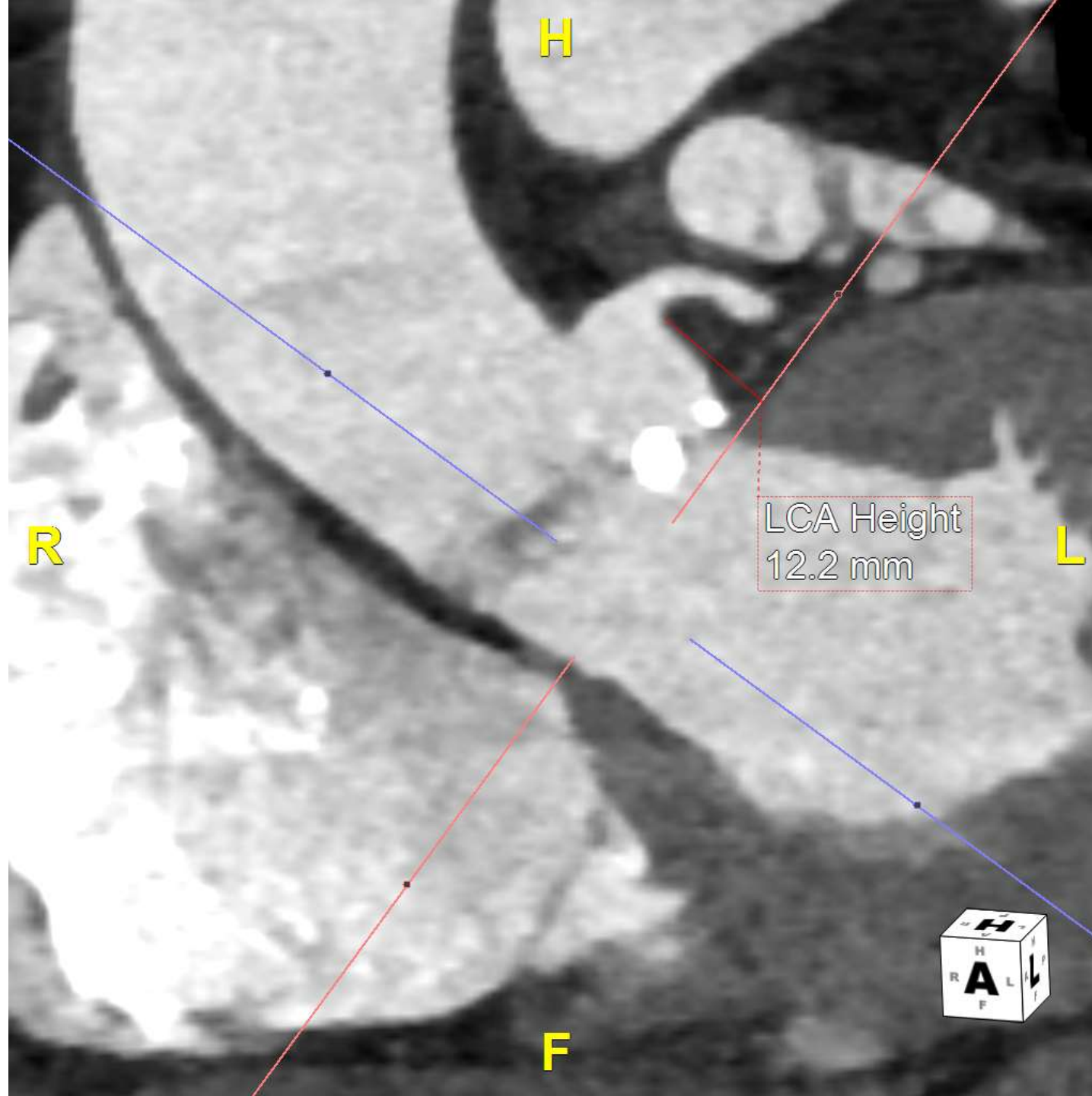
w: 779 L: 346



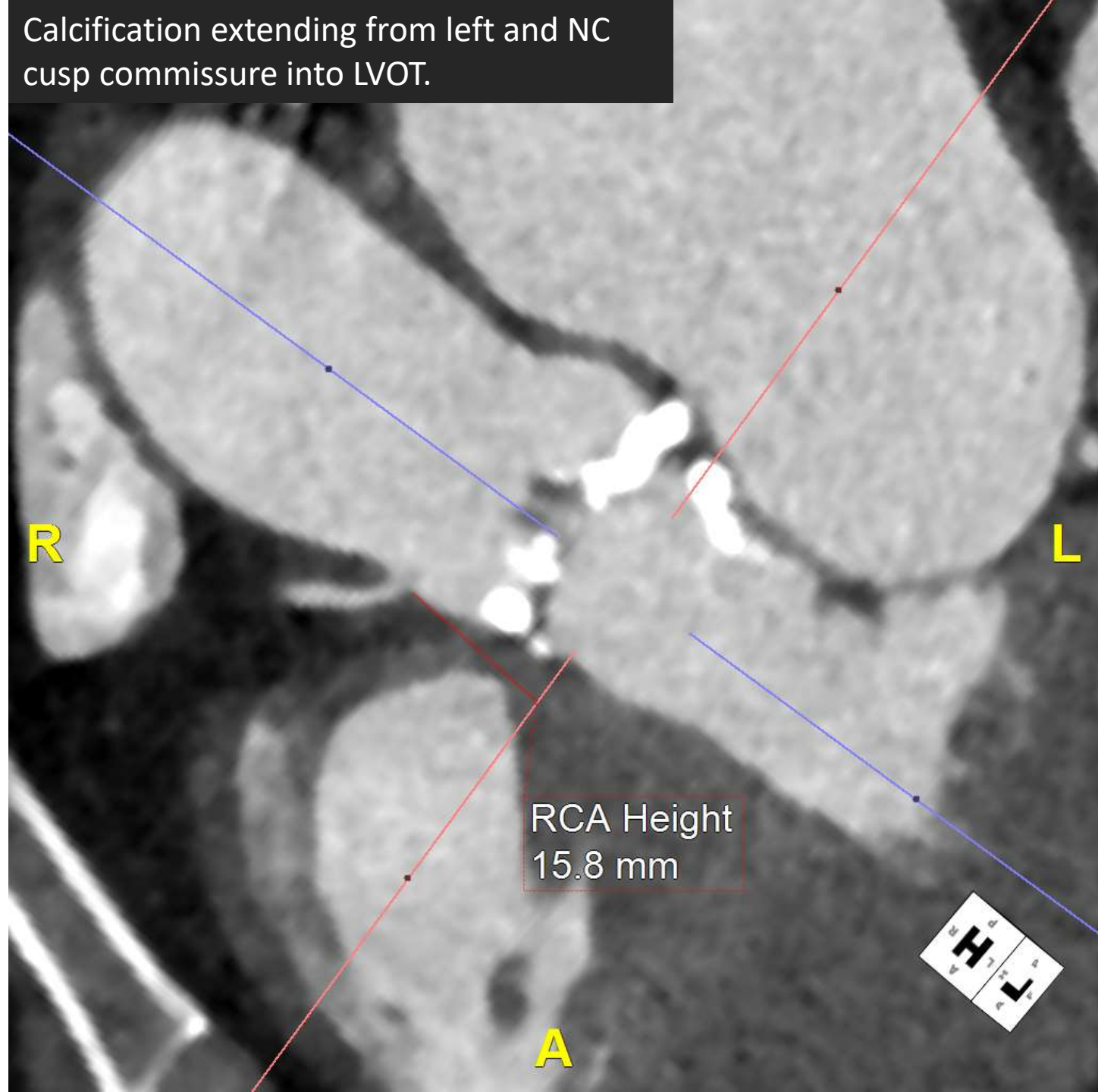
Area of 478mm<sup>2</sup>, 26 S3 is 430 to 540mm<sup>2</sup>





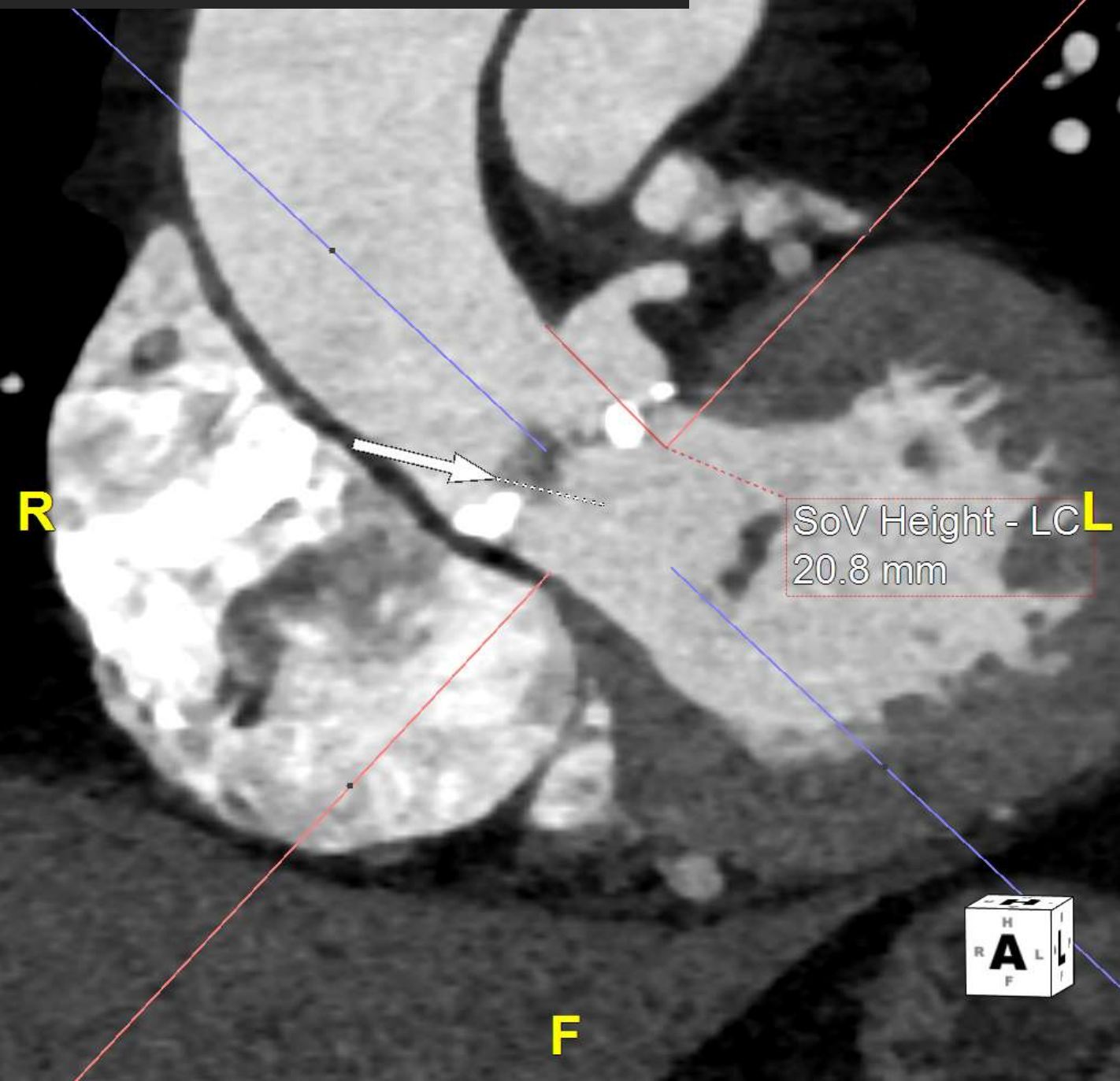


Calcification extending from left and NC cusp commissure into LVOT.



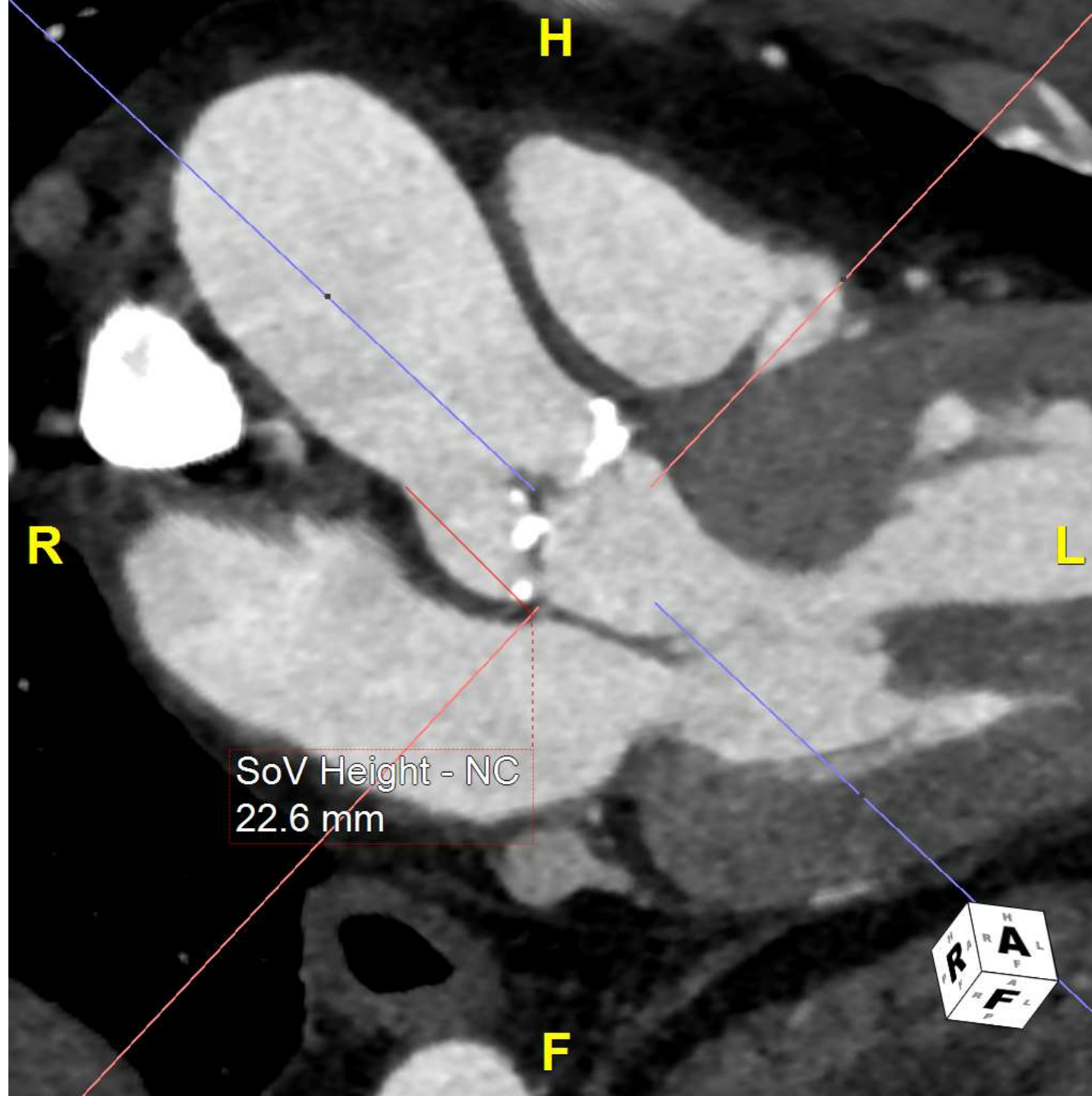


Aortic root dimension is 34mm x 32mm



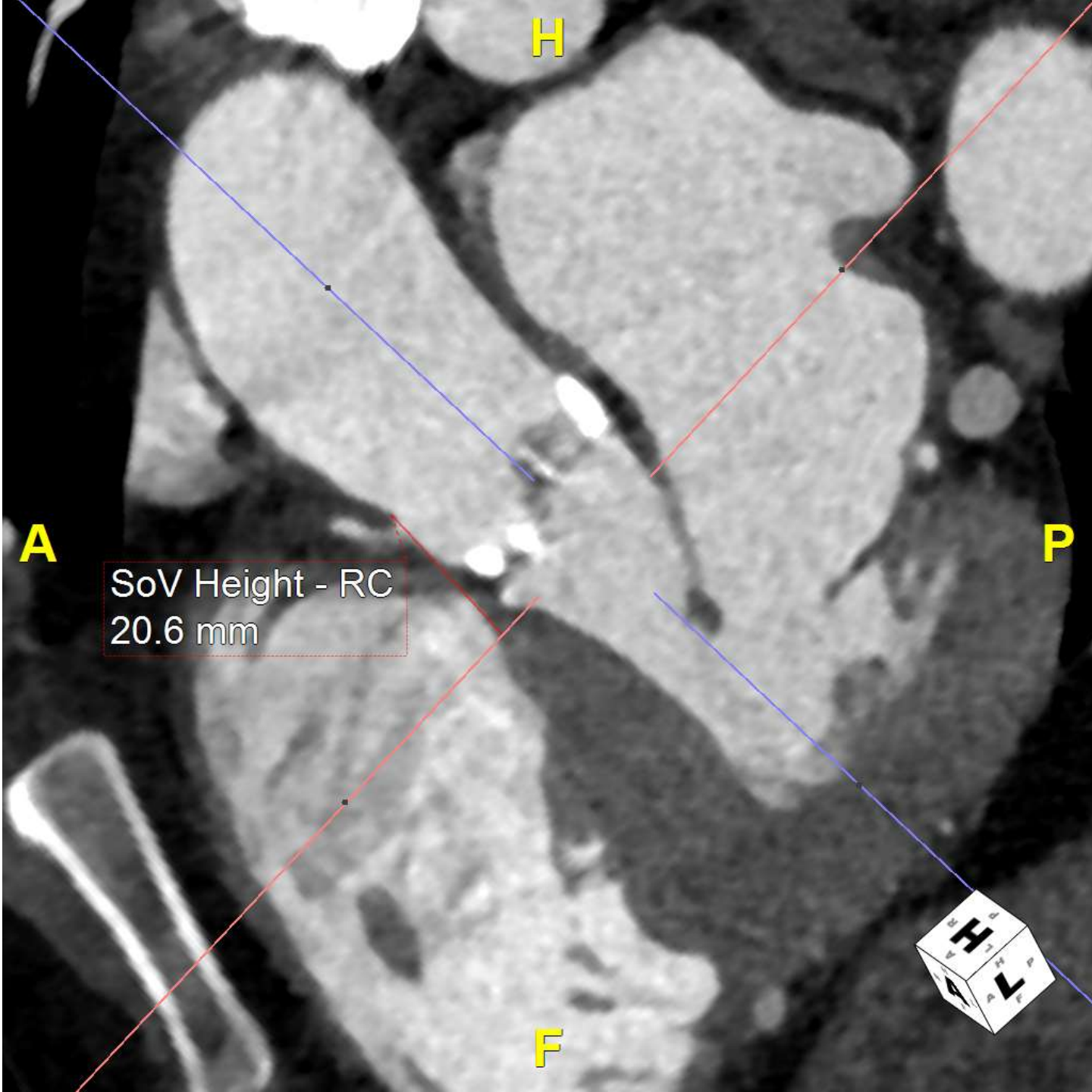
SoV Height - LC<sup>L</sup>  
20.8 mm





SoV Height - NC  
22.6 mm





A

SoV Height - RC  
20.6 mm

H

P

F





# Wise, Edward, Anthony **A**

SMICPA  
SOMATOM Force  
CTAWP75513  
512x512  
MPR  
Filter: None

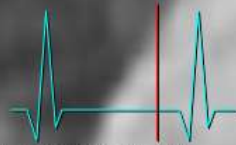
77544385 , 16470137  
Age: 63, M  
Se: 6  
02/11/2020 7:39 AM  
Kern: Bv36d  
72 bpm, 73 % D, 66  
C: Isovue 370  
Mag: 4.867 / 72.74 mm

SoV - RC  
29.4 mm

Mean: 454  
Area: 7.57 cm<sup>2</sup>  
Min: -36  
Max: 1291  
SDev: 223  
Avg. Diameter: 31.0 mm  
Perimeter: 100 mm

**H**

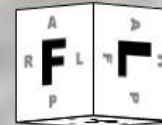
%R-R: 73



SoV - NC  
30.3 mm

SoV - LC  
32.3 mm

Spacing: 0.70 mm  
FOV: 354.00 mm  
Thickness: 0.75 mm  
TP73PC0782  
120 kV  
1416 mA  
Tilt: 0.00  
LAO 96: CAU 43



**P**



Pre Echo

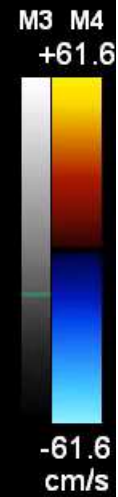
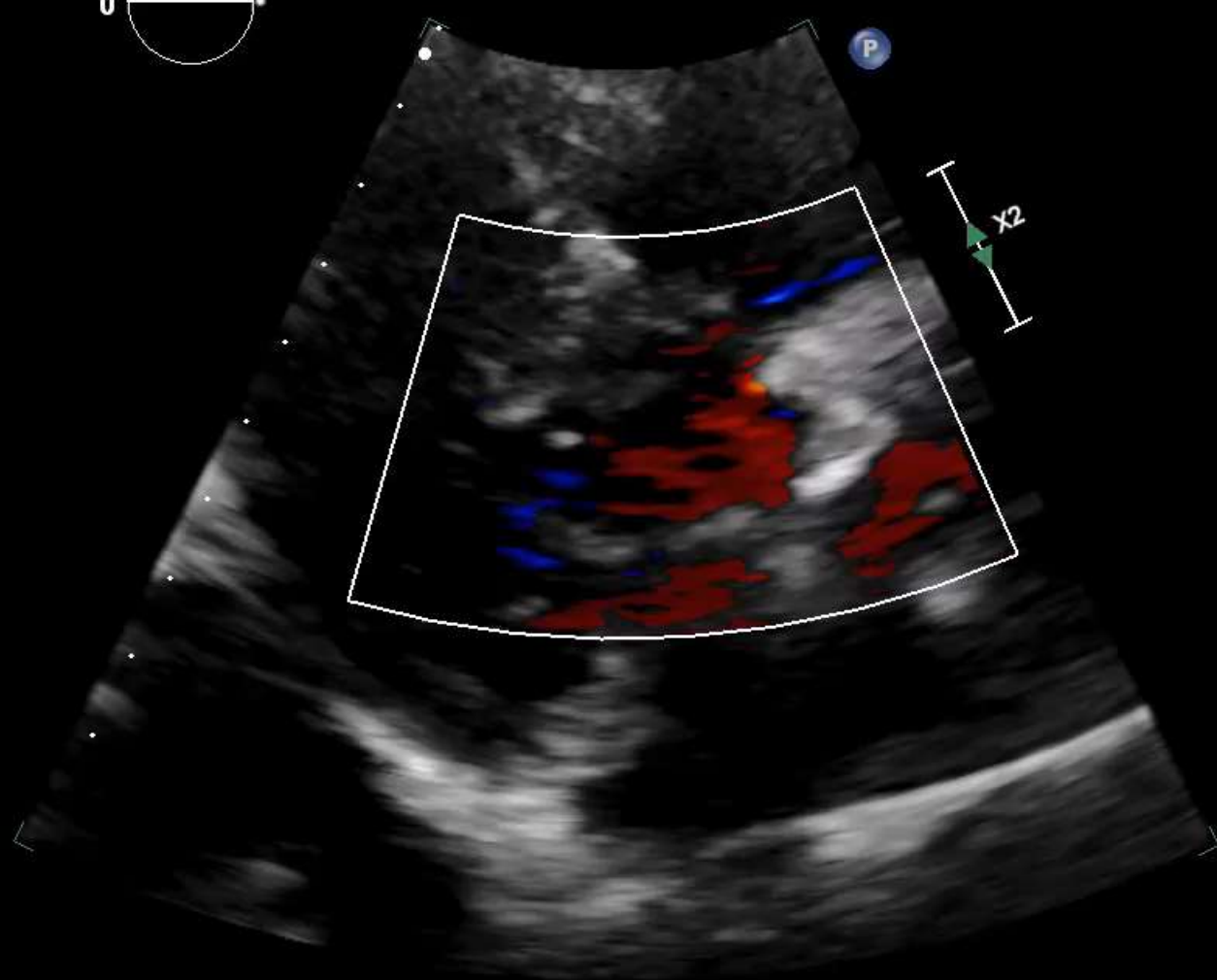
TIS1.0 MI 0.9

X5-1  
20Hz  
15cm



2D  
69%  
C 53  
P Low  
HGen

CF  
50%  
4000Hz  
WF 399Hz  
2.5MHz



V

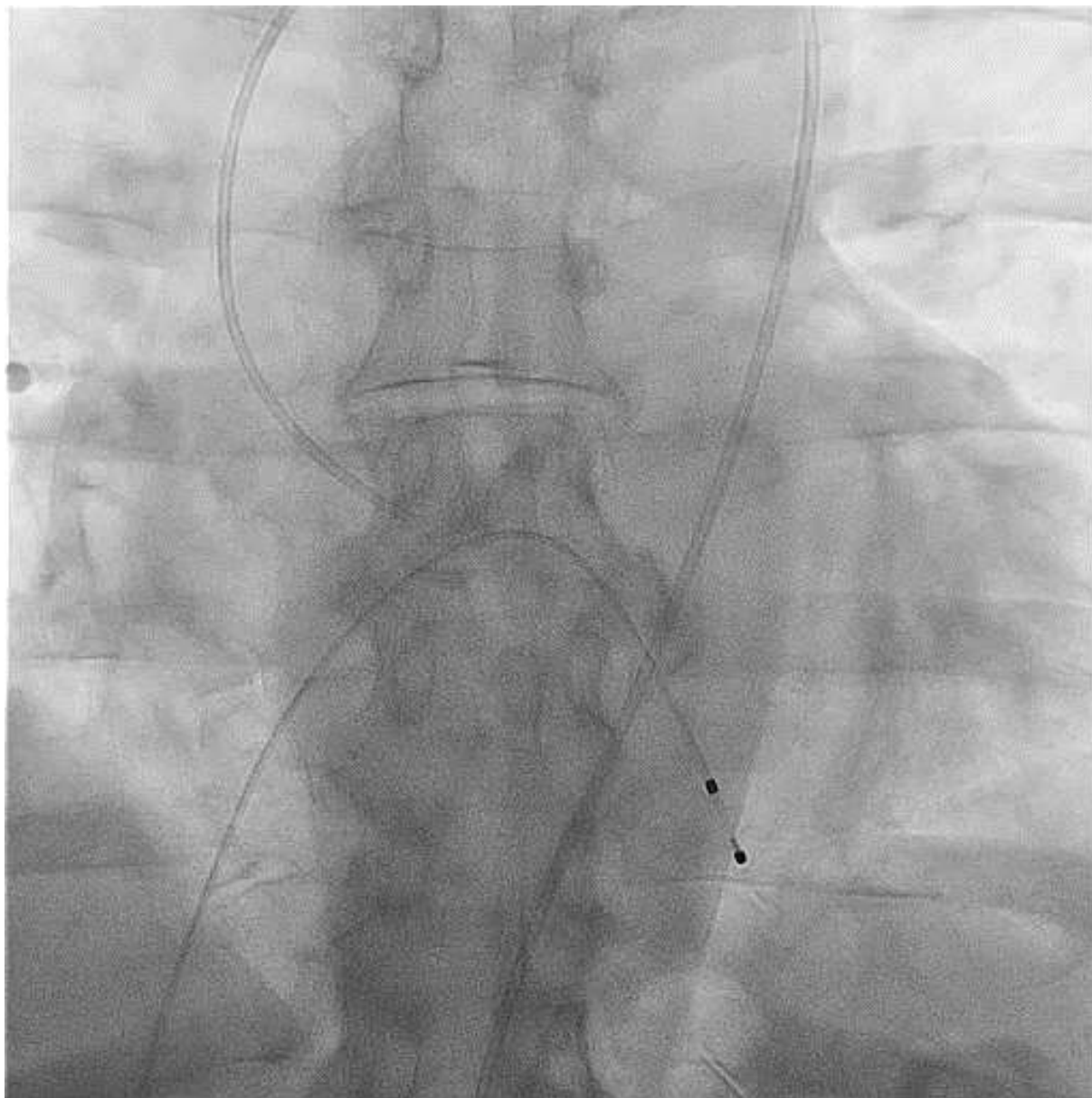
76 bpm











Predilatation?  
Nominal 26 S3?



# Optimal MDCT-Sizing of the SAPIEN 3 THV

- SAPIEN 3 Sizing Chart

It may not always be possible to implant the larger THV size for borderline annulus diameters. Consider the smaller THV in the following special situations:

- Severe annulus calcification
- Narrow root and low coronary ostia
- Narrow sinotubular junction
- Mitral annular calcification
- Porcelain aorta
- Bulky leaflet and low coronary ostia

If/when outside of recommended range:

- 1) Reference alternative sizing modalities (echocardiography, balloon sizing)
- 2) Consider the following factors in valve size selection
  - Clinical: very advanced age, corticosteroids, chest radiation, extensive calcification, calcium extending into the LVOT, etc

**Bold = recommended Sealing Zones** relate only to valves that are deployed with nominal volumes

3D Area-derived Diameter (mm)	20.0	20.2	20.5	20.7	21.0	21.1	21.4	21.7	22.0	22.3	22.6	22.8	23.0	23.1	23.4	23.7	23.9	24.0	24.2	24.5
3D Annular Area (mm <sup>2</sup> )	314	320	330	338	346	350	360	370	380	390	400	410	415	420	430	440	450	452	460	470
% Annular Area Over (+) or Under (-) Nominal by 3D CT	23 mm	29.3	26.9	23.0	20.1	17.3	16.0	12.8	9.7	6.8	4.1	1.5	-1.0	-2.2	-3.3	-5.6	-7.7	-9.8		
	26 mm										29.8	26.6	25.1	23.6	<b>20.7</b>	<b>18.0</b>	<b>15.3</b>	<b>14.8</b>	<b>12.8</b>	<b>10.4</b>
	29 mm																			

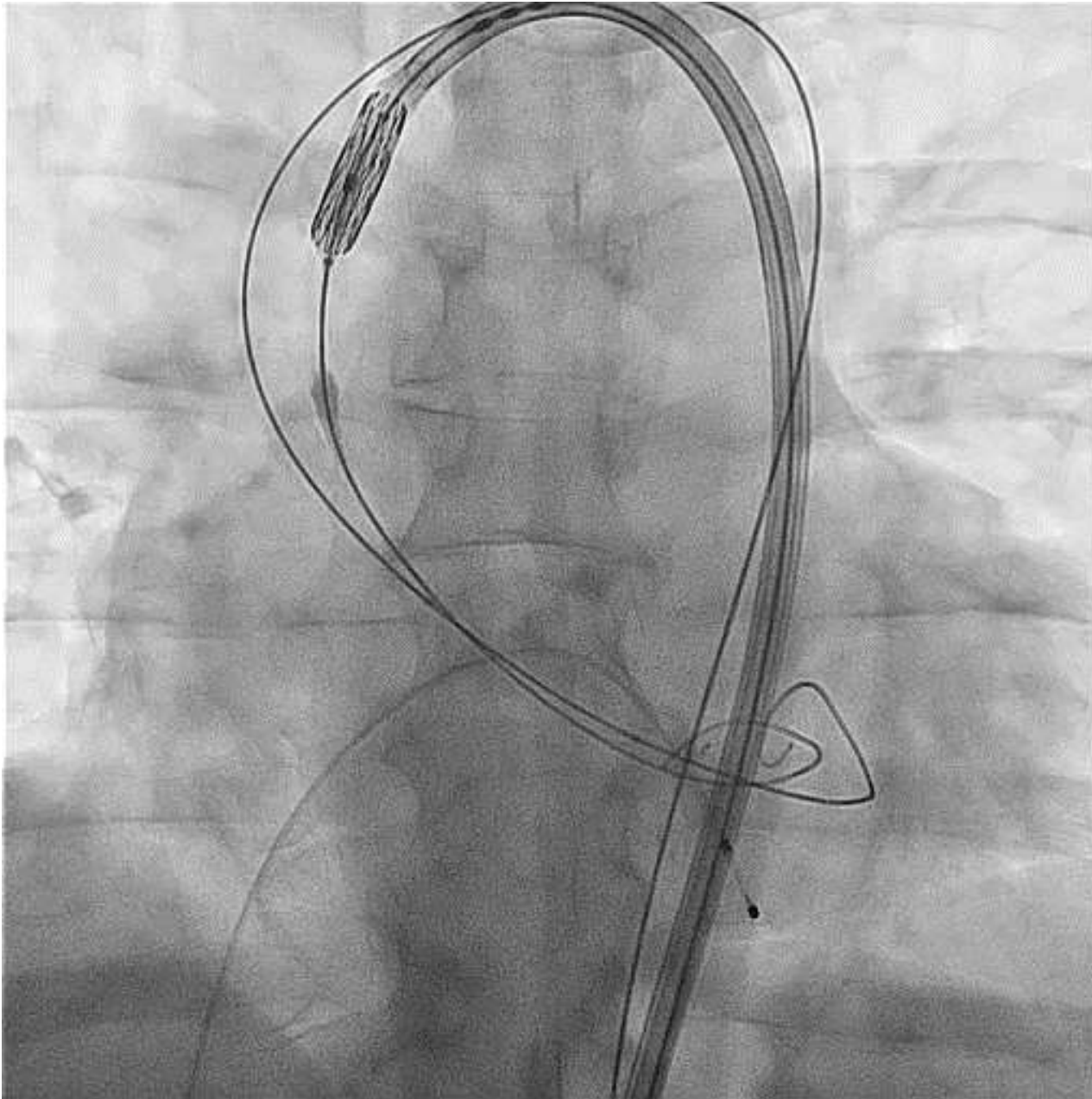
ALL VALUES PRESENTED ARE BASED ON NOMINAL/RECOMMENDED INFLATION VOLUMES.

SYSTOLIC MEASURES ARE RECOMMENDED

24.5	24.7	25.0	25.2	25.5	25.7	26.0	26.2	26.4	26.5	26.7	26.9	27.2	27.4	27.6	27.9	28.0	28.1	28.3	28.5	28.8	29.0	29.2	29.4	29.5	29.6	29.9	30.1	30.3	
470	480	490	500	510	520	530	540	546	550	560	570	580	590	600	610	615	620	630	640	650	660	670	680	683	690	700	710	720	
<b>10.4</b>	<b>8.1</b>	<b>5.9</b>	<b>3.8</b>	<b>1.8</b>	<b>-0.2</b>	<b>-2.1</b>	<b>-3.9</b>	<b>-4.9</b>	-5.6	-7.3	-8.9																		
			29.8	27.3	24.8	22.5	<b>20.2</b>	<b>18.9</b>	<b>18.0</b>	<b>15.9</b>	<b>13.9</b>	<b>11.9</b>	<b>10.0</b>	<b>8.2</b>	<b>6.4</b>	<b>5.5</b>	<b>4.7</b>	<b>3.0</b>	<b>1.4</b>	<b>-0.2</b>	<b>-1.7</b>	<b>-3.1</b>	<b>-4.6</b>	-5.0	-5.9	-7.3	-8.6	-9.9	

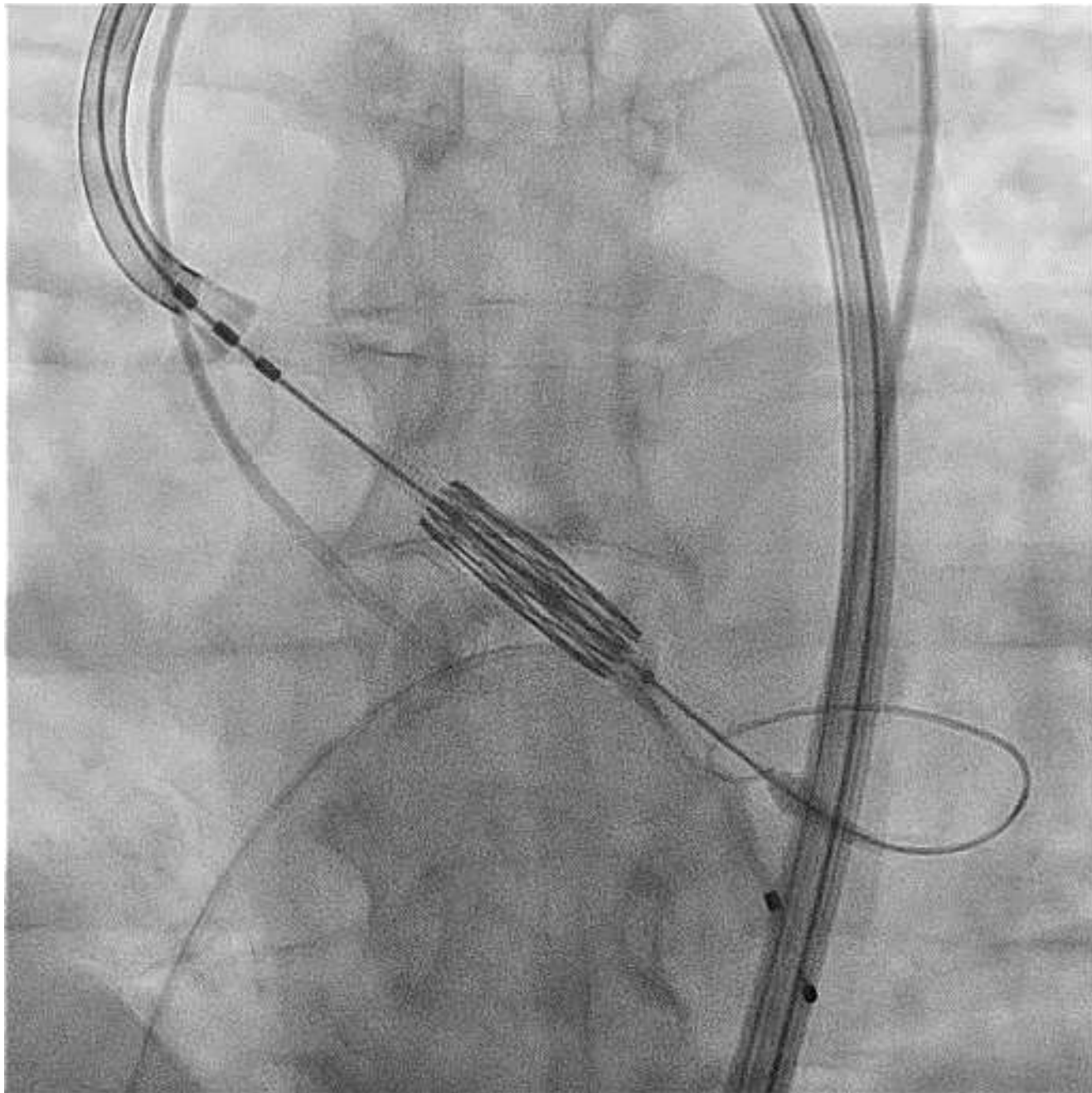


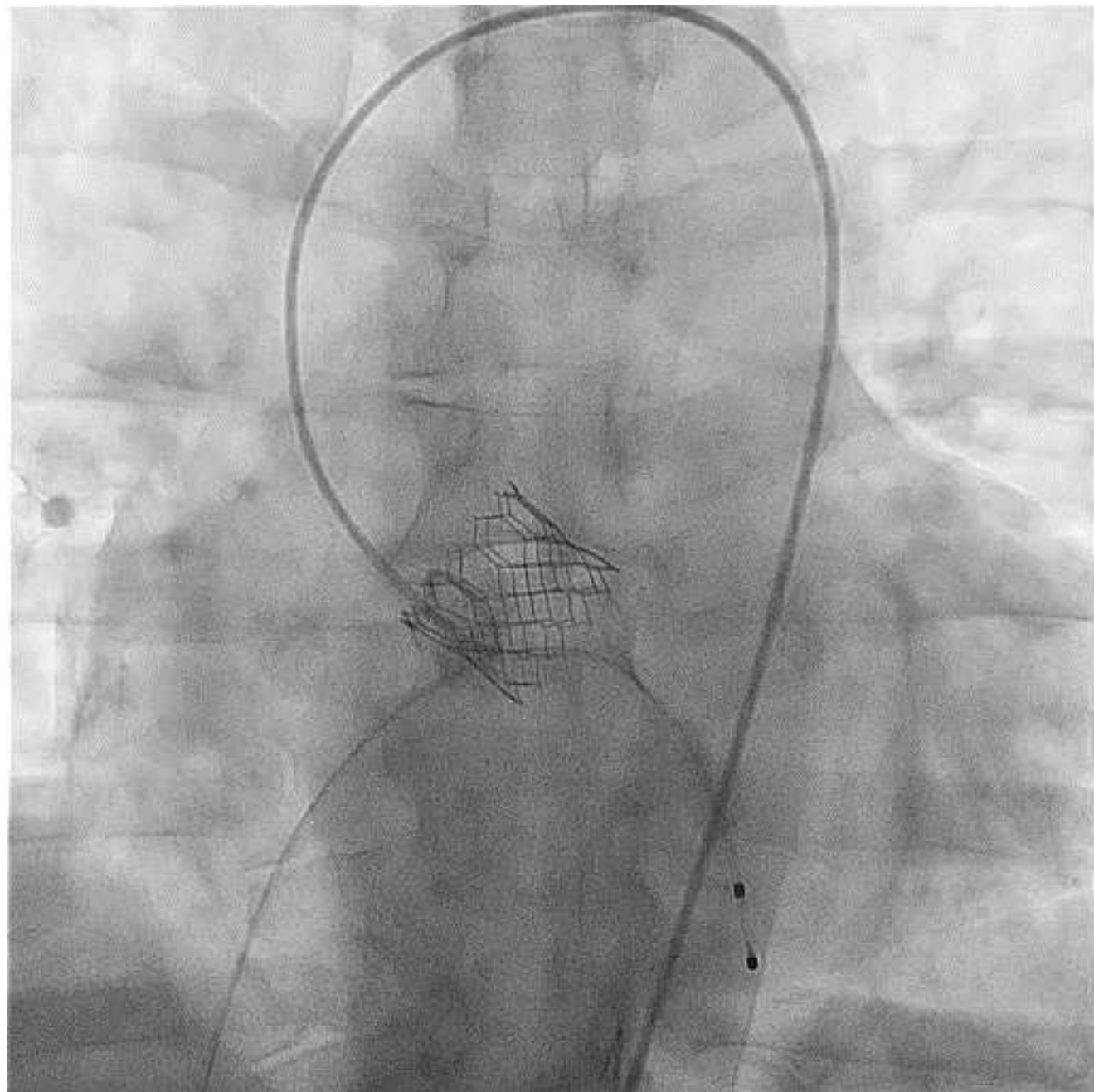




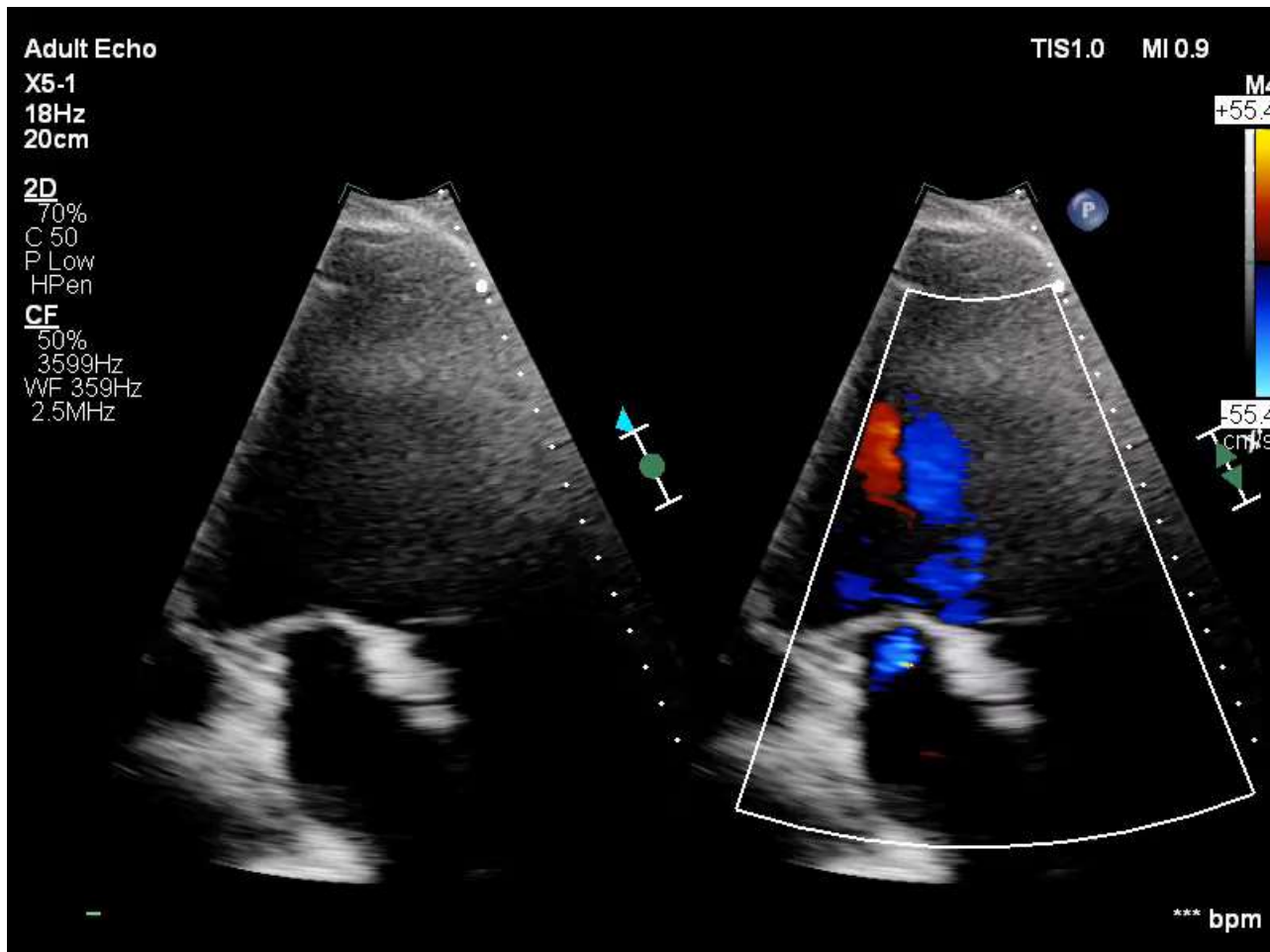
Cannot pass S3  
Contralateral upsize to 10F, 18mm True  
Balloon











Gradient next day 20mmHg and at 1 year 11mmHg.



## Case 2

**History:** 70 year old female with history of HTN, HLD, asthma, DM (oral), polio, arthritis, GIB (secondary to diverticulosis), and severe symptomatic AS. Currently symptomatic of fatigue, SOB, CHF exacerbation. Recently hospitalized at Regional for acute respiratory failure/CHF exacerbation.

<b>PFTs:</b>	<b>FEV1</b>	-	<b>Frailty:</b>	<b>BMI</b>	43.59	<b>STS</b>	2.8%
	<b>DLCO</b>	-		<b>Serum Albumin</b>	4.3 g/dL (-)		70 year old, female, Hispanic, 99.4 kg, 151 cm, (BSA 1.74), DM (oral), Cr 1.2, HTN, mild lung dz, CHF, NYHA Class III, EF 33%, AS, None AI, Moderate MR, Trace R, first op, elective
<b>Anticoagulation History/Regimen:</b>				<b>ADLs</b>	3/6 (+)		
ASA				<b>Grip Strength</b>	13 kg (+)		
				<b>5m WT</b>	10.64 sec (+)		
				<b>Score</b>	3/4		

<b>Echo:</b>	<b>Date</b>	2/24/2023	<b>RHC:</b>	<b>RA</b>	-	<b>Coronary heights:</b>	<b>LCA</b>	11.4 mm	<b>SOV Diameters:</b>	<b>RCC</b>	28.8 mm
Outside	<b>AVA</b>	0.80 cm <sup>2</sup>	-	<b>RV</b>	-		<b>RCA</b>	16.8 mm		<b>LCC</b>	30.5 mm
echo	<b>AVA<sub>AI</sub></b>	0.46 cm <sup>2</sup> /m <sup>2</sup>		<b>PA</b>	-	<b>ST Junction:</b>	27.5 x 26.8 mm			<b>NCC</b>	29.4 mm
	<b>V2 Max</b>	4.4 m/s		<b>PCW</b>	-	<b>Vascular access:</b>	<b>RCIA</b>	9.0 x 8.9	<b>SOV heights &gt; 15 mm:</b>	Lowest: NC@23.4 mm	
	<b>Gradient</b>	48 mmHg		<b>CO</b>	-	(in mm)	<b>REIA #1</b>	7.2 x 6.8	<b>Ascending Ao diameter:</b>	<b>Long Axis</b>	31.0 mm
	<b>V1/V2</b>	-		<b>CI</b>	-		<b>REIA #2</b>	7.5 x 6.2		<b>Short Axis</b>	28.4 mm
	<b>EF</b>	33%	<b>Cors:</b>	<b>LM</b>	-		<b>RCFA</b>	6.9 x 6.9	<b>Annulus:</b>	<b>Diameter</b>	~24.2 mm
	<b>RVSP</b>	33 mmHg	-	<b>LAD</b>	-		<b>LCIA</b>	8.3 x 8.0		<b>Long Axis</b>	25.7 mm
	<b>AI</b>	None		<b>LCX</b>	-		<b>LEIA #1</b>	7.0 x 6.6		<b>Short Axis</b>	22.7 mm
	<b>MR</b>	Moderate		<b>RCA</b>	-		<b>LEIA #2</b>	7.0 x 6.6		<b>Area</b>	436 mm <sup>2</sup>
	<b>TR</b>	Trace		<b>Grafts</b>	-		<b>LCFA</b>	6.7 x 6.5		<b>Perimeter</b>	75.6 mm

**Notes:** Labs: NT-proBNP xxx. CT: no evidence of proximal CAD, high bifurcation RCFA, FMD of R renal artery, multiple non-obstructing R renal calculi.

### Summary:

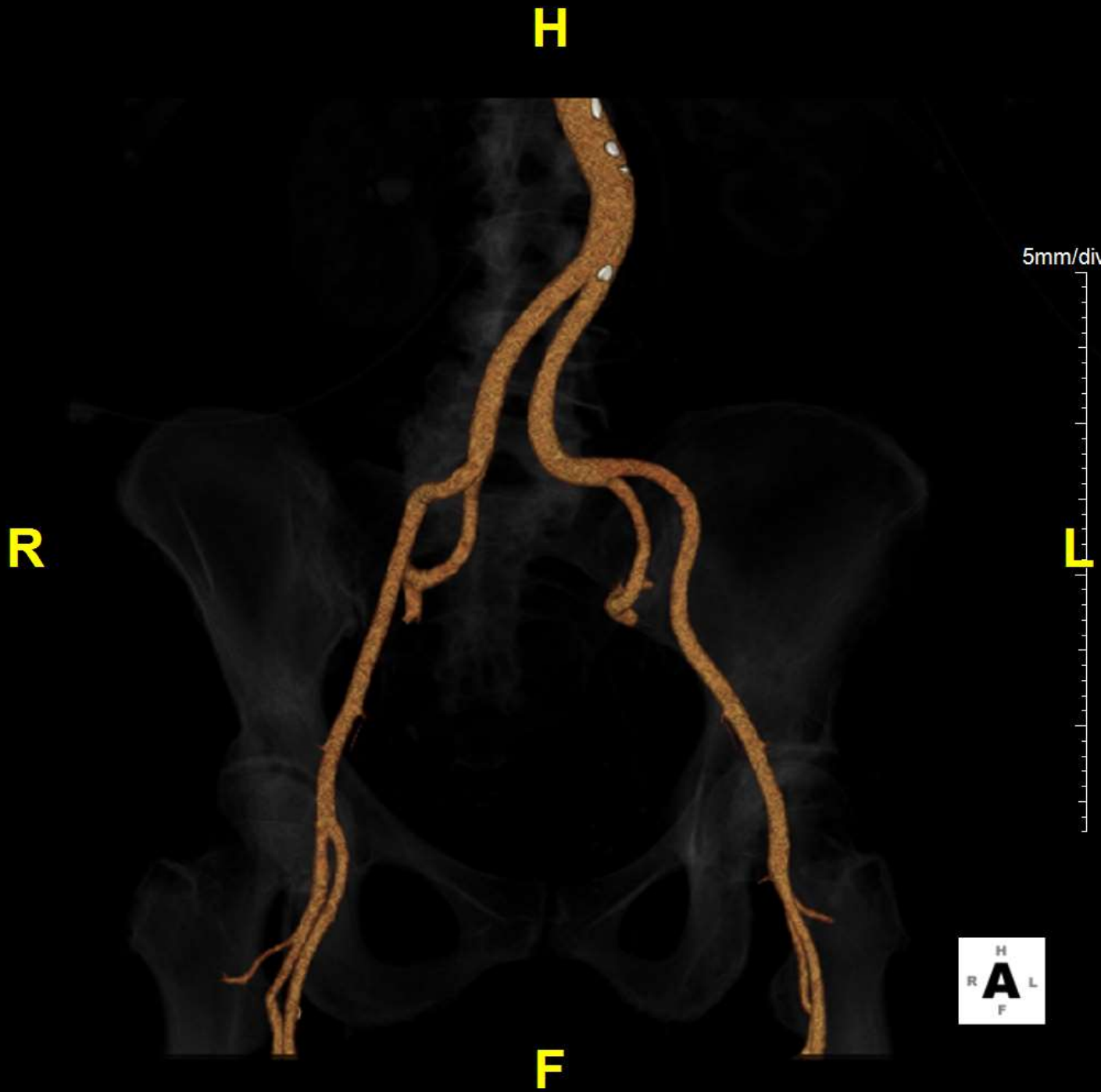
- 70 year old female
- STS 2.8%
- HR
- Plus cors at time of TAVR

### THV Notes:

- Commercial TAVR
- 26 mm Sapien 3 Ultra
- Transfemoral approach - Right side
- Fast track eligible

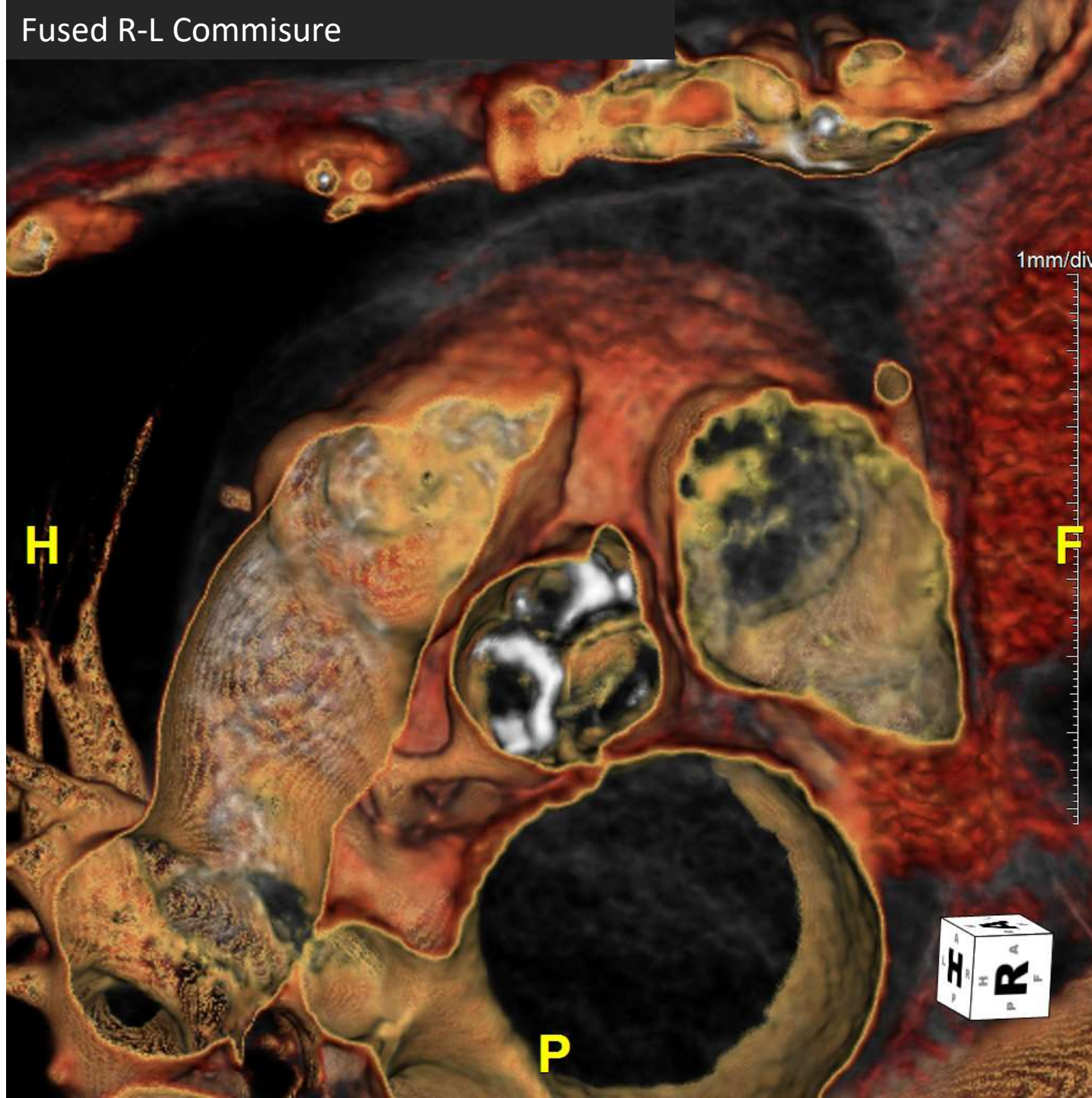
- OR staff: No/Perfusionist: No
- 
- Anesthesia Notes: MAC eligible
- Planned use of Sentinel device: No



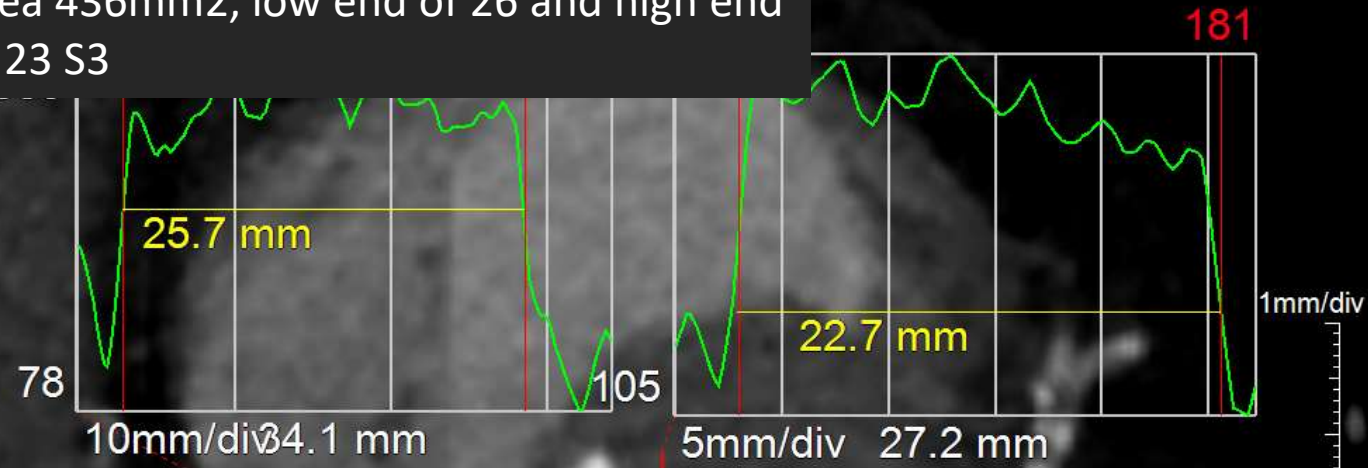




# Fused R-L Commisure



Area 436mm<sup>2</sup>, low end of 26 and high end of 23 S3



F

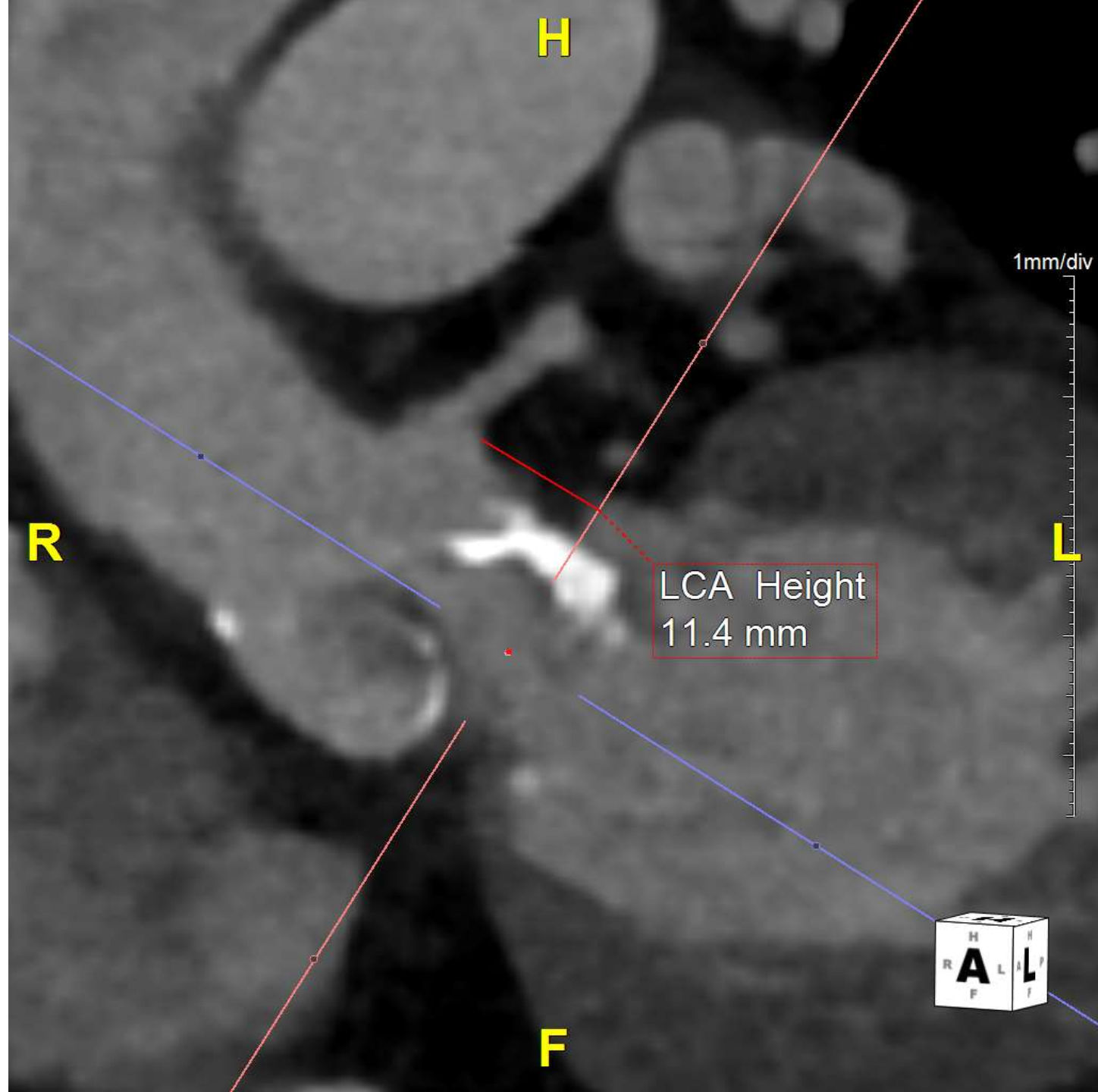
H

Mean: 335  
Area: 4.36 cm<sup>2</sup>  
Min: 89  
Max: 870  
SDev: 62.9  
Avg. Diameter: 23.5 mm  
Perimeter: 75.6 mm

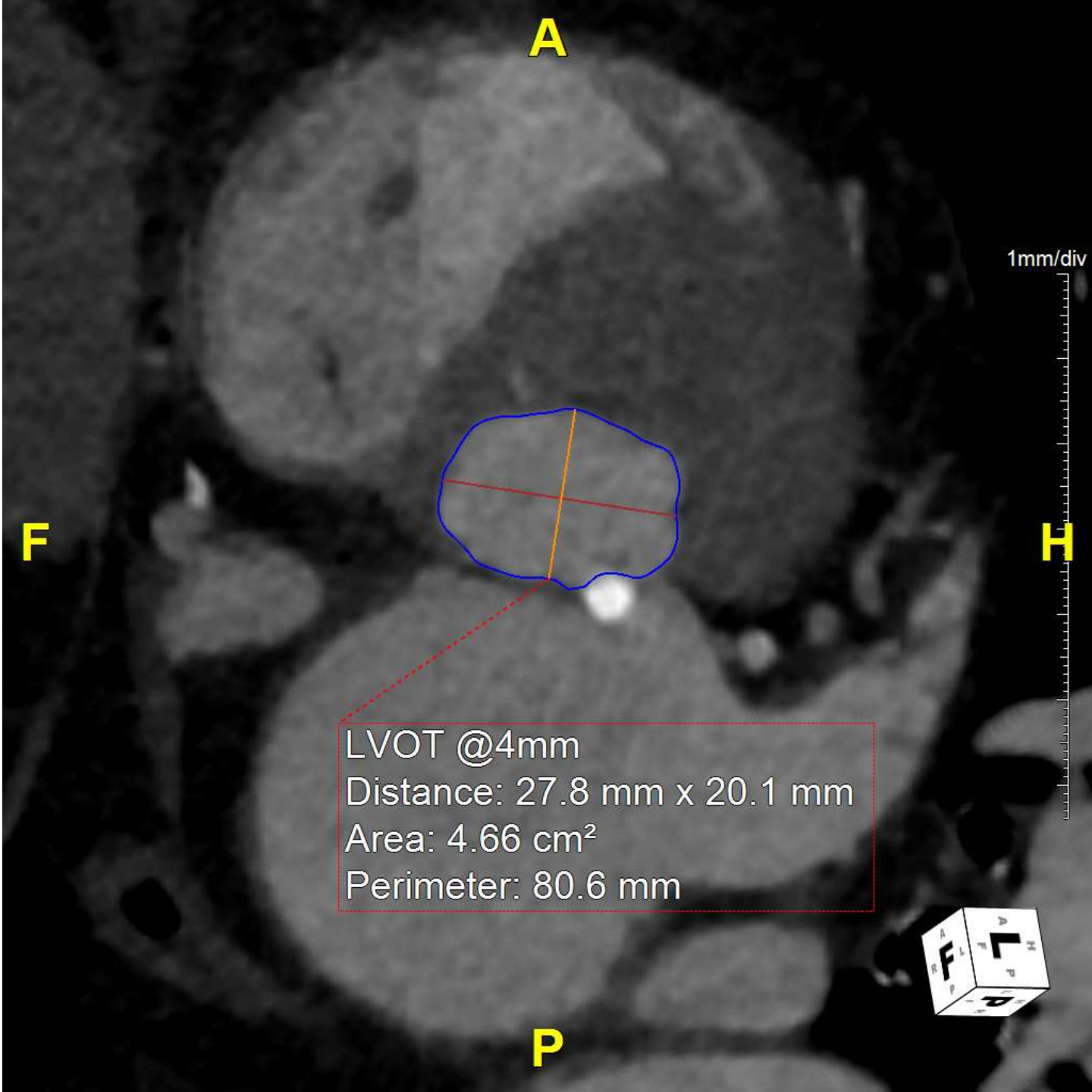
Mean: 328  
Area: 4.63 cm<sup>2</sup>  
Min: 242  
Max: 421  
SDev: 26.5

P



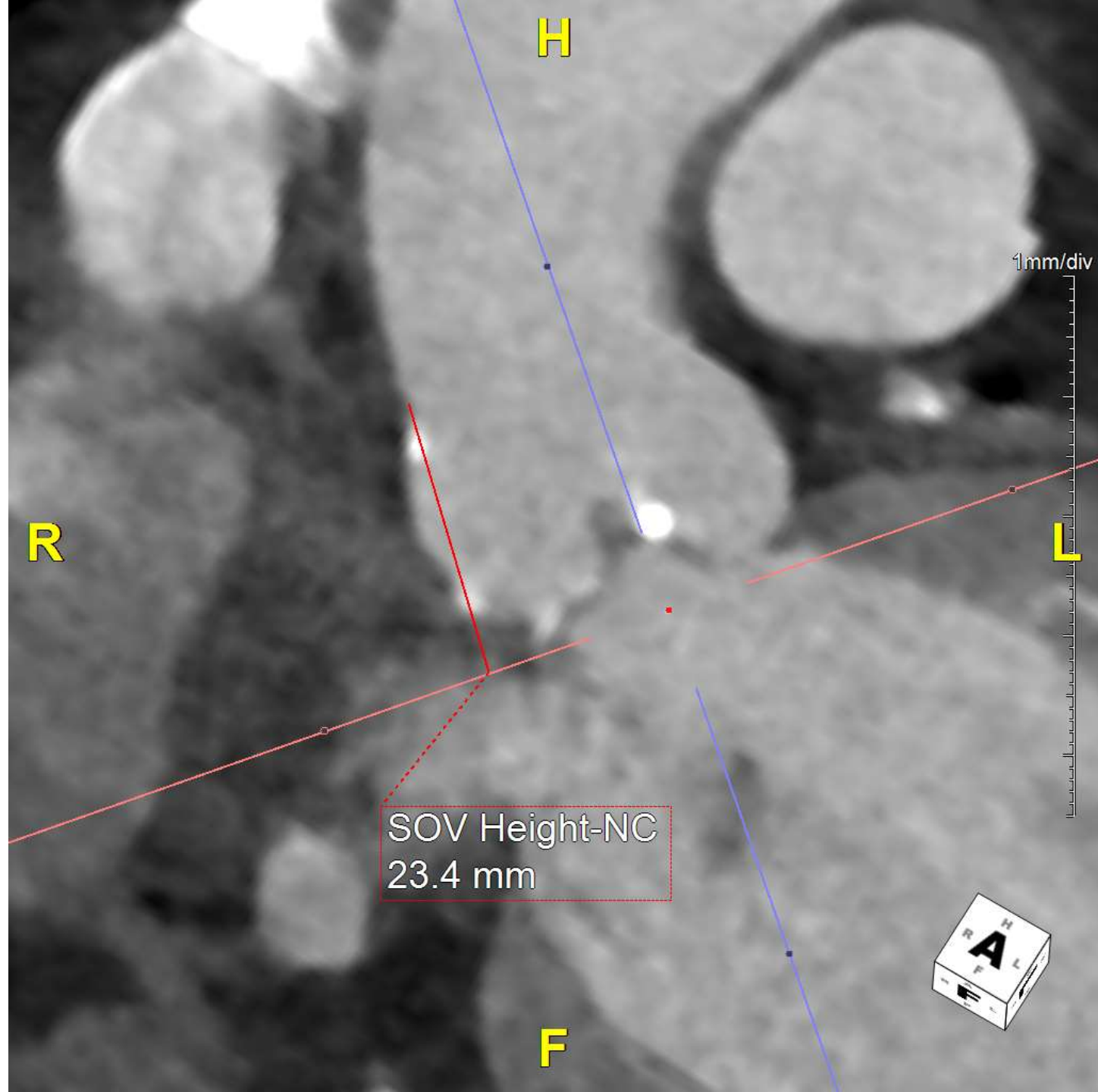






LVOT @4mm  
Distance: 27.8 mm x 20.1 mm  
Area: 4.66 cm<sup>2</sup>  
Perimeter: 80.6 mm

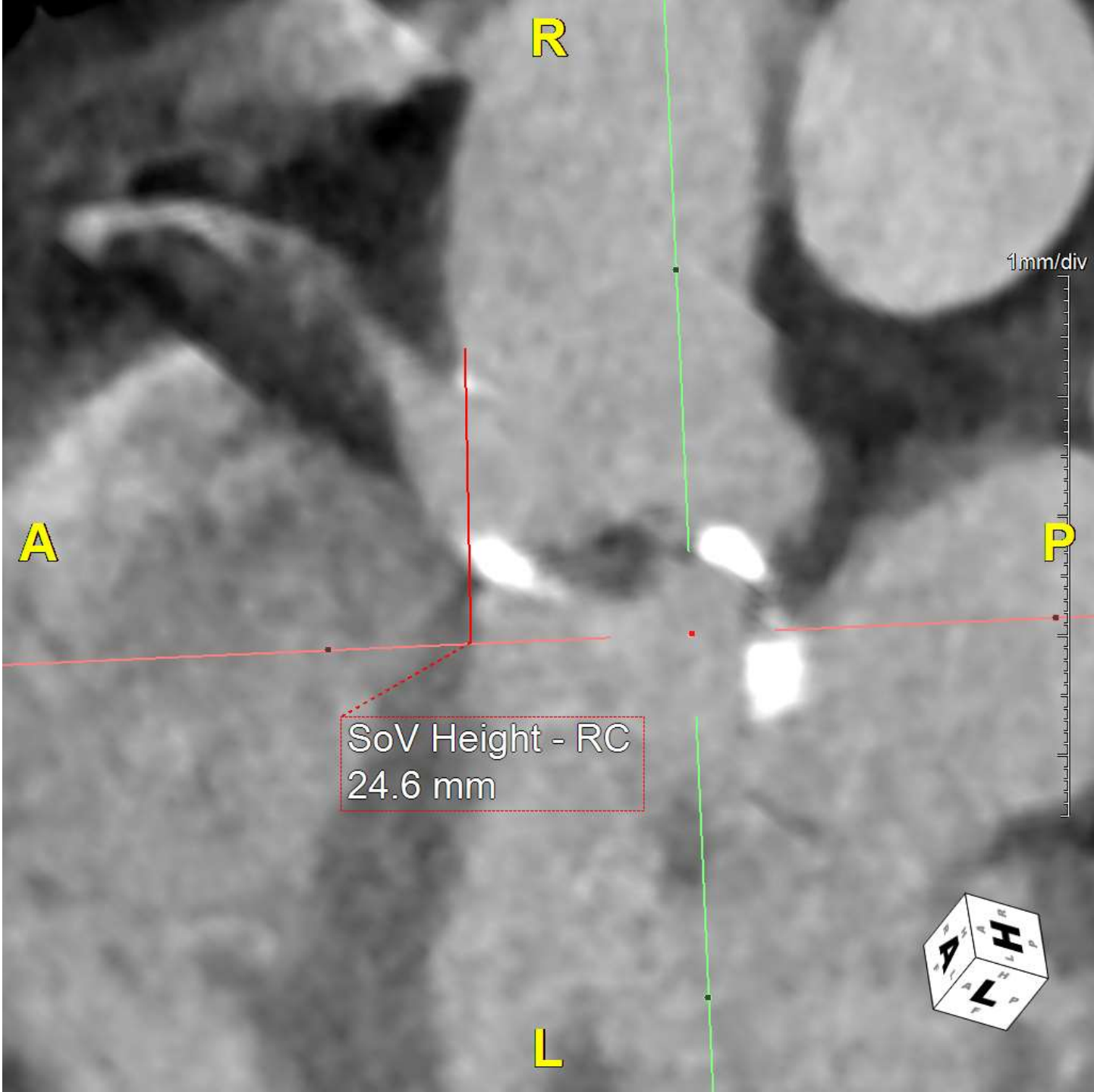




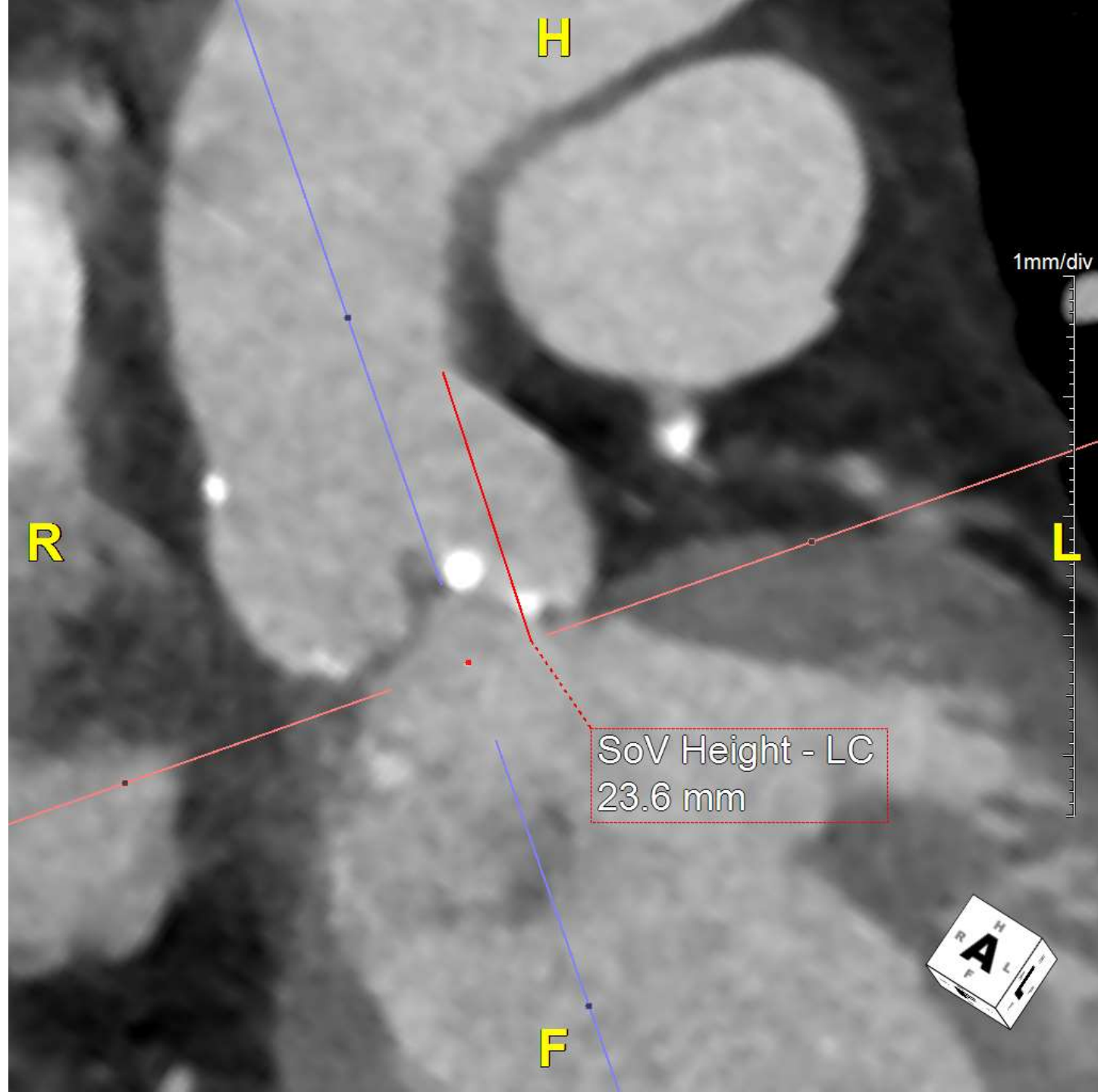
SOV Height-NC  
23.4 mm

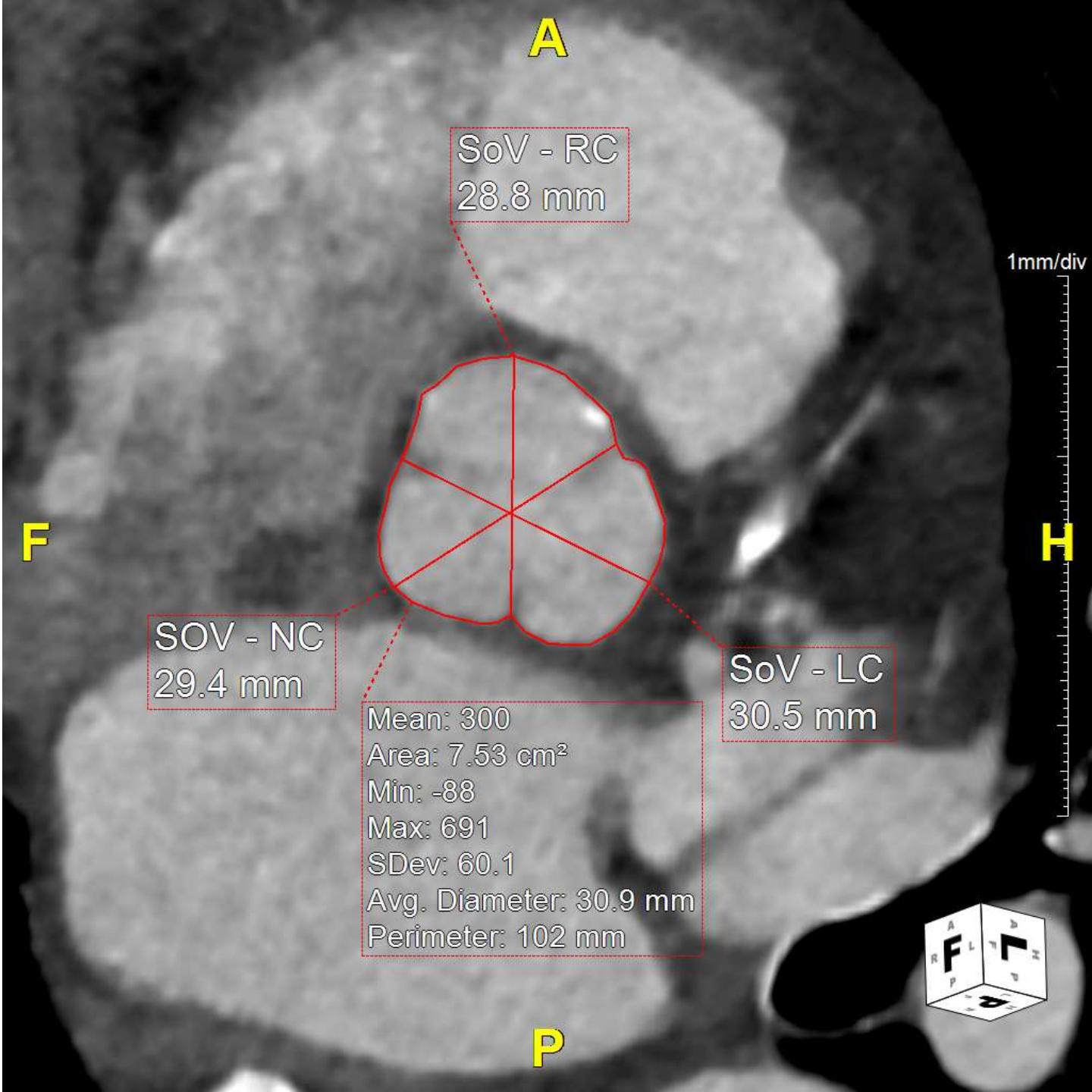
1mm/div

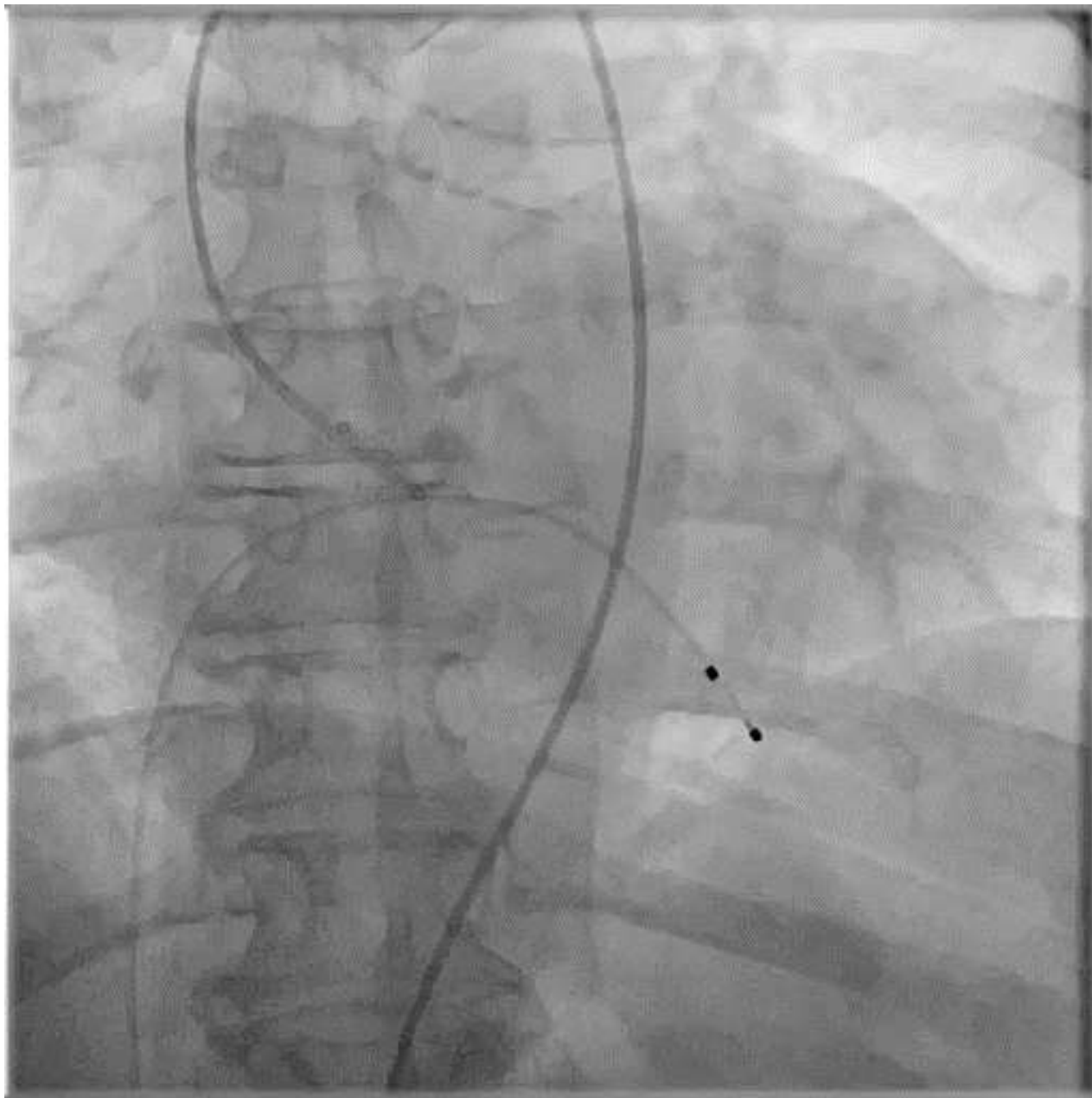












Predilatation?  
23 vs 26mm S3





# Optimal MDCT-Sizing of the SAPIEN 3 THV

- SAPIEN 3 Sizing Chart

It may not always be possible to implant the larger THV size for borderline annulus diameters. Consider the smaller THV in the following special situations:

- Severe annulus calcification
- Narrow root and low coronary ostia
- Narrow sinotubular junction
- Mitral annular calcification
- Porcelain aorta
- Bulky leaflet and low coronary ostia

If/when outside of recommended range:

- 1) Reference alternative sizing modalities (echocardiography, balloon sizing)
- 2) Consider the following factors in valve size selection
  - Clinical: very advanced age, corticosteroids, chest radiation, extensive calcification, calcium extending into the LVOT, etc

**Bold = recommended Sealing Zones** relate only to valves that are deployed with nominal volumes

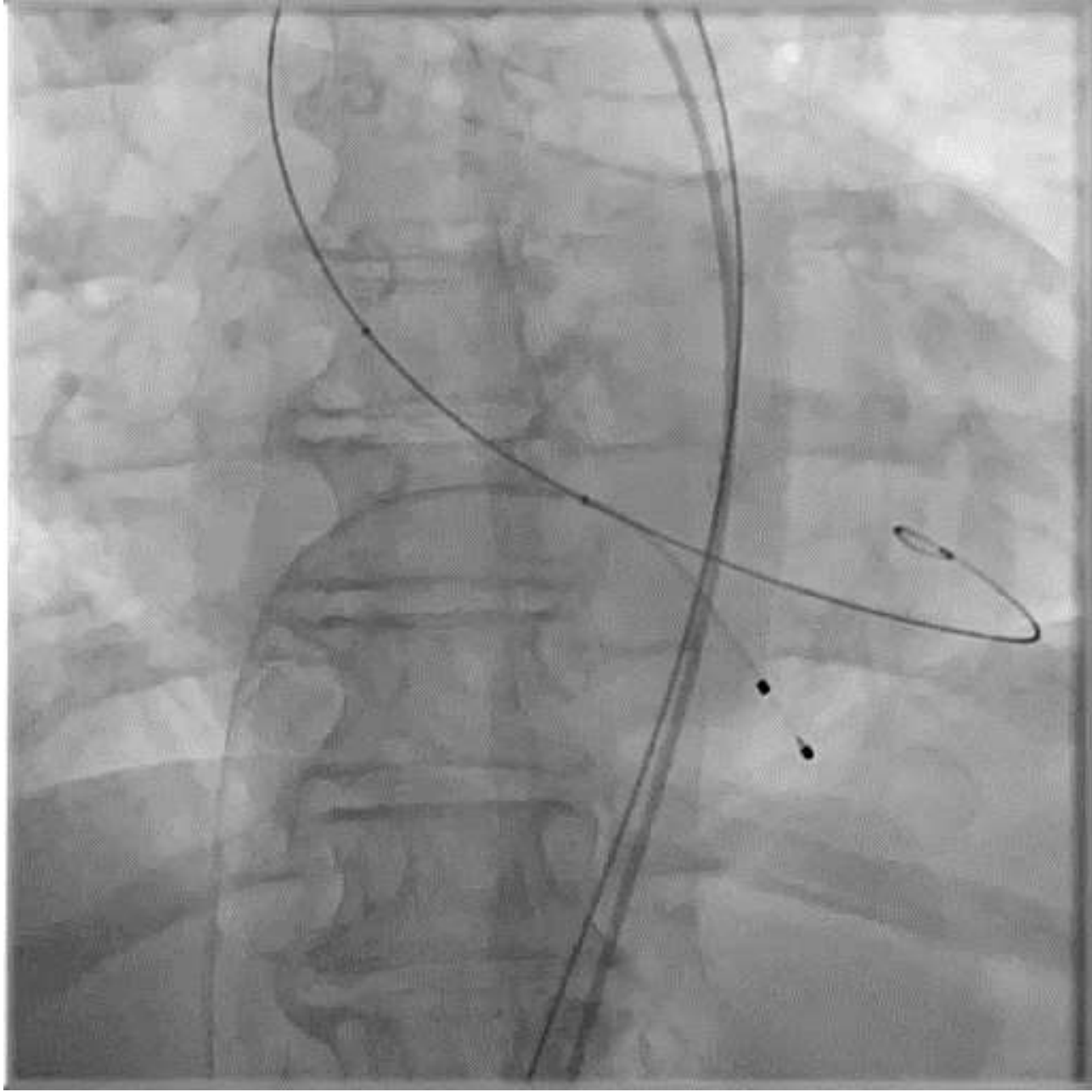
3D Area-derived Diameter (mm)	20.0	20.2	20.5	20.7	21.0	21.1	21.4	21.7	22.0	22.3	22.6	22.8	23.0	23.1	23.4	23.7	23.9	24.0	24.2	24.5
3D Annular Area (mm <sup>2</sup> )	314	320	330	338	346	350	360	370	380	390	400	410	415	420	430	440	450	452	460	470
% Annular Area Over (+) or Under (-) Nominal by 3D CT	23 mm	29.3	26.9	23.0	20.1	17.3	16.0	12.8	9.7	6.8	4.1	1.5	-1.0	-2.2	-3.3	-5.6	-7.7	-9.8		
	26 mm										29.8	26.6	25.1	23.6	<b>20.7</b>	<b>18.0</b>	<b>15.3</b>	<b>14.8</b>	<b>12.8</b>	<b>10.4</b>
	29 mm																			

ALL VALUES PRESENTED ARE BASED ON NOMINAL/RECOMMENDED INFLATION VOLUMES.

SYSTOLIC MEASURES ARE RECOMMENDED

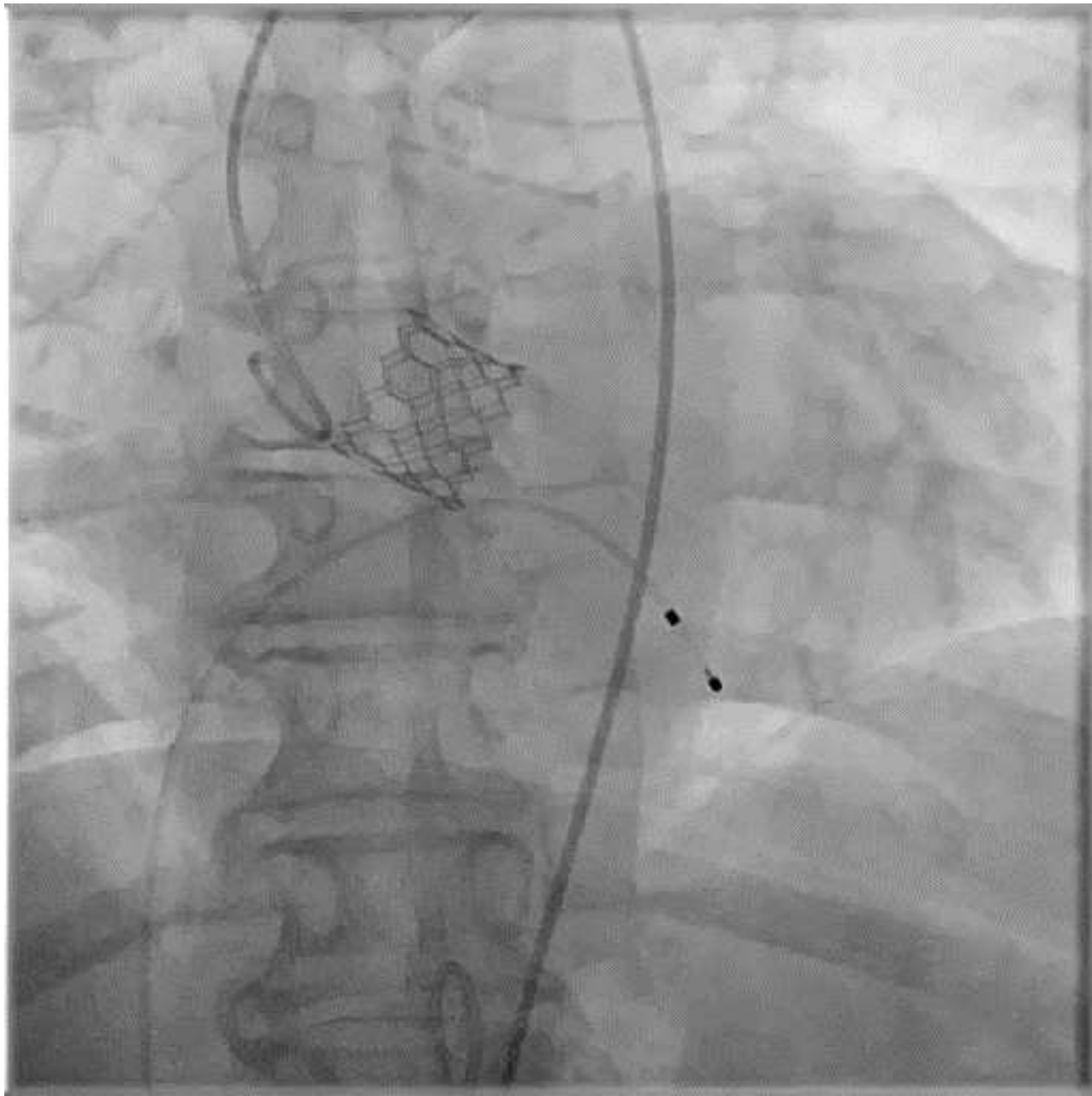
24.5	24.7	25.0	25.2	25.5	25.7	26.0	26.2	26.4	26.5	26.7	26.9	27.2	27.4	27.6	27.9	28.0	28.1	28.3	28.5	28.8	29.0	29.2	29.4	29.5	29.6	29.9	30.1	30.3
470	480	490	500	510	520	530	540	546	550	560	570	580	590	600	610	615	620	630	640	650	660	670	680	683	690	700	710	720
<b>10.4</b>	<b>8.1</b>	<b>5.9</b>	<b>3.8</b>	<b>1.8</b>	<b>-0.2</b>	<b>-2.1</b>	<b>-3.9</b>	<b>-4.9</b>	-5.6	-7.3	-8.9																	
			29.8	27.3	24.8	22.5	<b>20.2</b>	<b>18.9</b>	<b>18.0</b>	<b>15.9</b>	<b>13.9</b>	<b>11.9</b>	<b>10.0</b>	<b>8.2</b>	<b>6.4</b>	<b>5.5</b>	<b>4.7</b>	<b>3.0</b>	<b>1.4</b>	<b>-0.2</b>	<b>-1.7</b>	<b>-3.1</b>	<b>-4.6</b>	-5.0	-5.9	-7.3	-8.6	-9.9

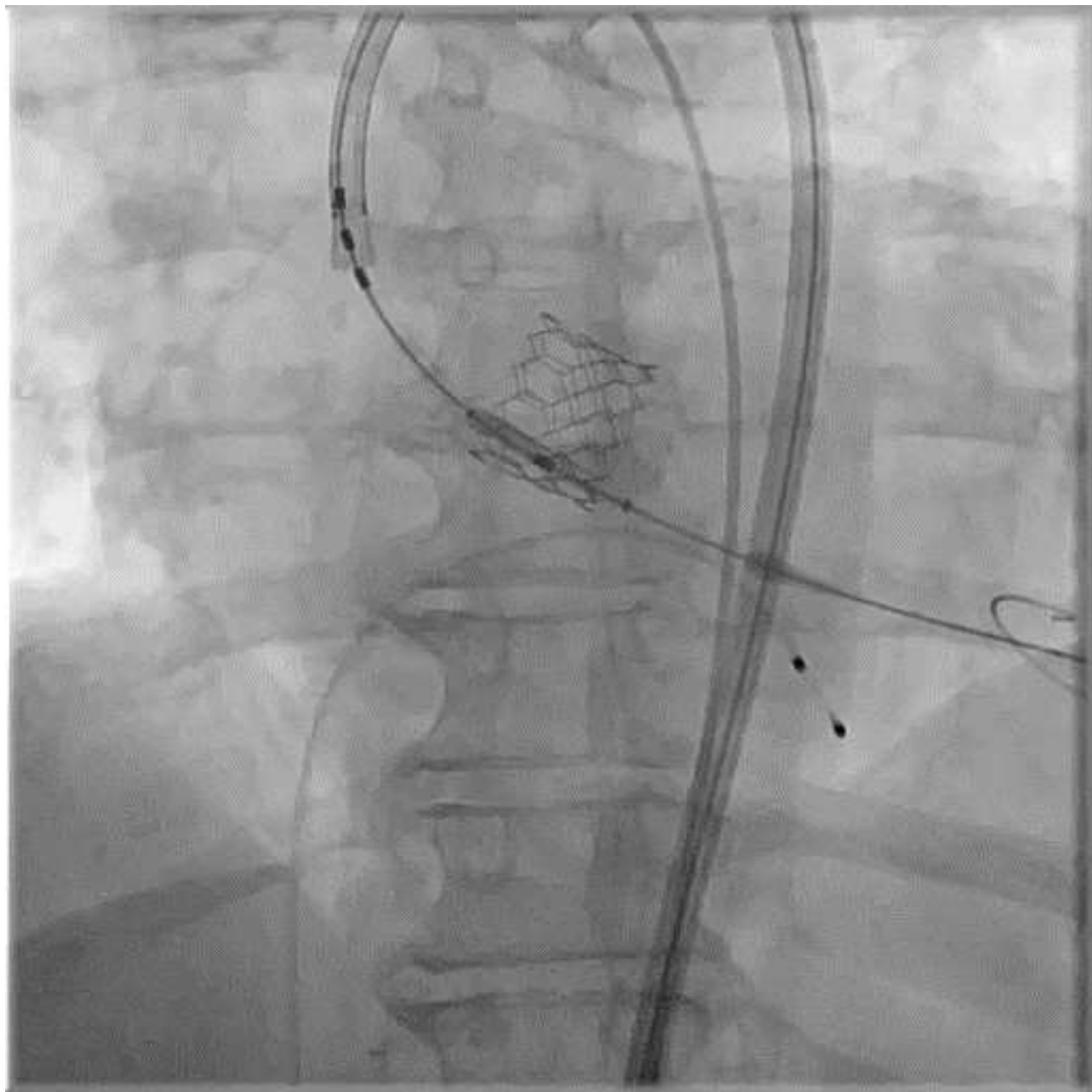














After adding 1 cc to 23 Sapien 3 Ultra

Post procedure gradient of 11mmHg and  
next day echo gradient of 16mmHg.





# Annular Rupture is not Random

## Univariate

Predictors	Odds Ratio (95%CI)	P value
LVOT calcification $\geq$ moderate	10.92 (3.23-36.91)	<0.001
Prosthesis area oversizing $\geq$ 20%	8.38 (2.67-26.33)	<0.001



# Consider a oversizing a smaller valve due to anatomical factors:

- Annular calcium
  - LVOT calcification, porcelain aorta
- Coronary obstruction concerns
  - (Narrow root, bulky leaflets, low coronary ostia)
- Narrow STJ
- Anterior mitral leaflet calcification

