



The role of CT in valve prosthesis assessment

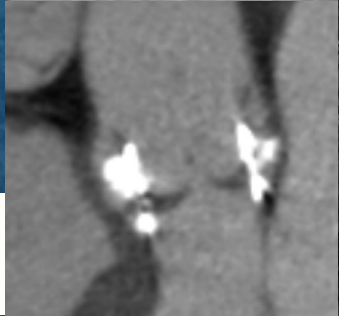
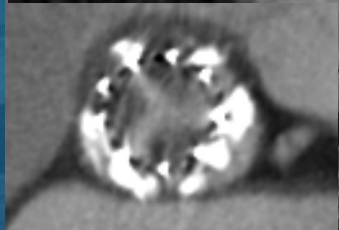
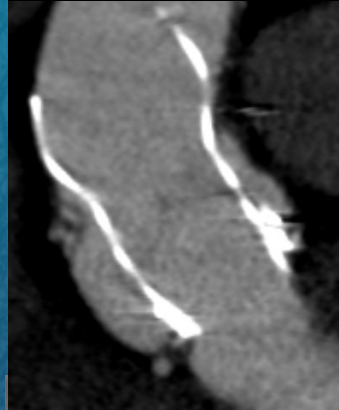
Jonathan Weir-McCall



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[@jweirmccall](https://twitter.com/jweirmccall)

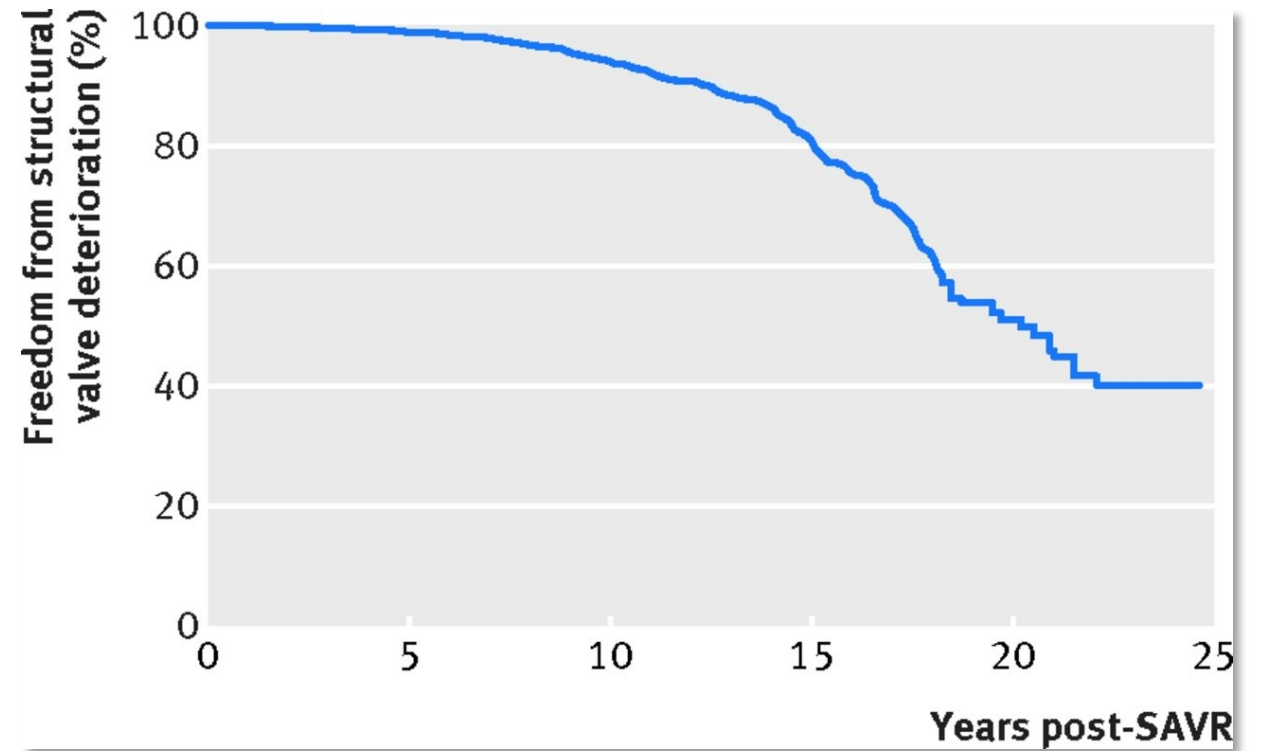
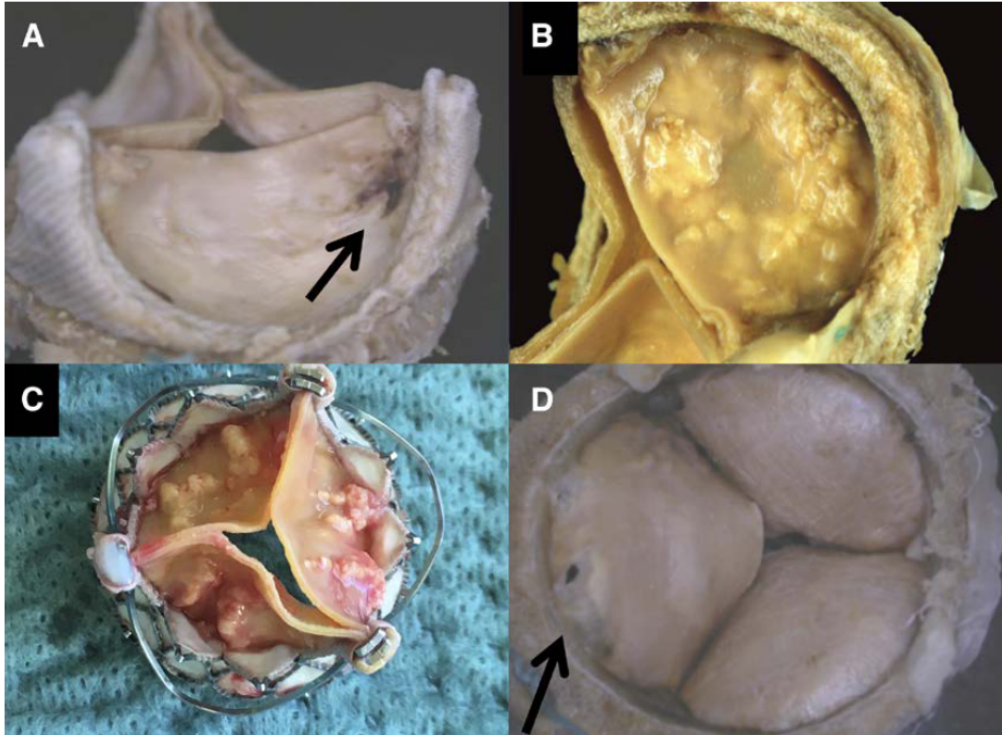


Royal Papworth Hospital
NHS Foundation Trust

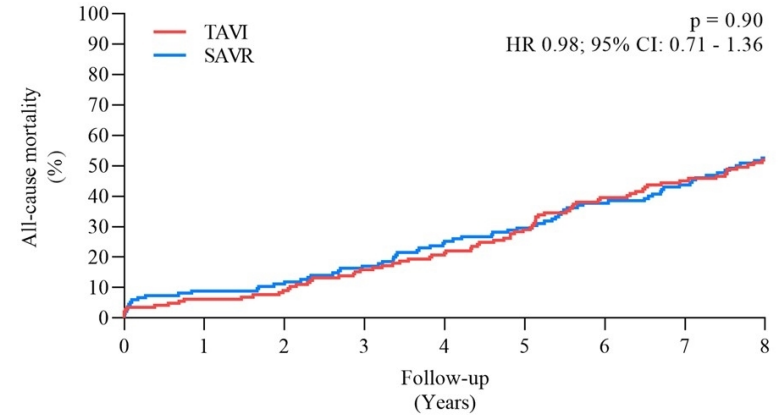
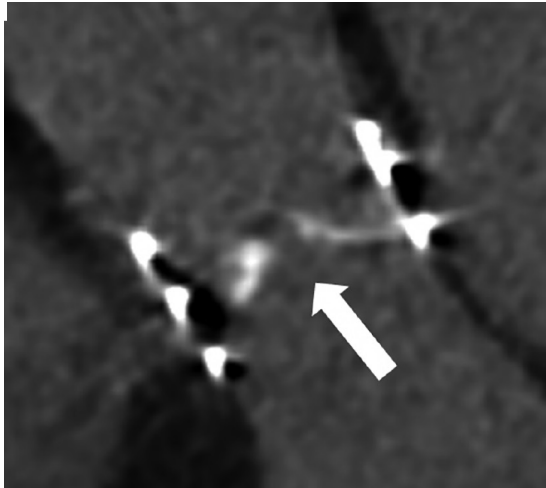


UNIVERSITY OF
CAMBRIDGE

Structural Valvular Degeneration

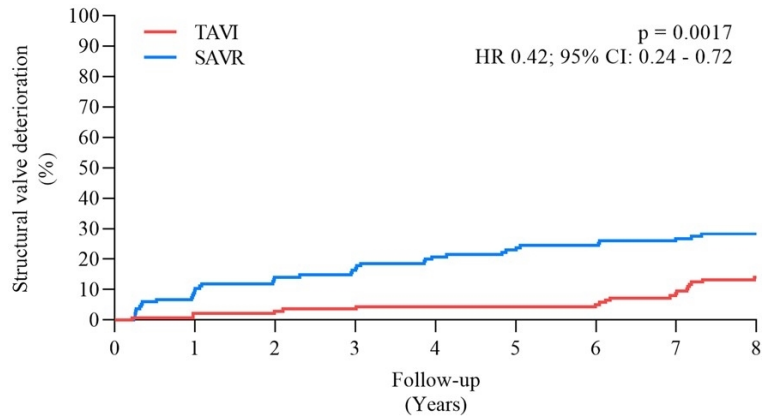


Structural Valvular Degeneration



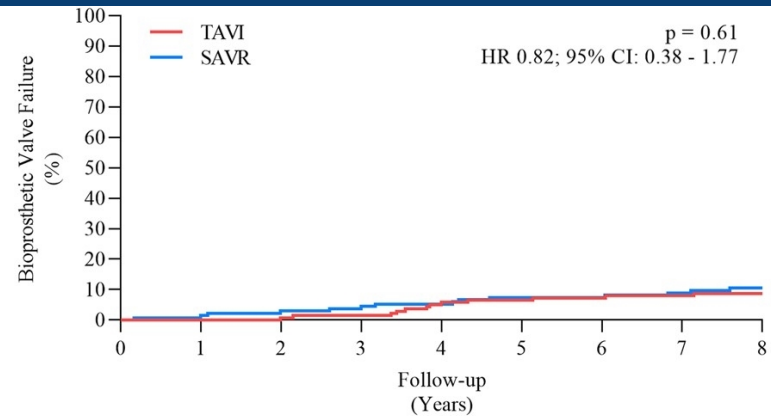
TAVI	145	136	132	122	115	101	86	78	64
SAVR	135	123	120	112	102	95	83	74	57

All cause Mortality



TAVI	145	130	126	115	107	94	80	68	50
SAVR	135	113	105	97	84	75	62	54	40

Structural Valve deterioration



TAVI	145	133	128	118	109	96	82	73	60
SAVR	135	125	121	113	103	94	82	73	55

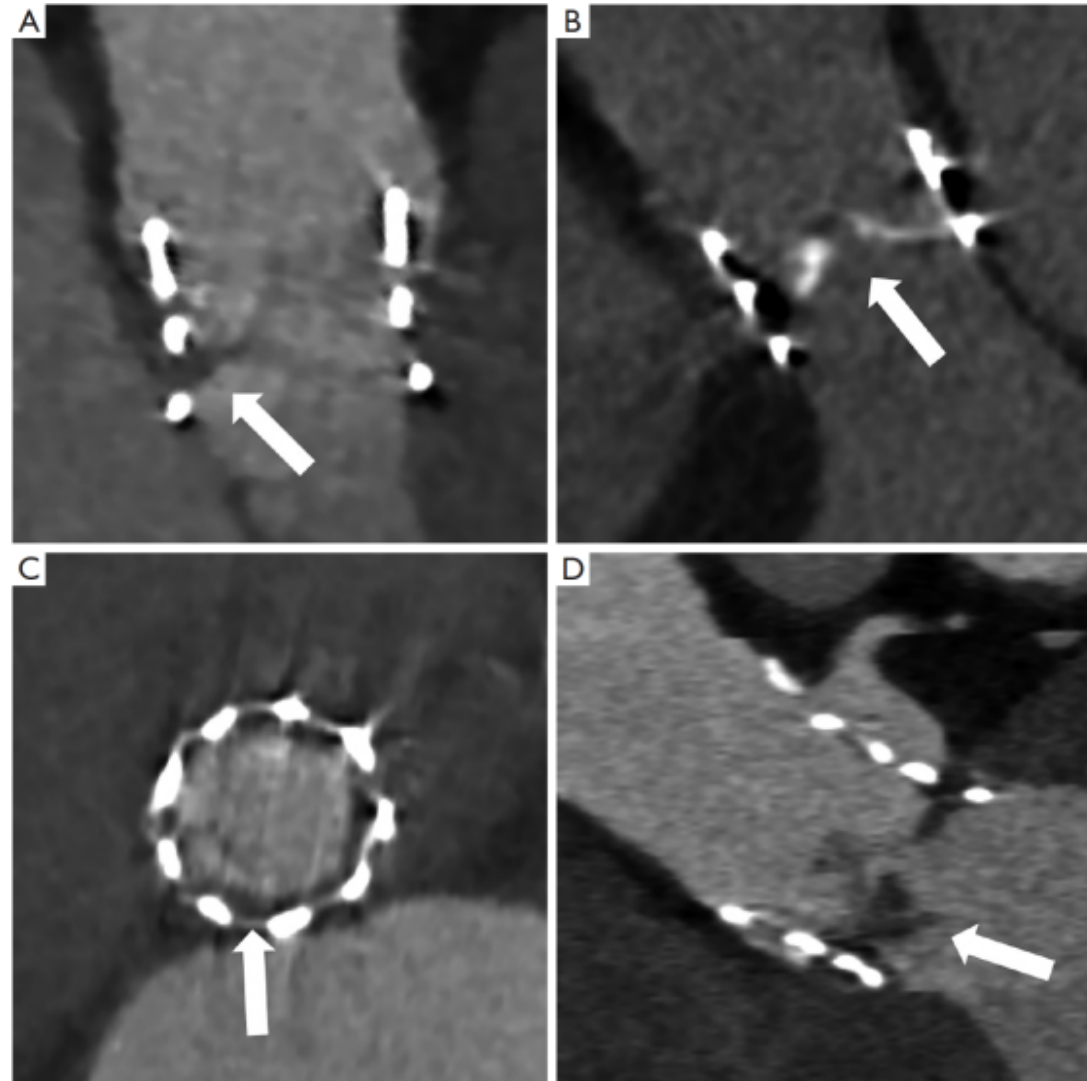
Bioprosthetic Valve Failure

Structural Valvular Degeneration - Definition

SVD Stage 0	• No significant change from immediate post implantation*
SVD Stage 1	• Morphological leaflet abnormality without significant hemodynamic changes[†]
SVD Stage 2S	• Moderate stenosis[‡]
SVD Stage 2R	• Moderate regurgitation[§]
SVD Stage 2RS	• Moderate stenosis and moderate regurgitation
SVD Stage 3	• Severe stenosis and/or severe regurgitation

Variable	Prosthetic Aortic Valve Stenosis		
	Normal	Moderate Stenosis	Severe Stenosis
Qualitative parameters			
Valve structure and motion	Normal	Often abnormal	Abnormal
Transvalvular flow envelope	Triangular, early peaking	Triangular to intermediate	Rounded, symmetrical
Semiquantitative parameters			
Acceleration time, ms	<80	80–100	>100
Acceleration time/LV ejection time ratio	<0.32	0.32–0.37	>0.37
Quantitative flow-dependent parameters			
Peak velocity, m/s	<3	3–4	>4
Mean gradient, mm Hg	<20	20–40	>40
Increase in mean gradient during follow-up associated with decrease in EOA and DVI	<10	10–20	>20
Quantitative flow-independent parameters*			
Doppler velocity index	>0.35	0.25–0.35	<0.25
EOA for BSA ≥1.6 m ²	>1.2	1.0–1.2	<1.0
EOA for BSA <1.6 m ²	>1.1	0.8–1.1	<0.8

Structural Valvular Degeneration - Aetiology



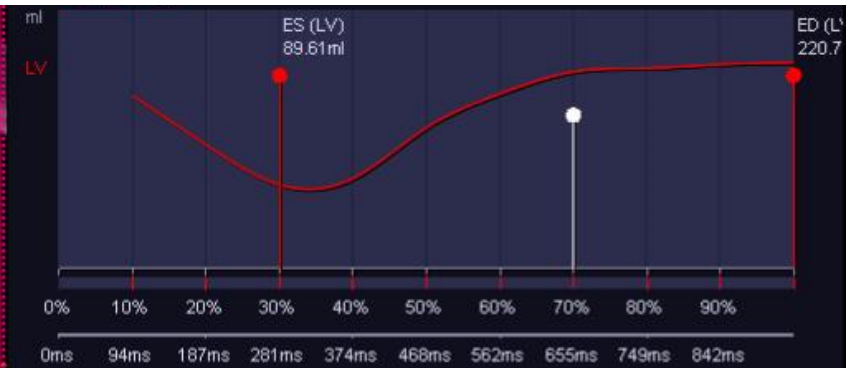
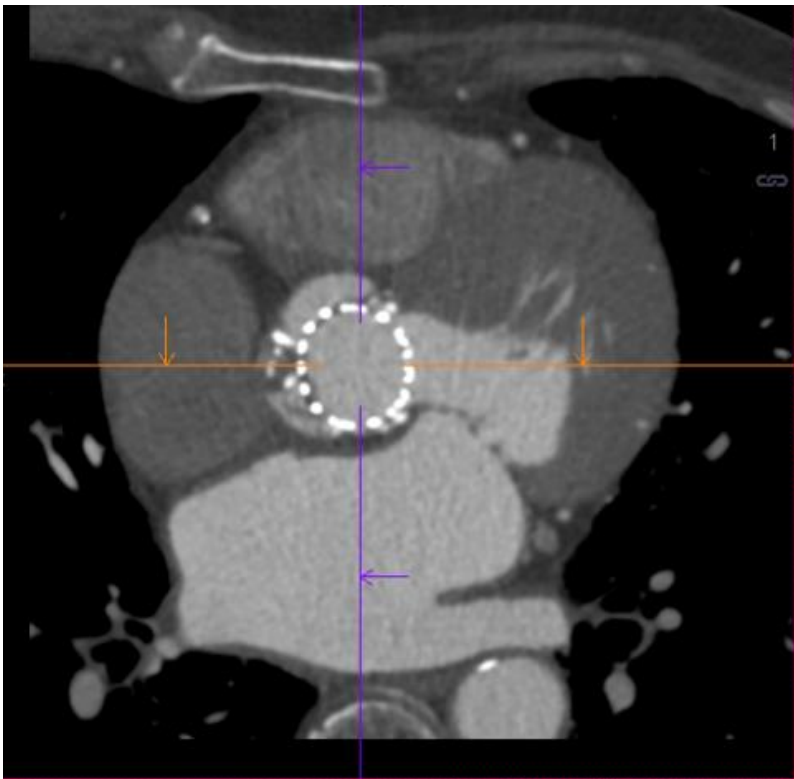
Male, 70s,

PMH:

- Bicuspid aortic valve with severe calcific aortic stenosis
- Complex TAVI with Evolut valve, multiple pre and postdilation of valve.

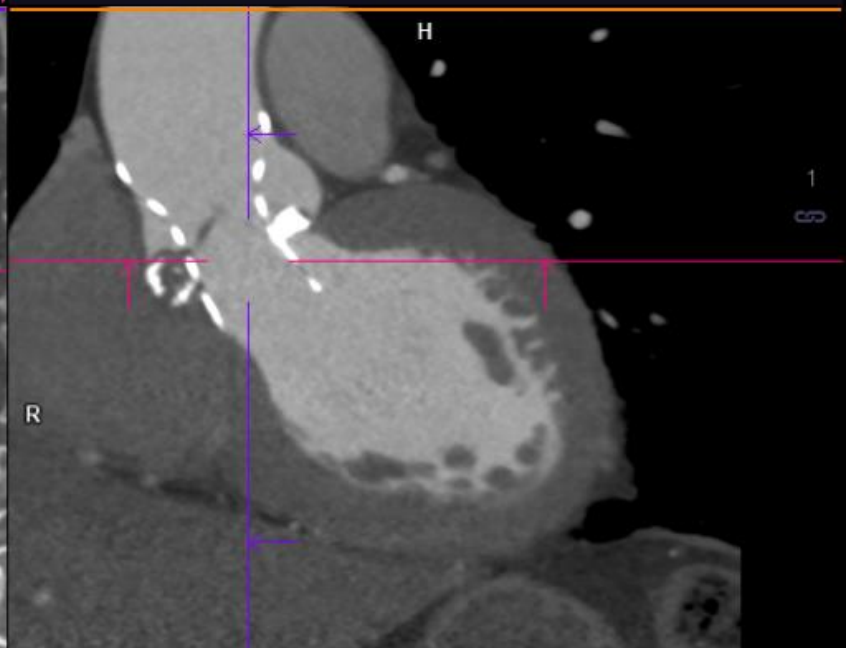
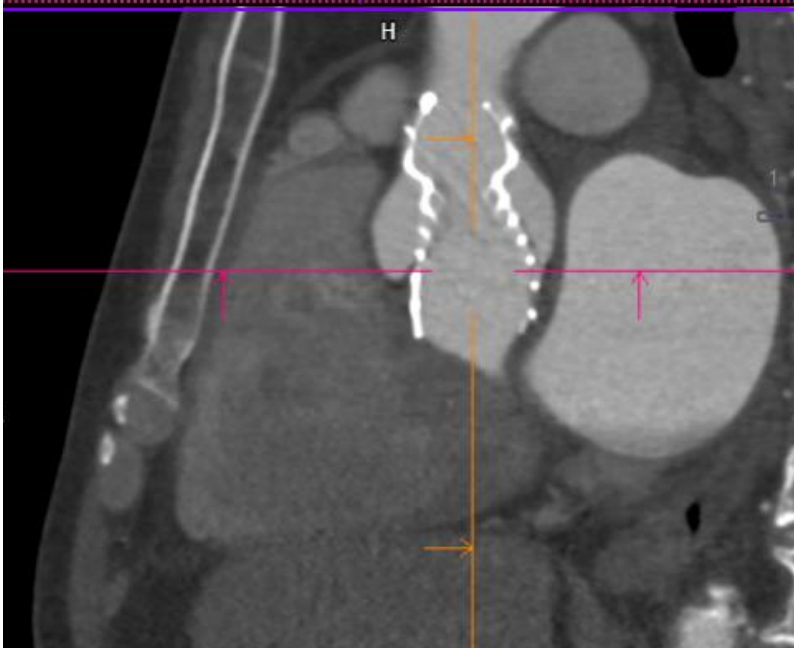
Echo:

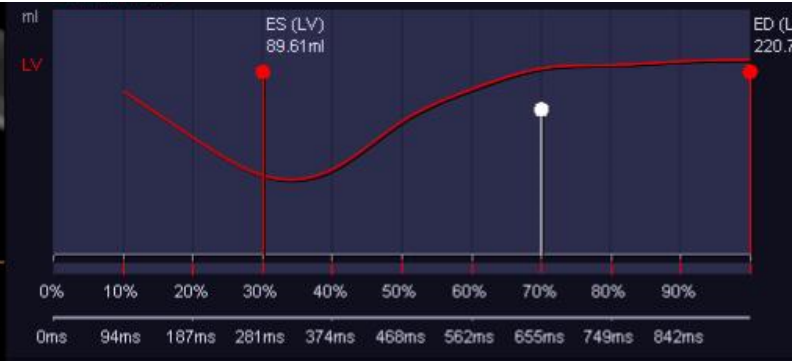
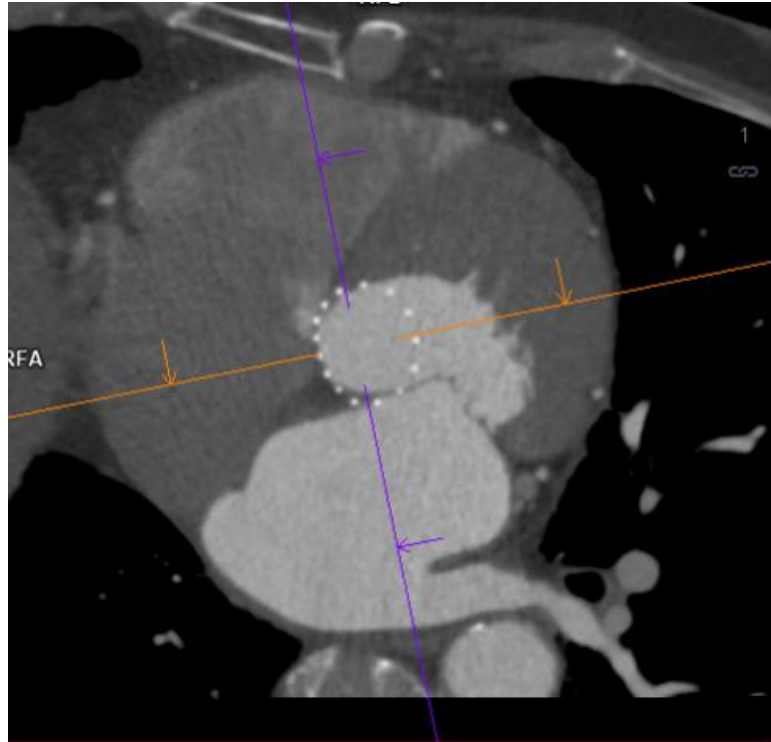
- Mildly elevated gradients at 1 month follow-up (MG 15mmHg versus 5mmHg on pre-discharge echo)
- Normal LV function



Standard Values		Indexed Values	
Standard Mode		LV	Normal Values
Ejection Fraction	%	59	56 - 78
Myocardial Mass ED	g	174.72	118 - 238
Stroke Volume	ml	131.08	51 - 133
ED Volume	ml	220.7	77 - 195
ES Volume	ml	89.61	19 - 72
Cursor Volume	ml	210.69	
Cardiac Output	(l/min)	8.39	2.82 - 8.82

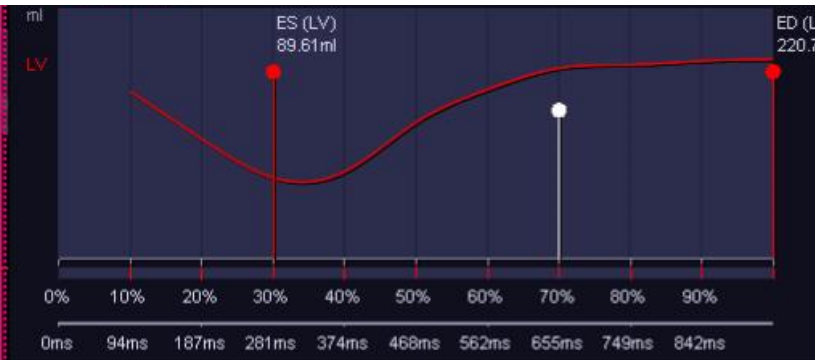
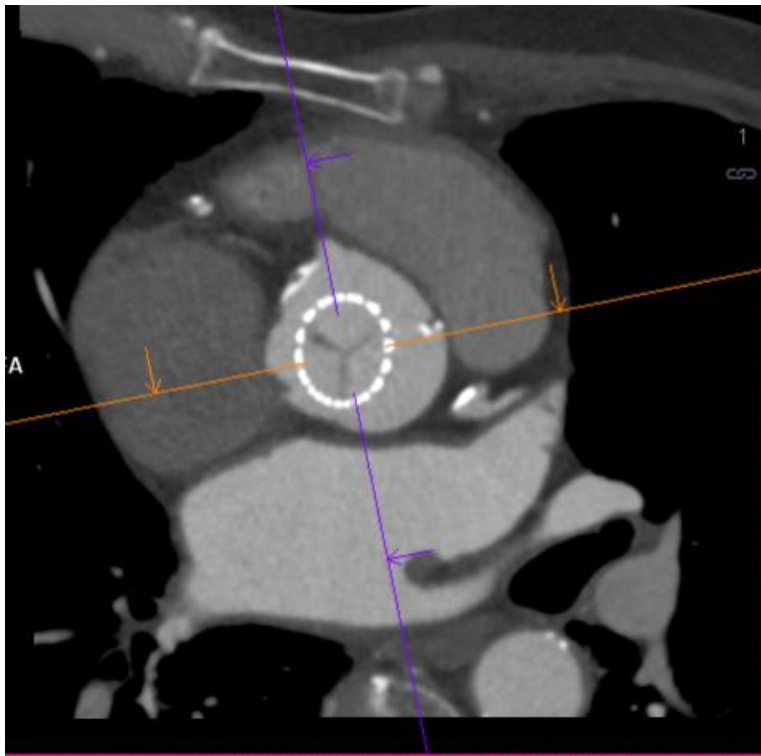
Height: cm ft in Sex: Male
 Weight: kg lbs BSA / m²





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			BSA / m ² -



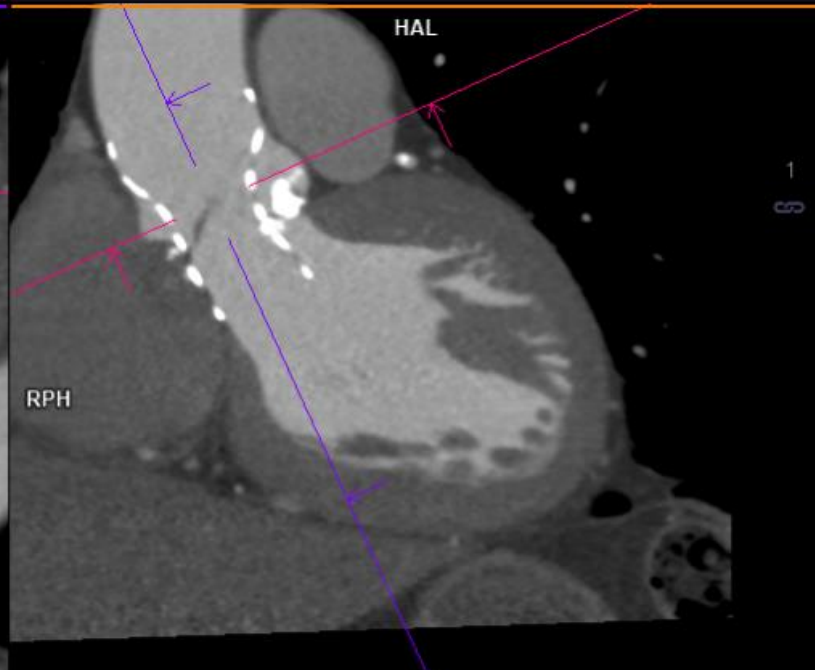


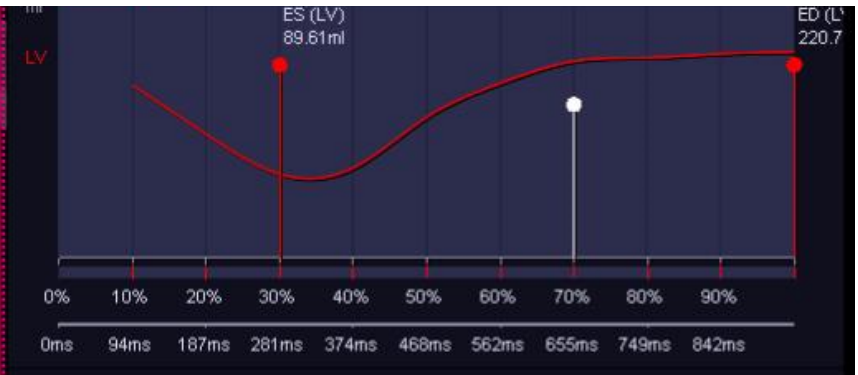
Standard Values

Indexed Values

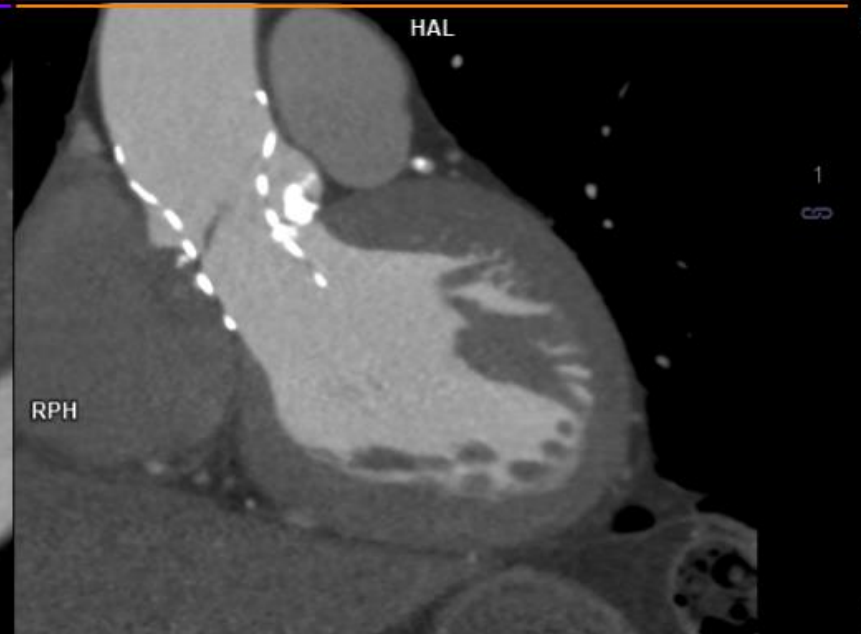
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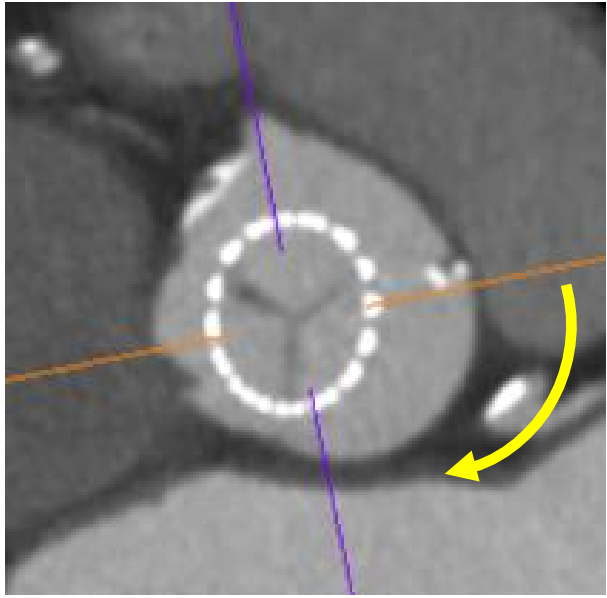
Height: - cm - ft - in Sex: Male
 Weight: - kg - lbs BSA / m² -

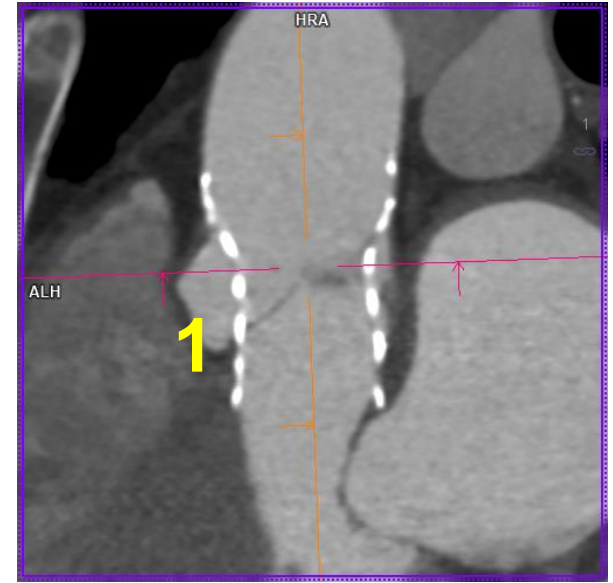
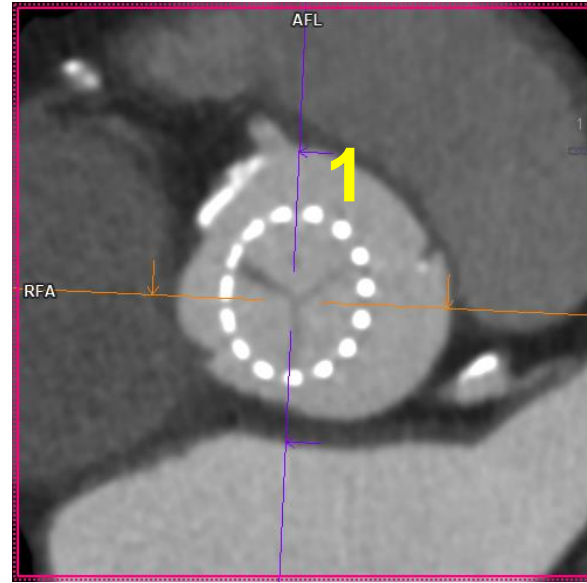
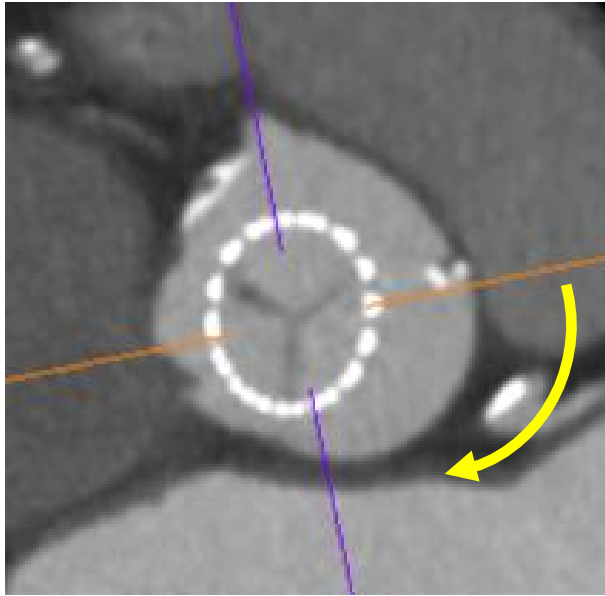


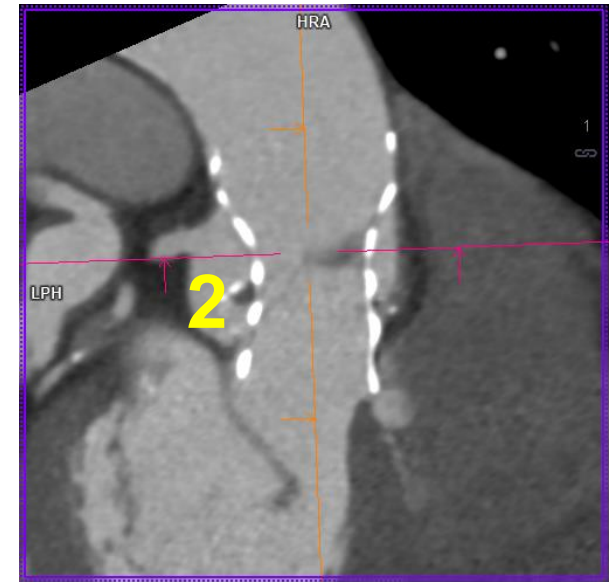
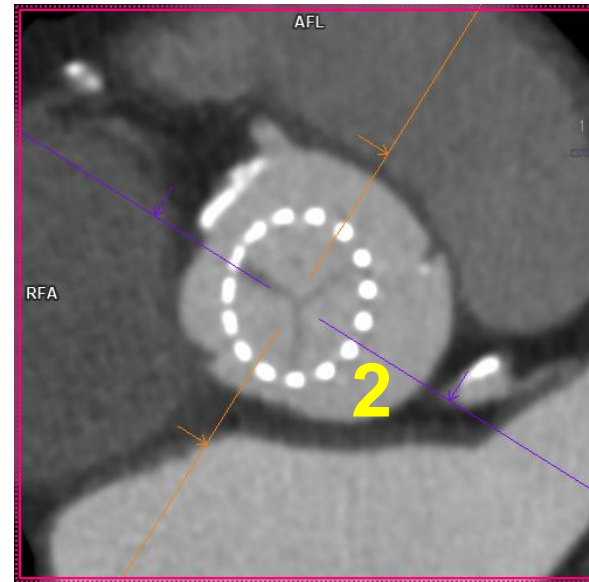
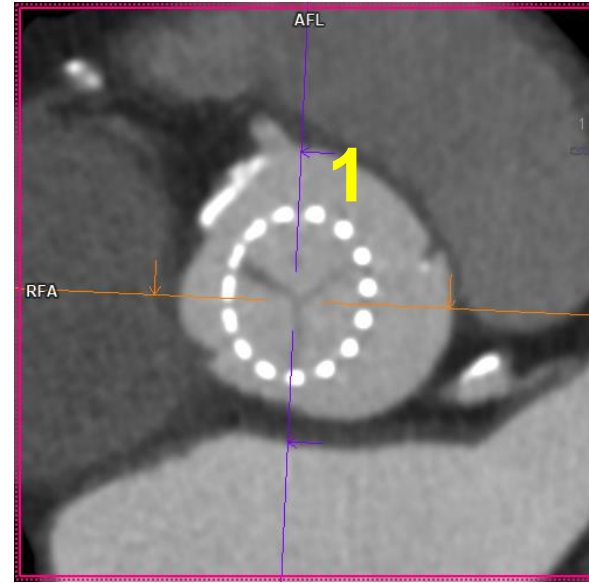
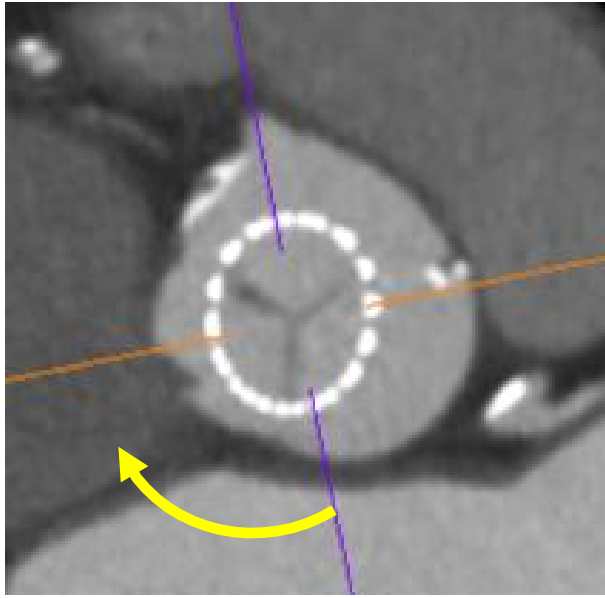


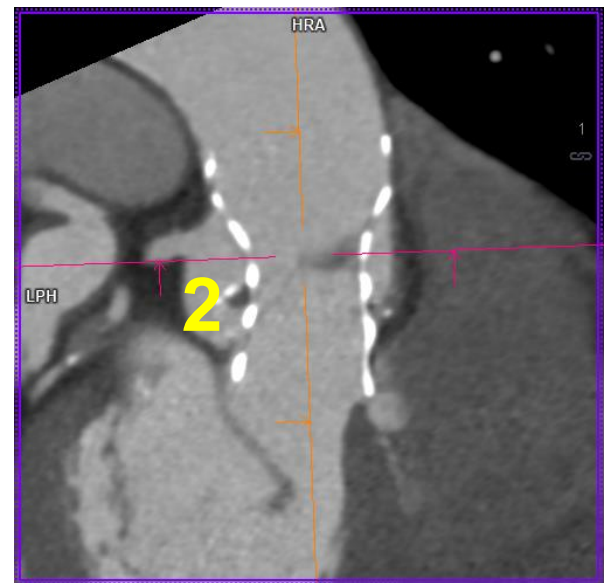
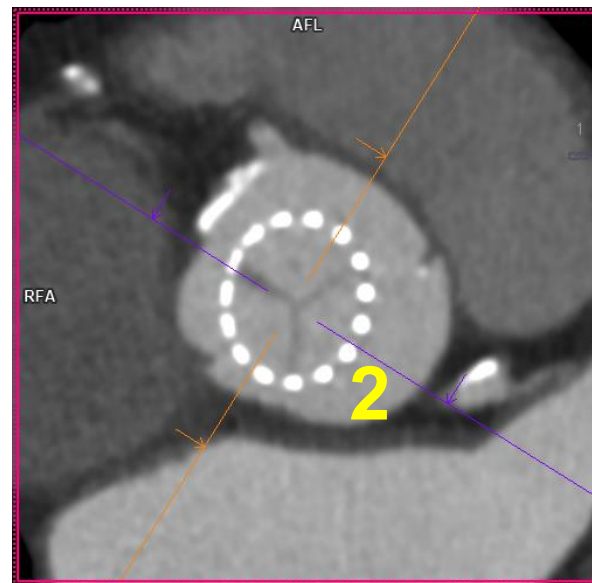
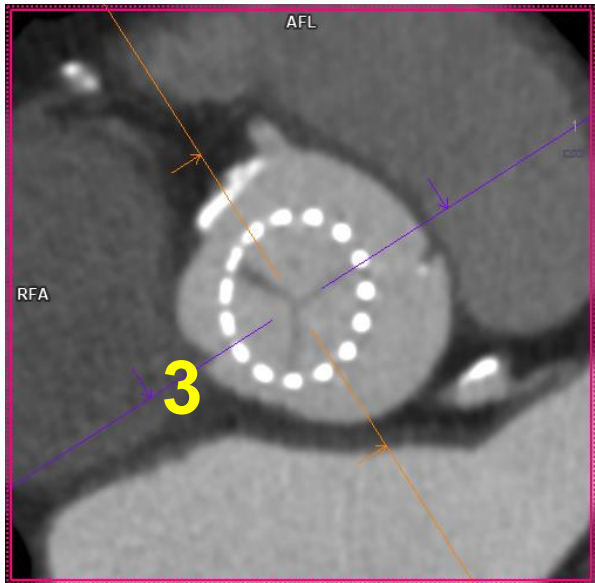
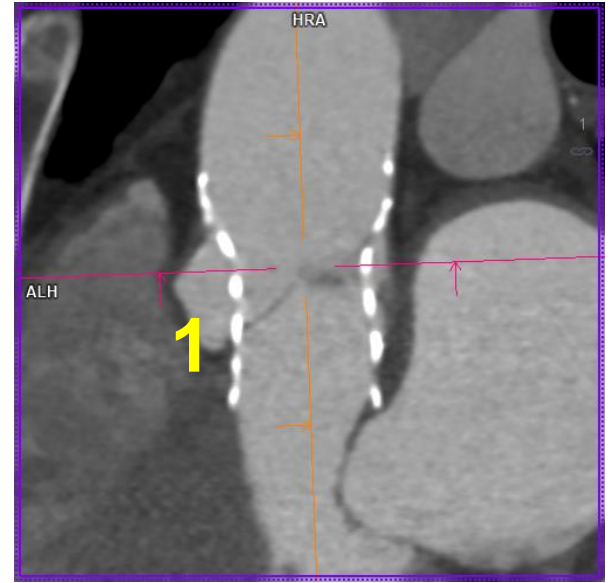
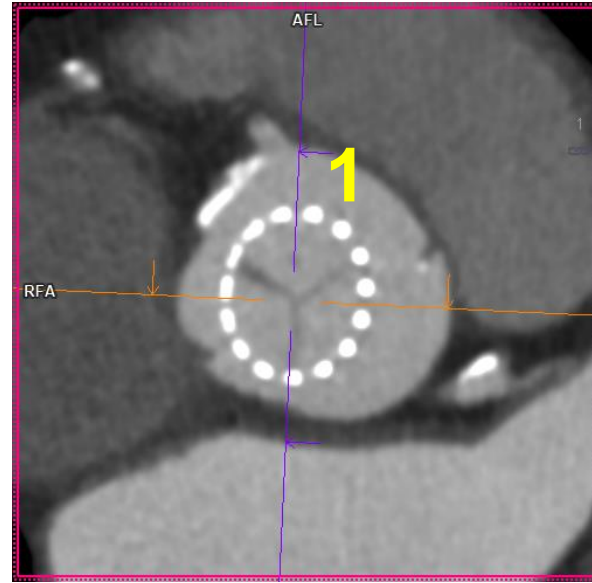
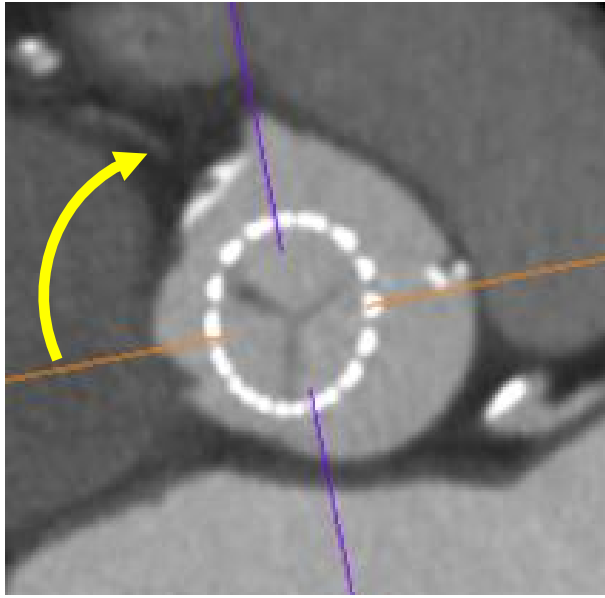
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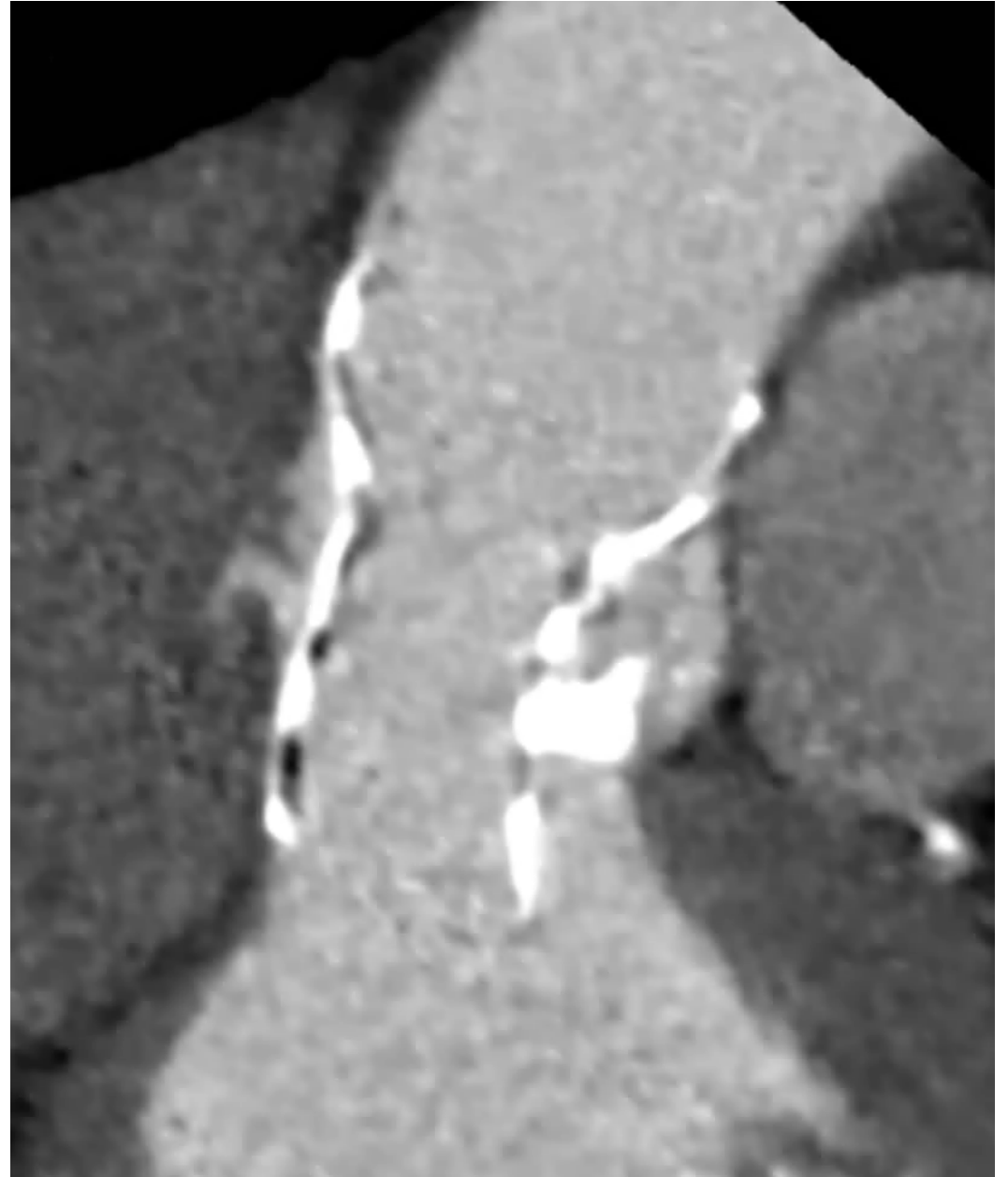
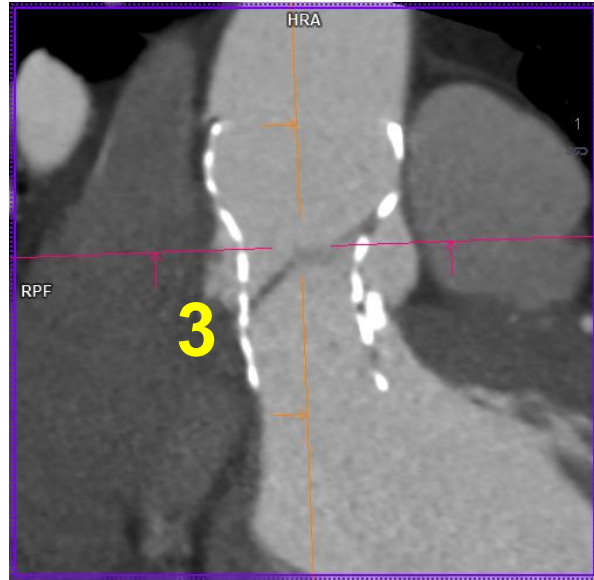
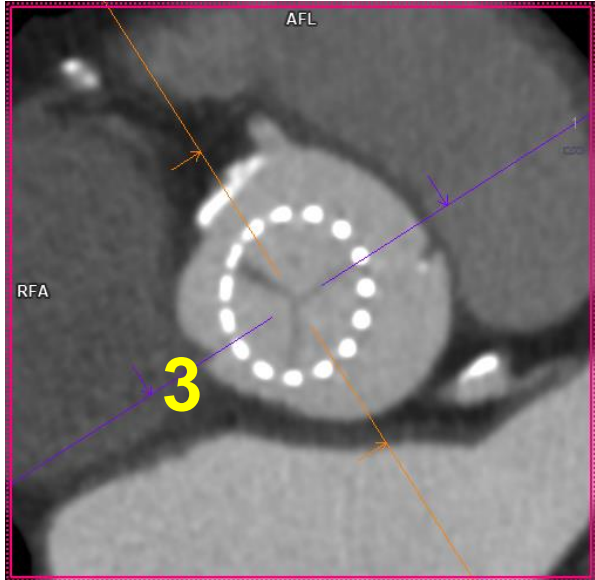




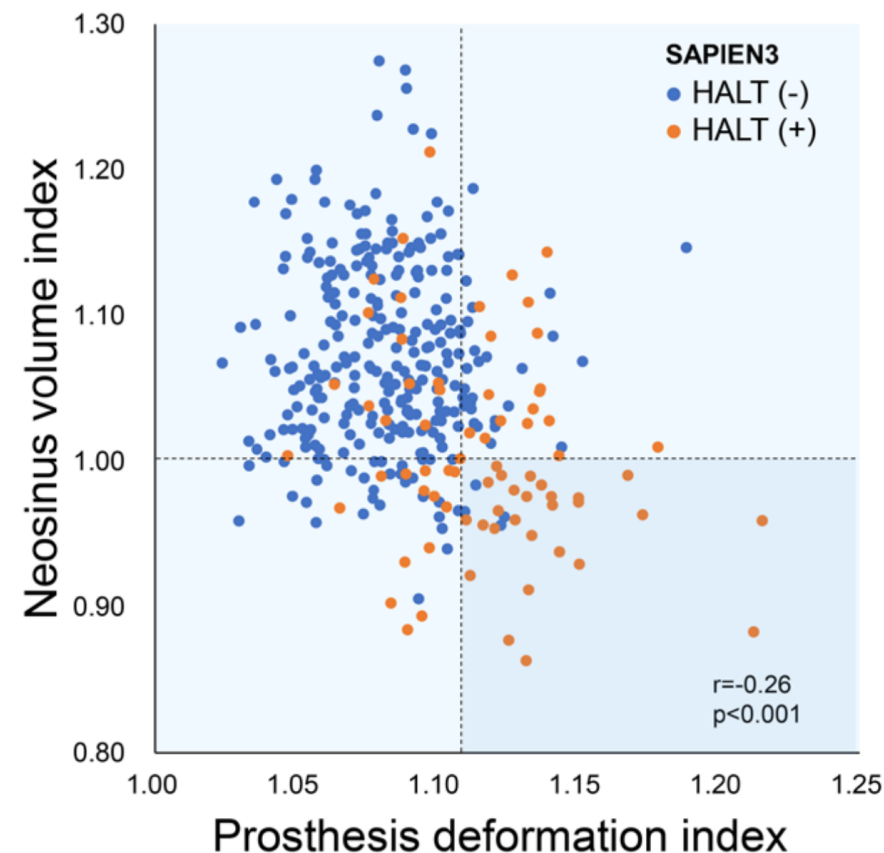
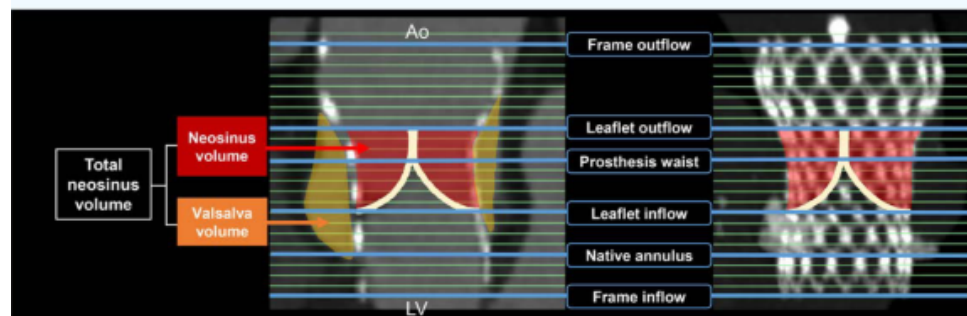
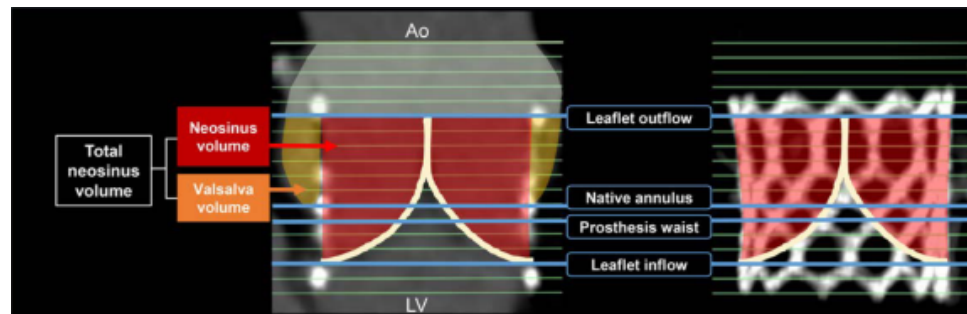
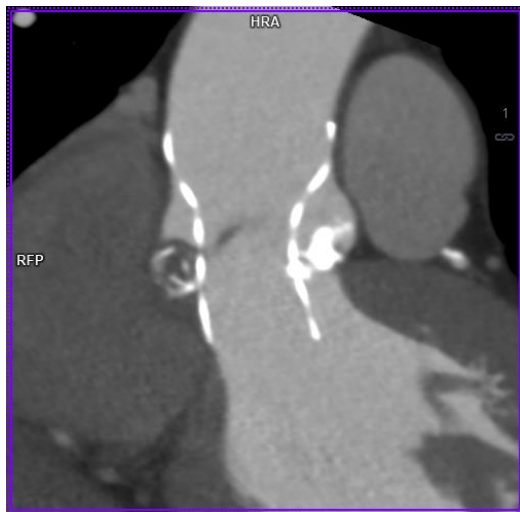
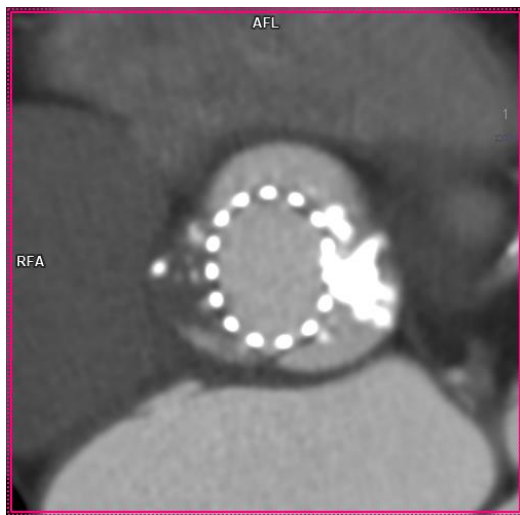








Possible mechanical mechanisms



Male, 80s, presenting with congestive cardiac failure. Recently stopped OAC due to falls.

PMH:

- Previous CABG 32 years prior
- TAVI 12 years prior
 - Complicated by abdominal aortic perforation and bowel ischaemia and perforation
- PPM
- TIA

Echo post TAVI:

1. Mild PVL

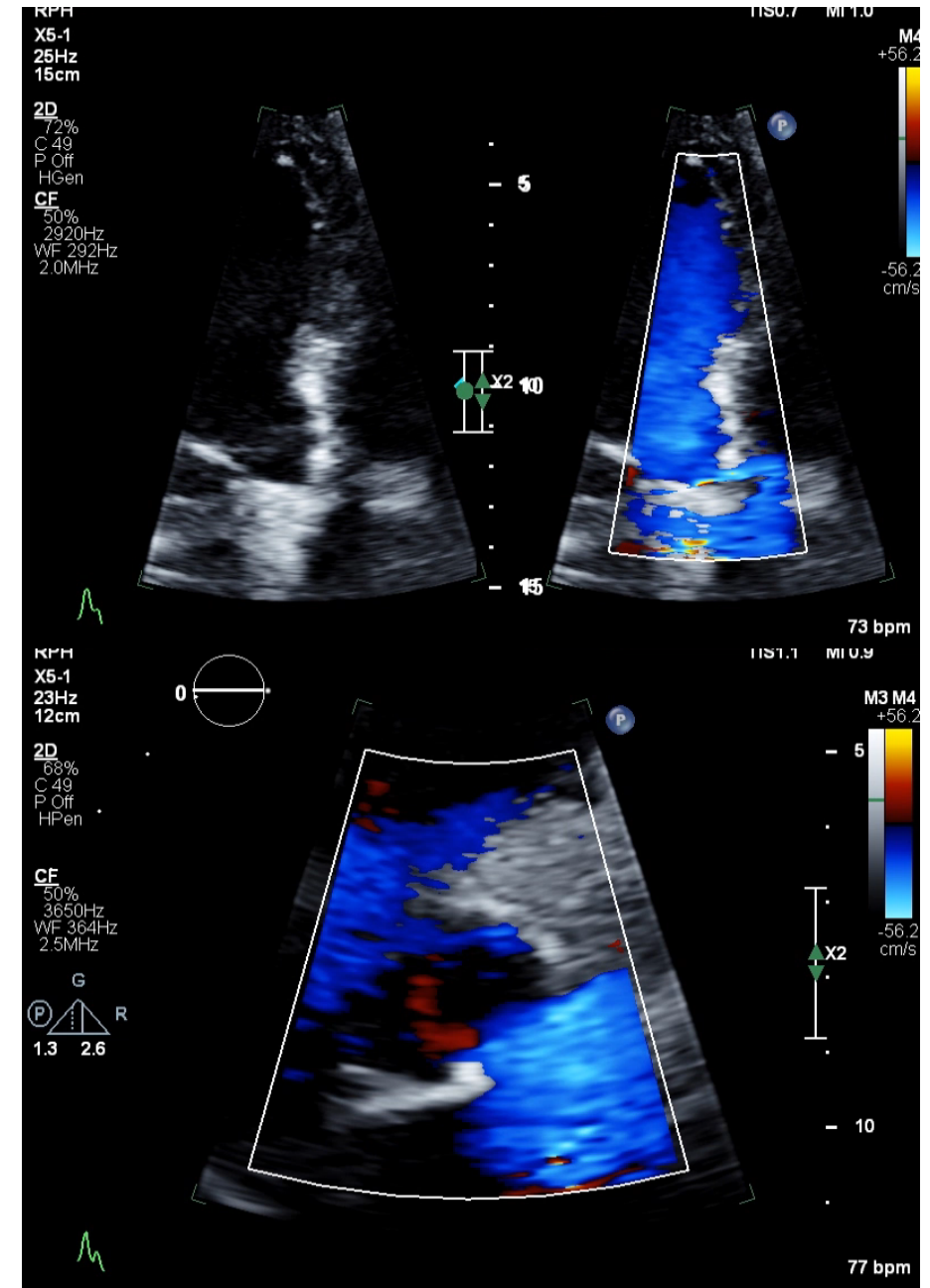
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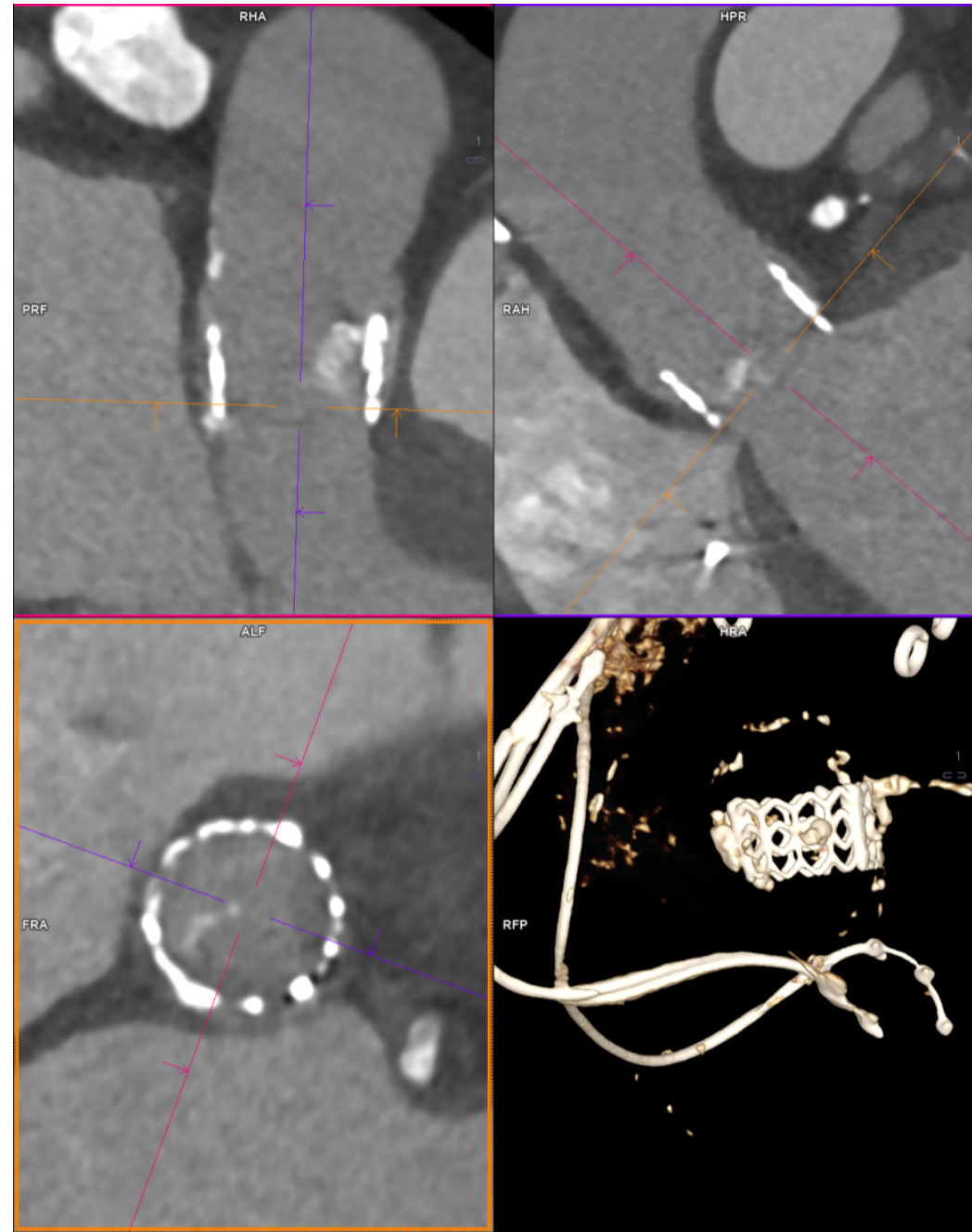
- Previous CABG 32 years prior
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- TIA

Echo on presentation:

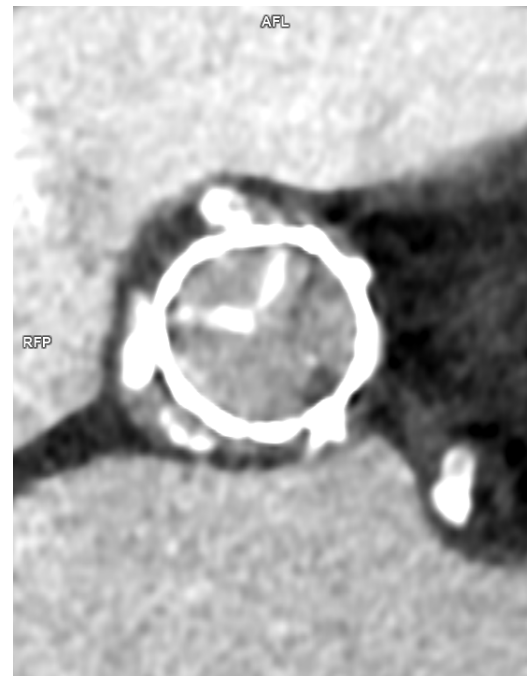
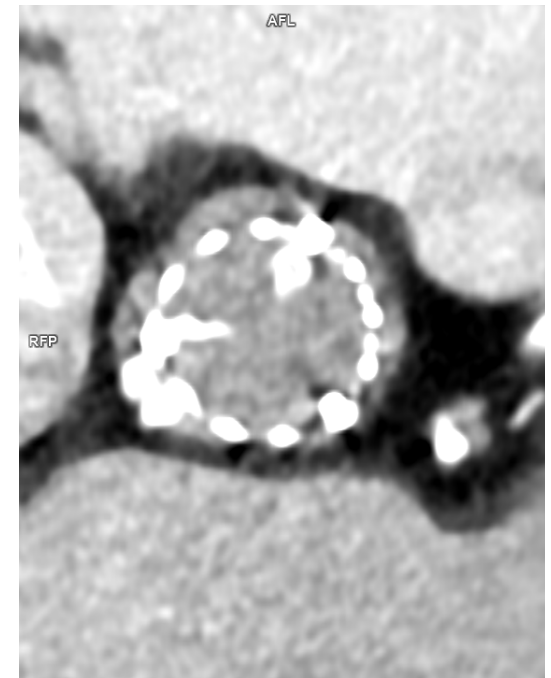
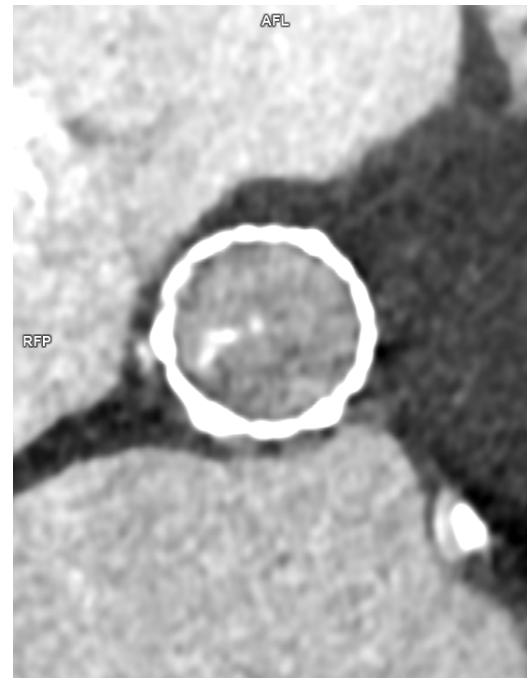
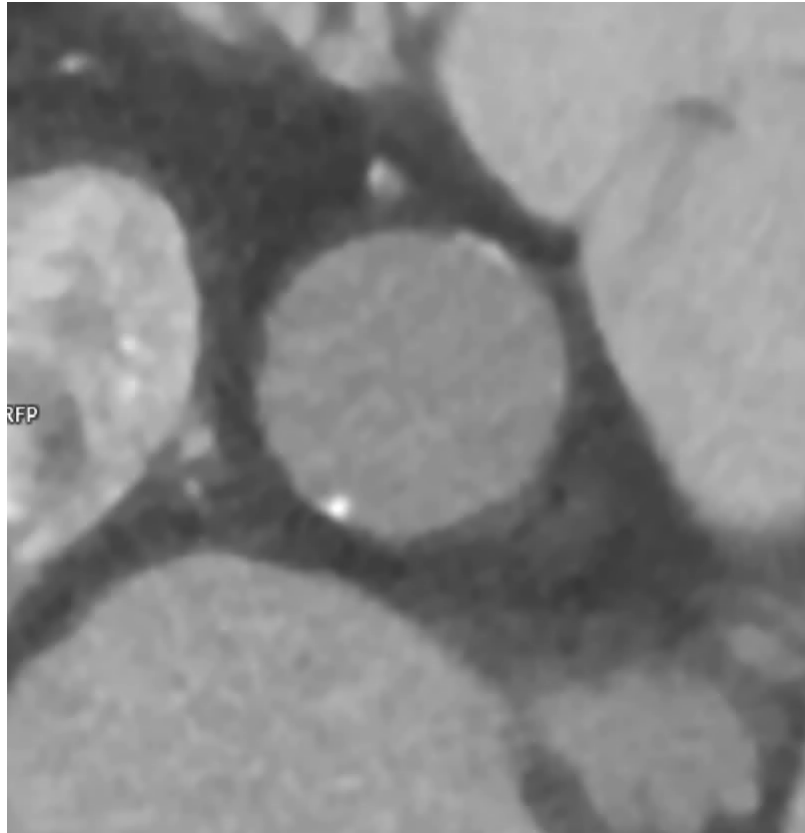
1. TAVI - The prosthesis was well-seated with some degree of restriction of motion and thickened. Severe aortic regurgitation (2 jets anterior >posterior appears severe, highly eccentricity). Low gradient across the prosthesis. Peak gradient of 30mmHg and mean gradient of 15mmHg. Likely both paravalvular and transvalvular component.
2. At least mild to moderately impaired systolic function
Visual EF 40-45%.



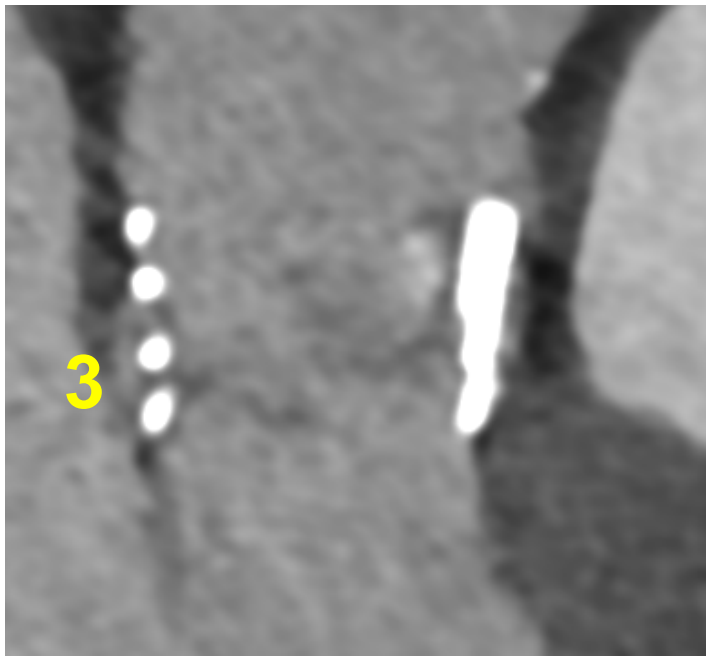
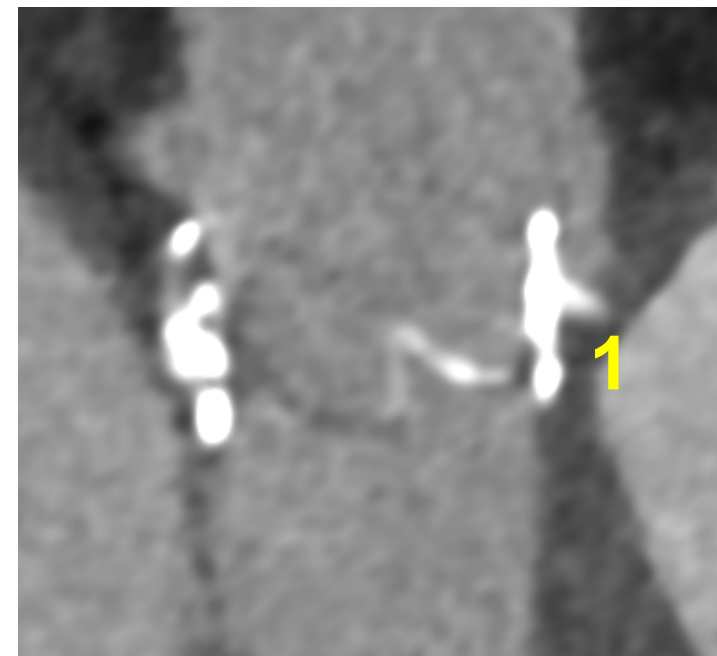
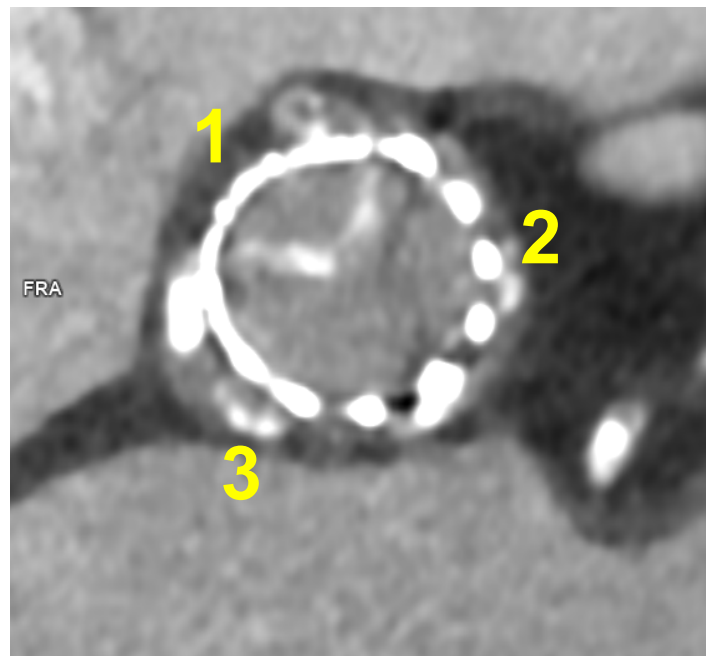
Assess valve seating



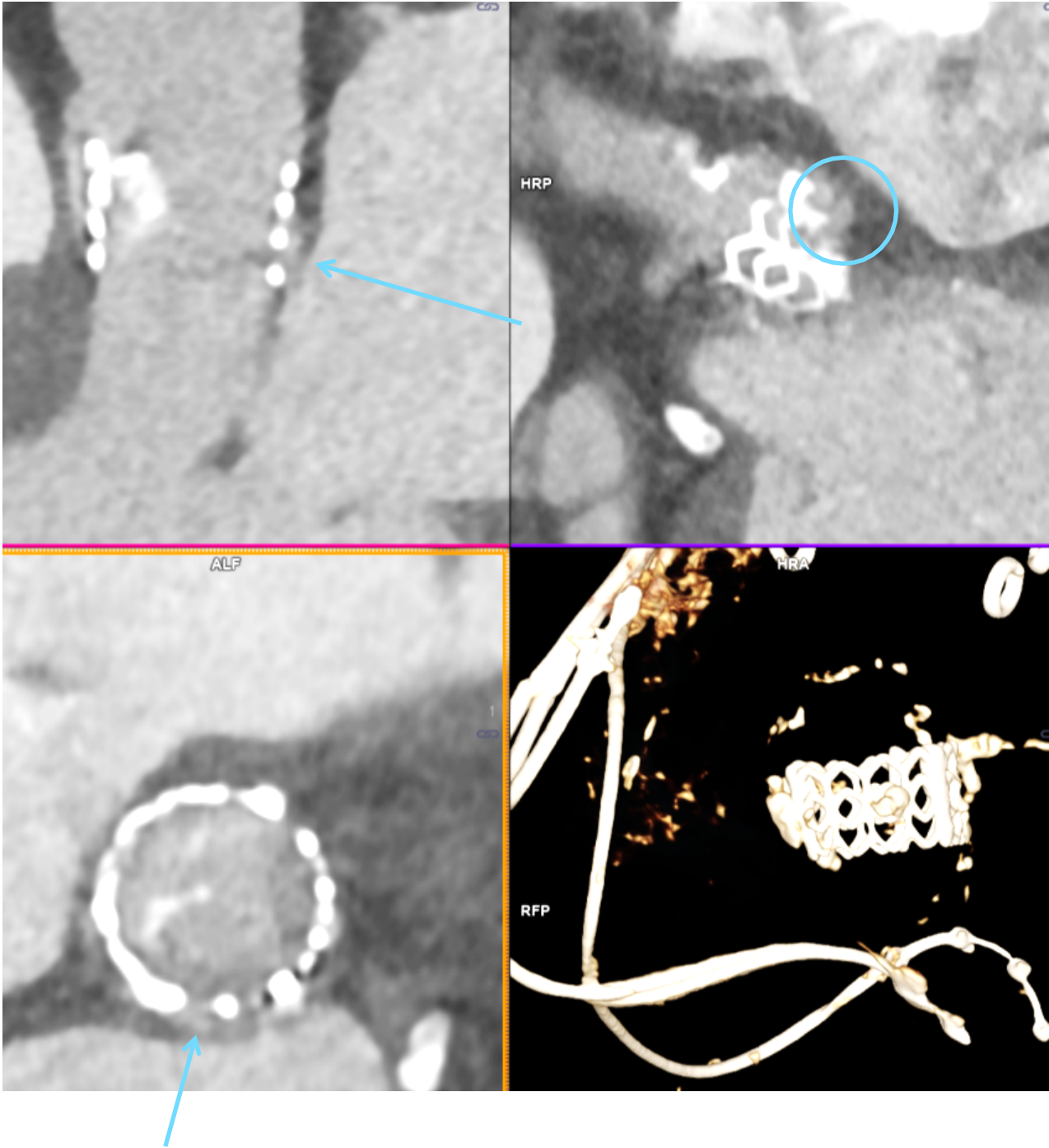
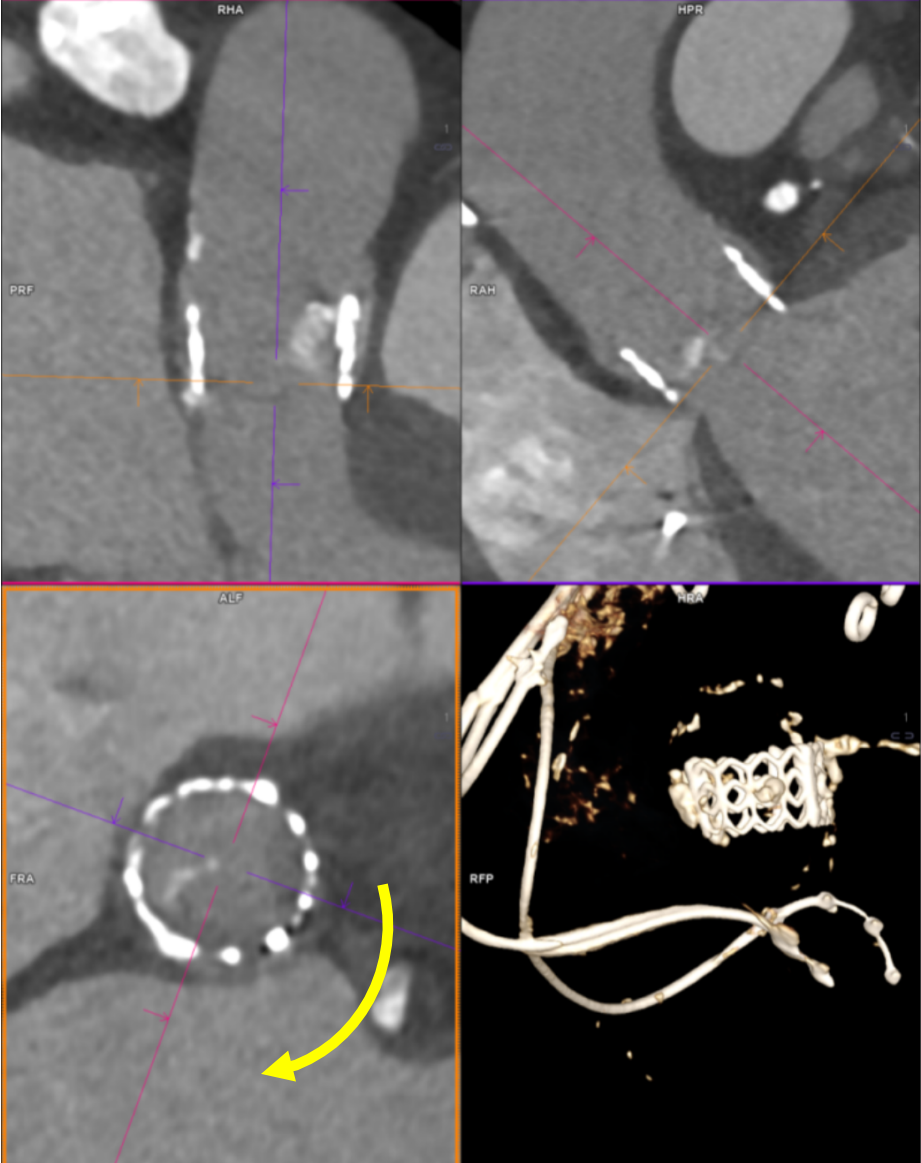
Assess TAVI cusps:



Assess TAVI cusps:



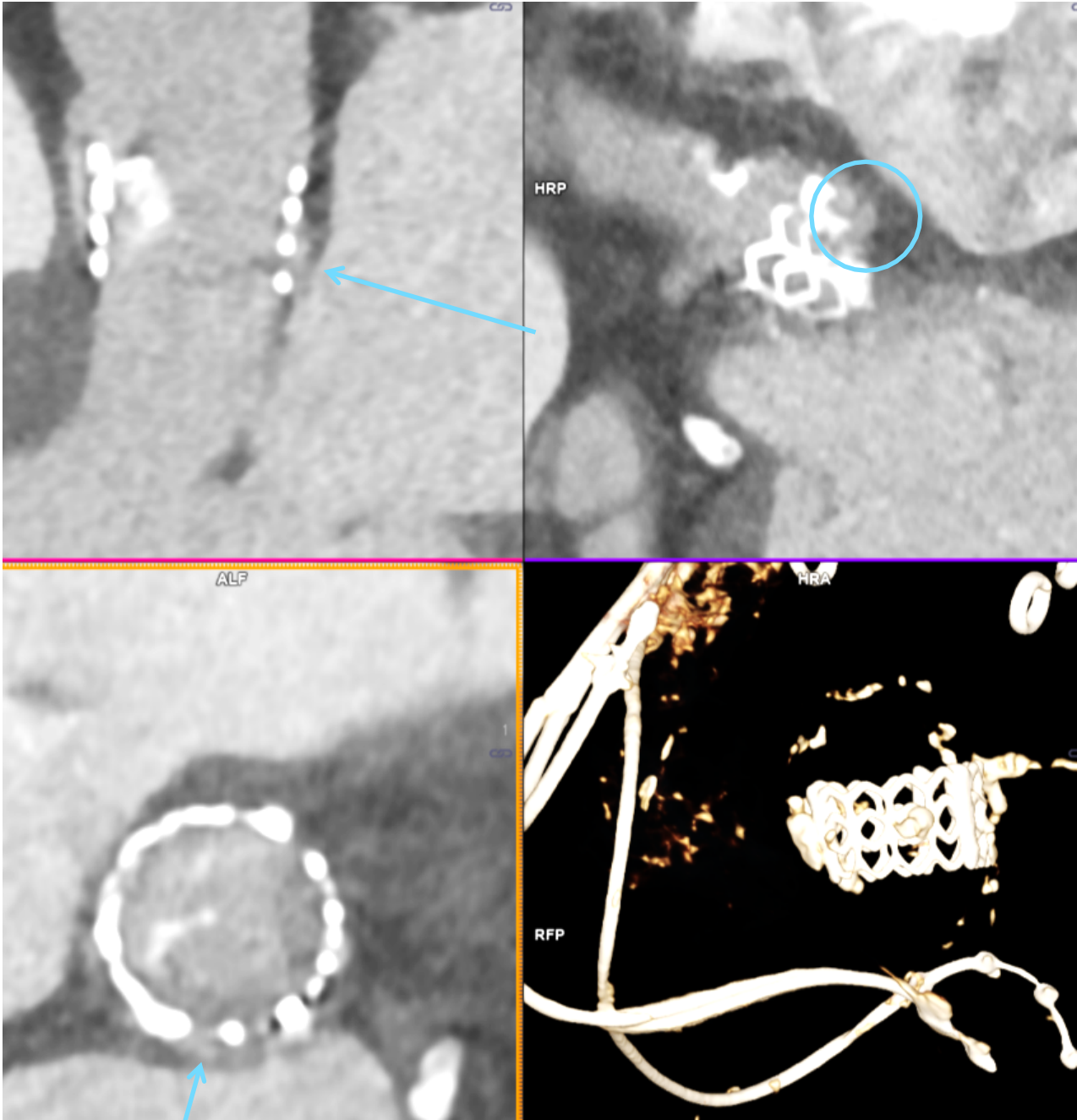
Assess for PVL



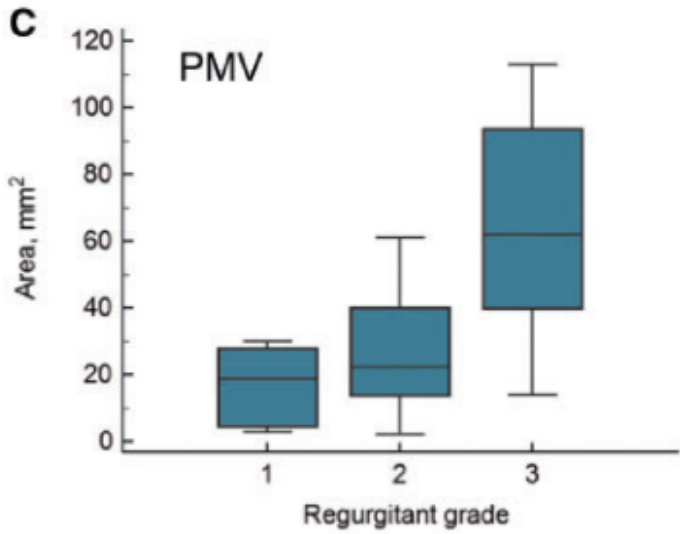
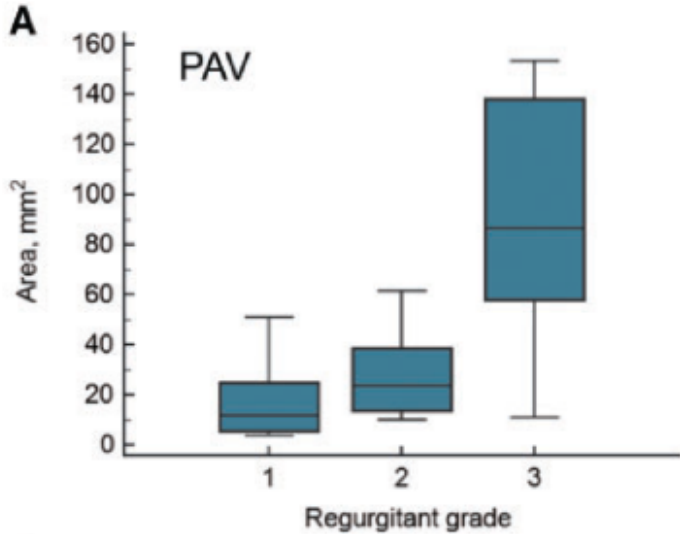
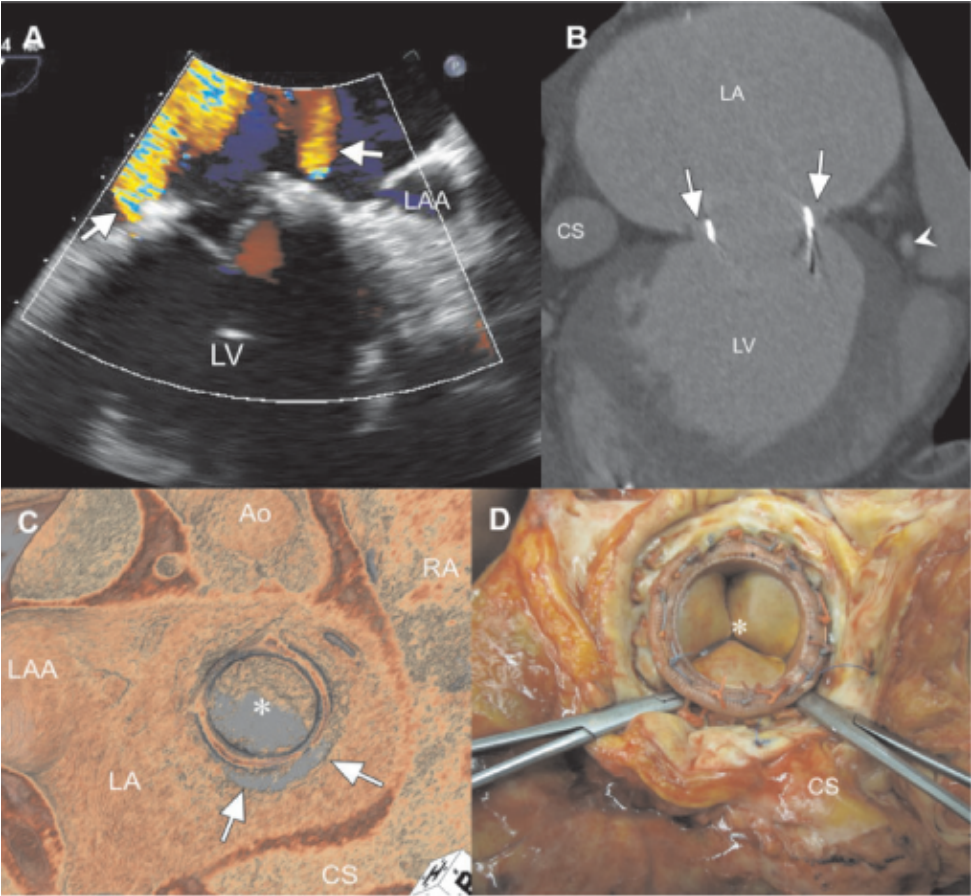
Assess for PVL



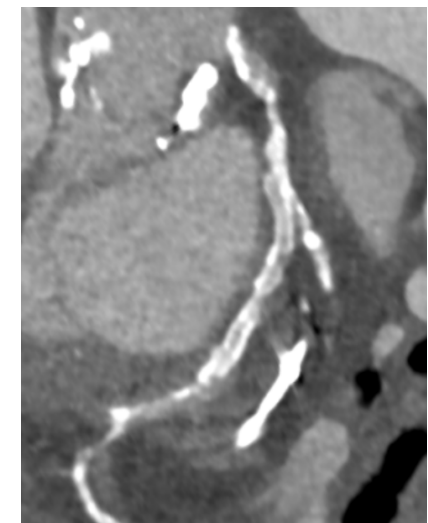
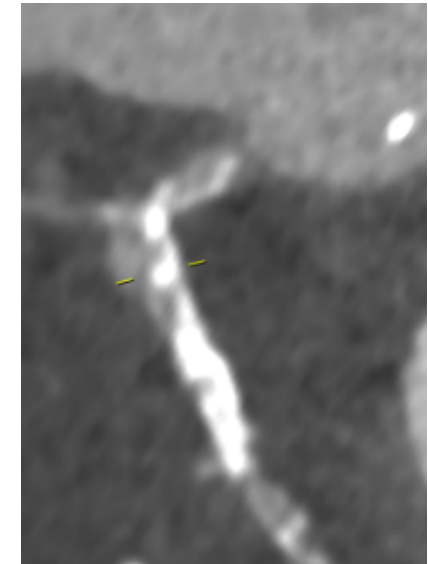
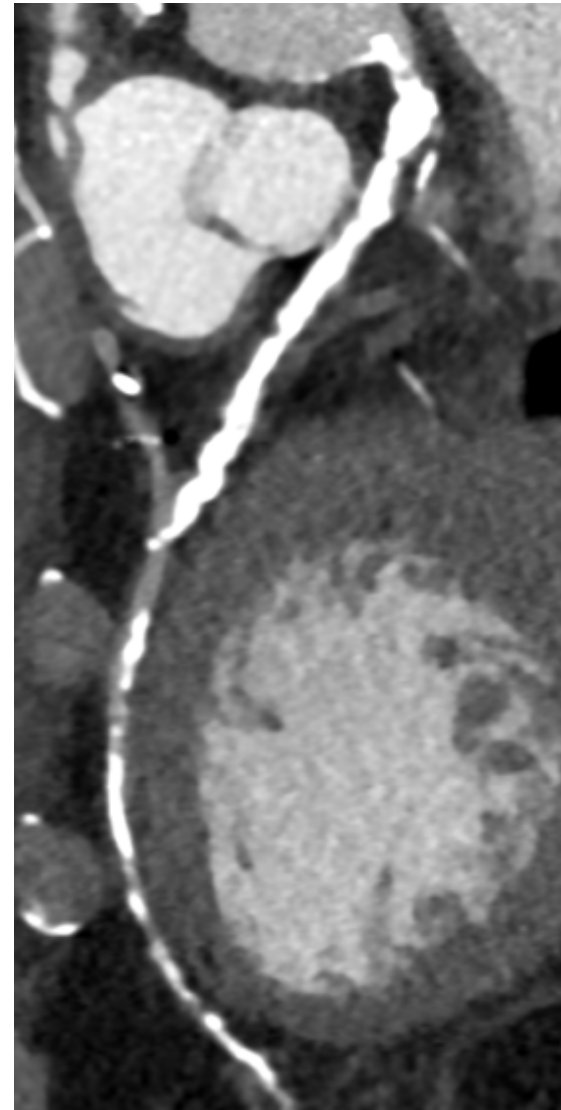
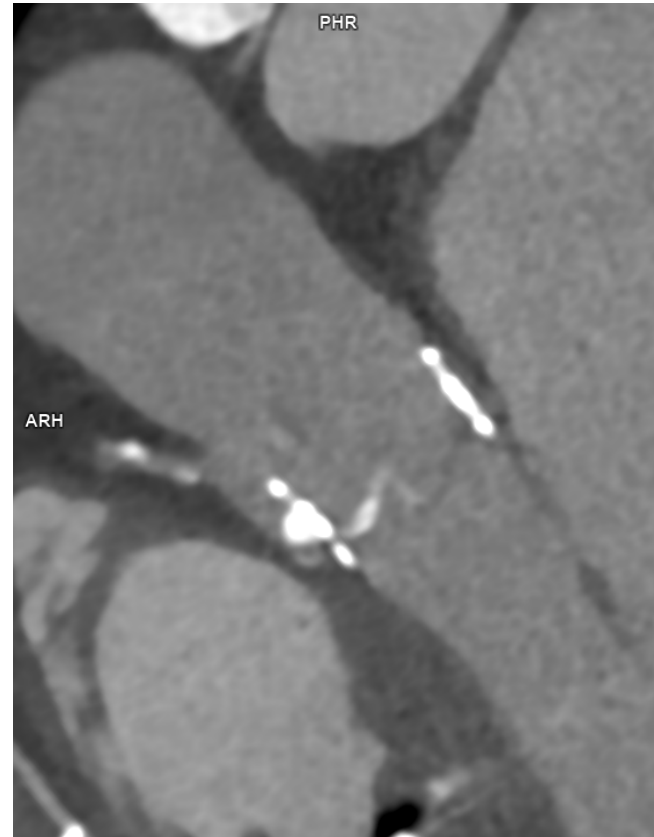
RAO 80 CAU 45



Excellent agreement between area and PVL grade



Assess for virtual transcatheter to coronary distance

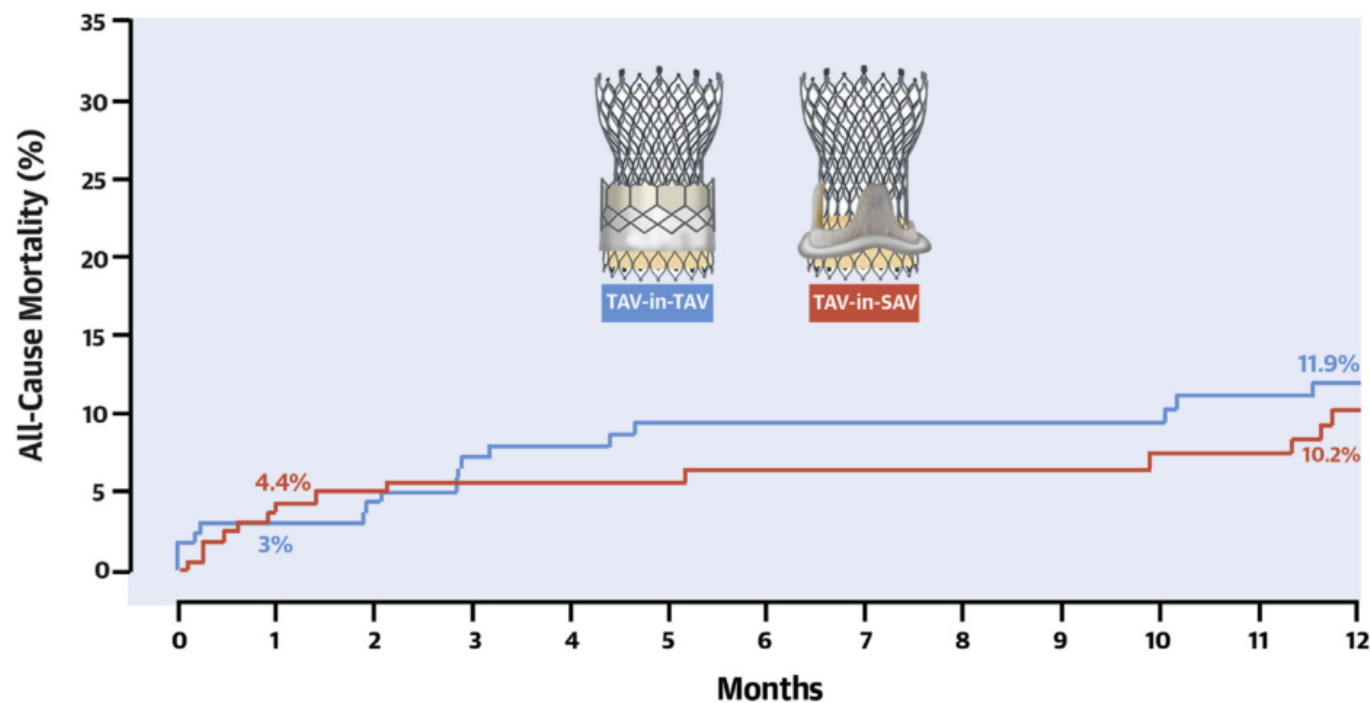
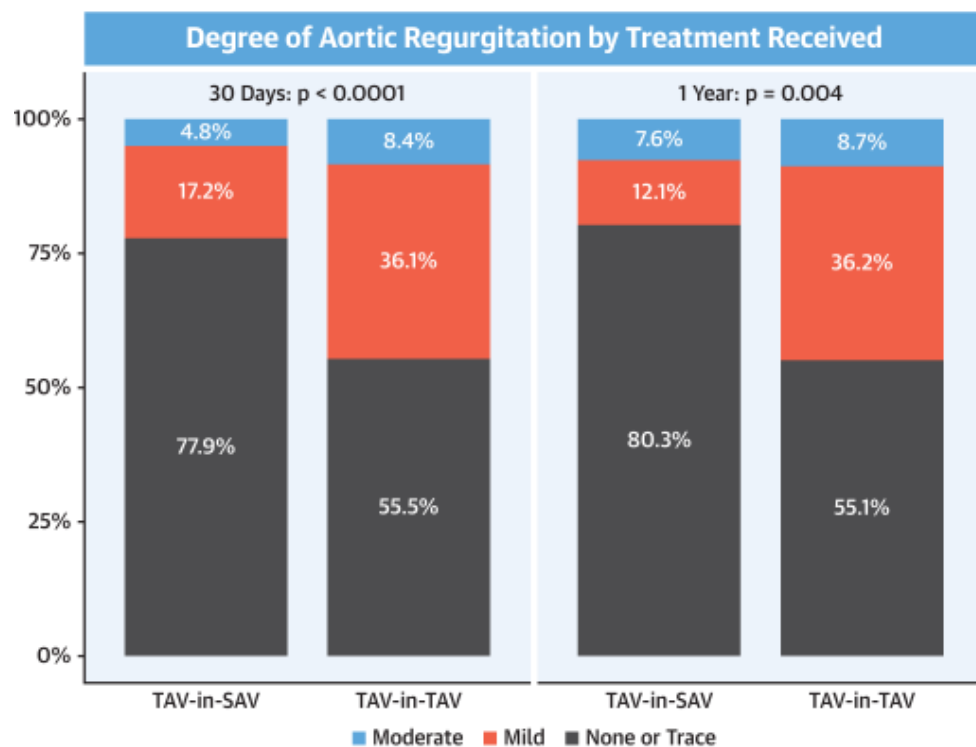


- Grafts:
 - Patent LIMA to LAD, patent SVG to OM.
 - LCx graft occluded
 - RCA graft occluded.

TAV – in - TAV

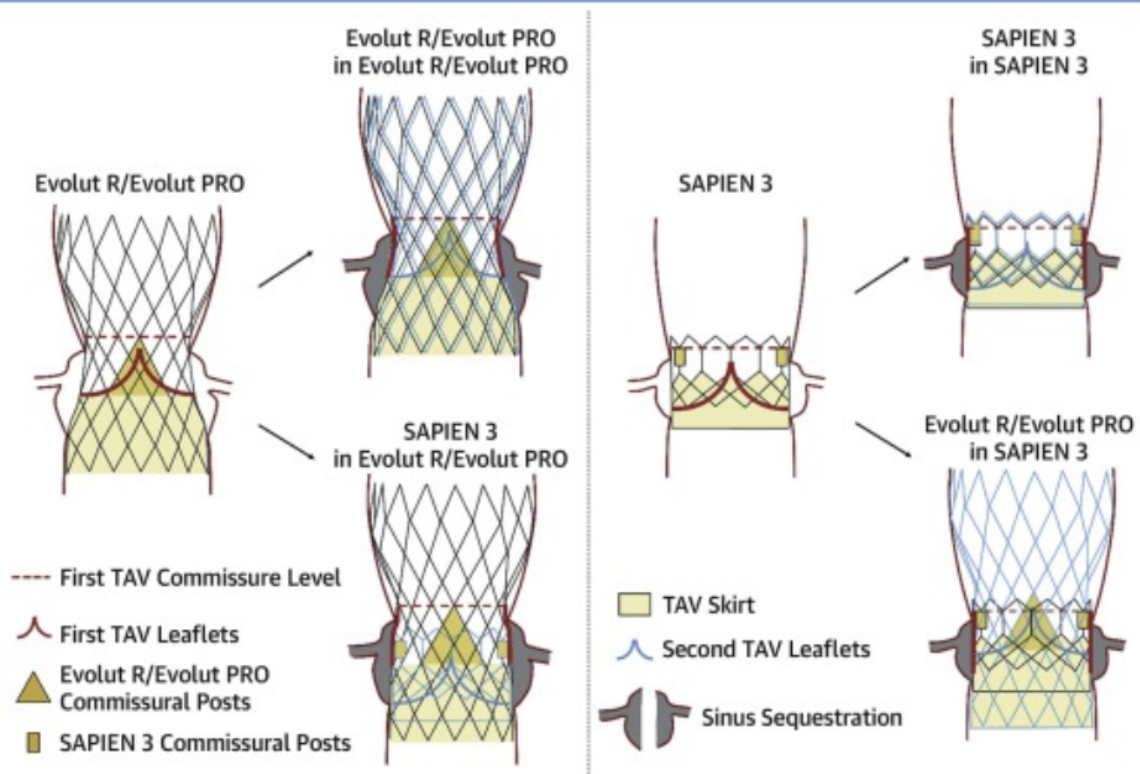
37 centres

165 TAV-in-TAV propensity matched with 165 TAV-in-SAV

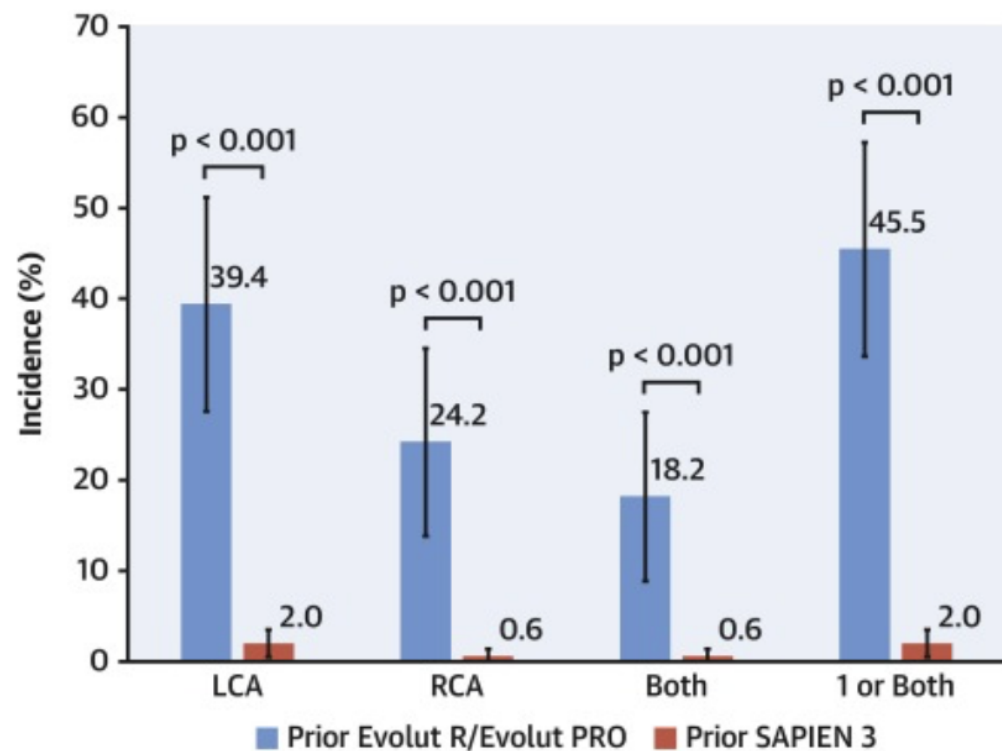


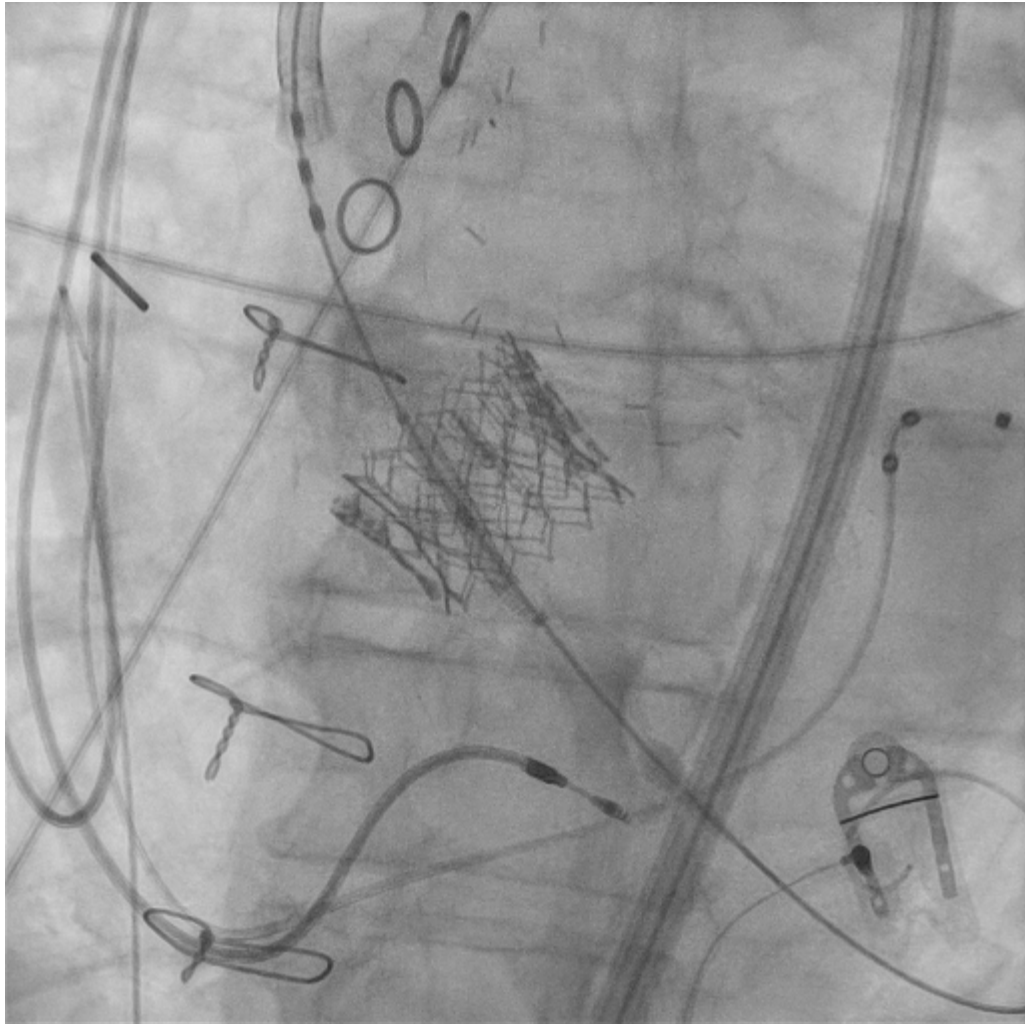
TAV – in - TAV

Mechanism of Coronary Obstruction Due to Sinus Sequestration in Redo TAVR



Computed Tomography-Identified Risk of Coronary Obstruction Due to Sinus Sequestration in Redo TAVR





**Sapien 3 in Sapien XT valve in
valve performed**

No complications

**No post procedural transvalvular
or paravalvular regurgitation**

Female, 60s, shortness of breath and fever 6 weeks after redo AVR

PMH:

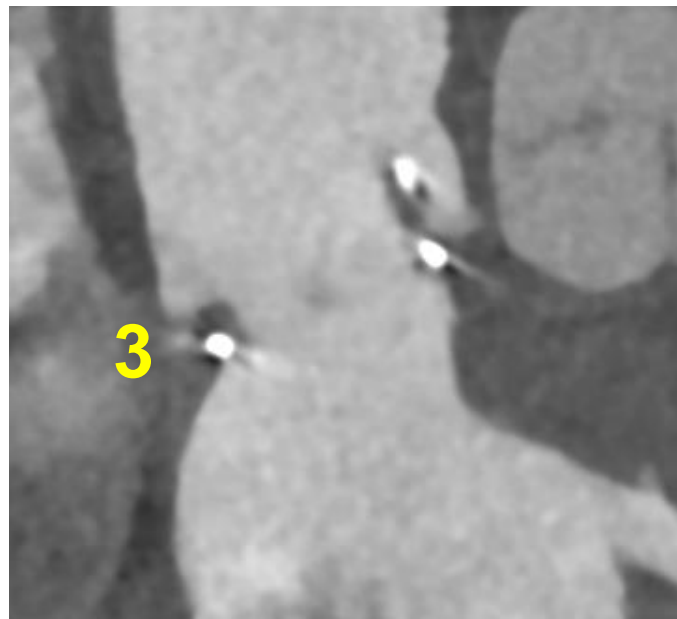
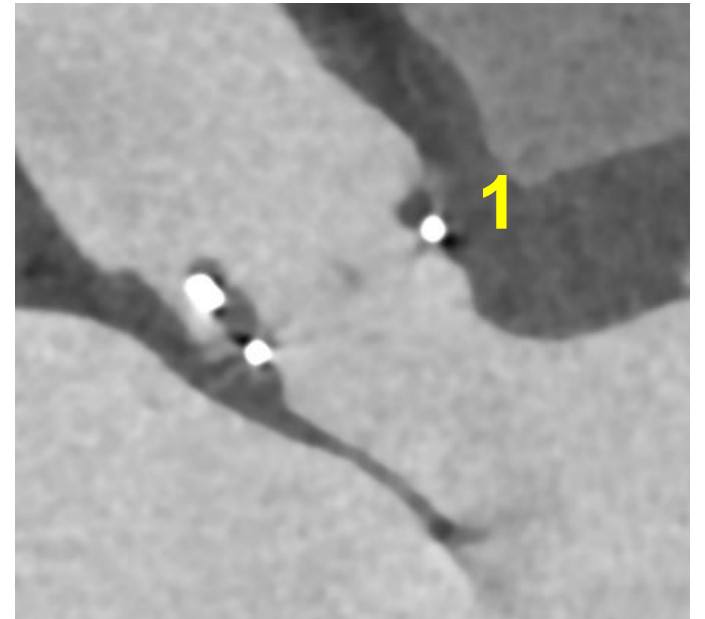
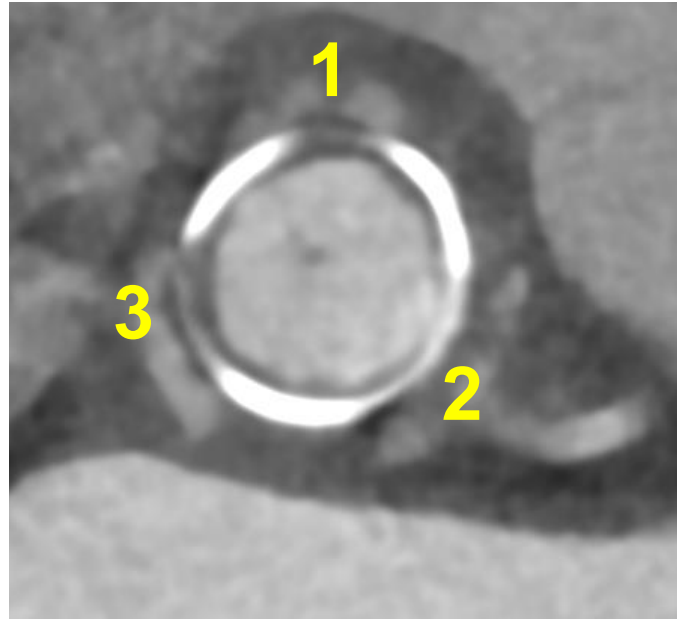
- Mechanical AVR 2008
- Valve endocarditis then replaced with bioprosthetic Hancock II valve and ascending aorta repair 2019.

Echo:

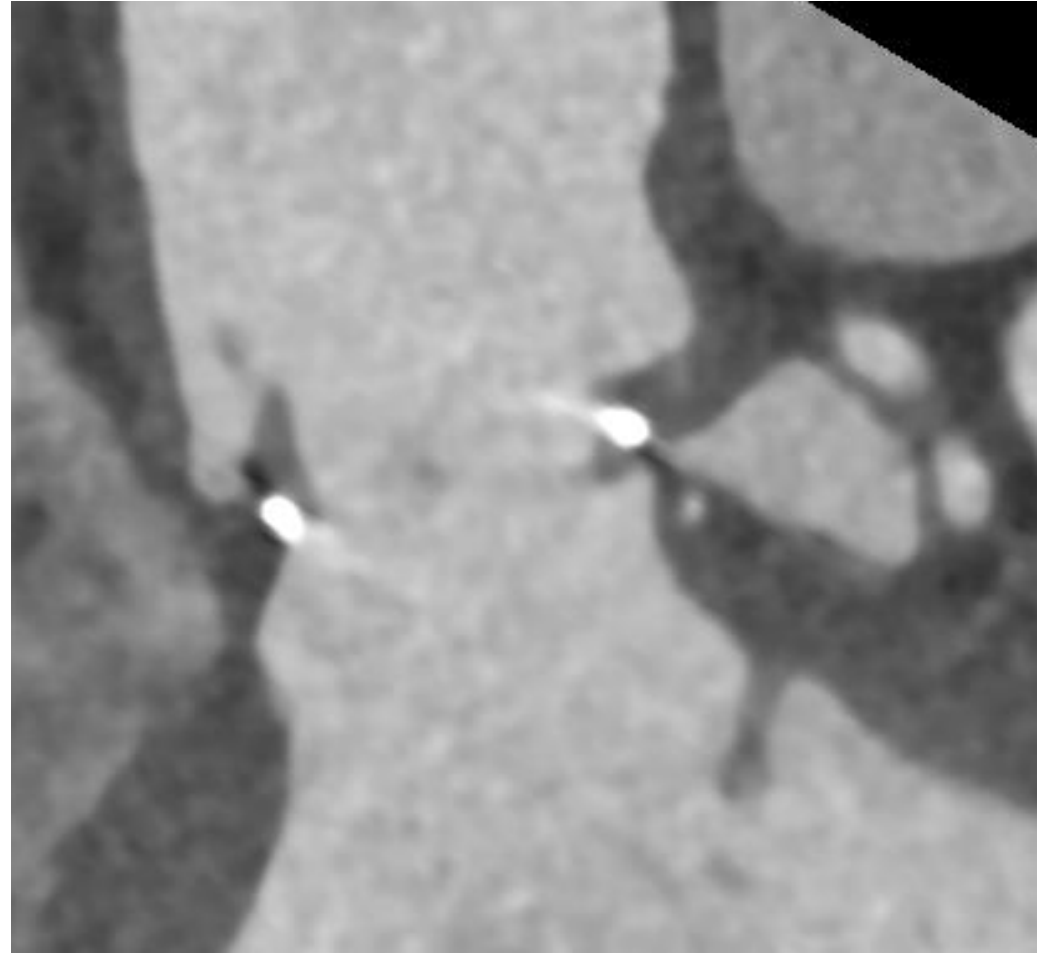
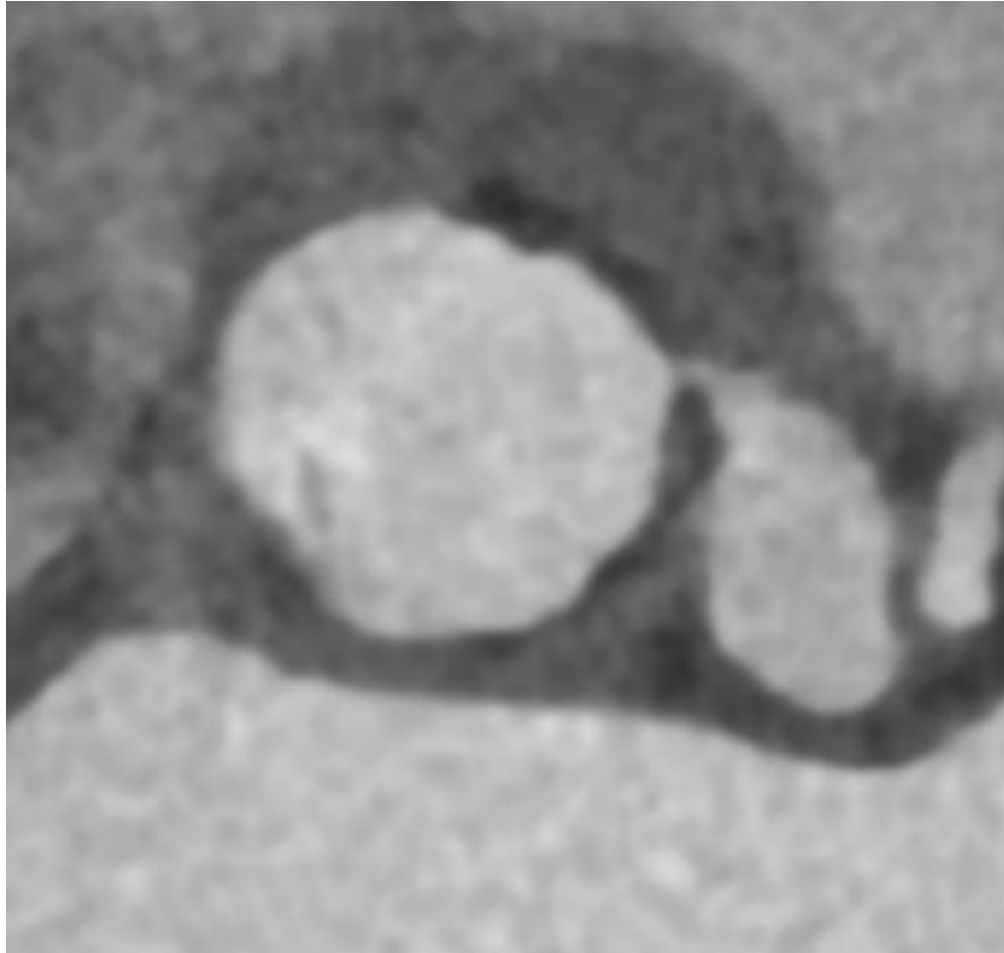
- Severe paravalvular leak
- Valve leaflet vegetation

CT: Percutaneous option?

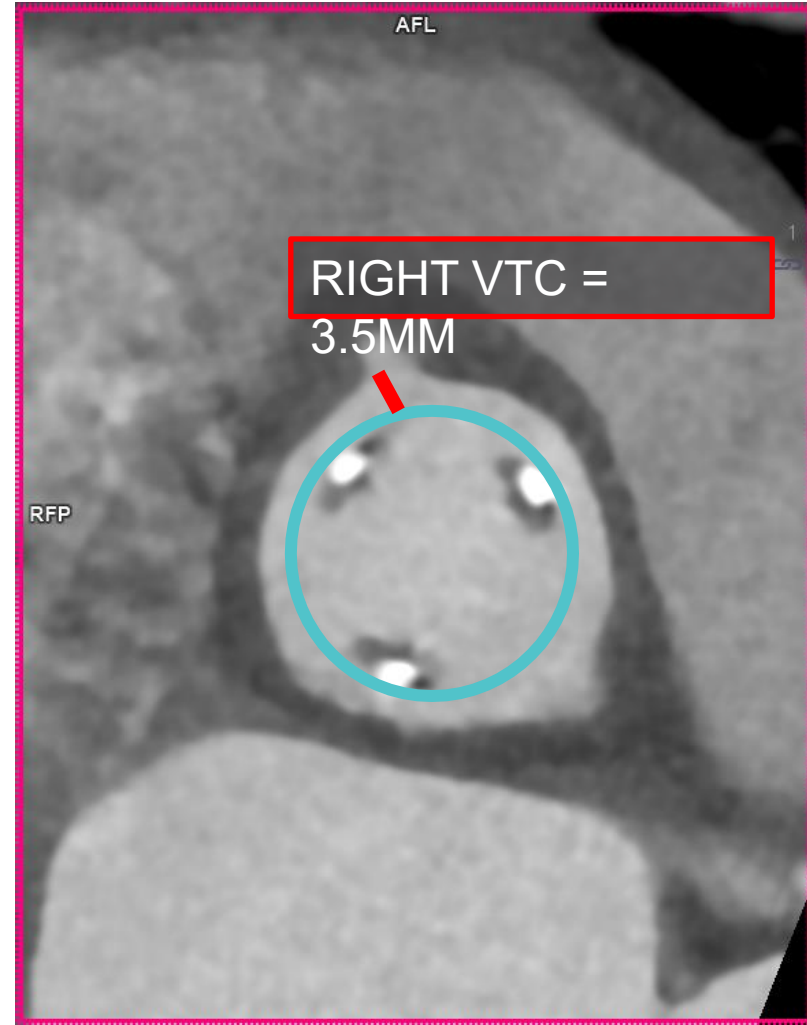
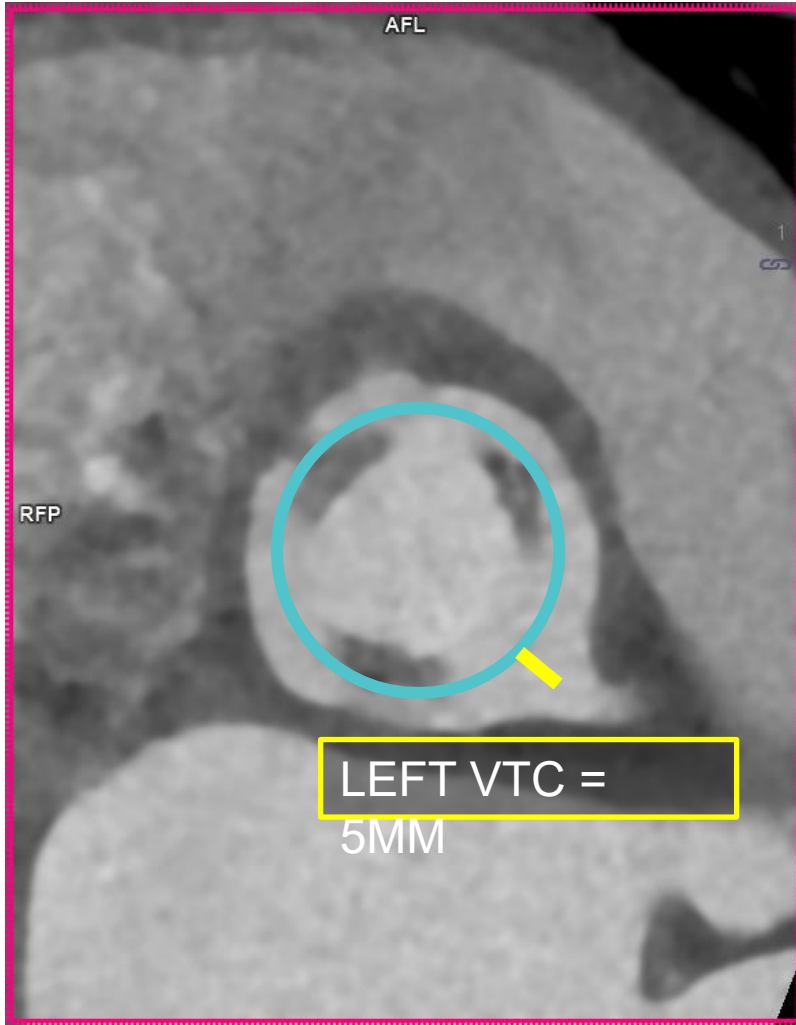
Valve assessment



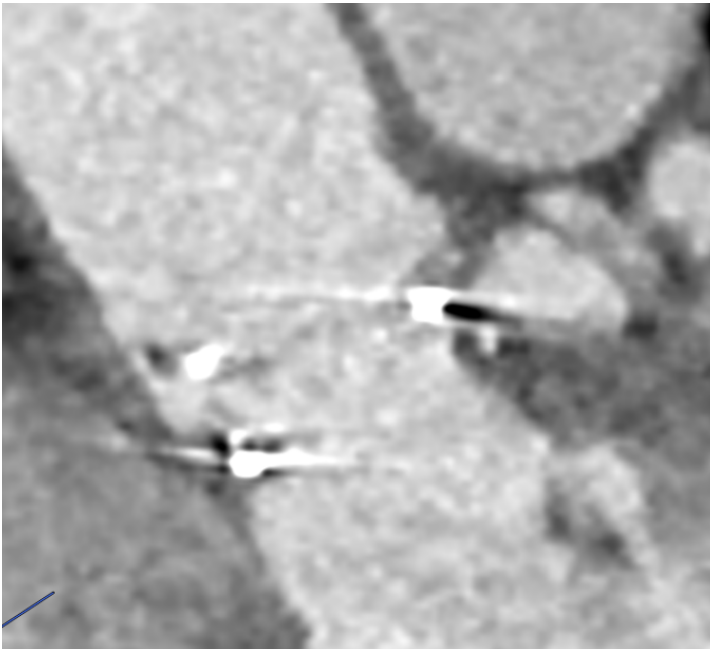
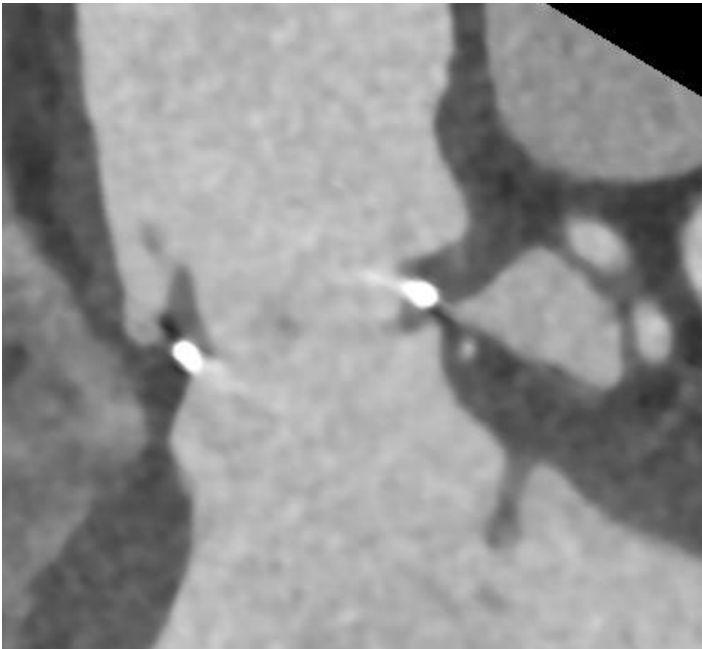
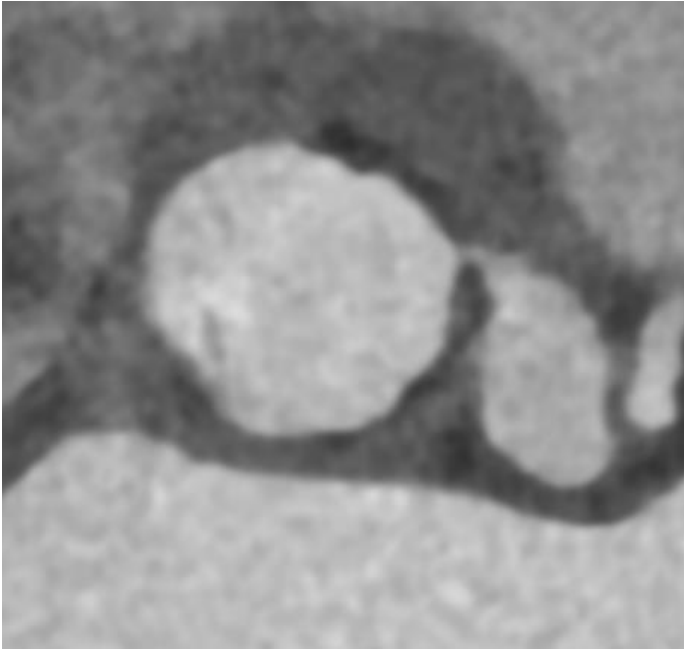
PVL assessment



VTC assessment



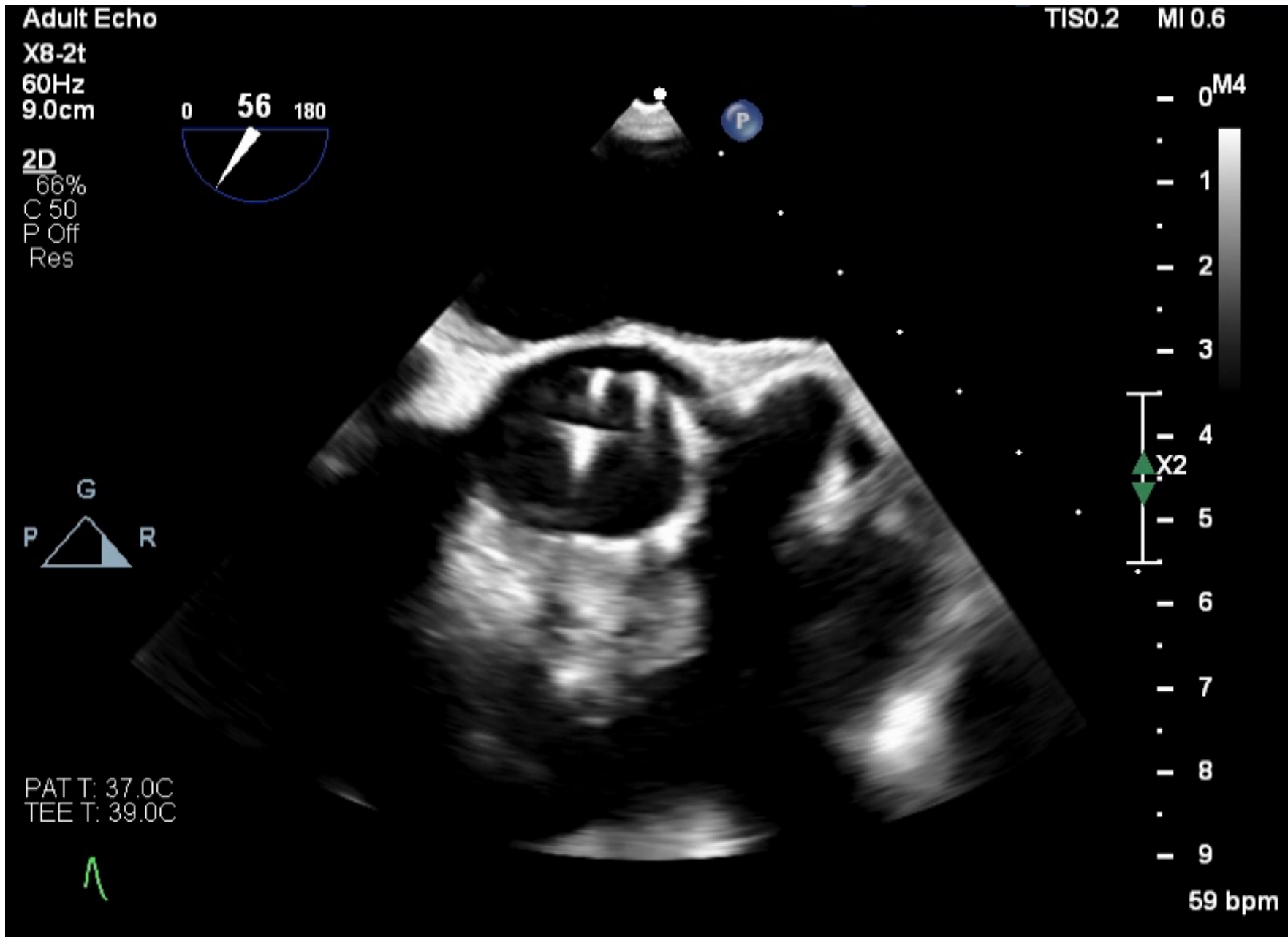
Follow-up



Decision:

Valve in valve TAVI

TOE support



ROUTINE FOLLOW-UP:

Echo:

- 1- Valve in valve TAVI in situ. No obvious regurgitation/paraprosthetic leaks. Increased transvalvular doppler parameters, with significant increase from post-procedural TTE. MG = 25mmHg, PG=48mmHg, AVA = 1.1cm²
- 2- Normal left ventricle cavity size with moderate concentric hypertrophy. Normal systolic function

CT: ?HALT



AFL

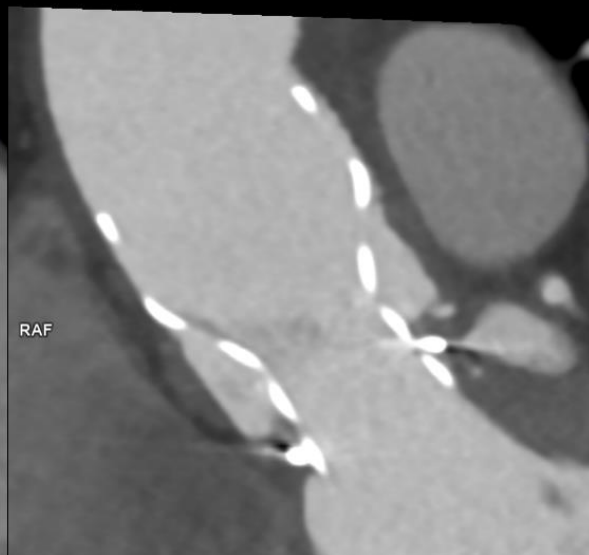


RAF

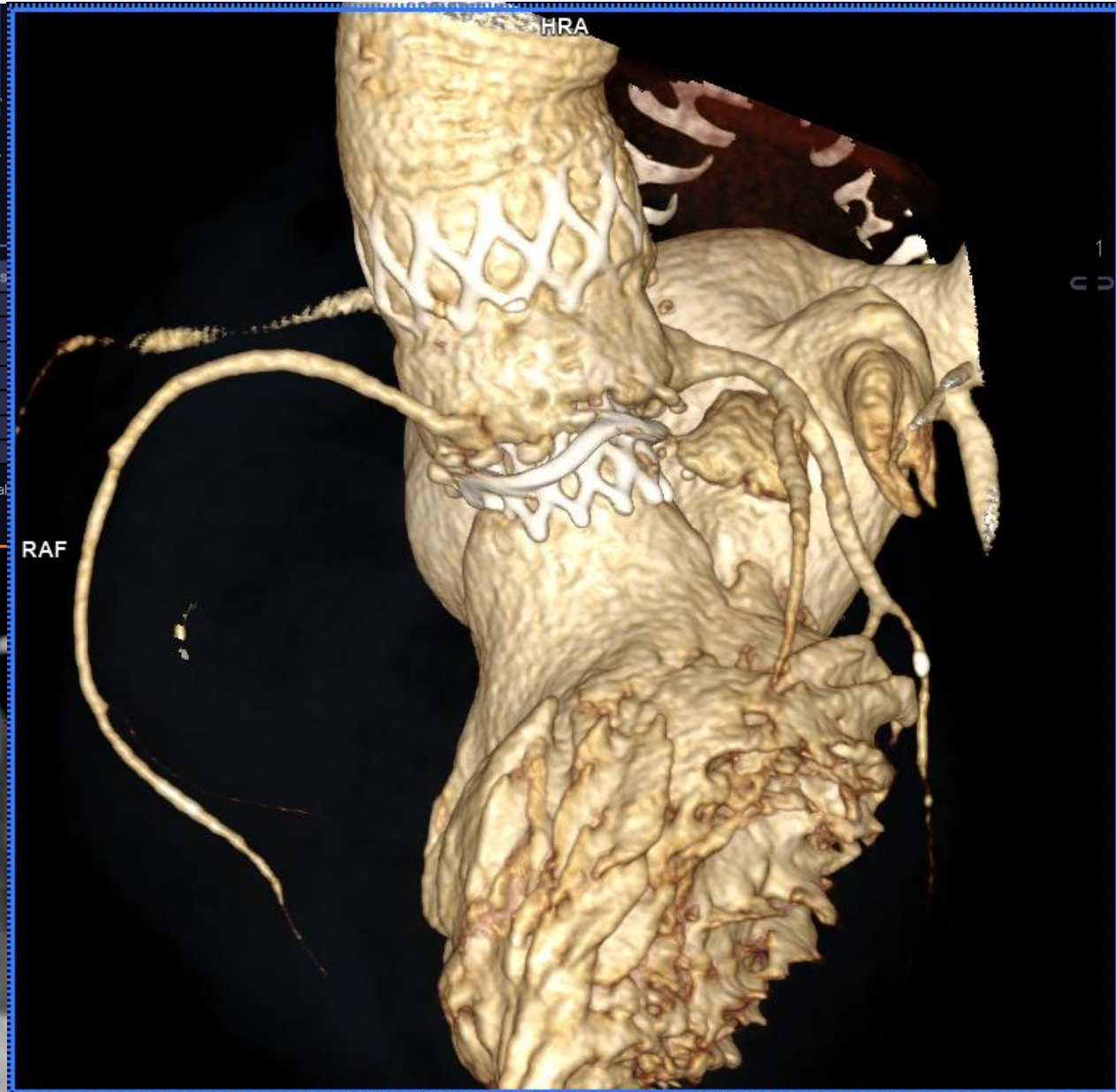
Standard Values		Indexed Values	
Standard Mode		LV	Normal Values
Ejection Fraction	%	-	56 - 78
Myocardial Mass ED	g	148.65	75 - 175
Stroke Volume	ml	-	33 - 97
ED Volume	ml	129.26	58 - 154
ES Volume	ml	-	13 - 51
Cursor Volume	ml	129.26	
Cardiac Output	(l/min)	-	2.85 - 5.98

Height: cm ft in Sex: Female
 Weight: kg lbs BSA/m²

HAL



RAF





Thank You

Questions?



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[@jweirmccall](https://twitter.com/jweirmccall)



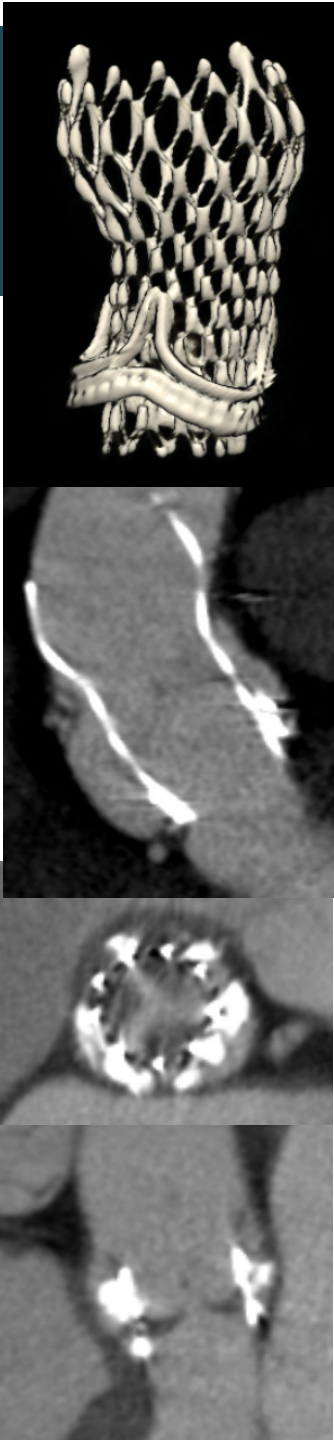
Royal Papworth Hospital
NHS Foundation Trust



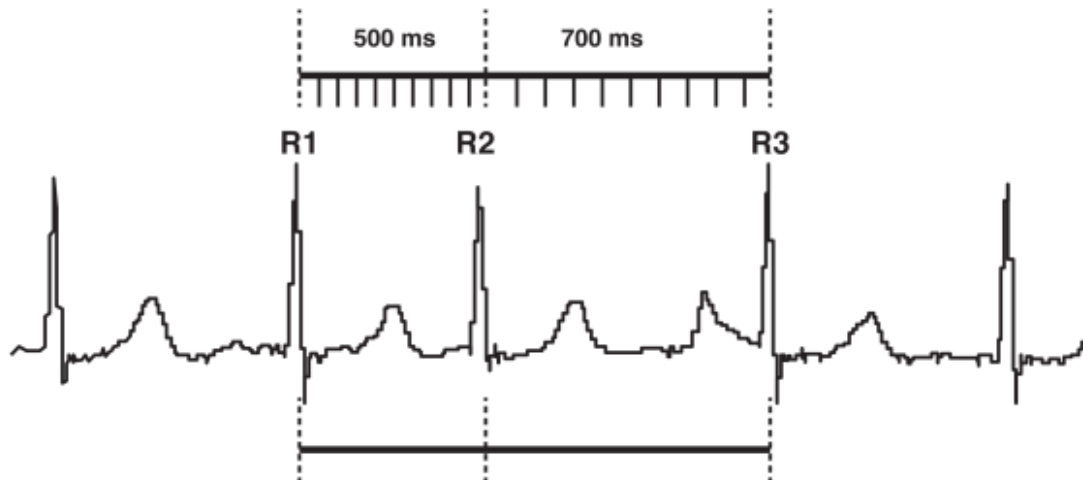
UNIVERSITY OF
CAMBRIDGE

Local protocol

- Full cardiac cycle
- 120kVp
- 70ml Contrast at 4ml/s, 50ml saline at 4 ml/s
- Soft tissue reconstructions with iterative reconstruction
- Additional sharp filter recons sometimes useful in valve in valves



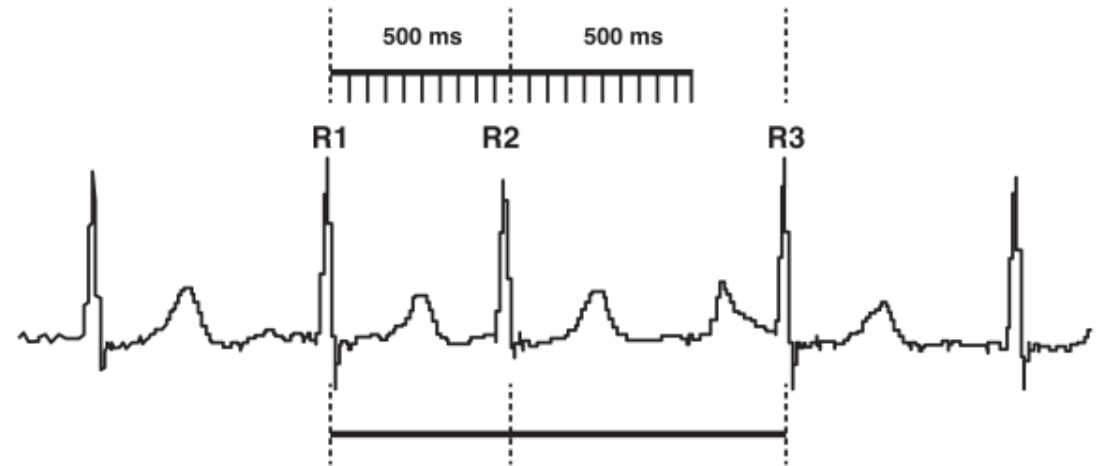
Post processing



HR (beats/min) Min: 75, Max: 128, Mean: 96 (R-R 621 ms)

	R_1R_2	R_2R_3
R-R interval	500 ms	700 ms
Reconstruction phase (10% of R-R interval)	50 ms, 100 ms, ..., 500 ms	70 ms, 140 ms, ..., 700 ms

Relative timing reconstruction (%)



HR (beats/min) Min: 75, Max: 128, Mean: 96 (R-R 621 ms)

	R_1R_2	R_2R_3
R-R interval	500 ms	700 ms
Reconstruction phase (10% of shortest R-R interval)	50 ms, 100 ms, ..., 500 ms	50 ms, 100 ms, ..., 500 ms

Absolute timing reconstruction (ms)

Post processing

