3D Simulation Predictive Modeling in Large Annulus Bicuspid Aortic Stenosis With Cardiogenic Shock

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Nature of Financial Relationship	Ineligible Company
Grant/Research Support	Boston Scientific
Consultant Fees/Honoraria	WL Gore, Edwards Lifesciences, Boston Scientific
Individual Stock(s)/Stock Options	
Royalties/Patent Beneficiary	
Executive Role/Ownership Interest	
Other Financial Benefit	

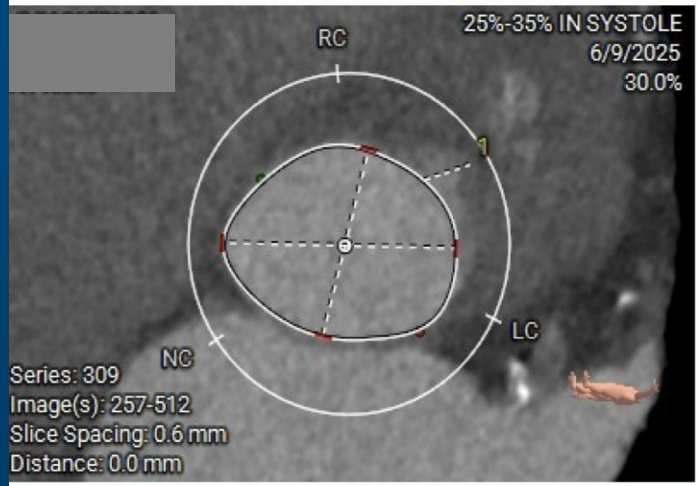
All Relevant Financial Relationships have been mitigated.
Faculty disclosure information can be found on the app

Case Presentation

- A 67 year old male was referred for evaluation of aortic stenosis and low EF. He had a history of alcoholic cardiomyopathy and CHF with Class 3 symptoms.
- Echo demonstrated a bicuspid valve peak gradient 32 mm Hg mean gradient 18 mm Hg, LVEF of 10%-20%.
- He acutely decompensated within 1 week of initial evaluation and was admitted in cardiogenic shock.

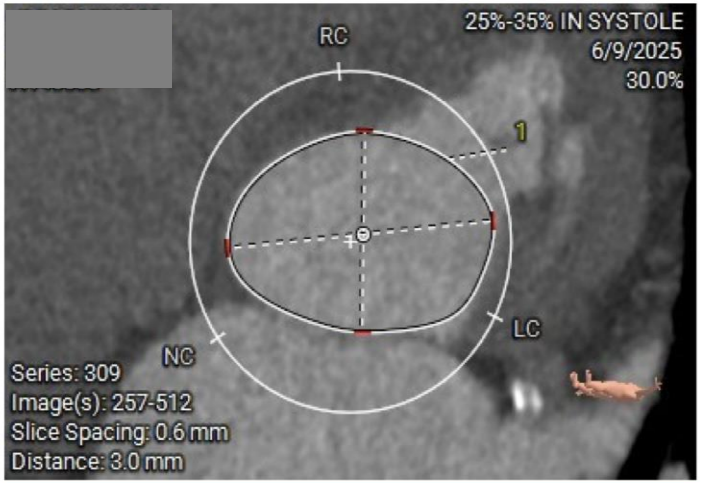
Aortic annular area of 924 mm²
LVOT 1102 mm²

Perpendicular Plane



ID	Type	Label	Value
1	Polygon	Min. Ø	30.4 mm
		Max. Ø	39.2 mm
		Avg. Ø	34.8 mm
		Area derived Ø	34.3 mm
		Perimeter derived Ø	34.9 mm
		Area	923.6 mm²
		Perimeter	109.7 mm

LVOT



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		Max. Ø	44.8 mm
		Avg. Ø	38.2 mm
		Area derived Ø	37.5 mm
		Perimeter derived Ø	38.5 mm
		Area	1102.8 mm²
		Perimeter	120.8 mm

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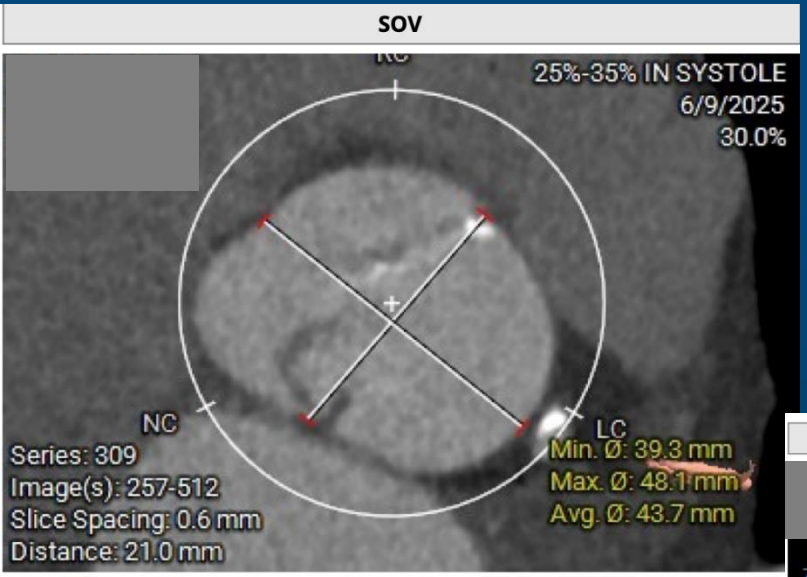

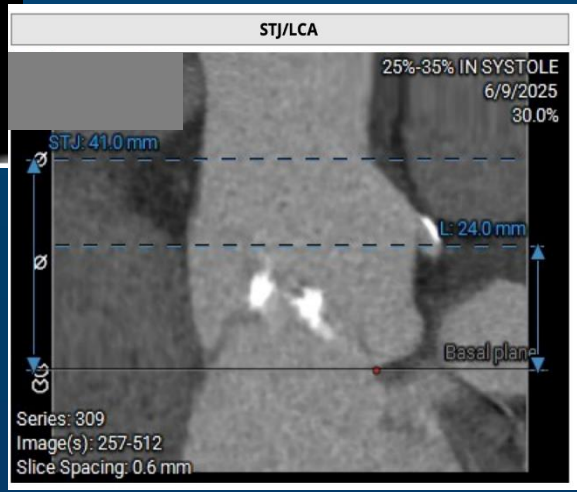

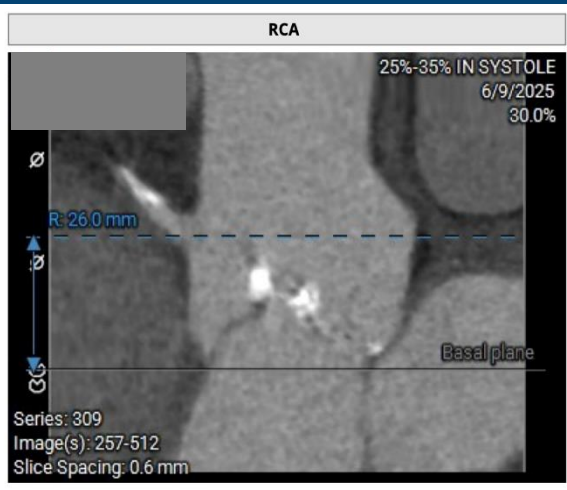

SOV Avg 44mm

Heart Team discussion-
Not a surgical candidate

LCA 24mm and RCA 26mm
STJ 41mm

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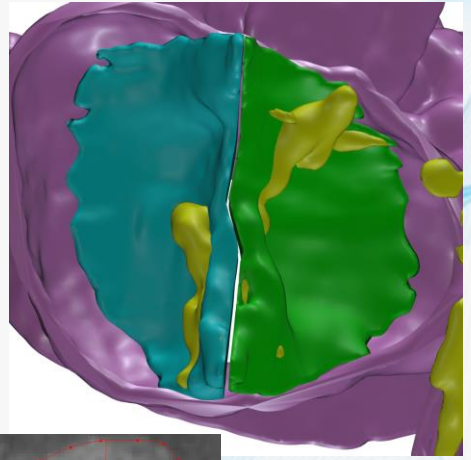
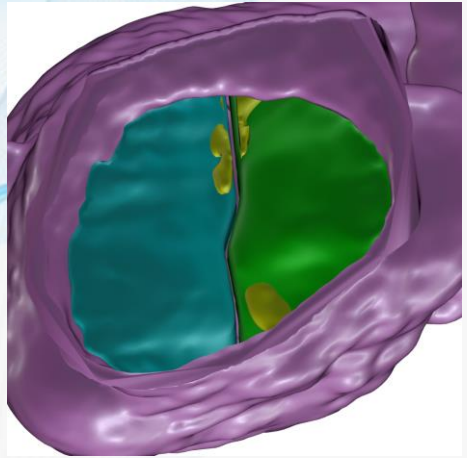
Case Details

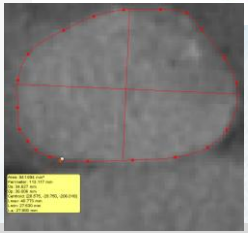
Age	67
Sex	Male
Valve Type	Bicuspid
Annulus Area & Phase [1]	941.0 mm^2 (Diastolic)
Segmentation Phase	Diastolic
CT Quality	Motion artifact, No full multiphase
Additional Notes	Prospective, In TAVR queue / inpatient, please model Sapien 29 mm nominal to 9 cc overexpansion;

STJ View



Annulus View





Left-Coronary Cusp

Right-Coronary Cusp

1. Blanke P et. al., J Am Coll Cardiol Img. 2019 Jan, 12 (1) 1–24

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Case Summary

Valve	% Oversizing [2]	Coronary Analysis [3,4]	Stent Apposition	Stretch Analysis [5]
BE 29	-31.0% undersized	LCA DLC/d = 3.8 RCA DLC/d = 3.4	Largest gap = 2.9 mm	Max Stretch 1.0
BE 29 +5cc	N/A	LCA DLC/d = 3.7 RCA DLC/d = 3.2	Largest gap = 1.5 mm	Max Stretch 1.2
BE 29 +9cc	N/A	LCA DLC/d = 3.7 RCA DLC/d = 3.1	Largest gap = 0.2 mm	Max Stretch 1.2

DLC=distance of leaflet to coronary
d= diameter of coronary
<0.7 =high risk of obstruction
0.7-1 intermediate risk
>1 low risk

Gap Analysis <2.5 mm 0 – trace PVL

Stretch Analysis >1.5 increased risk for annular injury

2. Blanke P, et. al., JACC: Cardiovascular Interventions (2017)
3. Holst K, et. al., The Annals of Thoracic Surgery (2024)
4. Heitkemper M, et. al., J Thorac Cardiovasc Surg. (2020)
5. Sirset, T. et al. J Am Coll Cardiol Intv. (2023)

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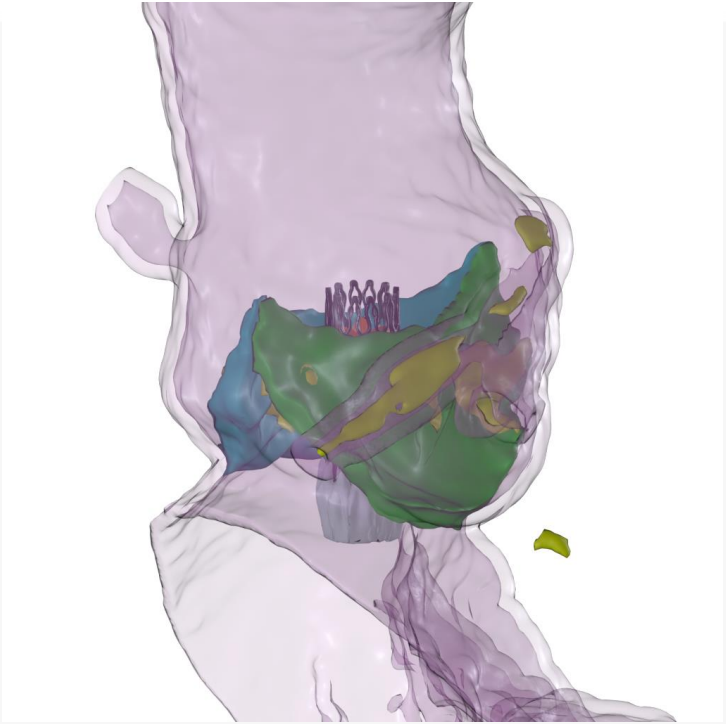
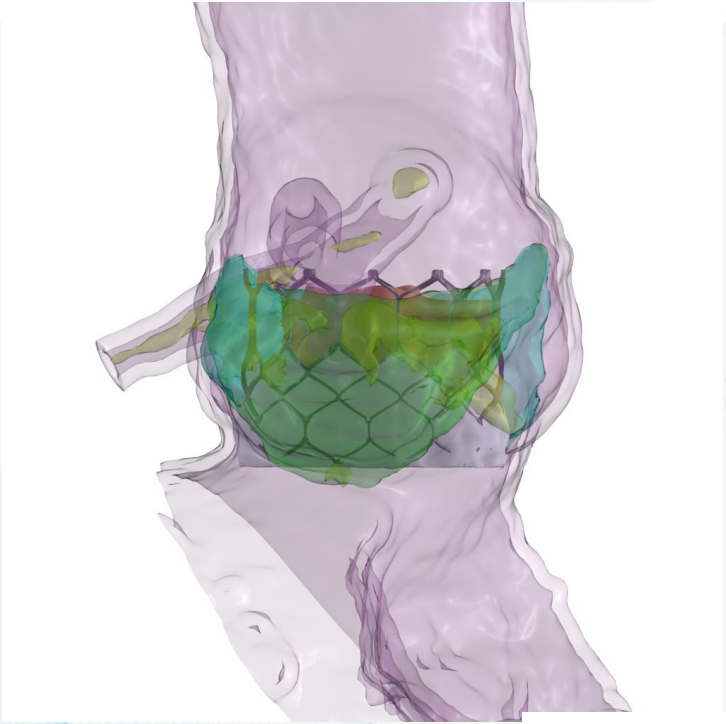
Balloon-Expandable 29 +5cc Expansion Animation

Left-Coronary Cusp

Right-Coronary Cusp

DASI Simulations





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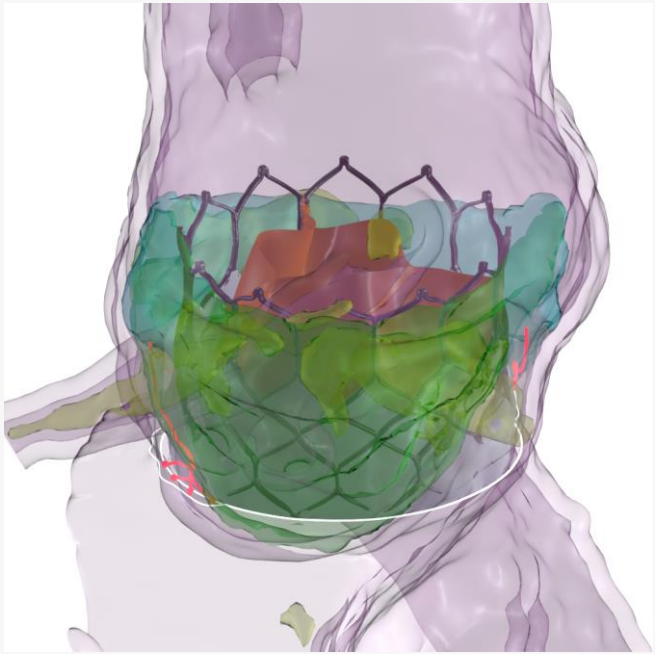
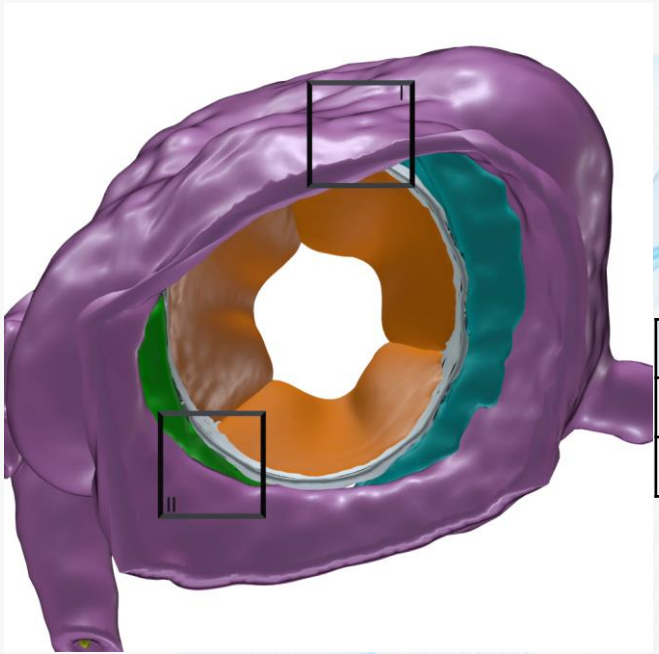
Balloon-Expandable 29 +5cc THV Apposition

Flow Trajectories



Annulus View



Left-Coronary Cusp

Right-Coronary Cusp

Gap Assessment

Gap	Thickness [mm]
I	1.5
II	0.8

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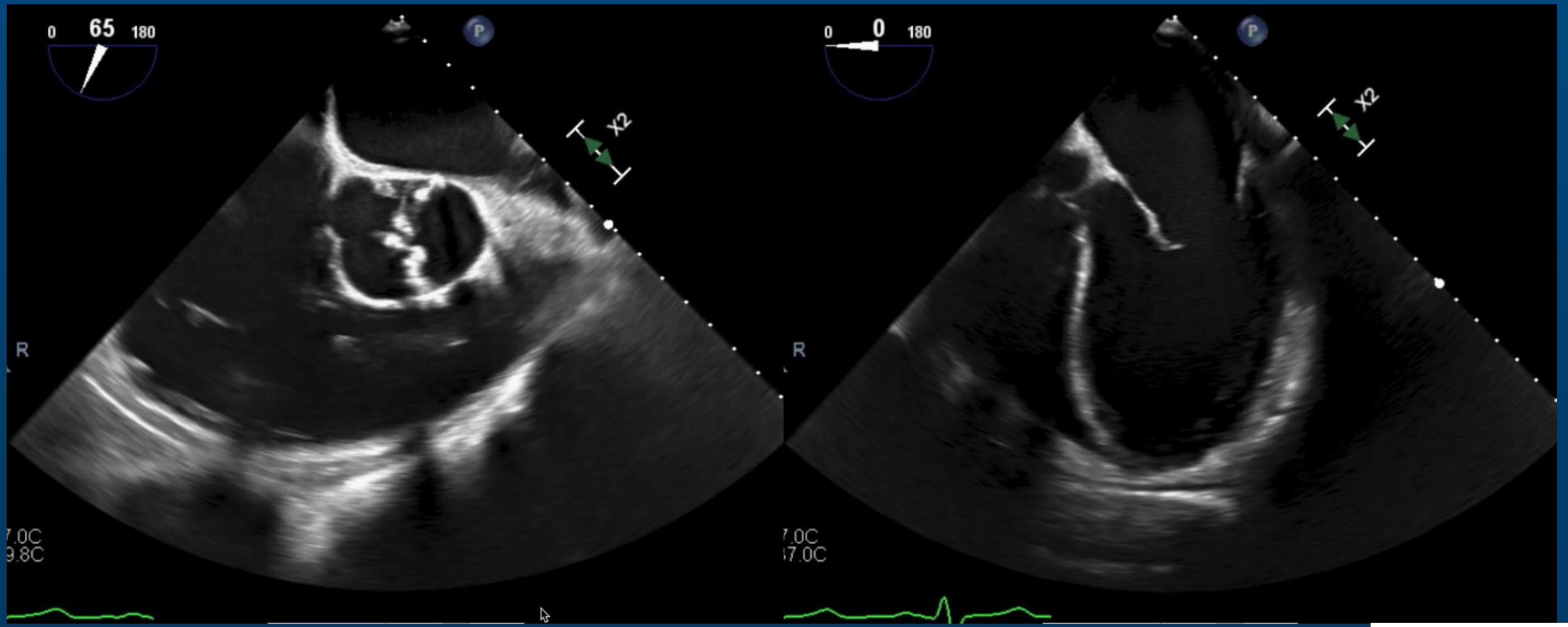
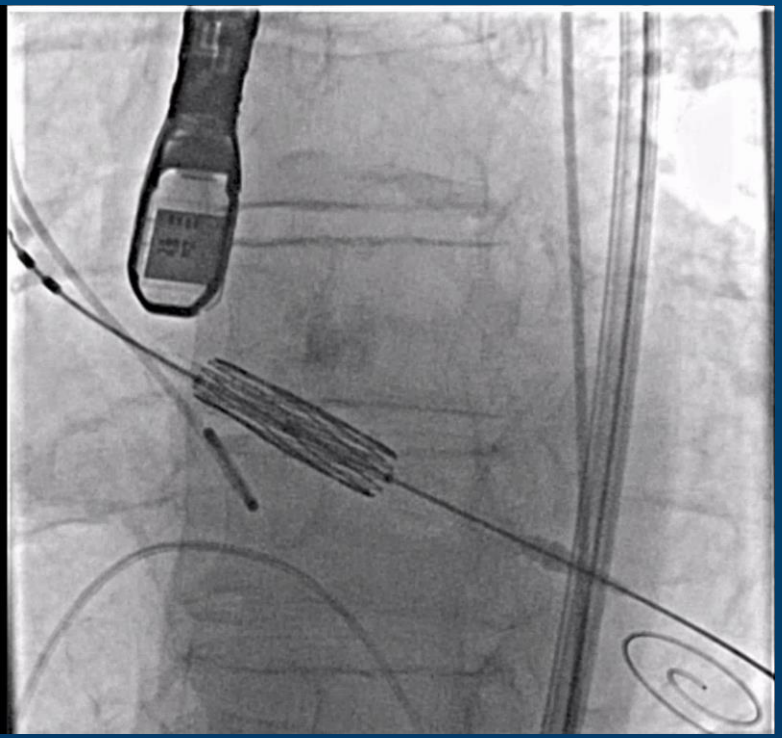
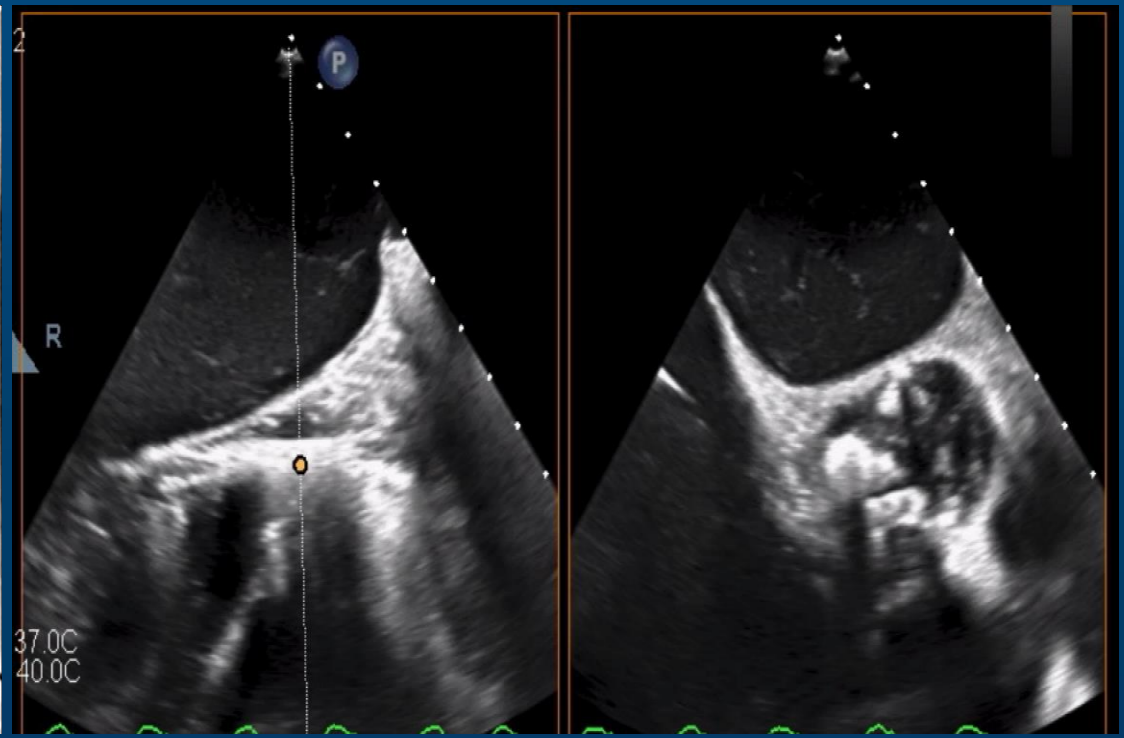

0
65
180
P
X2
R
0
0
180
P
X2
R

Right transfemoral with GA and TEE guidance

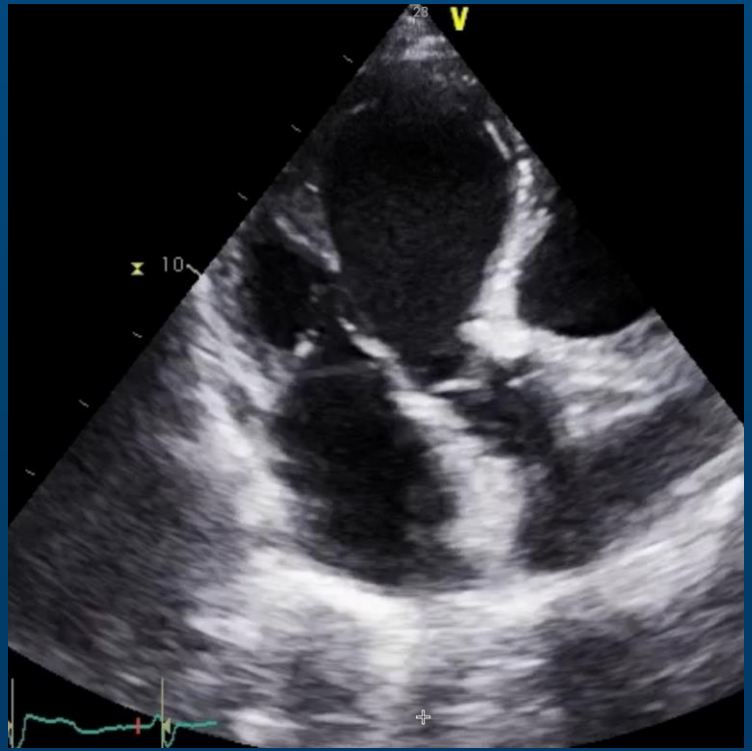




29 mm Sapien 3 Ultra Resilia +5 cc

Follow Up

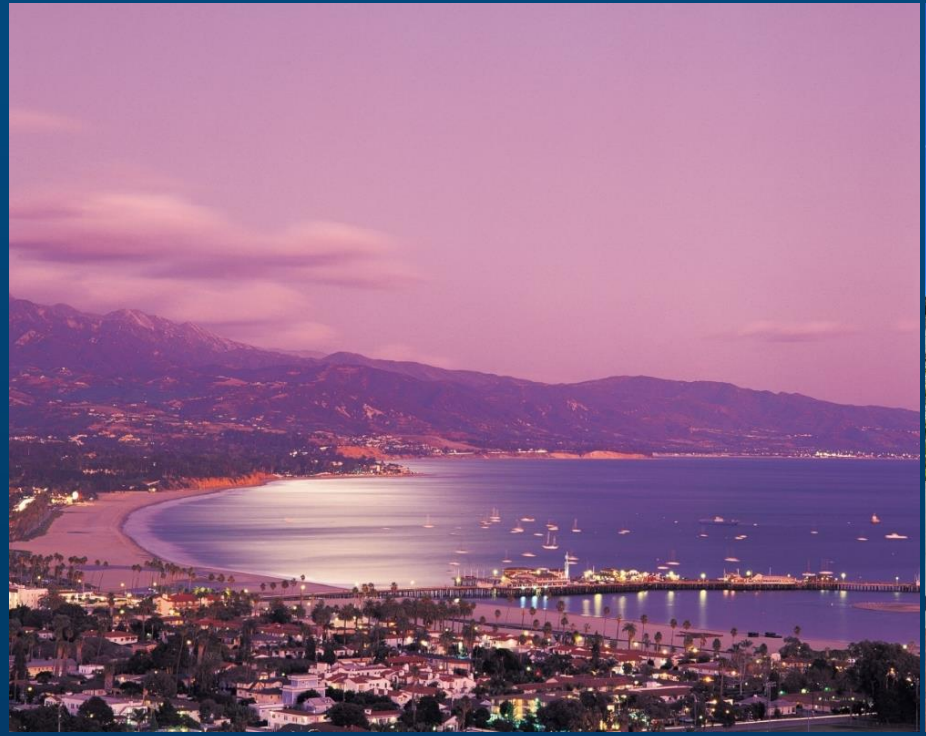
- Discharged in 24hr
- Follow up echo at 1 month showed modest improvement in LVEF, no PVL or central AI
- Class I symptoms



Conclusion

- The use of predictive modeling software was essential to success of the case.
- +5cc for balloon volume predicted the lowest risk of rupture, significant PVL, central AI and embolization.
- Our Heart Team has elected to perform DASI modeling on cases with large annuli, borderline coronary heights, and all patients younger than 75 years old.

Thank You



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