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REGIONAL MEDICAL CENTER
The Heart Institute

VIV-for degenerative valvular disease
瓣中瓣治疗外科生物瓣/TAVR瓣功能障碍

05/17/25

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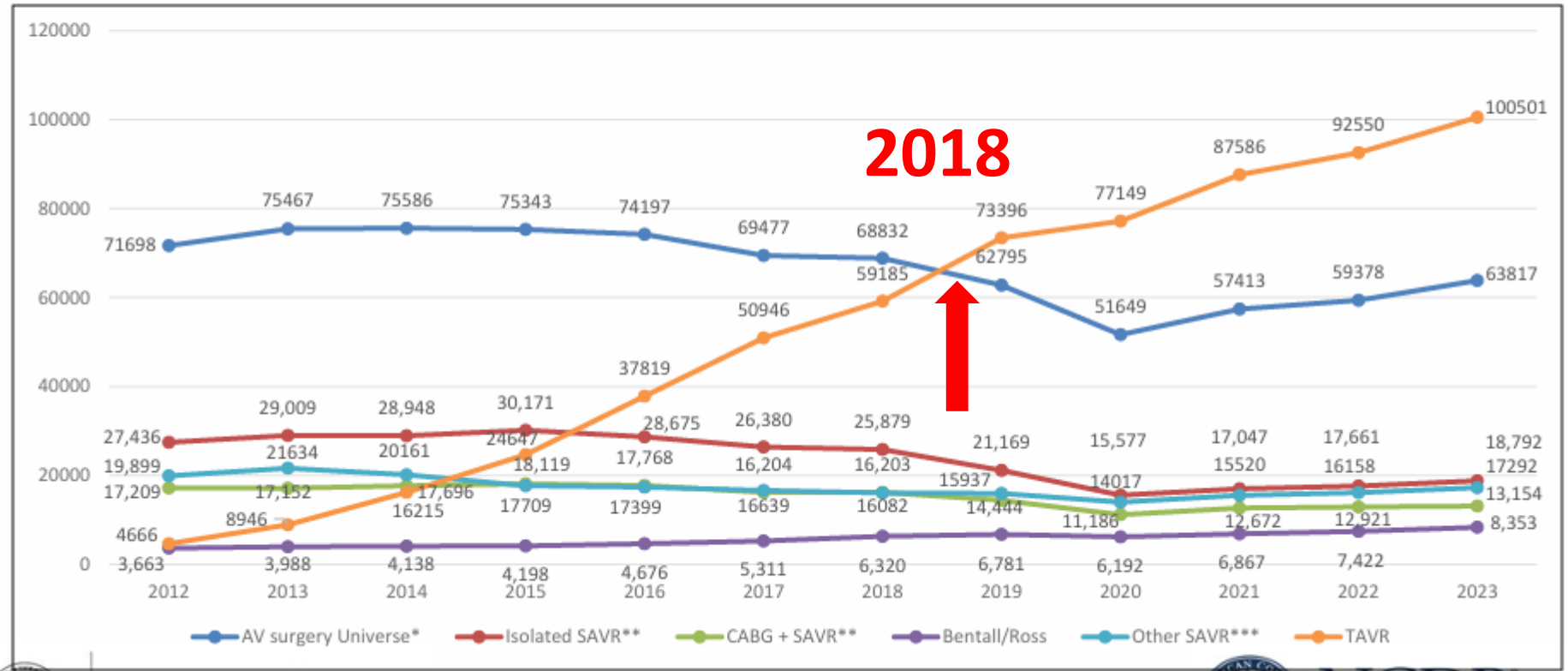
Aortic Valve Universe Slide



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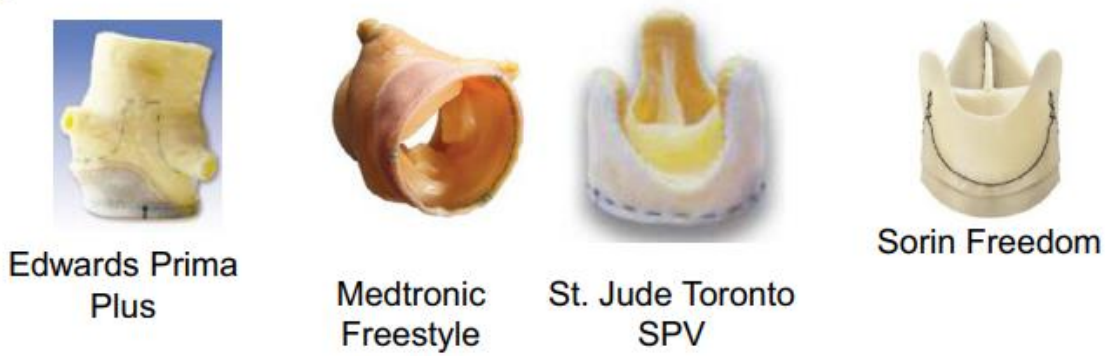
NCDR
NATIONAL CARDIOVASCULAR DATA REGISTRY

A **Stented pericardial bovine bioprosthetic valves**.

B **Stented porcine aortic valve bioprostheses**

C **Stentless bioprosthetic valves**.



Piazza et al JACC: Cardiovs Interv 2011;4 (7):721–32

外科生物瓣功能障碍的原因

SVD is an irreversible process manifested by gradual degenerative changes in the prosthesis, such as pannus growth, leaflet fibrosis and calcification, delamination of the connective tissue, and emergence of ruptures and perforations. Ultimately, this results in a BHV failure, cause stenosis or regurgitation

The onset of SVD generally occurs 7 to 8 years after BHV implantation, with freedom from SVD rates substantially decreasing 10 to 15 years after surgery.

Kostyunin et al JAHA. 2020;9:e018506

Table 1. Main aetiologies for failure of surgical bioprosthetic heart valves.

Structural valve deterioration (SVD)	生物瓣结构损害
Non-structural valve dysfunction	非生物瓣结构损伤
Paravalvular regurgitation	瓣周漏
Prosthesis-patient mismatch	患者假体不匹配
Valve thrombosis	血栓形成
Endocarditis	心内膜炎

Tarantini et al, EuroInterv 2021;17:709-719.

Proposed definition of structural valve deterioration (SVD) – European Association of Percutaneous Cardiovascular Interventions (EAPCI) endorsed by ESC and EACTS (2017)

欧洲

	Echocardiographic findings
Stage 0 (no SVD)	Normal valve morphology and function
Stage 1 (morphological SVD)	Intrinsic permanent structural changes to the prosthetic valve (leaflet integrity or structure abnormality, leaflet function abnormality, strut/frame abnormality)
Stage 2 (moderate haemodynamic SVD)	Mean transprosthetic gradient ≥20 mmHg and <40 mmHg Mean transprosthetic gradient ≥10 and <20 mmHg change from baseline Moderate intraprosthetic aortic regurgitation, new or worsening (>1+/4) from baseline
Stage 3 (severe haemodynamic SVD)	Mean transprosthetic gradient ≥40 mmHg Mean transprosthetic gradient ≥20 mmHg change from baseline Severe intraprosthetic aortic regurgitation, new or worsening (>2+/4) from baseline

Tarantini et al, EuroInter 2021;17:709-719.

美国 SVD 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

Dvir et al Circ 2018;137:388–399.

生物瓣结构损害定义

严重的血流动力学 **SVD**（以下任何一项）

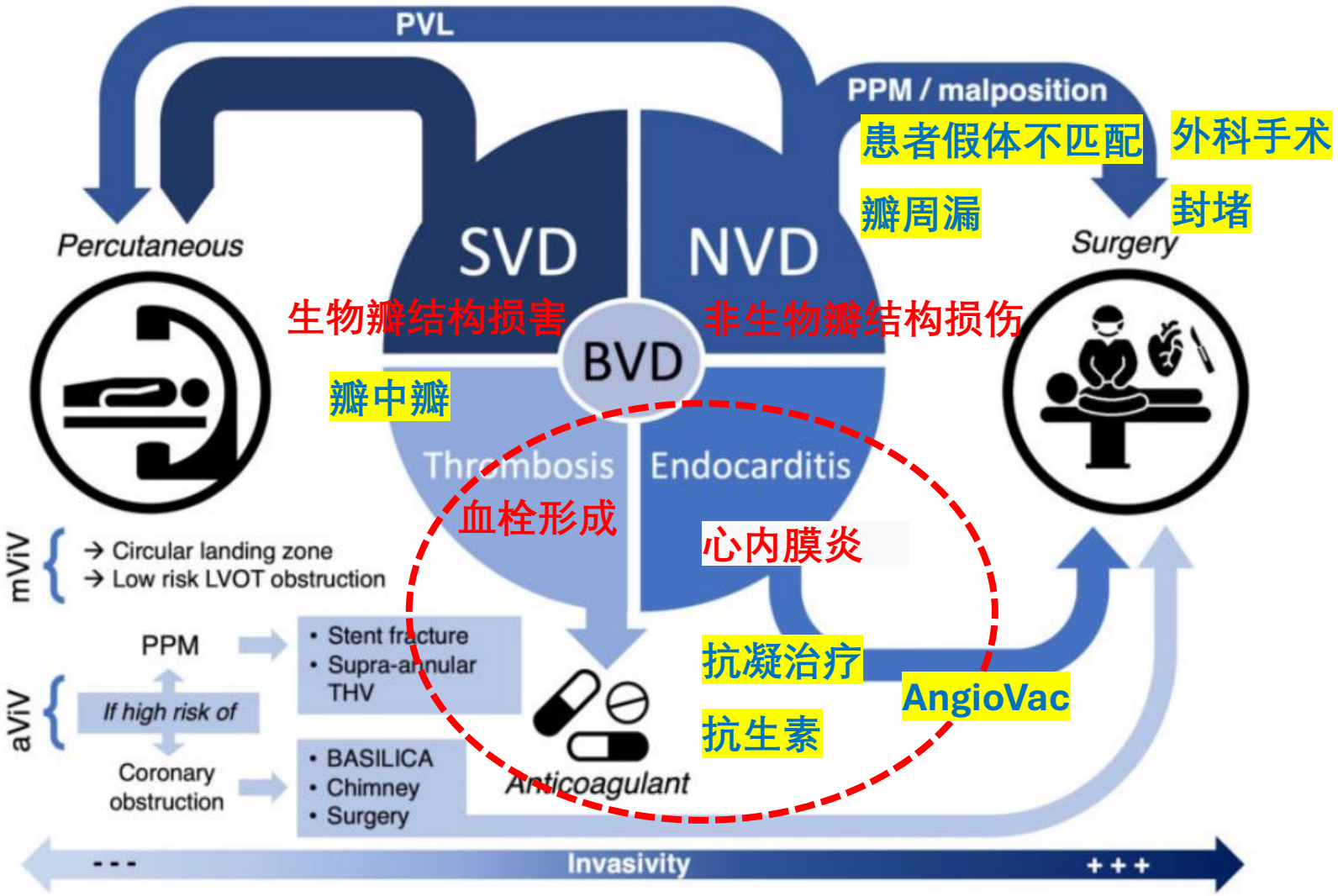
生物瓣平均压差 >_40 mmHg
于基线相比生物瓣平均压差变化 >_20 mmHg
生物瓣内严重主闭，较基线恶化主闭（>2+/ 4+）

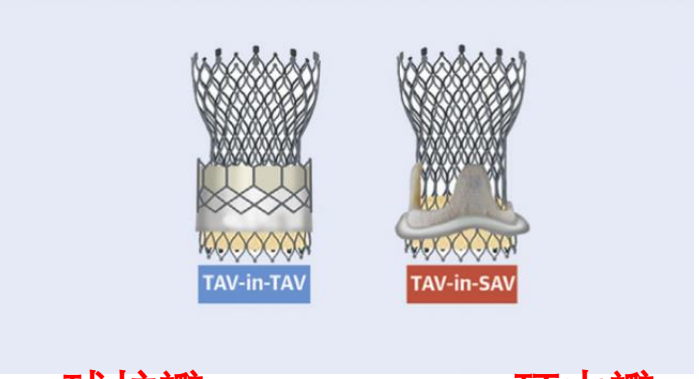
ESC
European Society of Cardiology

Aortic and mitral bioprosthetic valve dysfunction: surgical or percutaneous solutions?

Igor Belluschi, Nicola Buzzatti, Alessandro Castiglioni, Michele De Bonis, Francesco Maisano, and Ottavio Alfieri*

Belluschi, EHJ Supple. 2021; 23 (Supplement E), E6–E12





球扩瓣 Balloon-expandable 环中瓣

Edwards Sapien 3

Edwards Sapien 3 Ultra

自膨瓣 Self-expanding

环上瓣 Supra-annular

Medtronic CoreValve Evolut PRO+

Boston Scientific ACURATE neo2

JenaValve

Intra-annular

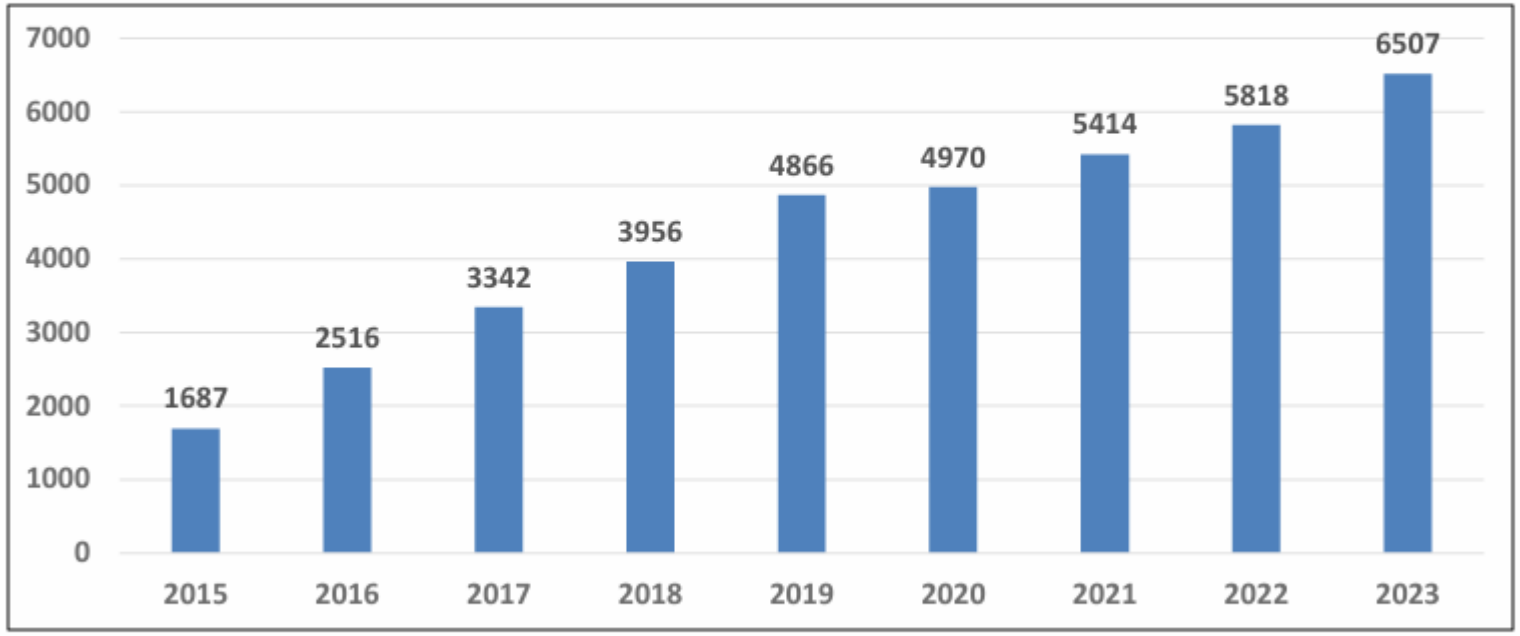
环中瓣

Abbott Portico

Abbott Navitor

TAVR
Valve in Valve

(Includes TAVR in Prior Surgical AVR and TAVR in prior TAVR)



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Source: STS/ACC TVT Registry Database

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瓣中瓣安全性

Valve-in-Valve TAVR vs Native Valve TAVR for AS

Circulation: Cardiovascular Interventions

ORIGINAL ARTICLE

Valve-in-Surgical-Valve With SAPIEN 3 for Transcatheter Aortic Valve Replacement Based on Society of Thoracic Surgeons Predicted Risk of Mortality

Tsuyoshi Kaneko, MD; Raj R. Makkar, MD; Amar Krishnaswamy, MD; James Hermiller, MD; Adam Greenbaum, MD; Vasilis Babaliaros, MD; Pinak B. Shah, MD; Stephen H. Bailey, MD; Vinnie Bapat, MD; Samir Kapadia, MD; Amr E. Abbas, MD

在 2015 年 6 月至 2020 年 1 月，所有 SAPIEN 3 和 Ultra 瓣膜的经股 VIV-TAVR 使用 STS 评分来分组 （低危：<4%，中危：4%≤和≤8%，高危险：>8%）。与 TAVR 的患者进行倾向匹配 (1:3) 分析 比较。

在 145917 名 SAPIEN 3 TAVR 患者中，4460 名 (3%) 接受了经股动脉 VIV-TAVR

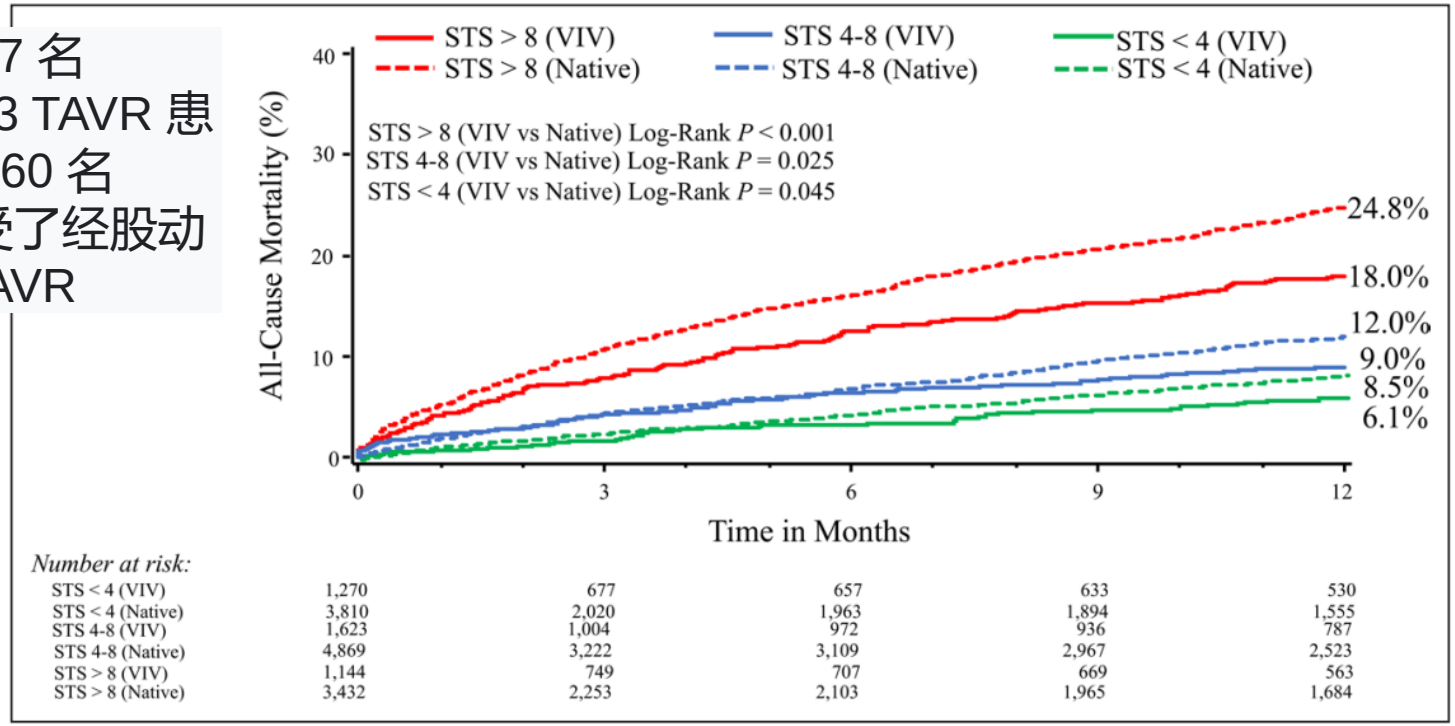

Figure 2. One-year all-cause mortality, transcatheter aortic valve replacement (TAVR)–valve-in-valve (VIV) vs TAVR-native by Society of Thoracic Surgery (STS) score.

30 天死亡率 两组相似，
1 年死亡率VIV-TAVR 比第一次TAVR患者低

Kaneko et al Circ Cardiovasc Interv. 2021;14:e010288

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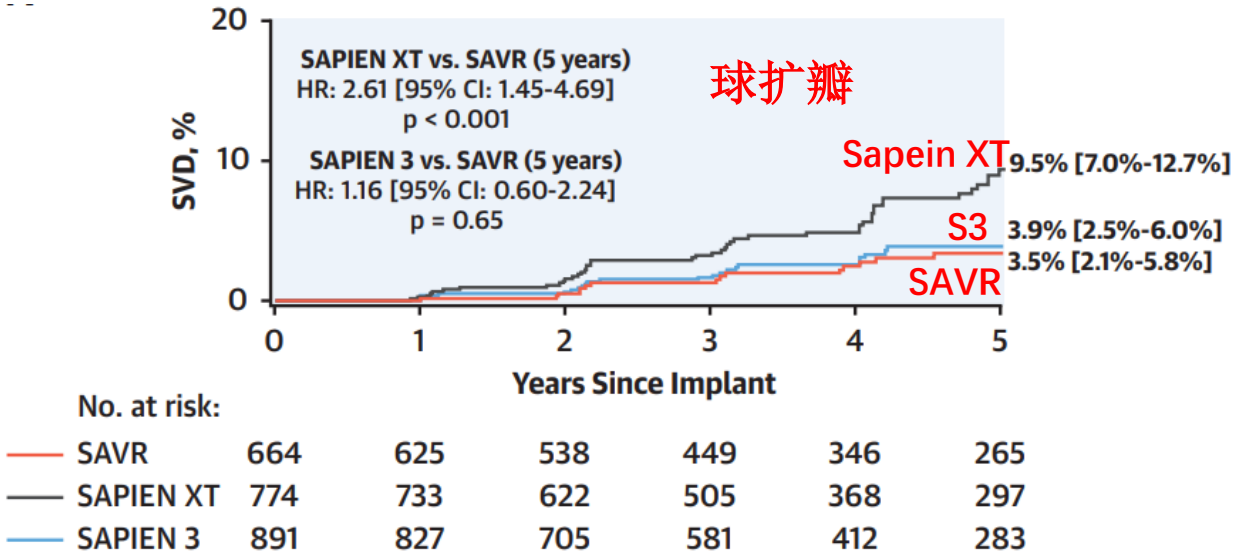
Structural Deterioration of Transcatheter Versus Surgical Aortic Valve Bioprostheses in the PARTNER-2 Trial

瓣膜耐久性

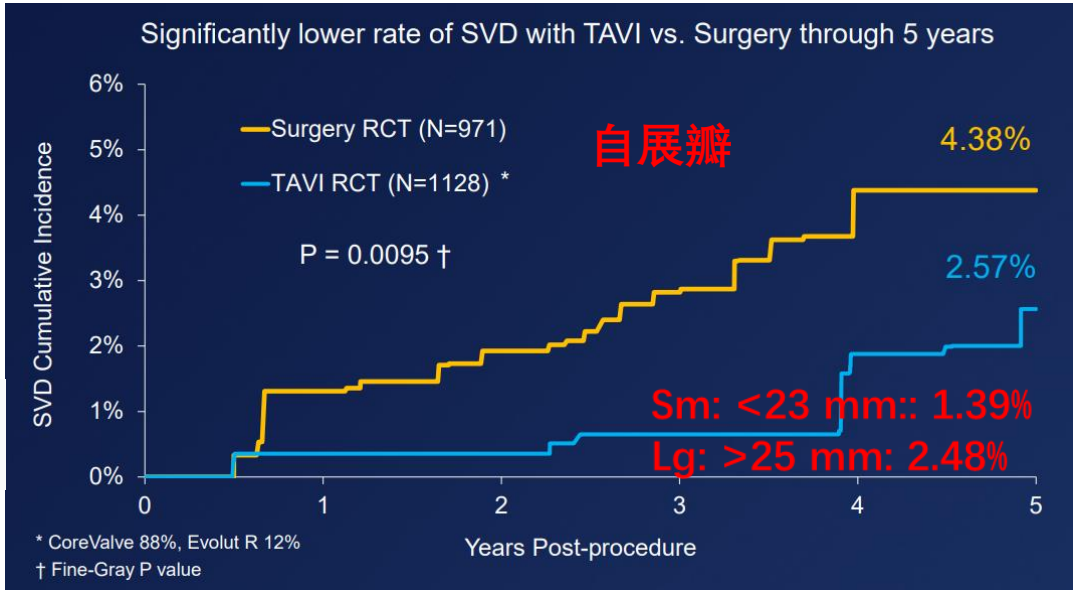


Compared with SAVR, SAPIEN XT has a higher 5-year rate of SVD, whereas SAPIEN 3 has a rate of SVD that was not different from SAVR

Pibarot et al, JACC 2020;76:1830–43

SAVR 相比，第二代 SAPIEN XT 球囊扩张瓣膜的 5 年SVD 率更高，而第三代 SAPIEN 3 的 SVD 率与 SAVR 没有区别。

5-Year Incidence, Outcomes and Predictors of Structural Valve Deterioration of Transcatheter and Surgical Aortic Bioprostheses:
Insights from the CoreValve US Pivotal and SURTAVI Trials



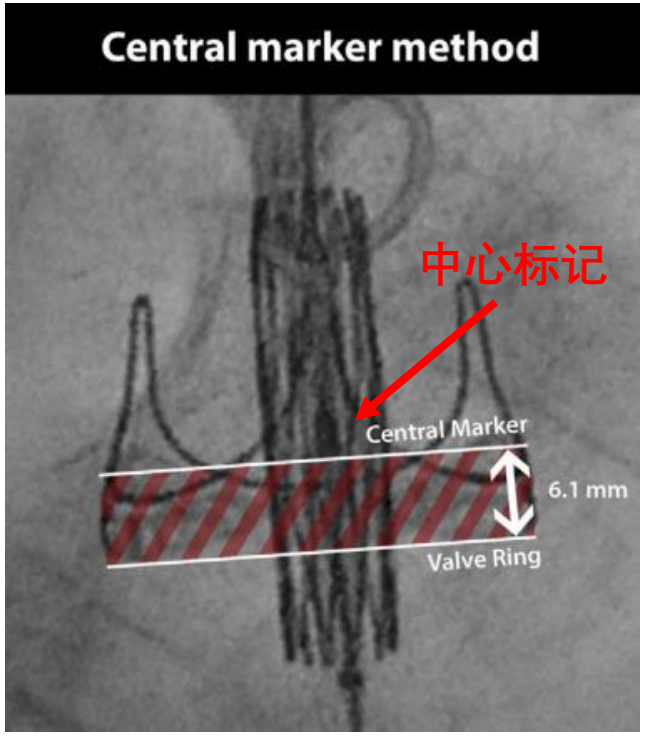
外科生物瓣TAVR瓣中瓣：如何确定经导管心脏瓣膜最佳定位

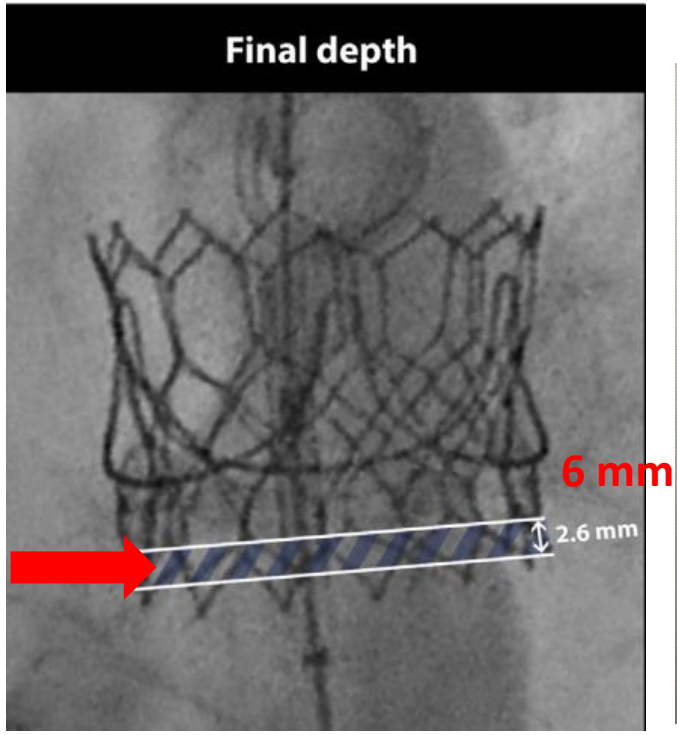
Optimal S3 positioning in aortic ViV is associated with better outcomes
Central marker bottom position should be 3 mm to 6 mm above the ring

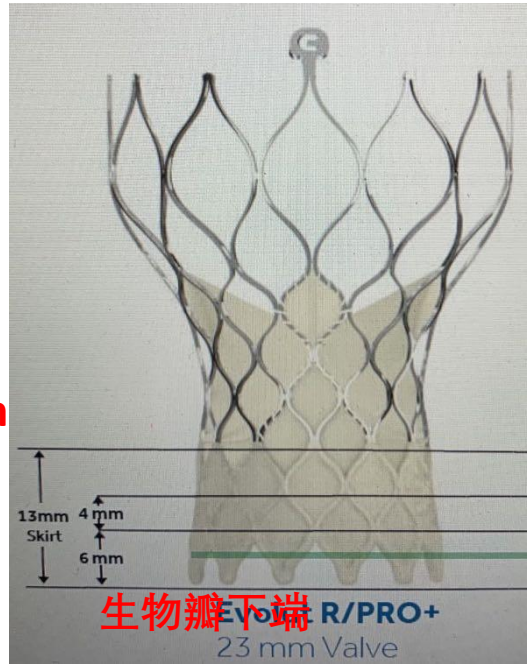
球扩瓣

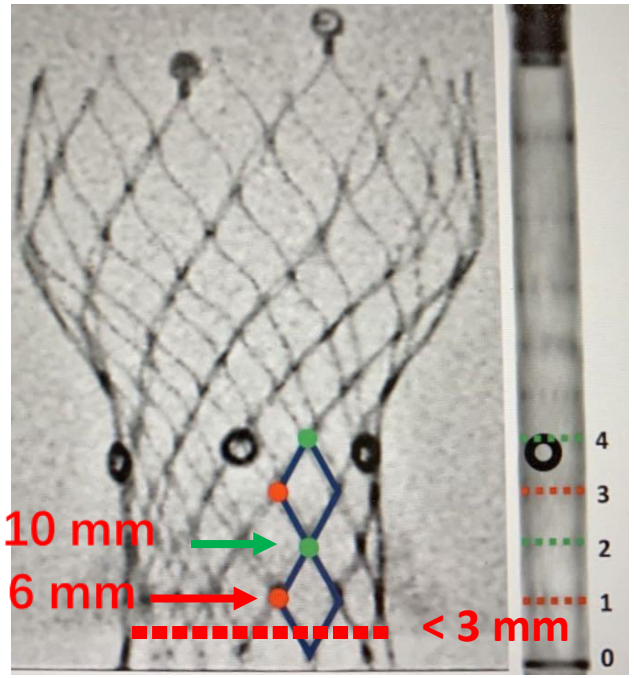
自展瓣

球扩瓣最佳定位： 中心标记底部位置应在环上方 3 毫米至 6 毫米处









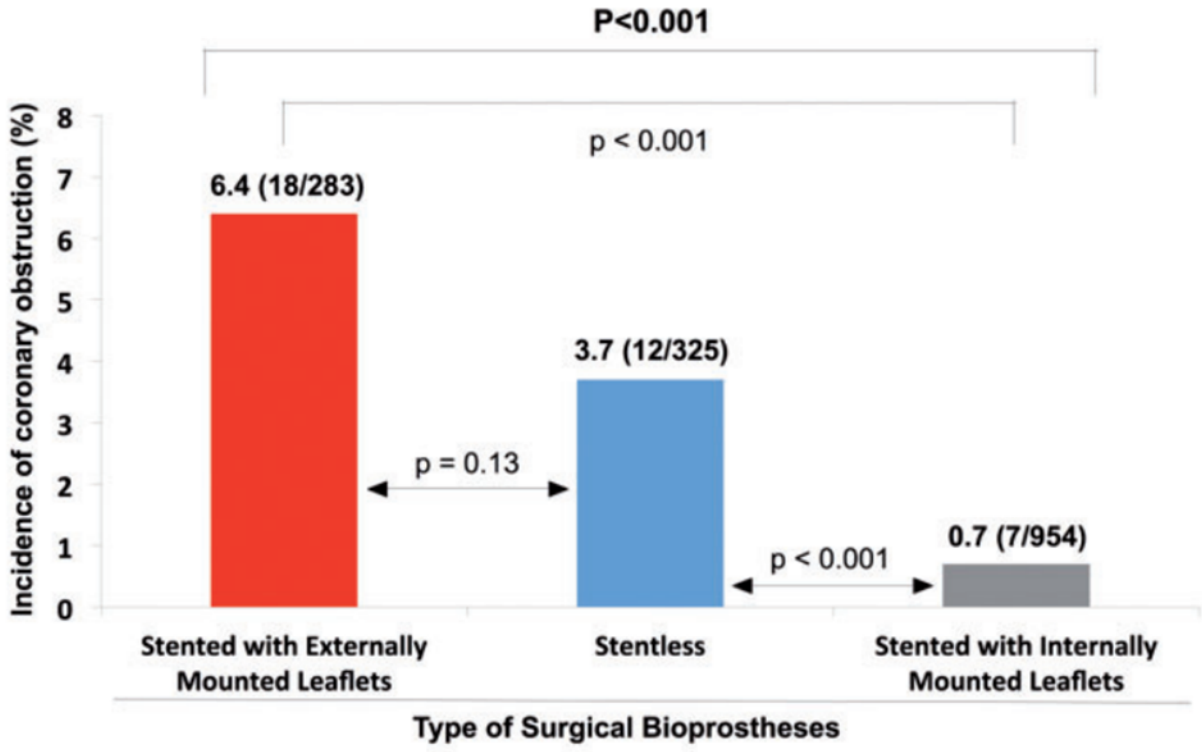
Simonato et al, JACC Intv 2019;12:1606–17

RISK FACTORS FOR CORONARY OBSTRUCTION
冠状动脉阻塞的危险因素

- Low-lying coronary ostia (< 12 mm)
- Narrow SOV or STJ
- Long leaflet length extending above coronary ostia
- Bulky/heavy calcified leaflet
- High implantation
- Externally mounted leaflets such as Mitroflow or Trifecta
- Stentless valve

- 低位冠状动脉开口 (< 12 mm)
- SOV/STJ 狭窄
- 较长的瓣叶延伸至冠状动脉开口上方
- 瓣叶体积大/严重钙化
- 高位植入
- 外置瓣叶，例如 Mitroflow 或 Trifecta
- 无支架瓣膜

Incidence of coronary obstruction following valve-in-valve procedures according to surgical bioprosthesis type

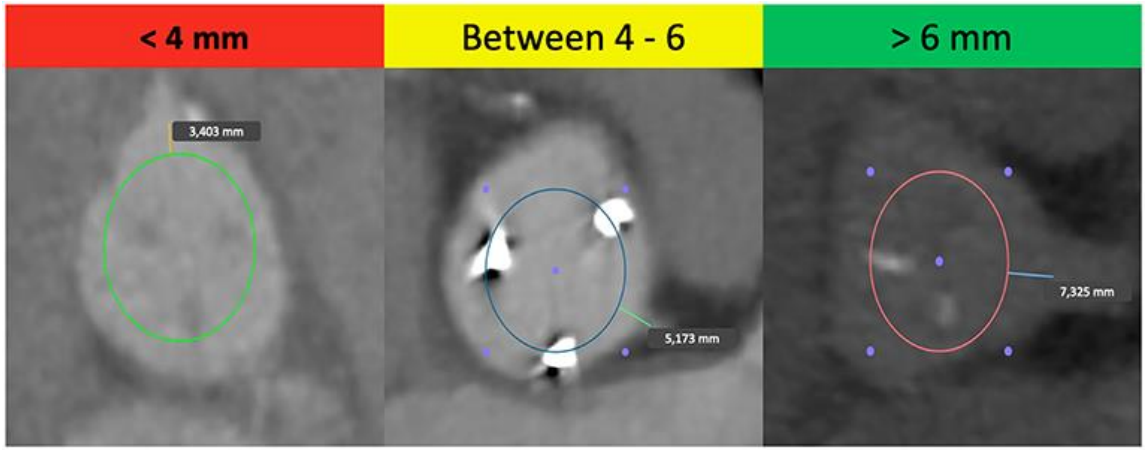


Ribeiro et al, EHJ 2018; 39, 687–695

Examples of the “virtual THV to coronary artery” distance (VTC) in high-risk, borderline and low-risk patients for coronary occlusion in TAVR-ViV procedure

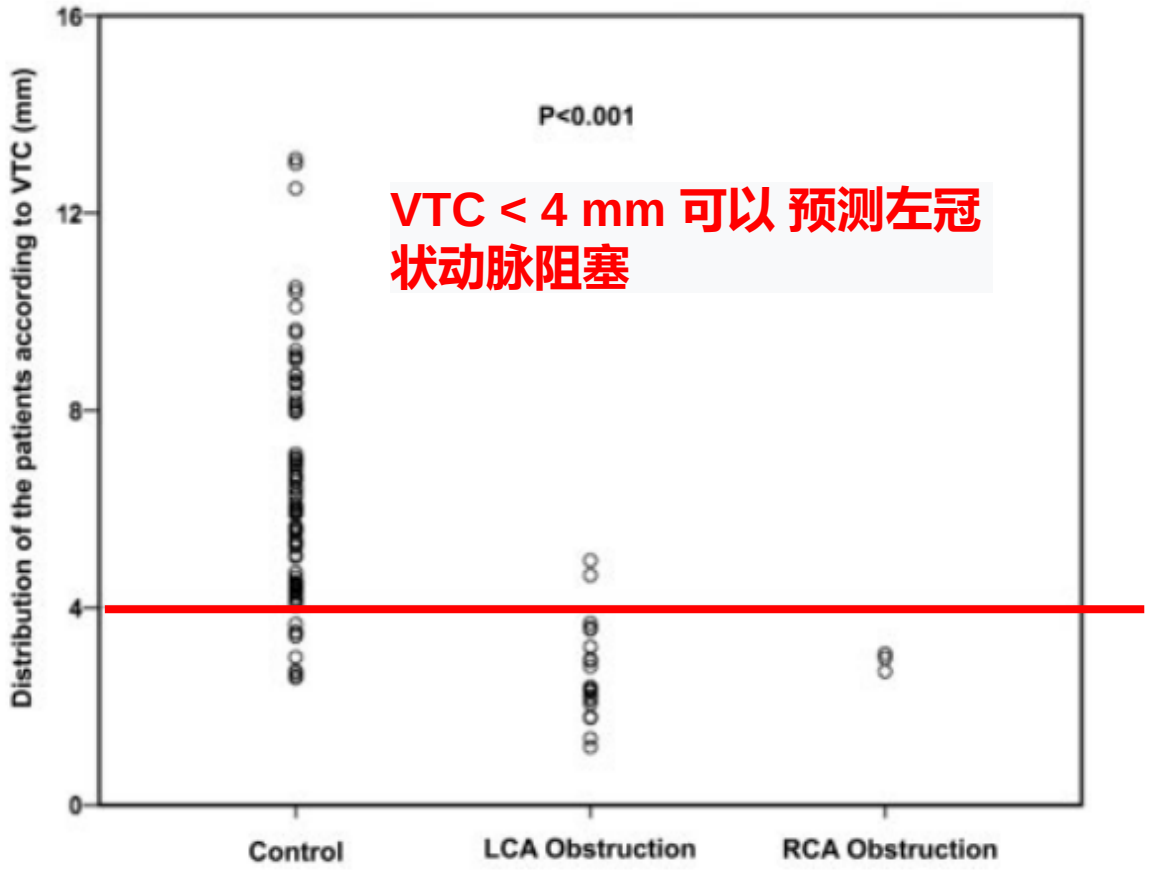
VTC：虚拟 THV 到冠状动脉开口”距离

高危　　中危　　低危



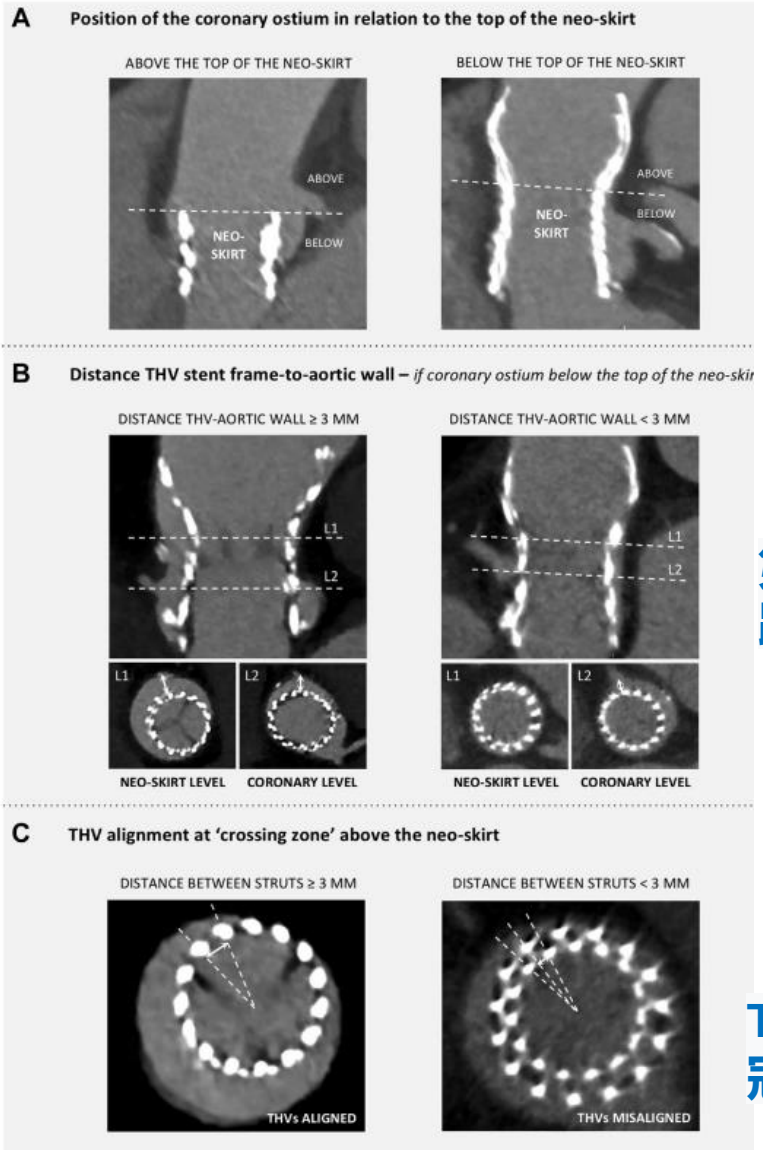
Valvo et al, Frontiers in Cardiovac Med. 2019;6:1-6

Distribution of distance of VTC in controls and in patients suffering coronary obstruction of the LCA and RCA



Ribeiro et al, EHJ 2018; 39, 687–695

TAVR瓣中瓣： 瓣膜选择-自膨瓣还是球扩瓣



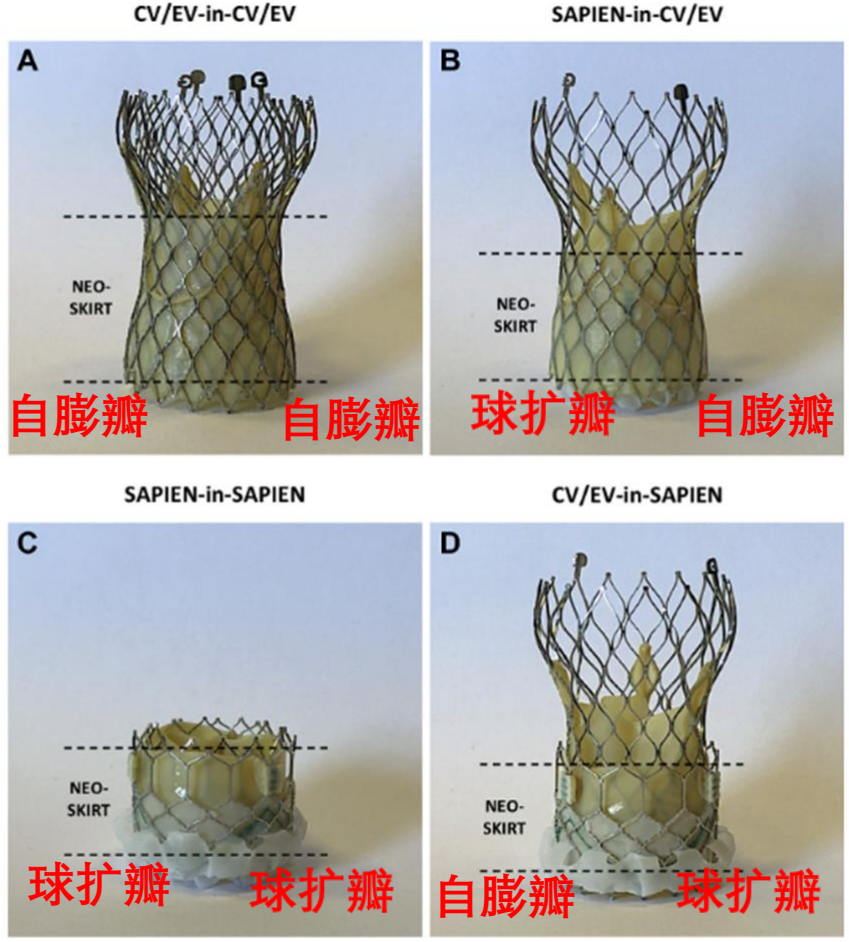
冠状动脉口相对于新裙顶部的位置- 上方还是下方

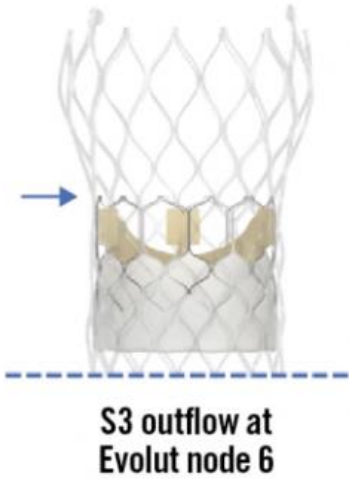
第一个 THV 和主动脉壁的距离

De Backer et al, JACC 2020;13:2528–38

THV 在新的裙边上方的冠脉开口水平处是否对齐

VIV in TAVR





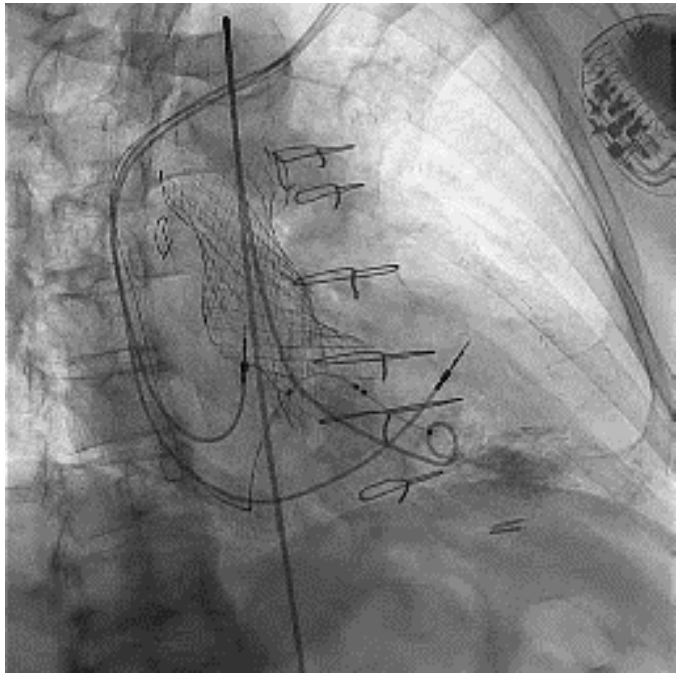
Case 1:

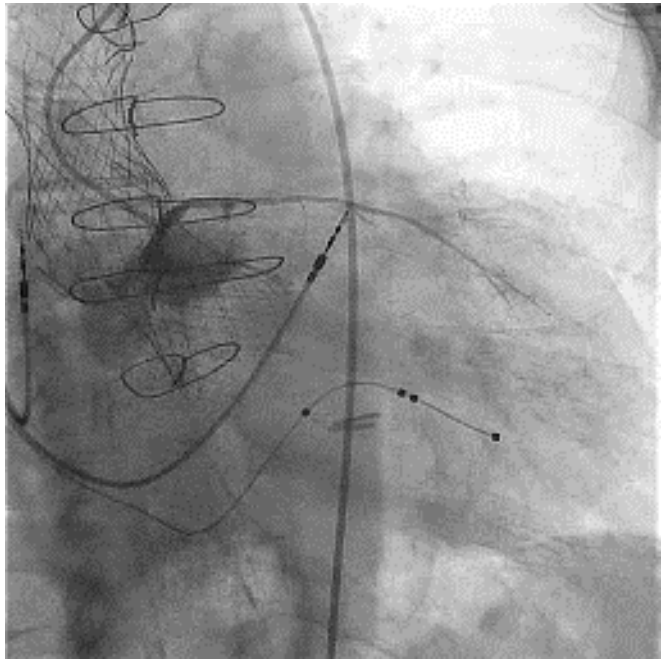
ViViV (TAVR –in- TAVR-in -TAVR)

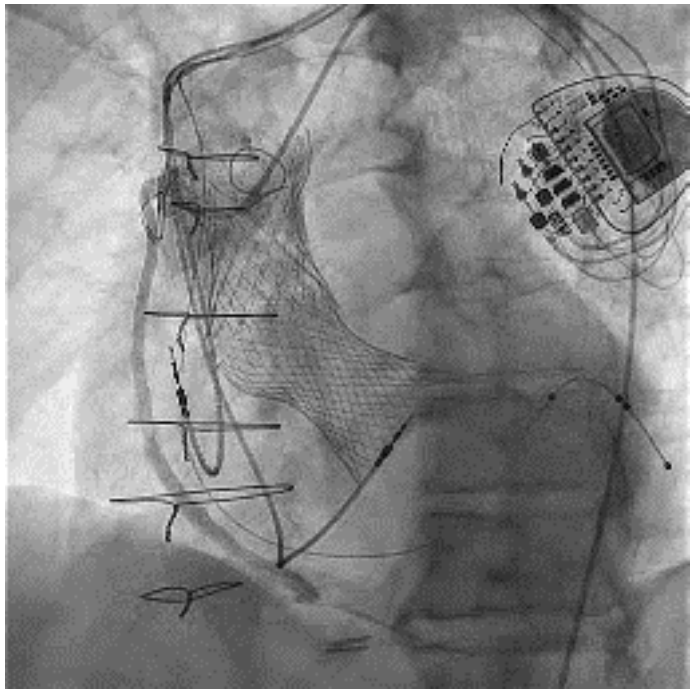
瓣中瓣：球扩瓣-自膨瓣

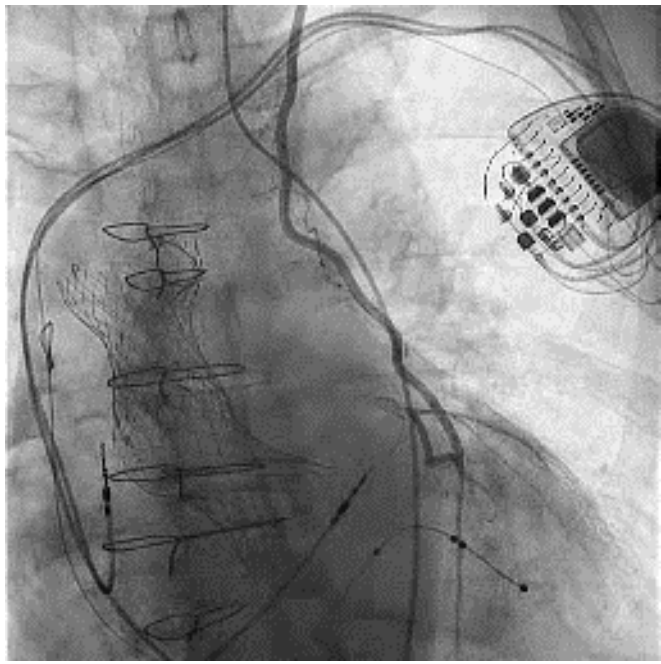
87-year-old male with PMH of HTN, CAD, S/P CABGx3 in 1996 (LIMA-LAD, SVG-OM3, SVG-PDA), AS, S/P TAVR with #34 mm CoreValve on 8/10/2017, MR, AF on Eliquis, intracranial hemorrhage, CHF, S/P ICD who presents with SOB for 2 weeks.

Cath on 1/24/23 showed severe CAD with 3 patent grafts with moderate stenosis of PDA graft.



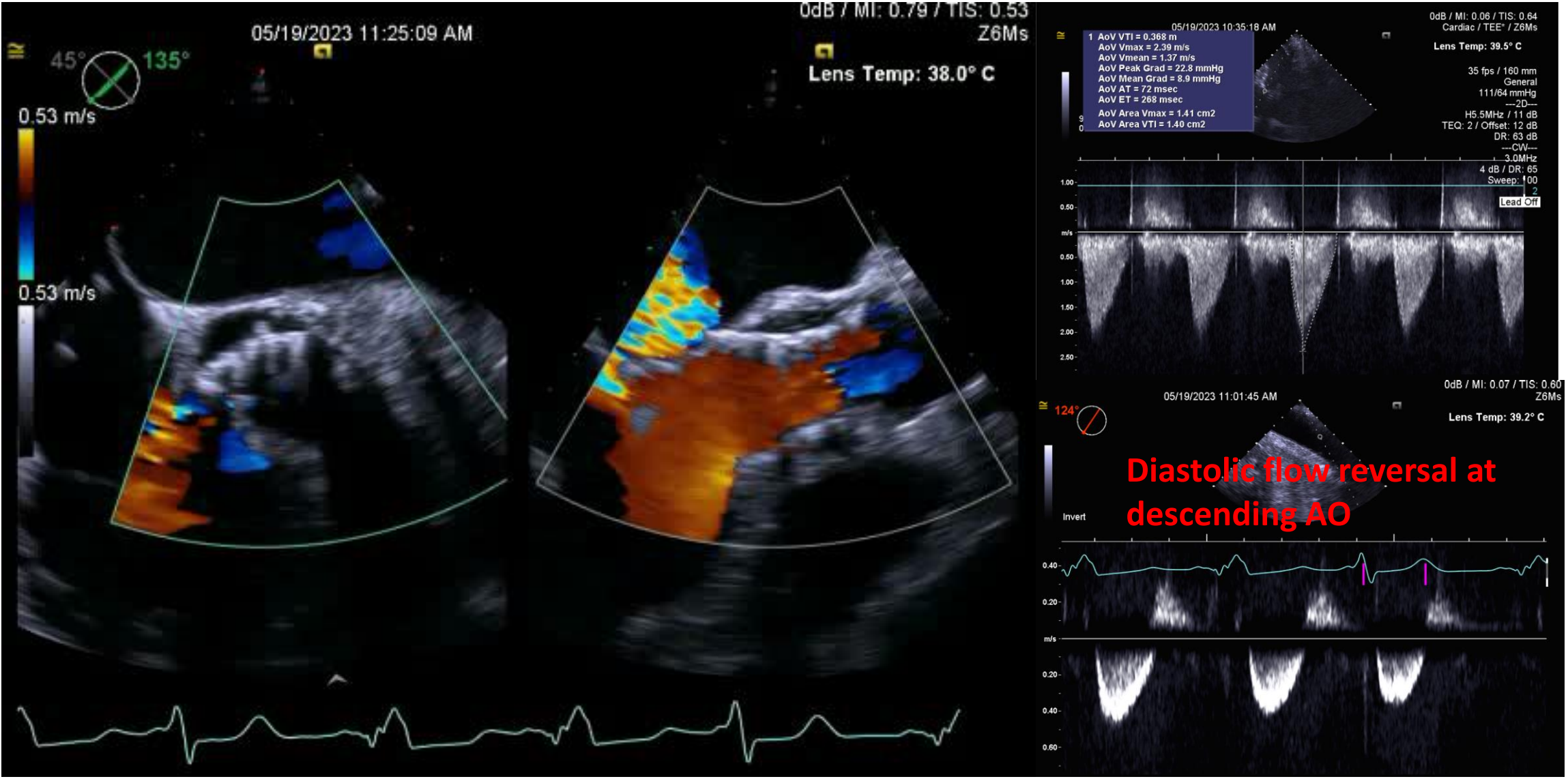






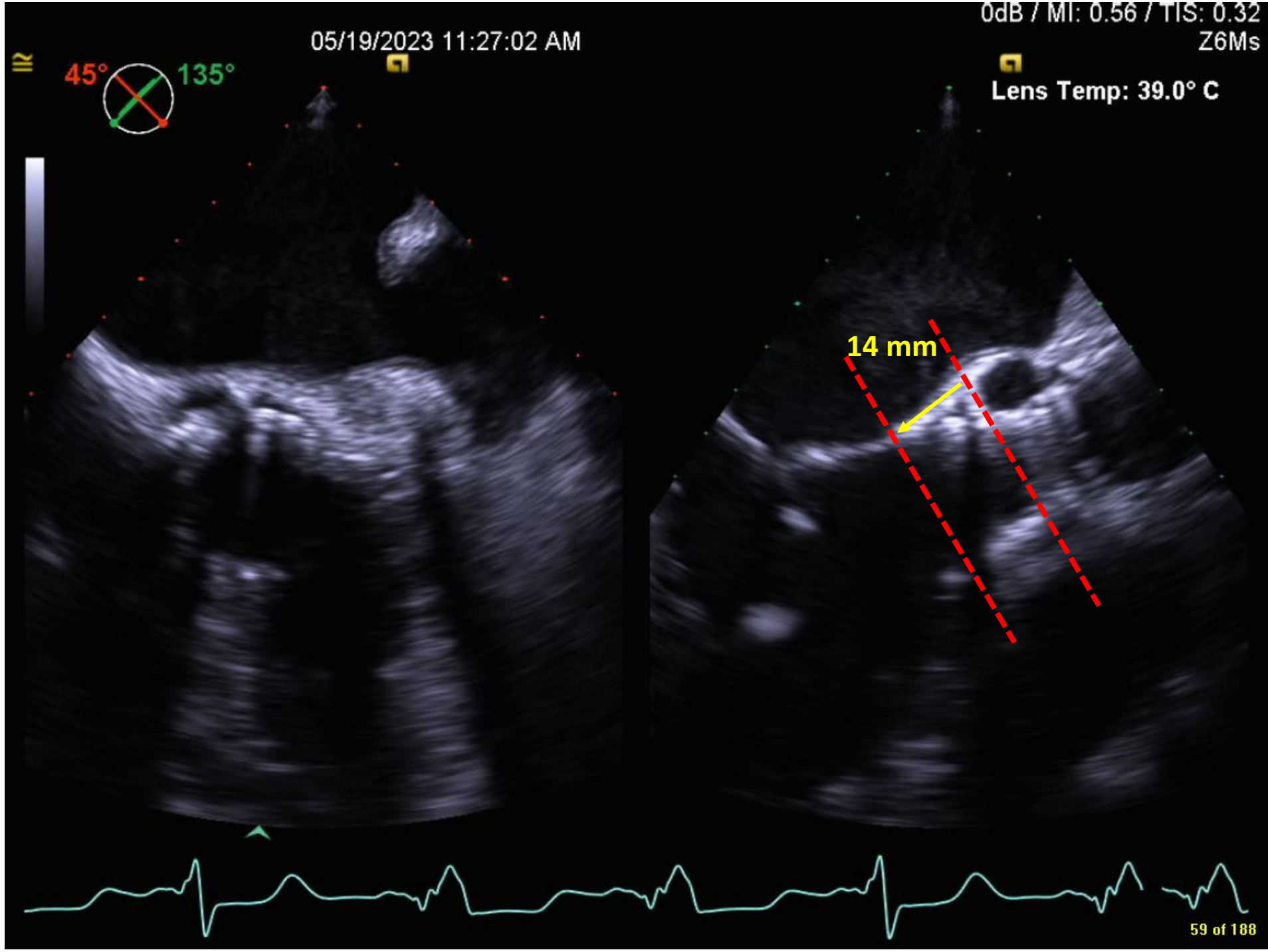
Case 1: 瓣中瓣：球扩瓣-自膨瓣

TEE: 5/19/2023



Case 1:

瓣中瓣：球扩瓣-自膨瓣



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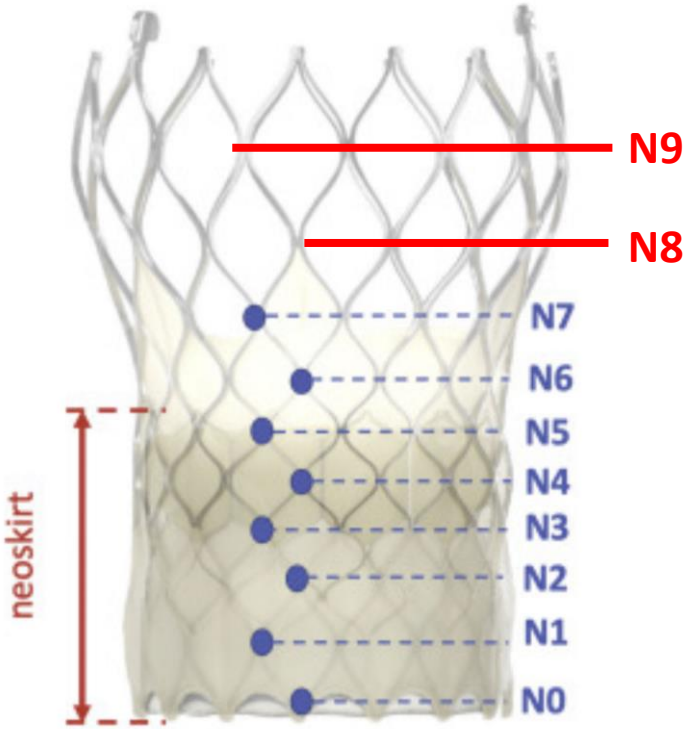
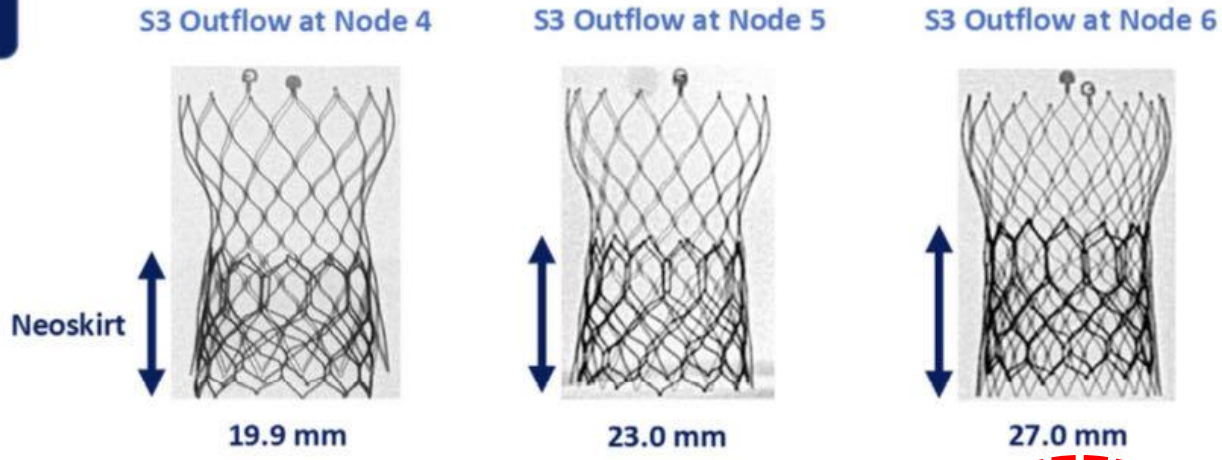
瓣中瓣：球扩瓣-自膨瓣



NEOSKIRT HEIGHT

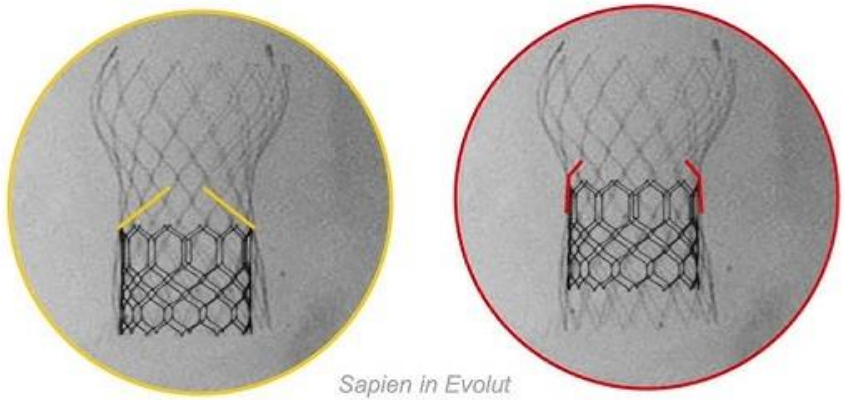
29mm S3
in 34mm Evolut

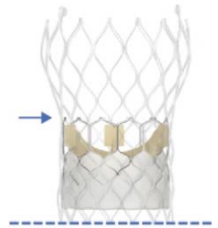


LEAFLET OVERHANG

What is Leaflet Overhang? 瓣叶悬垂

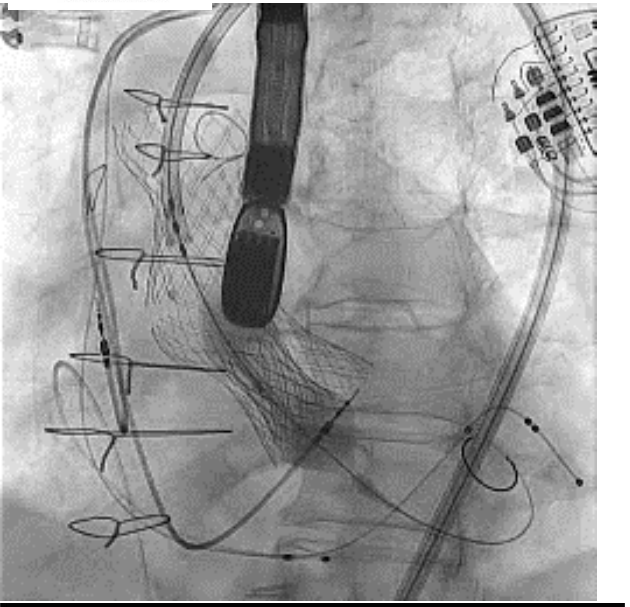
29mm S3
in 34mm Evolut

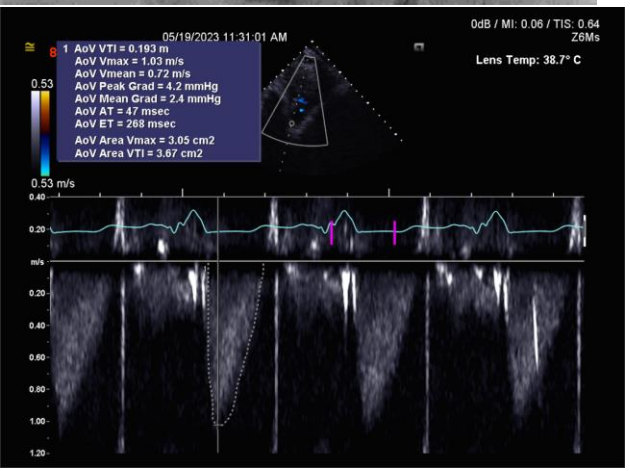


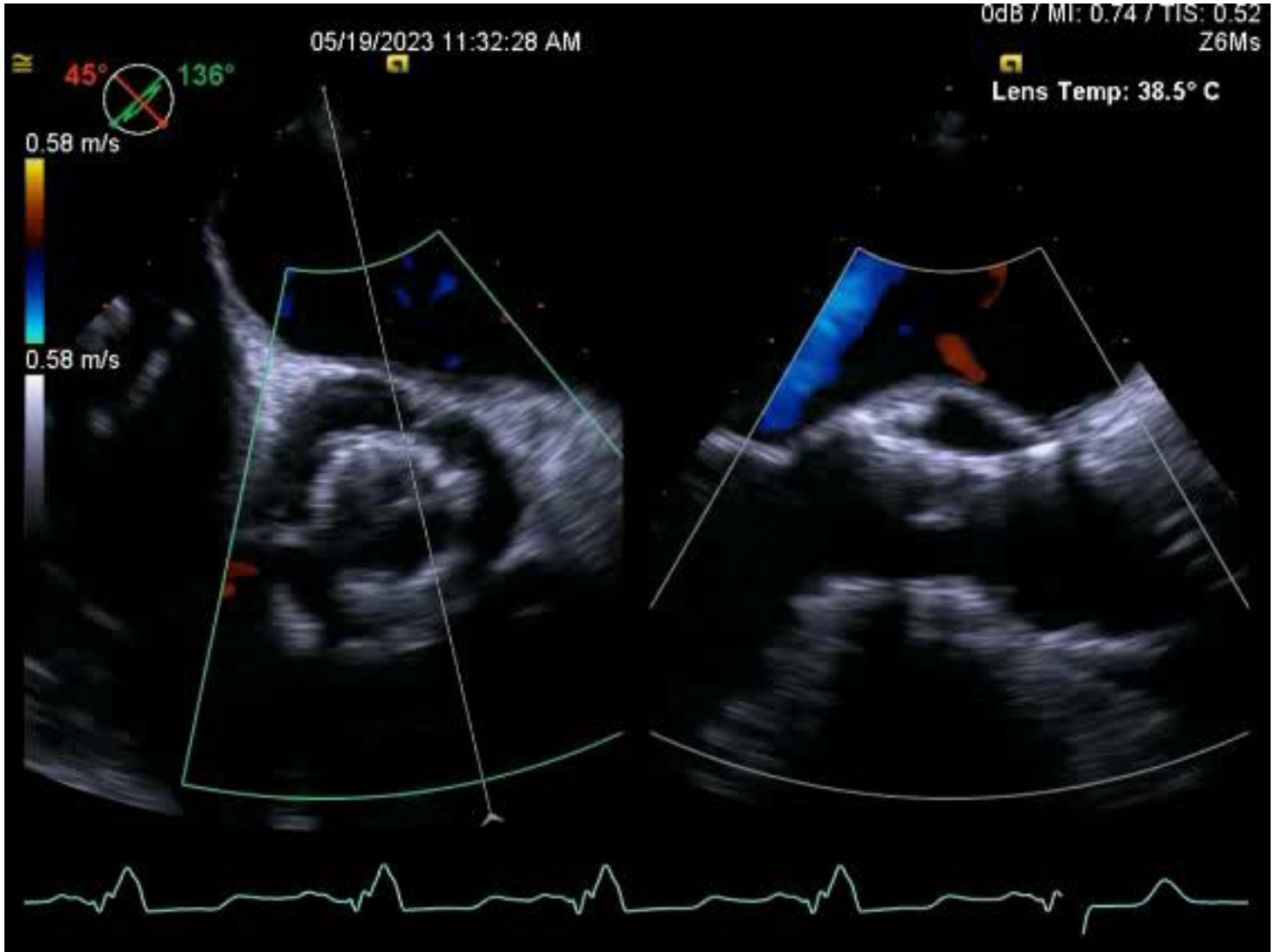


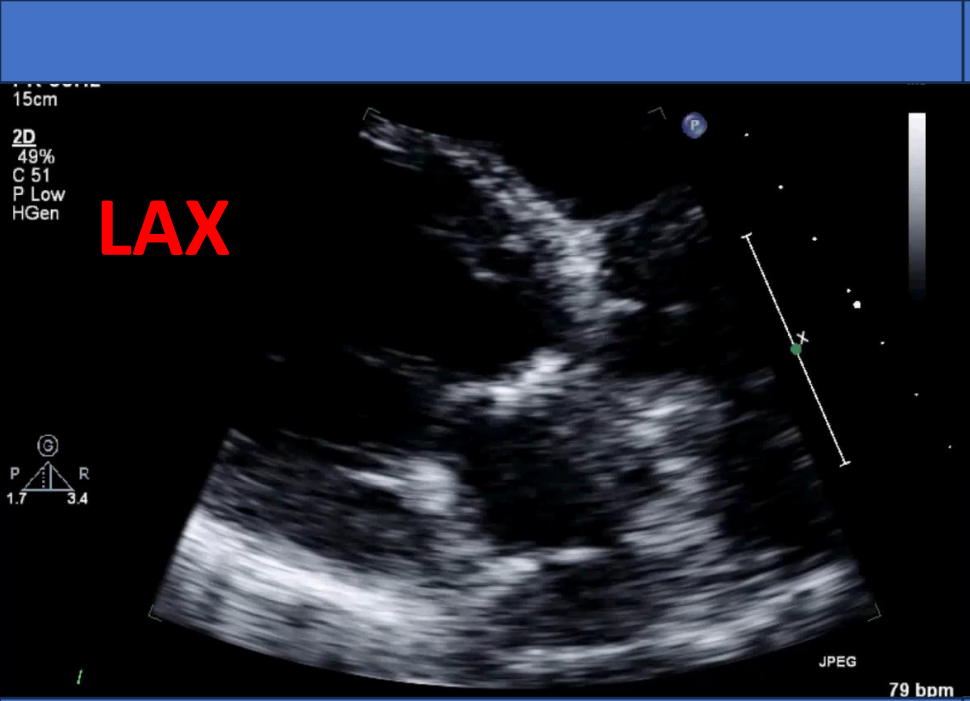
Case 1: 瓣中瓣：球扩瓣-自膨瓣

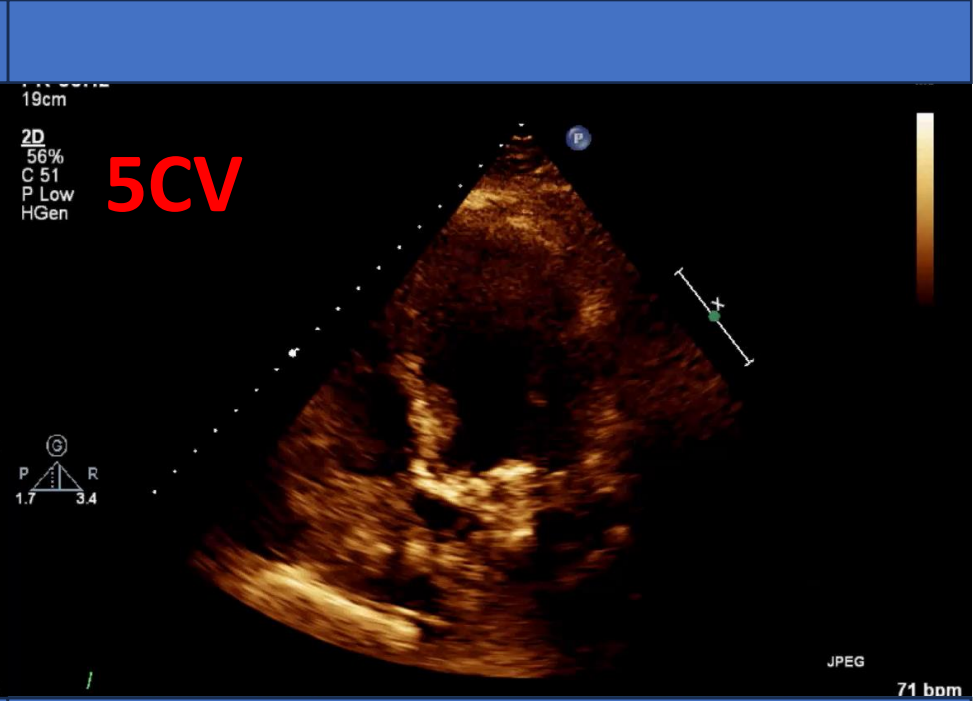
Final results: MG: 2.4 mmHg, NO AI

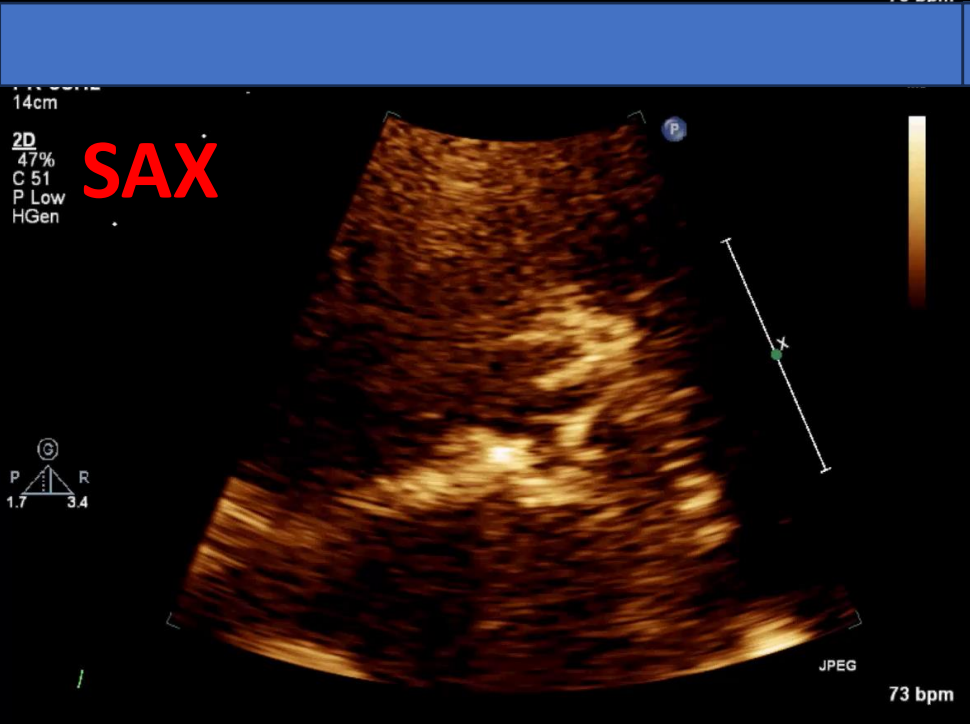


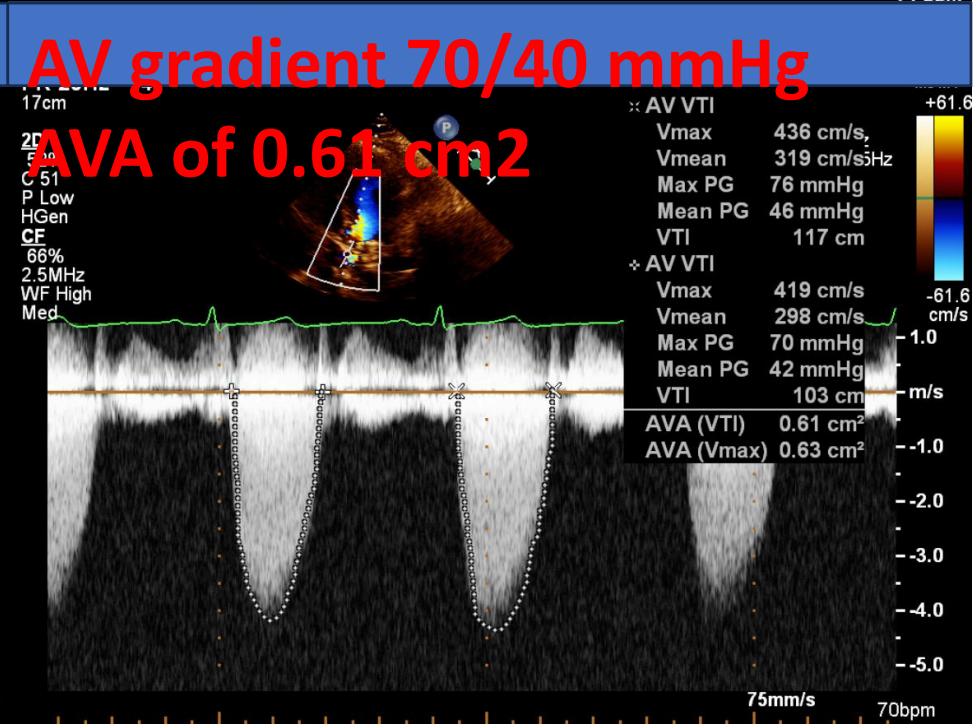












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Case 2:

65-yo-female with PMH of HTN, HLD, DM, hypothyroidism, OSA, cirrhosis secondary to chronic methotrexate use, obesity, who was admitted to ARMC in 04/15 with shortness of breath.

Echo on 4/3/15

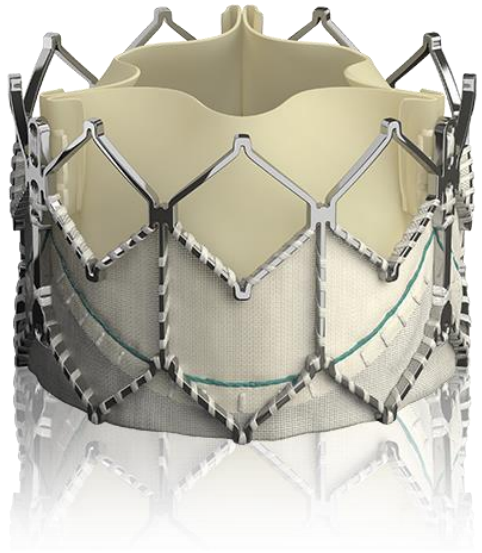
LVEF is 55-60%
Severe AS
AV gradient 76/46 mmHg
AVA of 0.61 cm2

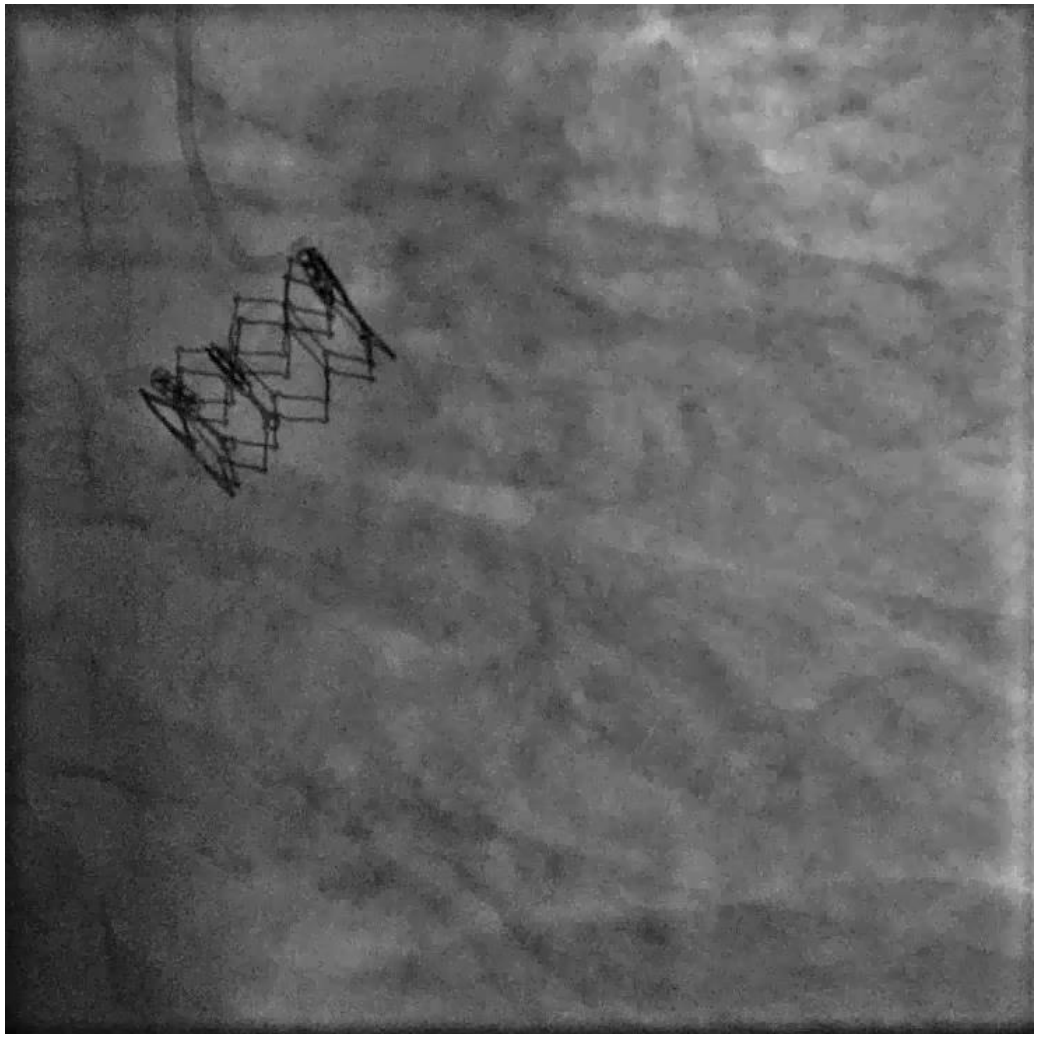
Case 2:

瓣中瓣： 自膨瓣-球扩瓣-球扩瓣

First TAVR (#23 SAPIEN XT，球扩瓣) on 7/17/2015

- She was deemed too high risk for an open AVR in 2015 due to cirrhosis and esophageal varices. She was referred to **Outside Hospital 1** for the first TAVR. She received a **#23 SAPIEN XT.**





Case 2:

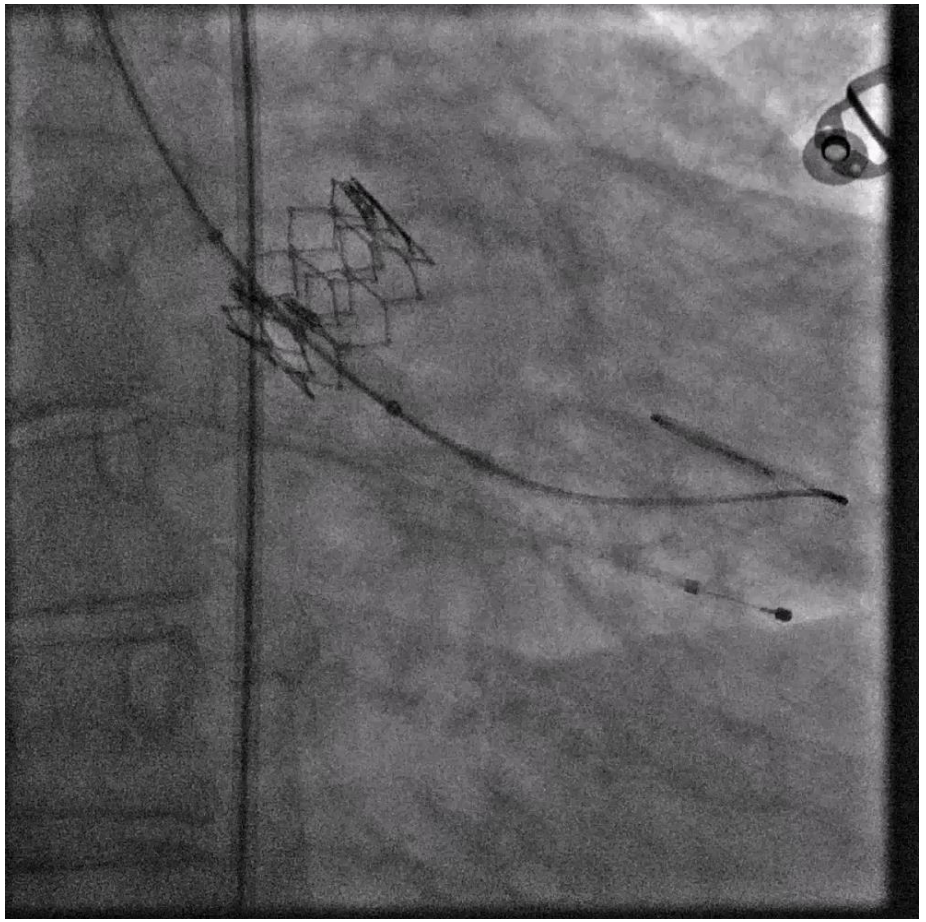
瓣中瓣： 自膨瓣-球扩瓣-球扩瓣

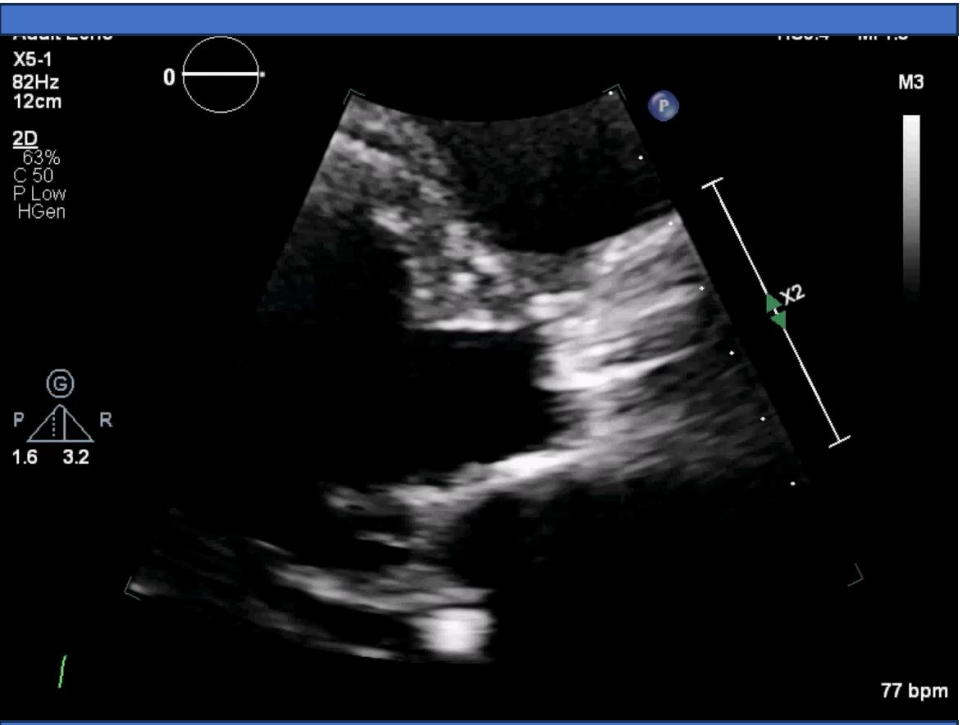
First TAVR (#23 SAPIEN XT， 球扩瓣) on 7/17/2015

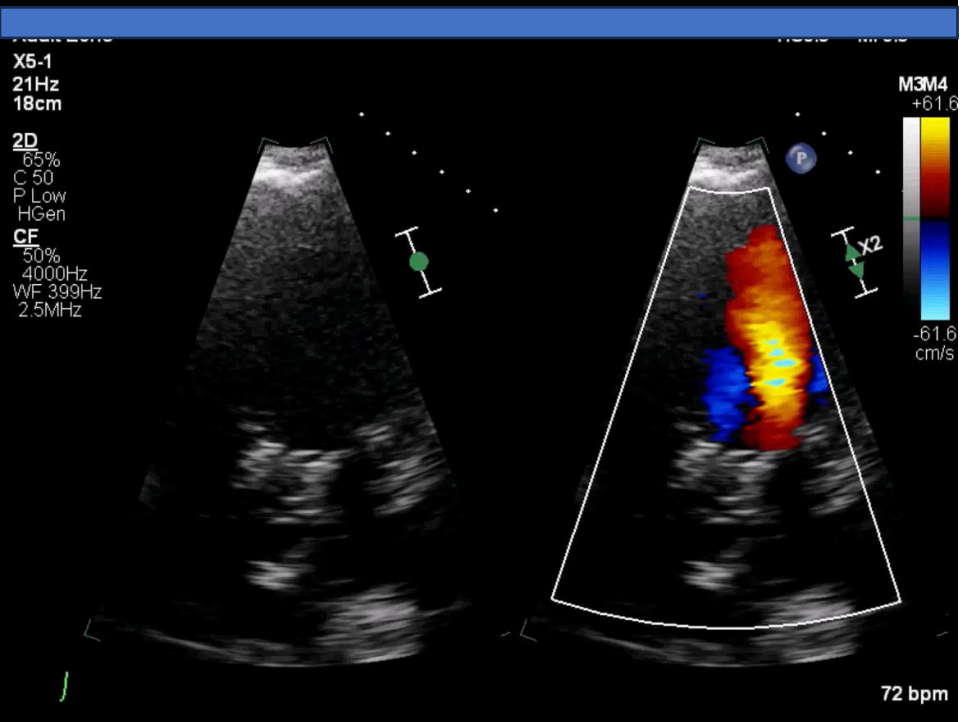
Two years after the first TAVR, patient developed recurrent syncope, increased shortness of breath with exertion, two-pillow orthopnea, and fatigue.

She had a visit with her cardiologist at the Outside Hospital 1 and he detected a significant paravalvular leak for which she was taken to the Cath Lab in July 2017. Multiple attempts to cross the paravalvular leak under TEE guidance were unsuccessful (封堵失败） and they proceeded to do a balloon valvuloplasty (球囊瓣膜成形术, BAV).

BAV-7/17/17





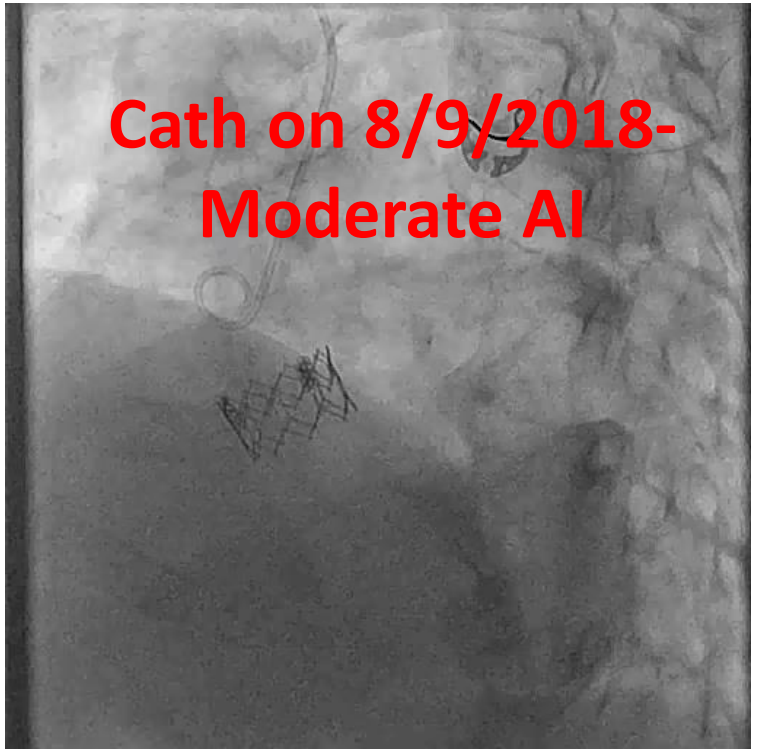


Case 2:

瓣中瓣： 自膨瓣-球扩瓣-球扩瓣

First TAVR (#23 SAPIEN XT， 球扩瓣) on 7/17/2015

Echo on 3/6/2018 showed
Moderate PVL-瓣周漏
peak and mean gradient of 21 and 12 mmHg.
Post TAVR AVA of 1.3 cm2



Case 2: 瓣中瓣： 自膨瓣-球扩瓣-球扩瓣

AtlantiCare REGIONAL MEDICAL CENTER The Heart Institute

First TAVR (#23 SAPIEN XT， 球扩瓣) on 7/17/2015

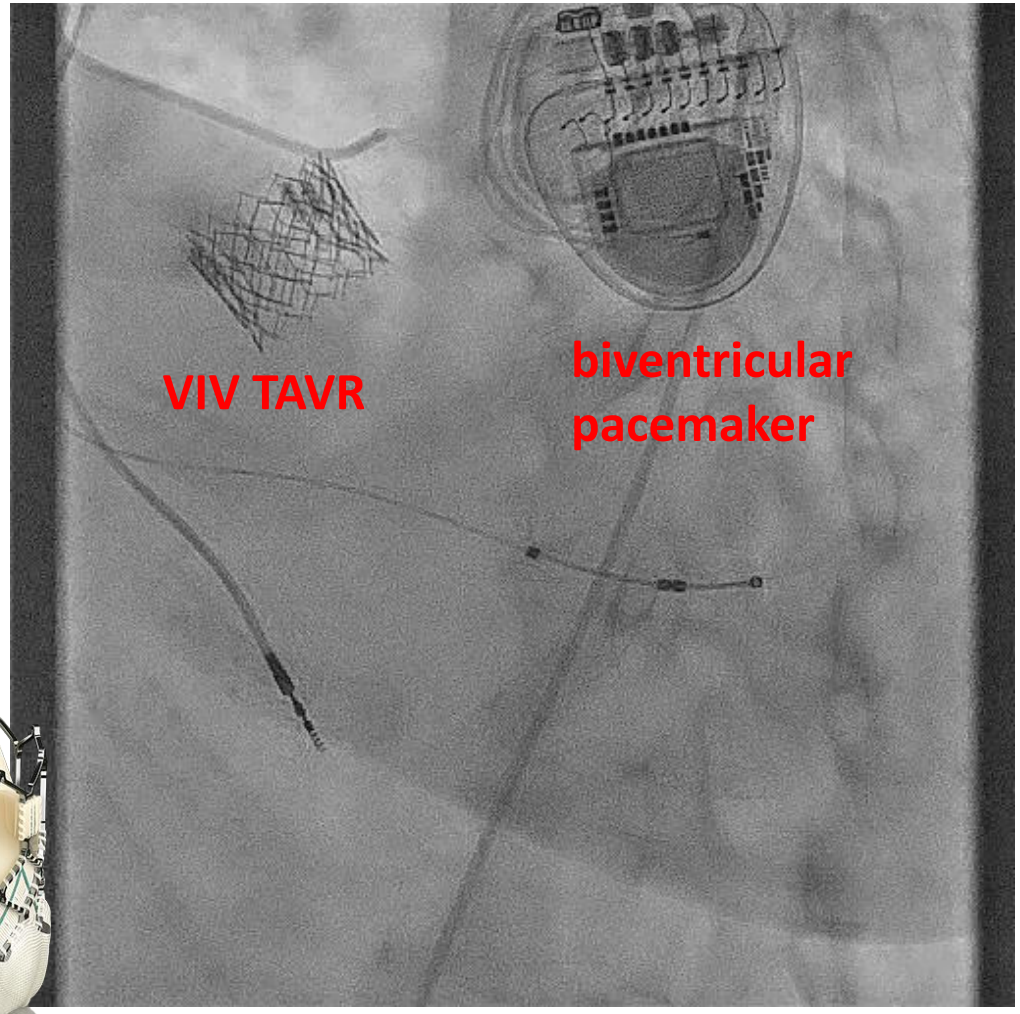
Second VIV (#23 S-#Sapien XT, 球扩瓣- 球扩瓣) TAVR on 9/17/2018

She sought a second opinion with Outside Hospital 2.

TEE on 8/23/18 demonstrated an AVA of 1.4 cm2 and MG of 10 mmHg. There was moderate PVL.

She underwent VIV TAVR with a SAPIEN 3 #23 valve on 9/17/18.

She underwent biV PMK on 3/16/23 due to bradycardia, presyncope, LBBB with QRS 170 ms and EF of 40-45%

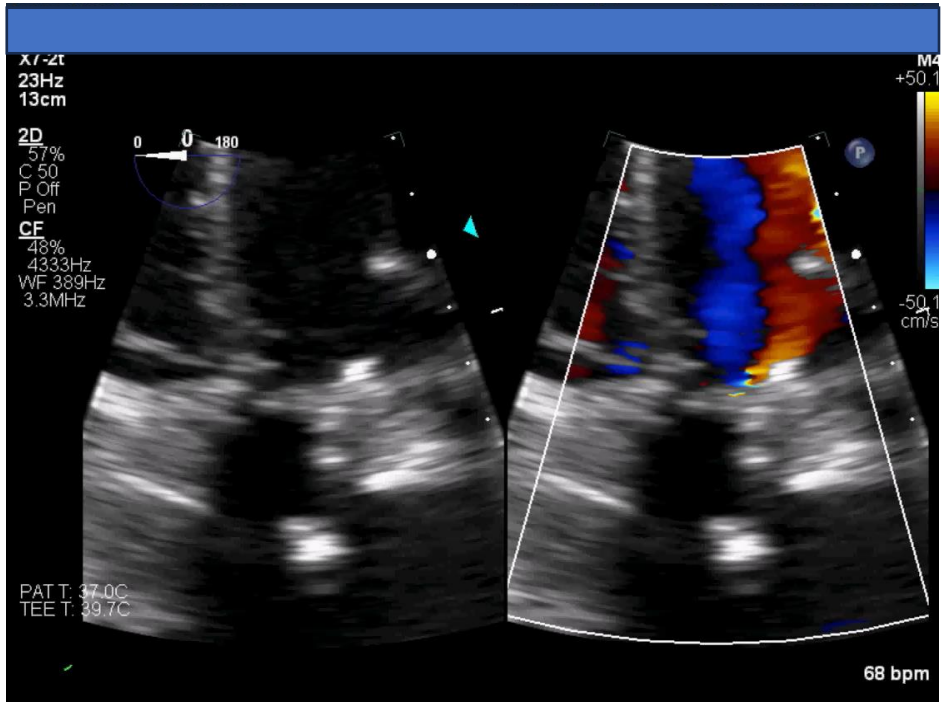


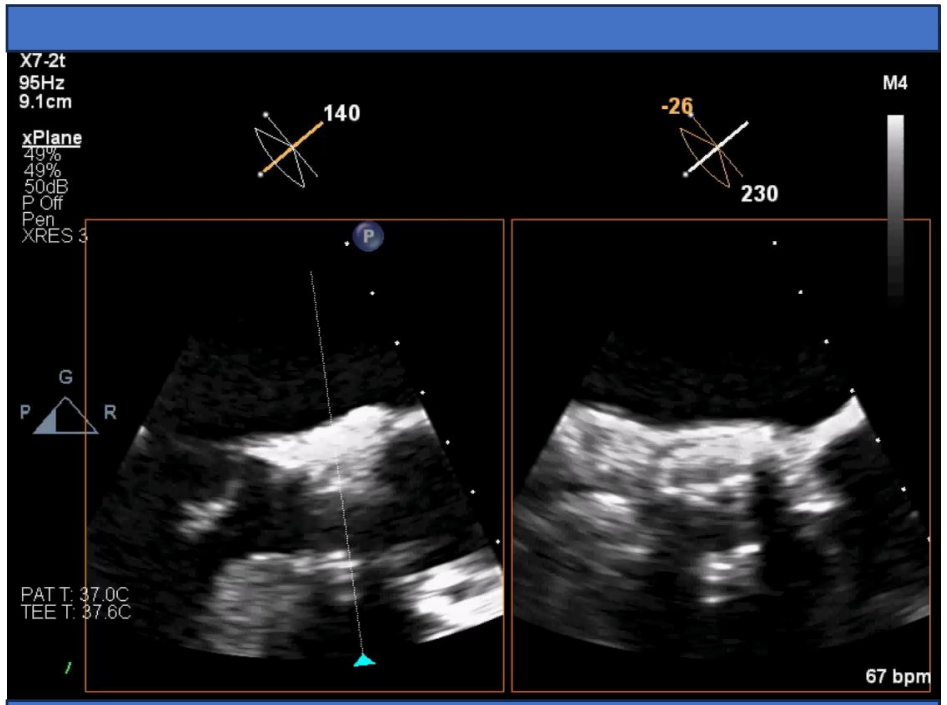
First TAVR (球扩瓣)on 7/17/2015
Second VIV ((球扩瓣- 球扩瓣) TAVR on 9/17/18

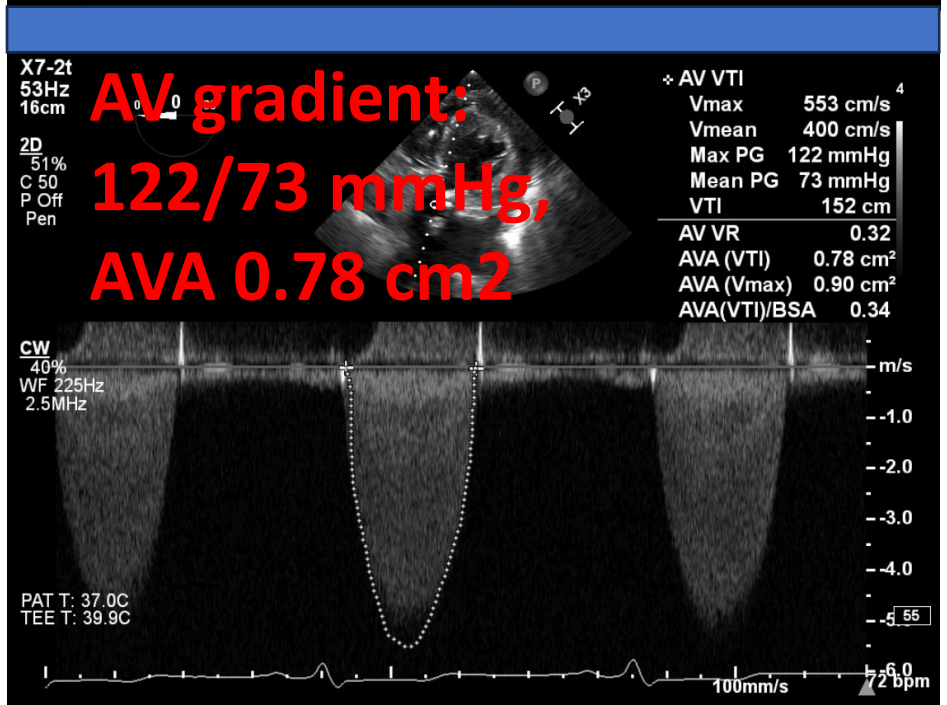
She was admitted to ARMC on 8/4/2023 - 8/10/2023 due to increased of SOB and LE edema and 20 pounds weight gain.

Labs on 8/13/23 showed ProBNP of 18961,

TEE on 8/7/23







Case 2:

STS Score: 15.1%

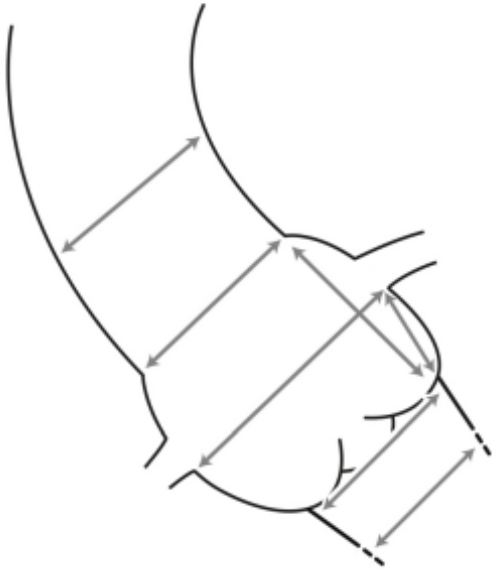
3 Mensio measurements

ANNULUS

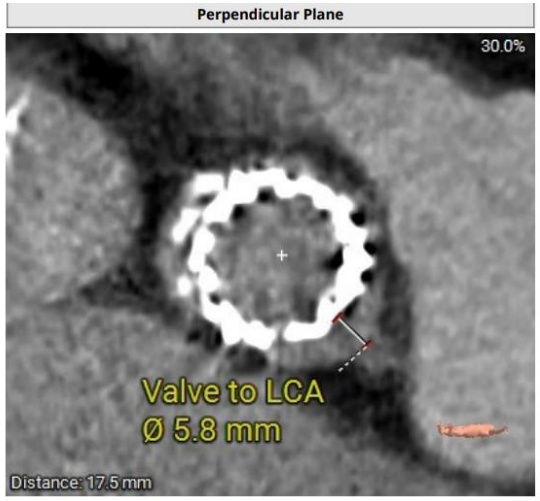
Diameter (mm)	21.2	x	21.7	,	21.5
	Min		Max		Mean
Perimeter (mm)	67.5	, Derived Ø (mm)			21.5
Area (mm²)	362.7	, Derived Ø (mm)			21.5

LVOT

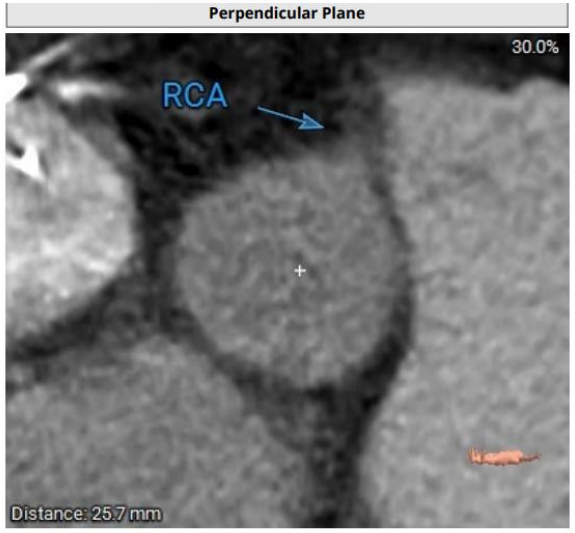
Diameter (mm)	21.2	x	29.5	,	25.3
	Min		Max		Mean
Perimeter (mm)	82.2	, Derived Ø (mm)			26.2
Area (mm²)	511.0	, Derived Ø (mm)			25.5



Max Ascending Aorta Diameter (mm)	29.7			
Sinotubular Junction Diameter (mm)	29.0	x	29.4	
	Min		Max	
Sinus of Valsalva Diameter (mm)	29.5	31.2	32.8	
	LCC	RCC	NCC	
Sinus of Valsalva Height (mm)	27.8	28.5	25.0	
	LCC	RCC	NCC	
Coronary Ostia Height (mm)	15.2	23.2		
	Left	Right		



LCA – VTC is approx. 5.8 mm



RCA appears to originate above stent frame

Case 2: 瓣中瓣：自膨瓣-球扩瓣-球扩瓣

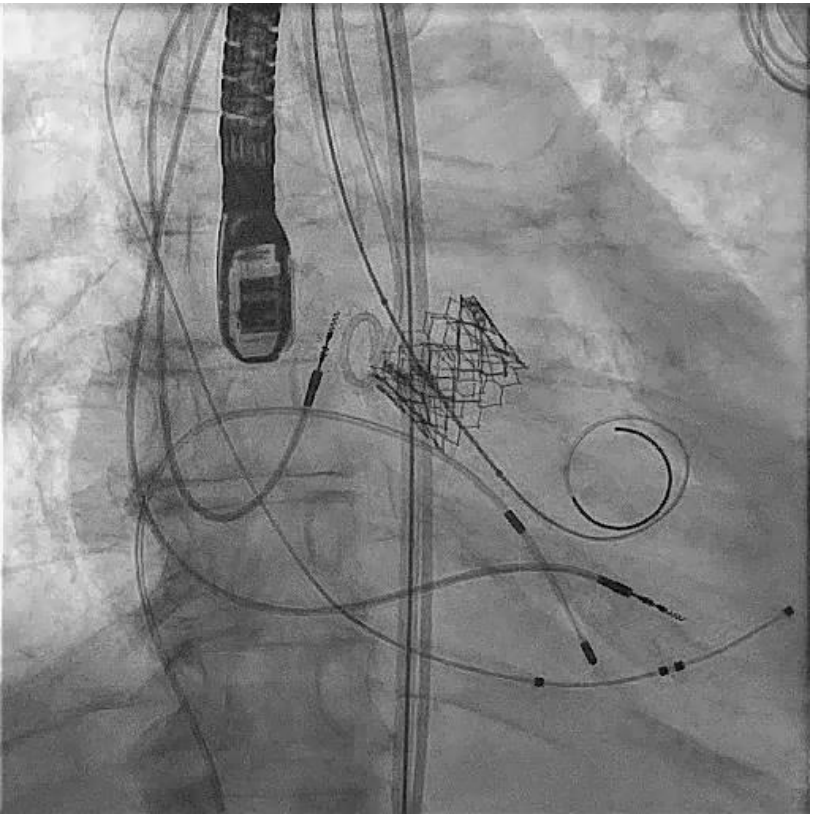
AtlantiCare REGIONAL MEDICAL CENTER The Heart Institute

First TAVR (#23 SAPIEN XT，球扩瓣) on 7/17/2015

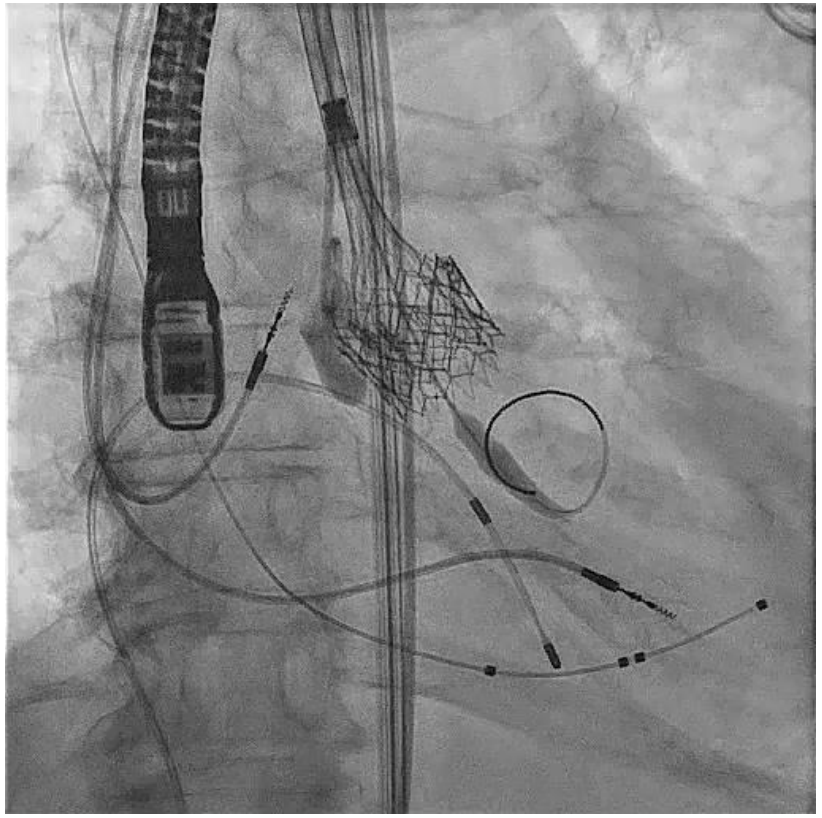
Second VIV (#23 S-#Sapien XT, 球扩瓣- 球扩瓣) TAVR on 9/17/2018

Third TAVR with #26 Evolut (自膨瓣-球扩瓣-球扩瓣VIV, VIV) on 8/16/2023

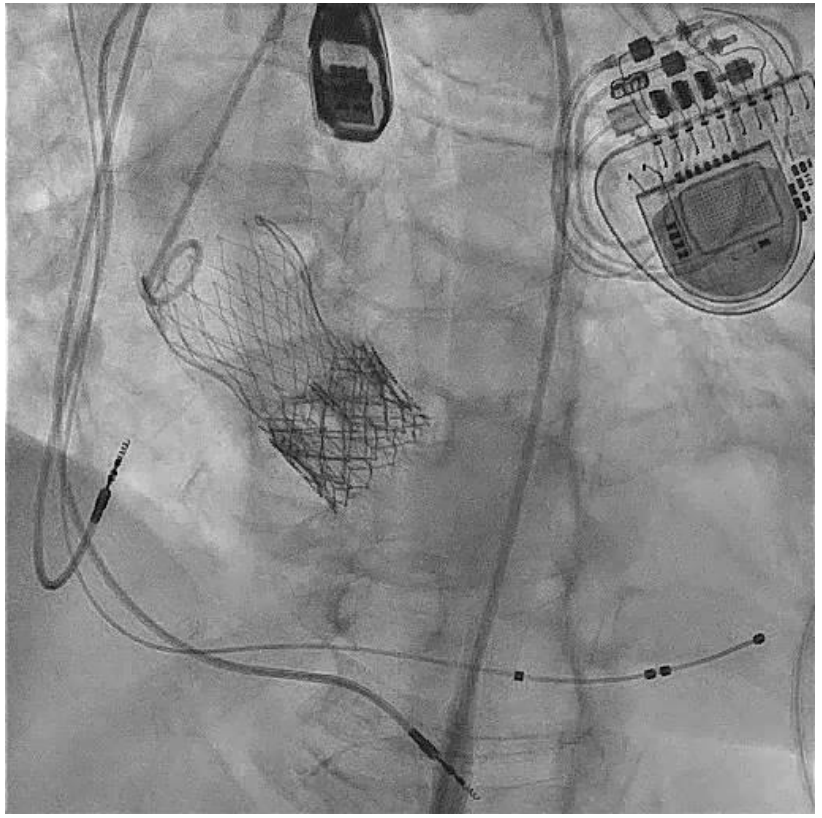
BAV with #23 mm True Balloon



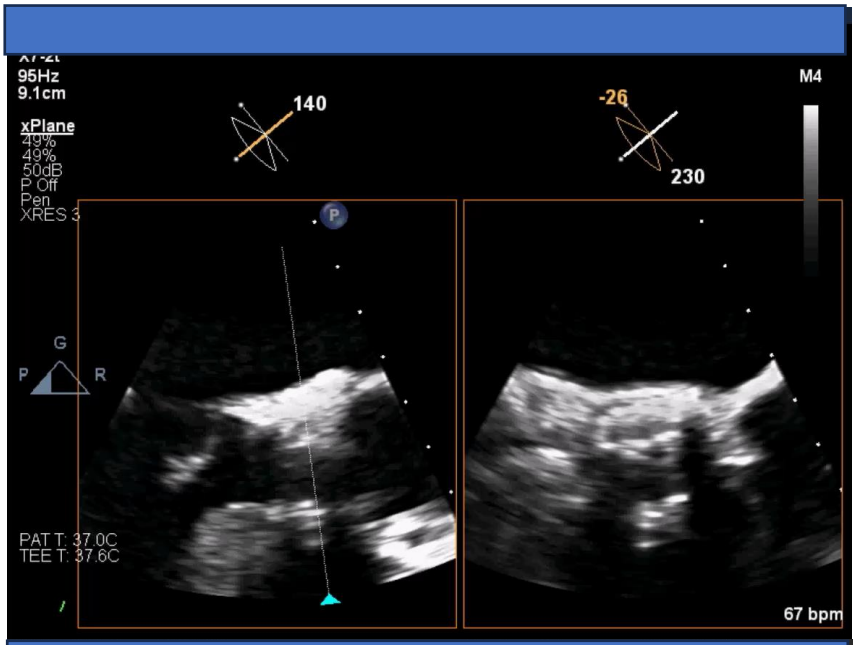
VIV TAVR-#26 Evolut FX

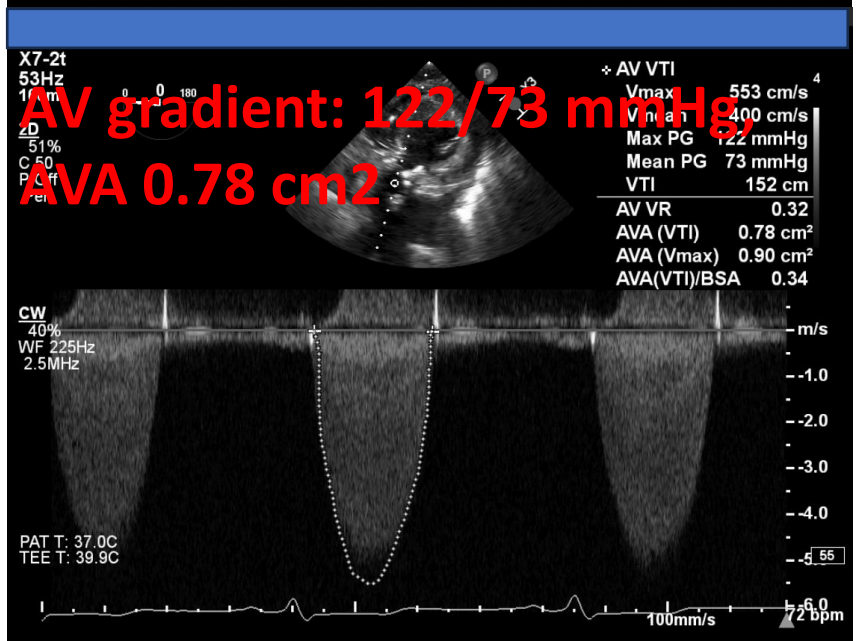


Final Result



Pre VIV TAVR-8/16/23



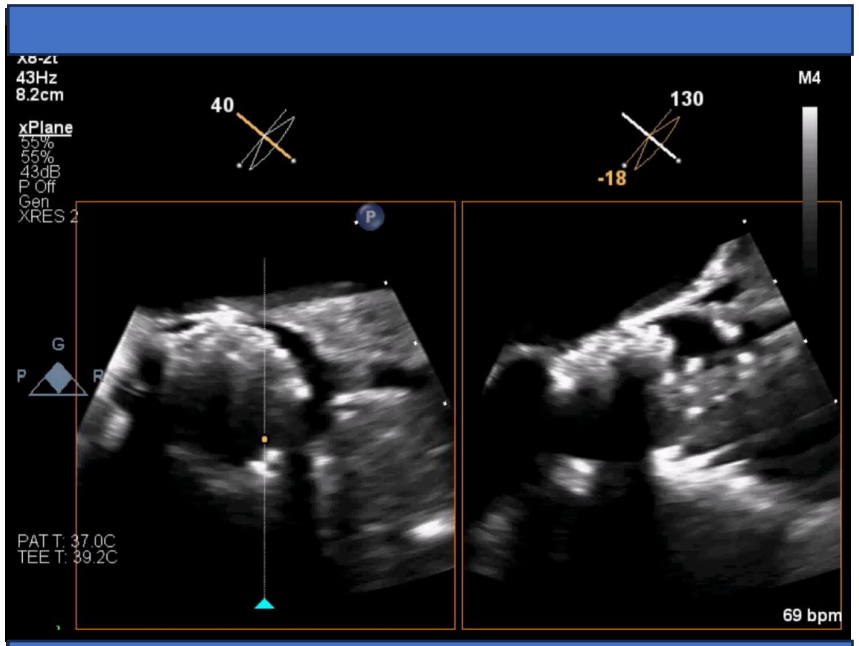


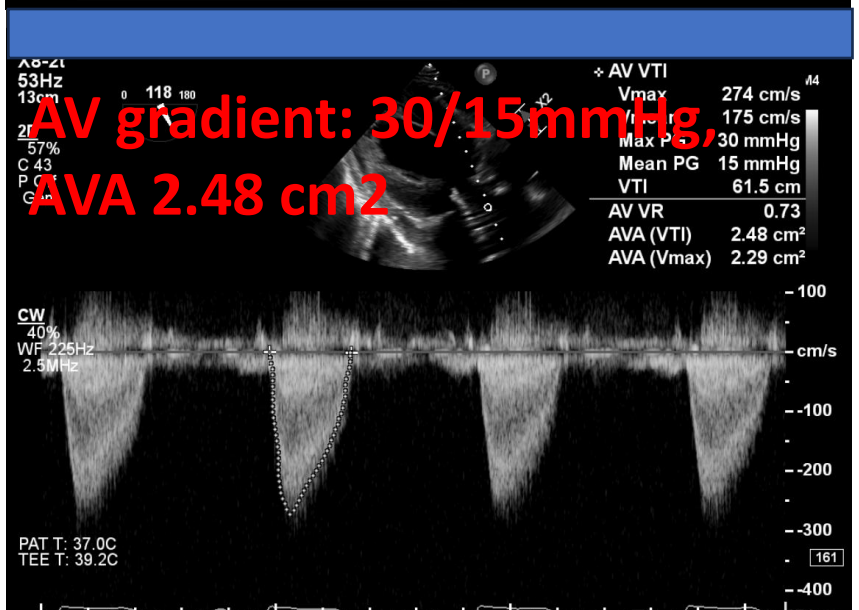
AV gradient: 122/73 mmHg,
AVA 0.78 cm2

Third TAVR with #26 Evolut

(自膨瓣-球扩瓣-球扩瓣,VIV, VIV) on 8/16/2023

Final Result





AV gradient: 30/15mmHg,
AVA 2.48 cm2

Case 2: 瓣中瓣：自膨瓣-球扩瓣-球扩瓣

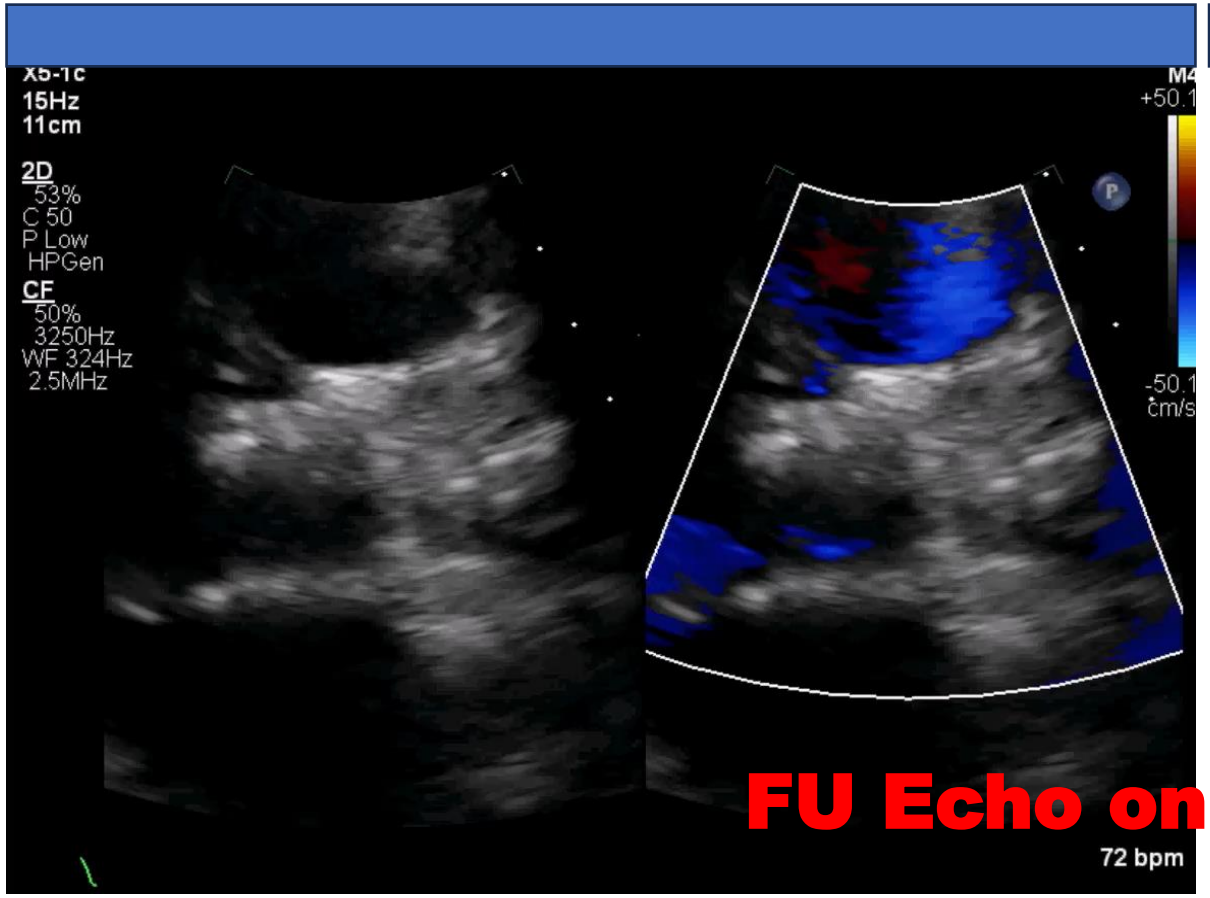
AtlantiCare REGIONAL MEDICAL CENTER The Heart Institute

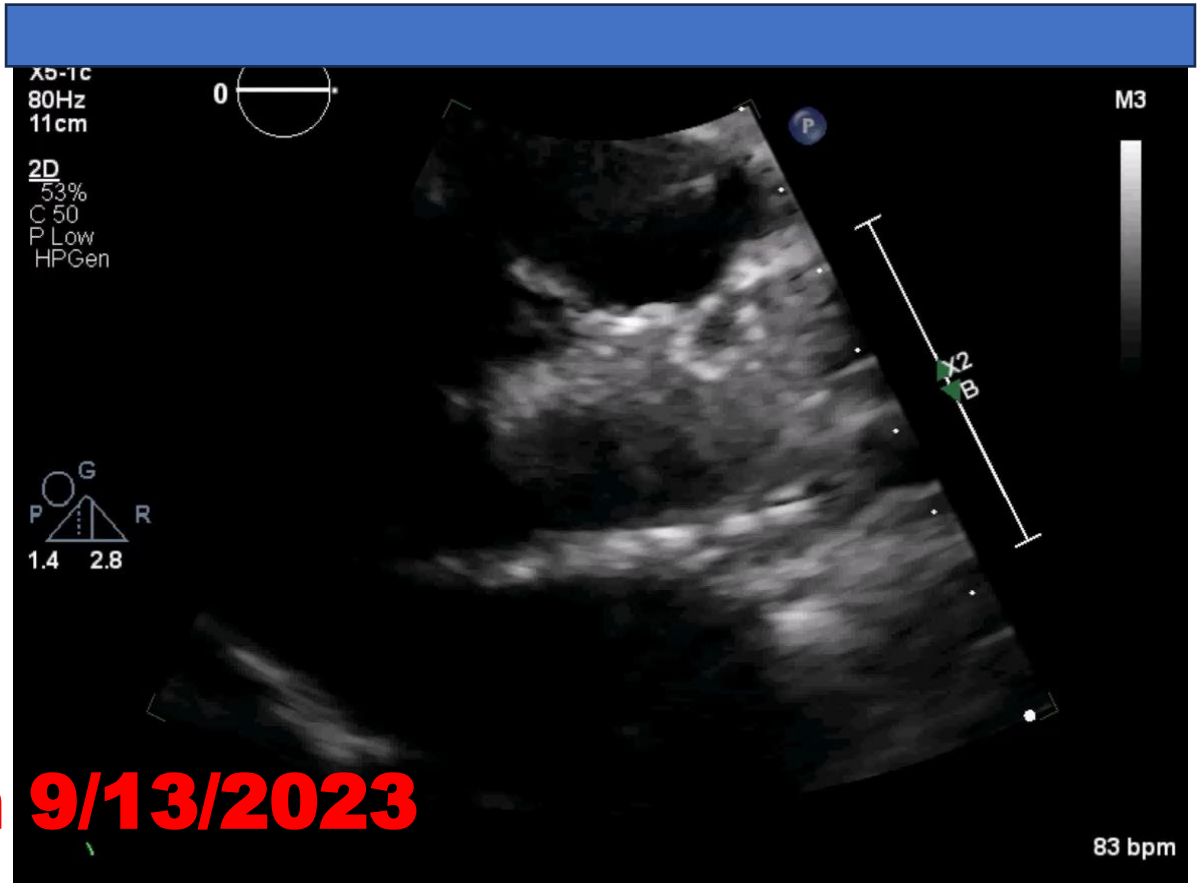
First TAVR (#23 SAPIEN XT，球扩瓣) on 7/17/2015

Second VIV (#23 S-#Sapien XT, 球扩瓣- 球扩瓣) TAVR on 9/17/2018

Third TAVR with #26 Evolut (自膨瓣-球扩瓣-球扩瓣VIV, VIV) on 8/16/2023

Patient was doing well after third TAVR, she was discharged home on 8/18/23



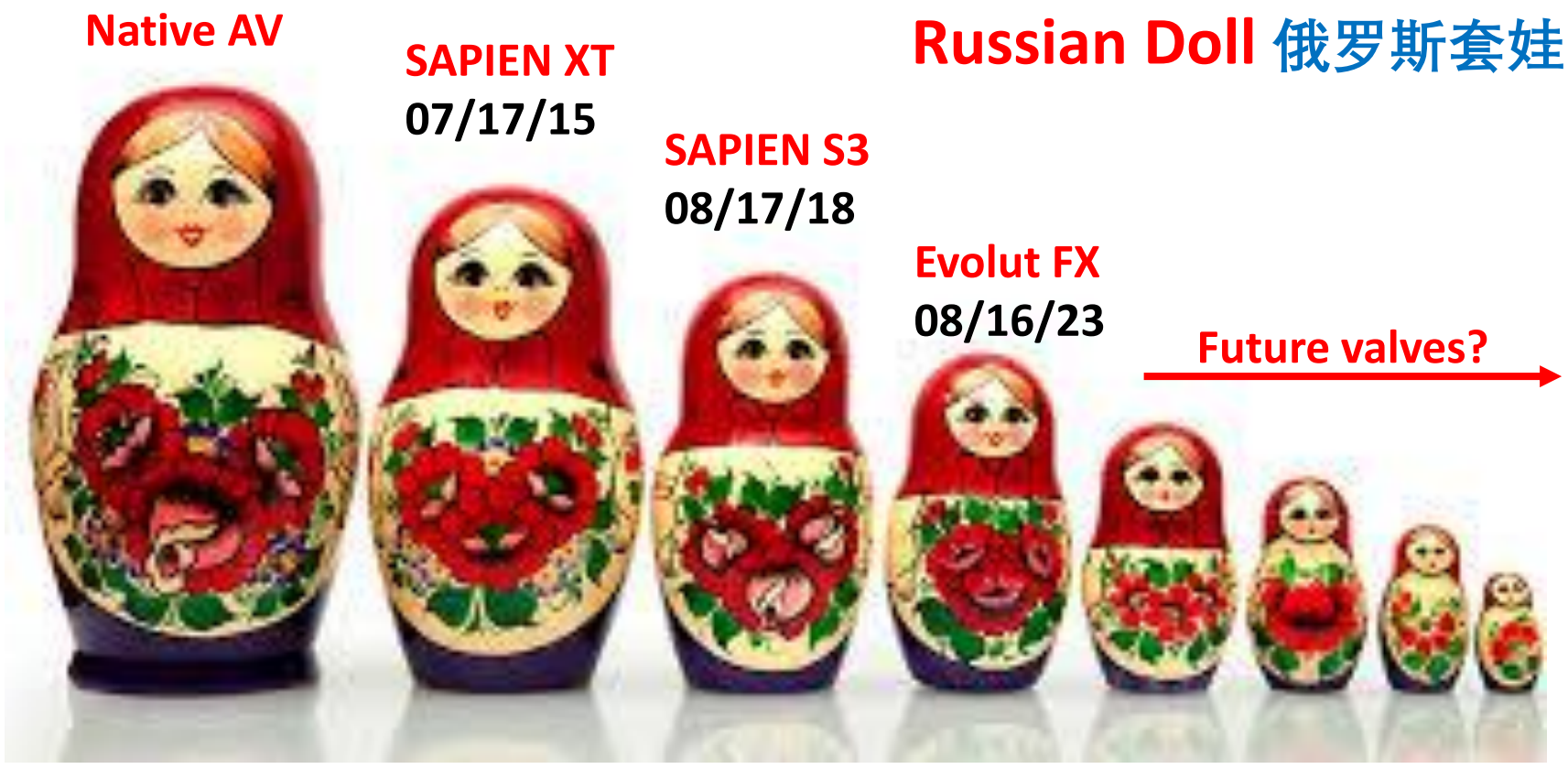


FU Echo on 9/13/2023

AtlantiCare
REGIONAL MEDICAL CENTER
The Heart Institute

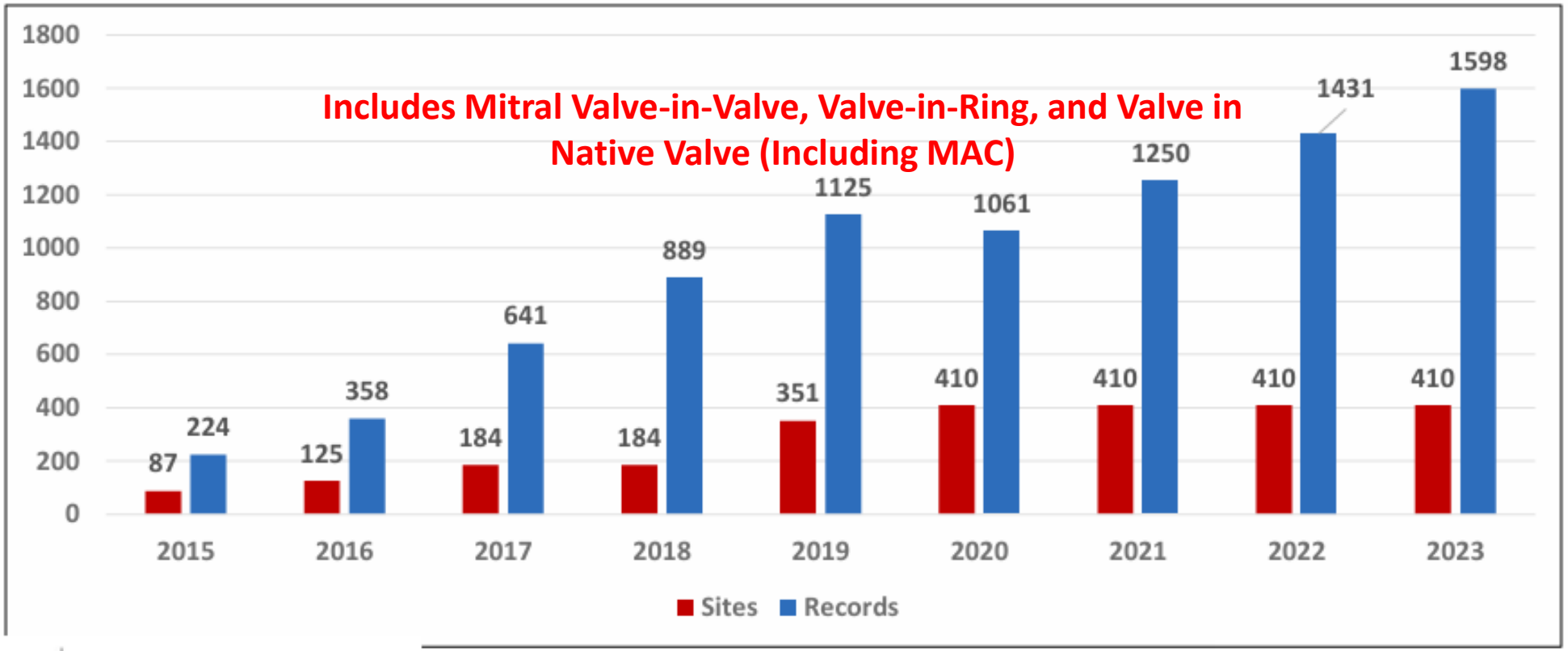
To the best of our knowledge and Medtronic data base, this is the first in the world 3 TAVR valves (VIV, VIV) in the AS patient.

据我们所知以及美敦力数据库显示，这是世界上第一例在主狭患者中使用 3 个 TAVR 瓣膜（自膨瓣-球扩瓣-球扩瓣, VIV、VIV）的病例



AtlantiCare MEDICAL CENTER Heart Institute

TMVR Sites and Records Submitted



STS National Database™ Trusted. Transformed. Real-Time.

Source: STS/ACC TVT Registry Database

NCDR® NATIONAL CARDIOVASCULAR DATA REGISTRY

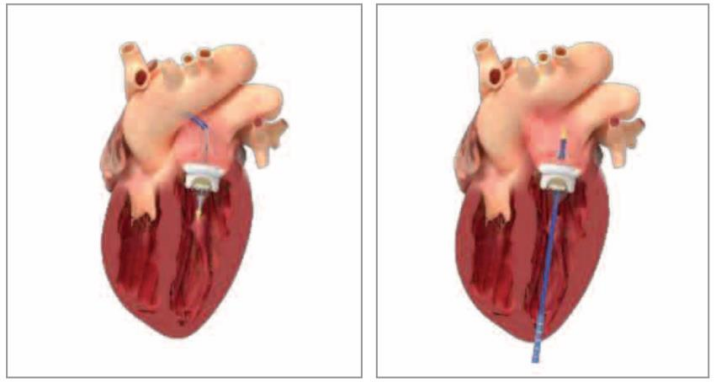
TMVR包括瓣中瓣（valve-in-valve，ViV）、环中瓣（valve-in-ring，ViR）、自体环中瓣（valve-in-mitral annular calcification，ViMAC）

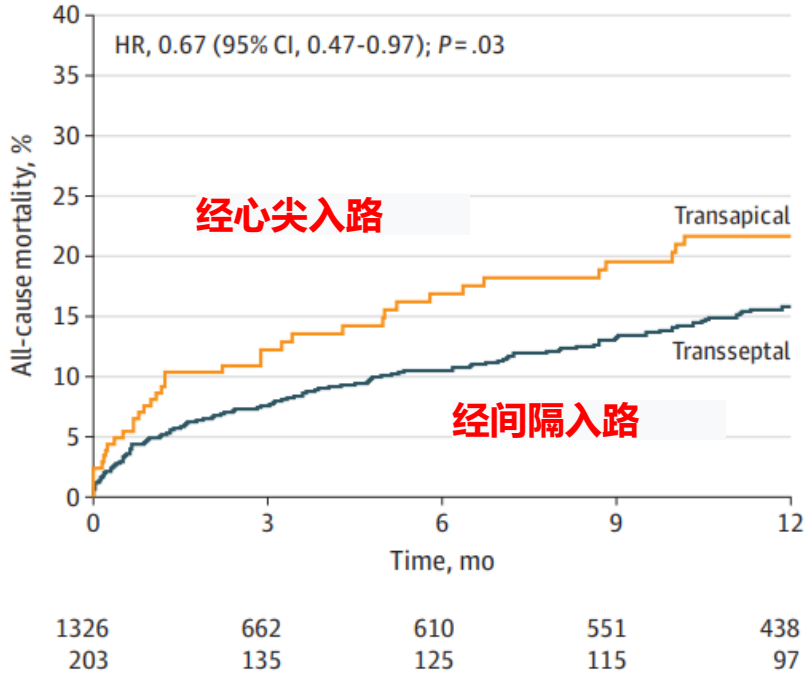
球扩瓣与经导管二尖瓣中瓣置换术

采用球扩瓣进行经导管二尖瓣中瓣置换术（MViV）治疗二尖瓣病变已成为外科高危患者的一种选择。

在这项基于SAPIEN 3 MViV的前瞻性研究中，对2015年6月至2019年7月进入STS/ACC经导管瓣膜治疗注册中心的**1529高危患者**接受sapien3 作为二尖瓣中瓣置换术治疗进行了分析，手术技术成功率为96.8%，30天全因死亡率为5.4%，1年时为16.7%

经间隔入路　　**经心尖入路**





	经心尖入路	经间隔入路
转换手术	2.5%	0.7%
住院天数	6 天	2 天
30天心血管死亡率	5.1%	2.1%
1 年全因死亡率	21.7%	15.8%

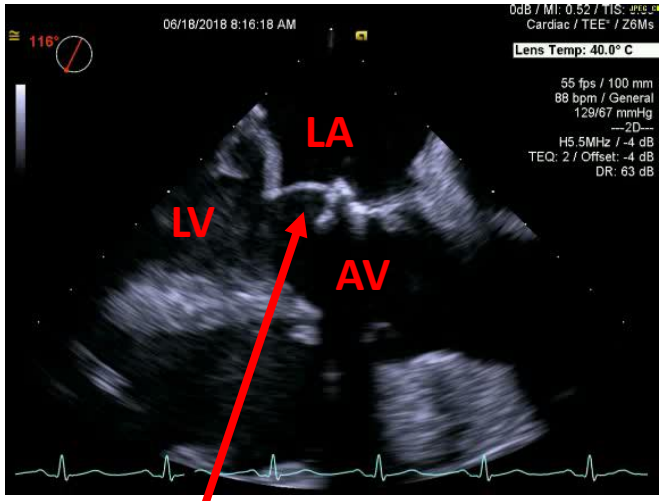
***Whisenant et al JAMA Cardiol.* 2020;5(11):1245-1252.**

Case 3 -经导管二尖瓣中瓣置换术
经心尖途径 VIV TMVR

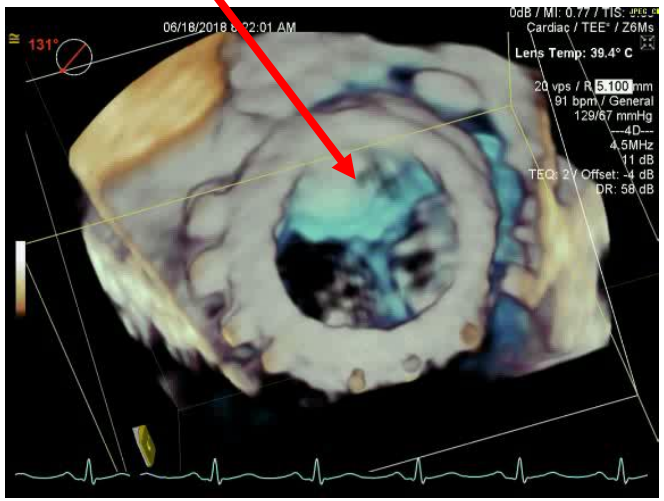
患者是一名72岁的亚洲男性患者既往史包括严重的二尖瓣脱垂，2009年3月24日进行#32二尖瓣成形术, 9 年后又出现重度二尖瓣关闭不全。

患者于3/28/2018 用了#29心包生物瓣做了二尖瓣换瓣术。

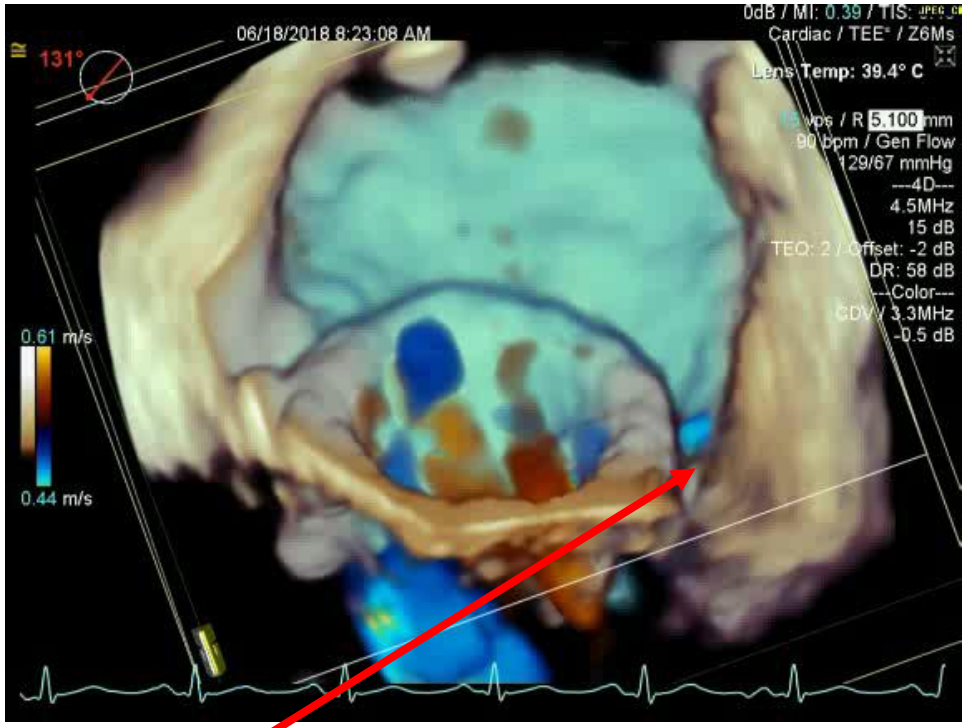
术后3个月，患者于因心衰入院。



二尖瓣开放受限



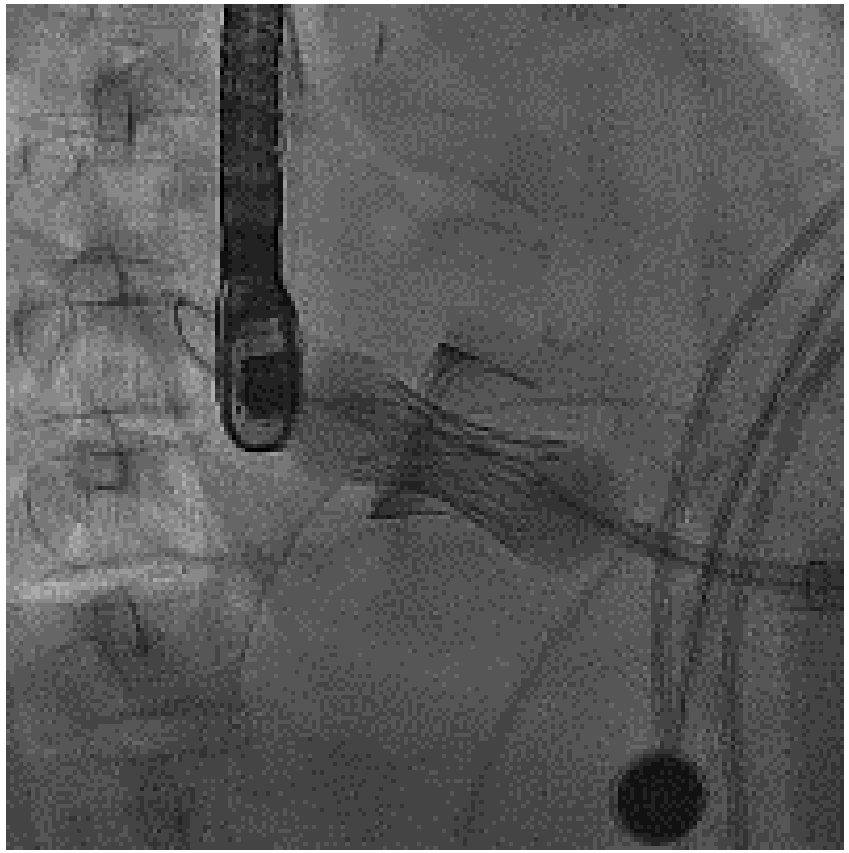
重度中央型二尖瓣关闭不全



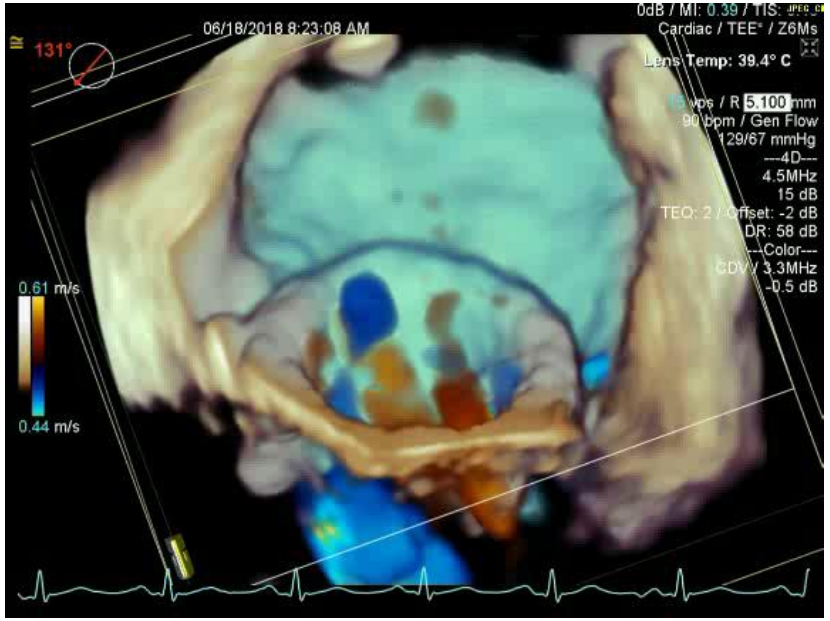
PVL: 瓣周漏

Case 3 -经心尖途径 VIV TMVR

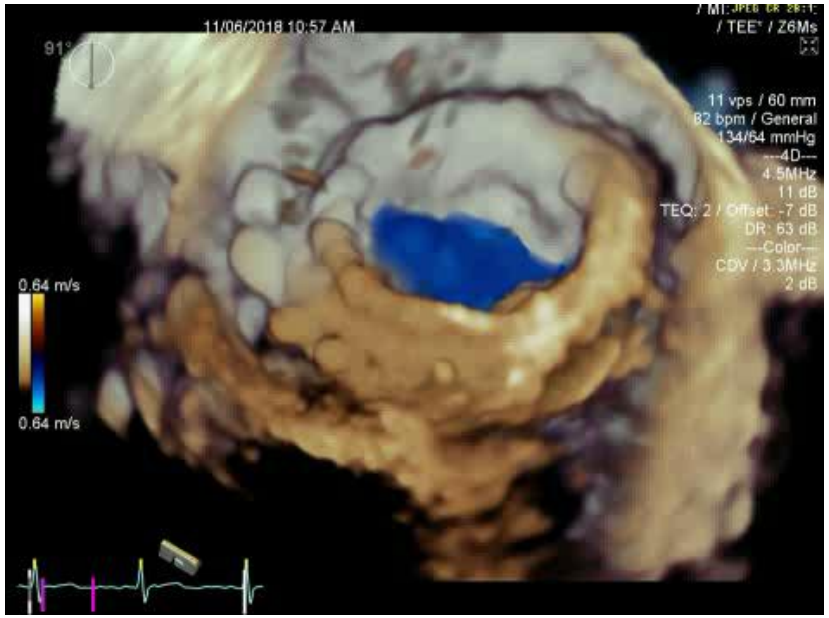
应用SAPIEN3 瓣膜经心尖途径做
经导管瓣中瓣二尖瓣膜置换术



TMVR 术前
重度二尖瓣关闭不全



TMVR 术后
无二尖瓣关闭不全



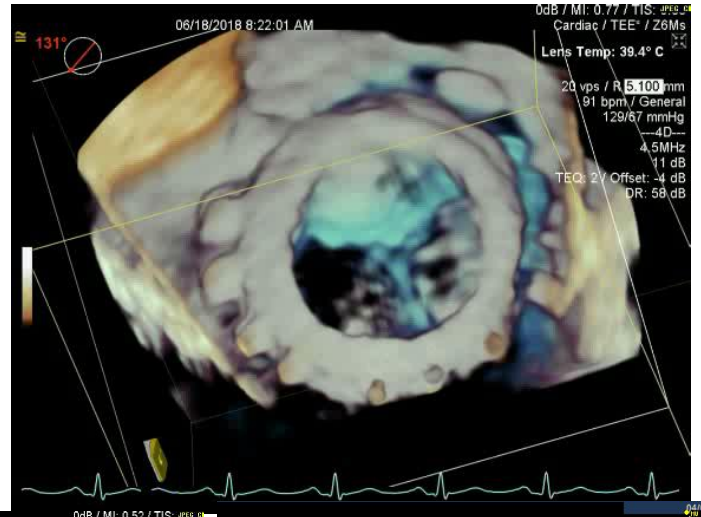
Case 3 -经心尖途径 VIV TMVR

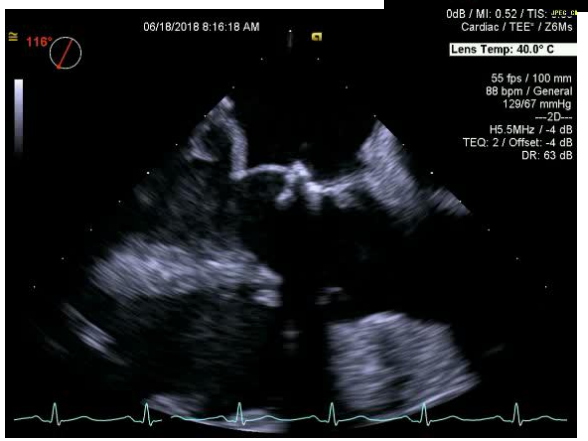
Case 3

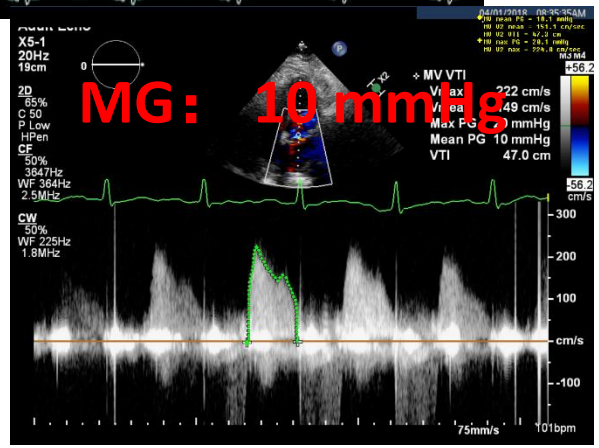
TMVR 术前

TMVR 术后

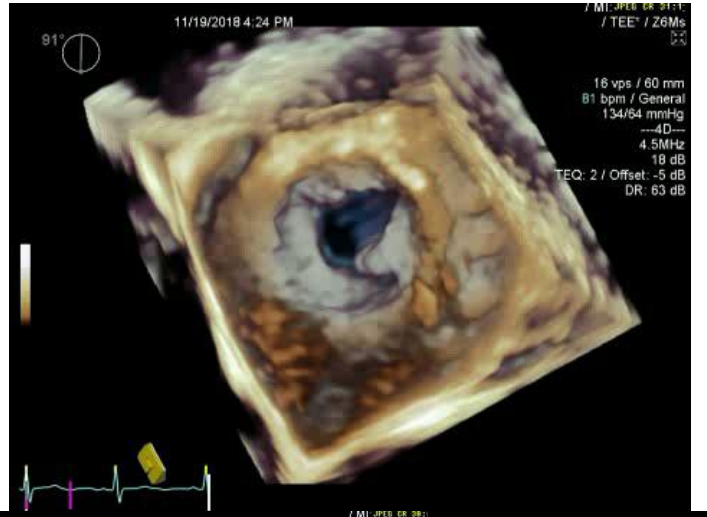
TMVR 术前: 二尖瓣开放受限，平均梯度为10 mmHg

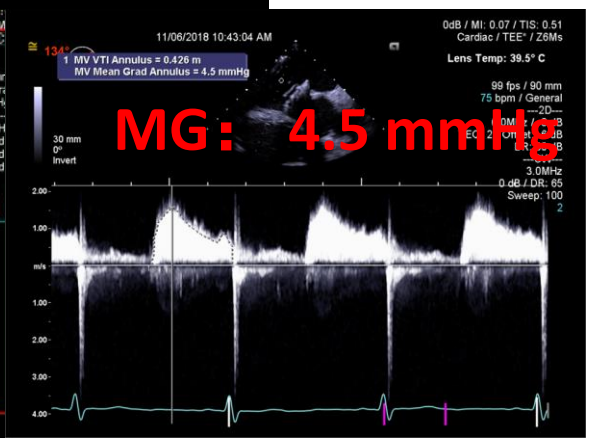






TMVR 术后: 二尖瓣开放正常，二尖瓣平均梯度降至4.5 mmHg





Case 4: 经导管二尖瓣中瓣置换术可能出现的左心室流出道阻塞

LVOT obstruction can be a potentially fatal complication of TMVR

左室流出道梗阻（LVOTO）可能是 TMVR 的潜在致命并发症

Risk: VIM > VIR > VIV

Incidence: 40% VIM （自体环中瓣）, 5-8% VIR （环中瓣）and 2% VIV （瓣中瓣）

LVOT obstruction is the #1 predictor of morbidity and mortality after TMVR

30-day mortality 34% vs 2% without LVOT obstruction

LVOT 阻塞是 TMVR 术后发病率和死亡率的首要预测因素 30 天死亡率：34% vs 无 LVOT 阻塞者：2%

Case 4: LVOT obstruction in TMVR

1. Anatomical Factors

Fixed (固定)

Small/hypertrophied LV 左心室流出道小/肥厚 ***LVOT < 180 mm2***

Asymmetrical septal hypertrophy 室间隔不对称肥厚

Aorto-mitral angle 主动脉-二尖瓣夹角 ***< 120 degree***

Dynamic (动态)

Long/redundant anterior leaflet 前瓣叶过长或冗余 ***> 25 mm***

2. Valve Factors

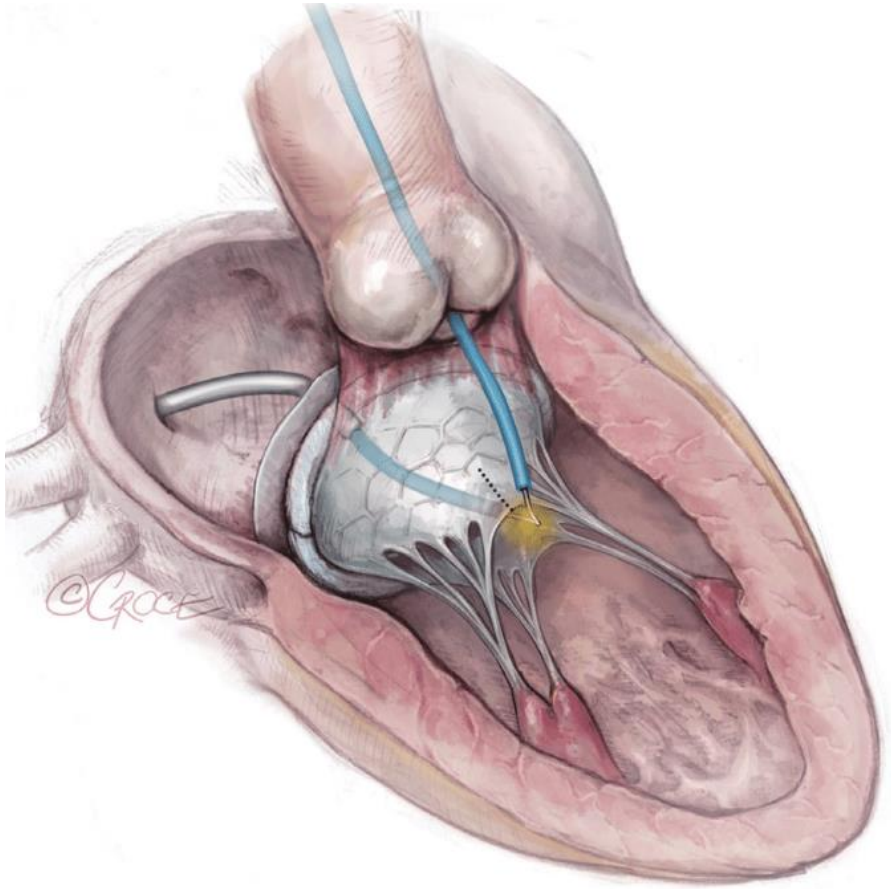
Skirt neoLVOT-新左心室流出道-***NeoLVOT < 150 mm2***

Valve alignment 瓣膜对齐

Common Approaches to Prevent LVOT Obstruction

Septal ablation (室间隔消融术)

LAMPOON (二尖瓣前叶撕裂术): "**L**aceration of the **A**nterior **M**itral leaflet to **P**revent **O**utflow **O**bstructio**n**"; this technique involves intentionally making a small tear in the anterior mitral valve leaflet using a catheter to prevent it from obstructing the LVOT during valve placement



Case 4: Tip-to-Base LAMPOON

(尖部至基部二尖瓣前叶撕裂术)

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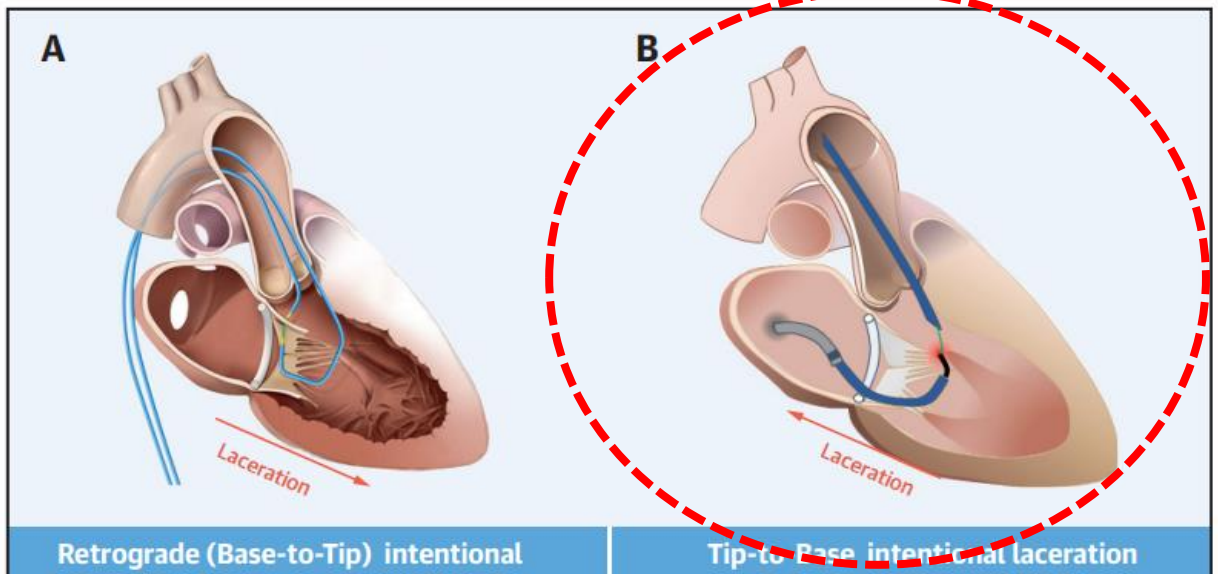
CENTRAL ILLUSTRATION Tip-to-Base LAMPOON Is a Simplified Approach to Lacerate the Anterior Mitral Leaflet



Retrograde (Base-to-Tip) intentional laceration of the anterior mitral leaflet to prevent left ventricular outflow tract obstruction	Tip-to-Base intentional laceration of the anterior mitral leaflet to prevent left ventricular outflow tract obstruction
Requires technically challenging leaflet traversal	Allows for leaflet laceration without traversal
Solely preventive strategy	Preventive or rescue strategy
Applicable to patients with mitral annular calcification, surgical mitral valve replacement, or mitral ring	Applicable to patients with surgical mitral valve replacement or mitral ring

Lisko, J.C. et al. J Am Coll Cardiol Intv. 2021;14(5):541-50.

A comparison of LAMPOON techniques. **(A)** Retrograde LAMPOON. **(B)** Tip-to-Base LAMPOON. LAMPOON = intentional laceration of the anterior mitral leaflet to prevent left ventricular outflow tract obstruction; MAC = mitral annular calcification; SMVR = surgical mitral valve replacement.

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Tip-to-Base LAMPOON for Transcatheter Mitral Valve Replacement With a Protected Mitral Annulus

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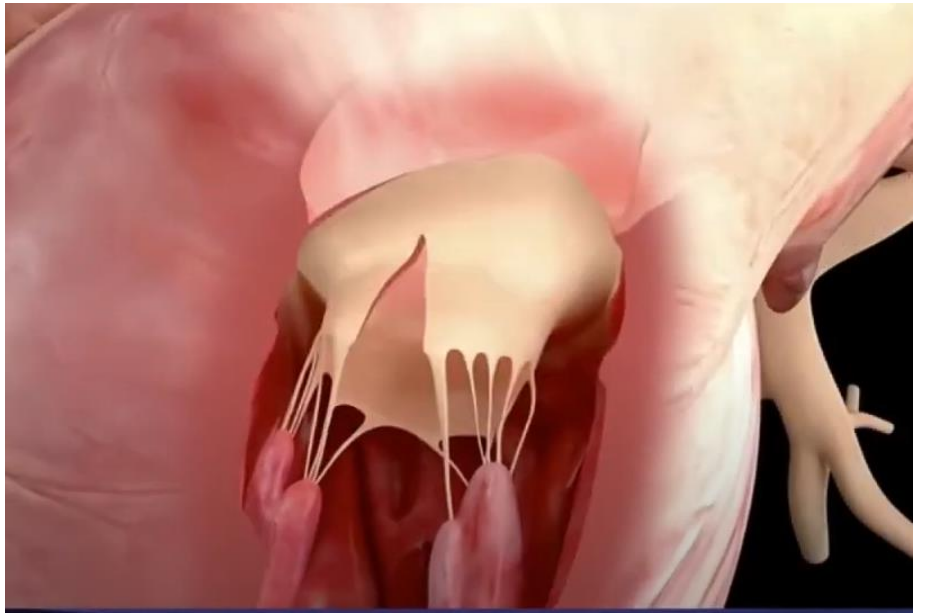
Lisko, J.C. et al. JACC Intv. 2021;14(5):541–50.



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Without LAMPOON, a transcatheter MVR displaces the native anterior mitral valve leaflet causing LVOT obstruction. (Right) After LAMPOON, LVOT obstruction is reduced.

LAMPOON Procedure Performed Concurrently with TMVR (Patients)

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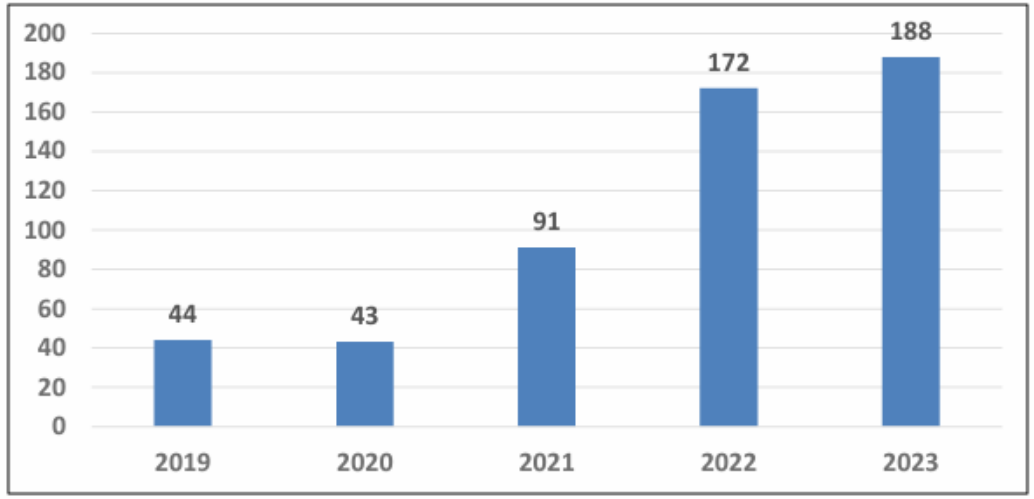


STS National Database™ Trusted. Transformed. Real-Time.

Source: STS/ACC TVT Registry Database

NCDR® NATIONAL CARDIOVASCULAR DATA REGISTRY

The LAMPOON (Laceration of the Anterior Mitral leaflet to Prevent Outflow Obstruction) procedure is a transcatheter technique used to prevent left ventricular outflow tract (LVOT) obstruction during transcatheter mitral valve replacement (TMVR)

LAMPOON（二尖瓣前叶撕裂术以防止流出道阻塞）手术是一种经导管技术，用于在经导管二尖瓣置换术（TMVR）期间防止左心室流出道（LVOT）阻塞

Case 4: LAMPOON-Case Presentation

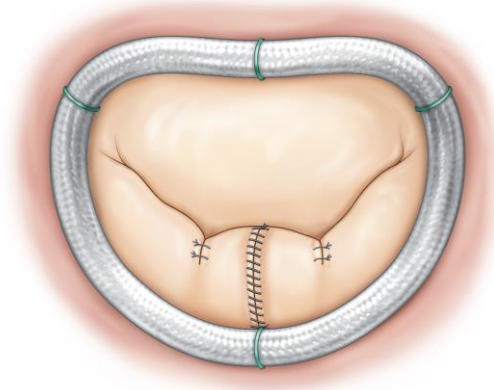
采用二尖瓣前叶撕裂术在经导管二尖瓣环内瓣膜置换术的应用

This is a 77-year-old female, with PMH of MVP, S/P MV repair with a 32 mm Annuloflex ring in 2006 at Univ. of Penn, hypertension, hyperlipidemia, severe pulmonary hypertension, DM, CVA, thyroid nodules, benign essential tremors who presented to ARMC with CC of increasing SOB for several months.

STS: 7.11%

Echo 7/5/24: EF of 55-60%. MV MG: 10 mmHg.

Cardiac catheterization on 8/15/24: MVA: 0.73 cm2 with mean gradient of 11 mmHg. Coronary angiography revealed a left dominant system with no significant CAD. EF of 71%.



Mitral valve-in-ring

Case 4: LAMPOON in VIR

Pre Procedure TEE

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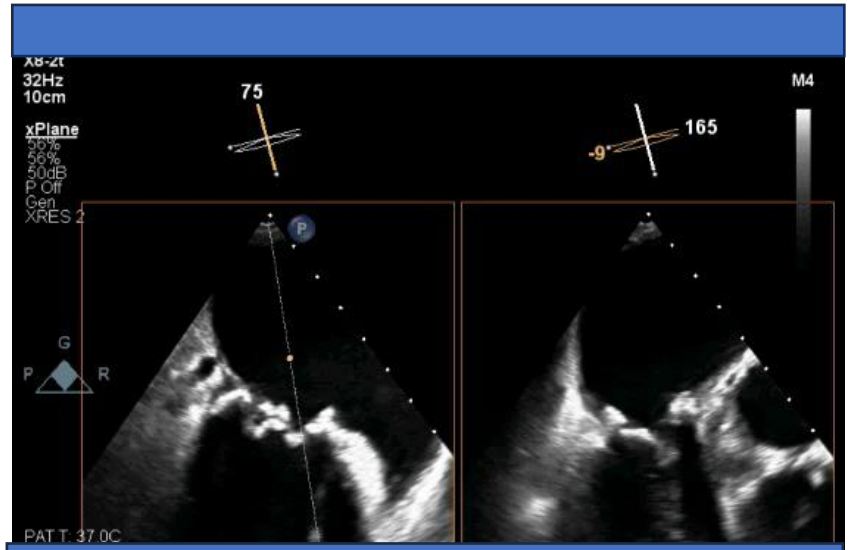
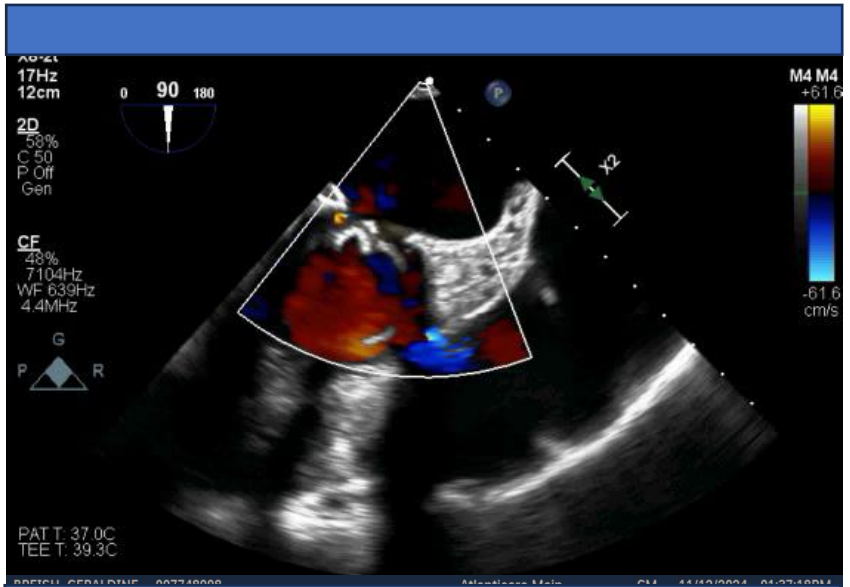
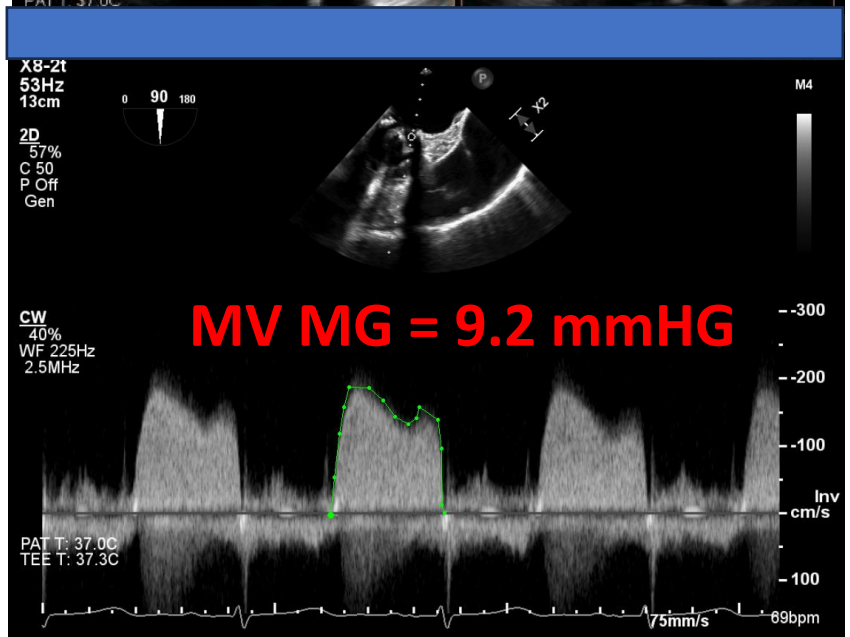
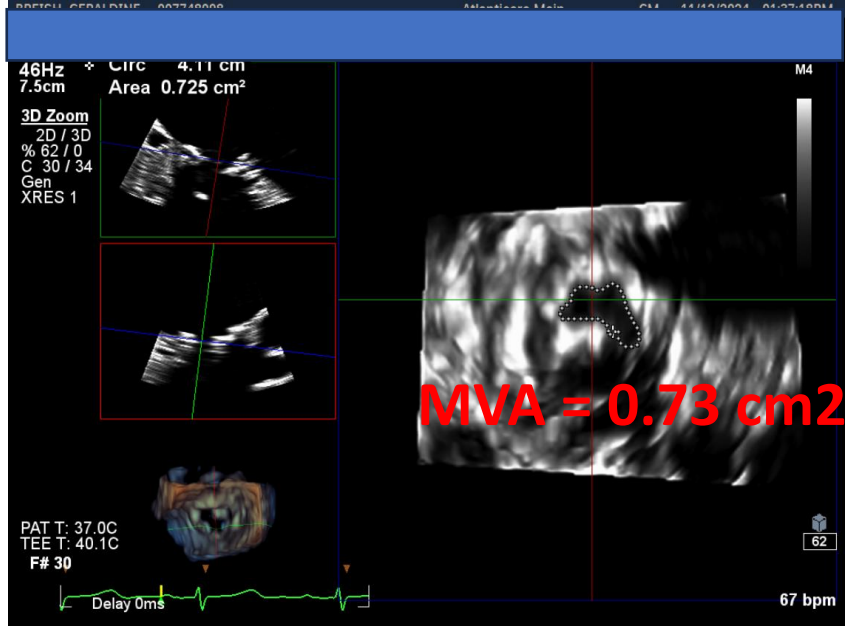
LVEF is normal. MV is severely calcified with restrictive opening. No significant MR









Case 4: LAMPOON in VIR

采用二尖瓣前叶撕裂术在经导管瓣中环的应用

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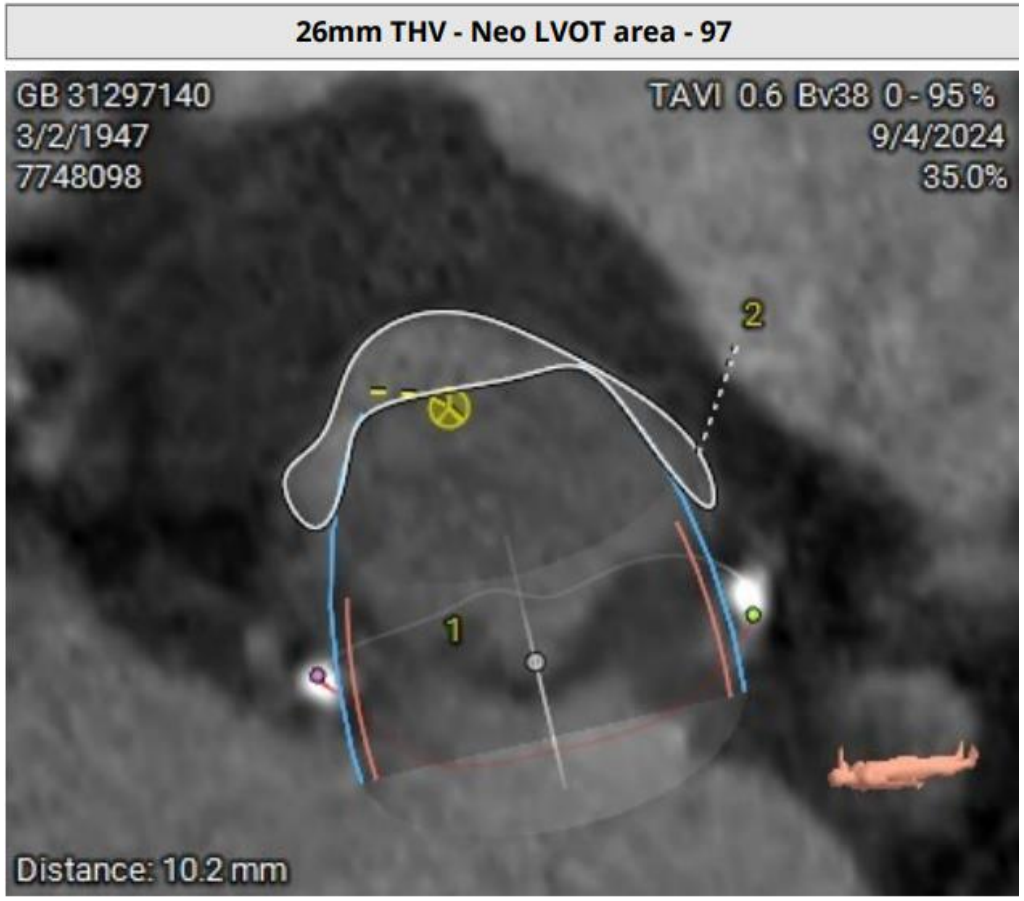
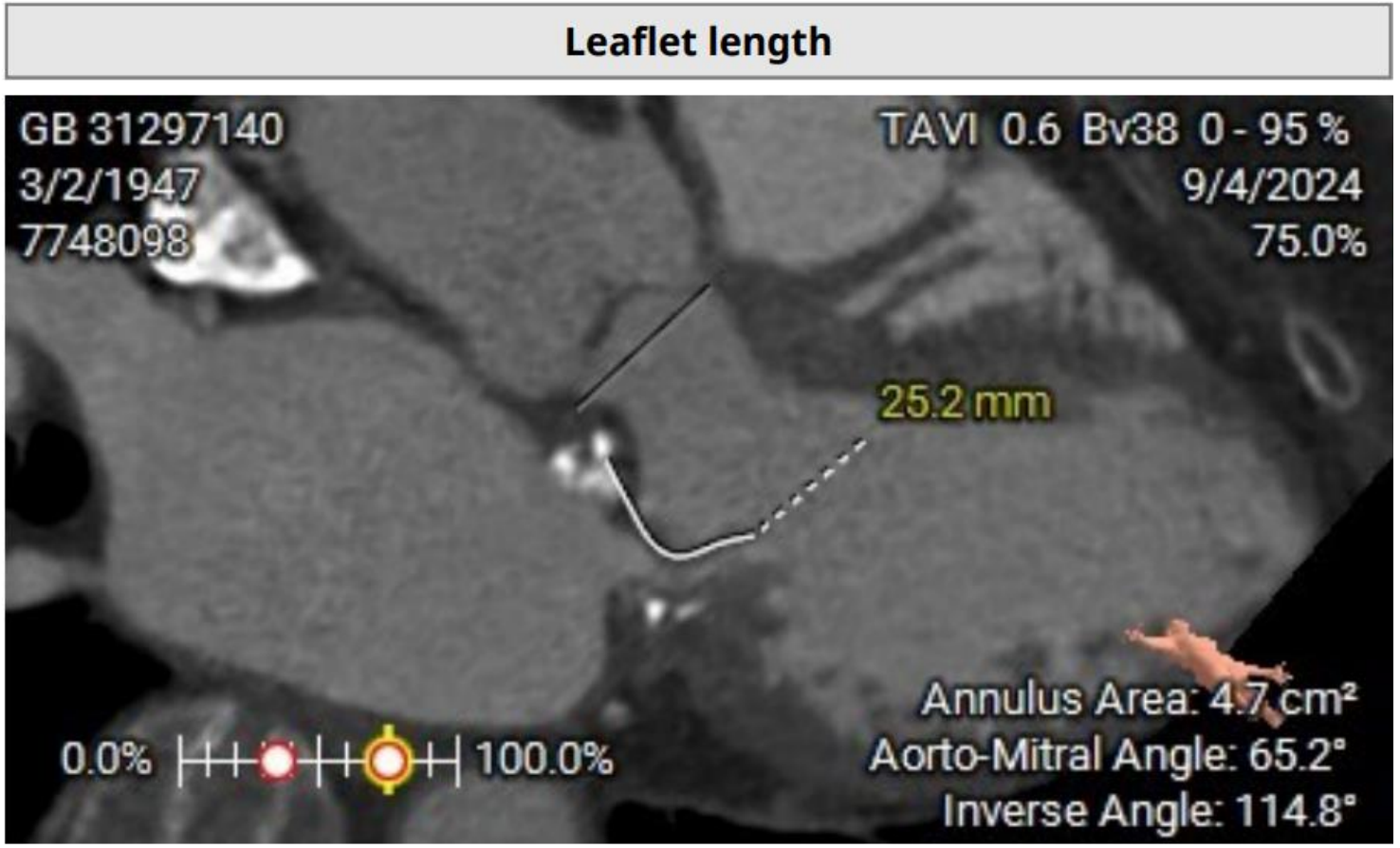
Pre procedure CTA for our patient-9/4/2024

Neo LVOT = 97 mm2 (< 150 mm2)

Anterior leaflet length: 25.2 mm (> 25 mm)



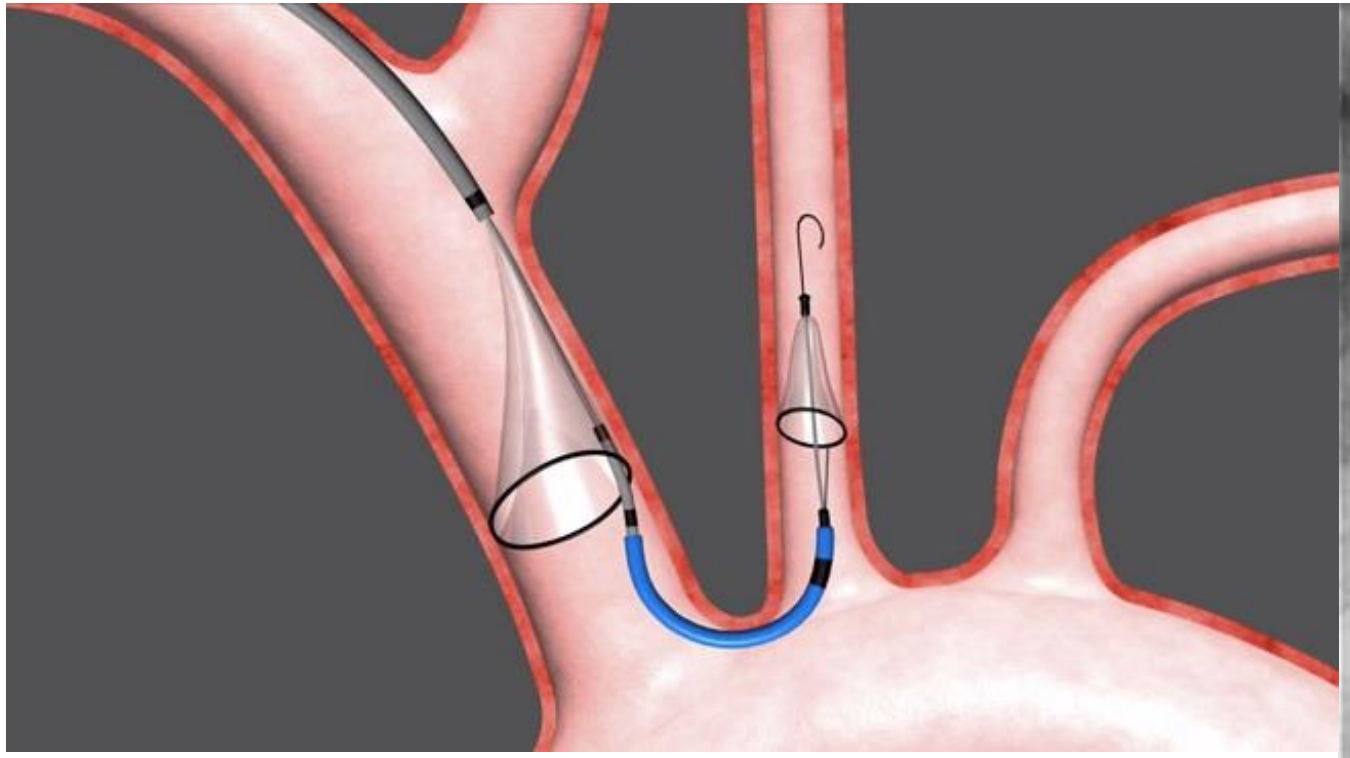


Case 4: LAMPOON-Case Presentation

采用二尖瓣前叶撕裂术在经导管二尖瓣环内瓣膜置换术的应用

Placement of Sentinel Cerebral Protection Device

(放置 SENTINEL抗栓塞脑保护装置)



Case 4: LAMPOON-Case Presentation

采用二尖瓣前叶撕裂术在经导管二尖瓣环内瓣膜置换术的应用

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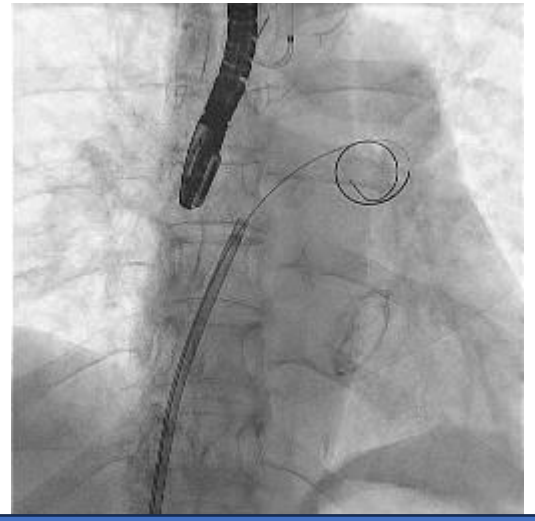
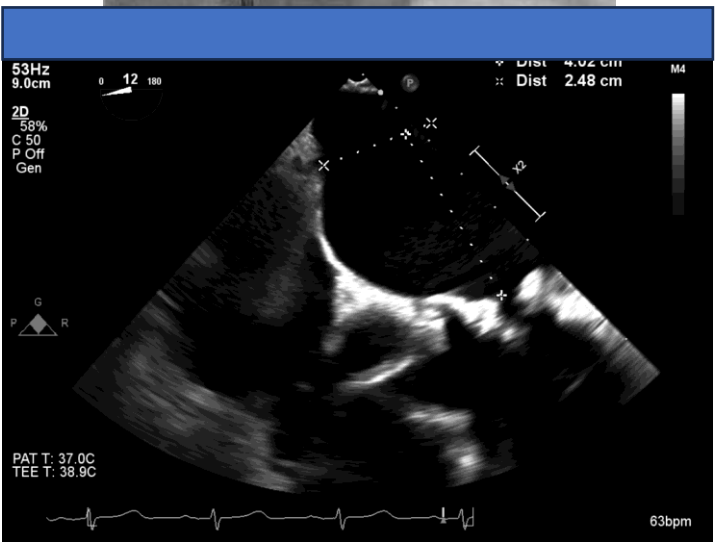
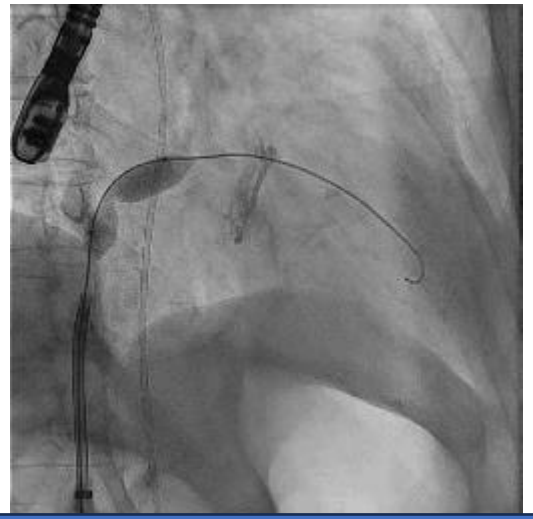
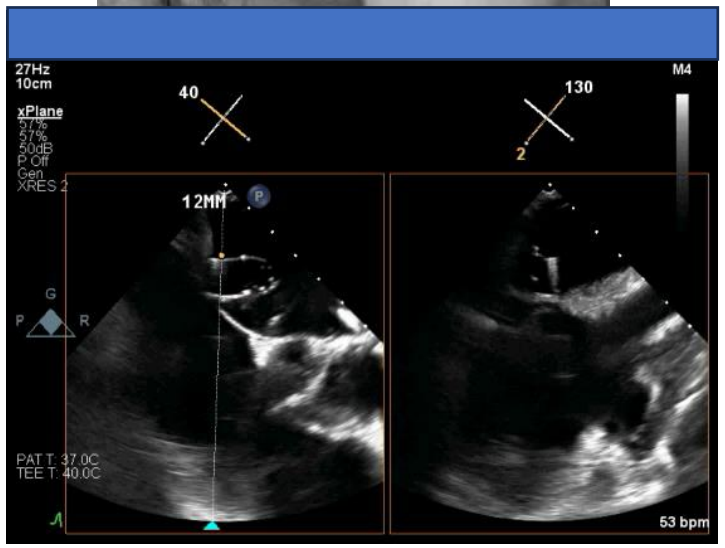
Transseptal puncture
房间隔穿刺



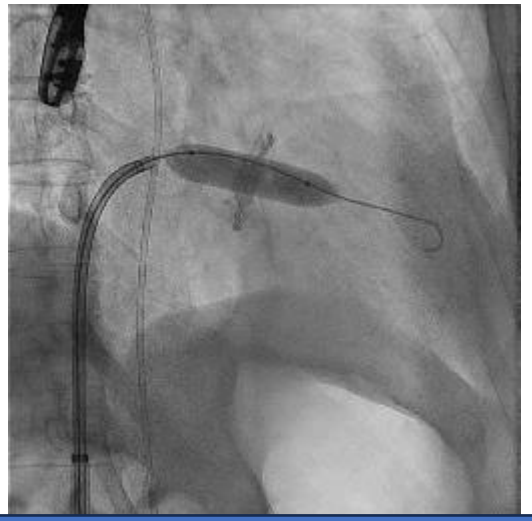


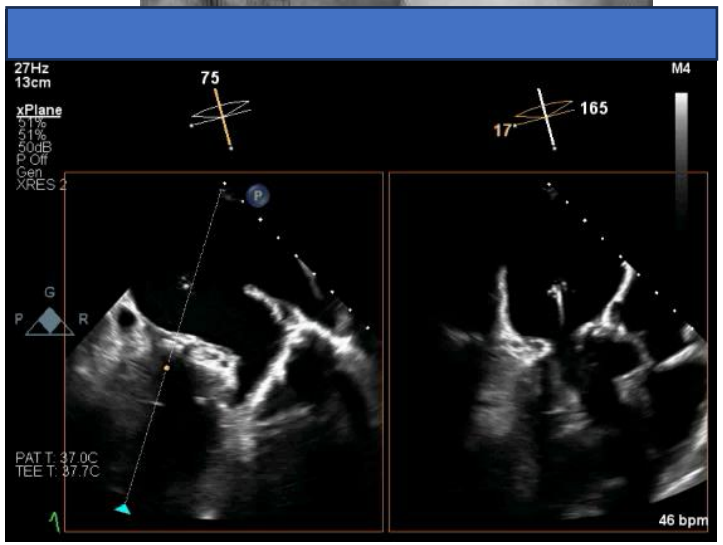
Septostomy
房间膜造口术





Balloon Valvuloplasty
球囊二尖瓣成形术

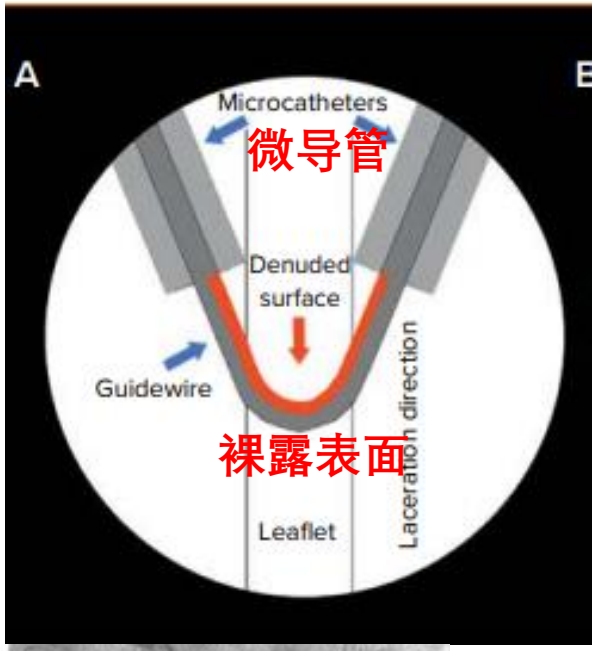




Case 4: LAMPOON-Case Presentation

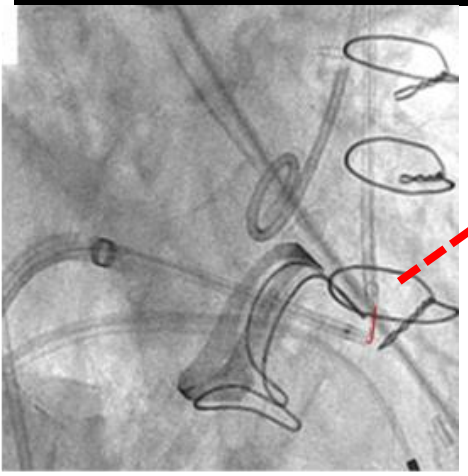
采用二尖瓣前叶撕裂术在经导管二尖瓣环内瓣膜置换术的应用

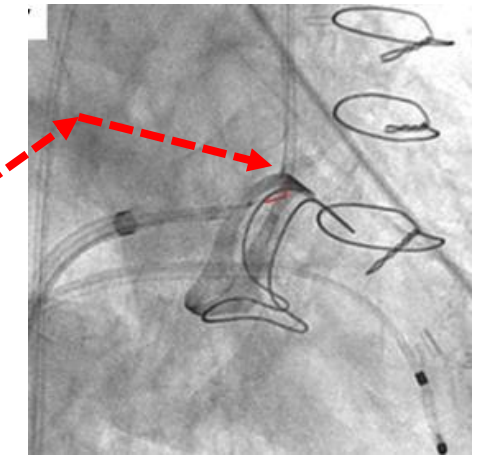
Flying V

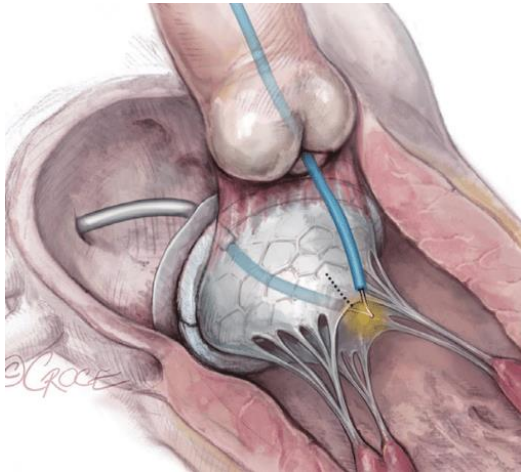


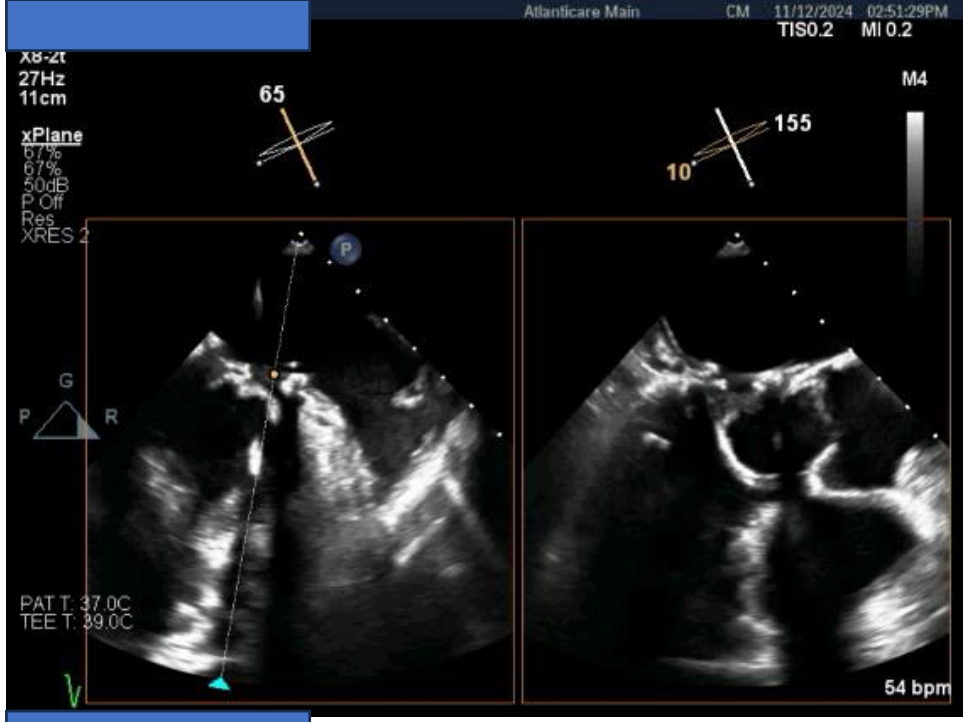
The flying-V lacerating system is positioned at the tip of the mitral valve. Laceration is performed from the tip to the base of the mitral leaflet.

飞V型切开系统位于二尖瓣尖端，从二尖瓣尖端向瓣基底部进行切开









Case 4: LAMPOON-Case Presentation

采用二尖瓣前叶撕裂术在经导管二尖瓣环内瓣膜置换术的应用

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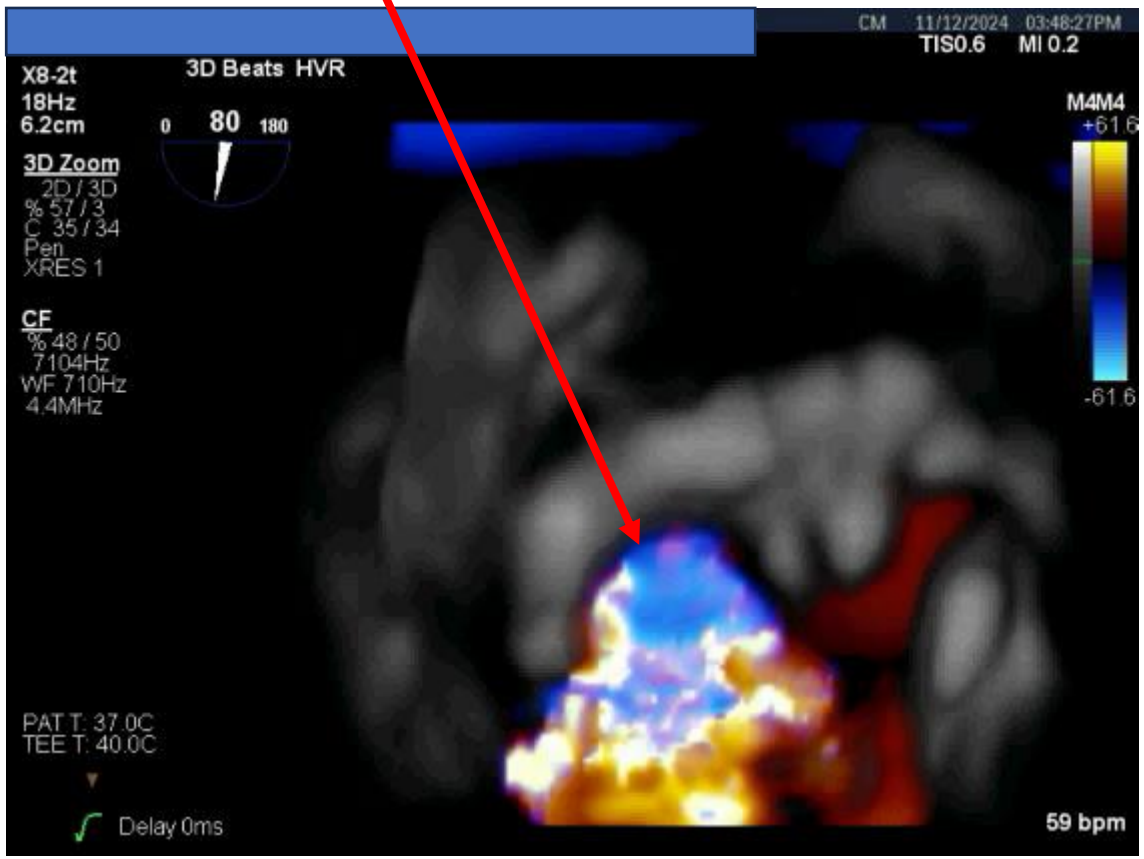
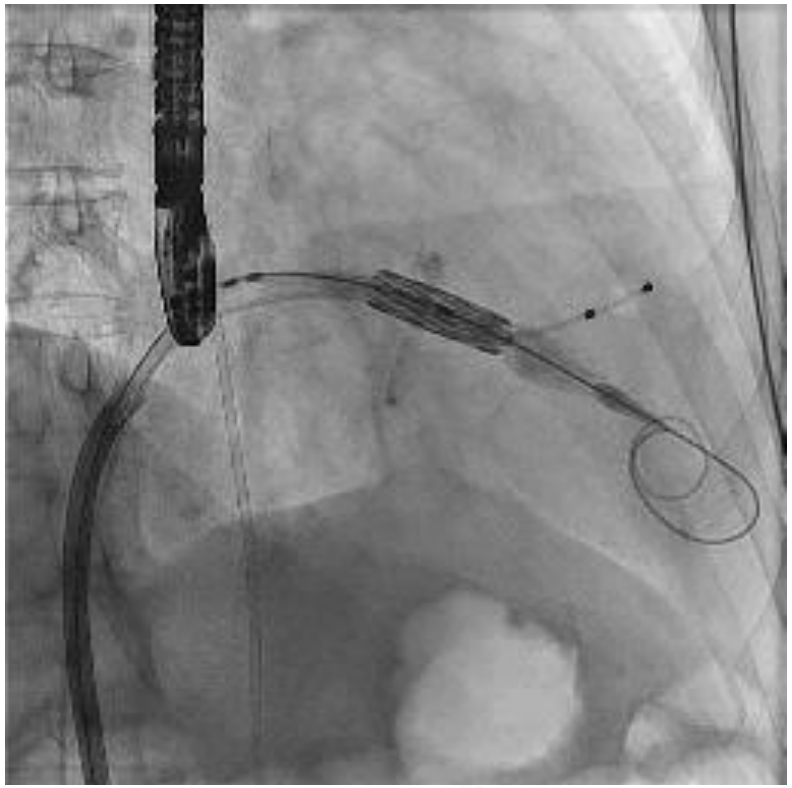
Post LAMPOON- laceration of anterior MV with severe MR

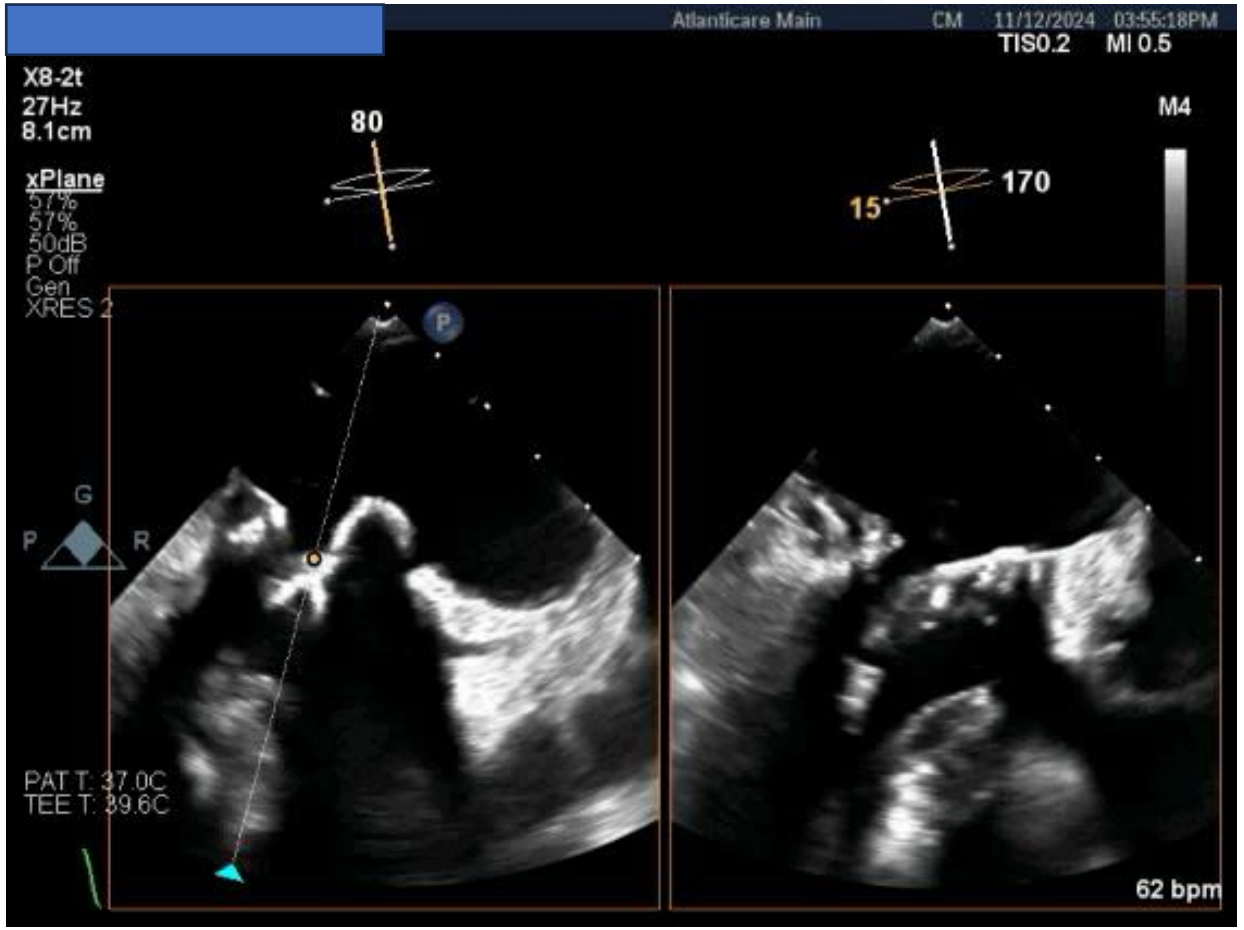
二尖瓣前叶撕裂后出现严重的二尖瓣反流

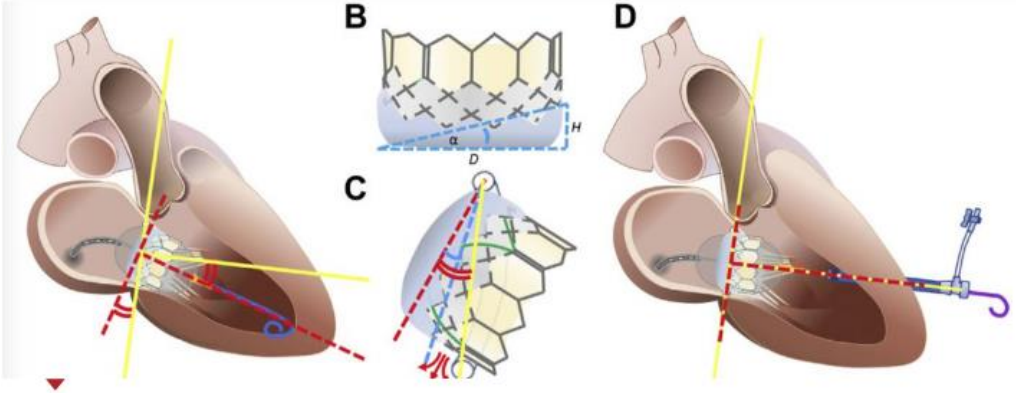


Valve-in-ring procedure

（二尖瓣环内瓣膜置换术）







Discordance between mitral annular centerline (yellow lines) and valve orientation imposed by guidewire position within the LV apex (red dashed lines). (B) Valve intrinsic angle (α) is determined by external skirt height. (C) When annular-apical "Emory" angle (red curves) exceeds α (blue curve), annular skirt apposition is not possible, causing PVL (red arrows). (D) The valve is oriented perpendicular to the annual plane using an exteriorized apical guidewire (solid yellow line)

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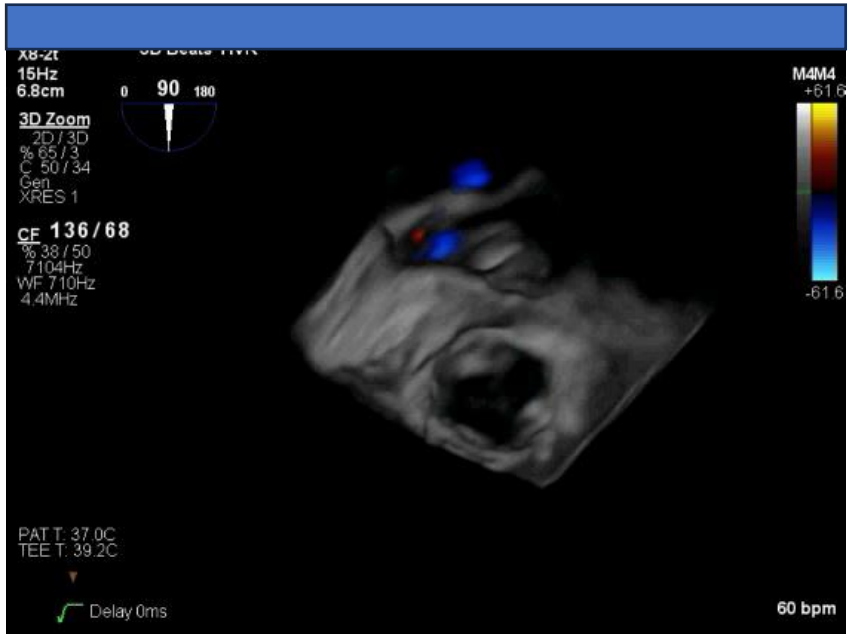
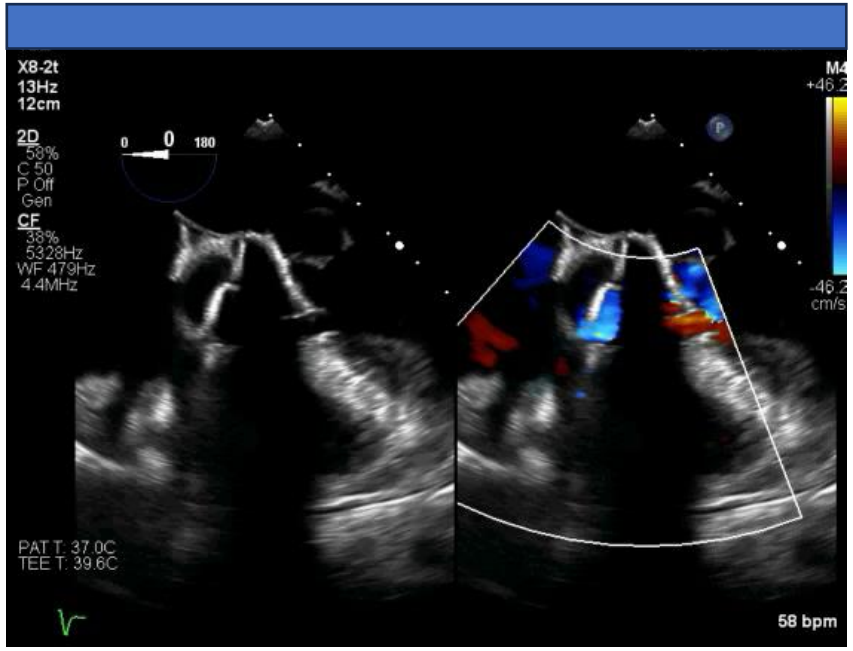
Valve-in-Ring –Final Result: no MR, MV MG = 2 mm Hg

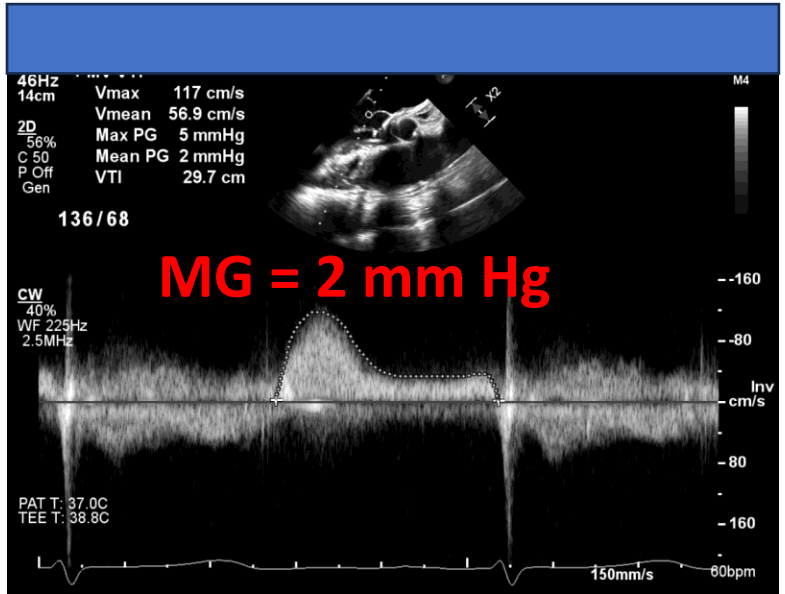
Case 4:

LAMPOON-Case

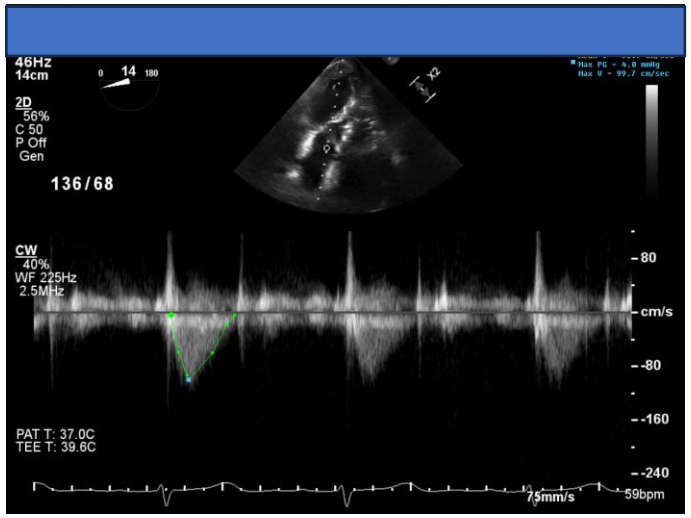
采用二尖瓣前叶撕裂术
在经导管二尖瓣环内瓣
膜置换术的应用







Post VIR: No significant LVOT gradient



Case 4: LAMPOON-Case

采用二尖瓣前叶撕裂术在经导管二尖瓣环内瓣膜置换术的应用

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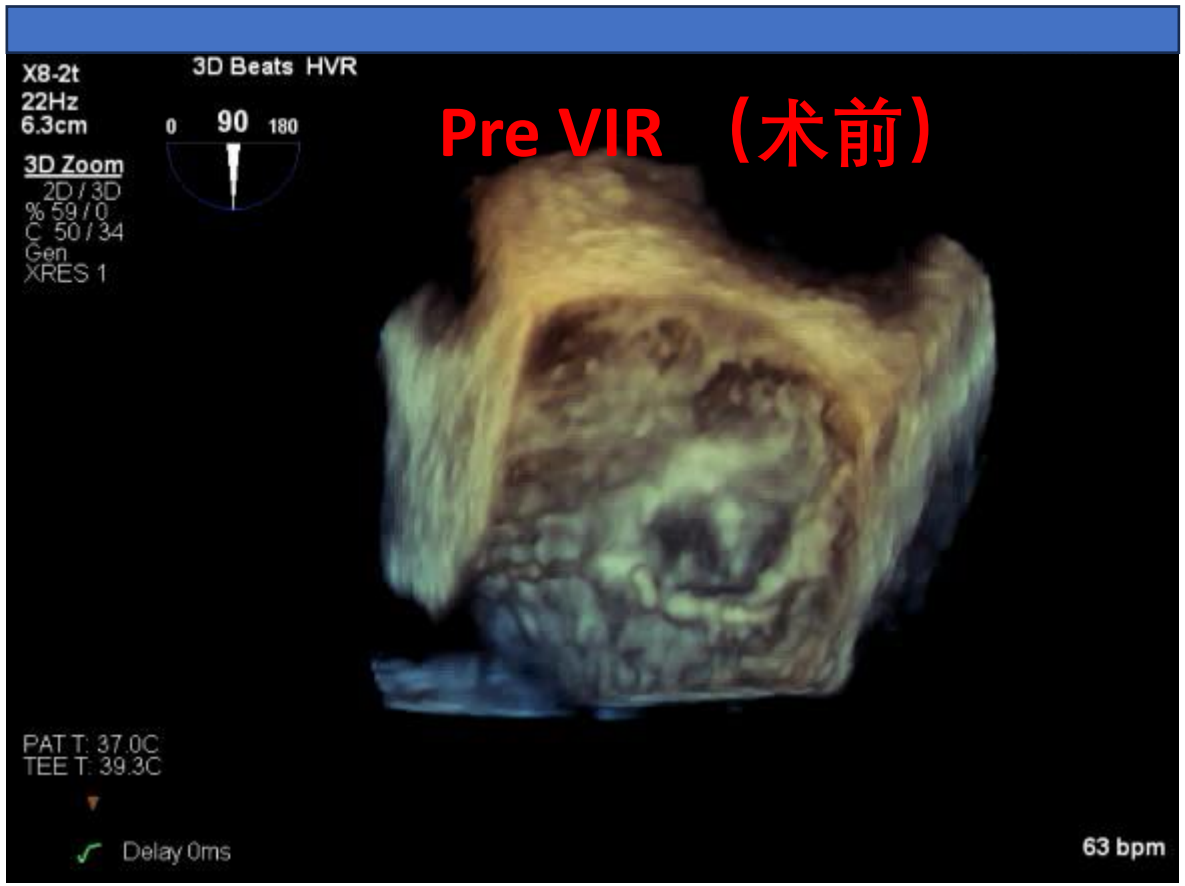
Valve-in-Ring –Final Result: no MR, MV MG = 2 mm Hg



Patient was discharged home the second day.

Case 5: VIV-TTVR-Case Presentation

经导管三尖瓣瓣中瓣植入术

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Patient is a 56-year-old retired Wrestler with PMH of bacterial endocarditis in 2011. He underwent AVR (#23 mm Edwards Carpentier Magna) and TVR (#33 mm Biocore prosthetic valve) in 2011 at Cleveland Clinic.

In 2018, he underwent redo AVR with #27 Carboseal Top-Hat (Mechanical vale, on Coumadin) at UPENN due to PPM (patient prosthetic mismatch).

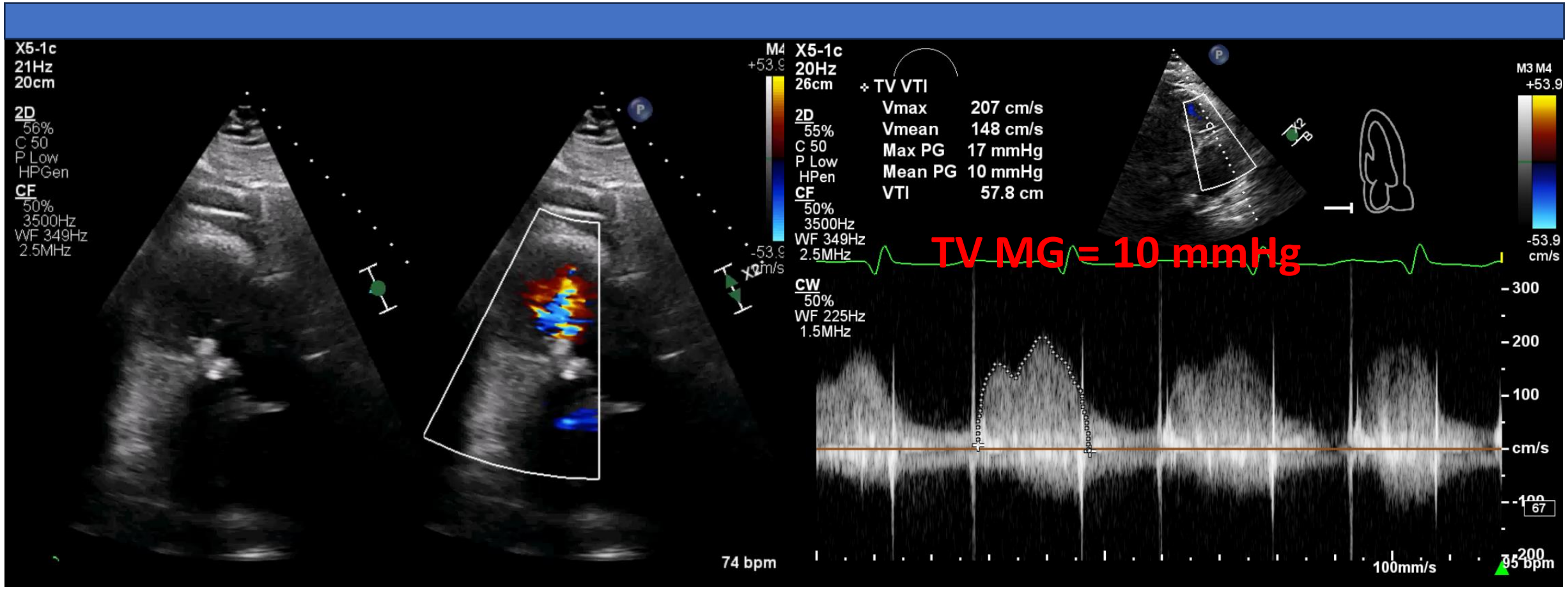
Other PMH included: persistent atrial fibrillation s/p multiple cardioversions and a-fib ablation in 12/26/23 with Dr. Link, hypertension, hyperlipidemia, HFrEF (40%), chronic lymphedema, CKDIII, morbid obesity BMI 44, chronic back pain d/t T11 compression fracture, gastroenteritis, OSA nonadherent to CPAP, and iron deficiency anemia.
He also had Sepsis 20 times over the last 12 years.

He presents with increasing SOB for several months.

Case 5: VIV-TTVR-Case Presentation

经导管三尖瓣瓣中瓣植入术

Echo on 5/21/2024

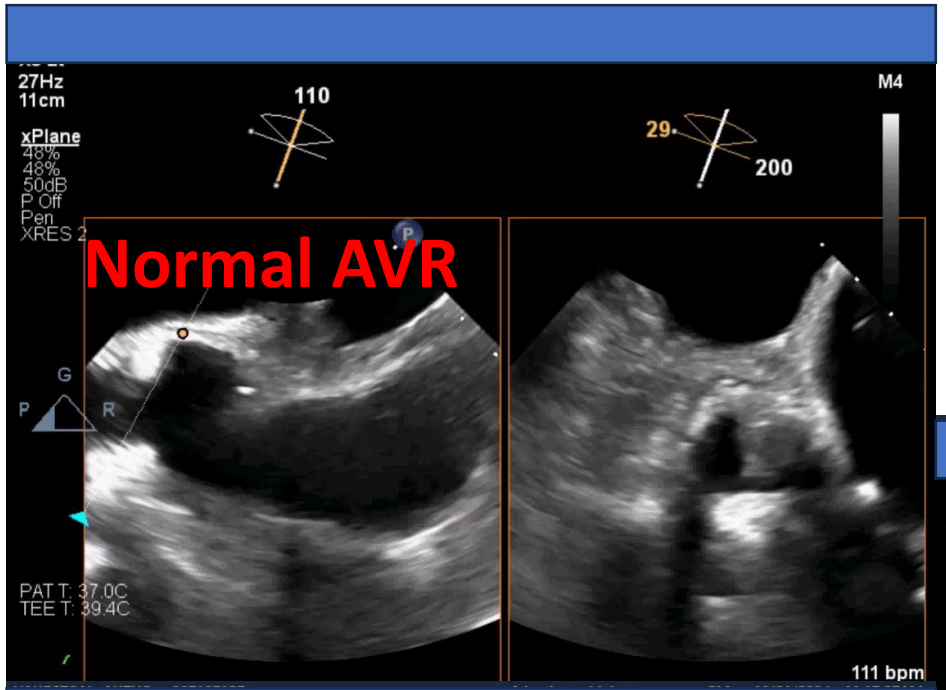


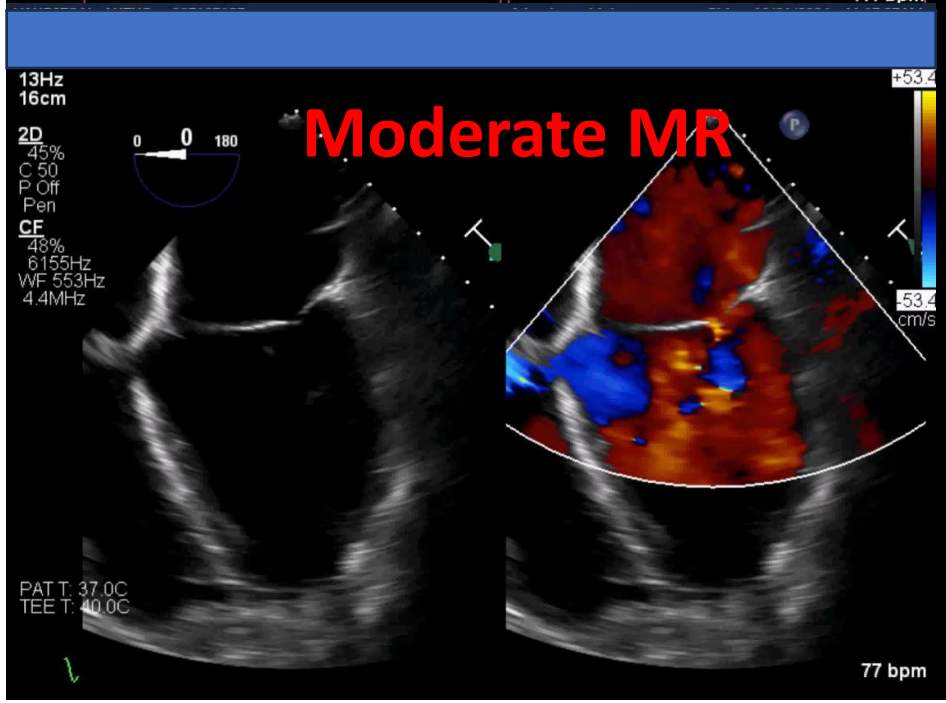
Case 5: VIV-TTVR-Case Presentation

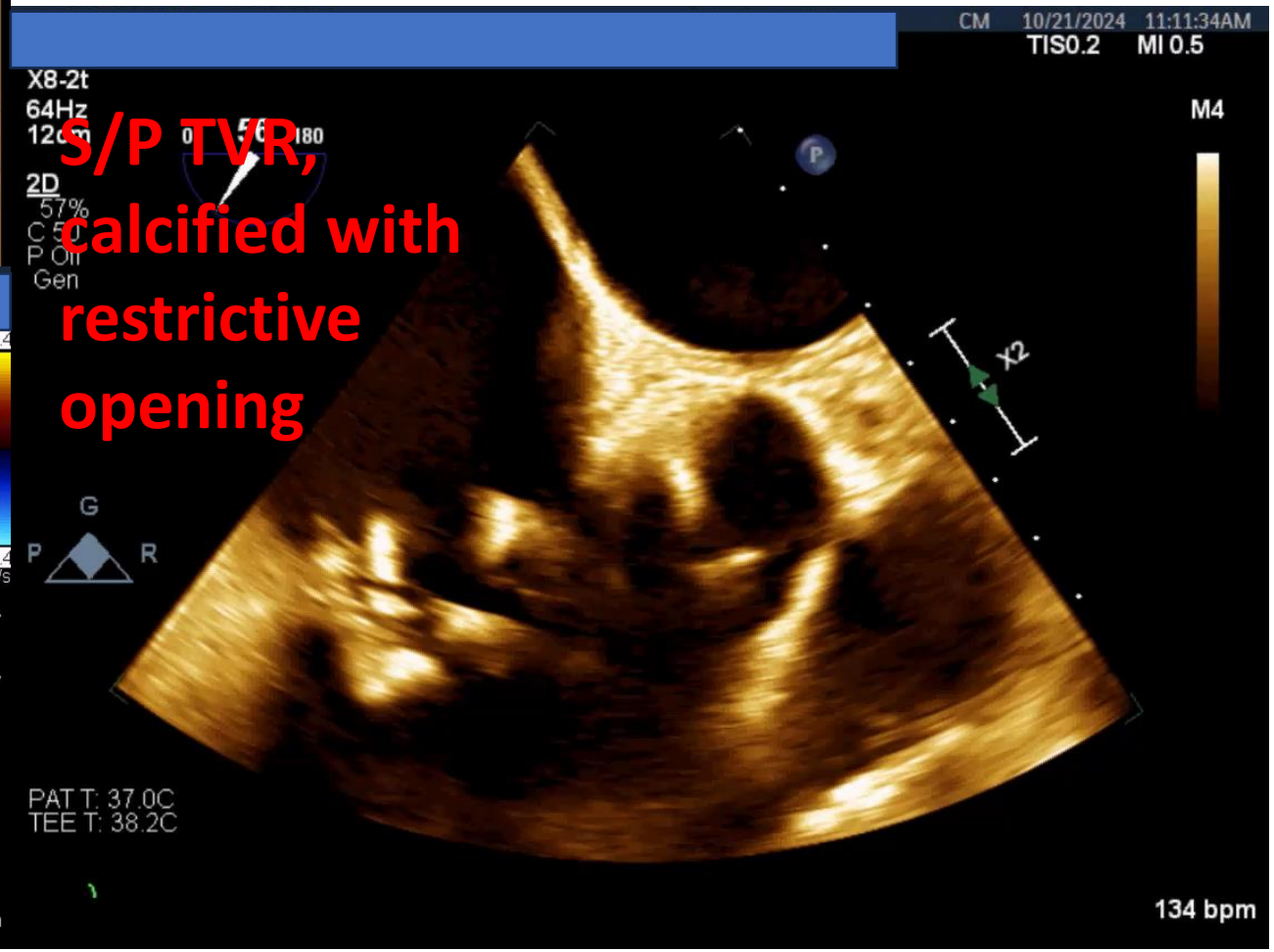
经导管三尖瓣瓣中瓣植入术

TEE on 10/21/2024

Cath on 10/24/24: TV MG = 7.7 mmHg







Case 5: VIV-TTVR-Case Presentation
经导管三尖瓣瓣中瓣植入术

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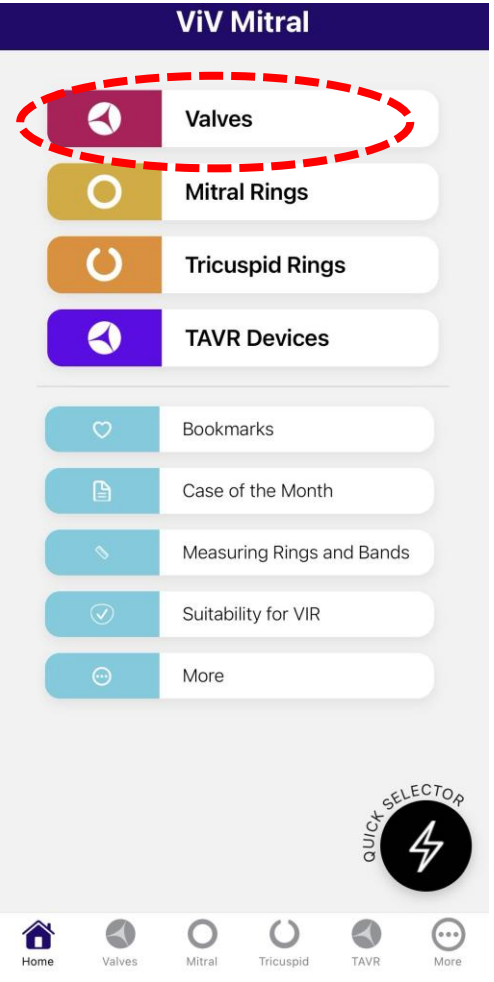
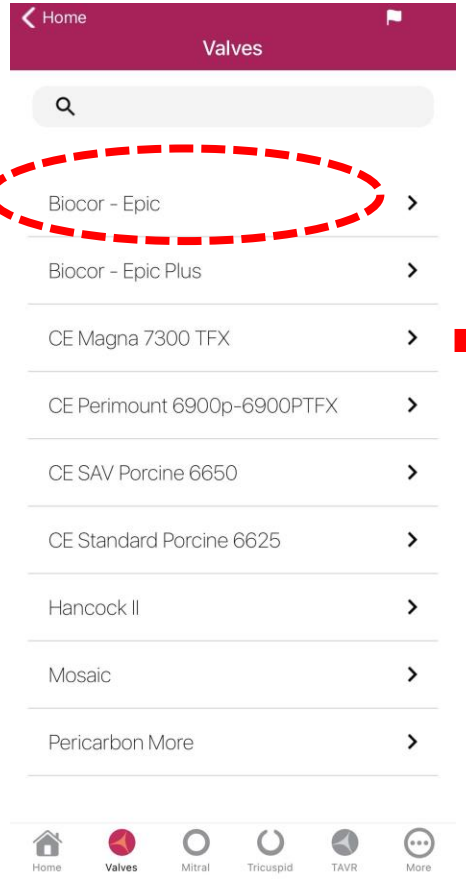
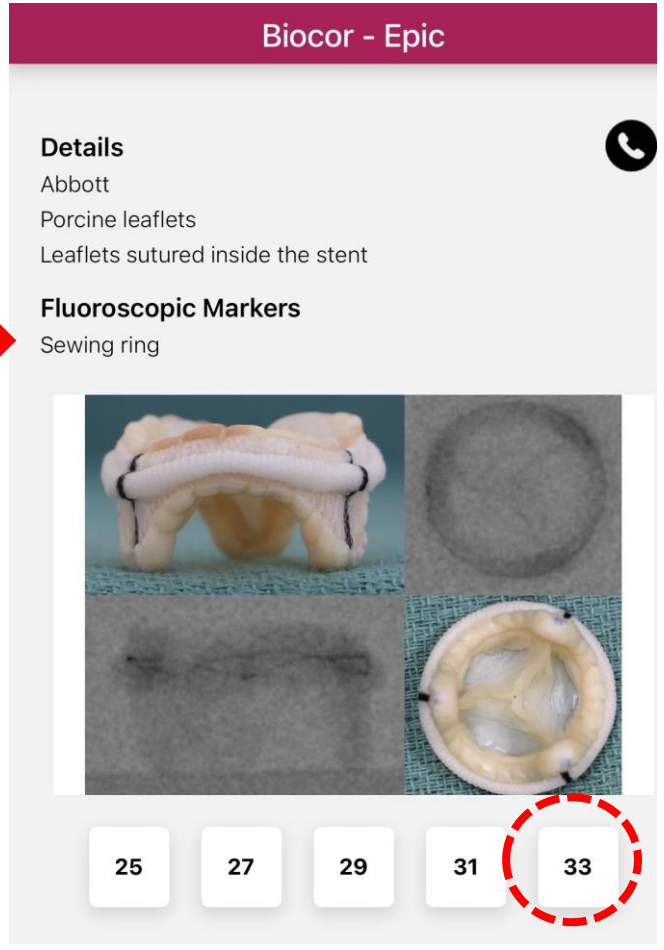
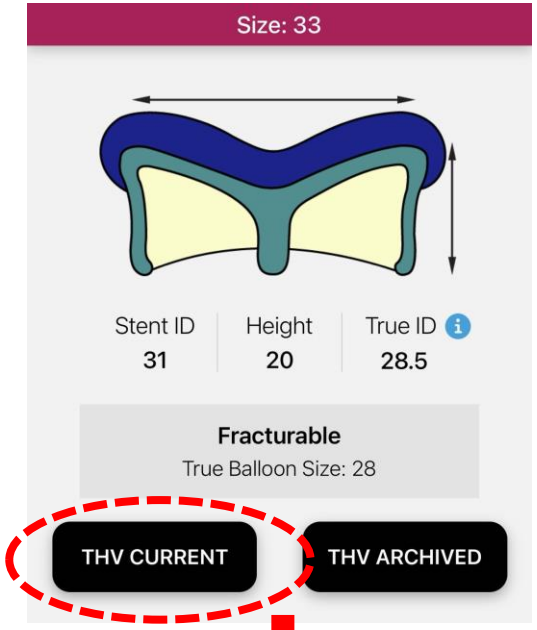
ViV Mitral

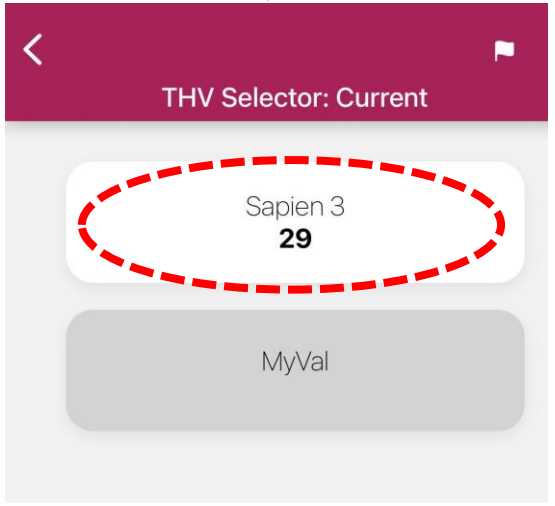
How to choose transcatheter valve
如何选择经导管瓣膜











Case 5: VIV-TTVR-Case Presentation

经导管三尖瓣瓣中瓣植入术

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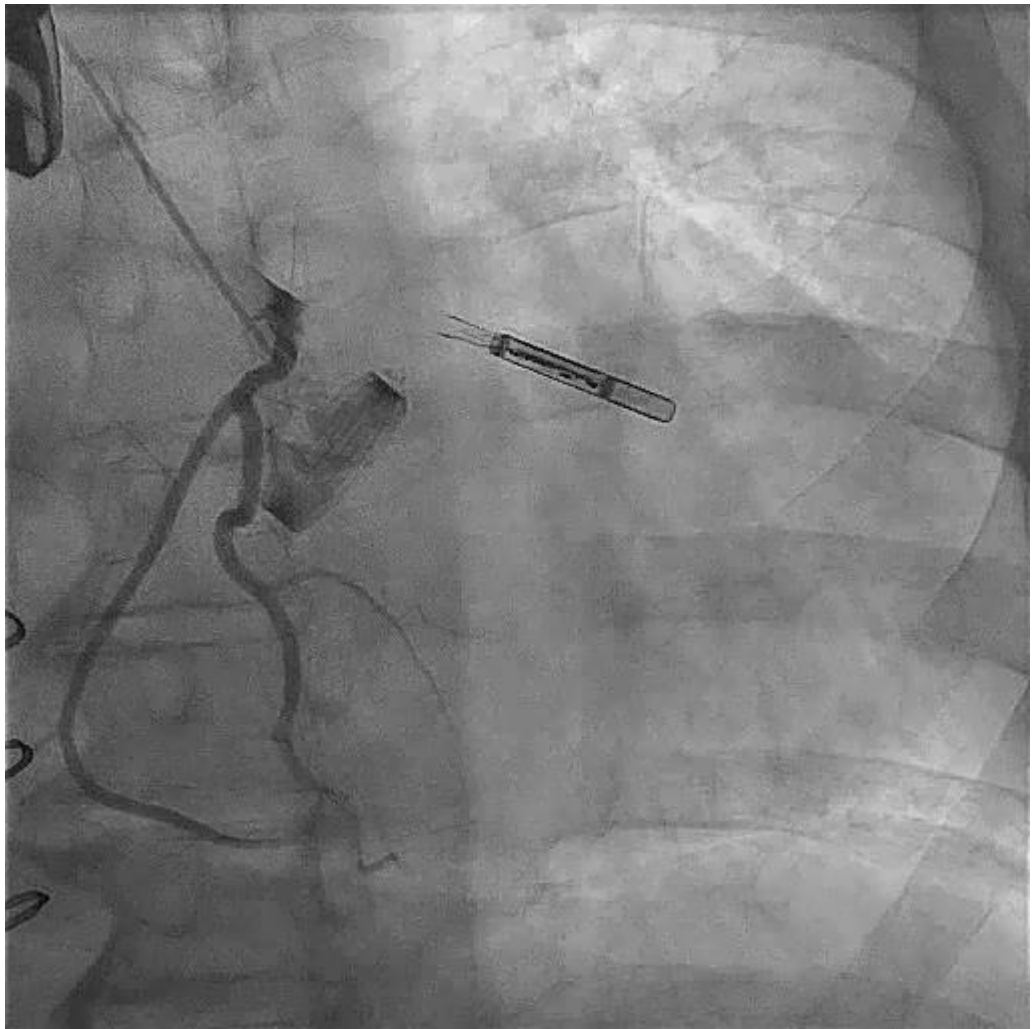
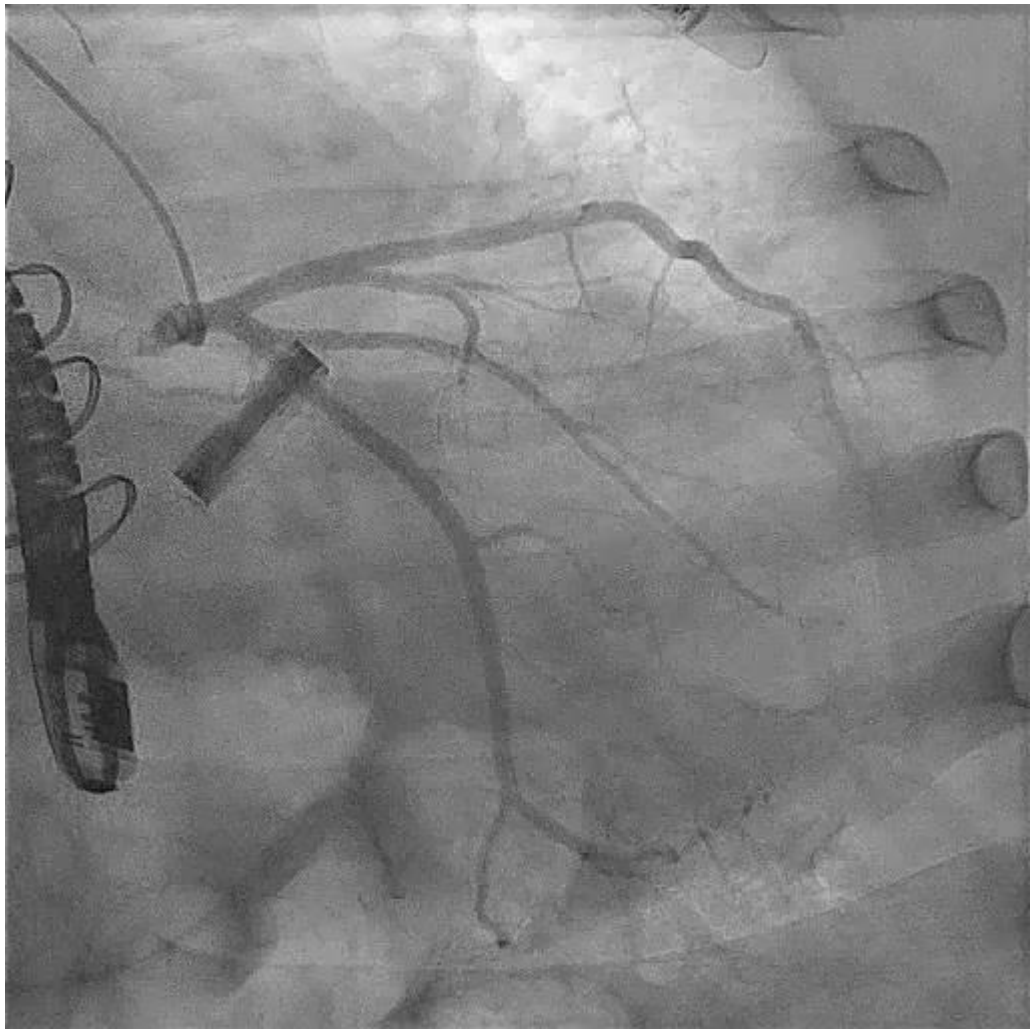
Cath: 4/22/2025-normal coronary arteries





Case 5: VIV-TTVR-on 4/22/2025

经导管三尖瓣瓣中瓣植入术

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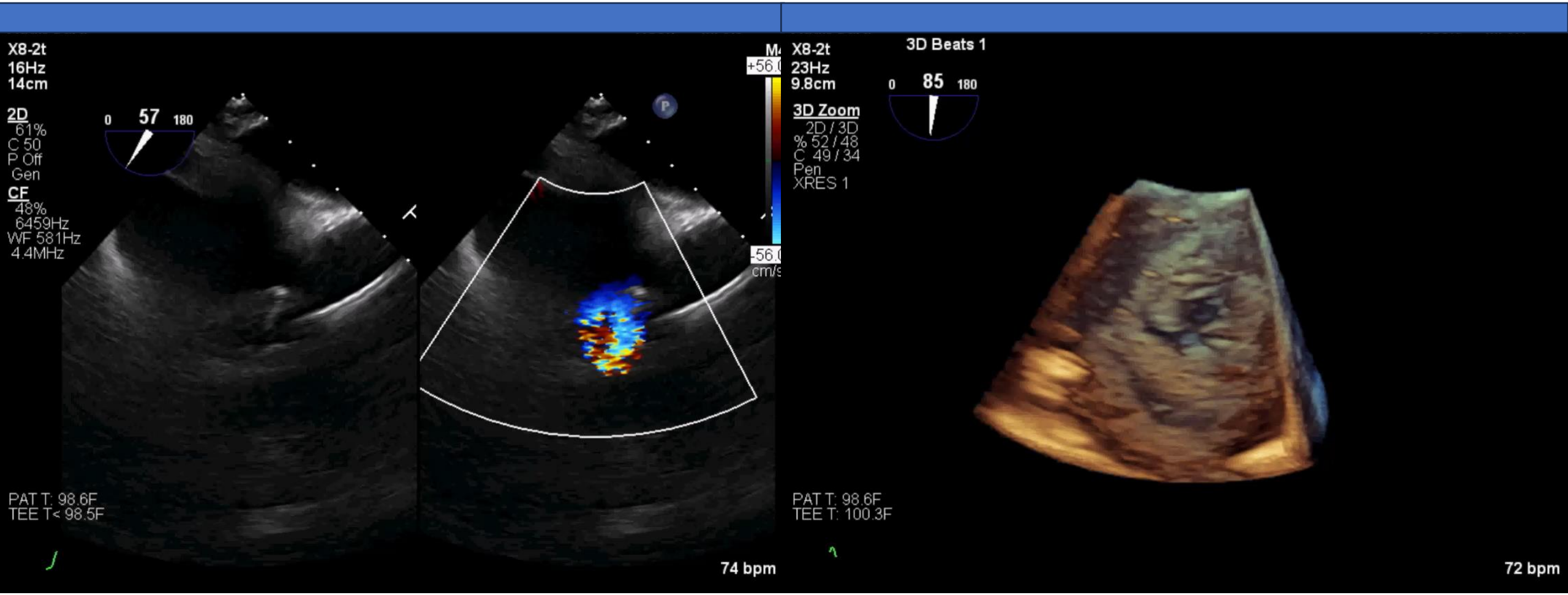
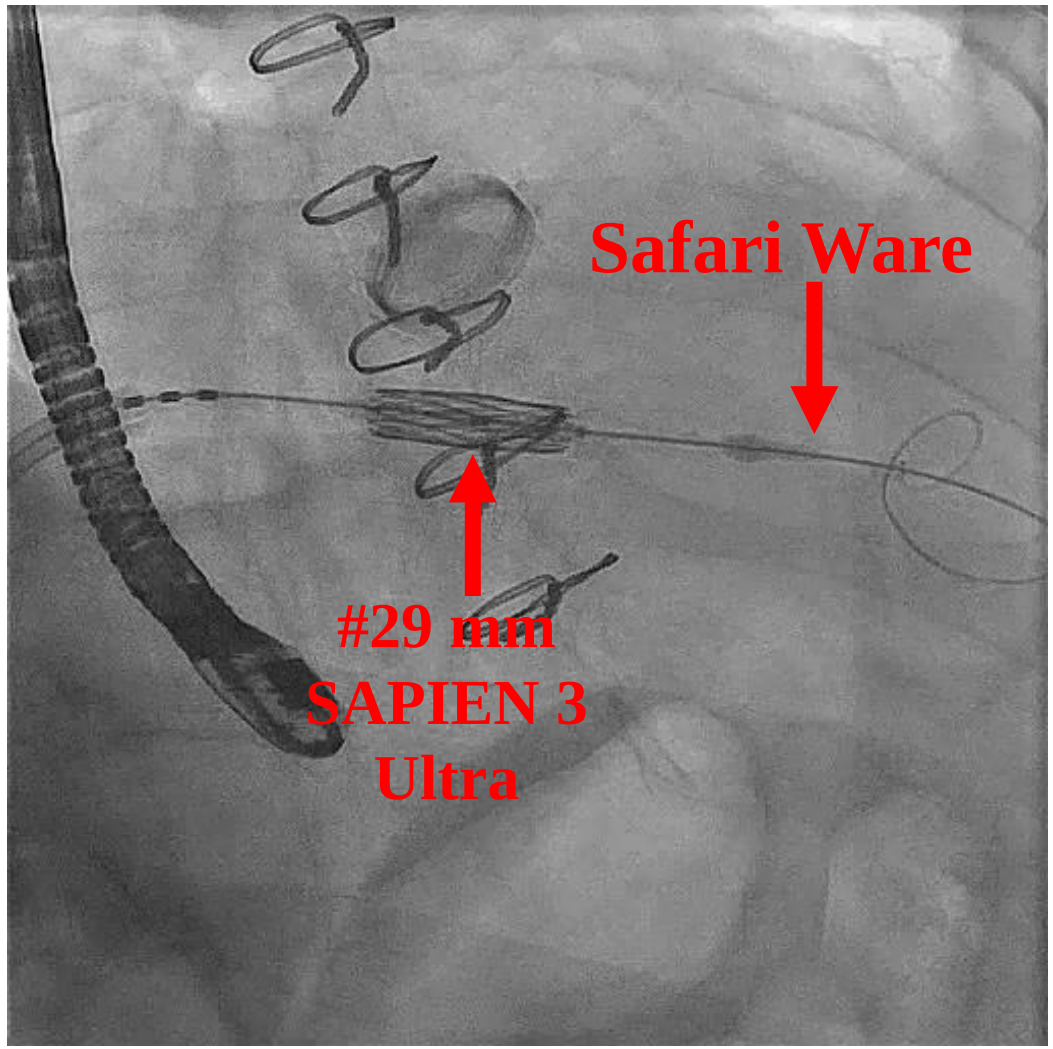
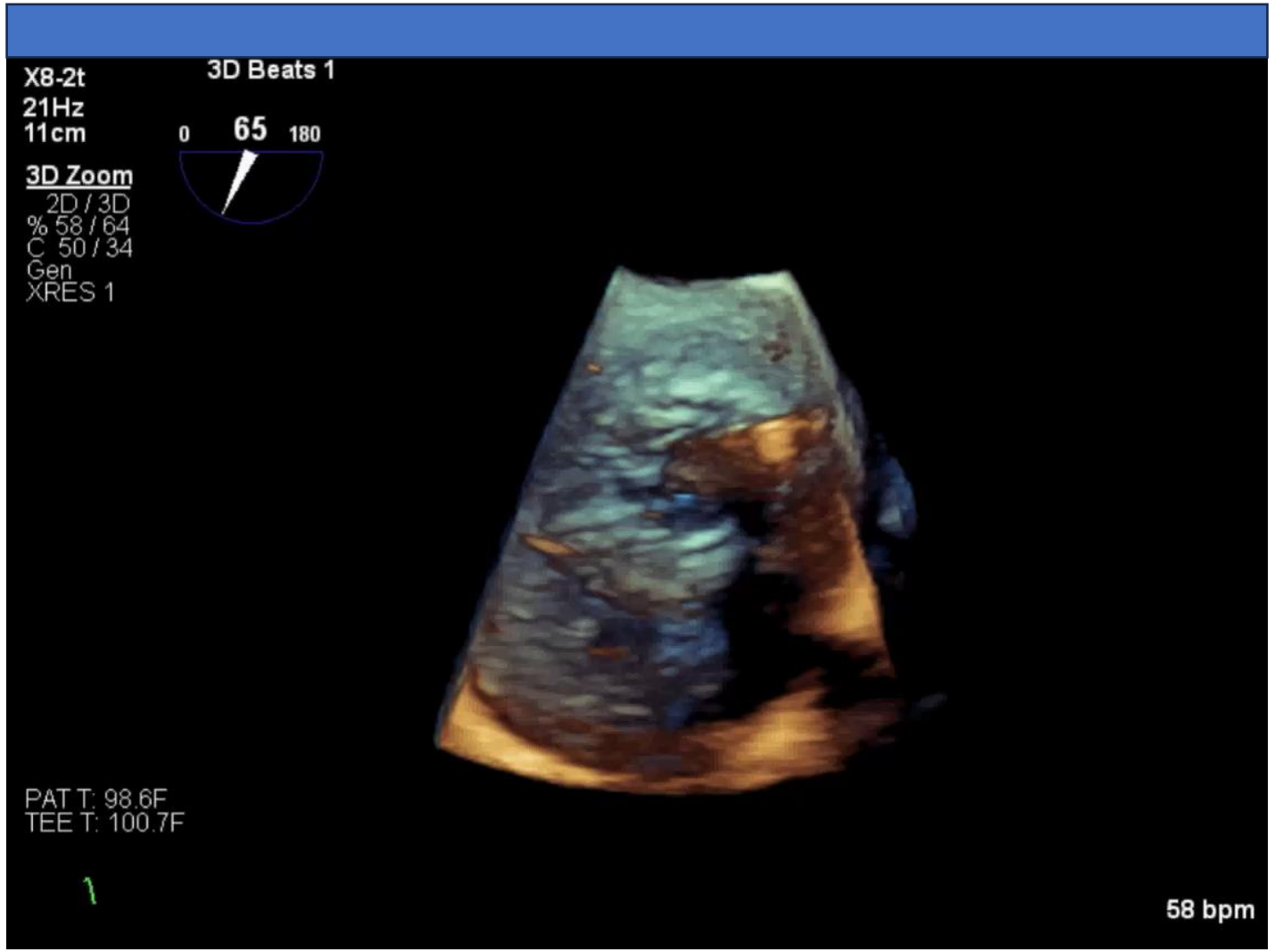
TEE: S/P TVR, heavily calcified TV with restrictive opening, TV MG 7 mmHg, mild TR



Case 5: VIV-TTVR with #29 mm SAPIEN 3 Ultra -on 4/22/2025

经导管三尖瓣瓣中瓣植入术





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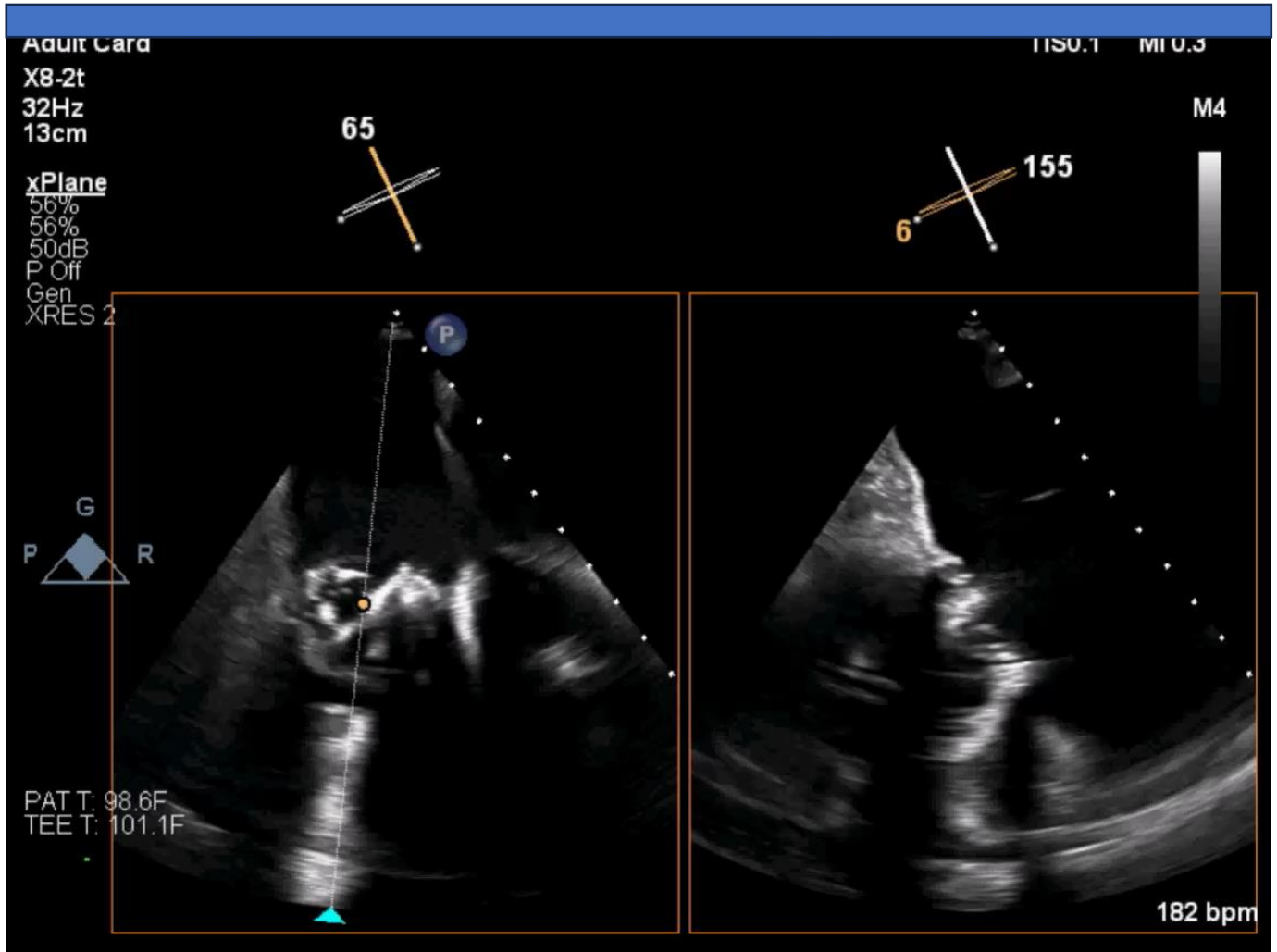
Case 5: VIV-TTVR with #29 mm SAPIEN 3 Ultra -on 4/22/2025

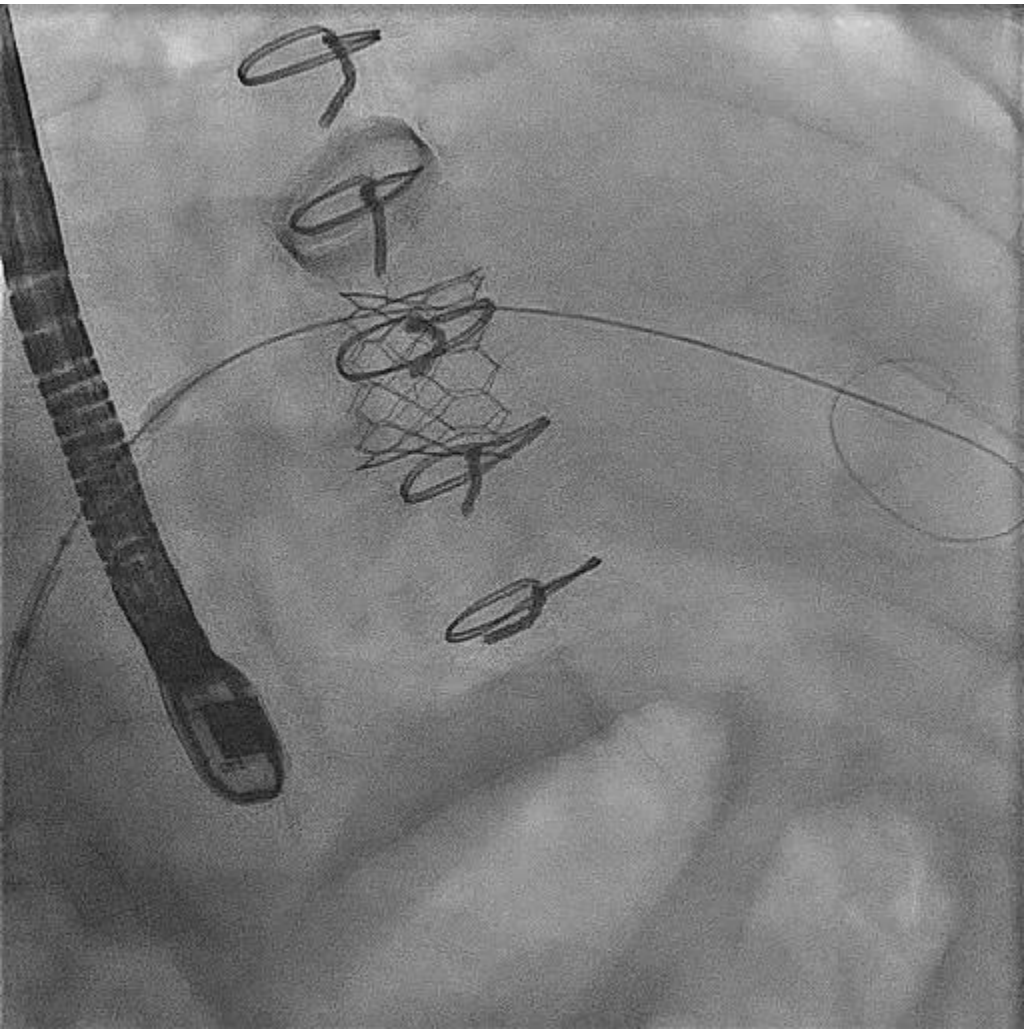
经导管三尖瓣瓣中瓣植入术

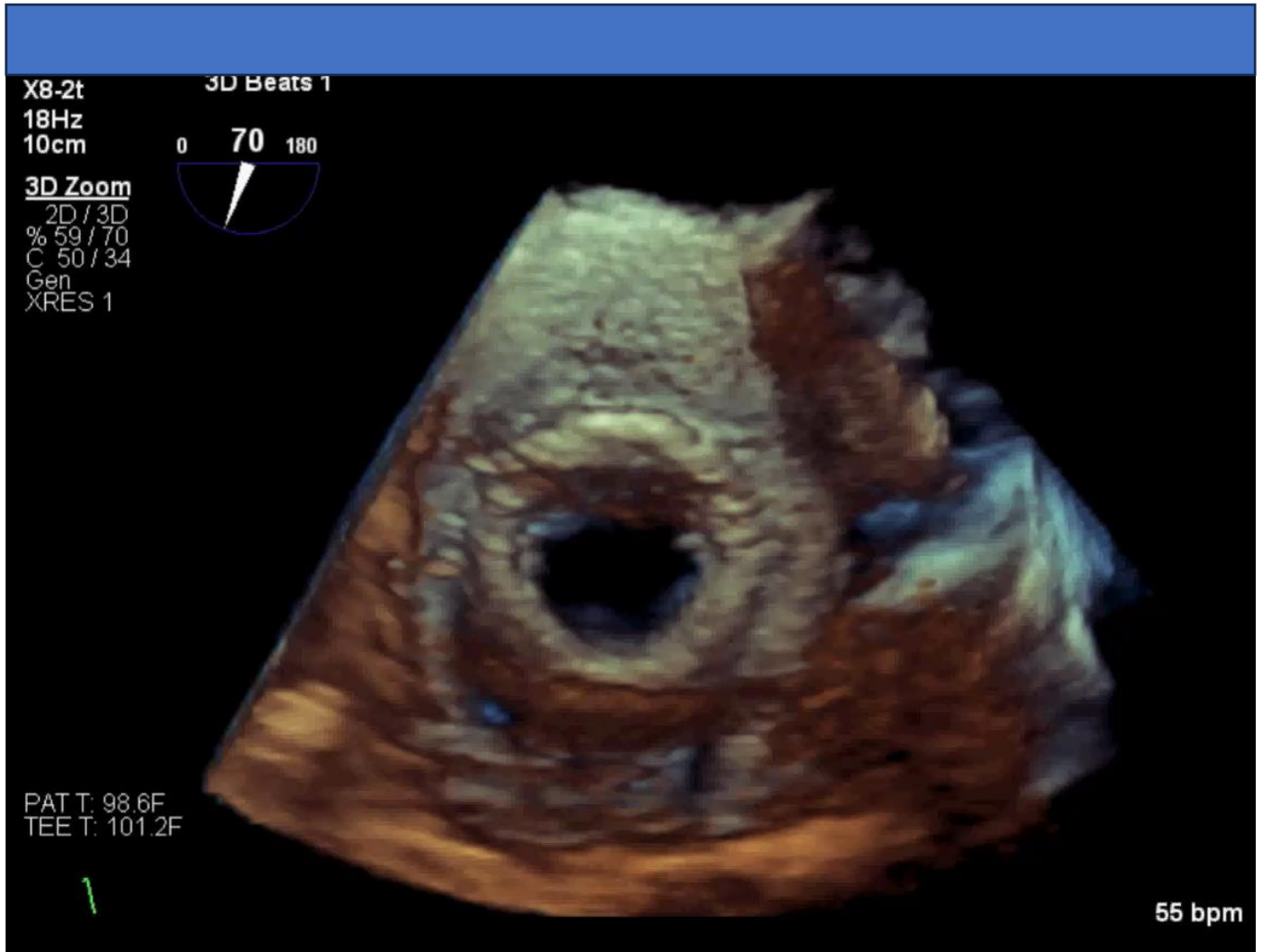


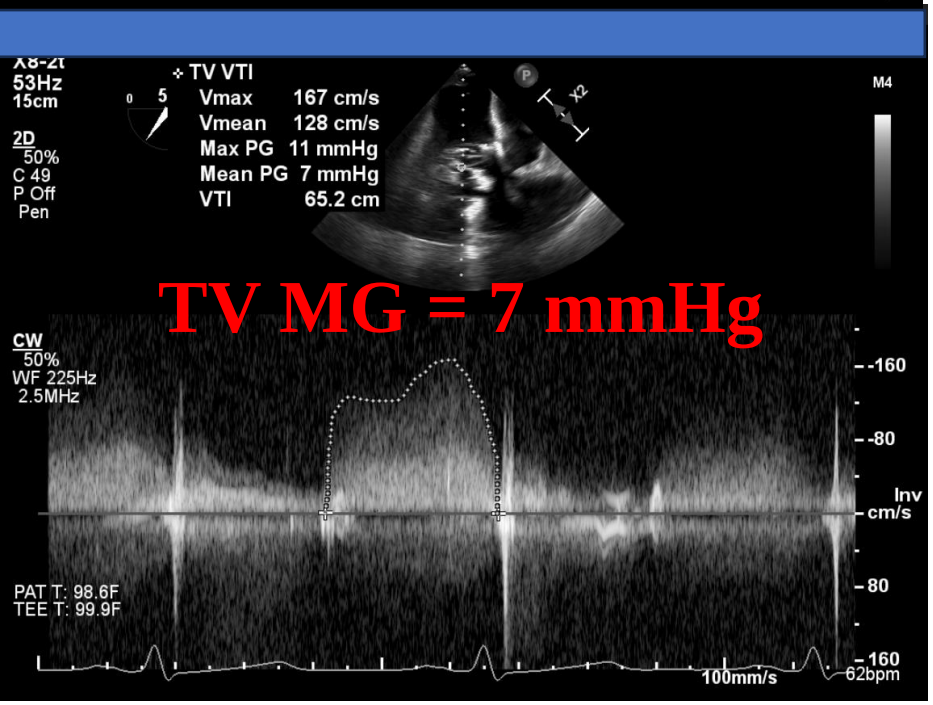
Case 5: VIV-TTVR with #29 mm SAPIEN 3 Ultra -on 4/22/2025

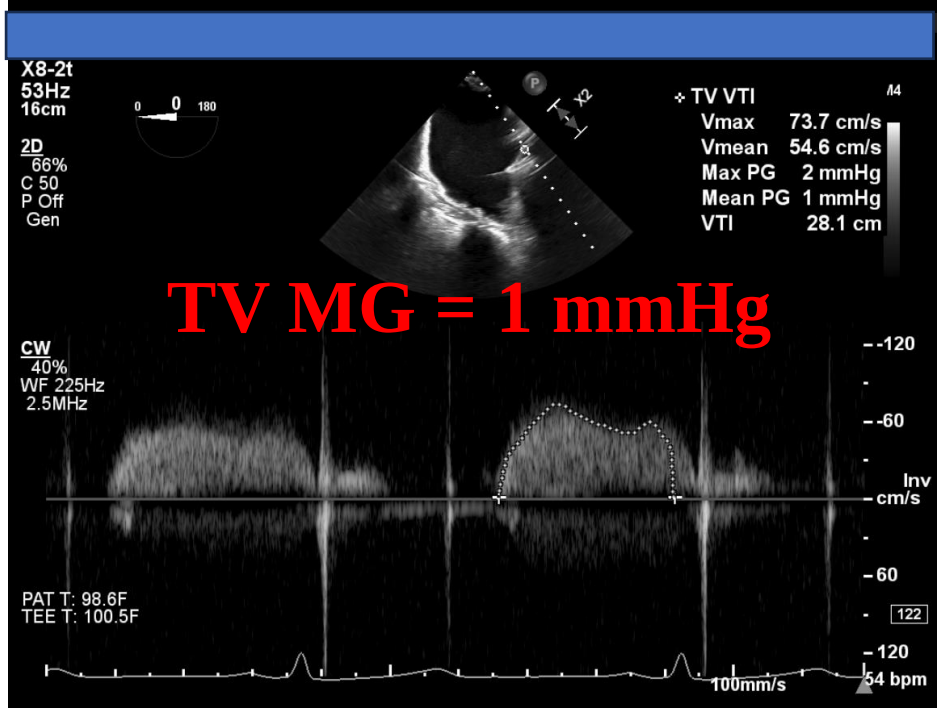
经导管三尖瓣瓣中瓣植入术

Final Result （最终结果）









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Case 5: VIV-TTVR with #29 mm SAPIEN 3 Ultra -on 4/22/2025

经导管三尖瓣瓣中瓣植入术

Patient was doing well after VIV TTVR. He was discharged home the second after the procedure

患者恢复良好。术后第二天就出院回家

Case 6: AngioVac- for Post MVR-mass

Case Presentation

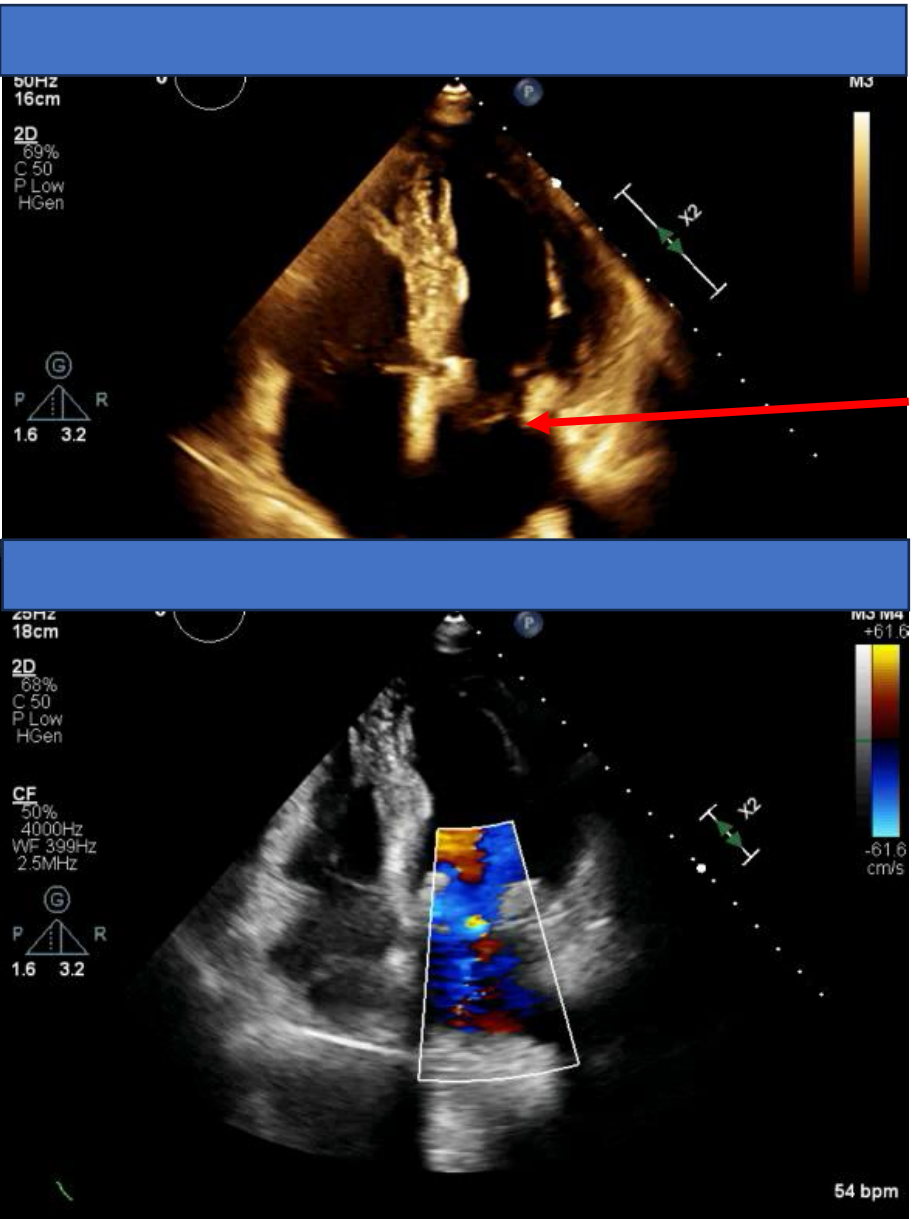
67-year-old female, with PMH of severe MR, HTN, hyperlipidemia, hypothyroidism, TIA, smoker, DVT, rheumatoid arthritis, COPD, who presented with CC of increase of SOB for several months.

TEE on 4/5/24 showed normal EF, Severe MR, incomplete coaptation of MV, LVOT gradient of 299 mmHg, severe LA enlargement.

Cath on 4/22/24: moderate stable CAD, 40% mRCA, 30% dLCX, normal LVEF

On 5/17/24, she underwent transaortic septal myectomy, MVR with #31 mm St. Jude medical epic porcine Valve.

Post-Op Routine Echo on 8/28/2024:



Case 6: AngioVac-治疗二尖瓣换瓣术后和并感染性心内膜炎

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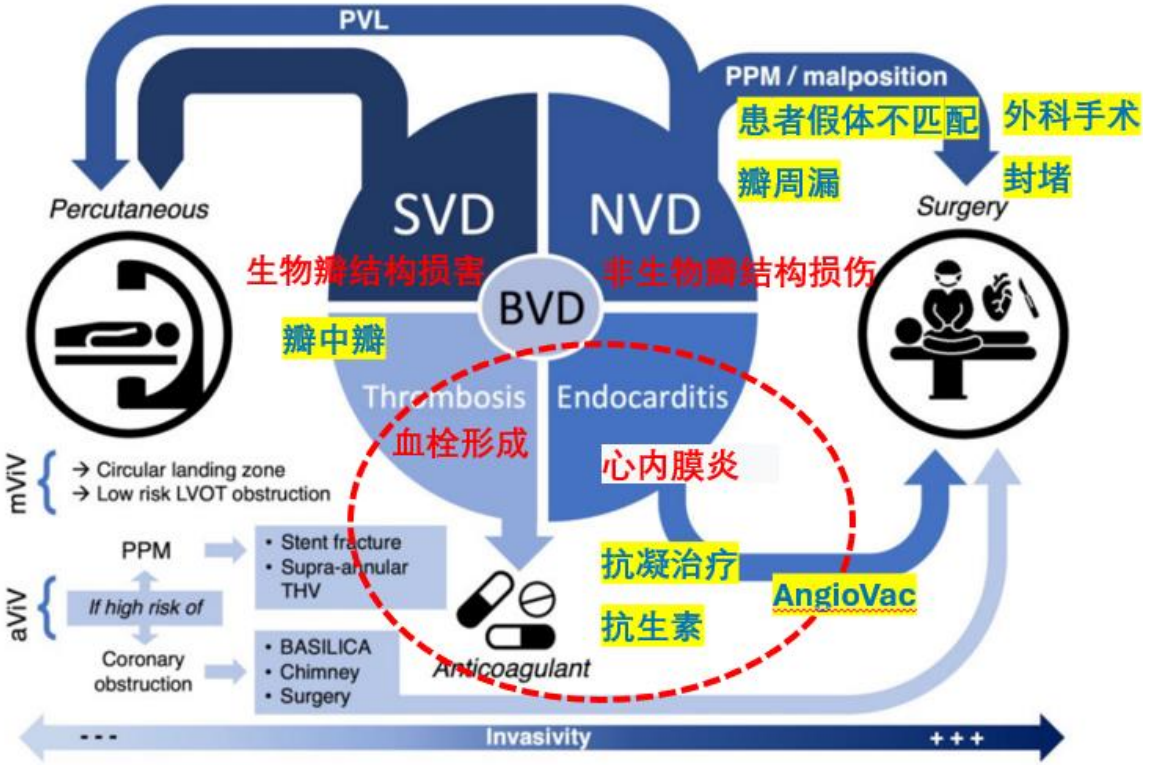
Normal LVEF, S/P MVR with a mobile mass attached to MVR, mild MR



Case 6: AngioVac-治疗二尖瓣换瓣术后和并感染性心内膜炎

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TEE on 9/13/24

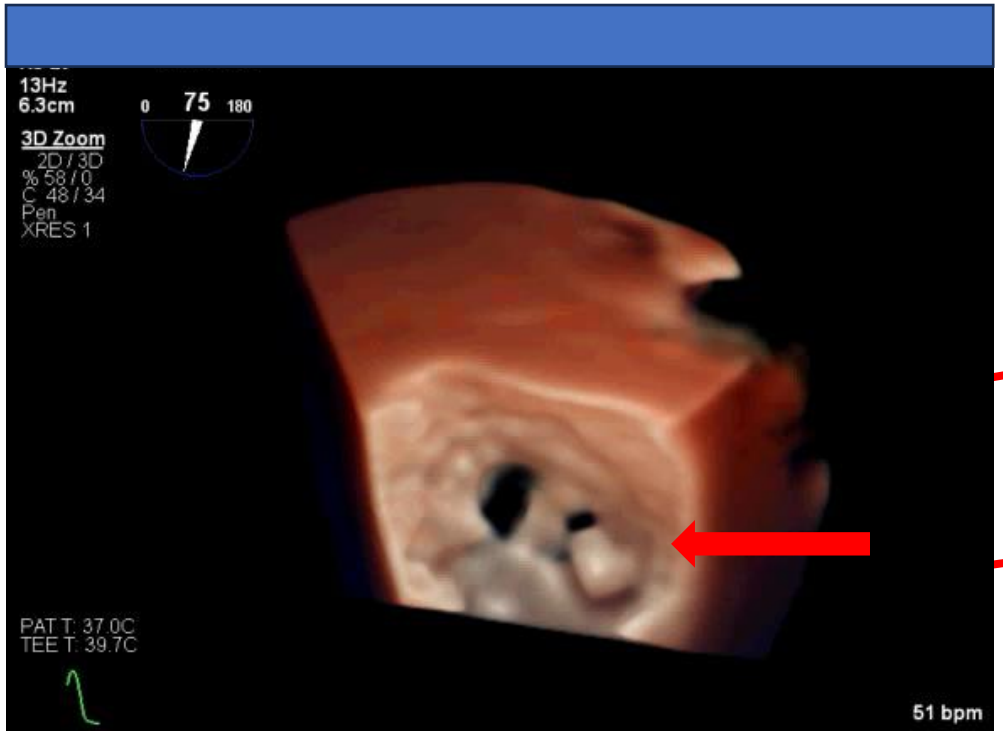
Patient remains asymptomatic

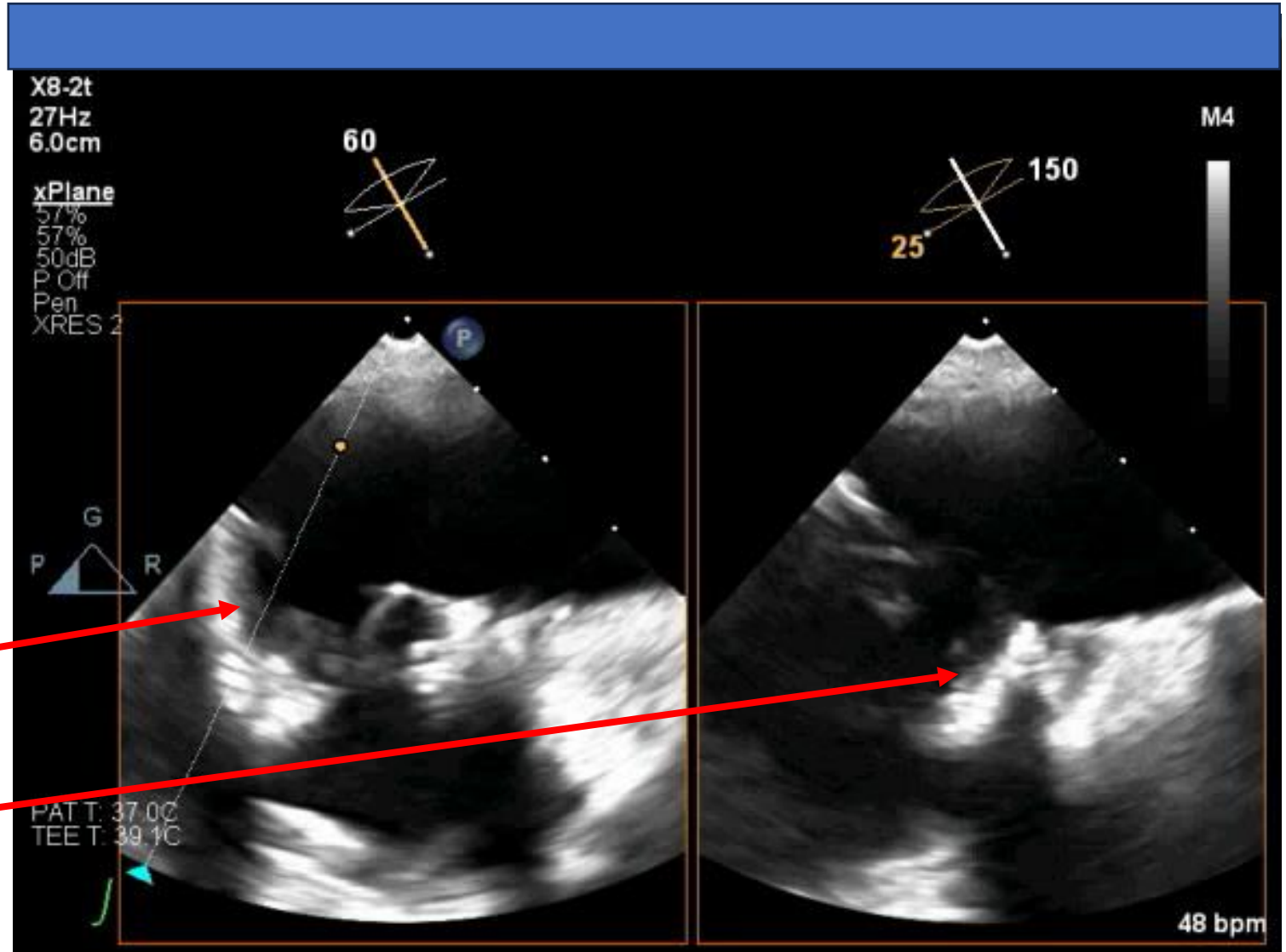
No fever， WBC = 5.4

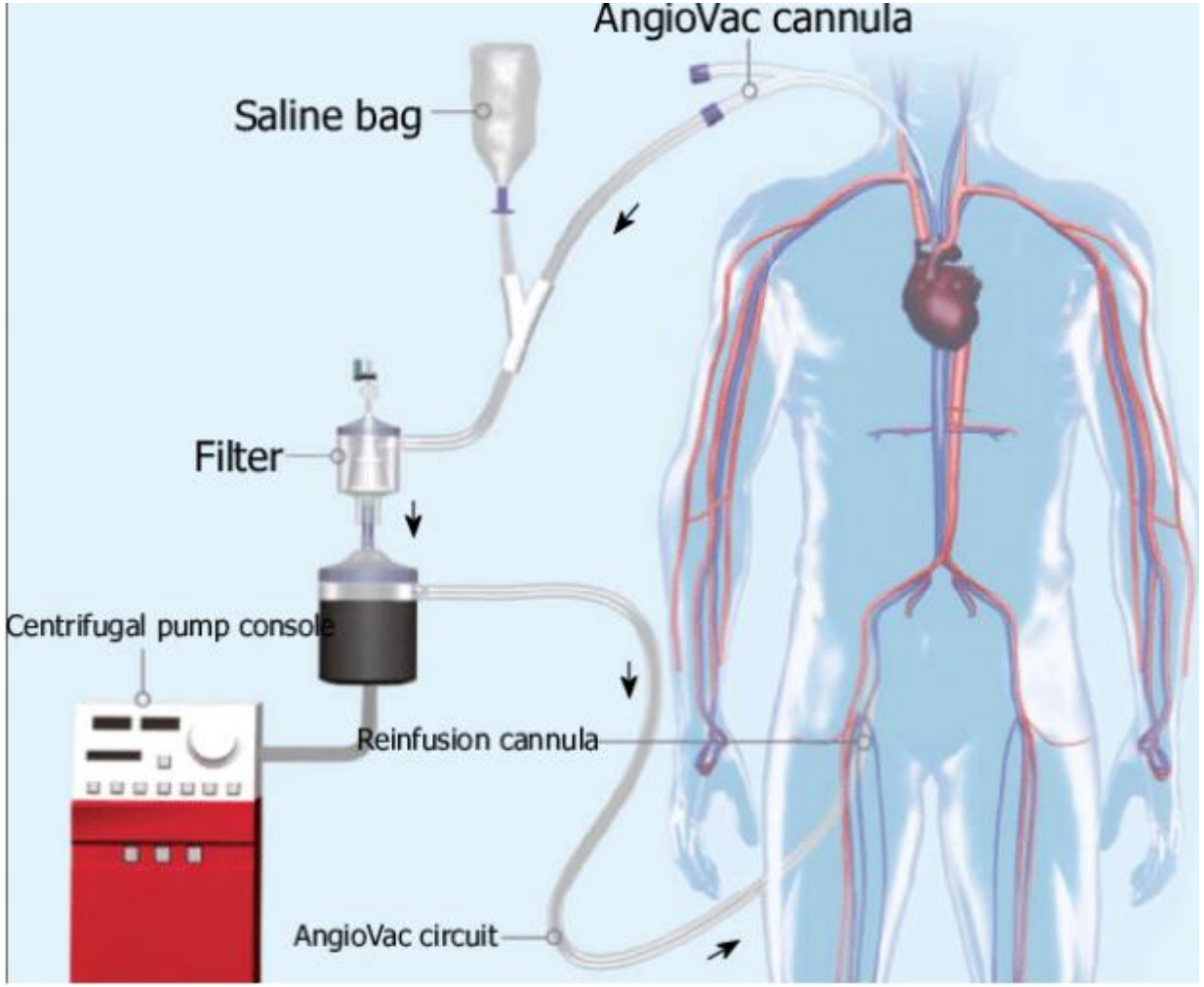
TEE on 9/13/24: Normal EF

Multiple mobile masses

Largest one 1.5 x 0.66 cm attached to MV at LA side







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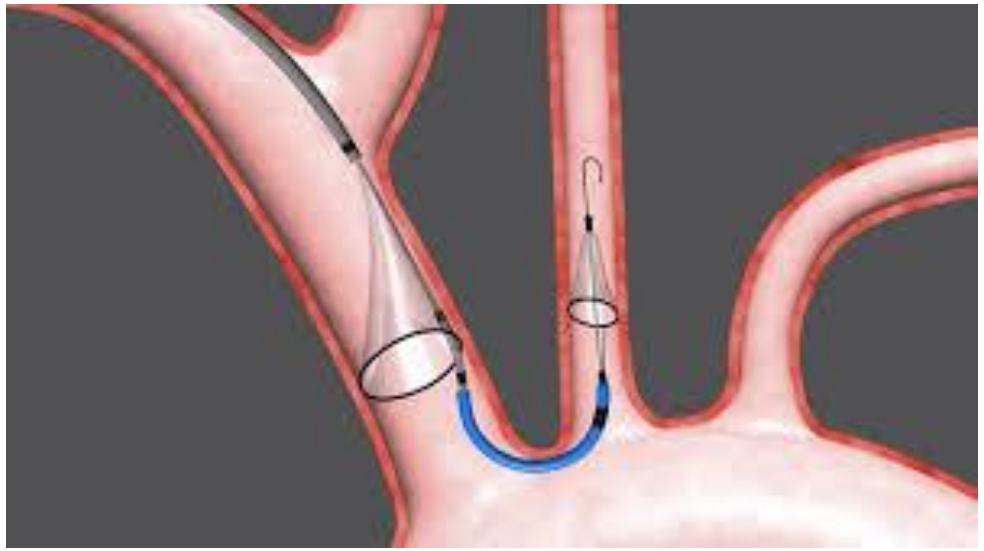
感染性心内膜炎 （SBE）治疗通常需要IV 抗生素、控制病源和手术（贅生物切除术或TV修复术）。但SBE 对药物治疗无效且手术介入的风险高的患者，经皮 AngioVac 系統 (AngioDynamics) 可以提供另一种选择。靜脉流套管可通过真空抽吸血栓或贅生物，滤後的血液然後通过其靜脉-靜脉 (VV)体外循环返回給患者。

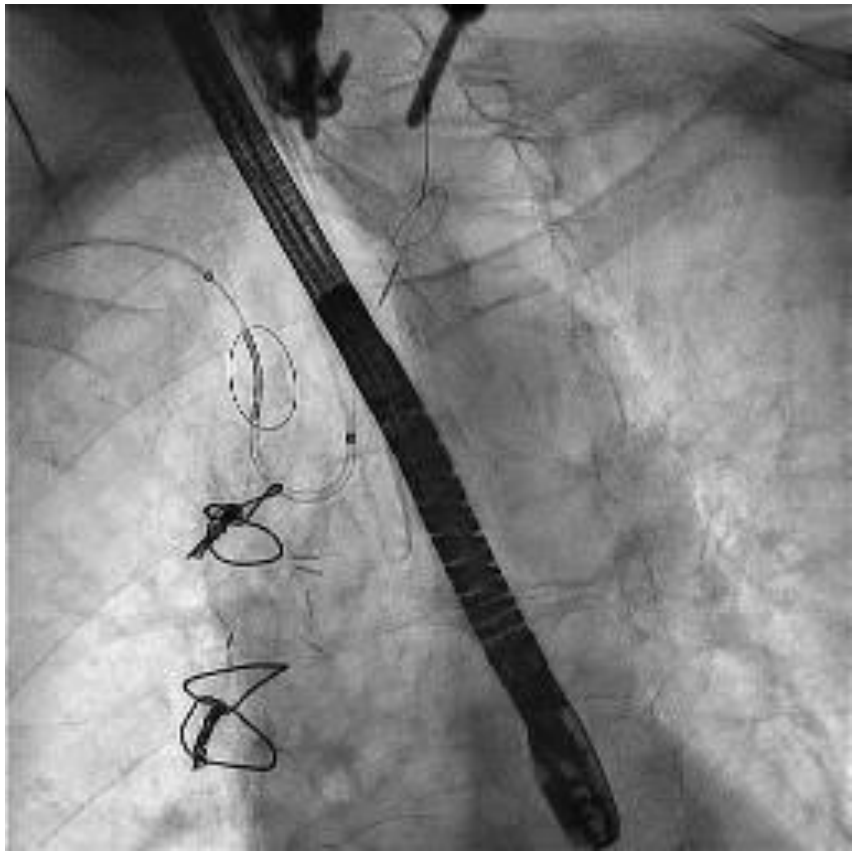
Case 6: AngioVac-治疗二尖瓣换瓣术后和并感染性心内膜炎

AngioVac – 9/17/24

Placement of Sentinel Device for cerebral protection

(放置 SENTINEL抗栓塞脑保护装置)

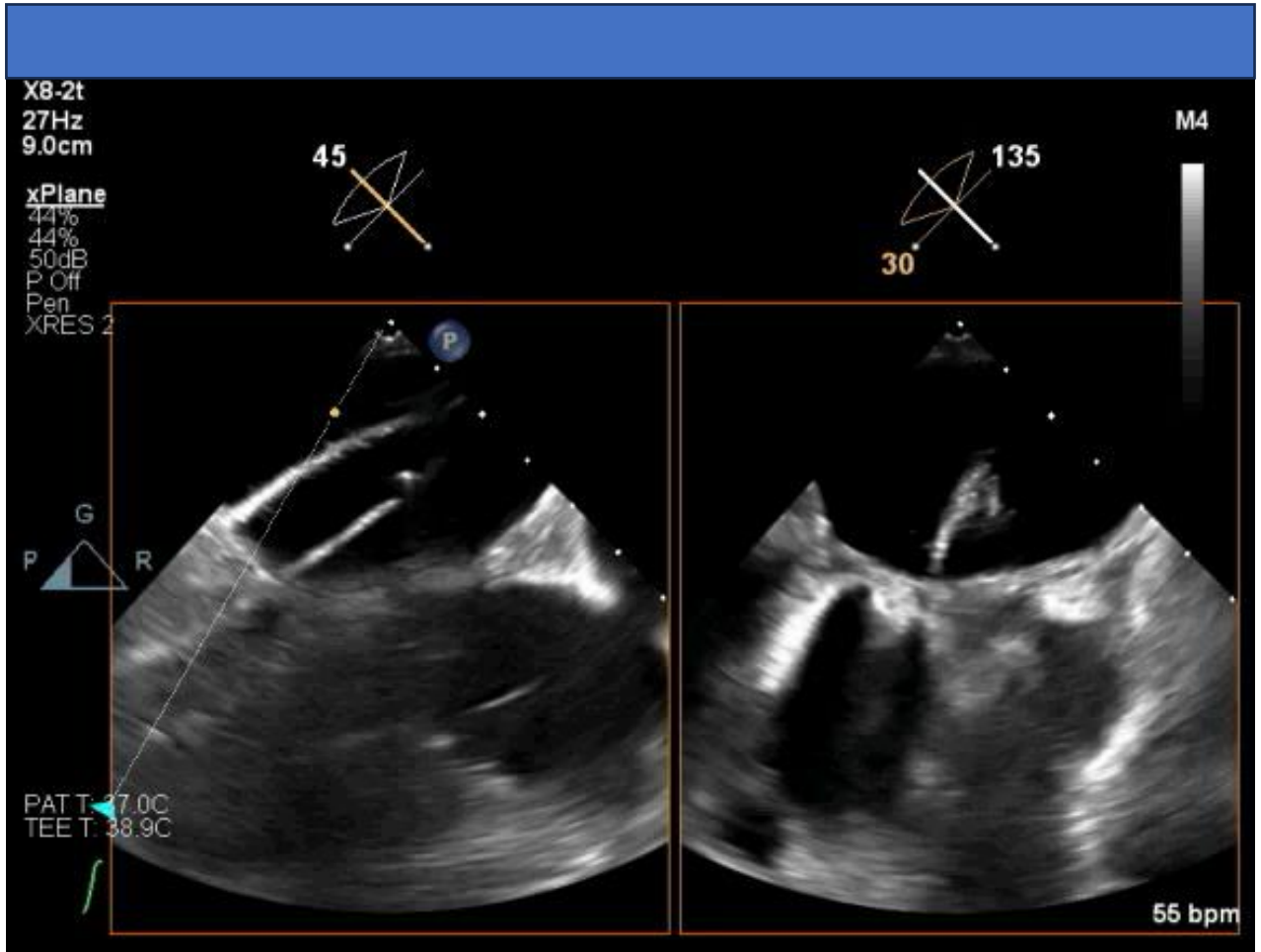


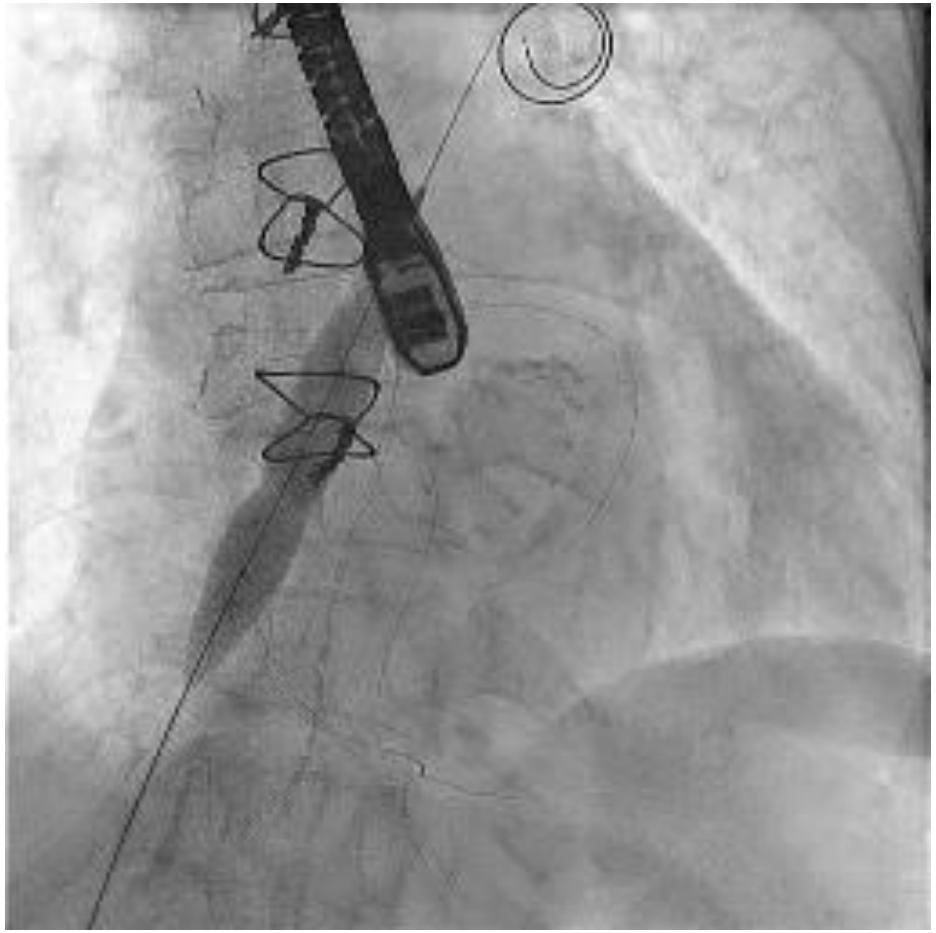


Case 6: AngioVac-治疗二尖瓣换瓣术后和并感染性心内膜炎

AngioVac – 9/17/24

14x40 mm Atlas balloon-atrial septostomy 房间膜造口术

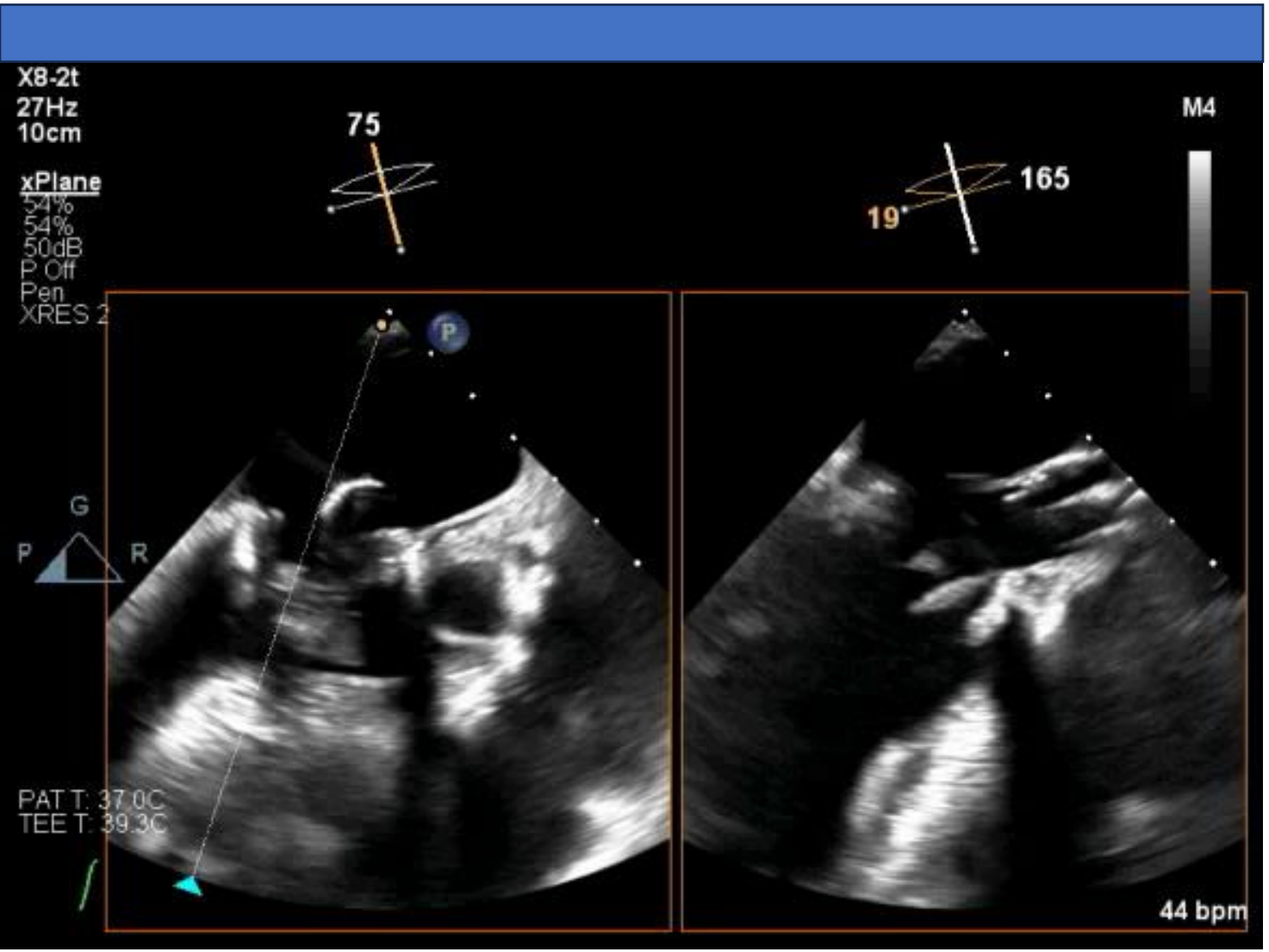


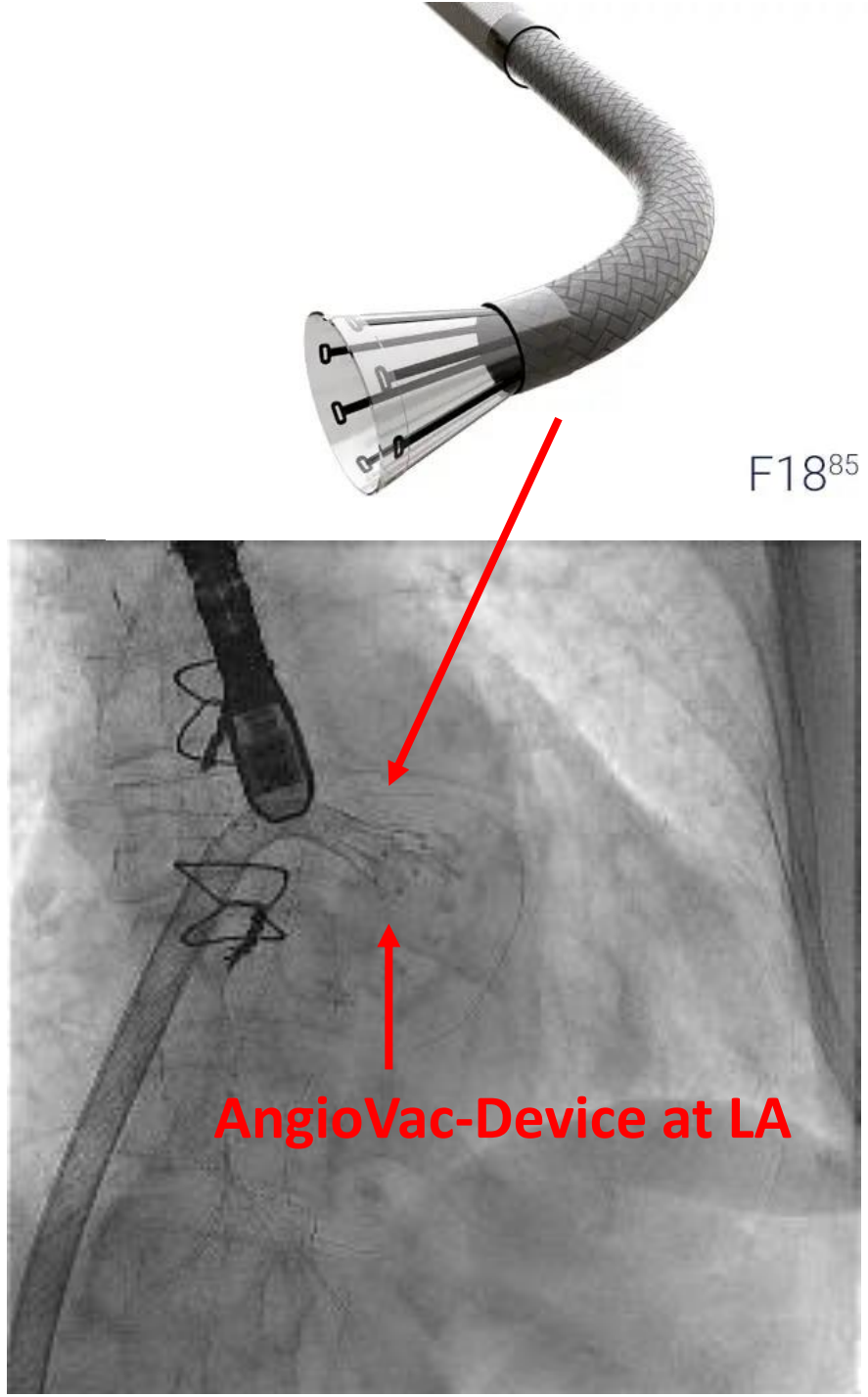


Case 6: AngioVac-治疗二尖瓣换瓣术后

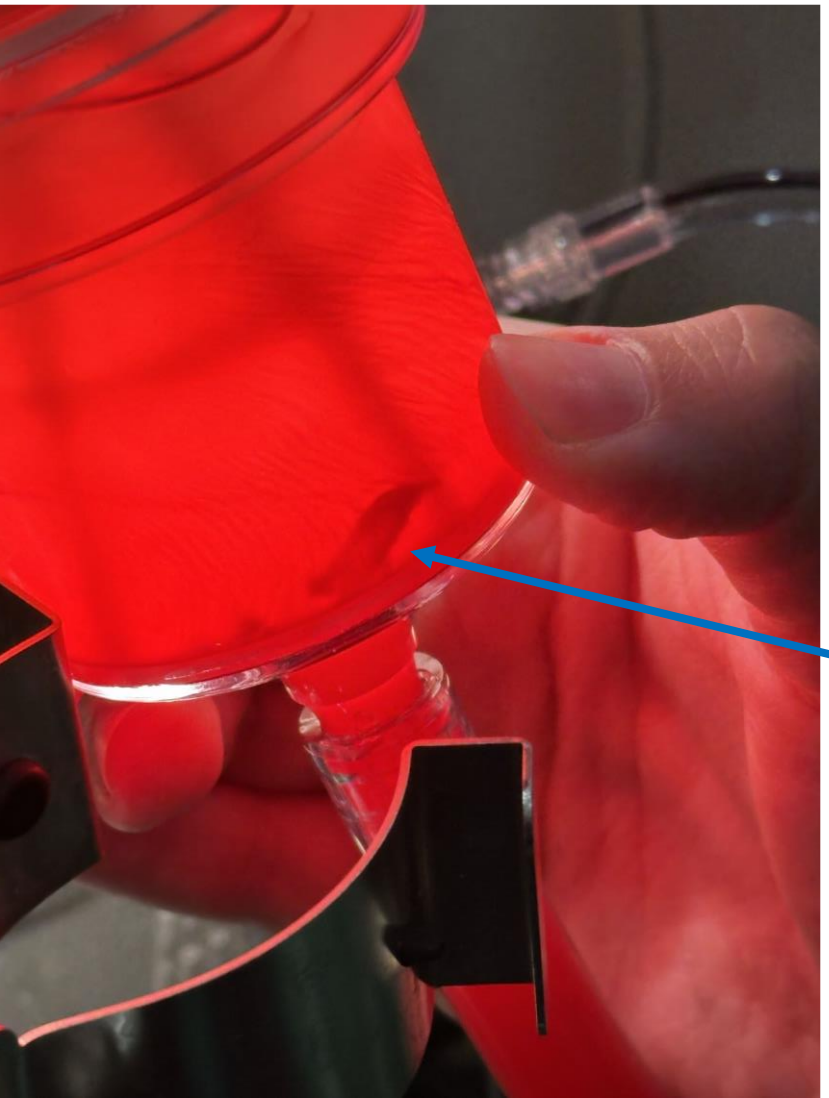
和并感染性心内膜炎

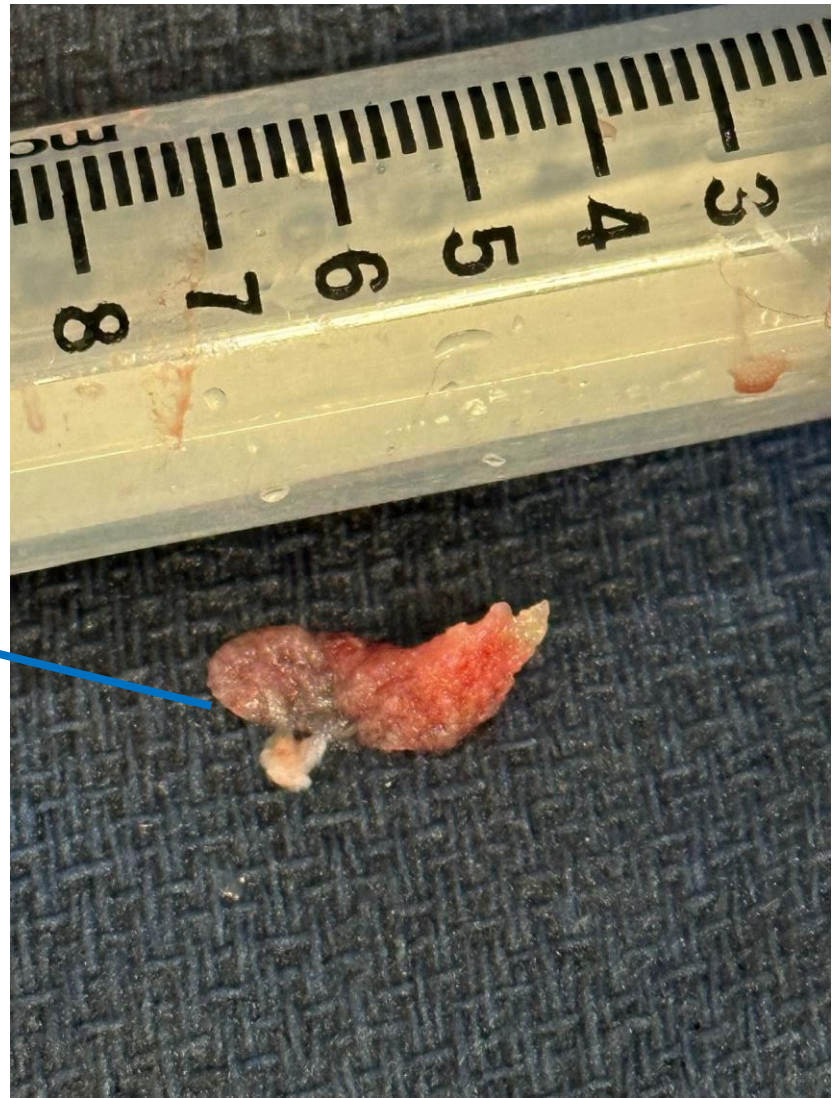
AngioVac – 9/17/24



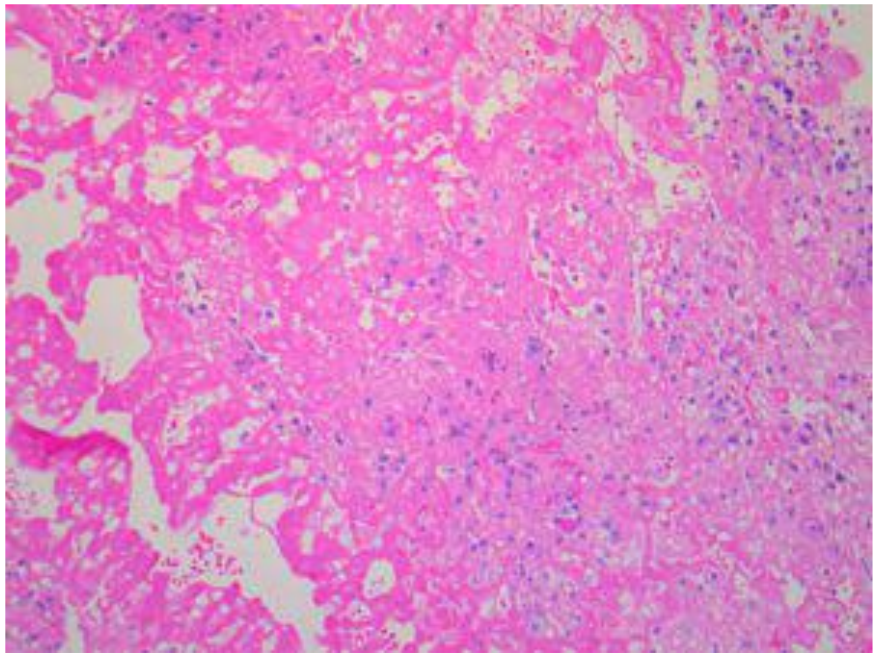


Case 6: AngioVac-治疗二尖瓣换瓣术后和并感染性心内膜炎





Pathology Report



FINAL DIAGNOSIS:

Bioprosthetic mitral valve, excision:

-Fibrinous material with acute and chronic inflammatory cells

AngioVac – 9/17/24

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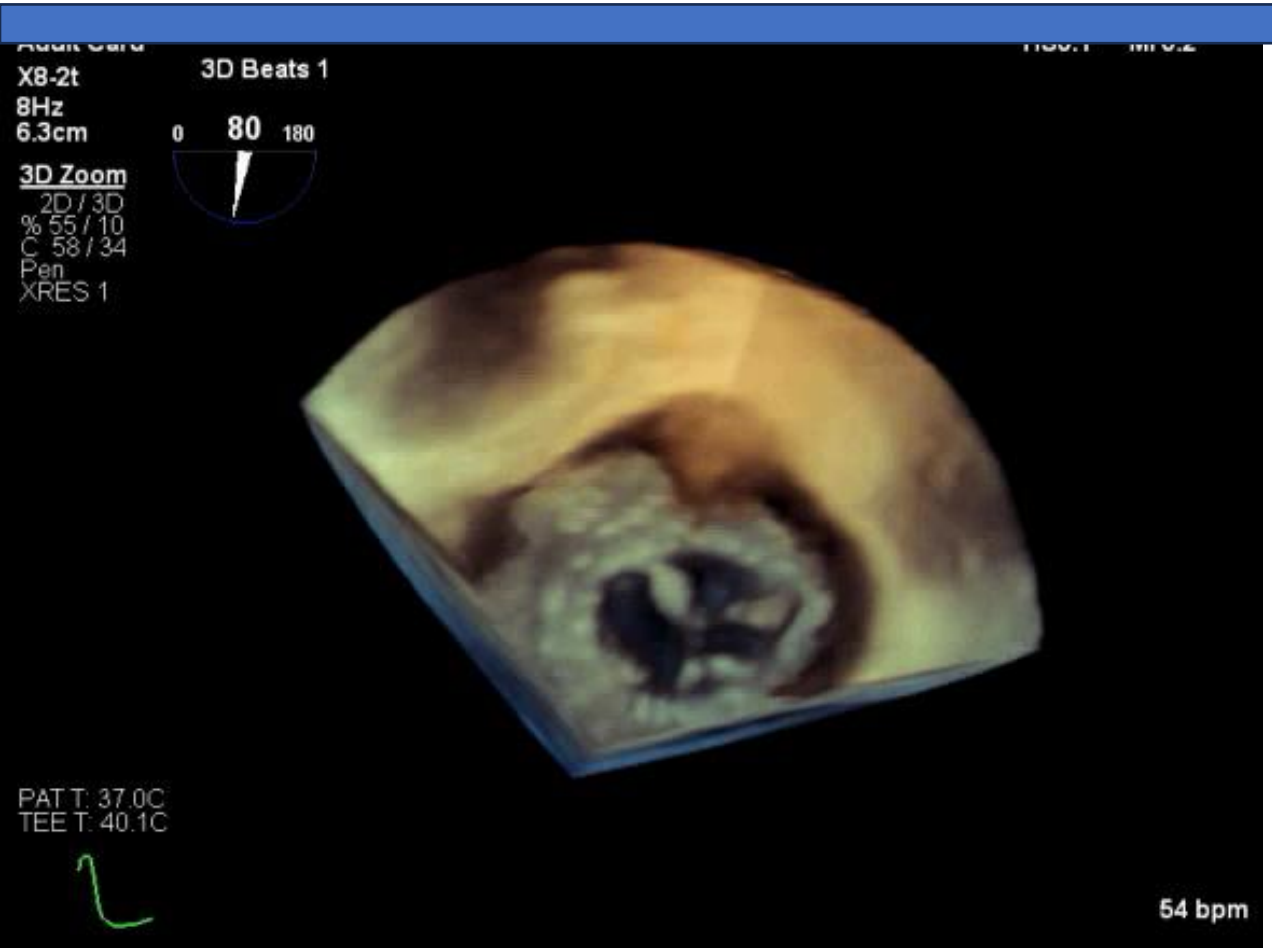
Pre AngioVac



Post AngioVac

Case 6: AngioVac-治疗二尖瓣换瓣术后和并感染性心内膜炎

Echo follow up on 11/04/24

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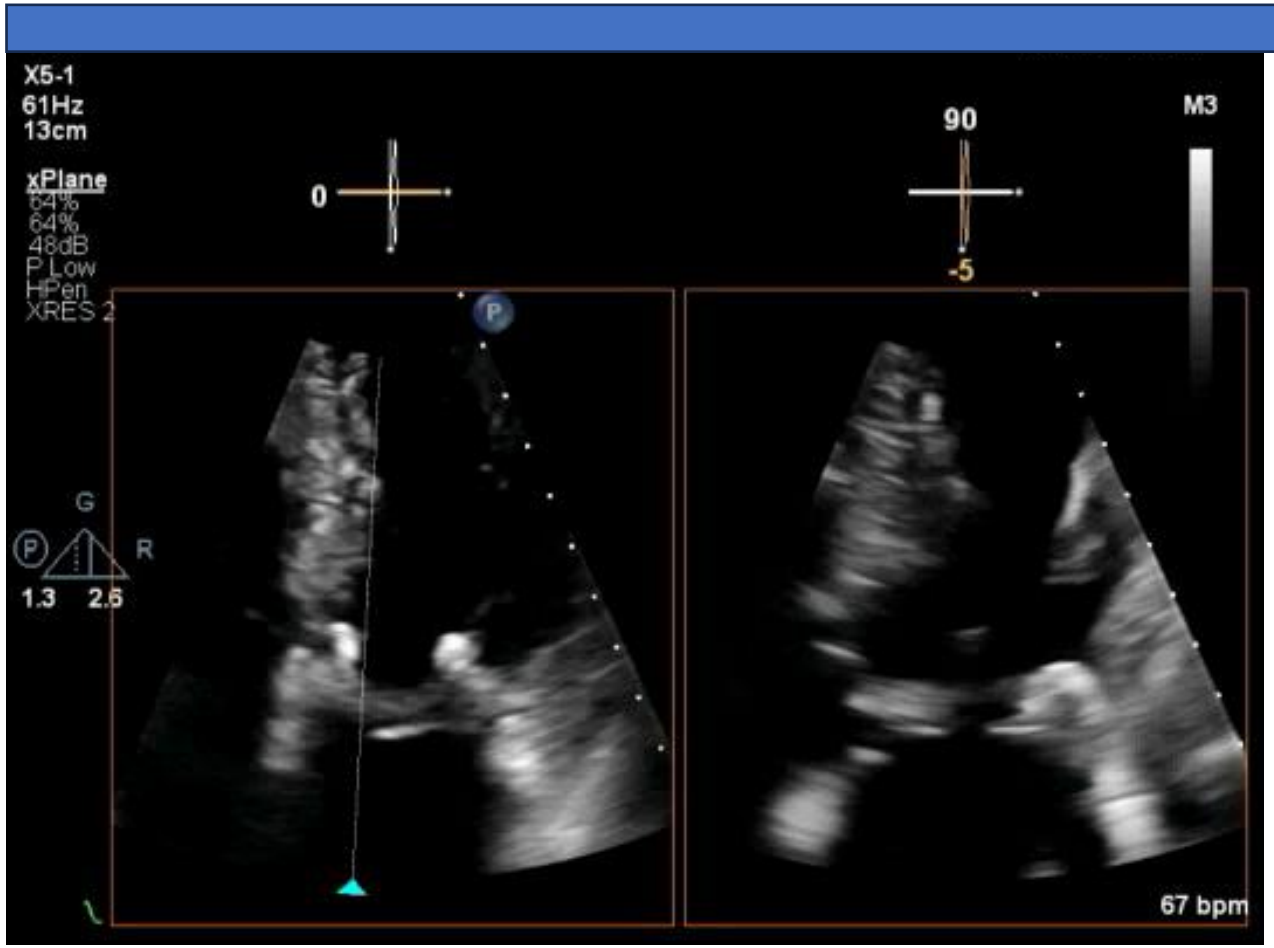
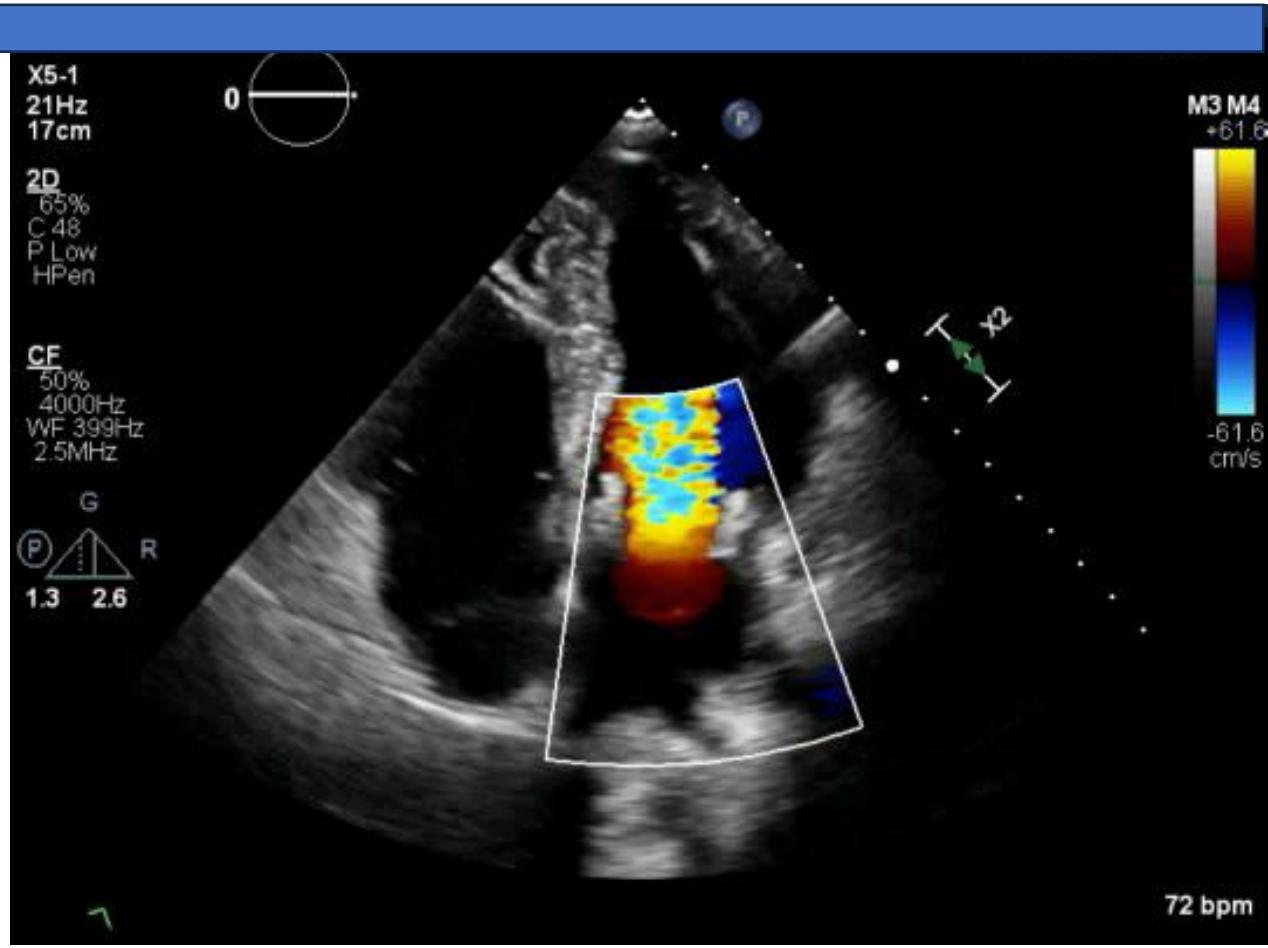
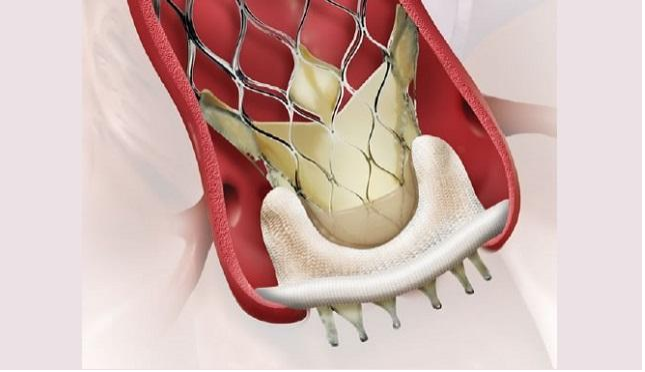




AngioVac 技术虽然存在一定局限性，但为高风险患者提供了一种微创的治疗选择，能够暂时稳定病情，为后续的抗真菌治疗创造条件。同时，多学科诊疗在这类复杂病例的治疗中起着关键作用，综合多方面的专业知识和技术，有助于提高患者的诊疗效果



总结

外科生物瓣衰败是临床上的一大难题，传统的外科二次手术治疗因患者组织粘连严重、分离困难，往往创伤大、风险高、难度

瓣中瓣植入术避免了再次开胸的创伤，具有创伤小、出血少、恢复快等优势，为患者提供了更安全、有效的治疗新选择

首次瓣膜的选择对预测未来再介入至关重要

建立一个以病人为中心的多学科综合管理团队，负责术前评估、手术策略制定、手术实施及术后全病程管理

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Thanks!!