

Challenging Anatomy and Advanced Techniques

Jung-Sun Kim, MD, Ph D, FESC

**Division of Cardiology, Severance Hospital
Yonsei University College of Medicine
President of K-SCI Club**

7 min

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Disclosure Information

Jung-Sun Kim, MD, PhD

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- Support/Consultant: None
- Speaker's Bureau: Abbott Vascular

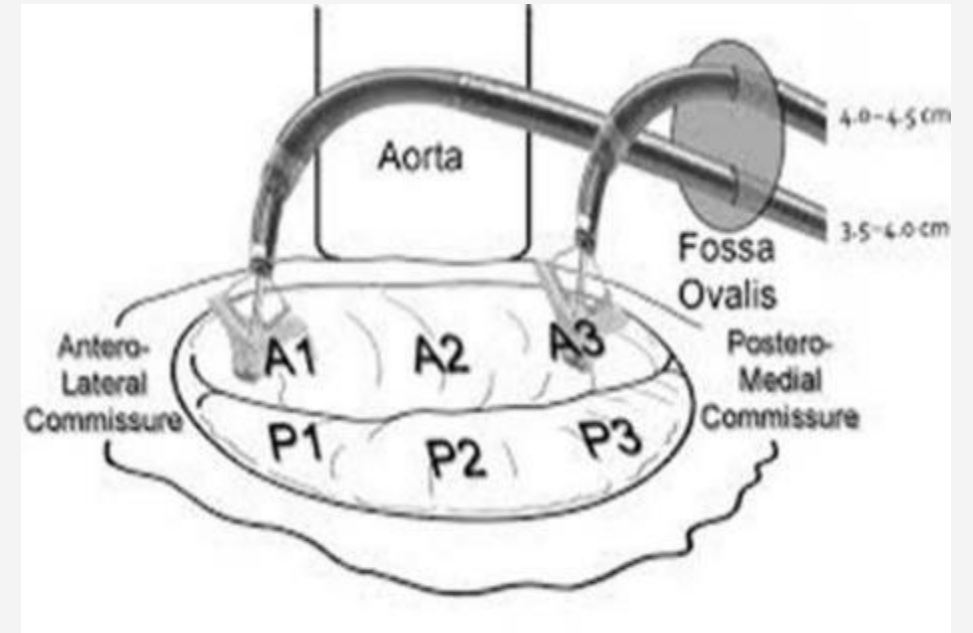
Issues of Septal Puncture

Optimal Puncture Site

Consideration: *Etiology and site of MR*

- TSP must be performed in the **mid-posterior part** of the fossa ovalis and at a sufficient distance (height) from the mitral valve
- **Primary MR**, the TSP height should be **4.5–5 cm above the mitral annulus** to allow the capture of prolapsed valves.
- **Secondary MR**, the puncture site must be lower, approximately **4.0–4.5 cm above the annular plane** in order to be able to advance the catheter more deeply into the LA because of valve tethering.

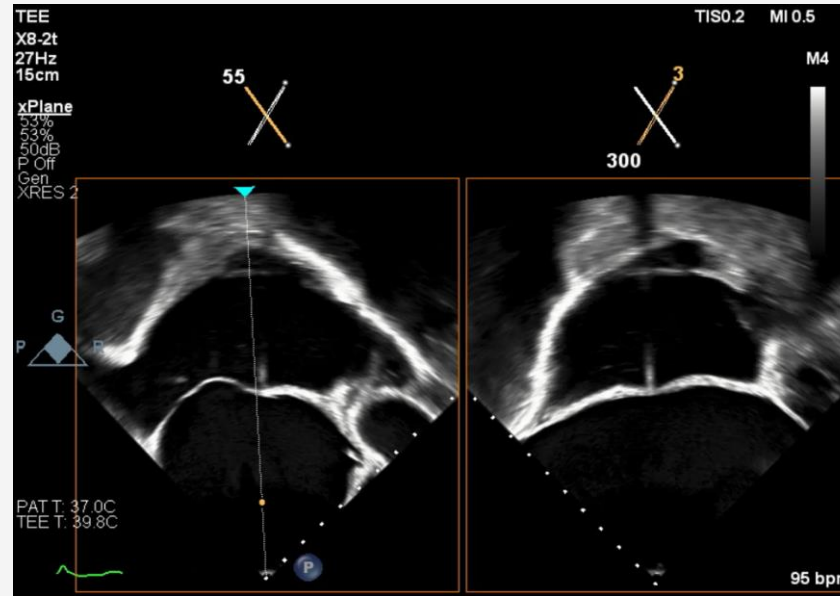
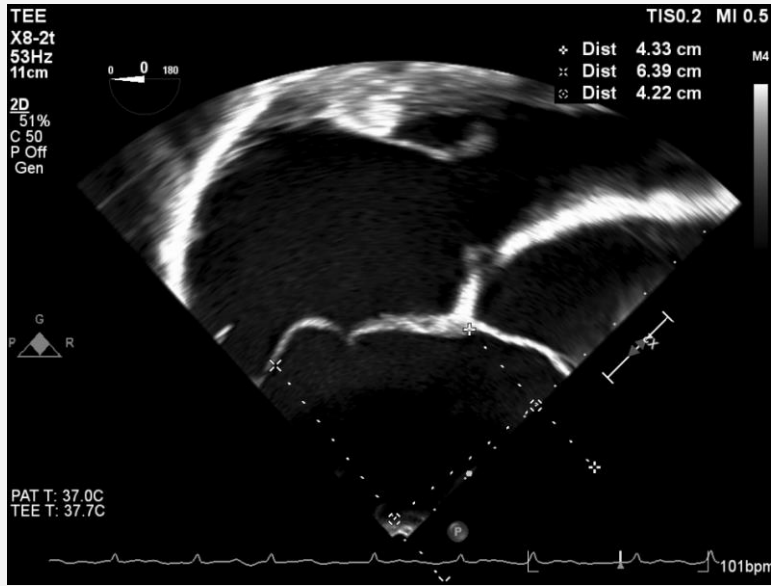
Better to **have more rather than less height**, and thus a transseptal puncture height of **≥4 cm** is usually favorable.



Atrial MR - **4.5–5 cm above the mitral annulus**
Medial site needs a greater height than lateral site.

Sharma V, et al. US Cardiology Review 2022;16:e24

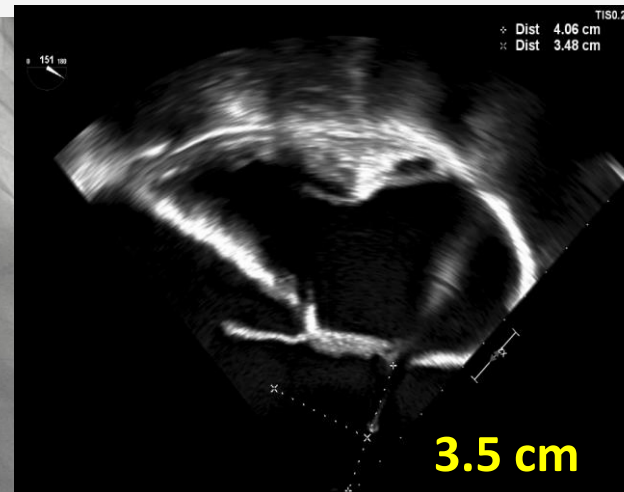
Transseptal puncture – 3rd attempt – Septal Injury



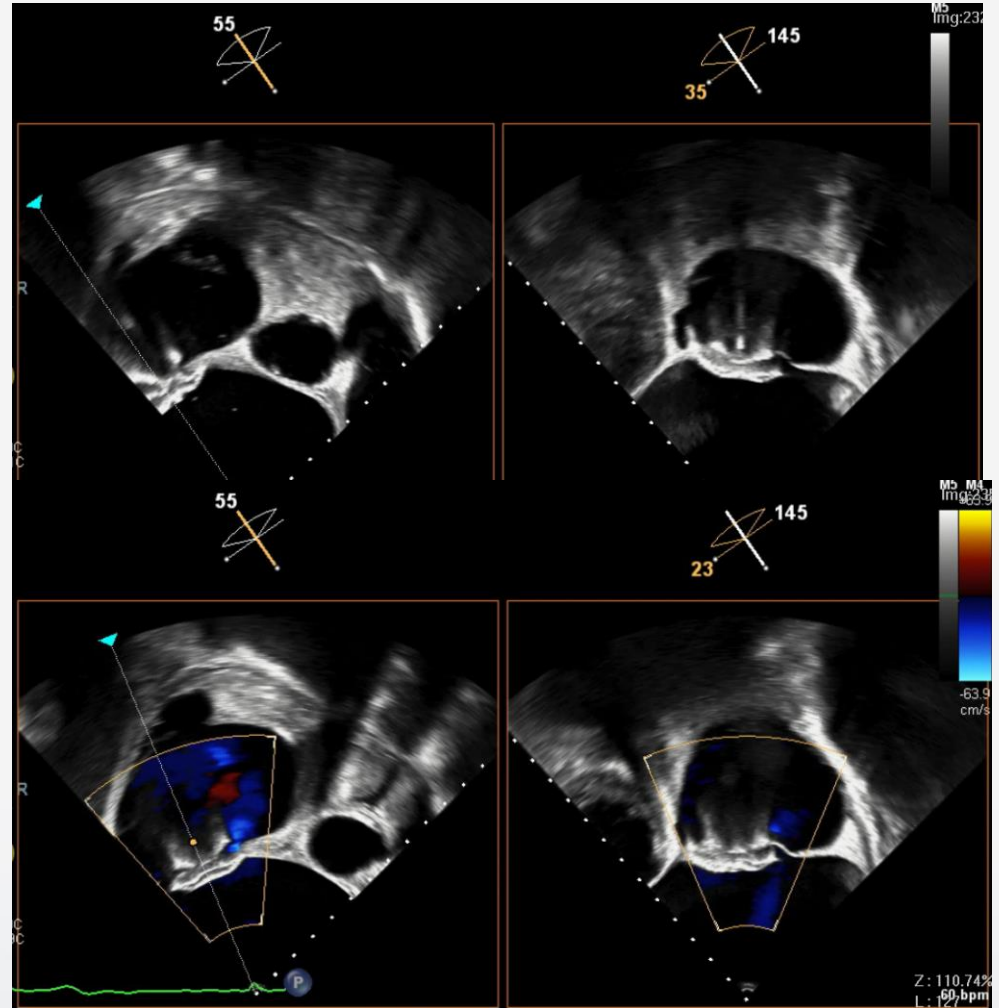
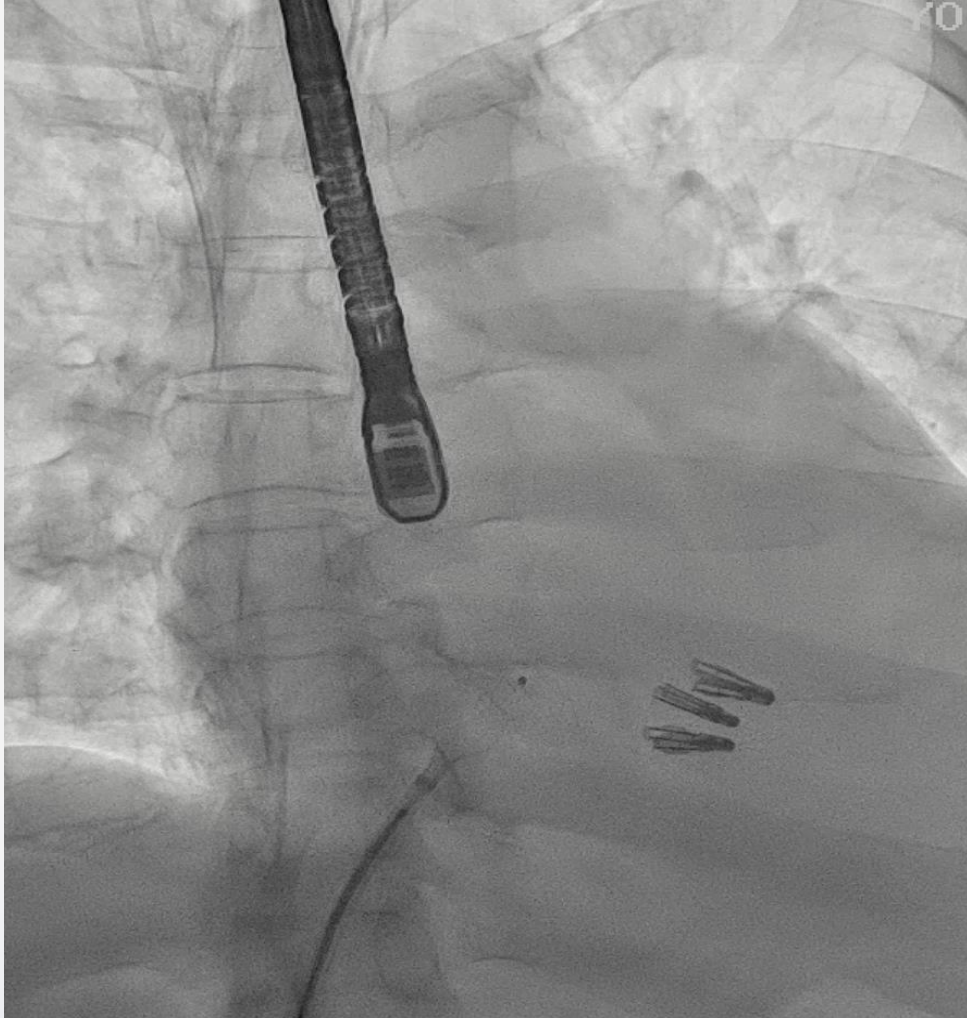
ASD developed around puncture site



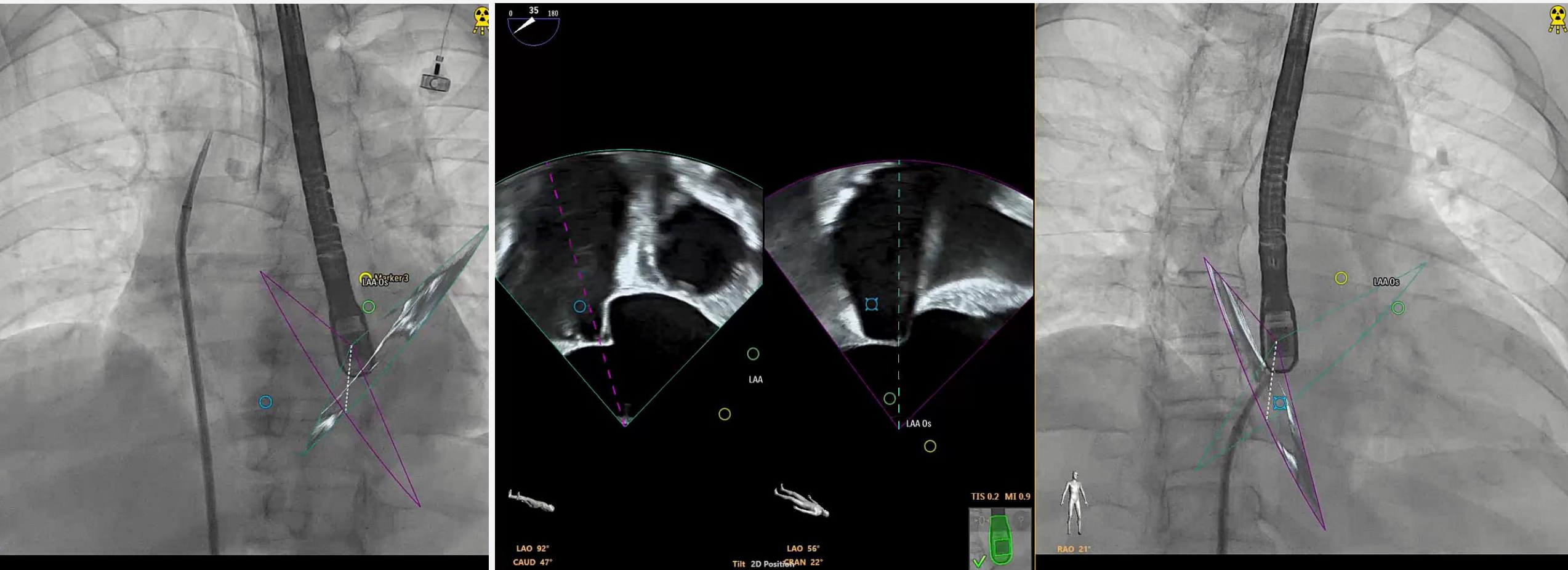
3rd trial



ASD closure after TEER



Septal Puncture



Septal puncture by SL1 + BRK needle under EchoNavigator guidance

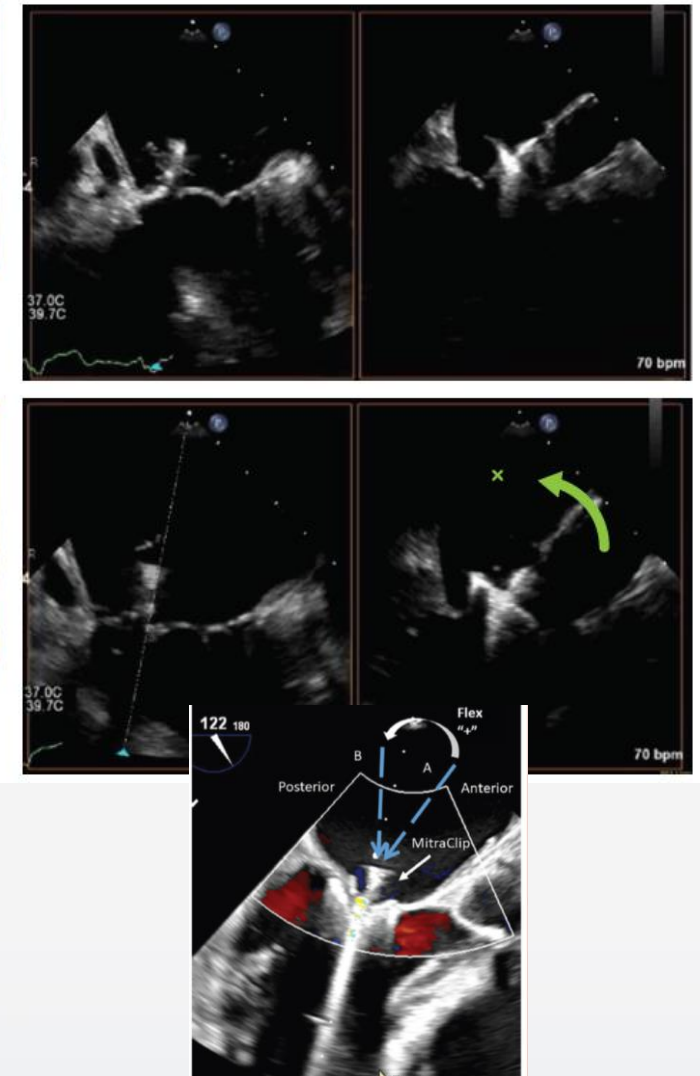
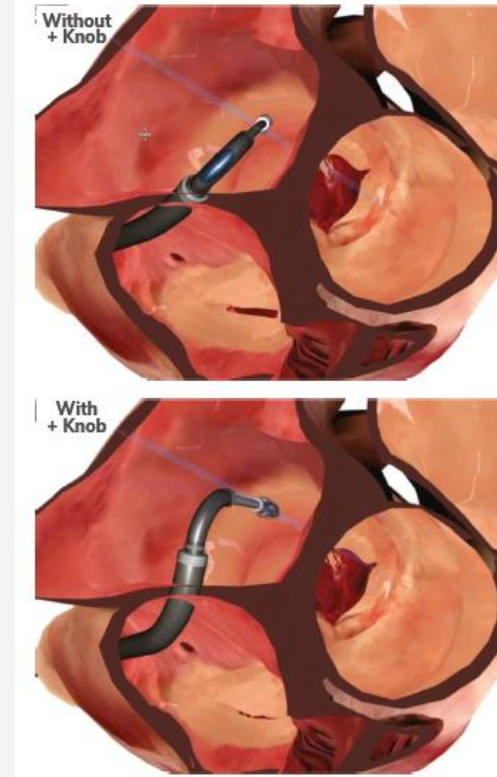
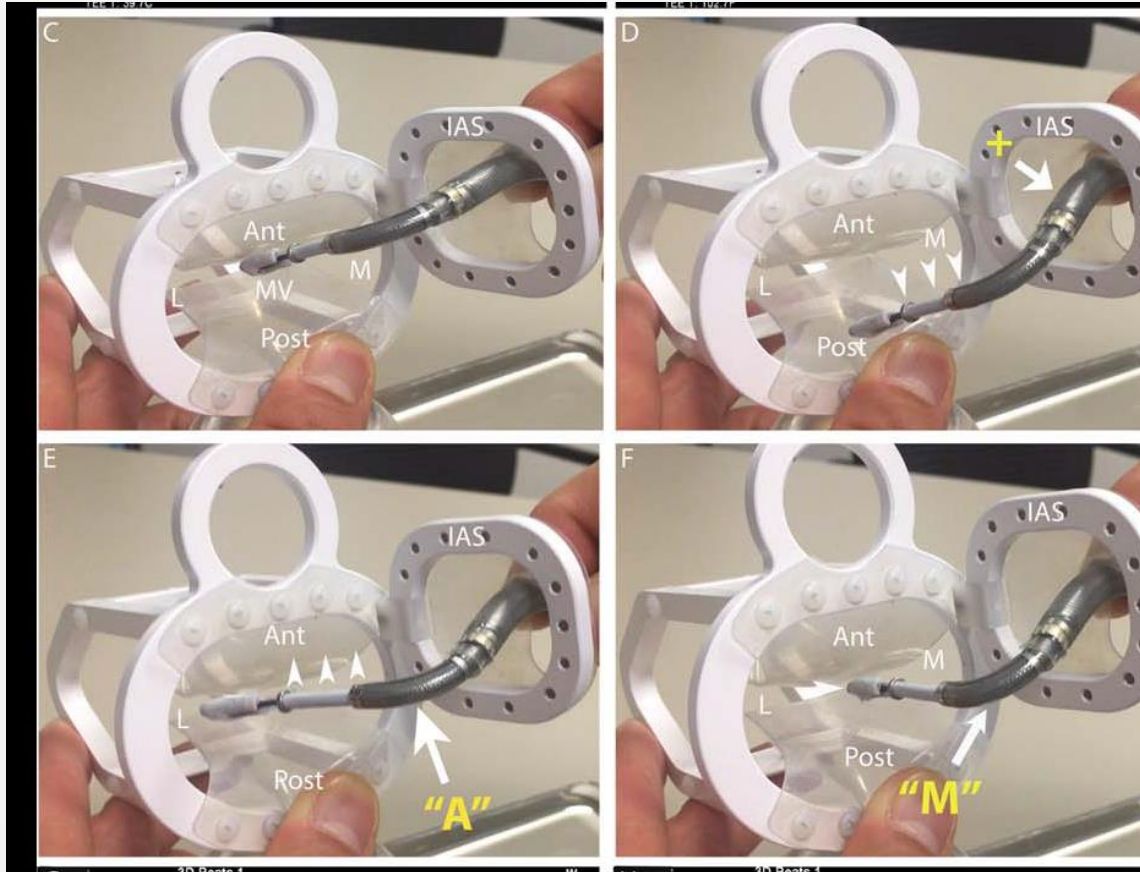
MitraClip Device Component Movement

	ANTERIOR	POSTERIOR	MEDIAL	LATERAL	LOSE HEIGHT ABOVE VALVE	GAIN HEIGHT ABOVE VALVE
Steerable Guide Catheter (SGC)						
Plus (+)		++	+		+	
Minus (-)	++			+		+
Clockwise rotation		++				+
Counter-clockwise rotation	++				+	
Clip Delivery system (CDS)						
Medial (M)			+++		+	
Lateral (L)				+++		+
Posterior (P)		+	+		+	
Anterior (A)	+			+		+
Stabilizer						
Push In (L)				+		
Pull out (M)			+			

It is important to note that the movements of the steerable sleeve are only predominant in their direction, and are not pure in any single path.

Clinical Situations

Anterior Transseptal Puncture or "Aorta Hugger"



addition of "M" on the "M" knob or withdrawal of the SGC

Sorajja P, et al. CCI 2017
 Transcatheter Edge-to-Edge Repair. Textbook of SCAI
 Sharma V, et al. US Cardiology Review 2022;16:e24

Clinical Situations

Transseptal height is too High

SGC is rotated **counterclockwise (anteriorly)**, with posterior correction of the SS by applying **“P” on the “A/P” knob**. As the turning toward **“P”** also moves the system medially, releasing the **“M” or advancing the SGC** to move laterally.

Chordal Entrapment

Once the operator has advanced the MitraClip into the LV, past the mitral valve leaflets, only **minimal device manipulations** should be performed in **LV**

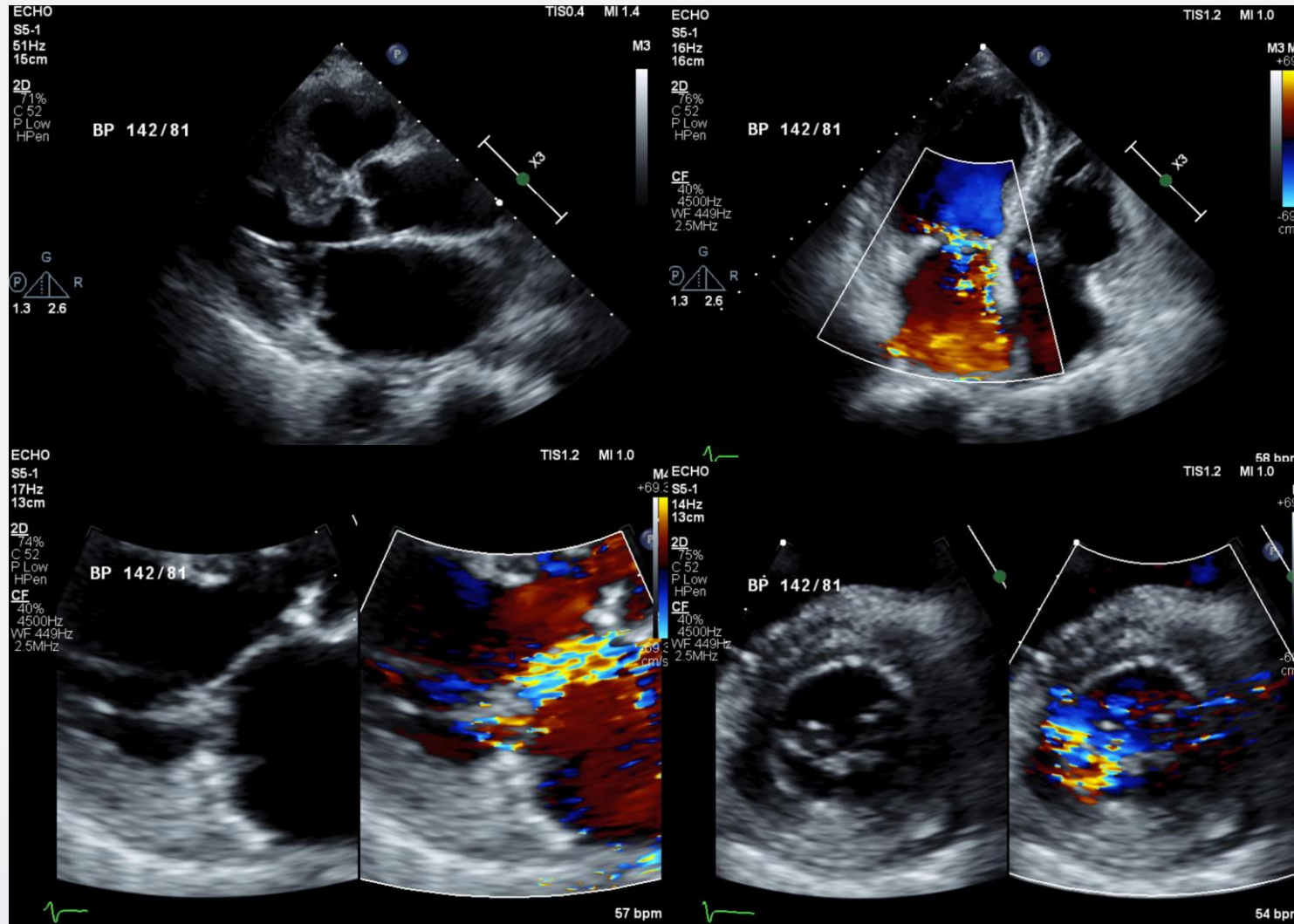
Transseptal height is too Low

SGC is rotated **clockwise (posteriorly)**, with anterior correction of the SS by applying **“A” on the “A/P” knob**. As the turning toward **“A”** also moves the system laterally, application of the **“M” or withdrawal of the SGC** to move medial may be required.

1. Invert a Clip
2. Rising and/or lowering of the grippers
3. Reverse ordered maneuvers
4. Converted to a surgical procedure
5. If not surgical candidate, may need to be placed within the chordal apparatus

- **F/86**
- **Height: 145.5 cm / Weight: 44.4 kg / BSA: 1.34 m²**
- **Chief complaint**
 - **Dyspnea on exertion, orthopnea (Onset : 3 months ago)**
- **Comorbidities**
 - **Hypertension, dyslipidemia**
 - **Ovarian tumor**
 - **Alzheimer dementia**
- **STS score : 5.44% for MV repair, 6.94% for MV replacement**

Transthoracic echocardiography

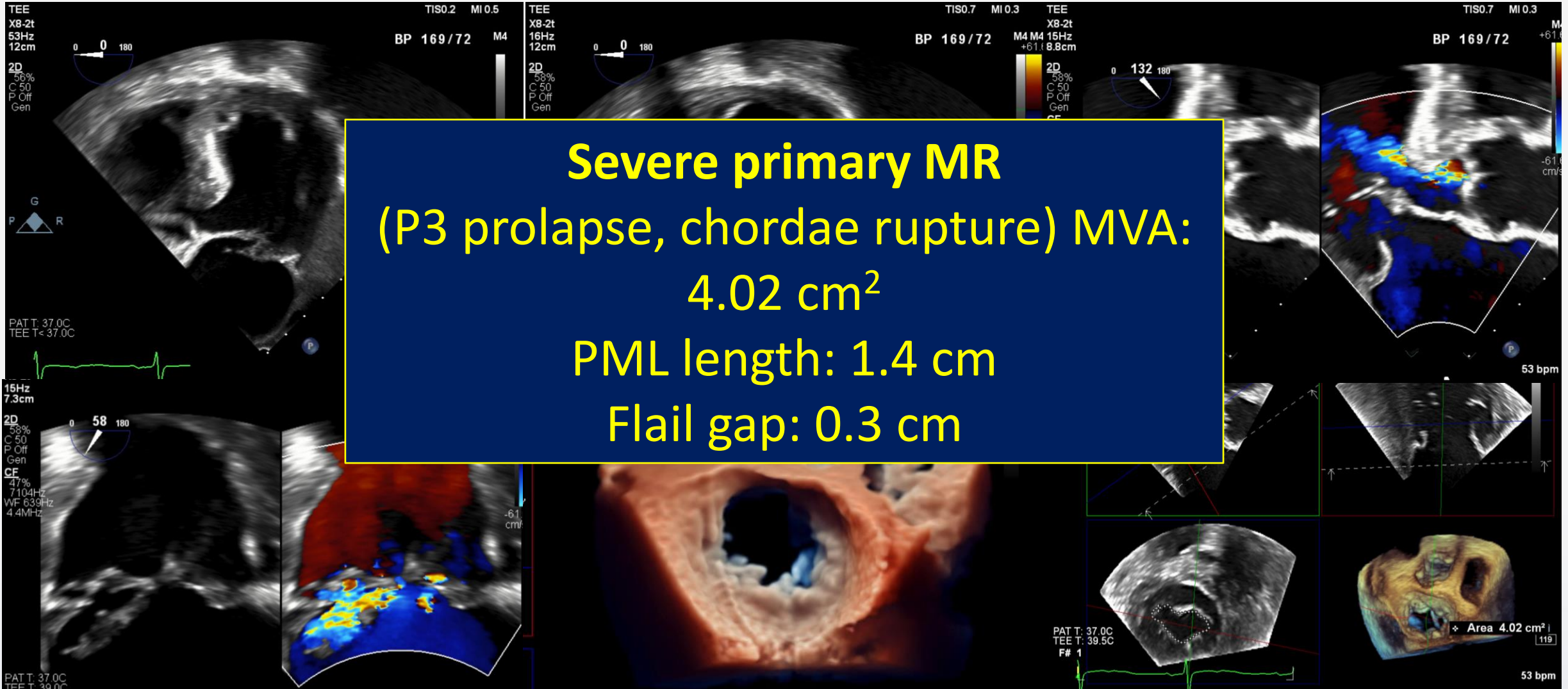


Severe MR, PML prolapse
(GIV, ERO: 32 mm², RV: 57 ml)
Mild TR

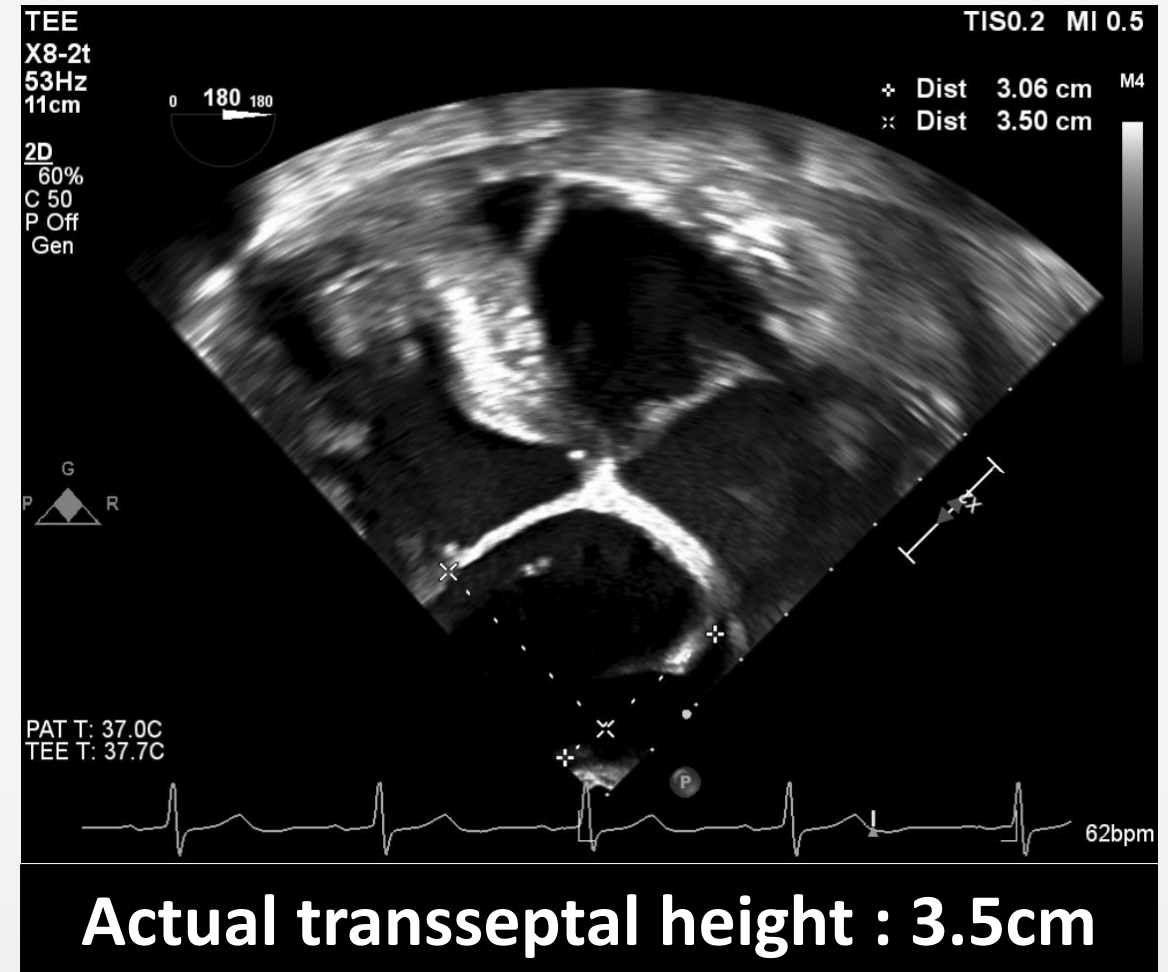
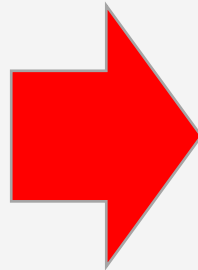
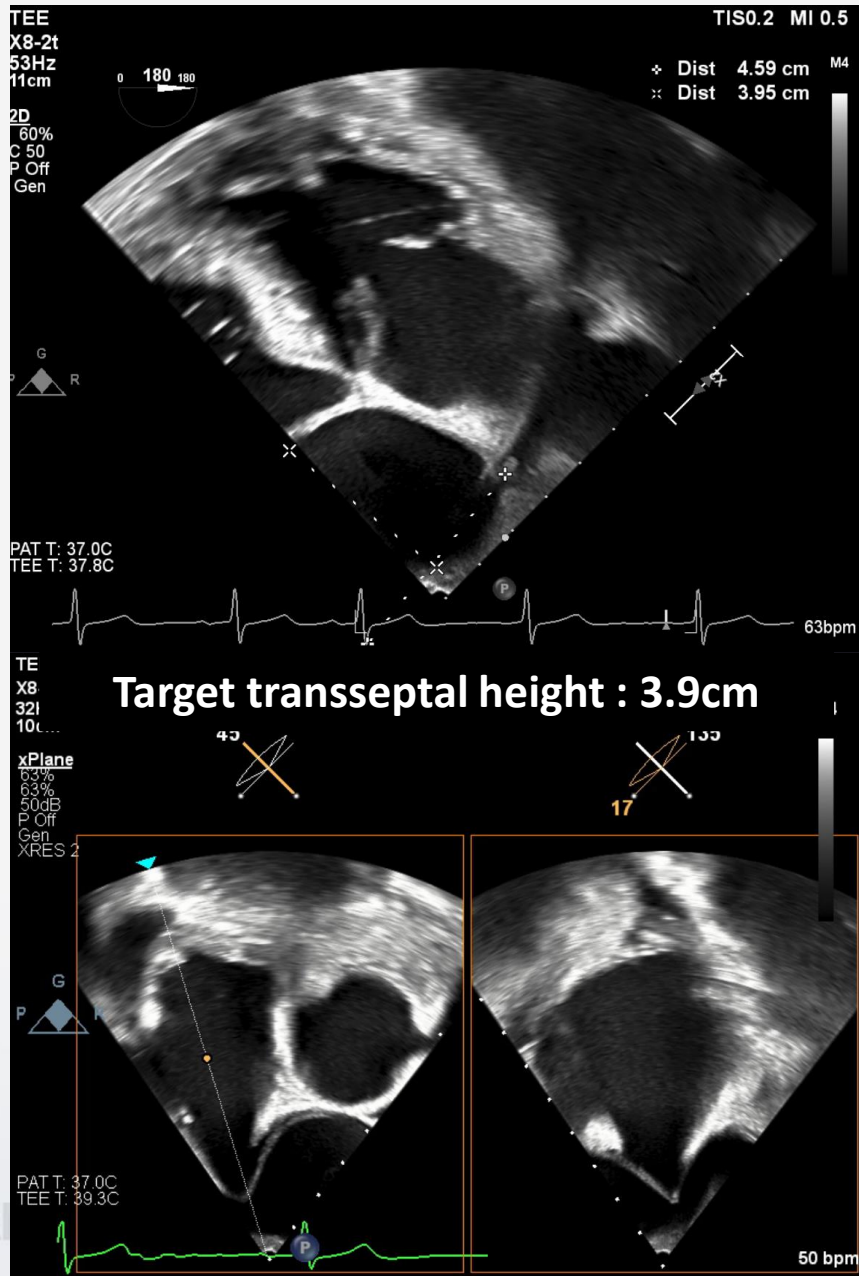
EF: 74%, LVEDD/ESD: 50/30 mm,
E/e' : 27

LAVi: 66.1 ml/m²,
RVSP: 49 mmHg

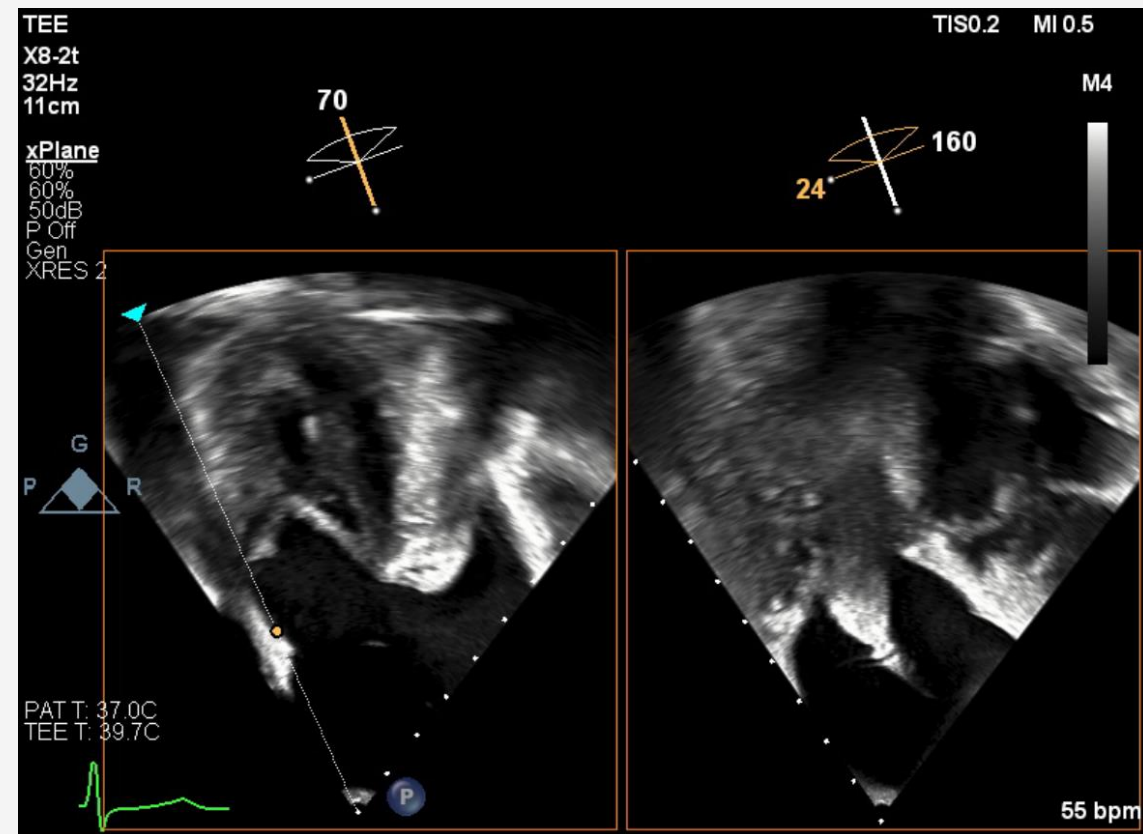
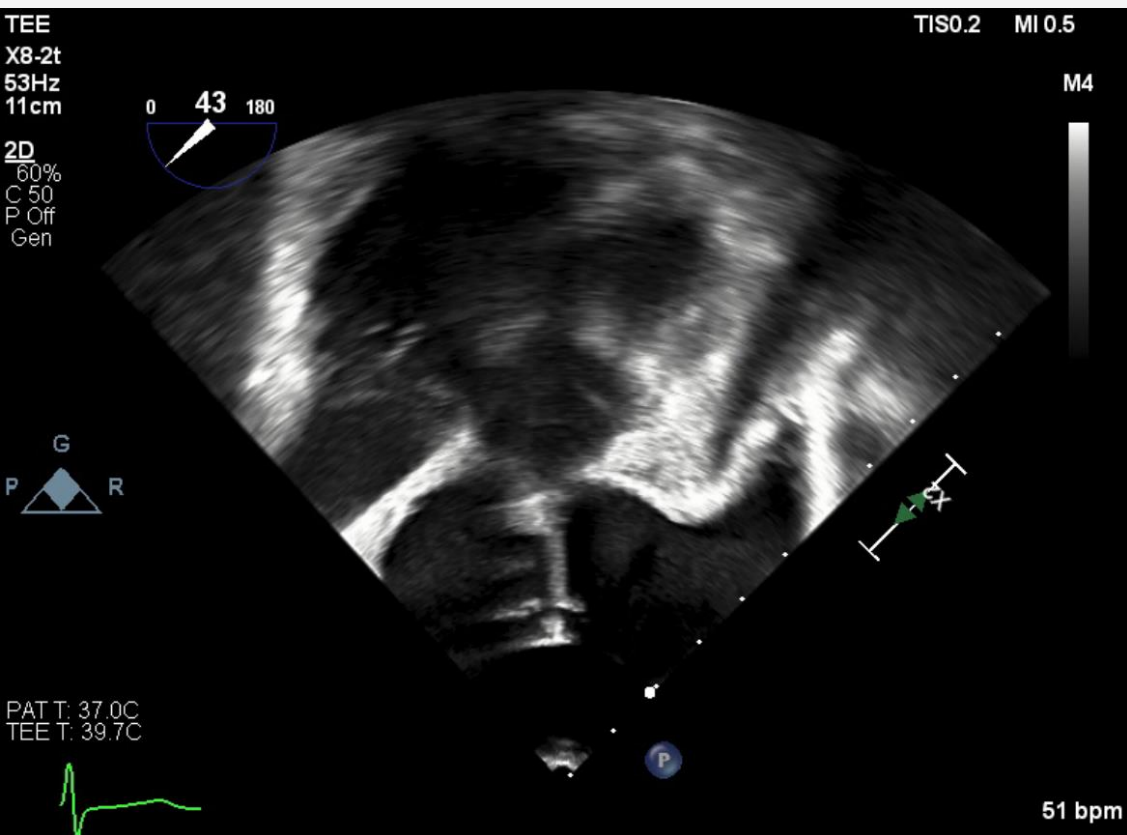
Transesophageal echocardiography



TEER : Transseptal puncture

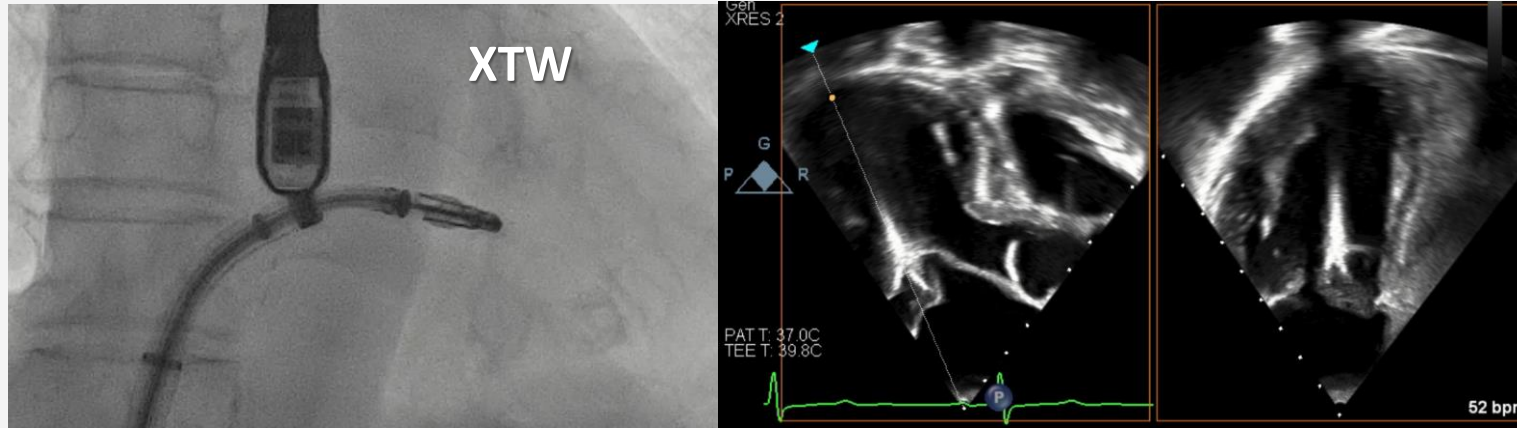


Low height clip maneuver

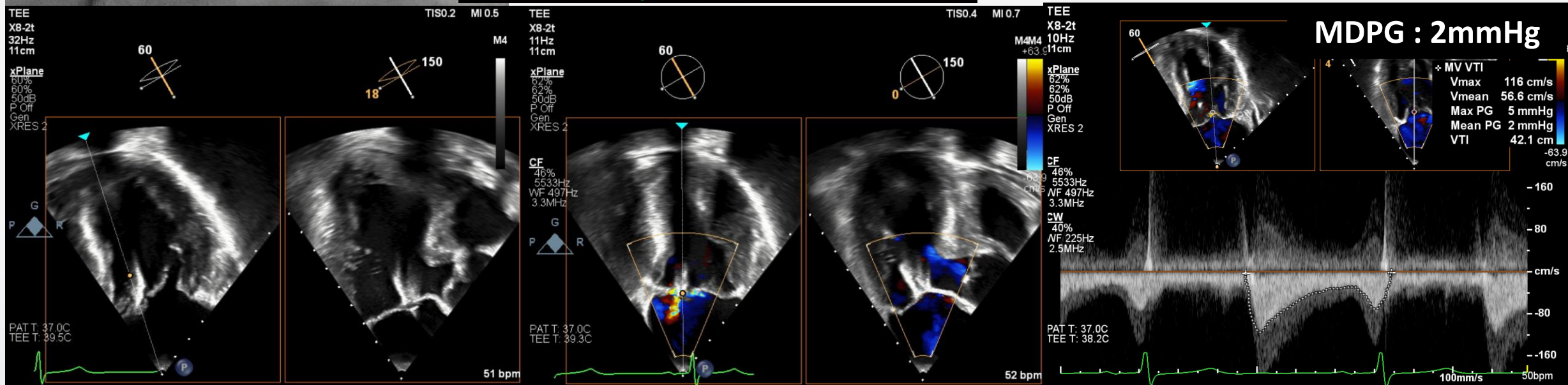


1. Clockwise rotation of SGC (Posterior movement)
2. A knob (Lateral movement)
3. Application with M-Knob (Medial movement)

TEER

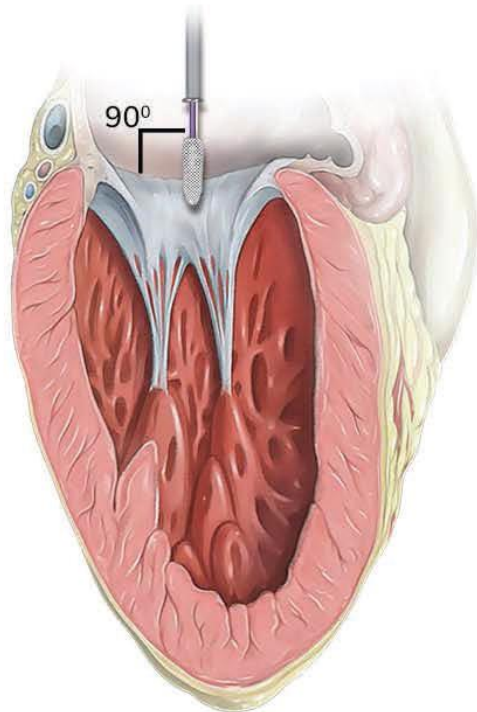


- ✓ More stable clip position
- ✓ More reduced MR



Issues of Clip Trajectory and Clip Orientation

BICOMM VIEW

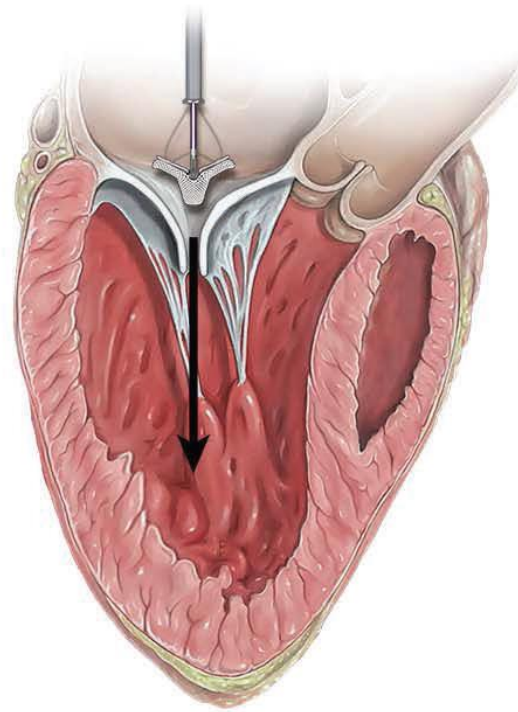


Clips should be orthogonal to mitral annular plane

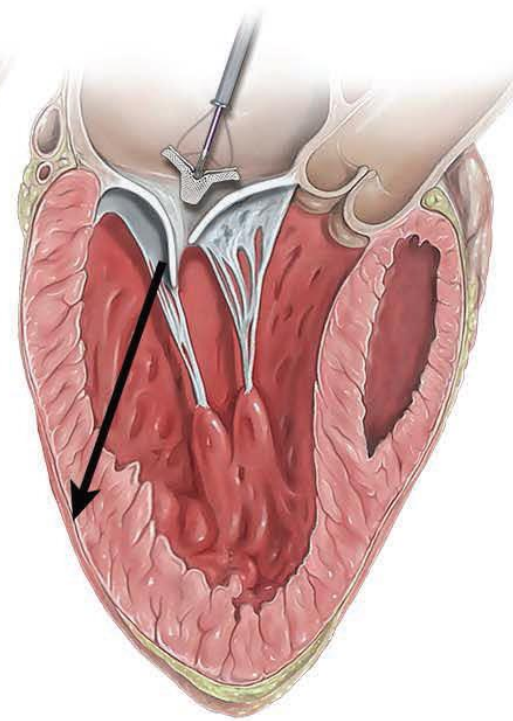
LVOT VIEW

(-) Knob

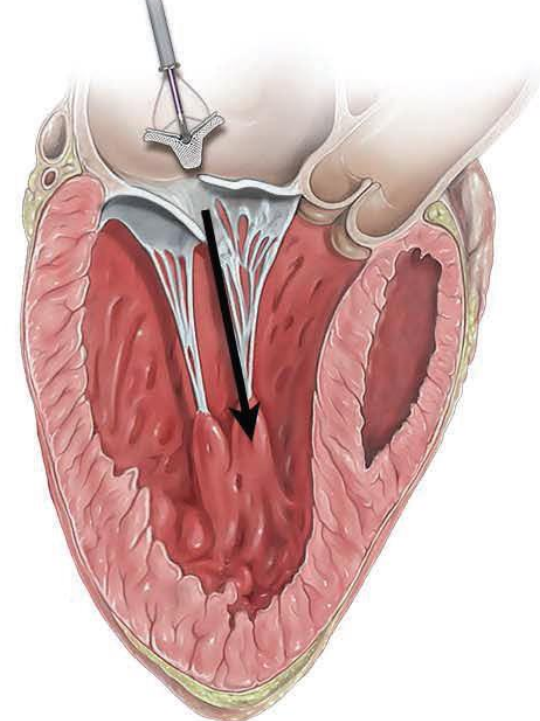
(+) Knob



Symmetric tethering



Asymmetric tethering



Anterior leaflet prolapse



Transcatheter Edge-to-Edge Repair. Textbook of SCAI

Careful use of fluoroscopy (**parallax** technique) in combination with 2D TEE X-plane imaging



This technique in fluoroscopy can help to ensure that trajectory and alignment of the clip are maintained while advancing into the left ventricle (LV) and can help with trajectory of subsequent clips.

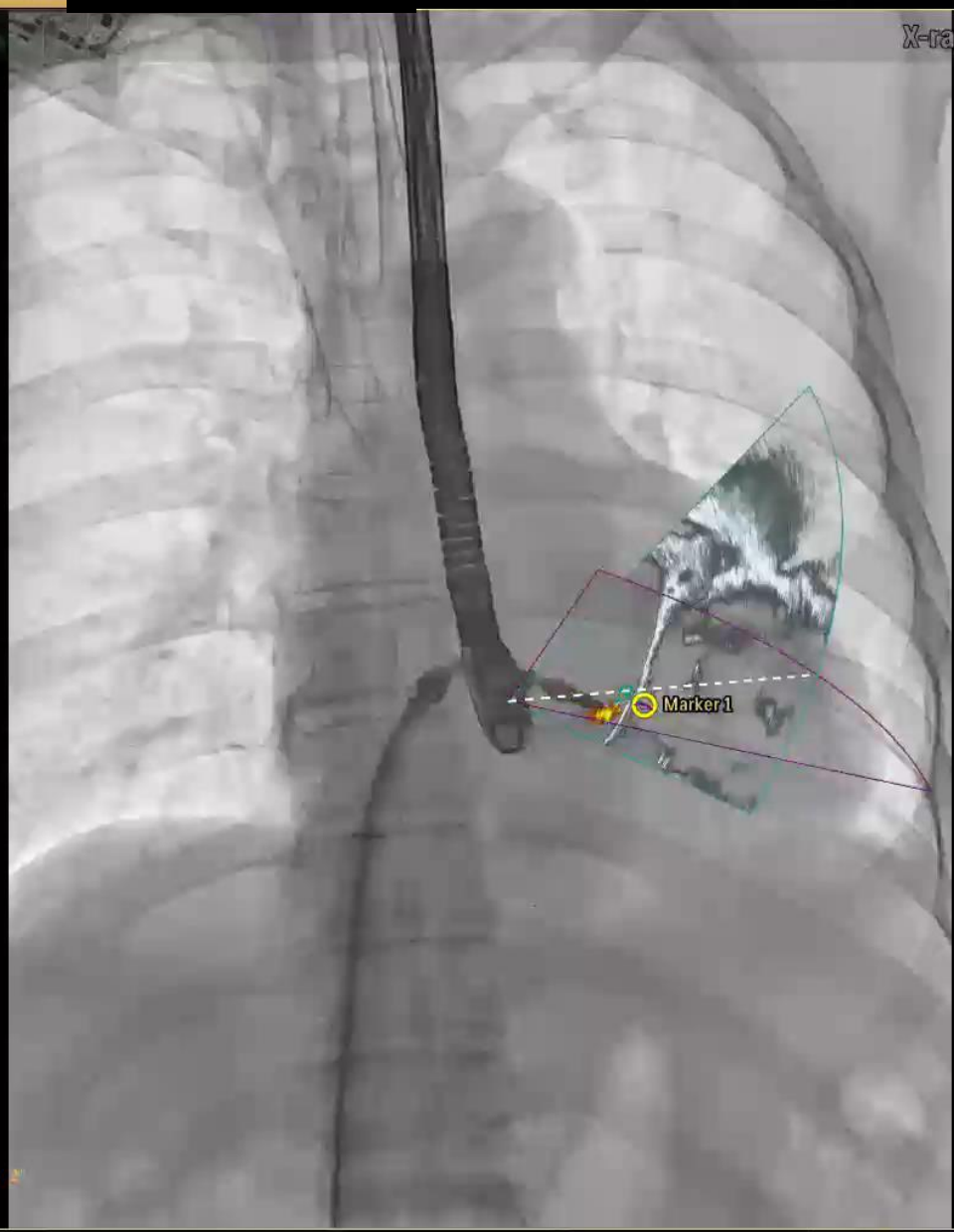
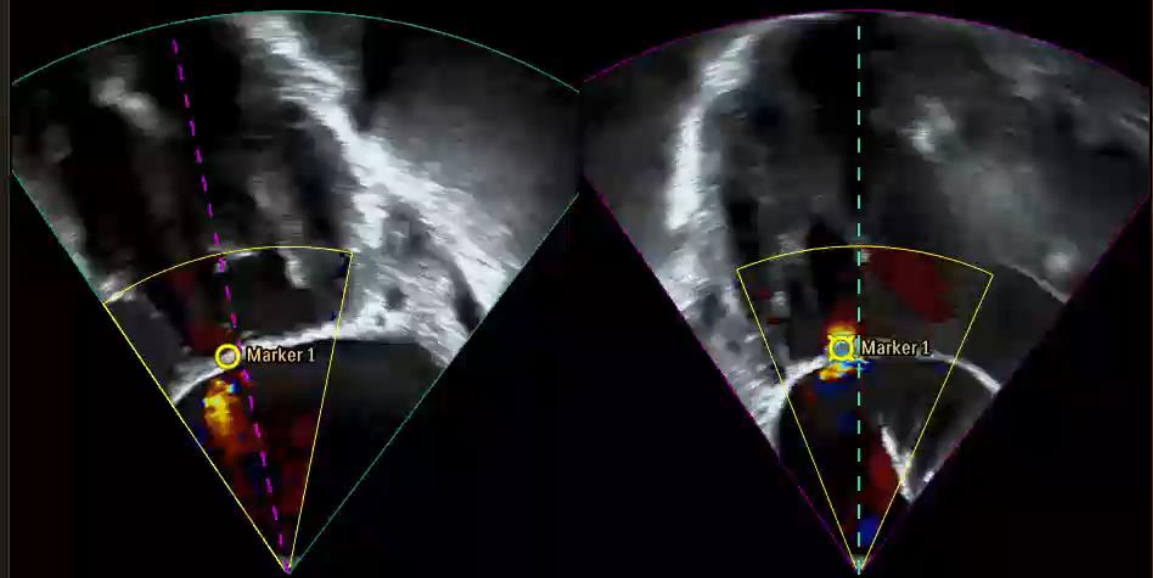
Transcatheter Edge-to-Edge Repair. Textbook of SCAI

Follow EPIQ Echo

X-ray 1



TEER using EchoNavigator



TIS 0.4 MI 0.7



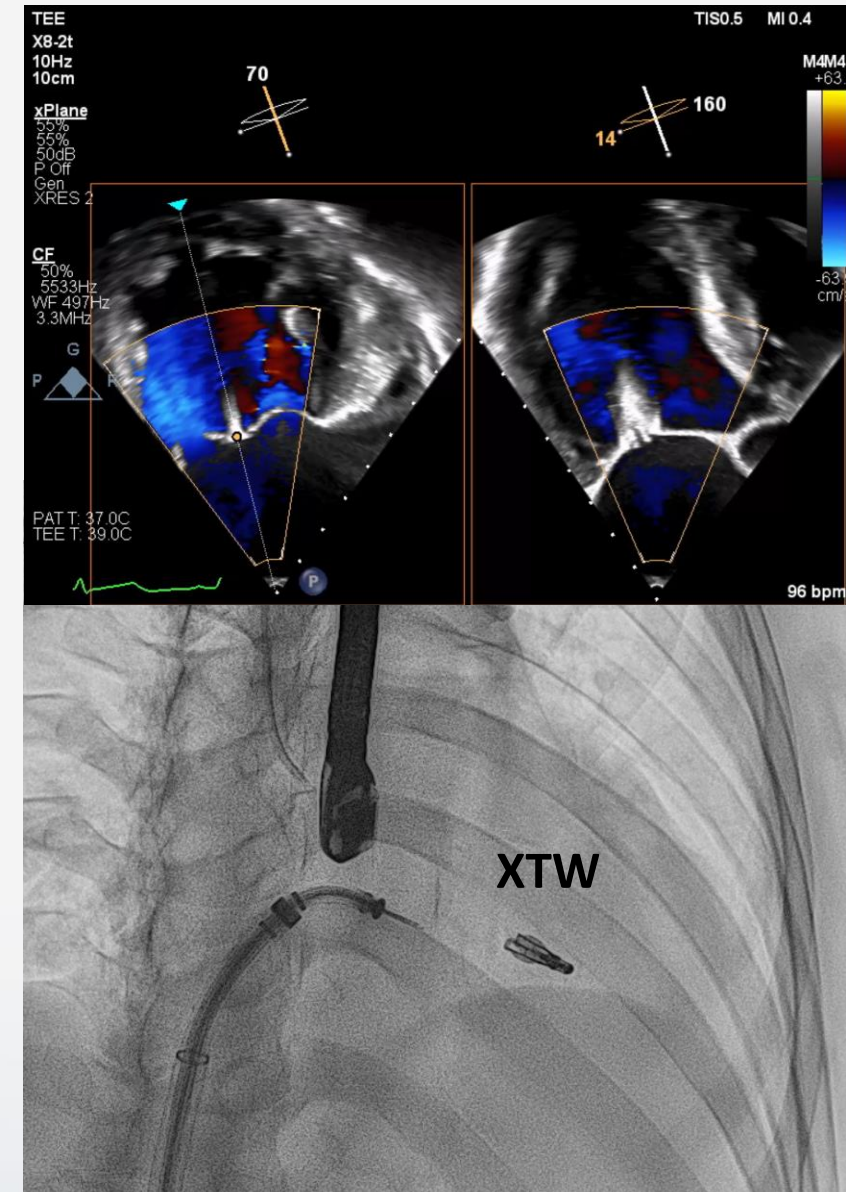
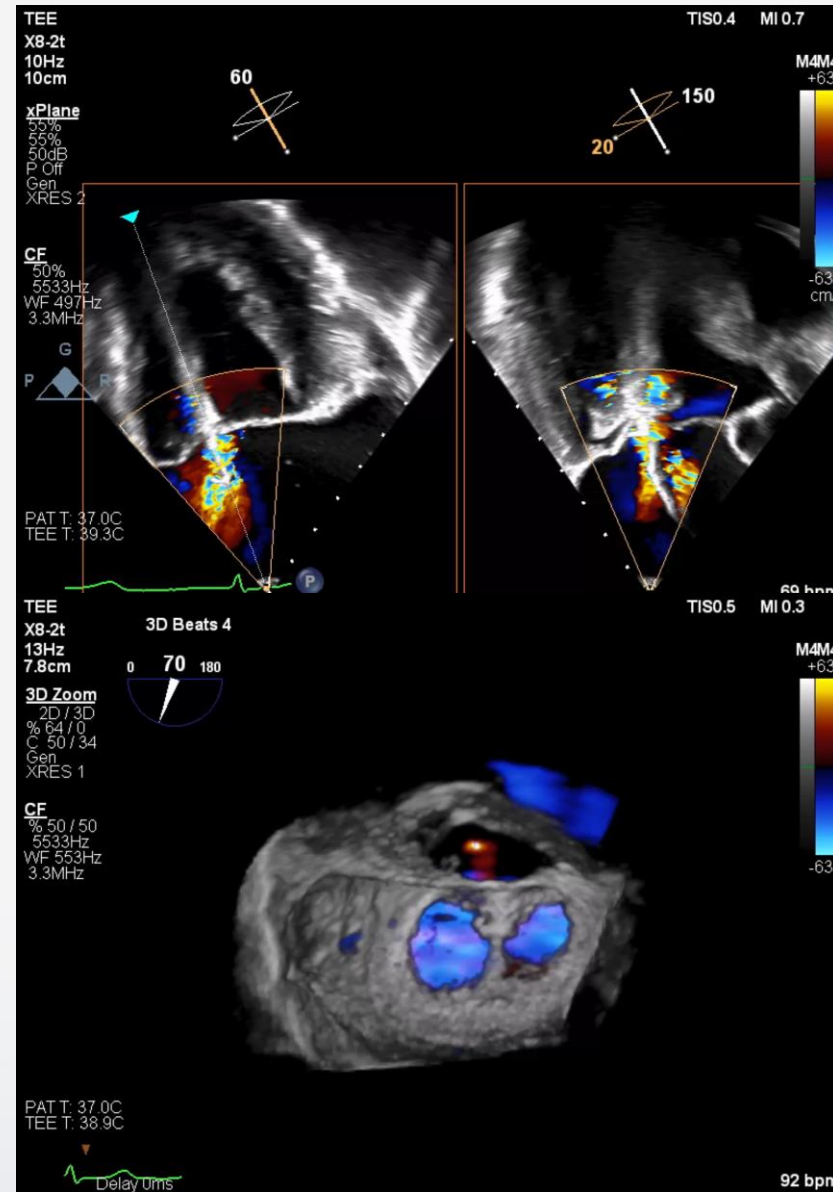
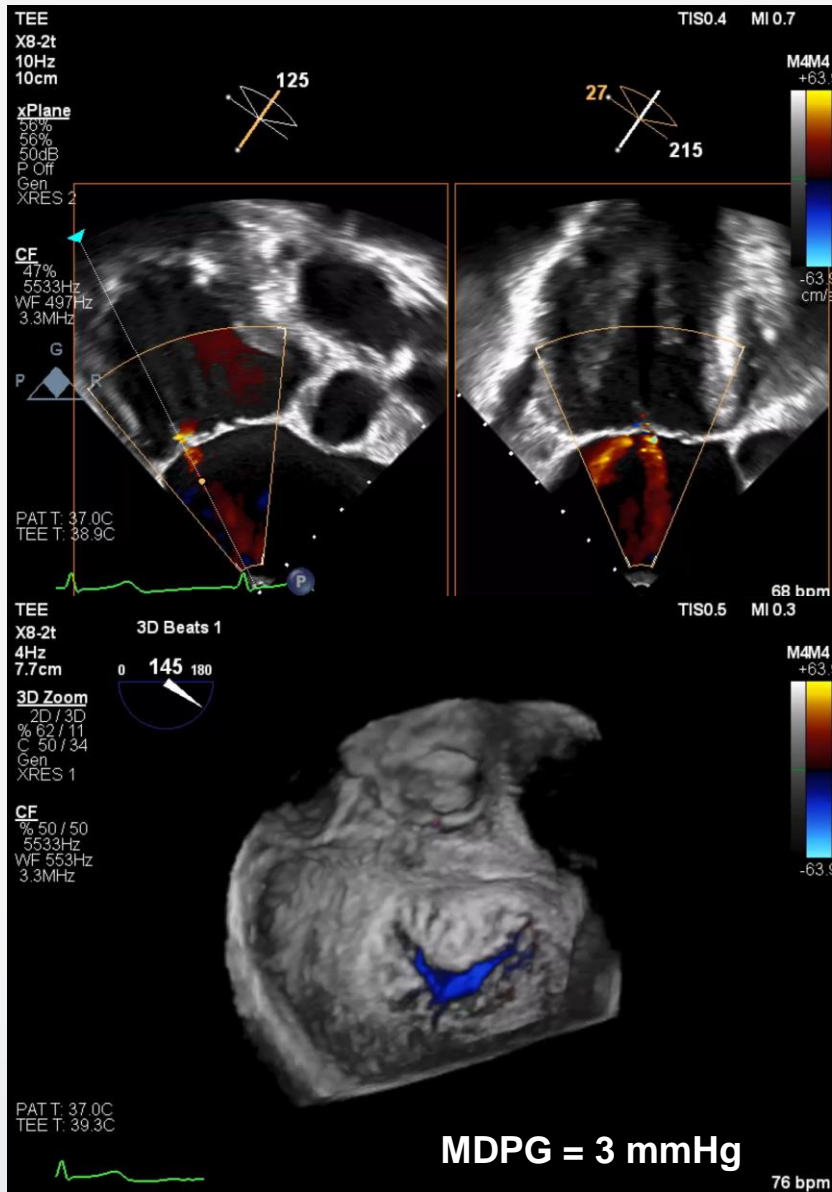
LAO

Tilt Box Position Box Size 2D Position

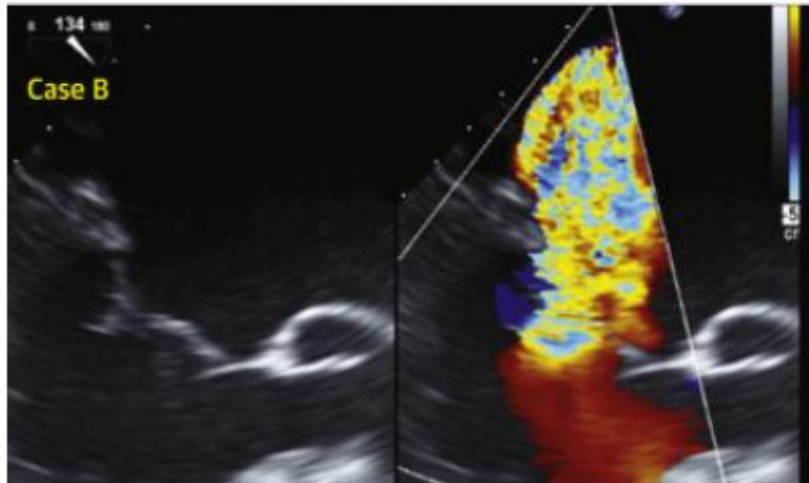
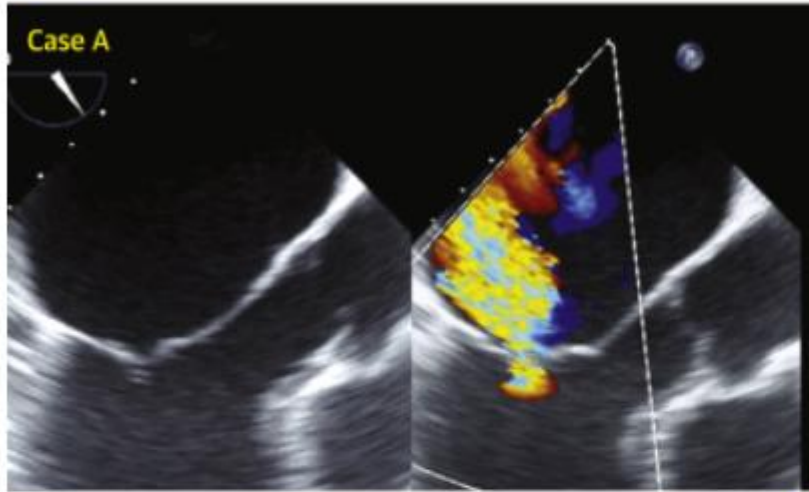
Recording _ (00:21:44 | 02:00:00)

16-Jan-2024 10:29

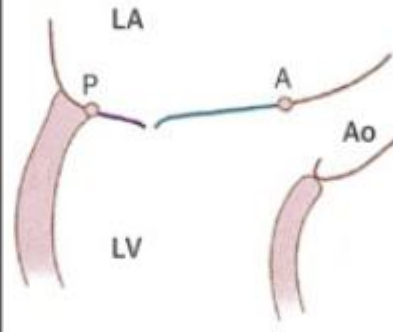
TEER



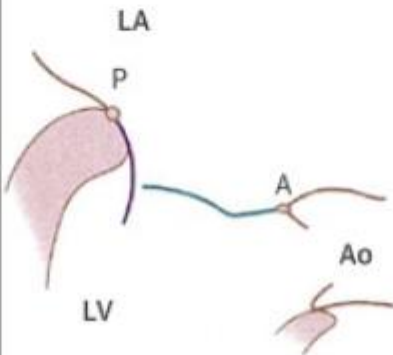
Transesophageal echocardiography



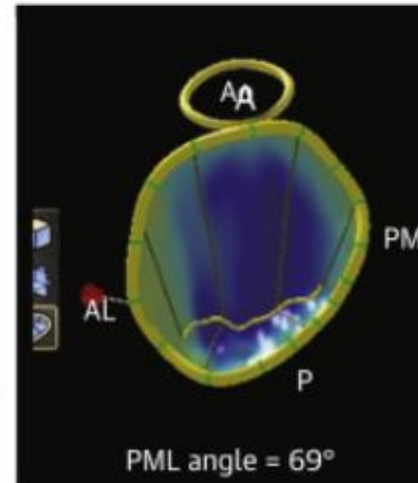
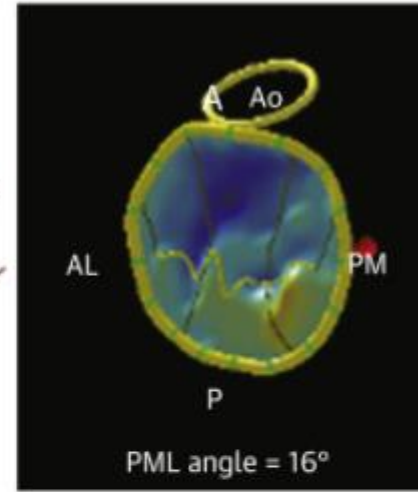
Schema



XT or XTW



3D modeling



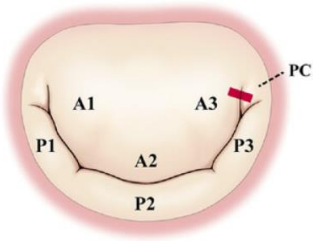
2 cases with different anatomical characteristics of the mitral valve. An annuloplasty alone may not always be effective.

Short PML -> NT or NTW

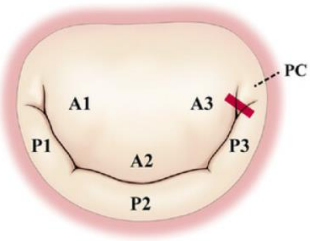
Kagiyama N, et al. J Am Coll Cardiol Img 2020;13:820–835

A) Posterior commissure case

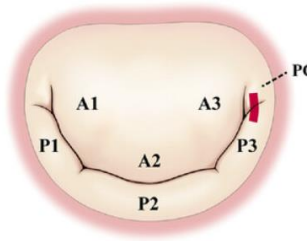
(a) A3-PC grasping



(b) Medial A3-P3 grasping

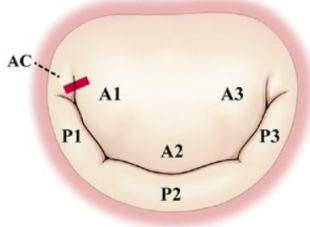


(c) PC-P3 grasping

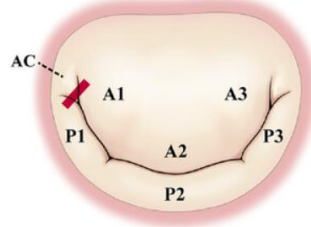


B) Anterior commissure case

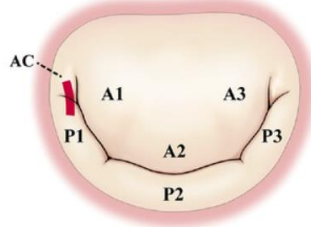
(a) A1-AC grasping



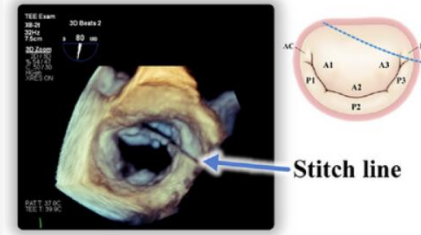
(b) Lateral A1-P1 grasping



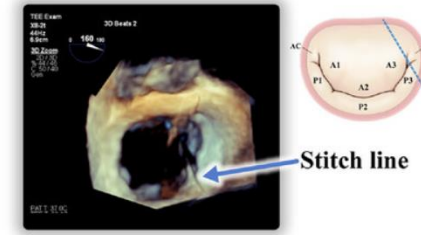
(c) AC-P1 grasping



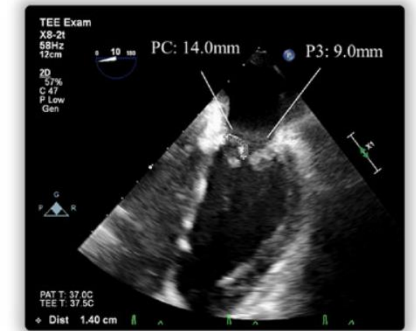
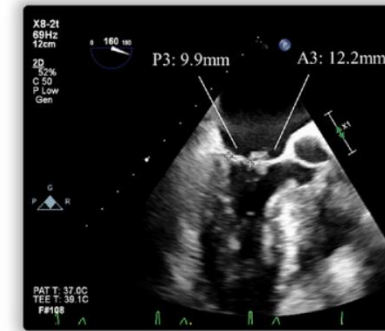
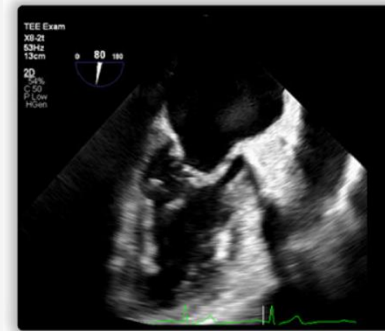
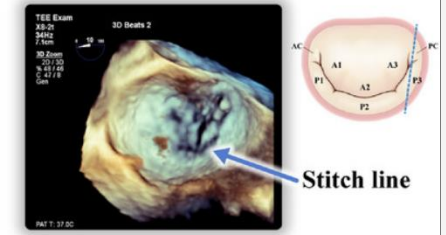
(A) A3-PC grasping



(B) Medial A3-P3 grasping



(C) PC-P3 grasping



Successful treatment of commissure TEER cases requires that the risk of clip-entanglement with subvalvular apparatus be minimized. Specifically, highly accurate clip-angle adjustment should be conducted at the LA. After the clip is inserted into the LV, clip manipulation should be restricted to “just open and pull up to stabilize leaflets to grasp”.

Seo M, et al. Echocardiography 2023

How to manage a residual MR ?

In MVL perforations,

- If the perforation was in the **body** of the MVL, the **Amplatzer atrial septal occluder (ASO)** device was the best choice.
- If the perforation was annularly located at the **base** of the MVL, the **Amplatzer VP-II** was the preferred device.

In post-clips residual MR,

- If the residual jet was **commissural between the MitraClip devices** and one of the MV commissures, the **Amplatzer VP-II** was utilized (TAIBA technique).
- If the residual jet was **inter-MitraClip between the clips** themselves, either an **Amplatzer ASO device** or a **VP-II** was used.

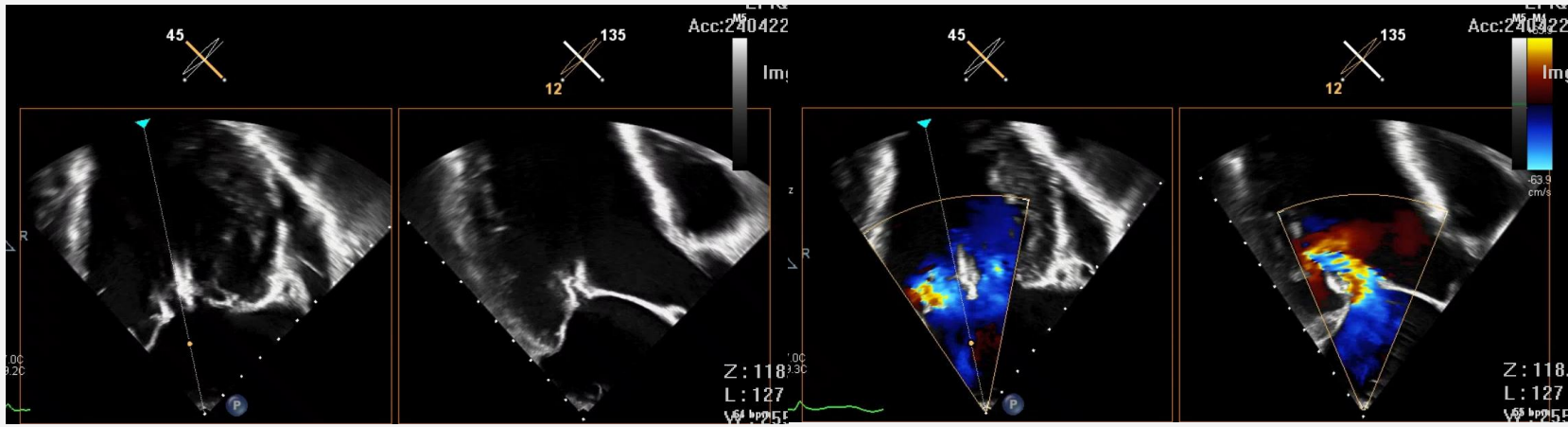
Taha FA, et al. Structural Heart 2022;6:100043

Multiple Clips

It is easier to deploy the **second clip lateral to the initial clip** as the maneuvering is more straightforward.

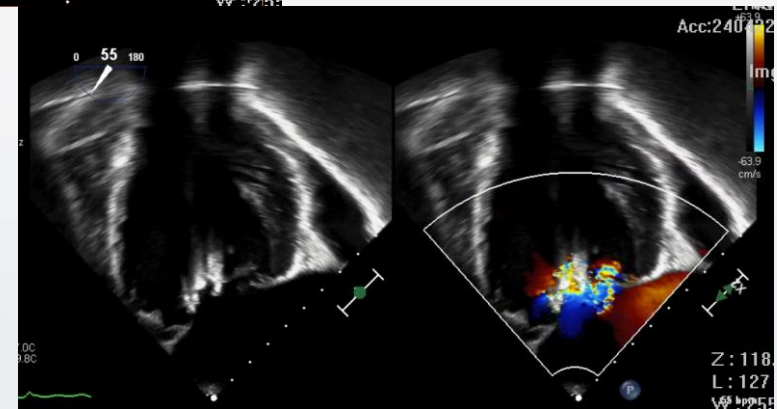
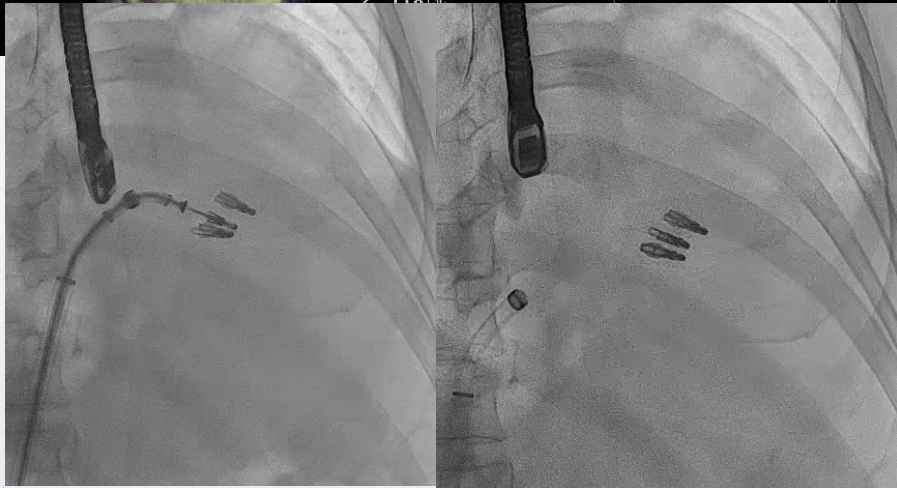
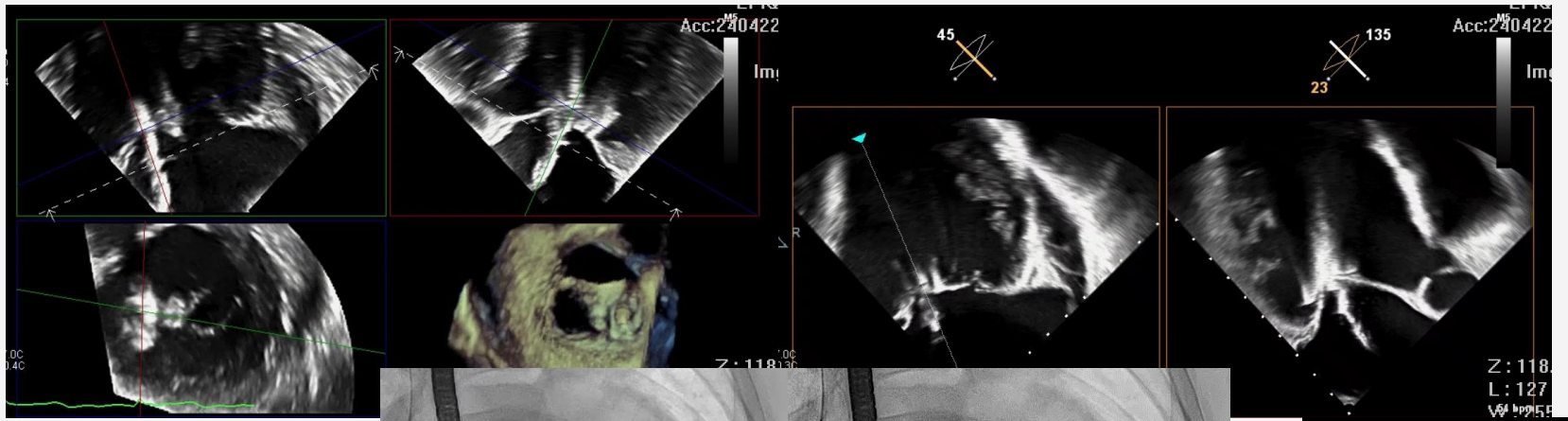
It is also **easier to deploy the second clip near the central A2-P2 segments** rather than in the commissures. Thus, it is recommended to plan the first clip accordingly to allow space and maneuverability for the additional clip.

Breath hold might be needed while advancing the clip in some cases to avoid the interaction with the previously placed clip. It is desirable to have **the second clip positioned as close to the first one** to minimize the residual mitral valve gradient.



Single leaflet Detachment in
2nd Clip

Corrected with 3rd Clip



Large Gap

Rapid ventricular pacing (140–180 BPM) to create ventricular standstill or the use of adenosine.

Cooperation with anesthesiologists to apply a PEEP and position change.

- **M/78**

- **Chief complaint**

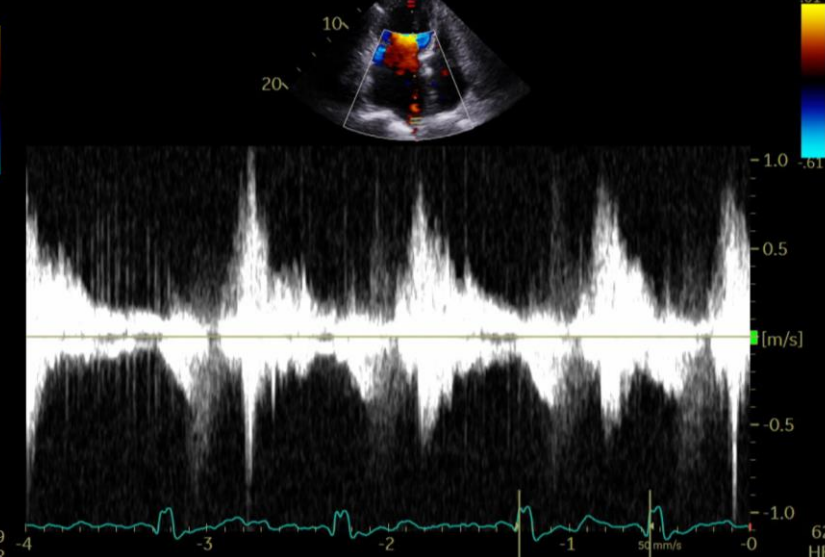
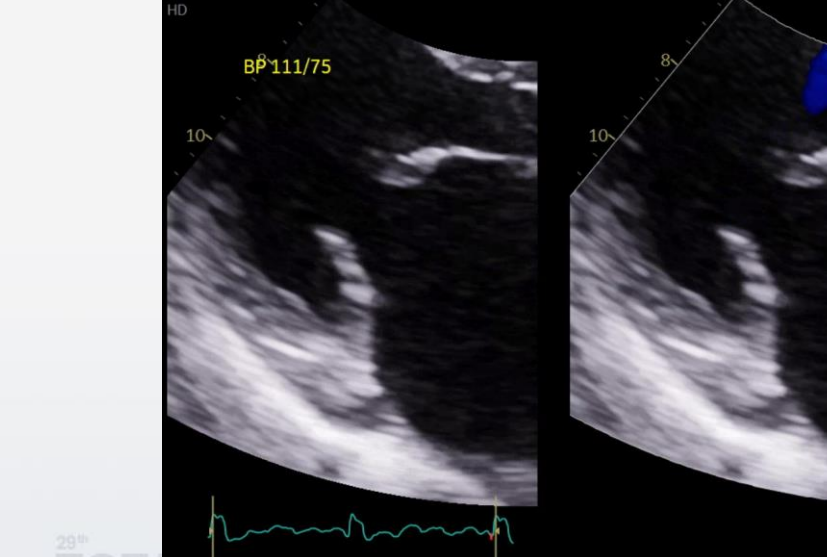
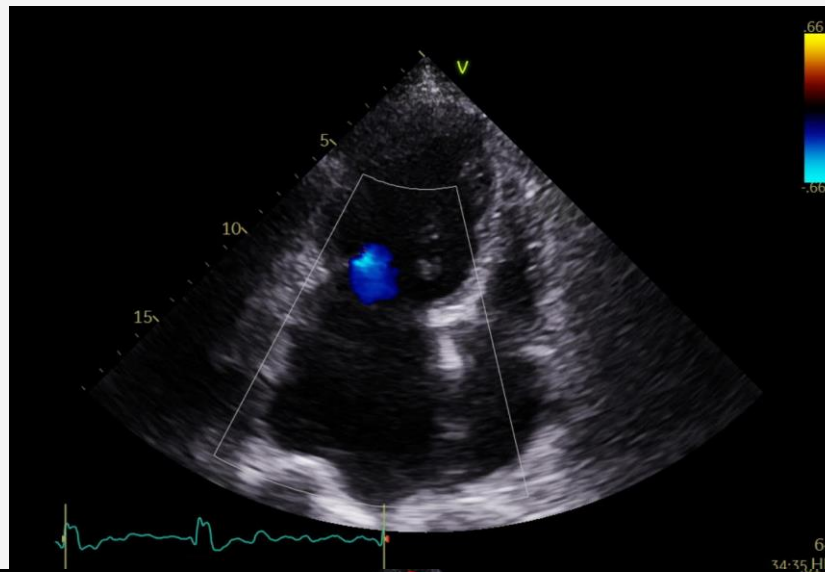
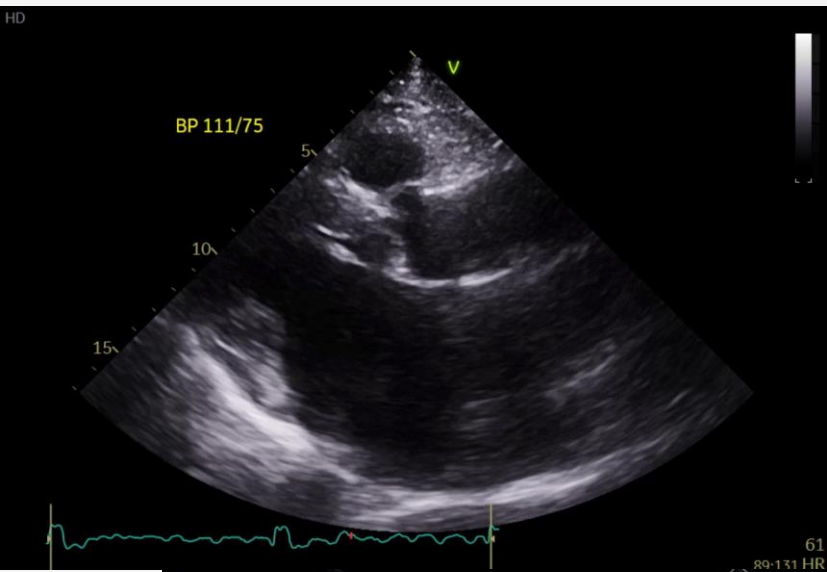
- **Dyspnea (Duration : 2wks) → Emergency department**

- **Comorbidity**

- **Persistent AF**
 - **Atrial functional MR**
 - **Hypertension, Diabetes mellitus taking oral hypoglycemic medication**
 - **Chronic obstructive pulmonary disease**
 - **Prostate cancer s/p prostatectomy (7-year-ago)**



TTE



Severe MR

ERO : 93mm², RV 97mL (by flow convergence)

Incomplete coaptation

Dilated MV annulus

PV systolic reversal

LVEF : 75%

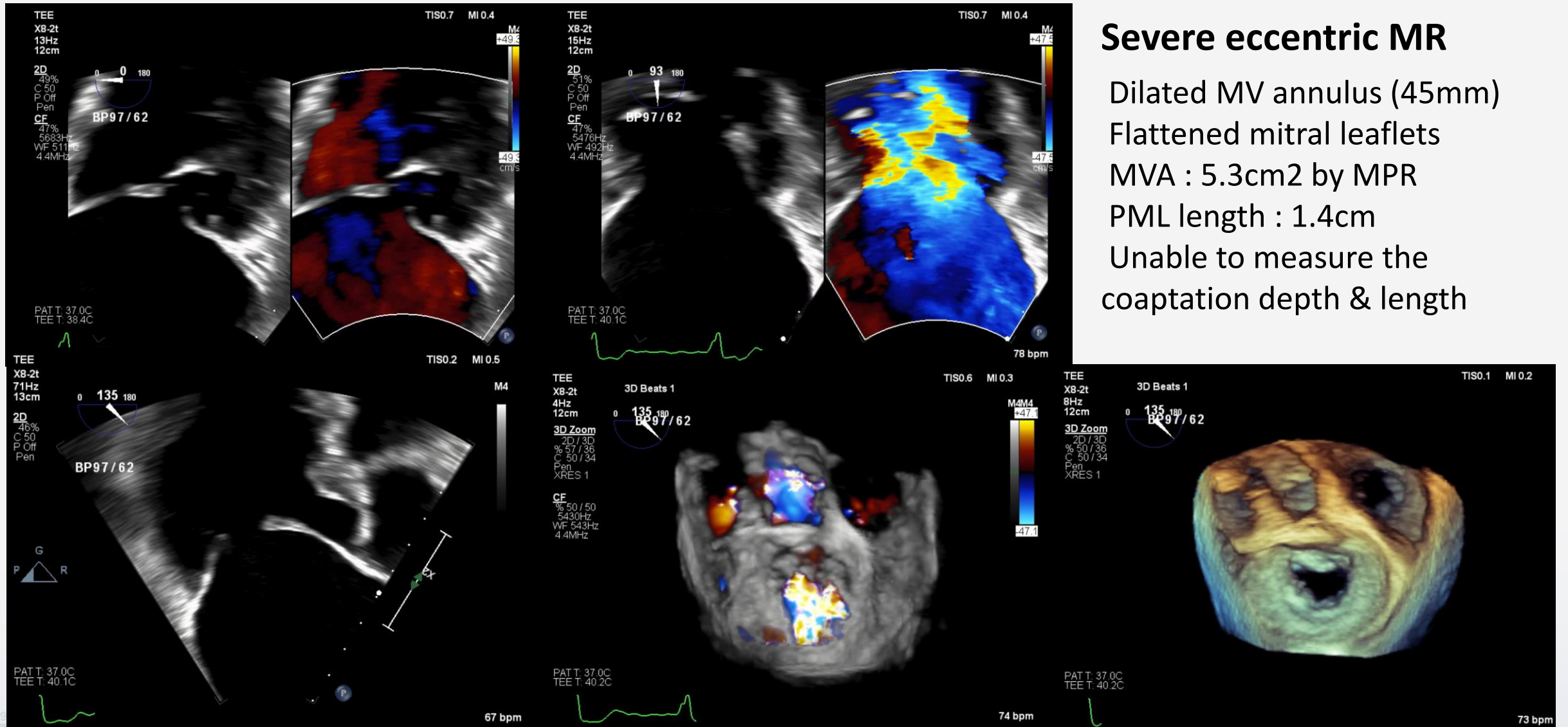
LVEDD/ESD : 60/35mm

LAVI : 151mL/m²

E/E' : 21

RVSP : 65mmHg

TEE



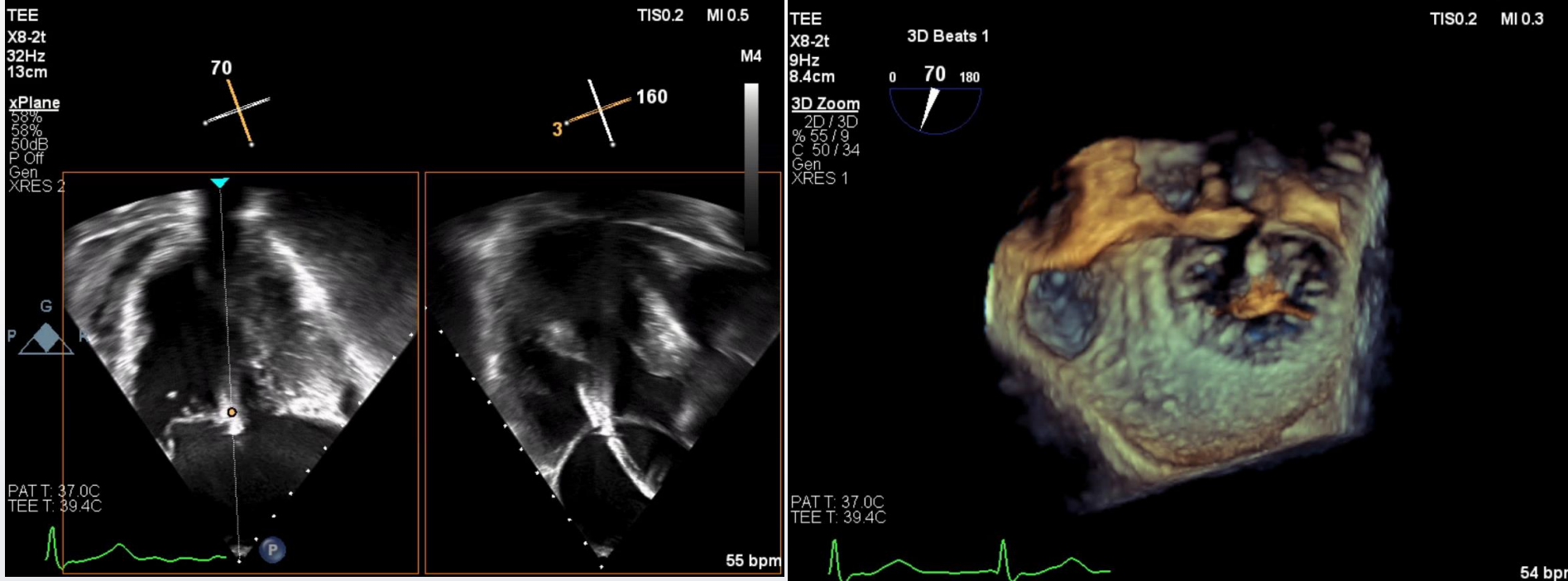
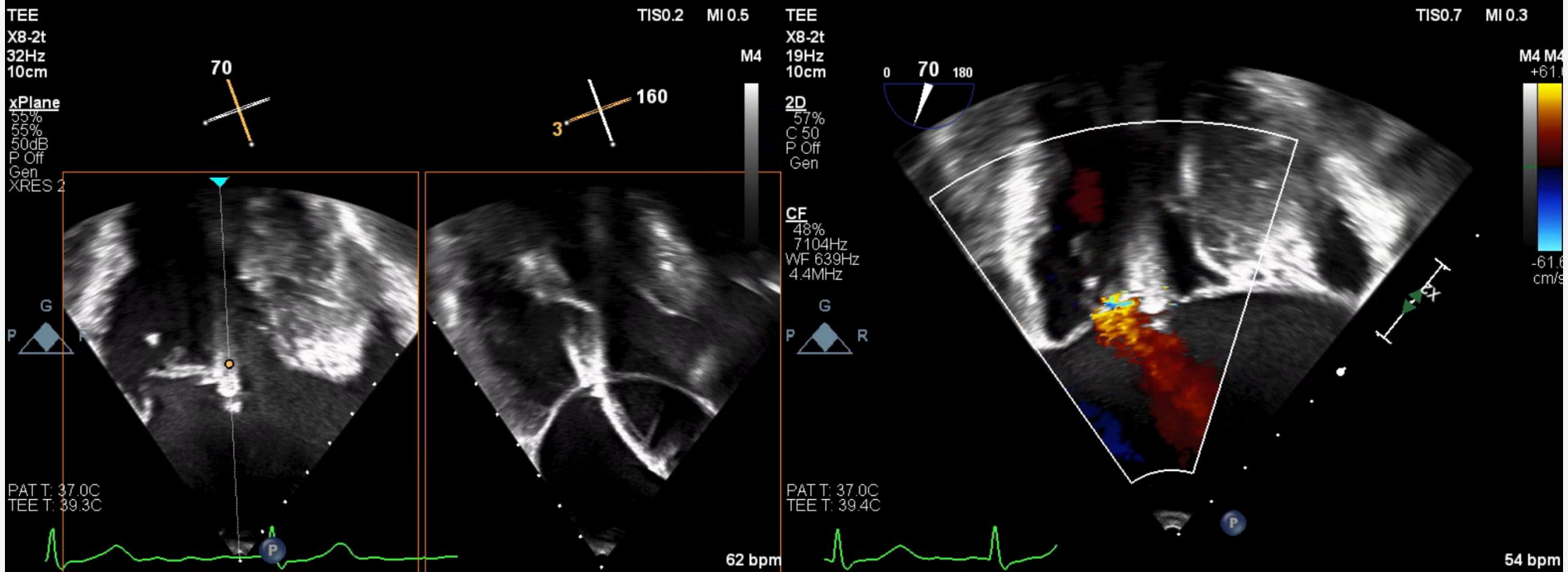
Severe eccentric MR

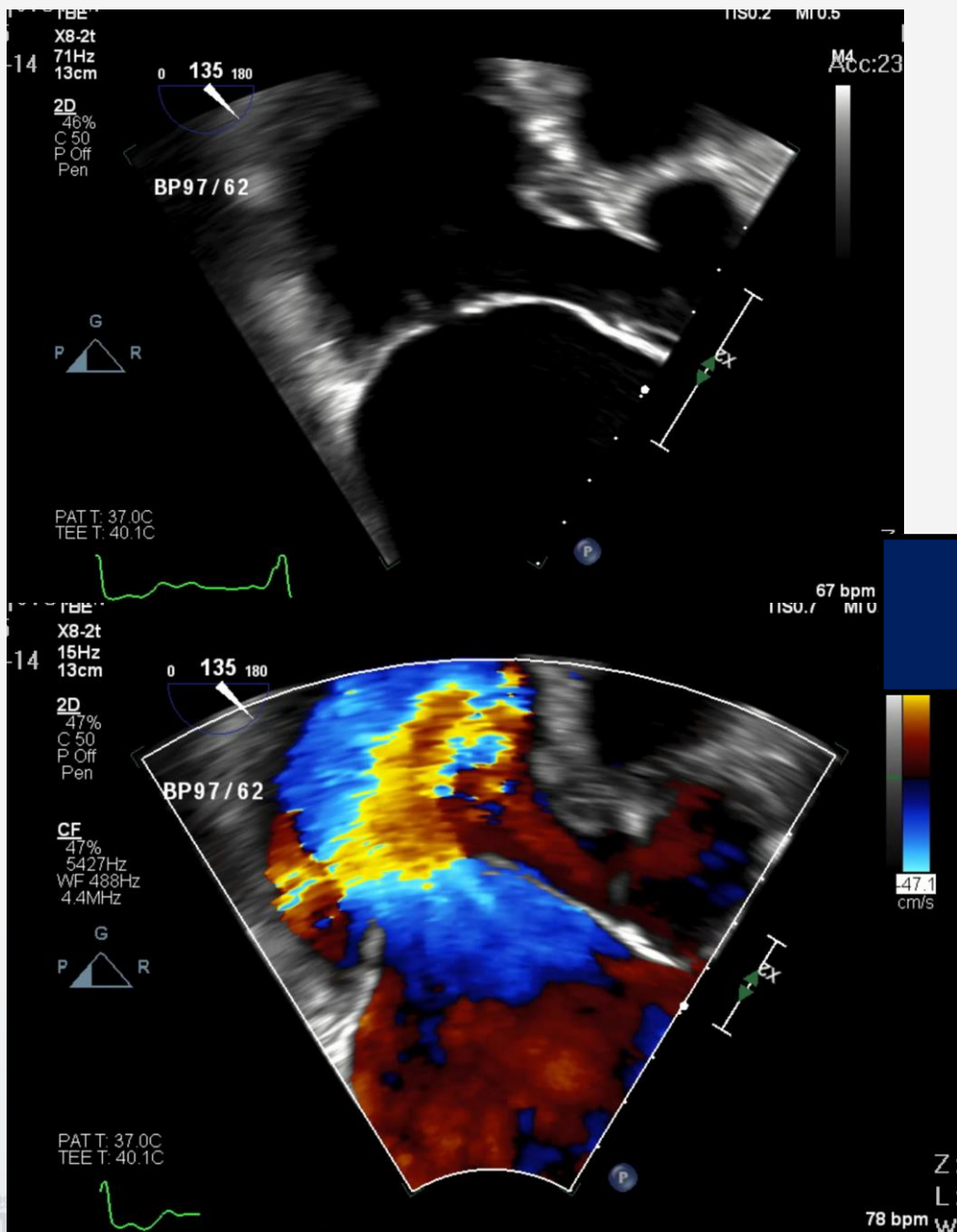
- Dilated MV annulus (45mm)
- Flattened mitral leaflets
- MVA : 5.3cm² by MPR
- PML length : 1.4cm
- Unable to measure the coaptation depth & length

TEER

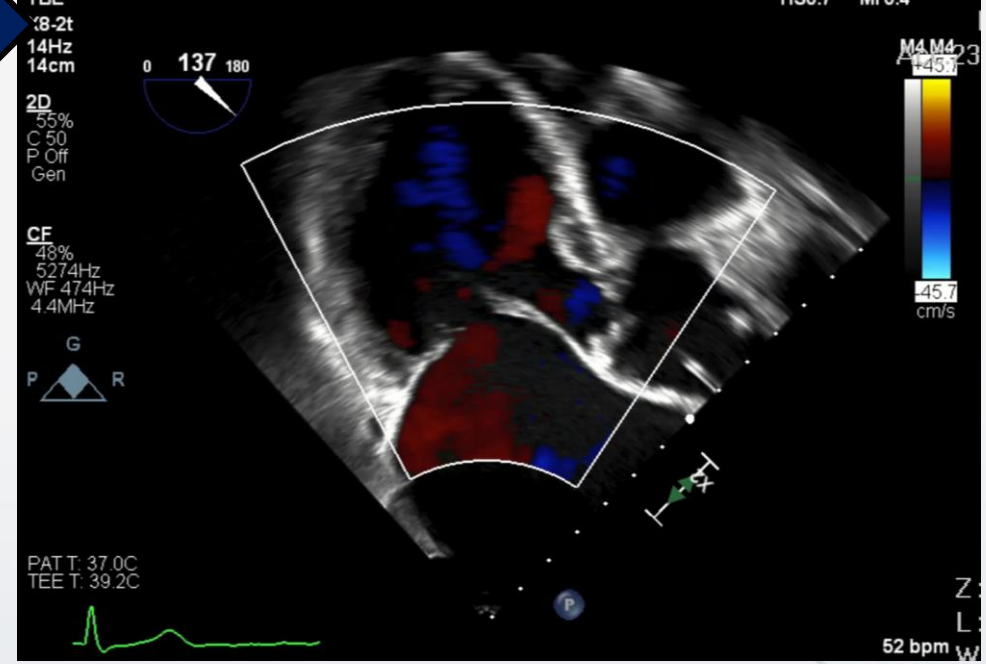
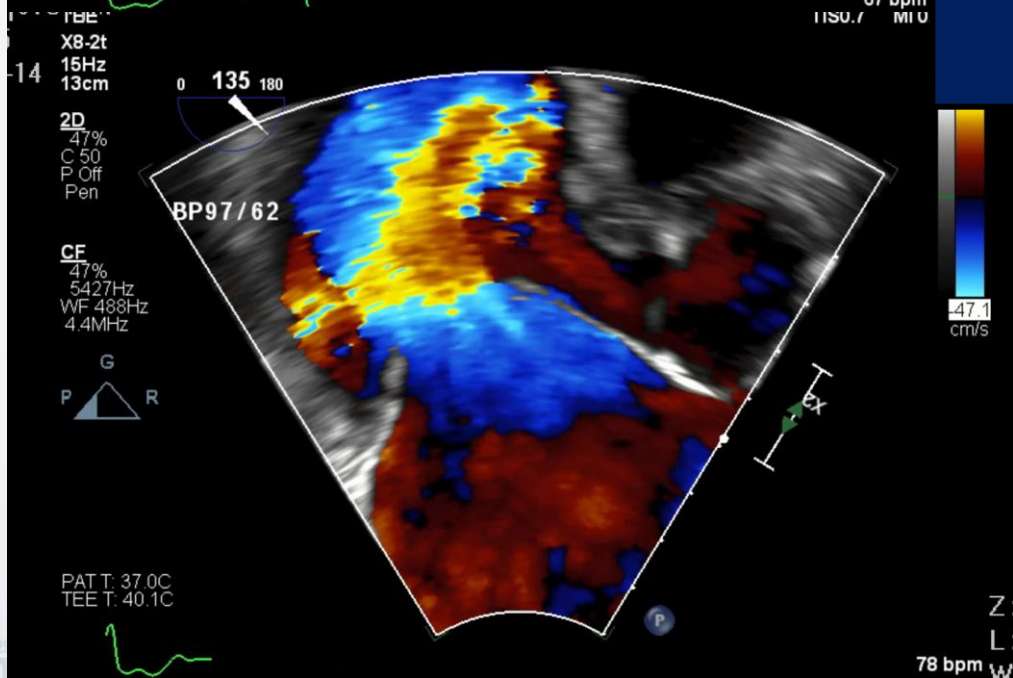
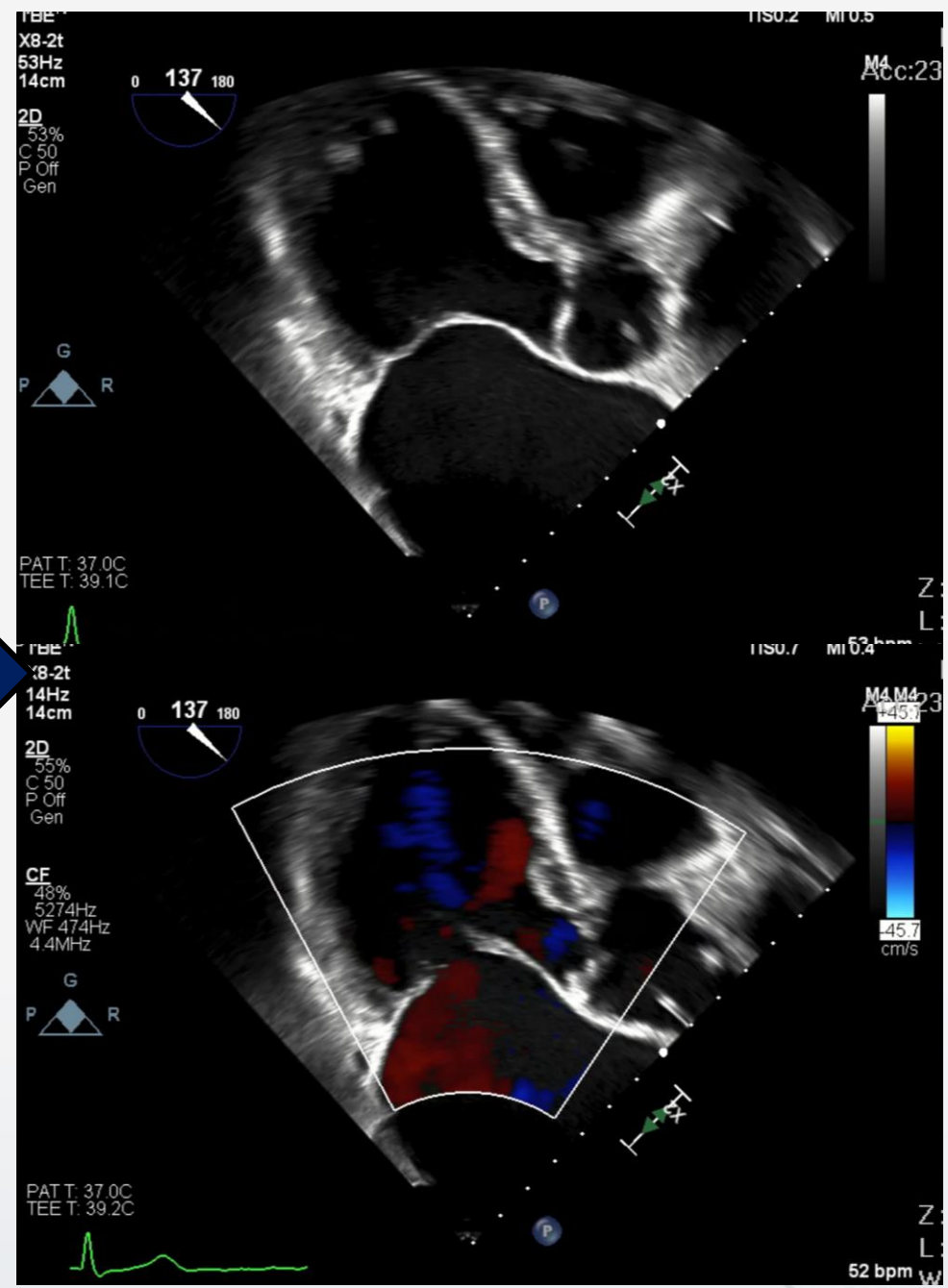
3 times attempts

XTW

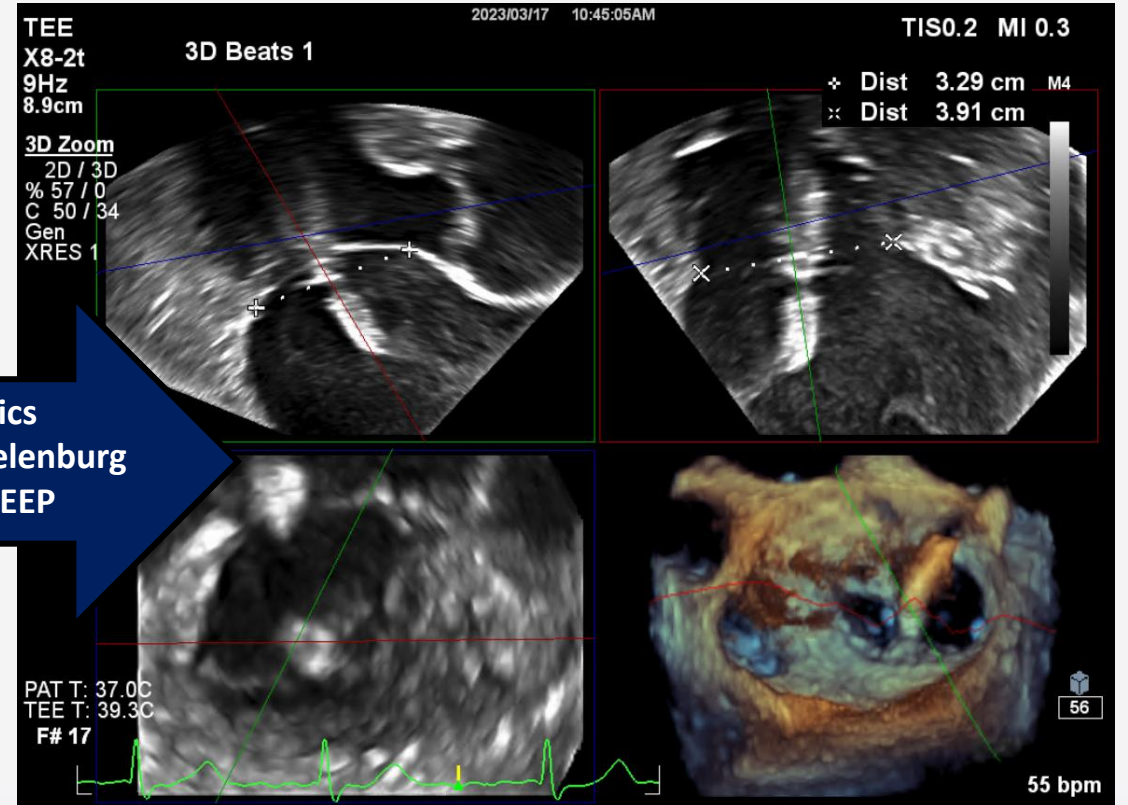
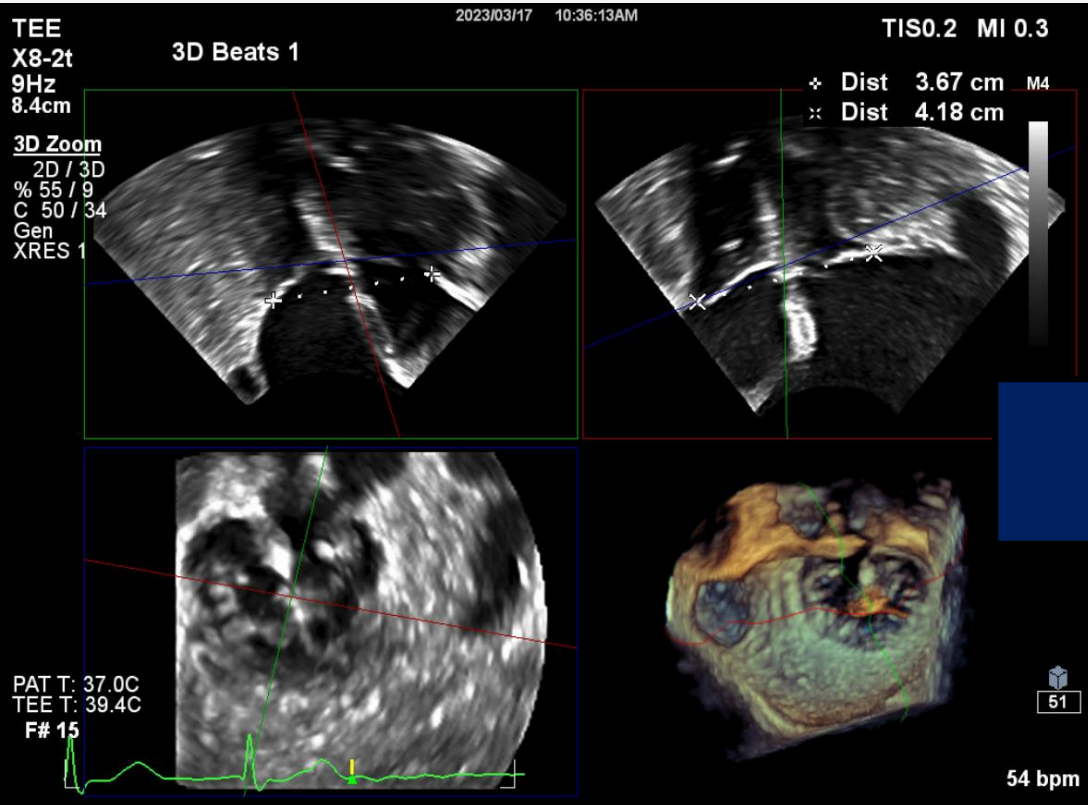




**IV Diuretics
 Reverse Trendelenburg
 Increase PEEP**



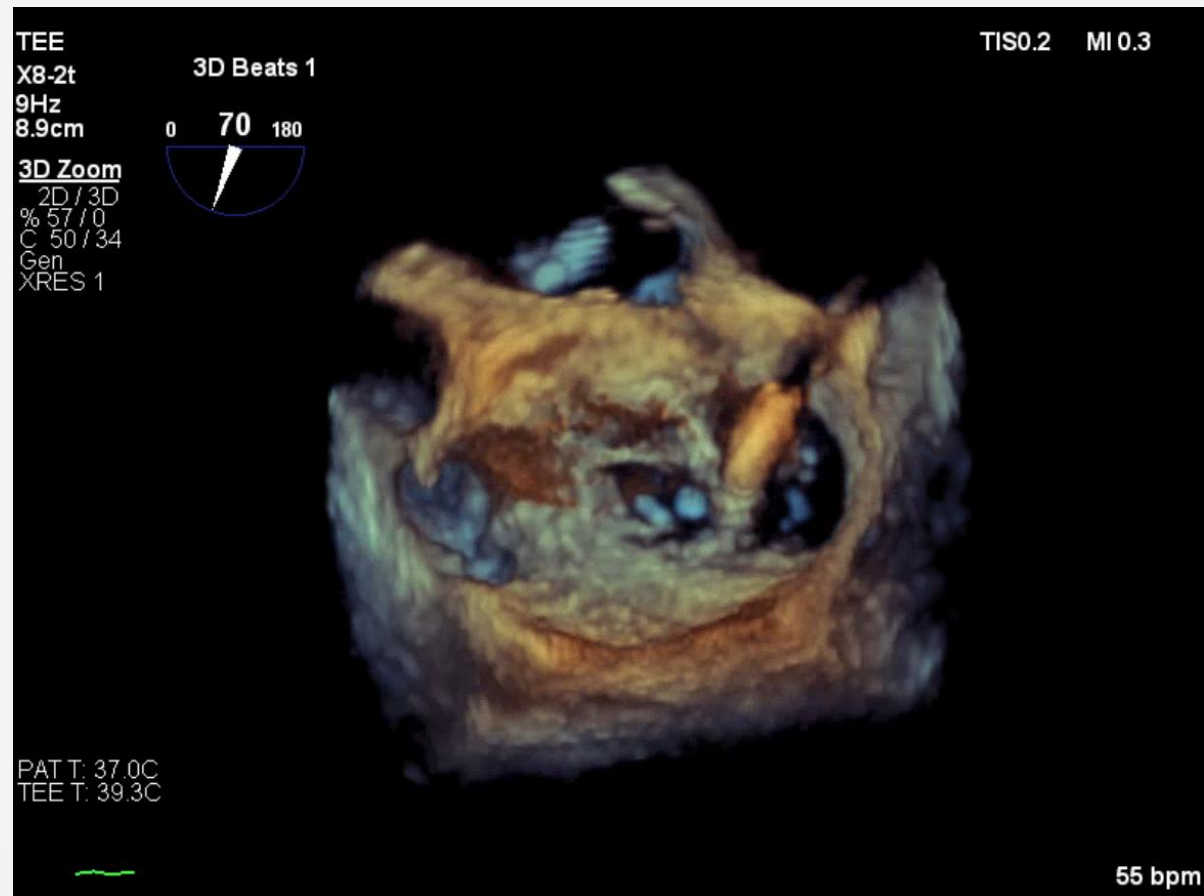
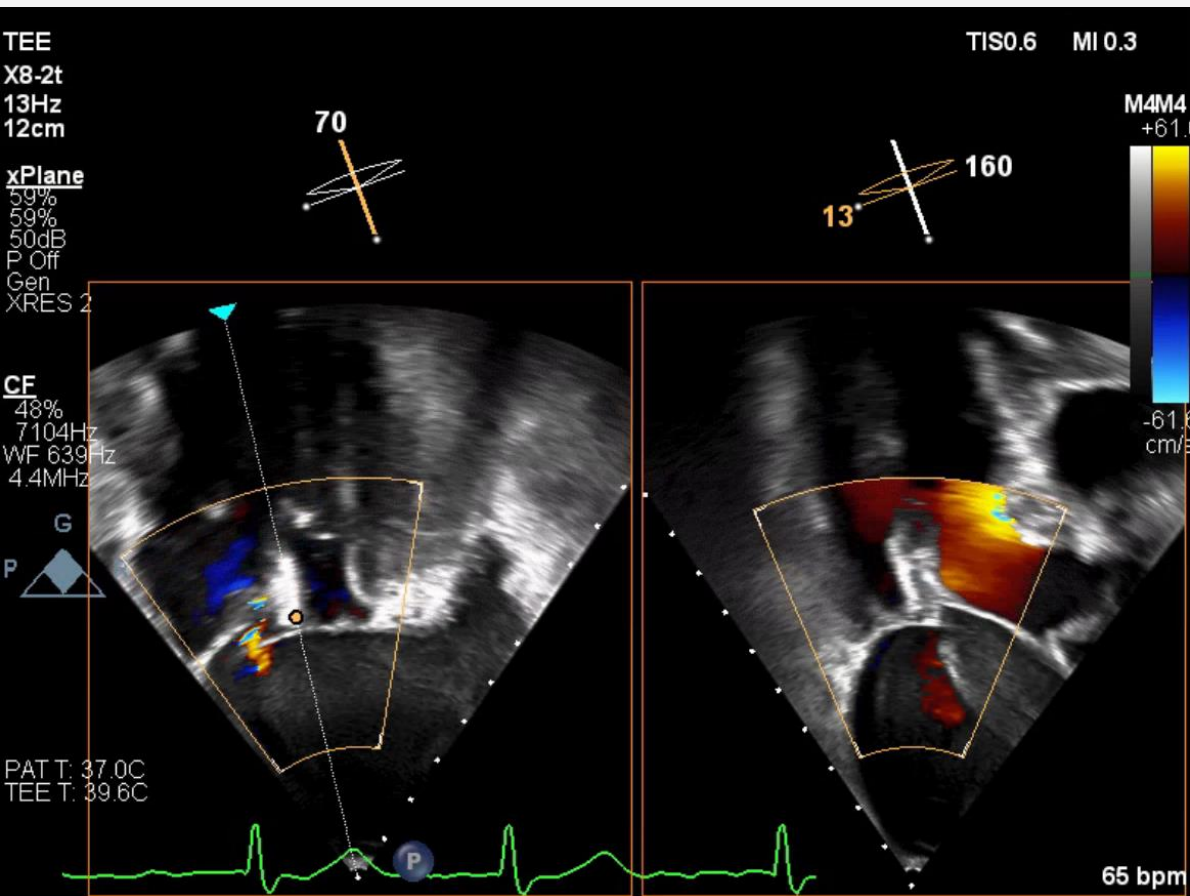
TEER – overcoming large gap



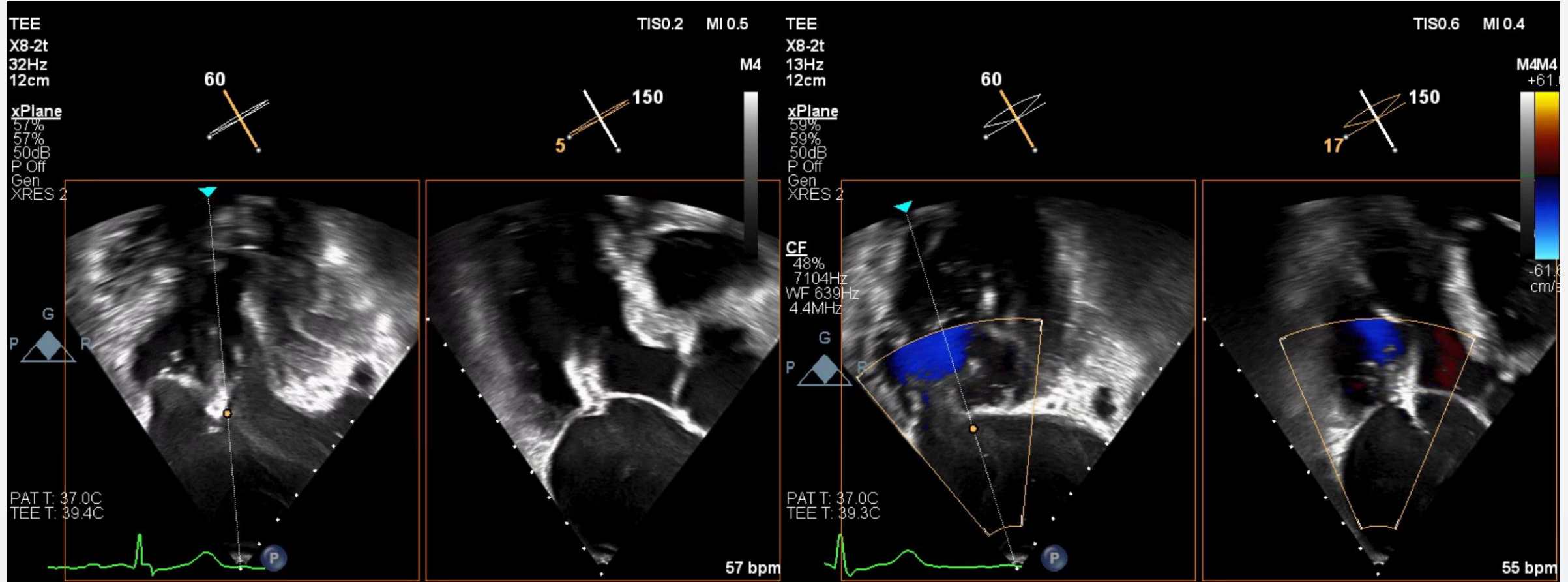
IV Diuretics
Reverse Trendelenburg
Increase PEEP

Inter-commissural diameter : 4.2cm → 3.9cm
Antero-posterior diameter : 3.7cm → 3.3cm

TEER – after PEEP & maneuver



TEER – after clipping



MDPG = 1.8mmHg

Summary

- 1. The optimal location of septal puncture is important.**
- 2. Understanding the function of the knob and SGC torque is crucial for overcoming special situations.**
- 3. Appropriate plans and goals are necessary for difficult cases.**
- 4. Close cooperation with imaging specialists and anesthesiologists is essential for overcoming difficult issues.**

Severance

With the Love of God, Free Humankind from Disease and Suffering

