

ASD and LAA closure

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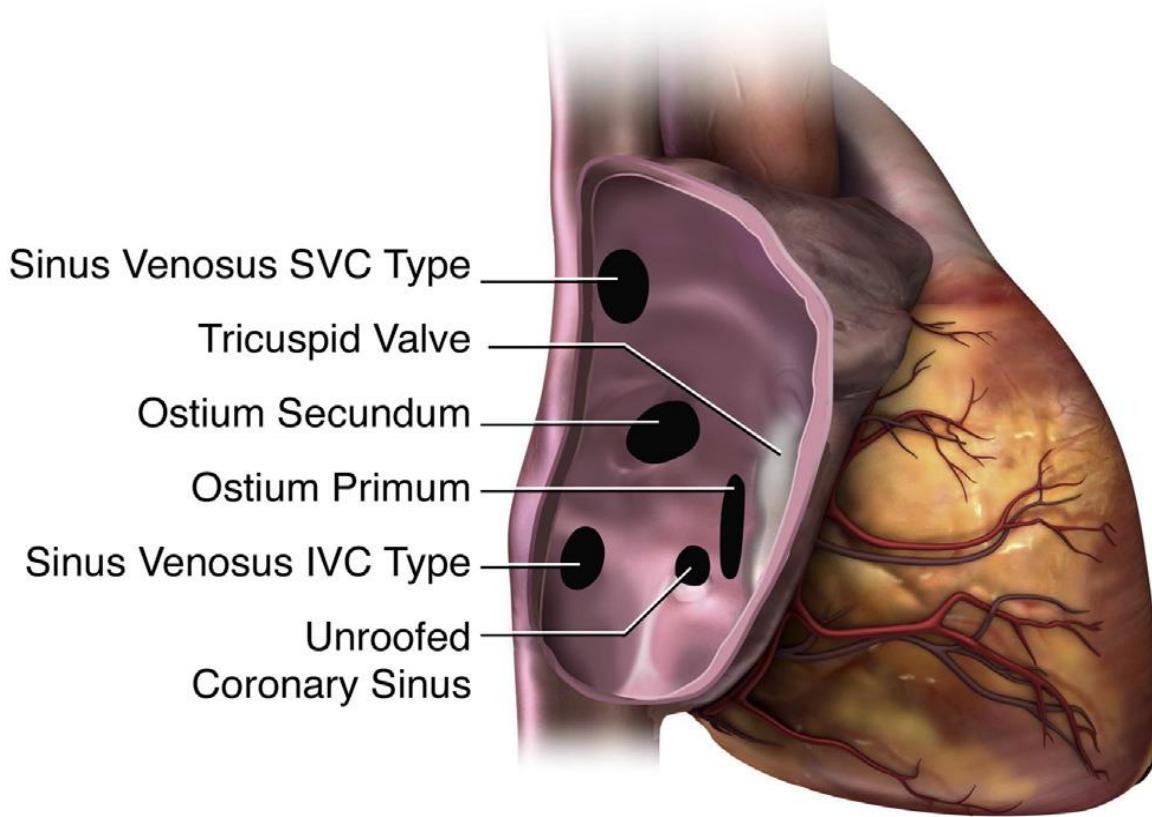
*Consultant cardiologist, Director of Echocardiography Lab
Aswan Heart Centre, Magdi Yacoub Foundation, Egypt*



Disclosure

- *All members of the Faculty have provided a declaration of potential or actual conflict of interest”*

ASD & PFO

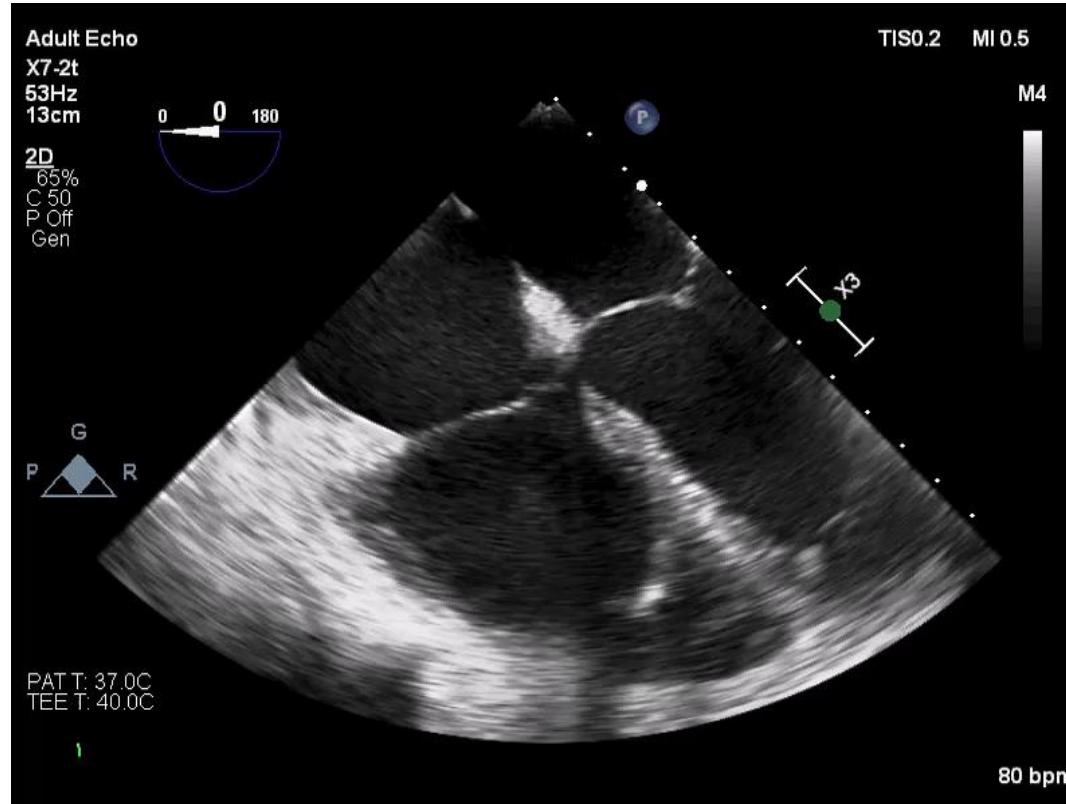


Ostium secundum ASD

Ostium secundum ASD

- An ostium secundum ASD most often occurs as the result of a true deficiency of septum primum tissue
- It is the most common form of a true ASD
- The superior and posterior margins of the defect are composed of the septum secundum, the anterior margin is composed of the AV canal septum, and the inferior margin is composed of the septum primum and left venous valve of the inferior vena cava

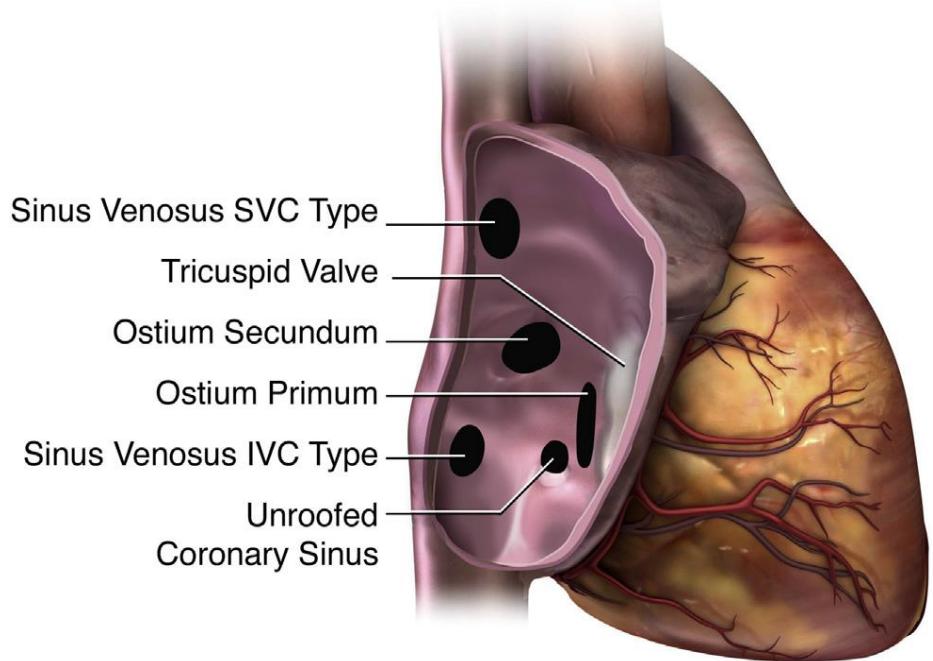
Ostium secundum ASD



2D TEOE imaging protocol

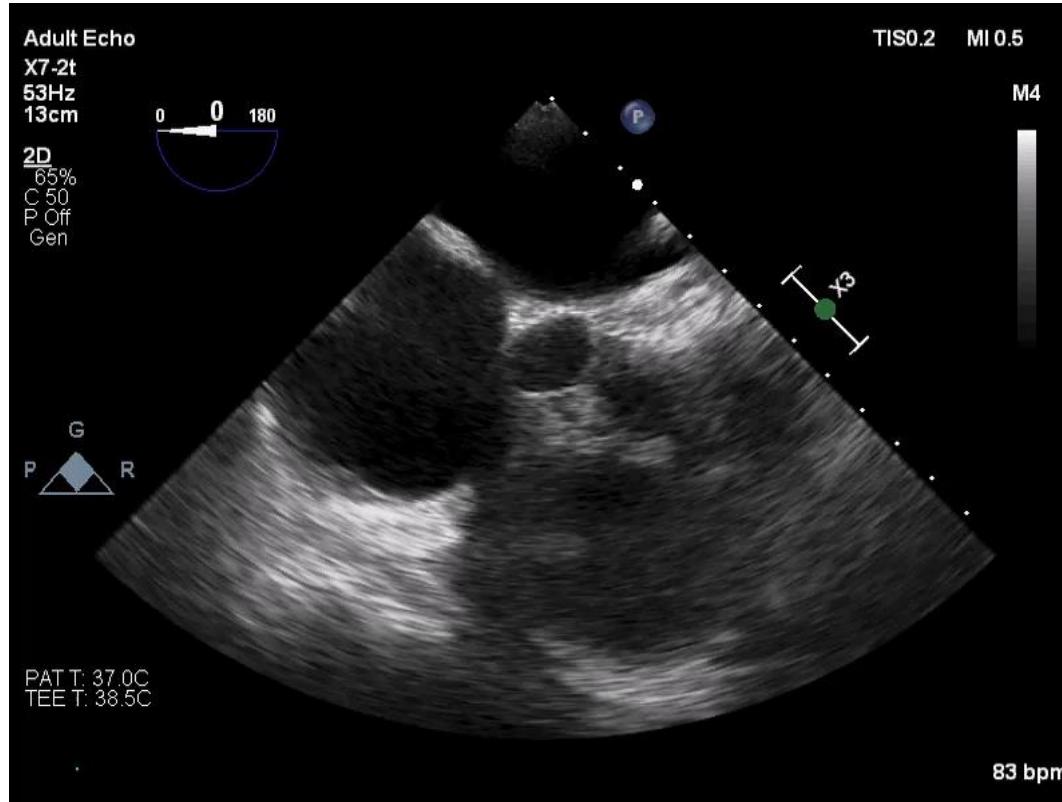
0 Degrees (Up & down)

90 Degrees (side to side)

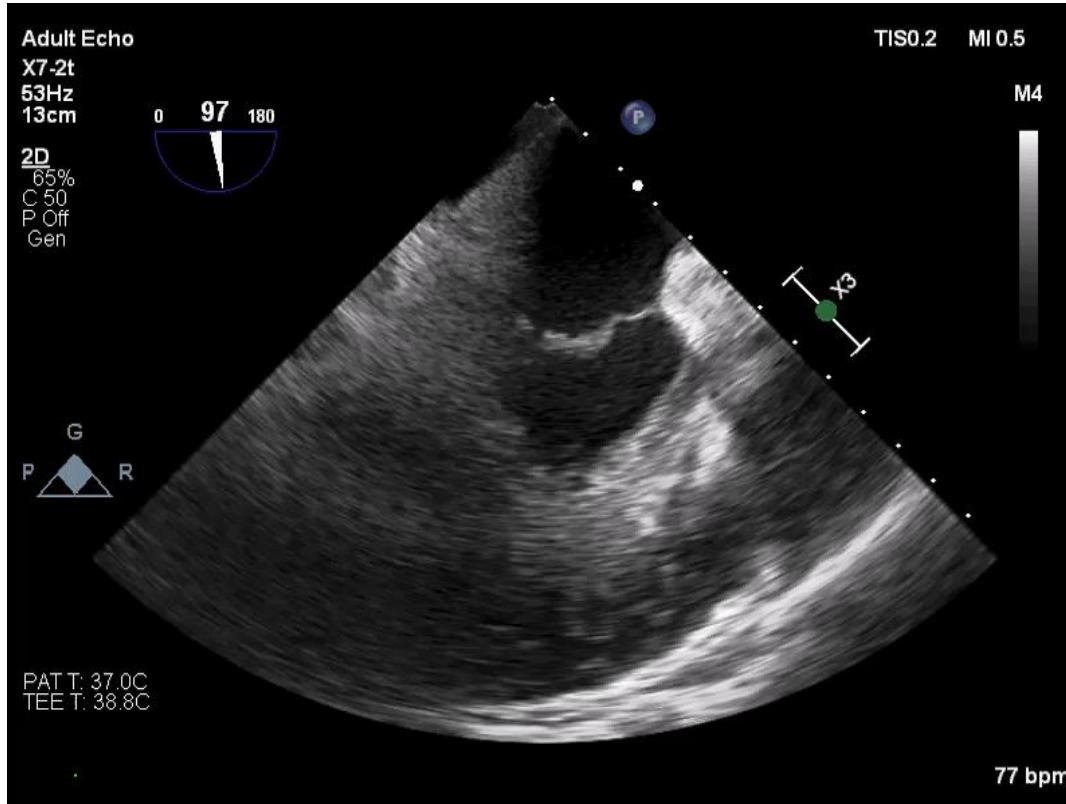


Speaker

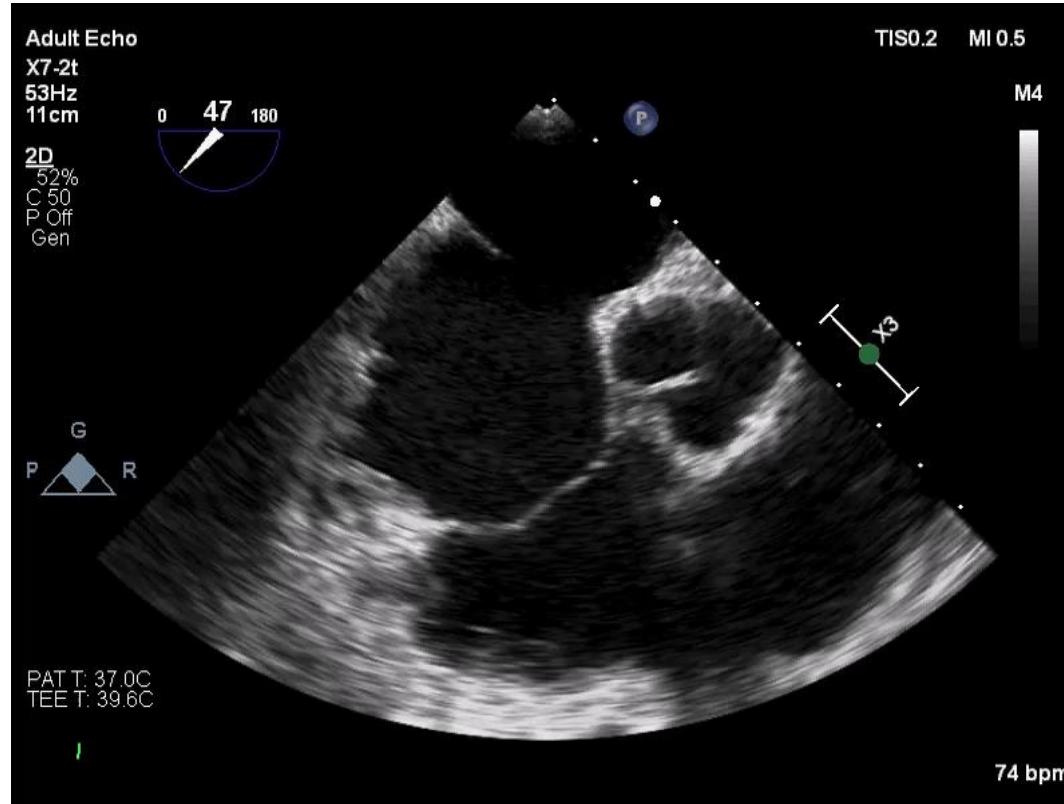
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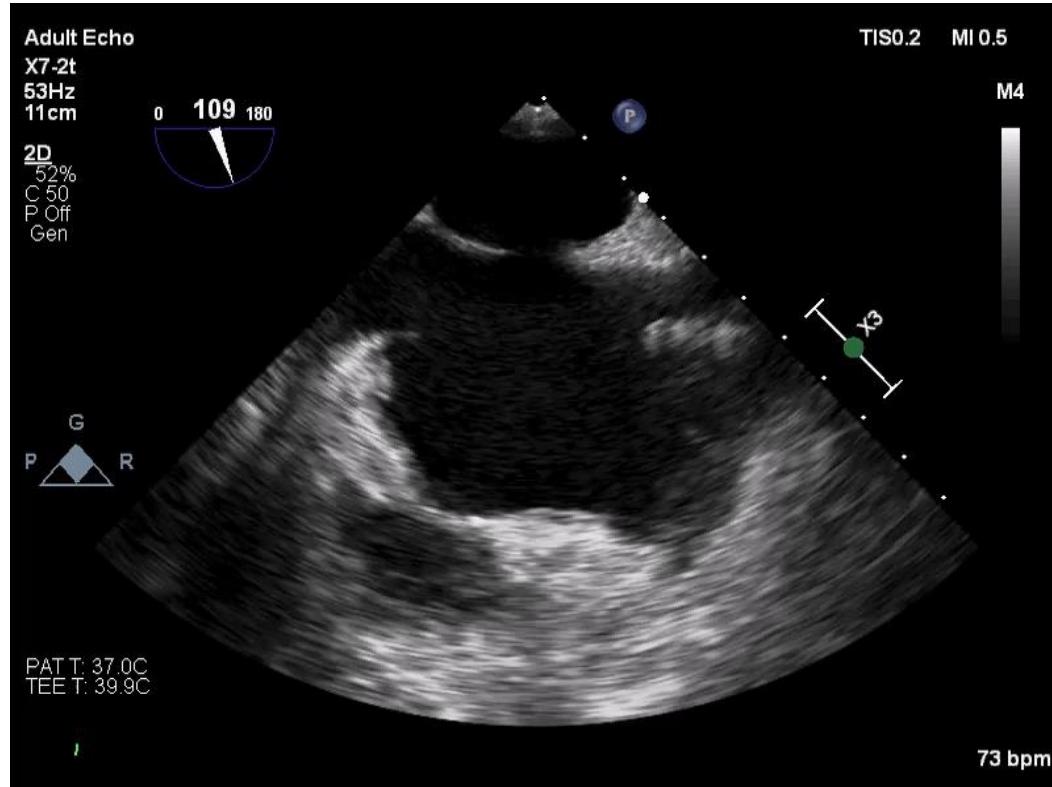
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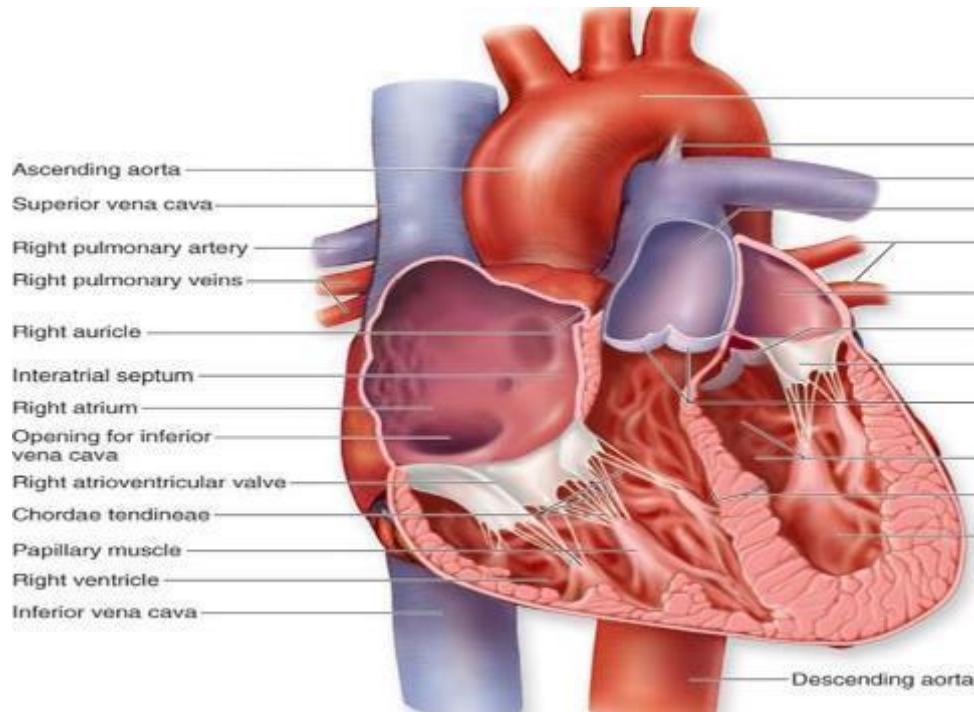
Ostium secundum ASD



Ostium secundum ASD



Imaging of the inter-atrial septum

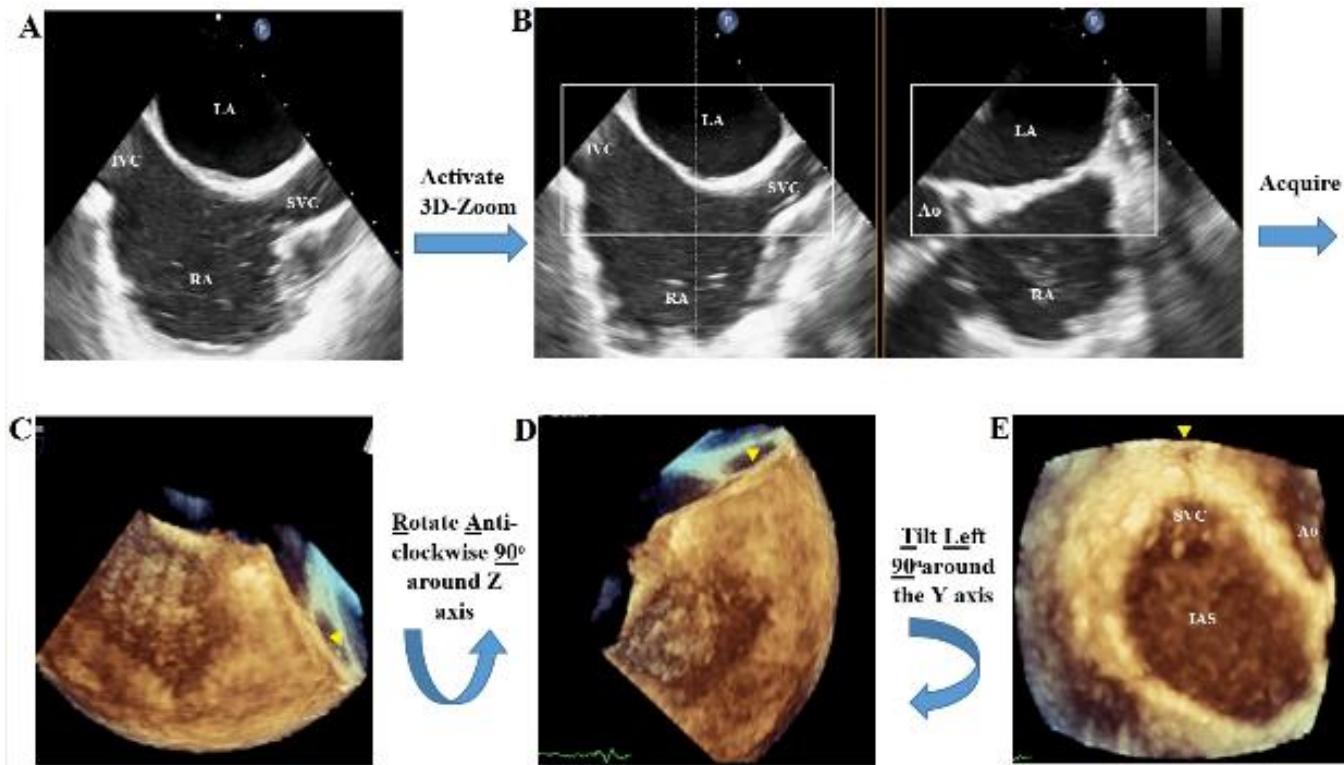


3D-TEE guided Septal Puncture

RATLe-90 maneuver

Imaging of the inter-atrial septum

RATLe-90 maneuver



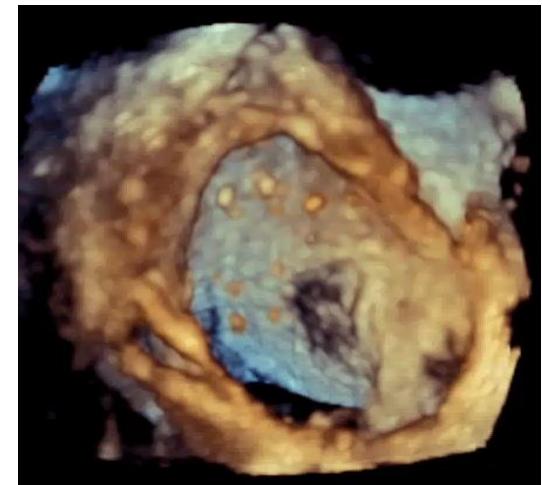
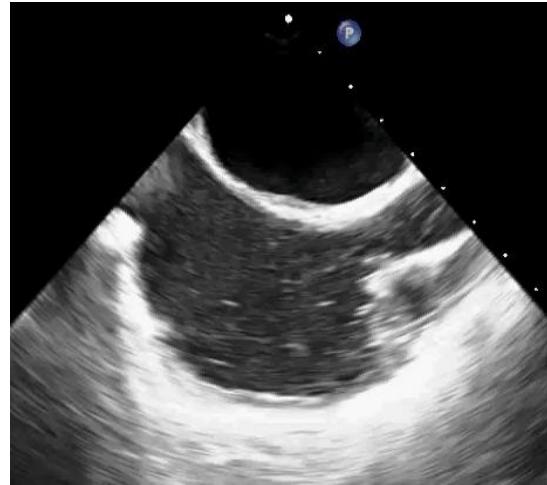
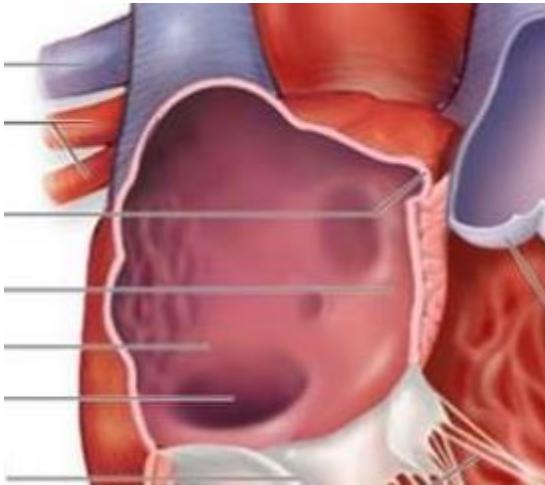
Imaging of the inter-atrial septum

RATLe-90 maneuver



Imaging of the inter-atrial septum

RATLe-90 maneuver



H. Mahmoud et al. Cardiol Res Pract, 2015. doi:10.1155/2015/174051

Dr. Hani Mahmoud

www.escardio.org/EACVI

Imaging of the inter-atrial septum

RATLe-90 maneuver

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<http://dx.doi.org/10.1155/2015/174051>

Research Article

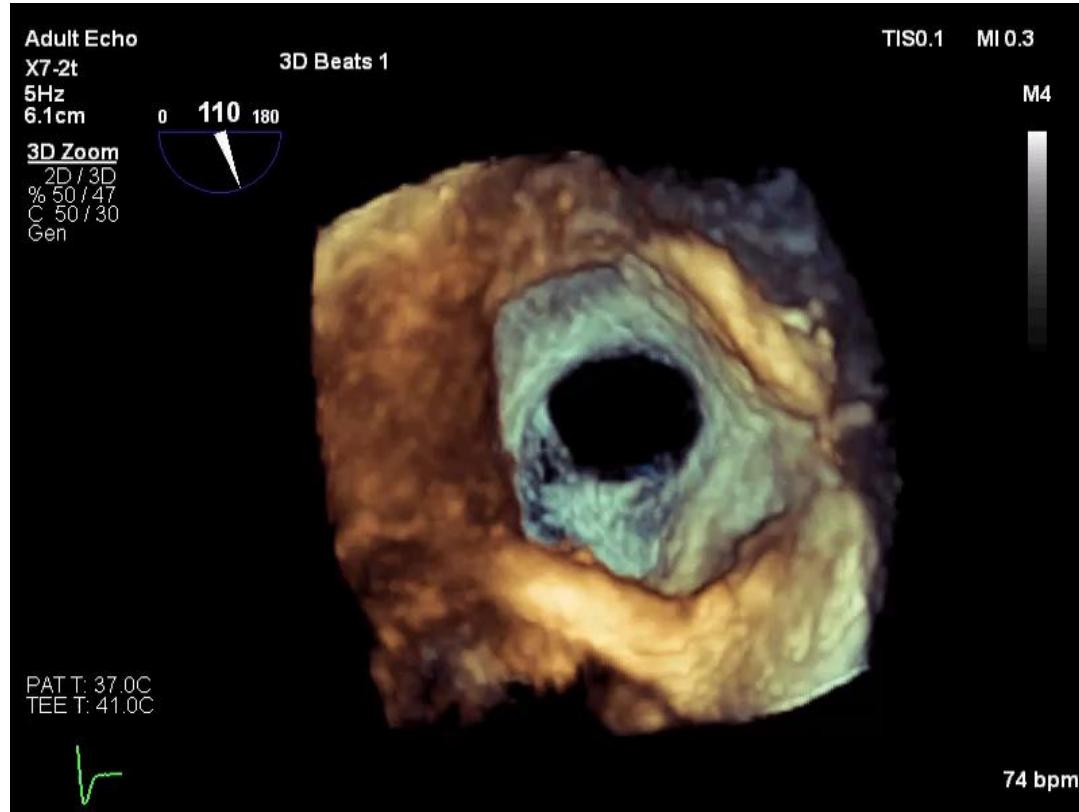
A Proposed Maneuver to Guide Transseptal Puncture Using Real-Time Three-Dimensional Transesophageal Echocardiography: Pilot Study

Hani M. Mahmoud,¹ Mohammed A. Al-Ghamdi,¹ Abdullah E. Ghabashi,¹ and Ashraf M. Anwar²

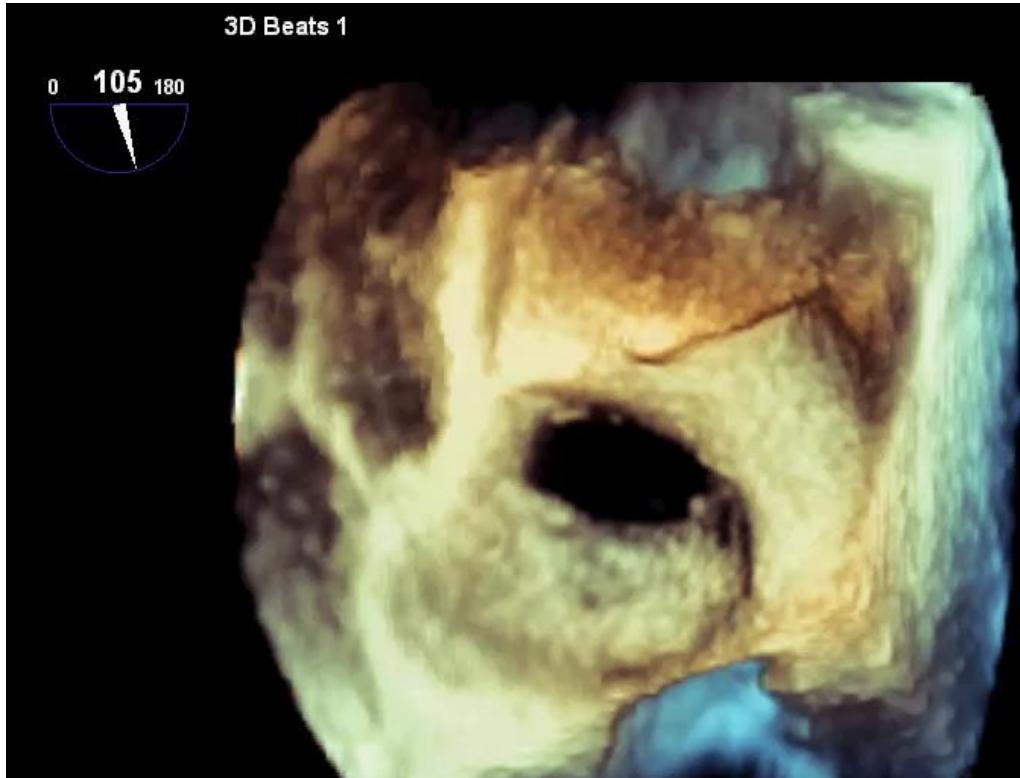
Received 20 April 2015; Revised 17 May 2015; Accepted 19 May 2015

Academic Editor: Terrence D. Ruddy

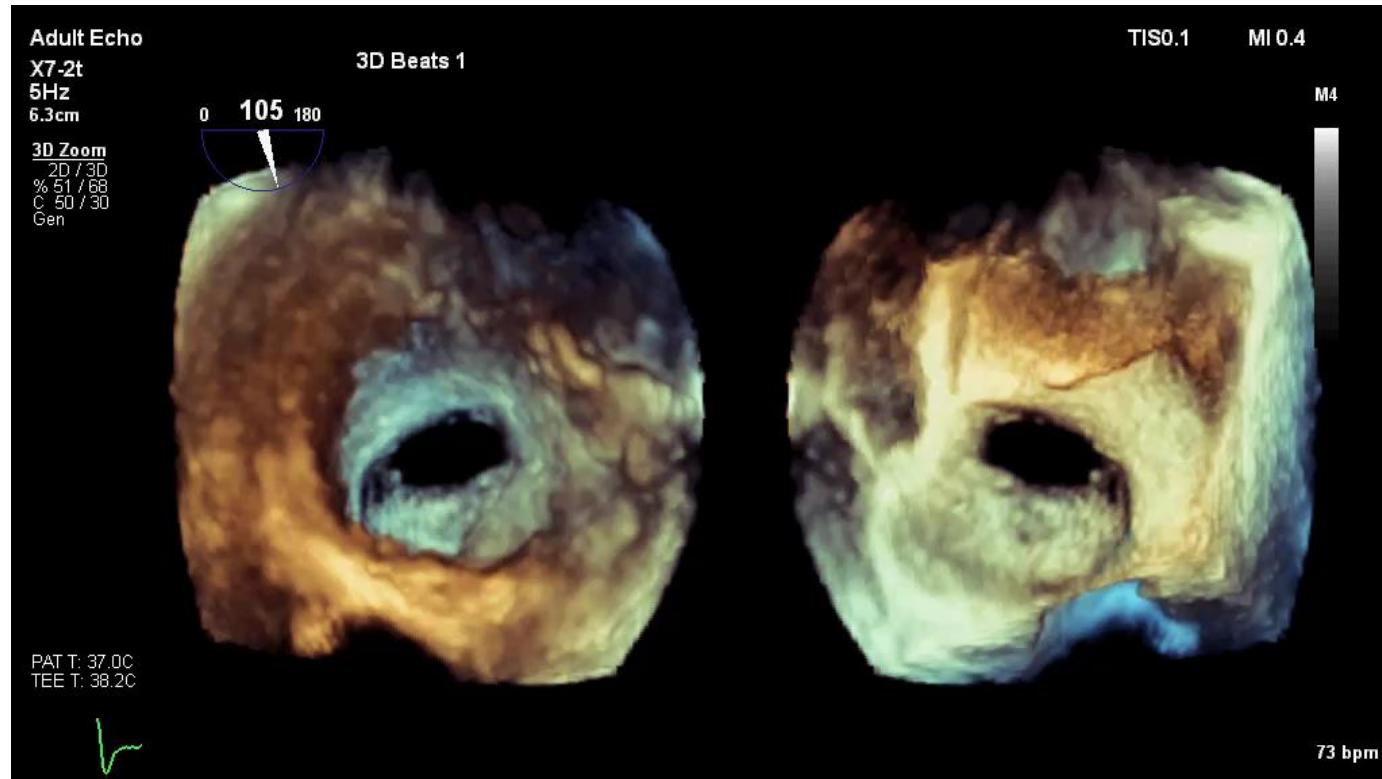
Ostium secundum ASD



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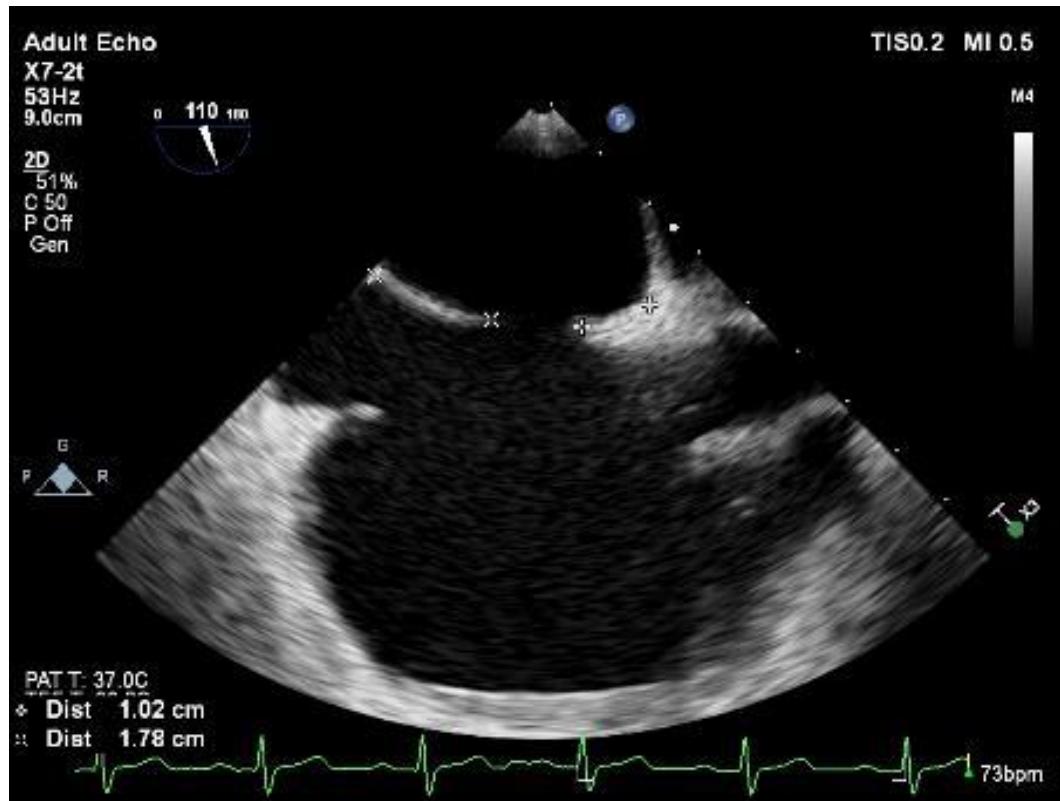


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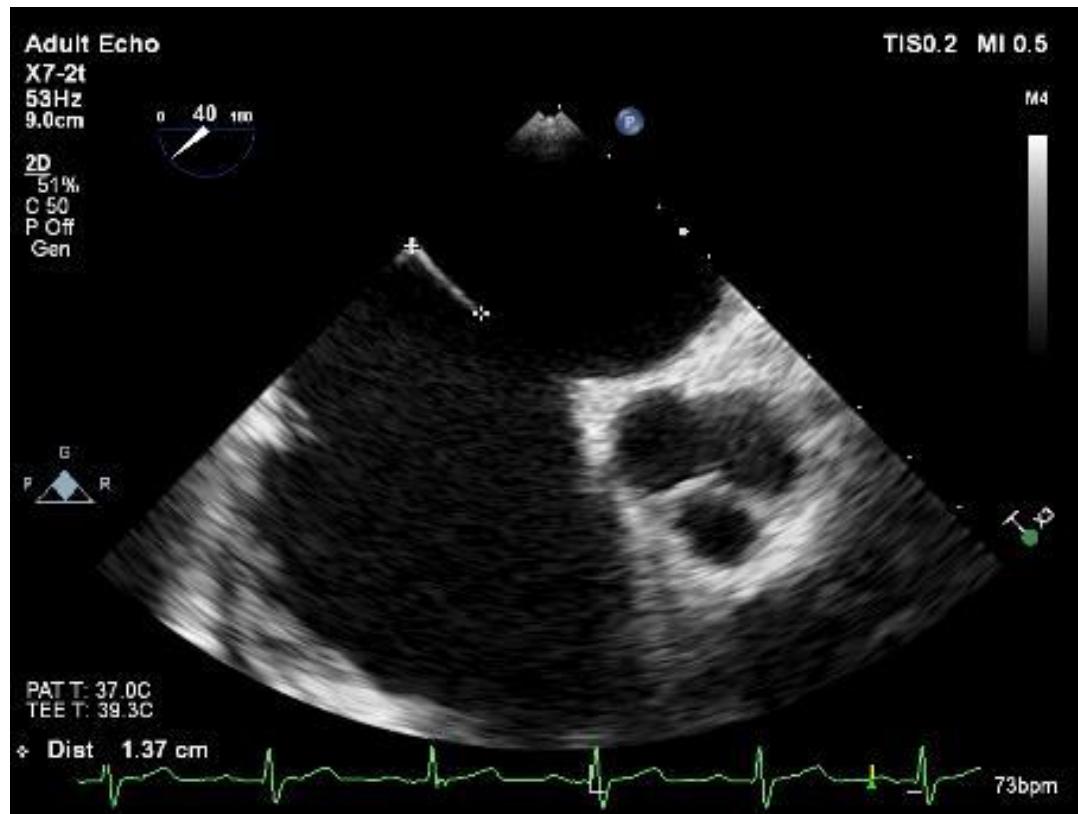


ASD Sizing

ASD Sizing



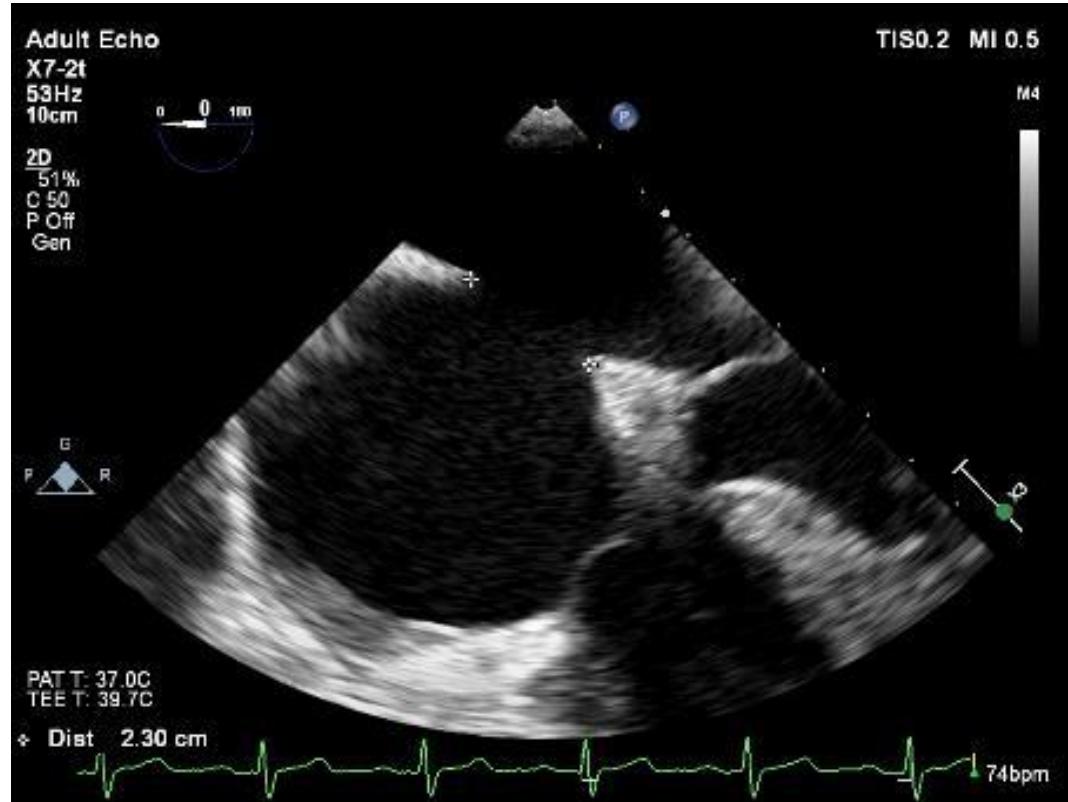
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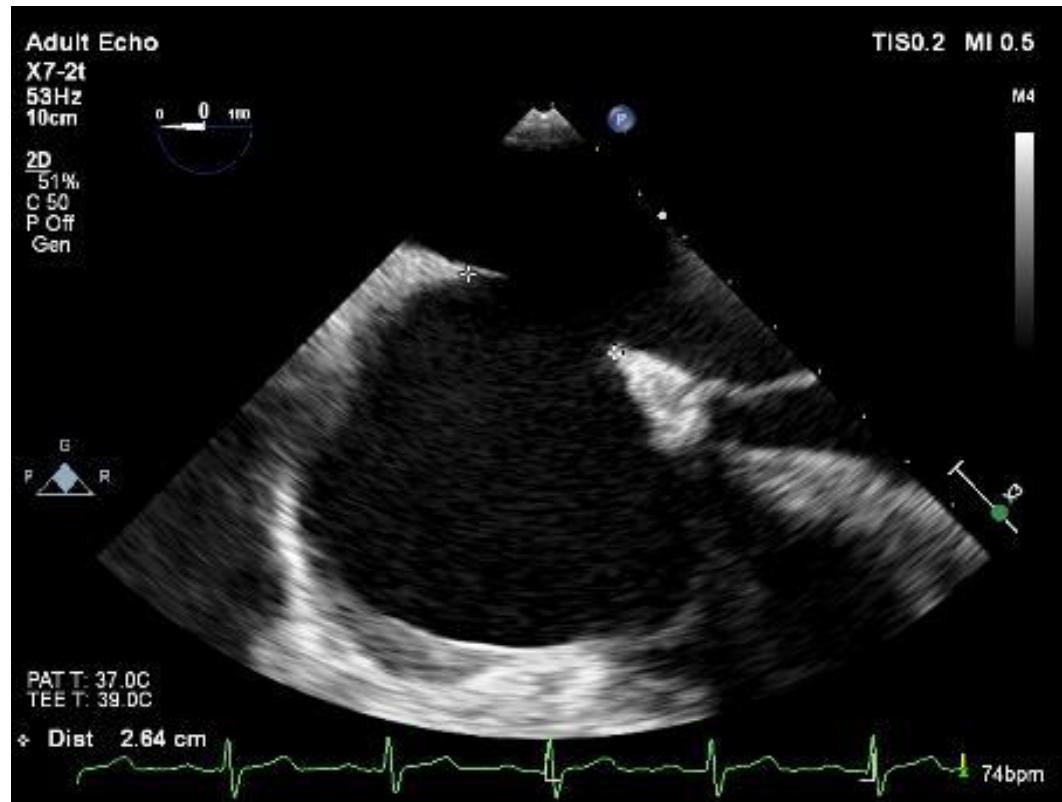
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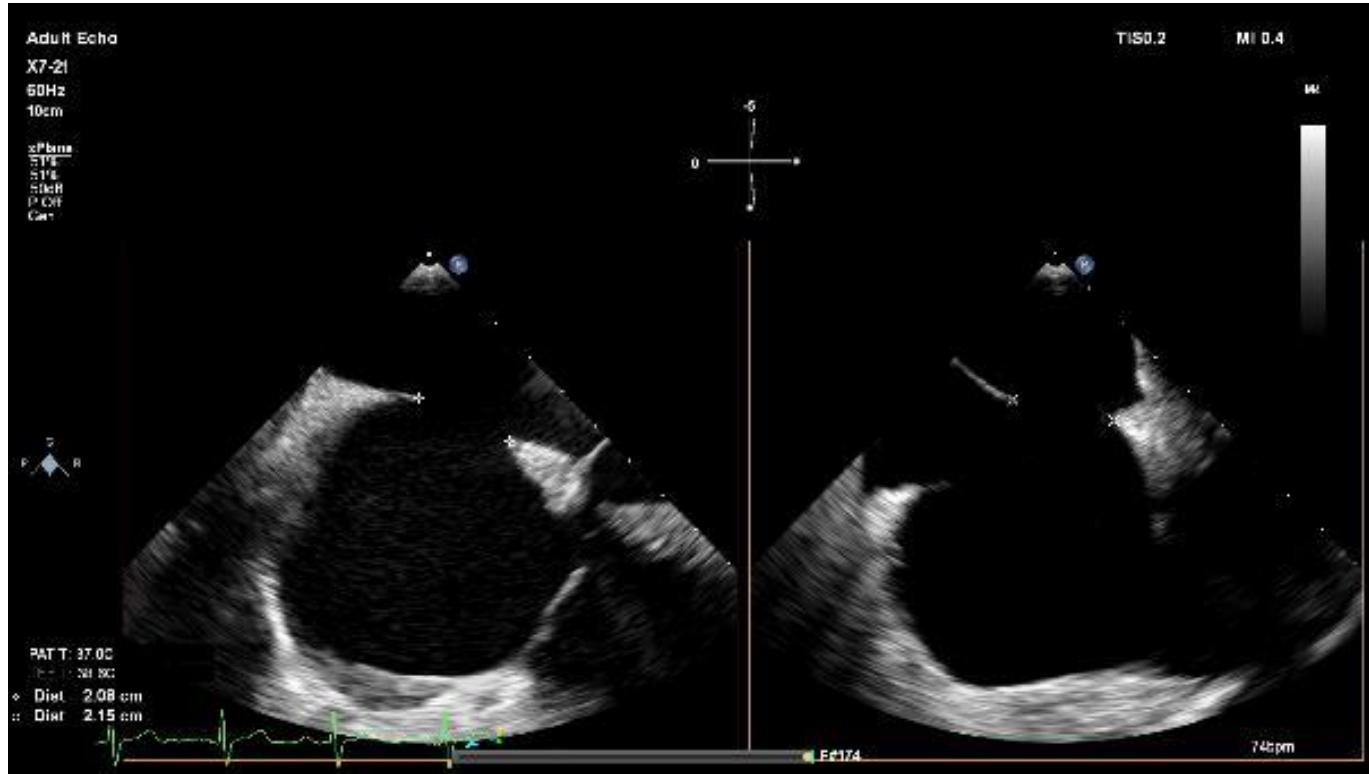
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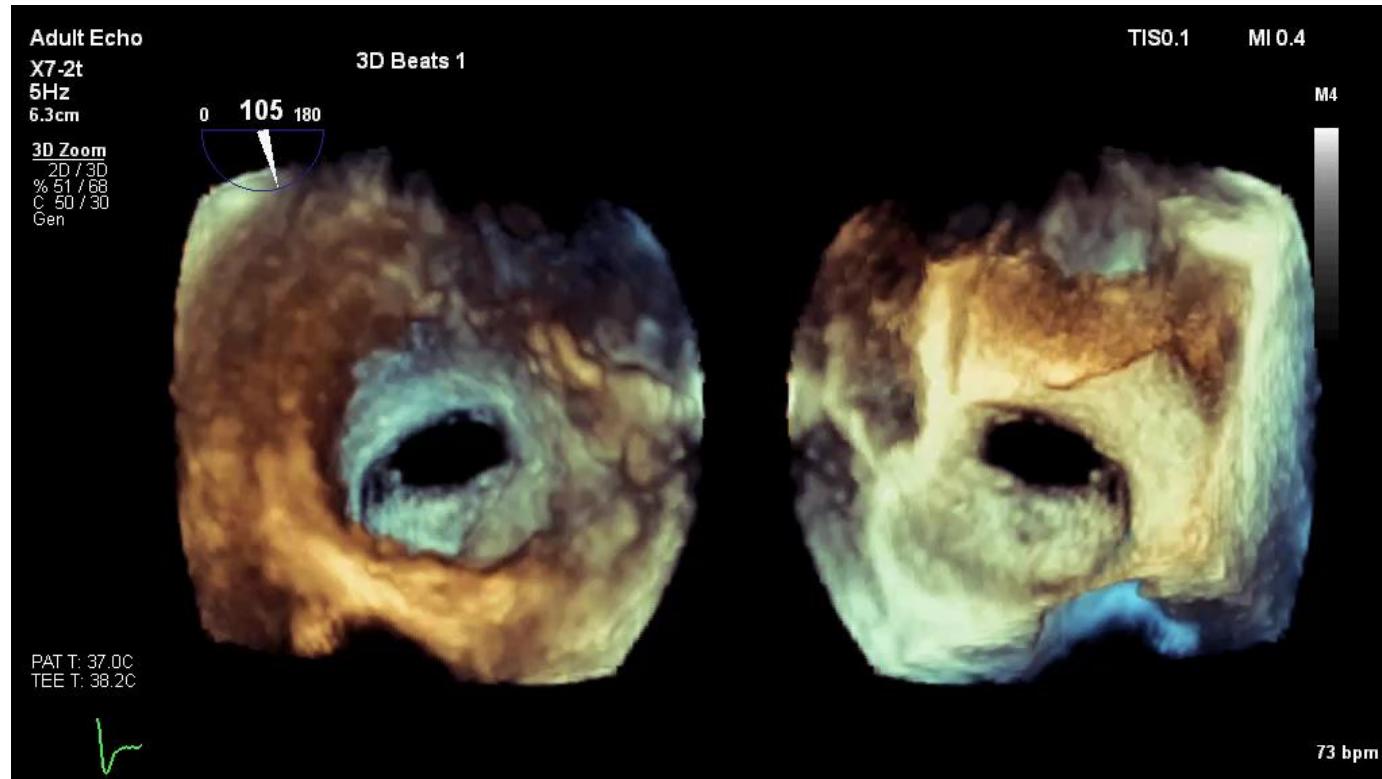
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ASD closure



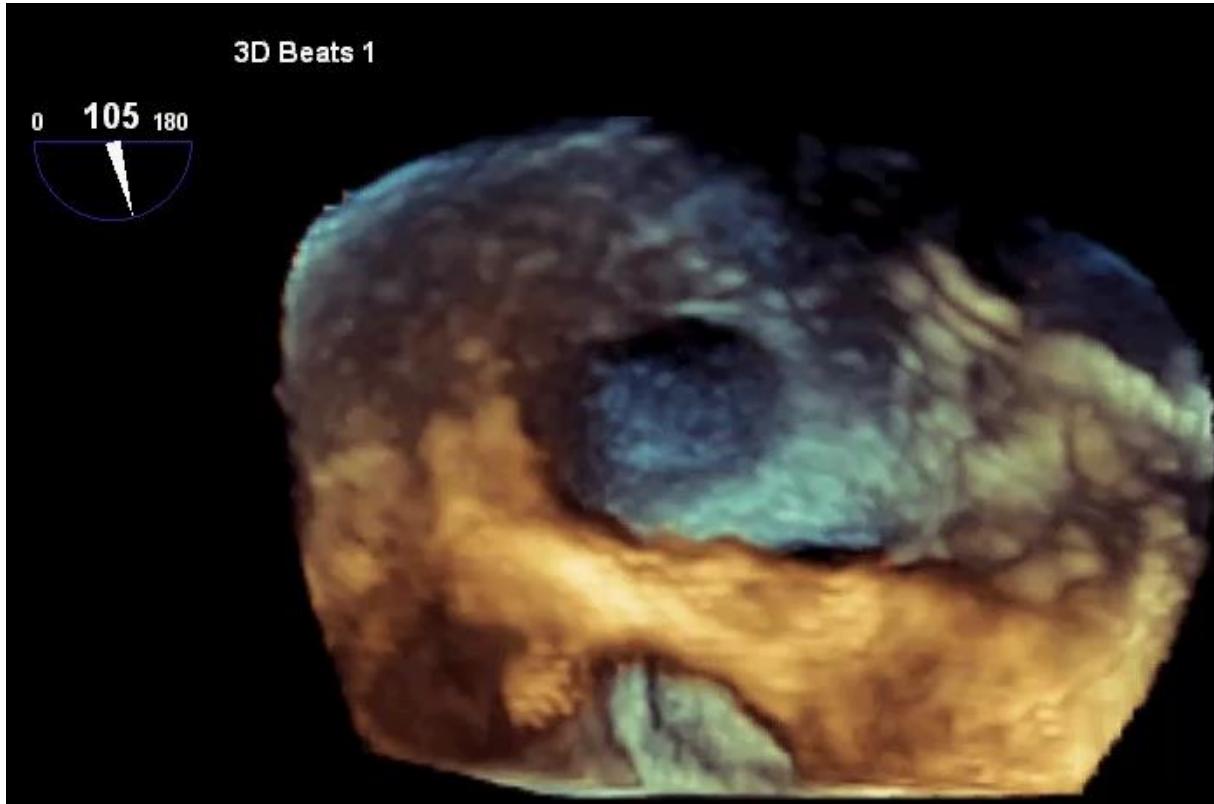
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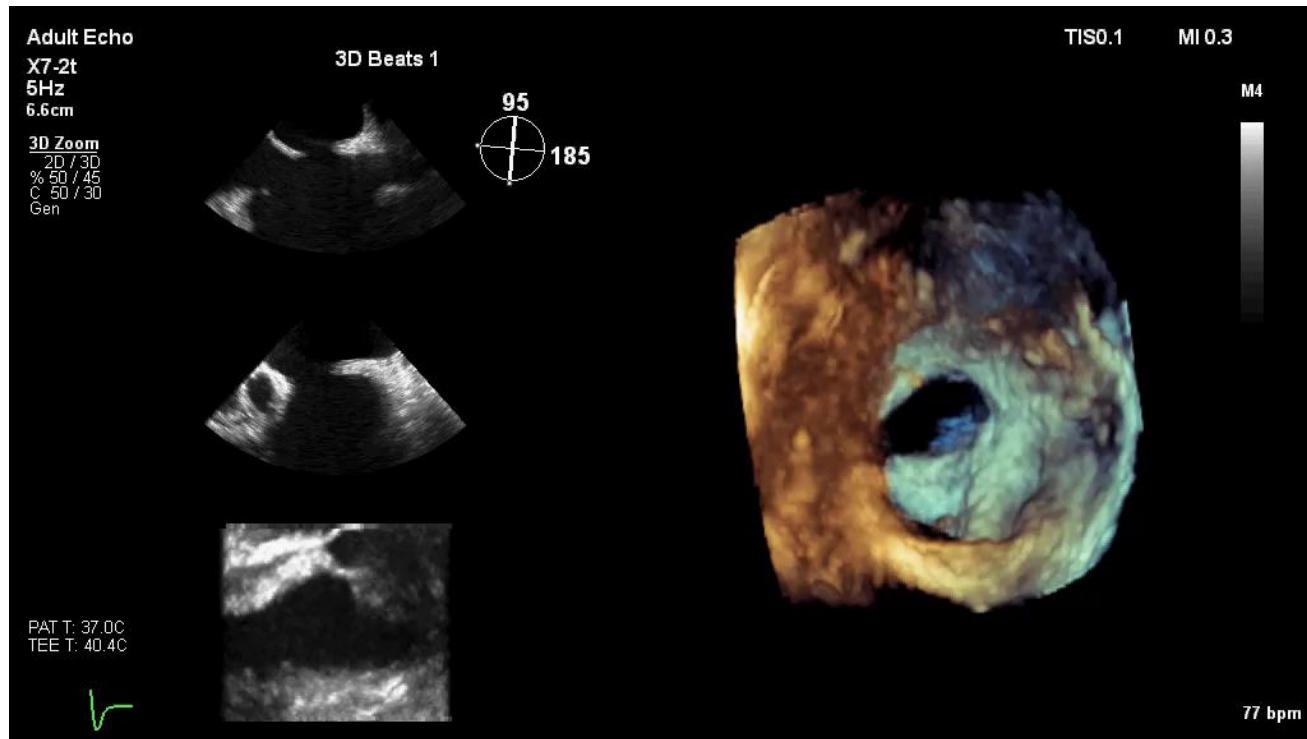
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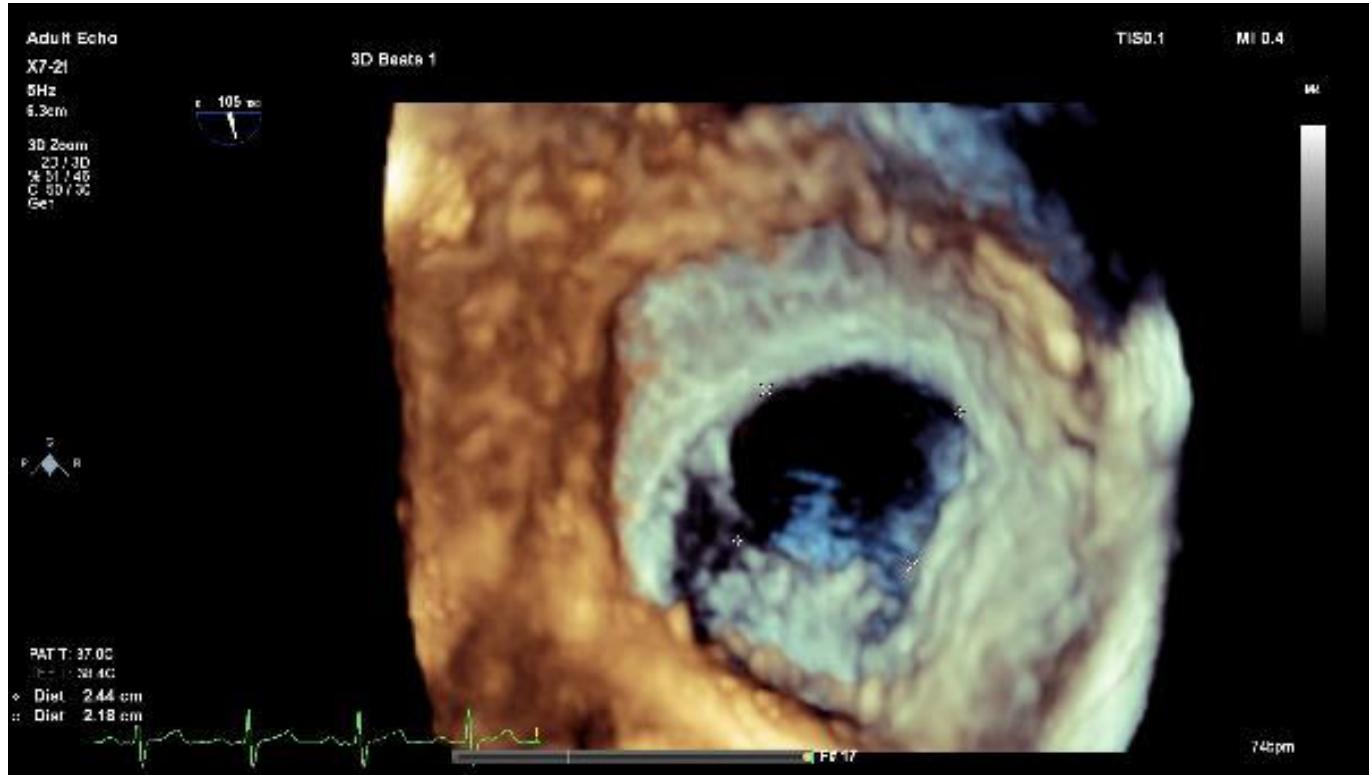
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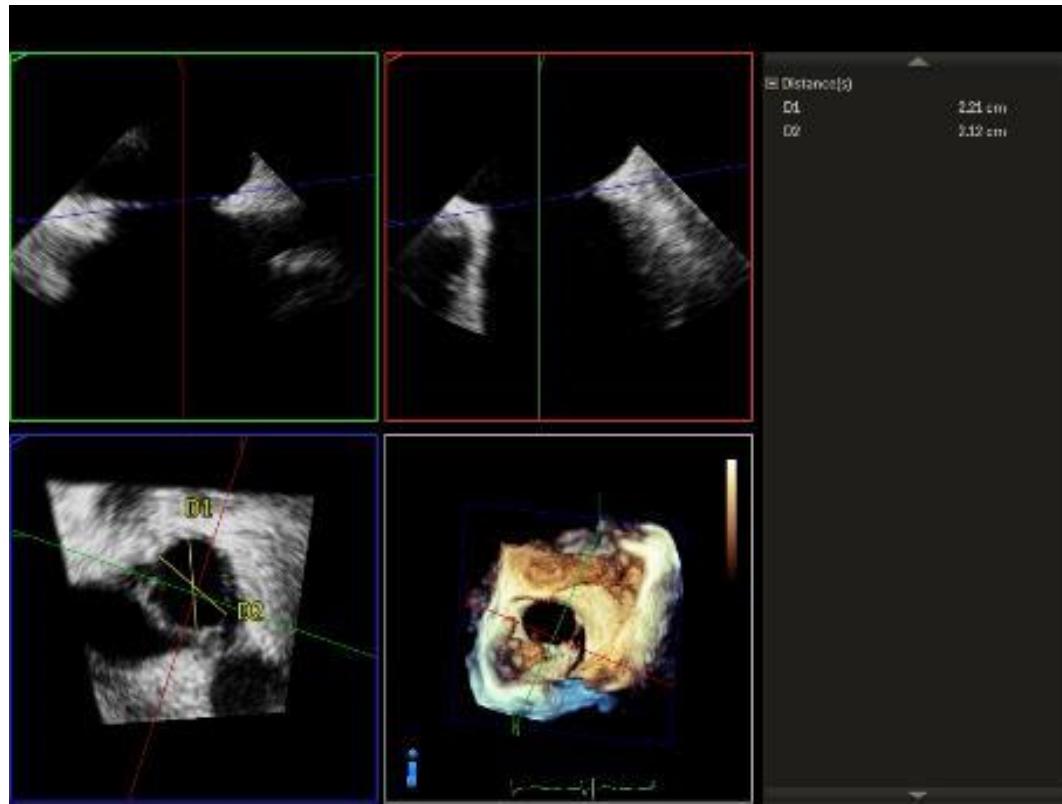
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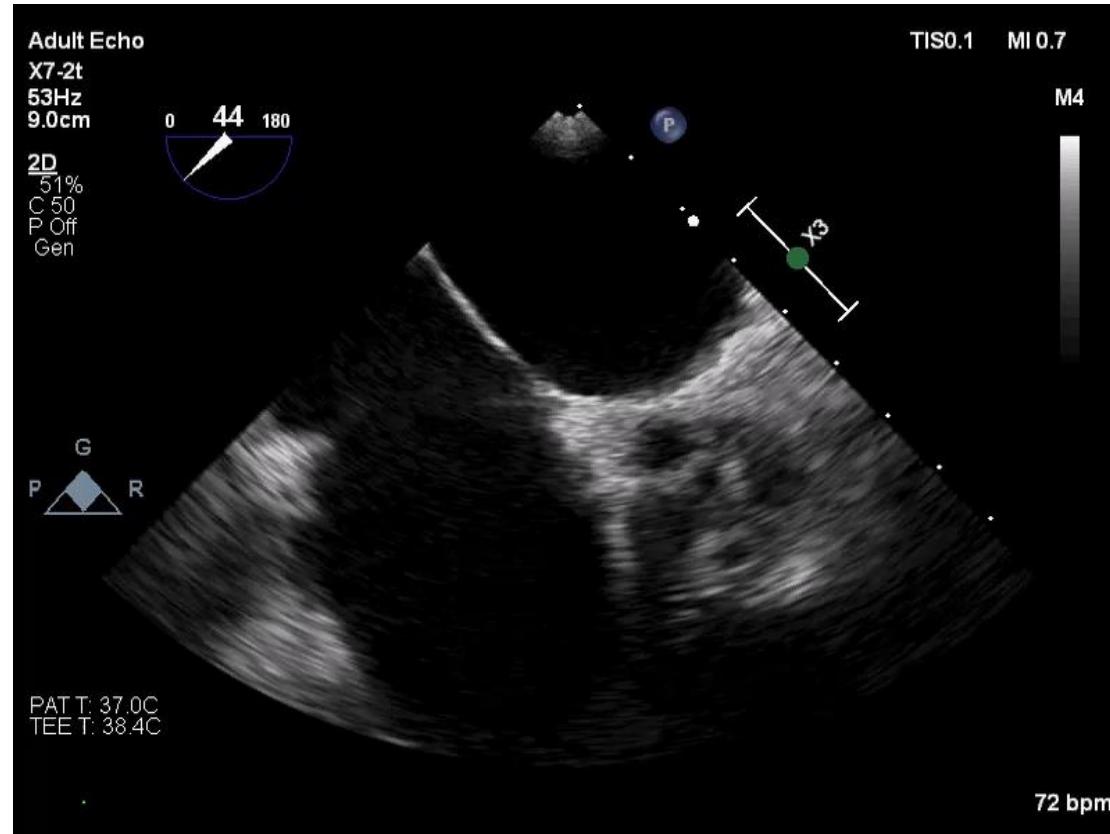


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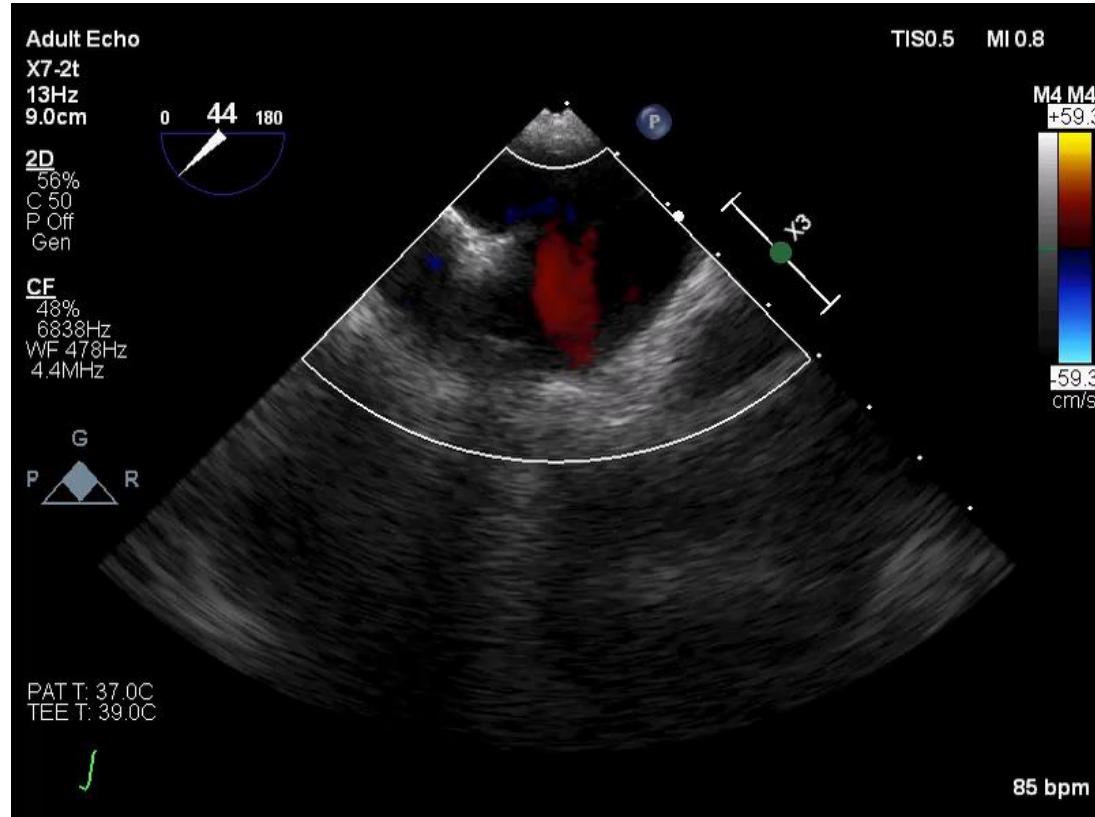
Pulmonary veins

Rt Pulm Veins



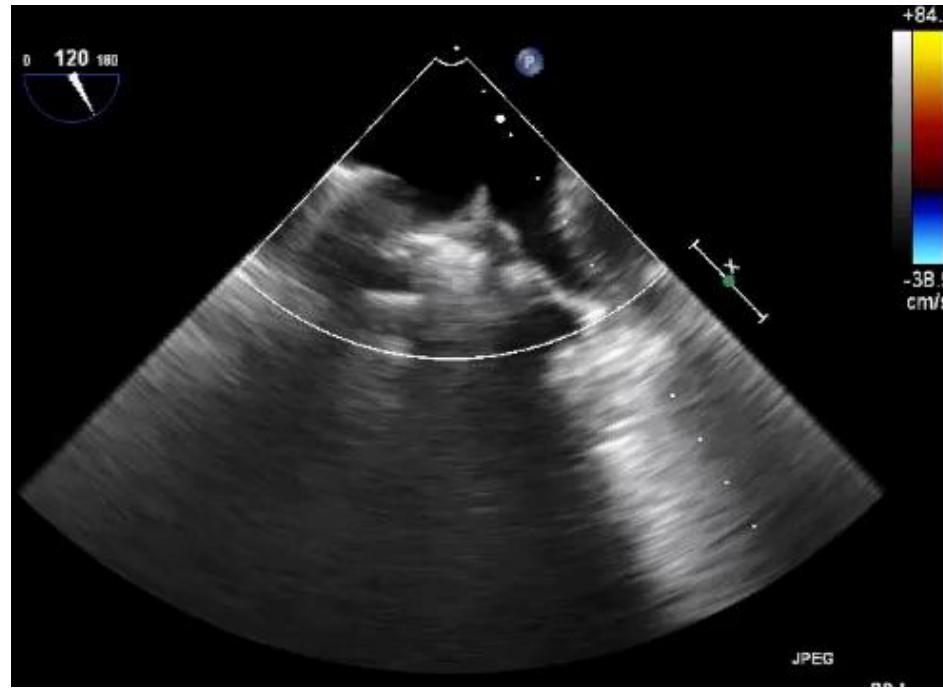
Pulmonary veins

Rt Pulm. Veins



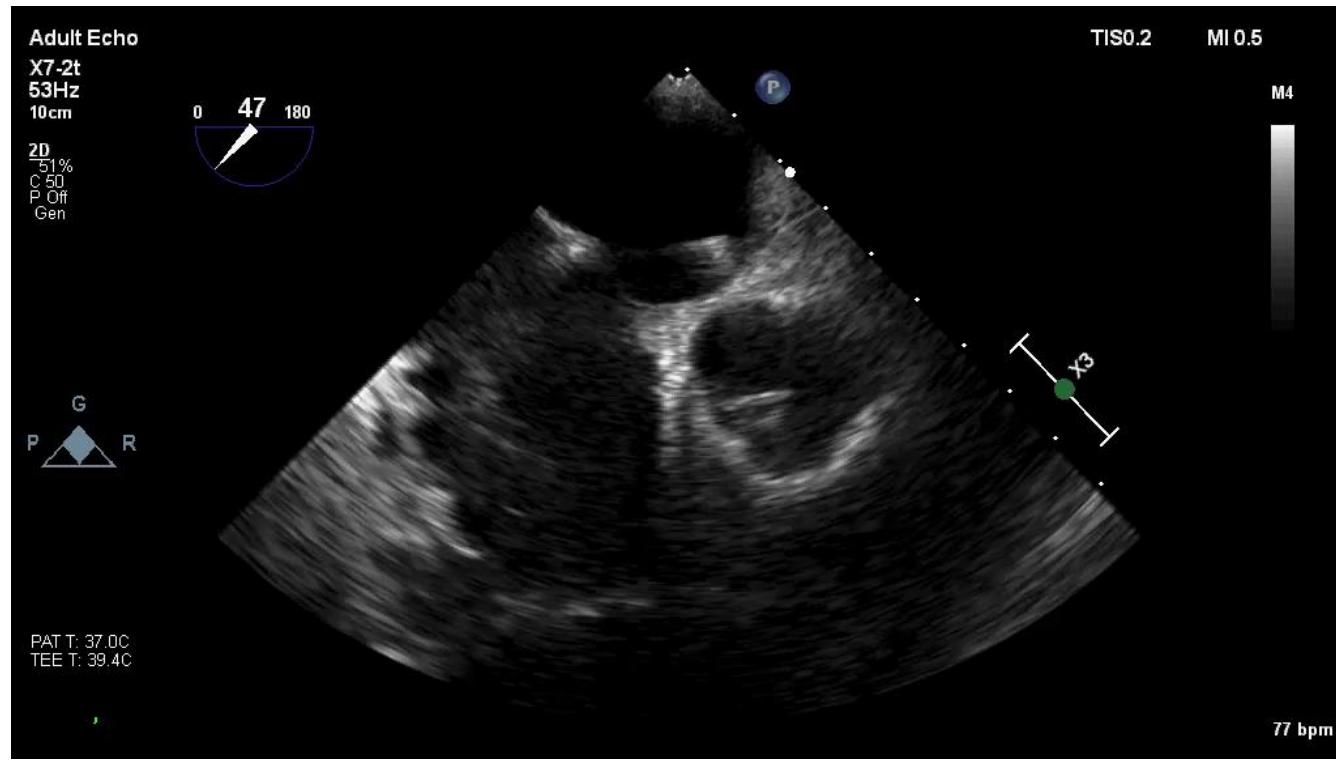
Pulmonary veins

Lt Pulm. Veins

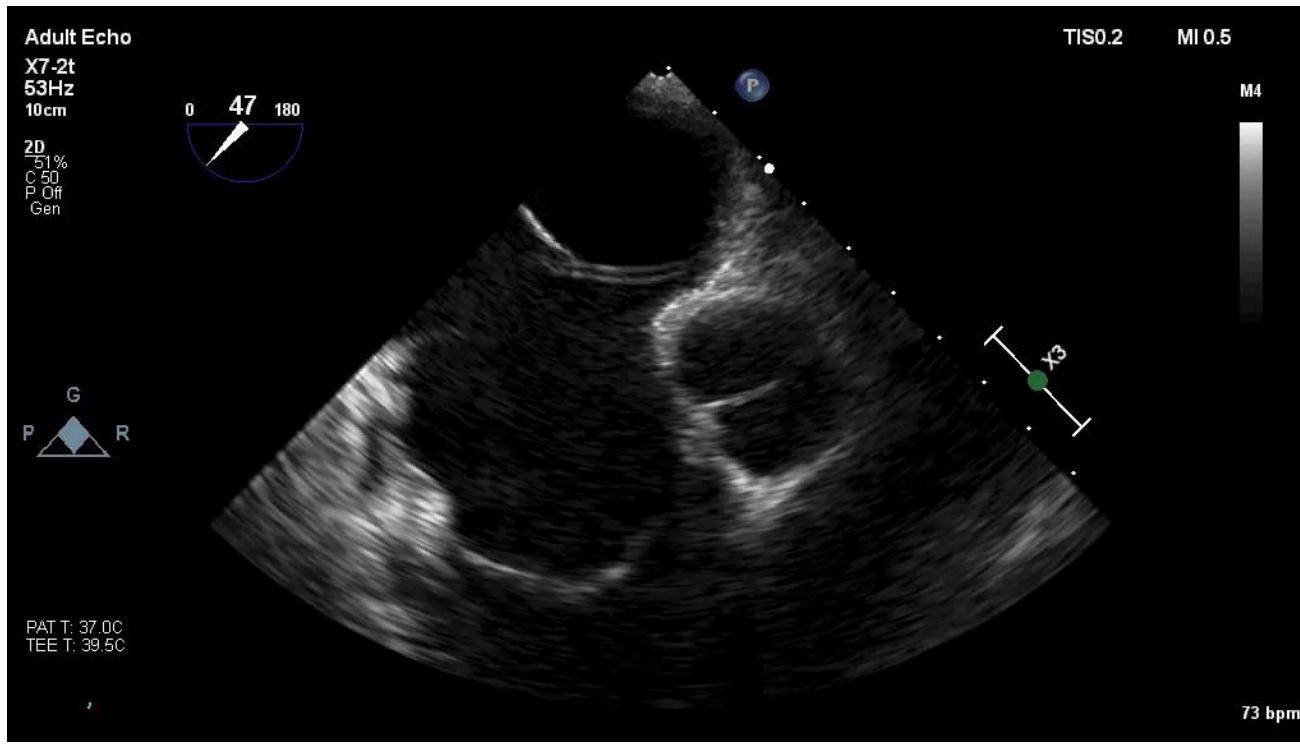


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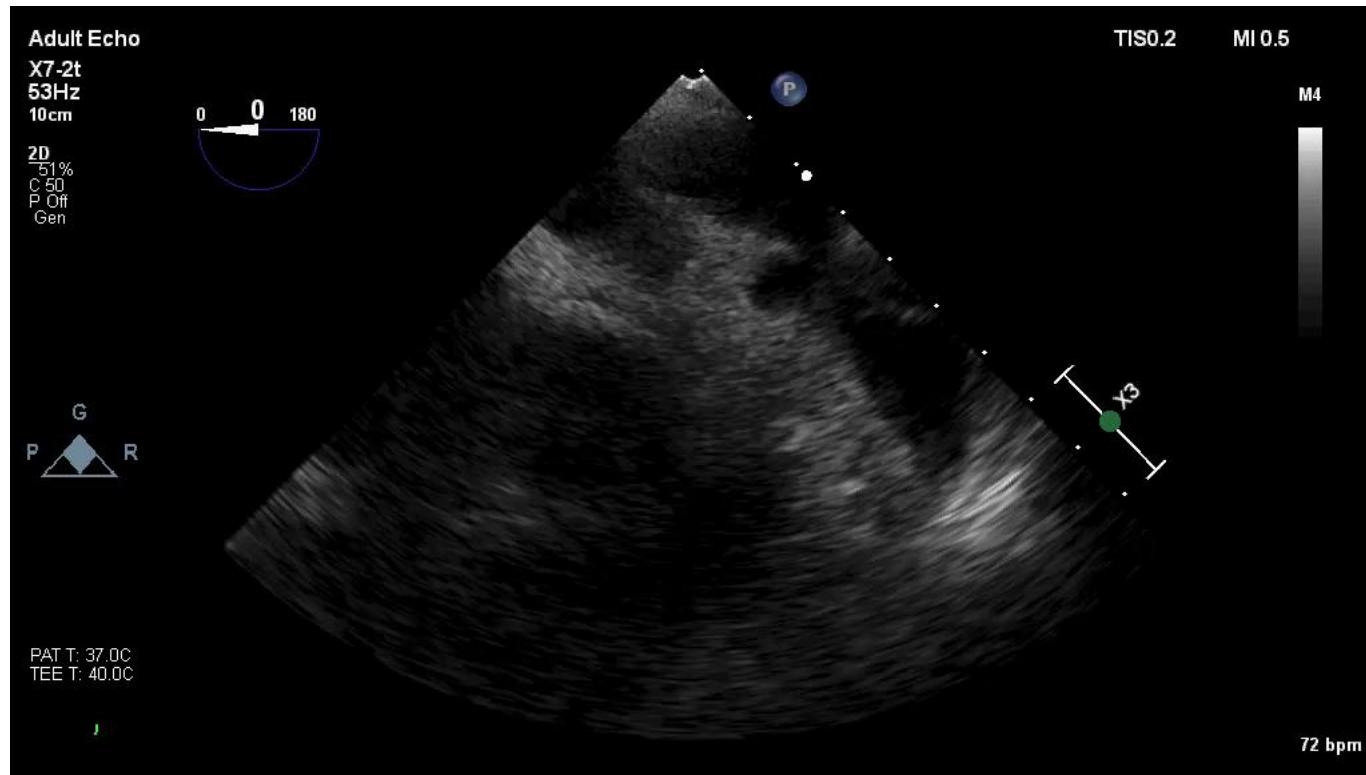
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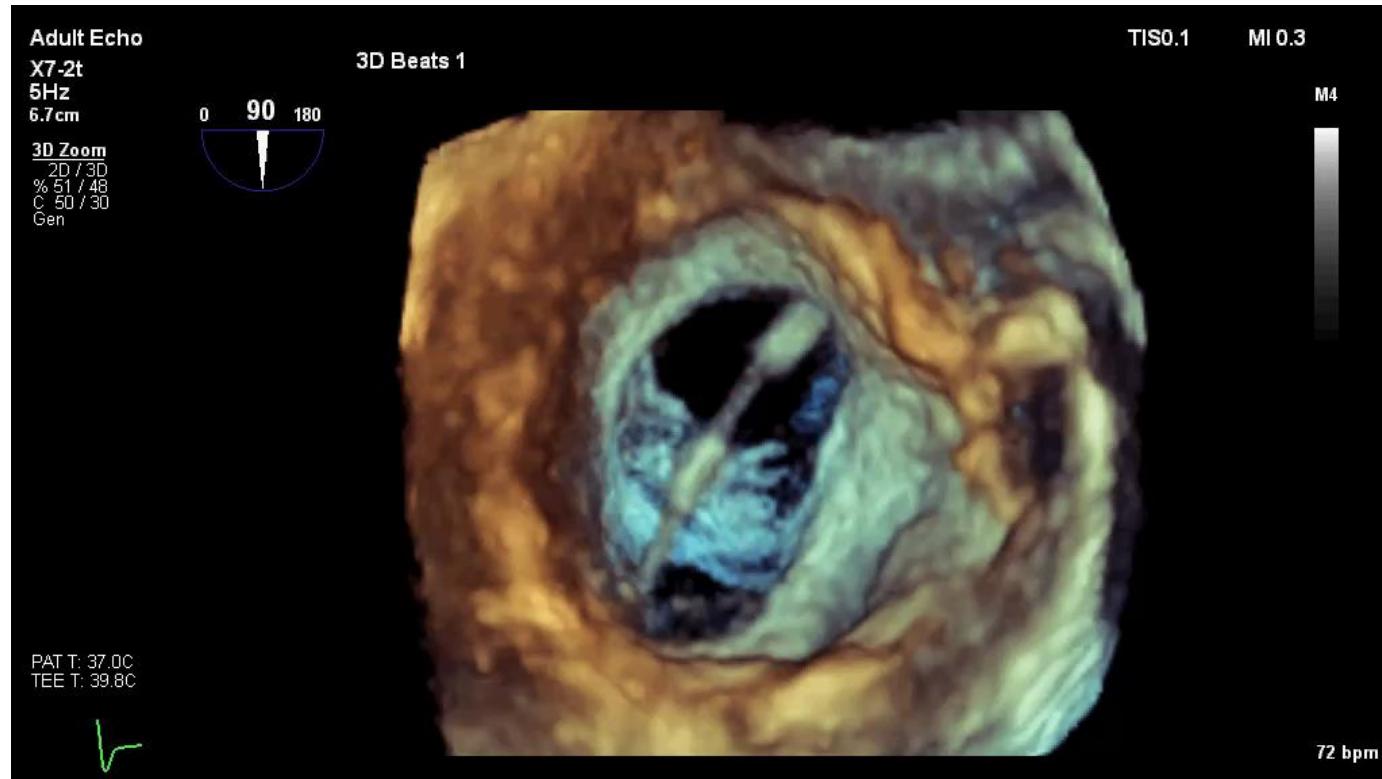
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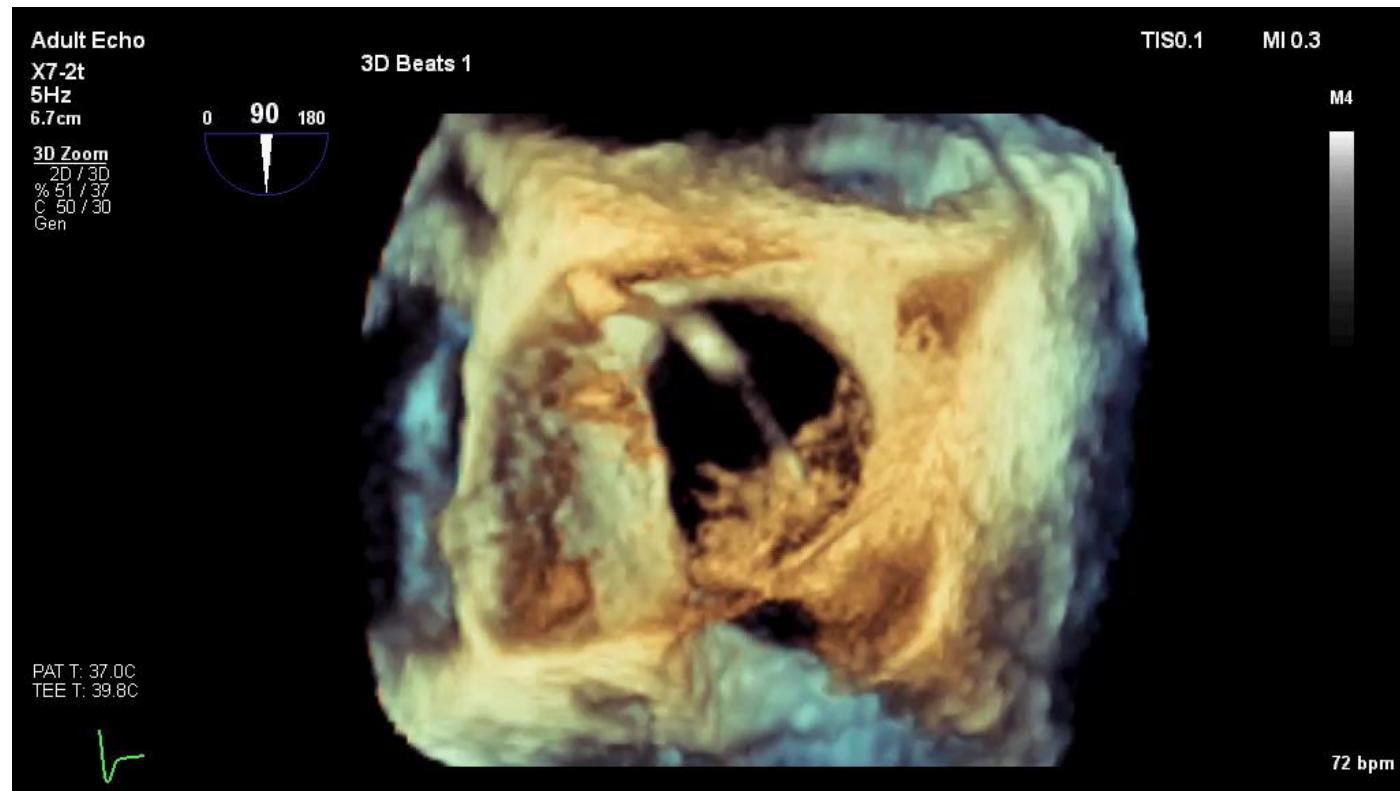
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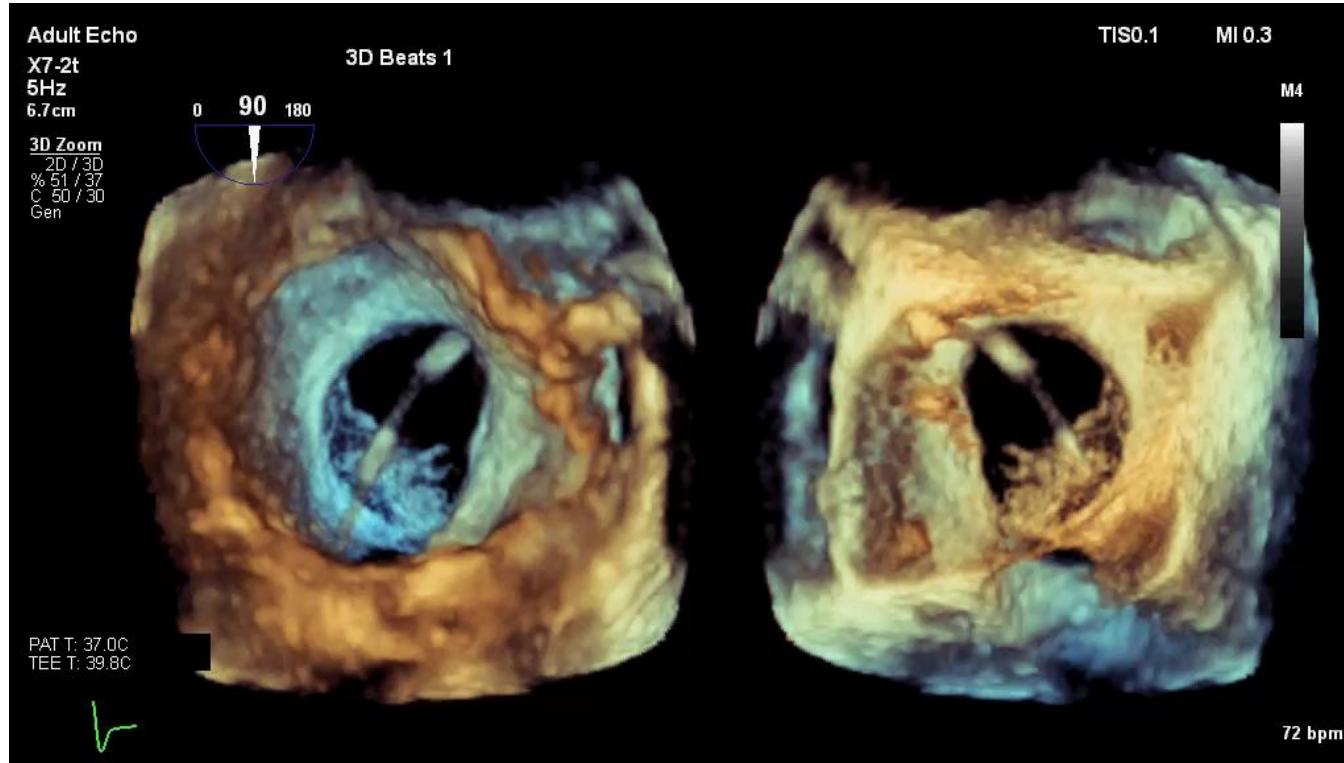
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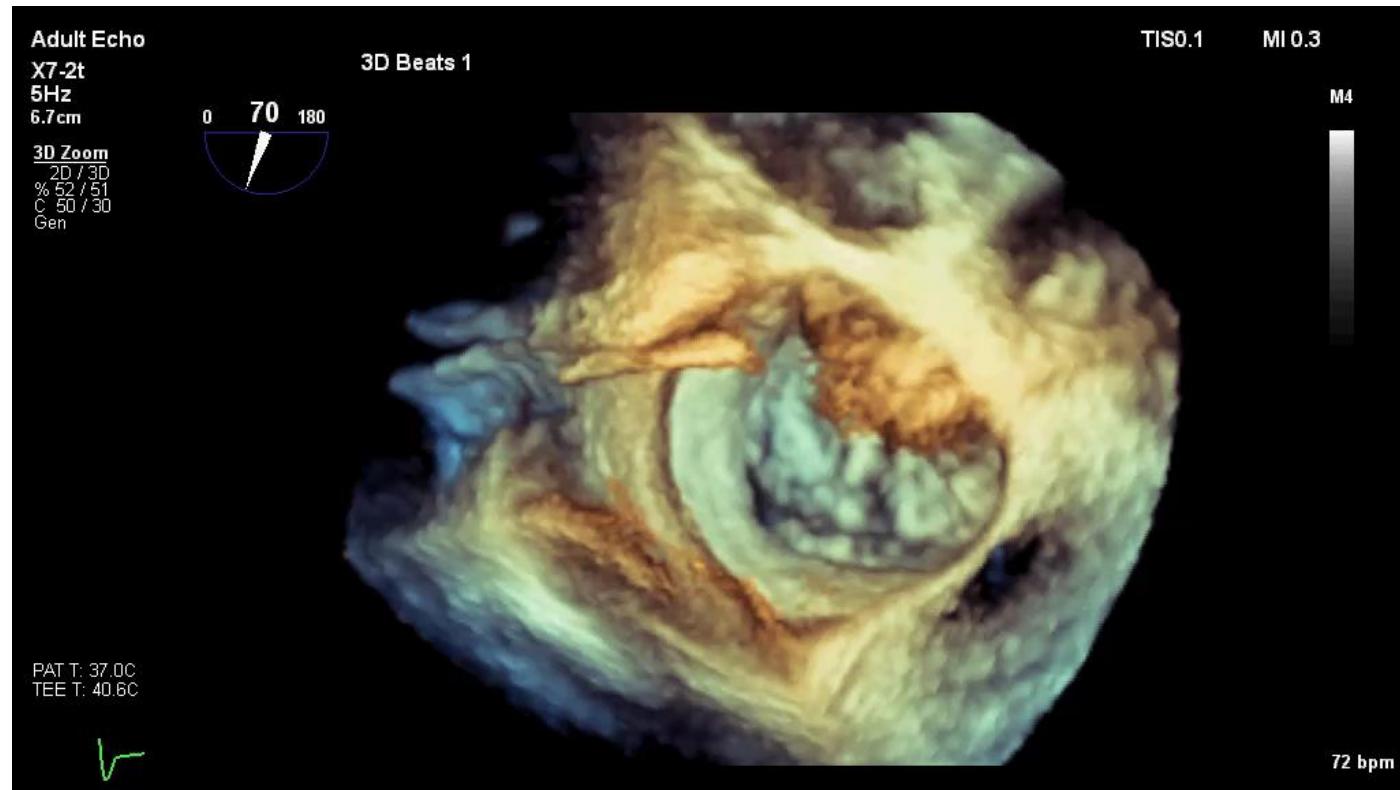
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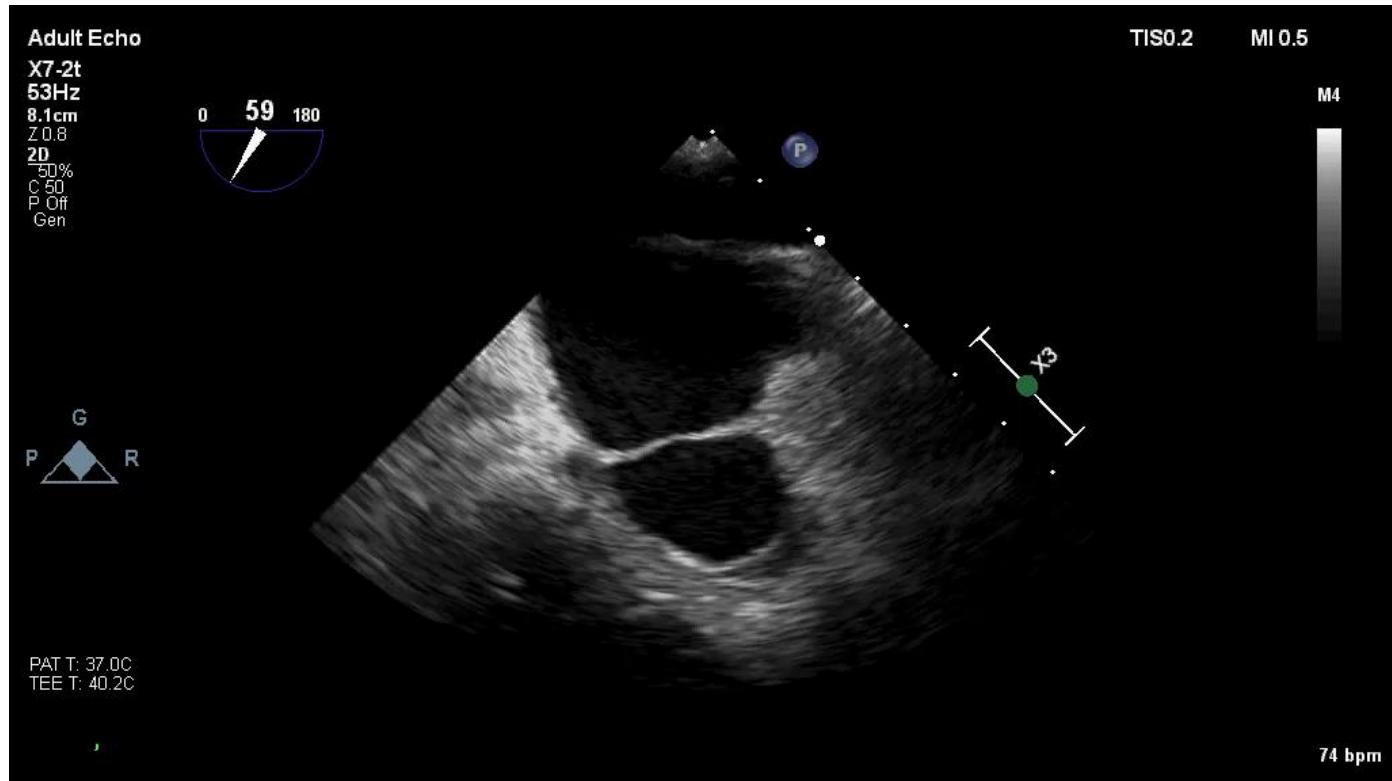
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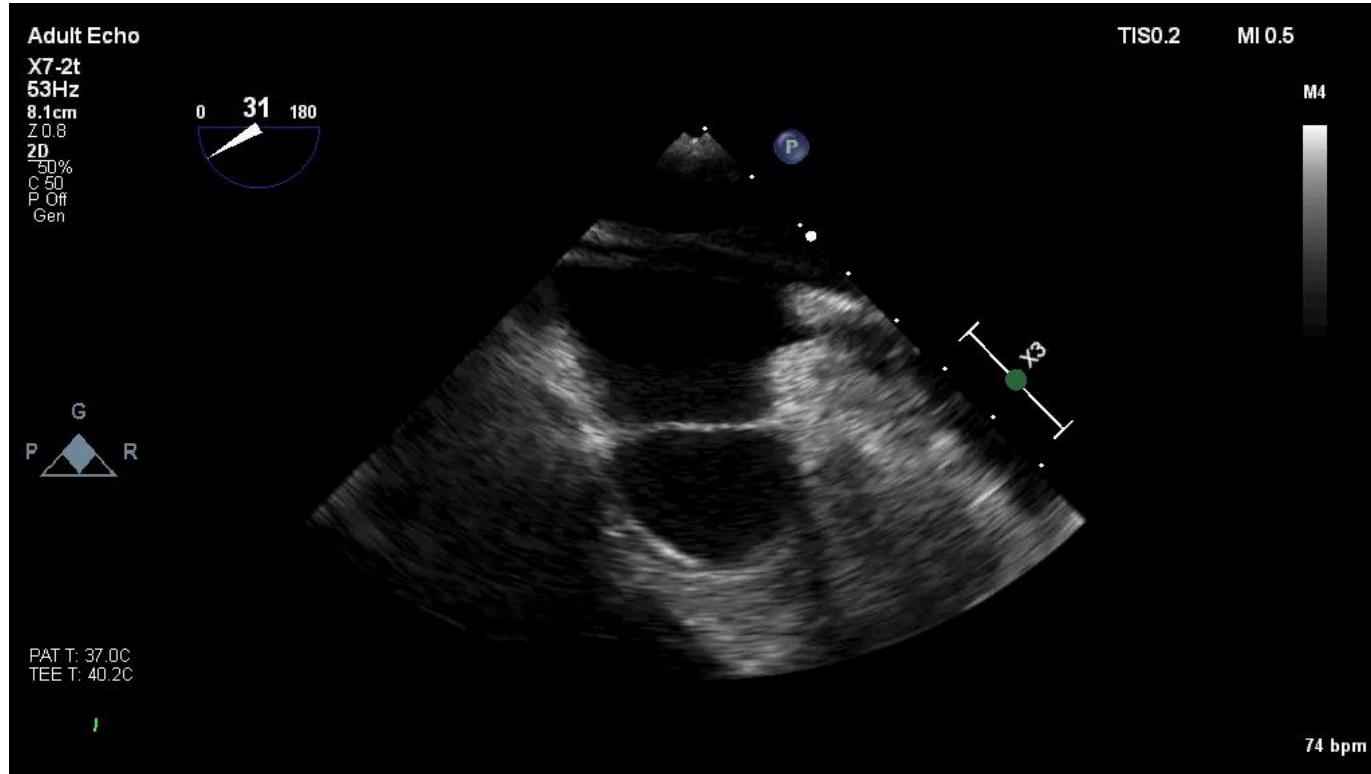
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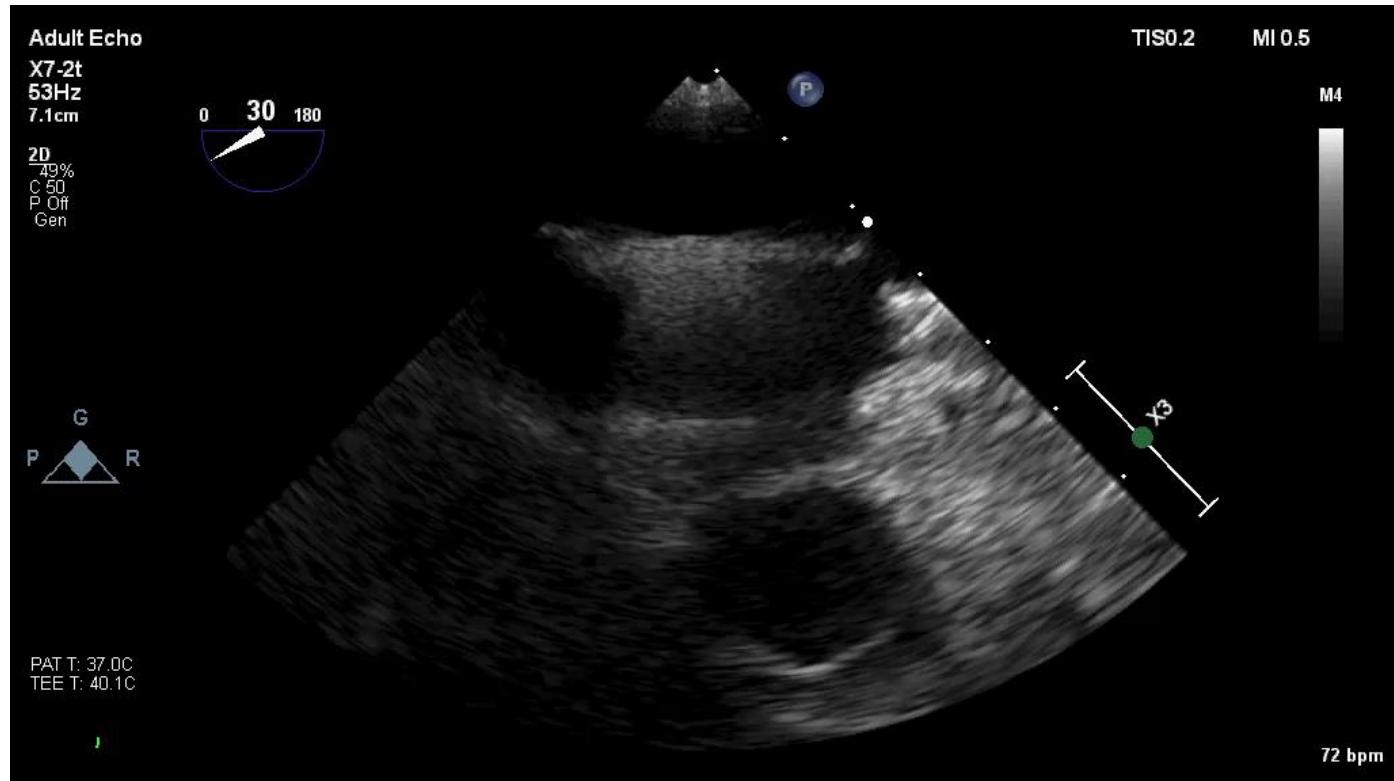
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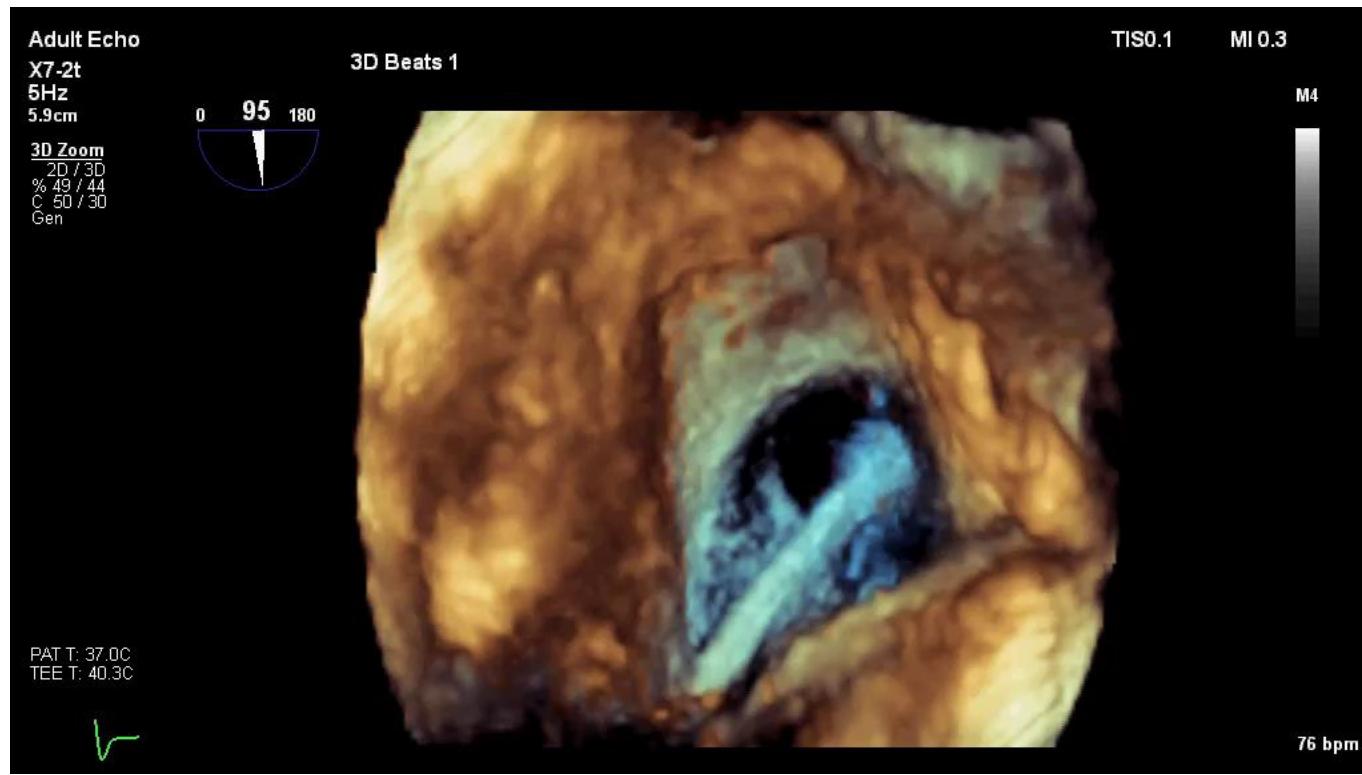
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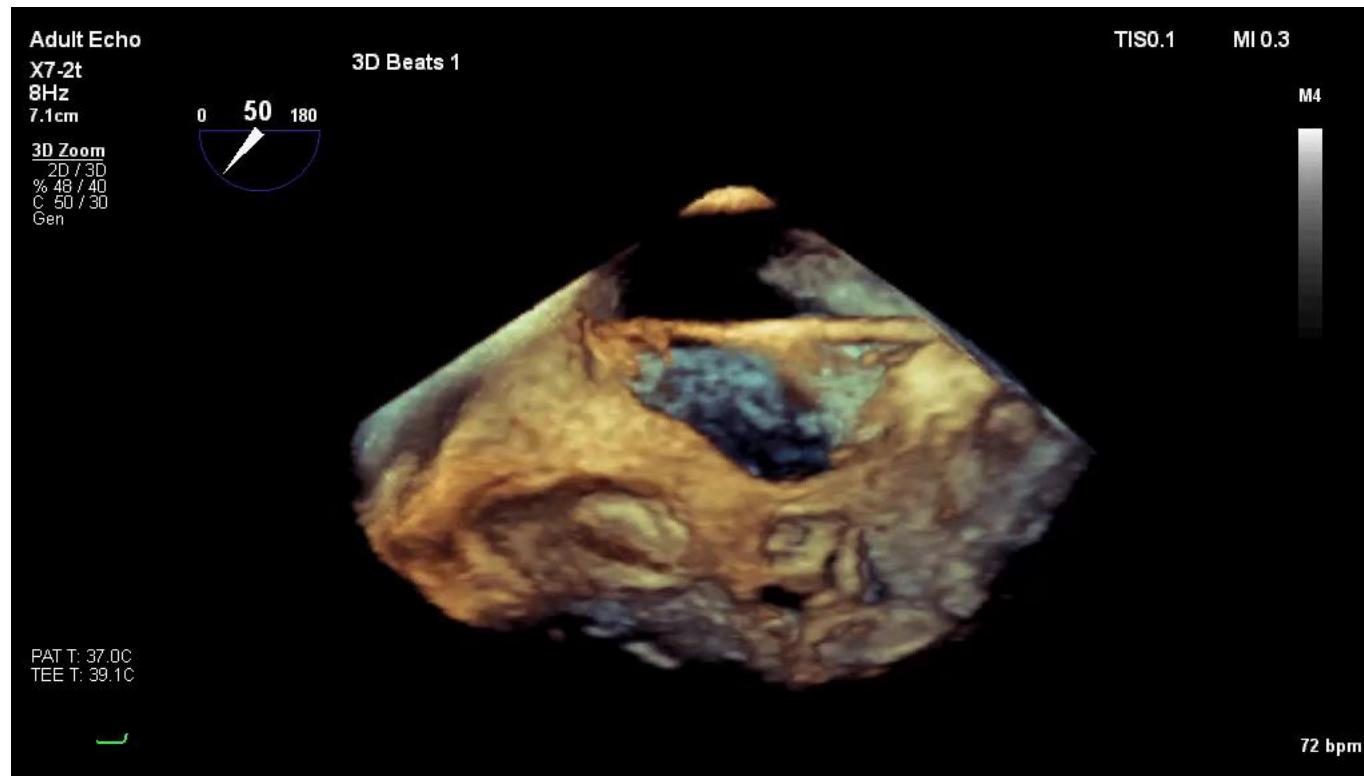
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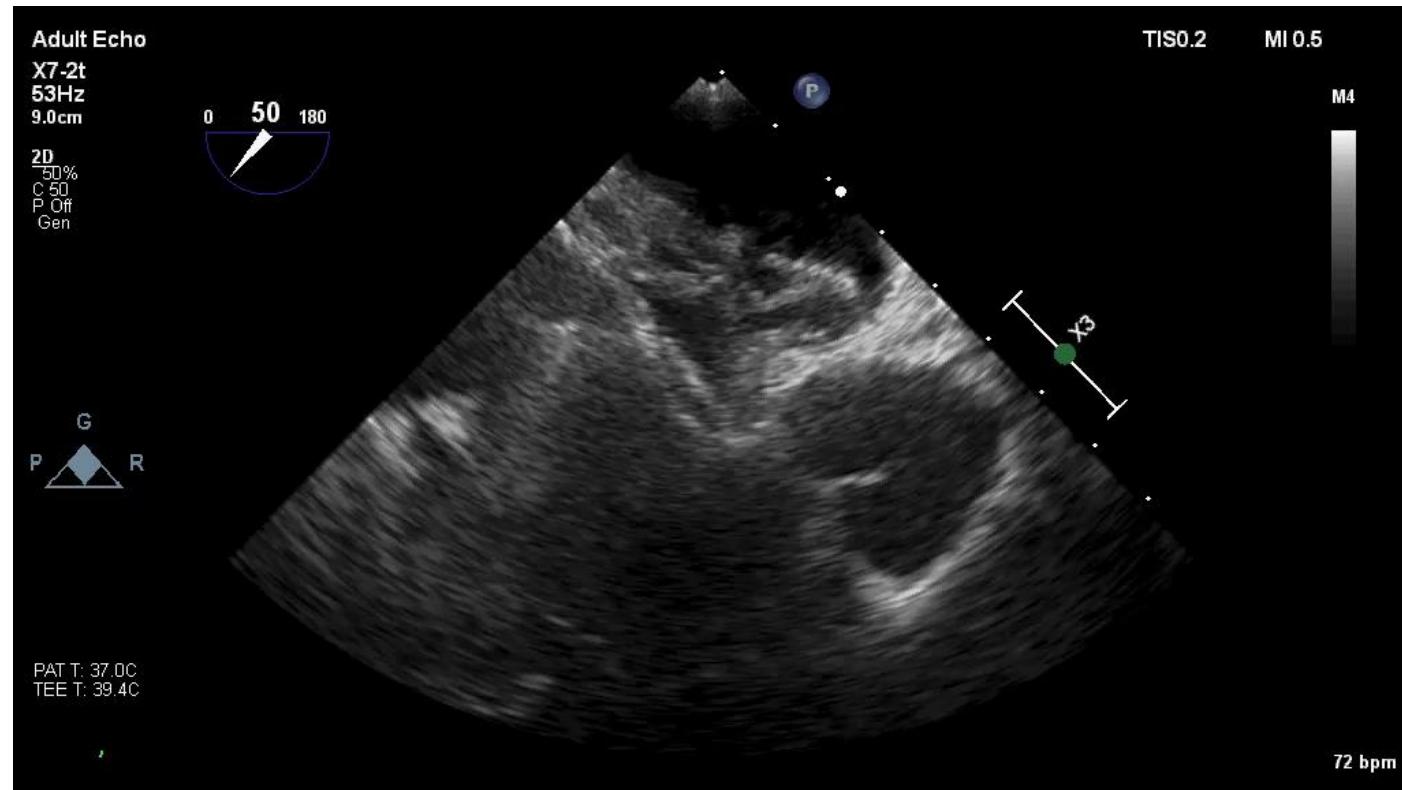
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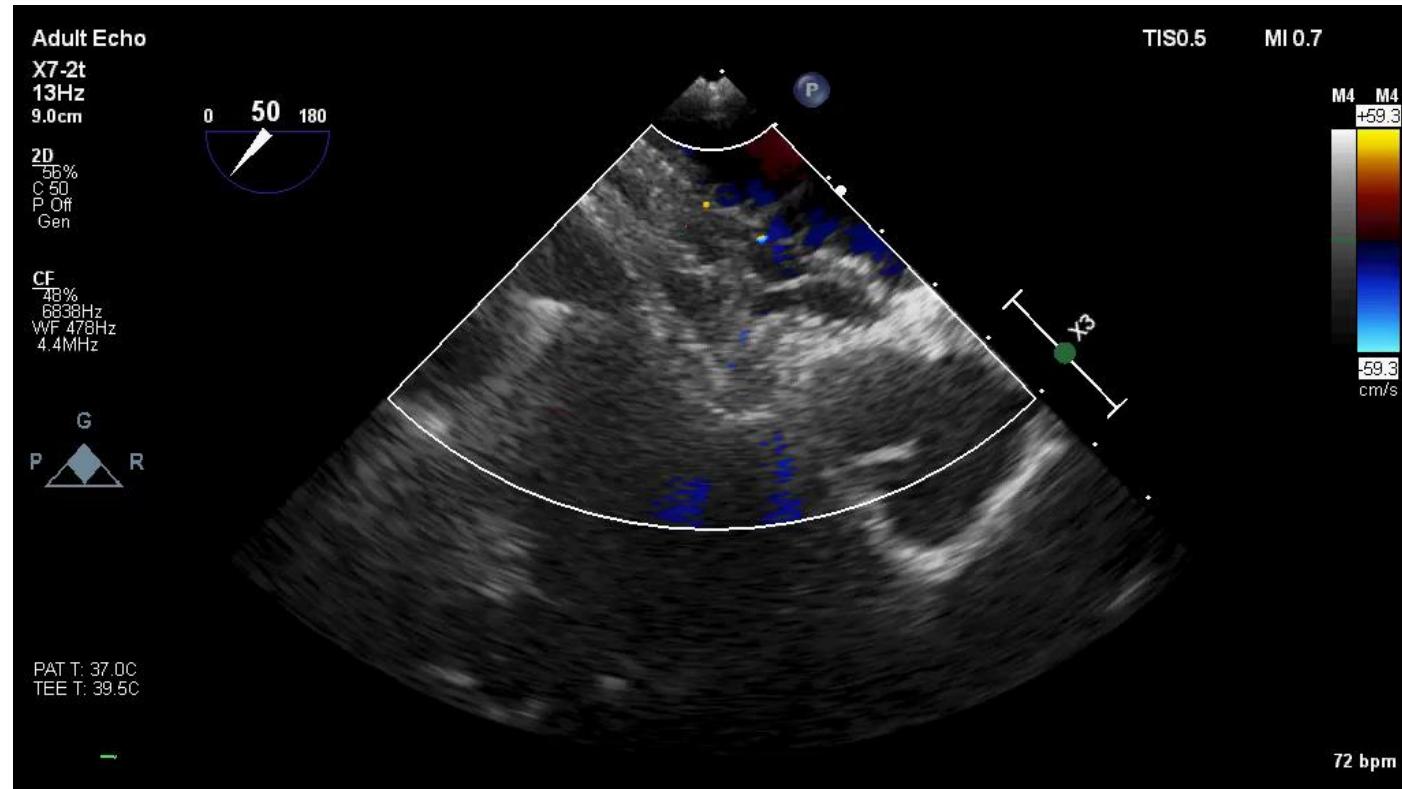
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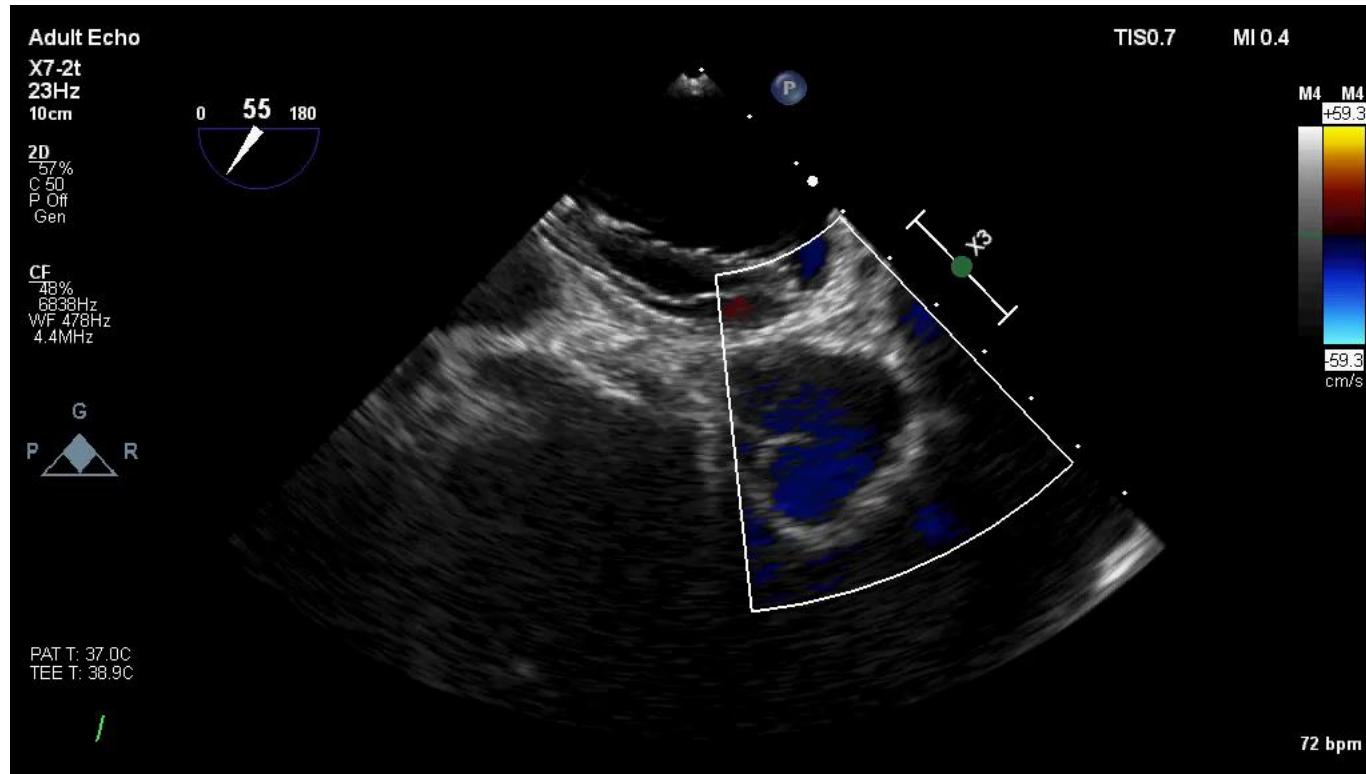
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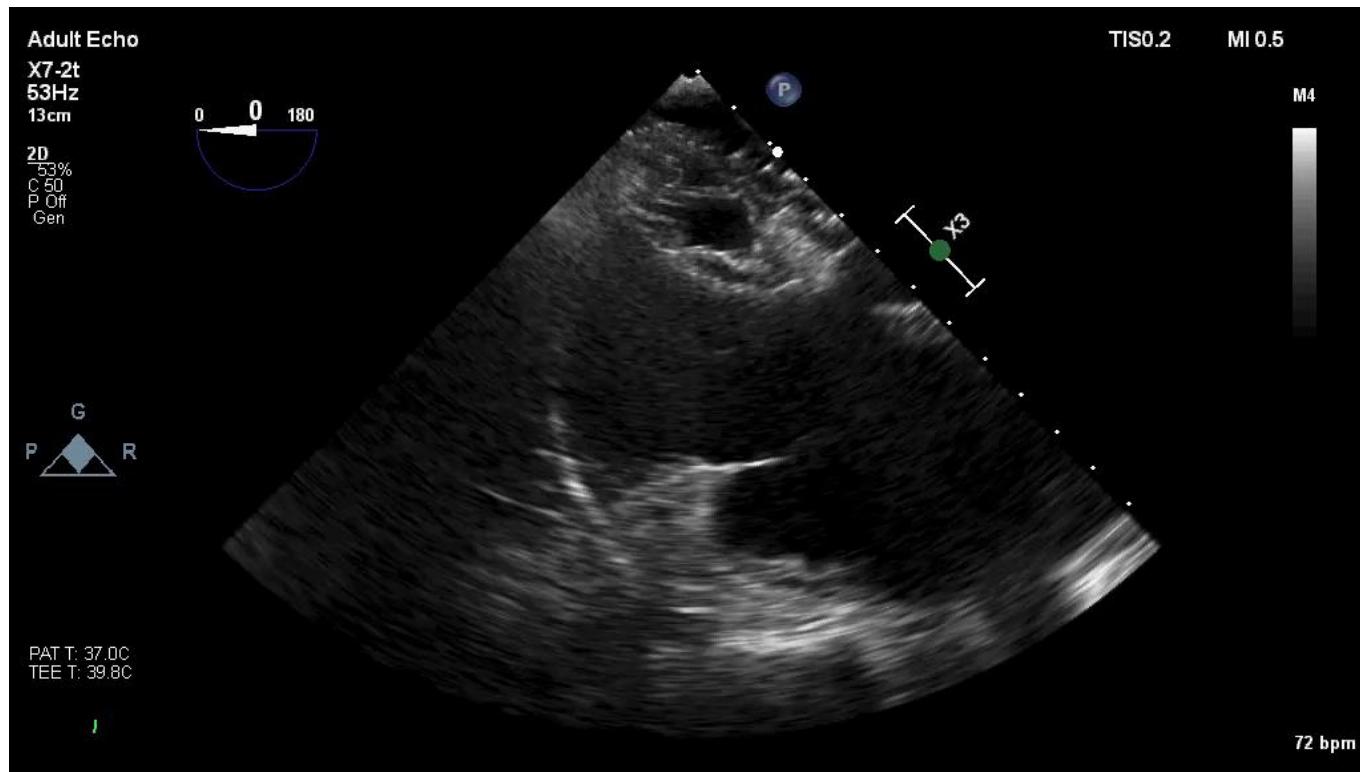
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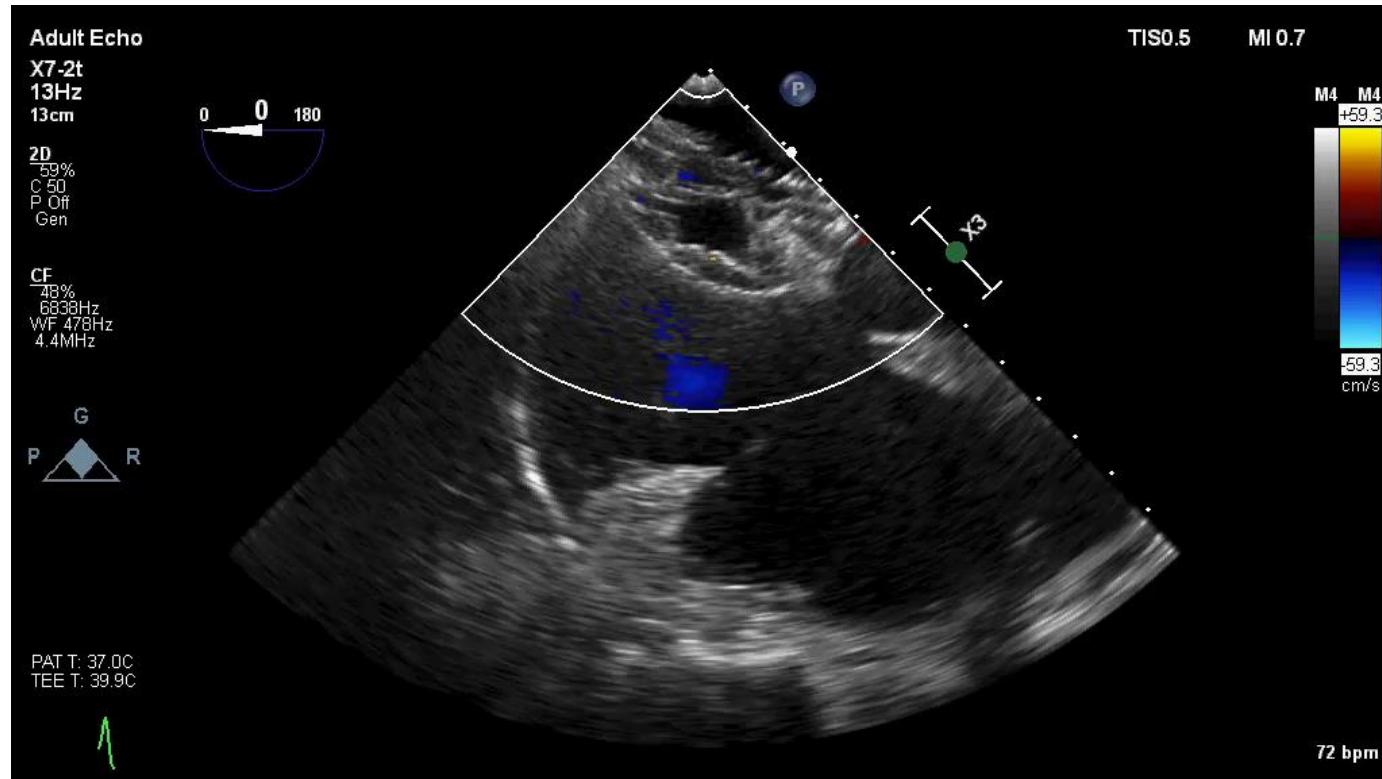
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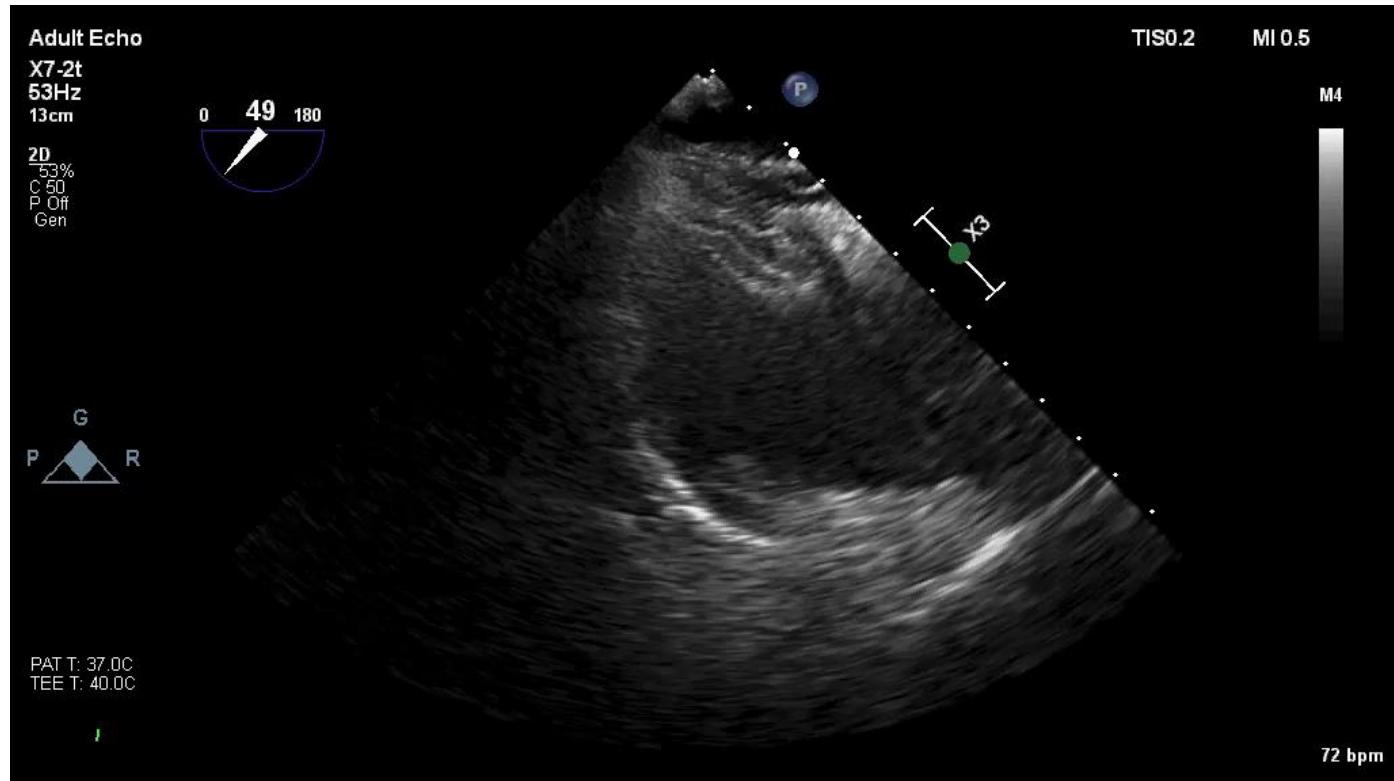
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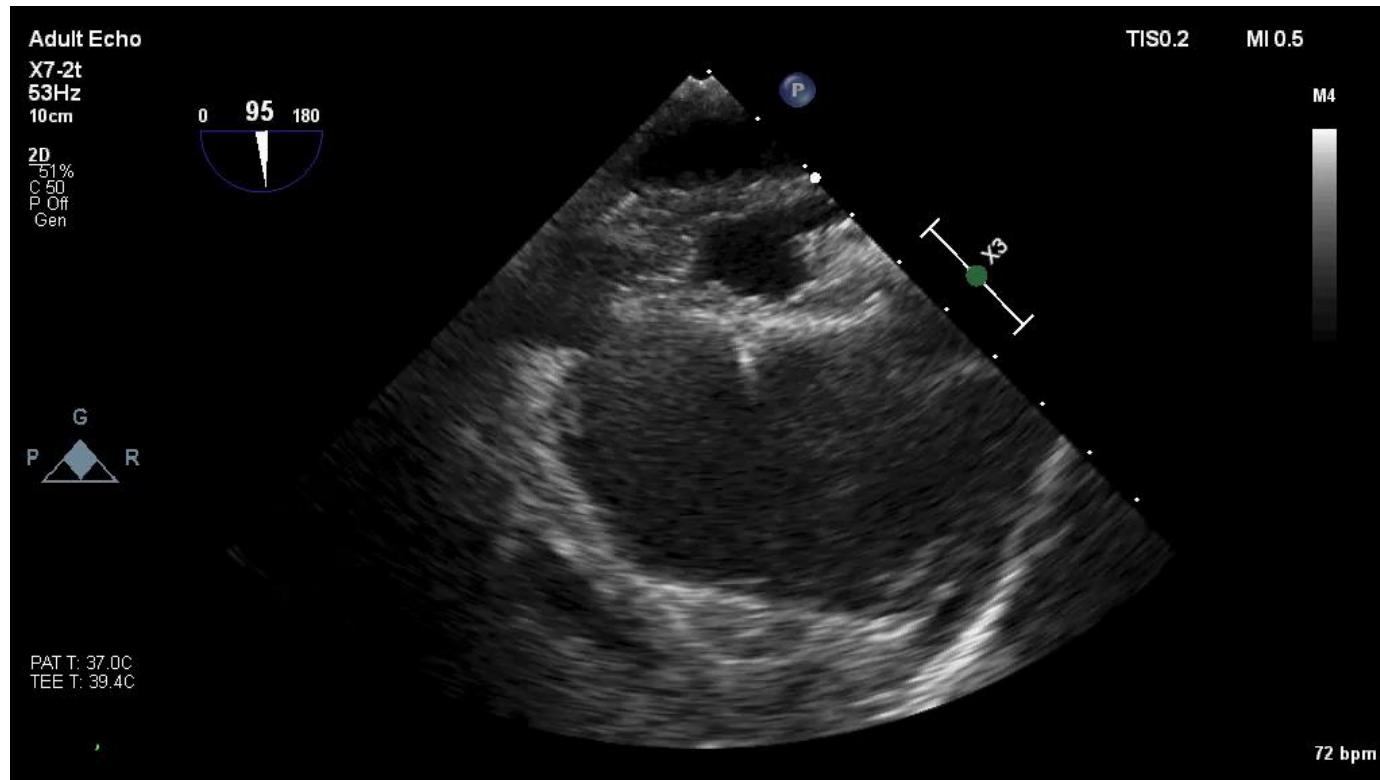
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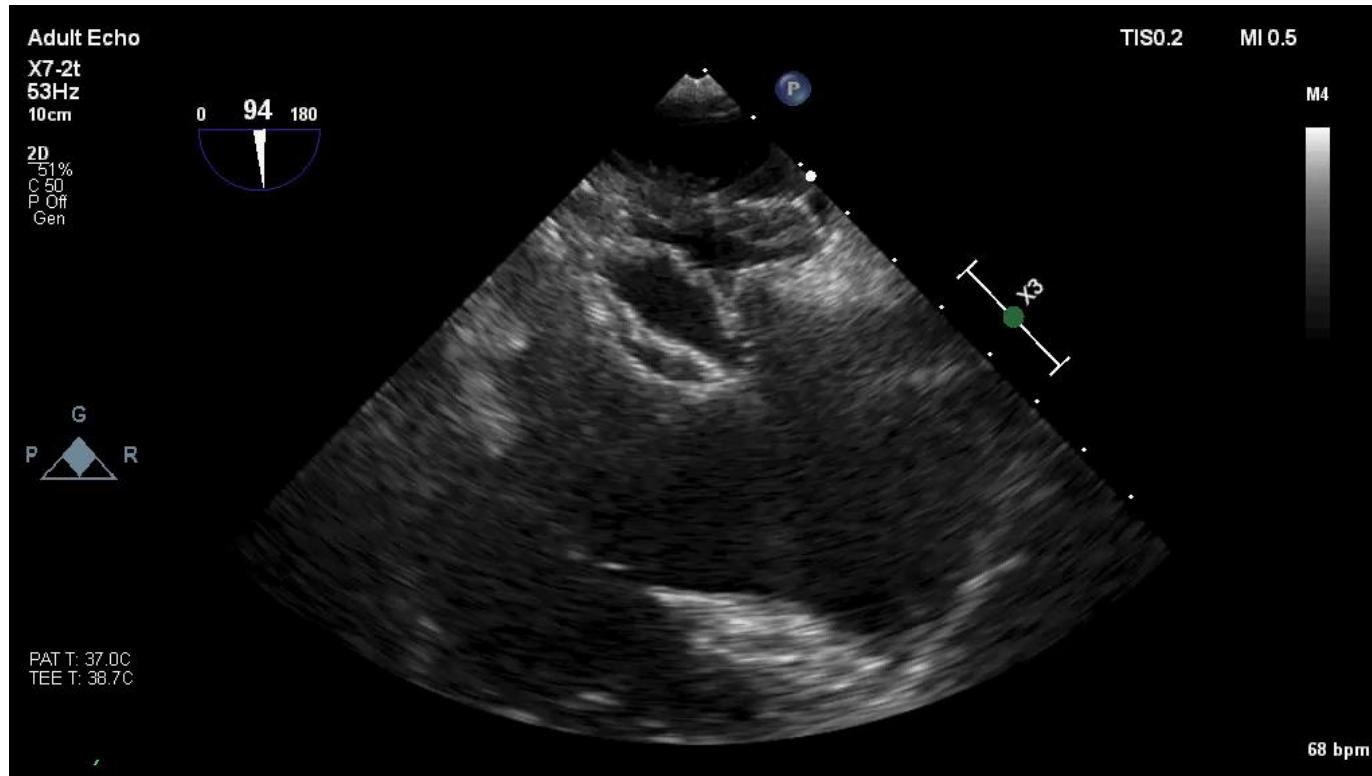
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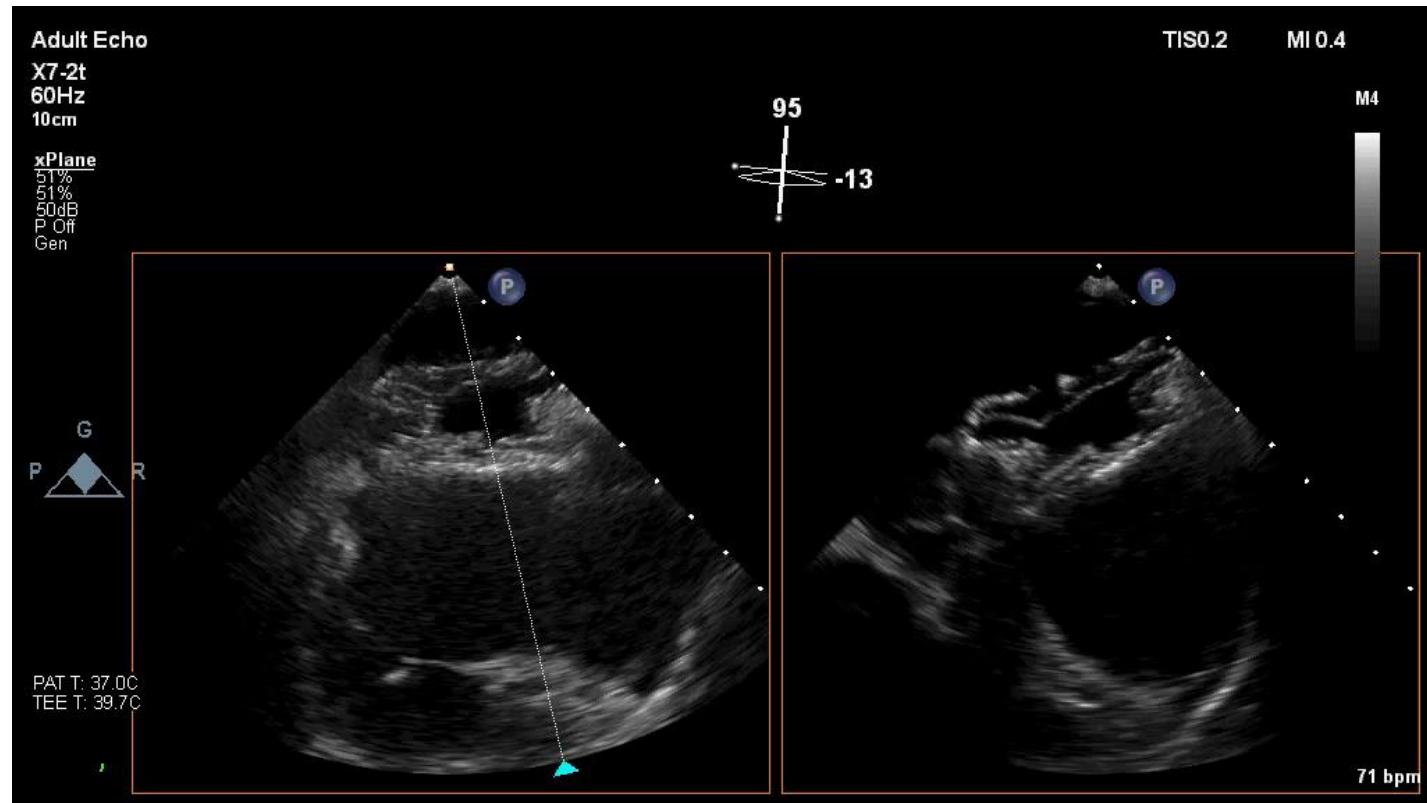
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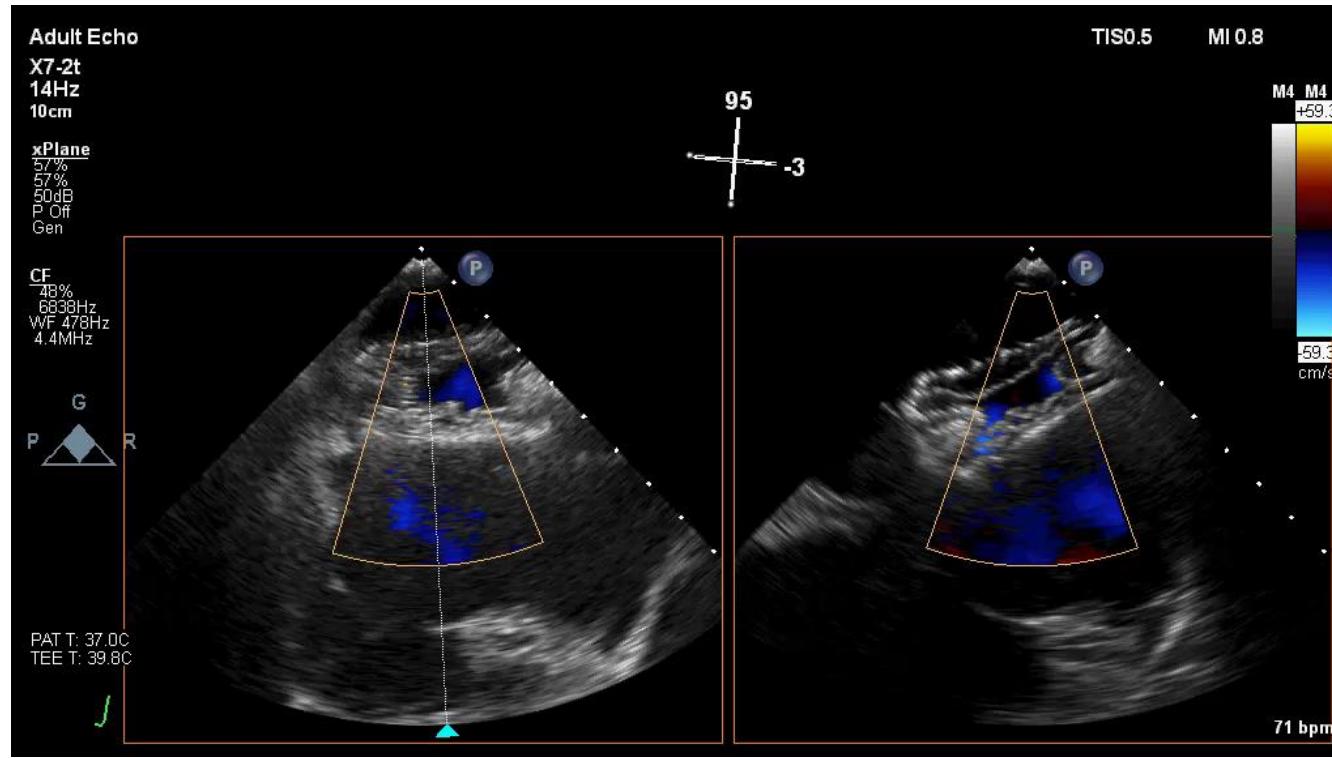
ASD closure (Tug test)



ASD closure

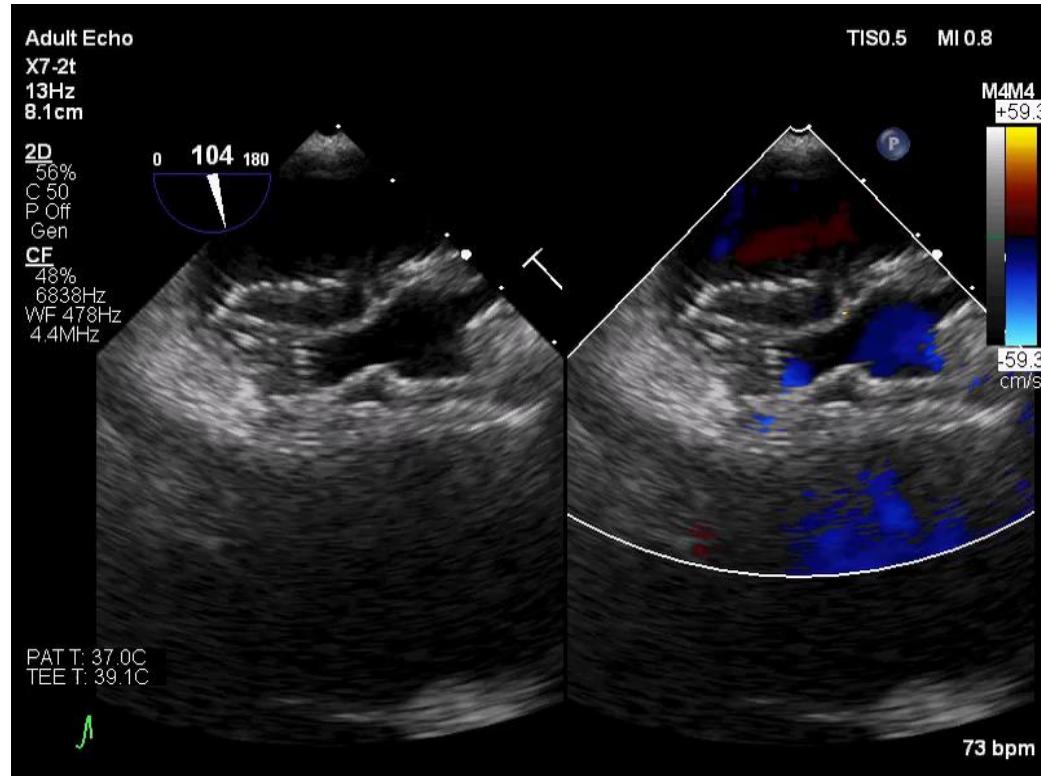


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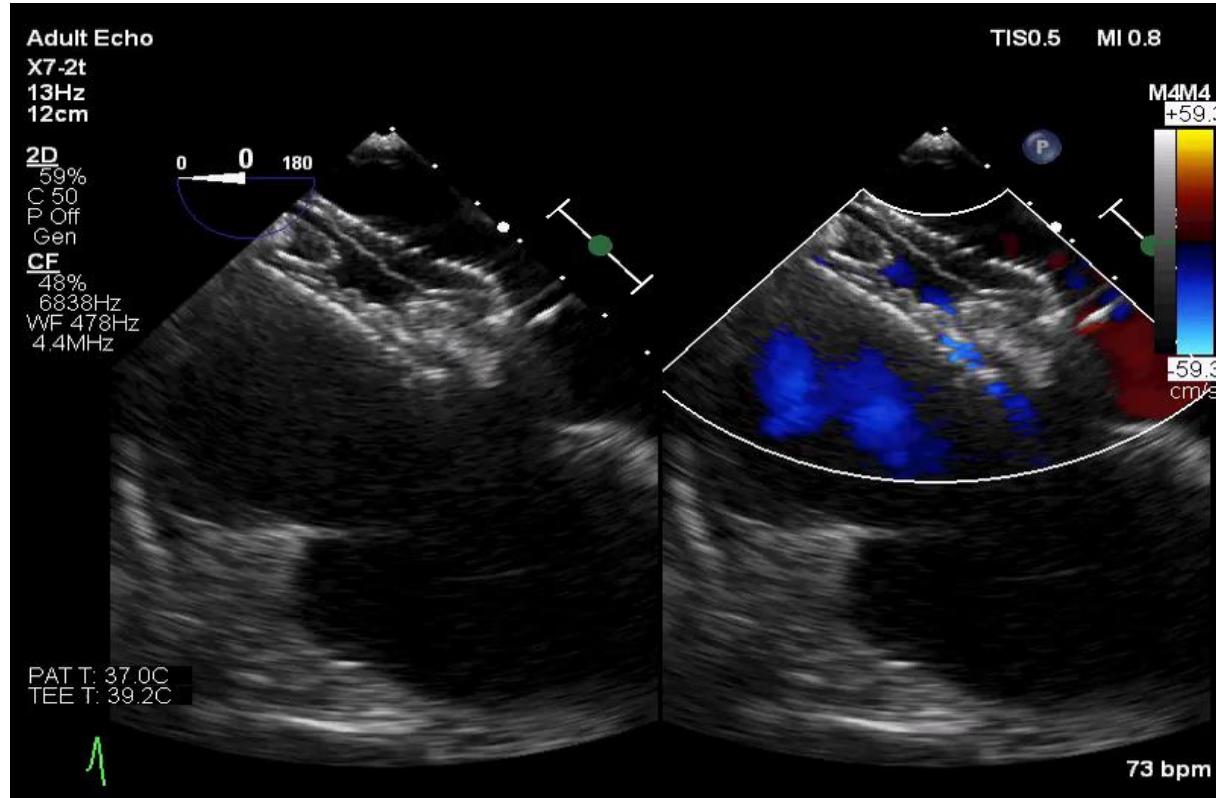


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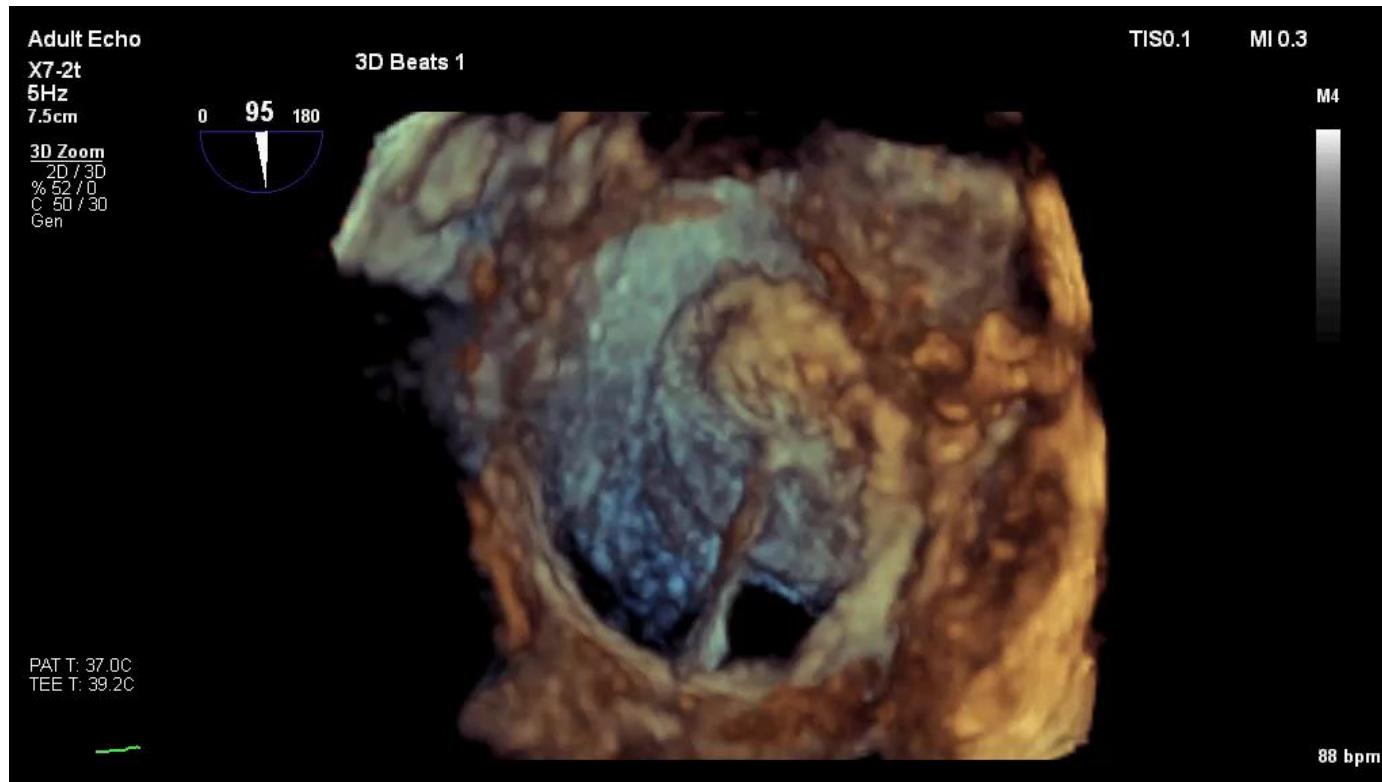
Coronary sinus



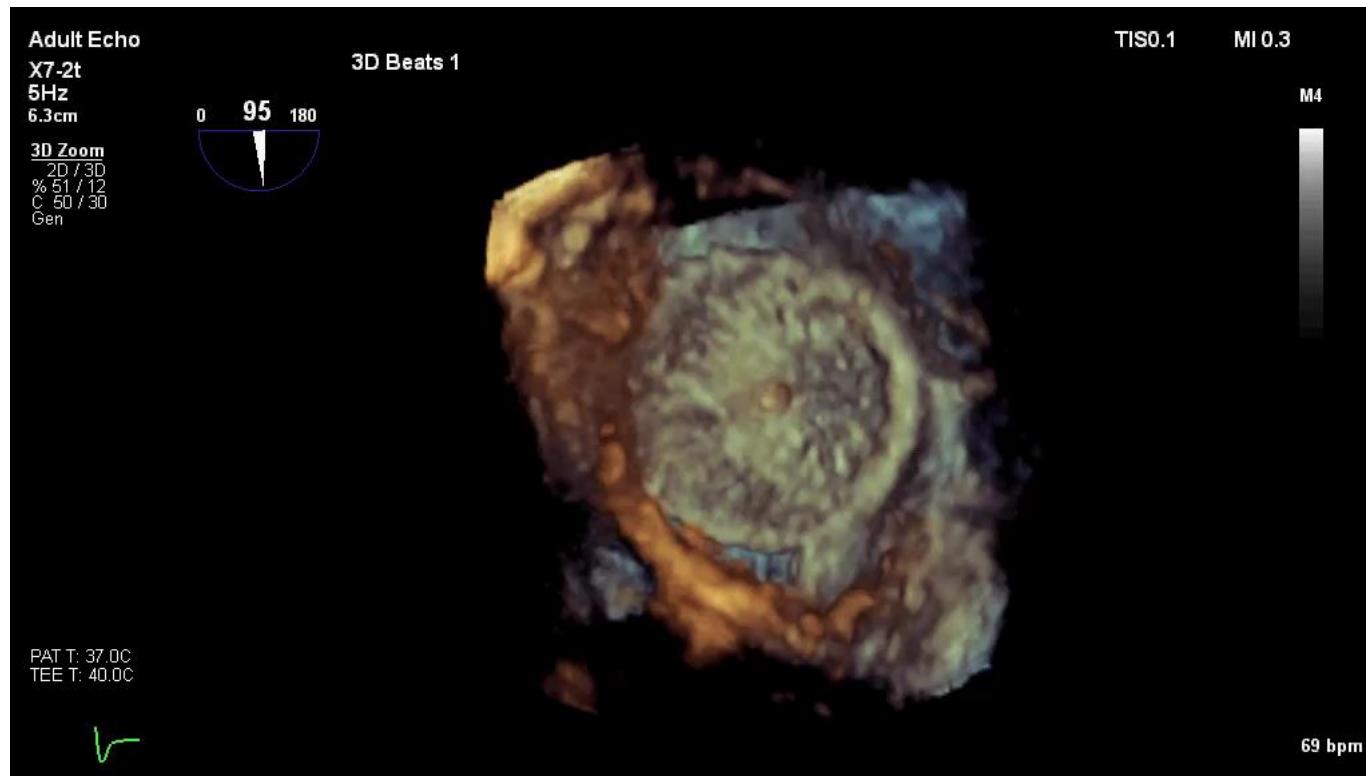
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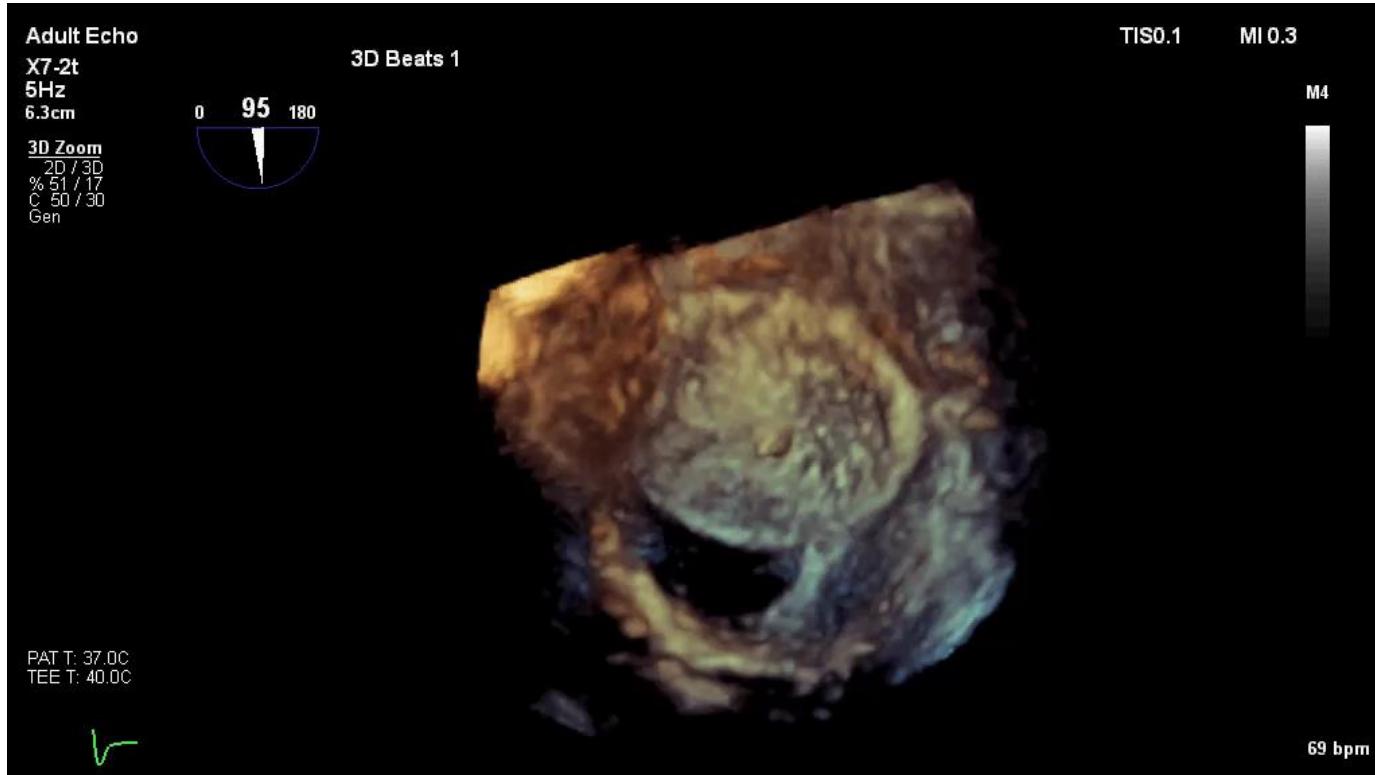
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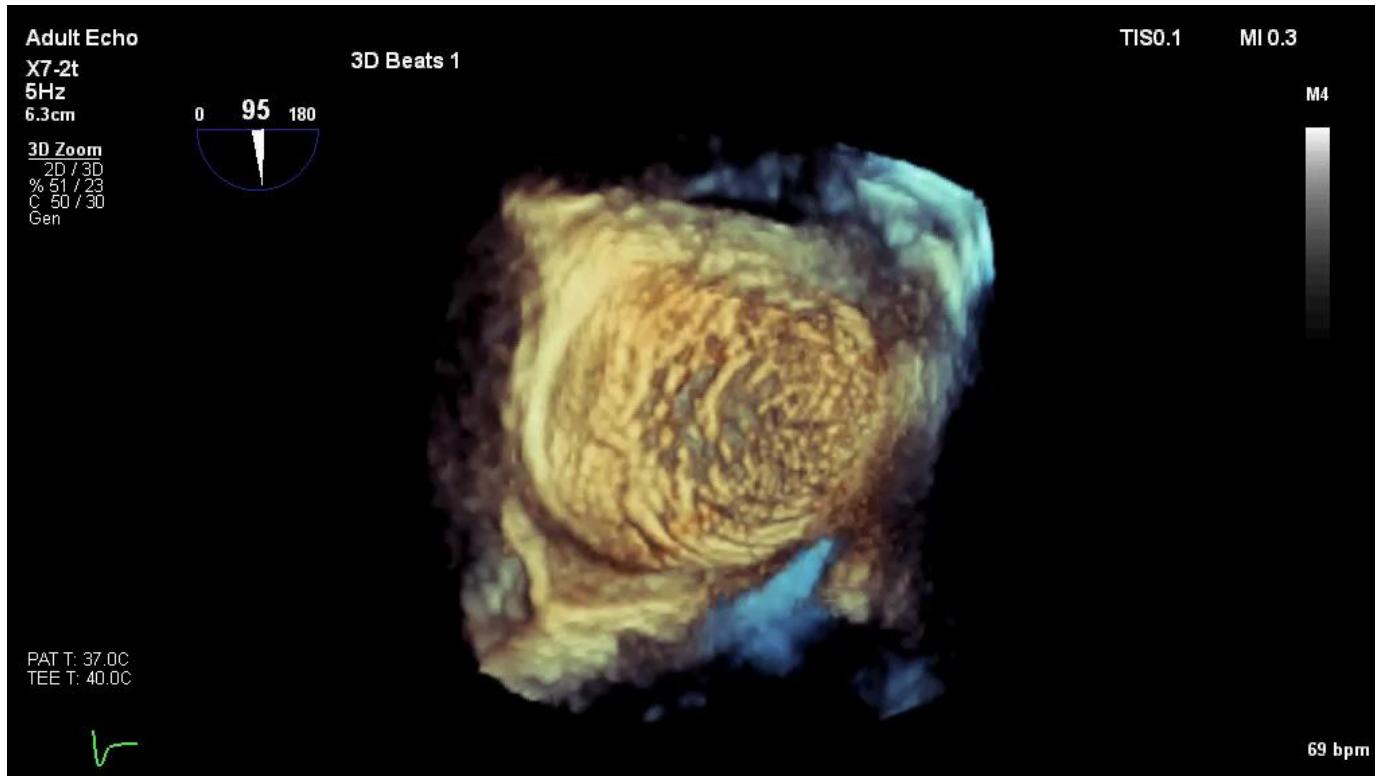
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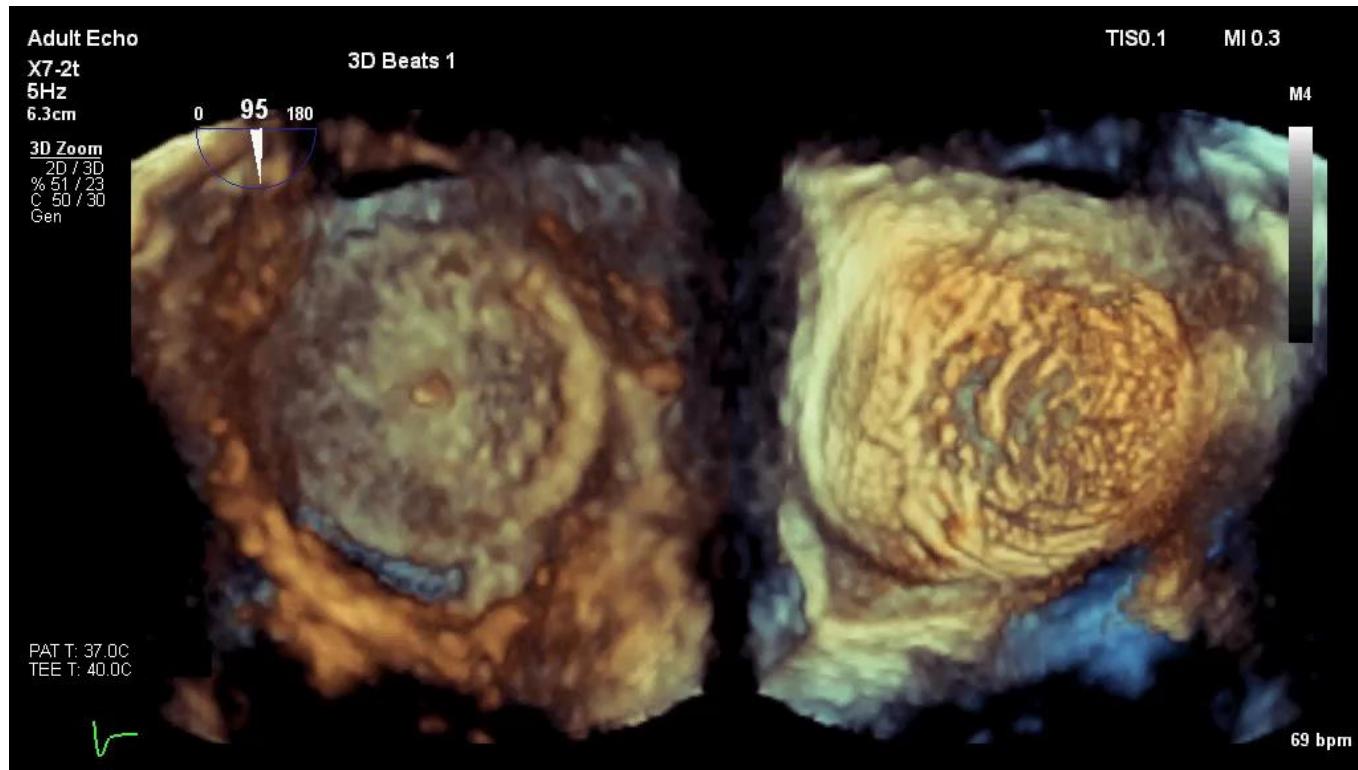
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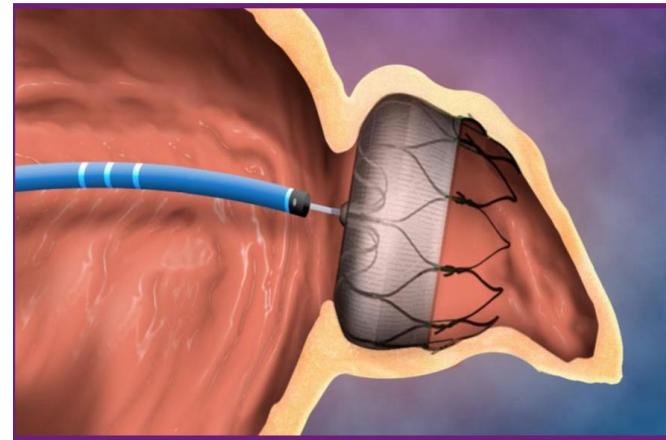
ASD closure



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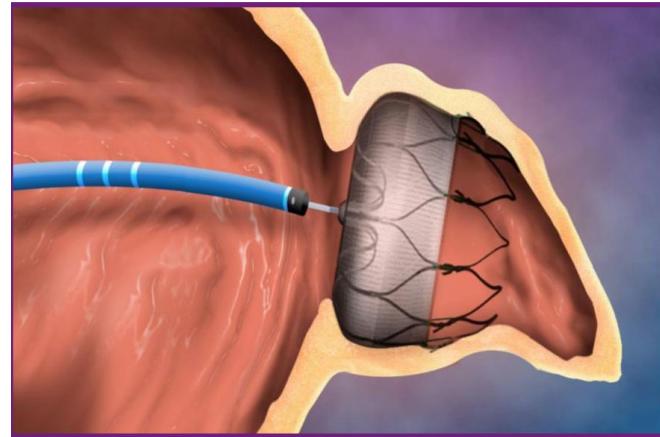
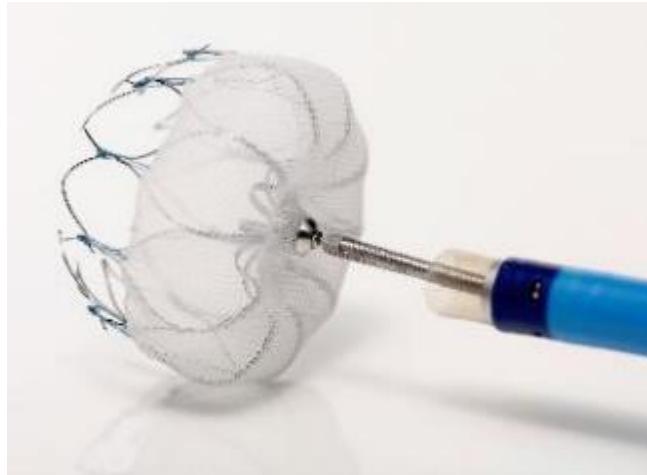


LAA closure



LAA closure

- **Ninety percent of AF-associated strokes result from emboli that arise from the left atrial appendage (LAA).**
- **One alternative approach to warfarin therapy has been to exclude the LAA using an implanted device to trap blood clots before they exit.**
- **The WATCHMAN Left Atrial Appendage Closure Device.**



LAA closure

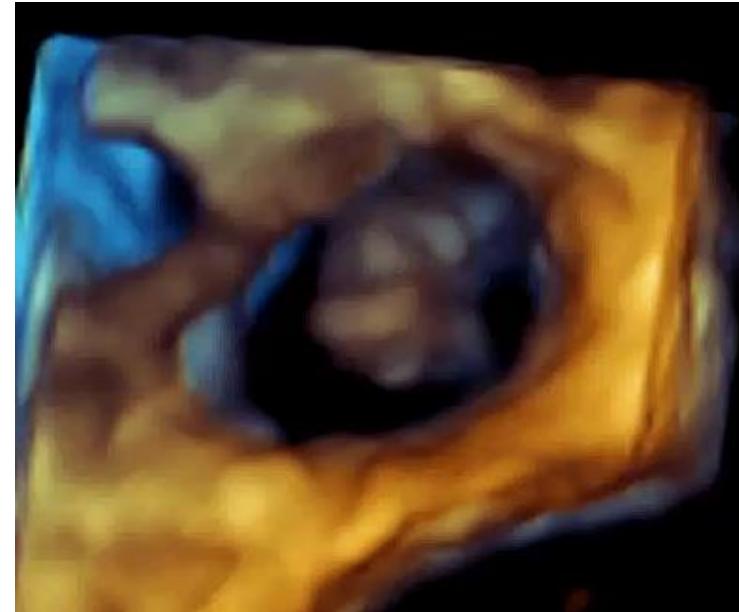


Preprocedural

- **Assessment of the LAA**
 - **Exclude thrombi**
 - **Shape**
 - **Number of lobes**
 - **Dimensions**

LAA closure

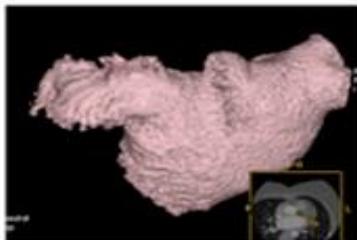
- Exclude thrombi



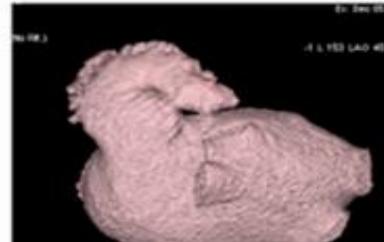
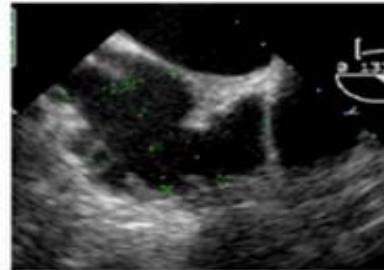
LAA assessment

➤ Shape

The **WindSock Type LAA** is an anatomy in which one dominant lobe of sufficient length is the primary structure.



The **ChickenWing Type LAA** is an anatomy whose main feature is a sharp bend in the dominant lobe of the LAA anatomy at some distance from the perceived LAA ostium.



The **Broccoli Type LAA** is an anatomy whose main feature is an LAA that has limited overall length with more complex internal characteristics.



LAA assessment

- **Number of lobes**
- ✓ > 80% has more than 1 lobe
- ✓ Go to the major lobe

LAA assessment

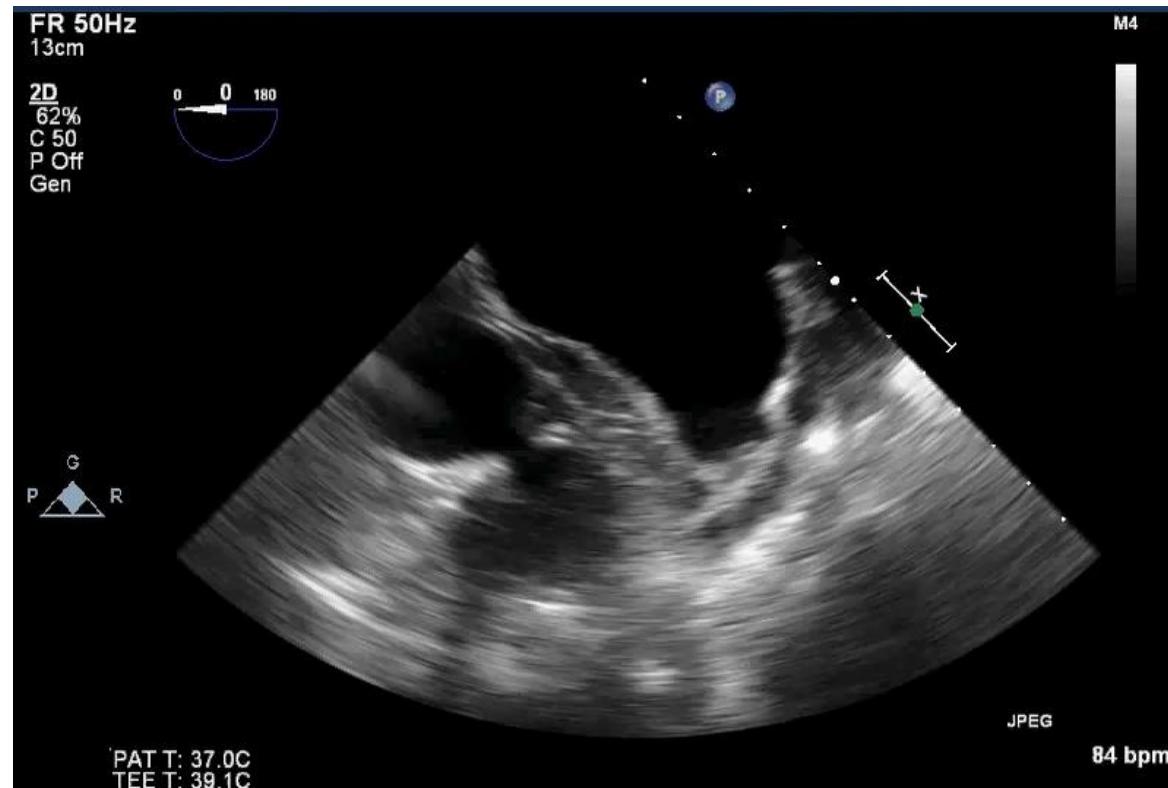
➤ Dimensions (for sizing)

Maximum LAA Ostium (mm)	Device Size (mm) <i>(uncompressed diameter)</i>
17-19	21
20-22	24
23-25	27
26-28	30
29-31	33

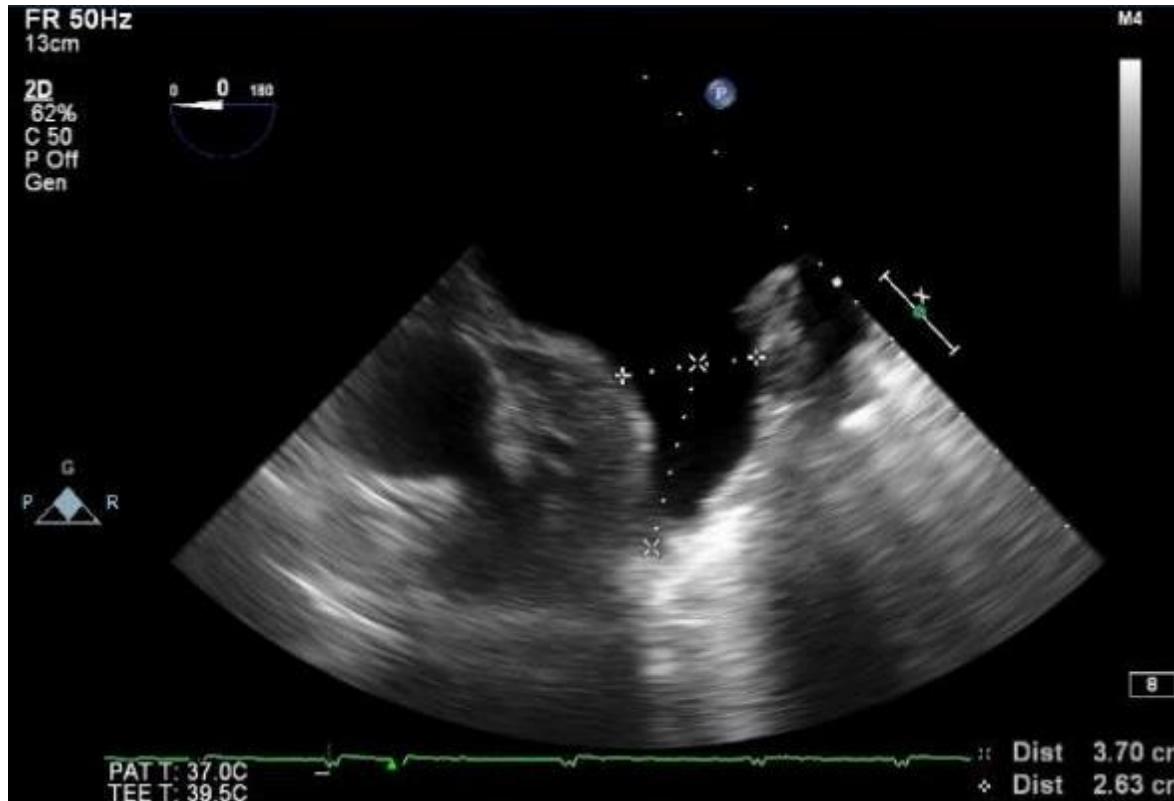
LAA assessment

0 degrees

LAA assessment

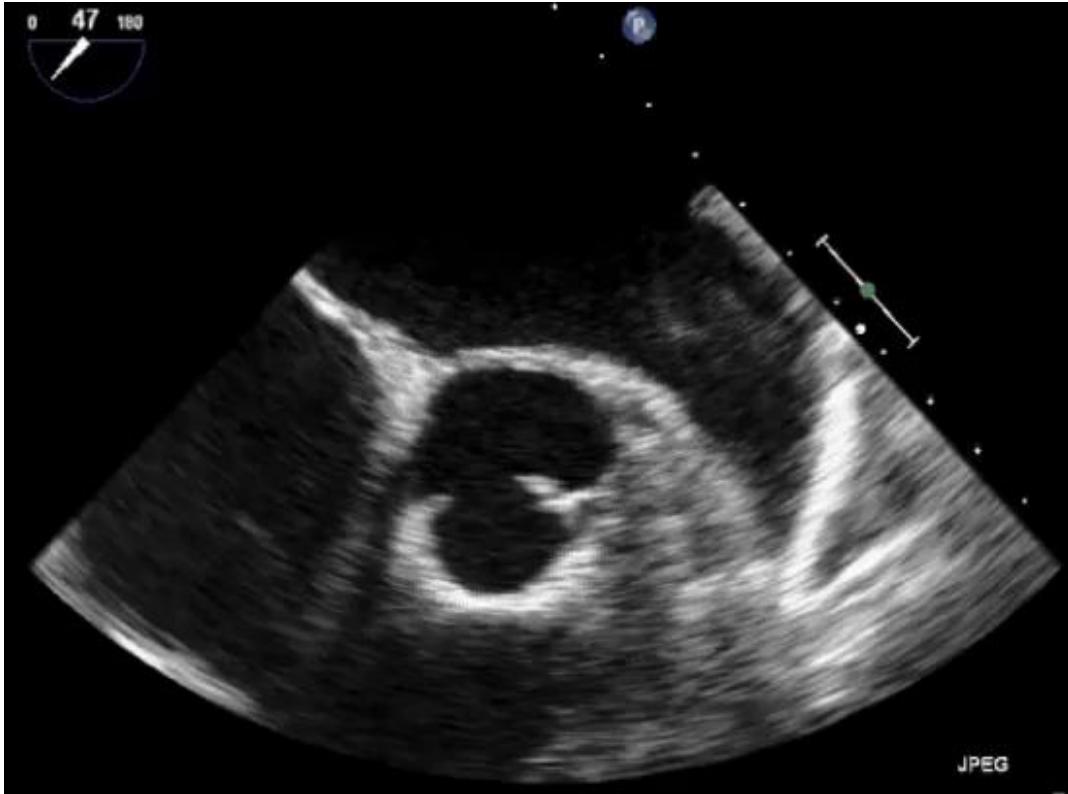


LAA assessment

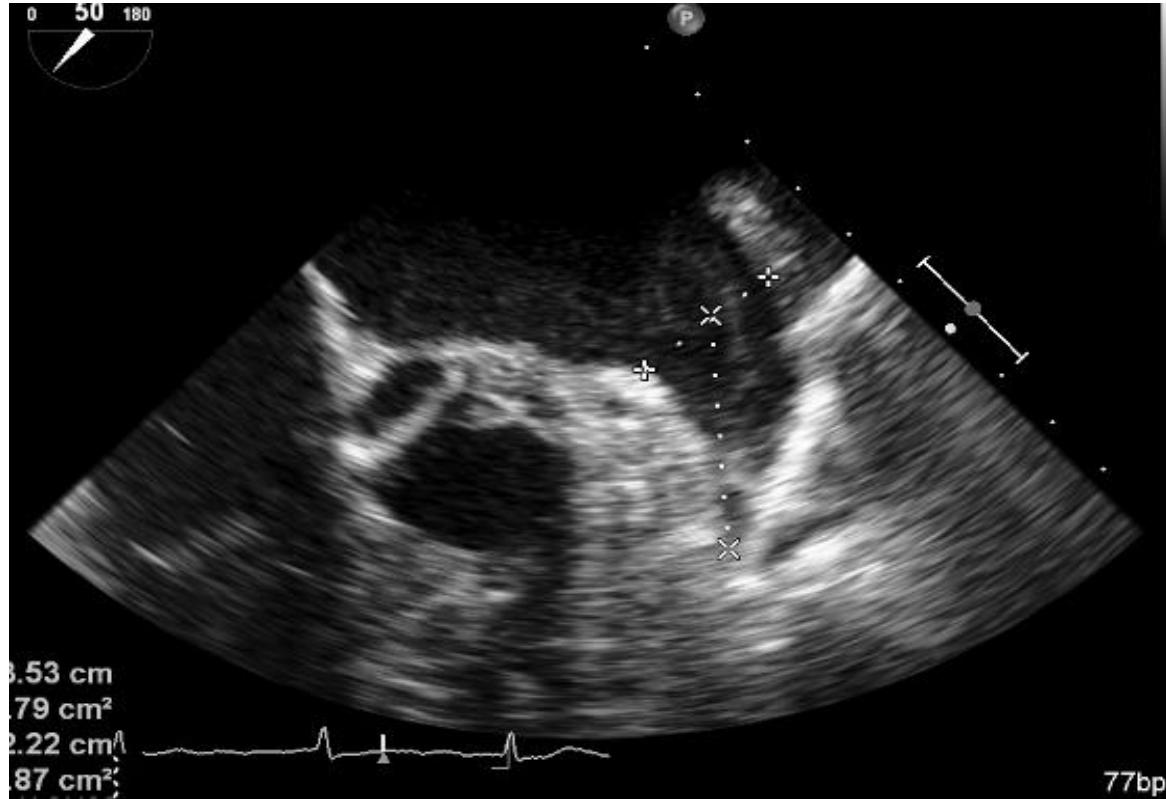


45 degrees

LAA assessment

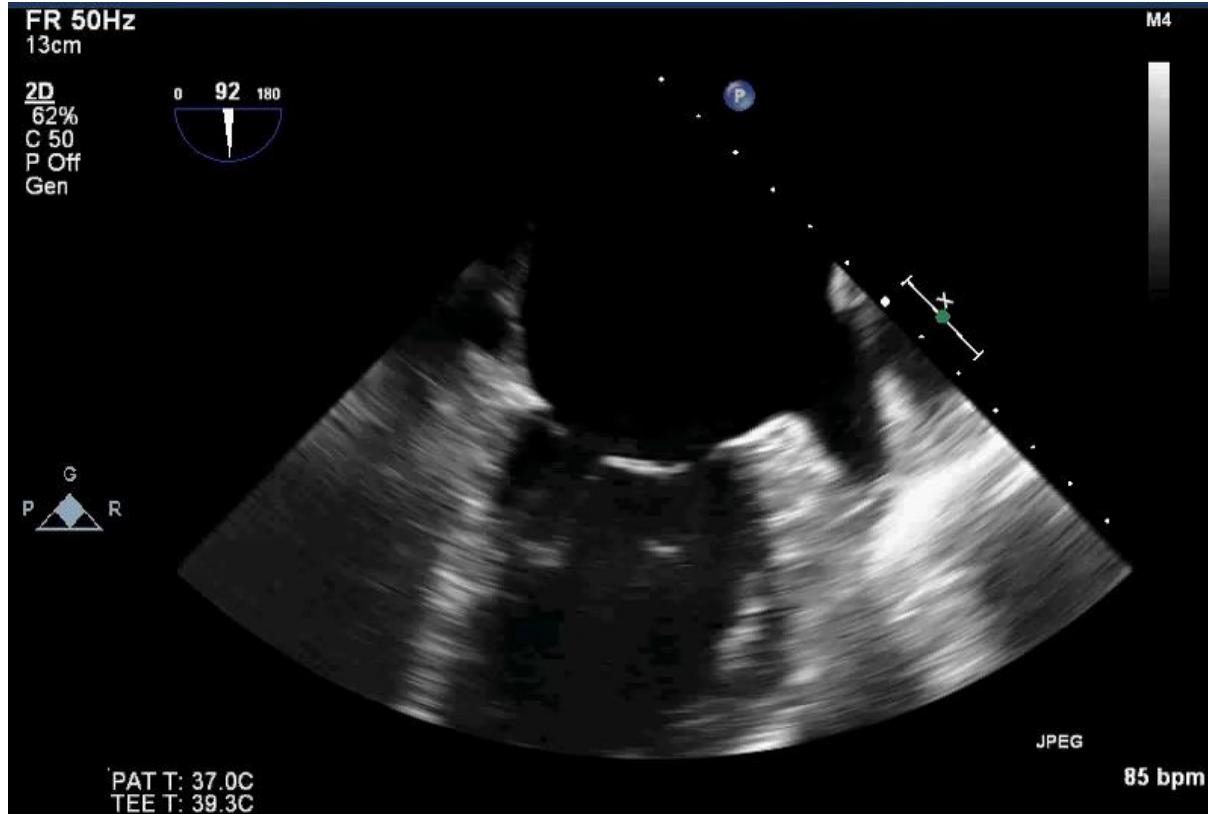


LAA assessment



90 degrees

LAA assessment



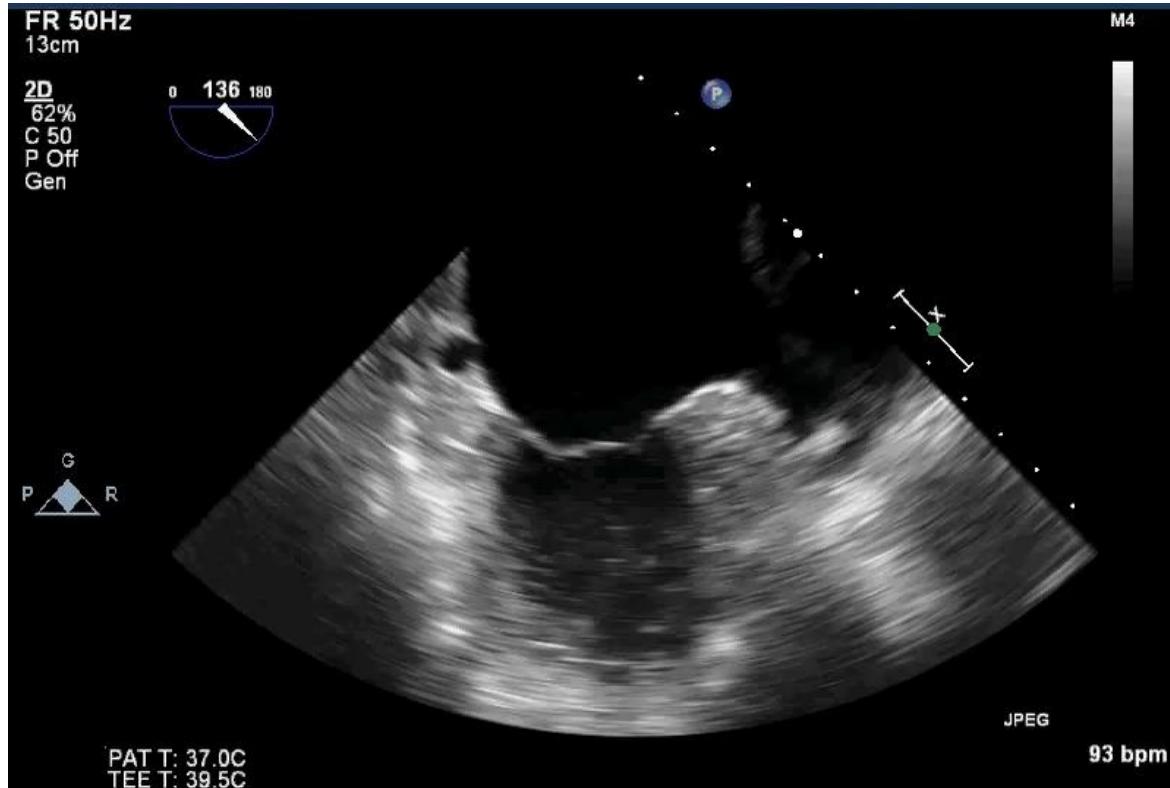
LAA assessment



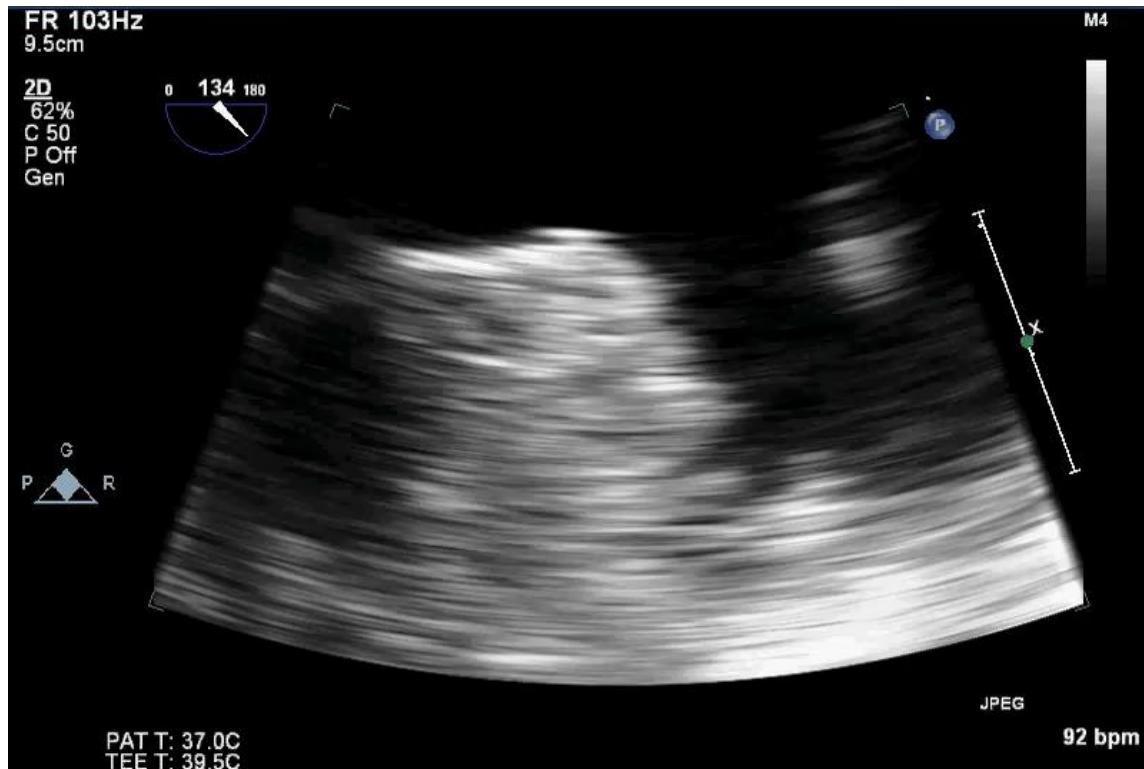
LAA assessment

135 degrees

LAA assessment



LAA assessment



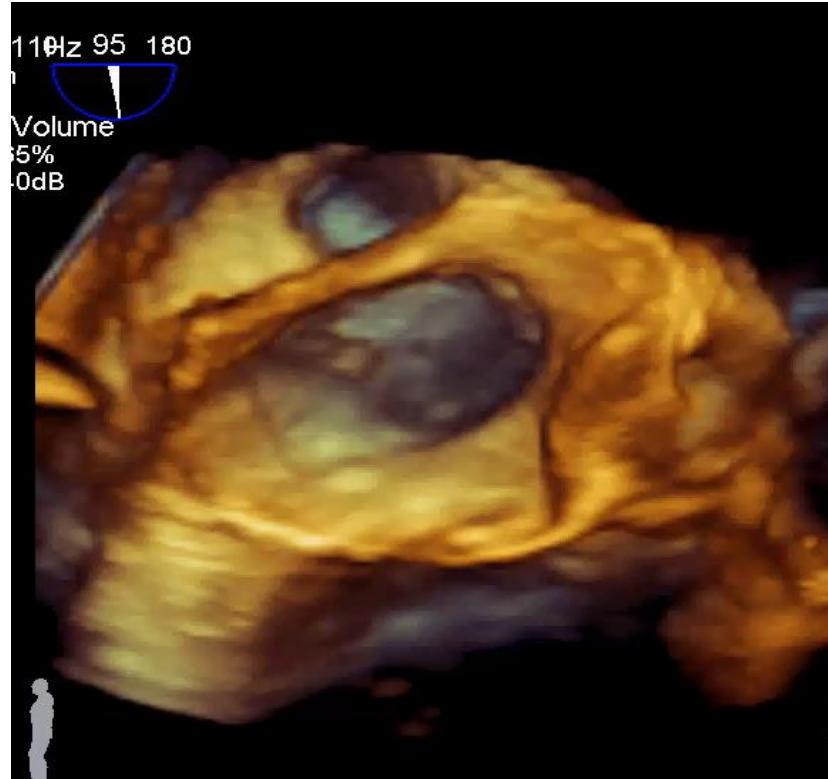
LAA assessment



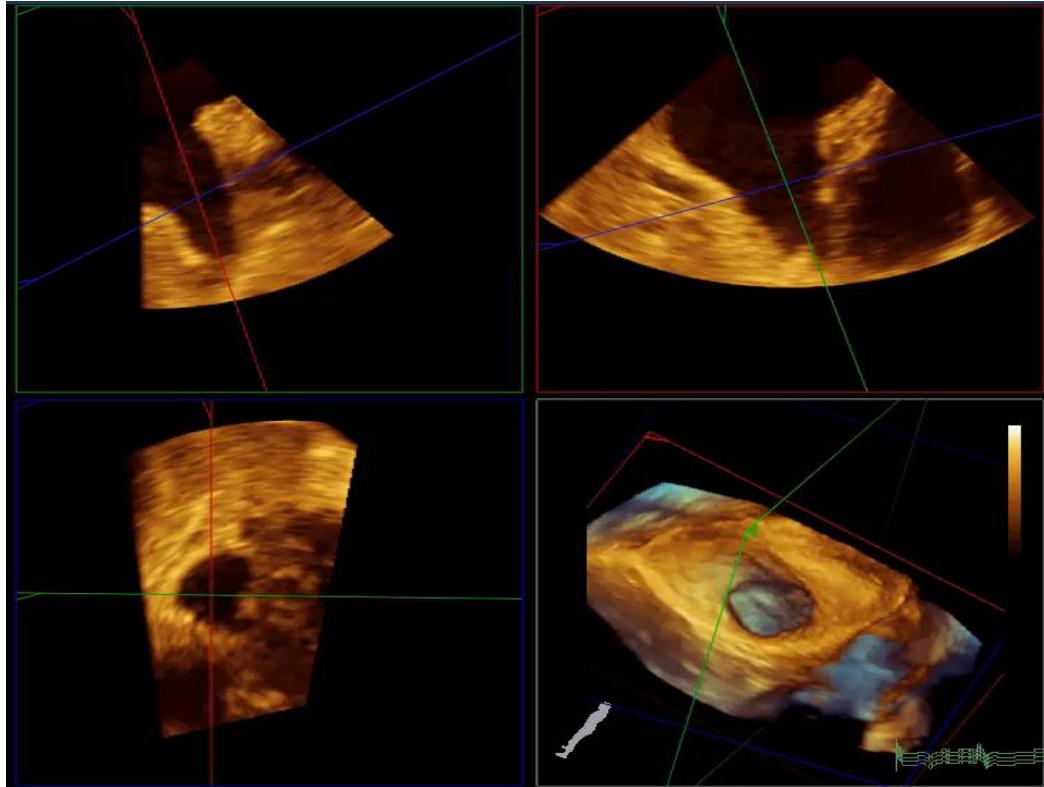
LAA assessment

3D-TEE

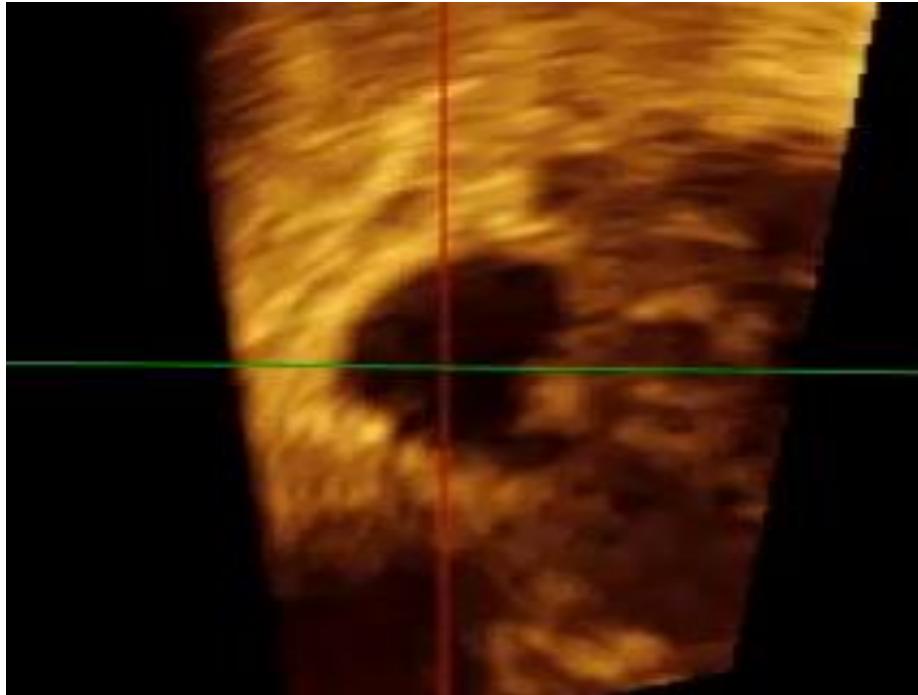
LAA assessment



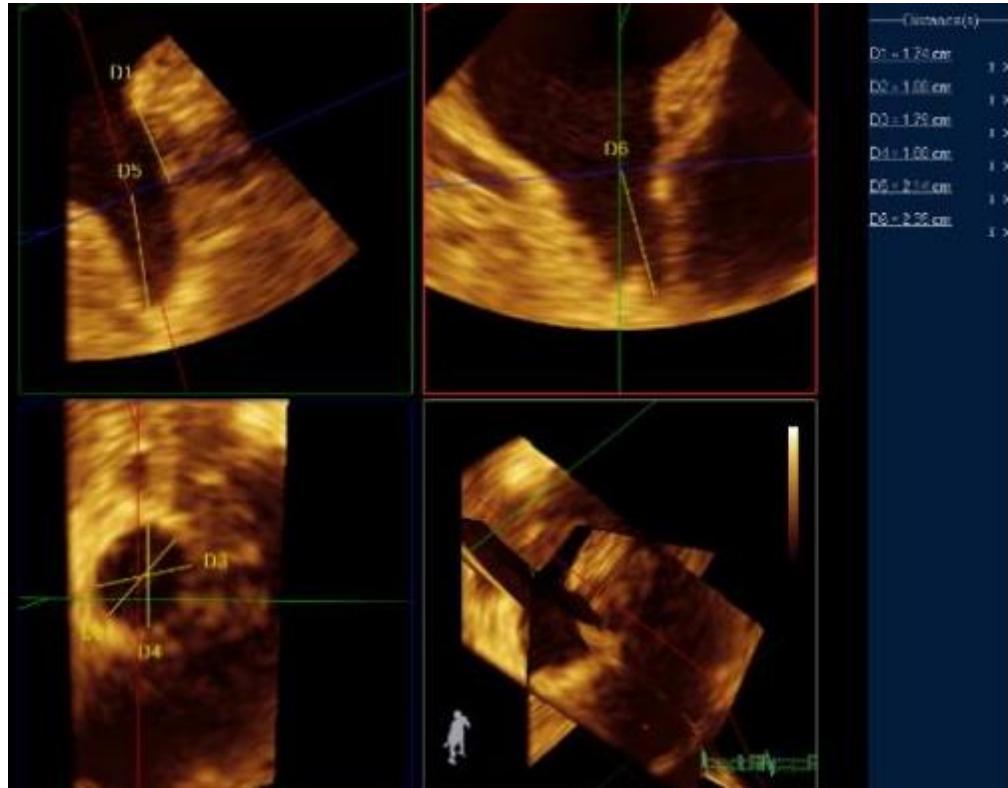
LAA assessment



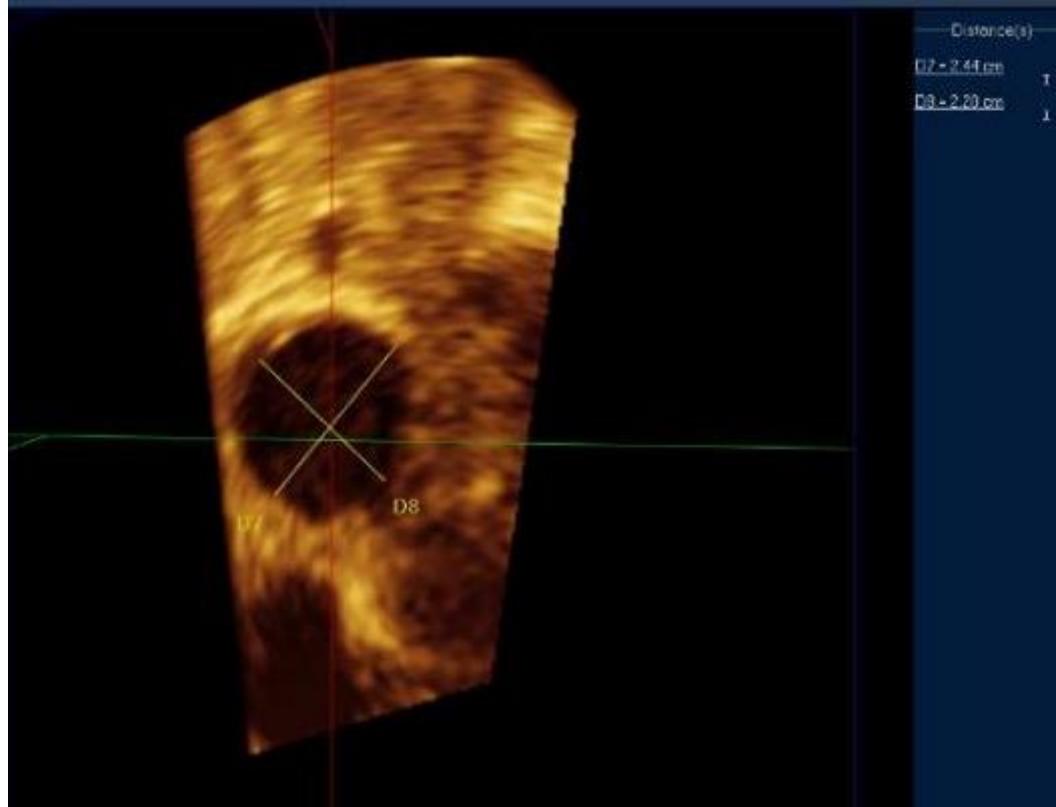
LAA assessment



LAA assessment



LAA assessment



LAA assessment

3D-TOE



Evaluation of the Left Atrial Appendage With Real-Time 3-Dimensional Transesophageal Echocardiography: Implications for Catheter-Based Left Atrial Appendage Closure
Gaetano Nucifora, Francesco F. Faletra, François Regoli, Elena Pasotti, Giovanni Pedrazzini,
Tiziano Moccetti and Angelo Auricchio

Circ Cardiovasc Imaging. 2011;4:514-523; originally published online July 7, 2011;
doi: 10.1161/CIRCIMAGING.111.963892

LAA assessment

3D-TOE

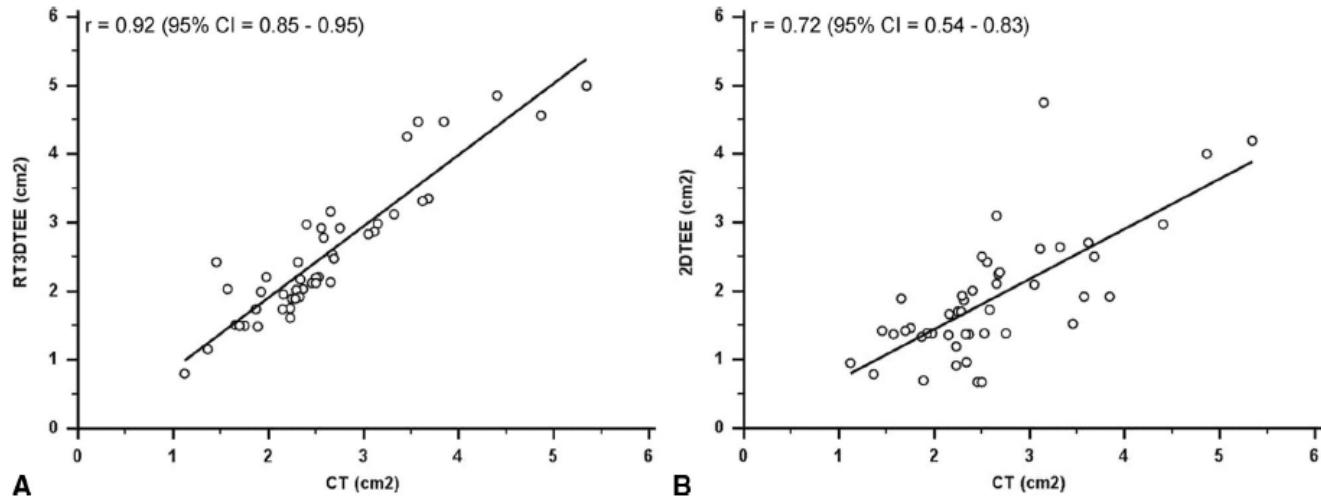


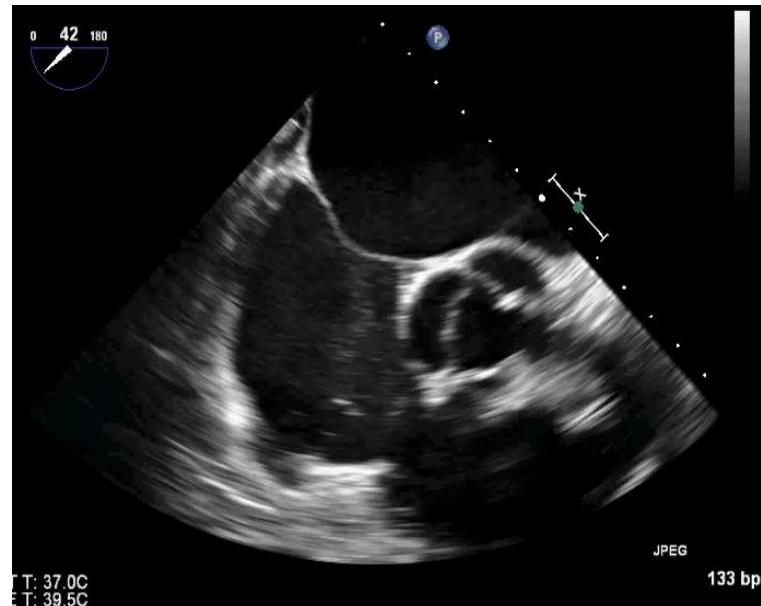
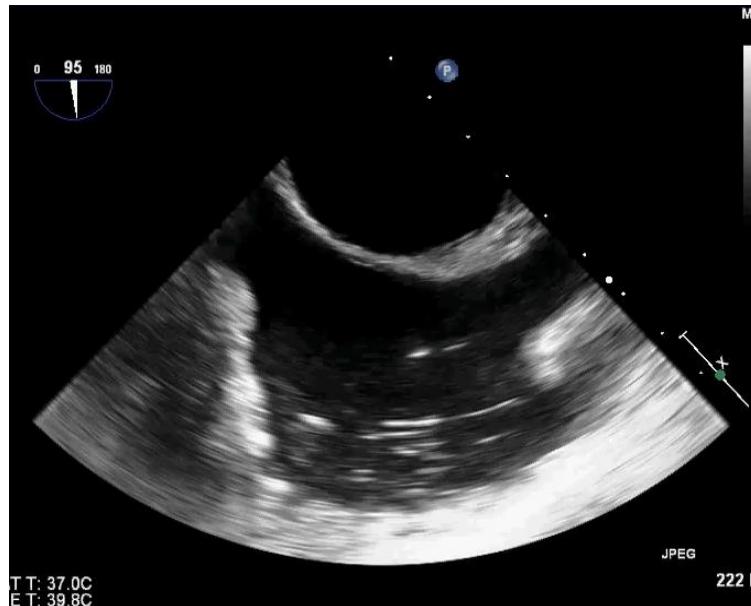
Figure 2. Scatterplots of linear regression analysis for real-time 3D transesophageal echocardiography (RT3DTEE) (A) and 2D transesophageal echocardiography (2DTEE) (B) measurements of the left atrial appendage (LAA) orifice area versus the computed tomography (CT) reference values.

Nucifora et al RT3DTEE Imaging of LAA Circ Cardiovasc 2011;4:514-523

Intraprocedural

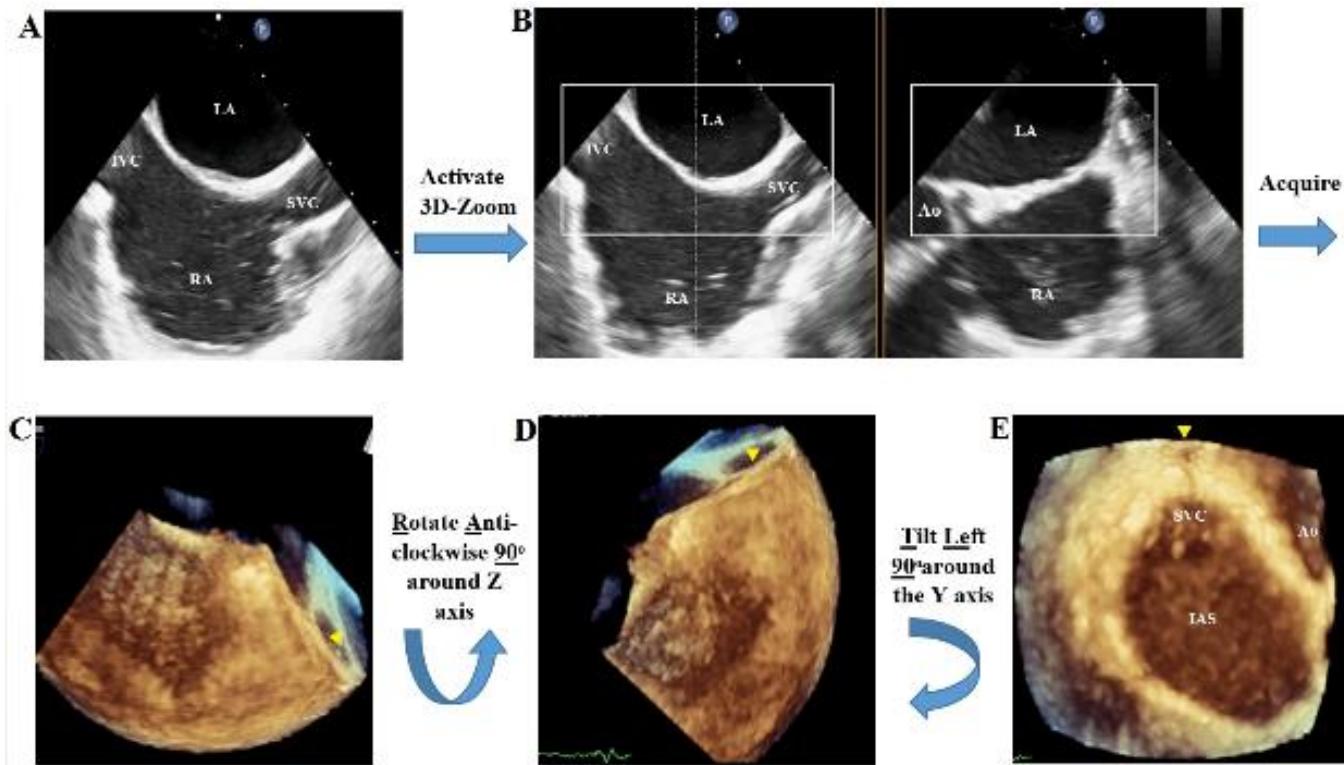


Imaging of the inter-atrial septum



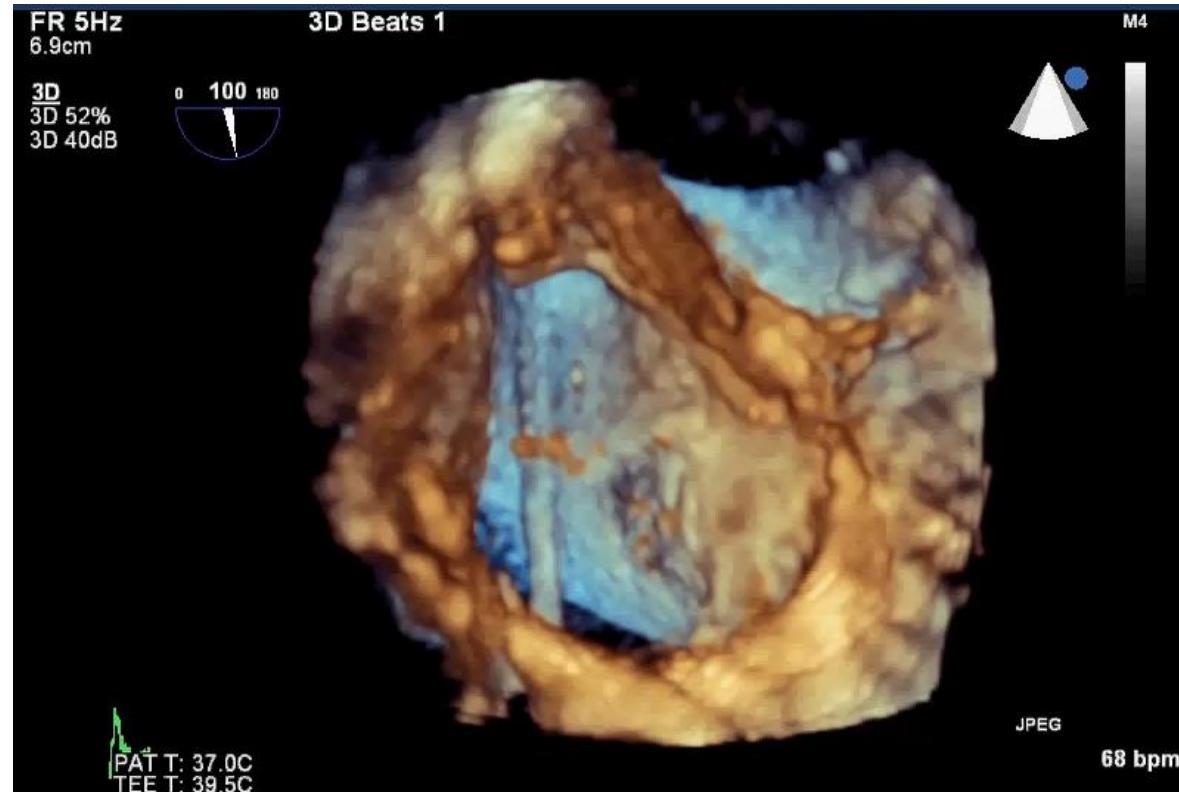
Imaging of the inter-atrial septum

RATLe-90 maneuver



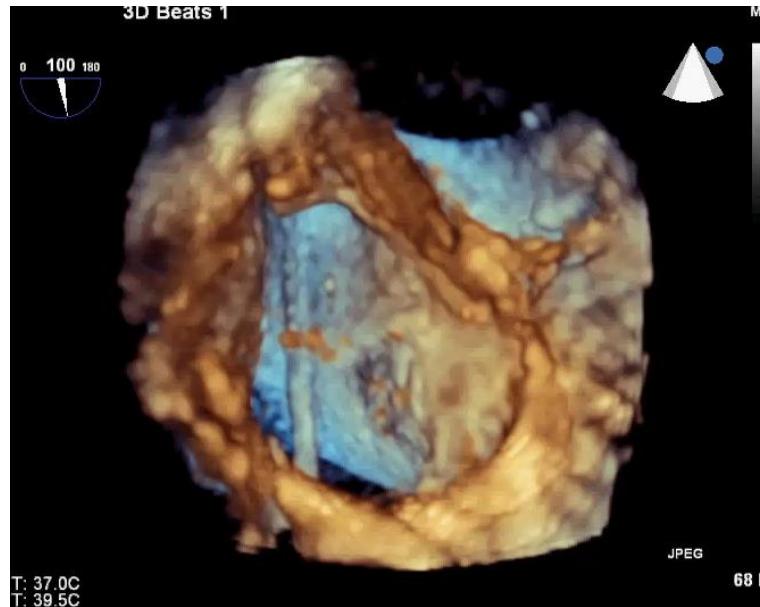
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RATLe-90 maneuver



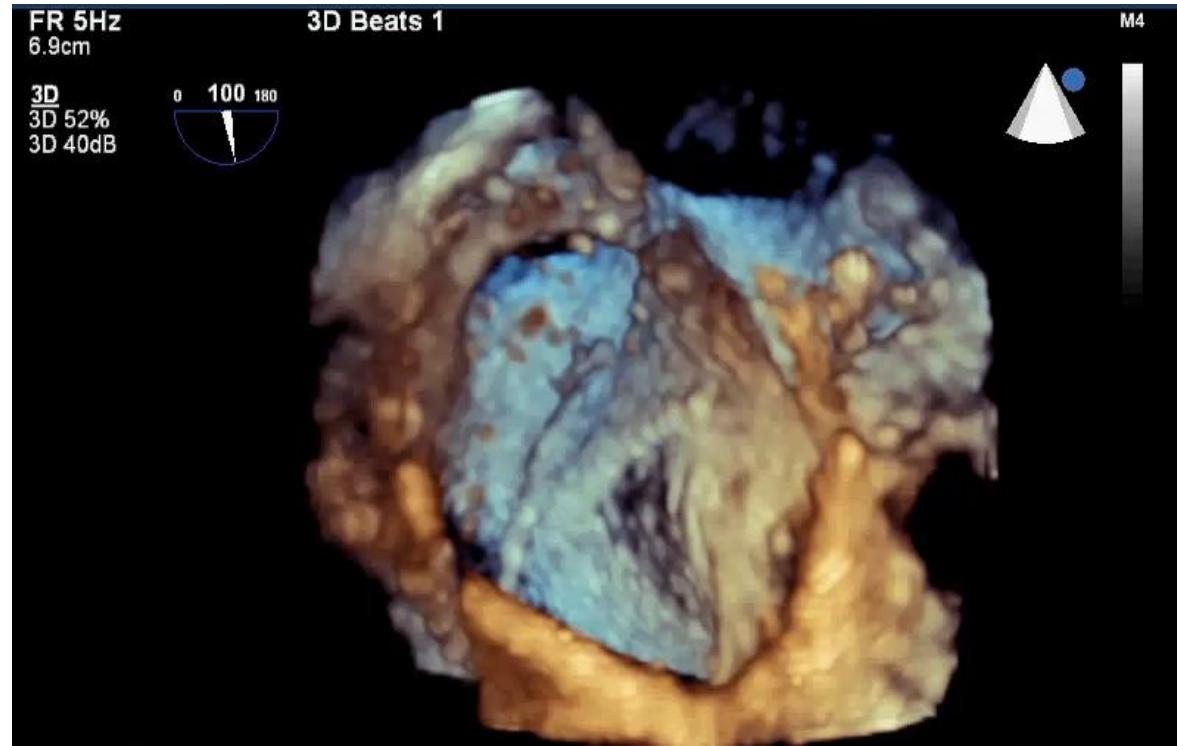
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RATLe-90 maneuver



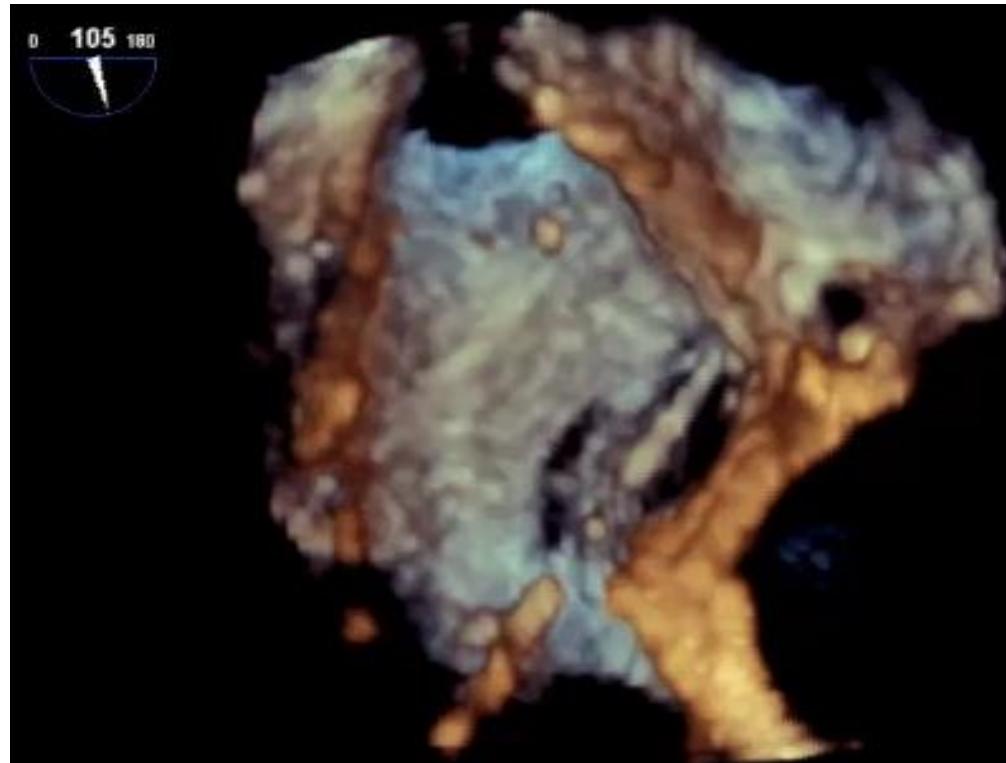
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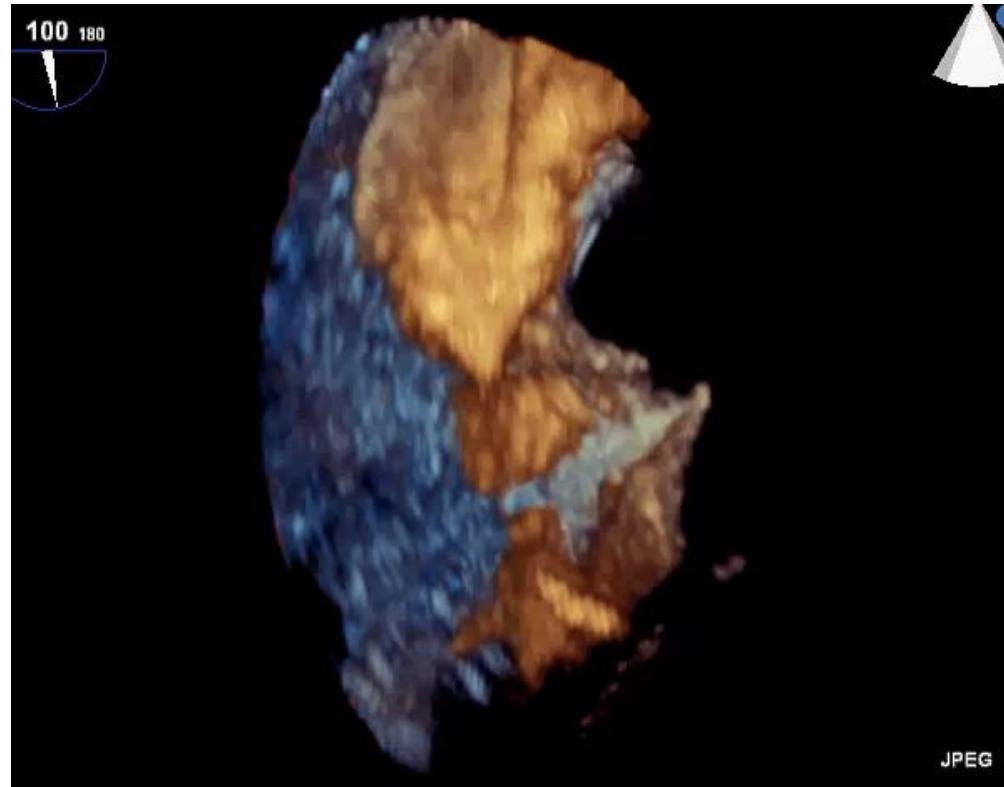
Imaging of the inter-atrial septum

RATLe-90 maneuver



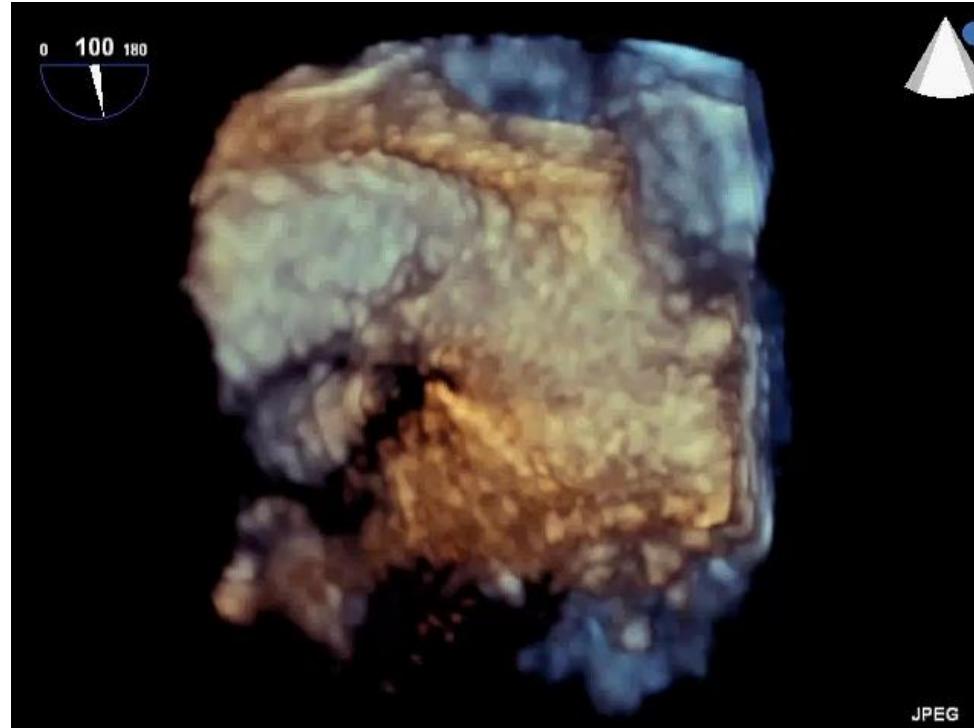
Imaging of the inter-atrial septum

RATLe-90 maneuver



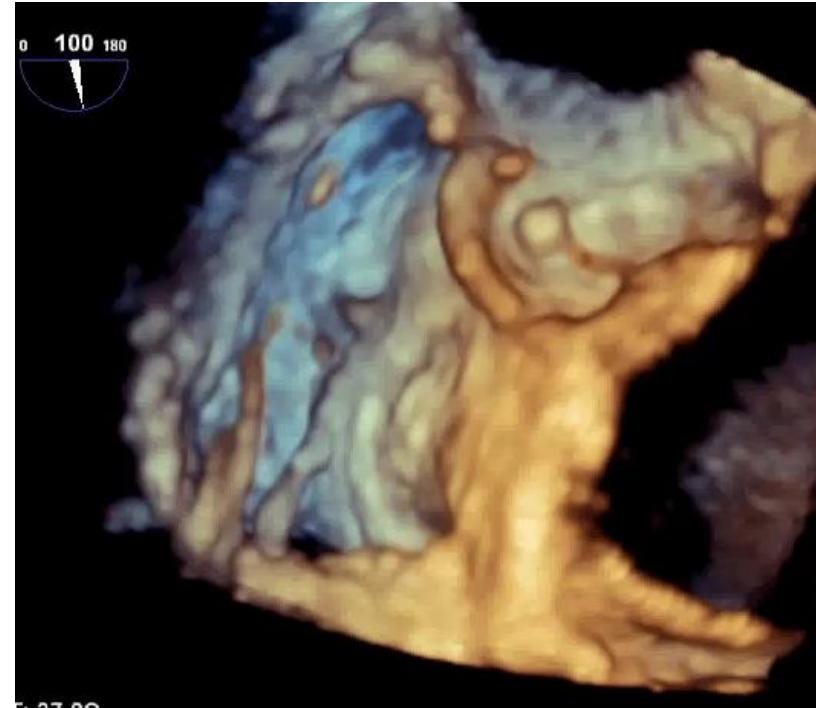
Imaging of the inter-atrial septum

RATLe-90 maneuver



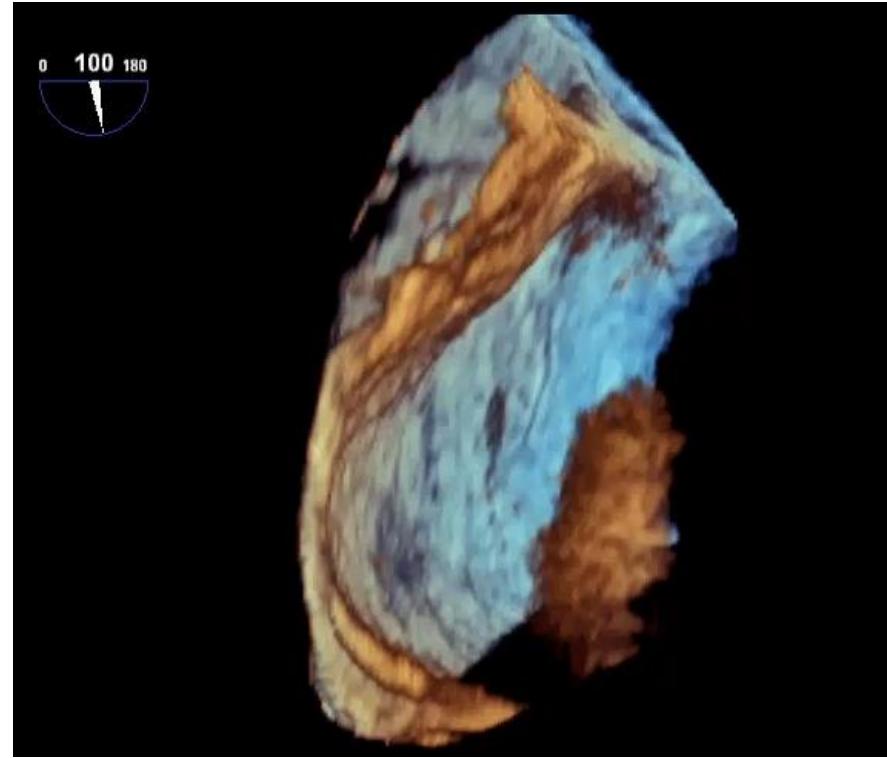
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RATLe-90 maneuver



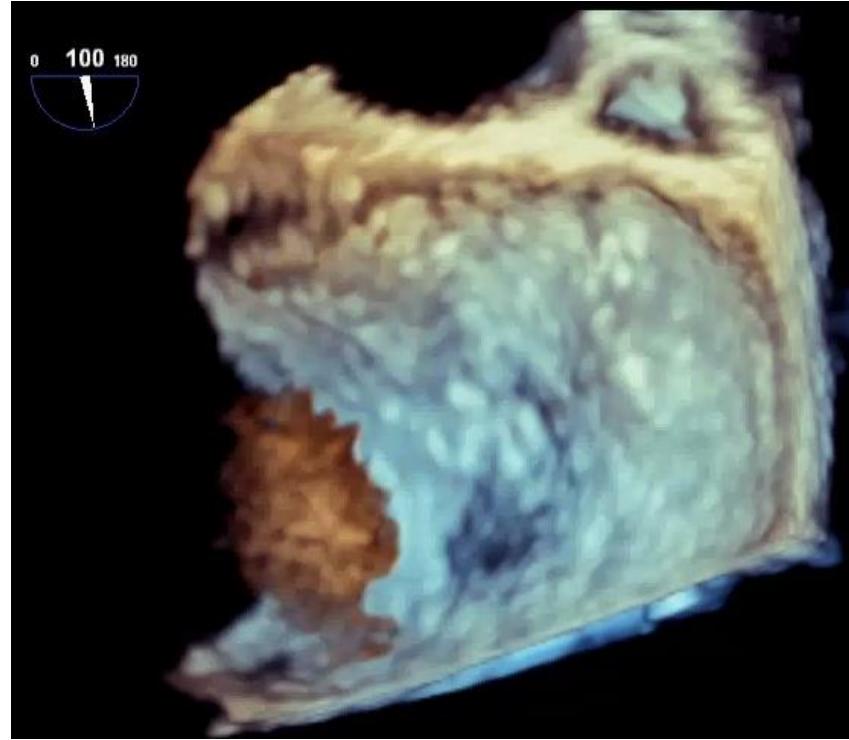
Imaging of the inter-atrial septum

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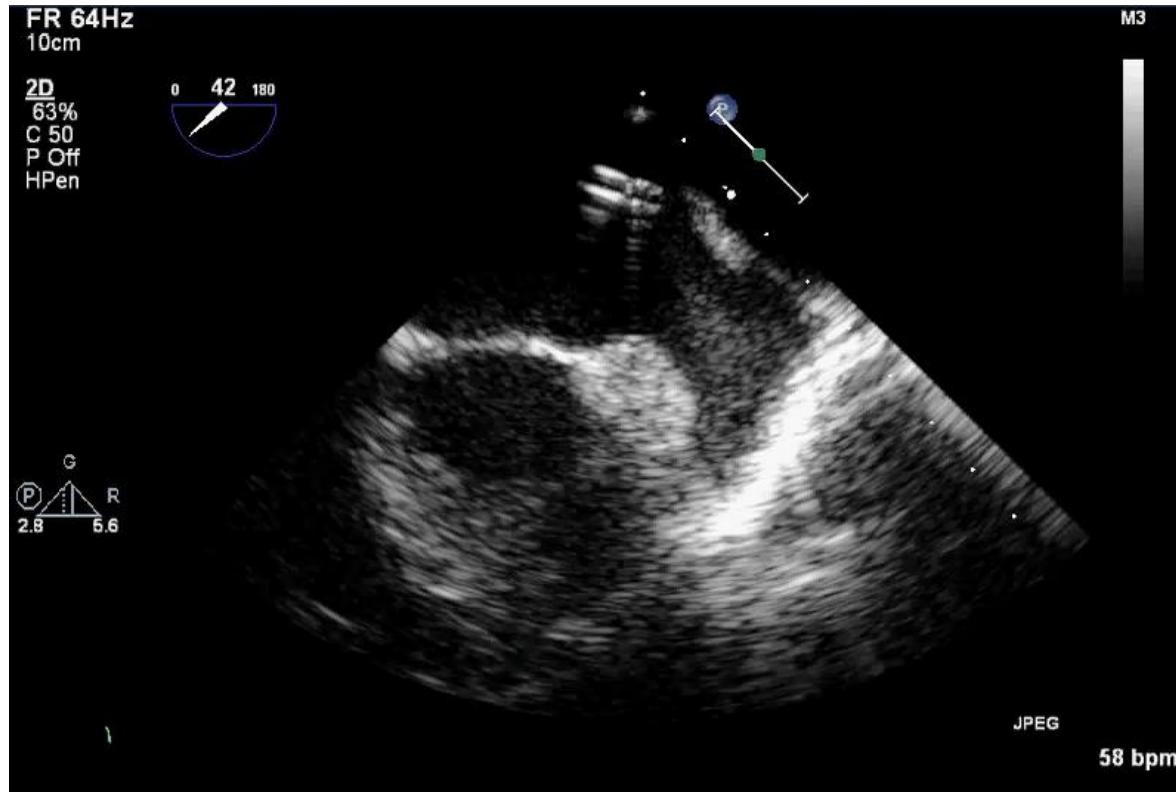
RATLe-90 maneuver



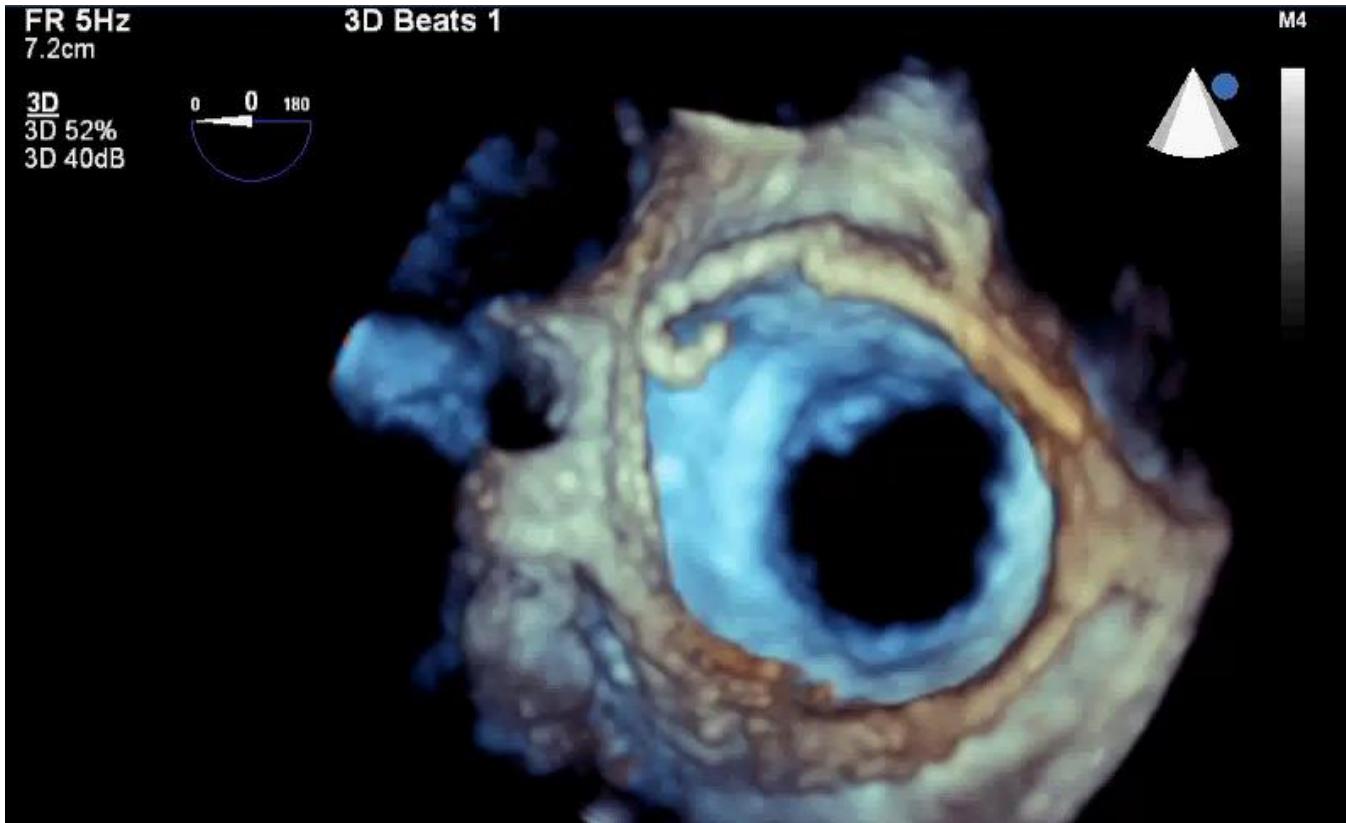
Septal Puncture



Sheath introduction



Wiring the pulmonary vein



Wiring the pulmonary vein



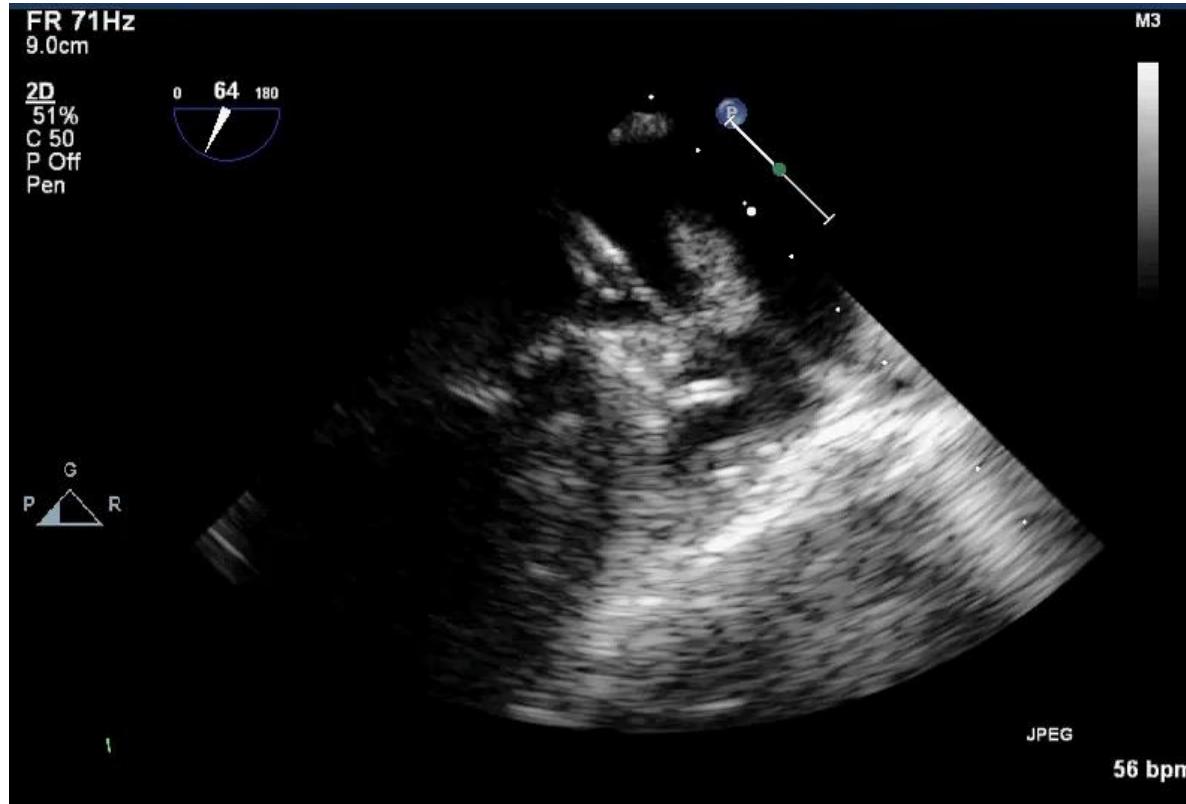
Introducing the Pig-tail catheter



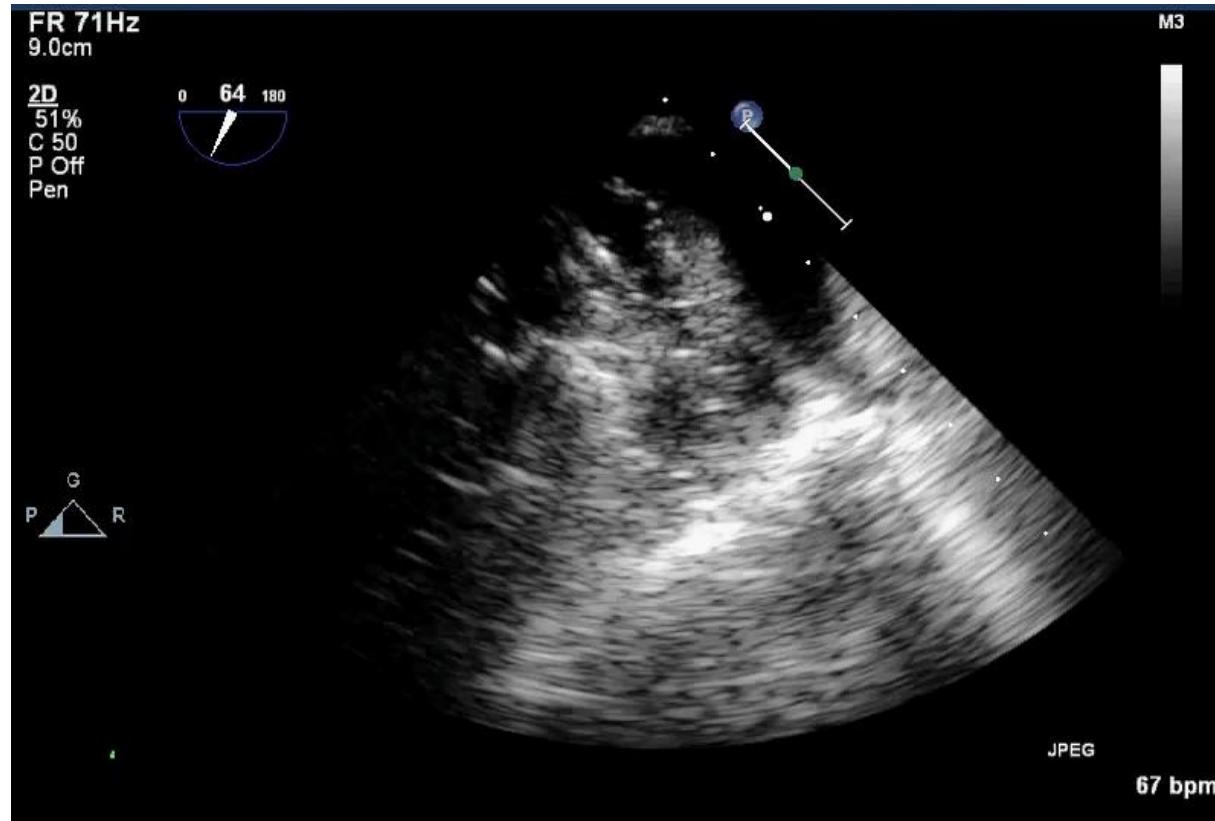
Pigtail catheter in LAA



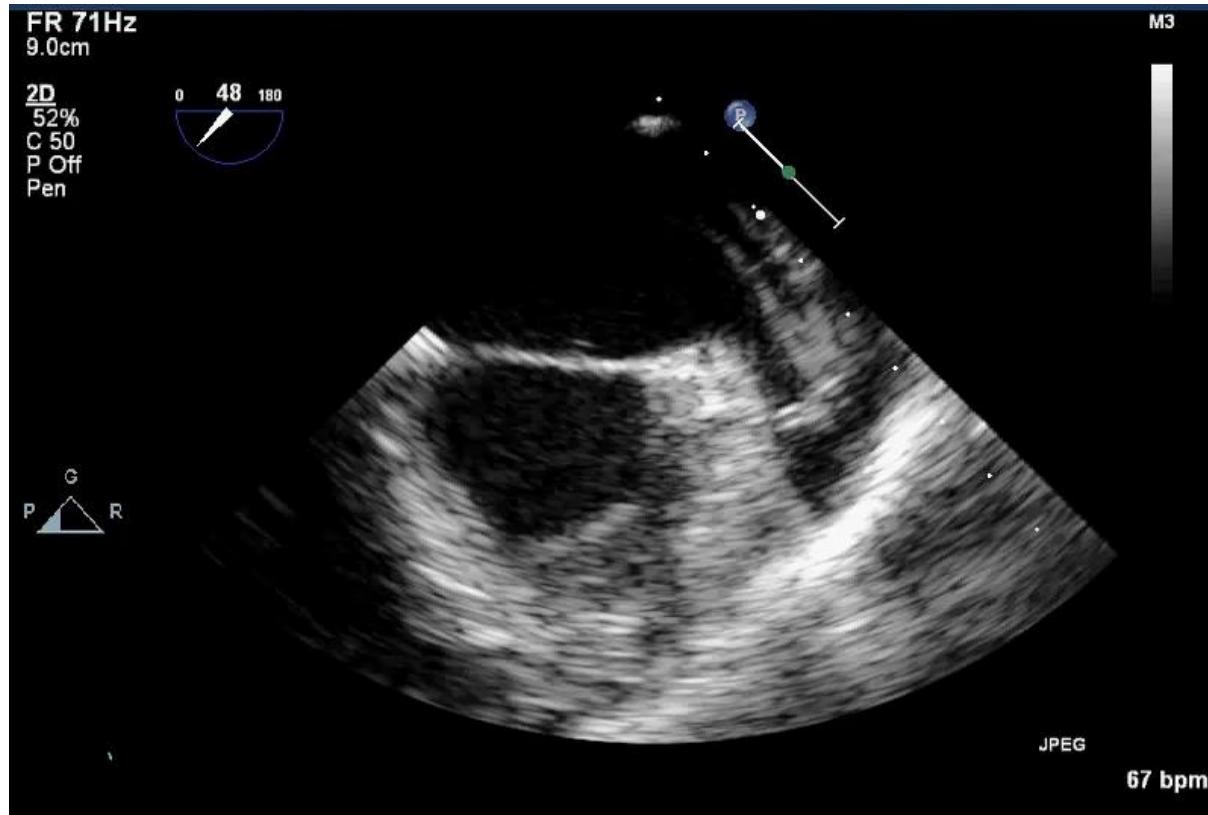
Pigtail catheter in LAA



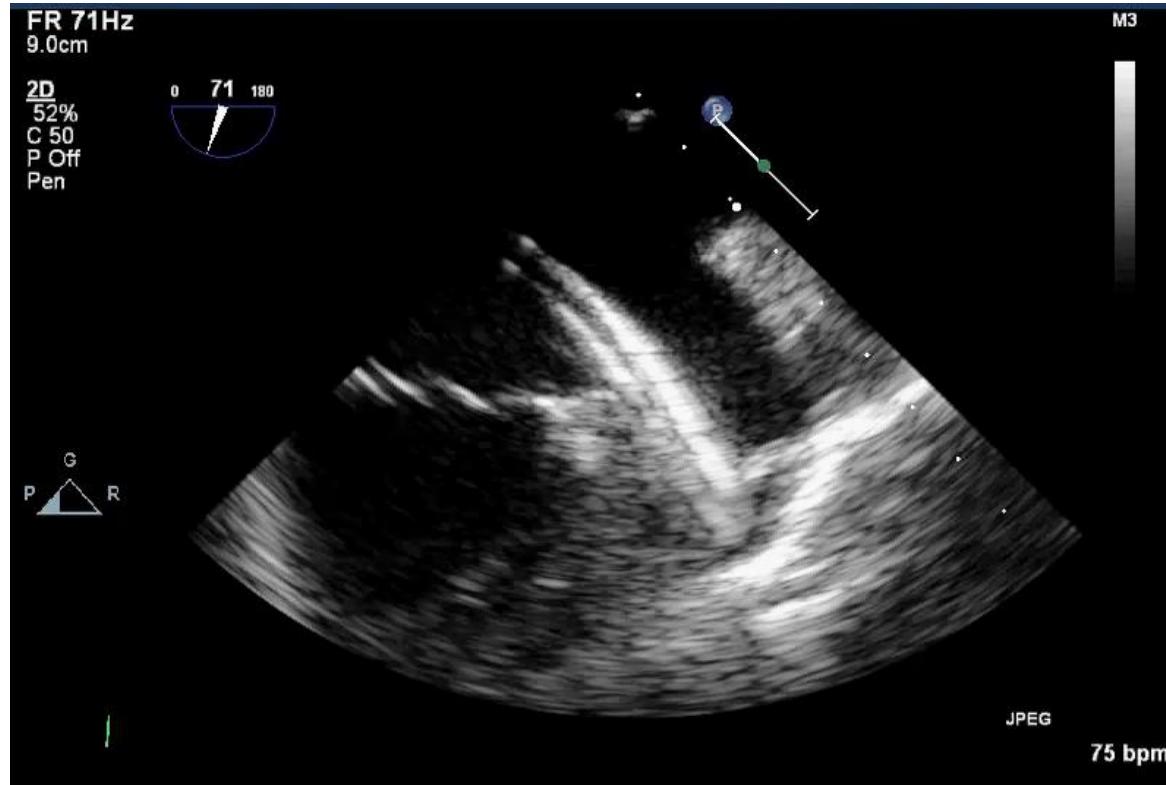
Contrast to measure dimensions by fluoroscopy



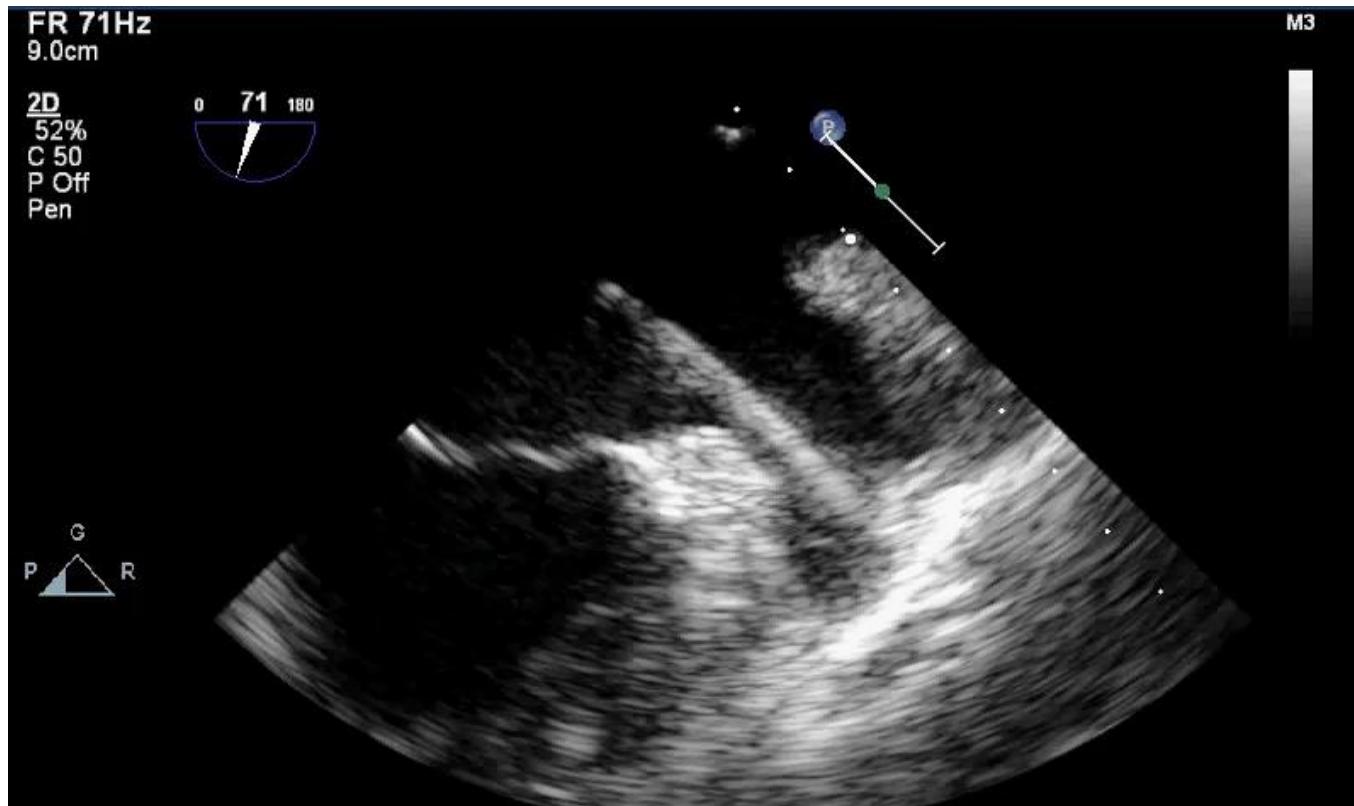
Sheath introduction into the LAA



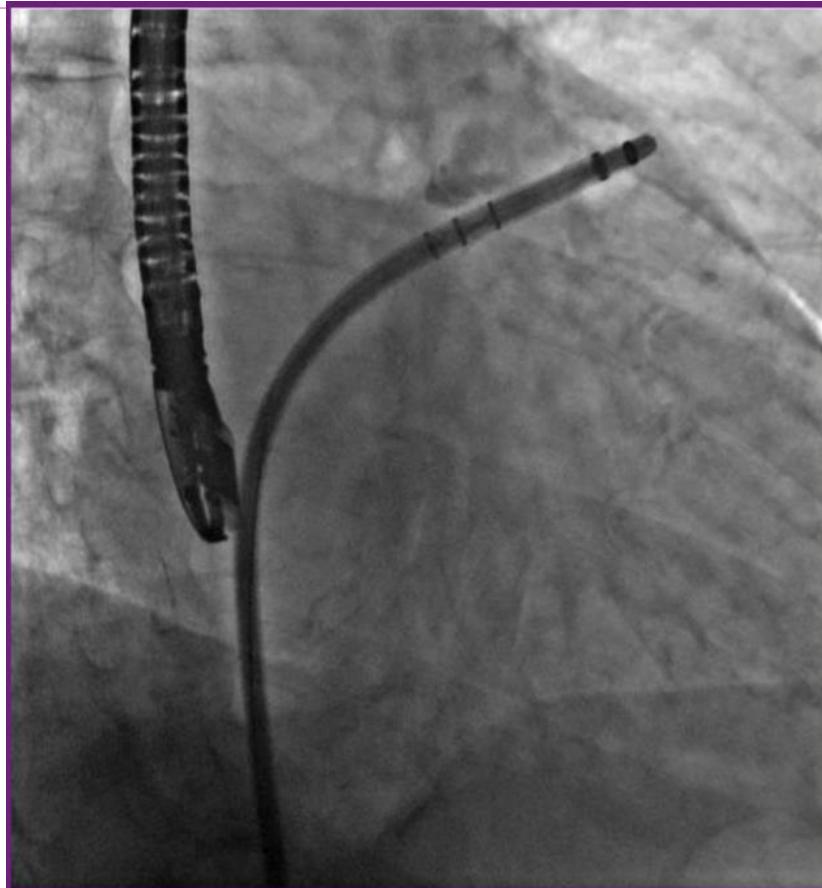
Sheath introduction into the LAA



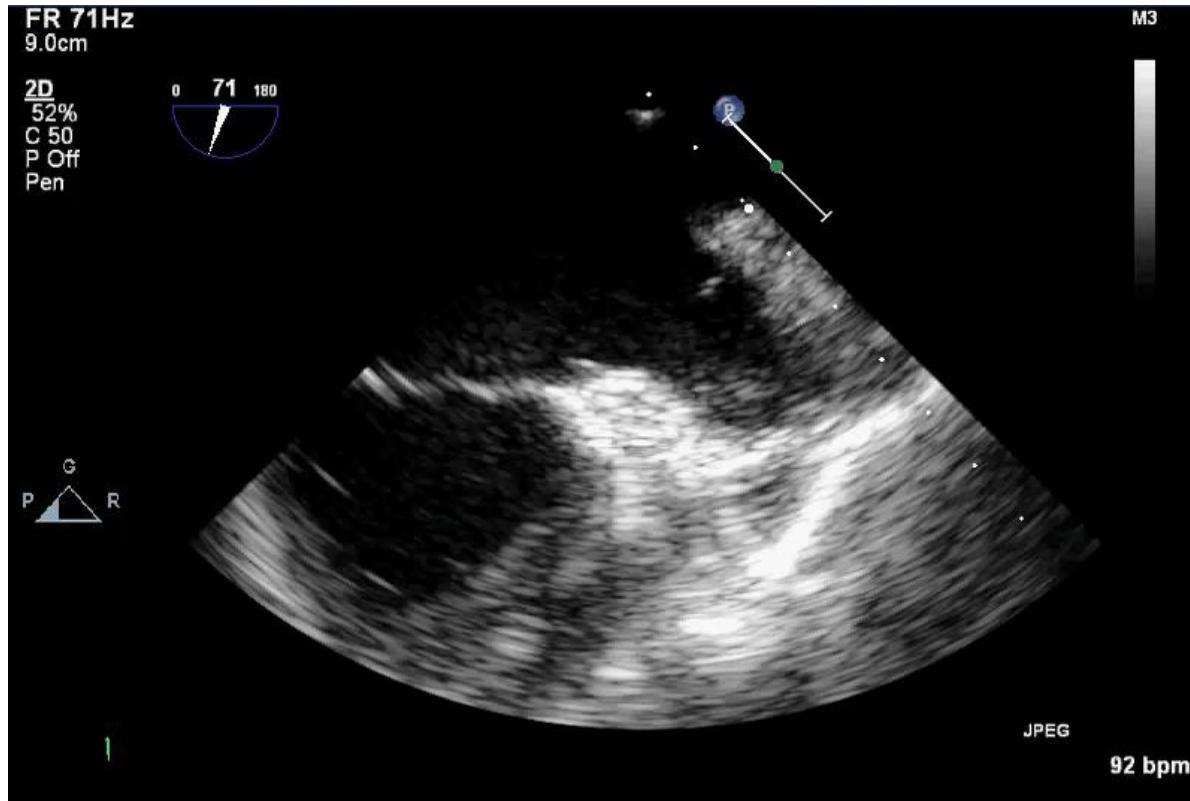
Sheath introduction into the LAA



Align the device inside the sheath under fluoroscopy



Pulling the sheath out to deploy the device



Assessment of the device before release

Device Release Criteria



All criteria must be met prior to device release (PASS)

Position – device is distal to or at the ostium of the LAA

Anchor – fixation anchors engaged / device is stable

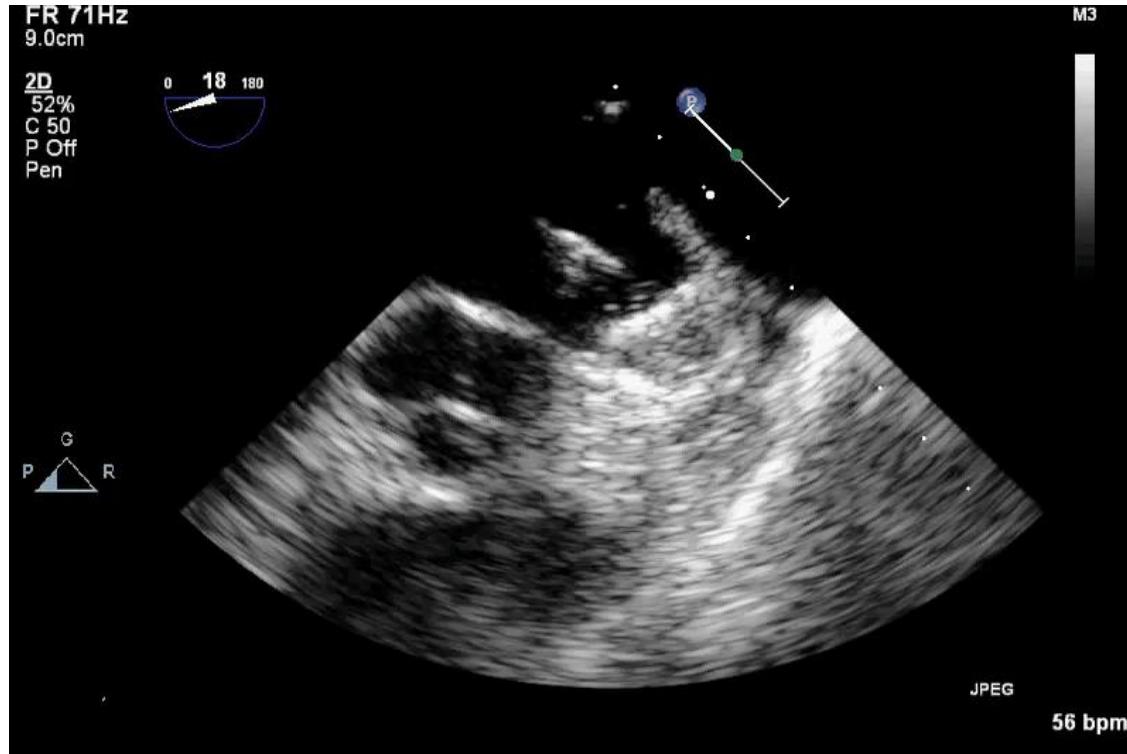
Size – device is compressed 8-20% of original size

Seal – device spans ostium, all lobes of LAA are covered

– If necessary, device can be recaptured (partial or full)

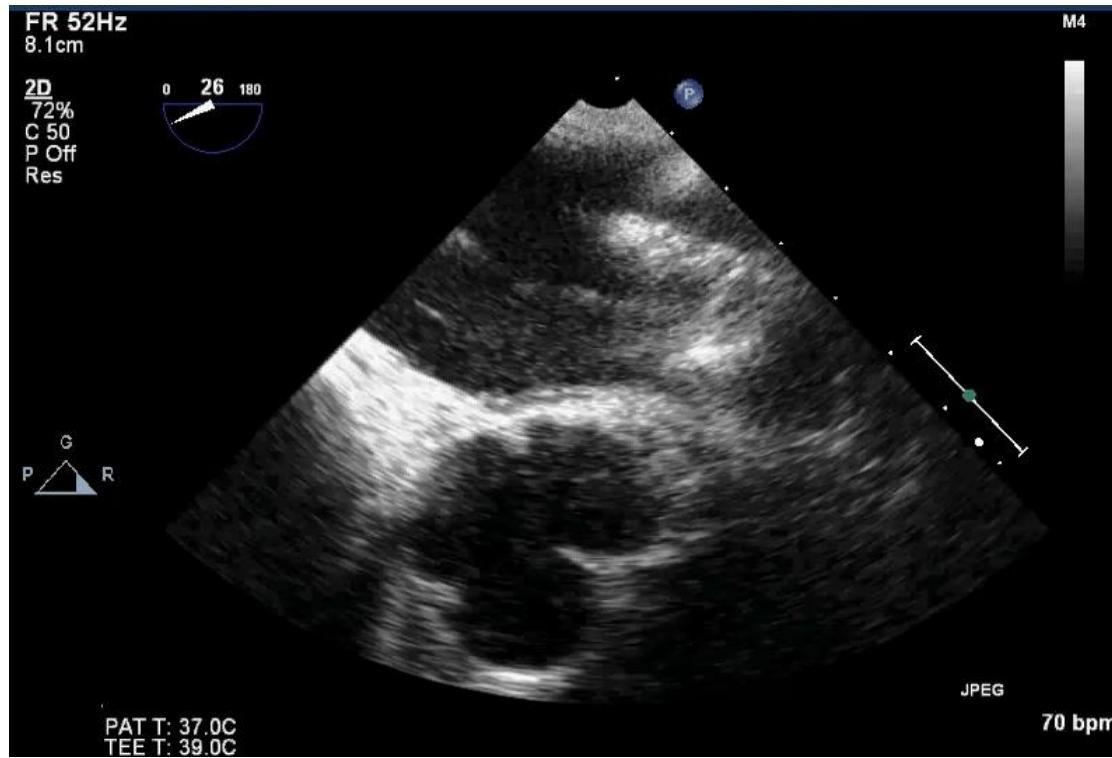
Assessment of the device before release

P: Position



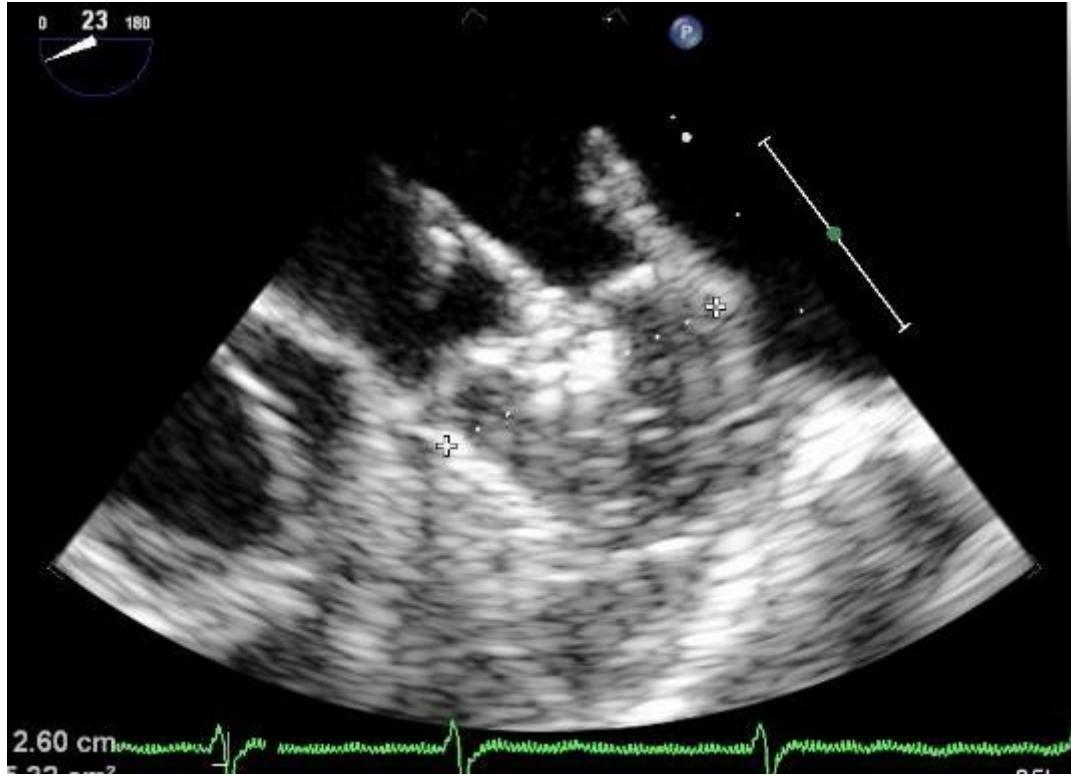
Assessment of the device before release

A: Anchor Tug test



Assessment of the device before release

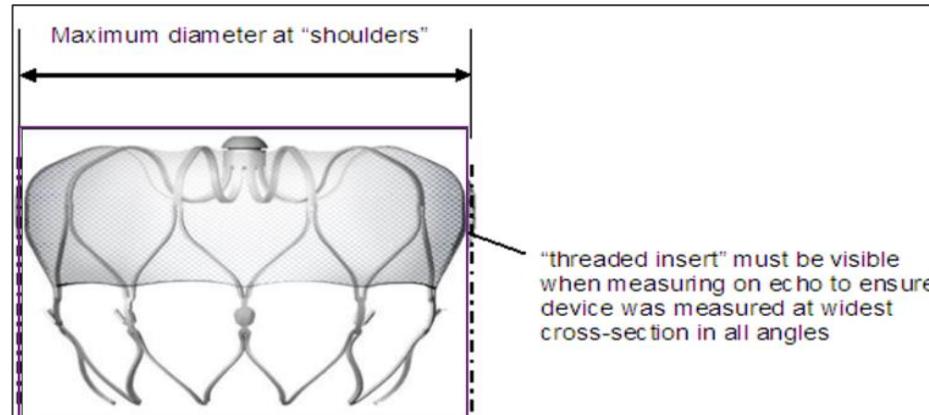
S: Size
Compression



Assessment of the device before release

S: Size Compression

Device Size <i>(uncompressed diameter)</i>	Maximum (20%) Compression Measured Diameter*	Minimum (8%) Compression Measured Diameter*
21	16.8 mm	19.3 mm
24	19.2 mm	22.1 mm
27	21.6 mm	24.8 mm
30	24.0 mm	27.6 mm
33	26.4 mm	30.4 mm

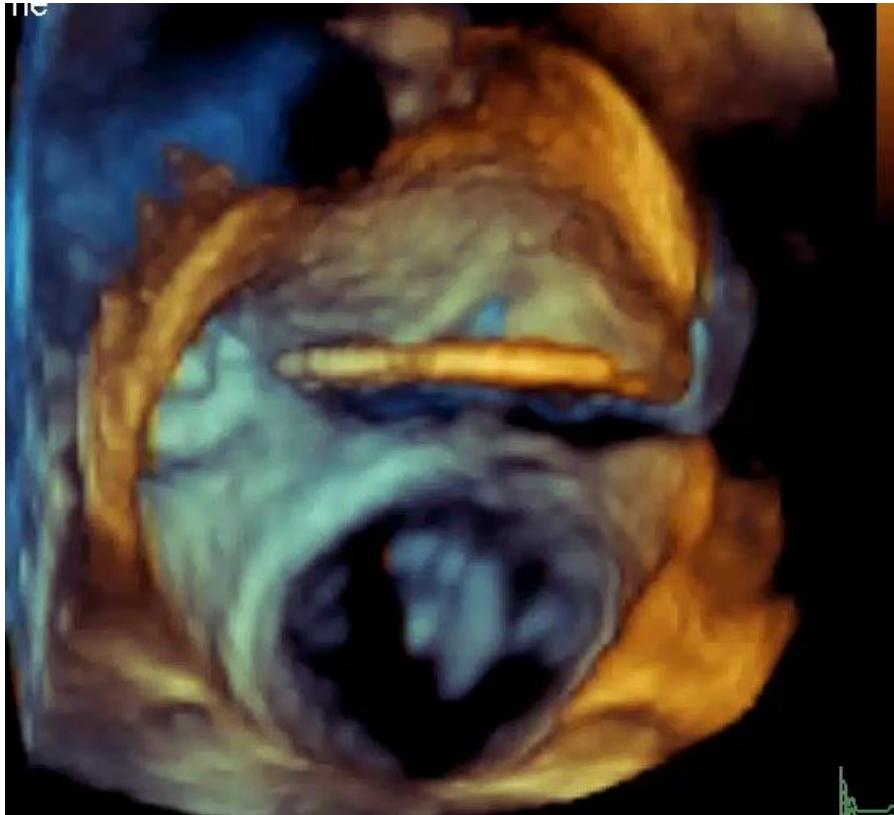


Assessment of the device before release

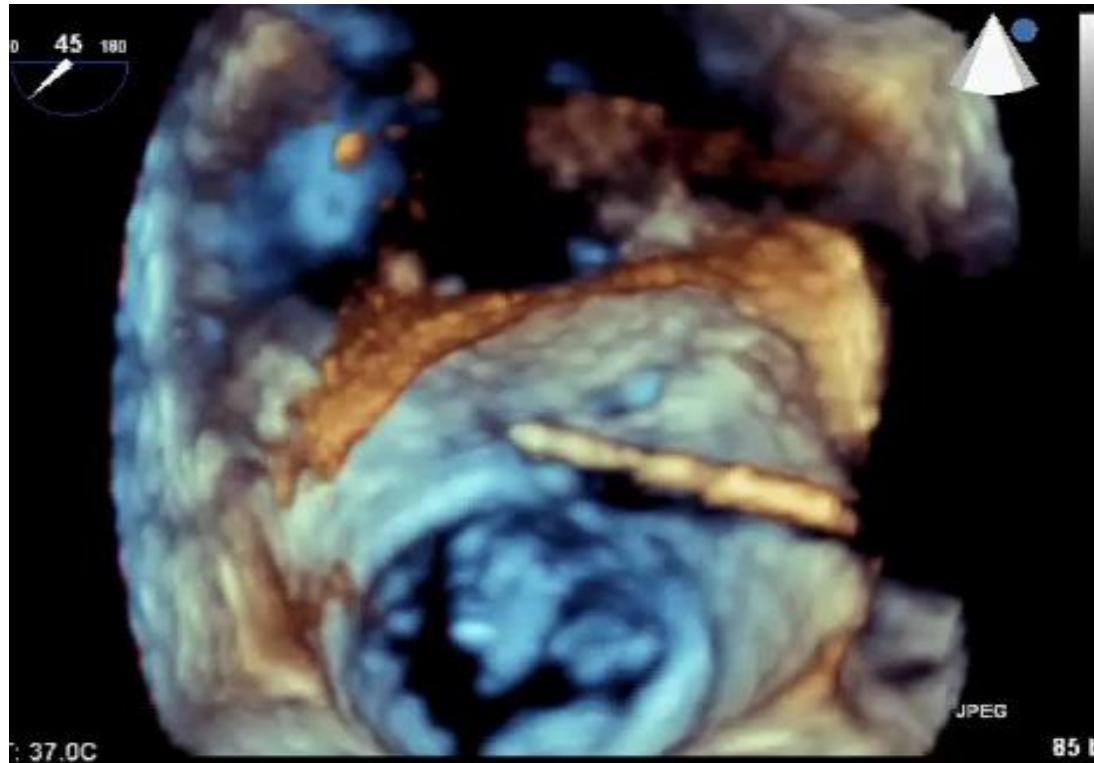
S: Seal



Device release



Device release



Final result



Check for complications

- Pericardial effusion & Tamponade (LAA perforation)
 - Check on regular intervals

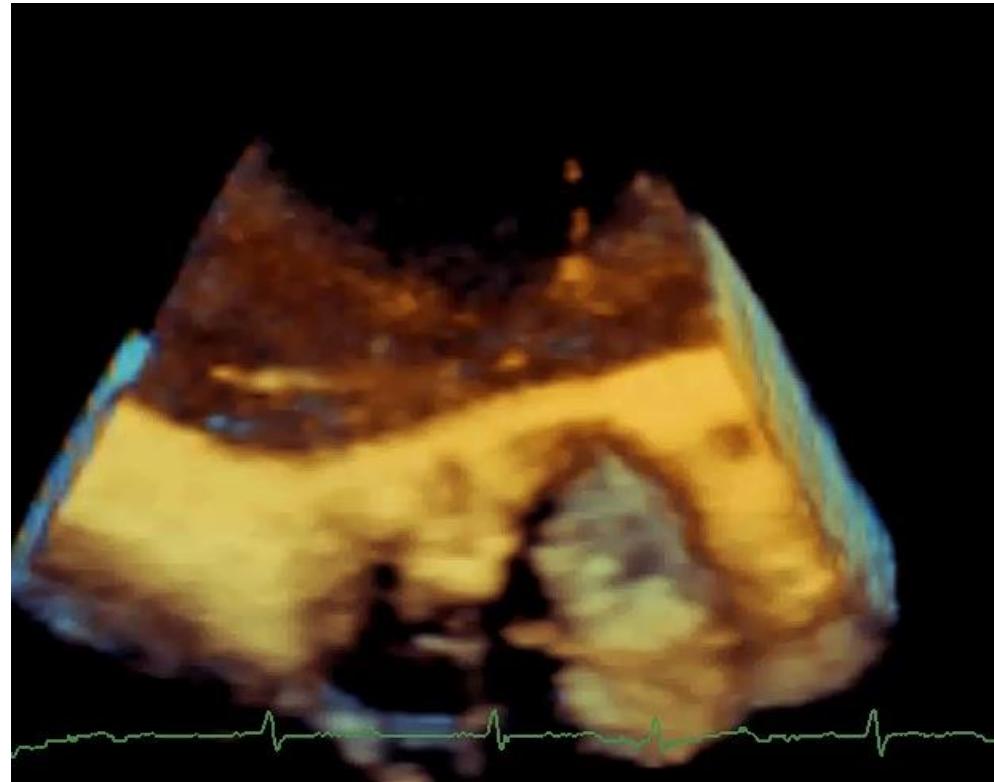
Check for complications

- Thrombosis



Check for complications

- Thrombosis



Conclusion

- **2D/3D-TEE is crucial before & during most of the steps of the ASD& LAA closure procedure.**
- **3D-TEE has an incremental value during many steps of the procedure due to:**
 - its ability to provide informative wide angle 3D views of the LAA, IAS & LA
 - Provides important measurements in extraordinary axes.
- **Creates a common language between the interventionist & the echocardiographer which makes the procedure easier & faster.**



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- ✓ Strain & Speckle Tracking
- ✓ Offline analysis Tutorials

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^ 2D/3D TRANS-ESOPHAGEAL ECHOCARDIOGRAPHY & SPECKLE TRACKING 1/11

- ▶ 1.1 TEE probe manipulation and intubation 10 min ✓

- ▶ 1.2 2D-Trans-esophageal Echocardiography "2D-TEE" (Basic Views) 41 min ✓

- ▶ 1.3 3D-Trans-esophageal Echocardiography "3D-TEE" (Image acquisition & display) Part 1 39 min ✓

- ▶ 1.4 3D-Trans-esophageal Echocardiography "3D-TEE" (Image acquisition & display) Part 2 33 min ✓

- ▶ 1.5 2D/3D-TEE in Aortic Valve disease (Stenosis & Regurgitation) 33 min ✓

- ▶ 1.6 2D/3D-TEE in Mitral Stenosis 13 min ✓

- ▶ 1.7 2D/3D-TEE in Mitral Regurgitation 33 min ✓

- ▶ 1.8 Mitral valve prolapse (Diagnosis, 3D Echo added values, what does the surgeon need to know) 27 min ✓

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- ▶ 1.11 2D/3D-TEE in Atrial Septal defects "ASD" (Diagnosis & guiding percutaneous closure) 36 min ✓

TEE probe manipulation and intubation

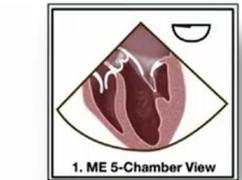


2D/3D TRANS-ESOPHAGEAL ECHOCARDIOGRAPHY & 1/11
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2D-trans-Esophageal Echocardiography (Basic views)

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Transducer Angle:
~ 0 - 10°
Level: Mid-esophageal
Maneuver (from prior image): NA

Aortic valve
LVOT
Left atrium/Right atrium
Left ventricle/Right ventricle/IVS
Mitral valve ($A_1A_2-P_1P_2$)
Tricuspid valve



Dr. Hani Mahmoud Elsayed



Hani MAHMOUD-ELSAYED (Aswan - EG)



2D/3D TRANS-ESOPHAGEAL ECHOCARDIOGRAPHY & SPECKLE TRACKING 1/11

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3D TEE (Image acquisition and display)

Mitral Valve



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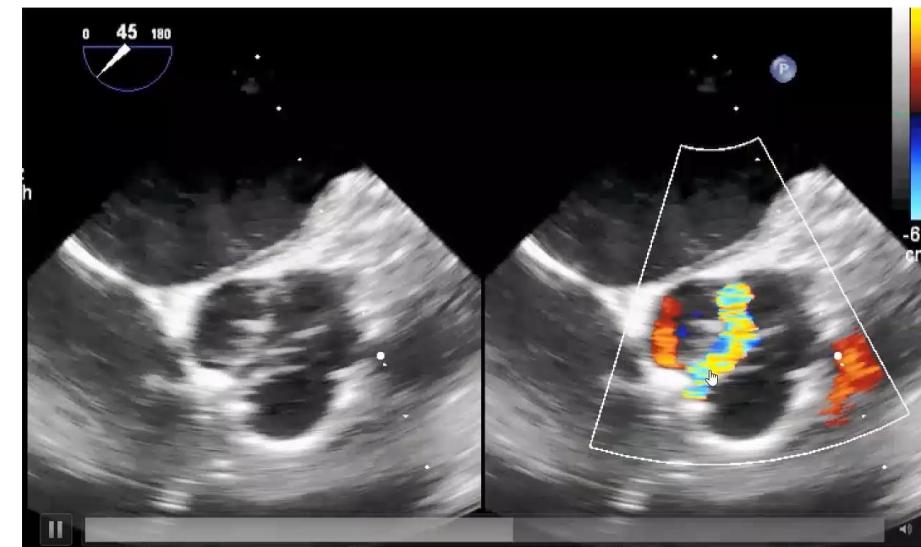
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2D/3D-TEE in Aortic Valve Disease

BAV



INTERVENTIONAL 2D/3D TRANS-ESOPHAGEAL ECHOCARDIOGRAPHY

0/7

- 2.1 How to image the inter-atrial septum using 3D-TEE -RATLe-90 maneuver 11 min

- 2.2 2D/3D-TEE in Left Atrial Appendage Closure (Watchman device) 21 min

- 2.3 2D/3D-TEE in TAVI procedure 25 min

- 2.4 2D/3D-TEE in Mitral Valve-in-Valve procedure 16 min

- 2.5 2D/3D-TEE in MitraClip procedure (Indication, step-by-step procedural guidance) 29 min

- 2.6 2D/3D-TEE in Mitral Para-valvular leak percutaneous closure 13 min

- 2.7 2D/3D-TEE in structural interventions (comprehensive presentation) 21 min

OFFLINE ANALYSIS TUTORIALS

0/12

- 3.1 Q-lab (Cropping tools: Conventional cropping, iCrop, Quick Vue) 11 min

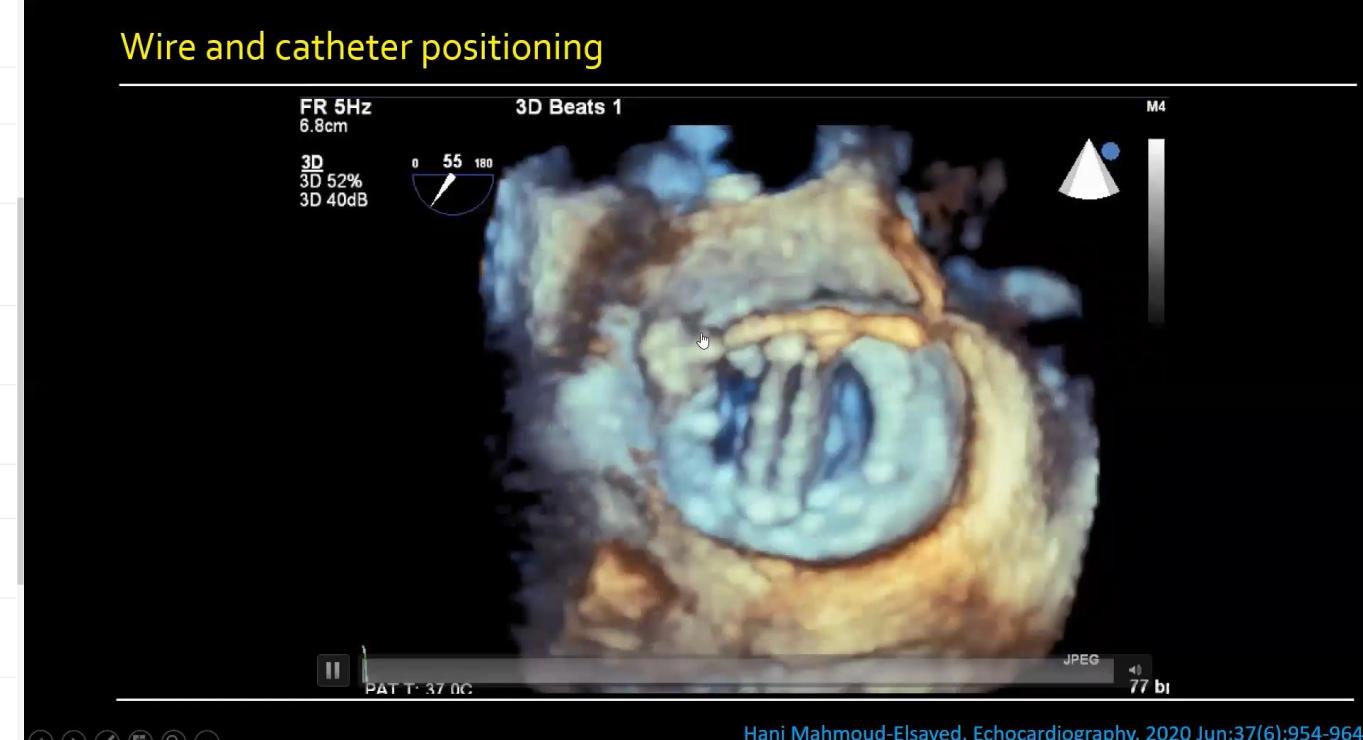
- 3.2 3D LV quantification (Q-Lab15: Offline analysis tutorial) 31 min

- 3.3 3D RV quantification (TOMTEC: Offline analysis tutorial) 07 min

- 3.4 Aortic valve & root 3D quantification (Q-Lab15: Offline analysis tutorial) 16 min

2D/3D-TEE in MV Para-Valvular Leak

Wire and catheter positioning



Hani Mahmoud-Elsayed, Echocardiography, 2020 Jun;37(6):954-964

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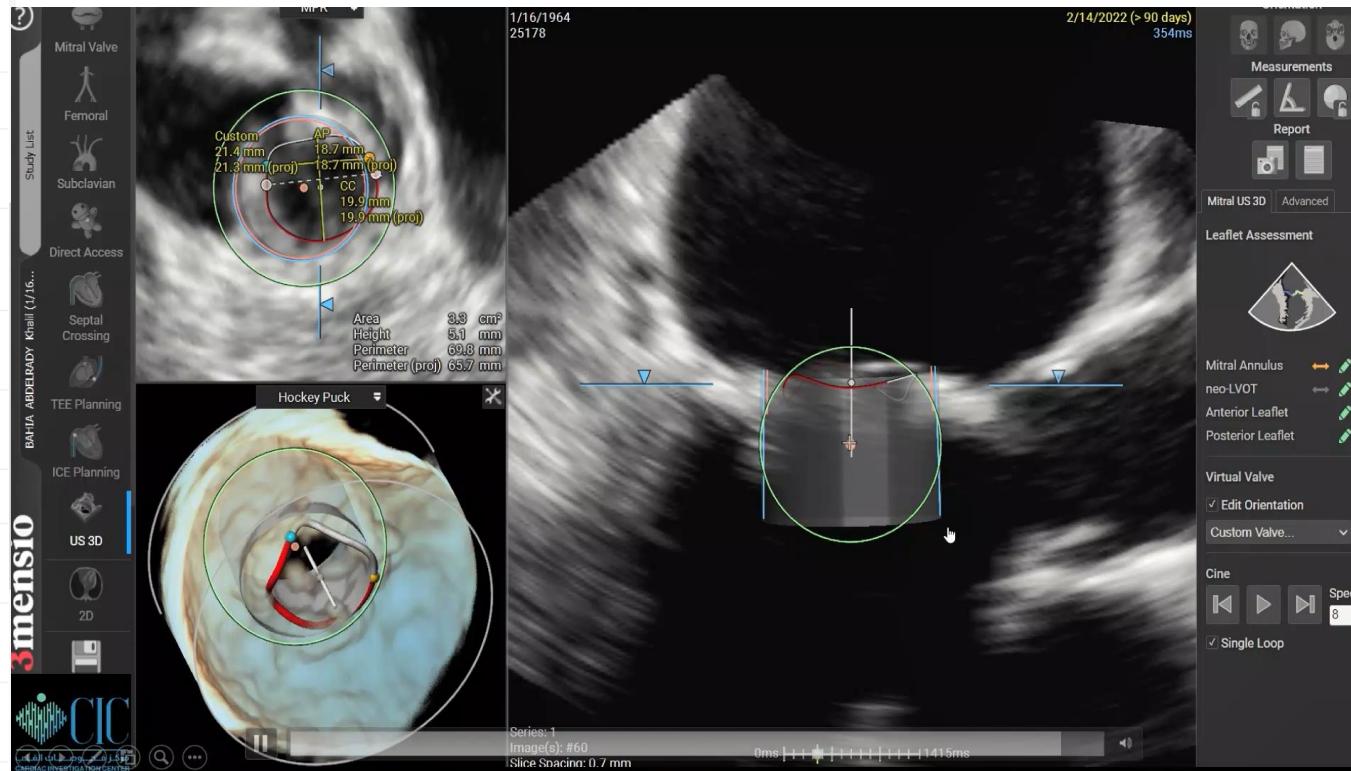
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2D/3D-TEE in Valve-in-Valve procedure



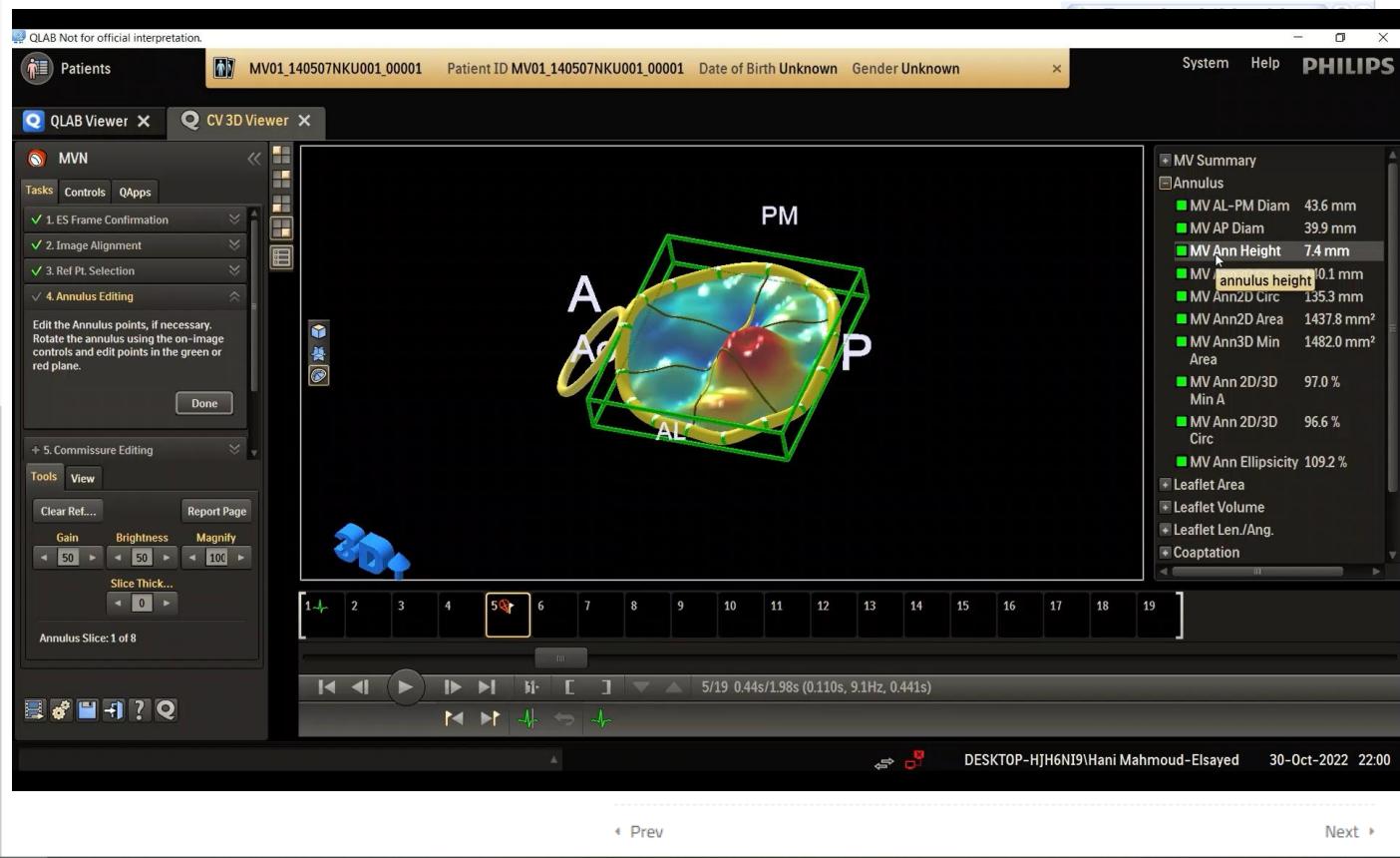
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- 3.6 3D Vena-Contracta Area (3D-VCA) quantification (Q-Lab15: Offline analysis tutorial) 08 min ✓
- 3.7 Mitral Stenosis 3D quantification (Q-Lab15: 3D-Planimetry Offline analysis tutorial) 07 min ✓
- 3.8 Mitral Stenosis 3D quantification (Q-Lab15: MVN method Offline analysis tutorial) 15 min ✓
- 3.9 LAA 3D quantification (Sizing for Watchman device closure) (Q-Lab15: Offline analysis tutorial) 13 min ✓
- 3.10 ASD 3D quantification (Q-Lab15: Offline analysis tutorial) 09 min ✓
- 3.11 2D LV Speckle-tracking (Q-Lab15/TOMTEC: Offline analysis tutorial) 10 min ✓
- 3.12 Prosthetic valve 3D quantification (PVL – Pannus- Bio-prosthetic degeneration) (Q-Lab15: Offline analysis tutorial) 09 min ✓

MV Prolapse 3D Quantification

Offline analysis (Step by Step tutorial)



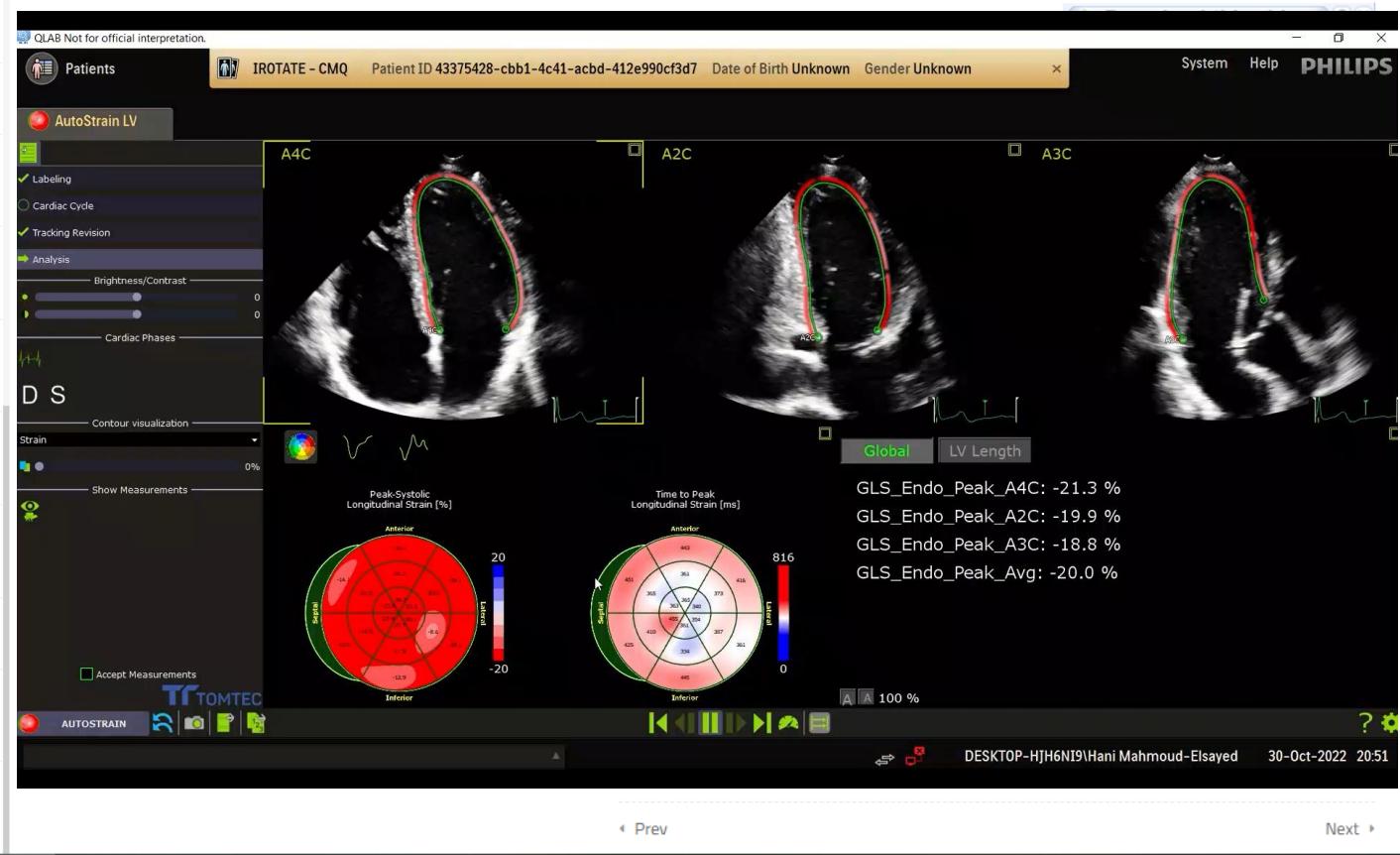
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2D LV Speckle tracking

Offline analysis (Step by Step tutorial)



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09 min ✓

- 3.11 2D LV Speckle-tracking (Q-Lab15/TOMTEC: Offline analysis tutorial)

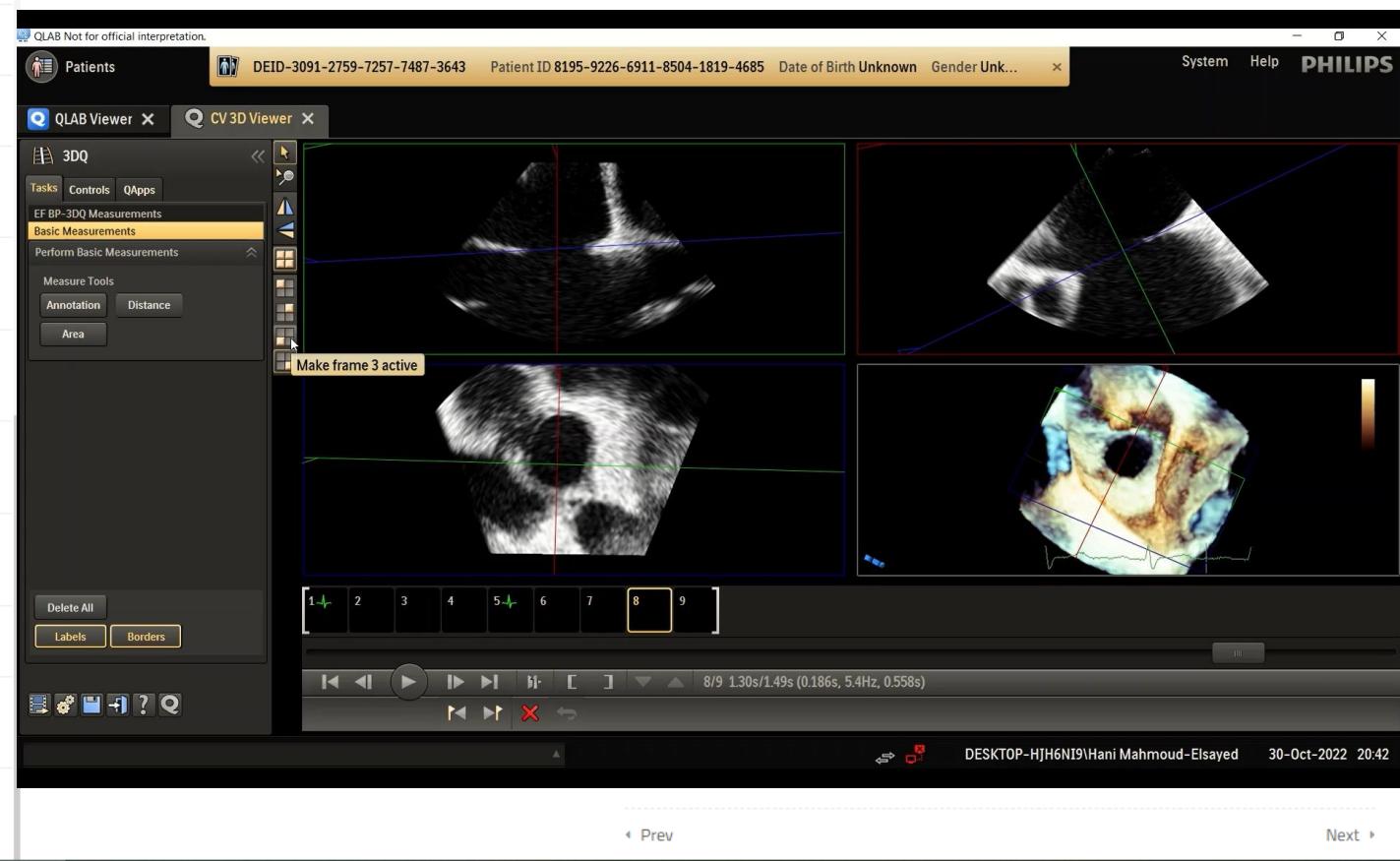
10 min ✓

- 3.12 Prosthetic valve 3D quantification (PVL – Pannus- Bio-prosthetic degeneration) (Q-Lab15: Offline analysis tutorial)

09 min ✓

ASD 3D Quantification

Offline analysis (Step by Step tutorial)



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