Routine MitraClip

Image Guidance Step by Step

Douglas C. Shook, MD, FASE
Director, Cardiothoracic Anesthesia Fellowship
Director, Cardiac Interventional Anesthesia
Department of Anesthesiology

BRIGHAM AND WOMEN'S HOSPITAL
Heart & Vascular Center

HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Disclosures

Sorin - Speaker

Edwards Lifesciences - Speaker

Objectives

By the end of the presentation, the viewer will be better able to....

- **understand the mitral anatomy as it applies to MitraClip placement.**
- **describe the key imaging steps for MitraClip placement.**
- **apply an anatomic approach to transesophageal echocardigraphic imaging for MitraClip placement.**

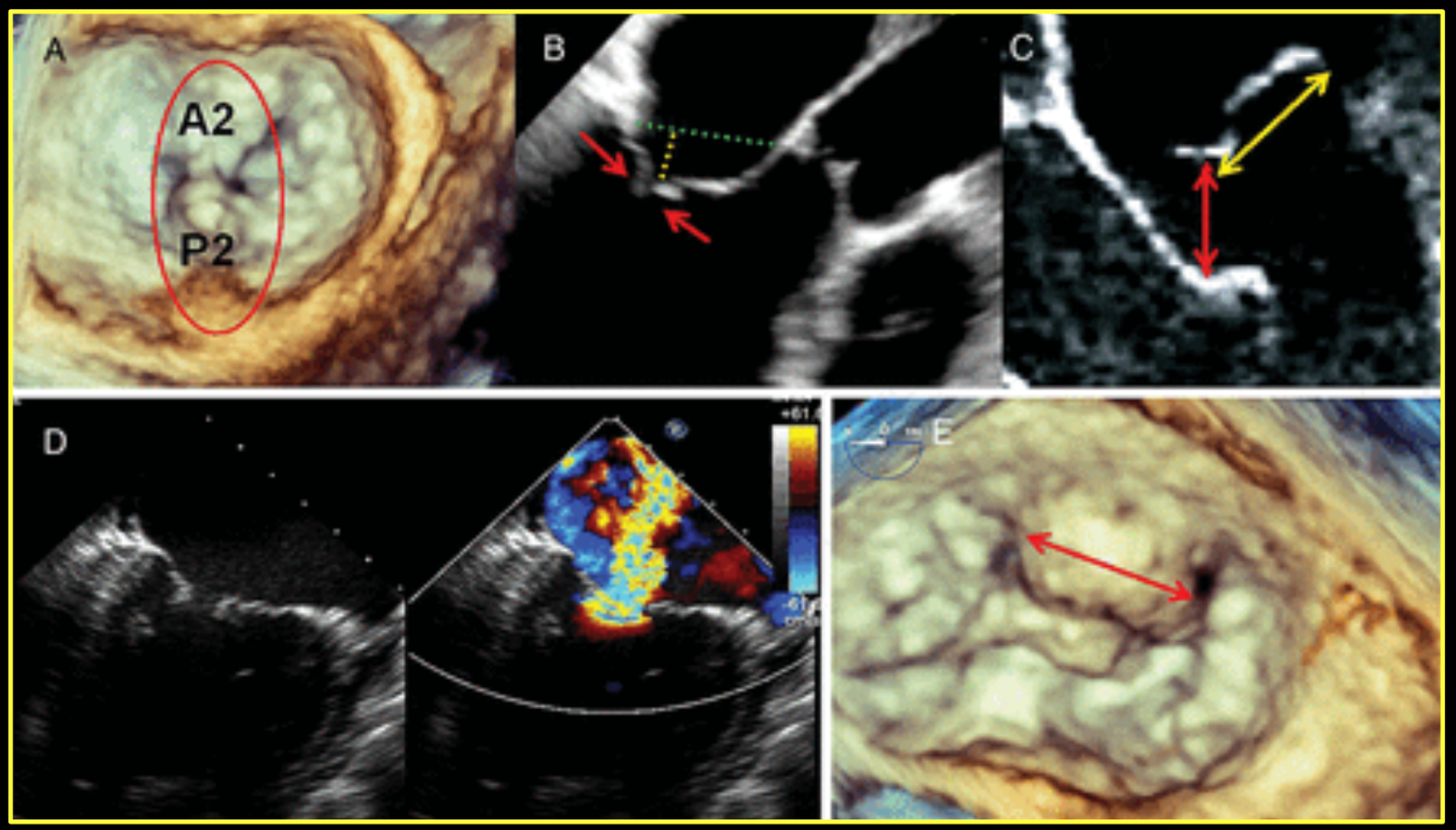
The MitraClip Procedure

The MitraClip Procedure

The MitraClip Procedure

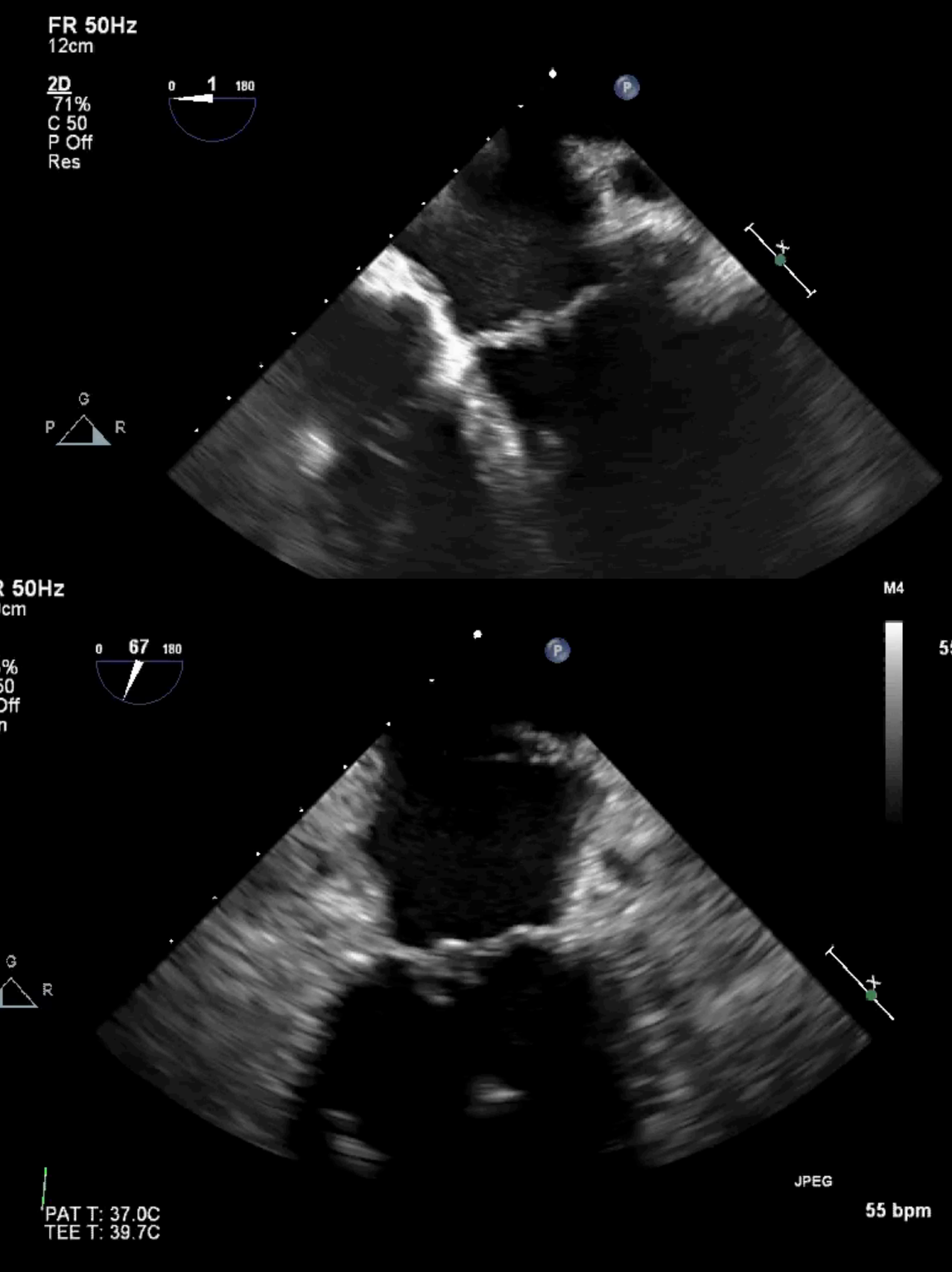
Ideal Valve Morphology

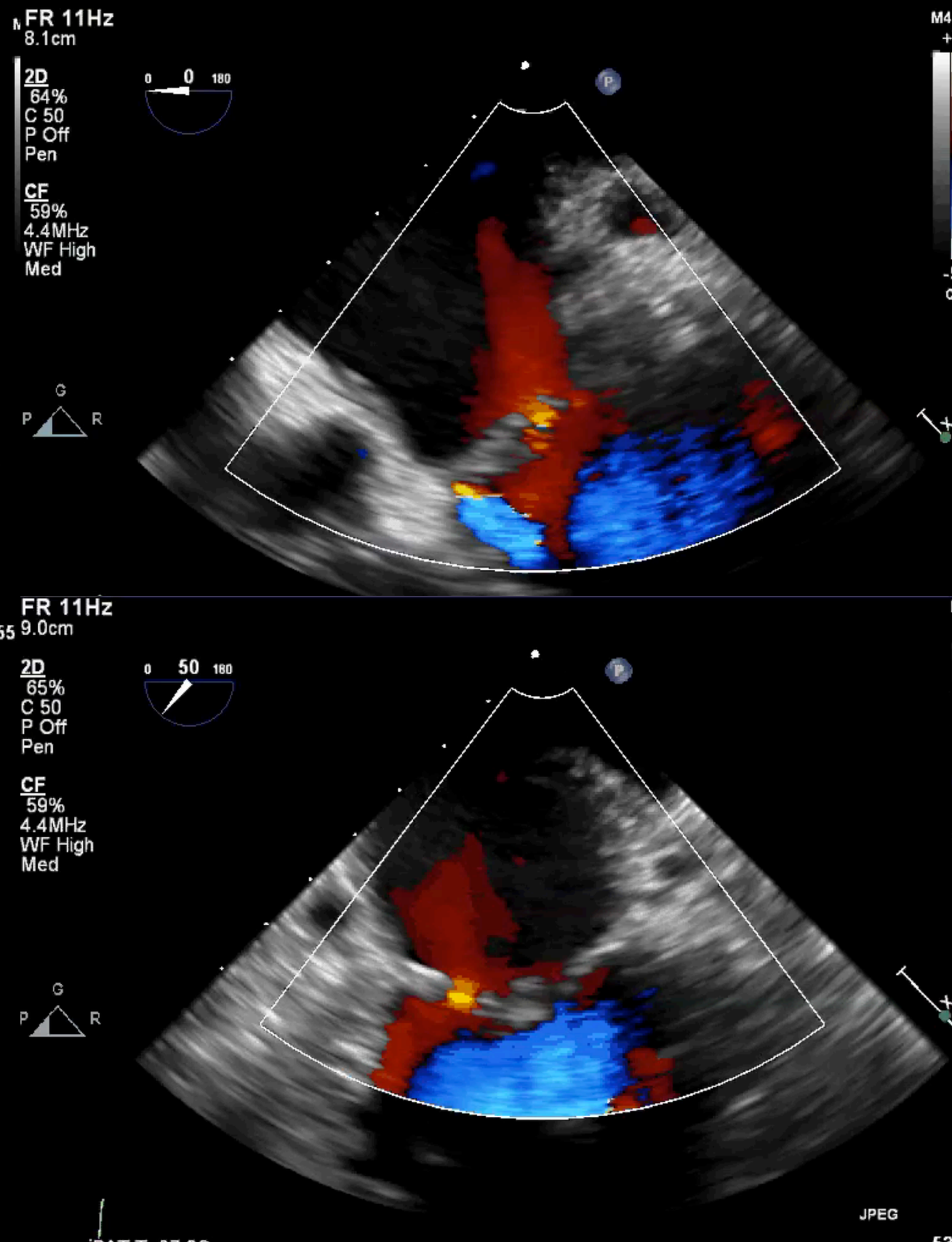
- MR originating at A2/P2 (degenerative or functional)
- Lack of Ca++ in grasping area
- MVA > 4cm^2
- PMVL > 10mm length
- Flail width <15mm
- Flail gap <10mm
- Sufficient tissue for grasping
  - Coaptation depth <11mm
  - Coaptation length >2mm



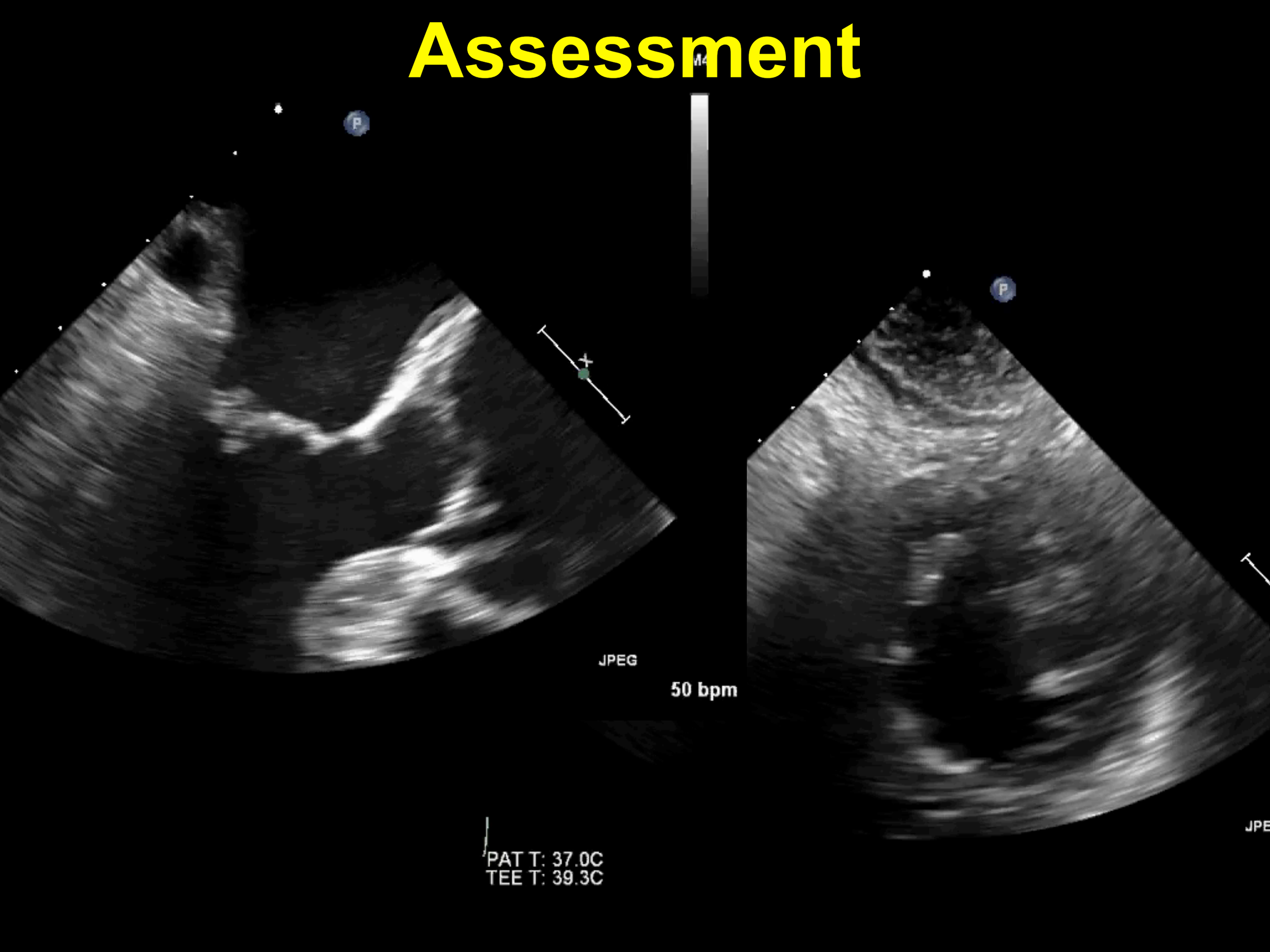
European Heart Journal – Cardiovascular Imaging (2013) **14**, 935–949

Assessment

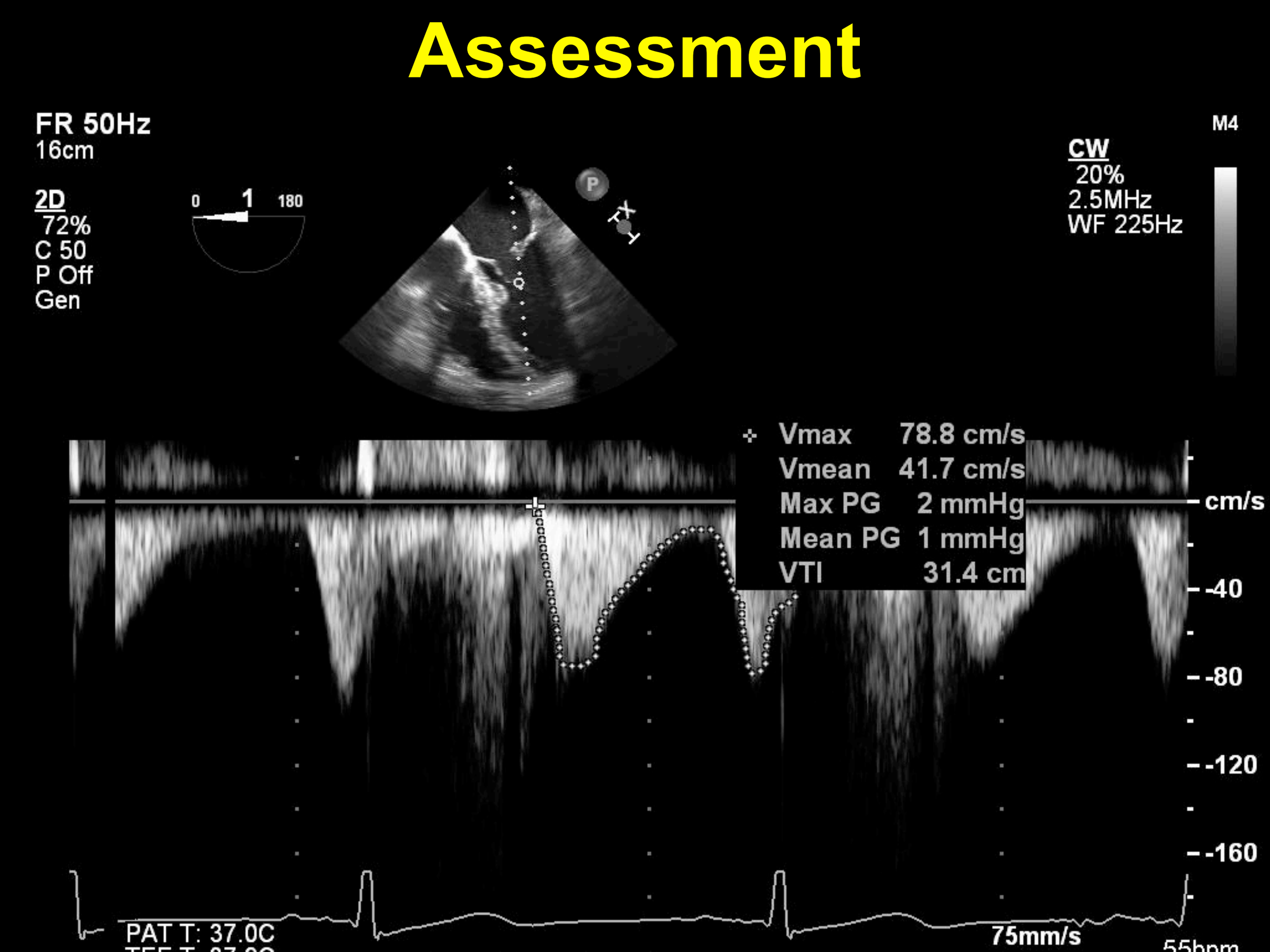

FR 50Hz
12cm
2D
71%
C 50
P Off
Res
0 1 180
M4
0 67 180
JPEG
55 bpm
PAT T: 37.0C
TEE T: 39.7C


FR 11Hz
8.1cm
2D
64%
C 50
P Off
Pen
CF
59%
4.4MHz
WF High
Med
0 0 180
M4
FR 11Hz
55 9.0cm
0 50 180
JPEG
PAT T: 37.0C

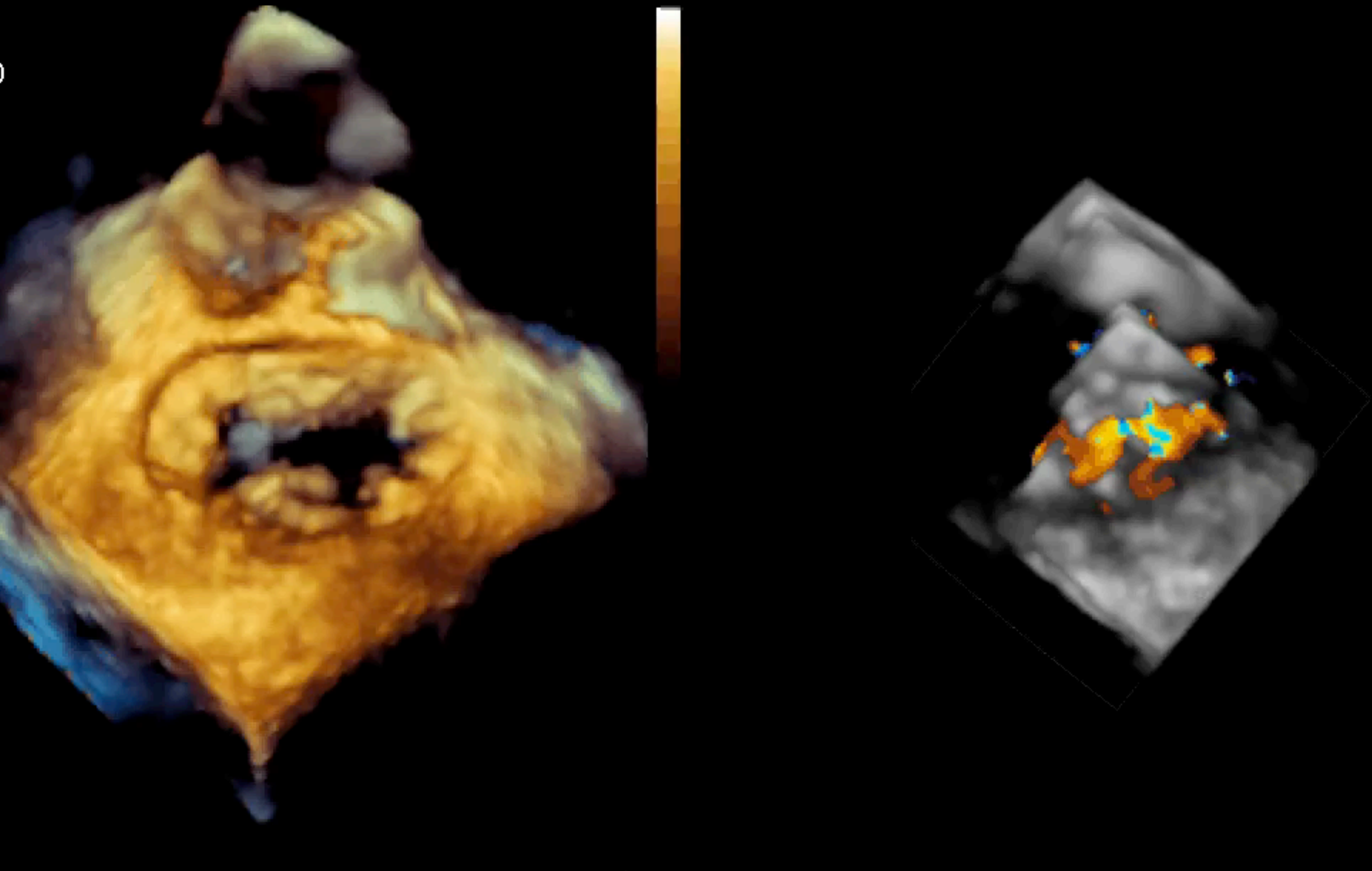
Assessment



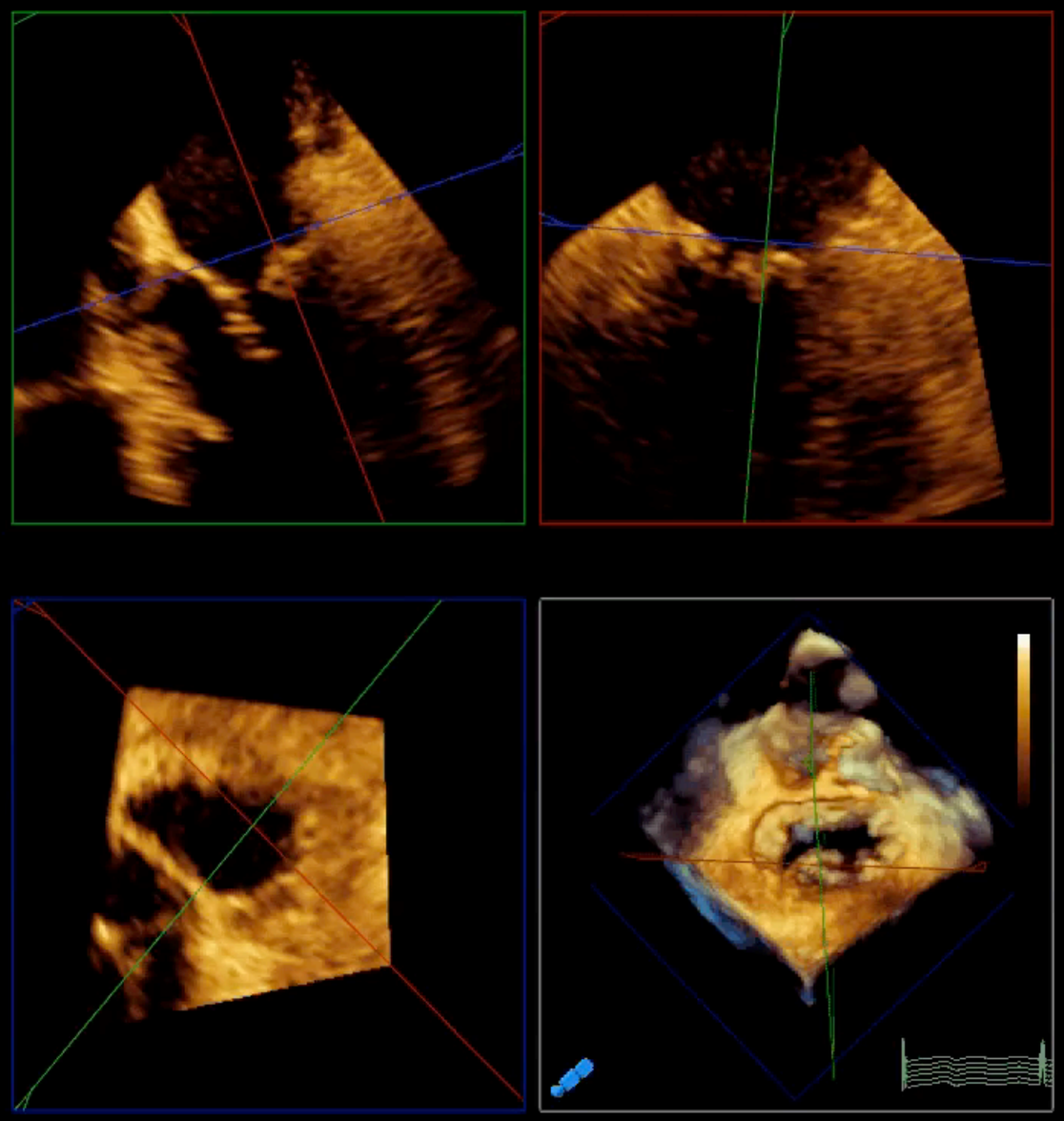
Assessment

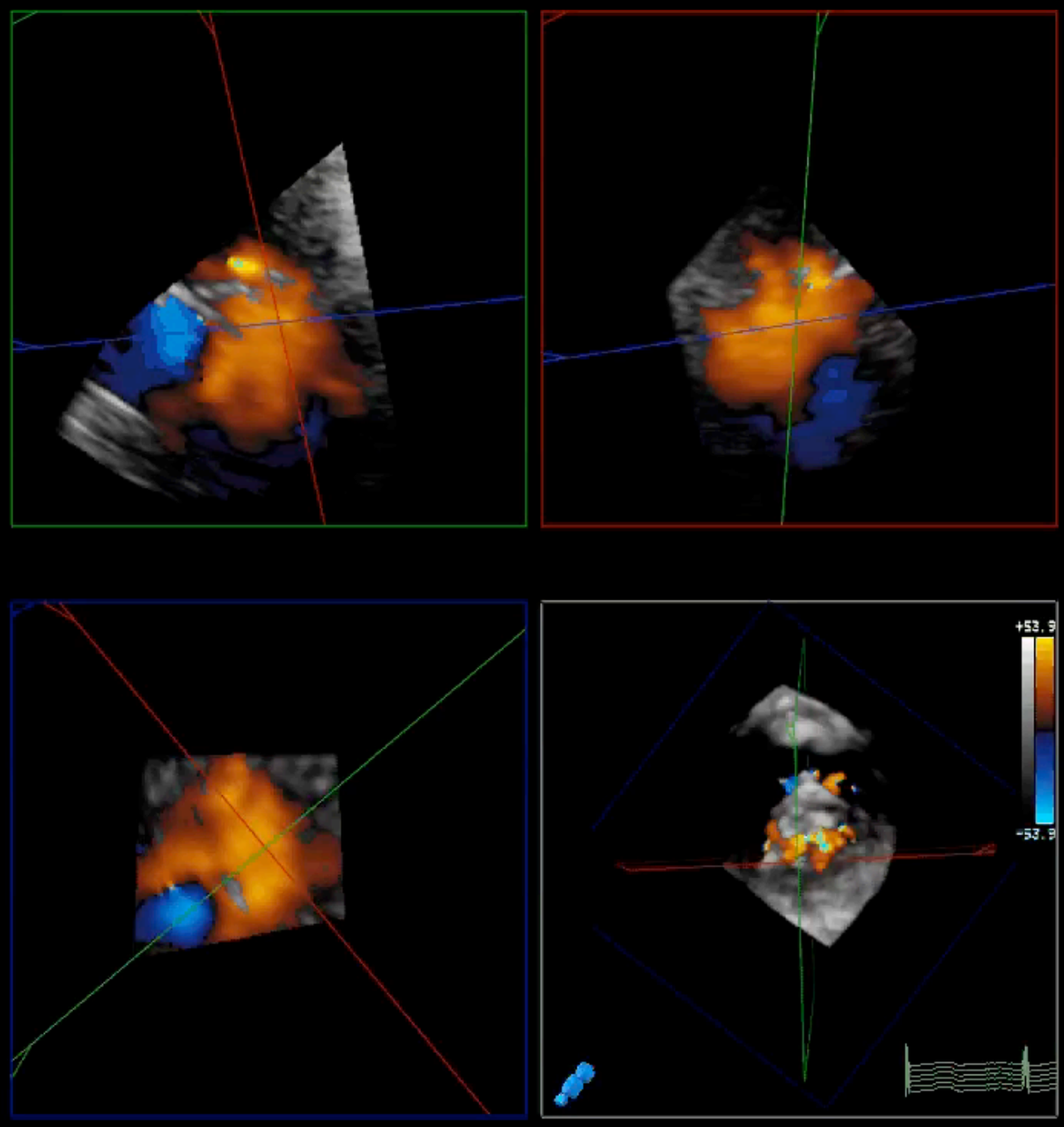

FR 50Hz
16cm
2D
72%
C 50
P Off
Gen
0
1
180
P
CW
20%
2.5MHz
WF 225Hz
M4
Vmax 78.8 cm/s
Vmean 41.7 cm/s
Max PG 2 mmHg
Mean PG 1 mmHg
VTI 31.4 cm
cm/s
-40
-80
-120
-160
PAT T: 37.0C
75mm/s
55bpm

Assessment

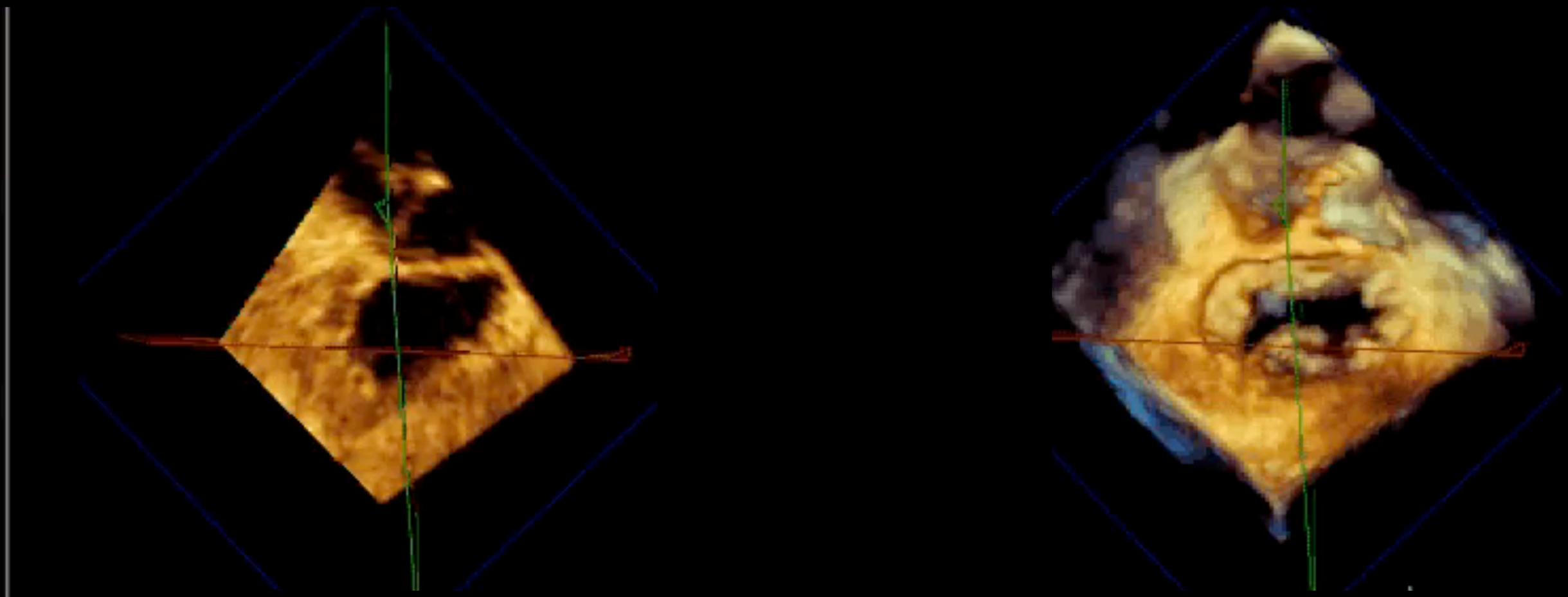


Assessment

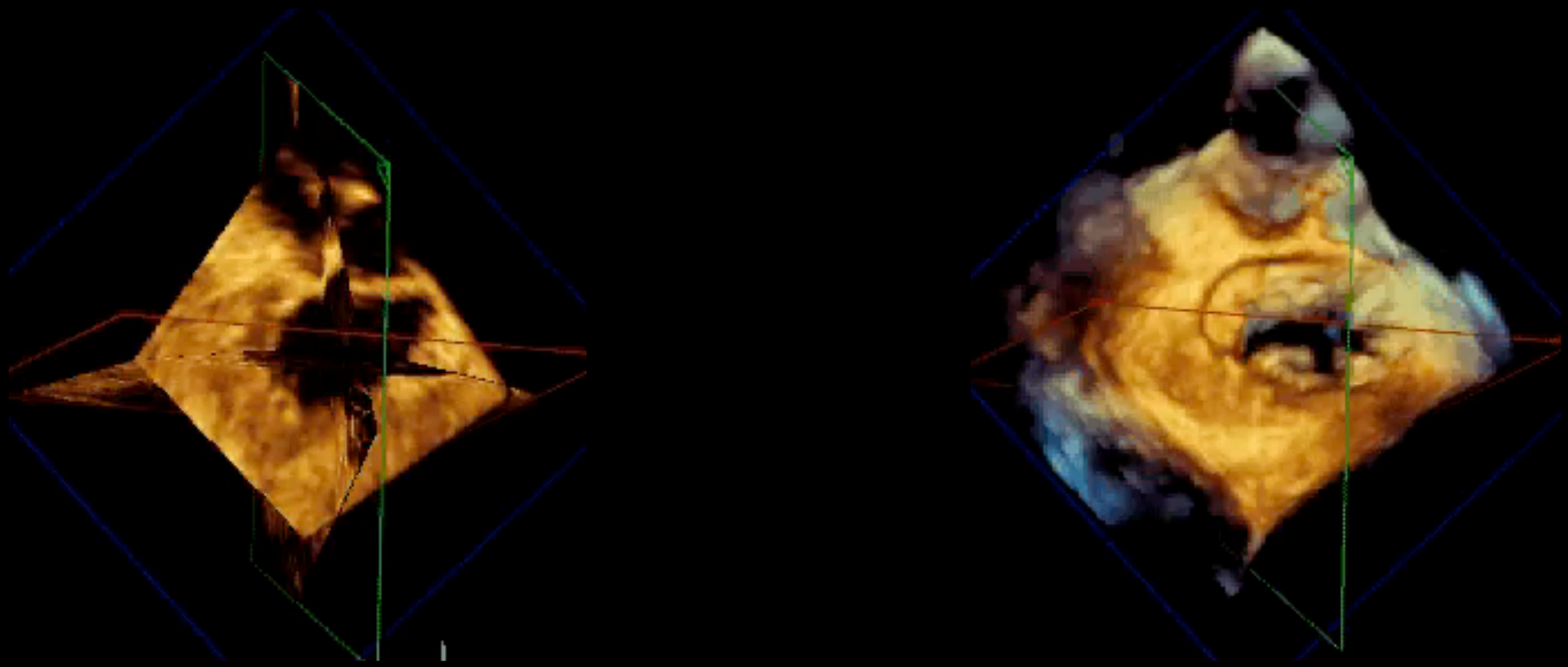




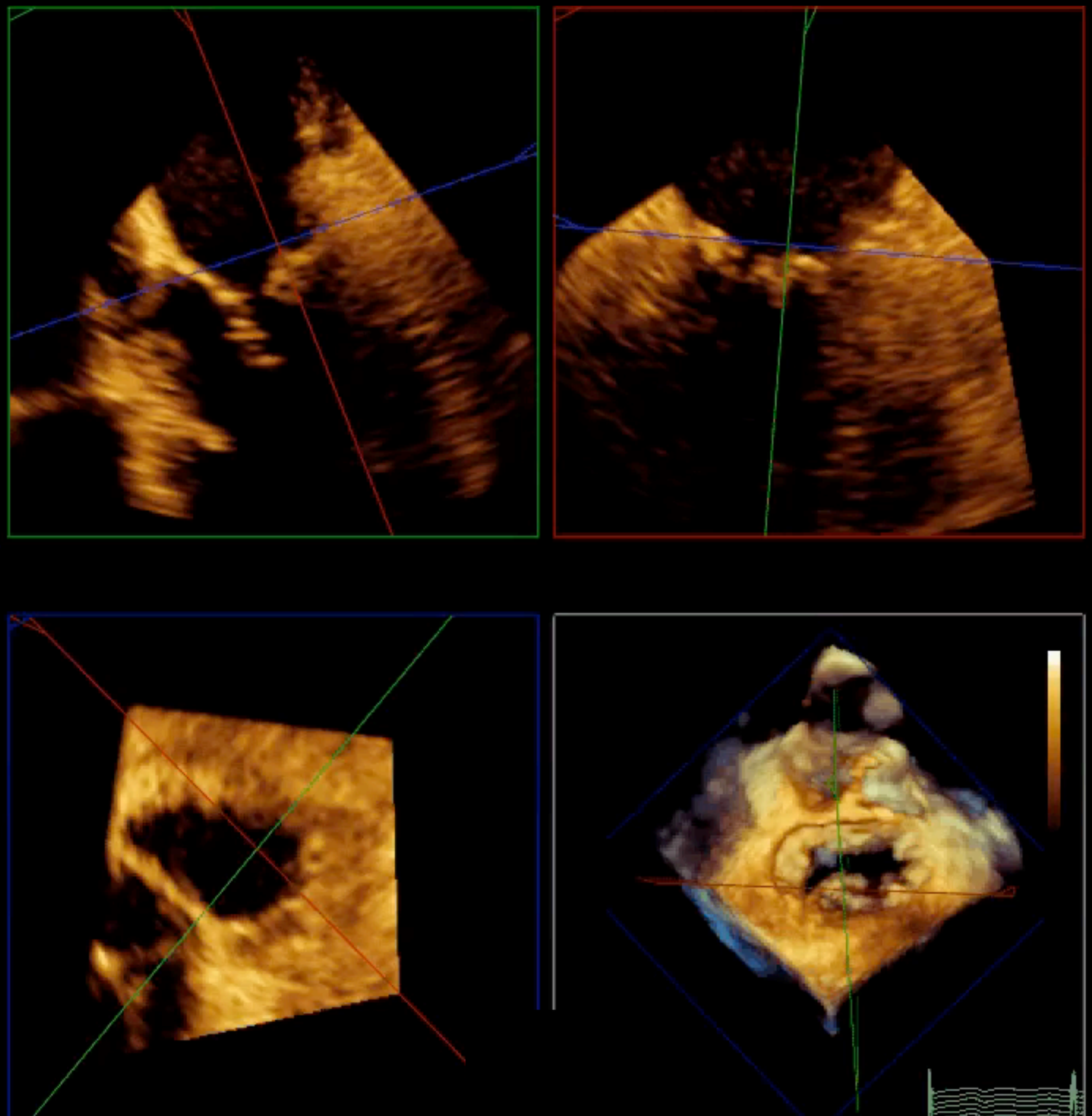
Parallax in 3D Imaging



Parallax in 3D Imaging



Assessment



Planning the MitraClip Approach?

Planning the MitraClip Approach?

- Where is the optimal transseptal puncture?

Planning the MitraClip Approach?

- Where is the optimal transseptal puncture?
- Where do you place this clip?

Planning the MitraClip Approach?

- Where is the optimal transseptal puncture?
- Where do you place this clip?
- How do you orient the clip relative to coaptation?

Planning the MitraClip Approach?

- Where is the optimal transseptal puncture?
- Where do you place this clip?
- How do you orient the clip relative to coaptation?
- How do you place the clip there while avoiding the subvalvular apparatus?

Planning the MitraClip Approach?

- Where is the optimal transseptal puncture?
- Where do you place this clip?
- How do you orient the clip relative to coaptation?
- How do you place the clip there while avoiding the subvalvular apparatus?
- What papillary muscle do the ruptured chords come from?

Planning the MitraClip Approach?

- Where is the optimal transseptal puncture?
- Where do you place this clip?
- How do you orient the clip relative to coaptation?
- How do you place the clip there while avoiding the subvalvular apparatus?
- What papillary muscle do the ruptured chords come from?
- How do you grasp the leaflets once you're there?

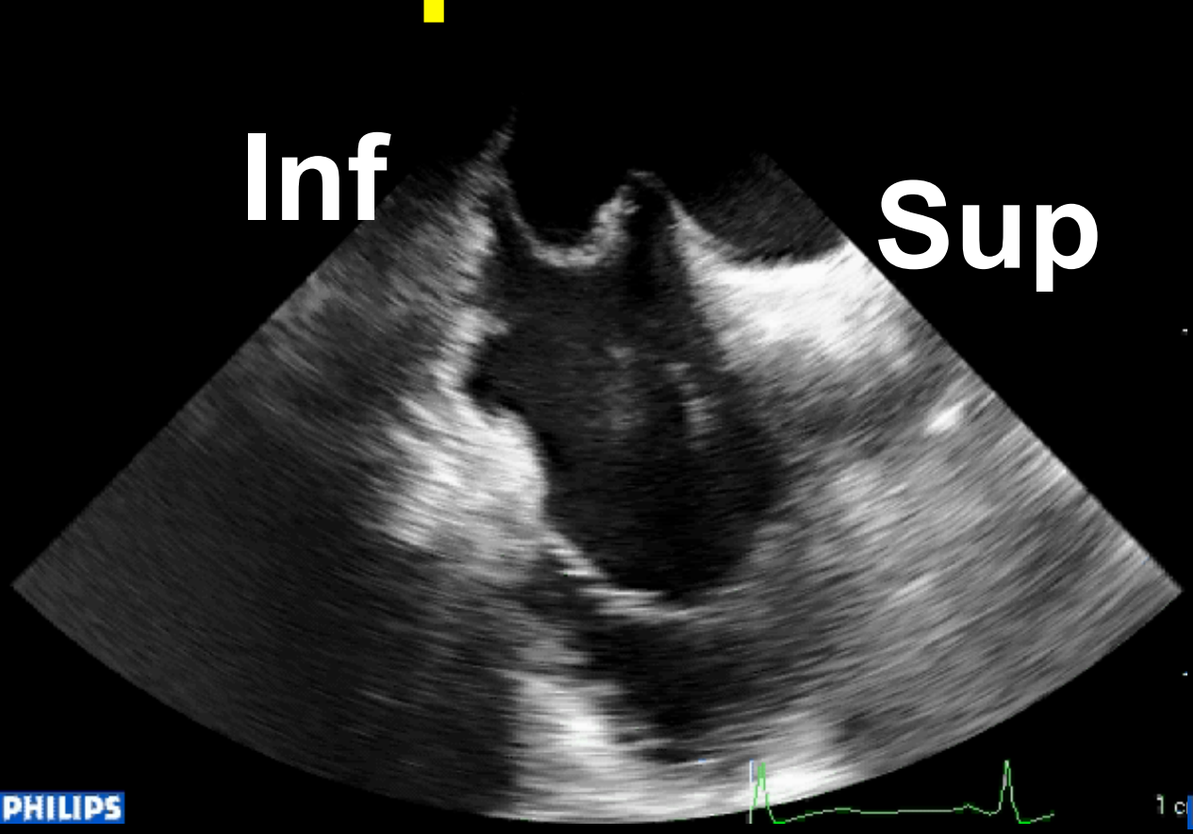
Planning the MitraClip Approach?

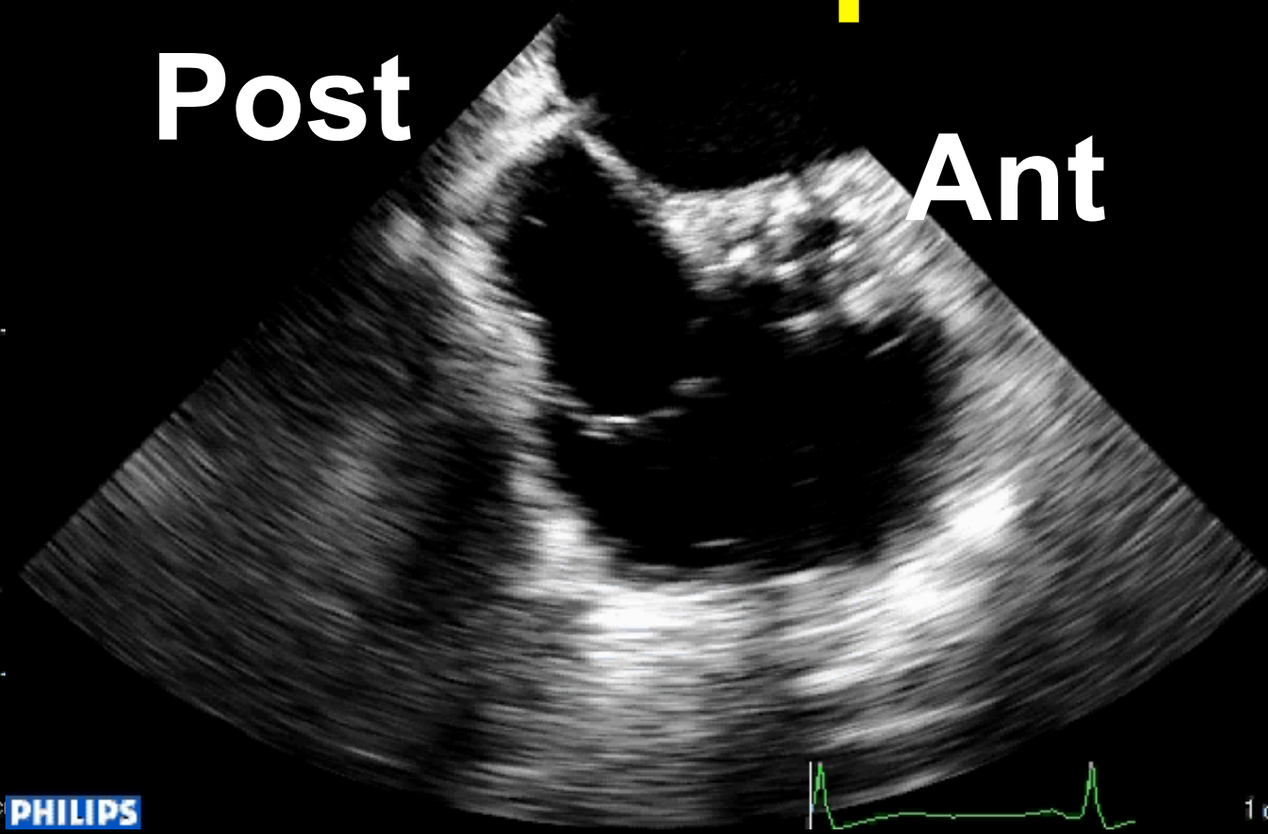
- Where is the optimal transseptal puncture?
- Where do you place this clip?
- How do you orient the clip relative to coaptation?
- How do you place the clip there while avoiding the subvalvular apparatus?
- What papillary muscle do the ruptured chords come from?
- How do you grasp the leaflets once you're there?
- How many clips will be needed to adequately reduce the MR

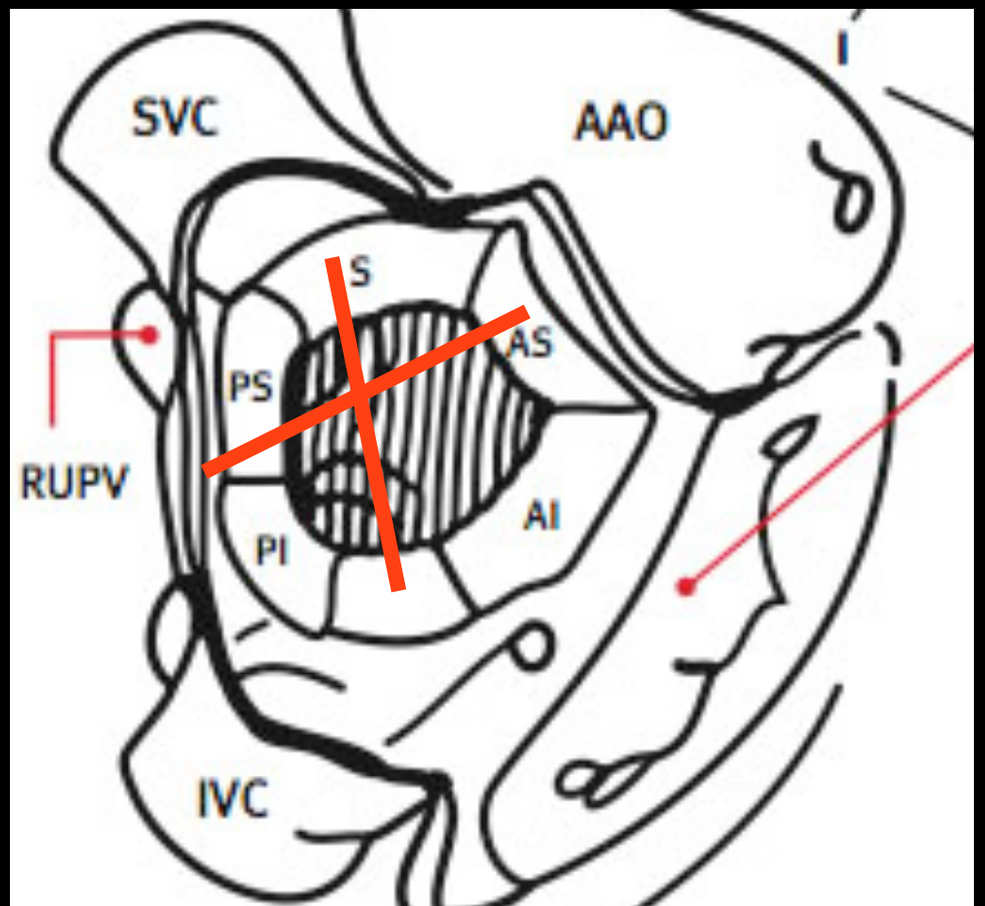
Procedural Steps for MitraClip

- Transseptal puncture
- Introduction of the steerable guide catheter into the left atrium
- Advancement of the clip delivery system into the left atrium
- Positioning the clip above the mitral valve
- Advancing the clip into the left ventricle
- Grasping the leaflets and assessing for insertion
- MR and MS evaluation
- Clip detachment and assess need for additional clips
- Assess for pericardial effusion and other complications

Septal Puncture - MitraClip

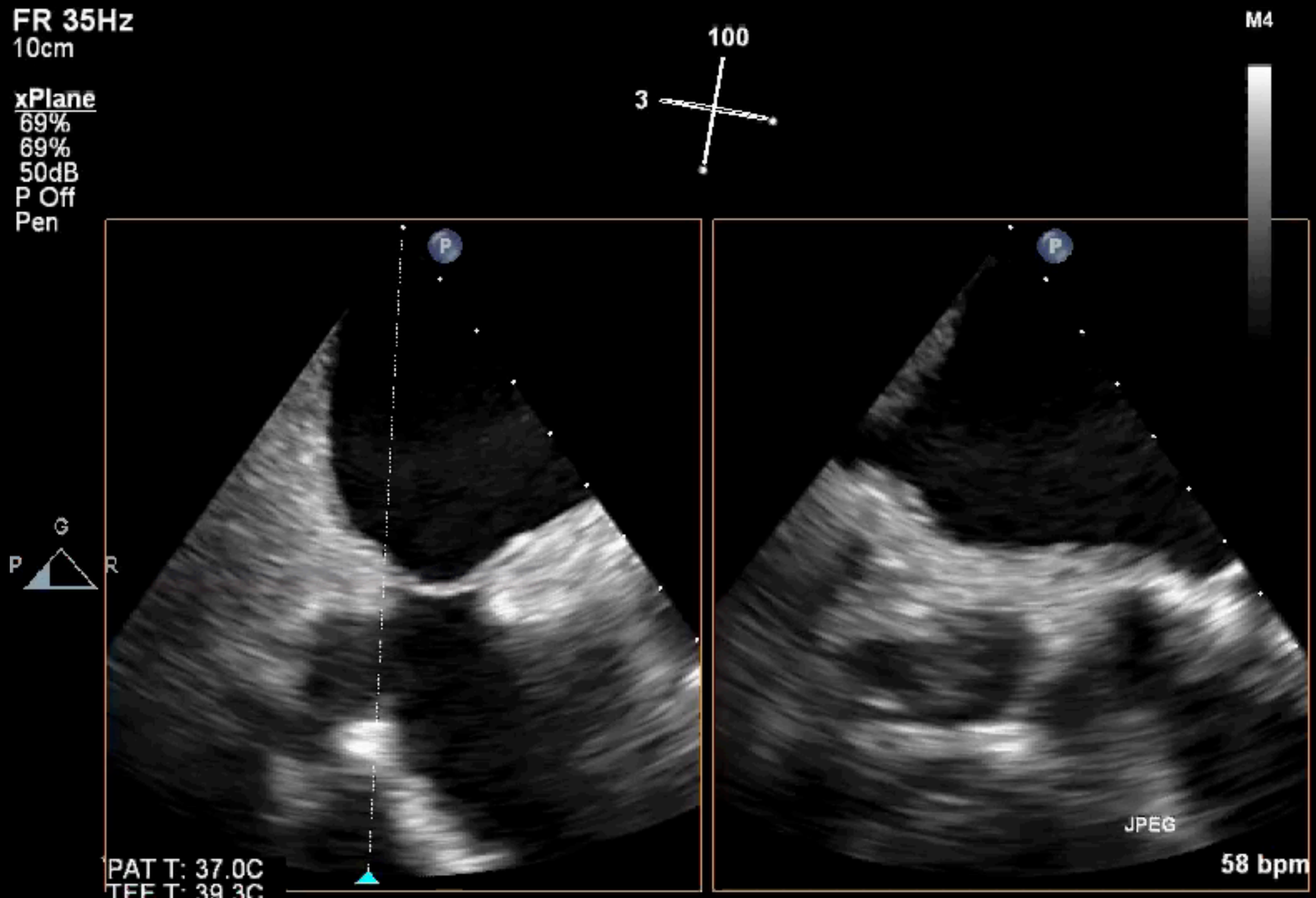






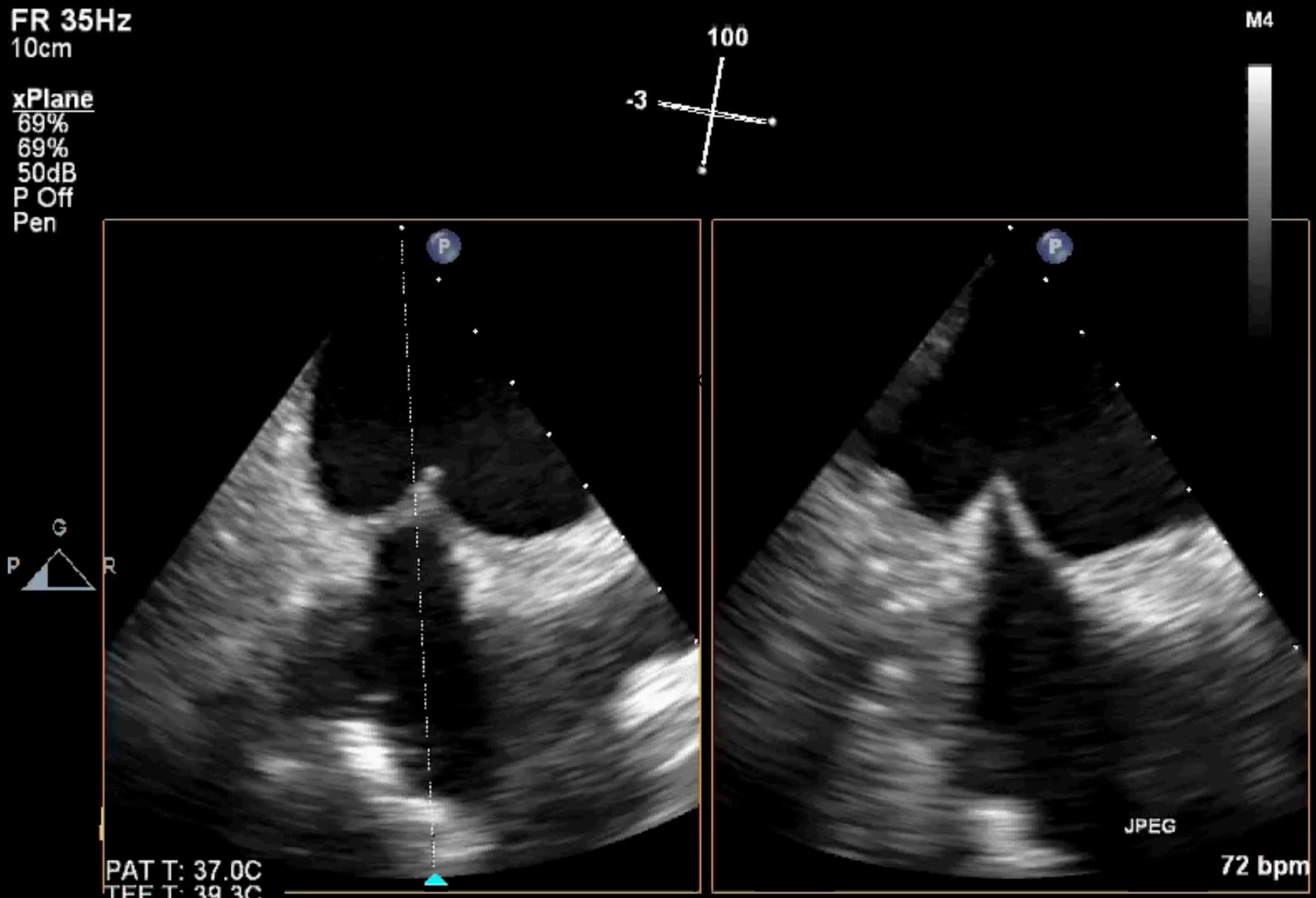
Superior
Posterior
Location

Transseptal Puncture



Superior and Posterior Location
4- 5 cm above the MV annulus

Transseptal Puncture



10cm

2D
69%
C 50
P Off
Pen

0 0 180

Dist 3.30 cm

FR 35Hz
10cm

xPlane
69%
69%
50dB
P Off
Pen

G
P R

M4

Dist 3.30 cm

56bpm

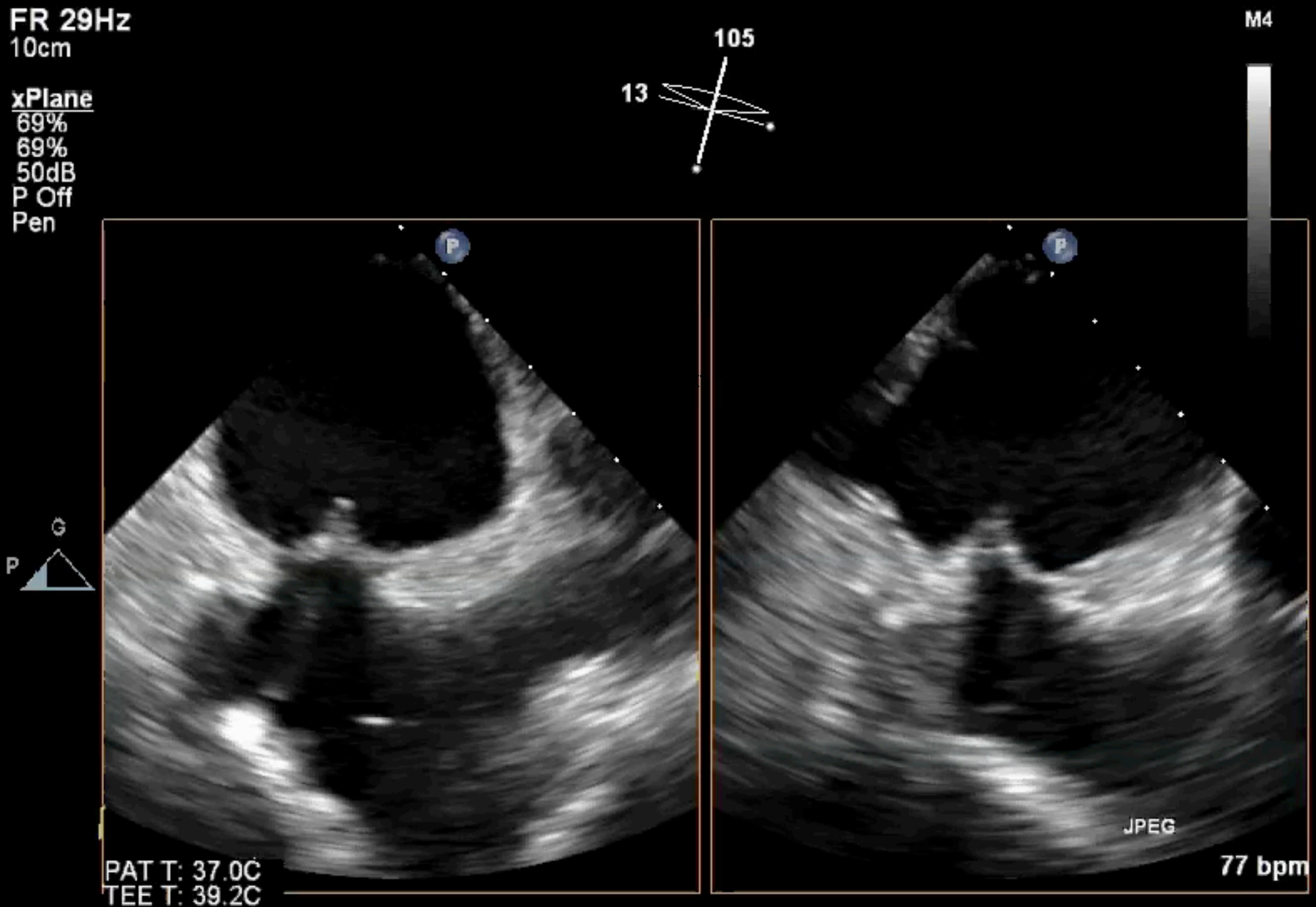
G
P R

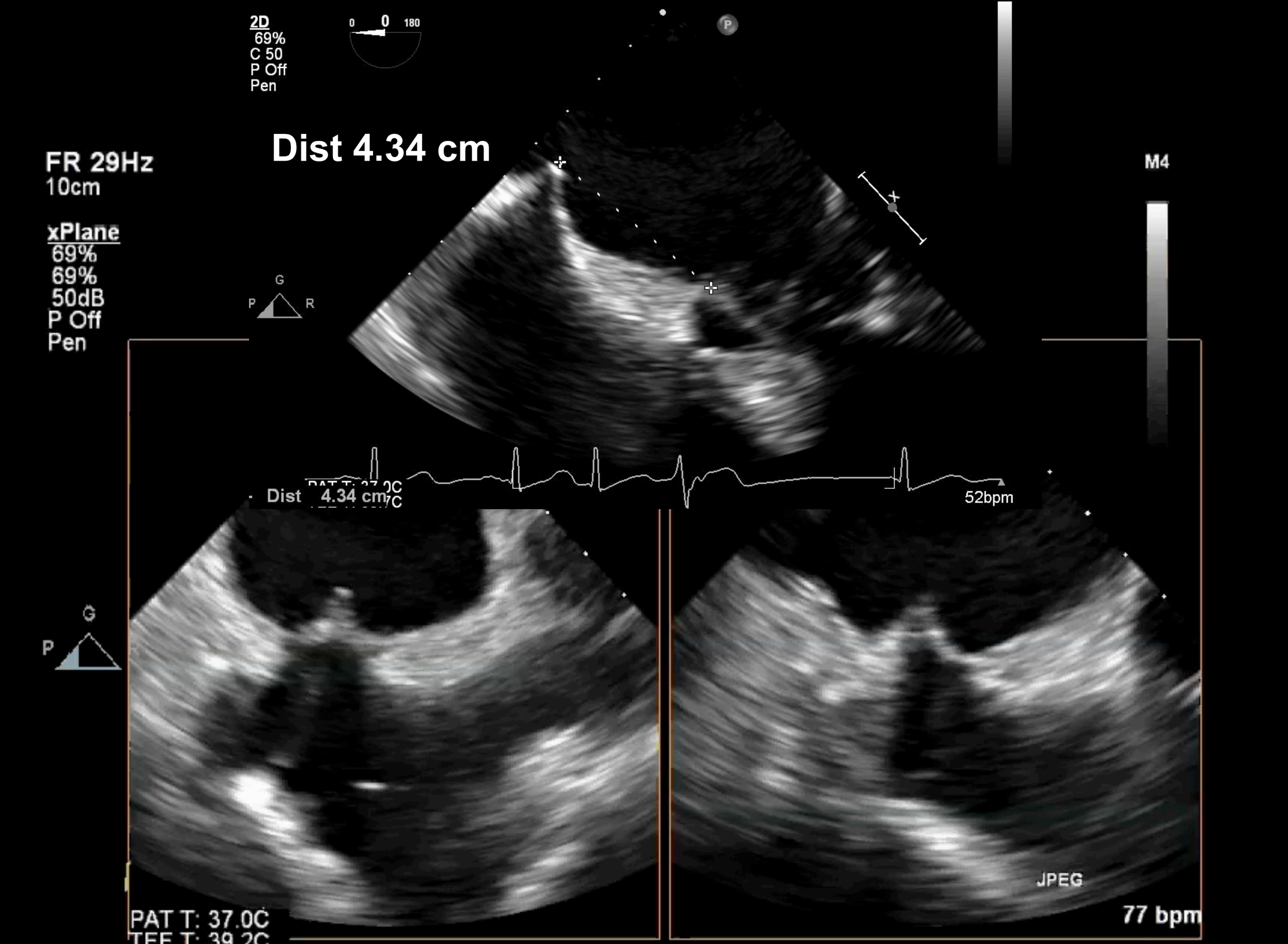
PAT T: 37.0C
TEE T: 39.3C

JPEG

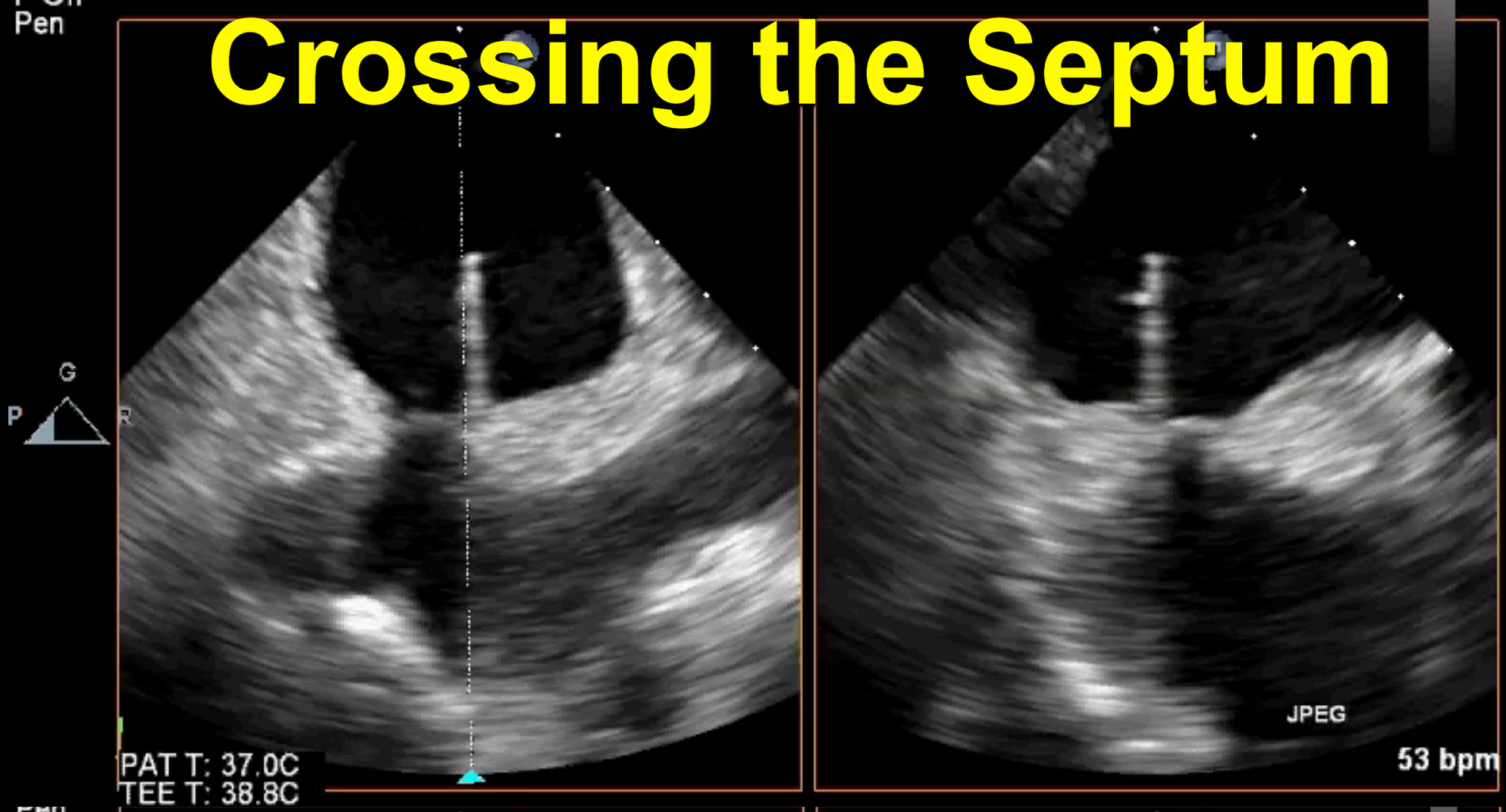
72 bpm

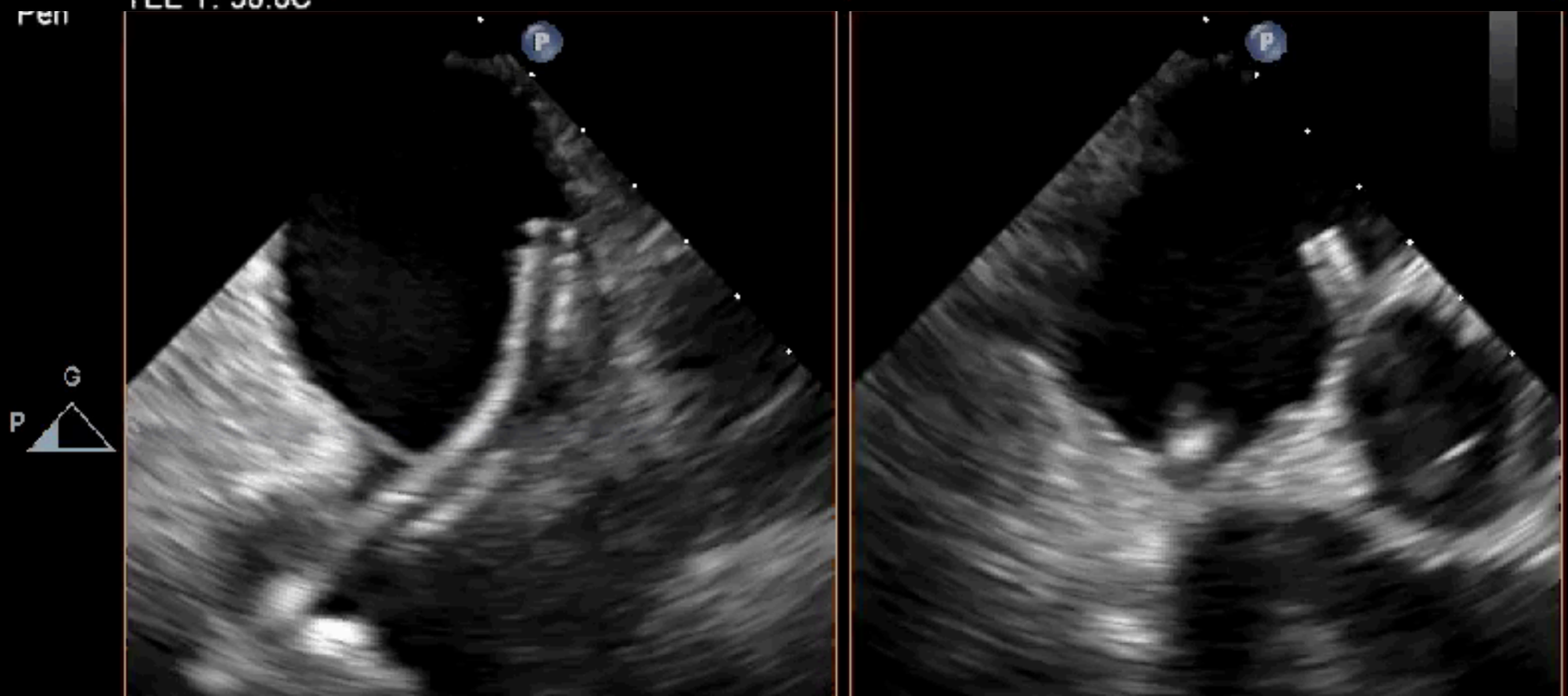
Transseptal Puncture



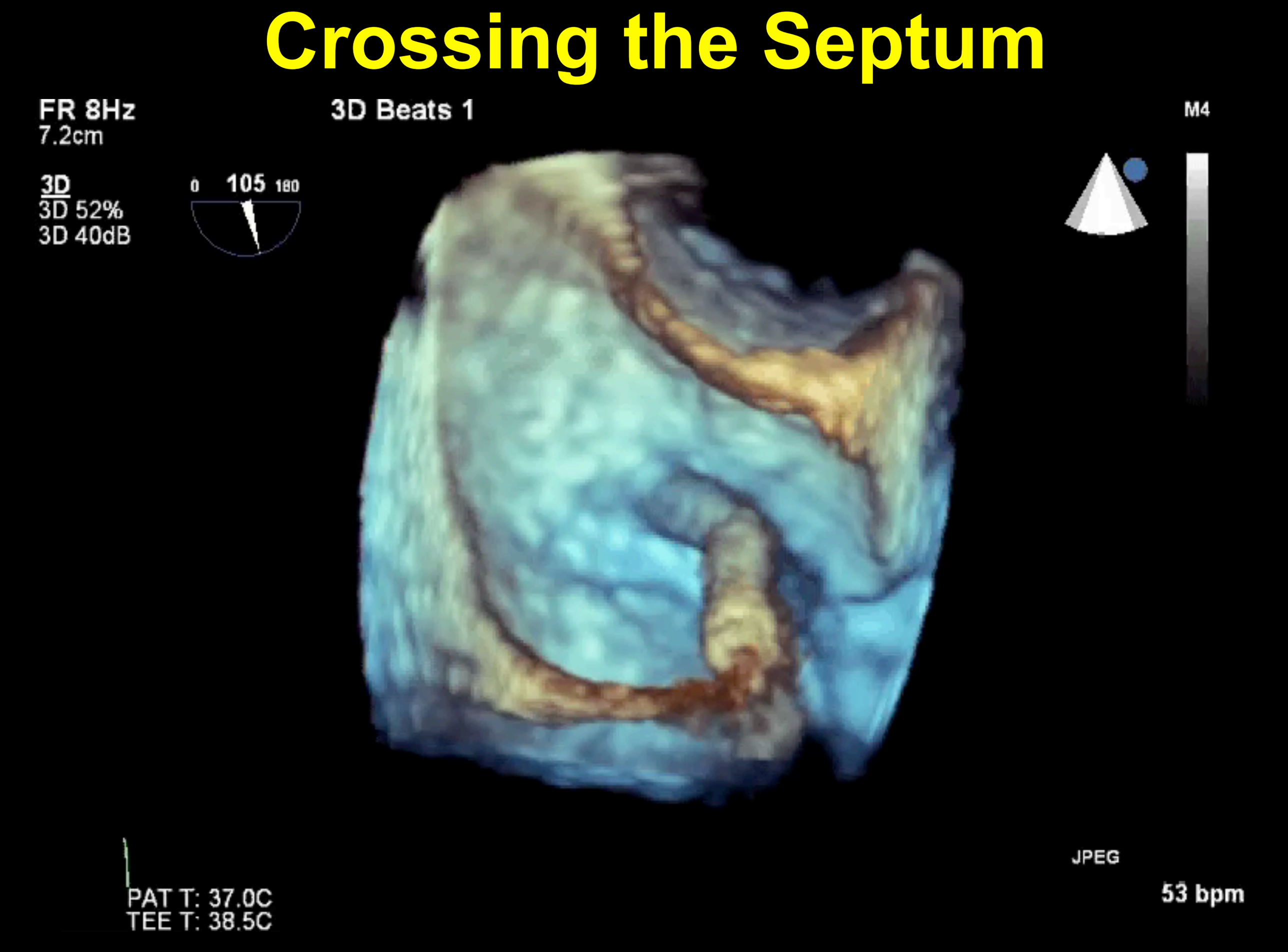

2D
69%
C 50
P Off
Pen
0 0 180
Dist 4.34 cm
FR 29Hz
10cm
xPlane
69%
69%
50dB
P Off
Pen
G
P R
M4
Dist 4.34 cm
52bpm
G
P
PAT T: 37.0C
TEE T: 39.2C
JPEG
77 bpm

Crossing the Septum

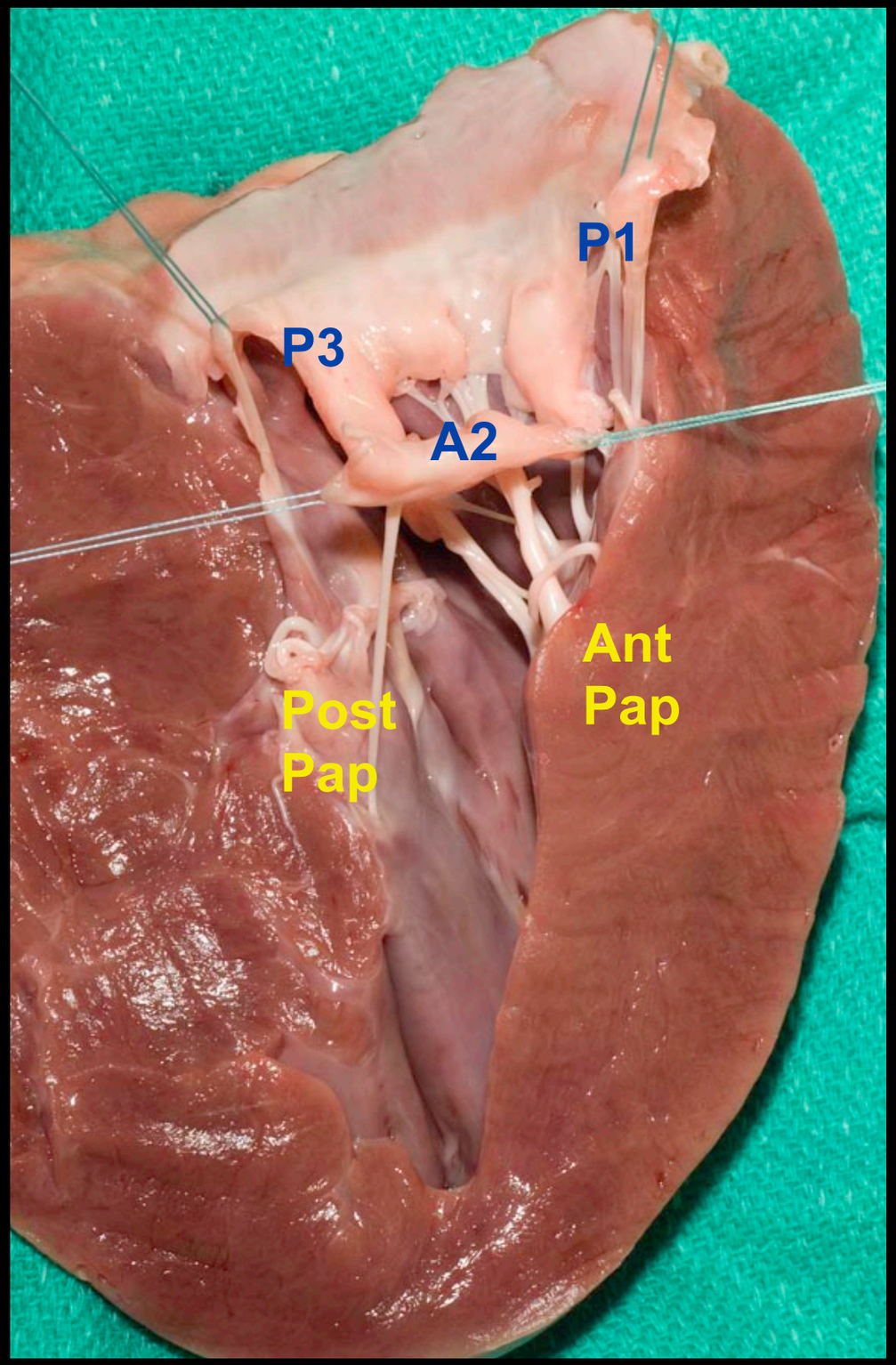


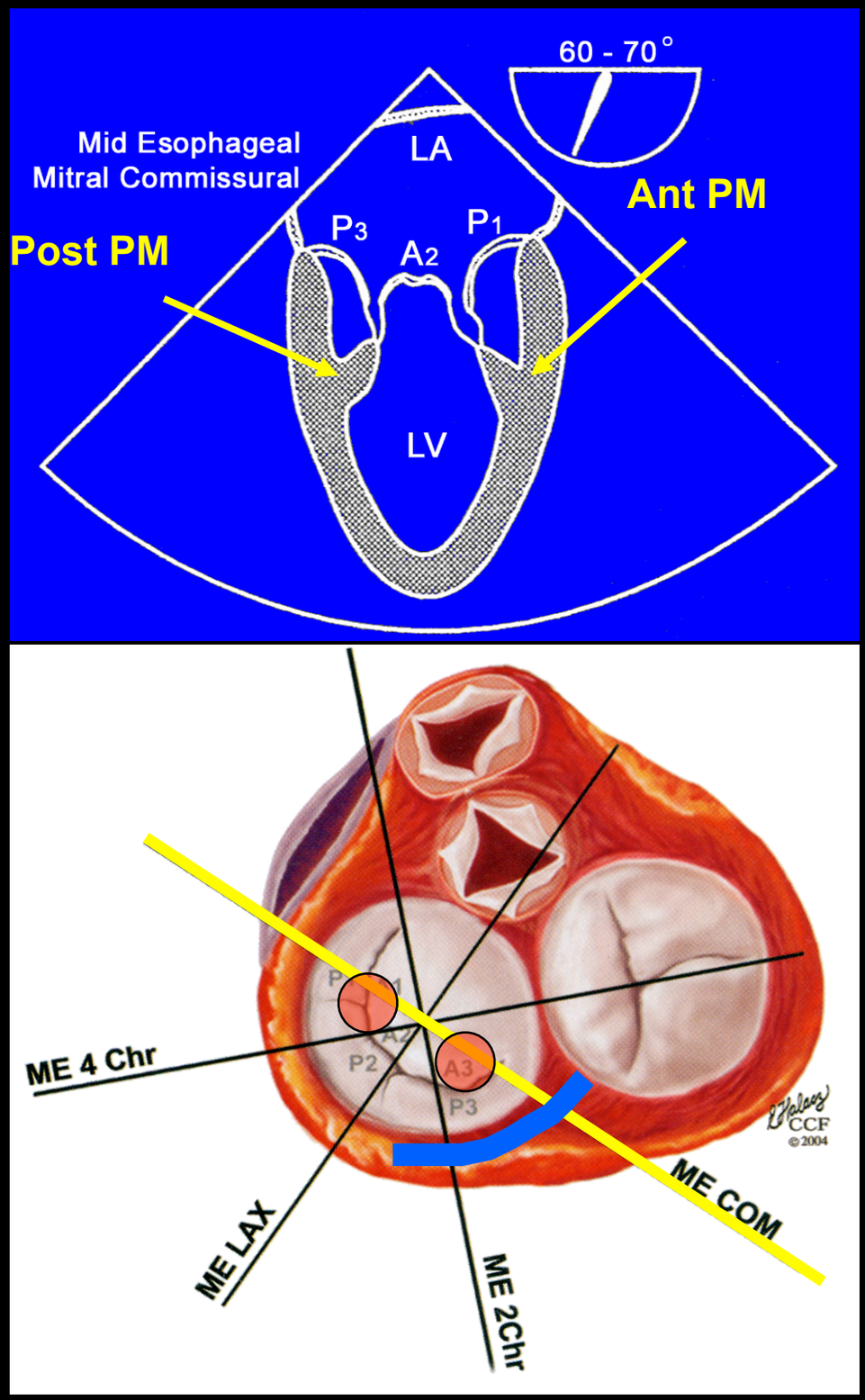


Crossing the Septum

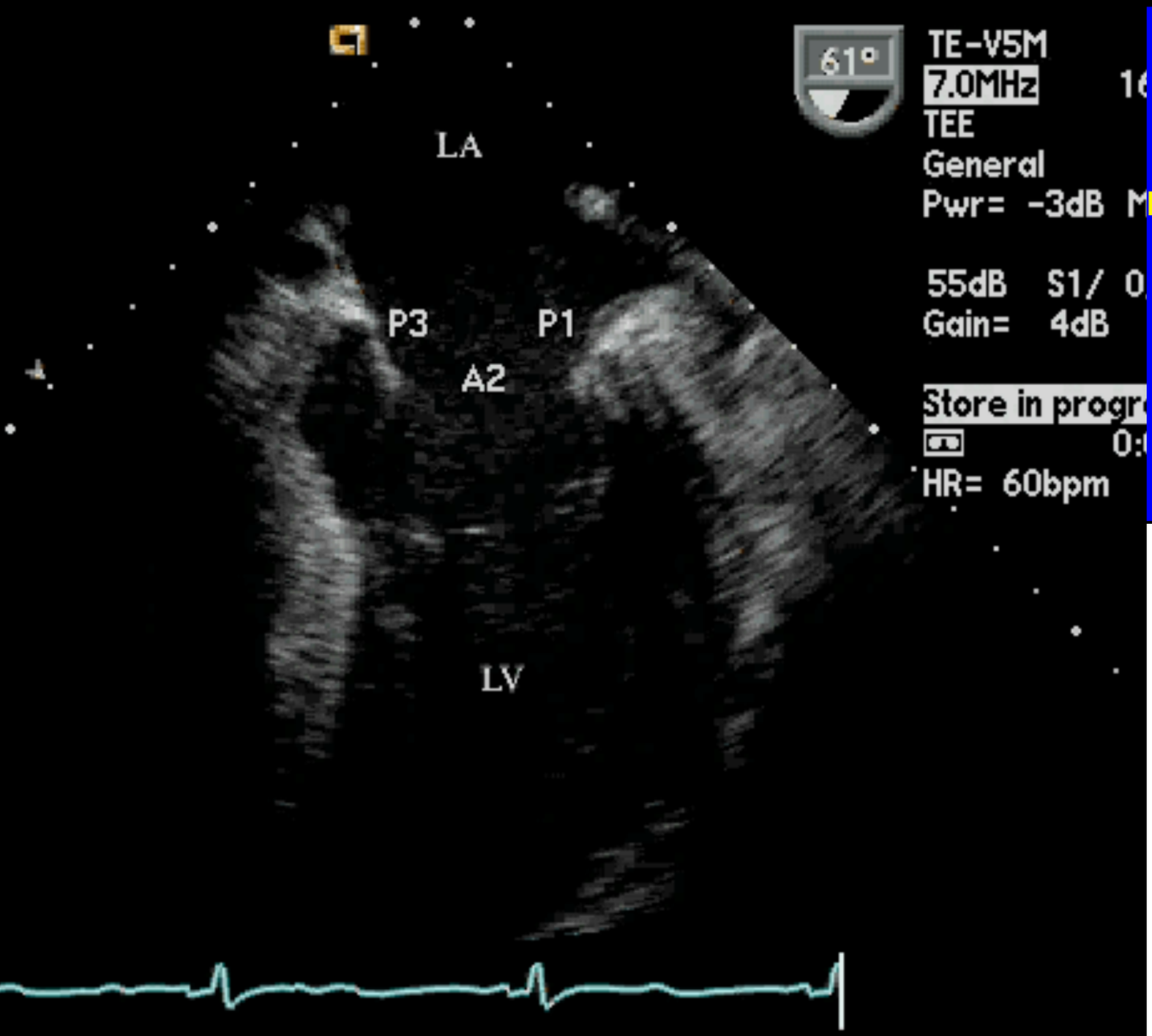


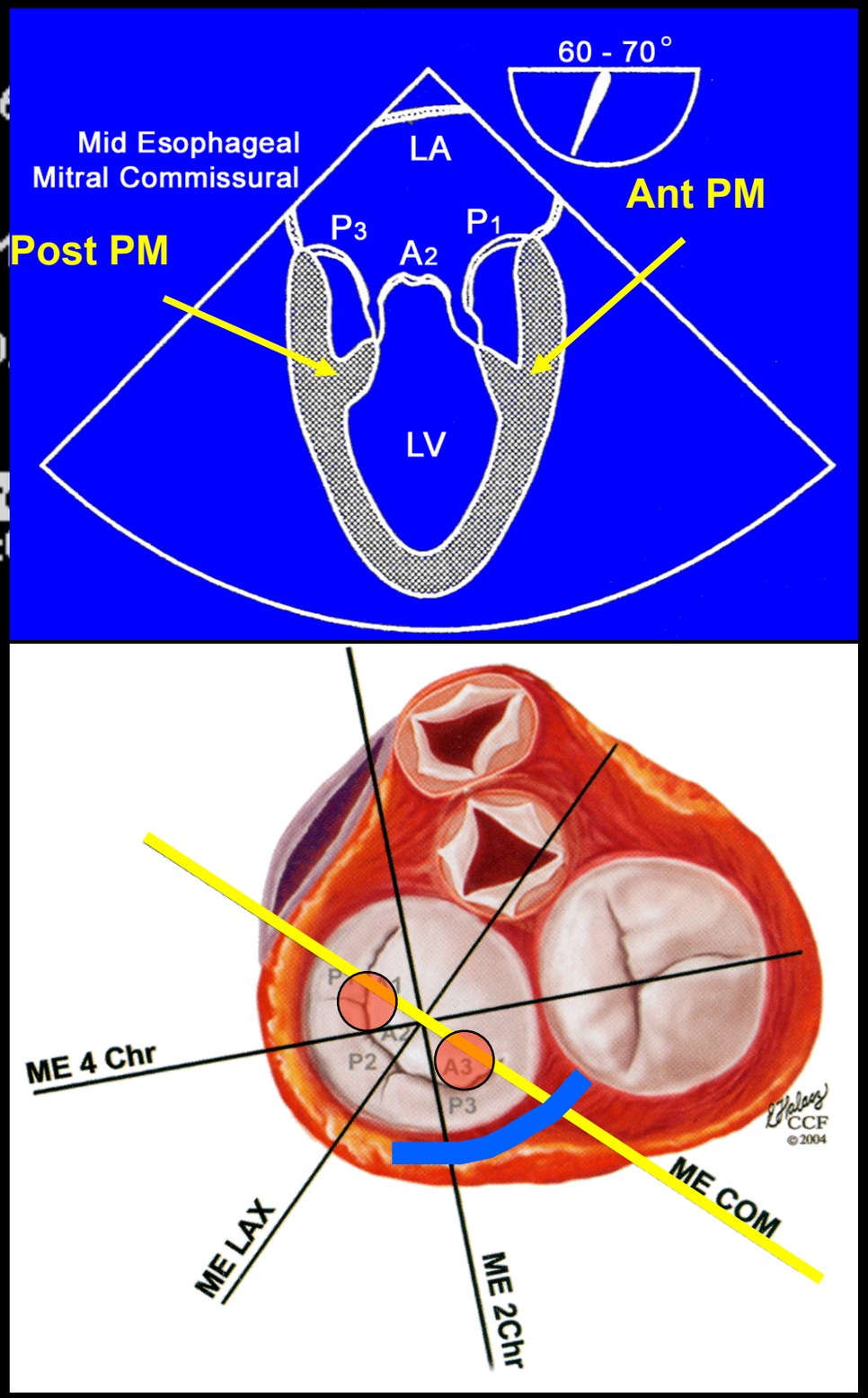
ME Commissural View (40-80^{0})



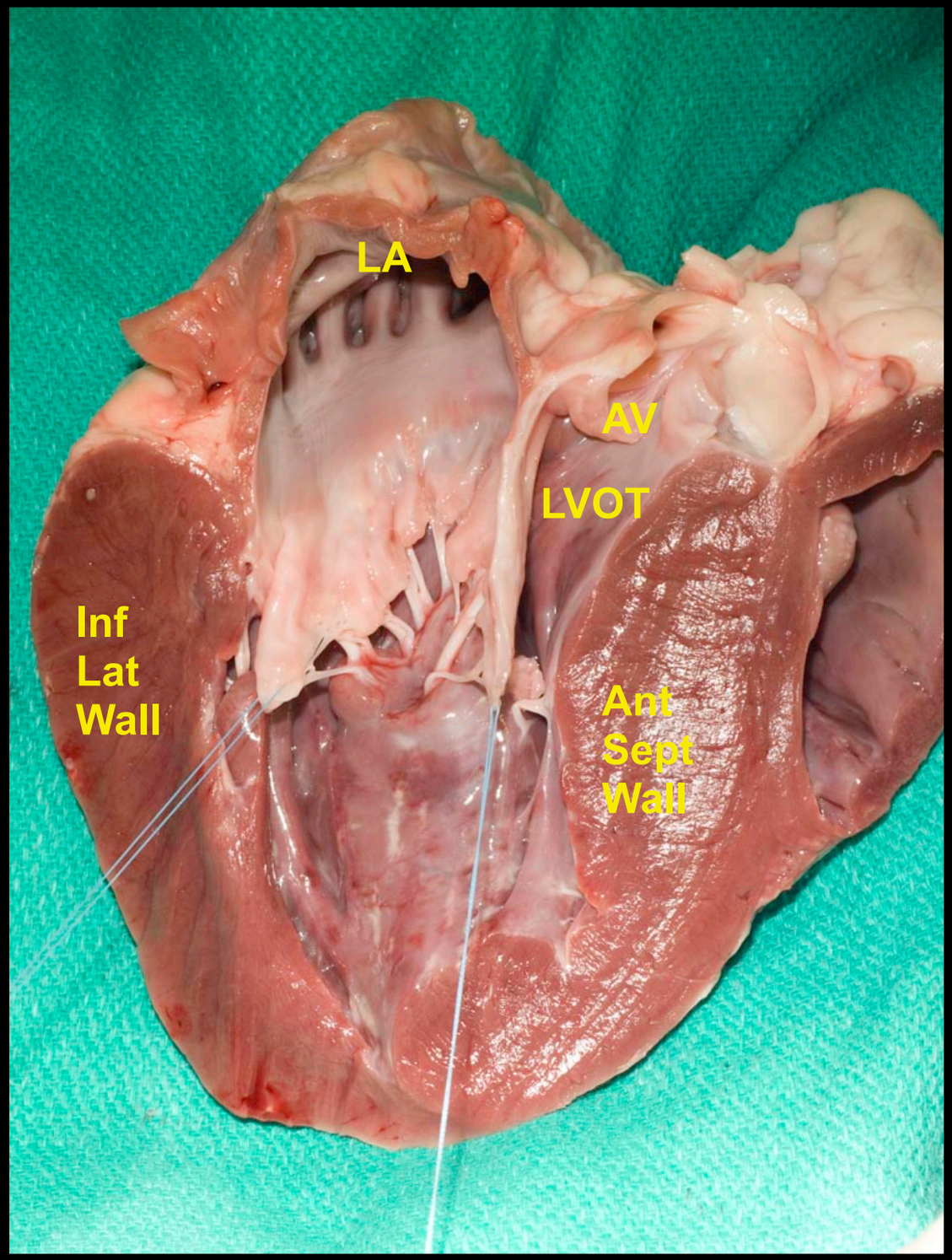


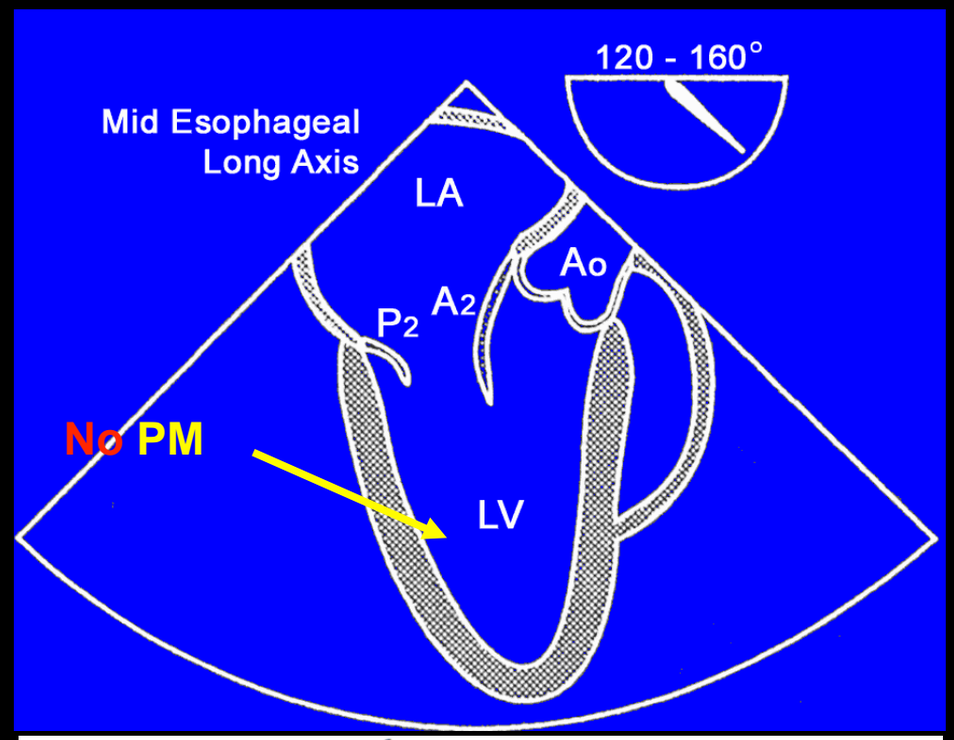
ME Commissural View (40-80^{0})

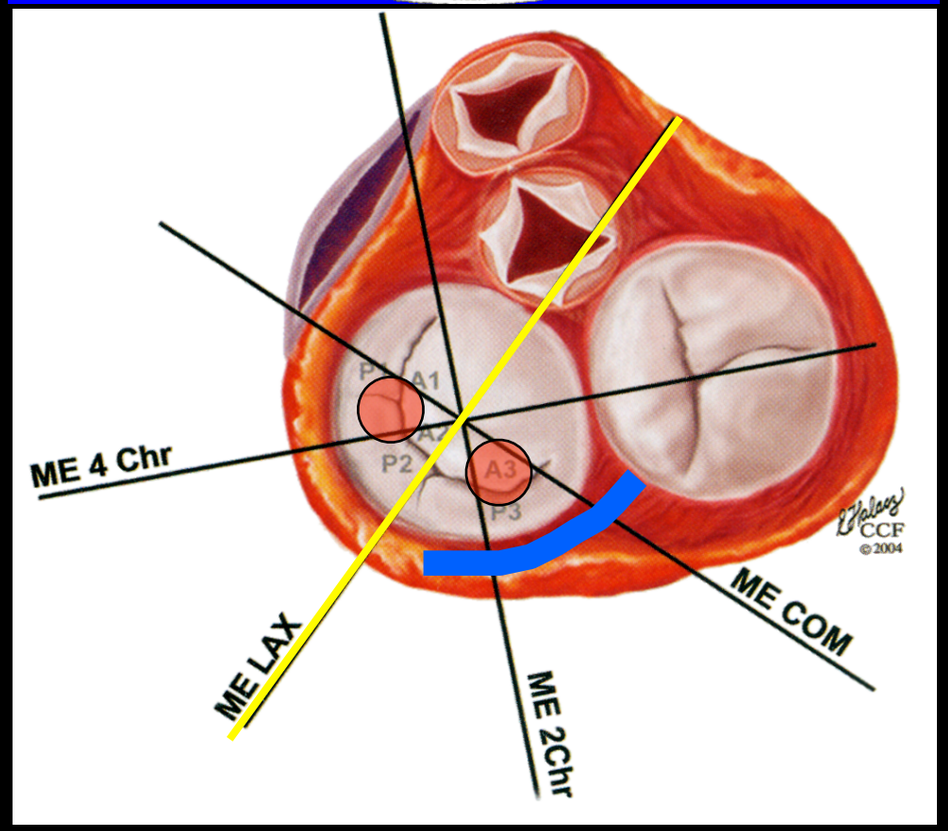




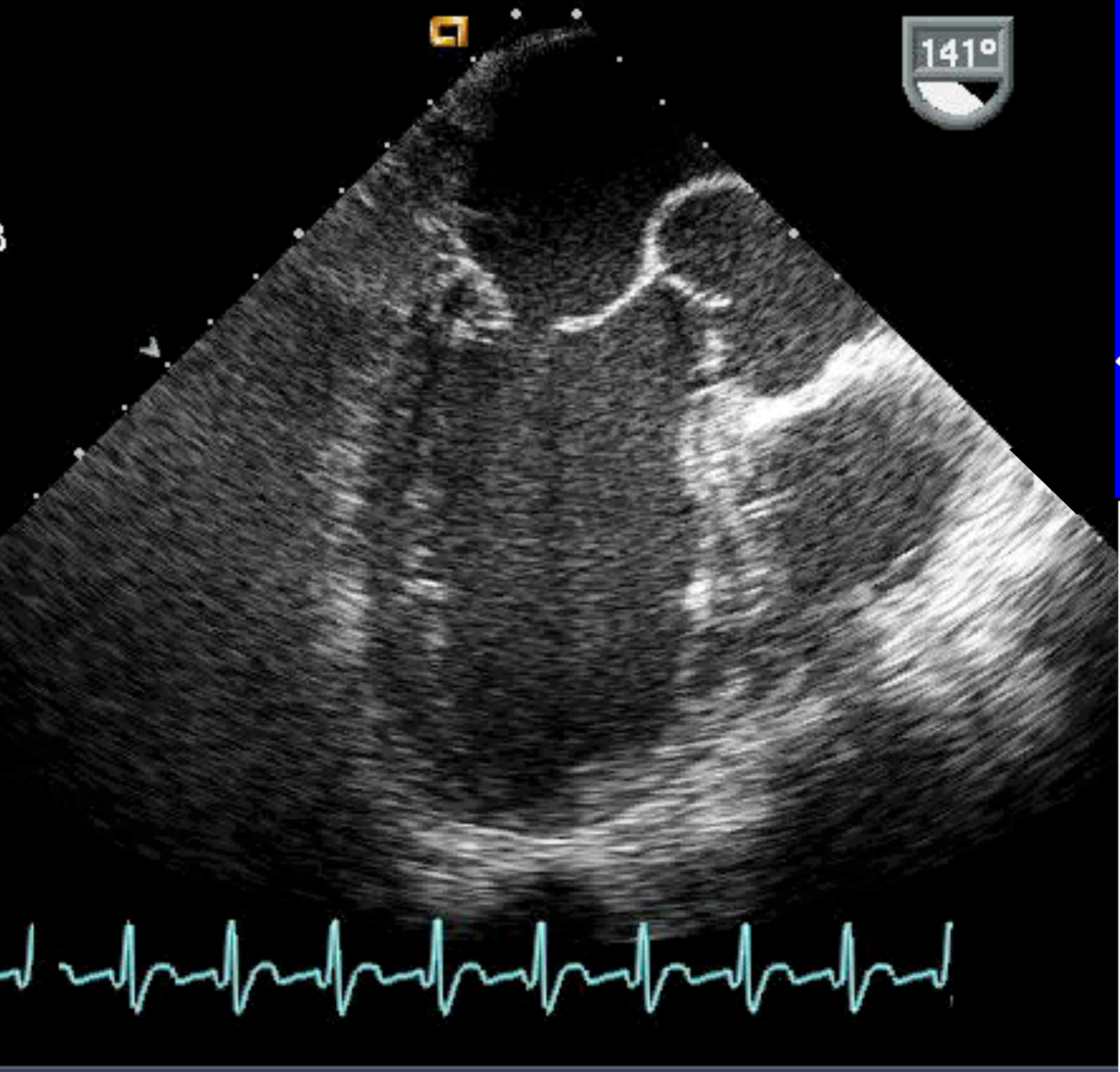
ME Long Axis View (120-160º)

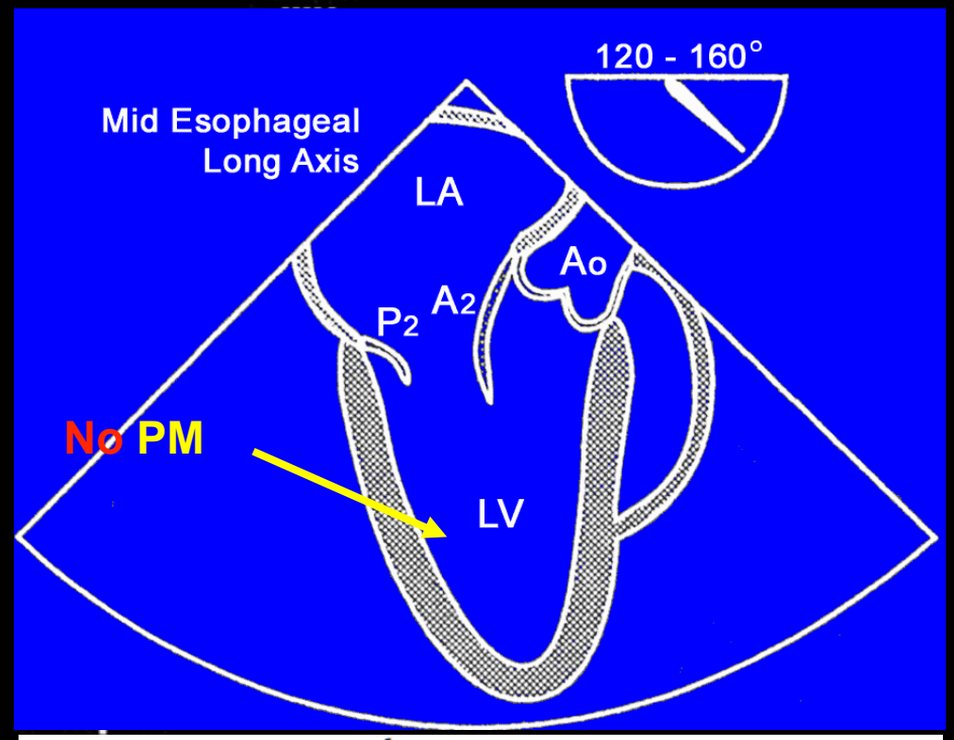


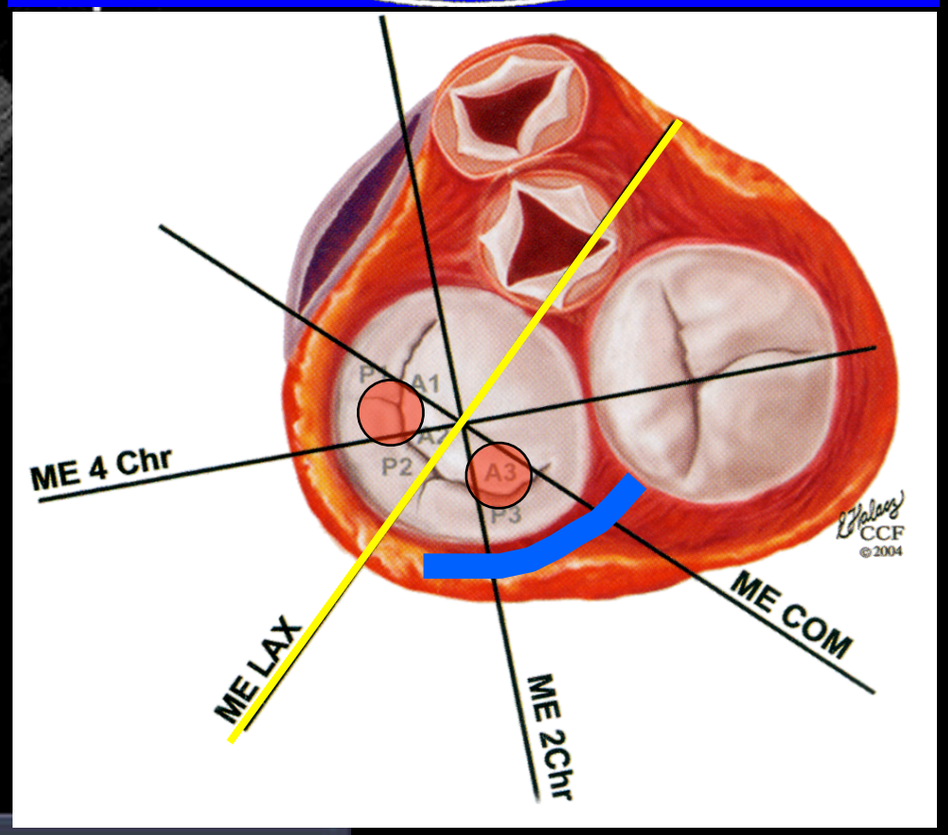


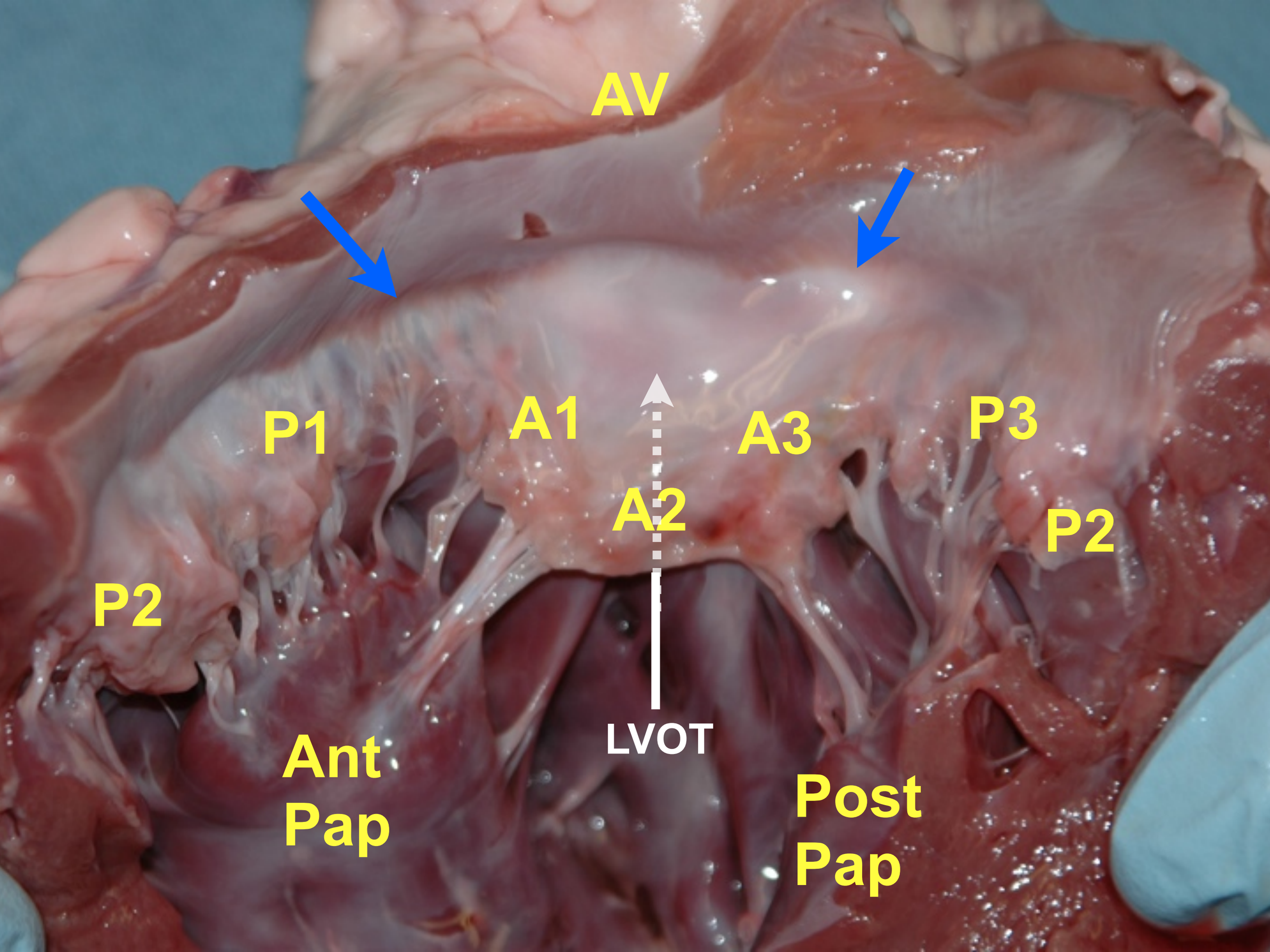


ME Long Axis View (120-160º)

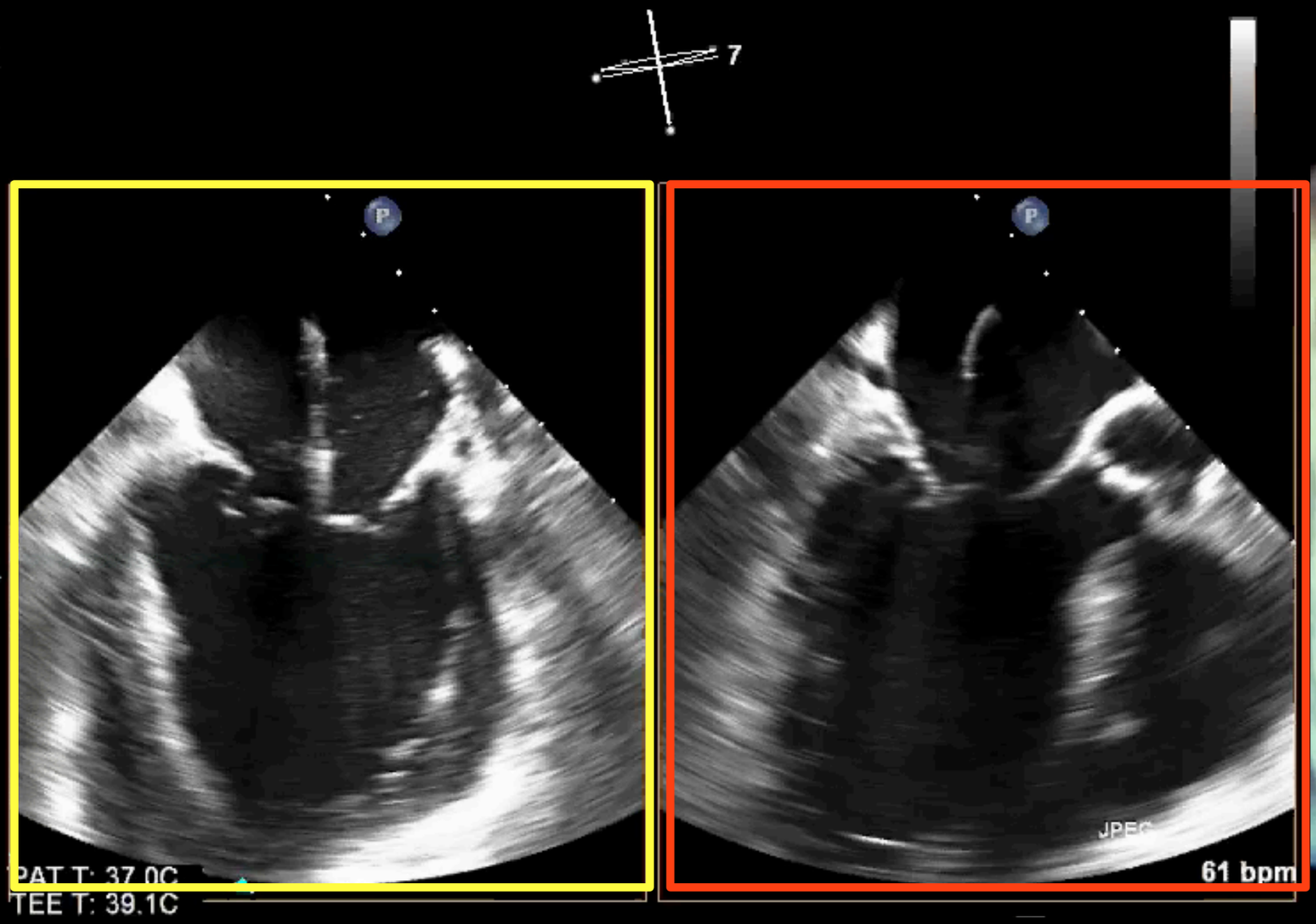


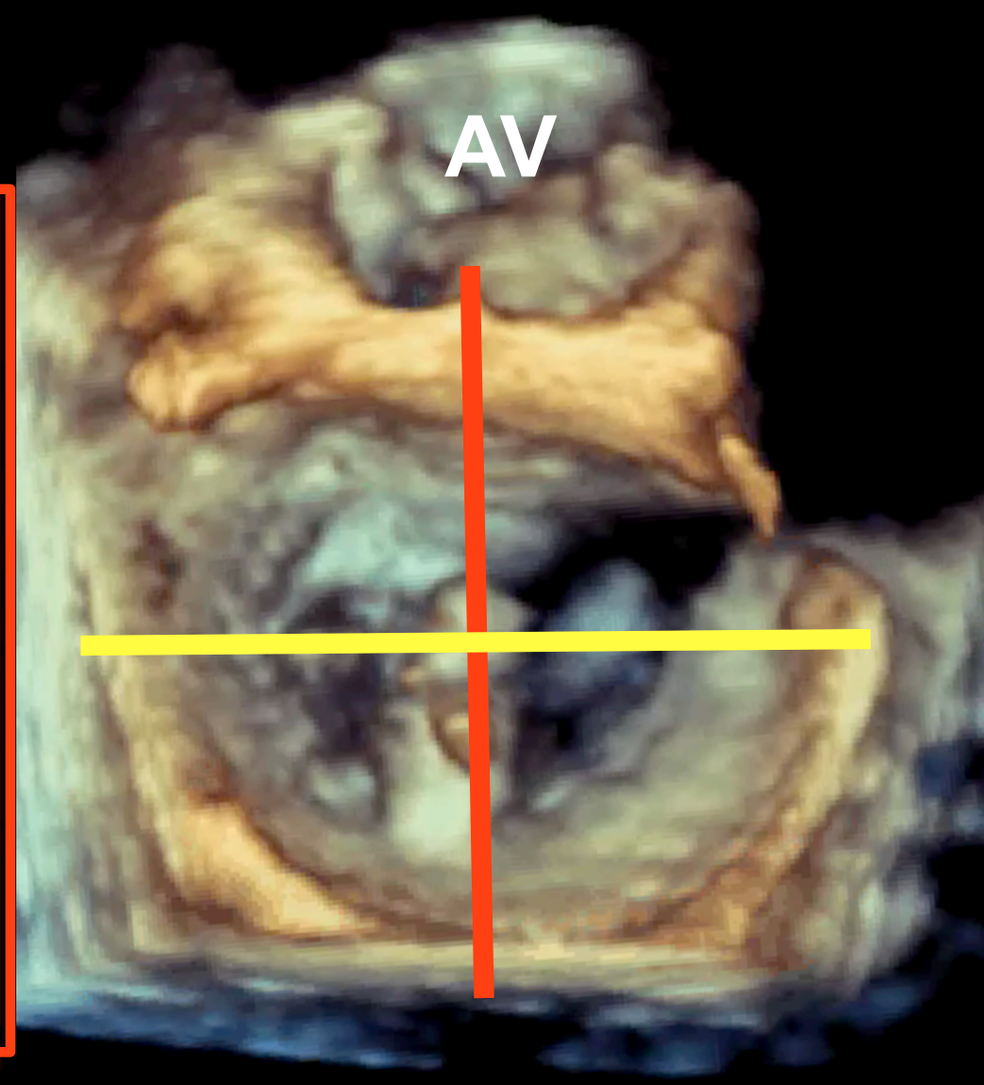




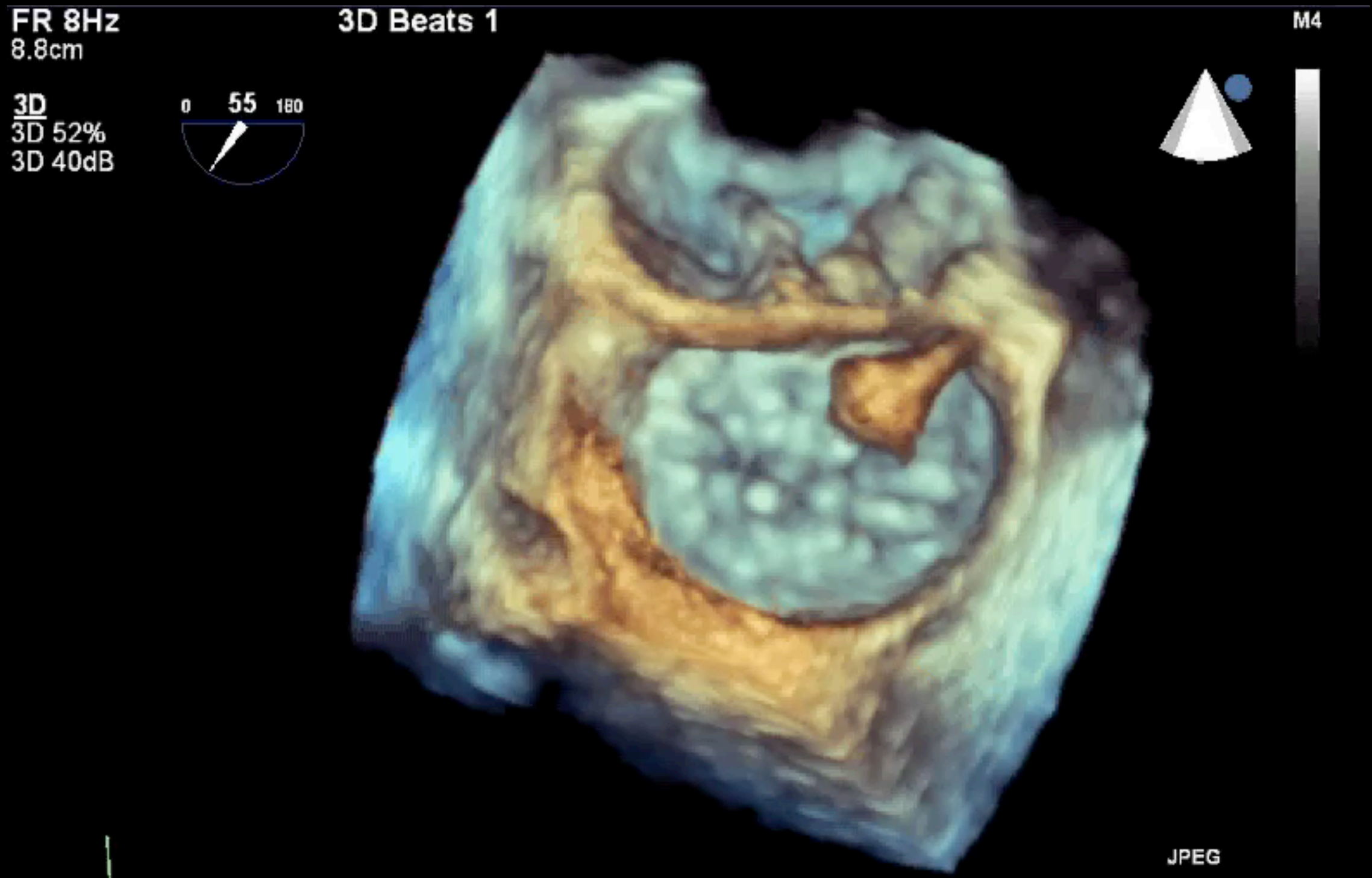

AV
P1
A1
A3
P3
A2
P2
P2
Ant
Pap
LVOT
Post
Pap

MitraClip Positioning

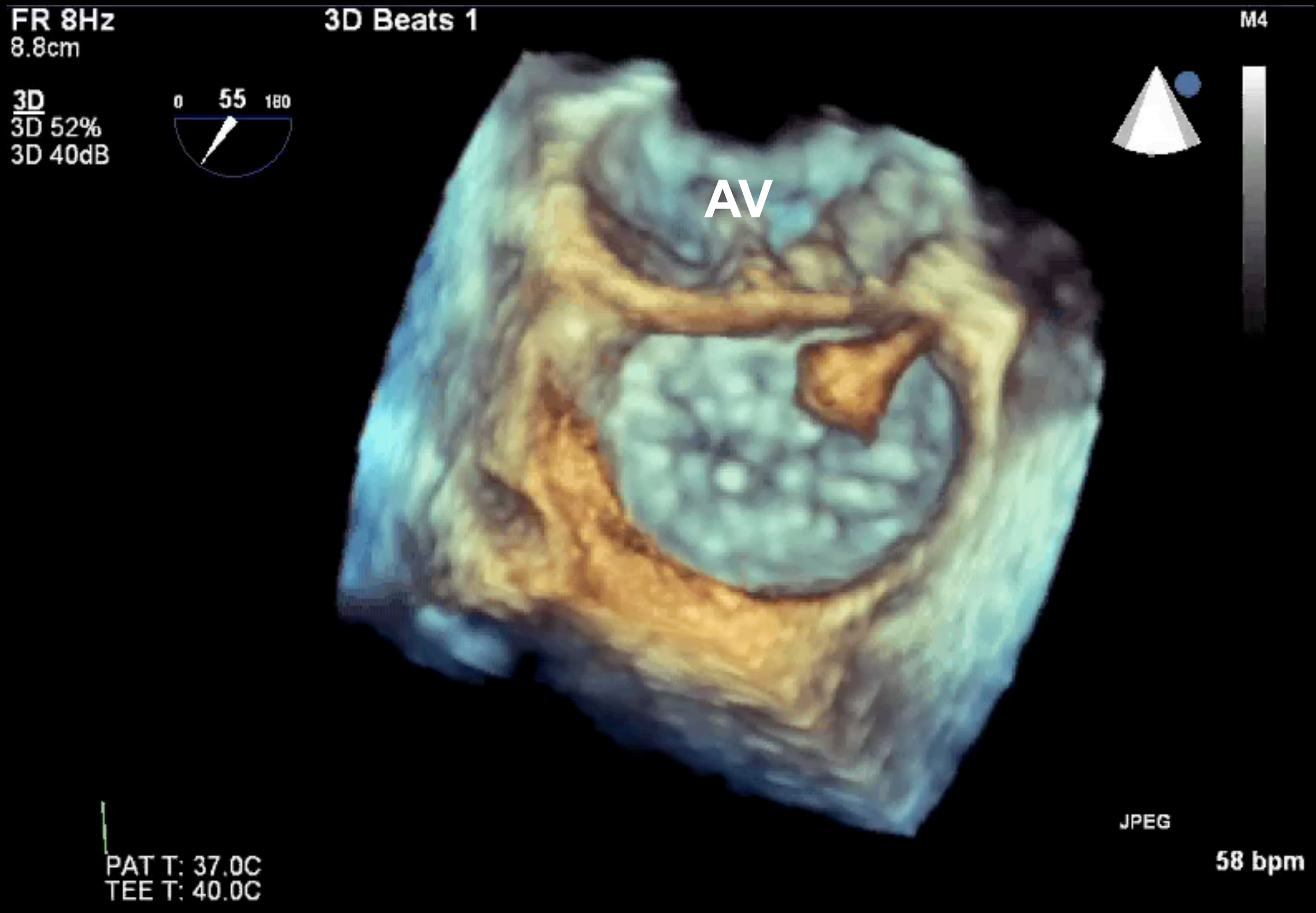




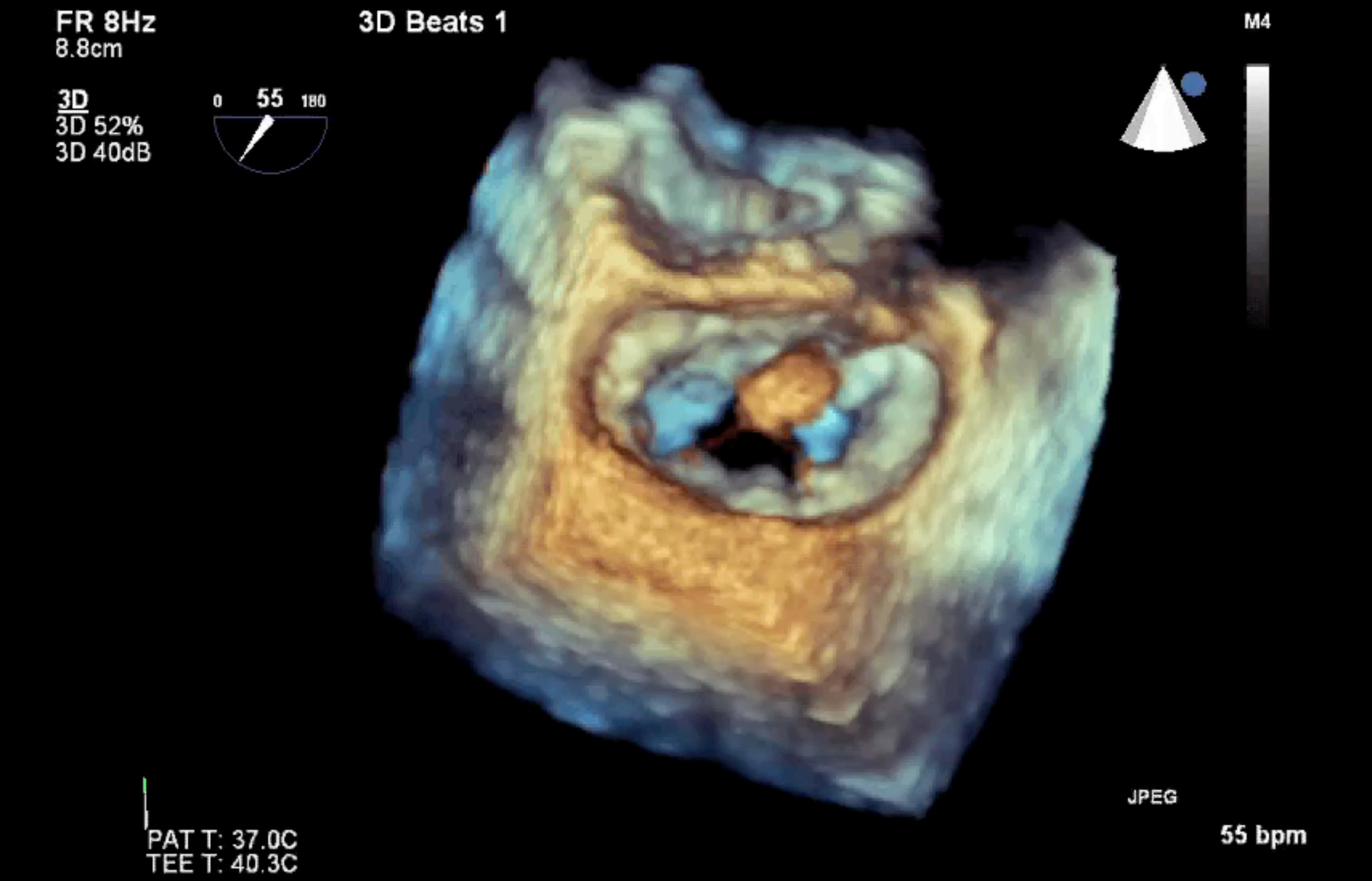
Positioning the Clip



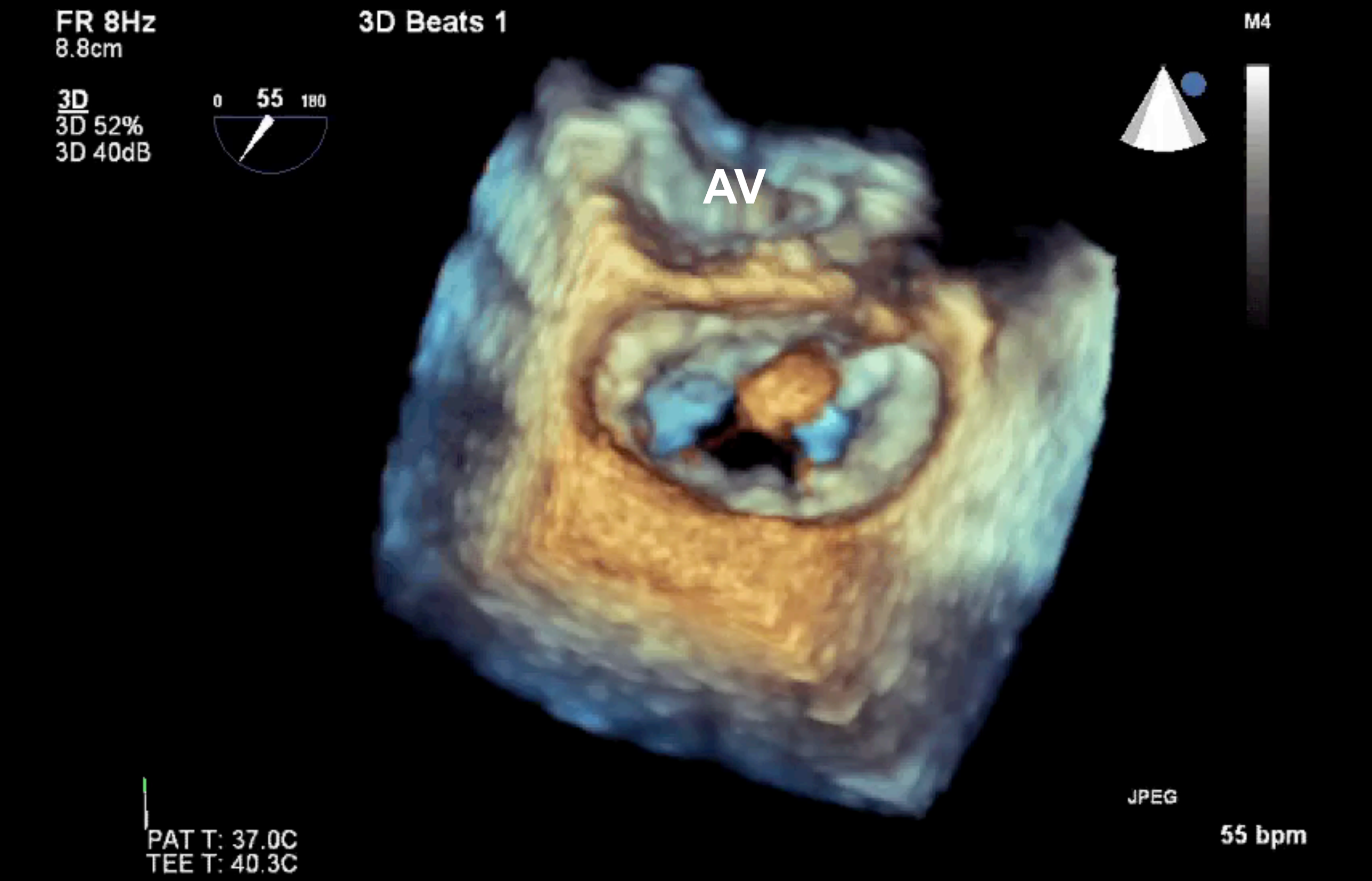
Positioning the Clip



Positioning the Clip

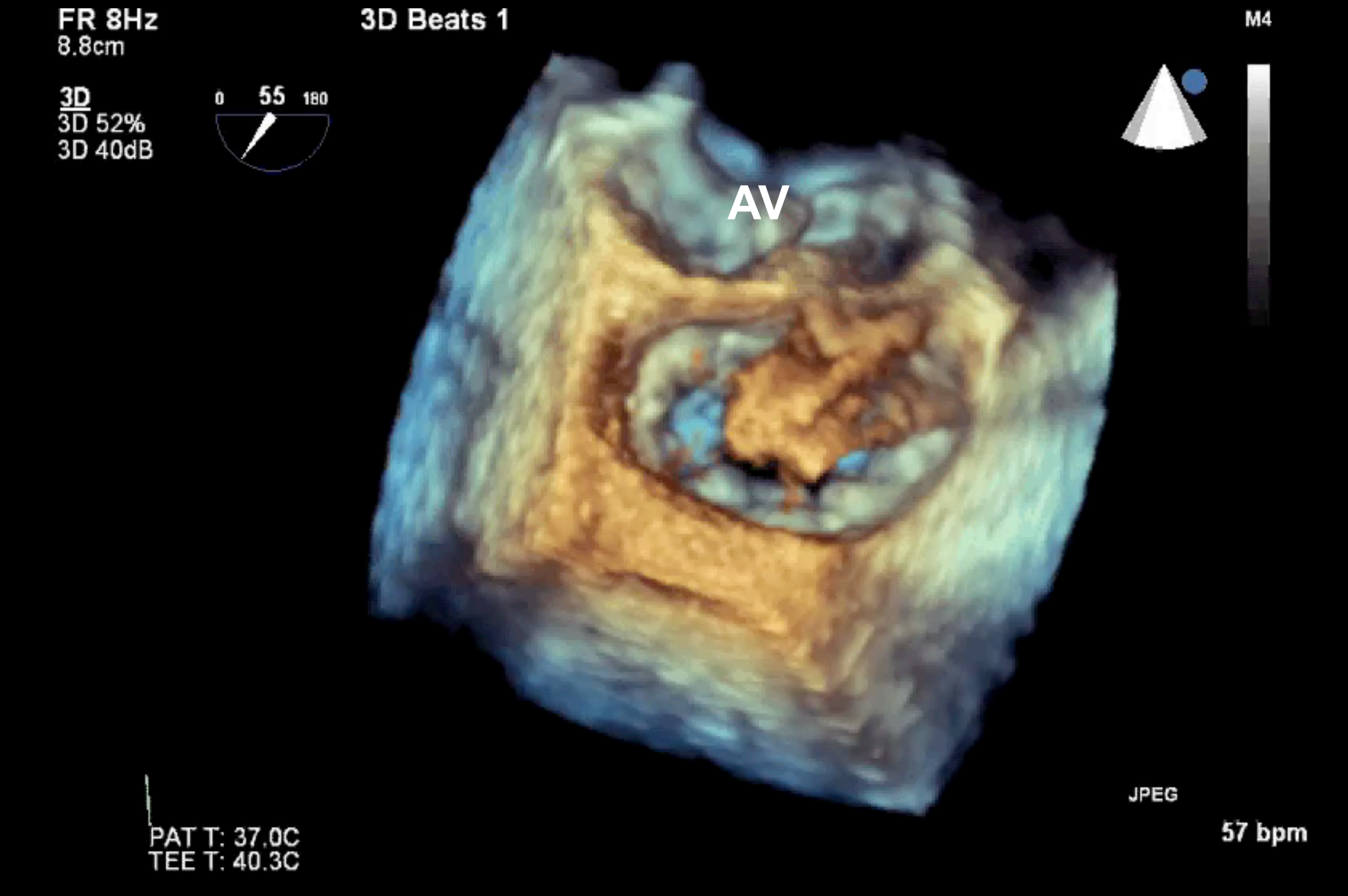


Positioning the Clip

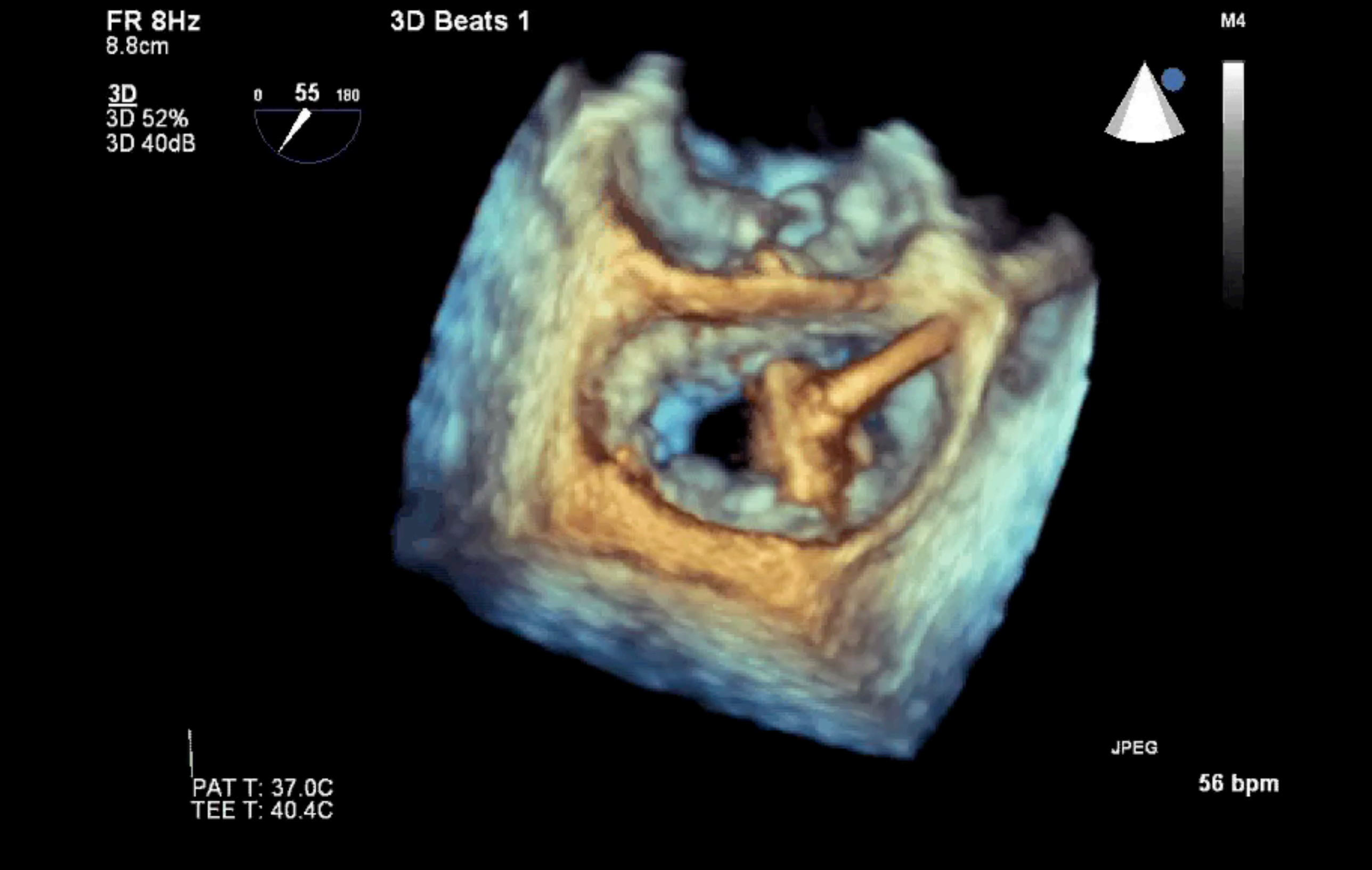


Positioning the Clip

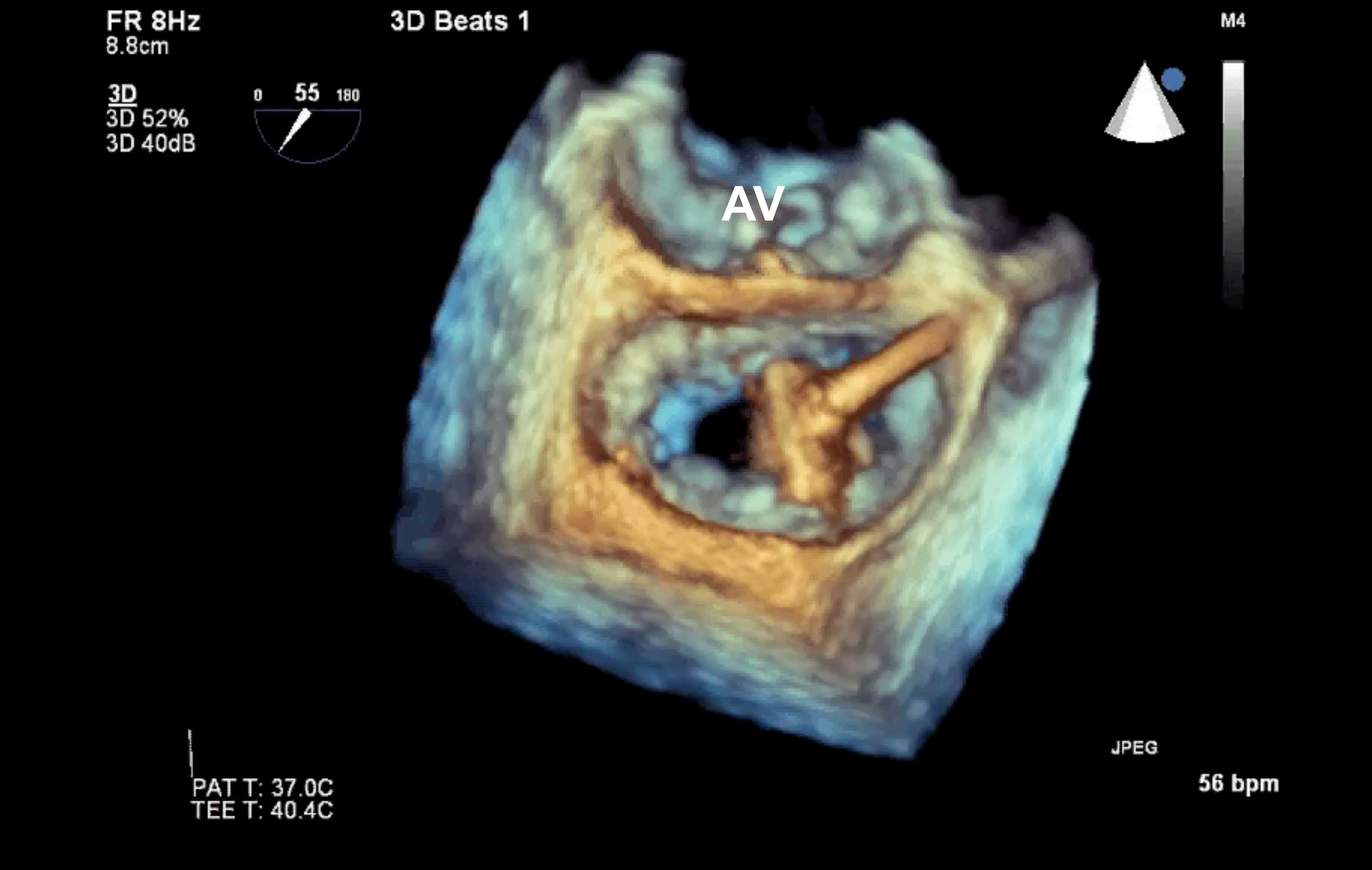
Positioning the Clip



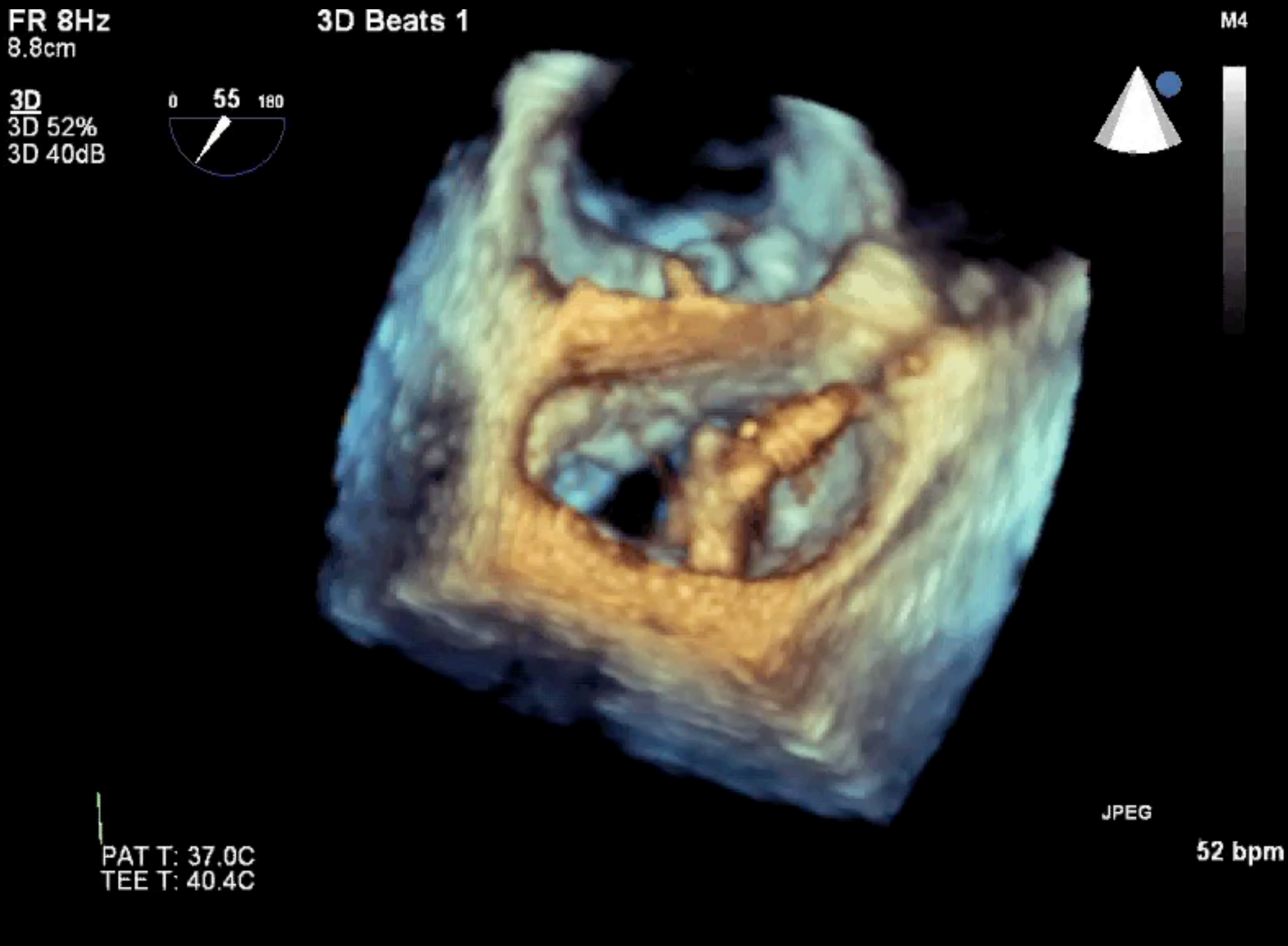
Positioning the Clip



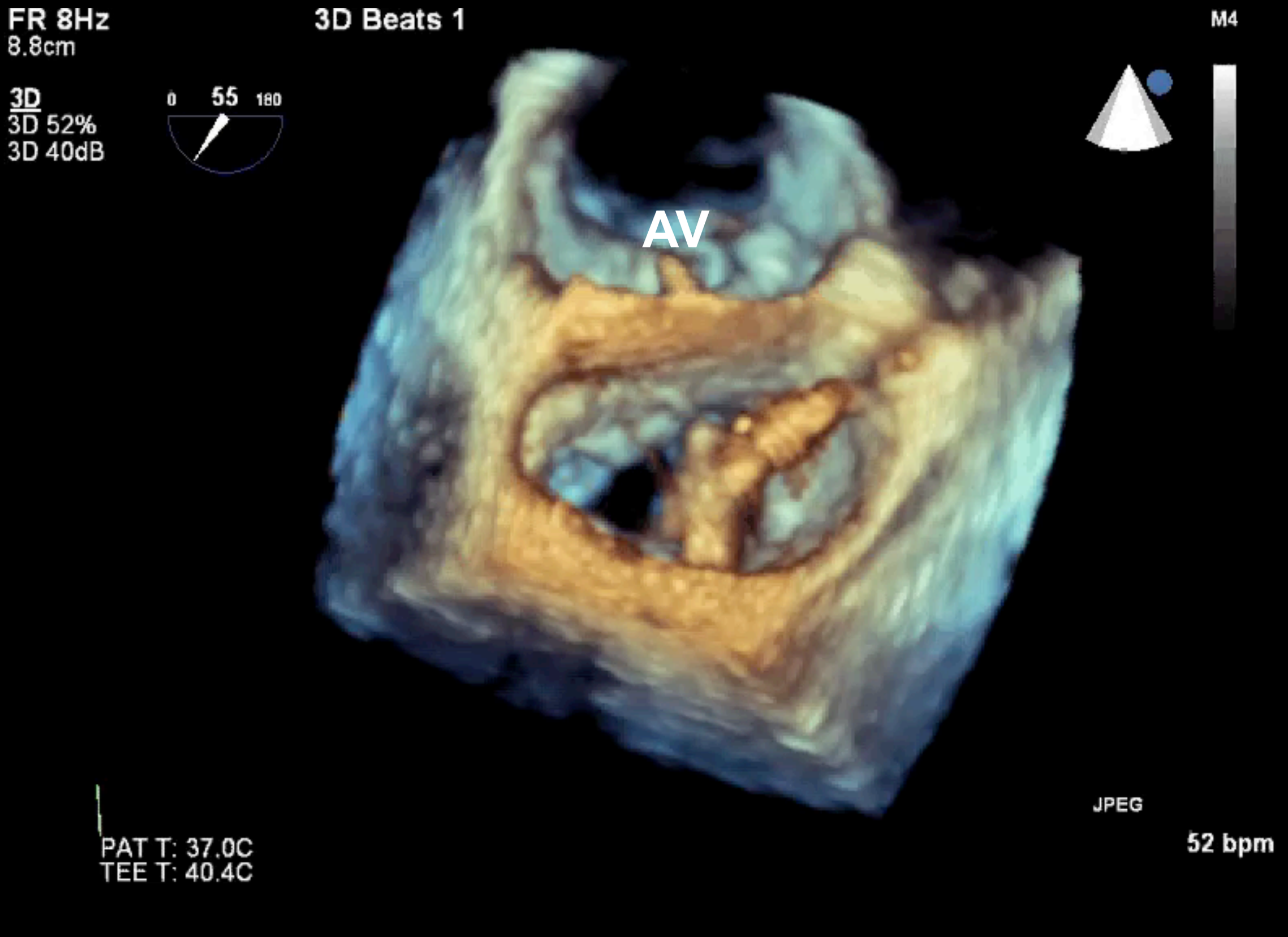
Positioning the Clip



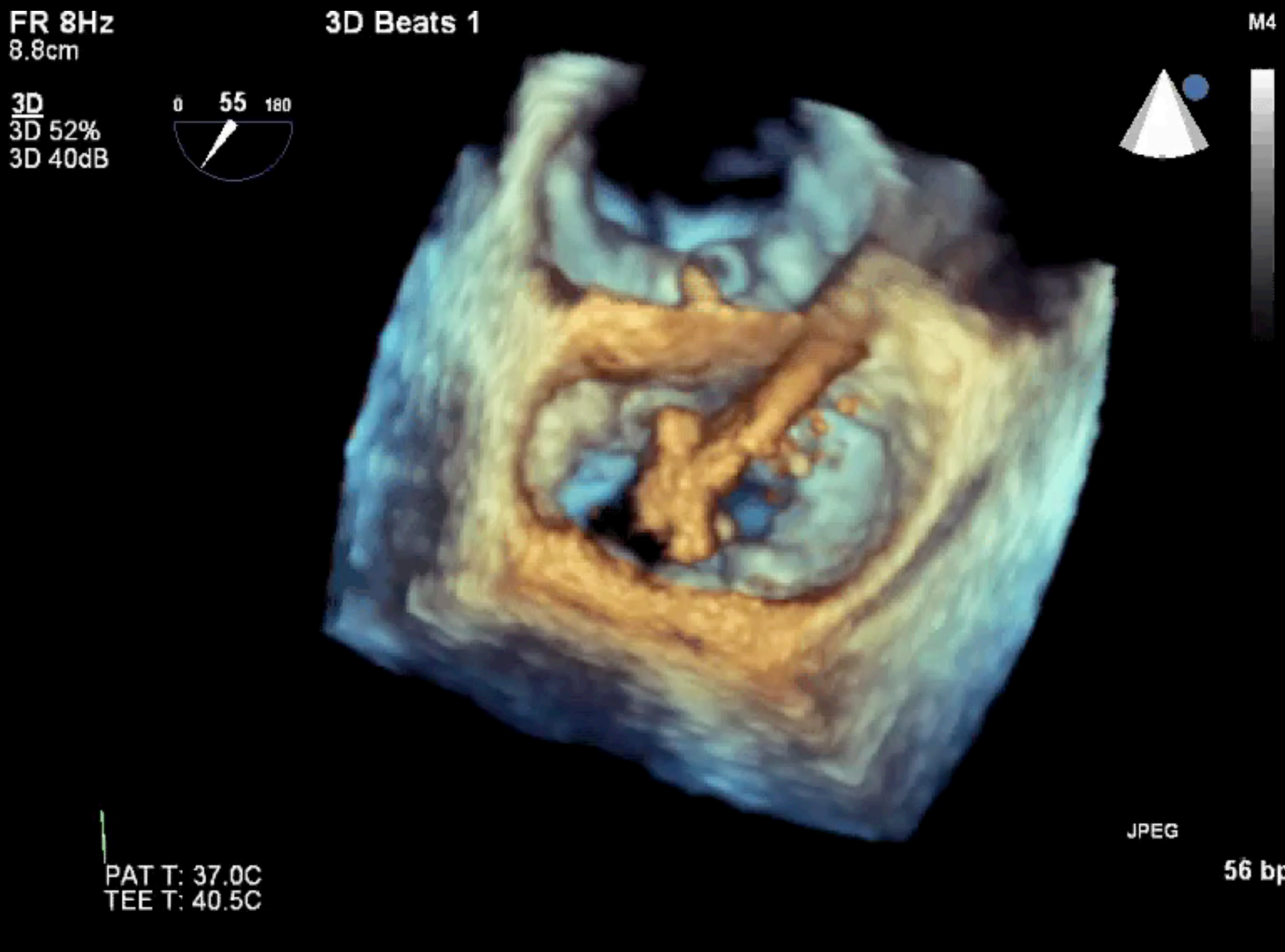
Positioning the Clip



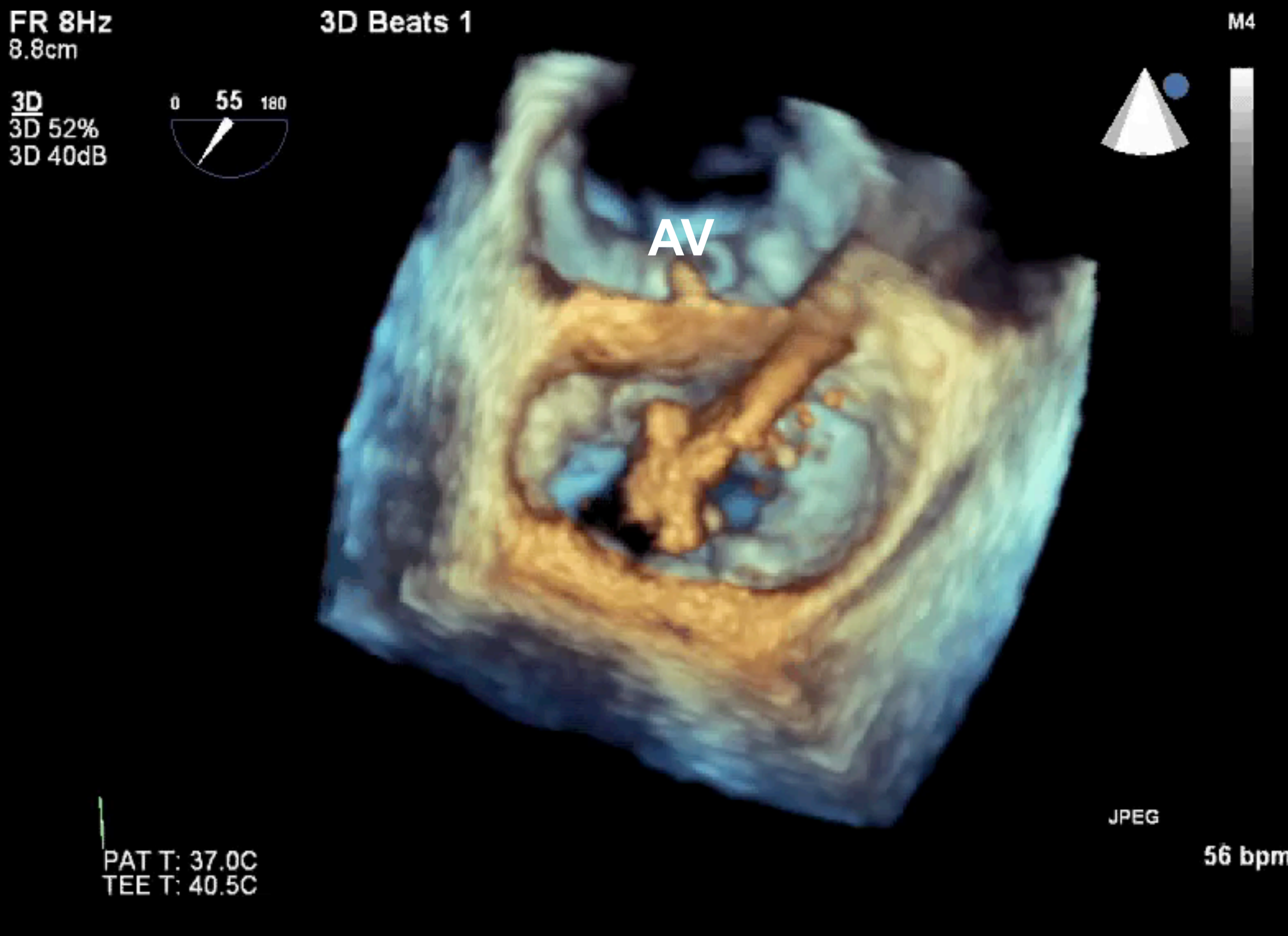
Positioning the Clip



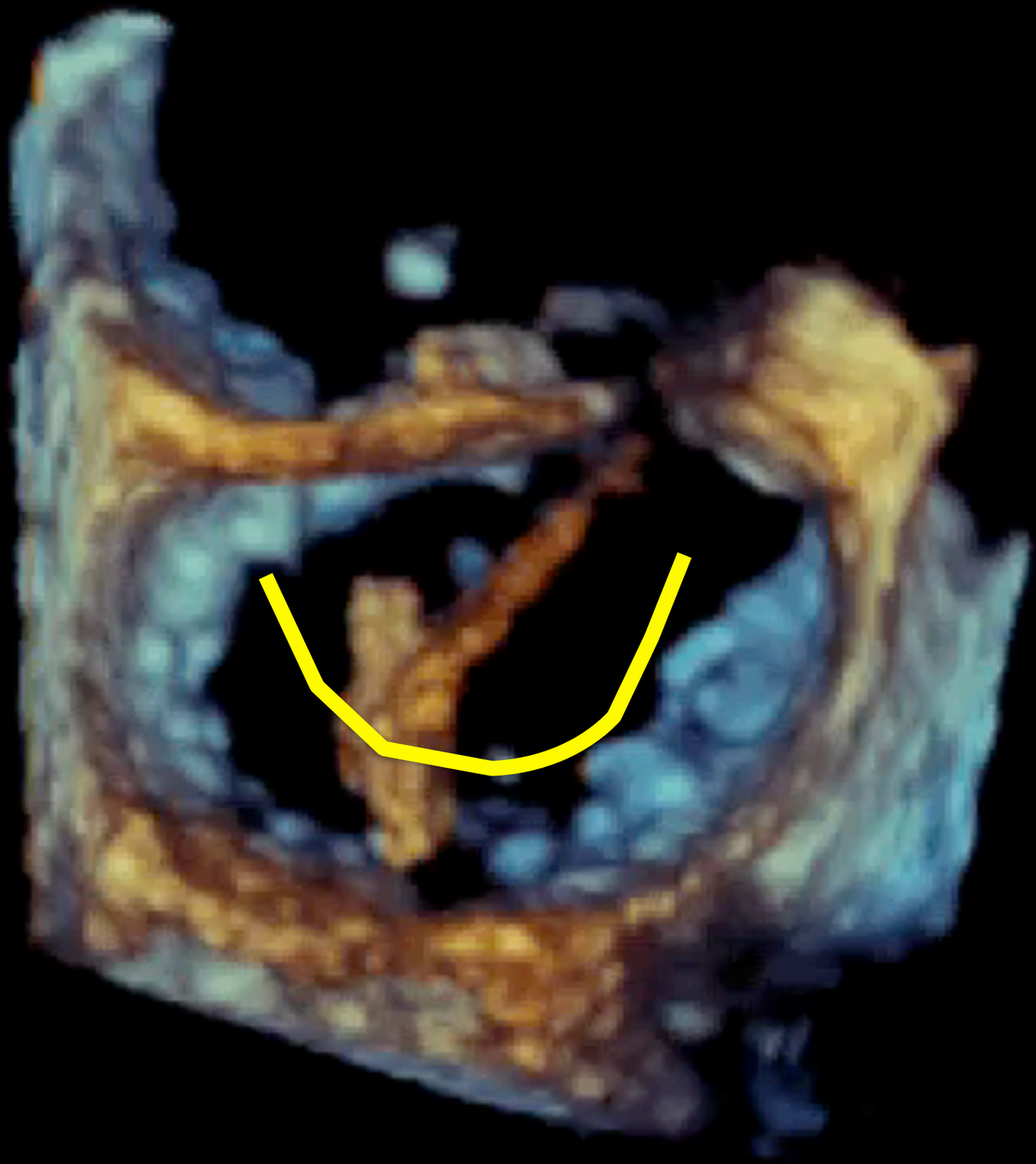
Positioning the Clip



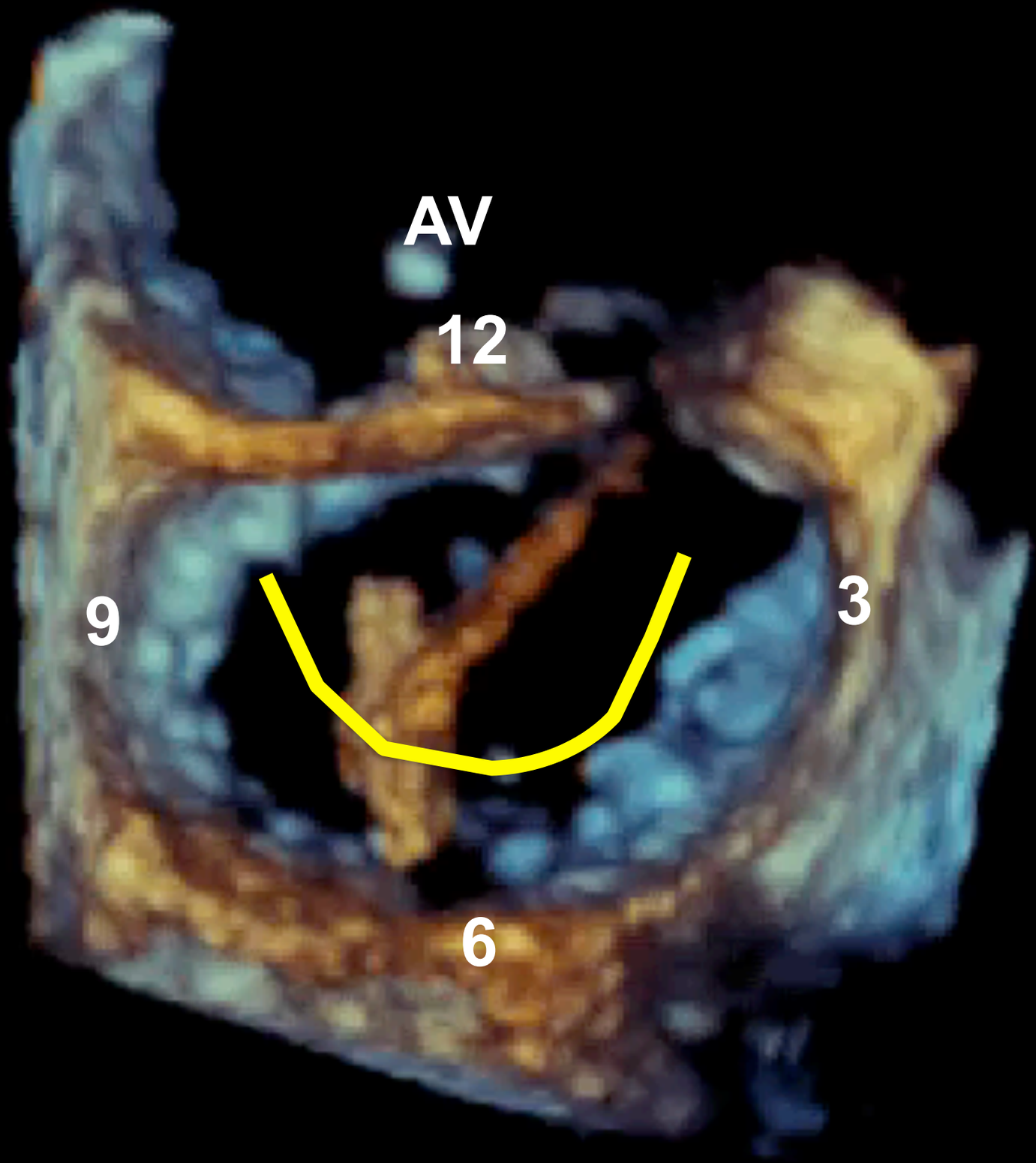
Positioning the Clip



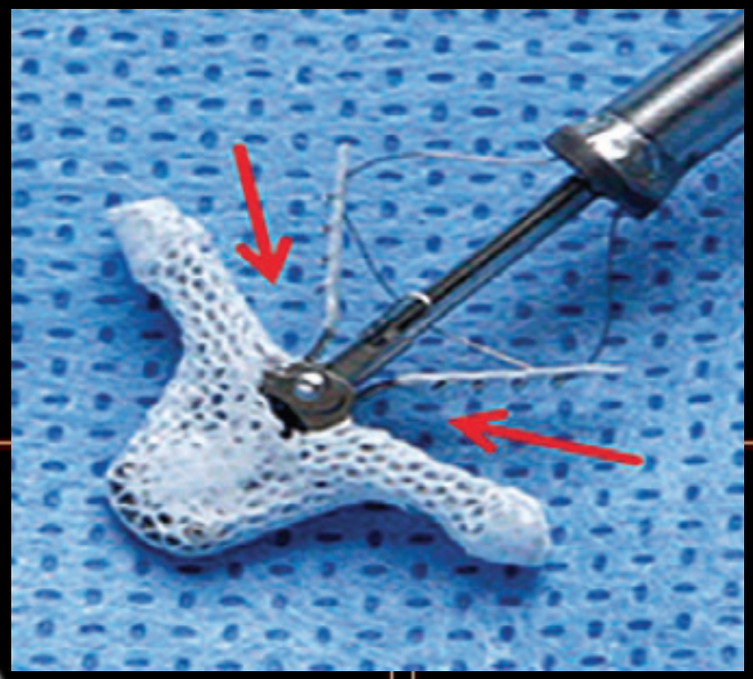
Turn Down the Gain



Turn Down the Gain



Clip Below the Valve in the LV



FR 35Hz
10cm

xPlane
69%
69%
50dB
P Off
Pen

M4

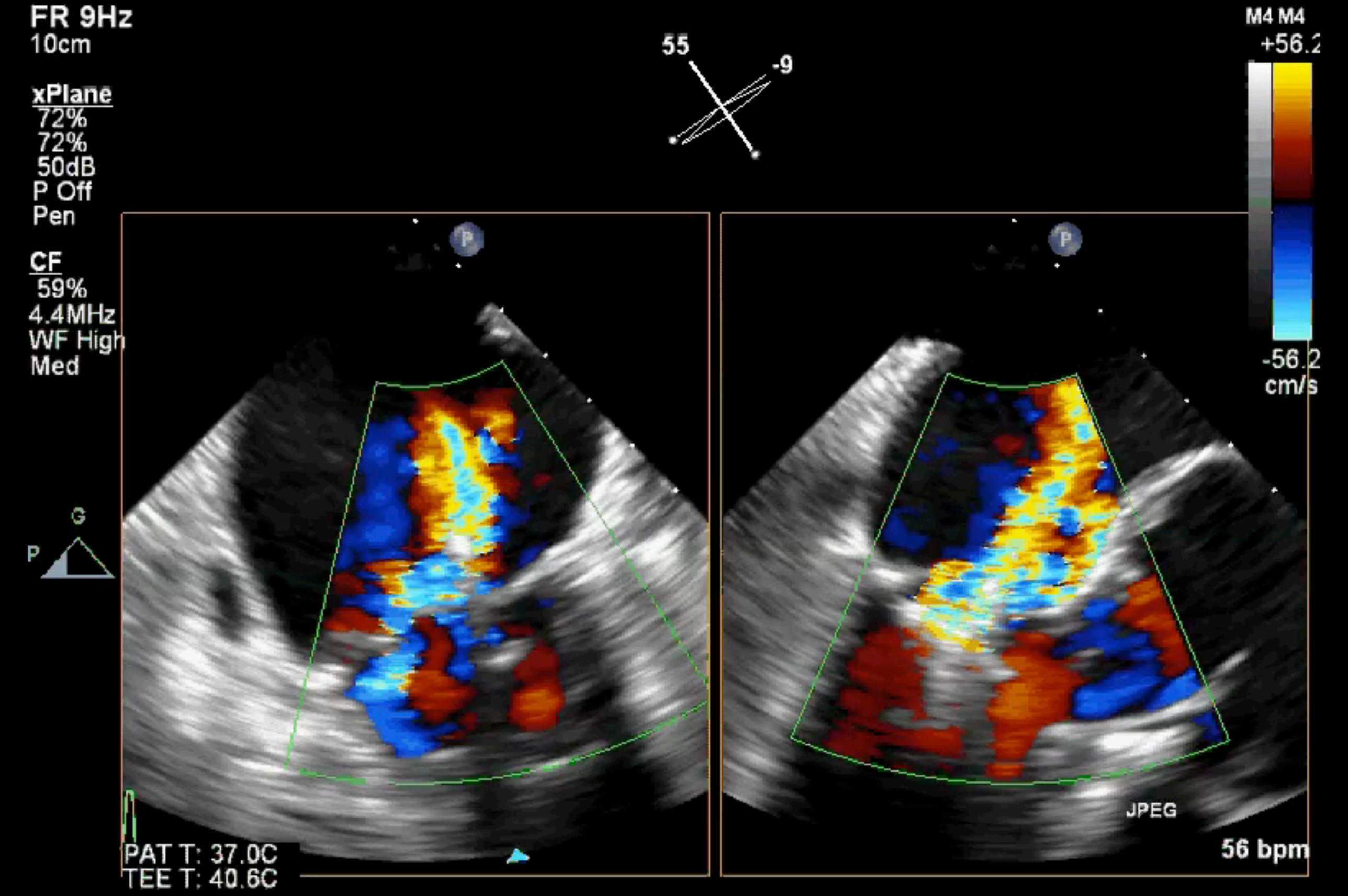
G
P
R

PAT T: 37.0C
TEE T: 40.0C

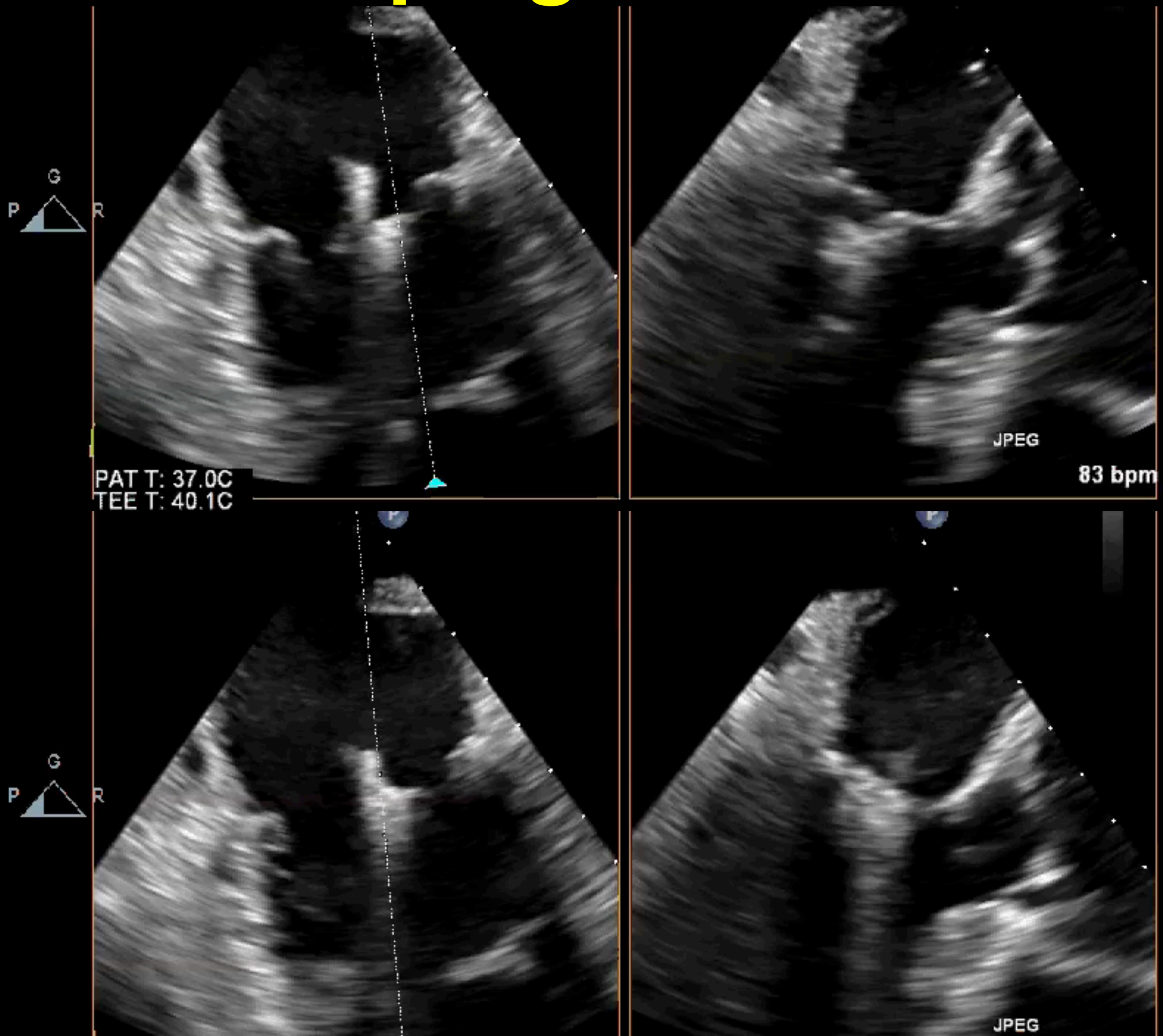
JPEG

79 bpm

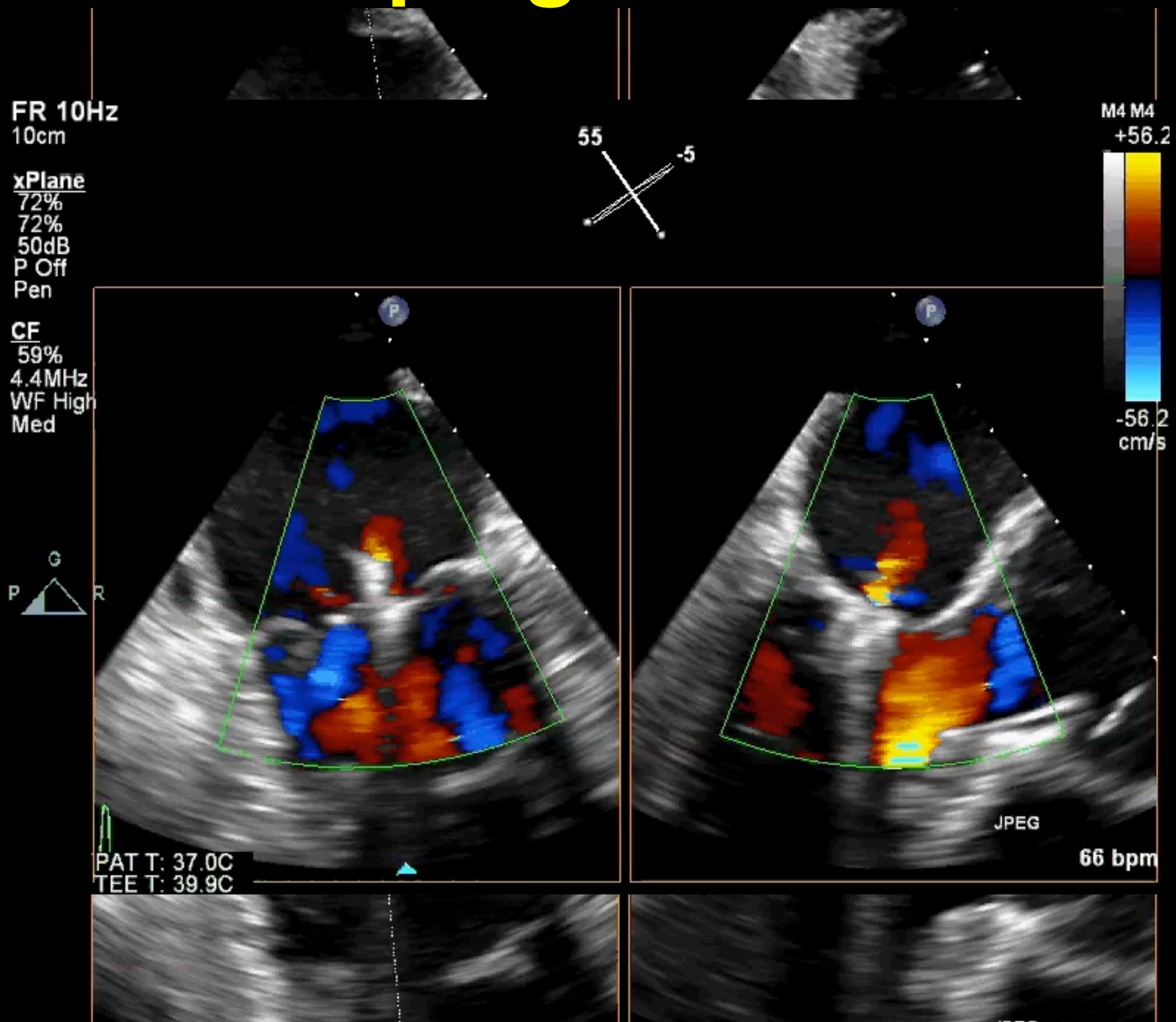
Clip Below the Valve in the LV



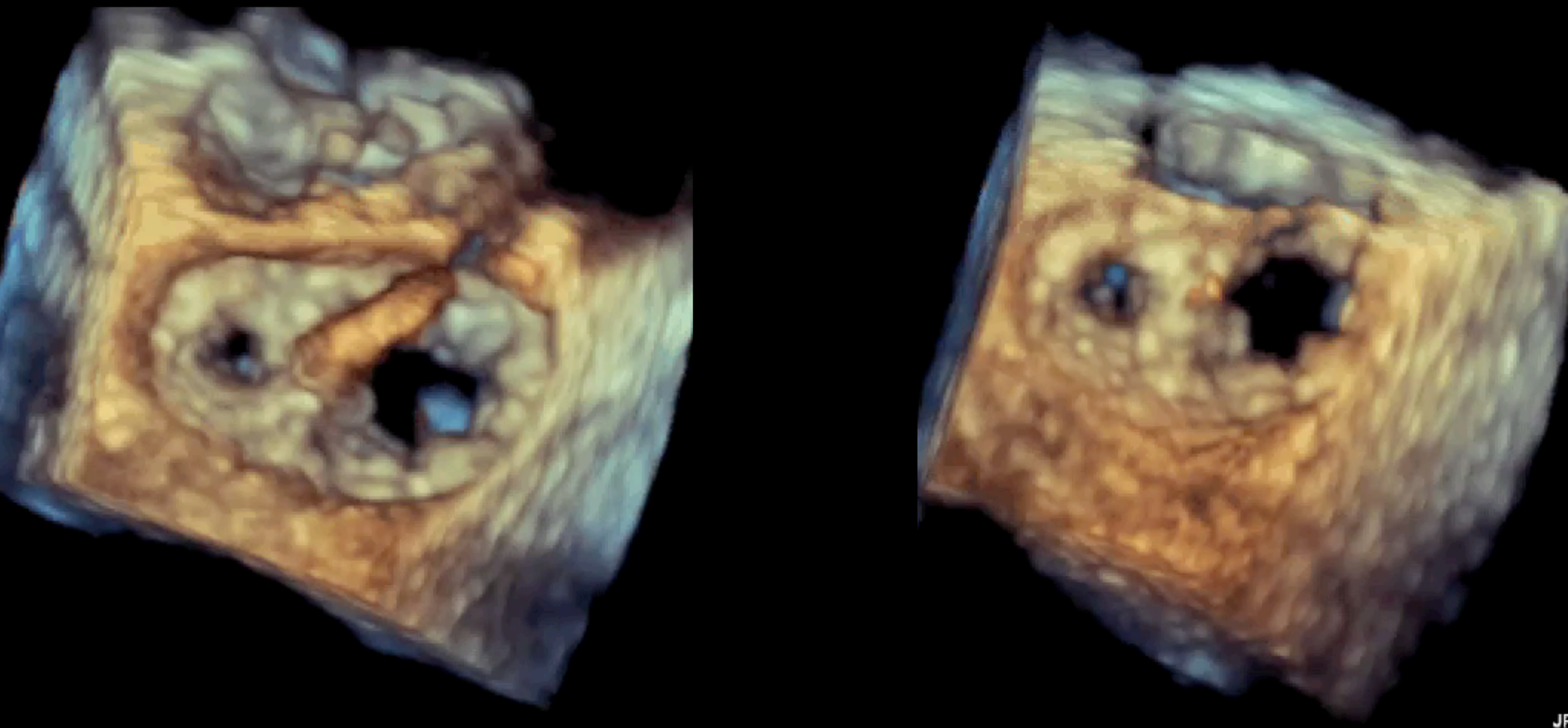
Grasping the Leaflets



Grasping the Leaflets

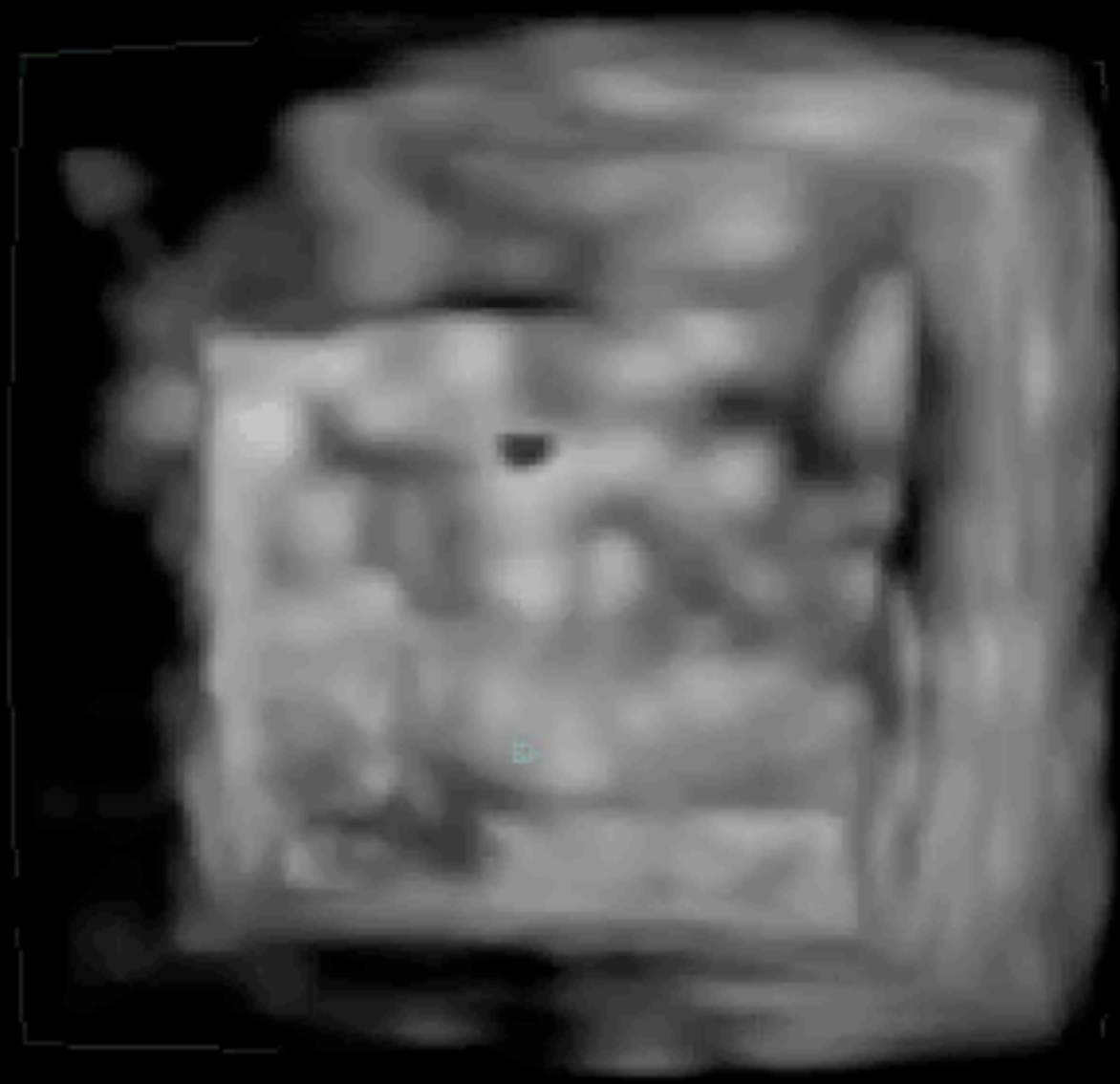


Releasing the Clip

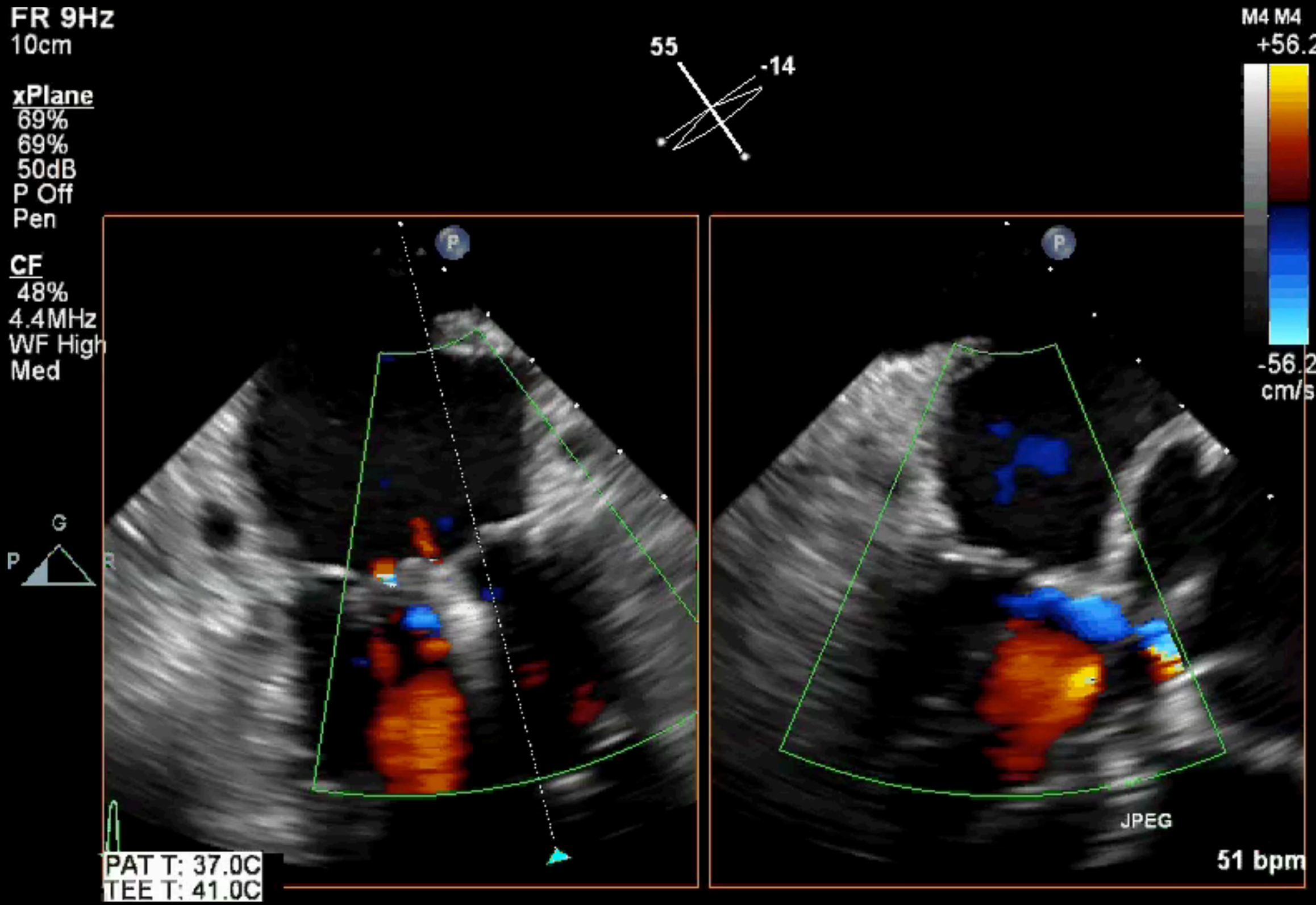


Measured Orifice > 1.5 cm^2

Releasing the Clip

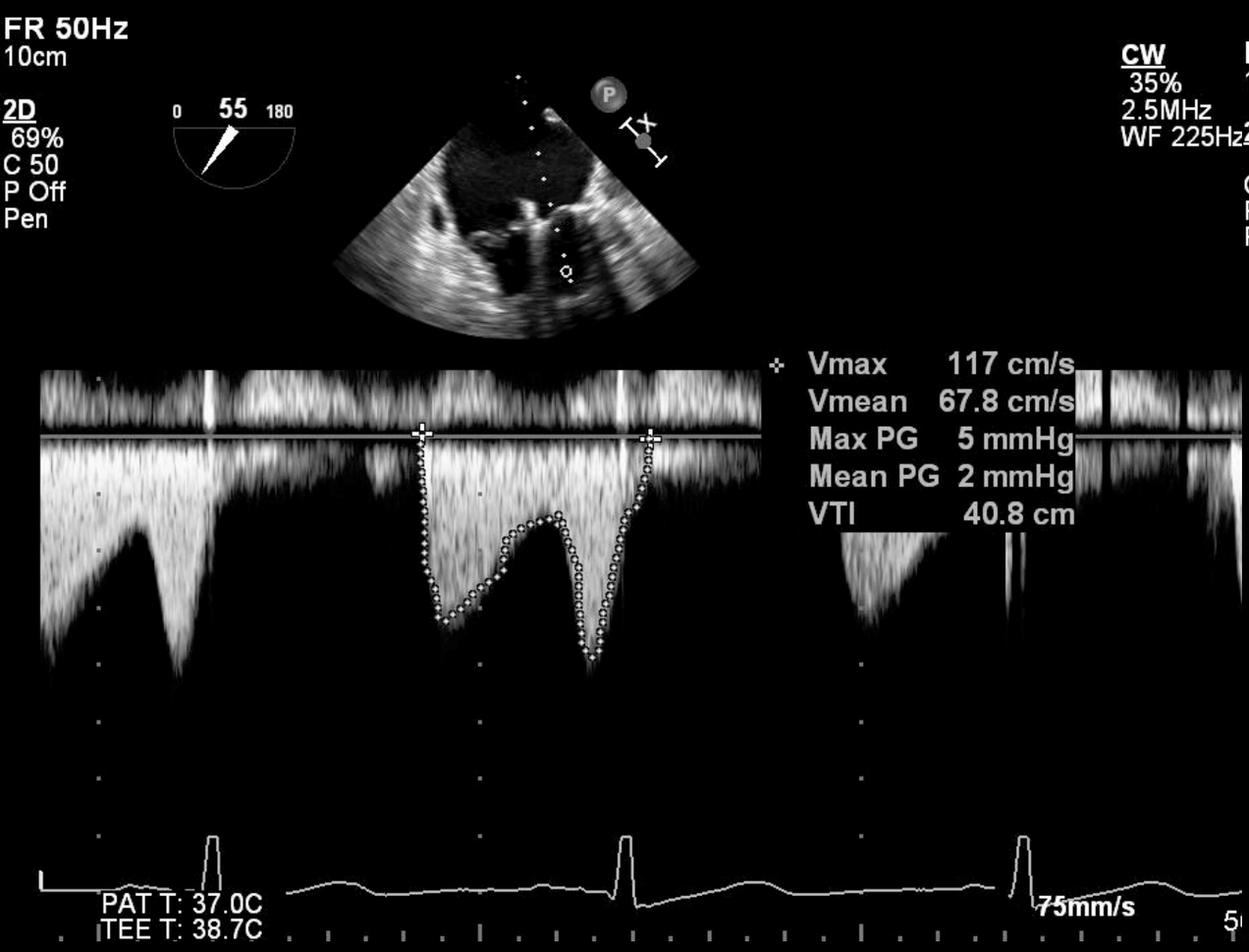


Releasing the Clip

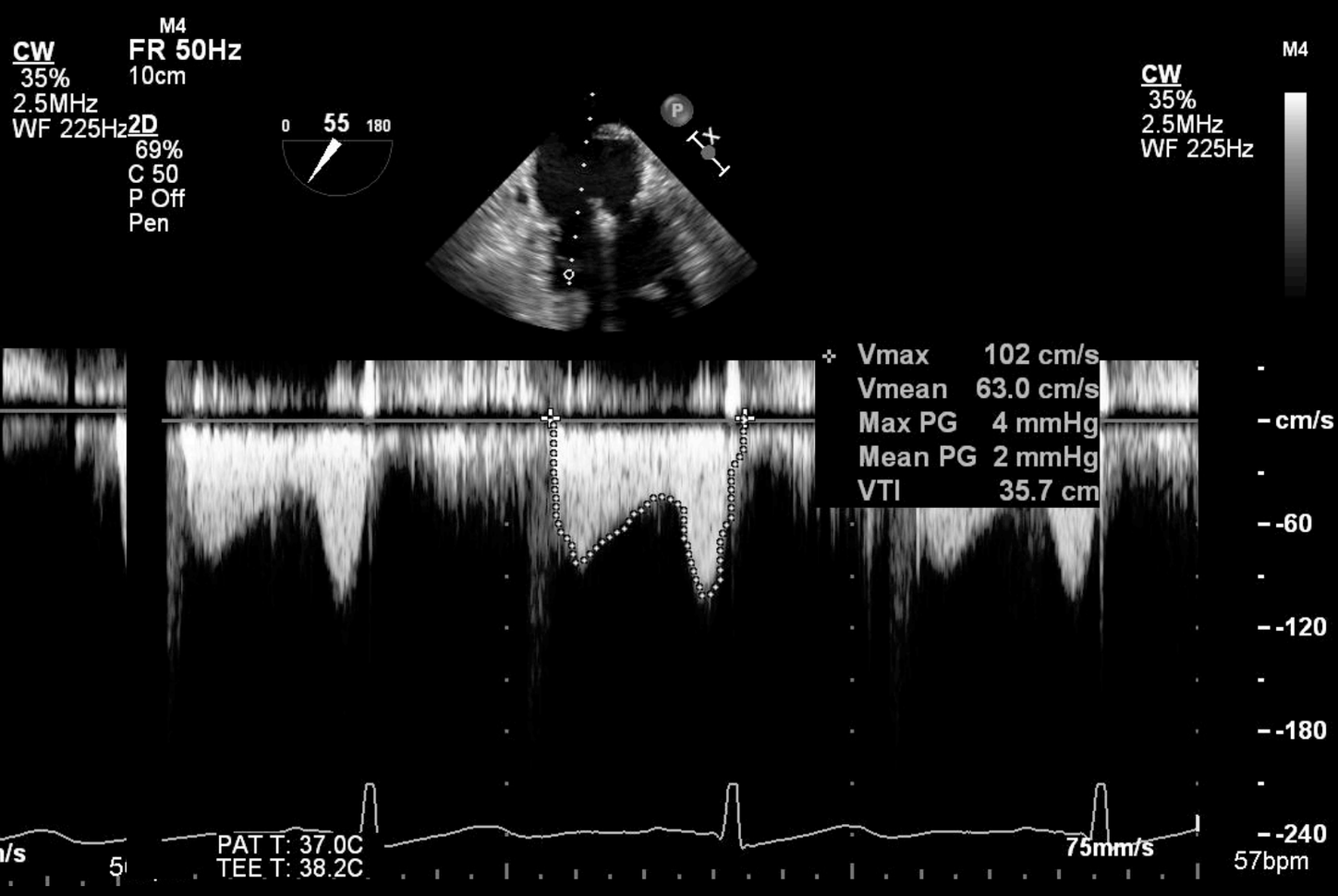


Gradients

Lateral Orifice



Medial Orifice



Mean Gradient < 5 mmHg

Echocardiographic Evaluation of Mitral Inflow Hemodynamics After Asymmetric Double-Orifice Repair

Agnieszka Trzcinka, MD,* John A. Fox, MD,* Douglas C. Shook, MD,* Jan N. Hilberath, MD,* Gregg Hartman, MD,† Bruce Bollen, MD,‡§ Xiaoxia Liu, MS,* Andrea Worthington, BA,* and Stanton K. Shernan, MD, FAHA, FASE*

BACKGROUND: A comprehensive transesophageal echocardiographic (TEE) examination is essential for the evaluation of a mitral valve (MV) repair. The edge-to-edge MV repair (i.e., Alfieri stitch) can pose a unique challenge in assessing iatrogenic mitral stenosis, especially when an asymmetric double-orifice is created. The reliability of the simplified Bernoulli equation for evaluating transvalvular pressure gradients across an asymmetric Alfieri MV repair remains controversial. We sought to evaluate the reliability of this principle further by comparing TEE-acquired pressure gradients across each orifice in patients undergoing asymmetric, double-orifice repair.

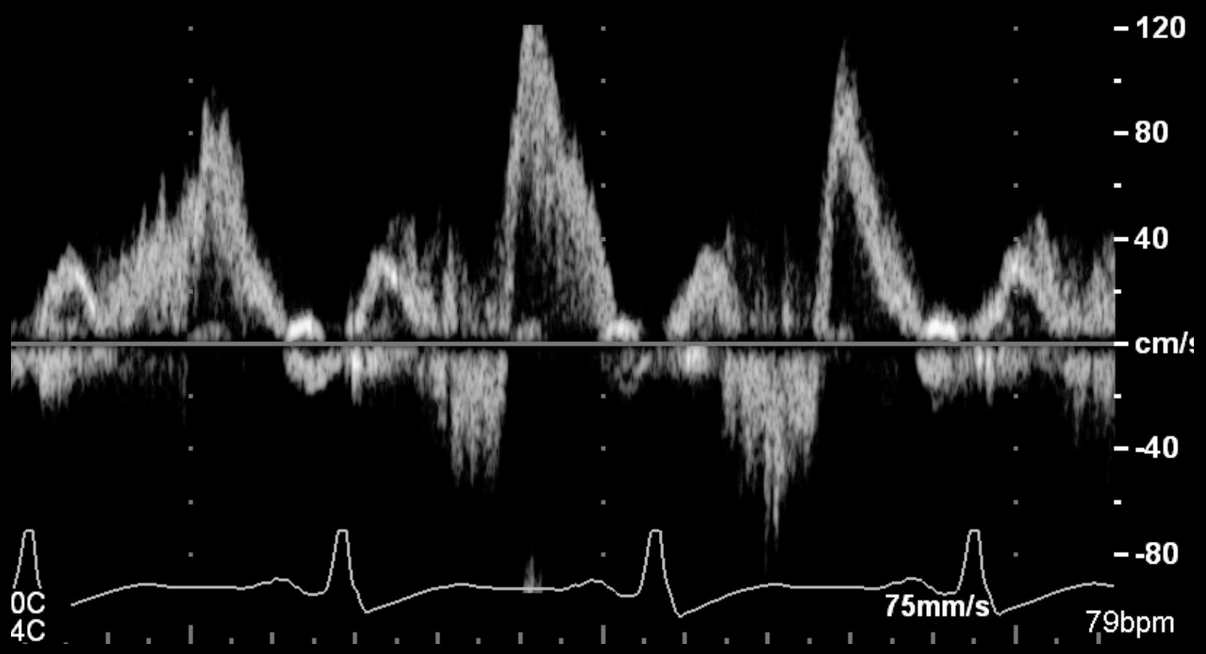
METHODS: Routinely collected intraoperative, 2-dimensional and 3-dimensional TEE datasets acquired from 15 patients undergoing double-orifice MV repair were retrospectively reviewed and analyzed. Planimetered anterior lateral (AL) and posterior medial (PM) orifice areas were acquired from 3-dimensional TEE full volume datasets, by cropping the image to develop a short-axis view at the narrowest diastolic orifice cross-sectional area at the MV leaflet tips. Transmitral Doppler flow velocity values were measured through the AL and PM orifices. Peak and mean pressure gradients were calculated from the simplified Bernoulli equation at both orifices and were compared to each respective orifice for each patient.

RESULTS: The mean difference between the AL and PM orifice areas for each patient was statistically significant (0.72 ± 0.40 cm^2, $P < 0.0001$). The mean differences between the AL and PM parameters were also significant for peak velocity: 0.15 m/s, SD: 0.08, $P < 0.0001$; peak pressure gradients: 1.76 mm Hg, SD: 1.42, $P < 0.0001$; and mean pressure gradient: 1.04 mm Hg, SD: 0.93, $P < 0.0001$.

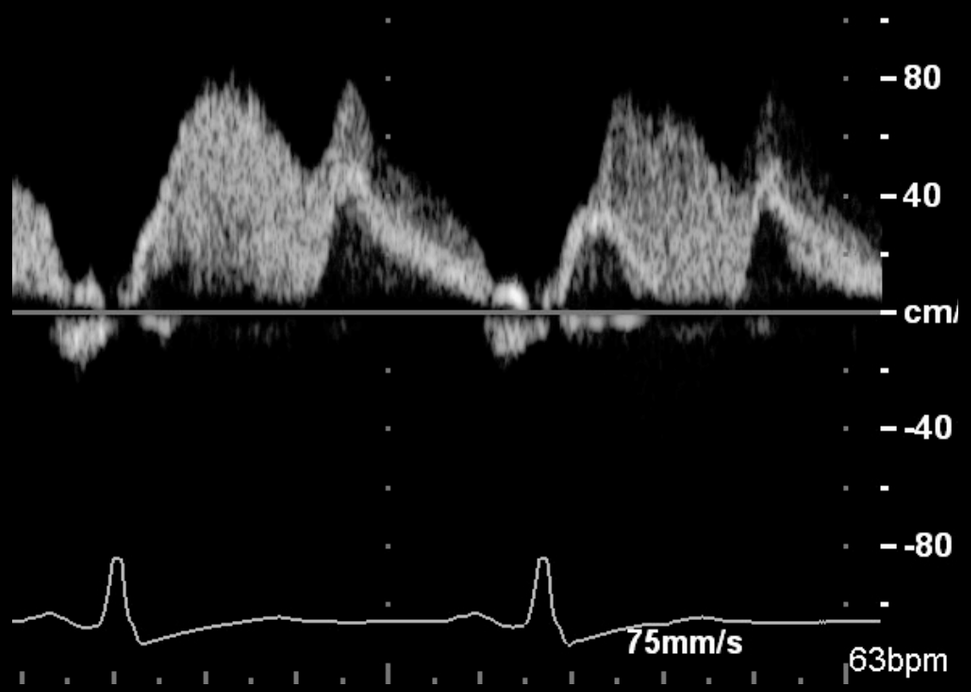
CONCLUSIONS: The echocardiographic assessment of MV dysfunction after an Alfieri repair is important. Although the differences that we demonstrated between orifice areas and maximum velocities across the asymmetric orifices after a double-orifice MV repair are statistically significant, the corresponding difference in mean transorifice pressure gradient is not clinically relevant. Thus, either orifice can be interrogated with Doppler echocardiography for the determination of pressure gradients after double-orifice MV repair. (Anesth Analg 2014;119:1259–66)

Pulmonary Veins

Before



After



Procedural Steps for MitraClip

- Transseptal puncture
- Introduction of the steerable guide catheter into the left atrium
- Advancement of the clip delivery system into the left atrium
- Positioning the clip above the mitral valve
- Advancing the clip into the left ventricle
- Grasping the leaflets and assessing for insertion
- MR and MS evaluation
- Clip detachment and assess need for additional clips
- Assess for pericardial effusion and other complications