Conoscere e Curare il Cuore 2019

GIOVEDI' 28 FEBBRAIO

ROLE OF ECHOGRAPHY, ECHOCARDIOGRAPHY DURING PERCUTANEOUS STRUCTURAL INTERVENTIONS

Giovanni La Canna

Applied Diagnostic Echocardiography,
Cardiovascular Department

Humanitas Clinical and Research Institute

Rozzano, Milan, Italy

giovanni.lacanna@humanitas.it lacannagiovanni.cardio@gmail.com

«The promise of percutaneous cardiac interventions»

- Effective and durable treatment of the target cardiac lesion
- Reproducibility of surgical techniques and results
- Avoiding sternotomy and extracorporeal circulation
- To reduce the Hospital stay
- To extend clinical applications over surgery
- To improve symptoms and survival

Structural Cardiac Interventions: Currently available procedures

- Closure of intra-cardiovascular shunts
- Treatment of valvular heart disease
- Paravalvular leak closure
- Obliteration of left atrial appendage
- Balloon valvuloplasty
- Alcoholic Septal Ablation
- Stenting of vessels disease

Structural Cardiac Percutaneous Therapy

Access Catheterization

- **Anterograde** (trans-septal)
- **Retrograde**
  - transaortic
  - transapical
- **Transvenous**

The use of imaging in new transcatheter interventions: an EACVI review paper

Jose Zamorano[1*], Alexandra Gonçalves[2,3], Patrizio Lancellotti[4,5,6], Kai A Andersen[7], Ariana González-Gómez[1], Mark Monaghan[8], Eric Brochet[9], Nina Wunderlich[10], Sameer Gafoor[11], Linda D. Gillam[12], and Giovanni La Canna[13]

European Heart Journal – Cardiovascular Imaging

Imaging Monitoring

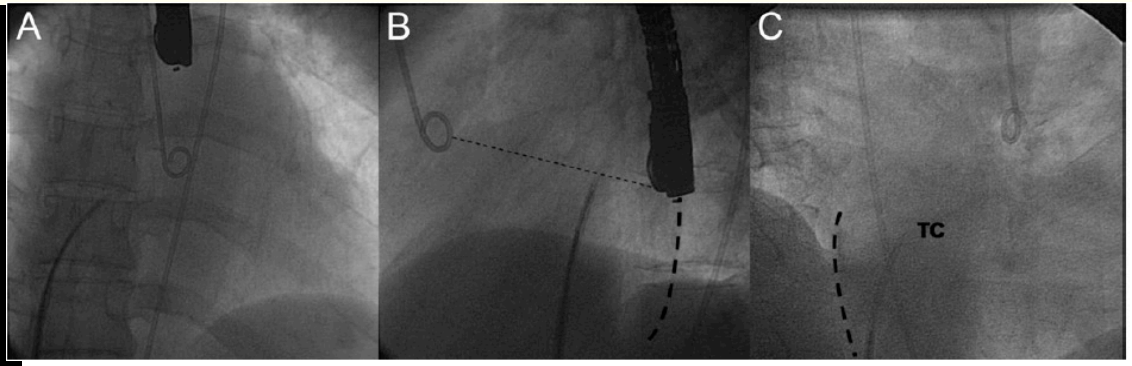
- **Fluoroscopy**
- **Echocardiography**
  - Transesophageal
  - Transthoracic
  - Intracardiac Echo
- **Imaging fusion**

Emerging Applications for Transseptal Left Heart Catheterization

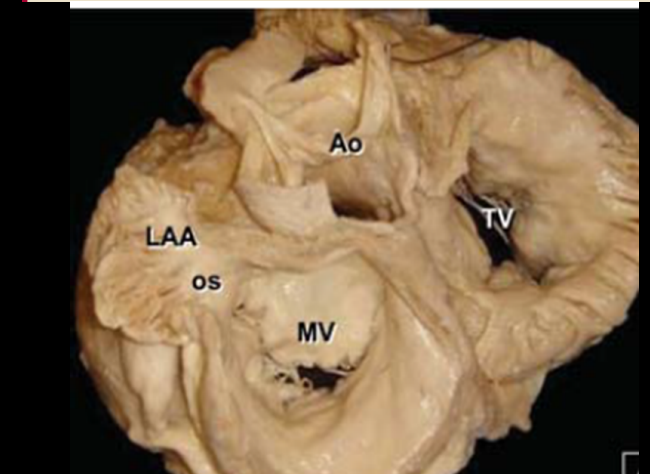
Old Techniques for New Procedures

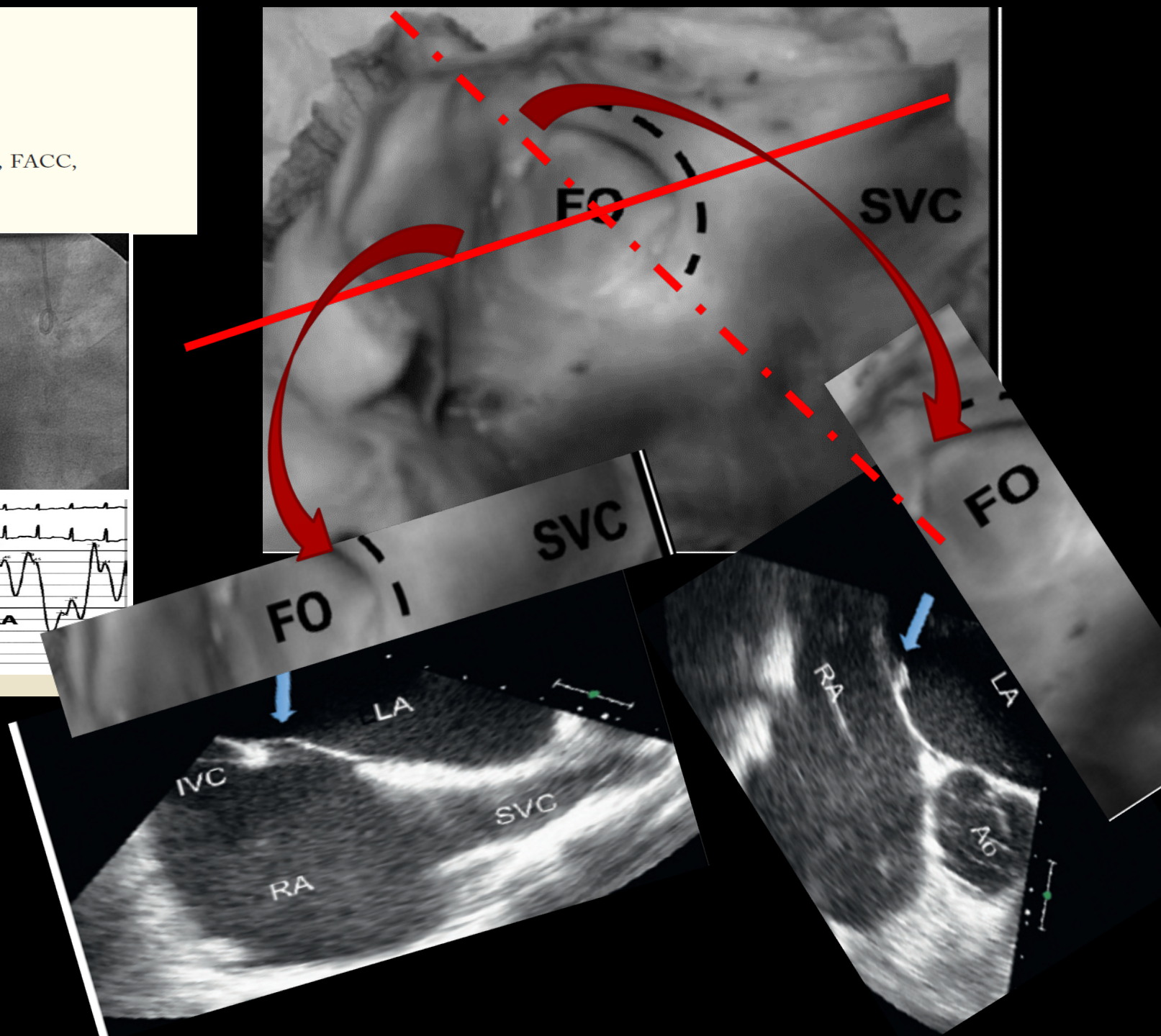
Vasilis C. Babaliaros, MD, Jacob T. Green, MD, Stamatios Lerakis, MD, FACC, Michael Lloyd, MD, Peter C. Block, MD, FACC

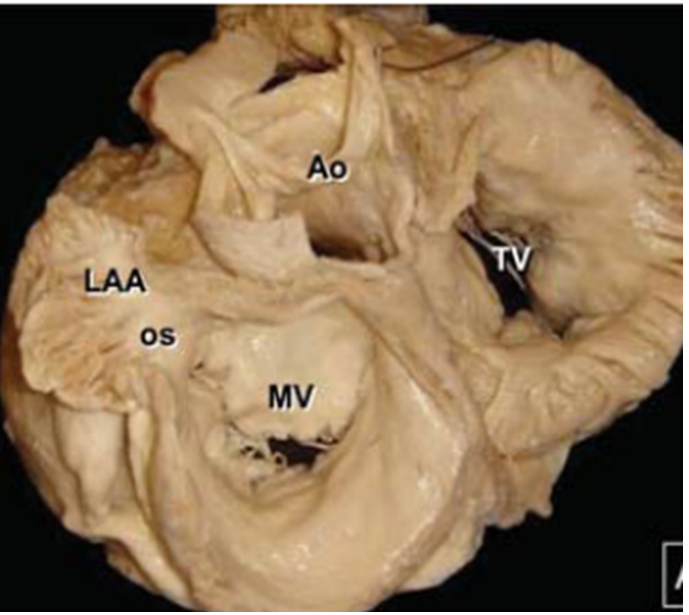
Atlanta, Georgia

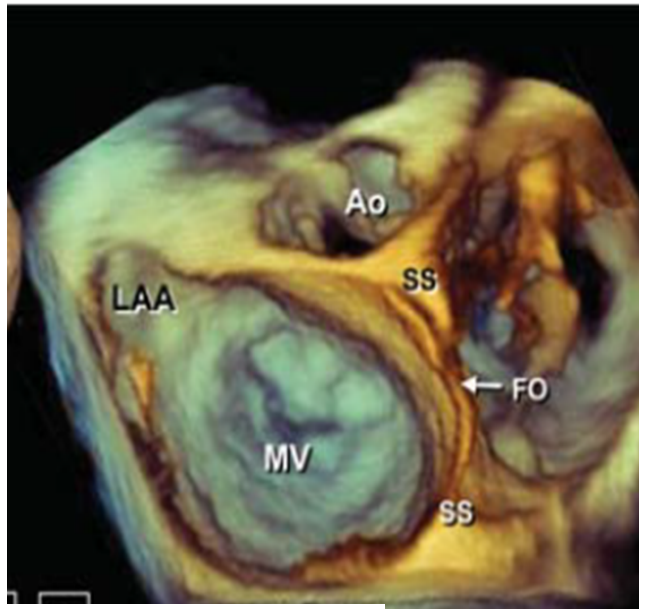


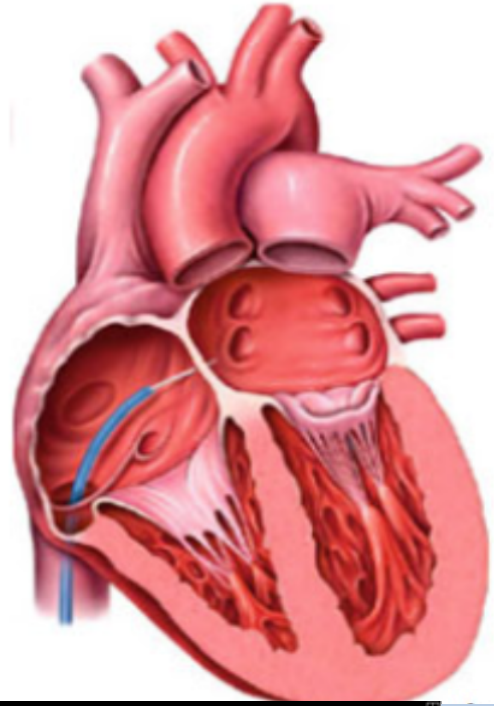
Pressure Tracing From Transseptal Needle During Transseptal Catheterization

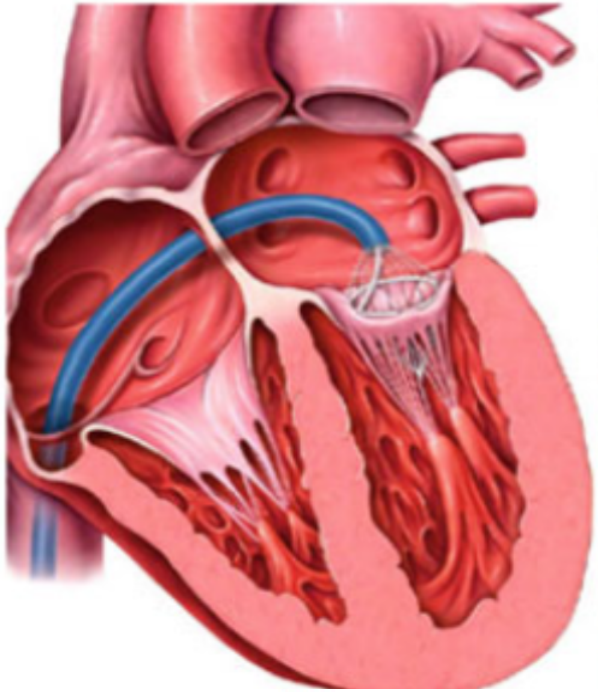


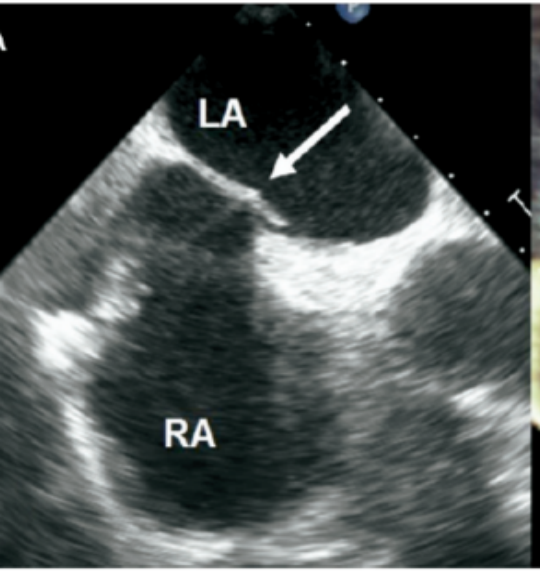


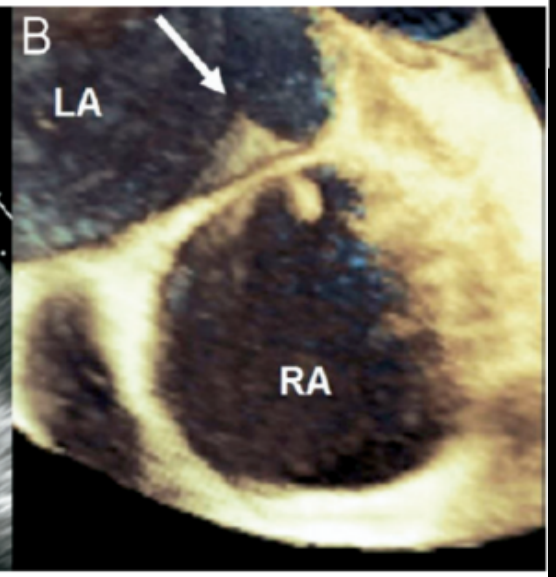






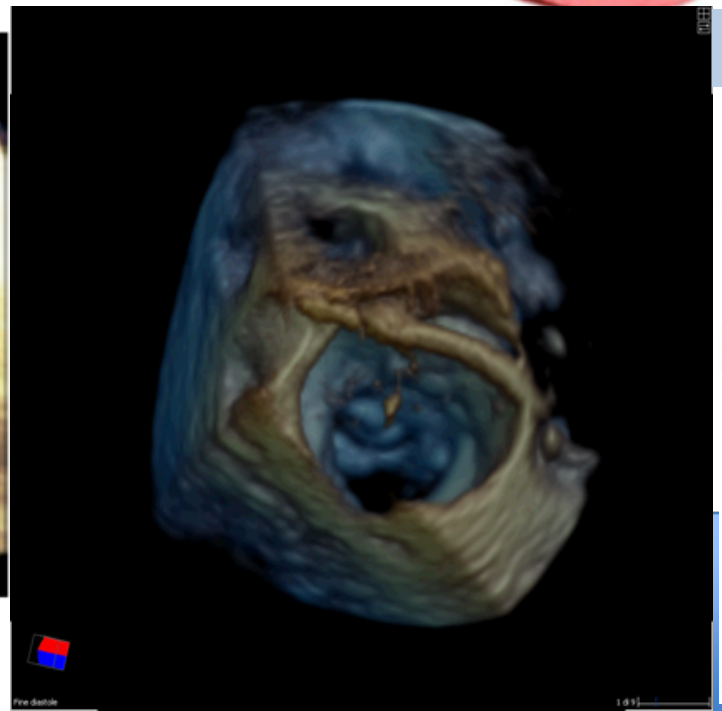




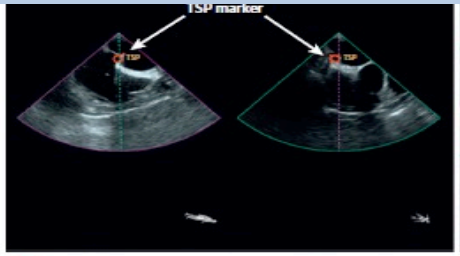


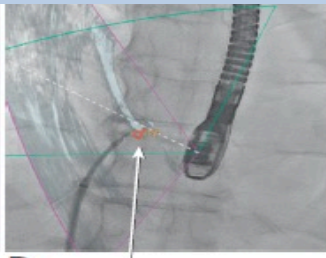
2 Dimensional ECHO Tenting

3 Dimensional ECHO Tenting

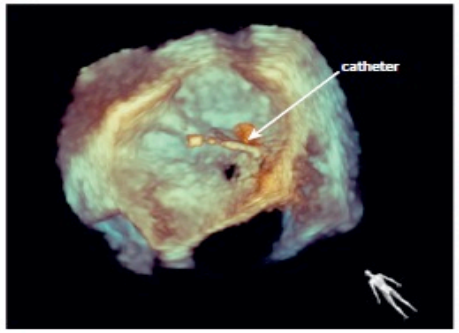


ECHO-FLUOROSCOPY FUSION IMAGING

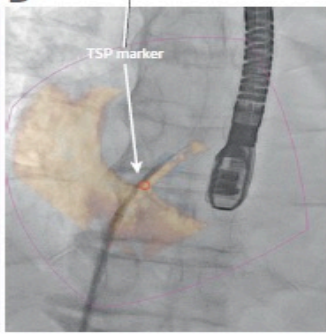




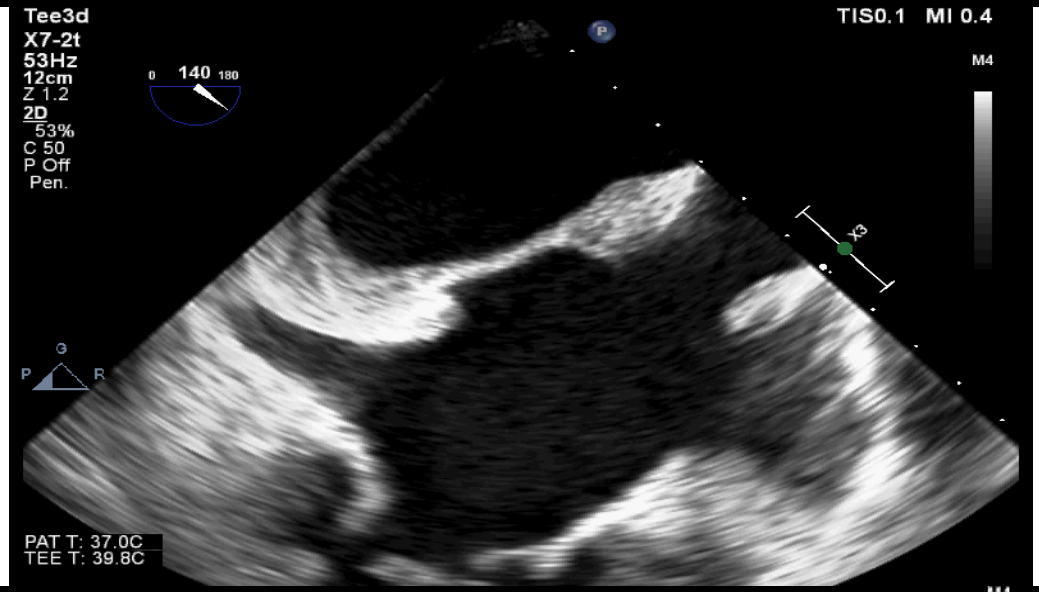
C

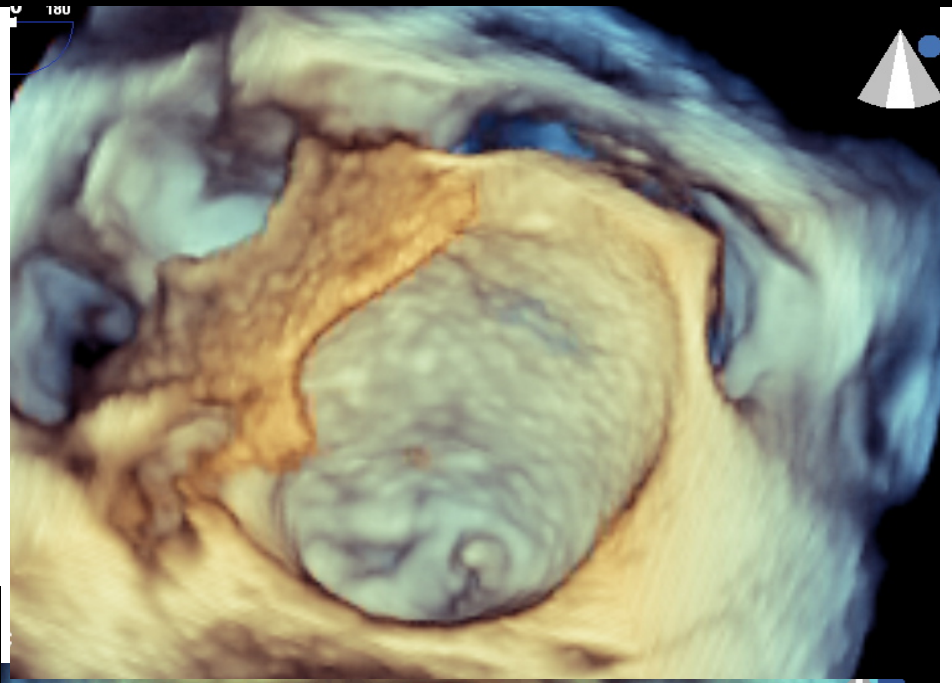


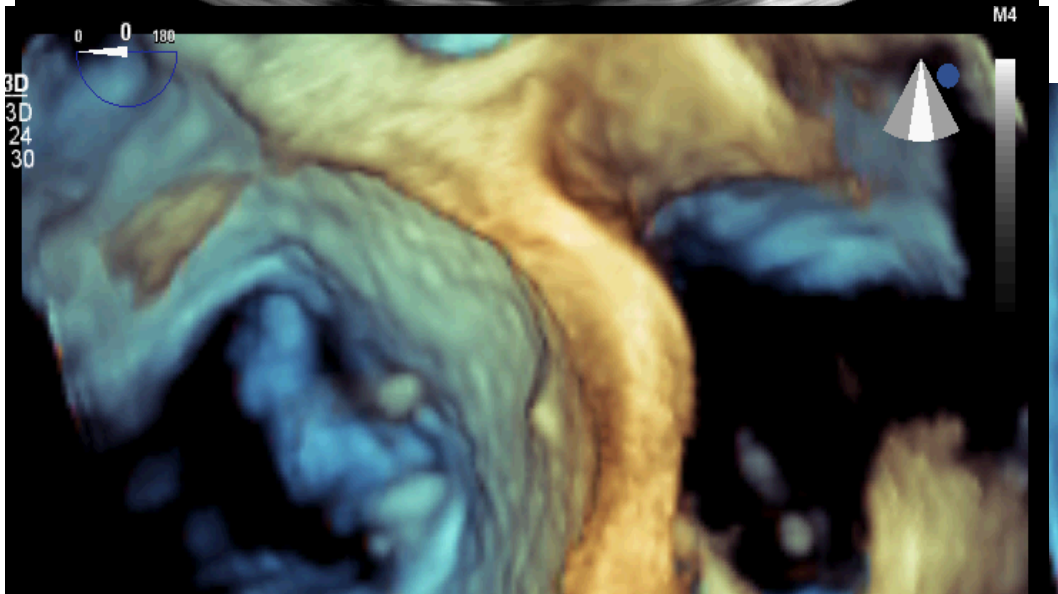
D

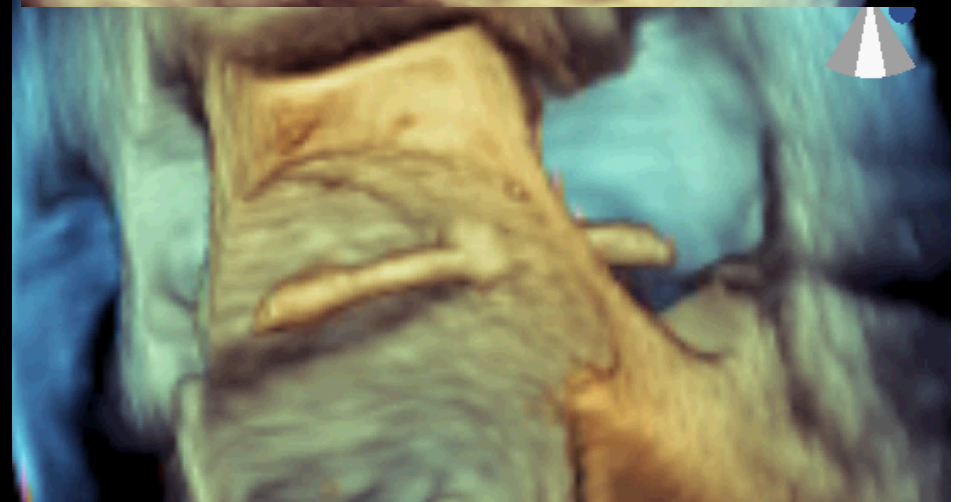


Interatrial septal involvement in amyloid cardiomyopathy: Technically demanding trans-septal catheterization





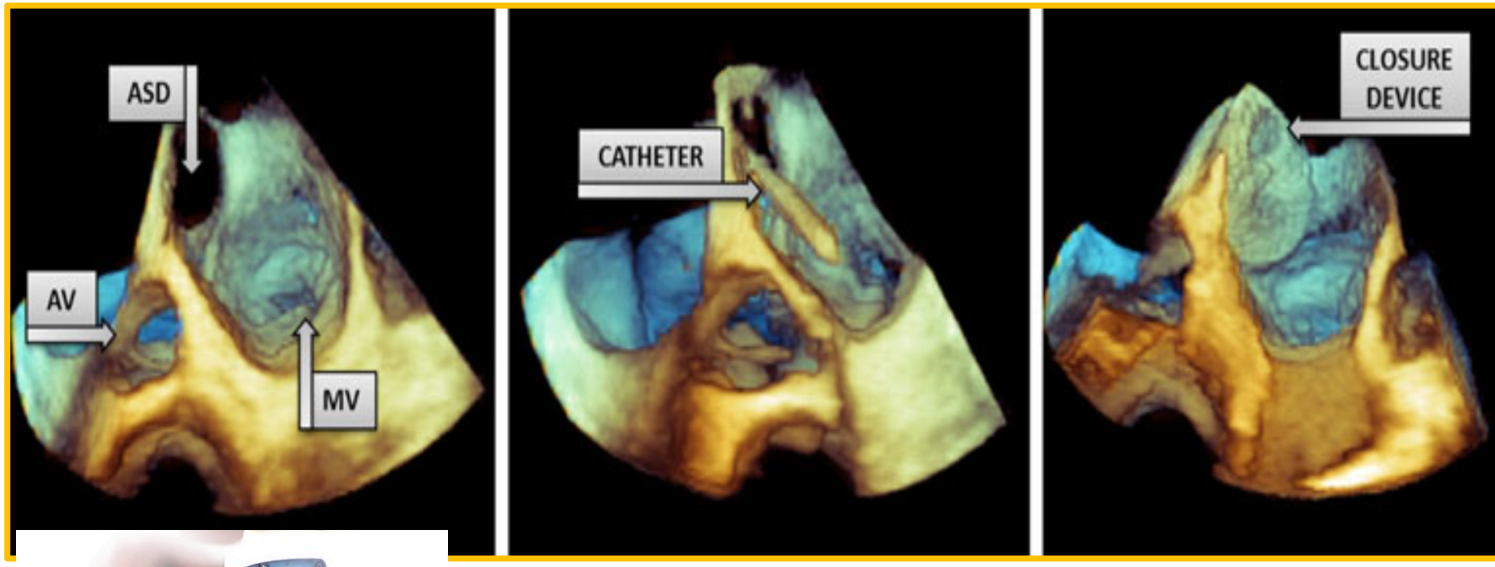


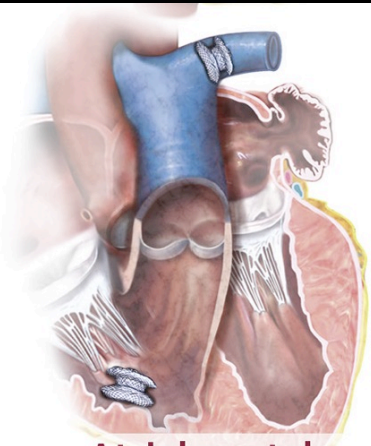


Targeting Atrial procedures

- Interatrial septum disease
  - Atrial septal defect
  - Patent foramen ovale
- Left atrial appendage closure
- Pulmonary vessel stenosis stenting
- Intra-atrial membrane

Percutaneous Septal Defect closure




Atrial septal defect closure

Anatomic Factors

Undersized device(s)

Large leaks

Procedural-related factors

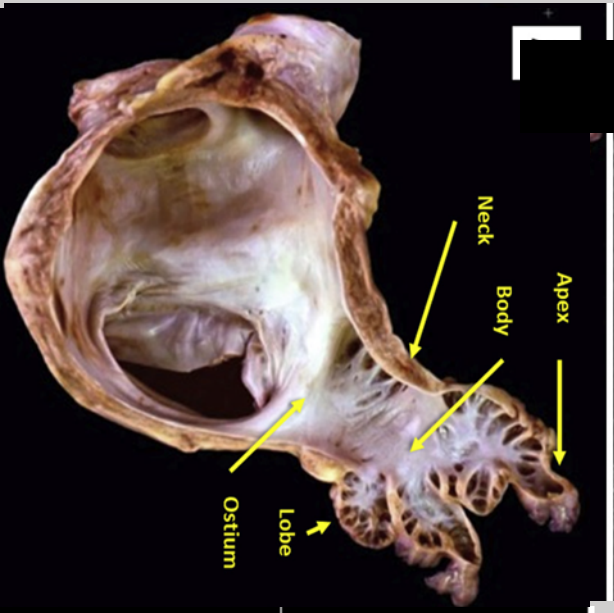
Non–self-centering devices

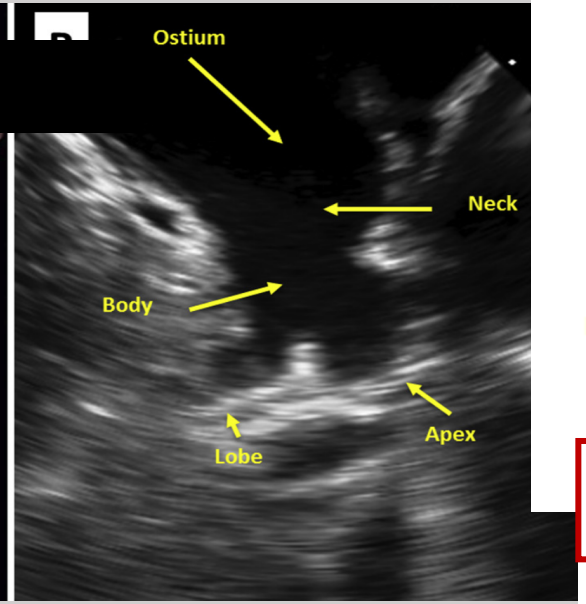
Excessive tug test

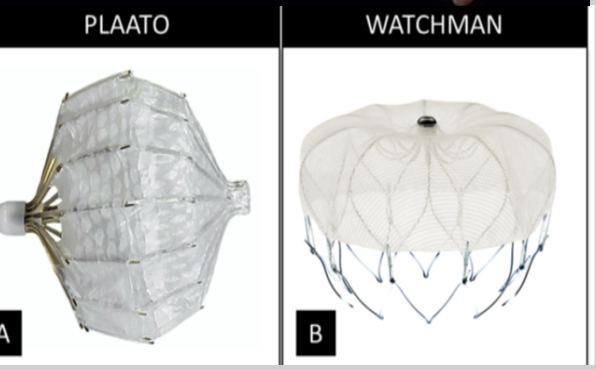
Stored cable tension

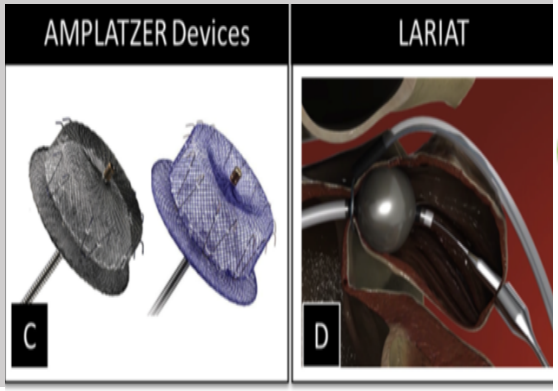
Targeting Atrial procedures

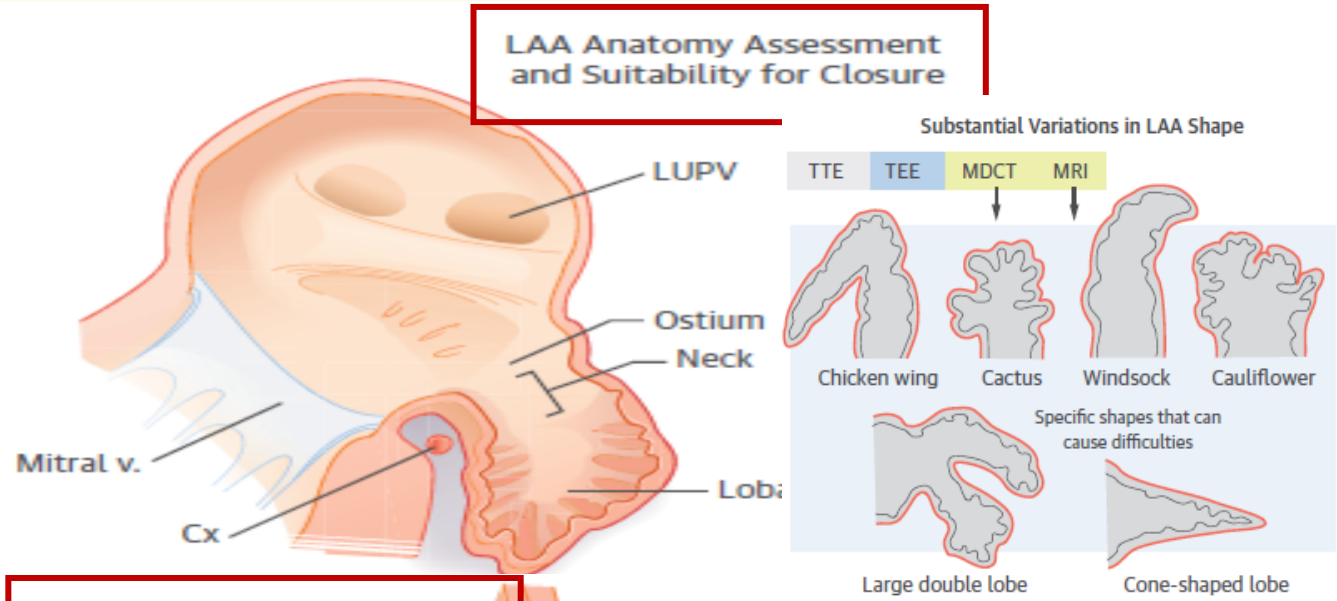
- *Left atrial appendage closure*

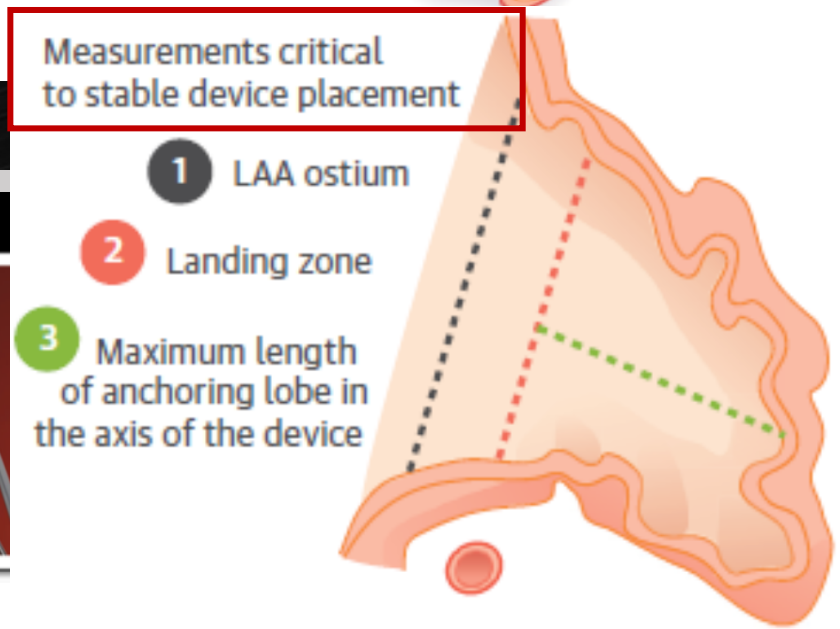


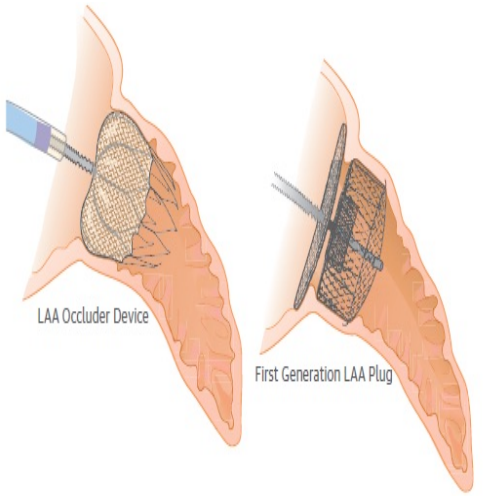






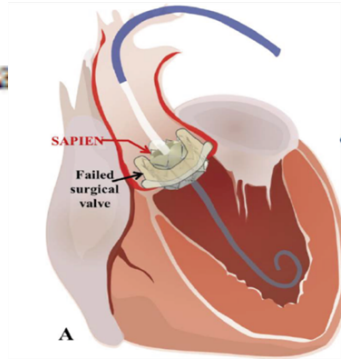


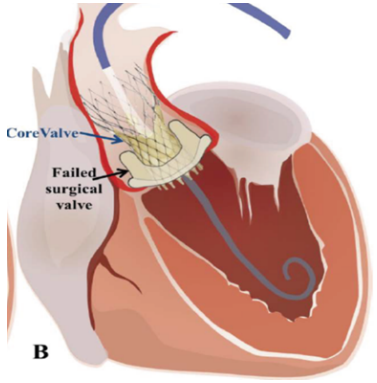


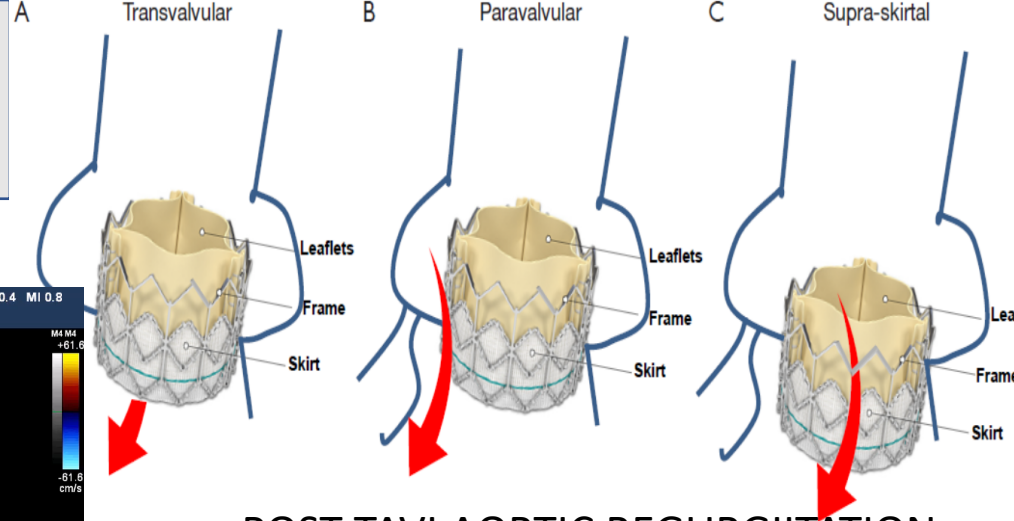


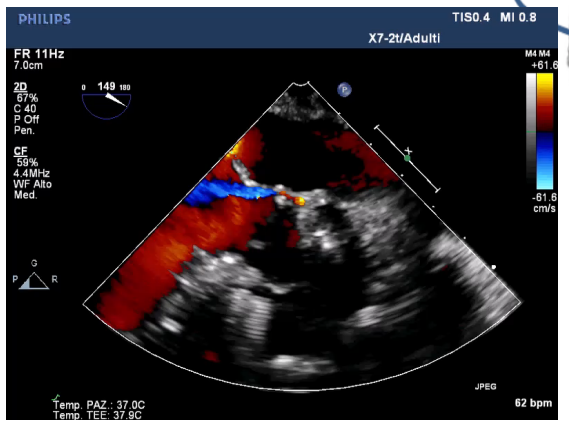
ECHOCARDIOGRAPHY FOR TAVI MONITORING

- Aortic regurgitation
  - Trans-valvar or paravalvar
    - Incorrect prosthesis positioning
    - May lead to embolization into the LV or aorta
  - Paravalvar regurgitation
- Myocardial ischaemia
- New wall motion abnormality
- Coronary occlusion
- Mitral regurgitation
- Damage to the valve leaflets or subvalvar apparatus
- Myocardial ischaemia
- Dyssynchrony secondary to pacing
- Pericardial effusion
- LV or RV perforation
- Unmasked LV dynamic obstruction
  - SAM related
  - Midventricular
- Aortic dissection or root rupture

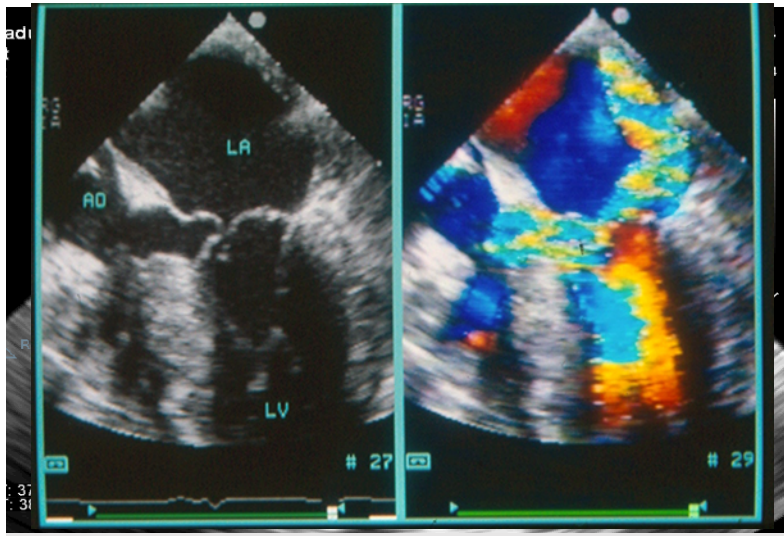


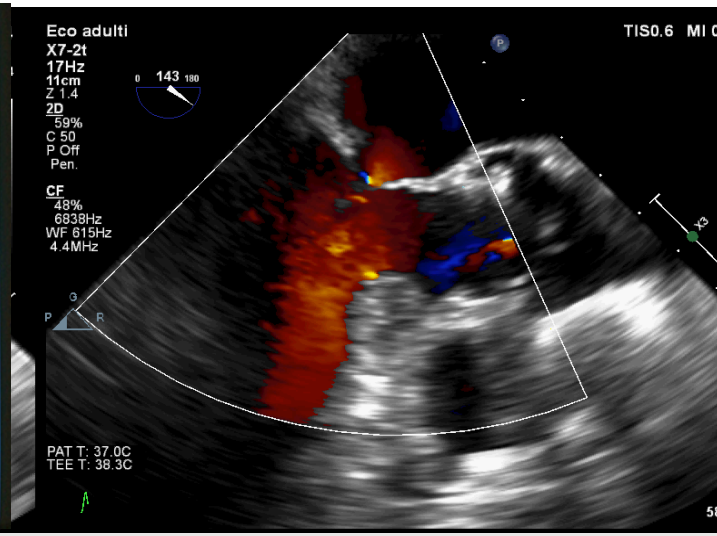






POST-TAVI AORTIC REGURGIITATION

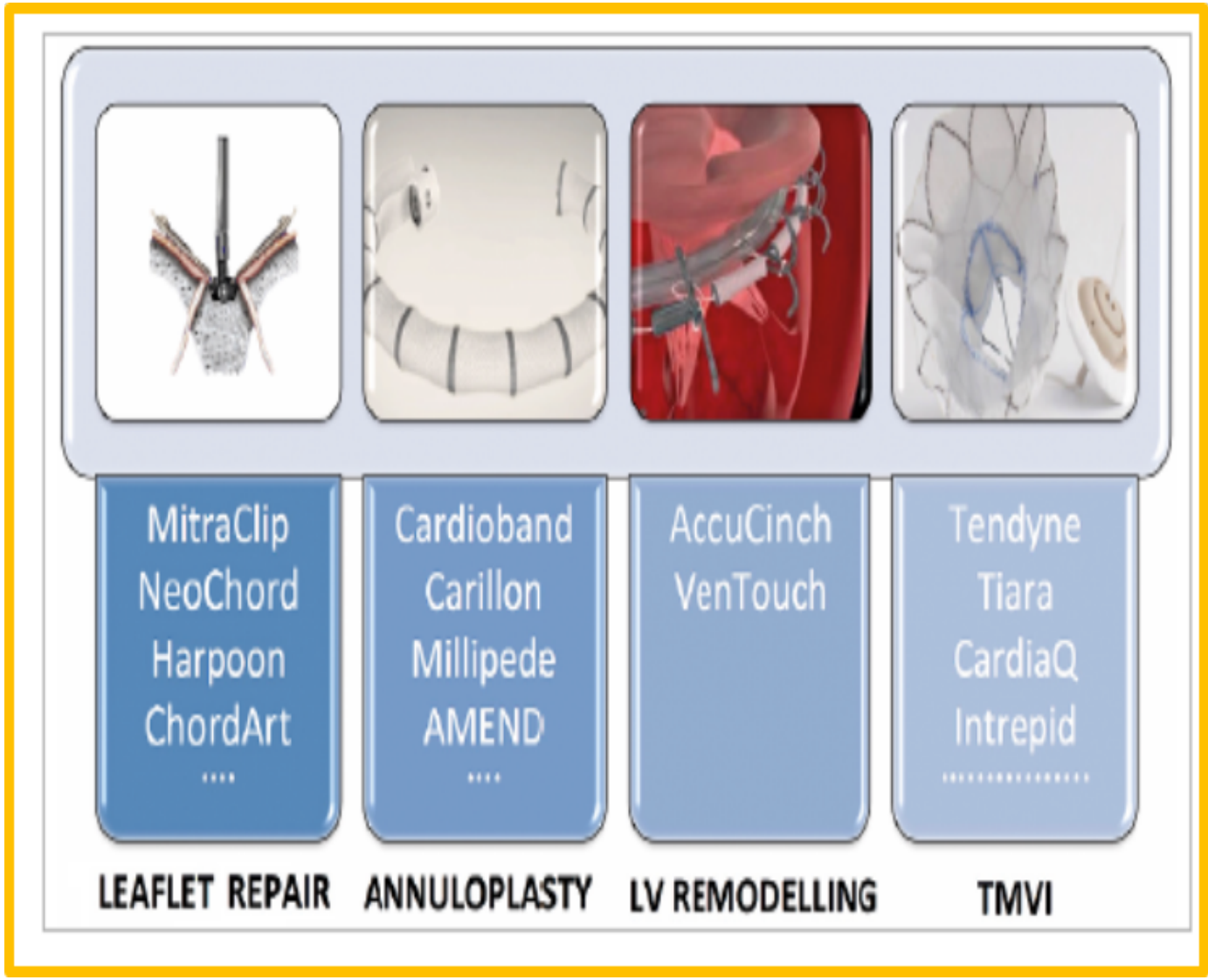




Unmasked LVOT obstruction in valvular aortic stenosis following TAVI

Transcatheter Mitral Valve Therapy

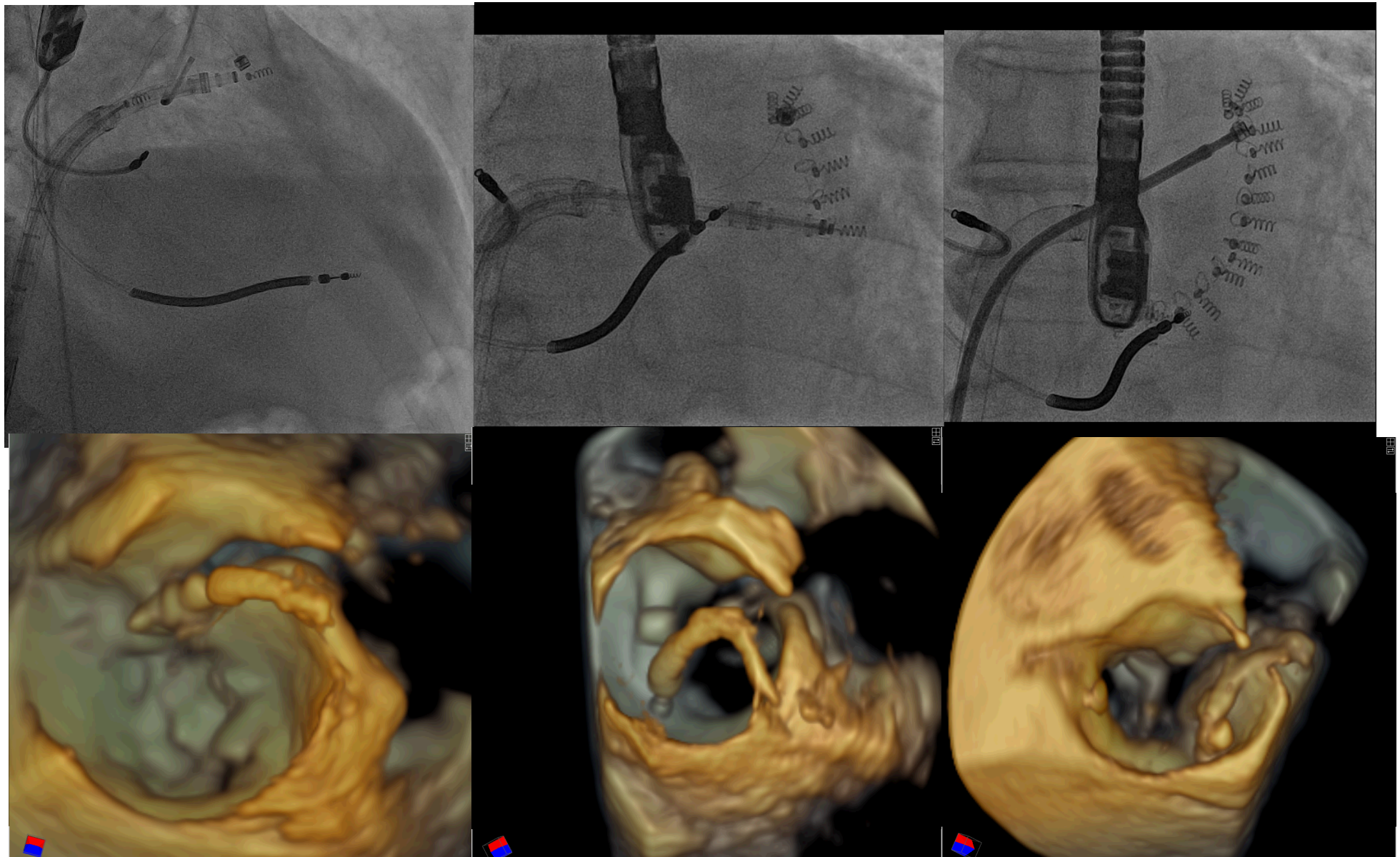
- **Primary leaflet repair**
  - Edge-to-Edge
  - Chordae replacement
- **Annuloplasty**
  - Indirect
  - Direct
- **Valve-in-valve/Valve-in-ring**
- **Mitral valve replacement**
- **Paravalvular leak closure**
- **Left Ventricular reshaping**
- **Combined procedures**



PERCUTANEOUS MITRAL RING IMPLANTATION:

First in-man Cardioband implantation

F. Maisano, G.La Canna, A. Latib et al. JACC Intervention 2014

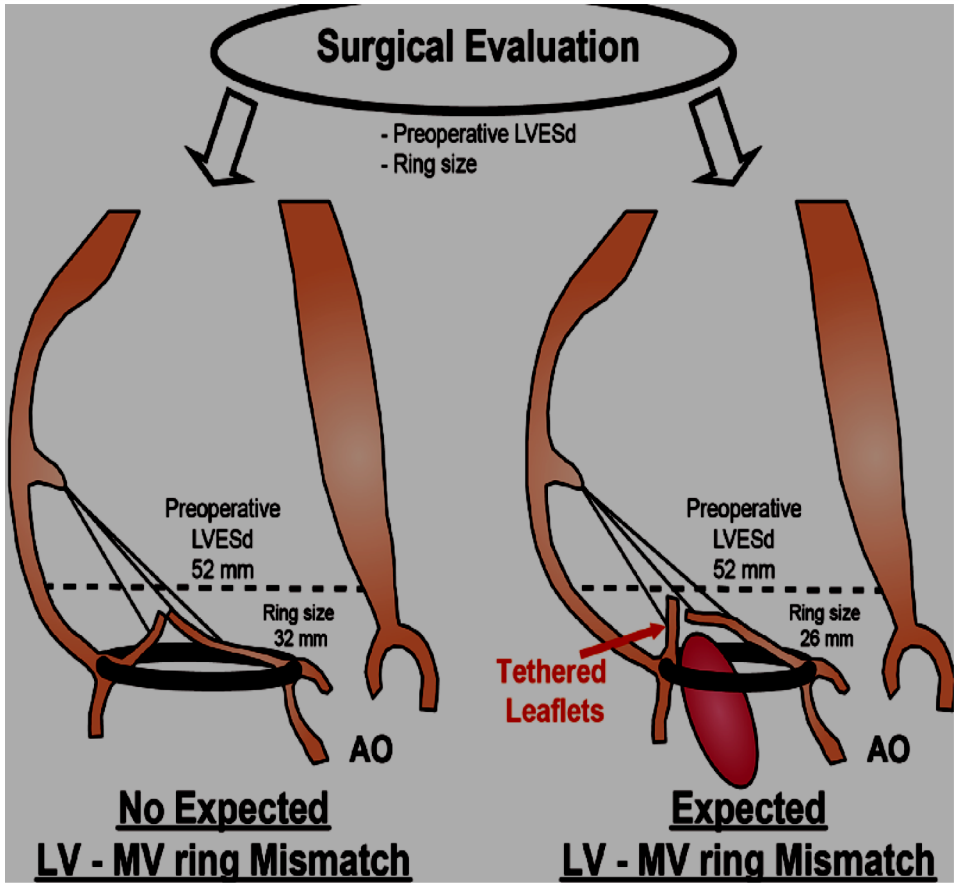


Optimizing Annuloplasty

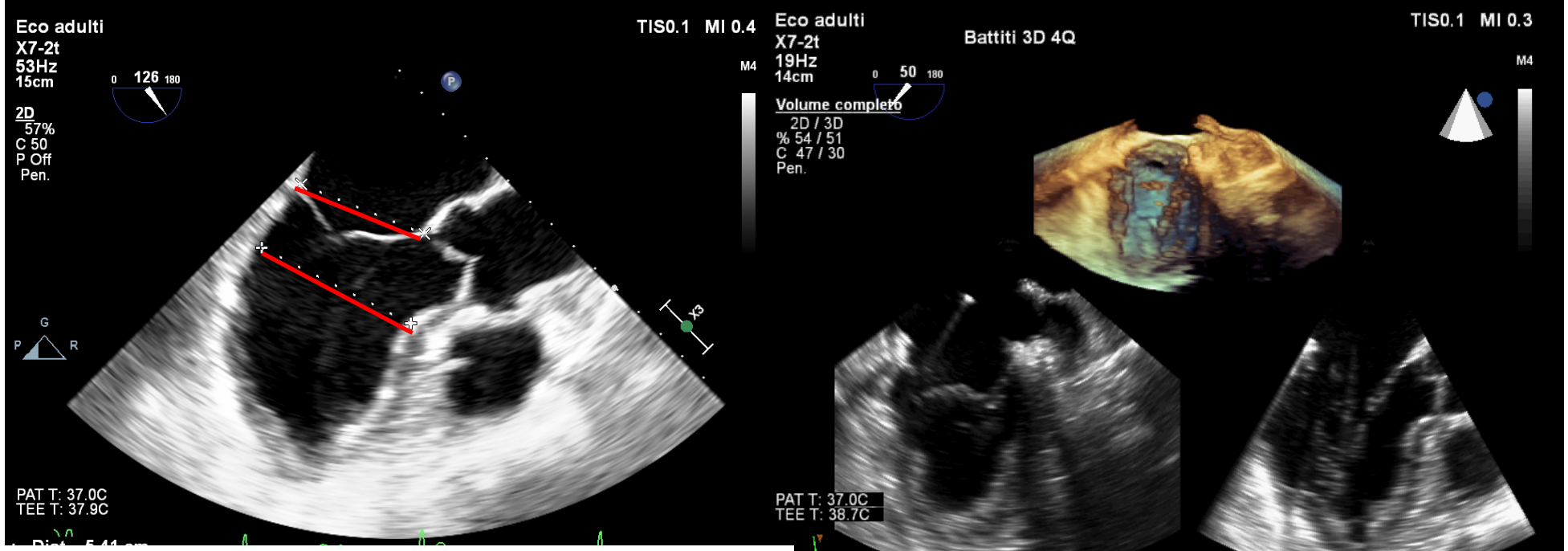
Predictors of unsuccessful mitral surgical annuloplasty

- Posterior Leaflet tethering angle >45°
- Anterior Leaflet tethering angle >25°
- Postero-basal LV anuerysm
- mismatch LV size/mitral valve size

persistence or worsening leaflet tethering

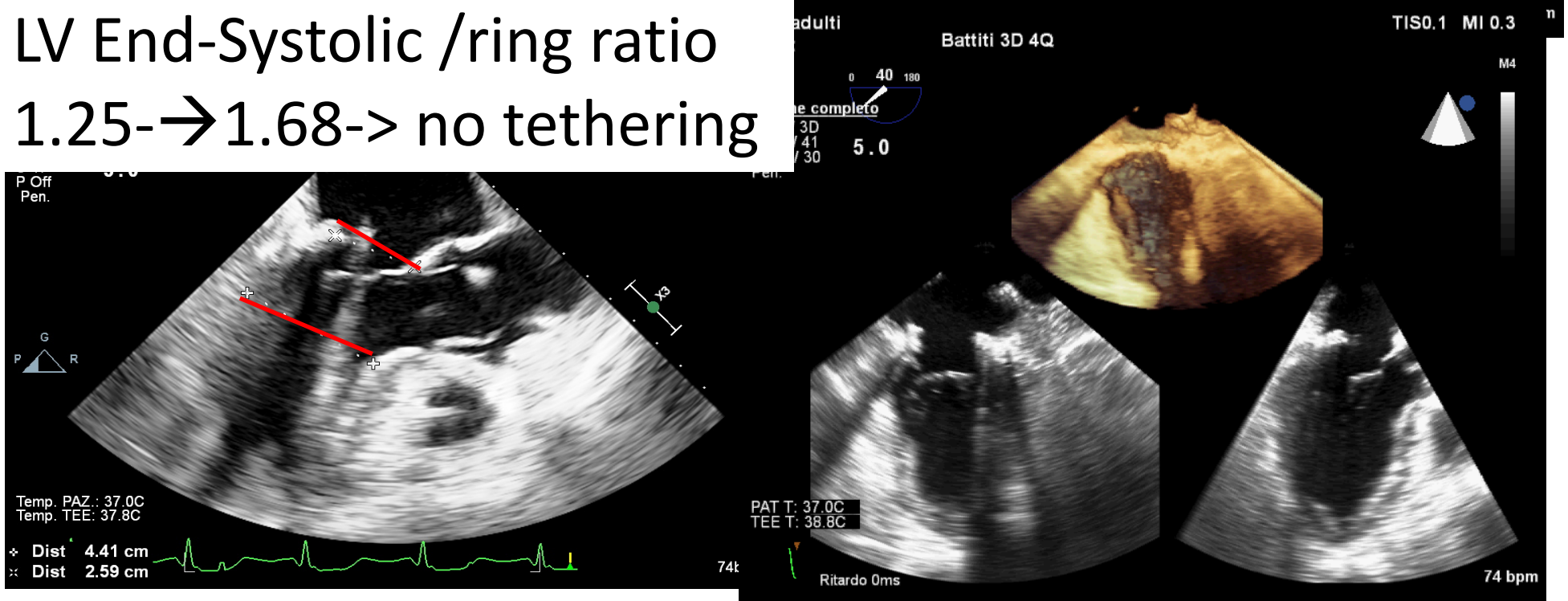


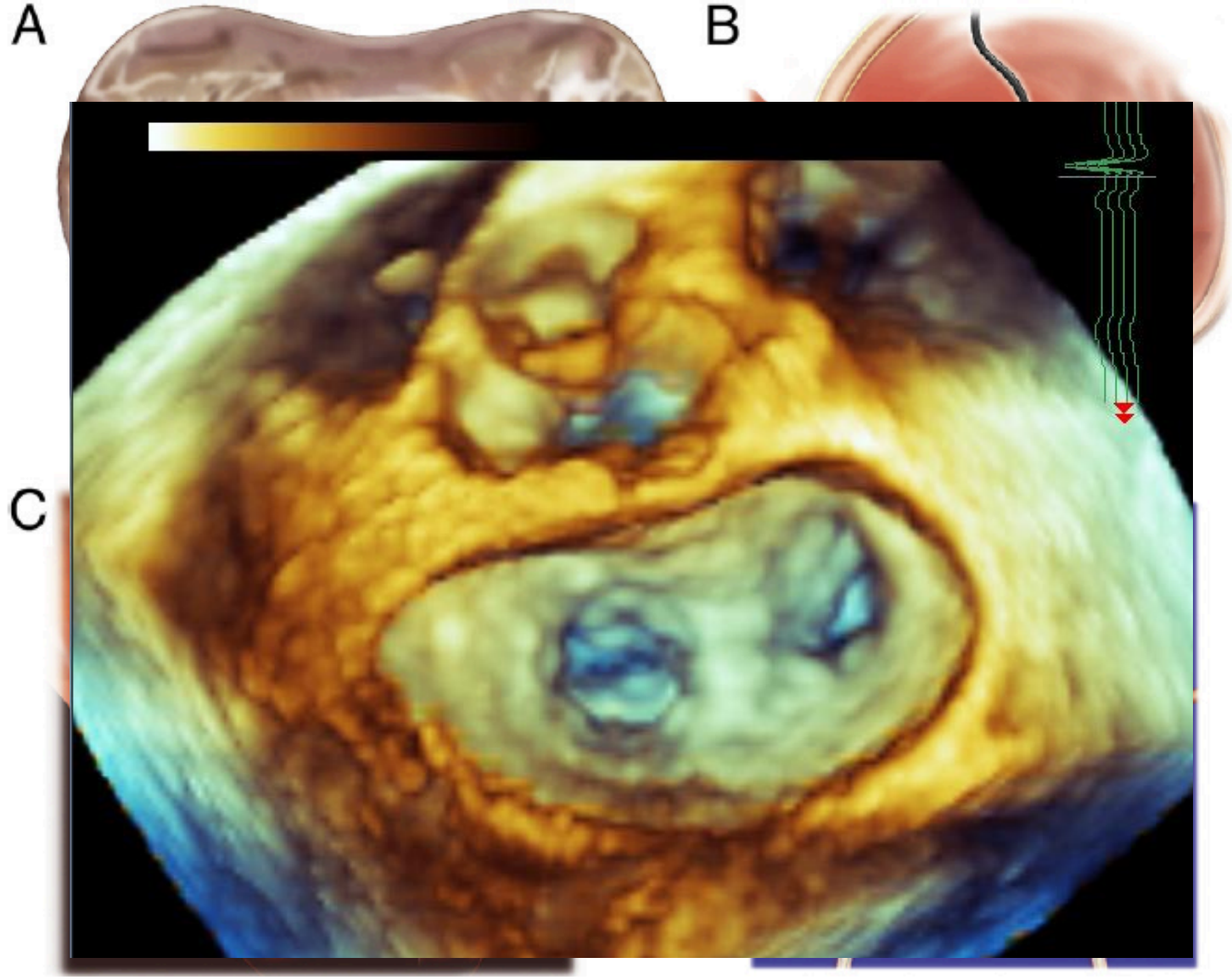
Capoulade R et al. Impact of LV to mitral valve ring mismatch on recurrent mitral regurgitation after ring annuloplasty. Circulation 2016;134:1247-1256



LV End-Systolic /ring ratio

1.25-→1.68-> no tethering





Maisano F, La Canna G, Colombo A, Alfieri A J Am Coll Cardiol 2011;58: 2174–82

MitraClip Therapy *Procedural ECHO-guidance*

- *Transeptal puncture and delivery system toward the mitral valve*
- *Adjustment of opened clip perpendicular to commissure in left atrium and left ventricle*

- *MitraClip system /target mitral valve lesion matching*
- *Grasping and leaflet insertion, creating double valve orifice*
- *Effectiveness on MR without stenosis and need for additional MitraClip*

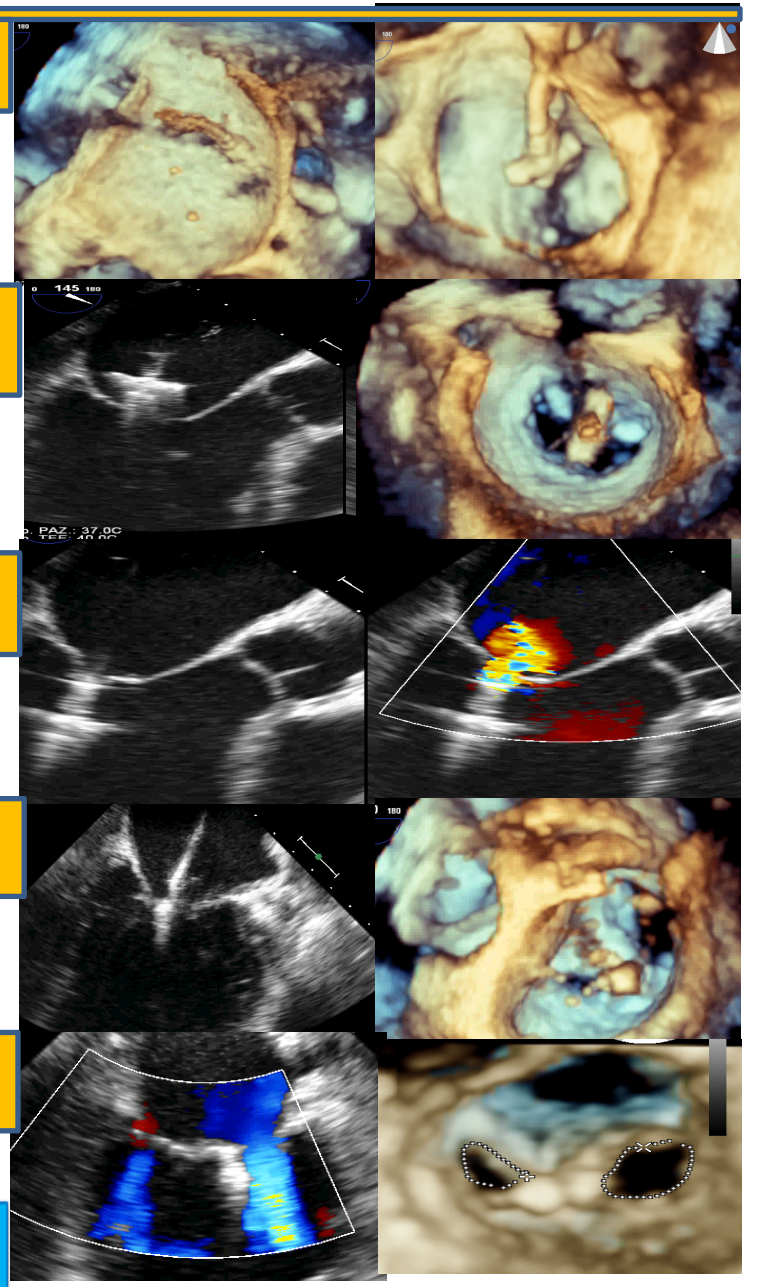
1

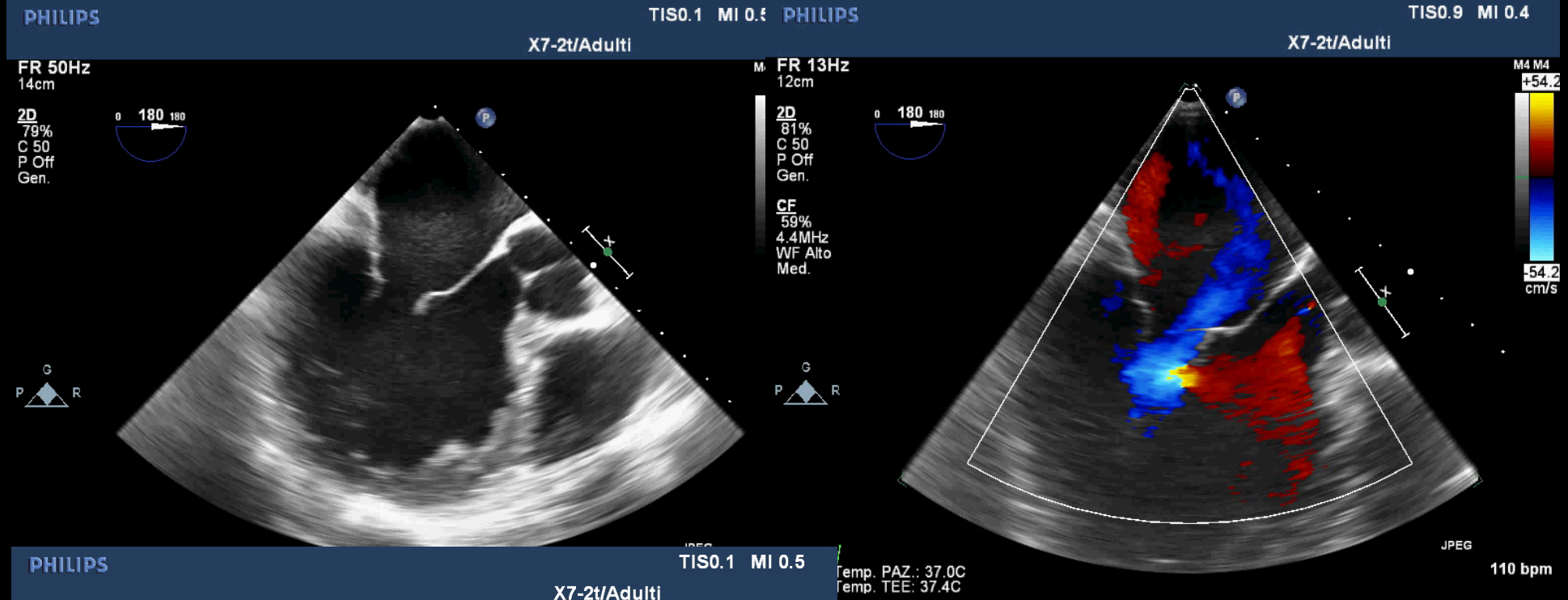
2

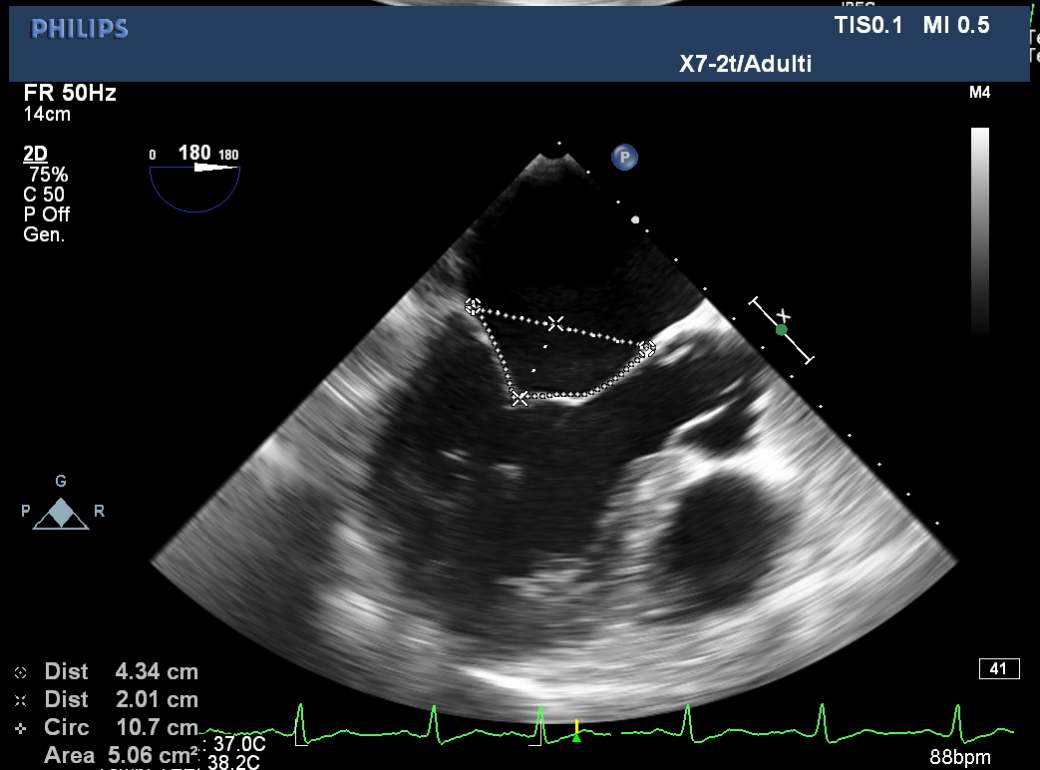
3

4

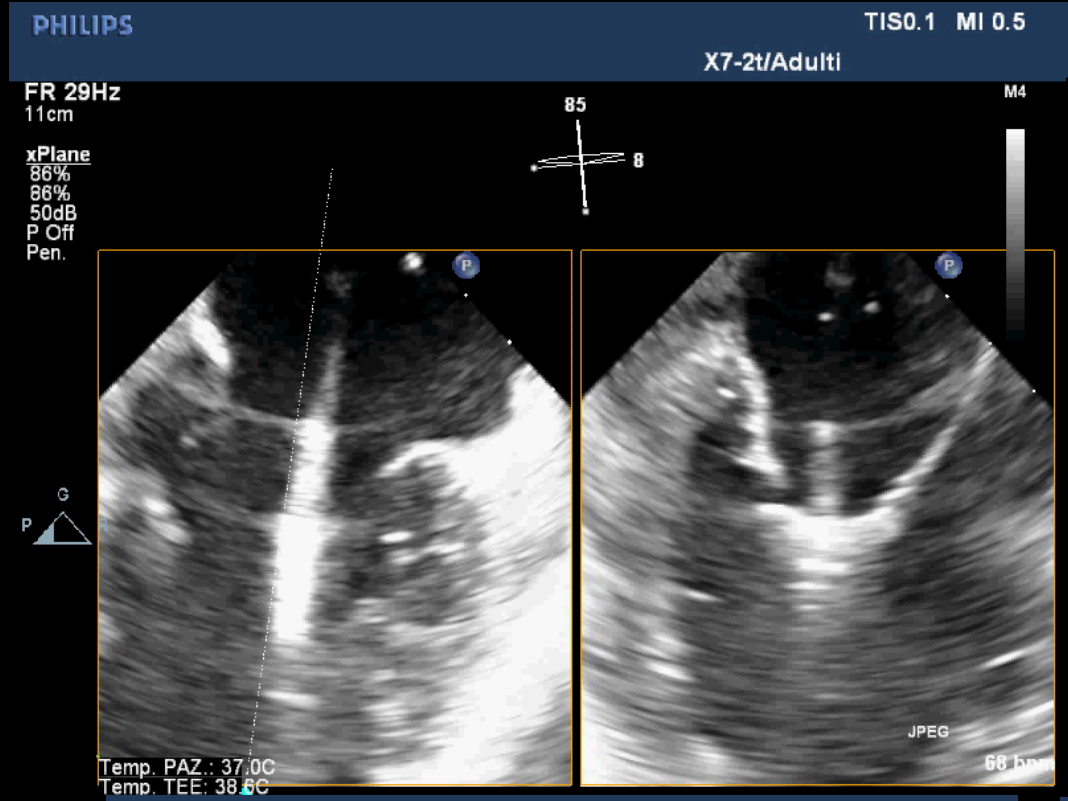
5

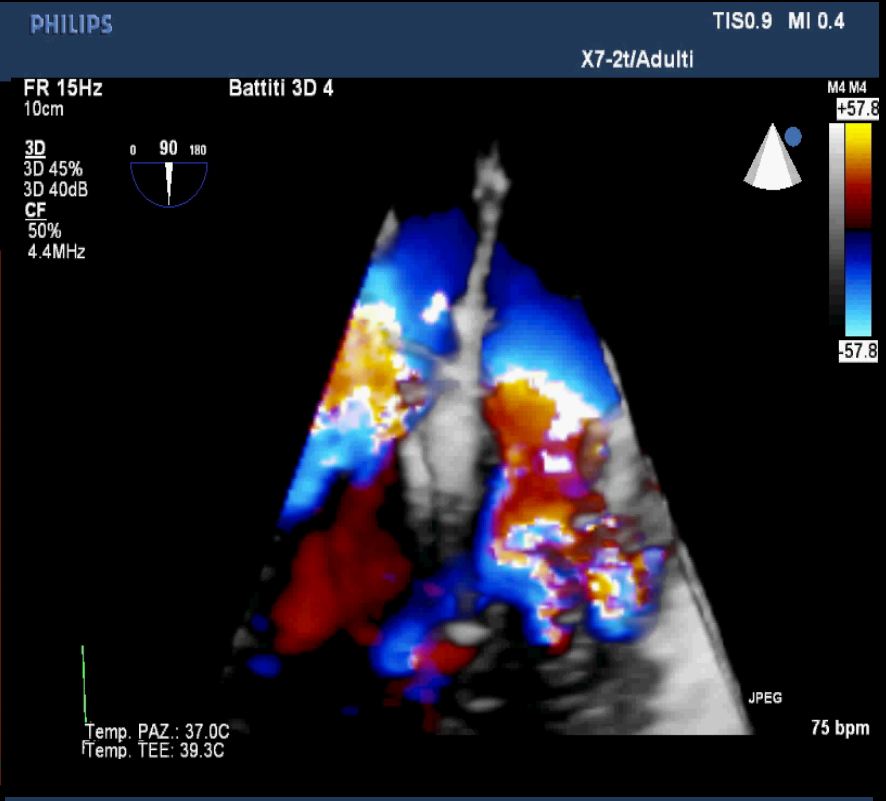


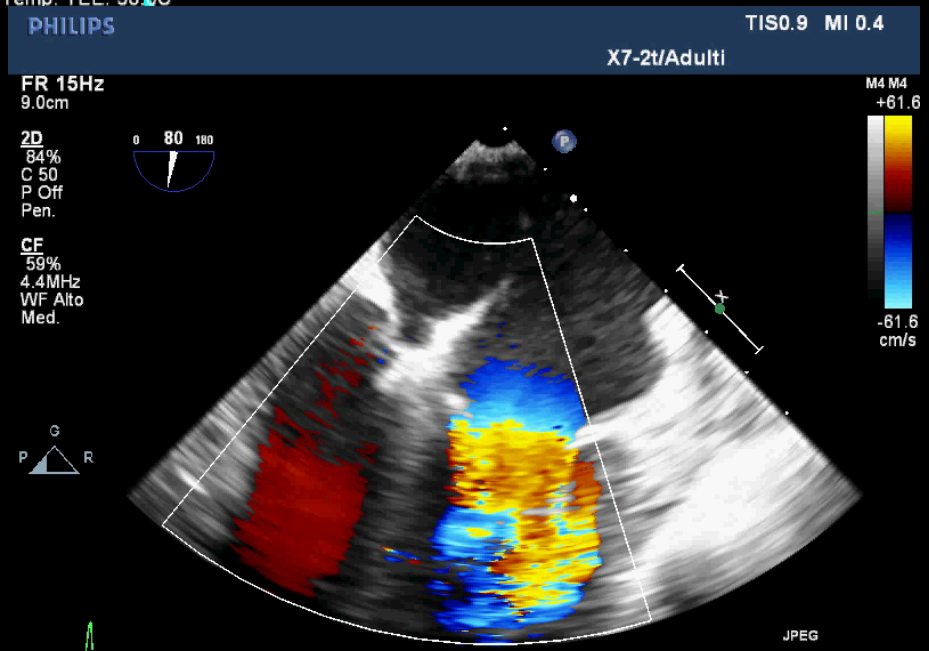


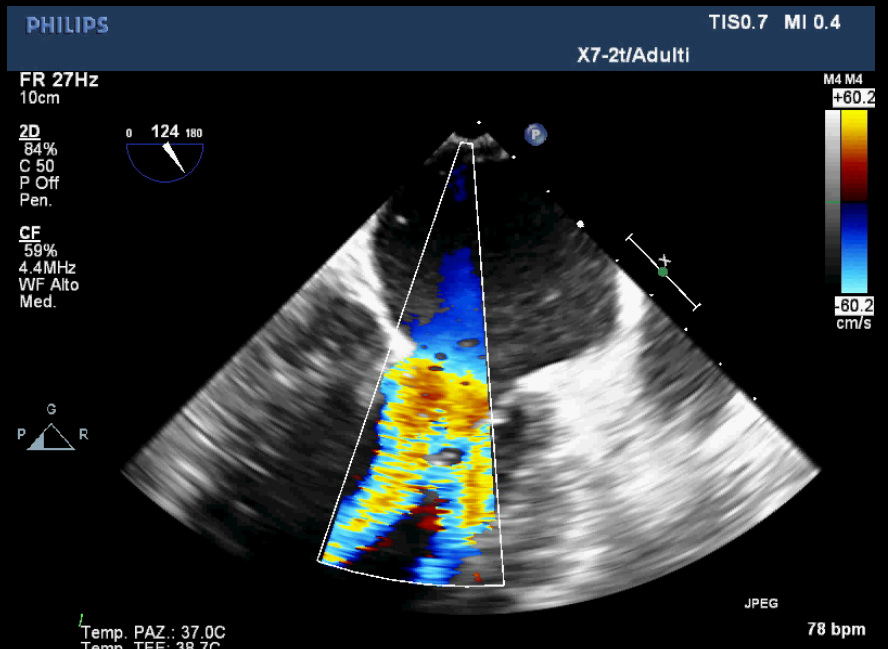


G.T. 71 years. CHF
EF 30%
No primary CABG indication
Low probability of successful repair

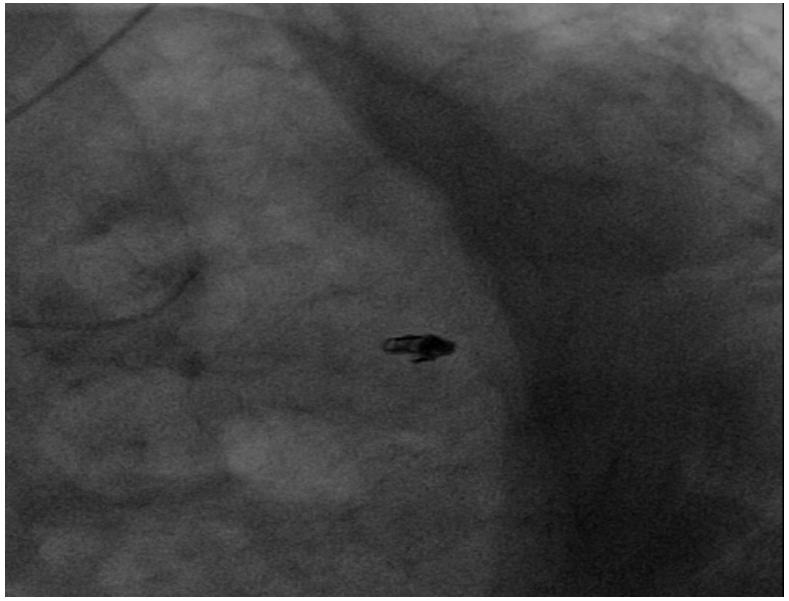

PHILIPS
TIS0.1 MI 0.5
X7-2t/Adulti
FR 29Hz
11cm
xPlane
86%
86%
50dB
P Off
Pen.
85
8
M4
JPEG
Temp. PAZ.: 37.0C
Temp. TEE: 38.6C

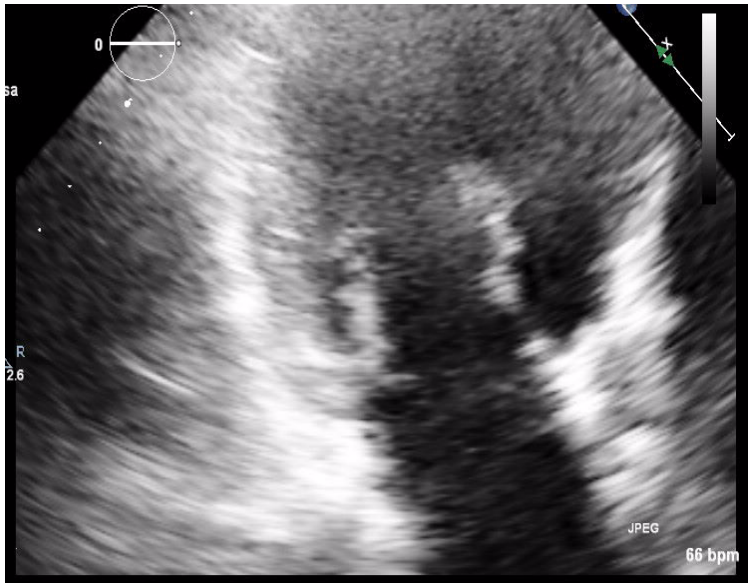

PHILIPS
TIS0.9 MI 0.4
X7-2t/Adulti
FR 15Hz
10cm
Battiti 3D 4
3D
3D 45%
3D 40dB
CF
50%
4.4MHz
0 90 180
M4 M4
+57.8
-57.8
JPEG
75 bpm
Temp. PAZ.: 37.0C
Temp. TEE: 39.3C

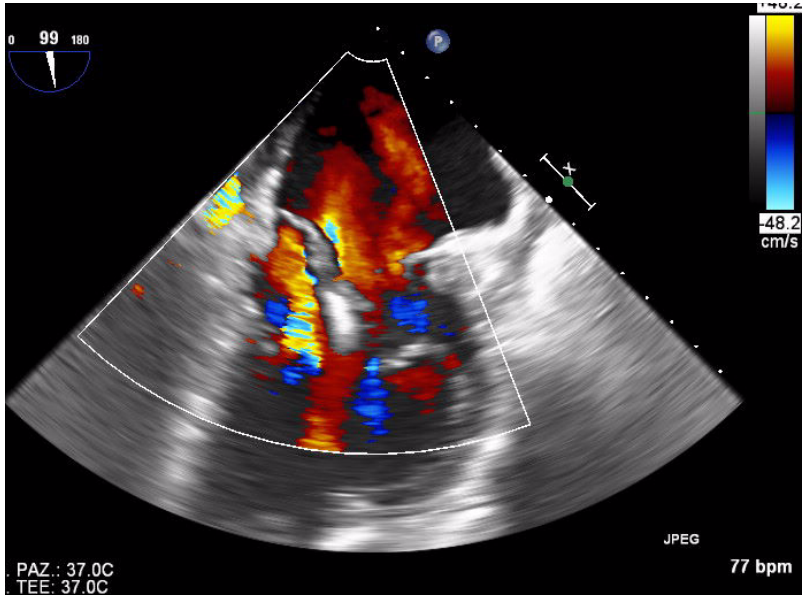

PHILIPS
TIS0.9 MI 0.4
X7-2t/Adulti
FR 15Hz
9.0cm
2D
84%
C 50
P Off
Pen.
CF
59%
4.4MHz
WF Alto
Med.
0 80 180
M4 M4
+61.6
-61.6
cm/s
JPEG

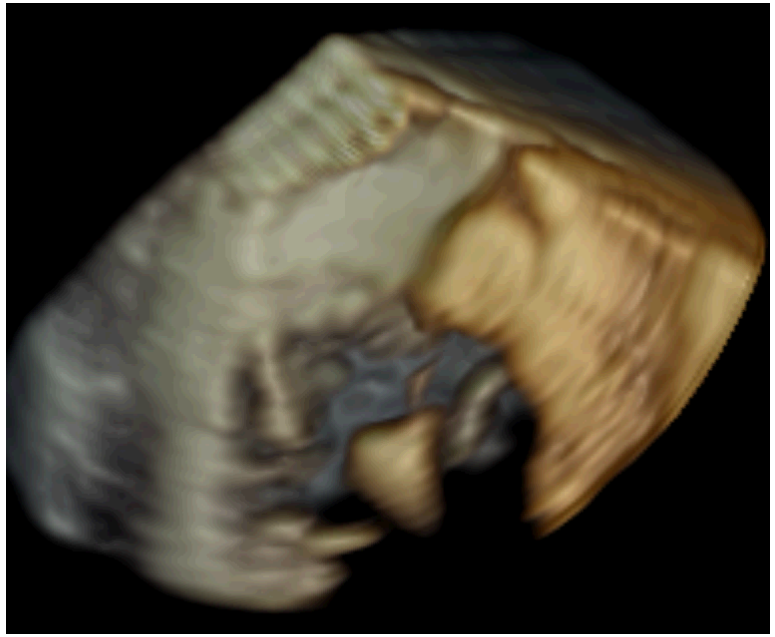

PHILIPS
TIS0.7 MI 0.4
X7-2t/Adulti
FR 27Hz
10cm
2D
84%
C 50
P Off
Pen.
CF
59%
4.4MHz
WF Alto
Med.
0 124 180
M4 M4
+60.2
-60.2
cm/s
JPEG
78 bpm
Temp. PAZ.: 37.0C

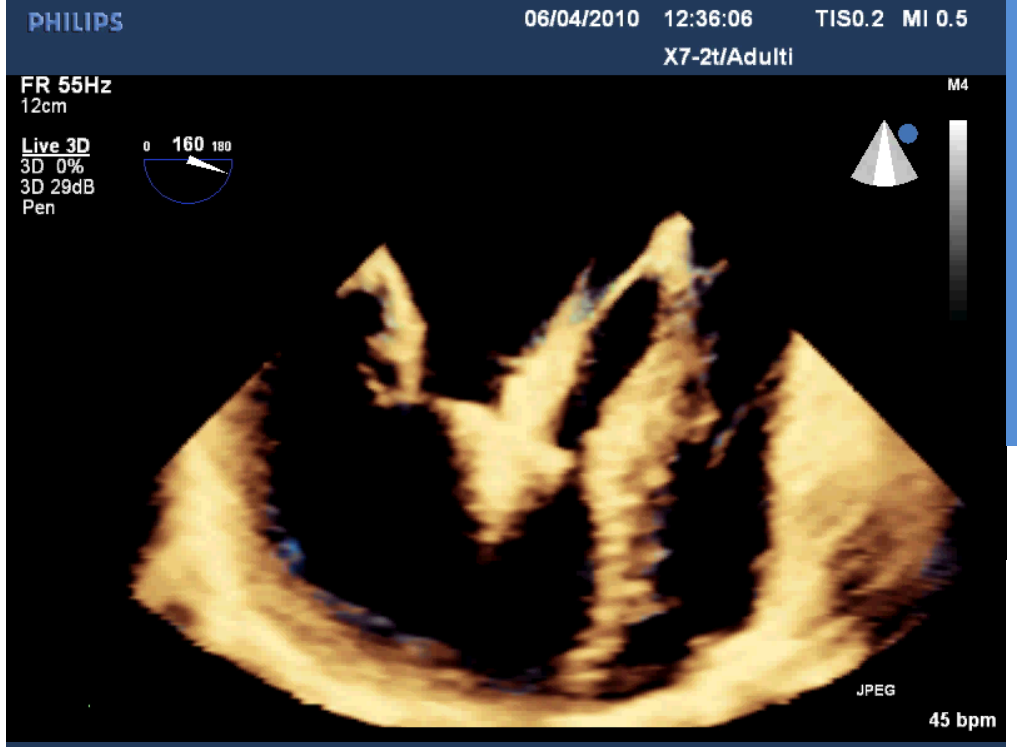
«dancing» Clip Detachment

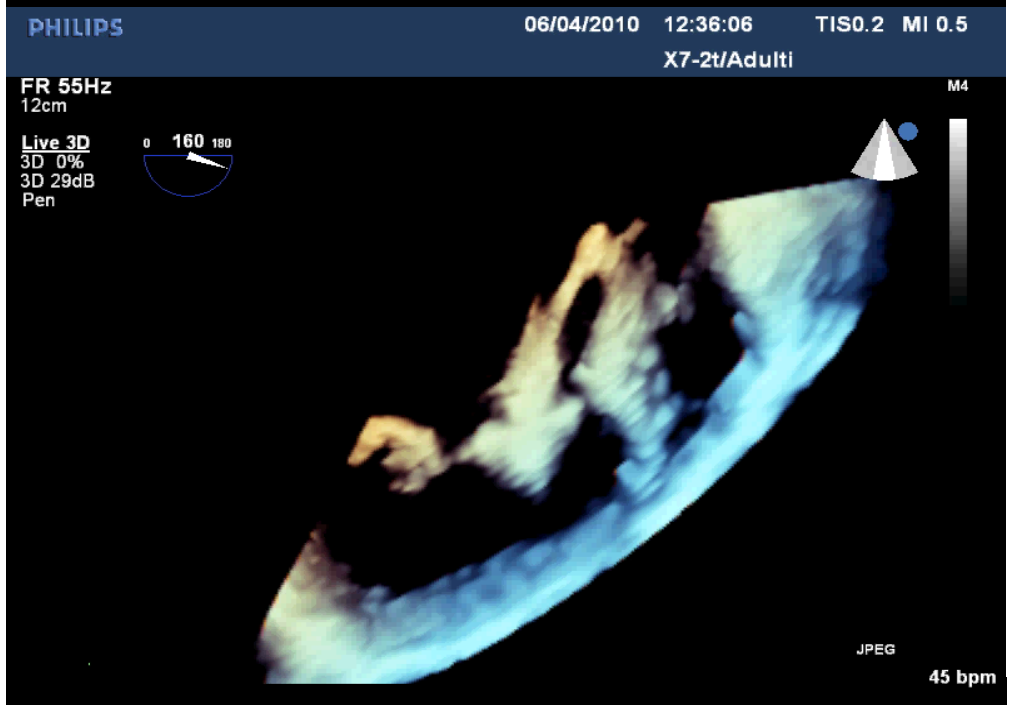




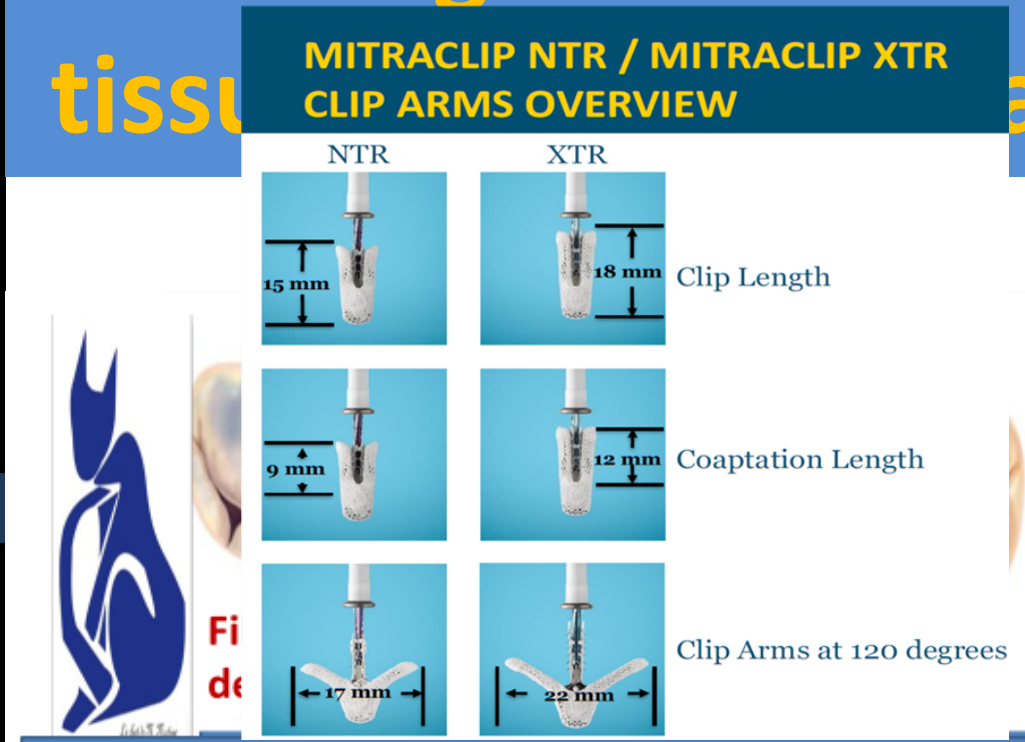


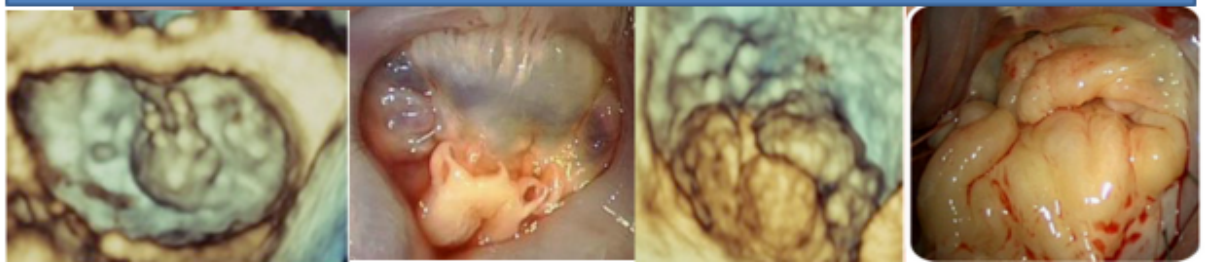


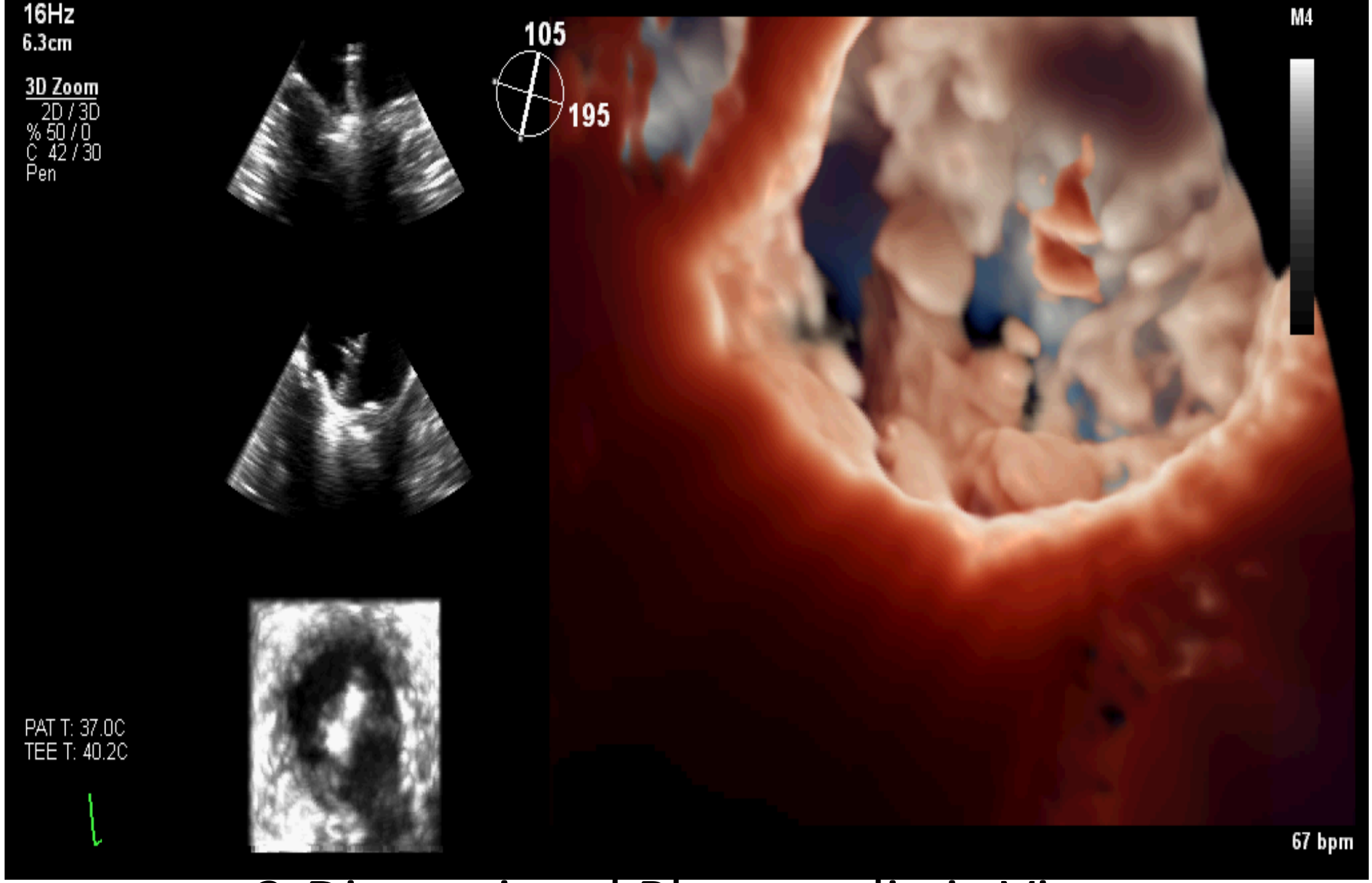




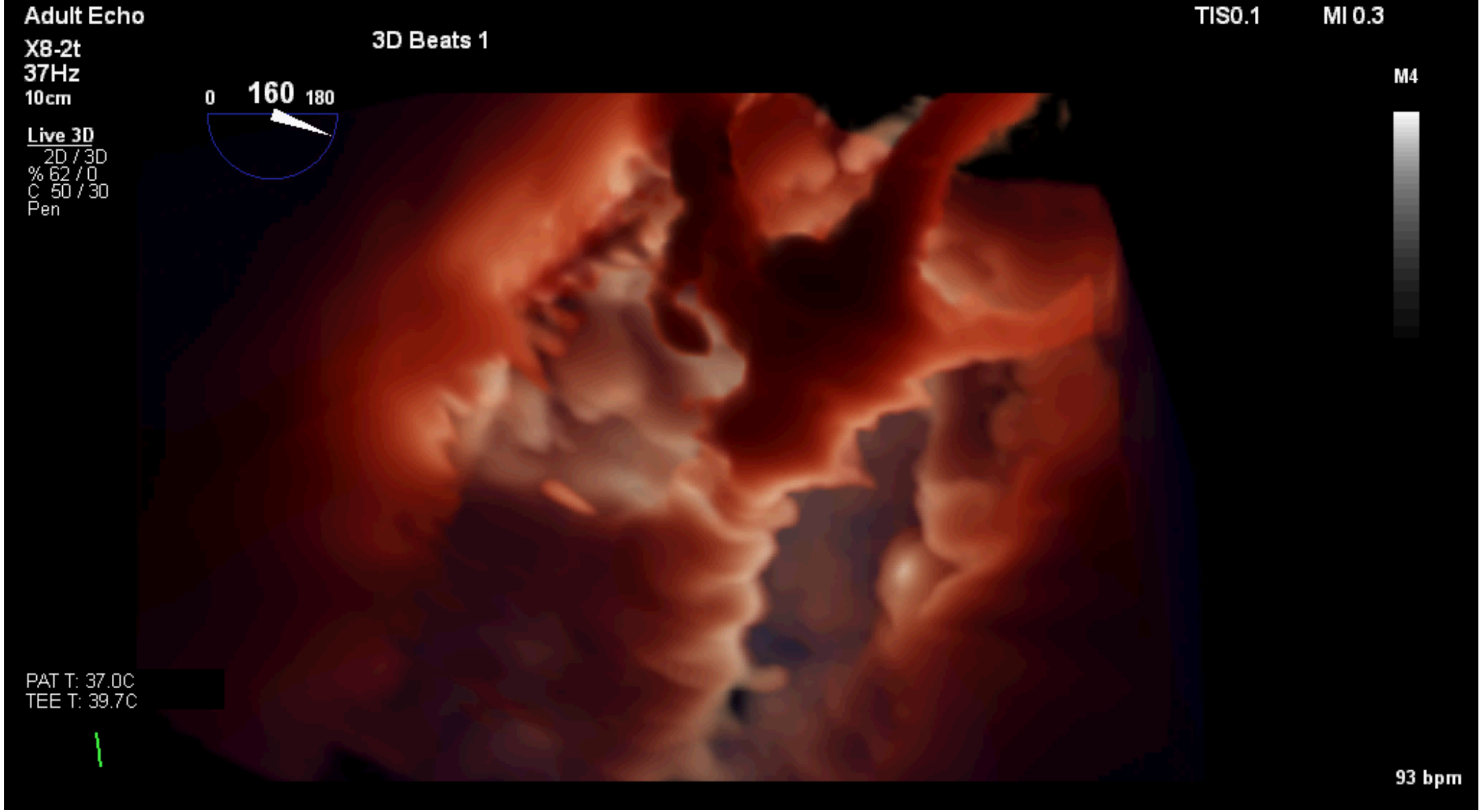
Barlow disease: High risk for tissu atch

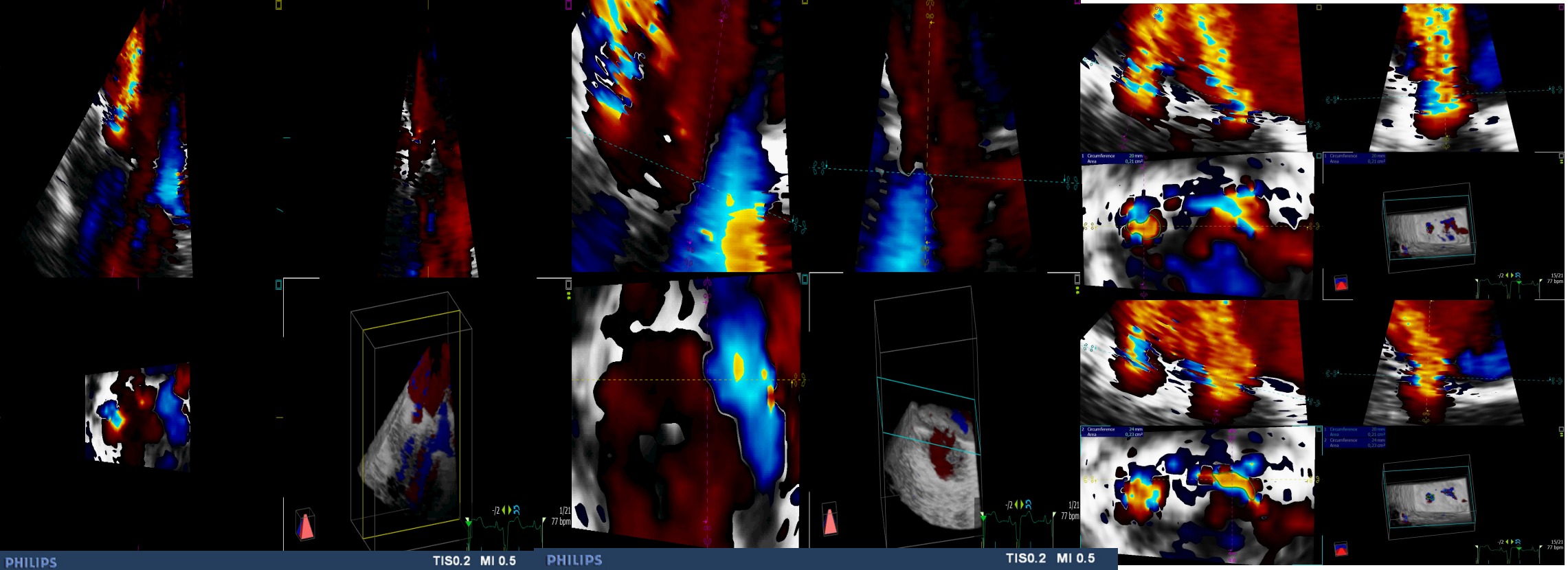


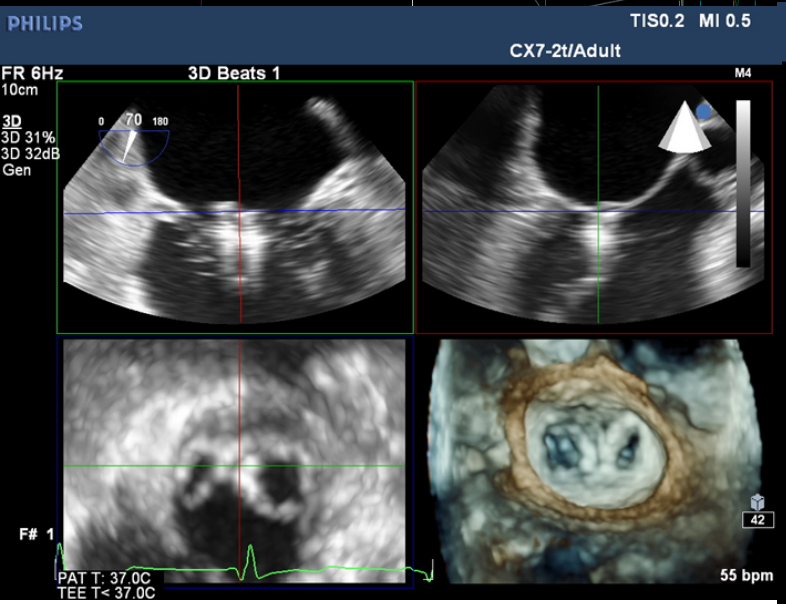


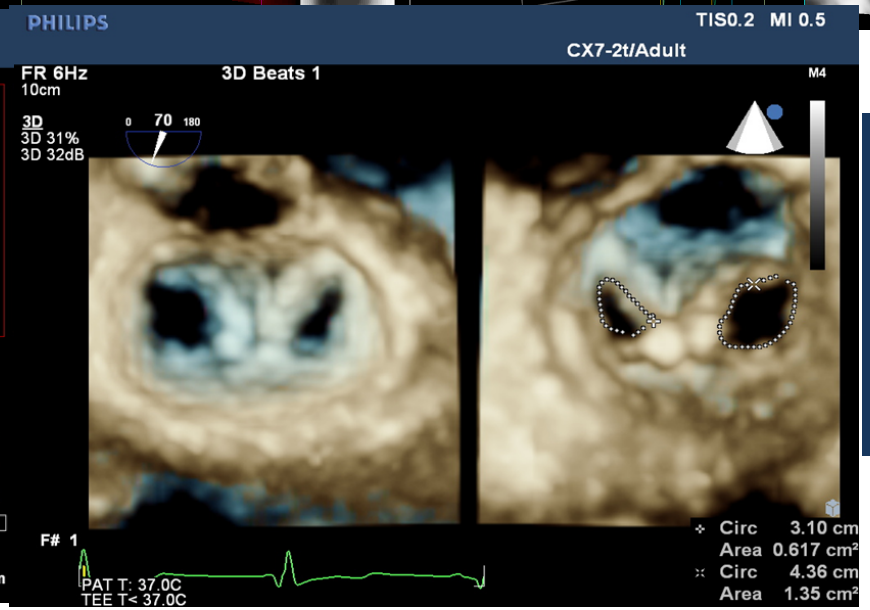


3-Dimensional Photorealistic View


Adult Echo
X8-2t
37Hz
10cm
Live 3D
2D / 3D
% 62 / 0
C 50 / 30
Pen
3D Beats 1
0
160
180
TIS0.1
MI 0.3
M4
PAT T: 37.0C
TEE T: 39.7C
93 bpm







Post-Clip Implantation

-Mitral Regurgitation

-Valve stenosis

INTRAPROCEDURAL STRESS ECHOCARDIORAPHY

- **Challenging contexts**

- Fluctuating mitral regurgitation
- Post-procedural ultimate functional MR severity
- SAM-related Mitral Regurgitation

- **Stress Modality**

- **Load-stress**

  Pre-load change

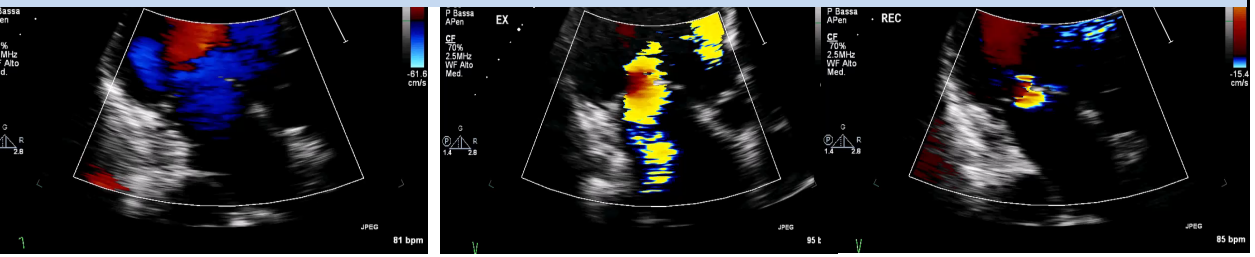
  Trendelenburg manuever
- **Pharmachological stress**

  Isoproterenol

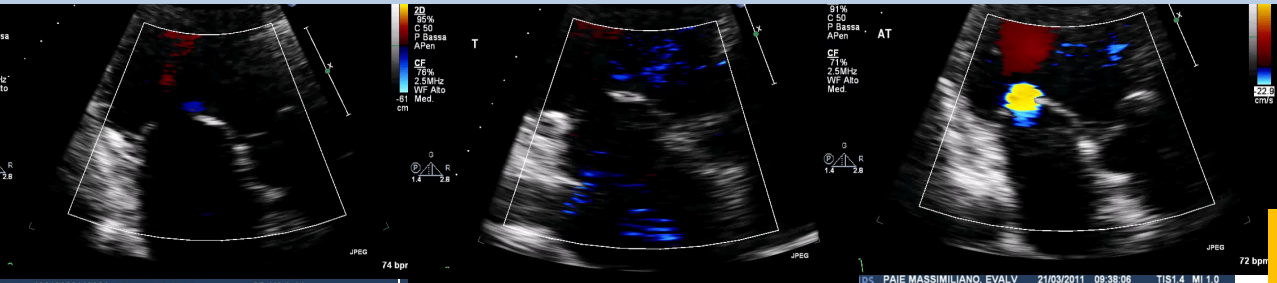
  Epinephrine

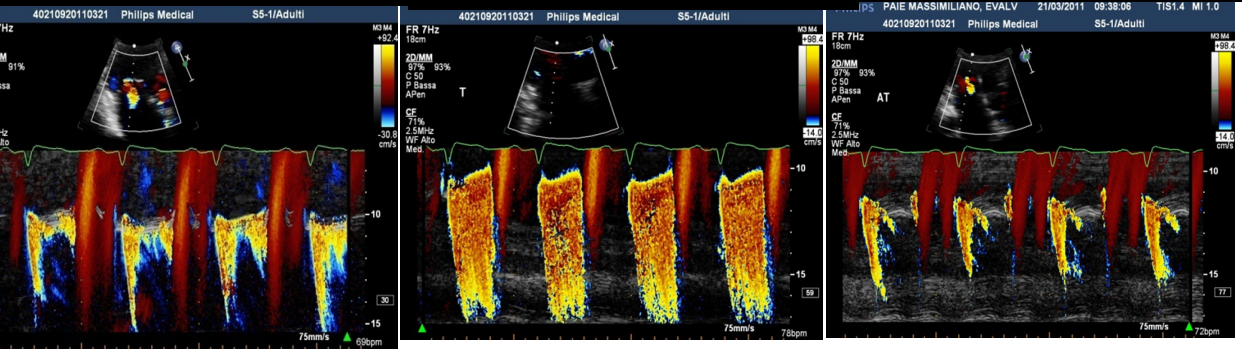
P.M. EF 20%, CAD, Multiple succcessful PCI
FLASH PULMONARY EDEMA mild baseline MR

Exercise transthoracic echocardiography

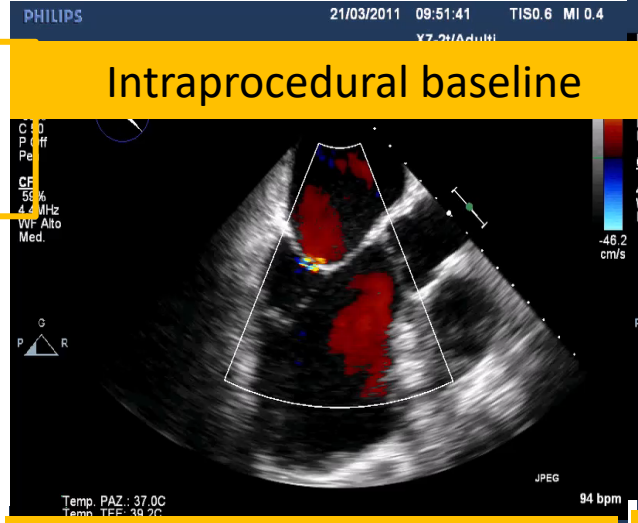


TRENDELENBURG MANUEVER

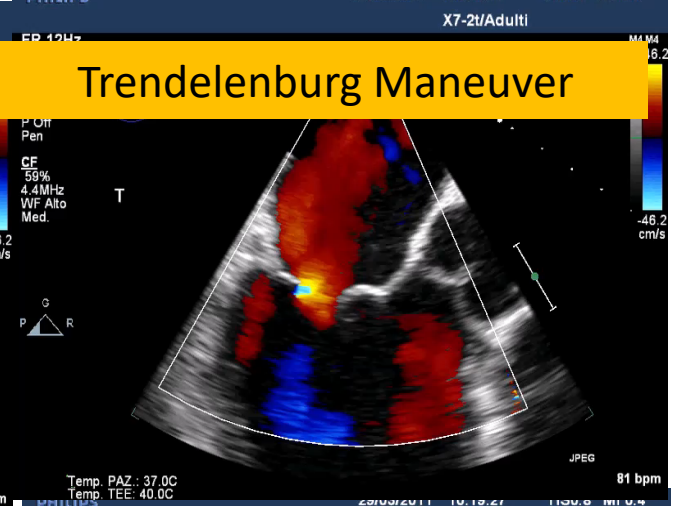




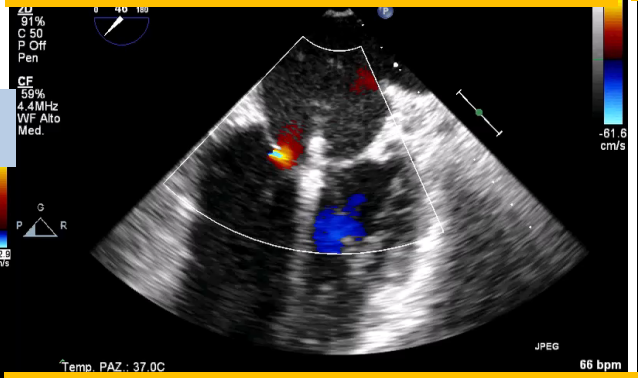
Intraprocedural baseline



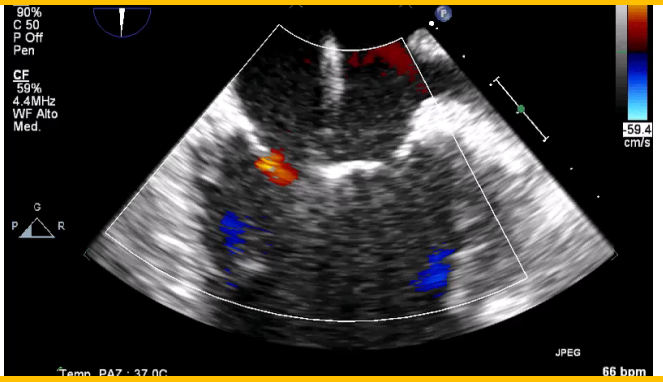
Trendelenburg Maneuver



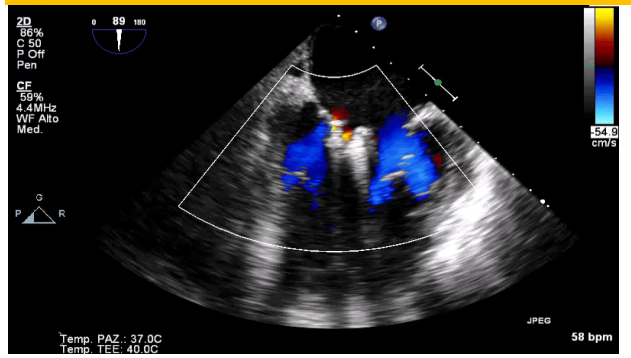
First MitraClip



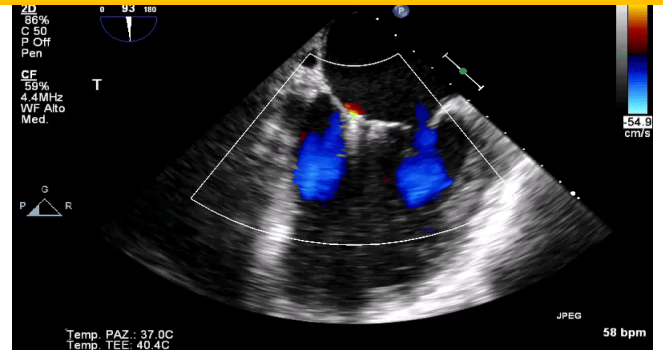
Trendelenburg Maneuver



Second MitraClip

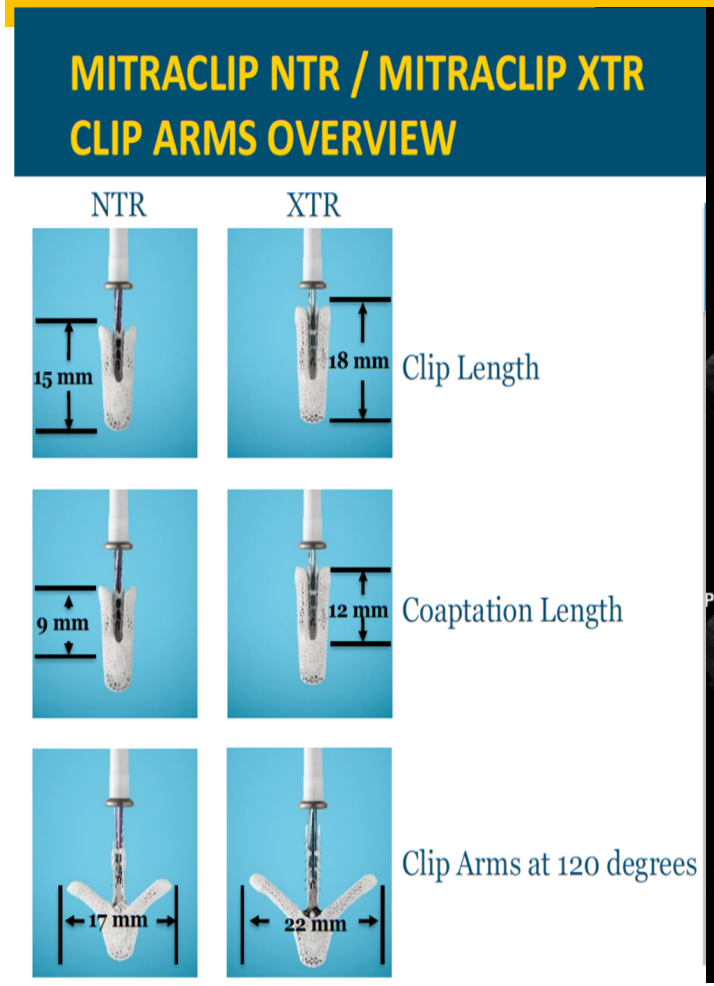


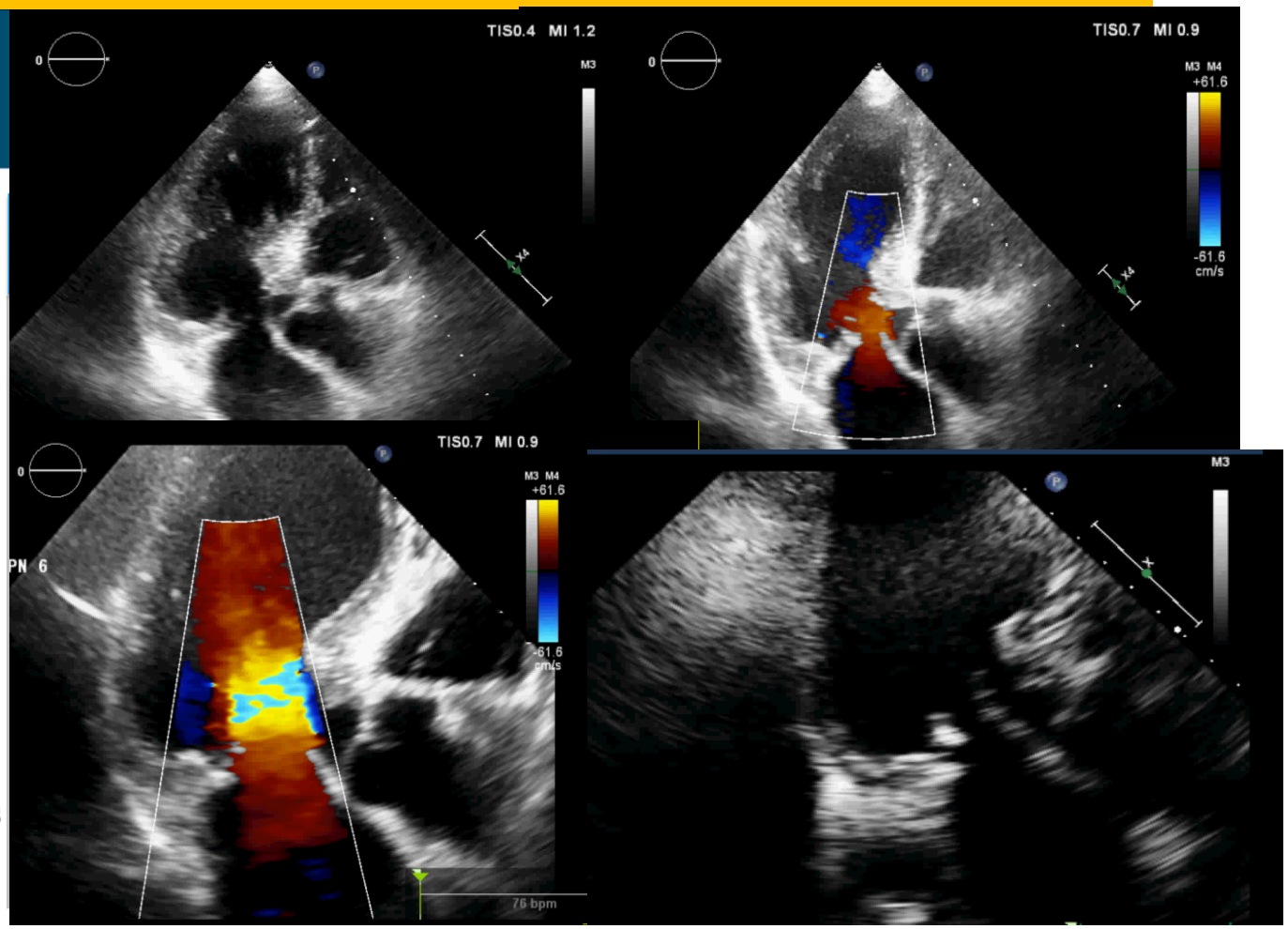
Trendelenburg Maneuver

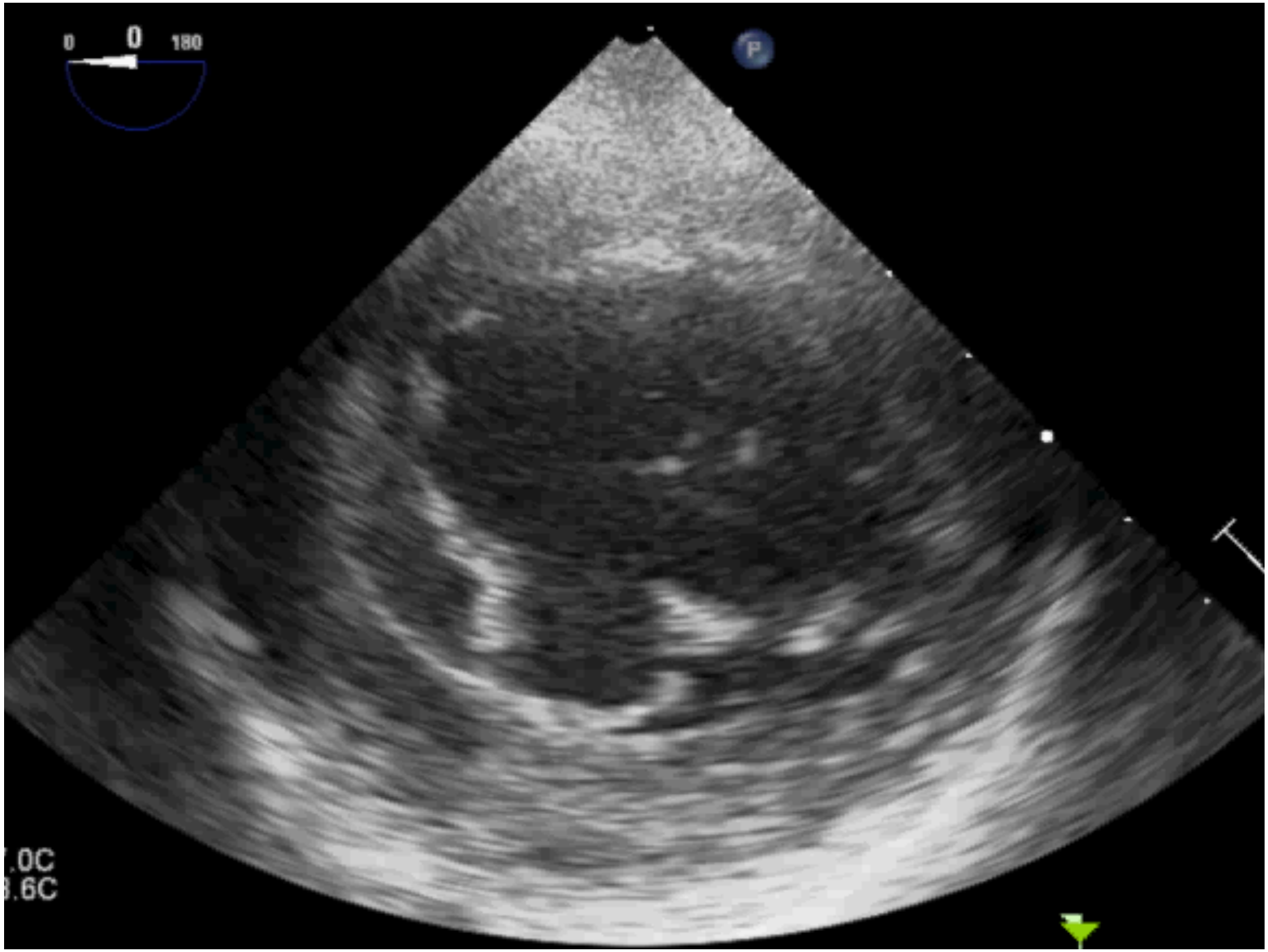


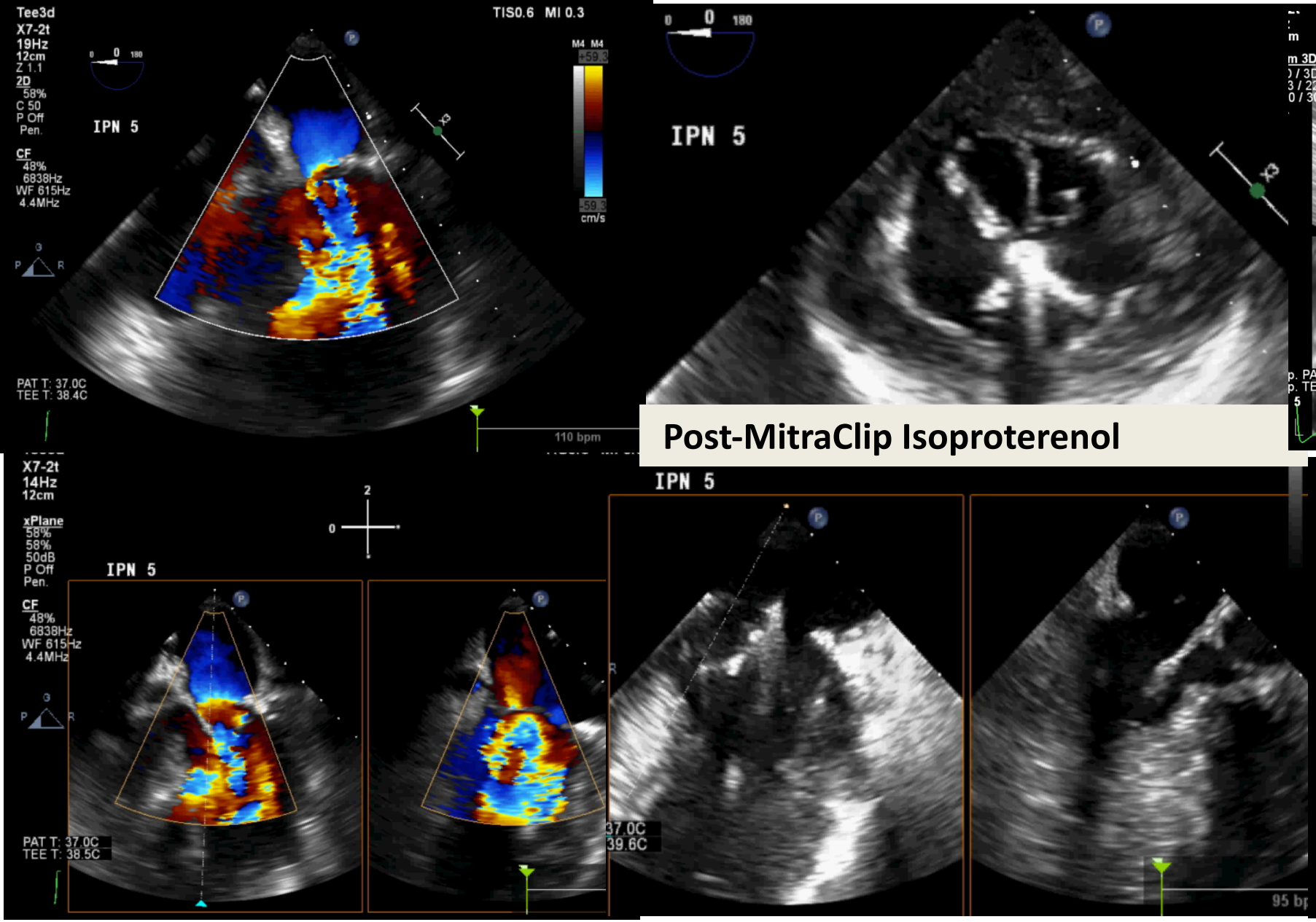
Rescue Mitraclip treatment of post-mitral repair symptomatic inducible LV obstruction

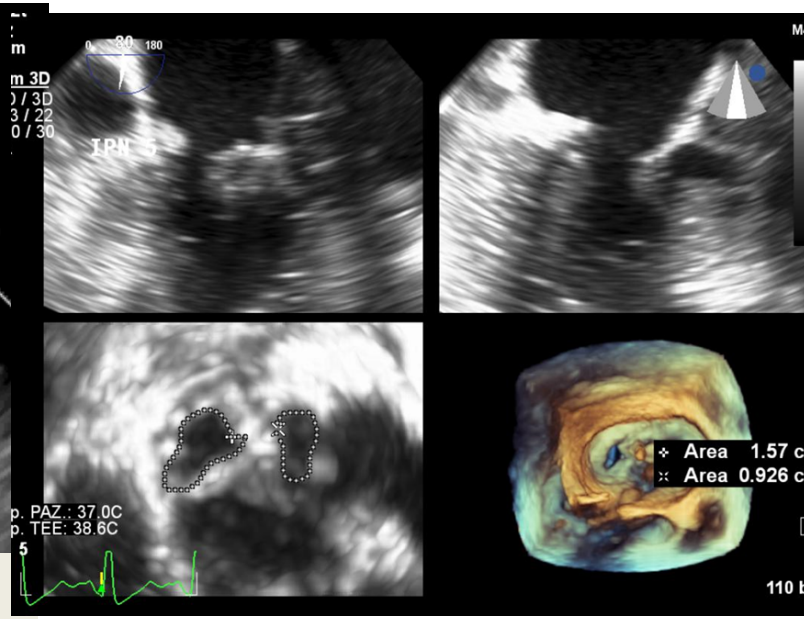
Echo-Doppler during iv isoproterenol infusion (0.2 mg/100cc)



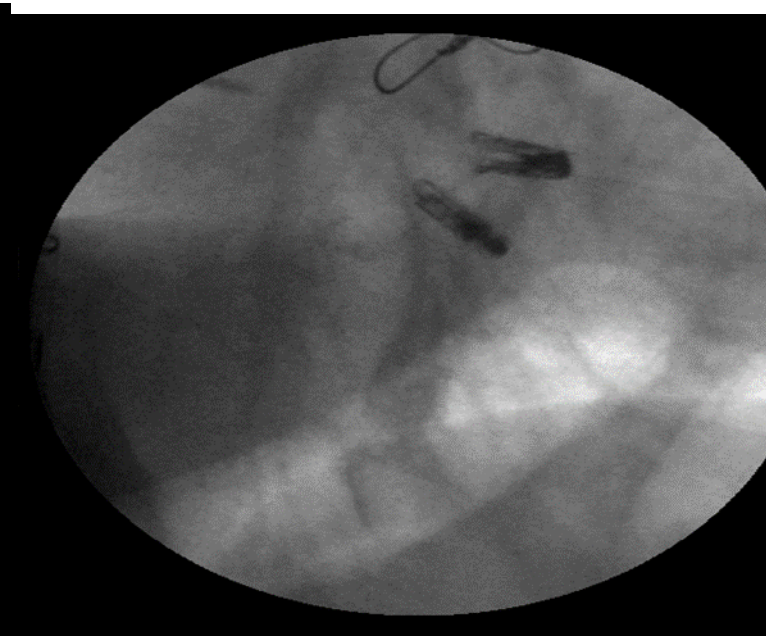



0
0
180
.0C
.6C

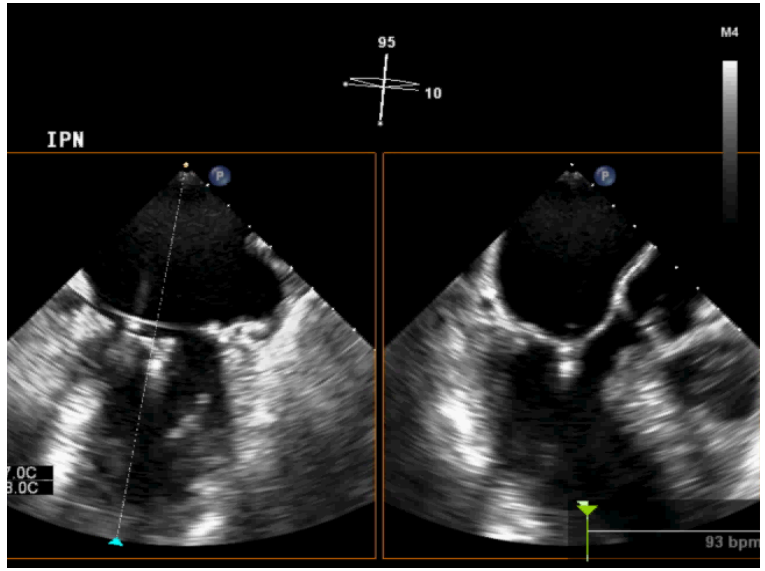


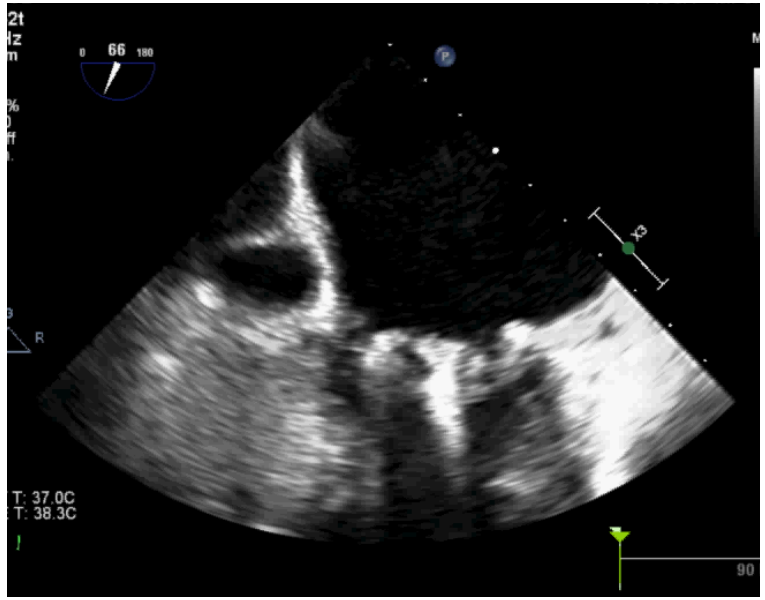


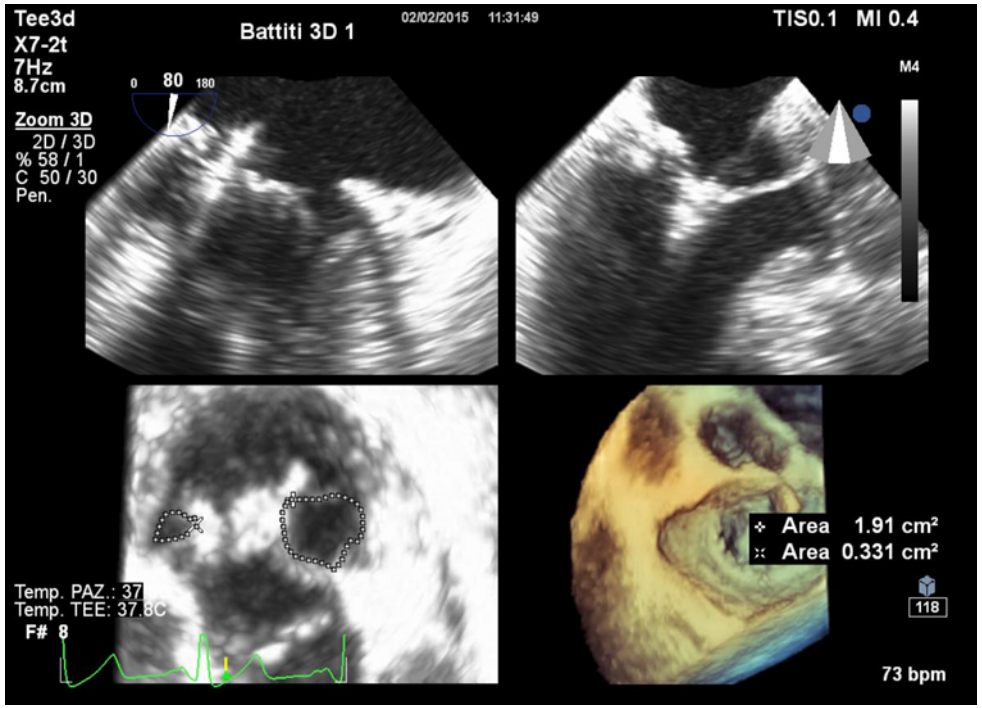
Post-MitraClip Isoproterenol

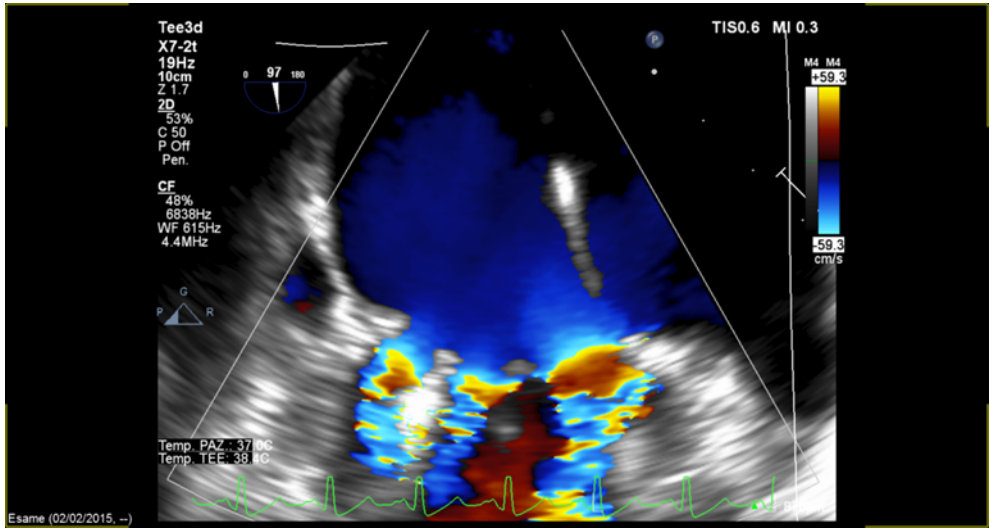


ISOPROTERENOL Test following 2 CLIP

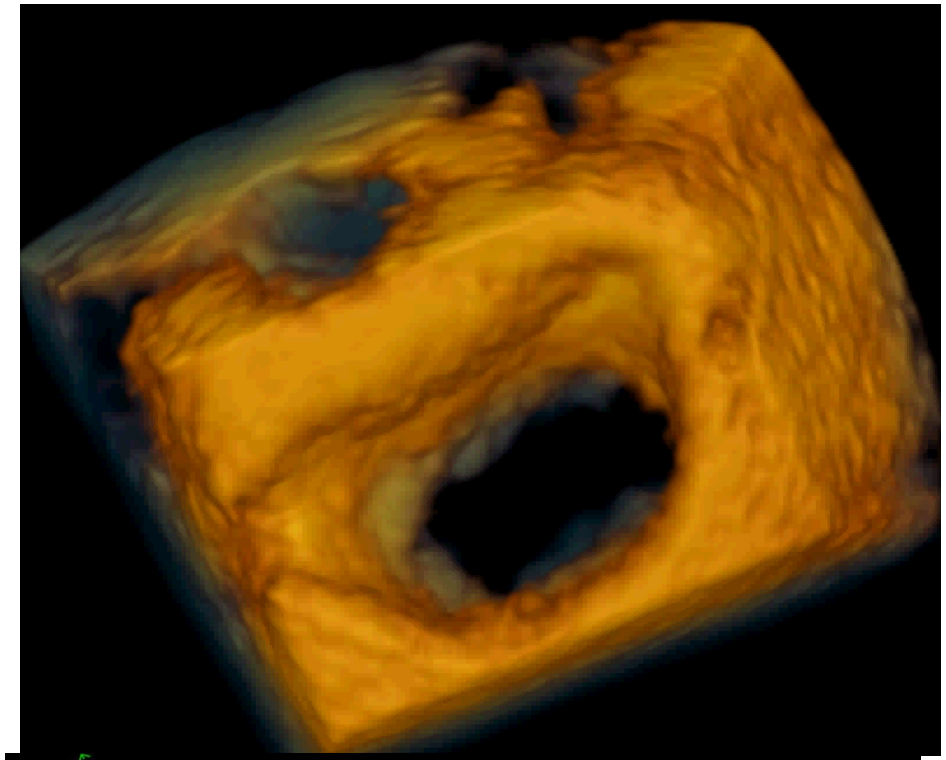


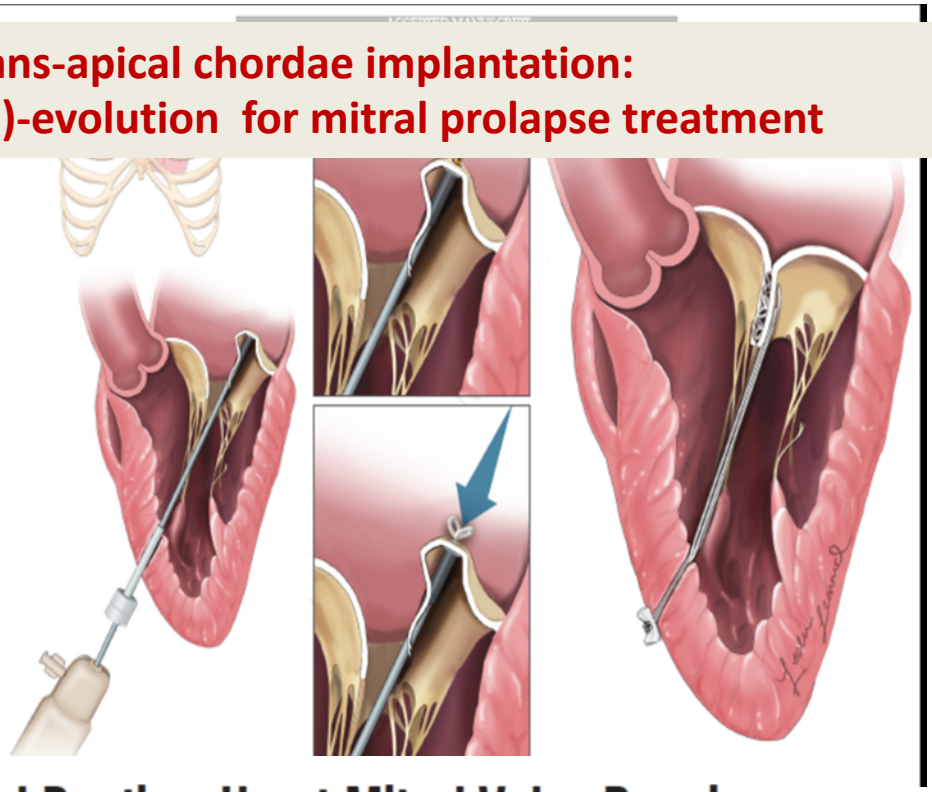


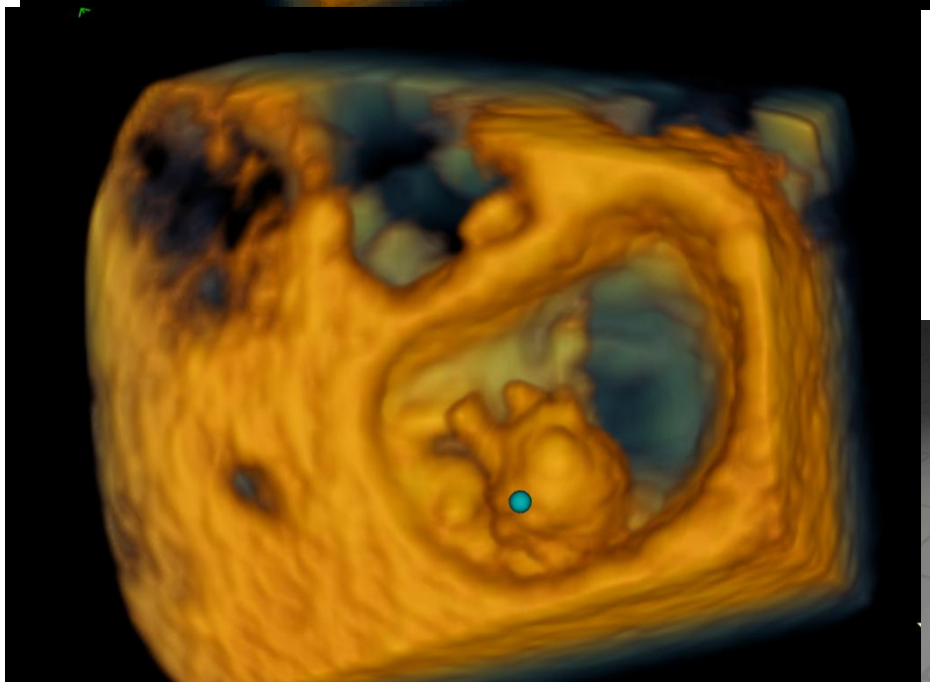




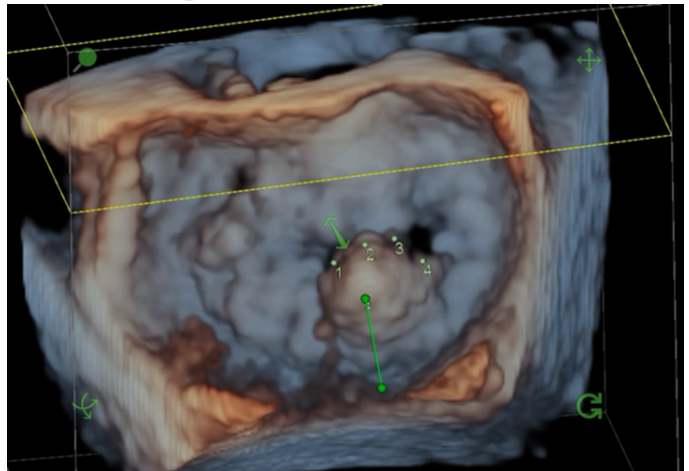
Trans-apical chordae implantation: (re)-evolution for mitral prolapse treatment



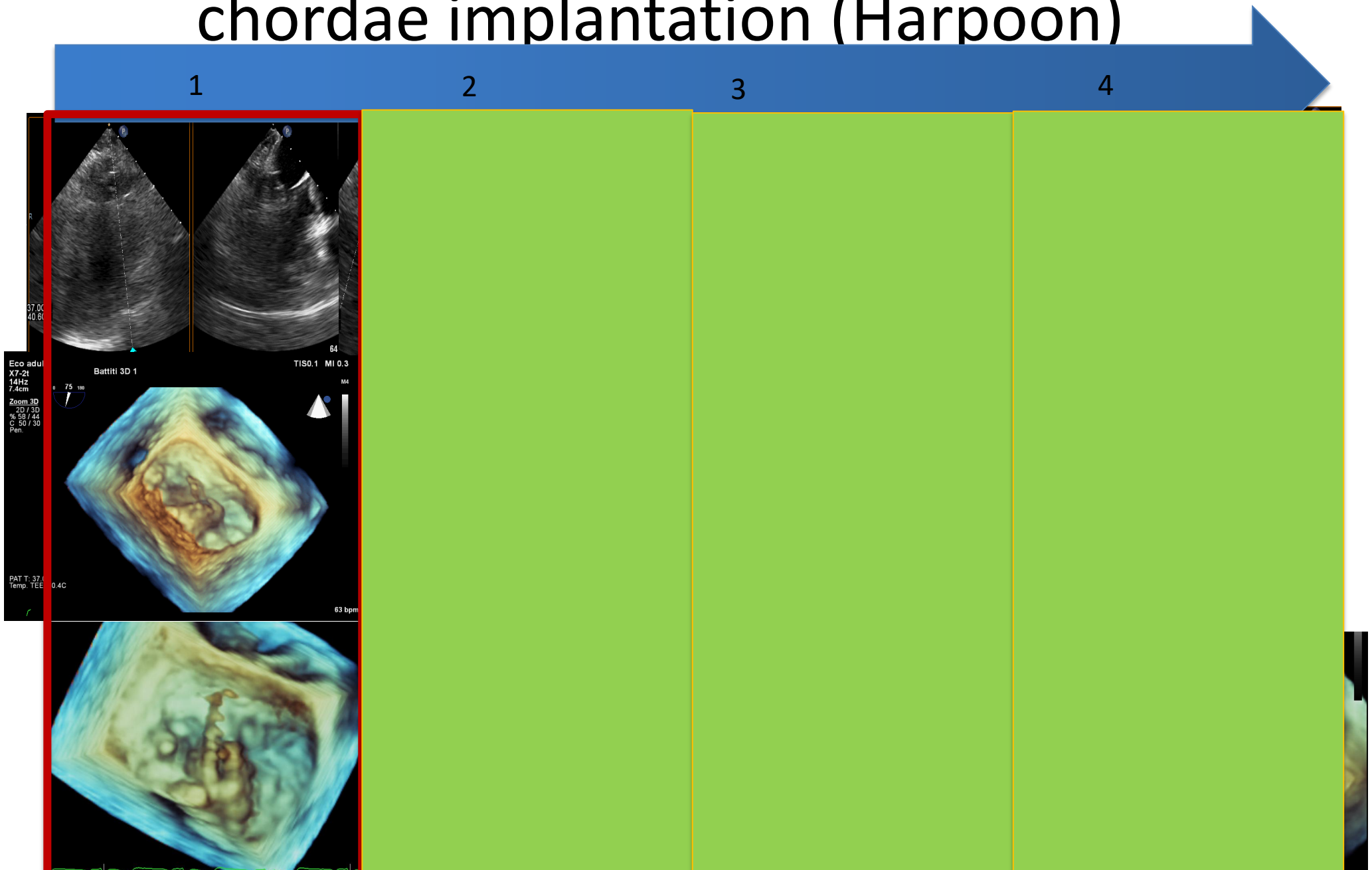




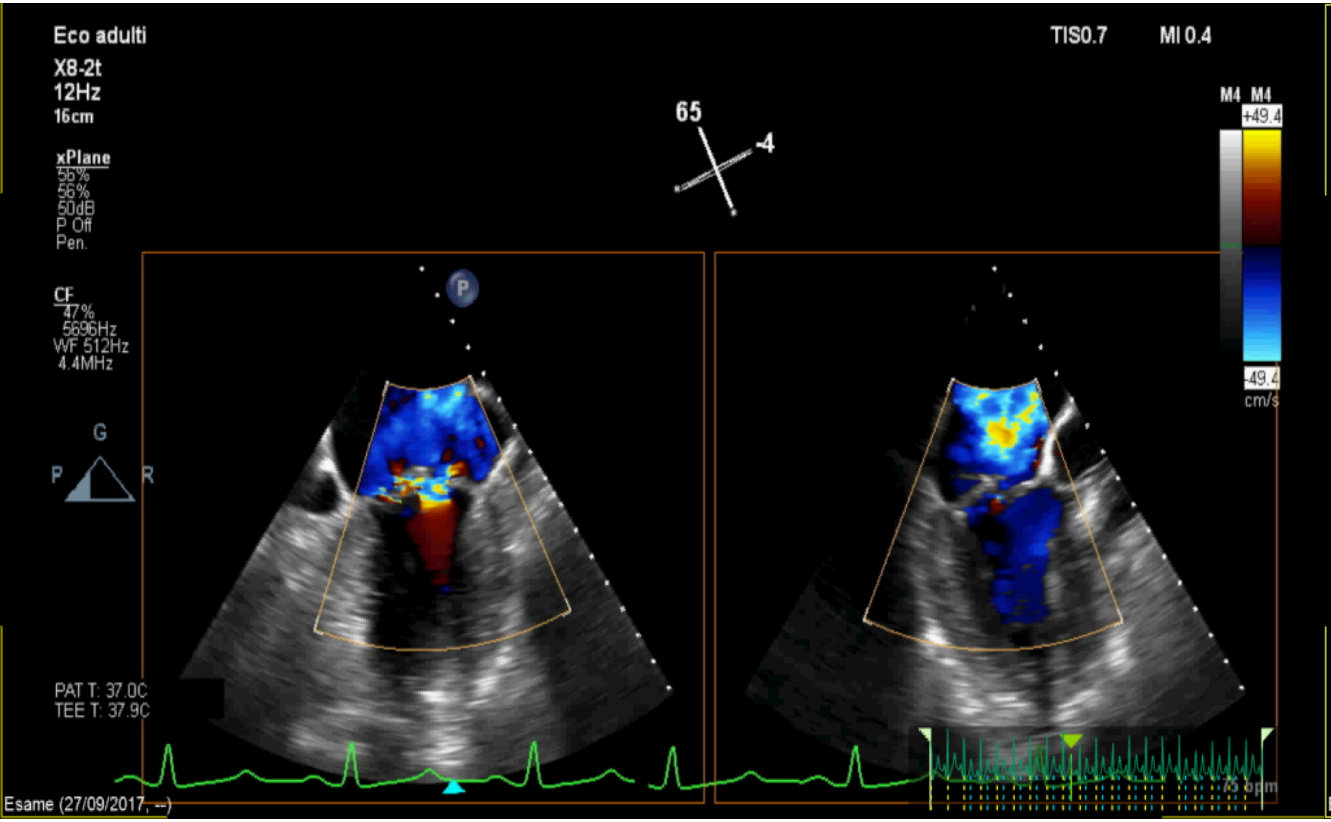
Transapical Beating-Heart Mitral Valve Repair With an Expanded Polytetrafluoroethylene Cordal Implantation Device

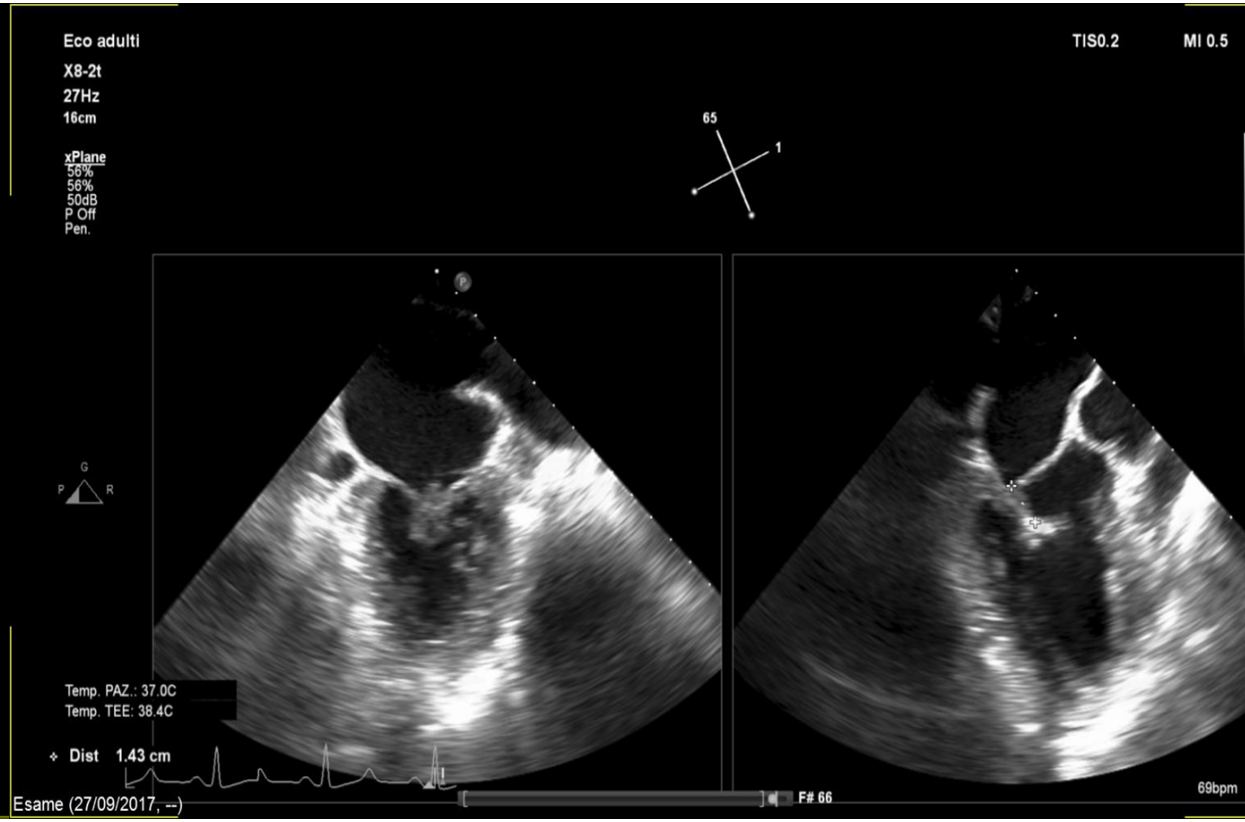


Sequential transapical beating heart chordae implantation (Harpoon)

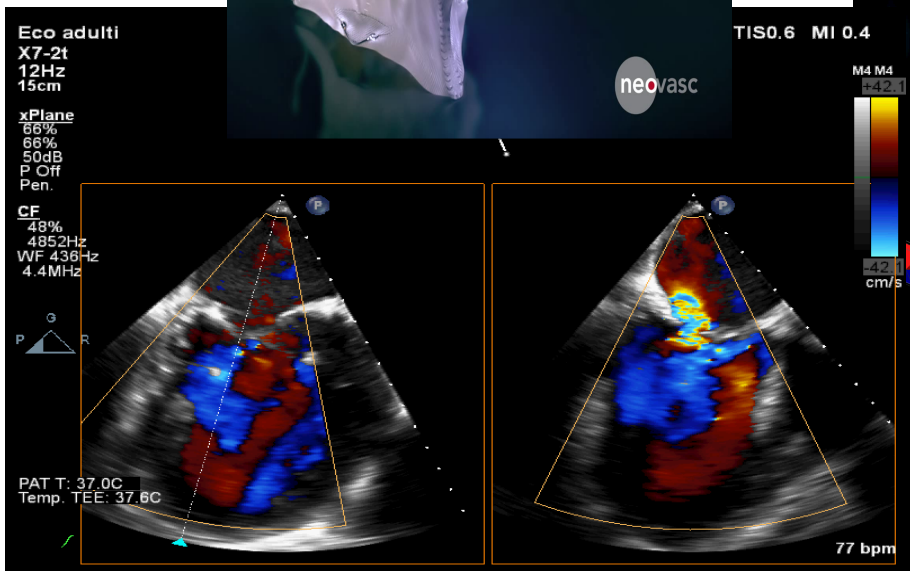


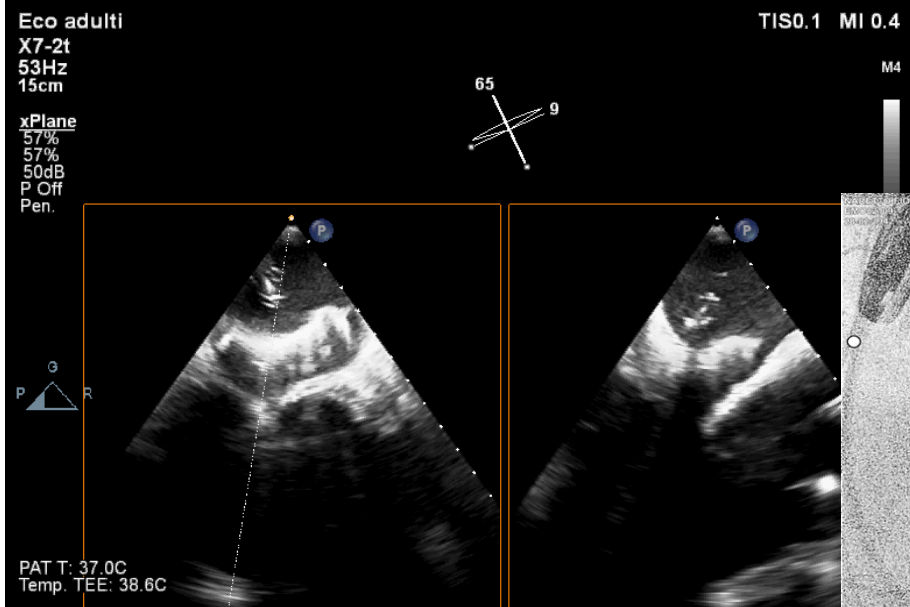
INTRAPROCEDURAL

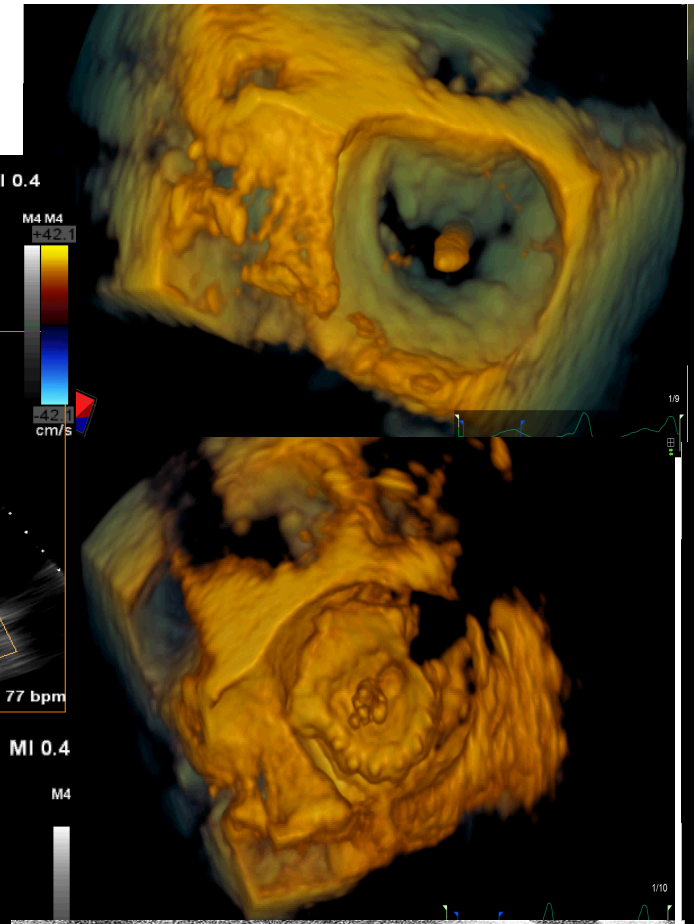


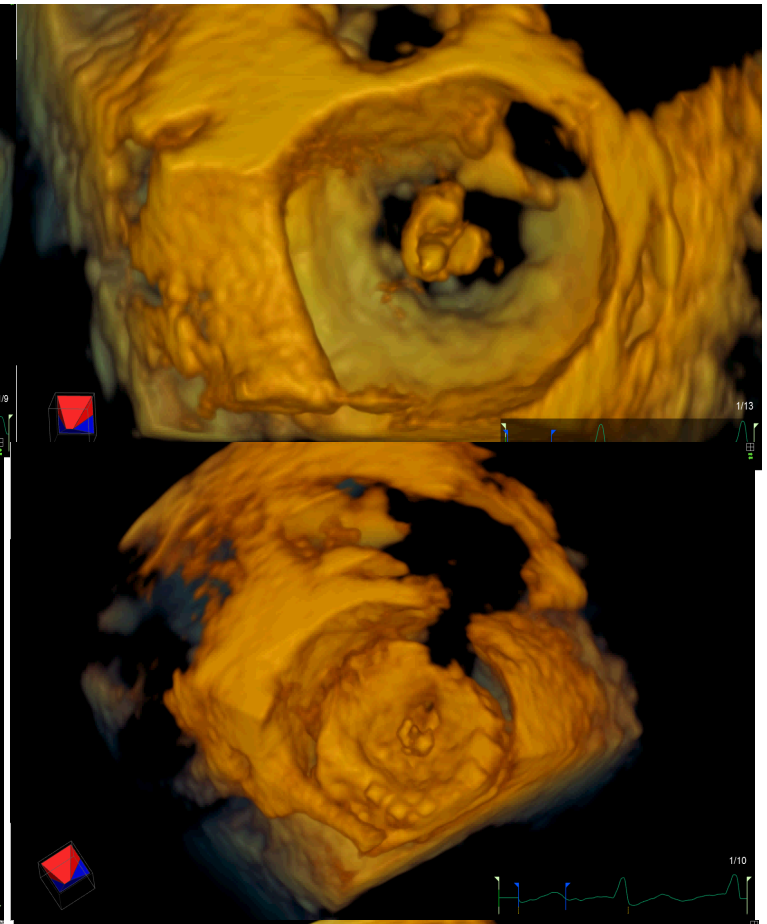


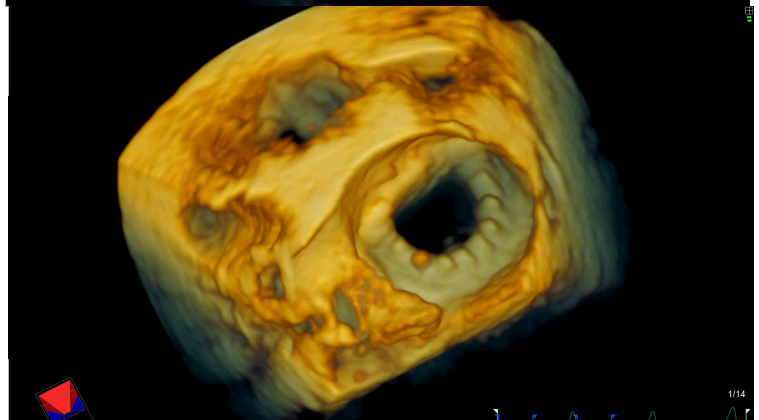
Percutaneous Transcatheter Mitral Valve Prosthesis

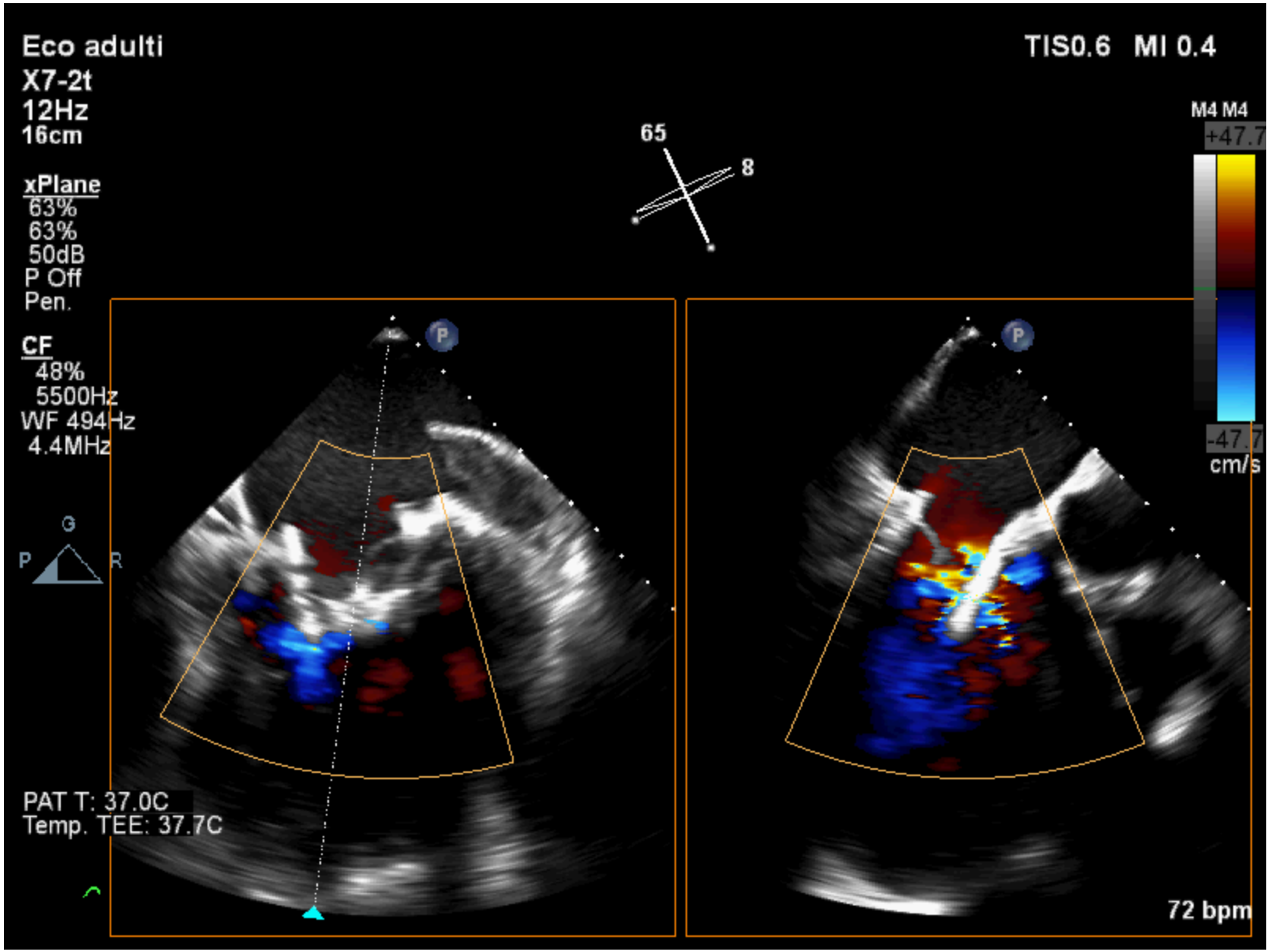


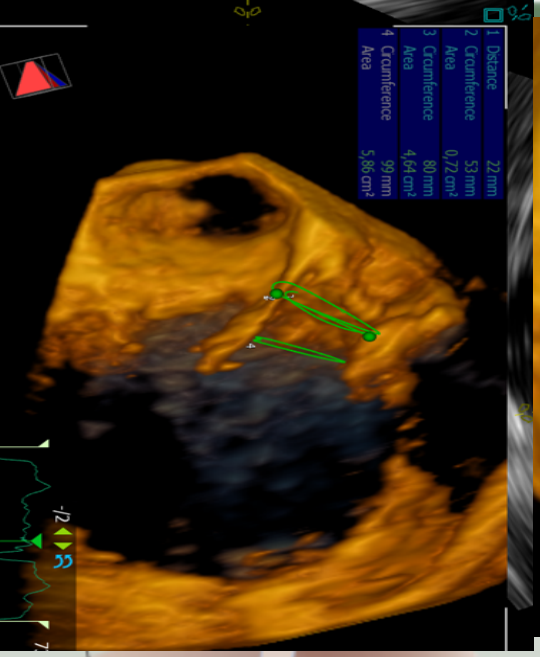


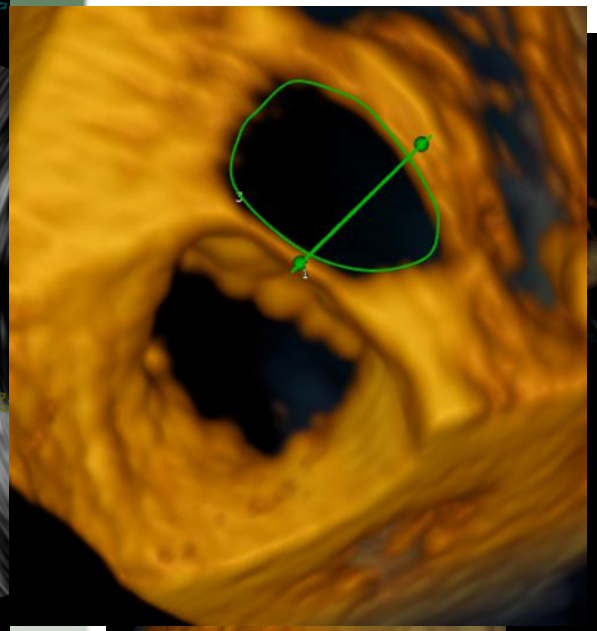


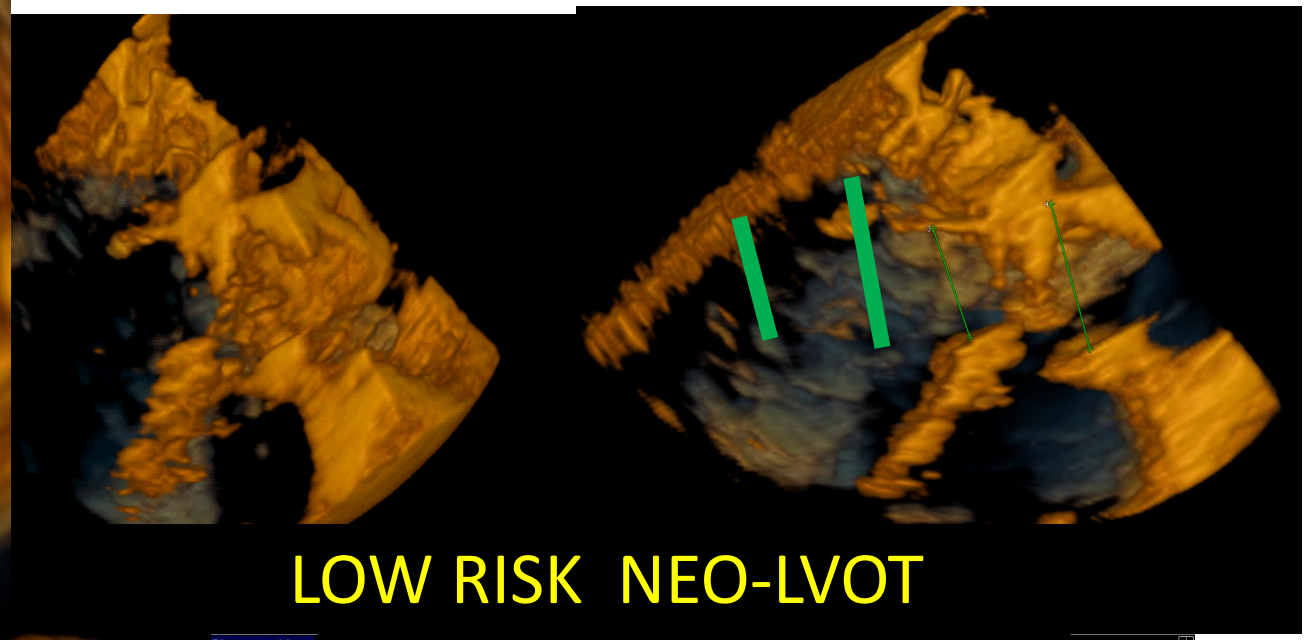




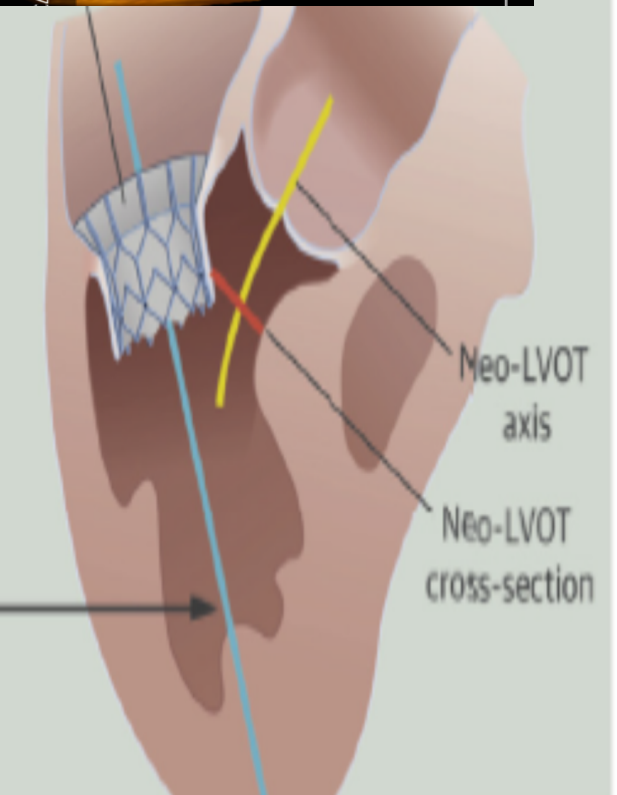

Eco adulti
X7-2t
12Hz
16cm
xPlane
63%
63%
50dB
P Off
Pen.
CF
48%
5500Hz
WF 494Hz
4.4MHz
TIS0.6 MI 0.4
65
8
M4 M4
+47.7
-47.7
cm/s
PAT T: 37.0C
Temp. TEE: 37.7C
72 bpm

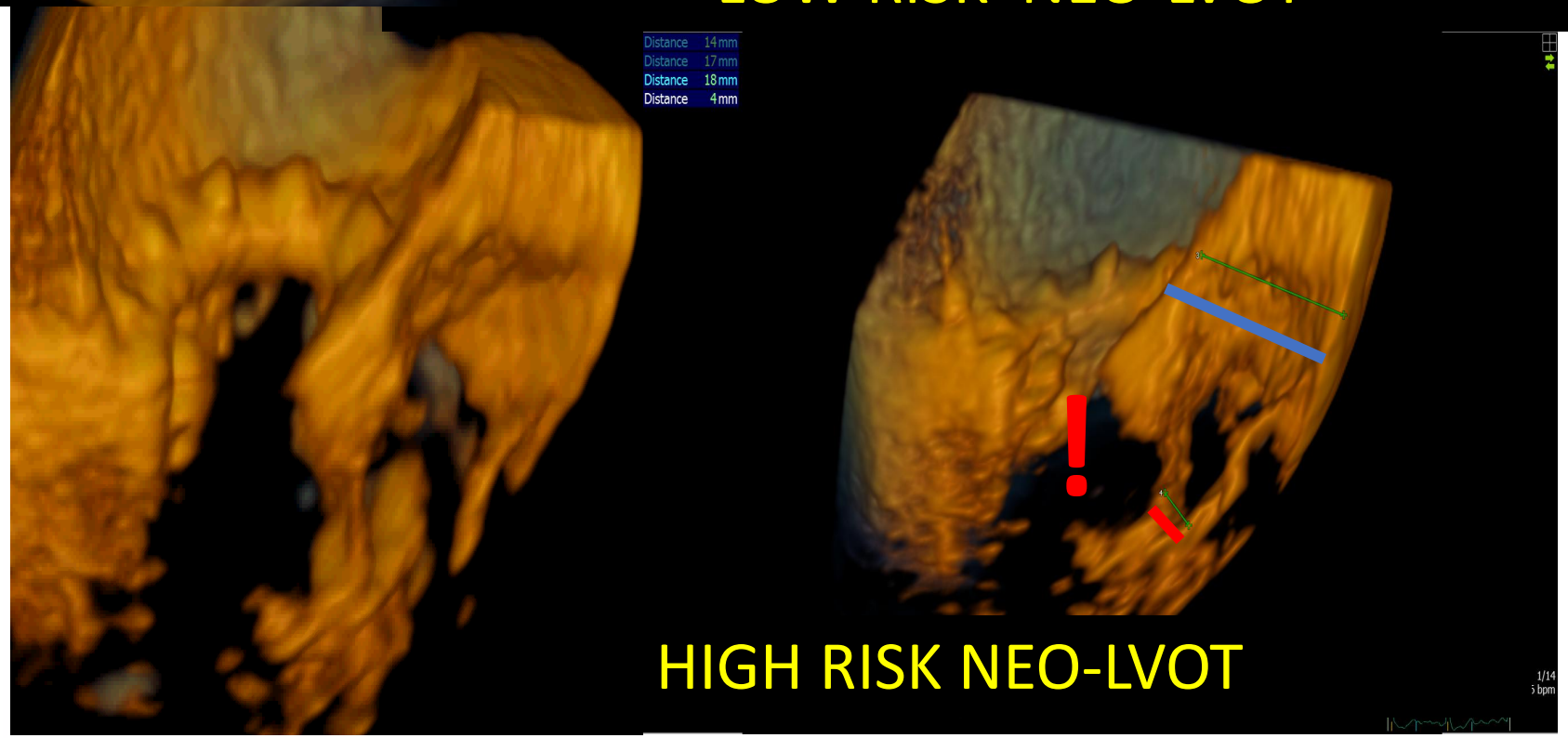




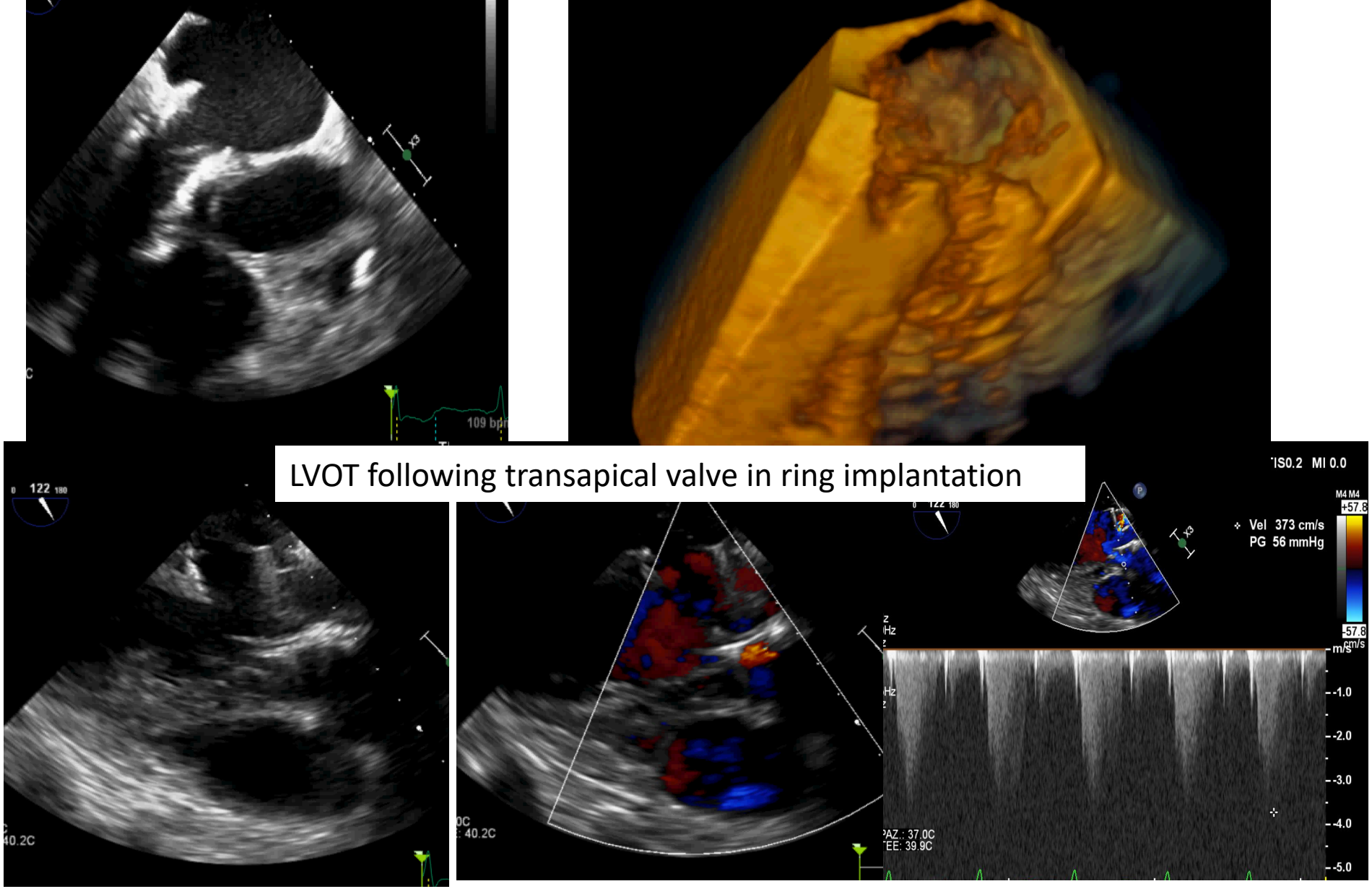


LOW RISK NEO-LVOT





HIGH RISK NEO-LVOT


LVOT following transapical valve in ring implantation
122
Vel 373 cm/s
PG 56 mmHg
M4 M4
+57.8
-57.8
cm/s
m/s
-1.0
-2.0
-3.0
-4.0
-5.0

Take-home message

- Percutaneous therapy is an attractive emergent tool in structural cardiac disease mimicking surgical approaches in selected patients
- Appropriate cardiac target lesion/device matching is paramount
- Echocardiography monitoring is the *key* to an effective and uneventful procedure, and with growing experience more complex and multiple lesions may be treated, but without *overstepping the mark*