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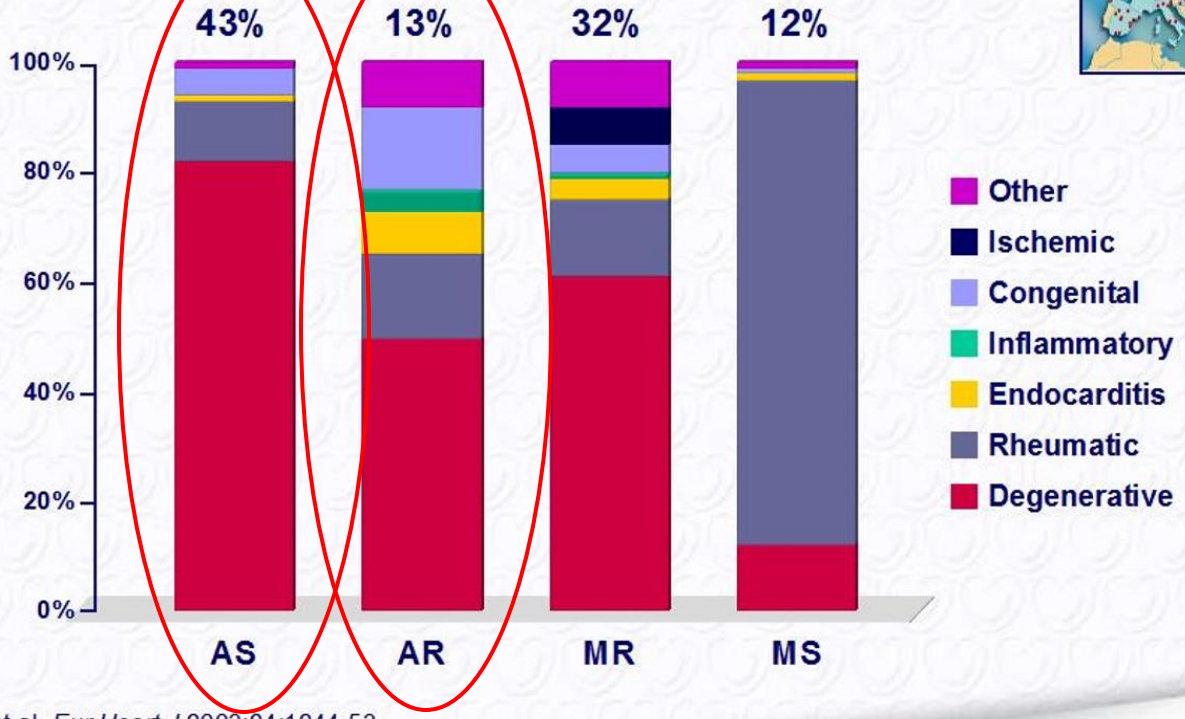
UNIVERSITY OF TORONTO

Aortic Valve:
Anatomy, Imaging, and Pathology

July 31, 2019
Department of Anesthesia and Pain Management- TGH, Toronto

Aetiologies of Single Valvular Heart Diseases in the Euro Heart Survey



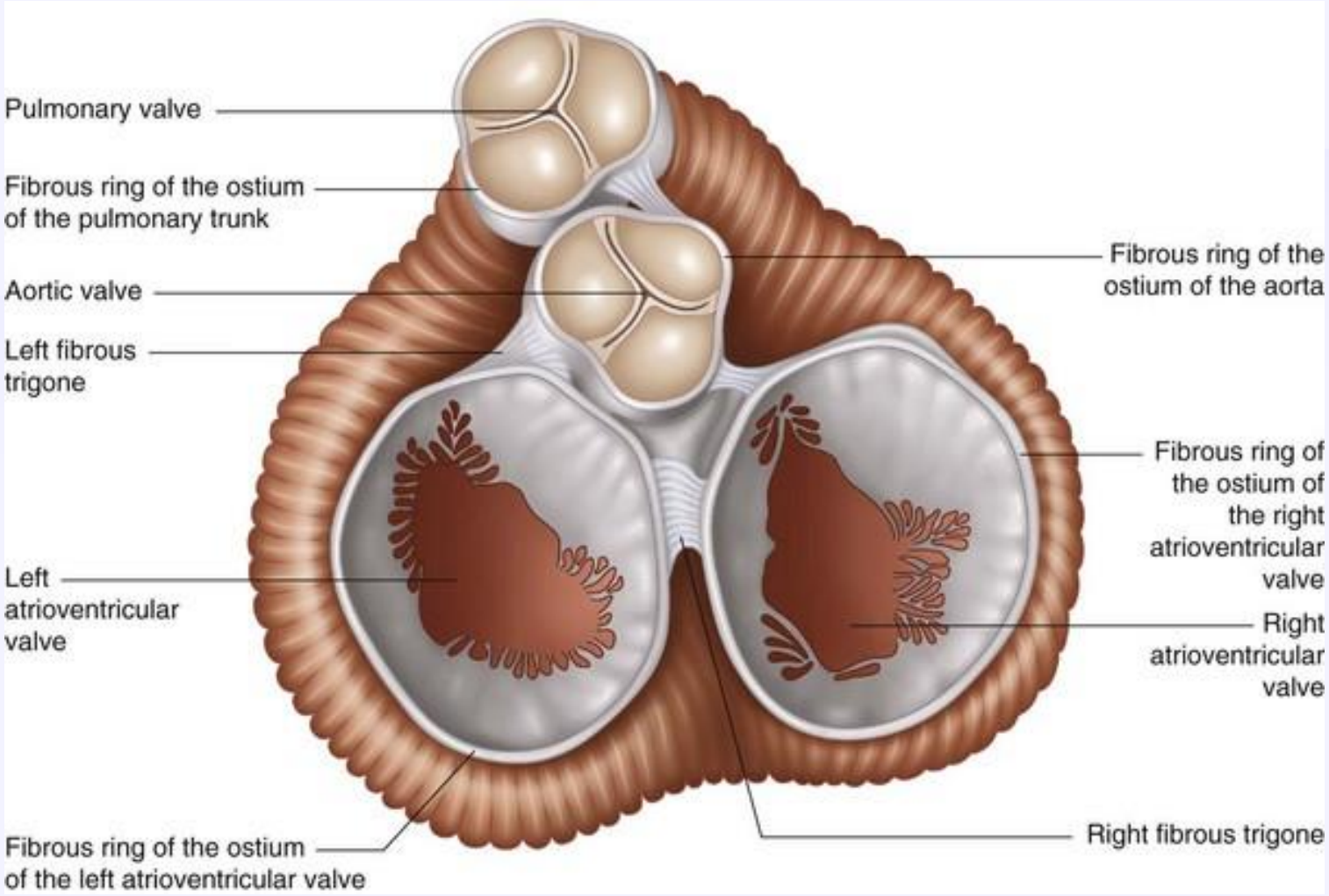
Iung et al. *Eur Heart J* 2003;24:1244-53

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

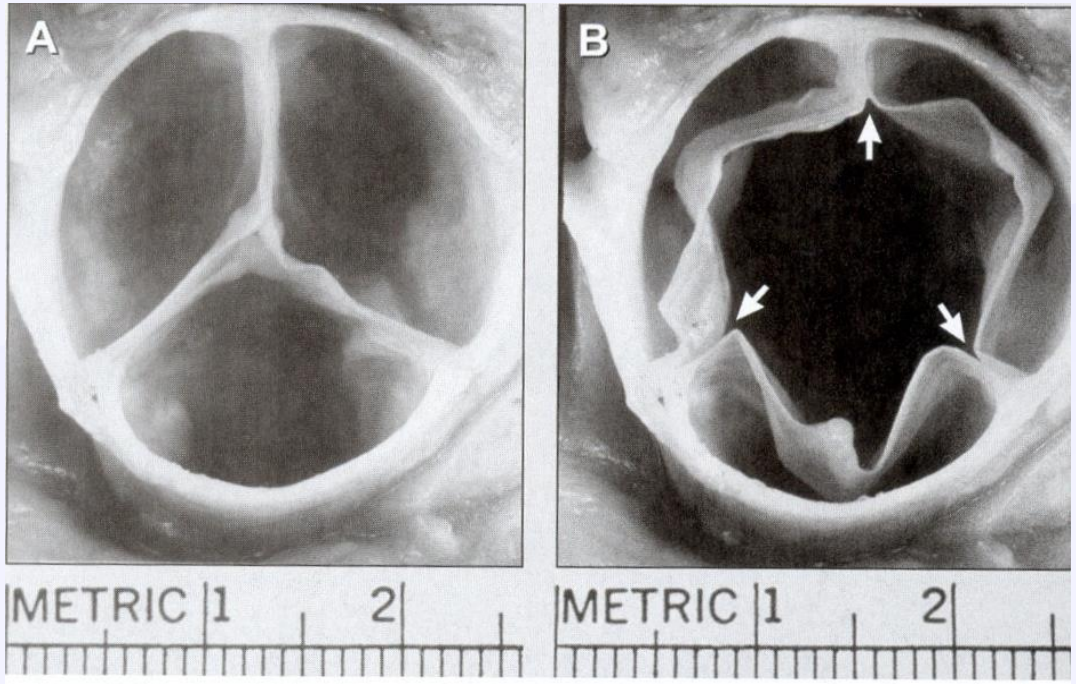
www.escardio.org/guidelines

EACTS

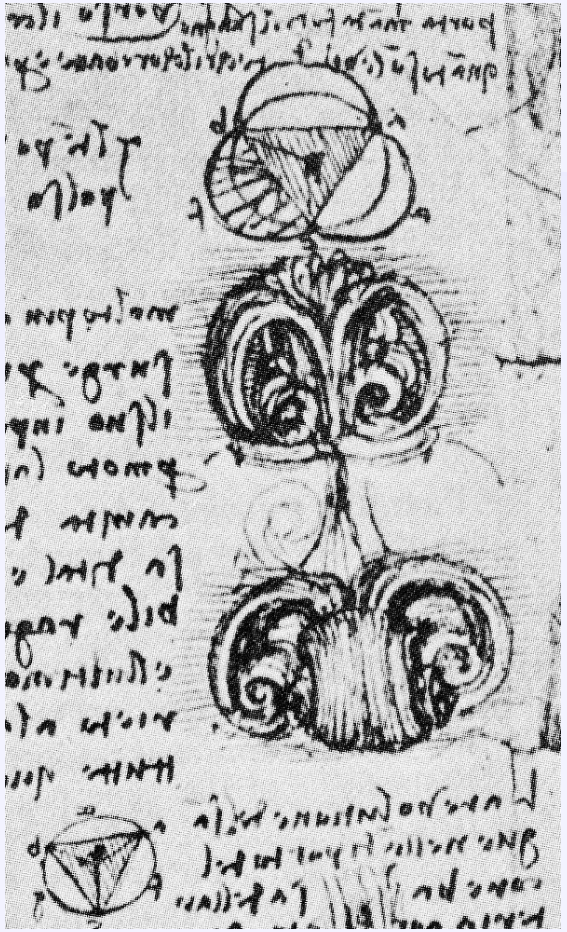
EUROPEAN SOCIETY OF



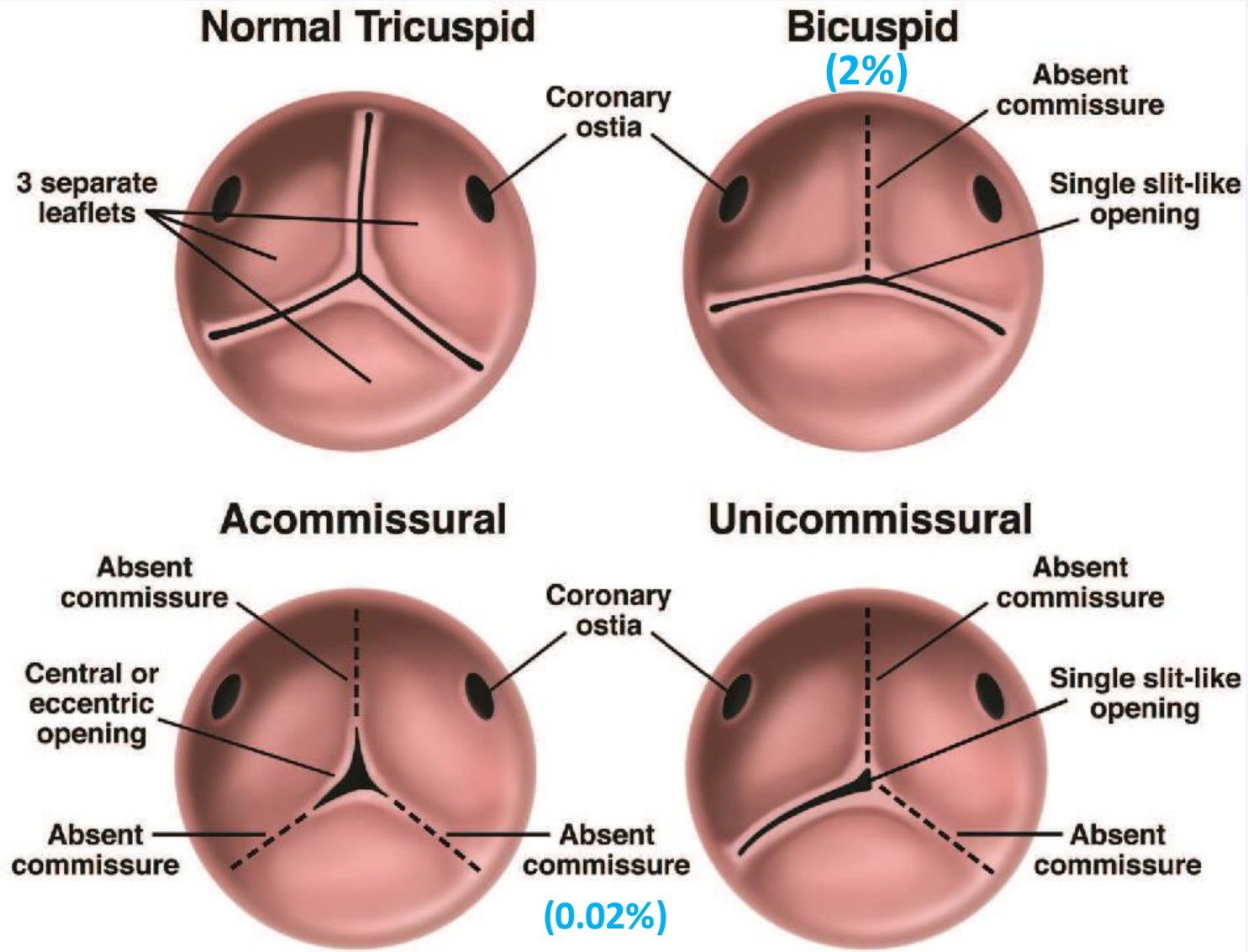
Fibrous skeleton of the heart (cardiac skeleton)

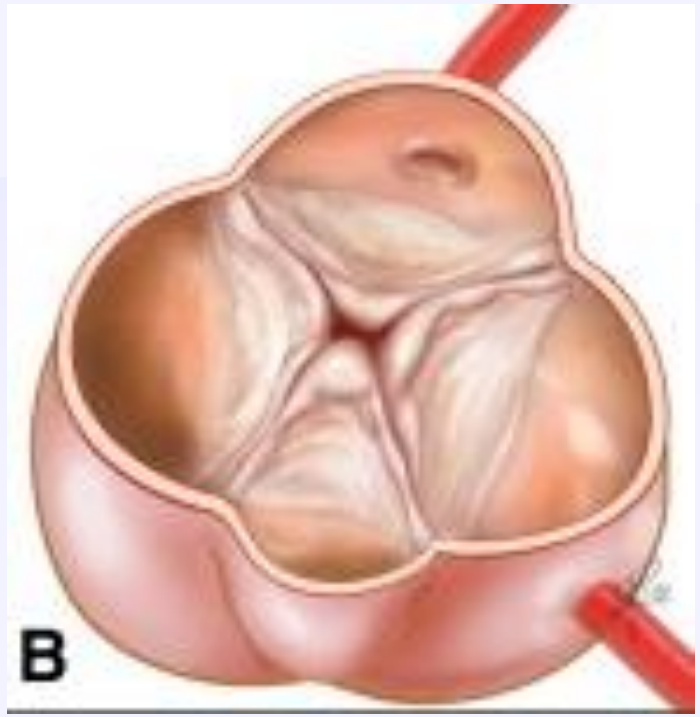


Normal aortic valve from aortic side

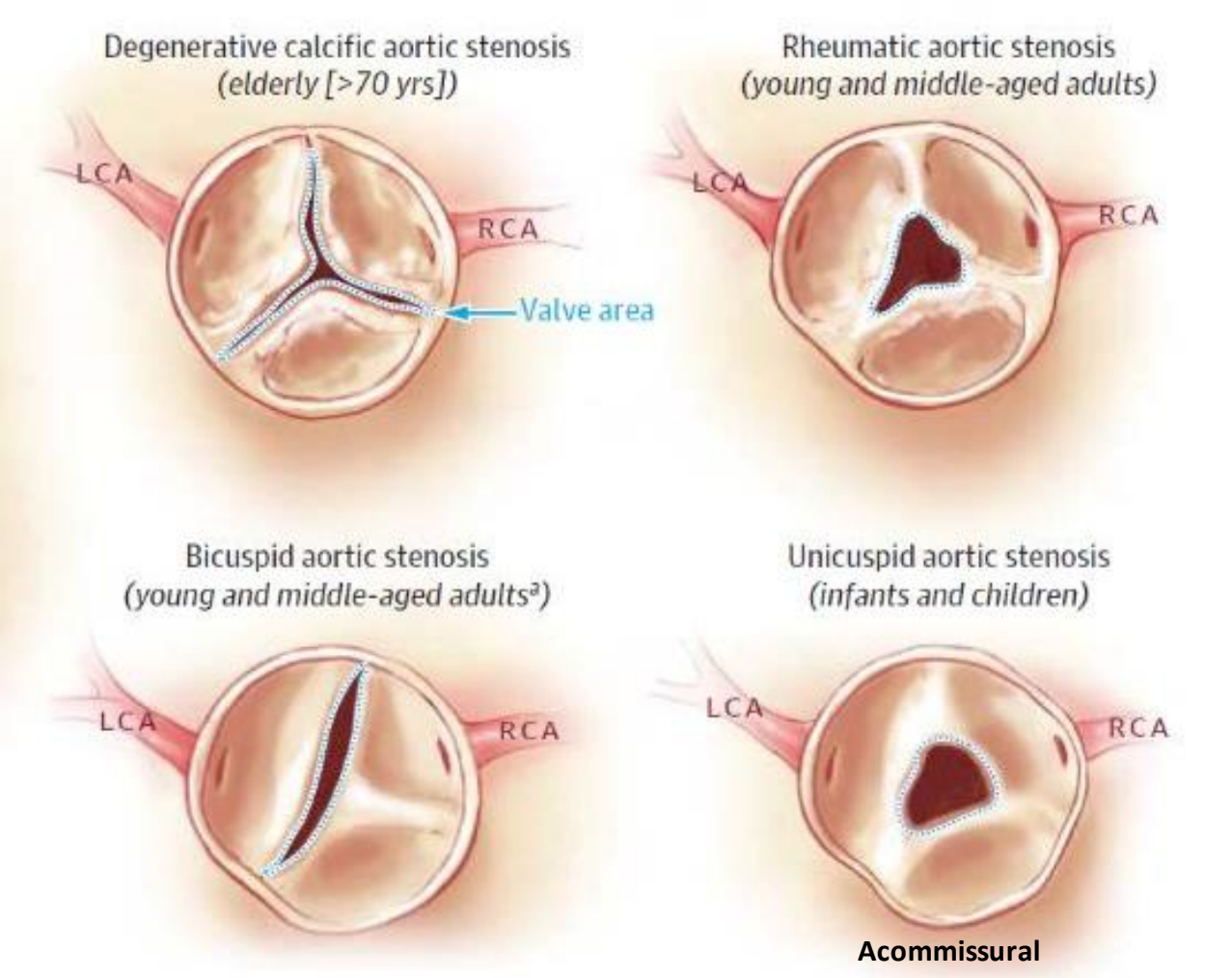


Aortic sinuses vortices was first described by Leonardo da Vinci in 1513

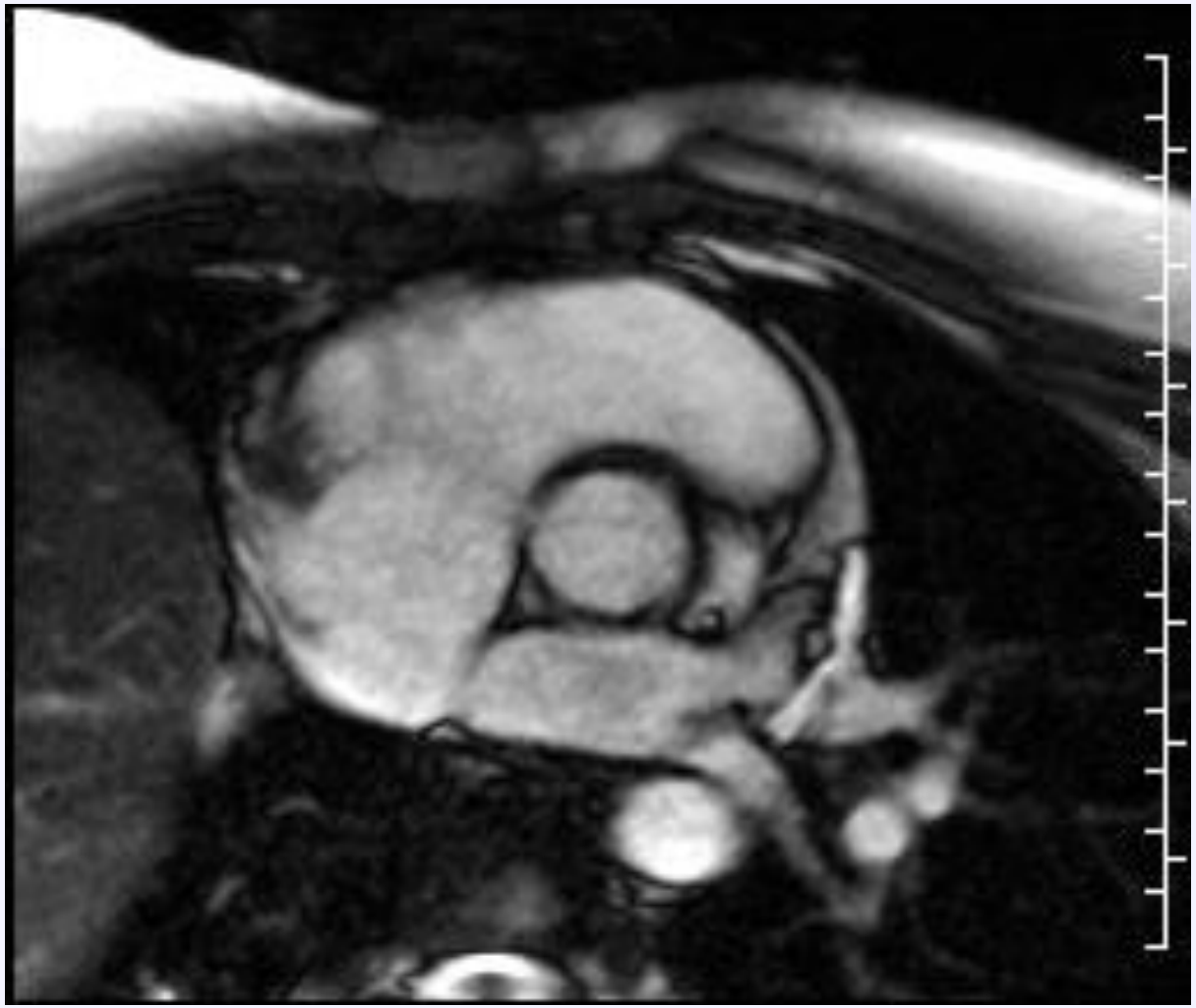


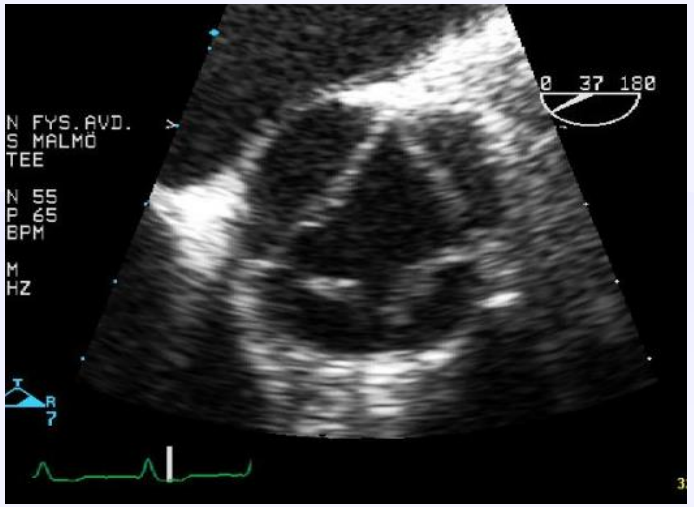


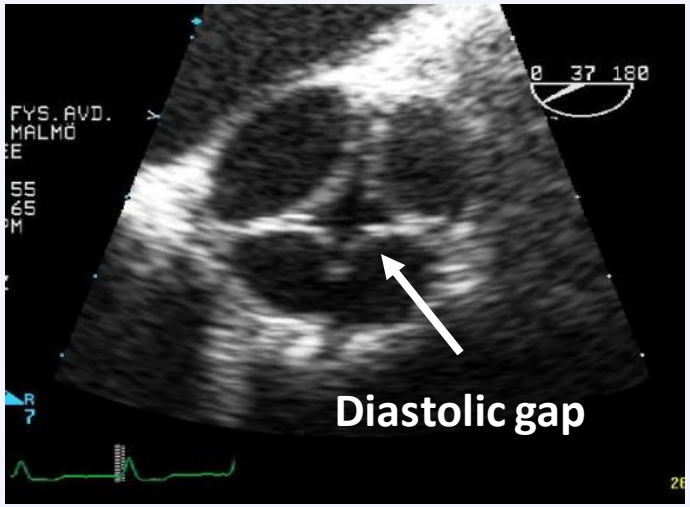
Quadricuspid (0.01%)



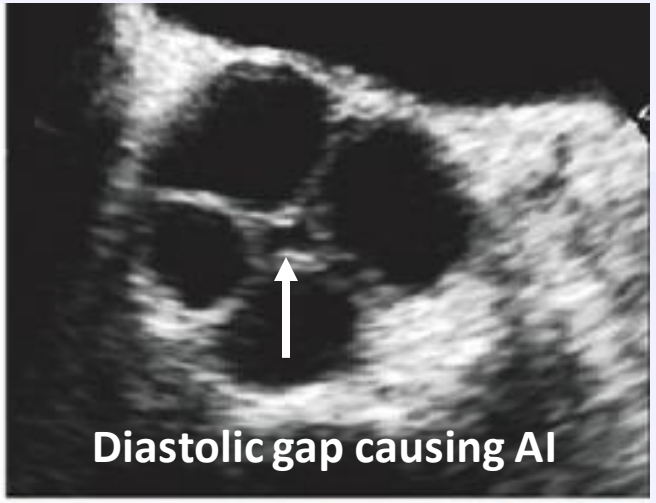
Type of aortic stenosis and age of presentation

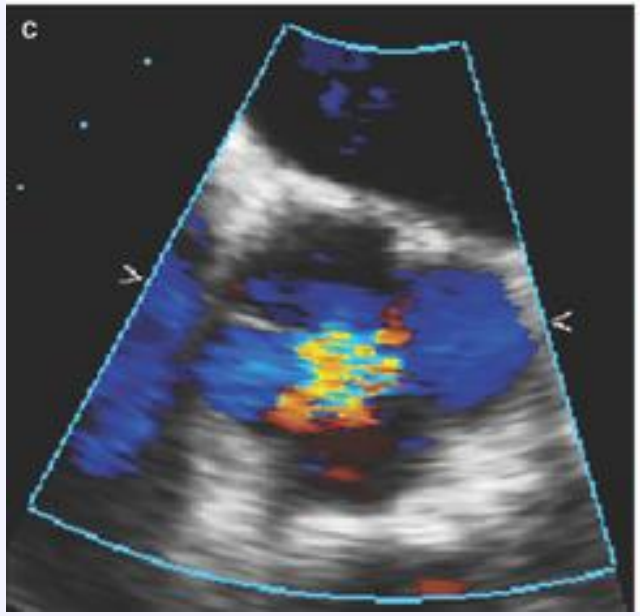


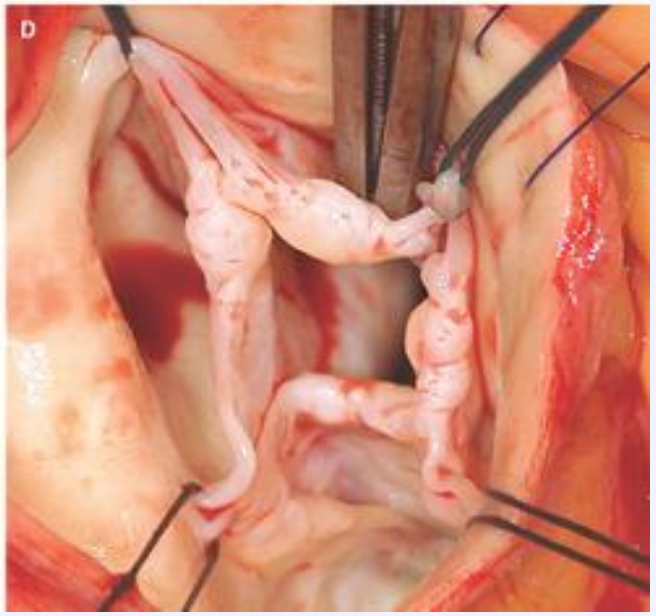


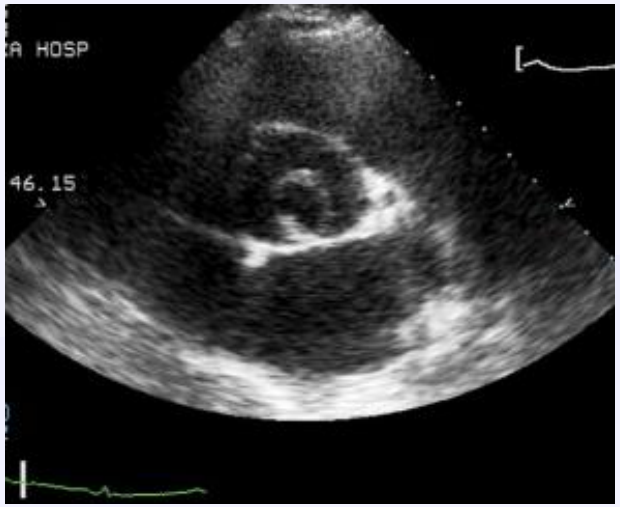


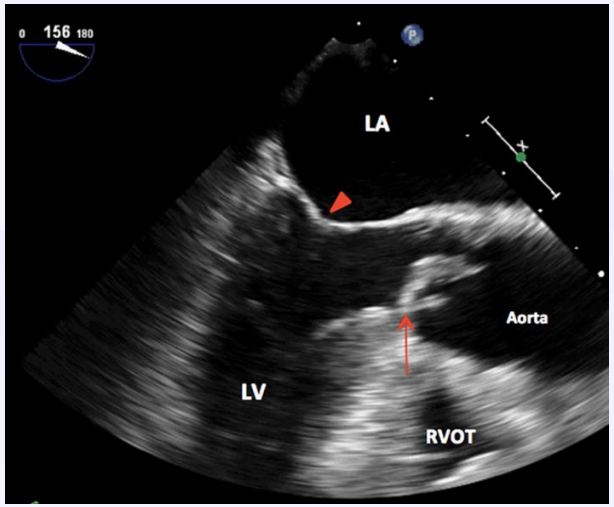
Quadricuspid aortic valve

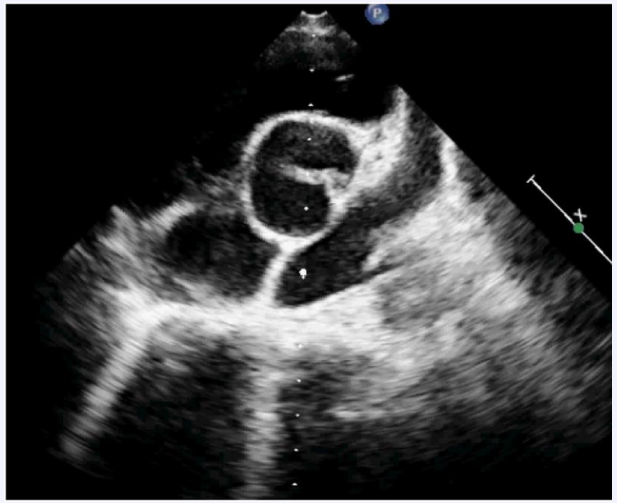

Diastolic gap causing AI


C

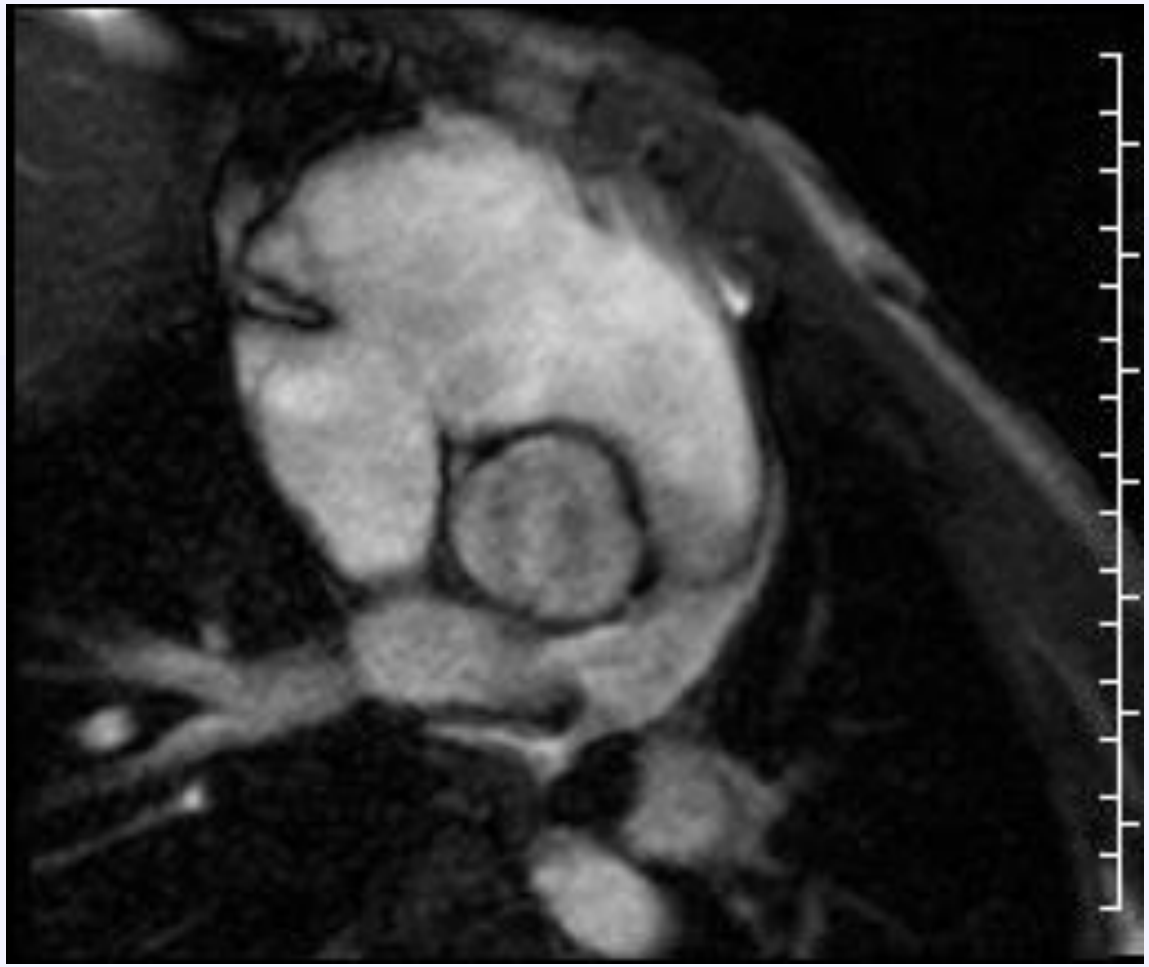

D

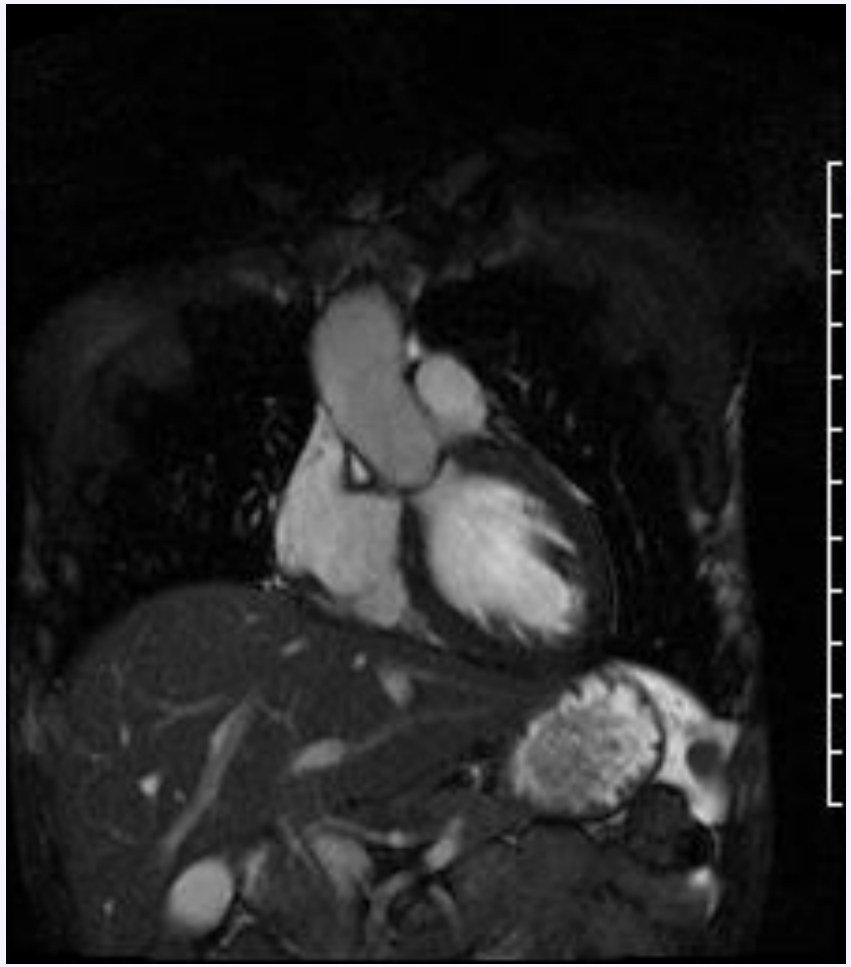




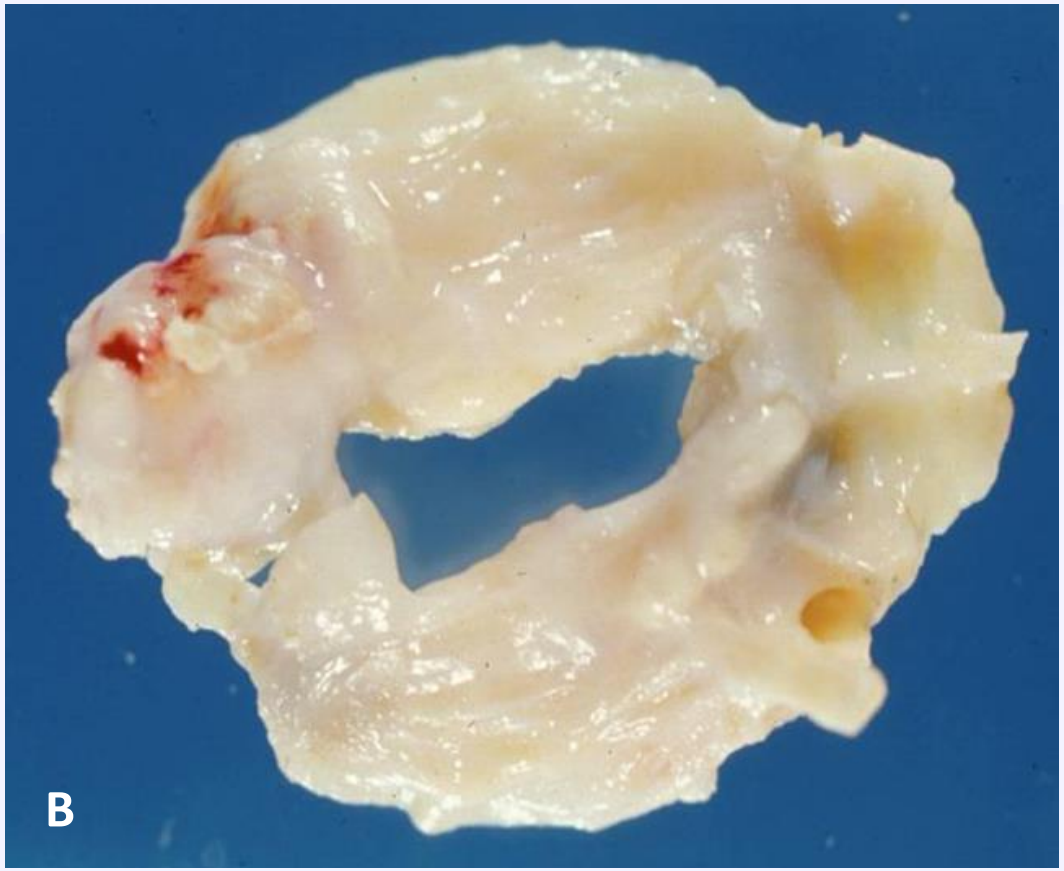


Uicuspid aortic valve (TTE, TEE)





Unicuspid unicommissural aortic valve



Unicuspid aortic valve. (A) Unicommissural. (B) Acommissural

- **0.02% of general population**
- **4-6% of individuals in adults undergoing isolated aortic valve surgery**

Bicuspid aortic valve

A classification system for the bicuspid aortic valve from 304 surgical specimens

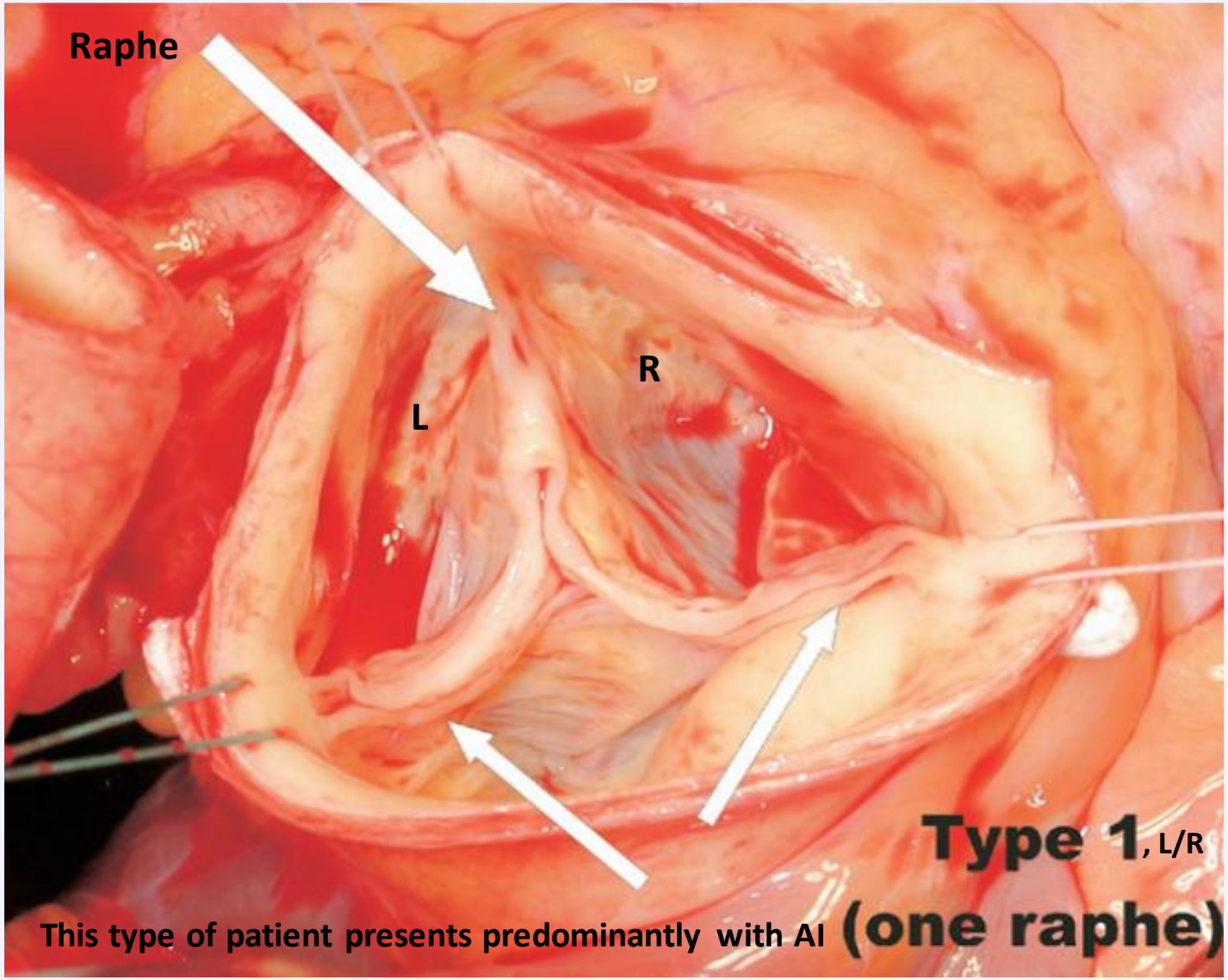
Hans-H. Sievers, MD, and Claudia Schmidtke, MD, MBA

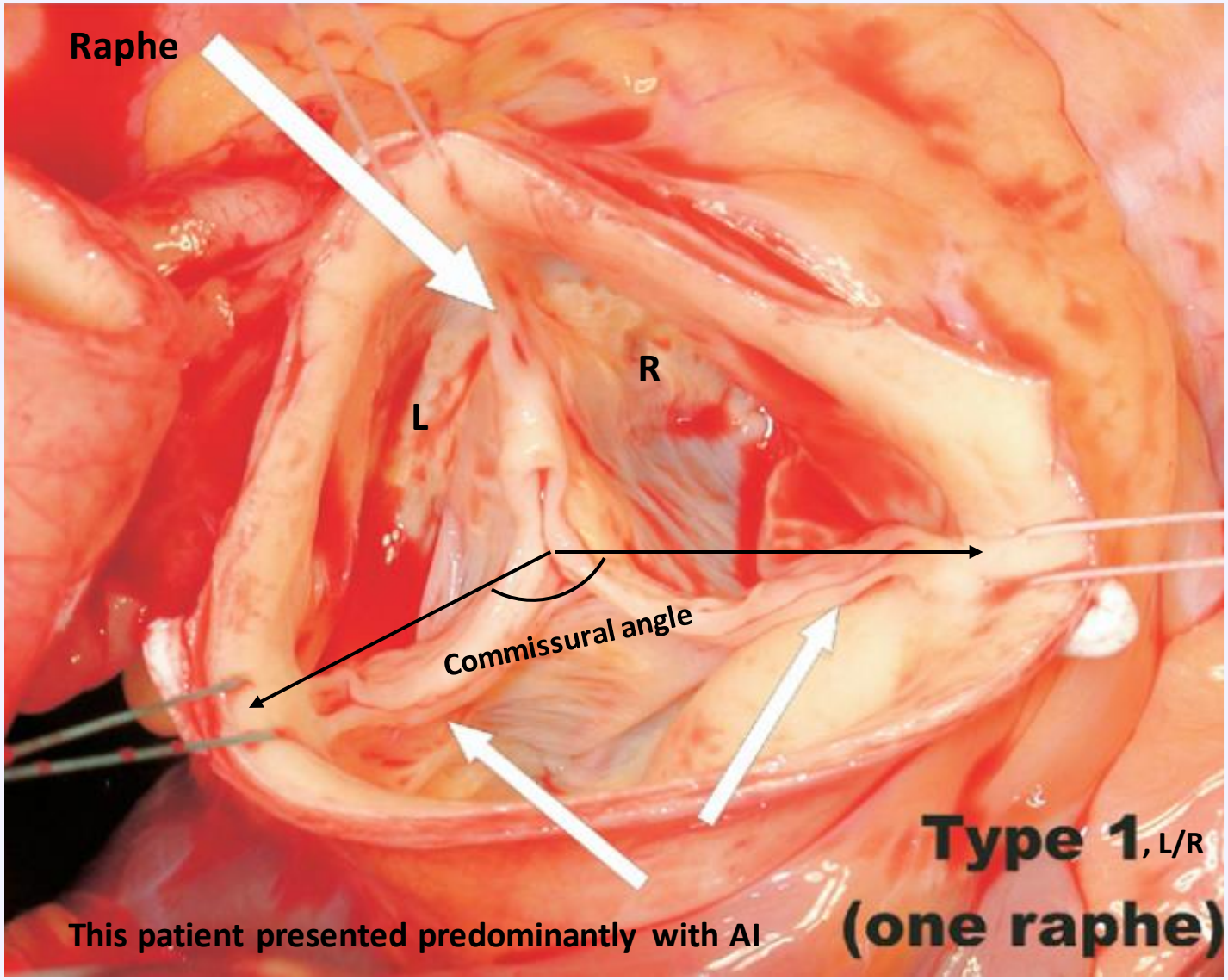
J Thorac Cardiovasc Surg 2007

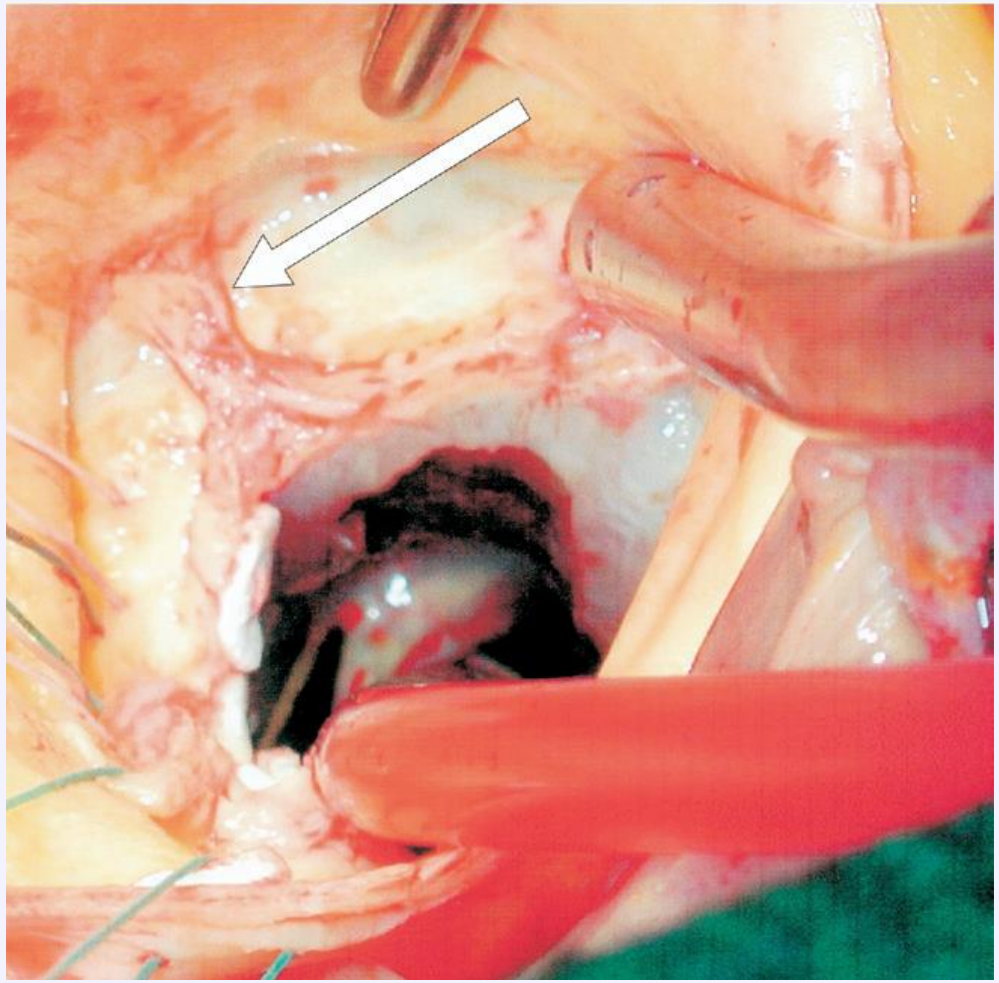
Objective: In general, classification of a disease has proven to be advantageous for disease management. This may also be valid for the bicuspid aortic valve, because the term "bicuspid aortic valve" stands for a common congenital aortic valve malformation with heterogeneous morphologic phenotypes and function resulting in different treatment strategies. We attempted to establish a classification system based on a 5-year data collection of surgical specimens.

Methods: Between 1999 and 2003 a precise description of valve pathology was obtained from operative reports of 304 patients with a diseased bicuspid aortic valve. Several different characteristics of bicuspid aortic valves were tested to generate a pithy and easily applicable classification system.

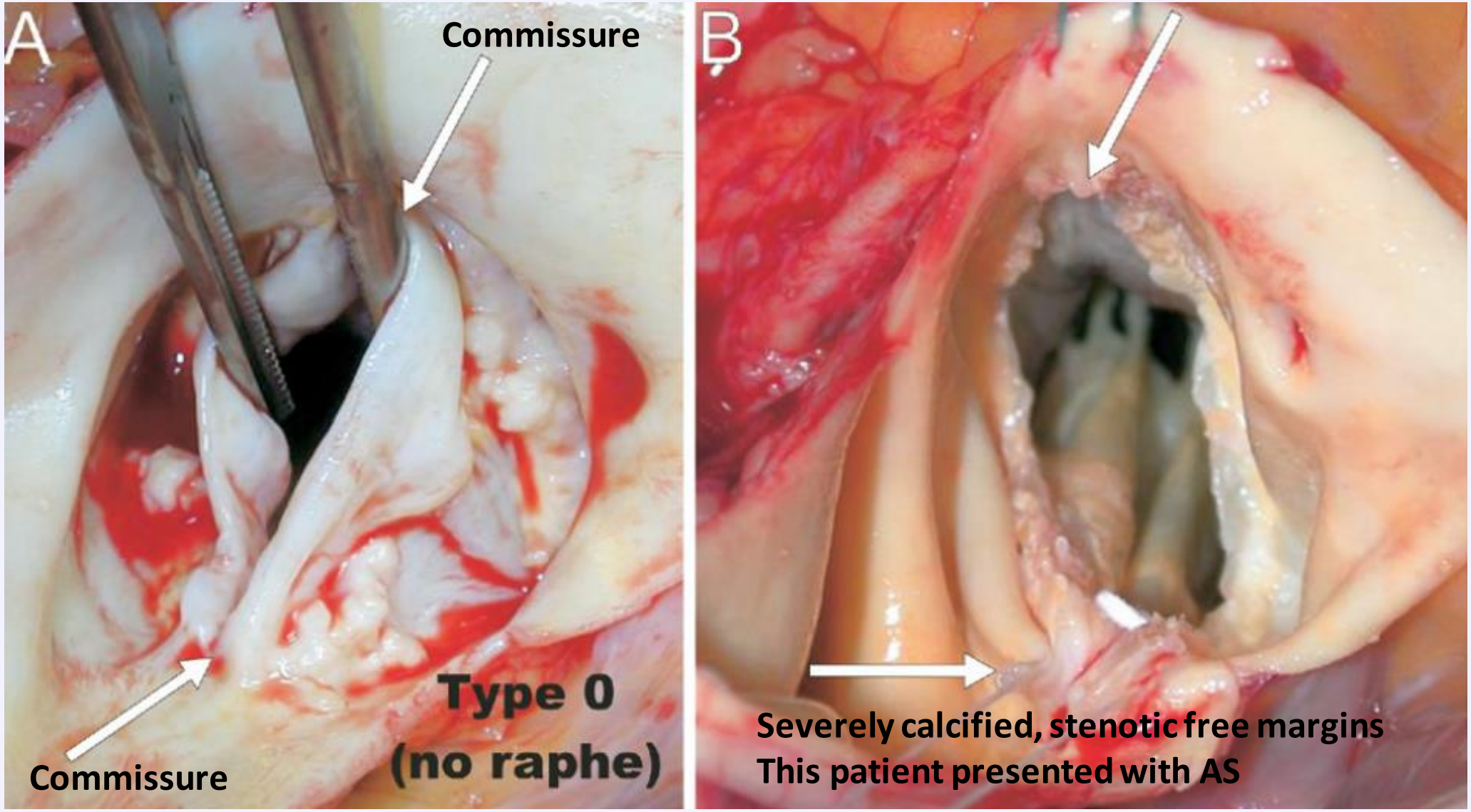
Results: Three characteristics for a systematic classification were found appropriate: (1) number of raphes, (2) spatial position of cusps or raphes, and (3) functional status of the valve. The first characteristic was found to be the most significant and therefore termed "type." Three major types were identified: type 0 (no raphe), type 1 (one raphe), and type 2 (two raphes), followed by two supplementary characteristics, spatial position and function. These characteristics served to classify and codify the bicuspid aortic valves into three categories. Most frequently, a bicuspid aortic valve with one raphe was identified (type 1, n = 269). This raphe was positioned between the left (L) and right (R) coronary sinuses in 216 (type 1, L/R) with a hemodynamic predominant stenosis (S) in 119 (type 1, L/R, S). Only 21 patients had a "purely" bicuspid aortic valve with no raphe (type 0).

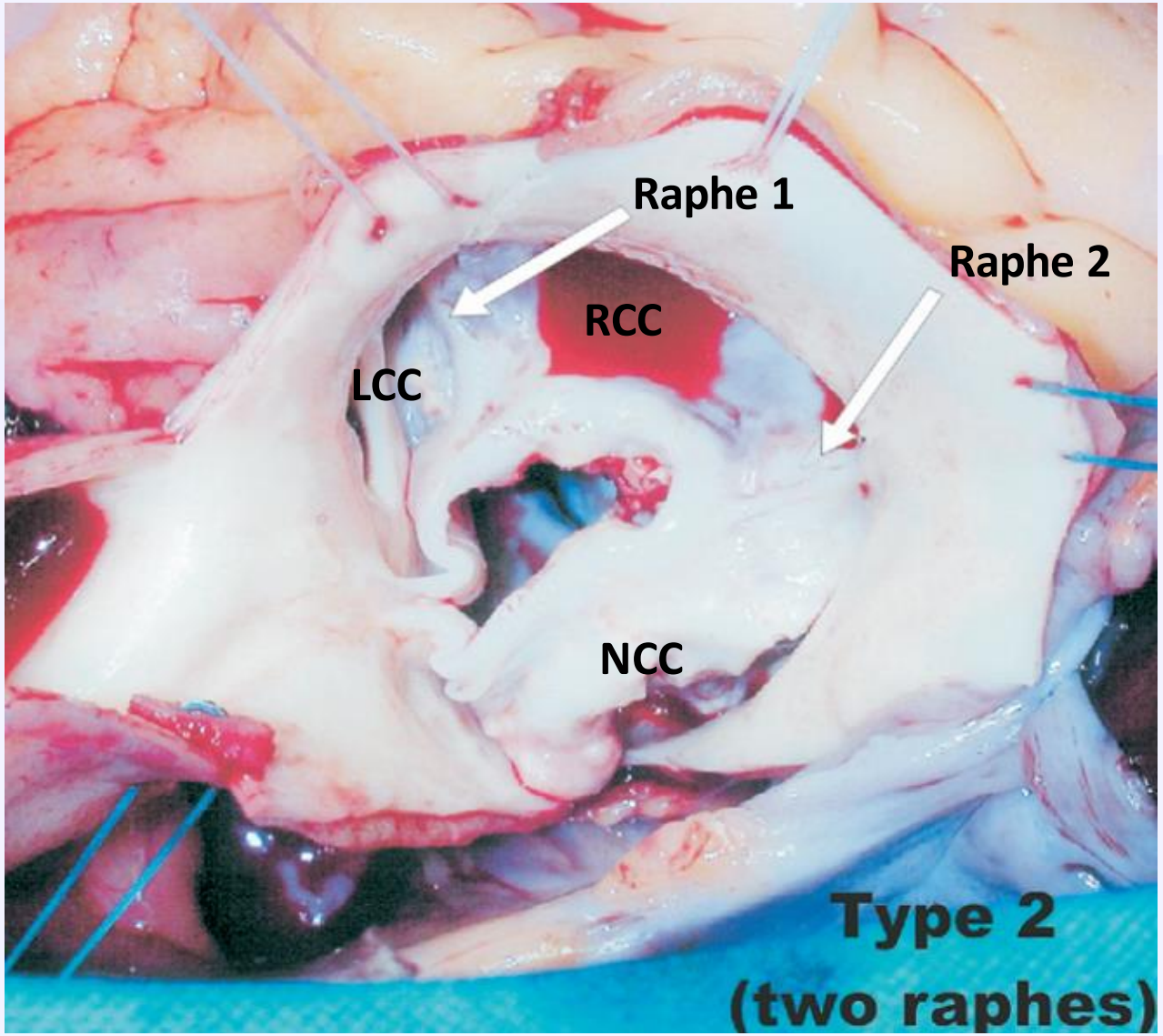

Raphe
R
L
Type 1, L/R
(one raphe)
This type of patient presents predominantly with AI


Raphe
R
L
Commissural angle
Type 1, L/R
(one raphe)
This patient presented predominantly with AI



Same patient with type 1, L/R BAV. Exploration of the raphes showing obliteration and mild calcification


A
Commissure
Commissure
Type 0
(no raphe)
B
Severely calcified, stenotic free margins
This patient presented with AS


Raphe 1
Raphe 2
RCC
LCC
NCC
Type 2
(two raphes)

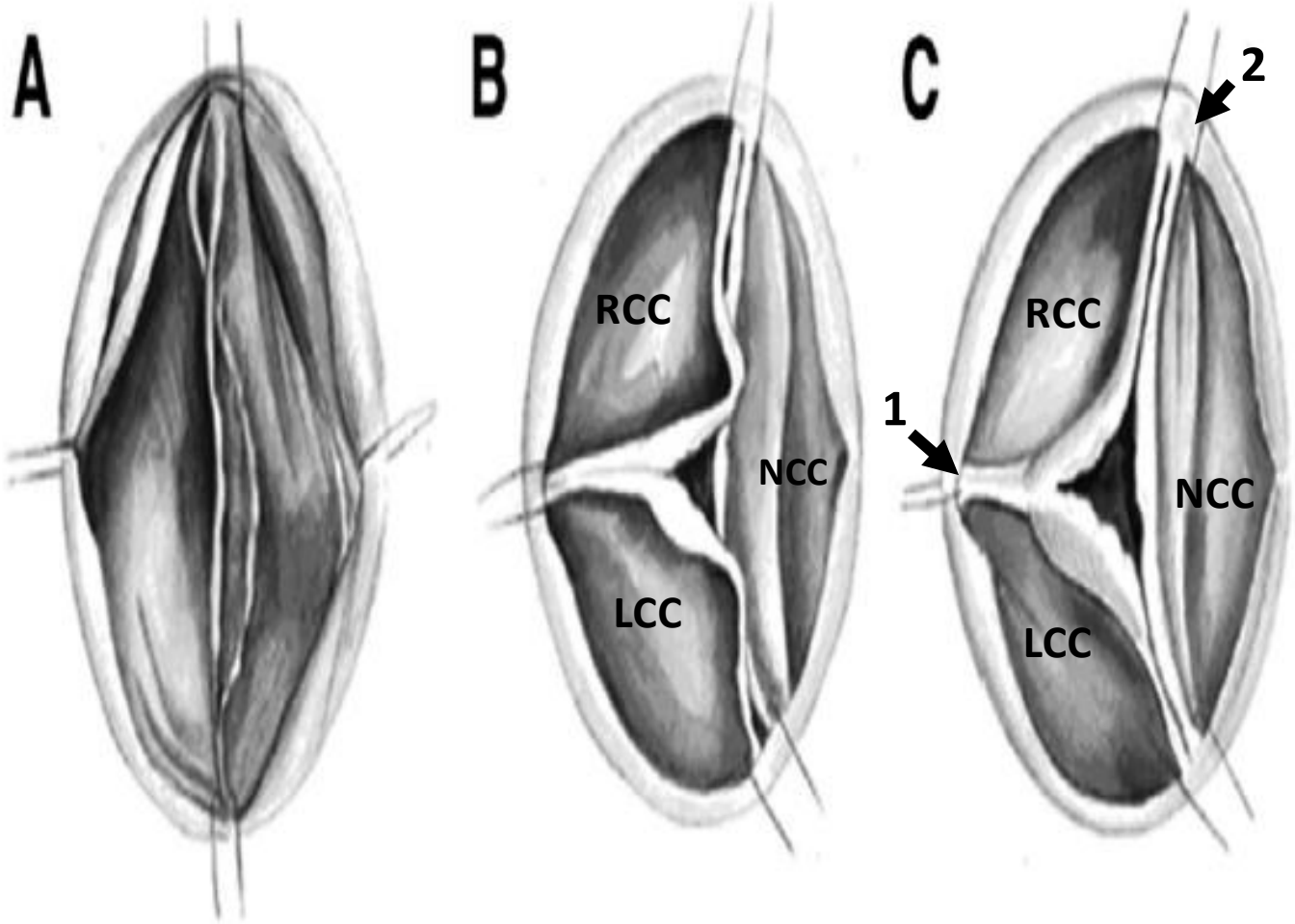


Fig 5. Three main Sievers types of bicuspid aortic valves. (A) Type 0 phenotype with no raphe, (B) type 1 phenotype with a single raphe attached at the base of the conjoint cusps (pseudocommissure) with an asymmetric shape of the aortic sinuses, and (C) type 2 phenotype with its 2 raphes and asymmetry of the aortic sinuses. Used with permission.[4]

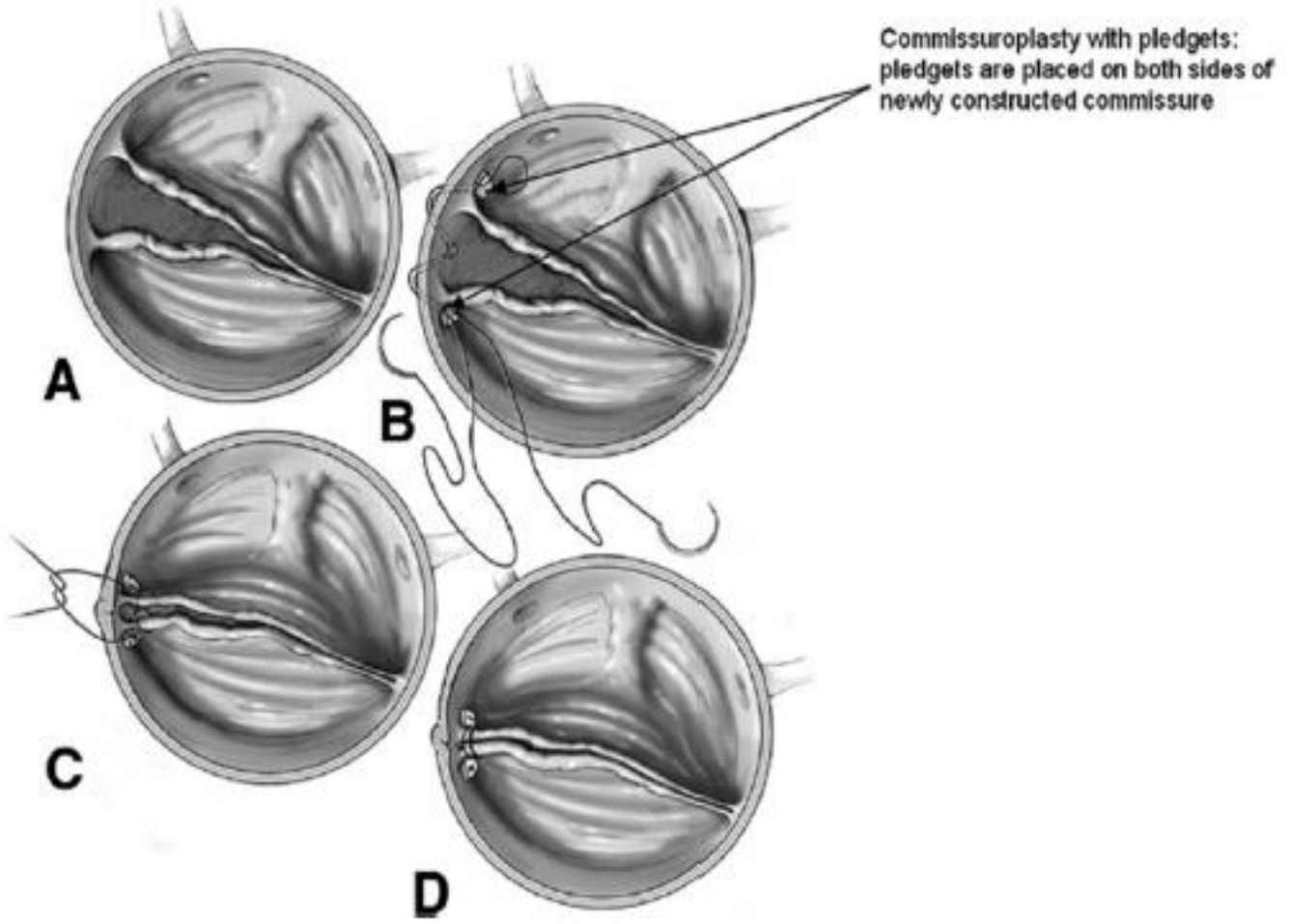


Fig 6. Bicuspid aortic valve repair with the commissuroplasty technique. (A) Sievers type 1 phenotype with a single raphe and misalignment of the commissures. (B-D) The commissural alignment and apposition can be restored with pledgeted commissuroplasty. Used with permission.[4]

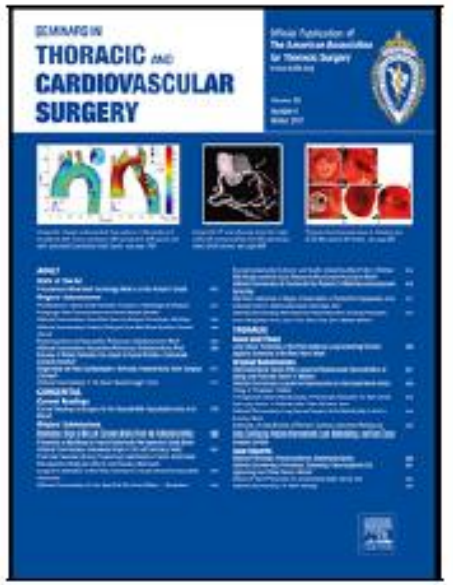
Bicuspid Aortic Valve and Aortopathy: Intervention

Recommendations	COR	LOE
Operative intervention to repair the aortic sinuses or replace the ascending aorta is indicated in patients with a bicuspid aortic valve if the diameter of the aortic sinuses or ascending aorta is greater than 5.5 cm	I	B
Operative intervention to repair the aortic sinuses or replace the ascending aorta is reasonable in patients with bicuspid aortic valves if the diameter of the aortic sinuses or ascending aorta is greater than 5.0 cm and a risk factor for dissection is present (family history of aortic dissection or if the rate of increase in diameter is ≥0.5 cm per year)	IIa	C

Bicuspid Aortic Valve and Aortopathy: Intervention

Recommendations	COR	LOE
Replacement of the ascending aorta is reasonable in patients with a bicuspid aortic valve who are undergoing aortic valve surgery because of severe AS or AR (Sections 3.4 and 4.4) if the diameter of the ascending aorta is greater than 4.5 cm	IIa	C

Accepted Manuscript



(Almost) All Non-stenotic Bicuspid Aortic Valves should be Preserved or Repaired

Shunsuke Miyahara MD , Ulrich Schneider MD ,
Lucie Morgenthaler RN , H.-J. Schäfers MD

PII: S1043-0679(18)30378-2
DOI: https://doi.org/10.1053/j.semtcvs.2019.03.008
Reference: YSTCS 1274

To appear in: *Seminars in Thoracic and Cardiovascular Surgery*

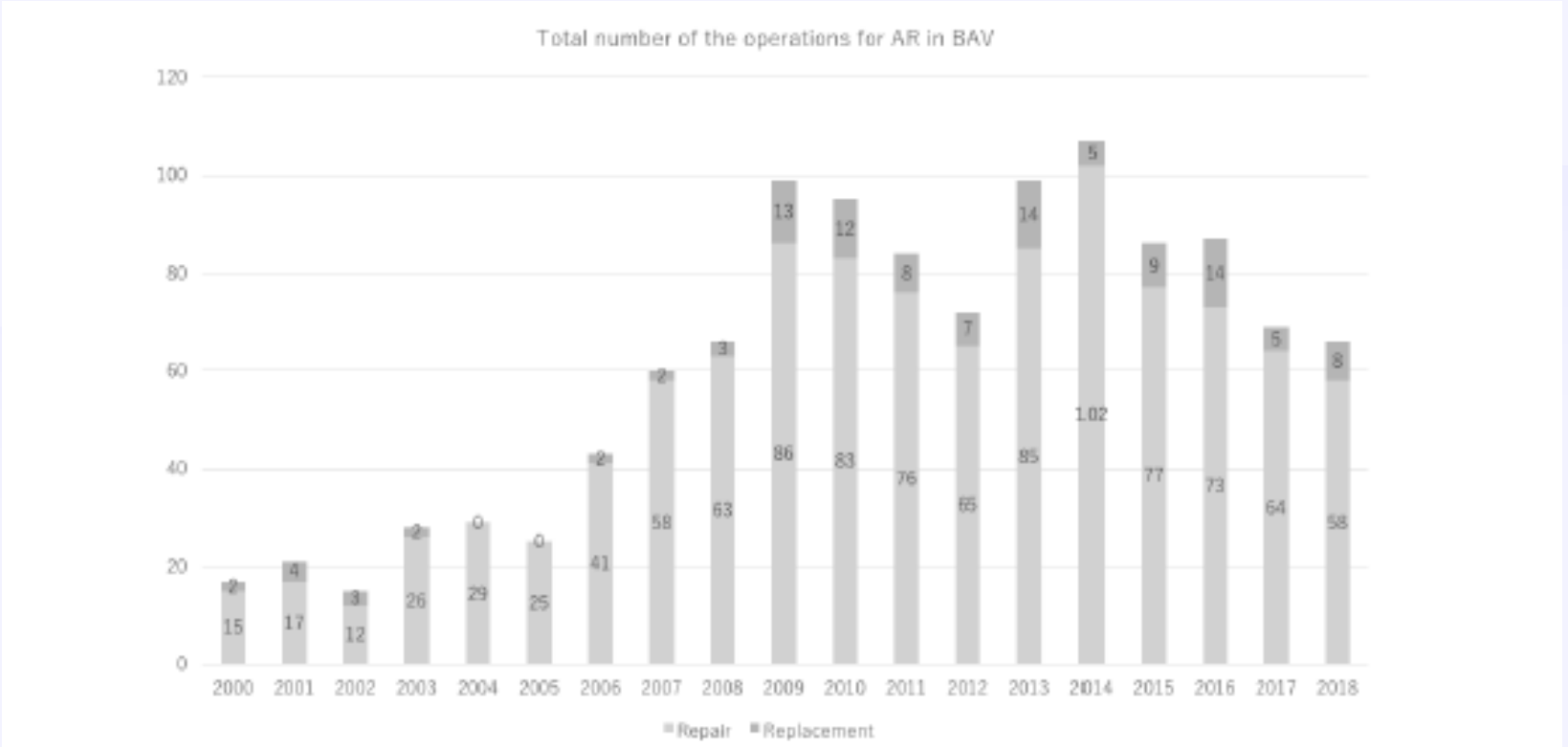
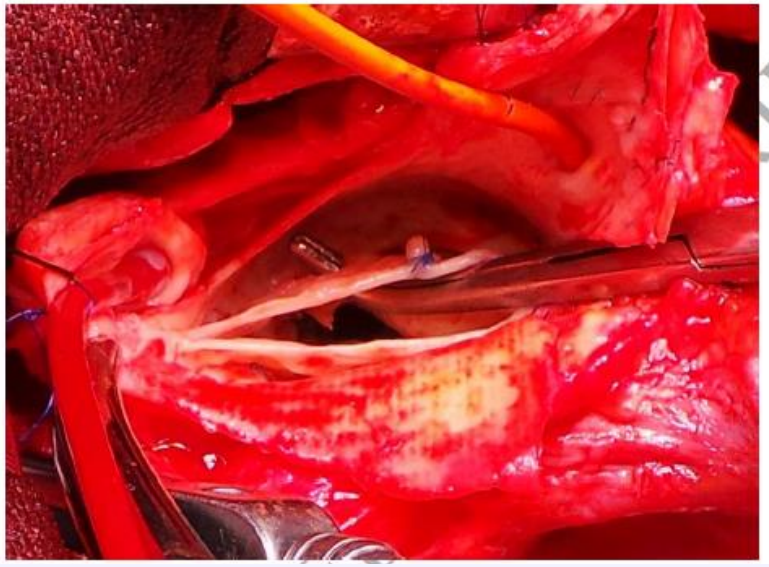


Figure 2. Annual number of the patients undergoing aortic valve surgery for pure aortic regurgitation with bicuspid pathology. The proportion of replacements has been low over the years. (AR: aortic regurgitation; BAV: bicuspid aortic valve

Central Picture: A perforated pericardial patch used to augment the conjoint cusp of an incompetent bicuspid aortic valve



Dr David's Central Massage: Most incompetent bicuspid aortic valves should be replaced; repair is reserved for young patients with cusps with normal tissue and satisfactory valve morphology

Valve Configuration Determines Long-Term Results After Repair of the Bicuspid Aortic Valve

Diana Aicher, MD; Takashi Kunihara, MD; Omar Abou Issa, MD; Brigitte Brittner, MD; Stefan Gräber, MD; Hans-Joachim Schäfers, MD

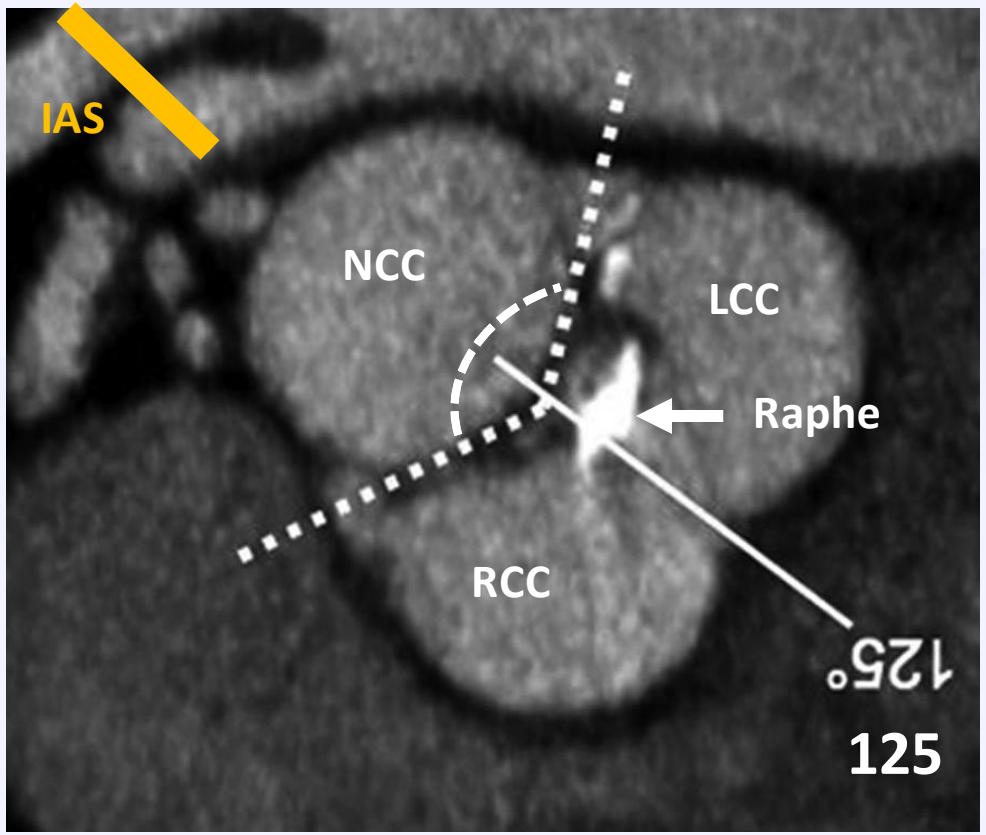
Circulation 2011

Background—Reconstruction of the regurgitant bicuspid aortic valve has been performed for >10 years, but there is limited information on long-term results. We analyzed our results to determine the predictors of suboptimal outcome.

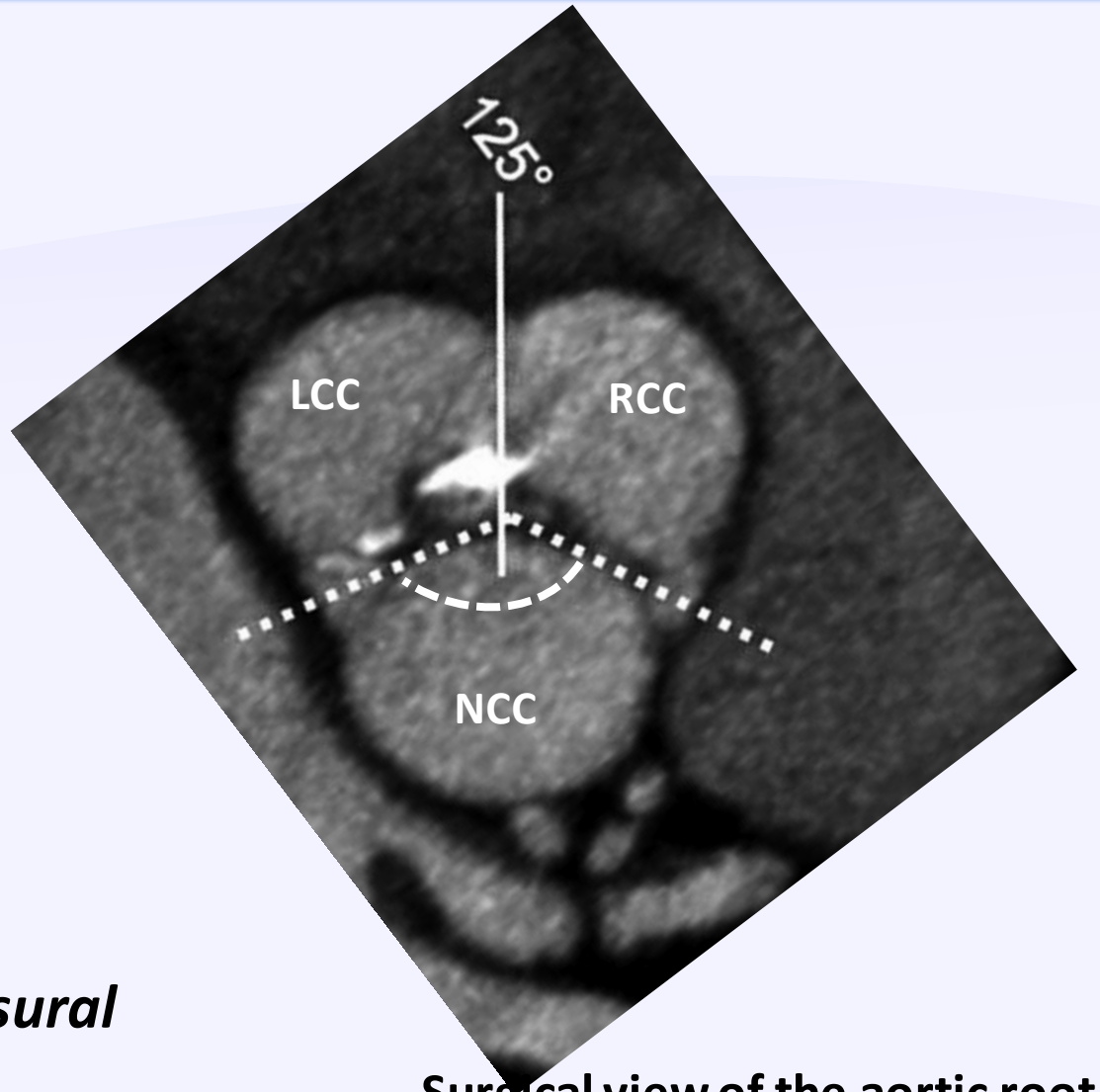
Methods and Results—Between November 1995 and December 2008, 316 patients (age, 49±14 years; male, 268) underwent reconstruction of a regurgitant bicuspid aortic valve. Intraoperative assessment included extent of fusion, root dimensions, circumferential orientation of the 2 normal commissures (>160°, ≤160°), and effective height after repair. Cusp pathology was treated by central plication (n=277), triangular resection (n=138), or pericardial patch (n=94). Root dilatation was treated by subcommissural plication (n=100), root remodeling (n=122), or valve reimplantation (n=2). All patients were followed up echocardiographically (cumulative follow-up, 1253 years; mean, 4±3.1 years). Clinical and morphological parameters were analyzed for correlation with 10-year freedom from reoperation with the Cox proportional hazards model. Hospital mortality was 0.63%; survival was 92% at 10 years. Freedom from reoperation at 5 and 10 years was 88% and 81%; freedom from valve replacement, 95% and 84%. By univariable analysis, statistically significant predictors of reoperation were age (hazard ratio [HR]=0.97), aortoventricular diameter (HR=1.24), effective height (HR=0.76), commissural orientation (HR=0.95), use of a pericardial patch (HR=7.63), no root replacement (HR=3.80), subcommissural plication (HR=2.07), and preoperative aortic regurgitation grade 3 or greater. By multivariable analysis, statistically significant predictors for reoperation were age (HR=0.96), aortoventricular diameter (HR=1.30), effective height (HR=0.74), commissural orientation (HR=0.96), and use of a pericardial patch (HR=5.16).

Conclusions—Reconstruction of bicuspid aortic valve can be performed reproducibly with good early results. Recurrence and progression of regurgitation, however, may occur, depending primarily on anatomic features of the valve. (***Circulation.*** **2011;123:178-185.**)

Key Words: aortic valve ■ regurgitation, aortic valve ■ bicuspid valve

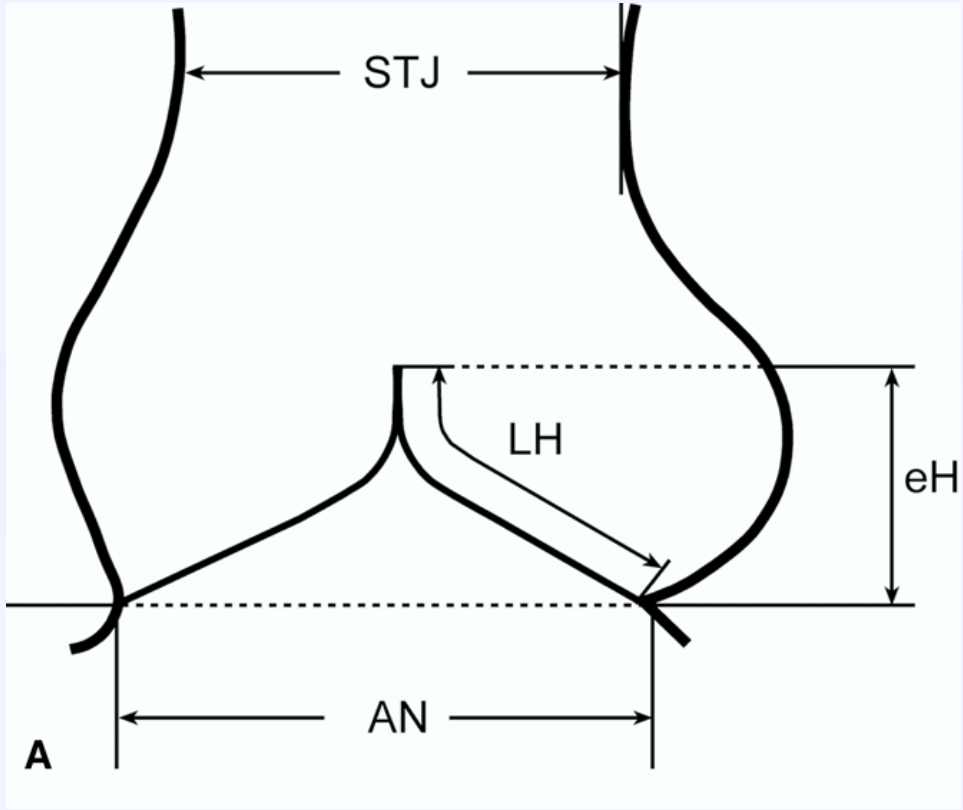


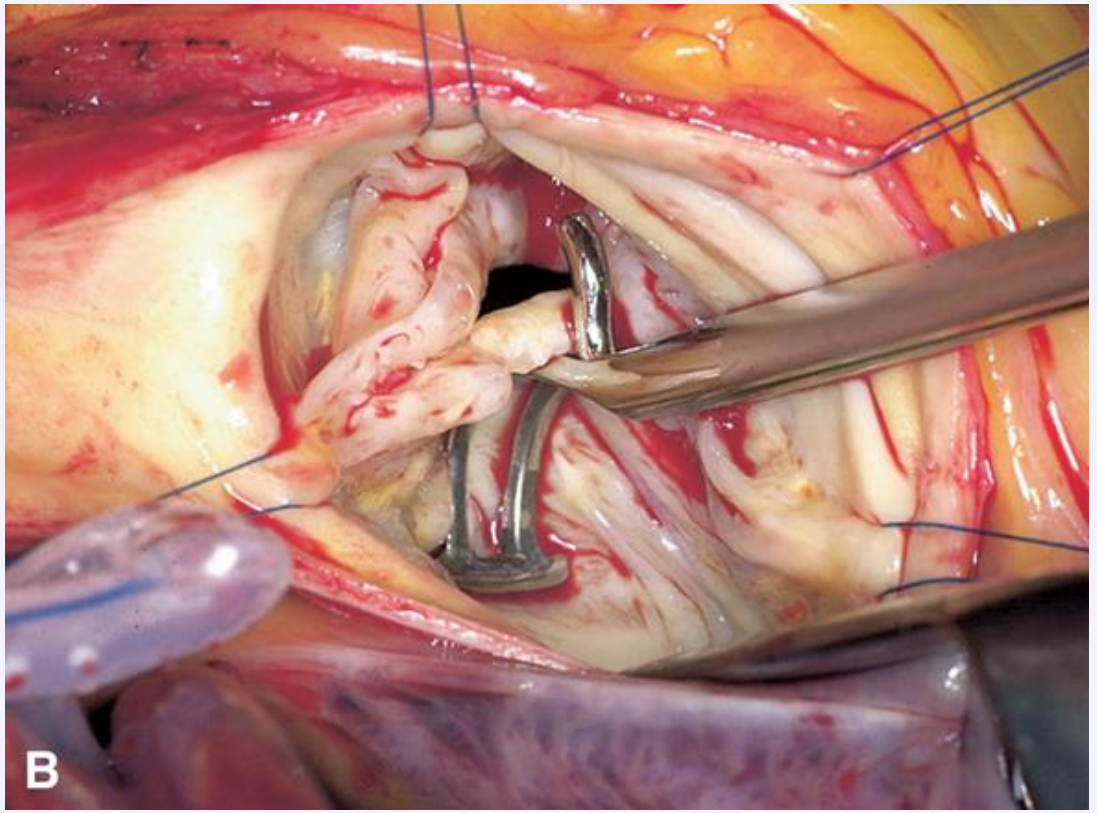
TEE view, short axis of the aortic root



Surgical view of the aortic root

Bicuspid aortic valve with a commissural orientation (angle) of the 125^{o}

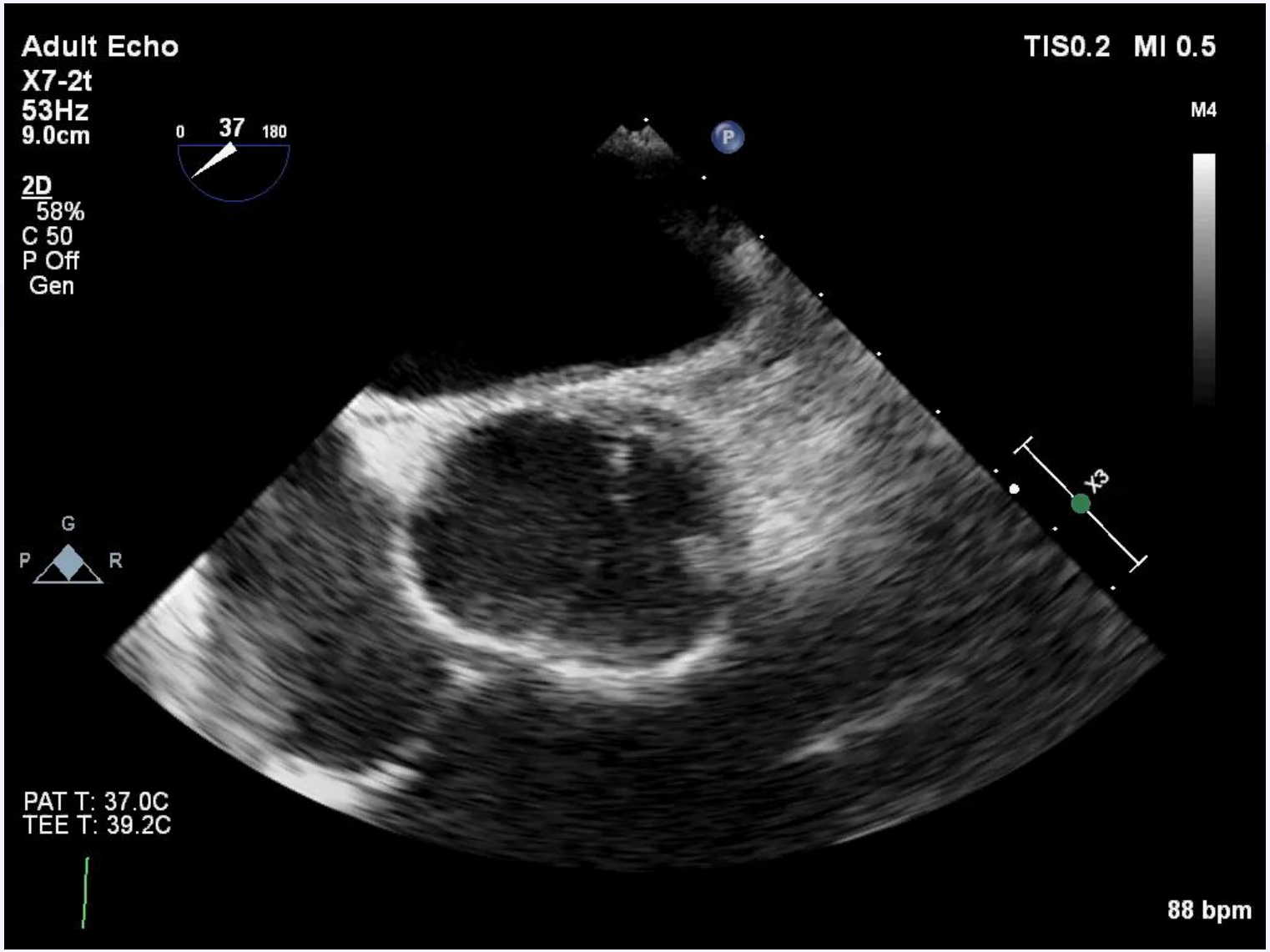


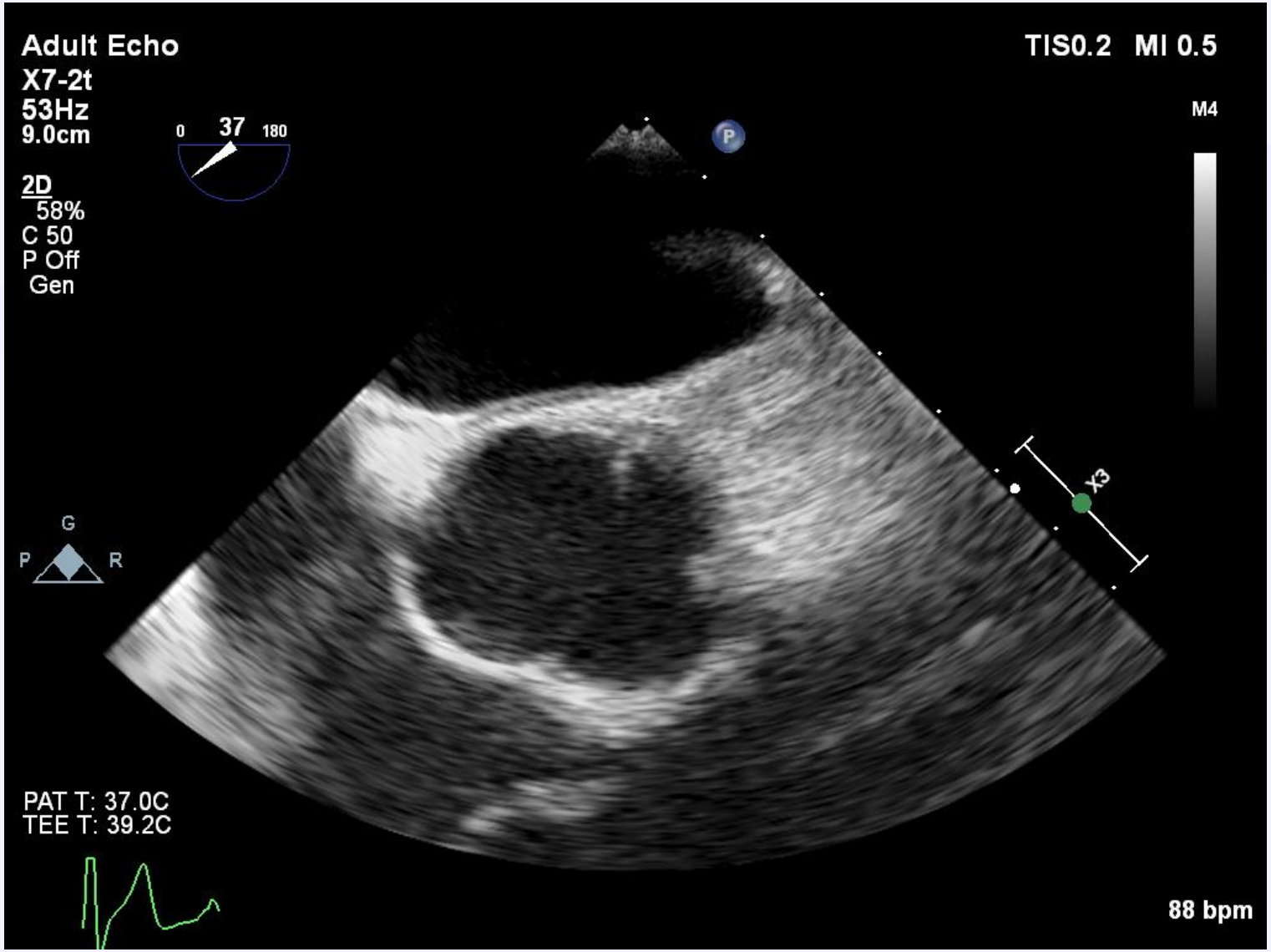


A, Schematic drawing of the aortic valve and root. Effective height is the height difference between central free margins and the aortic insertion lines. This can be measured intraoperatively by TEE LAX view as well as with a caliber by surgeon. B, Intraoperative photograph showing measurement of the effective height of the non-coronary cusp (non- fused cusp) of a bicuspid aortic valve with the caliber. STJ, Sinutubular junction; LH, leaflet or cusp height; eH, effective height.

Case 1

- 31-year-old man with known history of AI and mild dilatation of the LV was referred to TGH for aortic valve surgery


Adult Echo
X7-2t
53Hz
9.0cm
2D
58%
C 50
P Off
Gen
0
37
180
TIS0.2 MI 0.5
M4
X3
G
P
R
PAT T: 37.0C
TEE T: 39.2C
88 bpm


Adult Echo
X7-2t
53Hz
9.0cm
2D
58%
C 50
P Off
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M4
X3
G
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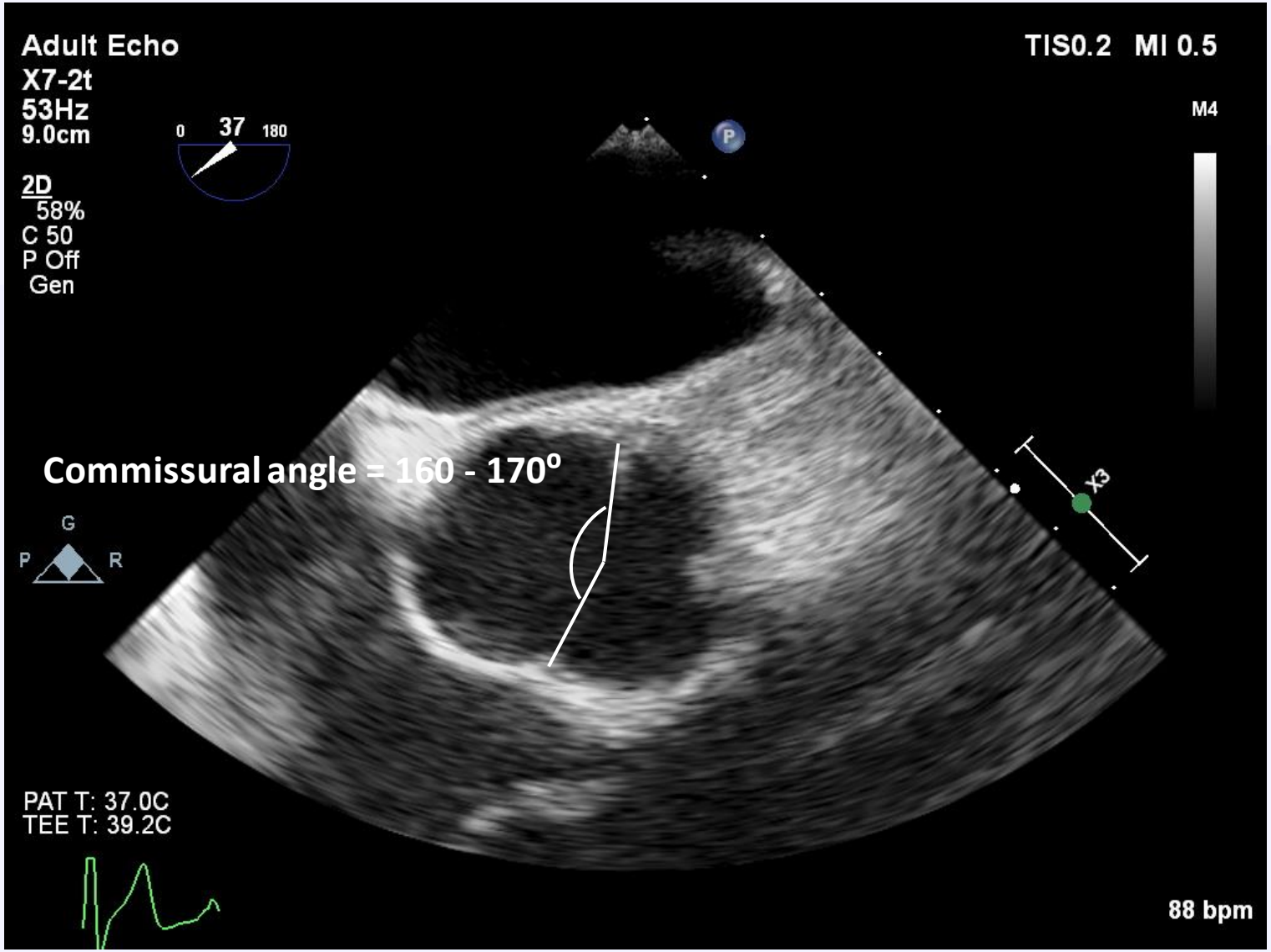
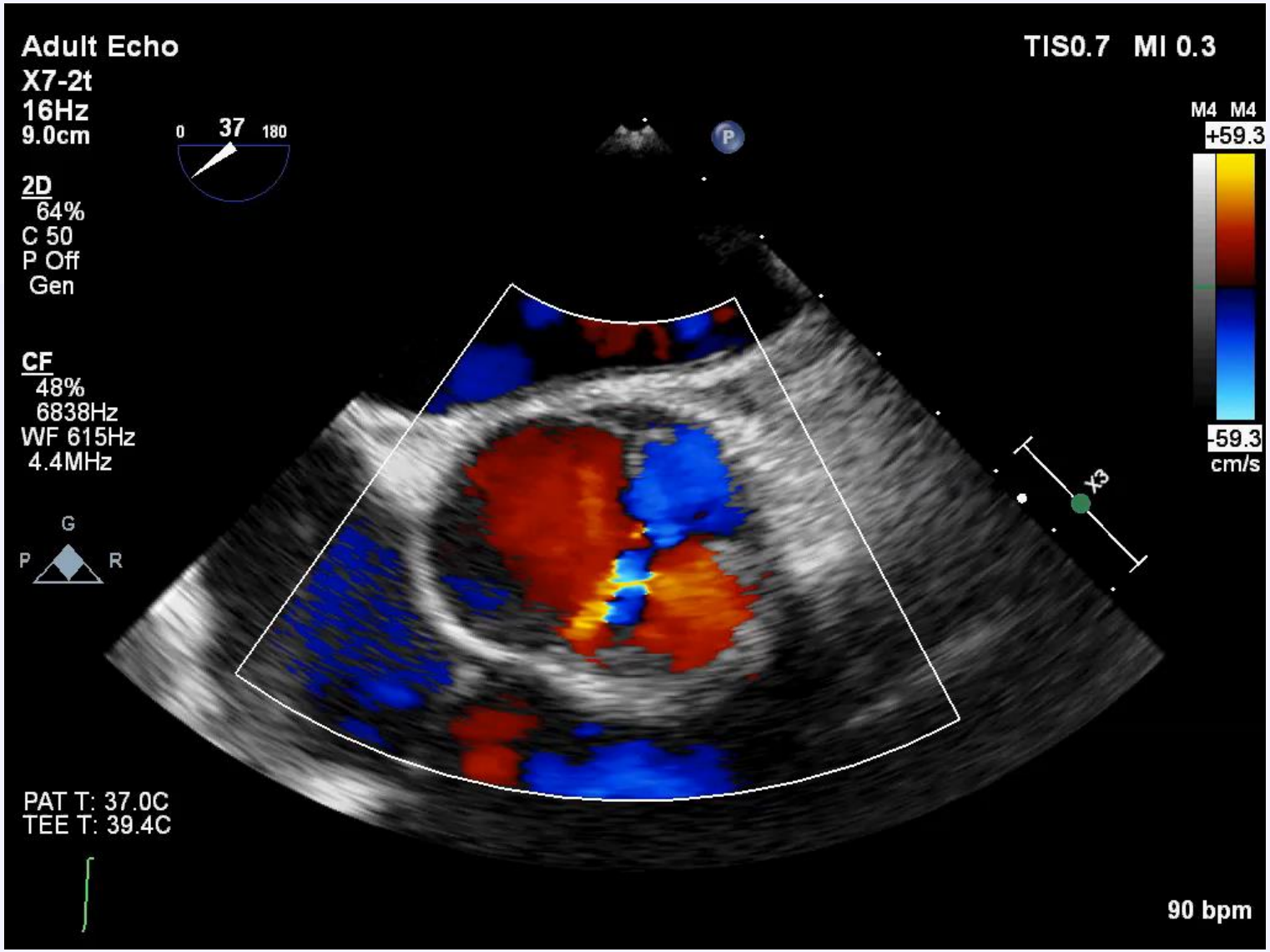
PAT T: 37.0C
TEE T: 39.2C
88 bpm


Adult Echo
X7-2t
53Hz
9.0cm
2D
58%
C 50
P Off
Gen
0
37
180
TIS0.2 MI 0.5
M4
Commissural angle = 160 - 170°
X3
G
P
R
PAT T: 37.0C
TEE T: 39.2C
88 bpm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16Hz
9.0cm
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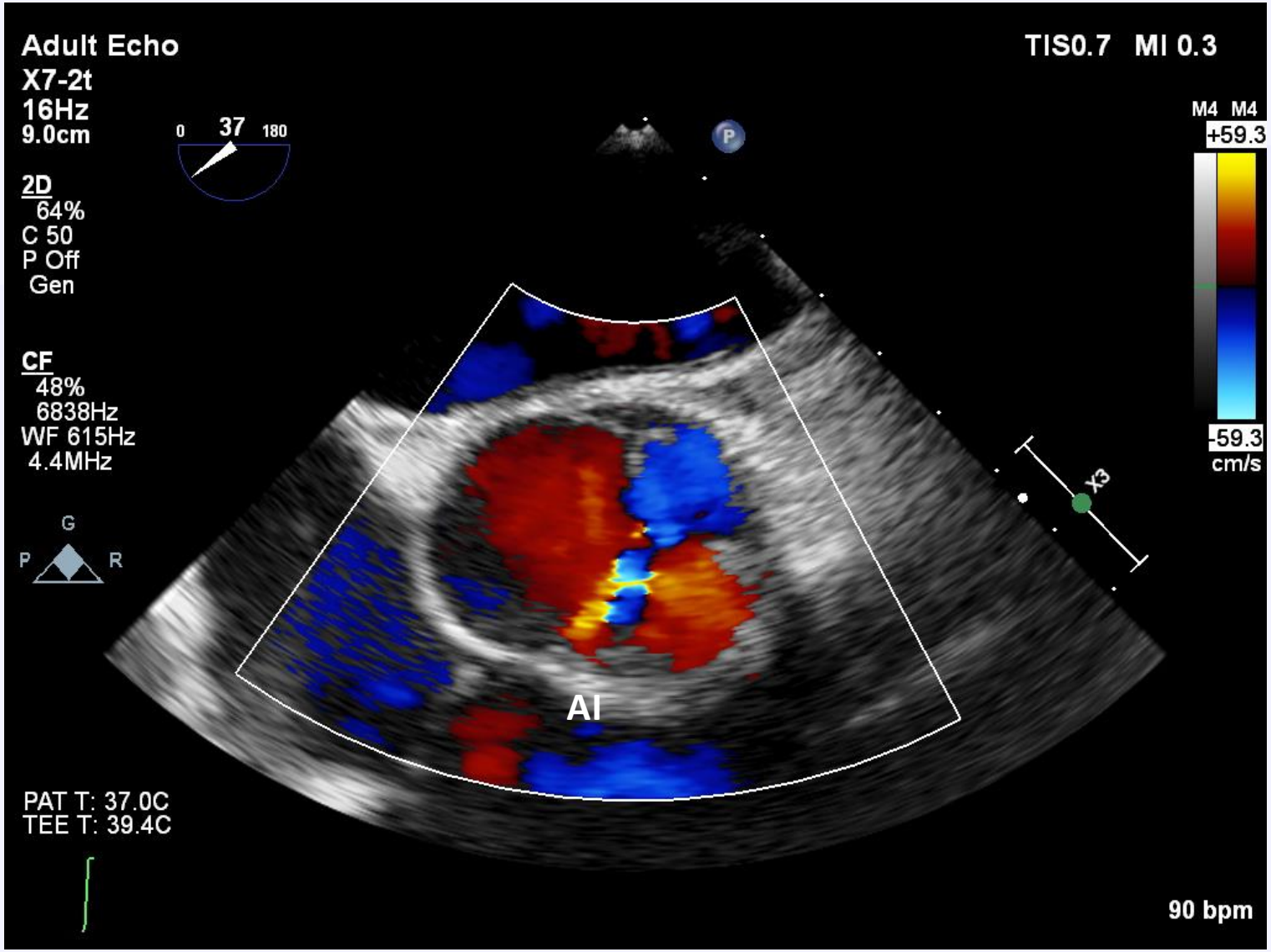
2D
64%
C 50
P Off
Gen
CF
48%
6838Hz
WF 615Hz
4.4MHz
G
P R
TIS0.7 MI 0.3
M4 M4
+59.3
-59.3
cm/s
X3
PAT T: 37.0C
TEE T: 39.4C
90 bpm


Adult Echo
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2D
64%
C 50
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4.4MHz
G
P R
TIS0.7 MI 0.3
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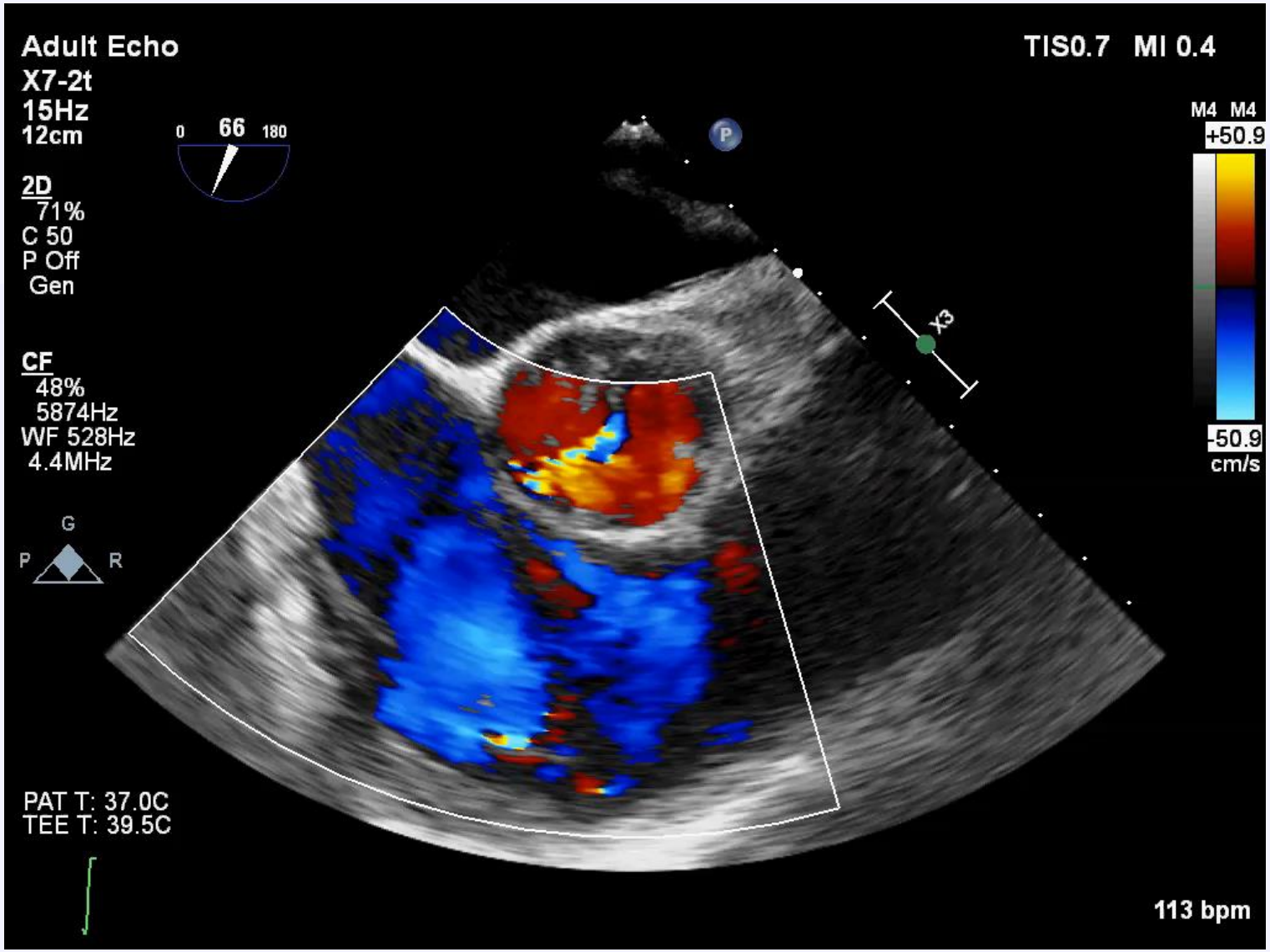
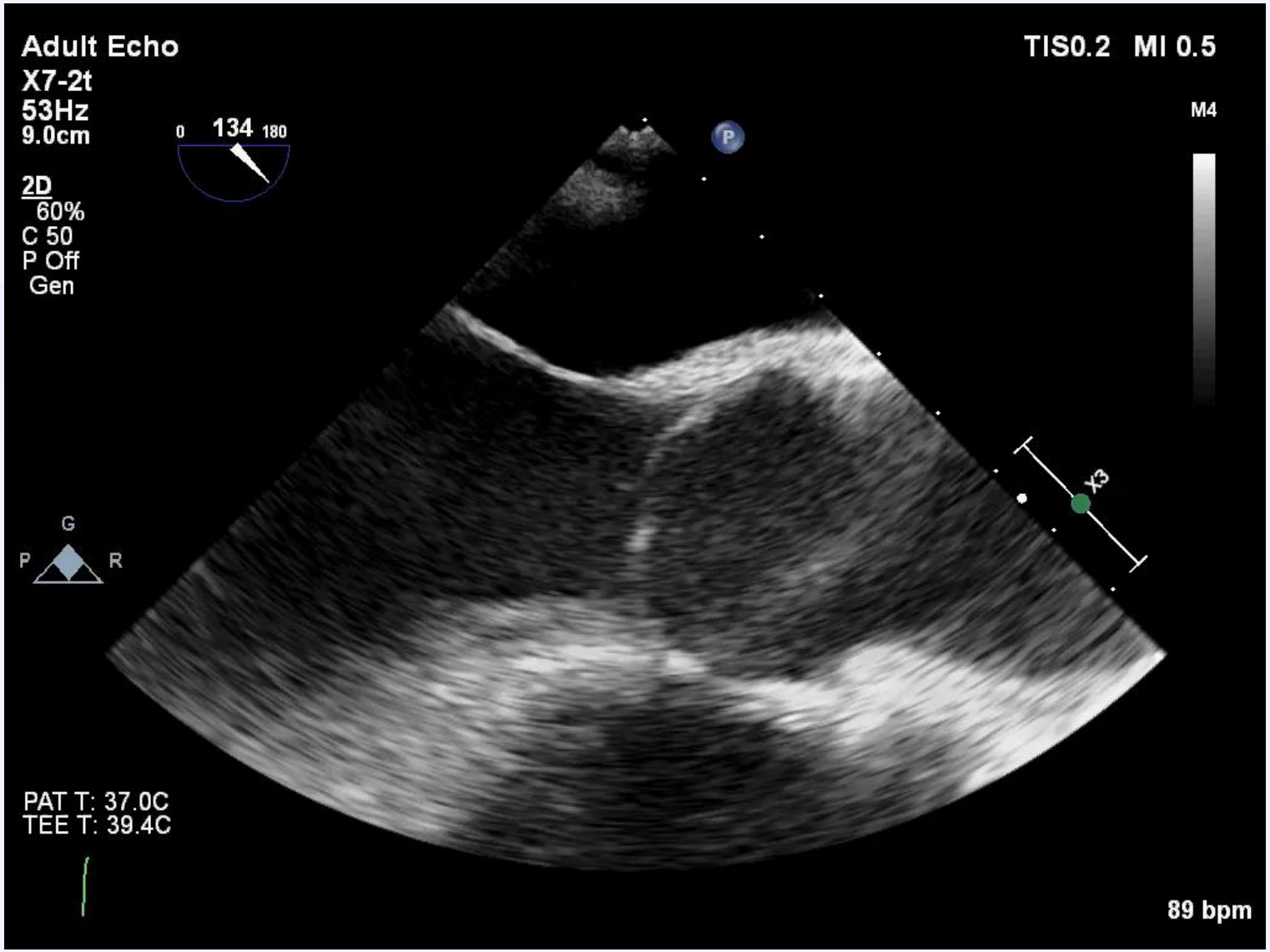
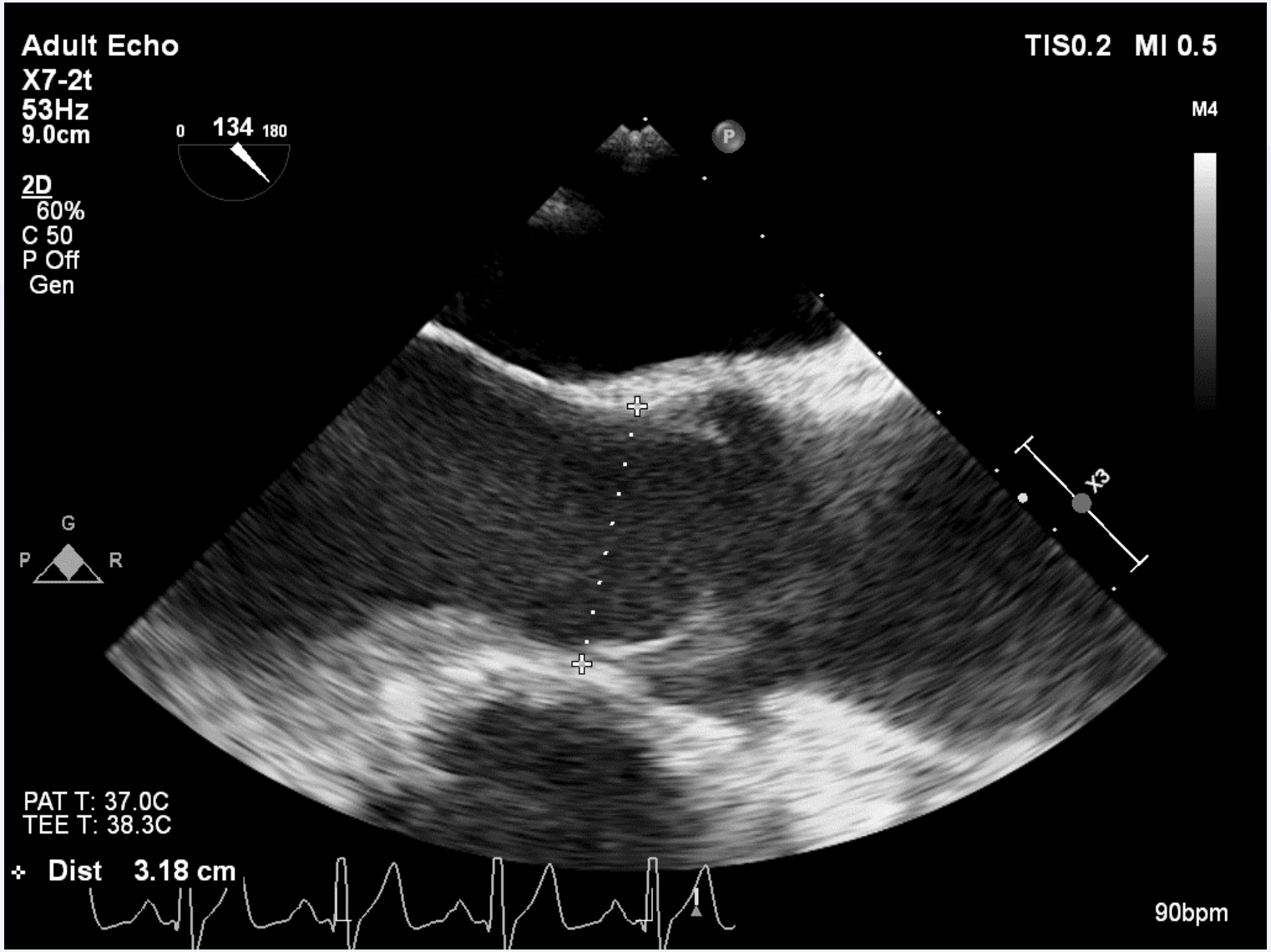
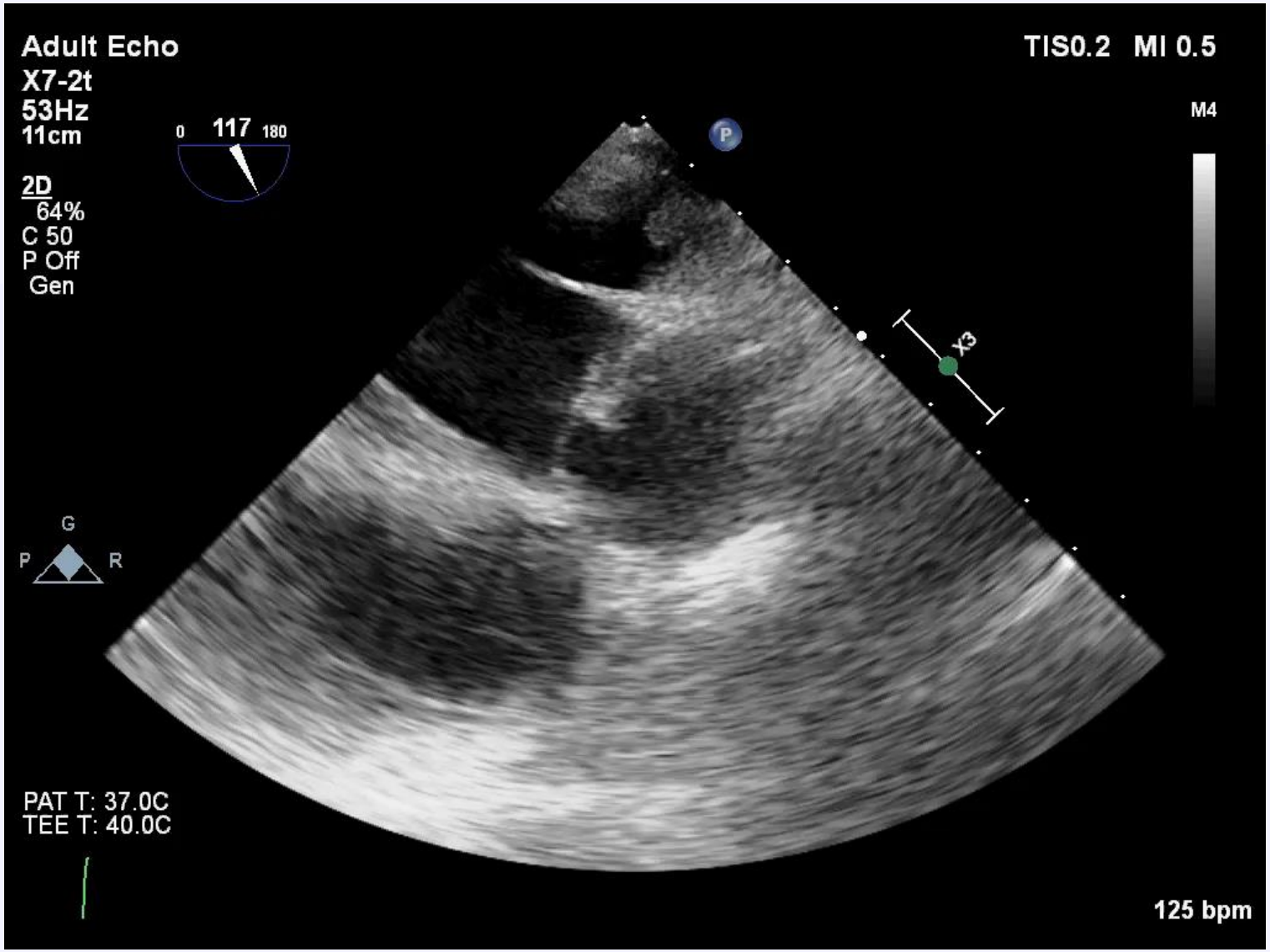
+59.3
-59.3
cm/s
X3
AI
PAT T: 37.0C
TEE T: 39.4C
90 bpm

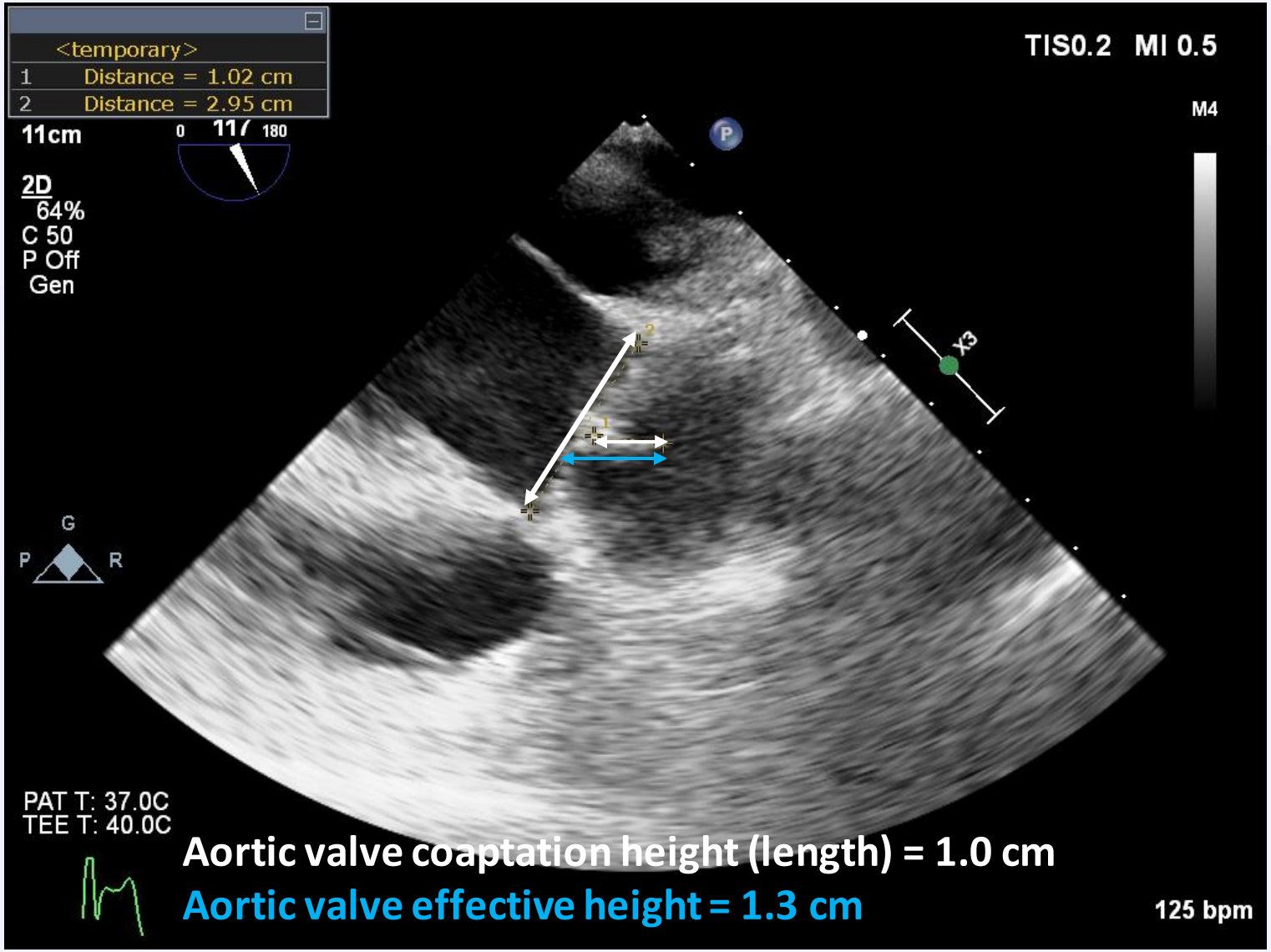

Adult Echo
X7-2t
15Hz
12cm
0
66
180
2D
71%
C 50
P Off
Gen
CF
48%
5874Hz
WF 528Hz
4.4MHz
G
P
R
TIS0.7 MI 0.4
M4 M4
+50.9
-50.9
cm/s
X3
PAT T: 37.0C
TEE T: 39.5C
113 bpm

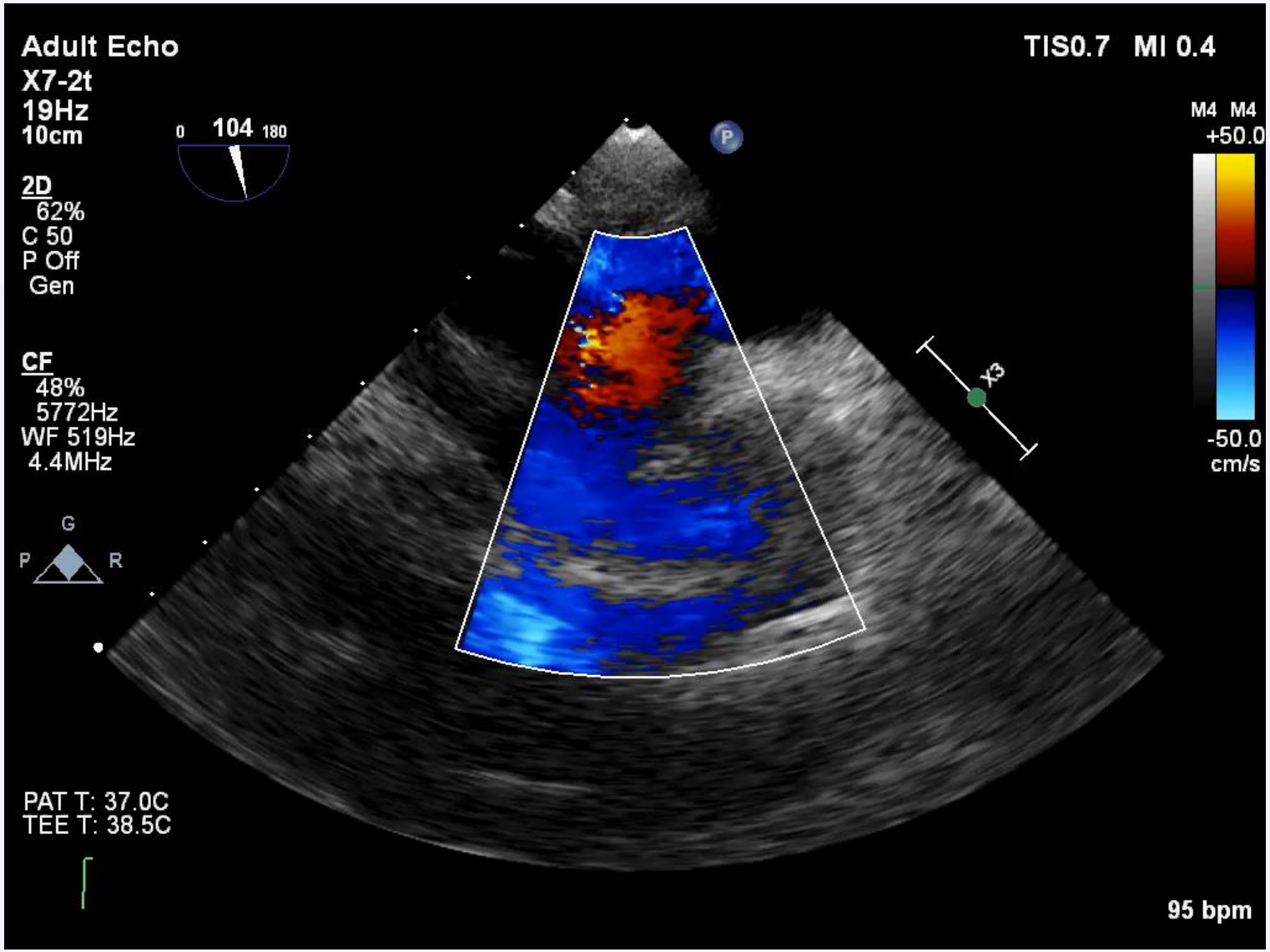

Adult Echo
X7-2t
53Hz
9.0cm
2D
60%
C 50
P Off
Gen
0
134
180
TIS0.2 MI 0.5
M4
X3
G
P
R
PAT T: 37.0C
TEE T: 39.4C
89 bpm

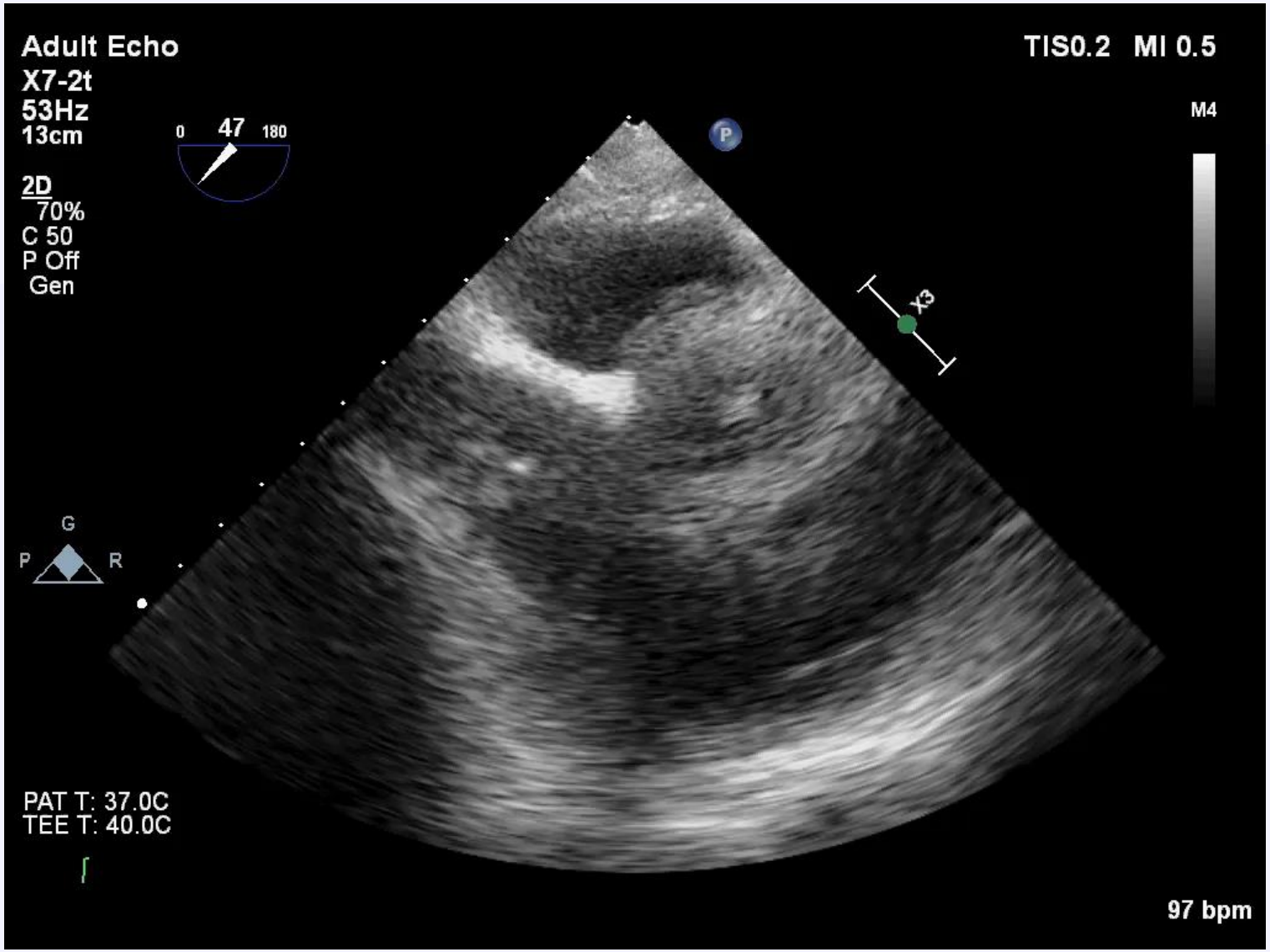

Adult Echo
X7-2t
53Hz
9.0cm
0 134 180
2D
60%
C 50
P Off
Gen
TIS0.2 MI 0.5
M4
P
X3
G
P R
PAT T: 37.0C
TEE T: 38.3C
Dist 3.18 cm
90bpm

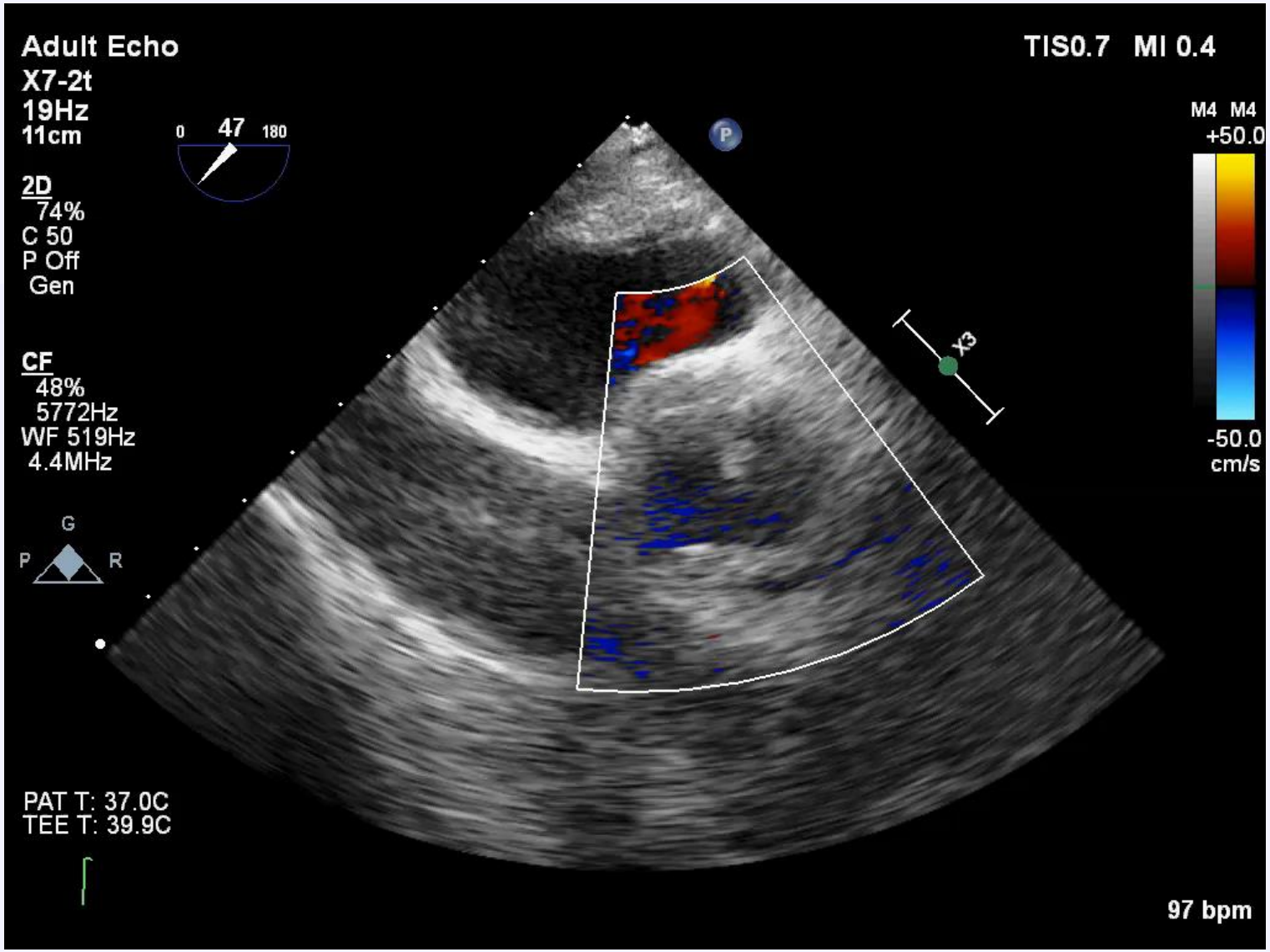
Post op TEE

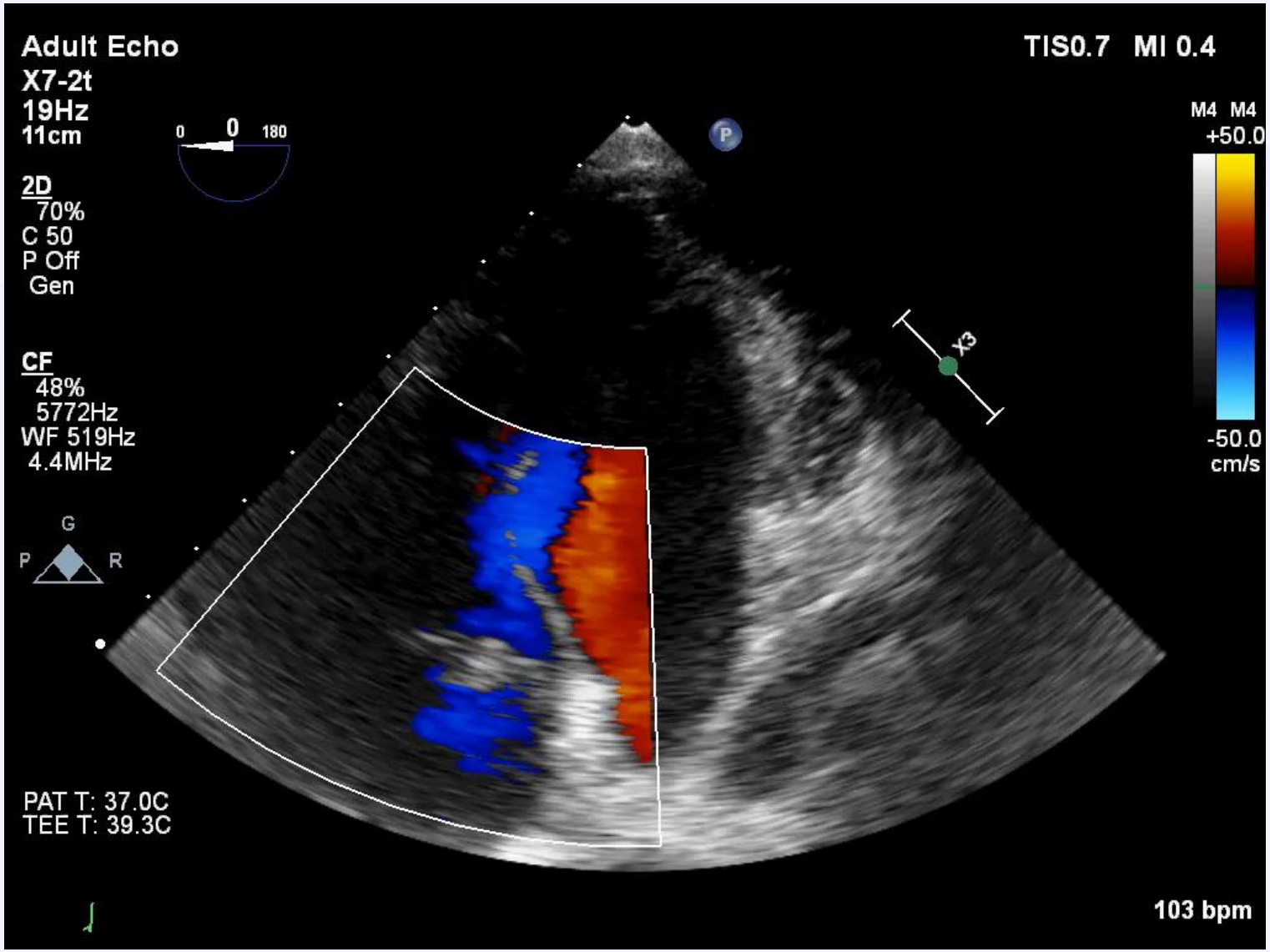

Adult Echo
X7-2t
53Hz
11cm
2D
64%
C 50
P Off
Gen
0
117
180
TIS0.2 MI 0.5
M4
P
X3
G
P
R
PAT T: 37.0C
TEE T: 40.0C
125 bpm

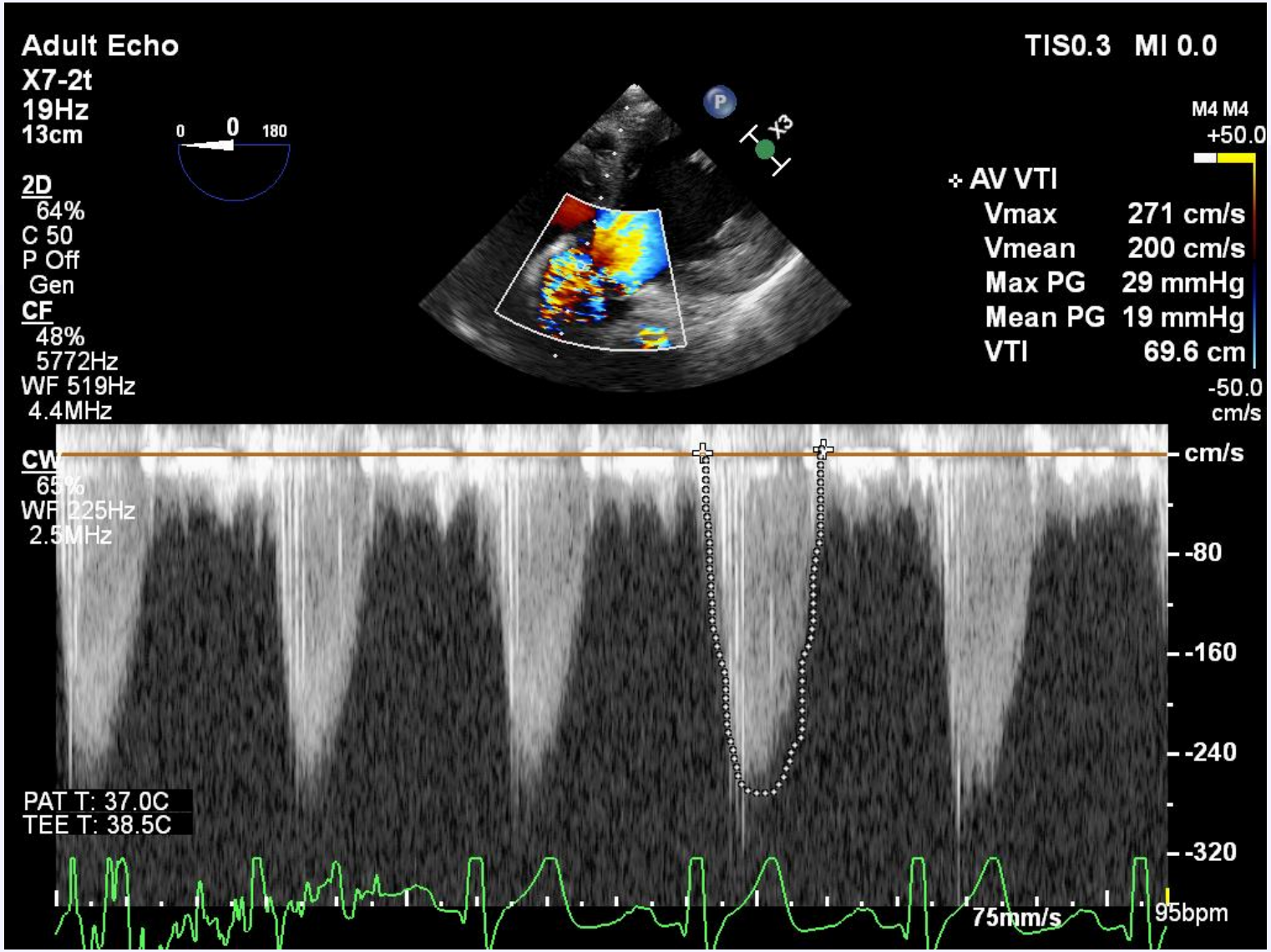

<temporary>
1 Distance = 1.02 cm
2 Distance = 2.95 cm
11cm
0 180
2D
64%
C 50
P Off
Gen
TIS0.2 MI 0.5
M4
X3
G
P R
PAT T: 37.0C
TEE T: 40.0C
Aortic valve coaptation height (length) = 1.0 cm
Aortic valve effective height = 1.3 cm
125 bpm


Adult Echo
X7-2t
19Hz
10cm
0 104 180
2D
62%
C 50
P Off
Gen
CF
48%
5772Hz
WF 519Hz
4.4MHz
G
P R
TIS0.7 MI 0.4
M4 M4
+50.0
-50.0
cm/s
X3
PAT T: 37.0C
TEE T: 38.5C
95 bpm


Adult Echo
X7-2t
53Hz
13cm
2D
70%
C 50
P Off
Gen
0
47
180
TIS0.2 MI 0.5
M4
X3
G
P
R
PAT T: 37.0C
TEE T: 40.0C
97 bpm

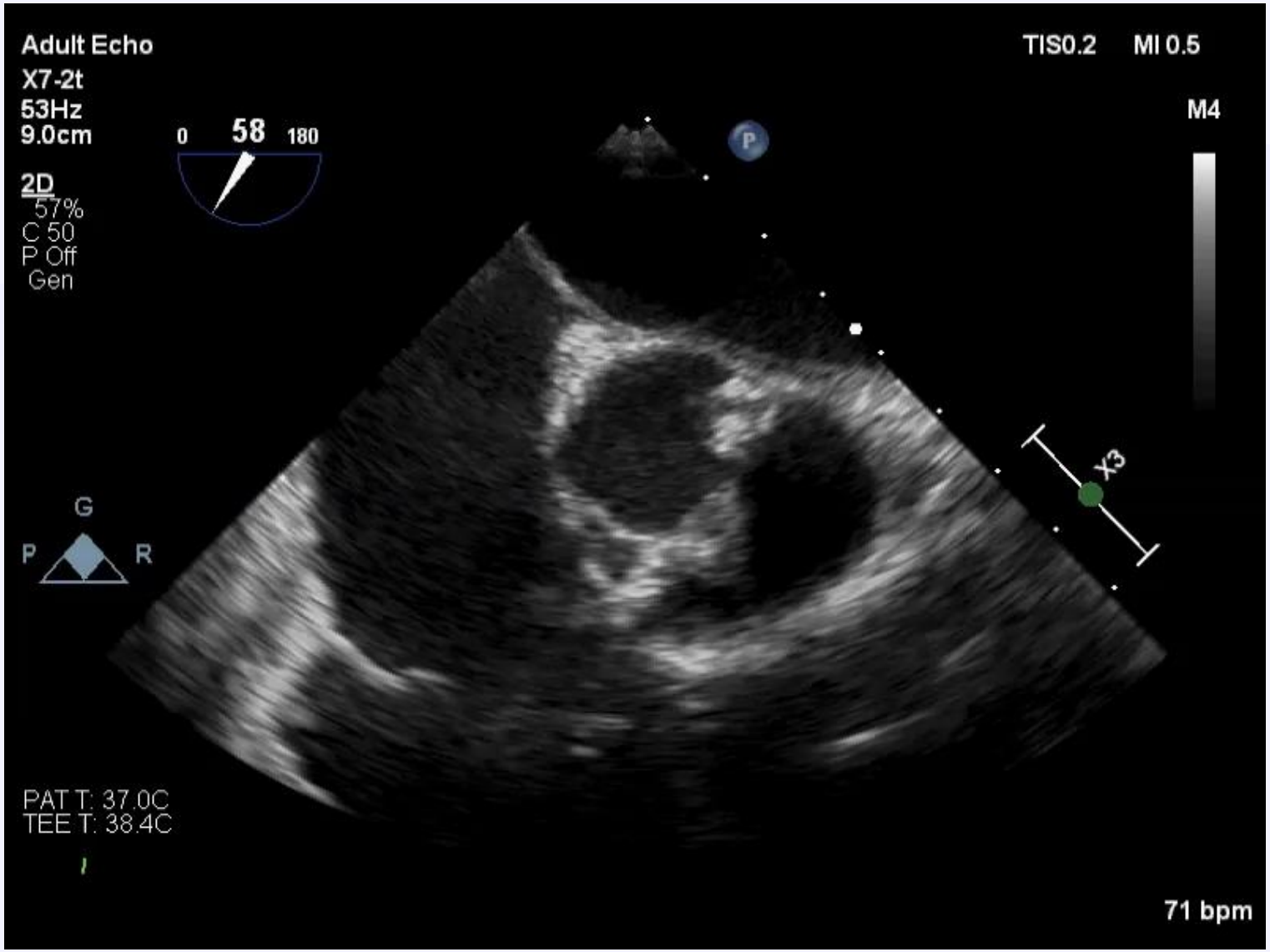

Adult Echo
X7-2t
19Hz
11cm
0 47 180
2D
74%
C 50
P Off
Gen
CF
48%
5772Hz
WF 519Hz
4.4MHz
G
P R
TIS0.7 MI 0.4
M4 M4
+50.0
-50.0
cm/s
X3
PAT T: 37.0C
TEE T: 39.9C
97 bpm

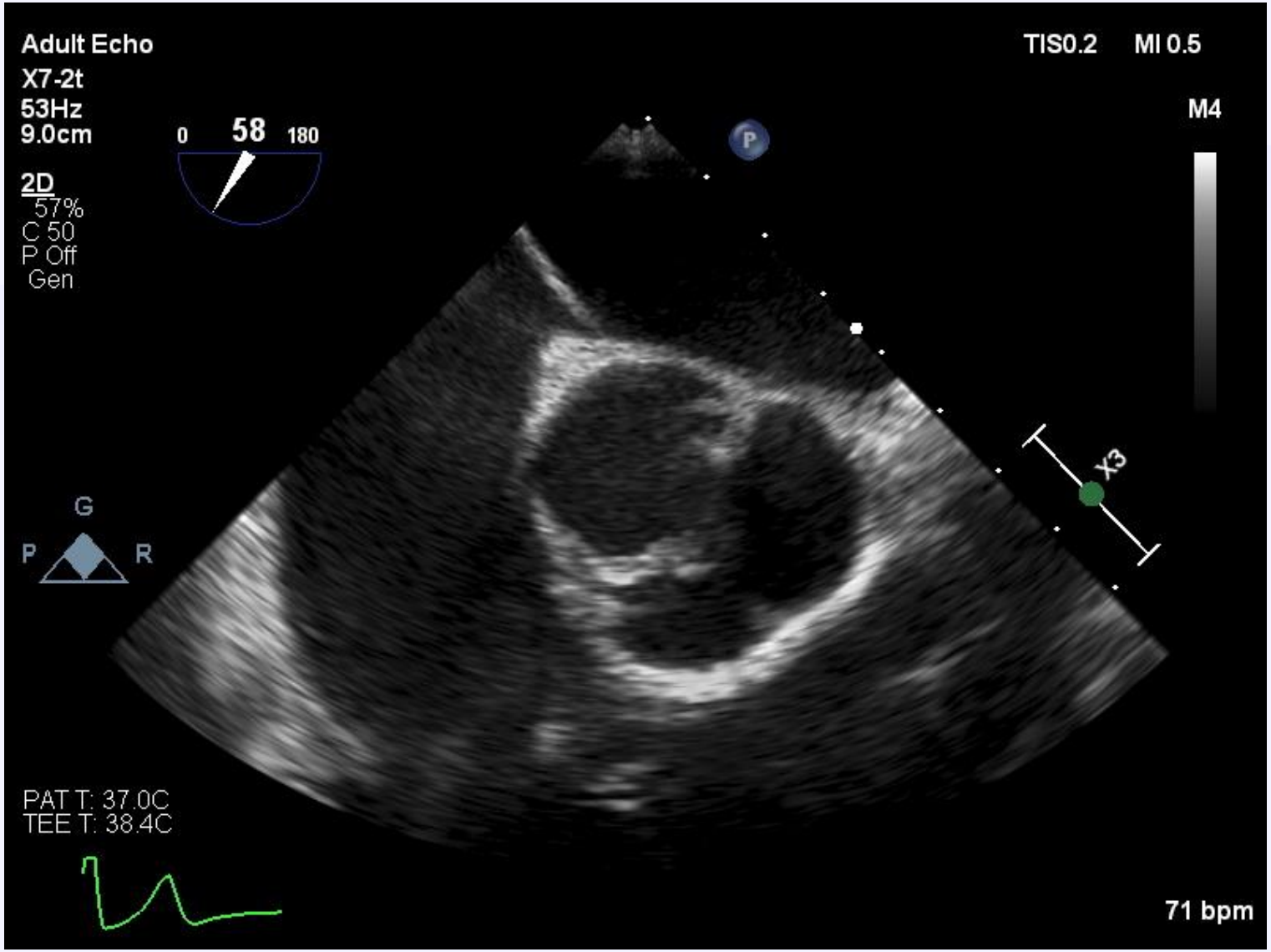

Adult Echo
X7-2t
19Hz
11cm
0 0 180
2D
70%
C 50
P Off
Gen
CF
48%
5772Hz
WF 519Hz
4.4MHz
G
P R
TIS0.7 MI 0.4
M4 M4
+50.0
-50.0
cm/s
X3
PAT T: 37.0C
TEE T: 39.3C
103 bpm

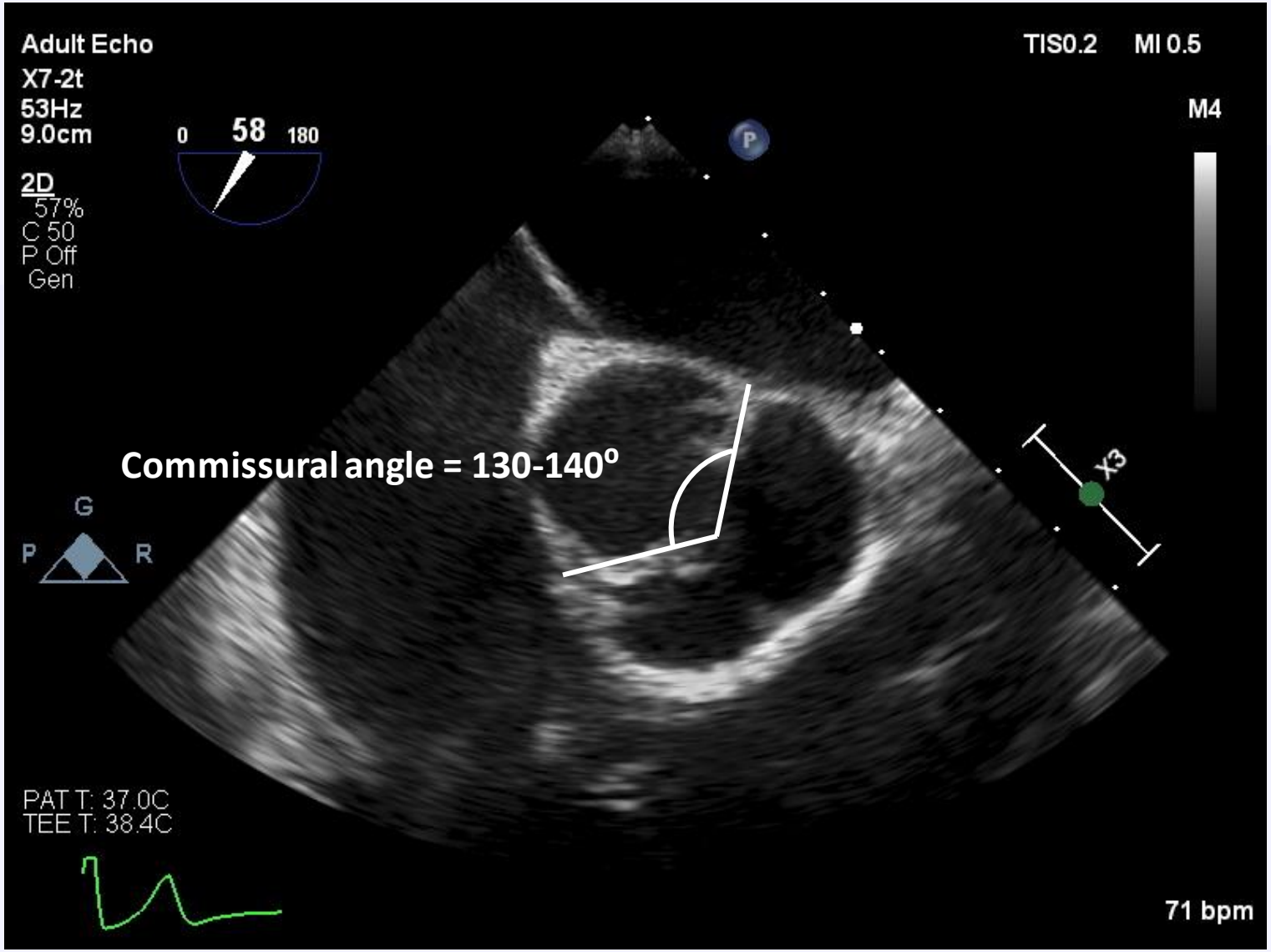

Adult Echo
X7-2t
19Hz
13cm
0 0 180
2D
64%
C 50
P Off
Gen
CF
48%
5772Hz
WF 519Hz
4.4MHz
TIS0.3 MI 0.0
M4 M4
+50.0
AV VTI
Vmax 271 cm/s
Vmean 200 cm/s
Max PG 29 mmHg
Mean PG 19 mmHg
VTI 69.6 cm
-50.0
cm/s
CW
65%
WF 225Hz
2.5MHz
cm/s
-80
-160
-240
-320
PAT T: 37.0C
TEE T: 38.5C
75mm/s
95bpm

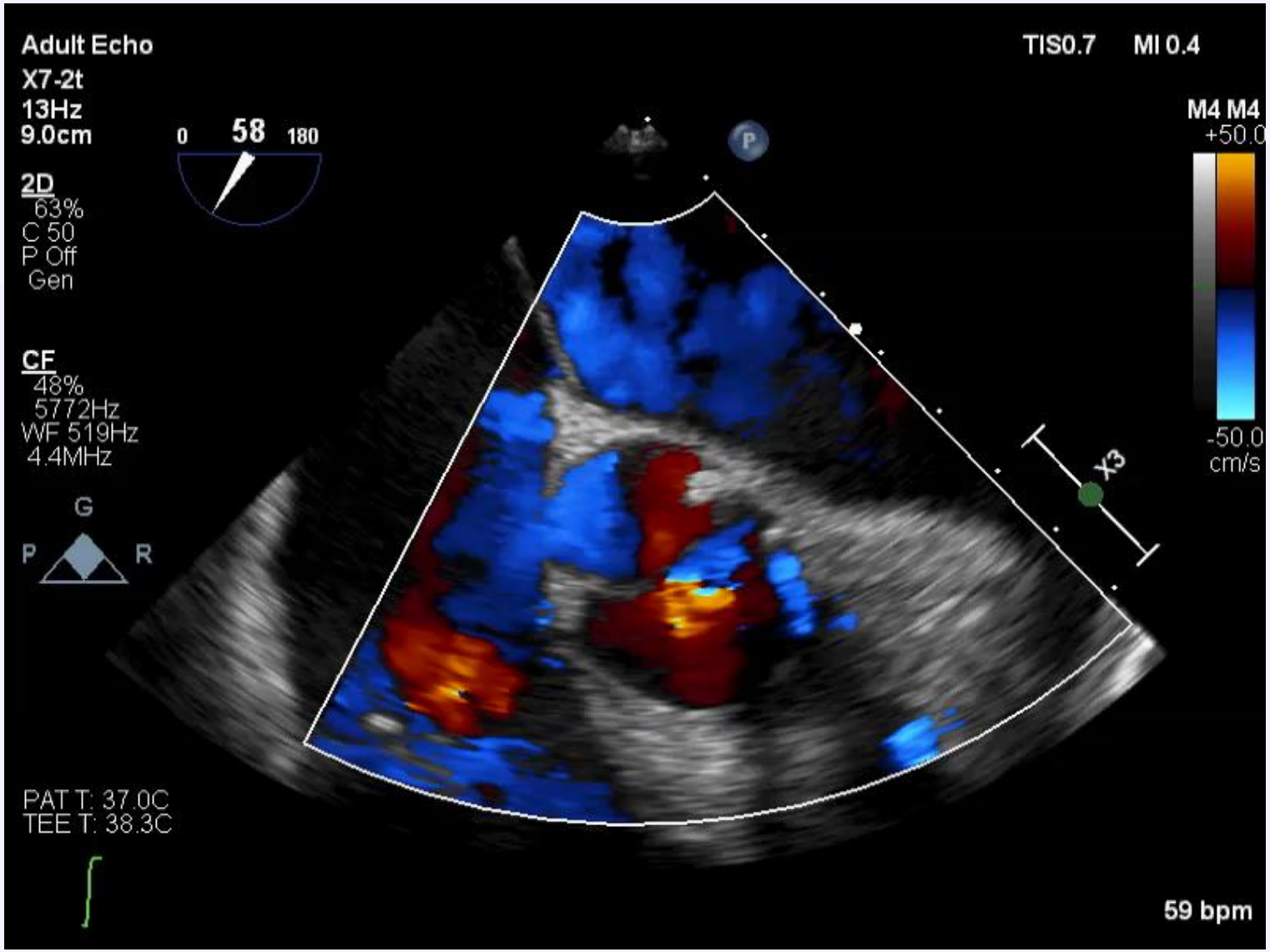
Case 2

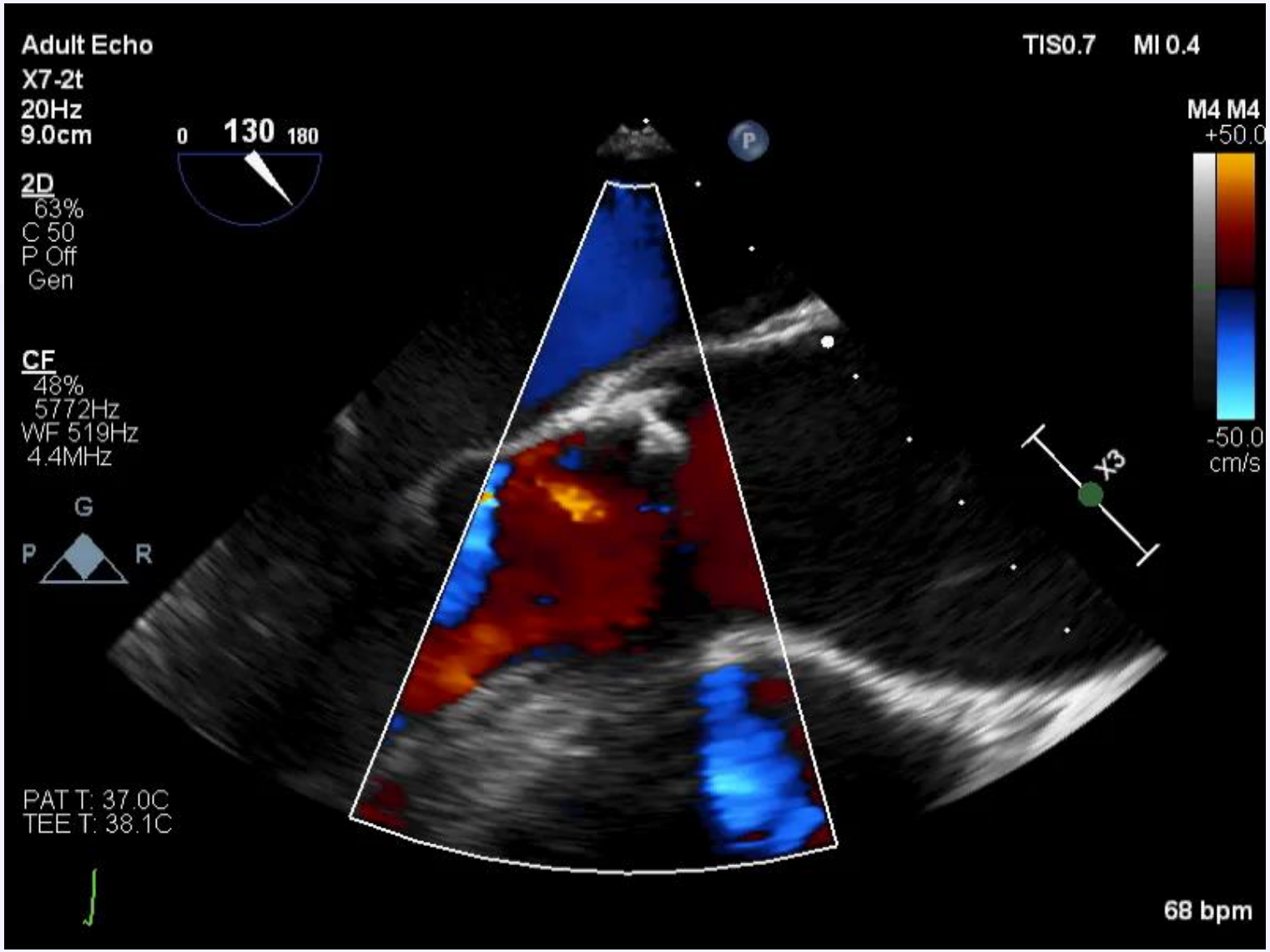
- 47-year-old man with known history of AI and aneurysm of ascending aorta was referred to Dr. David for aortic valve sparing operation

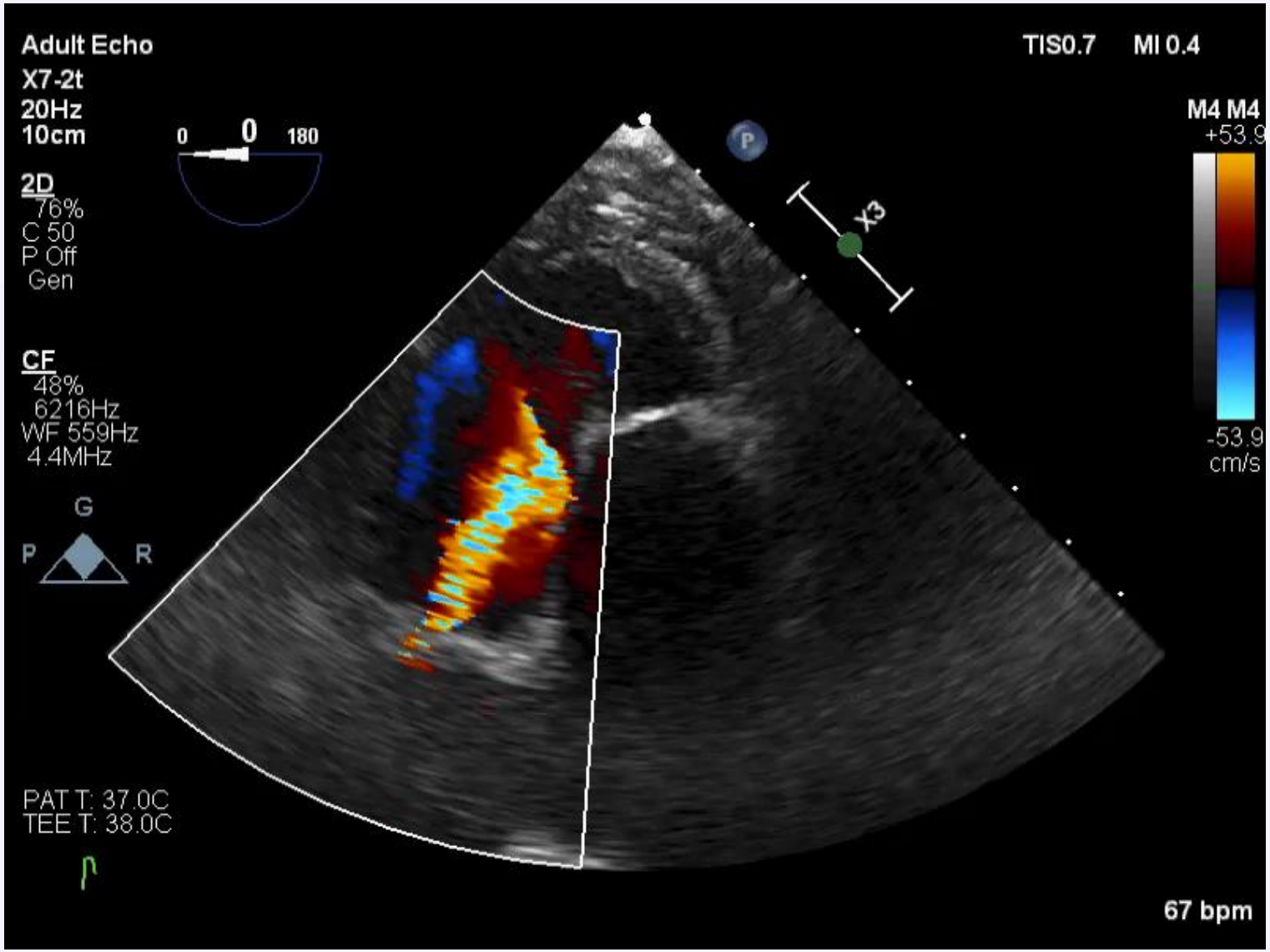

Adult Echo
X7-2t
53Hz
9.0cm
0
58
180
2D
57%
C 50
P Off
Gen
TIS0.2
MI 0.5
M4
X3
G
P
R
PAT T: 37.0C
TEE T: 38.4C
71 bpm


Adult Echo
X7-2t
53Hz
9.0cm
0
58
180
2D
57%
C 50
P Off
Gen
TIS0.2
MI 0.5
M4
X3
G
P
R
PAT T: 37.0C
TEE T: 38.4C
71 bpm


Adult Echo
X7-2t
53Hz
9.0cm
0
58
180
2D
57%
C 50
P Off
Gen
TIS0.2
MI 0.5
M4
Commissural angle = 130-140º
G
P
R
X3
PAT T: 37.0C
TEE T: 38.4C
71 bpm


Adult Echo
X7-2t
13Hz
9.0cm
0
58
180
2D
63%
C 50
P Off
Gen
CF
48%
5772Hz
WF 519Hz
4.4MHz
G
P
R
TIS0.7
MI 0.4
M4 M4
+50.0
-50.0
cm/s
x3
PAT T: 37.0C
TEE T: 38.3C
59 bpm


Adult Echo
X7-2t
20Hz
9.0cm
0 130 180
2D
63%
C 50
P Off
Gen
CF
48%
5772Hz
WF 519Hz
4.4MHz
G
P
R
TIS0.7 MI 0.4
M4 M4
+50.0
-50.0
cm/s
x3
PAT T: 37.0C
TEE T: 38.1C
68 bpm


Adult Echo
X7-2t
20Hz
10cm
0 0 180
2D
76%
C 50
P Off
Gen
CF
48%
6216Hz
WF 559Hz
4.4MHz
G
P
R
TIS0.7 MI 0.4
M4 M4
+53.9
-53.9
cm/s
X3
PAT T: 37.0C
TEE T: 38.0C
67 bpm

Aortic valve was not salvageable. AVR with bioprosthetic valve was done + replacement of non-coronary sinus of Valsalva + Supracoronary ascending aorta replacement. No coronary re-implantation.

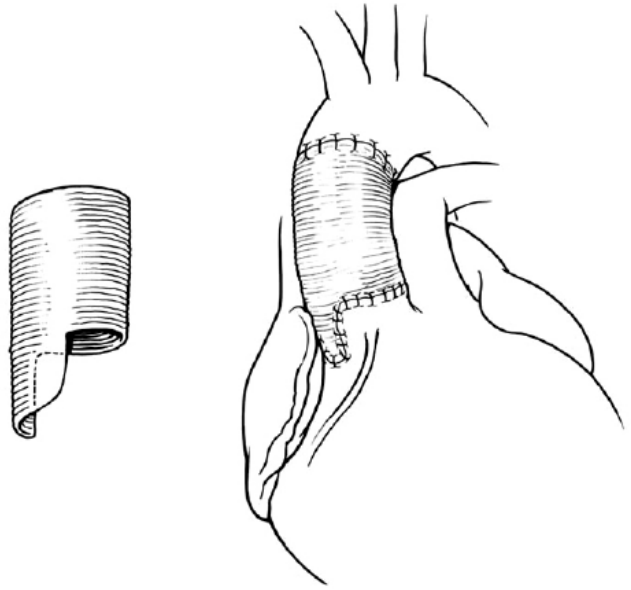
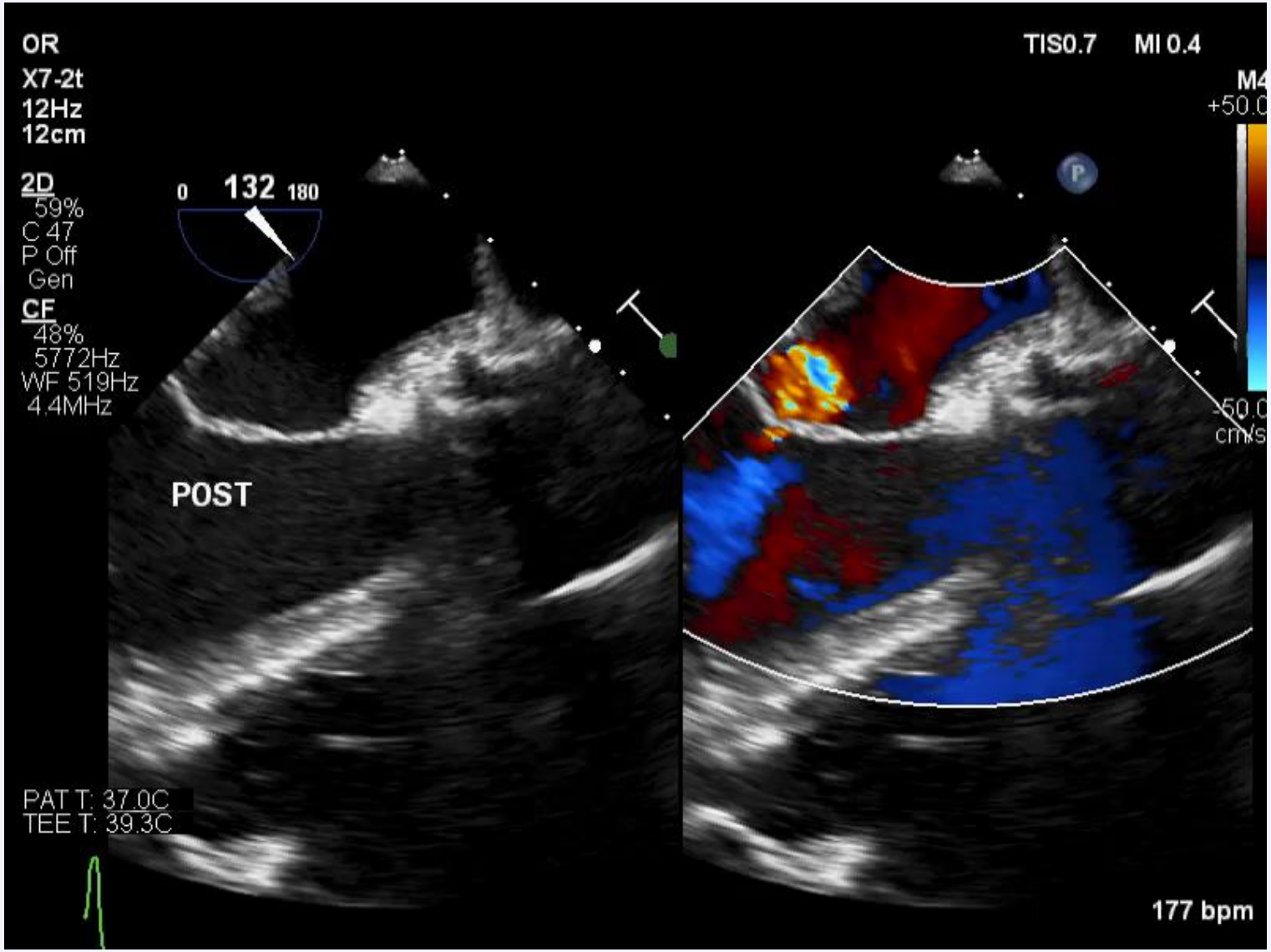
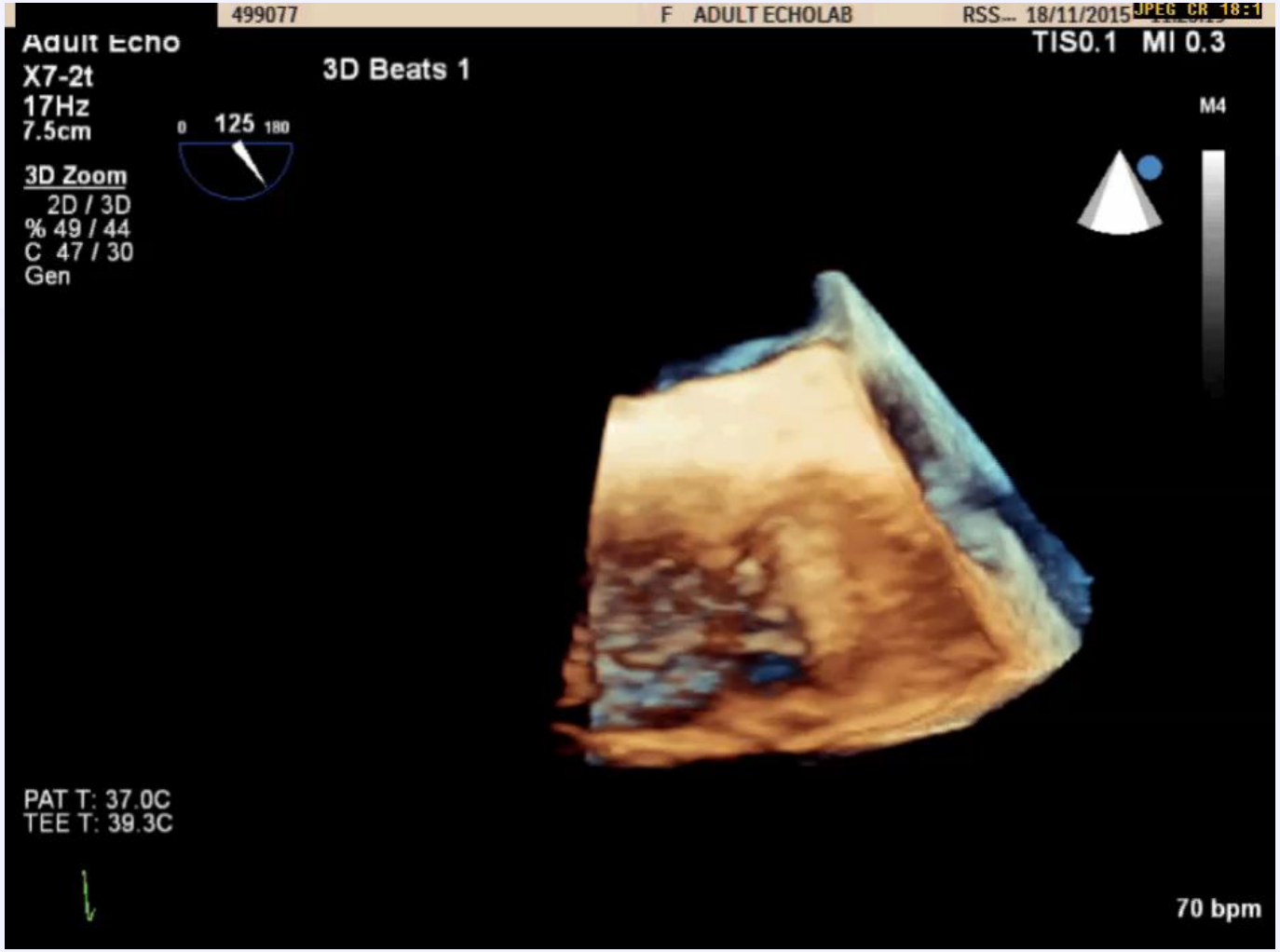


Fig. 2. Replacement of the ascending aorta with adjustment of diameter of the sinotubular junction and replacement of the non-coronary aortic sinus. When the non-coronary sinus is dilated, the graft selected to correct the dilatation of the sinotubular junction can be tailored to replace one or more sinues.

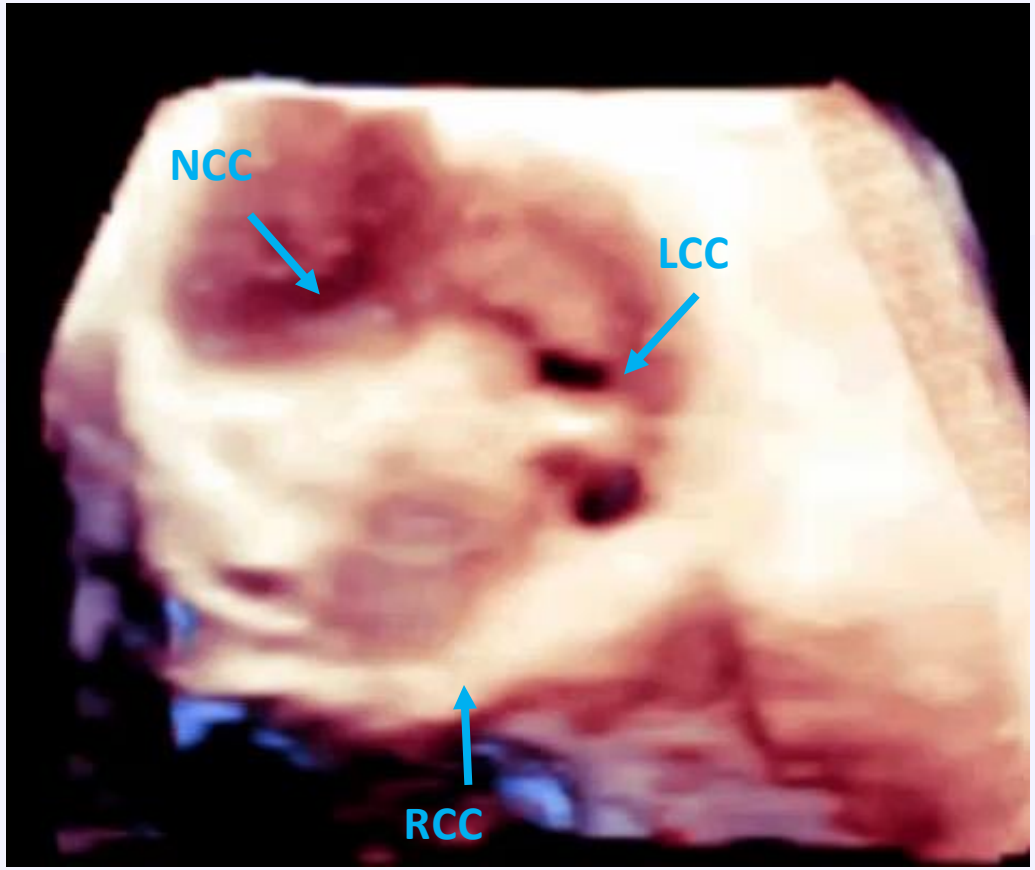

OR
X7-2t
12Hz
12cm
2D
59%
C 47
P Off
Gen
CF
48%
5772Hz
WF 519Hz
4.4MHz
0
132
180
TIS0.7
MI 0.4
M4
+50.0
-50.0
cm/s
POST
PAT T: 37.0C
TEE T: 39.3C
177 bpm

How to image the aortic valve?

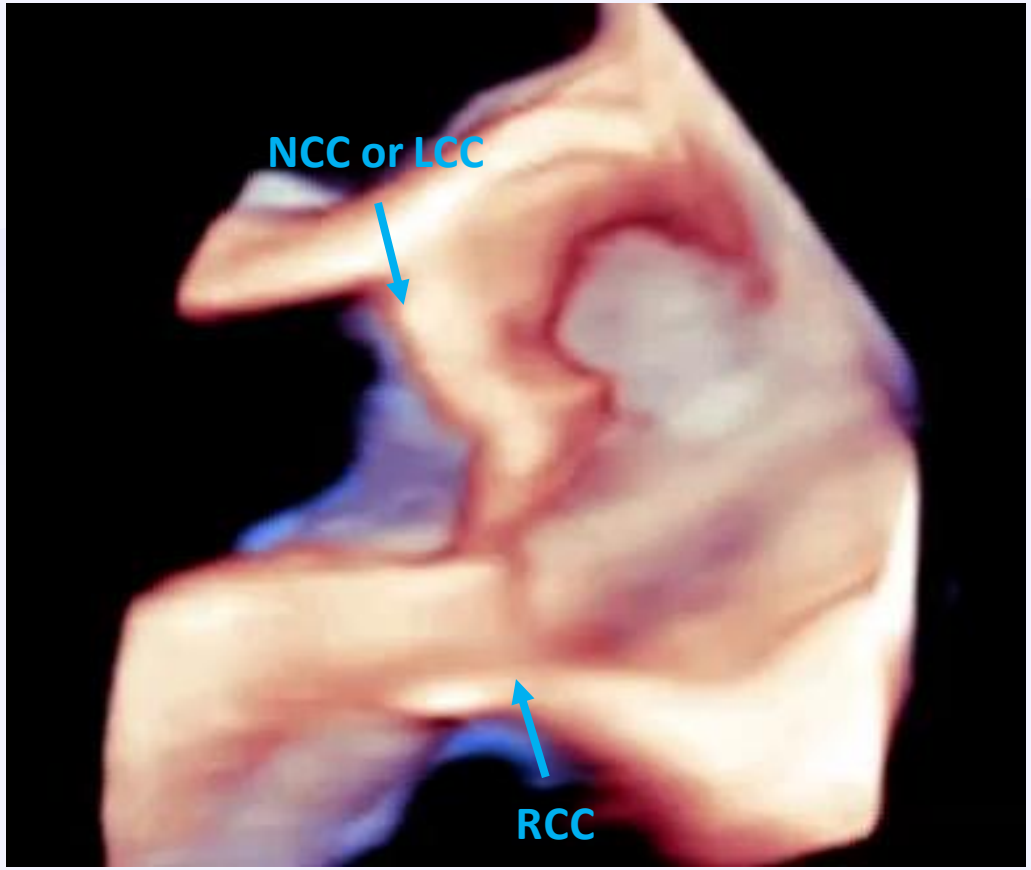
Normal aortic valve imaging, aortic root, Xplane



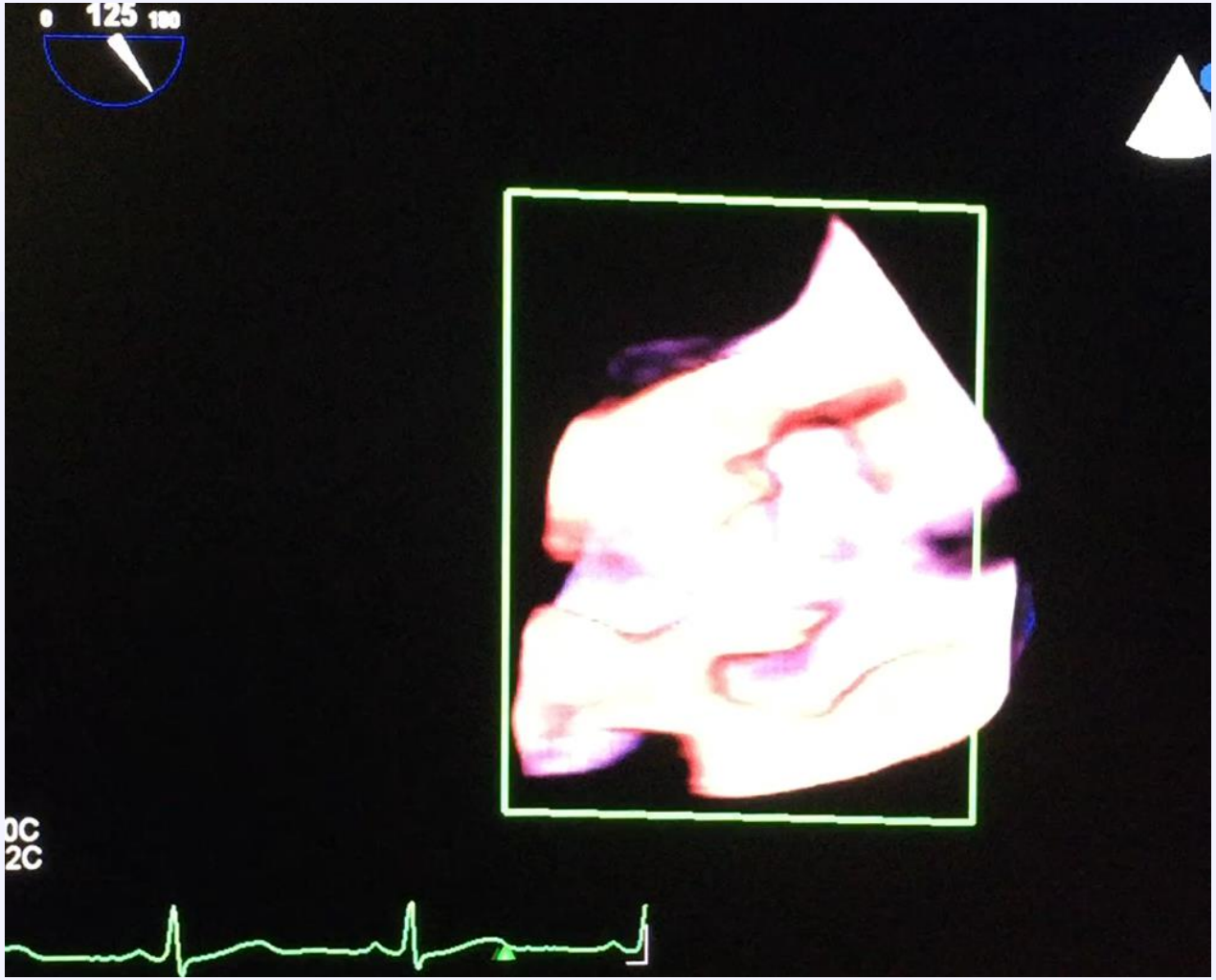
Aortic root LAX view



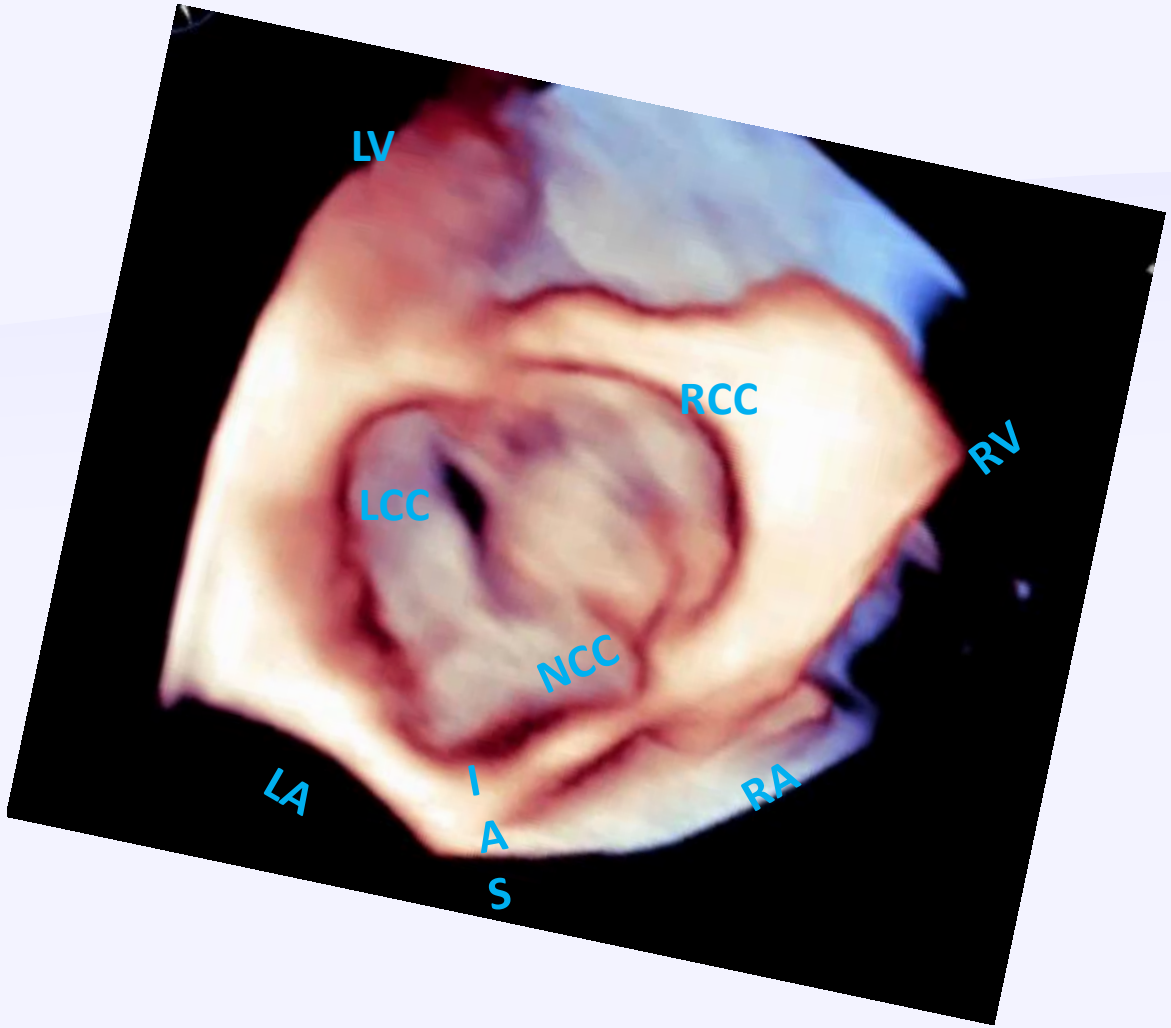
AoV, SAX view from aorta



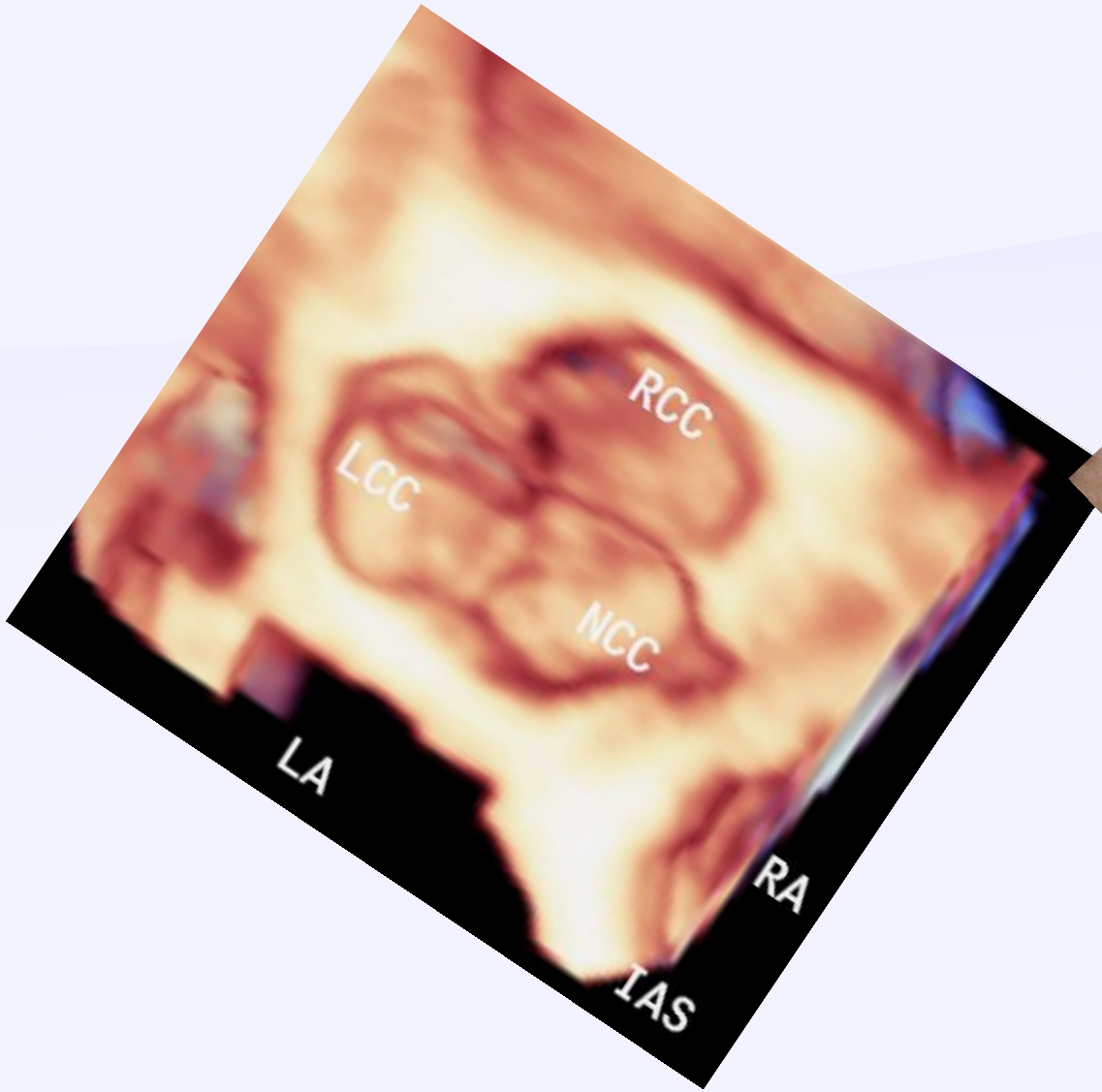
AoV, LAX view

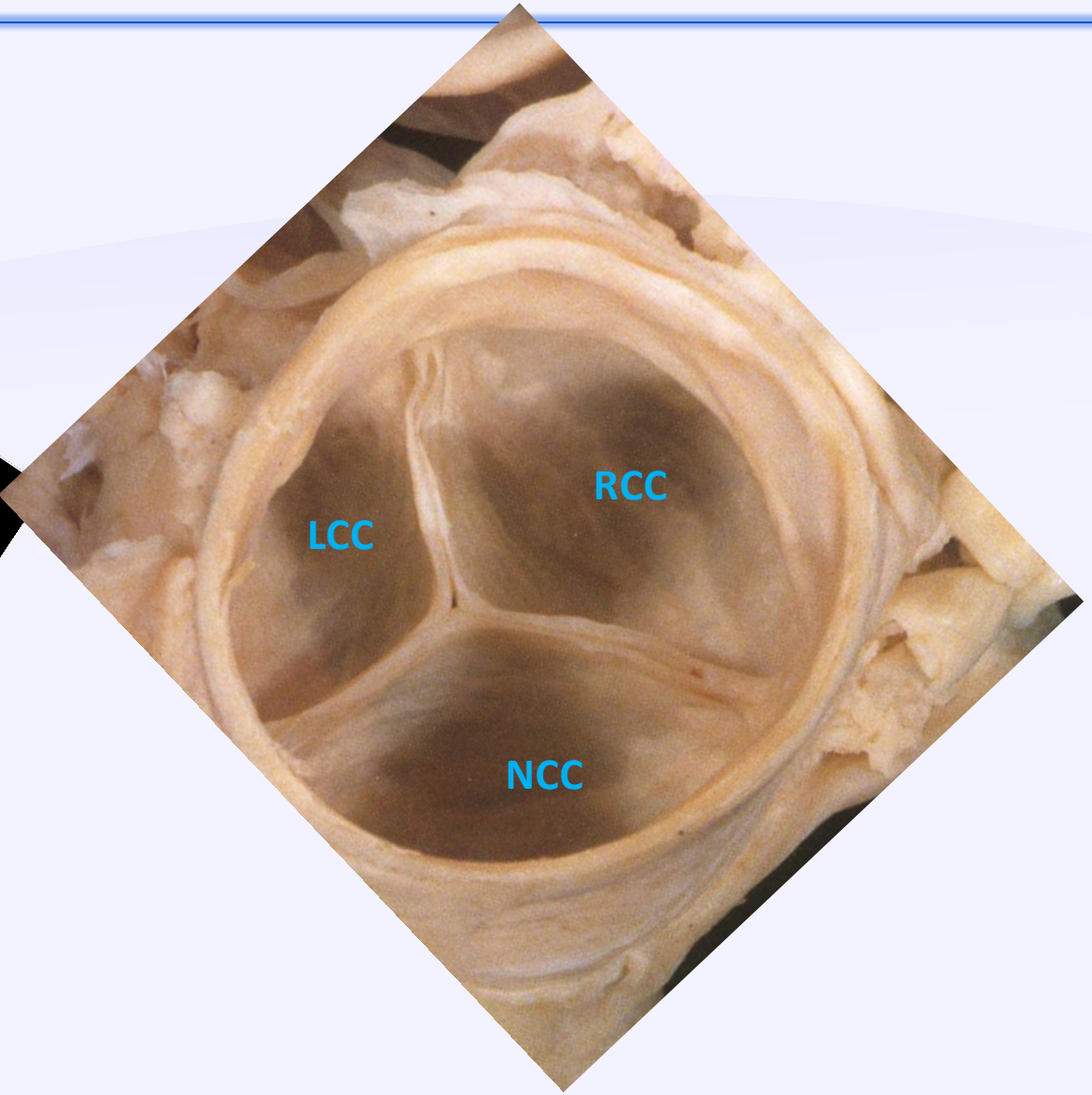


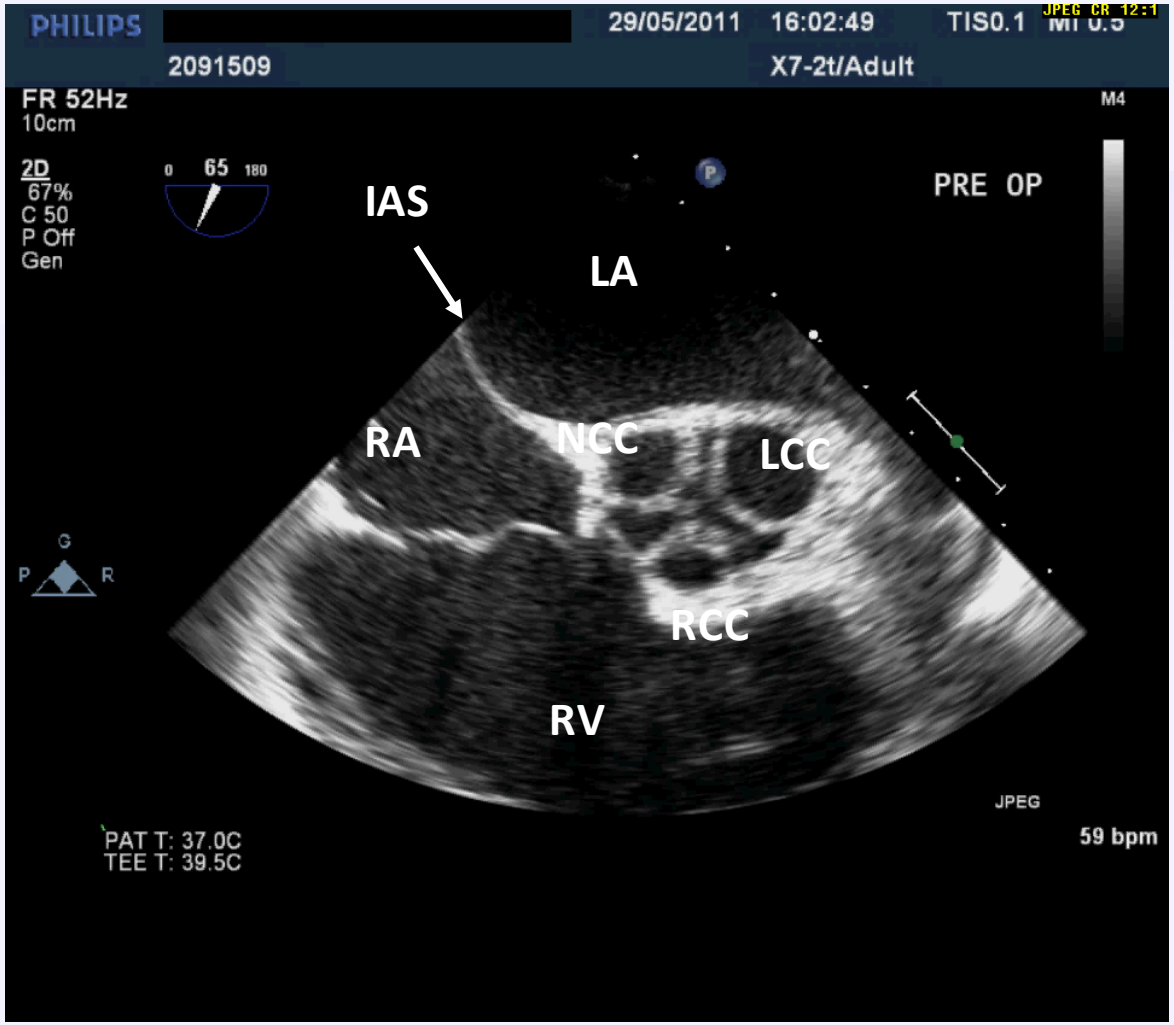
Creating surgical view of the aortic root



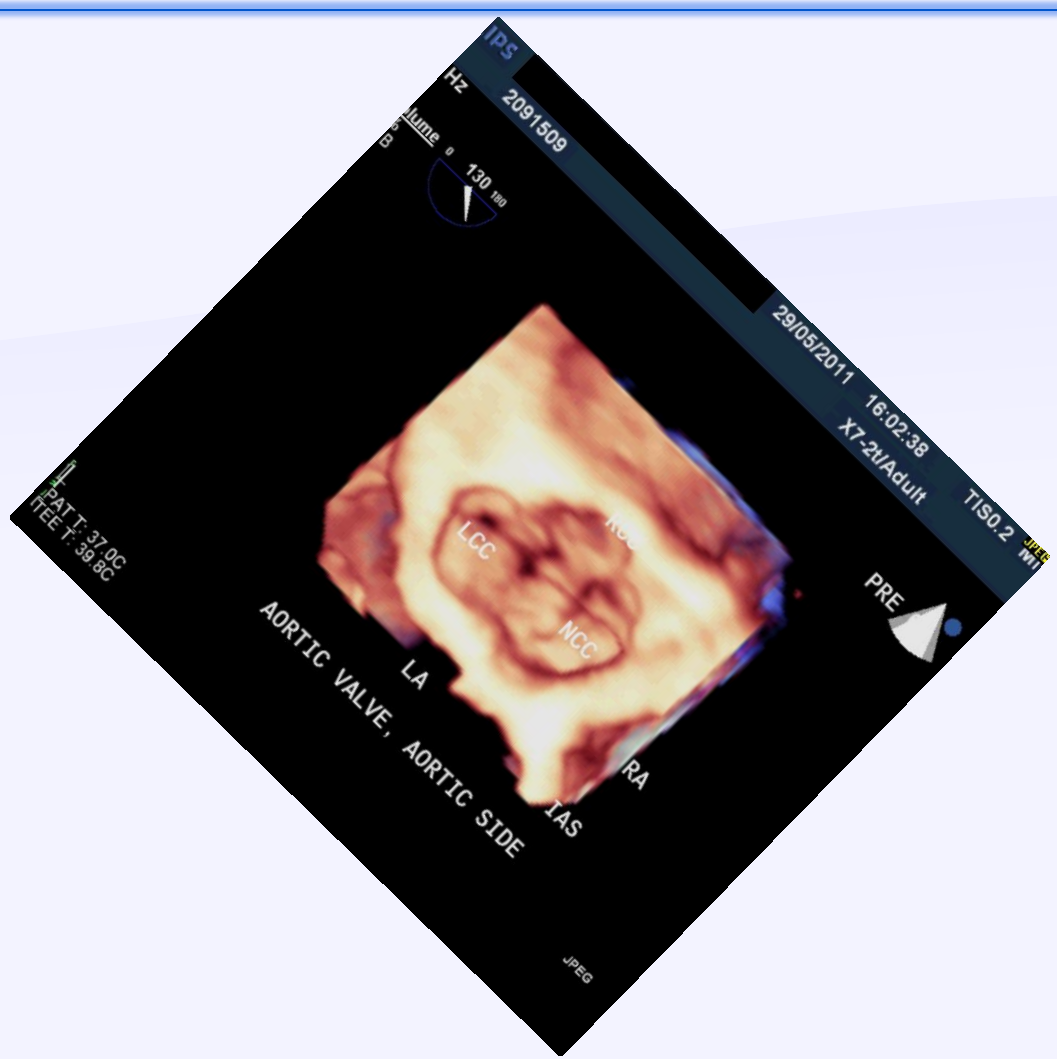
Surgeon’s view of the aortic valve


RCC
LCC
NCC
LA
RA
IAS


LCC
RCC
NCC



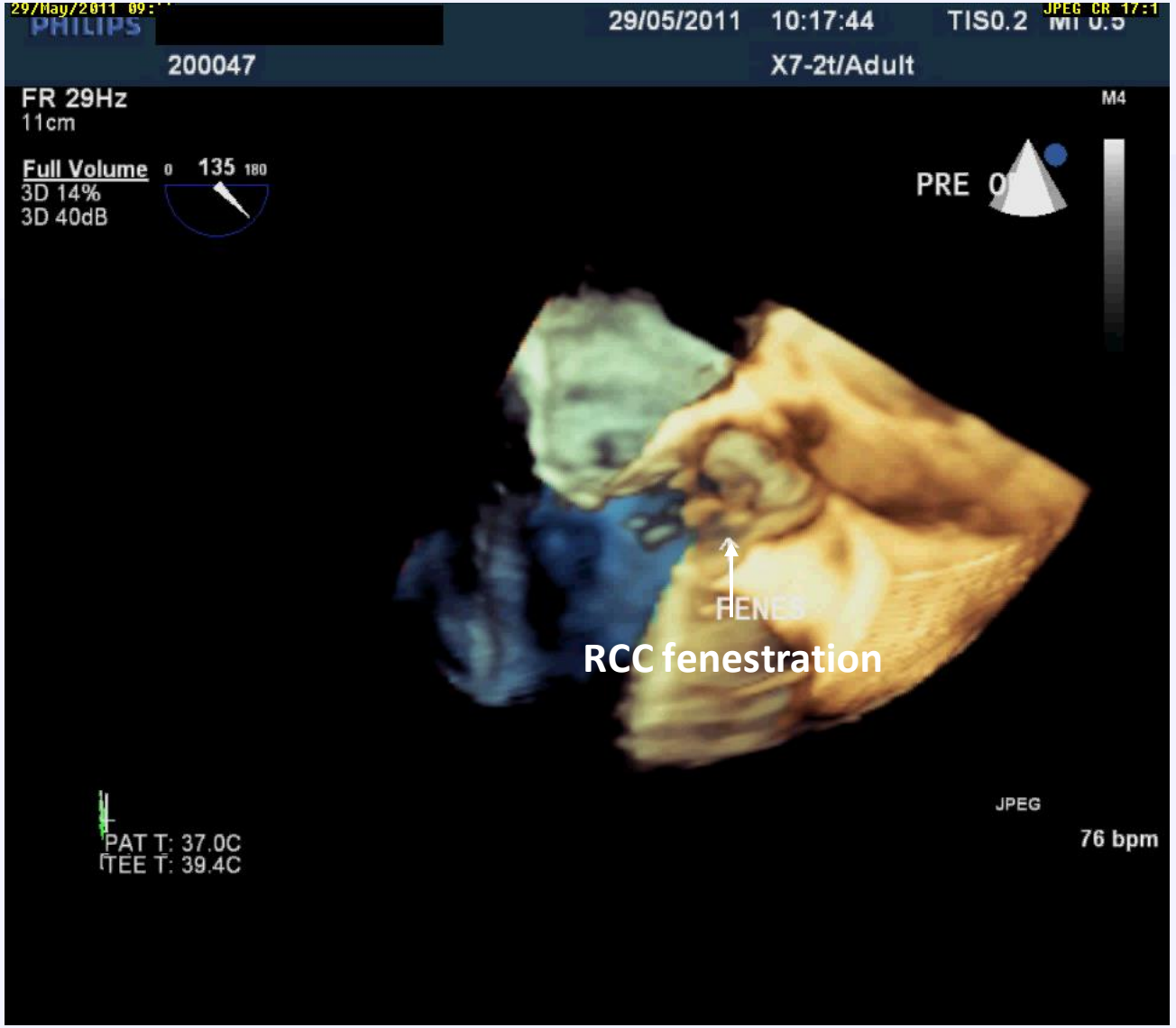
Normal AoV imaging, 2D TEE SAX view

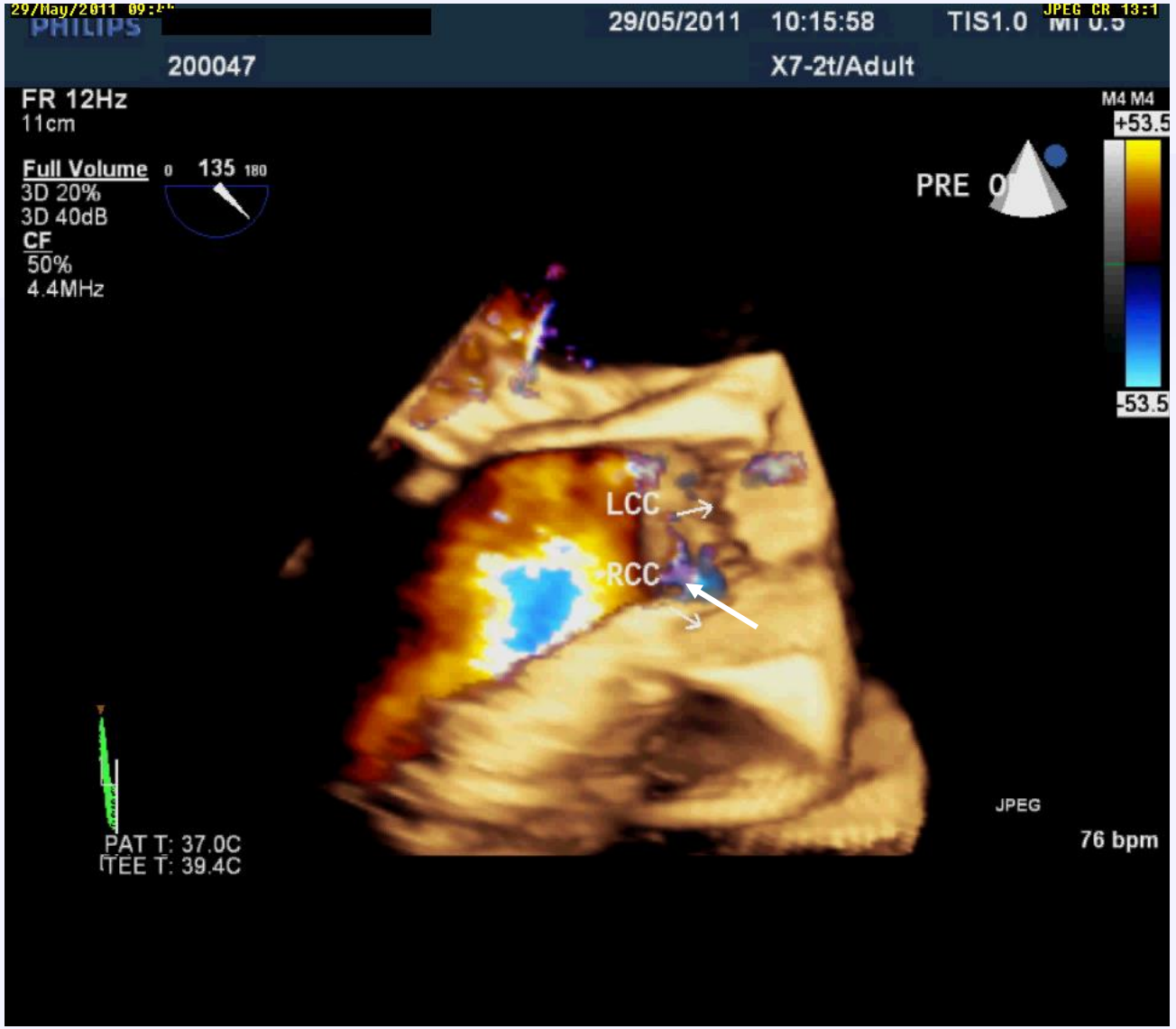


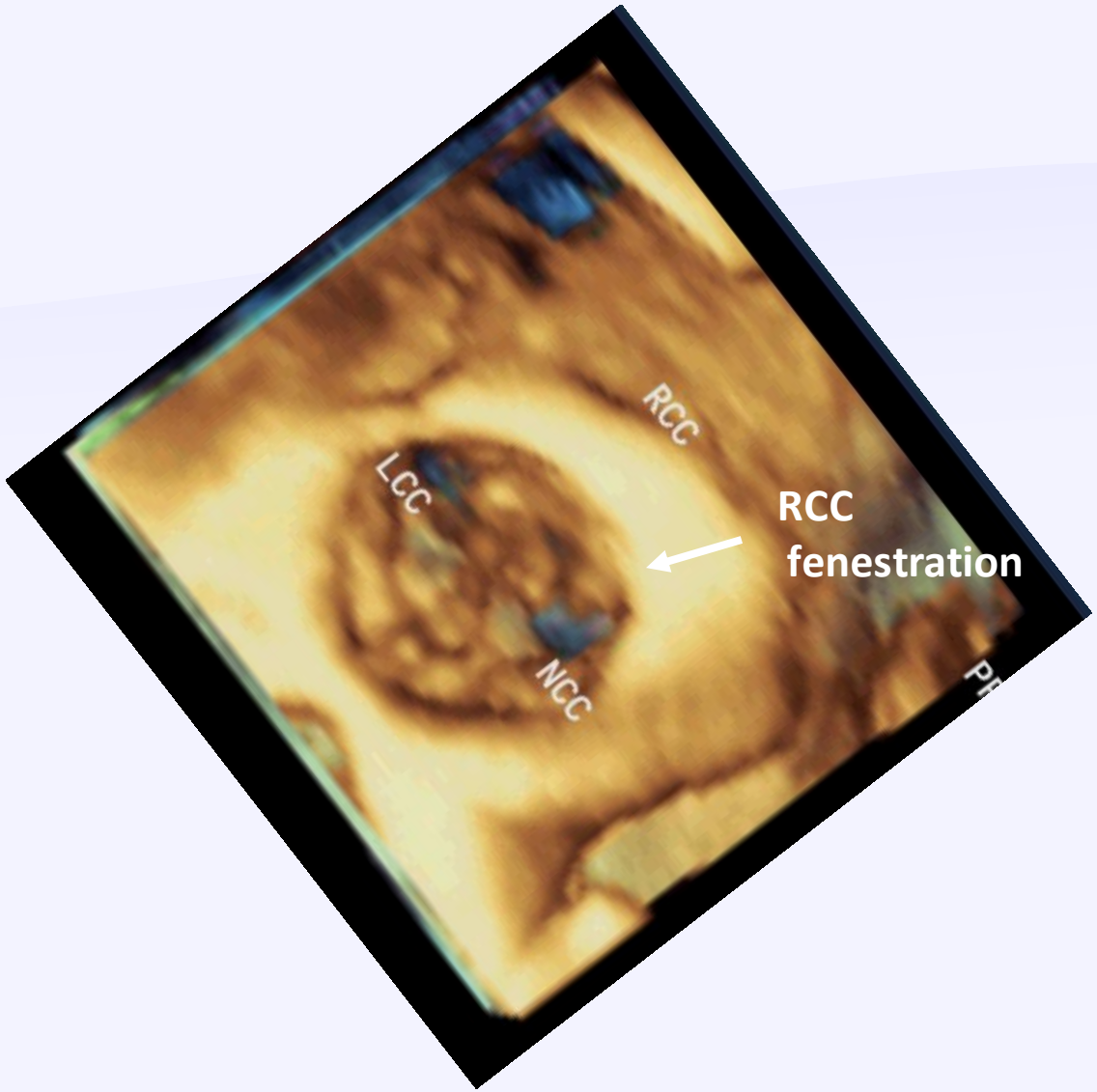
3D TEE SAX view, surgeon's view of the AoV

Case 3

- 67-year-old male with history of AOV endocarditis

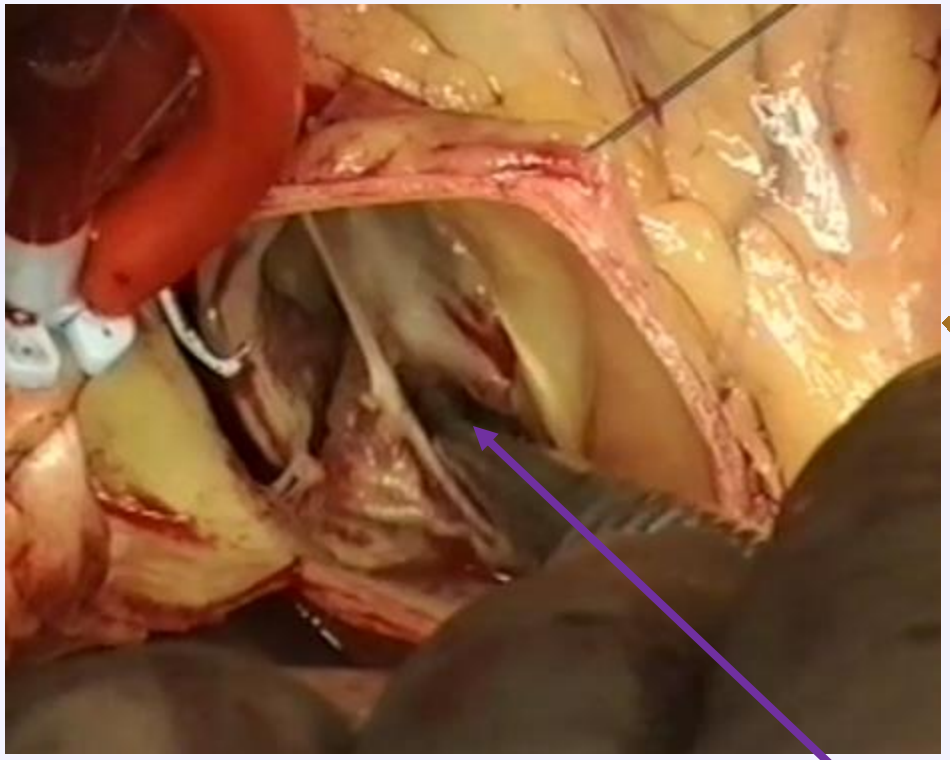

PHILIPS
29/05/2011 10:17:44 TIS0.2
200047
X7-2t/Adult
FR 29Hz
11cm
Full Volume
3D 14%
3D 40dB
0 135 180
M4
PRE
RCC fenestration
JPEG
76 bpm
PAT T: 37.0C
TEE T: 39.4C

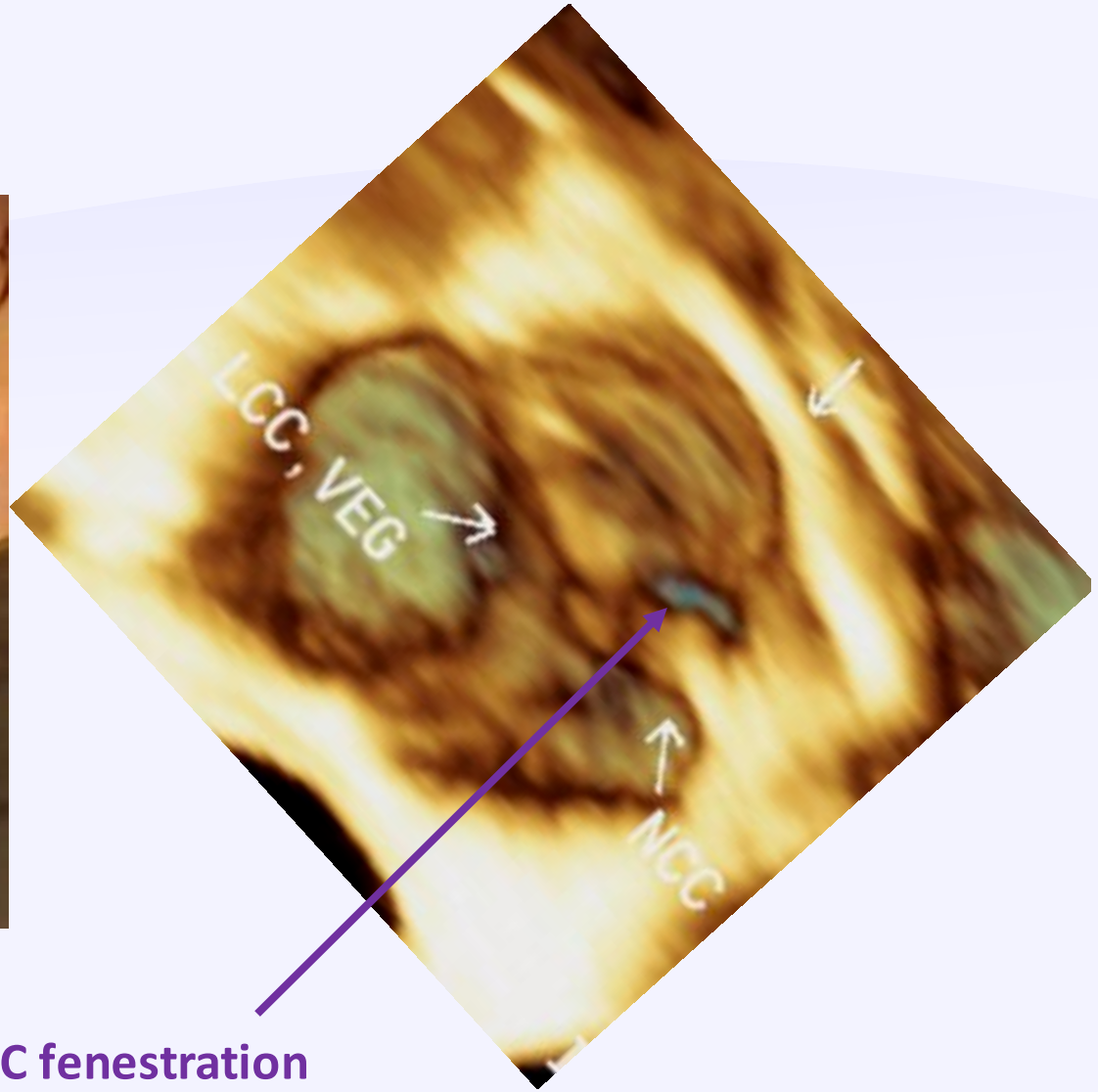

PHILIPS
29/05/2011 10:15:58 TIS1.0
200047
X7-2t/Adult
FR 12Hz
11cm
Full Volume
3D 20%
3D 40dB
CF
50%
4.4MHz
135
PRE
M4 M4
+53.5
-53.5
LCC
RCC
JPEG
76 bpm
PAT T: 37.0C
TEE T: 39.4C


RCC
LCC
NCC
RCC
fenestration

Dr. Al Khaldi, KACC, 2011

Endocarditis of AoV, fenestration on RCC and vegetation on LCC





RCC fenestration

An aortic valve-sparing operation for patients with aortic incompetence and aneurysm of the...

by David, T E; Feindel, C M

The Journal of thoracic and cardiovascular surgery, 04/1992, Volume 103, Issue 4

1992

Korean J Thorac Cardiovasc Surg 2012;45:205-212 ☐ Review ☐

ISSN: 2233-601X (Print) ISSN: 2093-6516 (Online) http://dx.doi.org/10.5090/kjtcs.2012.45.4.205

Aortic Valve Sparing Operations: A Review

Tirone E. David, M.D.

2012

Aortic valve sparing operations were developed to preserve the native aortic valve during surgery for aortic root aneurysm as well as surgery for ascending aortic aneurysms with associated aortic insufficiency. There are basically two types of aortic valve sparing oprations: remodeling of the aortic root and reimplantation of the aortic valve. These operations have been performed for over two decades and the clinical outcomes have been excellent in experienced hands. Although remodeling of the aortic root is physiologically superior to reimplantation of the

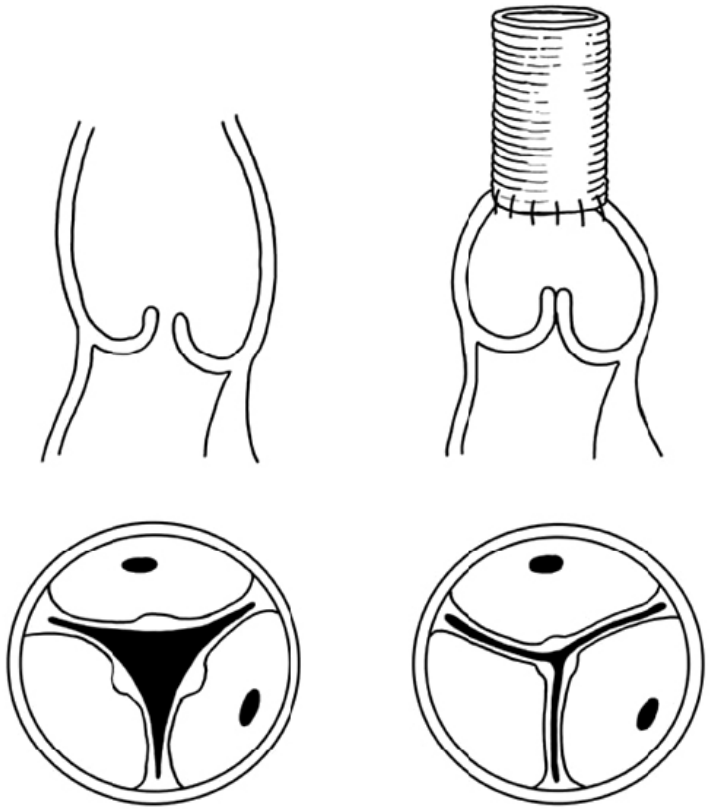


Fig. 1. Replacement of the ascending aorta with adjustment of diameter of the sinotubular junction to correct aortic insufficiency. Dilatation of the sinotubular junction prevents the cups from coapting centrally. Replacement of the ascending aorta with a graft of appropriate diameter and sutured to the aortic root at the level of the sinotubular junction restores valve competence.

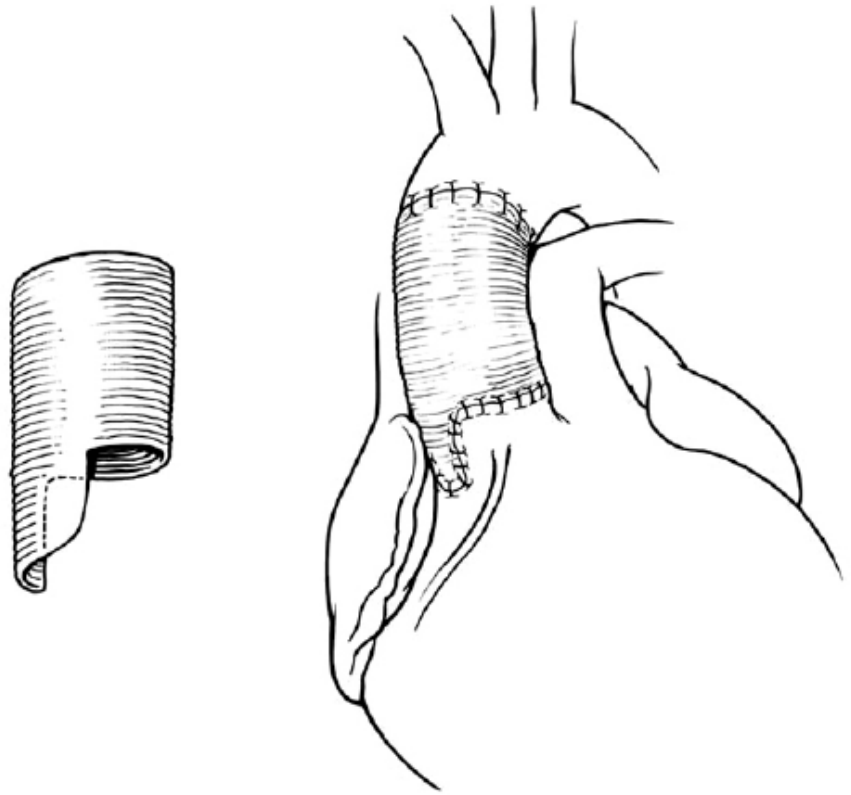


Fig. 2. Replacement of the ascending aorta with adjustment of diameter of the sinotubular junction and replacement of the non-coronary aortic sinus. When the non-coronary sinus is dilated, the graft selected to correct the dilatation of the sinotubular junction can be tailored to replace one or more sinues.

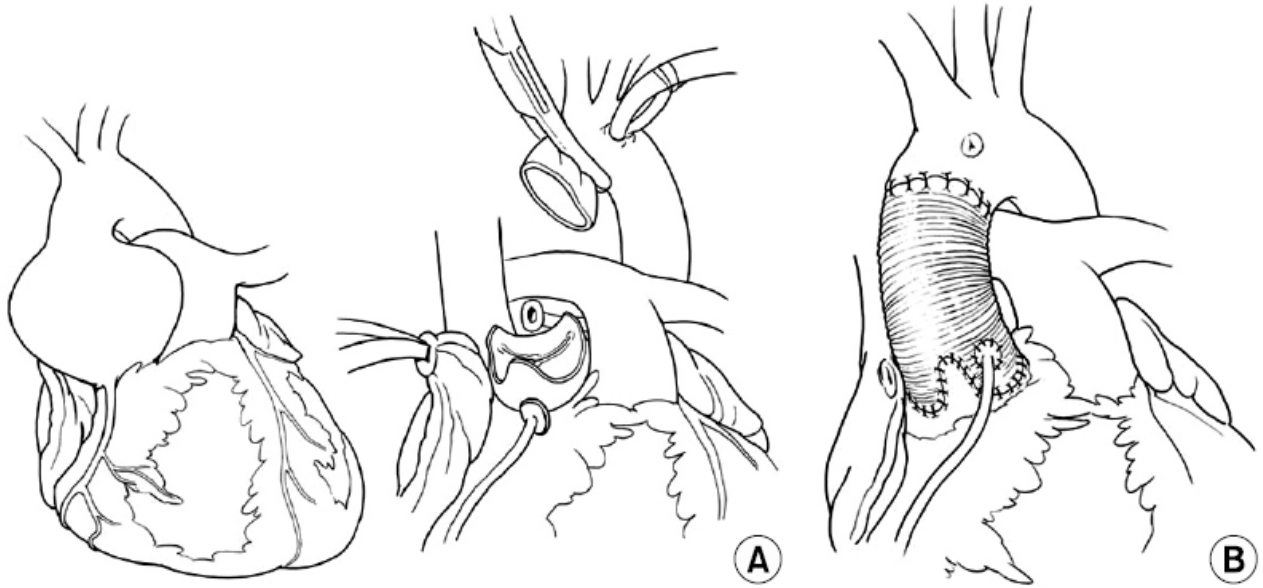
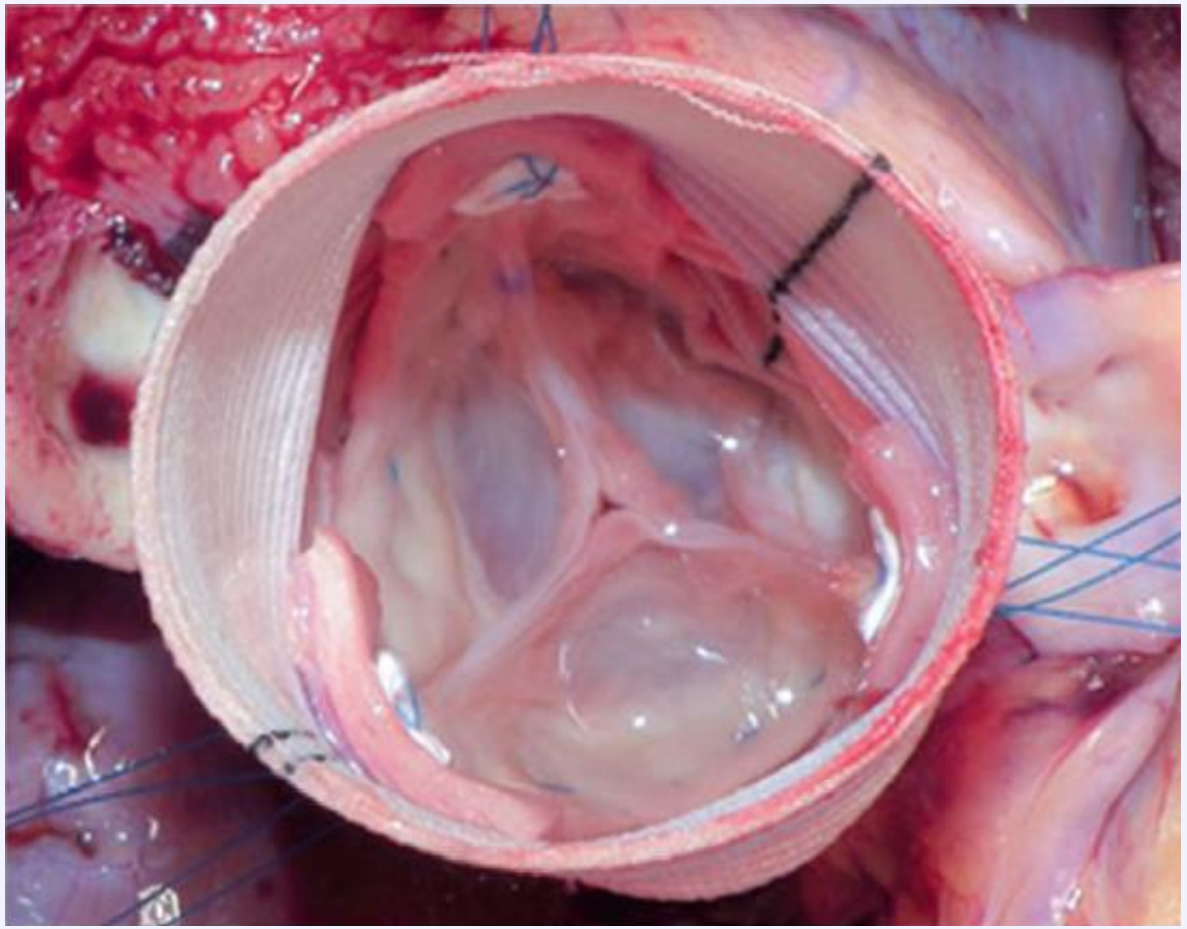


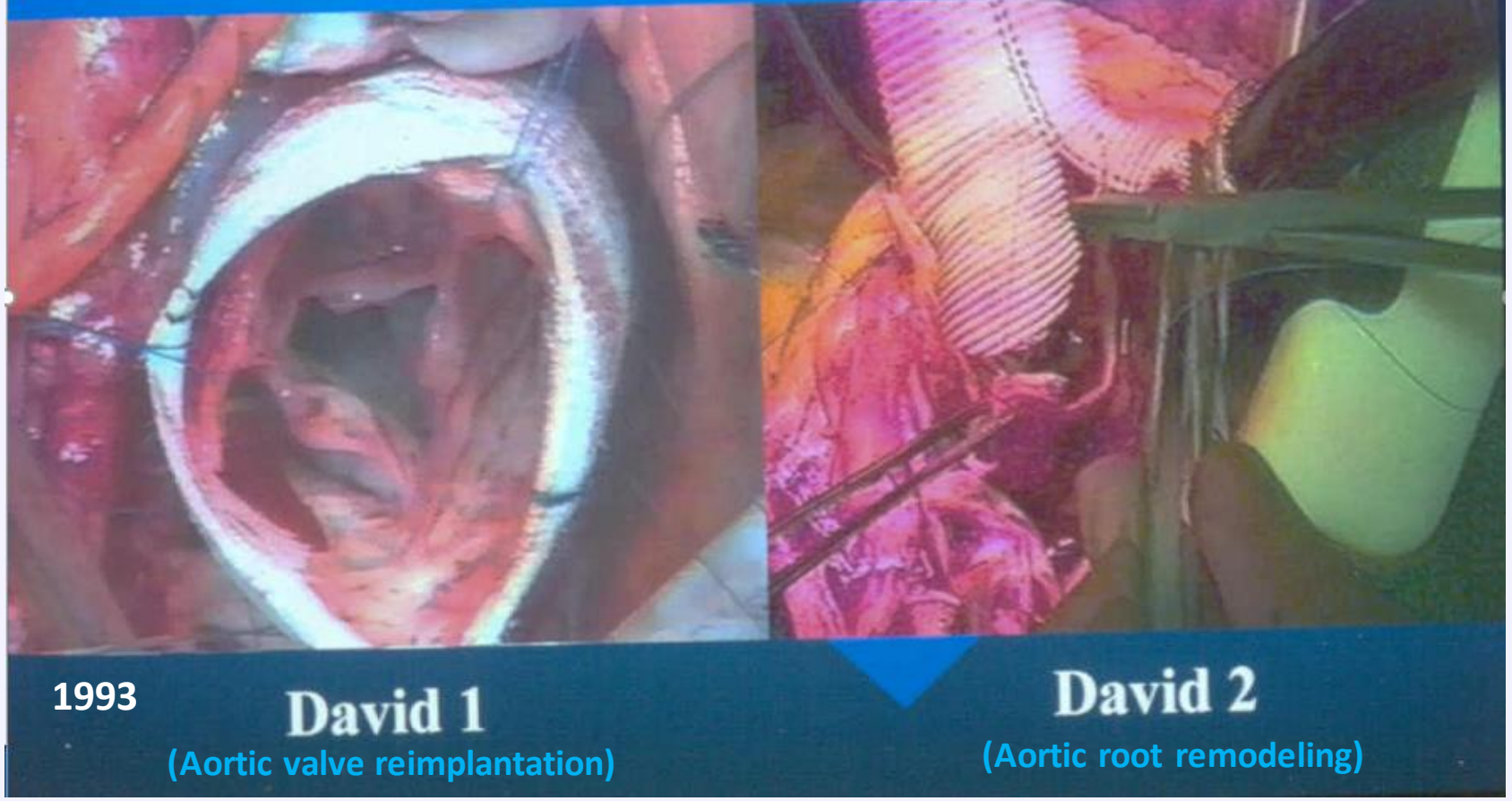
Fig. 3. Complete remodeling of the aortic root with replacement of all three aortic sinuses and reimplantation of the coronary arteries. (A) The three aortic sinuses are excised leaving 4 to 5 mm of sinus wall attached to the aortic annulus. (B) A tubular Dacron graft is tailored to create 3 neo-aortic sinuses. The coronary arteries are reimplanted.



Positioning of the native aortic valve within a tubular Dacron graft during the **David Operation** (reimplantation of the aortic valve)

Masri A, et al. Heart 2017

SUBCORONARY GRAFT



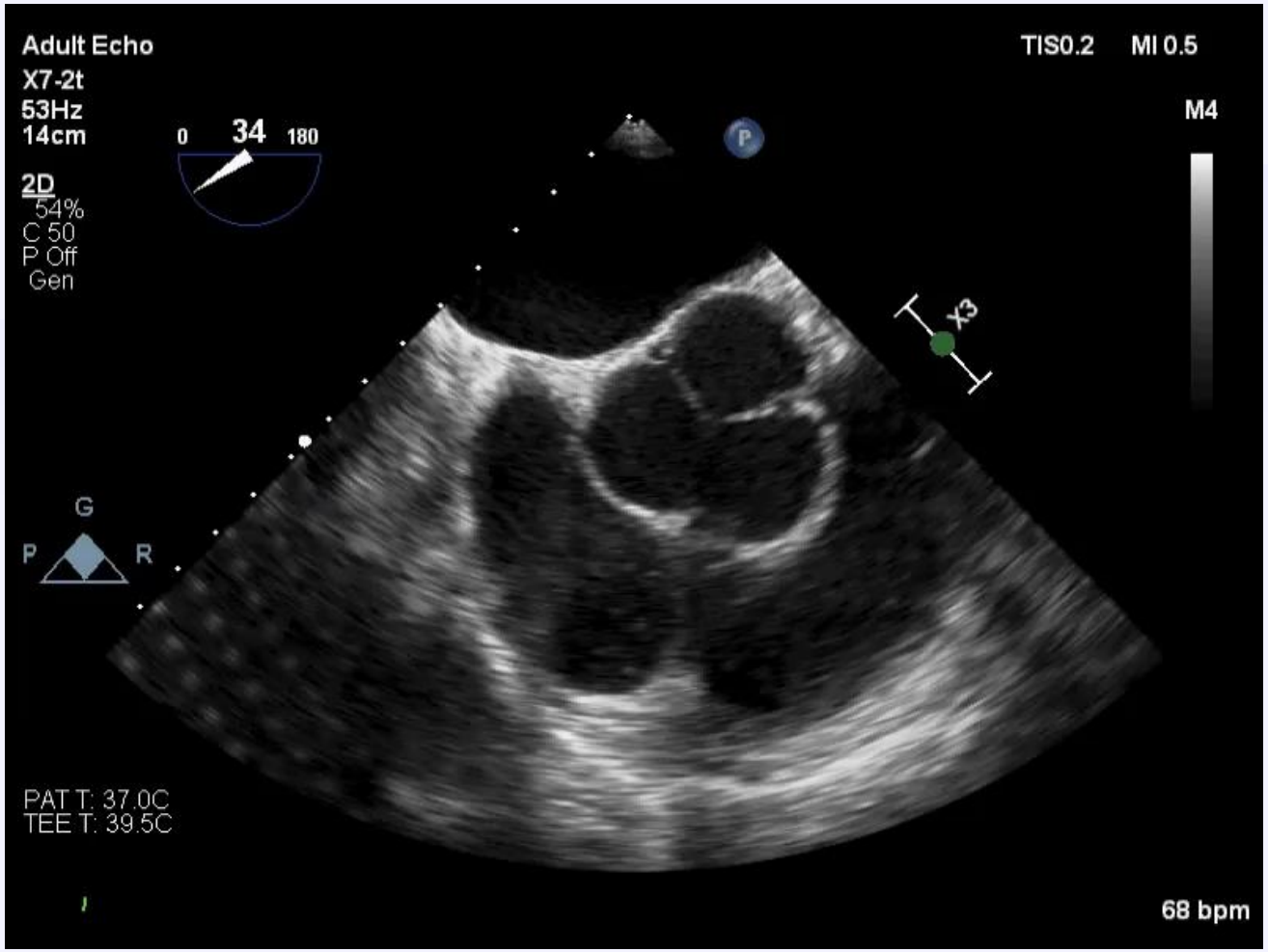
1993

David 1
(Aortic valve reimplantation)

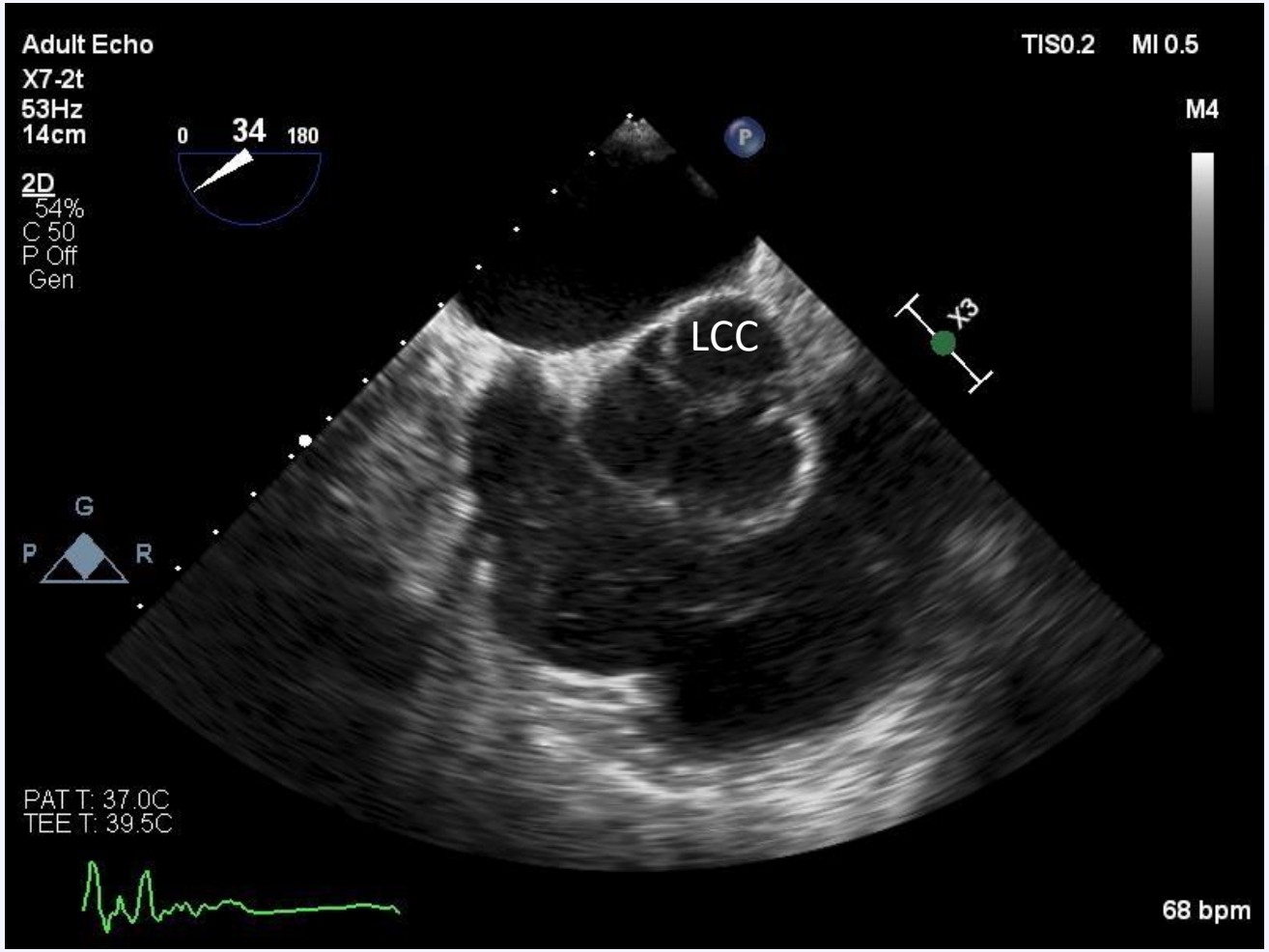
David 2
(Aortic root remodeling)

Case 4

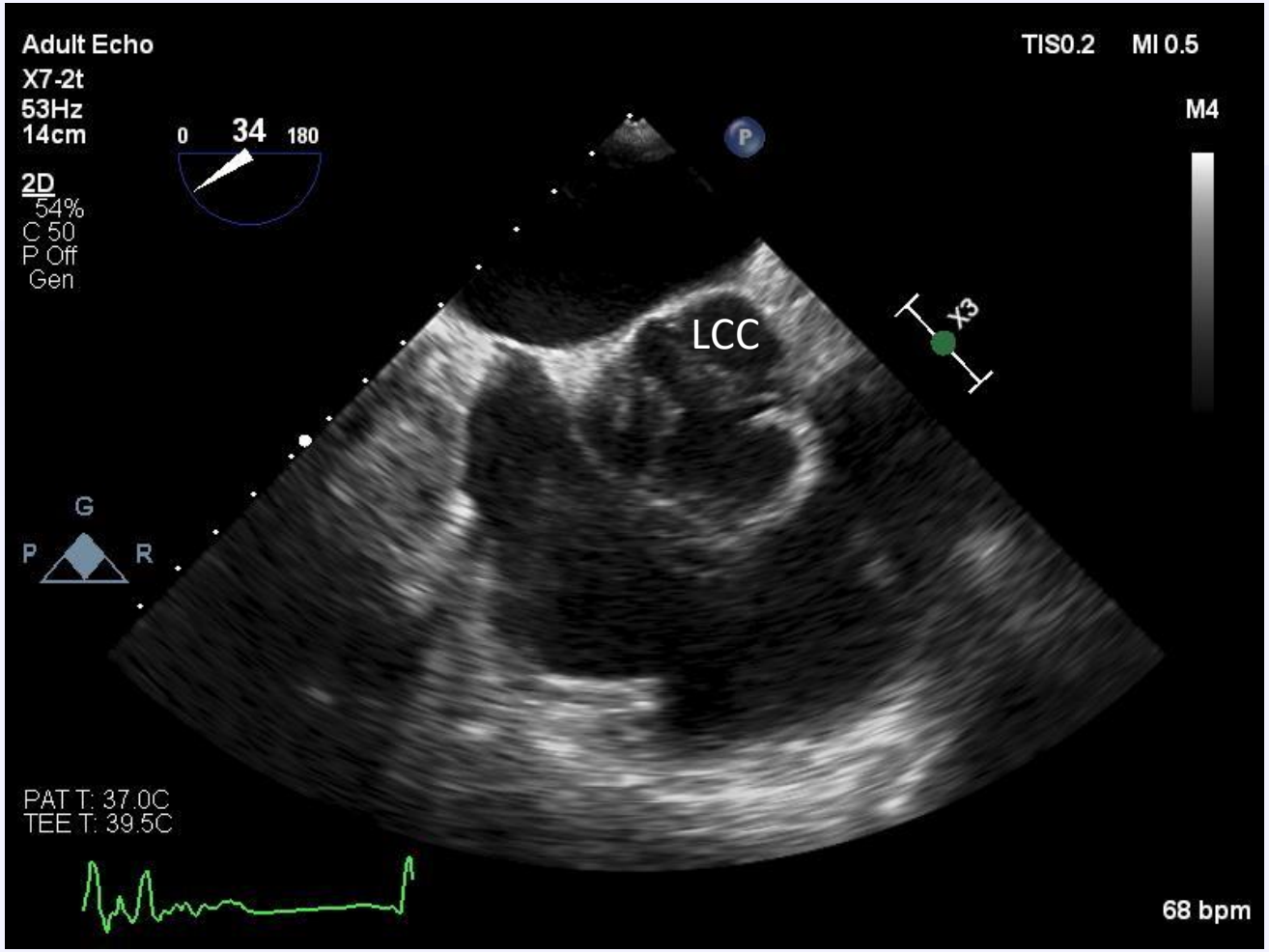
- 45-year-old mane was referred to TGH for severe AI



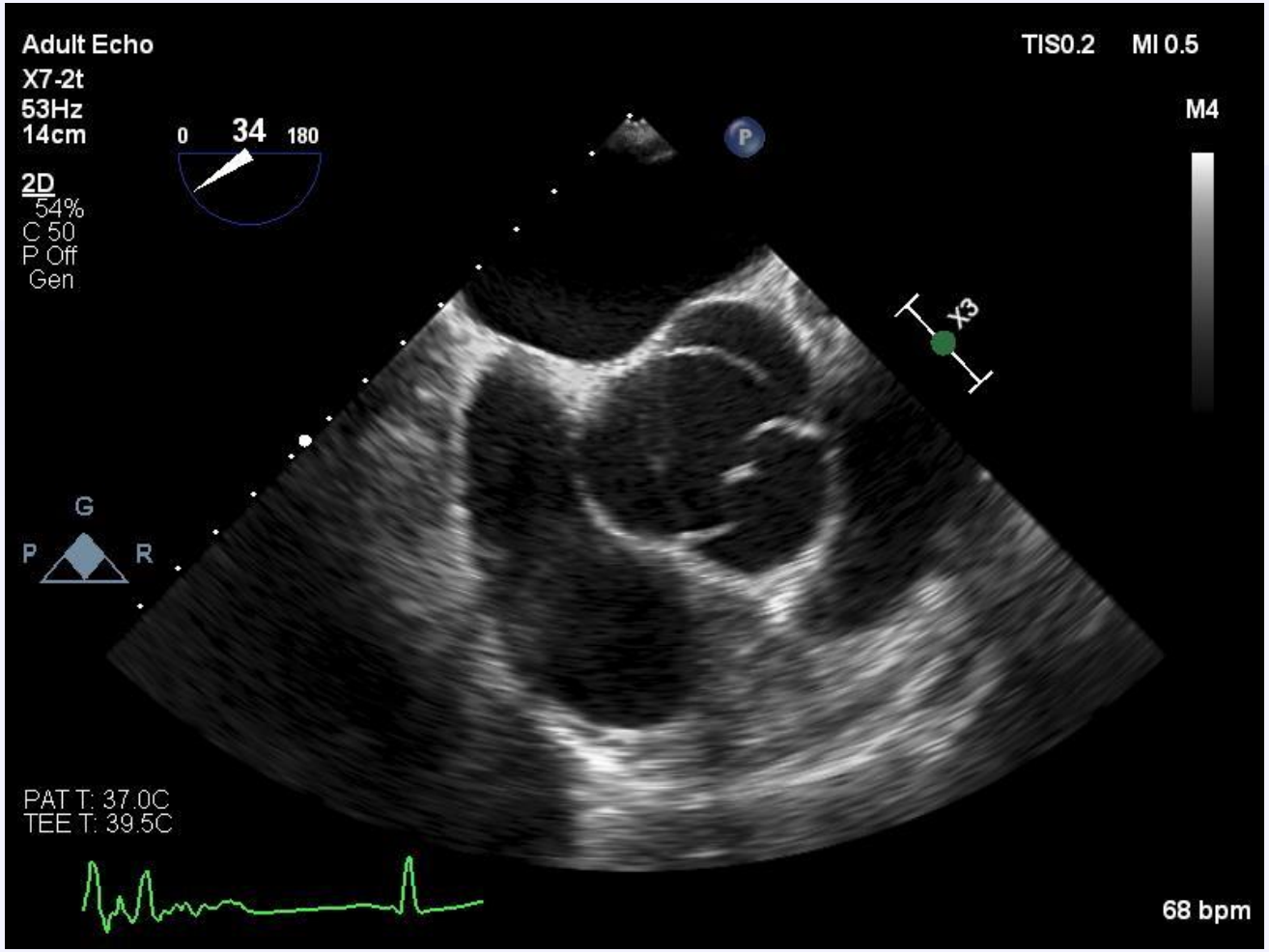
Aortic valve, short axis view showing severe prolapse/flail RCC and prolapse of LCC



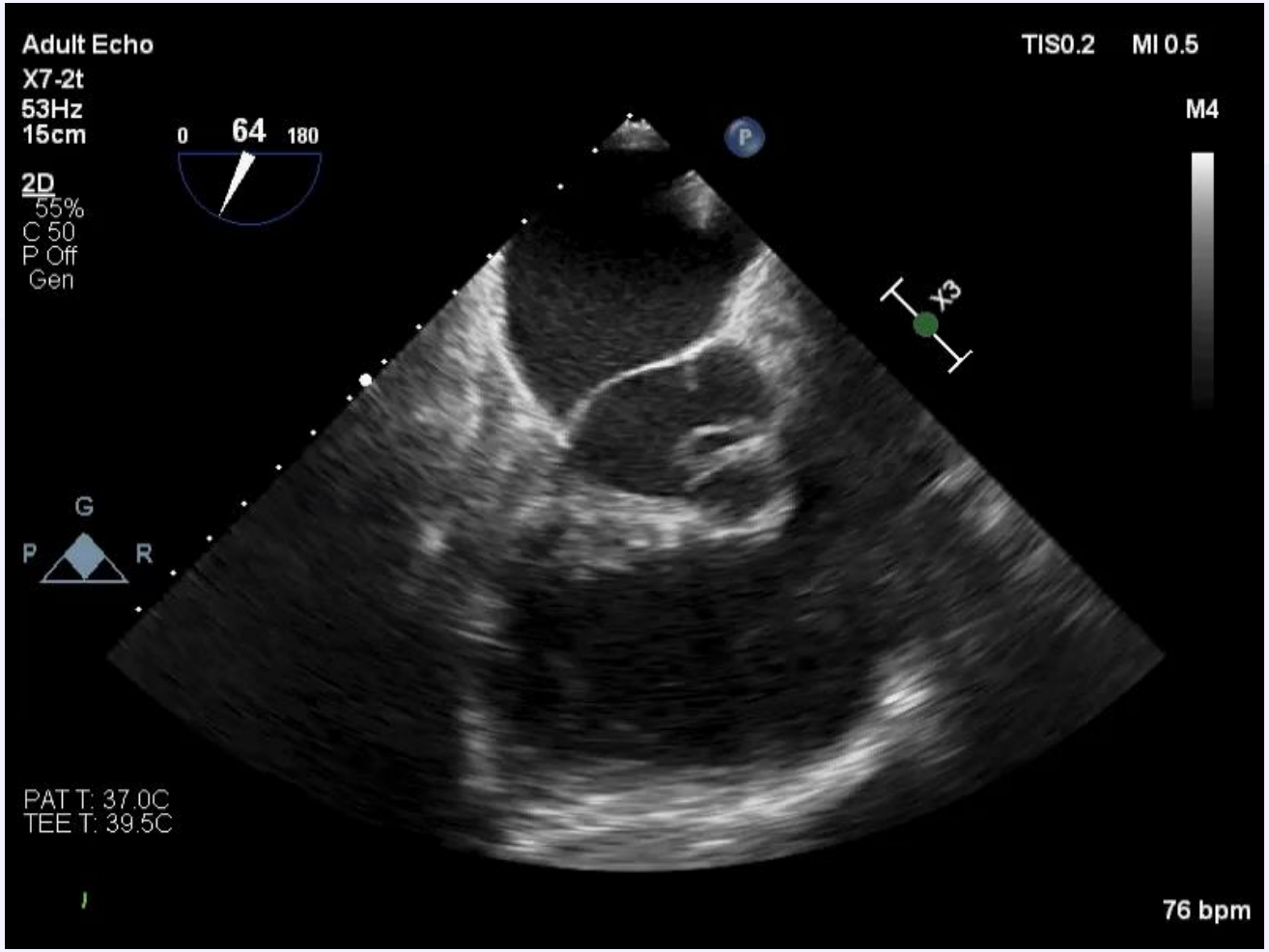
Prolapse of LCC with double line (double shadow) appearance during closing



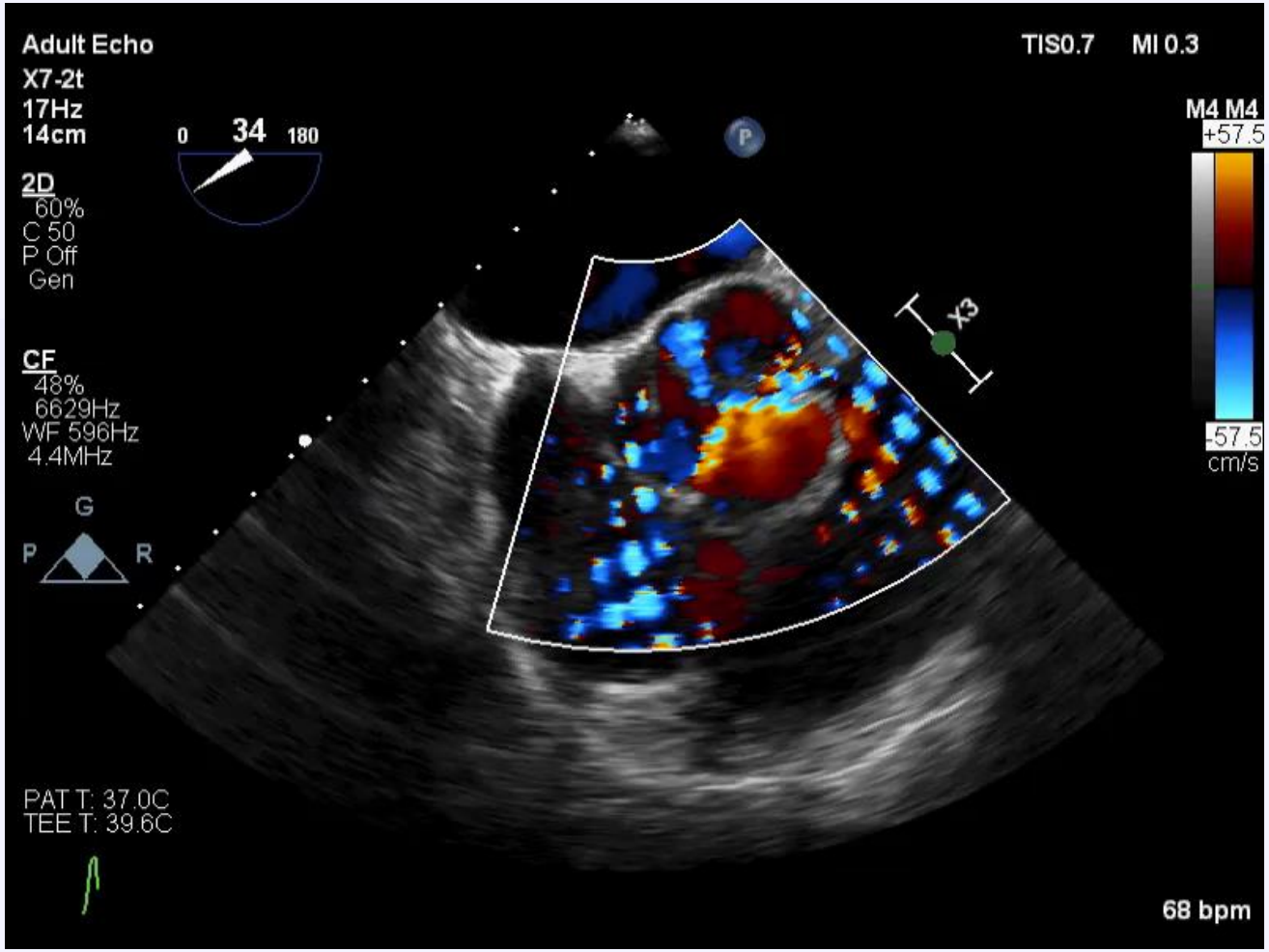
Prolapse of LCC with double line (double shadow) appearance during early systole



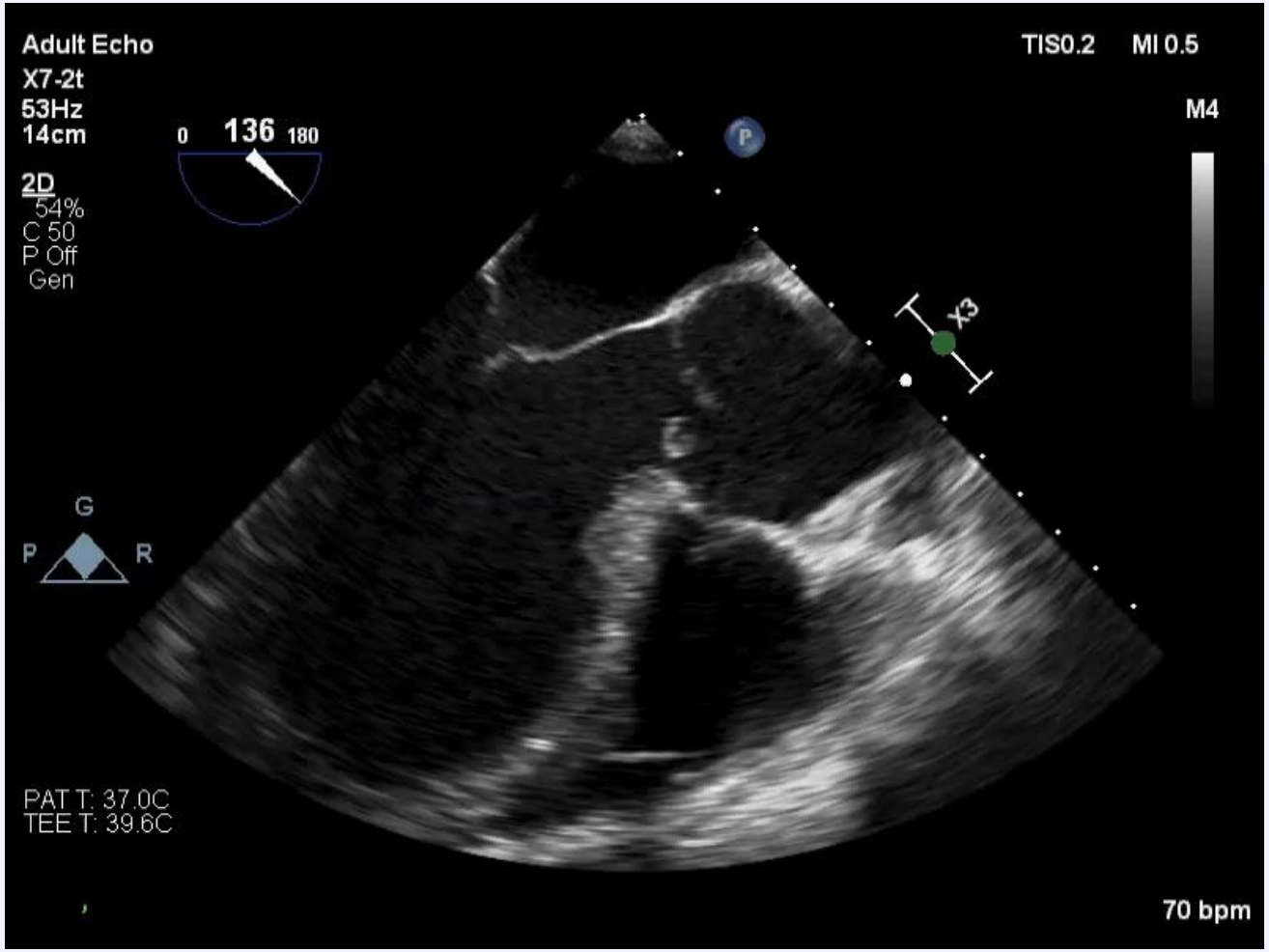
Excessive tissue and irregular appearance of free margin of the RCC during opening due to prolapse/ flail



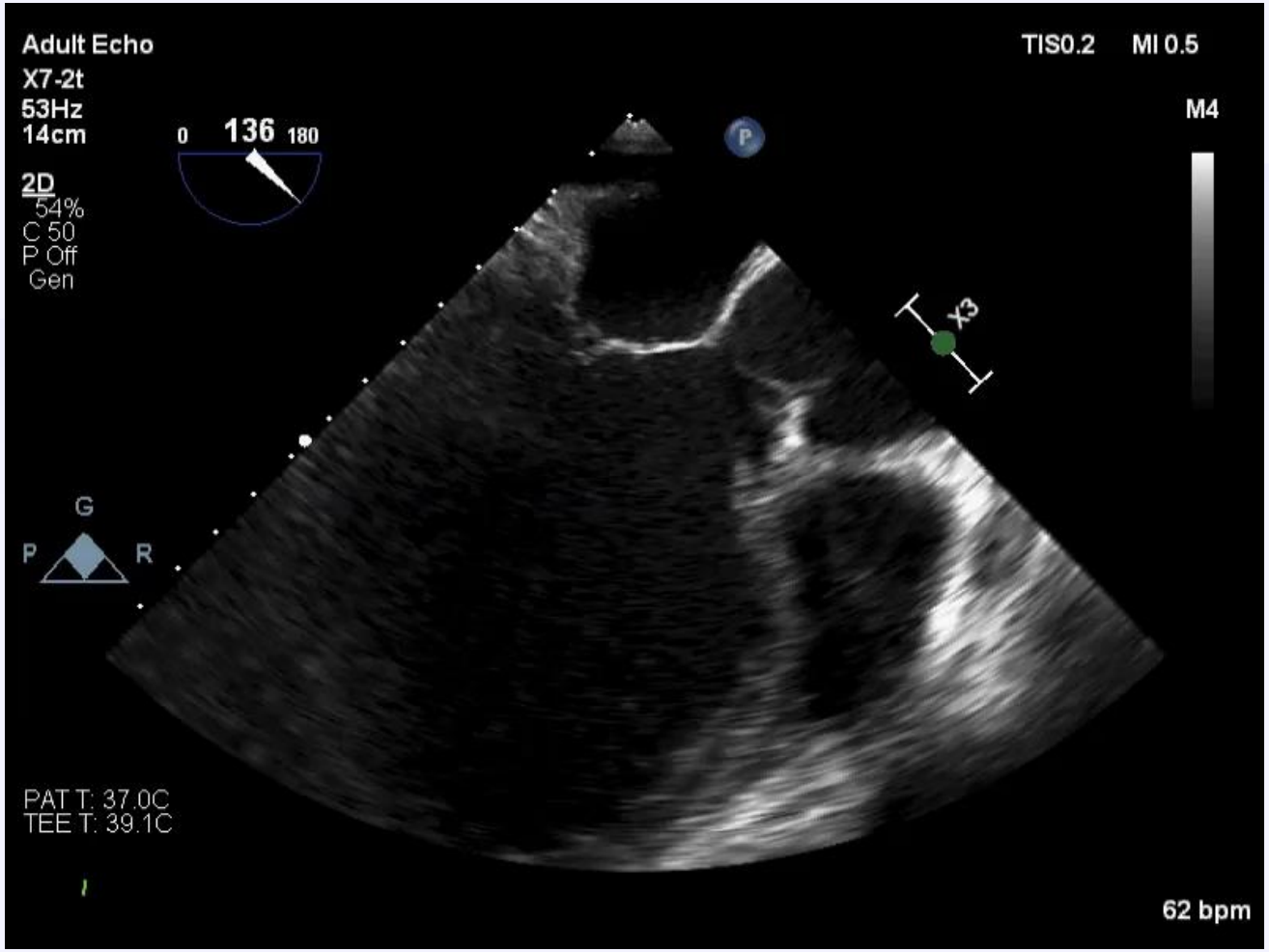
Severe prolapse/flail of RCC with double line (double shadow) appearance during closing



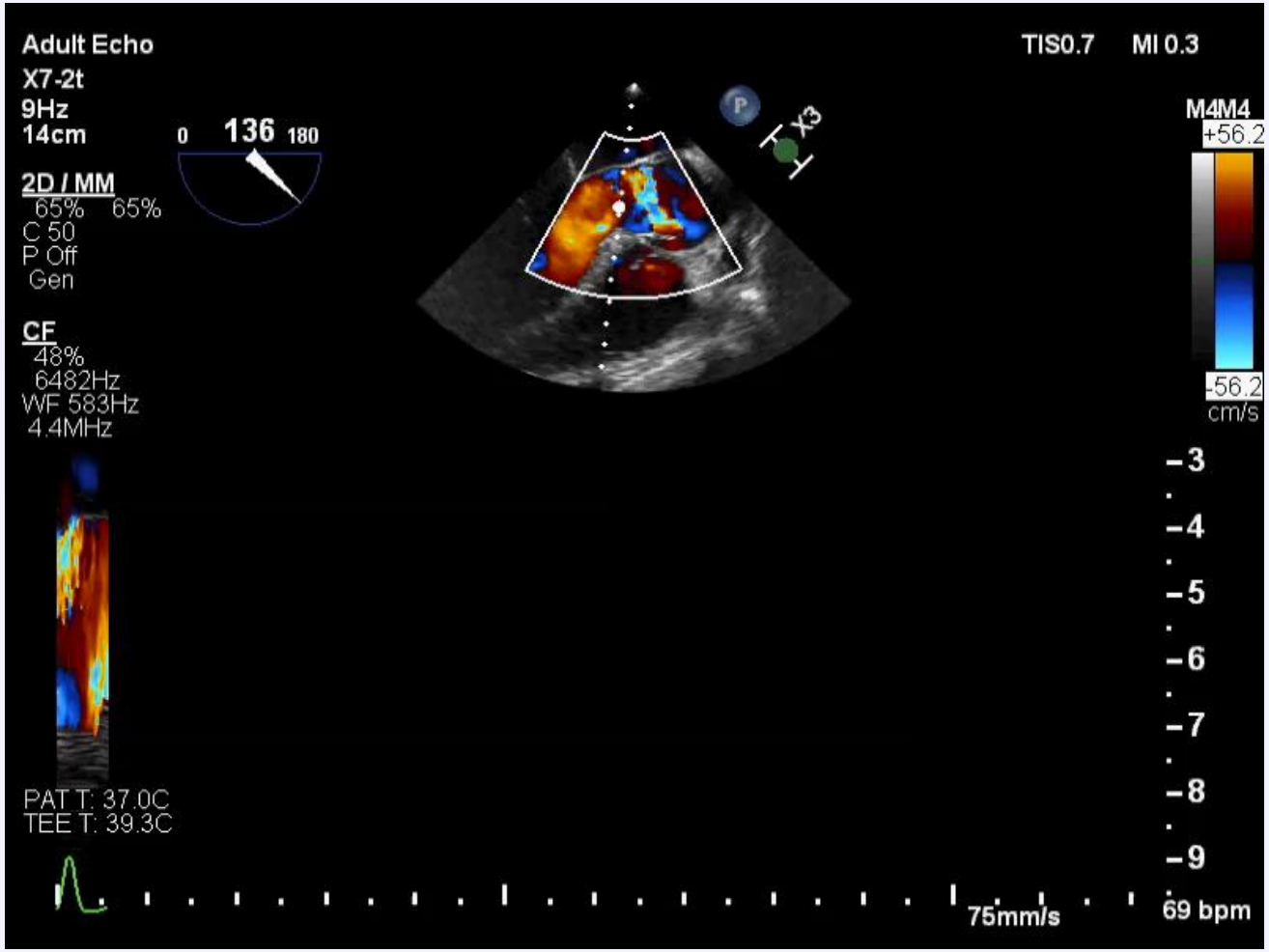
Severe AI seen mostly originating from the coaptation line of the prolapsed/flail RCC



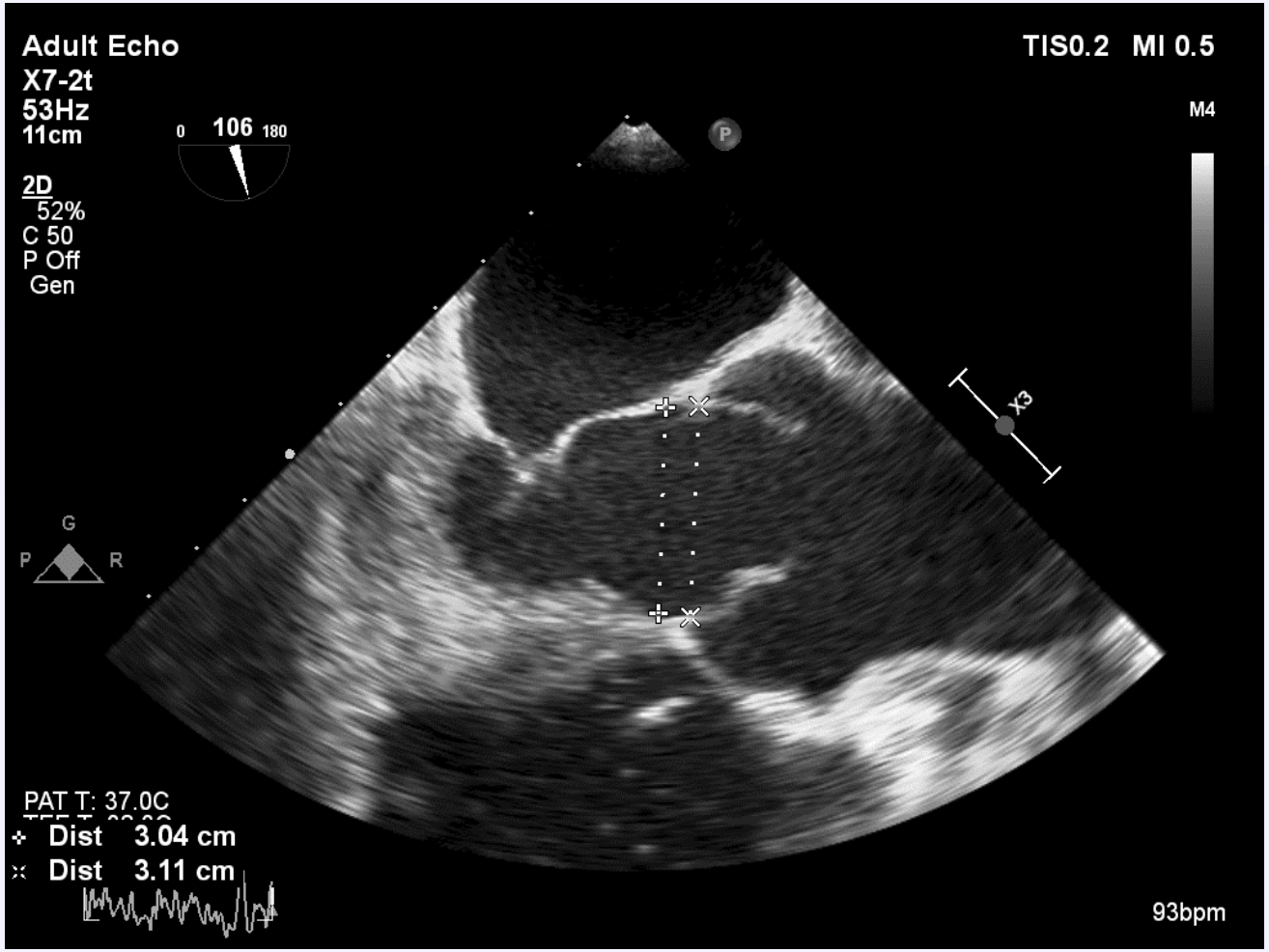
Lang axis view of the aortic valve showing severe prolapse/ flail of the RCC



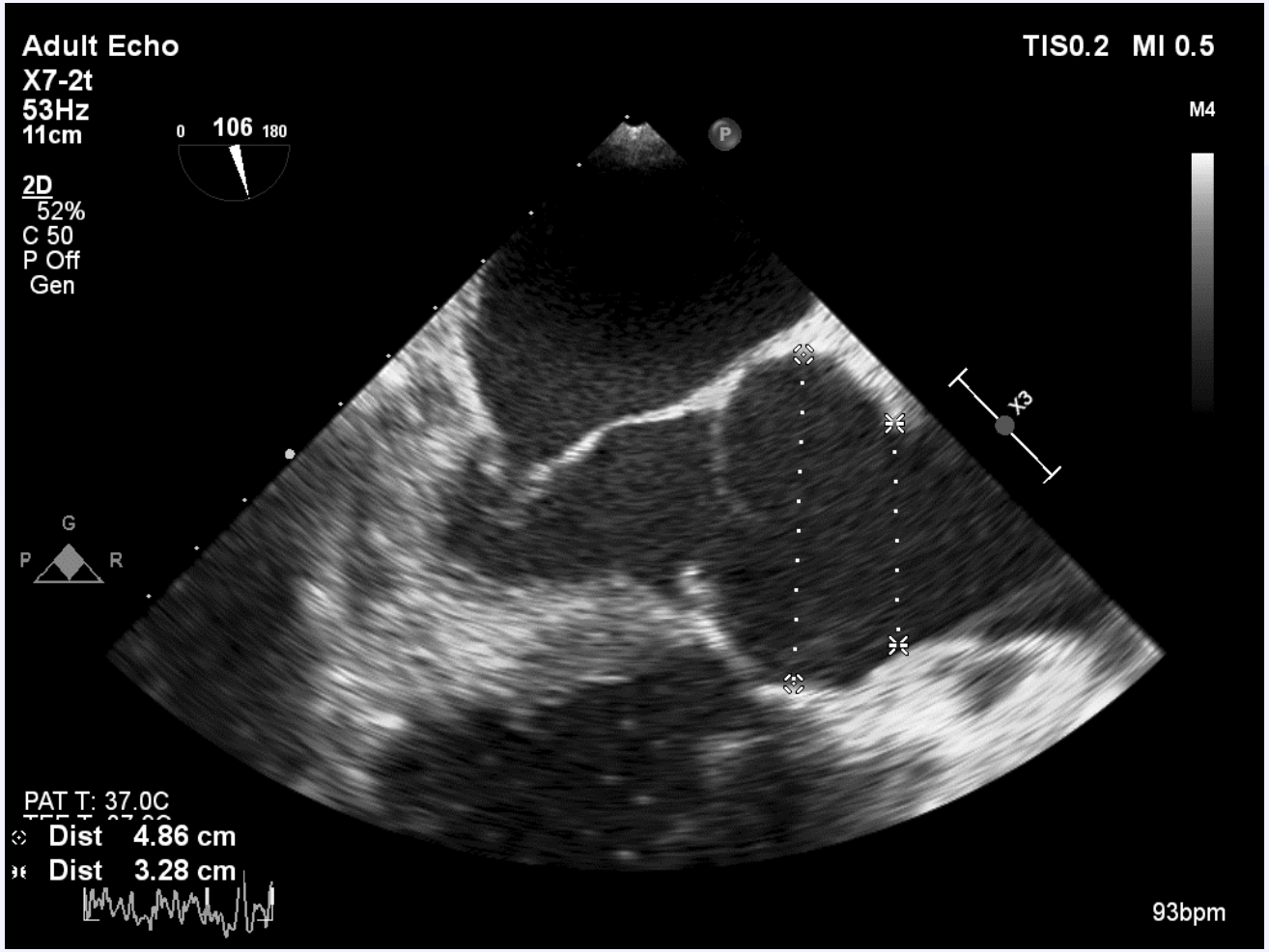
Lang axis view of the aortic valve showing severe prolapse/ flail of the RCC



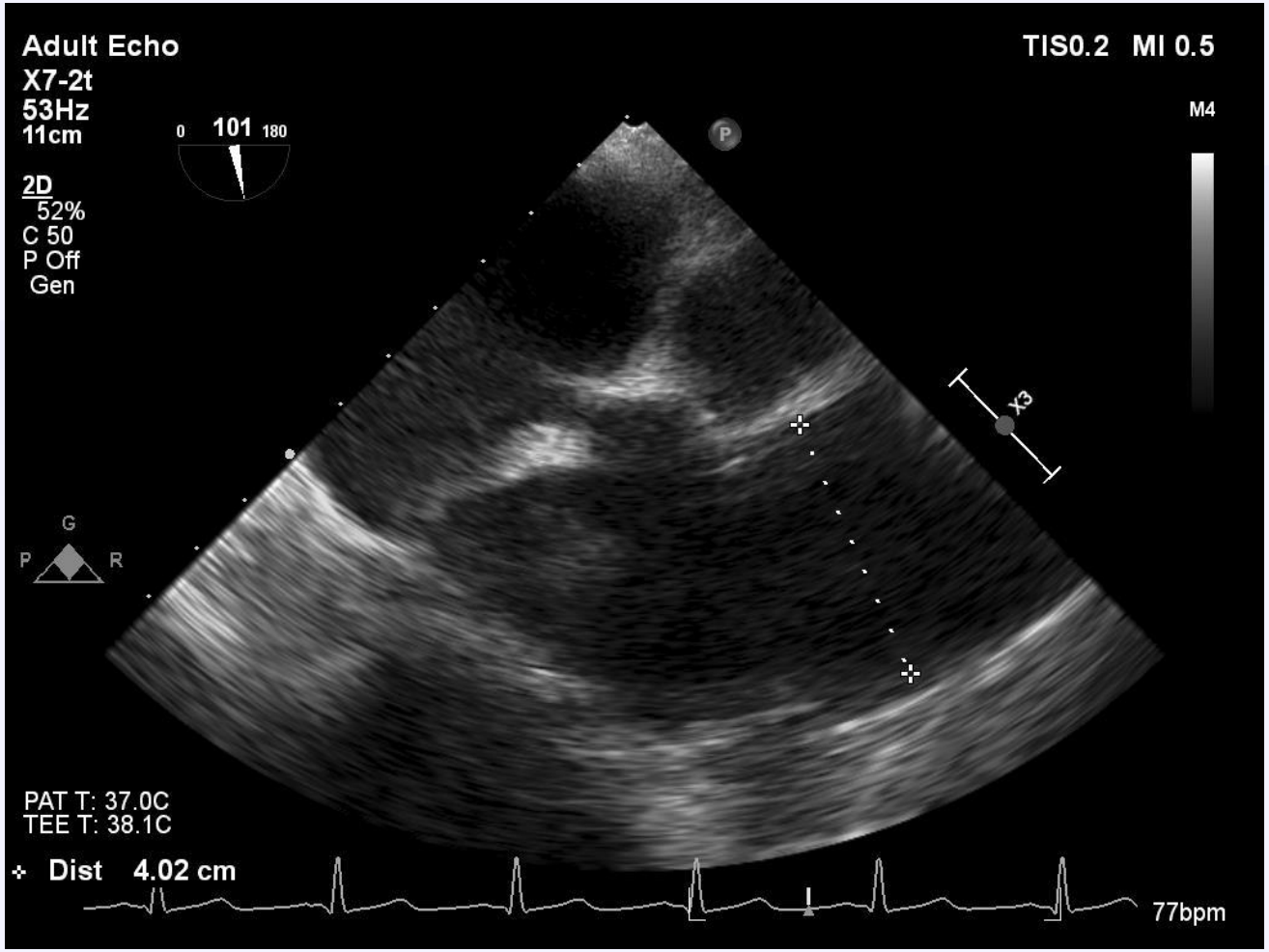
Lang axis view of the aortic valve showing severe AI



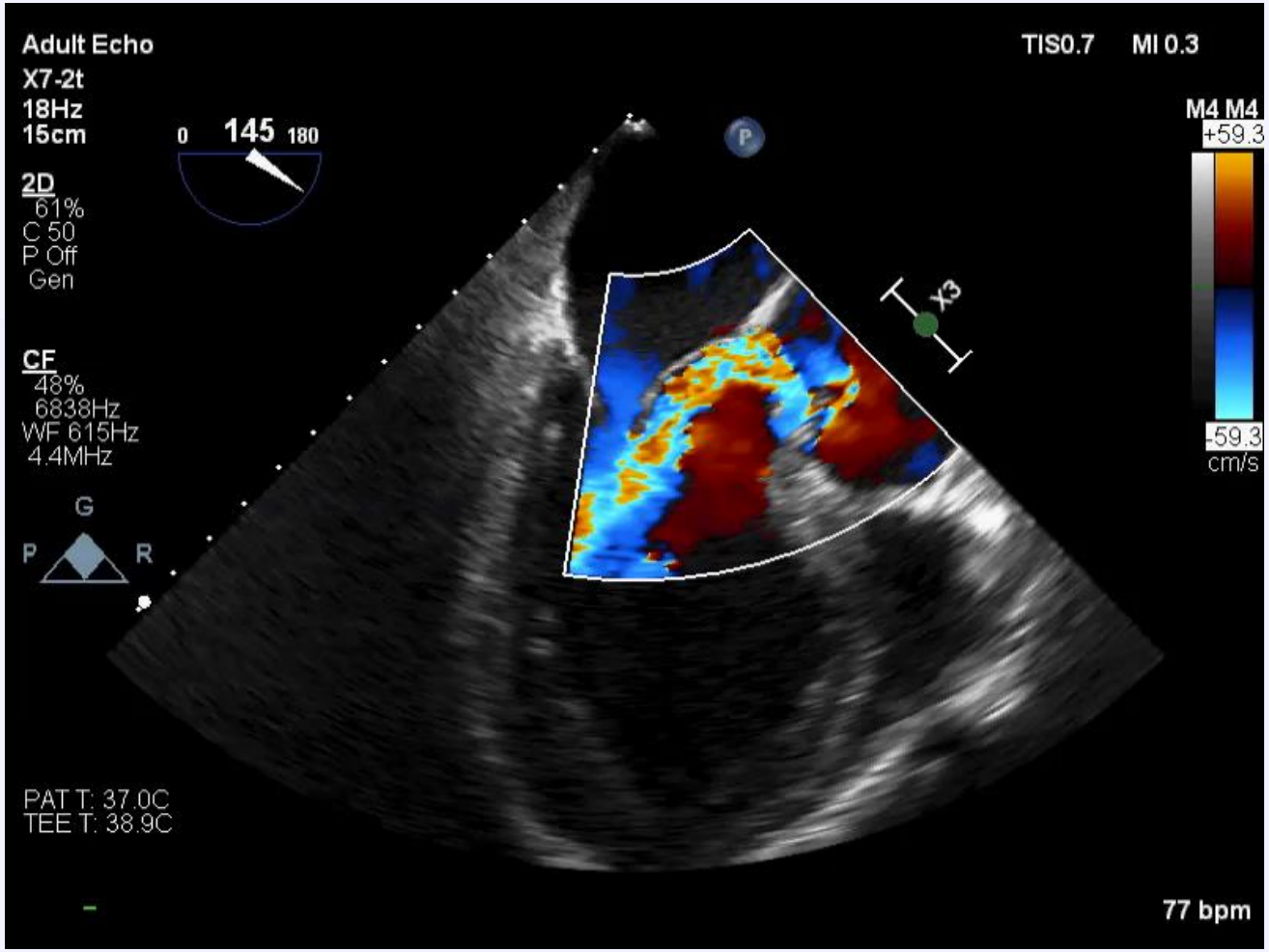
Lang axis view of the aortic root showing LVOT and aortic annular dimensions



Lang axis view of the aortic root showing sinus of Valsalva and STJ dimensions



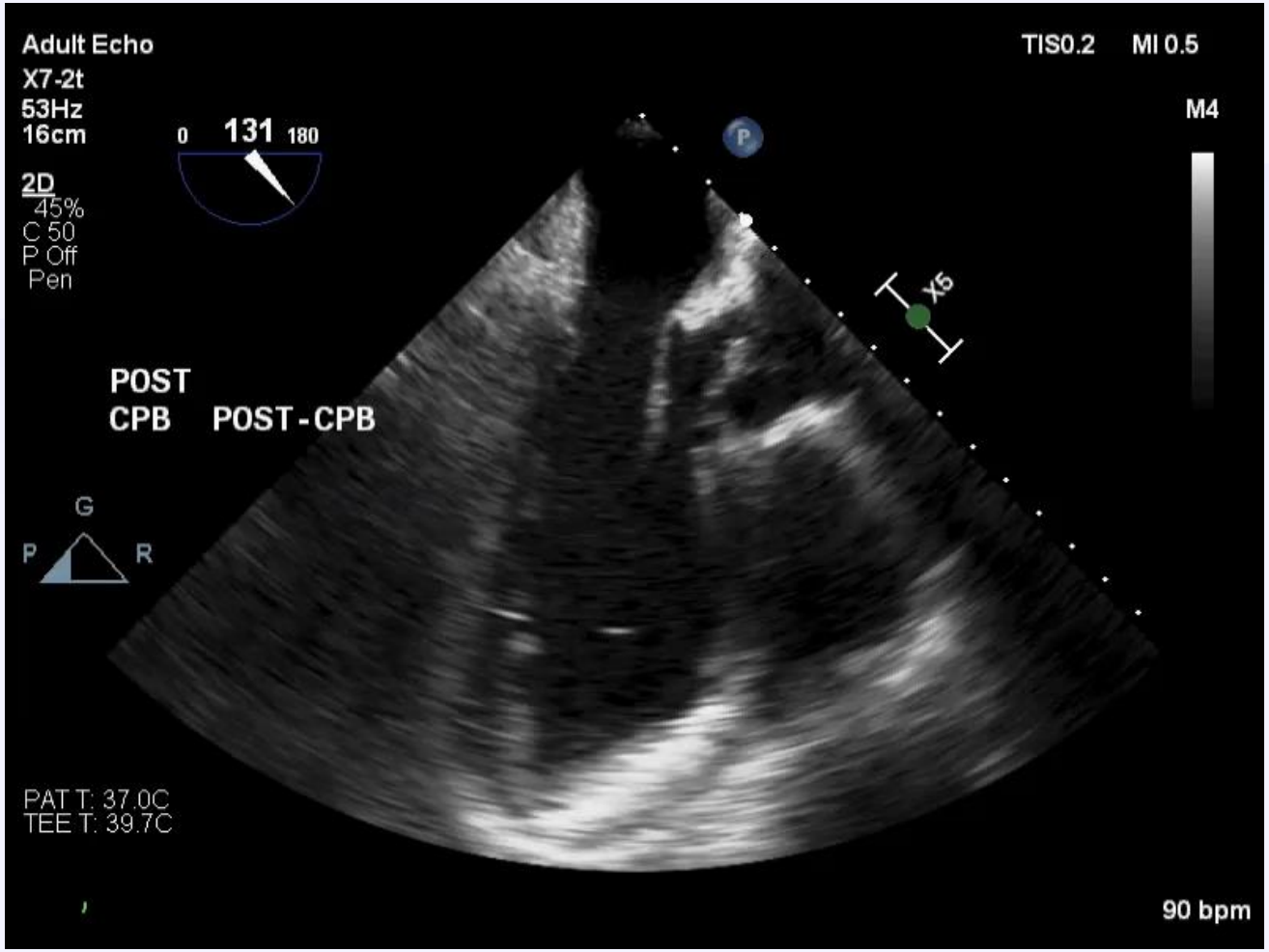
Lang axis view of the tubular ascending aorta showing the dimension



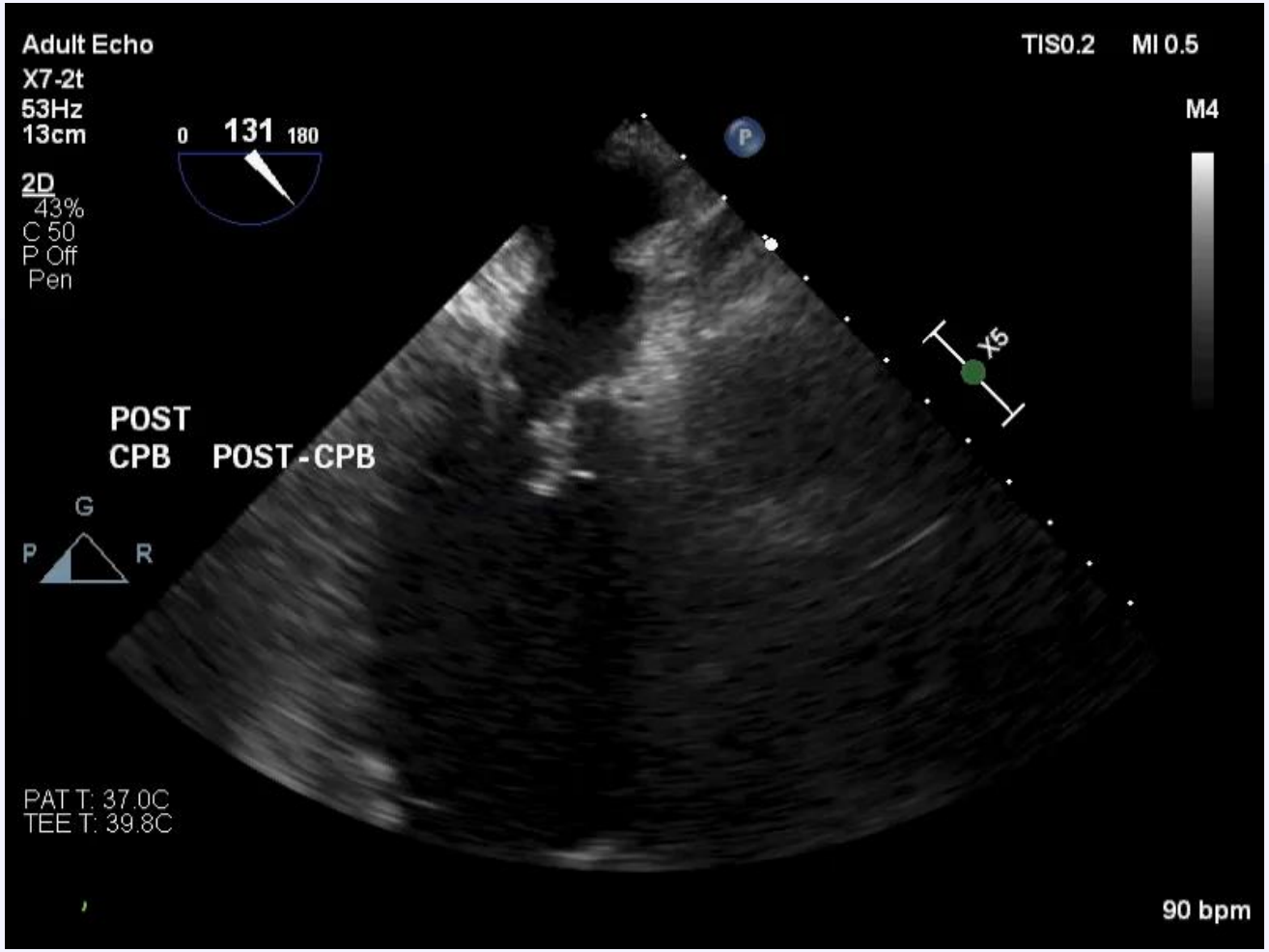
Lang axis view of the aortic valve showing severe eccentric posteriorly directed jet of AI due to flail RCC

Post op TEE

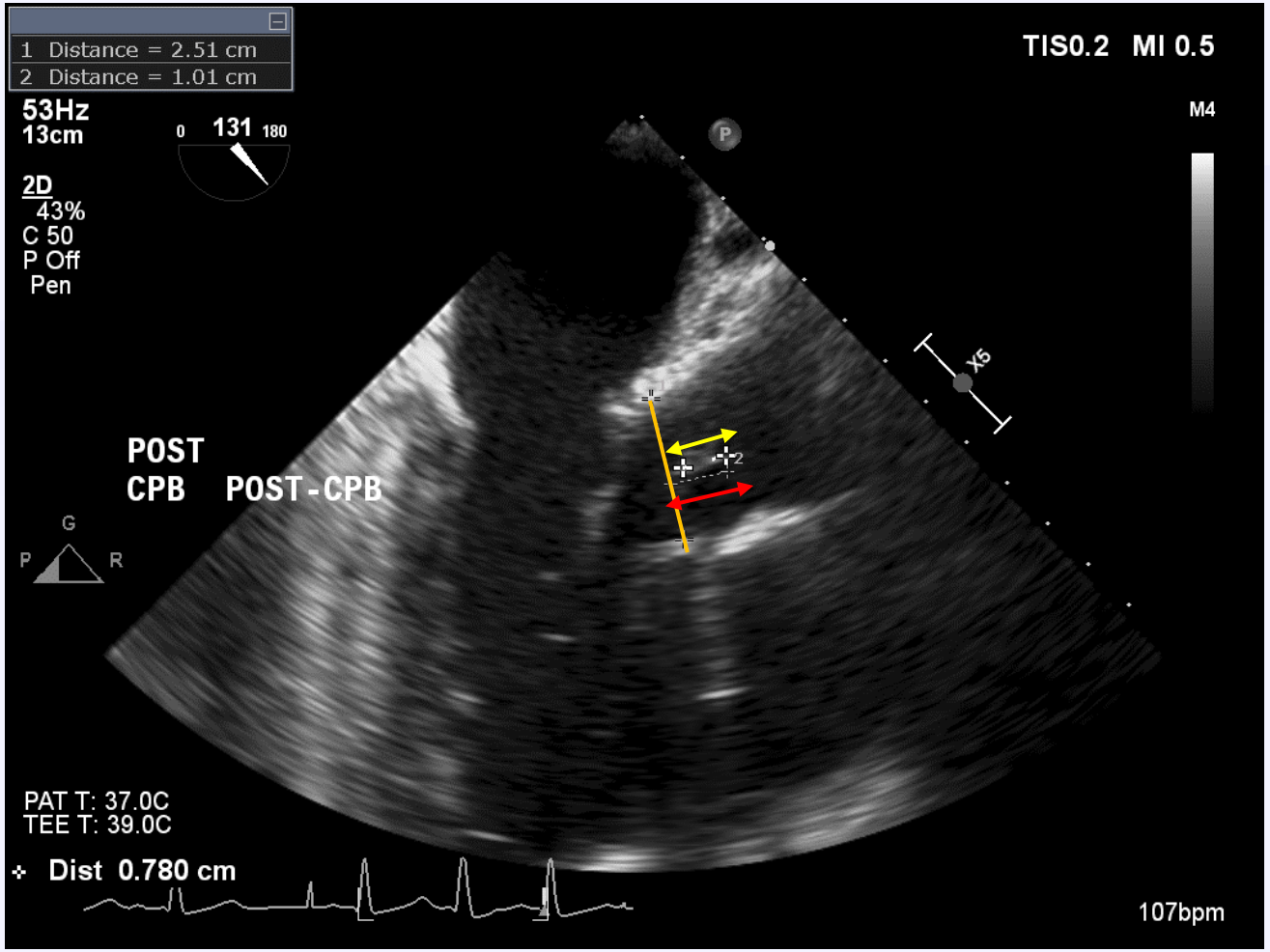
- Patient had aortic valve repair with Gore-Tex reinforcement of the RCC and LCC
- Aortic valve sparing operation (David Operation)



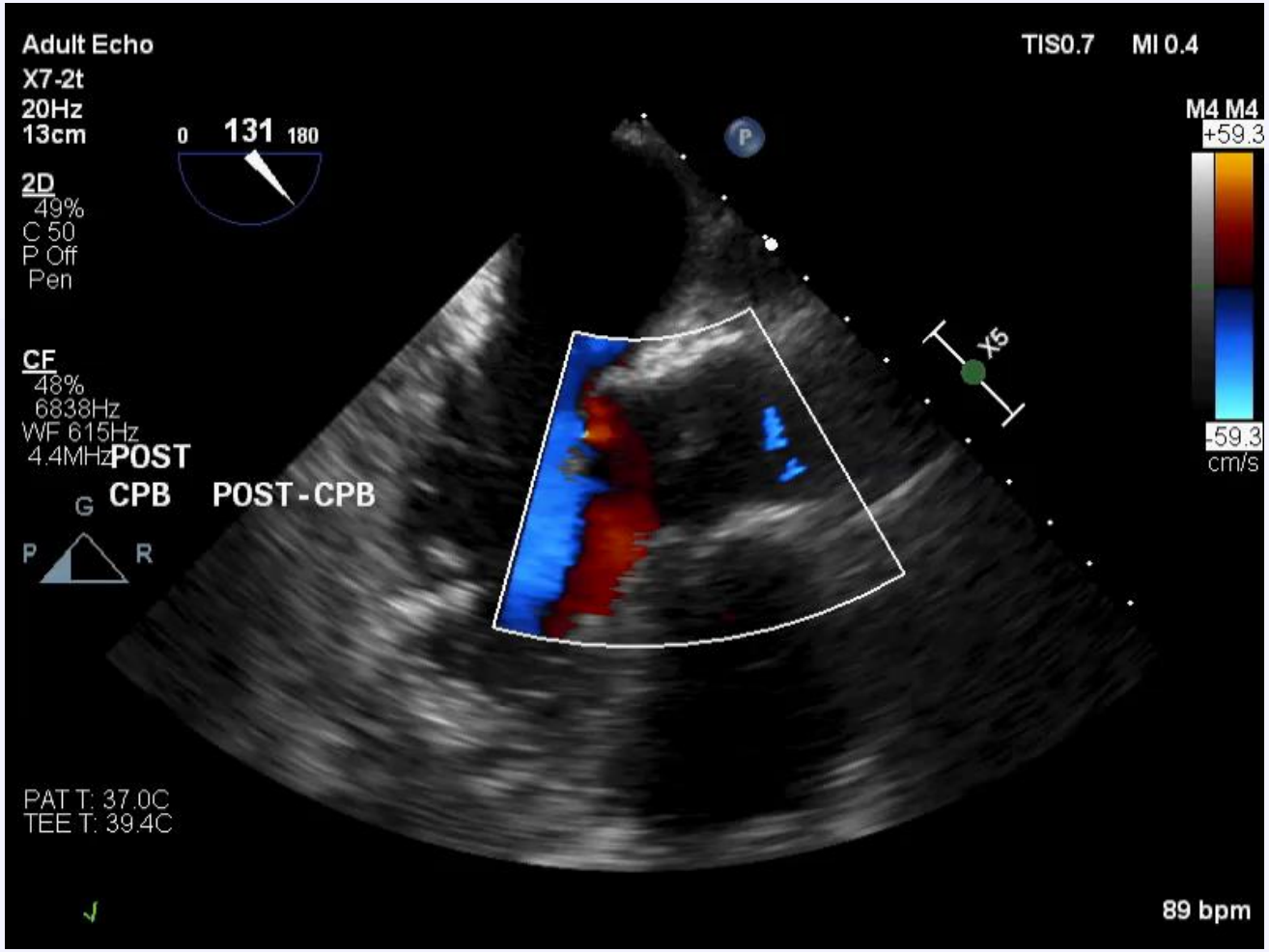
Post op, aortic valve repair with Gore-Tex re-inforcement of the RCC and LCC + David Operation



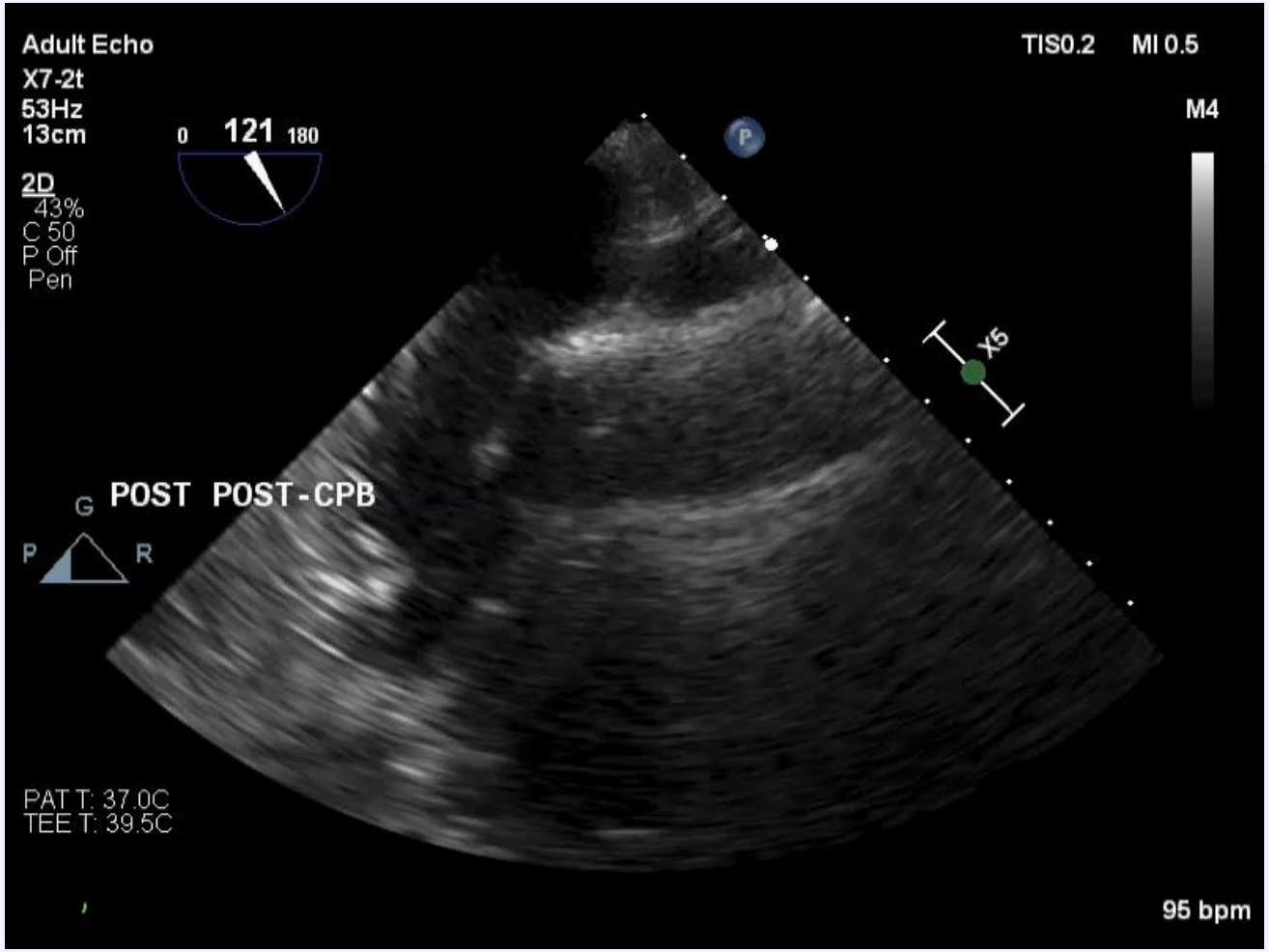
Aortic valve long axis view showing excellent coaptation of the aortic leaflets after repair



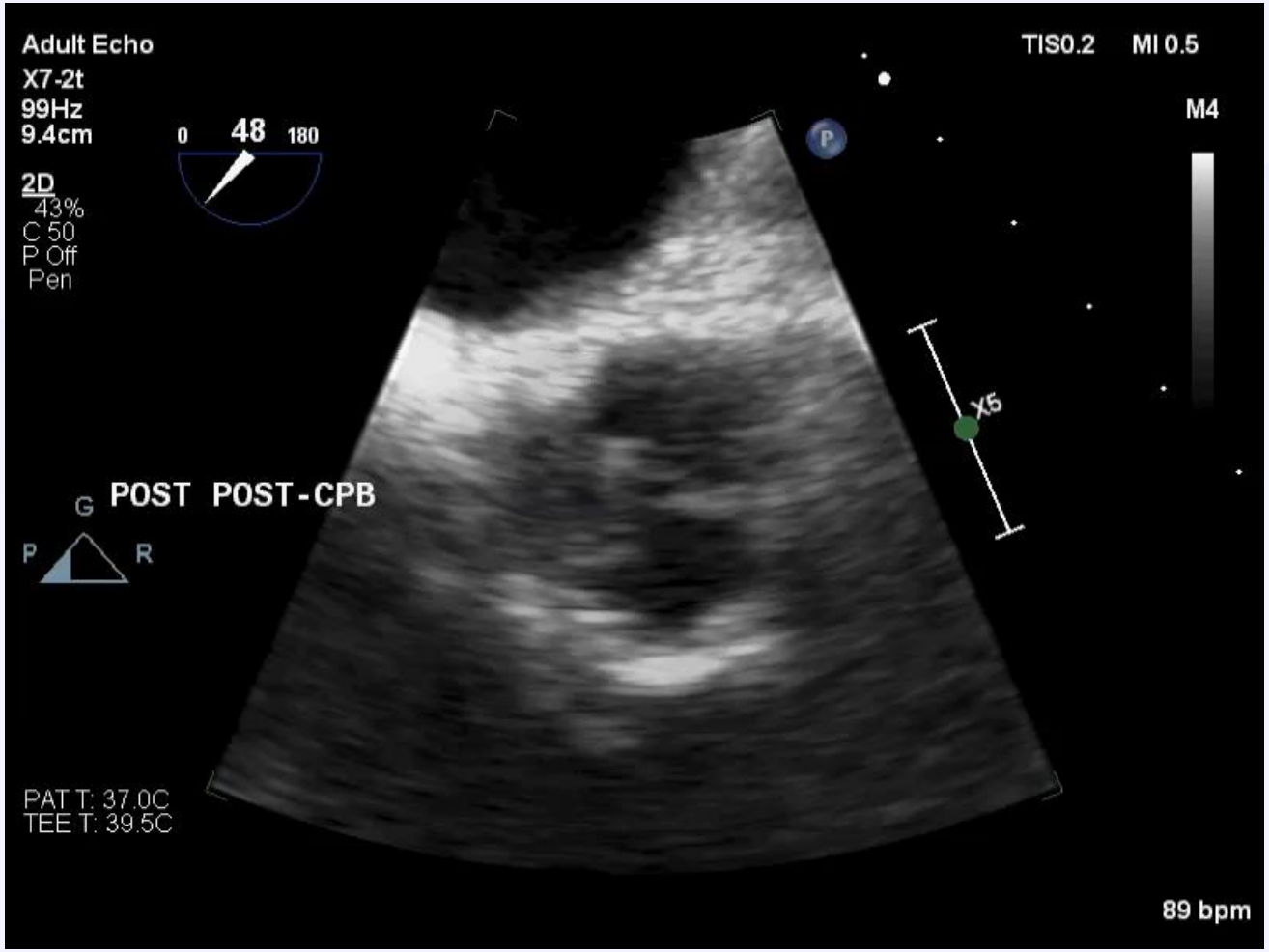
Measuring aortic valve coaptation height (length) = 8 mm (yellow) and aortic valve effective height (tip to the annulus) = 10 mm (red)



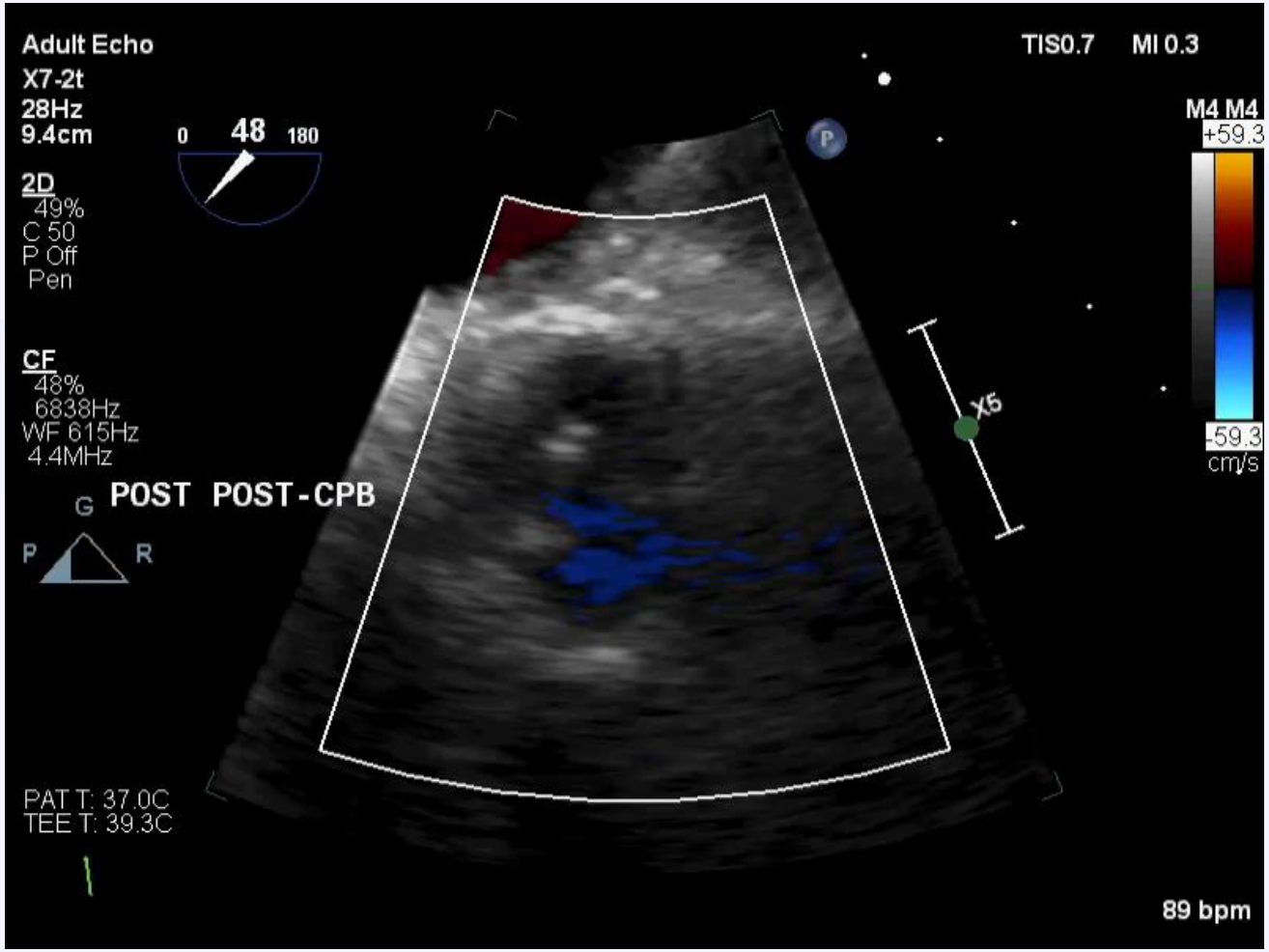
Aortic valve long axis view showing excellent repair of the valve with no AI (absolutely 0 !)



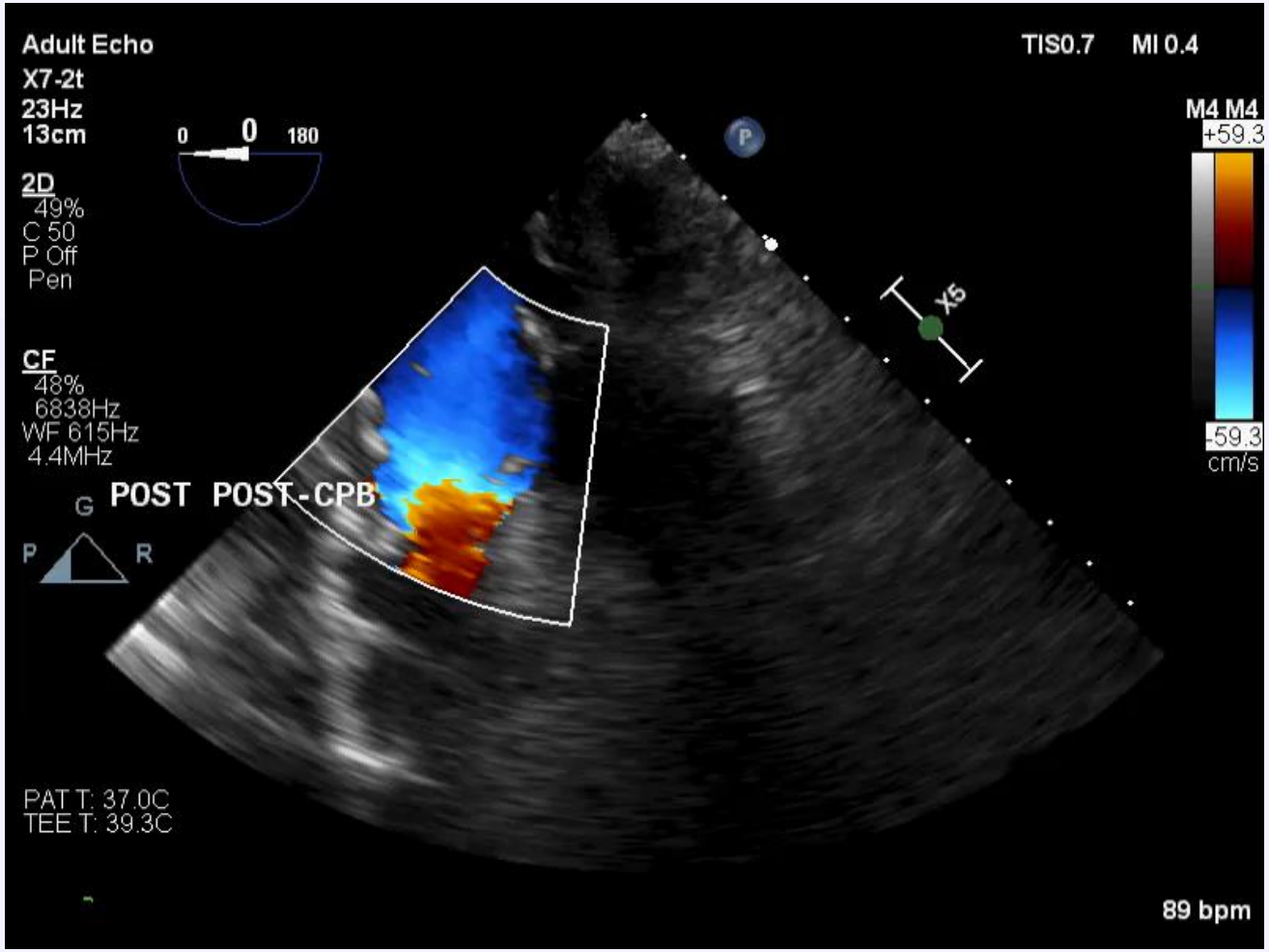
Ascending aorta showing Hemashield Dacron graft size # 32



Short axis view of the aortic valve showing Gore-Tex materials (brightness) on the RCC and LCC for repair, excellent coaptation of the leaflets



Short axis view of the aortic valve with no AI



Deep Transgastric view of the aortic valve confirming absolutely no AI !!

Valve-sparing root replacement in patients with bicuspid versus tricuspid aortic valves

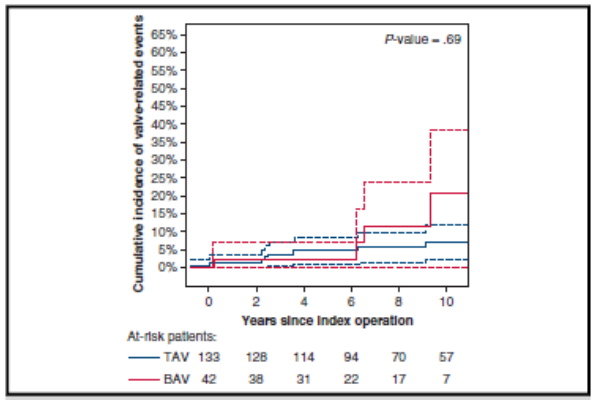
Maral Ouzounian, MD, PhD, Christopher M. Feindel, MD, MSc, Cedric Manlhiot, PhD, Carolyn David, RN, and Tirone E. David, MD

ABSTRACT

Objectives: We sought to compare the outcomes of patients undergoing aortic valve-sparing root replacement with bicuspid versus tricuspid aortic valves.

Methods: A total of 333 consecutive patients (bicuspid aortic valve, n = 45; tricuspid aortic valve, n = 288) underwent valve-sparing root replacement using the reimplantation technique from 1988 to 2012 at a single institution. The primary analysis was performed on a 1:3 bicuspid aortic valve:tricuspid aortic valve propensity-matched dataset to mitigate known differences between these 2 groups. In the matched, dataset, mean age (bicuspid aortic valve: 40 ± 13 years; tricuspid aortic valve: 41 ± 14) and rates of comorbidities were similar between groups. Patients with bicuspid aortic valves were less likely to have Marfan syndrome (bicuspid aortic valve: 9% vs tricuspid aortic valve: 53%, $P < .001$). Patients were followed prospectively with aortic root imaging for a median of 8.2 (5.3-12.2) years.

Results: Primary cusp repair was required more often in patients with bicuspid



Valve-related adverse events over time in patients undergoing AVS surgery.

Central Message

In well-selected patients with BAVs, valve-sparing root replacement offers excellent long-term clinical outcomes.

THE PRESENT AND FUTURE

JACC STATE-OF-THE-ART REVIEW

Ross Procedure in Adults for Cardiologists and Cardiac Surgeons

JACC State-of-the-Art Review

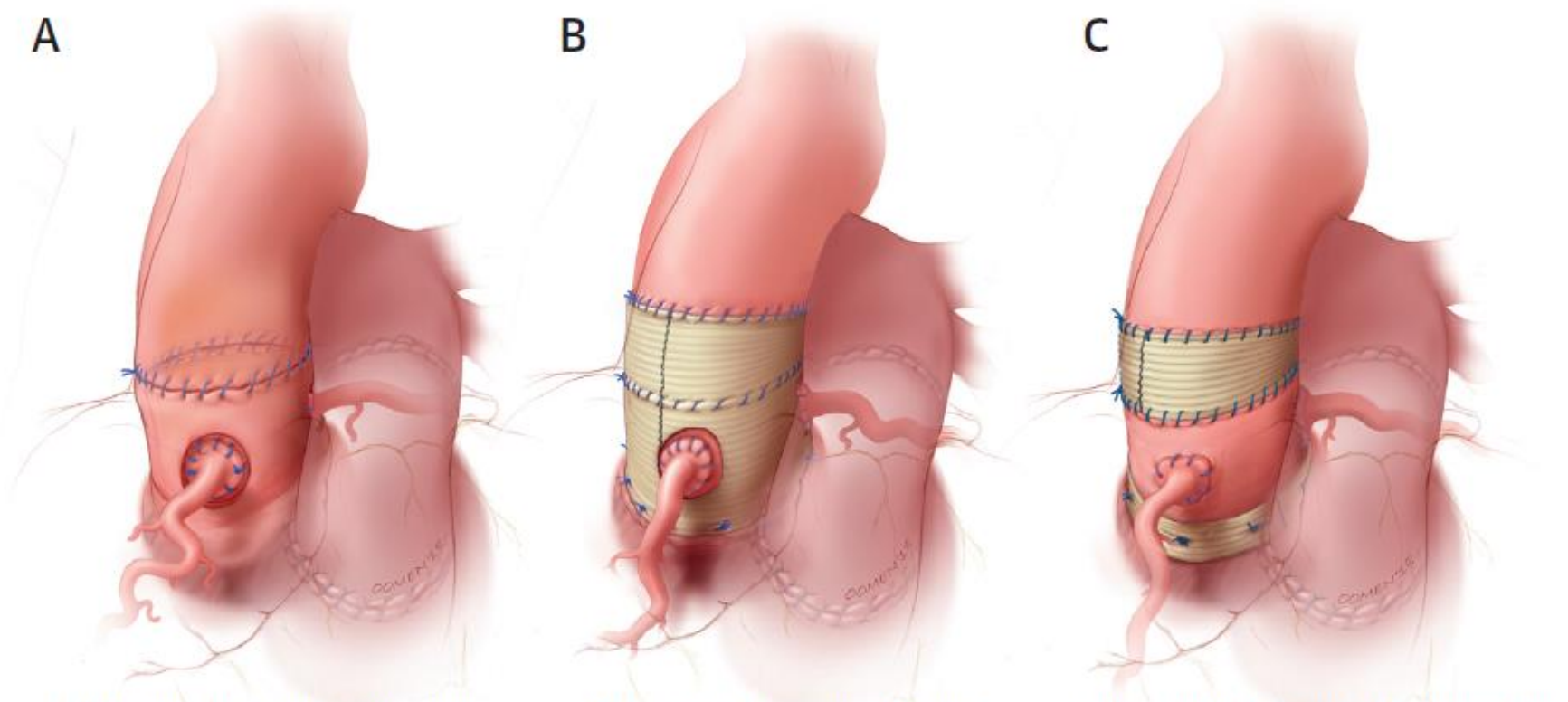
JACC 2018

Amine Mazine, MD, MSc,[a] Ismail El-Hamamsy, MD, PhD,[b] Subodh Verma, MD, PhD,[c] Mark D. Peterson, MD, PhD,[c] Robert O. Bonow, MD, MS,[d] Magdi H. Yacoub, MD, PhD,[e] Tirone E. David, MD,[f] Deepak L. Bhatt, MD, MPH[g]

ABSTRACT

The ideal aortic valve substitute for young and middle-aged adults remains elusive. The Ross procedure (pulmonary autograft replacement) is the only operation that allows replacement of the diseased aortic valve with a living substitute. However, use of this procedure has declined significantly due to concerns over increased surgical risk and potential long-term failure of the operation. Several recent publications from expert centers have shown that in the current era, the Ross procedure can be performed safely and reproducibly in appropriately selected patients. Furthermore, an increasing body of evidence suggests that the Ross procedure is associated with better long-term outcomes compared with conventional aortic valve replacement in young and middle-aged adults. In this paper, the authors review the indications and technical considerations of the Ross procedure, describe its advantages and drawbacks, and discuss patient selection criteria. Finally, the authors provide a comprehensive synthesis of the current Ross published reports to enable cardiologists and surgeons to make appropriate decisions for their patients with aortic valve disease. (J Am Coll Cardiol 2018;72:2761–77)

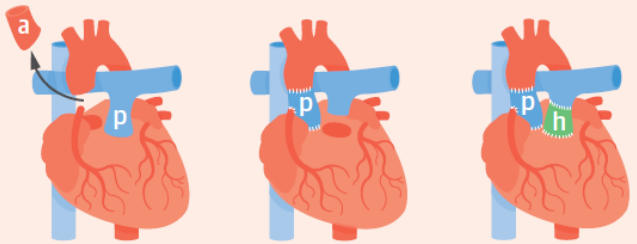
FIGURE 2 Technical Modifications of the Ross Procedure Aimed at Mitigating Late Autograft Dilatation and Insufficiency



(A) Autologous inclusion technique; **(B)** Dacron inclusion technique; **(C)** extra-aortic annuloplasty and interposition graft (Online Video 6).

CENTRAL ILLUSTRATION Algorithm for Patient Selection for the Ross Procedure

A THE ROSS PROCEDURE



The diseased aortic valve is removed

The pulmonic valve replaces the aortic valve

A homograft replaces the pulmonic valve

Advantages

- Excellent long-term survival
- Excellent quality of life
- Avoidance of anticoagulation
- Superior hemodynamics
- Low rates of valve-related complications

Potential Pitfalls

- Technical complexity
- Potential long-term failure of two valves
- Complexity of reoperations

B Patient Treatment Algorithm

High levels of physical activity and women contemplating pregnancy

Young/middle-aged adults with unrepairable aortic valve disease

Patients without: Familial aortopathy; connective tissue disorder; autoimmune disorder; limited life expectancy ≤15 years

Ideal anatomic substrate
Aortic stenosis
Small or normal-sized aortic annulus

Suboptimal anatomic substrate
Aortic insufficiency or mixed lesion with predominant aortic insufficiency
Dilated annulus (≥27 mm)
Aortic/pulmonary size (mismatch >2 mm)

Ross procedure (any technique)

Modified Ross procedure (autograft reinforcement)

Tight postoperative blood pressure control (for 6–12 months)

Mazine, A. et al. J Am Coll Cardiol. 2018;72(22):2761–77.

(A) Advantages and pitfalls of the Ross procedure; **(B)** indications and contraindications for the Ross procedure. This proposed algorithm remains to be further validated and supported by practice guidelines. a = aortic; p = pulmonic; h = homograft.

Echocardiographic Assessment of Valve Stenosis: EAE/ASE Recommendations for Clinical Practice

Helmut Baumgartner, MD,† Judy Hung, MD,‡ Javier Bermejo, MD, PhD,†
John B. Chambers, MD,† Arturo Evangelista, MD,† Brian P. Griffin, MD,‡ Bernard Iung, MD,†
Catherine M. Otto, MD,‡ Patricia A. Pellikka, MD,‡ and Miguel Quiñones, MD‡

JASE 2009

Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation

A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Magnetic Resonance

William A. Zoghbi, MD, FASE (Chair), David Adams, RCS, RDCS, FASE, Robert O. Bonow, MD, Maurice Enriquez-Sarano, MD, Elyse Foster, MD, FASE, Paul A. Grayburn, MD, FASE, Rebecca T. Hahn, MD, FASE, Yuchi Han, MD, MMSc,* Judy Hung, MD, FASE, Roberto M. Lang, MD, FASE, Stephen H. Little, MD, FASE, Dipan J. Shah, MD, MMSc,* Stanton Shernan, MD, FASE, Paaladinesh Thavendiranathan, MD, MSc, FASE,* James D. Thomas, MD, FASE, and Neil J. Weissman, MD, FASE, *Houston and Dallas, Texas; Durham, North Carolina; Chicago, Illinois; Rochester, Minnesota; San Francisco, California; New York, New York; Philadelphia, Pennsylvania; Boston, Massachusetts; Toronto, Ontario, Canada; and Washington, DC*

JASE 2017

Suggested reading materials

1. Echocardiographic Assessment of Valve Stenosis: EAE/ ASE Recommendations for Clinical Practice. JASE 2009.
2. 2017 AHA/ ACC Focused Update of the 2014 AHA/ ACC Guideline for the Management of Patients with Valvular Heart Disease.
3. Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation. A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Magnetic Resonance.

Questions

Question 1

Which of the following statements is CORRECT?

A. Quadricuspid aortic valve is the least common aortic valve pathology
B. Bicuspid aortic valve is always presenting as aortic stenosis
C. Unicuspid aortic valve will present only in infancy and children
D. Calcific aortic stenosis is always due to bicuspid aortic valve

Question 2

About bicuspid aortic valve (BAV) which of the following IS CORRECT?

A. Type 0 Sievers Classification is the most common type of BAV
B. Type 1 BAV is always with fusion of RCC and LCC
C. Type 0 is the easiest type for repair
D. Type 2 is mostly presenting with AI

Question 3

Which of the following valvular heart disease is more common in North America?

A. Rheumatic mitral regurgitation
B. Calcific aortic stenosis
C. Bicuspid aortic valve stenosis
D. Primary tricuspid regurgitation

Question 4

Which of the following statement about David operation IS CORRECT?

A. Bicuspid aortic valve is a contraindication for David operation
B. Aortic stenosis is a contraindication for David operation
C. In Marfan patients aortic root remodeling is better than aortic valve reimplantation
D. In patients with aortic annulus more than 2.8 cm, long-term result of David operation is not good

Question 5

All of the following statements about Ross Operation is correct EXCEPT

A. Ross operation is an ideal operation for female in child-bearing age
B. Patients with aortic regurgitation and dilated aortic annulus are not suitable candidates
C. Aortic /pulmonary root size mismatch more than 2 mm are suboptimal candidates
D. Congenital aortic stenosis is a contraindication for Ross operation

Correct Answers

1- A
2- C
3- B
4- B
5- D


Toronto
Thank you.