Ahmad S. Omran MD, FACC, FESC, FASE

Cardiology Consultant

Department of Anesthesia and Pain Management

Toronto General Hospital- UHN

University of Toronto

UHN Toronto General Toronto Western Princess Margaret Toronto Rehab
COURAGE LIVES HERE

UNIVERSITY OF TORONTO

Cardiomyopathies

Aug 29, 2019
Department of Anesthesia and Pain Management- TGH, Toronto

WHO definition of cardiomyopathy:

"Disease of the myocardium associated with cardiac dysfunction"

World Health Organization/International Society and Federation of Cardiology Task Force on the Definition and Classification of Cardiomyopathies

- Dilated Cardiomyopahty
- Hypertrophic Cardiomyopathy
- Restrictive Cardiomyopahty
- Arrhythmogenic Right Ventricular Cardiomyopathy
- Unclassified Cardiomyopathies
  - Fibroelastosis
  - Noncompacted myocardium
  - Systolic dysfunction with minimal dilatation
  - Mitochondrial involvement
- Specific Cardiomyopahties
  - Ischemic cardiomyopathy
  - Valvular cardiomyopahty
  - Hypertensive cardiomyopathy
  - Inflammatory cardiomyopathy
  - Metabolic cardiomyopathy
  - General system disease
  - Muscular distrophies
  - Neuromuscular disorders
  - Sensitivity and toxic reactions
  - Peripartum cardiomyopathy

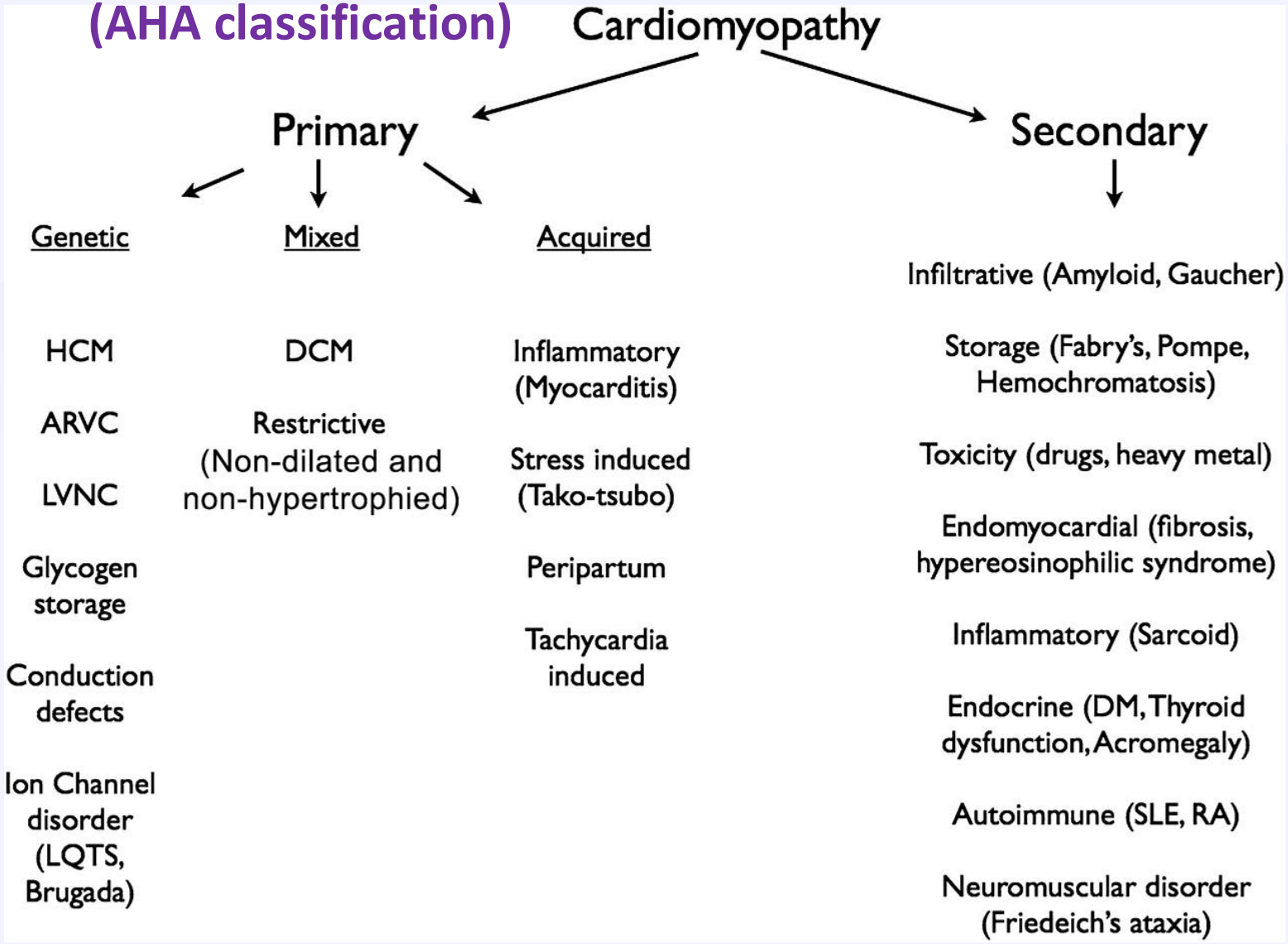
AHA Expert panel definition of cardiomyopathy:

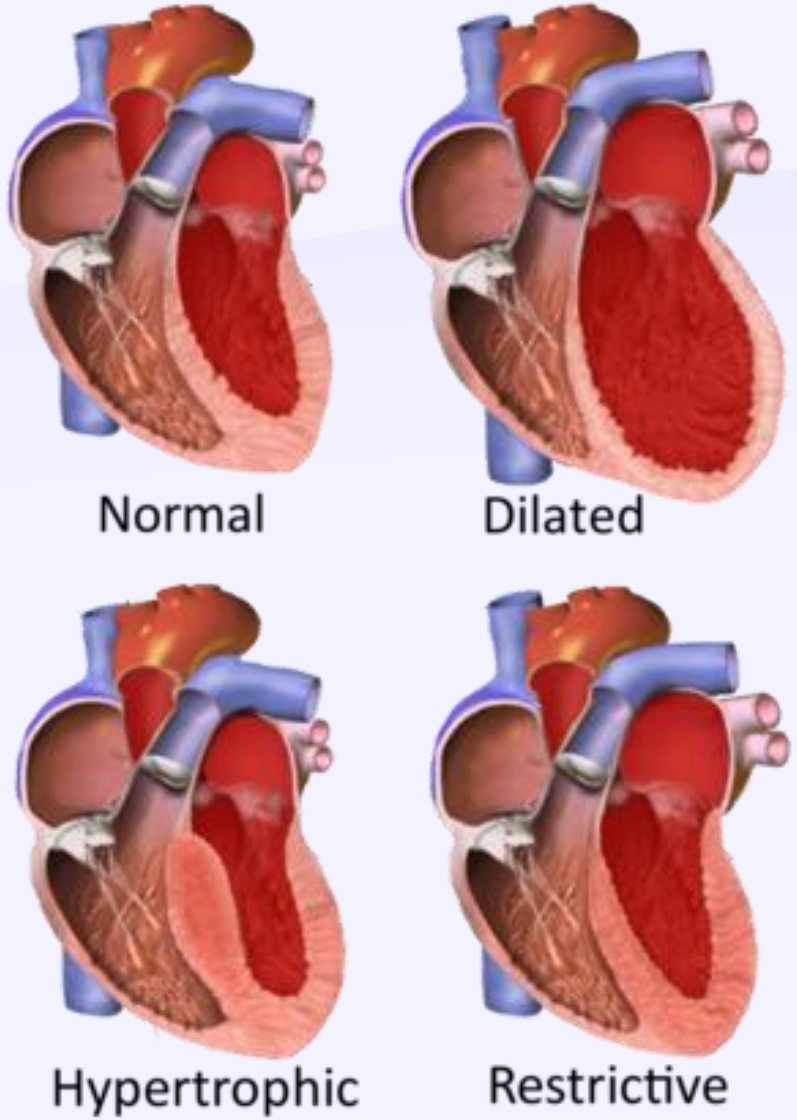
- "A heterogeneous group of disease of the myocardium associated with mechanical and or / electrical dysfunction that usually (not invariably) exhibit inappropriate ventricular hypertrophy or dilatation and are due to variety of causes that frequently are genetic

- Cardiomyopathies are either confined to the heart or are part of generalized systemic disorders often leading to cardiovascular death or progressive heart failure- related disability".

Maron BJ, et al. Circulation 2006

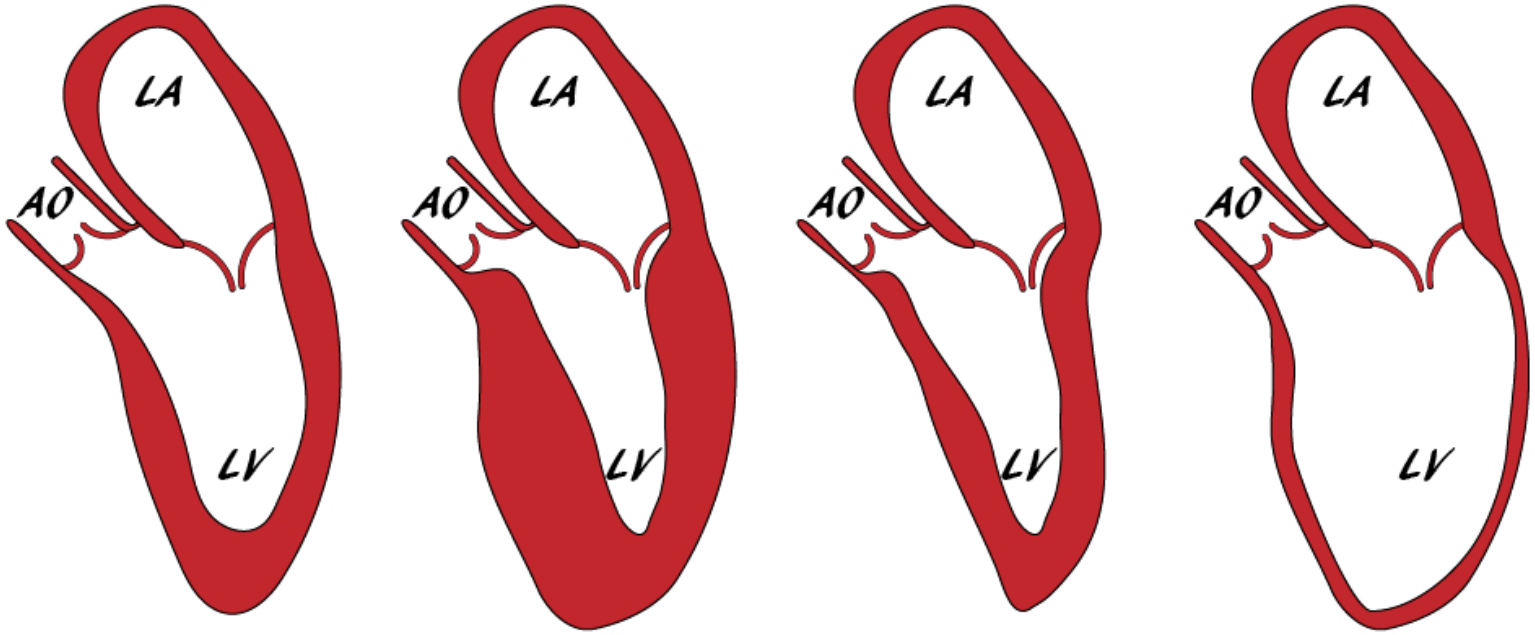
(AHA classification)




Normal
Dilated
Hypertrophic
Restrictive

Cardiomyopathy

Apical, Long Axis, Three Chamber View



Normal Heart

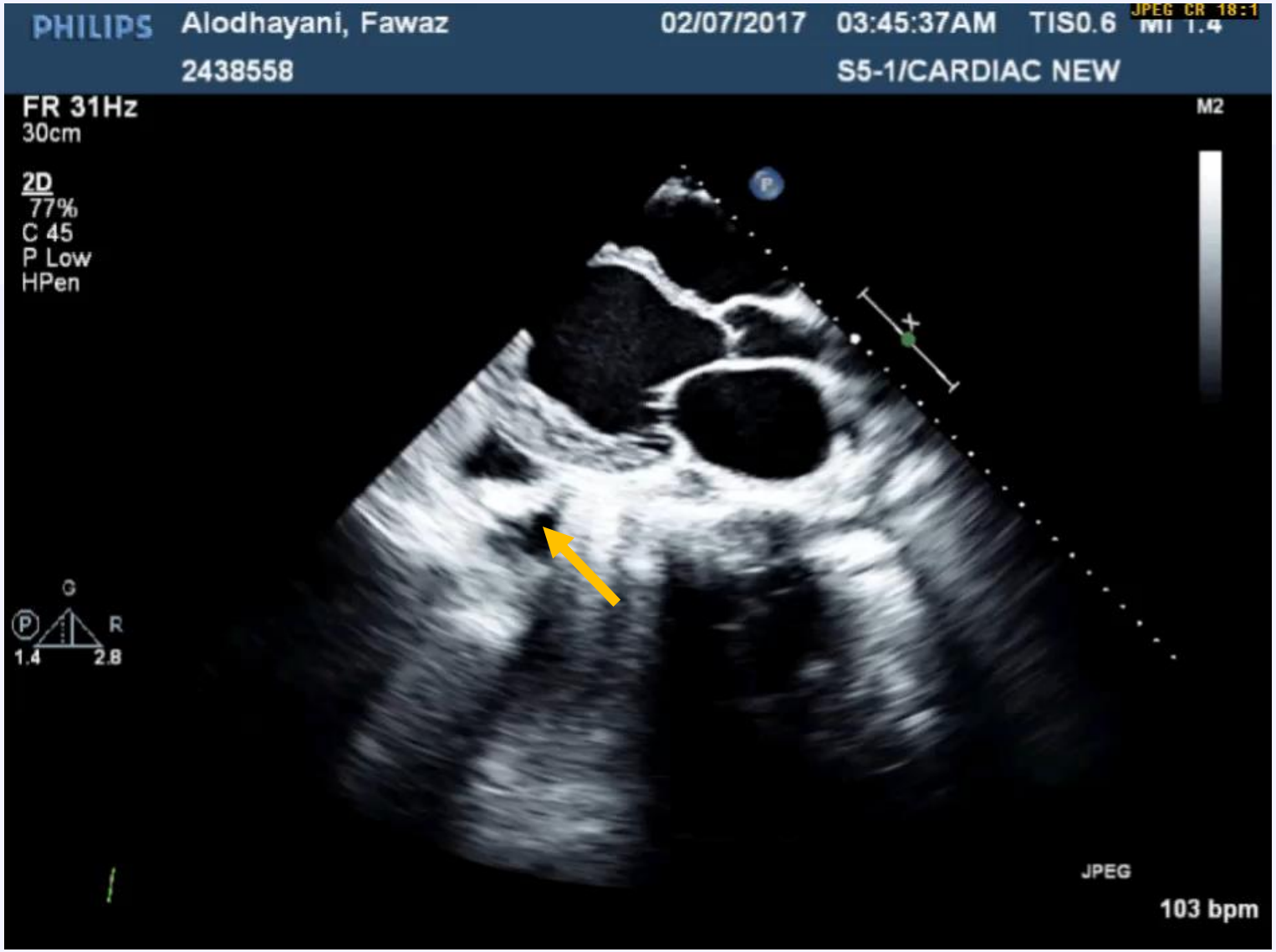
Hypertrophic Cardiomyopathy

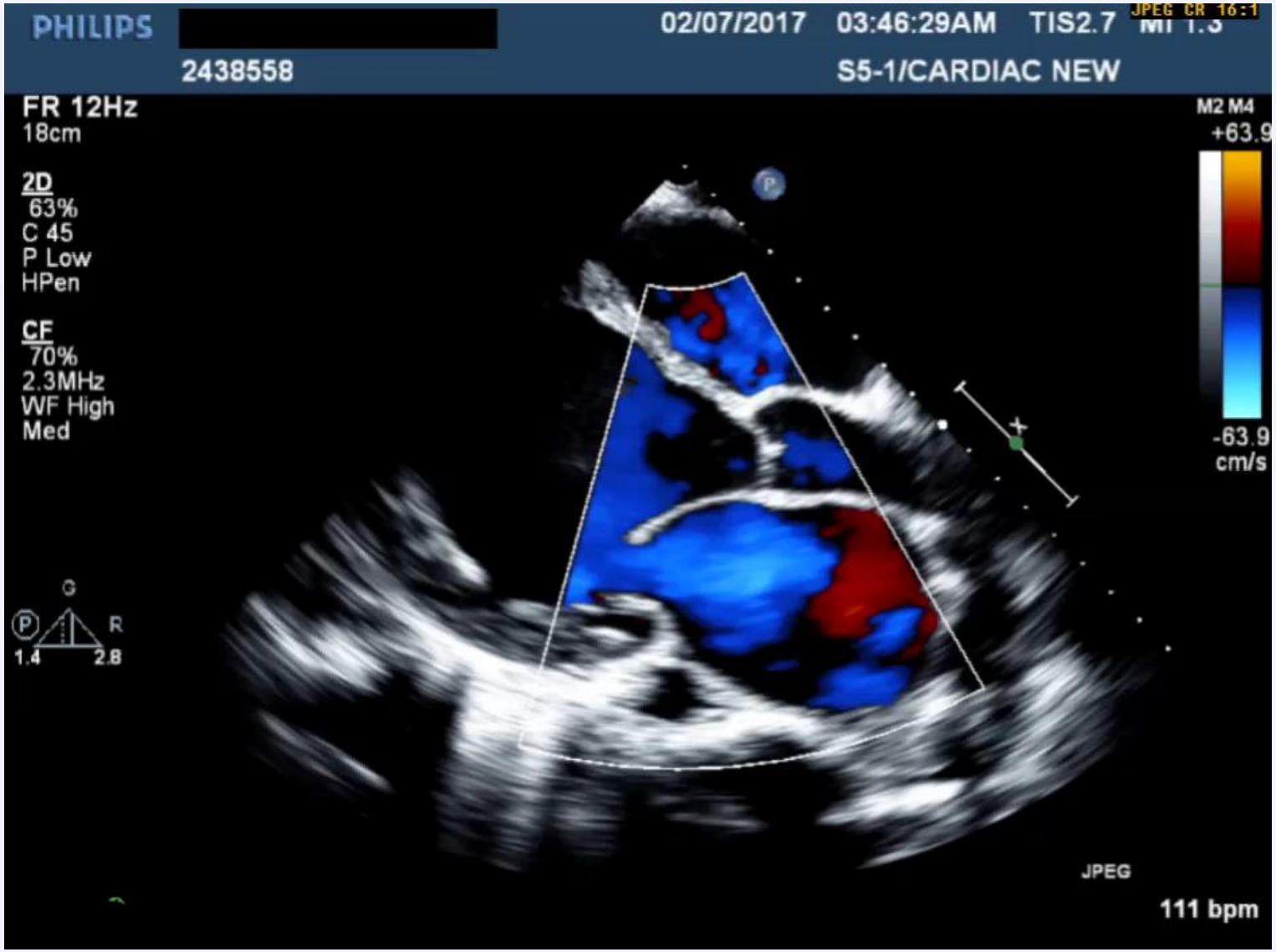
Restrictive Cardiomyopathy

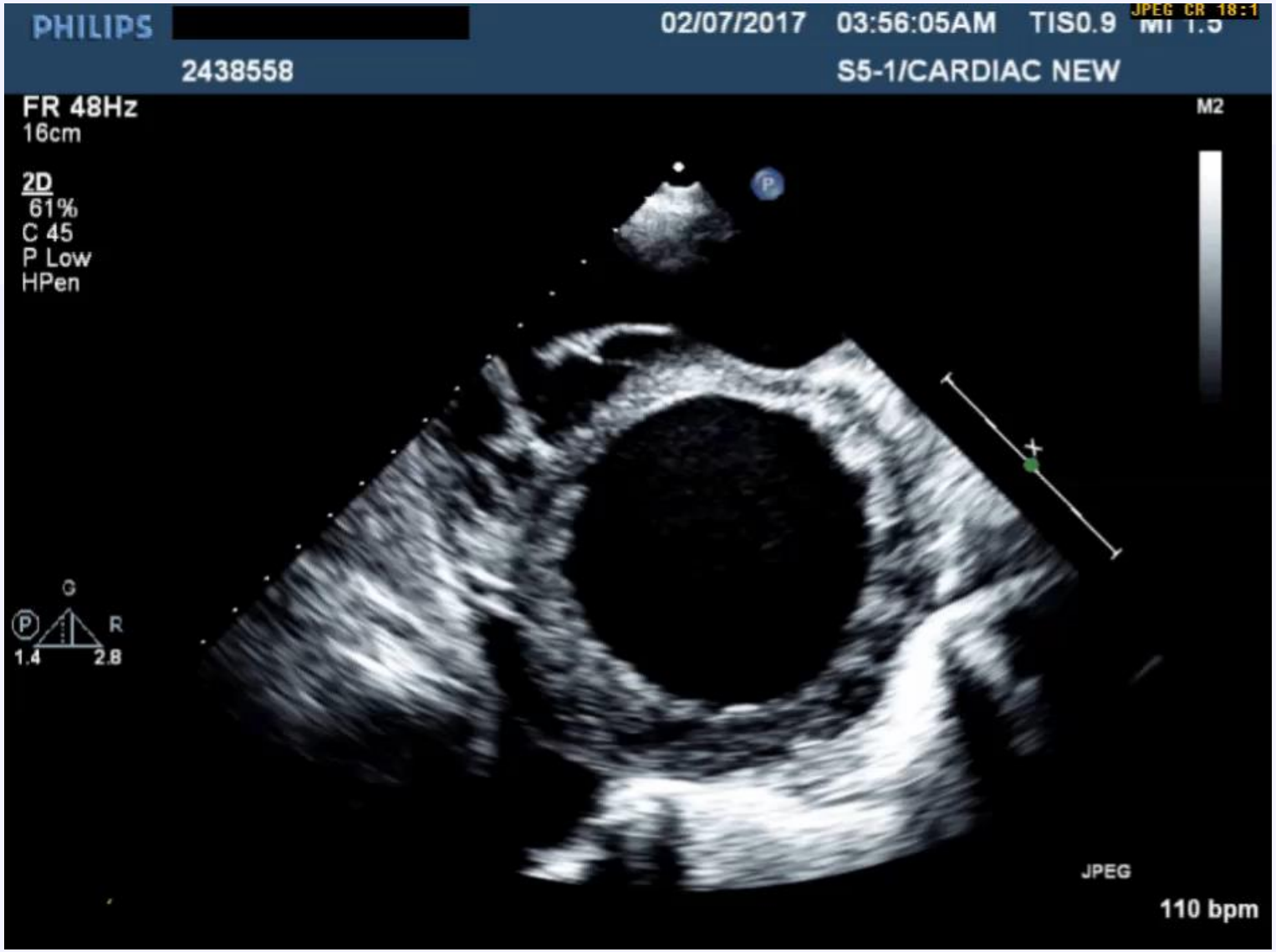
Dilated Cardiomyopathy

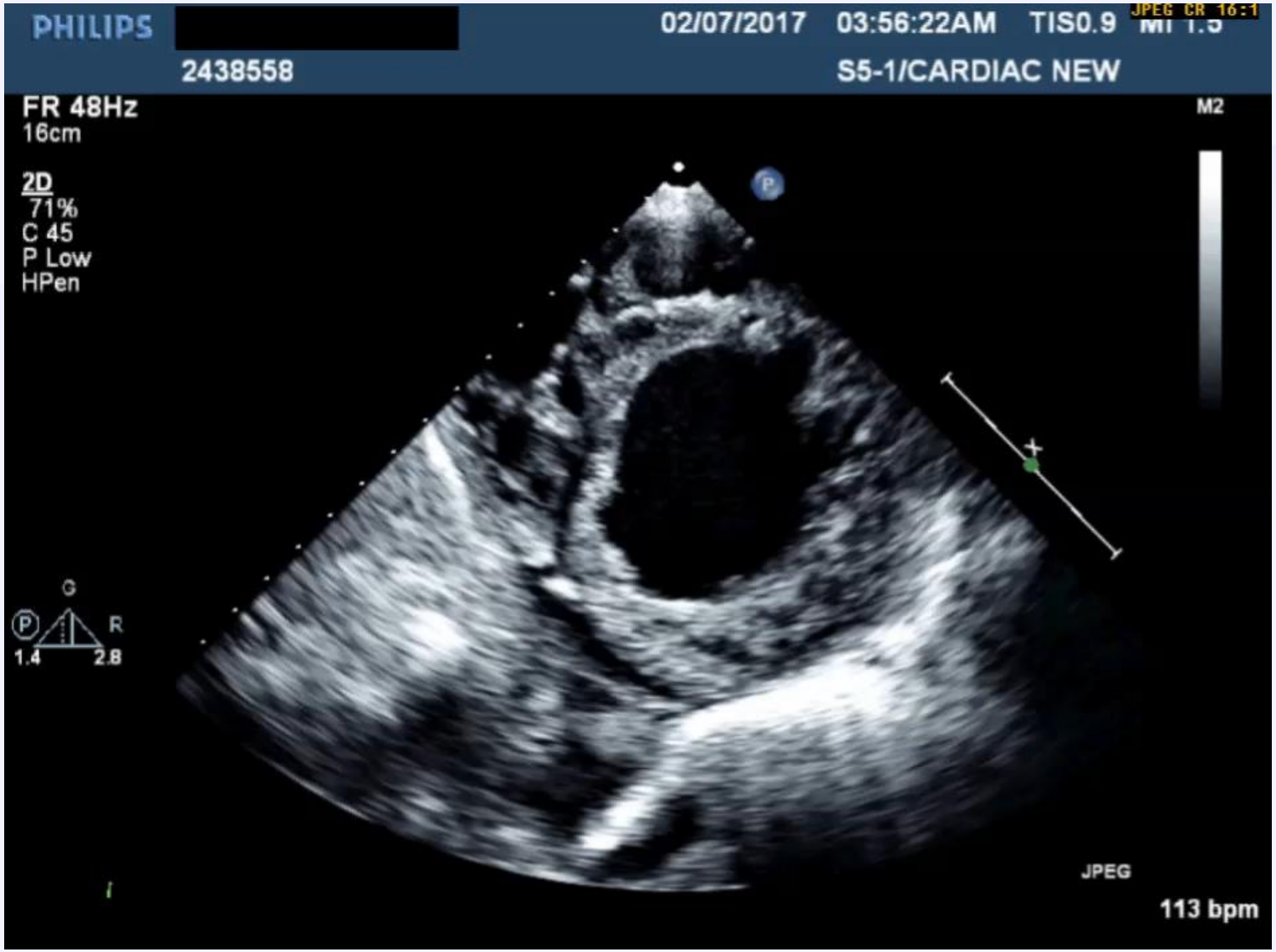
Case 1

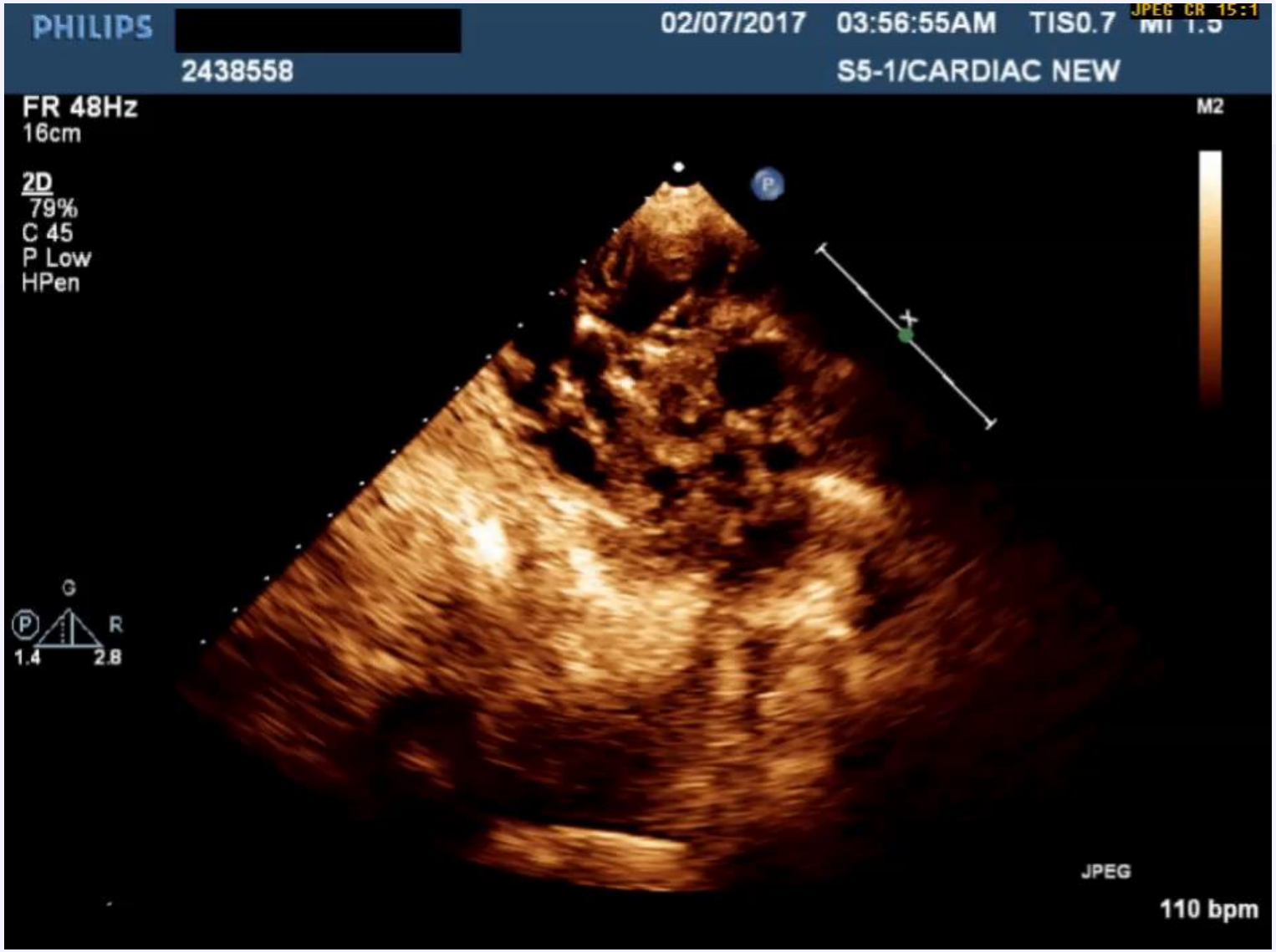
- 29-year-old man presented with SOB. Echocardiography was requested to rule out cardiac tamponade

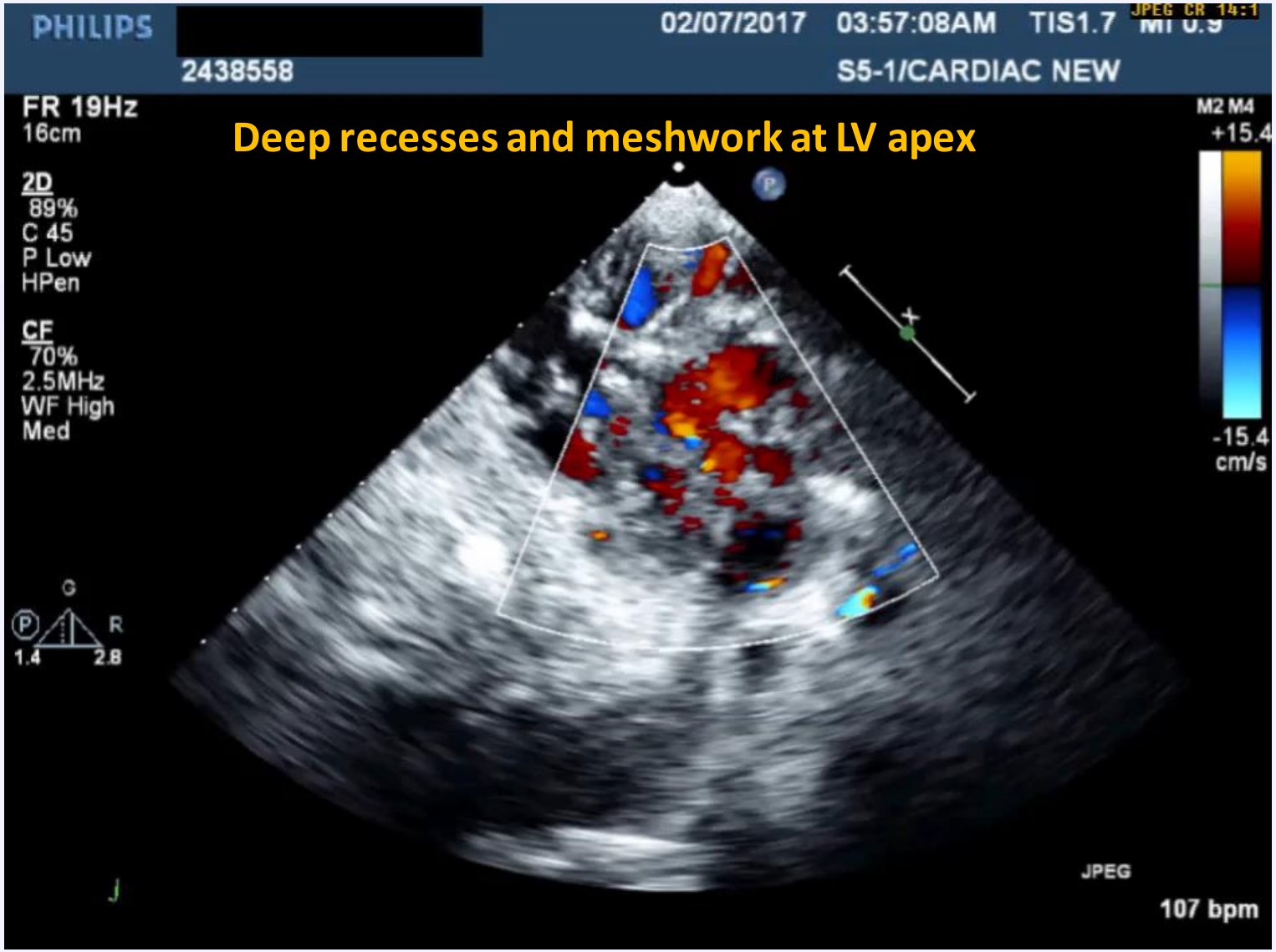

PHILIPS
Alodhayani, Fawaz
2438558
02/07/2017
03:45:37AM
TIS0.6
S5-1/CARDIAC NEW
FR 31Hz
30cm
2D
77%
C 45
P Low
HPen
M2
C
P
R
1.4
2.8
JPEG
103 bpm

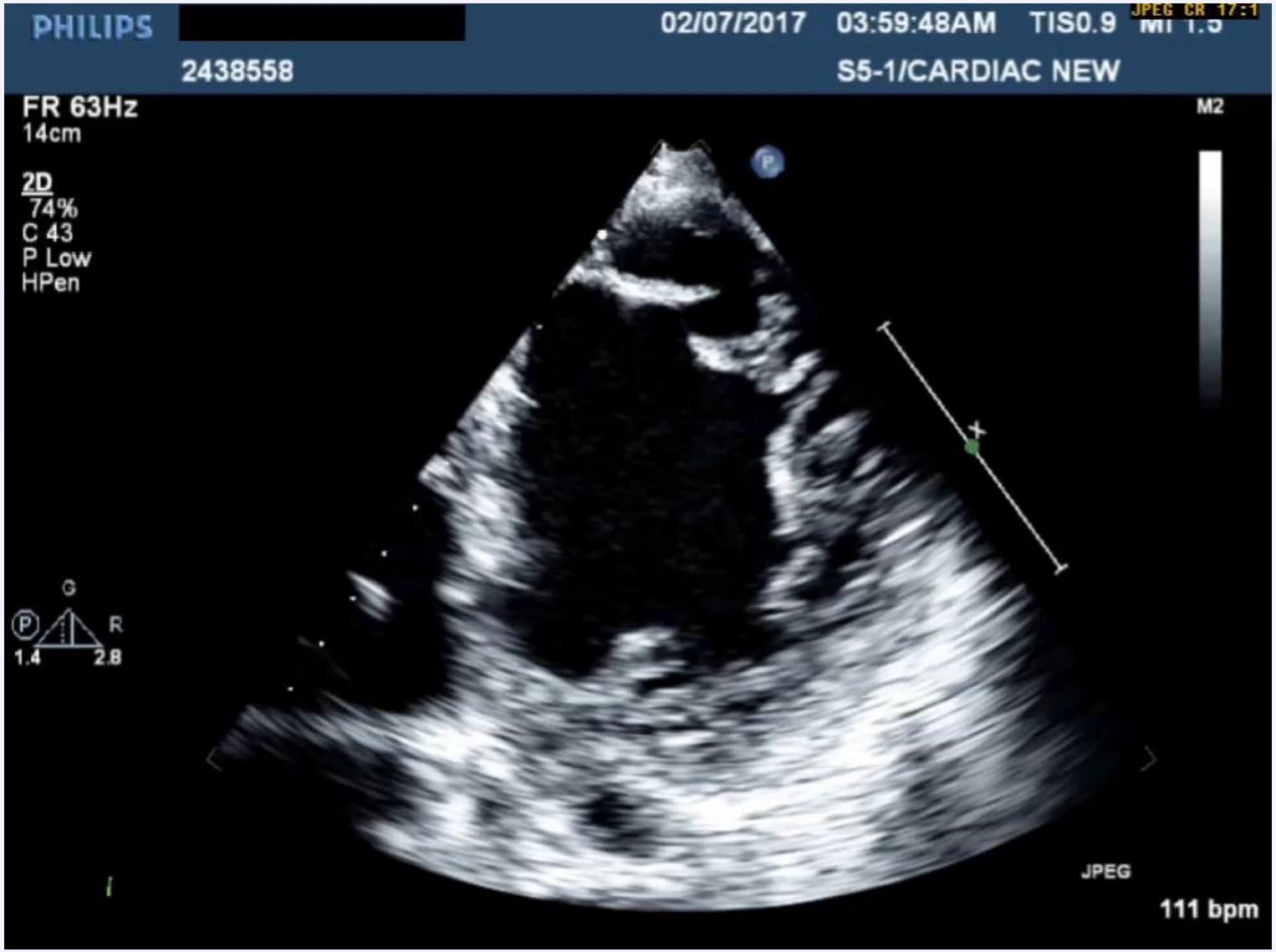

PHILIPS
02/07/2017
03:46:29AM
TIS2.7
2438558
S5-1/CARDIAC NEW
FR 12Hz
18cm
2D
63%
C 45
P Low
HPen
CF
70%
2.3MHz
WF High
Med
M2 M4
+63.9
-63.9
cm/s
1.4
2.8
JPEG
111 bpm

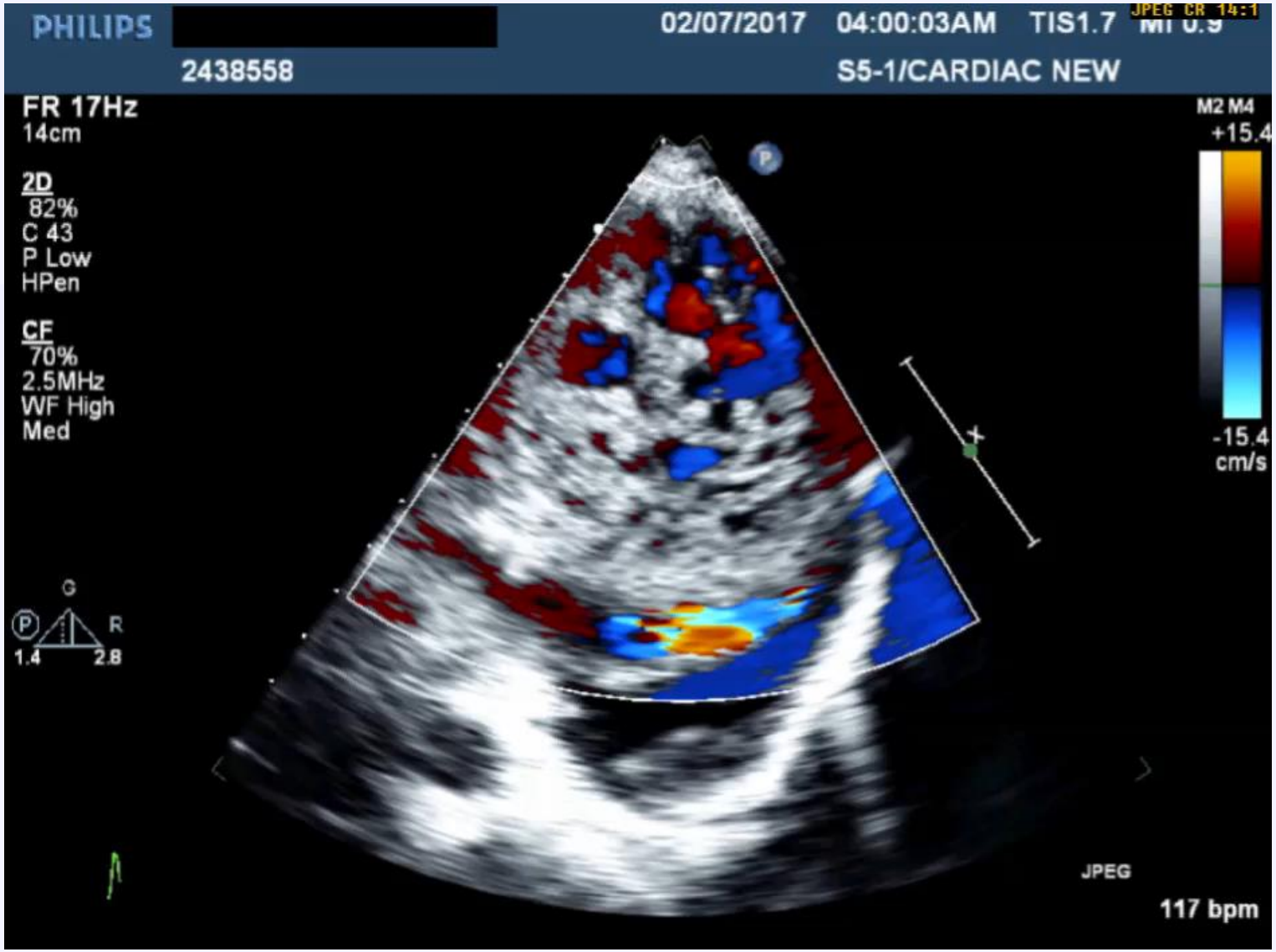

PHILIPS
02/07/2017
03:56:05AM
TIS0.9
2438558
S5-1/CARDIAC NEW
FR 48Hz
16cm
2D
61%
C 45
P Low
HPen
M2
C
P
R
1.4
2.8
JPEG
110 bpm


PHILIPS
02/07/2017
03:56:22AM
TIS0.9
2438558
S5-1/CARDIAC NEW
FR 48Hz
16cm
2D
71%
C 45
P Low
HPen
M2
C
P
R
1.4
2.8
JPEG
113 bpm

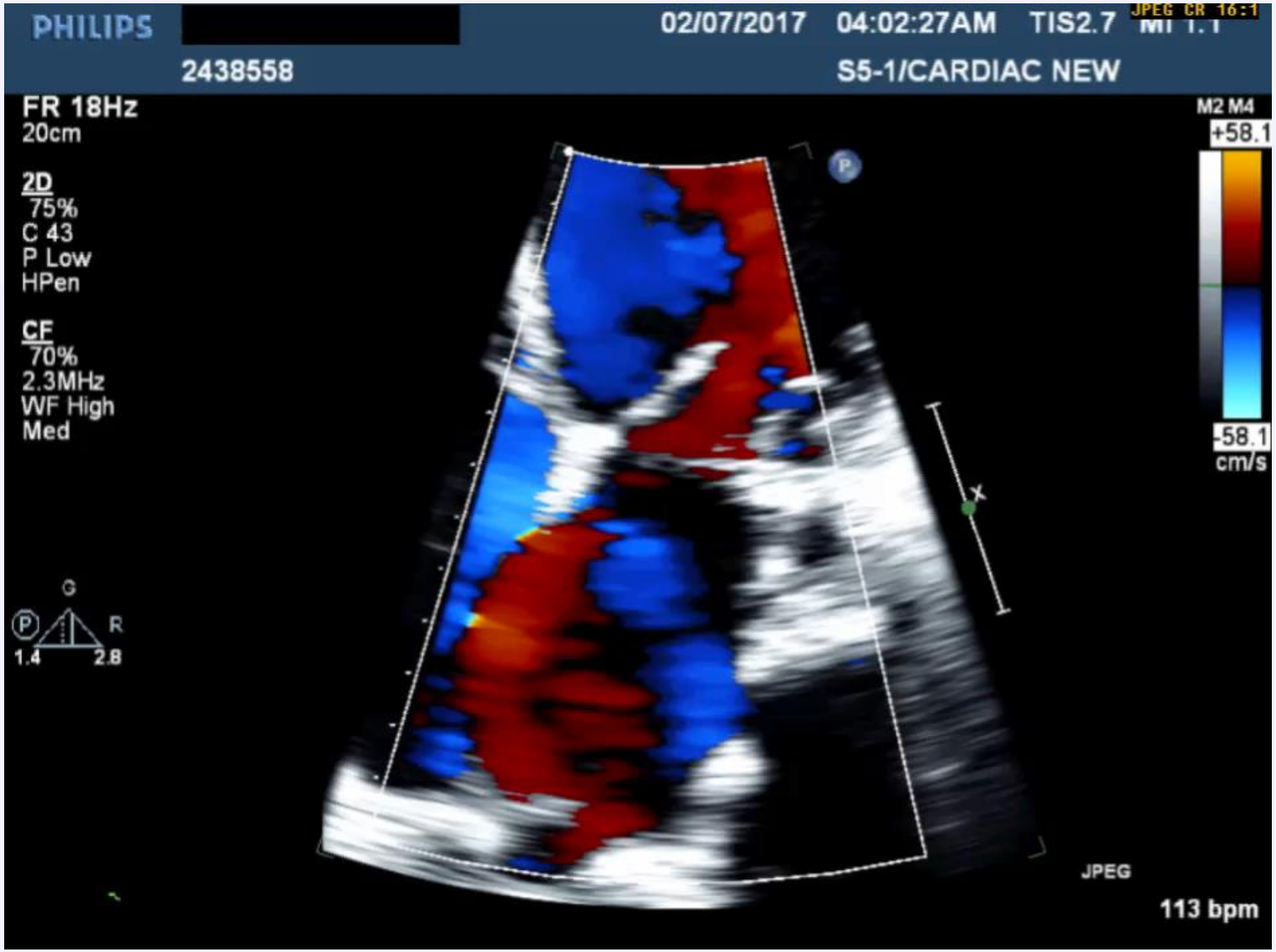

PHILIPS
[redacted]
02/07/2017
03:56:55AM
TIS0.7
JPEG CR 15:1
2438558
S5-1/CARDIAC NEW
FR 48Hz
16cm
2D
79%
C 45
P Low
HPen
M2
C
P
R
1.4
2.8
JPEG
110 bpm

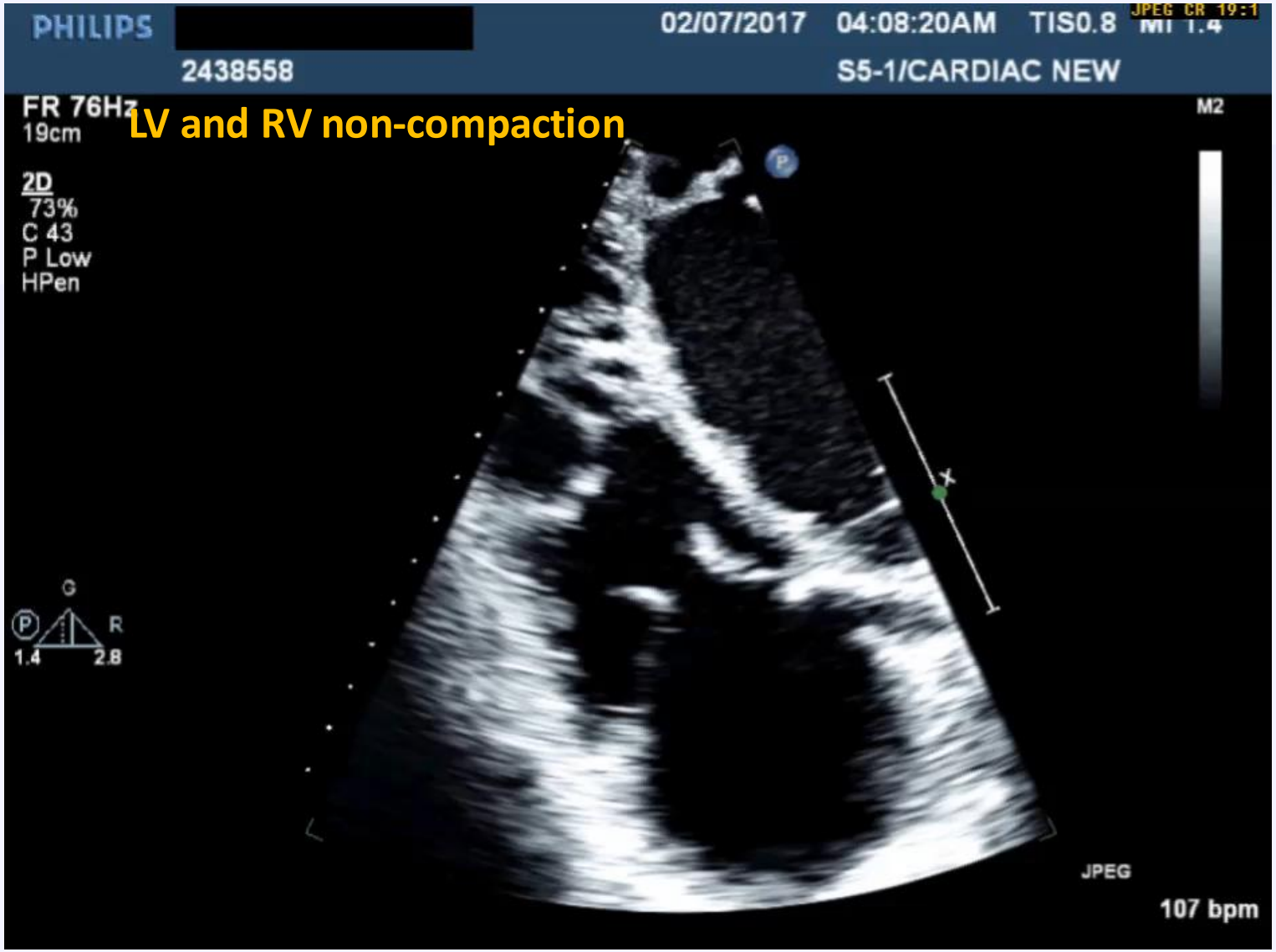

PHILIPS
02/07/2017
03:57:08AM
TIS1.7
2438558
S5-1/CARDIAC NEW
Deep recesses and meshwork at LV apex
FR 19Hz
16cm
2D
89%
C 45
P Low
HPen
CF
70%
2.5MHz
WF High
Med
M2 M4
+15.4
-15.4
cm/s
1.4
2.8
JPEG
107 bpm

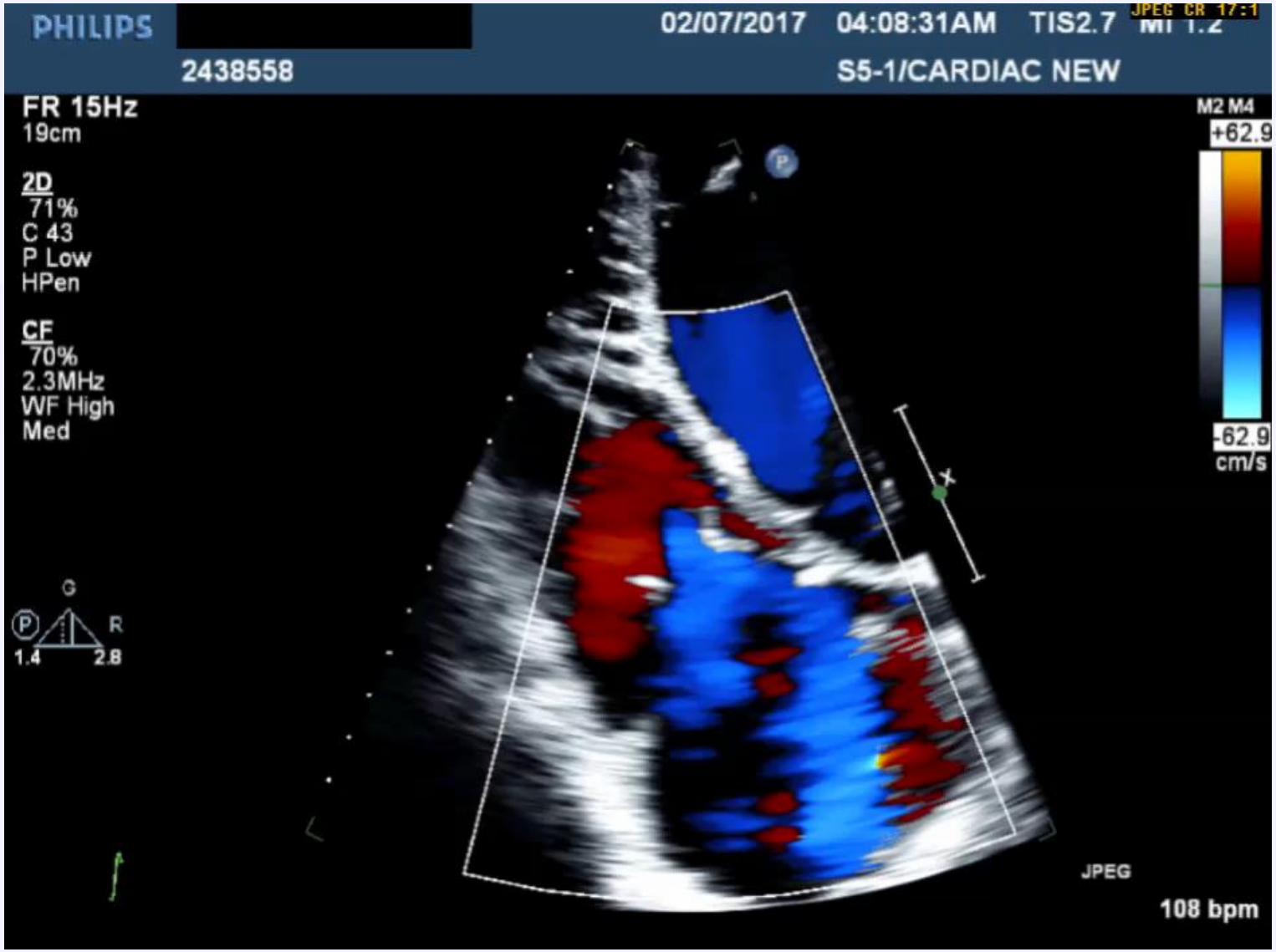

PHILIPS
02/07/2017
03:59:48AM
TIS0.9
JPEG CR 17:1
2438558
S5-1/CARDIAC NEW
FR 63Hz
14cm
2D
74%
C 43
P Low
HPen
M2
C
P
R
1.4
2.8
JPEG
111 bpm


PHILIPS
02/07/2017
04:00:03AM
TIS1.7
JPEG CR 14:1
2438558
S5-1/CARDIAC NEW
FR 17Hz
14cm
2D
82%
C 43
P Low
HPen
CF
70%
2.5MHz
WF High
Med
M2 M4
+15.4
-15.4
cm/s
C
P
R
1.4
2.8
JPEG
117 bpm

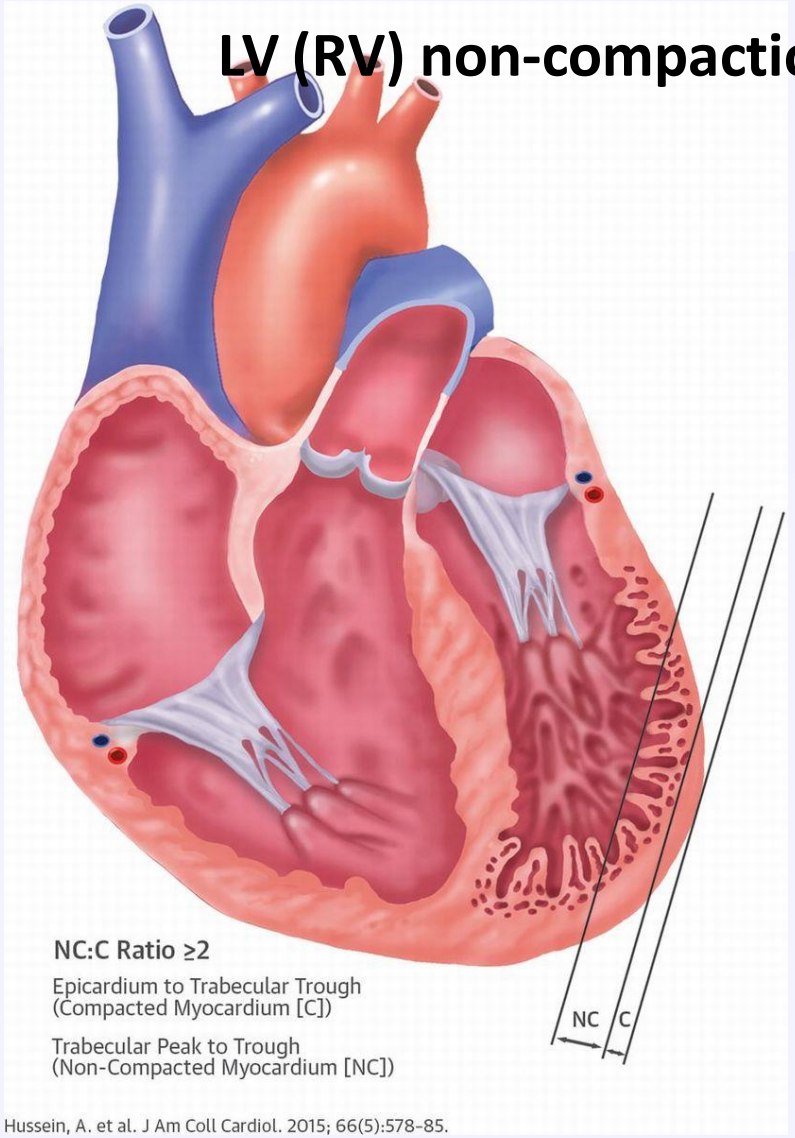

PHILIPS
02/07/2017
04:00:31AM
TIS0.9
2438558
S5-1/CARDIAC NEW
FR 63Hz
14cm
2D
74%
C 43
P Low
HPen
M2
C
P
R
1.4
2.8
JPEG
115 bpm


PHILIPS
[redacted]
02/07/2017
04:02:27AM
TIS2.7
JPEG CR 16:1
2438558
S5-1/CARDIAC NEW
FR 18Hz
20cm
2D
75%
C 43
P Low
HPen
CF
70%
2.3MHz
WF High
Med
M2 M4
+58.1
-58.1
cm/s
C
P
R
1.4
2.8
JPEG
113 bpm

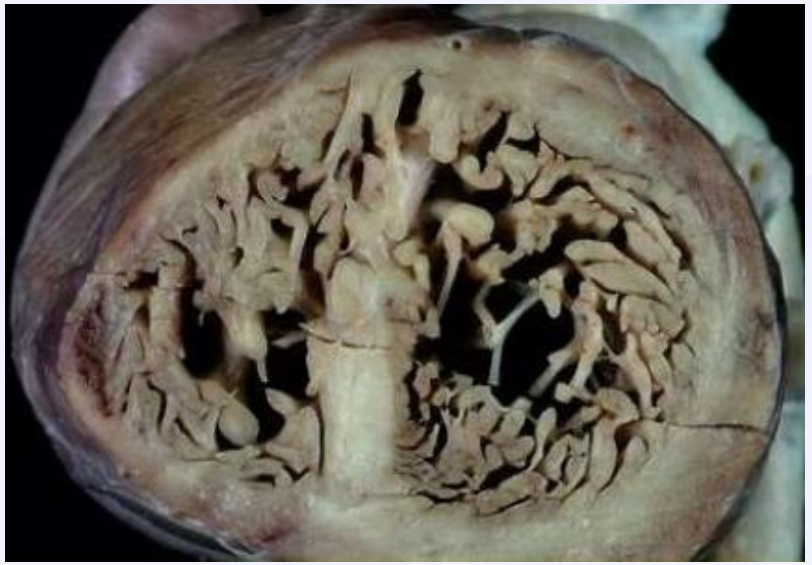

PHILIPS
02/07/2017
04:08:20AM
TIS0.8
2438558
S5-1/CARDIAC NEW
FR 76Hz
19cm
LV and RV non-compaction
2D
73%
C 43
P Low
HPen
M2
C
P
R
1.4
2.8
JPEG
107 bpm

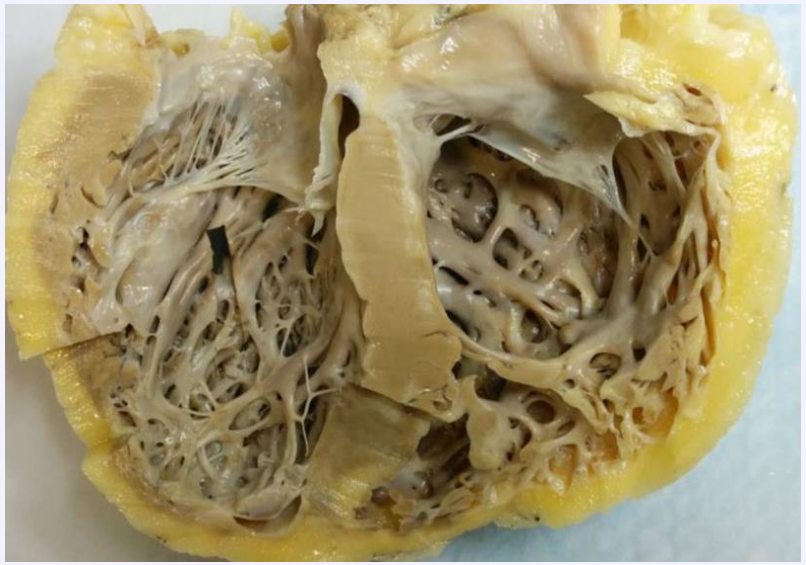

PHILIPS
02/07/2017
04:08:31AM
TIS2.7
JPEG CR 17:1
2438558
S5-1/CARDIAC NEW
FR 15Hz
19cm
2D
71%
C 43
P Low
HPen
CF
70%
2.3MHz
WF High
Med
M2 M4
+62.9
-62.9
cm/s
C
P
R
1.4
2.8
JPEG
108 bpm

LV (RV) non-compaction



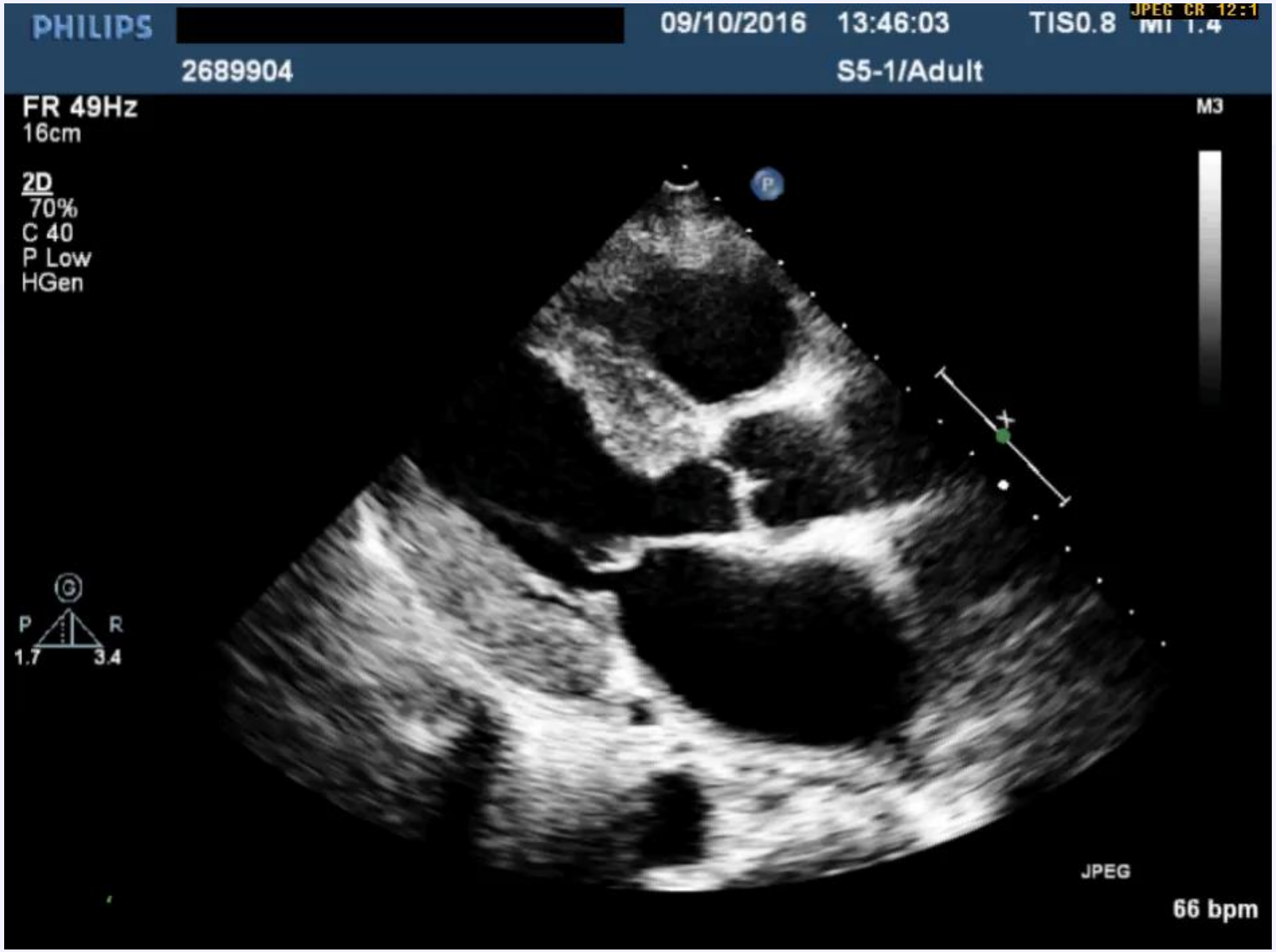
Hussein, A. et al. J Am Coll Cardiol. 2015; 66(5):578–85.

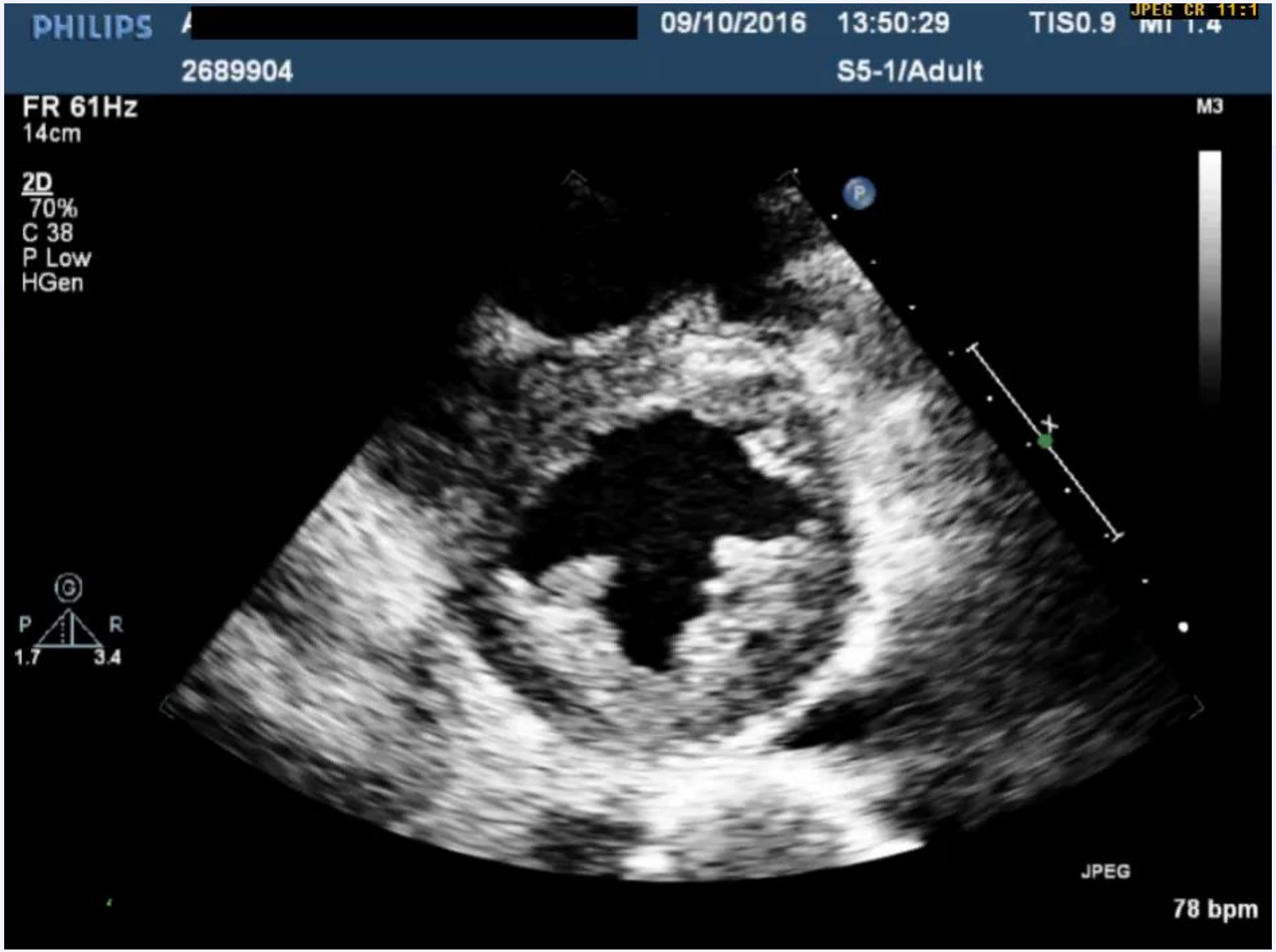


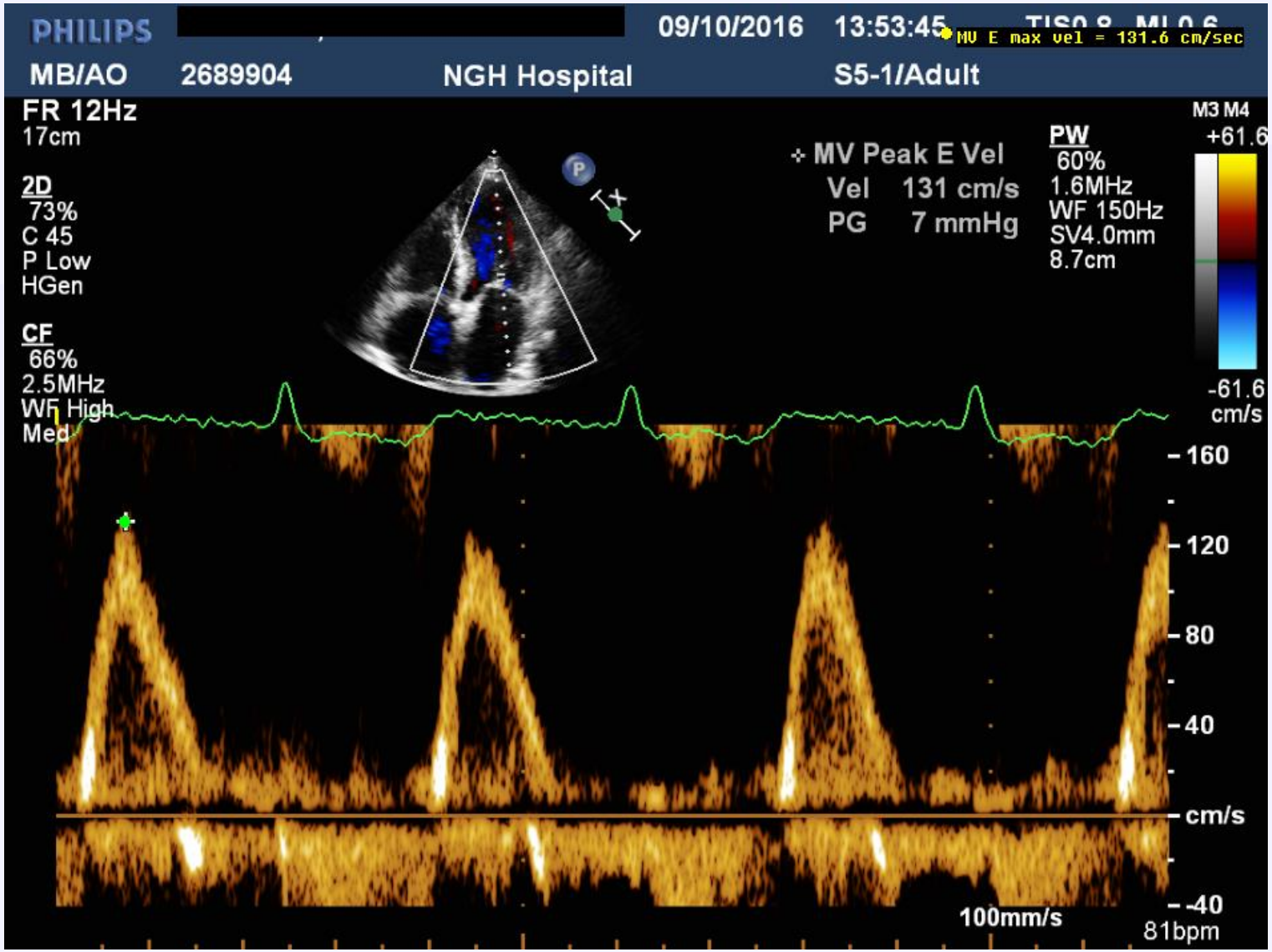


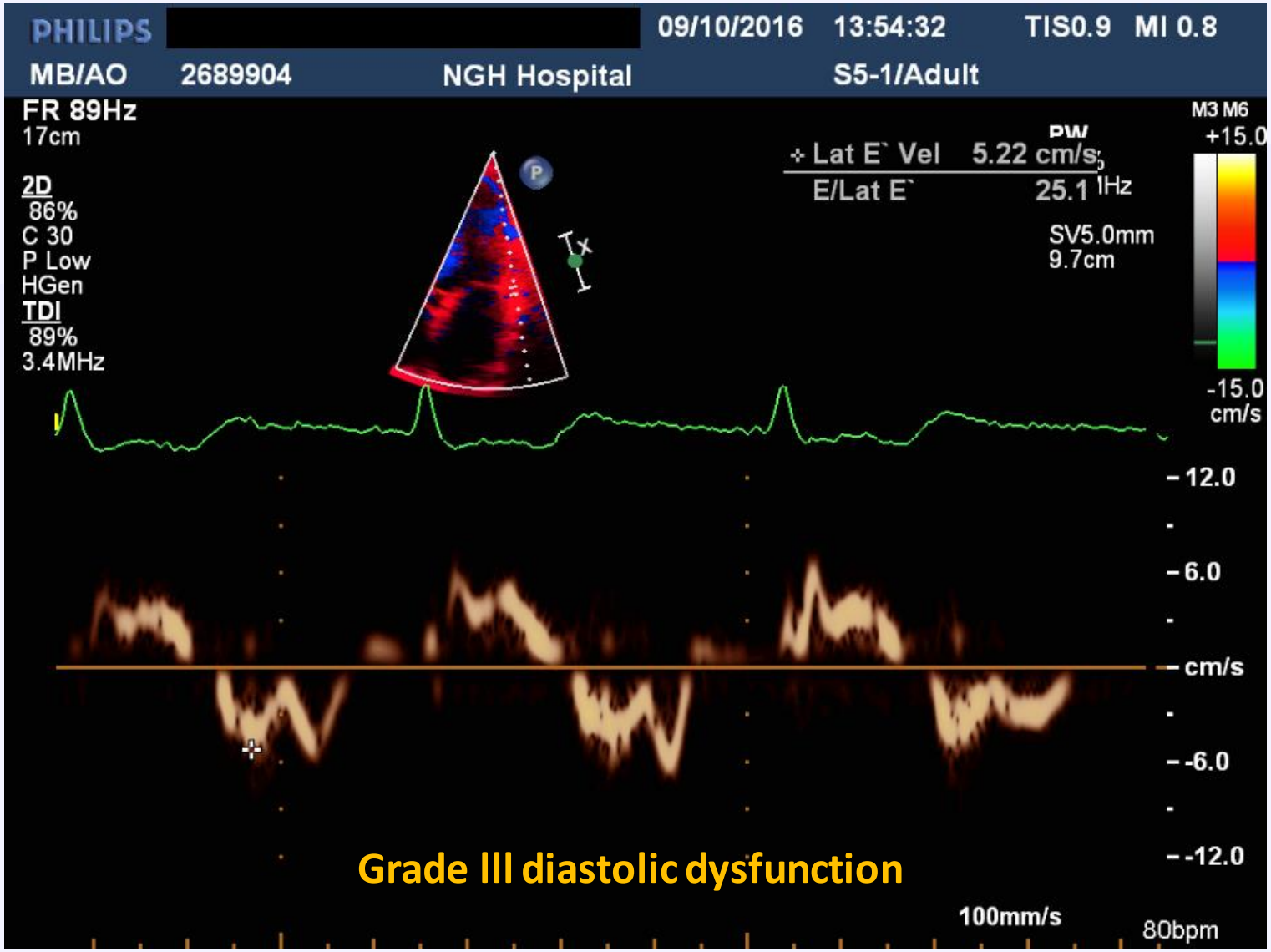
Case 2

- 82-year-old man presented to our center due to severe SOB and atrial fibrillation. No history of hypertension


PHILIPS
09/10/2016
13:46:03
TIS0.8
JPEG CR 12:1
2689904
S5-1/Adult
FR 49Hz
16cm
2D
70%
C 40
P Low
HGen
M3
P
R
1.7
3.4
JPEG
66 bpm


PHILIPS
09/10/2016
13:50:29
TIS0.9
JPEG CR 11:1
2689904
S5-1/Adult
FR 61Hz
14cm
2D
70%
C 38
P Low
HGen
M3
P
R
1.7
3.4
JPEG
78 bpm


PHILIPS
09/10/2016
13:53:45
MV E max vel = 131.6 cm/sec
MB/AO
2689904
NGH Hospital
S5-1/Adult
FR 12Hz
17cm
2D
73%
C 45
P Low
HGen
CF
66%
2.5MHz
WF High
Med
MV Peak E Vel
Vel 131 cm/s
PG 7 mmHg
PW
60%
1.6MHz
WF 150Hz
SV4.0mm
8.7cm
M3 M4
+61.6
-61.6
cm/s
160
120
80
40
cm/s
-40
100mm/s
81bpm


PHILIPS
09/10/2016 13:54:32 TIS0.9 MI 0.8
MB/AO 2689904 NGH Hospital S5-1/Adult
FR 89Hz
17cm
2D
86%
C 30
P Low
HGen
TDI
89%
3.4MHz
Lat E` Vel 5.22 cm/s
E/Lat E` 25.1
SV5.0mm
9.7cm
M3 M6
+15.0
-15.0
cm/s
12.0
6.0
cm/s
-6.0
-12.0
100mm/s
80bpm
Grade III diastolic dysfunction

20-OCT-1933 (85 yr)
Male Unknown

Room: 07
Loc: 71

Vent. rate	76	BPM
PR interval	144	ms
QRS duration	112	ms
QT/QTc	482/543	ms
P-R-T axes	47 -86	31

Sinus rhythm with 1st degree A-V block
Left axis deviation
Low voltage QRS
Inferior infarct , age undetermined
Possible Anterolateral infarct , age undetermined
Prolonged QT
Abnormal ECG

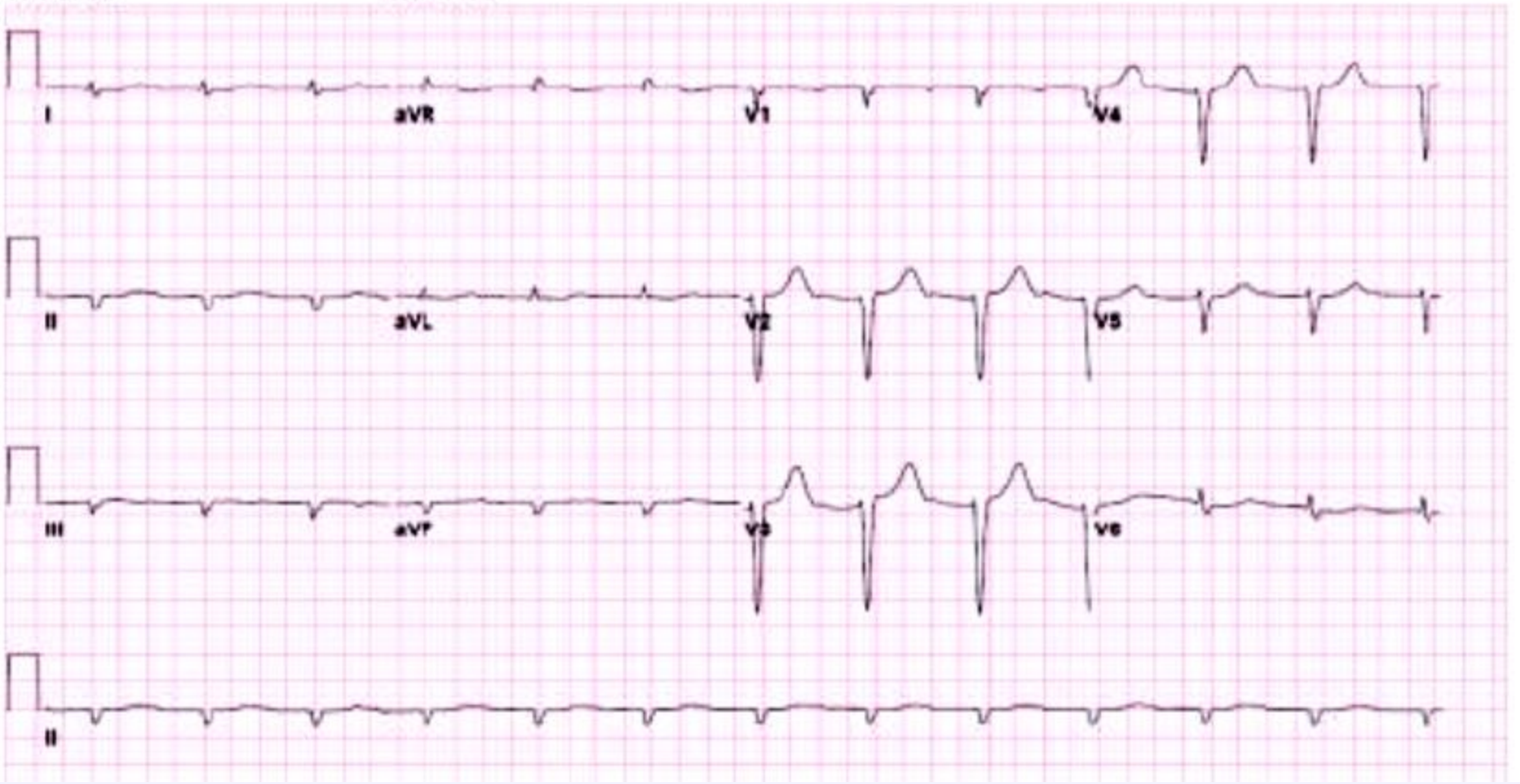
Technician: LOLITA DIZON
Test ind: POST AICD

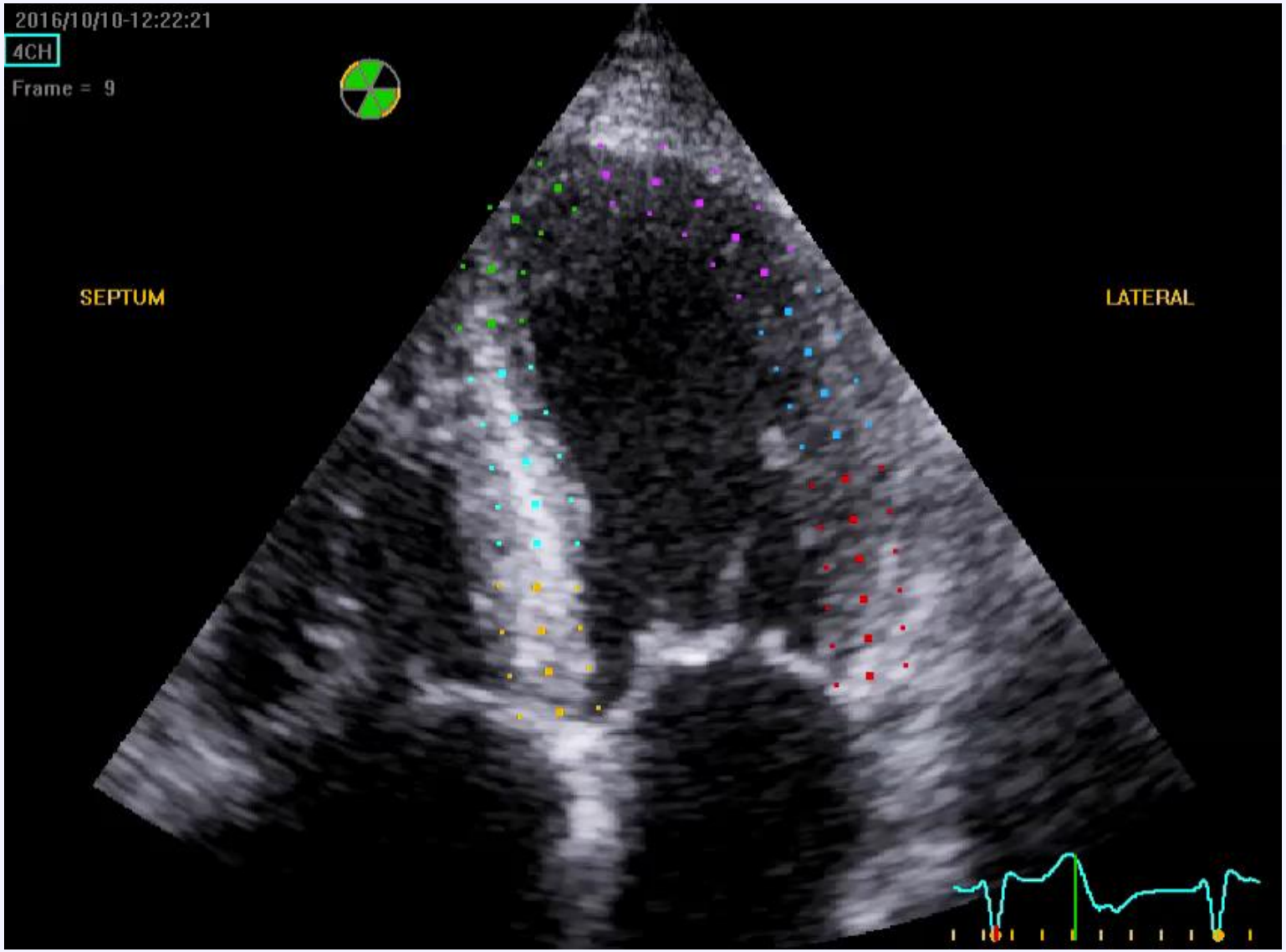
Referred by: Sadaf Al Kahan

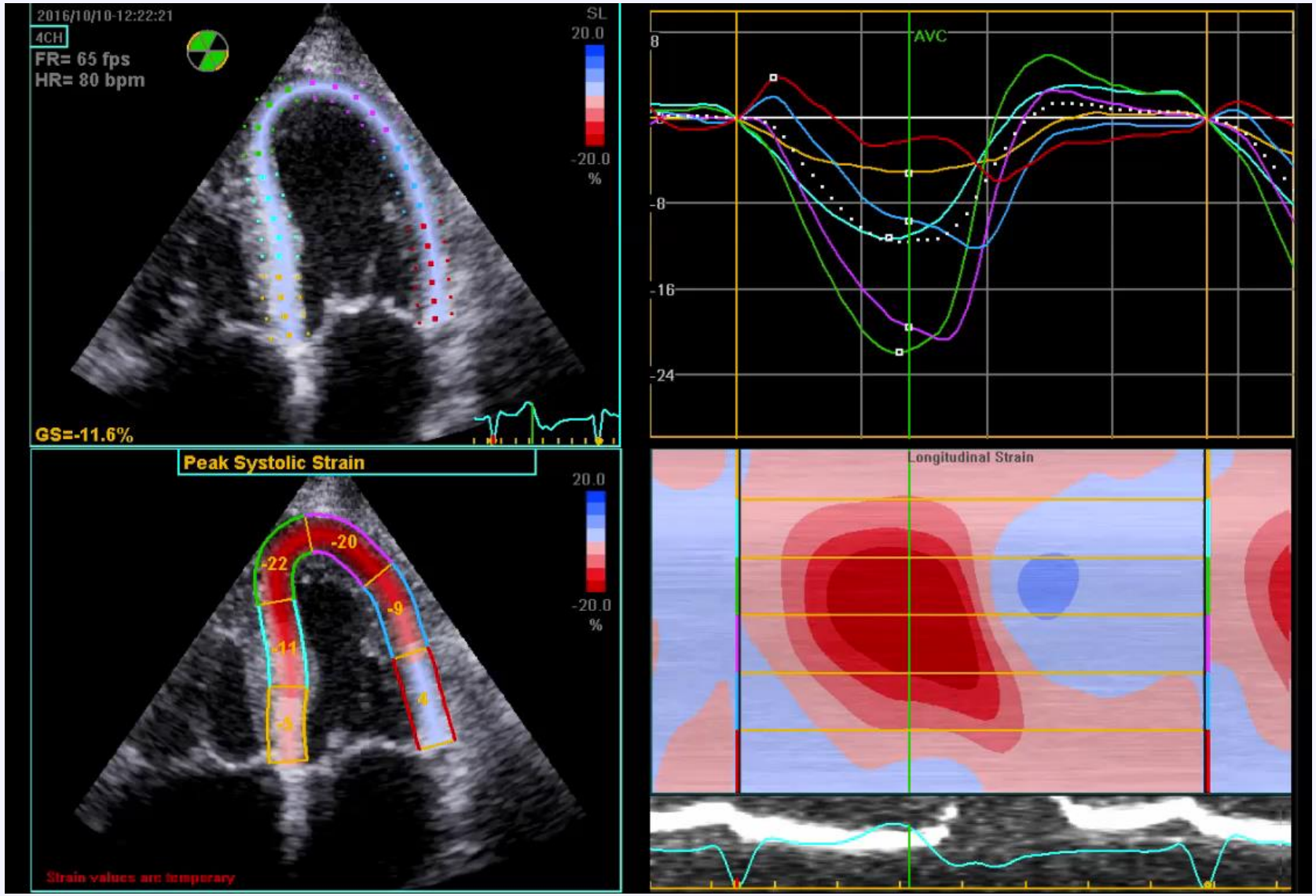
Confirmed By:

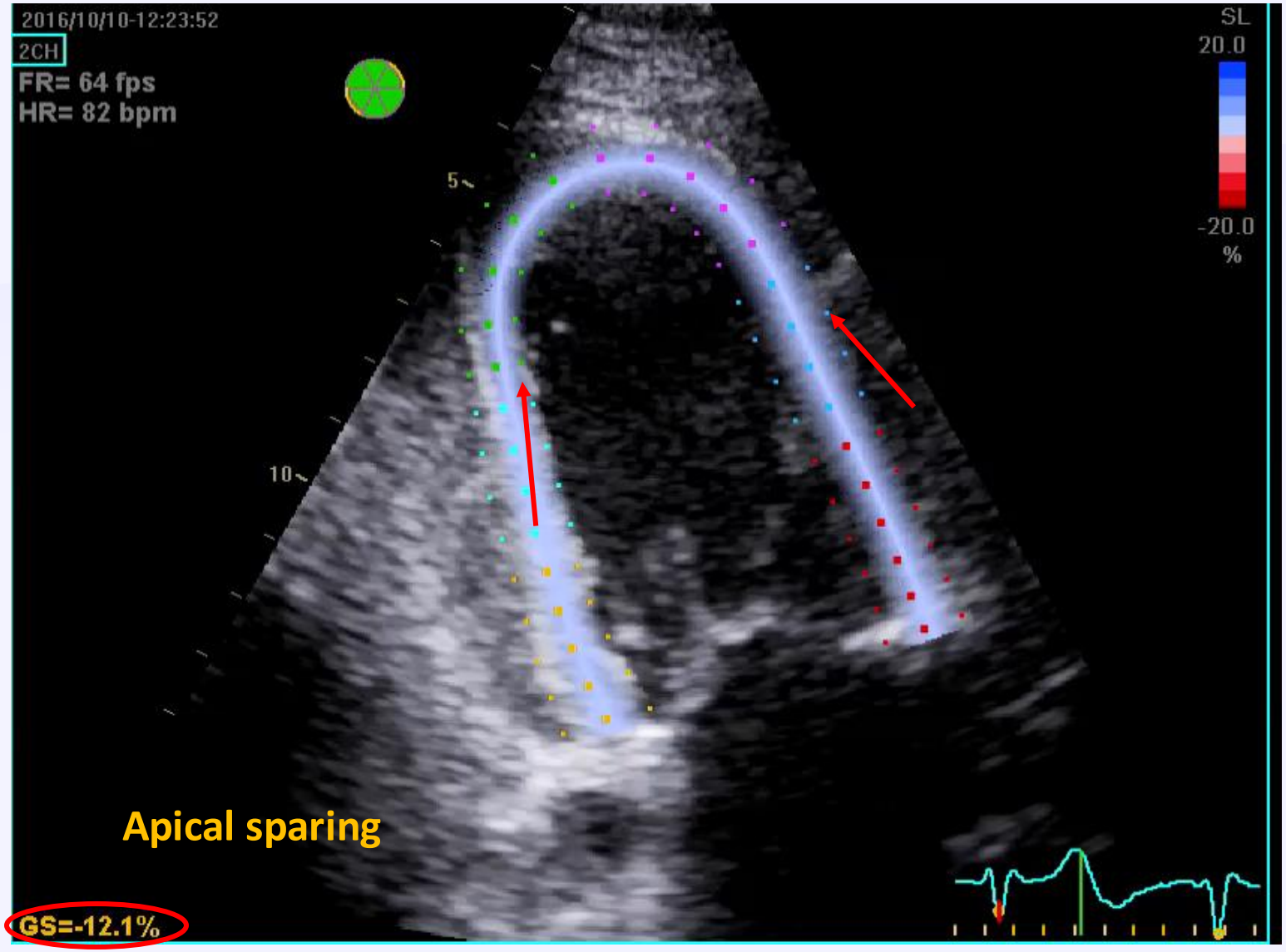
COMMENTS:

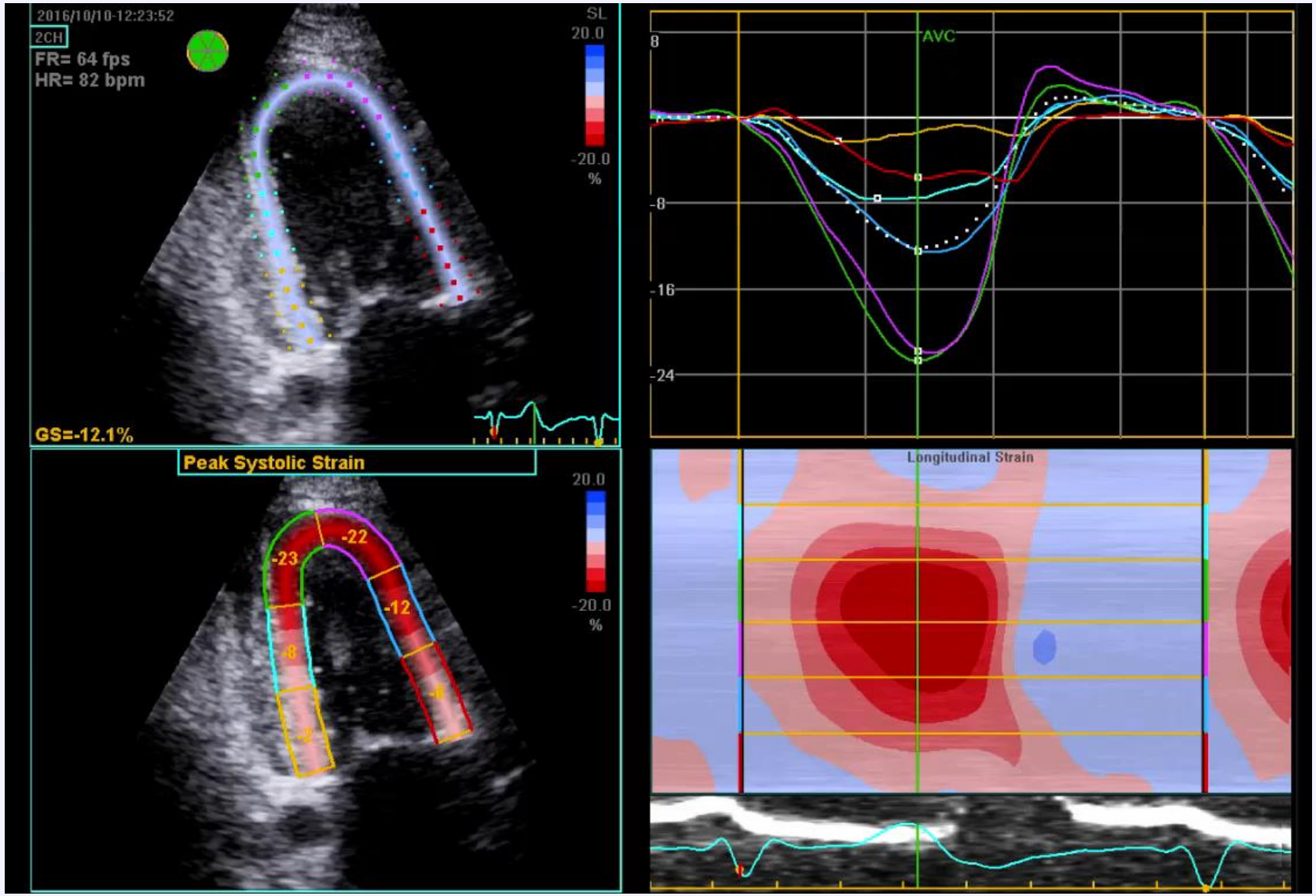
MACE-14: Yes

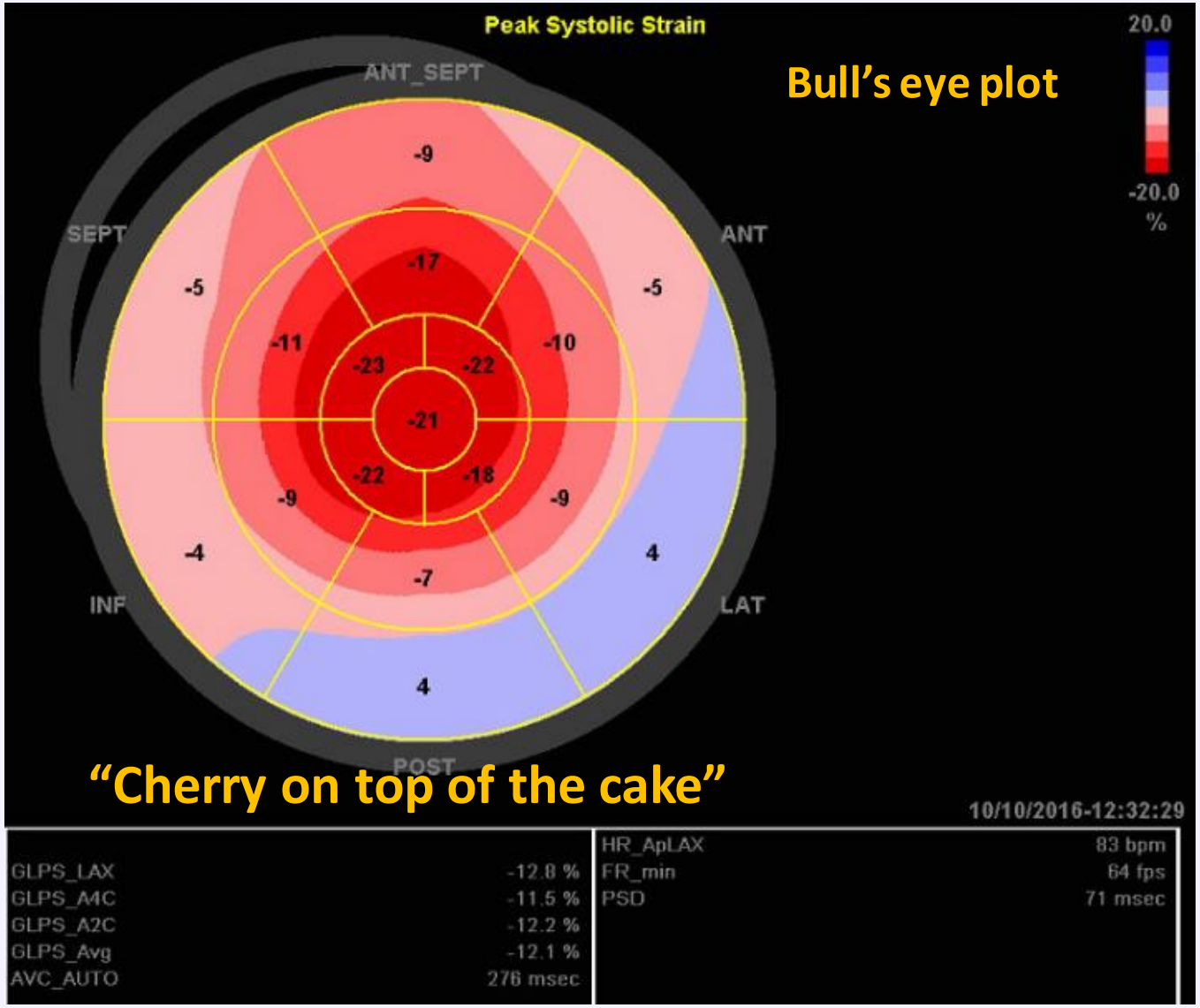



2016/10/10-12:22:21
4CH
Frame = 9
SEPTUM
LATERAL


2016/10/10-12:22:21
4CH
FR= 65 fps
HR= 80 bpm
SL
20.0
-20.0
%
GS=-11.6%
AVC
8
-8
-16
-24
Peak Systolic Strain
20.0
-20.0
%
-20
-22
-9
-11
-4
-4
Strain values are temporary
Longitudinal Strain

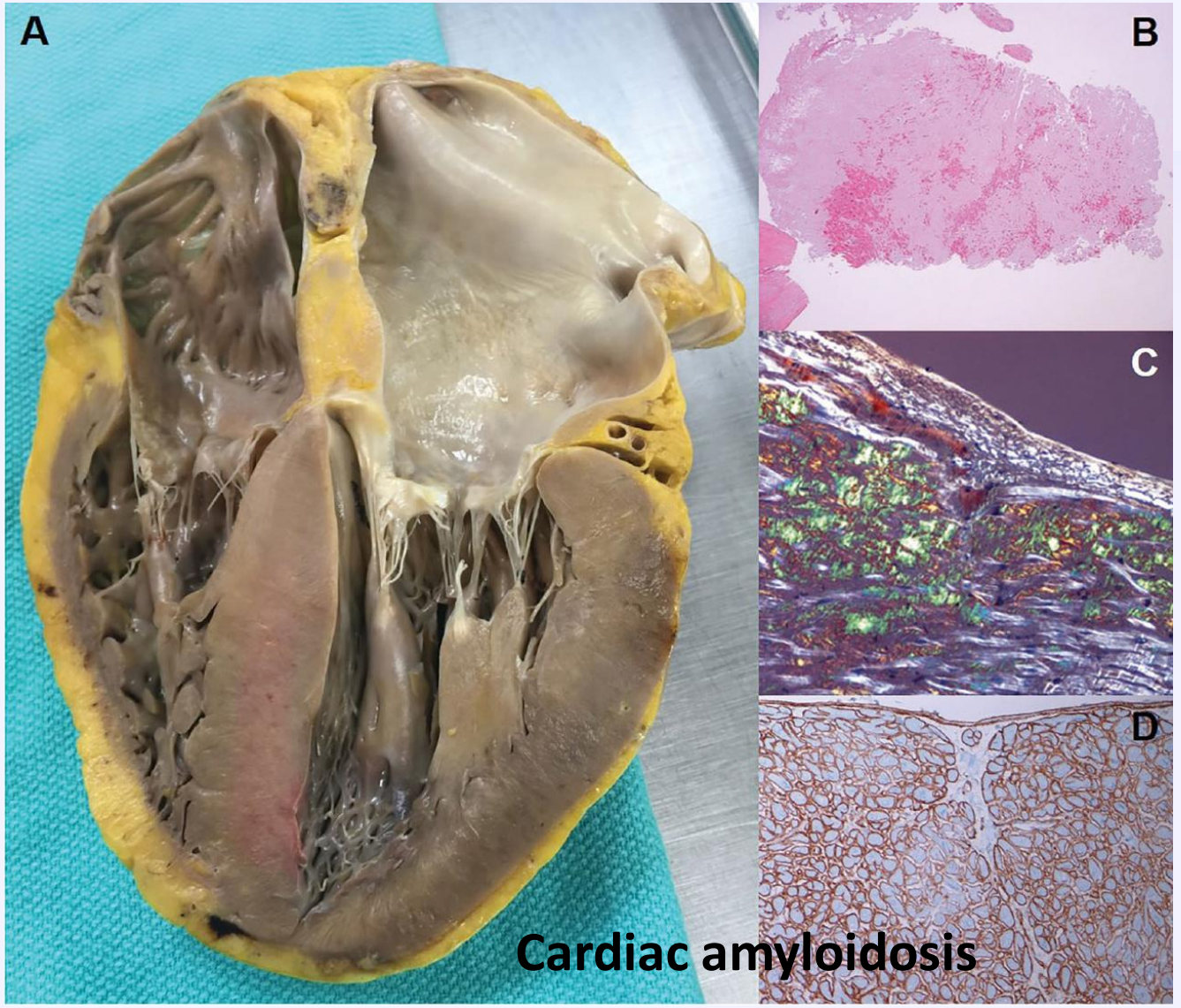

2016/10/10-12:23:52
2CH
FR= 64 fps
HR= 82 bpm
5
10
SL
20.0
-20.0
%
Apical sparing
GS=-12.1%


2016/10/10-12:23:52
2CH
FR= 64 fps
HR= 82 bpm
SL
20.0
-20.0
%
GS=-12.1%
AVC
8
-8
-16
-24
Peak Systolic Strain
20.0
-20.0
%
-22
-23
-12
-8
-4
-2
Longitudinal Strain



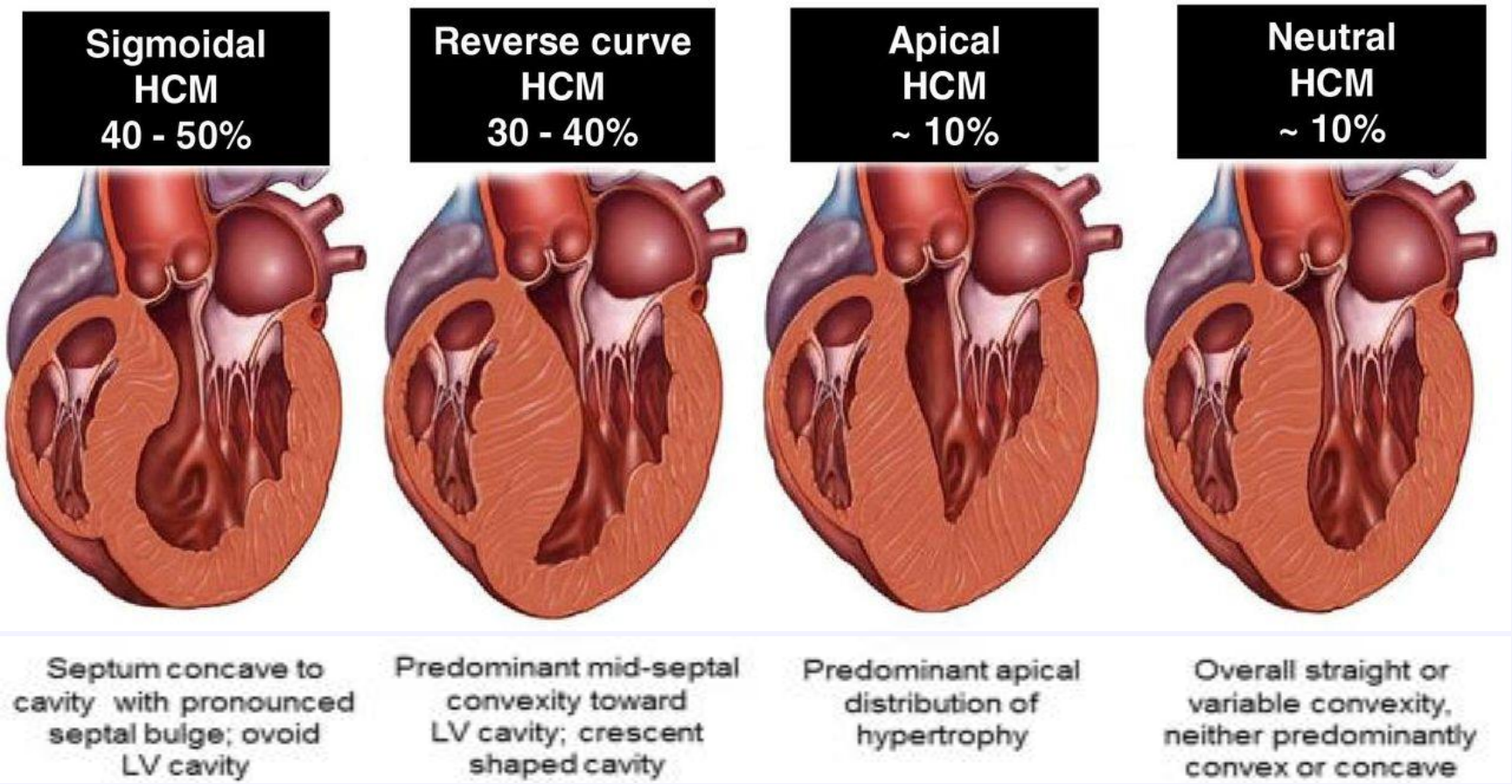
Bull's eye plot

"Cherry on top of the cake"



Cardiac amyloidosis

Hypertrophic cardiomyopathy (HCM)



HCM is a common genetic cardiovascular disease involving myocardium. HCM is affecting 1 in 500 general population which is equivalent to at least 600,000 (? 60,000 in Canada).

2011 ACC/AHA Guideline for HCM

Isolated septal myectomy for hypertrophic obstructive cardiomyopathy: an update on the Toronto General Hospital experience

Rachel D. Vanderlaan[1], Anna Woo[2], Anthony Ralph-Edwards[1,3]

[1]Division of Cardiac Surgery, the University of Toronto, Toronto, Canada; [2]Division of Cardiology, [3]Division of Cardiac Surgery, University Health Network, Toronto, Canada

Correspondence to: Anthony Ralph-Edwards. Division of Cardiovascular Surgery, University Health Network, 4N-448 Toronto General Hospital, 200 Elizabeth Street, Toronto, ON, M5G 2C4, Canada. Email: Anthony.ralph-edwards@uhn.ca.

Background: Isolated septal myectomy is considered the gold standard for refractory left ventricular outflow tract (LVOT) obstruction at centers with dedicated hypertrophic obstructive cardiomyopathy (HOCM) surgeons. In this paper, we provide an update on the Toronto General Hospital (TGH) experience for isolated septal myectomy and comment on the safety and efficacy of myectomy in patients with thin basal septal thickness at our institution.

Methods: We retrospectively reviewed all patients undergoing surgical myectomy at our institution from January 2012 to August 2016. We analyzed patient characteristics, intraoperative variables, pre- and post-procedural echocardiographic parameters, and key outcomes including post-operative stroke, renal failure, iatrogenic ventricular septal defect (VSD), post-procedure insertion of permanent pacemaker, and mortality.

Results: At our institution, 150 isolated septal myectomy surgeries were performed over the study period. Preoperative echocardiography demonstrated an average basal septal thickness of 2.10±0.43 cm with a resting gradient of 67±37 mmHg and a provoked gradient of 89±40 mmHg. Fifty percent of patients had significant systolic anterior motion (SAM) of their mitral valve and 53% had associated moderate to severe mitral regurgitation (MR). Of note, 24% of patients had a thin septum of ≤1.7 cm. Discharge echocardiograms demonstrated significant septal reduction to an average basal septal thickness of 1.04±0.26 ($P<0.05$), with negligible resting and provokable LVOT gradients. At the time of discharge, none of the patients had significant SAM and only 5.3% of patients had residual greater than mild MR. Patients undergoing isolated myectomy with a thin basal septum had similar outcomes to those with a >1.7 cm septal thickness. In our contemporary cohort, there were no iatrogenic VSDs, 5.3% of patients required a permanent pacemaker and there was one early death.

Ann Cardiothorac Surg 2017;6(4):364-368

Table 1 Major cardiac surgical procedures for HOCM patients

Cardiac surgical procedures	Cohort (n=291)
Isolated septal myectomy	150
Myectomy + CABG	65
Myectomy + mitral repair/replacement	17
Myectomy + other	59

HOCM, hypertrophic obstructive cardiomyopathy; CABG, coronary artery bypass grafting.

Table 2 Preoperative characteristics for isolated septal myectomy cohort

Patient preoperative variable	Value (cohort n=150)
Median age (years)	52 [42–61]
Sex (male)	93 (62%)
Median age for females (years)	55 [40–63]
Median age for males (years)	51 [44–58]
BSA	2.04 (1.85–2.2)
NYHA class (III-IV)	98 (65%)
CCS class (III-IV)	87 (58%)
Syncope	40 (27%)
Basal septal thickness ≤1.7 cm	36 (24%)
Concomitant atrial fibrillation procedure	9 (6%)

BSA, body surface area; NYHA, New York Heart Association; CCS, Canadian Cardiovascular Society.

Table 3 Echocardiography parameters

Parameter	Preoperative Echo	Discharge Echo
Basal septal thickness (cm)	2.10±0.43	1.04±0.26*
Resting LVOT gradient (mmHg)	67±38	11±7*
Provoked LVOT gradient (mmHg)	89±40	13±9*
Presence of significant SAM	75 (50%)	0 (0%)*
Moderate or severe mitral regurgitation	79 (53%)	8 (5.3%)*
Left atrial size (cm)	4.5±0.7	4.2±0.7
RVSP (mmHg)	33±10	34±10

*, $P<0.05$. LVOT, left ventricular outflow tract; SAM, systolic anterior motion; RVSP, right ventricular systolic pressure; Echo, echocardiogram.

Conclusions

Our cohort demonstrates that isolated septal myectomy remains a safe and effective operation that can achieve excellent results, irrespective of basal septal thickness, when performed by experienced surgeons in a dedicated HCM center.

GLOBAL CARDIOLOGY SCIENCE & PRACTICE

OPEN ACCESS

Review article

Alcohol septal ablation in hypertrophic cardiomyopathy

Juan José Santos Mateo[1], Juan R. Gimeno[2]*

[1] Hospital Virgen del Castillo, Yecla, Murcia, Spain
[2] Hospital Universitario Virgen de La Arrixaca, El Palmar, Murcia, Spain
*Email: jgimeno@secardiologia.es

ABSTRACT

Alcohol septal ablation (ASA) has become an alternative to surgical myectomy in obstructive hypertrophic cardiomyopathy since it was first introduced in 1994 by Sigwart. The procedure alleviates symptoms by producing a limited infarction of the upper interventricular septum, resulting in a decrease in left ventricular outflow tract (LVOT) gradient. The technique has been improved over time and the results are comparable with those of myectomy. Initial concerns about long-term outcomes have been largely resolved. In this review, we discuss indications, technical aspects, clinical results and patient selection to ASA.

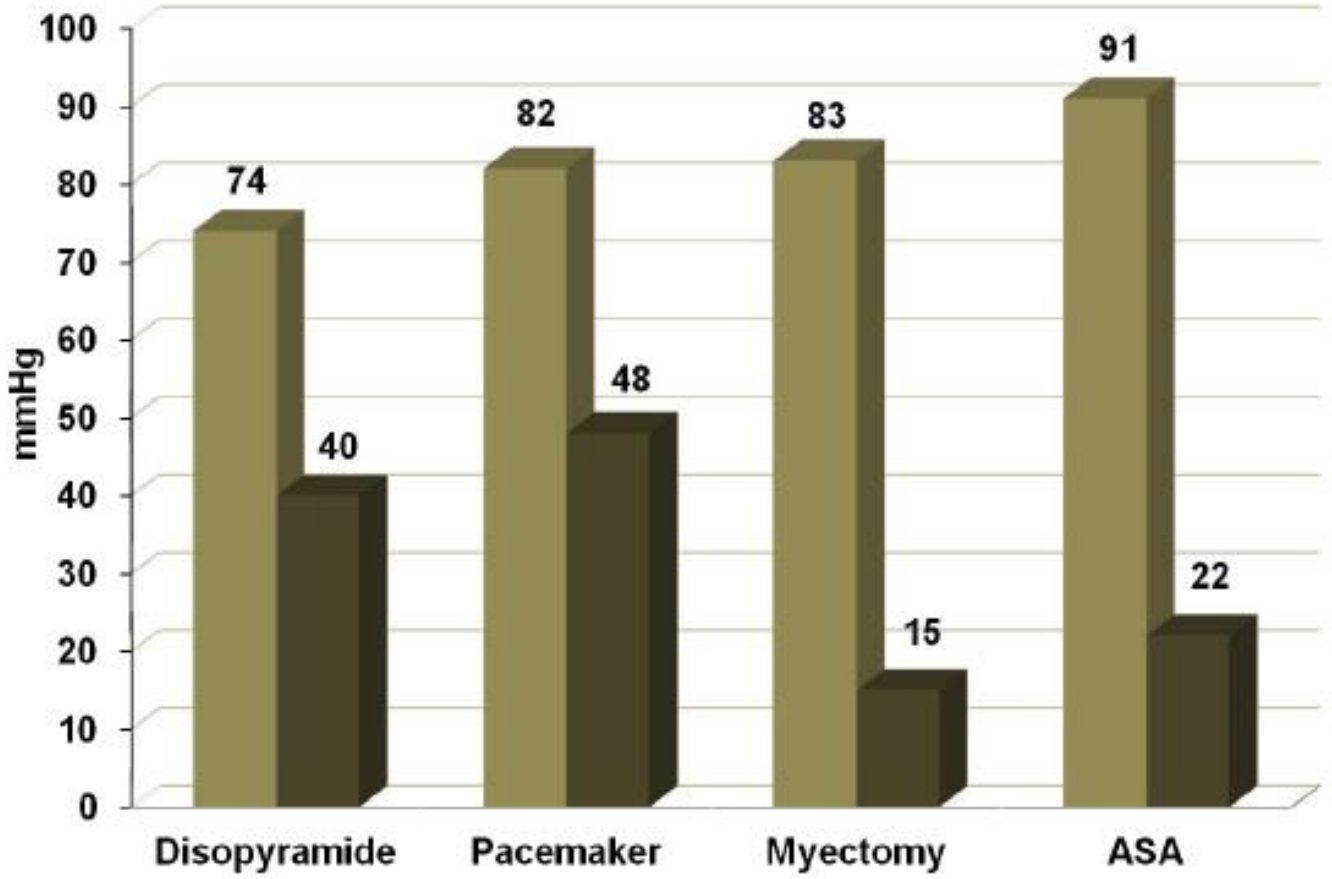


Figure 1. Reductions in the mean resting LVOT gradient in different treatments. Light grey bars represent pre-treatment gradients. Black bars represent post-treatment gradients.

Table 2 Considerations for selection of septal reduction therapies.

Septal myectomy	Septal ablation
Patient choice (immediate results)	Patient choice (less invasive and shorter recovery)
Concomitant cardiac disease	High surgical risk (comorbilities)
Longest follow-up data	Relatively shorter follow-up evidence
Expertise limited to few HCM centres	More reproductive results between centres
Massive hypertrophy	Mild-moderate hypertrophy (16–25 mm)
Mid-ventricular obstruction	
Younger patients	Elderly patients
	Cost of double risk of pacemaker and reinterventions.

Surgical myectomy, history

The Father of Septal Myectomy for Obstructive HCM, Who Also Had HCM

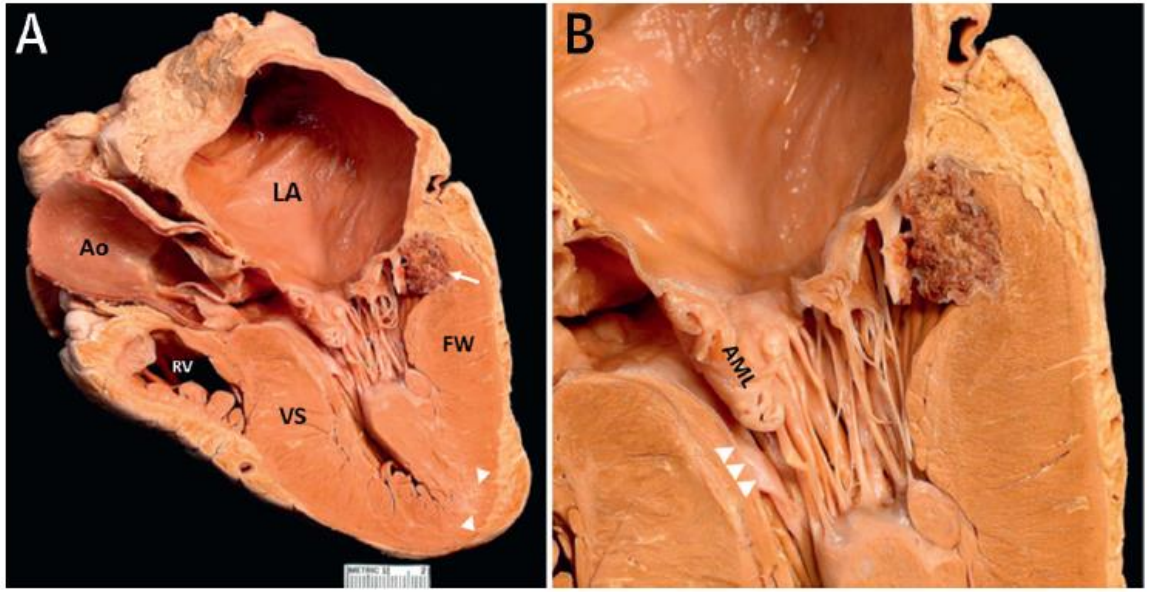
The Unbelievable Story

Barry J. Maron, MD,[a] William C. Roberts, MD[b]

JACC 2016

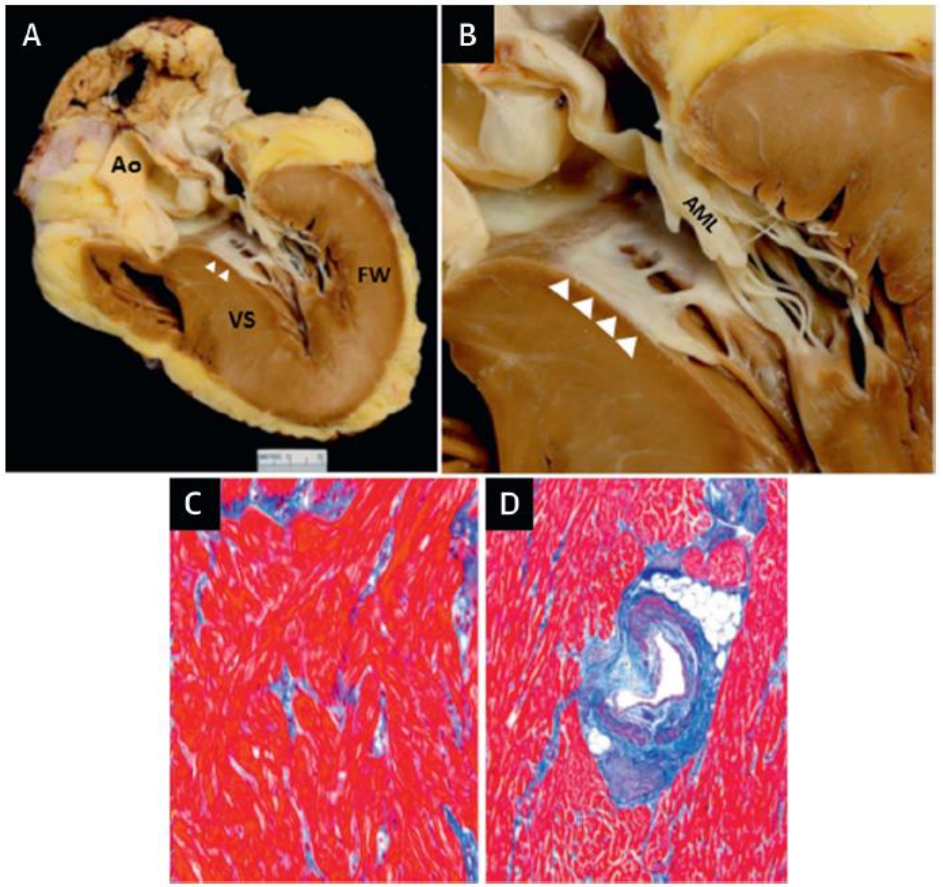
Dr. Andrew Glenn Morrow, chief of cardiac surgery at NIH. He was the first surgeon to perform the surgical myectomy in the early 1960s. He was diagnosed himself to have HOCM at the age of 40 by Dr Eugene Brawnwald. He refused to have surgery or even medical treatment and died suddenly at the age 60.

FIGURE 3 The Heart of Dr. Morrow



Weight, 645 g. **(A)** The ascending aorta (Ao) is free of atherosclerotic plaque, with a structurally normal aortic valve, nondilated left ventricular (LV) cavity, and greatly dilated left atrium (LA). Ventricular septal (VS) thickness is 20 mm, asymmetrically hypertrophied with respect to LV free wall (FW). Behind posterior mitral leaflet is a large calcific deposit **(arrow)**, frequent in older patients. Several small scars are evident in the VS and at the apex **(arrowheads)**. **(B)** In the subaortic region of the hypertrophied septum is a fibrous plaque **(arrowheads)** in apposition to the thickened anterior mitral leaflet (AML), evidence of prior outflow obstruction. RV = right ventricle.

FIGURE 4 The Explanted Heart of Daughter



Weight 510 g. **(A)** The VS thickness is 23 mm, asymmetrically hypertrophied with respect to LV FW, and with a nondilated LV cavity. **(B)** Septal endocardial fibrous plaque **(white arrowheads)** adjacent to the thickened AML, and prior evidence of mitral valve systolic anterior motion and obstruction. **(C)** Typical disorganized myocyte arrangement in septum, and areas of interstitial fibrosis **(blue)**; myocardial scarring was absent (×400). **(D)** Intramural coronary artery with disrupted media and intimal fibrous thickening (×100). Masson trichrome stain. Abbreviations as in Figure 3.

Art of Operative Techniques

Transaortic septal myectomy: techniques and pitfalls

Anthony Ralph-Edwards[1], Rachel D. Vanderlaan[1], Pietro Bajona[2,3]

[1]Division of Cardiovascular Surgery, Toronto General Hospital, University of Toronto, Toronto, ON, Canada; [2]Department of Cardiovascular and Thoracic Surgery, University of Texas Southwestern Medical Center, Dallas, TX, USA; [3]Institute of Life Sciences, Sant'Anna School of Advanced Studies, Pisa, Italy

Correspondence to: Anthony Ralph-Edwards, MD. Division of Cardiovascular Surgery, Toronto General Hospital, University of Toronto, 200 Elizabeth St 4N-448 Toronto, Ontario M5G 2C4, Canada. Email: Anthony.ralph-edwards@uhn.ca.

Hypertrophic cardiomyopathy (HCM) is the most common congenital cardiac disease, affecting up to 1 in 200 individuals. When it causes left ventricular outflow tract (LVOT) obstruction, treatment is indicated to reduce symptoms and the risk of sudden cardiac death. Pharmacologic therapy is the first line treatment, however if it fails, surgical myectomy or percutaneous ablation of the hypertrophic myocardium are the standard therapies to eliminate subaortic obstruction. Both surgical myectomy and percutaneous ablation have been demonstrated as safe and effective treatments; however, myectomy is the gold standard with a significantly lower complication rate and more complete and longstanding reduction of LVOT obstruction.

Ann Cardiothorac Surg 2017; 6 (4):410-415

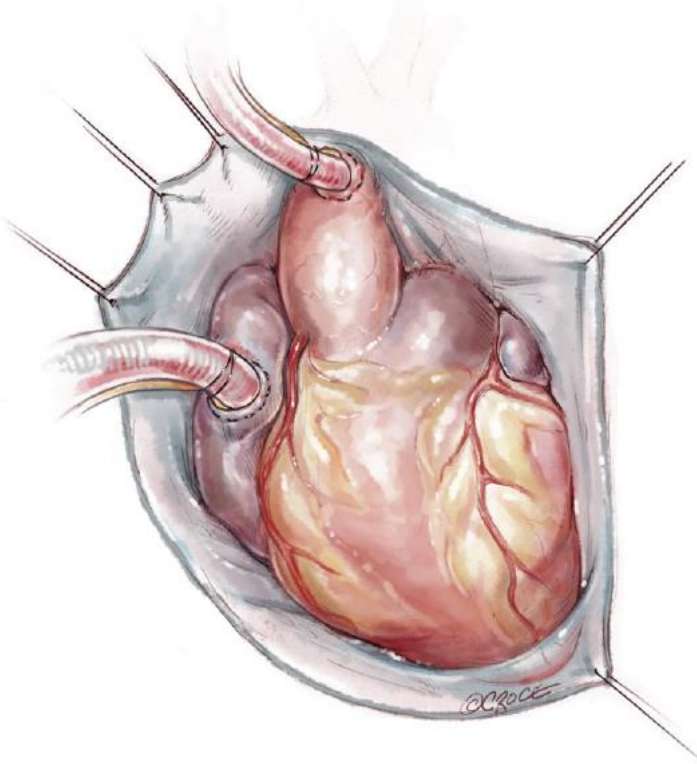


Figure 1 Multiple pericardial sutures are used to suspend the right pericardium to the adjacent superior sternal edge. Left pericardial suspension sutures are placed from the aortic annulus level to the pericardial reflection only, this allows the LV apex to drop into the left chest. This maneuver elevates the aorta to the sternal level and facilitates visualization during the procedure.

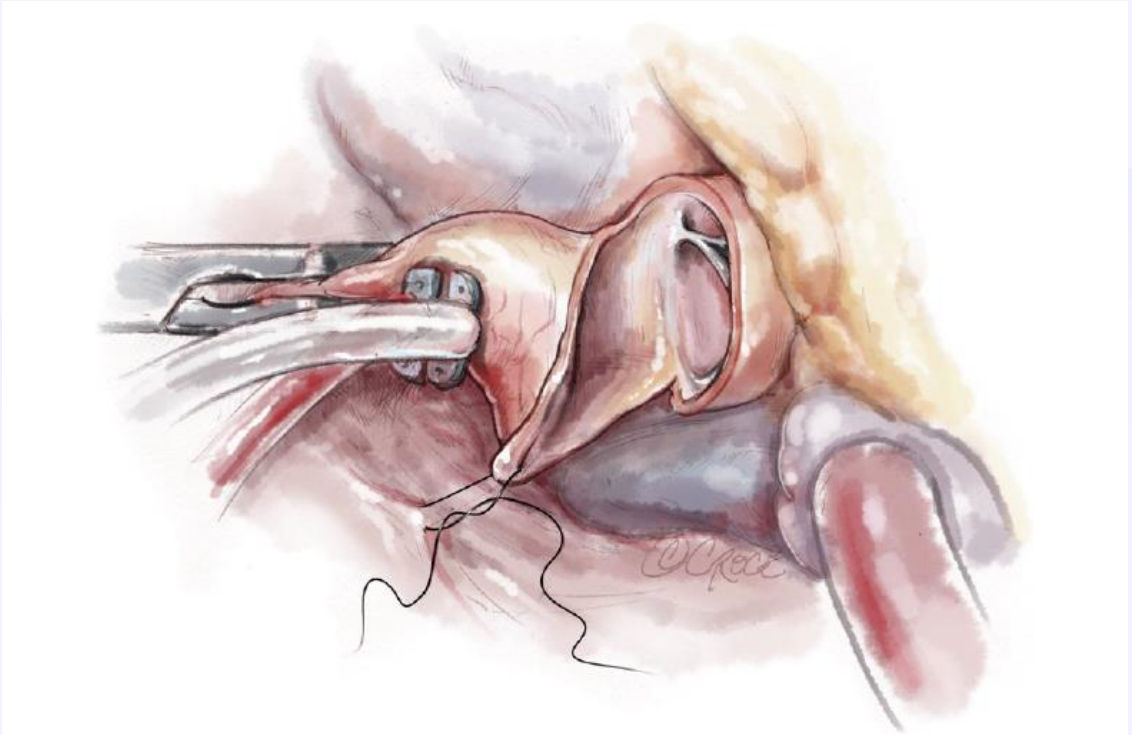


Figure 2 A transverse aortotomy is fashioned approximately 0.5 cm above the sinotubular junction. It is important not to cross the STJ with the incision as this prevents distortion of the aortic valve with closure of the aortotomy, which can result in aortic insufficiency. The distal aorta at the incision line is then tacked to the pericardial reflection at the level of the SVC for exposure.

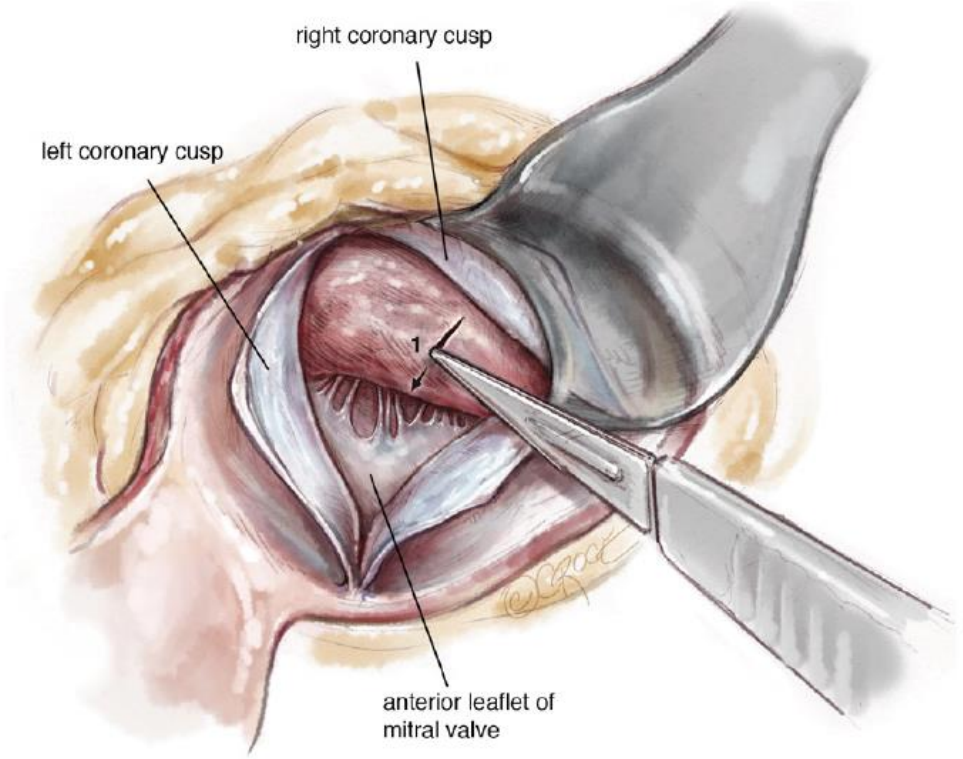


Figure 3 The first myectomy incision is made oriented towards the LV apex beginning 2mm below the right coronary leaflet hinge point and 2 mm towards the membranous septum. The depth of the incision is usually 1-1.5 cm and length 3.5-5 cm as guided by the preoperative echocardiogram.

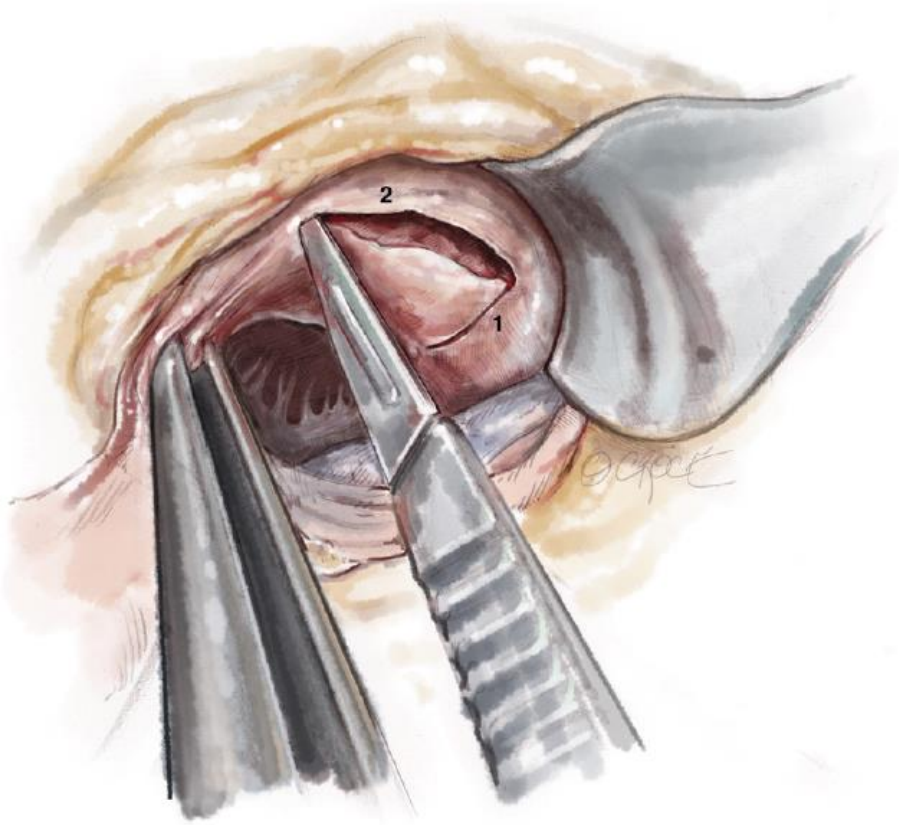


Figure 4 A series of 2.0 mm deep incisions running parallel to the LCC and RCC insertions are created to generate a myocardial flap corresponding to the desired resection thickness. Once the desired thickness has been generated, progress is made into the ventricle.

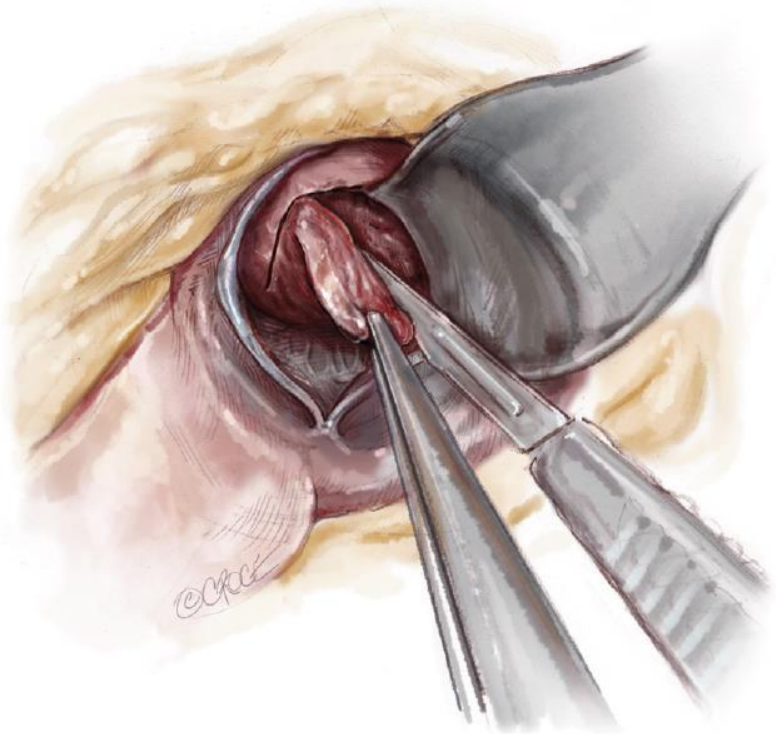


Figure 5 Using Argentine forceps, the 'LVOT flap' is grasped and distracted inferiorly. Now a second 2.0 mm deep incision is made at the superior border of incisions 2 and 3. In the region of the sub-commissural area the two original incisions are rounded with subsequent incisions. The process is repeated eventually forming a flap in the LVOT resection is terminated by placing downward traction on the specimen and incising across the base.

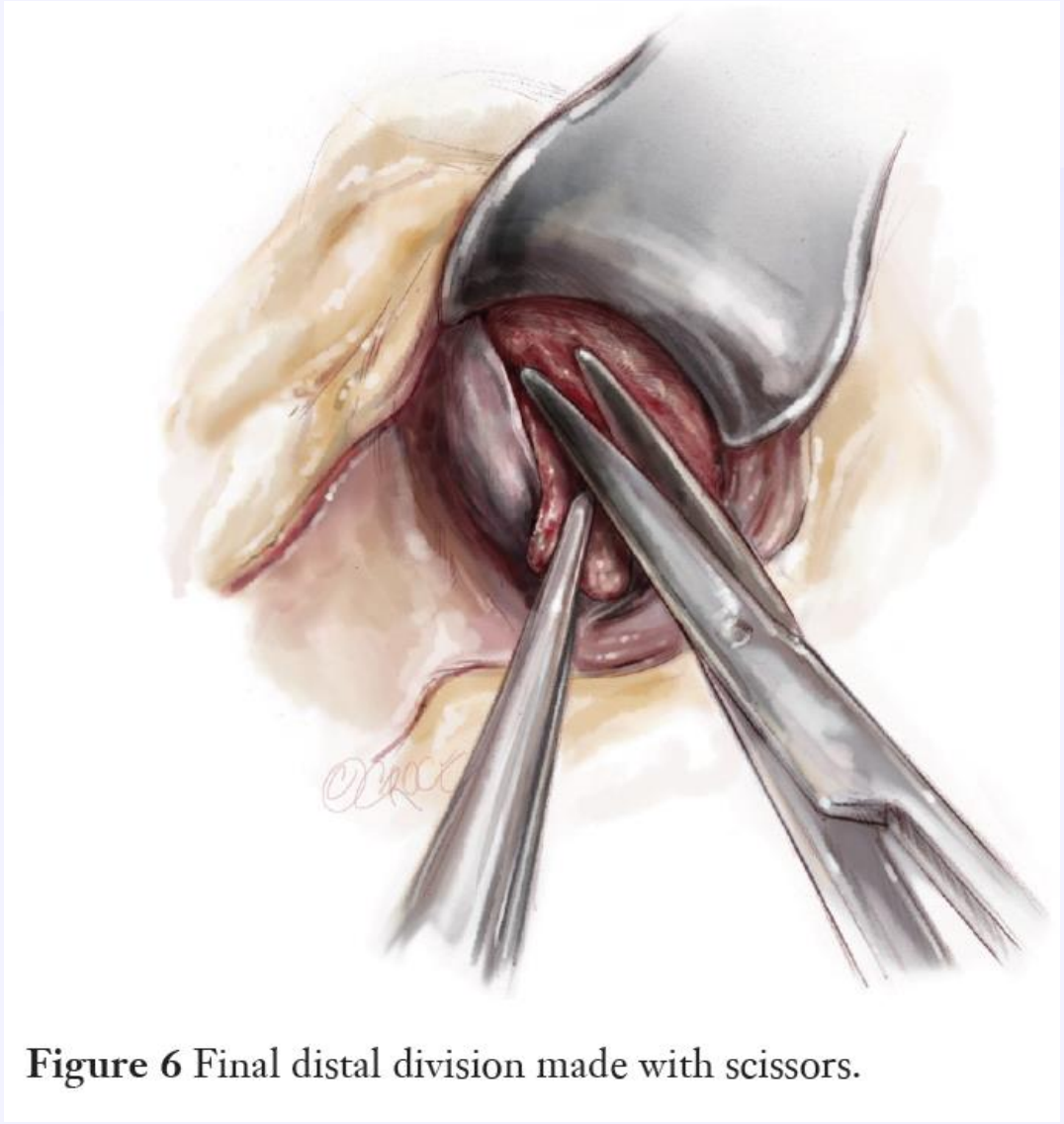


Figure 6 Final distal division made with scissors.

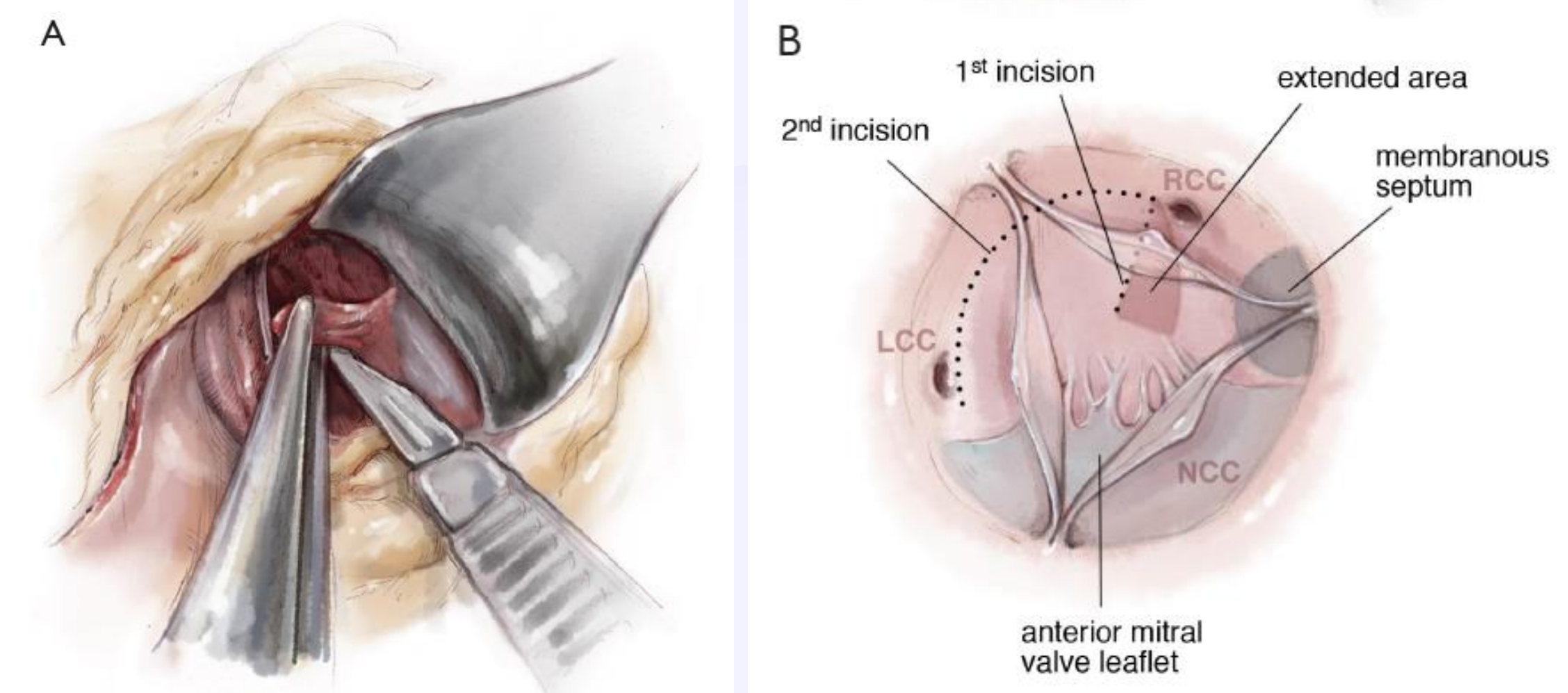


Figure 7 Extension of the resection under the membranous septum.

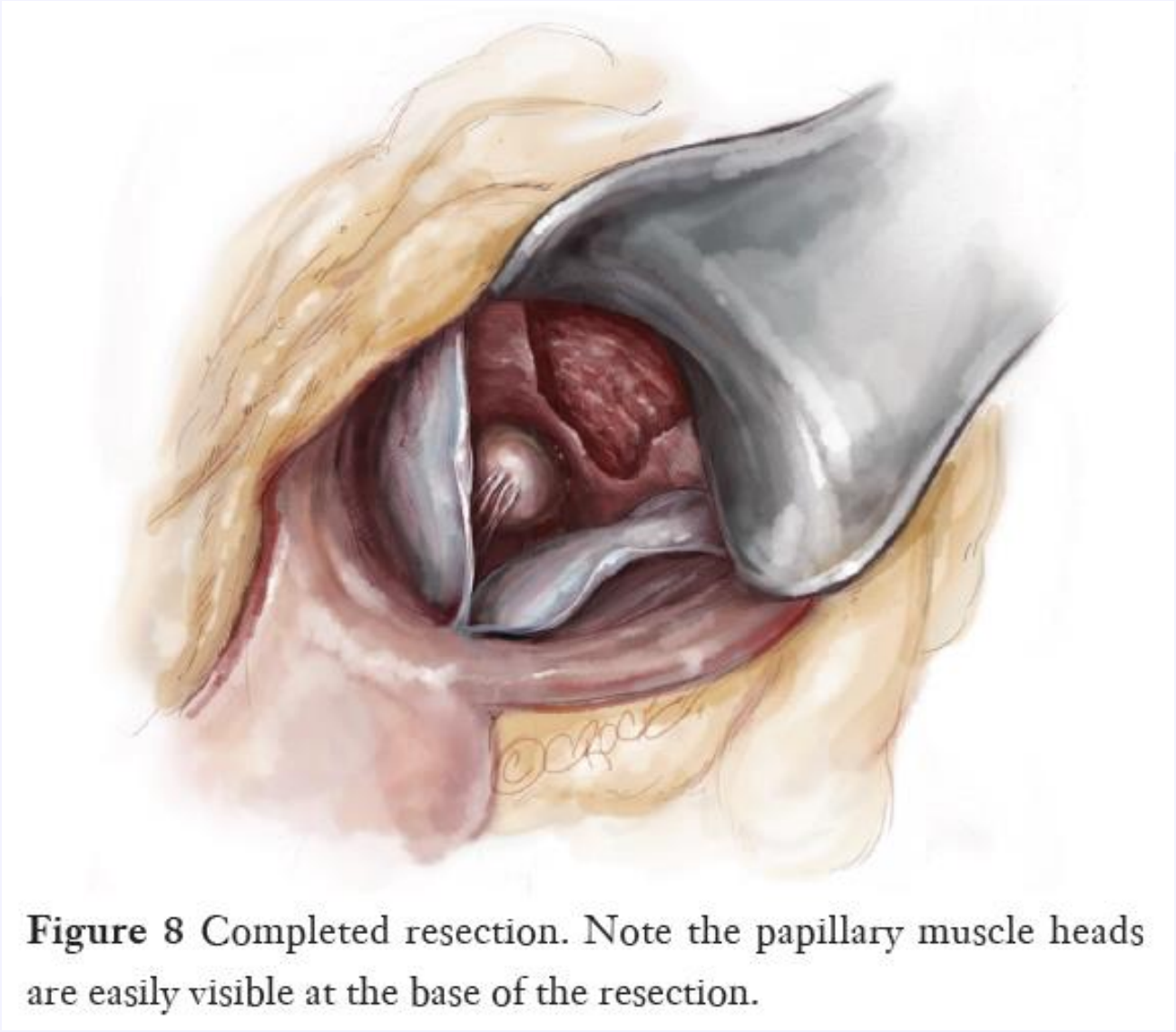


Figure 8 Completed resection. Note the papillary muscle heads are easily visible at the base of the resection.

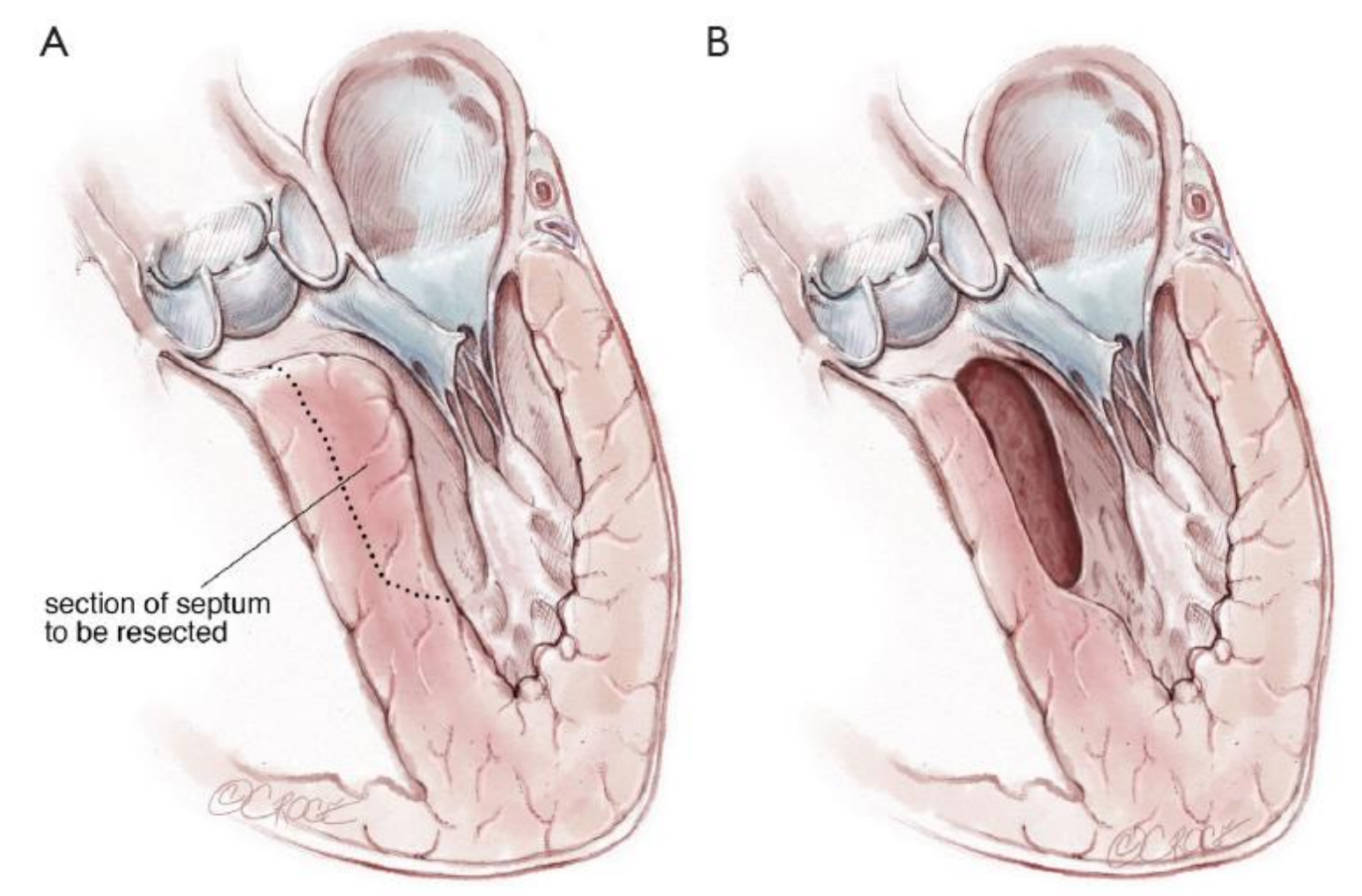


Figure 9 Illustration of septum resected.

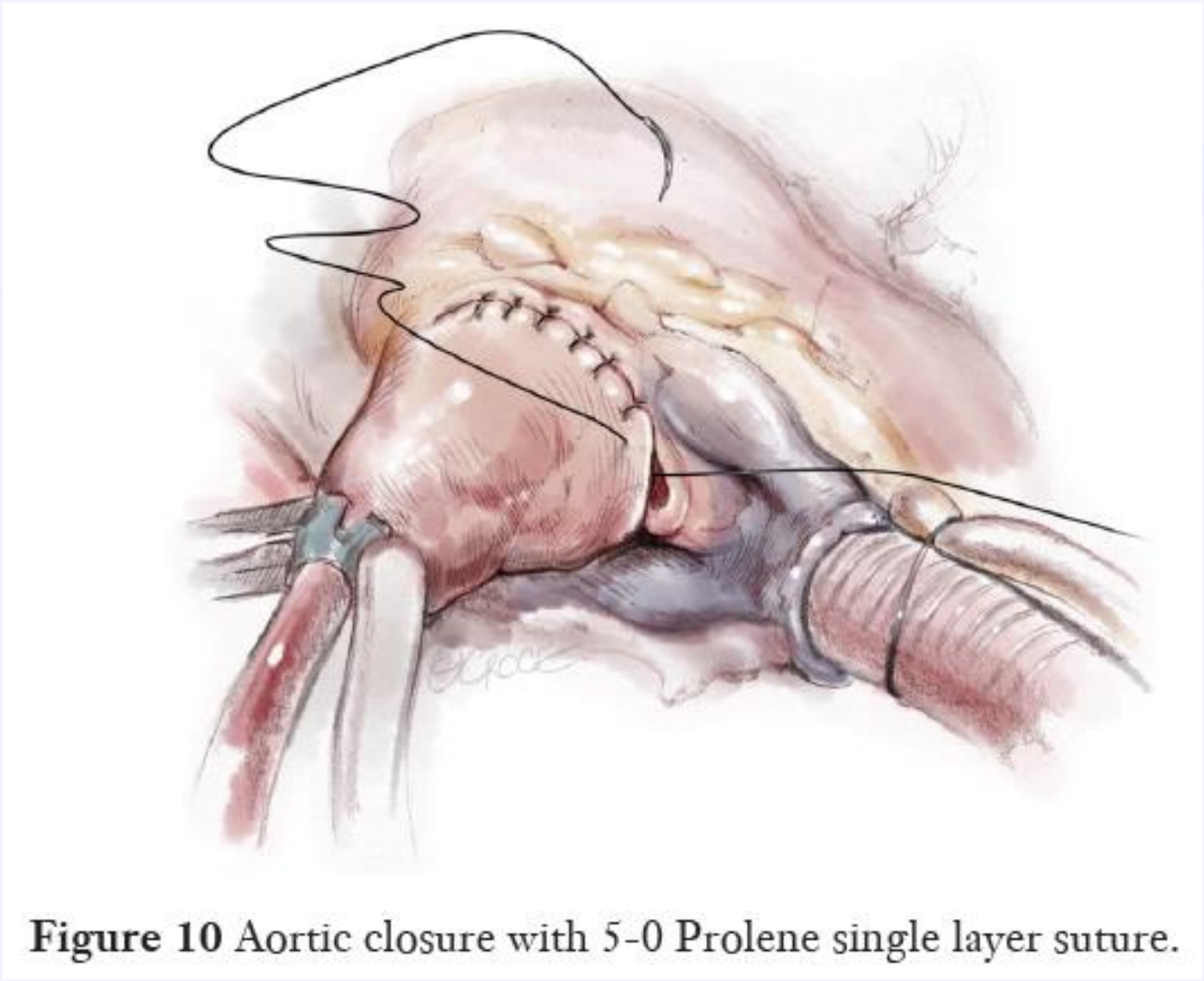


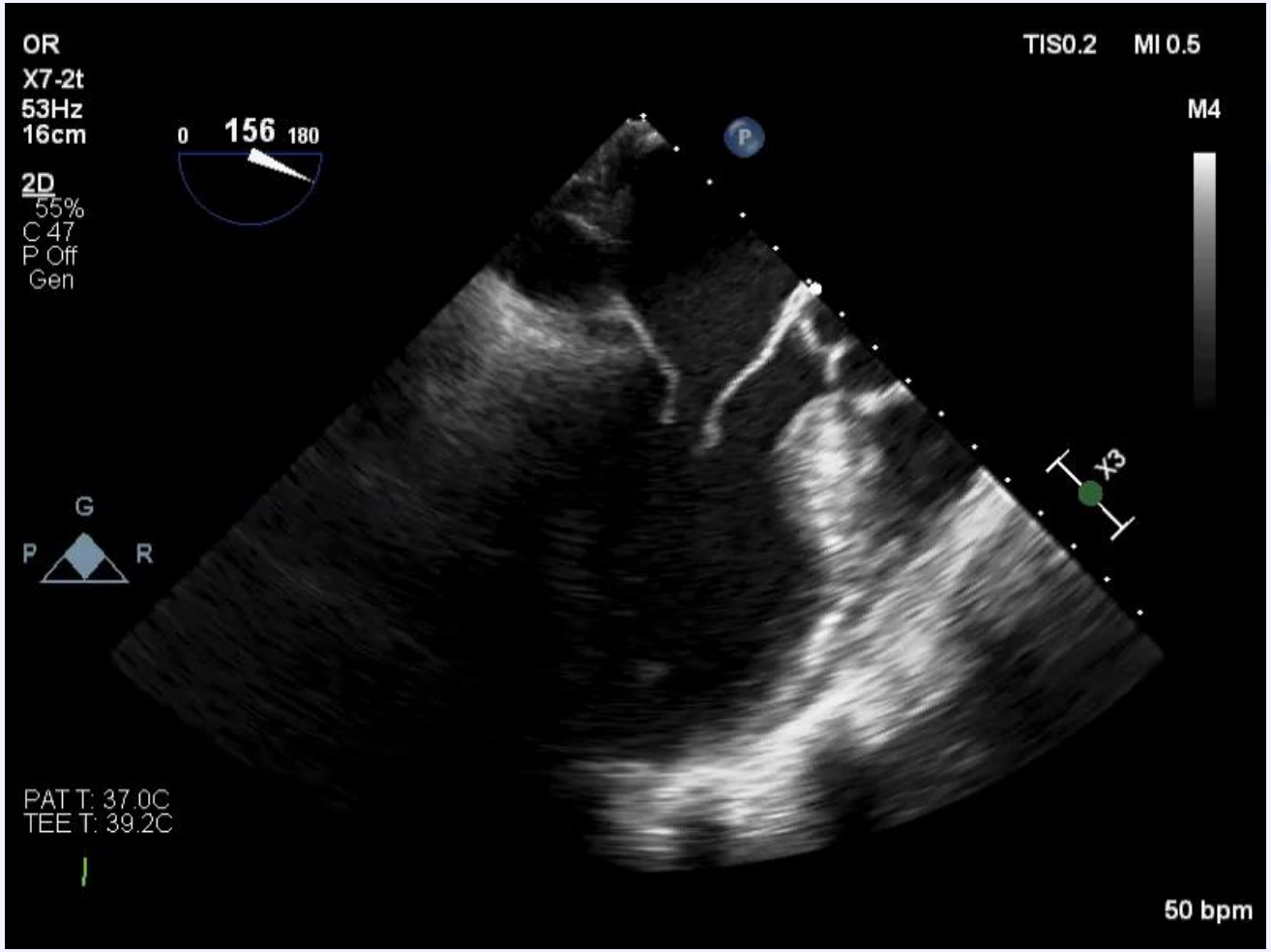
Figure 10 Aortic closure with 5-0 Prolene single layer suture.

Conclusions

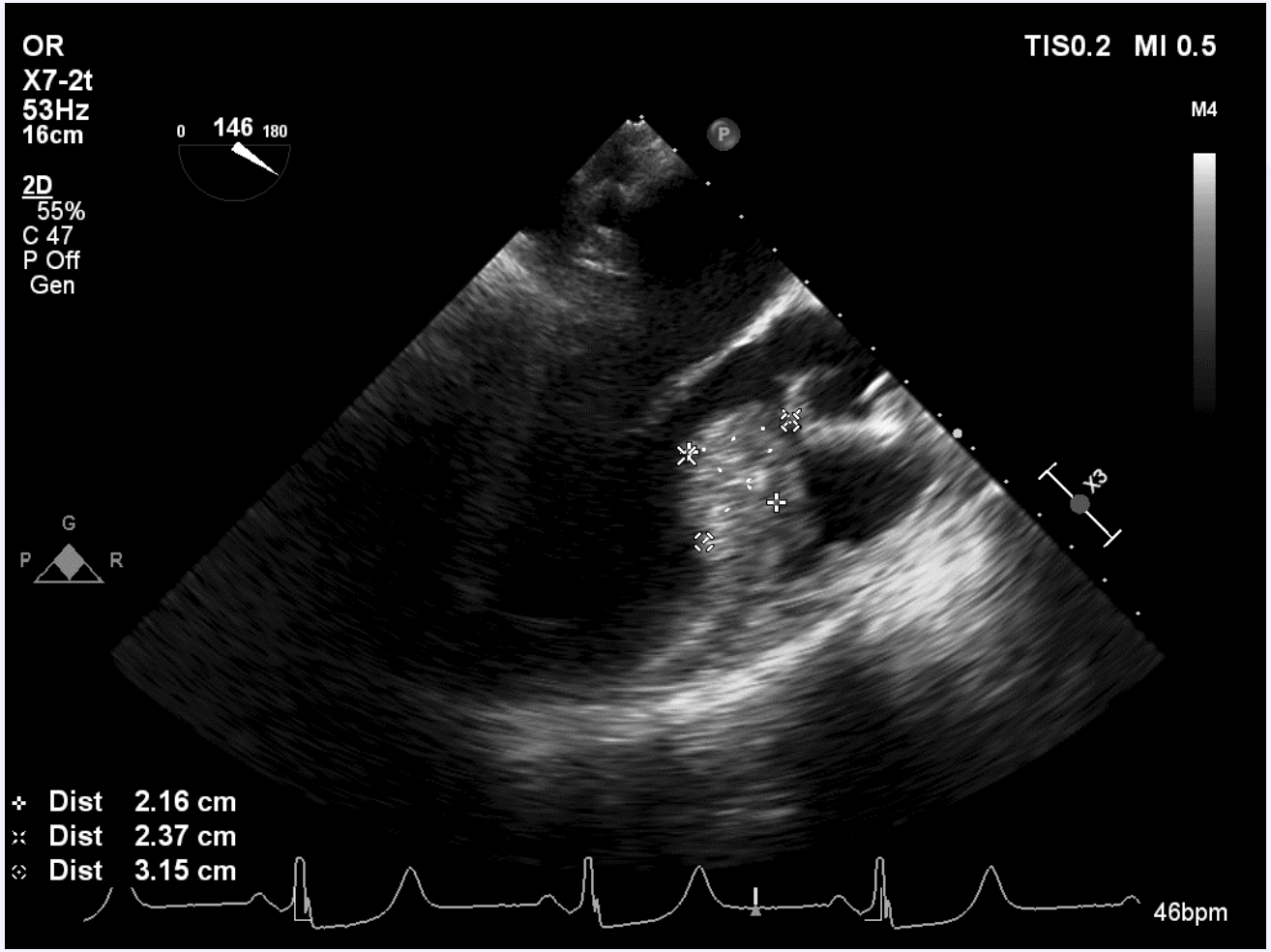
Myectomy is the gold standard for treatment of LVOT obstruction. Excellent results can be obtained at centres with dedicated HCM programs. Careful attention throughout the preoperative, intraoperative and postoperative settings can ensure low complication rates and favourable long-term results.

Case 3

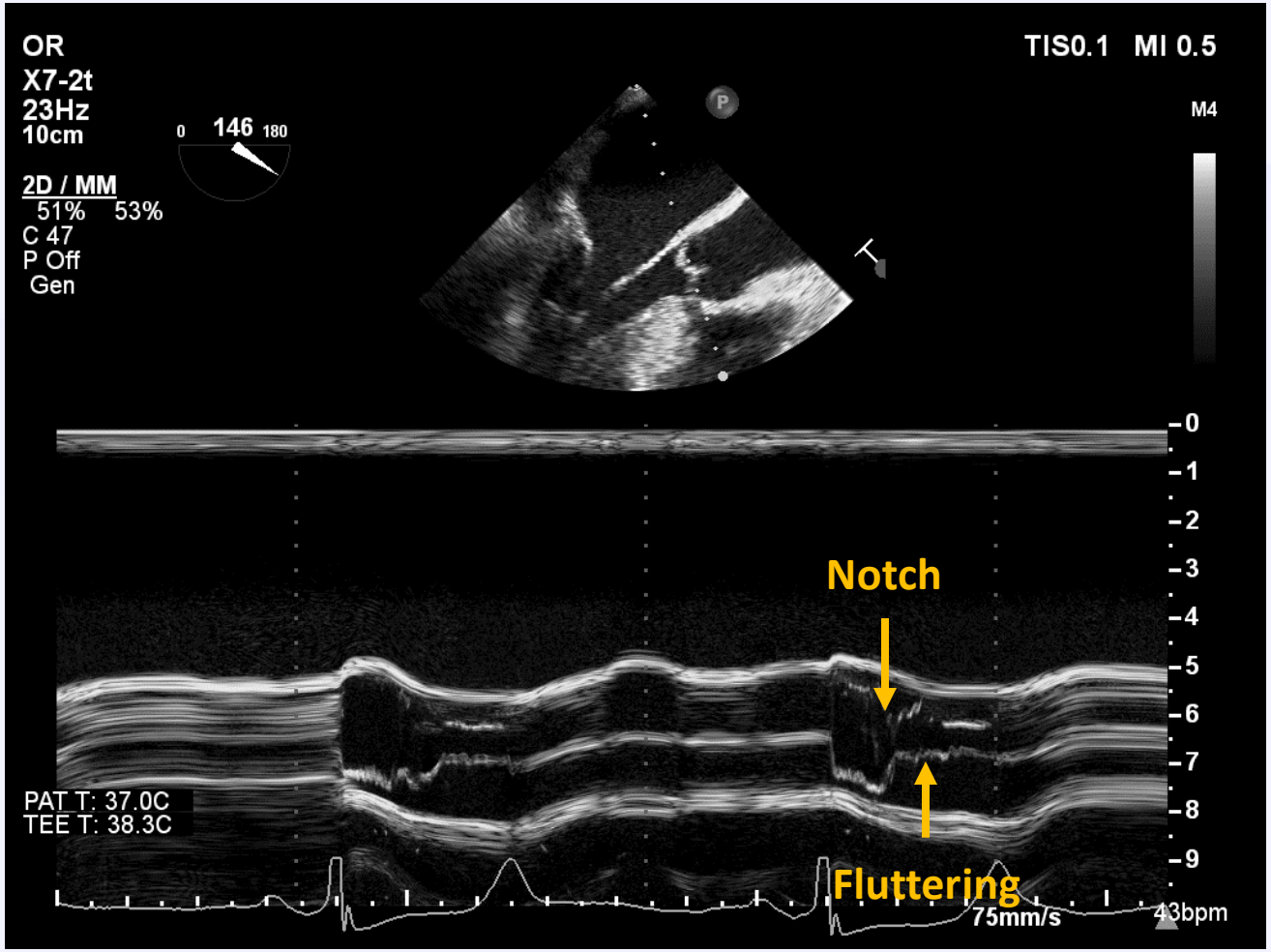
55-year-old woman with a known history of hypertrophic obstructive cardiomyopathy



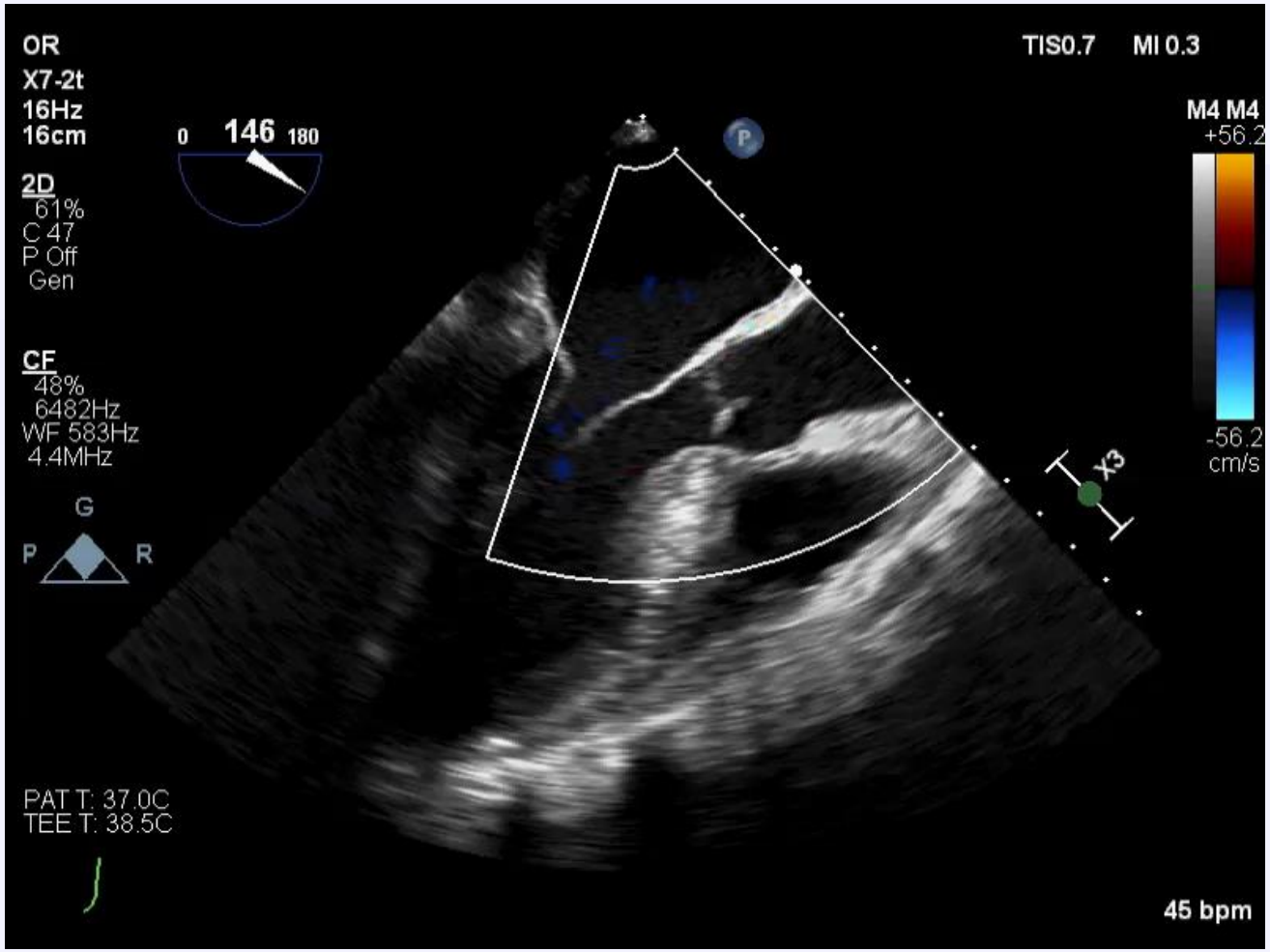
Pre op, long axis view of the LVOT showing severe thickening of the basal septum, severe SAM



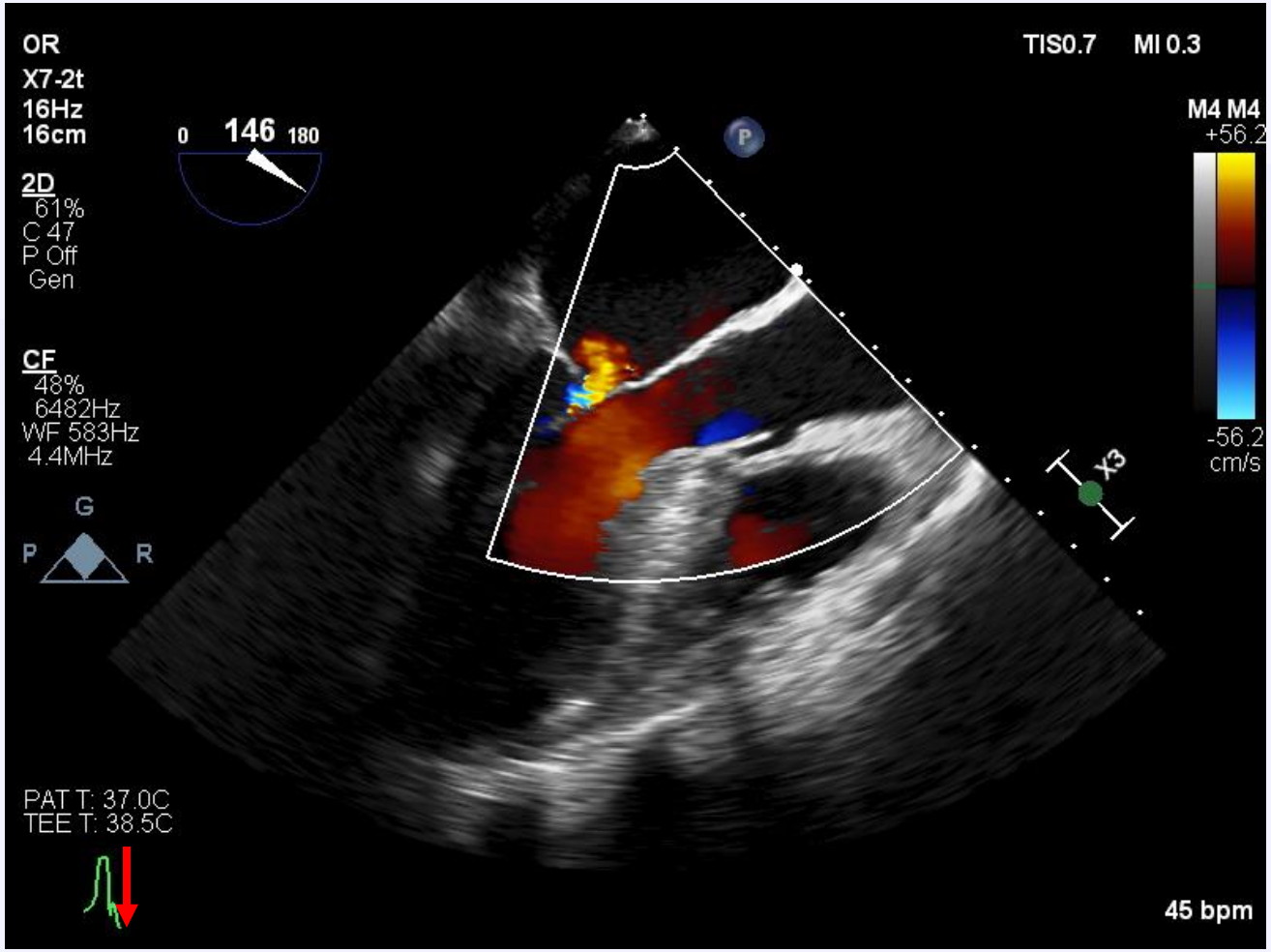
Pre op measurements: maximum septal thickness = 2.2 cm, distance of RCC to the SAM contact = 2.4 cm, and distance of RCC to the downward extension of thickening = 3.2 cm



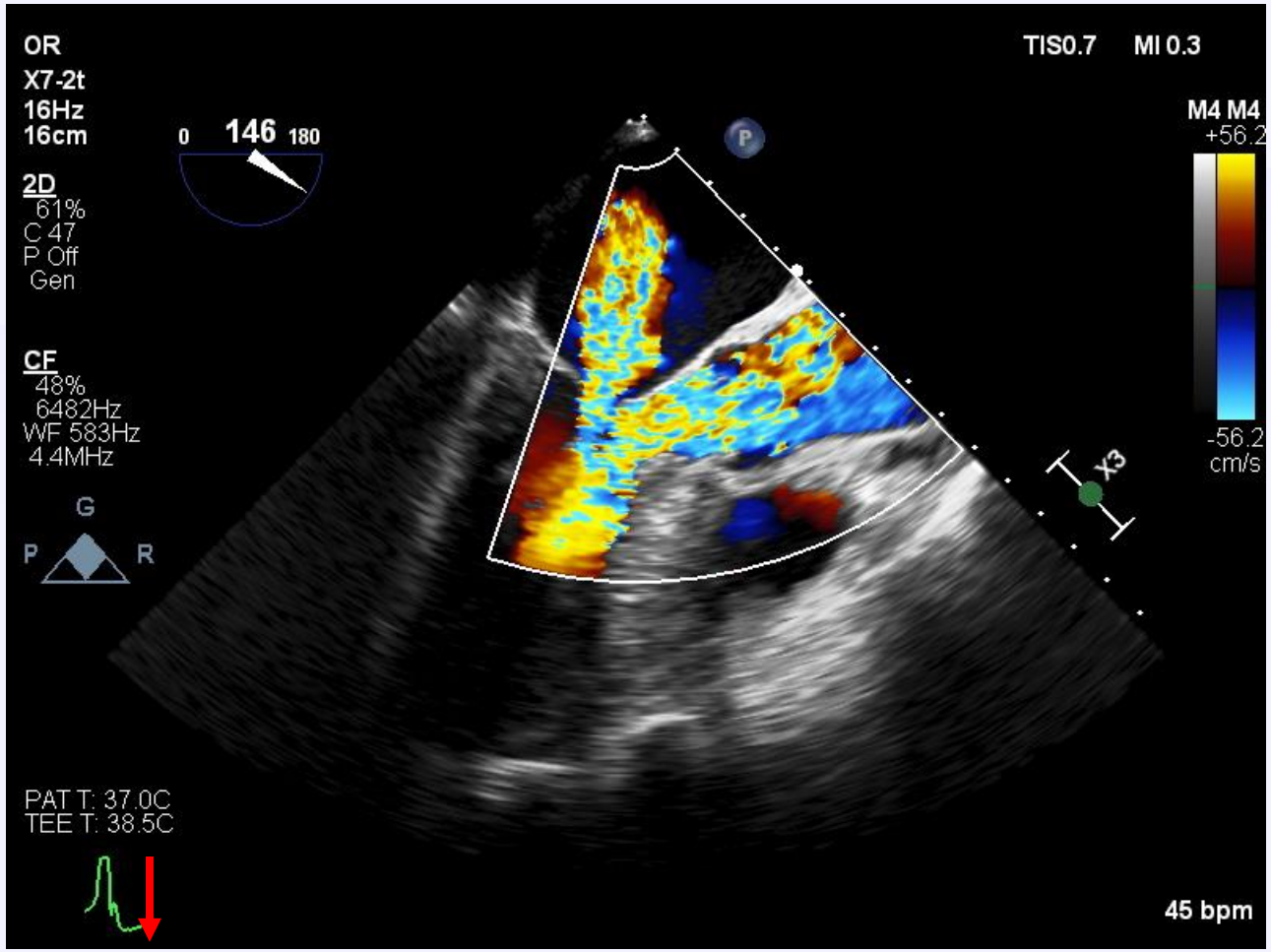
M-mode across the aortic valve showing classic sign of LVOT dynamic obstruction (mid systolic notch and aortic cusps fluttering)



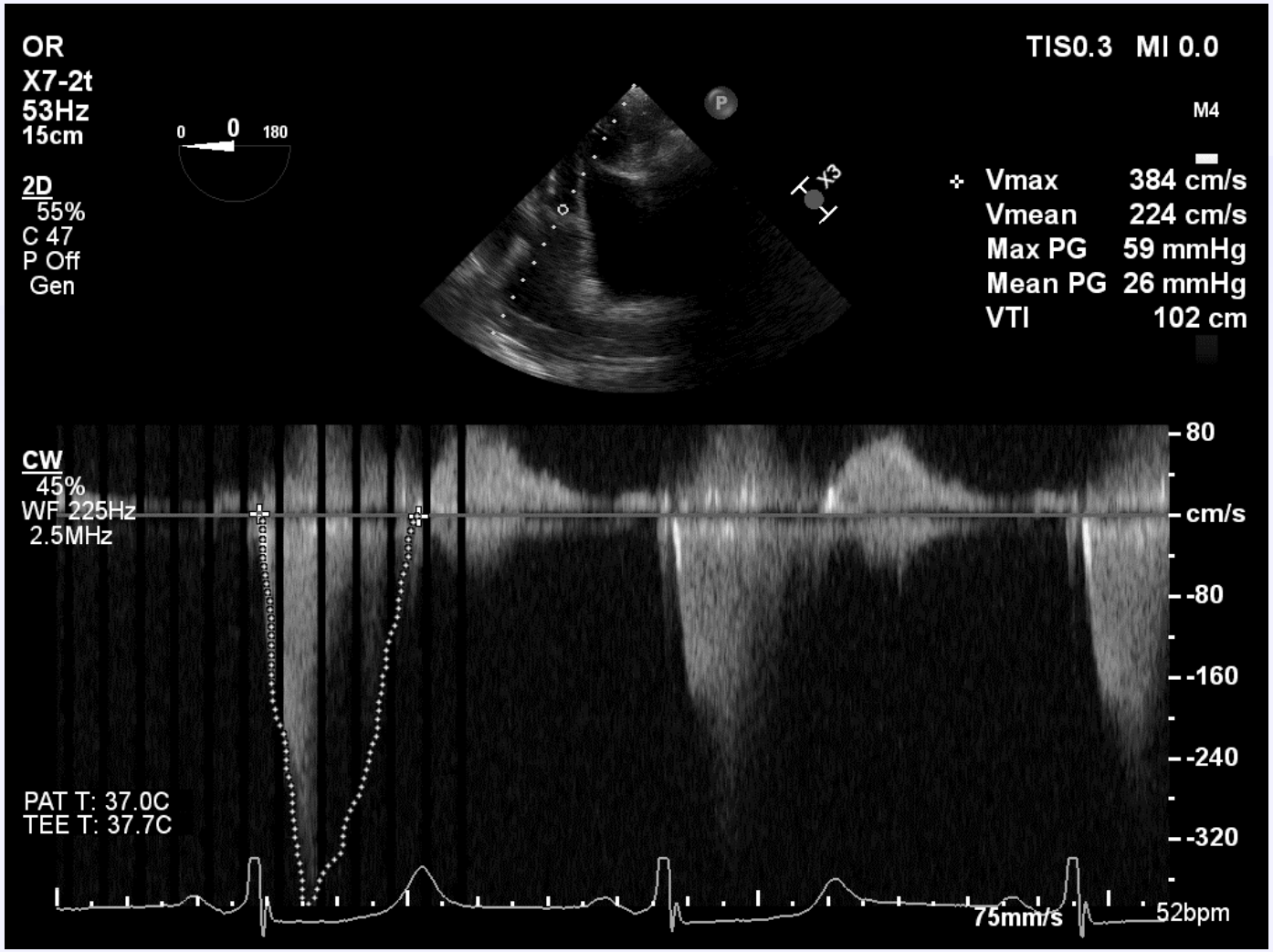
Pre op, long axis view of the LVOT showing severe posteriorly directed jet of MR following SAM



Trace early systolic MR which will remain after myectomy

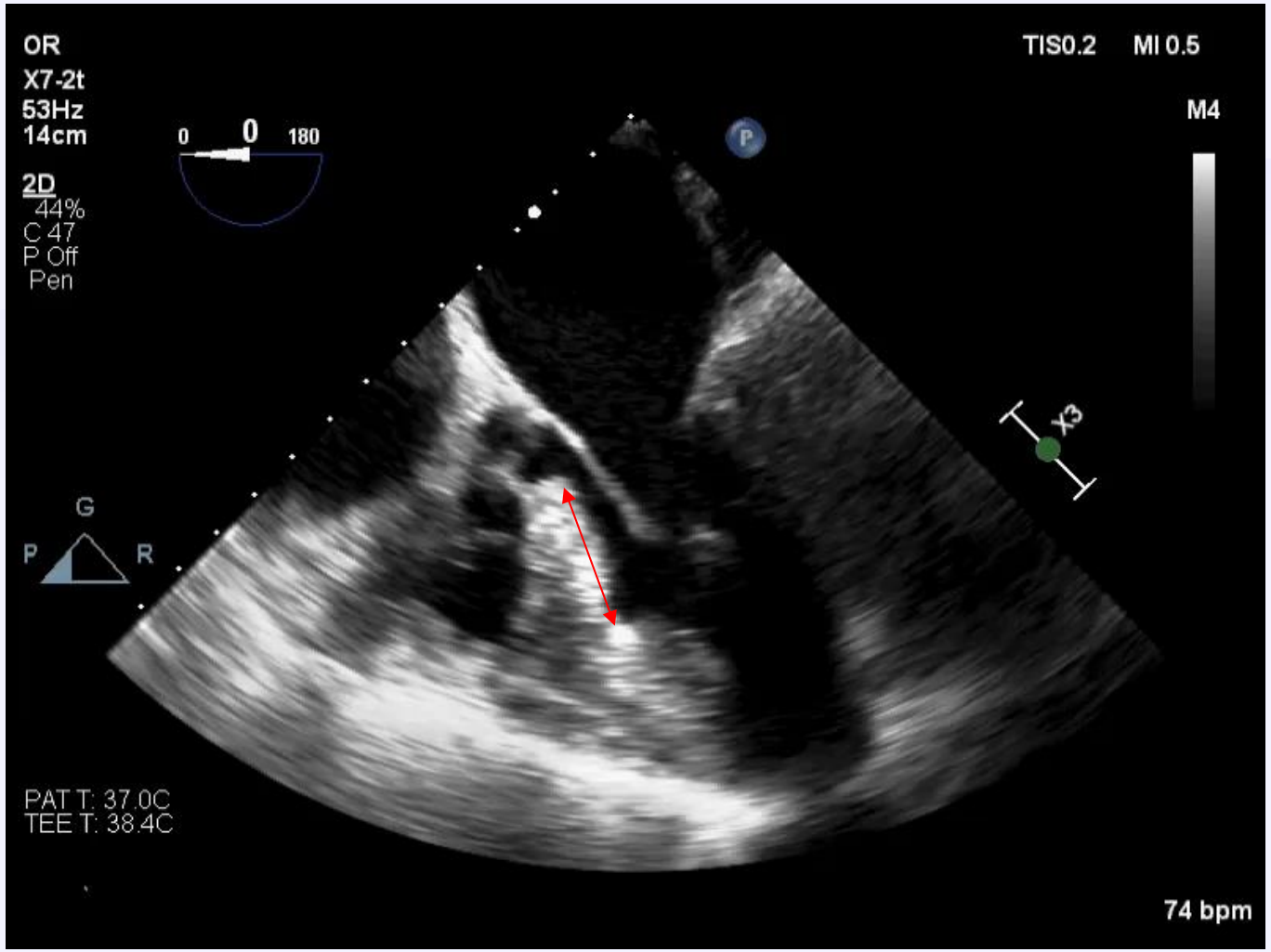


Late systolic MR following SAM which should disappear after a successful myectomy

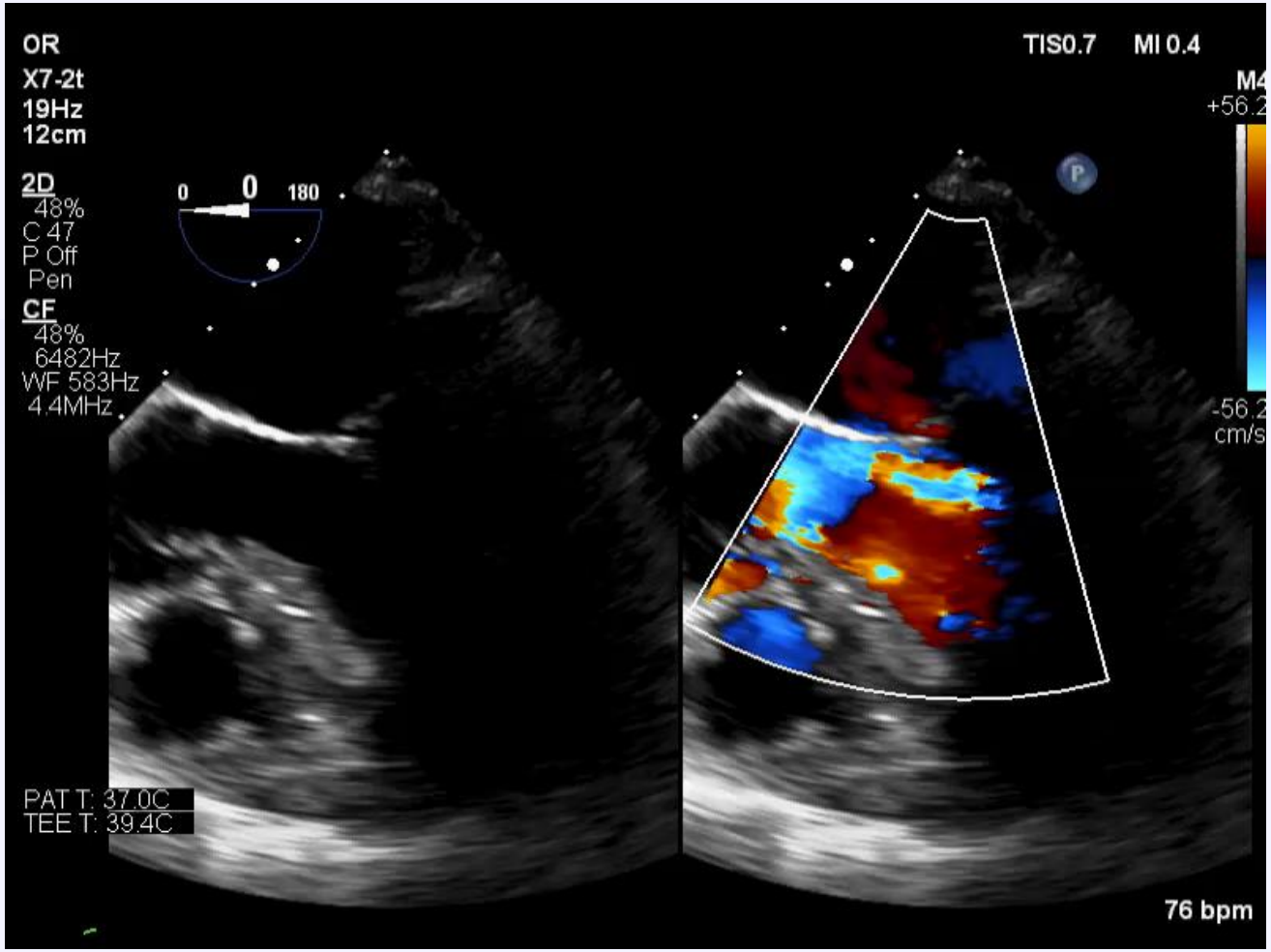


LVOT gradient, PIG = 59 mmHg (contaminated with MR)

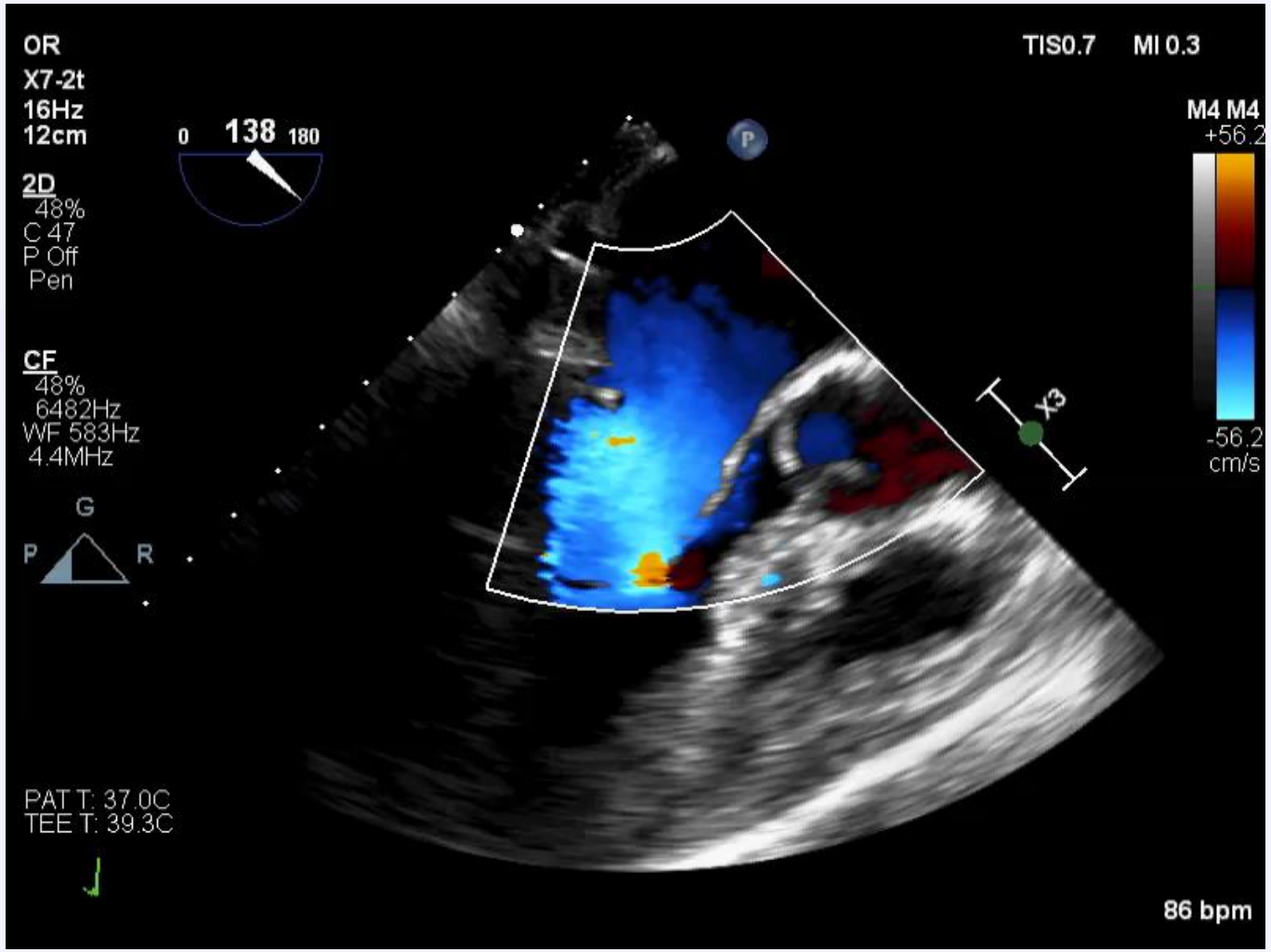
Post op



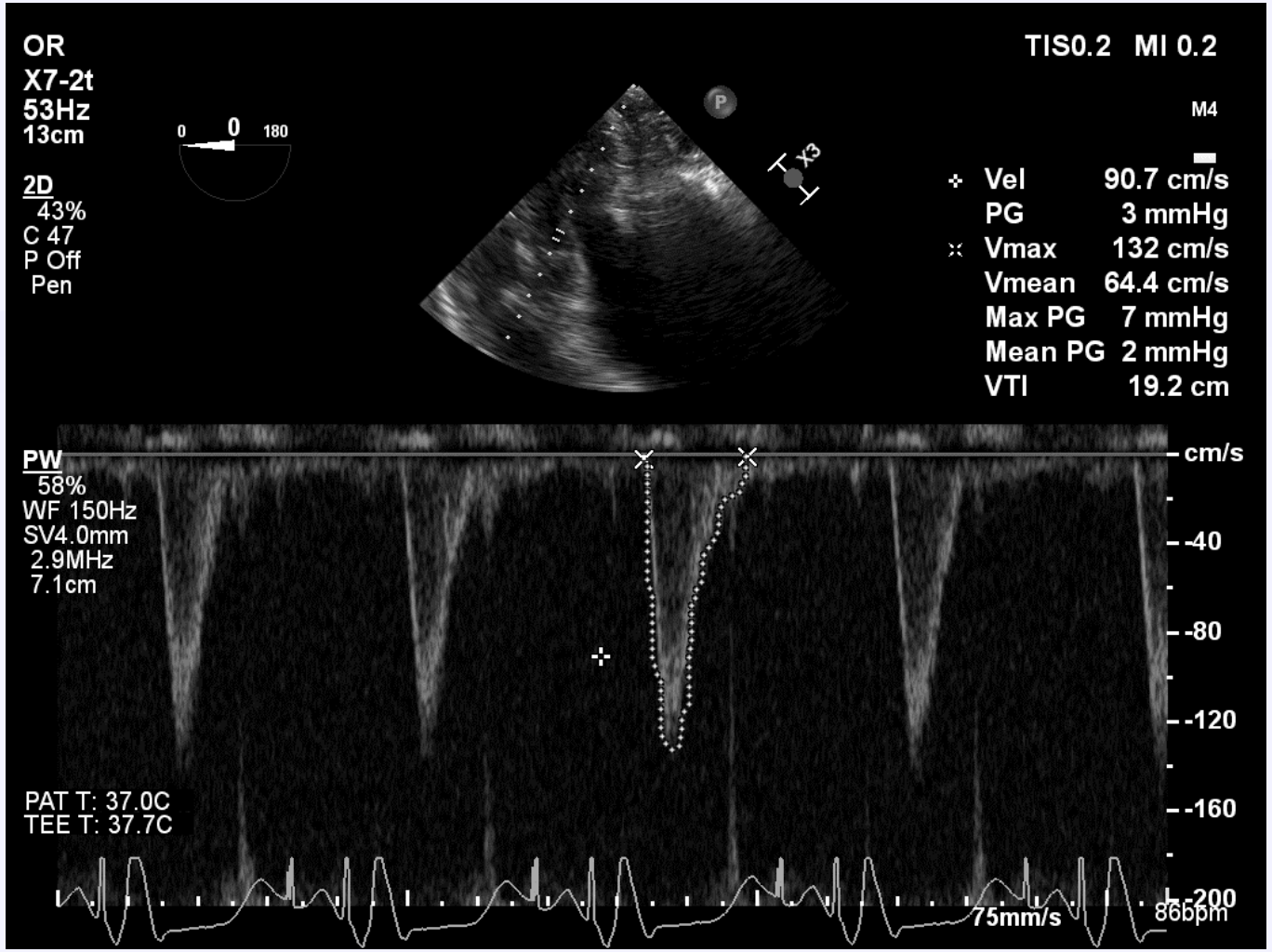
Extensive septal myectomy, very mild SAM



Post op, septal perforator at the site of myectomy, no LVOT systolic turbulence, no VSD, only trivial MR left



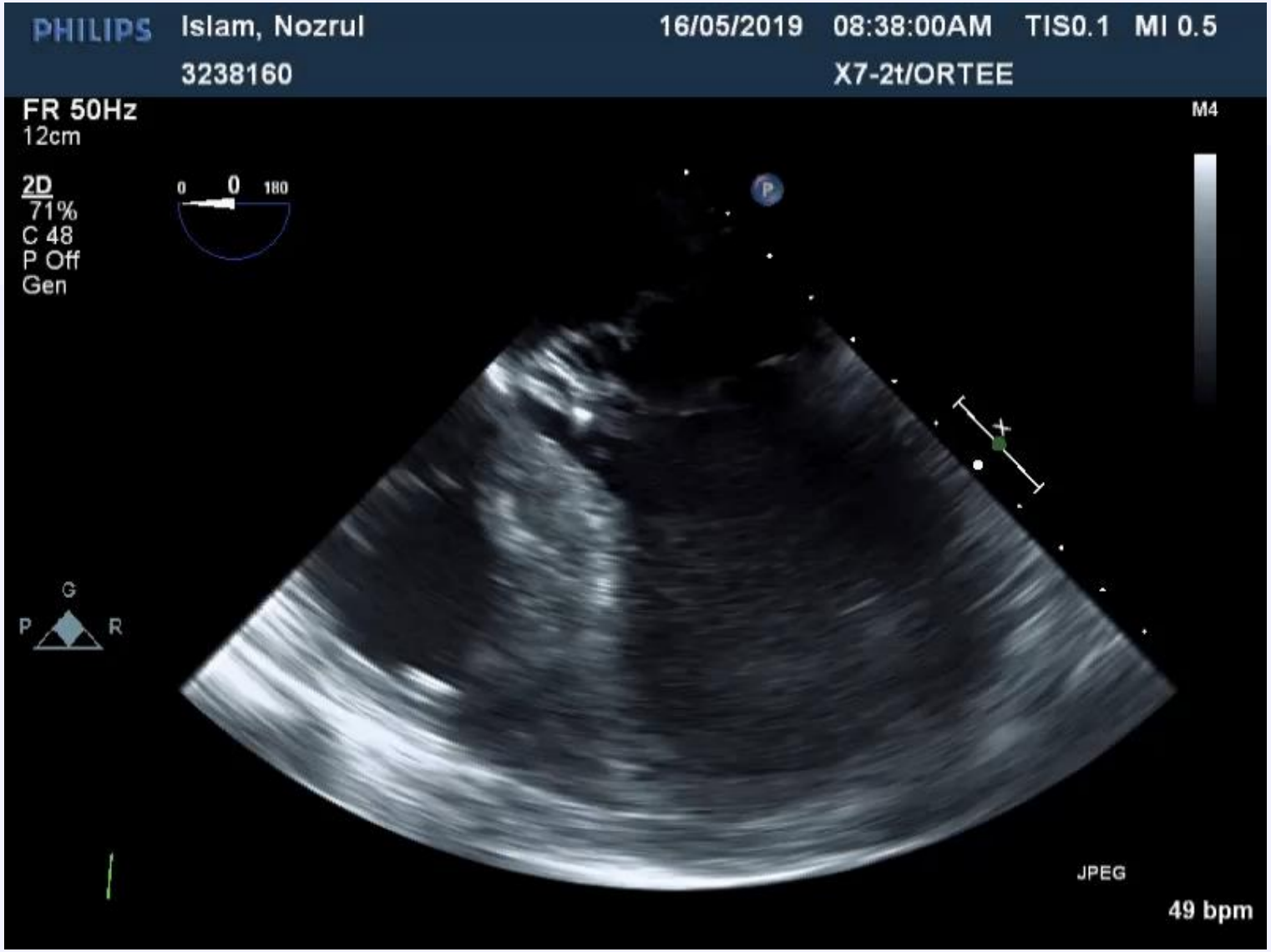
Post op long axis view, trivial early systolic MR

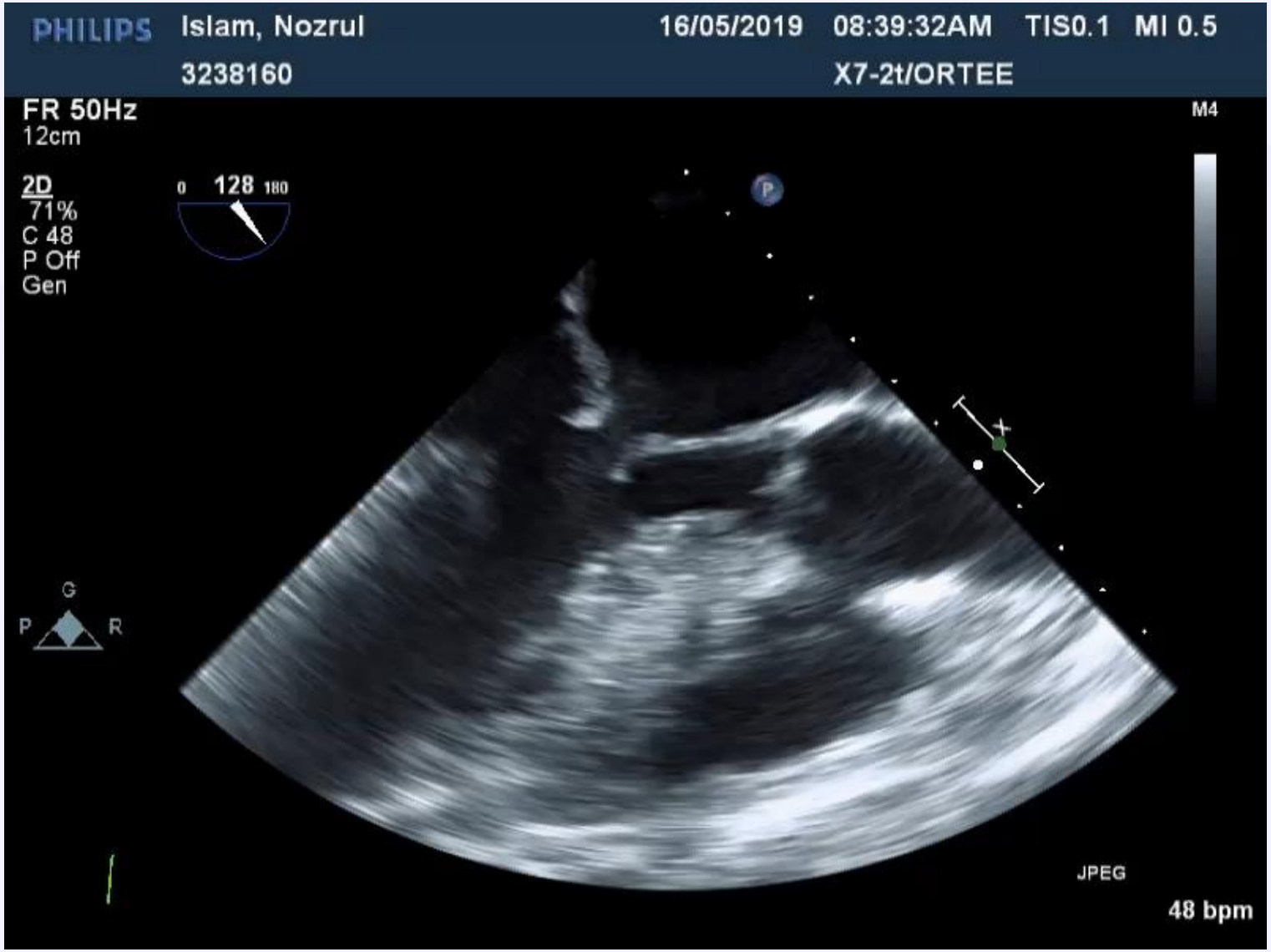


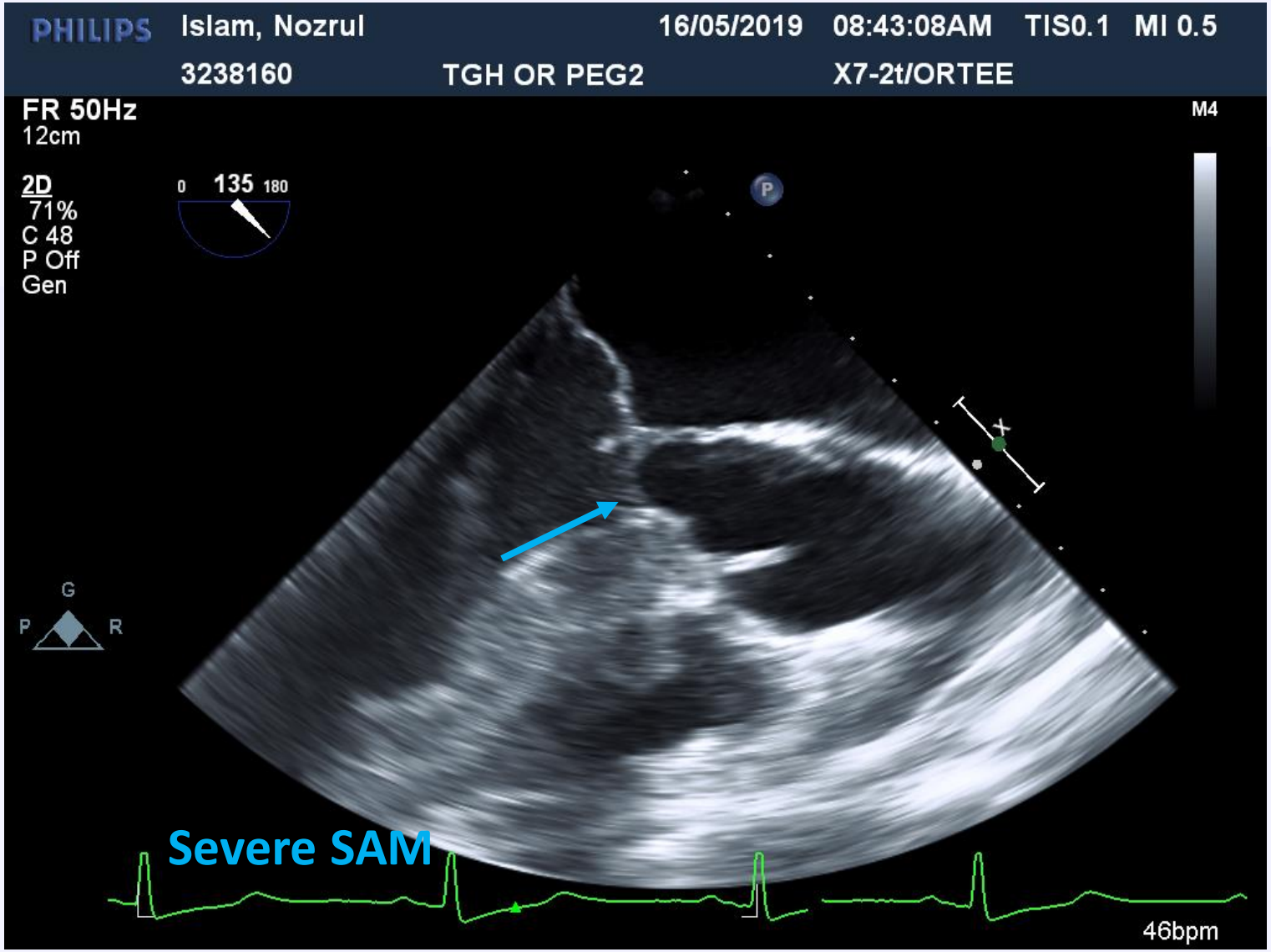
Post op LVOT gradient, PIG = 7, mean of 2 mmHg

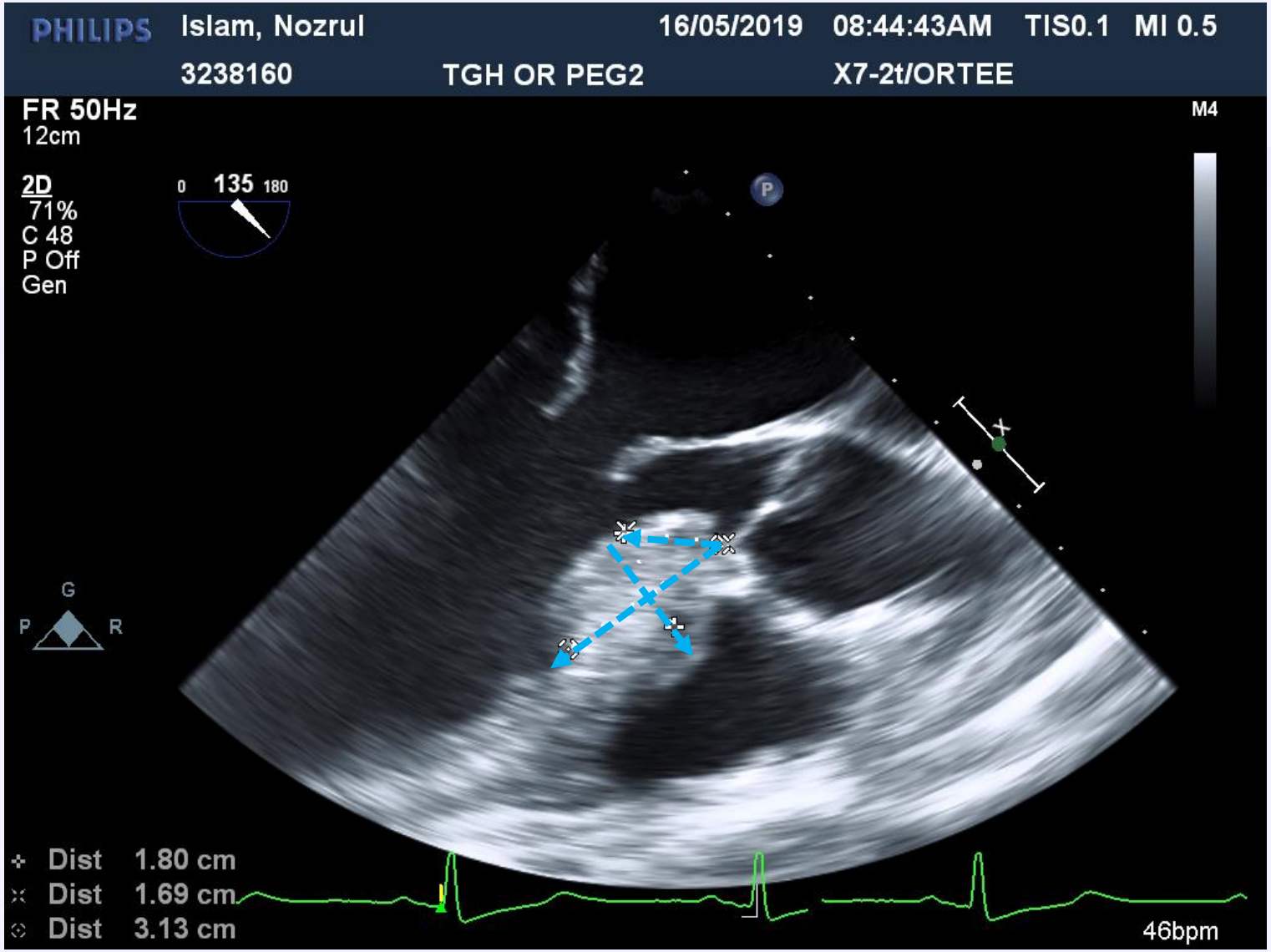
Case 4

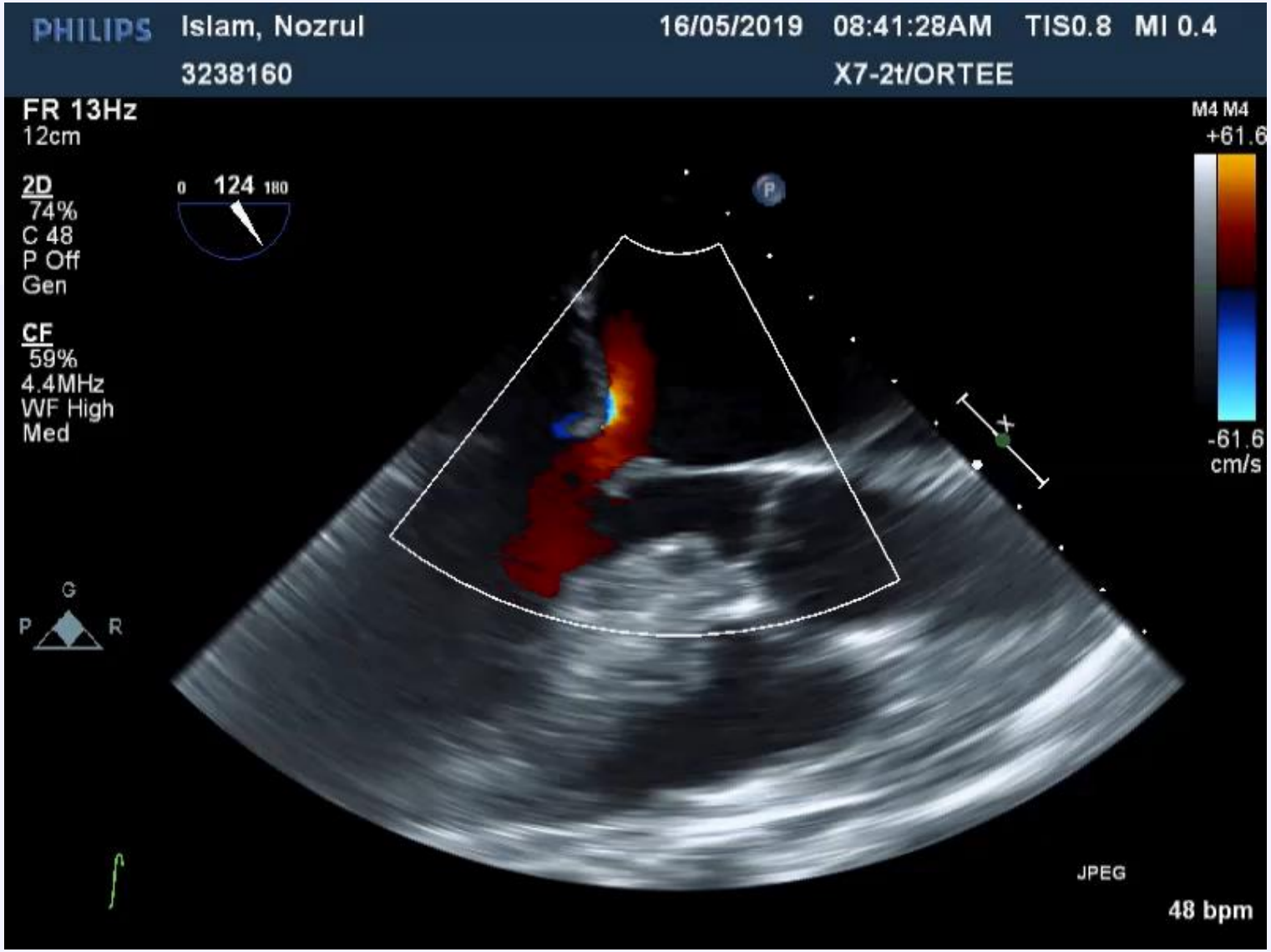
54-year-old man with a known history of hypertrophic obstructive cardiomyopathy

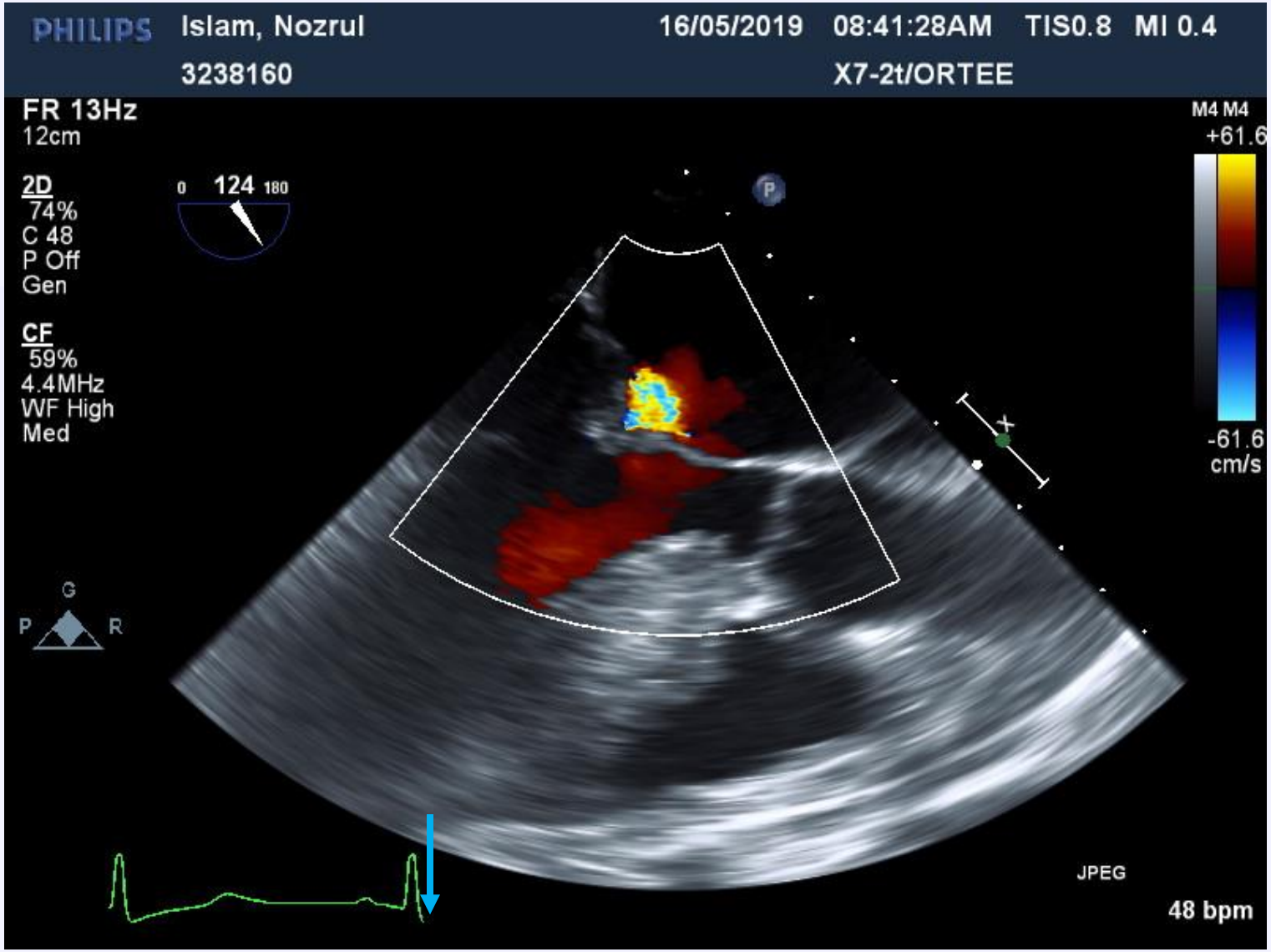

PHILIPS
Islam, Nozrul
3238160
16/05/2019
08:38:00AM
TIS0.1
MI 0.5
X7-2t/ORTEE
FR 50Hz
12cm
M4
2D
71%
C 48
P Off
Gen
0
0
180
G
P
R
JPEG
49 bpm

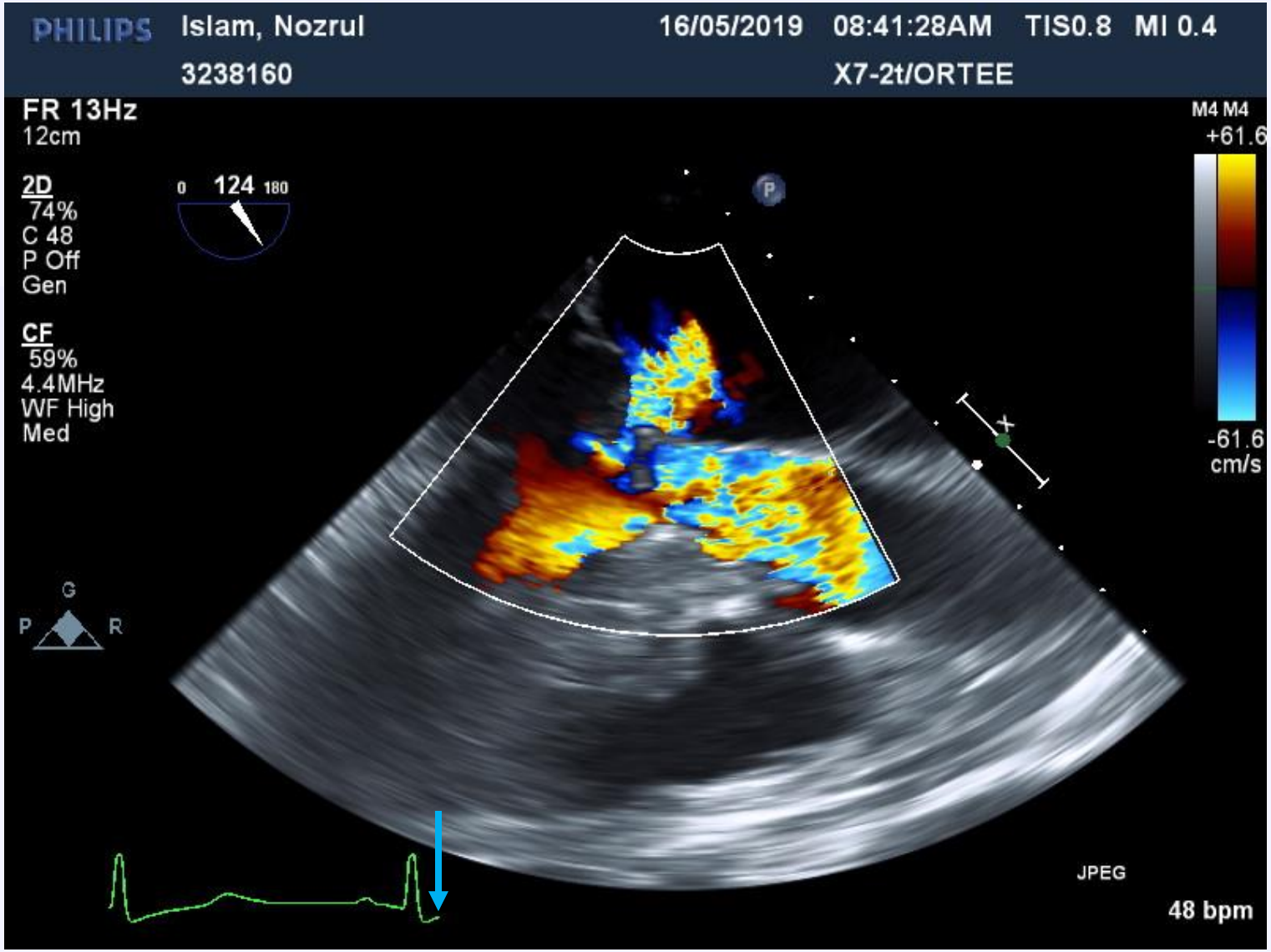

PHILIPS
Islam, Nozrul
3238160
16/05/2019
08:39:32AM
TIS0.1
MI 0.5
X7-2t/ORTEE
FR 50Hz
12cm
2D
71%
C 48
P Off
Gen
0
128
180
M4
G
P
R
JPEG
48 bpm

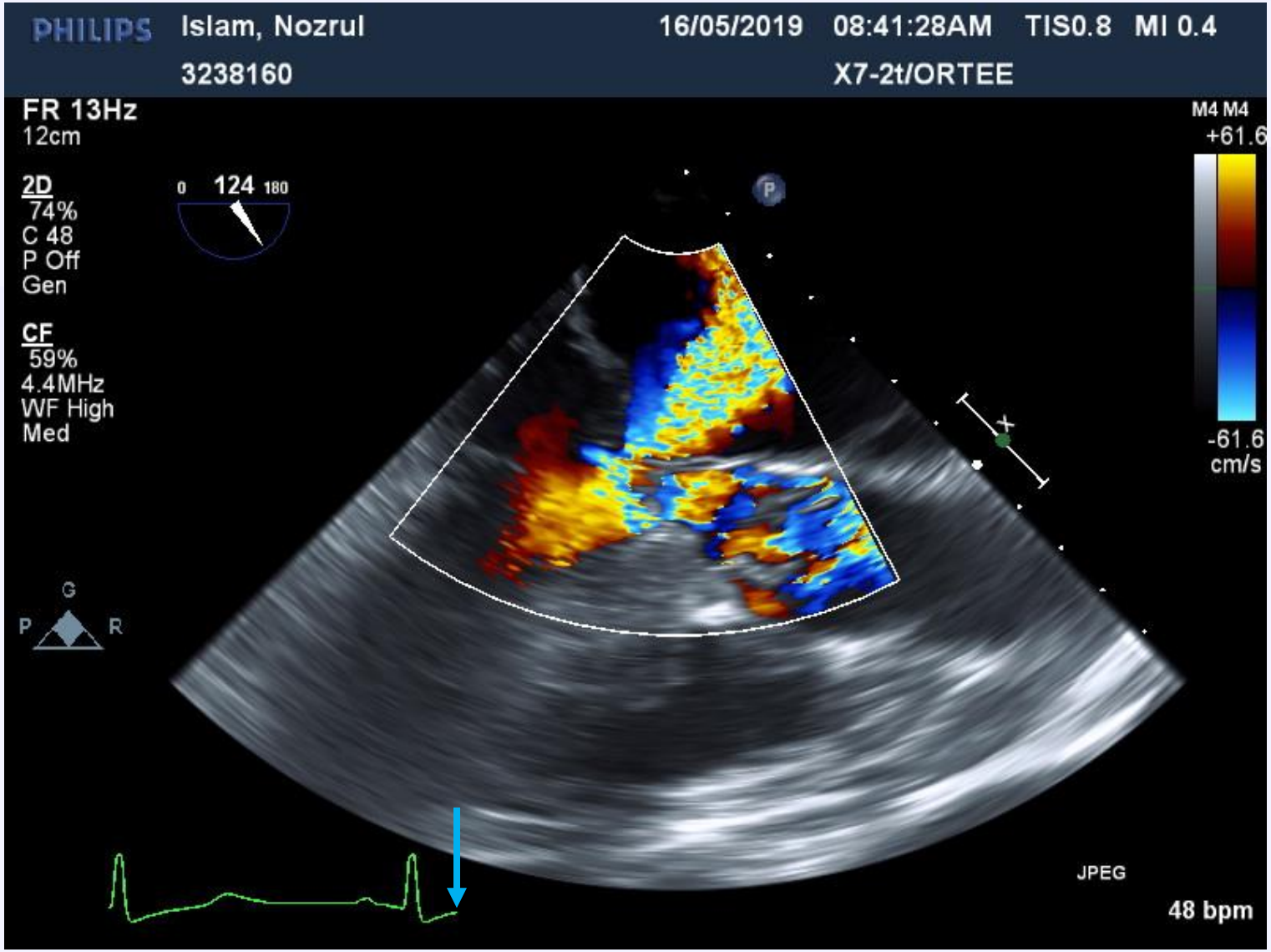

PHILIPS
Islam, Nozrul
16/05/2019
08:43:08AM
TIS0.1
MI 0.5
3238160
TGH OR PEG2
X7-2t/ORTEE
FR 50Hz
12cm
M4
2D
71%
C 48
P Off
Gen
0
135
180
G
P
R
Severe SAM
46bpm

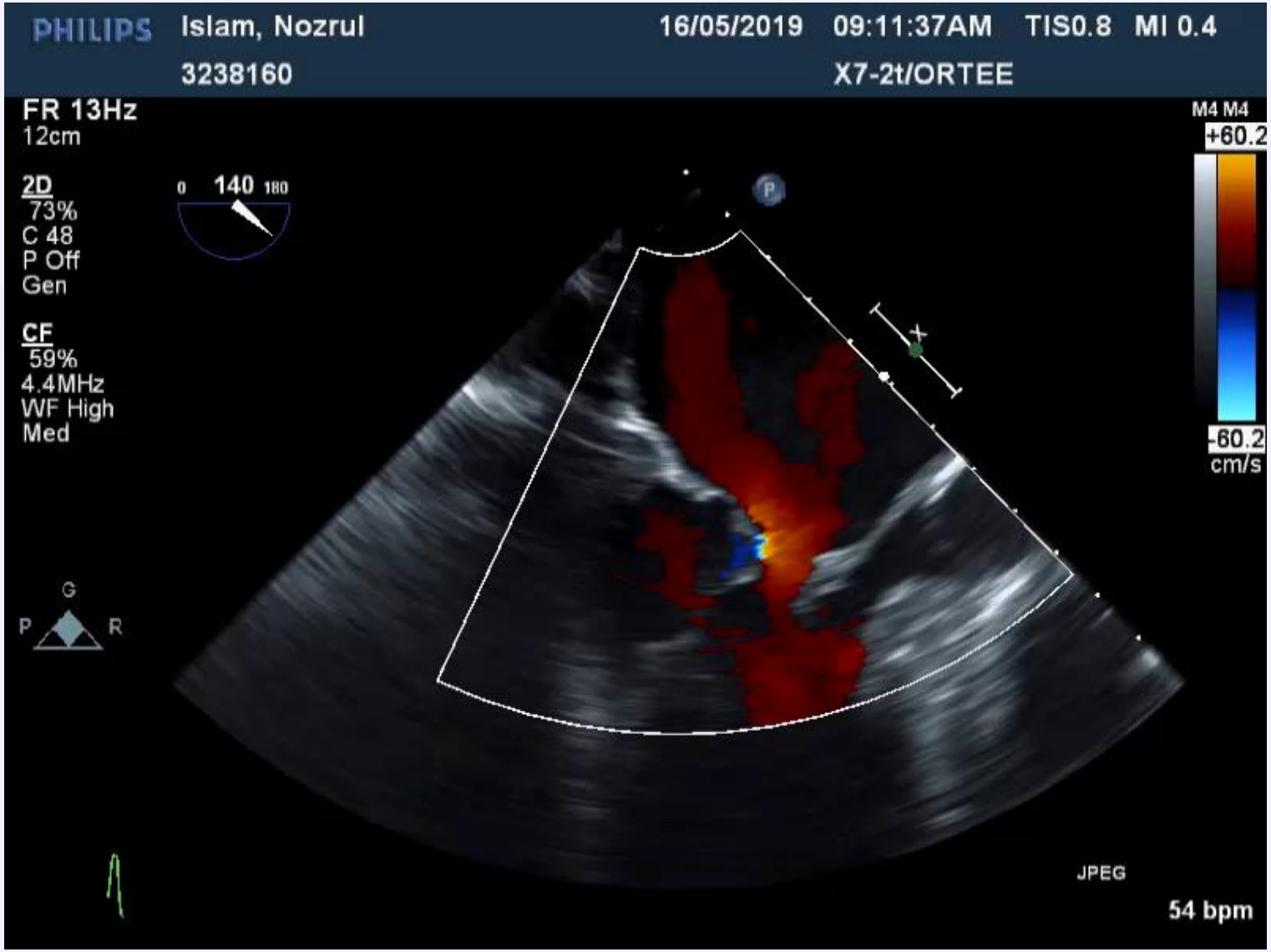

PHILIPS
Islam, Nozrul
16/05/2019
08:44:43AM
TIS0.1
MI 0.5
3238160
TGH OR PEG2
X7-2t/ORTEE
FR 50Hz
12cm
M4
2D
71%
C 48
P Off
Gen
0
135
180
G
P
R
Dist 1.80 cm
Dist 1.69 cm
Dist 3.13 cm
46bpm

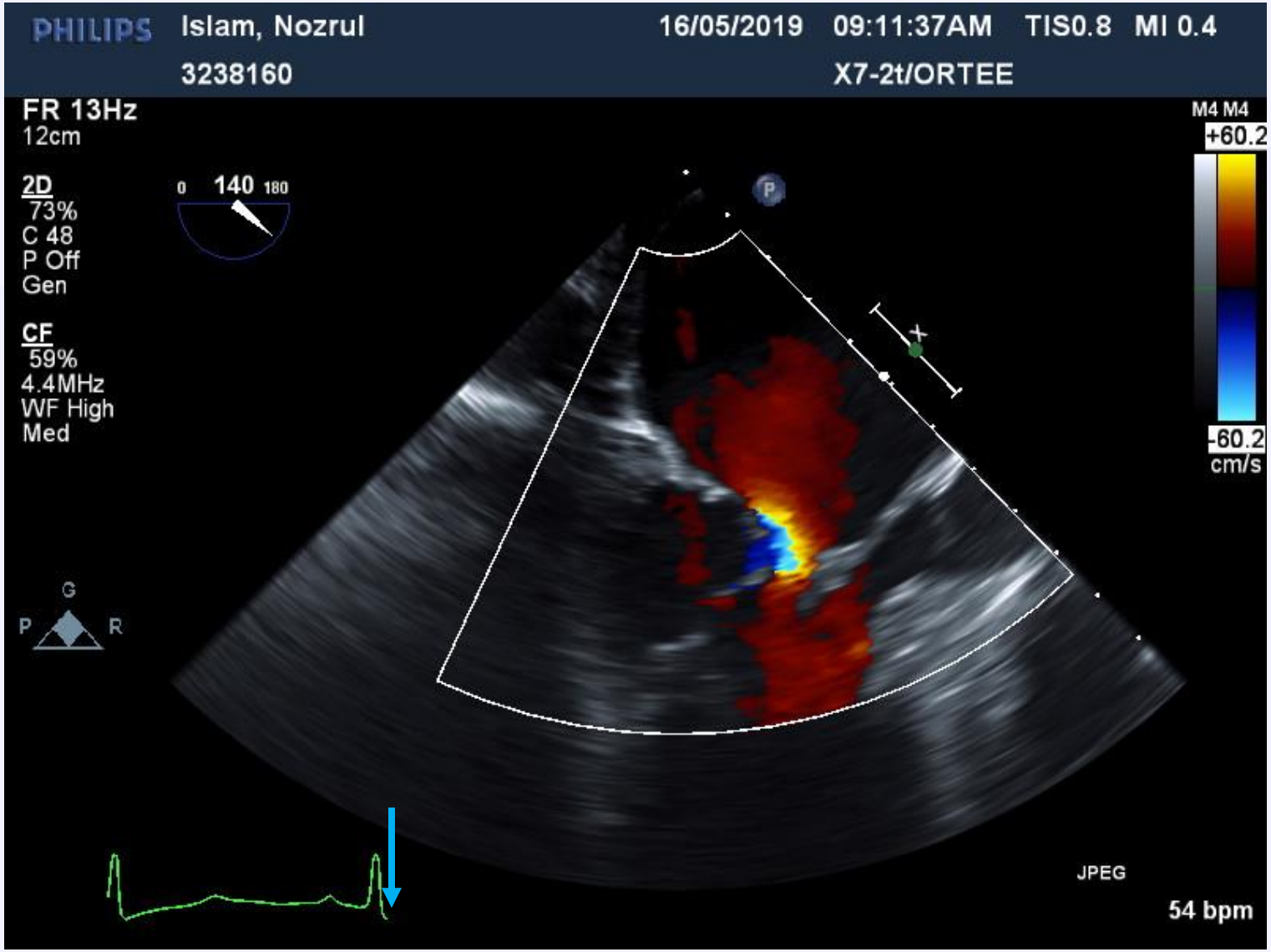

PHILIPS
Islam, Nozrul
3238160
16/05/2019
08:41:28AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
12cm
2D
74%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
124
180
M4 M4
+61.6
-61.6
cm/s
G
P
R
JPEG
48 bpm

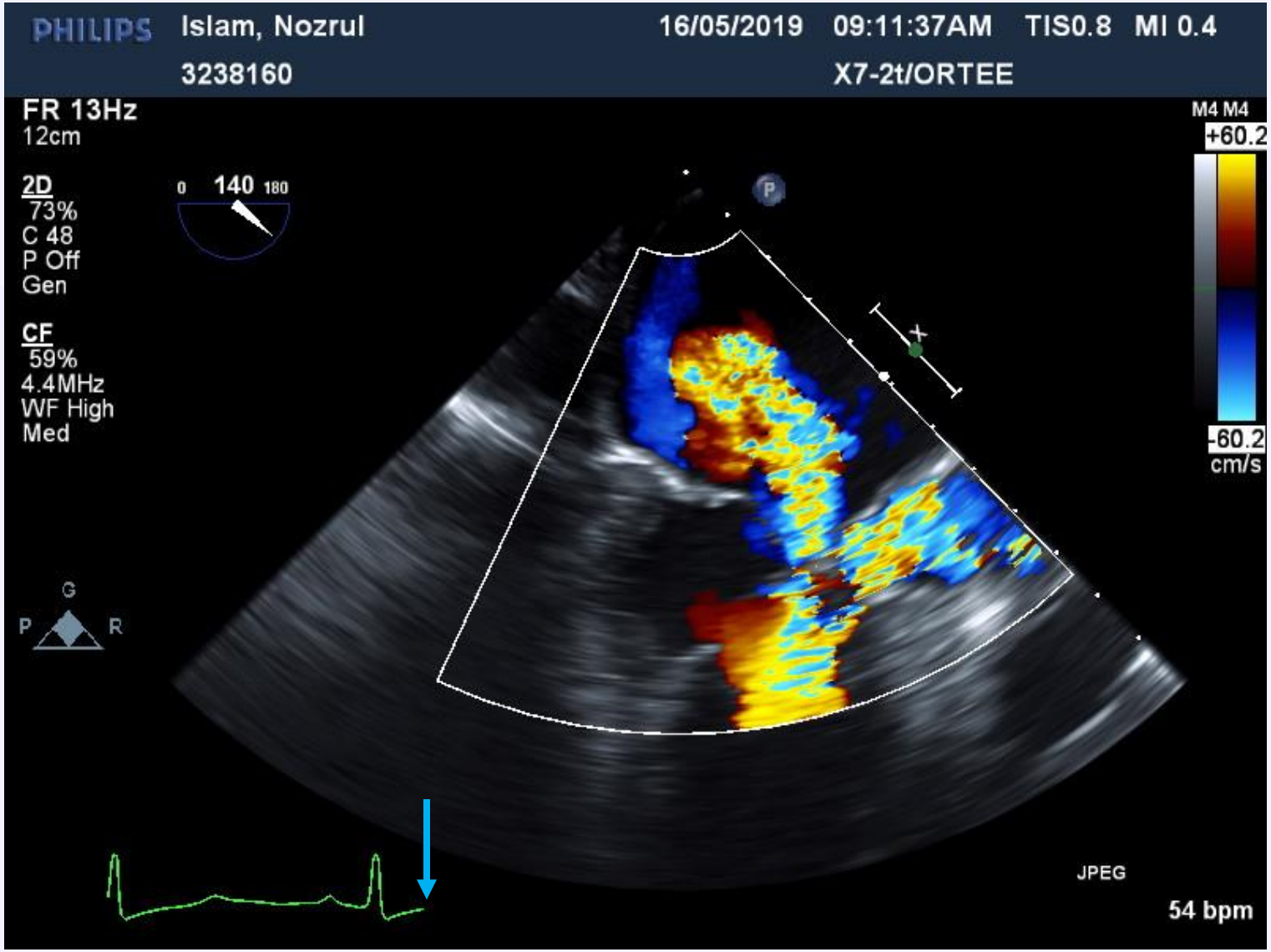

PHILIPS
Islam, Nozrul
3238160
16/05/2019
08:41:28AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
12cm
2D
74%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
124
180
M4 M4
+61.6
-61.6
cm/s
G
P
R
JPEG
48 bpm

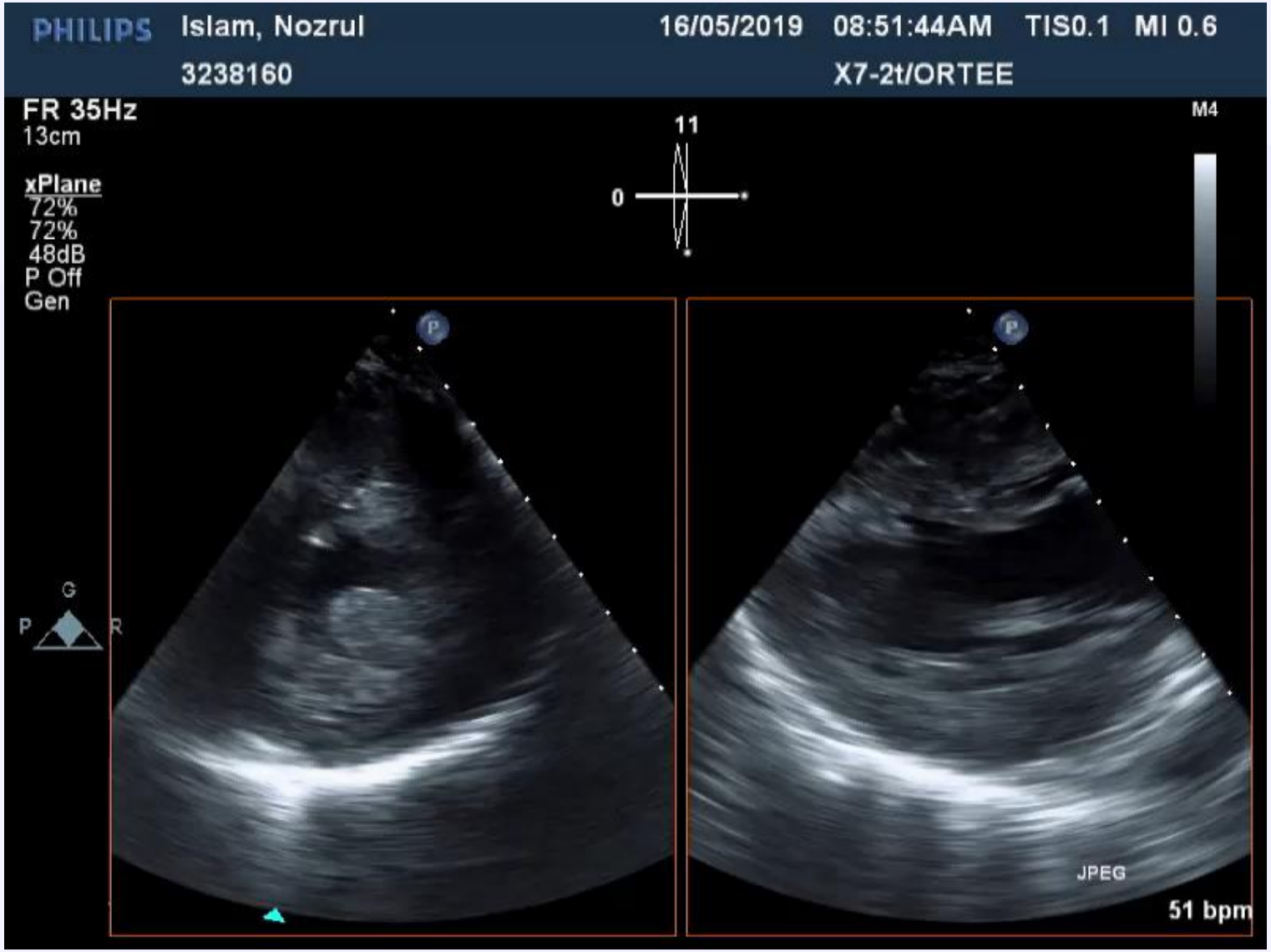

PHILIPS
Islam, Nozrul
3238160
16/05/2019
08:41:28AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
12cm
2D
74%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
124
180
M4 M4
+61.6
-61.6
cm/s
G
P
R
JPEG
48 bpm

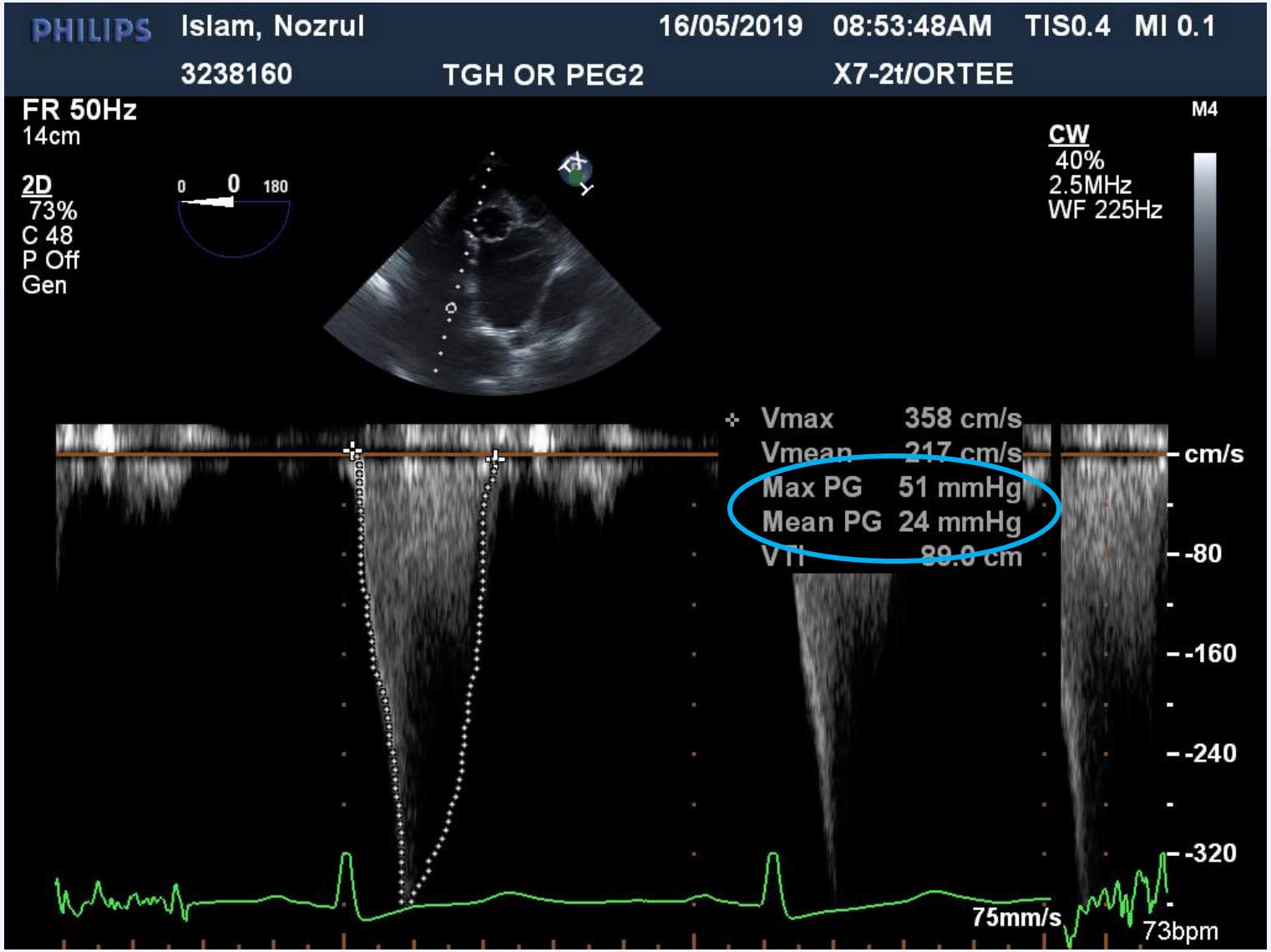

PHILIPS
Islam, Nozrul
3238160
16/05/2019
08:41:28AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
12cm
2D
74%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
124
180
M4 M4
+61.6
-61.6
cm/s
G
P
R
JPEG
48 bpm


PHILIPS
Islam, Nozrul
3238160
16/05/2019
09:11:37AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
12cm
2D
73%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
140
180
M4 M4
+60.2
-60.2
cm/s
G
P
R
JPEG
54 bpm

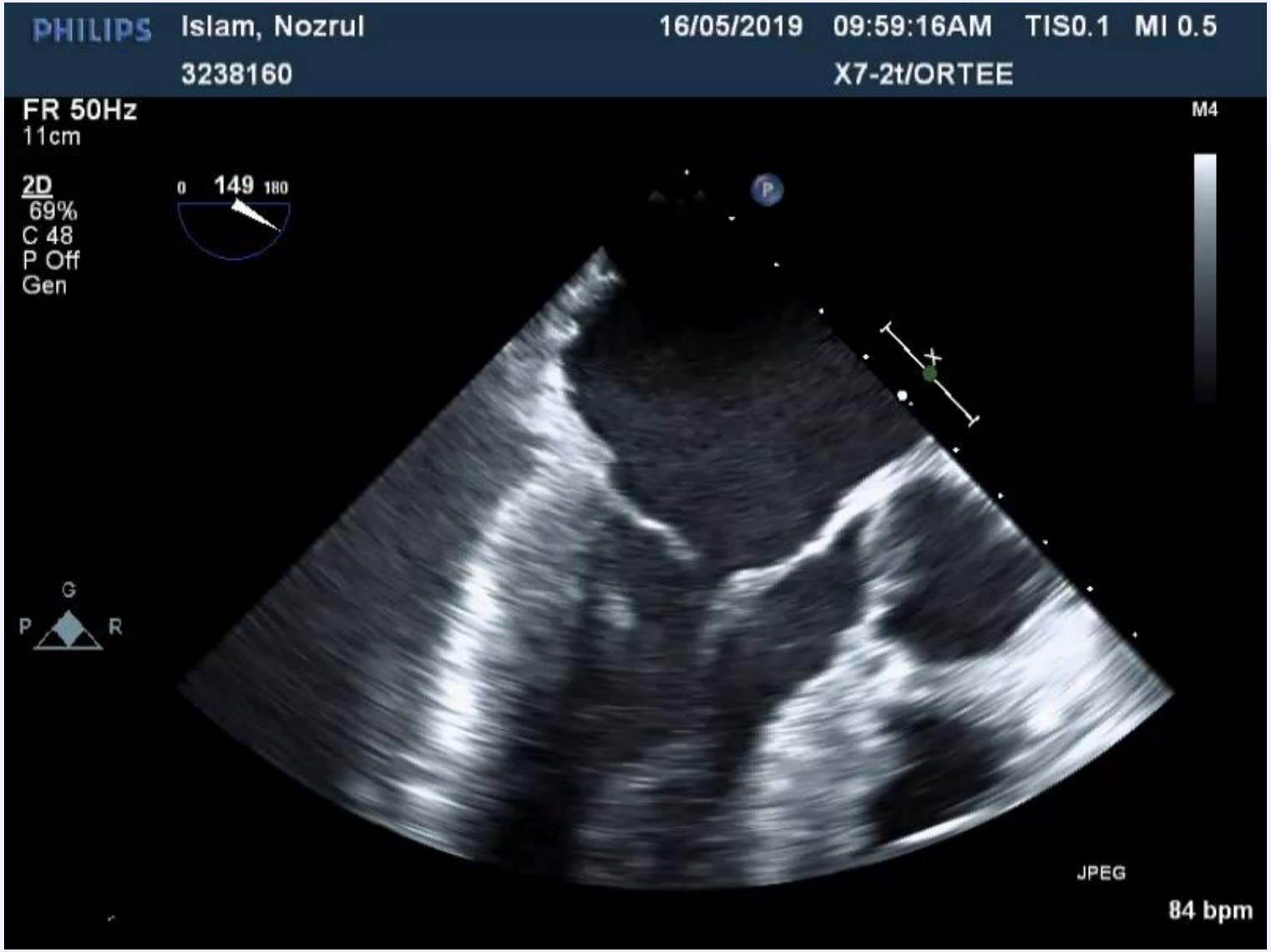

PHILIPS
Islam, Nozrul
3238160
16/05/2019
09:11:37AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
12cm
2D
73%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
140
180
M4 M4
+60.2
-60.2
cm/s
G
P
R
JPEG
54 bpm

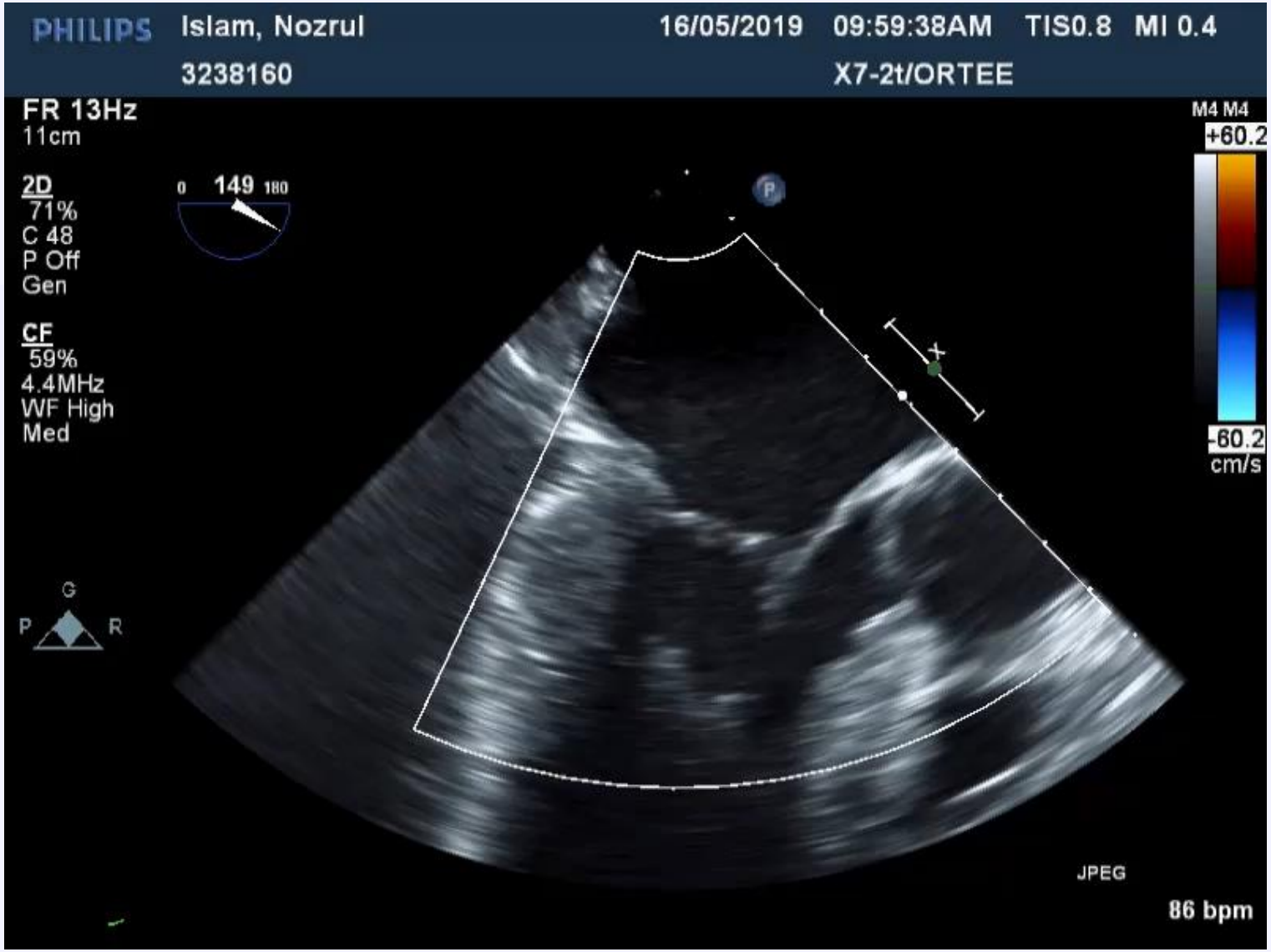

PHILIPS
Islam, Nozrul
3238160
16/05/2019
09:11:37AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
12cm
2D
73%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
140
180
M4 M4
+60.2
-60.2
cm/s
G
P
R
JPEG
54 bpm

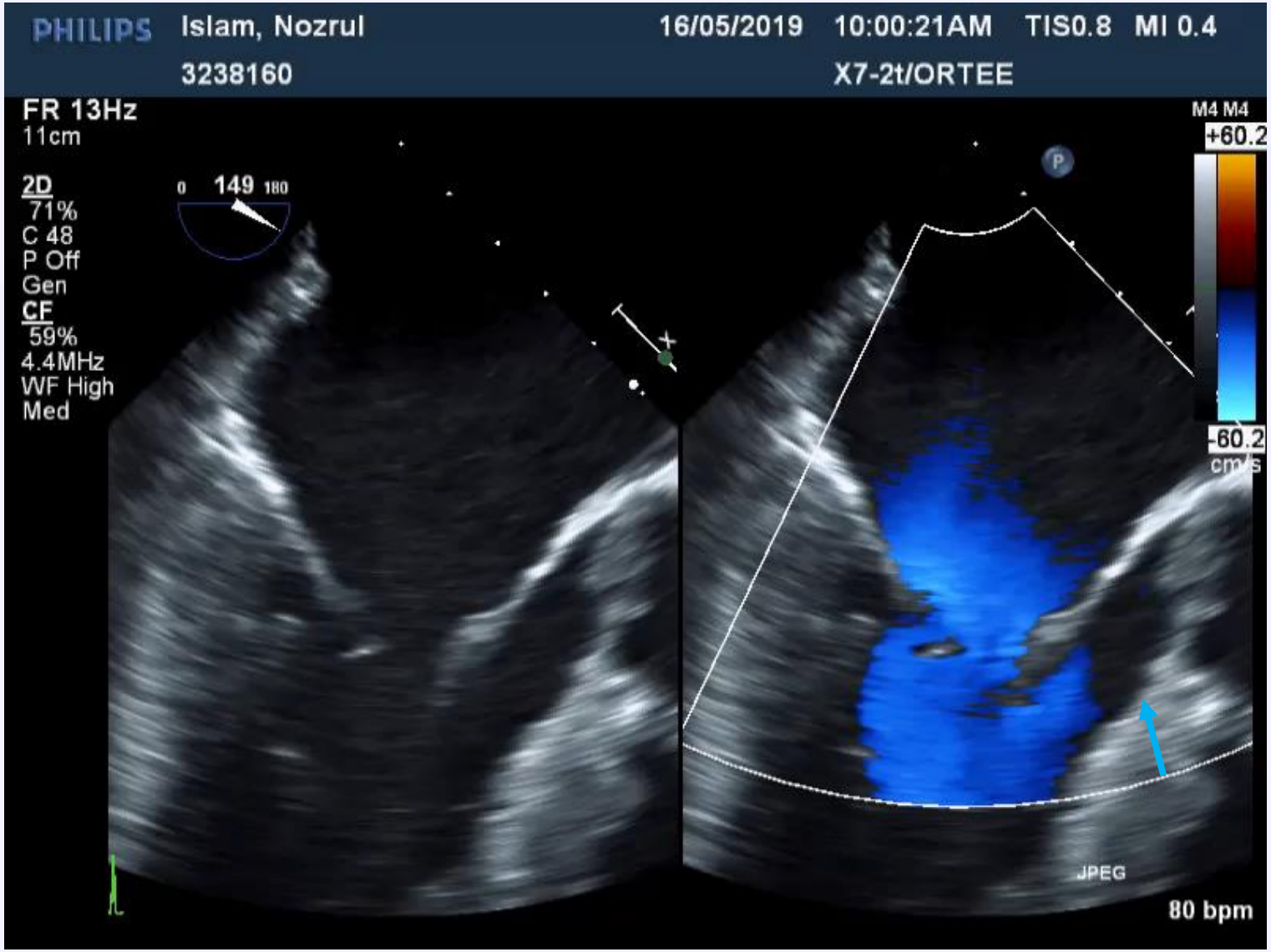

PHILIPS
Islam, Nozrul
3238160
16/05/2019
08:51:44AM
TIS0.1
MI 0.6
X7-2t/ORTEE
FR 35Hz
13cm
xPlane
72%
72%
48dB
P Off
Gen
11
0
M4
G
P
R
JPEG
51 bpm

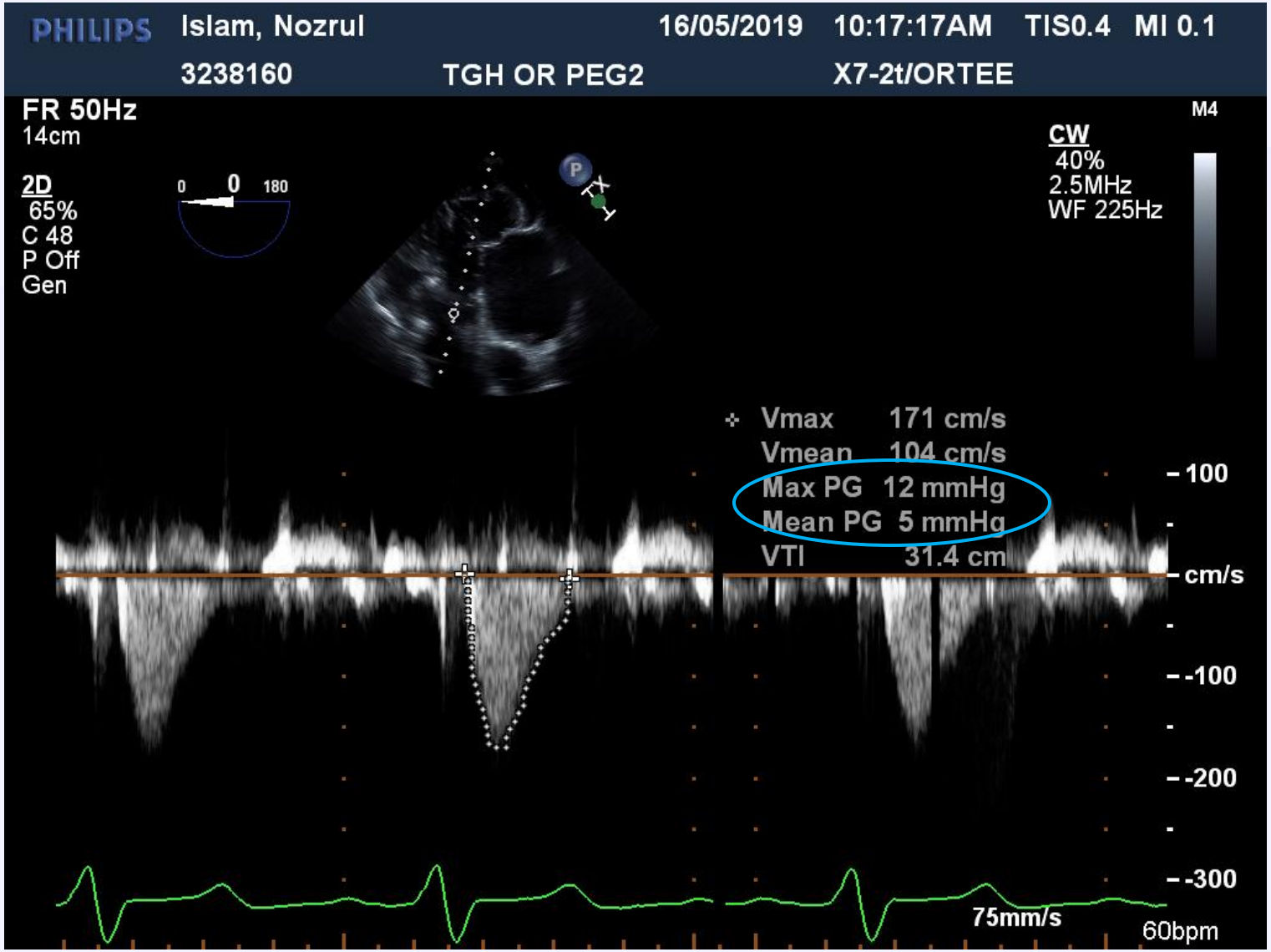

PHILIPS
Islam, Nozrul
16/05/2019
08:53:48AM
TIS0.4
MI 0.1
3238160
TGH OR PEG2
X7-2t/ORTEE
FR 50Hz
14cm
2D
73%
C 48
P Off
Gen
0
0
180
M4
CW
40%
2.5MHz
WF 225Hz
Vmax 358 cm/s
Vmean 217 cm/s
Max PG 51 mmHg
Mean PG 24 mmHg
VTI 89.0 cm
cm/s
-80
-160
-240
-320
75mm/s
73bpm

Post op


PHILIPS
Islam, Nozrul
3238160
16/05/2019
09:59:16AM
TIS0.1
MI 0.5
X7-2t/ORTEE
FR 50Hz
11cm
2D
69%
C 48
P Off
Gen
0
149
180
M4
G
P
R
JPEG
84 bpm

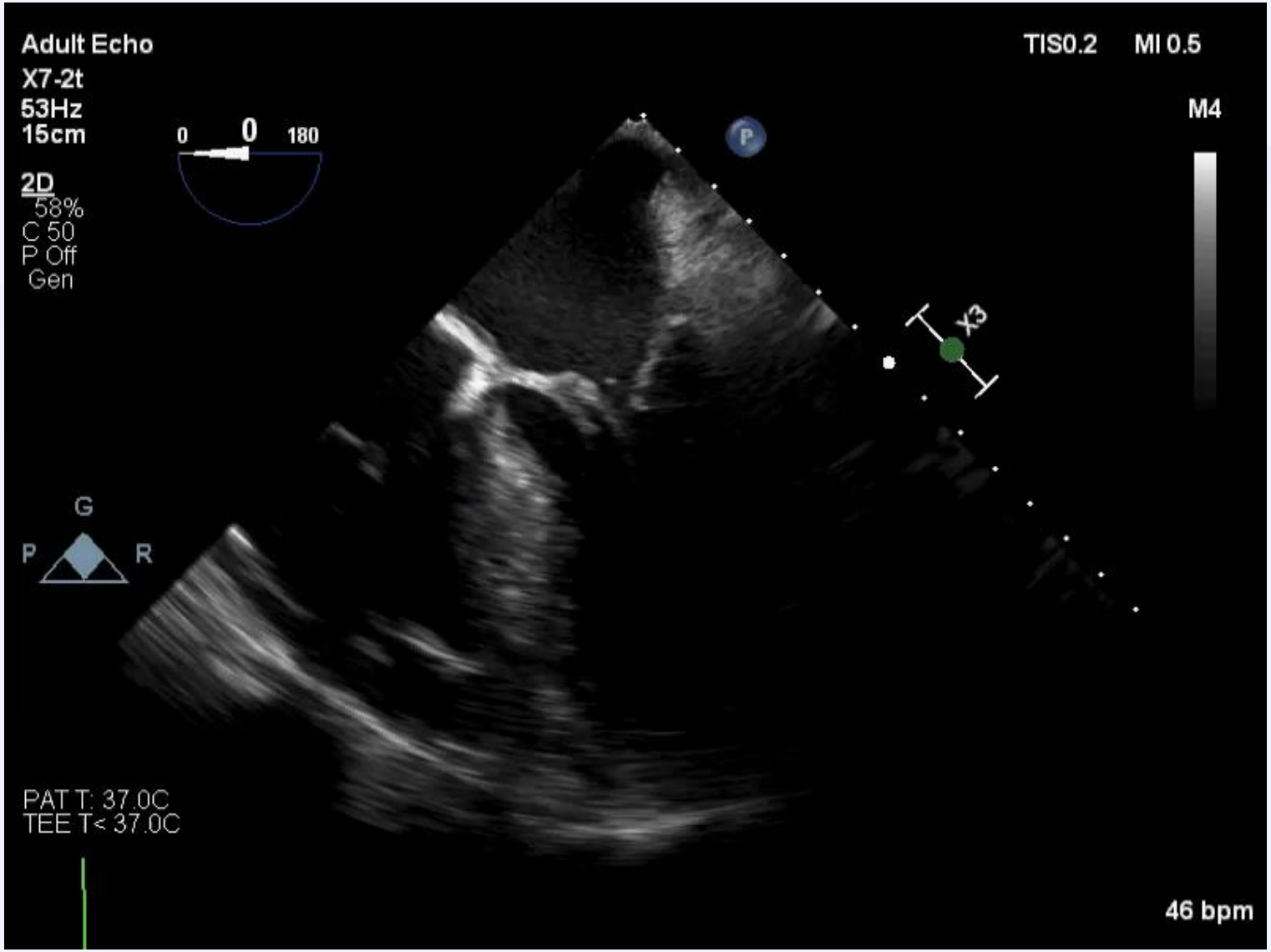

PHILIPS
Islam, Nozrul
3238160
16/05/2019
09:59:38AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
11cm
2D
71%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
149
180
M4 M4
+60.2
-60.2
cm/s
G
P
R
JPEG
86 bpm

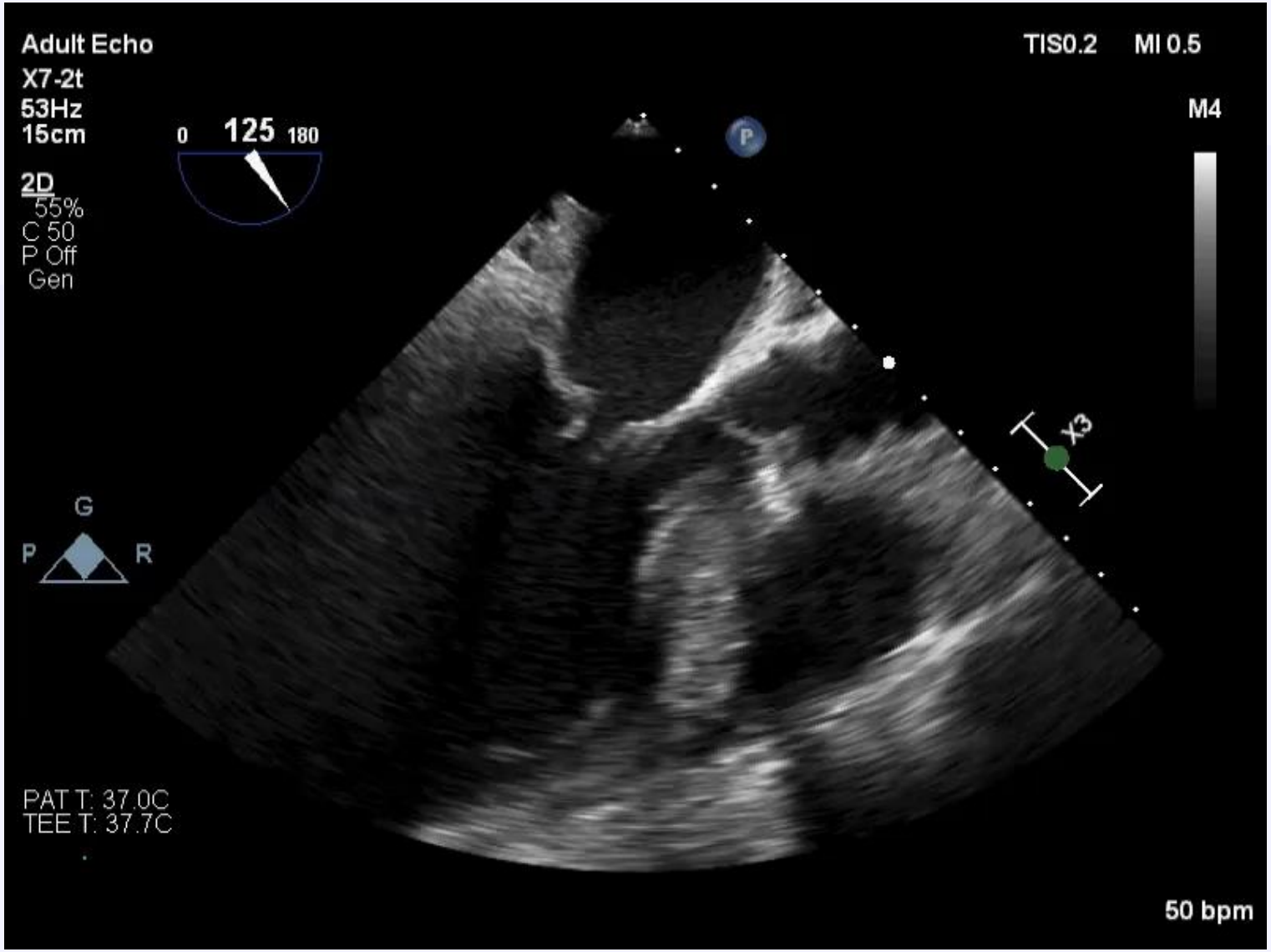

PHILIPS
Islam, Nozrul
3238160
16/05/2019
10:00:21AM
TIS0.8
MI 0.4
X7-2t/ORTEE
FR 13Hz
11cm
2D
71%
C 48
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
149
180
M4 M4
+60.2
-60.2
cm/s
JPEG
80 bpm

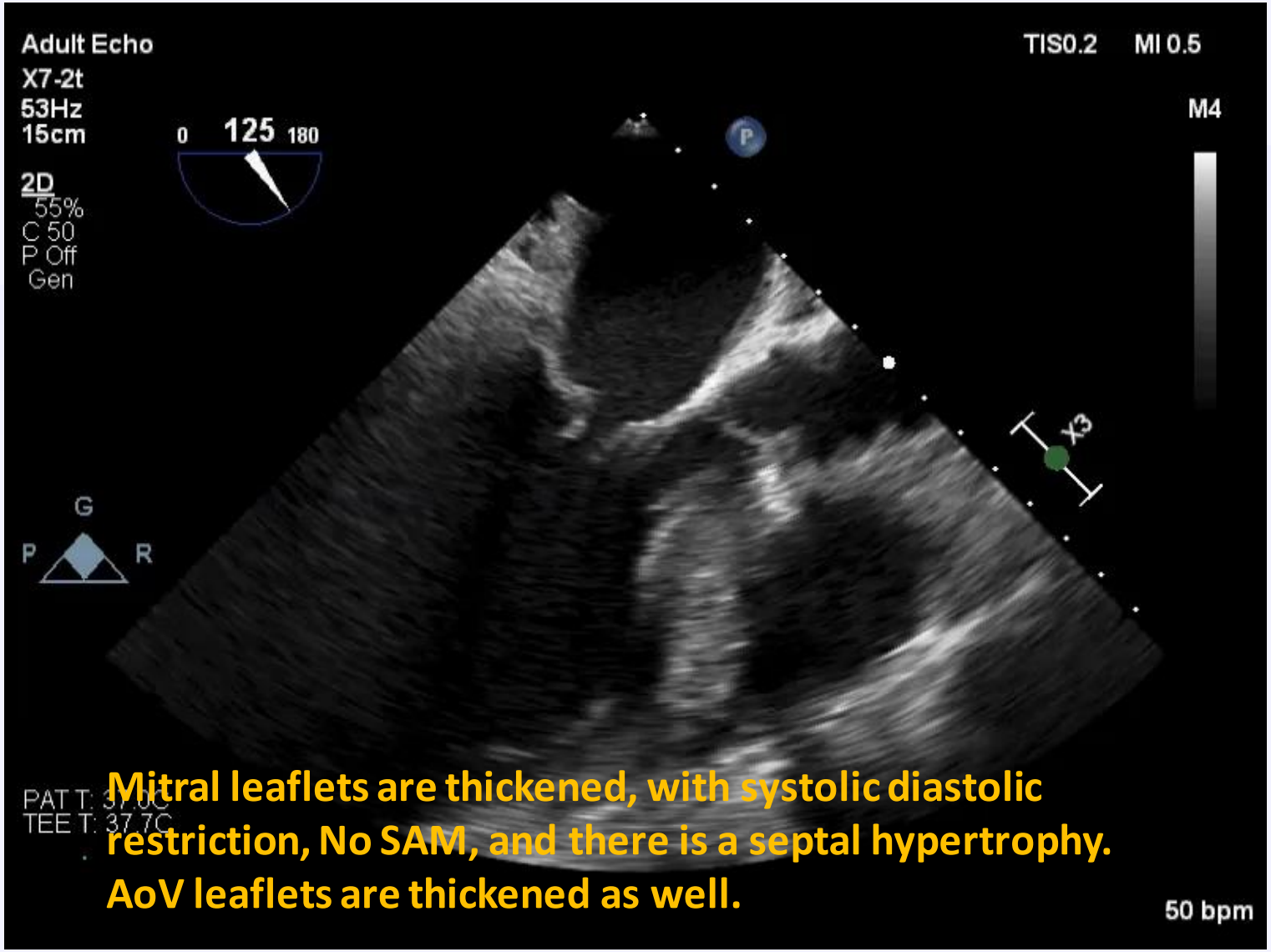

PHILIPS
Islam, Nozrul
16/05/2019
10:17:17AM
TIS0.4
MI 0.1
3238160
TGH OR PEG2
X7-2t/ORTEE
FR 50Hz
14cm
2D
65%
C 48
P Off
Gen
0
0
180
CW
40%
2.5MHz
WF 225Hz
M4
Vmax 171 cm/s
Vmean 104 cm/s
Max PG 12 mmHg
Mean PG 5 mmHg
VTI 31.4 cm
100
cm/s
-100
-200
-300
75mm/s
60bpm

Case 5

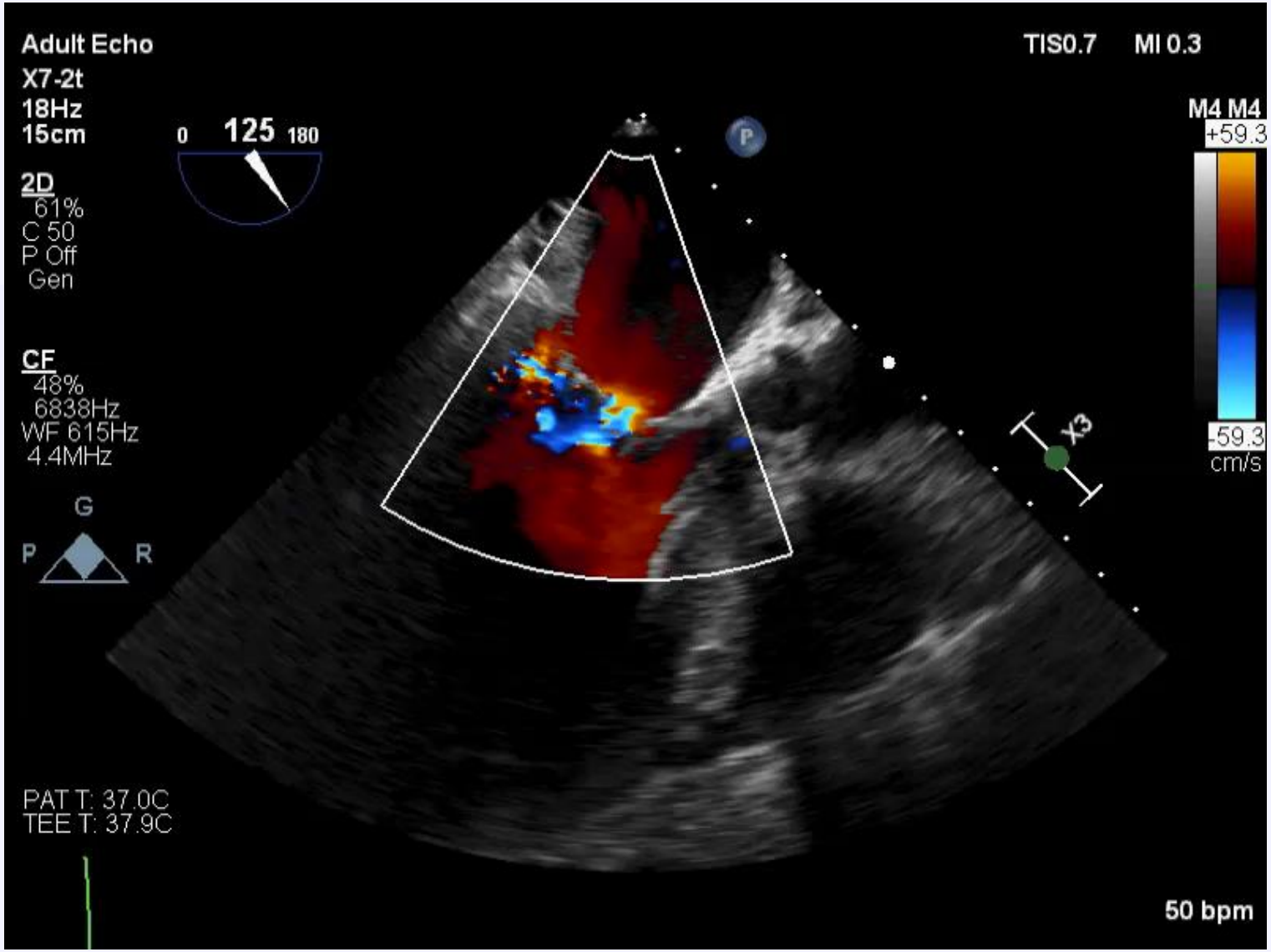
66-year-old woman was referred from BC. for myectomy

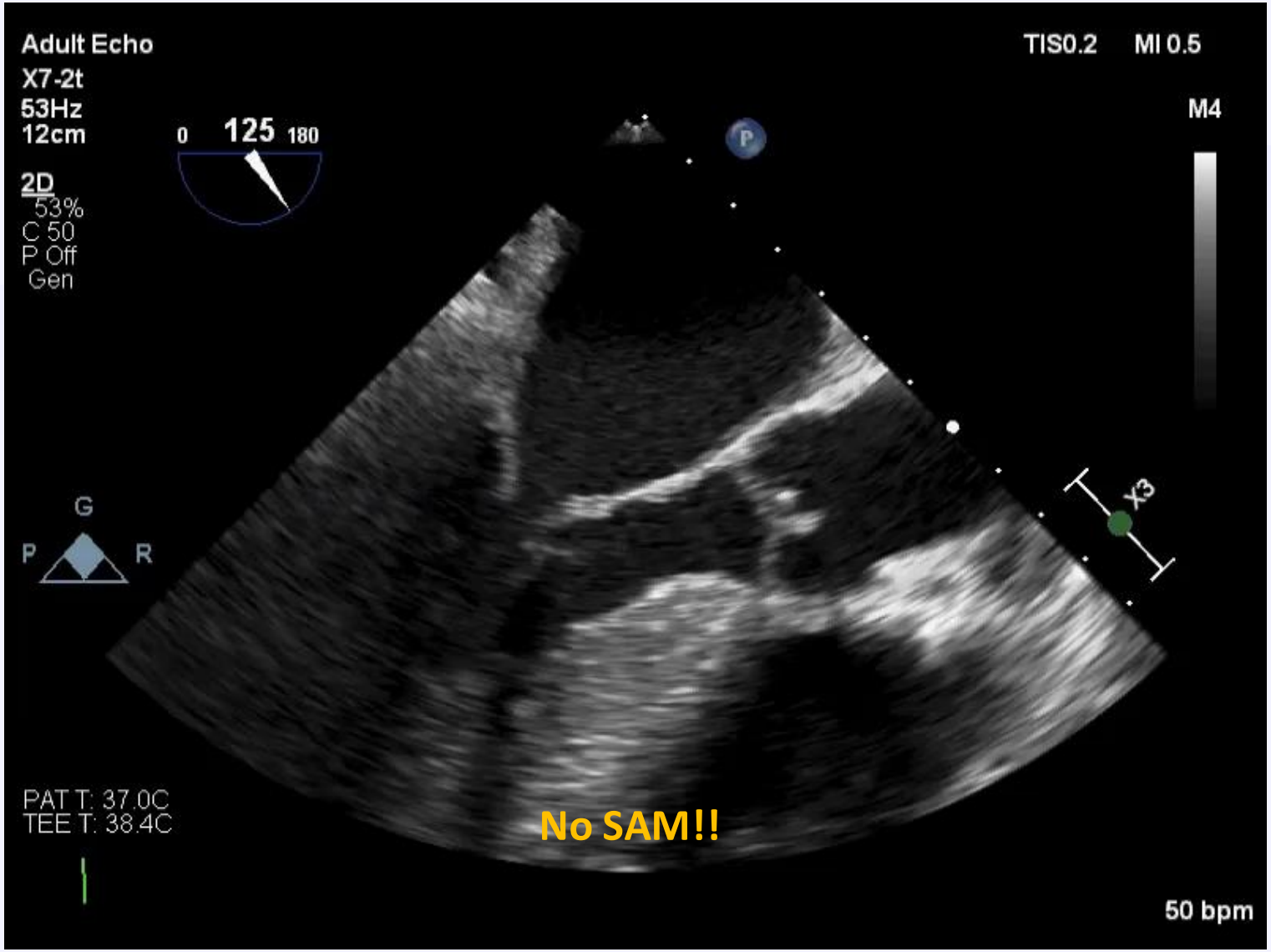

Adult Echo
X7-2t
53Hz
15cm
2D
58%
C 50
P Off
Gen
0
0
180
TIS0.2
MI 0.5
M4
X3
G
P
R
PAT T: 37.0C
TEE T< 37.0C
46 bpm

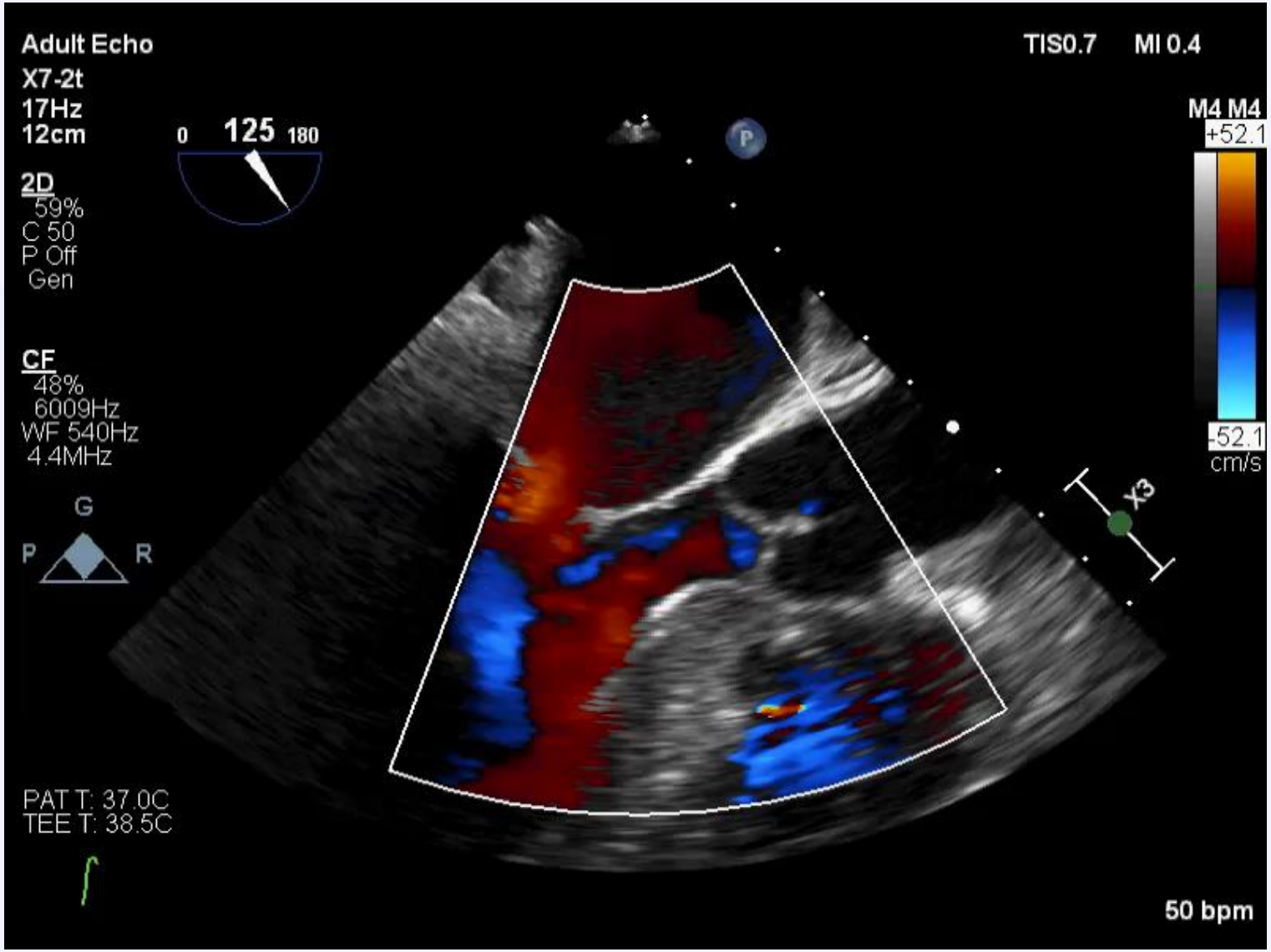

Adult Echo
X7-2t
53Hz
15cm
0
125
180
2D
55%
C 50
P Off
Gen
TIS0.2
MI 0.5
M4
X3
G
P
R
PAT T: 37.0C
TEE T: 37.7C
50 bpm

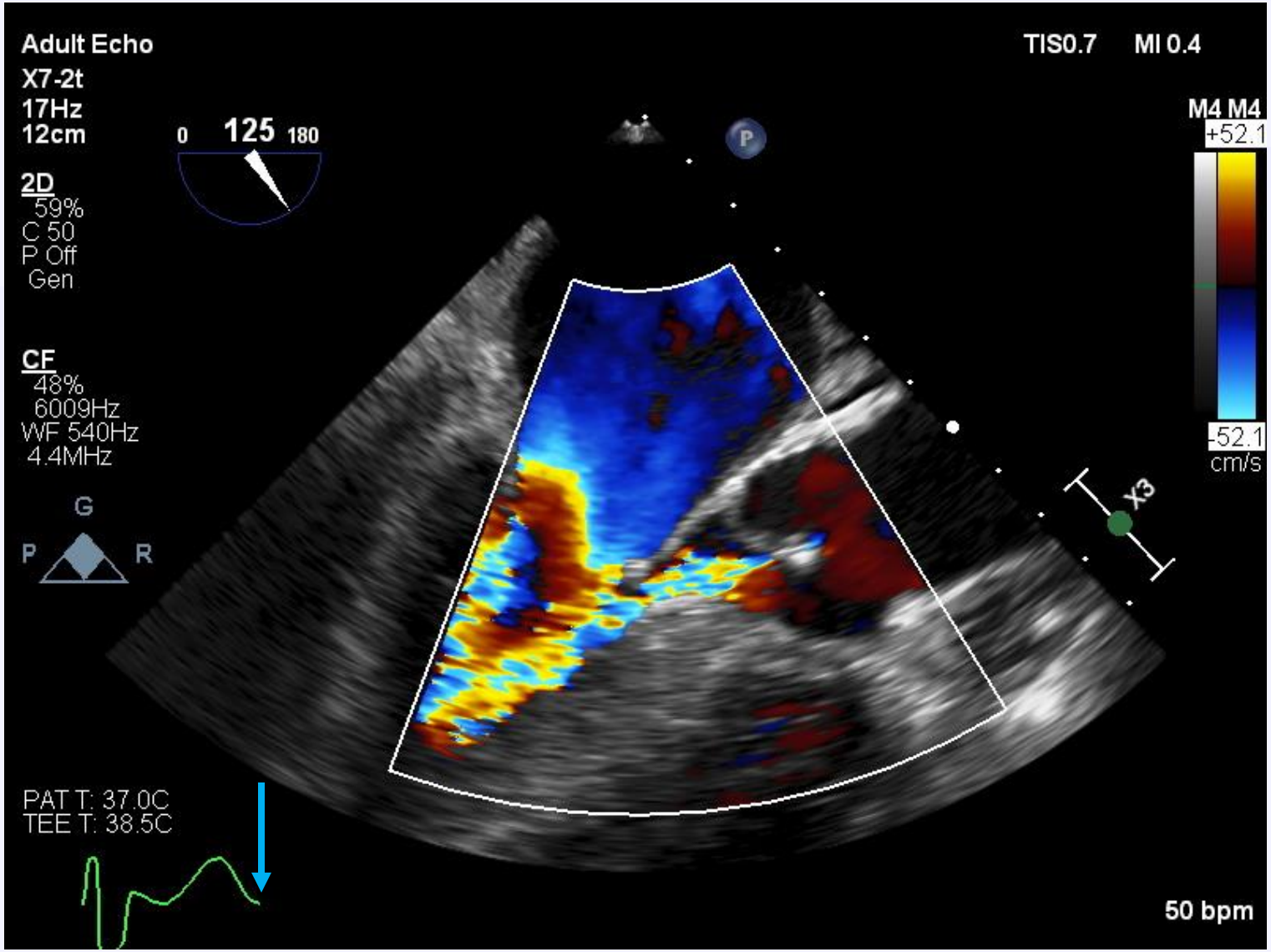


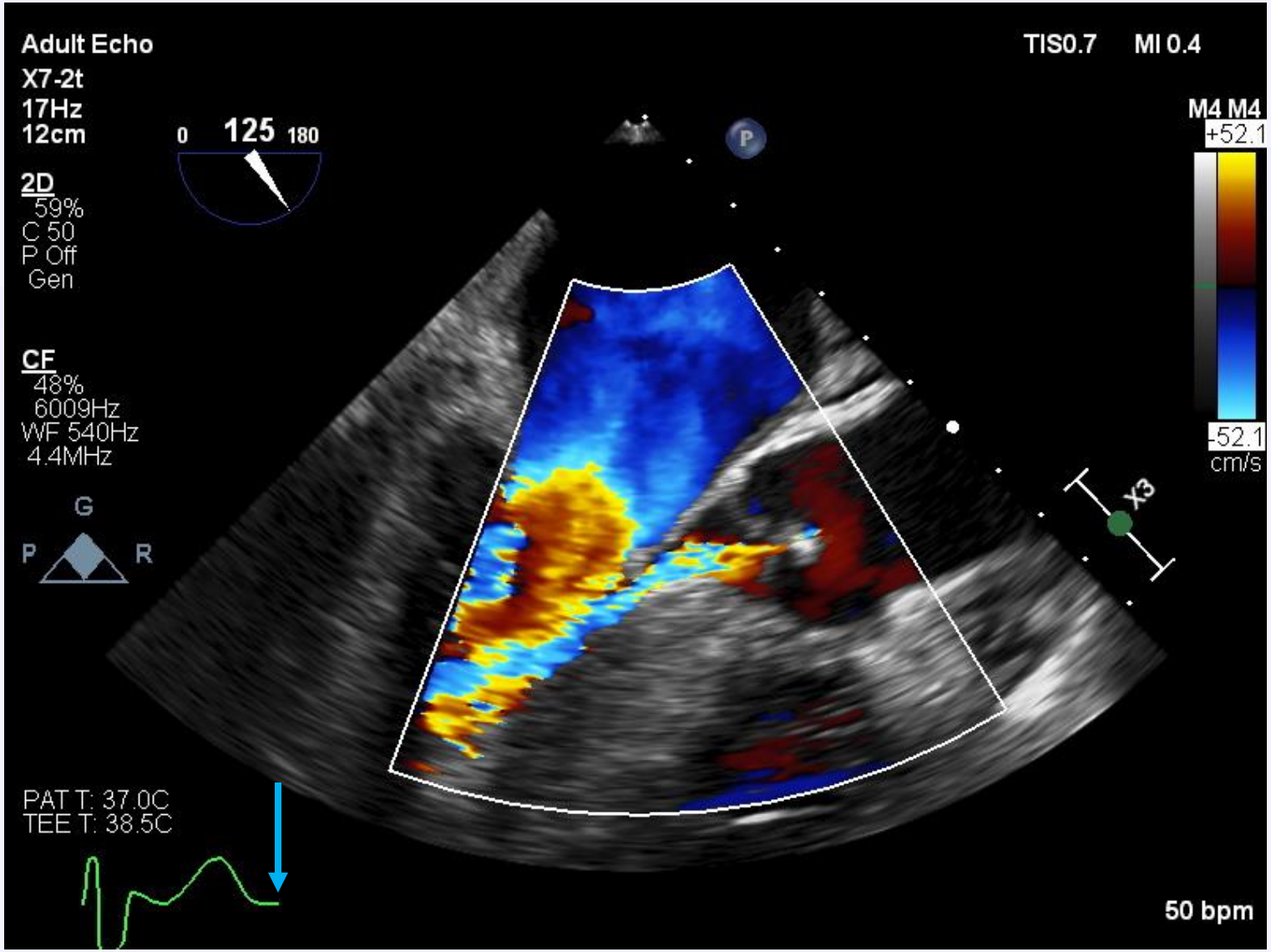
Mitral leaflets are thickened, with systolic diastolic restriction, No SAM, and there is a septal hypertrophy. AoV leaflets are thickened as well.

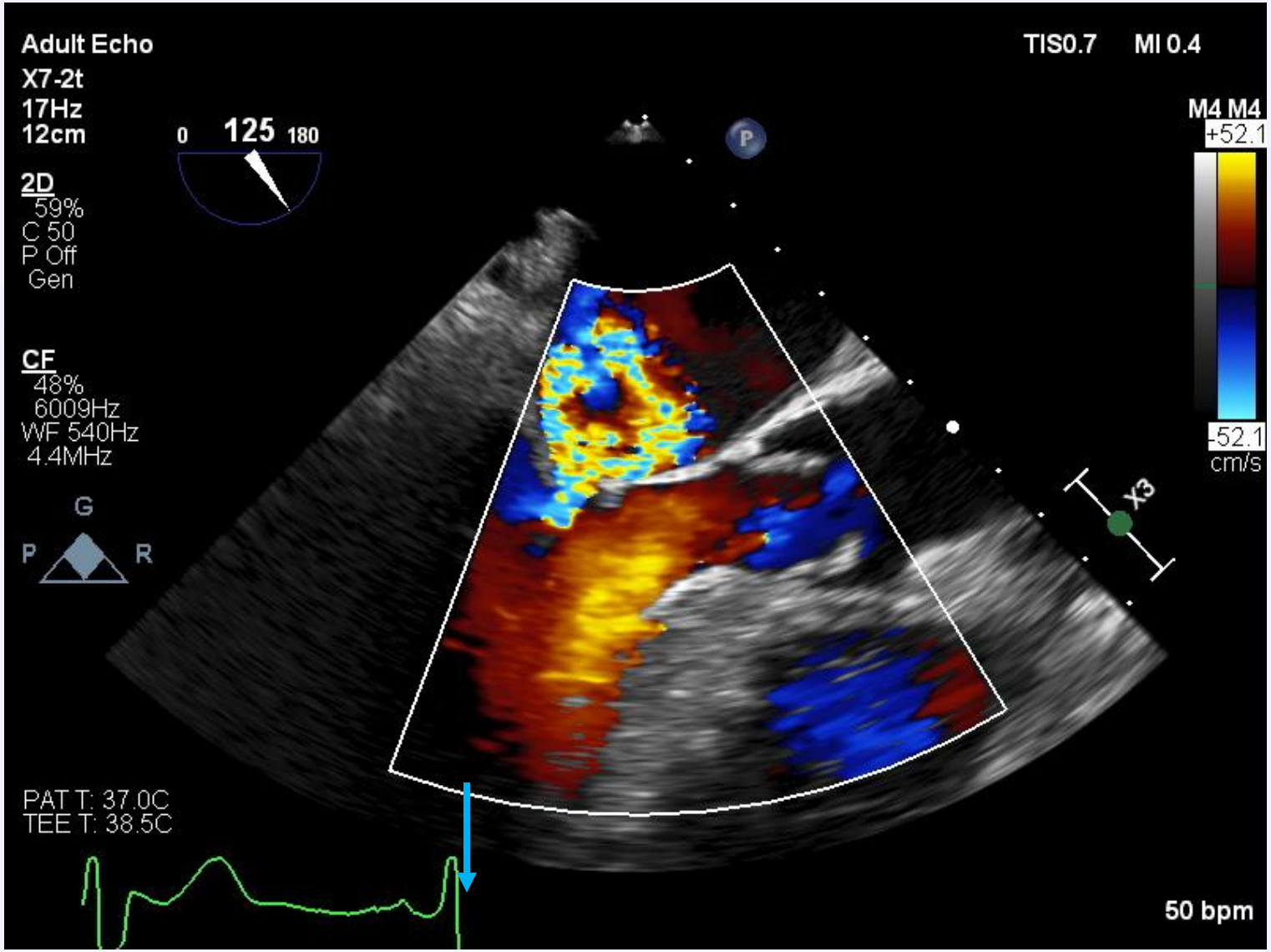

Adult Echo
X7-2t
18Hz
15cm
0
125
180
2D
61%
C 50
P Off
Gen
CF
48%
6838Hz
WF 615Hz
4.4MHz
G
P
R
TIS0.7
MI 0.3
M4 M4
+59.3
-59.3
cm/s
X3
PAT T: 37.0C
TEE T: 37.9C
50 bpm

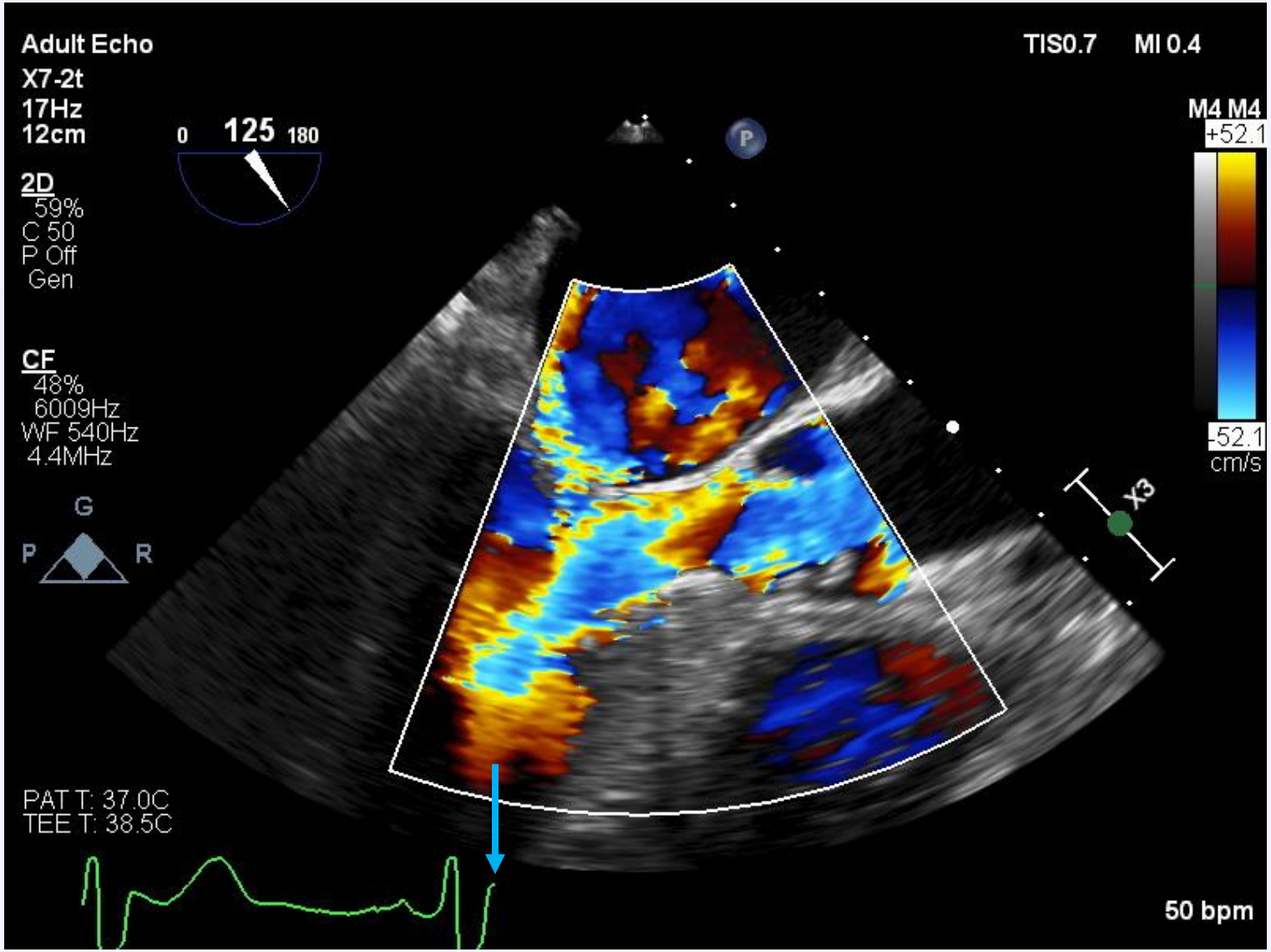

Adult Echo
X7-2t
53Hz
12cm
0
125
180
2D
53%
C 50
P Off
Gen
TIS0.2
MI 0.5
M4
G
P
R
X3
PAT T: 37.0C
TEE T: 38.4C
No SAM!!
50 bpm

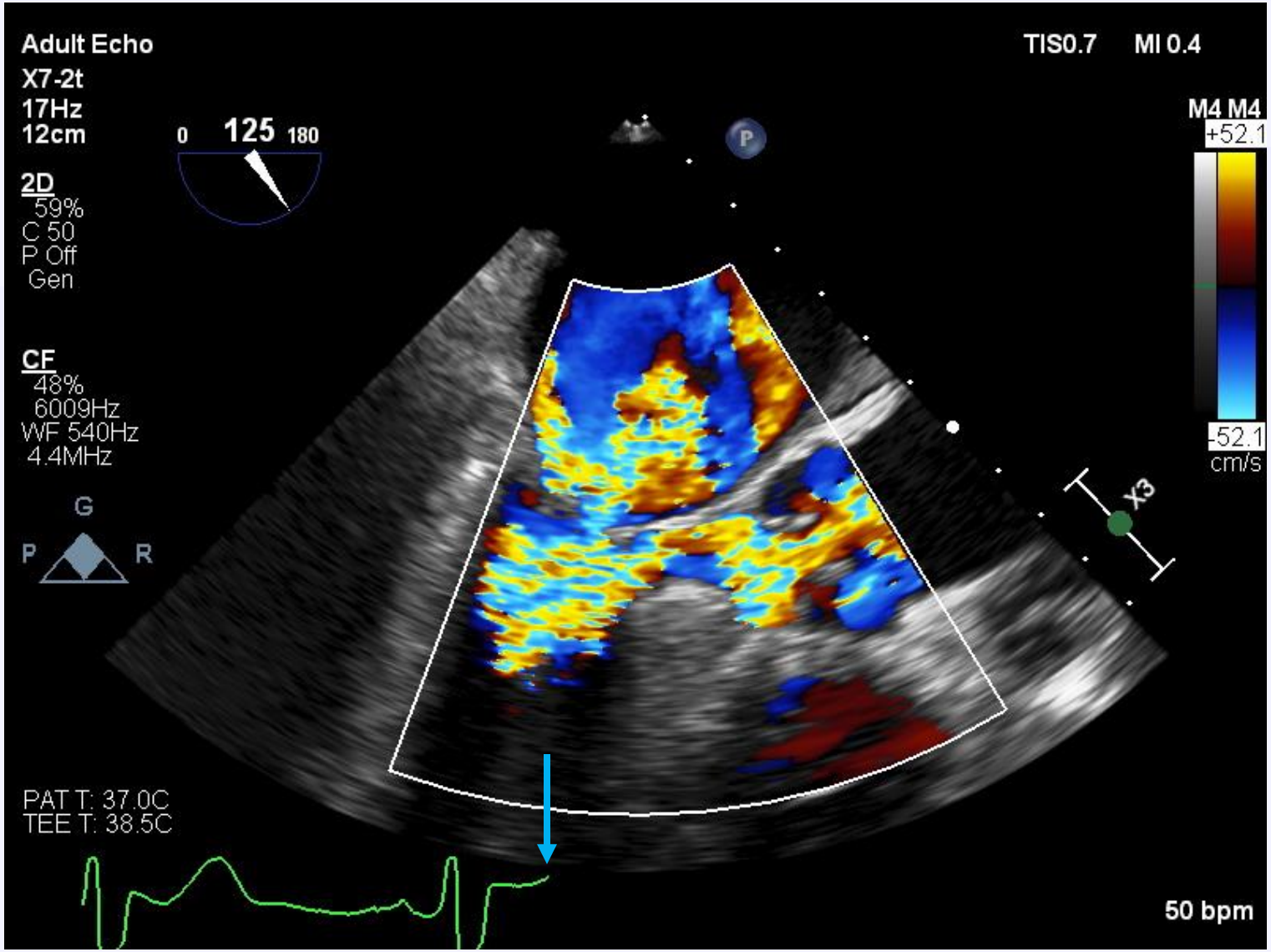

Adult Echo
X7-2t
17Hz
12cm
0 125 180
2D
59%
C 50
P Off
Gen
CF
48%
6009Hz
WF 540Hz
4.4MHz
G
P
R
TIS0.7 MI 0.4
M4 M4
+52.1
-52.1
cm/s
X3
PAT T: 37.0C
TEE T: 38.5C
50 bpm

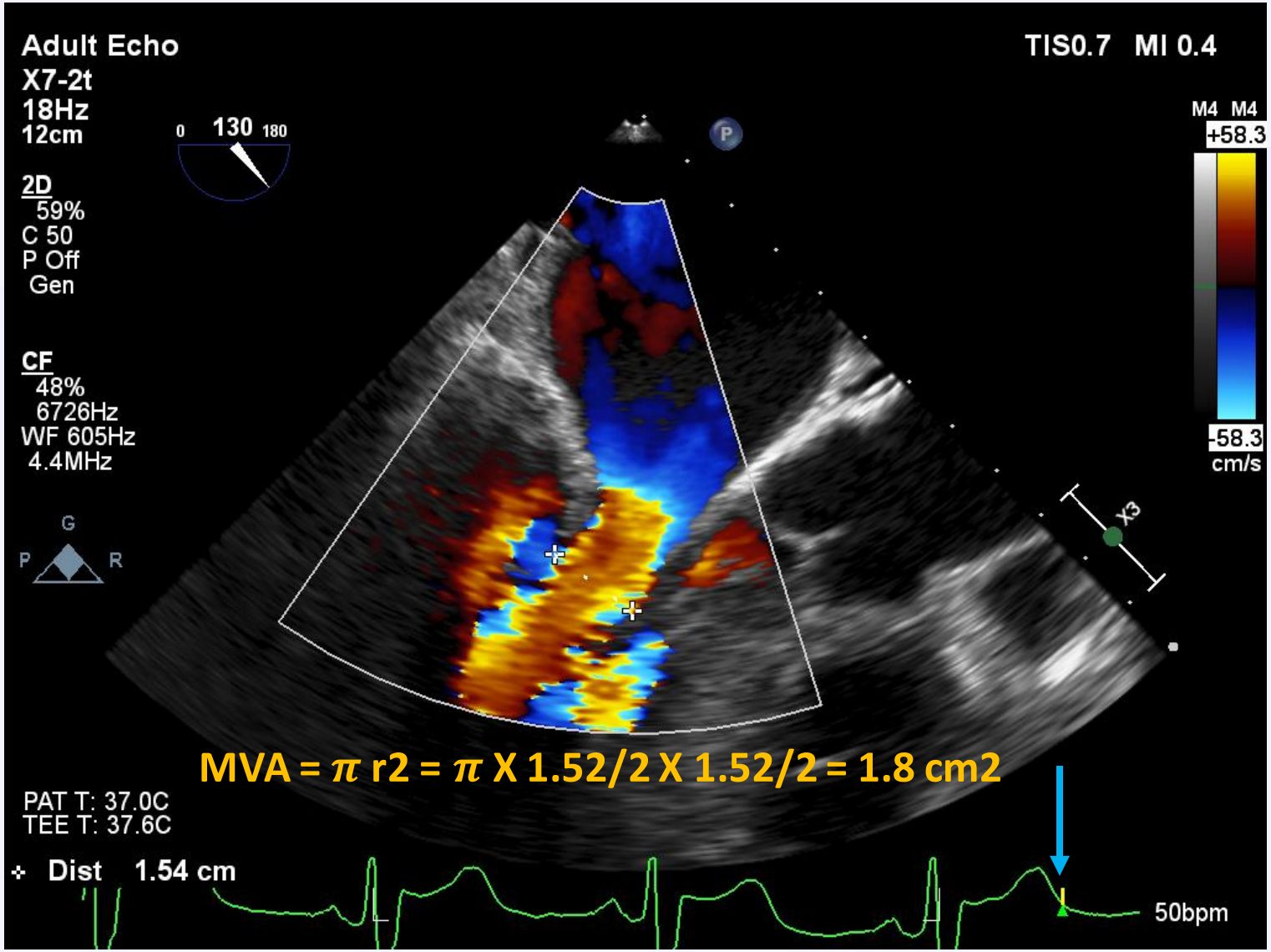

Adult Echo
X7-2t
17Hz
12cm
0
125
180
2D
59%
C 50
P Off
Gen
CF
48%
6009Hz
WF 540Hz
4.4MHz
G
P
R
TIS0.7
MI 0.4
M4 M4
+52.1
-52.1
cm/s
X3
PAT T: 37.0C
TEE T: 38.5C
50 bpm

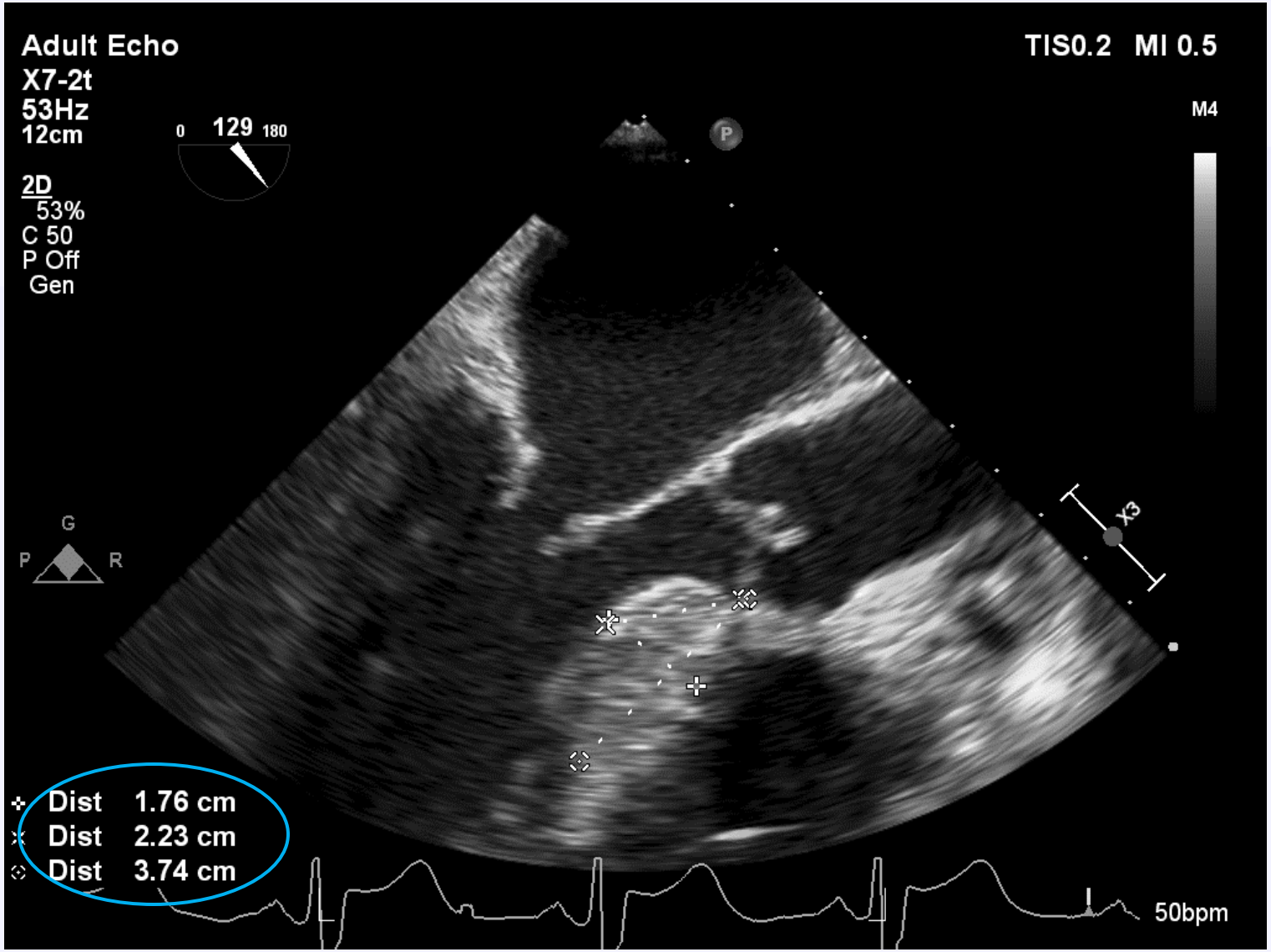

Adult Echo
X7-2t
17Hz
12cm
0
125
180
TIS0.7
MI 0.4
M4 M4
+52.1
-52.1
cm/s
2D
59%
C 50
P Off
Gen
CF
48%
6009Hz
WF 540Hz
4.4MHz
G
P
R
X3
PAT T: 37.0C
TEE T: 38.5C
50 bpm

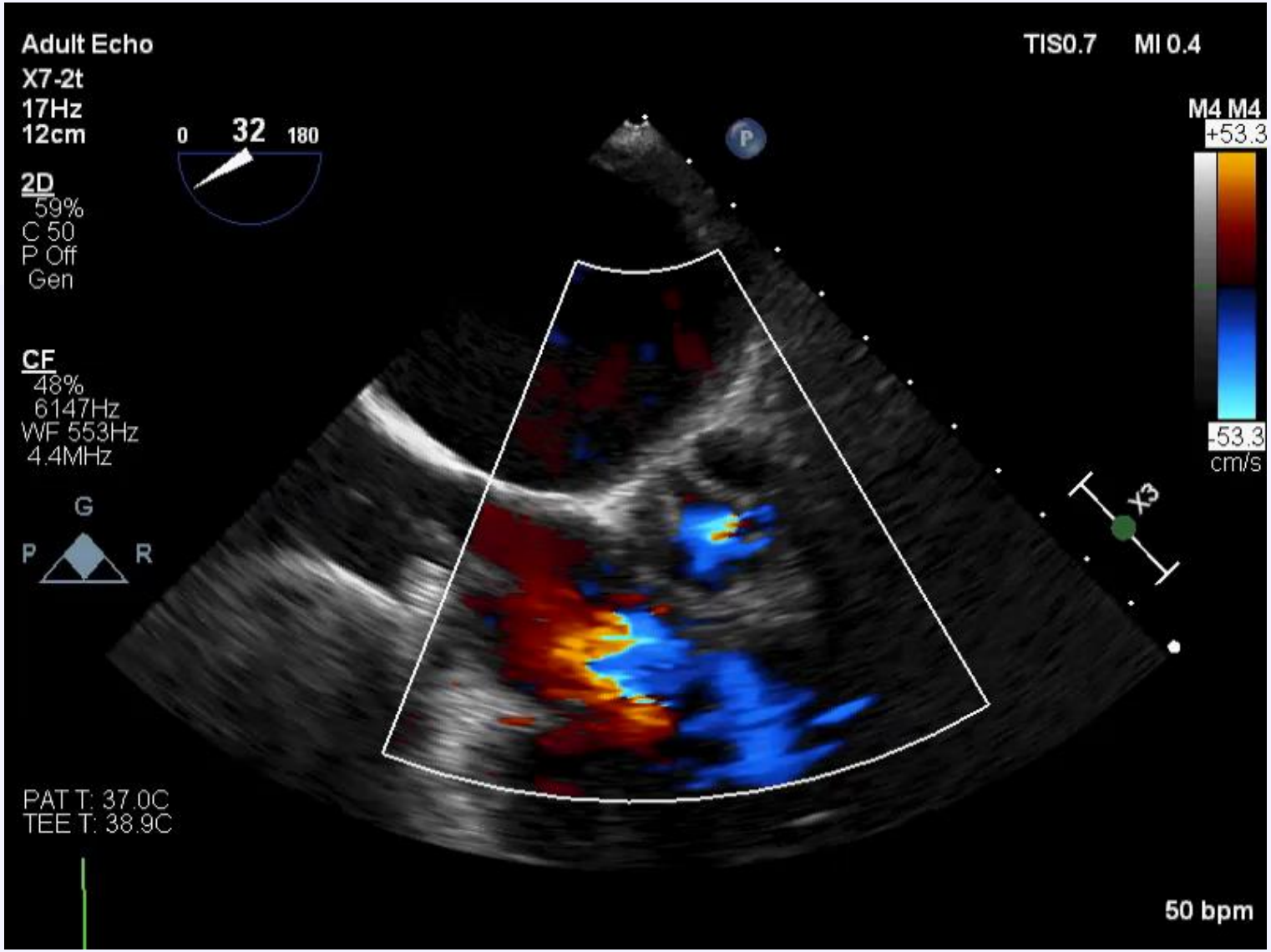

Adult Echo
X7-2t
17Hz
12cm
0
125
180
TIS0.7
MI 0.4
M4 M4
+52.1
-52.1
cm/s
2D
59%
C 50
P Off
Gen
CF
48%
6009Hz
WF 540Hz
4.4MHz
G
P
R
X3
PAT T: 37.0C
TEE T: 38.5C
50 bpm

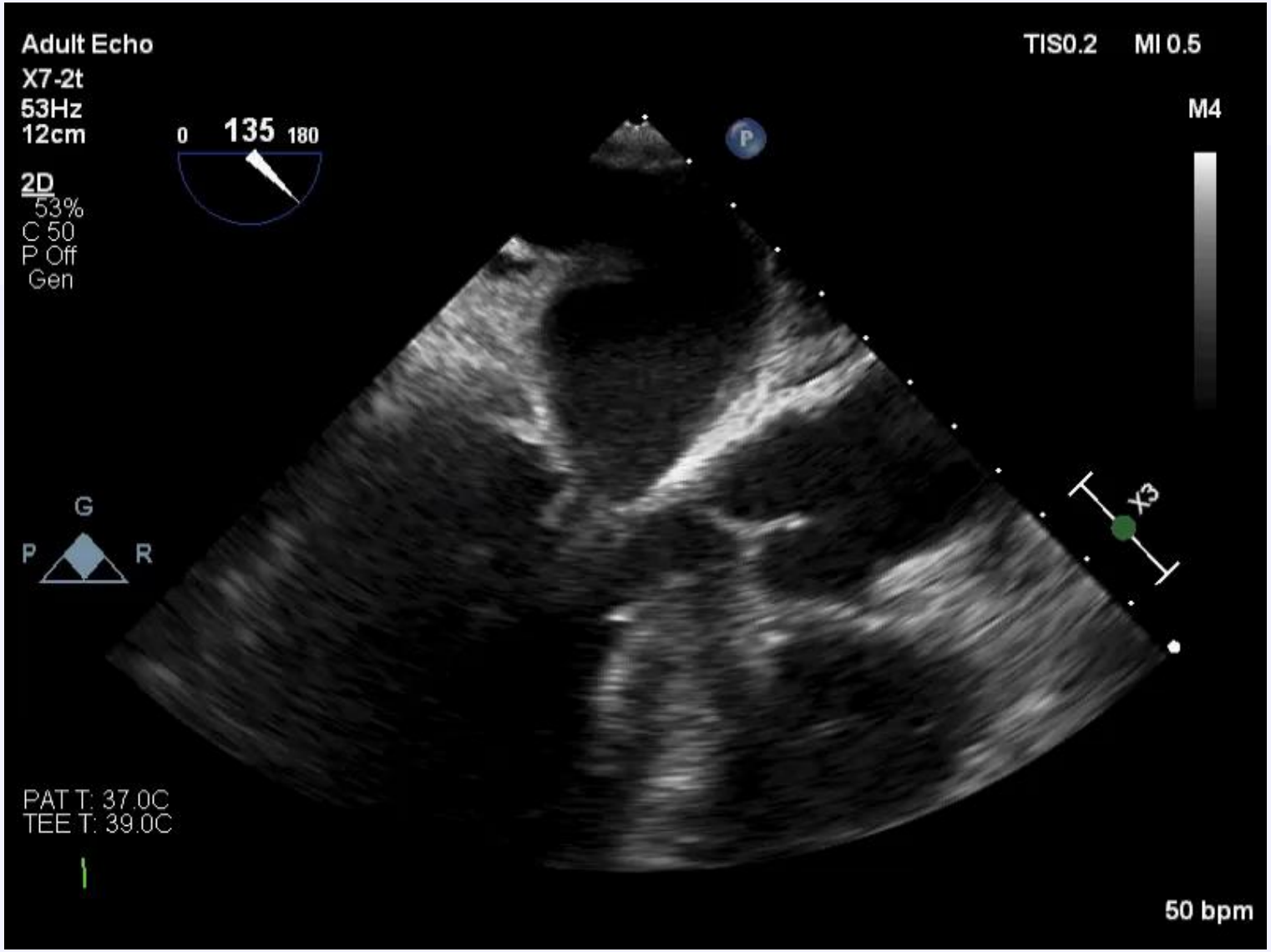

Adult Echo
X7-2t
17Hz
12cm
0
125
180
TIS0.7
MI 0.4
M4 M4
+52.1
-52.1
cm/s
2D
59%
C 50
P Off
Gen
CF
48%
6009Hz
WF 540Hz
4.4MHz
G
P
R
X3
PAT T: 37.0C
TEE T: 38.5C
50 bpm

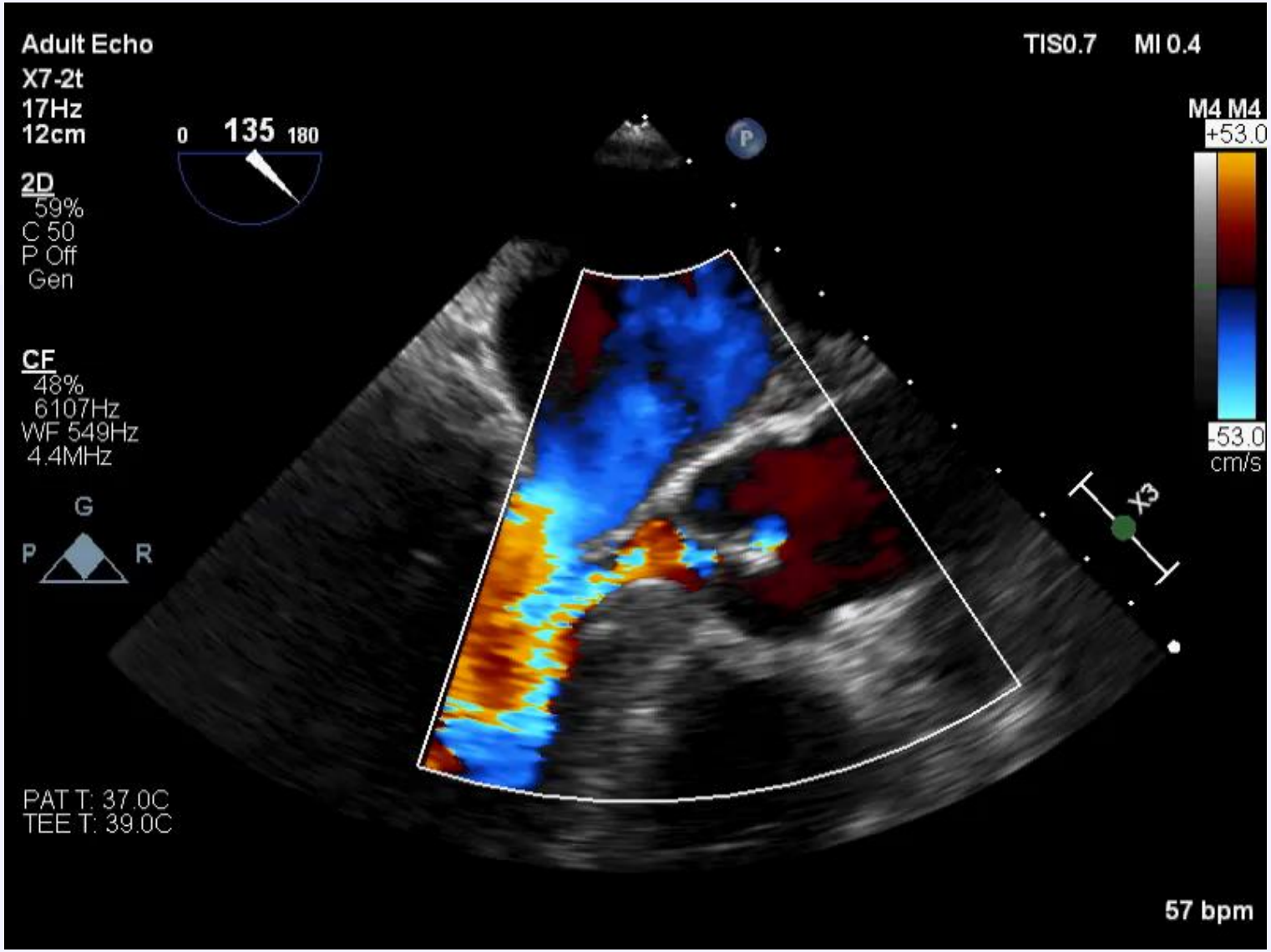

Adult Echo
X7-2t
17Hz
12cm
0 125 180
2D
59%
C 50
P Off
Gen
CF
48%
6009Hz
WF 540Hz
4.4MHz
G
P
R
TIS0.7 MI 0.4
M4 M4
+52.1
-52.1
cm/s
X3
PAT T: 37.0C
TEE T: 38.5C
50 bpm

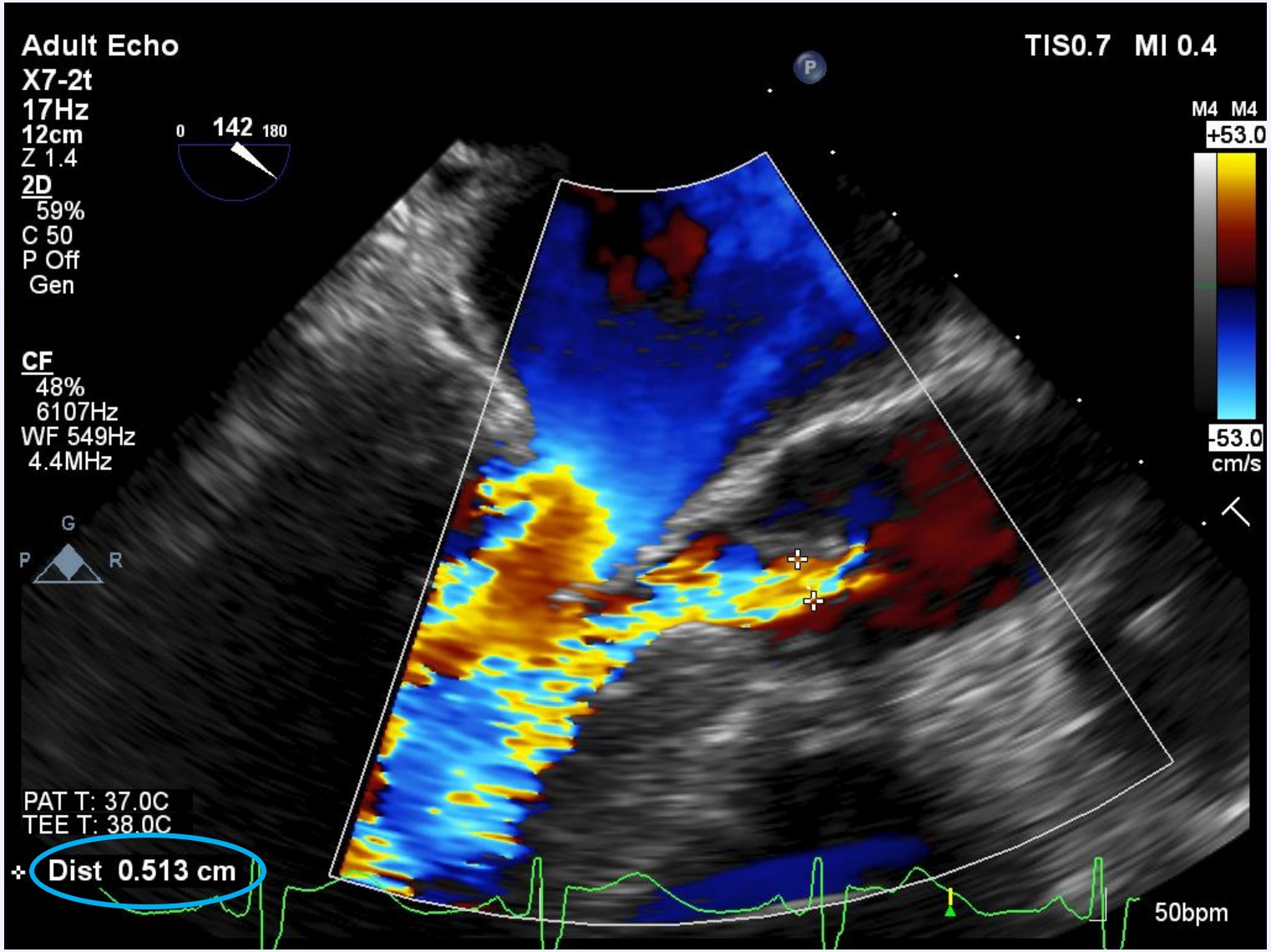

Adult Echo
X7-2t
18Hz
12cm
0 130 180
2D
59%
C 50
P Off
Gen
CF
48%
6726Hz
WF 605Hz
4.4MHz
TIS0.7 MI 0.4
M4 M4
+58.3
-58.3
cm/s
X3
MVA = π r2 = π X 1.52/2 X 1.52/2 = 1.8 cm2
PAT T: 37.0C
TEE T: 37.6C
Dist 1.54 cm
50bpm

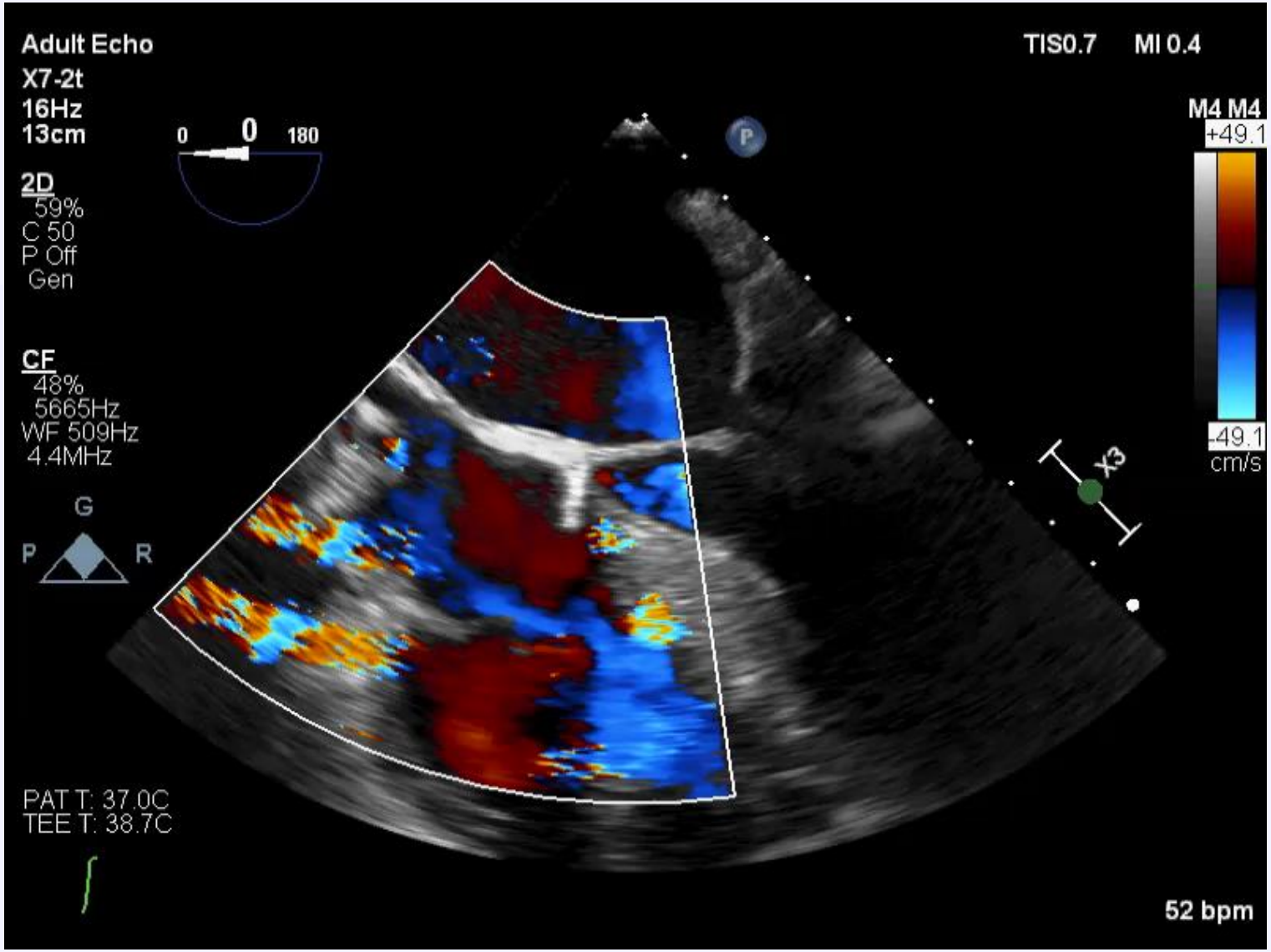

Adult Echo
X7-2t
53Hz
12cm
2D
53%
C 50
P Off
Gen
0
129
180
TIS0.2 MI 0.5
M4
P
G
P
R
X3
Dist 1.76 cm
Dist 2.23 cm
Dist 3.74 cm
50bpm

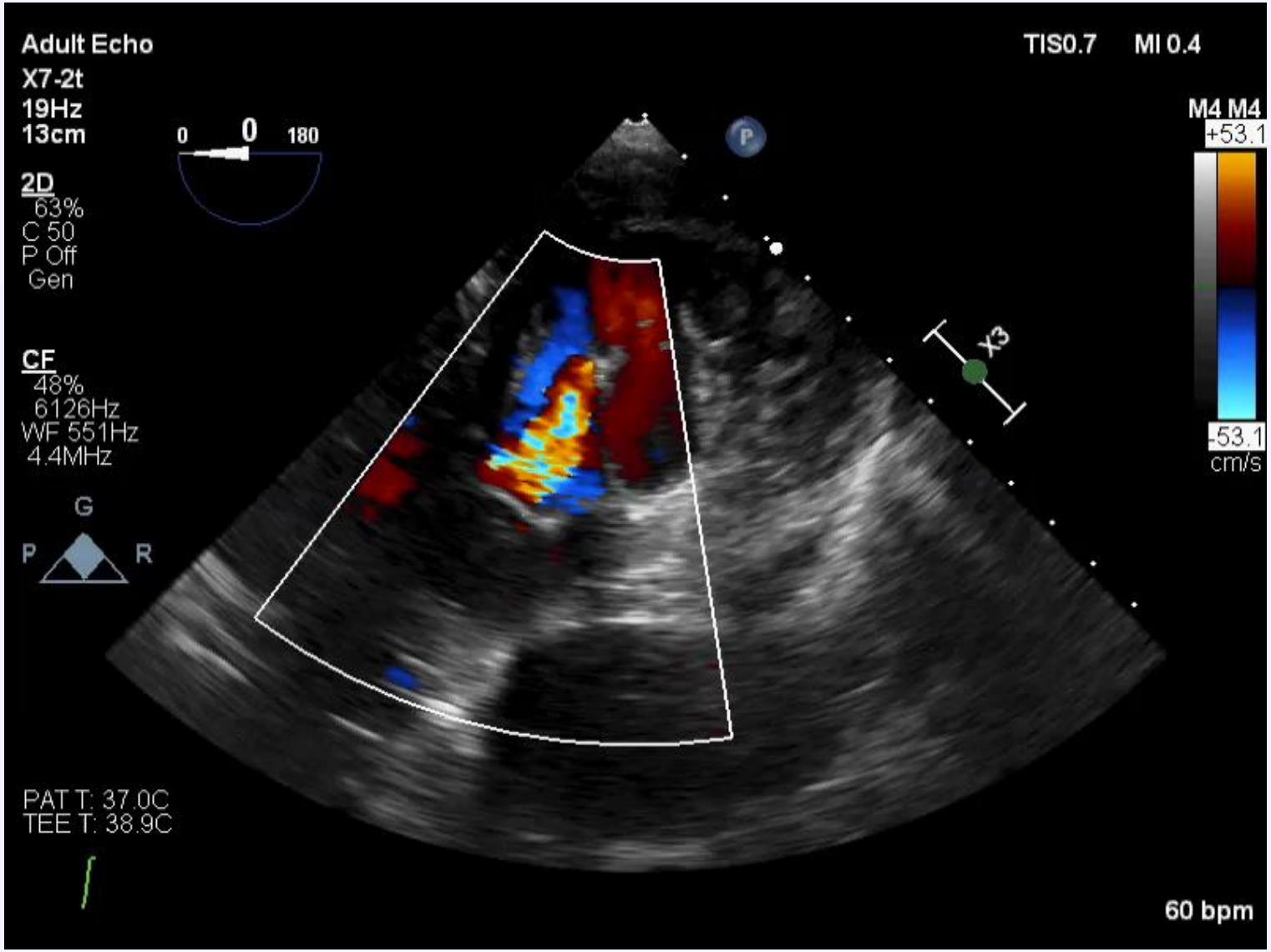

Adult Echo
X7-2t
17Hz
12cm
0
32
180
2D
59%
C 50
P Off
Gen
CF
48%
6147Hz
WF 553Hz
4.4MHz
G
P
R
TIS0.7
MI 0.4
M4 M4
+53.3
-53.3
cm/s
X3
PAT T: 37.0C
TEE T: 38.9C
50 bpm

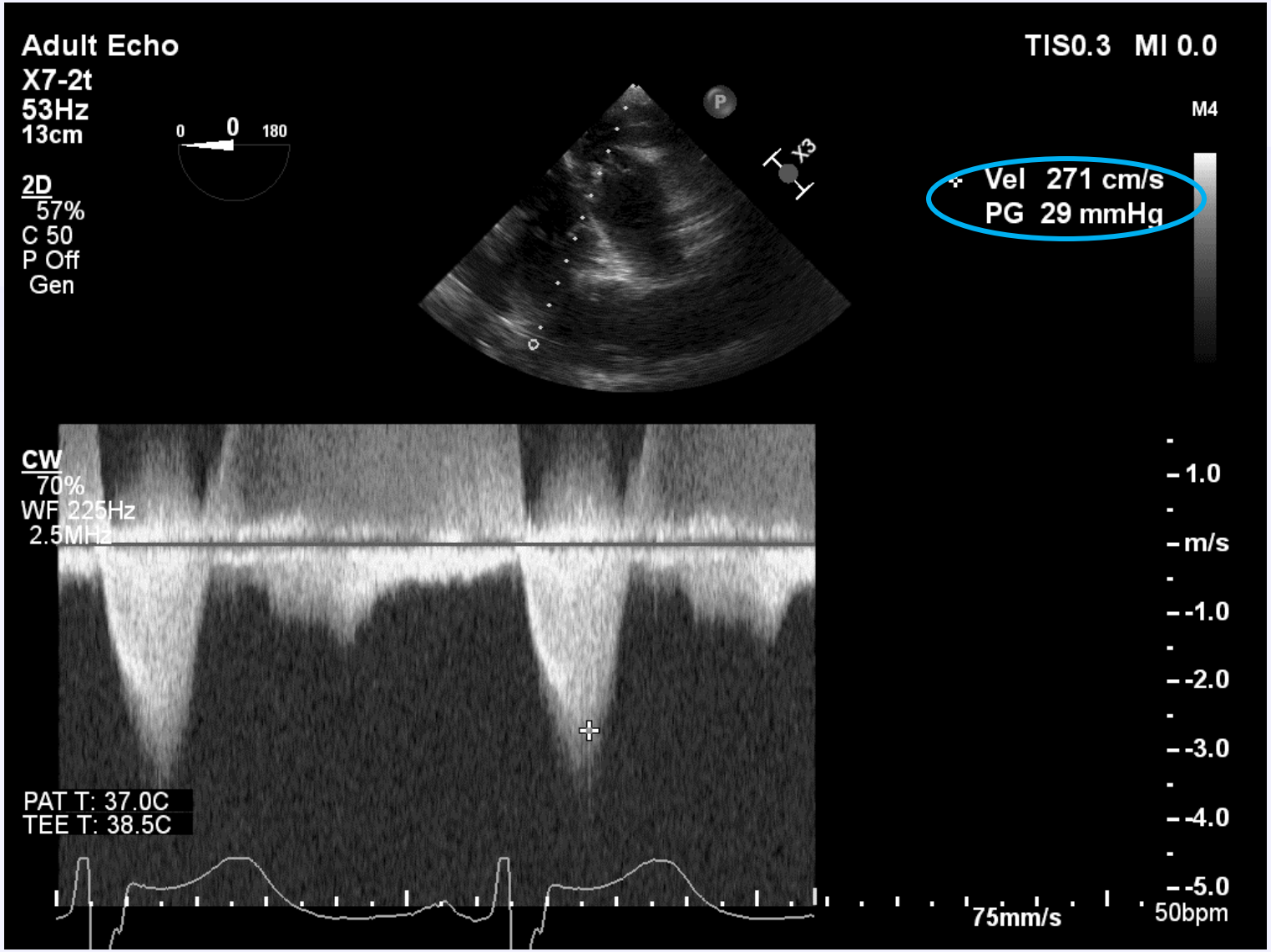

Adult Echo
X7-2t
53Hz
12cm
0
135
180
2D
53%
C 50
P Off
Gen
TIS0.2
MI 0.5
M4
G
P
R
X3
PAT T: 37.0C
TEE T: 39.0C
50 bpm


Adult Echo
X7-2t
17Hz
12cm
0 135 180
2D
59%
C 50
P Off
Gen
CF
48%
6107Hz
WF 549Hz
4.4MHz
G
P
R
TIS0.7 MI 0.4
M4 M4
+53.0
-53.0
cm/s
X3
PAT T: 37.0C
TEE T: 39.0C
57 bpm

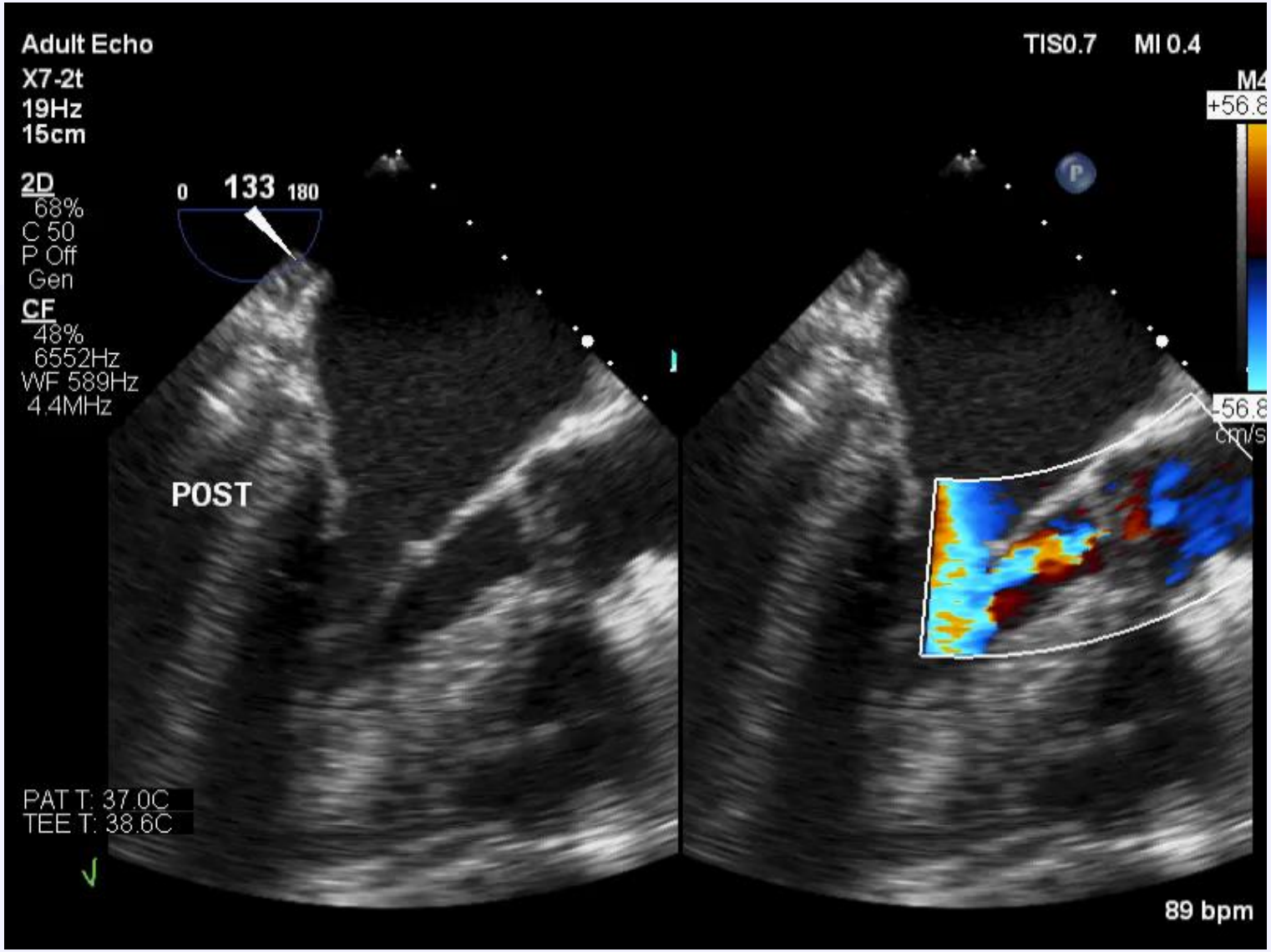

Adult Echo
X7-2t
17Hz
12cm
Z 1.4
2D
59%
C 50
P Off
Gen
0
142
180
CF
48%
6107Hz
WF 549Hz
4.4MHz
G
P
R
TIS0.7 MI 0.4
M4 M4
+53.0
-53.0
cm/s
PAT T: 37.0C
TEE T: 38.0C
Dist 0.513 cm
50bpm

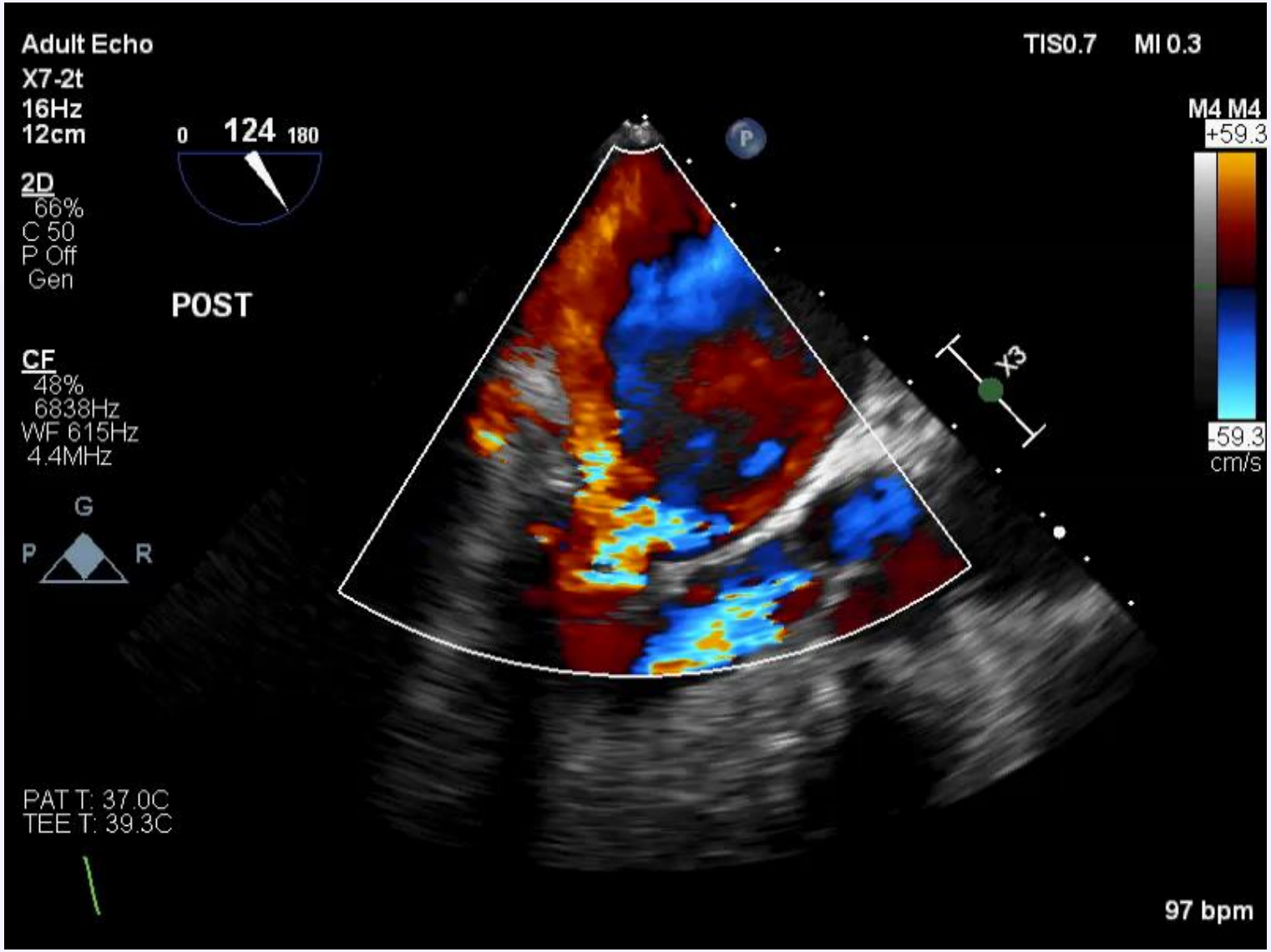

Adult Echo
X7-2t
16Hz
13cm
0 0 180
2D
59%
C 50
P Off
Gen
CF
48%
5665Hz
WF 509Hz
4.4MHz
G
P R
TIS0.7 MI 0.4
M4 M4
+49.1
-49.1
cm/s
X3
PAT T: 37.0C
TEE T: 38.7C
52 bpm

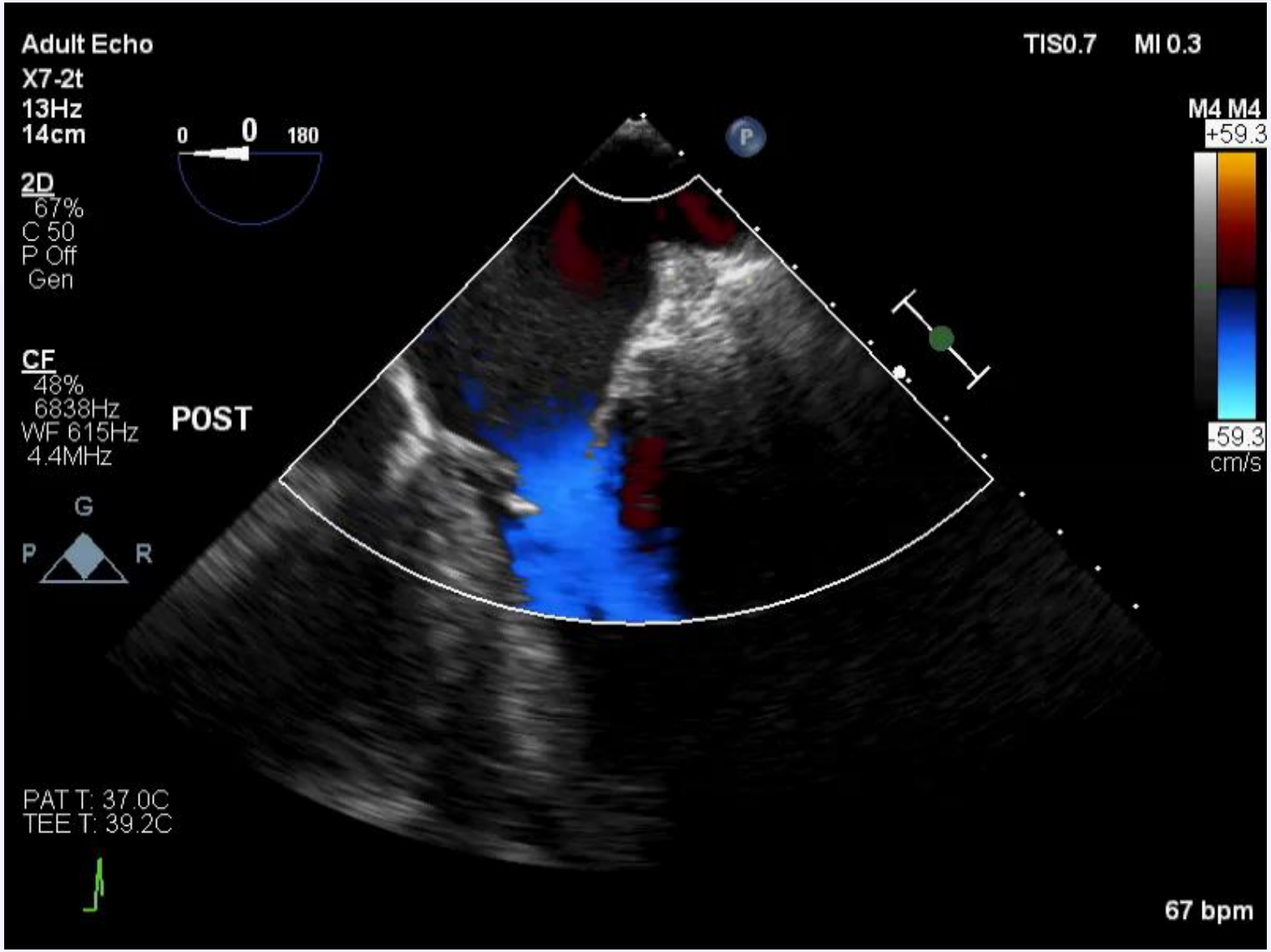

Adult Echo
X7-2t
19Hz
13cm
0 0 180
2D
63%
C 50
P Off
Gen
CF
48%
6126Hz
WF 551Hz
4.4MHz
G
P R
TIS0.7 MI 0.4
M4 M4
+53.1
-53.1
cm/s
X3
PAT T: 37.0C
TEE T: 38.9C
60 bpm

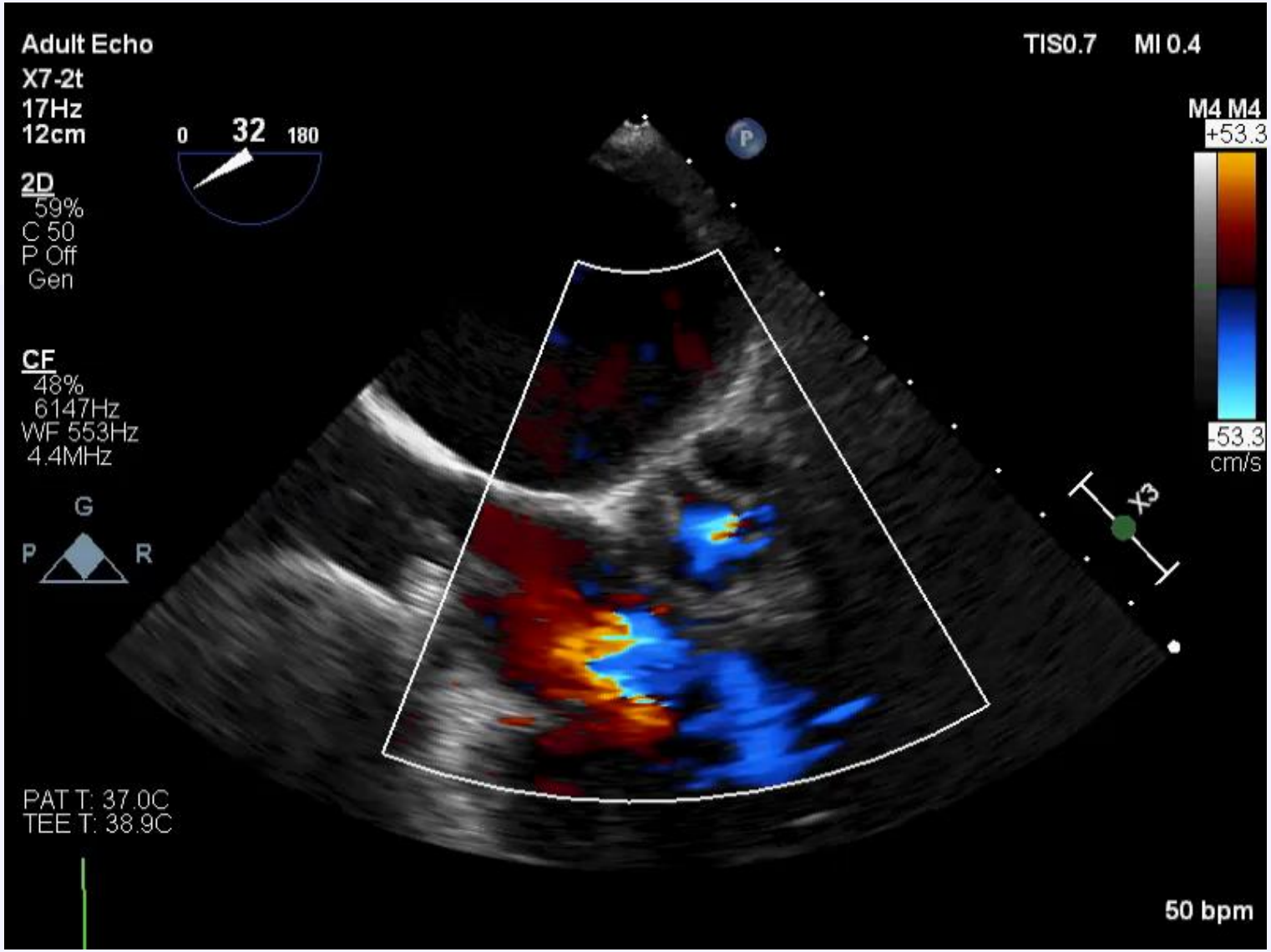

Adult Echo
X7-2t
53Hz
13cm
2D
57%
C 50
P Off
Gen
TIS0.3 MI 0.0
M4
Vel 271 cm/s
PG 29 mmHg
CW
70%
WF 225Hz
2.5MHz
PAT T: 37.0C
TEE T: 38.5C
1.0
m/s
-1.0
-2.0
-3.0
-4.0
-5.0
75mm/s
50bpm

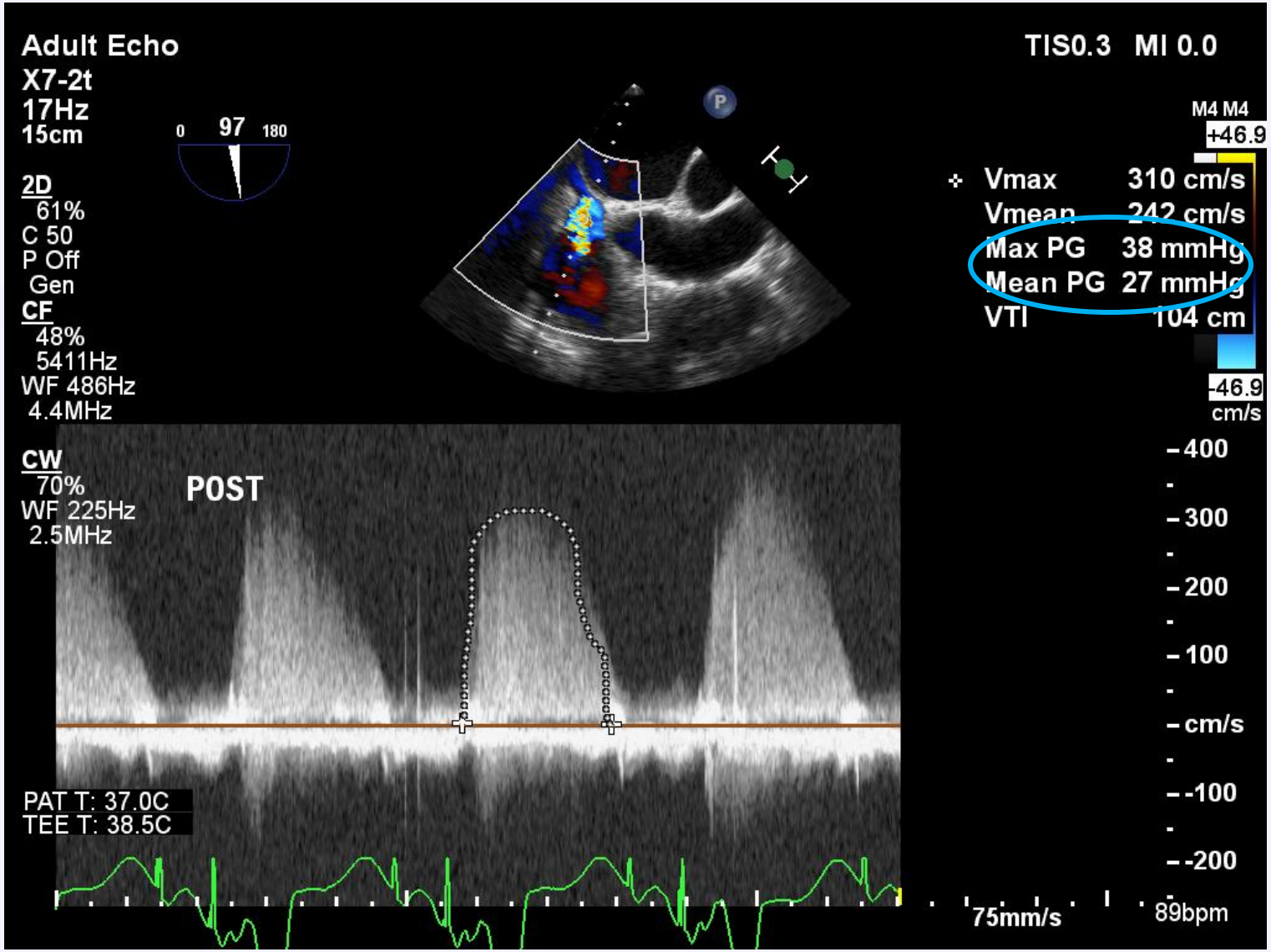
Post op

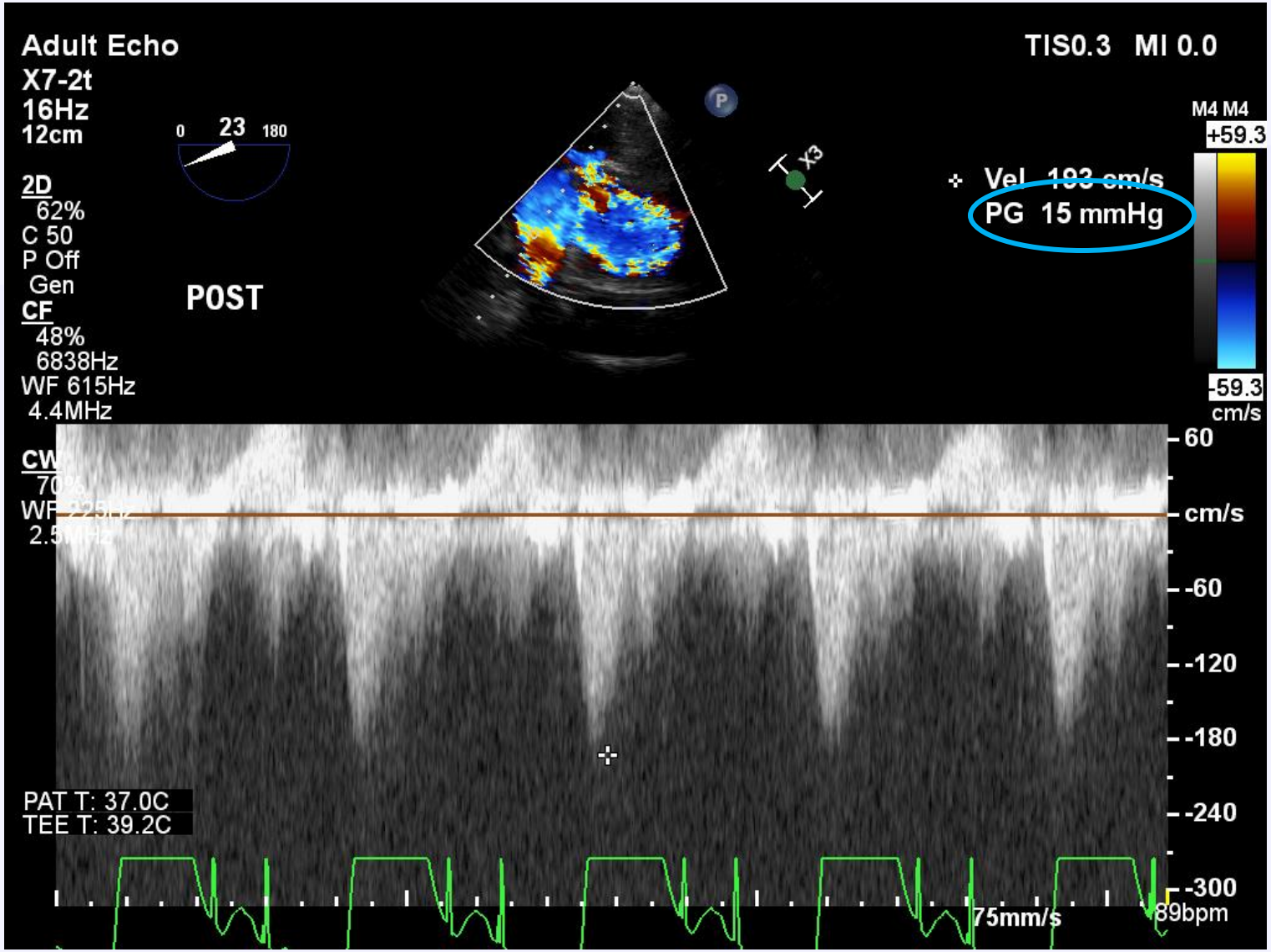

Adult Echo
X7-2t
19Hz
15cm
2D
68%
C 50
P Off
Gen
CF
48%
6552Hz
WF 589Hz
4.4MHz
0
133
180
TIS0.7
MI 0.4
M4
+56.8
-56.8
cm/s
POST
PAT T: 37.0C
TEE T: 38.6C
89 bpm


Adult Echo
X7-2t
16Hz
12cm
0 124 180
2D
66%
C 50
P Off
Gen
POST
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: 39.3C
97 bpm


Adult Echo
X7-2t
13Hz
14cm
0 0 180
2D
67%
C 50
P Off
Gen
CF
48%
6838Hz
WF 615Hz
4.4MHz
POST
G
P R
TIS0.7 MI 0.3
M4 M4
+59.3
-59.3
cm/s
PAT T: 37.0C
TEE T: 39.2C
67 bpm


Adult Echo
X7-2t
17Hz
12cm
0
32
180
2D
59%
C 50
P Off
Gen
CF
48%
6147Hz
WF 553Hz
4.4MHz
G
P
R
TIS0.7
MI 0.4
M4 M4
+53.3
-53.3
cm/s
X3
PAT T: 37.0C
TEE T: 38.9C
50 bpm


Adult Echo
X7-2t
17Hz
15cm
0 97 180
2D
61%
C 50
P Off
Gen
CF
48%
5411Hz
WF 486Hz
4.4MHz
TIS0.3 MI 0.0
M4 M4
+46.9
Vmax 310 cm/s
Vmean 242 cm/s
Max PG 38 mmHg
Mean PG 27 mmHg
VTI 104 cm
-46.9
cm/s
CW
70%
WF 225Hz
2.5MHz
POST
400
300
200
100
cm/s
-100
-200
PAT T: 37.0C
TEE T: 38.5C
75mm/s
89bpm


Adult Echo
X7-2t
16Hz
12cm
2D
62%
C 50
P Off
Gen
CF
48%
6838Hz
WF 615Hz
4.4MHz
CW
WF
2.5MHz
POST
0
23
180
TIS0.3 MI 0.0
M4 M4
+59.3
-59.3
cm/s
Vel 193 cm/s
PG 15 mmHg
60
cm/s
-60
-120
-180
-240
-300
PAT T: 37.0C
TEE T: 39.2C
75mm/s
89bpm

Patient had cardiac arrest in ICU the day after surgery and was resuscitated. She was discharged home one week later with moderate to severe MR.

Suggested reading materials

1. 2011 ACCF/AHA Guideline for the diagnosis and treatment of hypertrophic cardiomyopathy. JACC 2011.
2. 2011 American Society of Echocardiography clinical recommendations for multimodality cardiovascular imaging in patients with hypertrophic cardiomyopathy. JASE 2011.
3. 2014 ESC Guidelines on diagnosis and management of hypertrophic cardiomyopathy. European Heart Journal 2014.

Questions

Question 1

Based on AHA classification which of the following cardiomyopathy is a primary cardiomyopathy?

A. Stress induced cardiomyopathy (Takatsubo cardiomyopathy)
B. Cardiac amyloidosis
C. Duchenne cardiomyopathy
D. Hemochromatosis

Question 2

All of the followings are complications of surgical septal myectomy EXCEPT

A. VSD
B. Complete A-V block
C. Pulmonary regurgitation
D. Flail mitral valve

Question 3

Which of the following statements about results of surgical myectomy IS CORRECT?

A. Mortality of this surgery in an experienced center is about 2-3%
B. In group of patients with thinner septum (septal thickness less than 1.7 cm), chance of creating VSD is much higher
C. Chance of complete A-V block is less than alcohol septal ablation
D. Chance of residual severe SAM is about 5%

Question 4

Which of the following treatments in HCM is less effective in terms of reducing mean LVOT gradient?

A. Surgical myectomy
B. Pacemaker
C. Alcohol septal ablation
D. Disopyramide

Question 5

All of the following statements about alcohol septal ablation (ASA) in HCM are correct EXCEPT

A. It is less invasive compared to surgical myectomy
B. Chance of complete A-V block is about 10%
C. In elderly patients with comorbidities is a better choice than surgery
D. Relief of the gradient at the LVOT is faster than surgical myectomy

Correct Answers

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


Toronto
Thank you.