ZURICH HEART HOUSE
LONDON HEART HOUSE

Azərbaycan Kardiologiya Cəmiyyəti

Royal Brompton and Harefield hospitals NHS
Guy's and St Thomas' NHS Foundation Trust

Multimodality imaging

Shahana Alasgarli, MD, FESC

01.06.2025

Yeni Klinika, Baku, Azerbaijan, Head of Cardiology Department

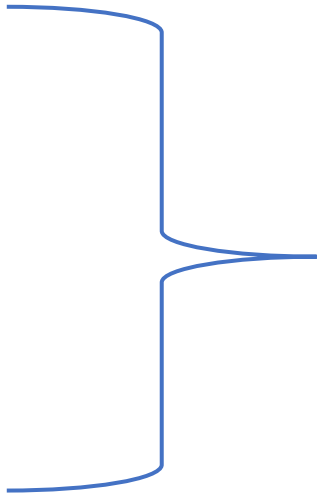
MasterCourse in Heart Failure Baku, Azerbaijan, May 30th – June 1st, 2025

Declaration of interest...

-I have nothing to declare

Cardiovascular imaging in heart failure patient

Systolic function
Diastolic function
Right ventricular function
Ischaemia assessment
Viability assessment
Therapy guidance
Fibrosis assessment



TTE
TOE
CMR
SPECT
PET

Review the guidlines

ESC
European Society of Cardiology
European Heart Journal (2021) **42**, 3599–3726
doi:10.1093/eurheartj/ehab368

ESC GUIDELINES

2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

With the special contribution of the Heart Failure Association (HFA) of the ESC

Authors/Task Force Members: Theresa A. McDonagh* (Chairperson) (United Kingdom), Marco Metra * (Chairperson) (Italy), Marianna Adamo (Task Force Coordinator) (Italy), Roy S. Gardner (Task Force Coordinator) (United Kingdom), Andreas Baumbach (United Kingdom), Michael Böhm (Germany), Haran Burri (Switzerland), Javed Butler (United States of America), Jelena Čelutkienė

Table 5 **Causes of heart failure, common modes of presentation and specific investigations**

Cause	Examples of presentations	Specific investigations
CAD	Myocardial infarction	Invasive coronary angiography
	Angina or "angina-equivalent"	CT coronary angiography
	Arrhythmias	Imaging stress tests (echo, nuclear, CMR)
Hypertension	Heart failure with preserved systolic function	24 h ambulatory BP
	Malignant hypertension/acute pulmonary oedema	Plasma metanephrines, renal artery imaging
		Renin and aldosterone
Valve disease	Primary valve disease e.g., aortic stenosis	Echo – transoesophageal/stress
	Secondary valve disease, e.g. functional regurgitation	
	Congenital valve disease	
Arrhythmias	Atrial tachyarrhythmias	Ambulatory ECG recording
	Ventricular arrhythmias	Electrophysiology study, if indicated
CMPs	All	CMR, genetic testing
	Dilated	
	Hypertrophic	
	Restrictive	Right and left heart catheterization
	ARVC	
	Peripartum	
	Takotsubo syndrome	CMR, angiography
	Toxins: alcohol, cocaine, iron, copper	Trace elements, toxicology, LFTs, GGT
Congenital heart disease	Congenitally corrected/repaired transposition of great arteries	CMR
	Shunt lesions	
	Repaired tetralogy of Fallot	
	Ebstein's anomaly	
Infective	Viral myocarditis	CMR, EMB
	Chagas disease	
	HIV	Serology
	Lyme disease	
Drug-induced	Anthracyclines	
	Trastuzumab	
	VEGF inhibitors	
	Immune checkpoint inhibitors	
	Proteasome inhibitors	
	RAF+MEK inhibitors	
Infiltrative	Amyloid	Serum electrophoresis and serum free light chains, Bence Jones protein, bone scintigraphy, CMR, CT-PET, EMB
	Sarcoidosis	Serum ACE, CMR, FDG-PET, chest CT, EMB
	Neoplastic	CMR, EMB
Storage disorders	Haemochromatosis	Iron studies, genetics, CMR (T2* imaging), EMB
	Fabry disease	α-galactosidase A, genetics, CMR (T1 mapping)
	Glycogen storage diseases	
Endomyocardial disease	Radiotherapy	CMR
	Endomyocardial fibrosis/eosinophilia	EMB
	Carcinoid	24 h urine 5-HIAA
Pericardial disease	Calcification	Chest CT, CMR, right and left heart catheterization
	Infiltrative	
Metabolic	Endocrine disease	TFTs, plasma metanephrines, renin and aldosterone, cortisol
	Nutritional disease (thiamine, vitamin B1 and selenium deficiencies)	Specific plasma nutrients
	Autoimmune disease	ANA, ANCA, rheumatology review
Neuromuscular disease	Friedreich's ataxia	Nerve conduction studies, electromyogram, genetics
	Muscular dystrophy	CK, electromyogram, genetics

Case 1

75 years old male

4 year history of dilated cardiomyopathy

2021 abdominal aortic aneurism-surgery

2021-coronary angiography-RCA aneurism gretf stenting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Coronaries
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RAO: 2 CRA: 33
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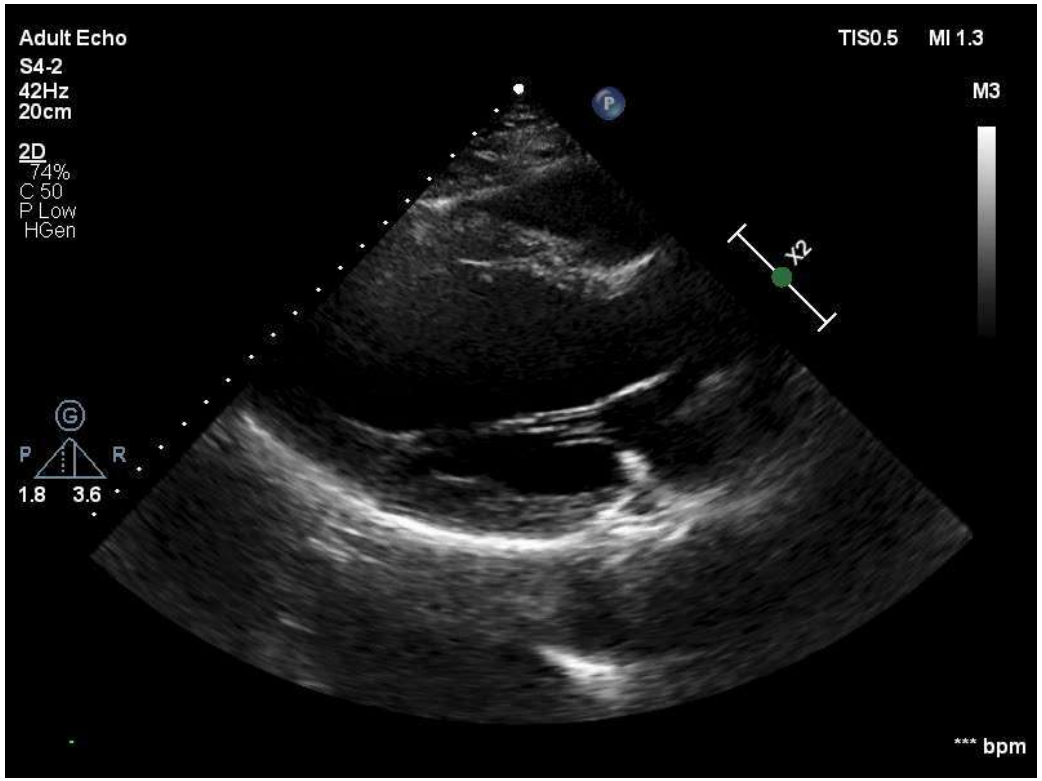
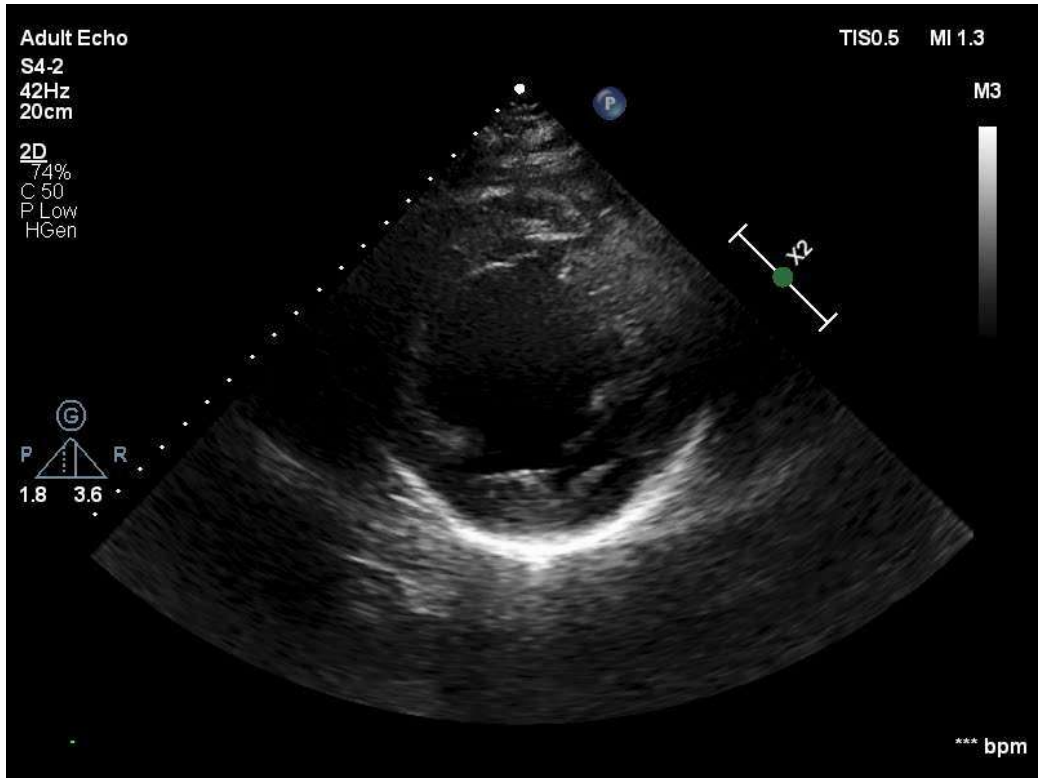
Transthoracal echocardiography





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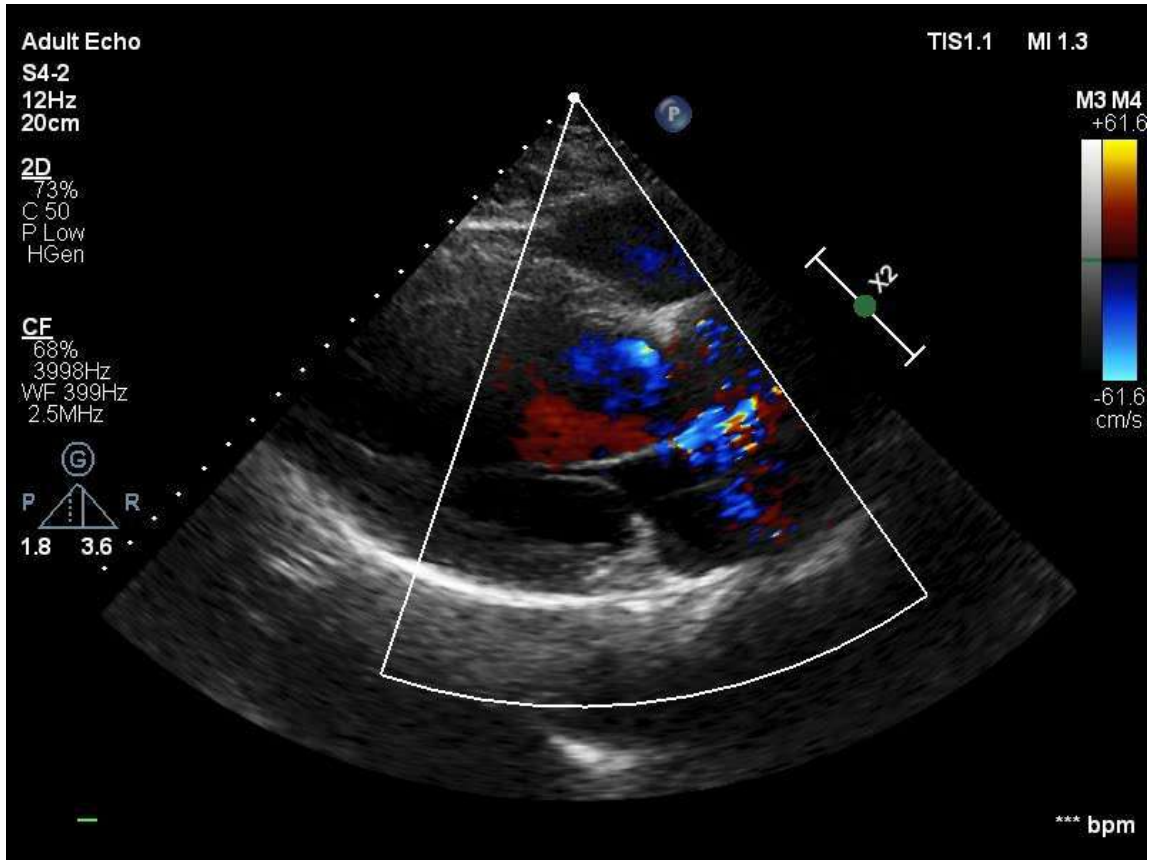

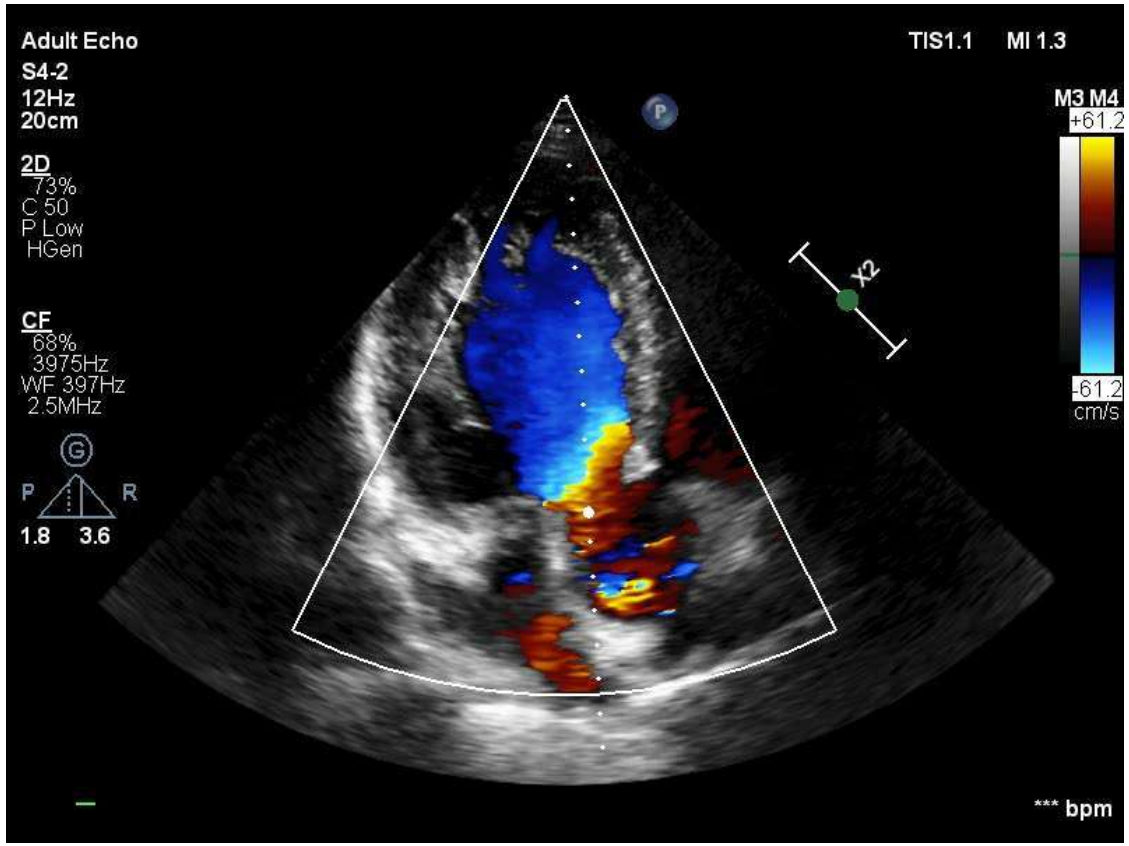

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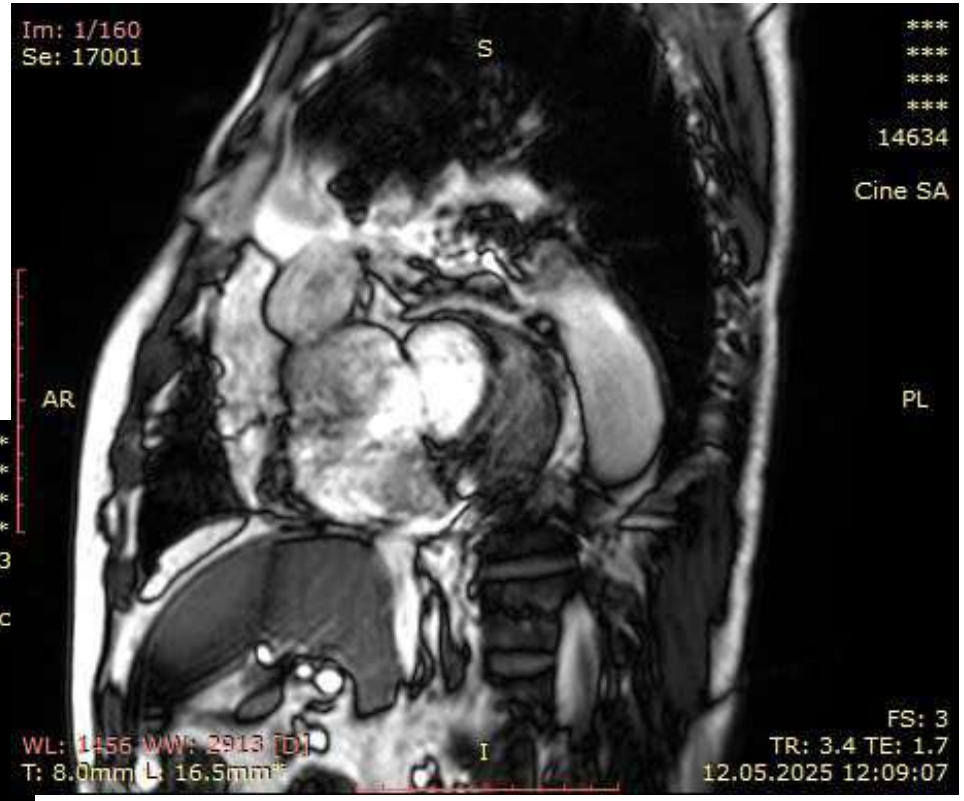
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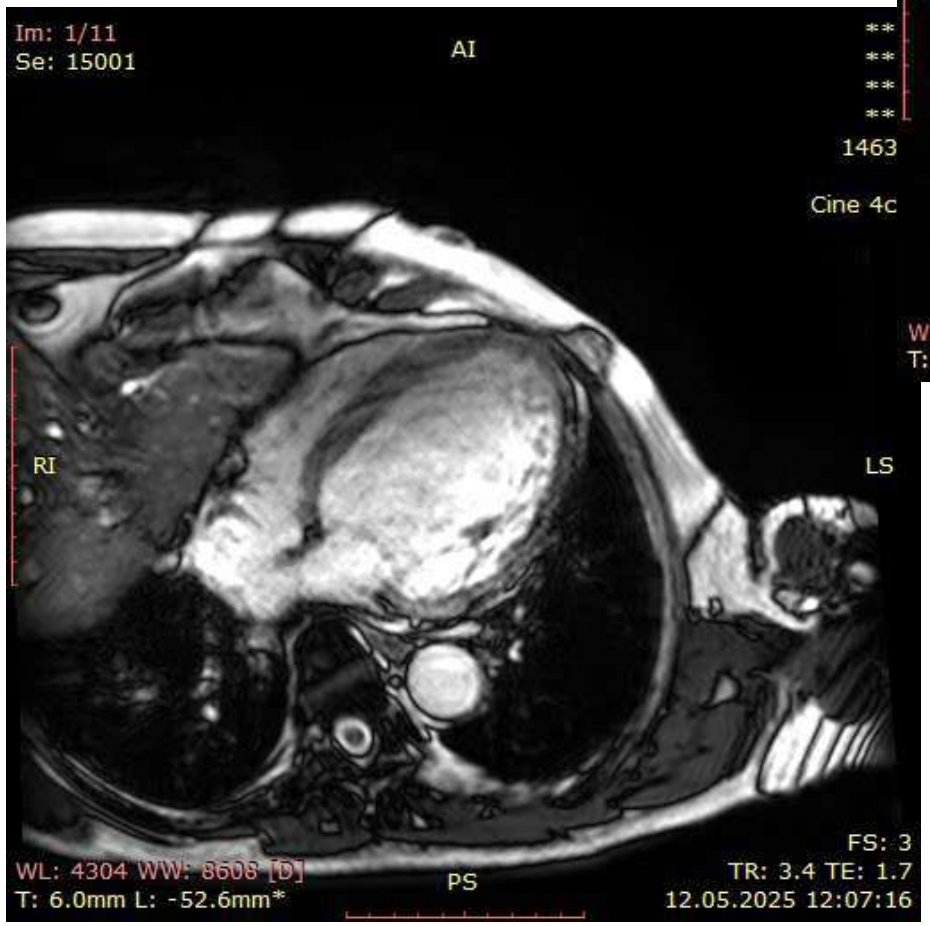
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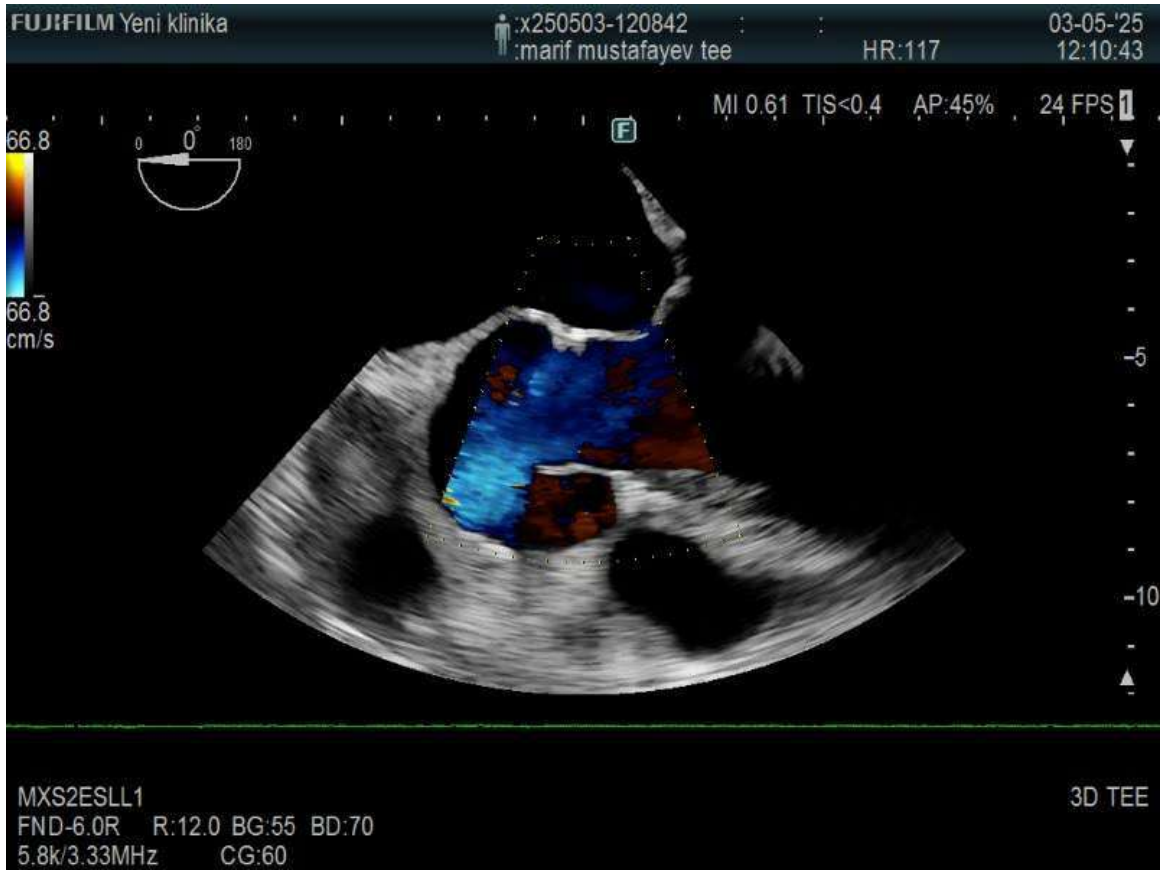
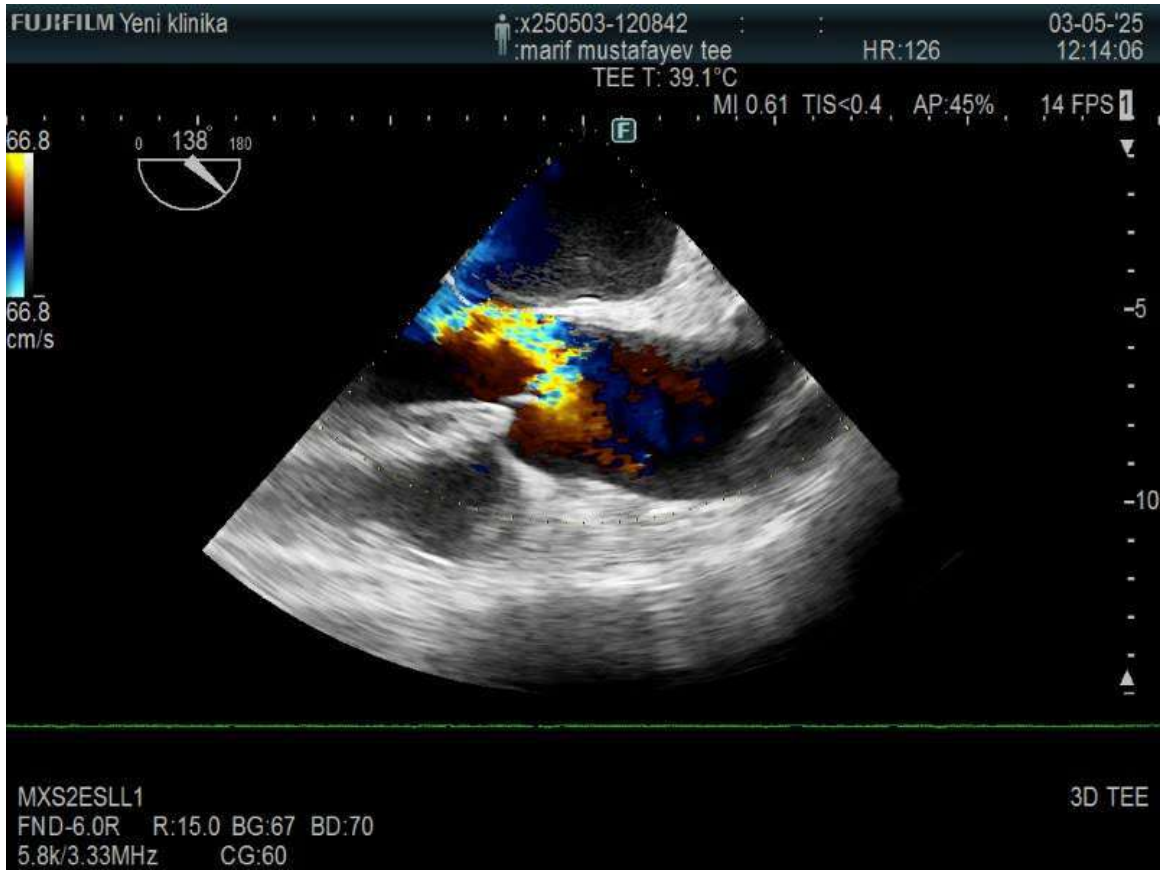
Whats next?

Transesophageal echocardiography





Final diagnosis

Severe aortic regurgitation due to enlarged aortic root
Left ventricular dilatation secondary to AR

Next step: aortic valve replacement

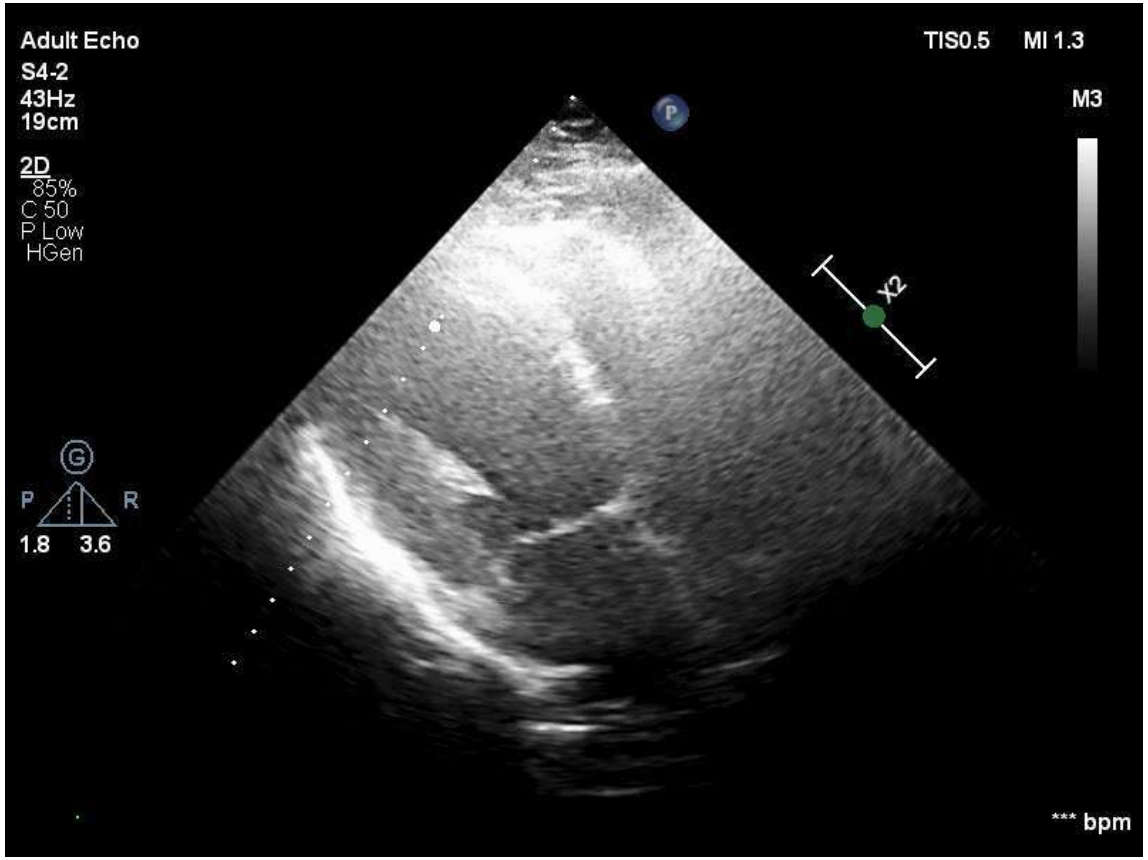
Case 2

62 years old male

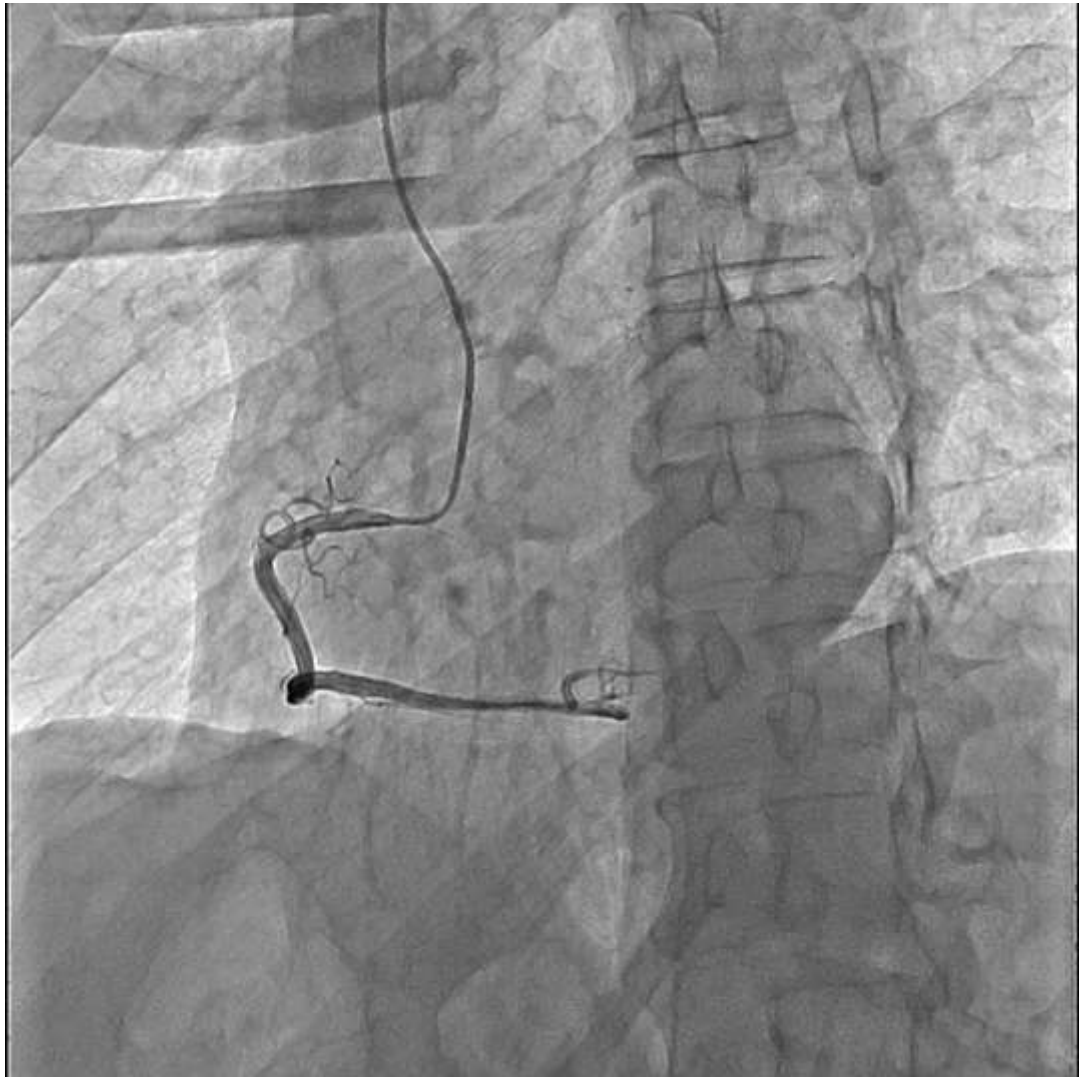
2015 LAD and Cx stenting due stable angina

2024- simptoms of heart failure

Echocardiography-TTE



Coronary angiogprahy



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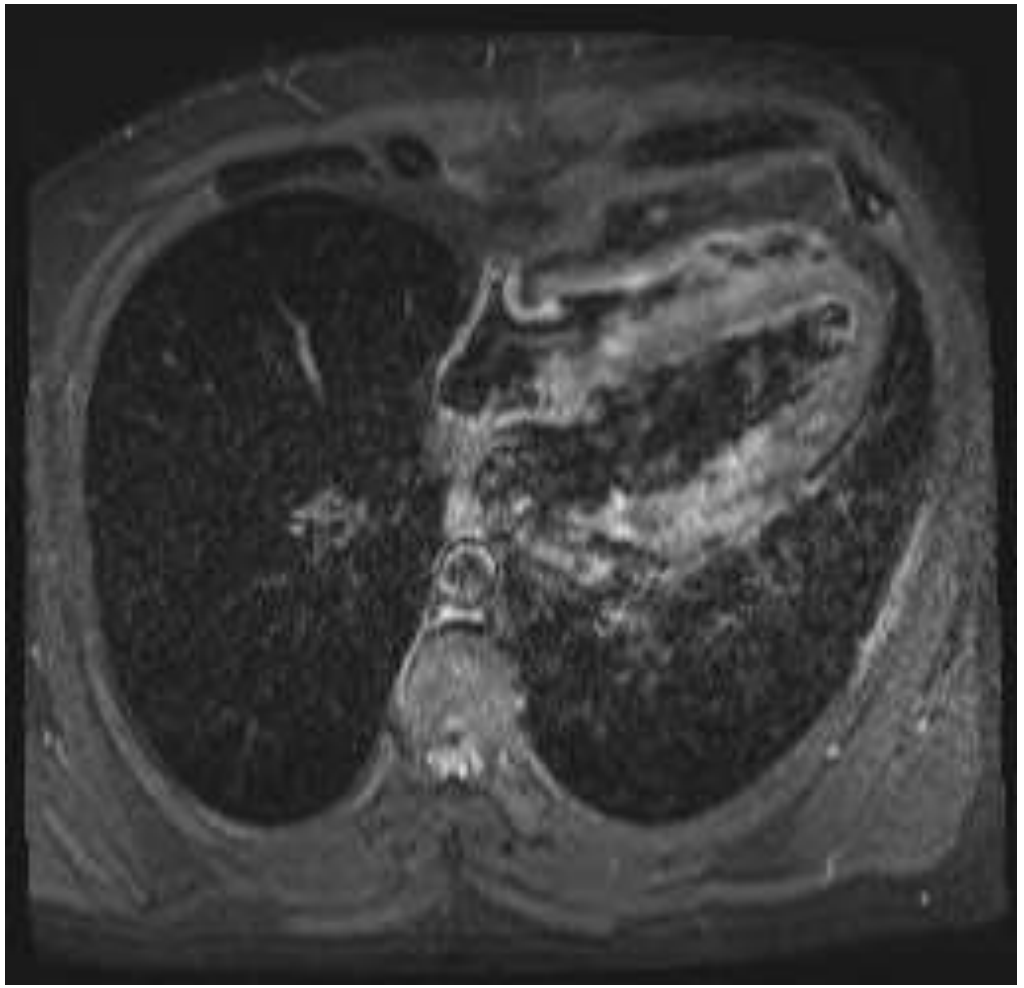
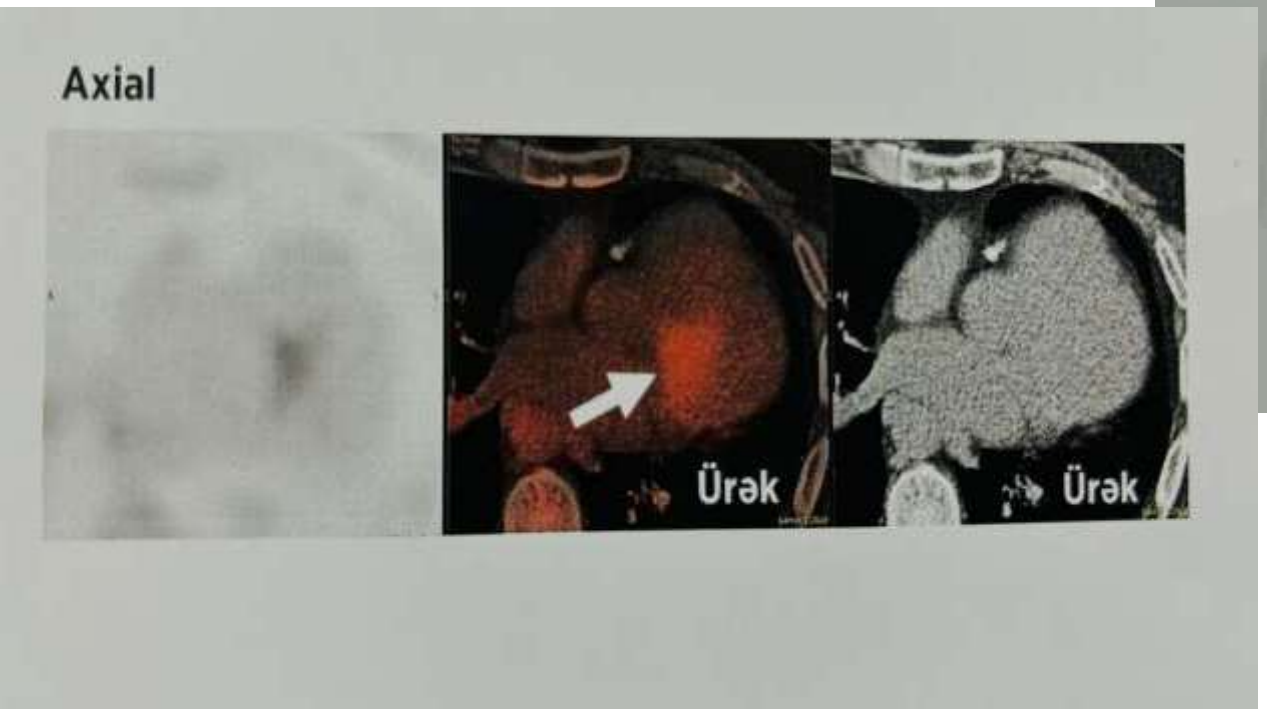


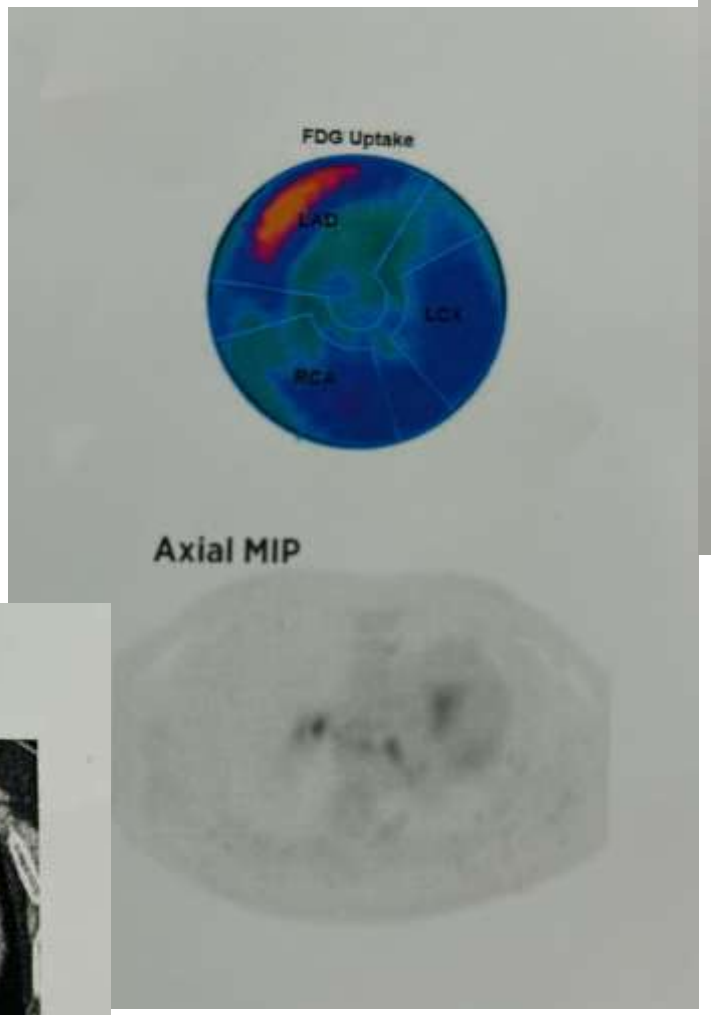
Whats next?

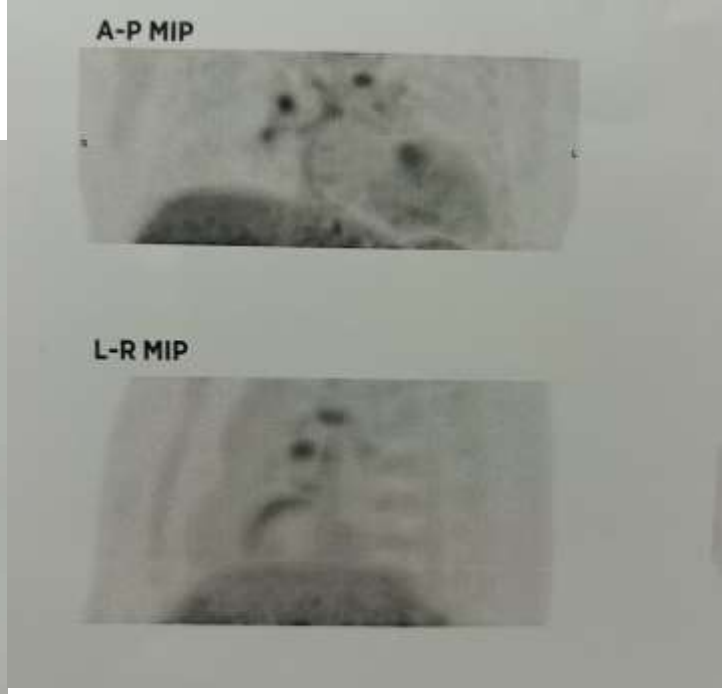
Guidlines

Recommendations	Class[a]	Level[b]
DPD/PYP/HMDP bone-tracer scintigraphy is recommended in patients with suspected ATTR-related cardiac amyloidosis to aid diagnosis.[166–168]	I	B
Contrast-enhanced cardiac CT should be considered in patients with suspected cardiomyopathy who have inadequate echocardiographic imaging and contraindications to CMR.[169,170]	IIa	C
In patients with suspected cardiomyopathy, CT-based imaging should be considered to exclude congenital or acquired coronary artery disease as a cause of the observed myocardial abnormality.[171]	IIa	C
18F-FDG-PET scanning should be considered for the diagnostic work-up in patients with cardiomyopathy in whom cardiac sarcoidosis is suspected.[164,172,173]	IIa	C

PET/CT







Final diagnosis

Cardiac sarcoidosis

Treatment-Metilprednisolon 8mgX1, Imuran 50mgx3

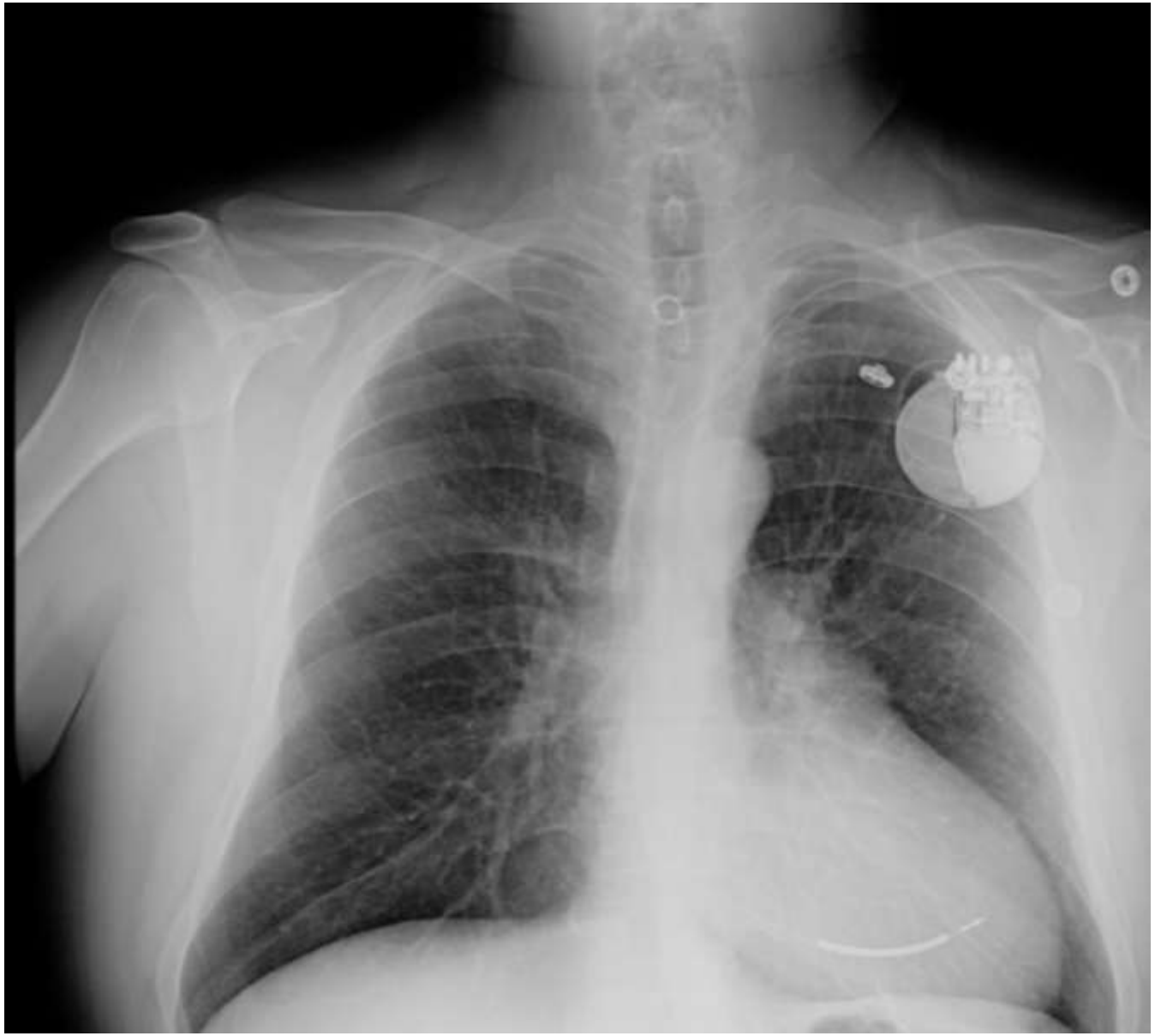
GDMT

ICD?

2022 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

Recommendations	Class[a]	Level[b]
Risk stratification and primary prevention of SCD		
ICD implantation is recommended in patients with cardiac sarcoidosis who have a LVEF ≤35%.[812,828–830,832]	I	B
In patients with cardiac sarcoidosis who have an indication for permanent cardiac pacing related to high-degree AV block, ICD implantation should be considered, regardless of LVEF.[816]	IIa	C
In patients with cardiac sarcoidosis who have a LVEF >35% but significant LGE at CMR after resolution of acute inflammation, ICD implantation should be considered.[817–819,821,833,834]	IIa	B
In patients with cardiac sarcoidosis who have a LVEF 35–50% and minor LGE at CMR, after resolution of acute inflammation, PES for risk stratification should be considered.	IIa	C
In patients with cardiac sarcoidosis, LVEF 35–50% and inducible SMVT at PES, ICD implantation should be considered.[823–825]	IIa	C

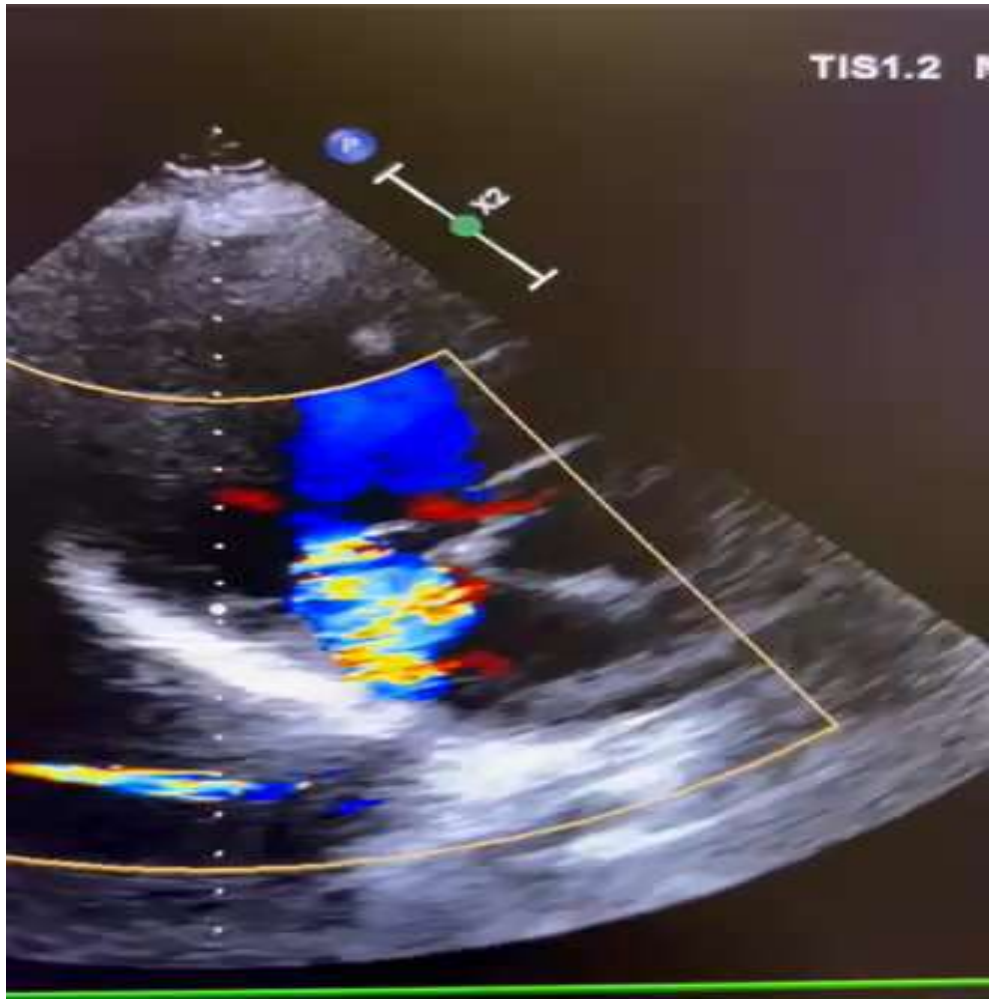
ICD implantation



Case 3

66 years old female
AVR with mechanical valve
LVEF-65%
Comorbidities-none
Discharge

2 weeks after discharge
Acute heart failure
Cardiogenic shock
B/P 90/30mmHg, HR 110 bmp, spo2 60%, peripherial oedema
Intubated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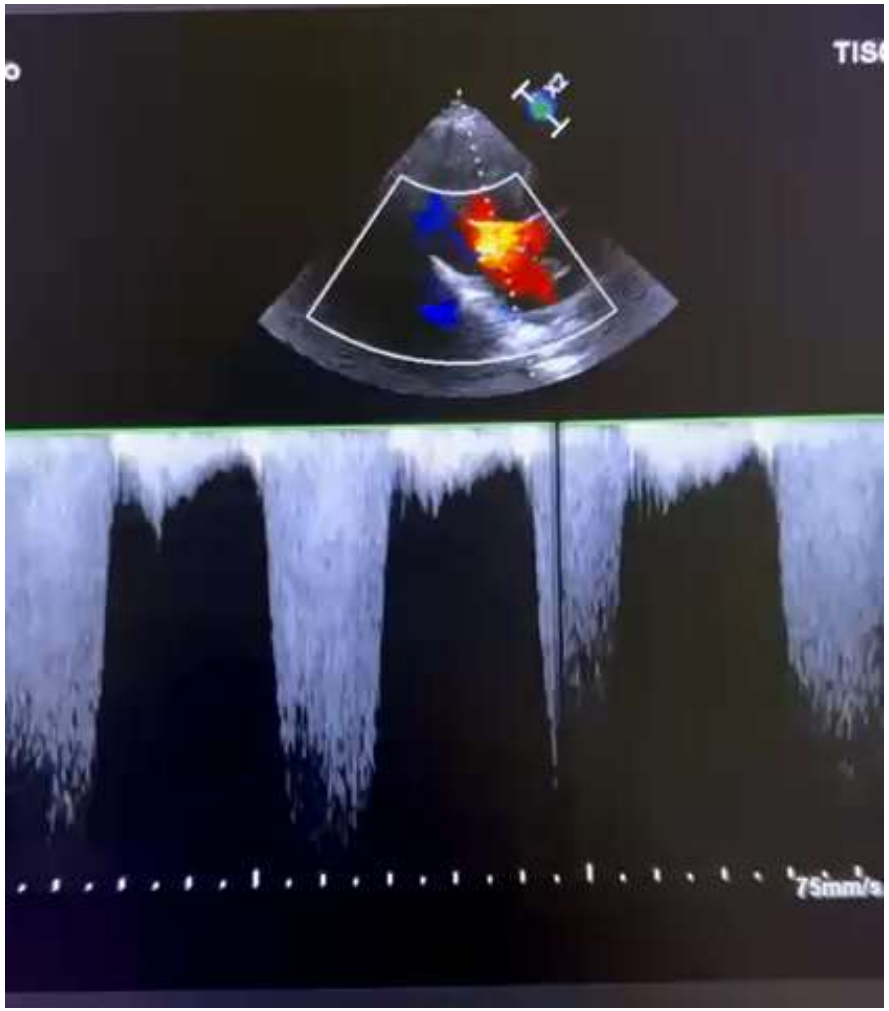
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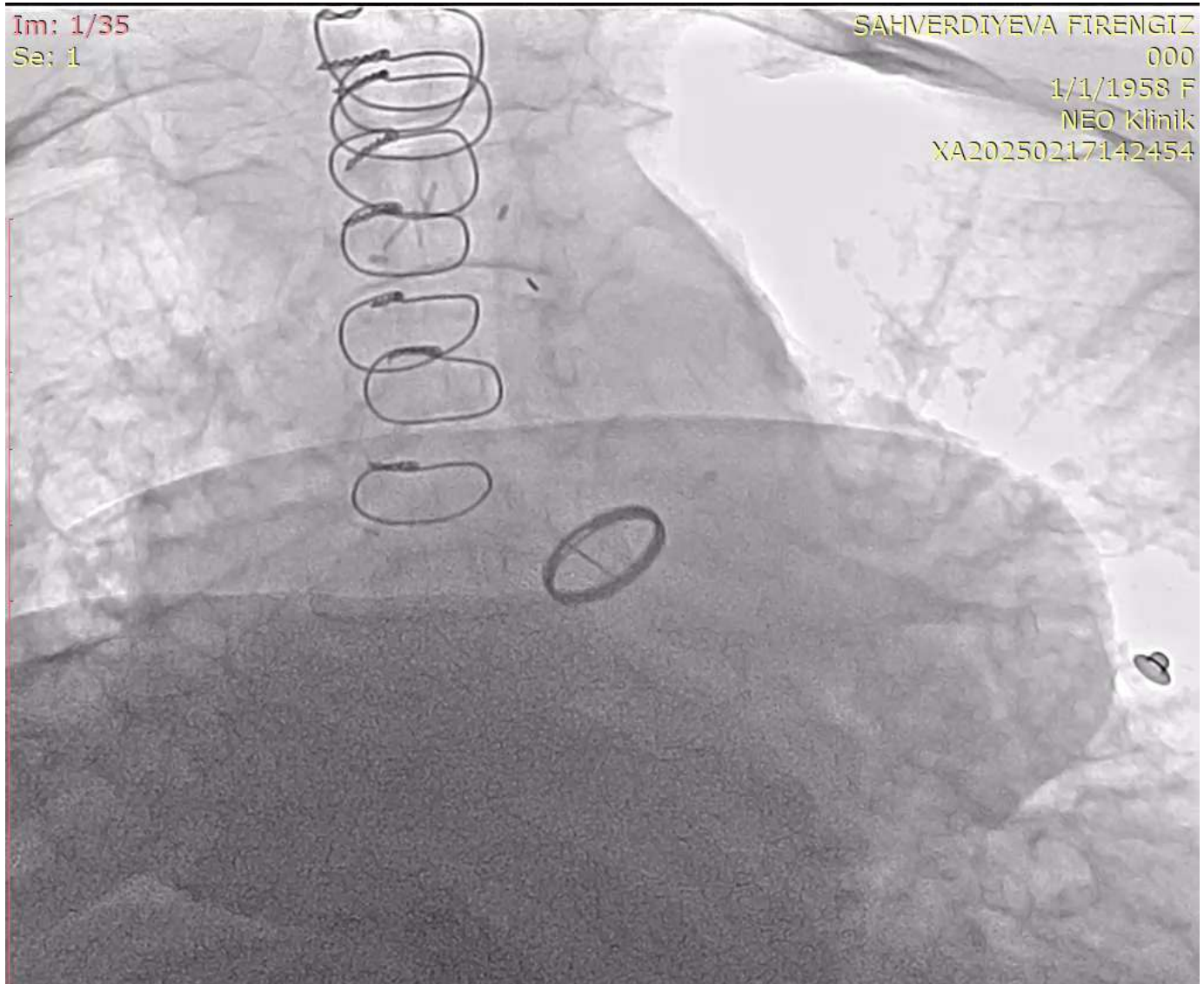
Whats next?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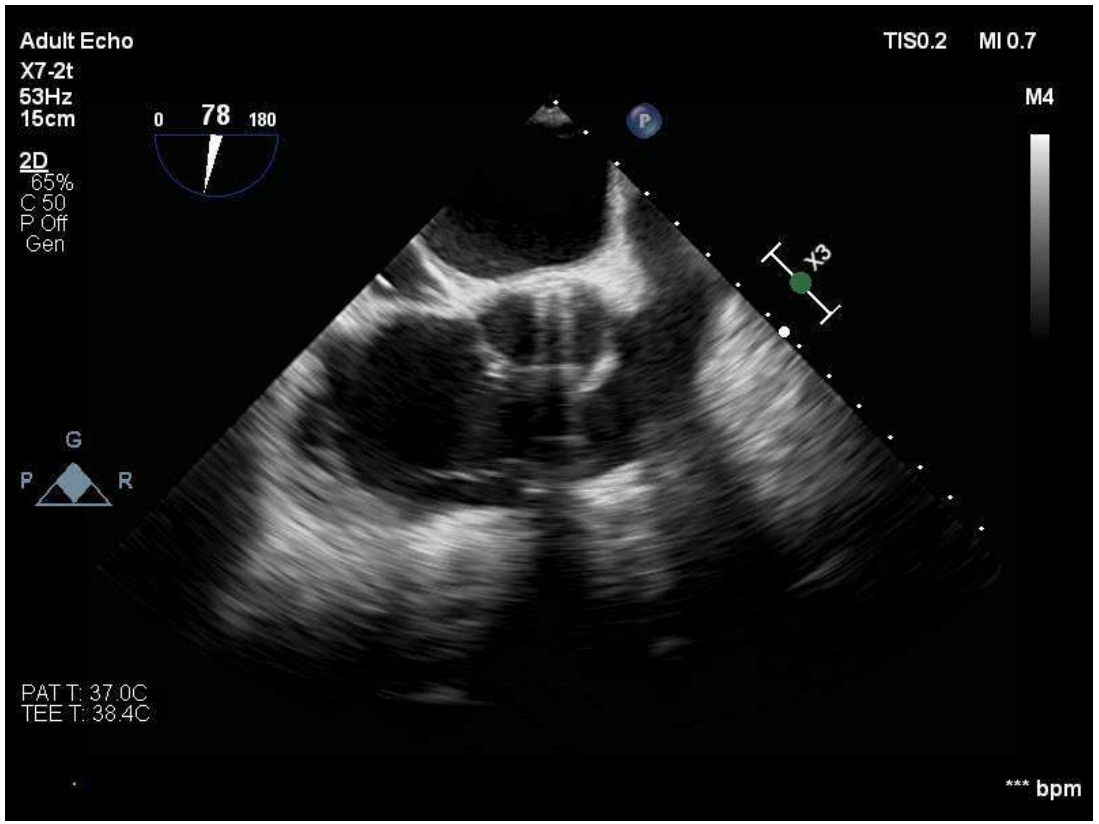
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2D
65%
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P Off
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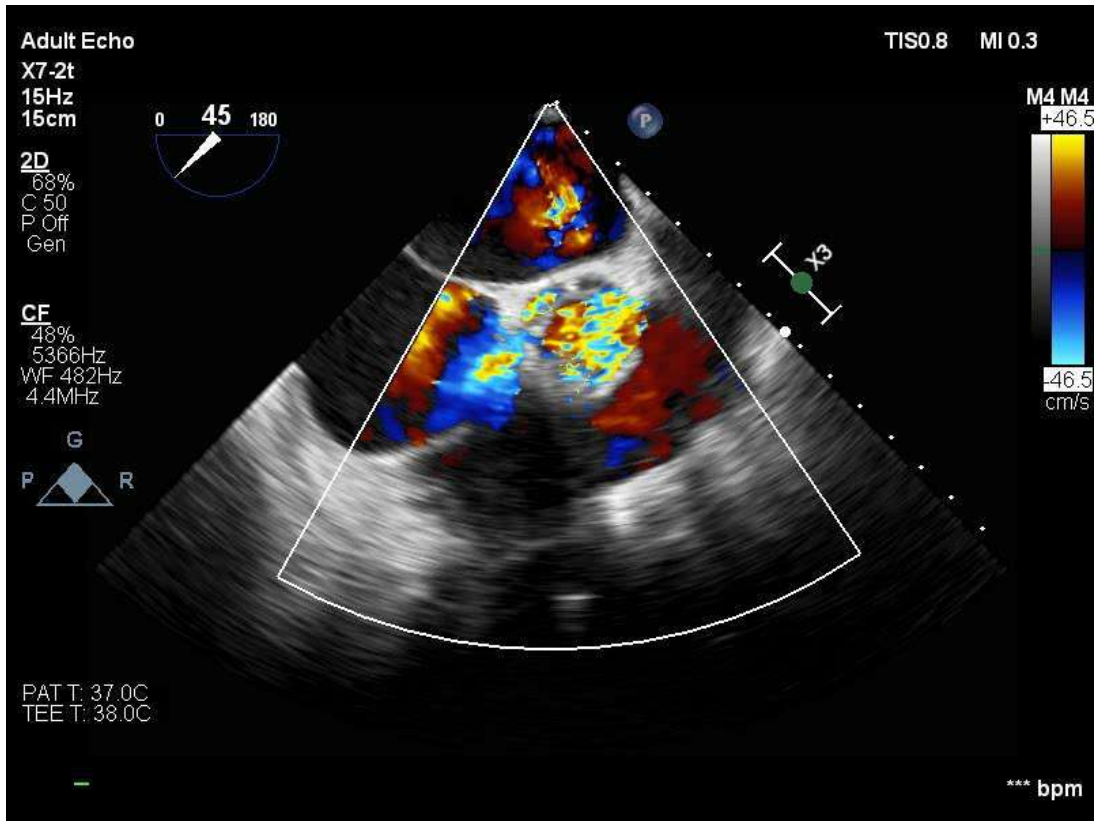
X3
G
P R
PAT T: 37.0C
TEE T: 38.4C
*** bpm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TIS0.8 MI 0.3
M4 M4
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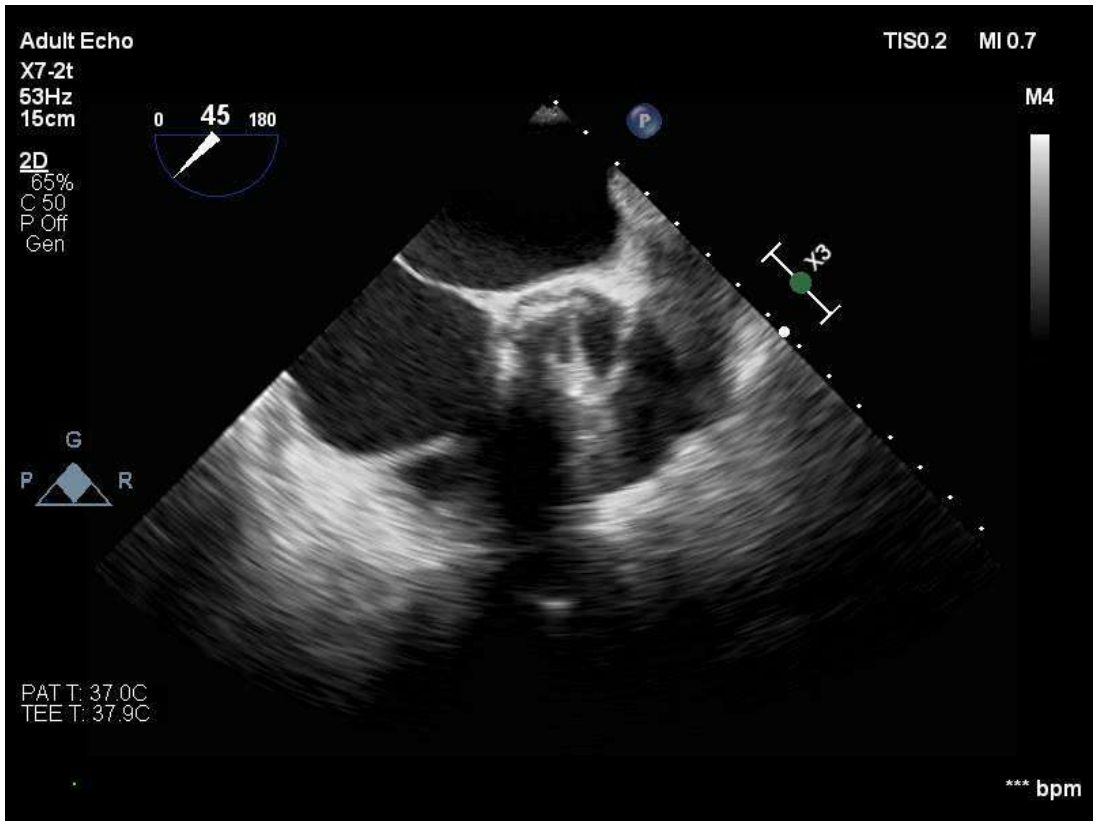
-46.5
cm/s
X3
G
P R
PAT T: 37.0C
TEE T: 38.0C
*** bpm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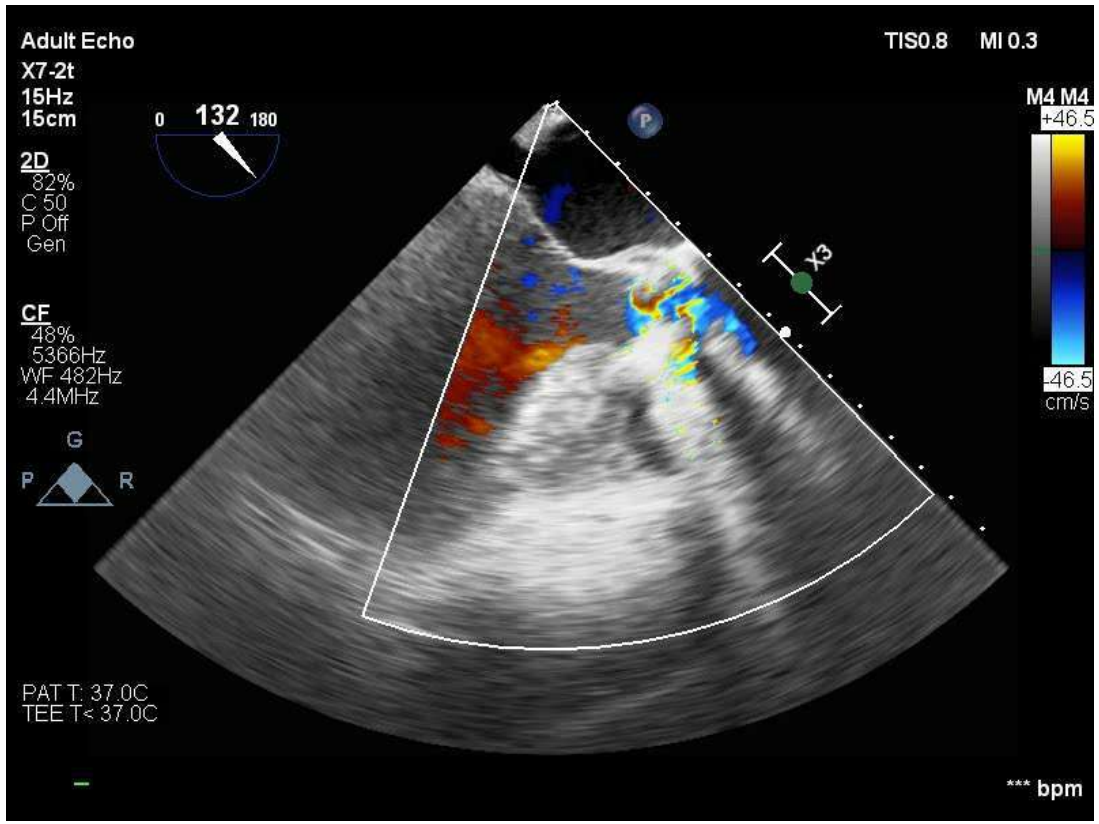
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cm/s
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G
P R
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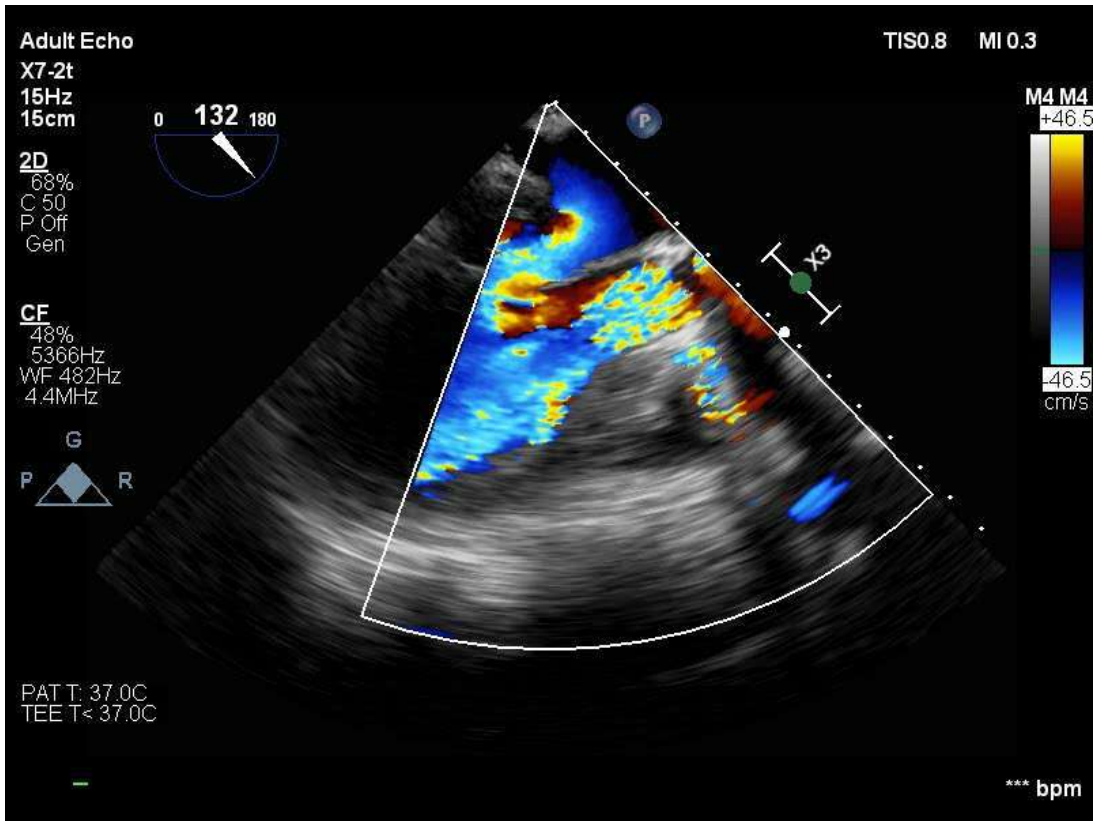
*** bpm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M4 M4
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X3
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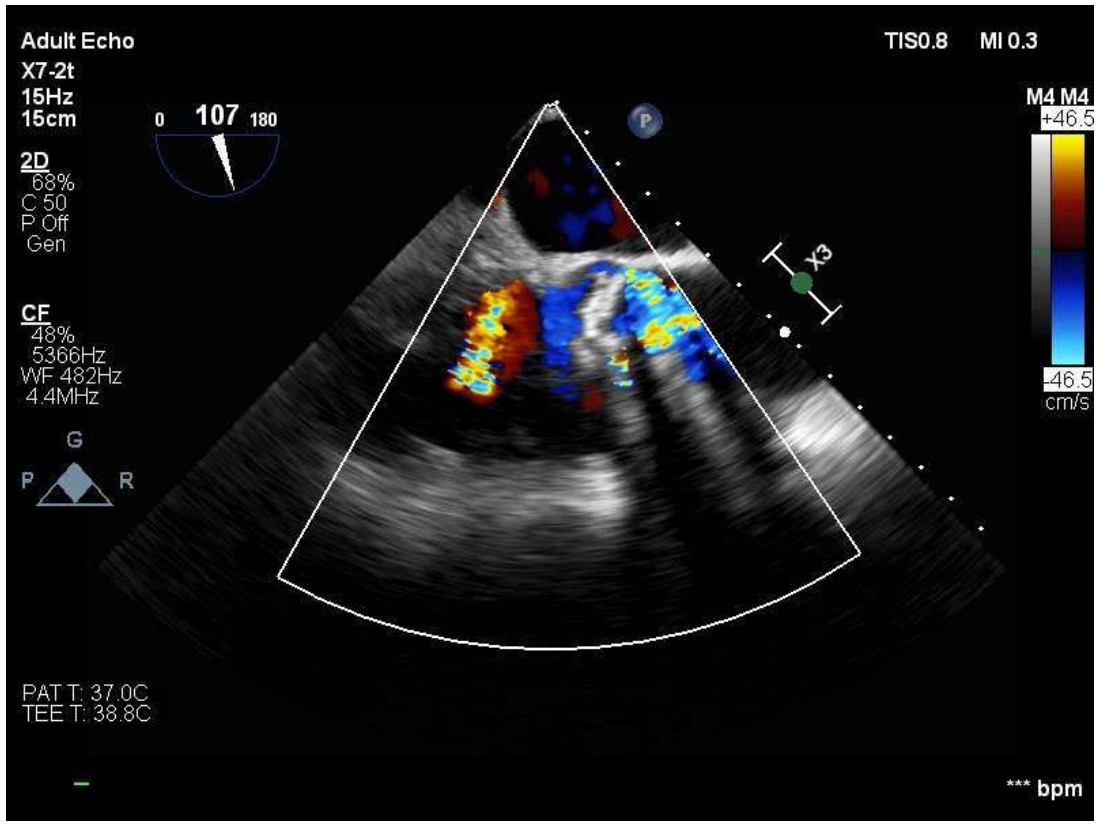
TEE T< 37.0C
*** bpm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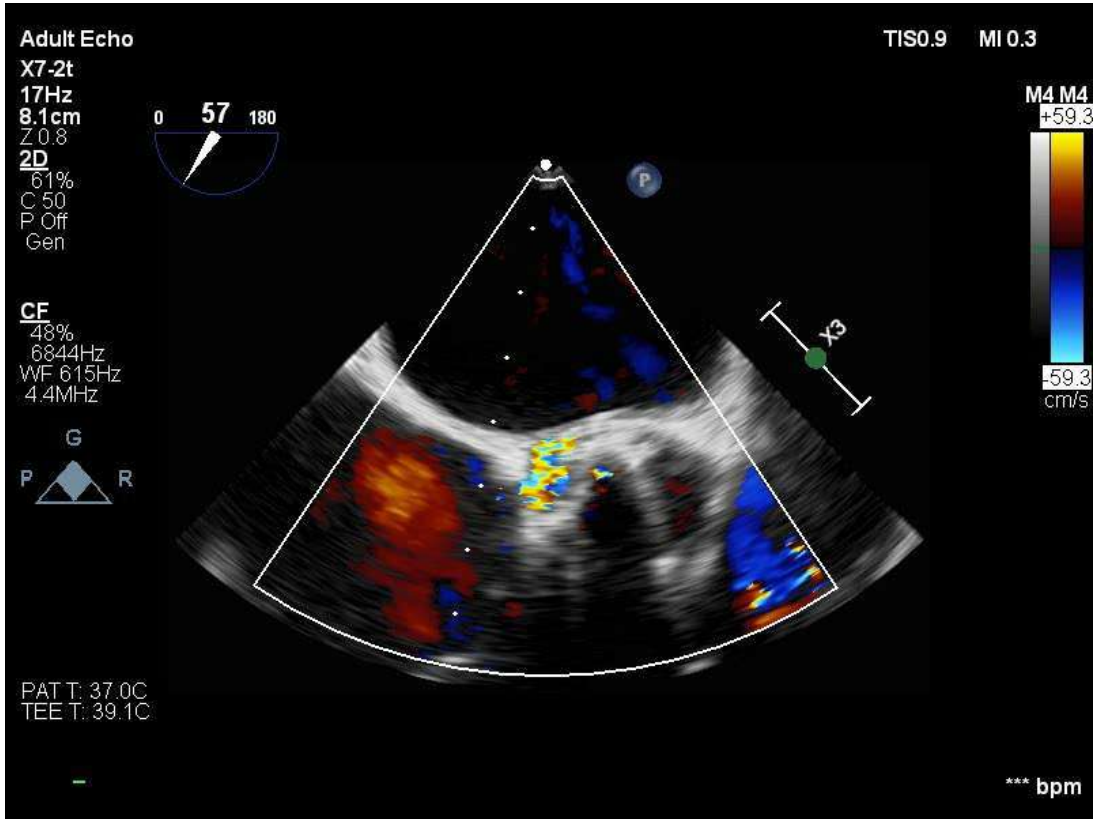
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TEE T: 39.1C
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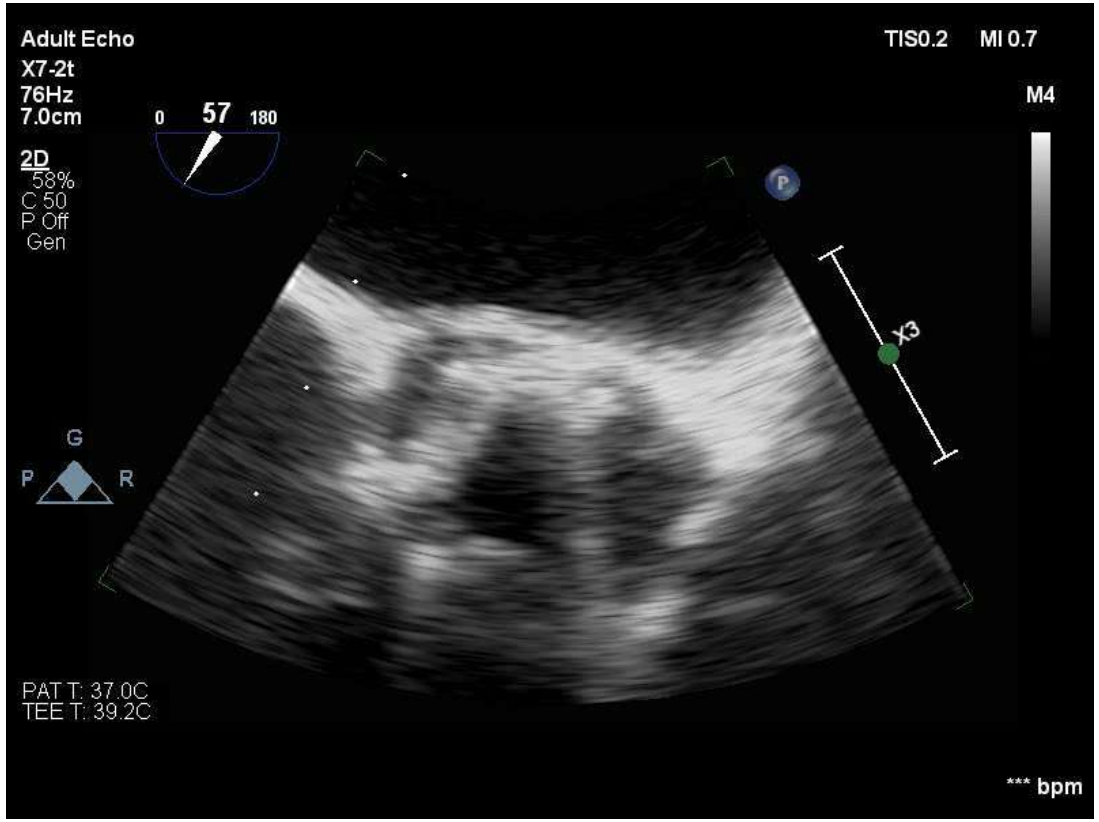
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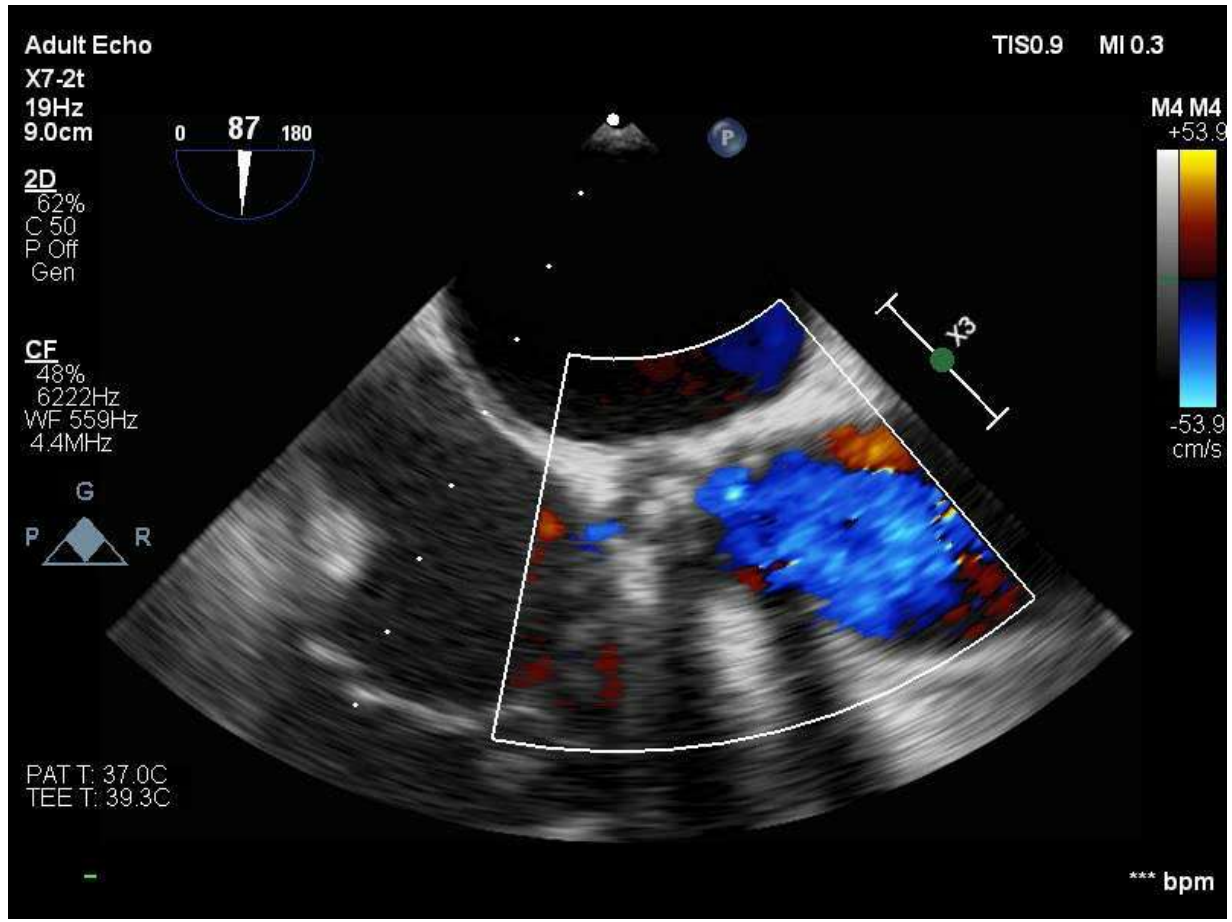
*** bpm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R
0
87
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MI 0.3
M4 M4
+53.9
-53.9
cm/s
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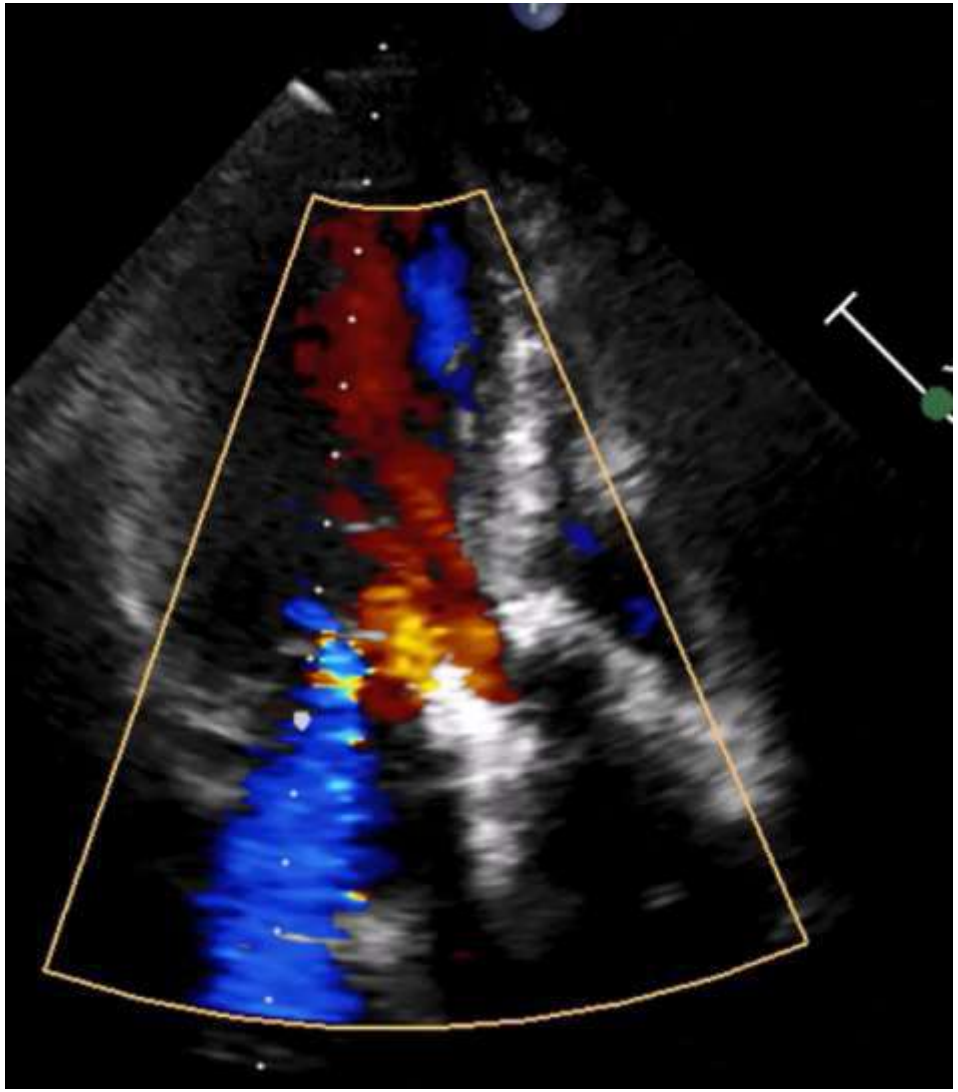
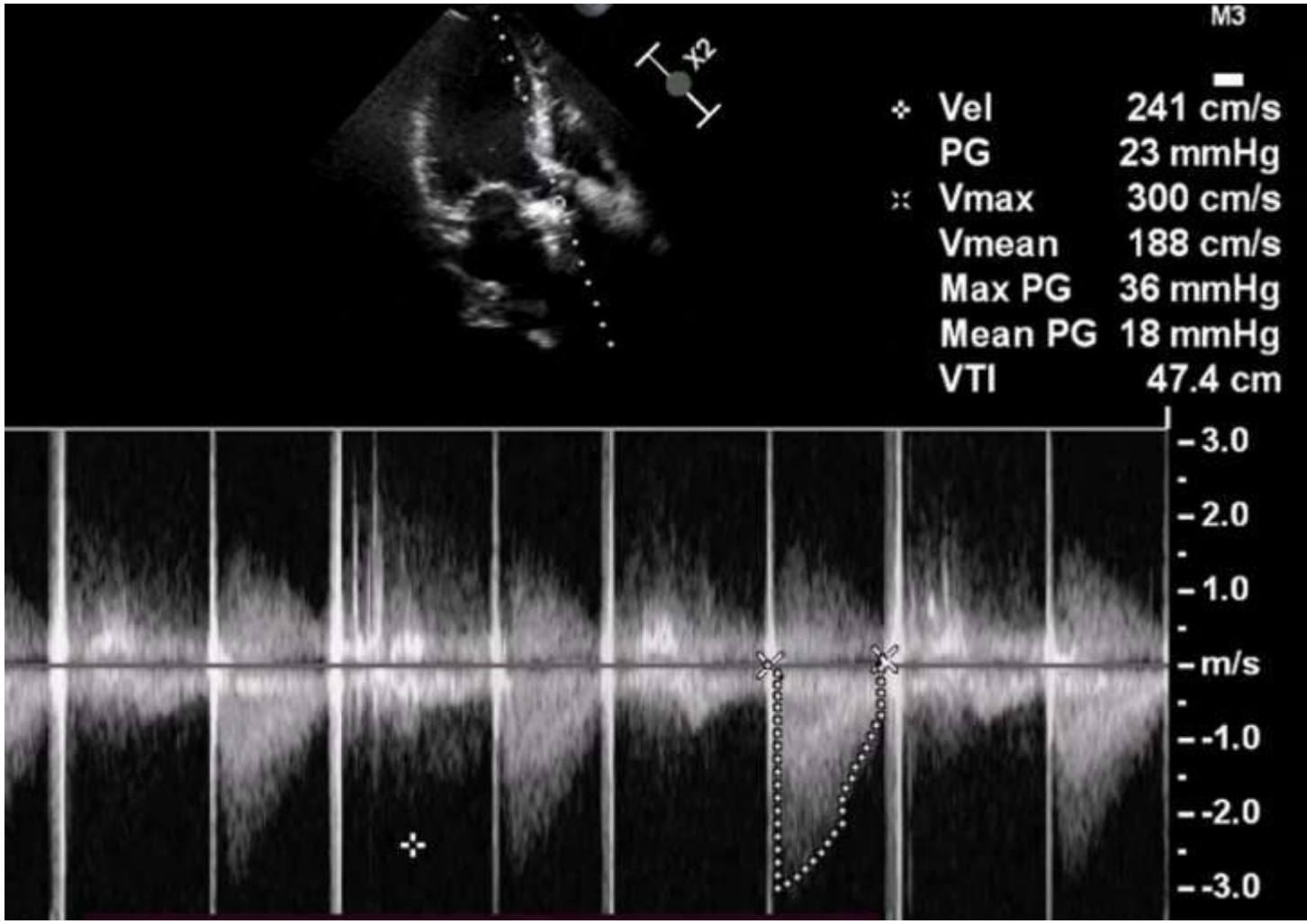
Final diagnosis

Mechanical aortic valve dehiscence due to suture rupture

Decision- Reoperation

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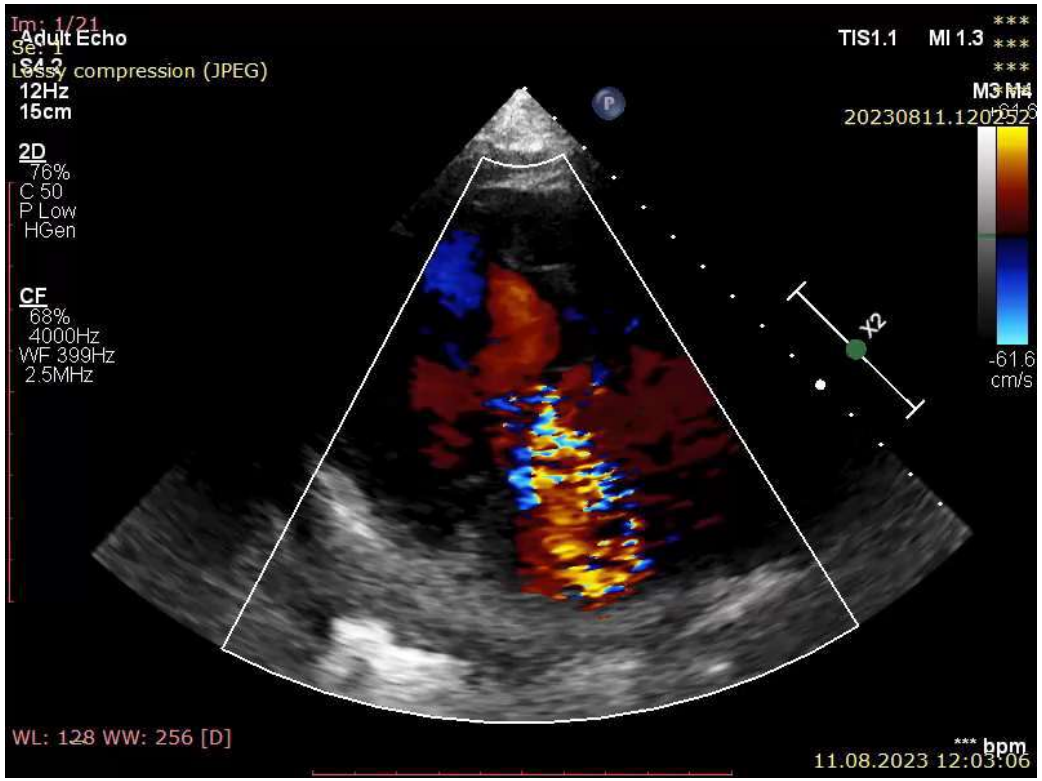
Vmax 300 cm/s
Vmean 188 cm/s
Max PG 36 mmHg
Mean PG 18 mmHg
VTI 47.4 cm
3.0
2.0
1.0
m/s
-1.0
-2.0
-3.0

Case 4

32 years old female
Postpartum-second pregnancy
Decompensated heart failure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HGen
CF
68%
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TIS1.1
MI 1.3
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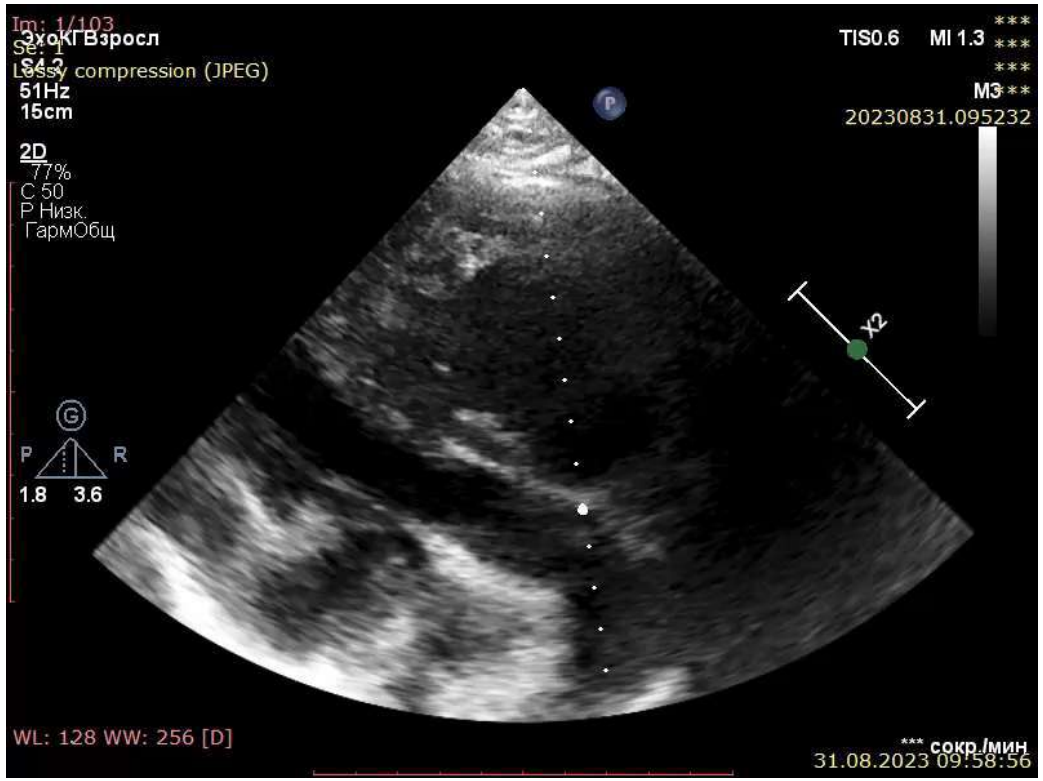
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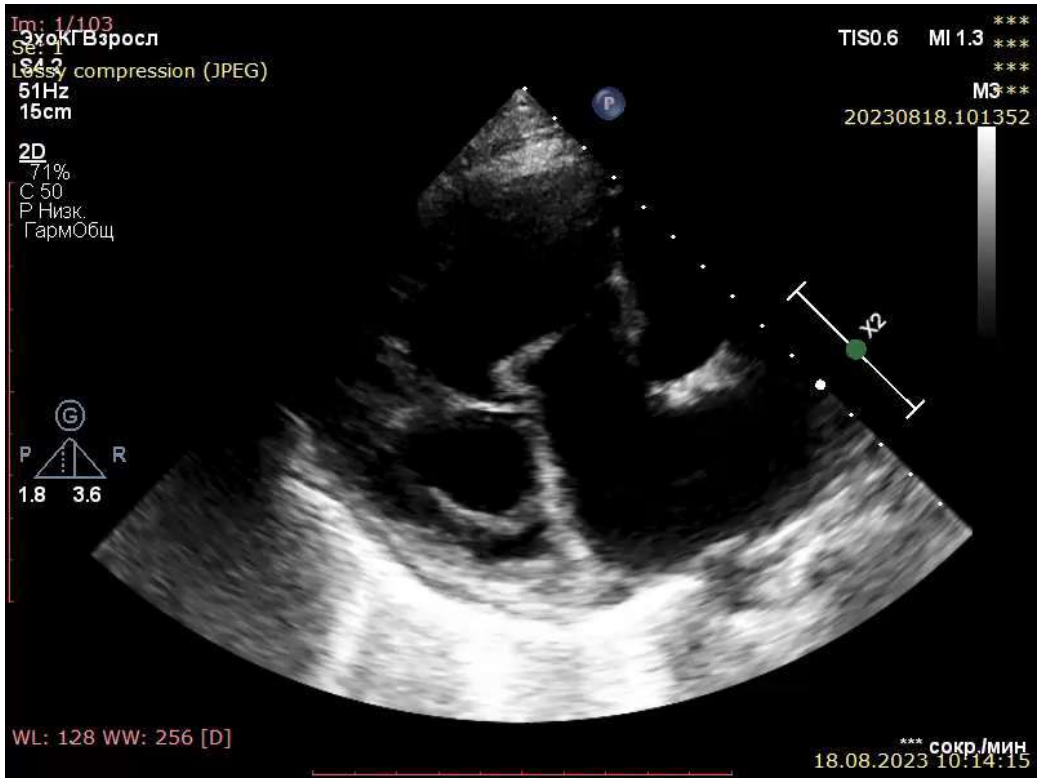
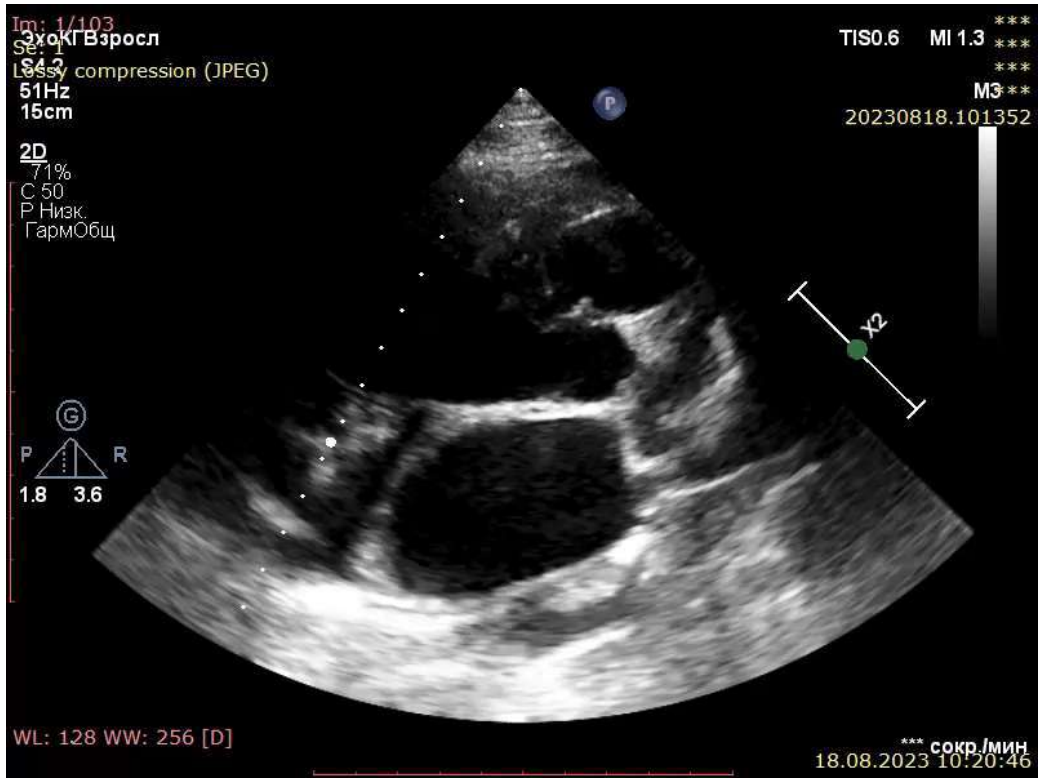
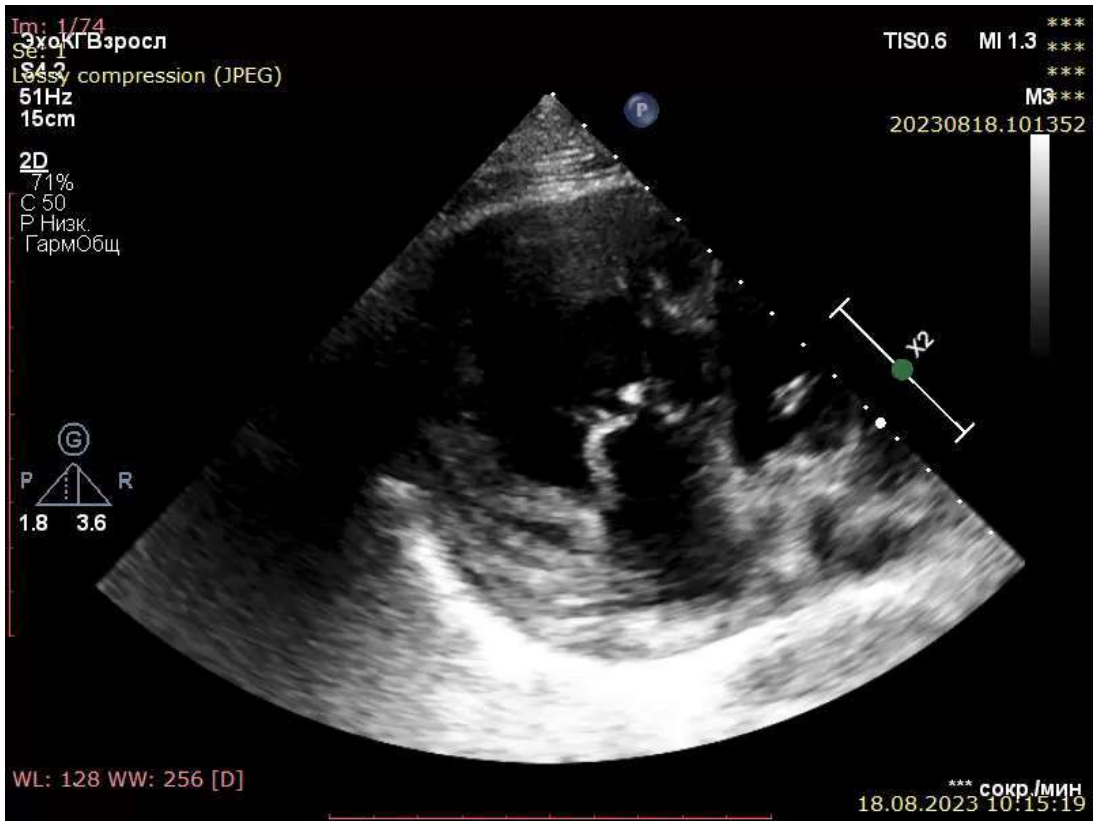
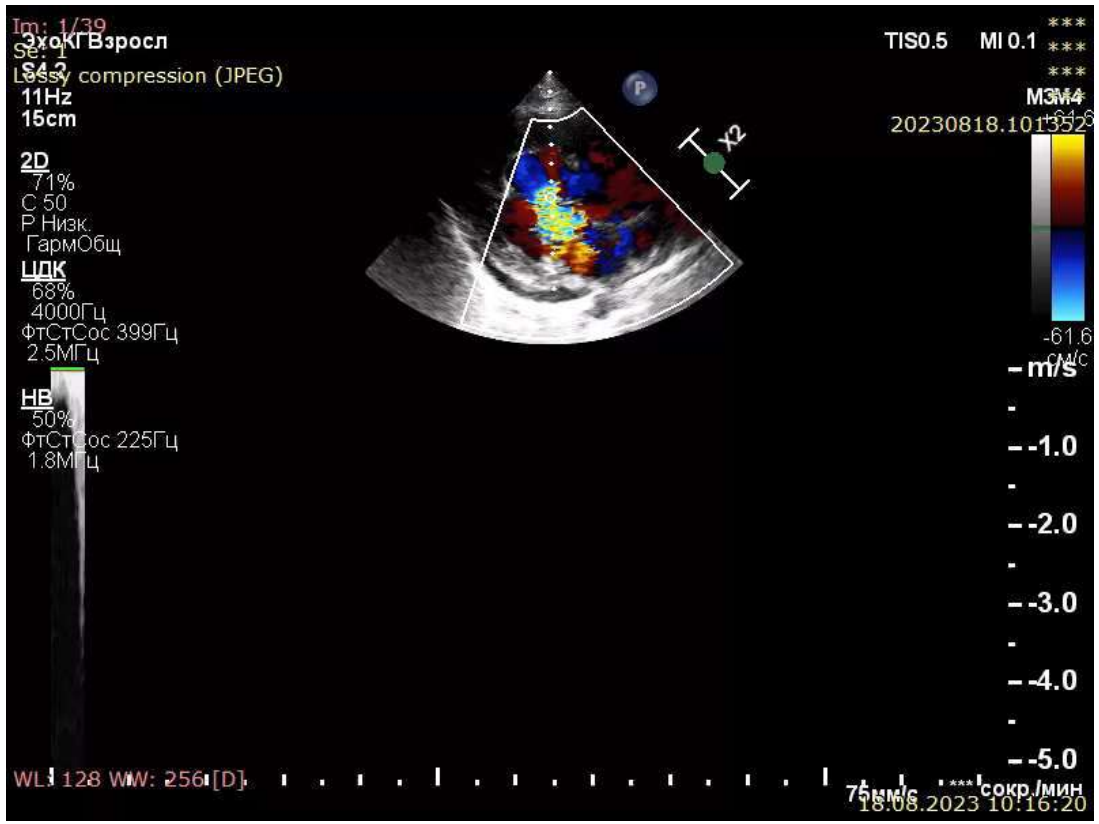

Im: 1/103
ЭхоКГВзросл
Se: 1
S4.2
Lossy compression (JPEG)
51Hz
15cm
2D
71%
C 50
P Низк.
ГармОбщ
TIS0.6 MI 1.3
M3
20230818.101352
X2
P R
1.8 3.6
WL: 128 WW: 256 [D]
*** сокр./мин
18.08.2023 10:14:15

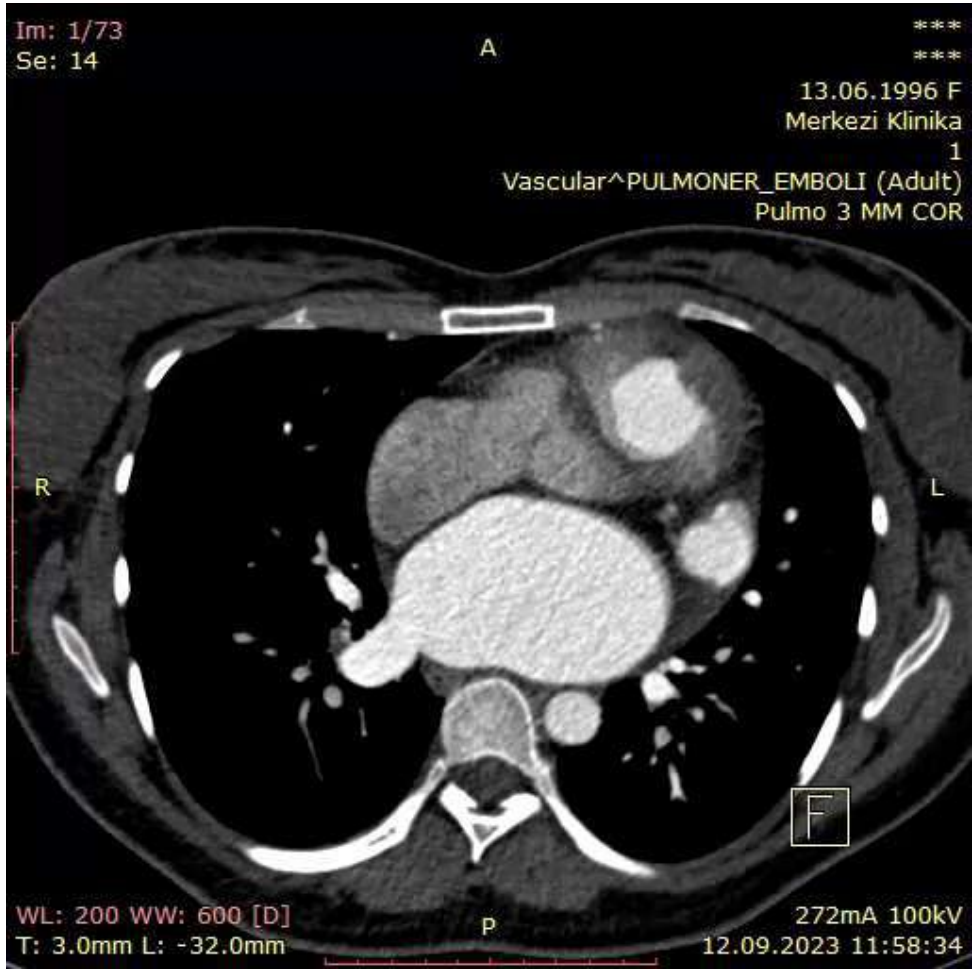

Im: 1/103
ЭхоКГВзросл
Se: 1
S4.2
Lossy compression (JPEG)
51Hz
15cm
2D
71%
C 50
P Низк.
ГармОбщ
TIS0.6 MI 1.3
M3
20230818.101352
X2
P R
1.8 3.6
WL: 128 WW: 256 [D]
*** сокр./мин
18.08.2023 10:20:46


Im: 1/74
ЭхоКГВзросл
Se: 1
S4-2
Lossy compression (JPEG)
51Hz
15cm
2D
71%
C 50
P Низк.
ГармОбщ
TIS0.6 MI 1.3
M3
20230818.101352
X2
P
R
1.8 3.6
WL: 128 WW: 256 [D]
*** сокр./мин
18.08.2023 10:15:19


Im: 1/39
ЭхоКГВзросл
Se: 1
S4-2
Lossy compression (JPEG)
11Hz
15cm
2D
71%
C 50
P Низк.
ГармОбщ
ЦДК
68%
4000Гц
ФтСтСос 399Гц
2.5МГц
HB
50%
ФтСтСос 225Гц
1.8МГц
TIS0.5 MI 0.1
M3M4
20230818.101352
X2
-61.6
cM/c
m/s
-1.0
-2.0
-3.0
-4.0
-5.0
WL: 128 WW: 256 [D]
75мм/с
*** сокр./мин
18.08.2023 10:16:20

Whats next?

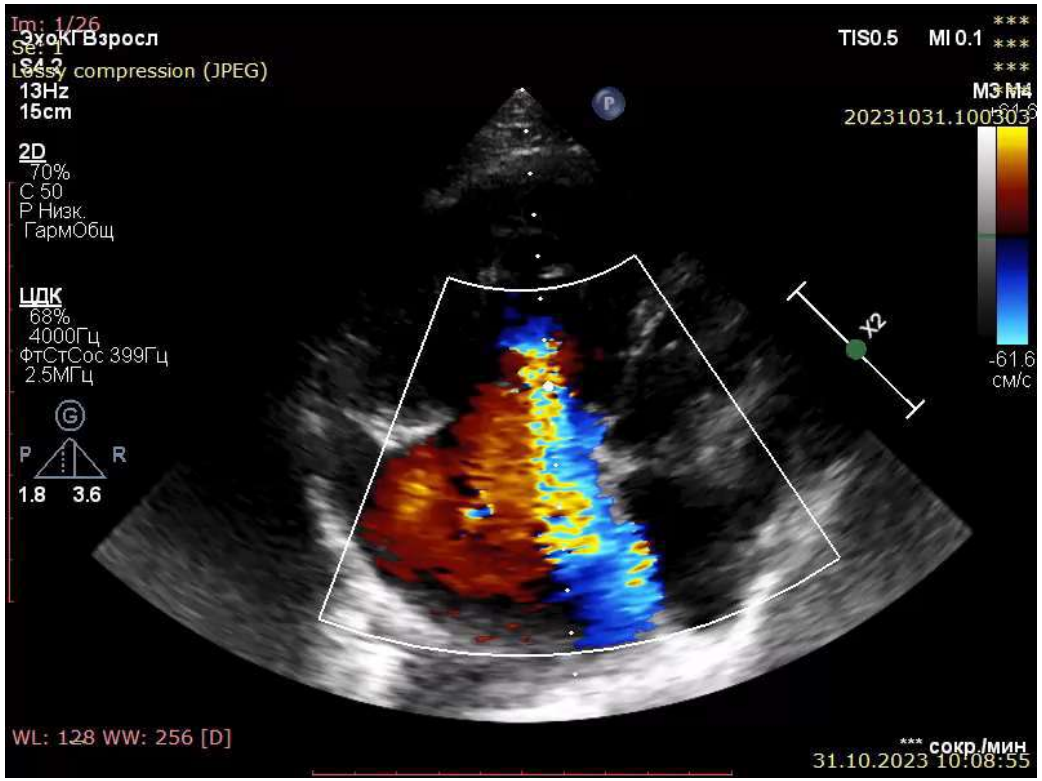
cc-TGA

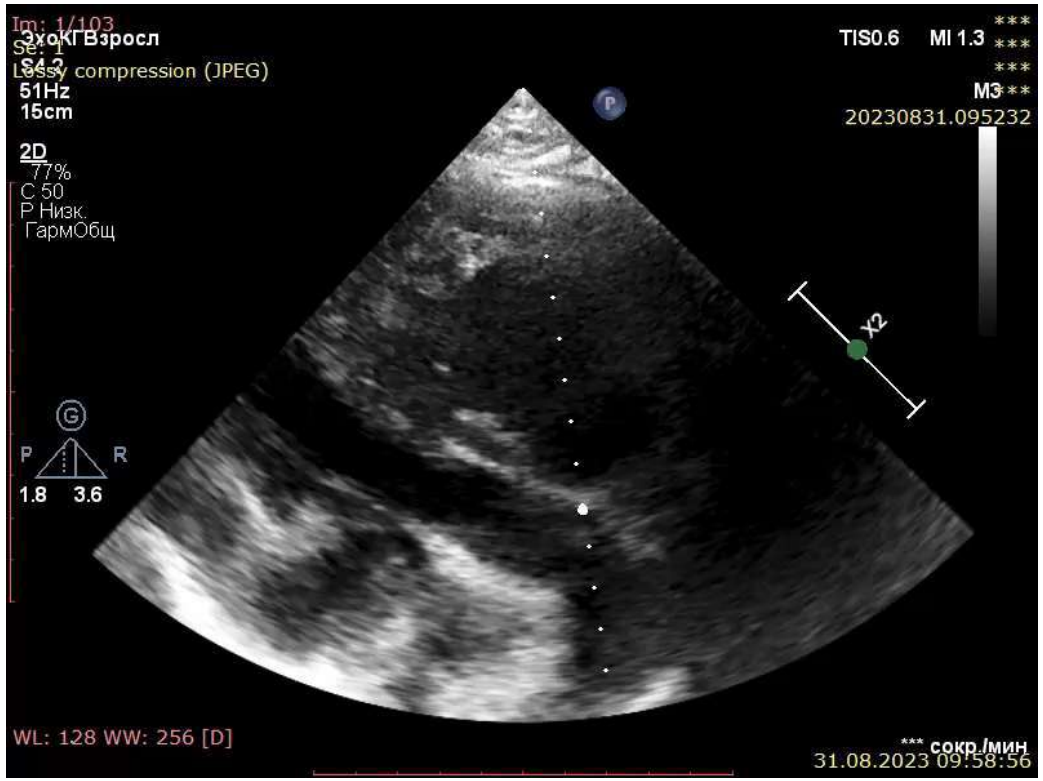

Im: 1/73
Se: 14
A
***
***
13.06.1996 F
Merkezi Klinika
1
Vascular^PULMONER_EMBOLI (Adult)
Pulmo 3 MM COR
R
L
F
WL: 200 WW: 600 [D]
T: 3.0mm L: -32.0mm
P
272mA 100kV
12.09.2023 11:58:34


Im: 1/88
Se: 13
S
***
***
13.06.1996 F
Merkezi Klinika
1
Vascular^PULMONER_EMBOLI (Adult)
Pulmo 3 MM AXS
R
L
A
WL: 200 WW: 600 [D]
T: 3.0mm L: -170.0mm
I
452mA 100kV
12.09.2023 11:58:33


Im: 1/30
Se: 1301
A
Huseynova Durdane
L0212345
01.01.1996 F
Customs Hospital
725779595
Urek
sBTFE_BH
R
L
FS: 3
P
T: 8.0mm L: 34.5mm*
05.09.2023 10:28:52


Im: 1/30
Se: 1301
A
Huseynova Durdane
L0212345
01.01.1996 F
Customs Hospital
725779595
Urek
sBTFE_BH
R
L
FS: 3
P
T: 8.0mm L: 34.5mm*
05.09.2023 10:28:52


Im: 1/26
Se: 1
S4.2
Эхо КГ Взросл
Lossy compression (JPEG)
13Hz
15cm
2D
70%
C 50
P Низк.
ГармОбщ
ЦДК
68%
4000Гц
ФтСтСос 399Гц
2.5МГц
TIS0.5 MI 0.1
M3 M4
20231031.100303
-61.6
см/с
X2
P R
1.8 3.6
WL: 128 WW: 256 [D]
*** сокр./мин
31.10.2023 10:08:55


Im: 1/103
Se: 1
S4.2
Эхо КГ Взросл
Lossy compression (JPEG)
51Hz
15cm
2D
77%
C 50
P Низк.
ГармОбщ
TIS0.6 MI 1.3
M3
20230831.095232
X2
P R
1.8 3.6
WL: 128 WW: 256 [D]
*** сокр./мин
31.08.2023 09:58:56

Final diagnosis

Peripartum cardiomyopathy on top of cc-TGA

Treatment-4 pillars, furosemide, Maybe surgery?

Take home message

No single imaging modality is sufficient for comprehensive assessment of heart failure—each has unique strengths.

Echocardiography remains the first-line tool, but advanced modalities provide essential complementary information

Cardiac MRI excels in tissue characterization and is the gold standard for assessing volumes and function.

CT and nuclear imaging play key roles in evaluating coronary anatomy, myocardial viability, and infiltrative diseases

Tailored imaging strategies based on the clinical question and patient characteristics improve diagnostic accuracy and guide therapy

Multimodal imaging enhances patient care through better risk stratification, therapy planning, and outcome prediction