HF - causes

I Leontsinis

Cardiologist

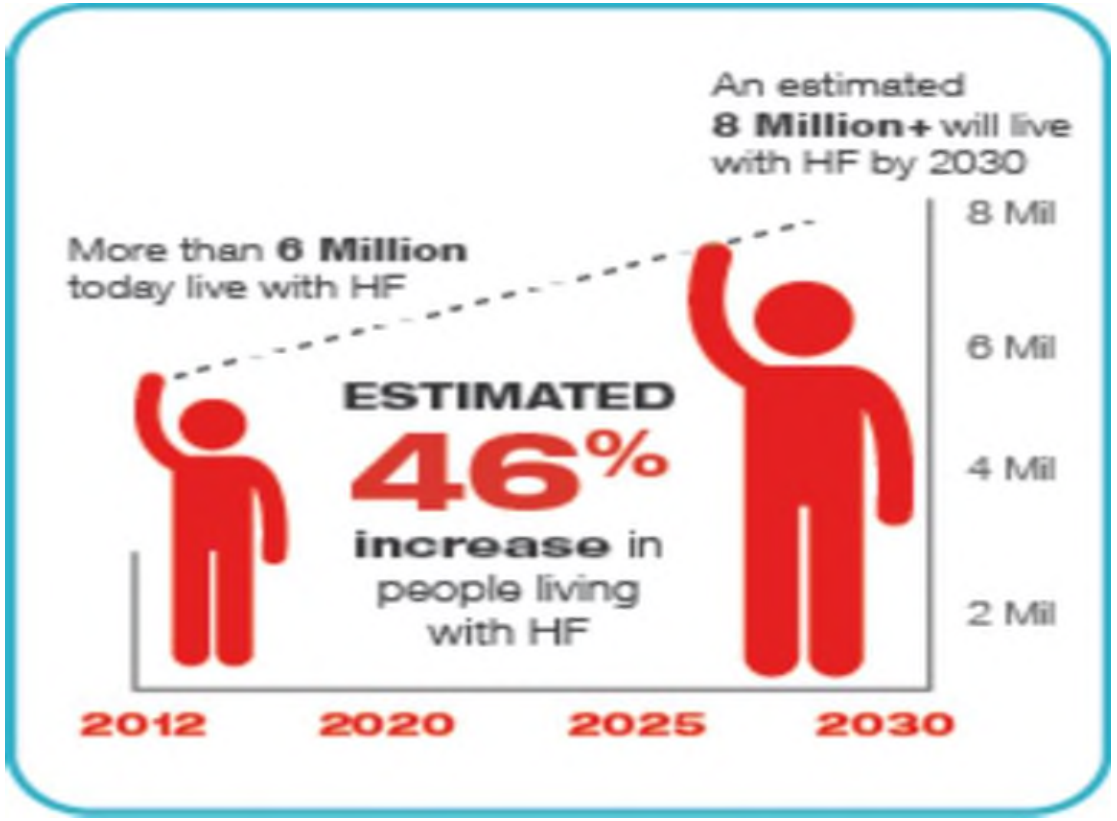
Hippocratio Athens GH

1st Cardiology University Dpt

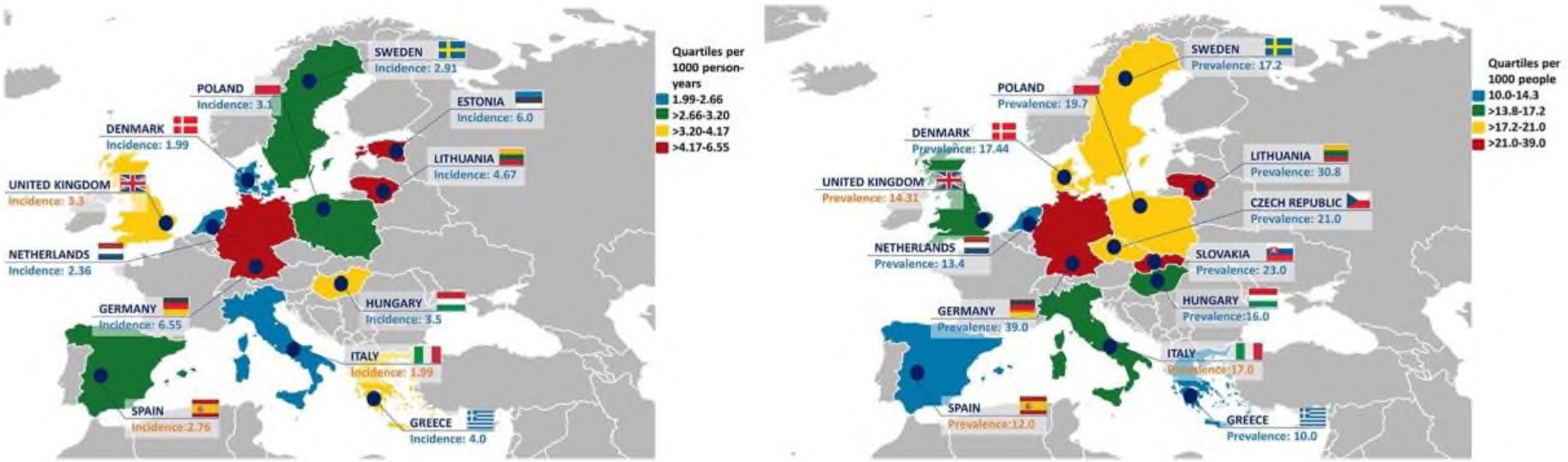
Heart Failure

1 – 2 % adults in Europe

- **10% > 70 ys**



Heart Org. 2019



ESC Heart Failure 2022; **9**: 2767–2778
DOI: 10.1002/ehf2.14076

HF

Clinical syndrome

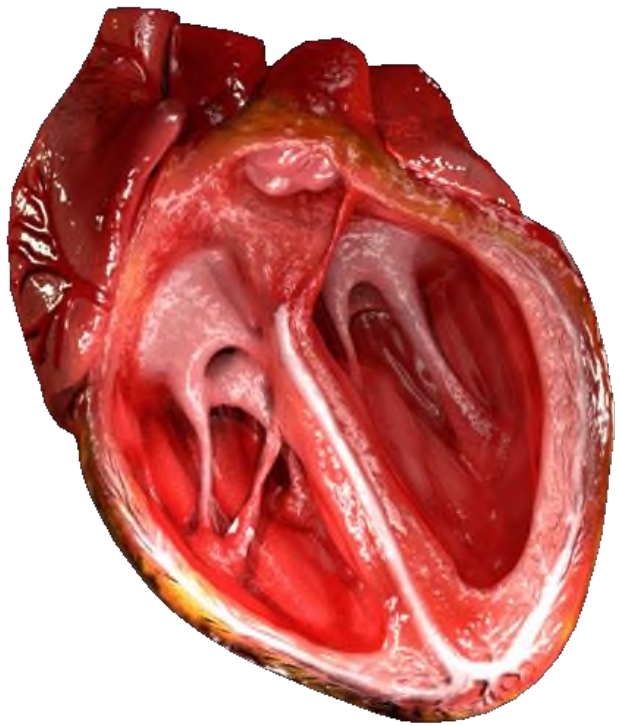
Symptoms
Signs

Structural and/or functional heart disorder

↑ elevated intracardiac pressures
↓ cardiac output (rest/exercise)

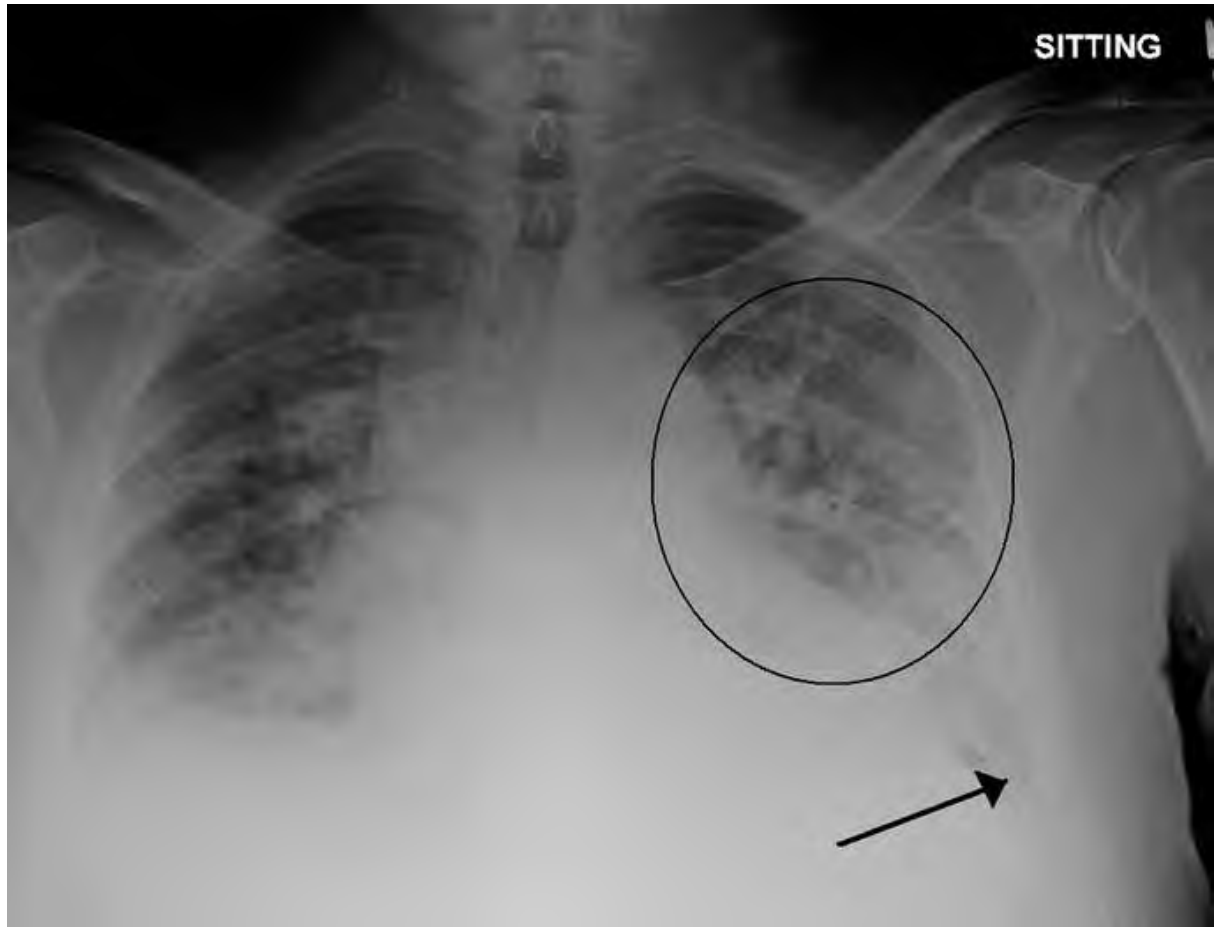
Symptoms	Signs
Typical	**More specific**
Breathlessness	Elevated jugular venous pressure
Orthopnoea	Hepatojugular reflux
Paroxysmal nocturnal dyspnoea	Third heart sound (gallop rhythm)
Reduced exercise tolerance	Laterally displaced apical impulse
Fatigue, tiredness, increased time to recover after exercise	
Ankle swelling	
Less typical	**Less specific**
Nocturnal cough	Weight gain (>2 kg/week)
Wheezing	Weight loss (in advanced HF)
Bloated feeling	Tissue wasting (cachexia)
Loss of appetite	Cardiac murmur
Confusion (especially in the elderly)	Peripheral oedema (ankle, sacral, scrotal)
Depression	
Palpitation	Pulmonary crepitations
Dizziness	Pleural effusion
Syncope	Tachycardia
Bendopnea[a]	Irregular pulse
	Tachypnoea
	Cheyne-Stokes respiration
	Hepatomegaly
	Ascites
	Cold extremities
	Oliguria
	Narrow pulse pressure

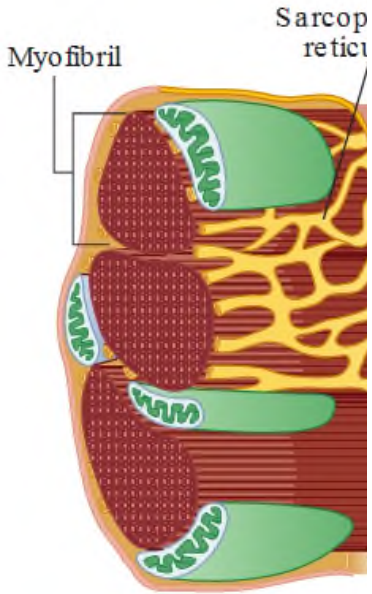
Type of HF		HFrEF	HFmrEF	HFpEF
CRITERIA	1	Symptoms ± Signs[a]	Symptoms ± Signs[a]	Symptoms ± Signs[a]
	2	LVEF ≤40%	LVEF 41–49%[b]	LVEF ≥50%
	3	–	–	Objective evidence of cardiac structural and/or functional abnormalities consistent with the presence of LV diastolic dysfunction/raised LV filling pressures, including raised natriuretic peptides[c]

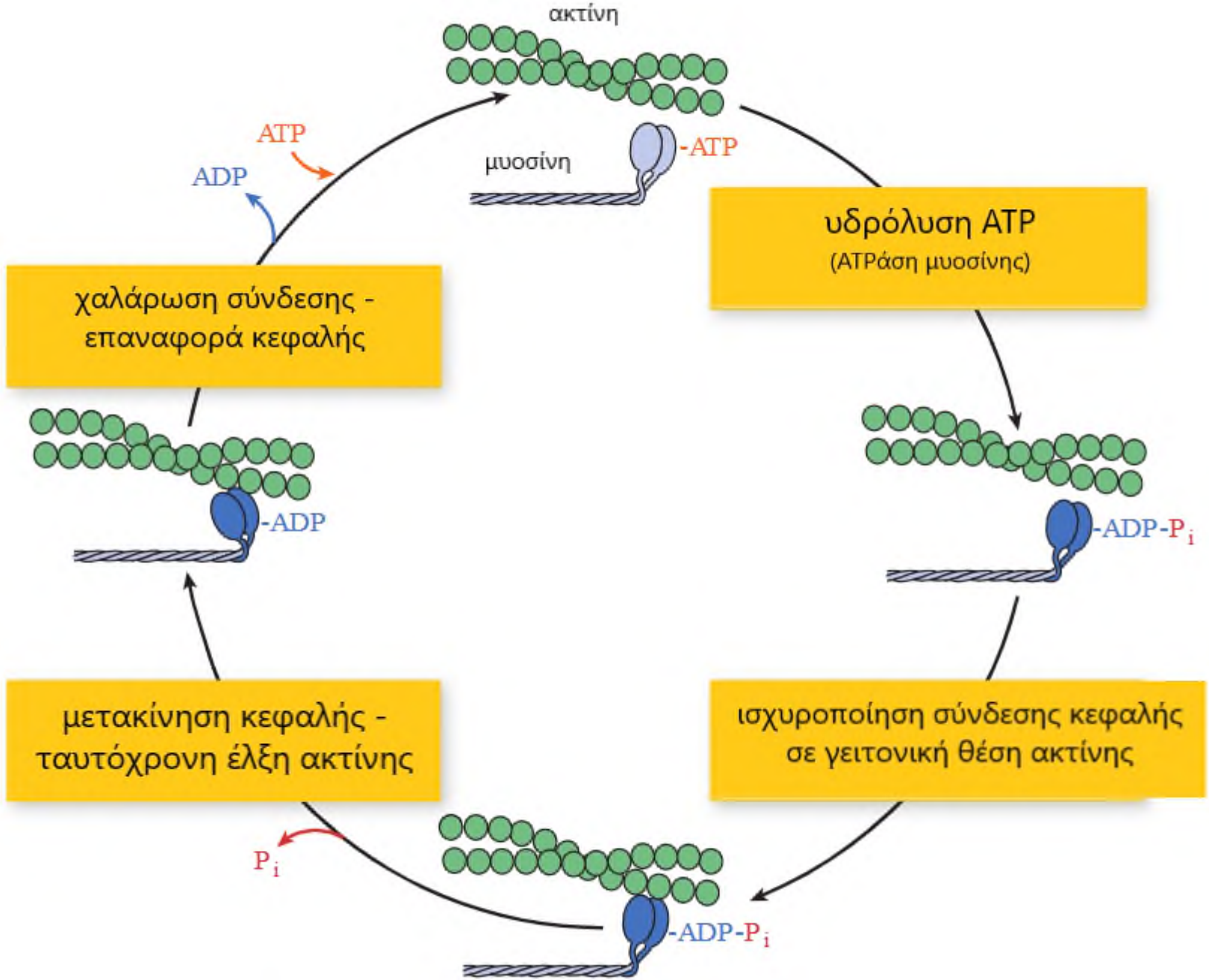


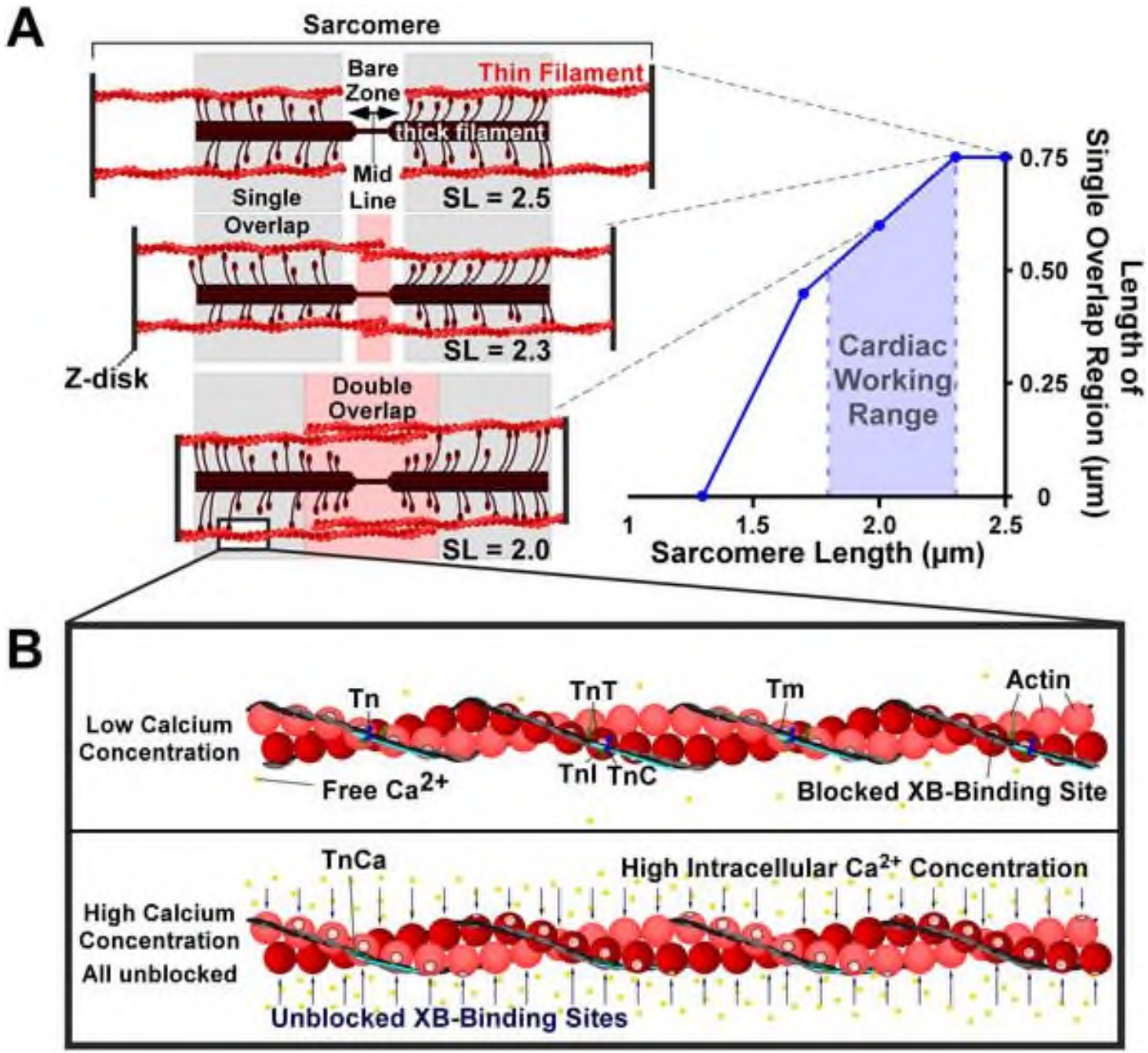
Dysfunctional

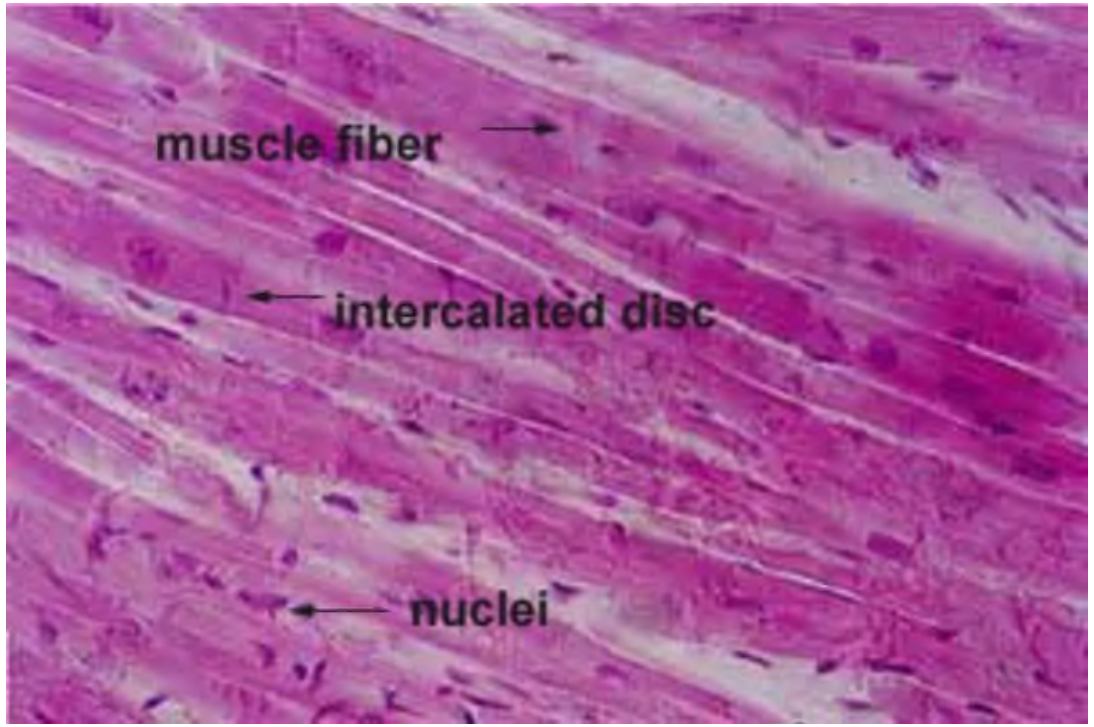
- **Myocardium**
- **Valves**
- **Pericardium**
- **Endocardium**
- **Heart rhythm generator/transmission**

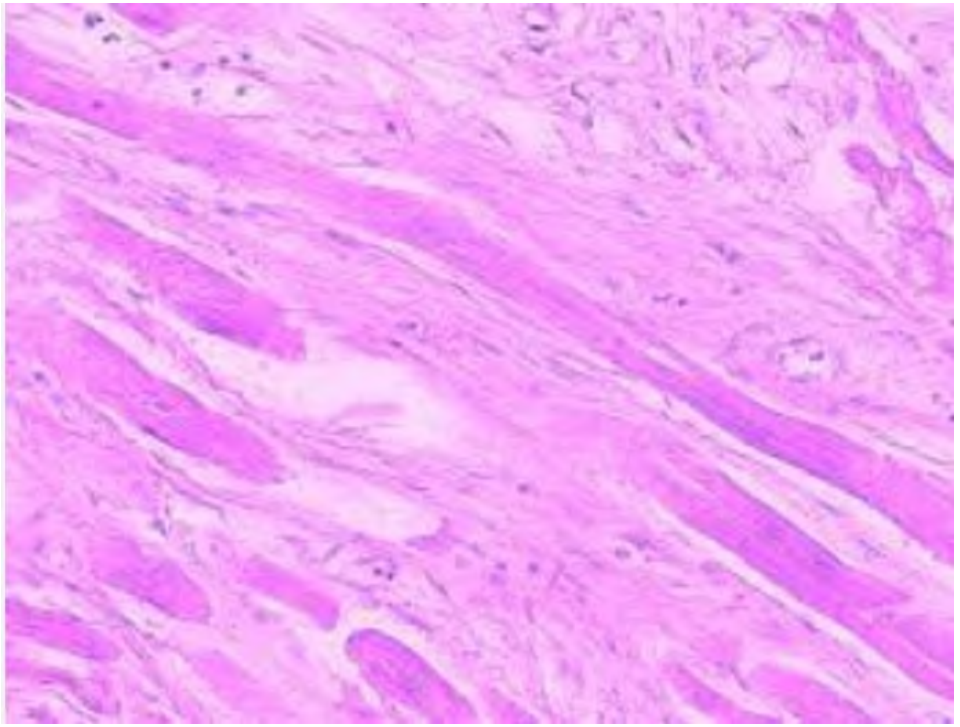

SITTING

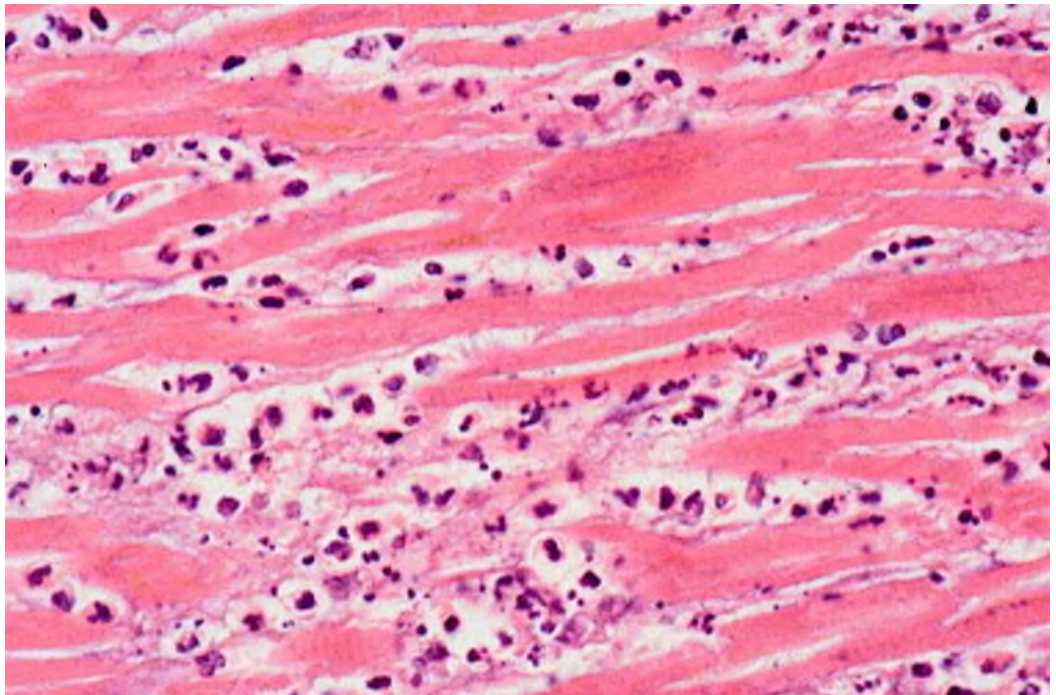

Myofibril
Sarcop
reticu

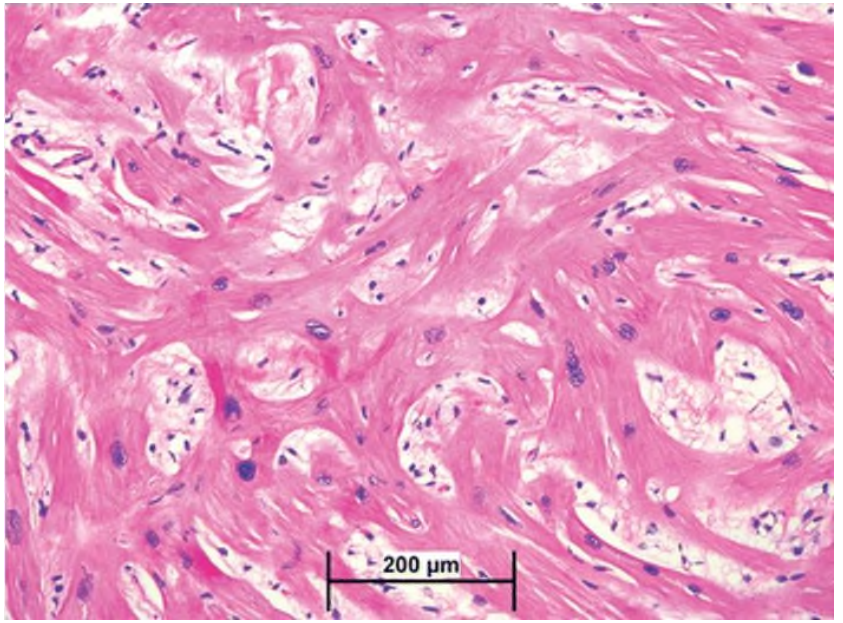

ακτίνη
μυοσίνη
-ATP
ATP
ADP
υδρόλυση ATP
(ATPάση μυοσίνης)
χαλάρωση σύνδεσης -
επαναφορά κεφαλής
-ADP-P i
-ADP
ισχυροποίηση σύνδεσης κεφαλής
σε γειτονική θέση ακτίνης
μετακίνηση κεφαλής -
ταυτόχρονη έλξη ακτίνης
P i
-ADP-P i


A
Sarcomere
Bare Zone
Thin Filament
thick filament
Mid Line
Single Overlap
SL = 2.5
SL = 2.3
Z-disk
Double Overlap
SL = 2.0
0.75
0.50
0.25
0
Length of Single Overlap Region (μm)
Cardiac Working Range
1
1.5
2.0
2.5
Sarcomere Length (μm)
B
Low Calcium Concentration
Tn
TnT
Tm
Actin
Free Ca2+
TnI TnC
Blocked XB-Binding Site
TnCa
High Intracellular Ca2+ Concentration
High Calcium Concentration
All unblocked
Unblocked XB-Binding Sites

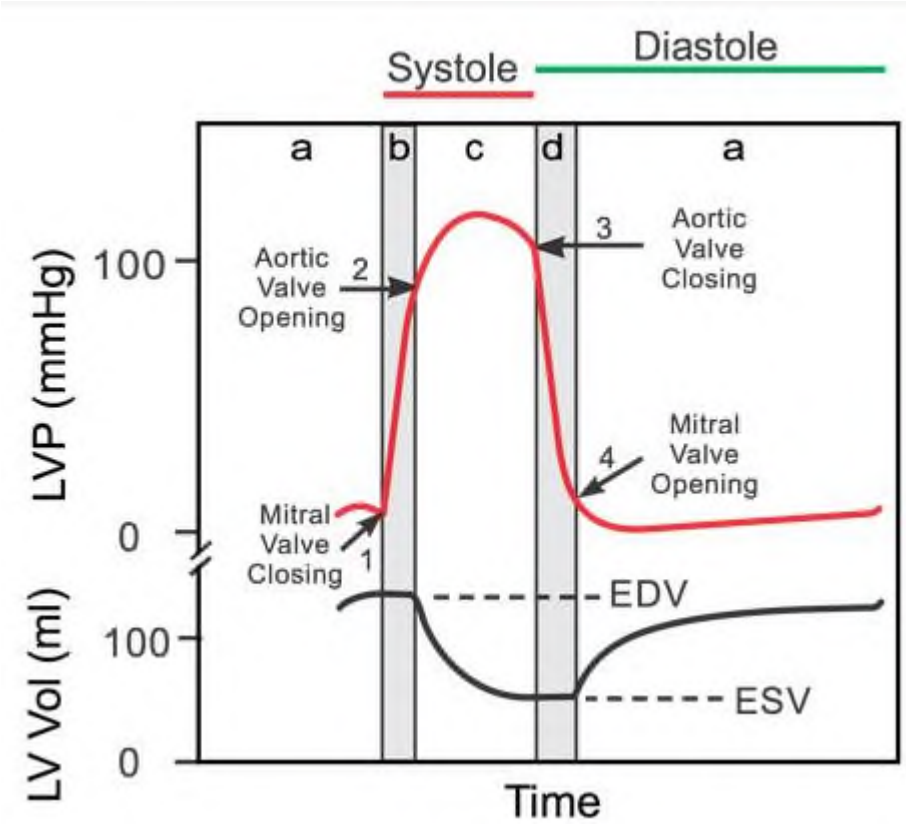


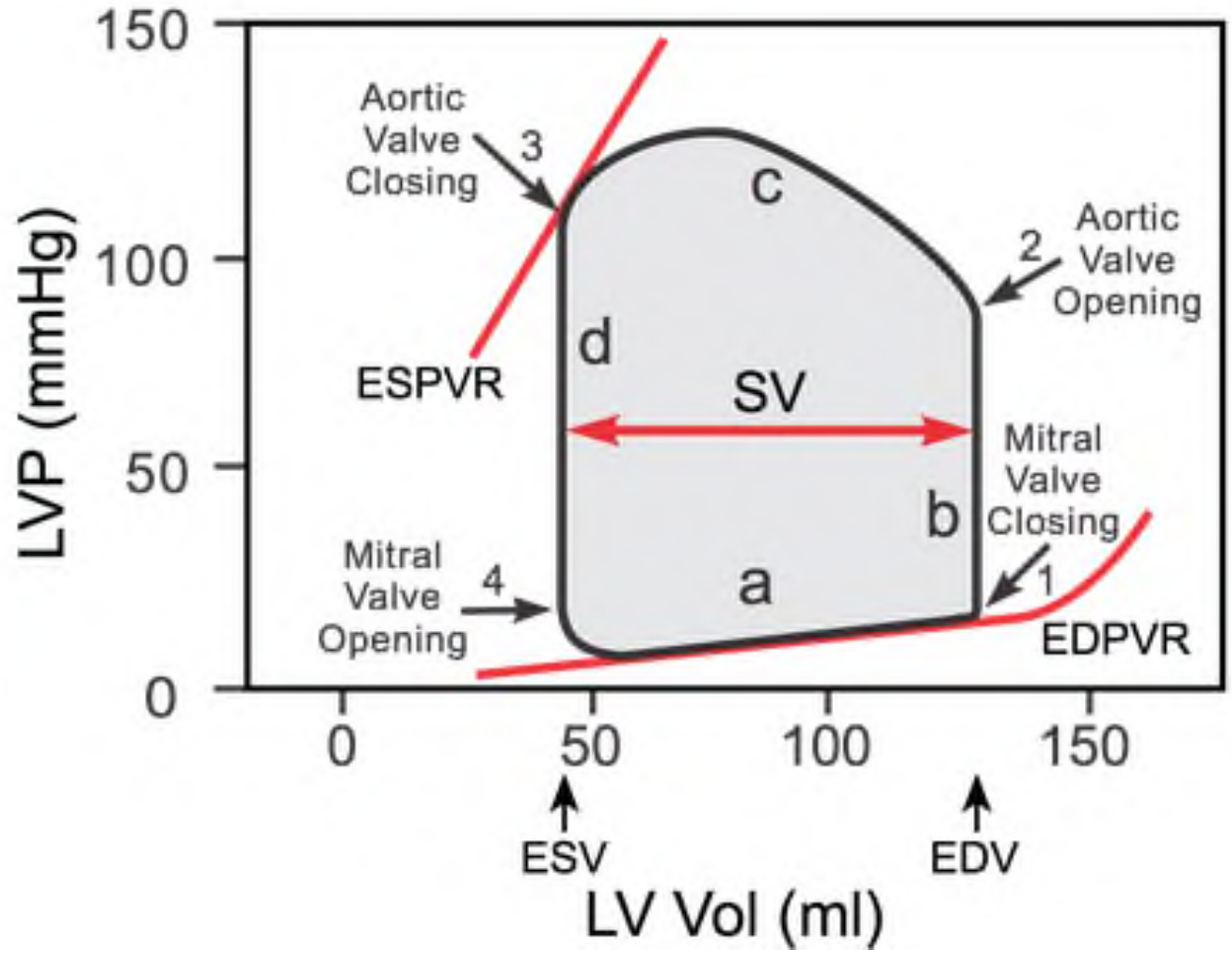




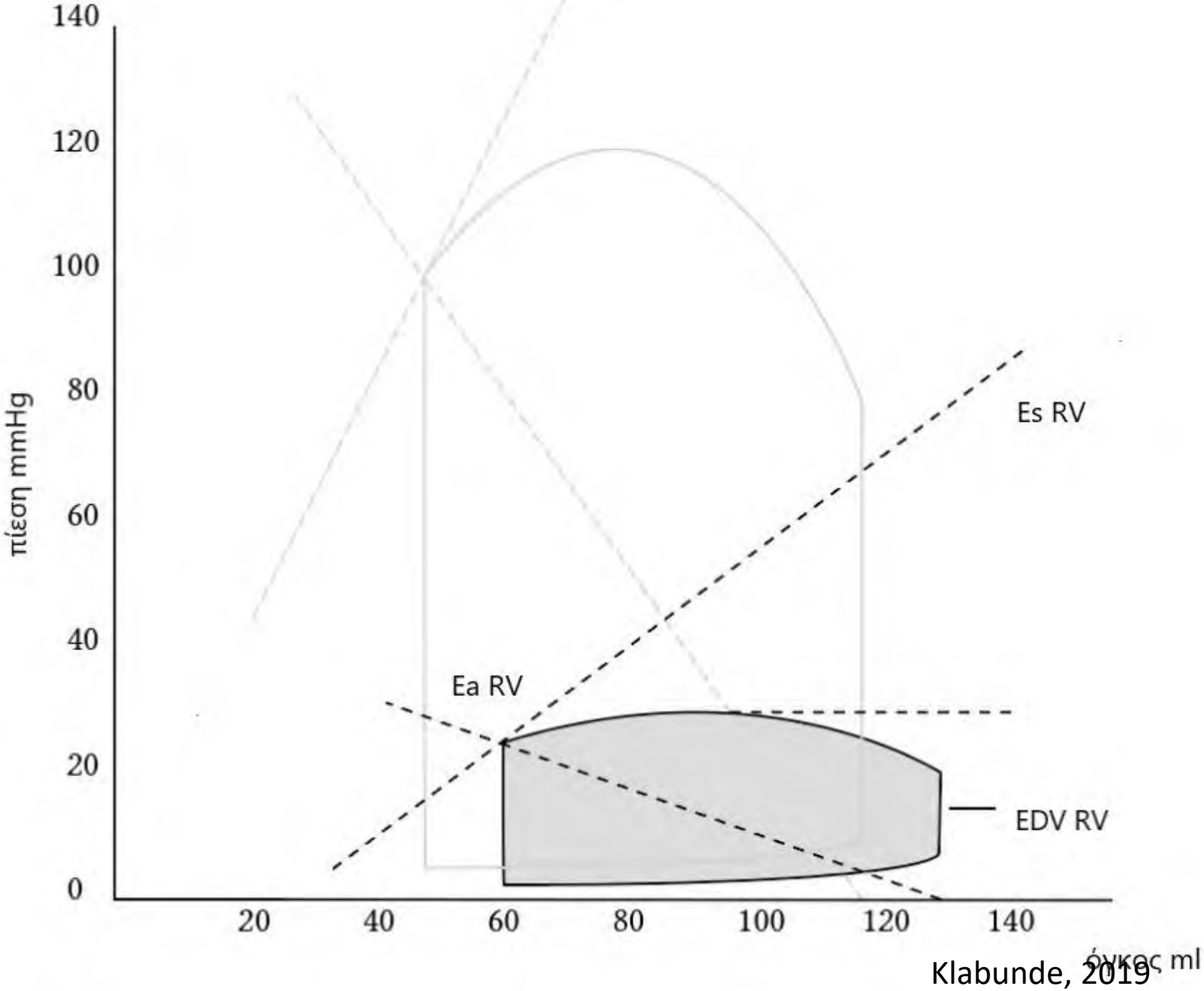


ESC Cardiac Disease 2019

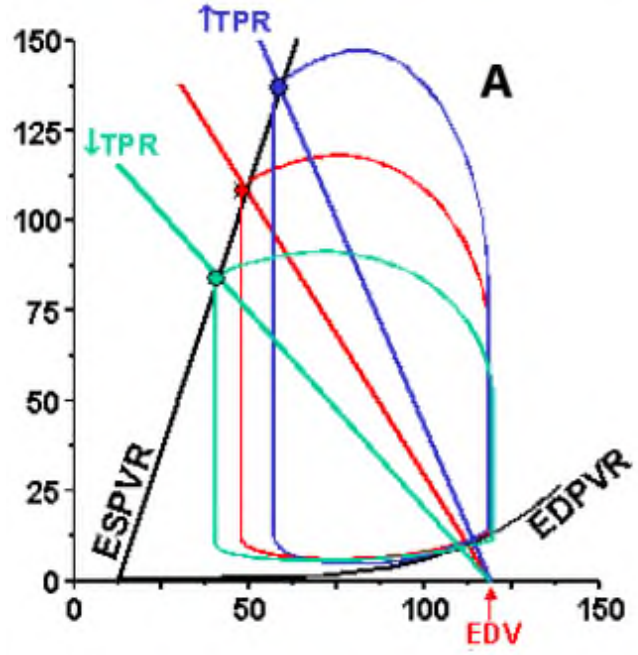


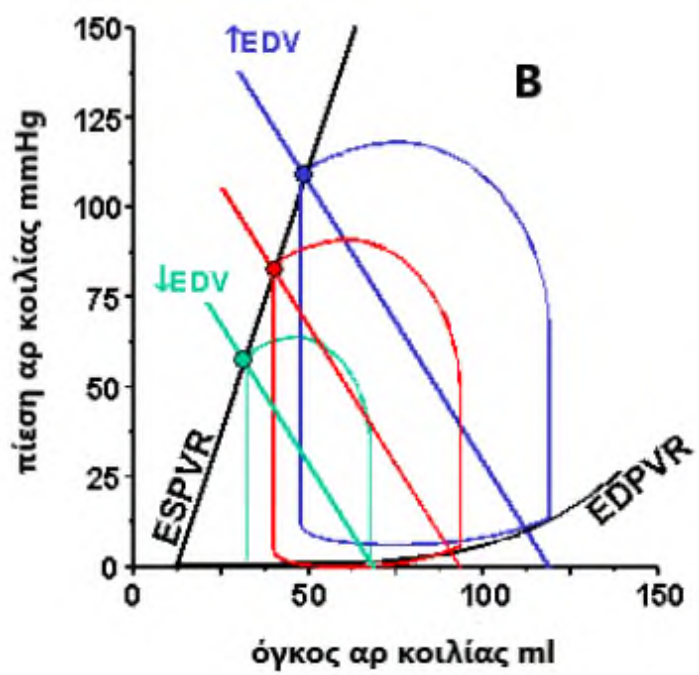


Klabunde, 2019

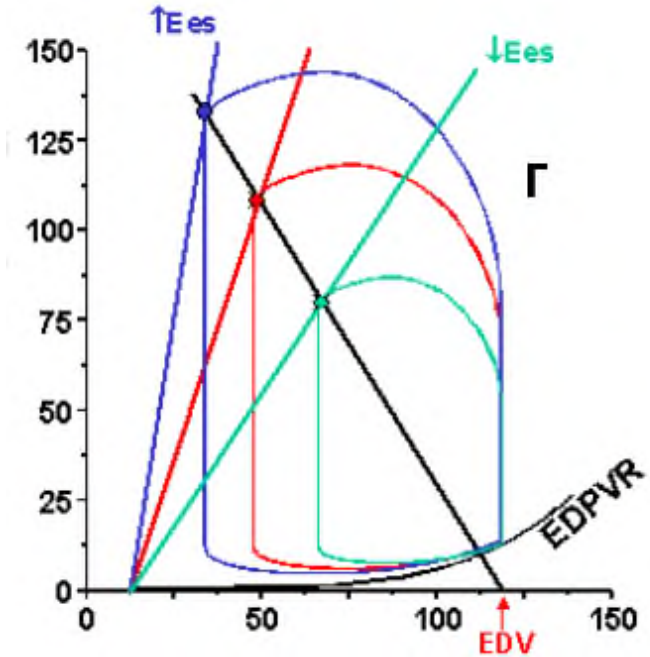


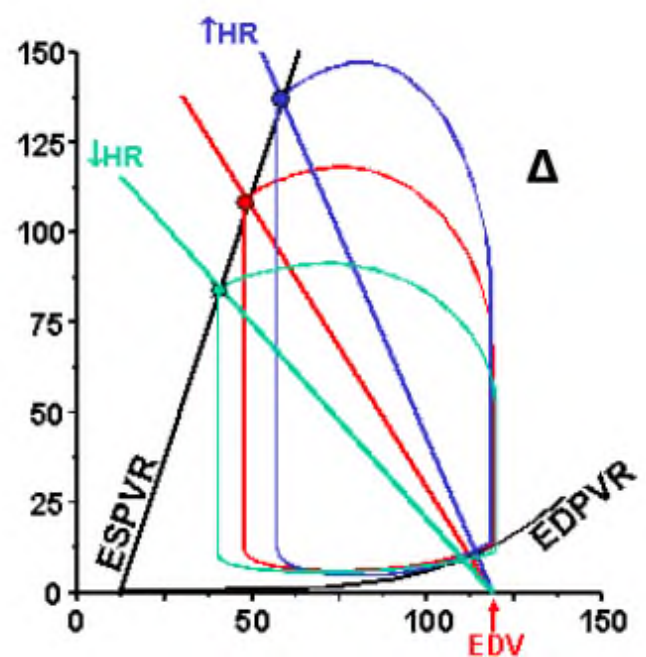
Klabunde, 2019



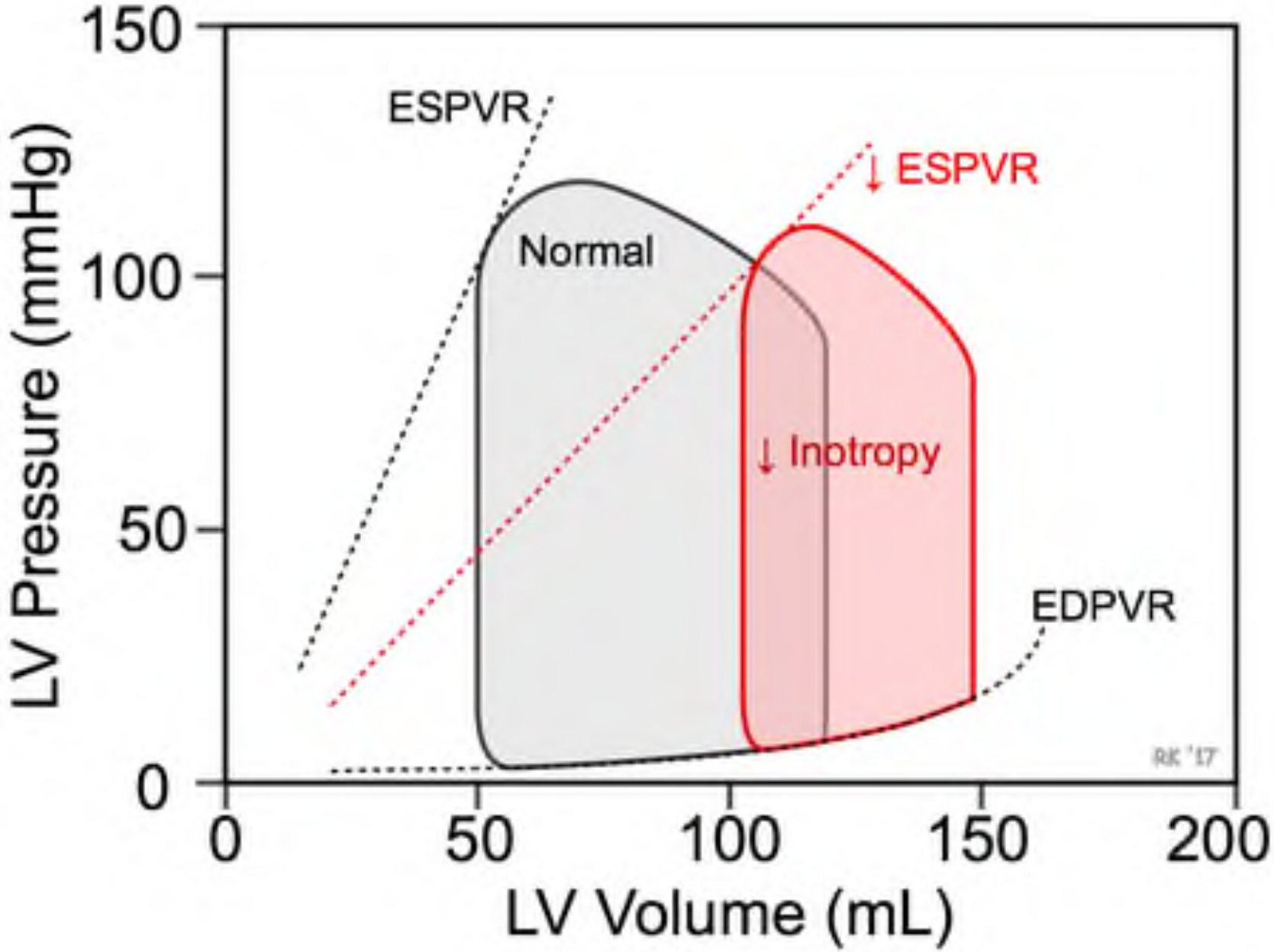


Cardiac Output = Stroke Volume x Heart Rate

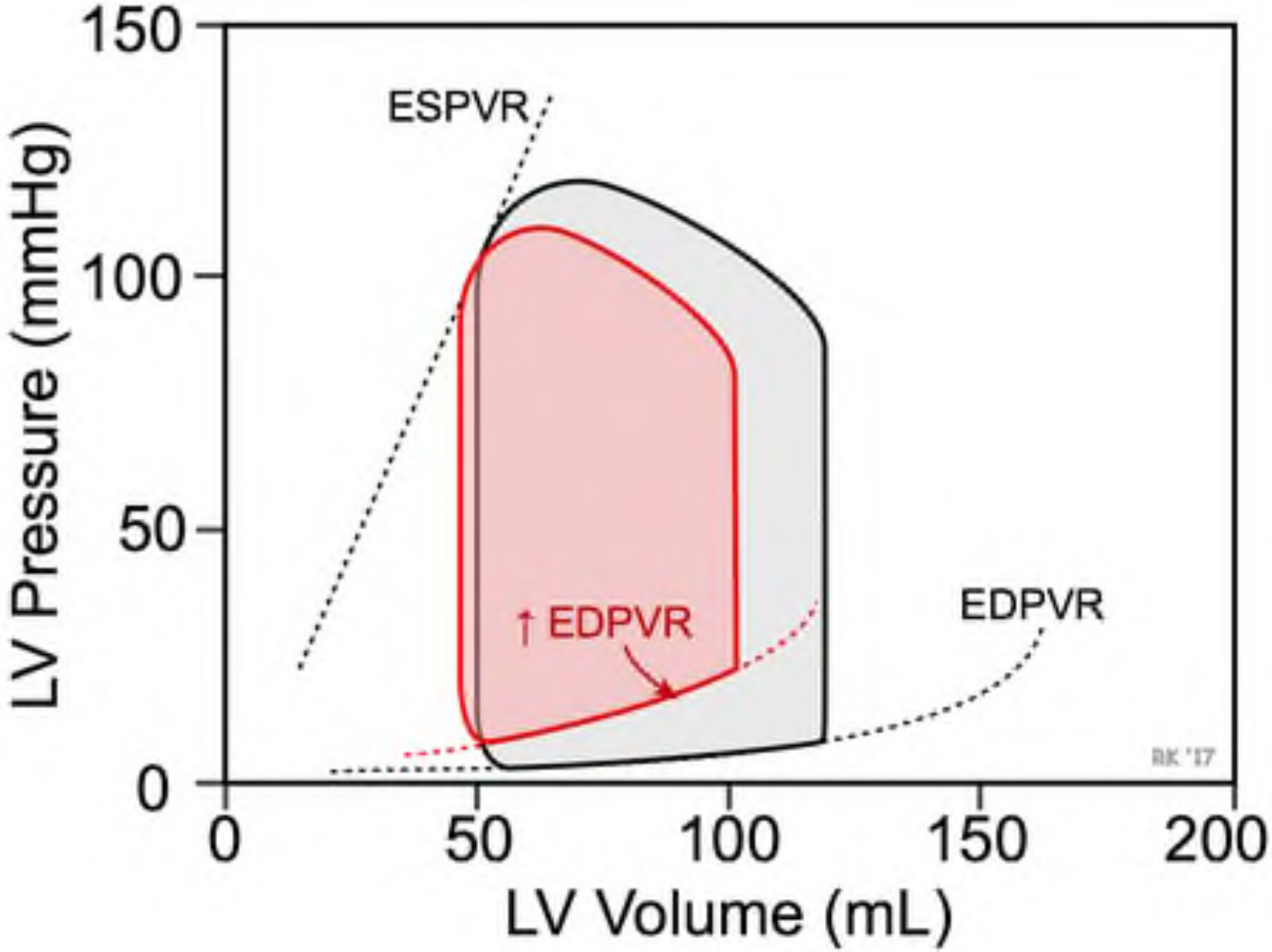




Klabunde, 2019

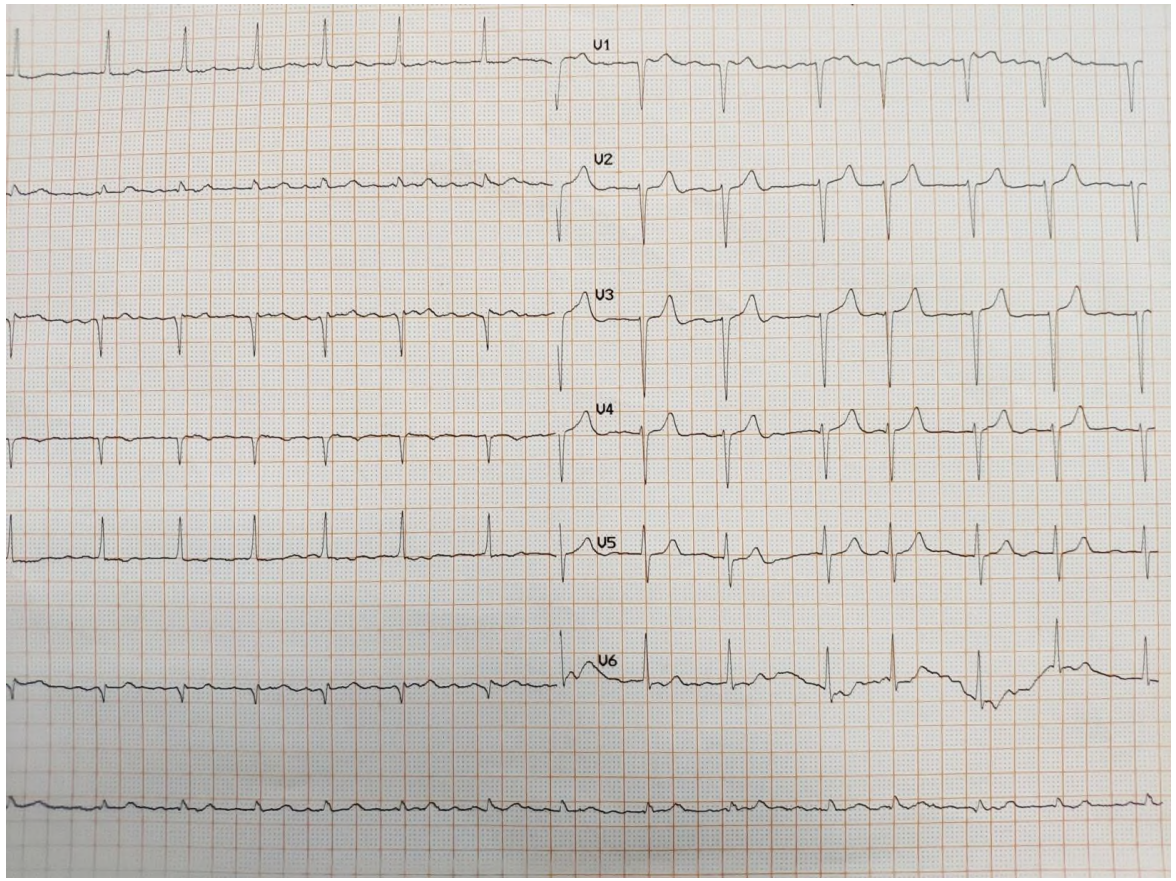


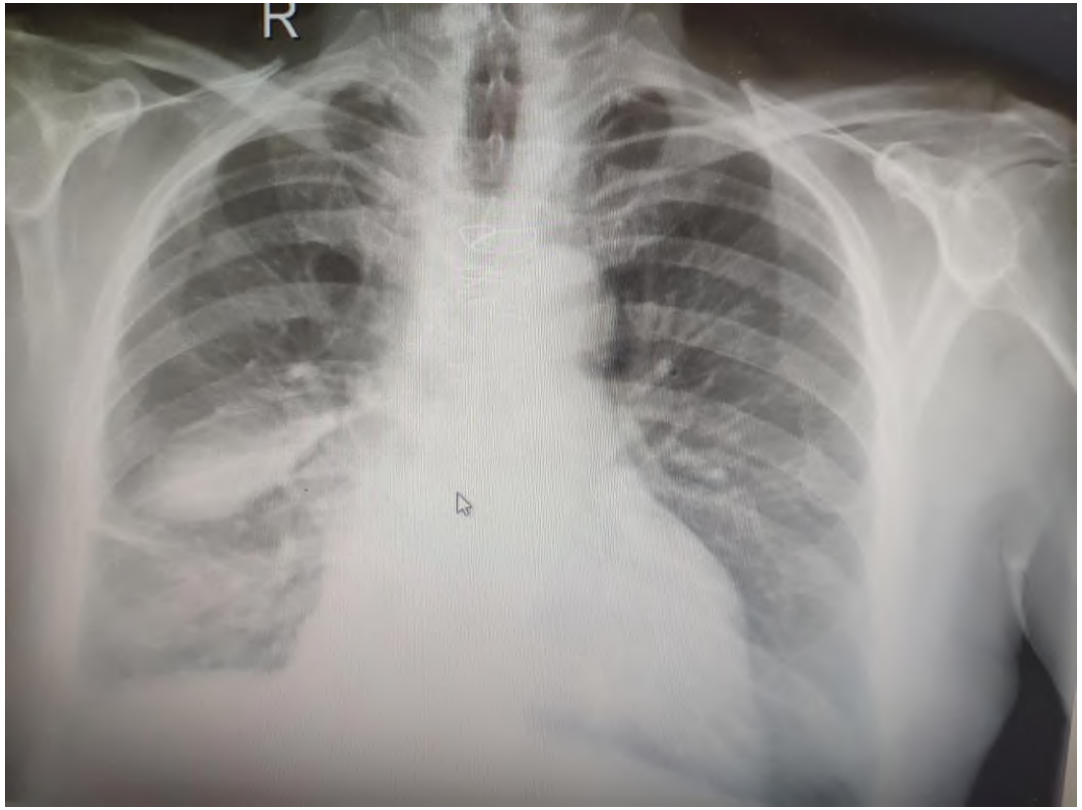
Klabunde, 2019



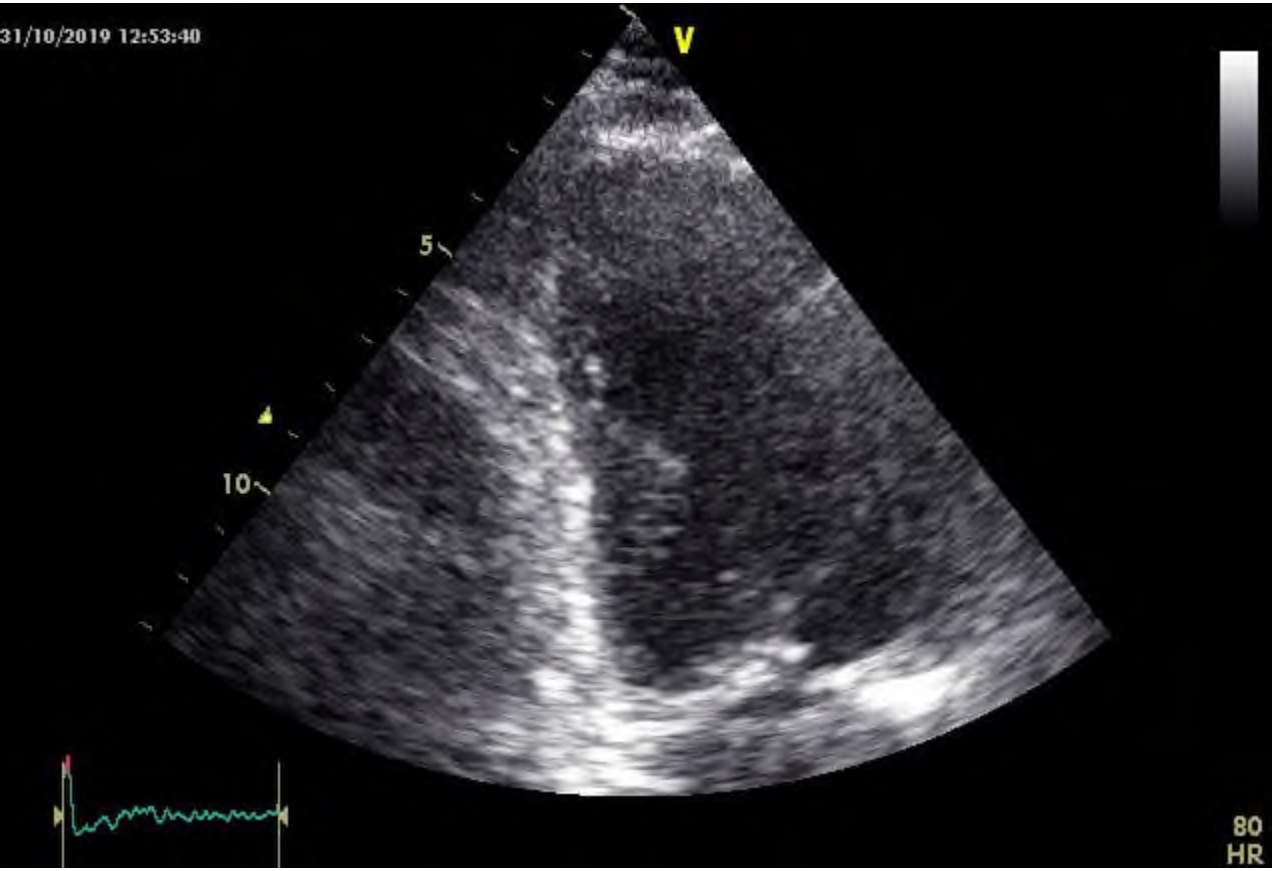
Klabunde, 2019

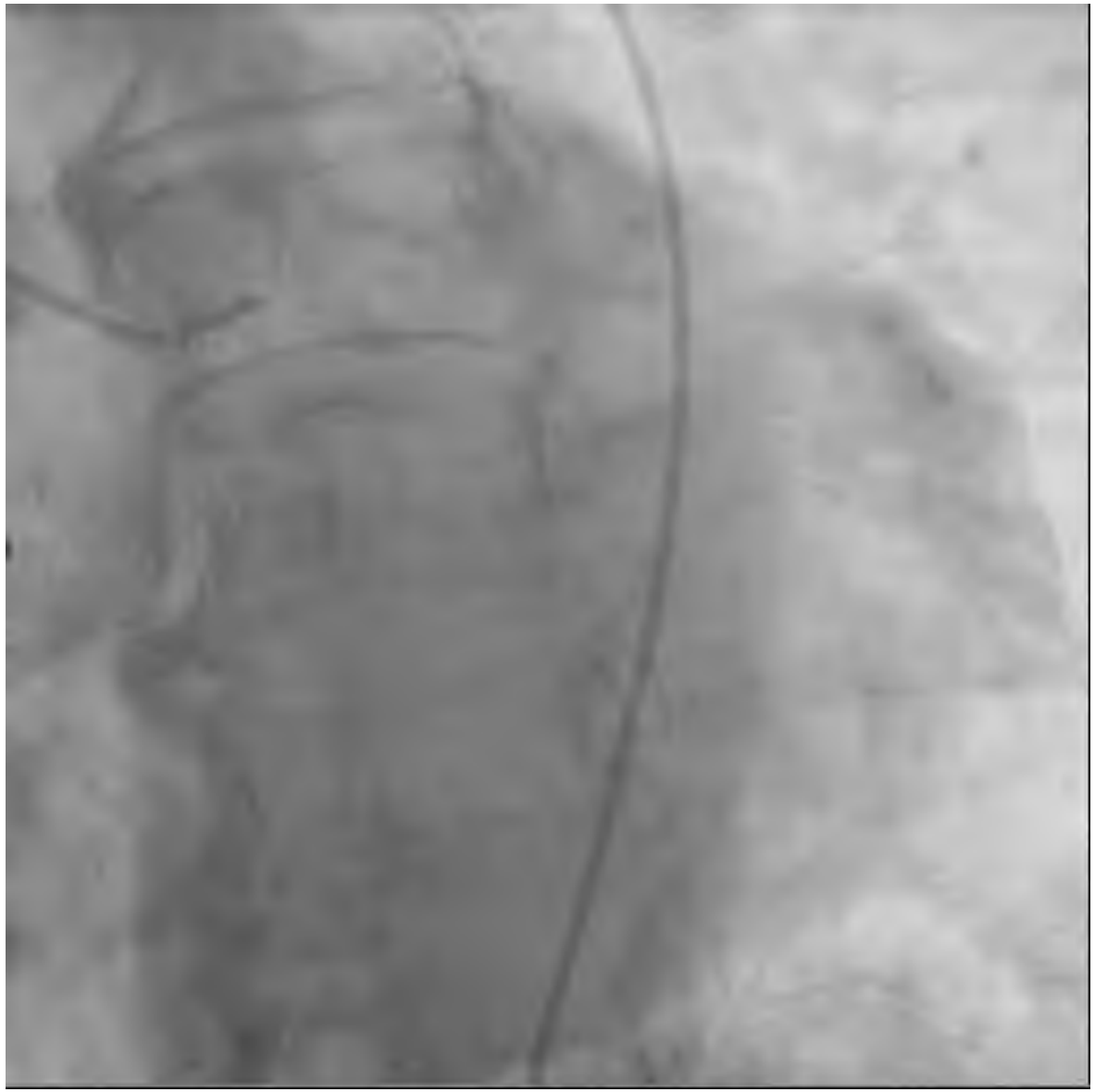
1. CAD

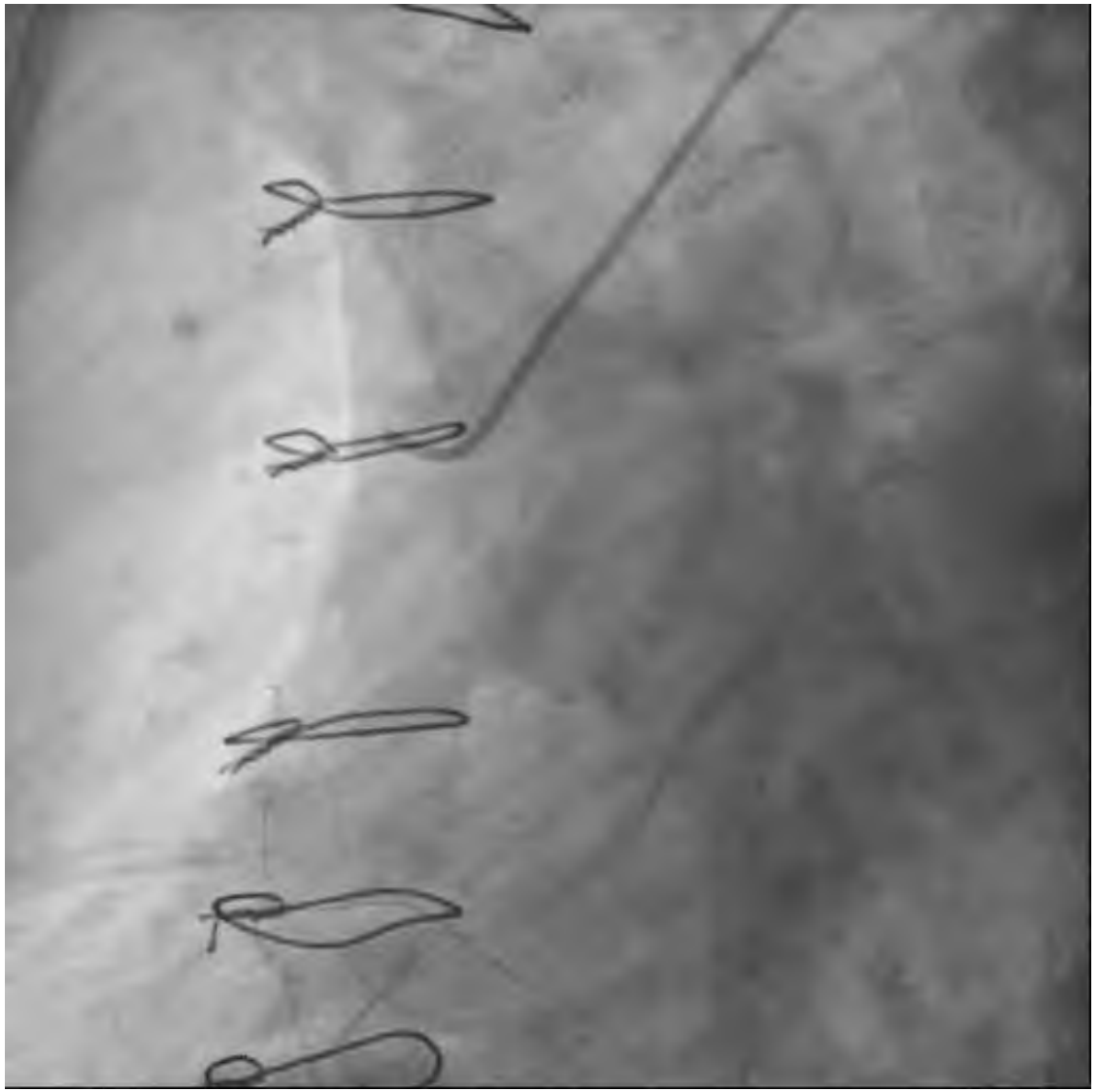





31/10/2019 12:53:28
V
5
10
31/10/2019 12:53:51
V
5
10
84
HR


31/10/2019 12:53:40
V
5
10
80
HR



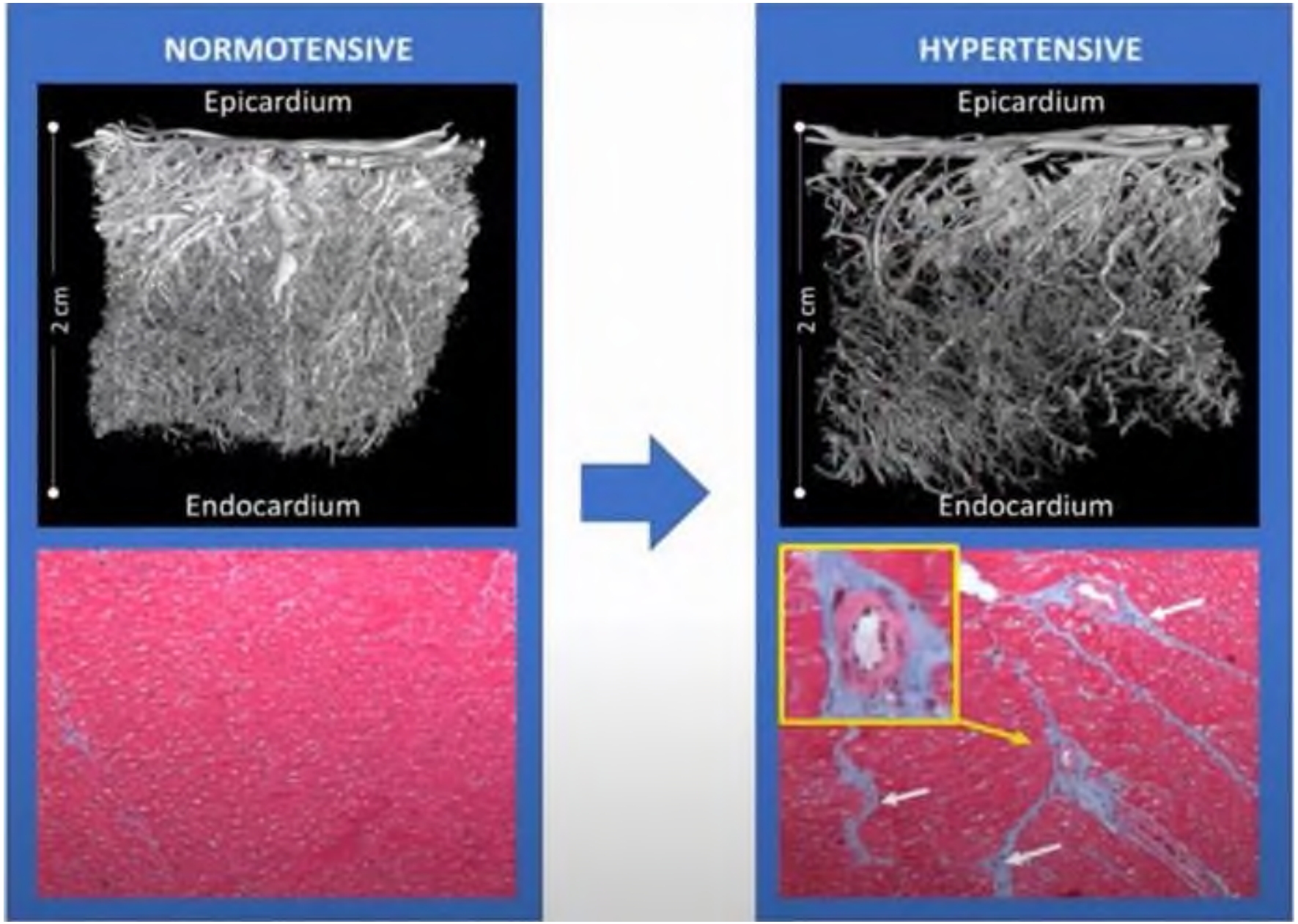


CAD - HF

- Mechanisms
  - Scar
  - Ischemia – hibernated myocardium

  - Commonly with risk factors
    - HTN
    - DM
    - Smoking
    - Dyslipidemia

→ Epicardial + microvascular disease



Escaned J, et al Eur Heart J 2020

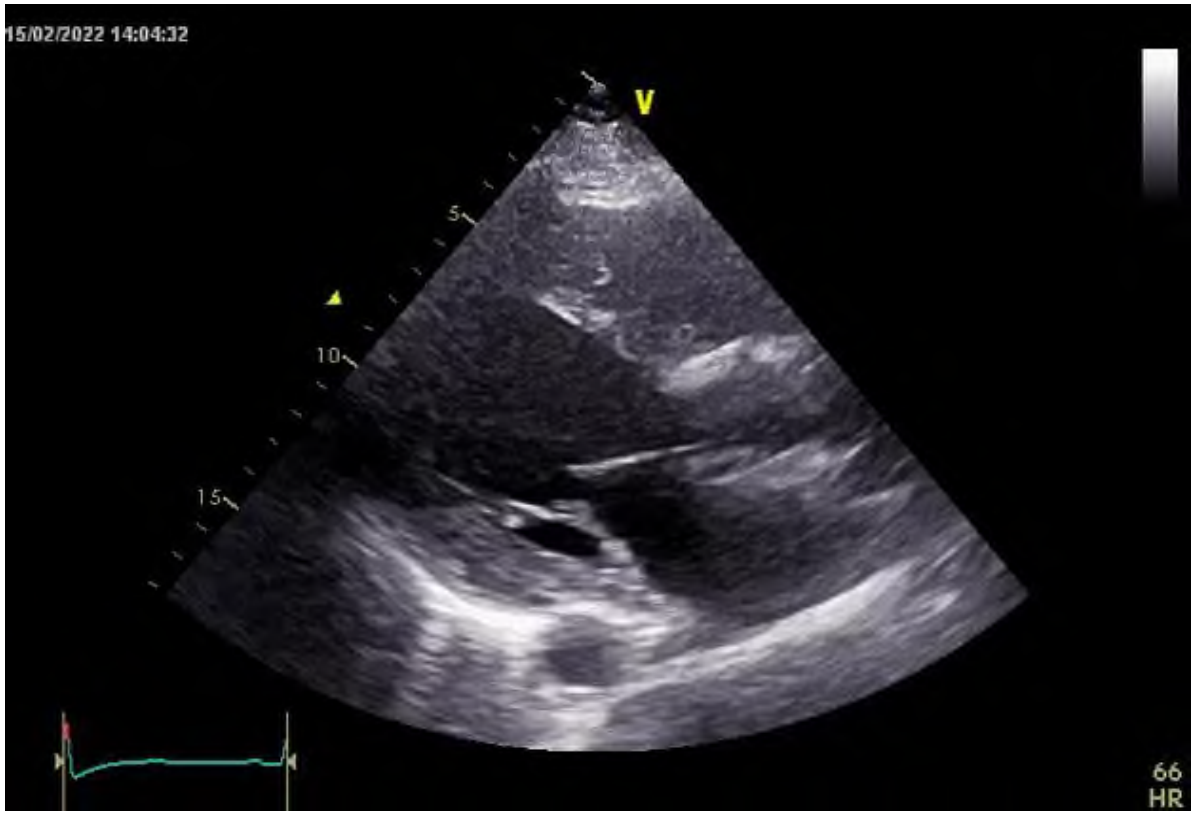
2. HTN

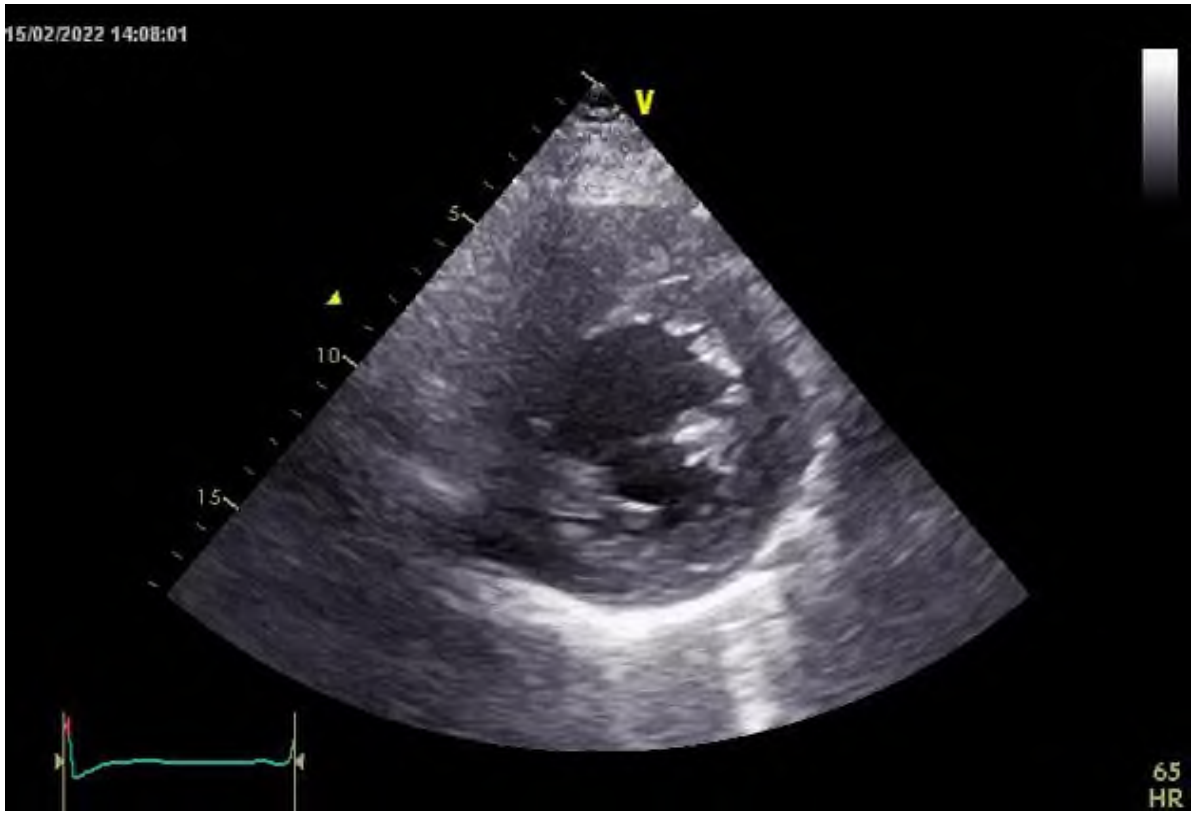
LVH

↓ CO (~EF)

Comorbidities

- **CAD**
- **CKD**
- **DM**
- **AF**


15/02/2022 14:04:32
V
5
10
15
66
HR

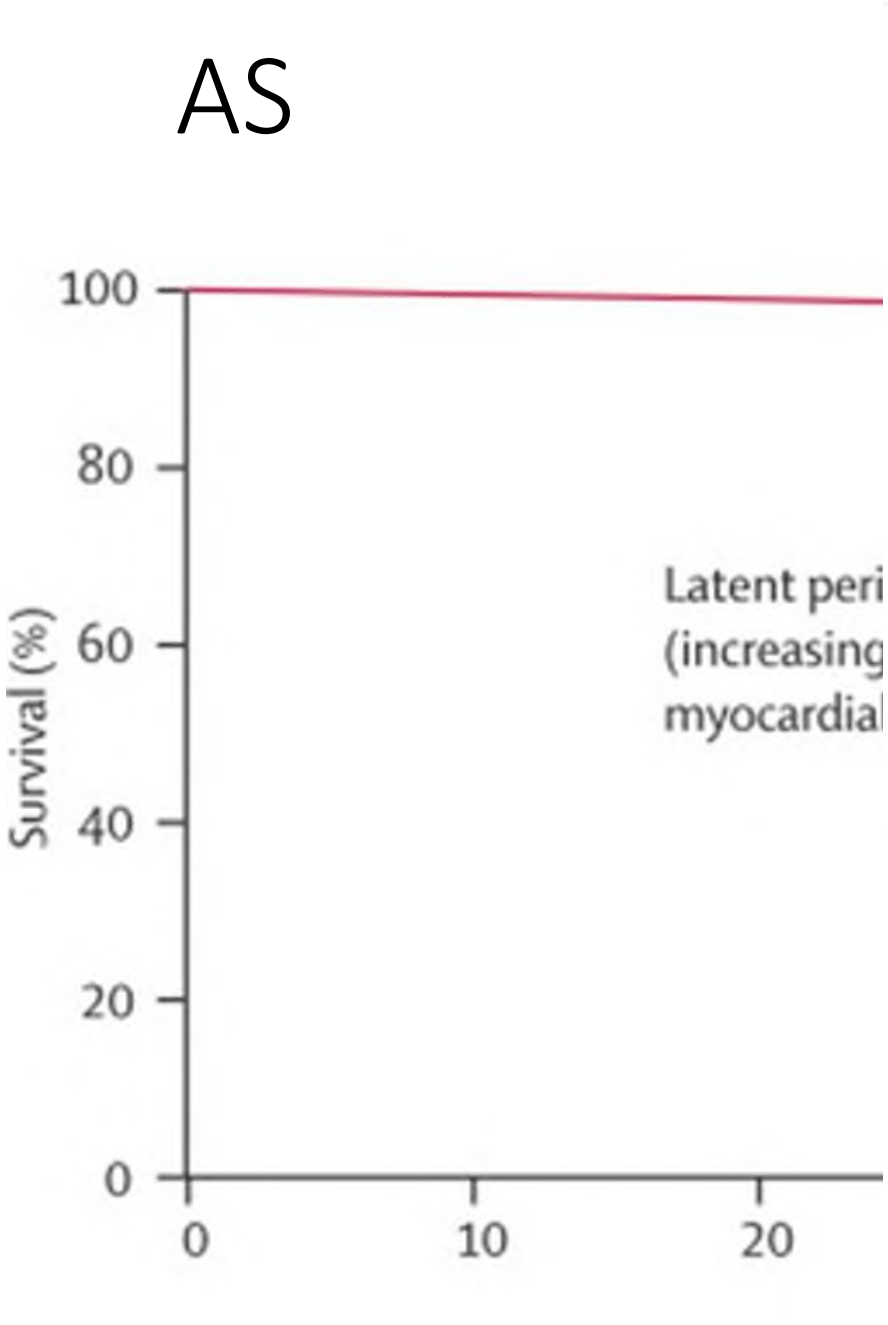

15/02/2022 14:08:01
V
5
10
15
65
HR

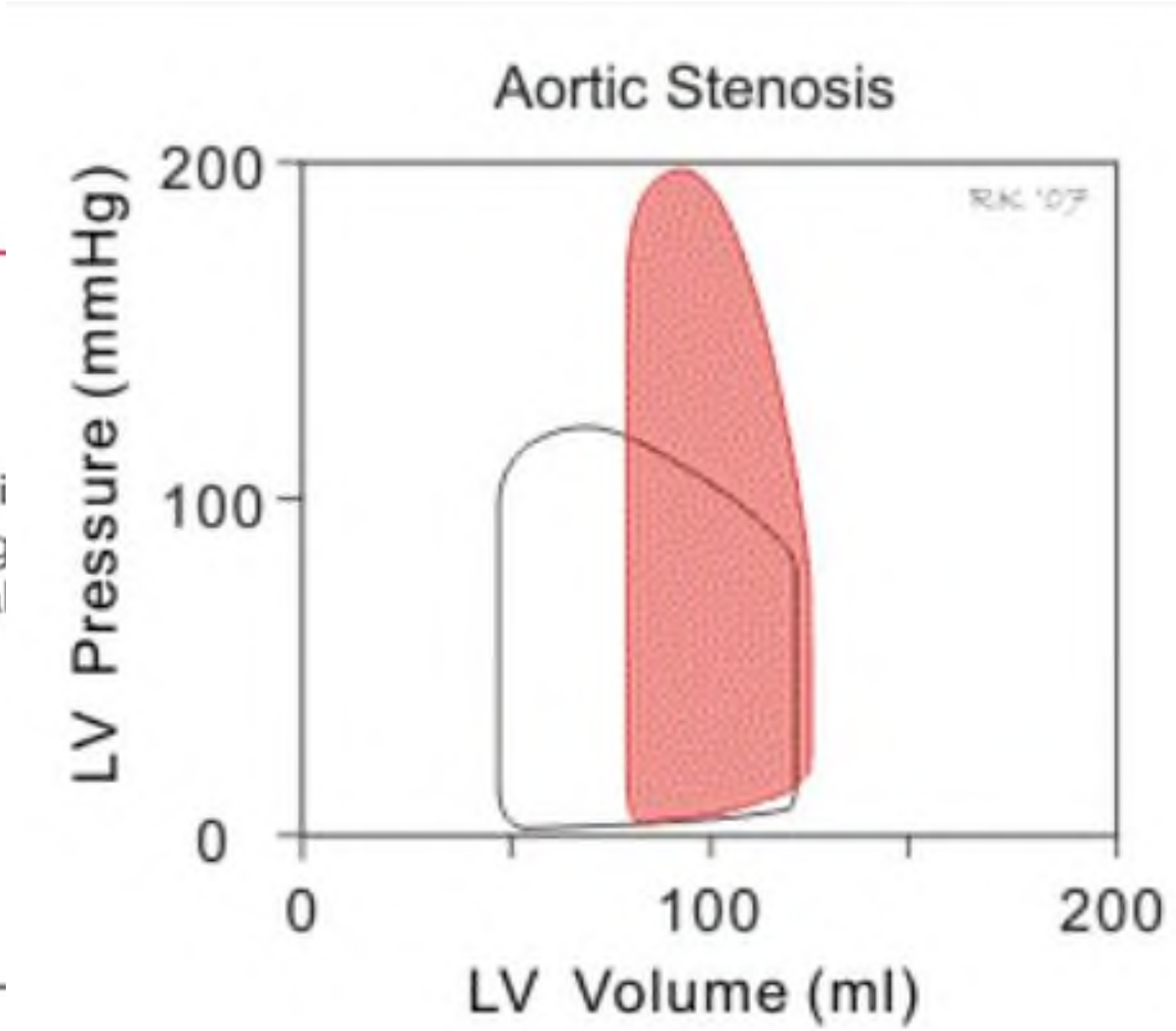
3. Valvular disease - AS

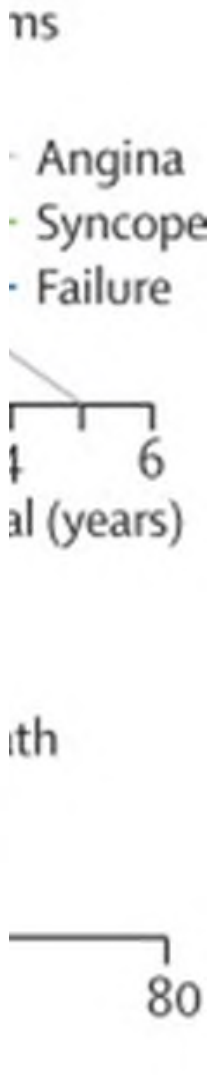
TABLE 1. Etiology of Native Valve Disease in Europe (Euro Heart Survey)

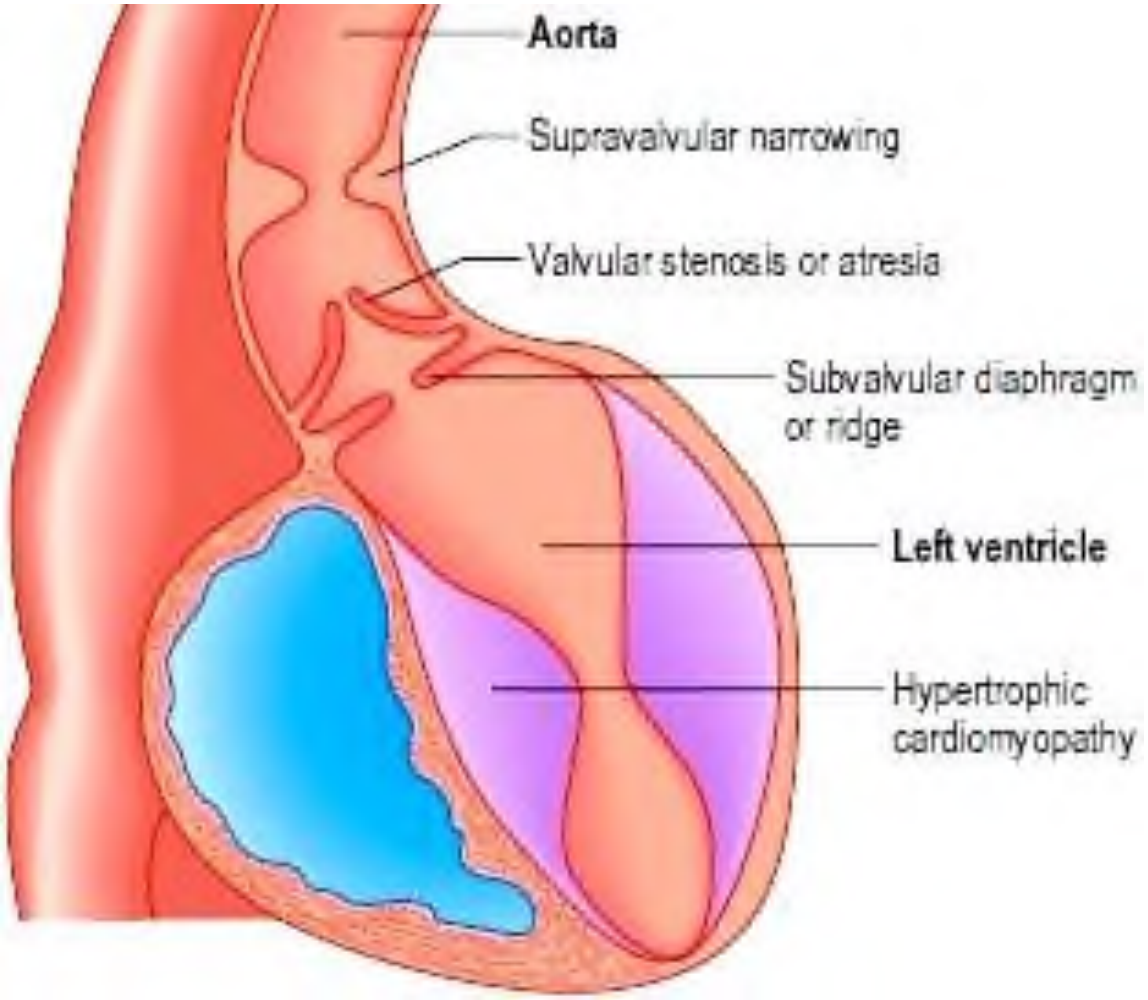
	Aortic Stenosis (n=1197)	Aortic Insufficiency (n=369)	Mitral Stenosis (n=336)	Mitral Insufficiency (n=877)
Degenerative, %	81.9	50.3	12.5	61.3
Rheumatic, %	11.2	15.2	85.4	14.2
Congenital, %	5.4	15.2	0.6	4.8
Others, %	1.5	19.3	1.5	16.2

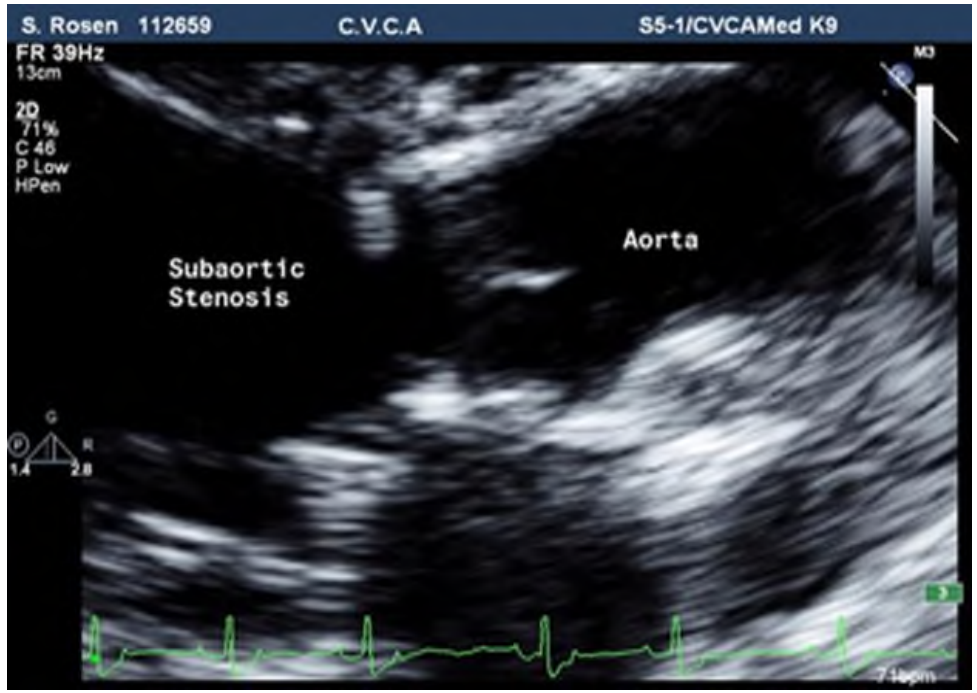
AS

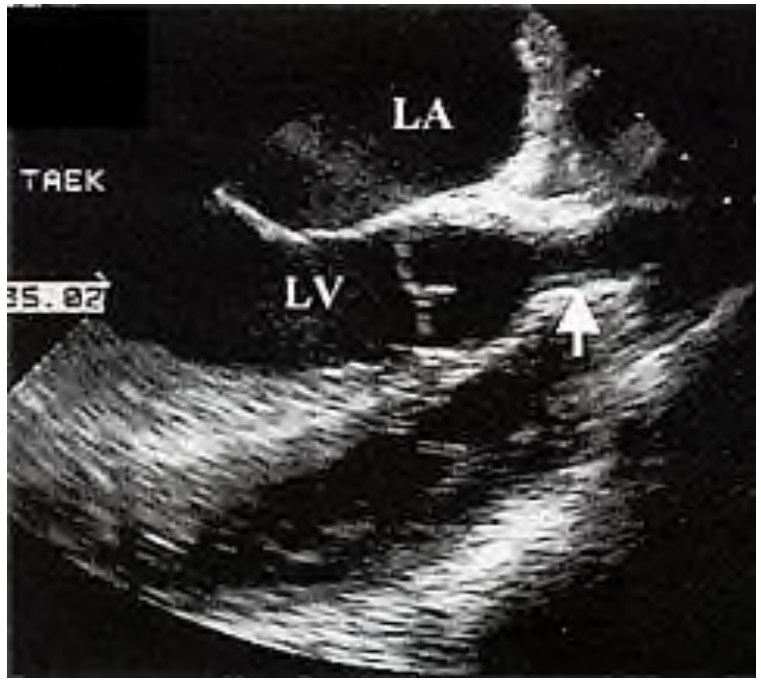

100
80
60
40
20
0
Survival (%)
0
10
20
Latent peri
(increasing
myocardial

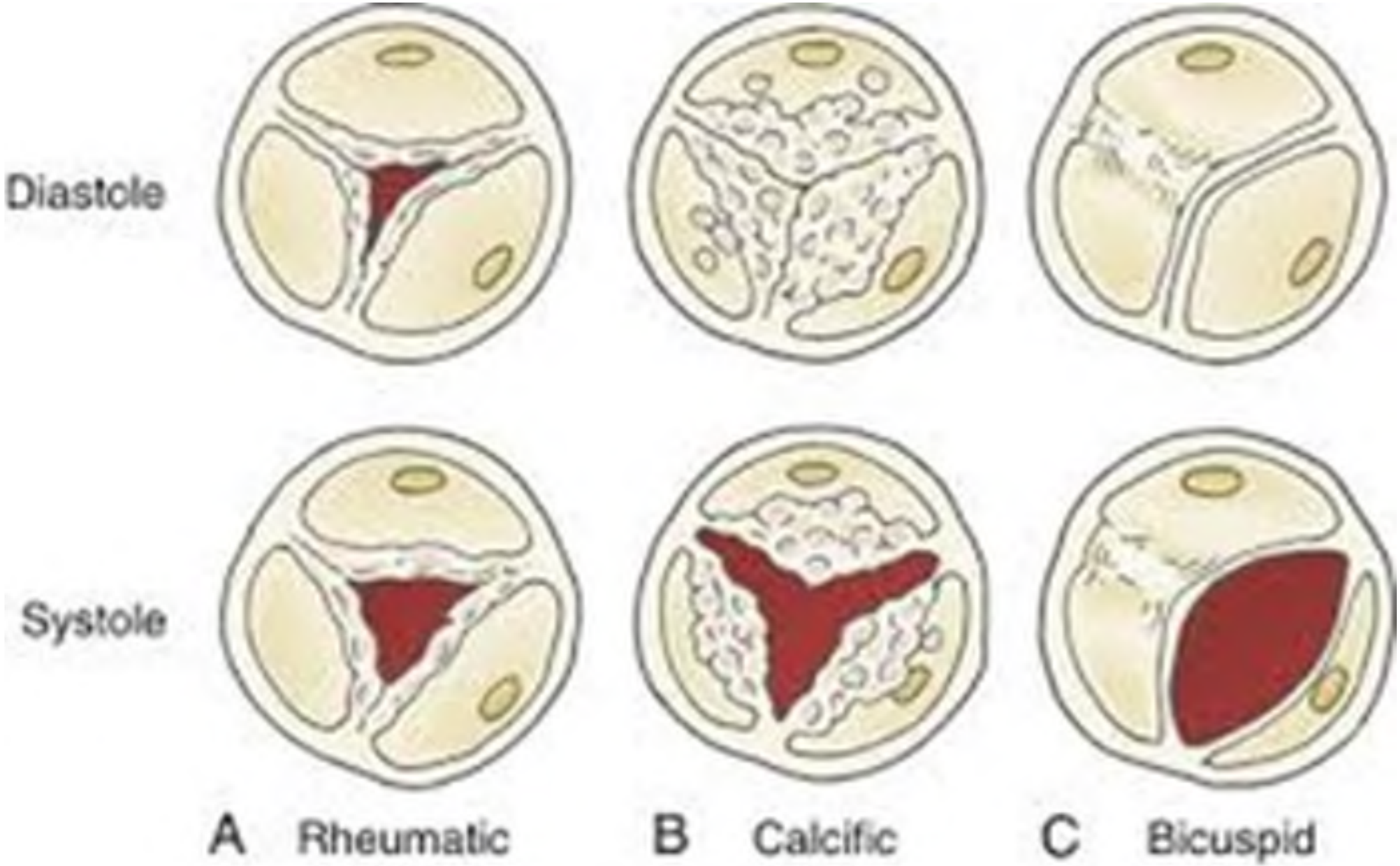

Aortic Stenosis
200
100
0
LV Pressure (mmHg)
0
100
200
LV Volume (ml)

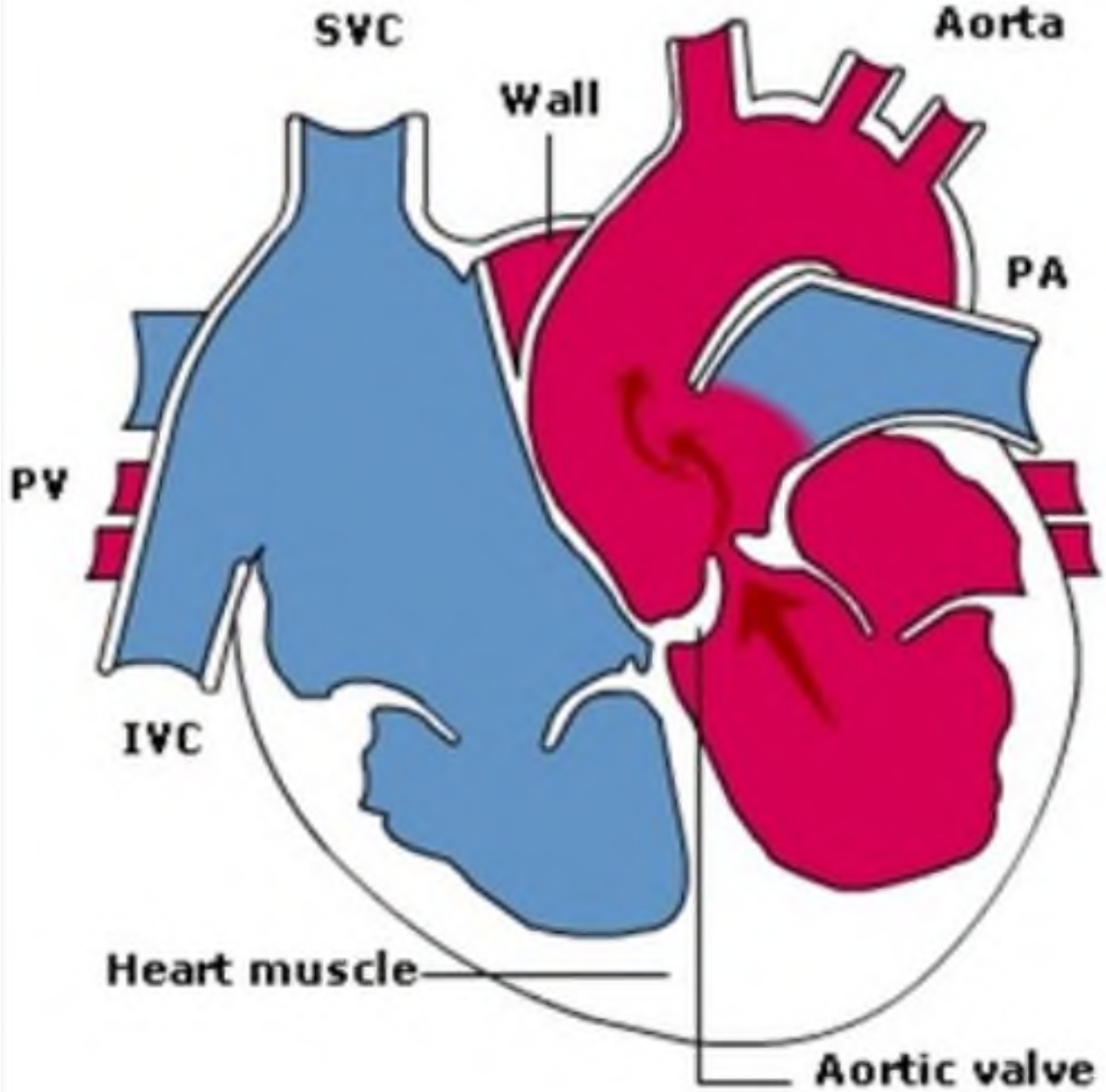

ms
Angina
Syncope
Failure
6
al (years)
ith
80

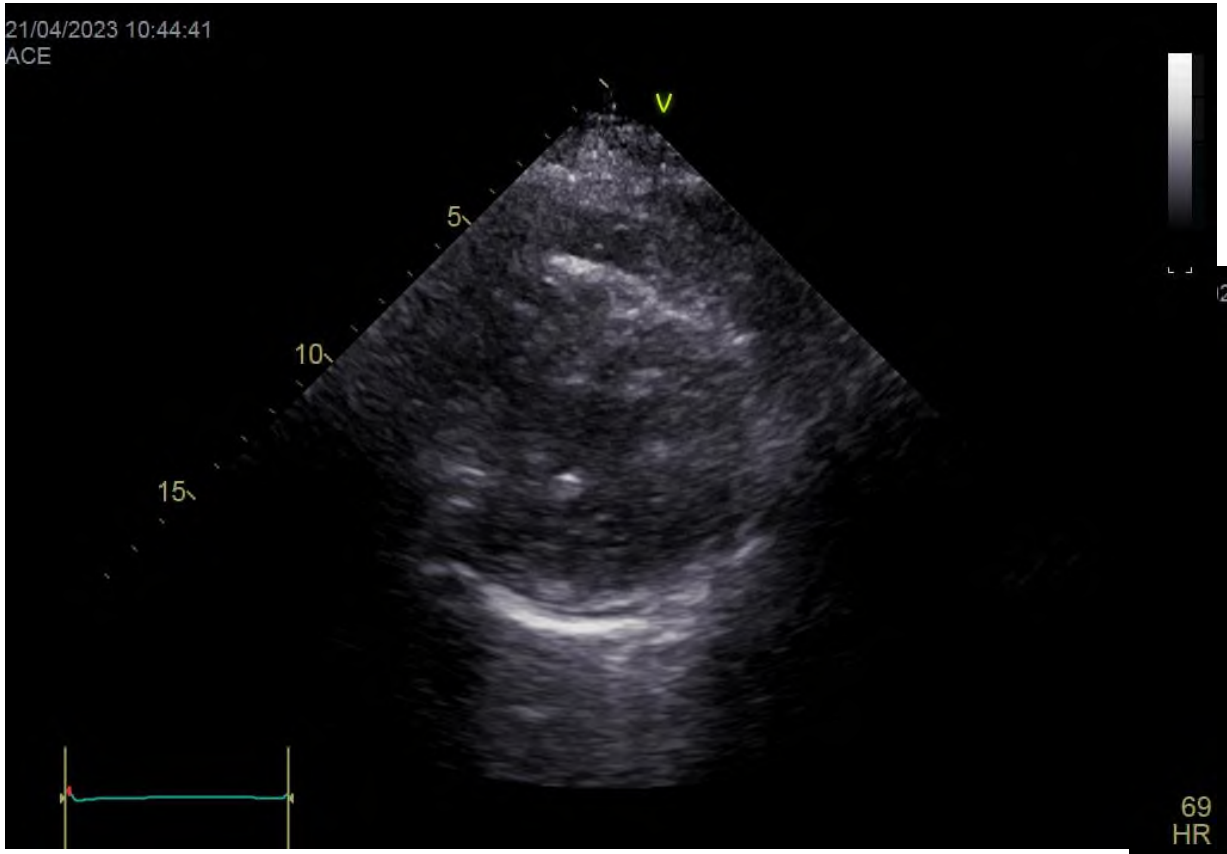

Aorta
Supravalvular narrowing
Valvular stenosis or atresia
Subvalvular diaphragm or ridge
Left ventricle
Hypertrophic cardiomyopathy

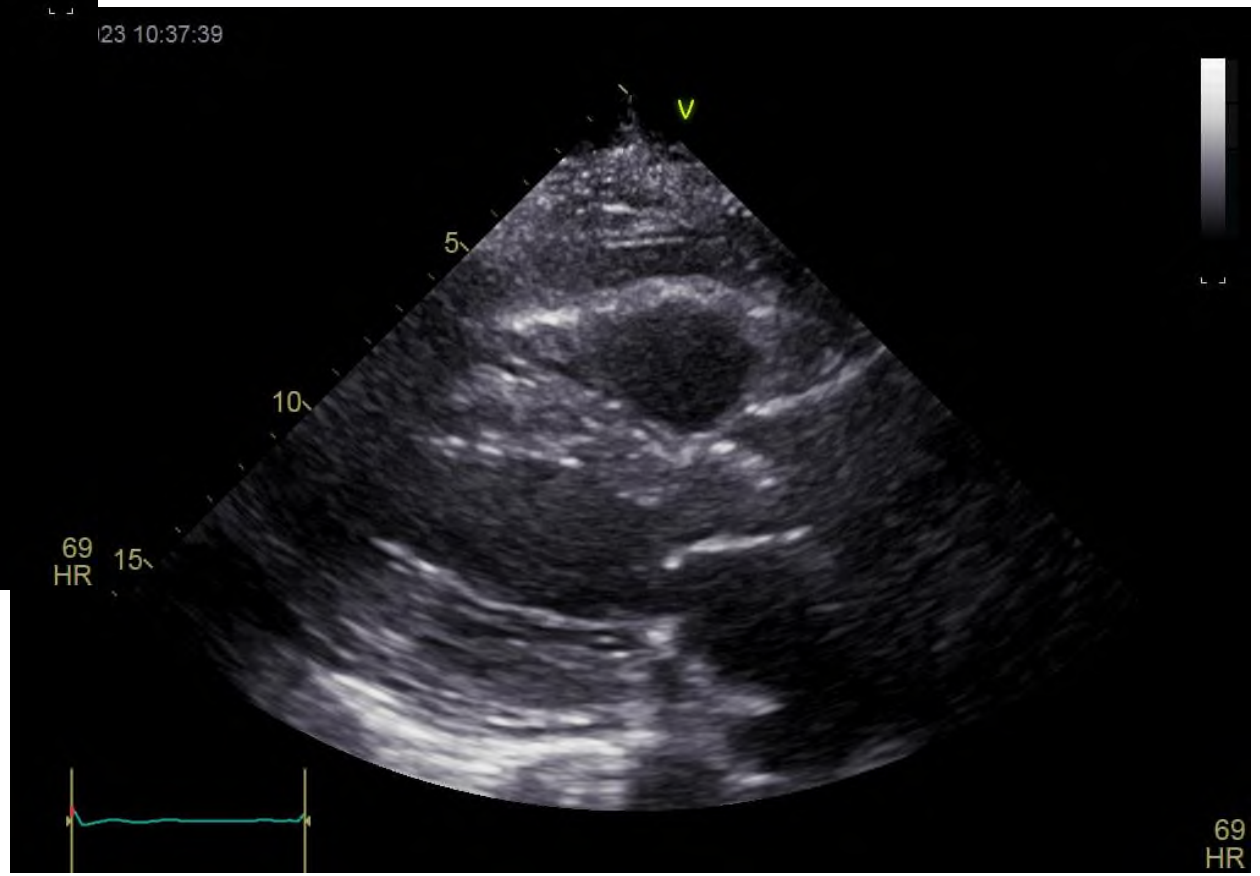

S. Rosen 112659
C.V.C.A
S5-1/CVCAMed K9
FR 39Hz
13cm
2D
71%
C 46
P Low
HPen
Aorta
Subaortic
Stenosis

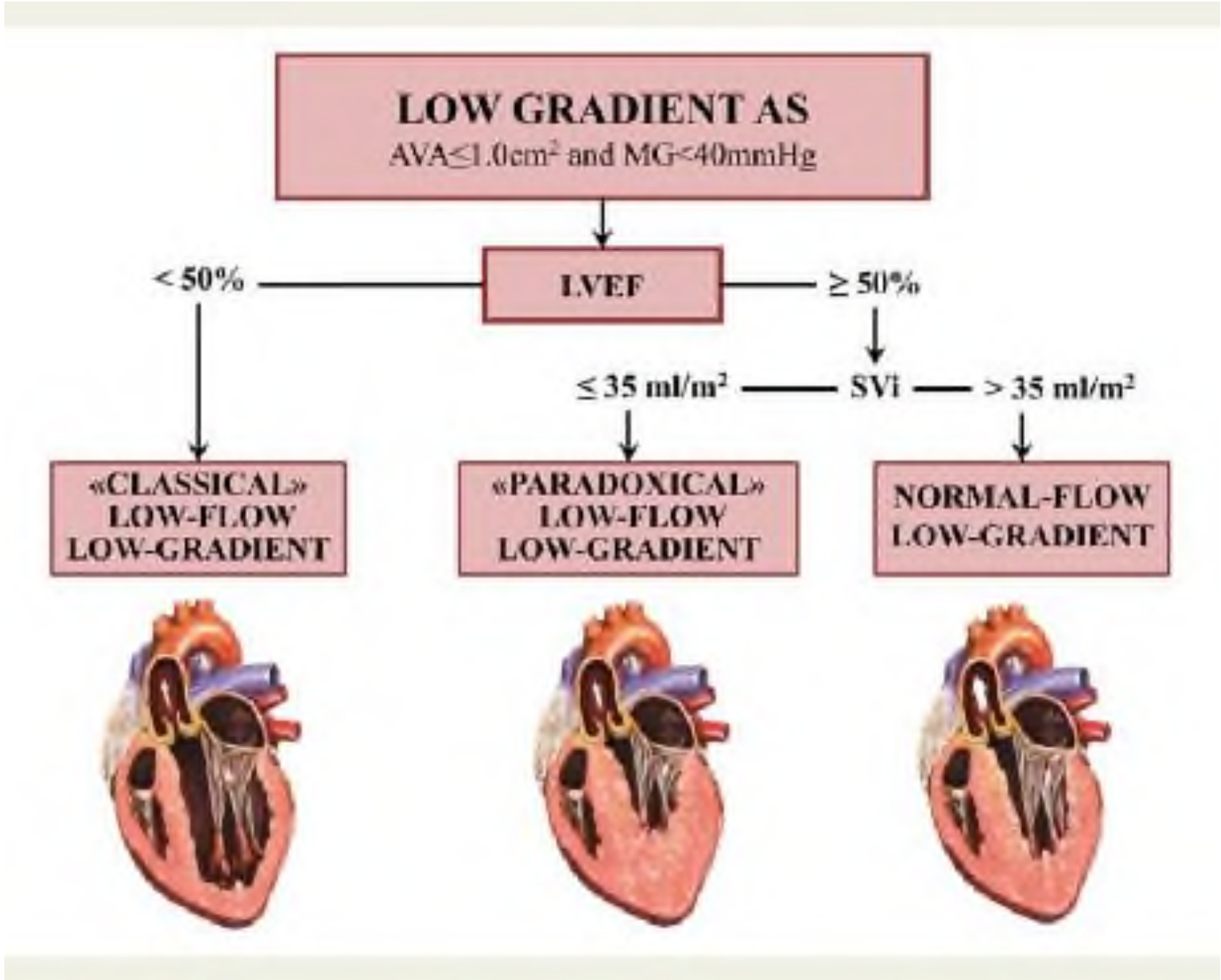

LA
LV
TAEK


Diastole
Systole
A Rheumatic
B Calcific
C Bicuspid


SVC
Aorta
Wall
PA
PV
IVC
Heart muscle
Aortic valve


21/04/2023 10:44:41
ACE
V
5
10
15

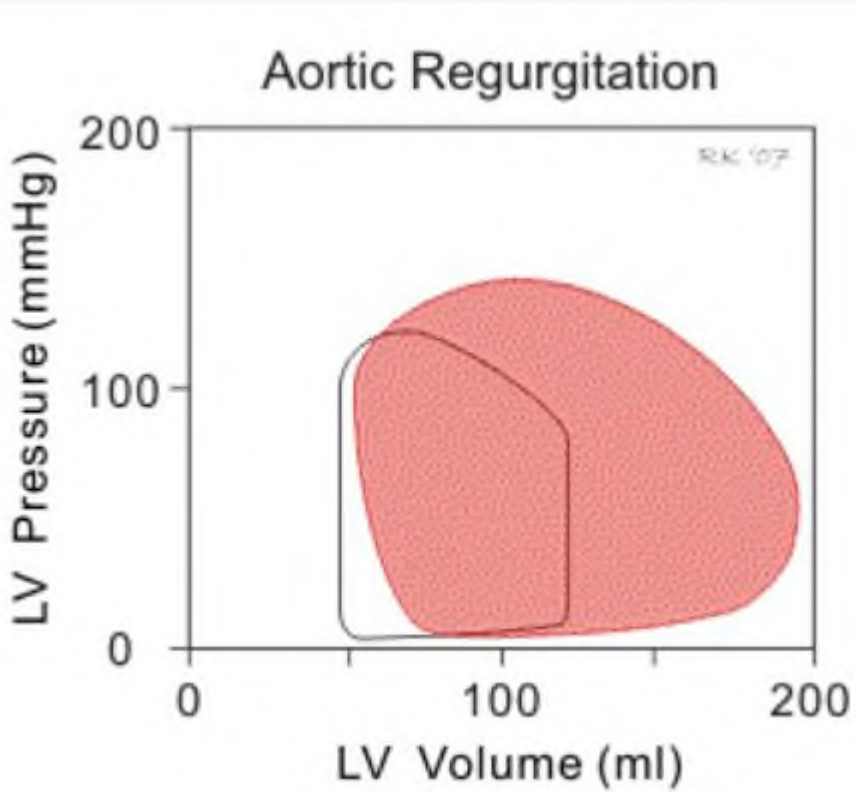

23 10:37:39
V
5
10
69
HR
15
69
HR

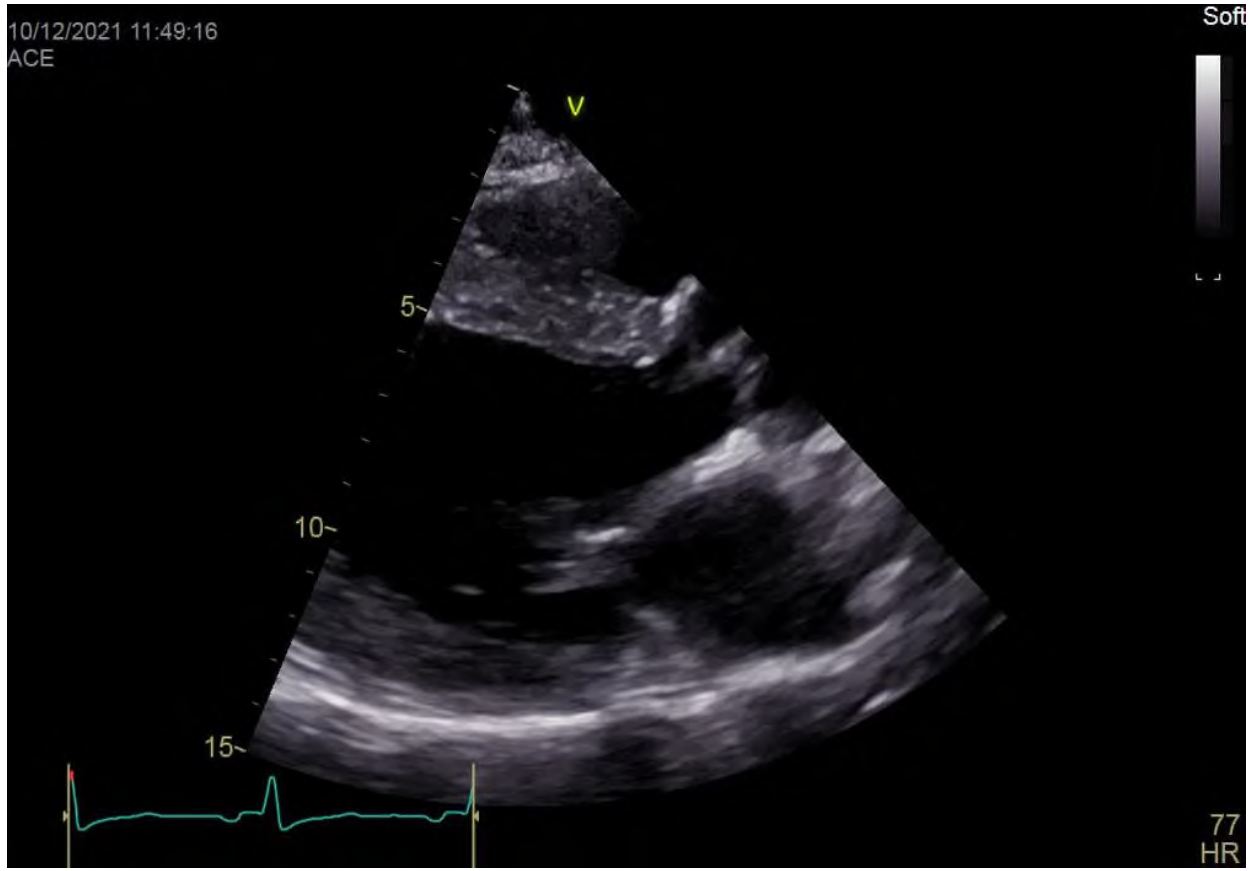

LOW GRADIENT AS
AVA≤1.0cm² and MG<40mmHg
LVEF
< 50%
≥ 50%
SVi
≤ 35 ml/m²
> 35 ml/m²
«CLASSICAL»
LOW-FLOW
LOW-GRADIENT
«PARADOXICAL»
LOW-FLOW
LOW-GRADIENT
NORMAL-FLOW
LOW-GRADIENT

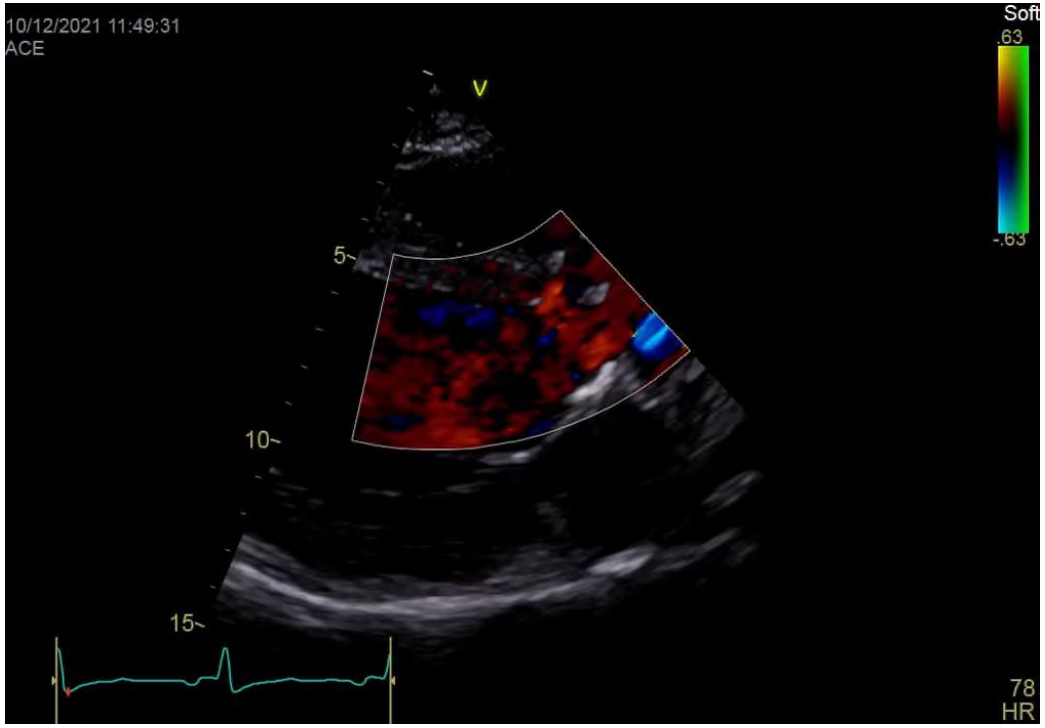
3. Valvular disease - AR

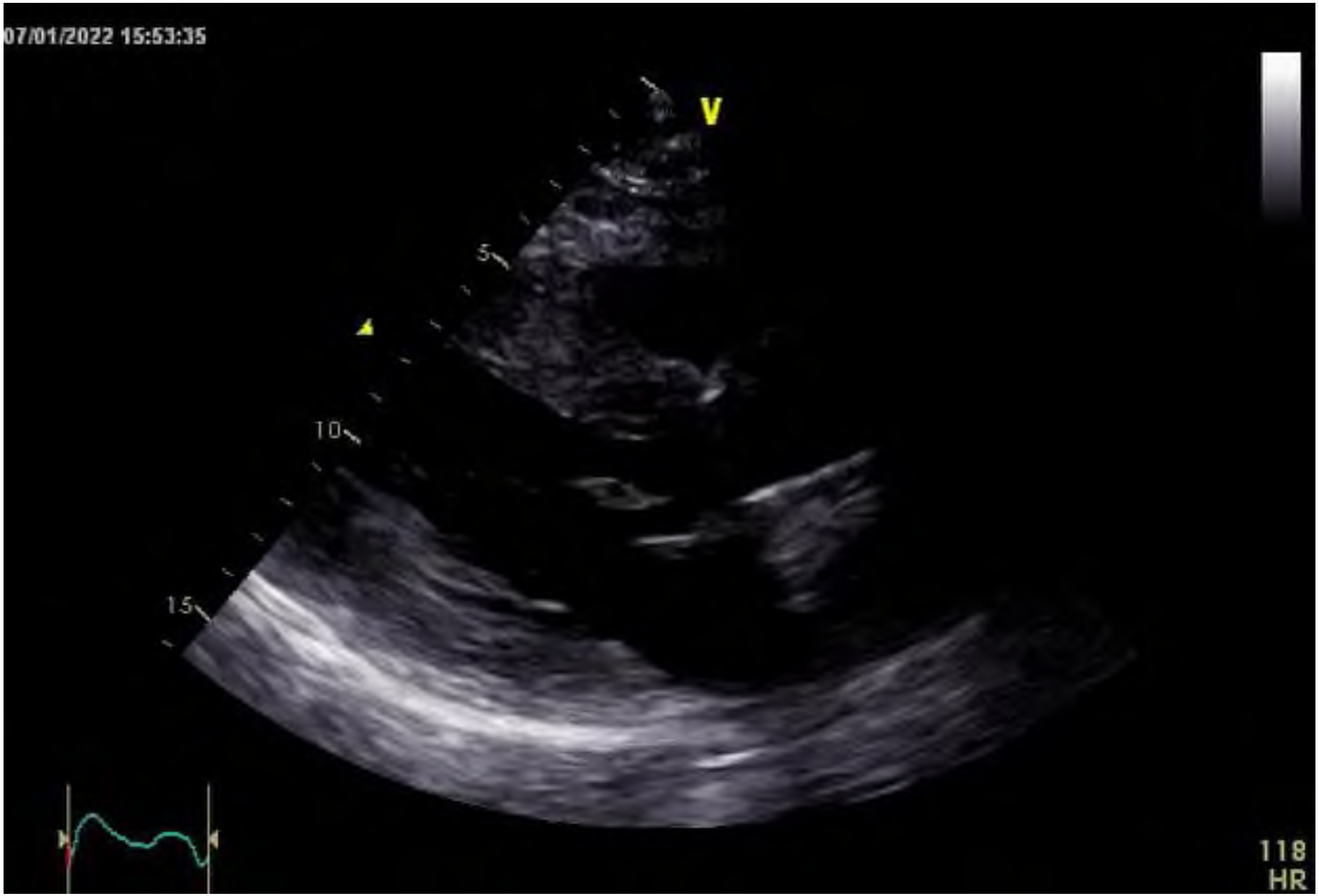
TABLE 1. Etiology of Native Valve Di
(Euro Heart Survey)

	Aortic Stenosis (n=1197)	Aortic Insufficiency (n=369)		
Degenerative, %	81.9	50.3		
Rheumatic, %	11.2	15.2		
Congenital, %	5.4	15.2	0.6	4.6
Others, %	1.5	19.3	1.5	16.2




10/12/2021 11:49:16
ACE
Soft
V
5
10
15
77
HR

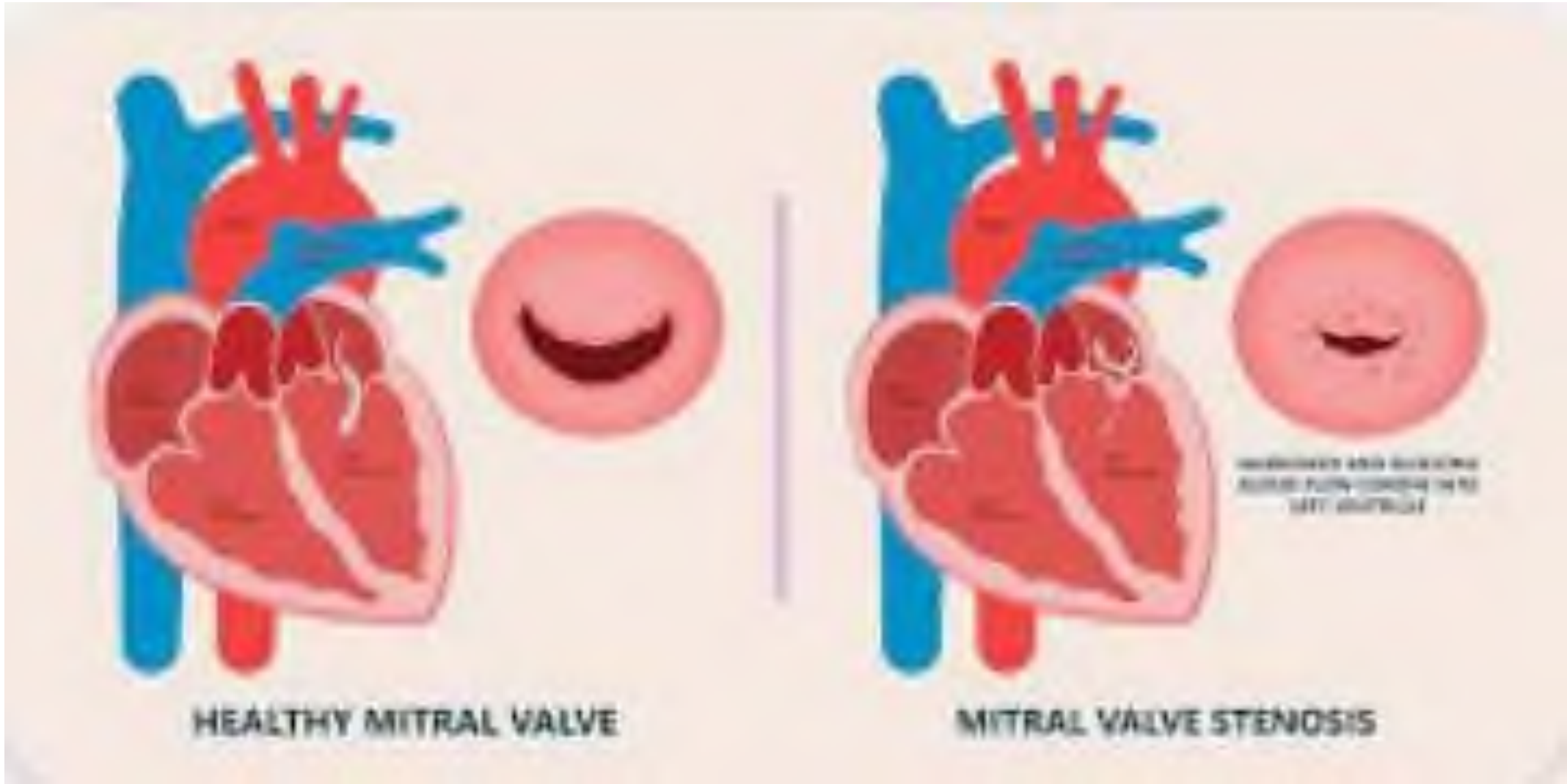

10/12/2021 11:49:31
ACE
Soft
.63
-.63
V
5
10
15
78
HR

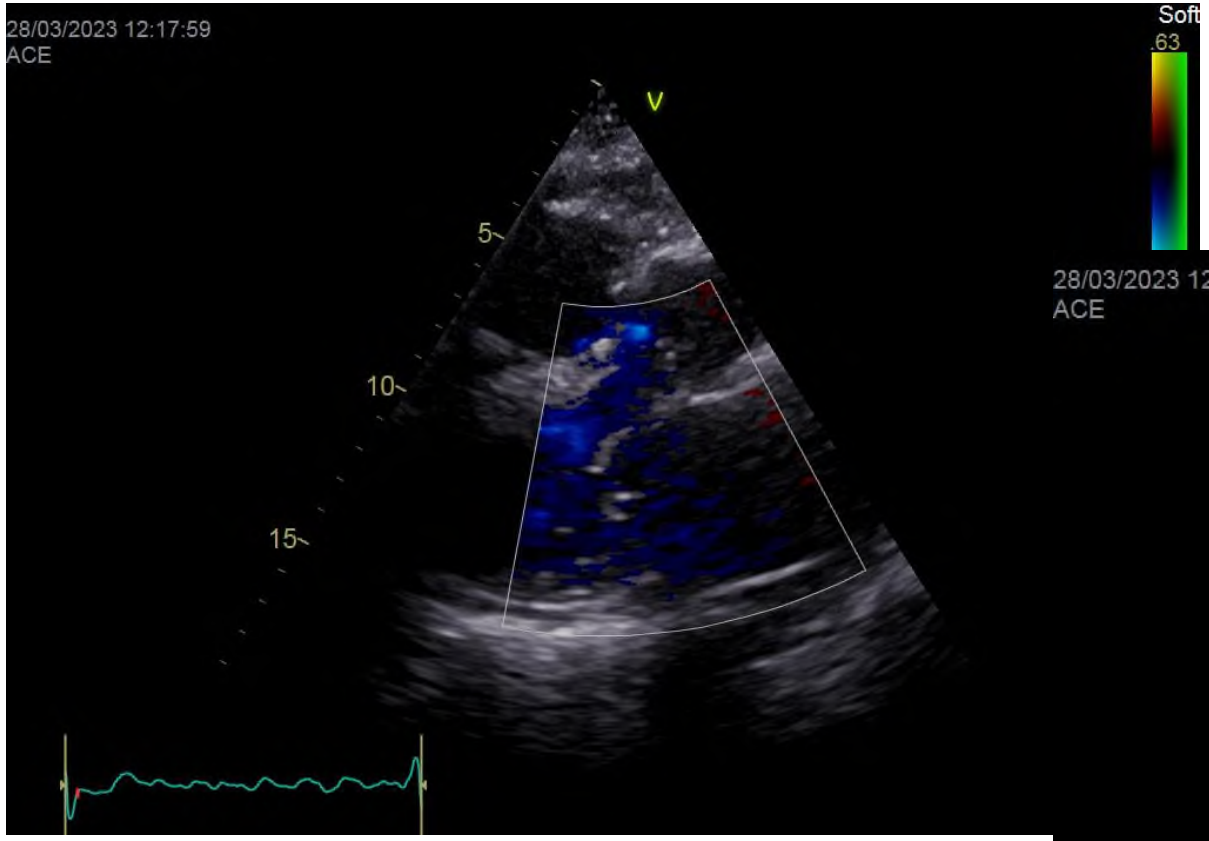

07/01/2022 15:53:35
V
5
10
15
118
HR

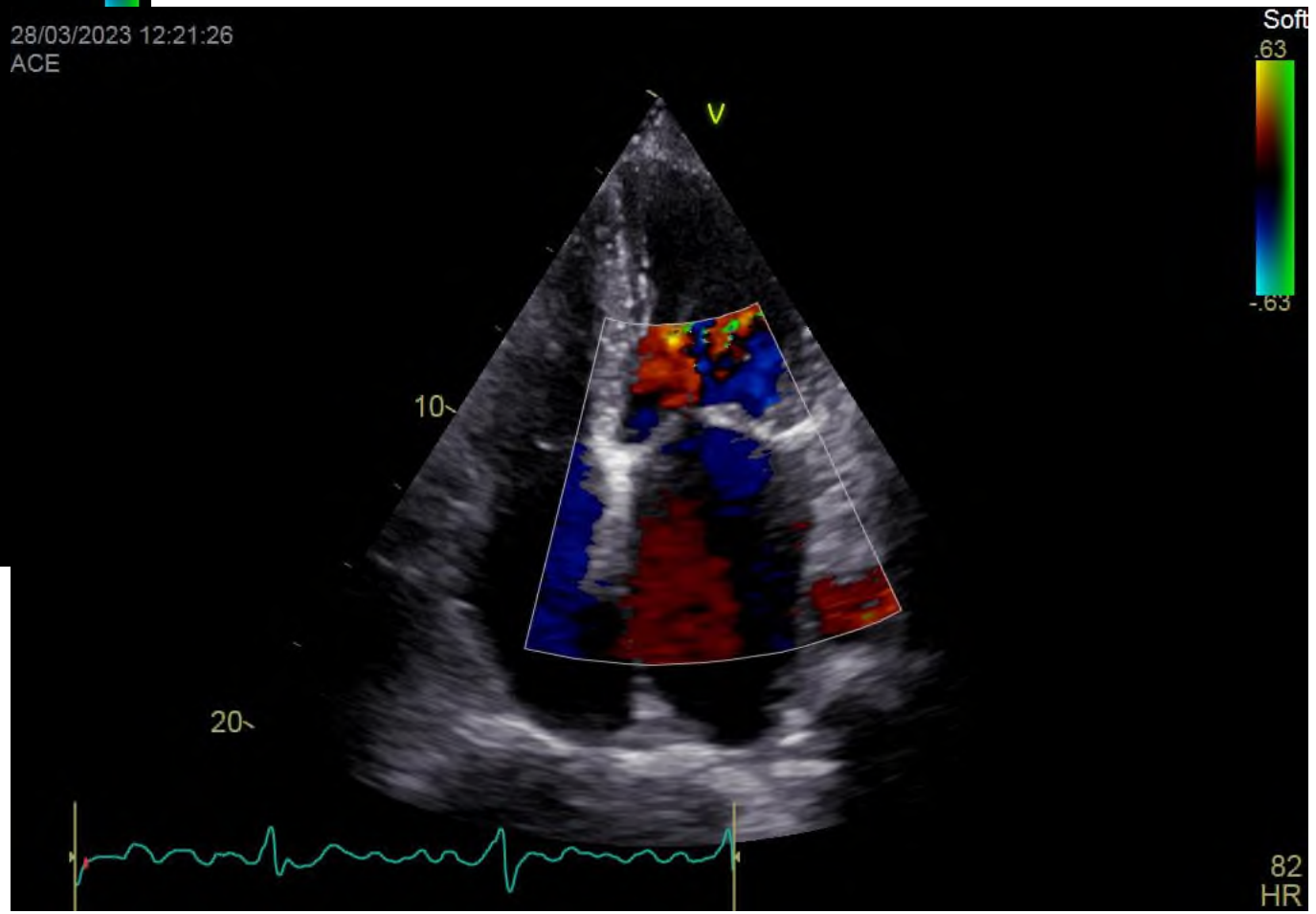
3. Valvular disease - MS

TABLE 1. Etiology of Native Valve Disease in Europe (Euro Heart Survey)

	Aortic Stenosis (n=1197)	Aortic Insufficiency (n=369)	Mitral Stenosis (n=336)	Mitral Insufficiency (n=877)
Degenerative, %	81.9	50.3	12.5	61.3
Rheumatic, %	11.2	15.2	85.4	14.2
Congenital, %	5.4	15.2	0.6	4.8
Others, %	1.5	19.3	1.5	16.2


HEALTHY MITRAL VALVE
MITRAL VALVE STENOSIS

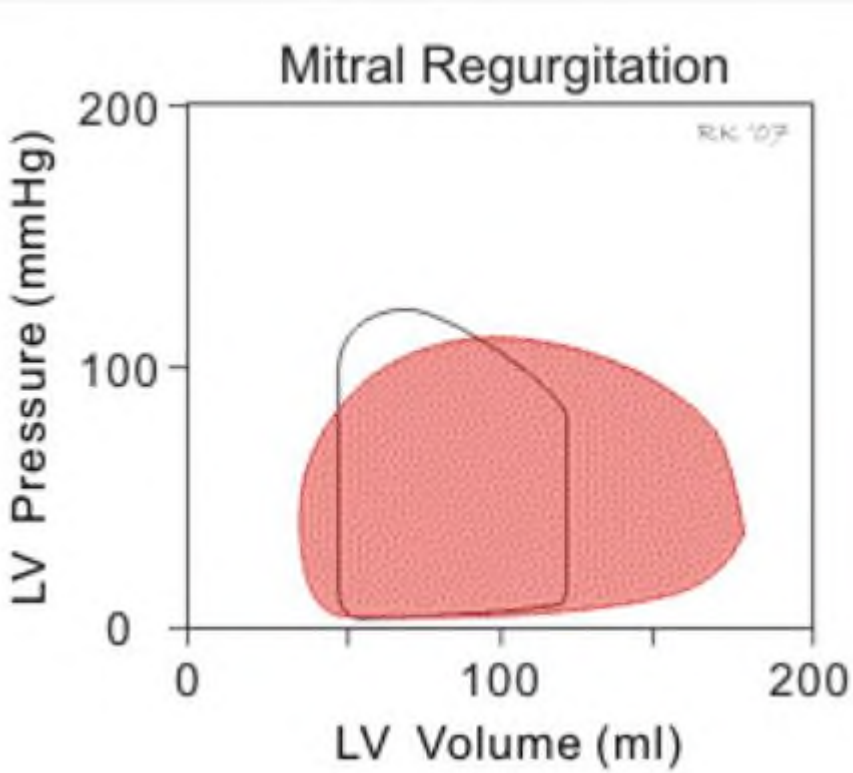

28/03/2023 12:17:59
ACE
Soft
.63
V
5
10
15

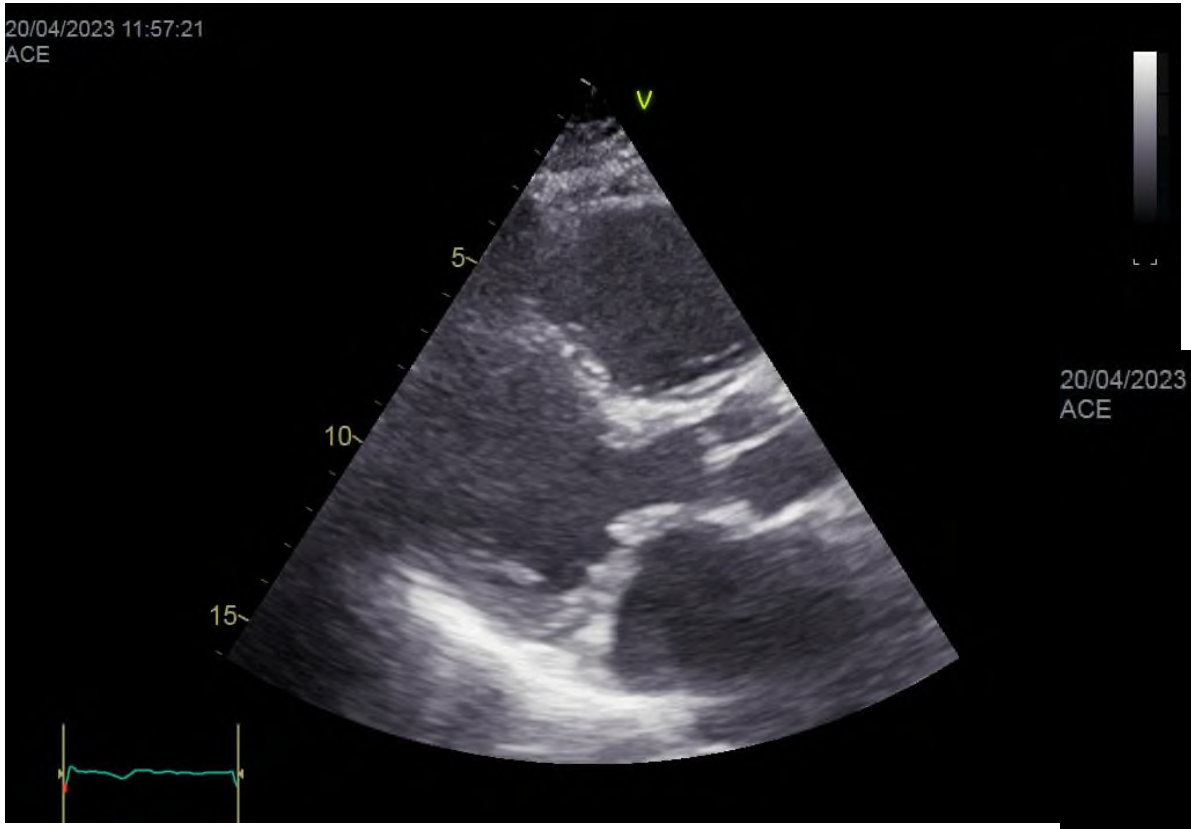

28/03/2023 12:21:26
ACE
Soft
.63
-.63
V
10
20
82
HR

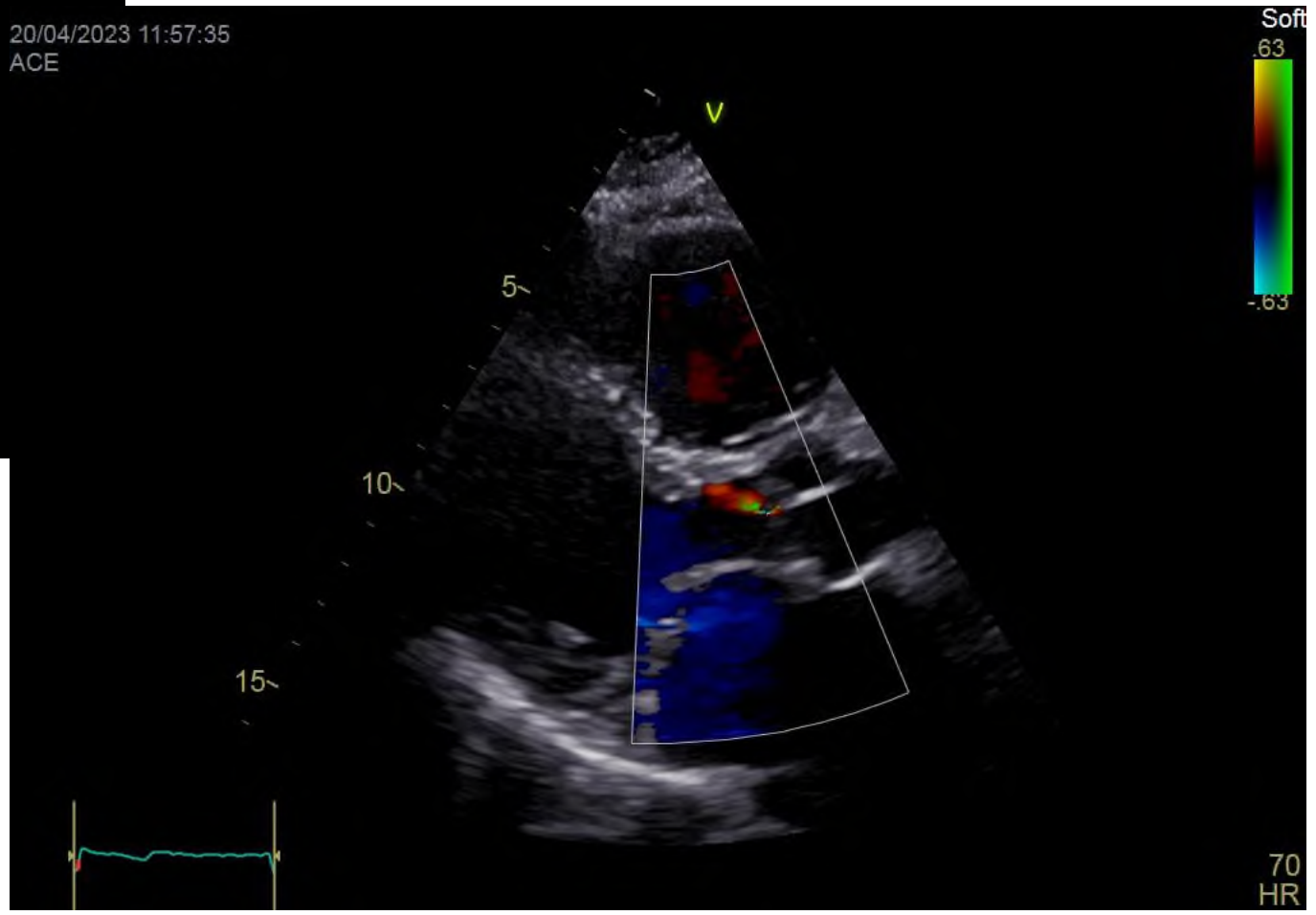
3. Valvular disease - MR

TABLE 1. Etiology of Native Valve Disease in Europe (Euro Heart Survey)

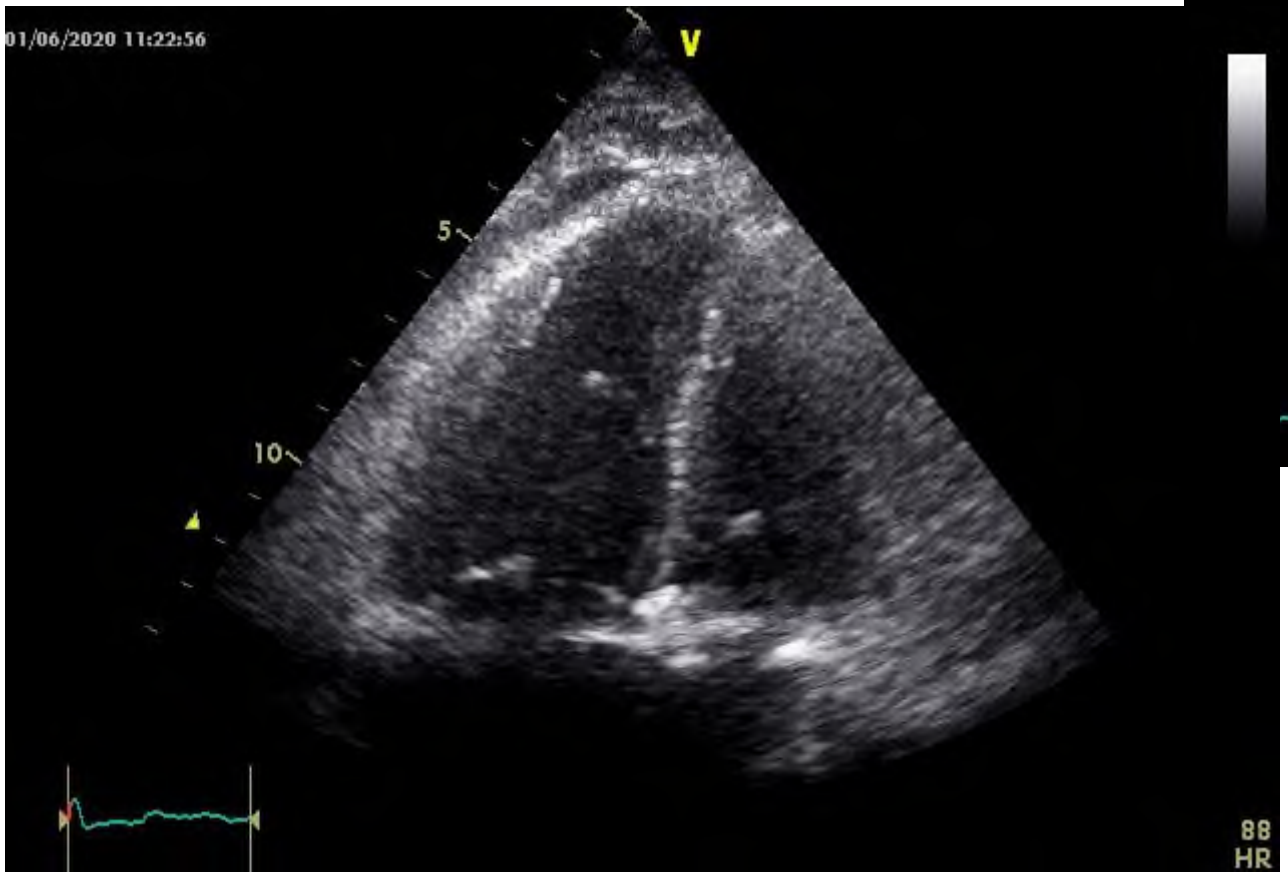
	Aortic Stenosis (n=1197)	Aortic Insufficiency (n=369)
Degenerative, %	81.9	50.3
Rheumatic, %	11.2	15.2
Congenital, %	5.4	15.2
Others, %	1.5	19.3
	1.5	16.2

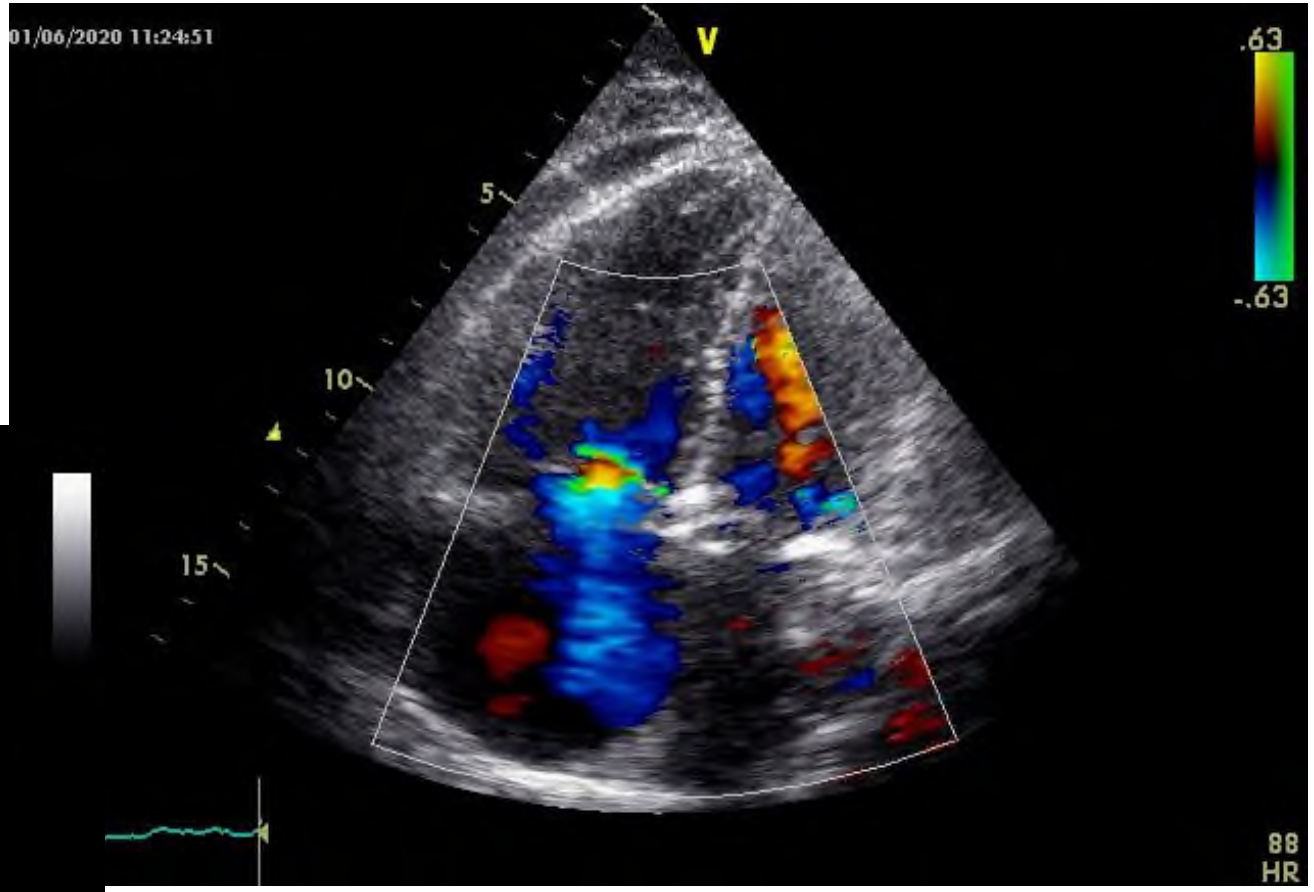



20/04/2023 11:57:21
ACE
V
5
10
15

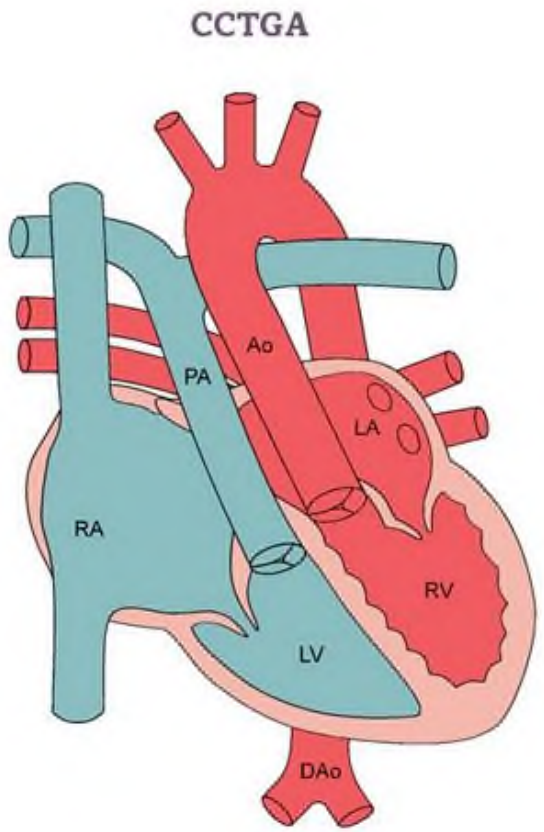

20/04/2023 11:57:35
ACE
Soft
.63
-.63
V
5
10
15
70
HR

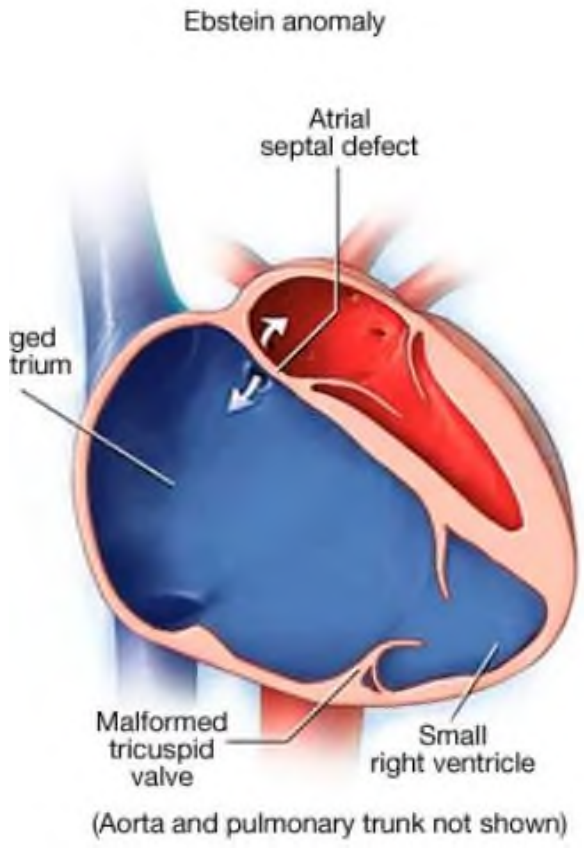
3. Valvular disease - TR

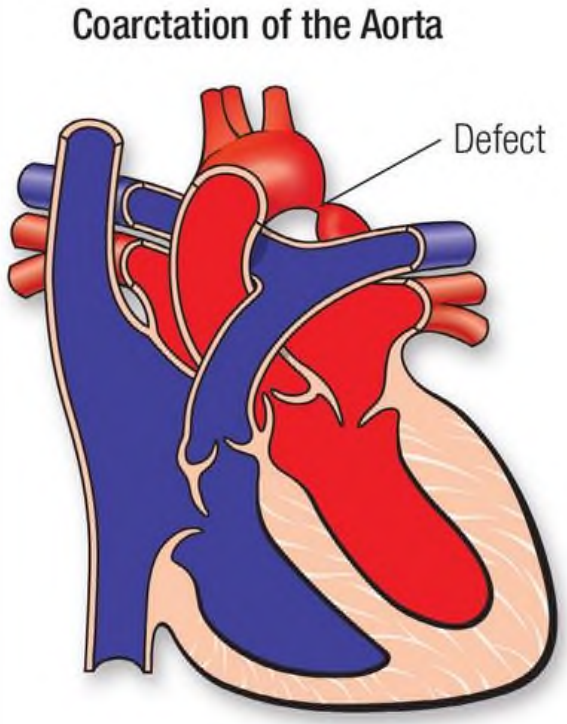


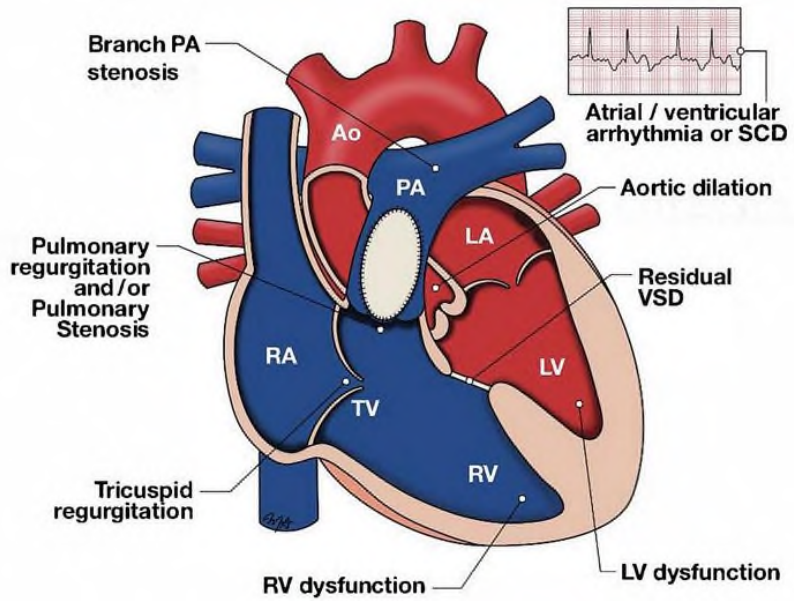


4. Congenital Heart Disease

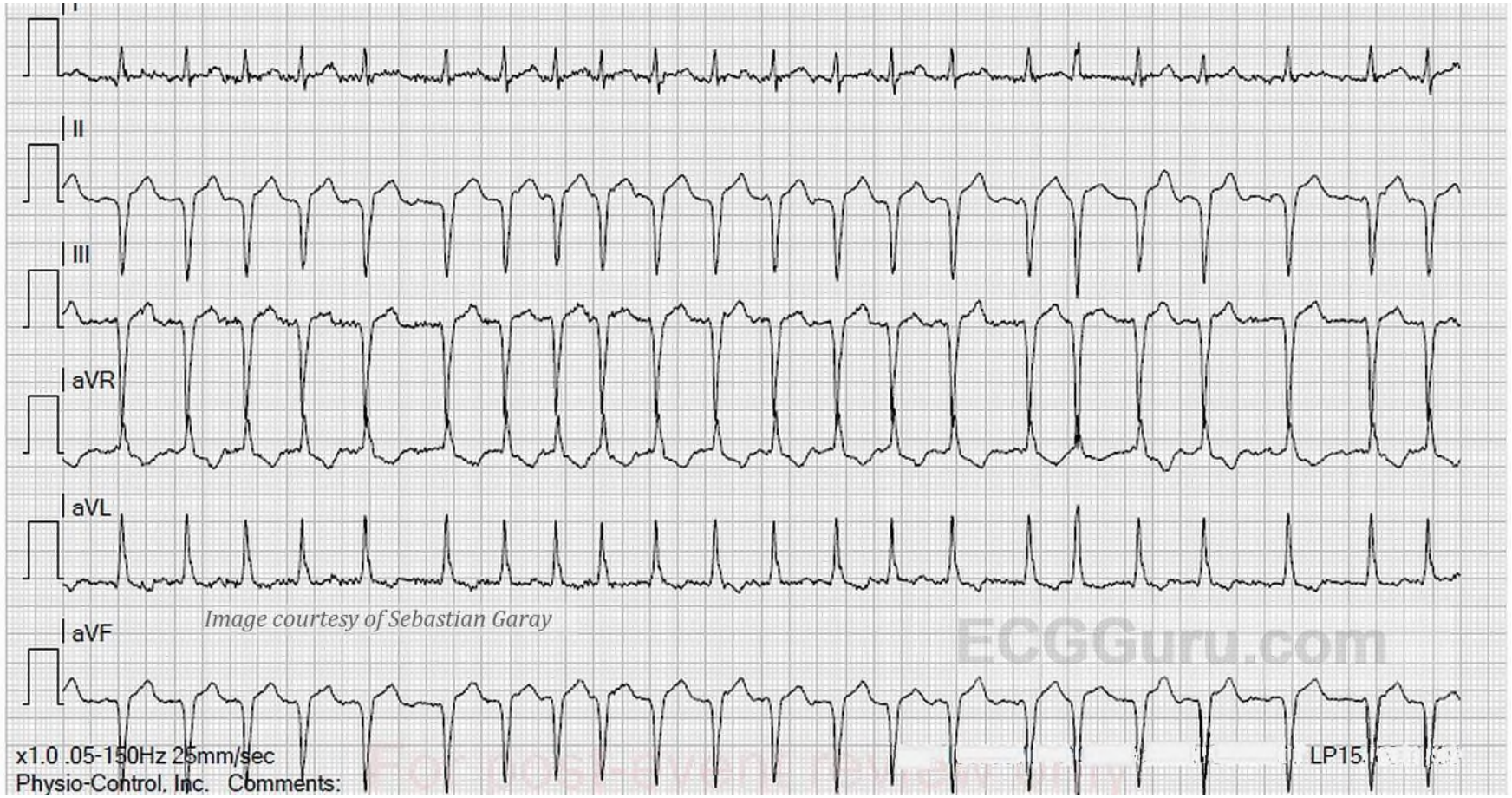








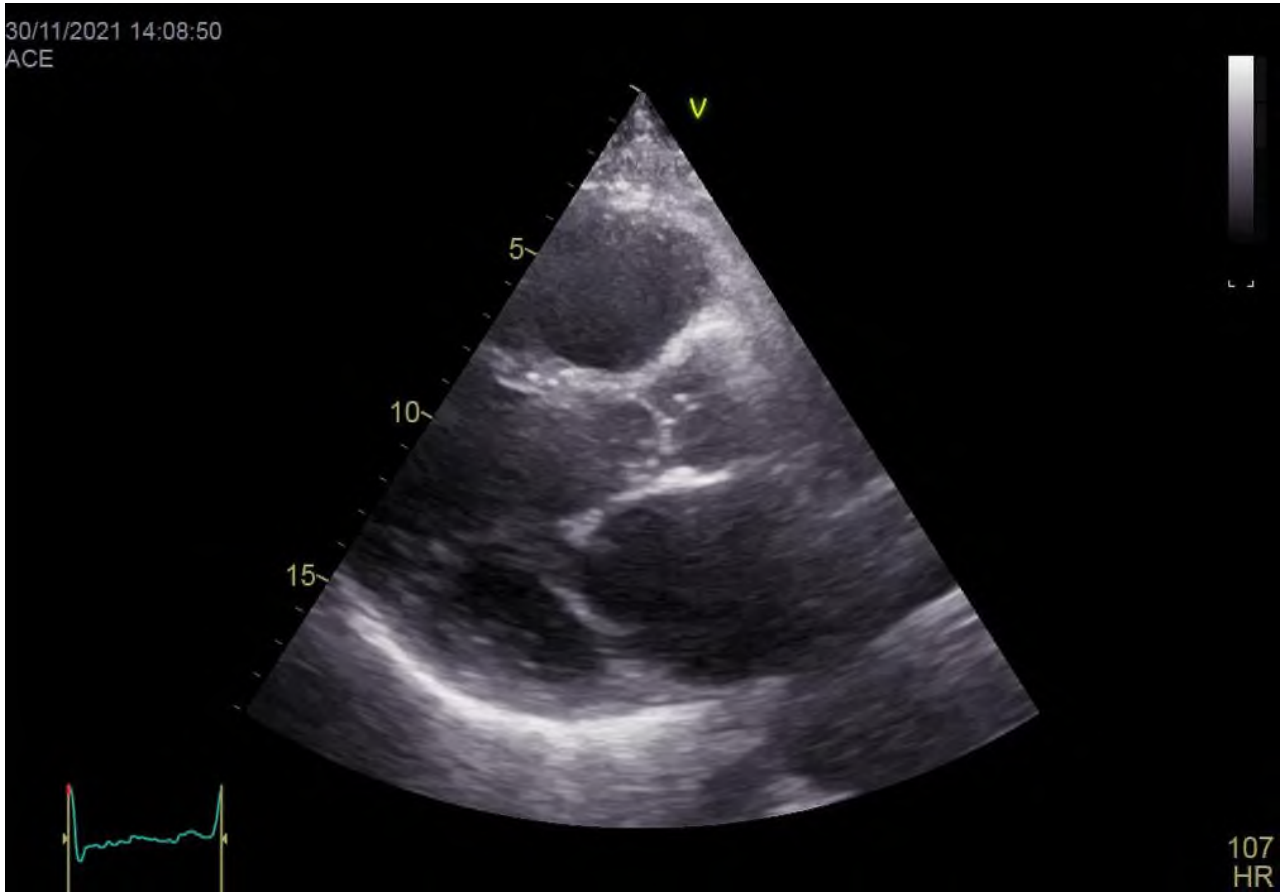
5. Tachyarrhythmias

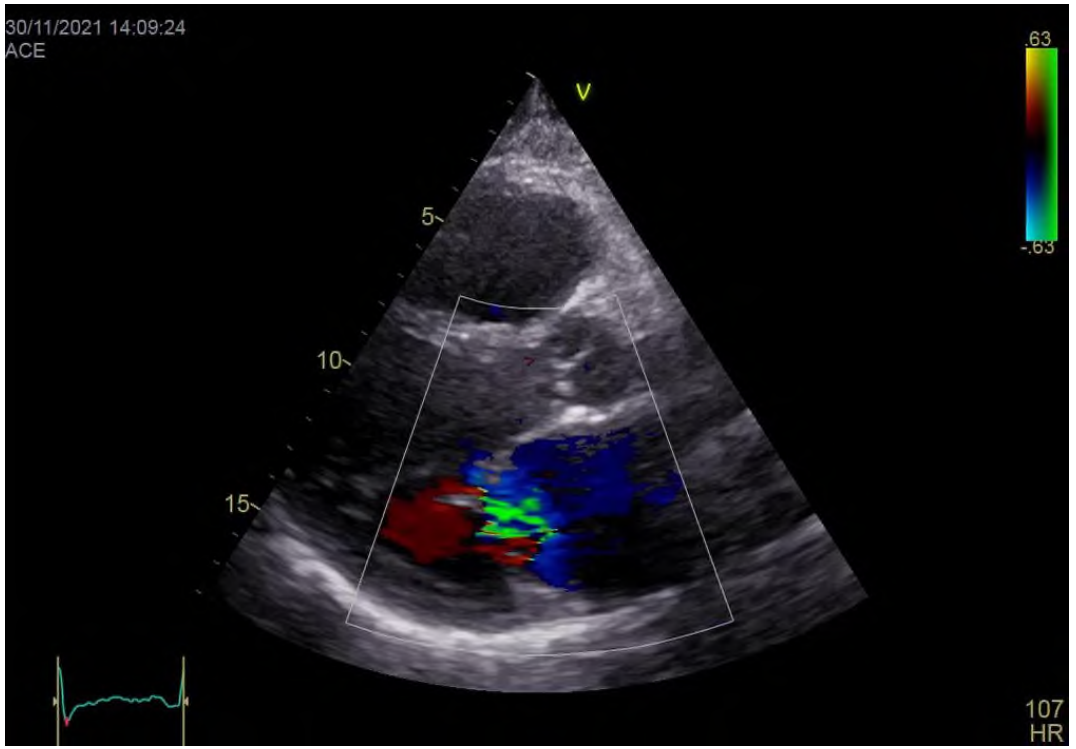


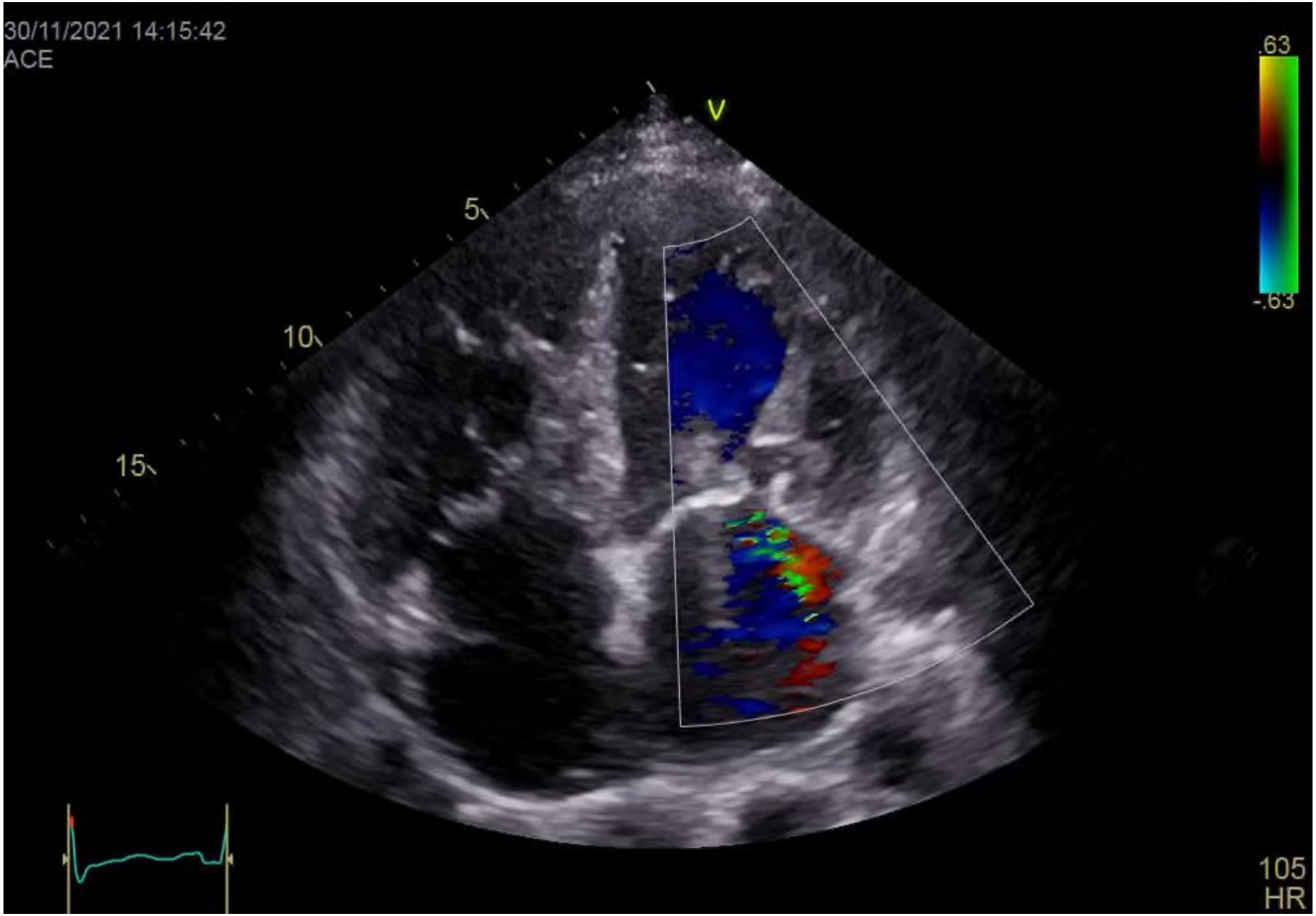
6. Bradycardia

7. Cardiomyopathies

- DCM



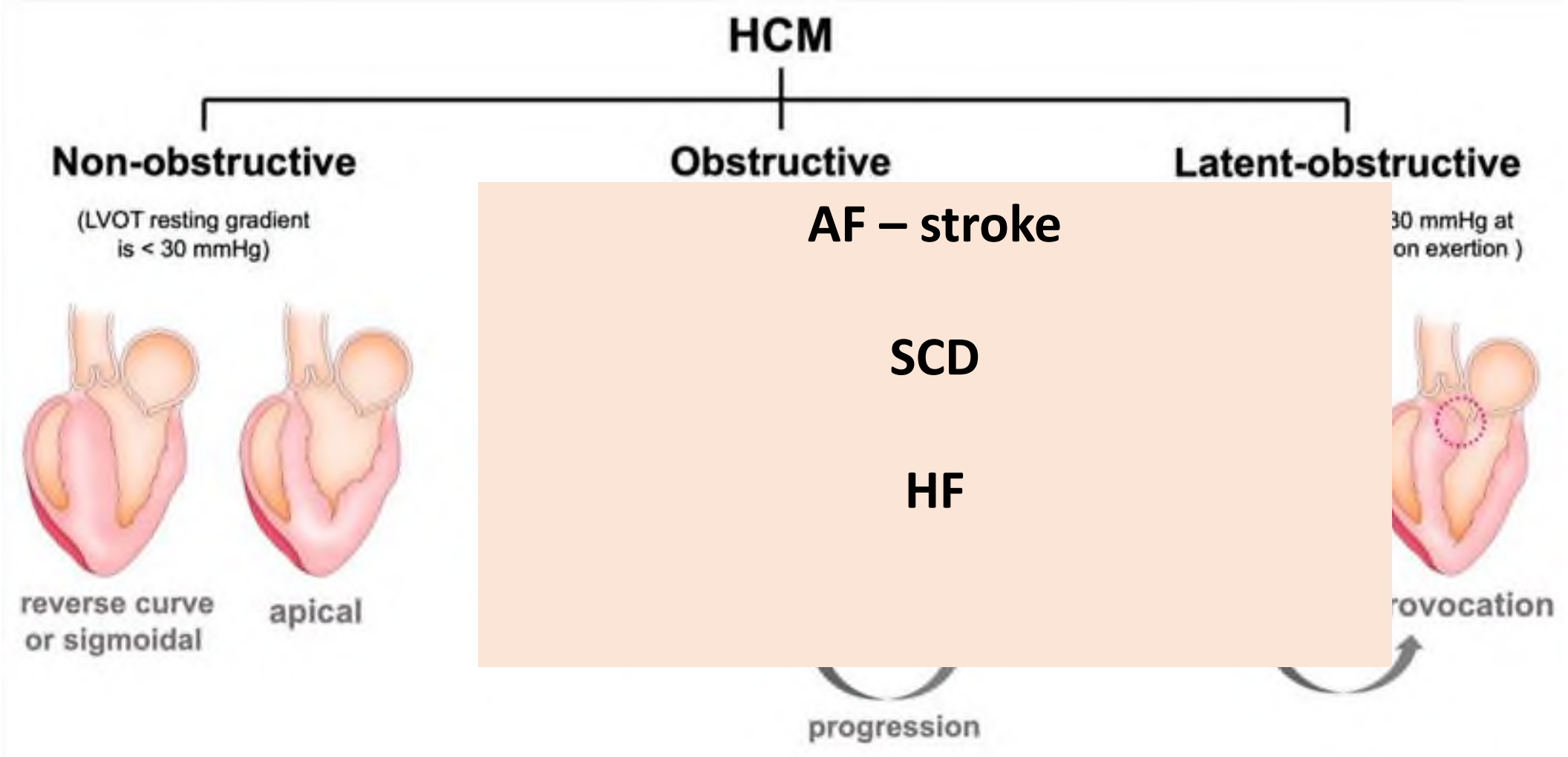



30/11/2021 14:15:42
ACE
V
5
10
15
.63
-.63
105
HR

DCM

- ***Post viral myocarditis***
- ***Idiopathic***
- ***Toxicity (chemotherapy, cocaine, ETOH, radiotherapy…)***
- ***Inherited***
- ***HIV***
- ***Post partum***

HCM

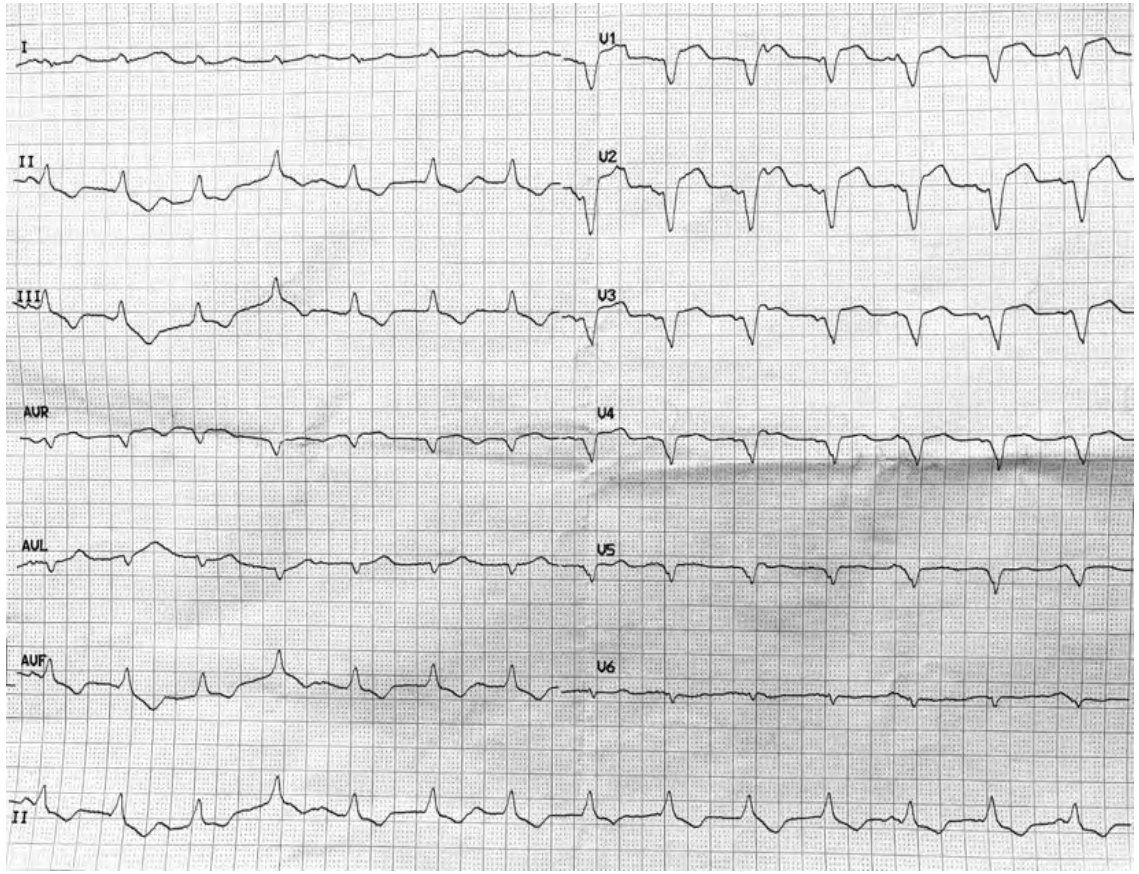


Kitai et a, J Card Dev 2022

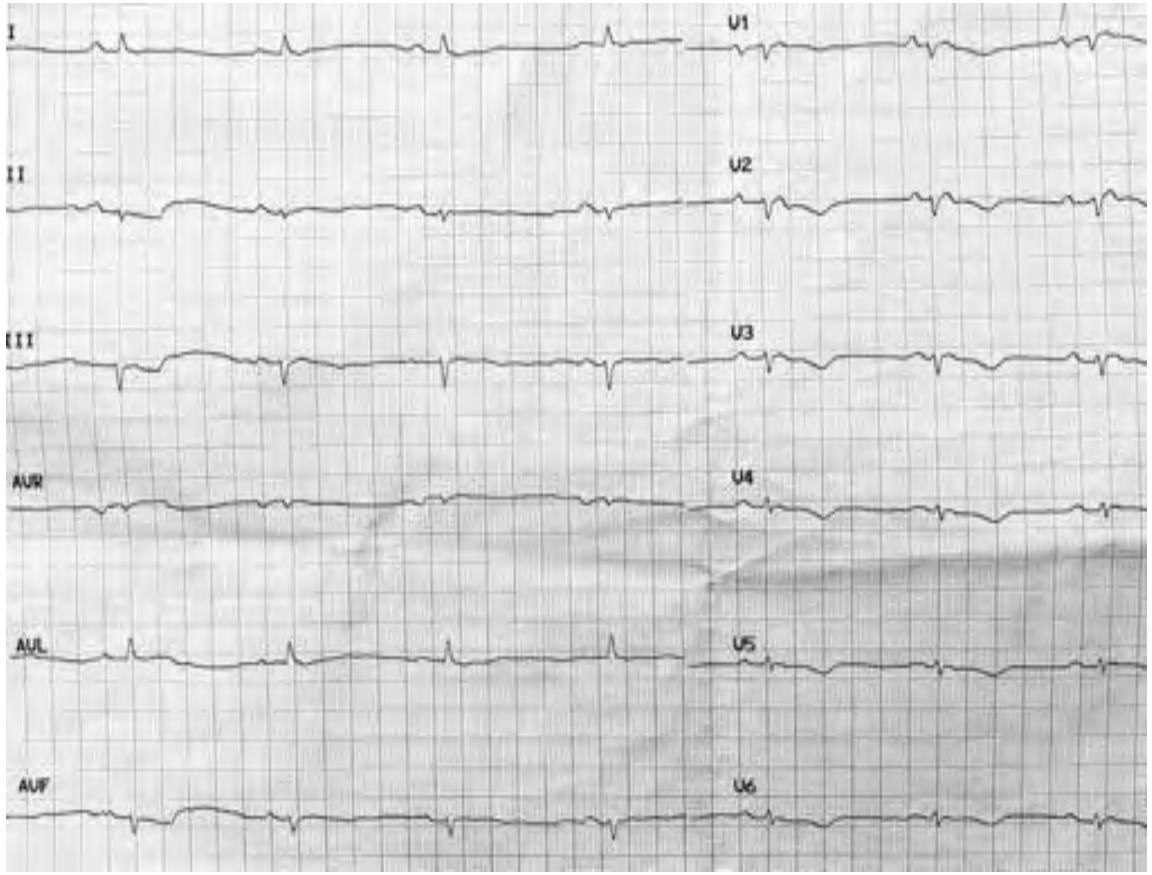
HCM phenocopies – storage diseases

- Fabry disease
- Hemochromatosis
- Glycogen storage disease

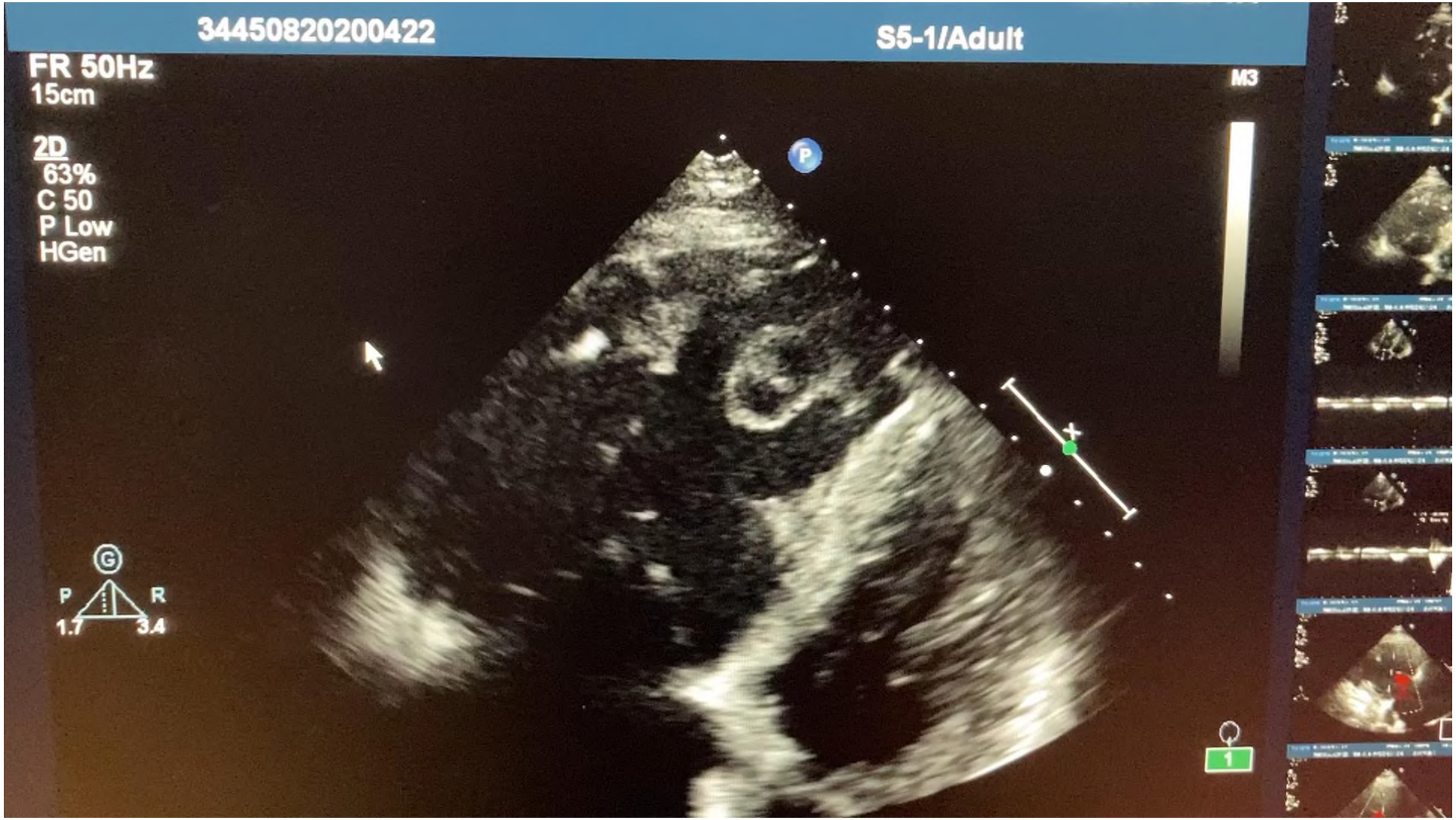
ECG : ARVC–VT (atrioventricular dissociation)



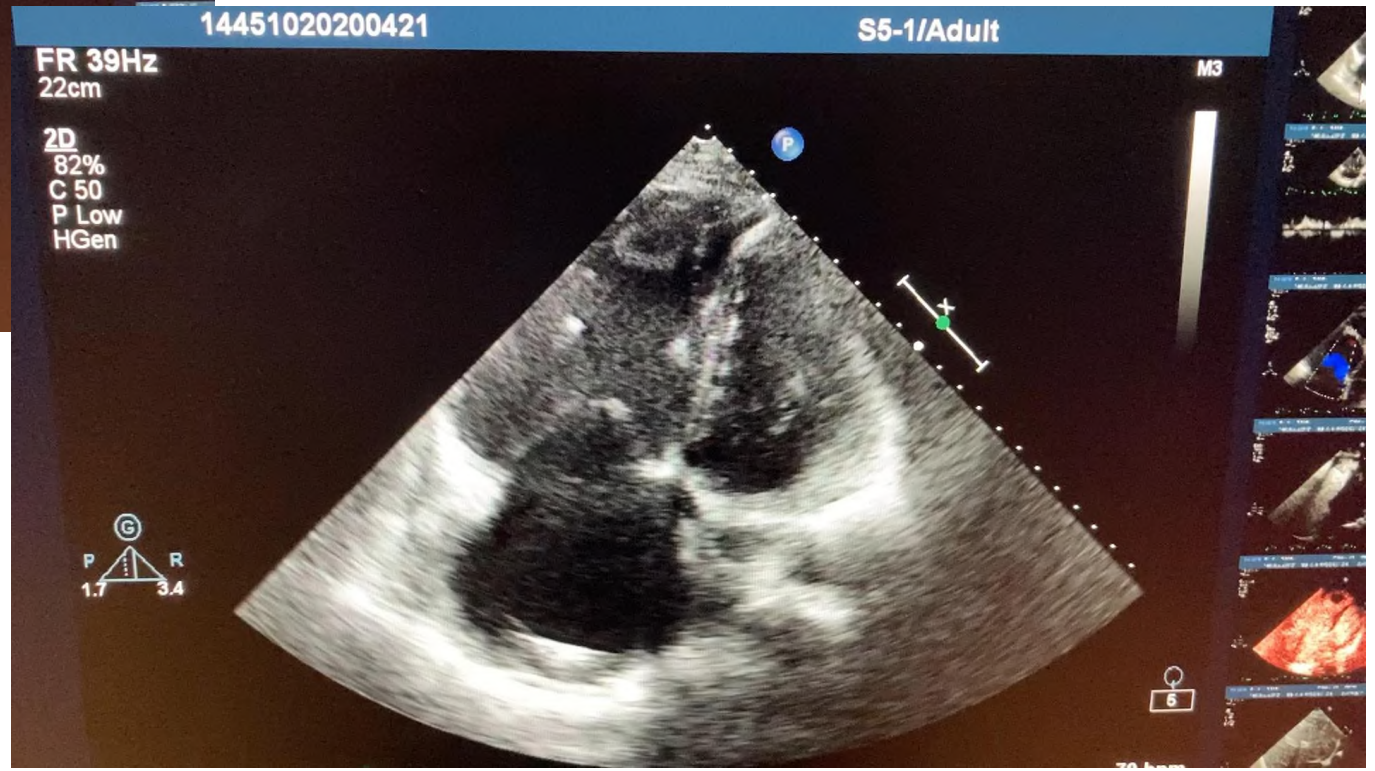
SR (negative T waves in right precordial leads)



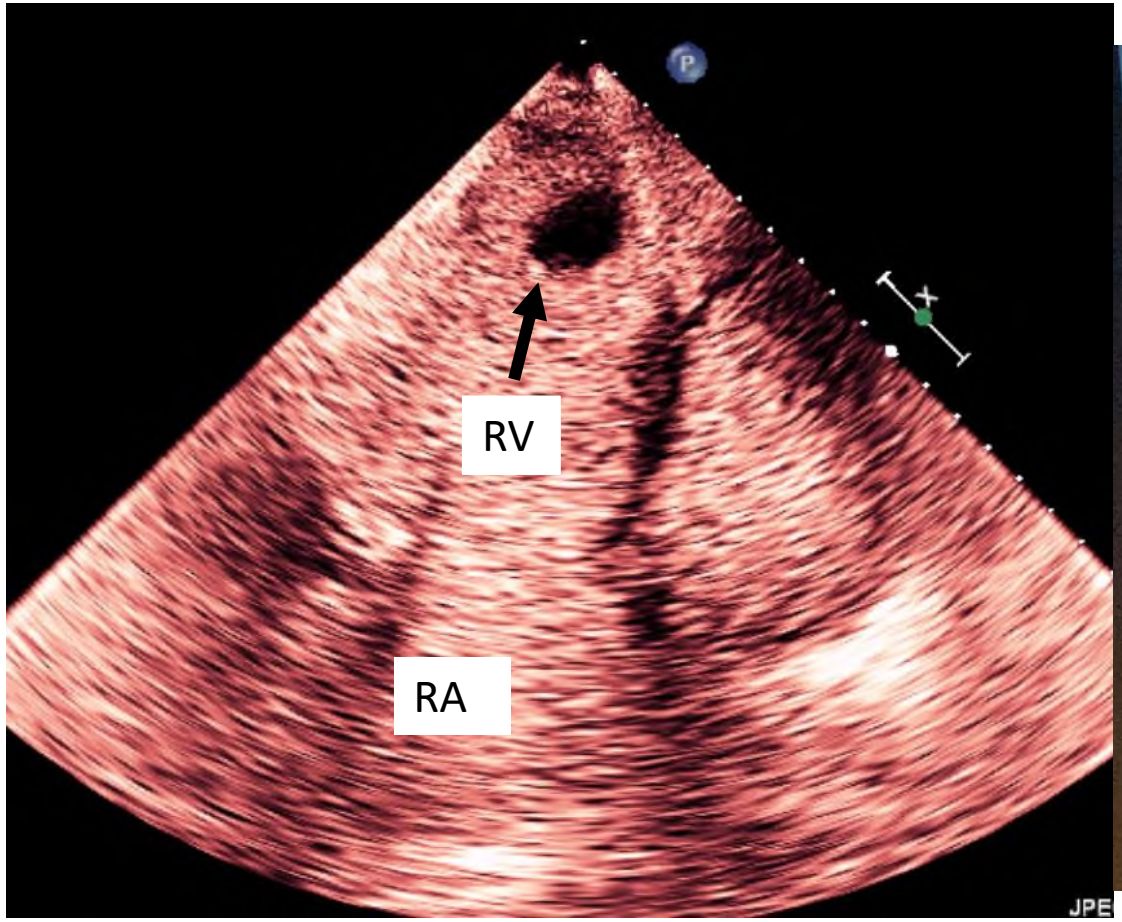
RV apex thrombus and basal free RV wall thrombus



Mobile apex thrombus (4x3.2cm)

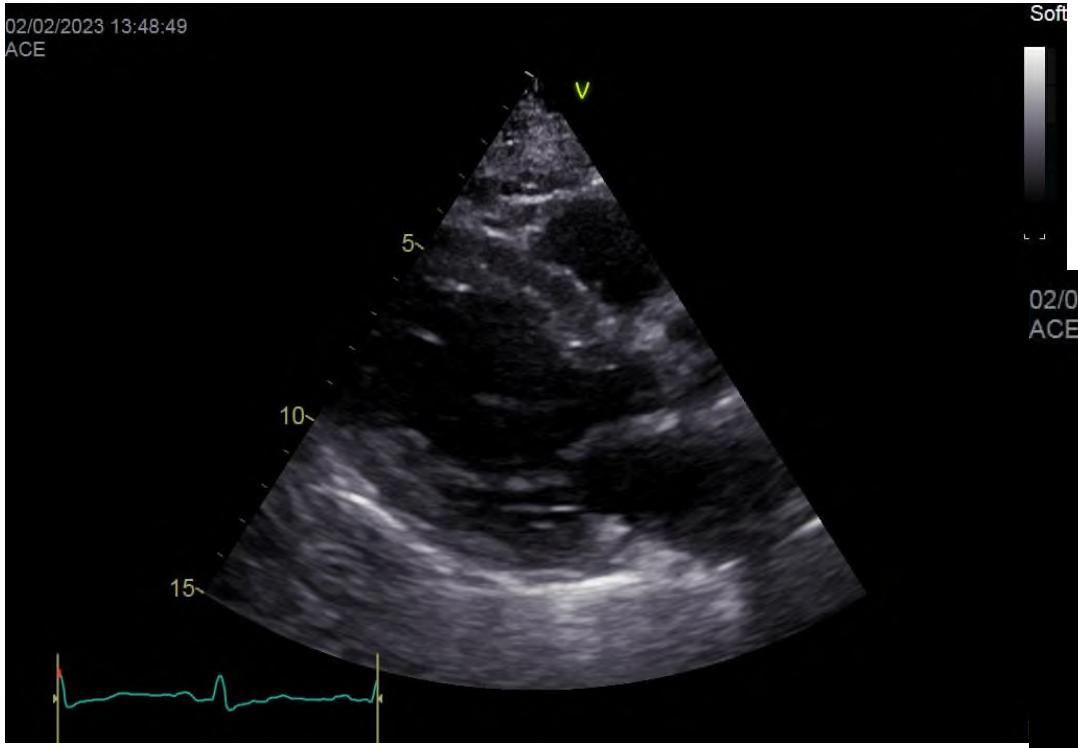


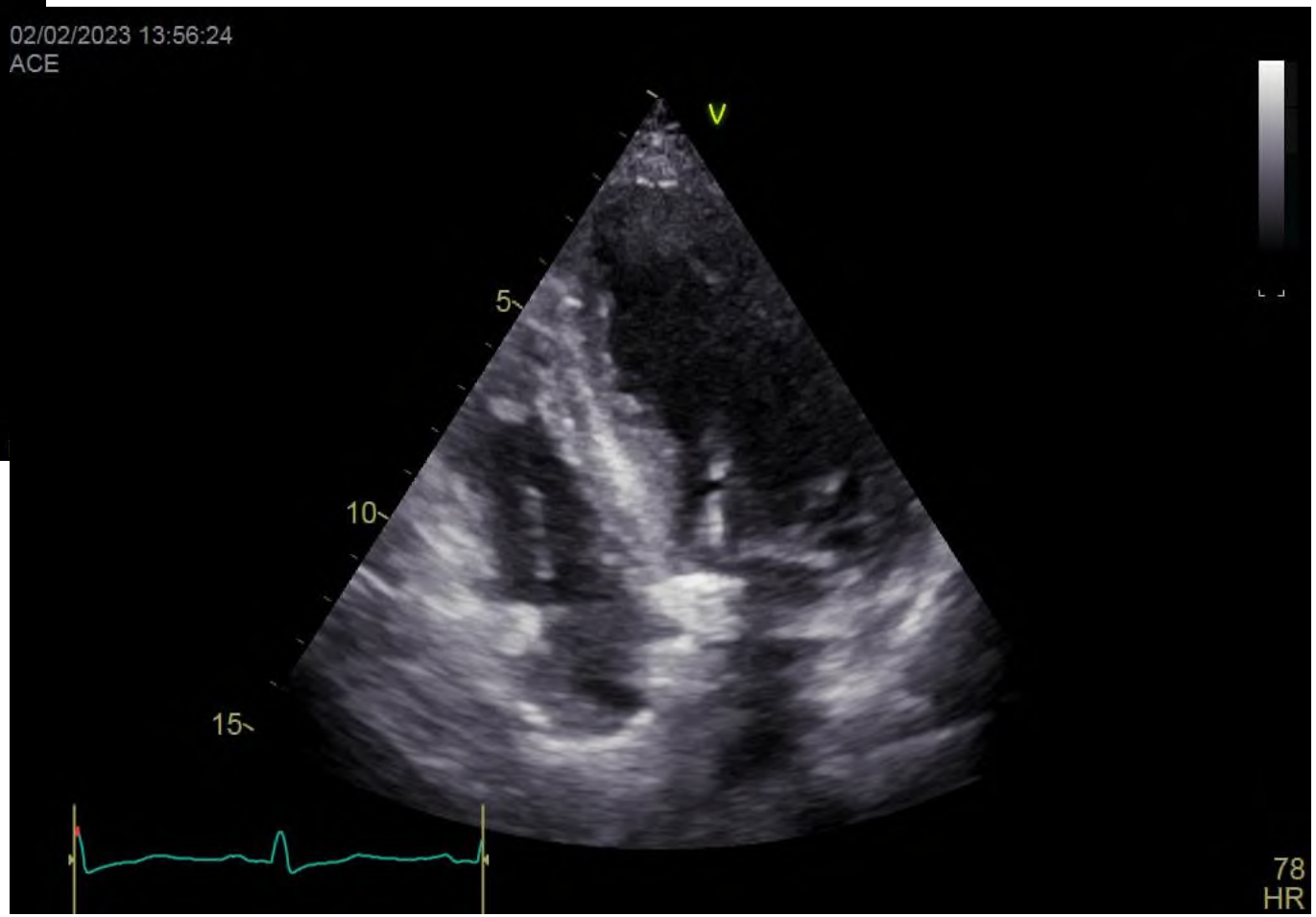
4CH view: The two thrombus (areas without contrast enhancement) were depicted at different sites (RV apex and tricuspid valve annulus) using contrast echo



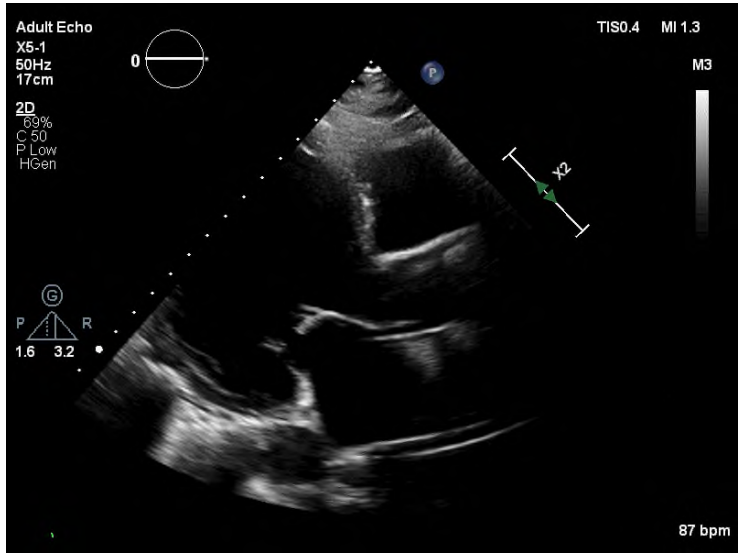
8. Infiltrative diseases

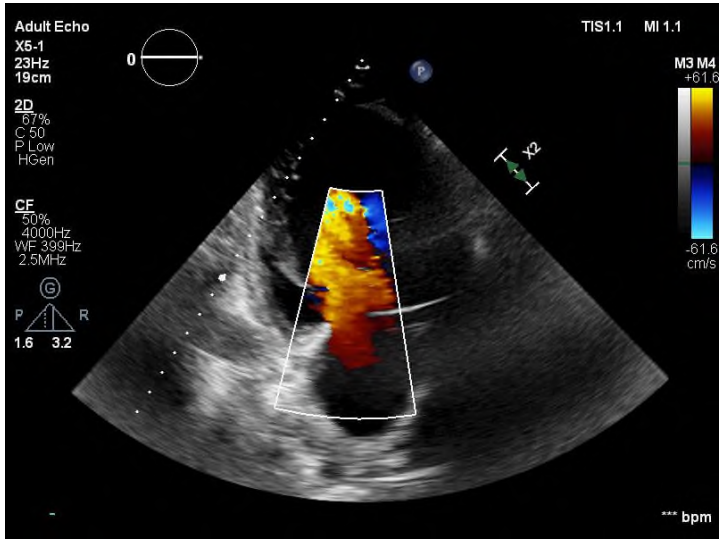
- Amyloid
- Sarcoidosis
- Neoplastic

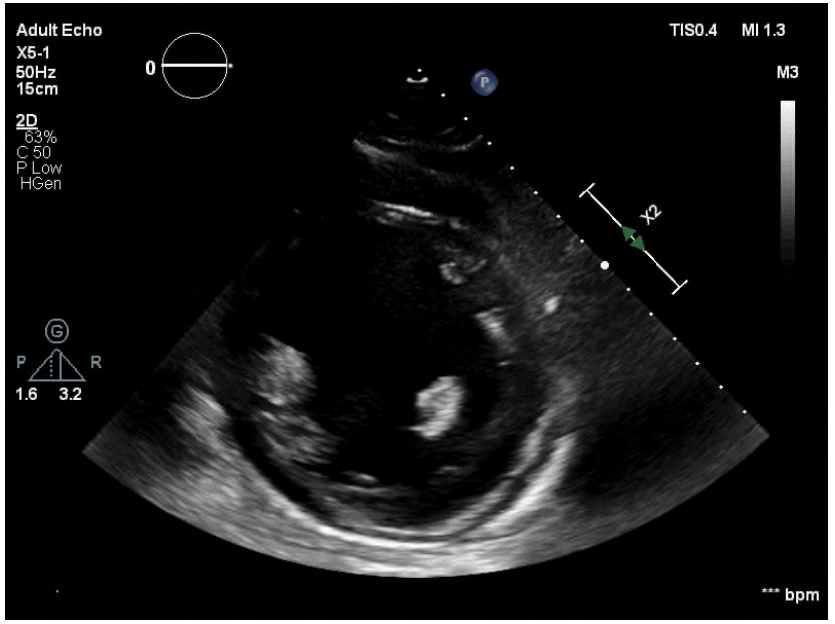

02/02/2023 13:48:49
ACE
Soft
V
5
10
15

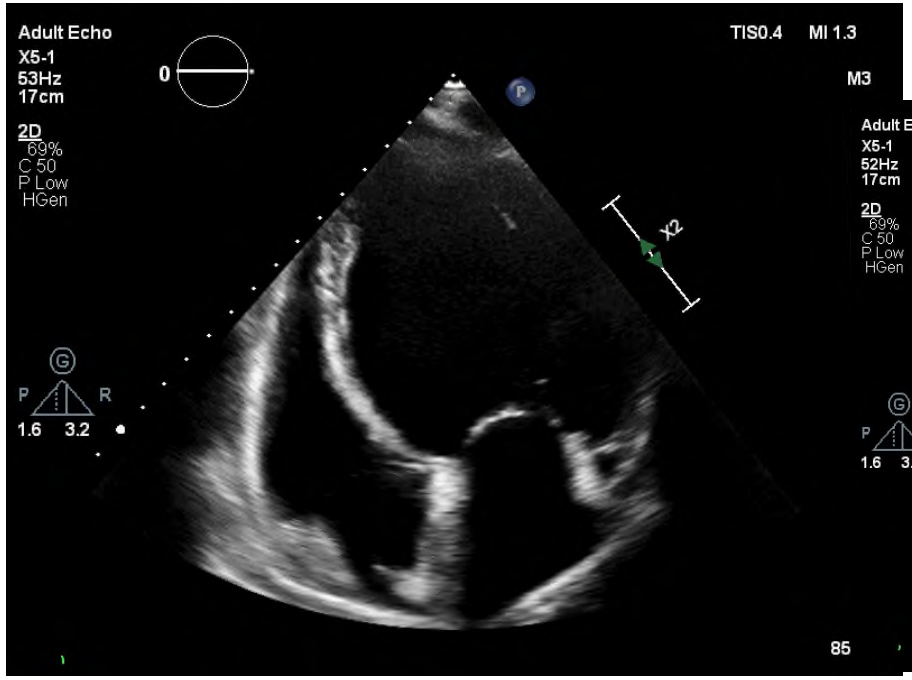

02/02/2023 13:56:24
ACE
V
5
10
15
78
HR

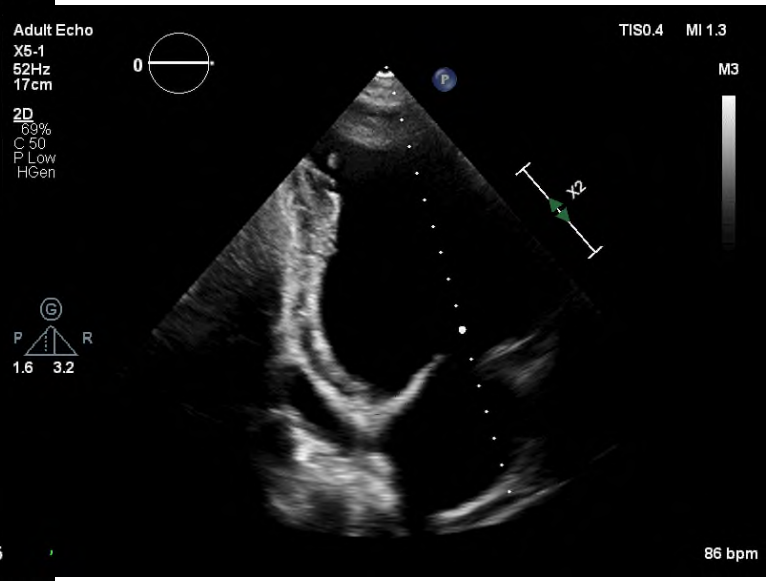

aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

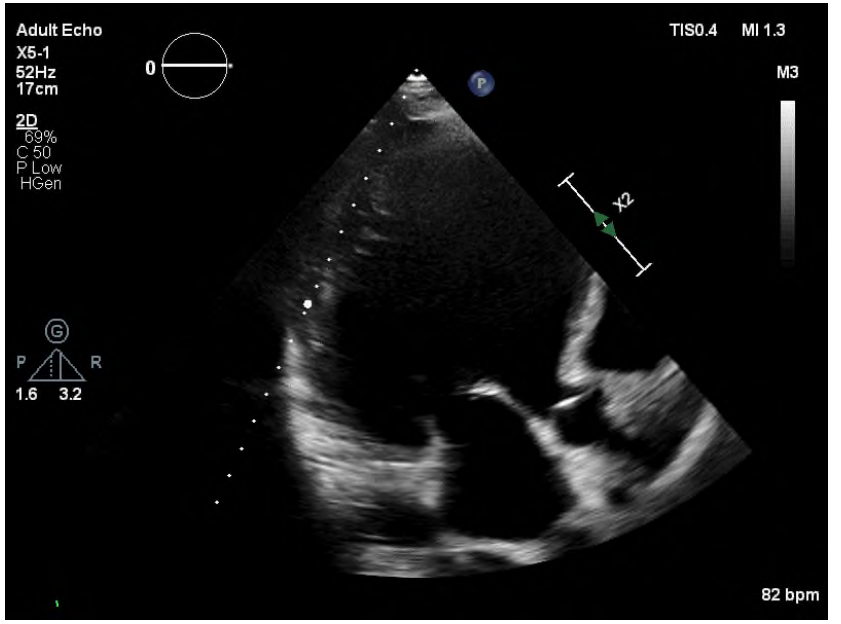

Adult Echo
X5-1
50Hz
17cm
2D
69%
C 50
P Low
HGen
TIS0.4 MI 1.3
M3
1.6 3.2
87 bpm

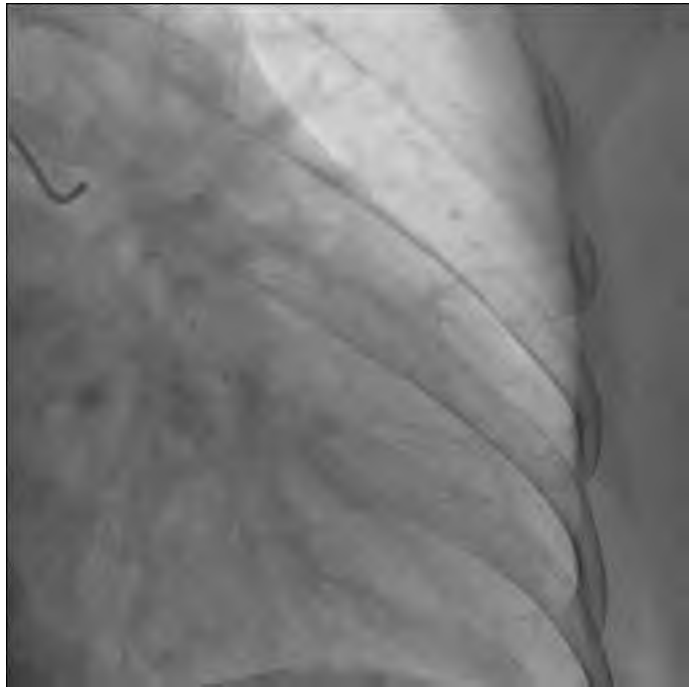

Adult Echo
X5-1
23Hz
19cm
2D
67%
C 50
P Low
HGen
CF
50%
4000Hz
WF 399Hz
2.5MHz
TIS1.1 MI 1.1
M3 M4
+61.6
-61.6
cm/s
1.6 3.2
*** bpm

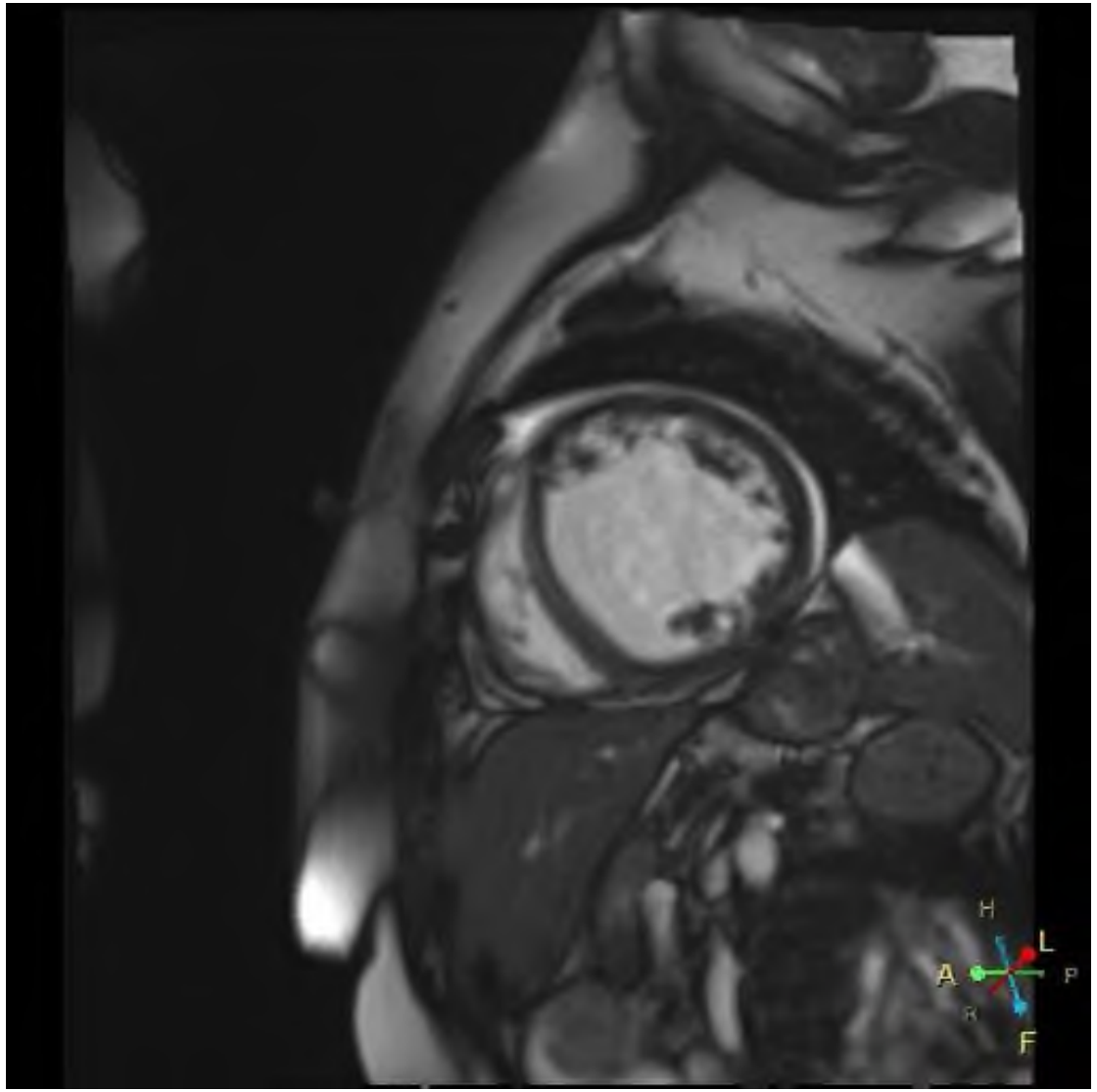

Adult Echo
X5-1
50Hz
15cm
2D
63%
C 50
P Low
HGen
TIS0.4 MI 1.3
M3
1.6 3.2
*** bpm

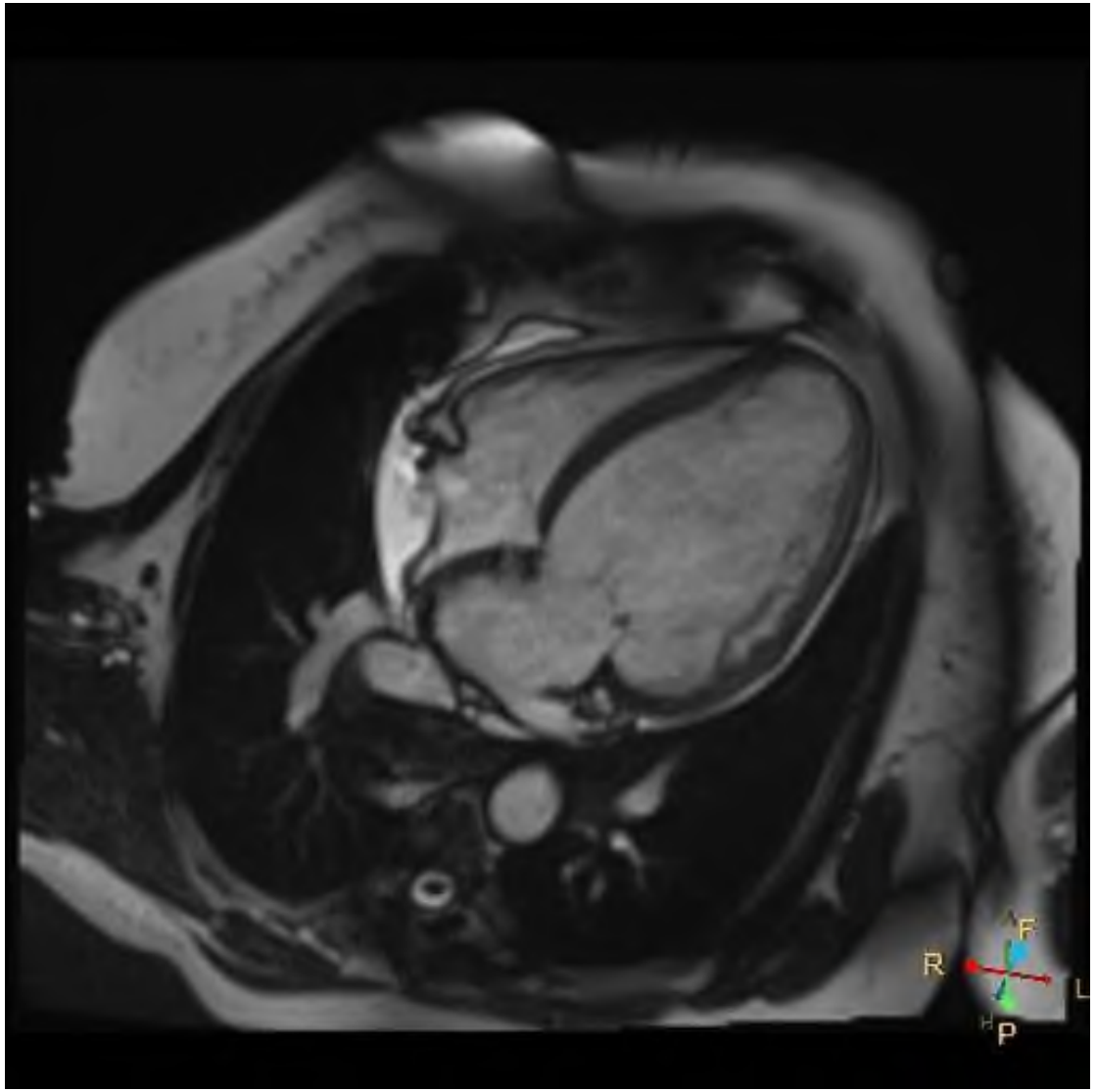

Adult Echo
X5-1
53Hz
17cm
2D
69%
C 50
P Low
HGen
TIS0.4 MI 1.3
M3
1.6 3.2
85

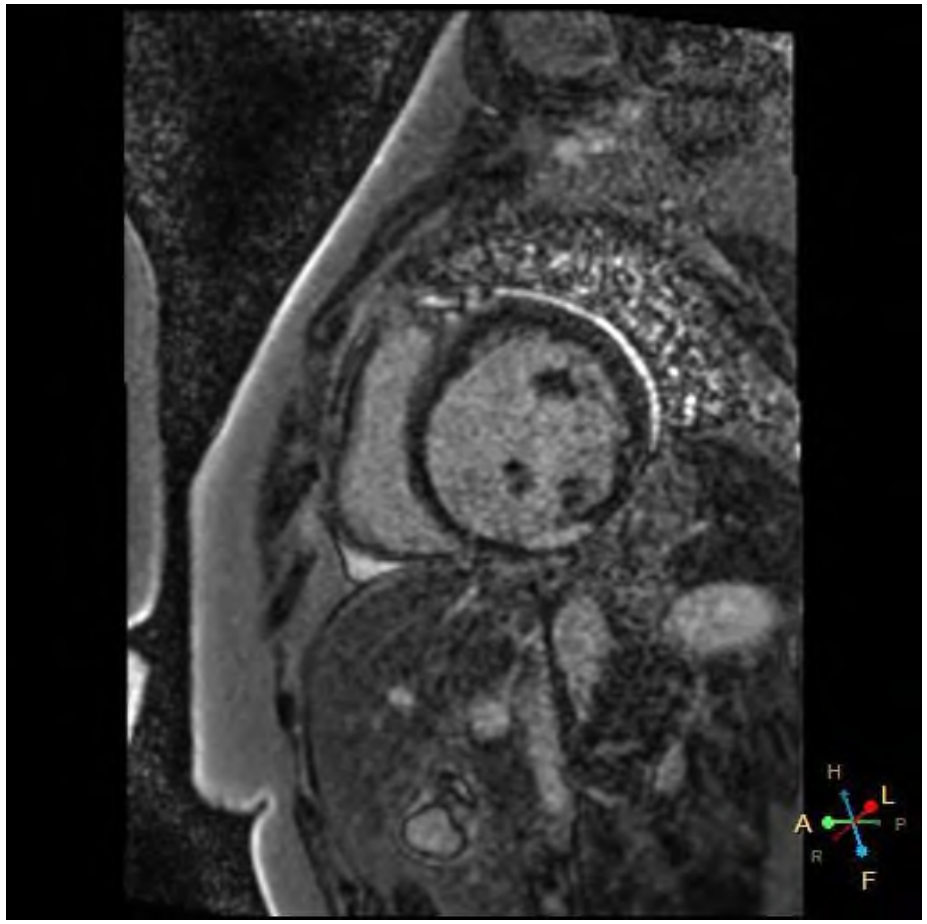

Adult Echo
X5-1
52Hz
17cm
2D
69%
C 50
P Low
HGen
TIS0.4 MI 1.3
M3
1.6 3.2
86 bpm

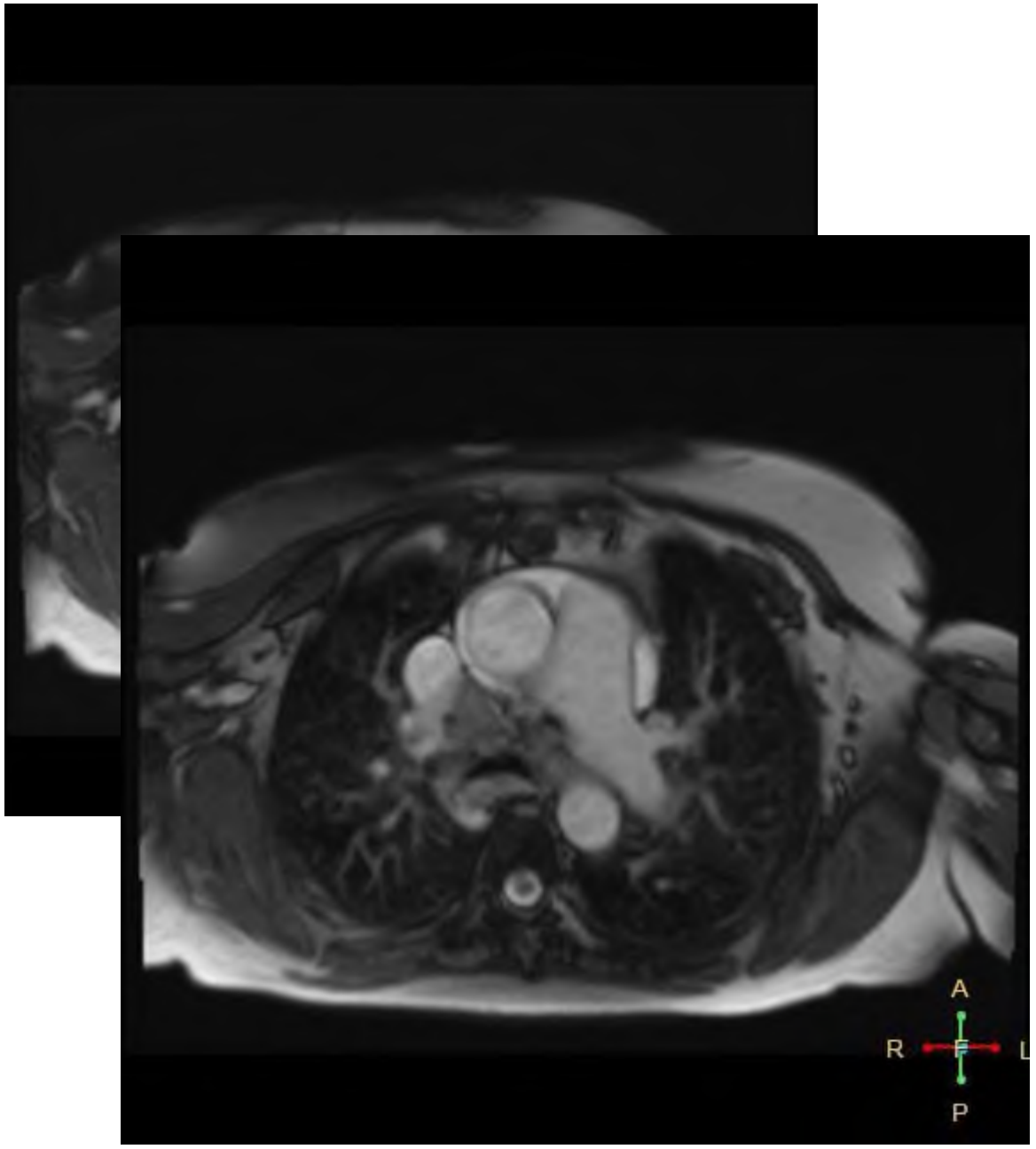

Adult Echo
X5-1
52Hz
17cm
2D
69%
C 50
P Low
HGen
TIS0.4 MI 1.3
M3
1.6 3.2
82 bpm

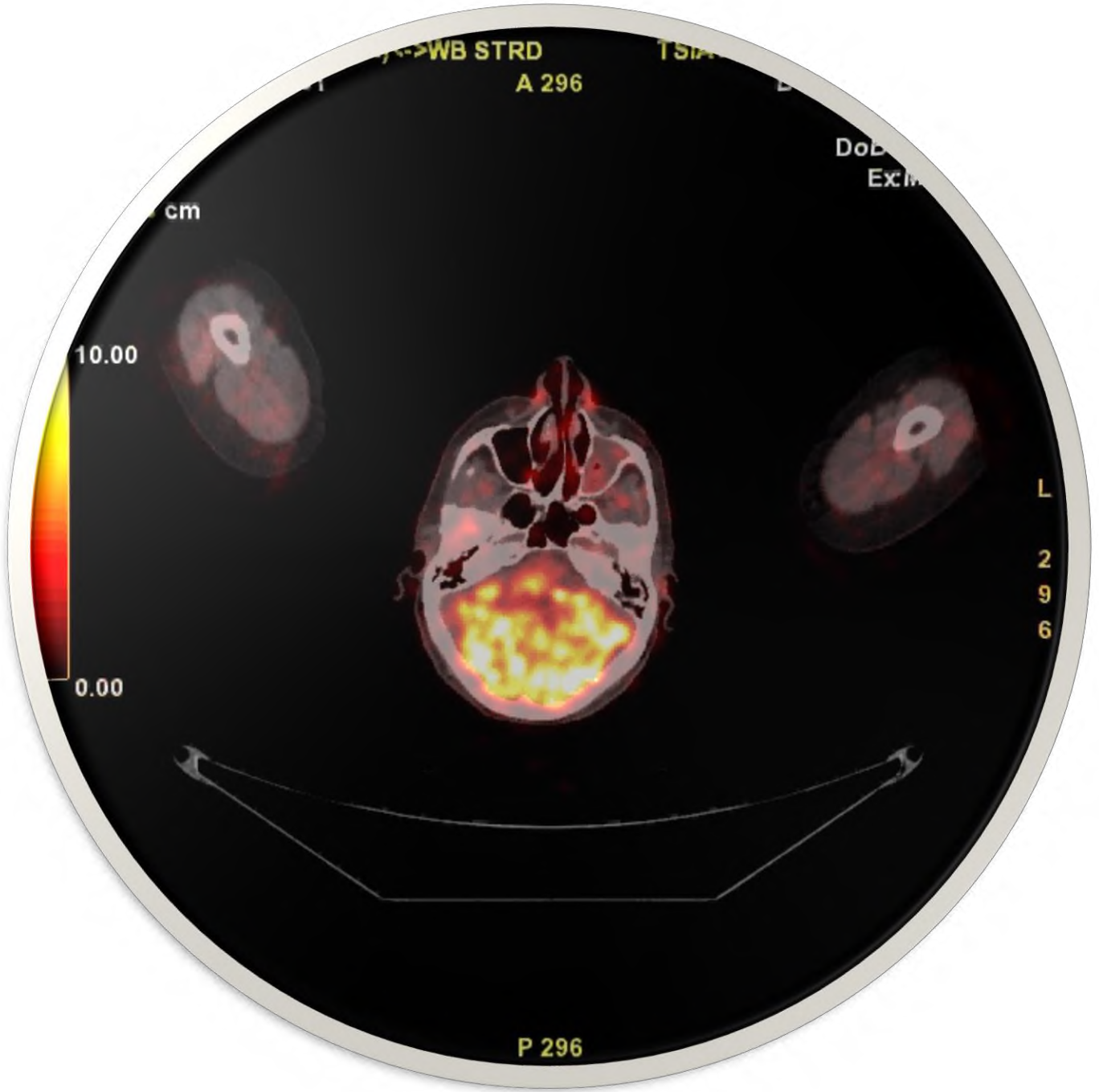



H
L
A
P
R
F


F
R
L
H
P


H
L
A
P
R
F


A
R
L
P


WB STRD
A 296
cm
10.00
0.00
L
2
9
6
P 296

Cardiac sarcoidosis

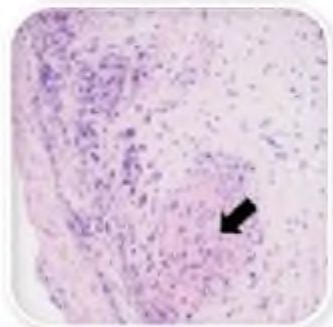
Pathogenesis

- Unknown environmental triggers
- Genetic predisposition
- Granulomas → fibrotic scarring

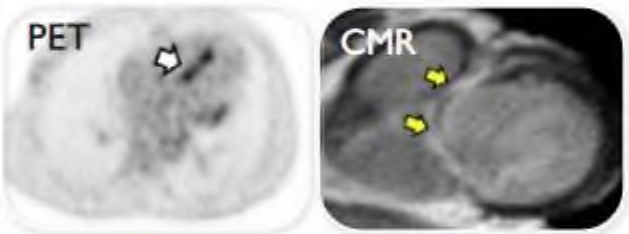
Main manifestations

- Subclinical cardiomyopathy
- Atrio-ventricular block
- Ventricular tachycardia (VT)
- Heart failure

Diagnostic biopsy

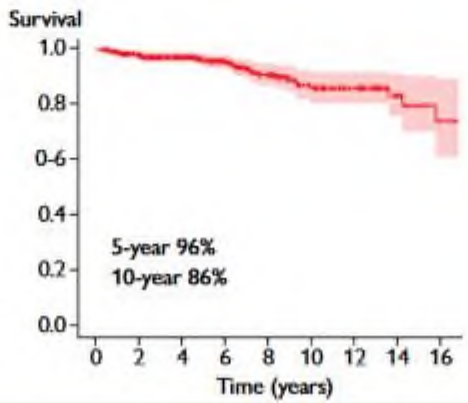


Diagnostic imaging



Therapy

- Tiered immunosuppression
- Treatment of arrhythmias and heart failure
- Consideration of an ICD to prevent SCD



Factors predictive of worse outcome

- Extent of myocardial involvement (several indices)
- Presentation with VT or heart failure
- *De novo* or *clinically isolated* cardiac involvement
- Definite vs. probable diagnosis

Lehtonen et al, EHJ 2023

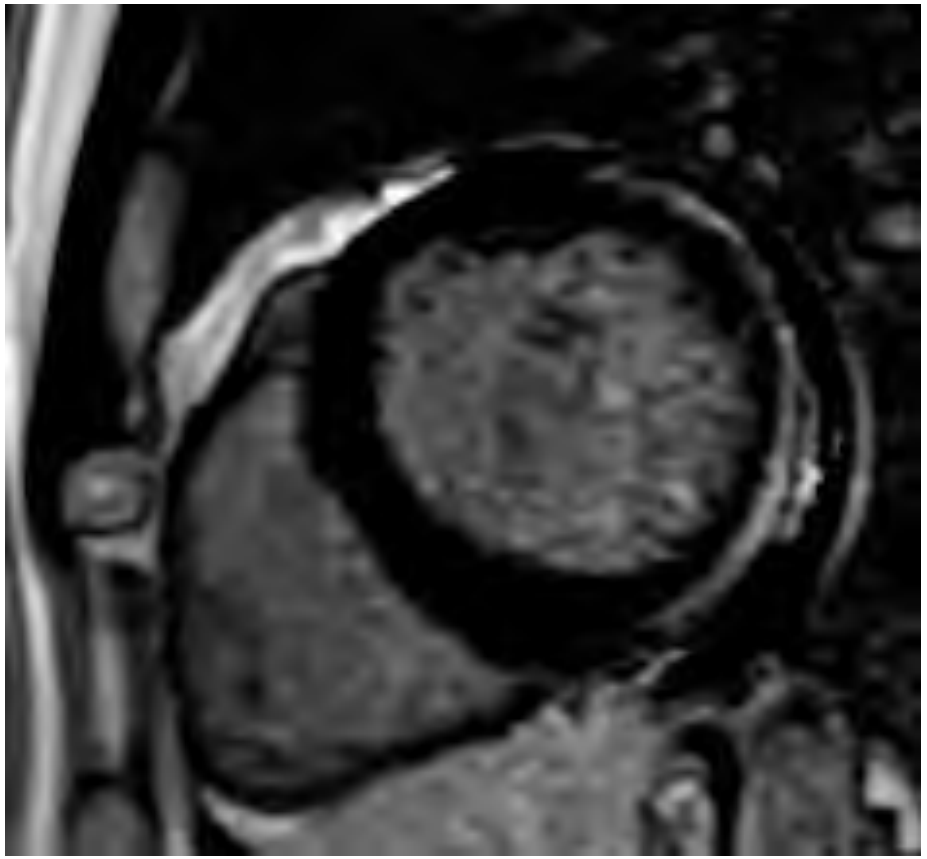
Other

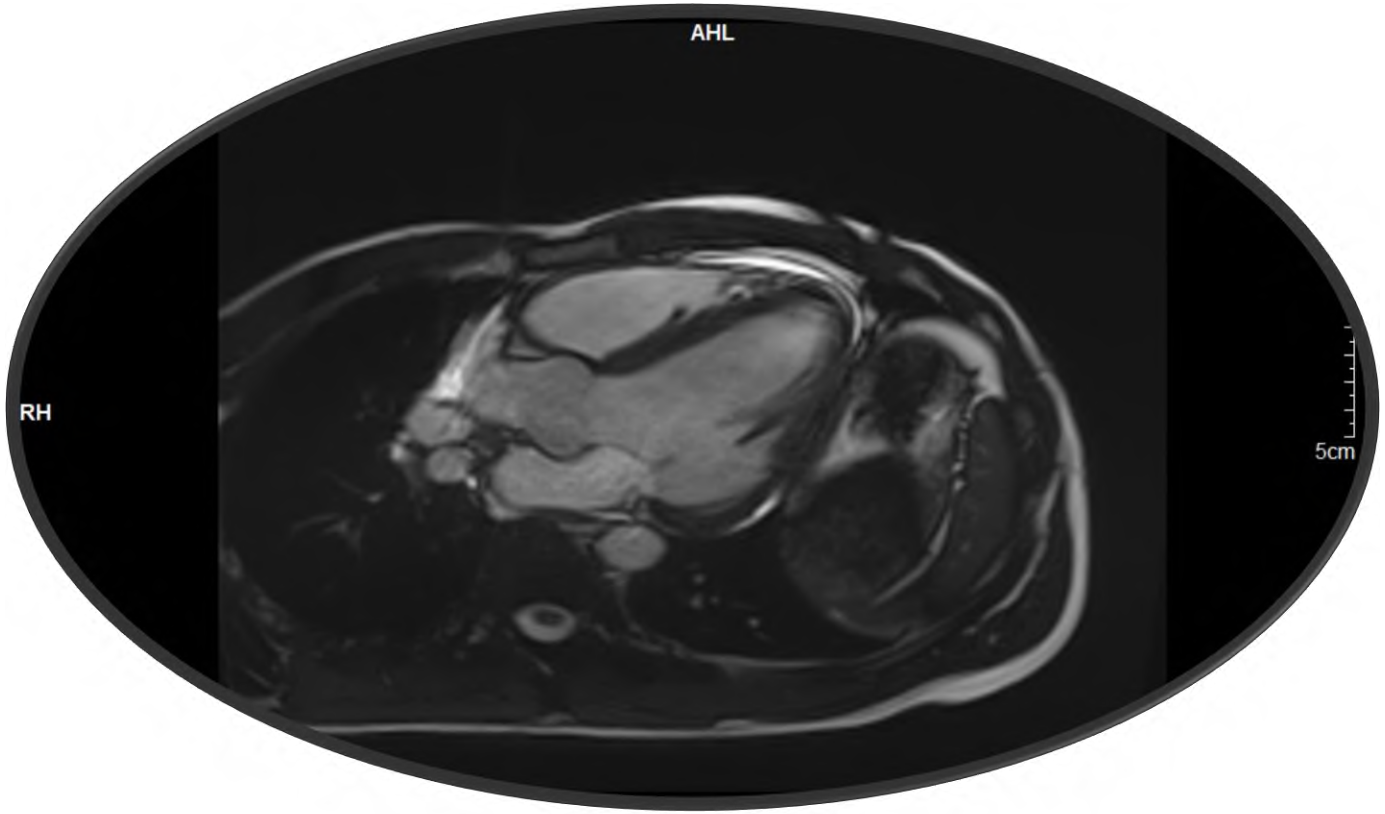
9. Pericardial disease
    - Calcification
    - Infiltrative
10. Endomyocardial disease
    - Radiotherapy
    - Endomyocardial fibrosis
    - Carcinoid
11. Neuromuscular disease
    - Friedreich’s ataxia
    - Muscular dystrophy

12. Metabolic diseases

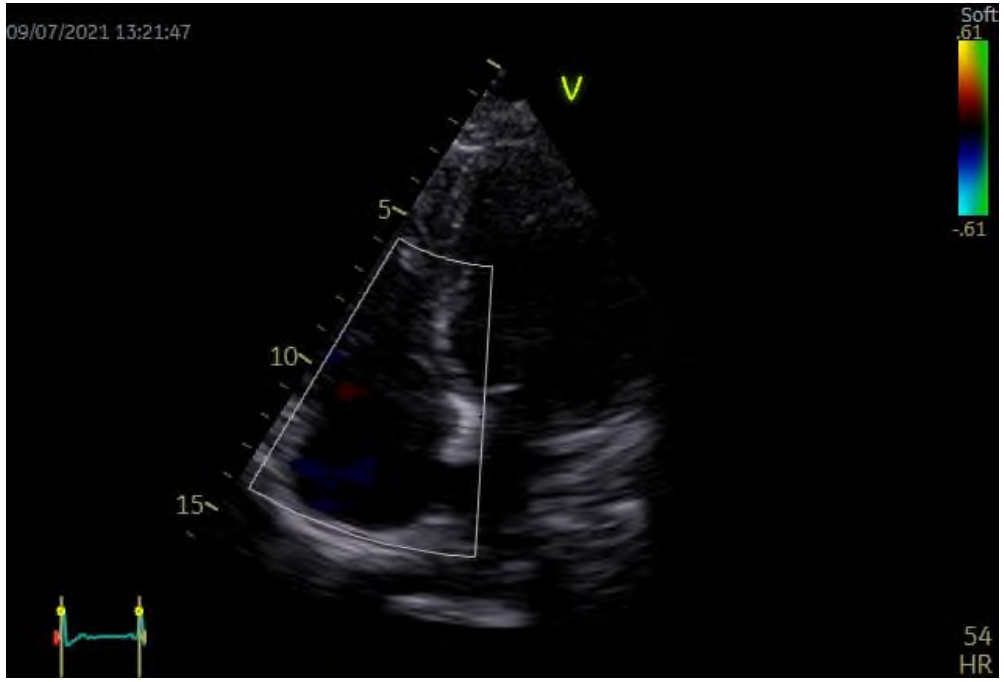
- Thyroid disease
- Autoimmune diseases

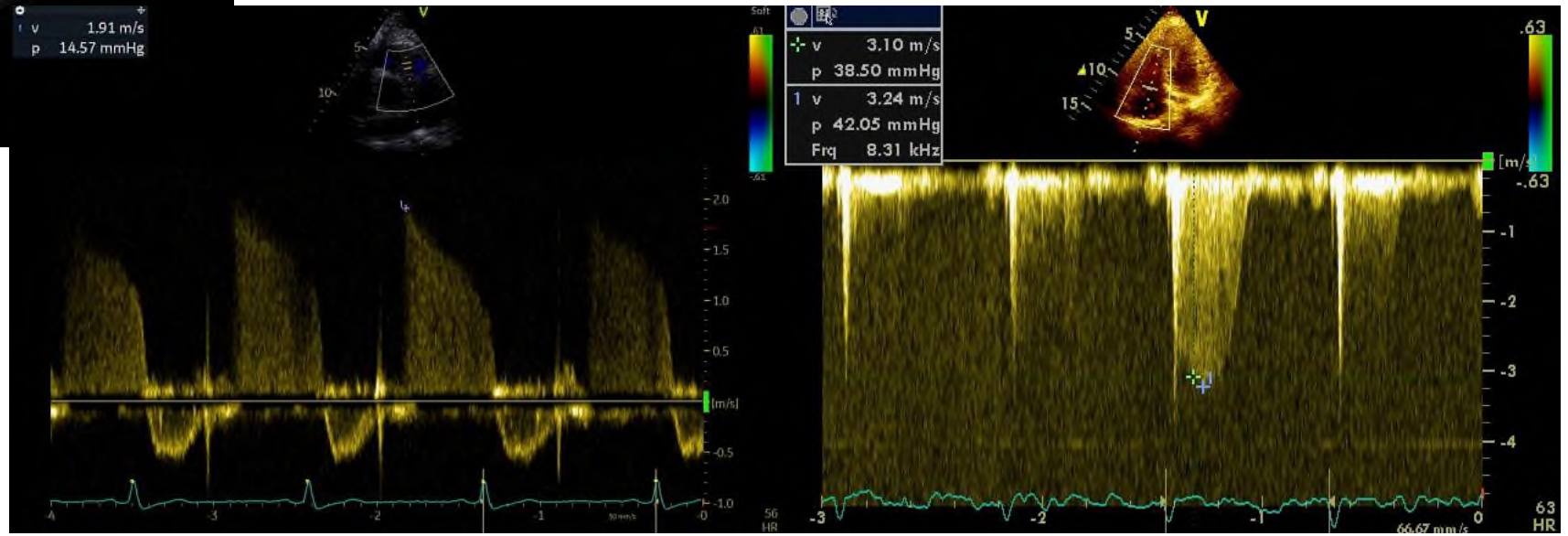
SLE

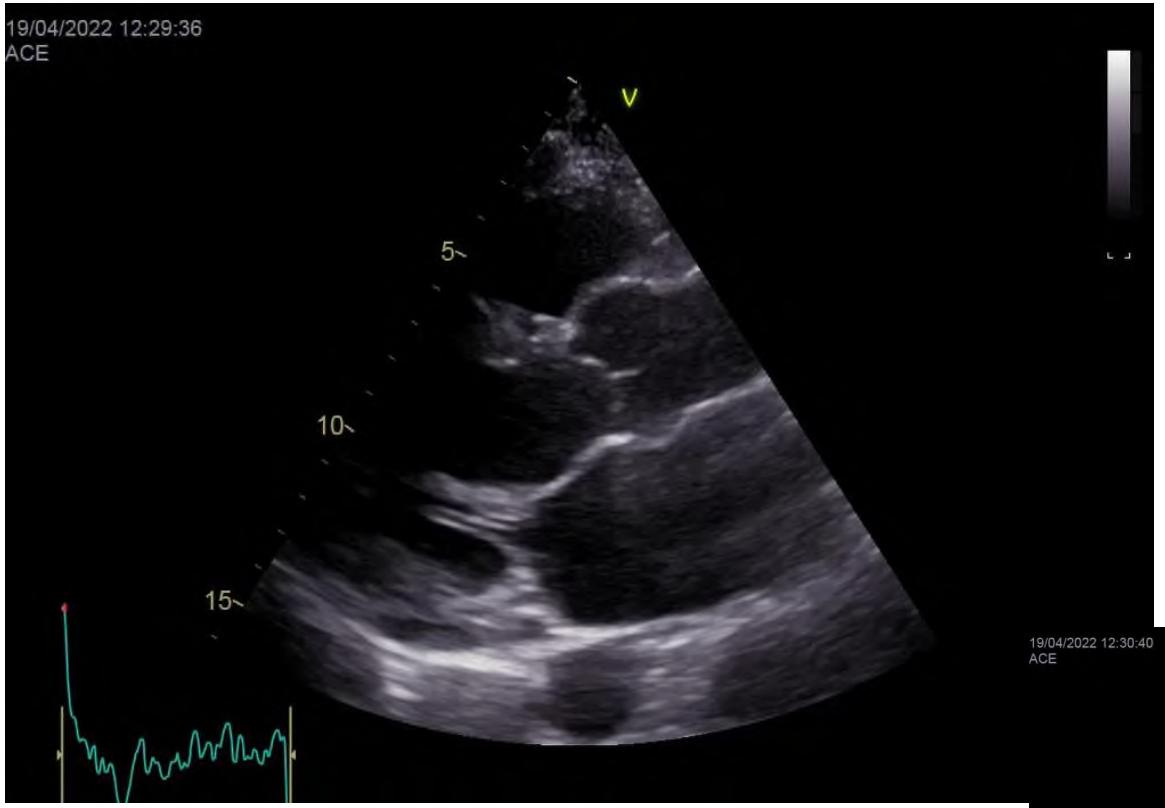


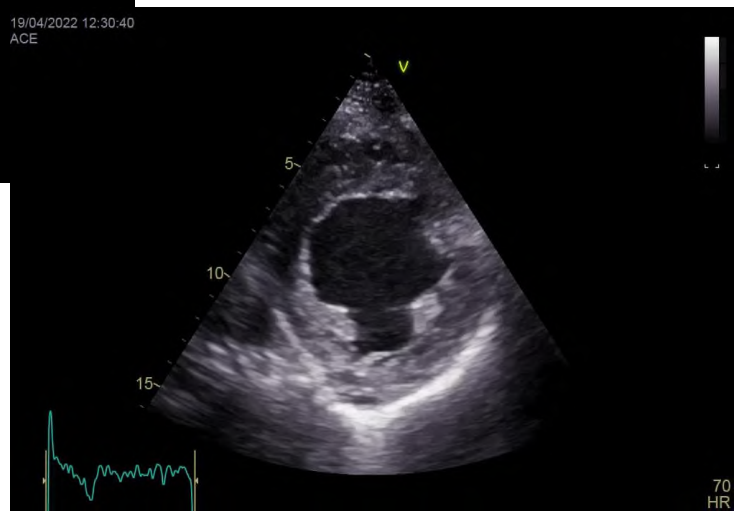


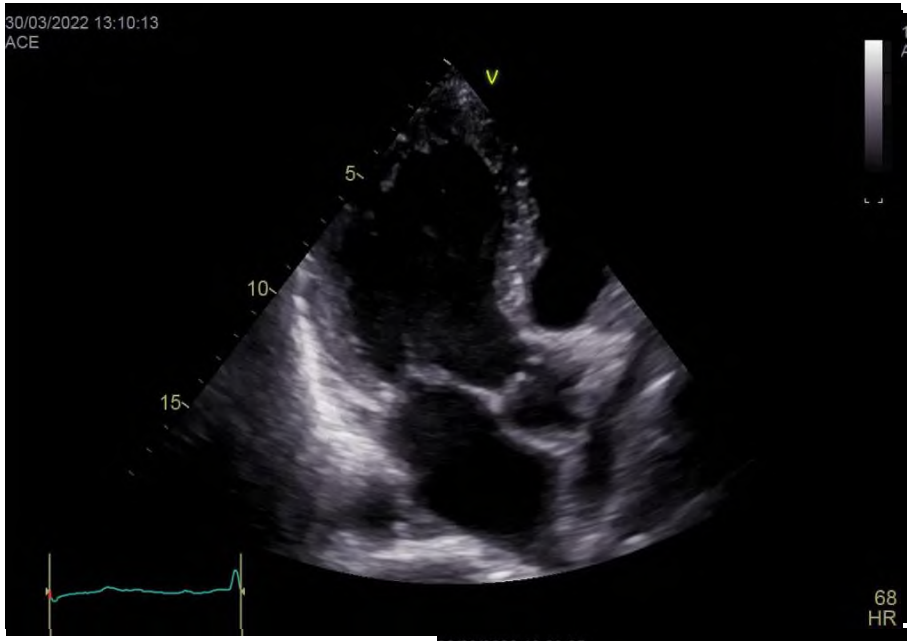
Hyperthyroidism

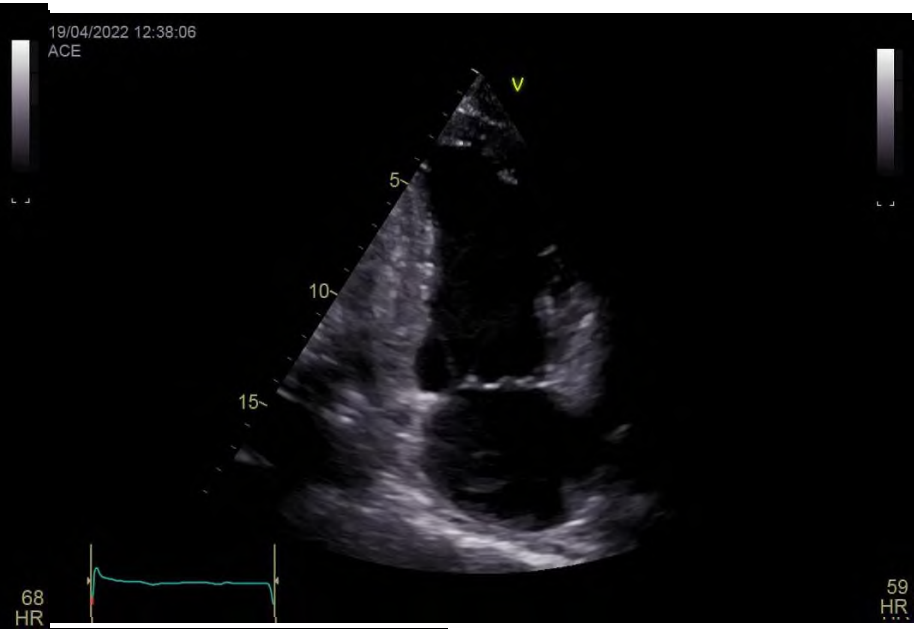


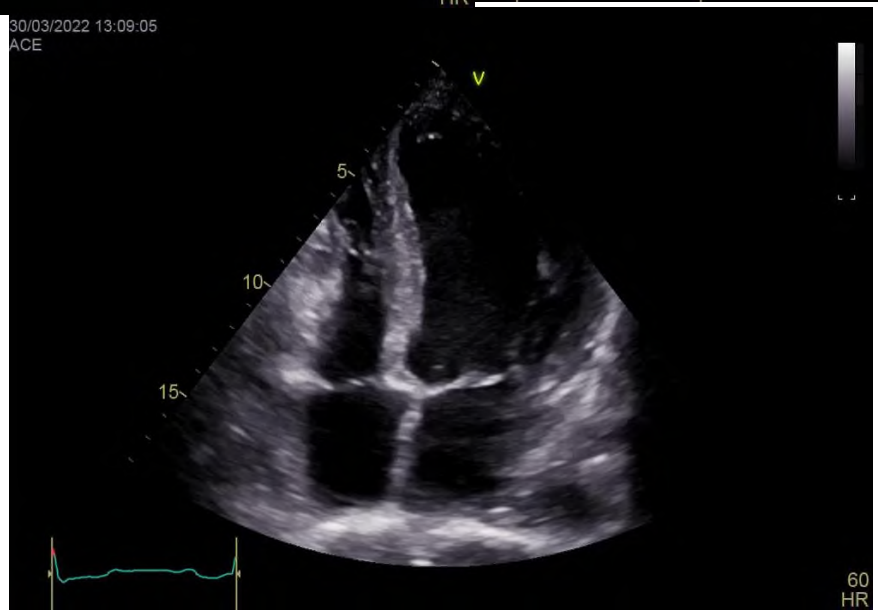



19/04/2022 12:29:36
ACE
V
5
10
15


19/04/2022 12:30:40
ACE
V
5
10
15
70
HR


30/03/2022 13:10:13
ACE
V
5
10
15


19/04/2022 12:38:06
ACE
V
5
10
15
68
HR
59
HR

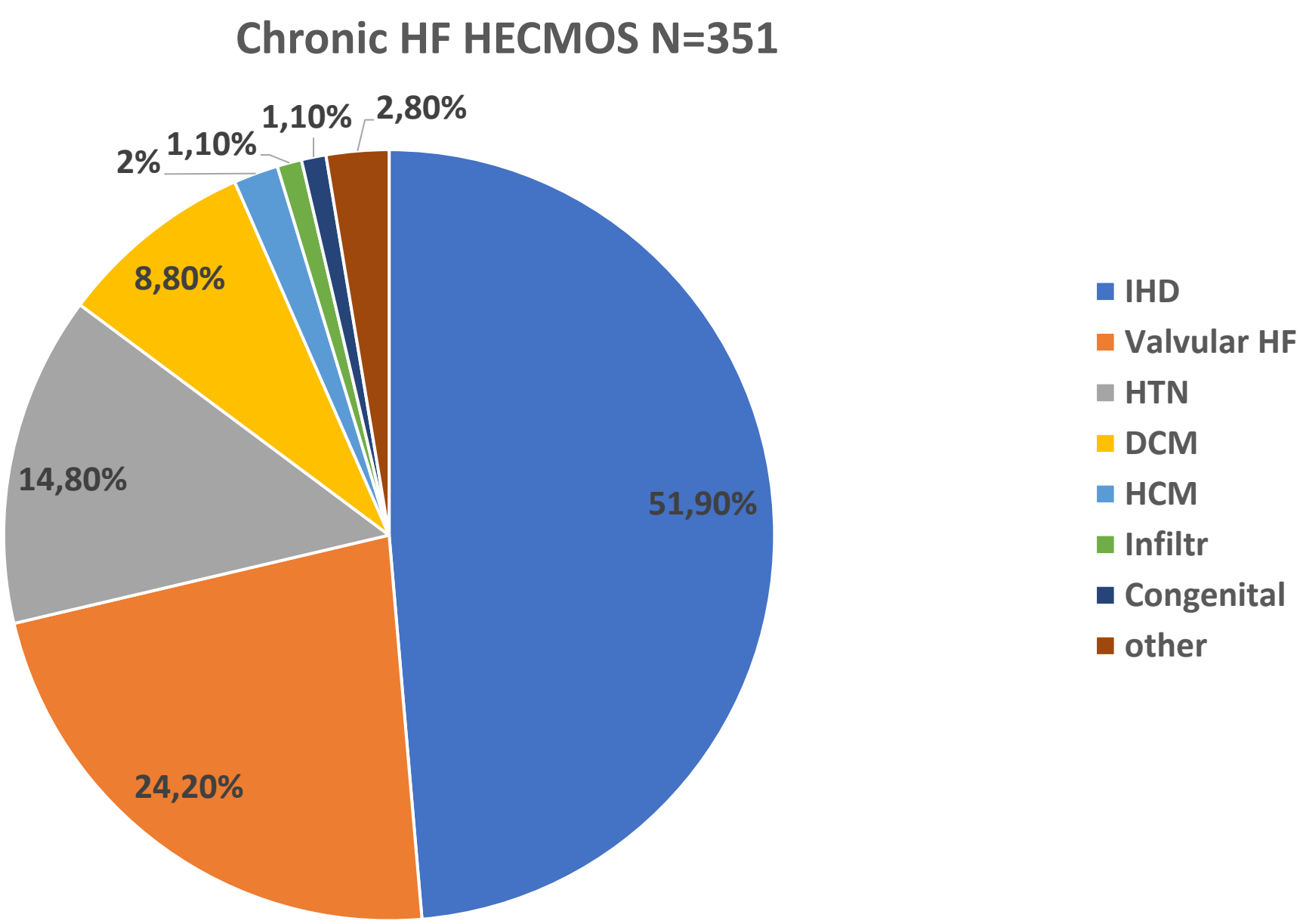

30/03/2022 13:09:05
ACE
V
5
10
15
60
HR


AZ6259
Azurion
Left Coronary 15 fps Normal
22-March-2022 9:29:21
RAO: 0.70 CAU: 38.30
XA
JPEGLossless:Non-hierarchical-1stOrderPrediction
Images: 1/65
899 mA 80.04kV
Series: 1
WL: 2048 WW: 4096


AZ6259
Azurion
Left Coronary 15 fps Normal
22-March-2022 9:29:59
RAO: 0.70 CRA: 37.00
XA
JPEGLossless:Non-hierarchical-1stOrderPrediction
Images: 1/58
868 mA 84.60kV
Series: 2
WL: 2048 WW: 4096


AZ6259
Azurion
Left Coronary 15 fps Normal
22-March-2022 9:36:10
LAO: 36.60 CAU: 6.10
XA
JPEGLossless:Non-hierarchical-1stOrderPrediction
Images: 1/85
801 mA 89.19kV
Series: 8
WL: 2048 WW: 4096


AZ6259
Azurion
Left Coronary 15 fps Normal
22-March-2022 9:38:59
RAO: 30.30 CAU: 2.00
XA
JPEGLossless:Non-hierarchical-1stOrderPrediction
Images: 1/87
725 mA 75.12kV
Series: 9
WL: 2048 WW: 4096


Chronic HF HECMOS N=351
51,90%
24,20%
14,80%
8,80%
2%
1,10%
1,10%
2,80%
IHD
Valvular HF
HTN
DCM
HCM
Infiltr
Congenital
other

HF - causes

- Clinical syndrome
- Variety of reasons
- Variety of mechanisms – some unknown

    - Recognizable structural/functional patterns
    - Hemodynamic changes

        - Personalized understanding and treatment

Q1

- Η συχνότερη αιτία Καρδιακής ανεπάρκειας στην Ελλάδα είναι

Α. στεφανιαία νόσος

Β. Υπέρταση

Γ. συγγενείς καρδιοπάθειες

Δ. άλλο

Q2

- Στο σύνδρομο καρδιακής ανεπάρκειας προϋπόθεση είναι η ύπαρξη:

Α. υπερτροφίας της αριστερής κοιλίας

Β. διάταση του αριστερού κόλπου

Γ. αυξημένη πίεση αριστερού κόλπου

Δ. τίποτα από τα παραπάνω

Ε. όλα τα παραπάνω

Q3

Η βαλβιδική νόσος που συχνότερα απαντάται ως αιτία καρδιακής ανεπάρκειας στην Ευρώπη είναι

Α. στένωση αορτικής βαλβίδας

Β. στένωση μιτροειδούς βαλβίδας

Γ. ανεπάρκεια μιτροειδούς βαλβίδας

Δ. στένωση πνευμονικής βαλβίδας

Q4

Ποιο από τα παρακάτω νοσήματα μπορεί να σχετίζονται με την εμφάνιση καρδιακής ανεπάρκειας

Α. Συστηματικός ερυθηματώδης λύκος

Β. Σακχαρώδης διαβήτης

Γ. Σαρκοείδωση

Δ. όλα τα παραπάνω