UNIVERSITATEA DE MEDICINĂ ȘI FARMACIE
GRIGORE T. POPA IAȘI

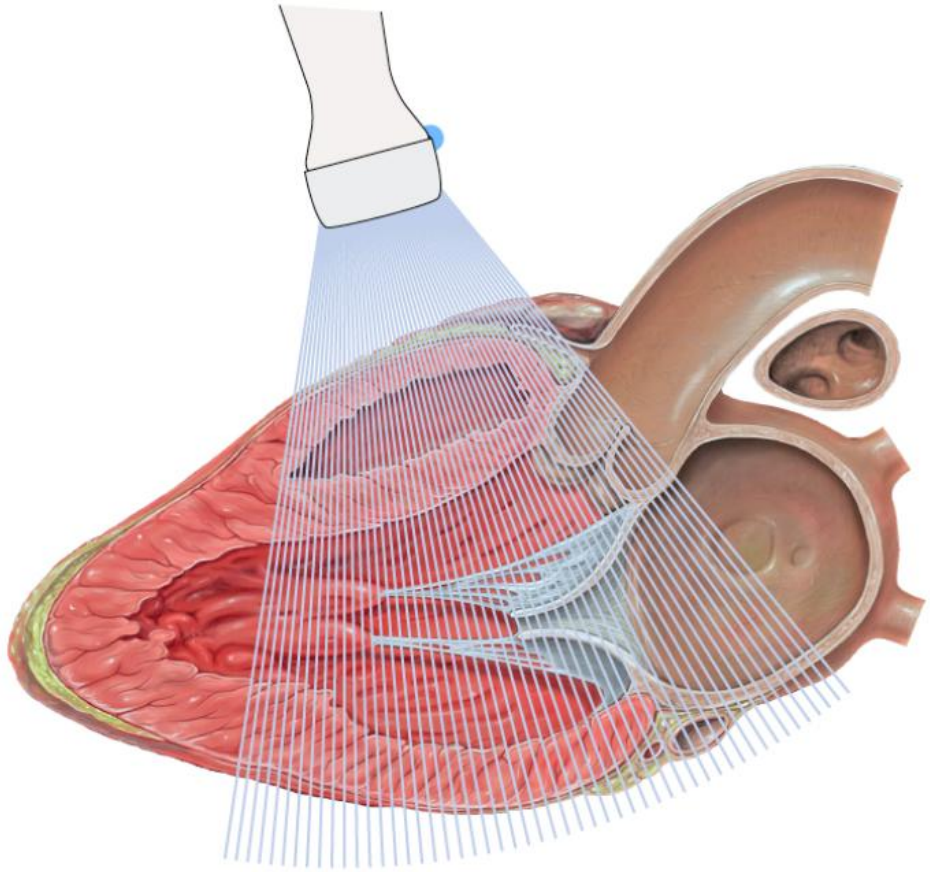
EVALUAREA ECOCARDIOGRAFICA A CAVITATILOR STANGI

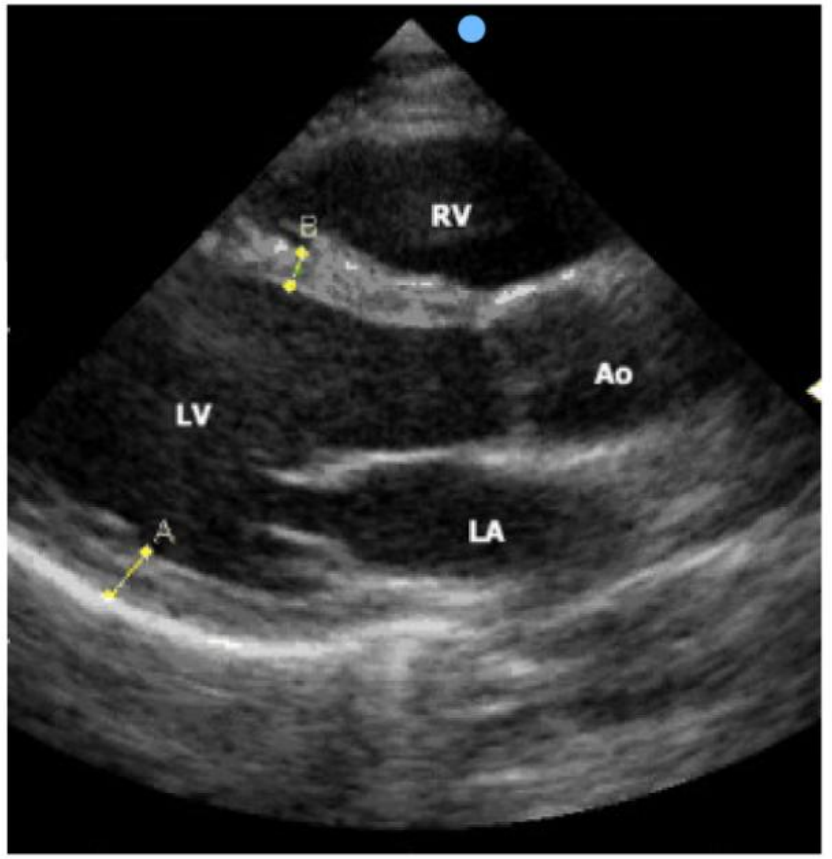
D. MARCU
PROF. M. FLORIA

Previously in EchoVengers

Moduri de examinare

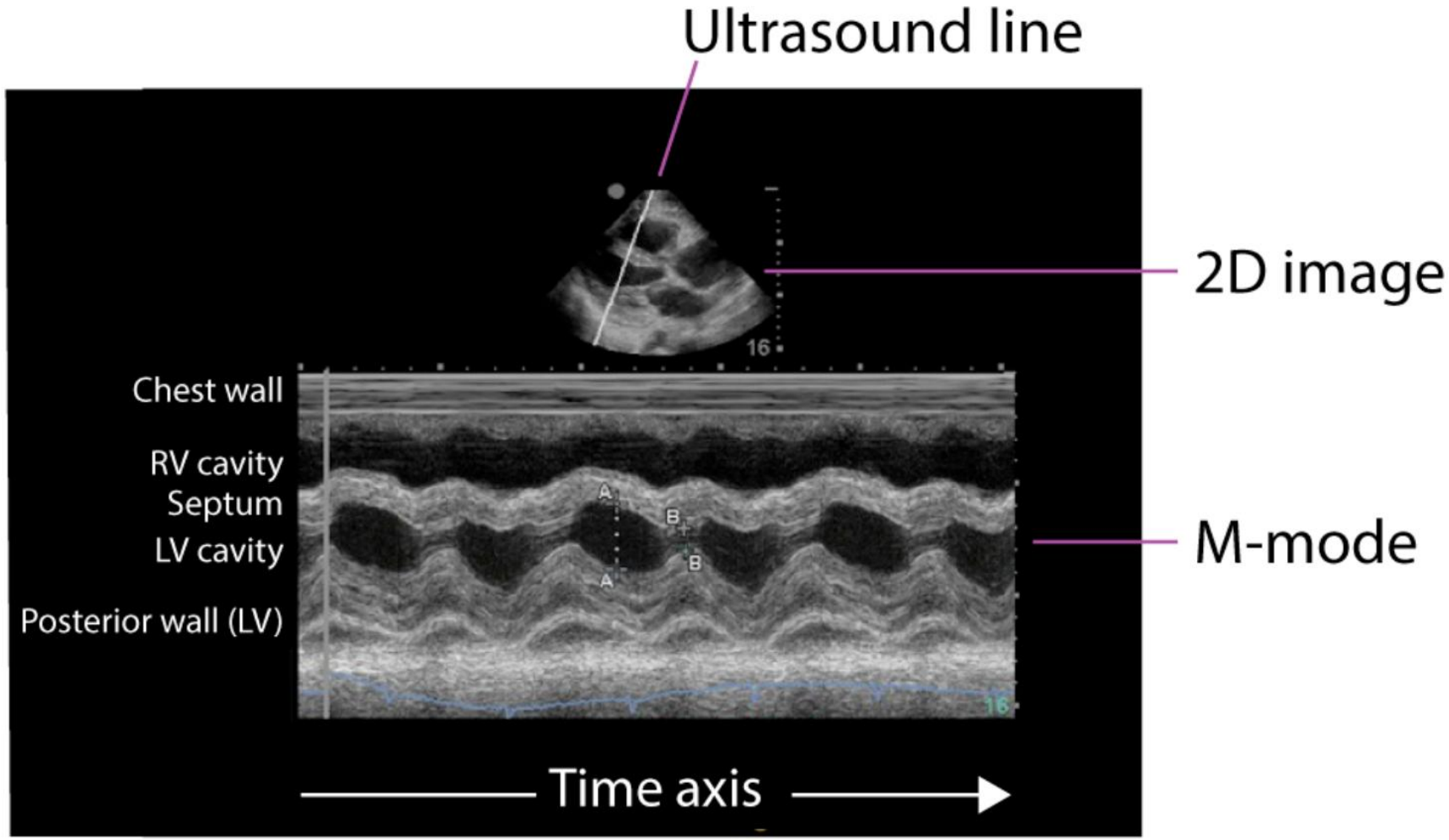
2D (two-dimensional) ultrasound





Moduri de examinare

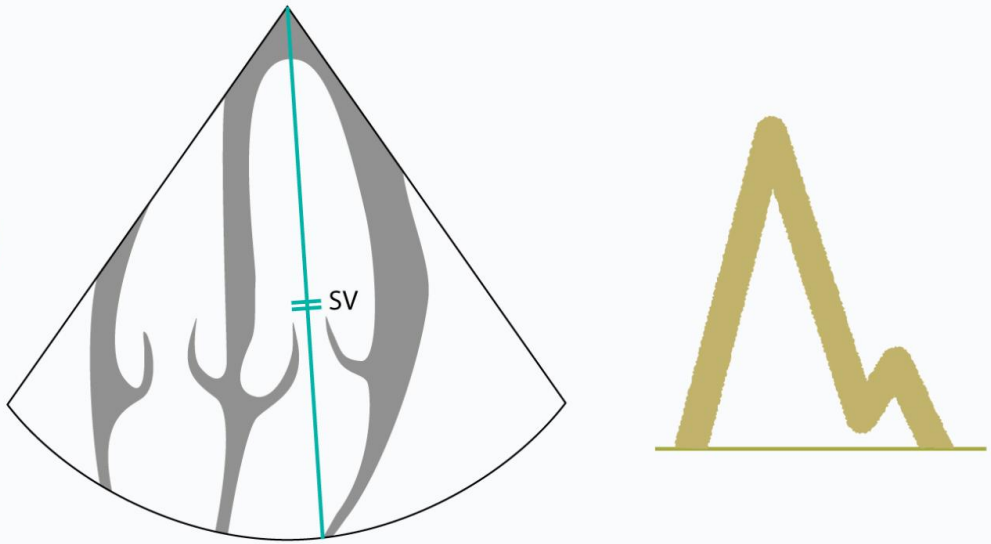
M-mode (Motion mode)



Moduri de examinare

Pulsed wave Doppler

A



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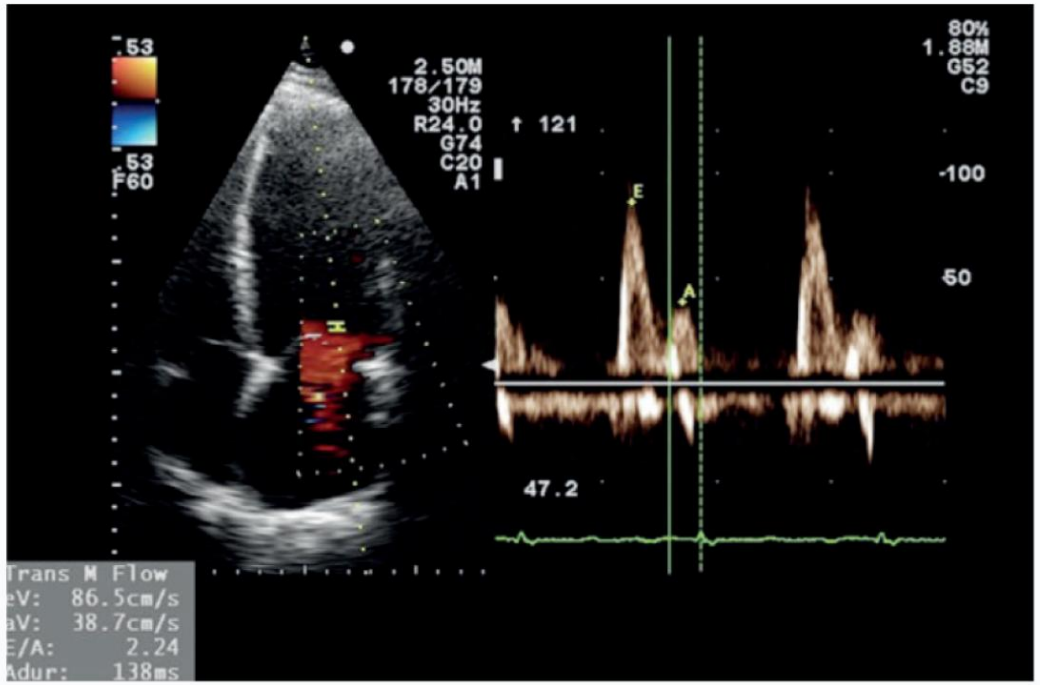
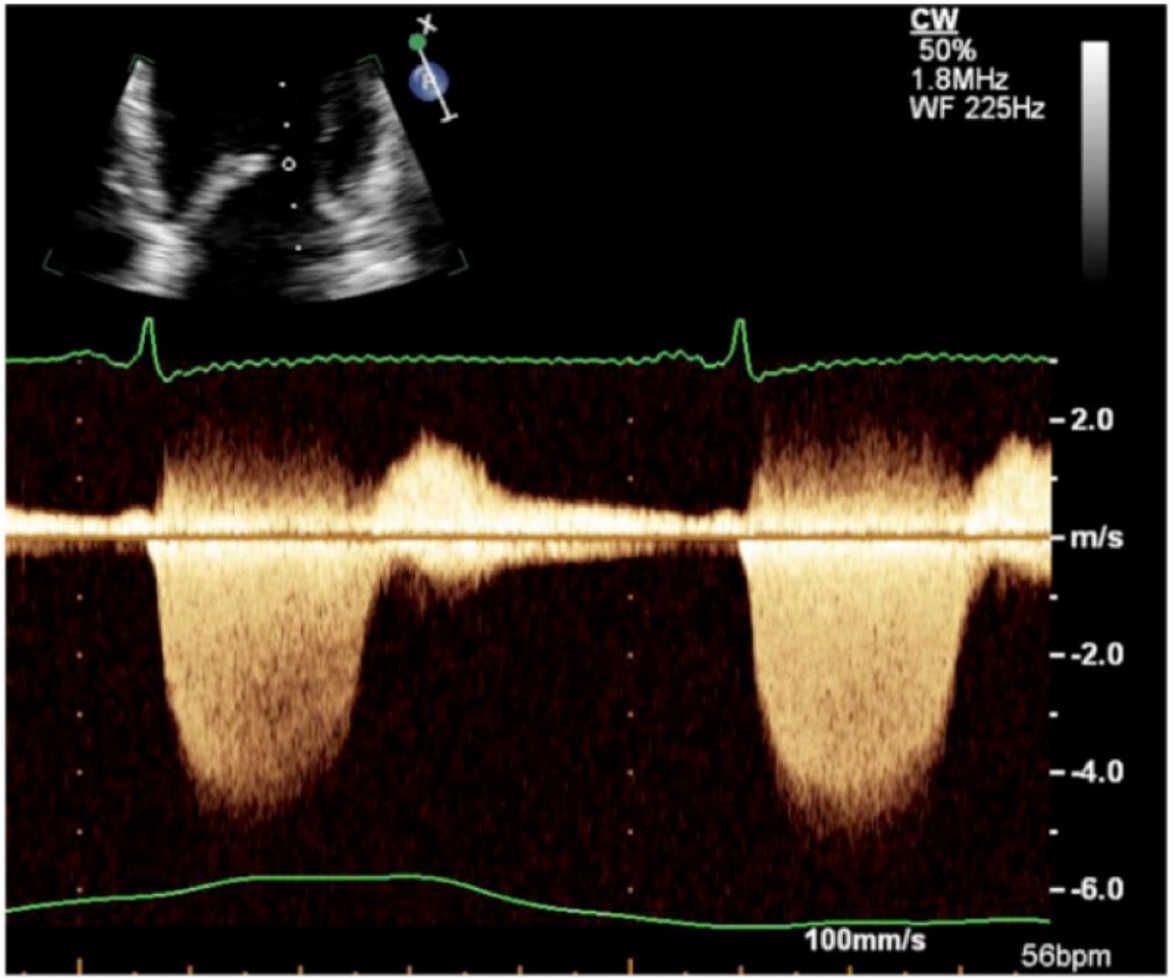


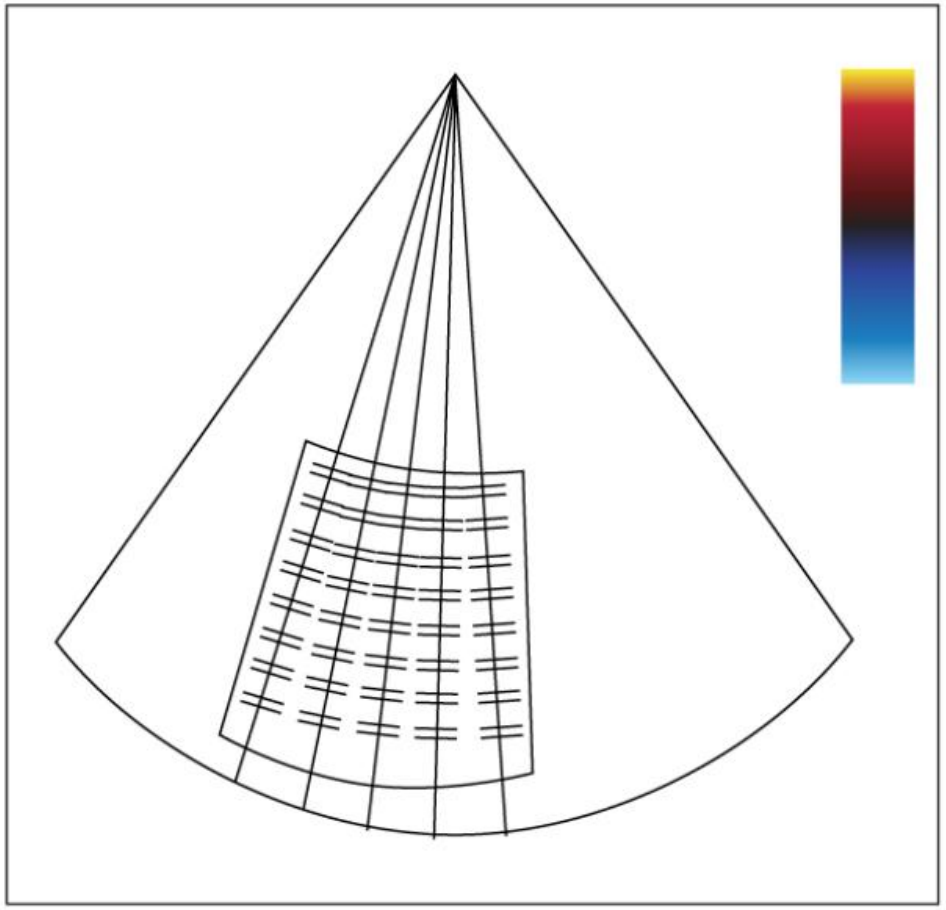
Moduri de examinare

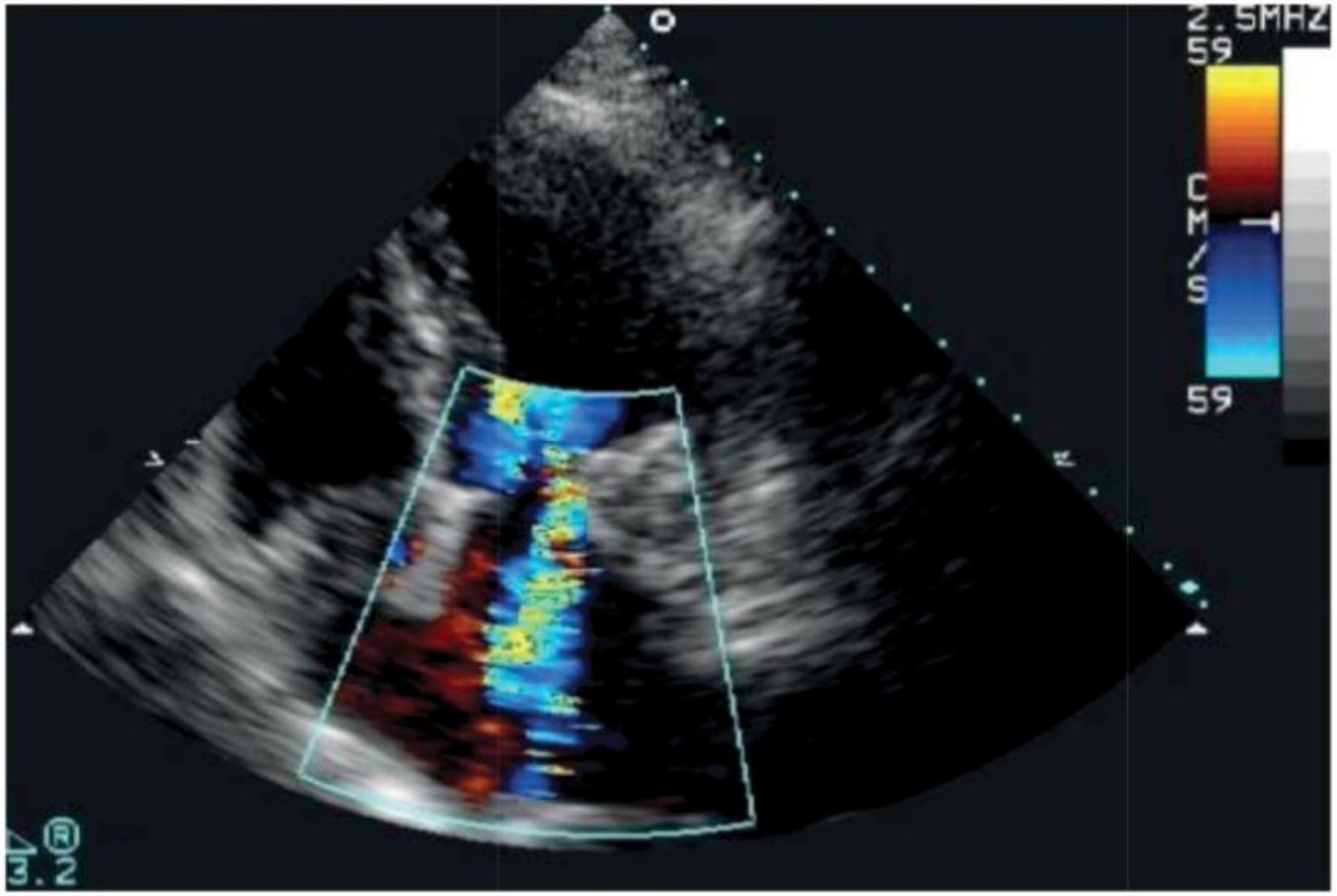
Continuous wave Doppler



Moduri de examinare

Color Doppler

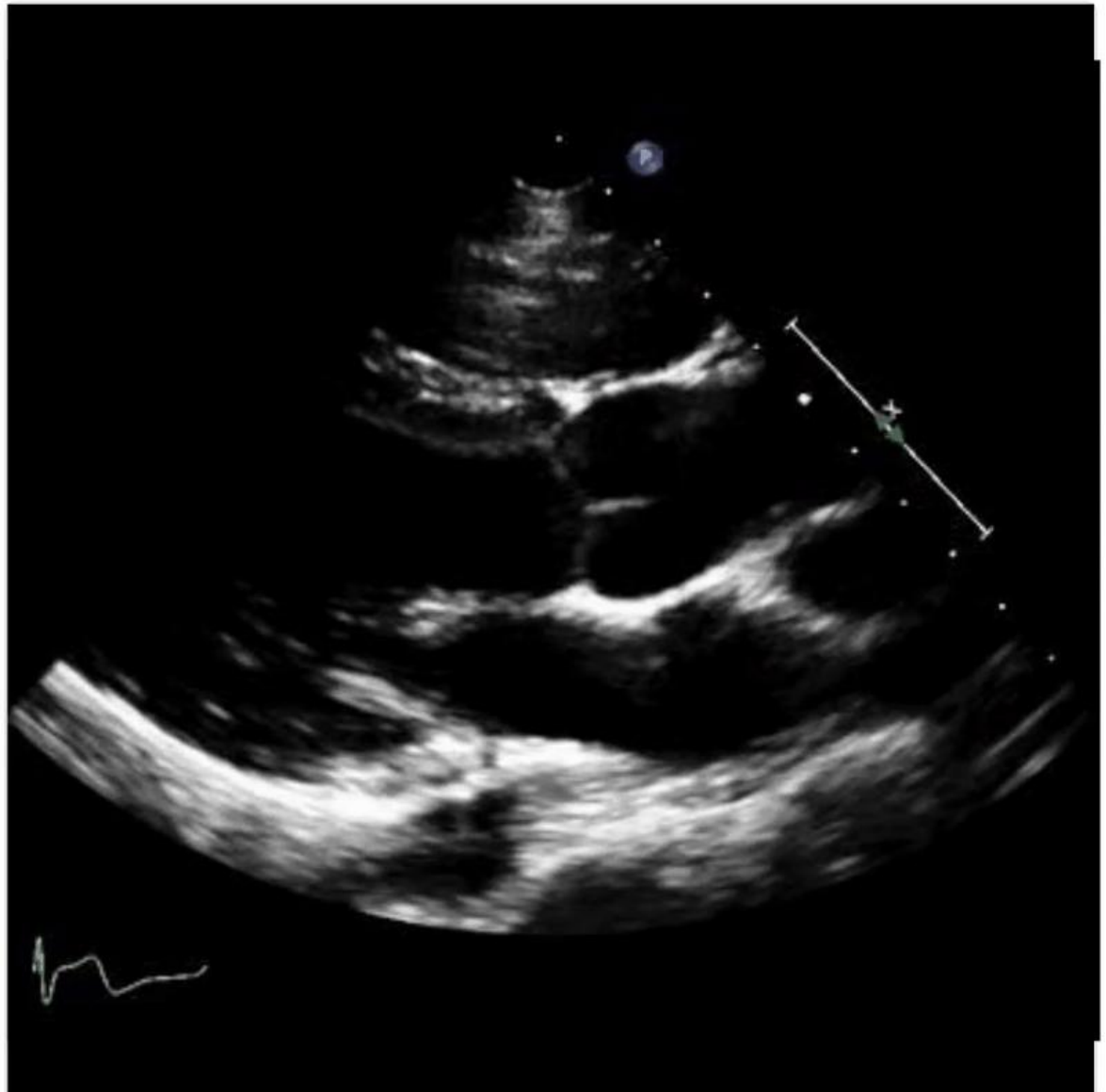


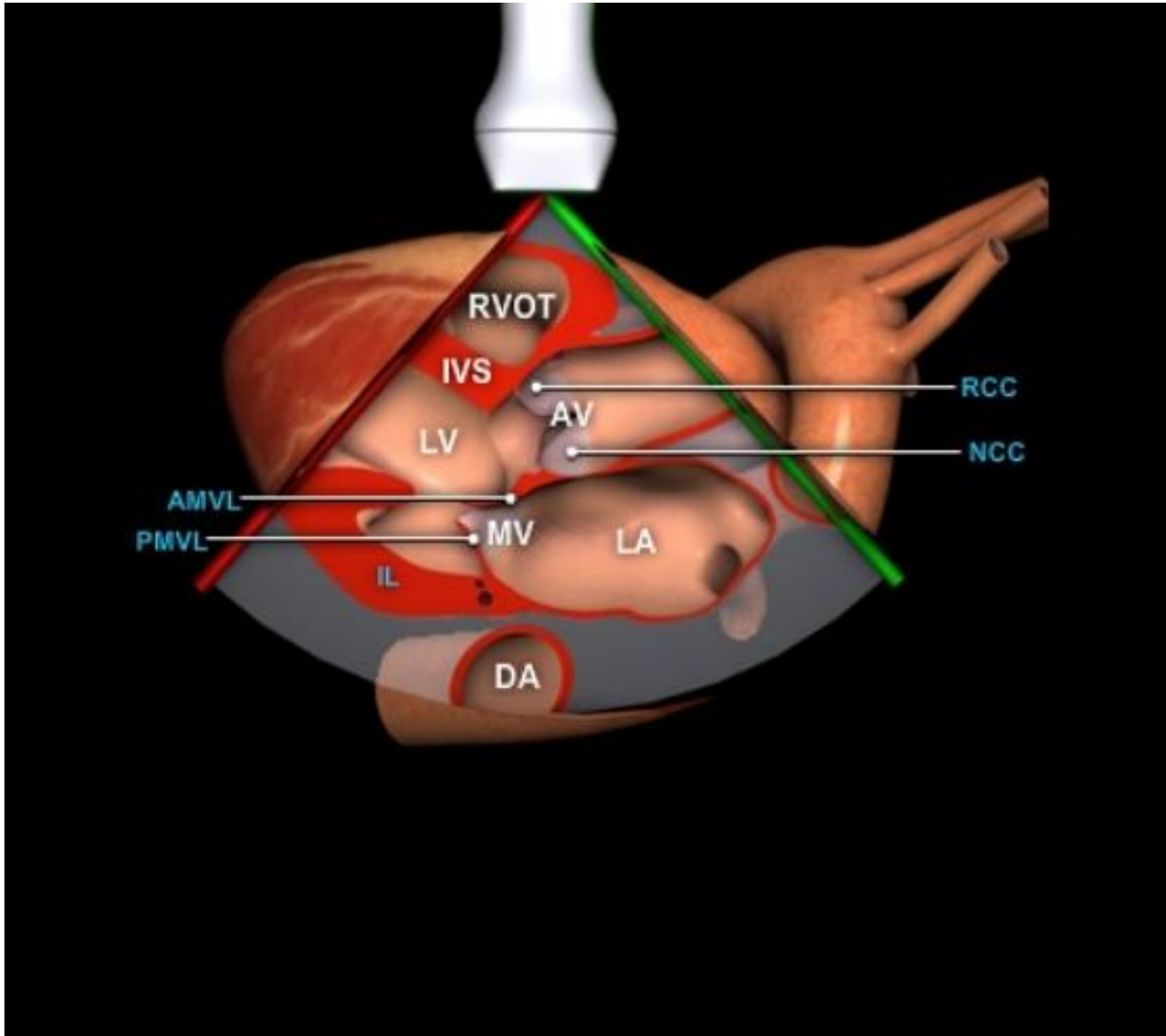


Incidente

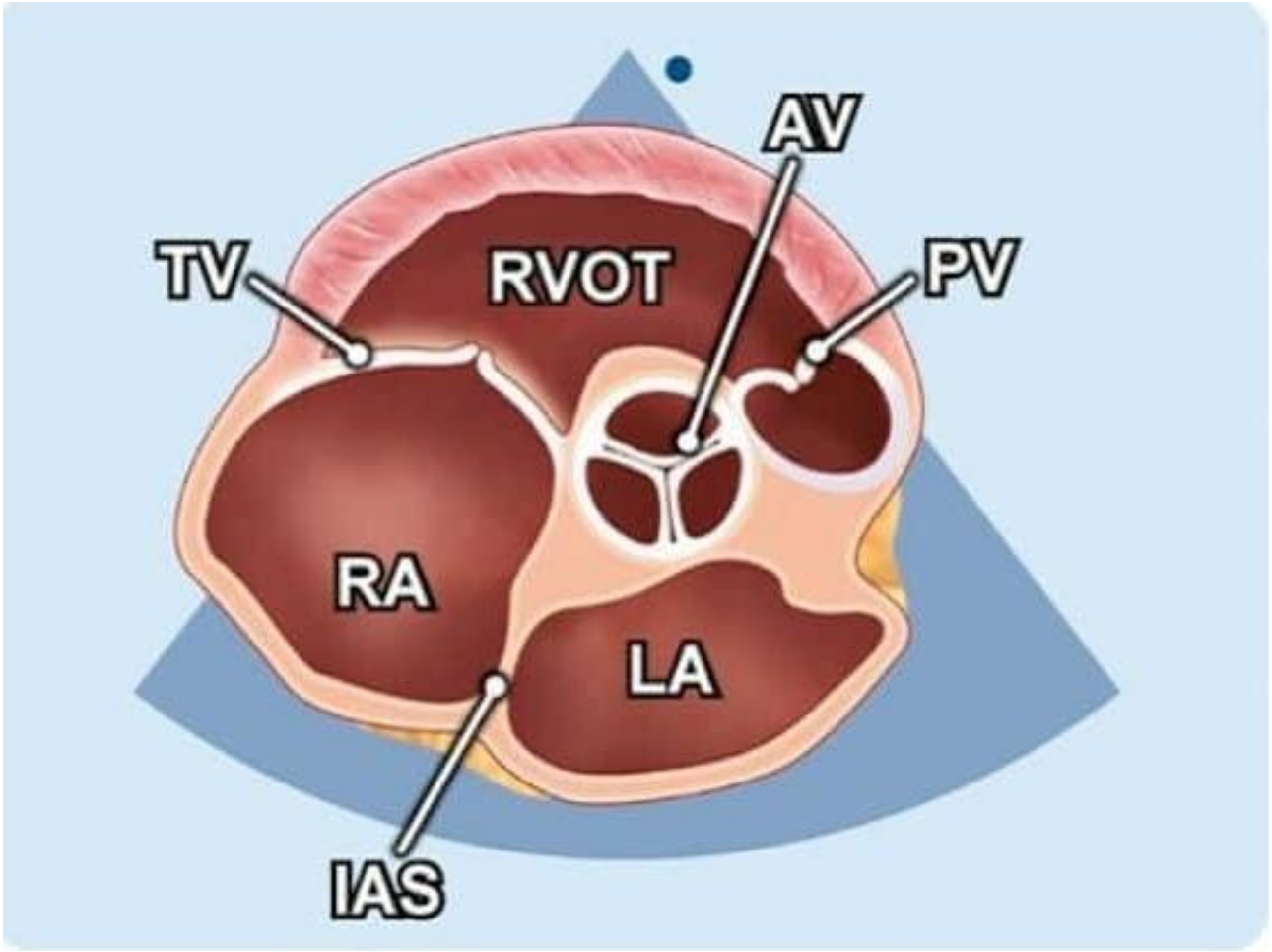
Parasternal stâng	Apical	Subcostal	Suprasternal	Parasternal drept
				

Parasternal ax lung

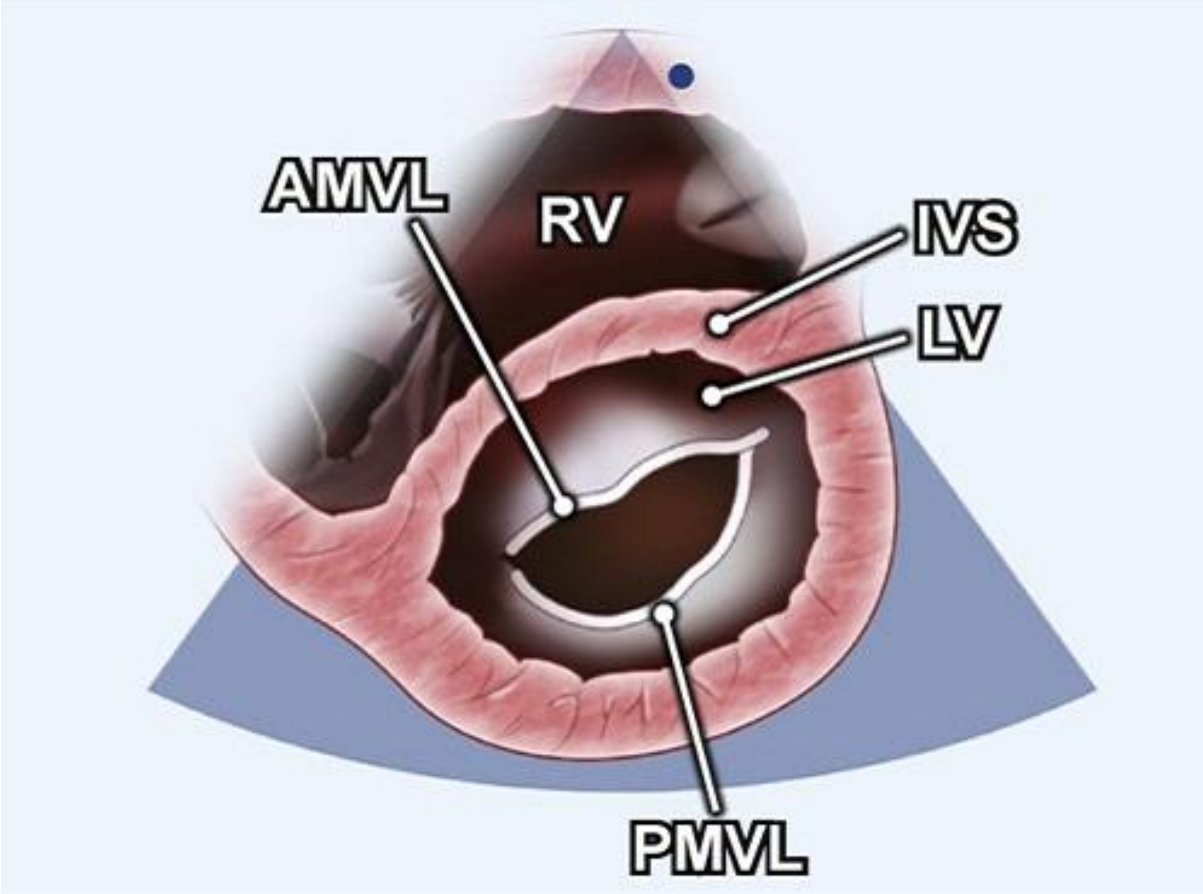




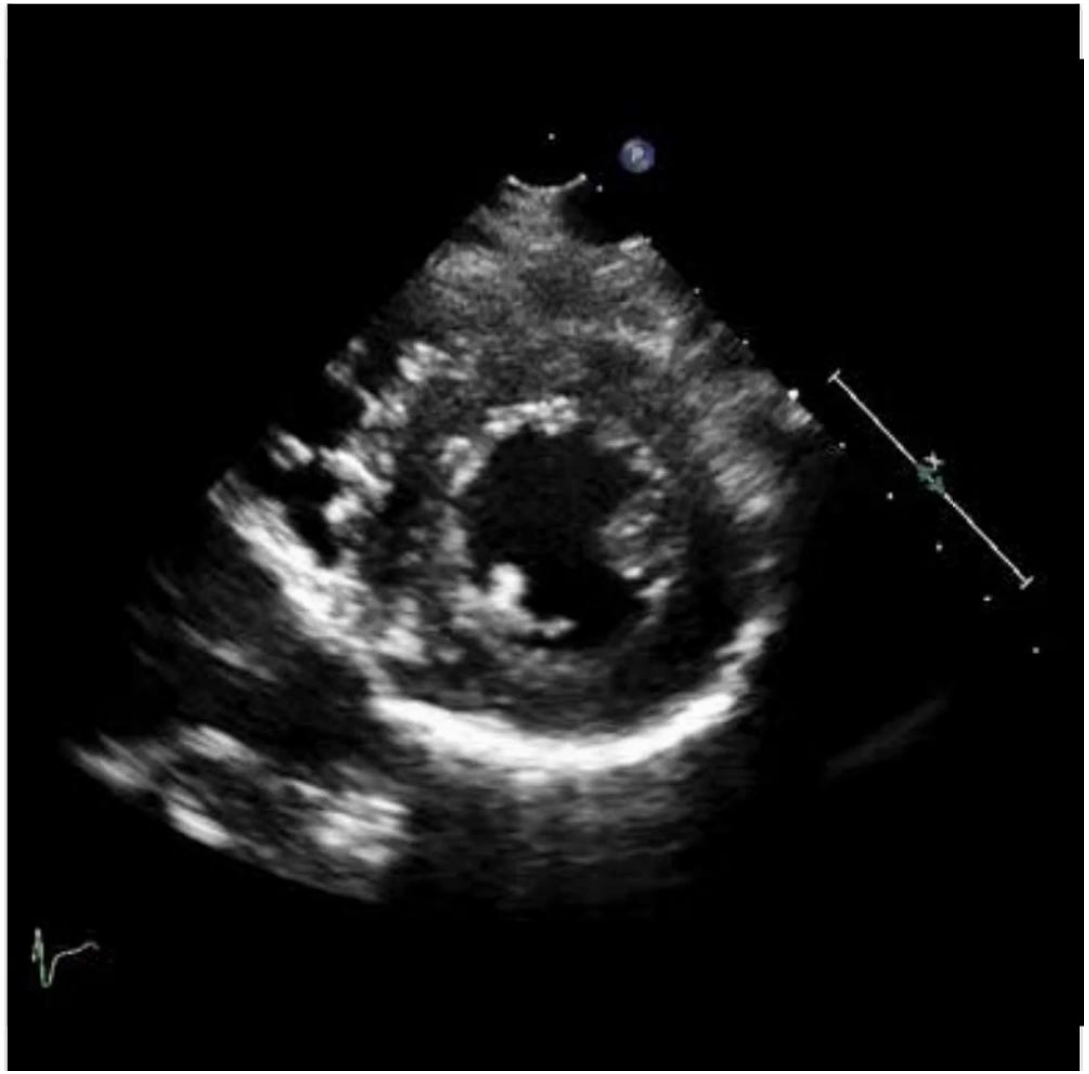
Parasternal ax scurt - mari vase

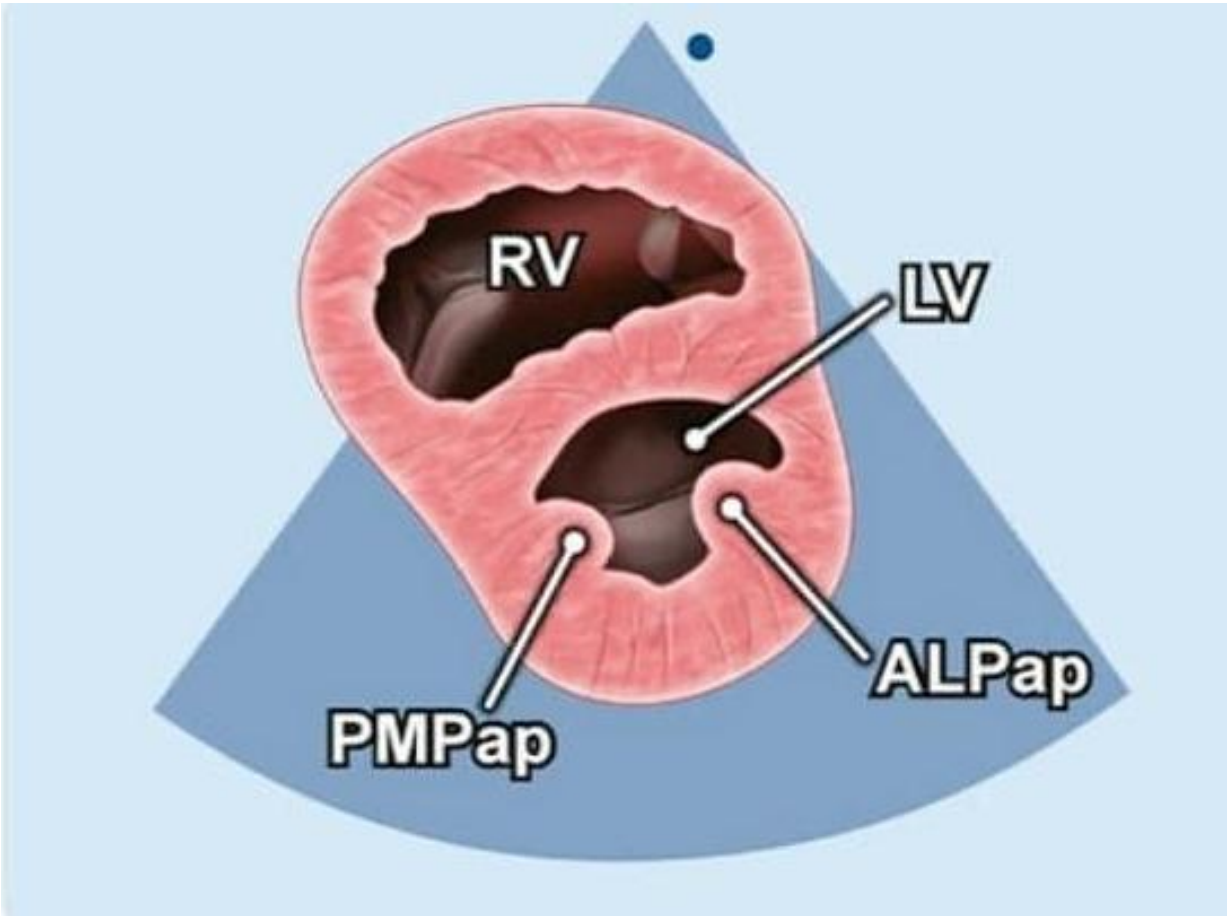


Parasternal ax scurt - valva mitrala

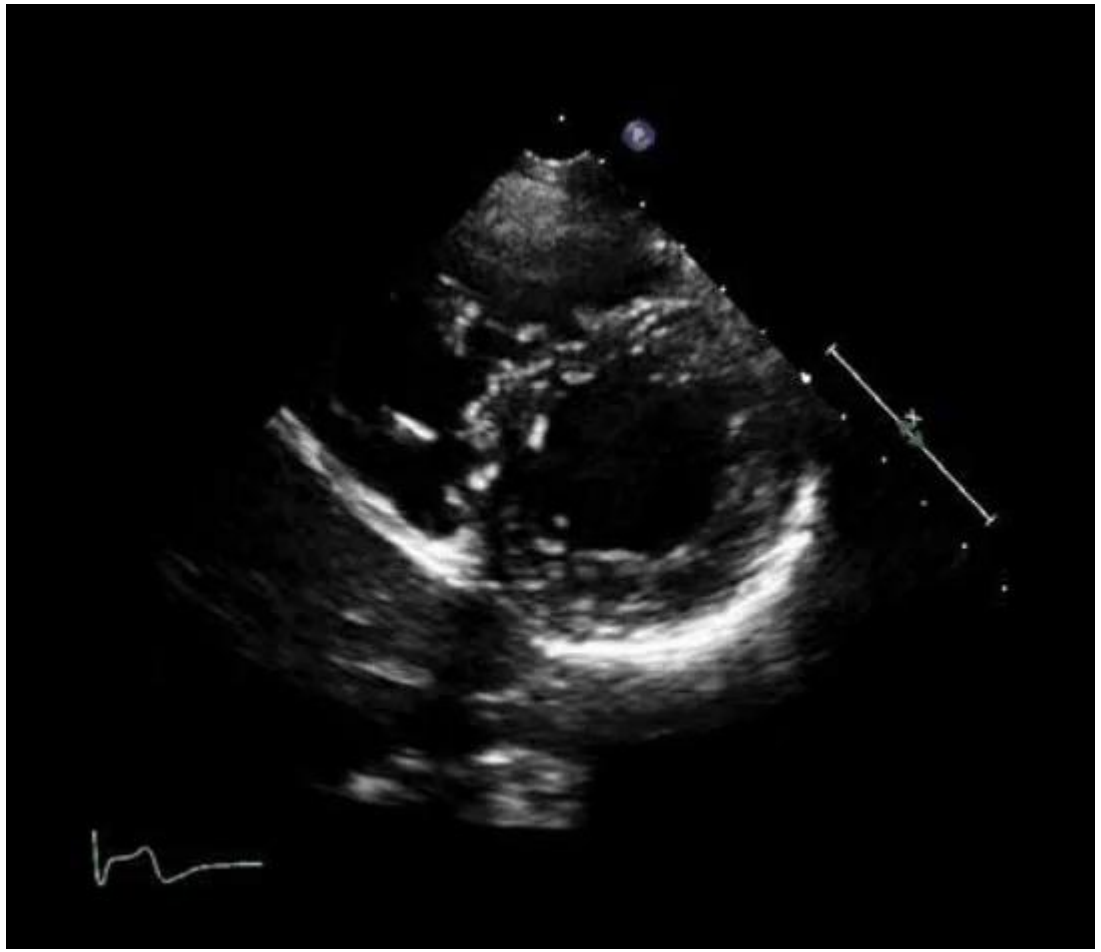


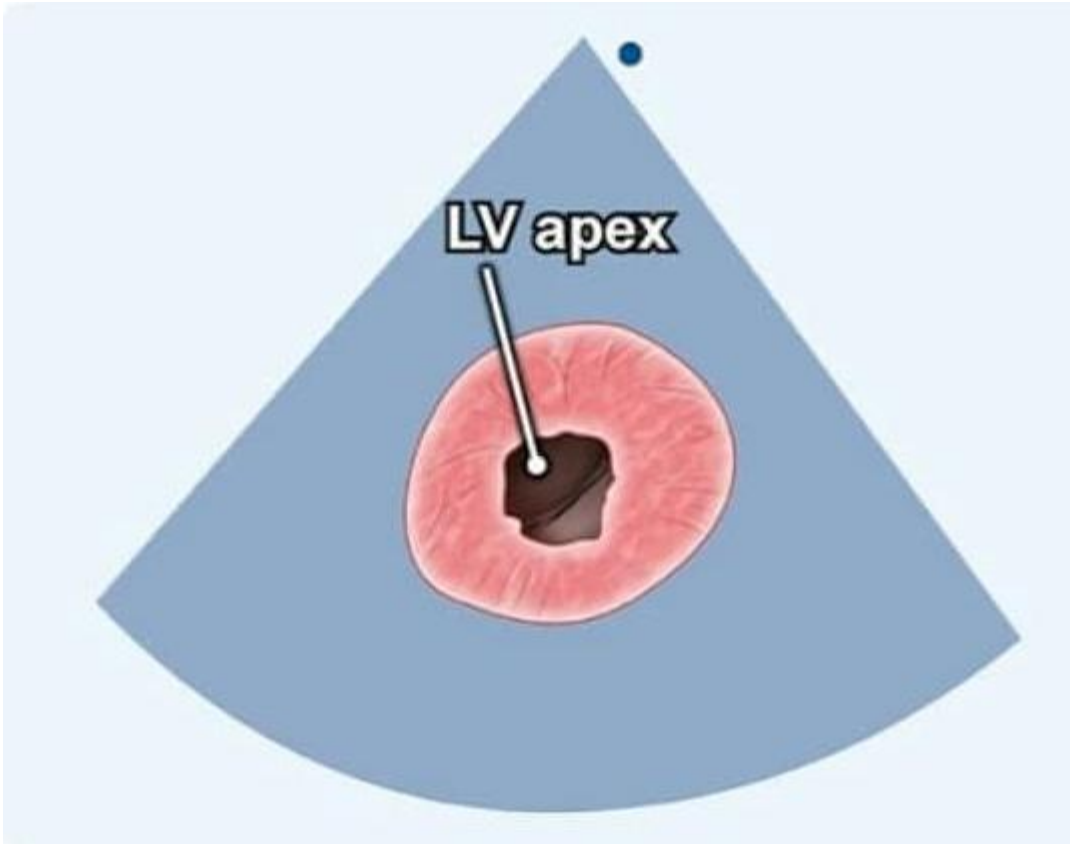
Parasternal ax scurt - muschi papilari



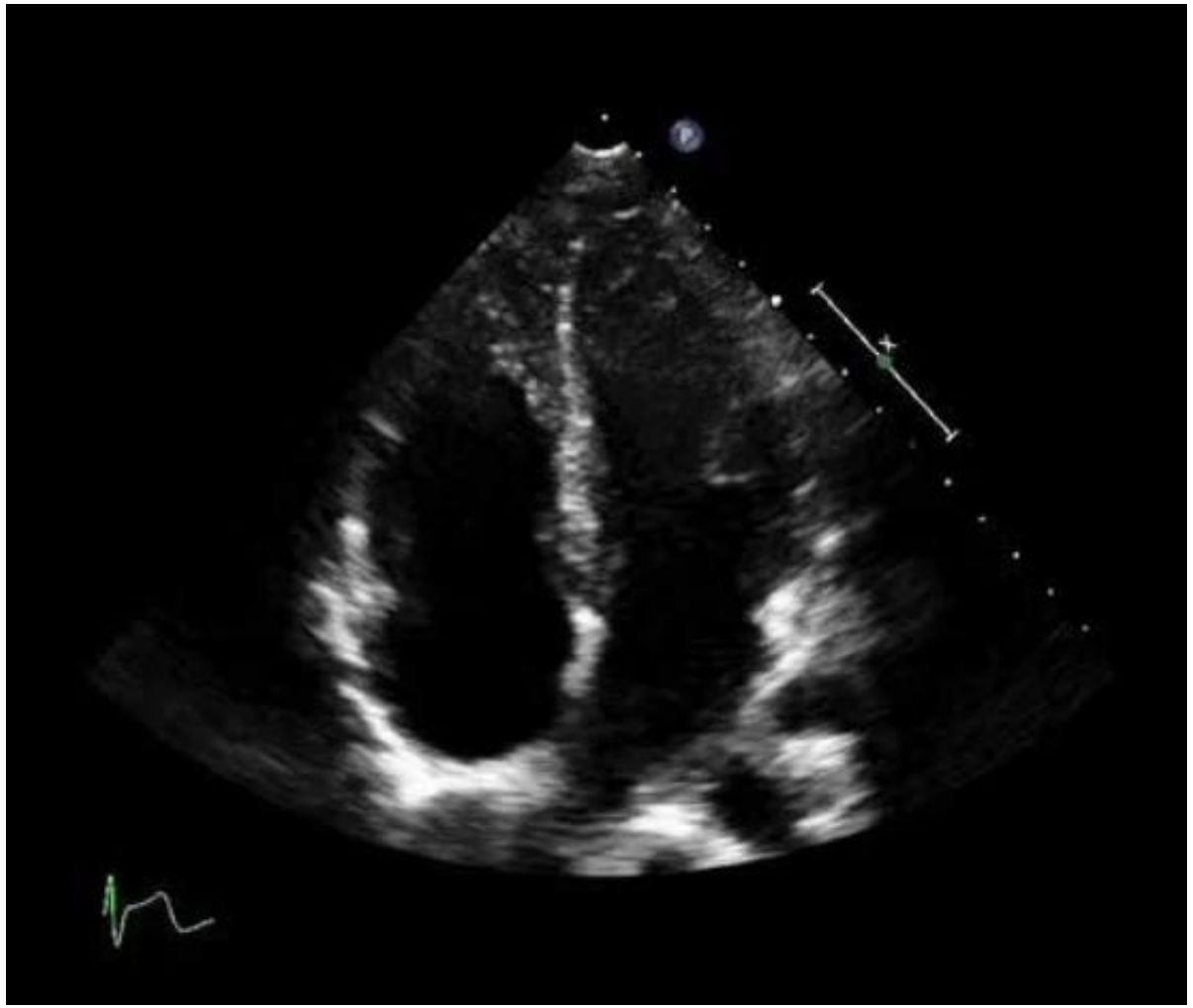


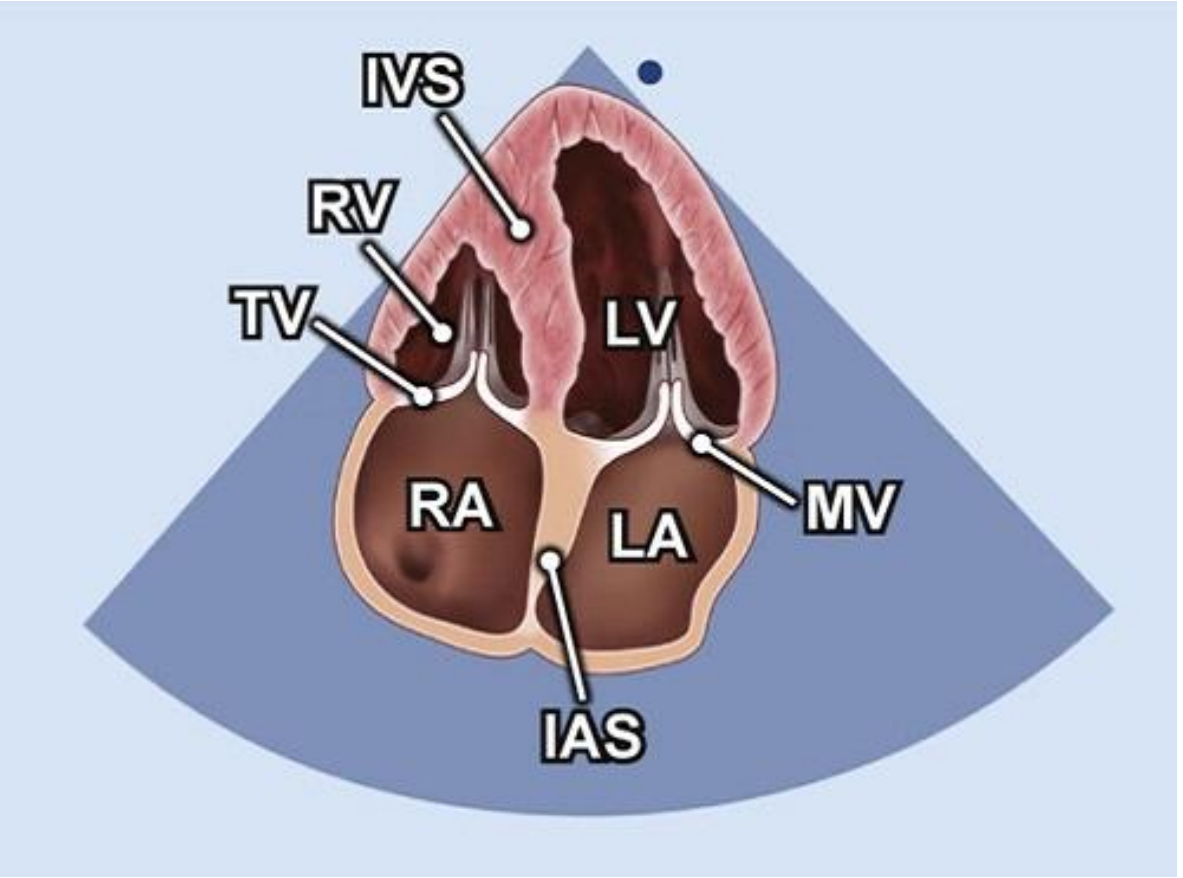
Parasternal ax scurt - apex



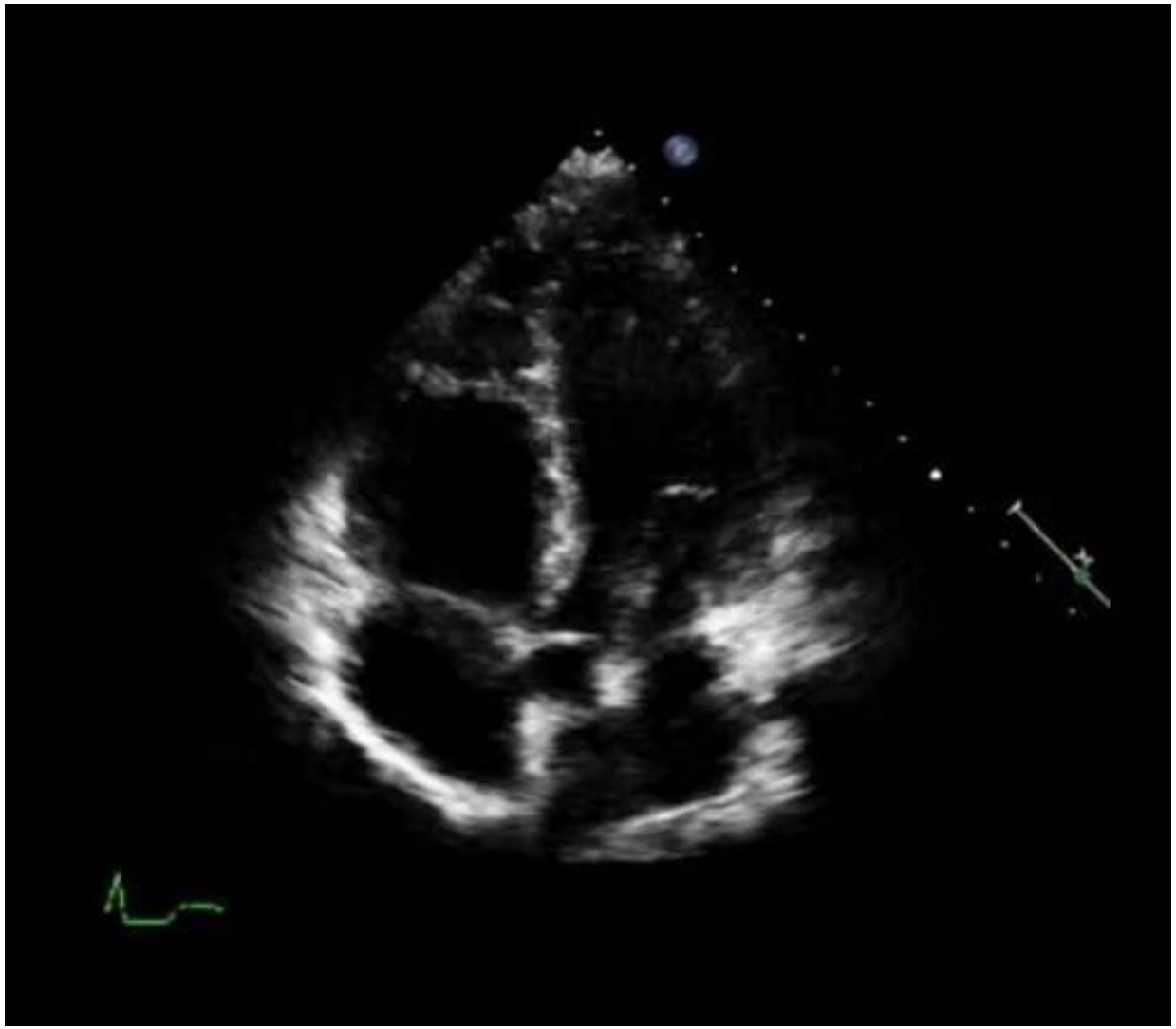


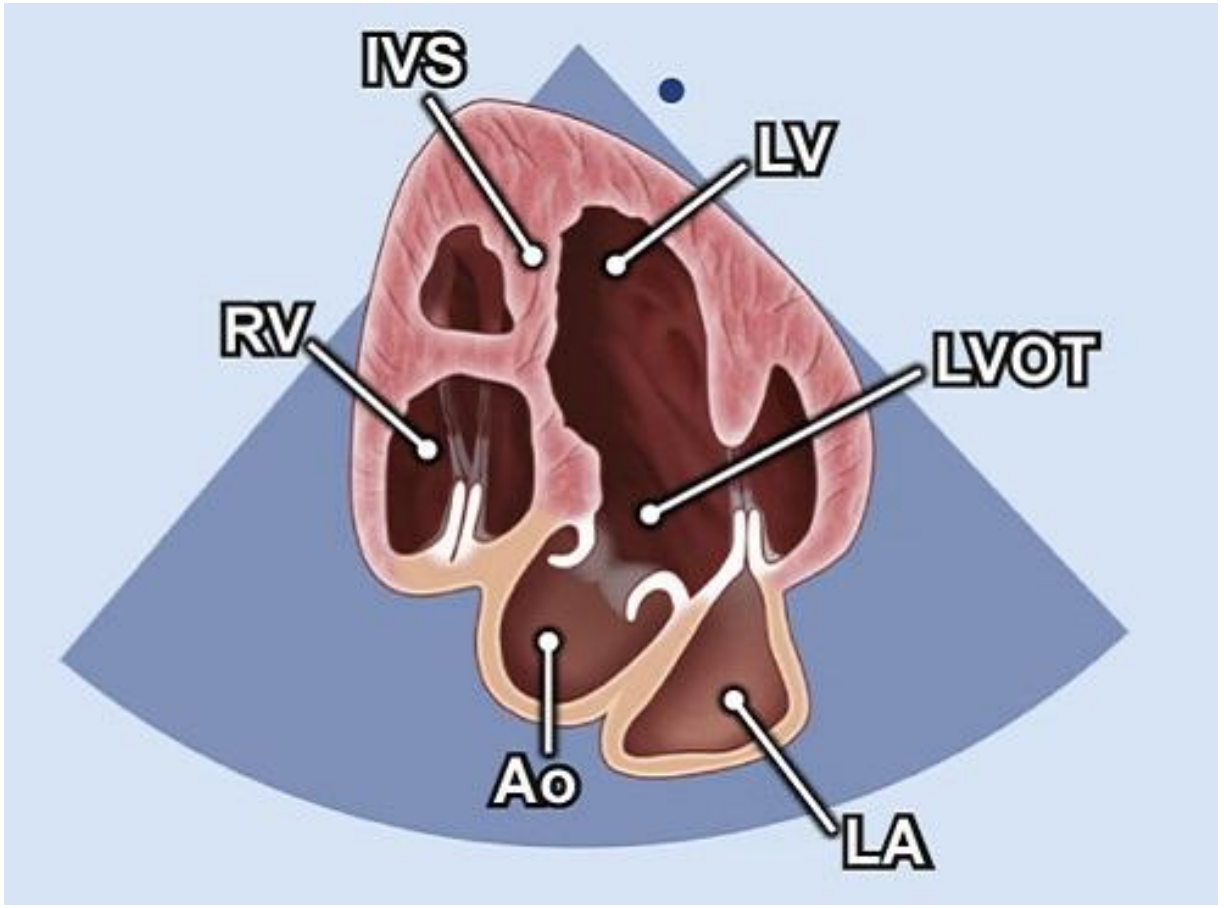
APICAL 4 CAMERE





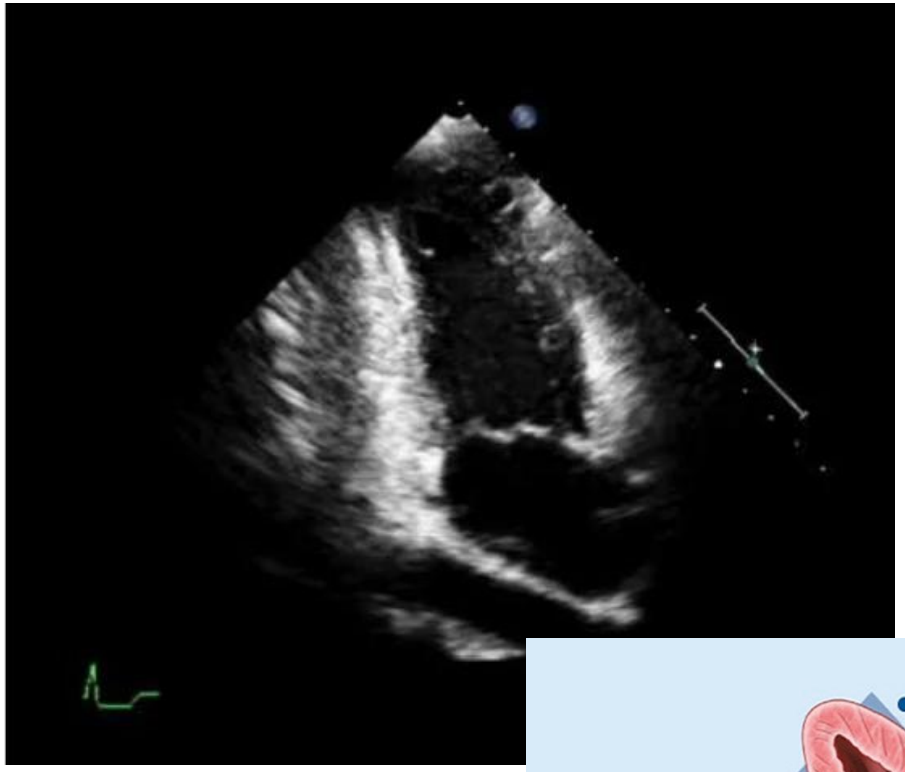
APICAL 5 CAMERE

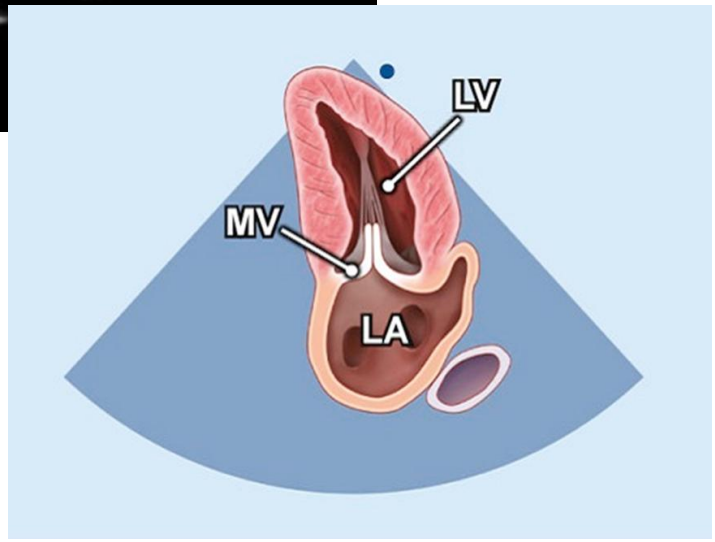


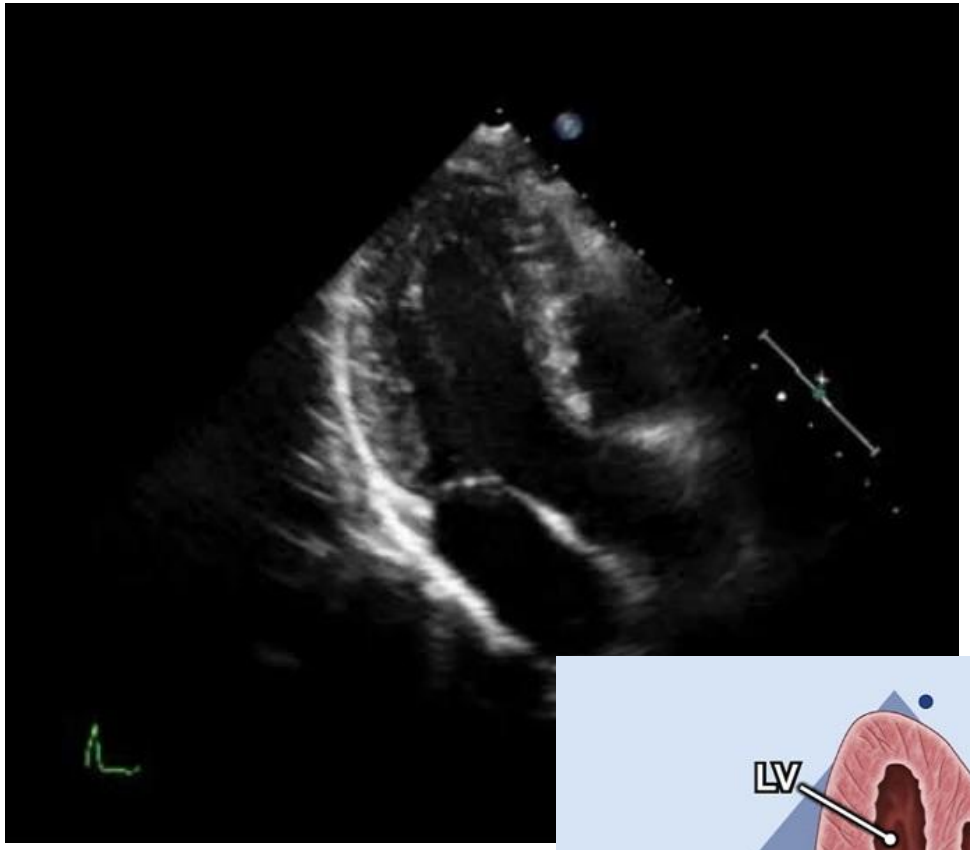


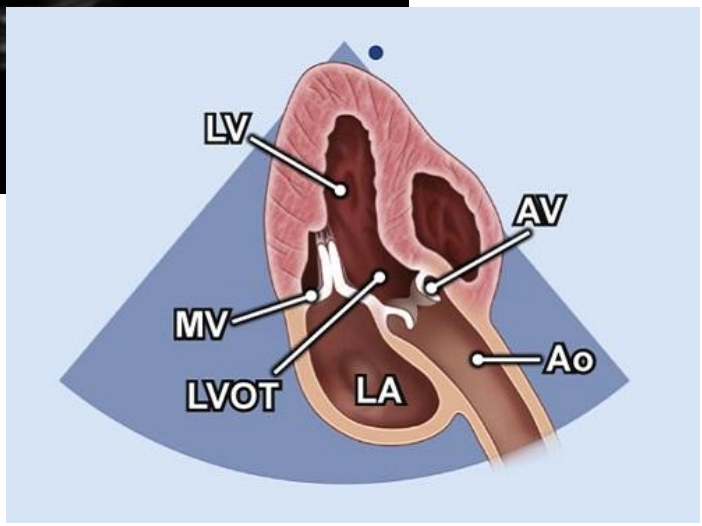
APICAL ...2 CAMERE

3 CAMERE





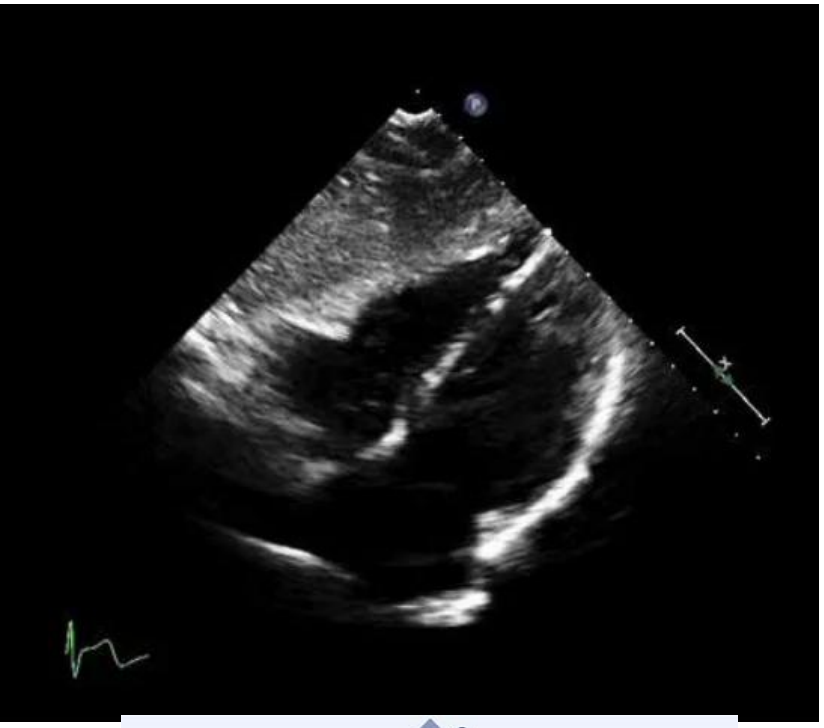


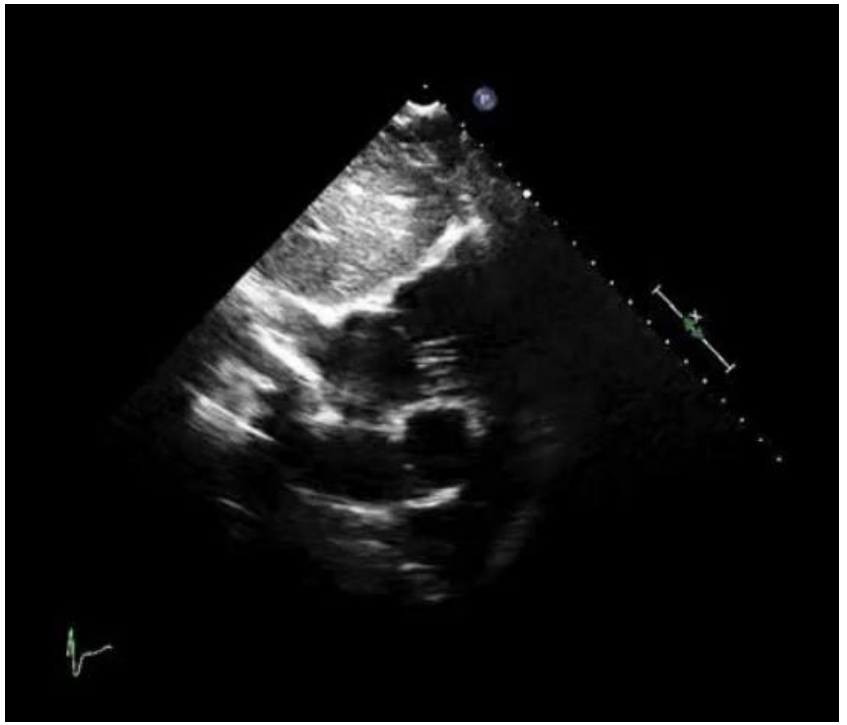


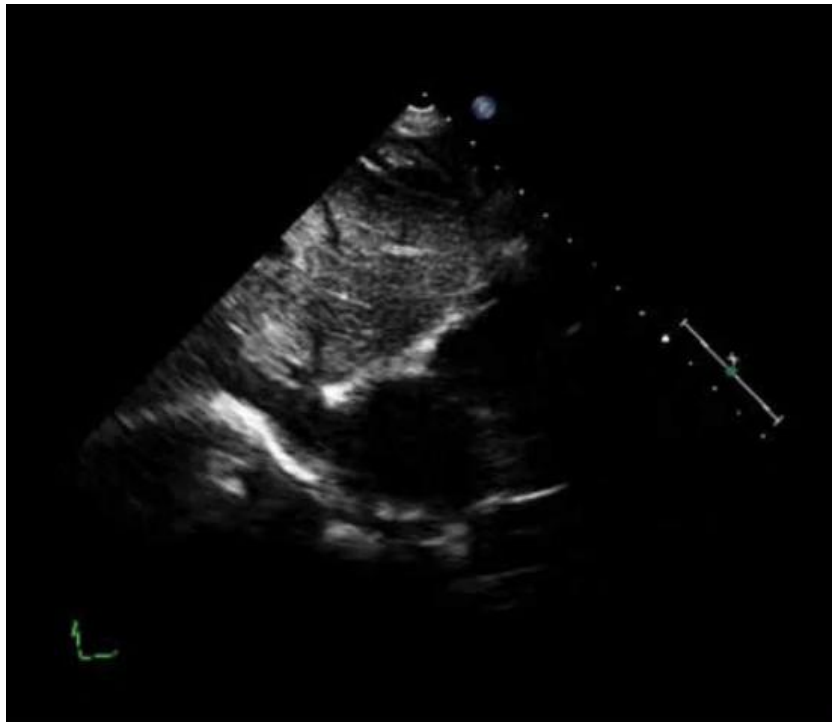
SUBCOSTAL ...4 CAMERE

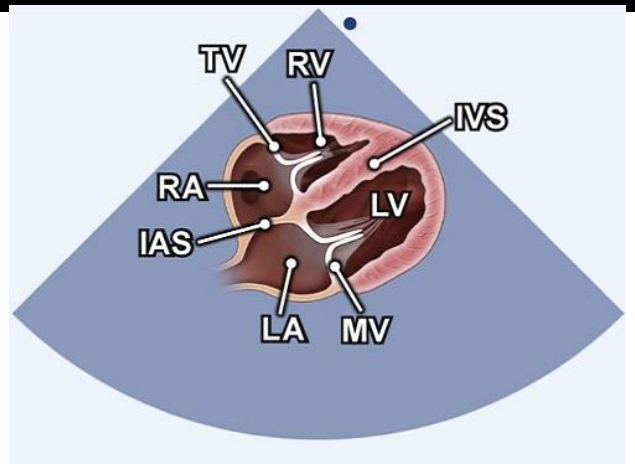
AX LUNG

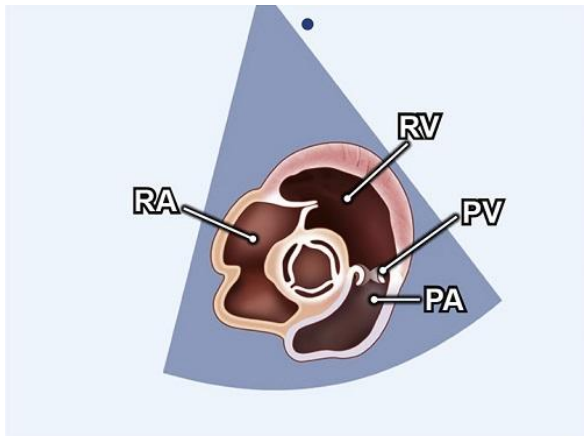
VCI

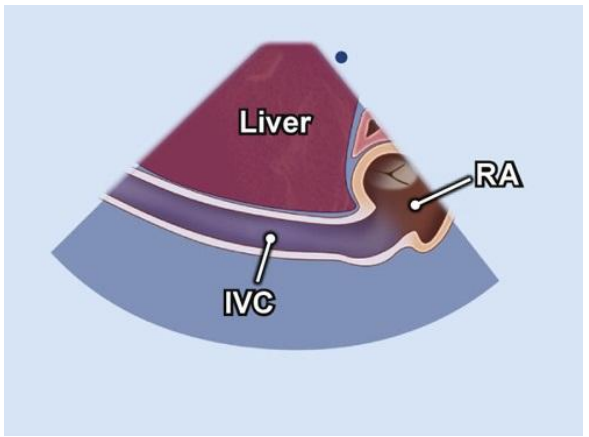




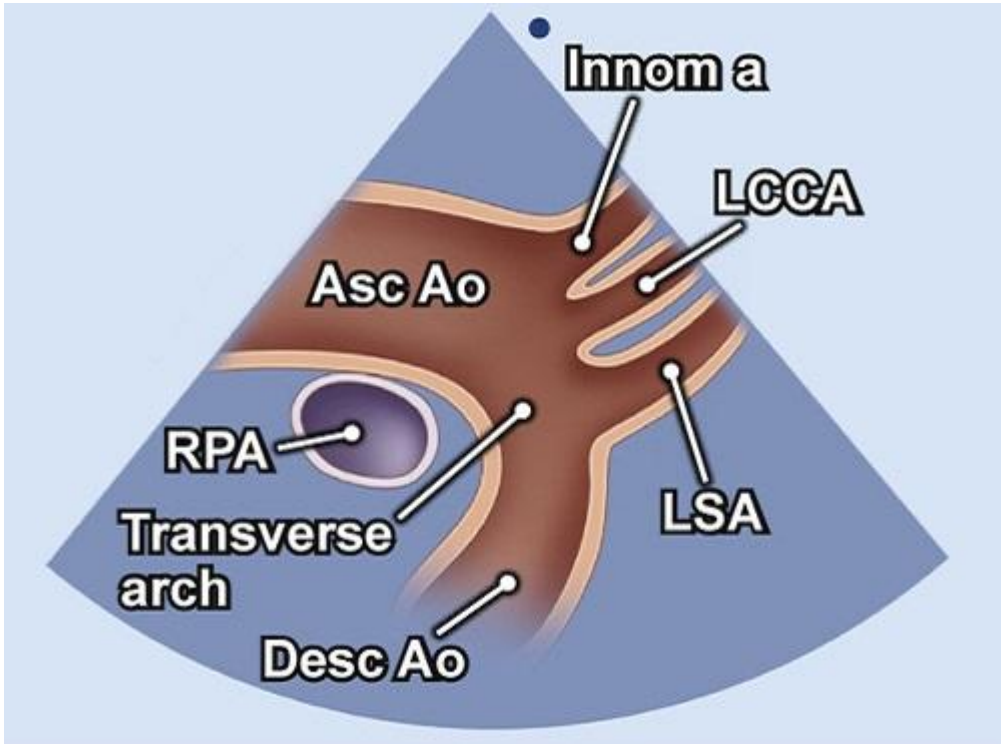








Fereastra suprasternala



Filmul seriii...

Eco

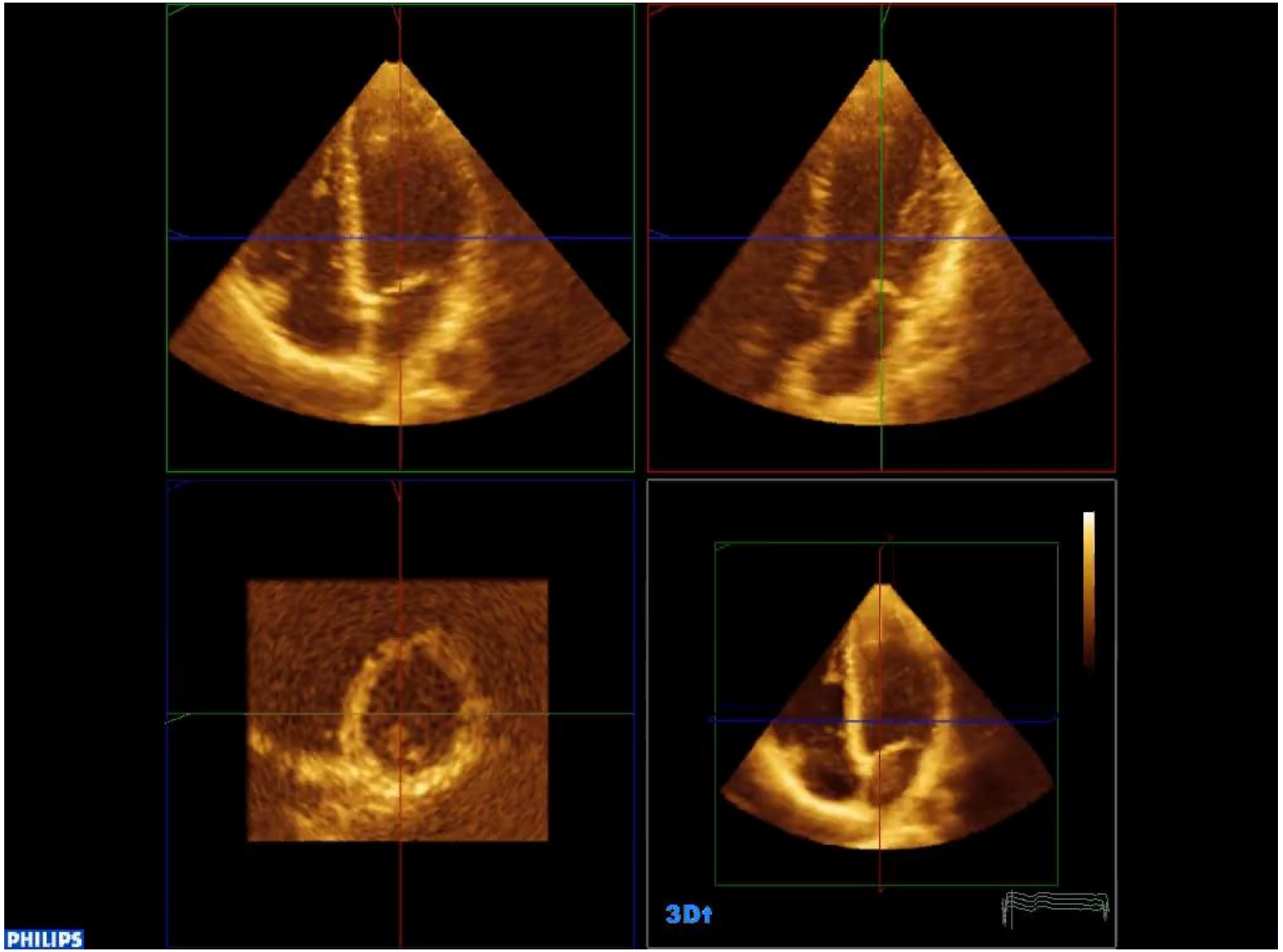
I *Atriul stâng*

II *Dimensiunea și funcțiile VS*

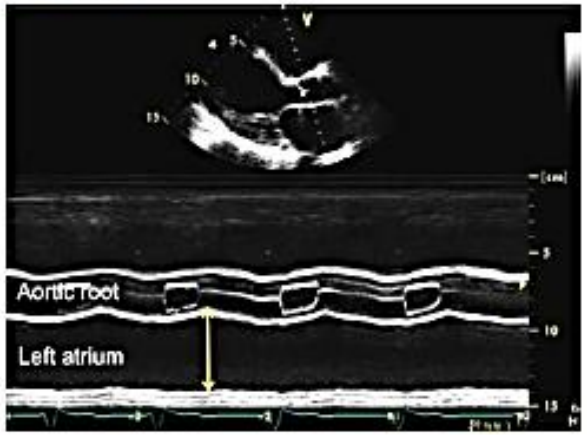
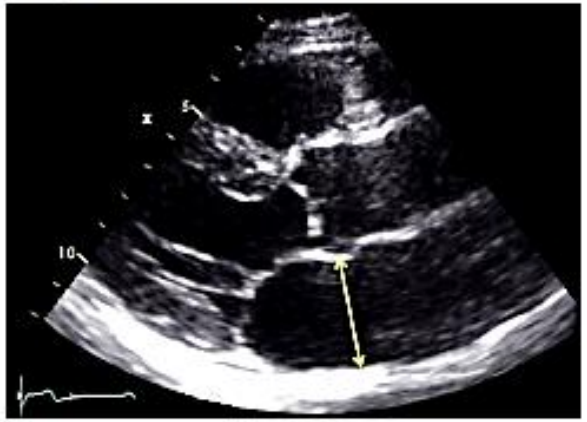
III *Ischemia*

Atriul stang

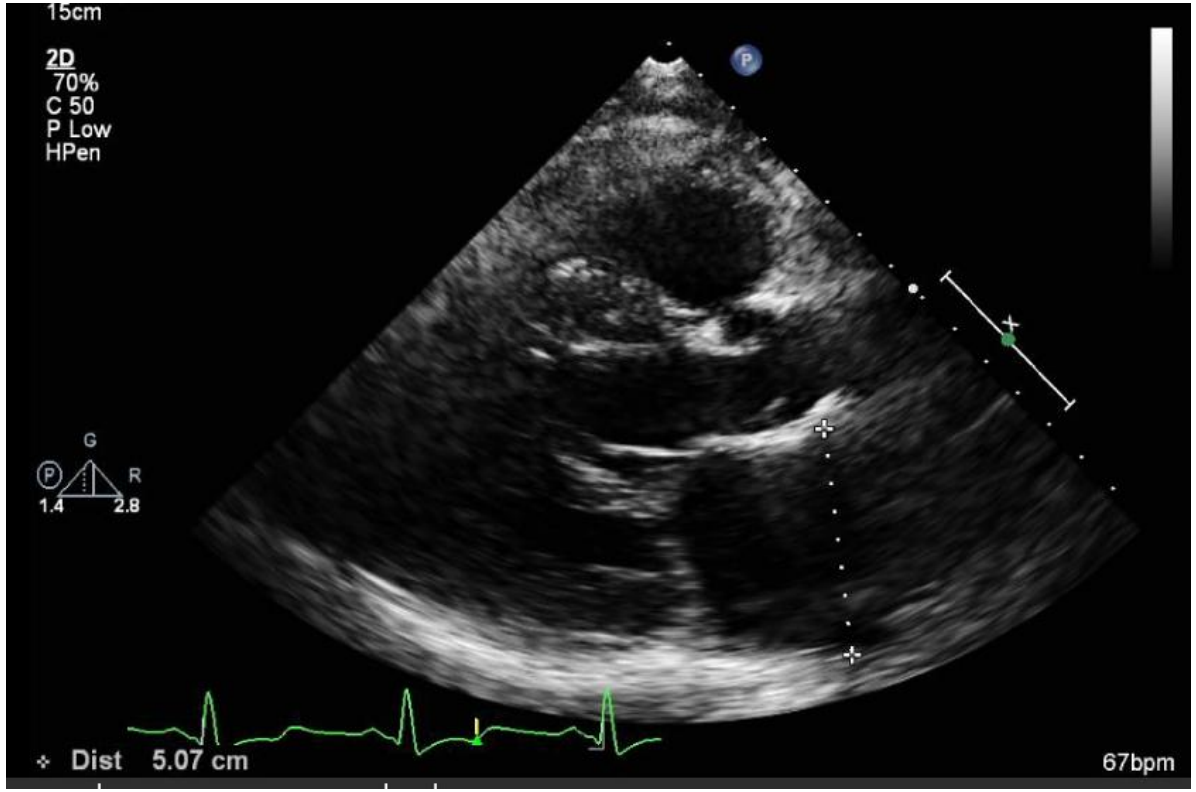
1. Marimea si functiile atriului stang
2. Evaluarea peri si postprocedurala
3. Inchiderea urechiusei stangi

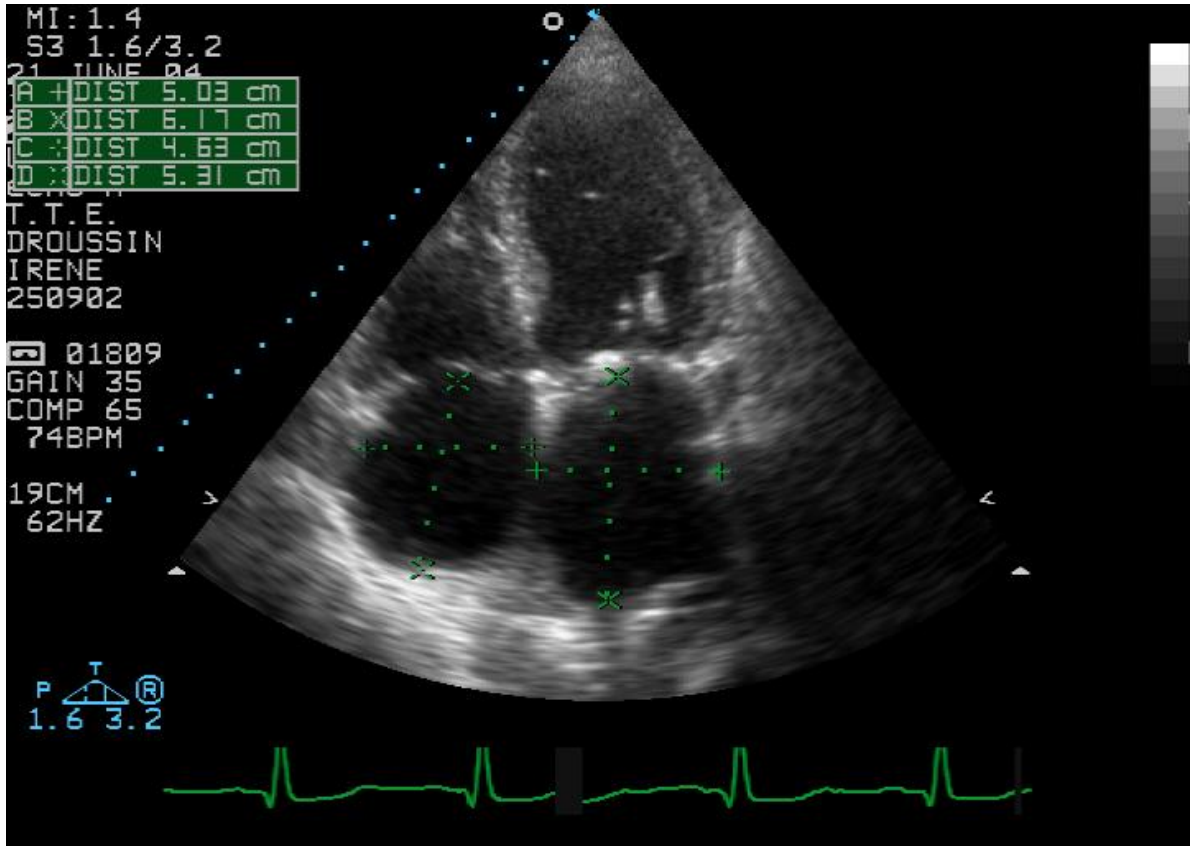


ATRIUL STANG - DIAMETRE

Internal linear dimensions. The anteroposterior diameter of the left atrium can be measured in the parasternal long-axis view perpendicular to the aortic root long axis, and measured at the level of the aortic sinuses by using the leading-edge to leading-edge convention.	M-mode tracing 	• Reproducible • High temporal resolution • Wealth of published data	Single dimension not representative of actual LA size (particularly in dilated atria)
	2D-guided linear measurements 	• Facilitates orientation perpendicular to LA posterior wall	• Lower frame rates than in M-mode • Single dimension only

ATRIUL STANG





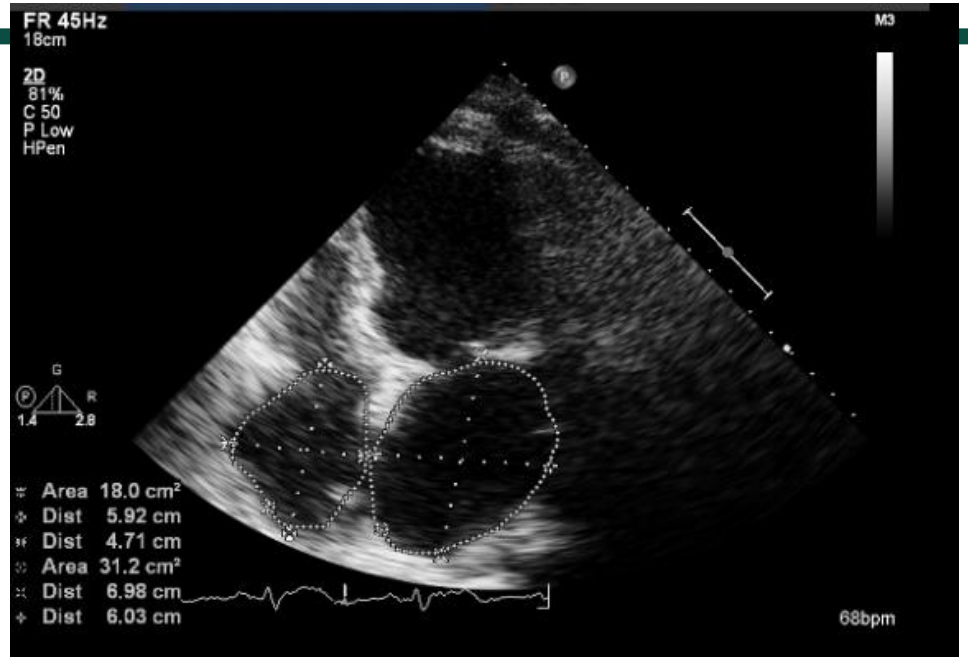
ATRIUL STÂNG - ARIE

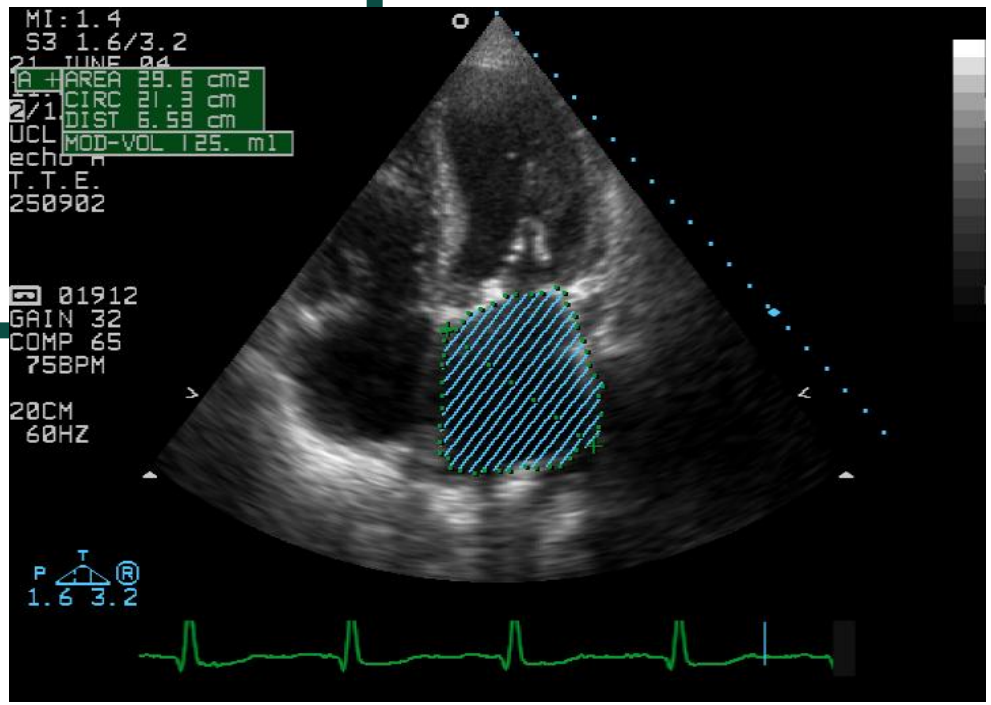
Area.
Measured in four-chamber apical view, at end-systole, on the frame just prior to mitral valve opening by tracing the LA inner border, excluding the area under the mitral valve annulus and the inlet of the pulmonary veins.

2D images

- More representative of actual LA size than ante-roposterior diameter only

- Need for a dedicated view to avoid LA fore-shortening
- Assumes a symmetric shape of the atrium





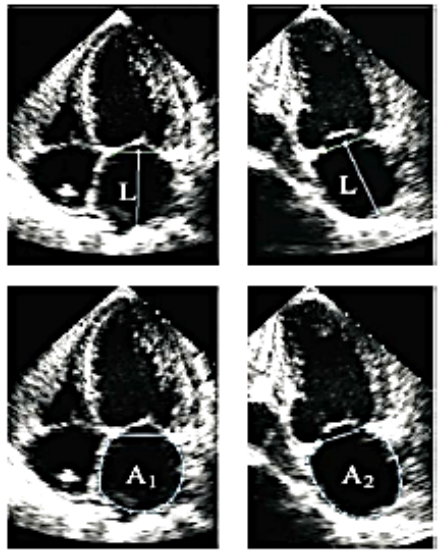
ATRIUL STÂNG - VOLUM 2D

Volume.
2D volumetric measurements are based on tracings of the blood-tissue interface on apical four- and two-chamber views. At the mitral valve level, the contour is closed by connecting the two opposite sections of the mitral annulus with a straight line. Endocardial tracing should exclude atrial appendage and pulmonary veins. LA length L is defined as the shortest of the two long axes measured in the apical two- and four-chamber views (to provide reliable calculations the two lengths should not differ more than 5 mm). Volumes can be computed by using the area-length approximation:

$$\frac{8}{3\pi}\left[\frac{(A_1 \cdot A_2)}{L}\right]$$

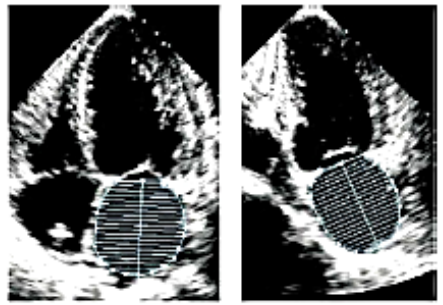
where A1 and A2 are the corresponding LA areas. Alternatively LA volume can be calculated using the disk summation technique by adding the volume of a stack of cylinders of height h and area calculated by orthogonal minor and

2DE
Area-length technique



A4C A2C

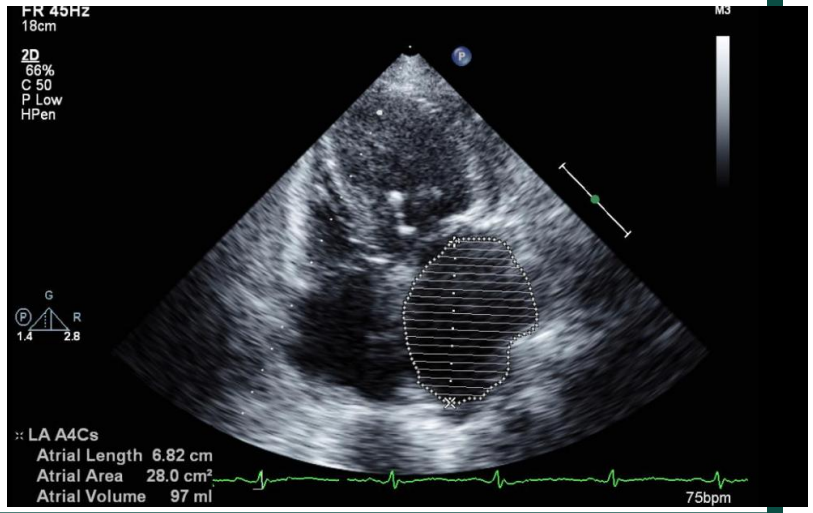
Biplane method of disks



A4C A2C

- Enables accurate assessment of the asymmetric remodeling of the left atrium
- More robust predictor of cardiovascular events than linear or area measurements

- Geometric assumptions about LA shape
- Few accumulated data on normal population
- Single plane volume calculations are inaccurate since they are based on the assumption that A1 = A2

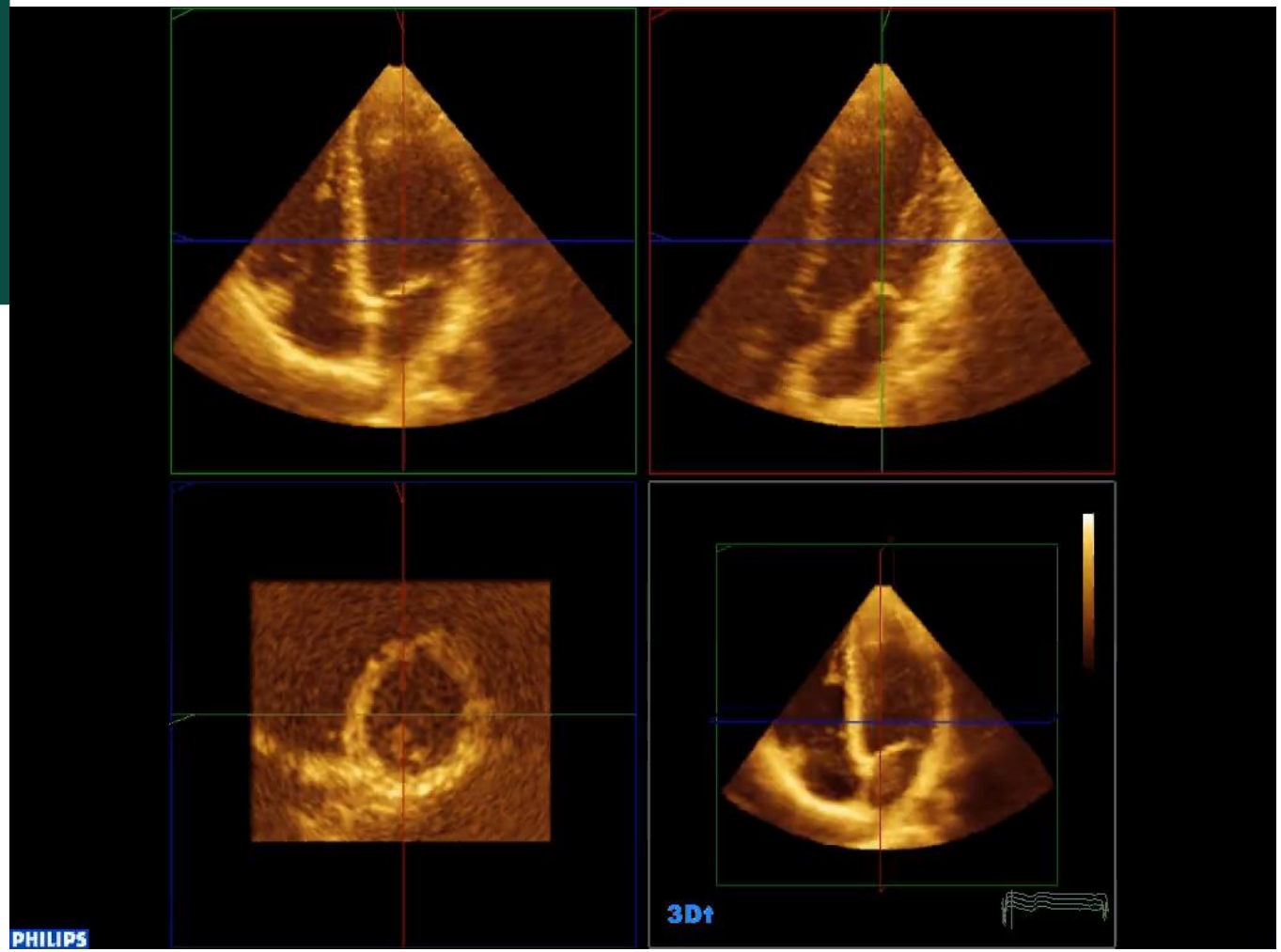


ATRIUL STÂNG - VOLUM 3D

3D data sets

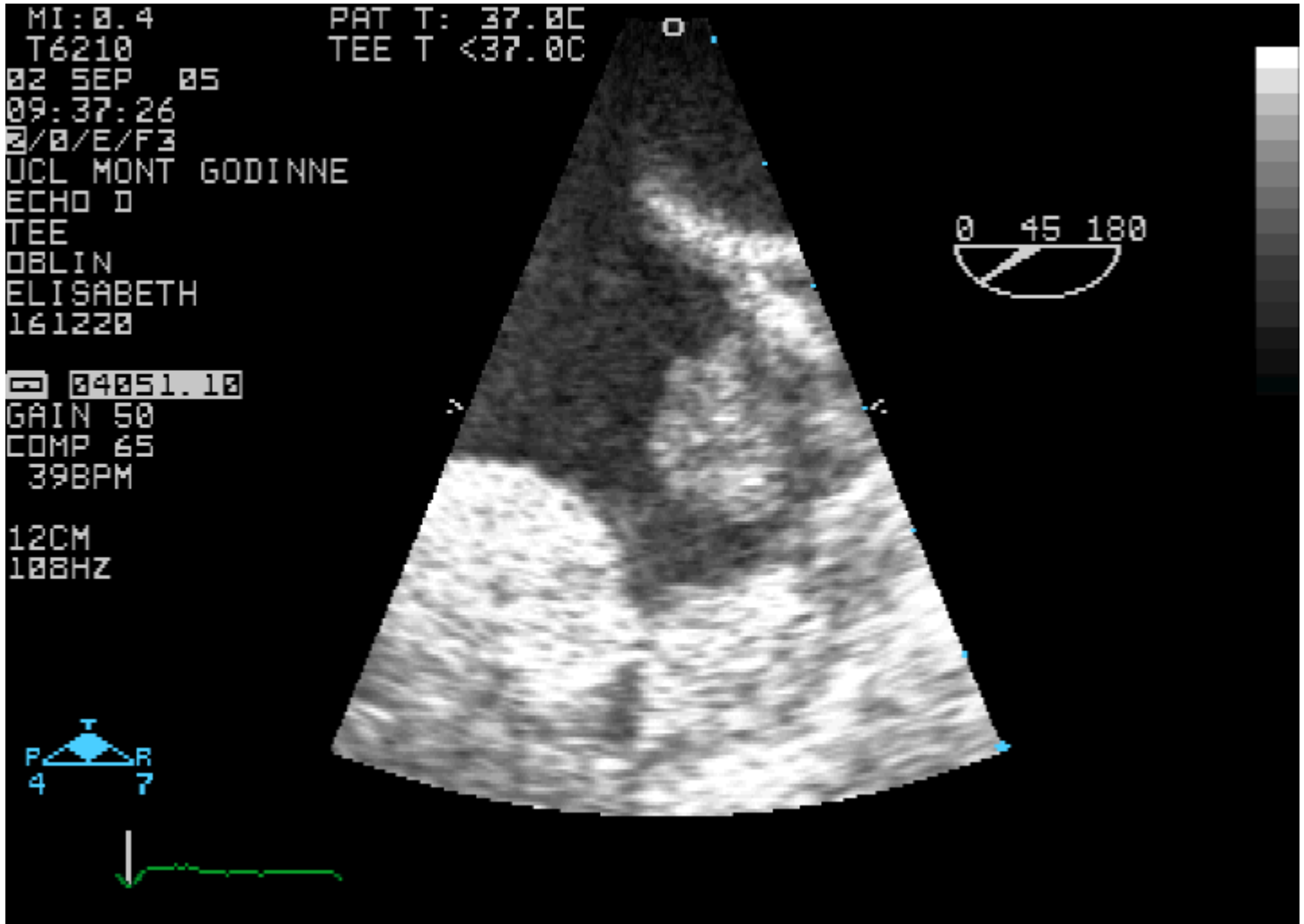
- No geometrical assumption about LA shape
- More accurate when compared to 2D measurements

- Dependent on adequate image quality
- Lower temporal resolution
- Limited data on normal values
- Patient's cooperation required

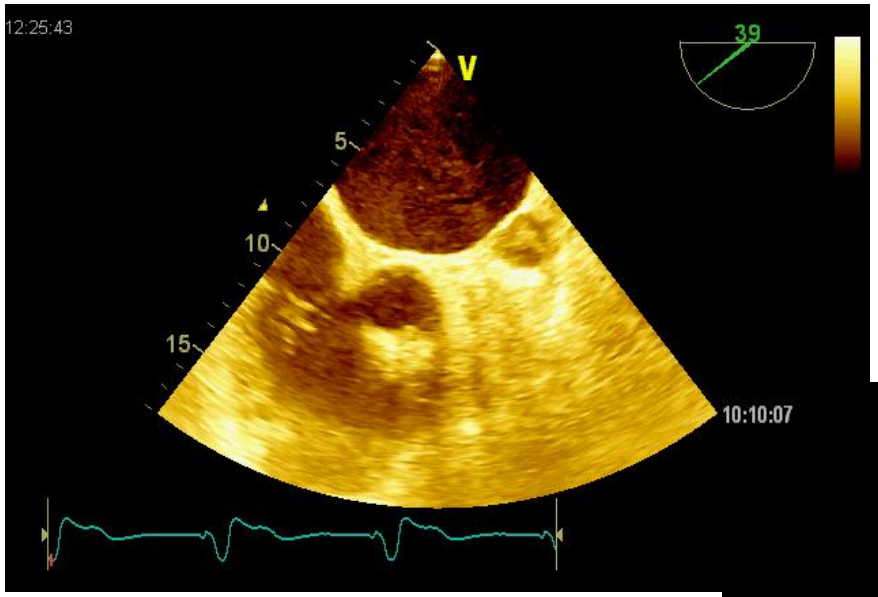


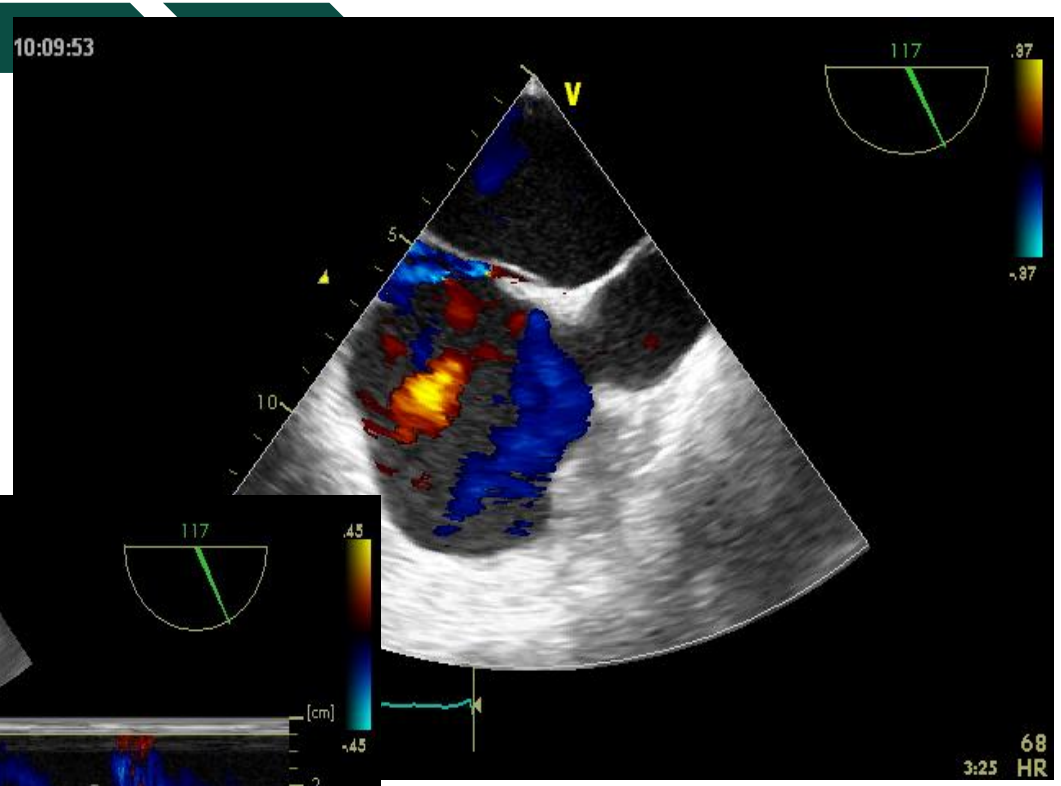
ATRIUL STANG - ETE

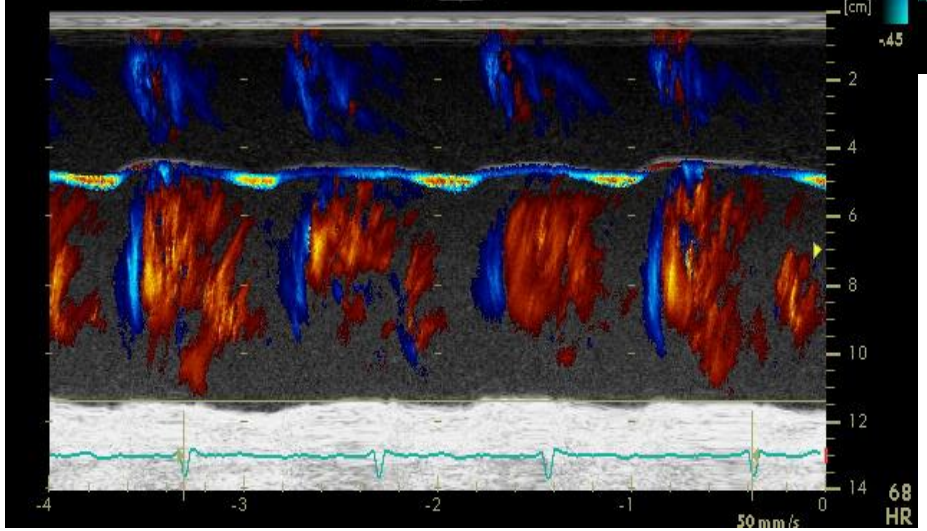
- exclude un ***status pro-trombotic/tromb*** în US/AS
- măsoară ***velocitățile de golire*** a US
- ***FOP+/-DSA***
- vizualizează ***VP***
- ***stenoza de VP*** preexistentă (proceduri multiple)
- ***rețeaua Chiari/valva Eustachio***



ATRIUL STANG - ETE

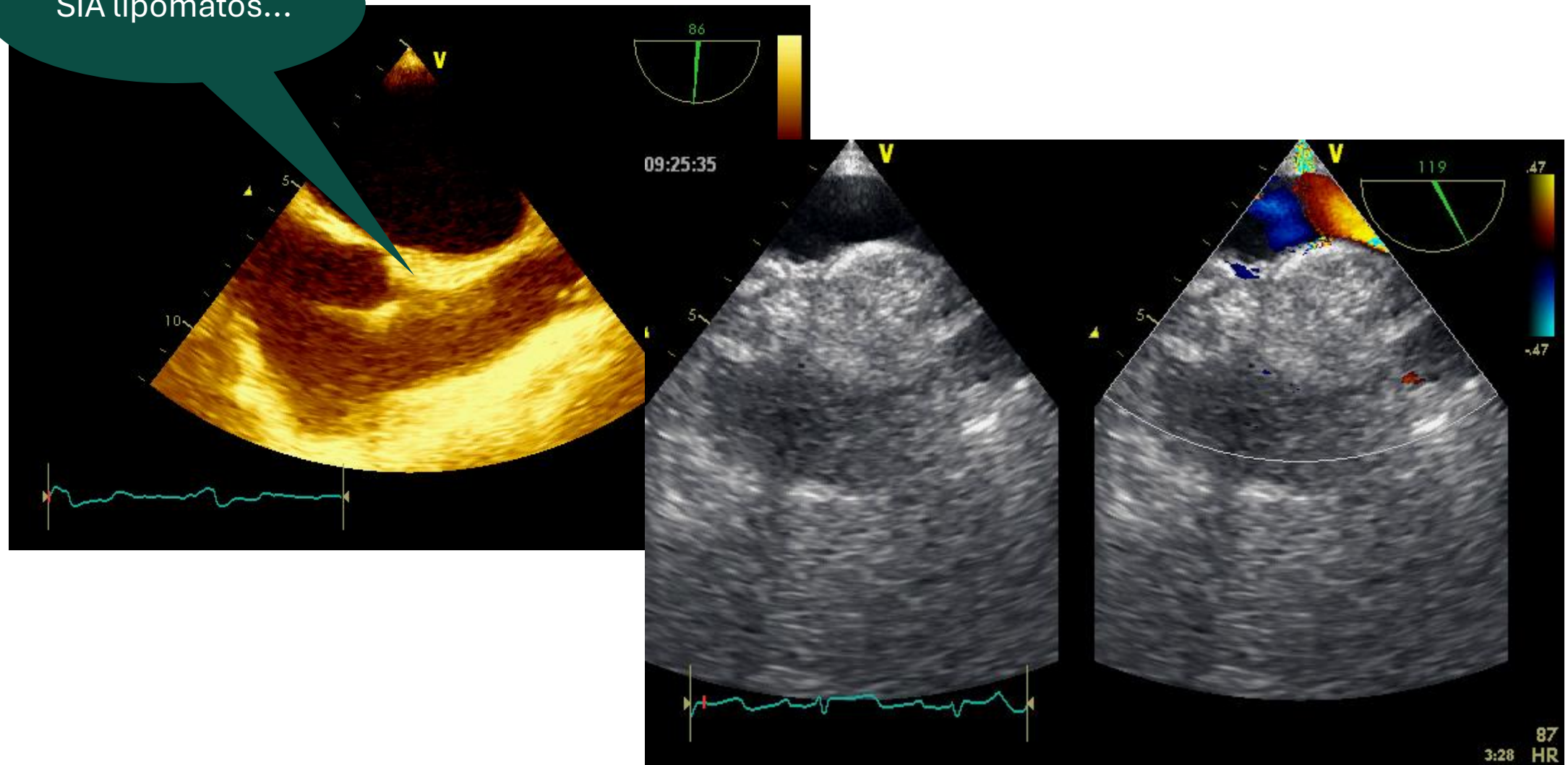






ATRIUL STANG - ETE

SIA lipomatos...



Dimensiunea si Functiile VS

PlAx: DTDVS, DTSVS, SIV, PPVS

A4C: FEVS, MAPSE

A2C: FEVS

...

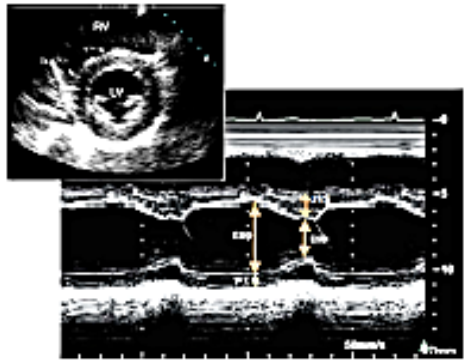
Dimensiuni VS

Dimensiuni liniare

Linear method:
Cube formula
LV mass = $0.8 \cdot 1.04 \cdot [(IVS + LVID + PWT)^3 - LVID^3] + 0.6g$

Where IVS is interventricular septum; LVID is LV internal diameter, and PWT is inferolateral wall thickness.
Linear internal measurements of the LV should be acquired from the parasternal approach and carefully obtained perpendicular to the LV long axis, and measured at the level of the mitral valve leaflet tips. M-mode measurements should be obtained from a targeted SAX or a parasternal LAX view. All measurements should be performed at end-diastole.

M-mode tracing



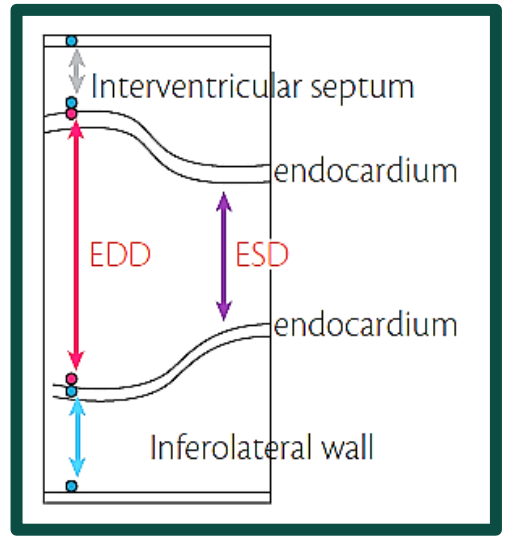
- Fast and widely used
- Wealth of published data
- Demonstrated prognostic value
- Fairly accurate in normally shaped ventricles (i.e., systemic hypertension, aortic stenosis)
- Simple for screening large populations

- Based on the assumption that the left ventricle is a prolate ellipsoid with a 2:1 long/short axis ratio and symmetric distribution of hypertrophy
- Beam orientation frequently off axis
- Since linear measurements are cubed, even small measurement errors in dimensions or thickness have an impact on accuracy
- Overestimates LV mass
- Inaccurate in the presence of asymmetric hypertrophy, dilated ventricles and other diseases with regional variations in wall thickness

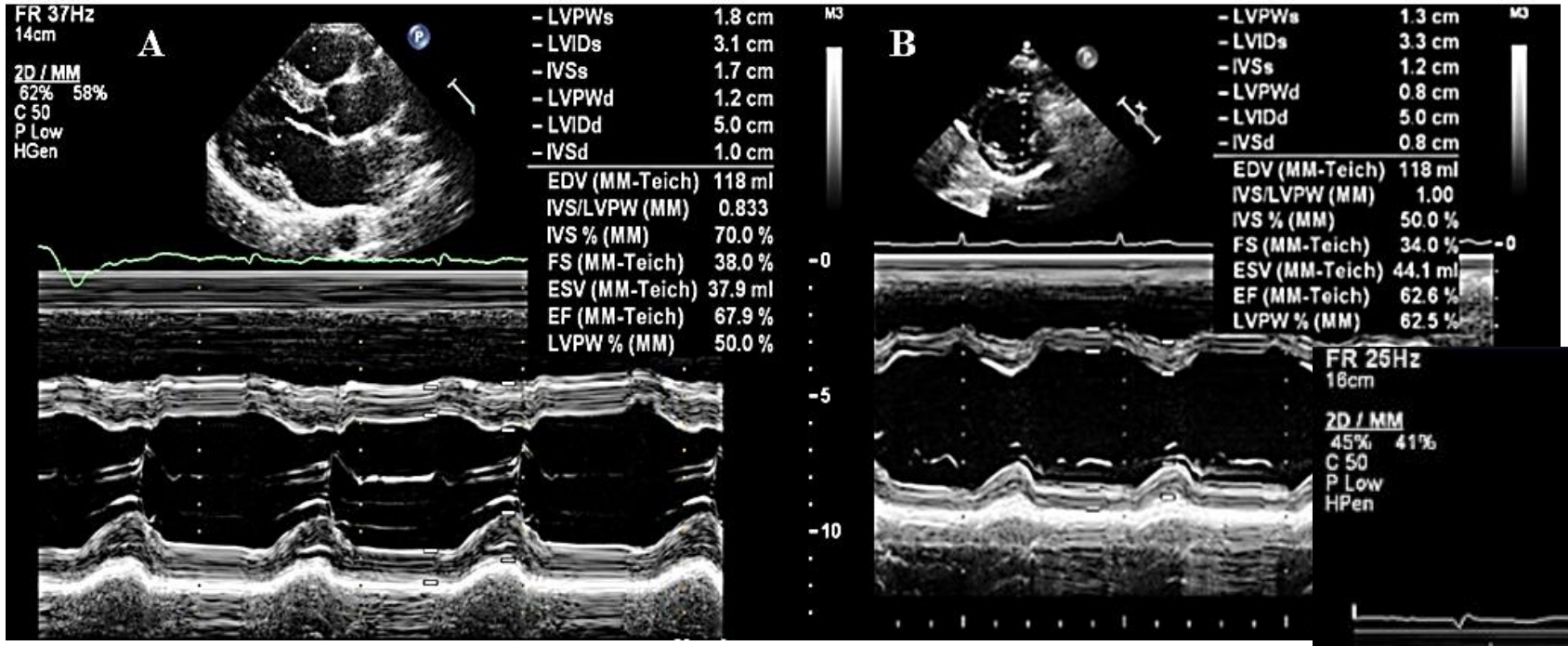
2D

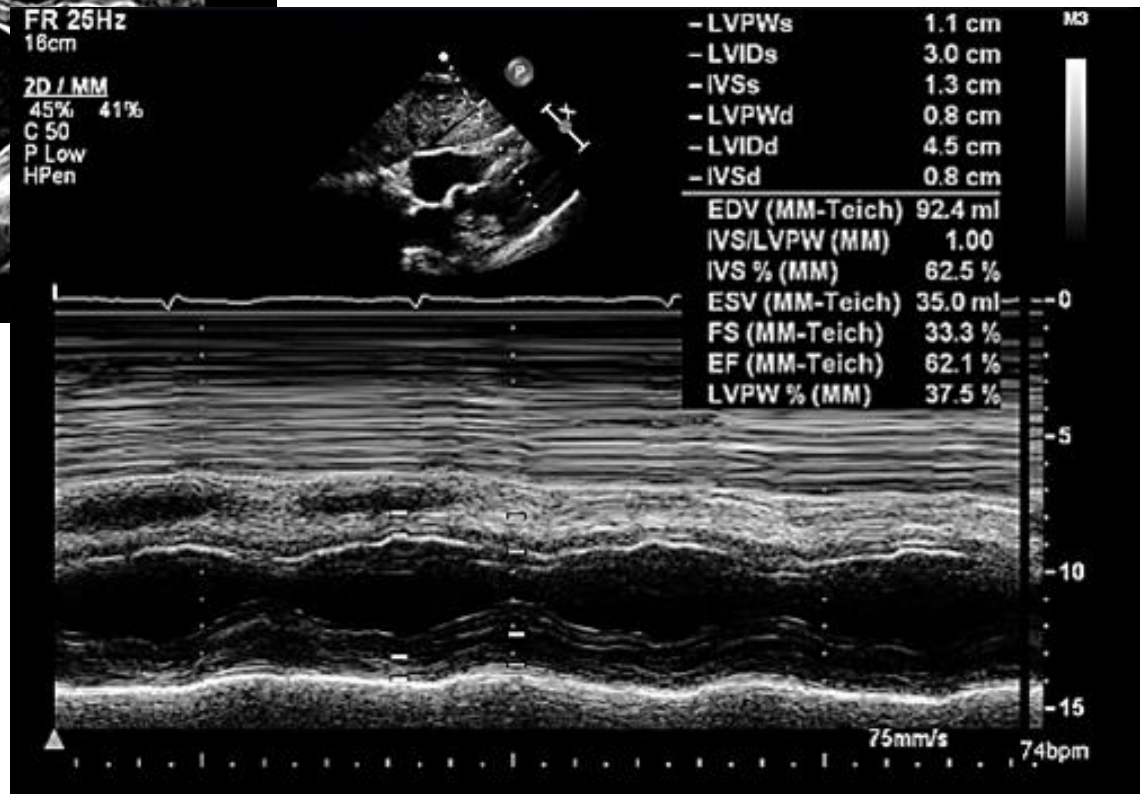
- Facilitates orientation perpendicular to the LV long axis

- Based on the same geometrical assumptions as M-mode
- Same limitations as M-mode in patients with abnormal LV geometry
- Impact of harmonic imaging on the mass calculations and normal values remains to be defined
- Normal values are less well established than for M-mode measurements

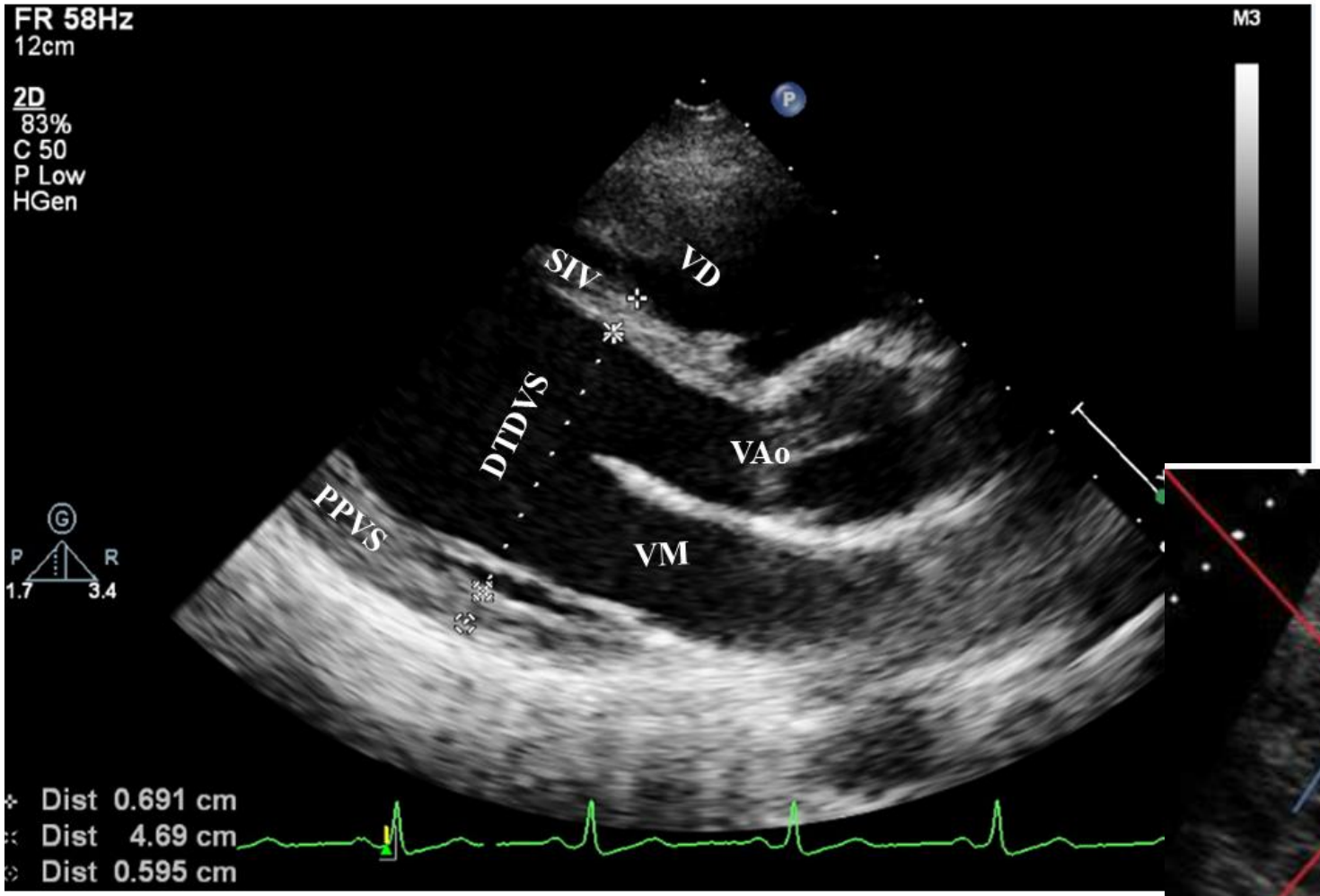


Dimensjunle VS



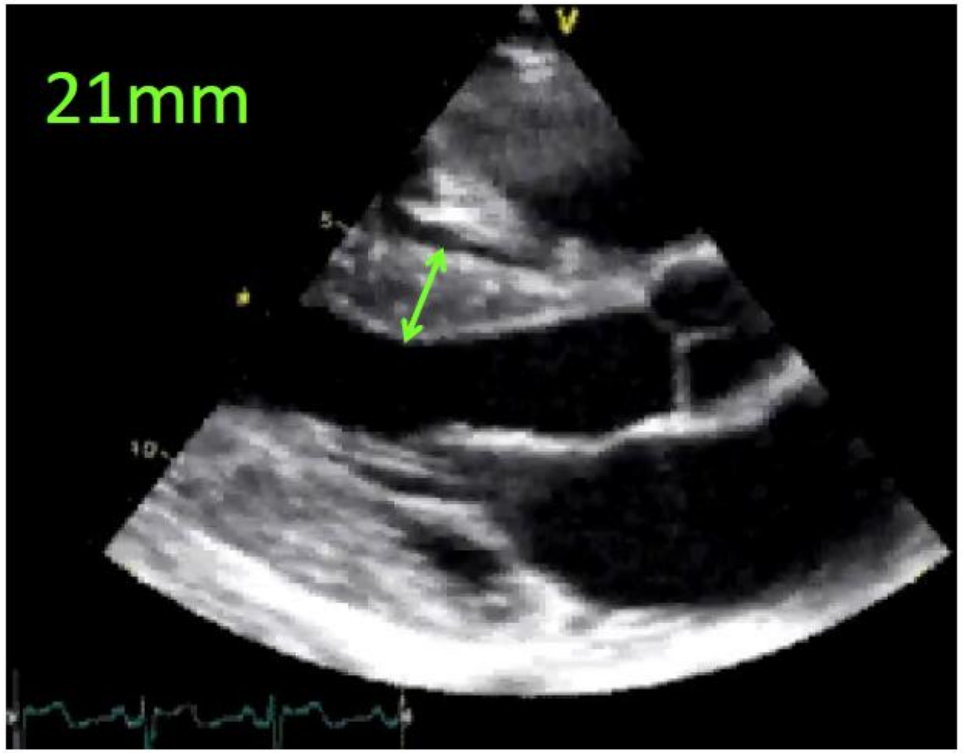


Dimensiunile VS



Wall thickness

EACVI
European Association of Cardiovascular Imaging

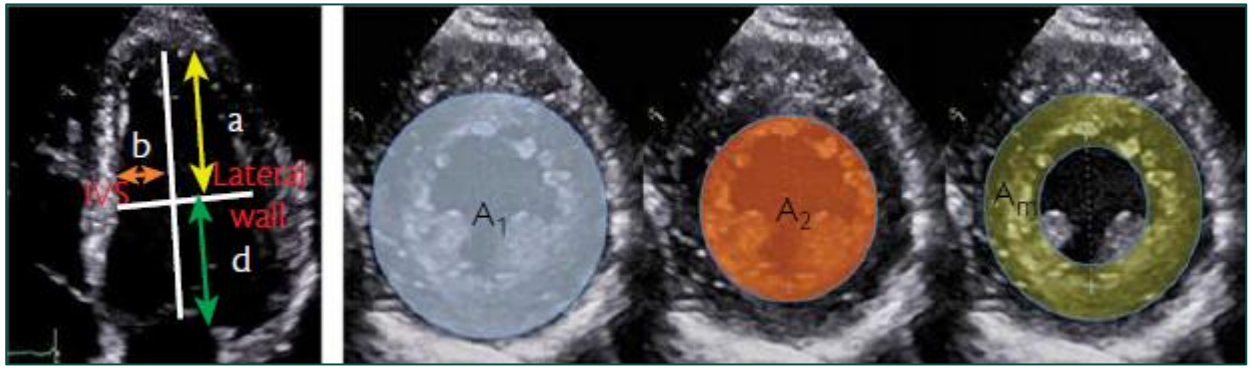


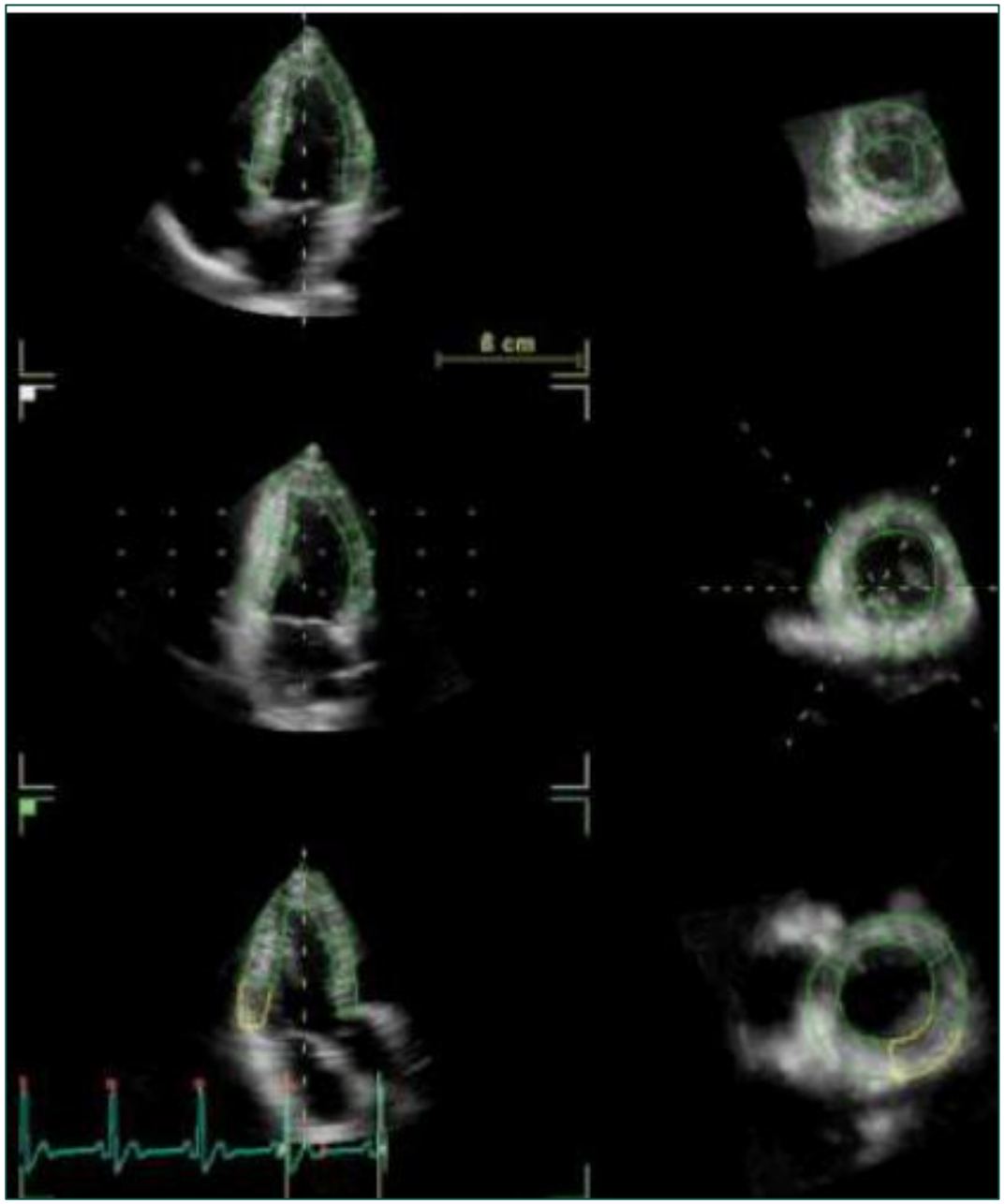
Normally: 6-12mm in diastole

Hypertrophy: severe if >20mm

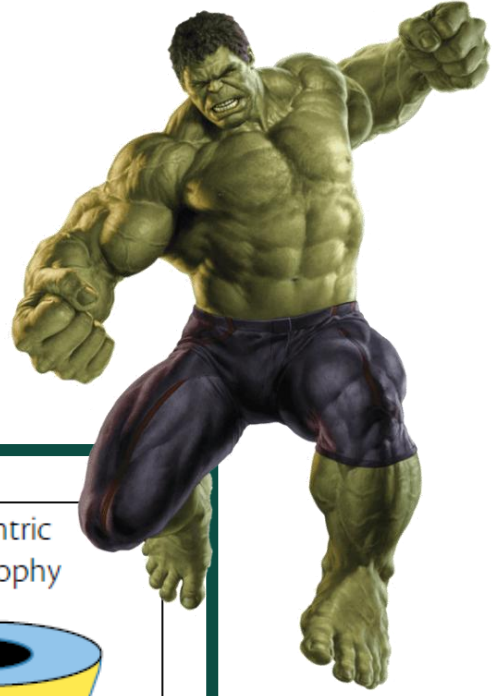
Masa VS

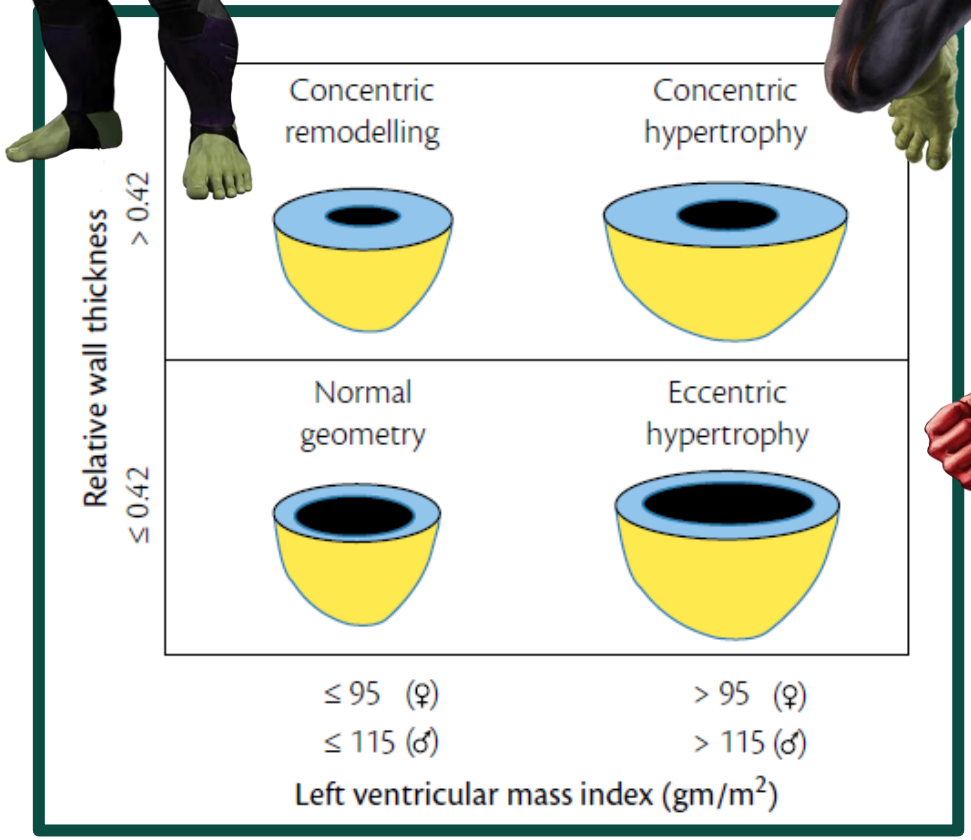
LV mass = (LV epicardial volume – LV endocardial volume). 1.05 = LV myocardial volume. 1.05





	Women	Men
Linear method		
LV mass (g)	67–162	88–224
LV mass/BSA (g/m²)	***43–95***	***49–115***
Relative wall thickness (cm)	0.22–0.42	0.24–0.42
Septal thickness (cm)	***0.6–0.9***	***0.6–1.0***
Posterior wall thickness (cm)	***0.6–0.9***	***0.6–1.0***
2D method		
LV mass (g)	66–150	96–200
LV mass/BSA (g/m²)	***44–88***	***50–102***





Functia sistolica VS

2D based formulas.
Truncated ellipsoid:

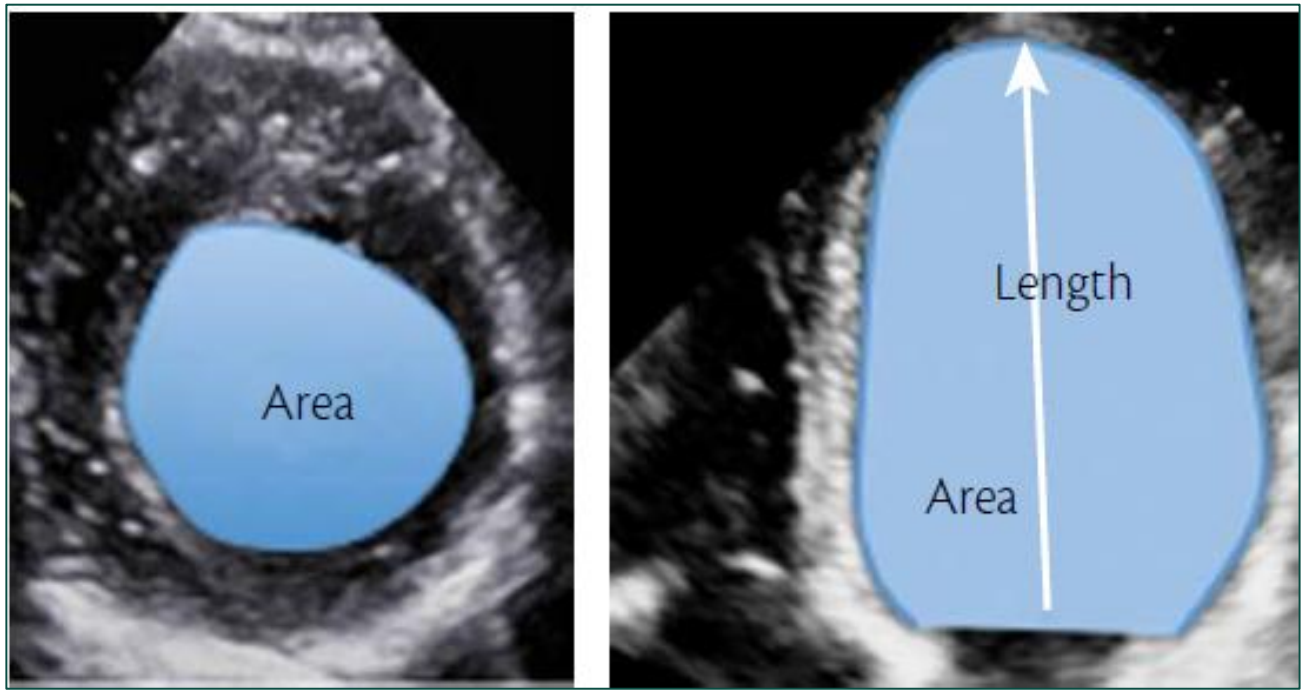
$$\text{LV mass} = 1.05\pi\left\{(b+t)^2\left[\frac{2}{3}(a+t)+d-\frac{d^3}{3(a+t)^2}\right]-b^2\left[\frac{2}{3}a+d-\frac{d^3}{3a^2}\right]\right\}$$

- Partial correction for shape distortions
- Less dependent on geometrical assumptions than the linear measurements

- Good image quality and properly oriented parasternal short-axis views (no oblique planes) are required
- Good epicardial definition is required
- Cumbersome methodology
- Higher measurement variability
- Few published normative data
- Limited prognostic data

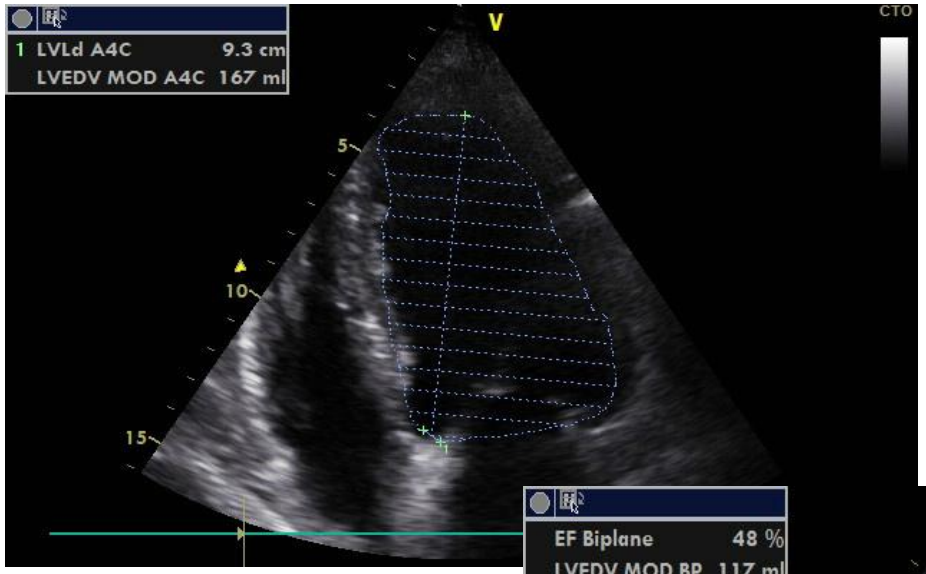
Volumul VS si FEVS: metoda 2D

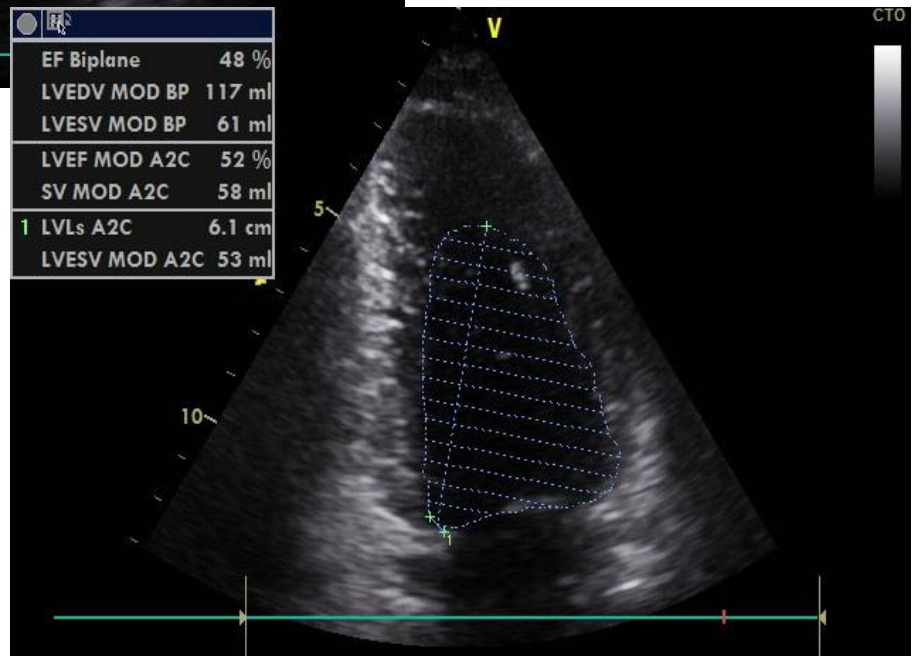
Metoda arie-lungime

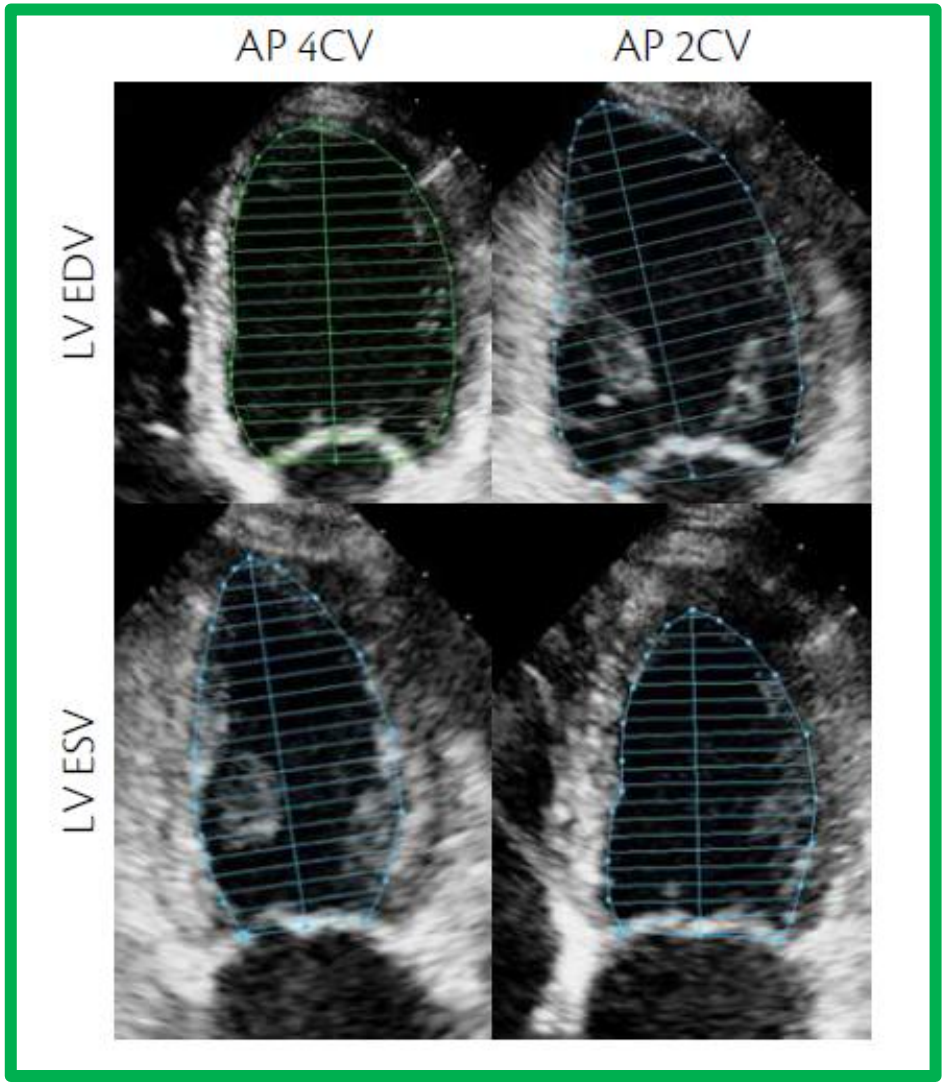


FUNCTIA SISTOLICA VS

Volumul VS si FEVS – metoda SIMPSON



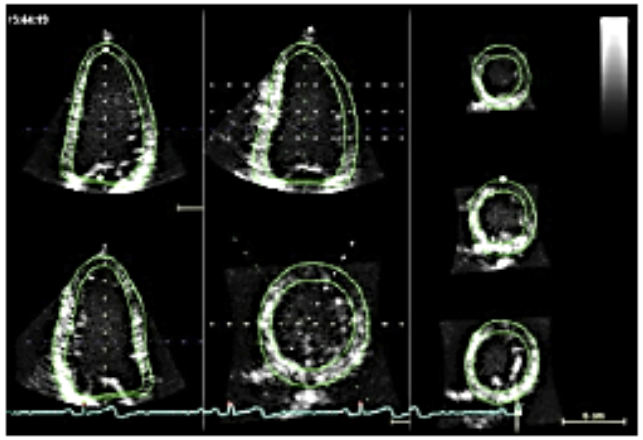





13/06/1938 1584128 UCL GODINNE ECHO A 55-1/TTE
FR 55Hz
A4Cd
LV Length 6.52 cm
LV Area 24.4 cm²
LV Vol 74 ml
A4Cs
LV Length 5.48 cm
LV Area 15.7 cm²
LV Vol 39 ml
EF (A4C) 47 %
A2Cd
LV Length 7.33 cm
LV Area 29.0 cm²
LV Vol 94 ml
EDV (BP) 89 ml
A2Cs
LV Area 18.0 cm²
LV Vol 46 ml
EF (A2C) 51 %
ESV (BP) 45 ml
EF (BP) 49 %

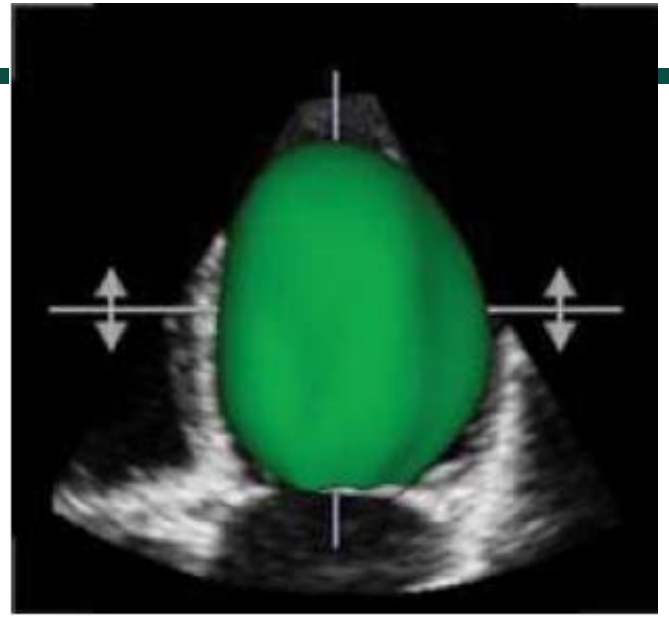
FEVS: metoda 3D

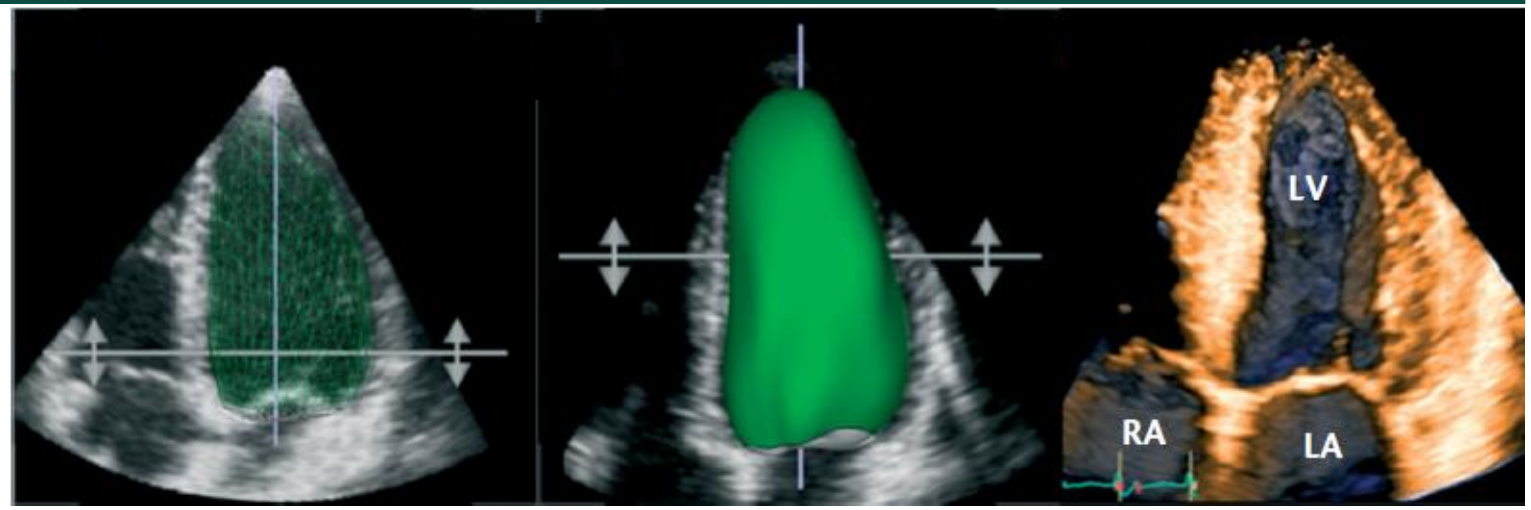
3D data set



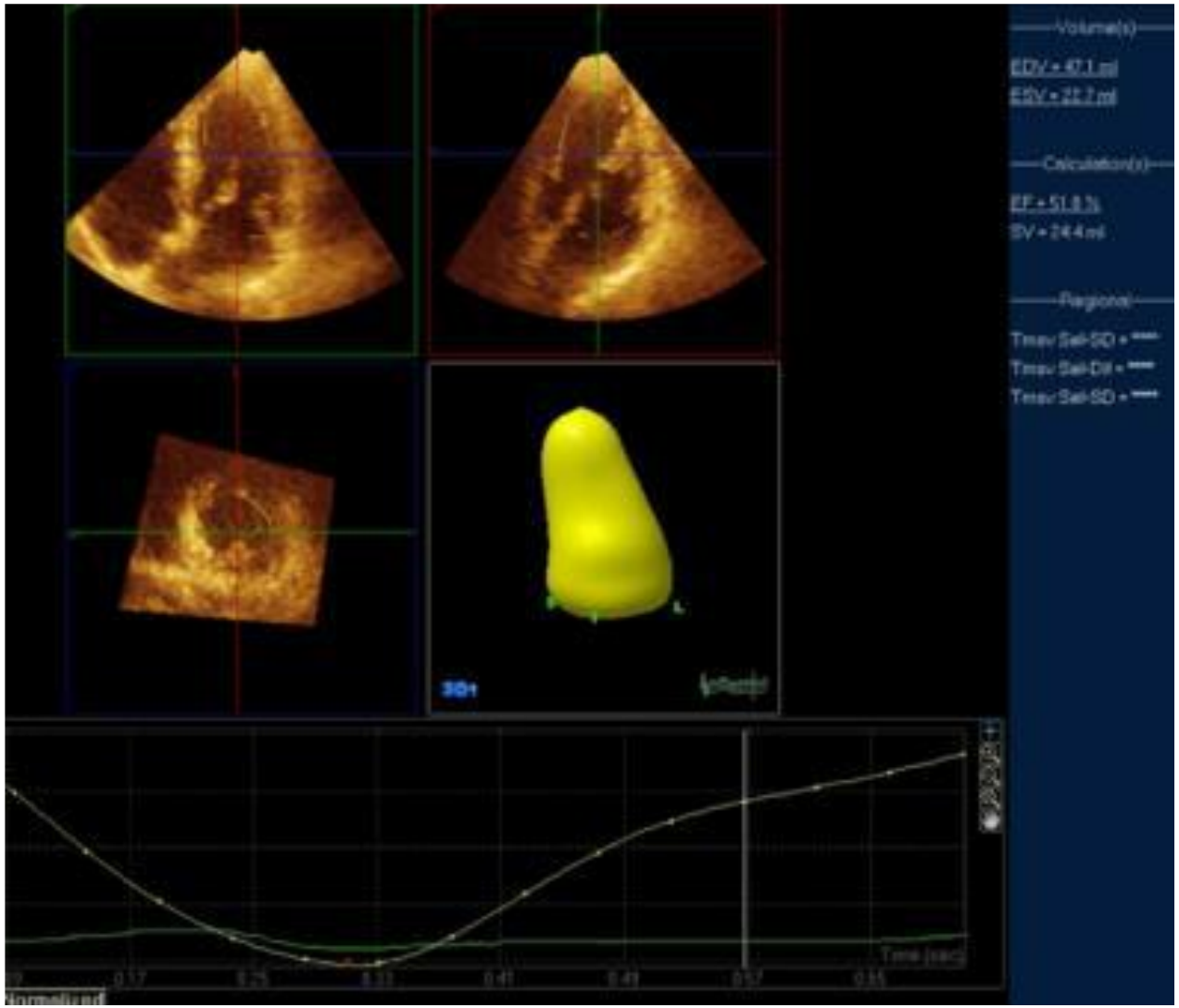
- Direct measurement without geometrical assumptions about cavity shape and hypertrophy distribution
- More accurate than the linear or the 2D measurements
- Higher inter-measurement and test/re-test reproducibility
- Better discriminates small changes within a patient

- Normal values less well established
- Dependent on image quality
- Patient's cooperation required



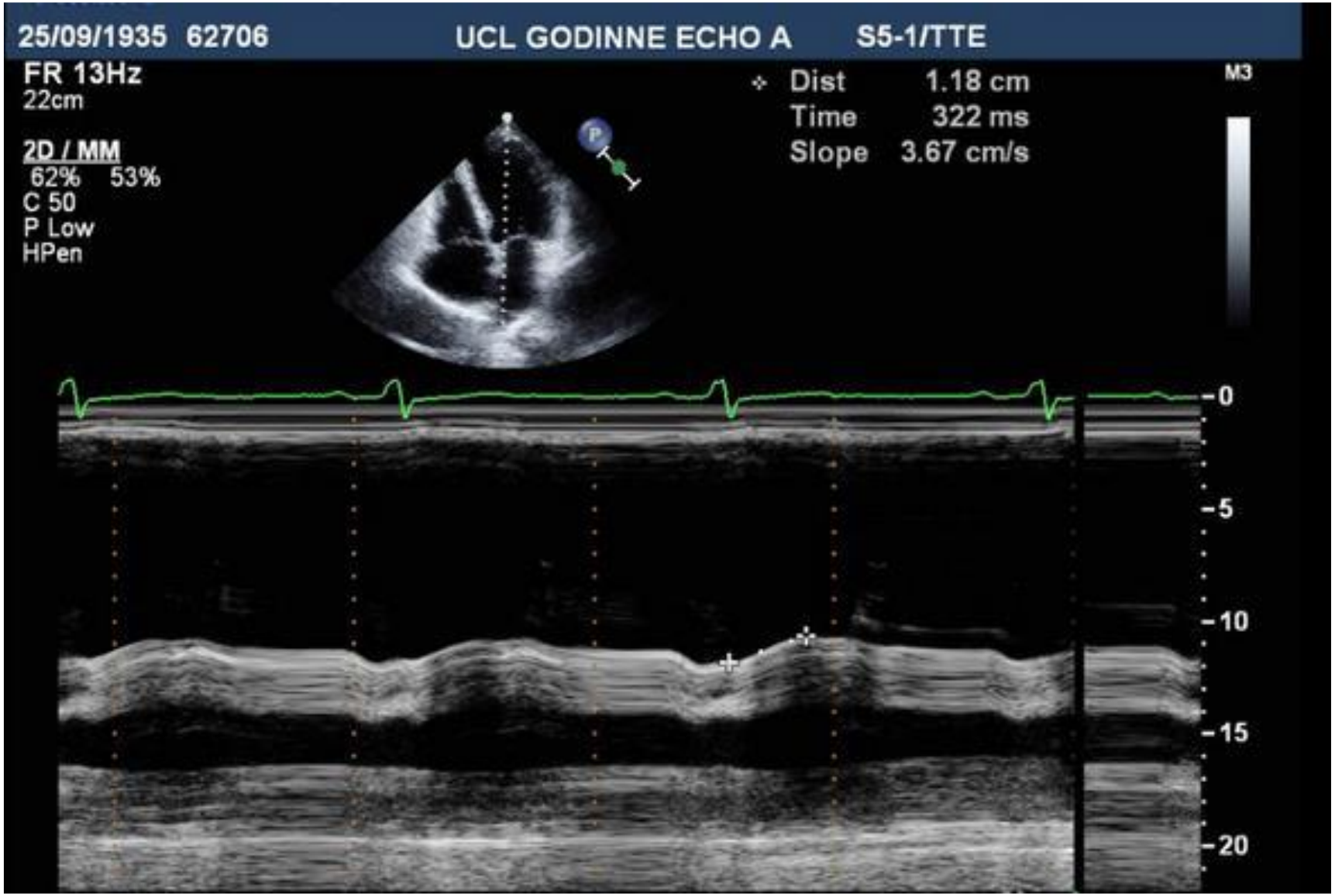


FEVS: metoda 3D



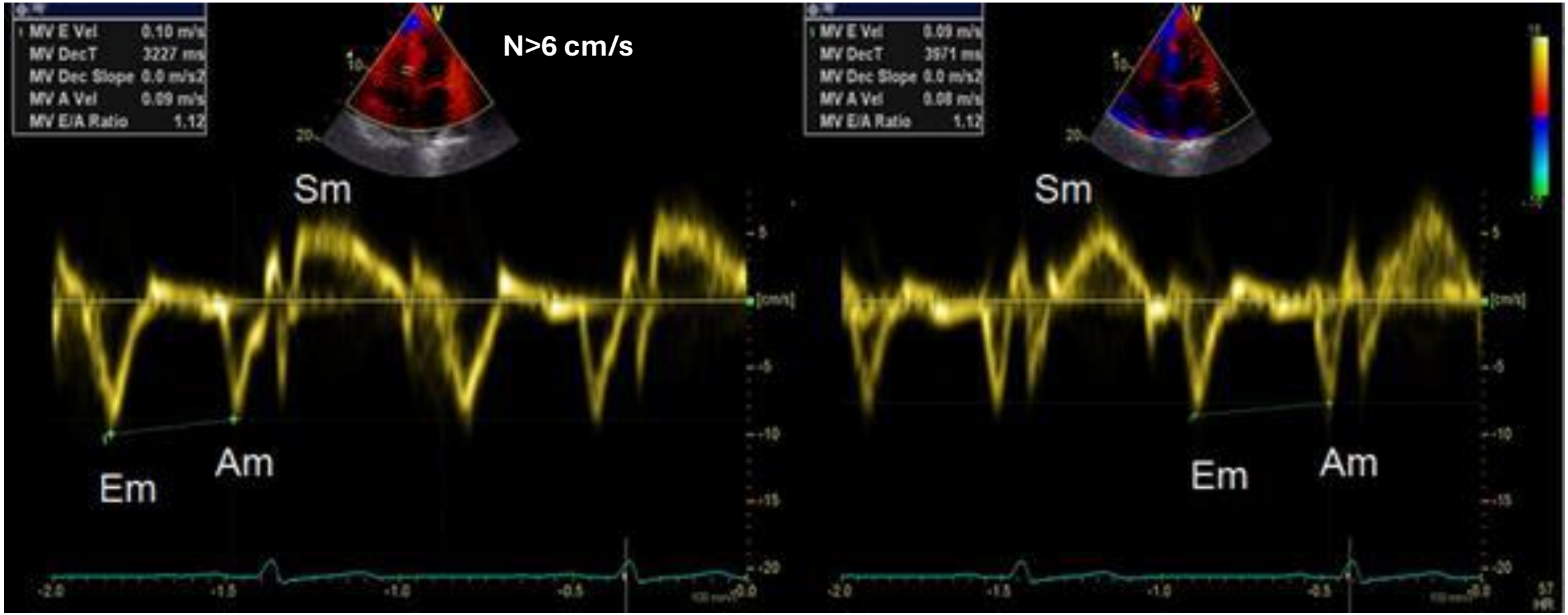
Functia sistolica VS

Functia sistolica longitudinala a VS - MAPSE



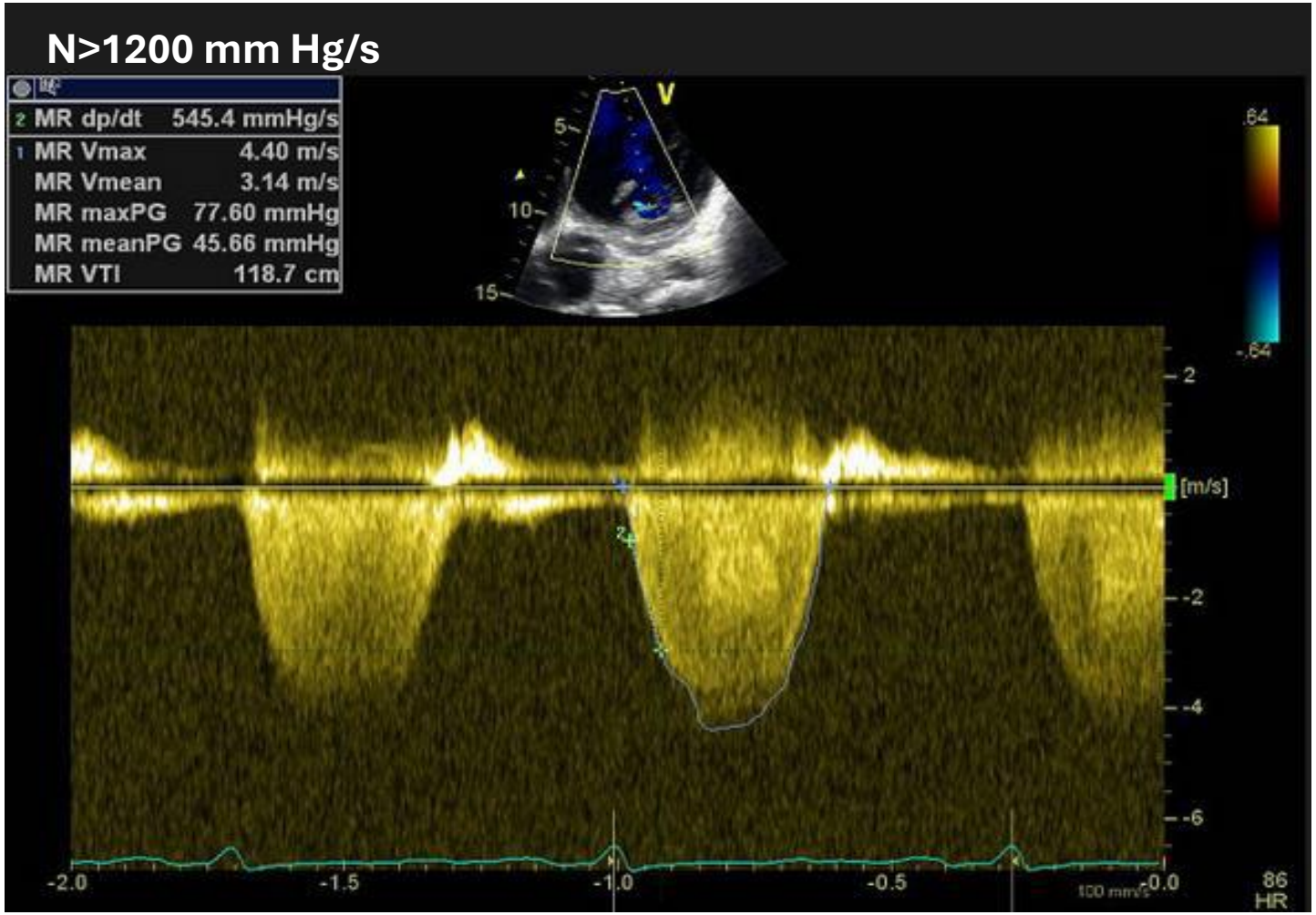
FUNCTIA SISTOLICA VS

DOPPLER TISULAR



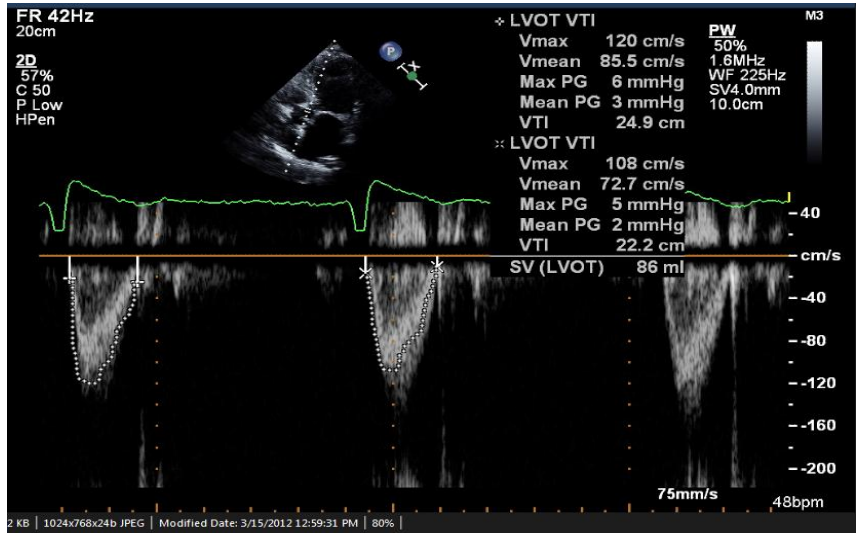
FUNCTIA SISTOLICA VS

Dp/Dt

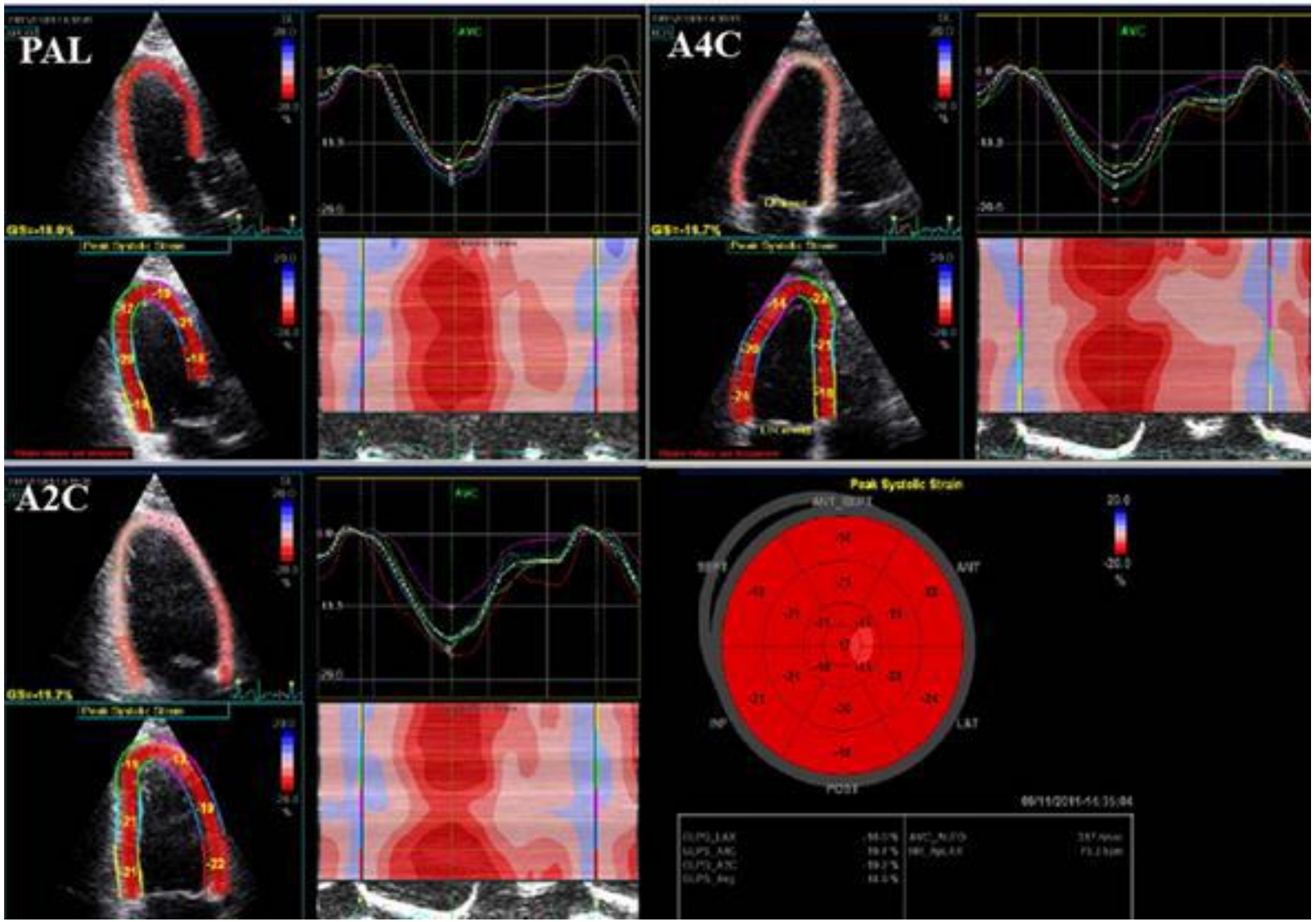


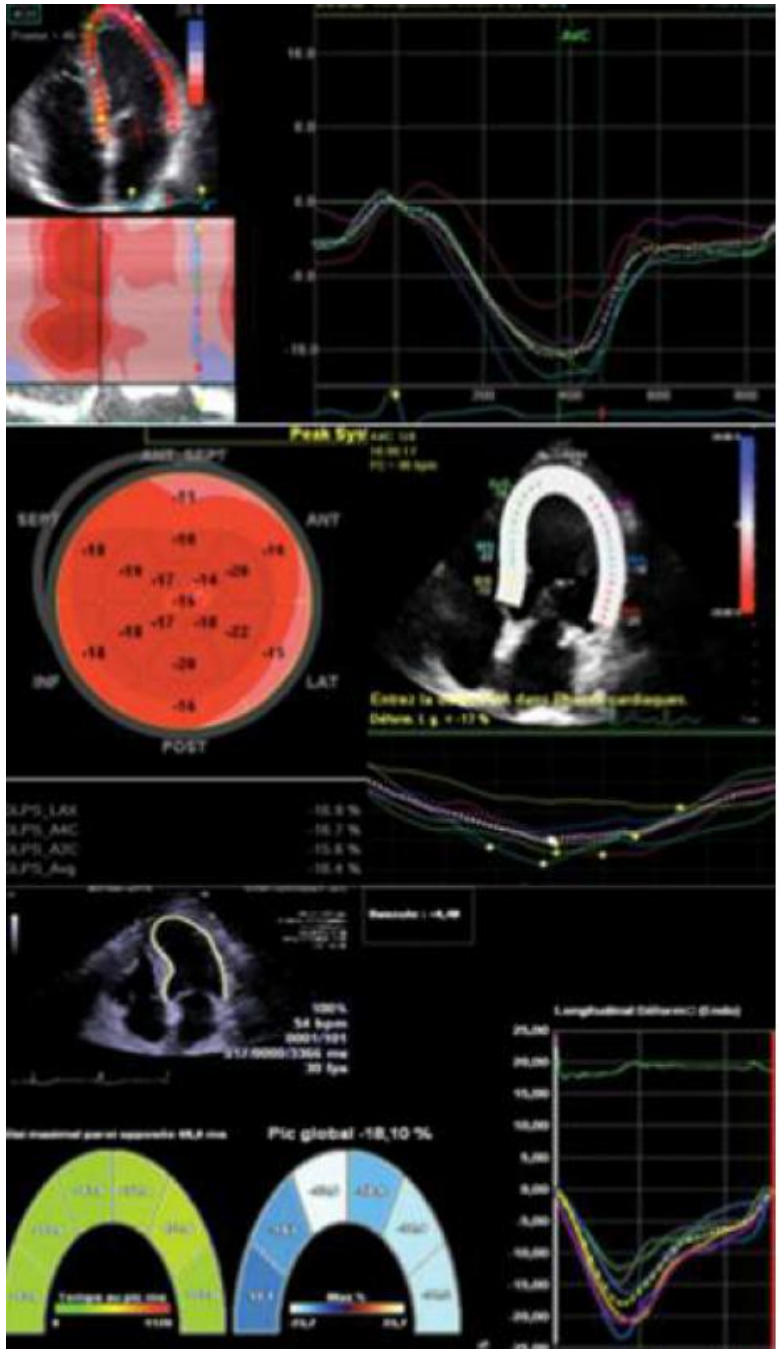
FUNCTIA SISTOLICA VS

DEBIT BĂTAIE
DEBIT CARDIAC



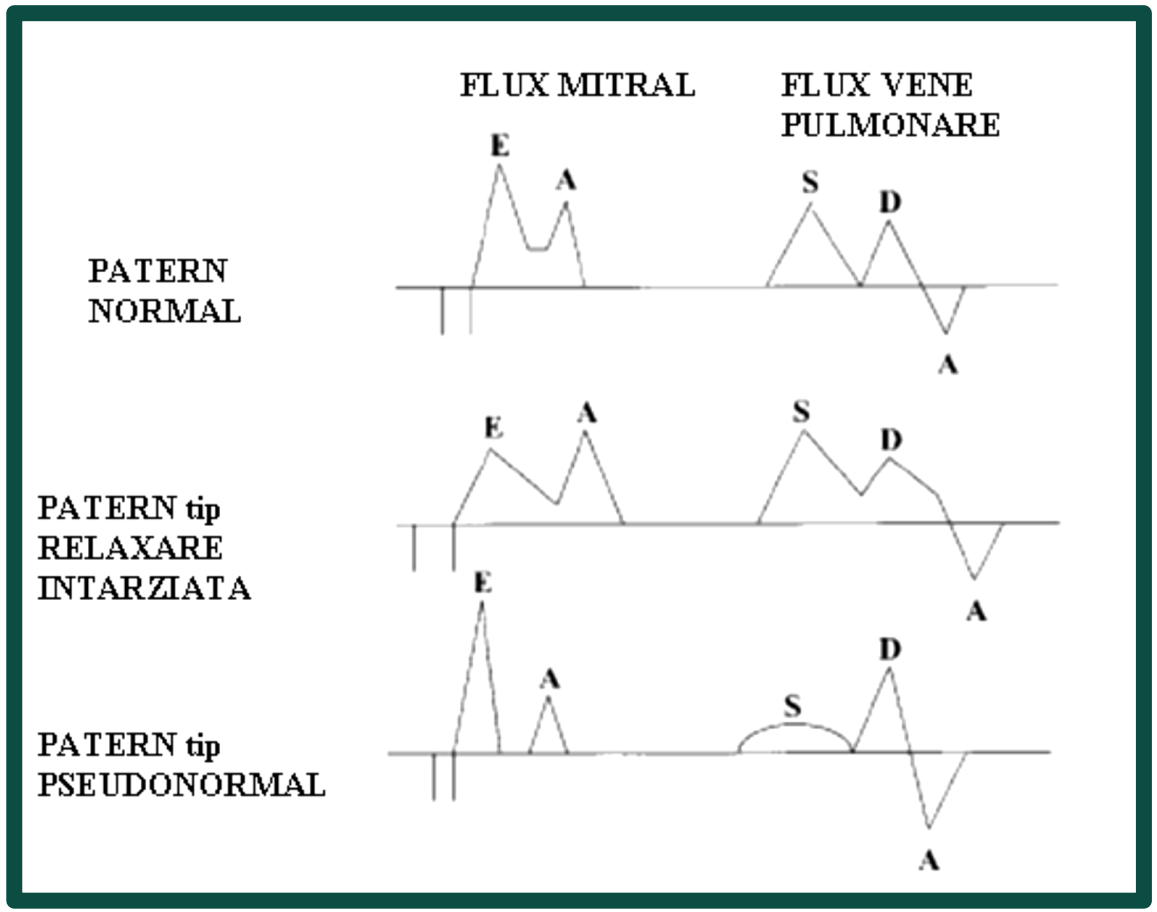
Disfunctia sistolica subclinica de VS



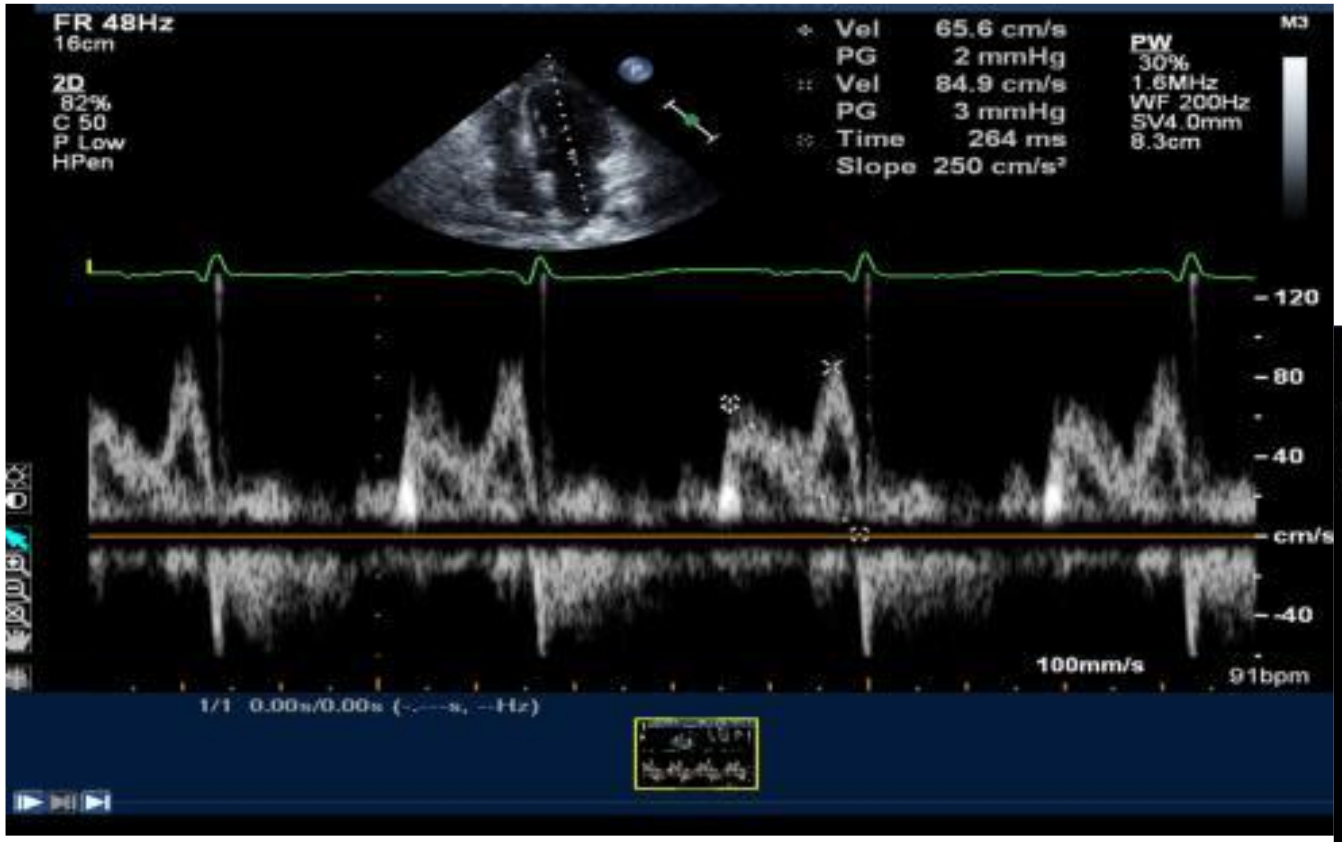


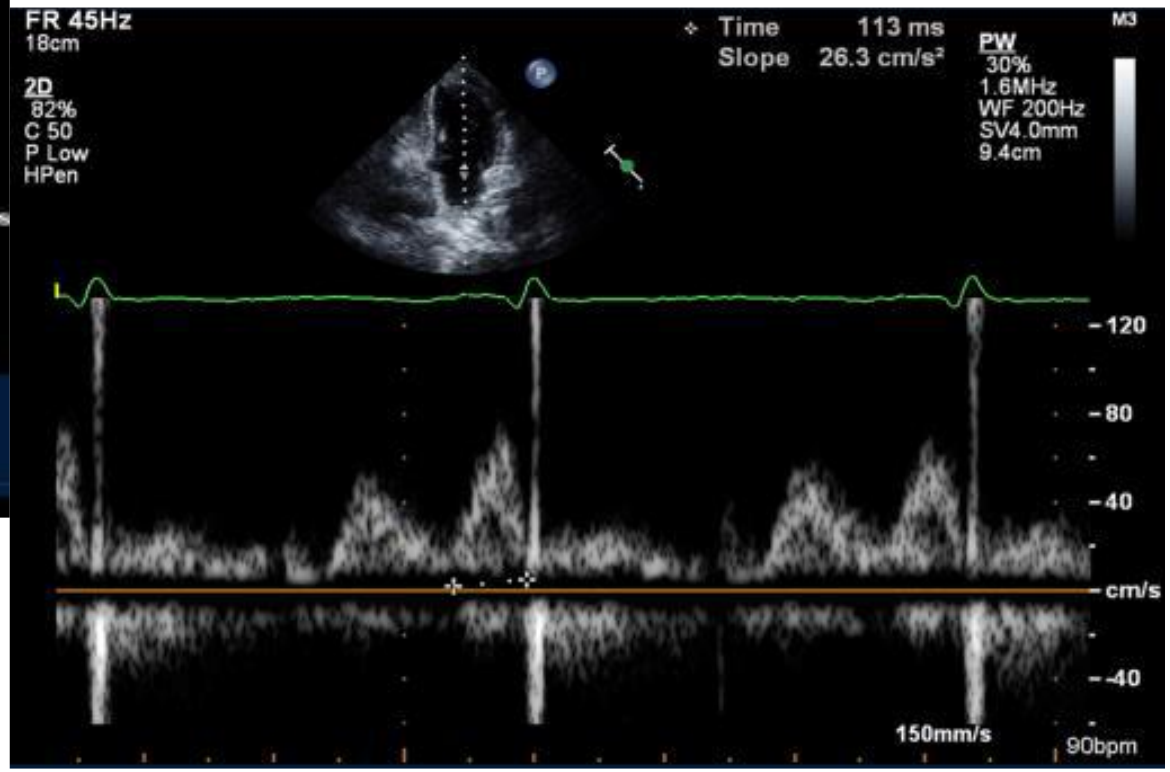
FUNCTIA DIASTOLICA VS

E/Em<8	PTDVS normală
E/Em>15	PTDVS crescută
E/Em=8-15	Se calculează parametri suplimentari pentru estimarea PTDVS

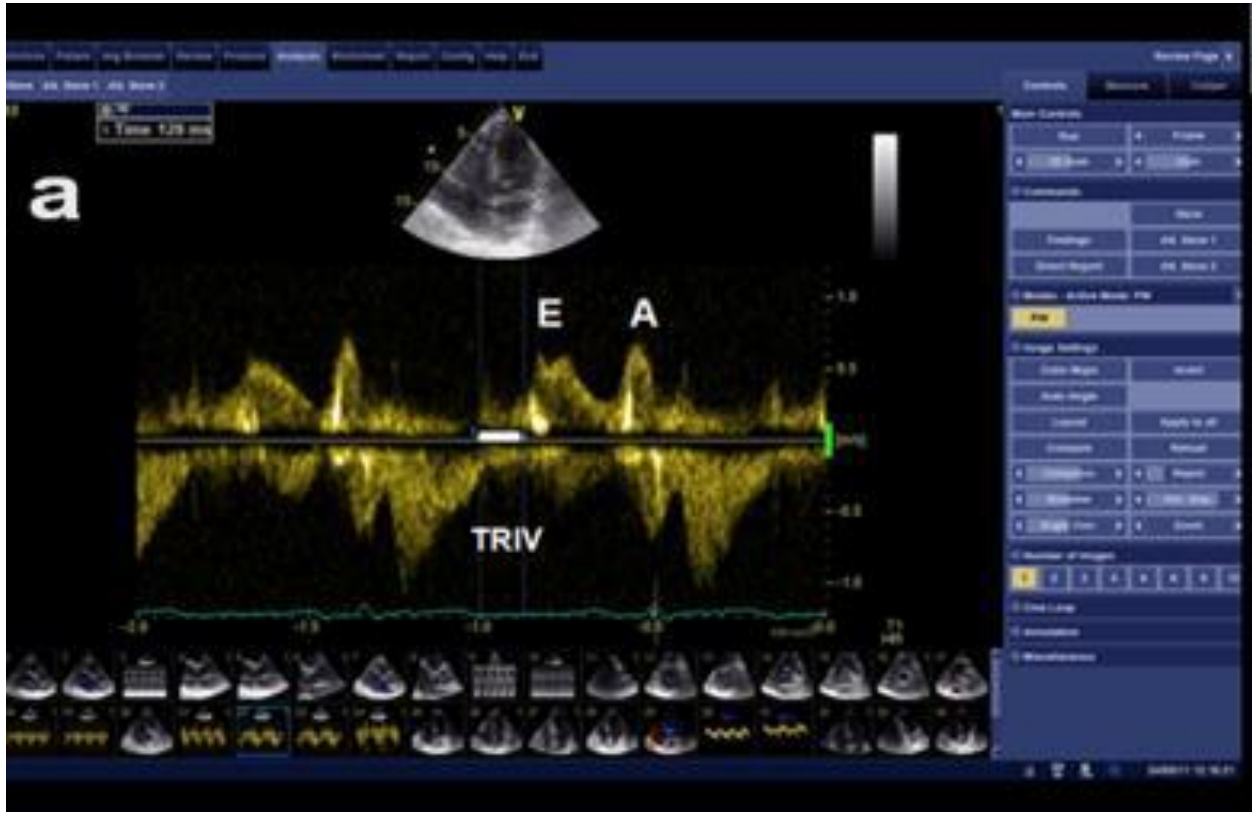


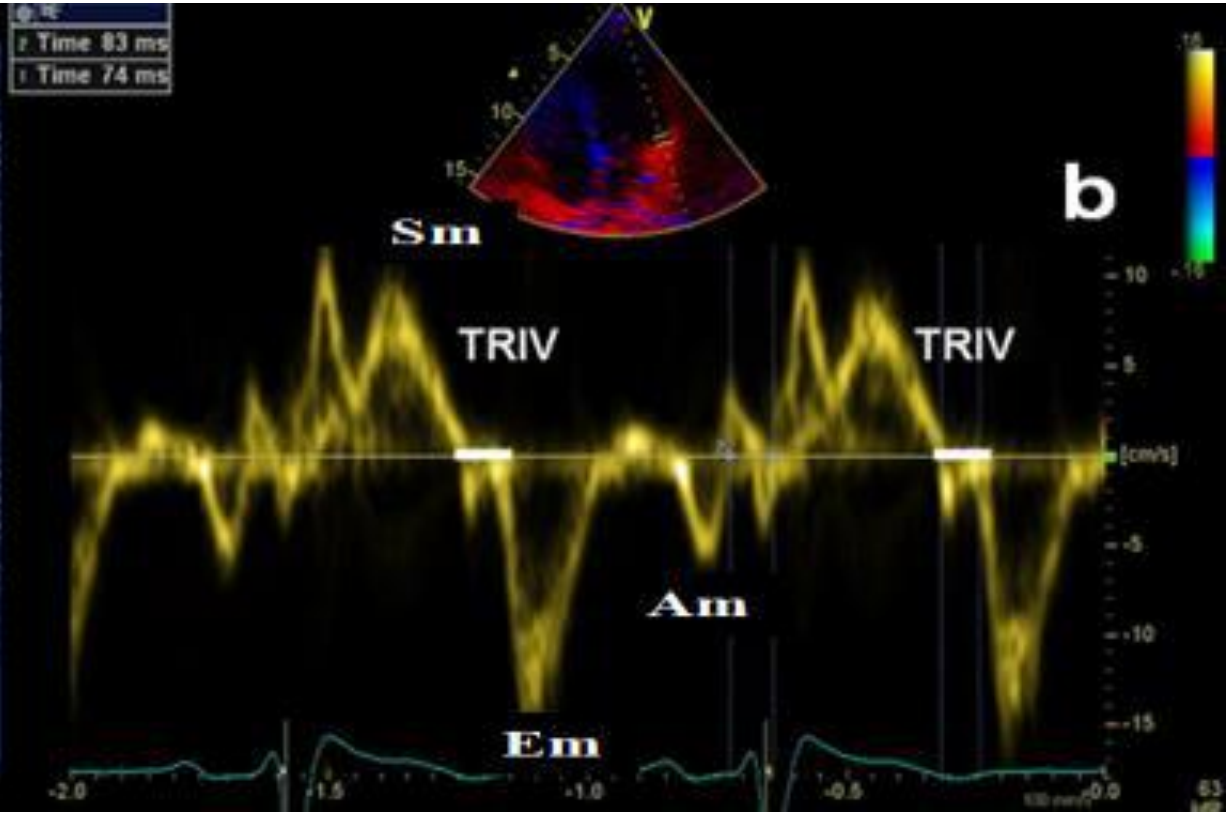
Functia diastolica VS





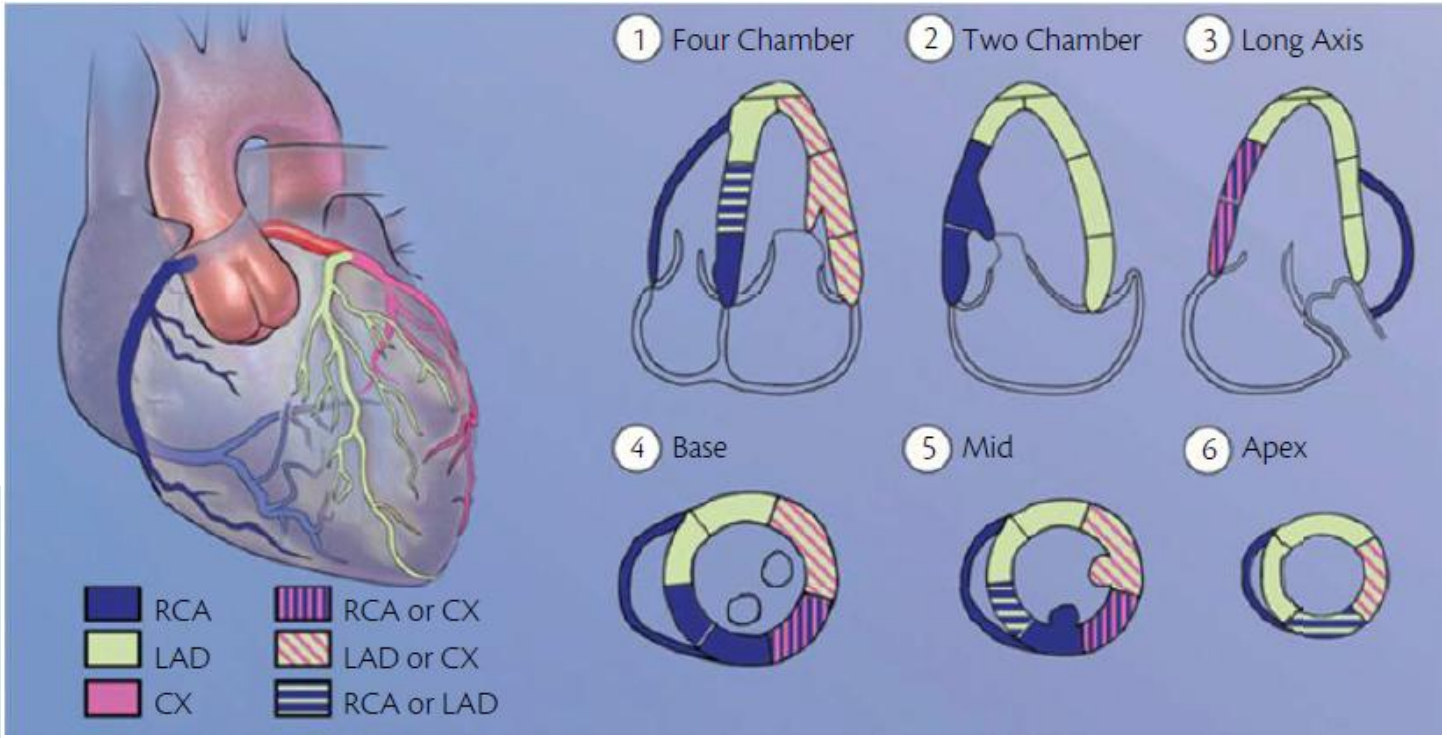
Functia diastolica VS





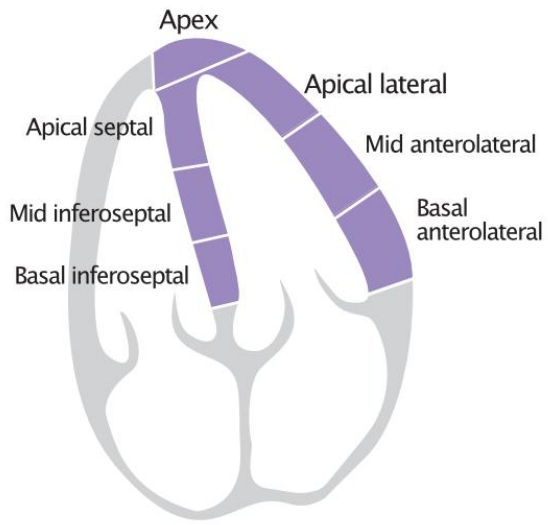
Evaluarea ischemiei - functia regionala VS

- Normal (↑ thickness in systole >50% that in diastole)
- Hypokinesia (↑ thickness in systole 10-40% that in diastole)
- Akinesia (↑ thickness in systole <10 that in diastole)
- Dyskinesia (outward motion and wall thinning in systole)

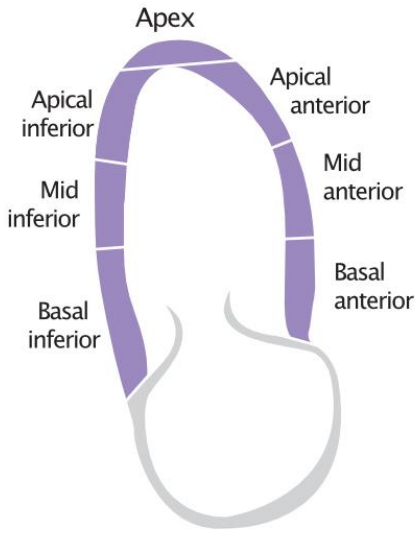


Segmentation of the left ventricle

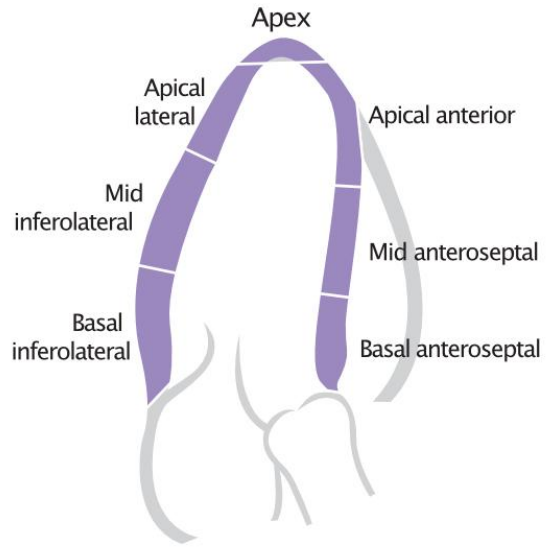
Apical 4–chamber view (A4C)



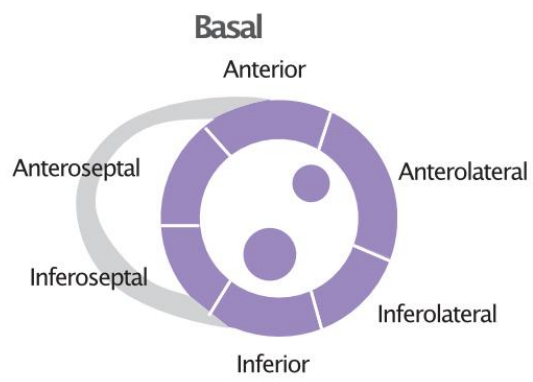
Apical 2–chamber view (A2C)

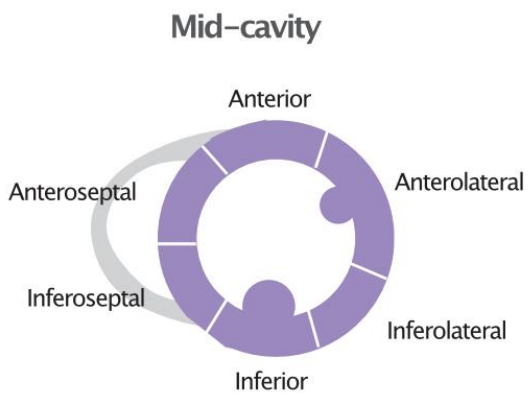


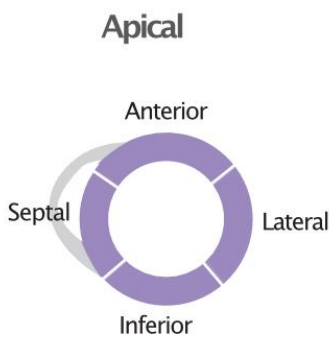
Parasternal long–axis view (PLAX)



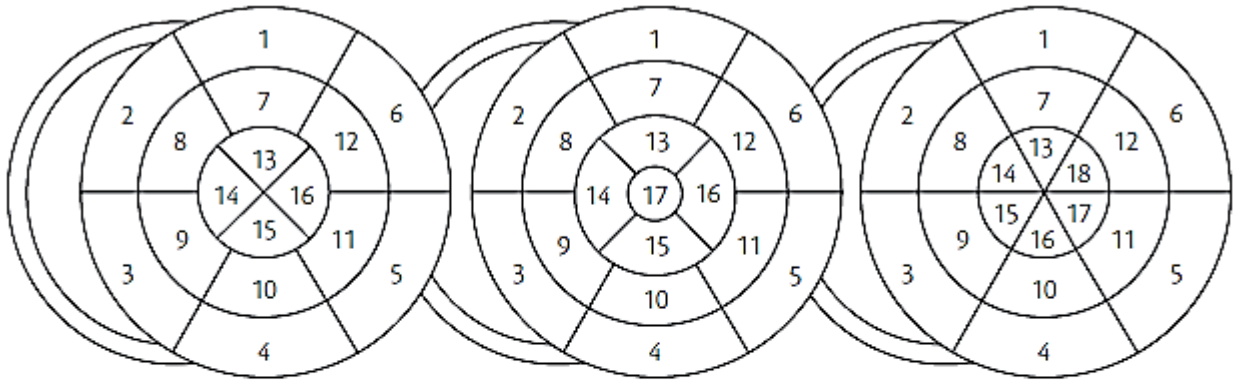
Parasternal short–axis view (PSAX)







Functia sistolica regionala a VS



all models
1. basal anterior
2. basal anteroseptal
3. basal inferoseptal
4. basal inferior
5. basal inferolateral
6. basal anterolateral
7. mid anterior
8. mid anteroseptal
9. mid inferoseptal
10. mid inferior
11. mid inferolateral
12. mid anterolateral

16 and 17 segment model
13. apical anterior
14. apical septal
15. apical inferior
16. apical lateral

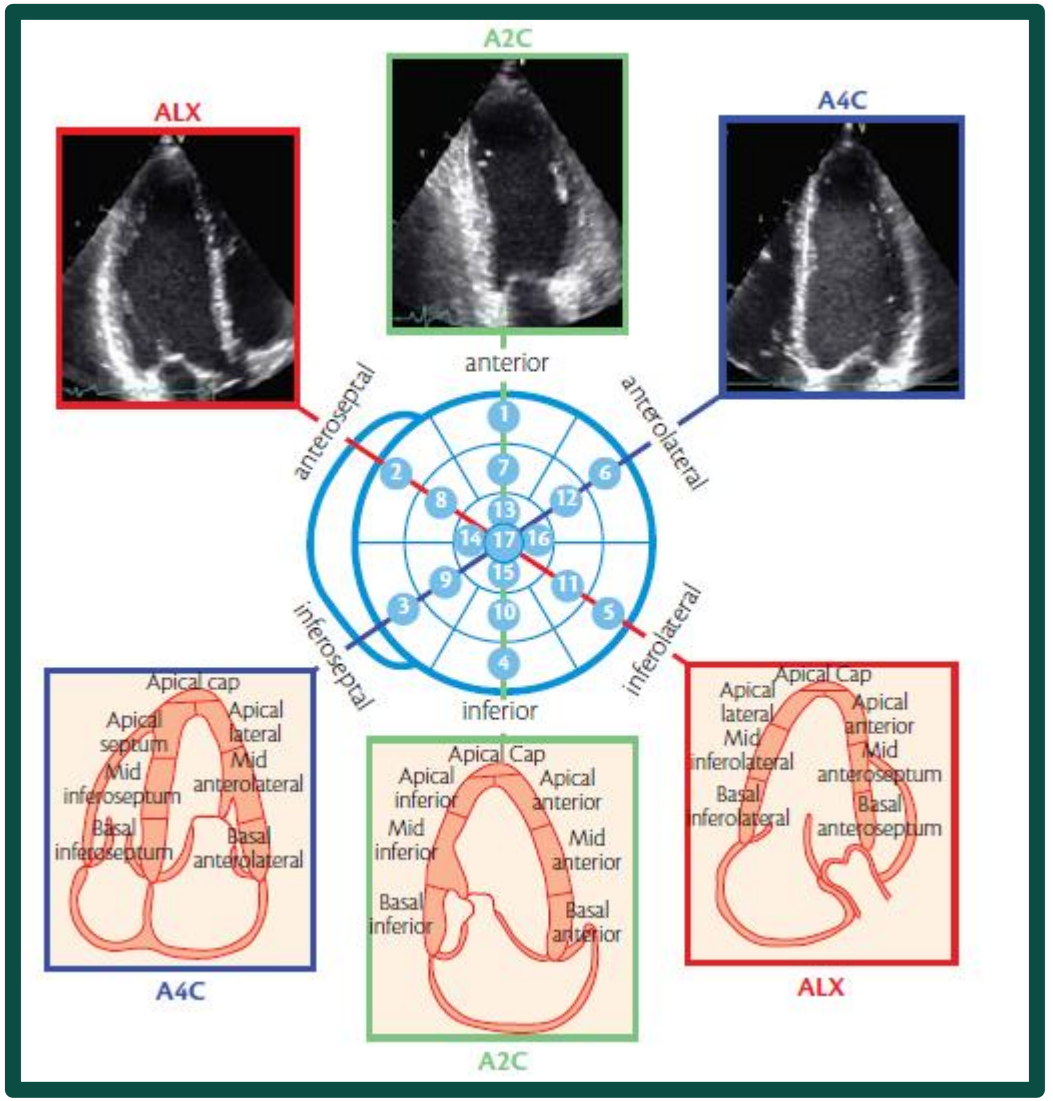
17 segment model only
17. apex

18 segment model only
13. apical anterior
14. apical anteroseptal
15. apical inferoseptal
16. apical inferior
17. apical inferolateral
18. apical anterolateral

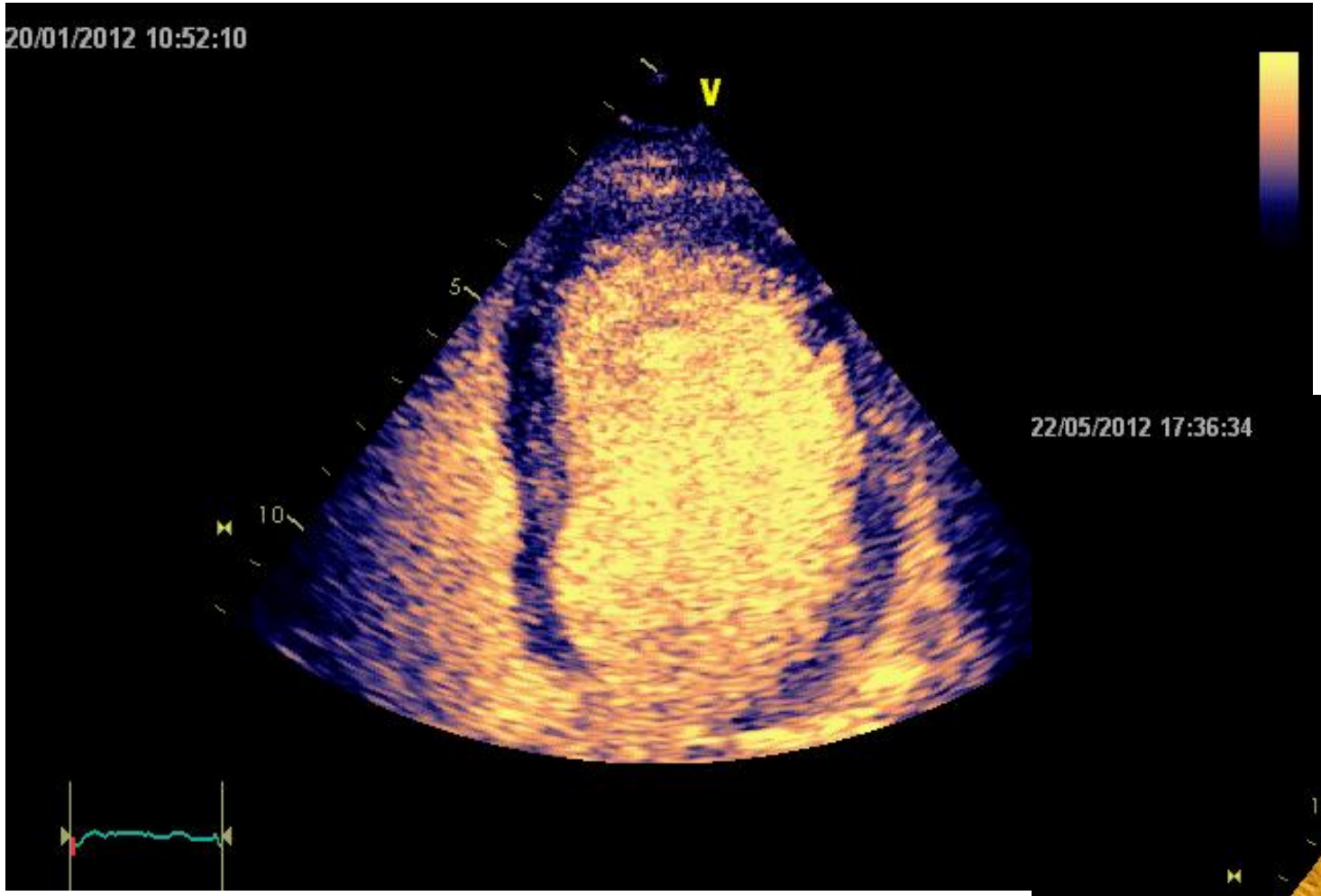
alternatively, walls are commonly labelled as:
3., 9., 15(18-seg).: septal; 5., 11., 17(18-seg).: posterior; 6.,12.,18(18-seg).: lateral

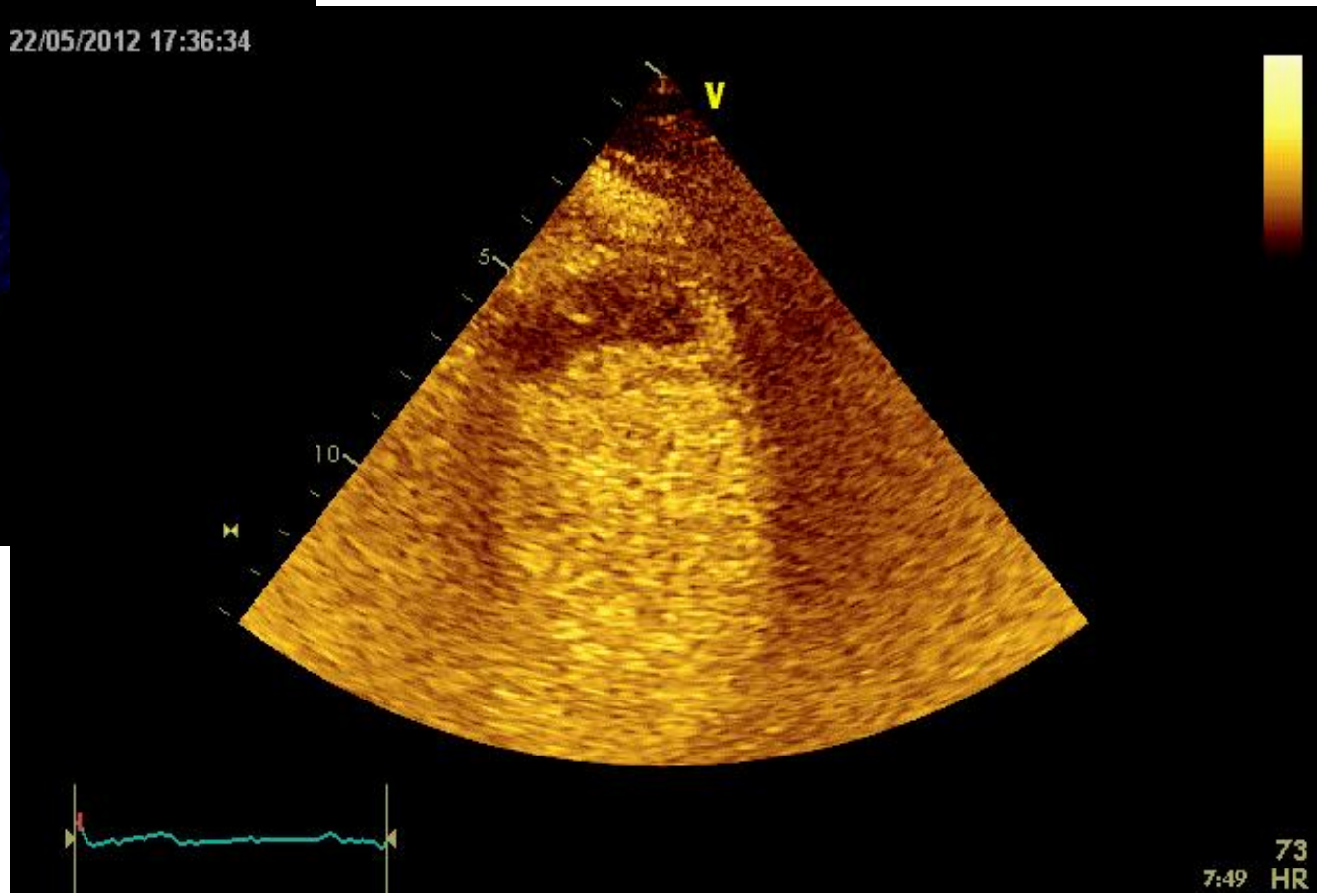
WMSI – index sistolic de miscare a peretilor

1=normal
2=hipokinezie
3=akinezie (nu se mișcă)
4=diskinezie (mișcare sistolică paradoxală sau altfel spus în sistolă are o mișcare inversă față de restul cavității VS)
5=anevrismală (deformare sistolică și diastolică).

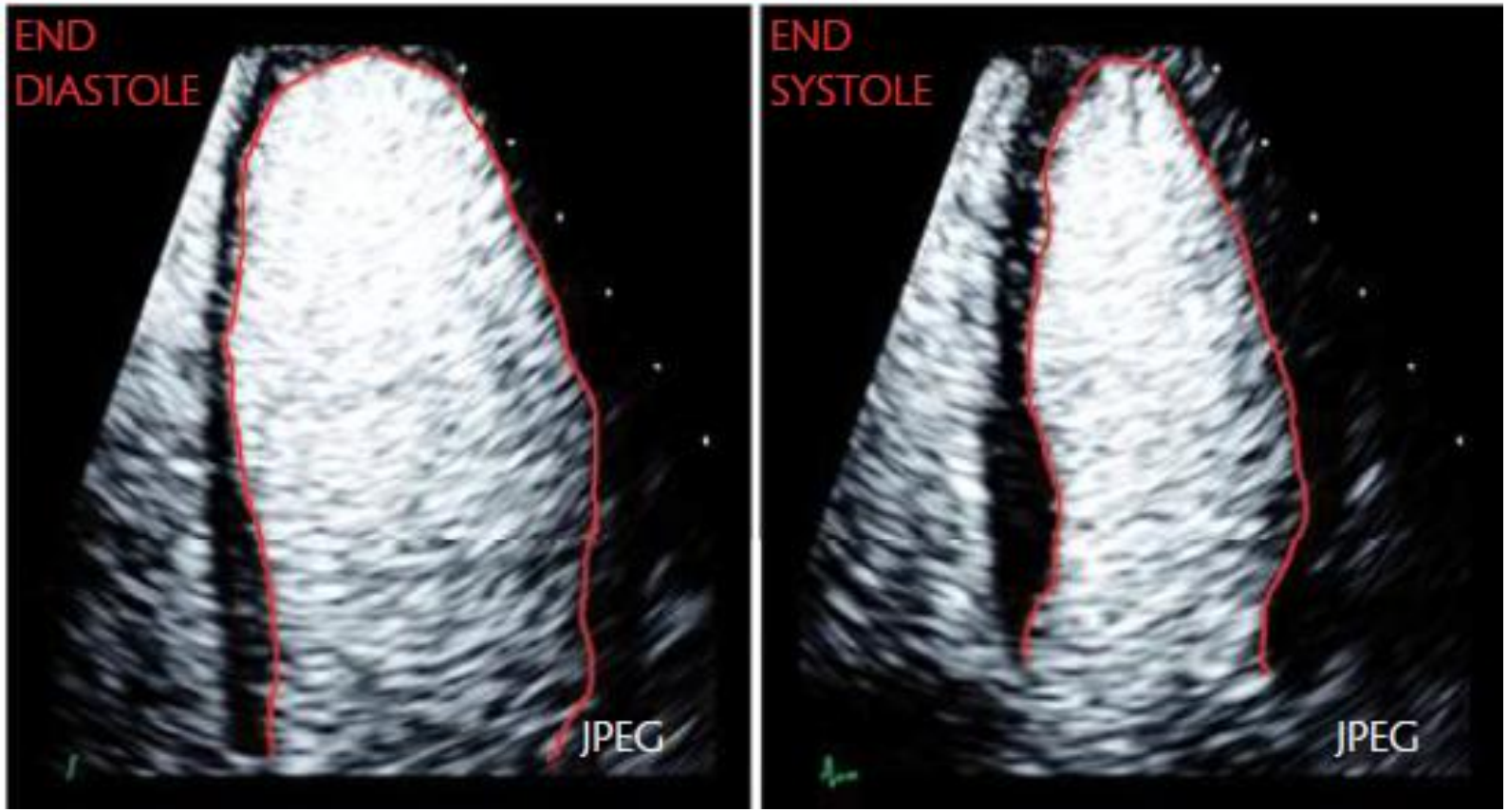


ECO DE CONTRAST
Cinetica regionala, trombi

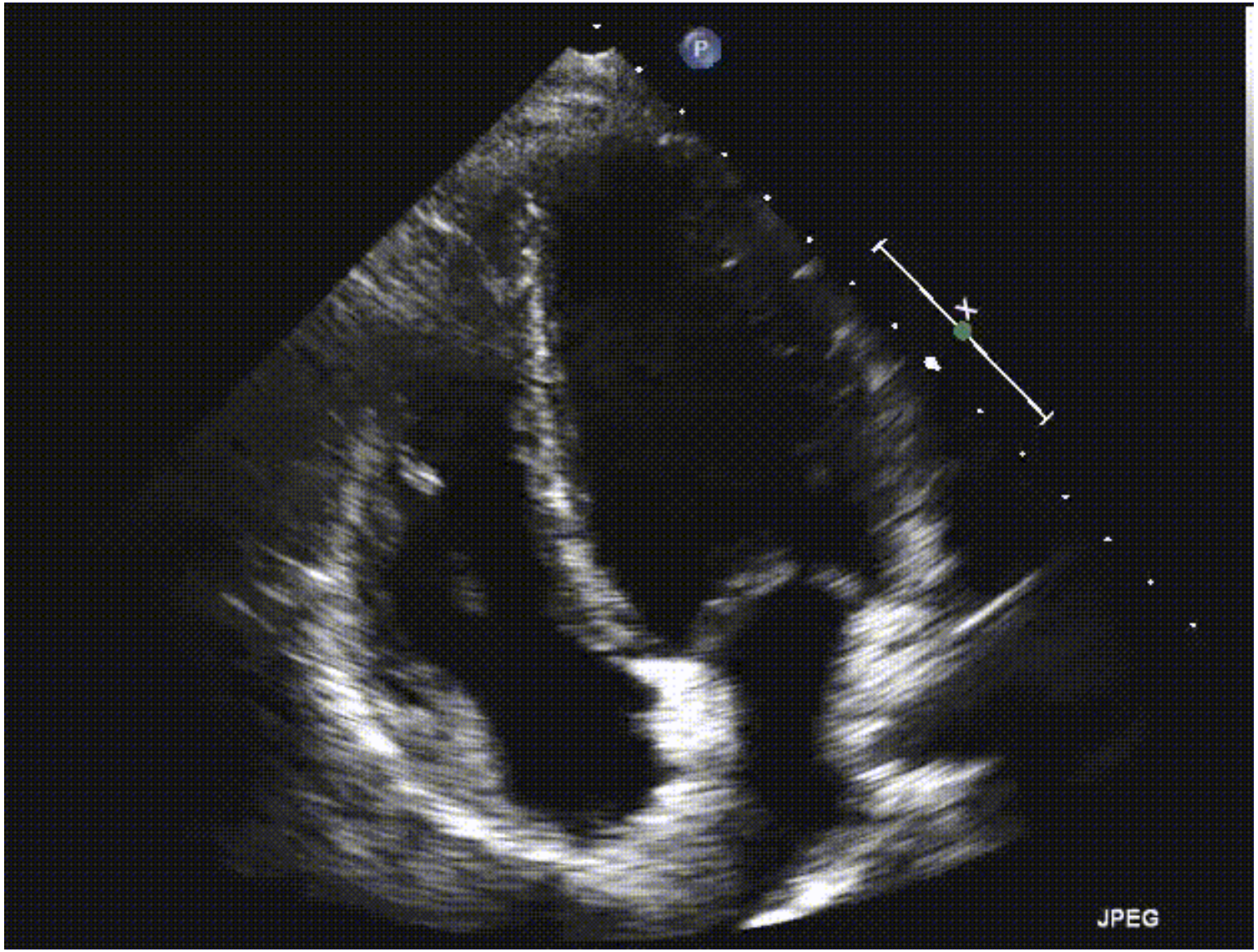


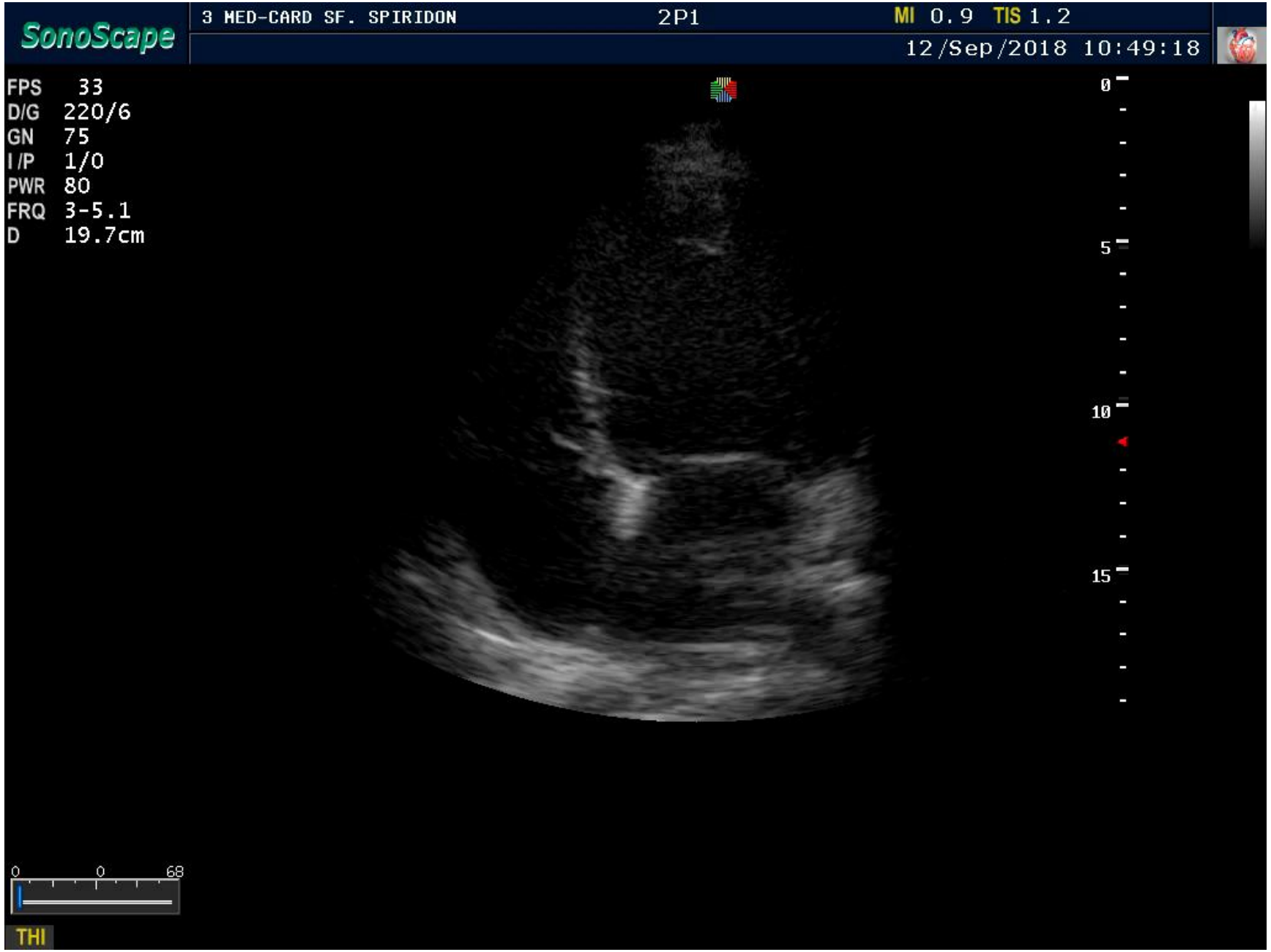


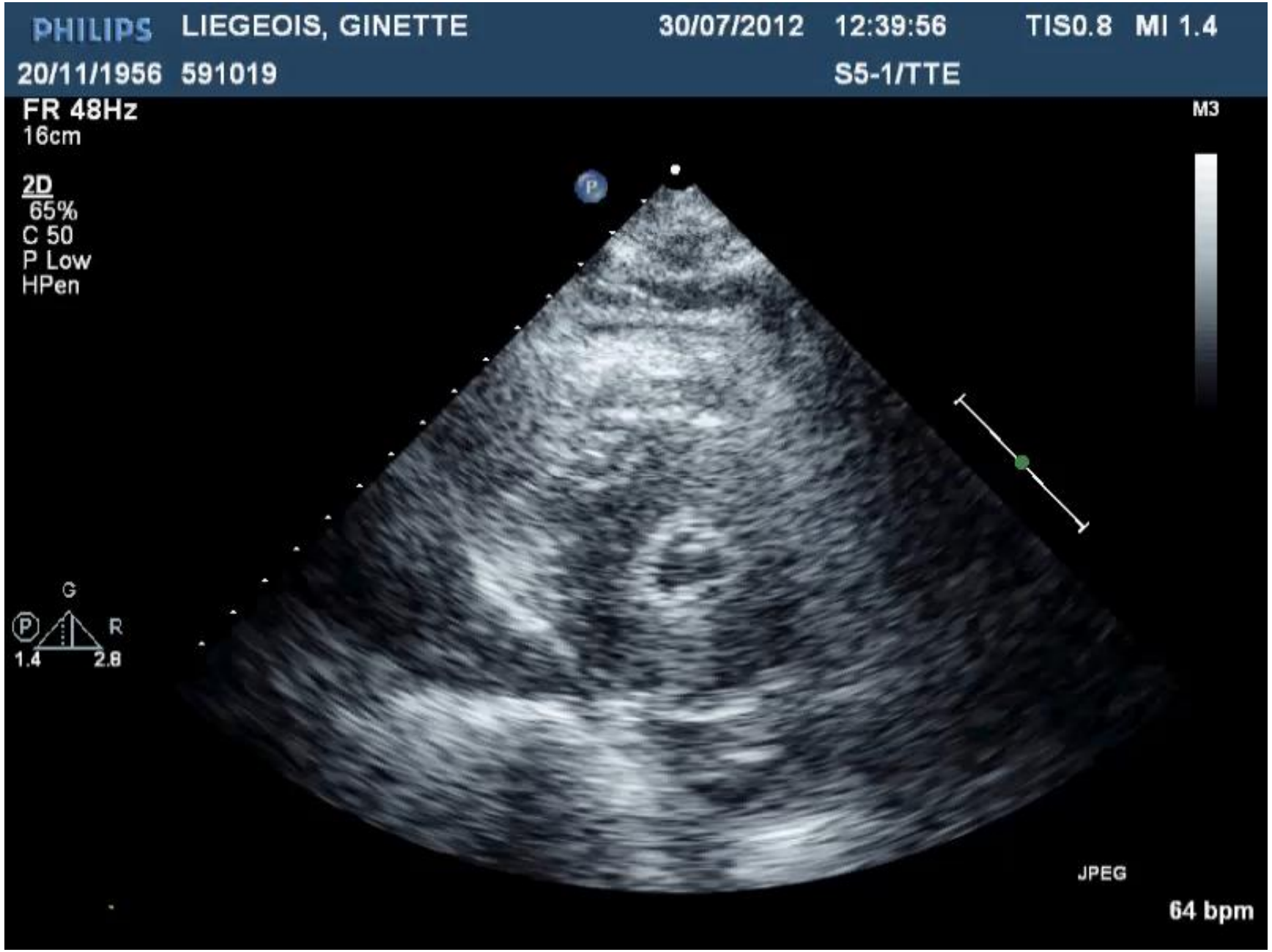
ECO DE CONTRAST
Cinetica globala - FEVS

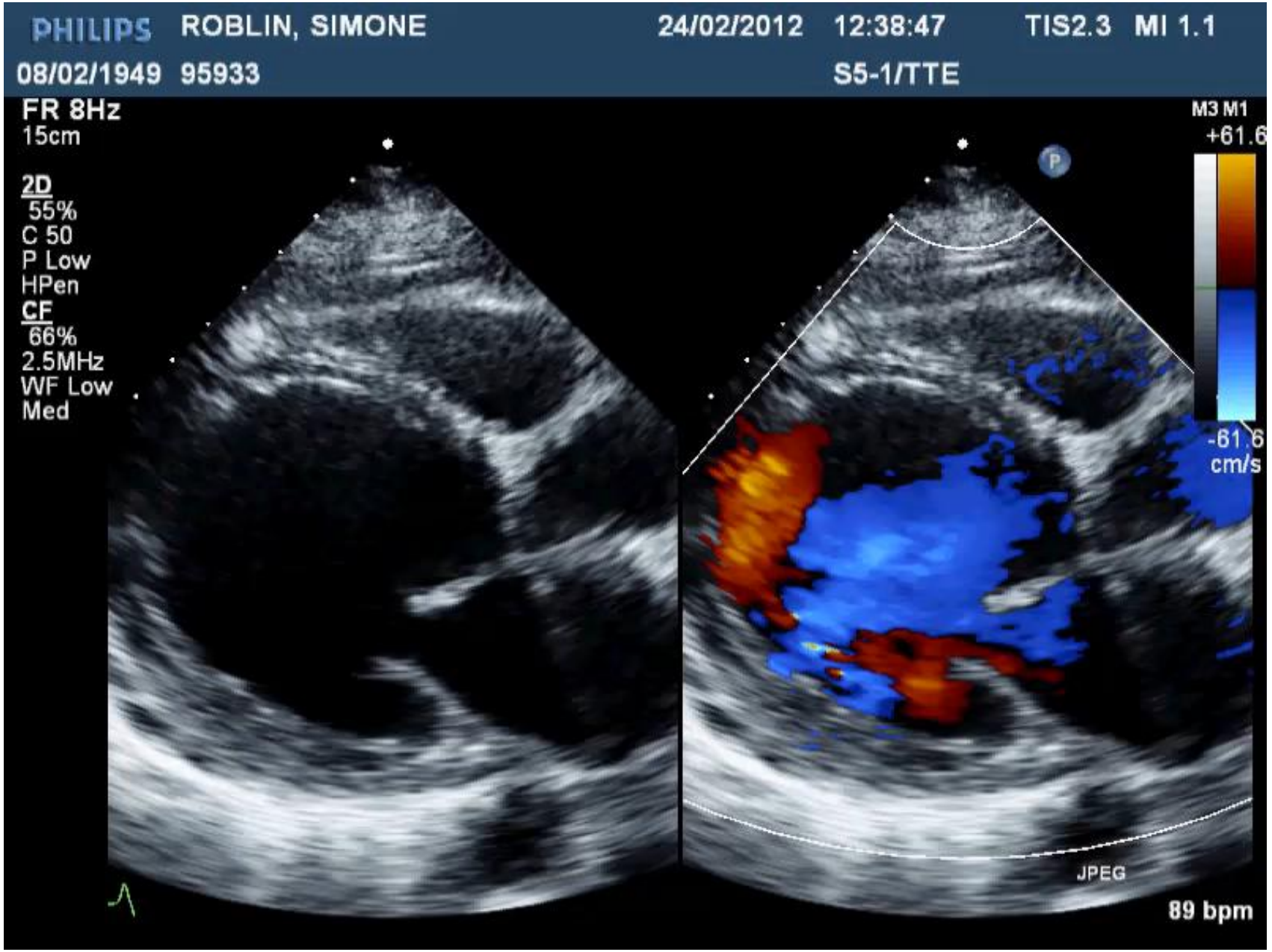


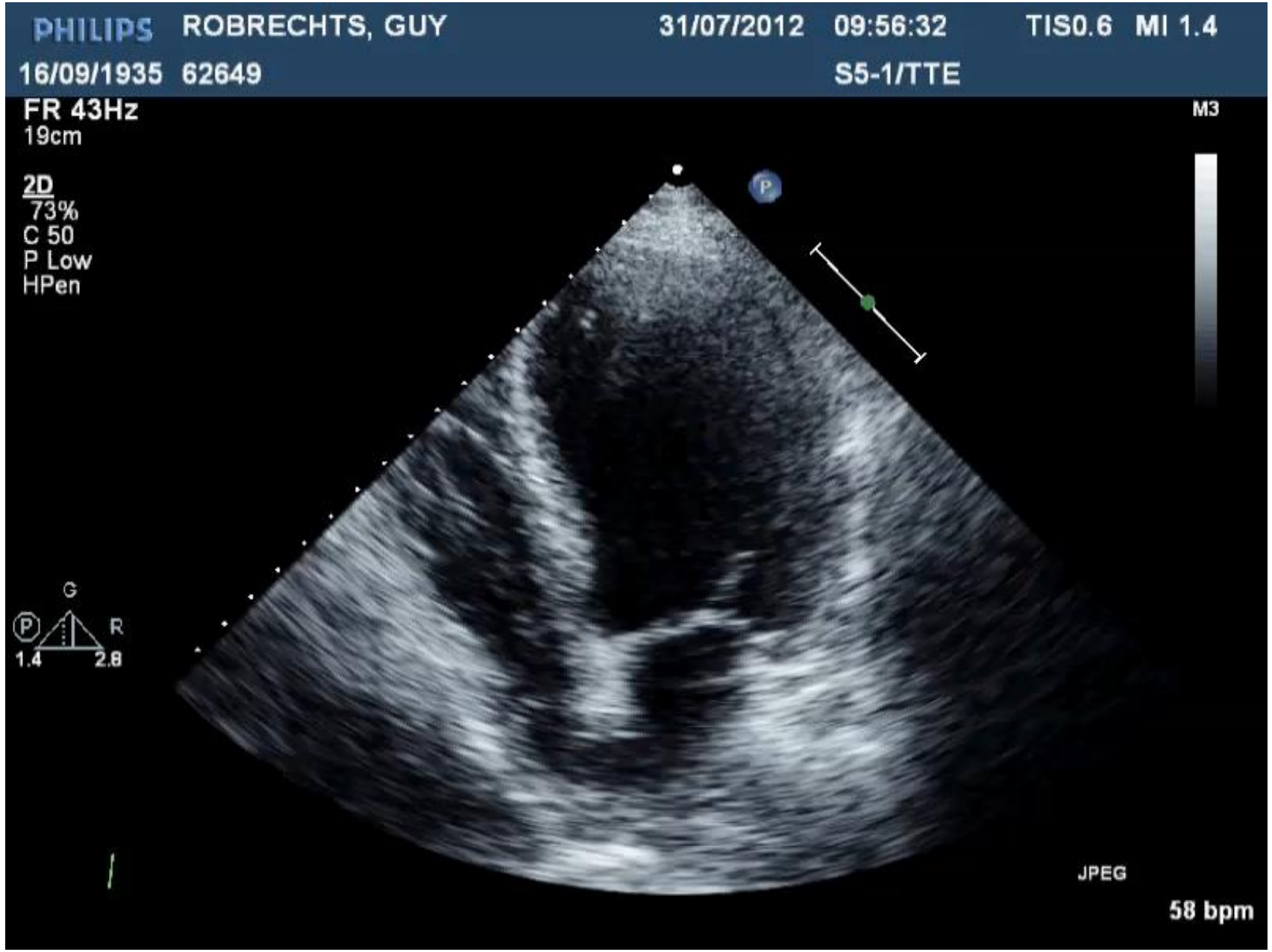
EchovengersEchogame

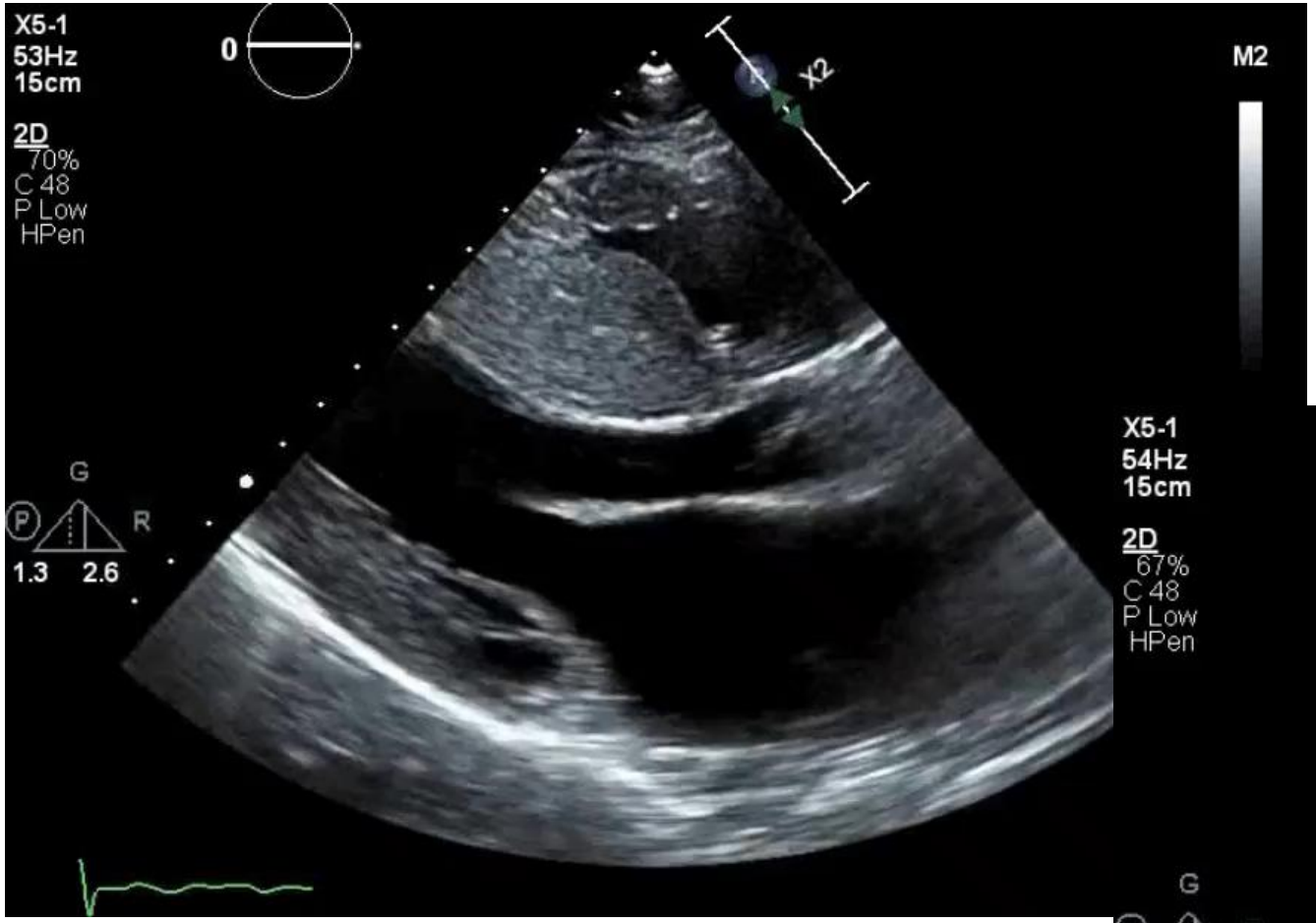

P
JPEG

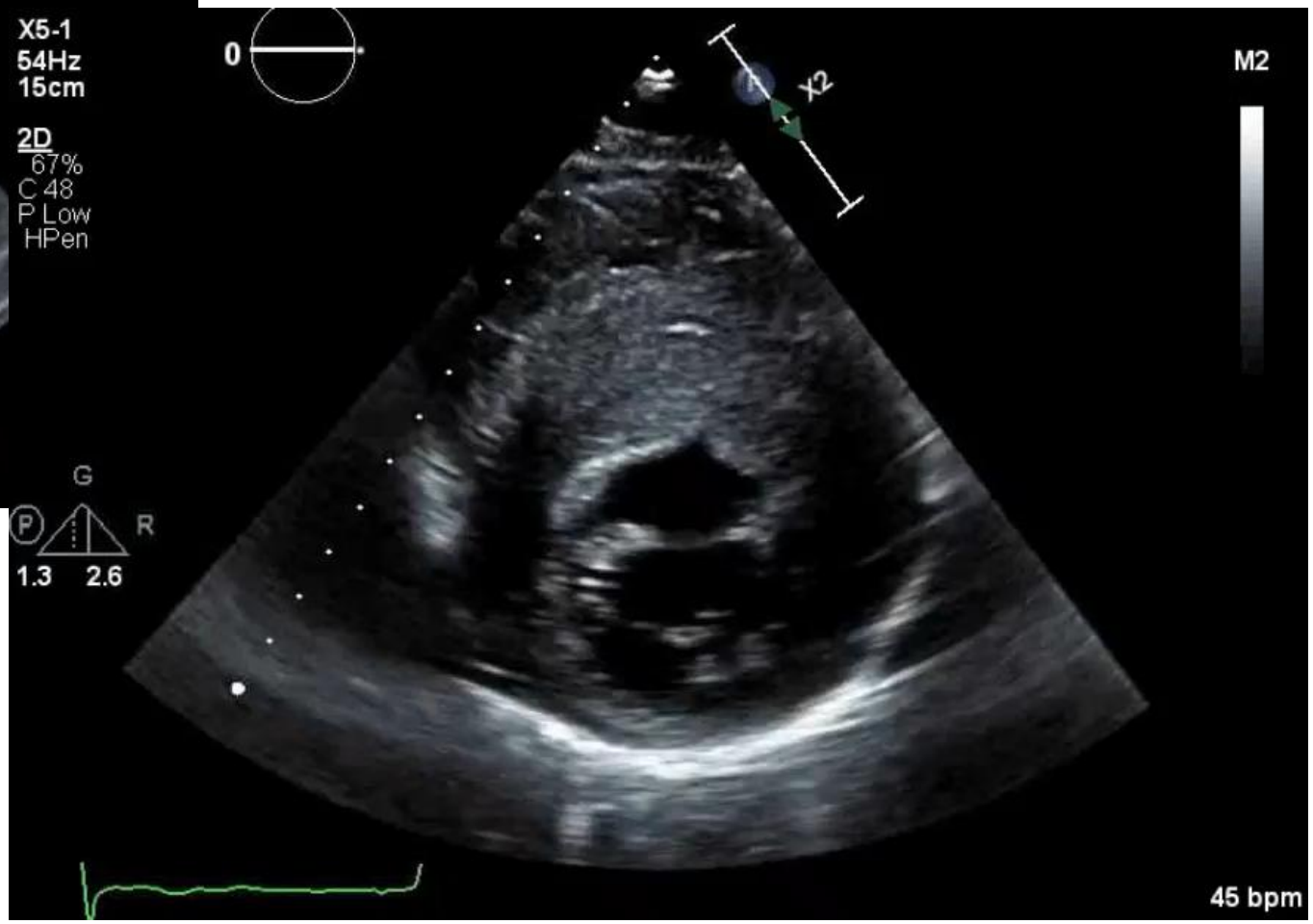

SonoScape
3 MED-CARD SF. SPIRIDON
2P1
MI 0.9 TIS 1.2
12/Sep/2018 10:49:18
FPS 33
D/G 220/6
GN 75
I/P 1/0
PWR 80
FRQ 3-5.1
D 19.7cm
0
5
10
15
0 0 68
THI


PHILIPS
LIEGEOIS, GINETTE
30/07/2012
12:39:56
TIS0.8
MI 1.4
20/11/1956
591019
S5-1/TTE
FR 48Hz
16cm
2D
65%
C 50
P Low
HPen
M3
G
P
R
1.4
2.8
JPEG
64 bpm


PHILIPS
ROBLIN, SIMONE
24/02/2012
12:38:47
TIS2.3
MI 1.1
08/02/1949
95933
S5-1/TTE
FR 8Hz
15cm
2D
55%
C 50
P Low
HPen
CF
66%
2.5MHz
WF Low
Med
M3 M1
+61.6
-61.6
cm/s
JPEG
89 bpm


PHILIPS
ROBRECHTS, GUY
31/07/2012
09:56:32
TIS0.6
MI 1.4
16/09/1935
62649
S5-1/TTE
FR 43Hz
19cm
M3
2D
73%
C 50
P Low
HPen
G
R
1.4
2.8
JPEG
58 bpm


X5-1
53Hz
15cm
2D
70%
C 48
P Low
HPen
0
X2
M2
G
P
R
1.3
2.6


X5-1
54Hz
15cm
2D
67%
C 48
P Low
HPen
0
X2
M2
G
P
R
1.3
2.6
45 bpm

Prezenta!

GOT QUESTIONS?

(WE GOT ANSWERS)


Facultatea de Medicina.
(Universitatea Veche.)