UNIUNEA EUROPEANĂ | GUVERNUL ROMÂNIEI | Fondul Social European POSDRU 2007-2013 | Instrumente Structurale 2007-2013 | GUVERNUL ROMÂNIEI MINISTERUL MUNCII, FAMILIEI, PROTECŢIEI SOCIALE ŞI PERSOANELOR VÂRSTNICE OIRPOSDRU REGIUNEA CENTRU | UNIVERSITATEA DE MEDICINĂ ŞI FARMACIE "CAROL DAVILA" BUCUREŞTI

«AD-COR Program inovativ de formare in domeniul cardiologiei pediatrice POSDRU/179/3.2/S/152012"

Iunie 2015

MODUL TEORETIC

INTRODUCERE IN ECOCARDIOGRAFIE

Continut documentat/ validat/ prezentat de:

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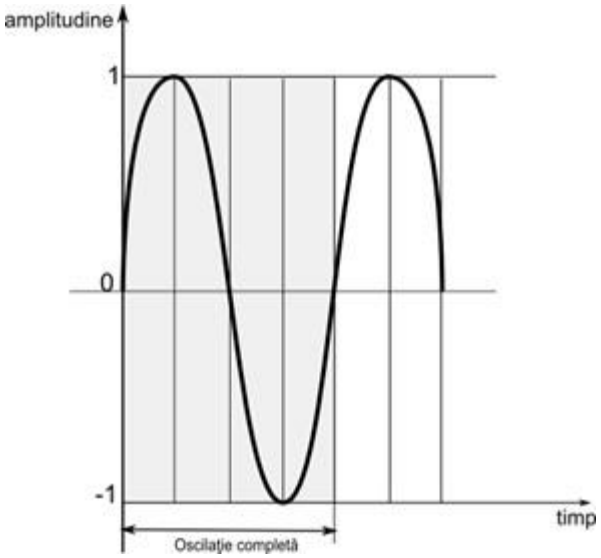
- Expert formare medici: VEDUTA Alina
- Expert formare asistente: FILIP Cristina

Ecoul

- daca strigam intr-un put, ecoul se intoarce dupa cateva momente;
- ecoul apare pentru ca undele sonore se reflecta pe o suprafata (fie apa din fundul putului, fie peretii putului), si se intorc spre noi;
- un principiu similar se aplica si in ultrasonografia cardiaca

Notiuni despre fizica ultrasunetelor(1)

- Sunetul = unda mecanica transmisa printr-un mediu elastic ce contine particule care vibreaza, permitand propagarea sunetului
- Sunetele cu o frecventa>20.000Hz= ultrasunete



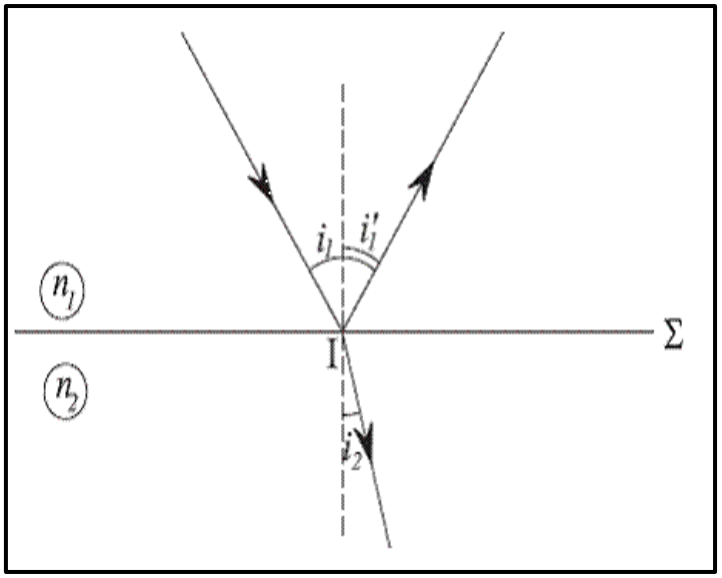
- **Reprezentarea grafica a undei acustice**:

-sinusoida, cu zone de compresie si rarefactie;
-1 compresie+ 1 rarefactie= 1ciclu;
-numarul de ciclii/sec= frecventa undei sonore;
-distanta dintre 2 puncte similare= lungimea de unda;
-lungime de unda mica⇔fracventa mare;
-unitatea de masura pentru frecventa=Hz=1 ciclu/secunda;
-gama de frecvente folosite in medicina: 2MHz-40MHz (2-5MHz in ecografia transtoracica).

Notiuni despre fizica ultrasunetelor(2)

Viteza cu care ultrasunetele emise de transductor se propaga prin tesuturi este proportionala cu densitatea acestora. Viteza medie de propagare a ultrasunetelor in corpul uman=1540m/s.

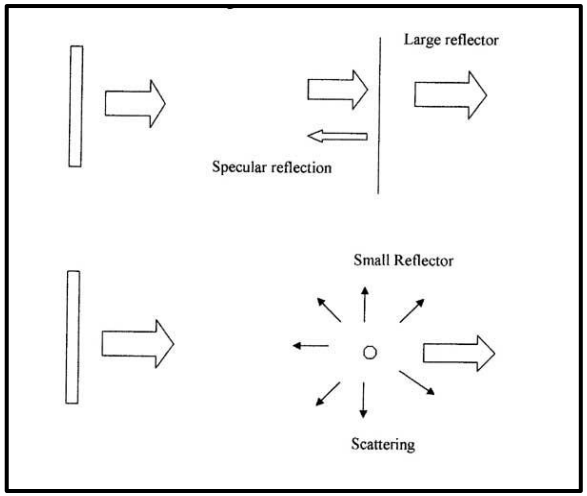
$\lambda = v/f$ λ=lungimea de unda a ultrasunetelor
v=viteza de propagare a ultrasunetelor in tesut
f=frecventa ultrasunetelor emise de transductor



La interfata dintre doua medii cu densitati diferite, **ultrasunetele se reflecta si se refracta**, ceea ce sta la baza formarii imaginii ecocardiografice.

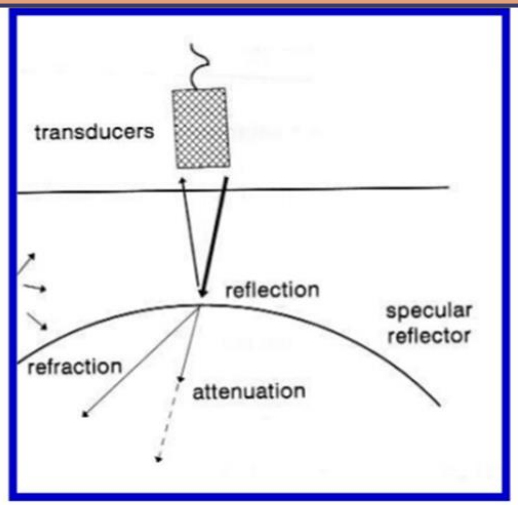
Reflectia depinde de impedanta acustica dintre 2 medii: cu cat acesta este mai mare, cu atat se reflecta mai mult din fasciculul incident (gelul reduce diferenta de impedanta dintre medii).

Notiuni despre fizica ultrasunetelor(3)



- *Reflectia speculara*: lungimea de unda intalneste o structura mare si neteda => reflectia se produce pe aceeasi directie
- *Fenomenul de scattering*: lungimea de unda intalneste o suprafata rugoasa => reflectia nu se produce pe aceeasi directie; se imprastie.
- Fenomenul de scattering sta la baza imagisticii Doppler. Permite vizualizarea particulelor paralele cu fasciculul; permite vizualizarea in scale de gri.
- Efectul Doppler: 2 obiecte in miscare relativa: frecventa undei emise este mai inalta daca obiectul se apropie, si invers

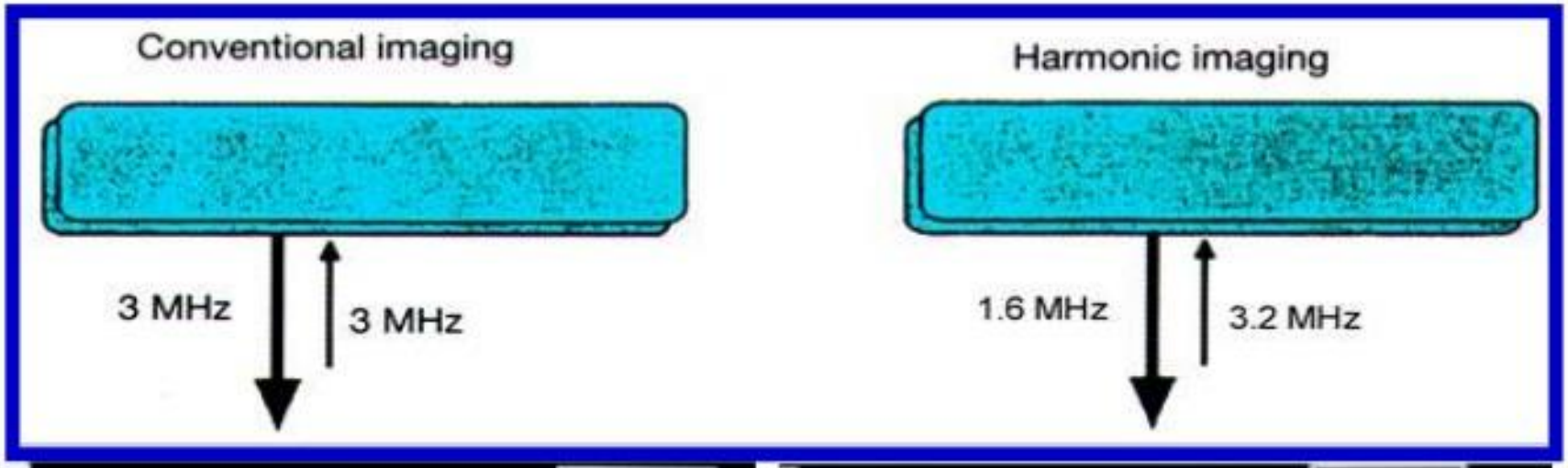
Ultrasunetele trimise dinspre peretele toracic

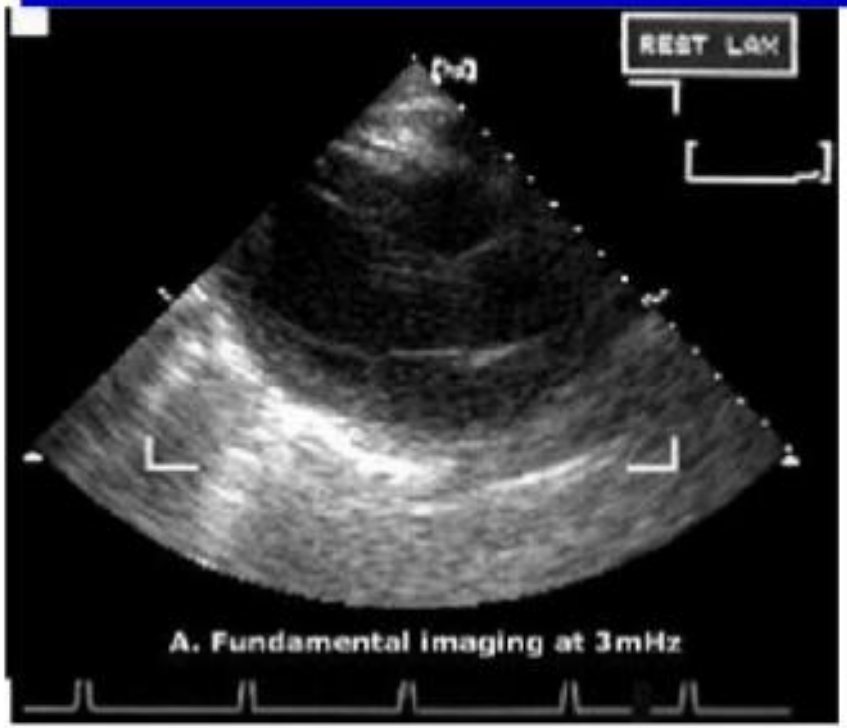


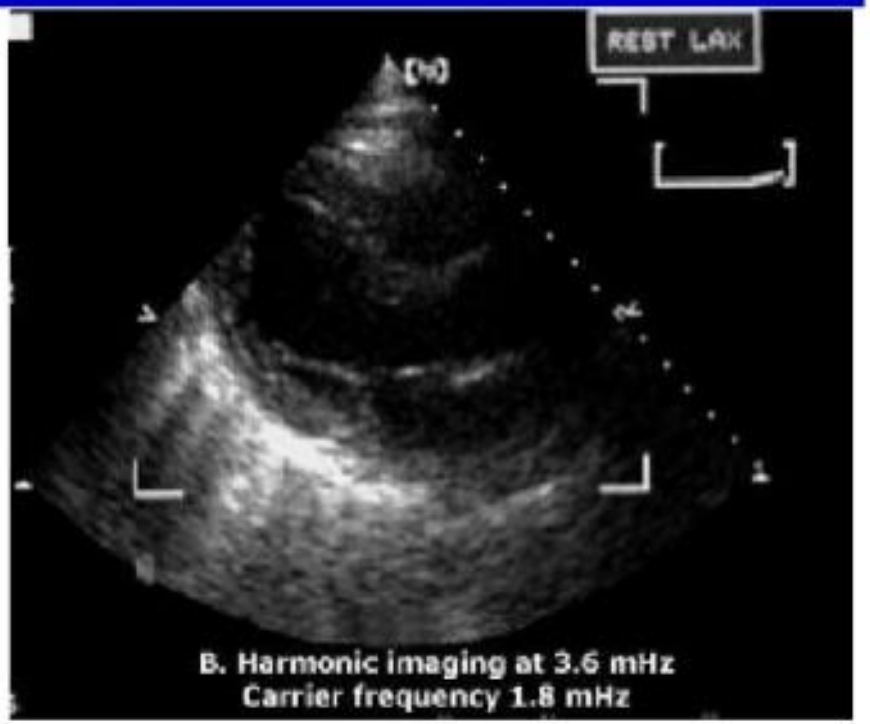
- Atenuare: puterea semnalului se reduce progresiv datorita absorbtiei energiei US prin conversie catreecaldura
  - ➢ Aerul are o impedanta acustica inalta cu atenuare semnificativa in contrast cu lichidul
  - ❖ Pneumotorax/pleurezie

Armonici

- Unda de US trecand prin tesut devine distorsionata,generandu-se frecvente sonore aditionale care sunt armonici ale frecventei originale
- Se folosesc transductoare care pot receptiona transmisia acestor frecvente
- Imaginea este mult imbunatatita


Conventional imaging
3 MHz
3 MHz
Harmonic imaging
1.6 MHz
3.2 MHz

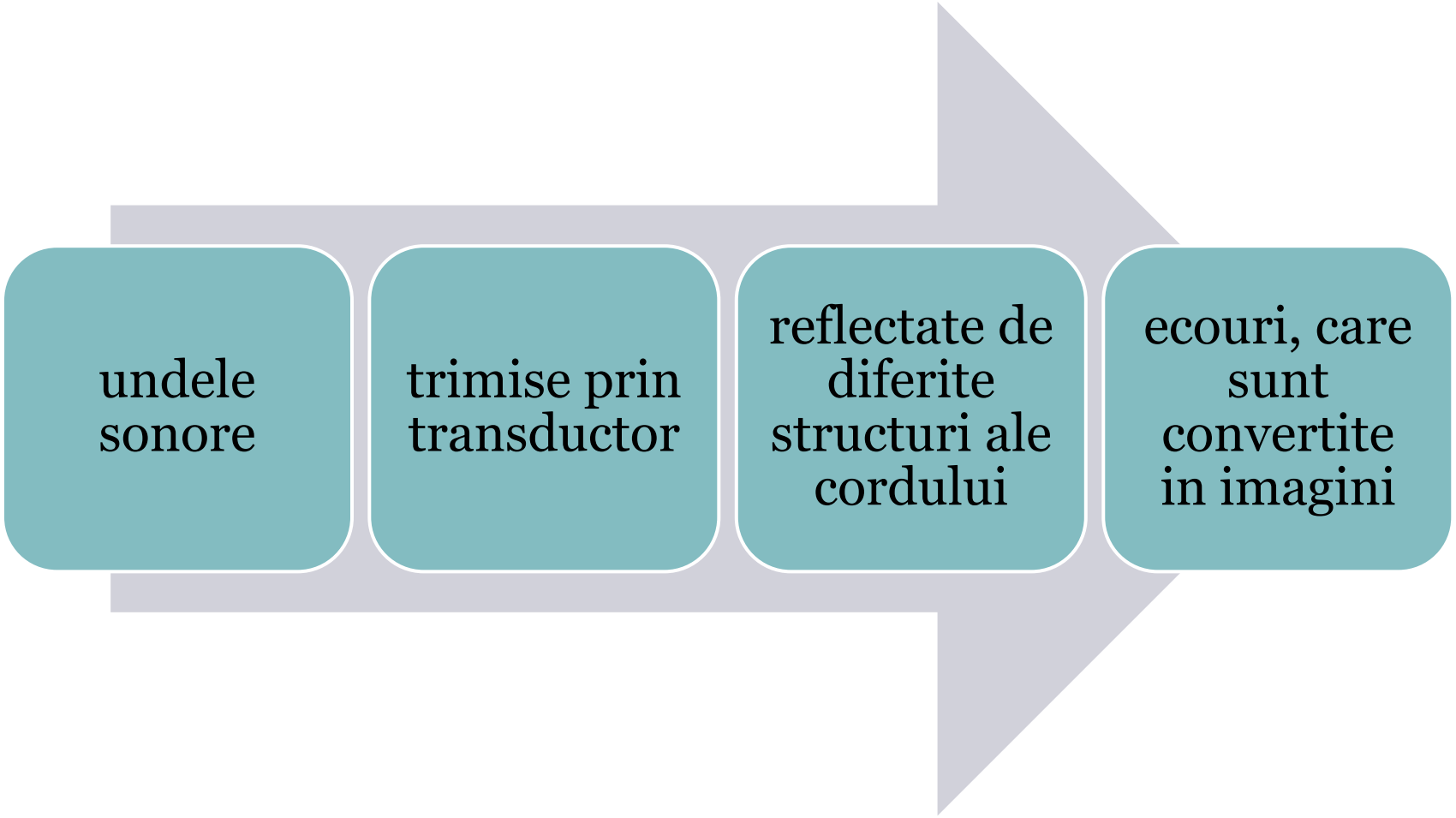

REST LAX
A. Fundamental imaging at 3mHz


REST LAX
B. Harmonic imaging at 3.6 mHz
Carrier frequency 1.8 mHz

Optimizarea imaginii 2-D
-factori tehnici-

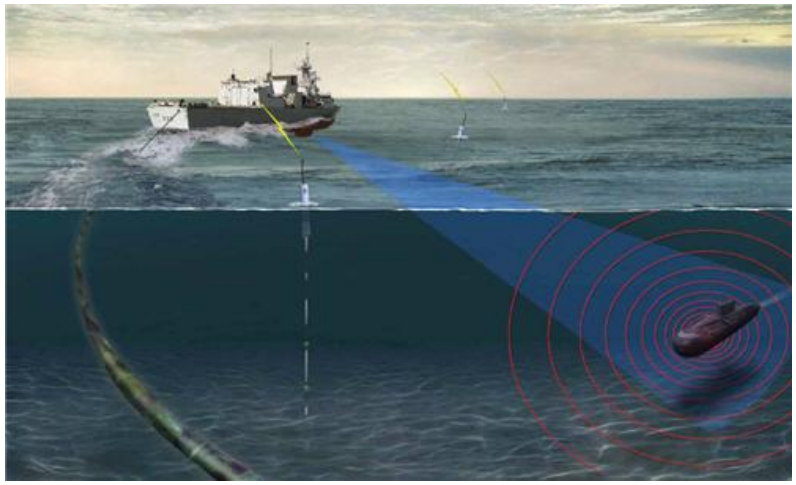
- **Transductorul**:
  -frecventa inalta: creste retrodifuziunea si rezolutia, dar nu are o buna penetrare;
  -frecventa joasa: permite o buna penetrare, dar reduce rezolutia imaginii;
- **Adancimea**:
  -cu cat este mai mare adancimea, cu atat este mai mic frame-rate-ul;
  -cautam cea mai mica adancime care permite afisarea regiunii de interes ;
- **Focusul**: indica zona imaginii in care raza ultrasunetului este cea mai ingusta; rezolutia este cea mai buna in aceasta regiune;
- **Gain-ul**: ajusteaza amplitudinea tuturor semnalelor afisate.

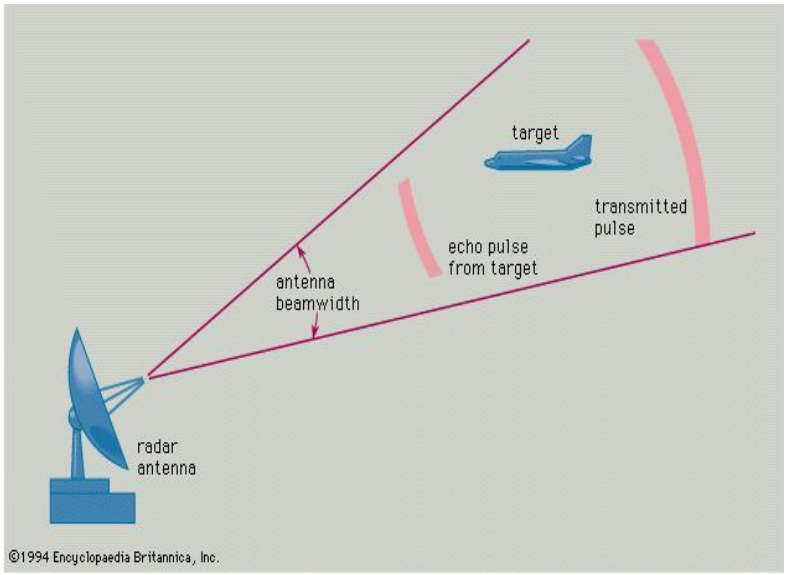
Pe scurt


undele sonore
trimise prin transductor
reflectate de diferite structuri ale cordului
ecouri, care sunt convertite in imagini

Originea ecocardiografiei(1)

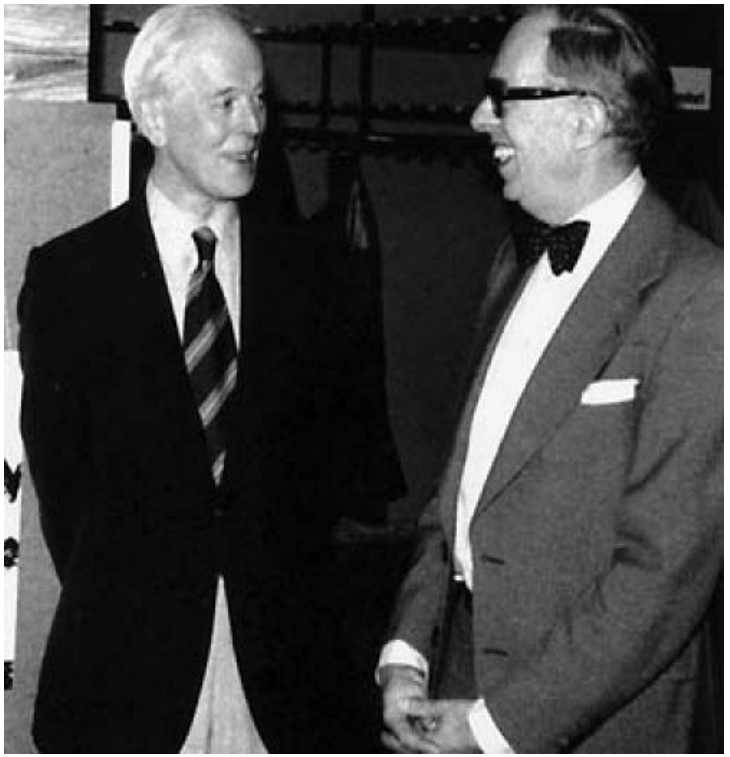
- 1842-Christian Johann Doppler- noteaza ca frecventa undei sonore variaza daca sursa sunetului se misca;
- Lazzaro Spallanzani- arata ca ecourile reflectate ale sunetelor neauzibile permit liliecilor sa navigheze;
- Langevin in 1915, dezvolta sistemul SONAR (Sound navigation and ranging) folosit pentru detectarea submarinelor inamice in primul razboi mondial;
- In 1941 in cel de-al 2 lea razboi mondial, armata Statelor Unite foloseste undele radio pentru detectarea avioanelor, o tehnologie numita RADAR (Radio detection and ranging);





Originea ecocardiografiei(2)

- In 1946- Andre Denier propune folosirea ultrasunetelor pentru vizualizarea organelor interne ale corpului uman
- In 1953 Edler si Hertz, in laboratorul Universitatii din Lund pun sonda de ultrasunete deasupra inimii lui Hertz, si, spre fascinatia lor, vad un ecou miscandu-se inainte si inapoi de-a lungul axei-X a ecranului osciloscopuli la o adancime de 8-9cm de la peretele toracic
- In octombrie 1953 cu Ultraschall Impulsgerat, Inge Edler si Helmuth Hertz au inregistrat prima imagine in miscare a cordului, inaugurand ecocardiografia (Ultrasound cardiography)



- Inge Edler (stanga) and Carl Hellmuth Hertz, echipa cardiolog-fizician care a dat lumii ecocardiografia, la un simpozion in Lund, Suedia, 1977.

Aparatul

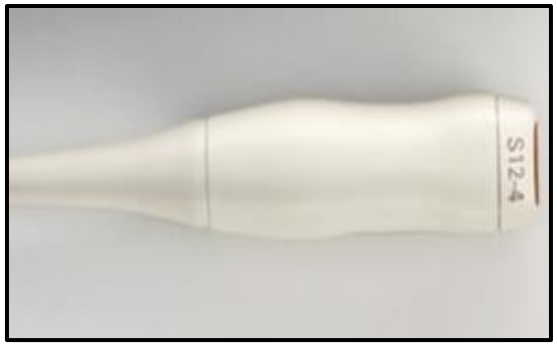
Are 5 componente de baza:

1. **generatorul de impuls**: foloseste voltaj de mare amplitutine pentru a energiza cristalele
2. **transductorul**: converteste enrgia electrica in energie mecanica
3. **receptorul**: detecteaza si amplifica semnalele slabe
4. **monitorul**: prezinta semnalele in variate moduri
5. **memoria**

take home message

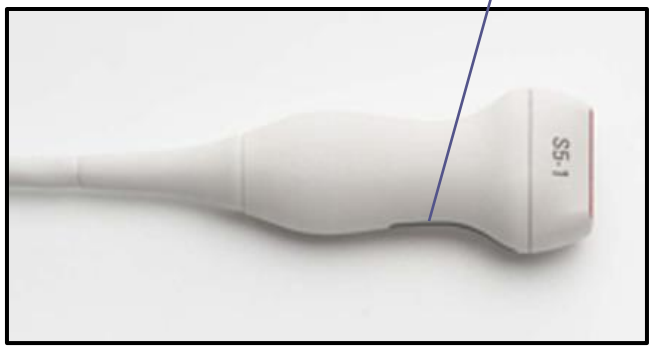
- se recomanda selectarea sondei cu cea mai mare frecventa care permite o penetrare adecvata a structurilor de examinat;
- la pacientii slabi/copii, la care penetranta nu reprezinta o problema sunt optime sondele de frecventa mai inalta, care permit o buna rezolutie;
- in cazul unui perete toracic mai gros (pacienti obezi), devine necesara folosirea unei frecvente joase.

marker

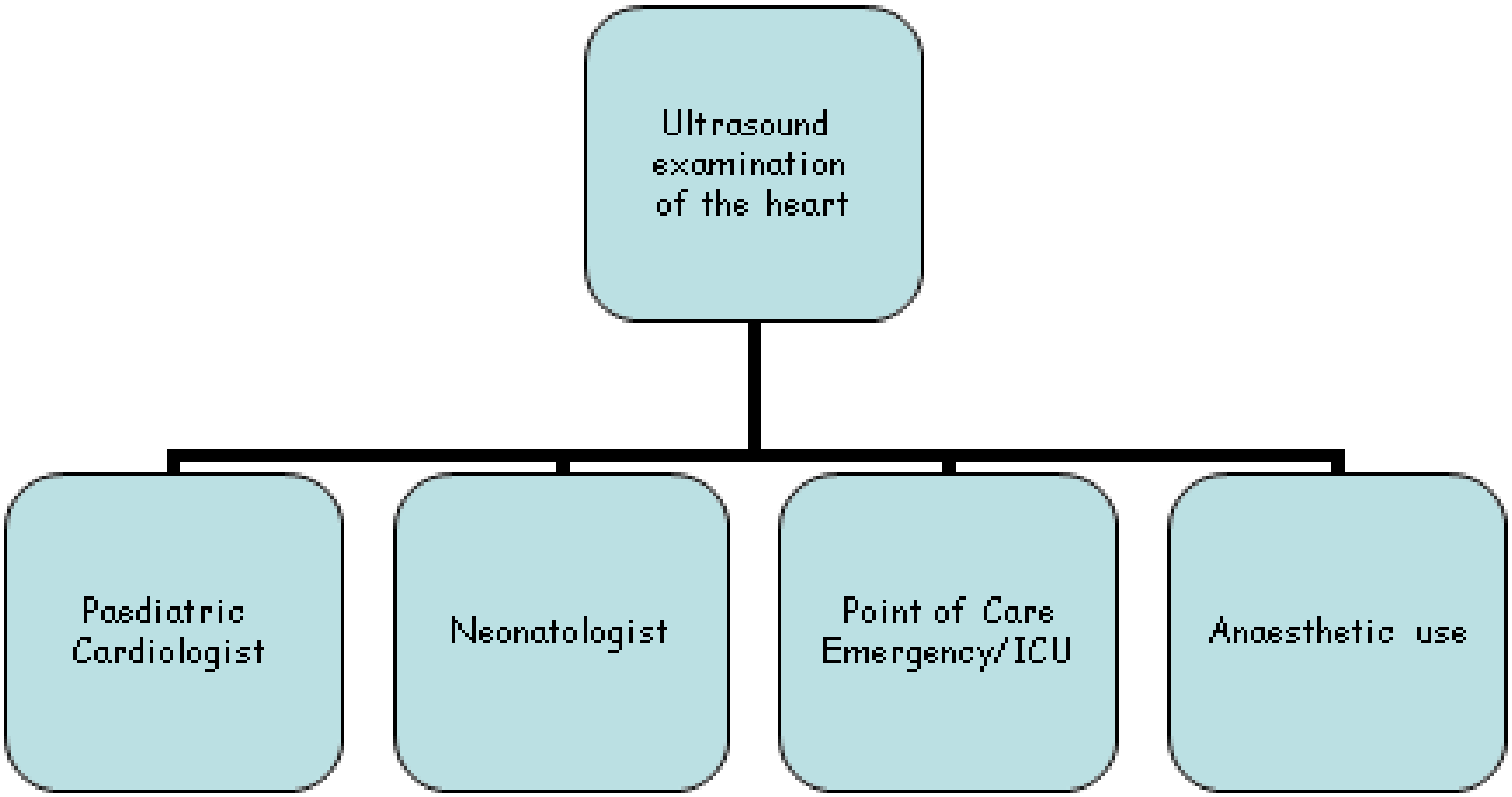


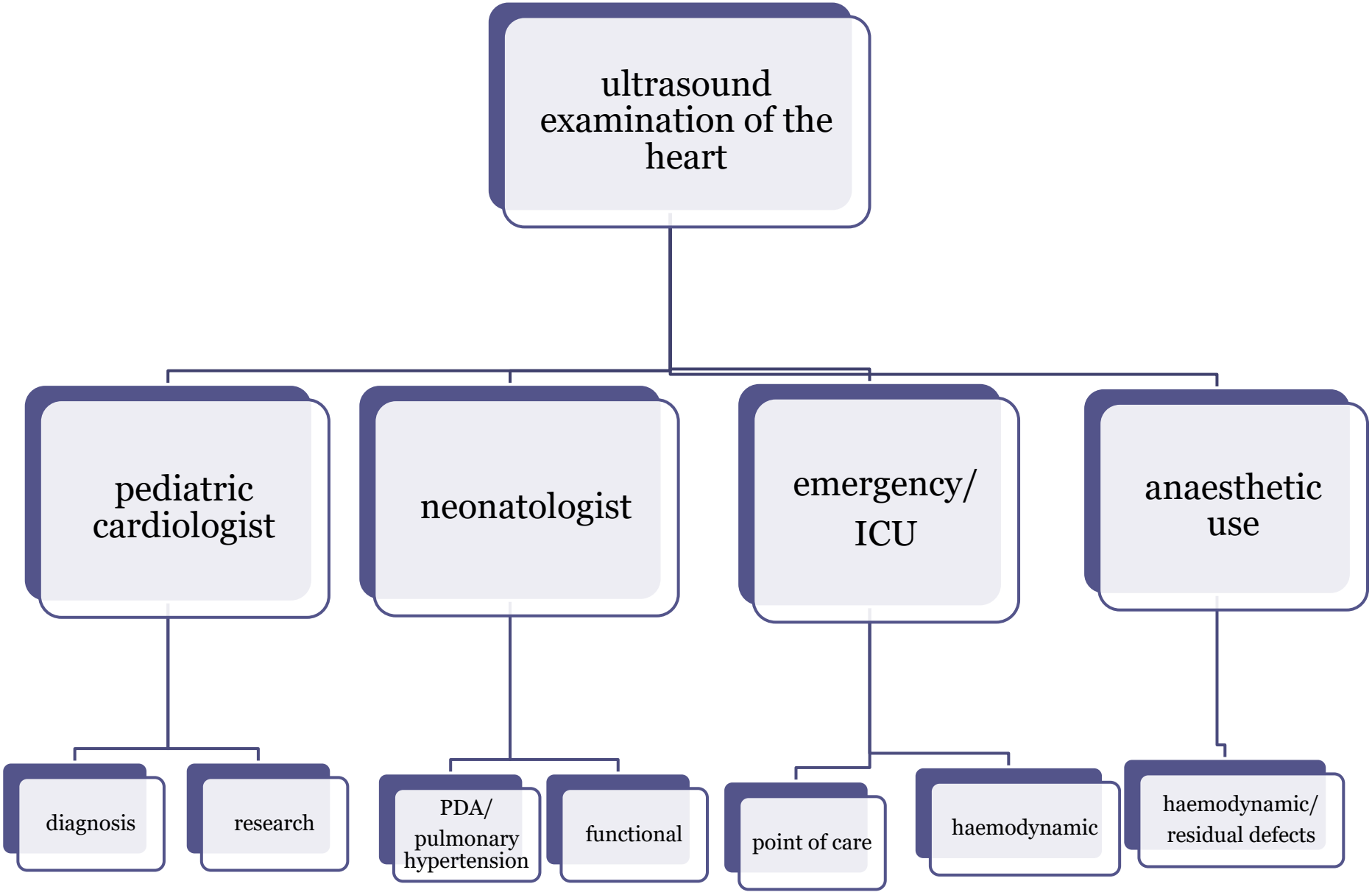
Sonda nou-nascuti 12-4

Sonda copii mici 8-3



Sonda copii mari/adulti 5-1


Ultrasound examination of the heart
Paediatric Cardiologist
Neonatologist
Point of Care Emergency/ICU
Anaesthetic use


ultrasound examination of the heart
pediatric cardiologist
neonatologist
emergency/ ICU
anaesthetic use
diagnosis
research
PDA/ pulmonary hypertension
functional
point of care
haemodynamic
haemodynamic/ residual defects

American Society of Echocardiography

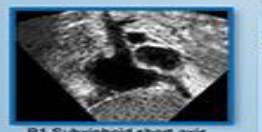
Heart and Circulation Ultrasound Specialists

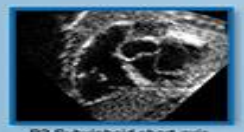
Guidelines for Pediatric Echocardiography


A1 Suprasternal transverse

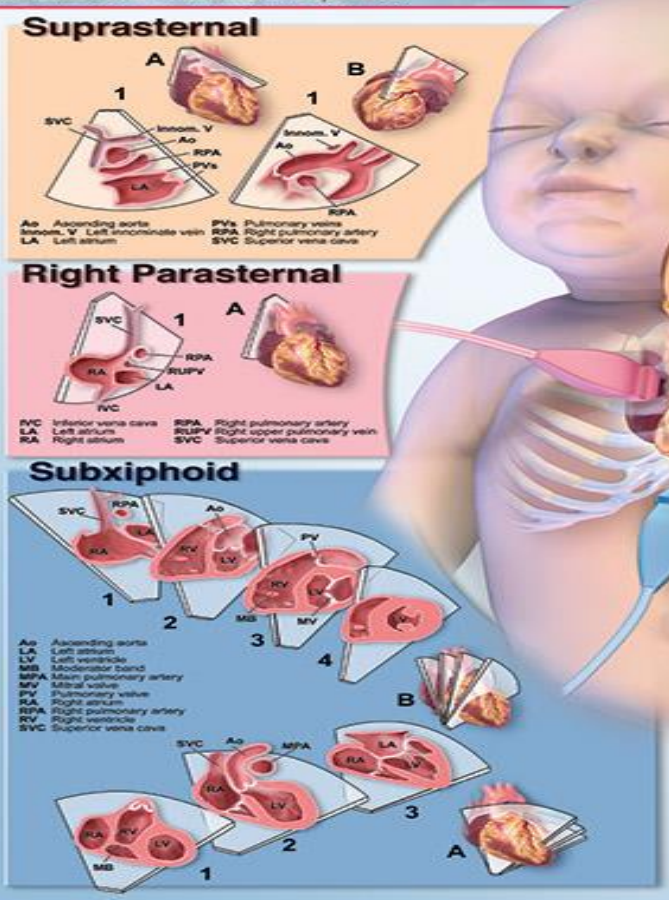

B1 Suprasternal aortic arch


A1 Right parasternal


B1 Subxiphoid short-axis


B2 Subxiphoid short-axis

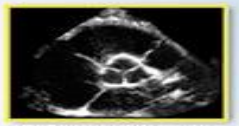

B3 Subxiphoid short-axis




A1 Parasternal long-axis


A2 Parasternal long-axis

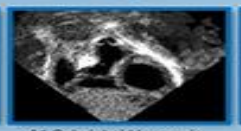

A3 Parasternal long-axis


B1 Parasternal short-axis


B2 Parasternal short-axis

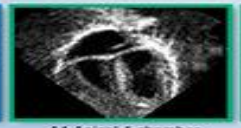

B3 Parasternal short-axis

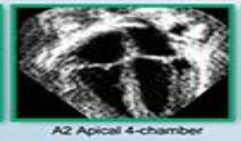

B4 Subxiphoid short-axis

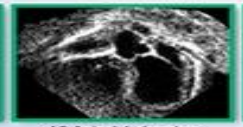

A1 Subxiphoid long-axis

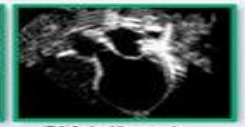

A2 Subxiphoid long-axis


A3 Subxiphoid long-axis


A1 Apical 4-chamber


A2 Apical 4-chamber


A3 Apical 4-chamber


B1 Apical long-axis

Measurements of Structures

Measurement	Timing	View(s)
Tricuspid Valve Annulus	Diastole	Apical 4
Pulmonary Valve Annulus	Systole	PSAX/PLAX
Main Pulmonary Artery	Systole	PSAX/PLAX
Left/Right Pulmonary Artery	Systole	PSAX/PLAX
Left Atrial Diameter	Diastole	PLAX
Mitral Valve Diameter	Diastole	PLAX/Apical 4
Aortic Valve Annulus	Systole	PLAX
Aortic Root	Systole	PLAX
Ascending Aorta	Systole	PLAX
Transverse Aortic Arch	Systole	SSN
Aortic Isthmus	Systole	SSN

Apical 4-chamber (Apical 4), Parasternal long axis (PLAX), Parasternal short axis (PSAX), Suprasternal notch view (SSN)

Doppler Measurements

Structure	Measurements*
Tricuspid Valve	E wave velocity, A wave velocity, deceleration time, IVRT, mean gradient, regurgitant jet velocity
RV Outflow	peak gradient, mean gradient, VTI
Pulmonary Valve	peak gradient, mean gradient, regurgitant jet velocity, VTI
Branch Pulmonary Artery	peak gradient, mean gradient, VTI
Mitral Valve	E wave velocity, A wave velocity, deceleration time, IVRT, mean gradient
LV Outflow	peak gradient, mean gradient, VTI
Aortic Valve	peak gradient, mean gradient, VTI, pressure half-time
Aortic Arch	peak gradient, mean gradient, VTI

Isovolumic relaxation time (IVRT), Velocity time integral (VTI)
*Recording of images adequate for the measurements listed should be considered for inclusion in a complete examination protocol. This is not intended to be a comprehensive list of recommended Doppler measurements.

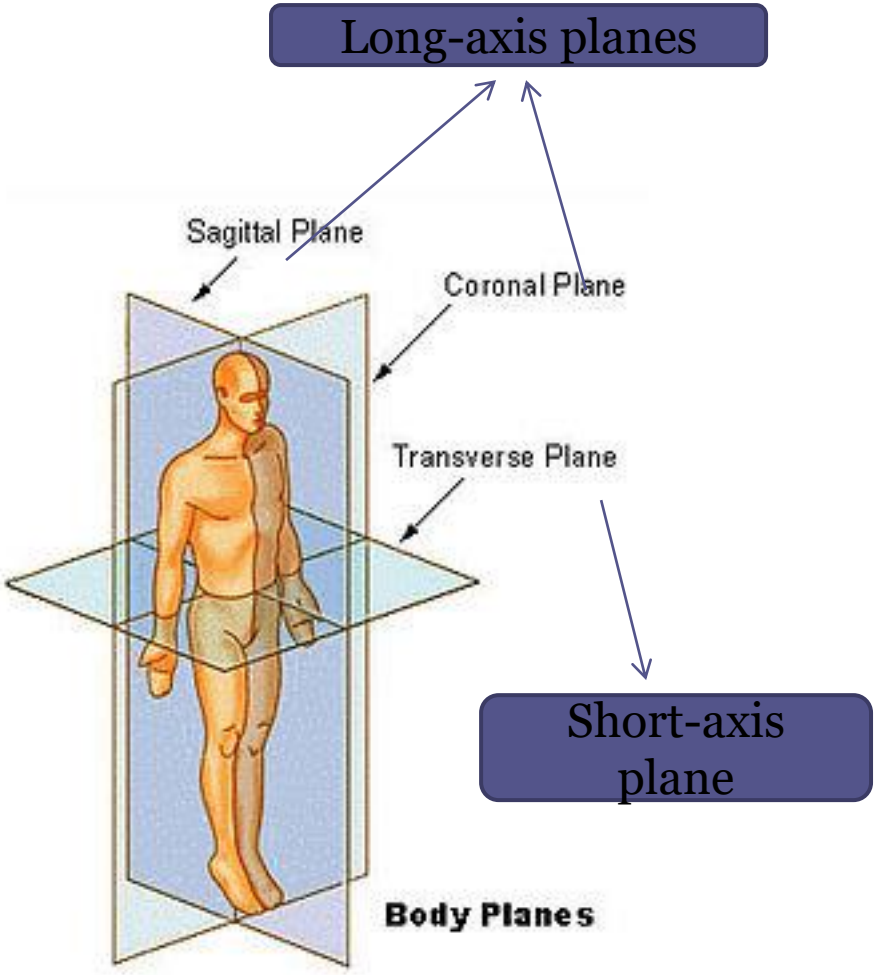
Report Elements

- Patient identifier data
  - Name
  - Date of birth
  - Medical record identifier
- Date of study
- Location of study
- Referring physician
- Patient height & weight (for body surface area calculation)
- Sonographer/Physician who performed the study
- Findings section
  - Structural/anatomic features
  - Quantitative data
  - Doppler (hemodynamic) findings
- Summary section

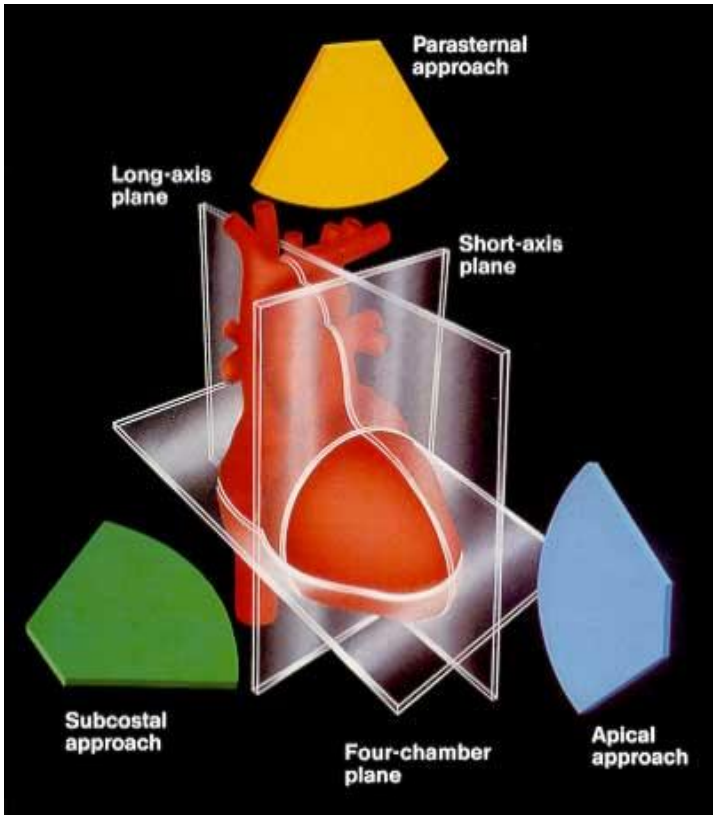
Poster ordering information and full text of ASE guideline documents available at: www.asecho.org

Adapted from: Wyman W. Lai, MD, MPH, FASE, Tal Geva, MD, FASE, Girish S. Shirali, MD, Peter C. Frommelt, MD, Richard A. Humes, MD, FASE, Michael M. Brook, MD

Planurile ortogonale

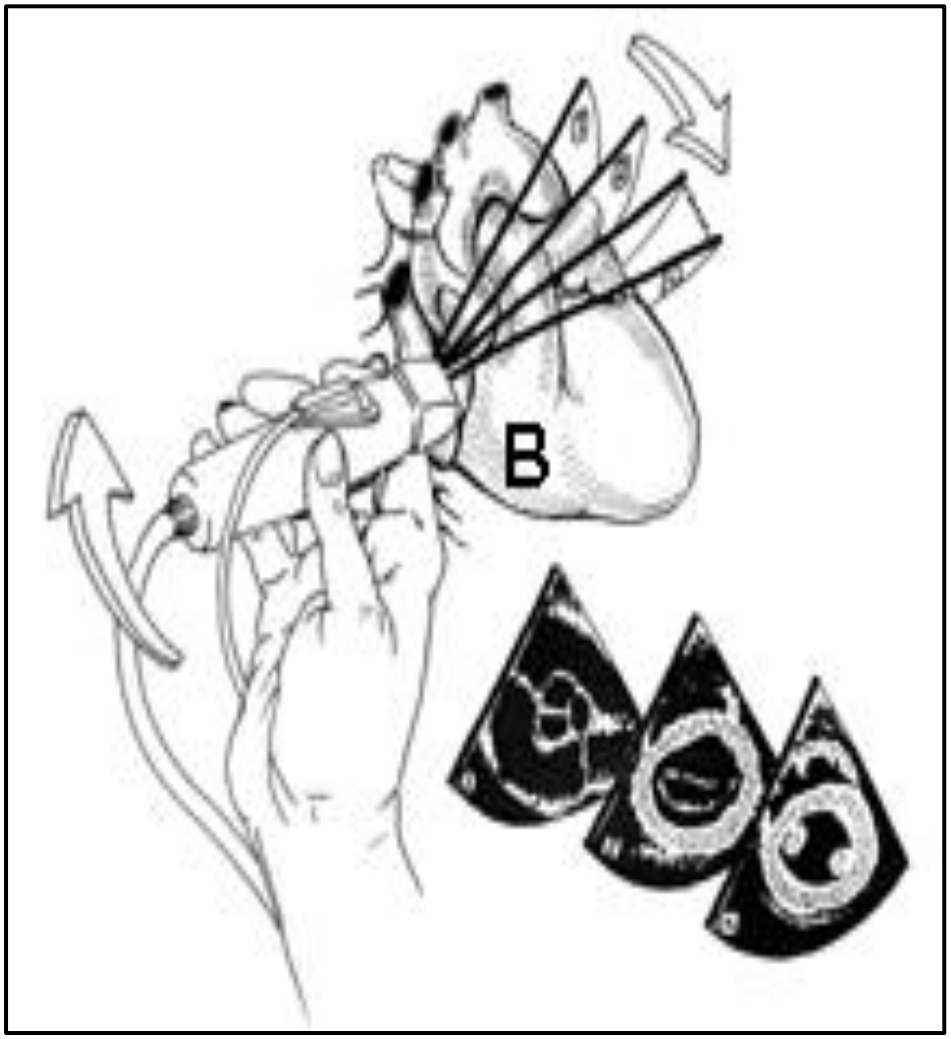


Planurile ortogonale ale corpului



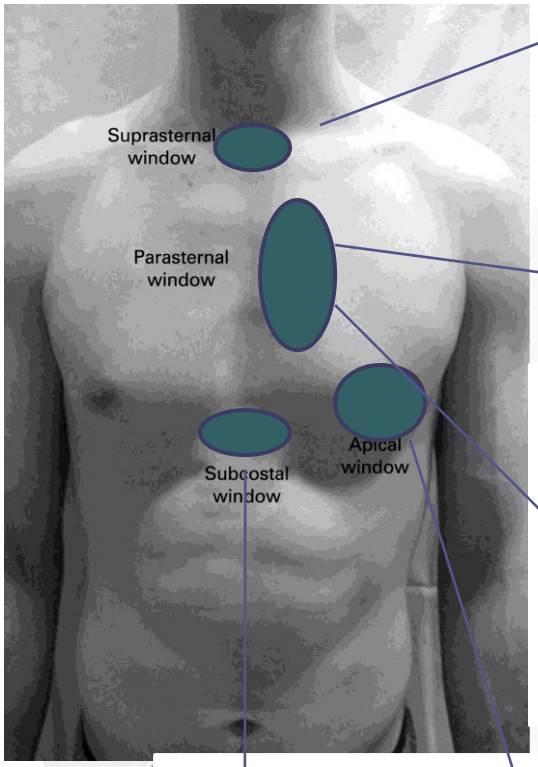
Planurile ortogonale ale cordului

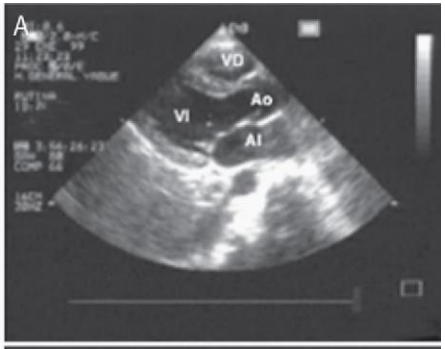
Miscari ale transductorului:

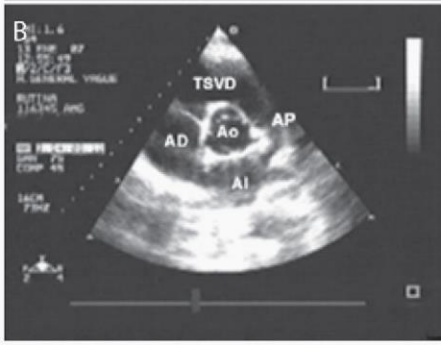


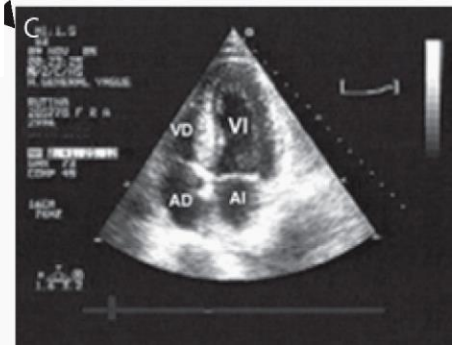
- **Rotatie**: in sens orar/antiorar;
- **Angulare**: in directie craniala, caudala, spre stanga sau spare dreapta.
- **Translatie**: un spatiu mai sus/mai jos/lateral/medial

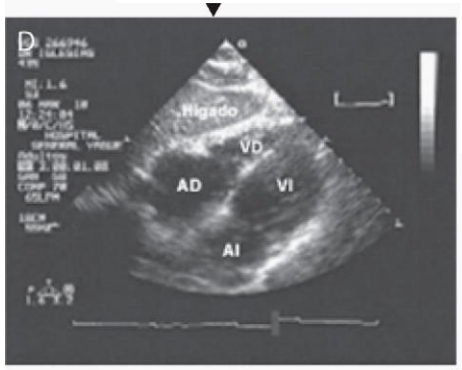
Sectiuni standard in ecocardiografie

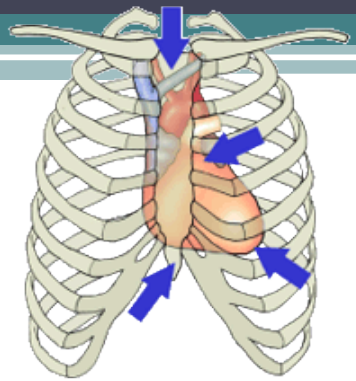






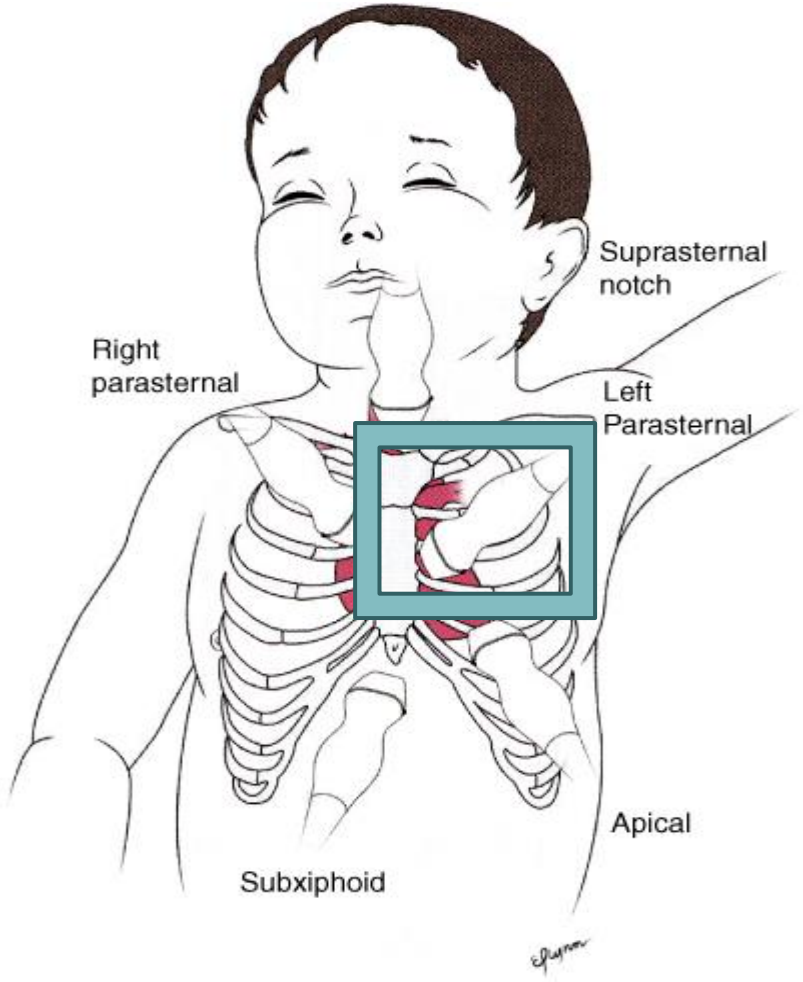






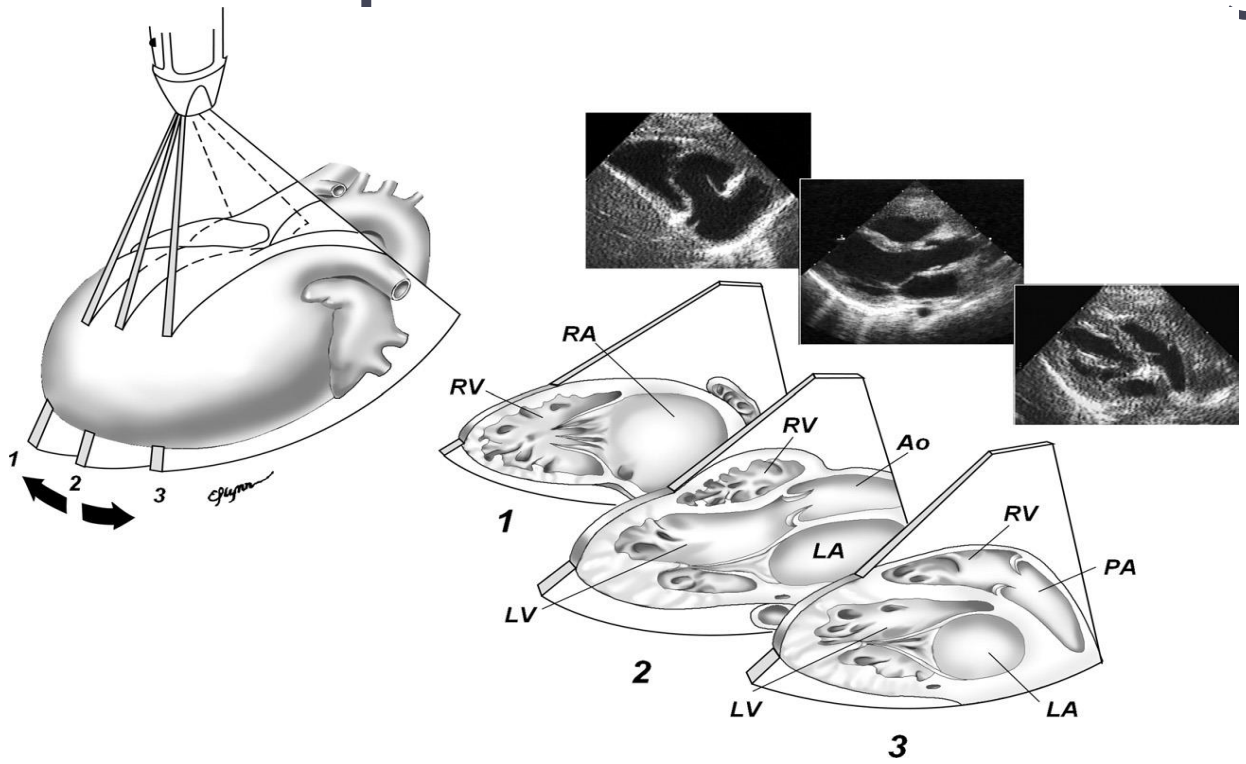
1. parasternal ax lung
2. parasternal ax scurt
3. apical 4 camere
4. subcostal
5. suprasternal

Sectiunea parasternal ax lung



Source: Gleason MM, Rychik J, Shaddy R: *Pediatric Practice: Cardiology*: www.accesspediatrics.com

Sectiunea parasternal ax lung(2)



Sectiuni modificate ax lung:

-pentru tractul de intrare VD: prin angulare spre superior si lateral fata de pozitia necesara obtinerii sectiunii parasternale ax lung;

-pentru tractul de iesire VD: angulare in sens invers.

Guidelines and Standards for Performance of a Pediatric Echocardiogram: A Report from the Task Force of the Pediatric Council of the American Society of Echocardiography

Wyman W. Lai, MD, MPH, FASE, Tal Geva, MD, FASE, Girish S. Shirali, MD,Peter C. Frommelt, MD, Richard A. Humes, MD, FASE,Michael,M. Brook, MD,Ricardo H. Pignatelli, MD, and Jack Rychik, MD, Writing Committee, *New York, New York;Boston, Massachusetts; Charleston, South Carolina; Milwaukee, Wisconsin; Detroit, Michigan; San Francisco, California;Houston, Texas; and Philadelphia, Pennsylvania*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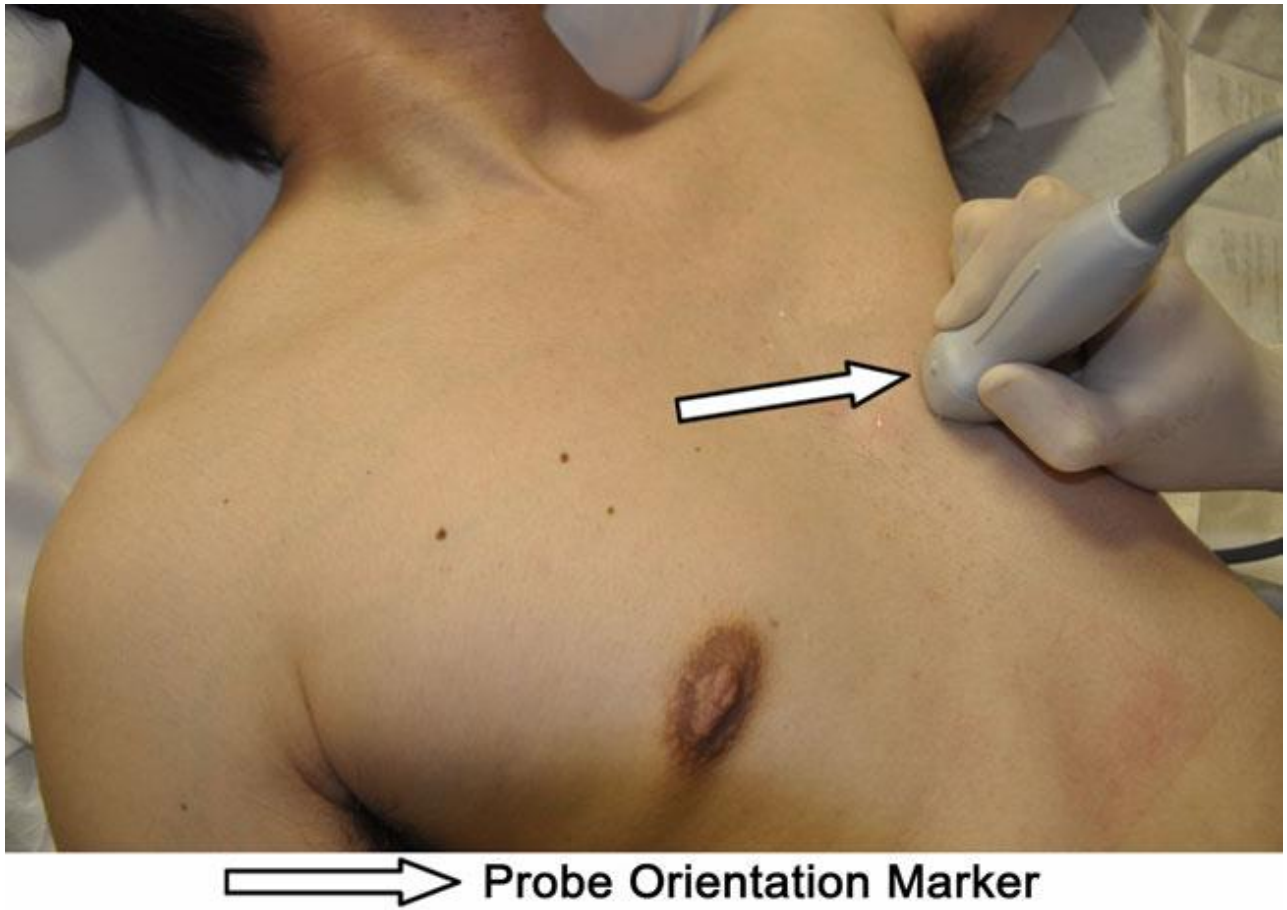
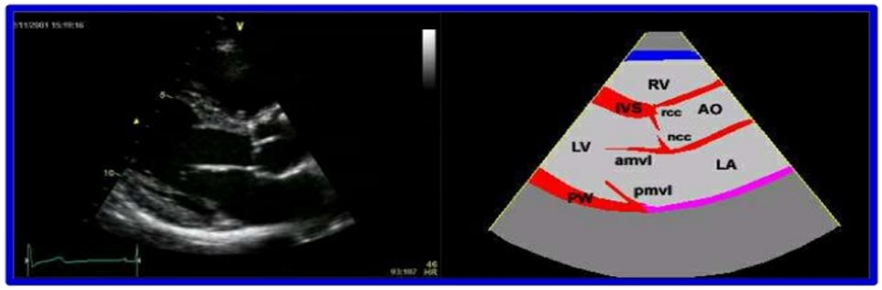
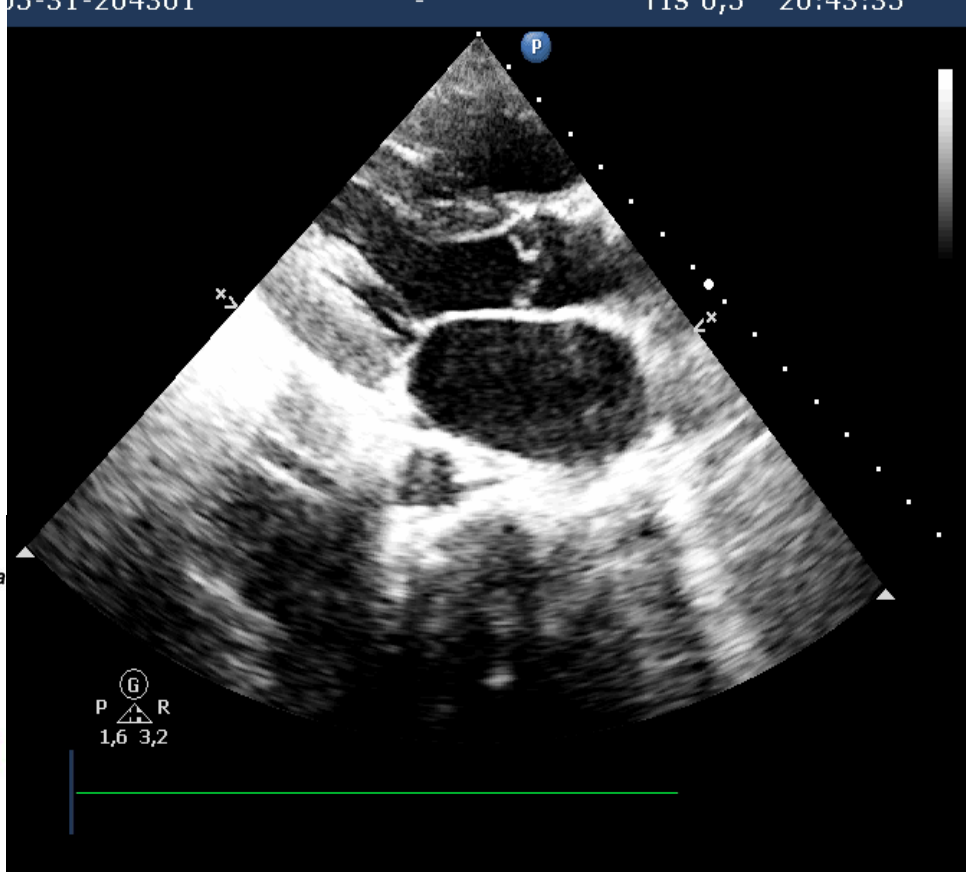
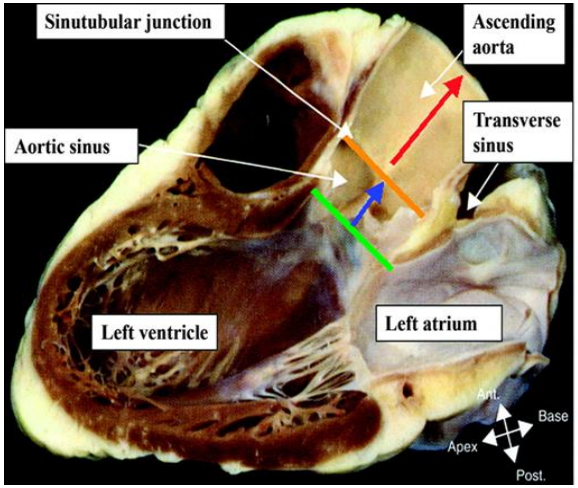
Sectiunea parasternal ax lung(1)

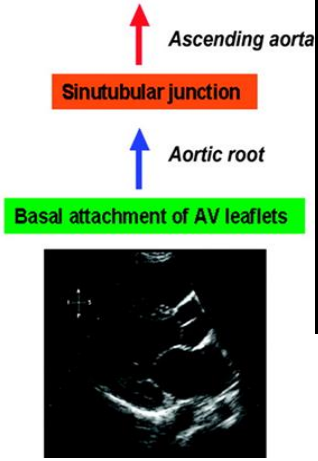


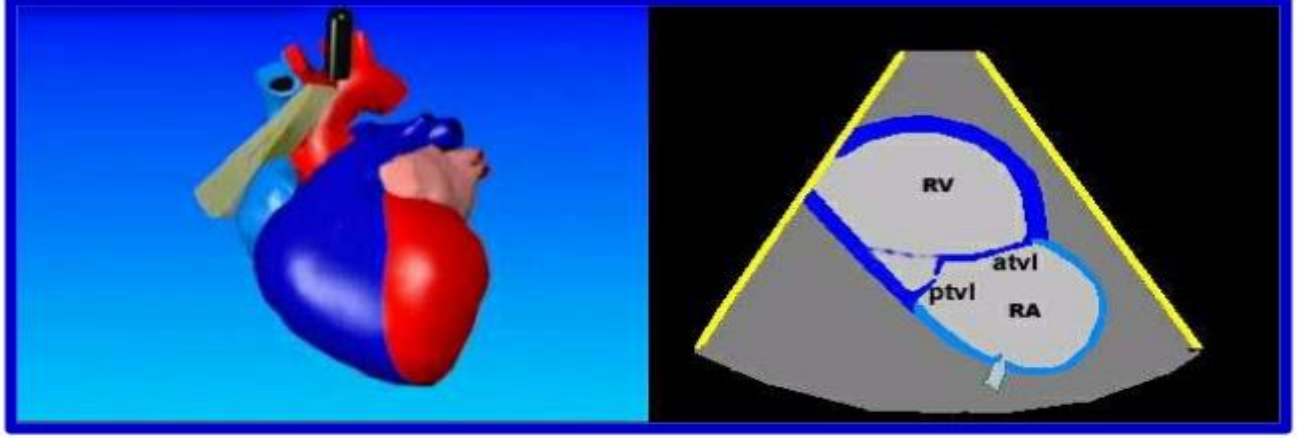
Sonda se plaseza in spatiul III, IV sau V intercostal stang; markerul sondei orientat catre clavicula dreapta a pacientului,ora 11.

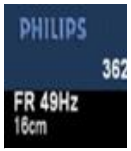

RV
IVS
rcc
AO
ncc
LV
amvl
LA
PW
pmvl

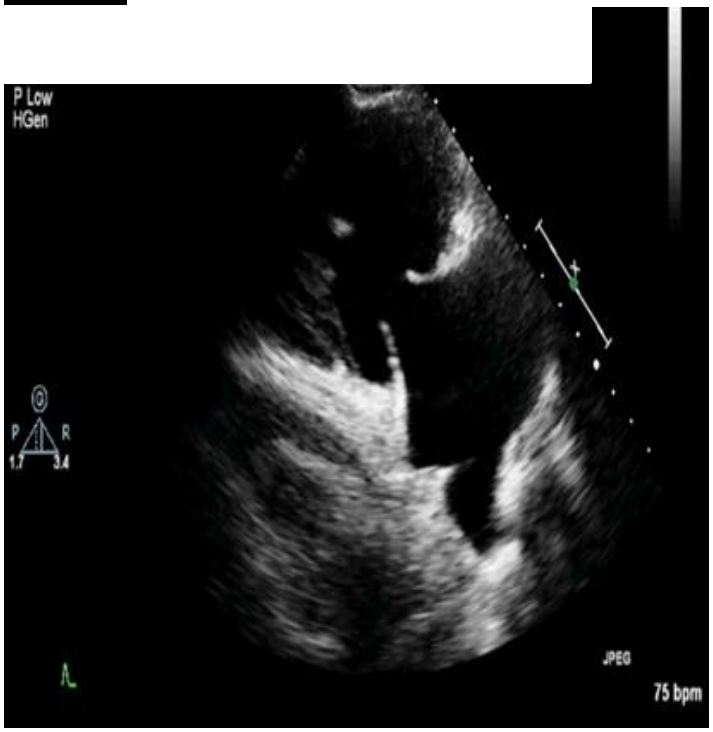

P
G
P
R
1,6 3,2

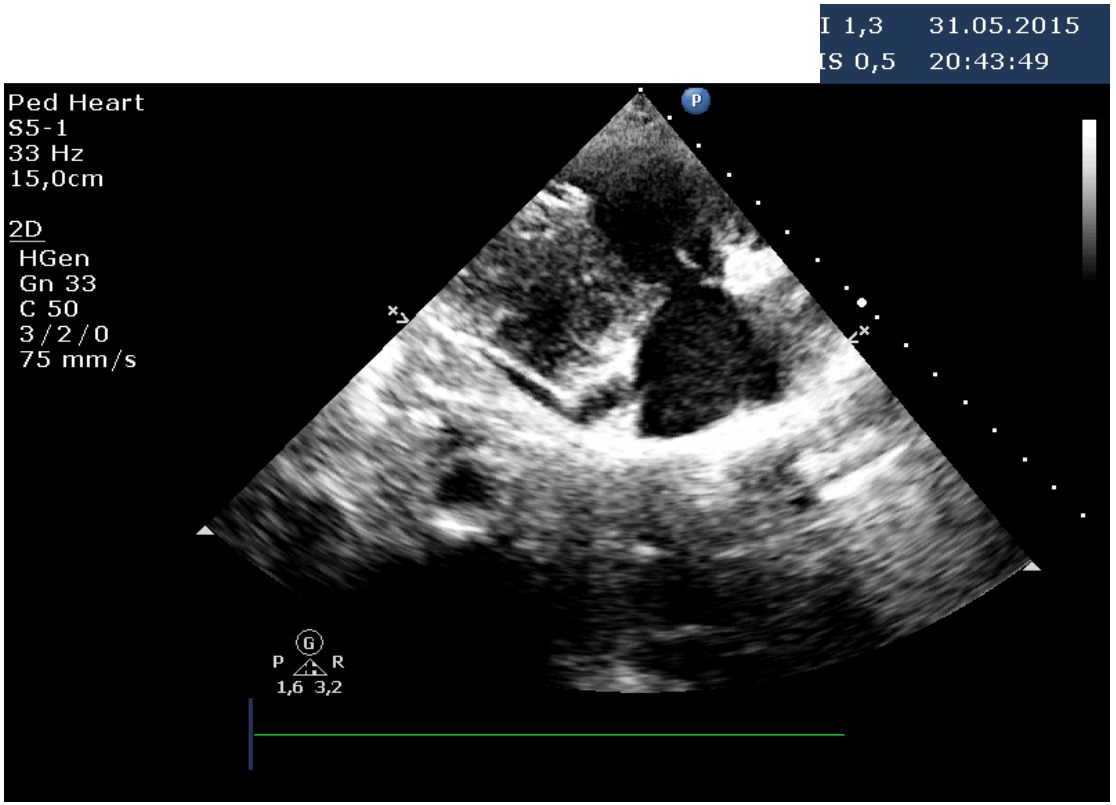

Sinutubular junction
Ascending aorta
Aortic sinus
Transverse sinus
Left ventricle
Left atrium
Ant.
Base
Apex
Post.

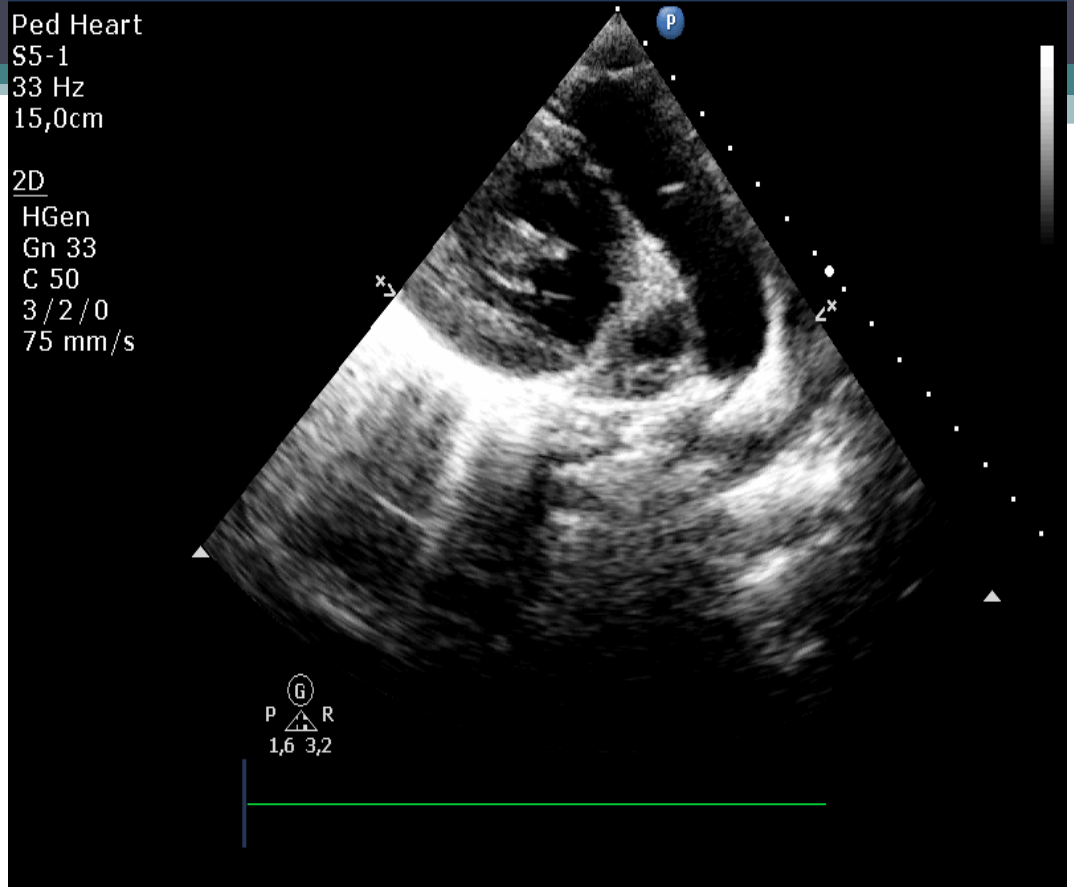

Ascending aorta
Sinutubular junction
Aortic root
Basal attachment of AV leaflets

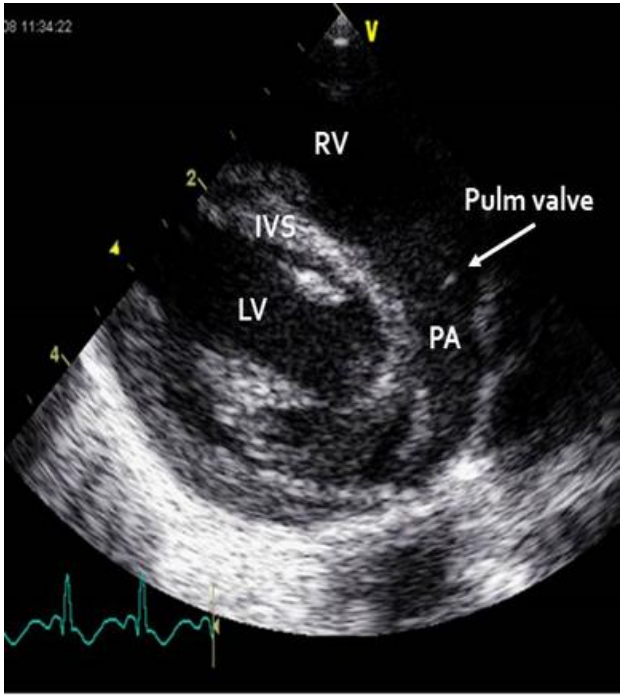

RV
atvl
ptvl
RA


PHILIPS
362
FR 49Hz
16cm

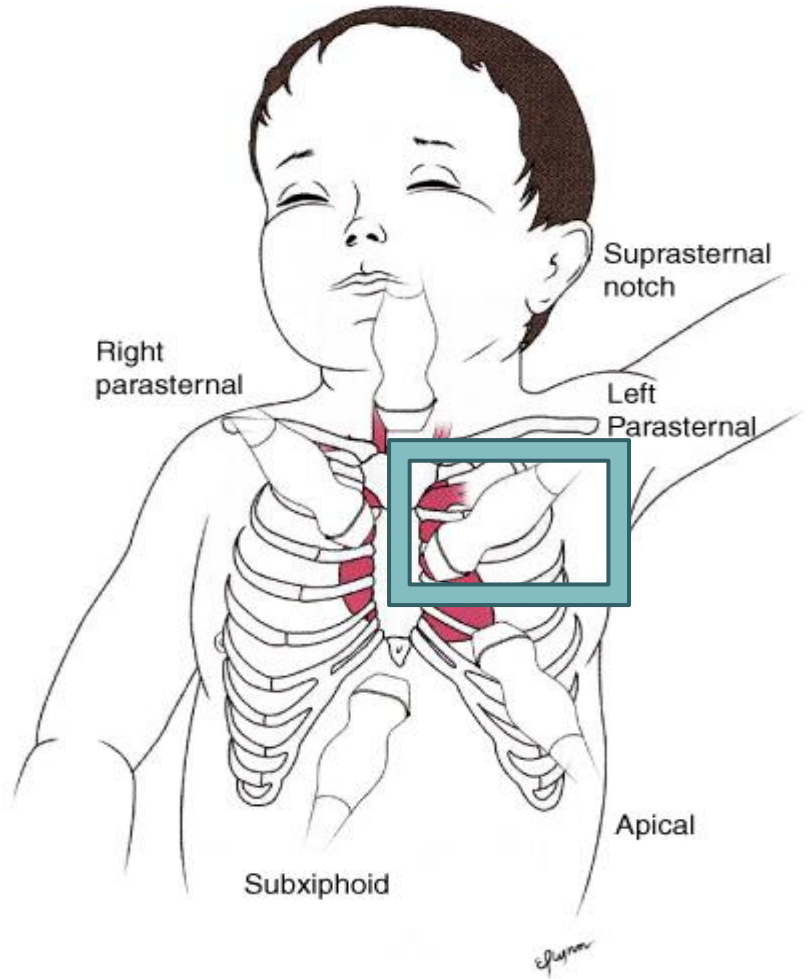

P Low
HGen
P
R
1.7
3.4
JPEG
75 bpm


I 1,3
31.05.2015
IS 0,5
20:43:49
Ped Heart
S5-1
33 Hz
15,0cm
2D
HGen
Gn 33
C 50
3/2/0
75 mm/s
P
G
P
R
1,6 3,2


Ped Heart
S5-1
33 Hz
15,0cm
2D
HGen
Gn 33
C 50
3/2/0
75 mm/s
P
G
P R
1,6 3,2

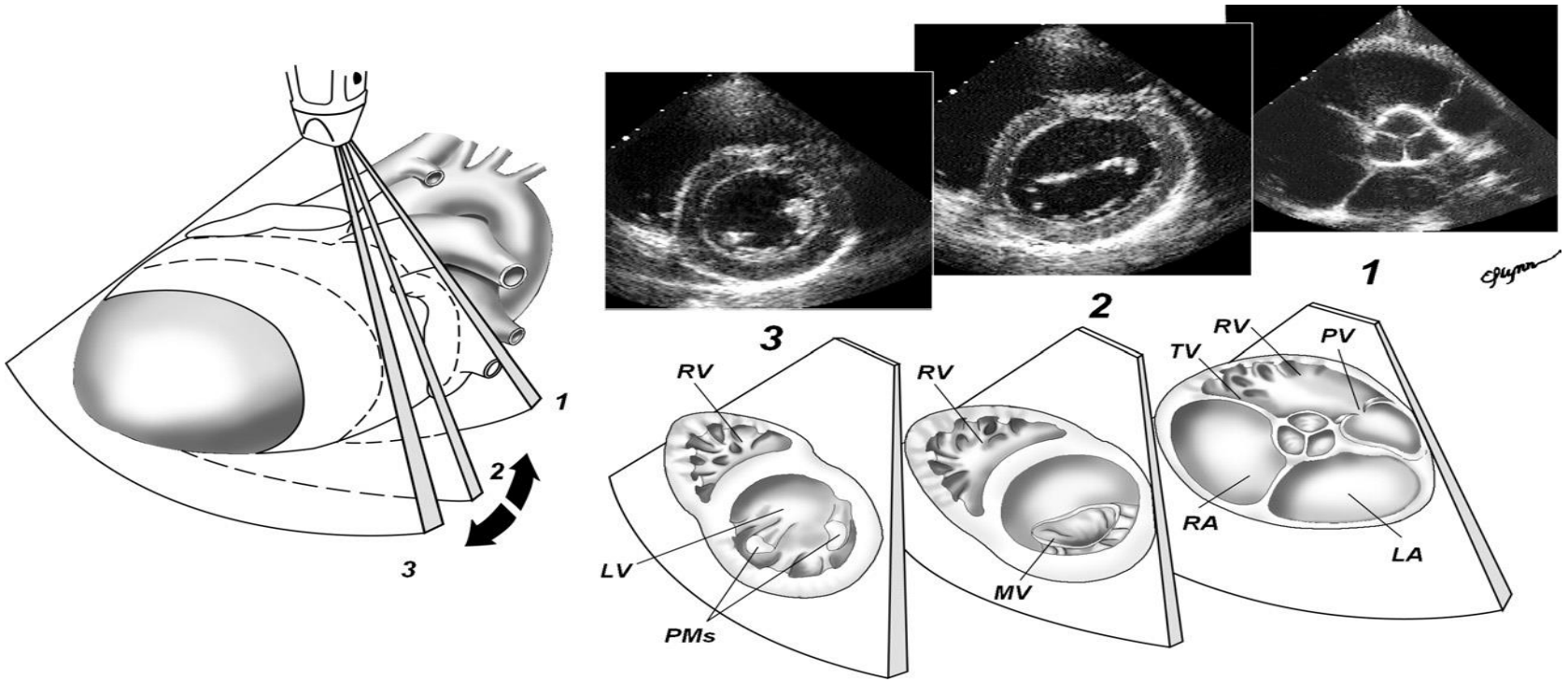

RV
IVS
Pulm valve
LV
PA

Sectiunea parasternal ax scurt



Source: Gleason MM, Rychik J, Shaddy R: *Pediatric Practice: Cardiology*: www.accesspediatrics.com

Sectiunea parasternal ax scurt(2)



- Prin angularea catre inferior si lateral, fata de pozitia anterioara a sondei, se poate vizualiza axul scurt al VS la diferite niveluri: valvei mitrale; muschilor papilari; apexului

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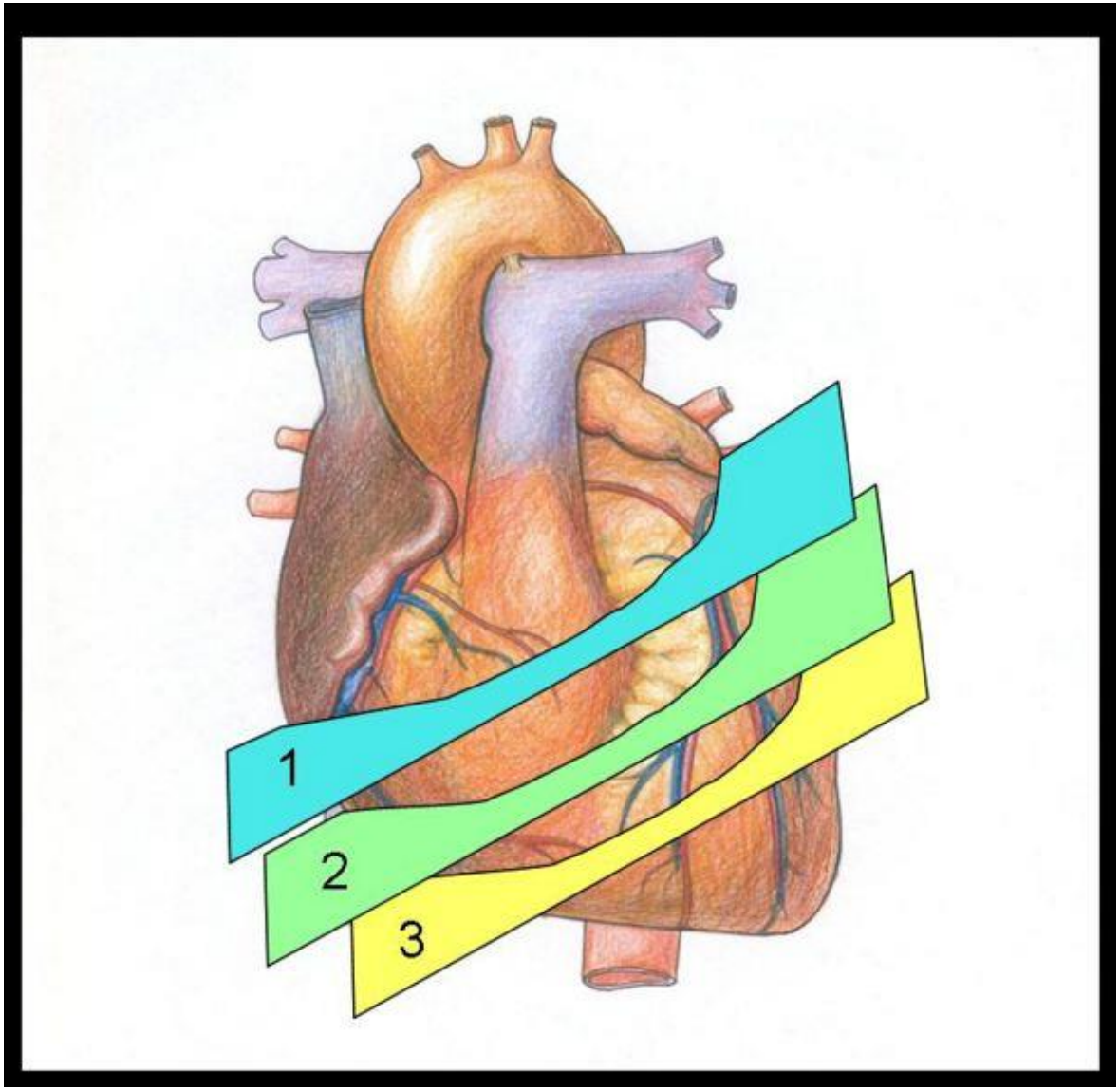
1
2
3


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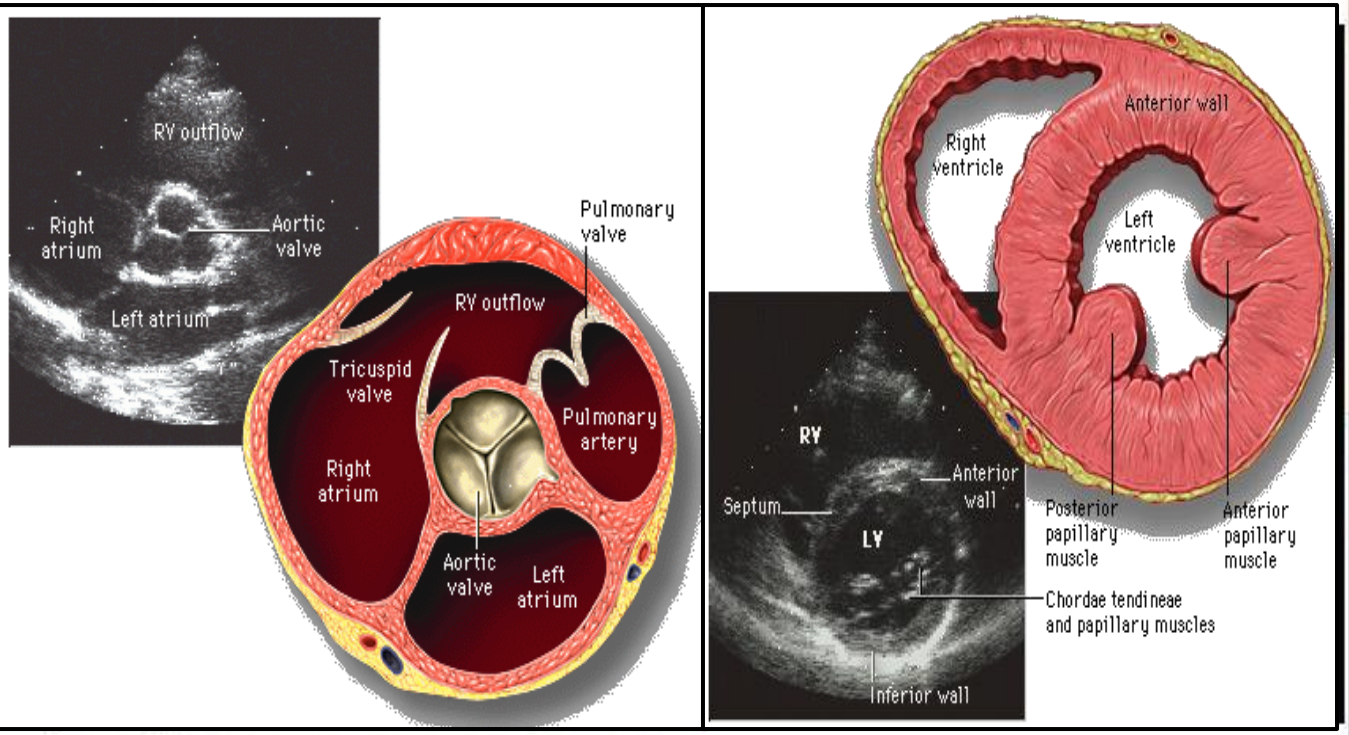
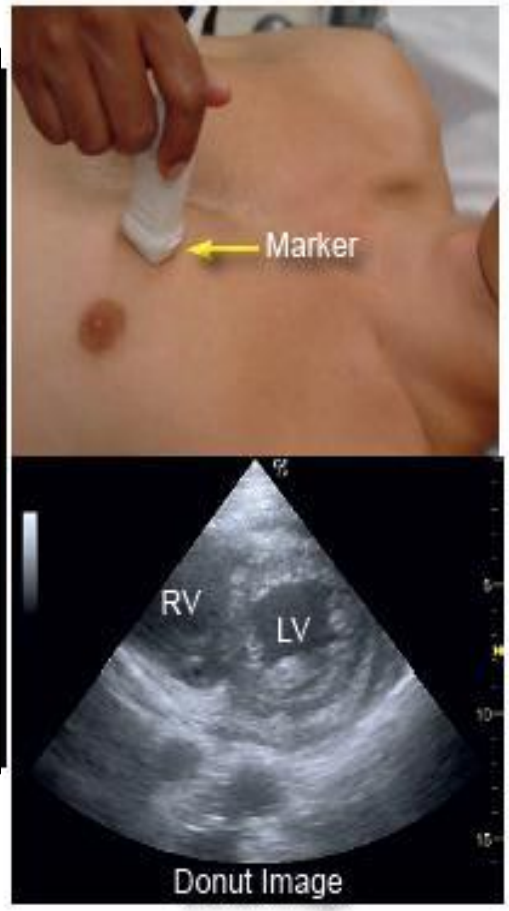
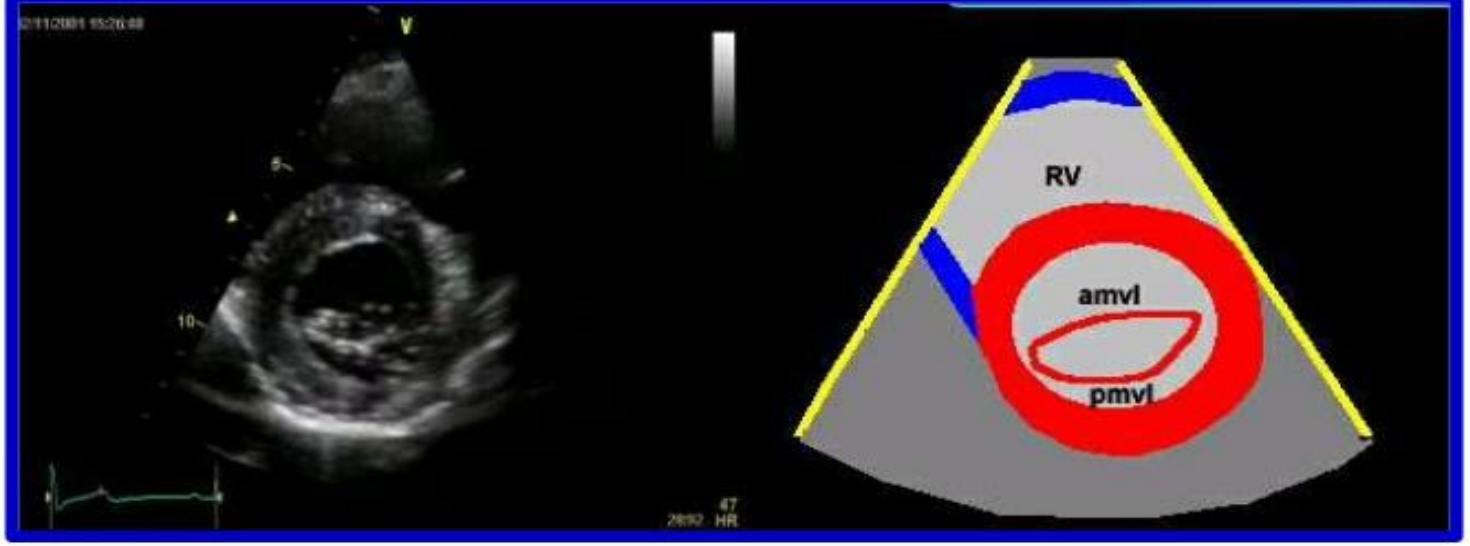
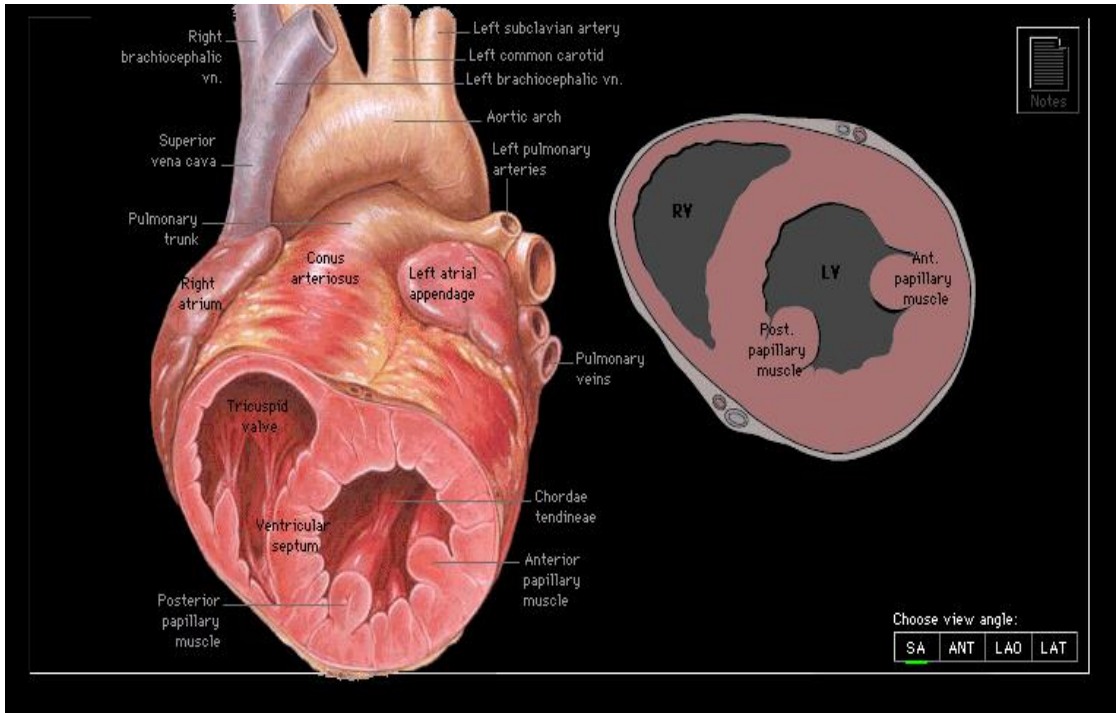
Sectiunea parasternal ax scurt(1)

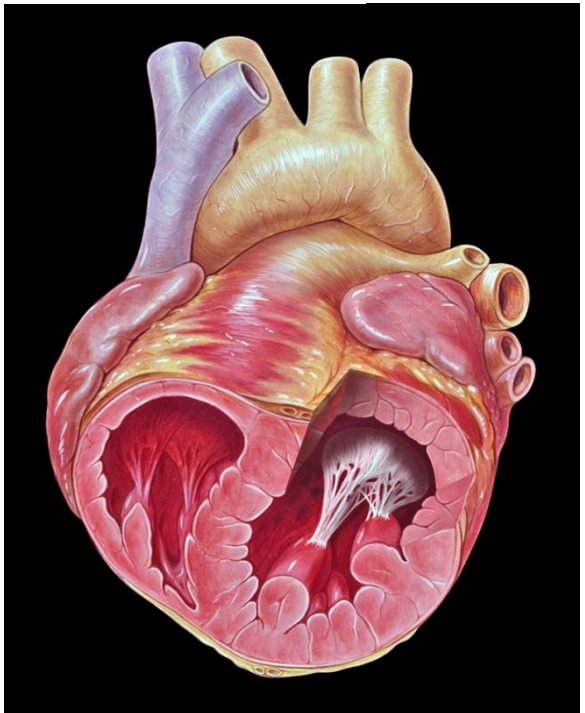


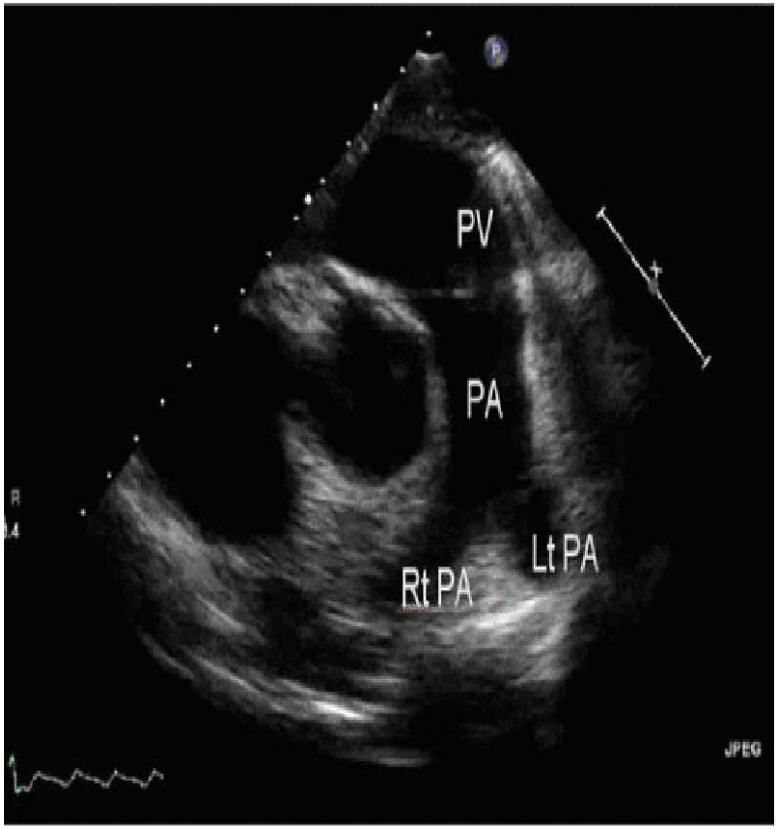


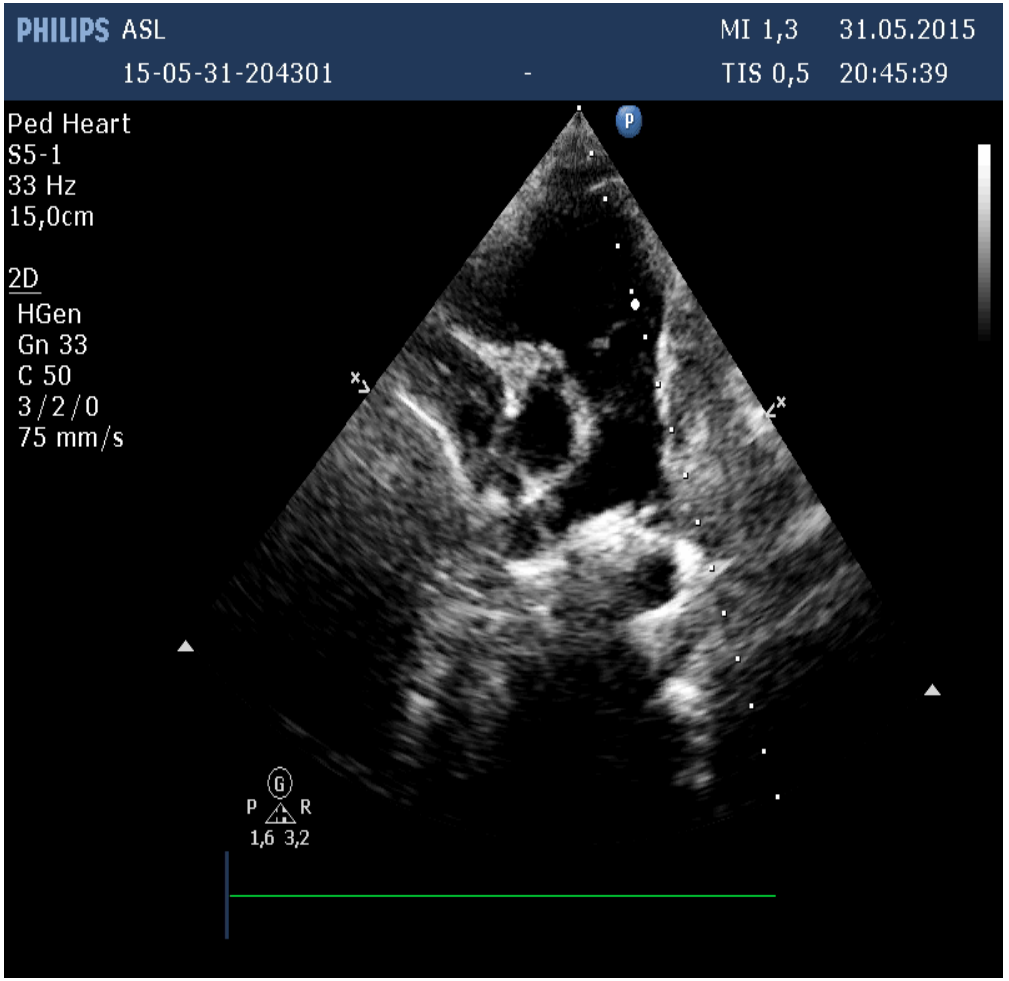
fata de pozitia sondei din parasternal ax lung, prin rotire cu aproximativ 90⁰ in sensul acelor de ceasornic: baza marilor

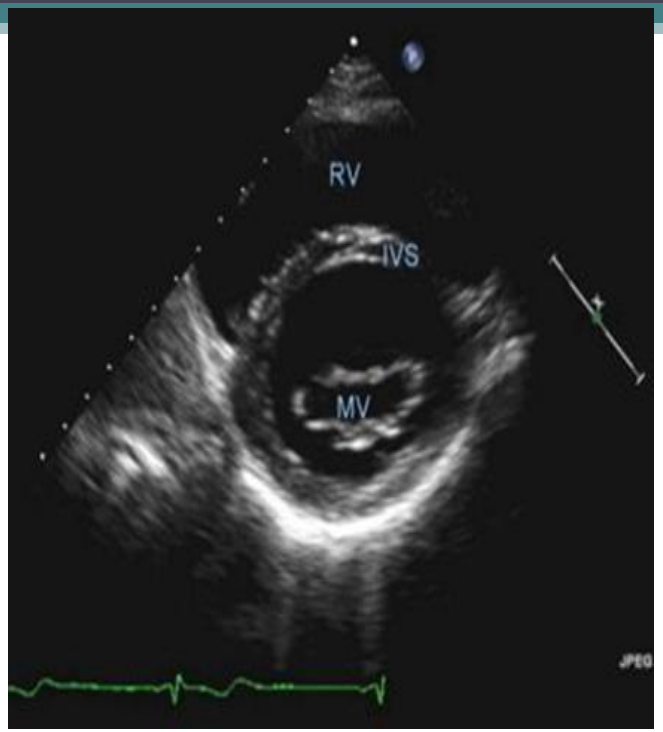

RV
amvl
pmvl

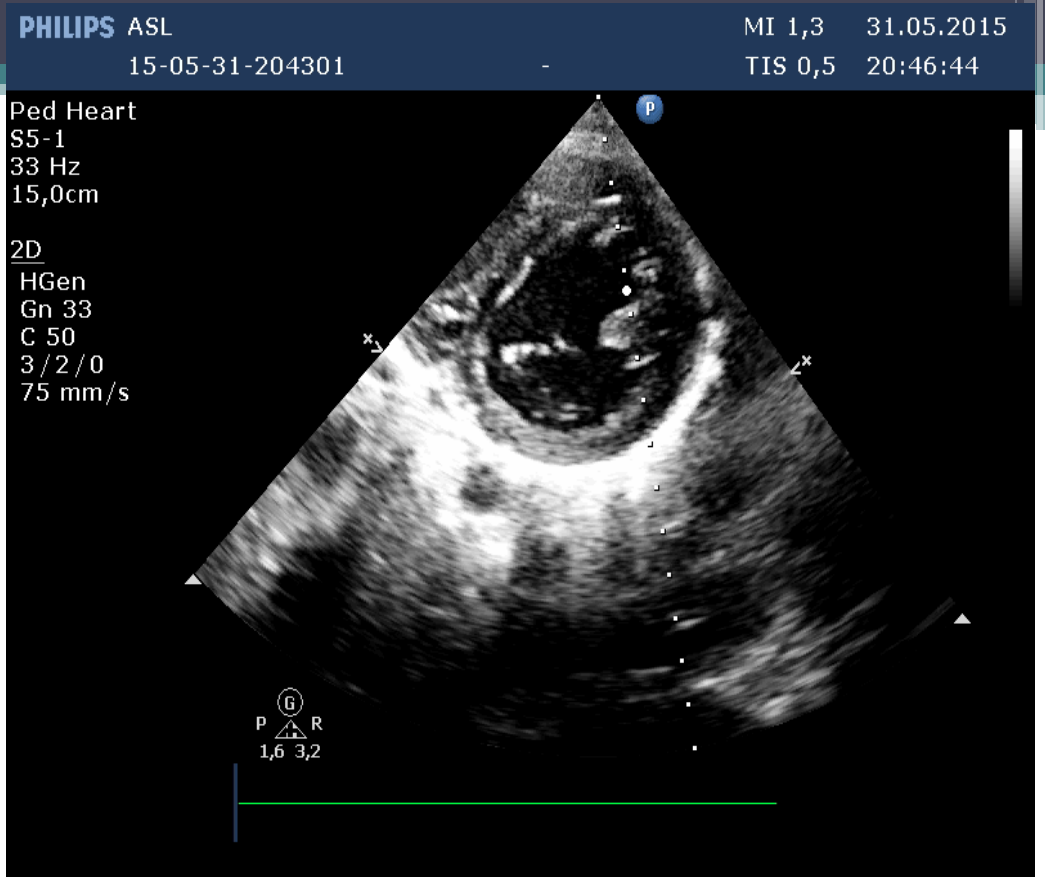

Right brachiocephalic vn.
Left subclavian artery
Left common carotid
Left brachiocephalic vn.
Aortic arch
Superior vena cava
Left pulmonary arteries
Pulmonary trunk
Conus arteriosus
Left atrial appendage
Right atrium
Pulmonary veins
Tricuspid valve
Chordae tendineae
Ventricular septum
Anterior papillary muscle
Posterior papillary muscle
RV
LV
Ant. papillary muscle
Post. papillary muscle
Notes
Choose view angle:
SA
ANT
LAO
LAT

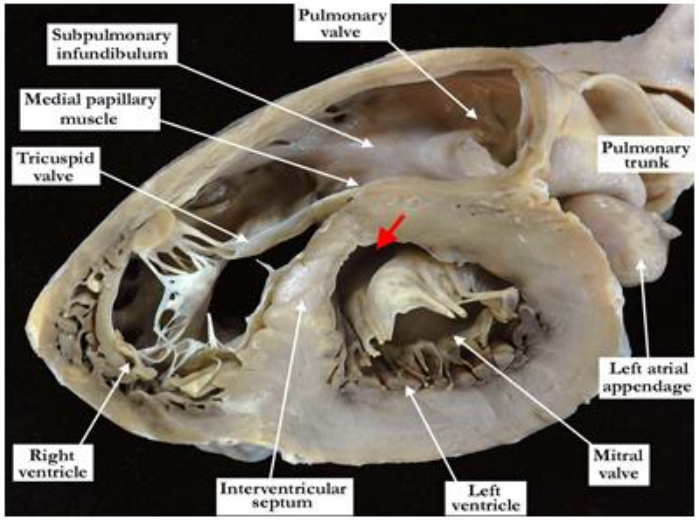


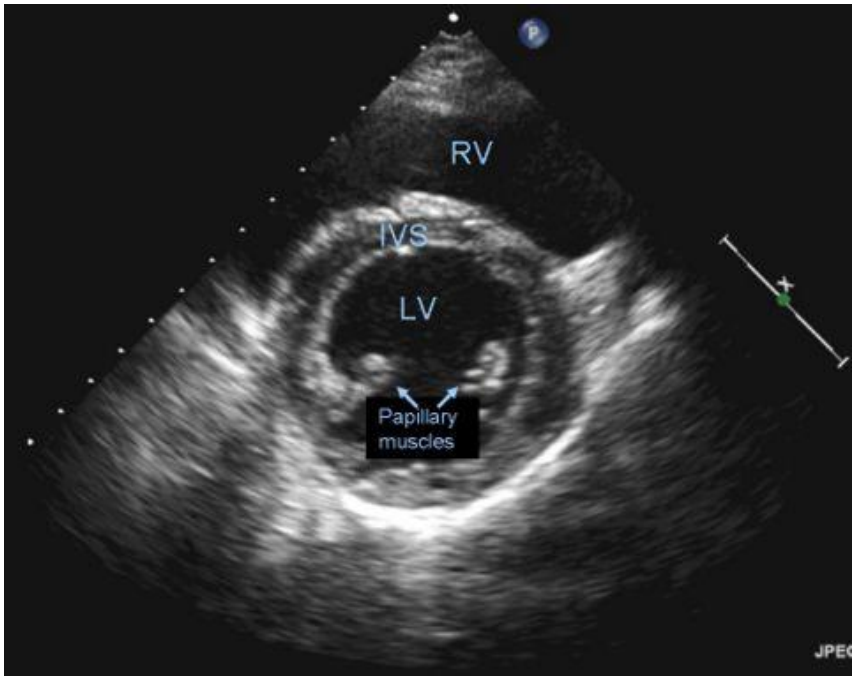

PV
PA
Lt PA
Rt PA
JPEG


PHILIPS ASL
MI 1,3
31.05.2015
15-05-31-204301
TIS 0,5
20:45:39
Ped Heart
S5-1
33 Hz
15,0cm
2D
HGen
Gn 33
C 50
3/2/0
75 mm/s
P
R
1,6 3,2

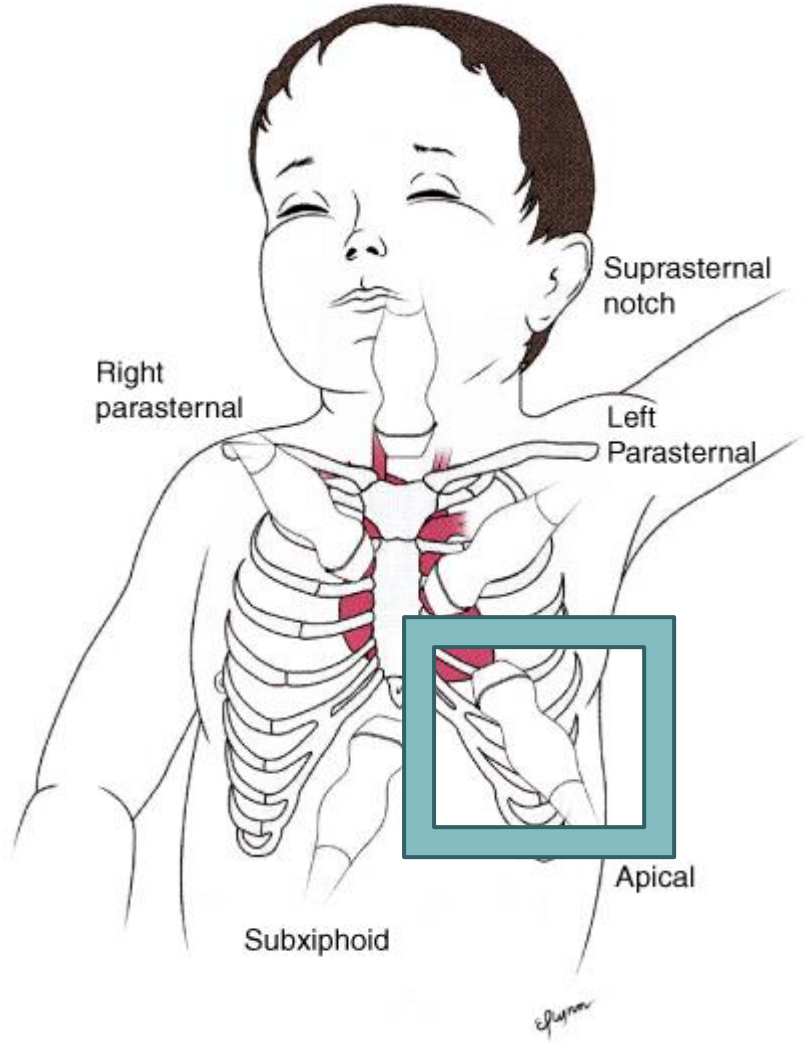

RV
IVS
MV


PHILIPS ASL
MI 1,3
31.05.2015
15-05-31-204301
TIS 0,5
20:46:44
Ped Heart
S5-1
33 Hz
15,0cm
2D
HGen
Gn 33
C 50
3/2/0
75 mm/s
P
G
P R
1,6 3,2


Subpulmonary infundibulum
Pulmonary valve
Medial papillary muscle
Tricuspid valve
Pulmonary trunk
Left atrial appendage
Right ventricle
Interventricular septum
Left ventricle
Mitral valve

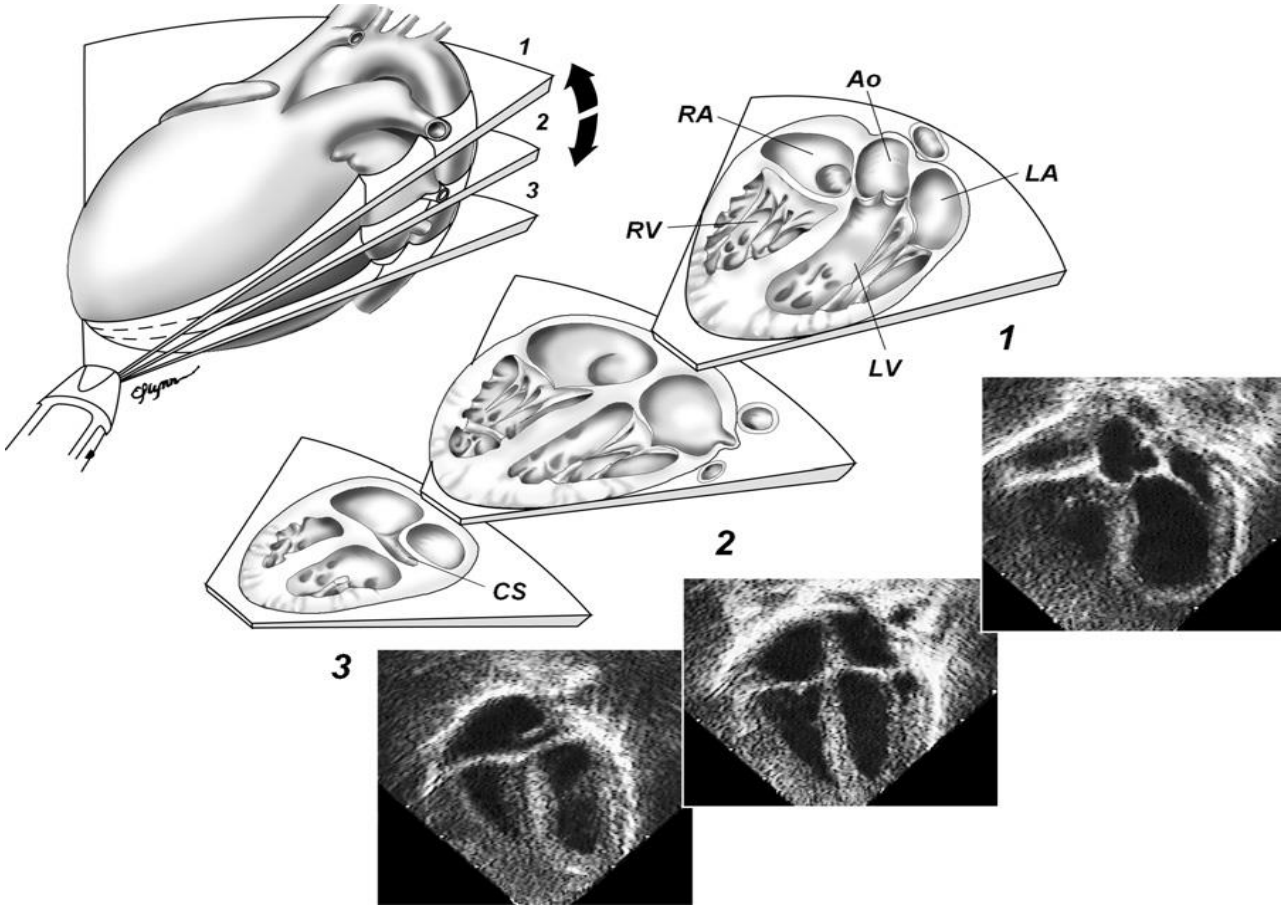

RV
IVS
LV
Papillary muscles

Sectiunea apical



Source: Gleason MM, Rychik J, Shaddy R: *Pediatric Practice: Cardiology*: www.accesspediatrics.com

Sectiunea apical patru camere



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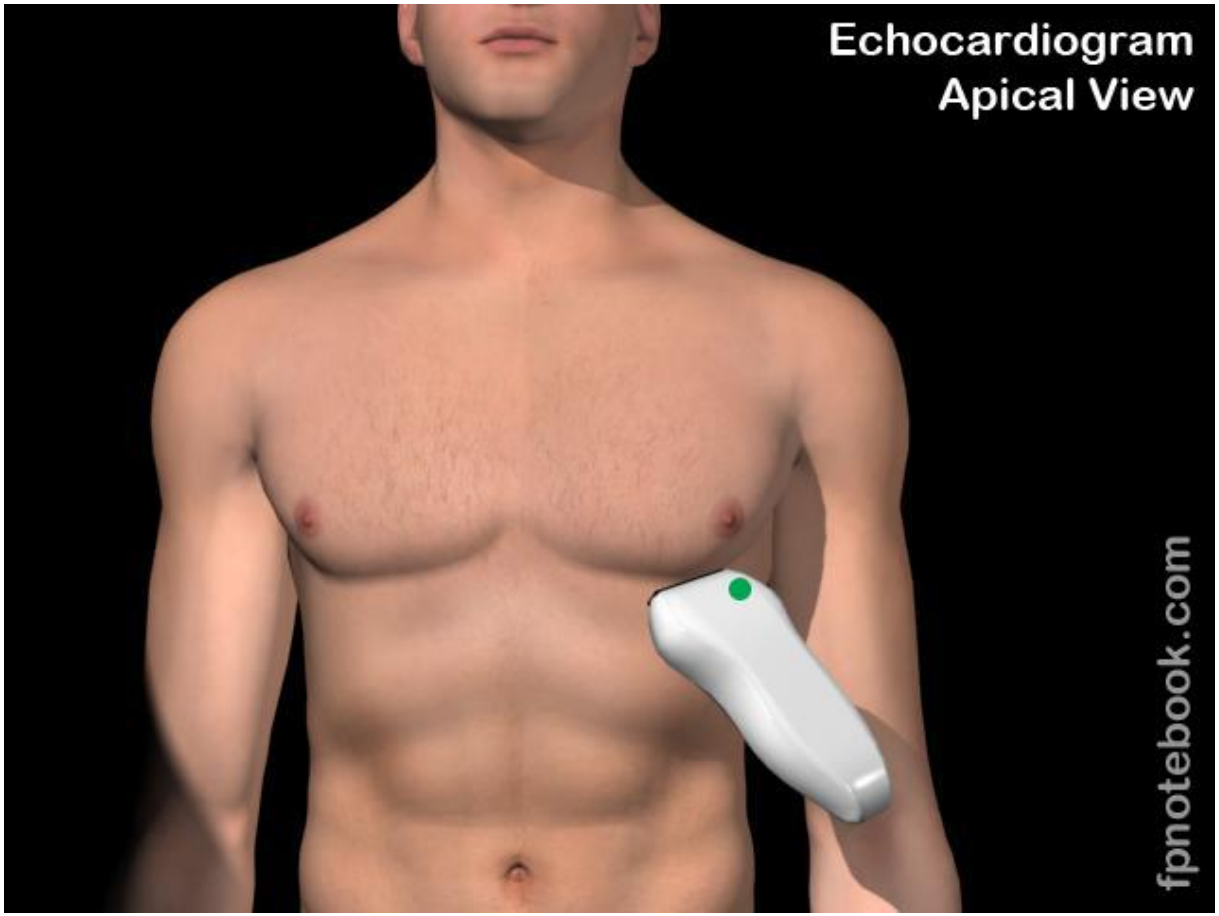
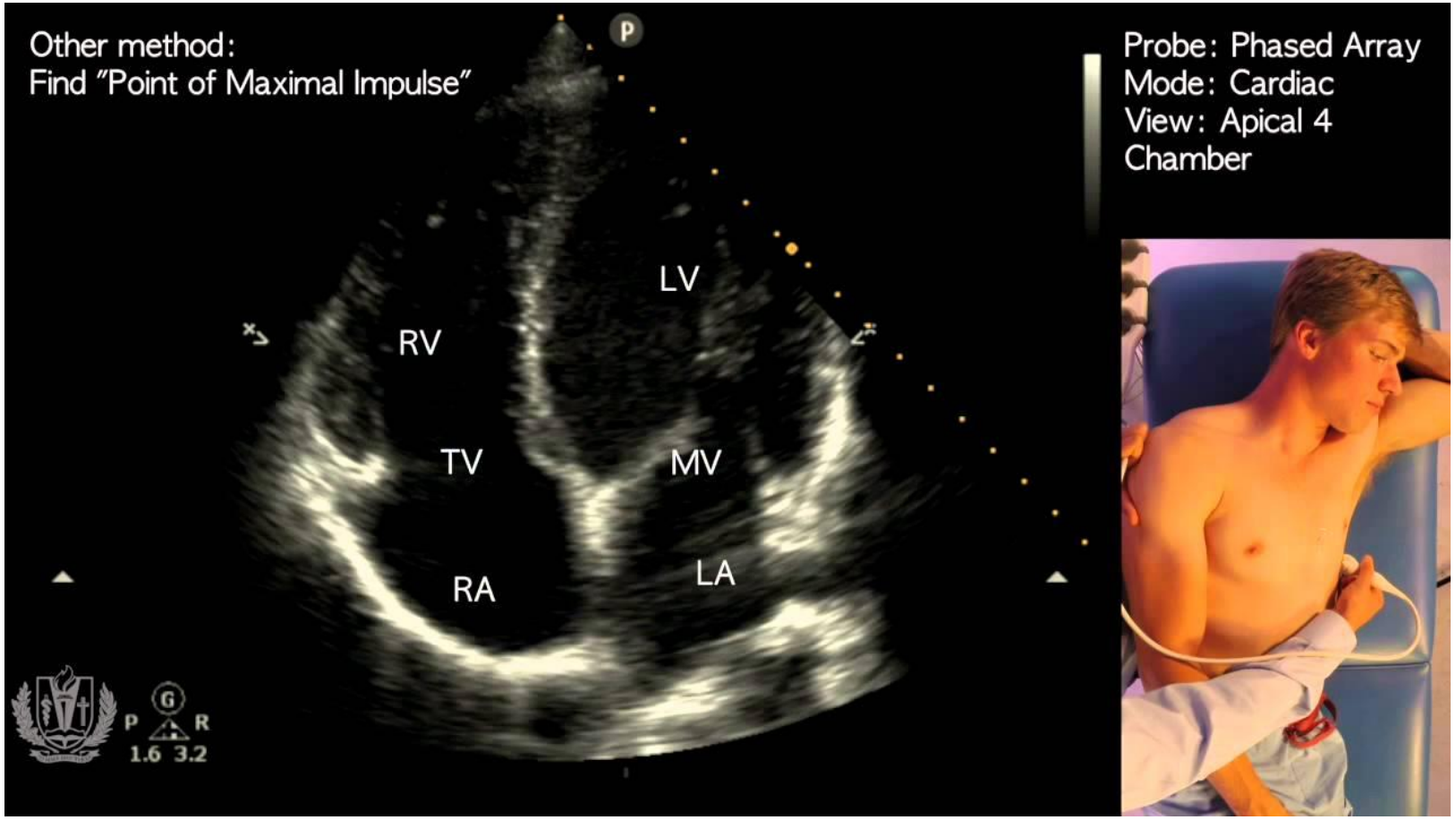
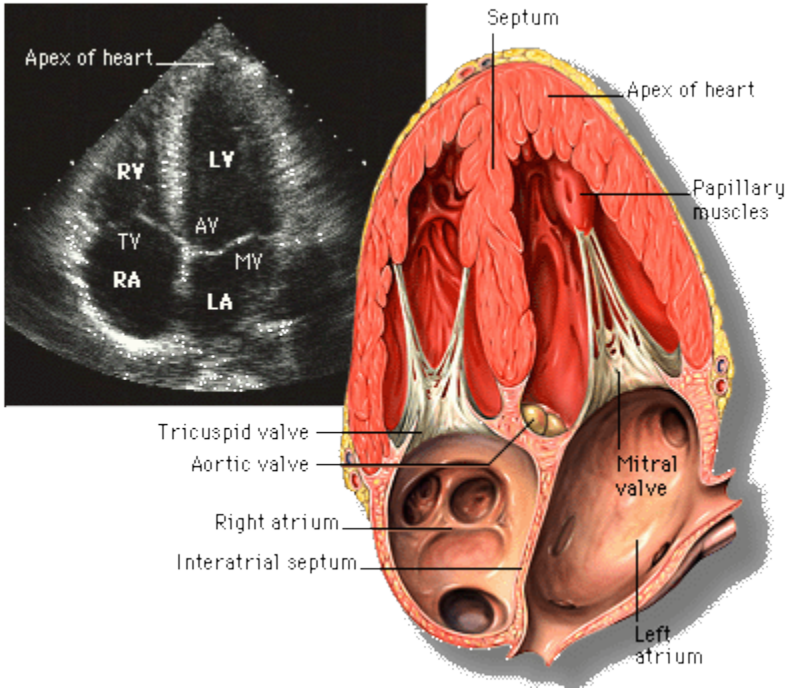
Sectiunea apical

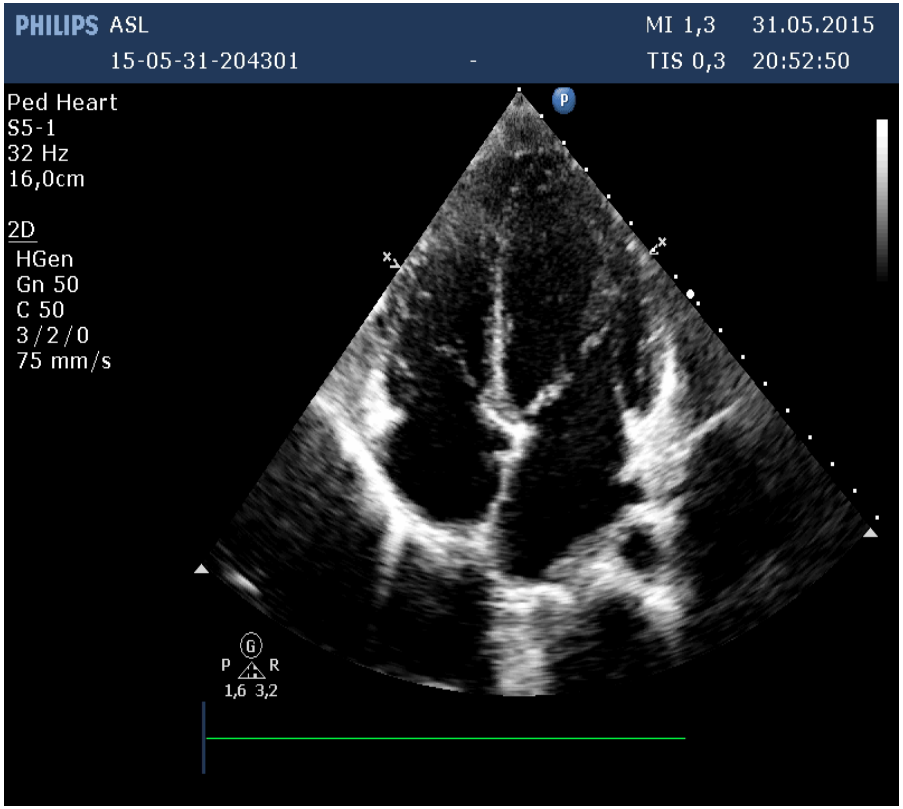


Sectiunea apical

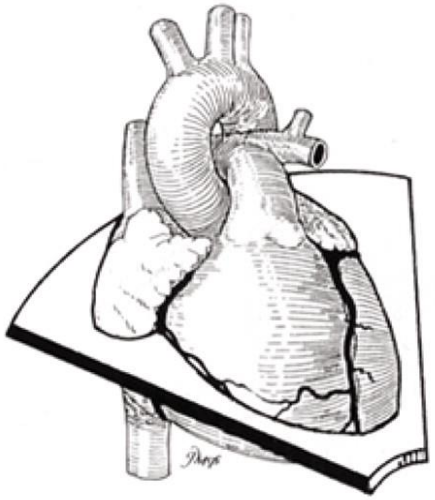


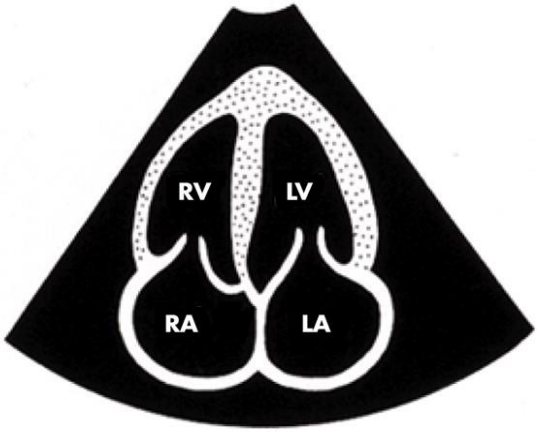
Sectiunea apical patru camere

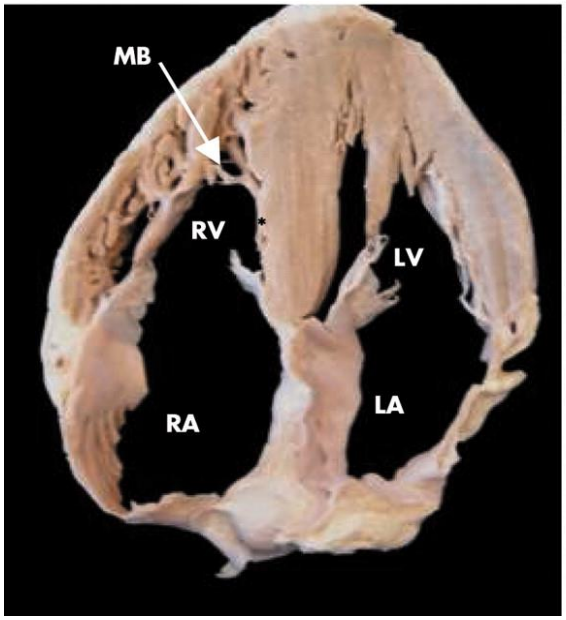


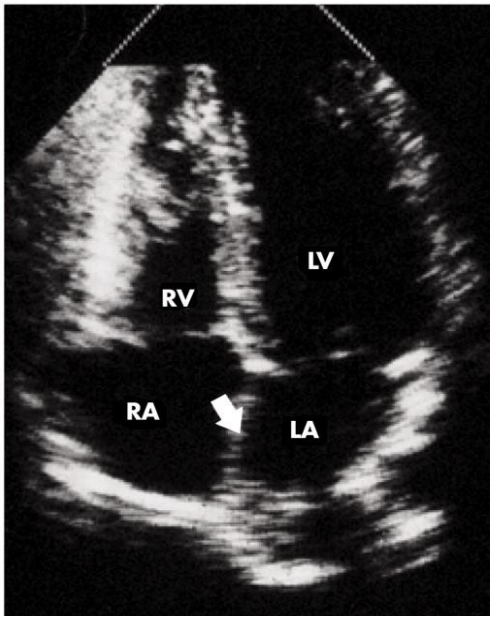


- Sonda se plaseaza cat mai posterior, in vecinatatea soculii apexian, in general in spatiul V intercostal stg, pe linia axilara anterioara; markerul sondei se orienteaza catre ora 3.

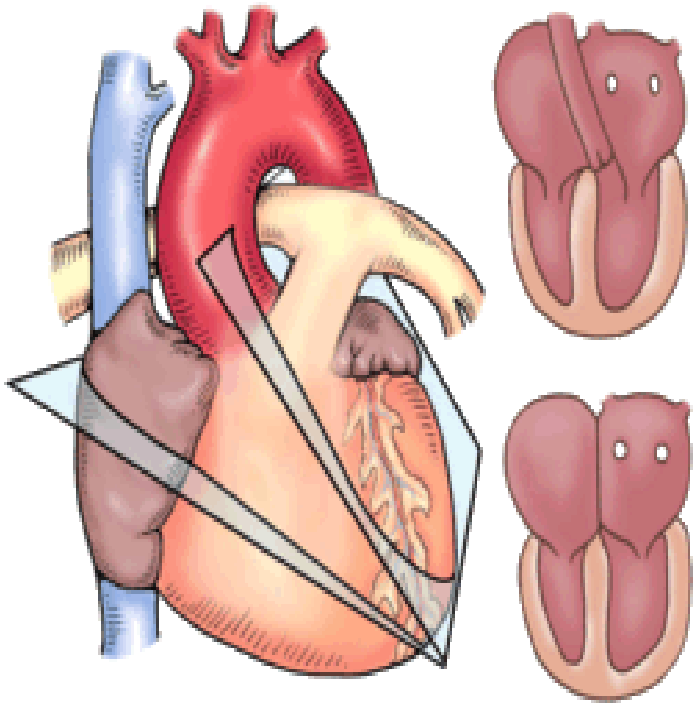



RV
LV
RA
LA

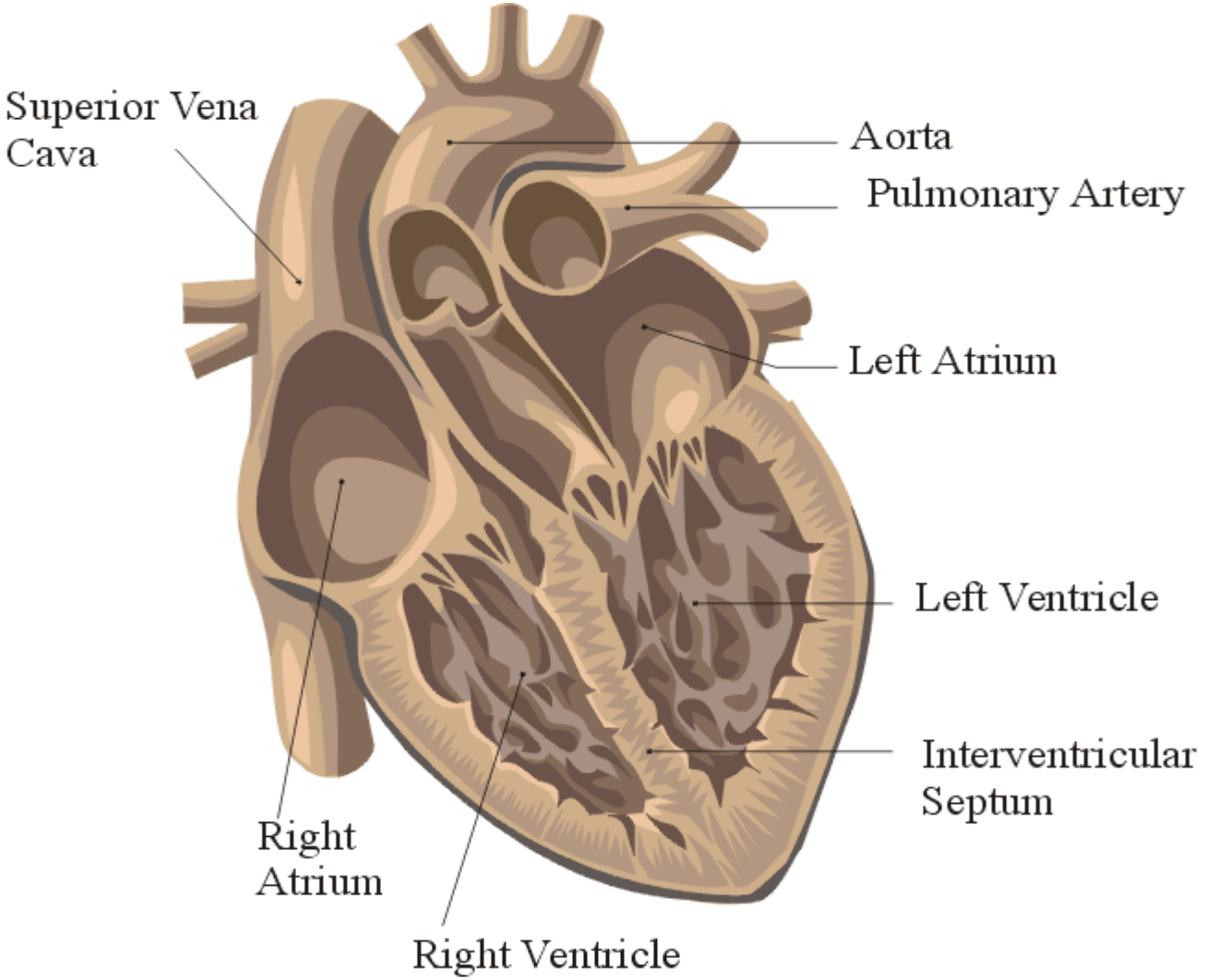

MB
RV
LV
RA
LA


LV
RV
RA
LA

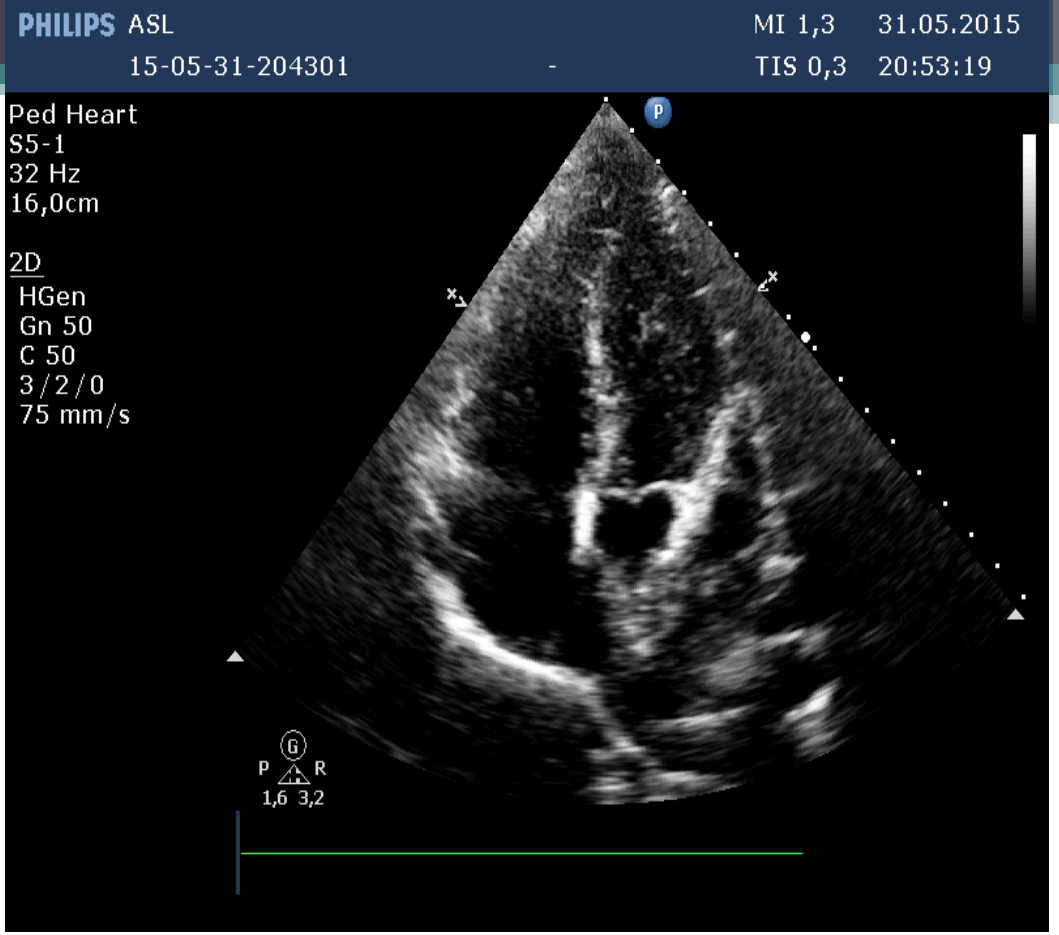
Sectiunea apical 5 camere

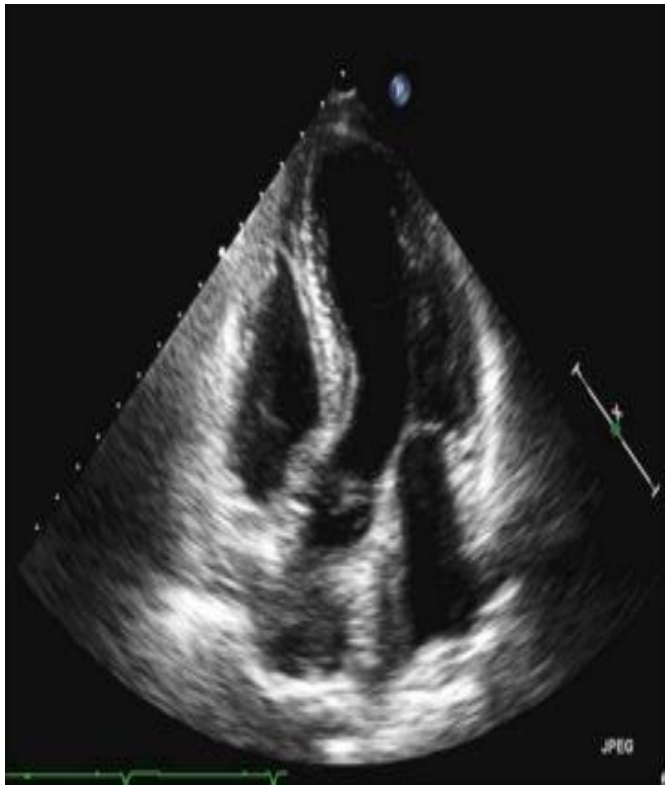


- Prin angulare anterioara a sondei pana la cuprinderea in imaginea 4C a tractului de ejectie VS si a valvei aortice: sectiune apical 5 camere

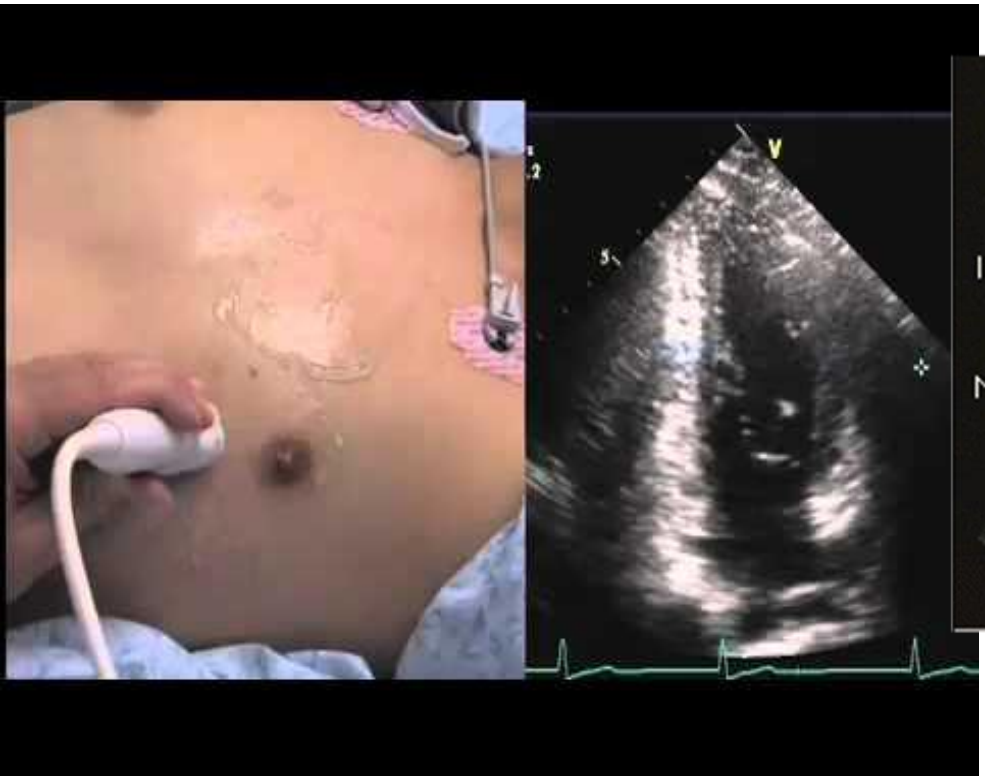


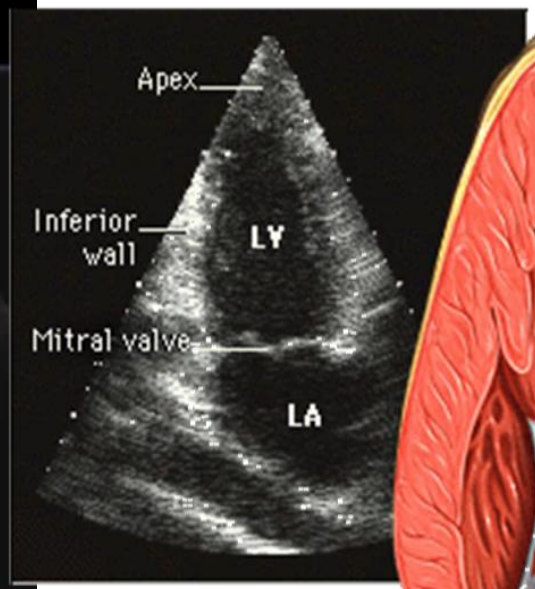
Adapted from Corel Draw 9 Library


PHILIPS ASL
MI 1,3
31.05.2015
15-05-31-204301
-
TIS 0,3
20:53:19
Ped Heart
S5-1
32 Hz
16,0cm
2D
HGen
Gn 50
C 50
3/2/0
75 mm/s
P
G
P
R
1,6 3,2


JPEG

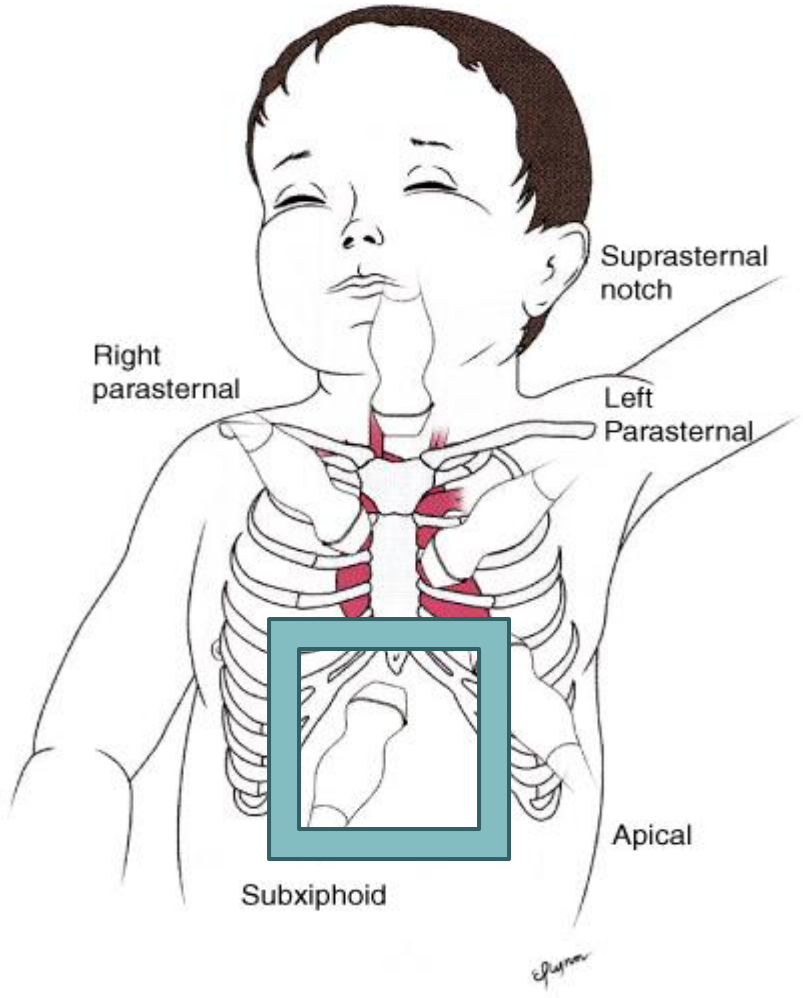
Sectiunea apical doua camere





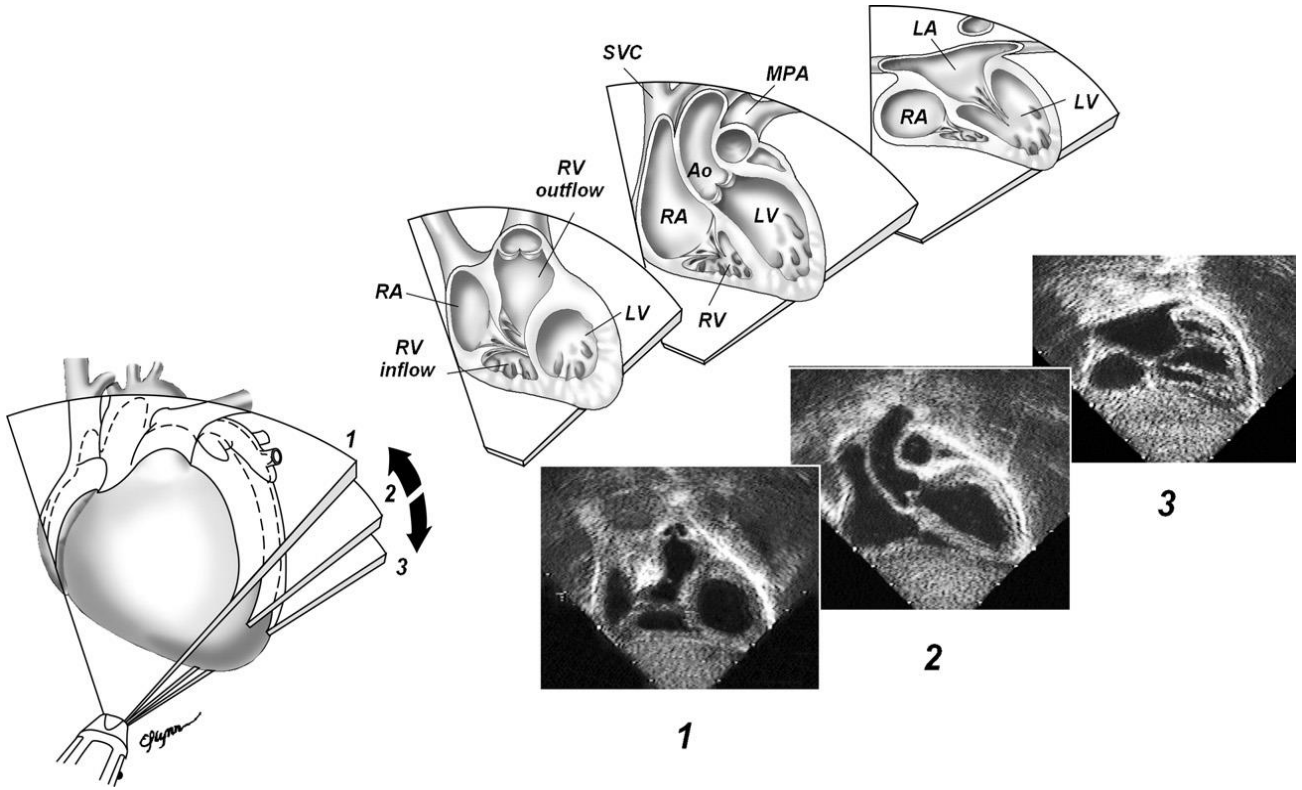
- Fata de pozitia necesara pentru obtinerea imaginii apical 4C, se rotesete sonda in sens invers acelor de ceasornic cu aproximativ 45-60^0

Sectiunea subcostal



Source: Gleason MM, Rychik J, Shaddy R: *Pediatric Practice: Cardiology*: www.accesspediatrics.com

Sectiunea subcostal ax lung



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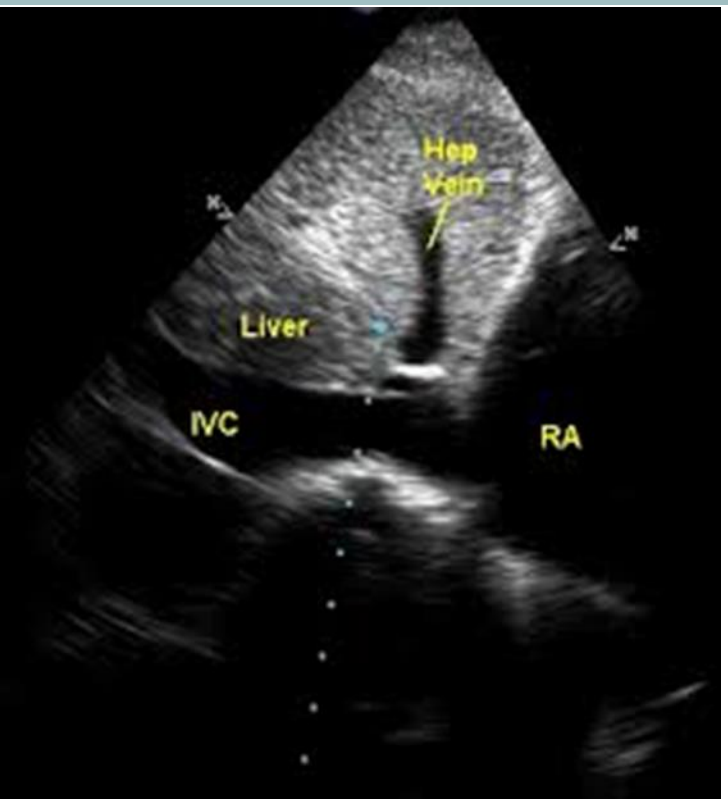
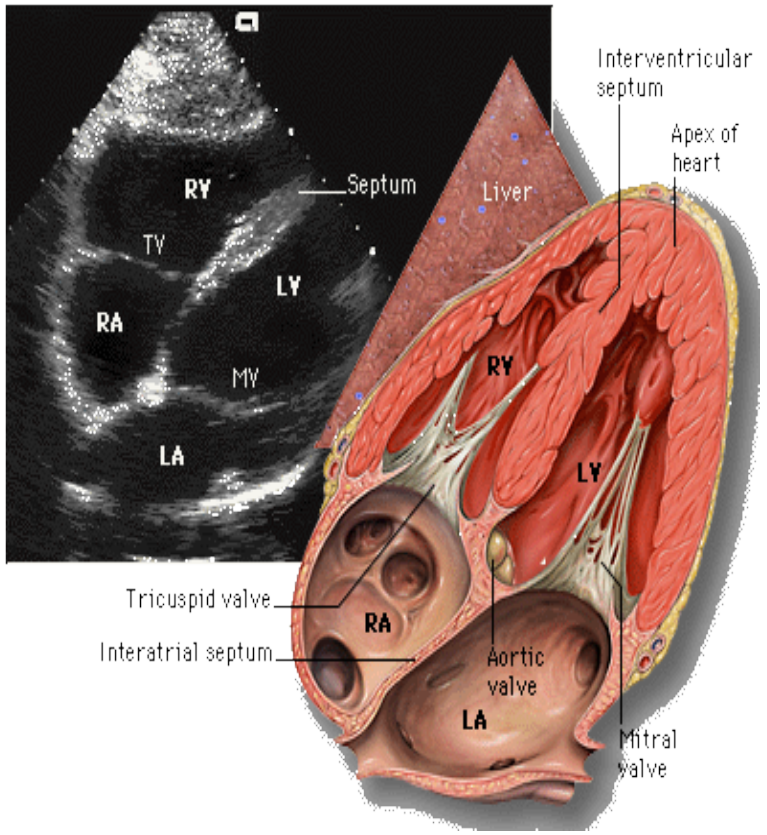
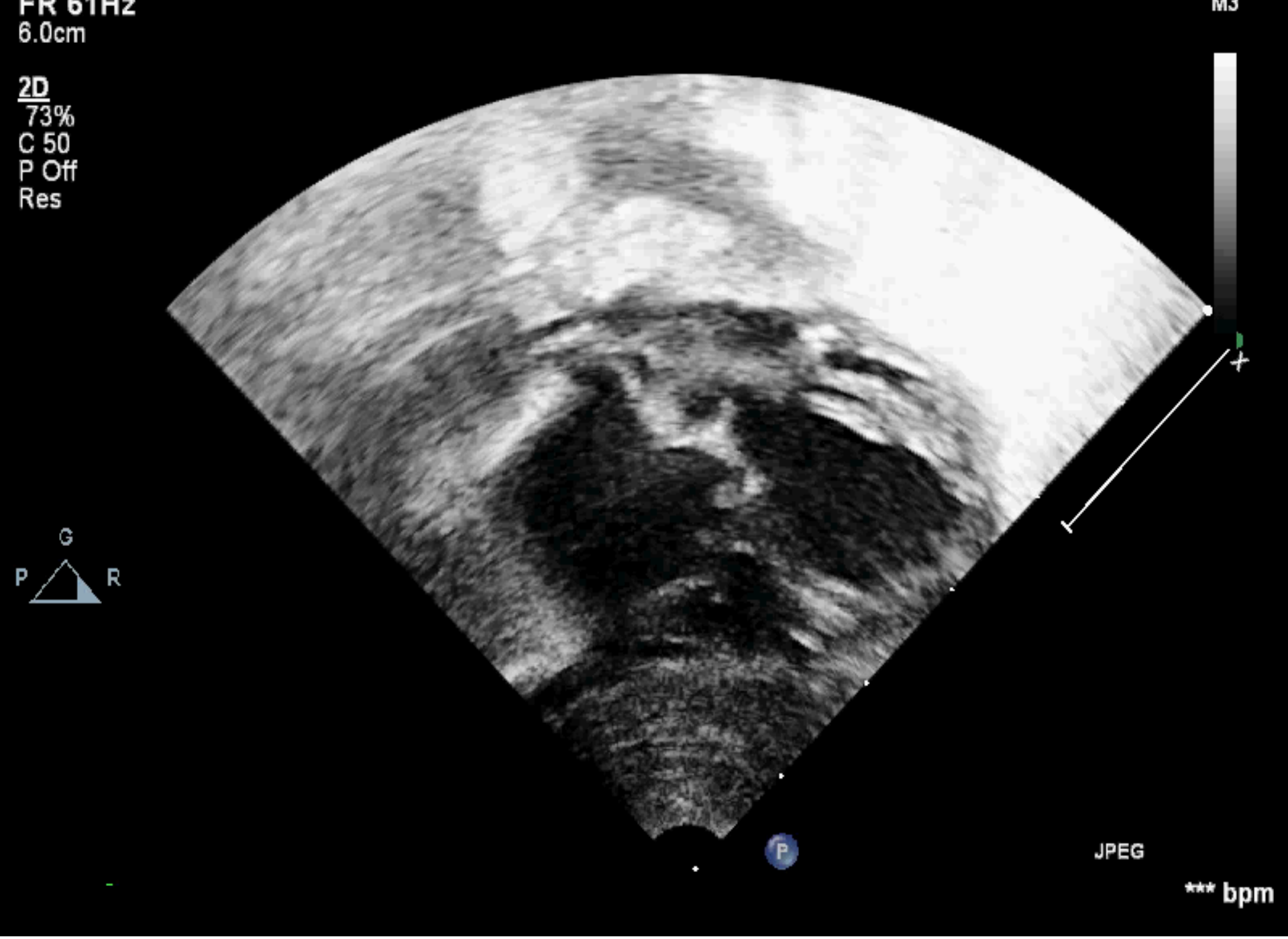
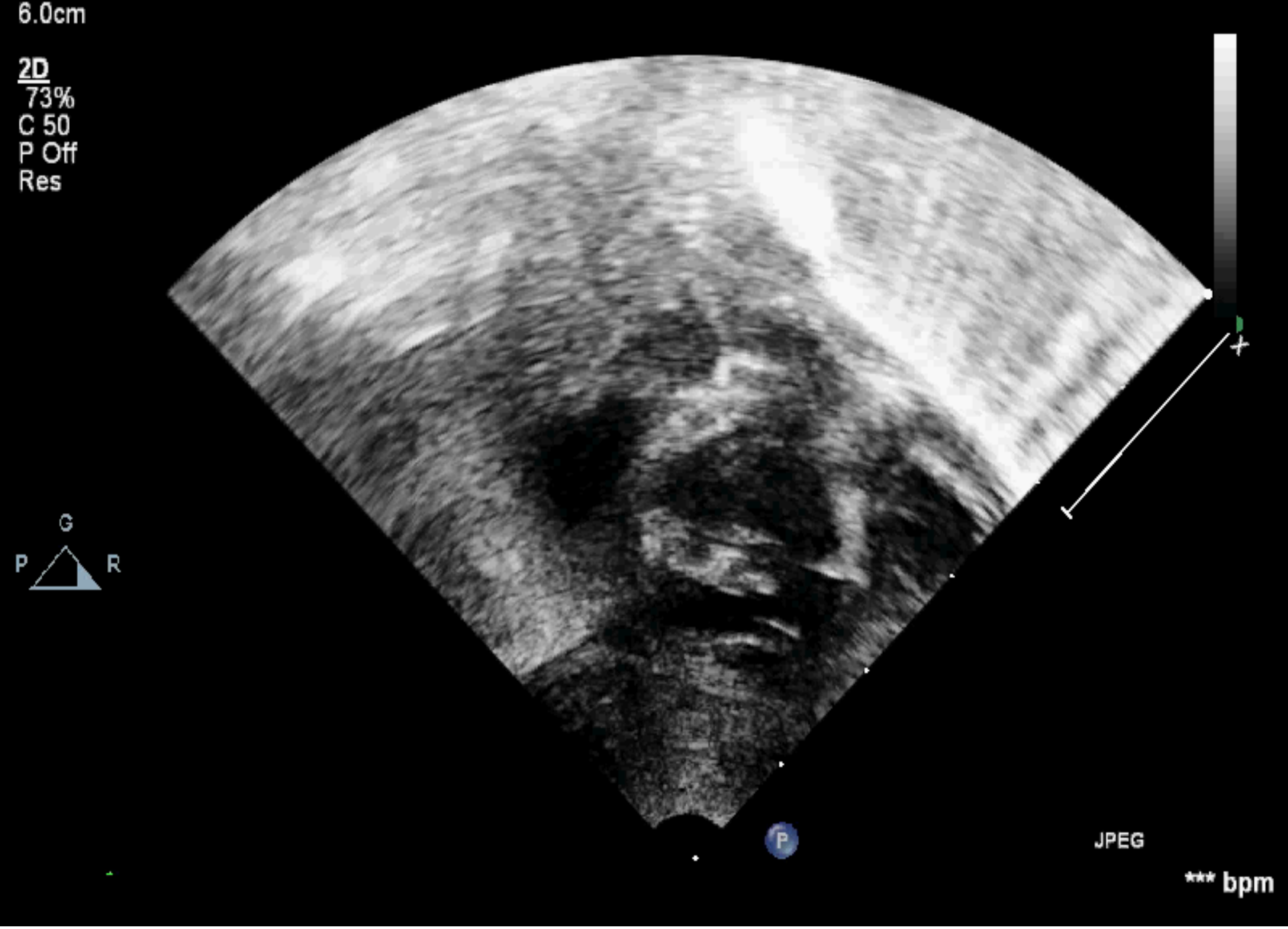
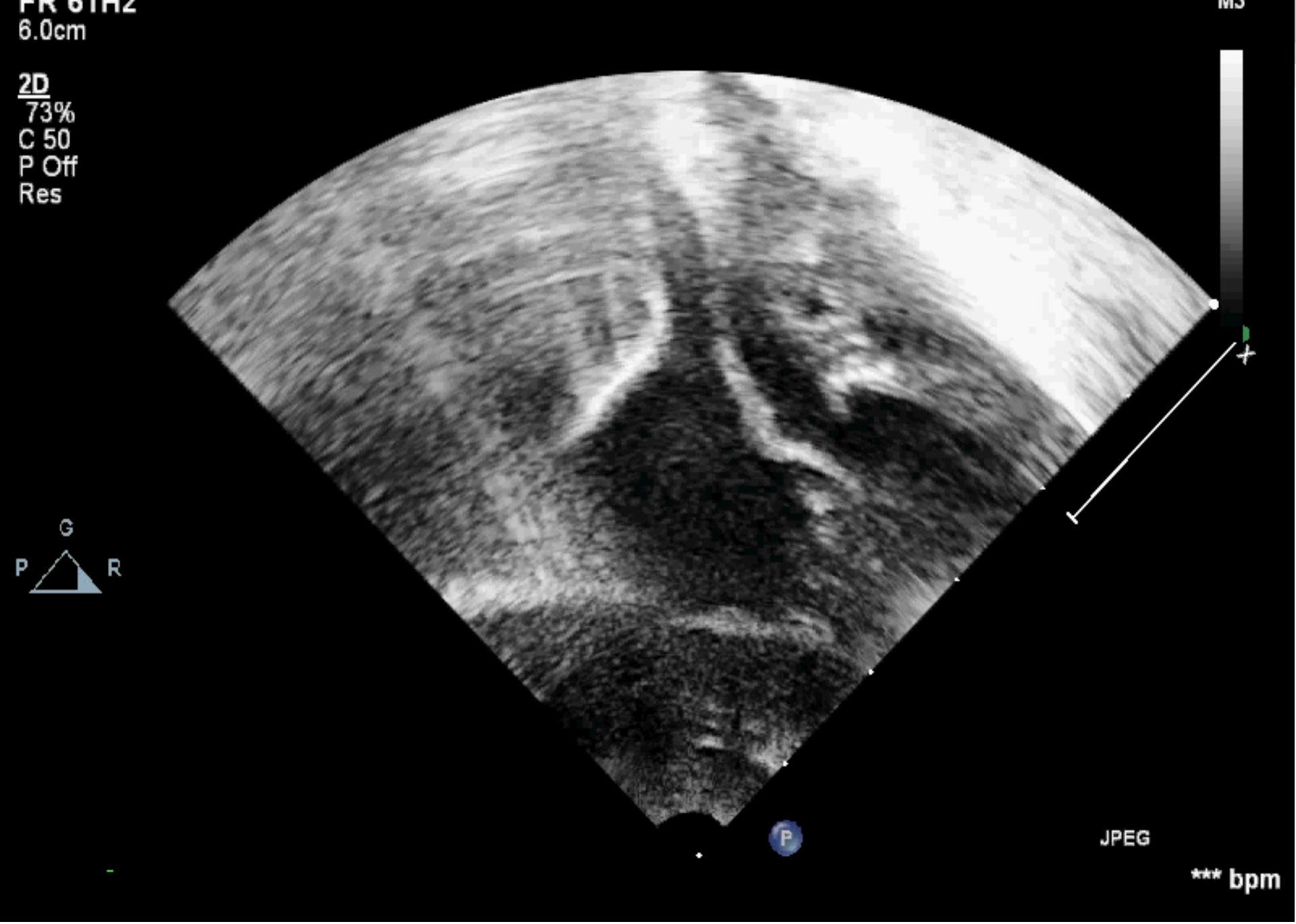
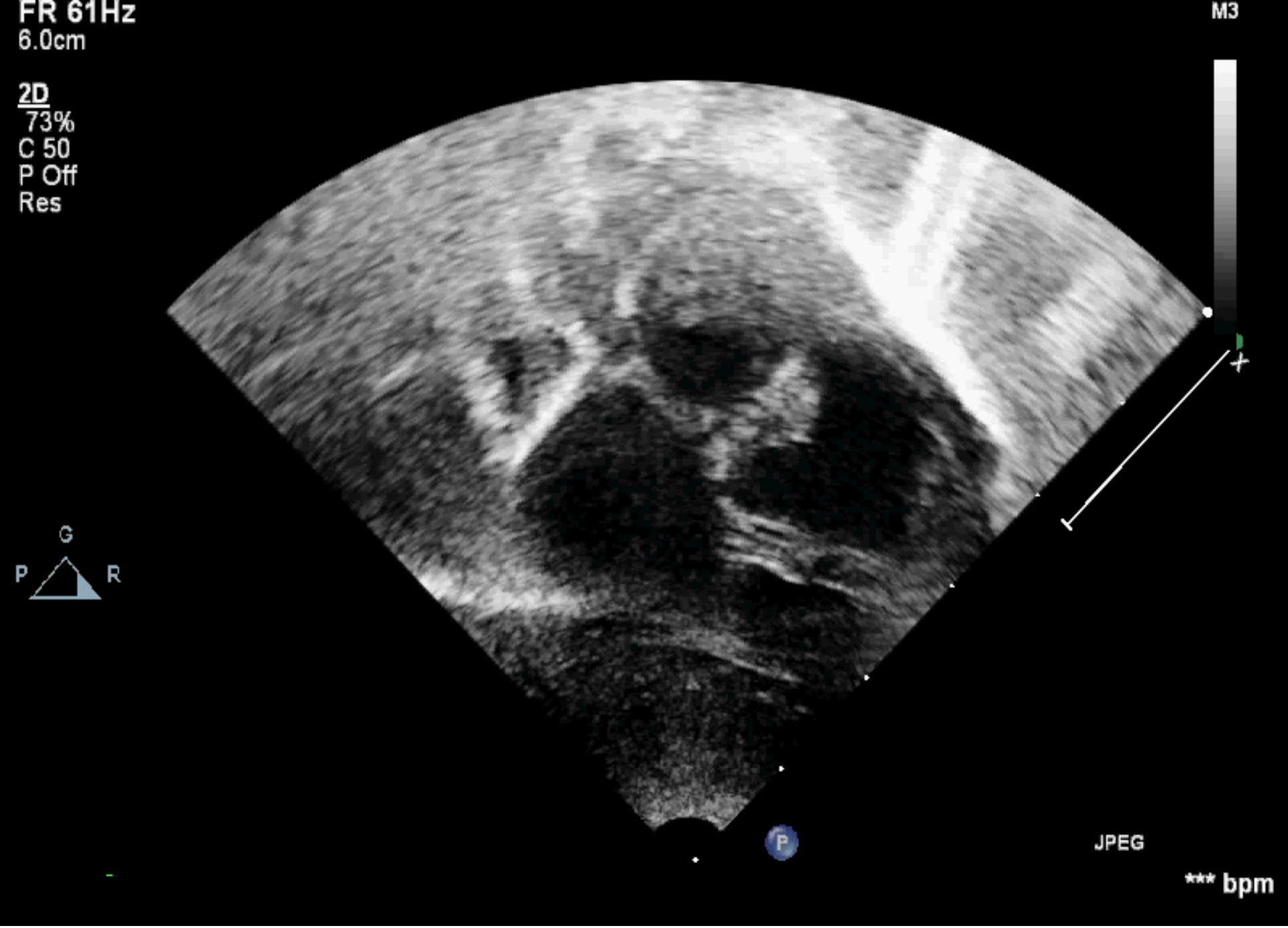

Hep
Vein
Liver
IVC
RA


RV
Septum
TV
LV
RA
MV
LA
Liver
Interventricular septum
Apex of heart
RV
LV
Tricuspid valve
RA
Interatrial septum
Aortic valve
LA
Mitral valve

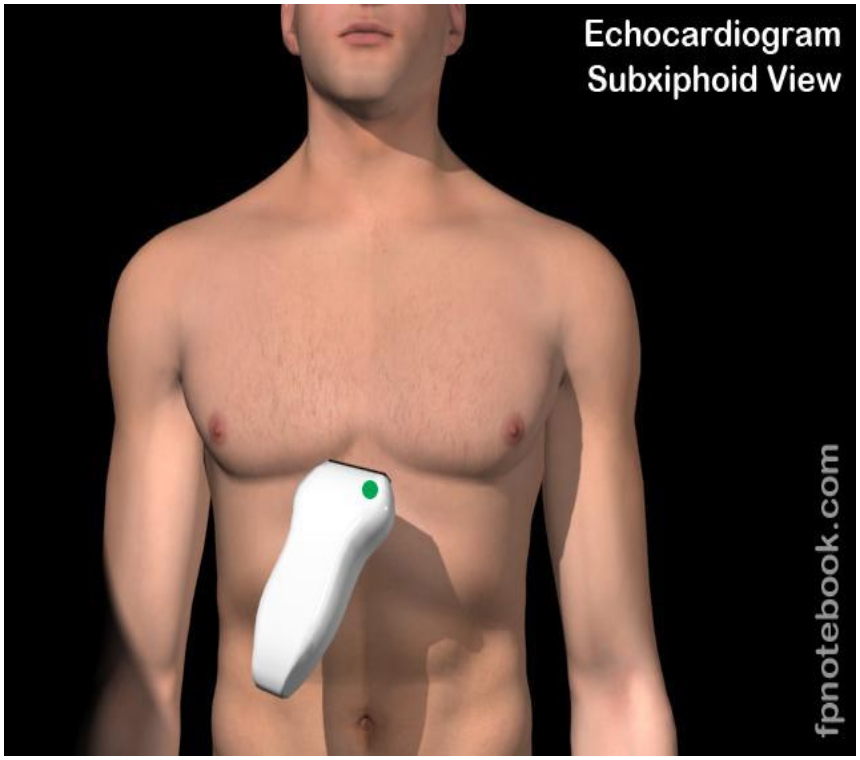

FR 61Hz
6.0cm
2D
73%
C 50
P Off
Res
M3
G
P
R
JPEG
*** bpm

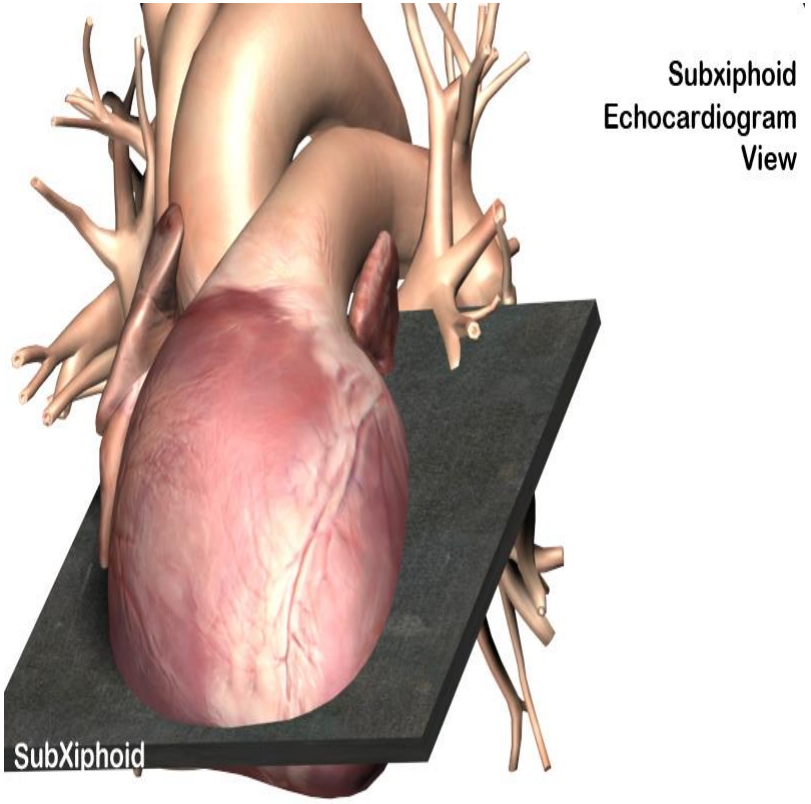

6.0cm
2D
73%
C 50
P Off
Res
G
P
R
JPEG
*** bpm


FR 61H2
6.0cm
2D
73%
C 50
P Off
Res
M3
G
P
R
JPEG
*** bpm


FR 61Hz
6.0cm
2D
73%
C 50
P Off
Res
M3
G
P
R
JPEG
*** bpm

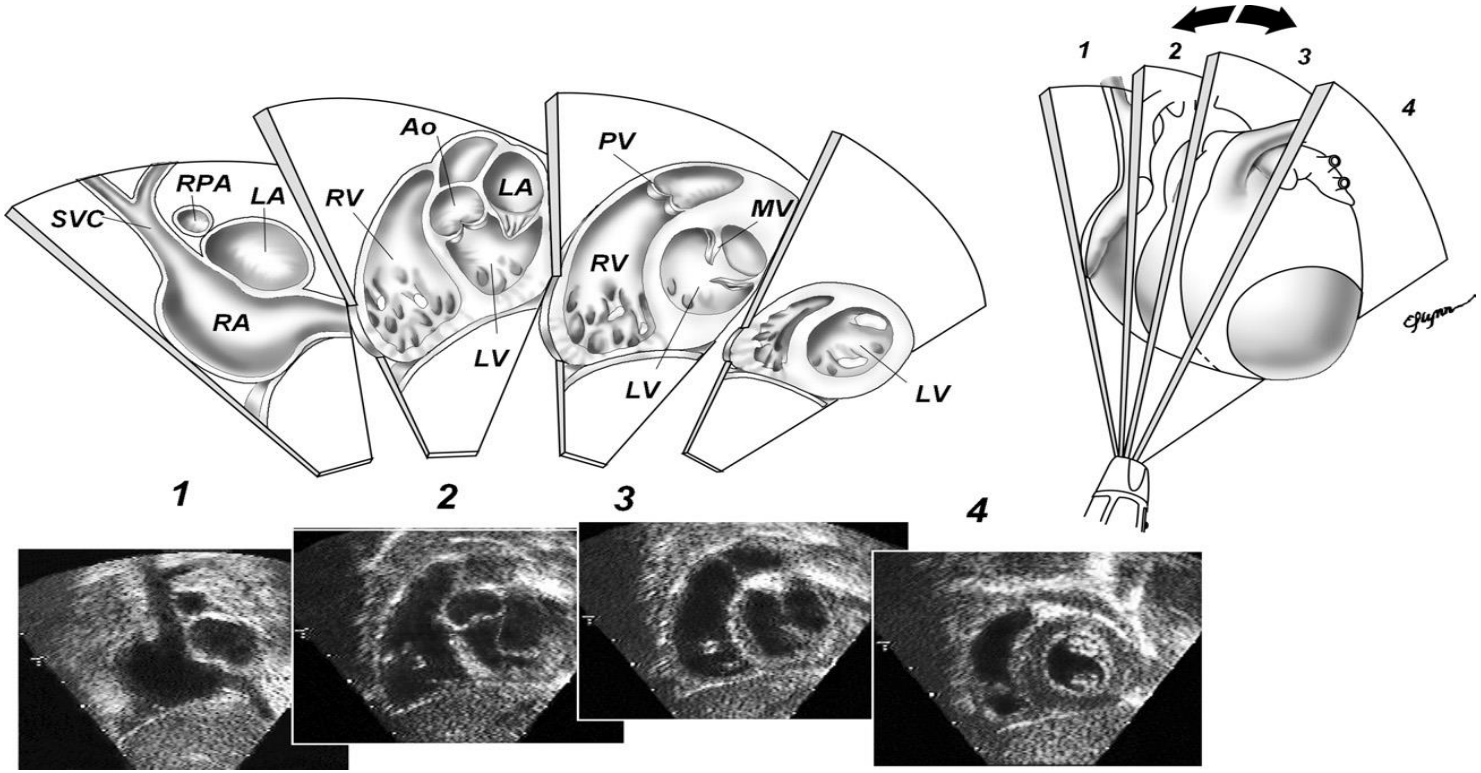
Sectiunea subcostal ax scurt





- Subcostal 4 camere:pacientul in decubit dorsal, genunchii in flexie pentru relaxarea abdomenului, se plaseaza sonda subxifoidian, pe linia mediana a corpului(eventual usor catre dreapta pacientului). Sonda este angulata catre anterior si dreapta, astfel inact fasciculul de ultrasunete sa fie orientat catre umarul stang. Markerul sondei este orientat catre ora 3.

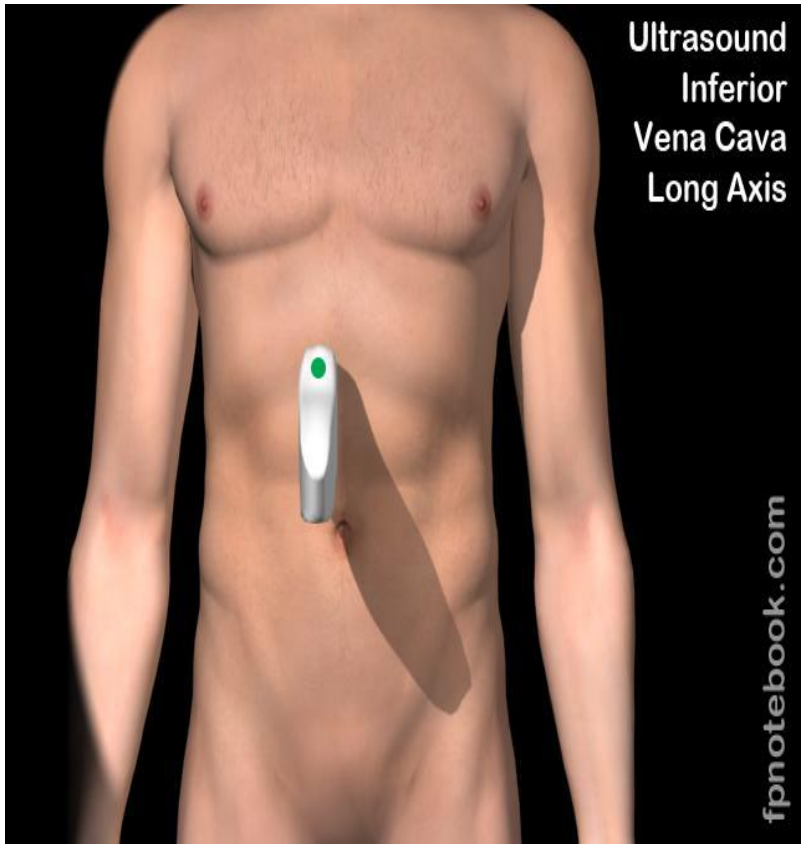
Sectiunea subcostal ax scurt

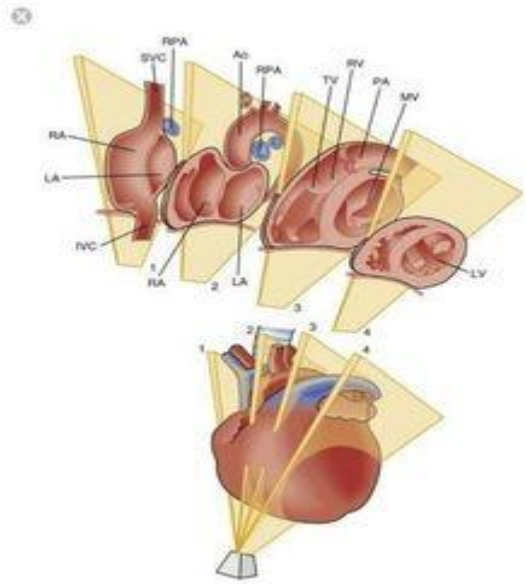


Guidelines and Standards for Performance of a Pediatric Echocardiogram: A Report from the Task Force of the Pediatric Council of the American Society of Echocardiography

Wyman W. Lai, MD, MPH, FASE, Tal Geva, MD, FASE, Girish S. Shirali, MD,Peter C. Frommelt, MD, Richard A. Humes, MD, FASE,Michael,M. Brook, MD,Ricardo H. Pignatelli, MD, and Jack Rychik, MD, Writing Committee, *New York, New York;Boston, Massachusetts; Charleston, South Carolina; Milwaukee, Wisconsin; Detroit, Michigan; San Francisco, California;Houston, Texas; and Philadelphia, Pennsylvania*

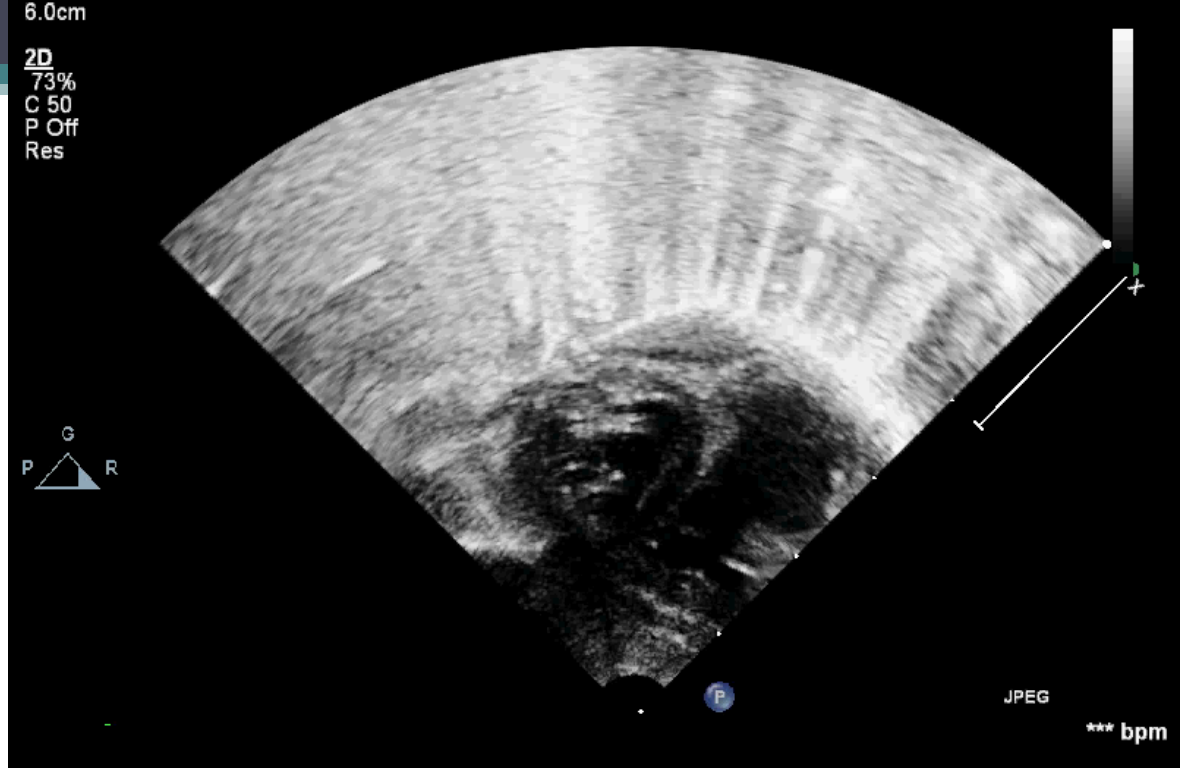
Sectiunea subcostal ax lung



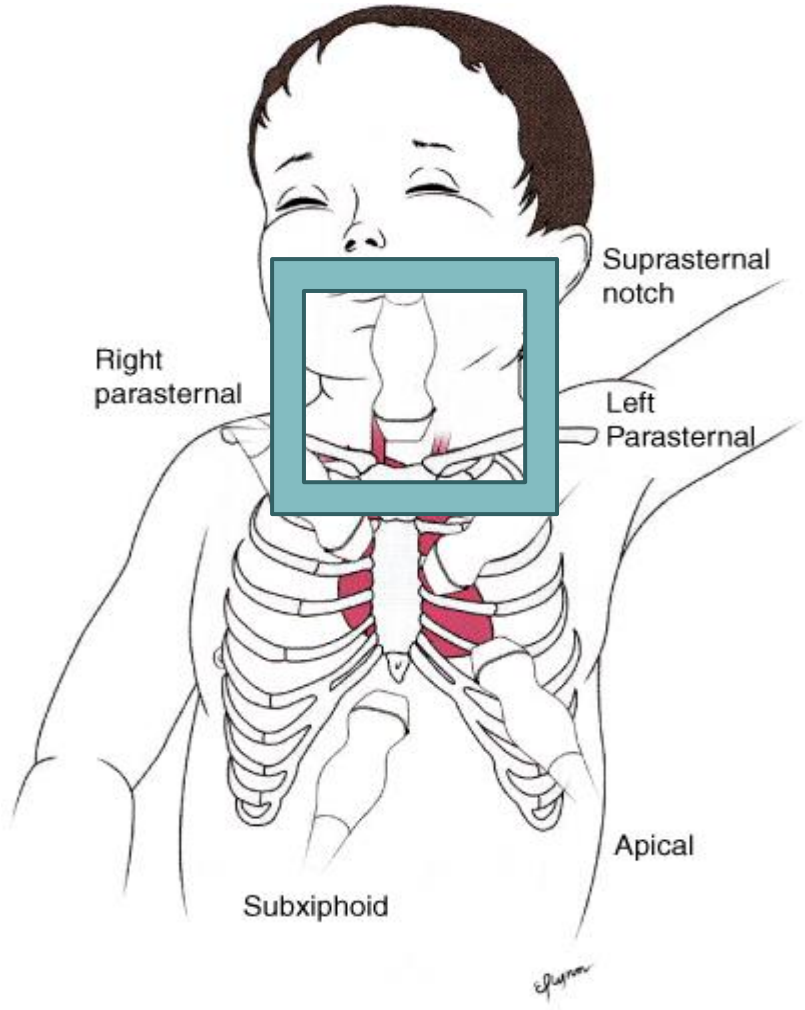


- Subcostal ax scurt: fata de pozitia anterioara, se roteste sonda cu aproximativ 90^0 in sens invers acelor de ceasornic; markerul sondei este orientat catre ora 12.


FR 61Hz
6.0cm
2D
73%
C 50
P Off
Res
M3
G
P
R
JPEG
*** bpm

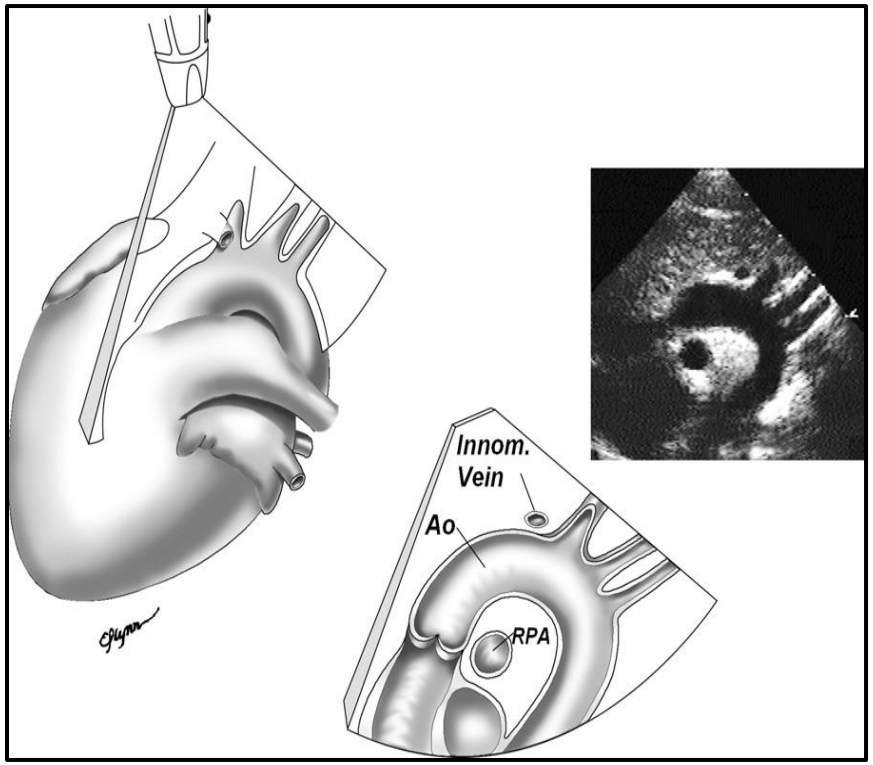

6.0cm
2D
73%
C 50
P Off
Res
G
P
R
JPEG
*** bpm

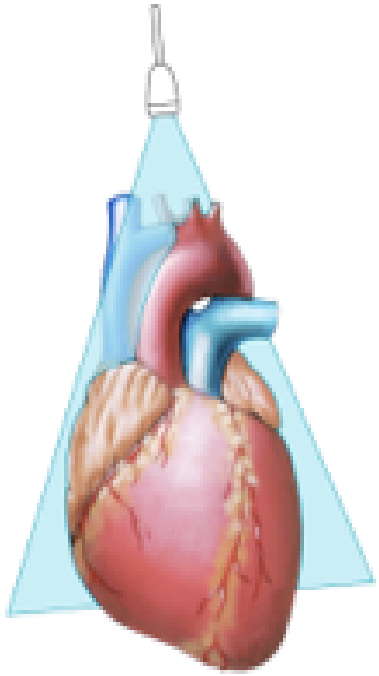
Sectiunea suprasternal



Source: Gleason MM, Rychik J, Shaddy R: *Pediatric Practice: Cardiology*: www.accesspediatrics.com

Sectiunea suprasternal





Guidelines and Standards for Performance of a Pediatric Echocardiogram: A Report from the Task Force of the Pediatric Council of the American Society of Echocardiography

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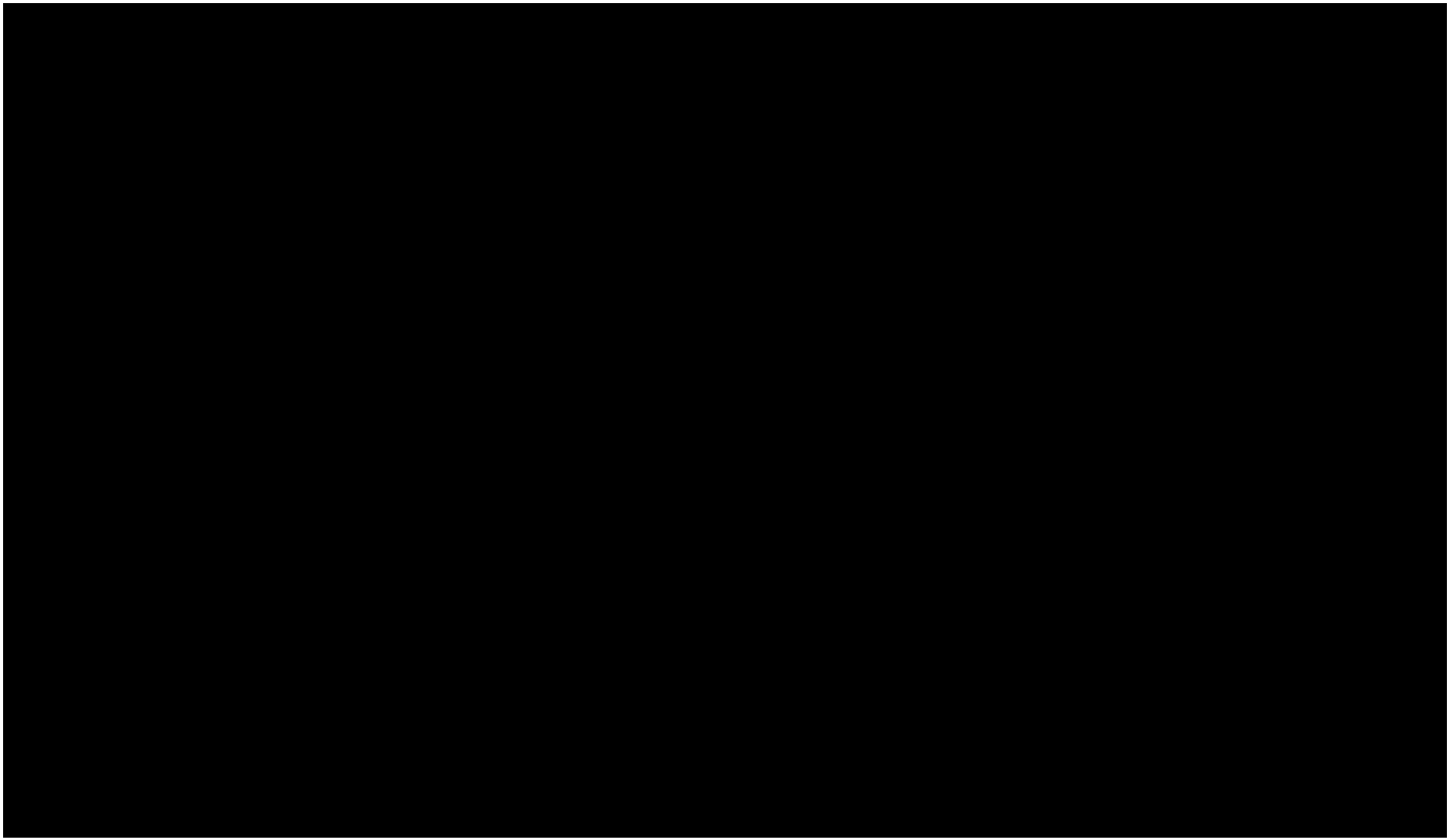
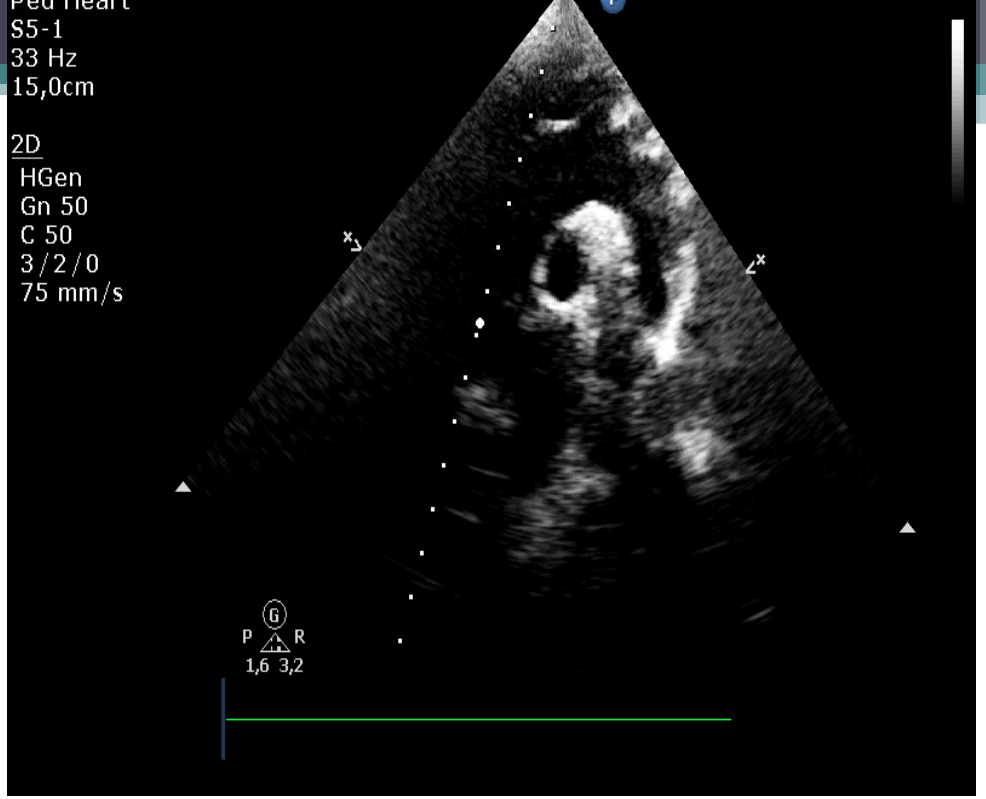
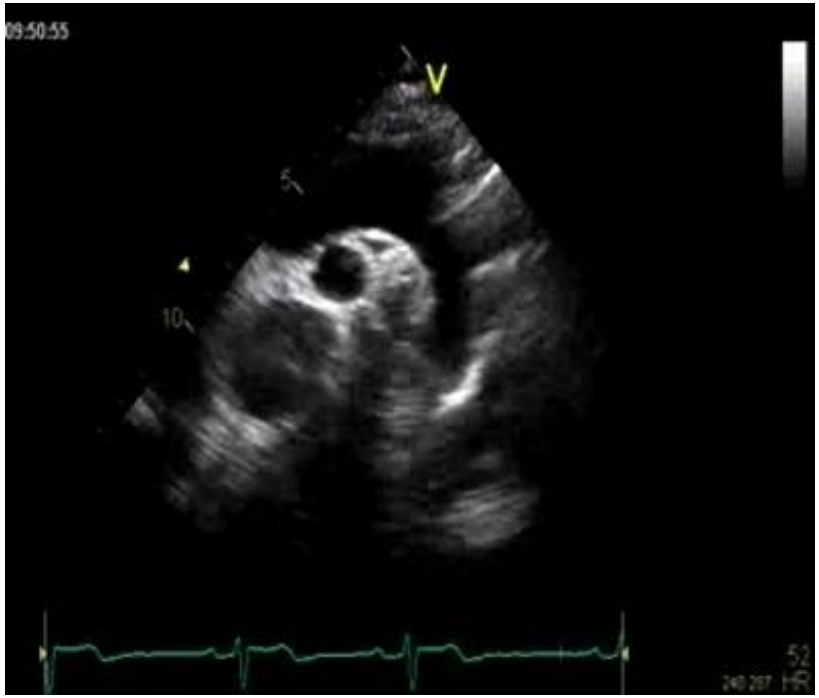


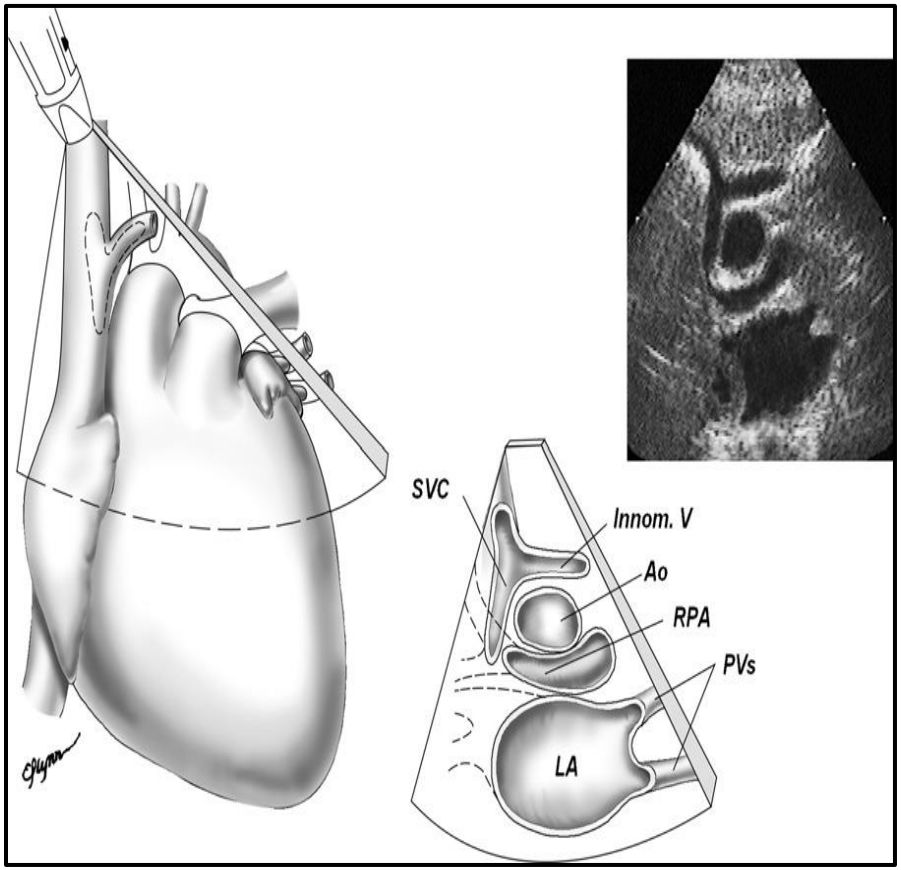
Sectiunea suprasternal

- Pacientul in decubit dorsal si gatul in hiperextensie: se plaseaza sonda in incizura suprasternala, cu angularea ei catre inferior si anterior astfel incat sa fie aproape paralela cu traheea. Markerul sondei este orientat catre ora 1.

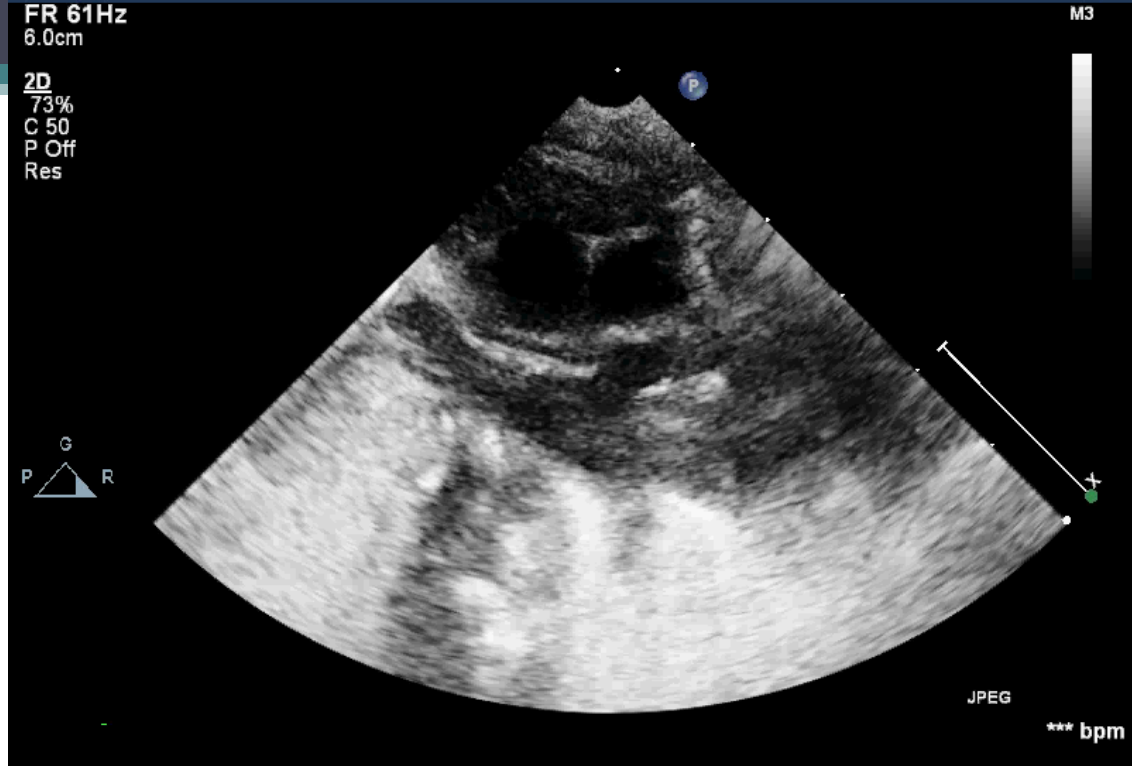

Ped Heart
S5-1
33 Hz
15,0cm
2D
HGen
Gn 50
C 50
3/2/0
75 mm/s
P R
1,6 3,2


09:50:55
V
5
10
52

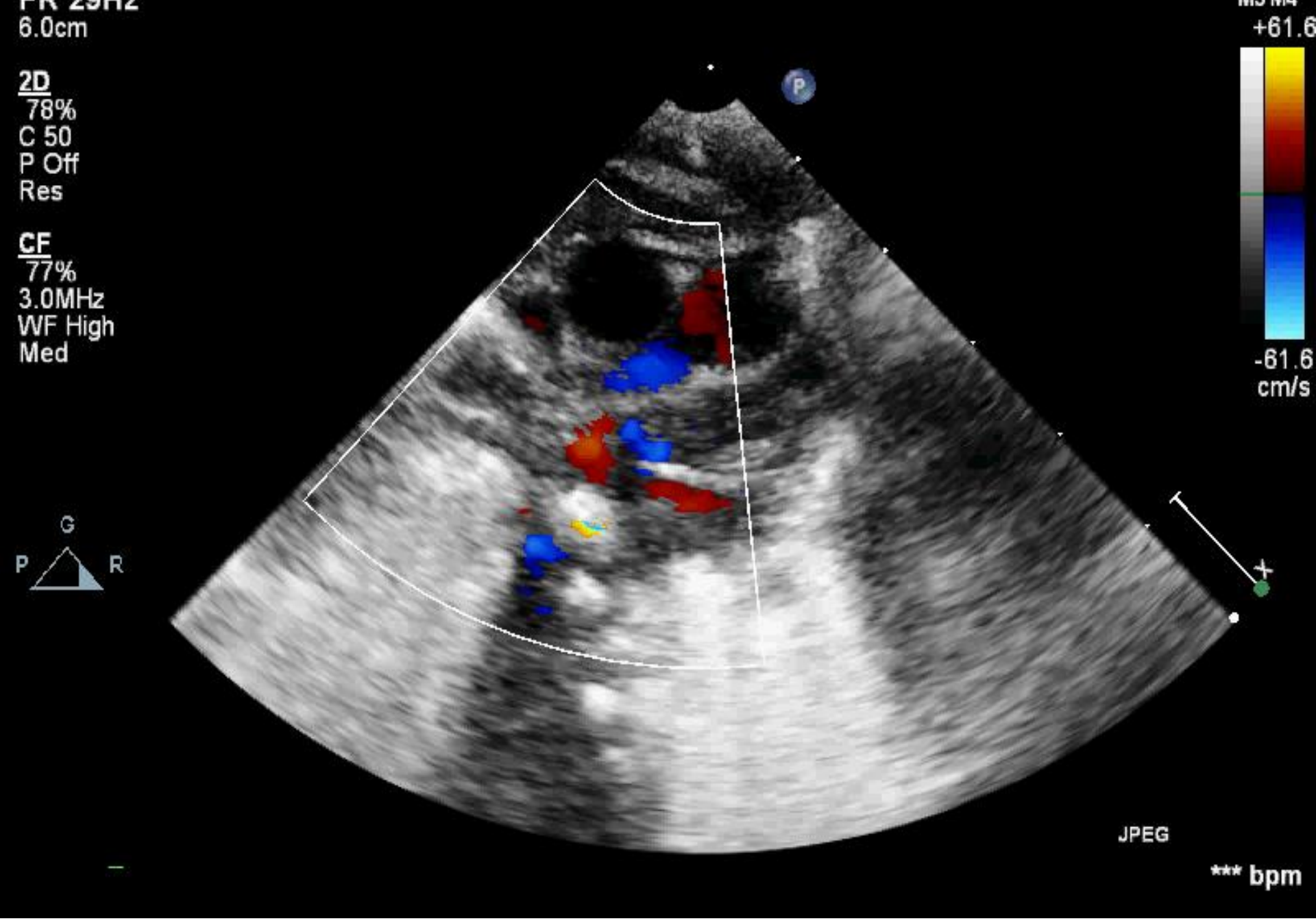
Sectiunea suprasternal



- Fata de pozitia precedenta, daca se roteste sonda cu aproximativ 90^0 in sensul acelor de ceasornic, se obtine sectiunea suprasternala perpendiculara pe aorta. Markerul sondei este orientat catre ora 4.


FR 61Hz
6.0cm
2D
73%
C 50
P Off
Res
M3
G
P
R
JPEG
*** bpm


SVC
Ao
RPA
LA


PR 29Hz
6.0cm
2D
78%
C 50
P Off
Res
CF
77%
3.0MHz
WF High
Med
+61.6
-61.6
cm/s
G
P
R
JPEG
*** bpm

take home message

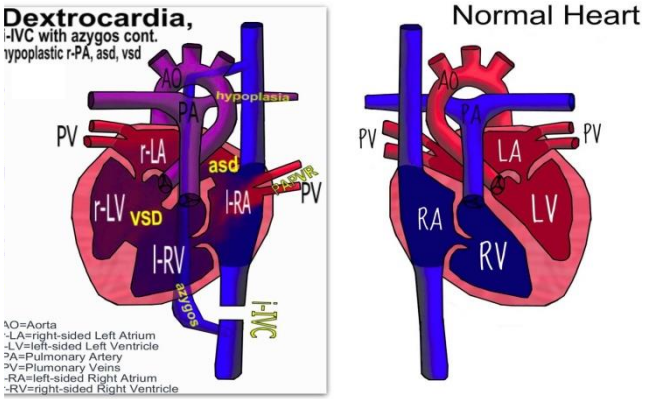
- Inainte de inceperea ecografiei:
- CONSULTATI PACIENTUL
- CONSULTATI PACIENTUL
- CONSULTATI PACIENTUL

take home message

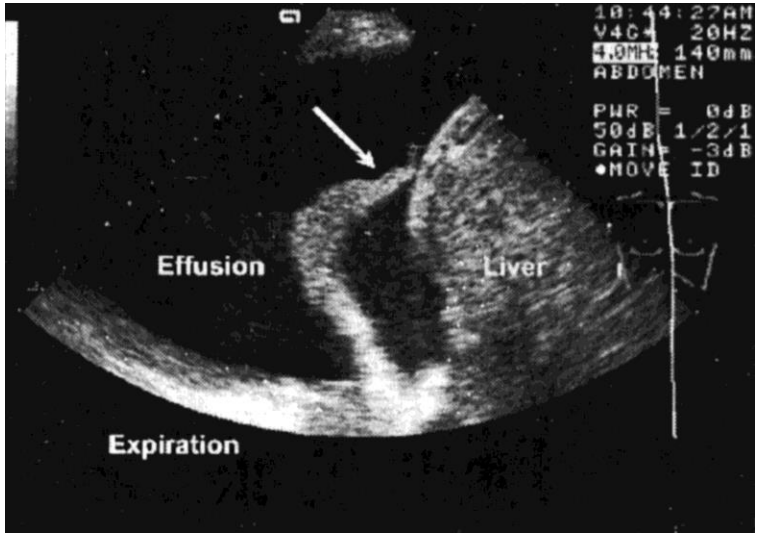
- Paralel cu ecografia: inregistrare EKG;
- O structura cardiaca se examineaza intotdeauna din cel putin din 2 planuri ortogonale;
- **Necesitatea unui algoritm de examinare** de la care sa nu ne abatem: examinarea sistematica a structurilor (preferabil in ordinea curgerii sangelui) in fiecare sectiune, in secventa:

  2D (+ M-mode)->Doppler color (+/- M-mode)->Doppler spectral

Situatii particulare de obtinere a sectiunilor

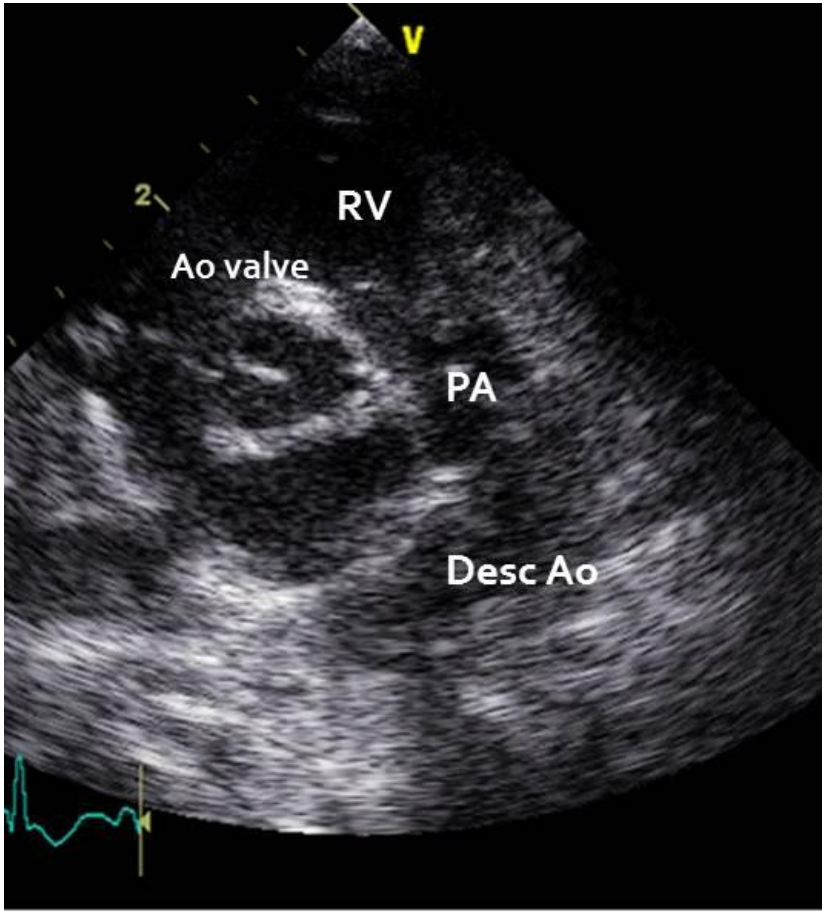


- Dextrocardie: se folosesc ferestre/sectiuni ecocardiografice “in oglinda” cu cele prezentate;



- In caz de revarsate pleurale mari: se incearca obtinerea de imagini prin plasarea sondei la nivelul peretelui toracic posterior, cu pacientul in pozitie sezanda.

Ductal cut view



Segmental approach

- Step1 • Cardiac position
- Step2 • Great veins
- Step 3 • Visceral and atrial situs
- Step 4 • Venoatrial connection
- Step 5 • Ventricular looping
- Step 6 • Atrioventricular connections
- Step 7 • Relationship between great arteries
- Step 8 • Ventriculoarterial connection
- Step 9 • Associated anomalies

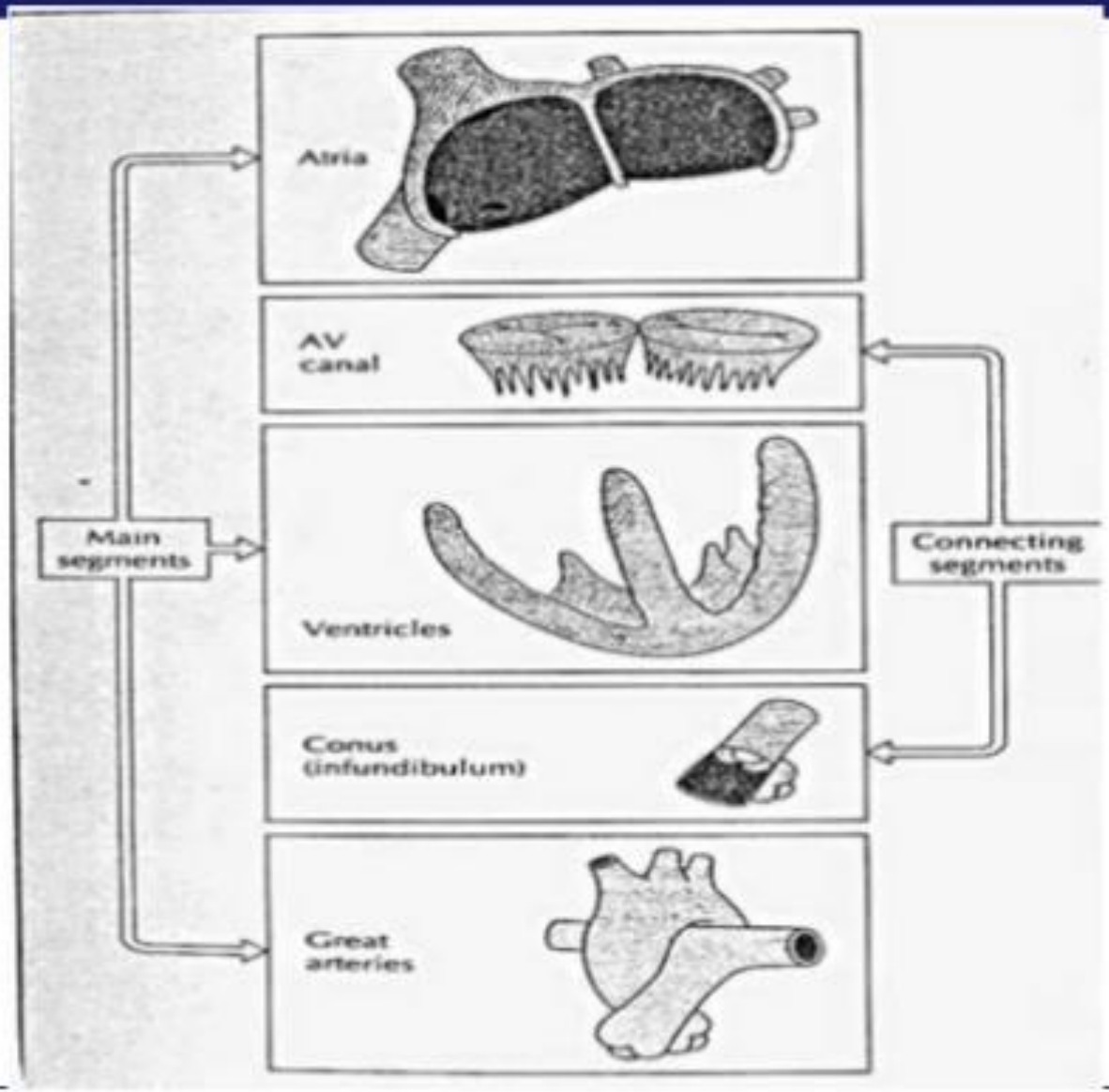
TREI SEGMENTE CARDIACE

ATRIU

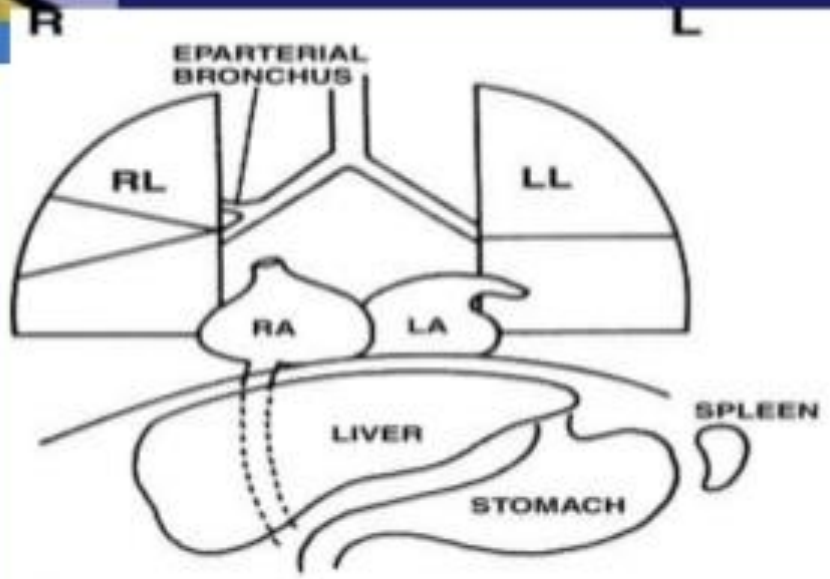
VENTRICUL

MARILE VASE

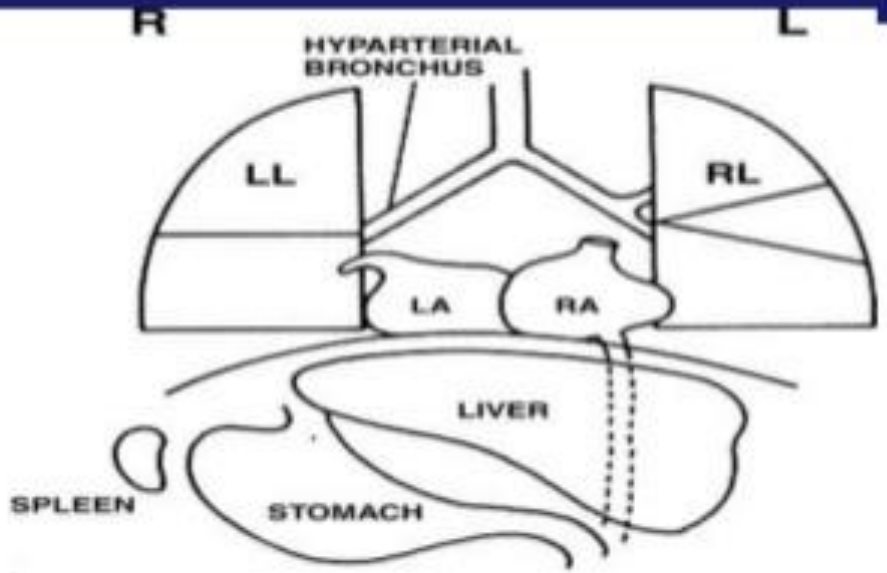
Segmental Approach



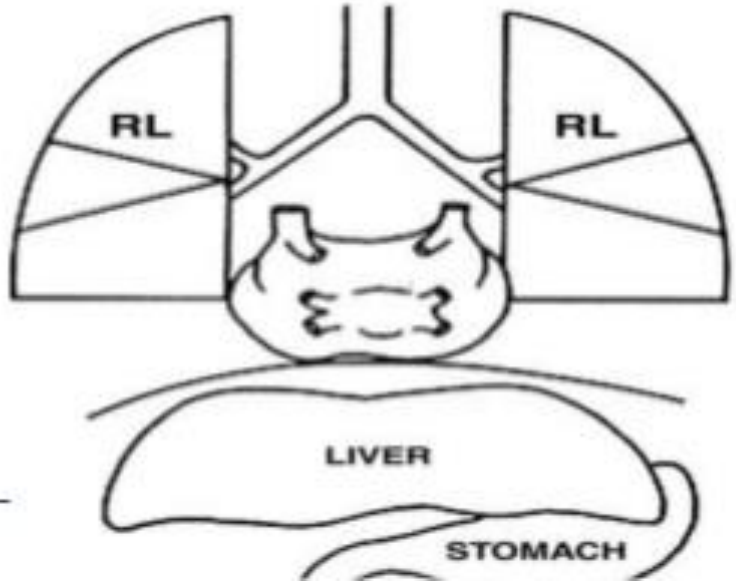
Segmental Approach

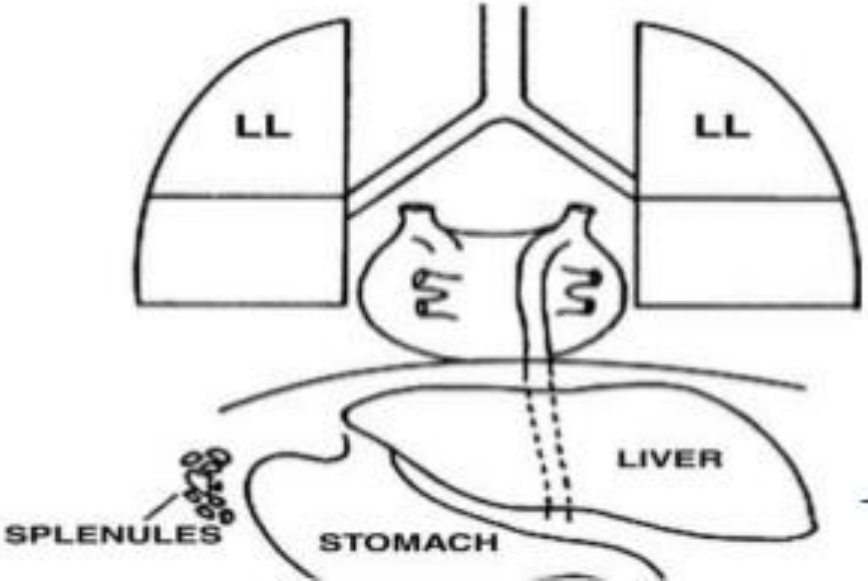


a.

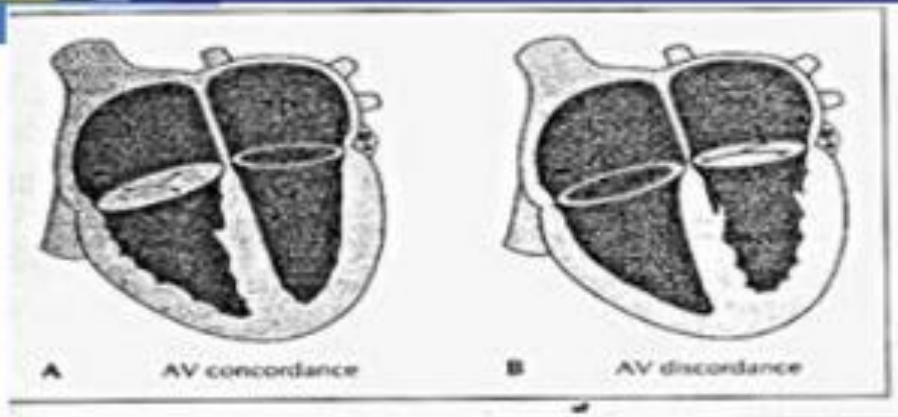


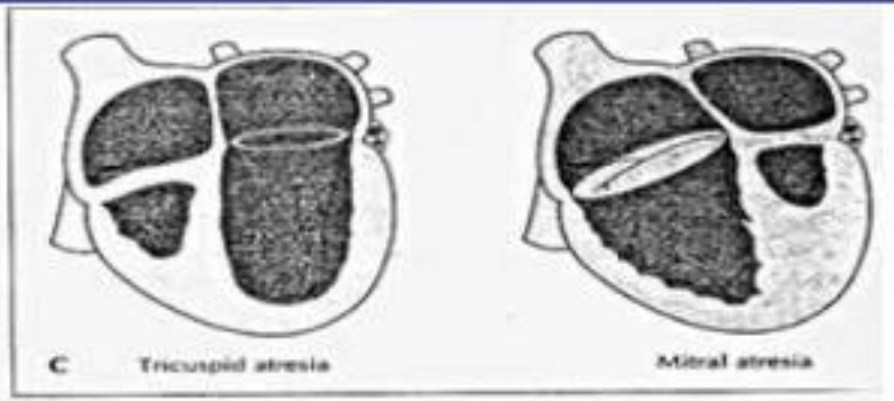
b.

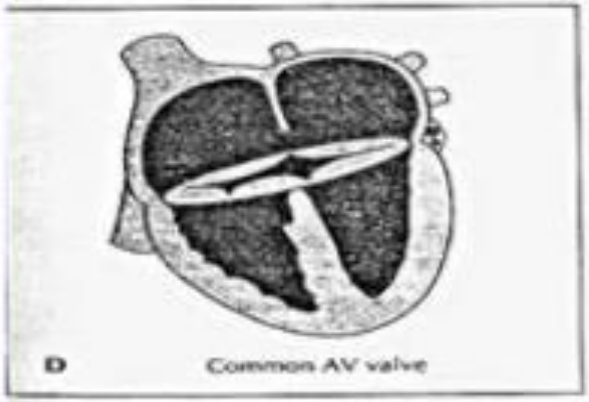


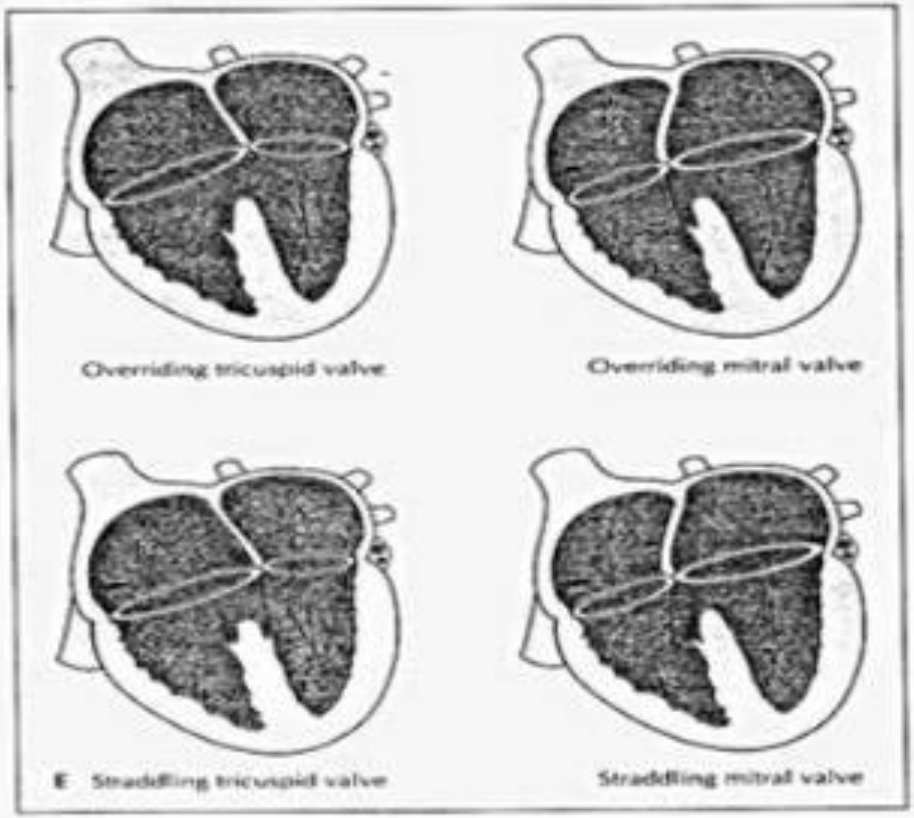


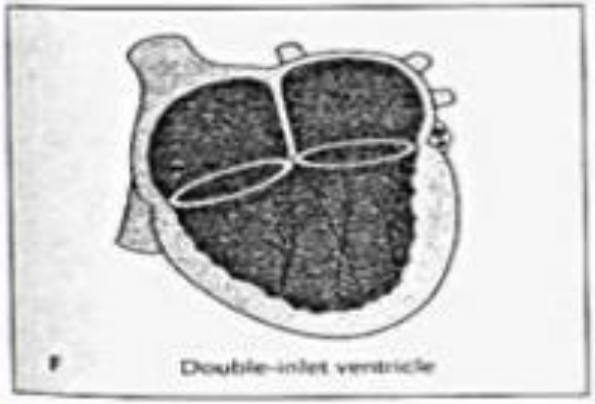
Segmental Approach



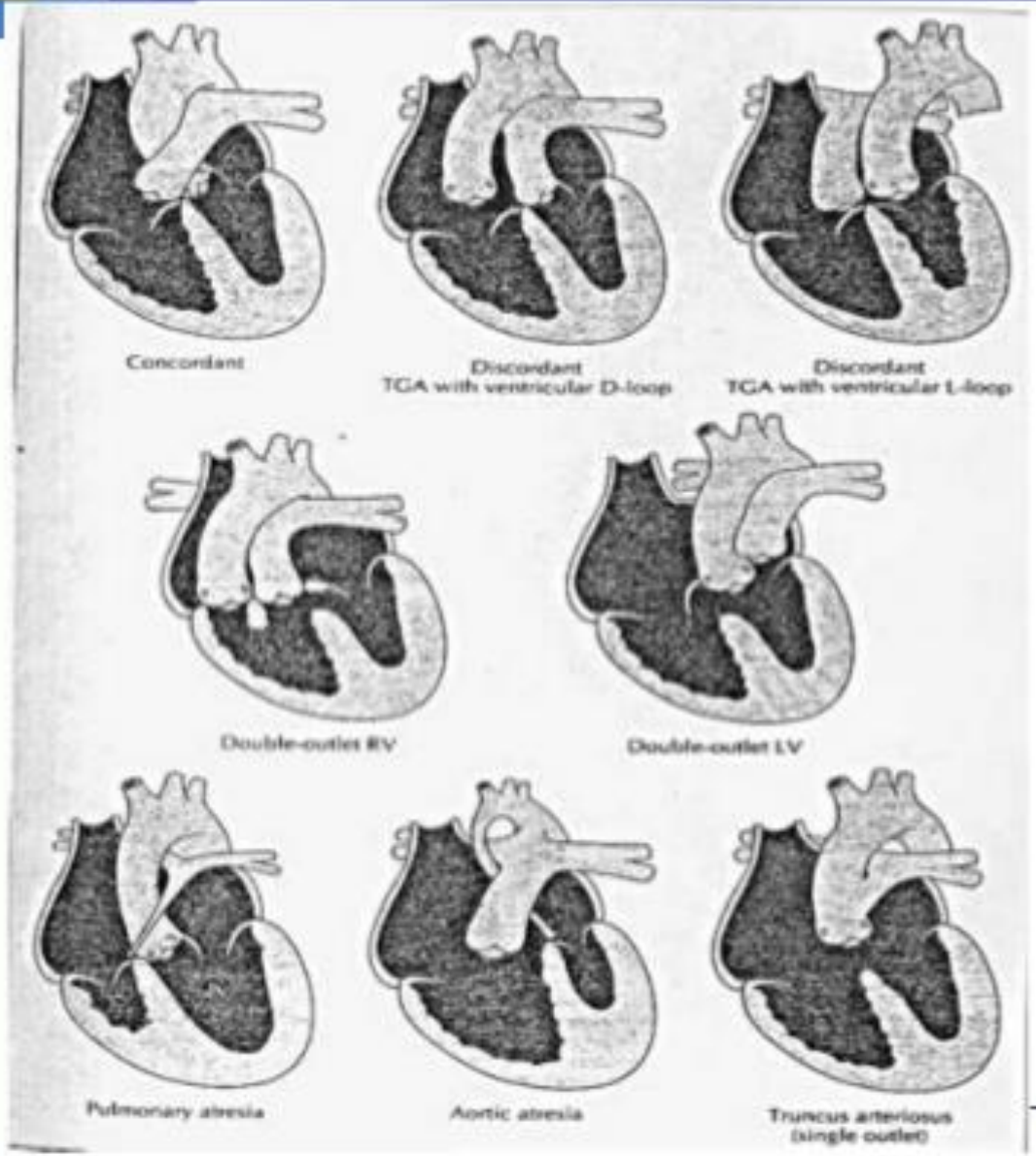








Segmental Approach

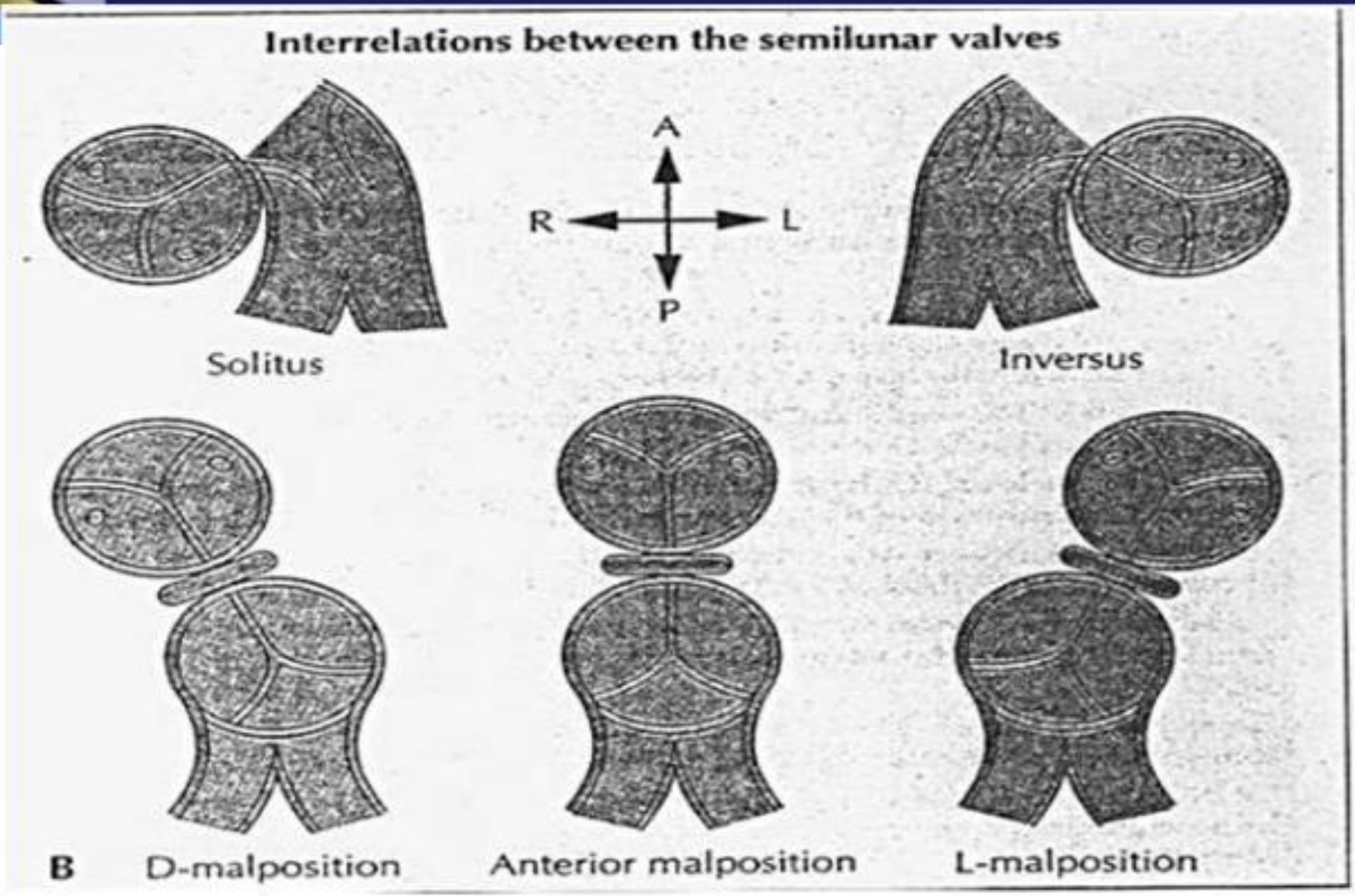


Concordant or
Discordant

Double outlet
Ventricle

Single outlet

Segmental Approach



Tipuri de examinare ecocardiografica