Διαθωρακικο υπερηχογραφημα

Κ. Αγγελη

Καθηγ. Καρδιολογίας

Α Πανεπ. Καρδιολογική Κλινική

Guidelines for Performing a Comprehensive Transthoracic Echocardiographic Examination in Adults: Recommendations from the American Society of Echocardiography

A review of the imaging protocol

Peter S Rahko MD, FASE
Webinar: January 31, 2019

Webinar Outline

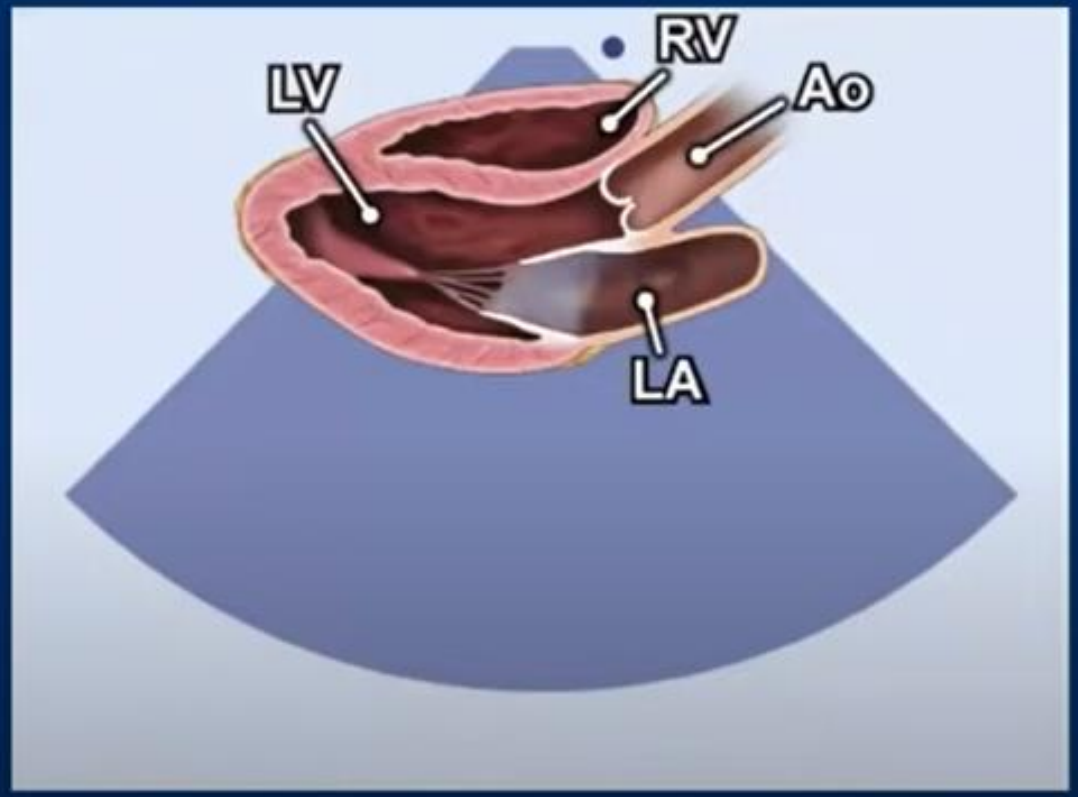
- Review the Standard imaging views that constitute a comprehensive transthoracic echocardiogram
- Discuss the rationale for various aspects of the imaging protocol
- Highlight some specific aspects of various views and measurements
- Review information that should be obtained for more limited studies

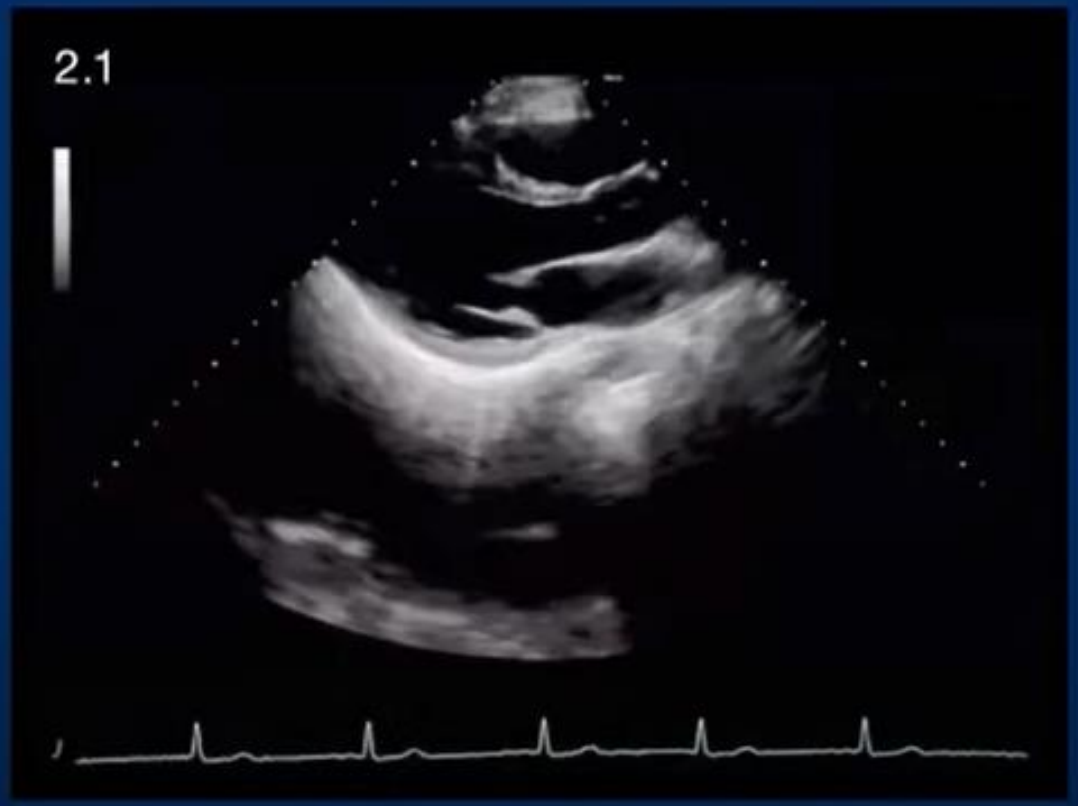
Guidelines for Performing a Comprehensive Transthoracic Echocardiographic Examination in Adults: Recommendations from the American Society of Echocardiography

Carol Mitchell, PhD, ACS, RDMS, RDCS, RVT, RT(R), FASE, Co-Chair, Peter S. Rahko, MD, FASE, Co-Chair, Lori A. Blauwet, MD, FASE, Barry Canaday, RN, MS, RDCS, RCS, FASE, Joshua A. Finstuen, MA, RT(R), RDCS, FASE, Michael C. Foster, BA, RCS, RCCS, RDCS, FASE, Kenneth Horton, ACS, RCS, FASE, Kofo O. Ogunyankin, MD, FASE, Richard A. Palma, BS, RDCS, RCS, ACS, FASE, and Eric J. Velazquez, MD, FASE, *Madison, Wisconsin; Rochester, Minnesota; Klamath Falls, Oregon; Durham, North Carolina; Salt Lake City, Utah; Ikoyi, Lagos, Nigeria; and Hartford, Connecticut*

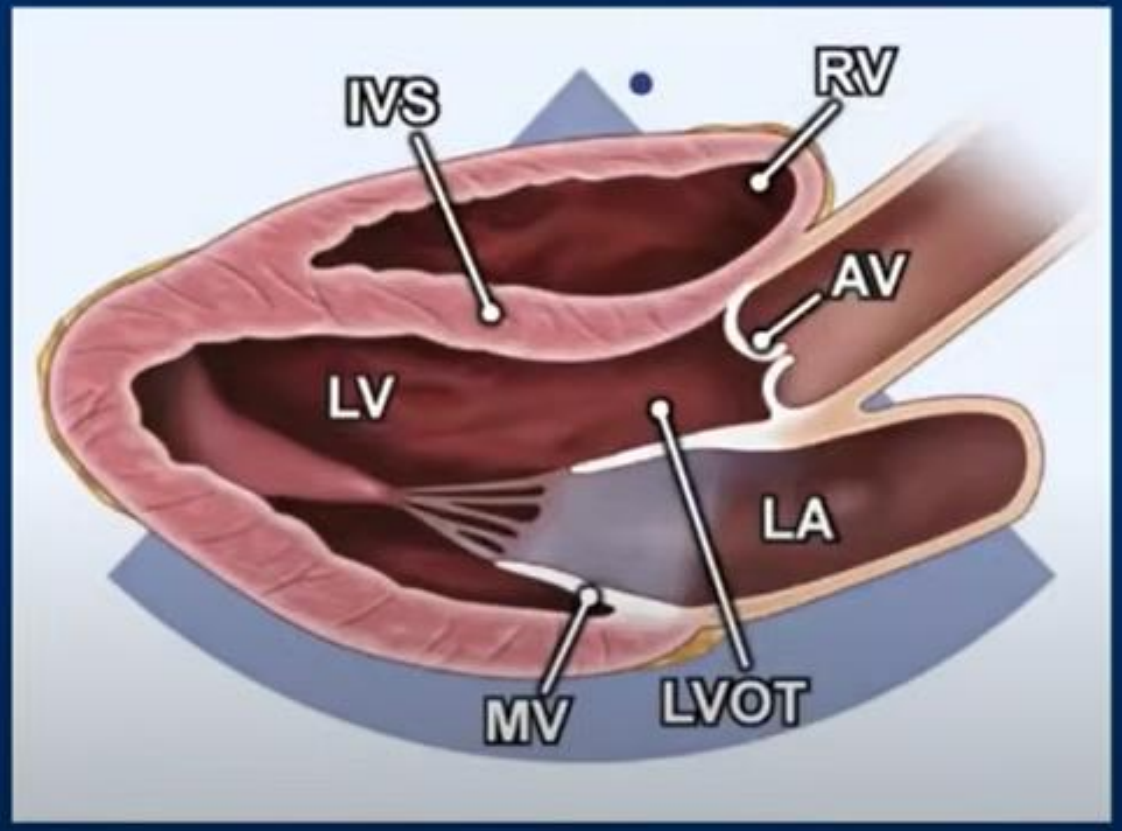
This document is endorsed by the following American Society of Echocardiography International Alliance Partners: Argentine Federation of Cardiology, Argentine Society of Cardiology, ASEAN Society of Echocardiography, Australasian Sonographers Association, British Society of Echocardiography, Canadian Society of Echocardiography, Chinese Society of Echocardiography, Department of Cardiovascular Imaging of the Brazilian Society of Cardiology, Indian Academy of Echocardiography, Indian Association of Cardiovascular Thoracic Anaesthesiologists, Indonesian Society of Echocardiography, InterAmerican Association of Echocardiography, Iranian Society of Echocardiography, Israel Work Group on Echocardiography, Italian Association of Cardiothoracic Anaesthesiologists, Japanese Society of Echocardiography, Korean Society of Echocardiography, National Society of Echocardiography of Mexico, Philippine Society of Echocardiography, Saudi Arabian Society of Echocardiography, Thai Society of Echocardiography, Vietnamese Society of Echocardiography.

Parasternal Long Axis – Increased Depth Scout View





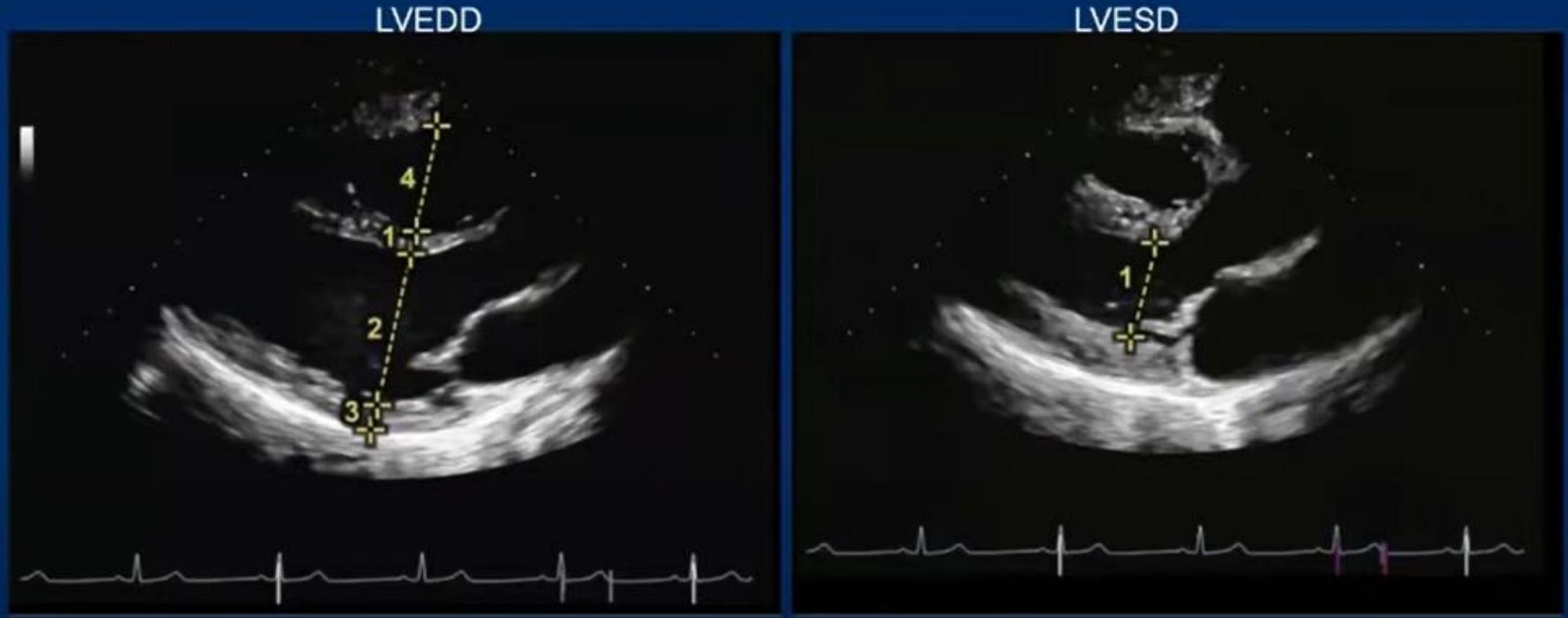
Parasternal Long Axis



Images and Measurements

- Establish your lab's standards for image acquisition and clip recording and when to measure.
- Record the clip and use a freeze frame from the same clip for measurements.
- Use the same heartbeat for systolic and diastolic measurements.
- The 2-D LAXX view should be used for linear measurements

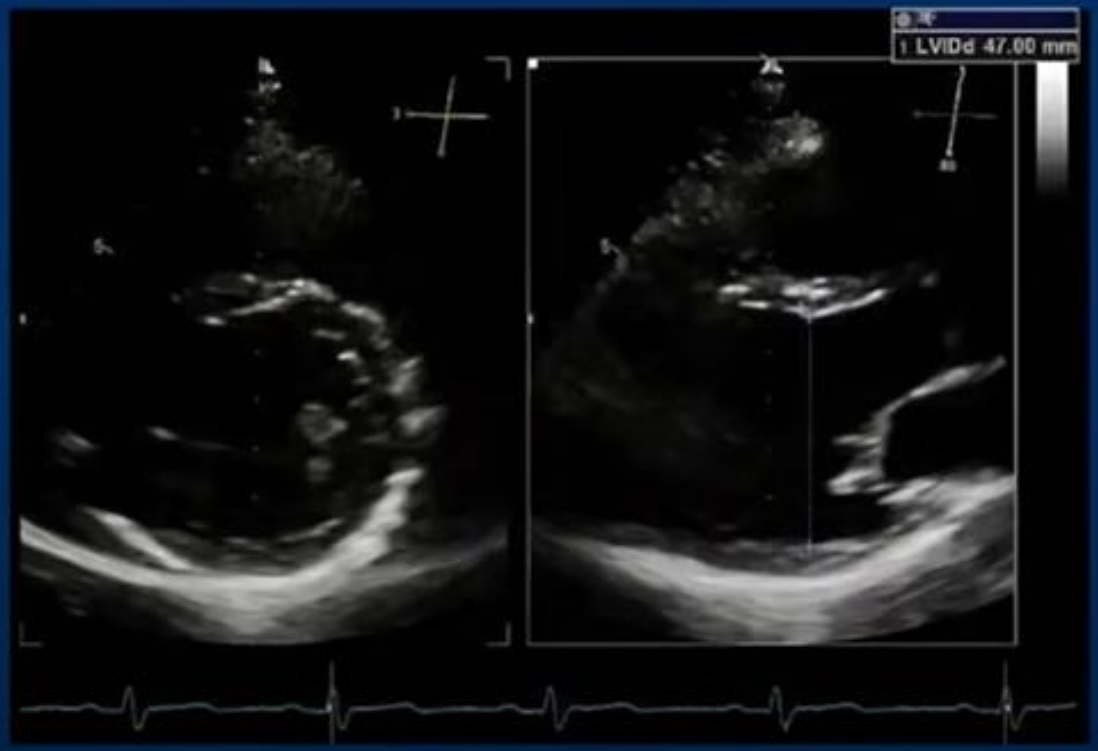
Parasternal Long Axis – 2D Measurements



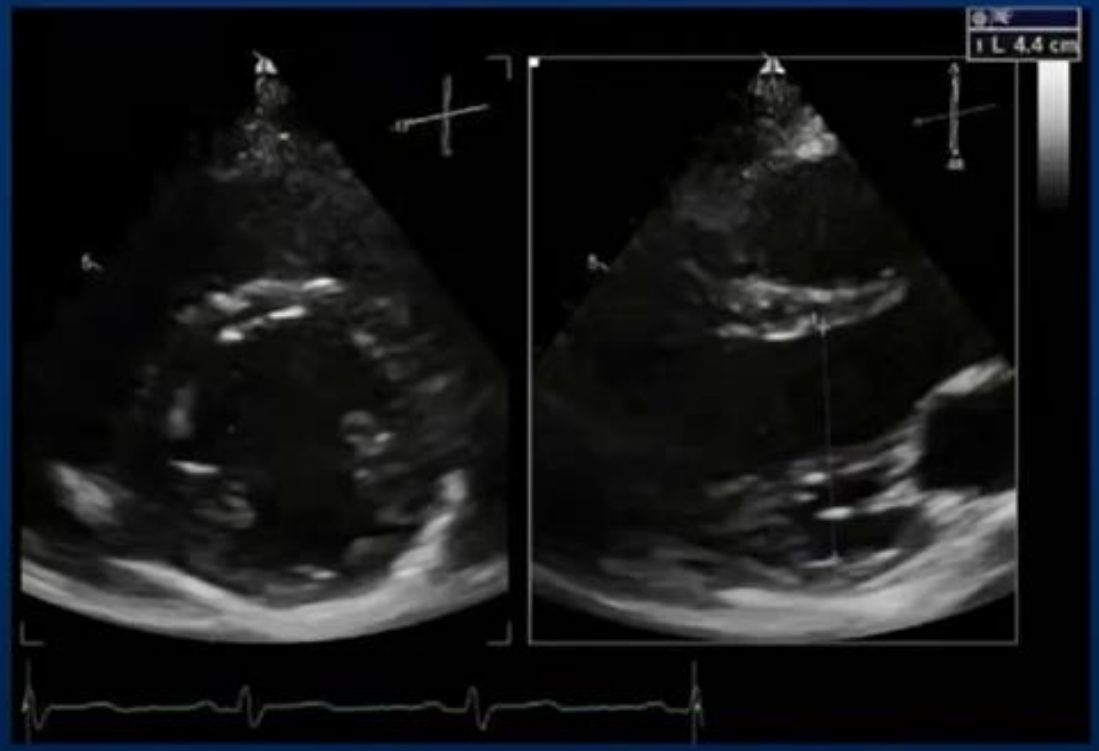
Center the LV, No pap muscles showing, Compacted interface, ED is the first frame when MV closed, ES is the minimum dimension

Long axis measurement Pitfalls

Correct centered LAXX



Incorrect off center measurement



DIAGNOSTIC TECHNIQUES

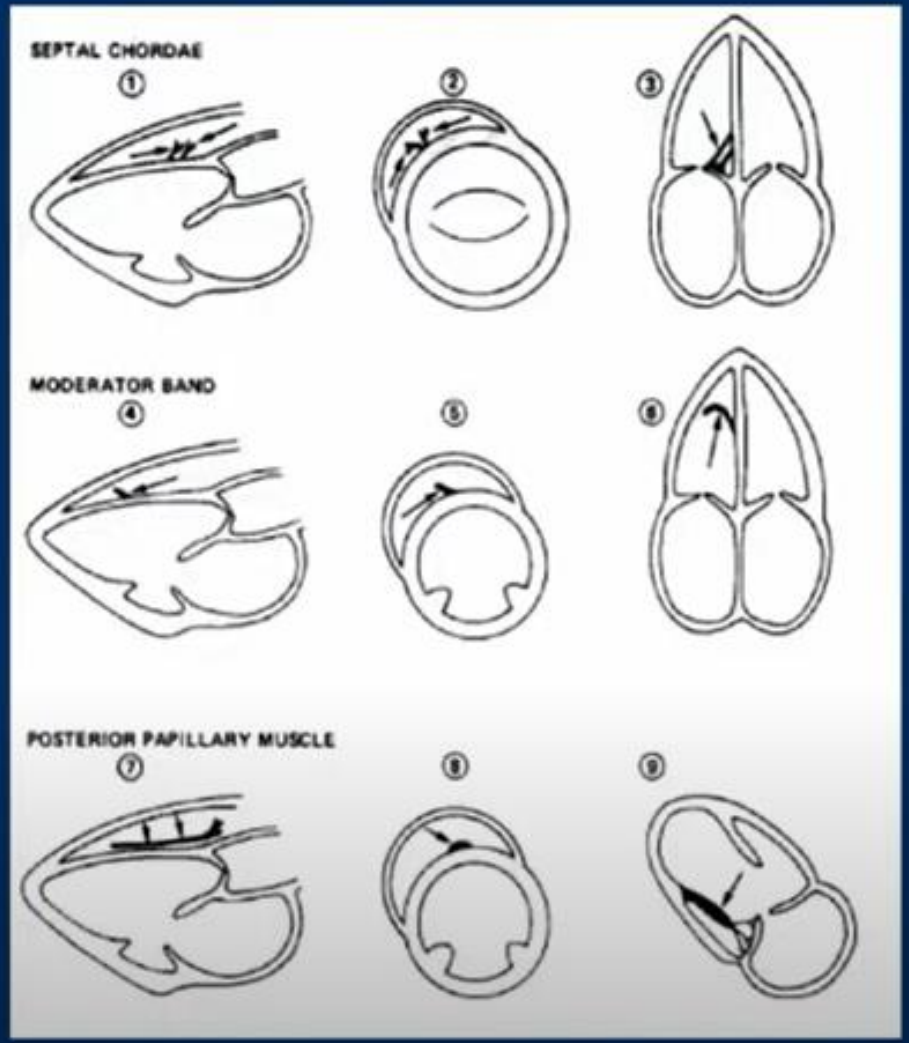
Echocardiographic Recognition of Paraseptal Structures

ANDRE KEREN, MD, MARGARET E. BILLINGHAM, MD, FACC, RICHARD L. POPP, MD, FACC

Stanford, California

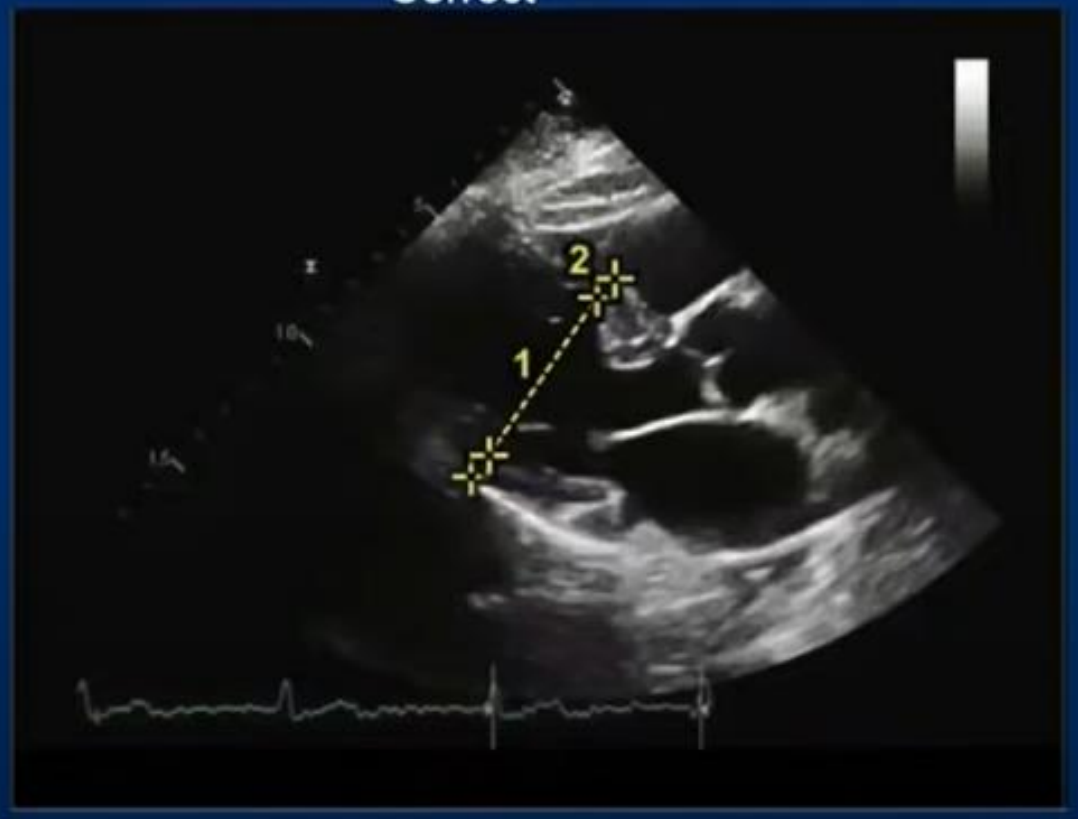
Improved echocardiographic equipment provides detailed images of the heart and shows anatomic paraseptal structures previously not well defined. Echocardiograms were analyzed from 33 patients who later underwent cardiac transplantation, and the paraseptal structures noted were correlated with the pathologic specimens. Patterns associated with right ventricular chordae tendineae, the moderator band and the posterior papillary muscle are illustrated. Hypertrophic and fibrotic right ventricular trabeculae and left ventricular paraseptal bands are noted. These structures can be specifically sought and identified using the current generation of echocardiographs, thereby avoiding potential problems of septal definition and measurement.

(J Am Coll Cardiol 1985;6:913–9)

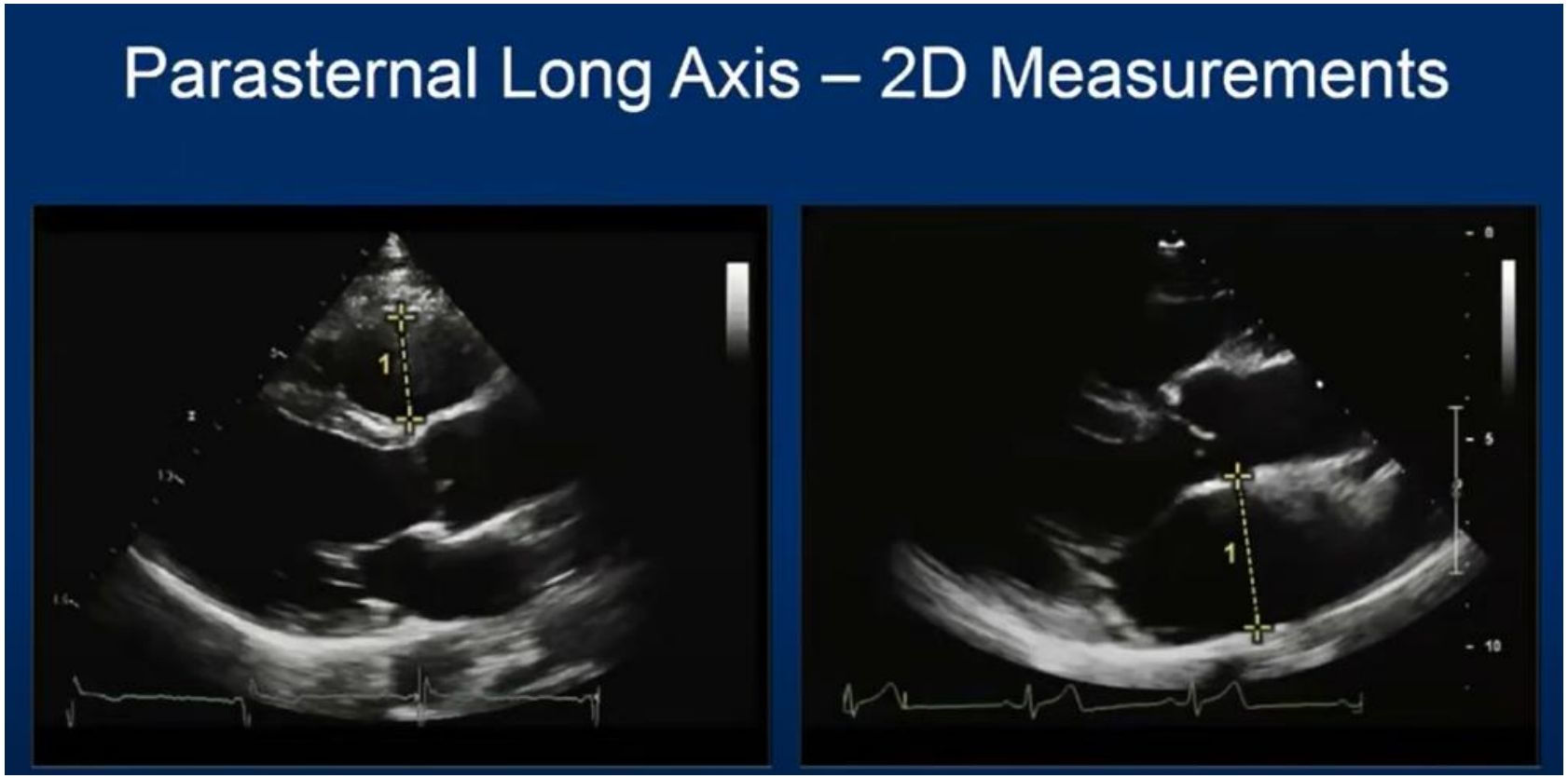


Parasternal Long Axis - Sigmoid Septum

Correct

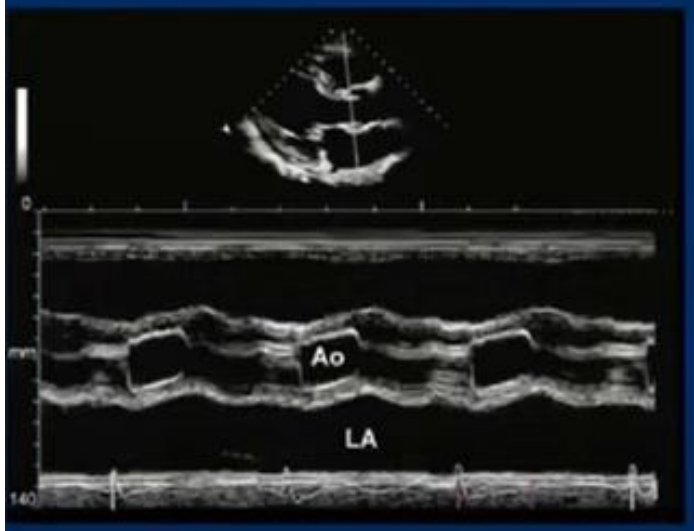


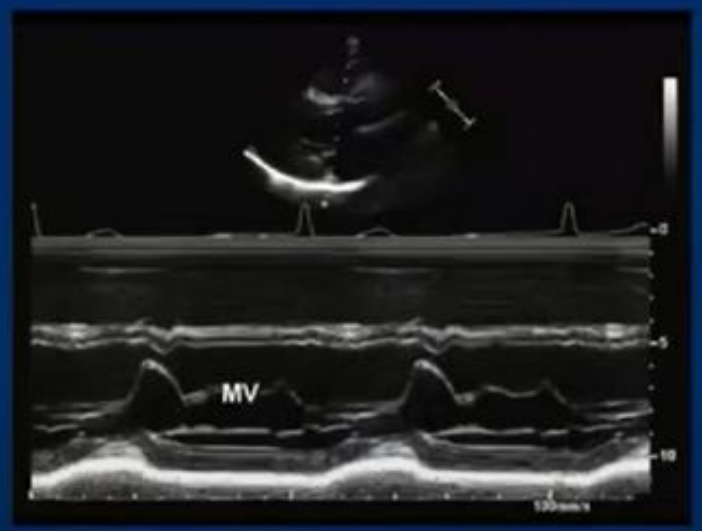
Incorrect

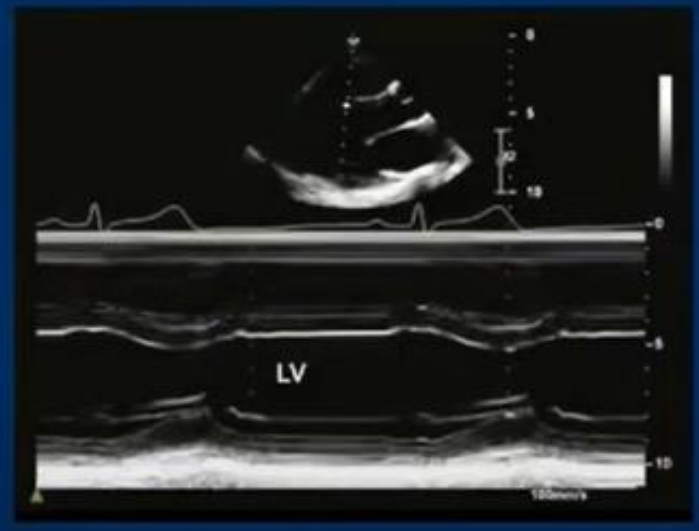


LA: measurement at valsalva using leading edge-to-leading edge

Parasternal Long Axis – M-mode

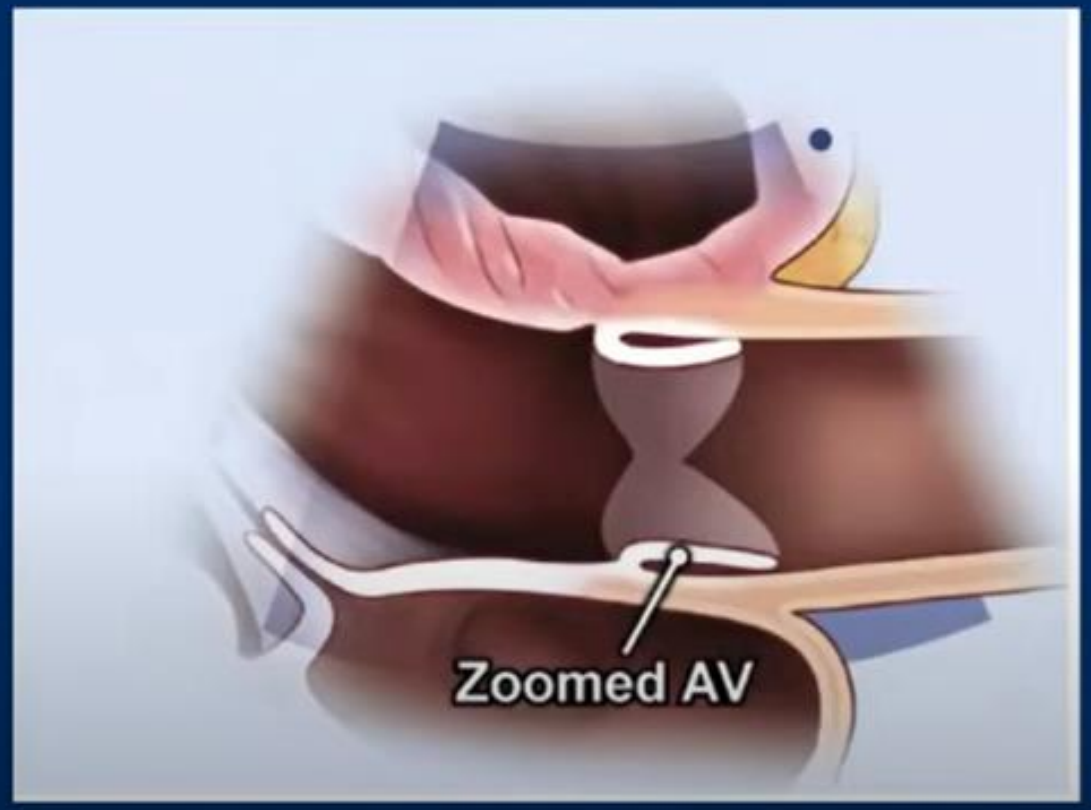


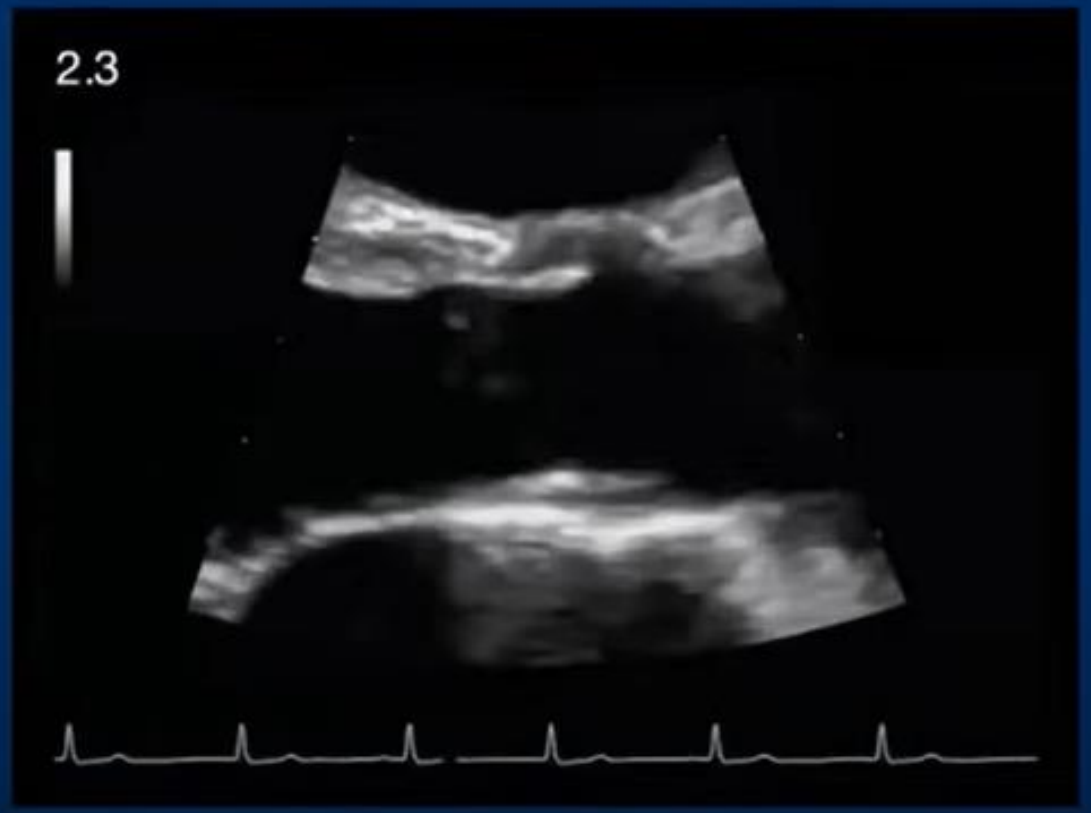




LA dimension, Motion patterns of multiple structures, Timing of events with and without color Doppler

Parasternal Long Axis – Zoomed Aortic Valve



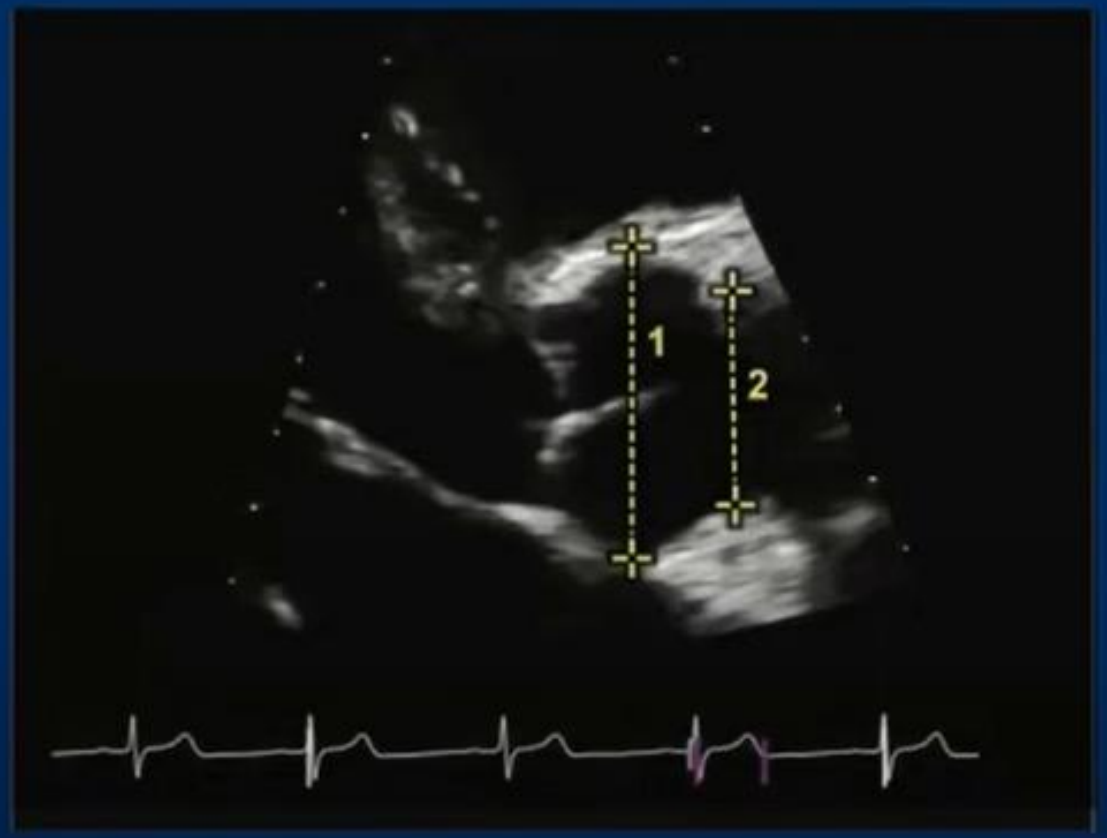


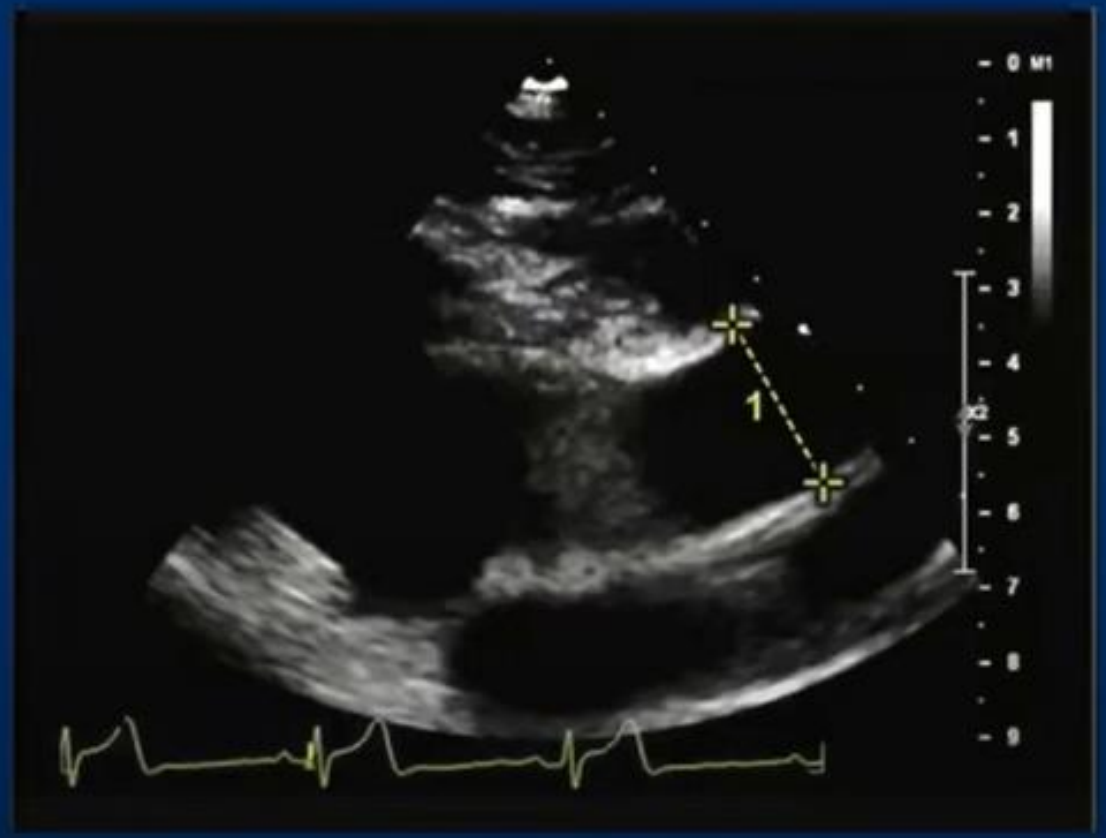
Parasternal Long Axis – LVOT / Aortic Valve Measurement:
Systolic Dimensions Inner edge to inner edge

Aortic Valve Annulus

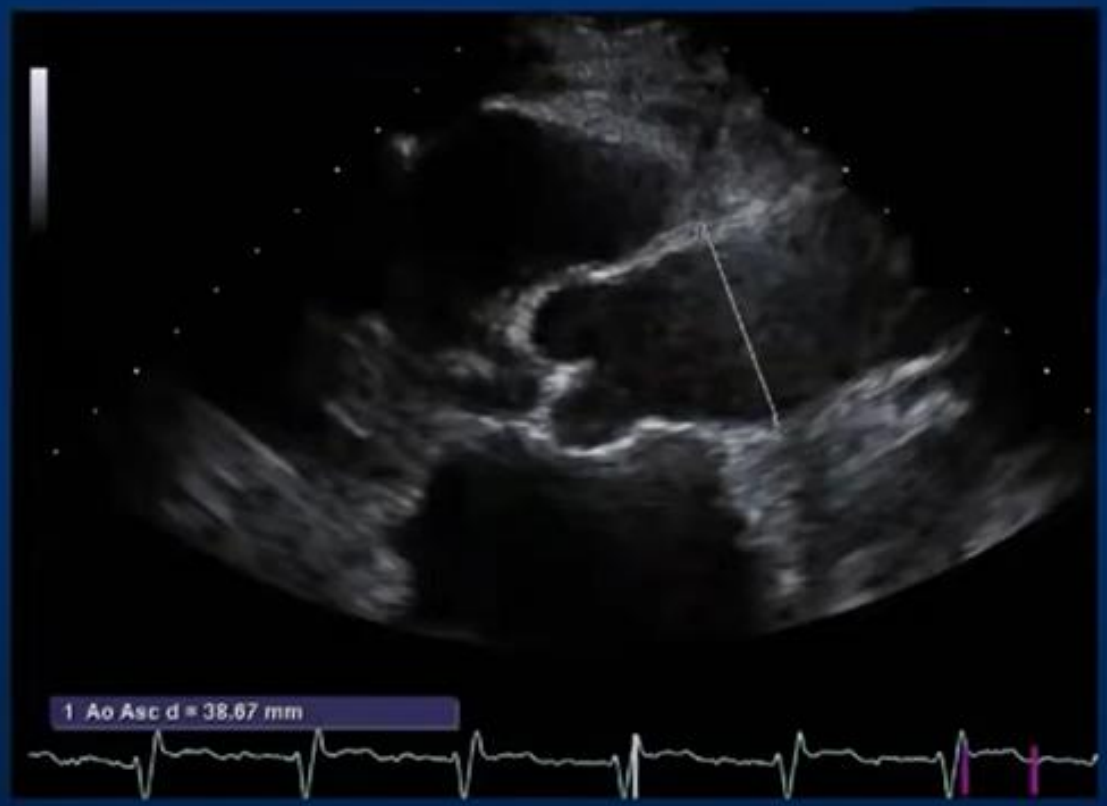
LVOT

Parasternal Long Axis – Ascending Aorta Measurement:
End diastolic dimensions leading edge to leading edge

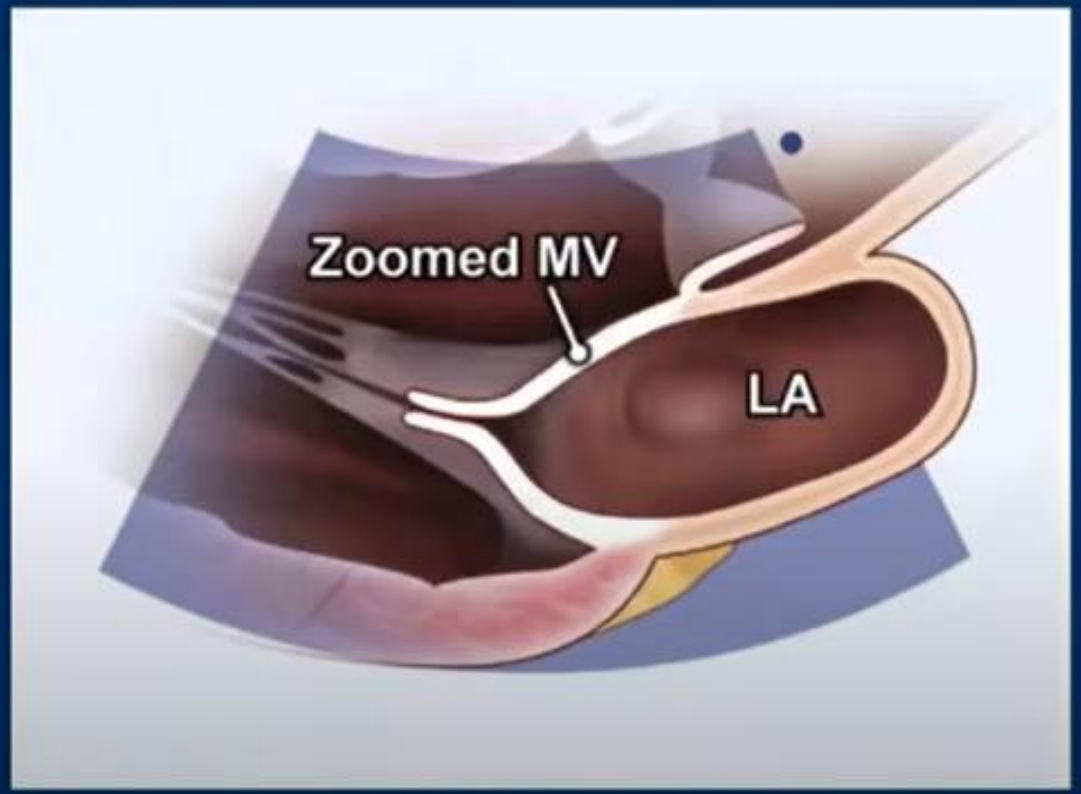




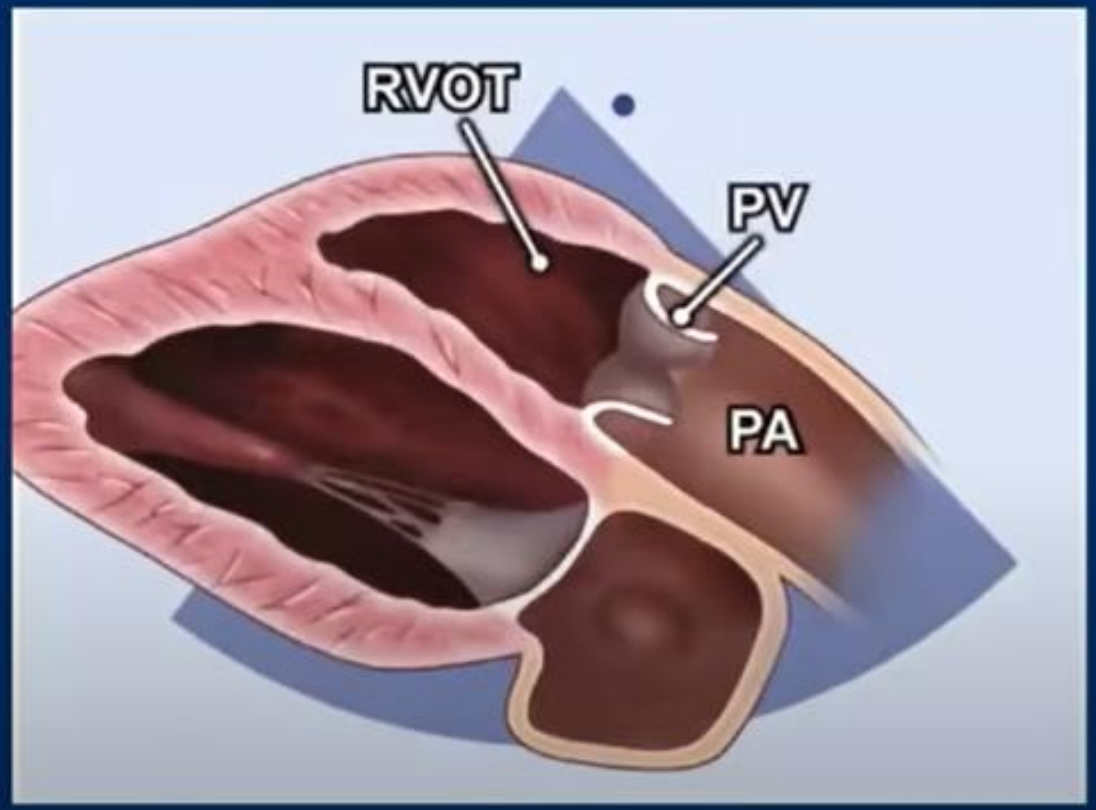
The aorta from a higher interspace



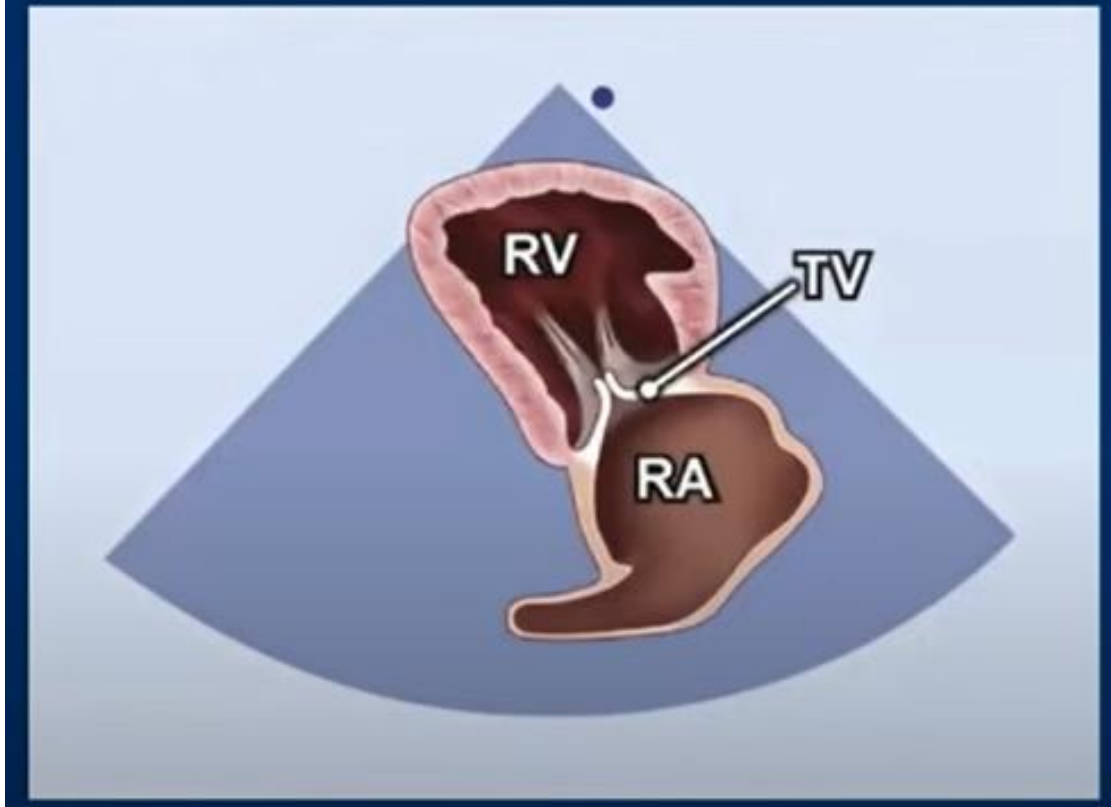
Parasternal Long Axis – Zoomed Mitral Valve



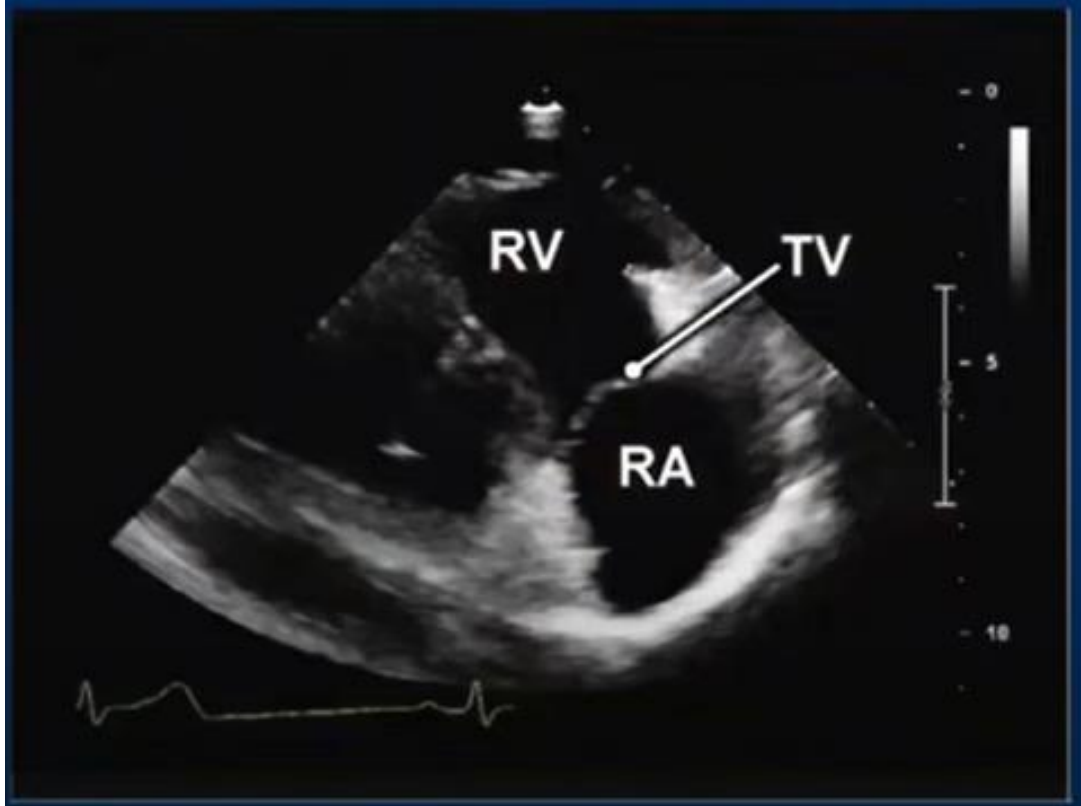
Parasternal Long Axis – RVOT / PV

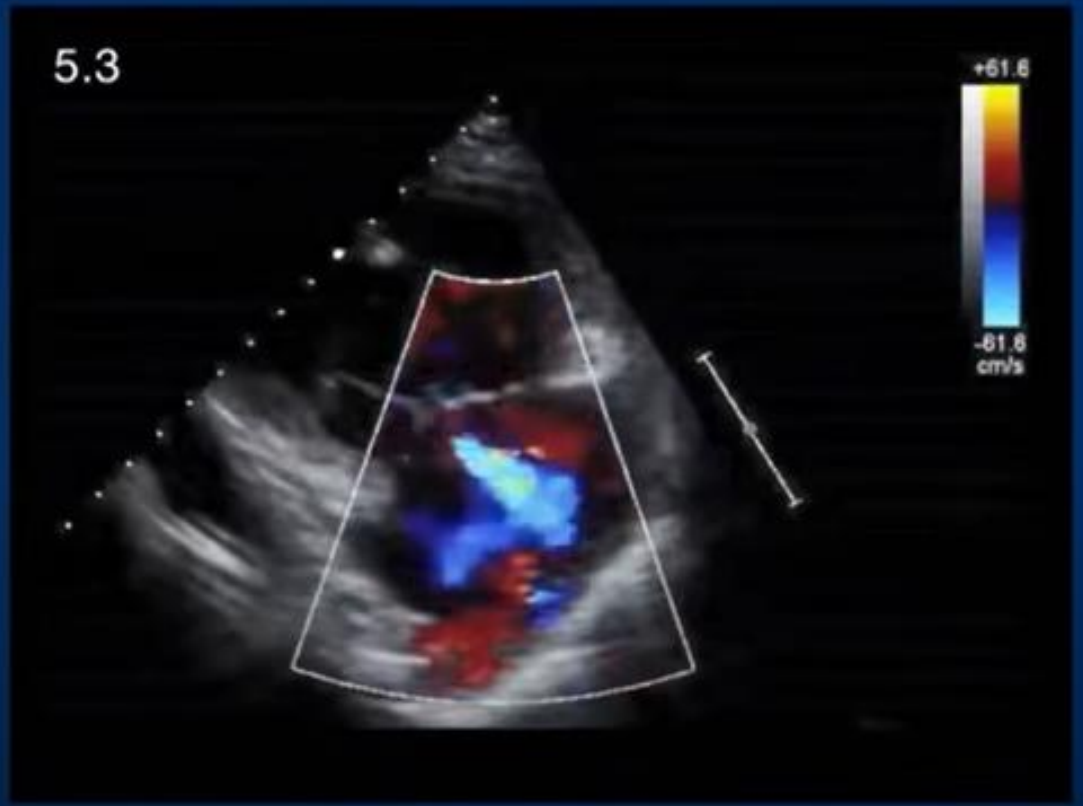


Parasternal Long Axis – RV Inflow

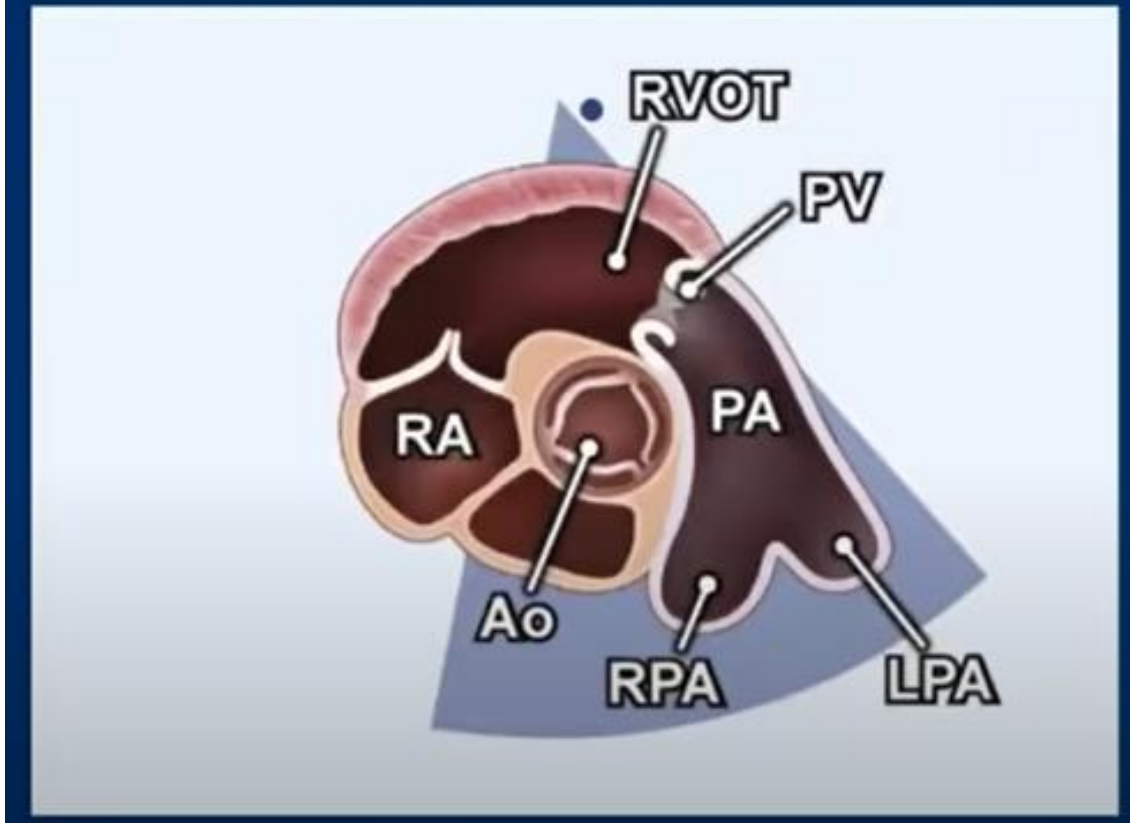


Parasternal Long Axis – RV Inflow



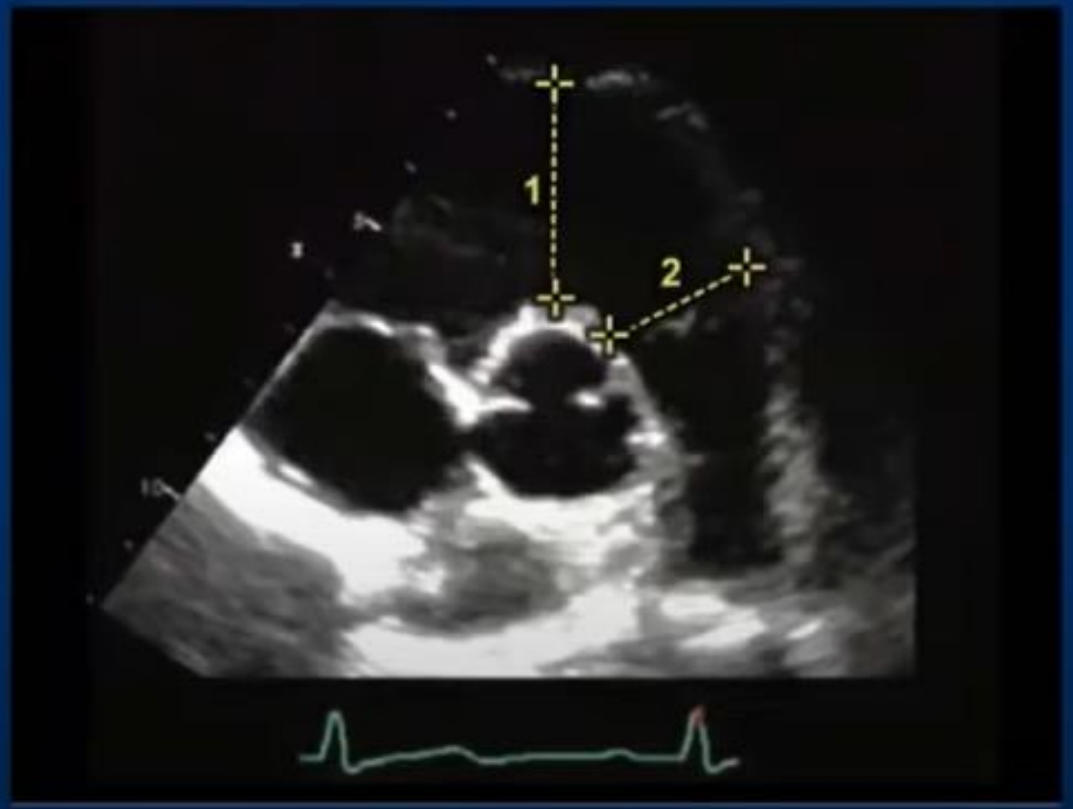


Parasternal Short Axis – Great Vessel Level

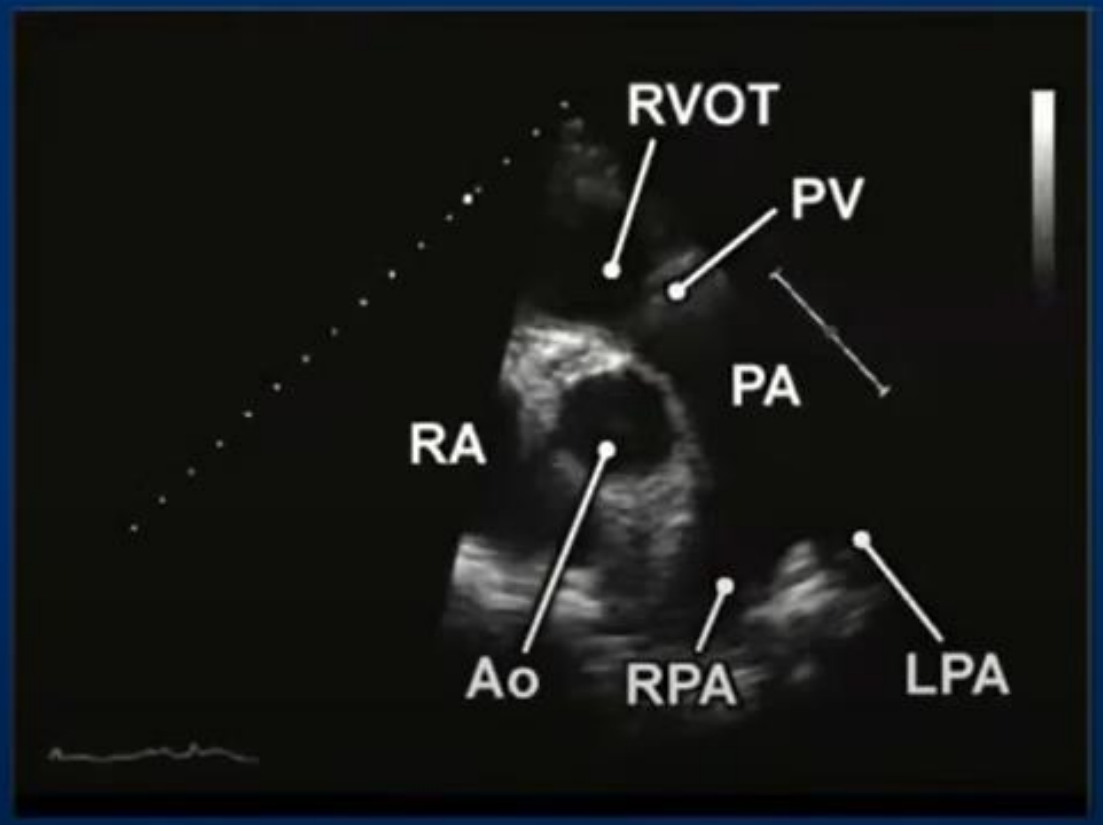


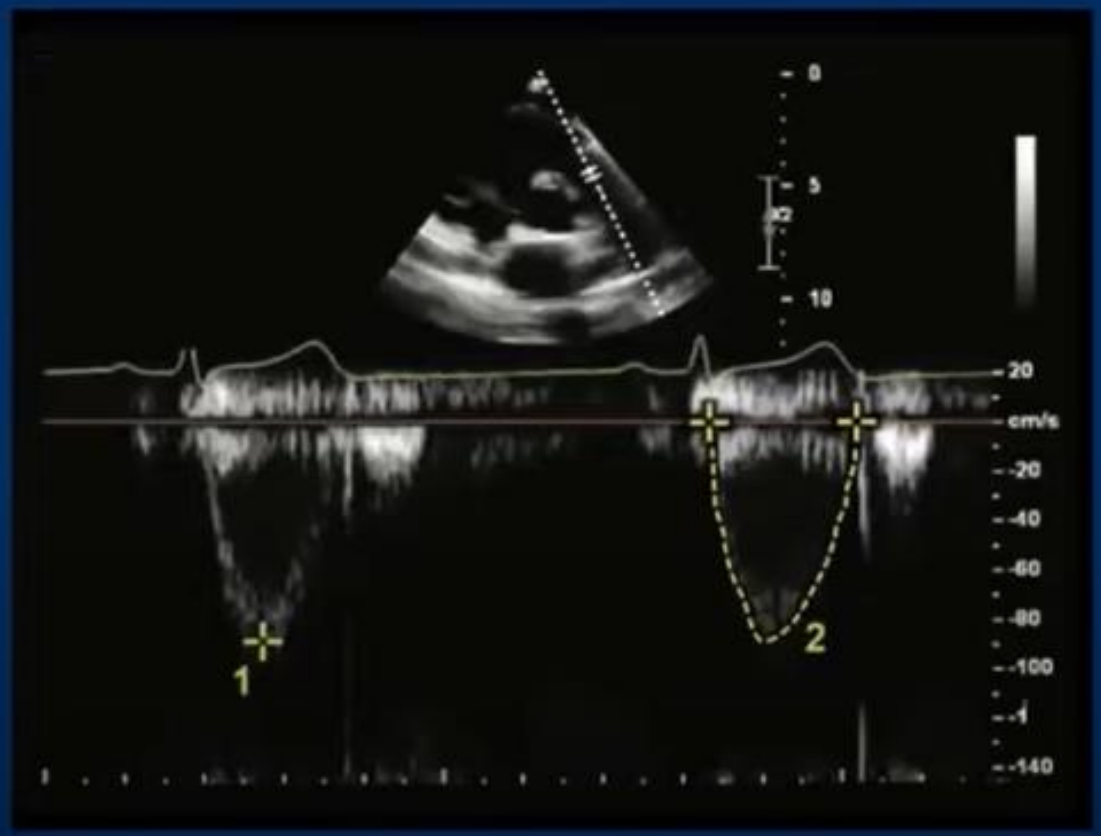
Parasternal Short Axis – Great Vessel Level

End diastole inner edge to inner edge

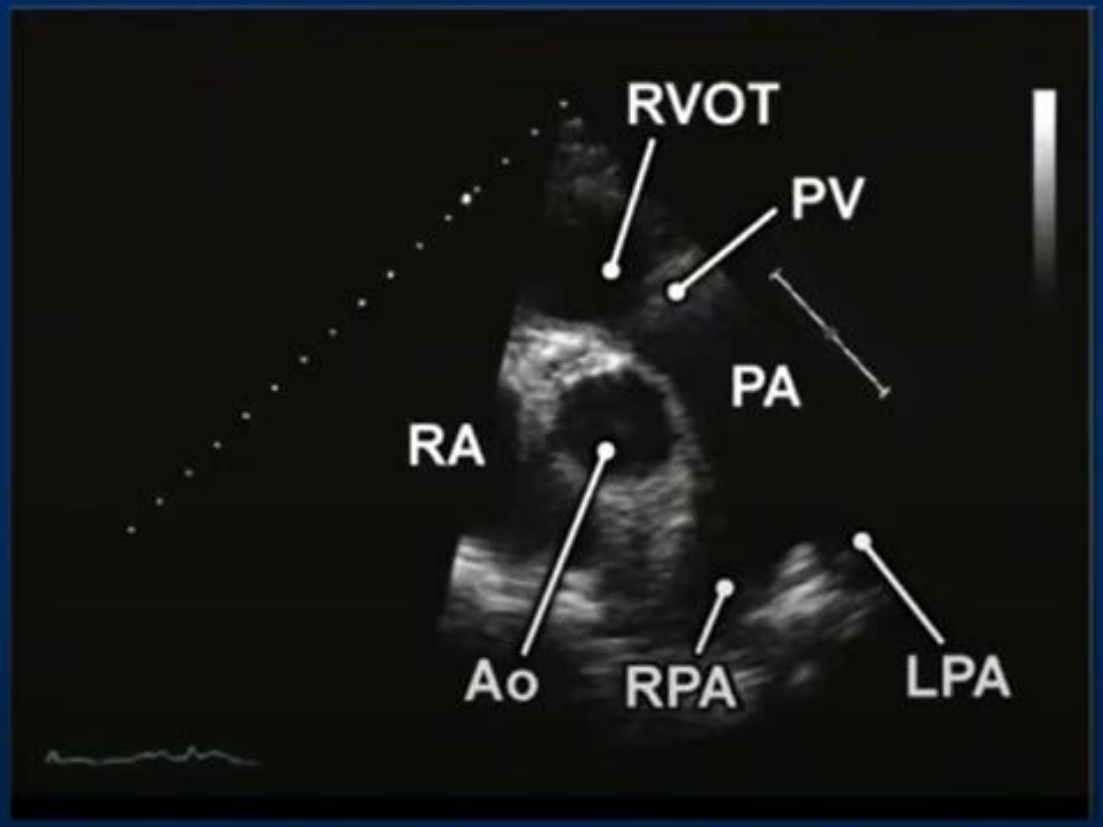


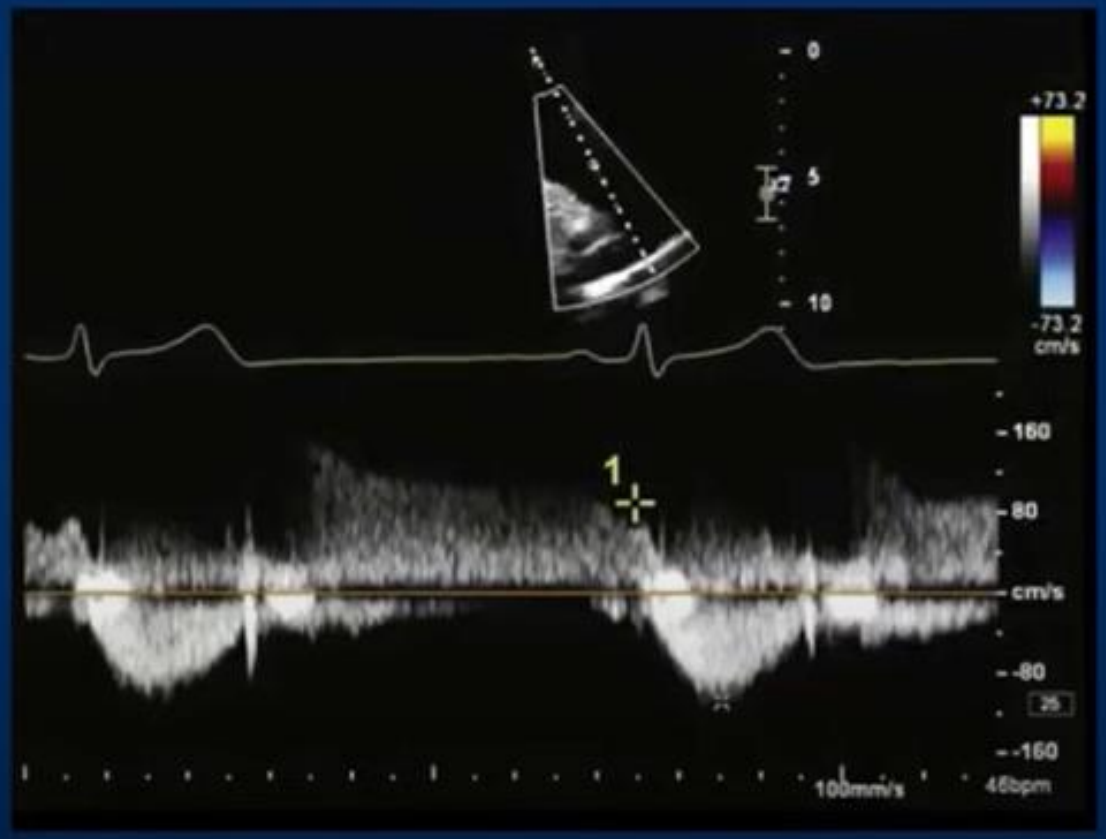
Parasternal Short Axis – RVOT PW Doppler



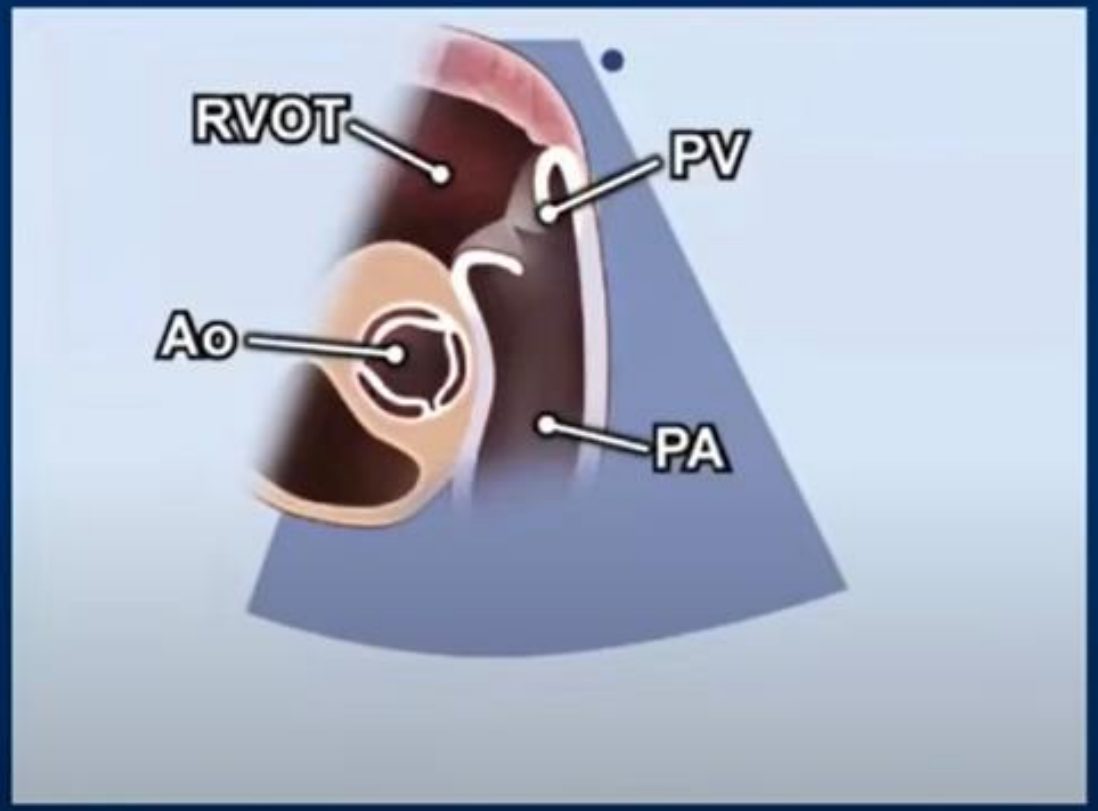


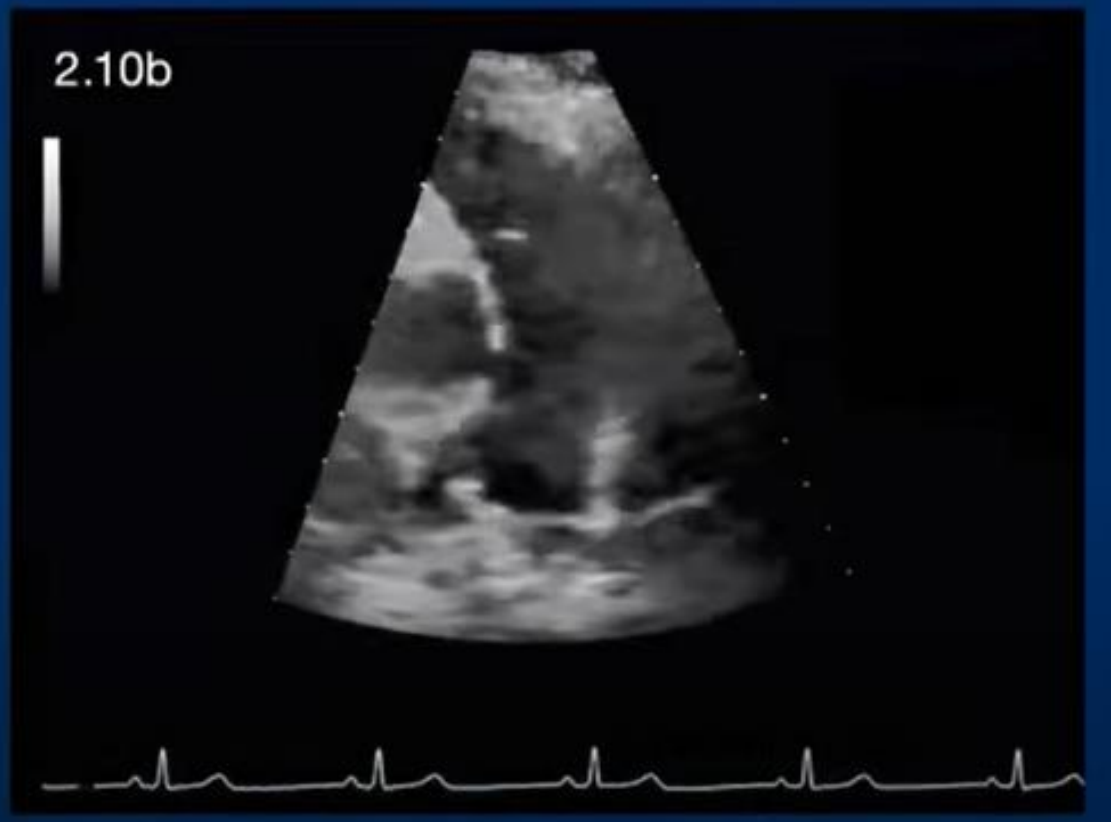
Parasternal Short Axis – PV CW Doppler



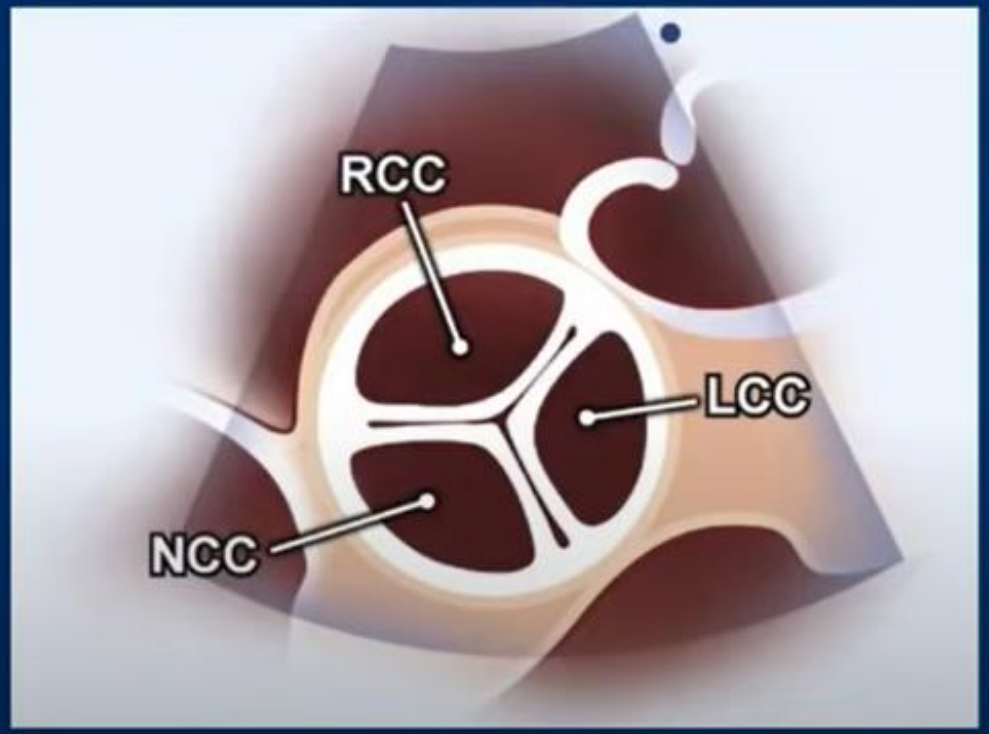


Parasternal Short Axis – RV Outflow (Narrow Sector)

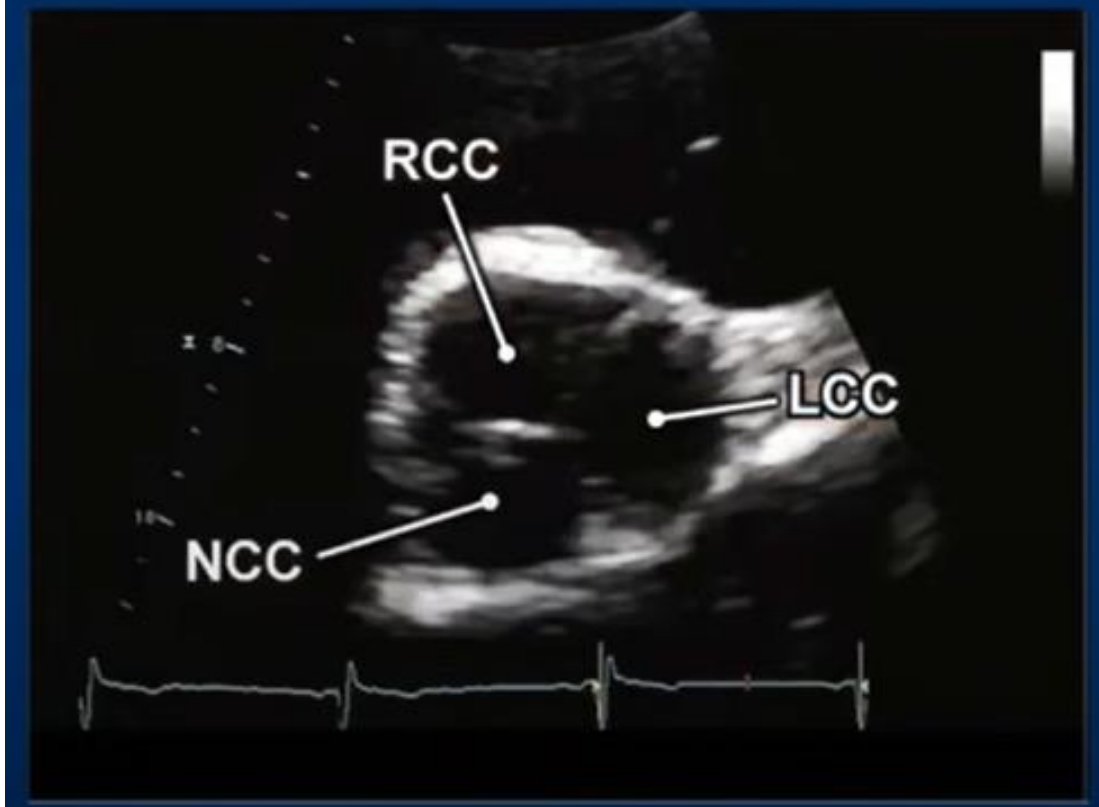


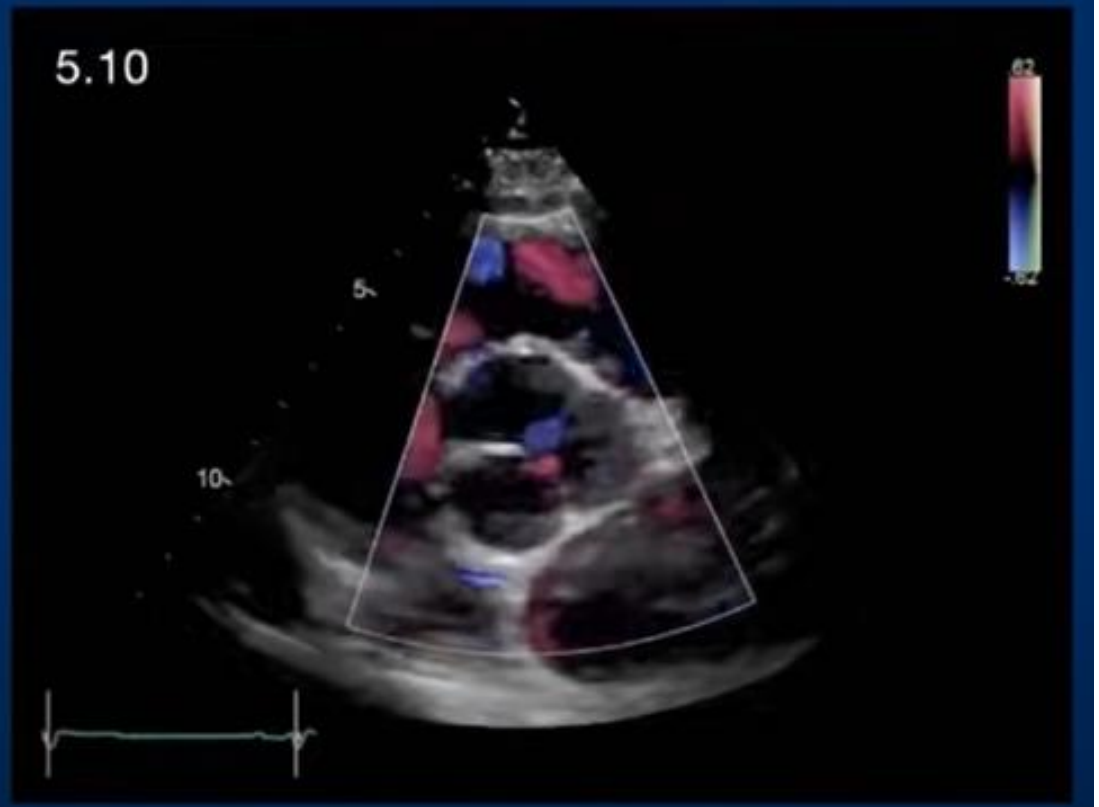


Parasternal Short Axis – Zoomed AV

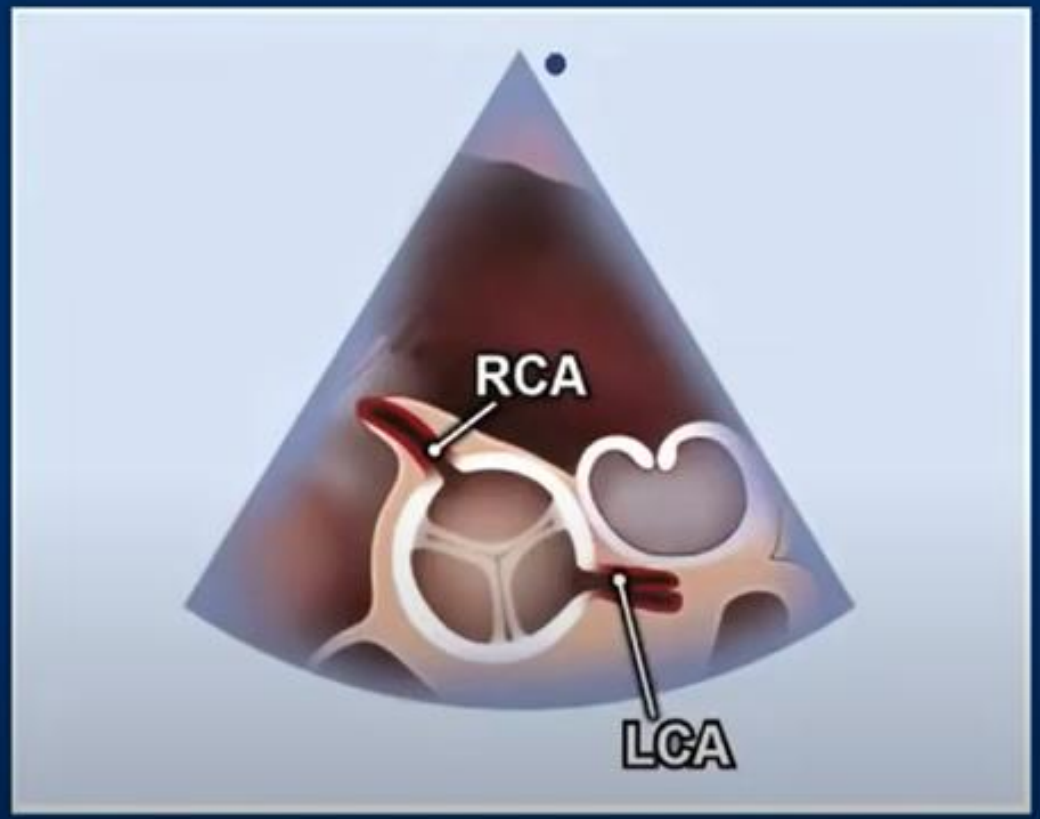


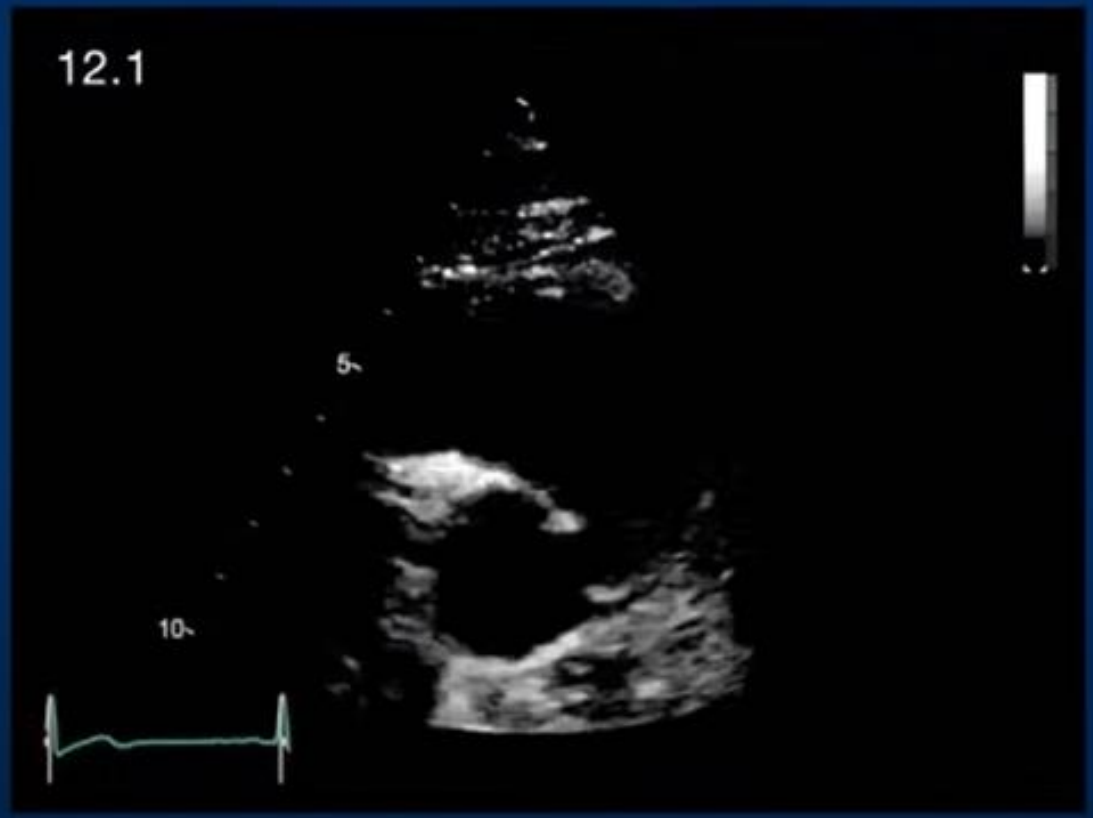
Parasternal Short Axis – Zoomed AV



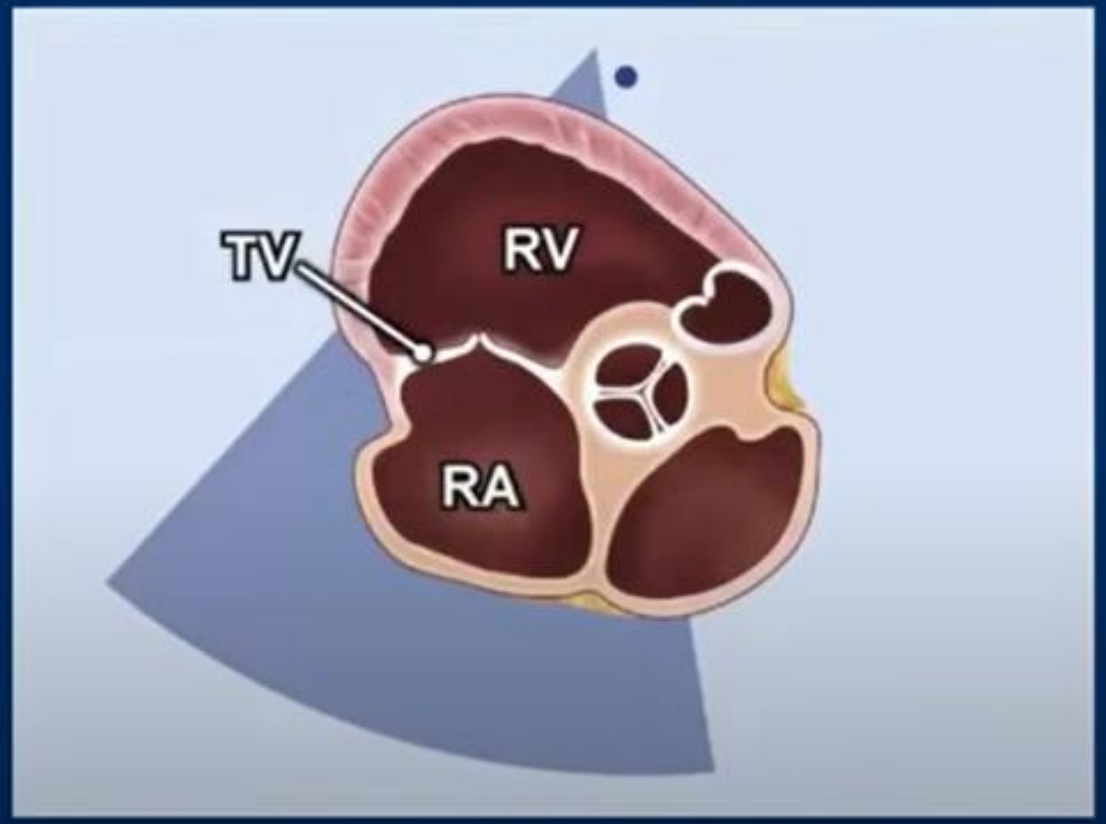


Parasternal Short Axis - Coronary Arteries

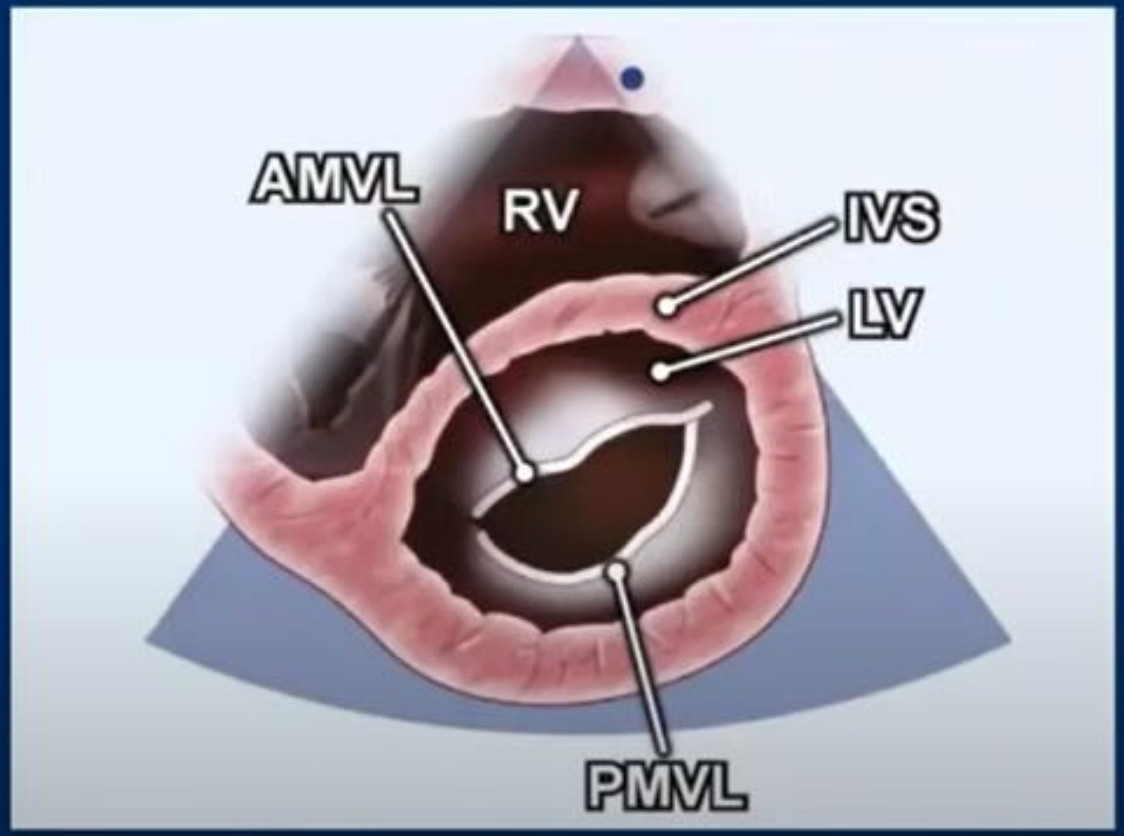




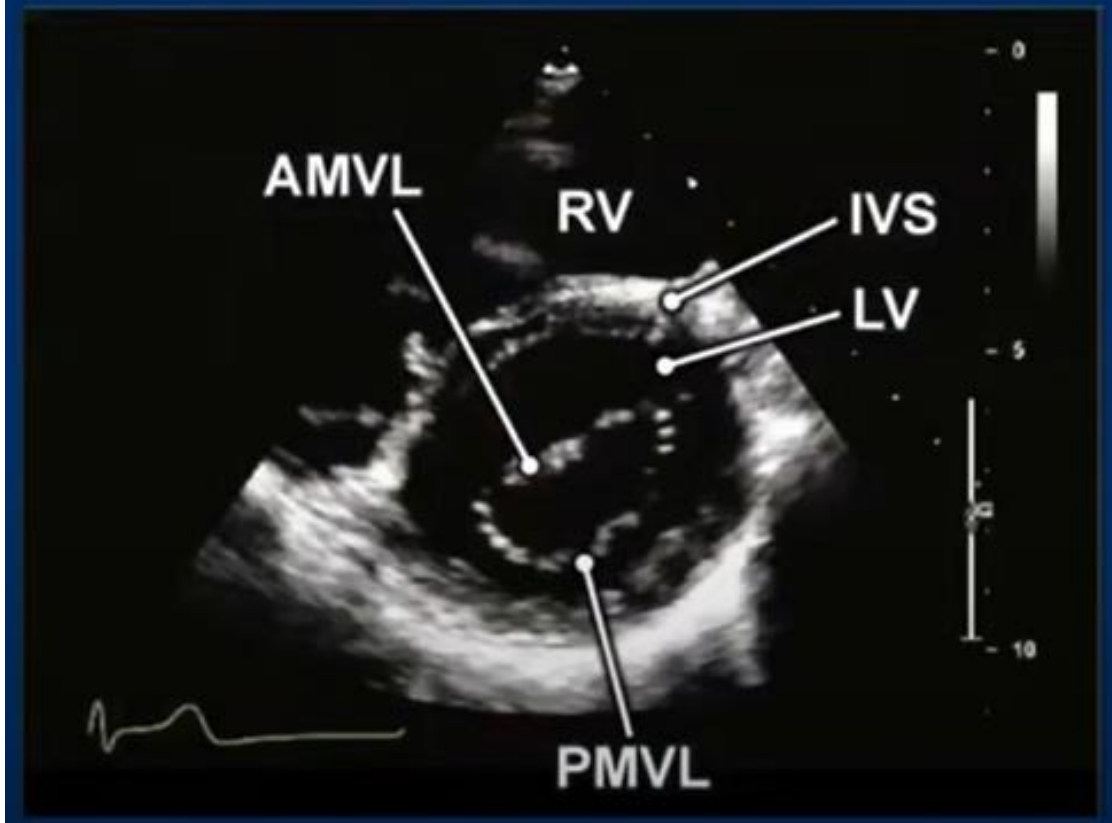
Parasternal Short Axis – RV Inflow (Narrow Sector)



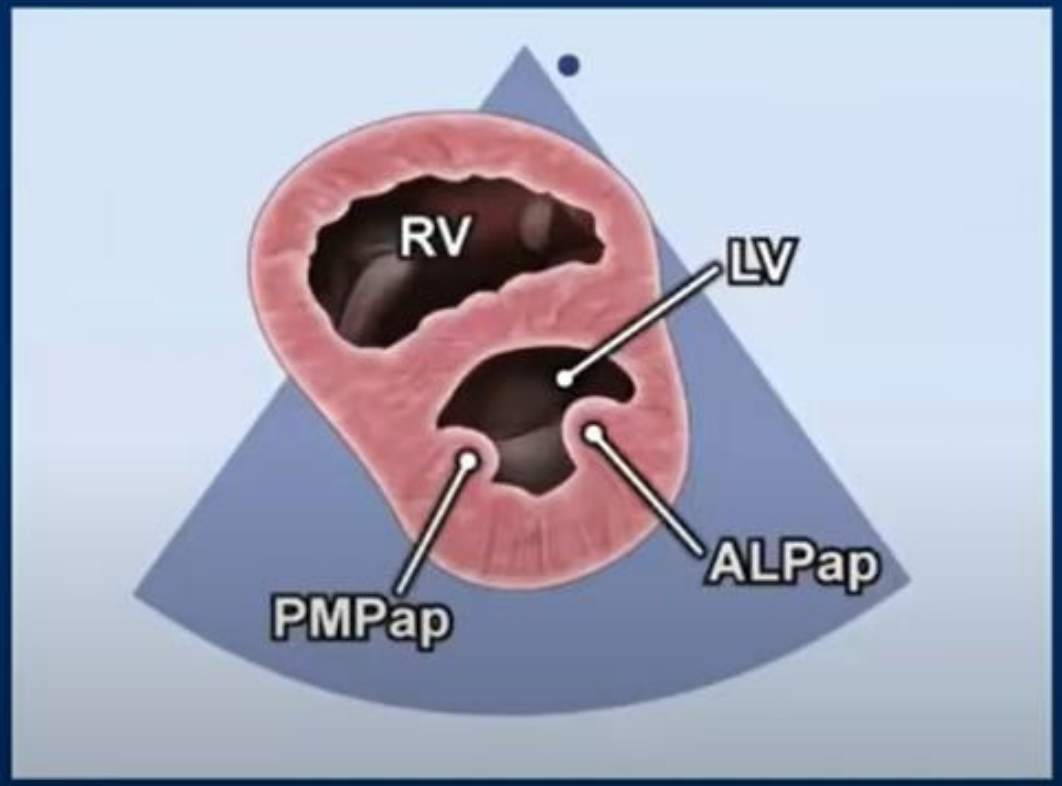
Parasternal Short Axis – MV Level



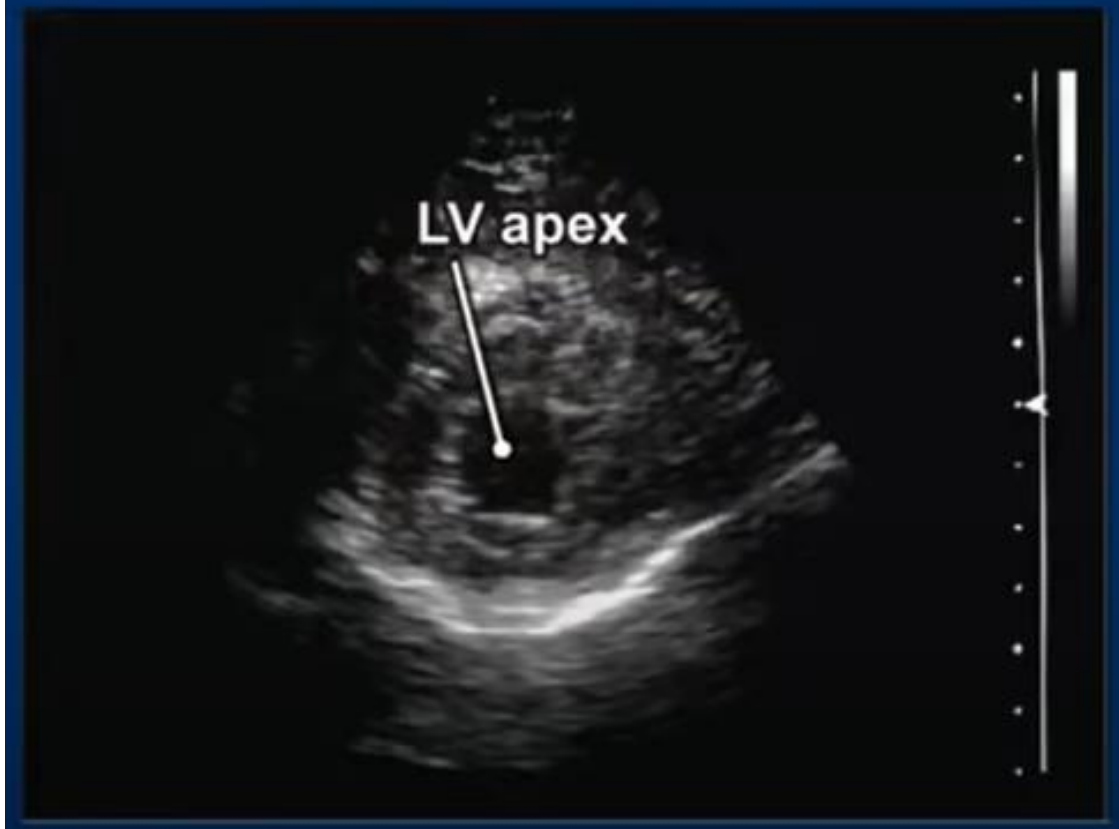
Parasternal Short Axis – MV Level

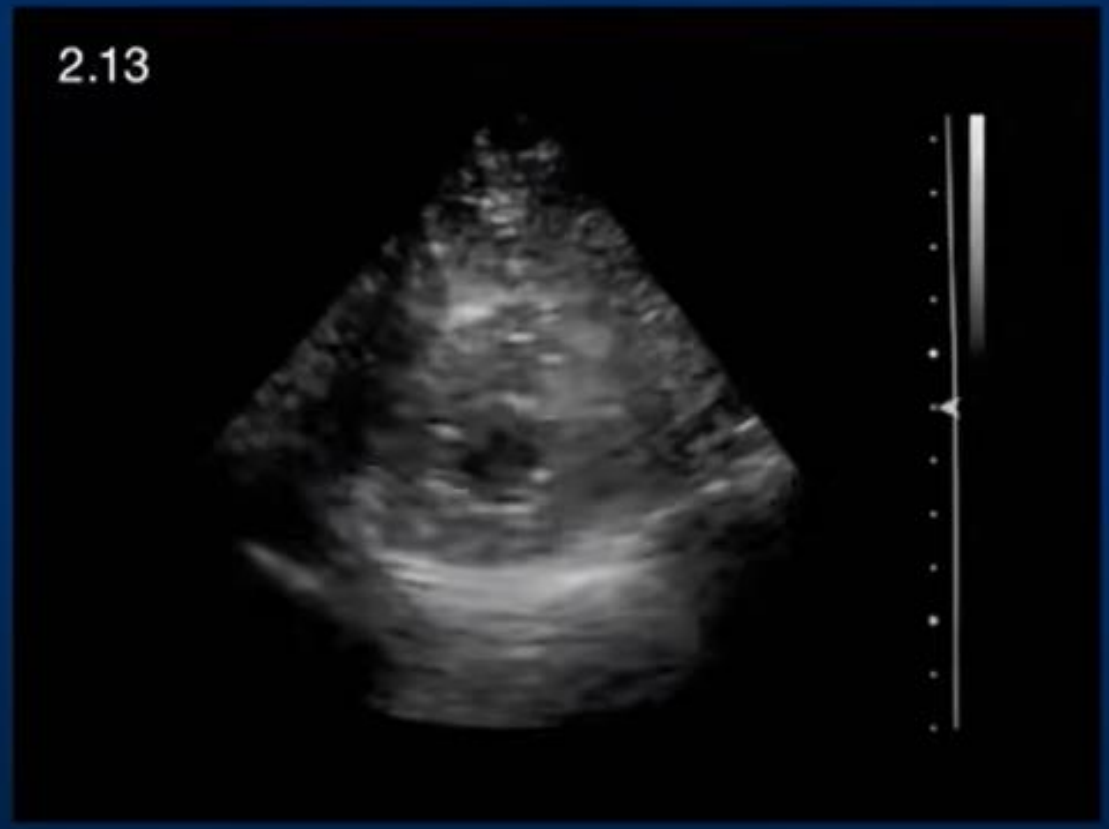


Parasternal Short Axis – Papillary Muscle Level

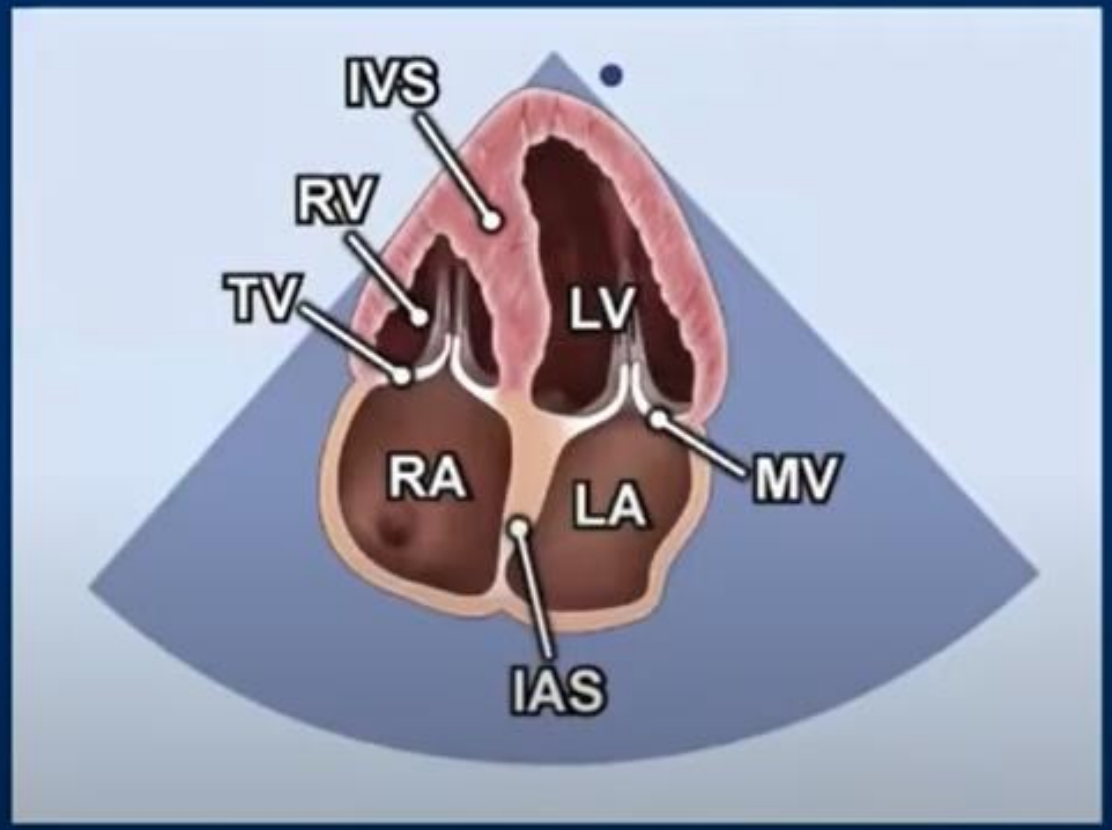


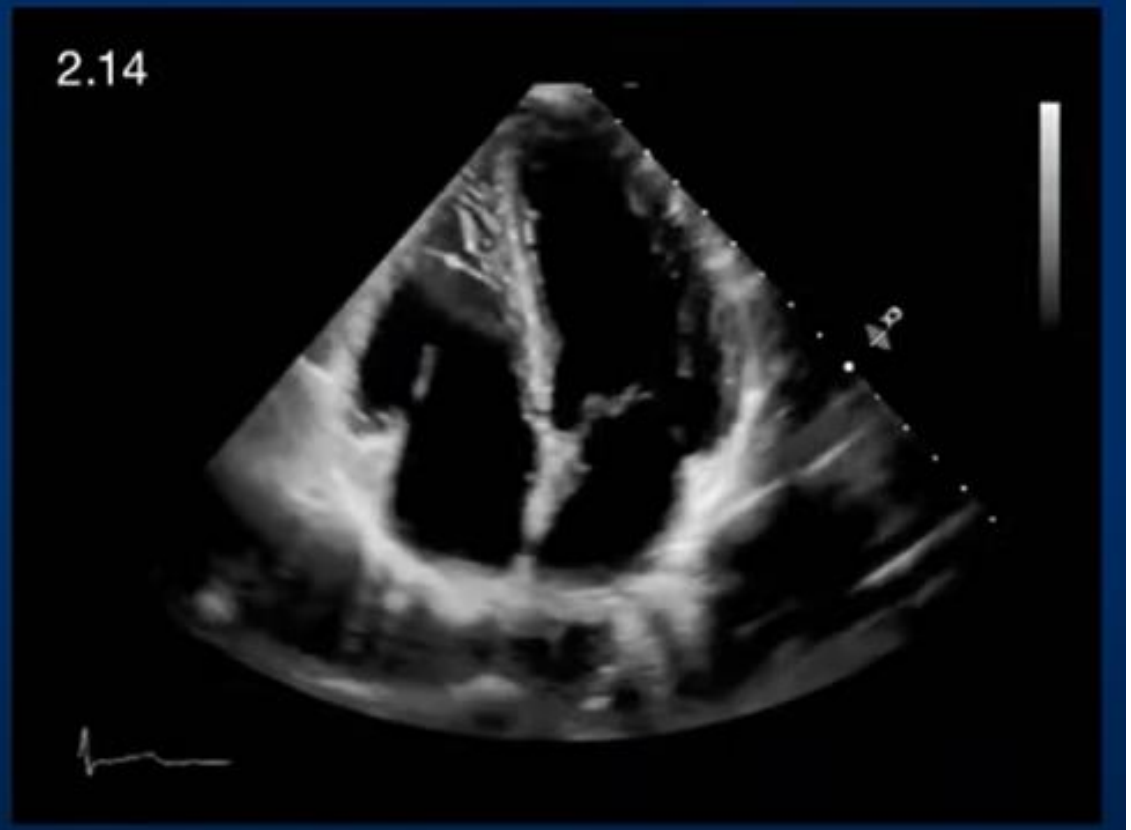
Parasternal Short Axis – Apex Level



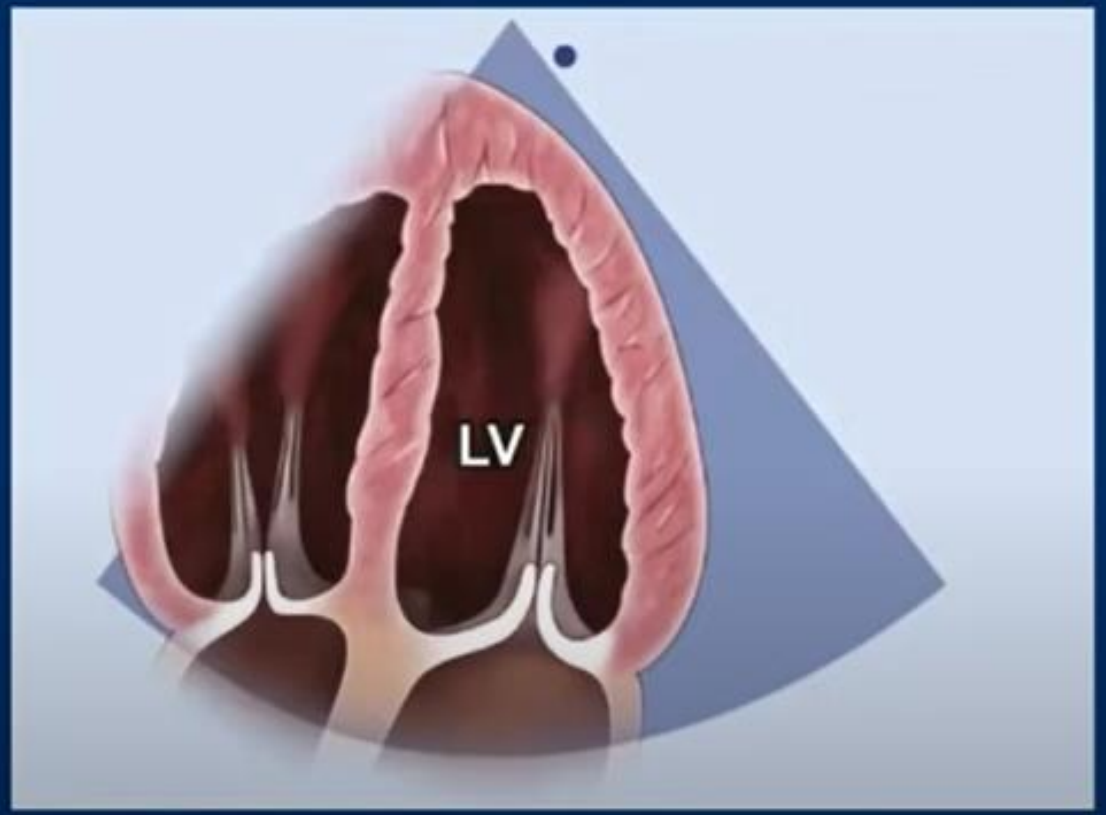


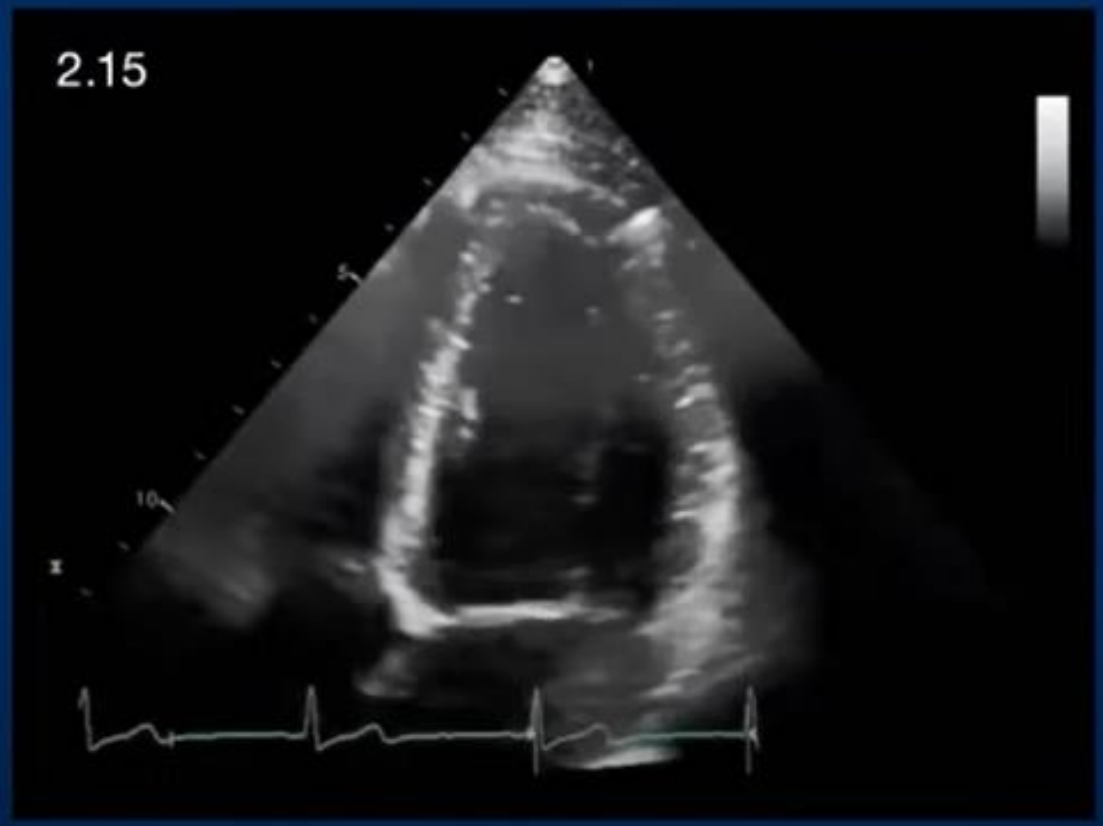
Apical – 4 Chamber



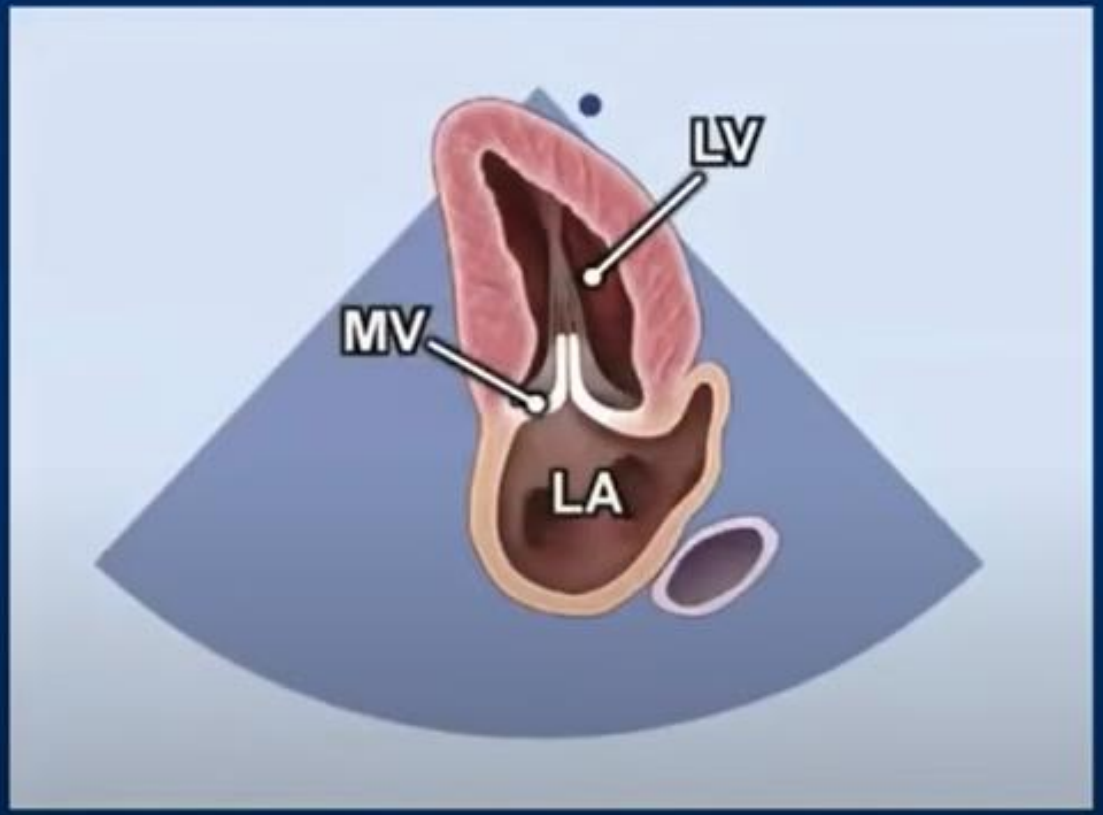


Apical – 4 Chamber Focused LV

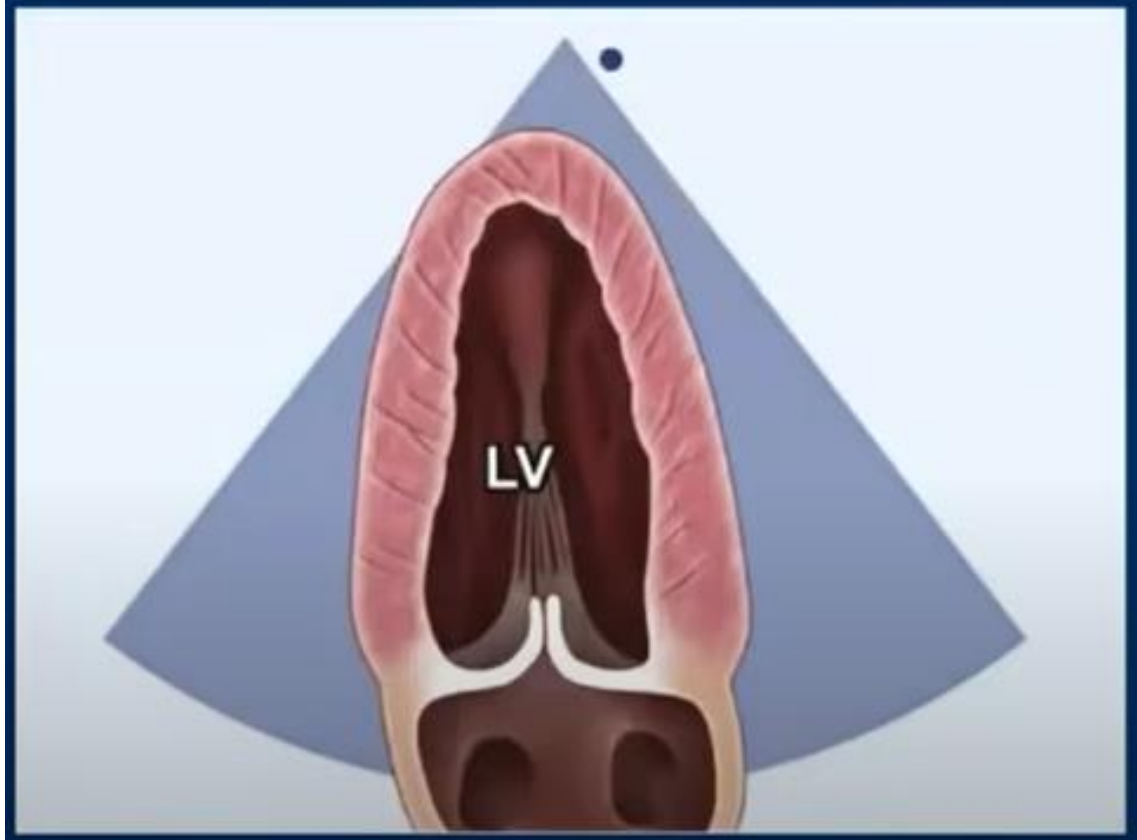


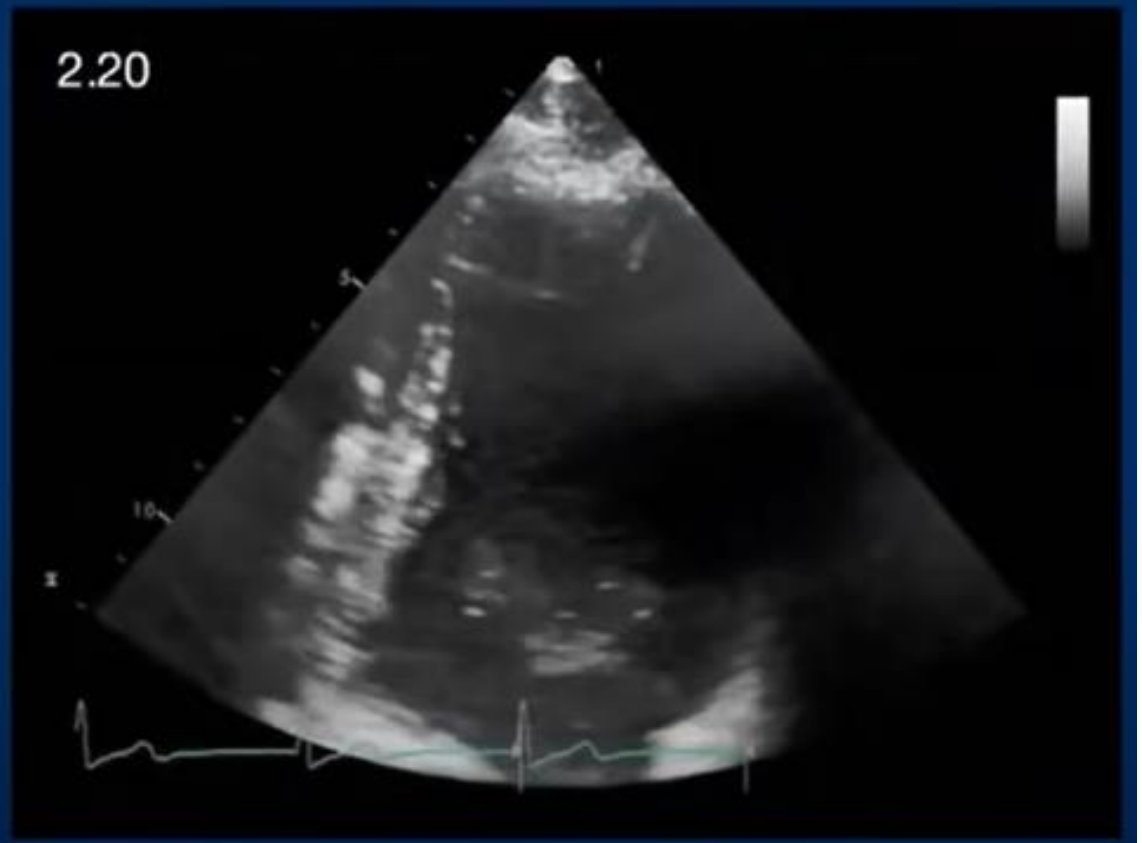


Apical – 2 Chamber

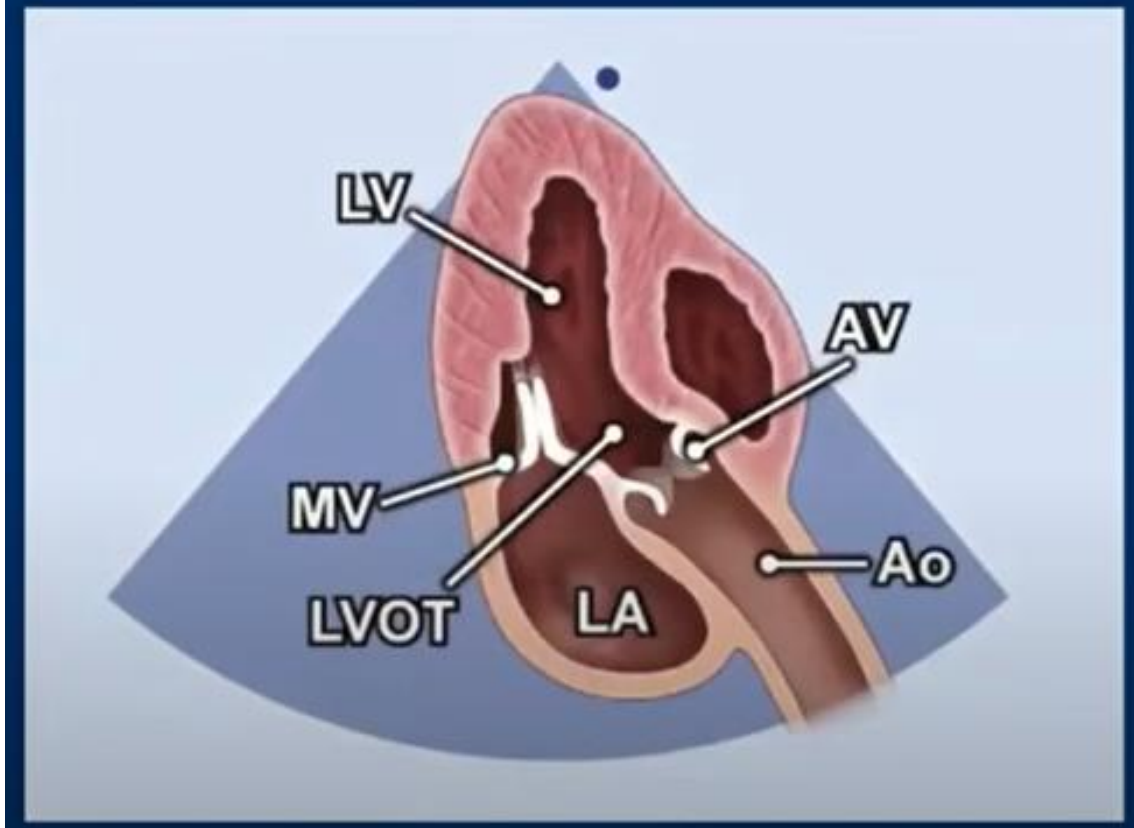


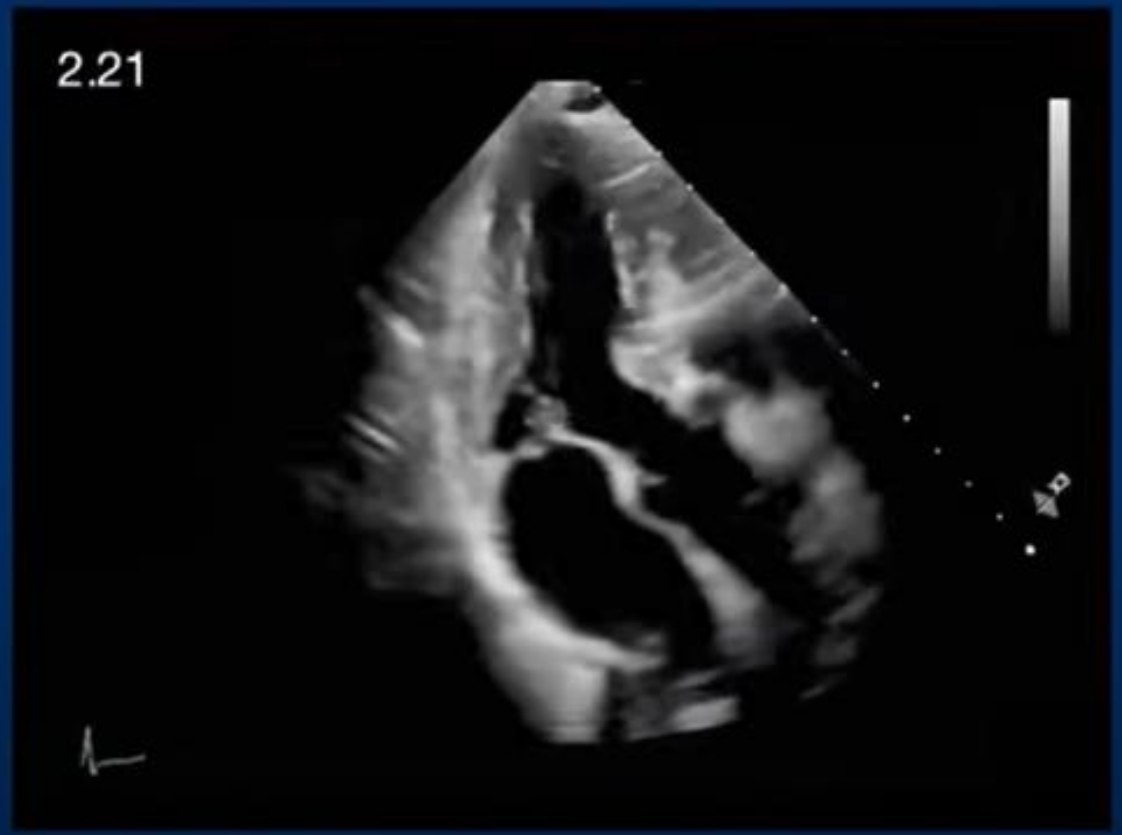
Apical – 2 Chamber Focused LV



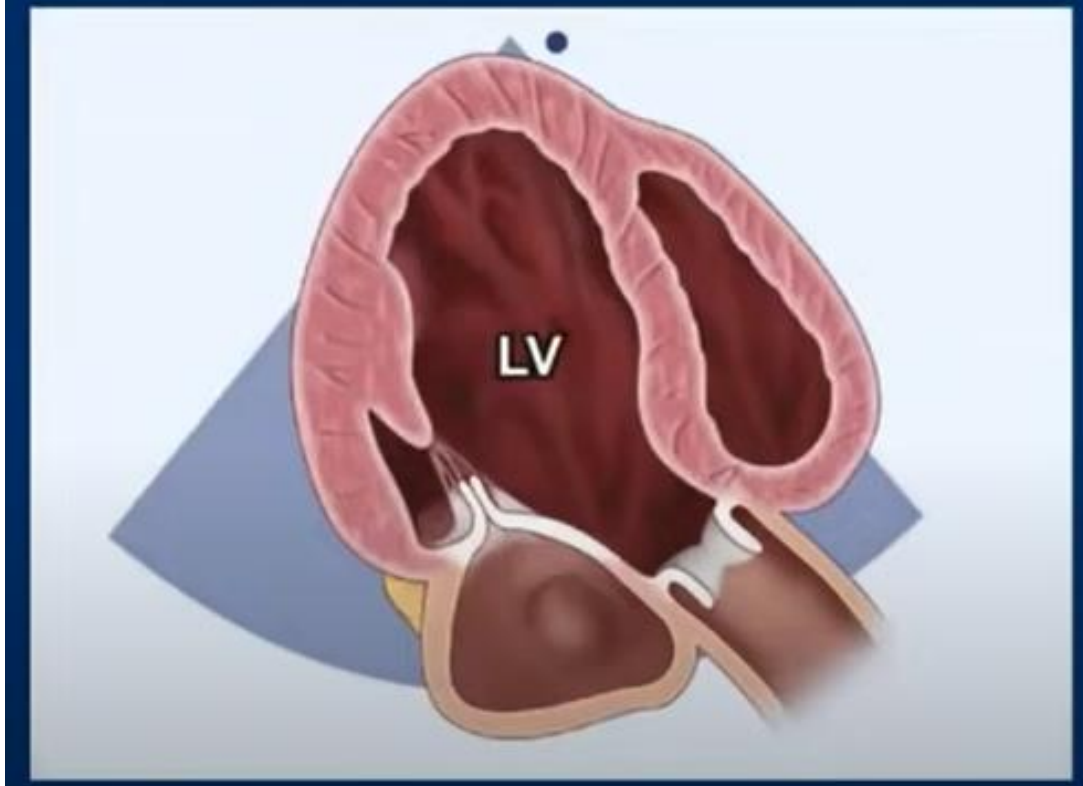


Apical – 3 Chamber





Apical – 3 Chamber Focused LV



Regional Wall Motion Maps

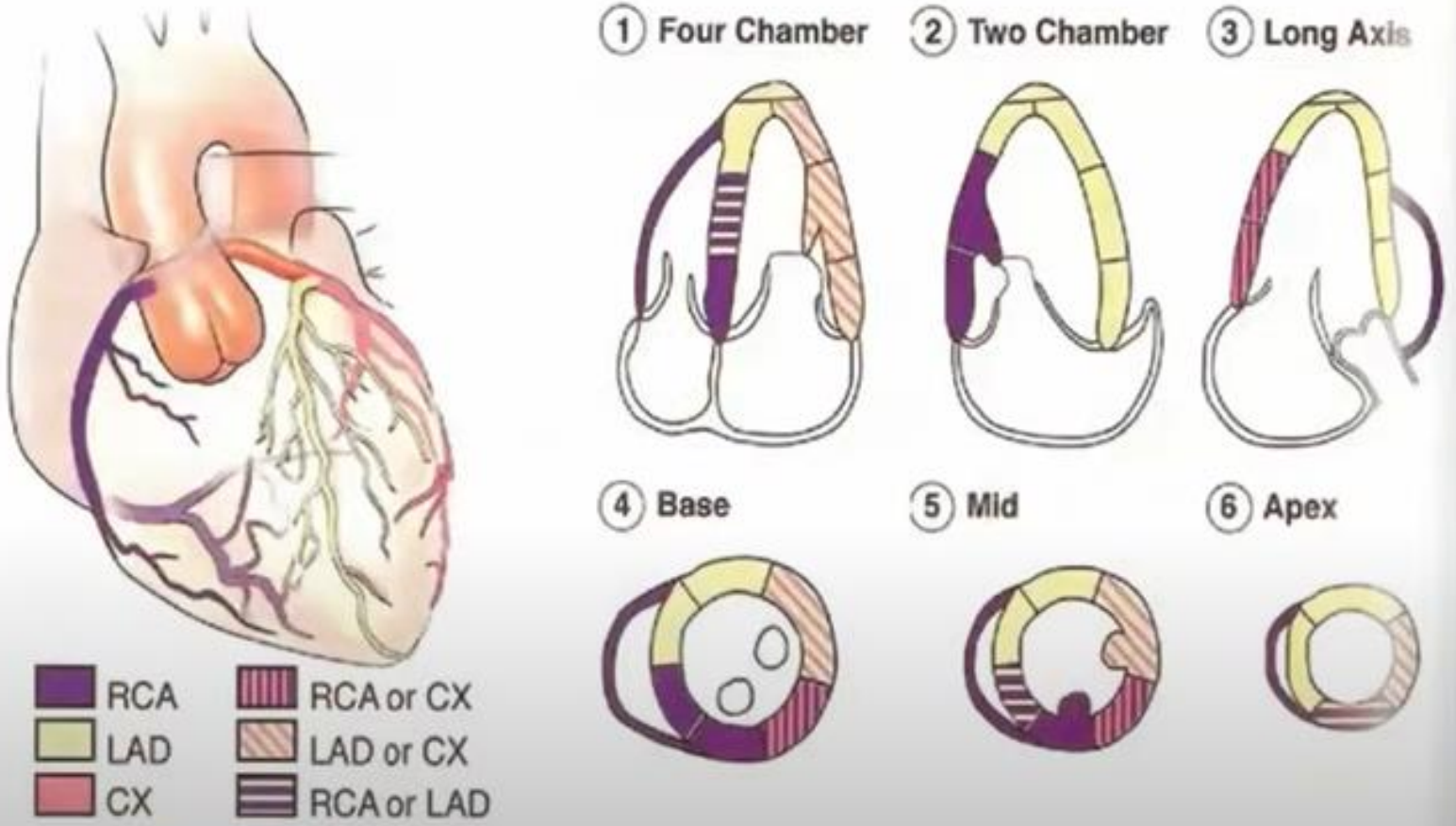
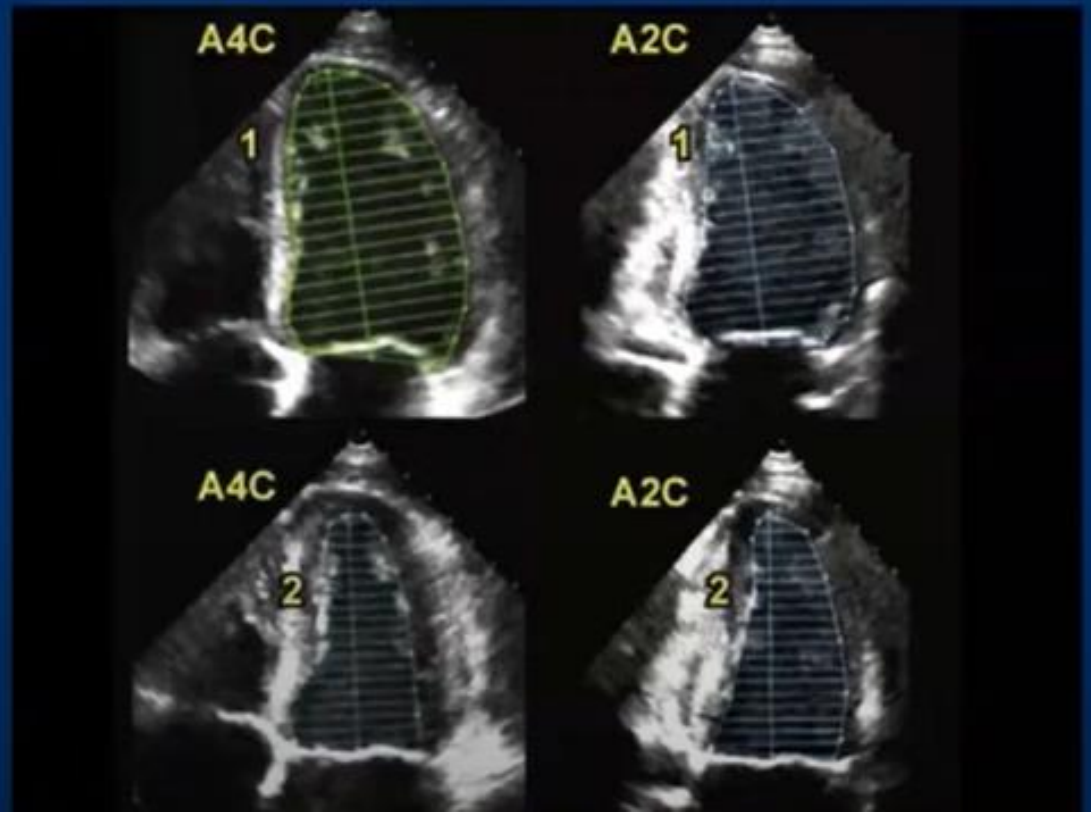


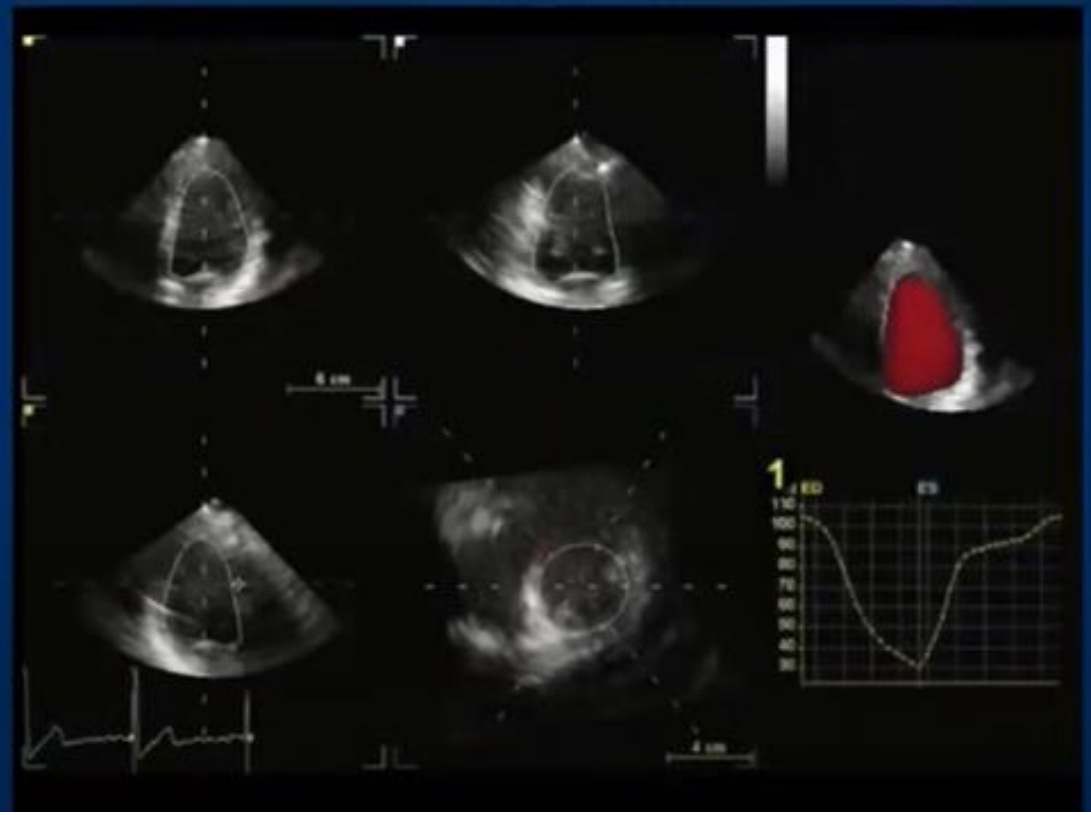
Figure 14–2. Typical coronary artery distribution of blood flow shown in the apical and parasternal short-axis views. CX, circumflex; LAD, left anterior descending; RCA, right coronary artery. (From Lang RM, Bierig M, Devereux RB, et al: J Am Soc Echocardiogr 18[12]:1440-1463, 2005.)

Apical –LV Volume/Function Quantification

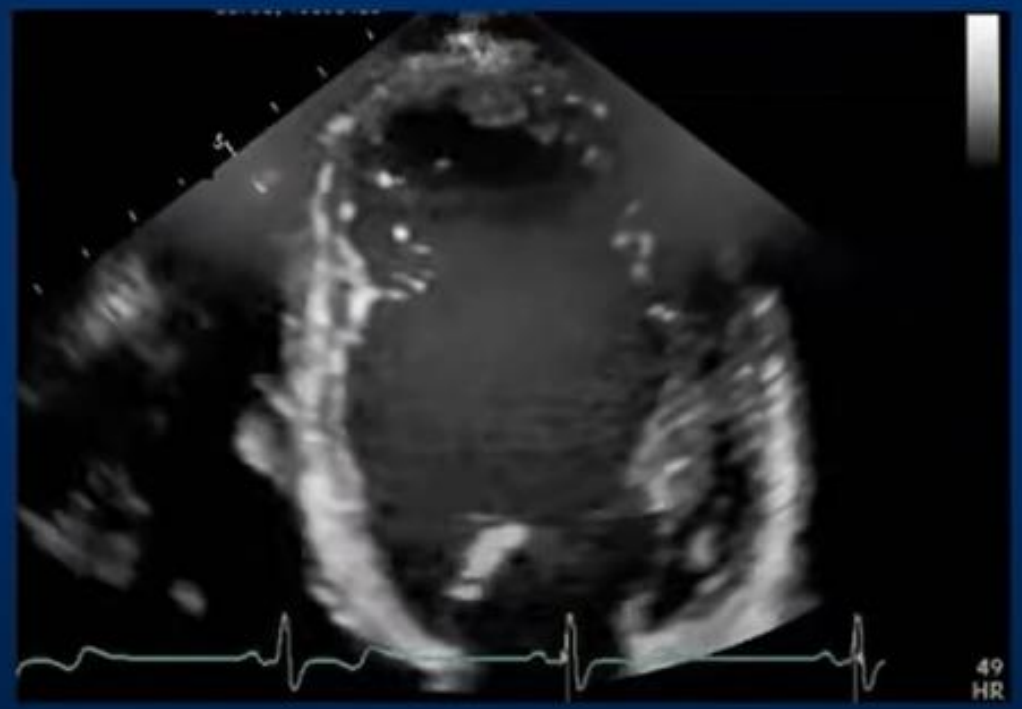
2D – Method of Disks

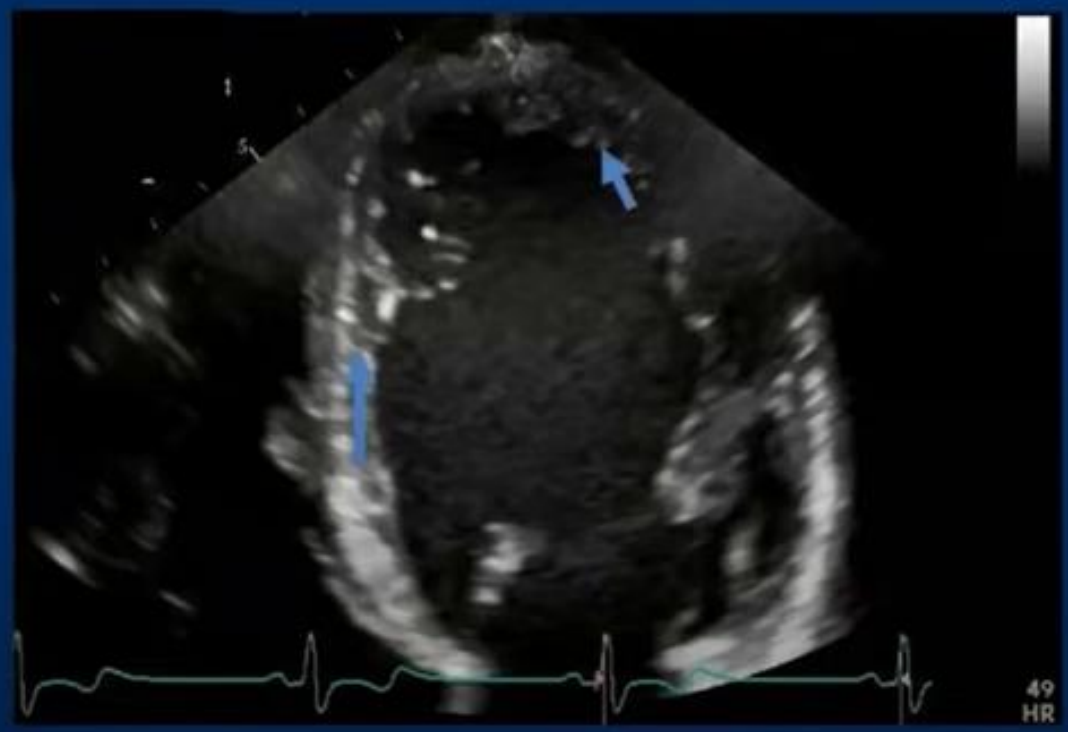


3D Method



Measure at the Compacted Myocardium

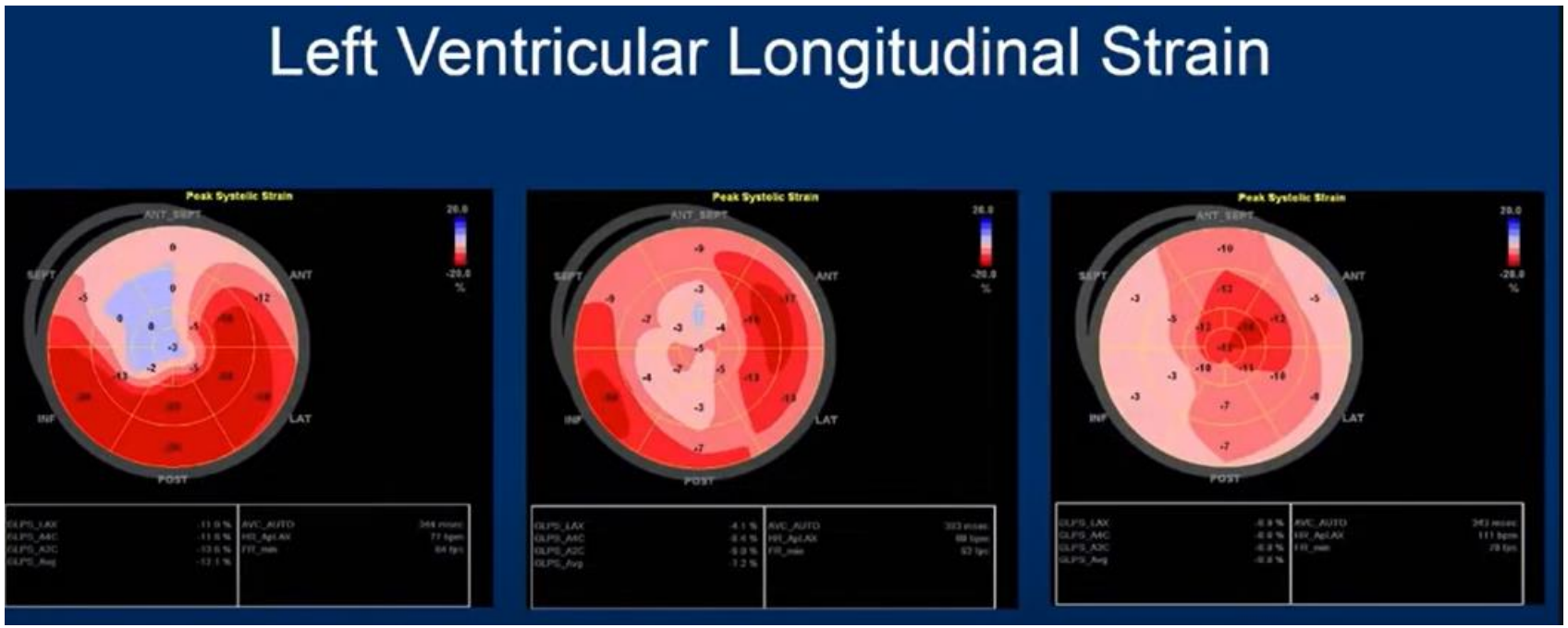




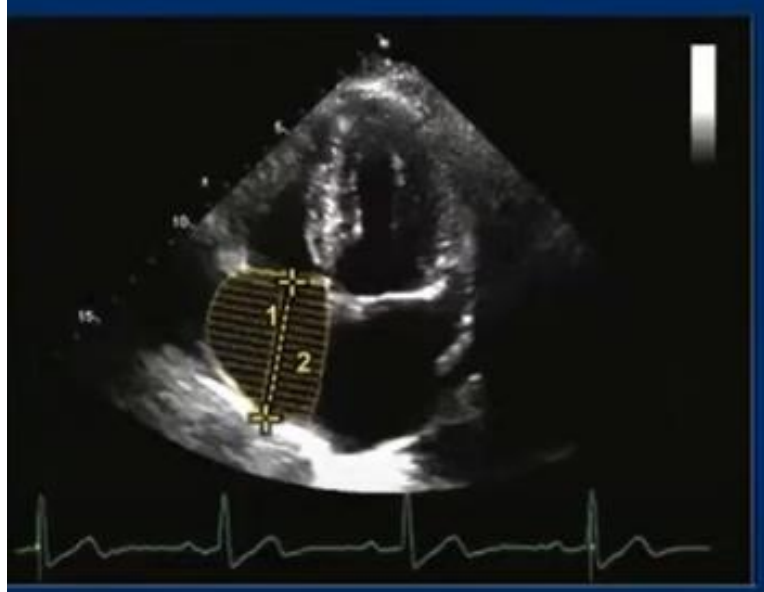
Measuring LV Volumes

Measurement using the compacted interface

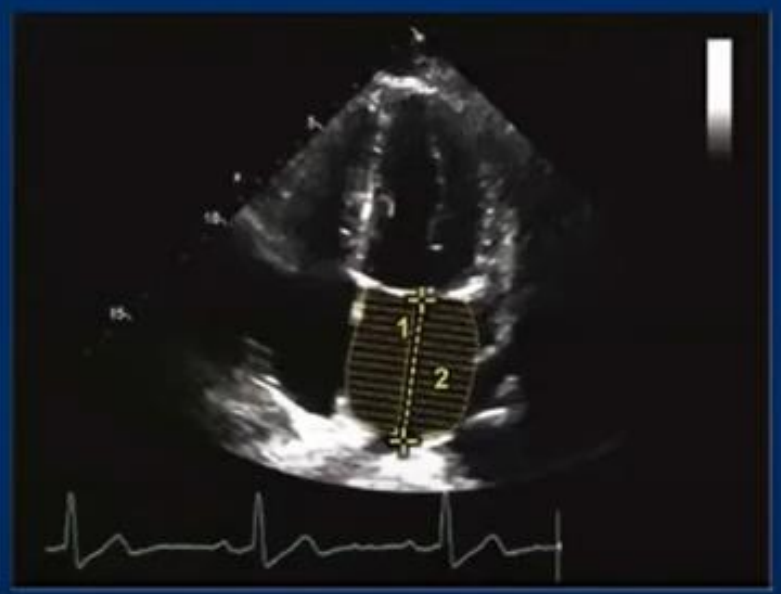
Left Ventricular Longitudinal Strain



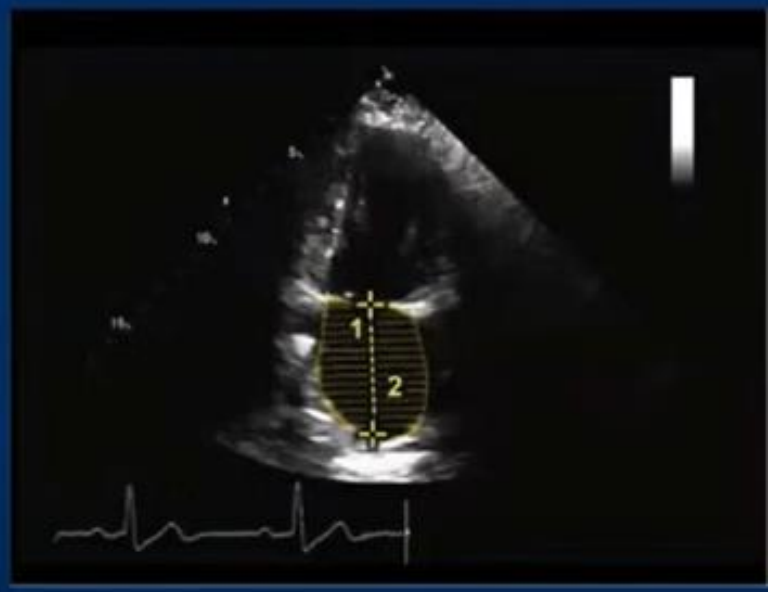
Apical – Atrial Volume Measurements



RA

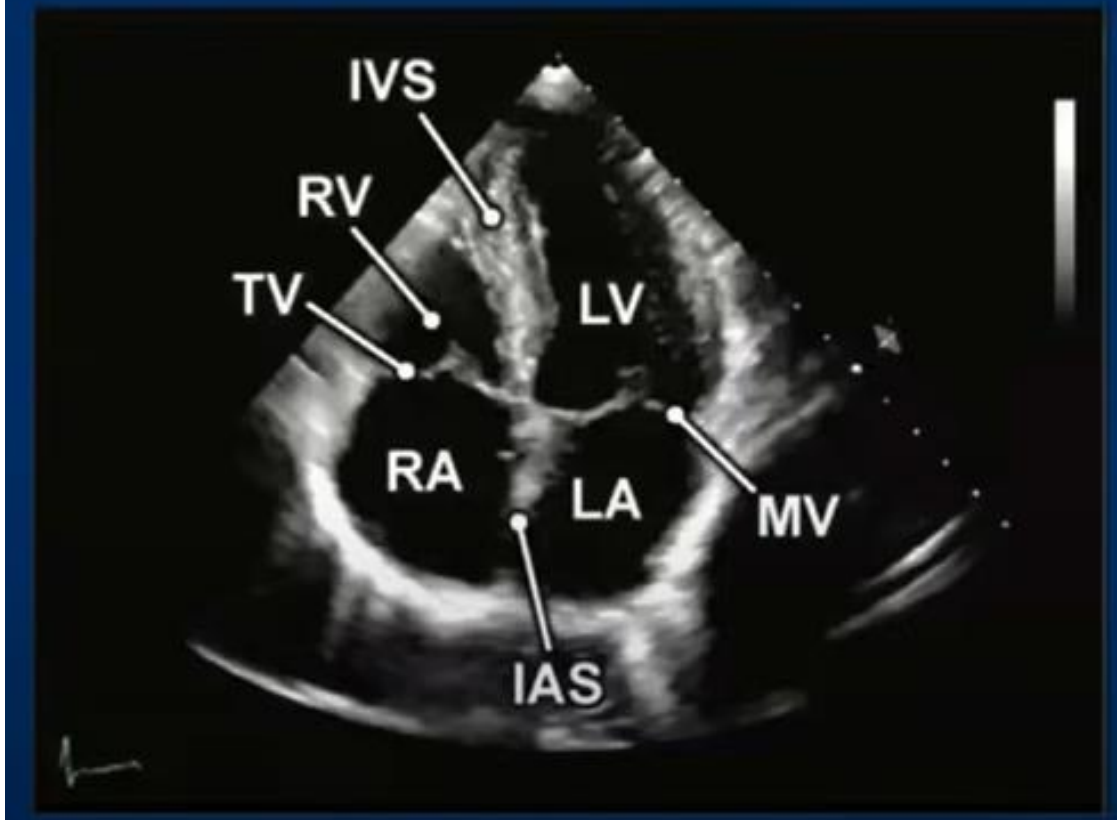


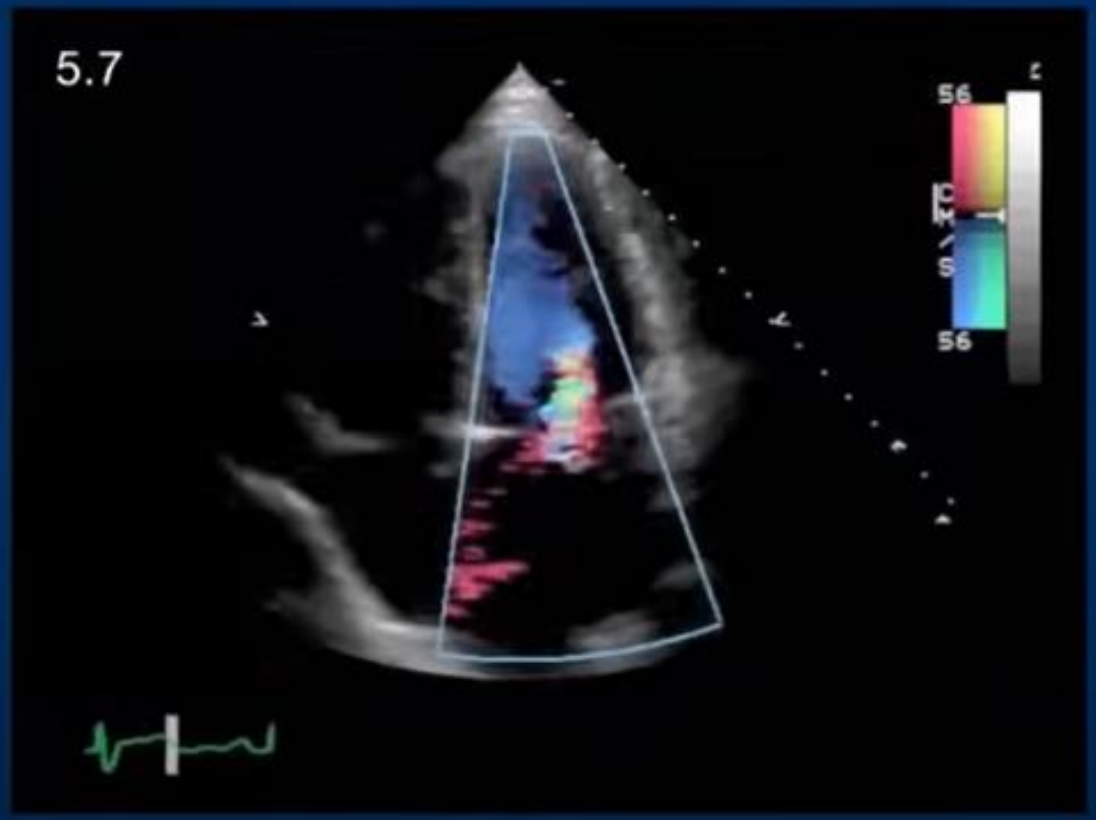
LA – 4 Chamber



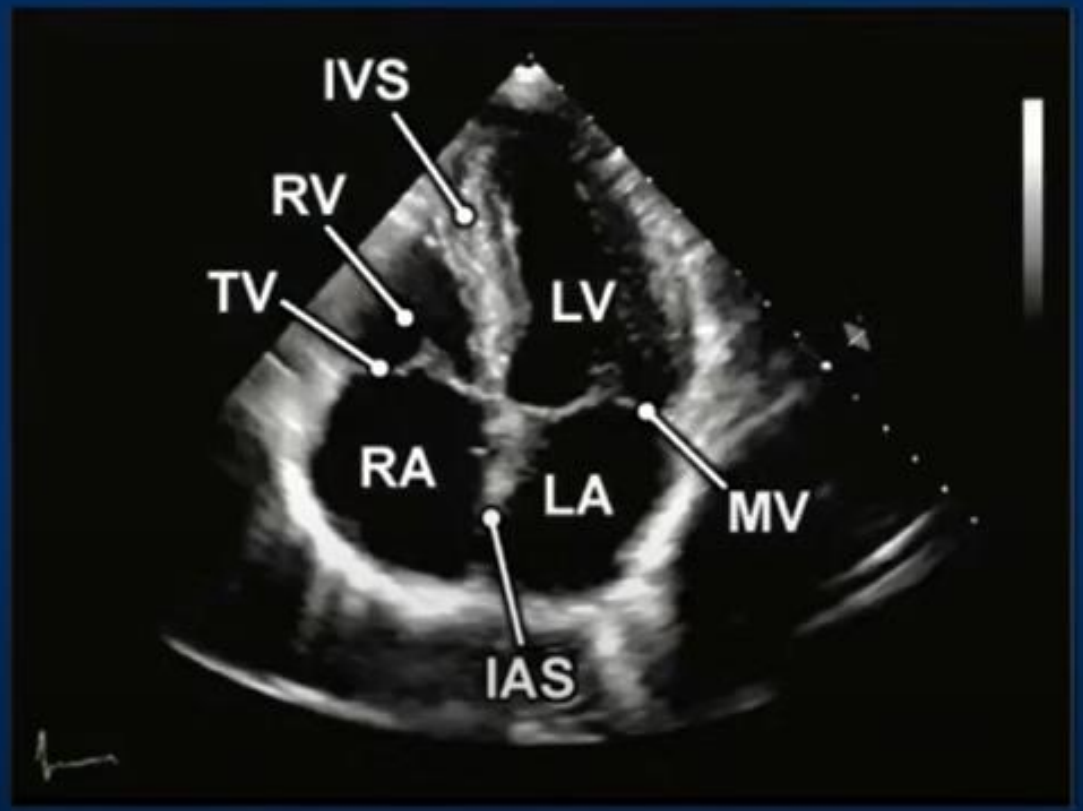
LA – 2 Chamber

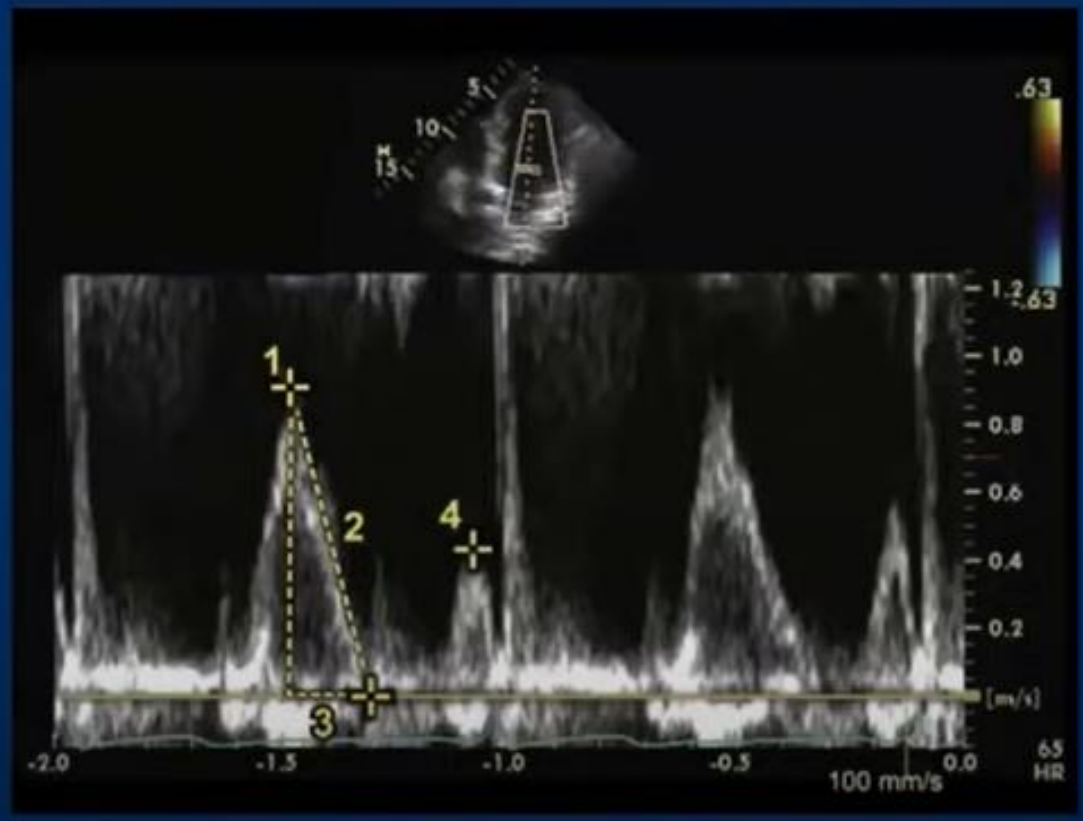
Apical – 4 Chamber



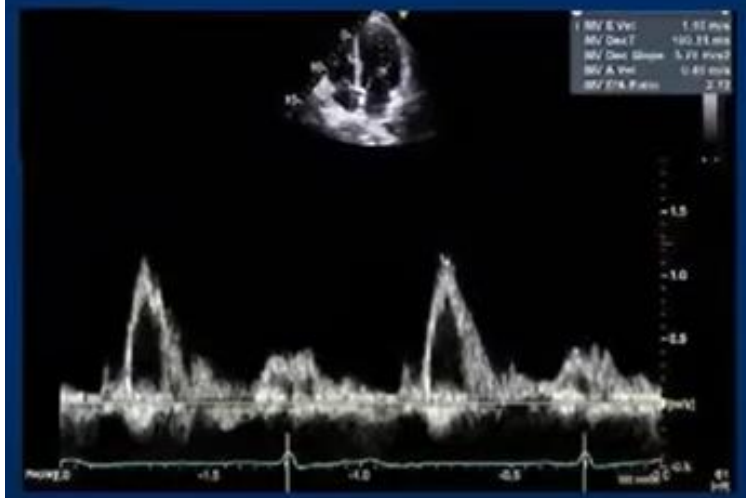


Apical 4C– Normal LV Inflow PW Doppler

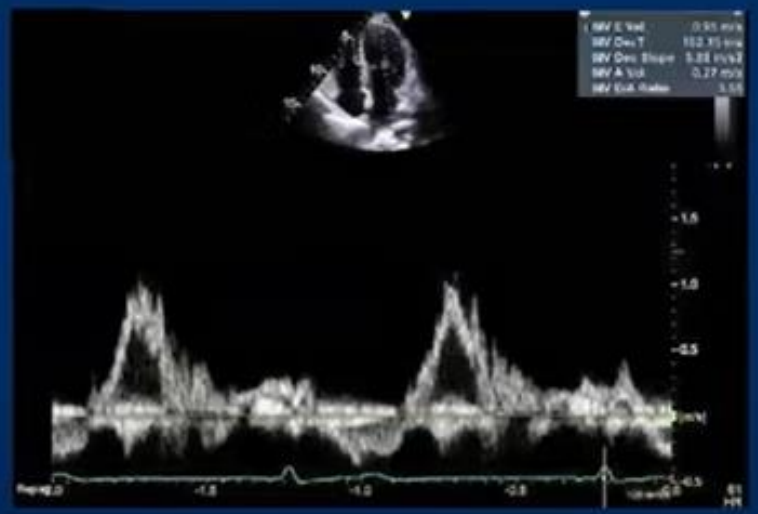




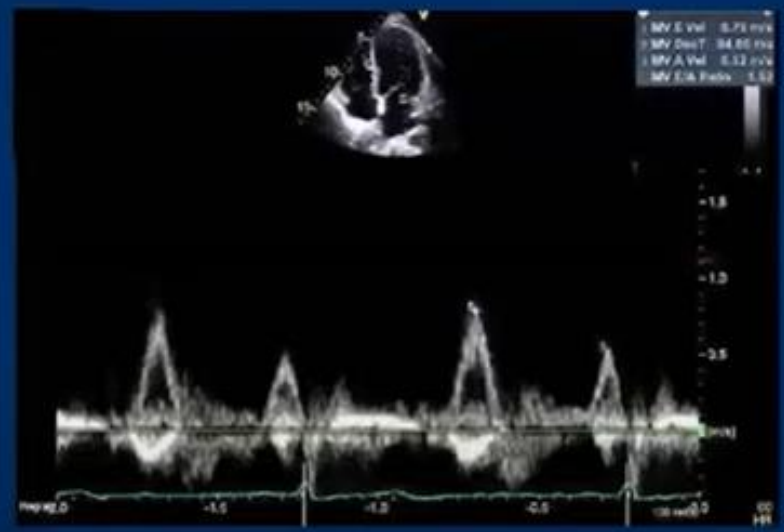
Effect of Sample Volume Location: MV



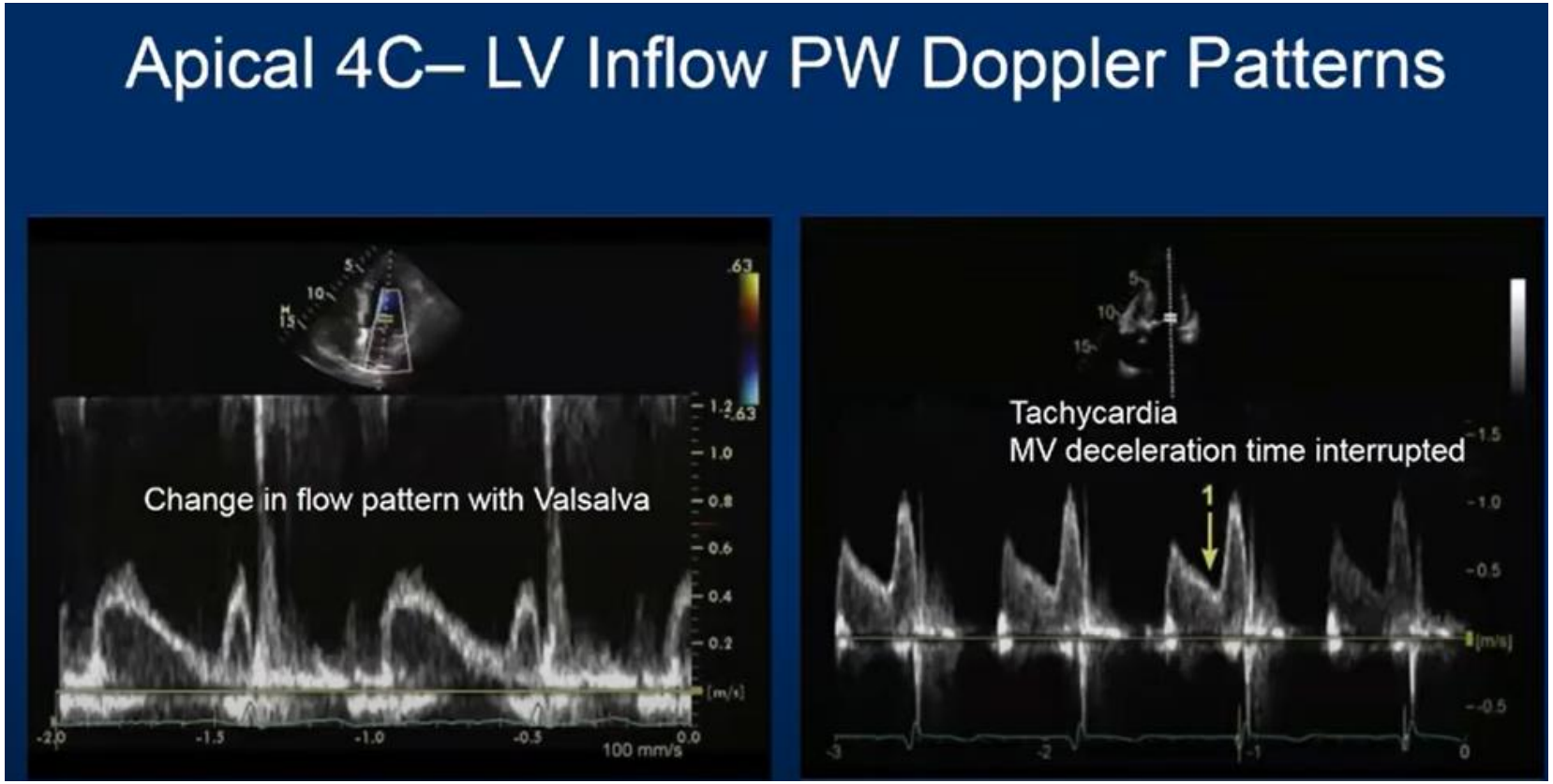
Normal position



Too apical

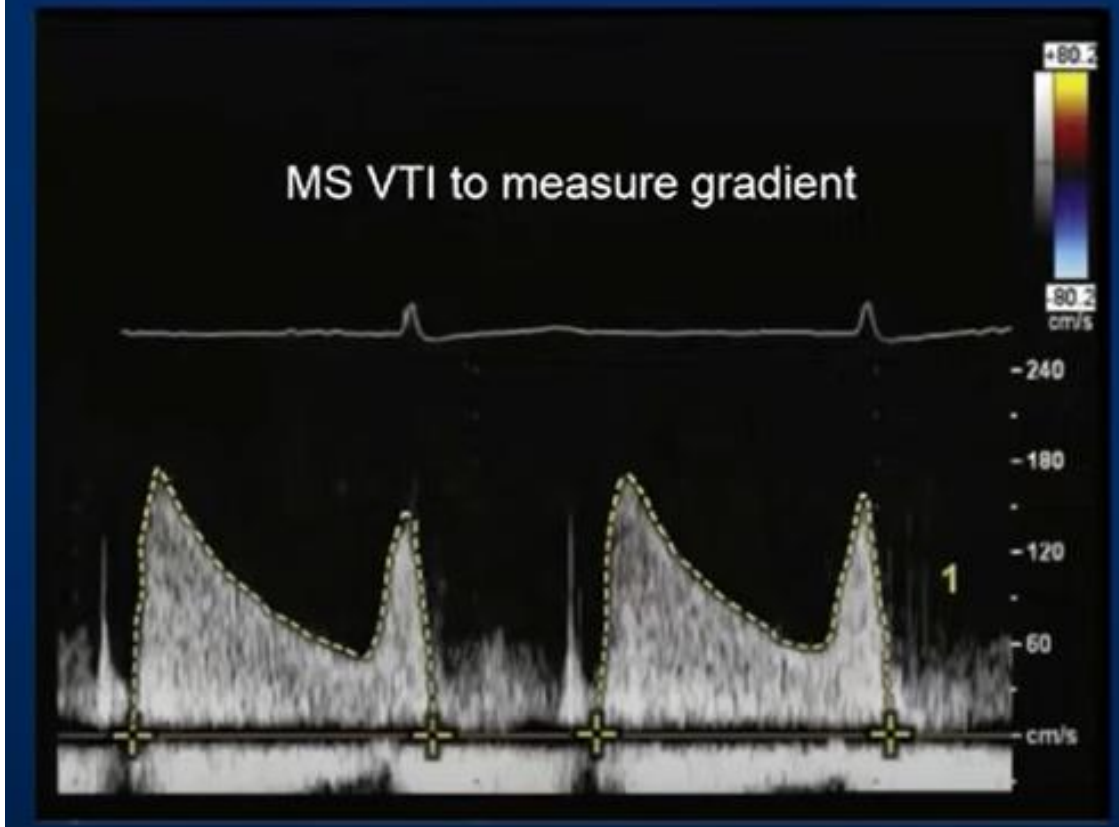


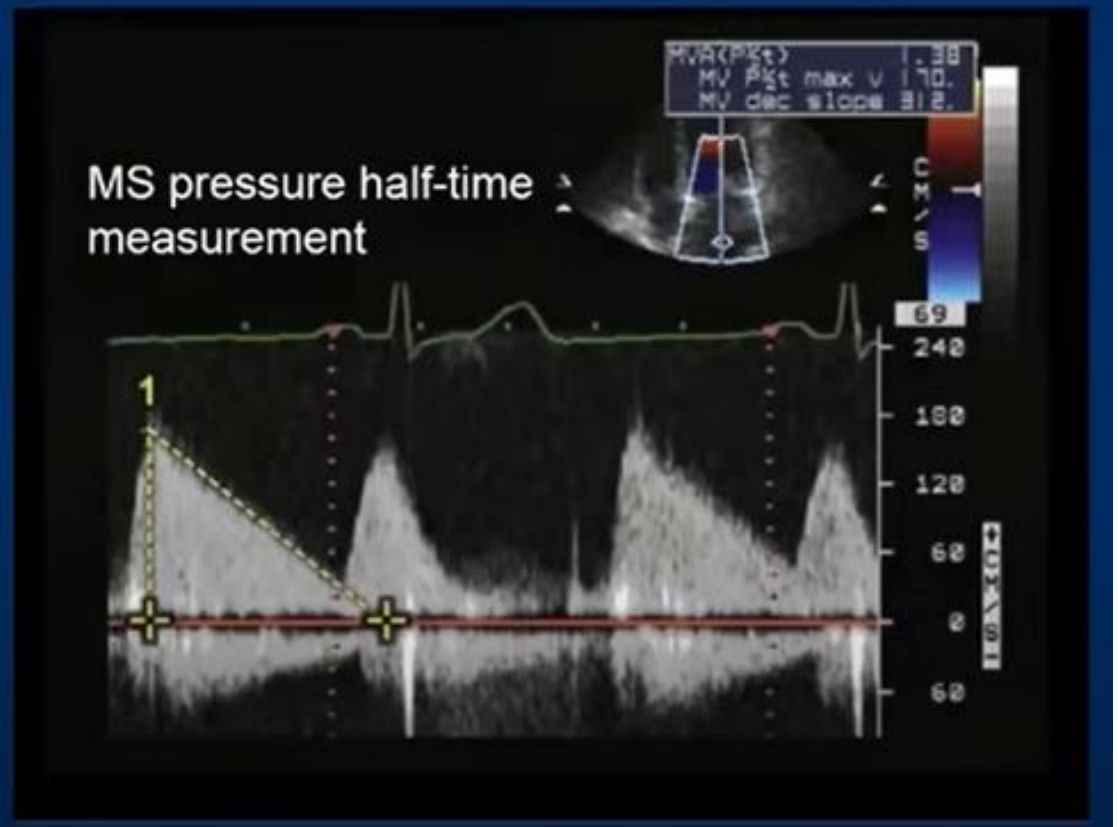
Too atrial



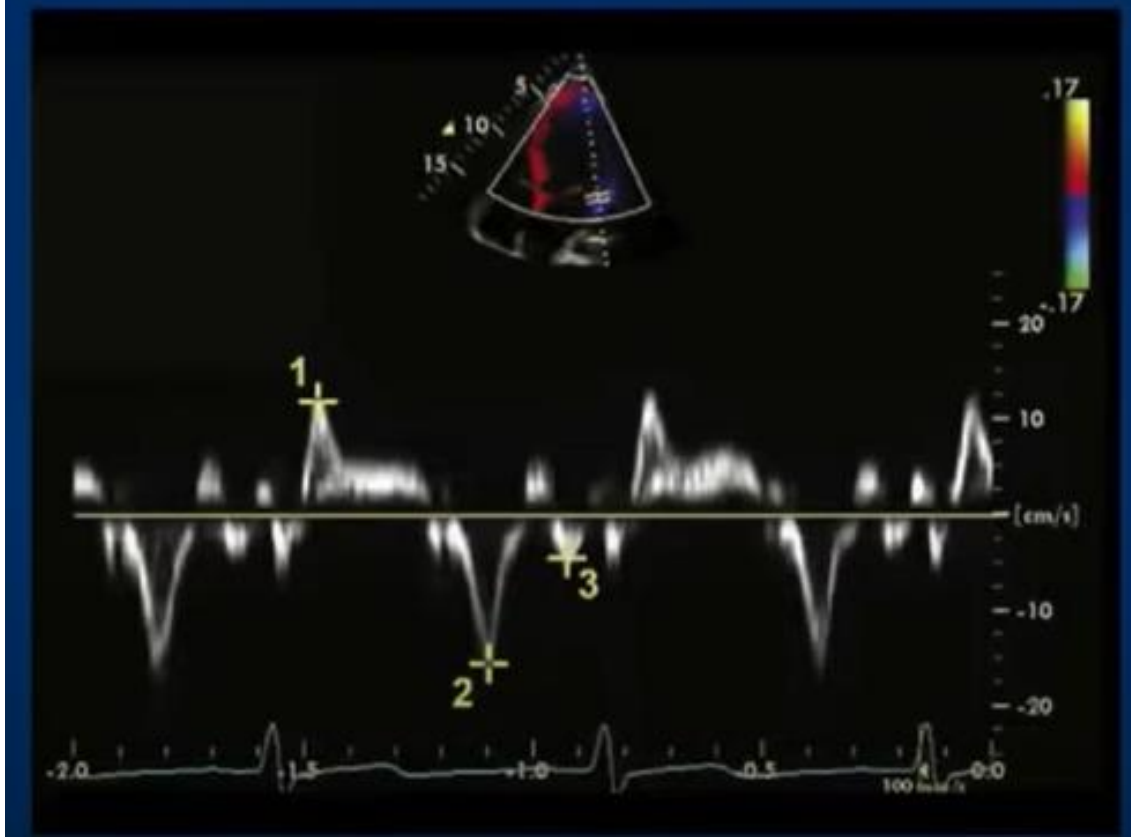
Not measure the DT in cases the v>20cm/sec (1)

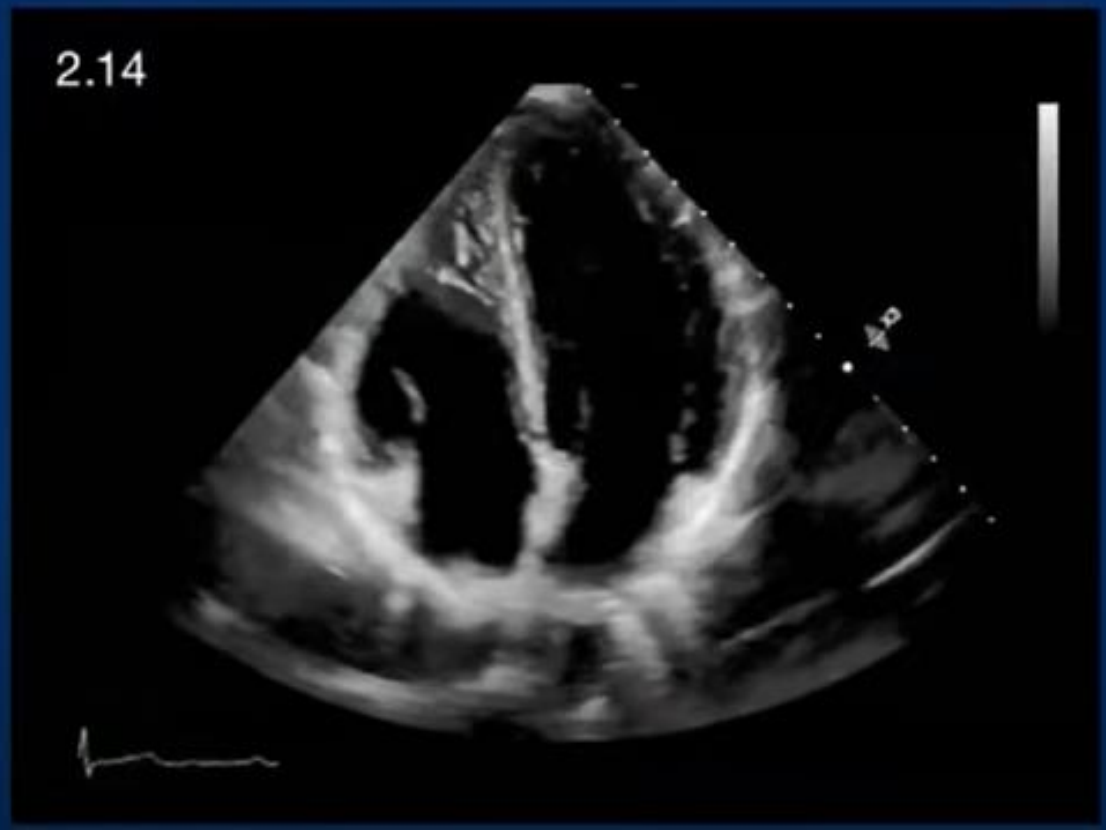
Apical 4C-CW Doppler MS Measurements



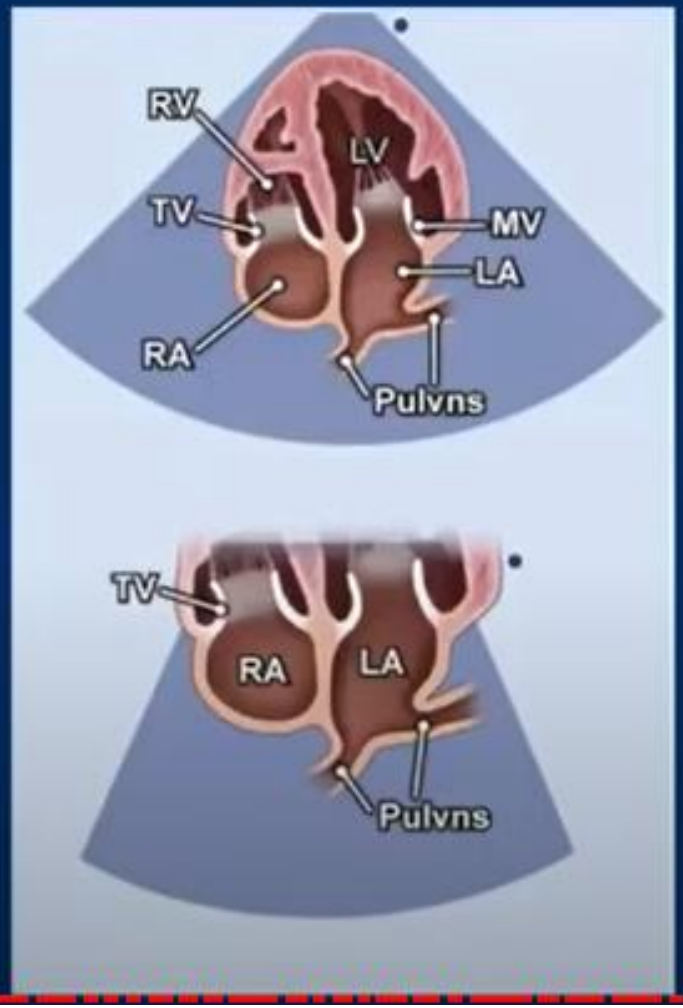


Apical 4C– Tissue Doppler Imaging

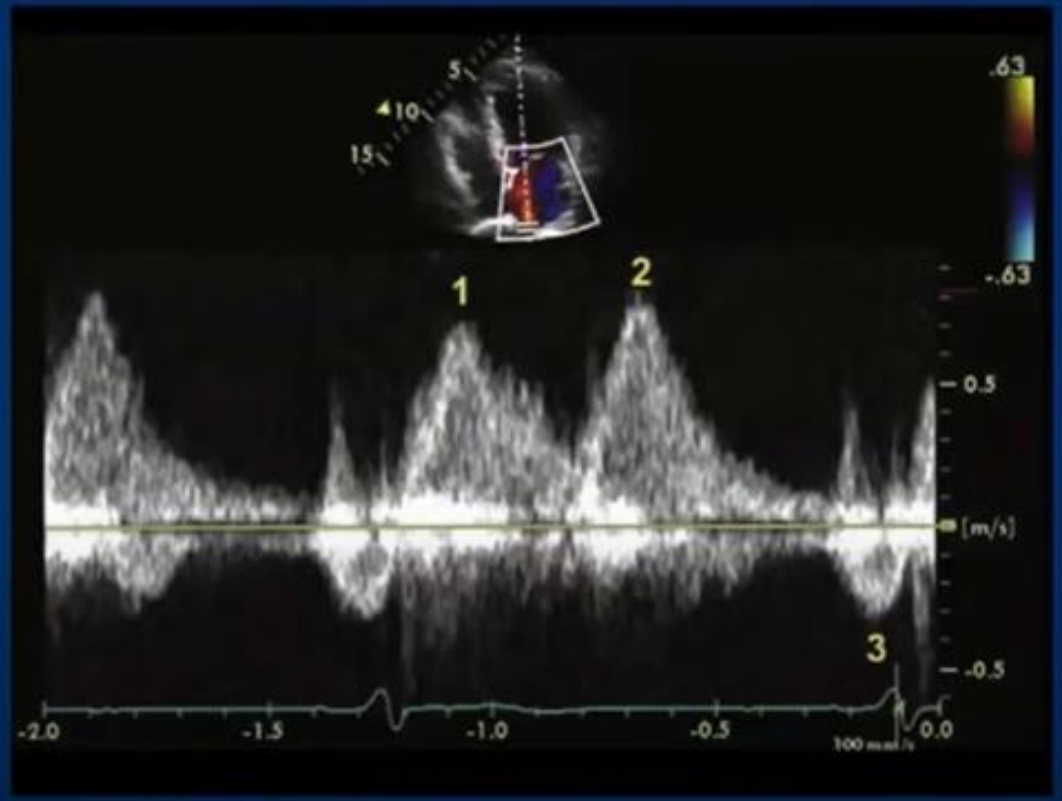




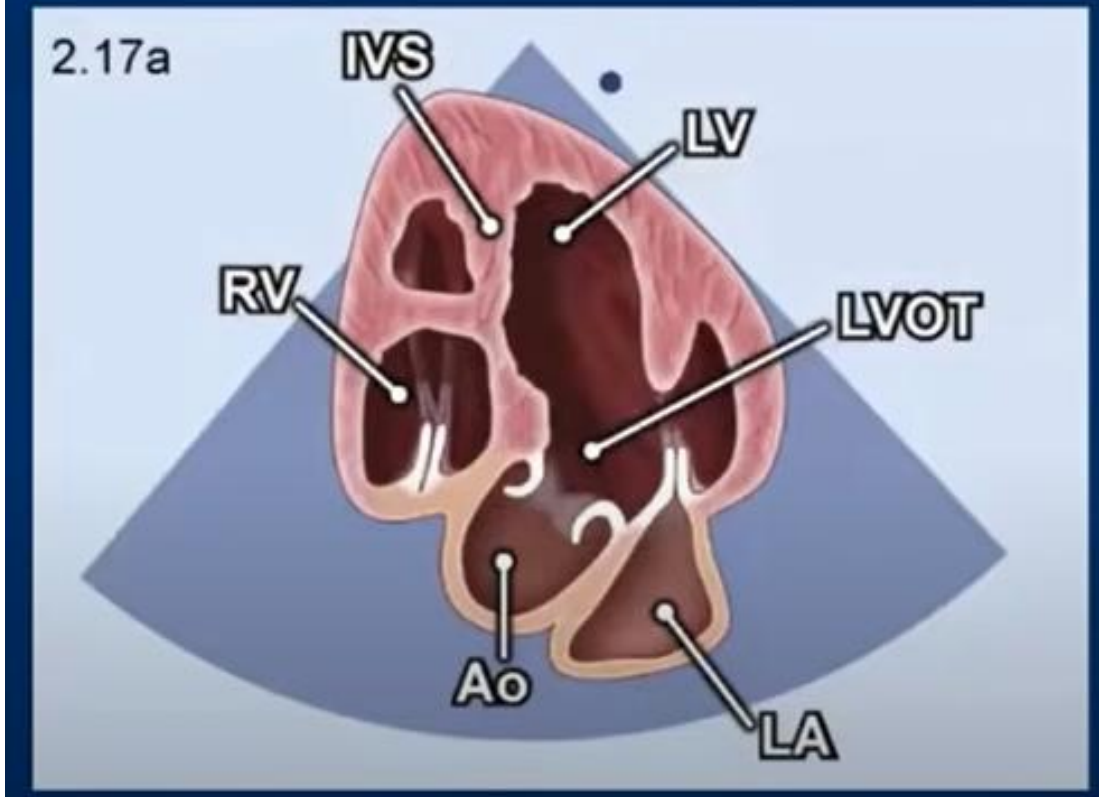
Apical 4C-Pulmonary Veins



Apical 4C-Pulmonary Veins PW Doppler

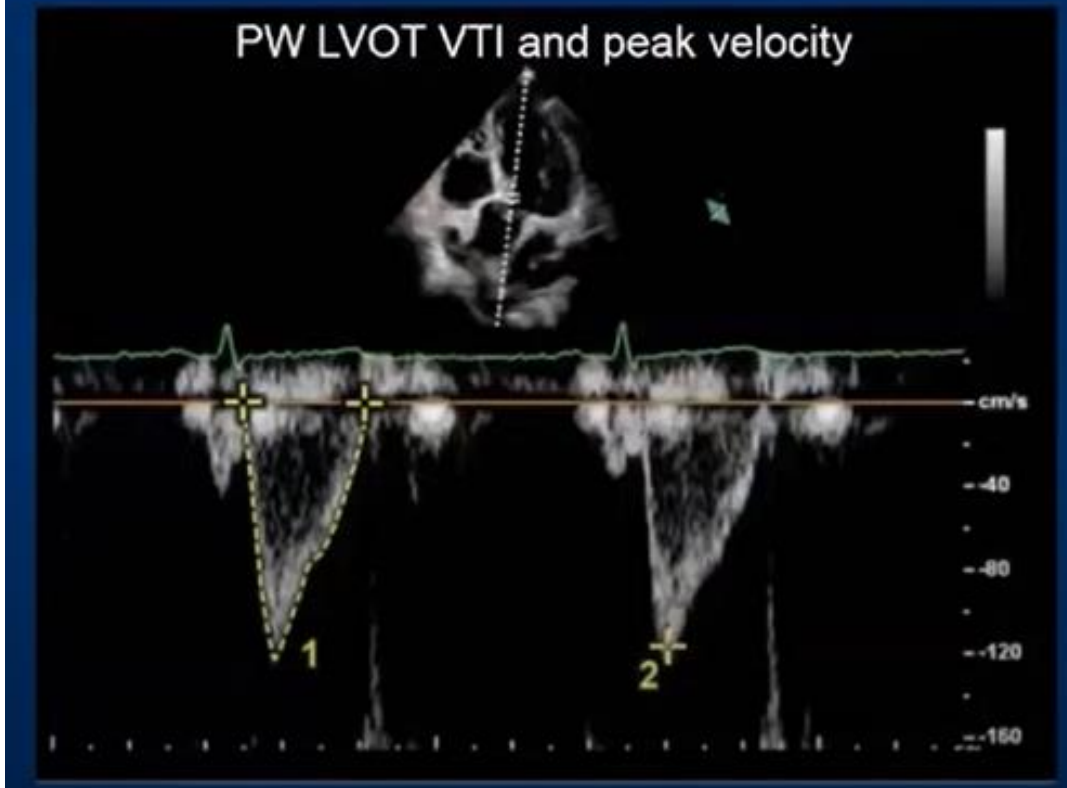


Apical – 5 Chamber

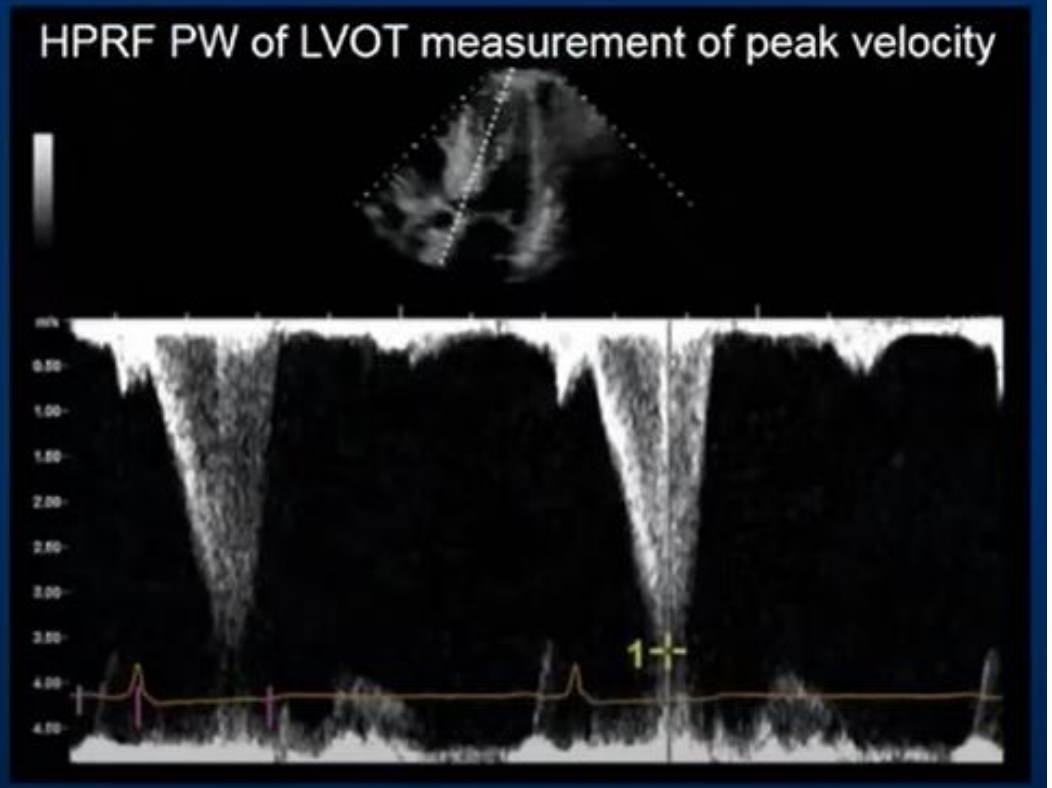


Apical - LVOT Doppler Measurements

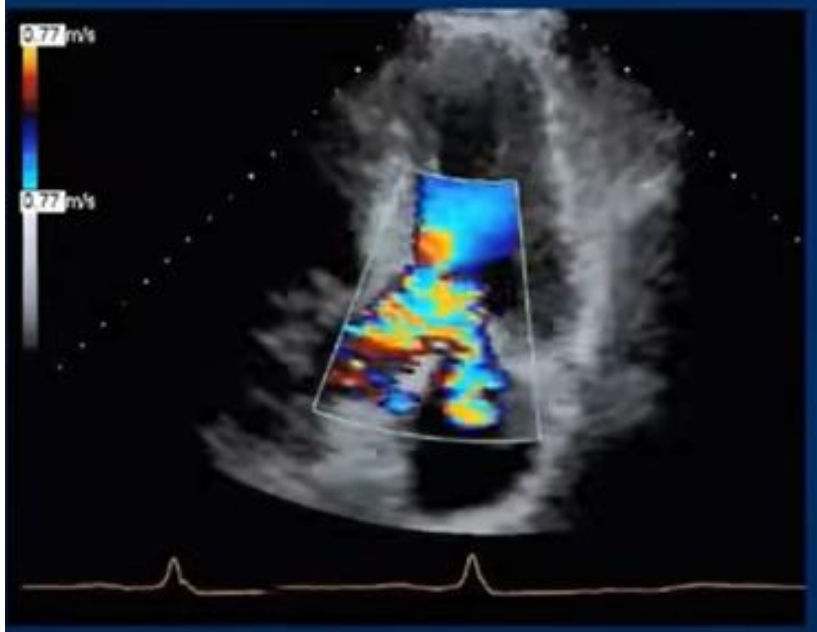
PW LVOT VTI and peak velocity

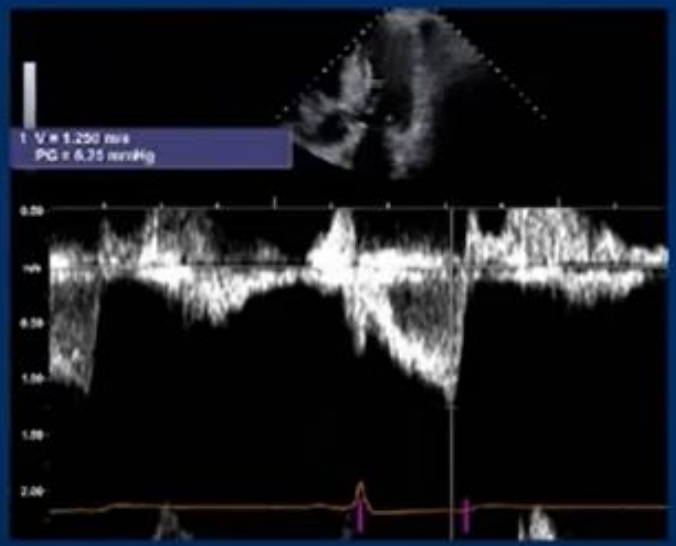


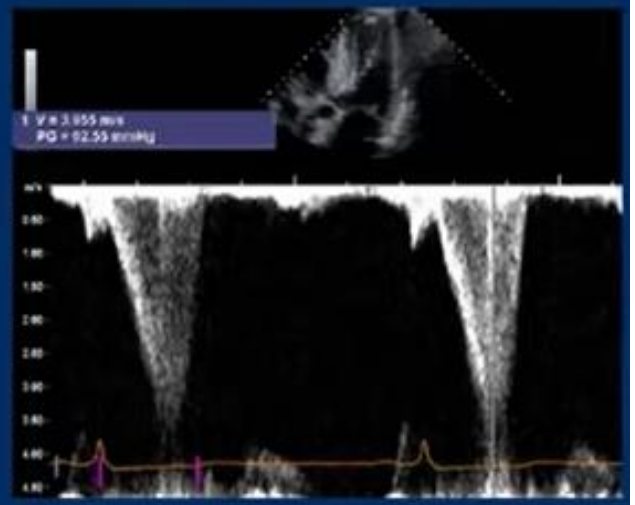
HPRF PW of LVOT measurement of peak velocity

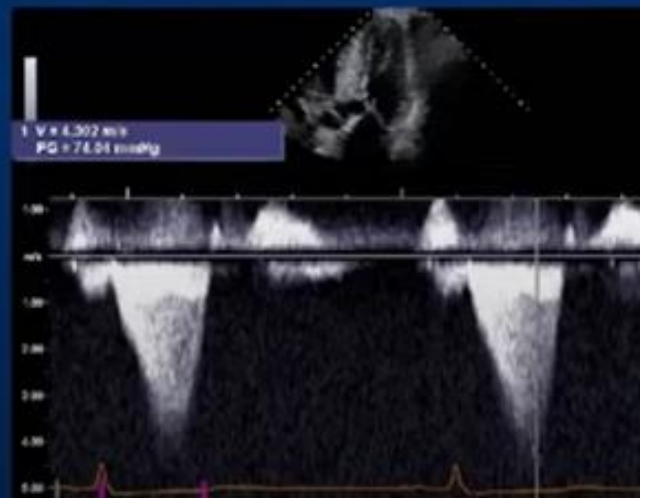


Mapping the LVOT: Color, PW, HPRF, CW

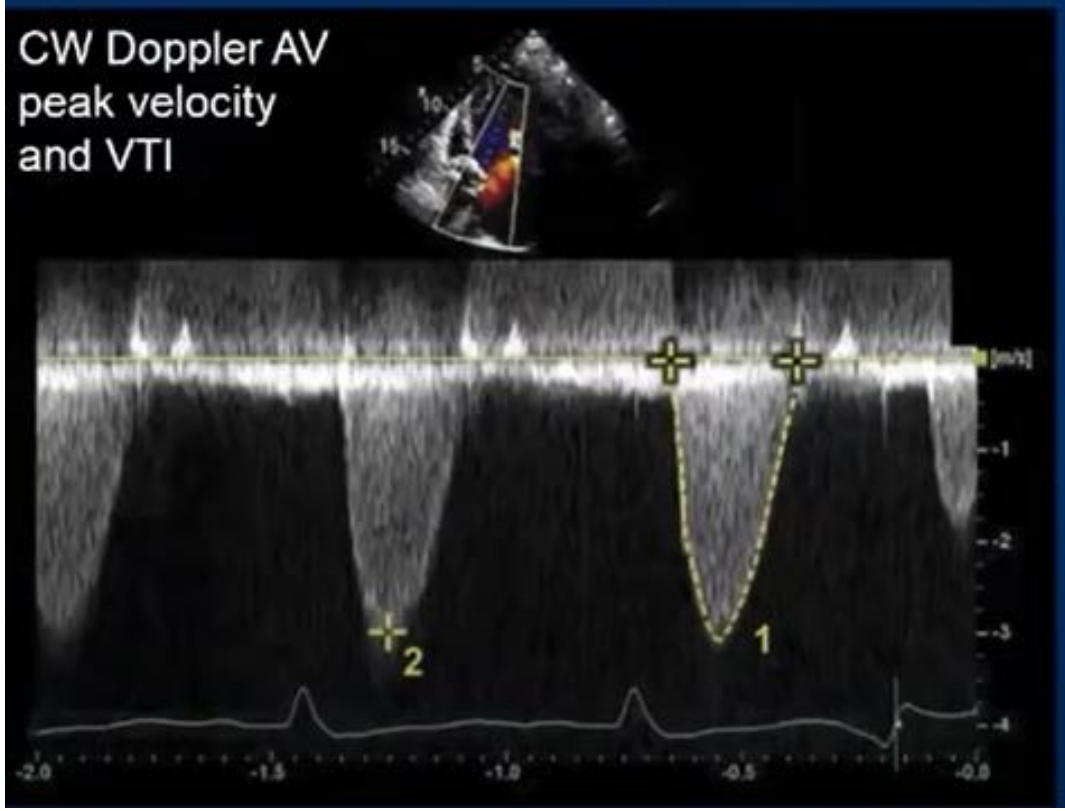


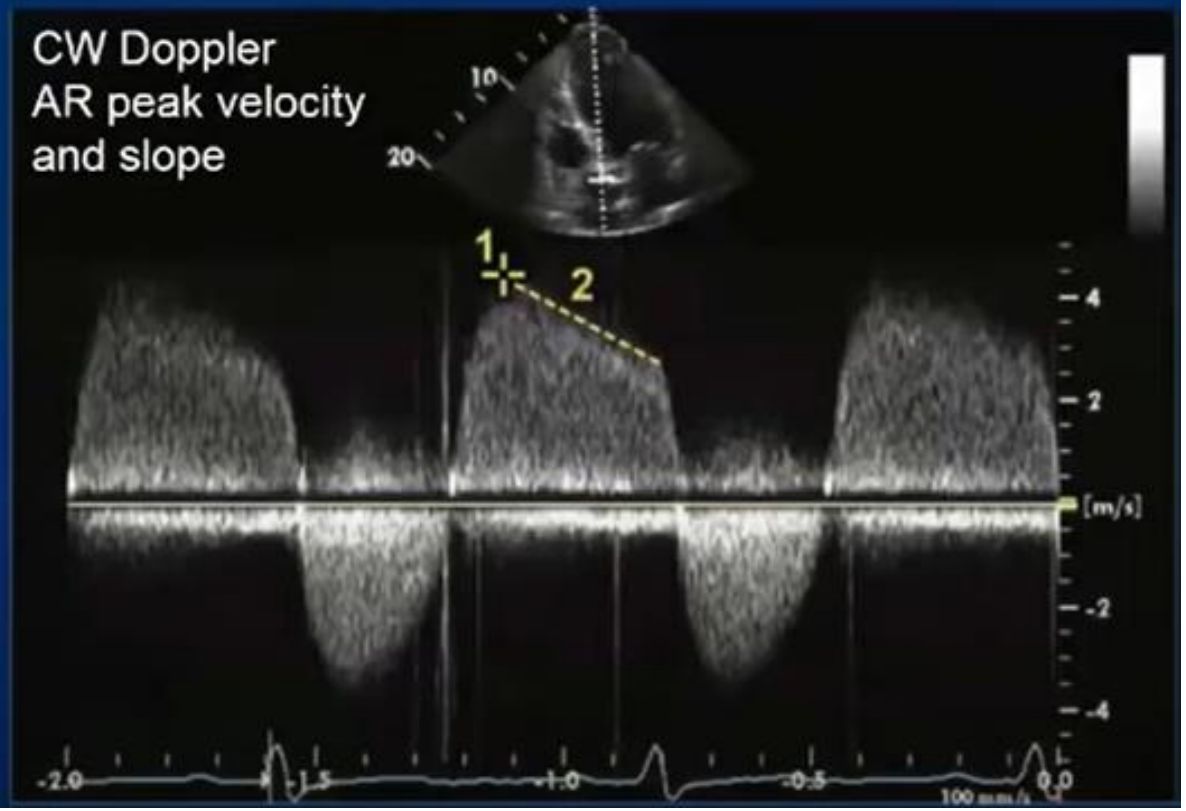




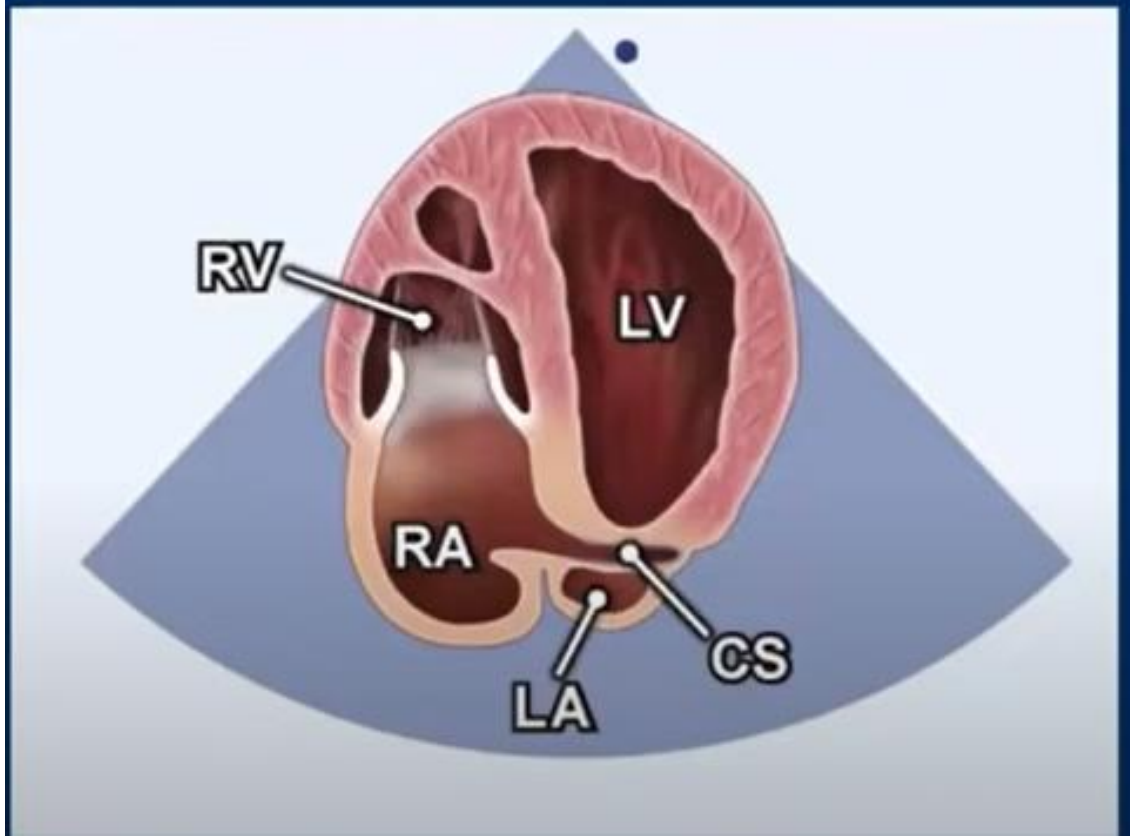


Apical – AV CW Doppler Measurements

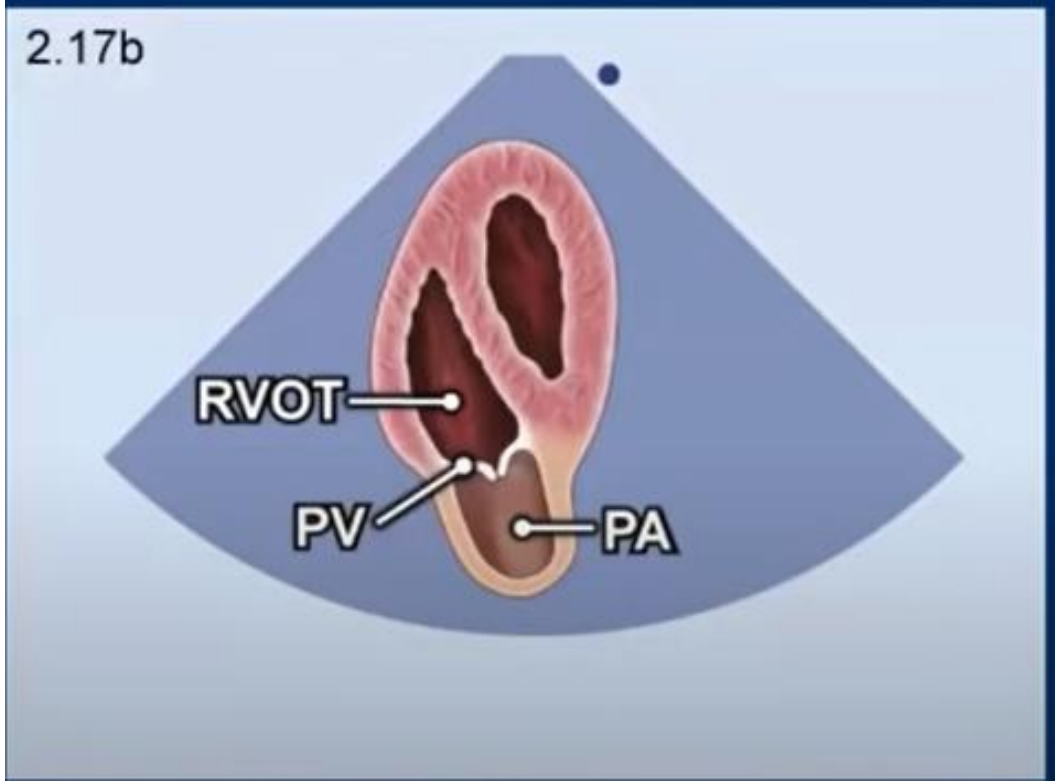


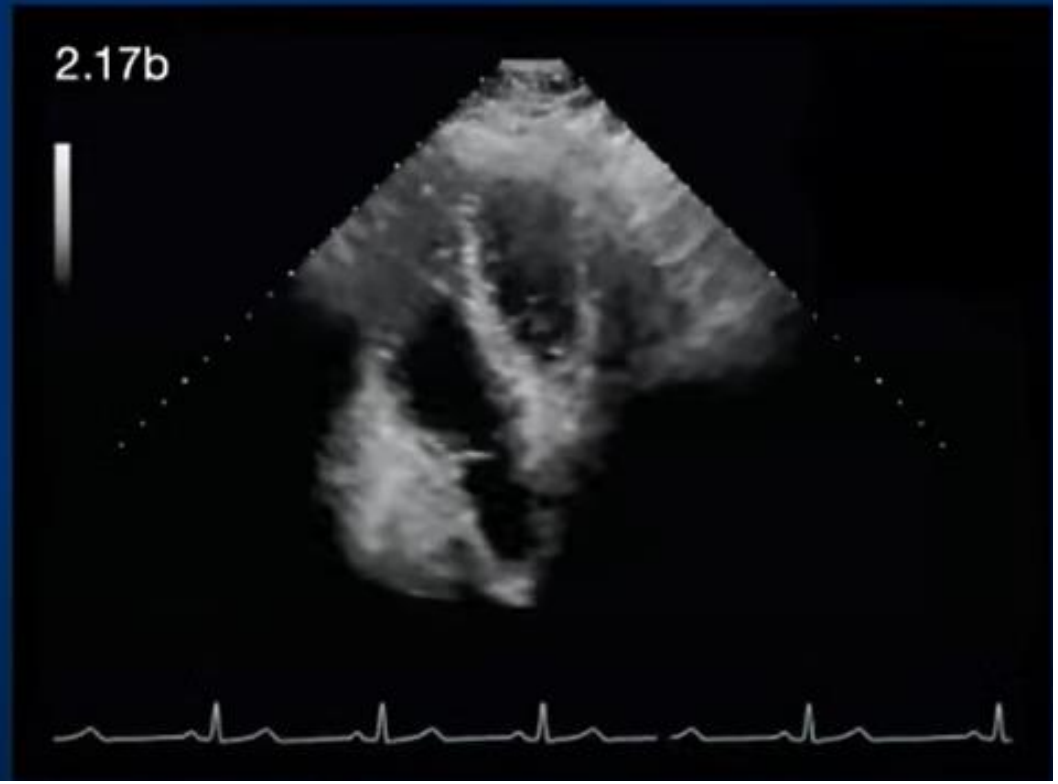


Apical – Coronary Sinus

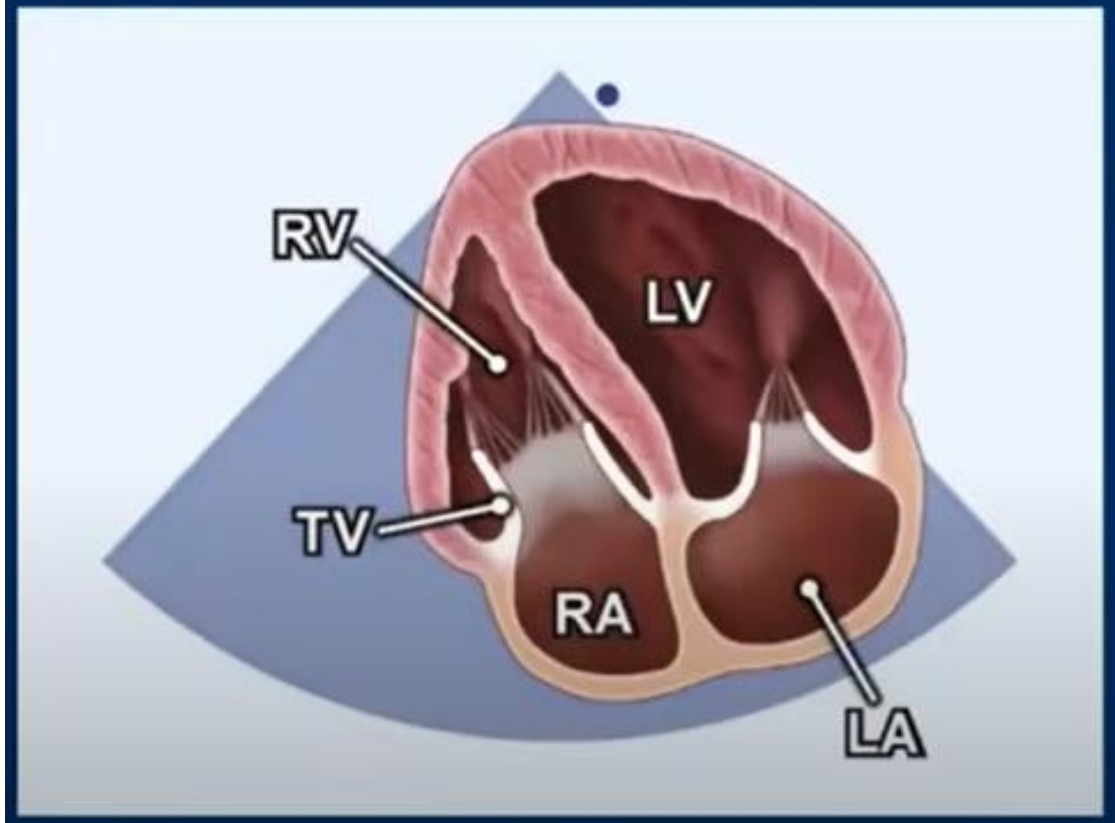


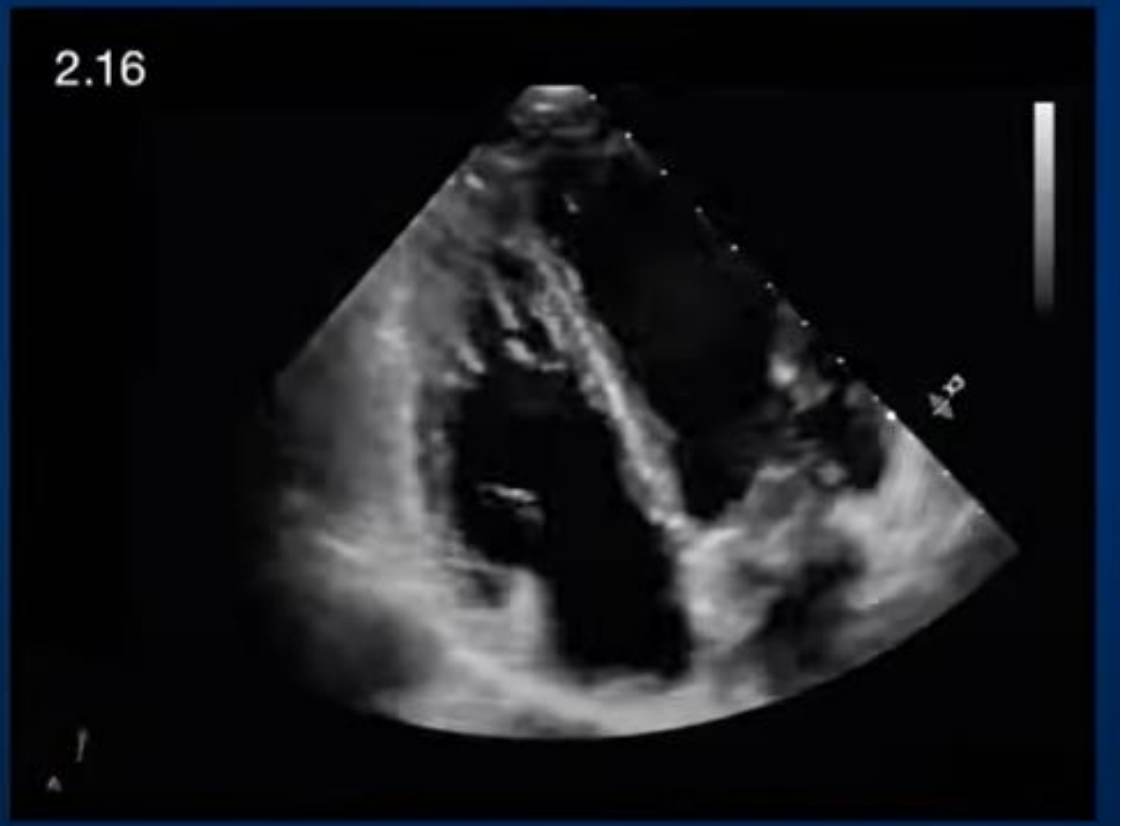
Apical – RVOT / PV



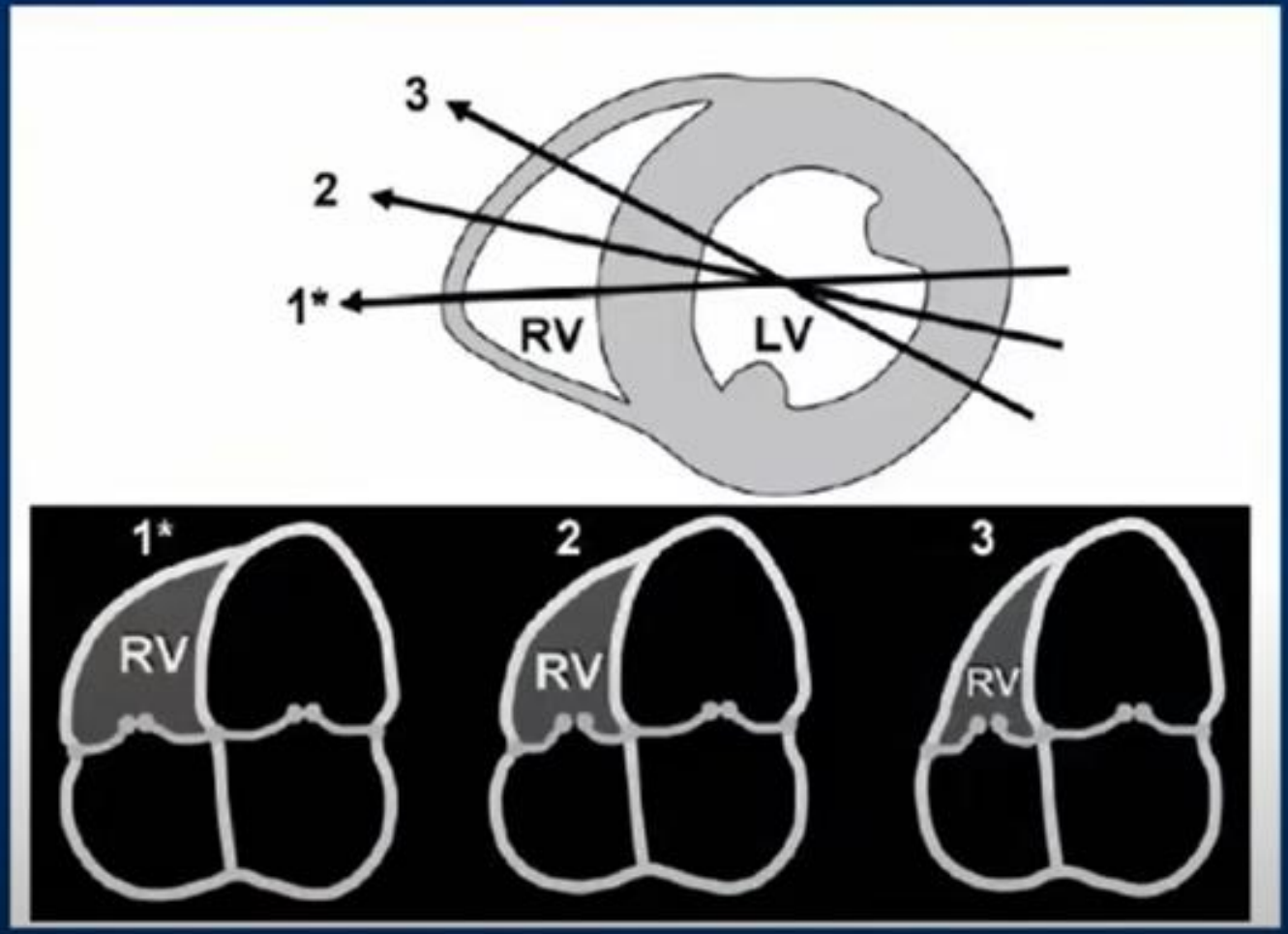


Apical – Focused RV



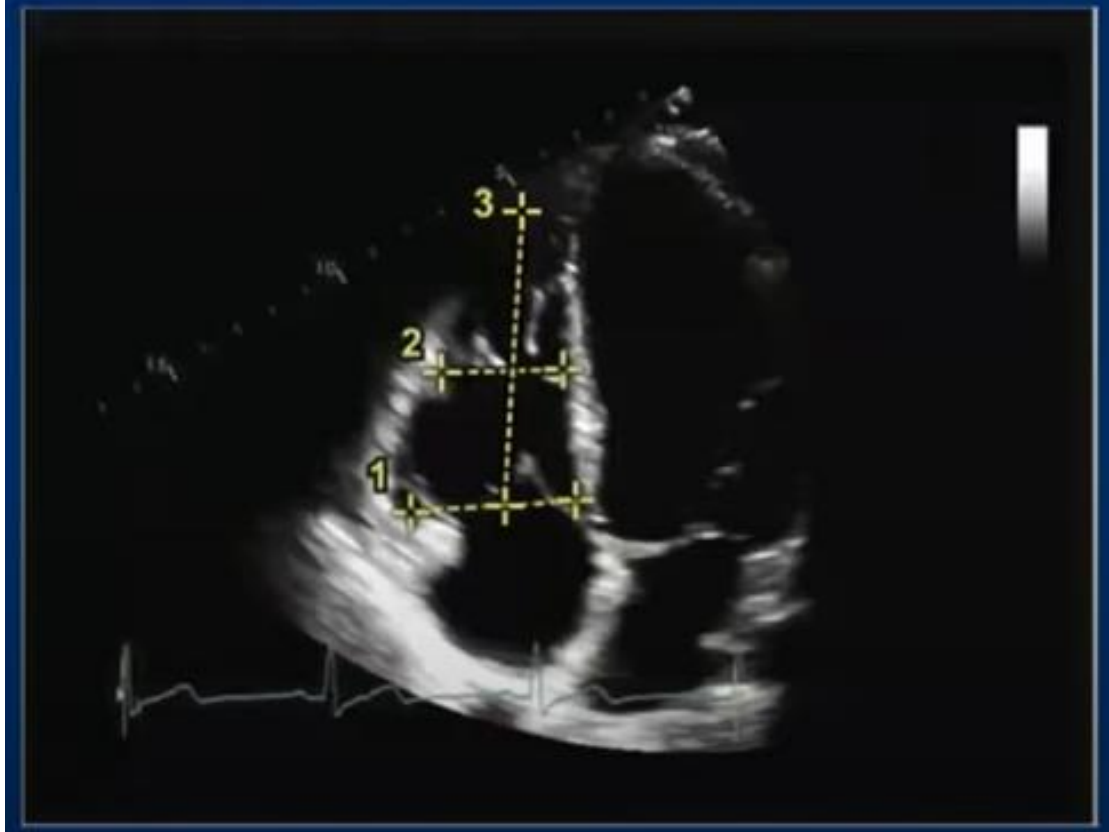


Correct position of the RV focused view



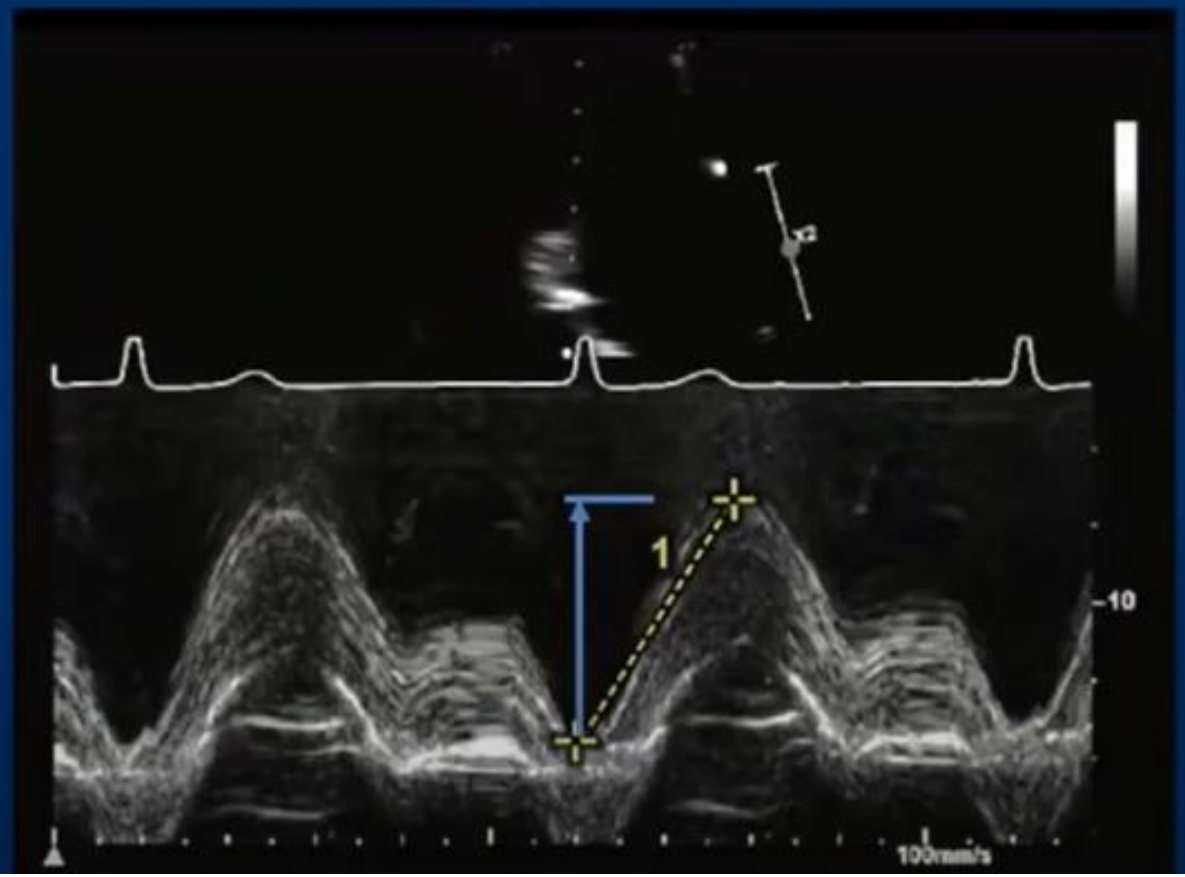
(J Am Soc Echocardiogr 2010;23:685-713.)

Apical – 2D RV Measurements



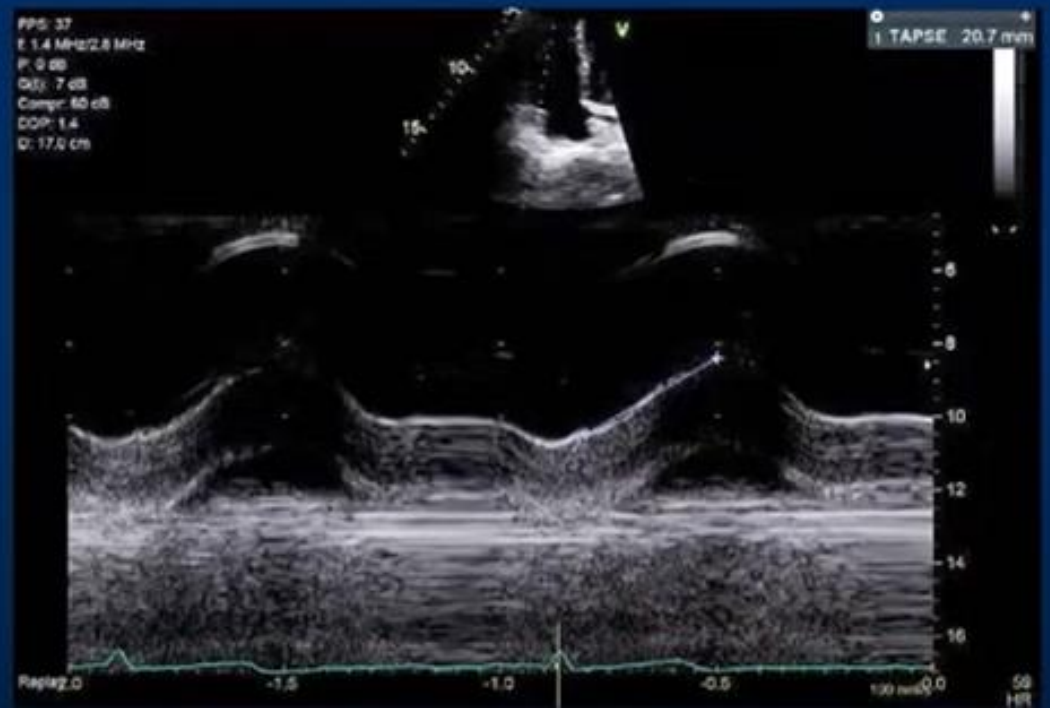
Apical - Focused RV TAPSE Measurement

Vertical Distance

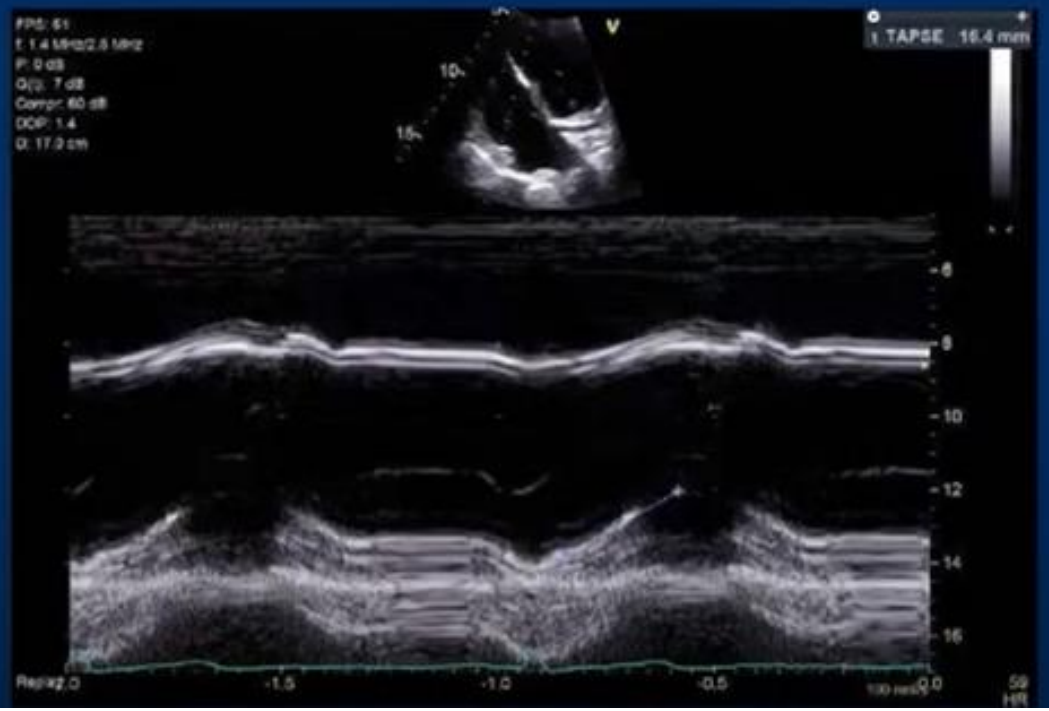


TAPSE is angle dependent

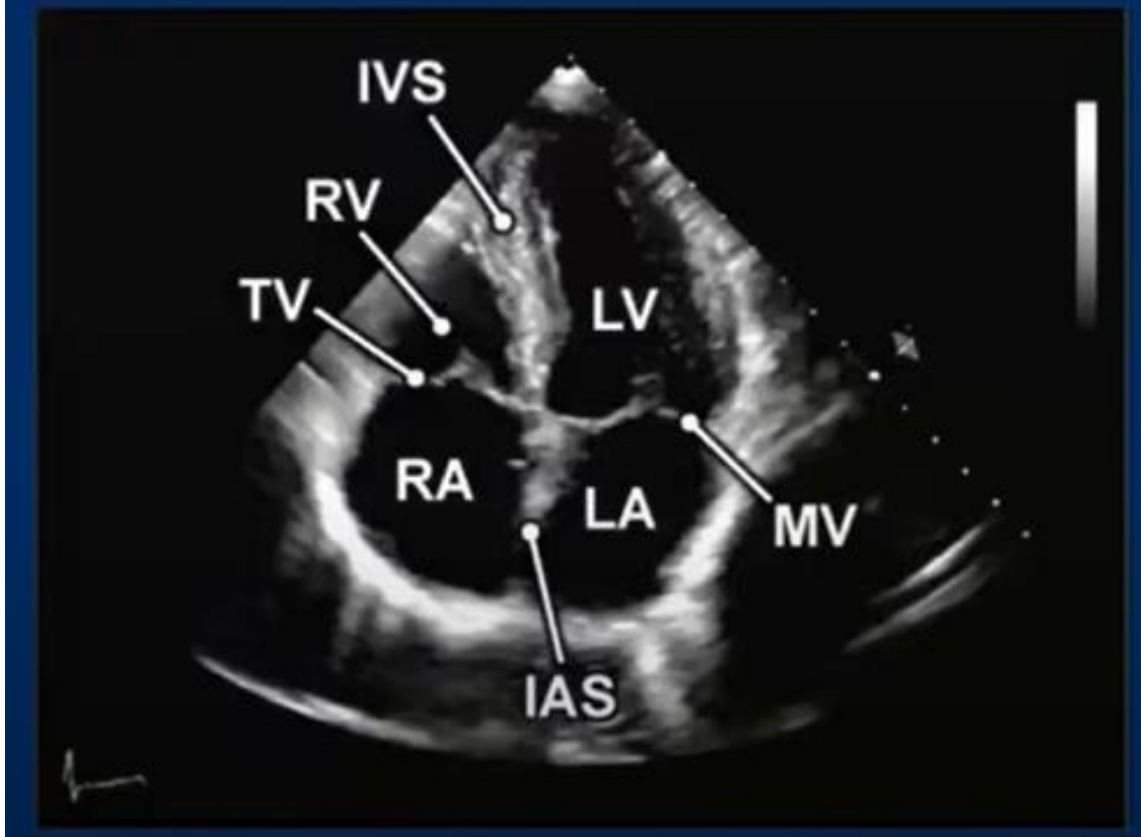
Vertical Alignment

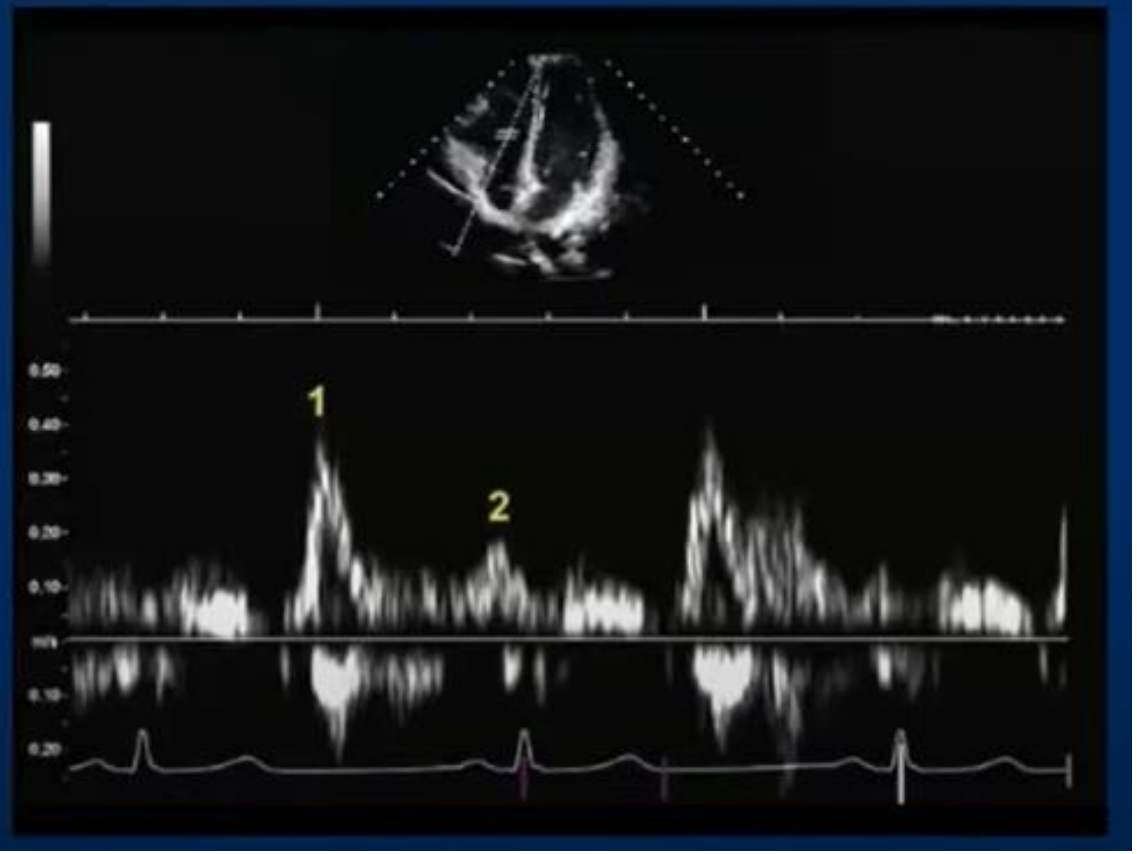


Off axis Alignment

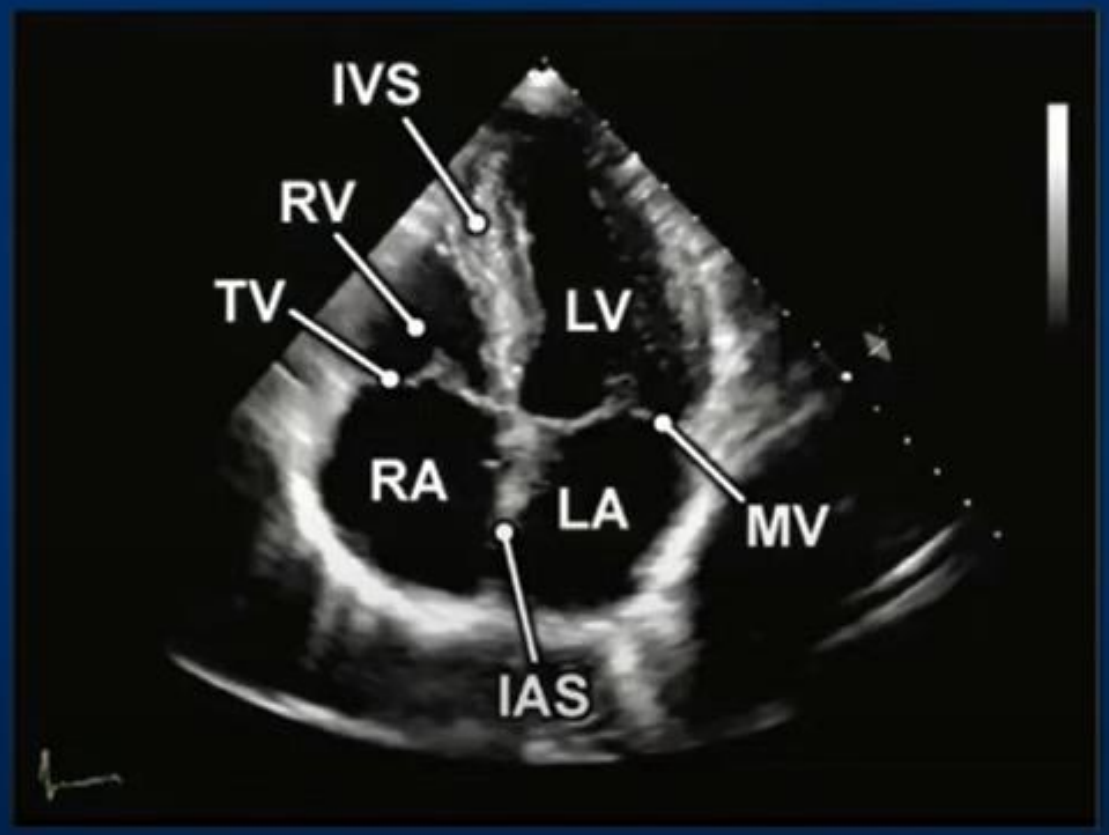


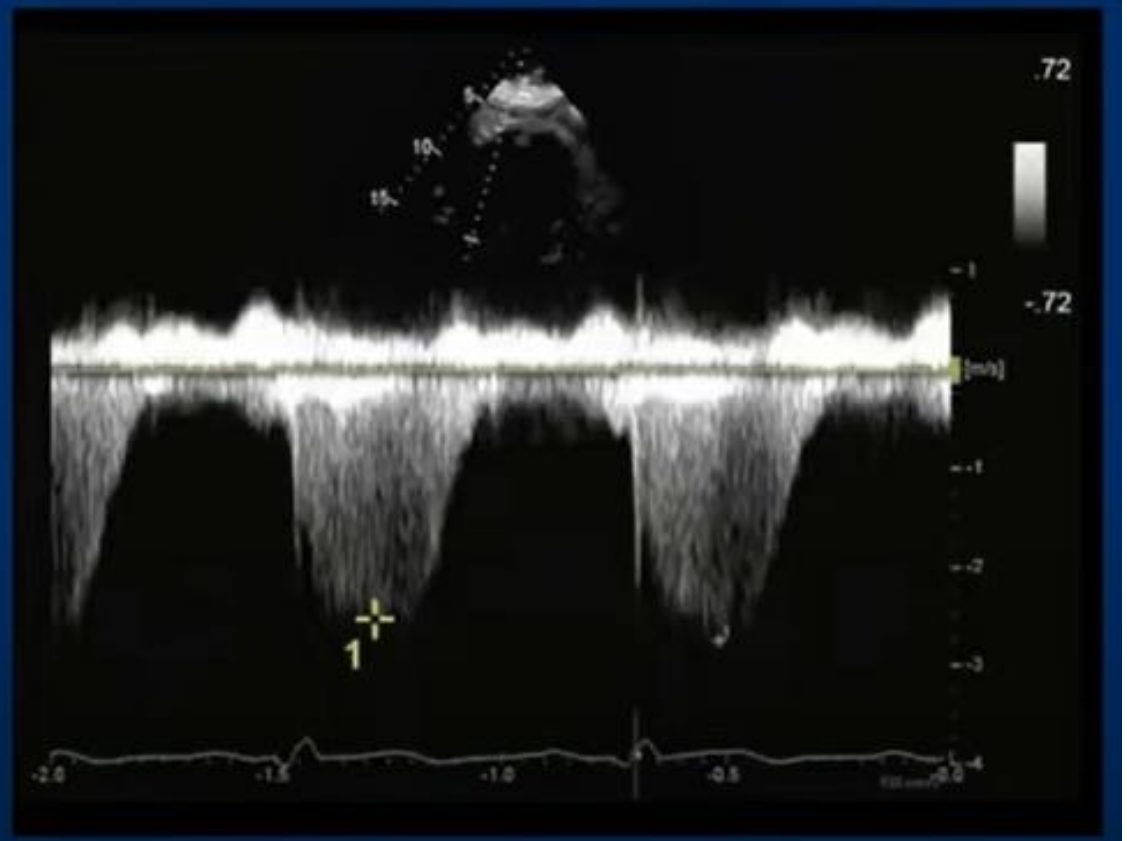
Apical 4C – Normal TV Inflow PW Doppler



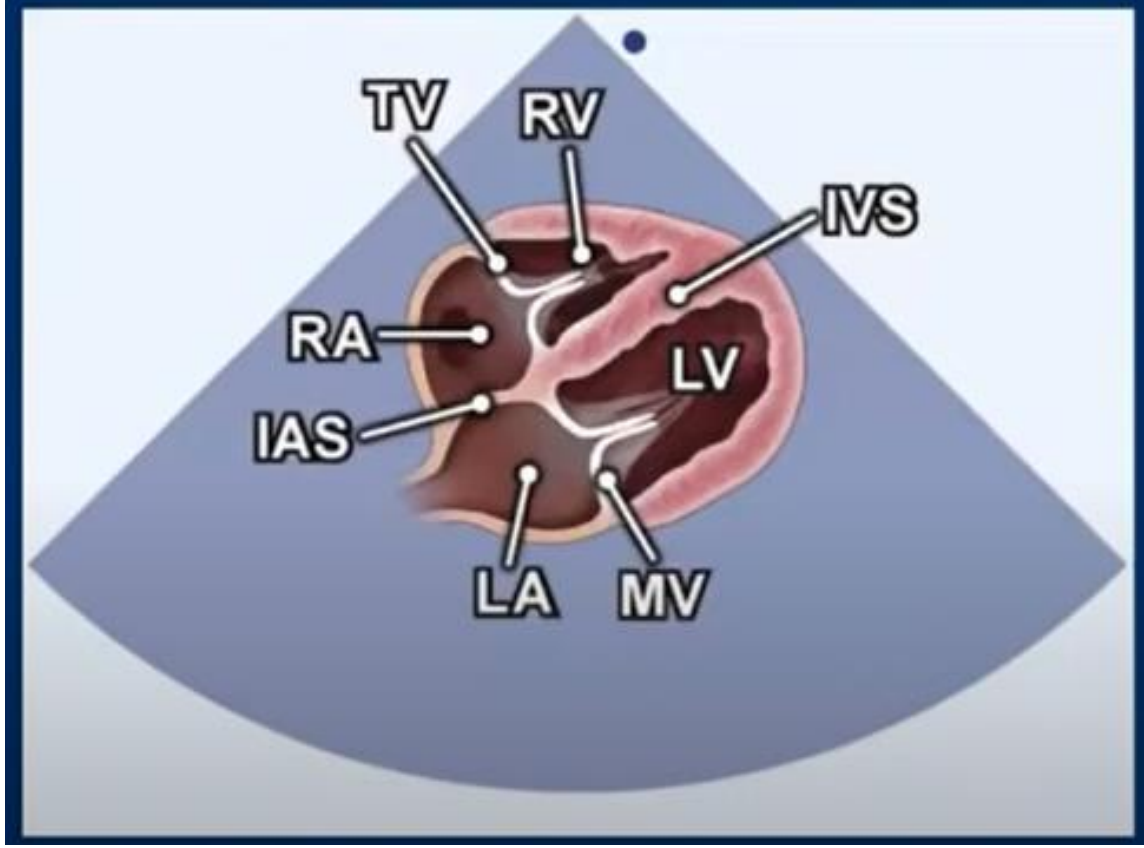


Apical 4C – TV Regurgitation CW Doppler

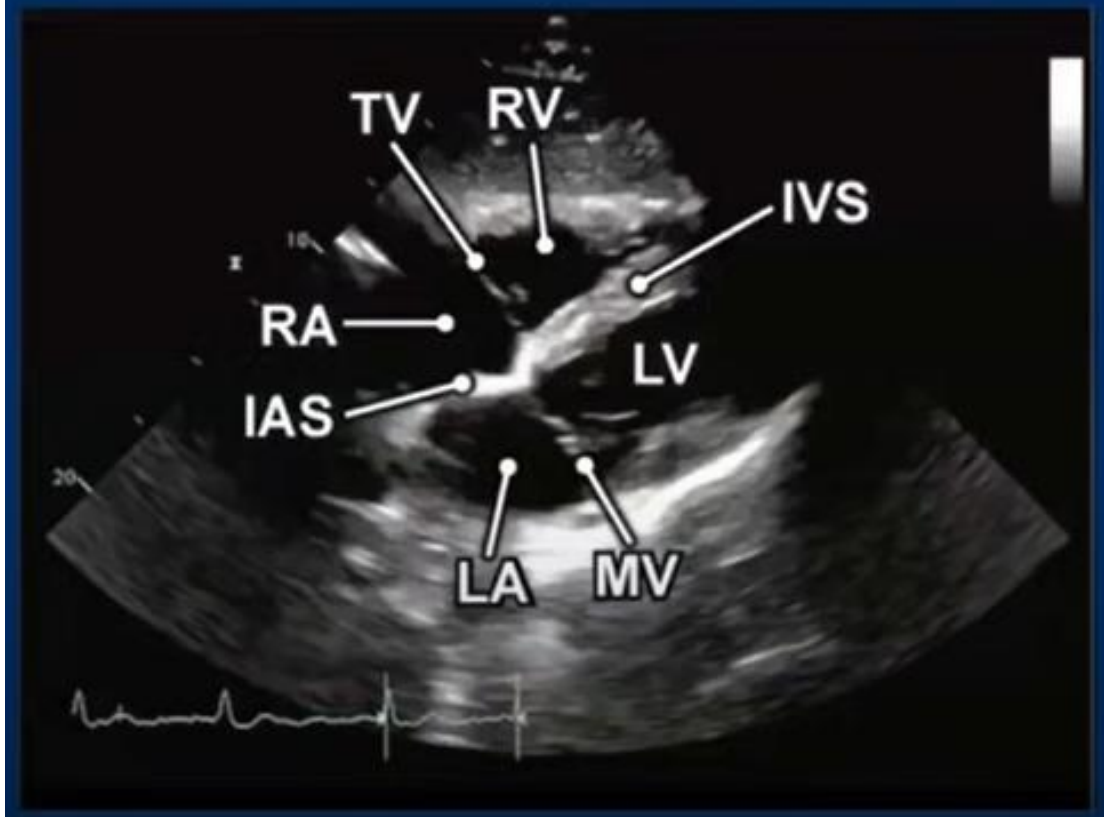


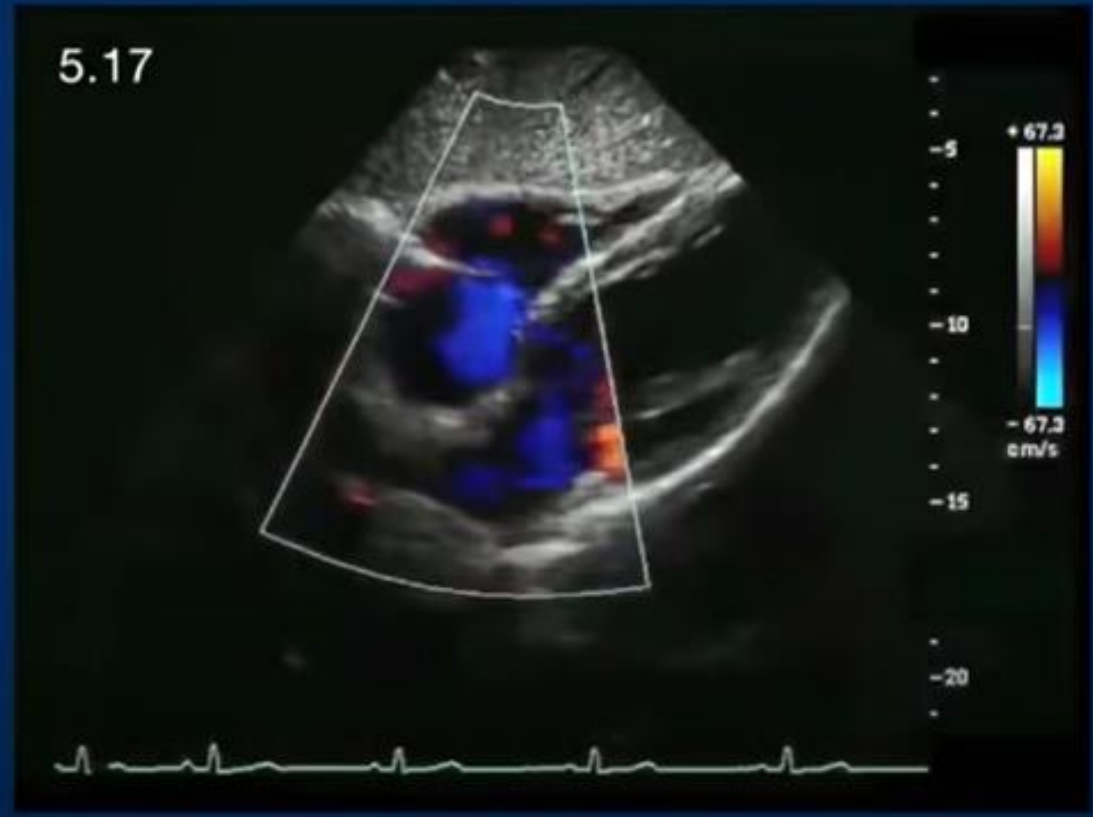


Subcostal – 4 Chamber

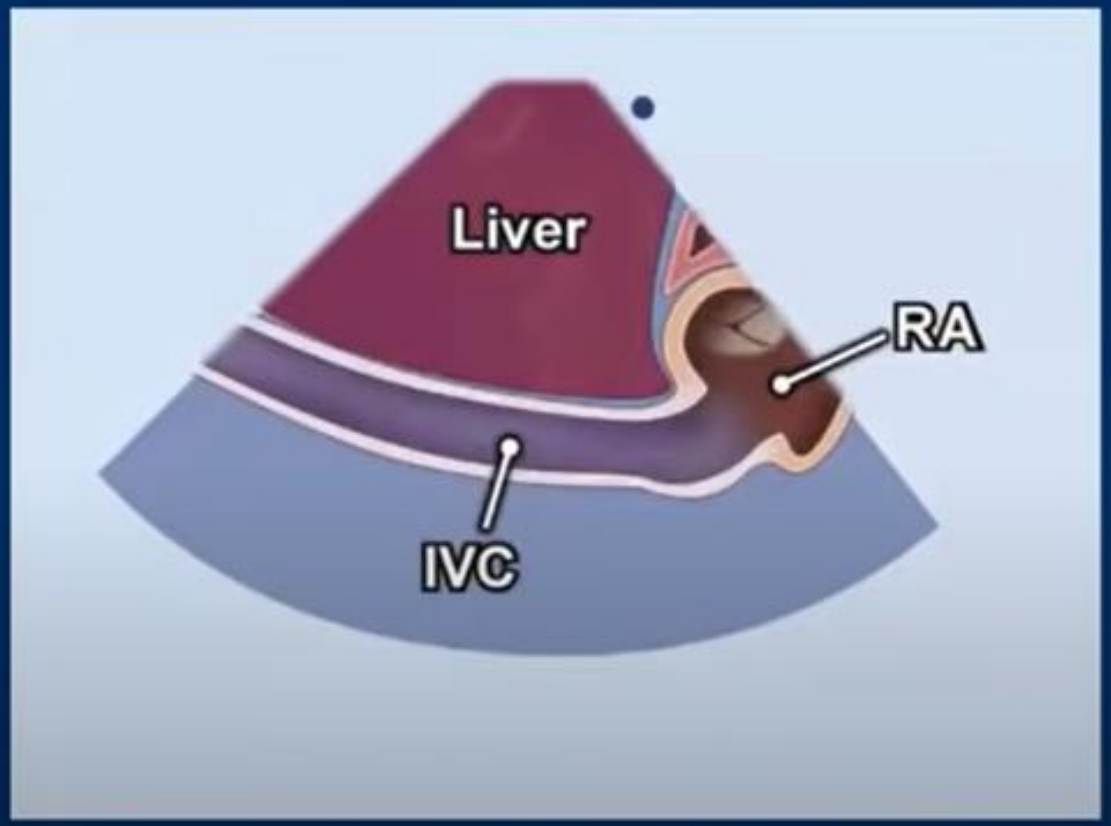


Subcostal – 4 Chamber

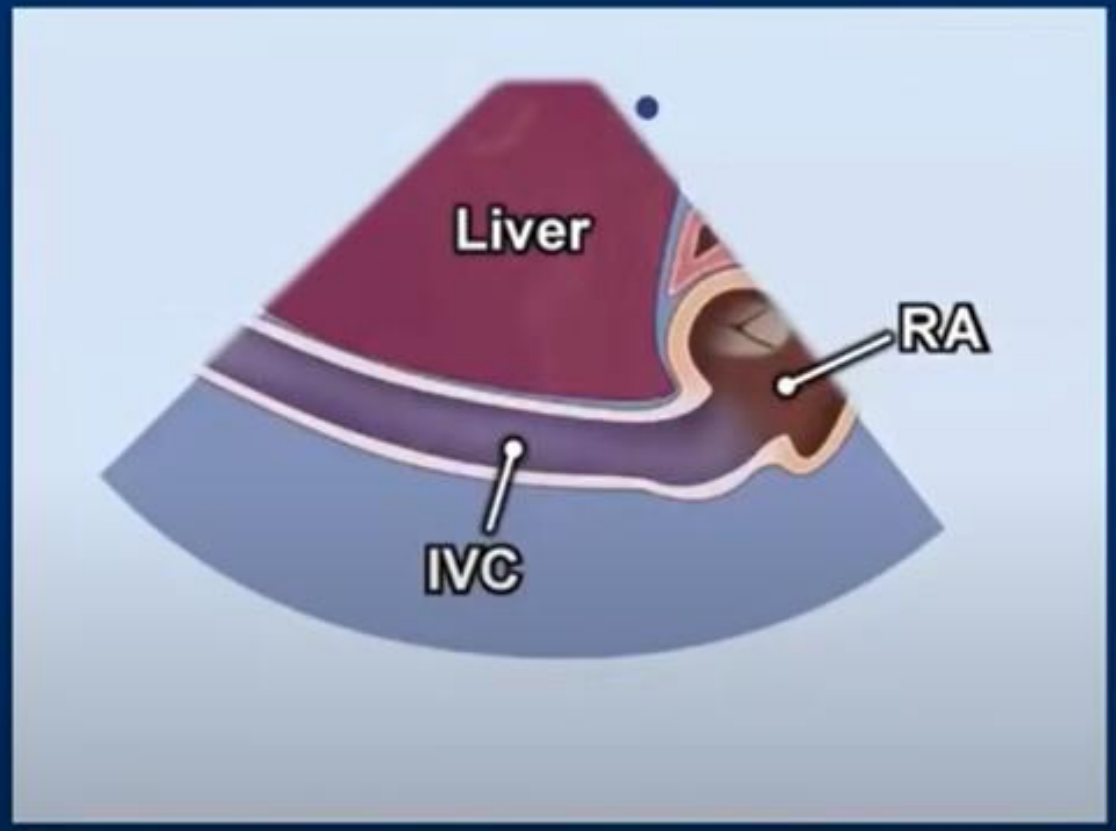




Subcostal - IVC



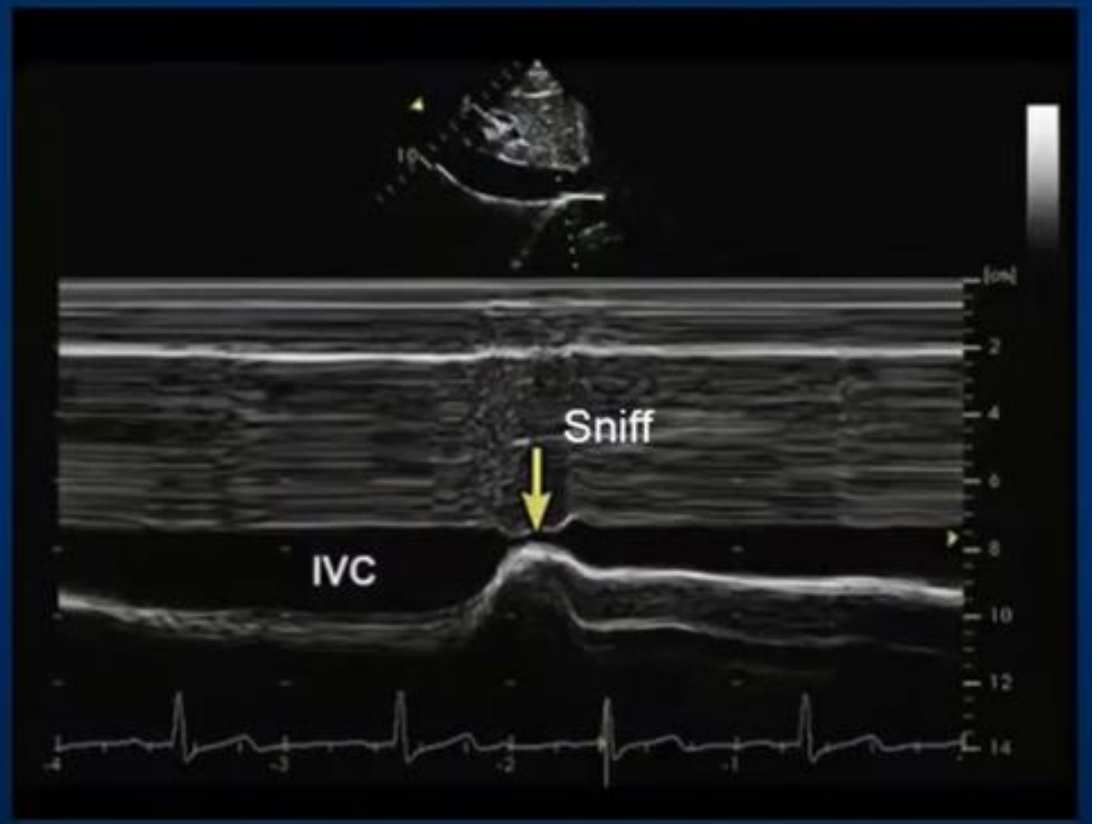
Subcostal - IVC



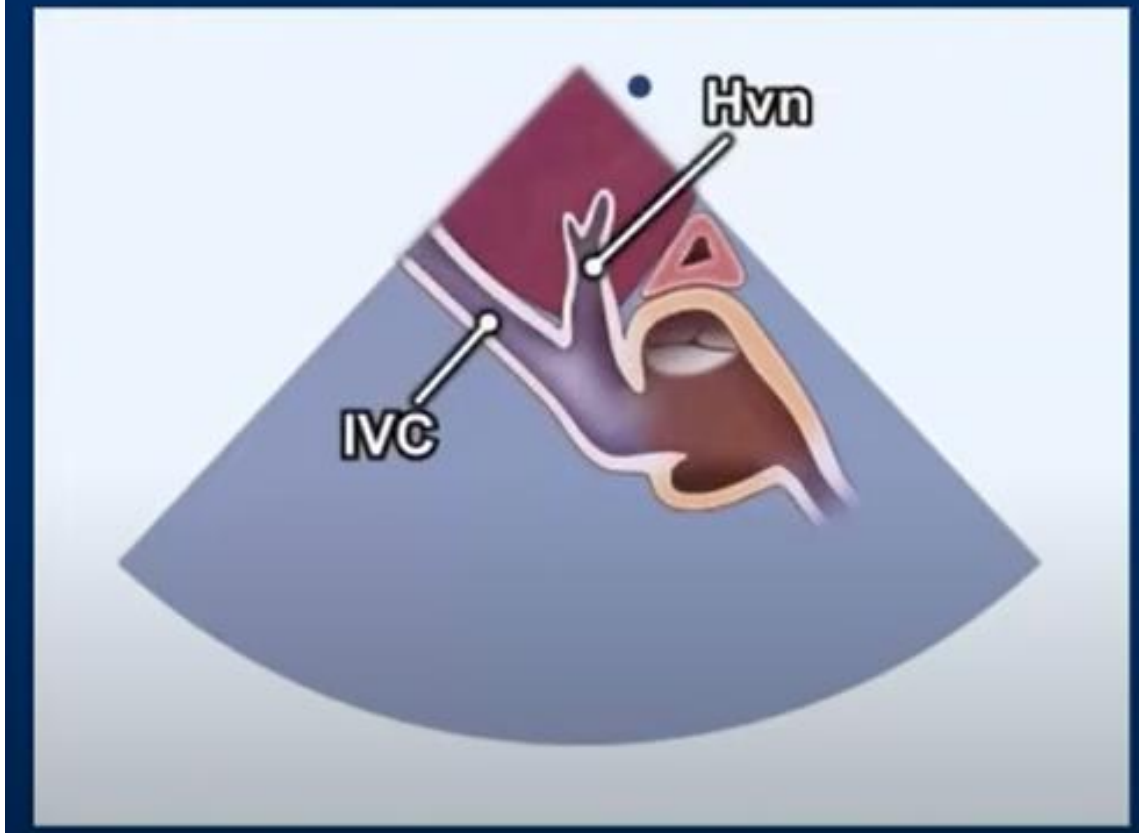
Subcostal – IVC Measurements

2D Diameter Measurement

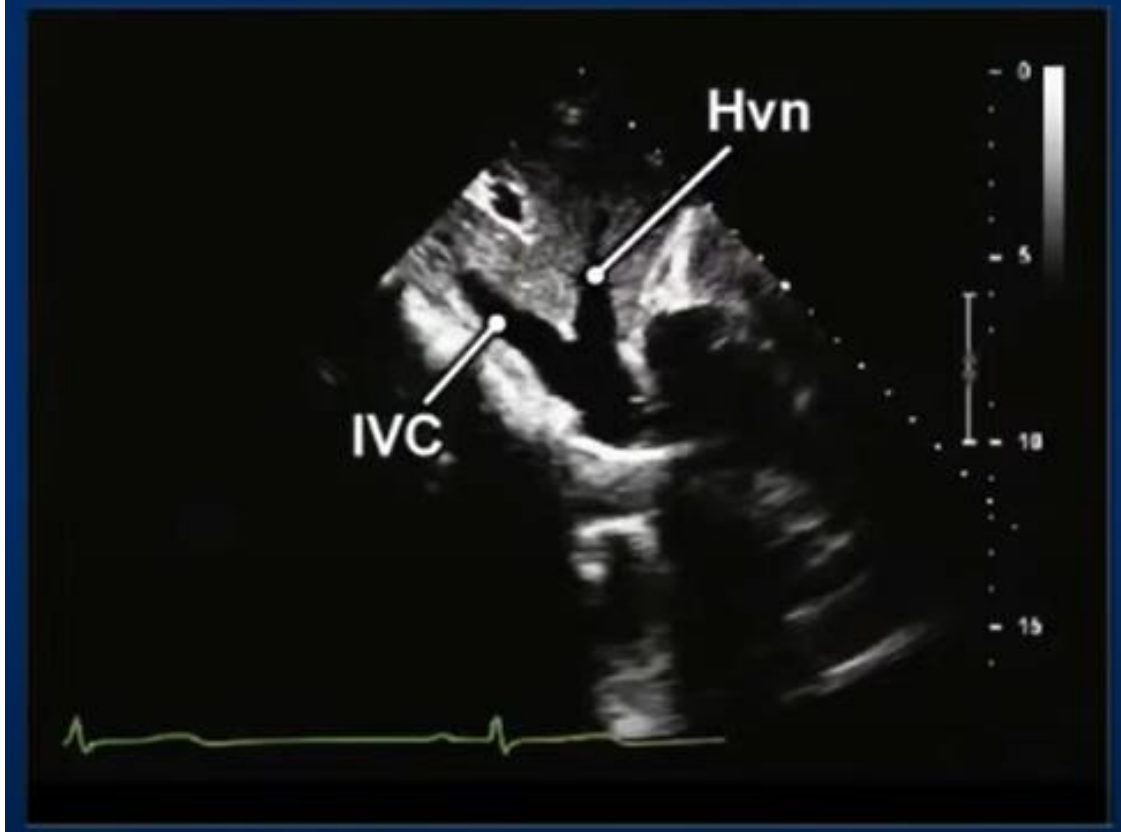
M-mode sniff

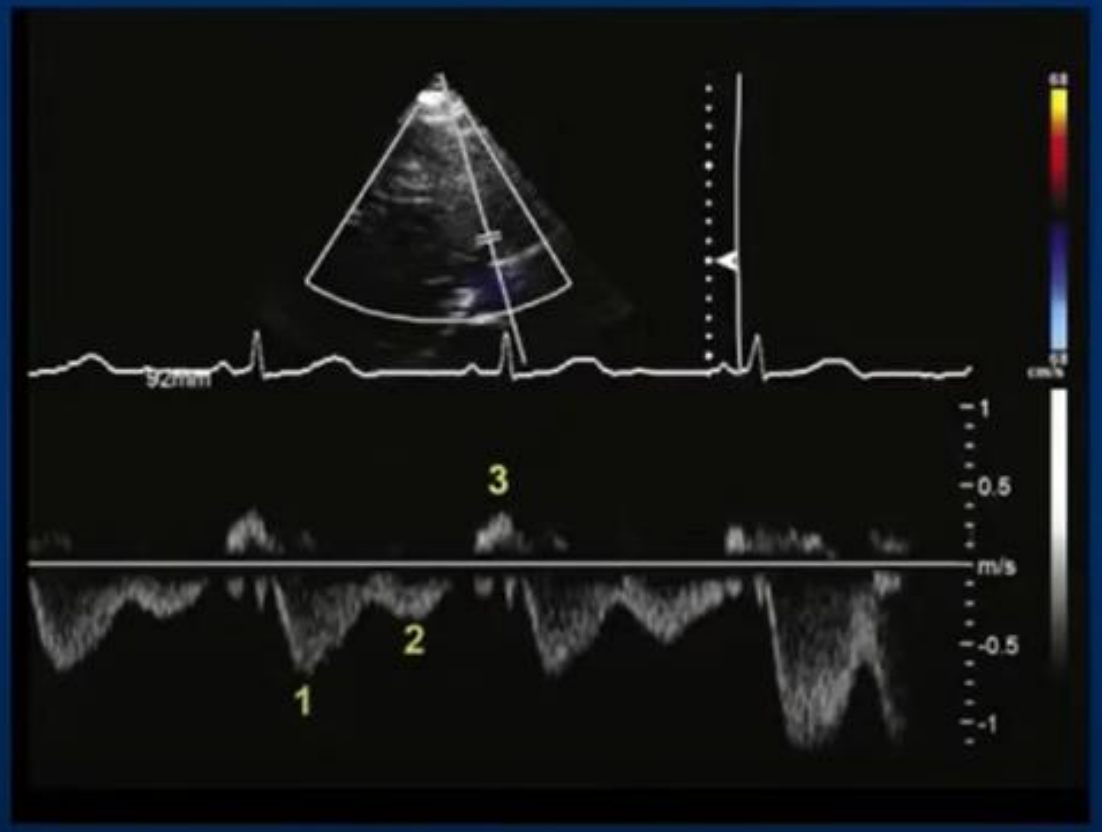


Subcostal – Hepatic Veins

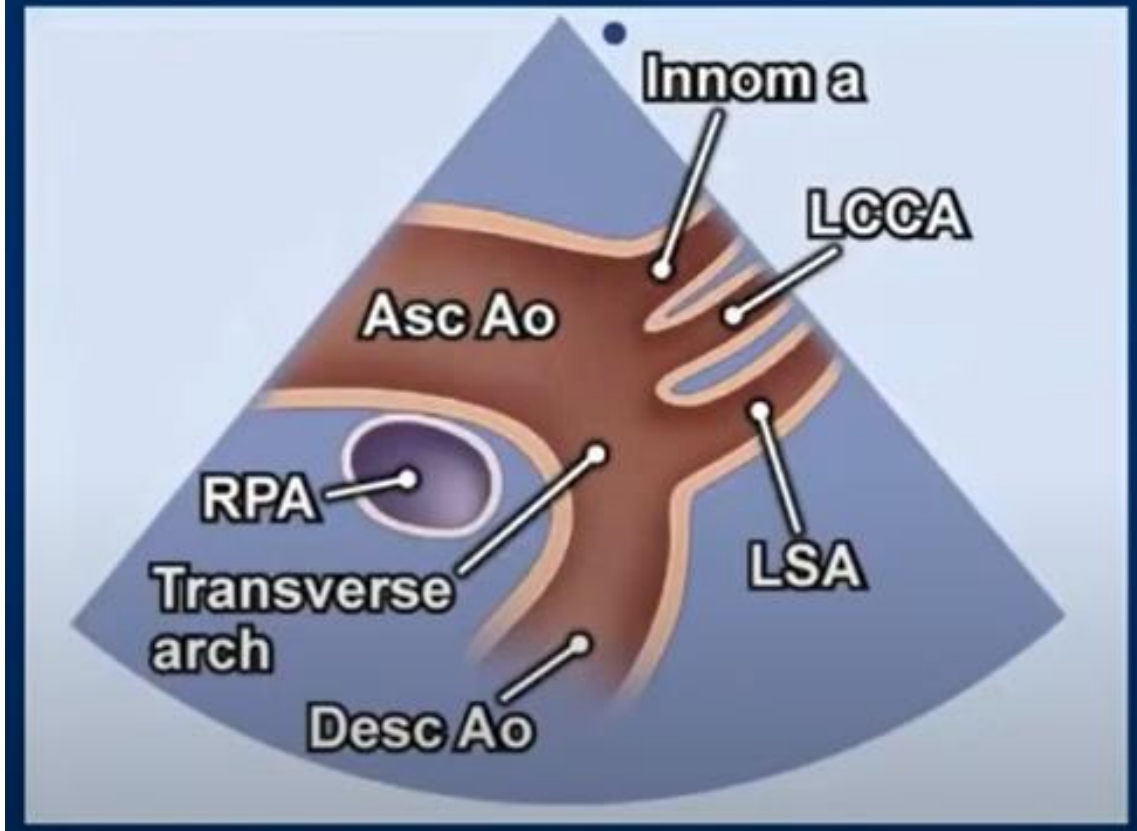


Subcostal – Hepatic Veins PW Doppler

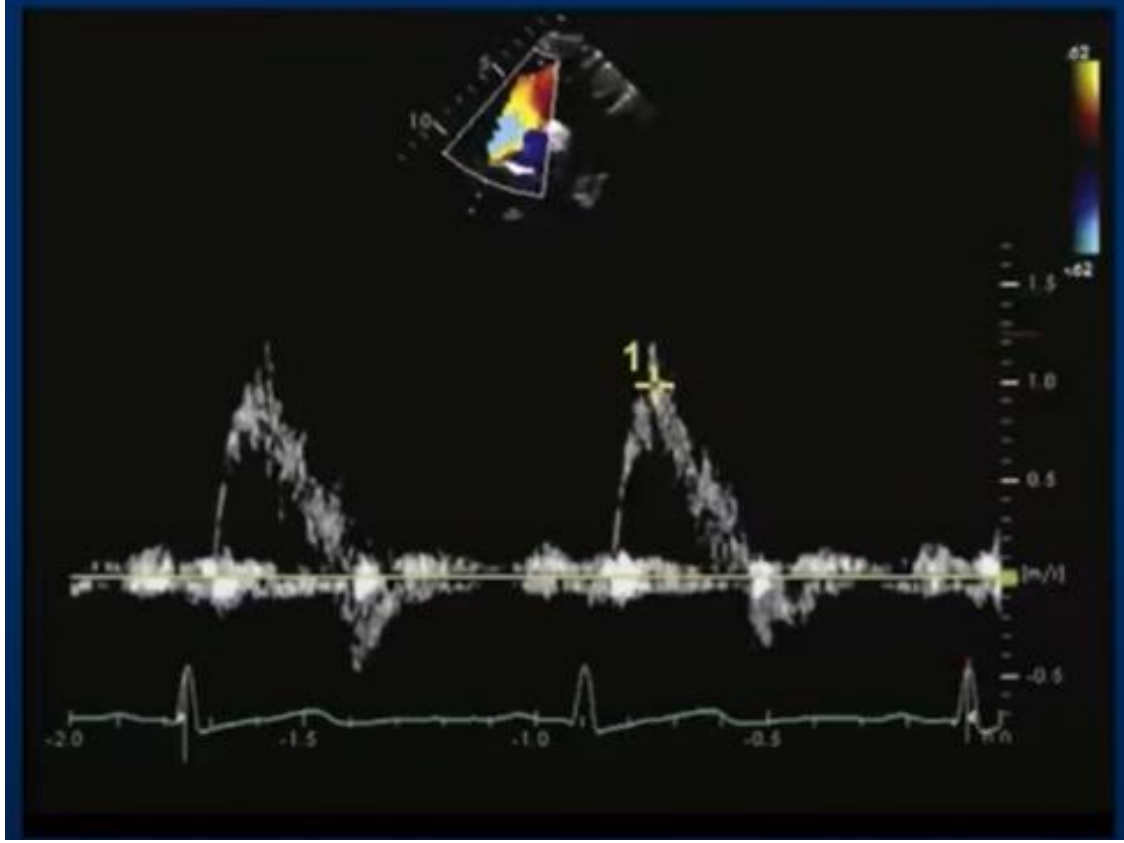


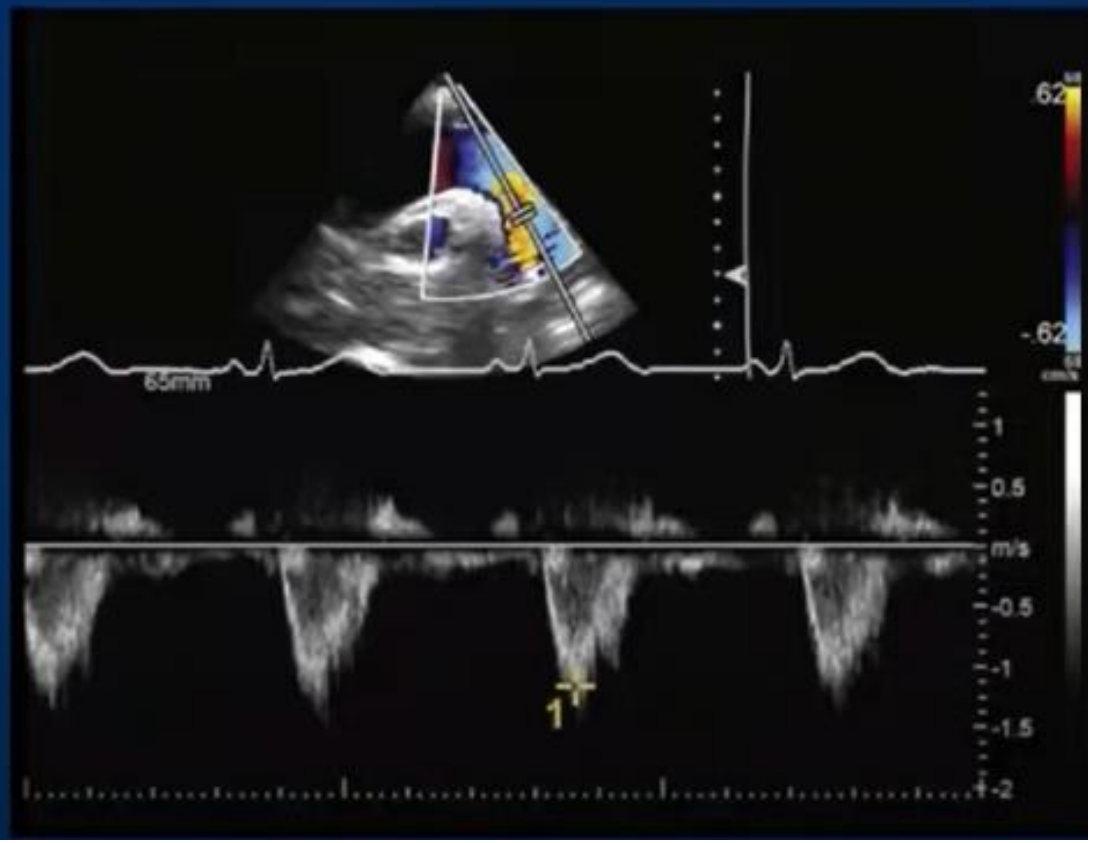


Suprasternal Notch – Aortic Arch

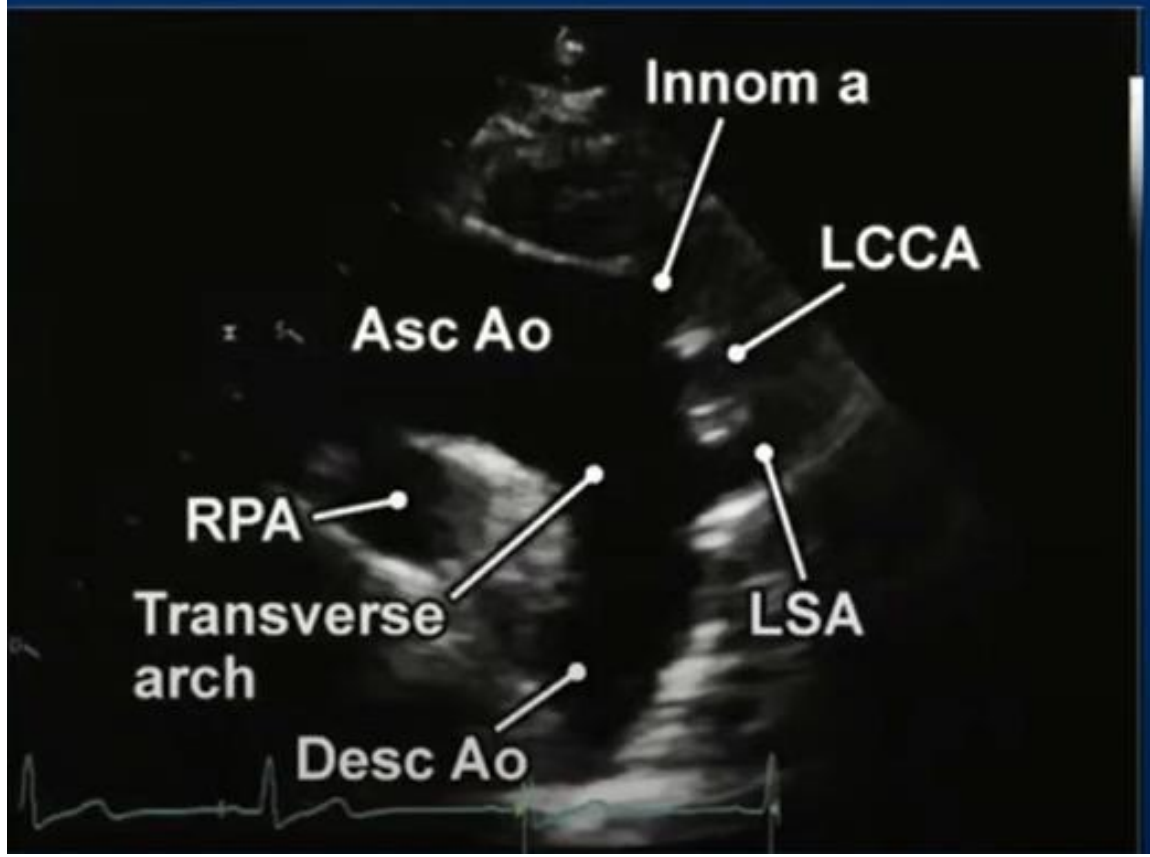


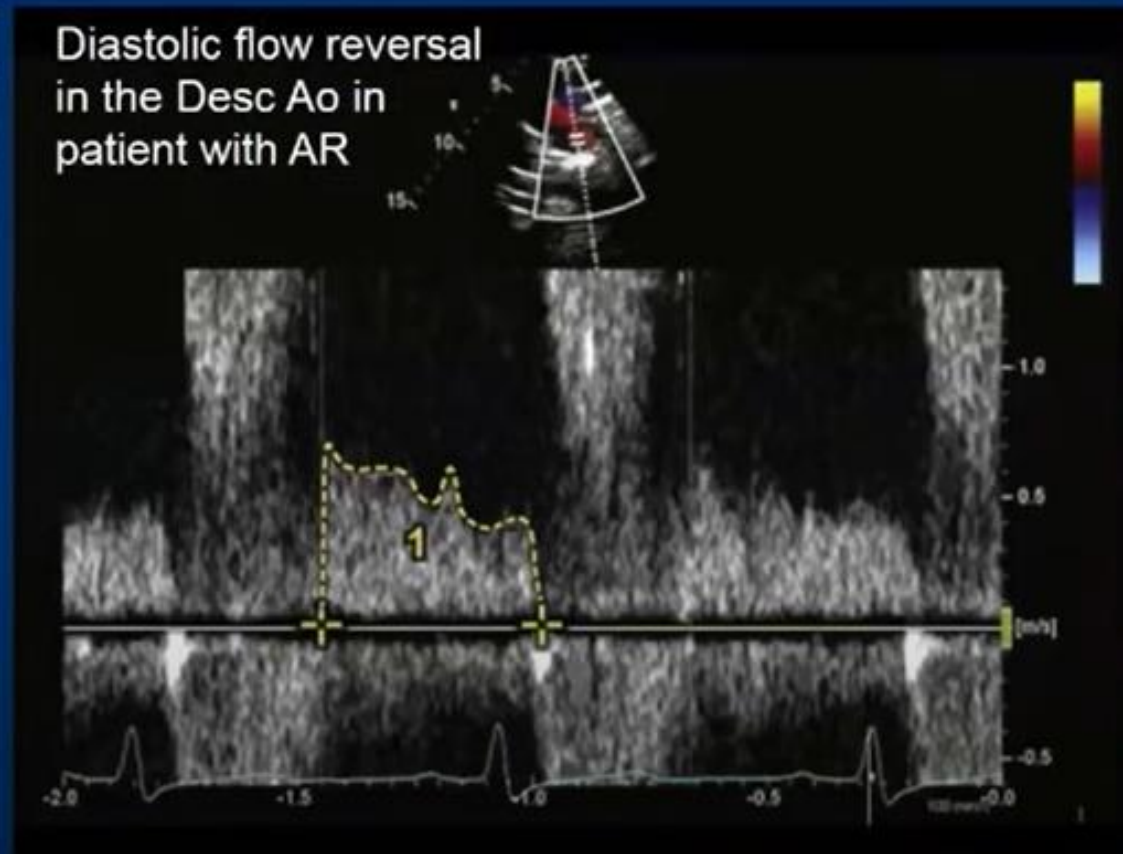
Suprasternal Notch – Ascending and Descending Aorta Doppler





Suprasternal Notch - Doppler



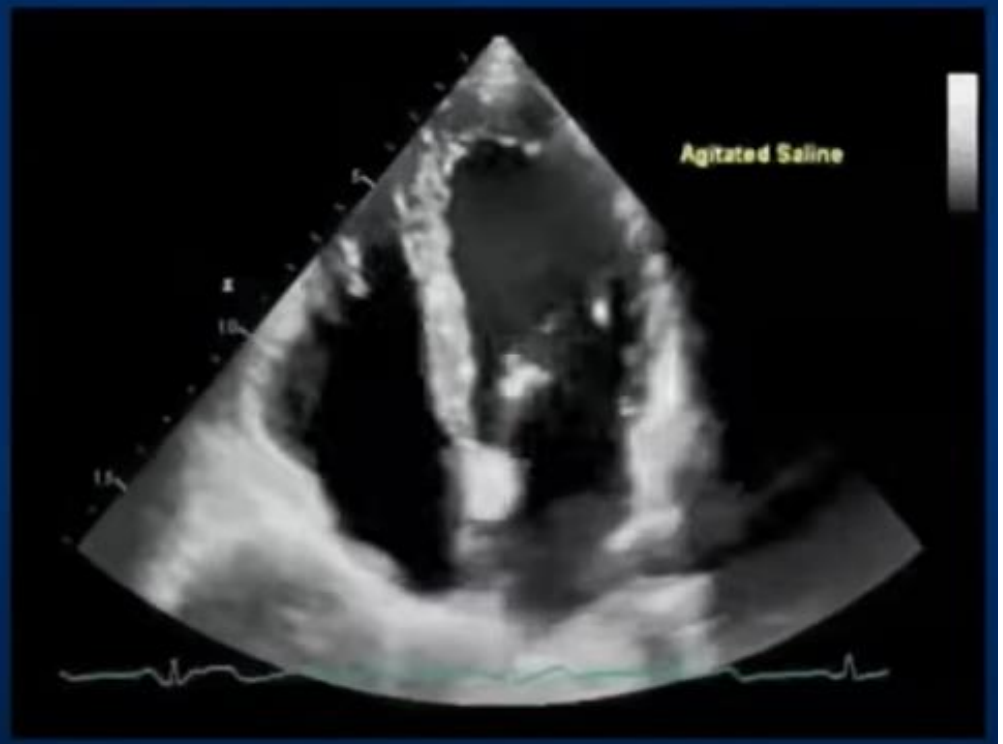


Saline Contrast

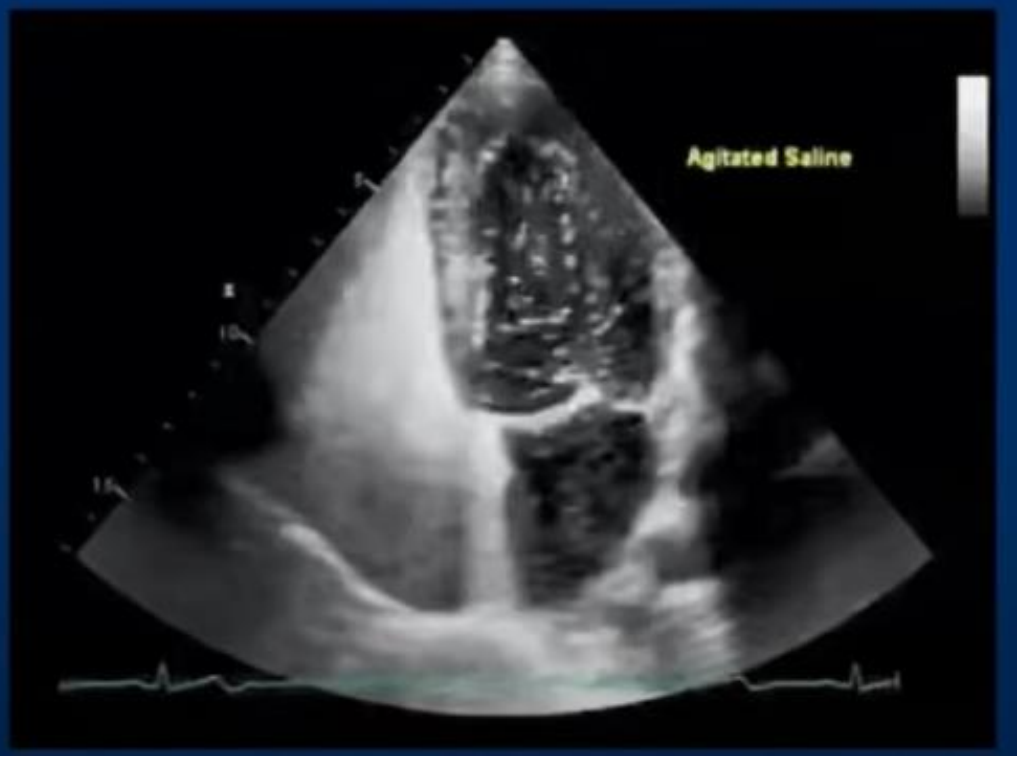
Positive and Negative Bubble Study for Patent Foramen Ovale

Extracardiac Shunt

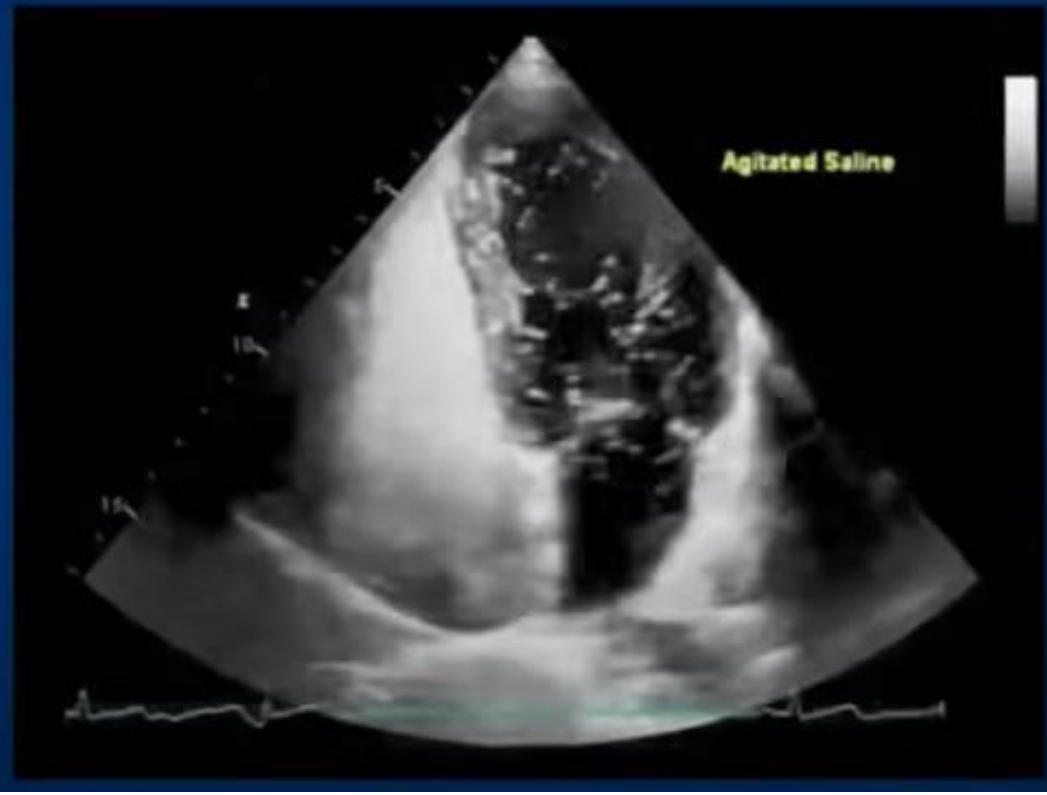
Positive Bubble Study for Patent Foramen Ovale (Beat 1)



Positive Bubble Study for Patent Foramen Ovale (Beat 1)

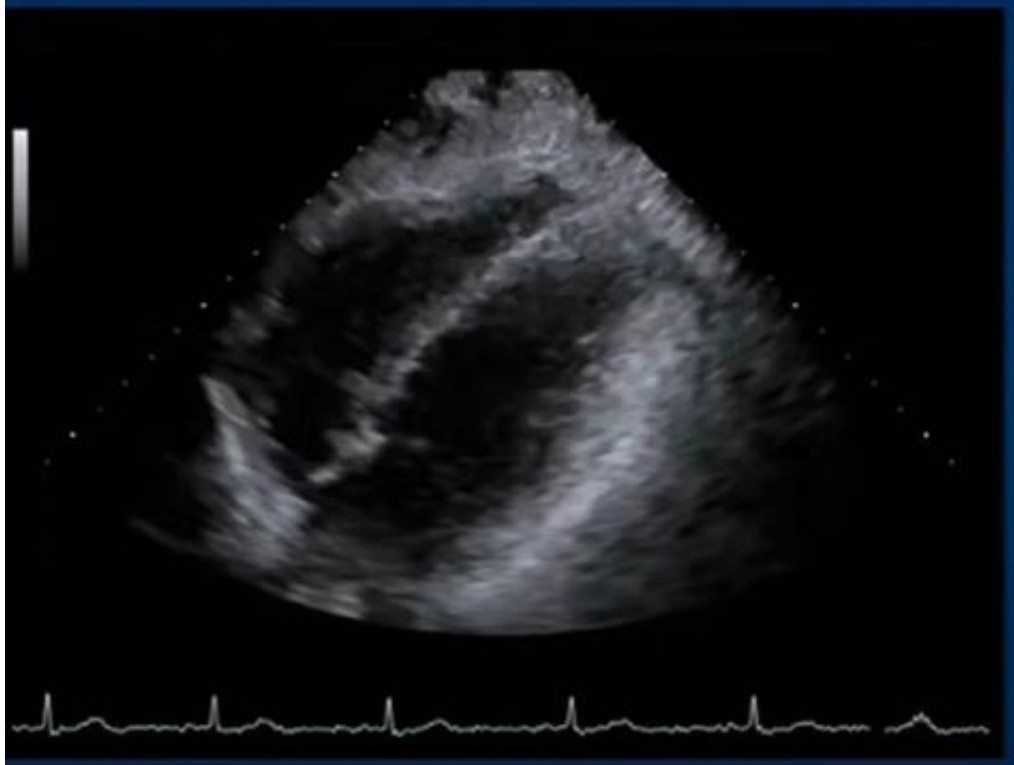


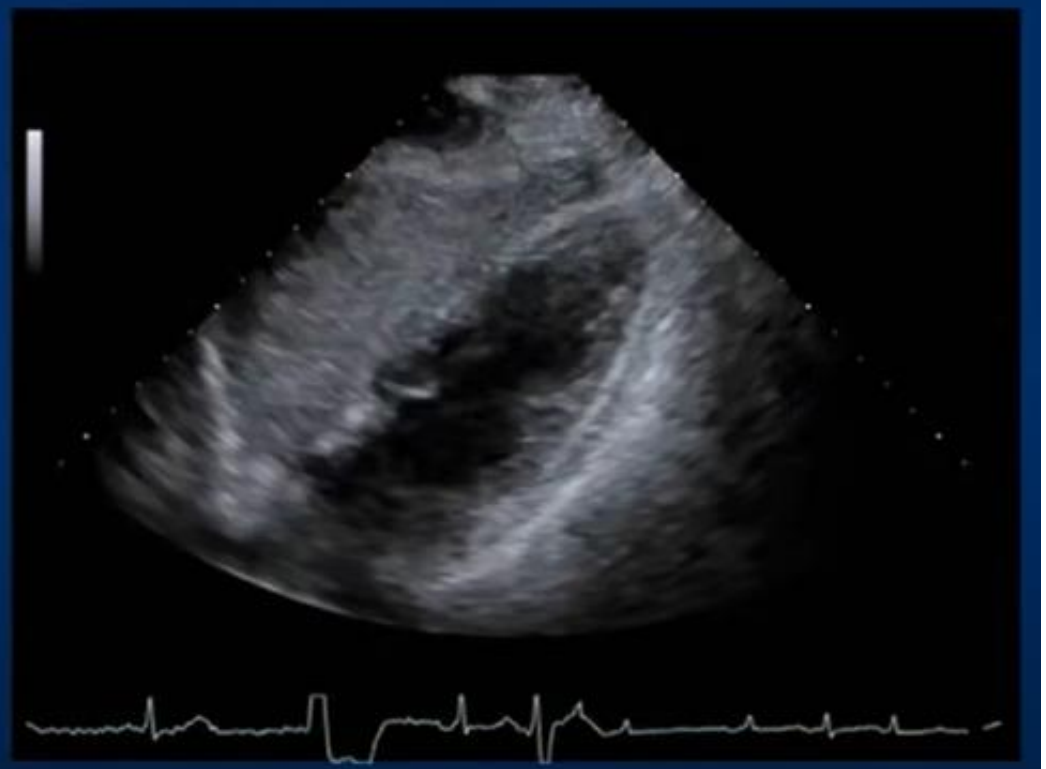
Positive Bubble Study for Patent Foramen Ovale (Beat 16 – Clearing of LA and LV)



Evaluation for Patent Foramen Ovale
Bubble Study – Negative for PFO, Positive for Extracardiac Shunt

Evaluation for Patent Foramen Ovale
Subcostal – 4 Chamber
Alternative View for Bubble Study





Inter-societal Accreditation Commission

"A limited study is generally only performed when the patient has recently undergone a complete examination and there is no clinical reason to suspect any changes outside the specific area of interest. A limited study generally examines a single area of the heart or answers a single clinical question."

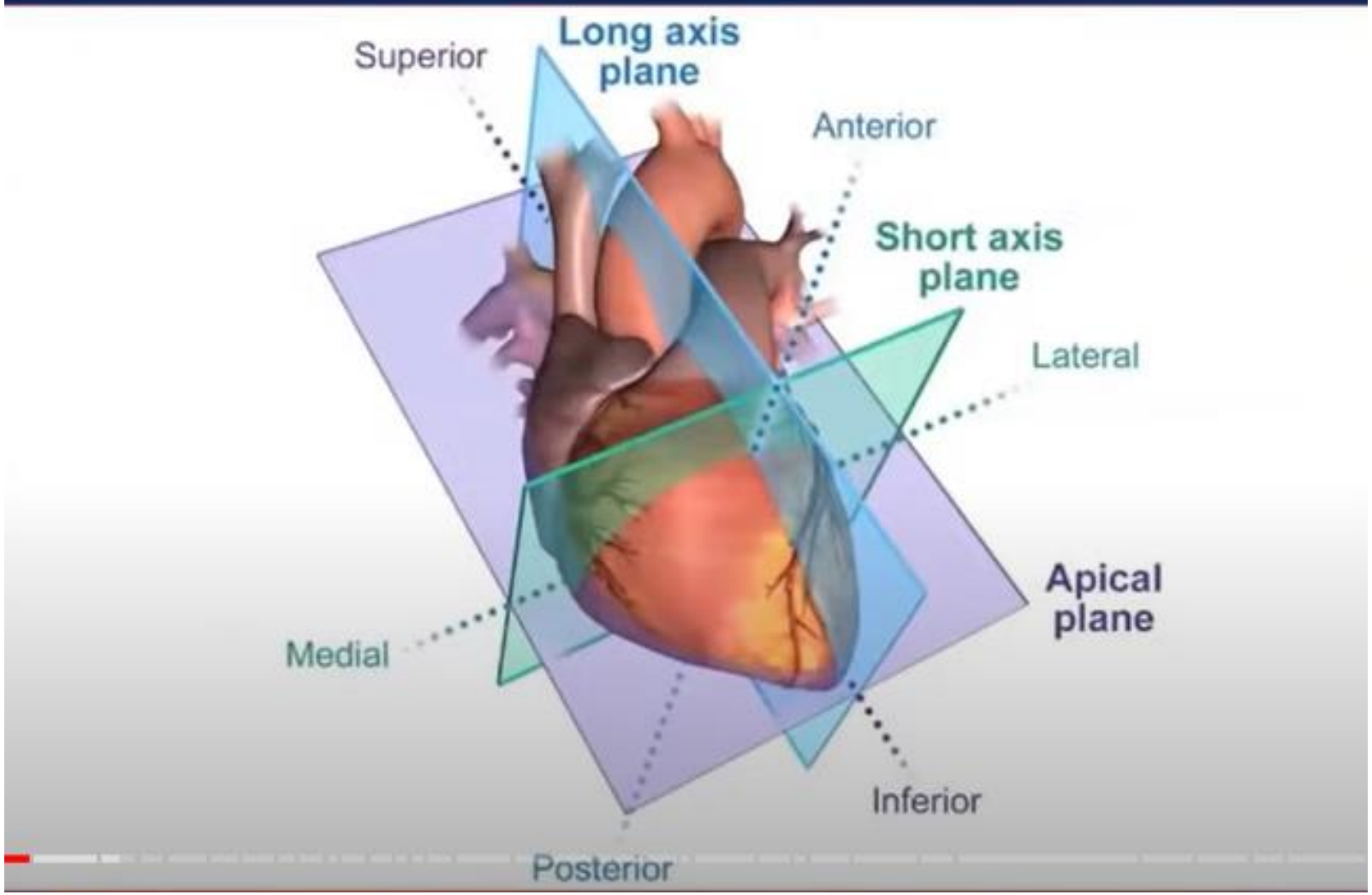
GUIDELINES AND STANDARDS

Guidelines for Performing a Comprehensive Transthoracic Echocardiographic Examination in Adults: Recommendations from the American Society of Echocardiography

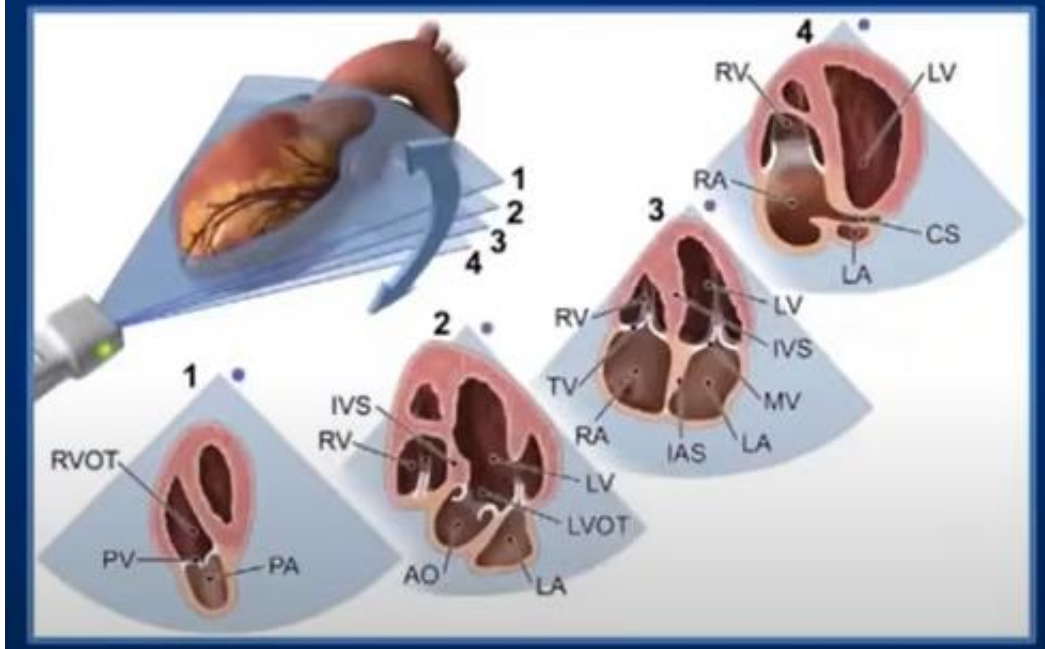
Carol Mitchell, PhD, ACS, RDMS, RDCS, RVT, RT(R), FASE, Co-Chair, Peter S. Rahko, MD, FASE, Co-Chair, Lori A. Blauwet, MD, FASE, Barry Canaday, RN, MS, RDCS, RCS, FASE, Joshua A. Finstuen, MA, RT(R), RDCS, FASE, Michael C. Foster, BA, RCS, RCCS, RDCS, FASE, Kenneth Horton, ACS, RCS, FASE, Kofo O. Ogunyankin, MD, FASE, Richard A. Palma, BS, RDCS, RCS, ACS, FASE, and Eric J. Velazquez, MD, FASE, *Madison, Wisconsin; Rochester, Minnesota; Klamath Falls, Oregon; Durham, North Carolina; Salt Lake City, Utah; Ikoyi, Lagos, Nigeria; and Hartford, Connecticut*

This document is endorsed by the following American Society of Echocardiography International Alliance Partners: Argentine Federation of Cardiology, Argentine Society of Cardiology, ASEAN Society of Echocardiography, Australasian Sonographers Association, British Society of Echocardiography, Canadian Society of Echocardiography, Chinese Society of Echocardiography, Department of Cardiovascular Imaging of the Brazilian Society of Cardiology, Indian Academy of Echocardiography, Indian Association of Cardiovascular Thoracic Anaesthesiologists, Indonesian Society of Echocardiography, InterAmerican Association of Echocardiography, Iranian Society of Echocardiography, Israel Work Group on Echocardiography, Italian Association of Cardiothoracic Anaesthesiologists, Japanese Society of Echocardiography, Korean Society of Echocardiography, National Society of Echocardiography of Mexico, Philippine Society of Echocardiography, Saudi Arabian Society of Echocardiography, Thai Society of Echocardiography, Vietnamese Society of Echocardiography.

Scanning Planes



Tilting


1
2
3
4
RV
LV
RA
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TV
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RA
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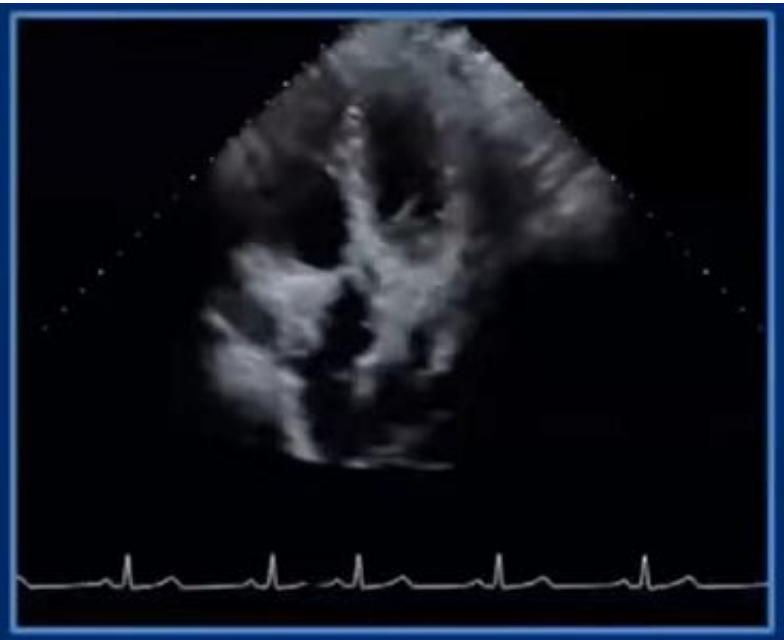
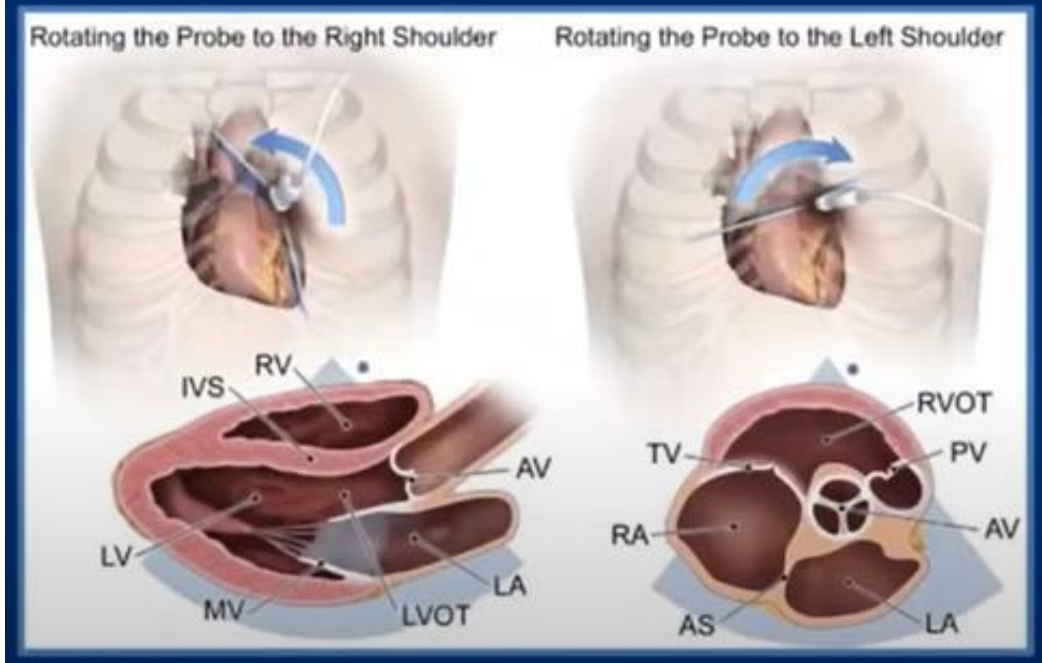
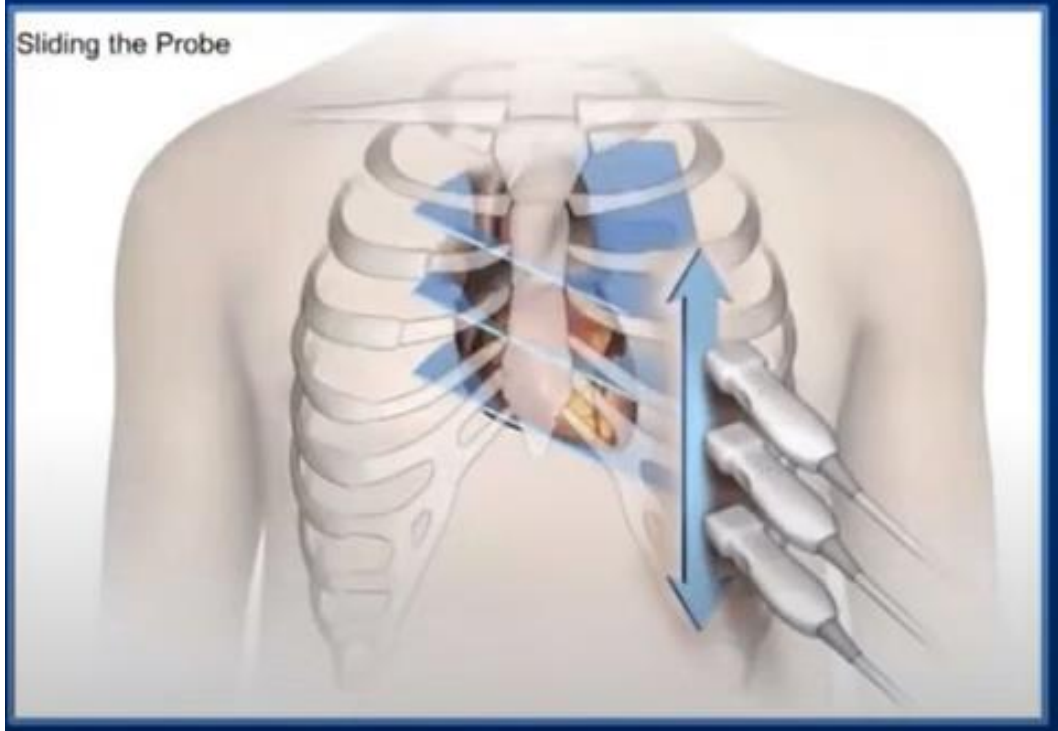


Rotating



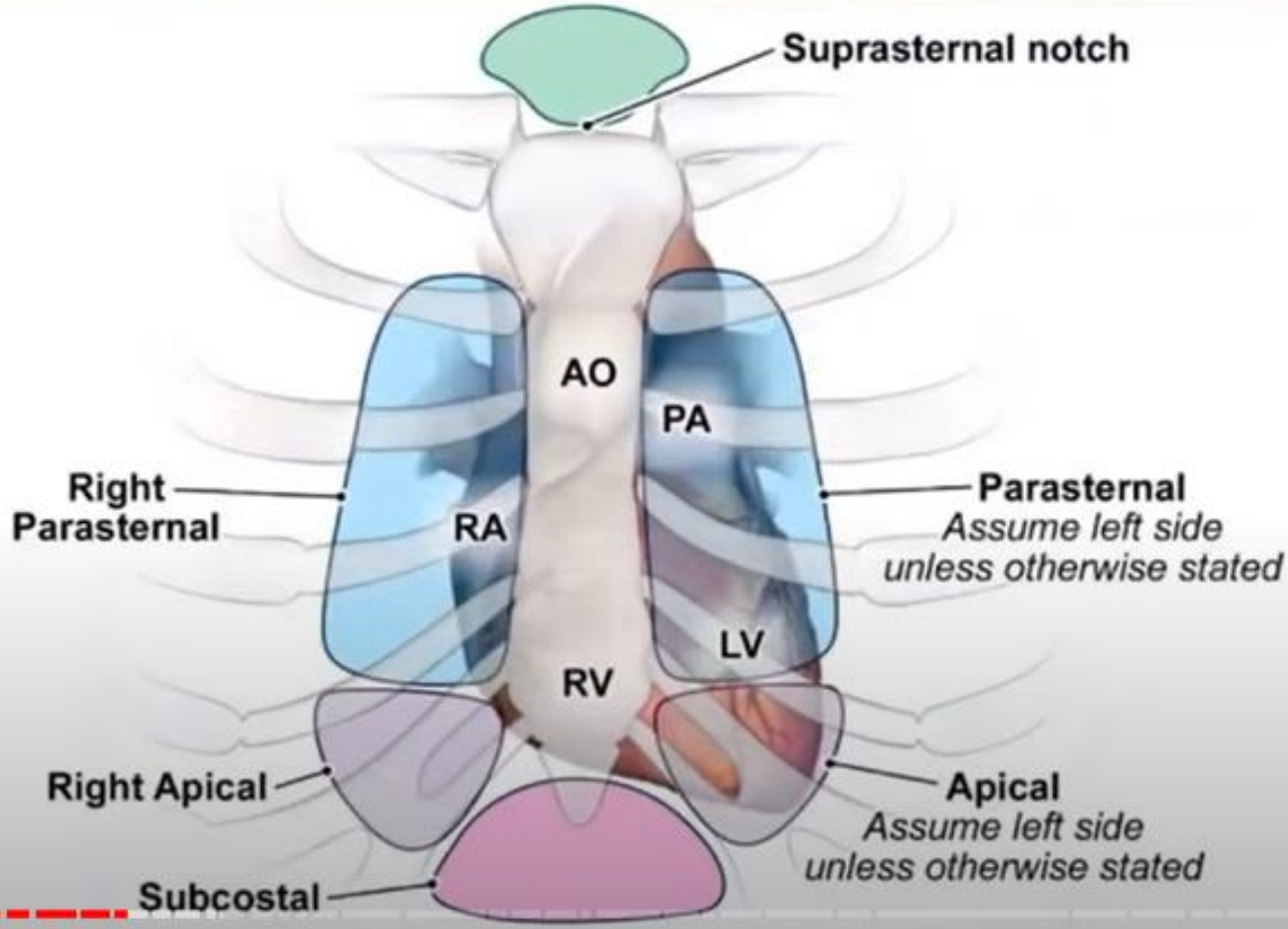
derson B. The two-dimensional echocardiographic examination. In: Anderson B, editor. Echocardiography: the normal examination and echocardiographic [illegible]. 2nd ed. Sydney, Australia: Echotext; 2017.

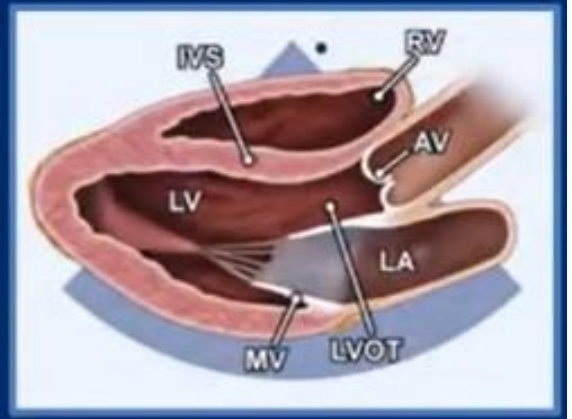
Sliding

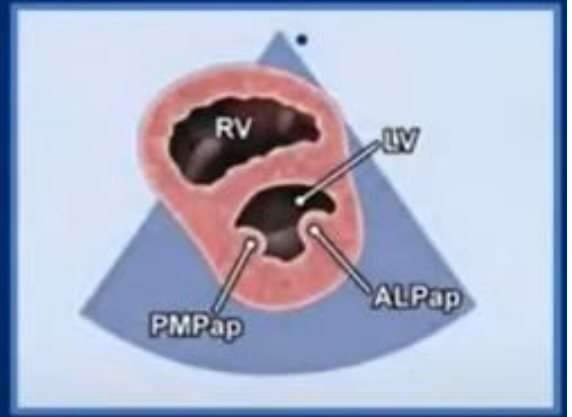


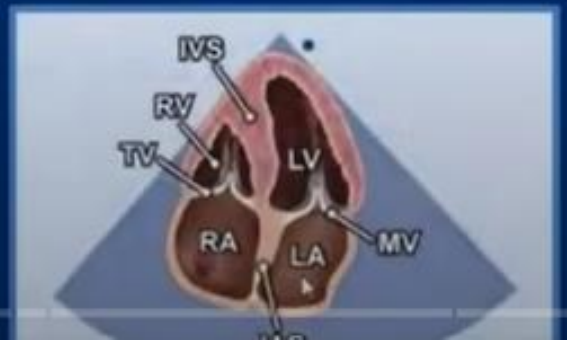
n B. The two-dimensional echocardiographic examination. In: Anderson B, editor. Echocardiography: the normal examination and echocardiographic

Image Acquisition Windows









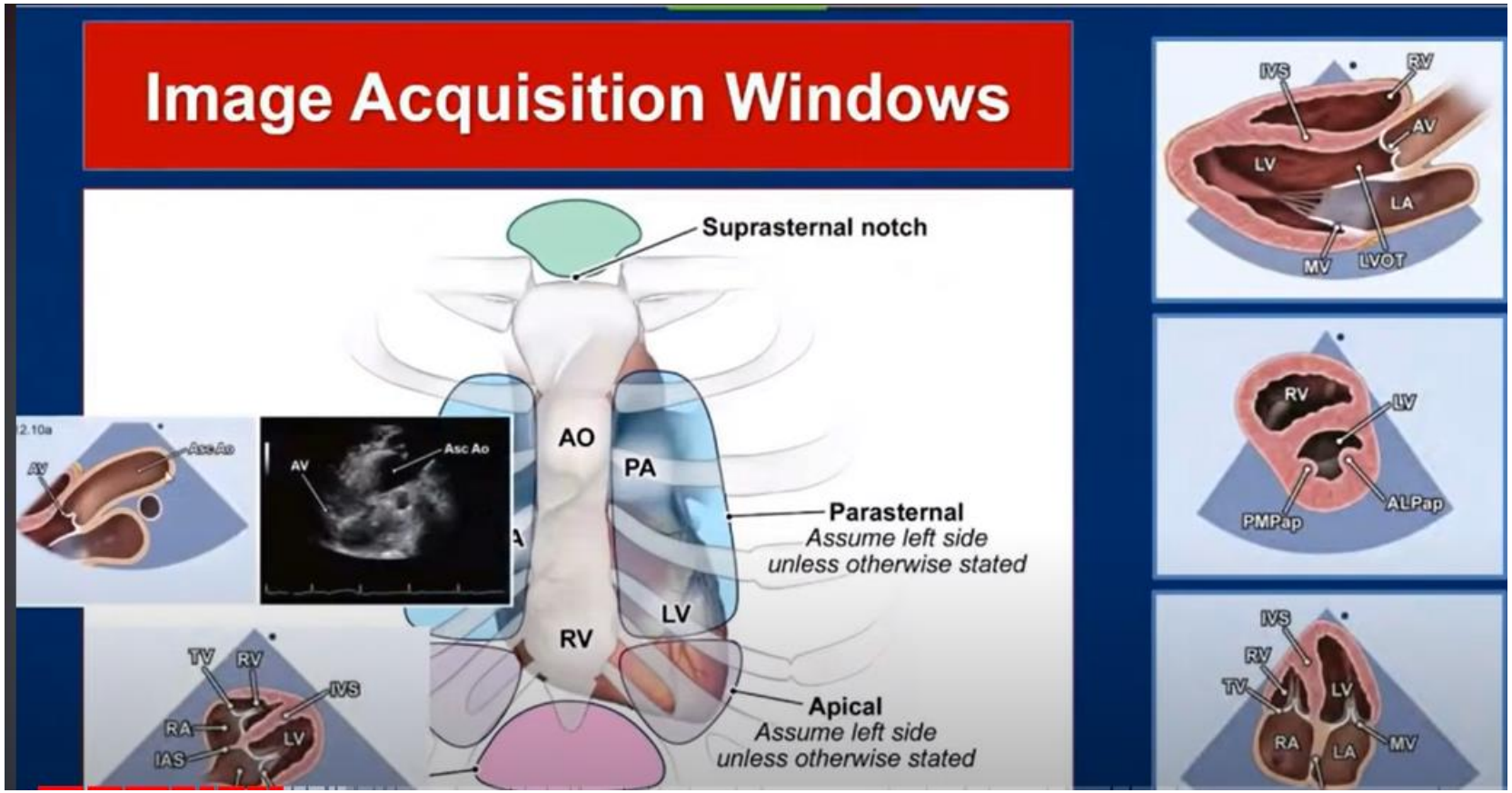
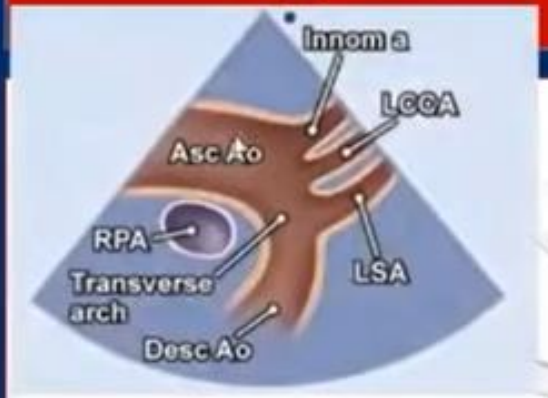
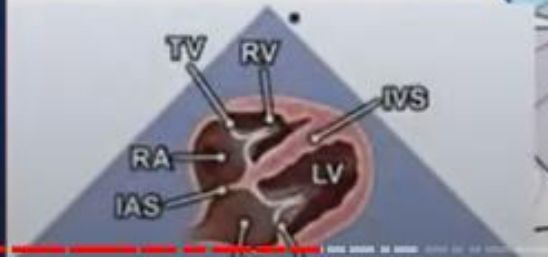
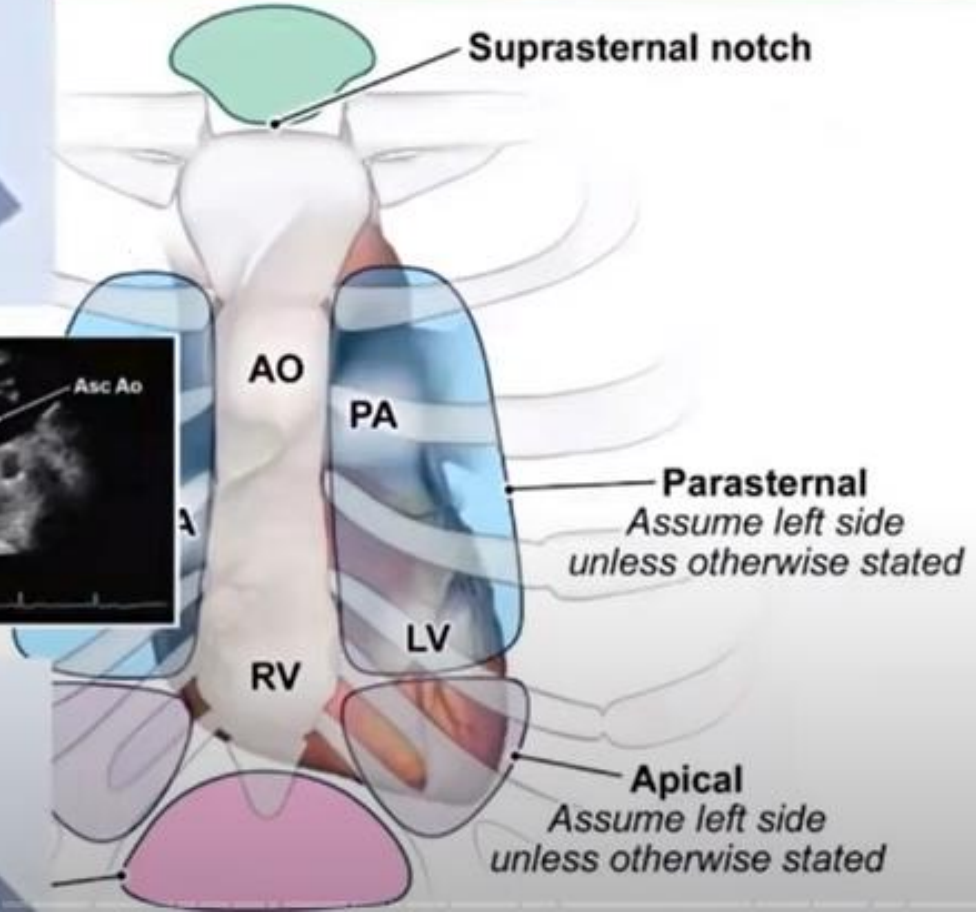


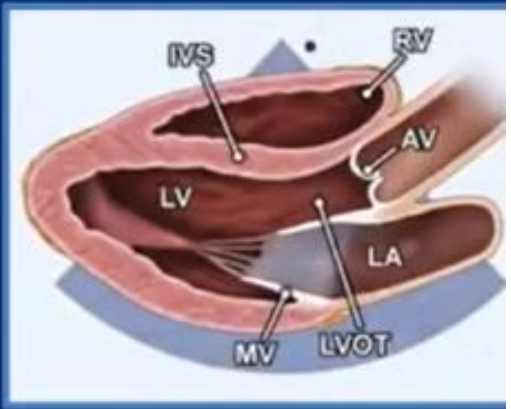
Image Acquisition Windows
Suprasternal notch
AO
PA
RV
LV
Parasternal
Assume left side
unless otherwise stated
Apical
Assume left side
unless otherwise stated
2.10a
Asc Ao
AV
Asc Ao
AV
TV
RV
IVS
RA
LV
IAS
IVS
RV
AV
LV
LA
MV
LVOT
RV
LV
PMPap
ALPap
IVS
RV
TV
LV
RA
LA
MV

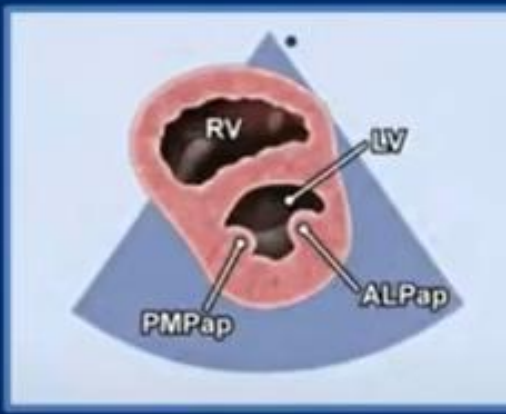
Image Acquisition Windows

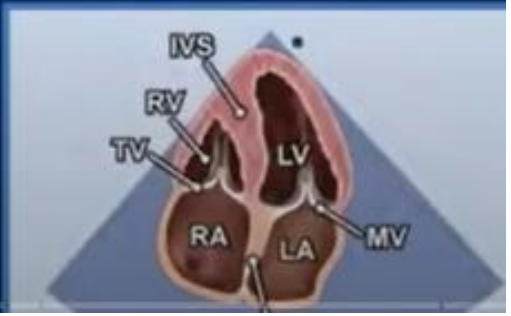




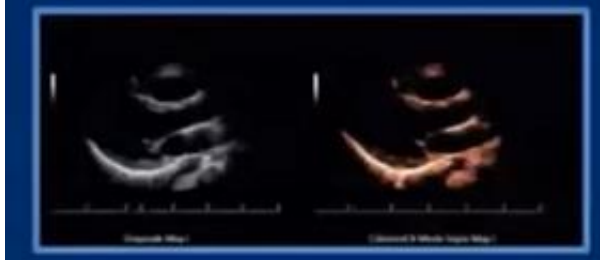






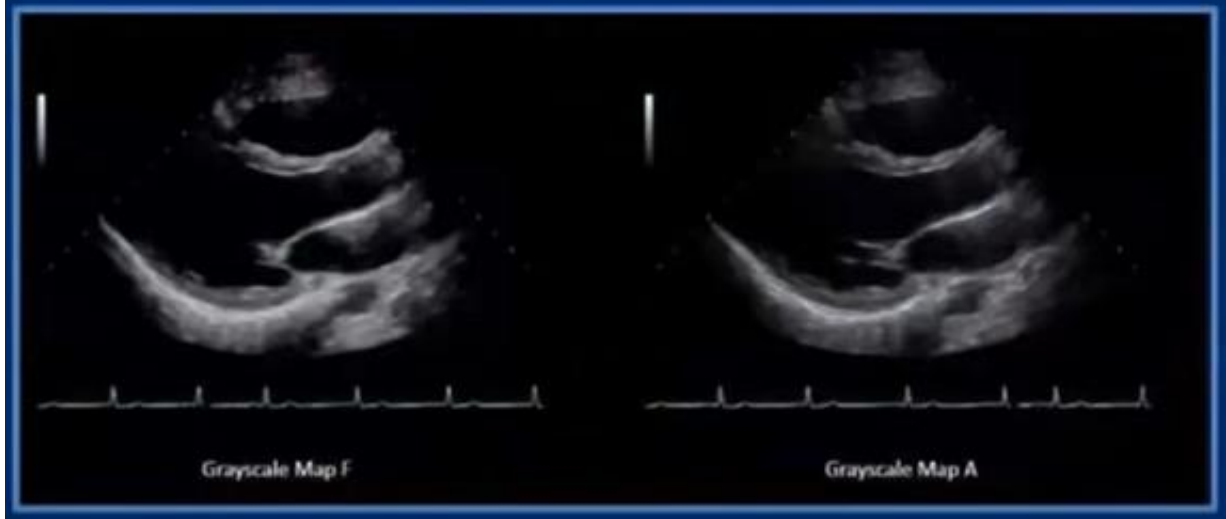


2D B-mode Instrumentation Settings



- Grayscale maps
- Overall Gain
- Dynamic range
- Time-gain-compensation (TGC)

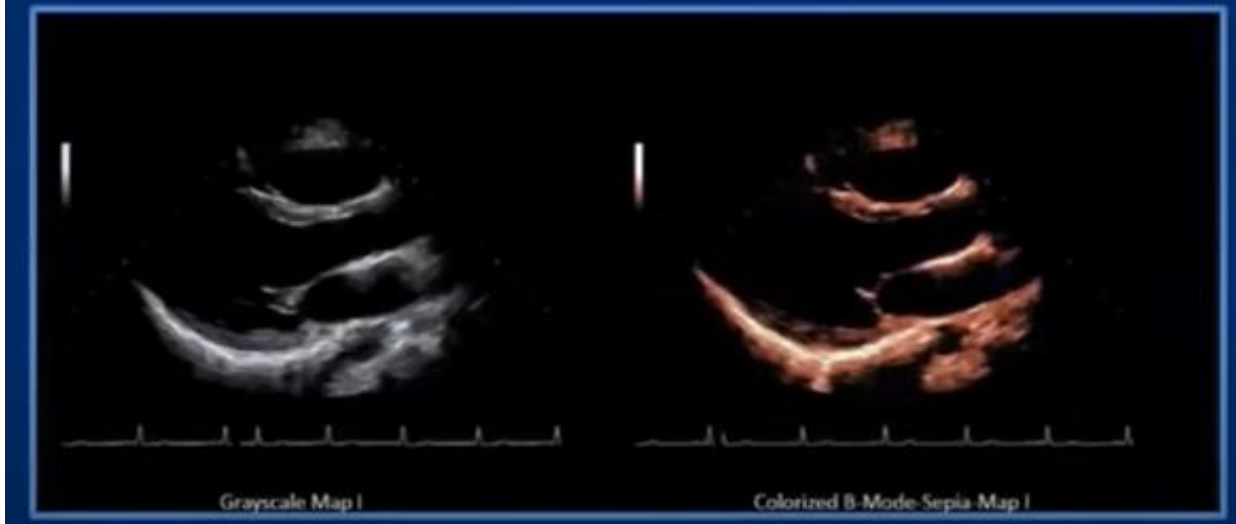
Grayscale Maps



Determines grayscale intensity value assigned to returning signals

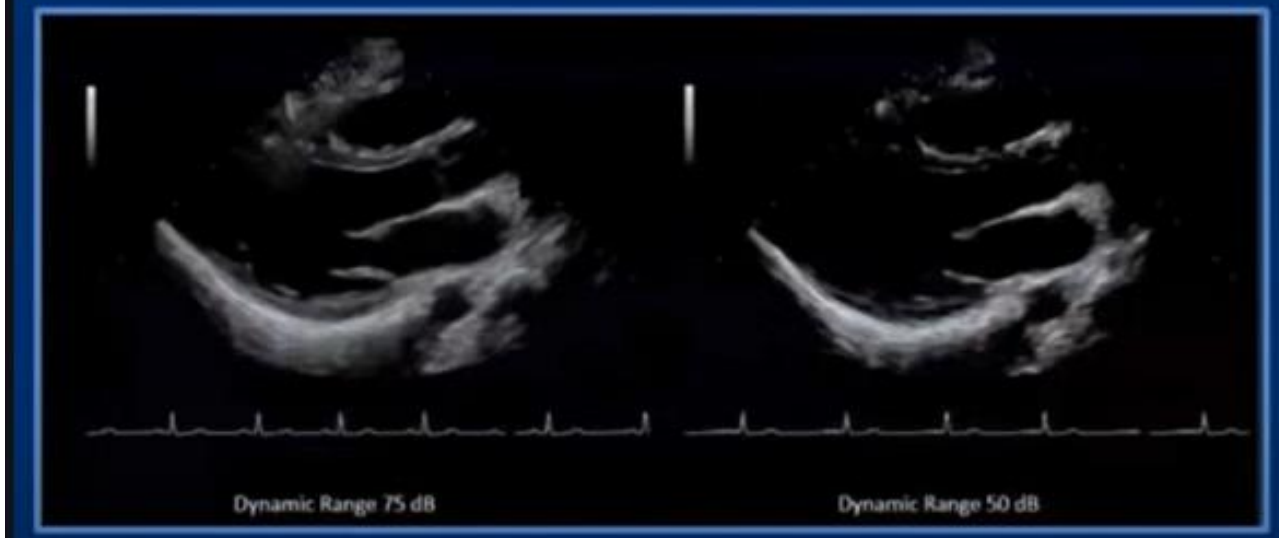
- **Definition**
  - Instrumentation setting that adjusts how shades of gray will be displayed on the image
  - Determines how the brightness of each shade of gray will be displayed in B-mode
- **Effect on Image**
  - Determines how shades of gray will be displayed
  - Operator may select based on specific findings in the image

B-mode Colorization



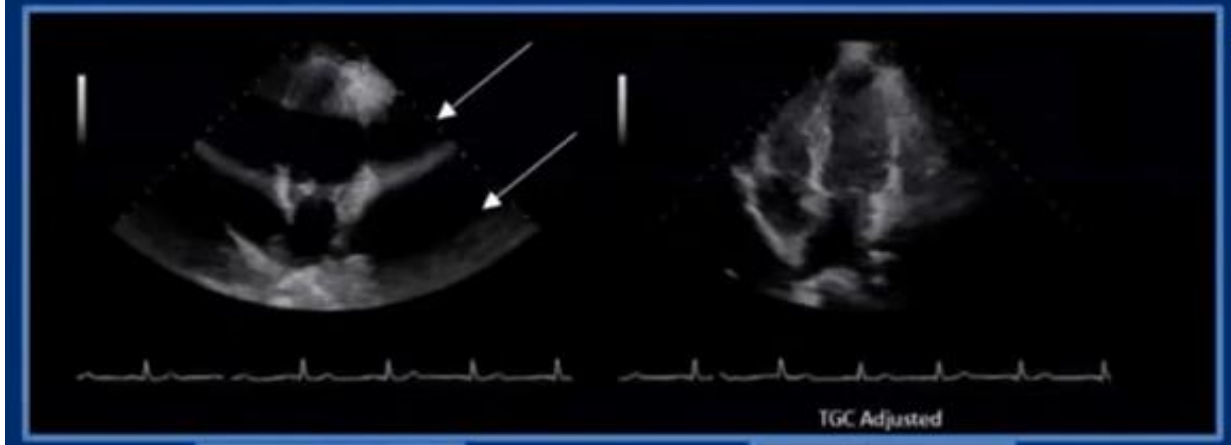
- **Definition**
  - Transforms grayscale image to a different range of colors
  - Lab preference
    - May demonstrate certain pathologies better
- **Effect on Image**
  - Grayscale image colorized
  - Does not change the amount or type of information displayed only the perception for the viewer

Dynamic Range



- **Definition**
  - Ratio between the highest and lowest received echo amplitudes in the image
- **Effect on Image**
  - Adjusts the appearance of the shades of gray on the image
  - low dynamic range setting yields an image that is very black and white (high contrast).
  - High dynamic range setting produces an image that has more shades of gray
    - Smaller range of amplitudes is assigned to a particular shade of gray making up the image
  - Cardiac imaging
    - Provide enough shades of gray to discern the interface between compacted and non-compacted myocardium

Time-Gain Compensation



- **Definition**
  - Usually a series of pods that can be adjusted to amplify a particular portion of the image
  - Used to make up for energy loss due to attenuation
- **Effect on image**
  - Selective amplification equalizes the appearance of structures across the entire image