



Welcome, Intro & Goals

PP16 Imaging Conference

Bicol Hospital, Legaspi City, Philippines

July 2016

David Adams, ACS, RCS, RDCS, FASE

Duke University Medical Center



Echocardiography



The Anatomy Lesson of
Dr. Tulp by Rembrandt



SMEE



ASE
Foundation



Proposed Echo SMEE



- **This SMEE will be an educational collaboration between the Navy, American Society of Echo Foundation (ASEF) and the Philippine Society of Echocardiography (PSE) at the Bicol Hospital.**
- **Navy Cardiologist CDR David Krause**
- **The ASEF - approved this as one of three 2016 global health initiatives.**
 - **Team Leader: David Adams, Duke Cardiac Sonographer**
 - **ASEF Staff: Andrea Van Hoever, VP of Research**
 - **additional ASE cardiologists & sonographers**
- **PSE President Dr. Edwin Tucay and Dr. Thad Ciocson from Bicol Hospital**
- **Format: 2 day seminar with lectures on current updates in echo and hands on training of echo techniques scanning patients provided by Dr. Ciocson. The emphasis will be on screening for congenital and rheumatic heart disease.**

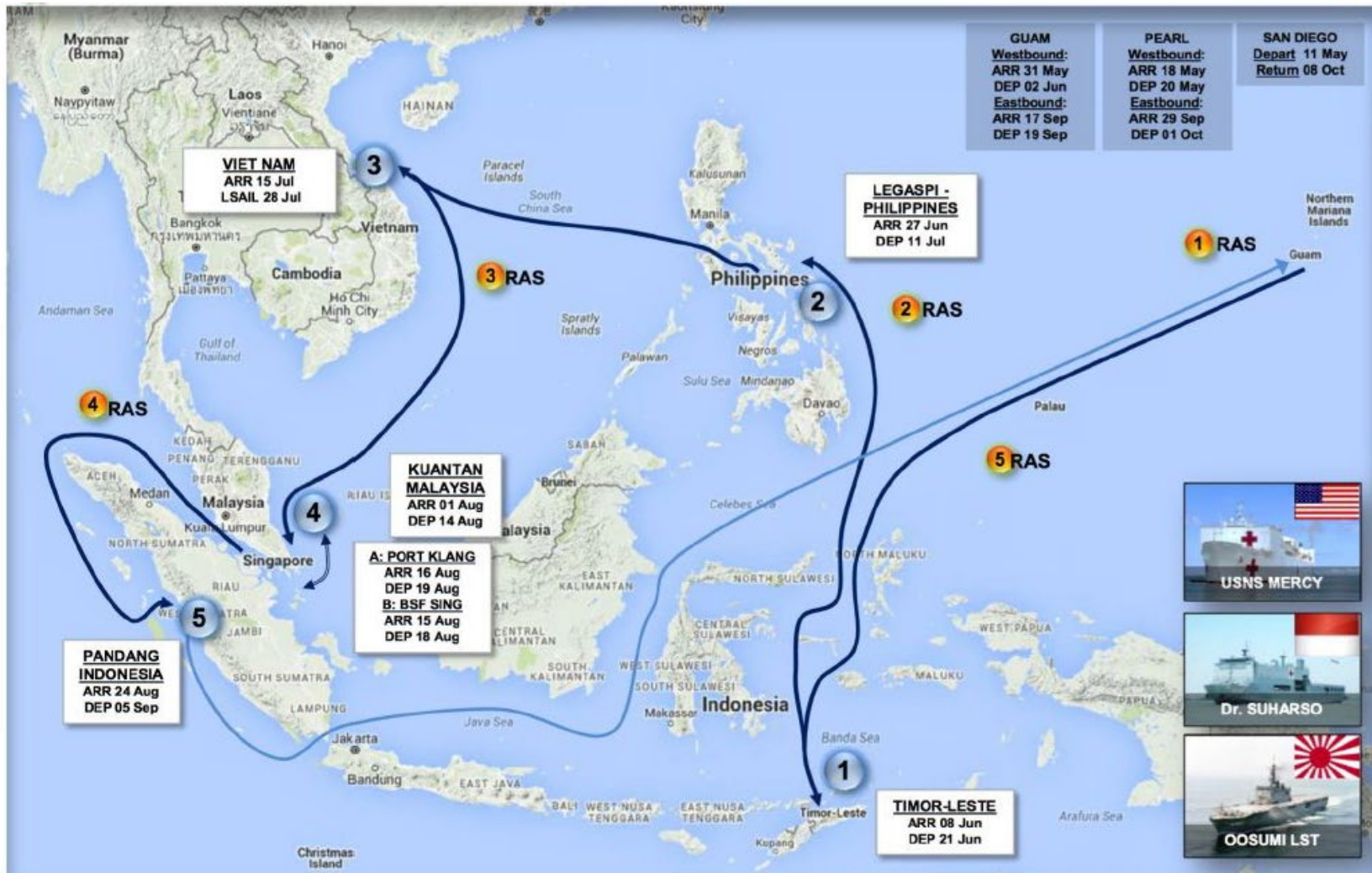


USNS Mercy





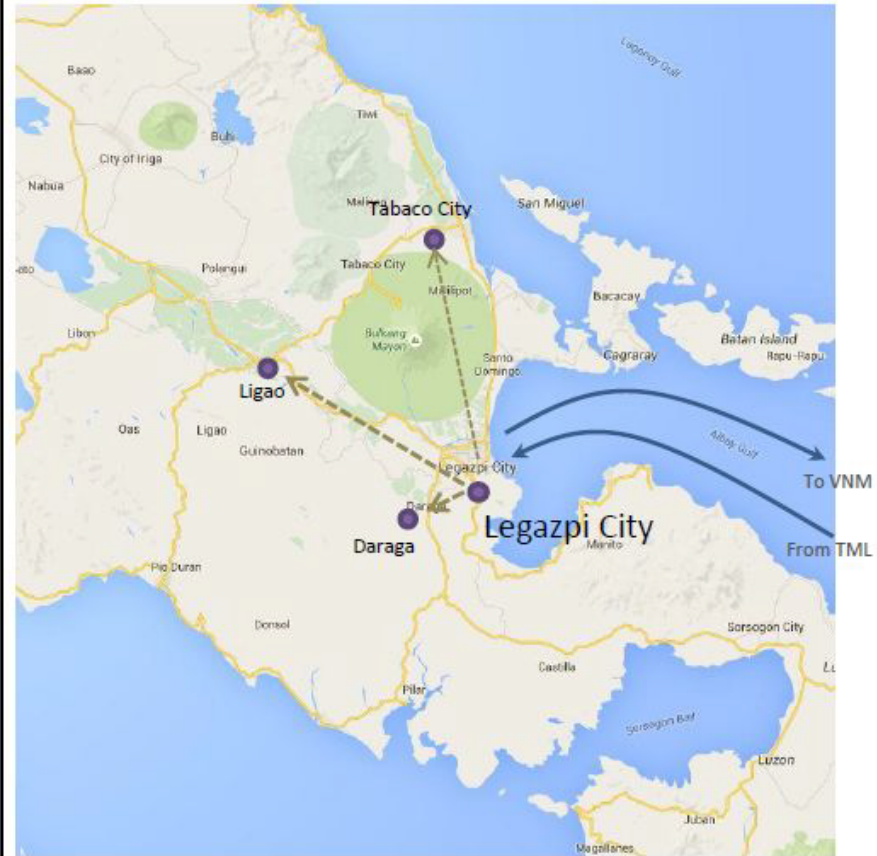
Countries in PP16





PP16 in Legazpi

- MON 27 JUN
 - ARRIVE IN LEGAZPI FROM TML
- TUE 28 JUN – SAT 09 JUL
 - MEDICAL/DENTAL/NURSING SMEEs
 - » ZIGA MEMORIAL HOSPITAL (TABACO CITY)
 - » JOSEFINA DURAN HOSPITAL (LIGAO)
 - » BICOL REGIONAL TEACHING AND TRAINING HOSPITAL (BRTTH) (LEGAZPI CITY)
 - SURGICAL CARE ONBOARD MERCY
- TUE 28 JUN – THU 07 JUL
 - CHE AND SMEE IN TABACO CITY, LIGAO, AND DARAGA
- THU 30 JUN
 - DISASTER SYMPOSIUM AT BRTTH
- SAT 09 JUL
 - CULMINATING DISASTER DRILL
- MON 11 JUL
 - DEPART LEGAZPI FOR DA NANG, VIETNAM





A long, long time ago





Goals



- **Learn from each other**



Day 1



Friday, July 1

08:45-09:00: Welcome, Introduction and Goals

09:00-09:30: Optimizing Echo / Hemodynamics - David Adams

09:30-10:00: Echo Assessment of Stenotic Lesions – Melissa Cundangan, MD

10:00-12:00: "Patient Scanning" with ASE / Navy / PSE team

10:00-10:30: Patient Prostheses Mismatch (PPM) – Myla Supe, MD

10:30-10:45: Break

10:45-11:15: Echo Assessment of Valvular Regurgitation – Gregg Pressman, MD

11:15-12:00: Echocardiography and Endocarditis – Gregg Pressman, MD

12:00-13:00: Lunch

13:00-14:00: Echocardiography Cases—Aurora Gamponia, Jonnie Bote-Nunez, David Adams & CDR Krause

14:00-16:00: "Patient Scanning" with ASE / Navy / PSE team



Day 2



Saturday, July 2

09:00-09:30: RV Size and Function – Edwin Tucay, MD

09:30-10:00: CHD: A Segmental Approach – Aurora Gamponia / Jonnie Bote-Nunez, MDs

10:00-12:00: “Patient Scanning” with ASE / Navy / PSE team

10:00-10:30: 2015 ASE Guidelines for Chamber Quantification – Jose Magno, MD

10:30-10:45: Break

10:45-11:15: Restrictive vs Constrictive Disease – Lucy Safi, MD

11:15-12:00: Implementing New Technology – David Adams

12:00-13:00: Lunch

13:00-14:00: Echocardiography Cases—David Adams & CDR Krause, MD

14:00-16:00: “Patient Scanning” with ASE / Navy / PSE team

16:15-16:30: Wrap up / Comments / Feedback



Goals



- **Learn from each other**
- **Ask questions**
- **Be flexible**
- **Take care of our patients**
- **Questions?**



Optimizing Echo / ~~Hemodynamics~~

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PACIFIC PARTNERSHIP 2016



Optimizing Echo / Hidden Things in the Heart

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Todays Talk

- **Optimizing the Echo Images**
- **Ultrasound Machine Controls**
 - **Why it's important**
 - **Good vs Bad**



Why its important

- **Operator dependent technique**
- **Image quality varies between pts**
- **Quality affects measurements**
- **And diagnosis**



The Challenge

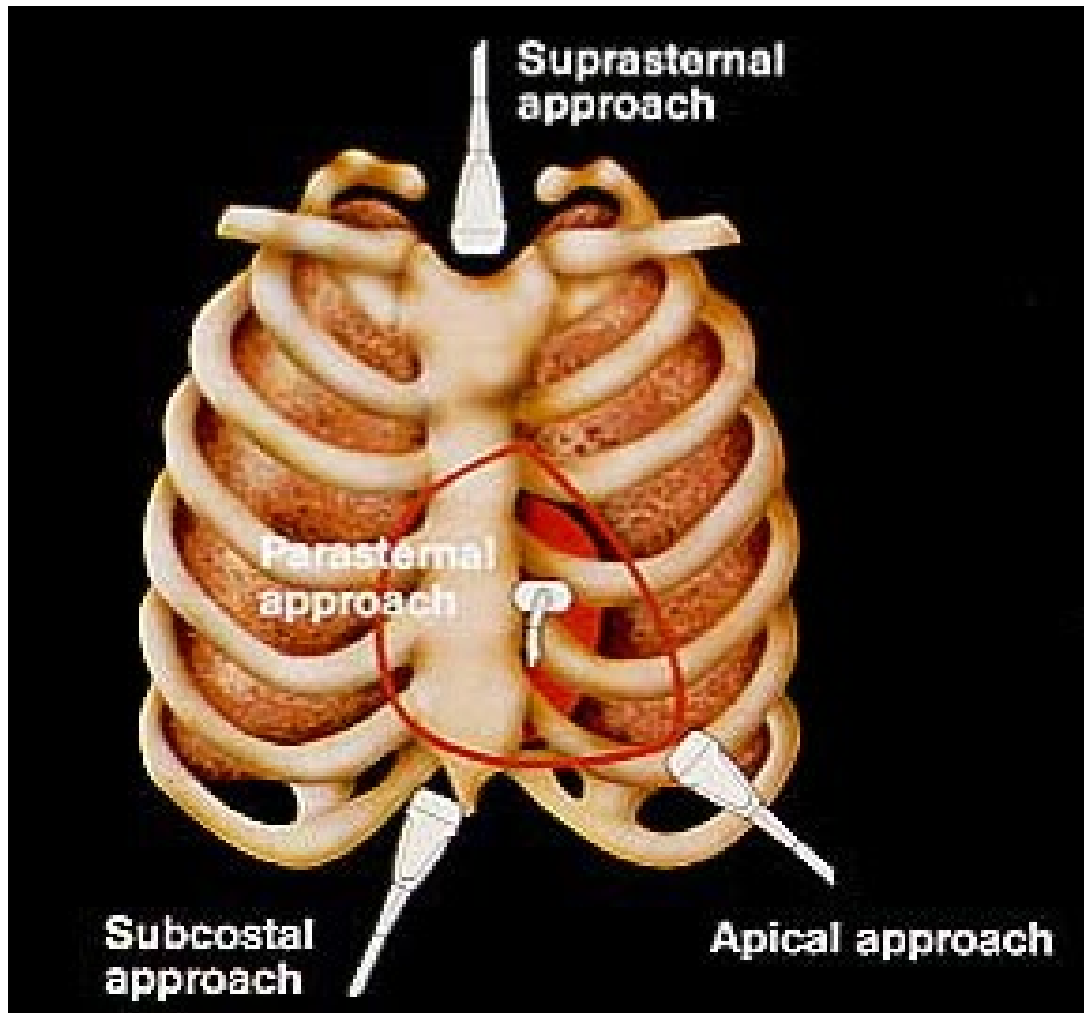


Fig 2-17



Knobology

- **The science of which knob or control to adjust and what it does to an ultrasound image.**



Goals

- **When to use what controls**
- **Optimizing the 2D images**



Controls: 2D Images

- **Depth**
- **Sector size**
- **Gain**
- **TGC**
- **Frequency**
- **Harmonics**
- **Gray scale**



2 Common Mistakes

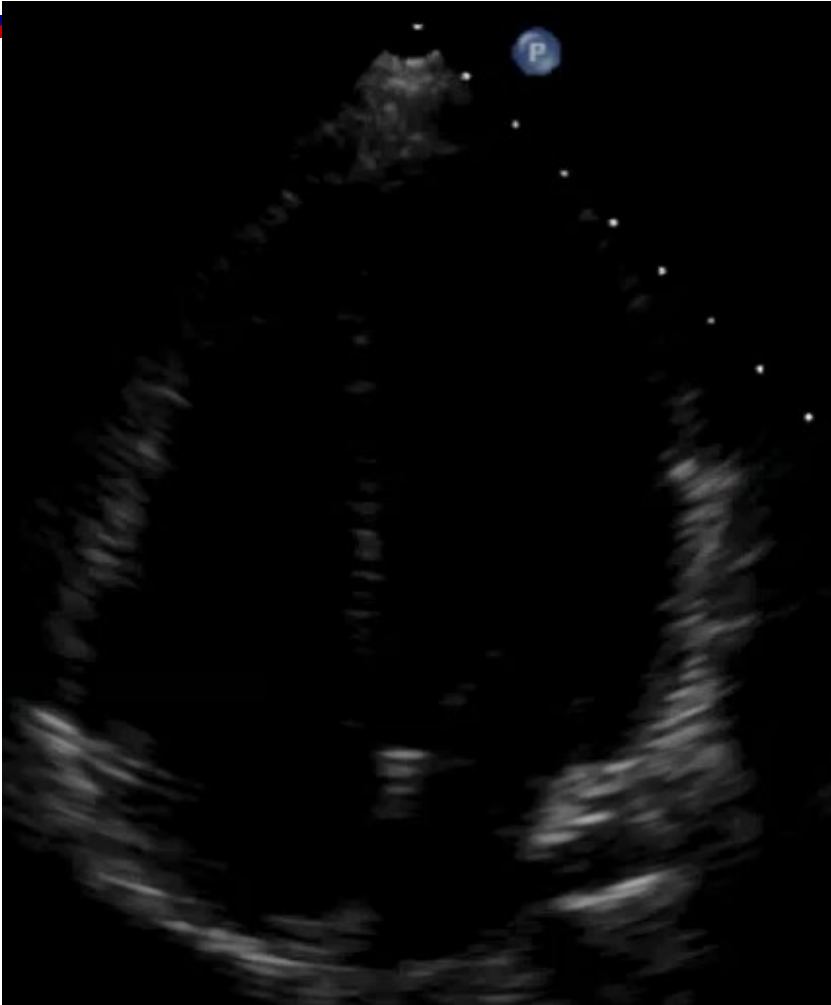
- **Over gaining**
 - **destroys resolution**

Important controls

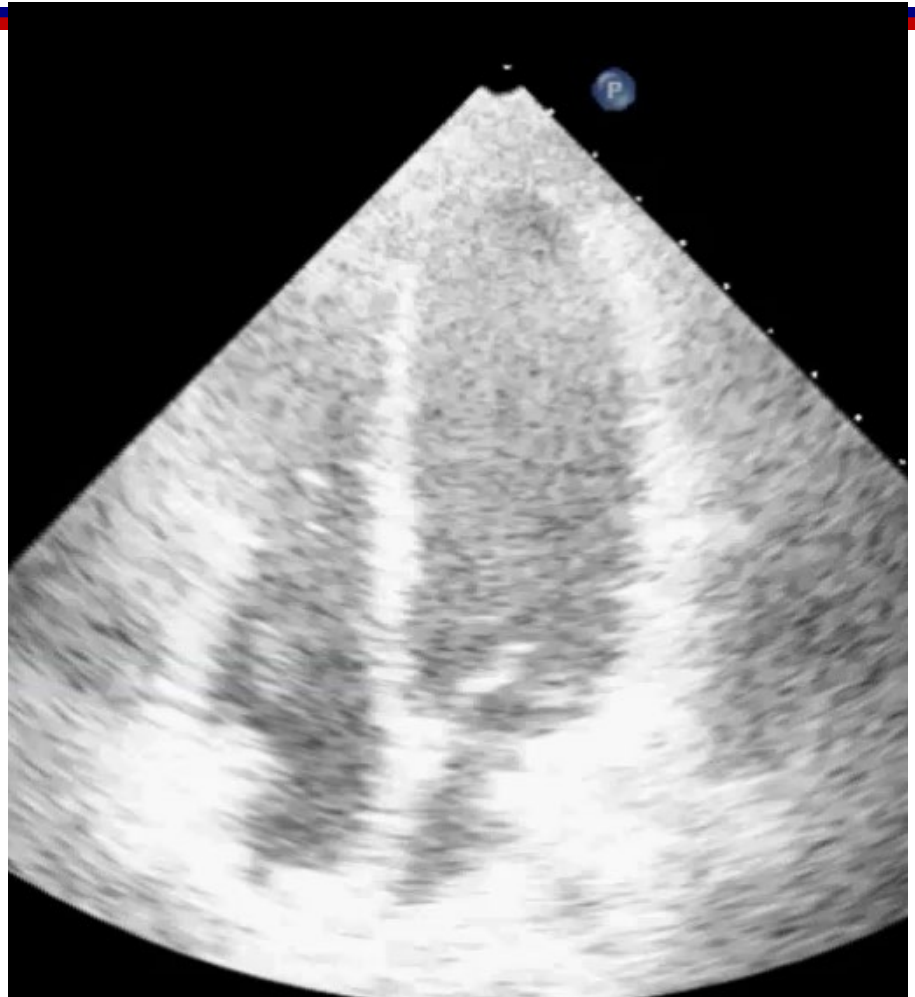




2D Gain



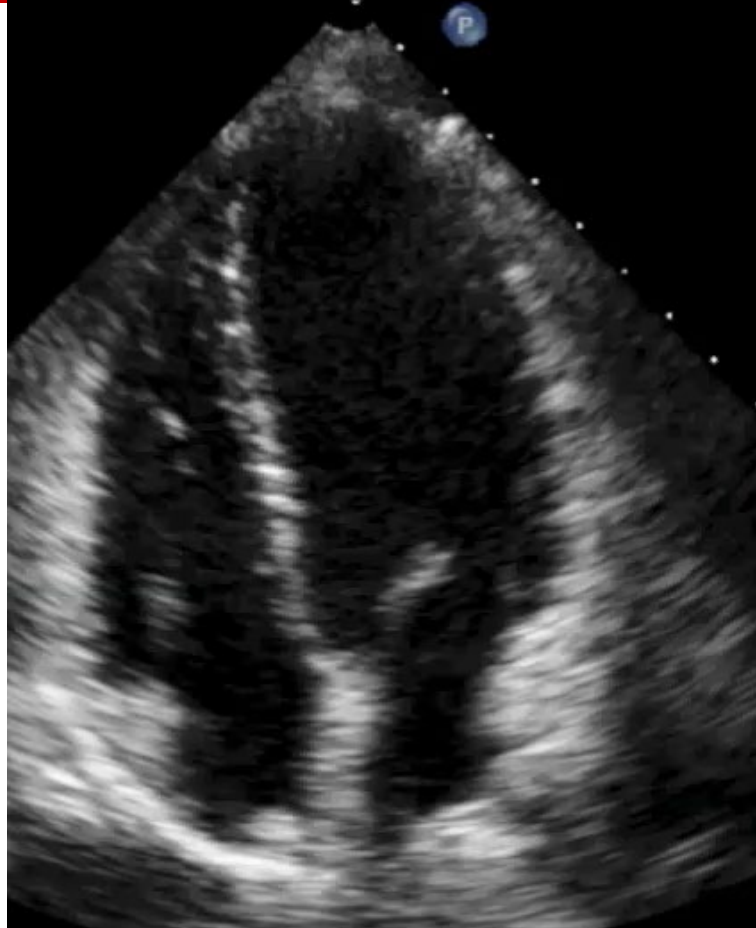
Too Low



Too High



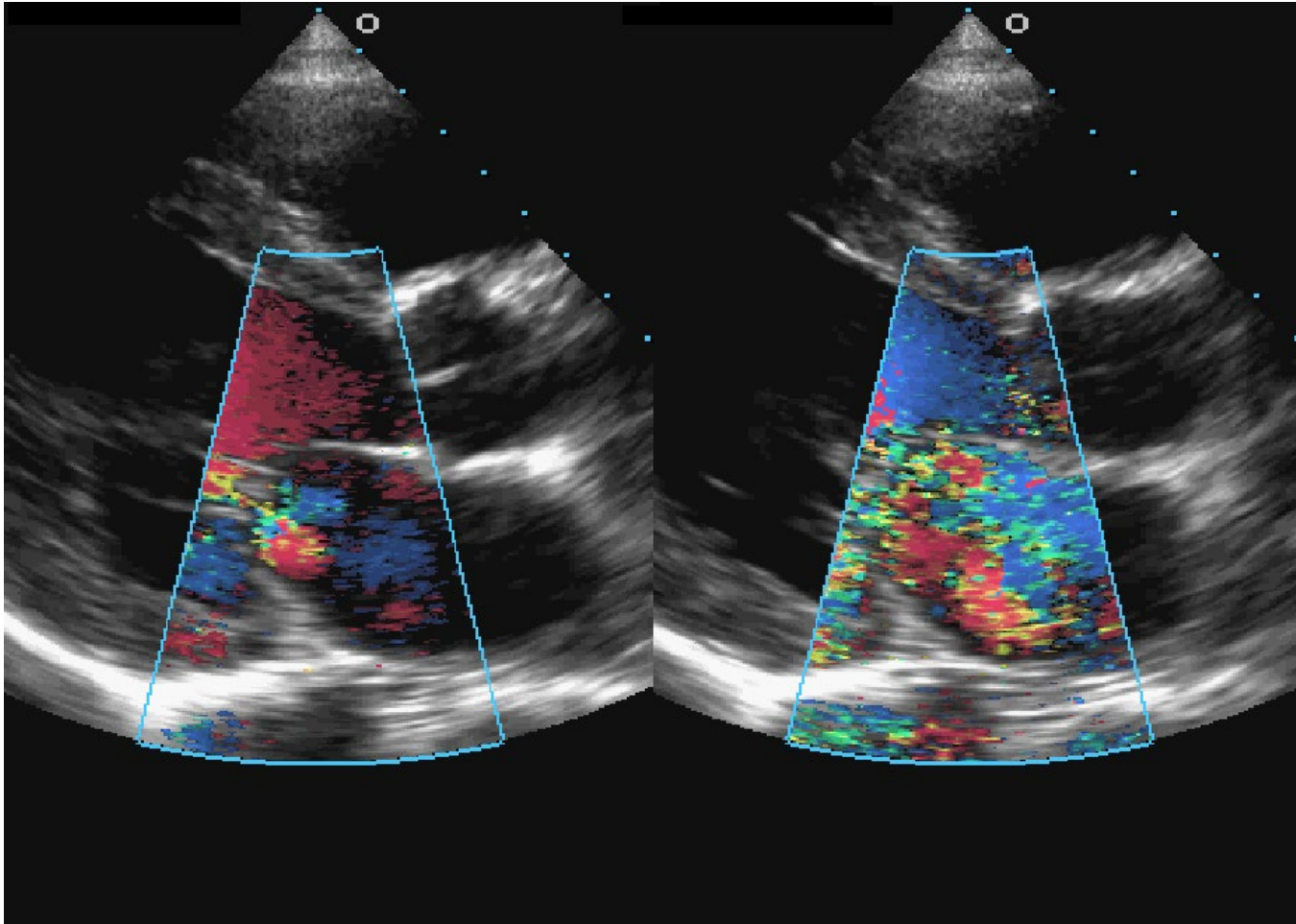
2D Gain



Just Right



Color Doppler Gain



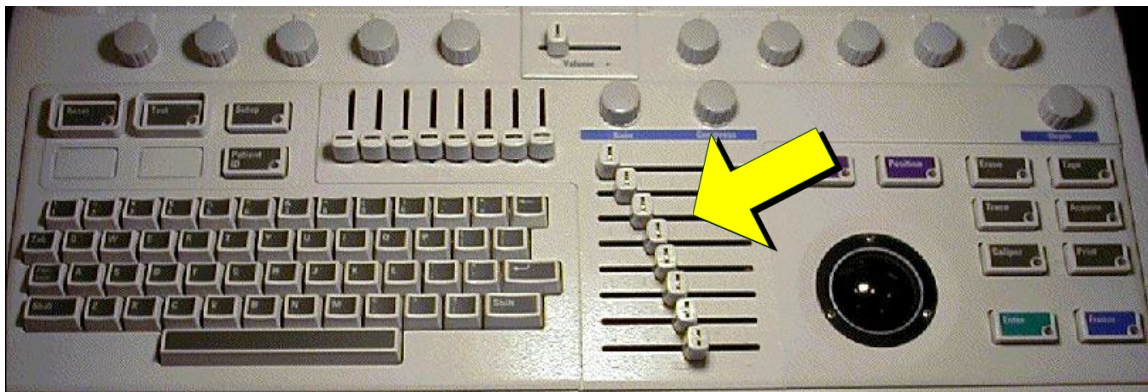
Good

Too High



TGC

- **Time Gain Control (Compensation)**
- **Evens out the overall image brightness**
- **Suppresses the strong near field echoes**
- **Boosts the weaker far field echoes**



Bad TGC Settings

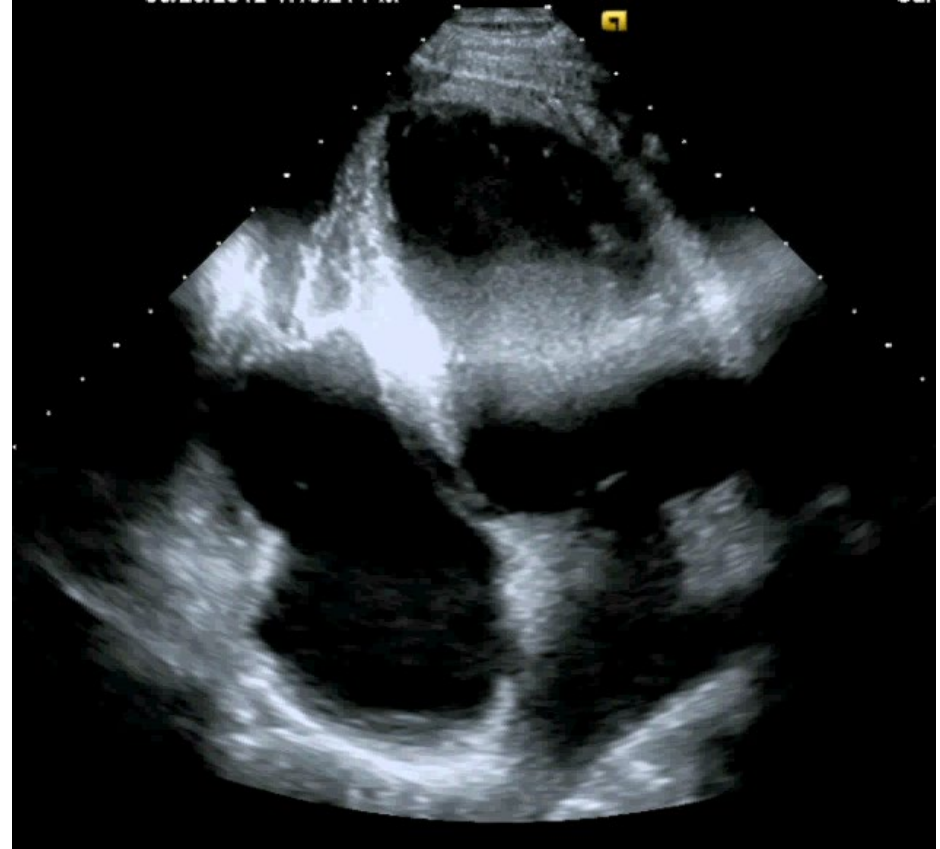
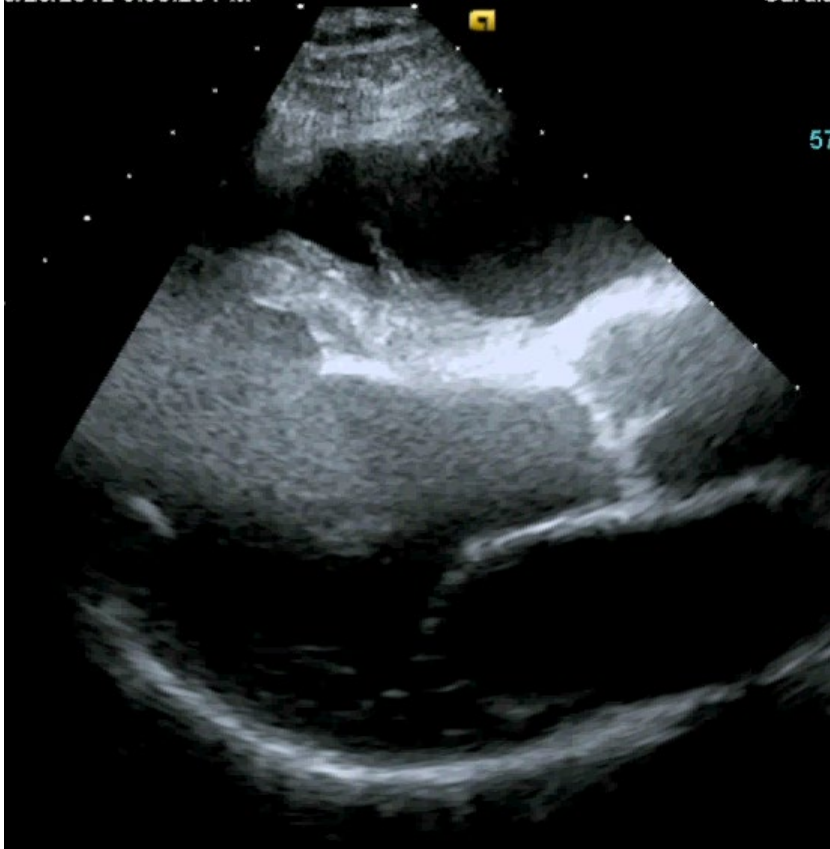




Image Quality

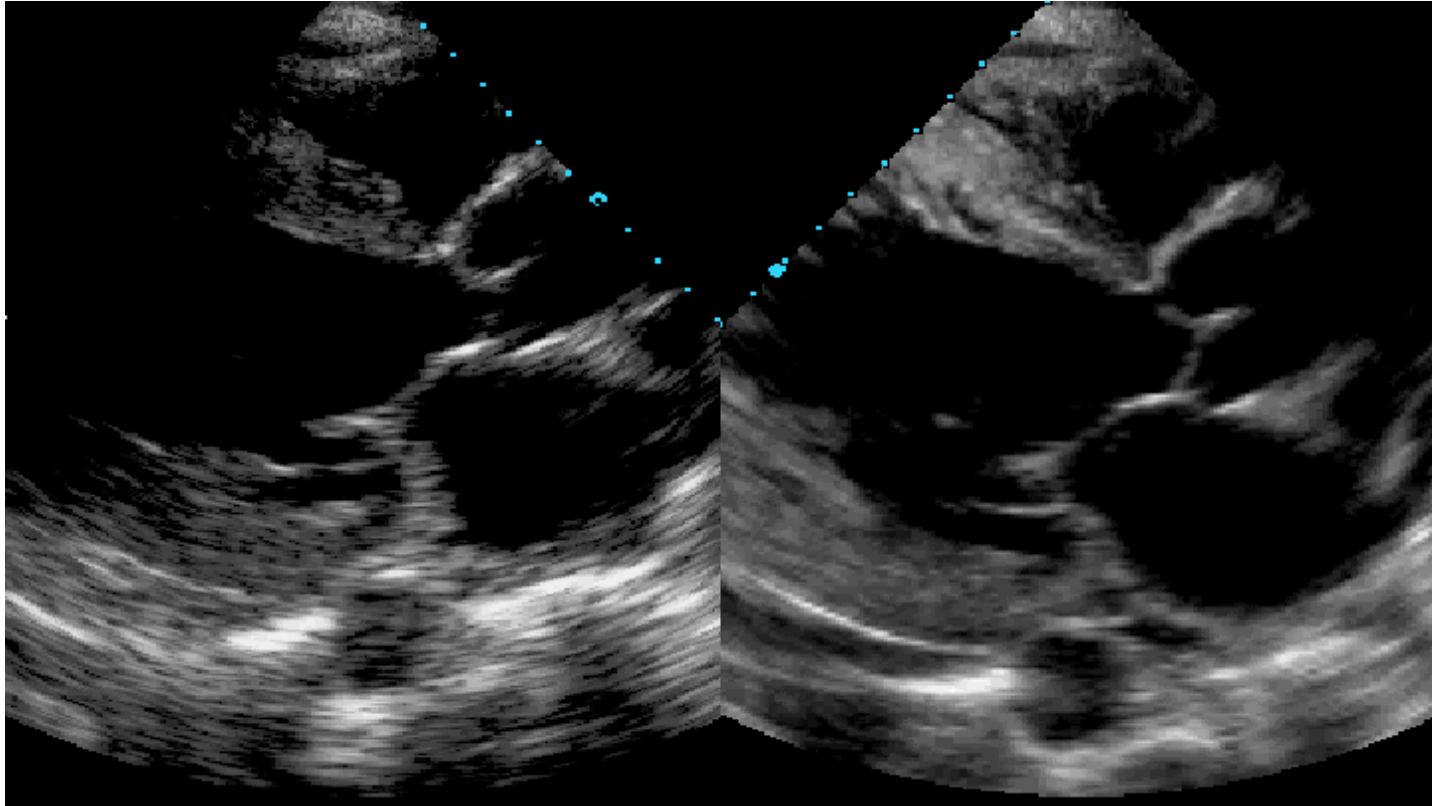
- **Resolution**
- **Target acquisition**
- **Display (gray scale)**



Transducer frequency

- **Lower frequency**
 - **better penetration (targets)**
 - **worse resolution**
- **Higher frequency**
 - **worse penetration (targets)**
 - **better resolution**

Resolution



2.5 MHz

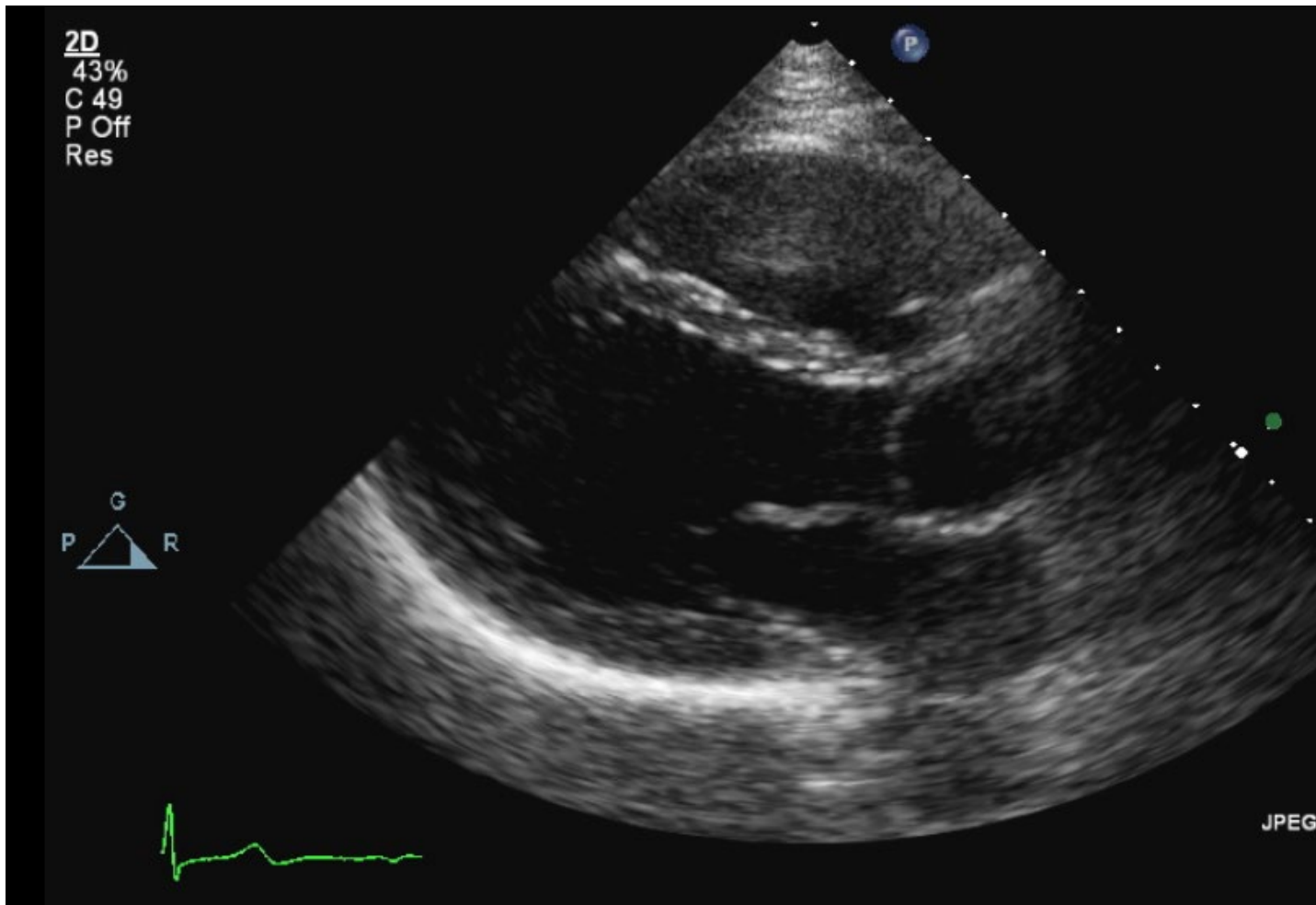
4.0 MHz



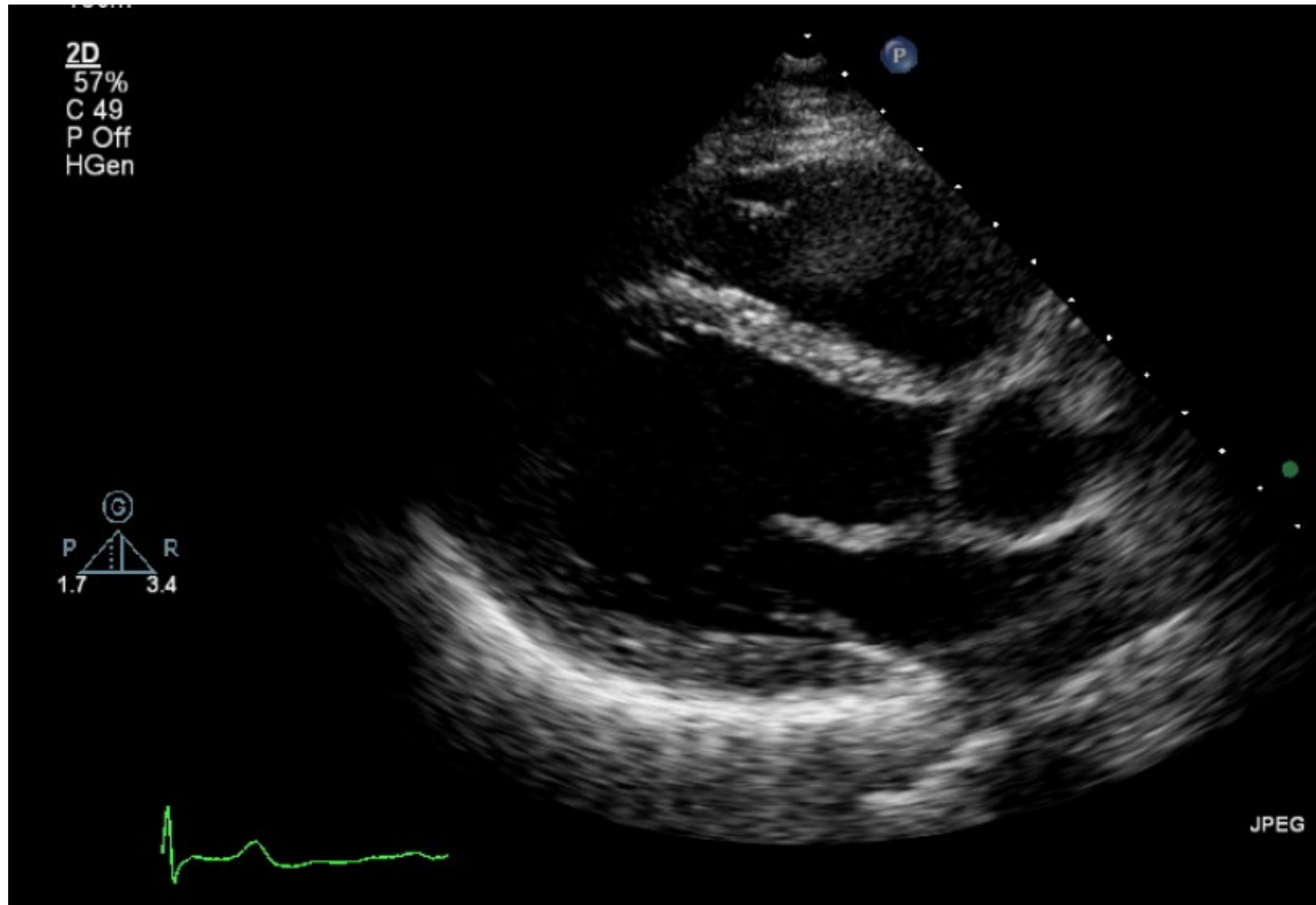
Harmonics

- **Fundamental**
 - **Transmit & receive at the same frequency**
- **Harmonics**
 - **Transmit & receive at different frequencies**

Fundamental Imaging



Harmonic Imaging

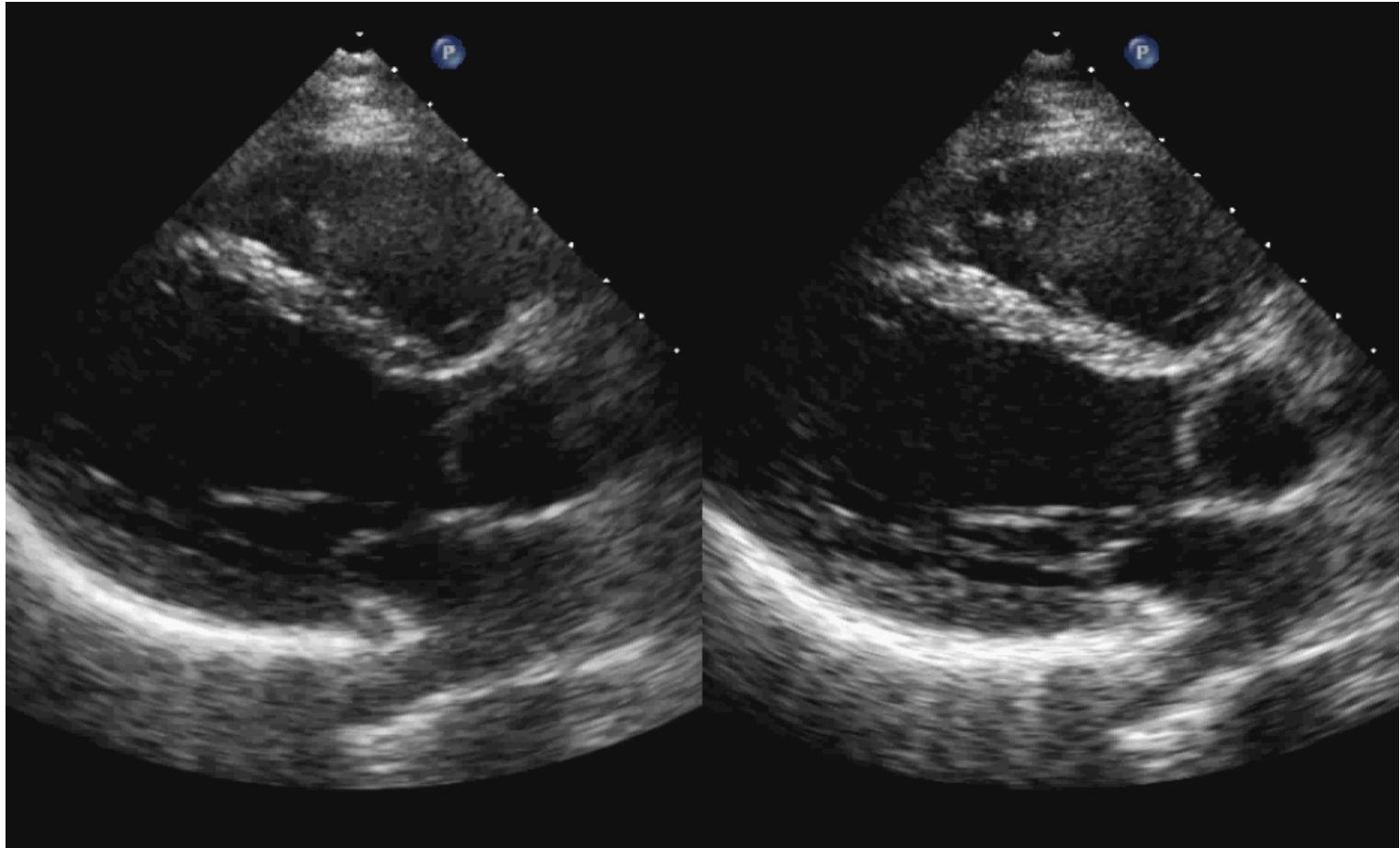




Harmonics

- **Why is it important?**
- **Harmonics causes the leaflets to be thicker.**
- **For RHD and measuring the leaflets – turn Harmonics off!!**

Harmonics



Off

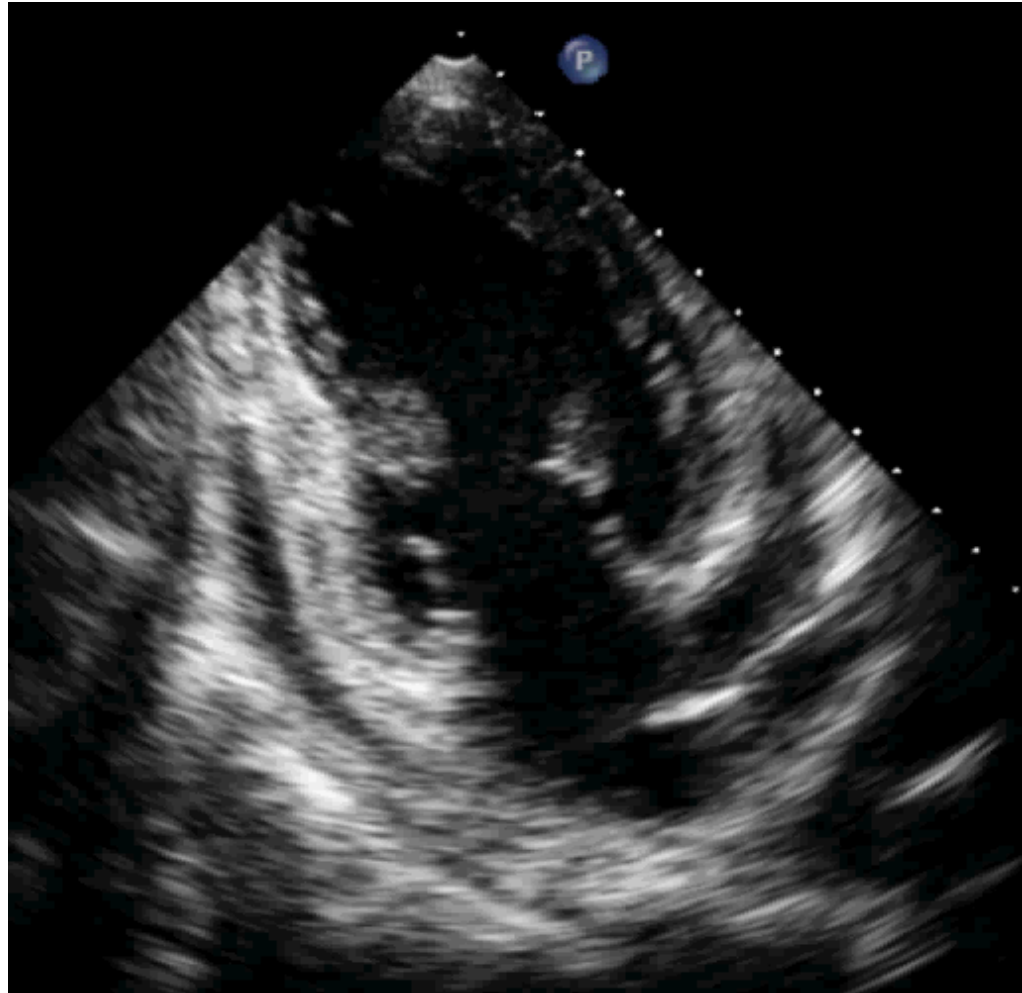
On



2 Common Mistakes

- **Over gaining**
- **Foreshortened
LV**

Foreshortened



Apical Four - Chamber

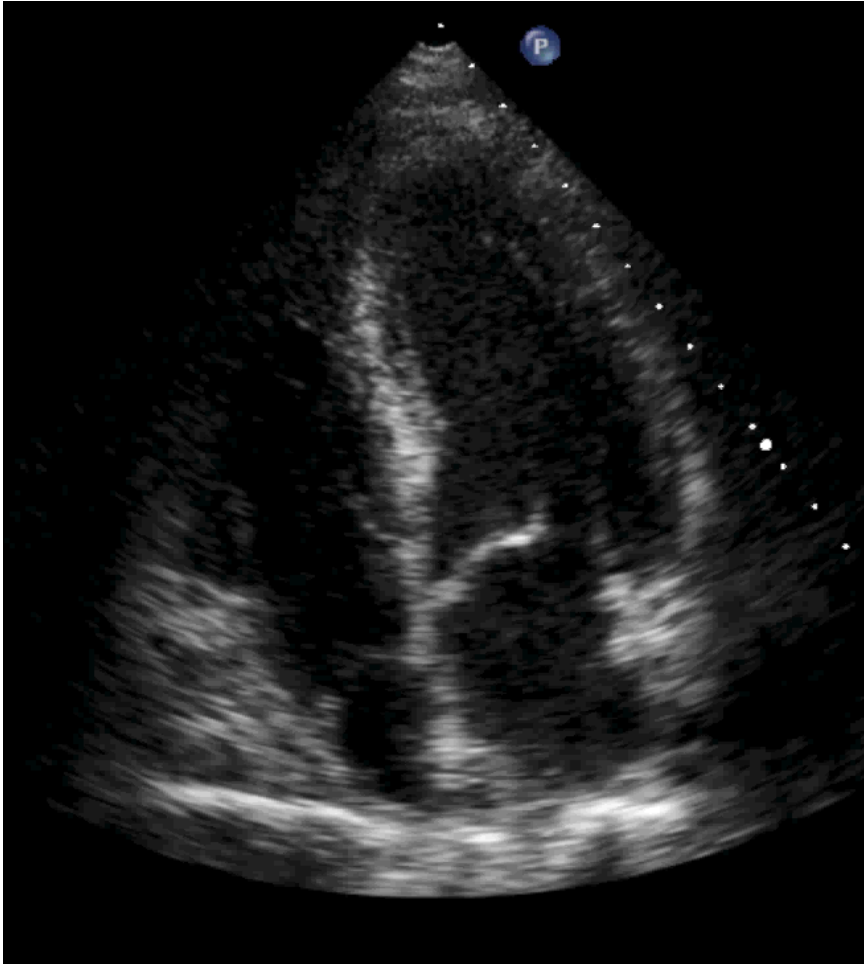


Image true apex

Maximize RV
dimension

No aorta

No coronary sinus



Systematic Approach

- **Optimal gray scale**
- **Adjust the monitor**
- **Image in view / depth**
- **TGC – even gray throughout**
- **Overall gain – do not over gain!!!**





Todays Talk

- **Optimizing the Echo Images**
- **Ultrasound Machine Controls**
 - **Why it's important**
 - **Good vs Bad**
- **Hidden Things in the Heart**



The Heart

- 4 chambers & 4 valves (hopefully)
- Other things we see:
 - ~~– Catheters / devices~~
 - ~~– Clots / cysts~~
 - ~~– Vegetation's~~
 - ~~– Tumors~~
 - ~~– Bullets / knives~~
 - ~~– Artifacts~~
 - Normal Variants



The Problem

- **Normal Variants can be confusing**
- **Mistaken for pathology**
- **Can lead to unnecessary tests or even cardiac surgery**
- **The Solution**
- **Know detailed anatomy**
- **Common things are common!**



Normal Variants

Eustachian valve

Crista terminalis

Ligament of Marshall

Trabeculations

Dumbell IAS

Q-tip sign

Coumadin ridge

Valve excrescences

Atrial septal aneurysms

Moderator Band

Pectinate muscles

False chords / tendons

Lipomatous Hypertrophy

Thebesian Valve

Chiari network

Eustachian ridge



Confusing!!!!!!

Eustachian all
Coun of Marshall
Q-tip sign
Crista terminalis
Eustachian valve
Trabeculations
Ligament of Marshall
Dumbell IAS
Valve excrums
escences
Pectinopharyngophary
Atrial septal aneurysm
Mod edge
Lipomatous rate
Chiari network
False chordae
Eustachian valve
Thebesian Valve
Band



Goals for Today

- **Review normal anatomy**
- **Review normal variants**
- **Show examples**
- **Become less confused**
- **The more you see the more you know**



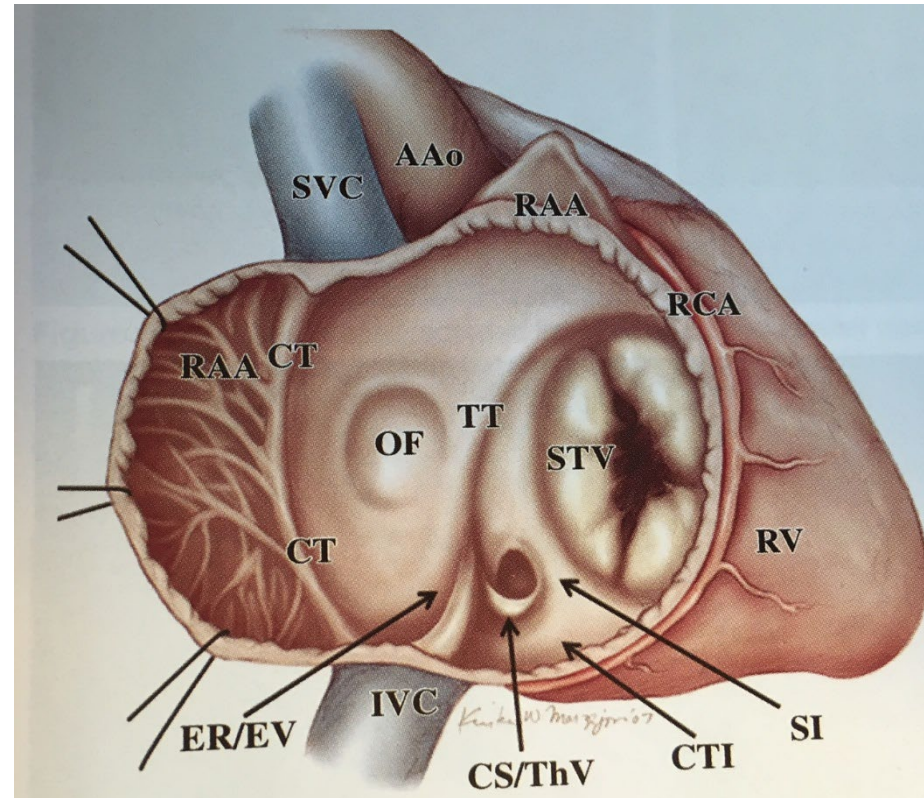
Right Atrium

- **Crista Terminalis**
- **Eustachian Valve**
- **Thebesian Valve**
- **Chiari Network**
- **IAS Lipomatous Hypertrophy**
- **IAS Aneurysm**



Crista Terminalis

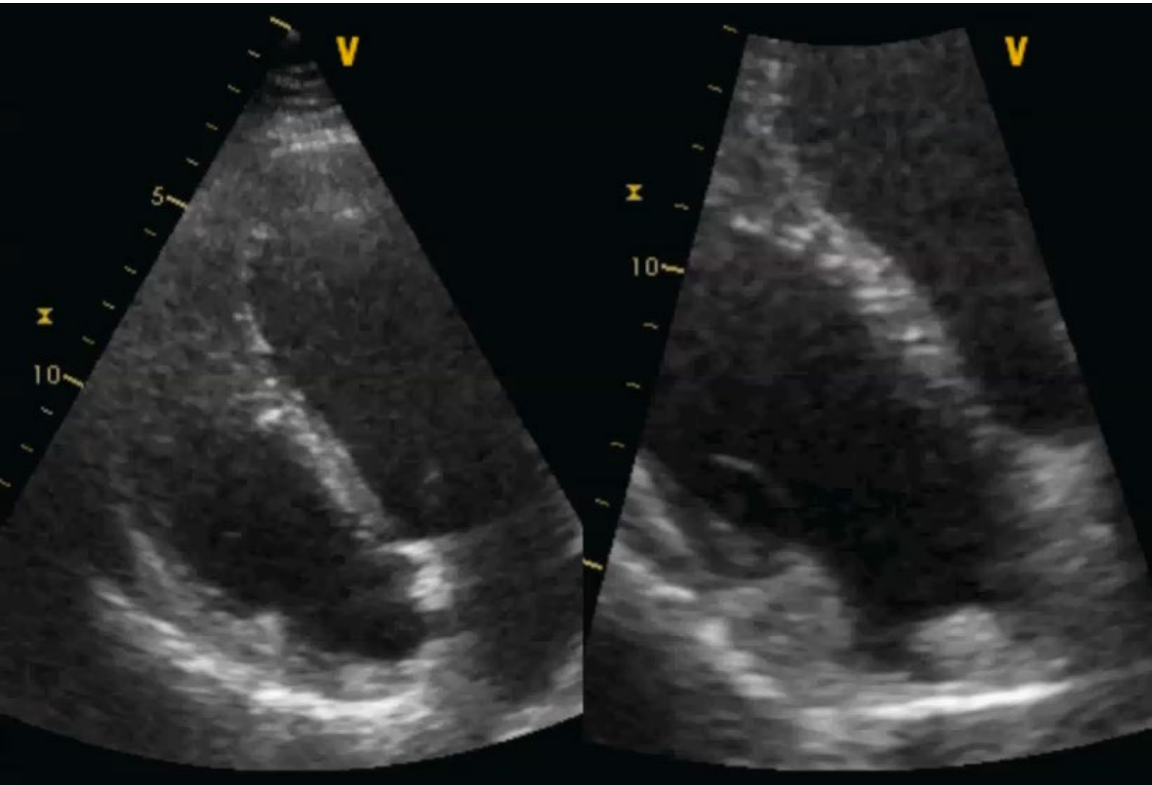
- Ridge between the smooth & trabeculated RA walls
- When prominent it may be mistaken for a RA mass



From *A Sonographer's Guide* textbook by Bonita Anderson



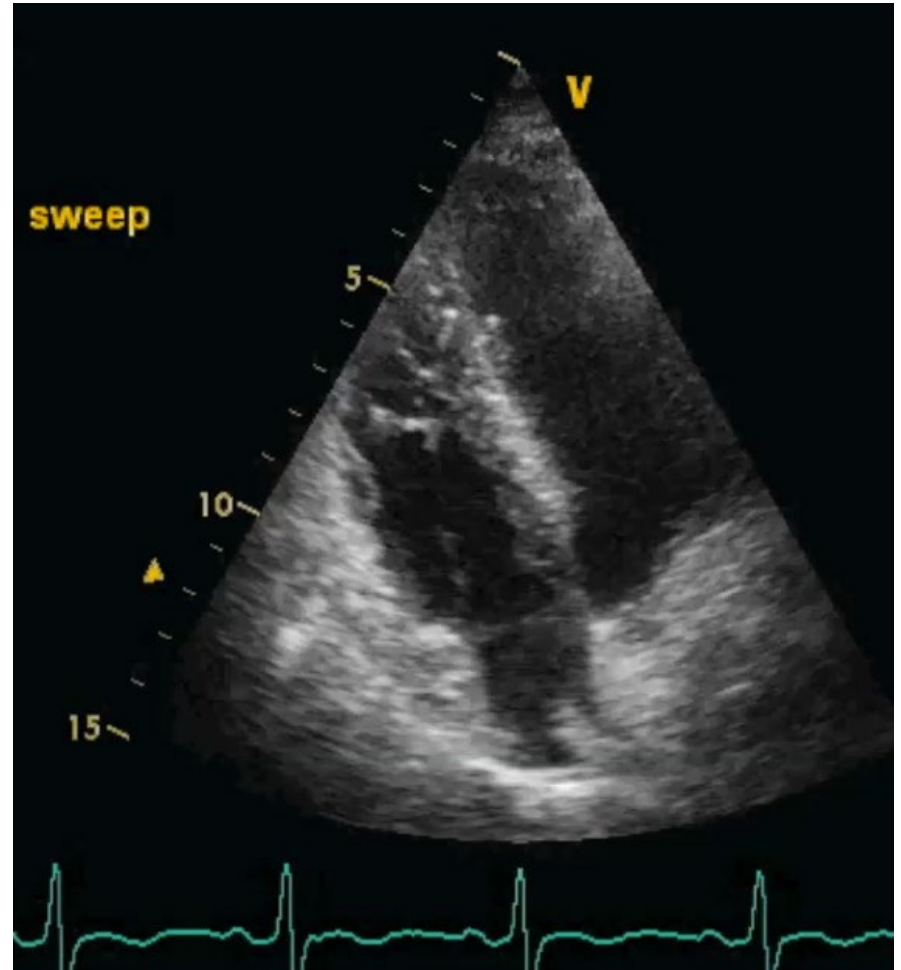
Crista terminalis





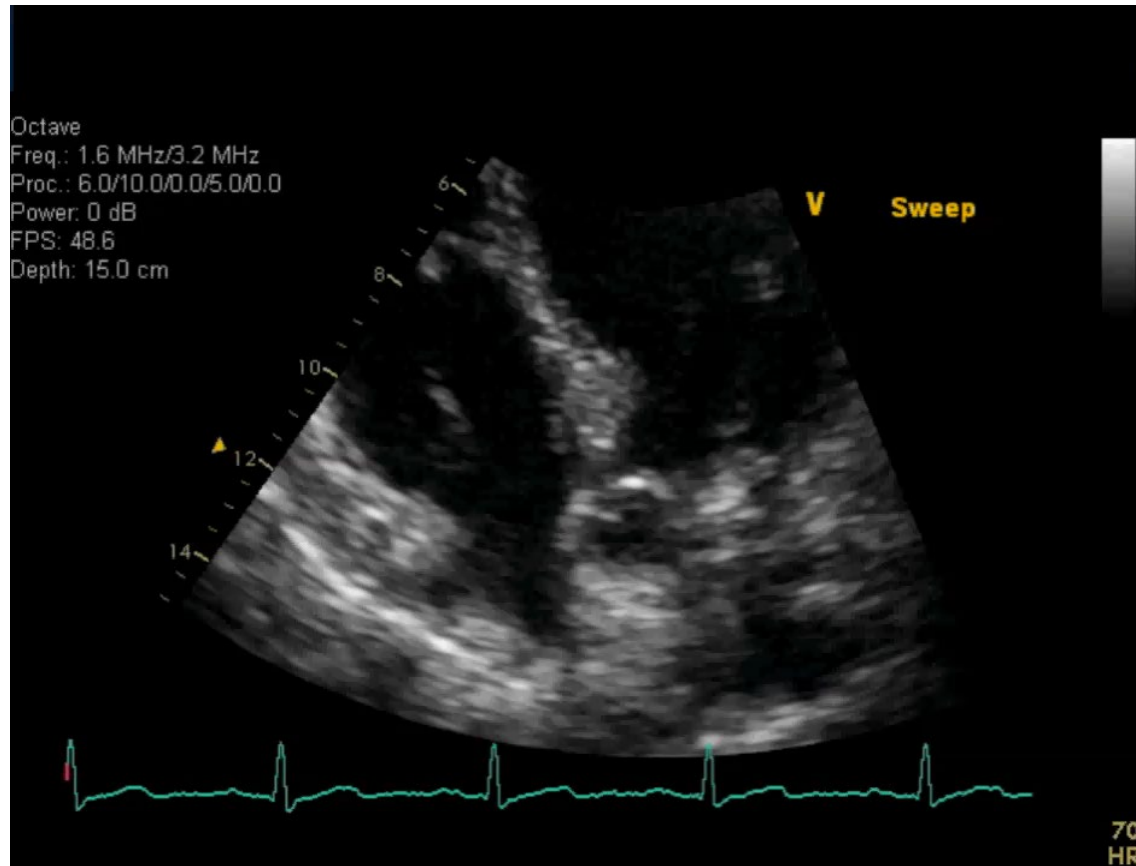
Crista terminalis

- Do sweeps
- Shows connections & the extent of anatomy





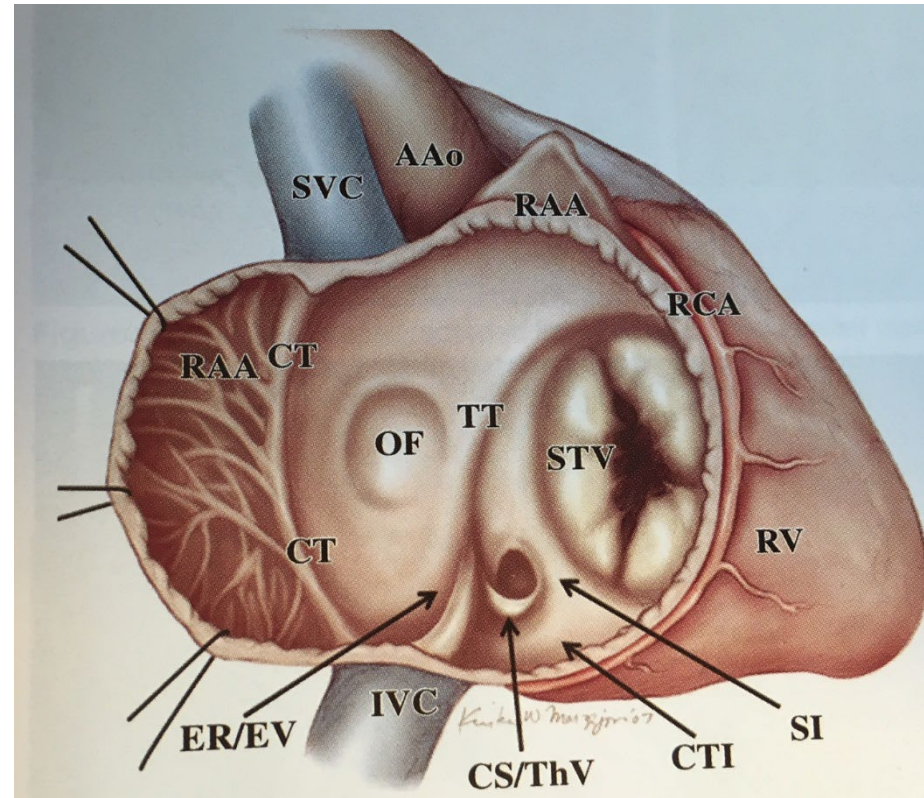
Crista terminalis





Eustachian Valve

- Valve of the IVC
- Directs flow to the LA in fetal circulation
- Best seen in the subcostal IVC view
- Can be prominent or undulating

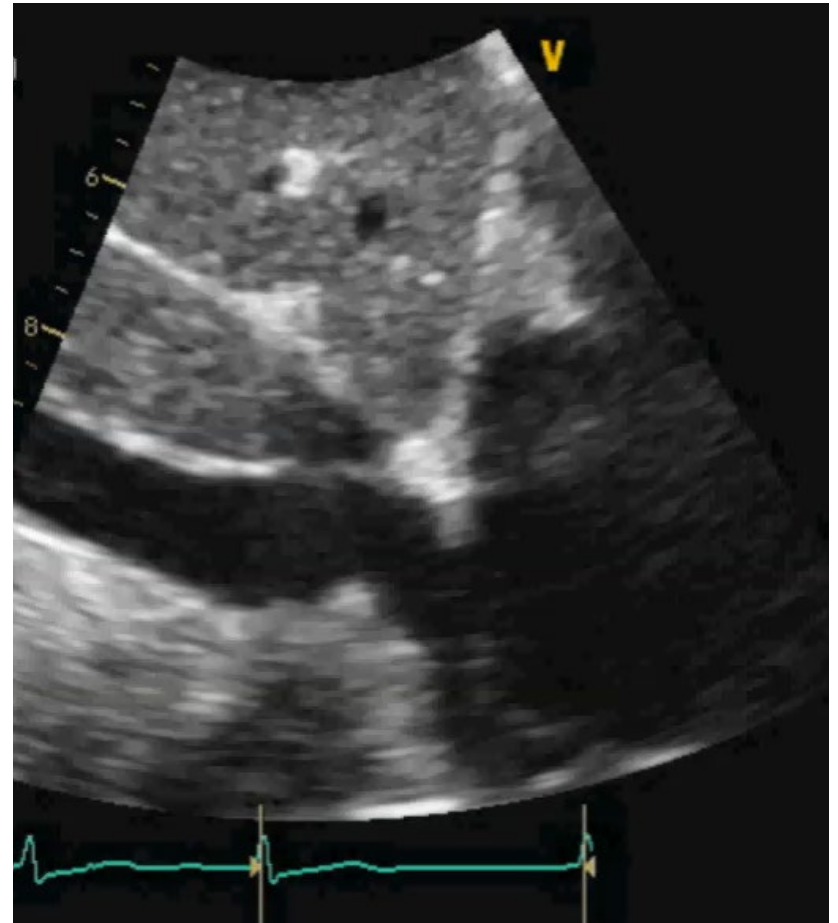


From *A Sonographer's Guide* textbook by Bonita Anderson



Eustachian Valve

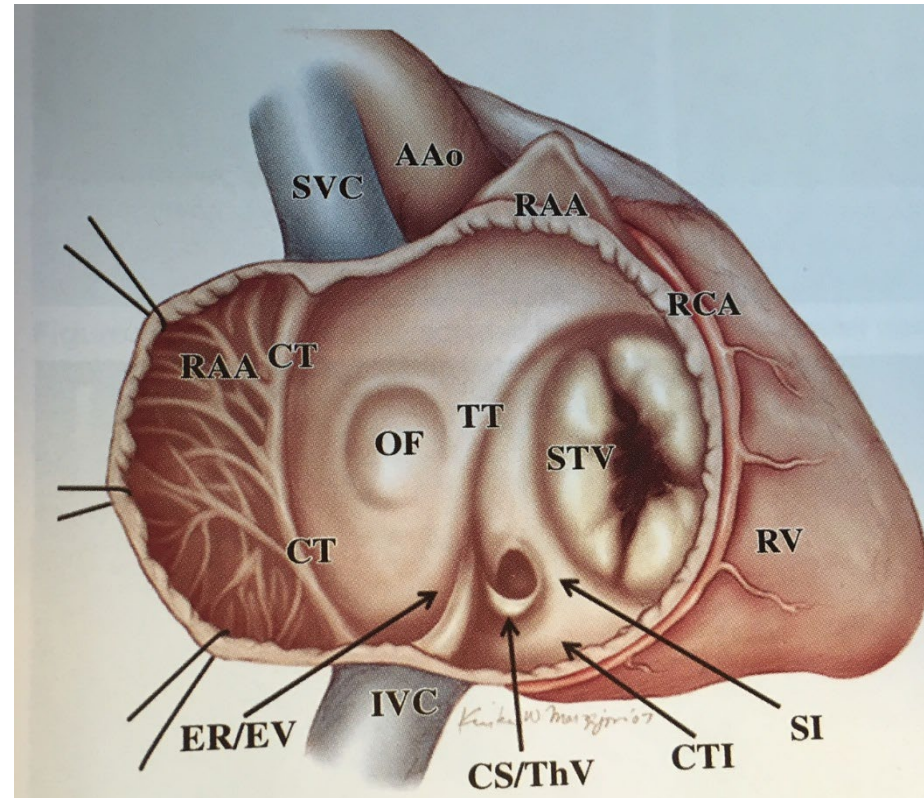
- Can be confused with intracardiac thrombus
- Or complicate IVC cannulation





Thebesian Valve

- Valve of the coronary sinus
- Well known to the EP docs for biV lead placement
- Best seen in the parasternal RVIT view

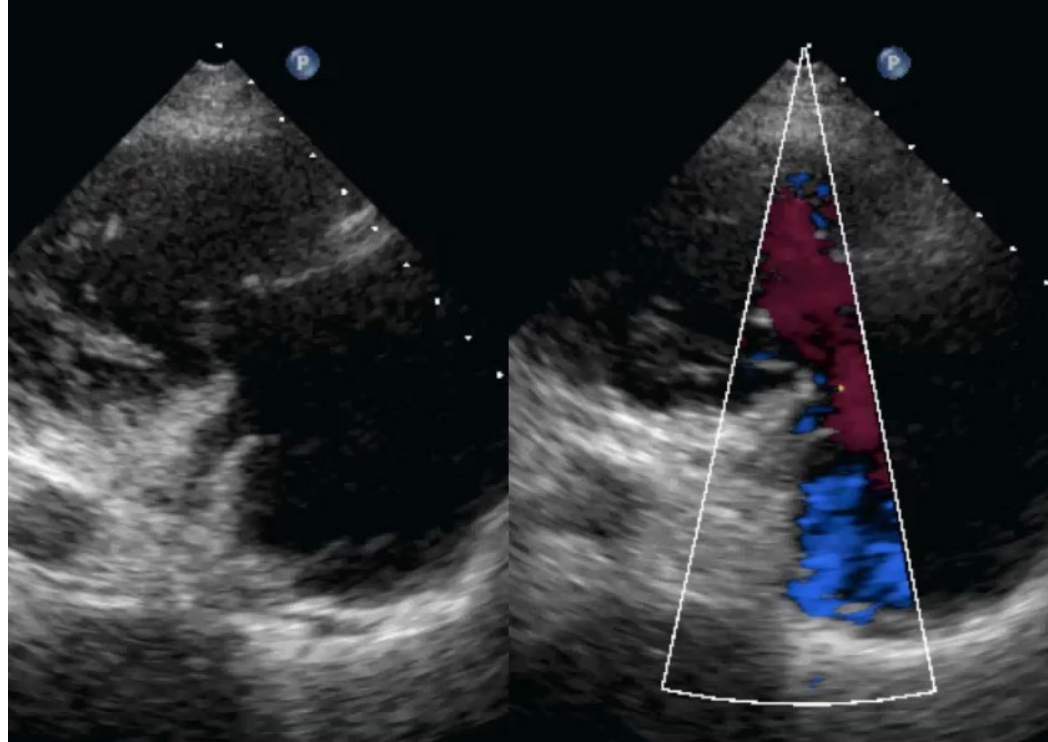


From *A Sonographer's Guide* textbook by Bonita Anderson



Thebesian Valve

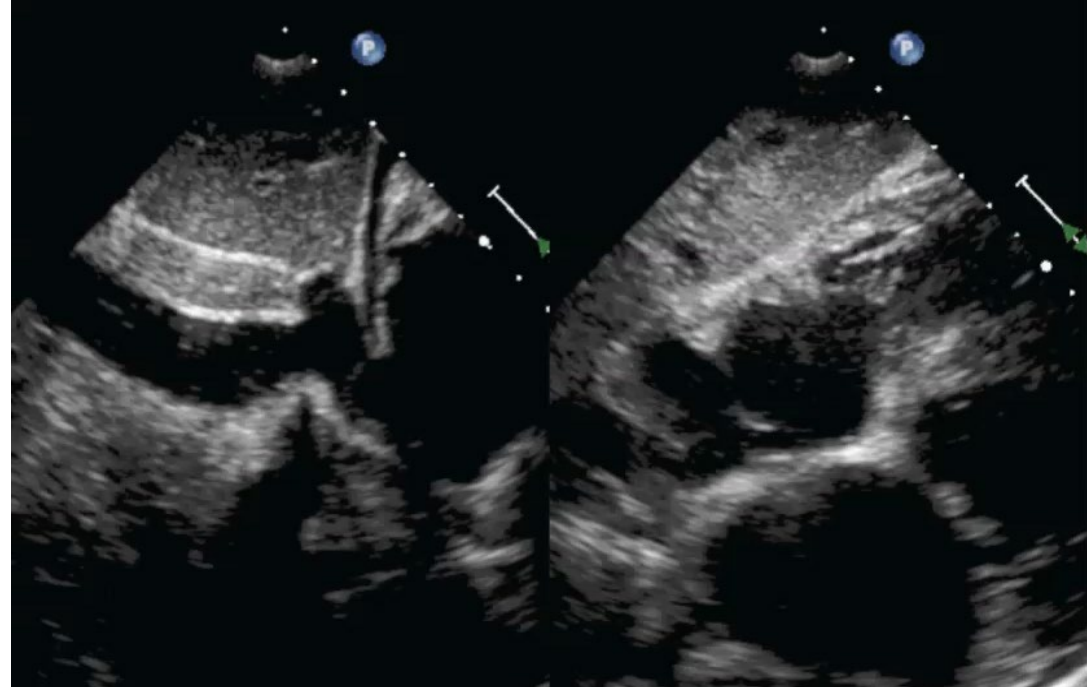
- Valve of the coronary sinus
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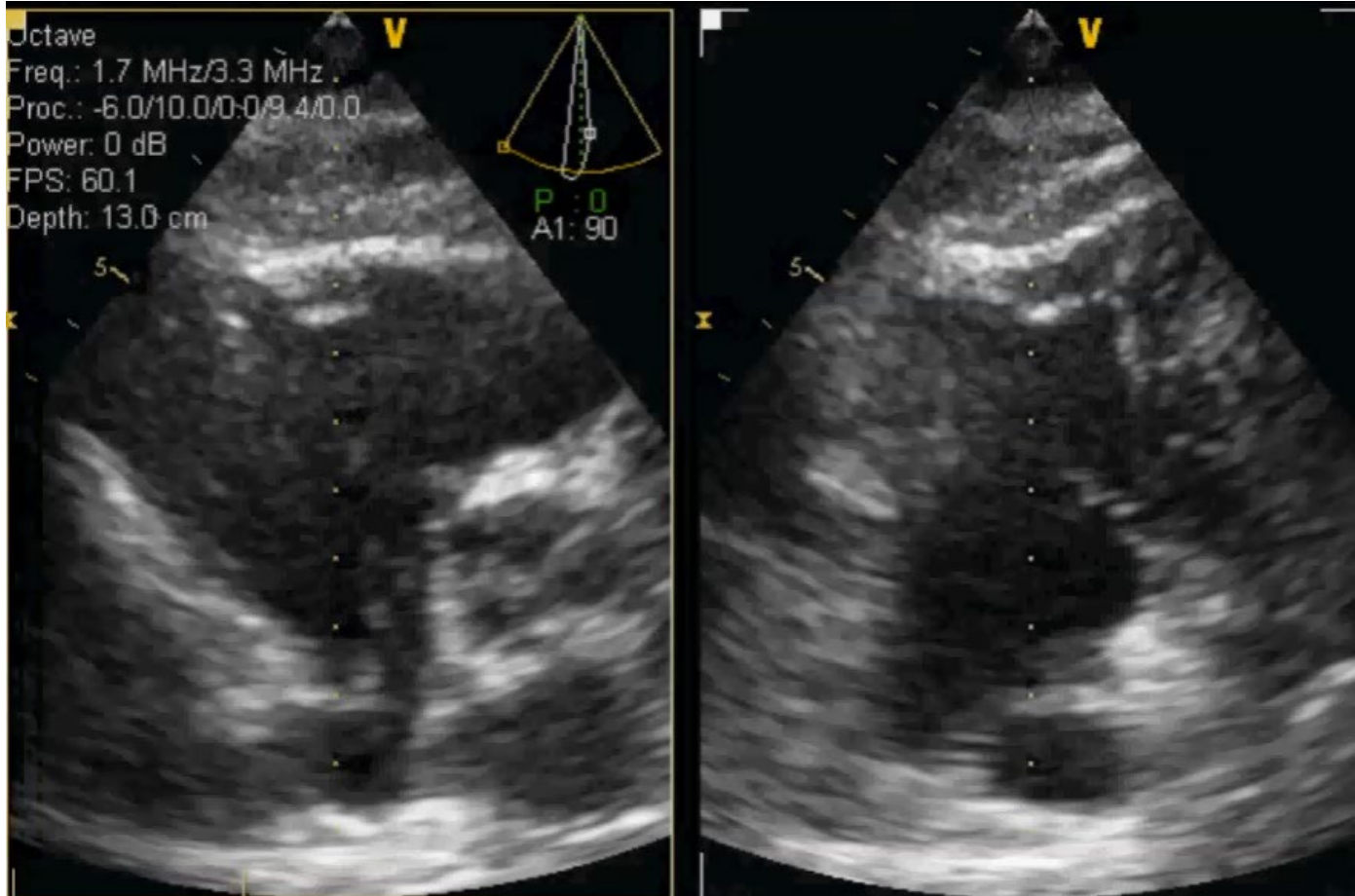
Chiari Network

- Mobile filamentous strands in the RA
- Random motion
- Has been associated with PFO's & IAS aneurysms



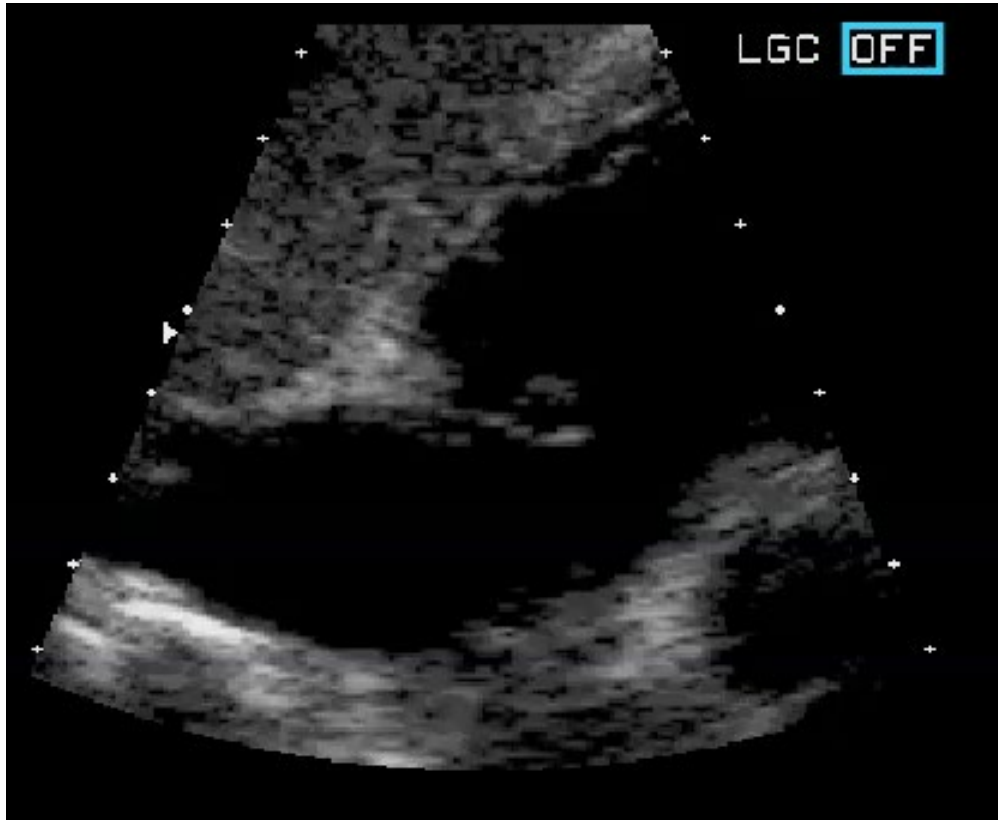


Chiari network





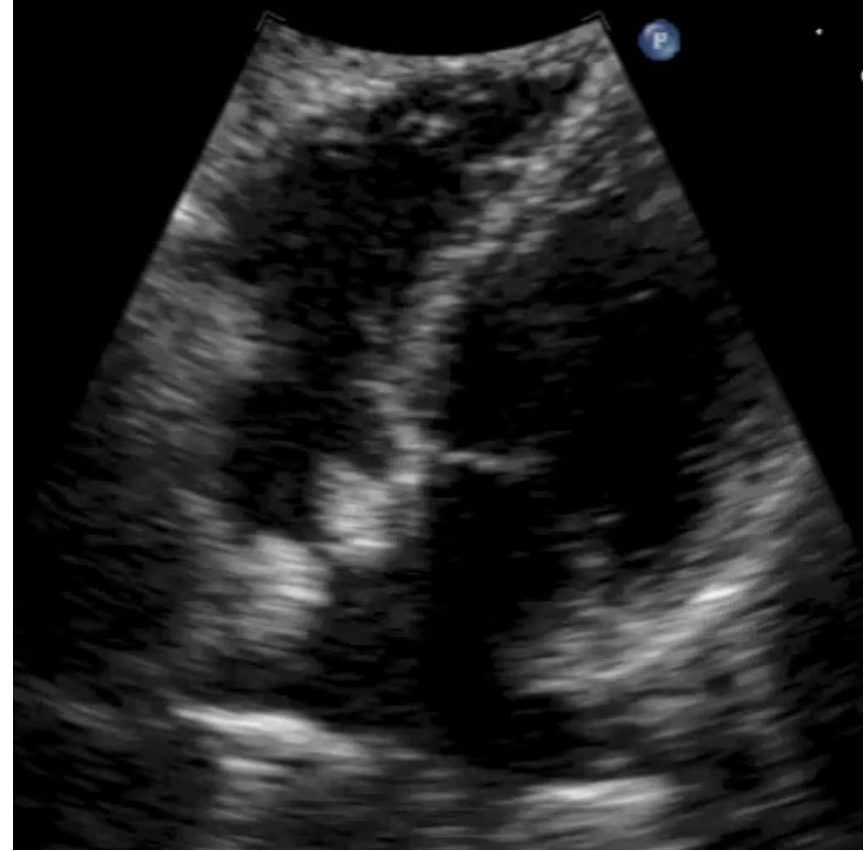
Chiari network





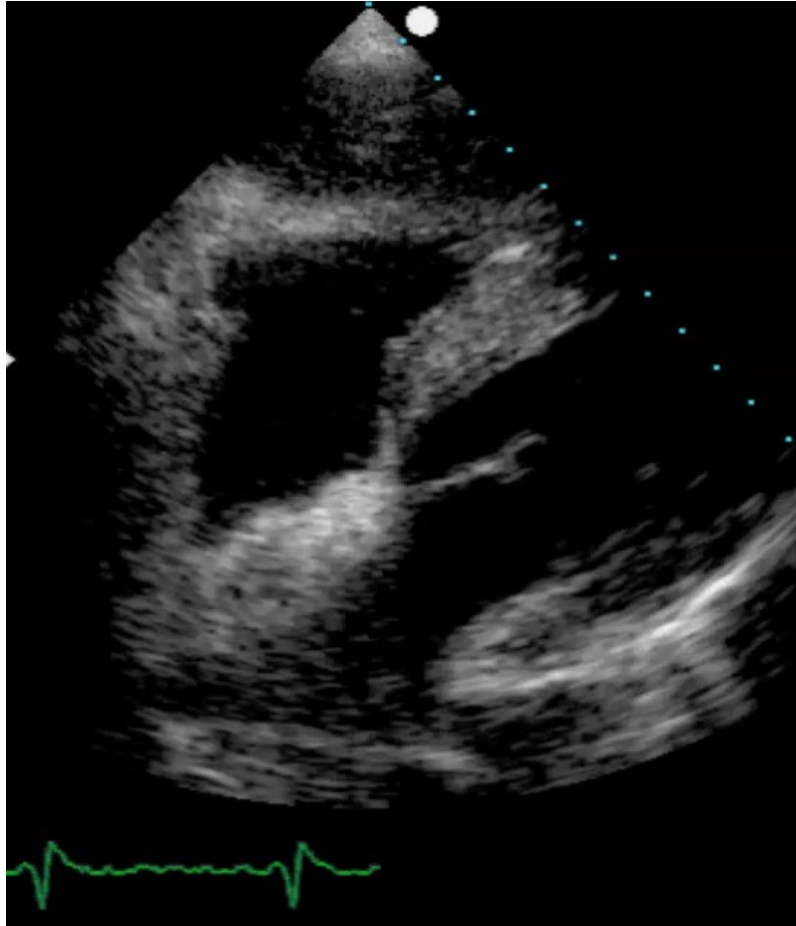
Hyperlipomatous IAS

- **Lipomatous hypertrophy of the IAS**
 - Benign process
 - “Dumbbell” appearance (Echo term)
 - Fossa ovalis is spared (lack of fat cells)





Hyperlipomatous IAS





Hyperlipomatous IAS





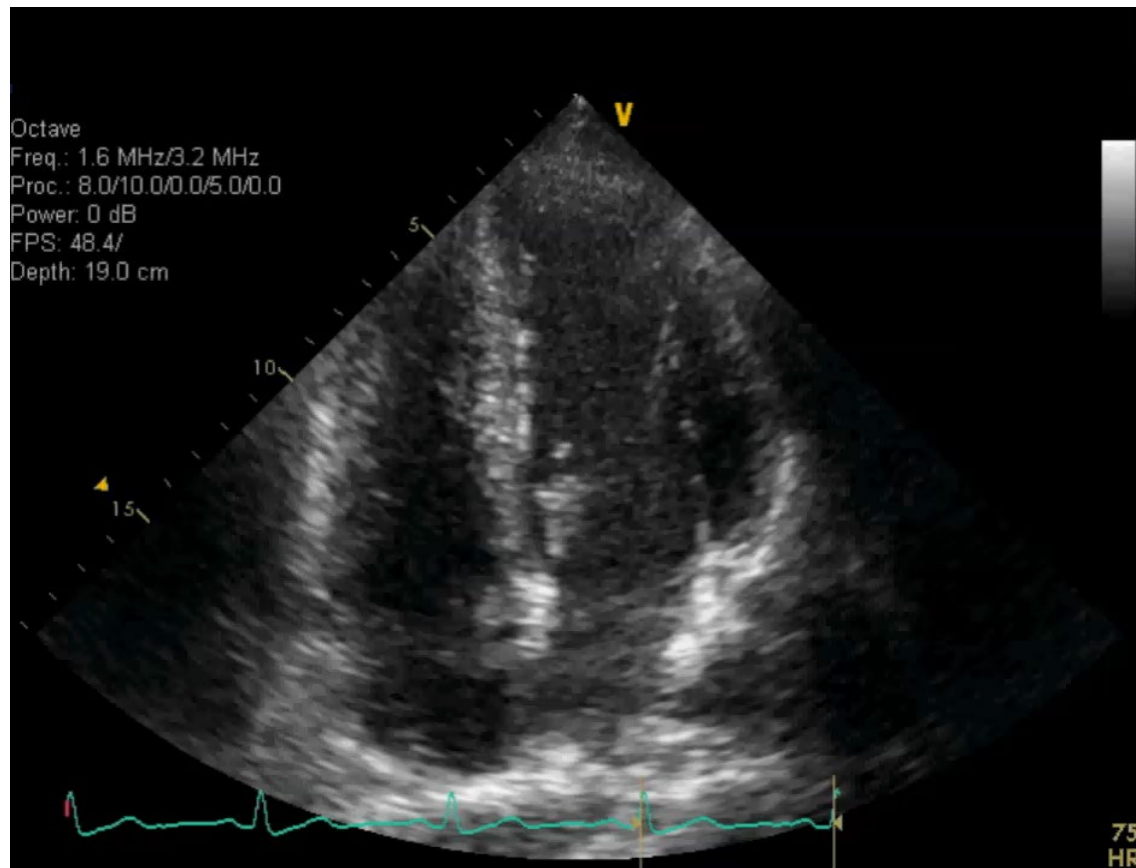
IAS Aneurysm

- Idiopathic or may develop due to high atrial pressures
- Thin and hypermobile movement of the central IAS
- Some say ≥ 15 mm
- Associated with PFOs & may be prone to thrombus formation



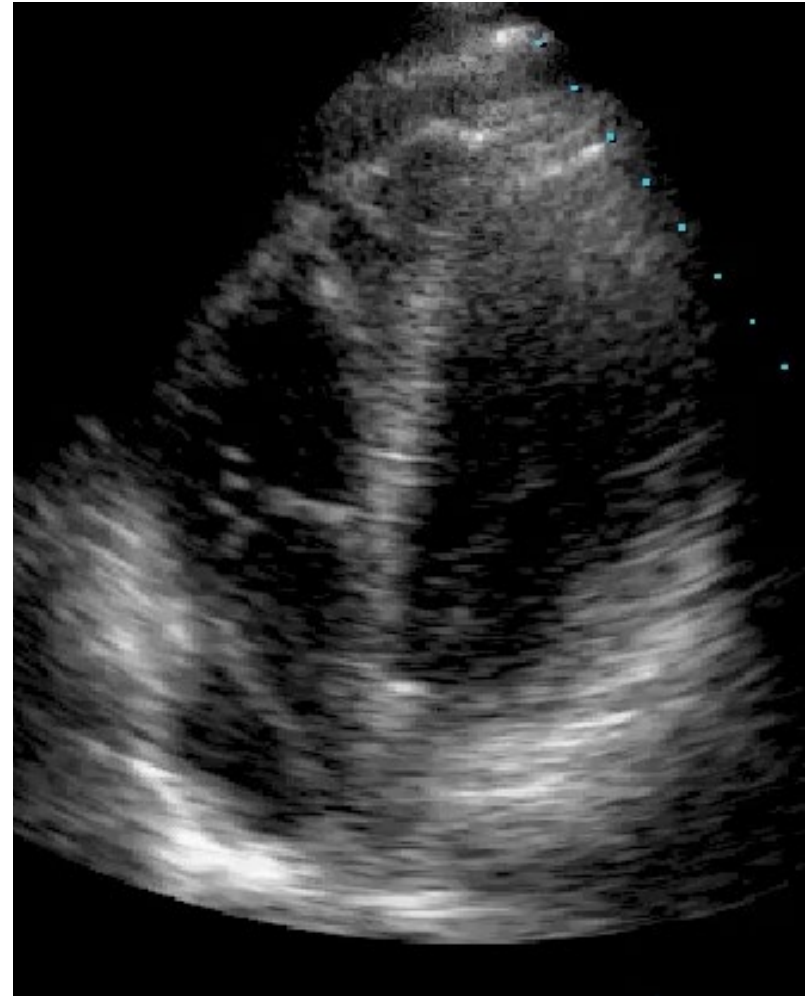
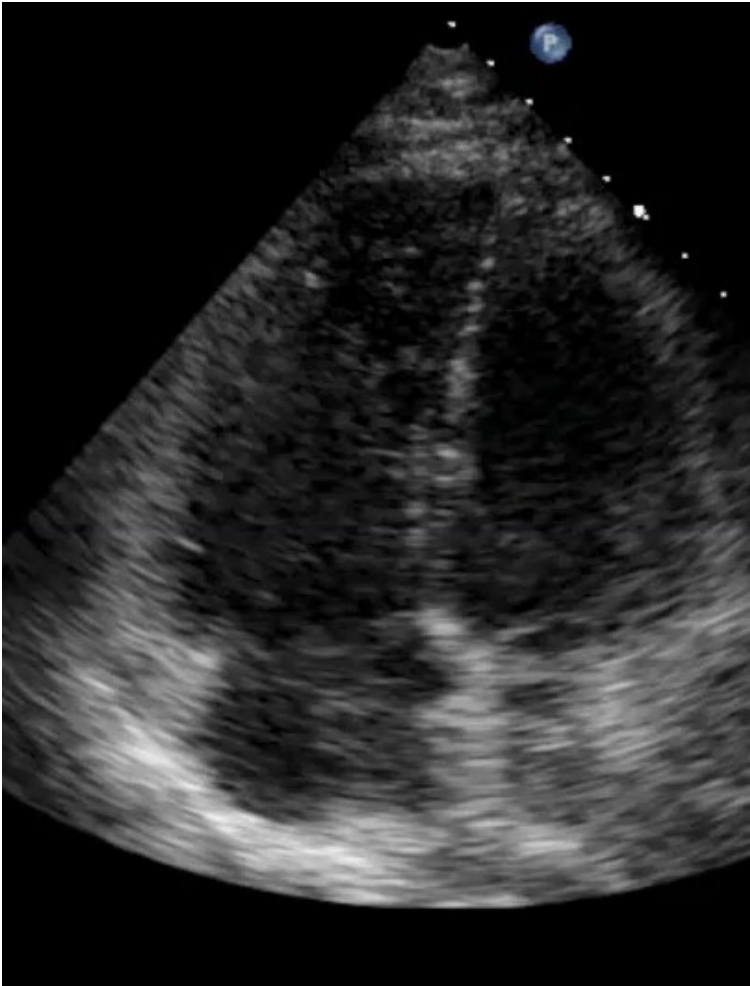


IASA





IASA





IASA Gross Pathology





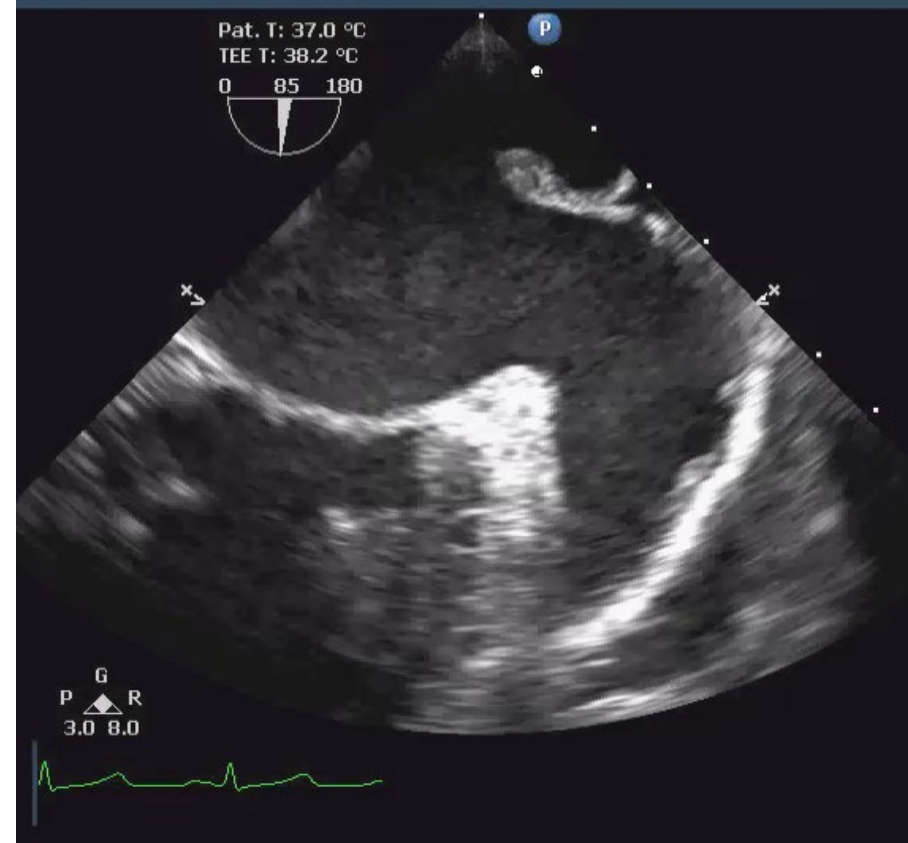
Left Atrium

- **LAA & Pectinate Muscle**
- **Ligament of Marshall**
- **Transverse Sinus**



LA Appendage

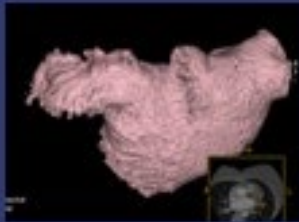
- Contractile
- Trabeculated – pectinate muscles
- Variable anatomy
- 1-5 lobes





Major LAA Types

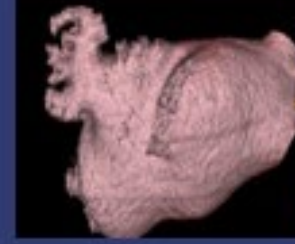
The **Wind Sock Type** LAA is an anatomy in which one dominant lobe of sufficient length is the primary structure



The **Chicken Wing Type** LAA is an anatomy whose main feature is a sharp bend in the dominant lobe of the LAA anatomy at some distance from the perceived LAA ostium



The **Broccoli Type** LAA is an anatomy whose main feature is an LAA that has limited overall length with more complex internal characteristics.

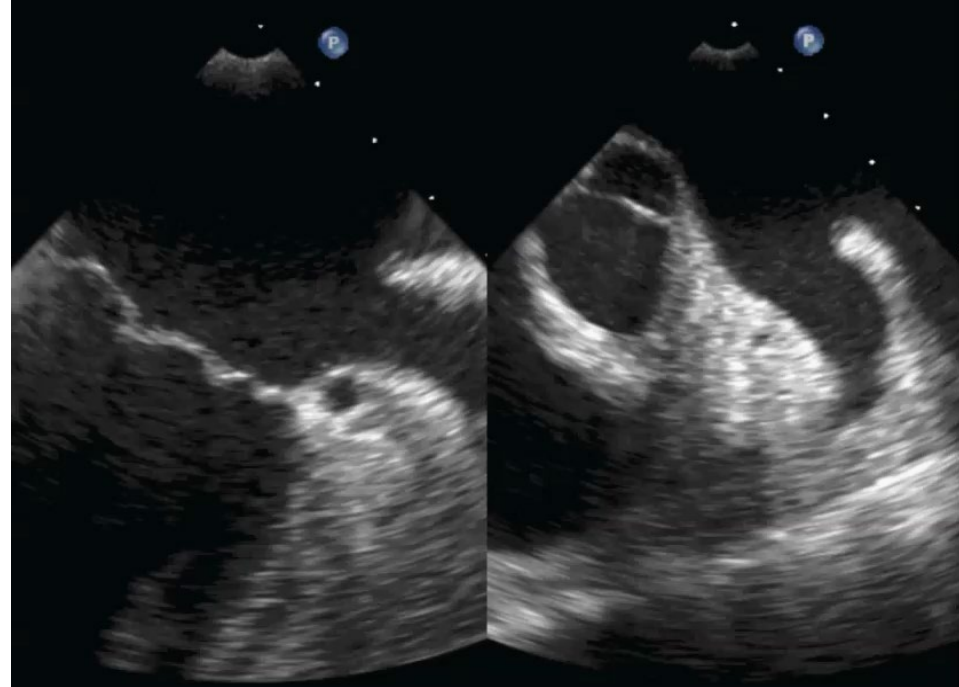


From JAFIB *LA Appendage Morphology* by Ajay Vallakati
Case Western Reserve University



Ligament of Marshall

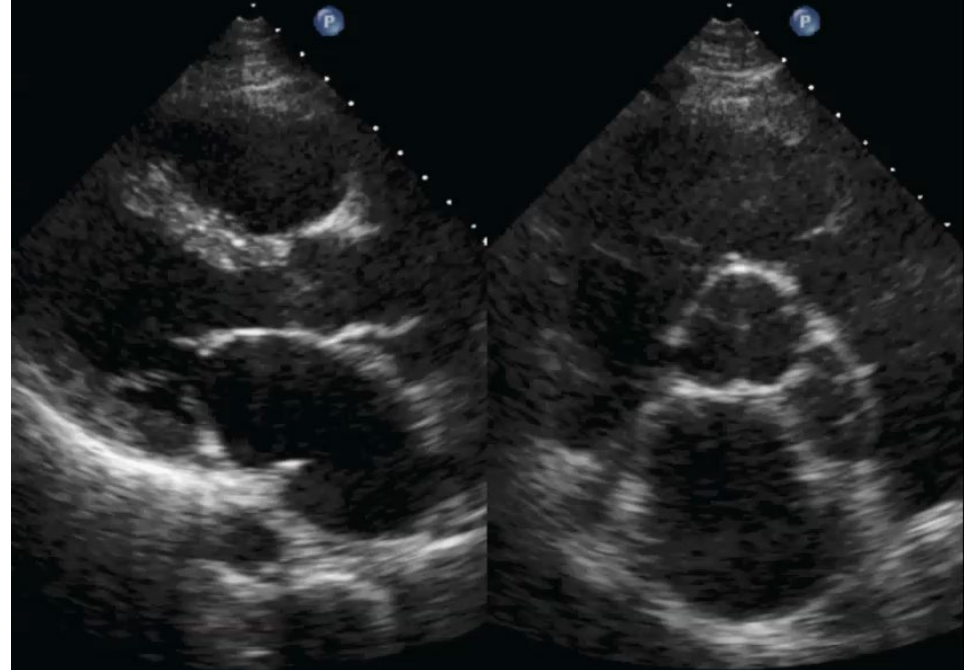
- Atrial tissue between the LUPV & LAA
- Also called the Q-tip, Warfarin or Coumadin ridge
- Has been mistaken for thrombus





Transverse sinus

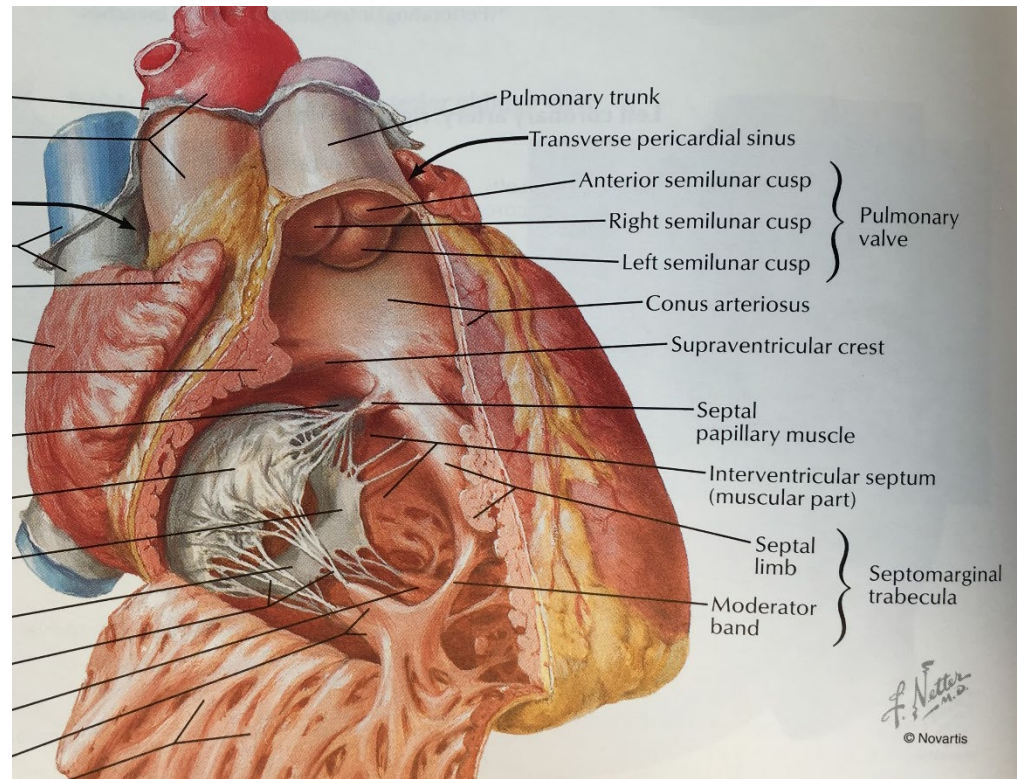
- Potential pericardial space between the LA & AO root
- Could be mistaken for an abscess





Right Ventricle

- **Trabeculations**
- **Moderator Band**

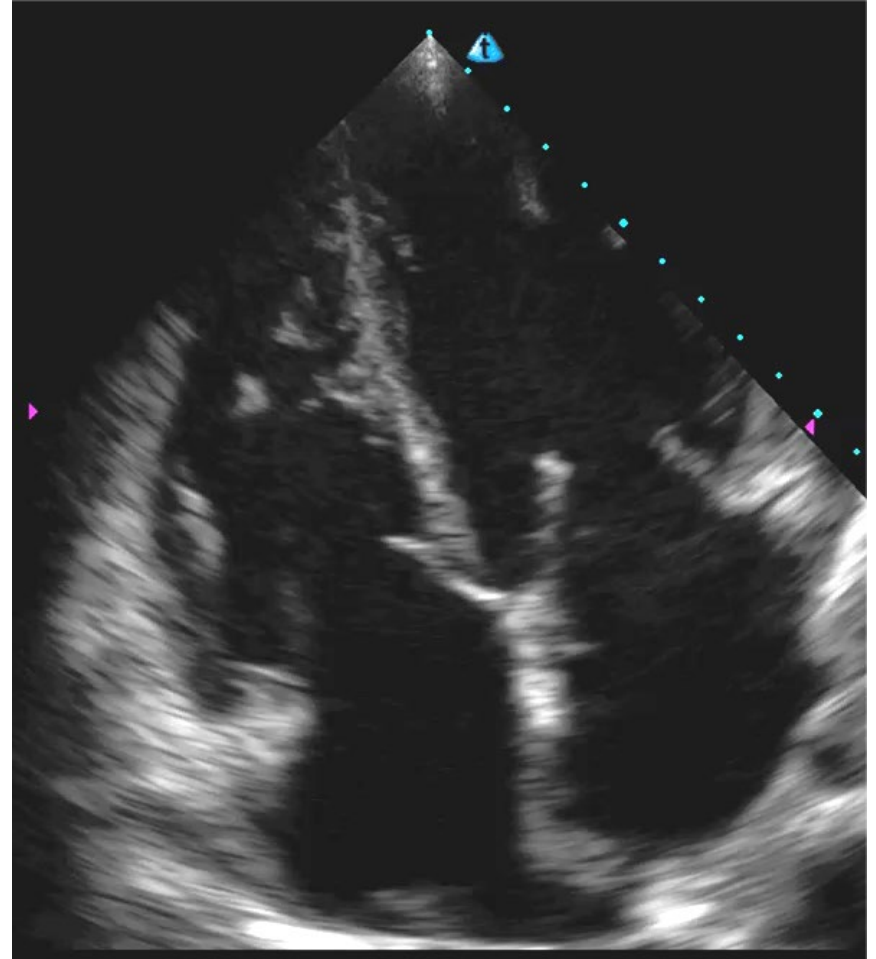


From *Atlas of Human Anatomy* by Frank Netter



RV Trabeculations

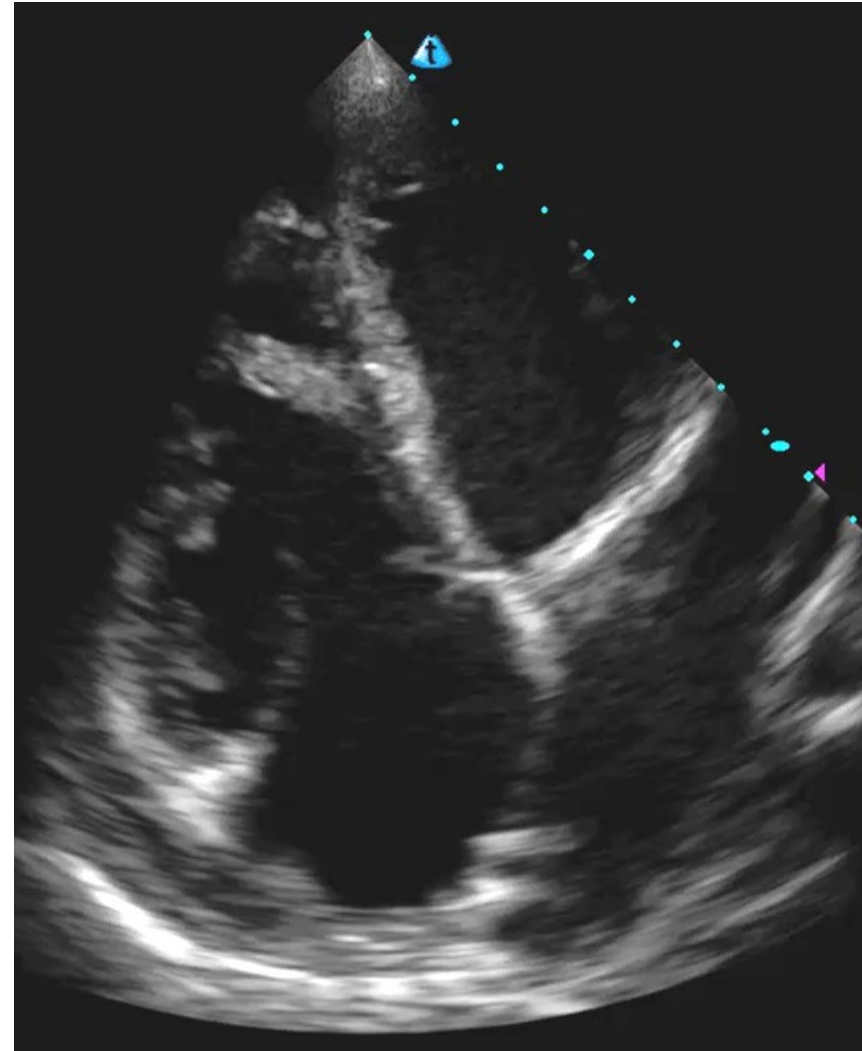
- The RV is normally more heavily trabeculated than the LV
- Difficult to see small, layered thrombi





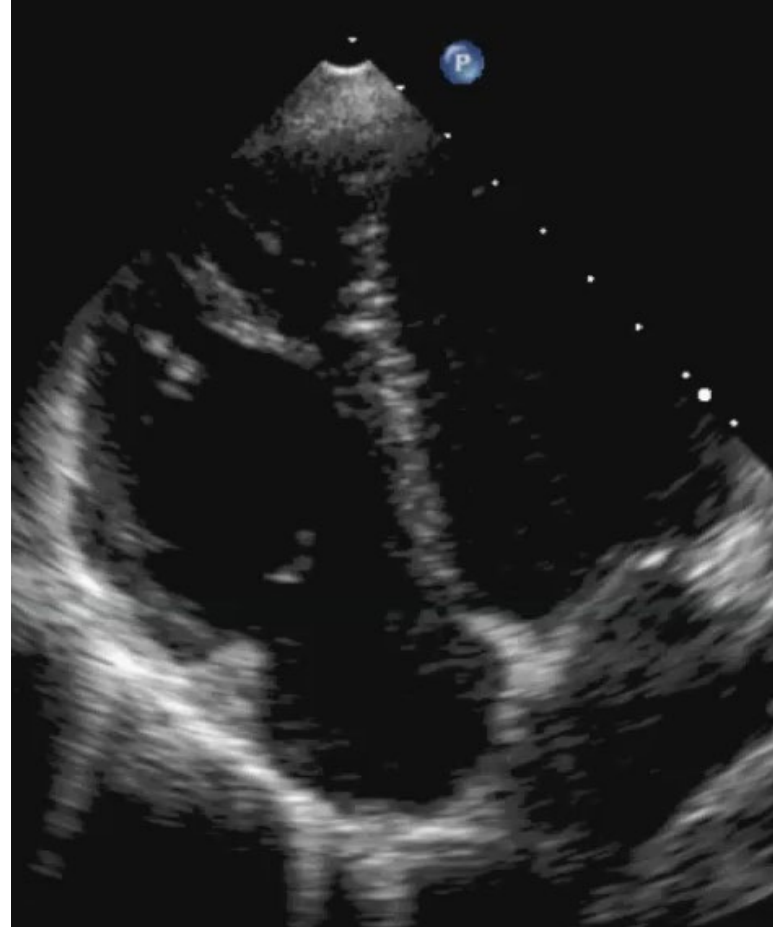
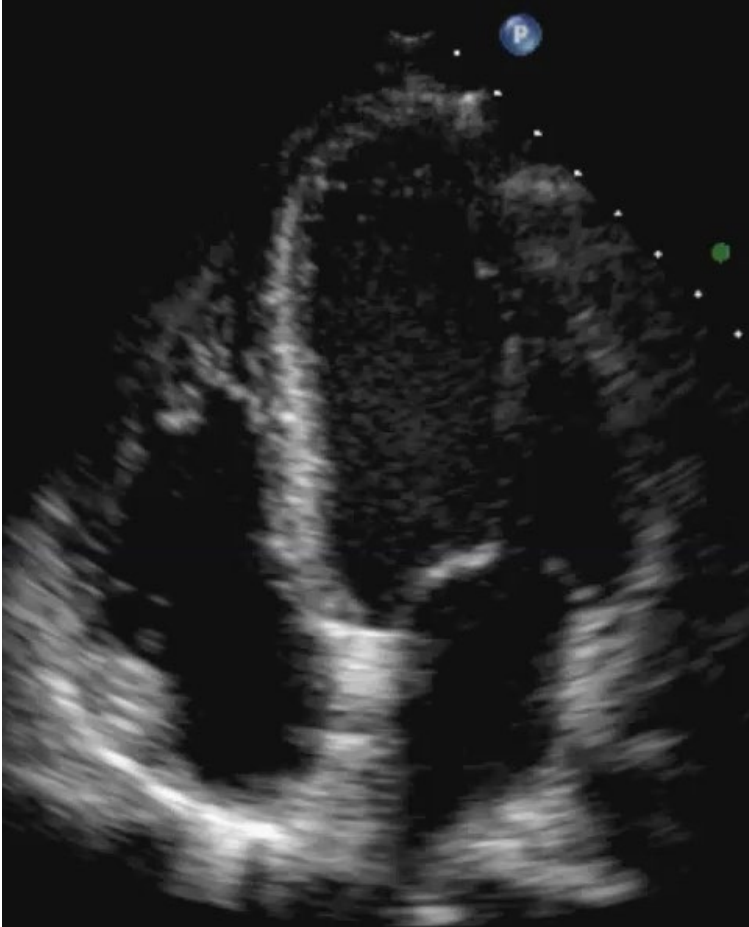
Moderator Band

- Septomarginal trabecula
- Helps define the anatomic RV in CHD





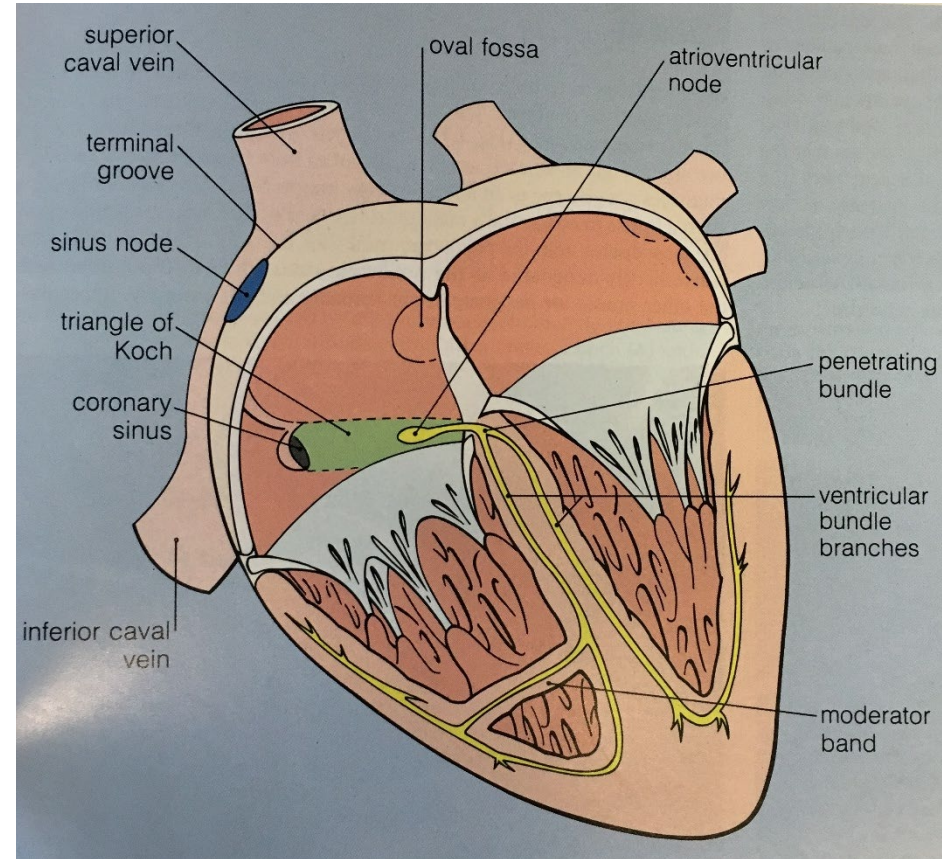
Moderator Bands





Moderator Band

- Septomarginal trabecula
- Helps define the anatomic RV in CHD
- Contains conduction fibers to the anterior pap muscle

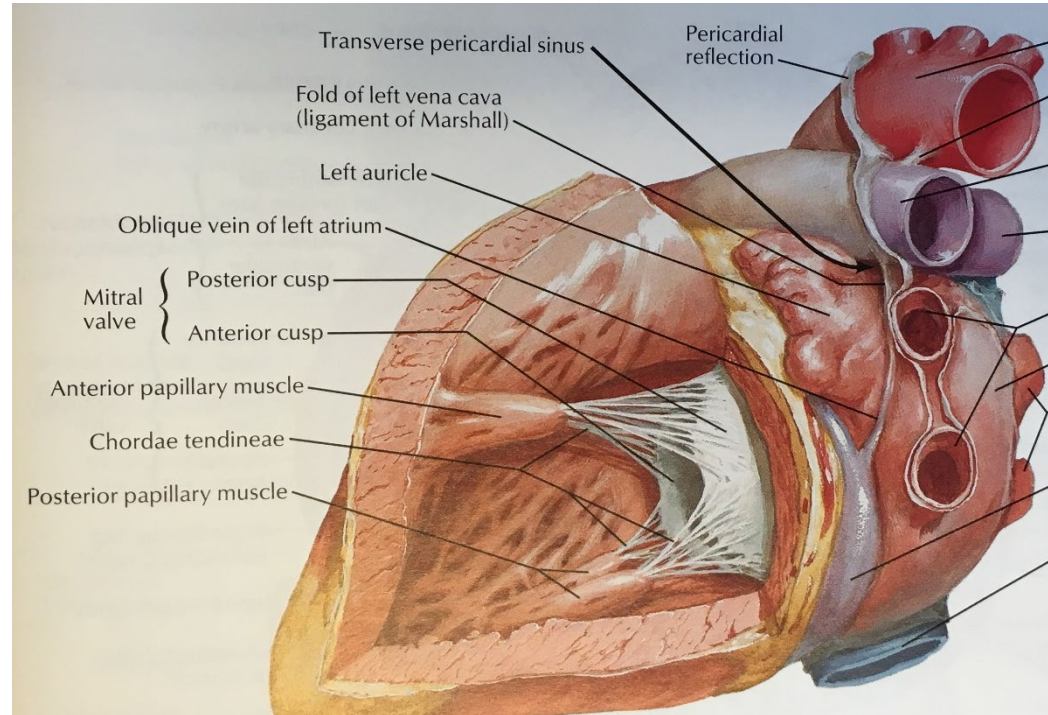


From *Diagnostic Atlas of the Heart* by Hurst & Alpert



Left Ventricle

- **False Tendons**
- **Trabeculations**
- **Lambl's Excrescences**

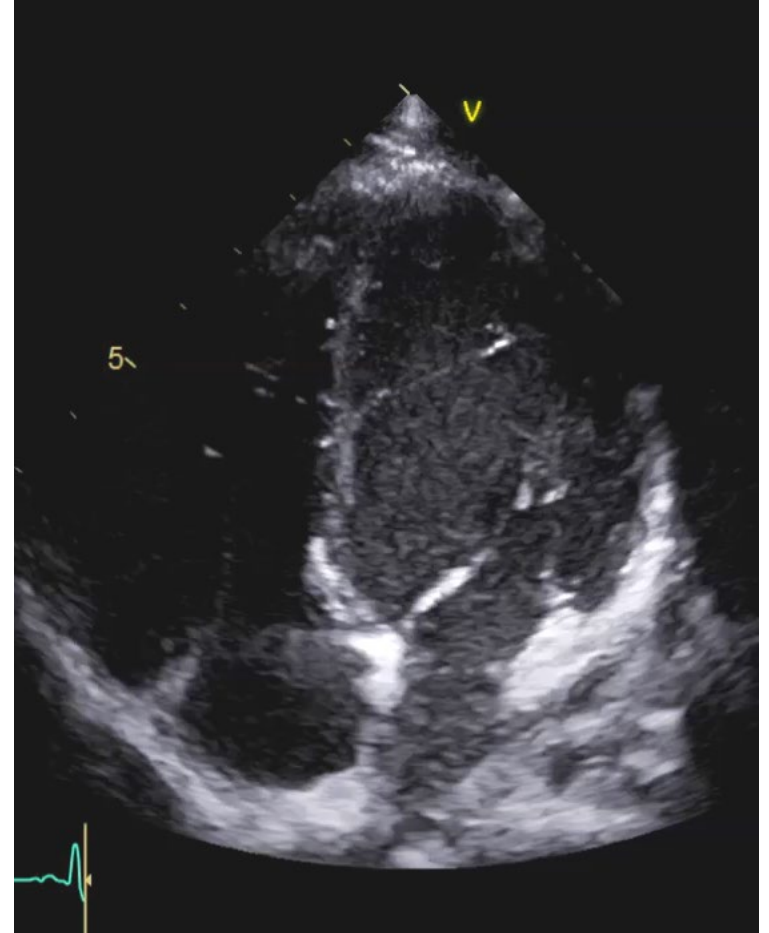


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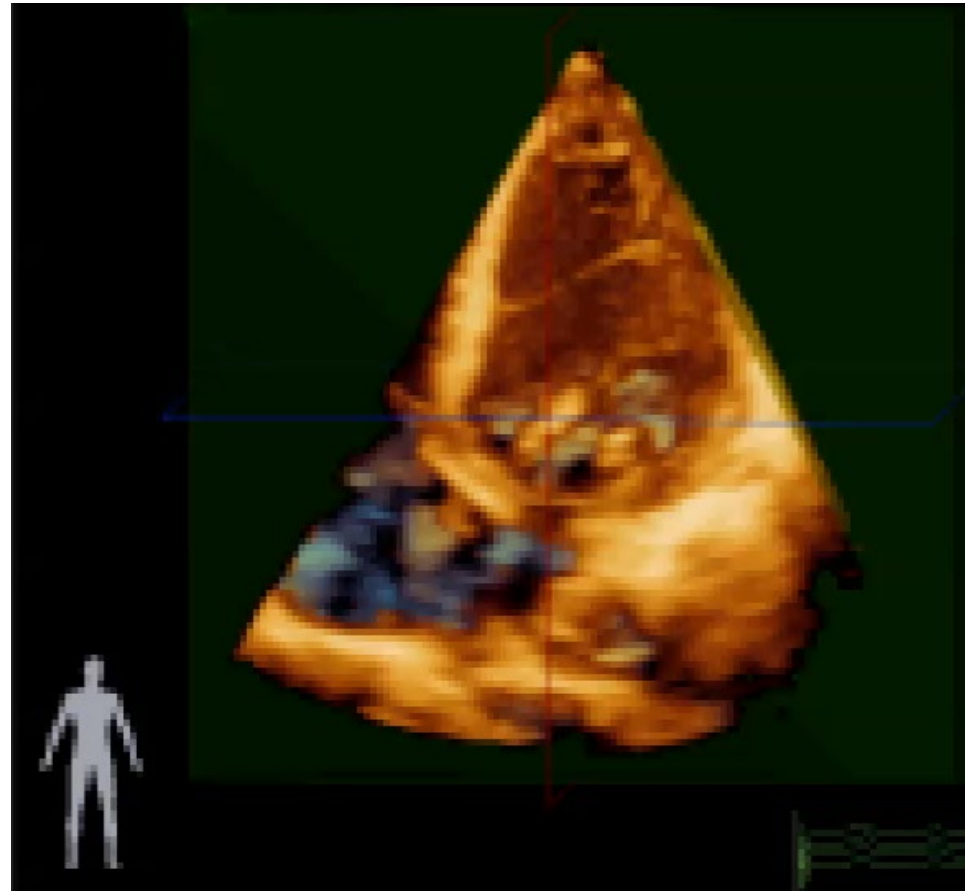
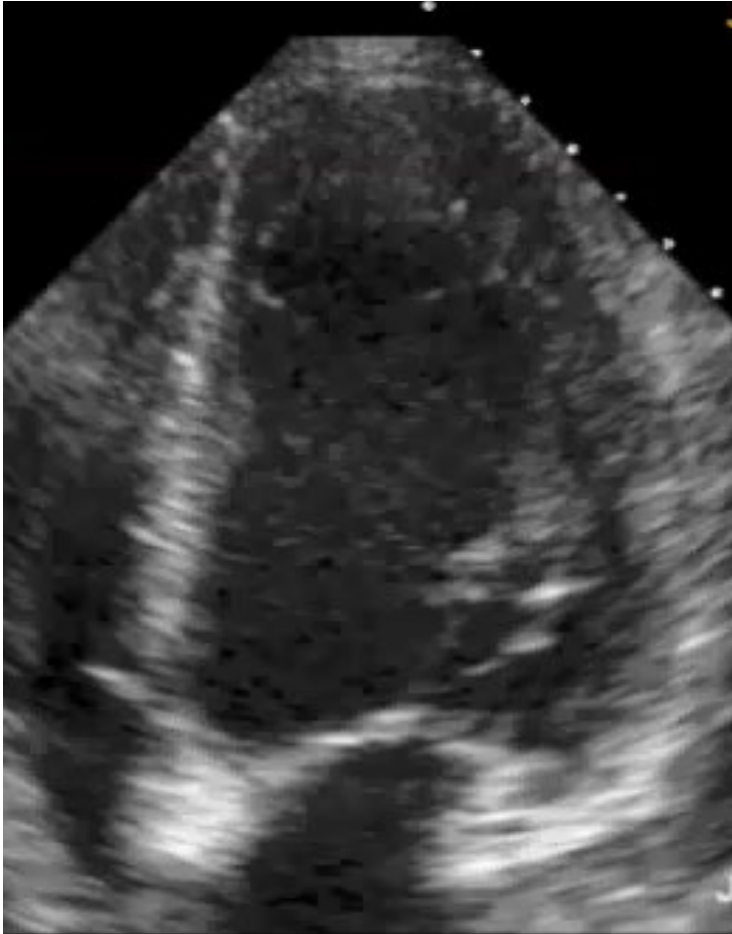
False Tendons

- Usually towards the LV apex
- Also called accessory chords, LV chords, aberrant bands or “heart strings”
- Known to cause a murmur
- May mimic thrombus or the edge of a tumor



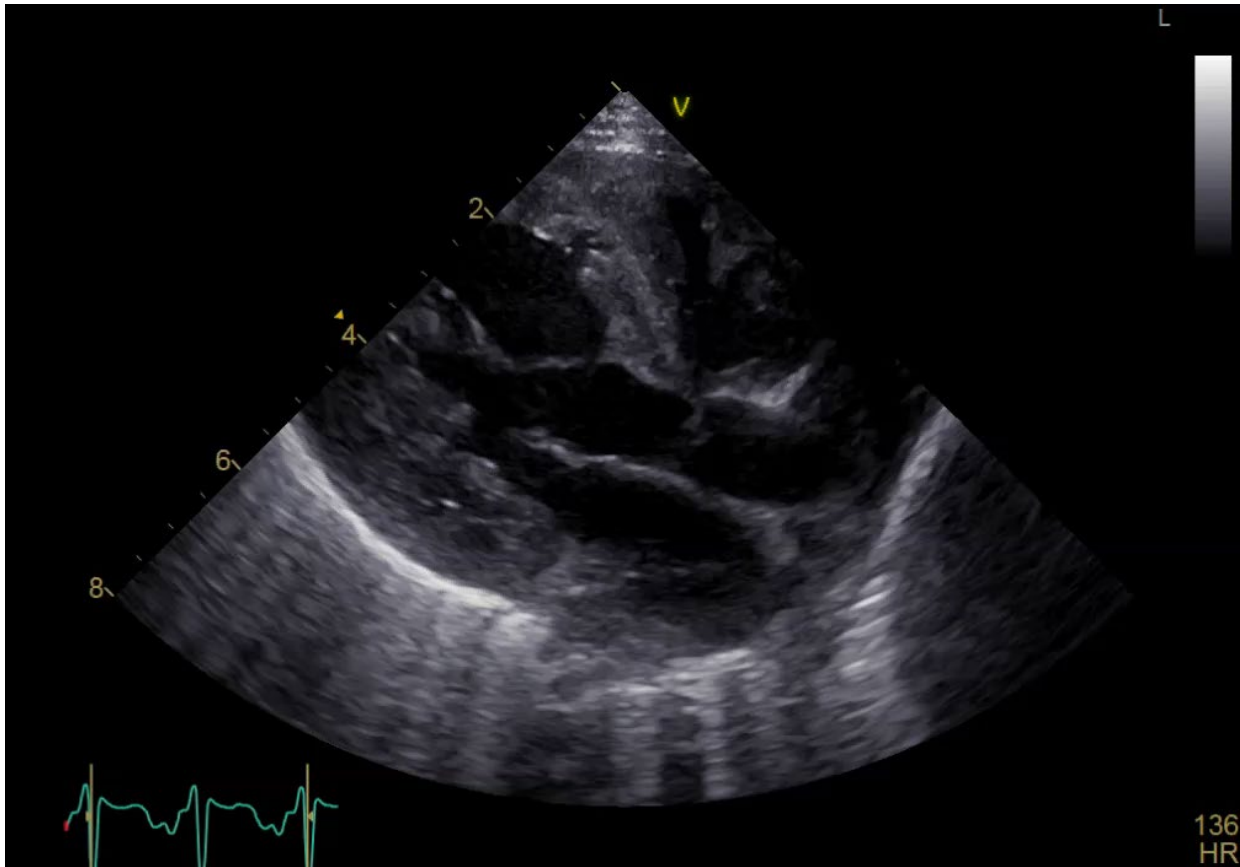


False Tendons (2D & 3D)



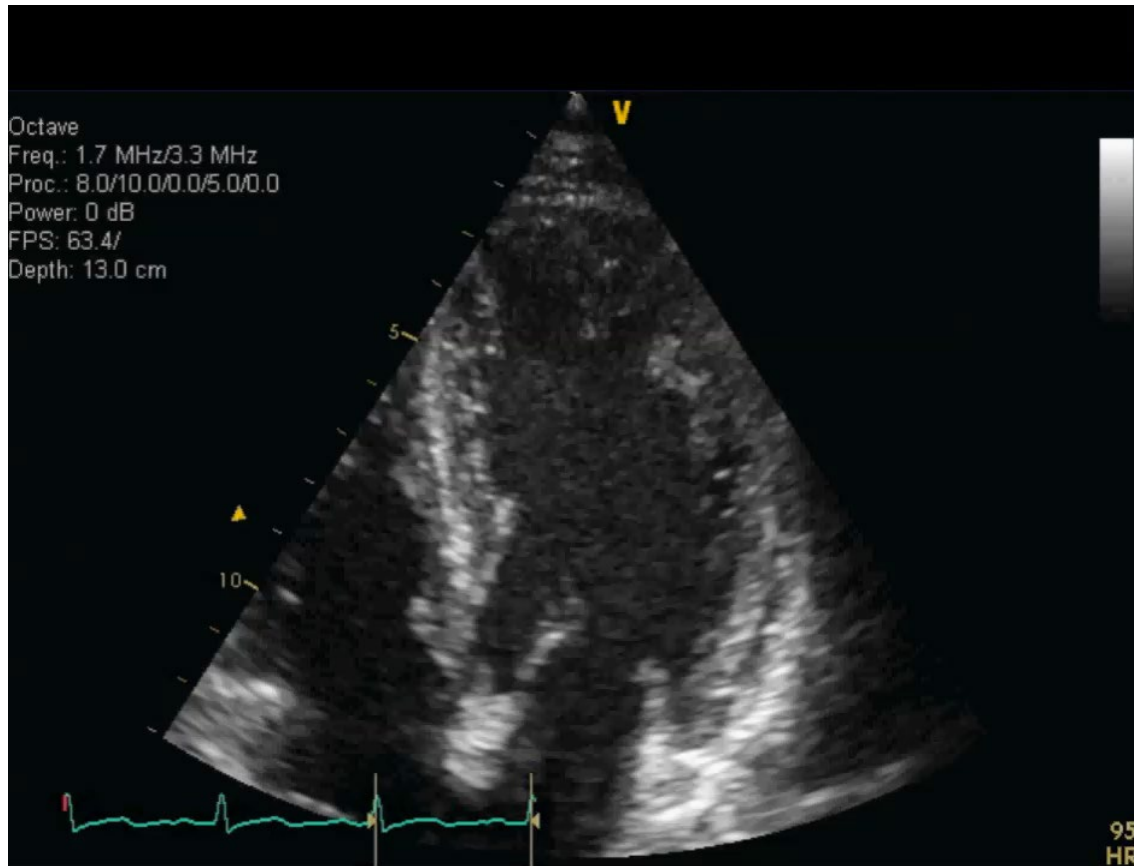


LV Chord





LV Chord





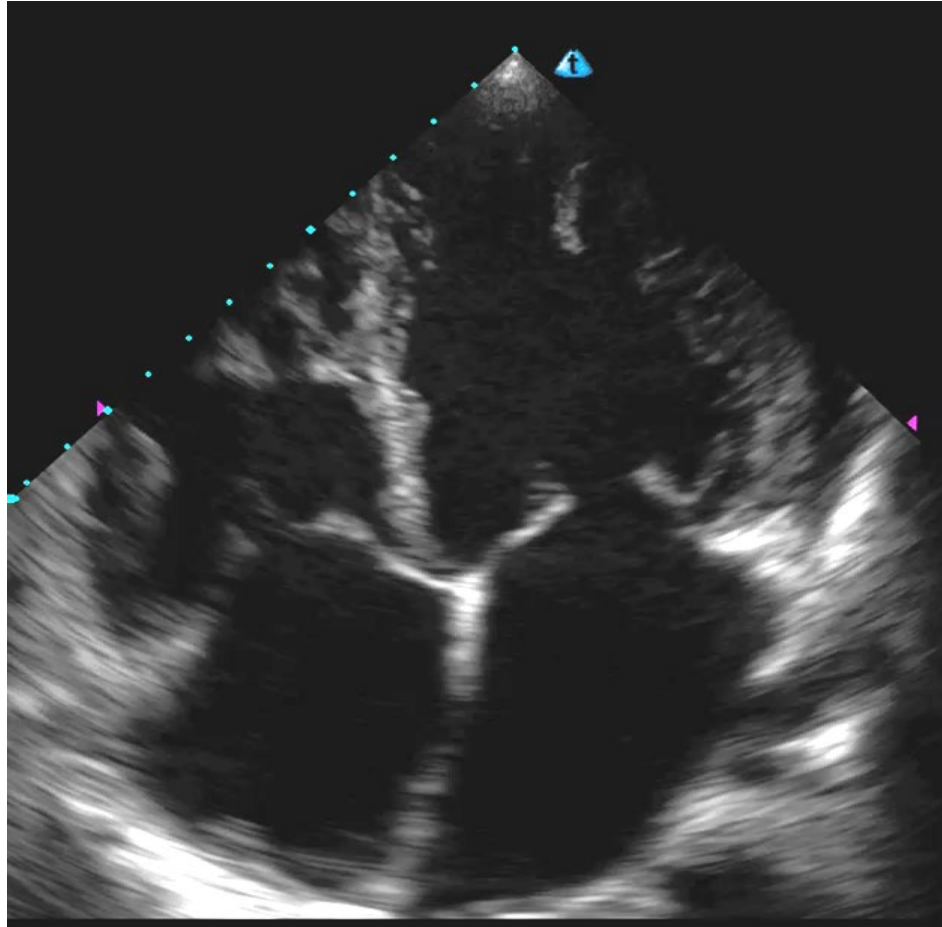
LV Trabeculations

- May be more prominent in remodeled ventricles (LVH)





RV & LV Trabeculations





Lambl's Excrescences

- Small, mobile filamentous strands coming off the AoV leaflets.
- May mimic valvular vegetations so must be put in a clinical context





Conclusions

- **Know cardiac anatomy**
 - **All of it!!**
- **Know the echo characteristics**
- **Remember that ultrasound beams diverge and have width**
- **Do sweeps to make connections**
- **Common things are common!**



The End

