# *Welcome, Intro & Goals*

## PP16 Imaging Conference

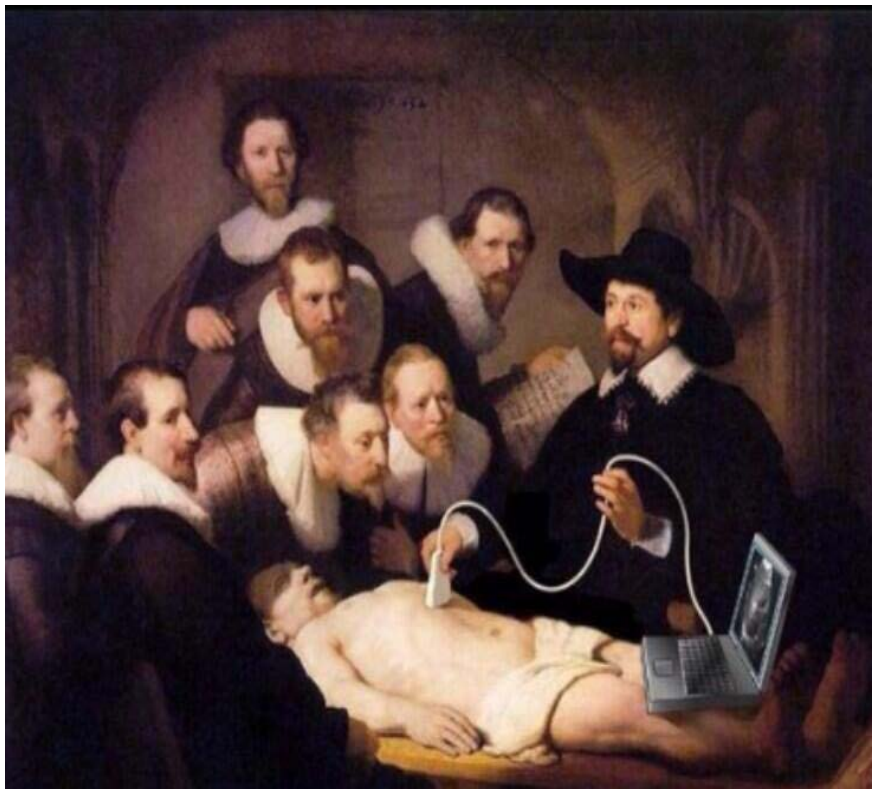
**Bicol Hospital, Legaspi City, Philippines**

**July 2016**

**David Adams, ACS, RCS, RDCS, FASE**

**Duke University Medical Center**

# *Echocardiography*



The Anatomy Lesson of Dr. Tulp by Rembrandt

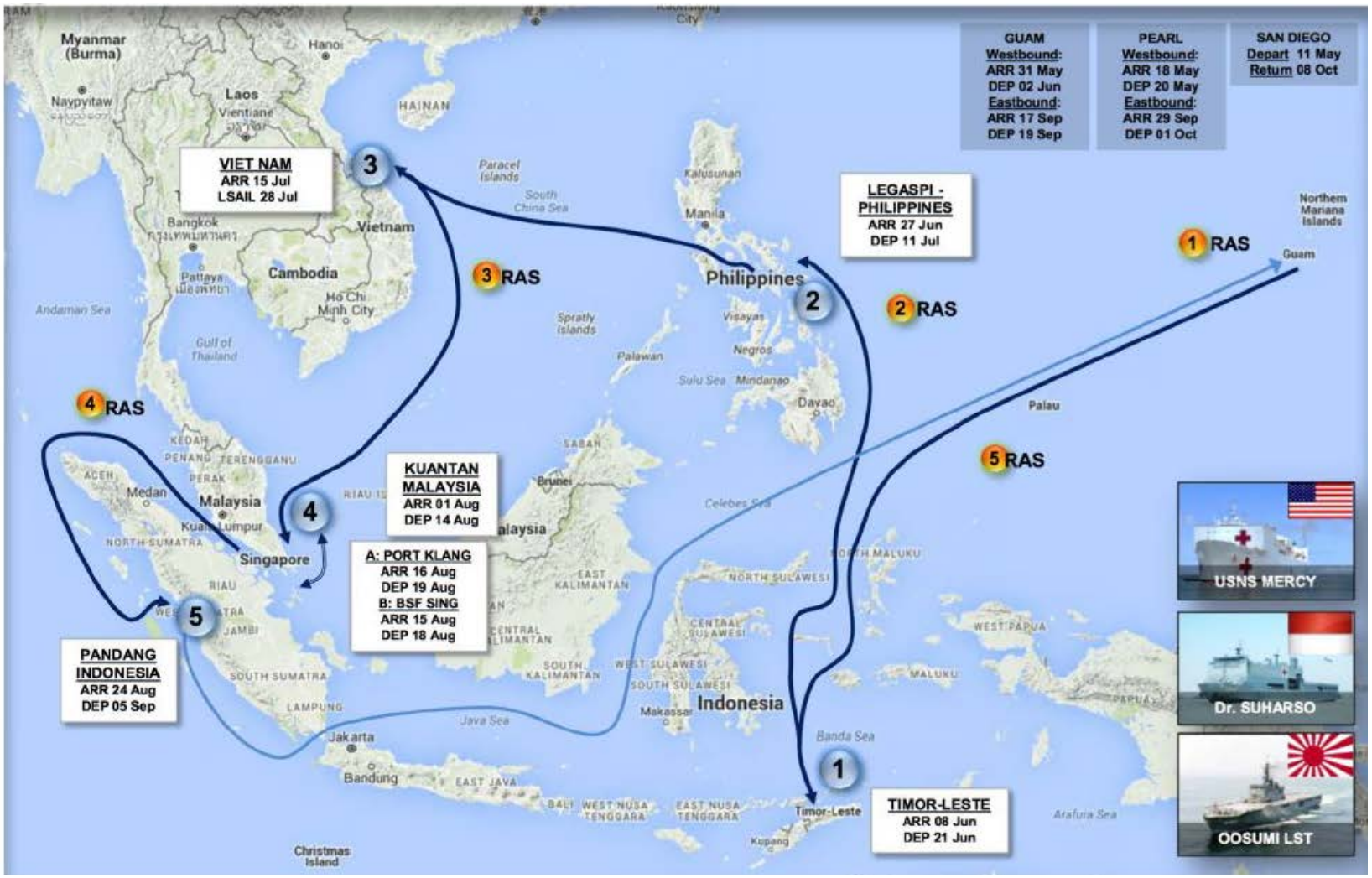
# *SMEE*

# 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.**

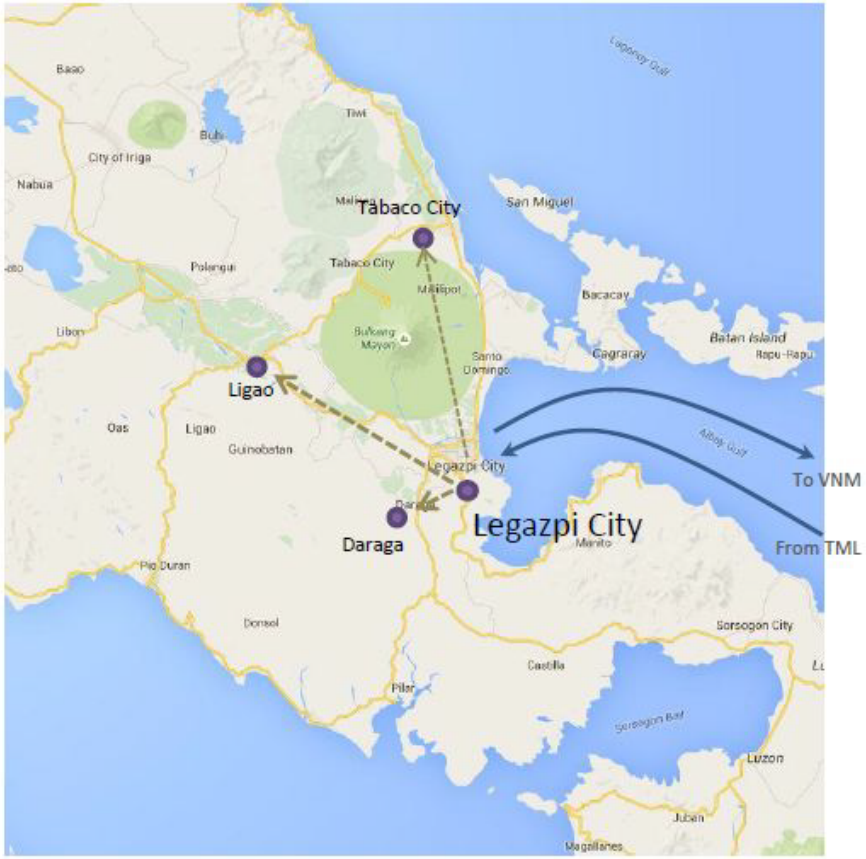
# *USNS Mercy*

# 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~~*

## PP16 Imaging Conference

**Bicol Hospital, Legaspi City, Philippines**

**July 2016**

**David Adams, ACS, RCS, RDCS, FASE**

**Duke University Medical Center**

# *Optimizing Echo / Hidden Things in the Heart*

## PP16 Imaging Conference

**Bicol Hospital, Legaspi City, Philippines**

**July 2016**

**David Adams, ACS, RCS, RDCS, FASE**

**Duke University Medical Center**

# *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

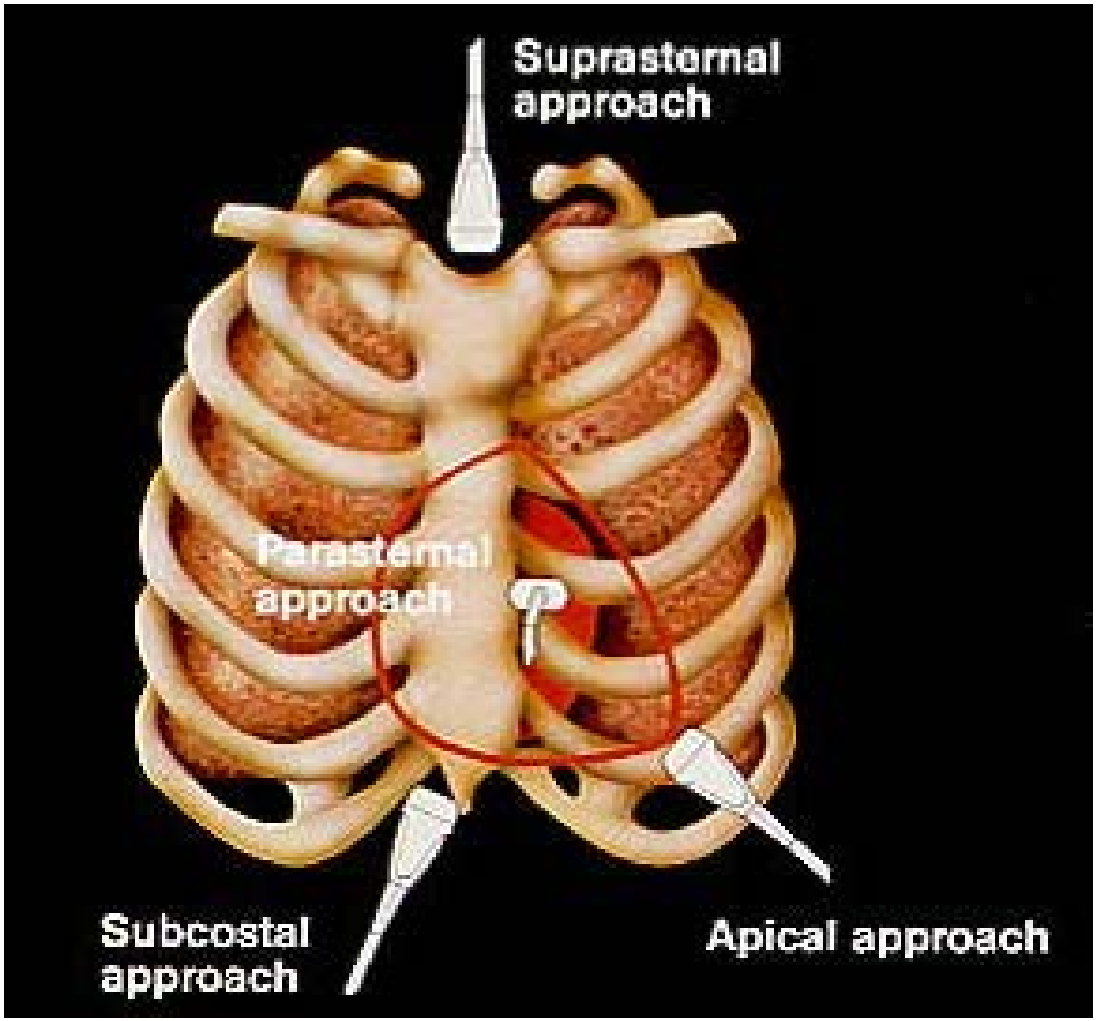



Fig 2-17

# *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

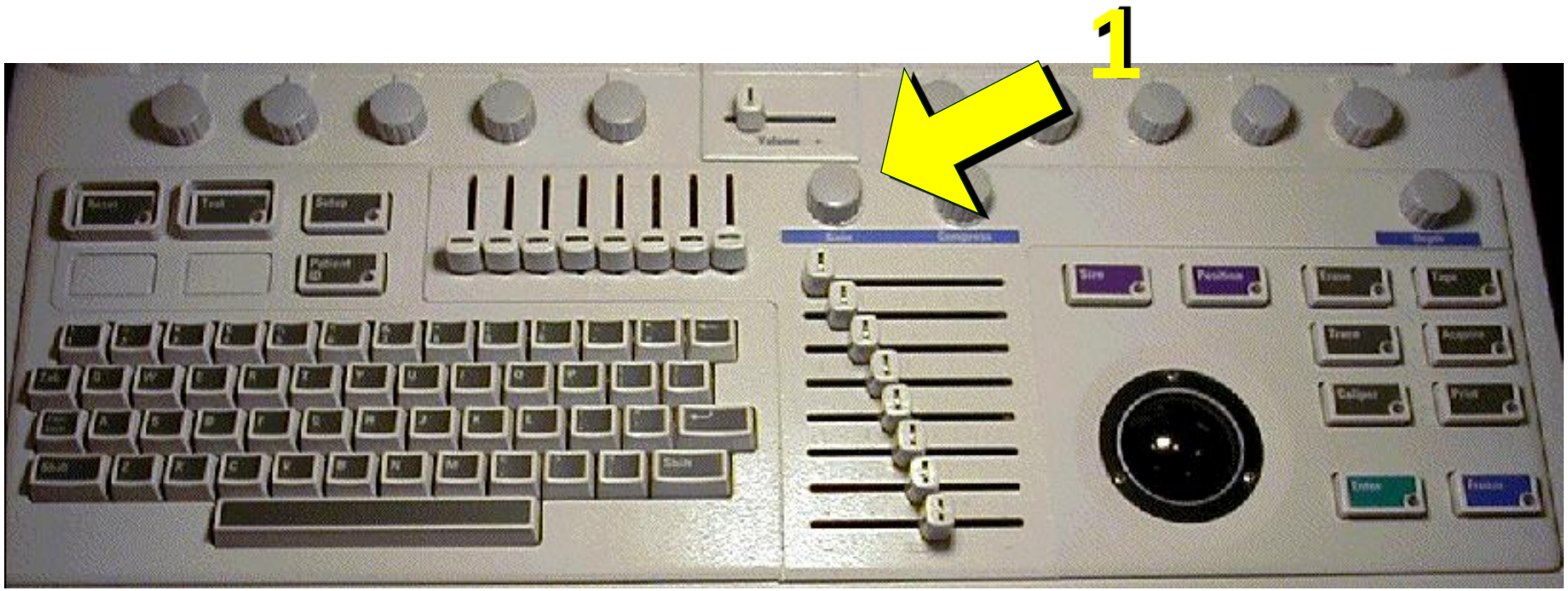
# *Controls: 2D Images*

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

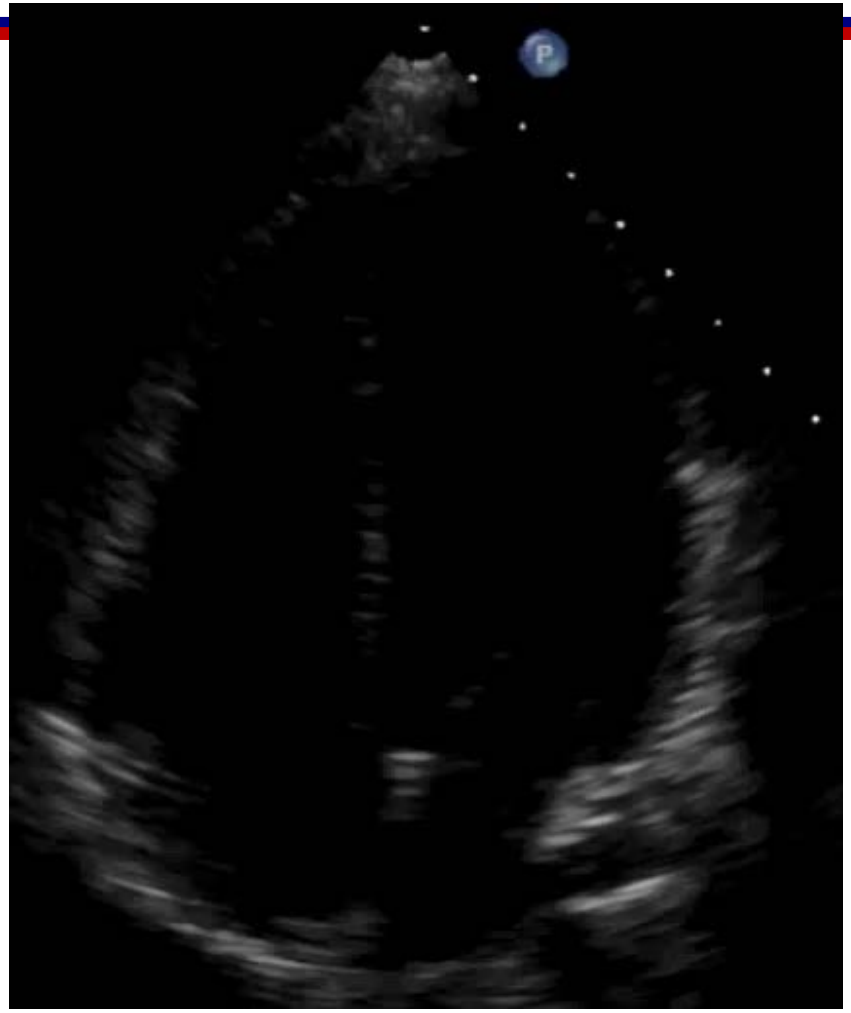
# 2 Common Mistakes

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

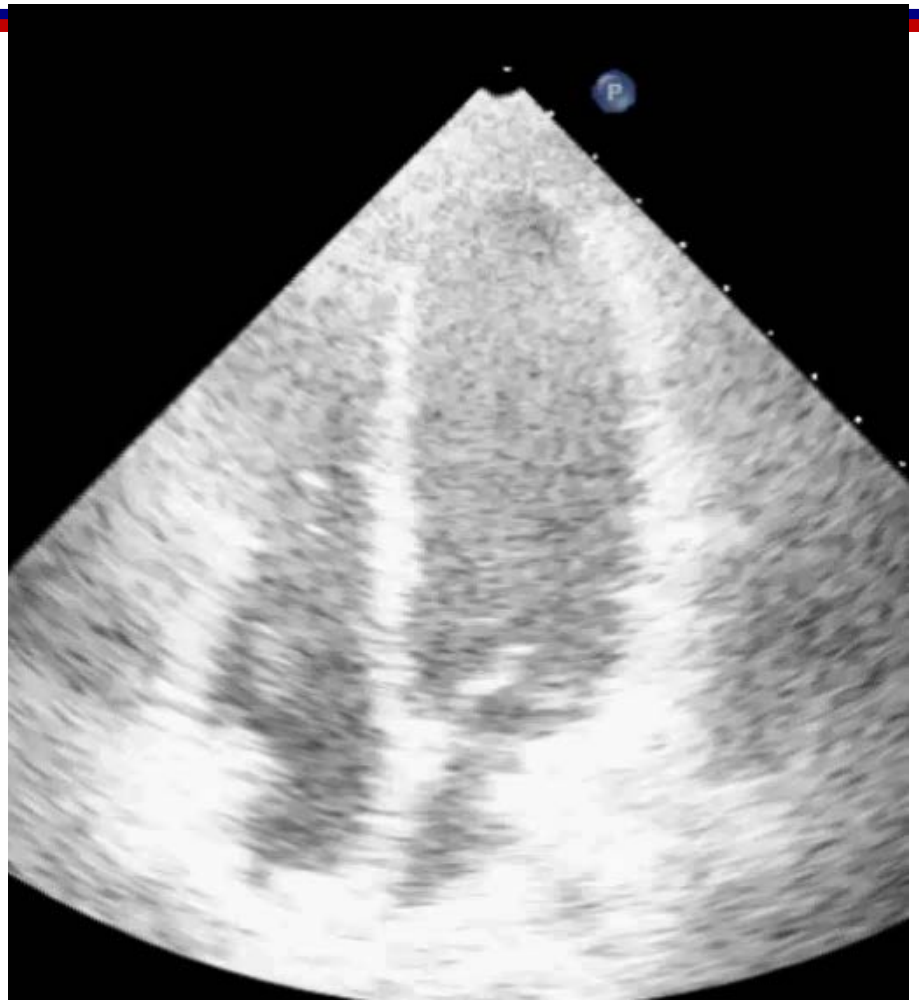
# *Important controls*



# 2D Gain



Too Low

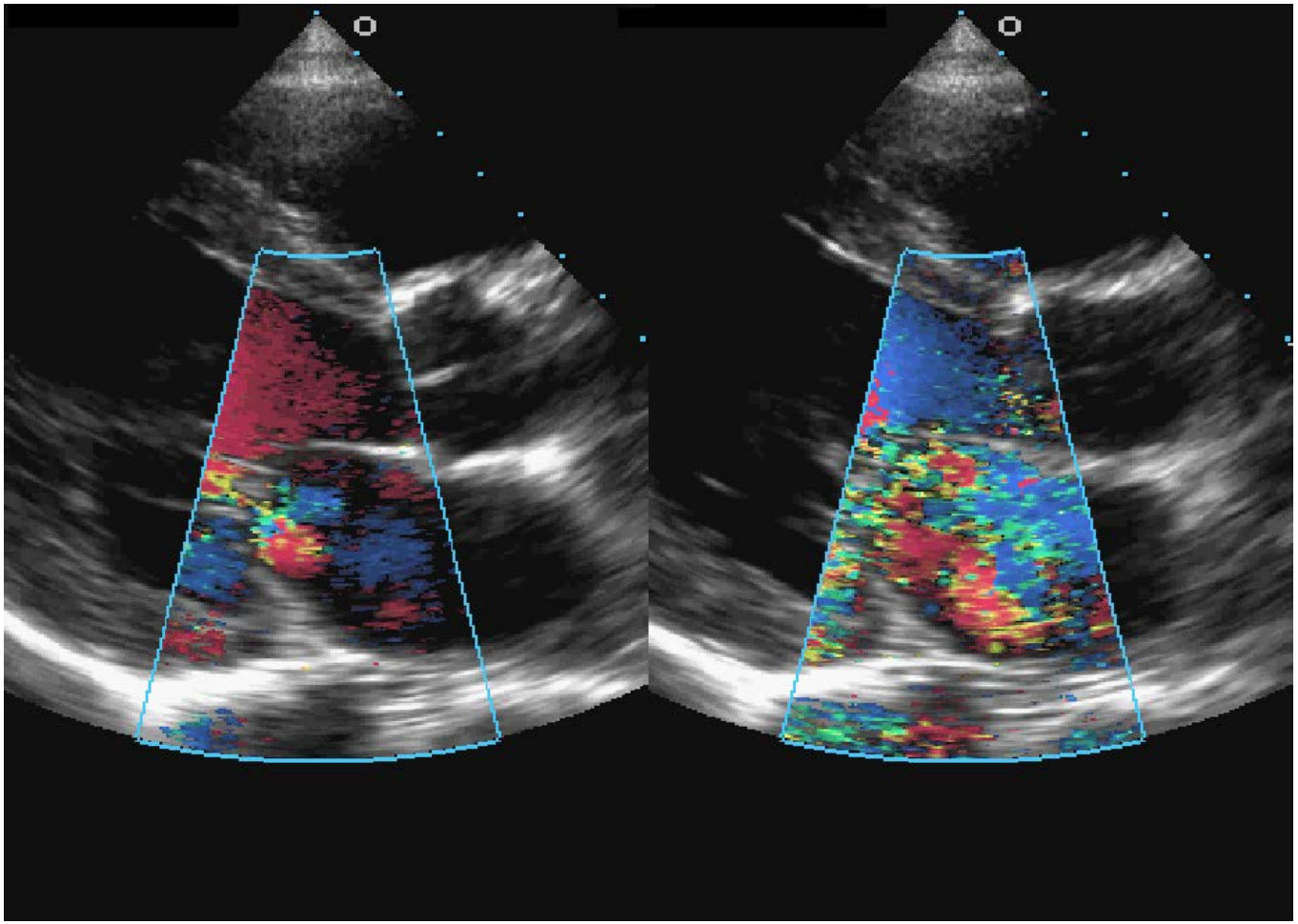


Too High

# 2D Gain

Just Right

# Color Doppler Gain

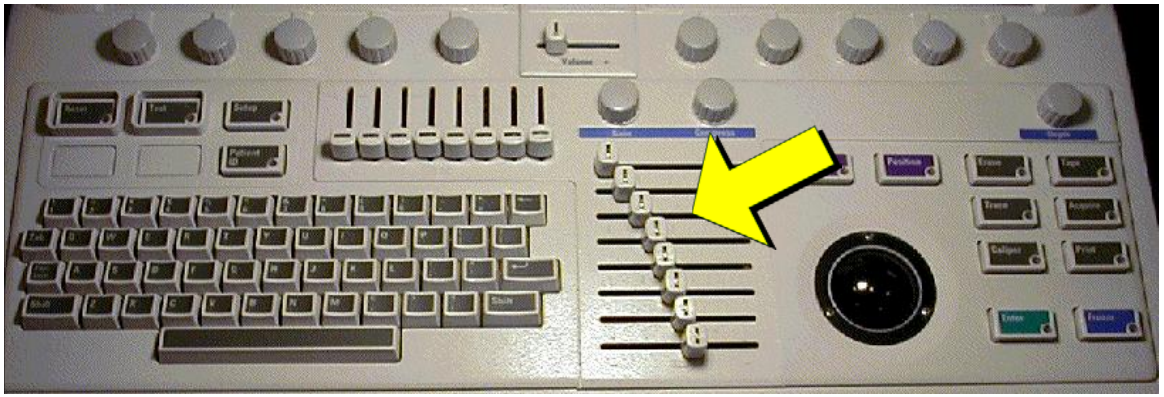


Good

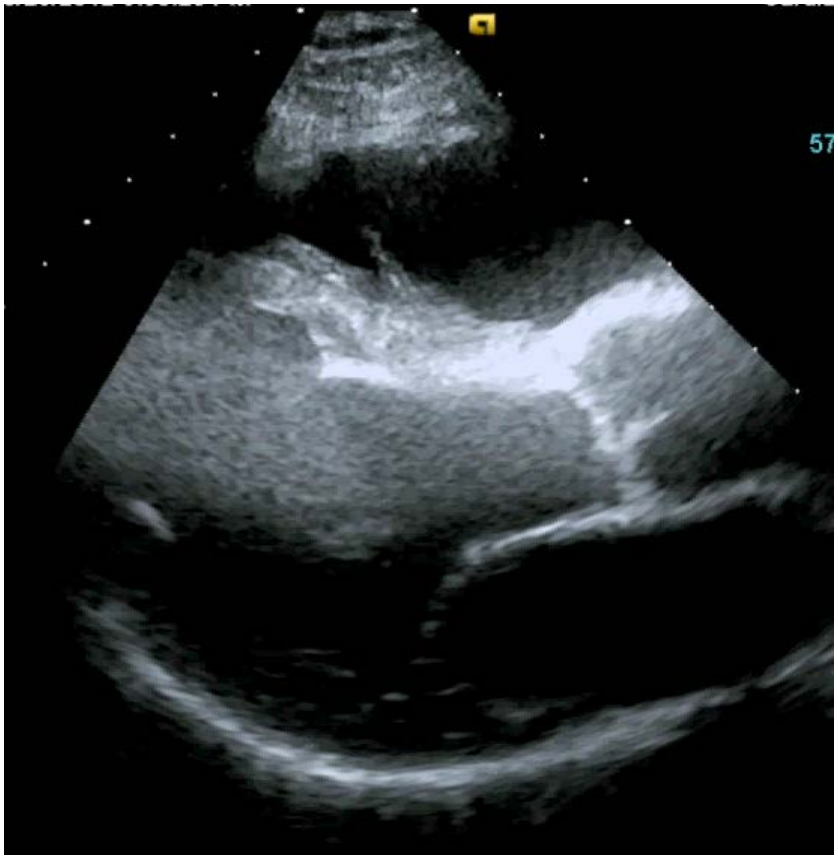
Too High

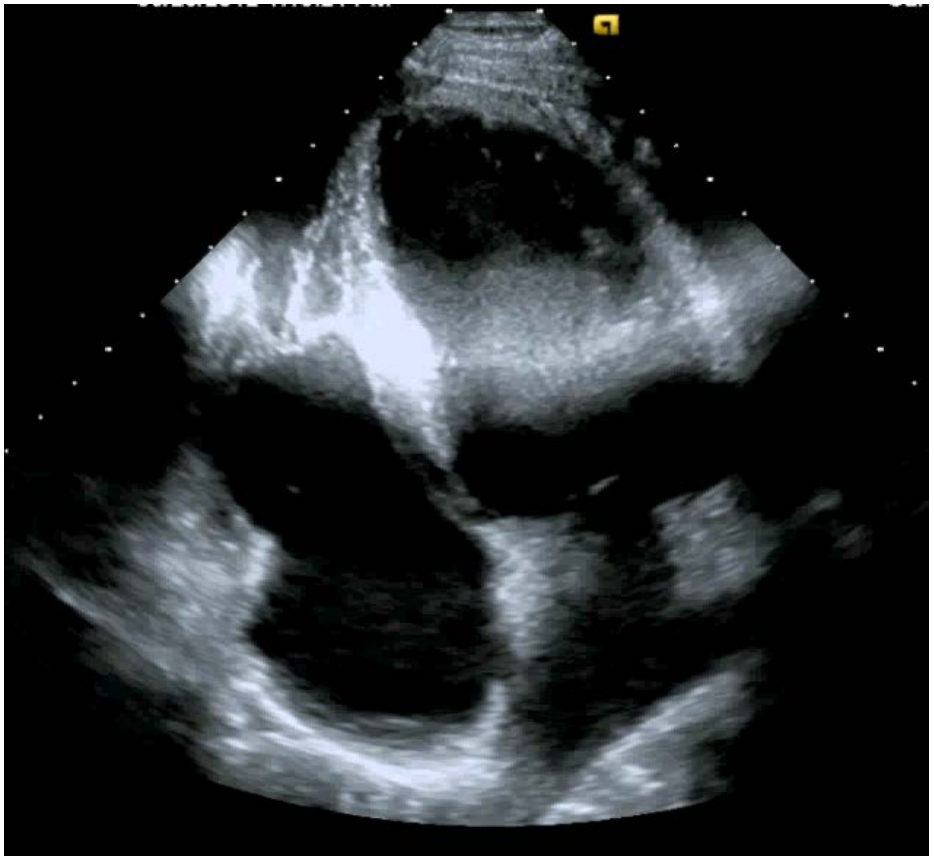
# TGC

- 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*





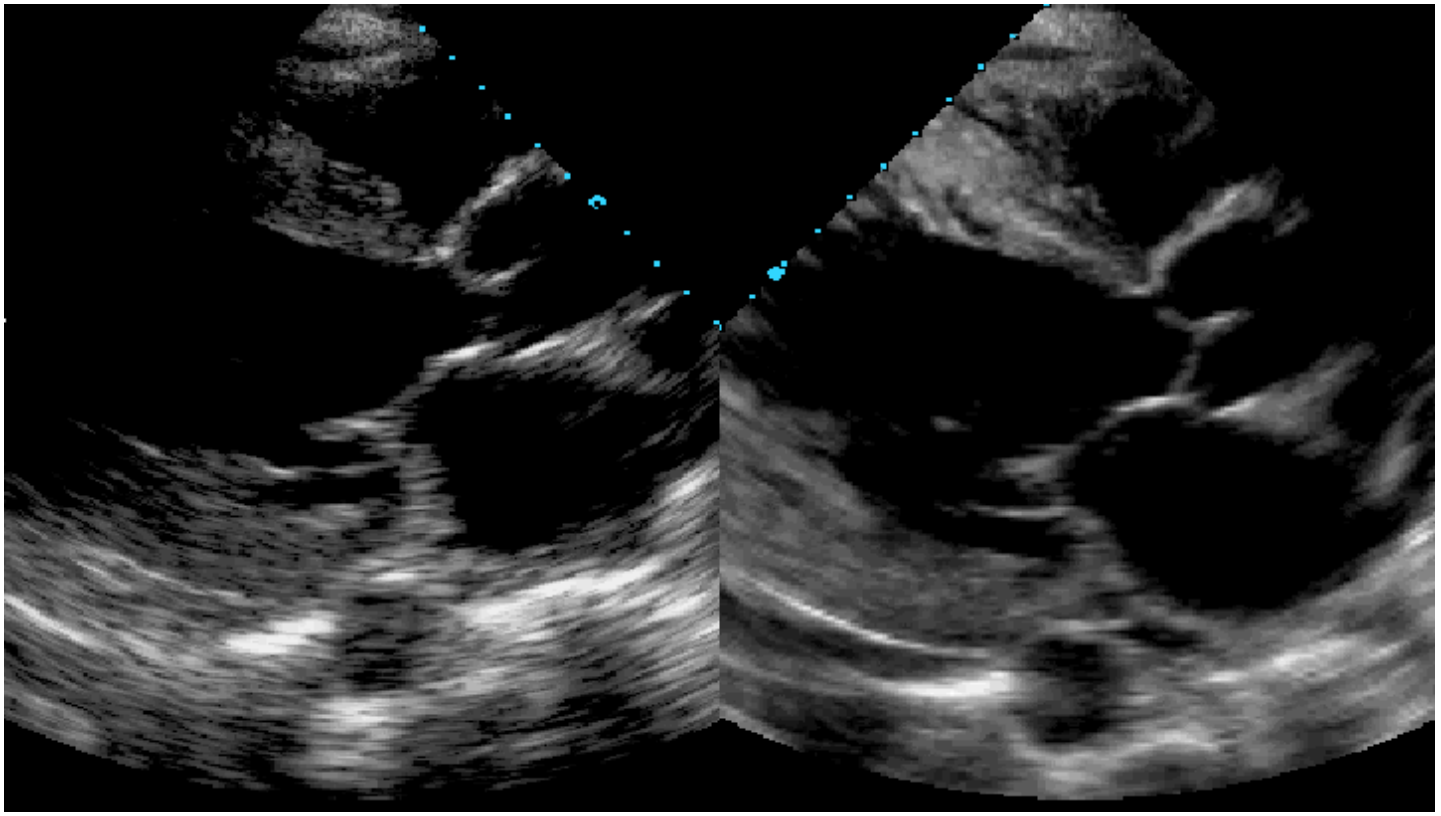
# *Image Quality*

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

# *Transducer frequency*

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

# *Resolution*

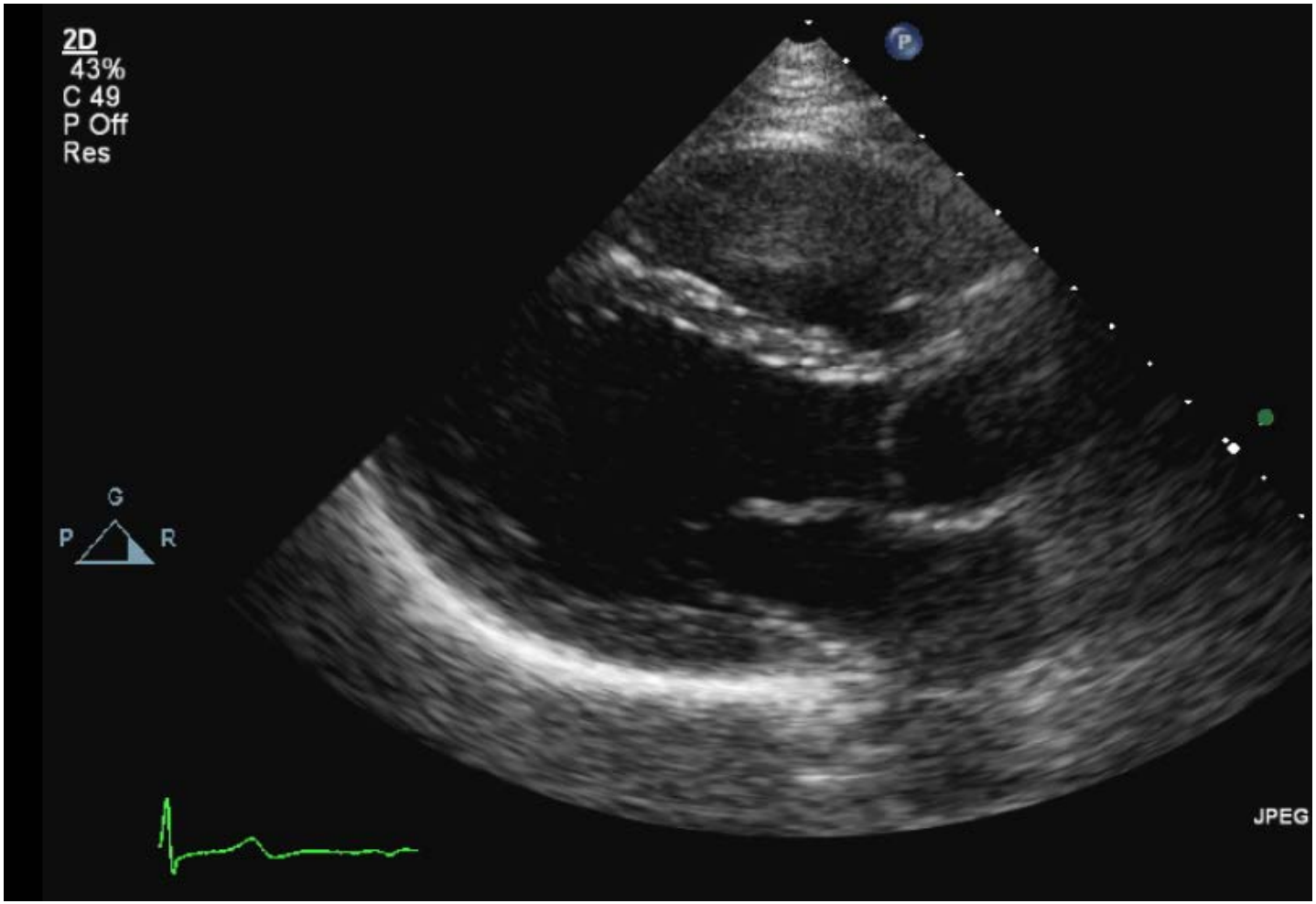


**2.5 MHz** **4.0 MHz**

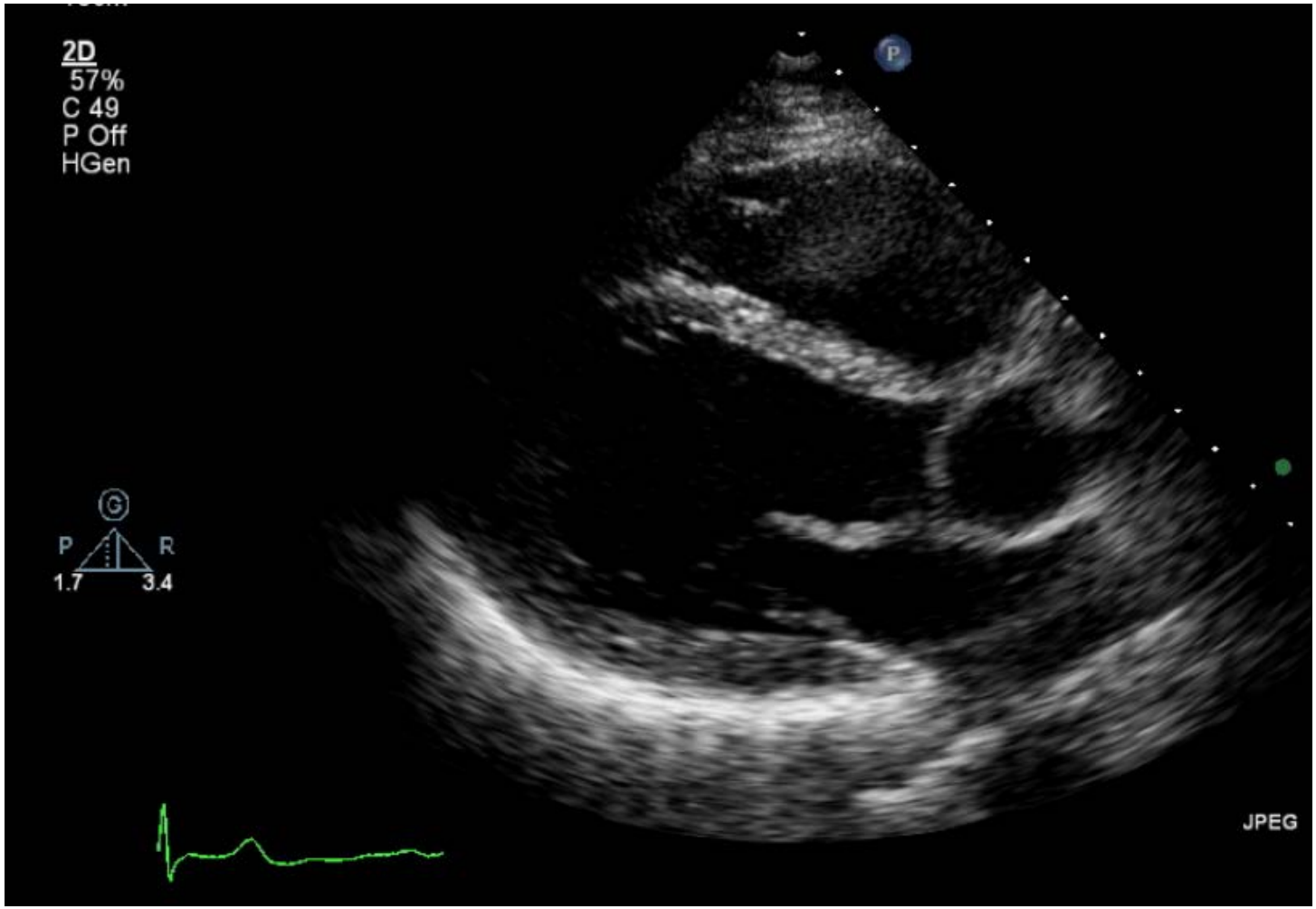
# *Harmonics*

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

# *Fundamental Imaging*



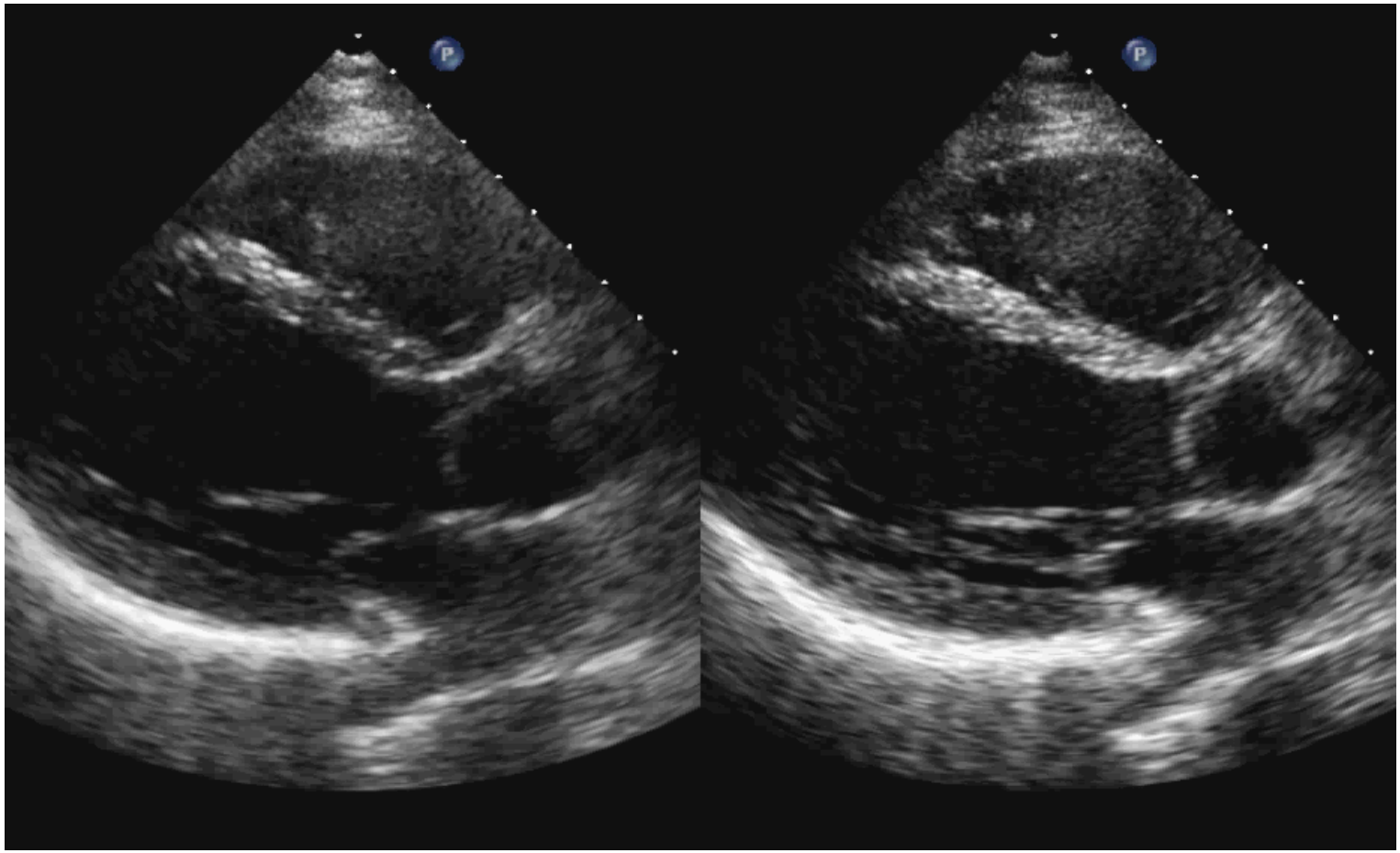
# *Harmonic Imaging*



# *Harmonics*

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

# *Harmonics*

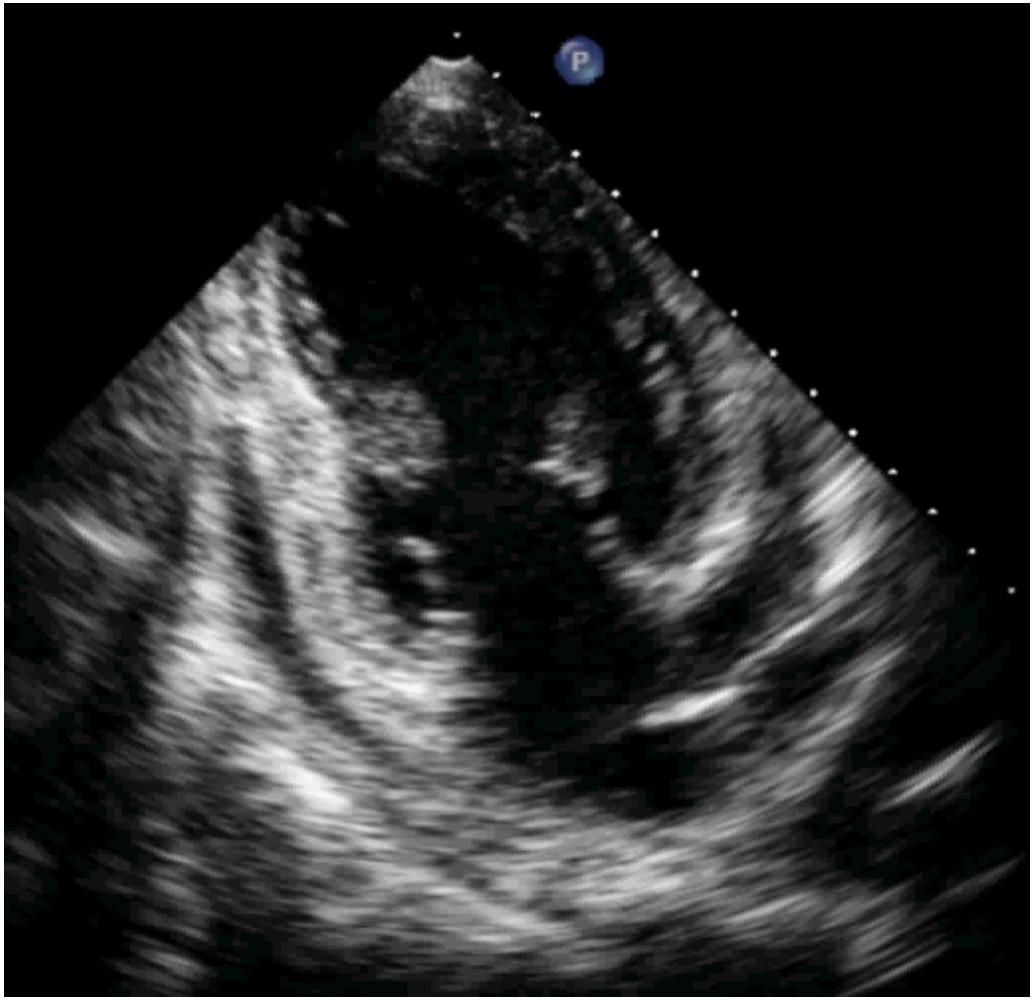


**Off** **On**

# *2 Common Mistakes*

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

# *Foreshortened*



# *Apical Four - Chamber*

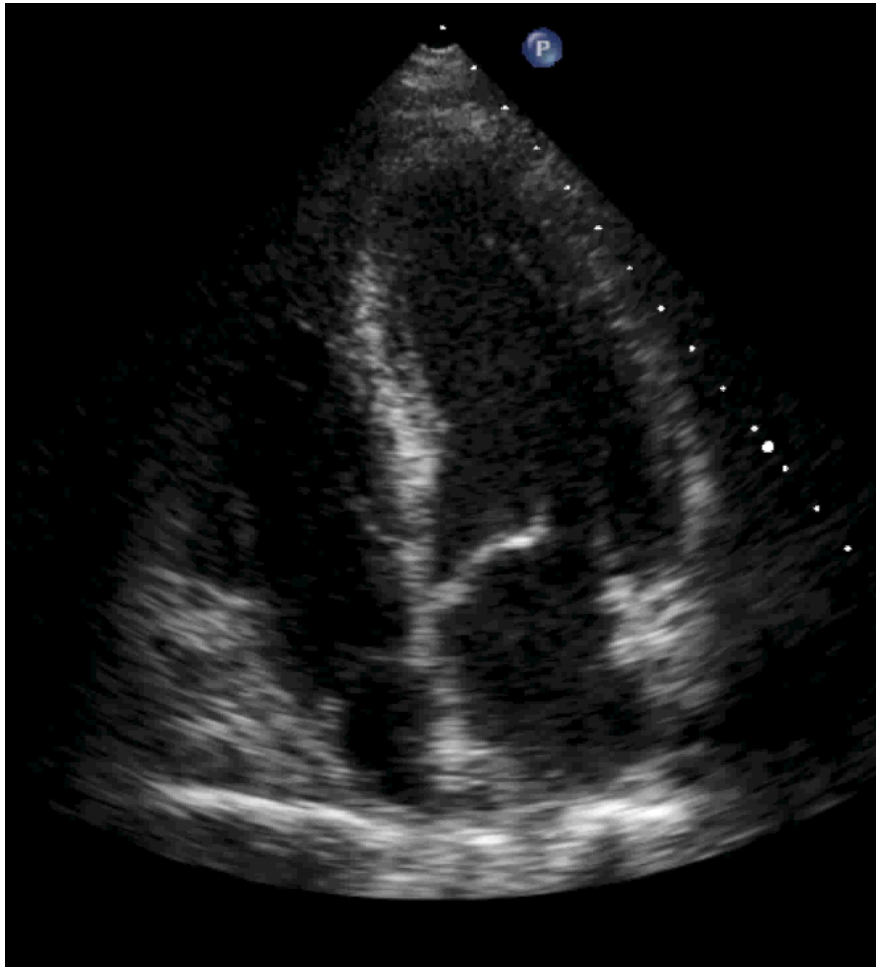


Image true apex

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 valve
Q-tip sign
Crista terminalis
Trabeculations
Coumadin ridge
Ligament of Marshall
Dumbell IAS
Valve excems
Aneurysm
Pectinate
Hypertrophy
Atrial septal aneurysm
Moderator Band
Lipomatous
Chiari network
False chordae
Eustachian ridge
Thebesian Valve

# *Goals for Today*

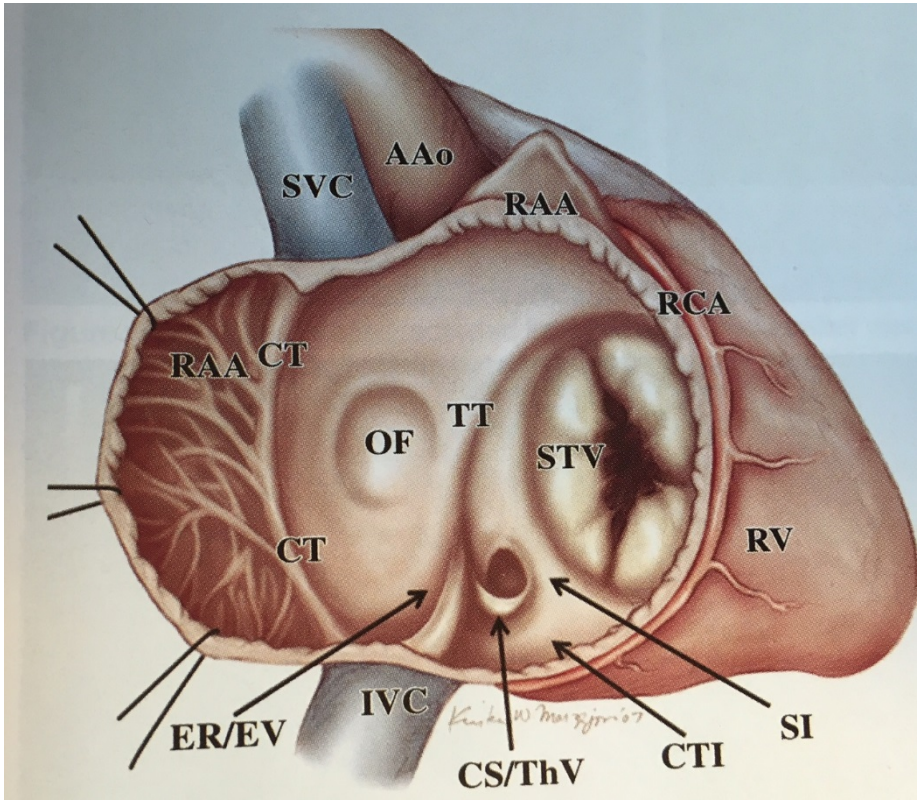
- **Review normal anatomy**
- **Review normal variants**
- **Show examples**
- **Become less confused**
- **The more you see the more you know**

# *Right Atrium*

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

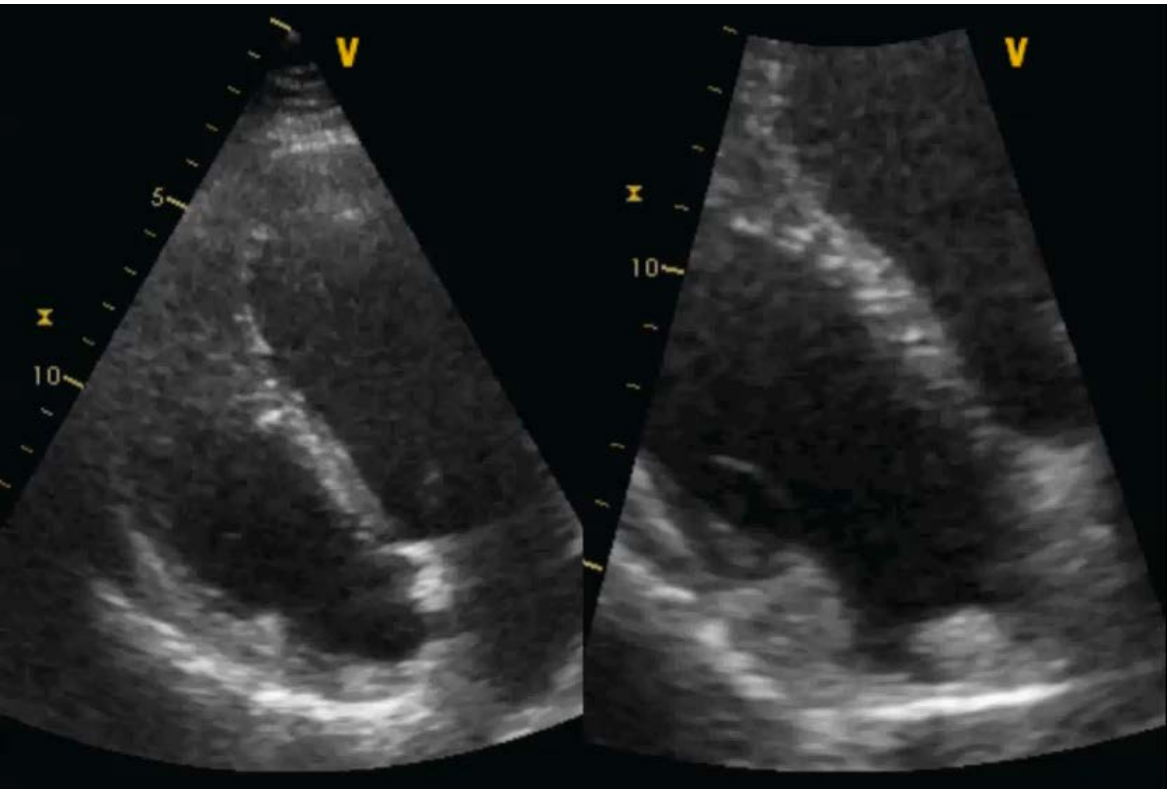
# Crista Terminalis

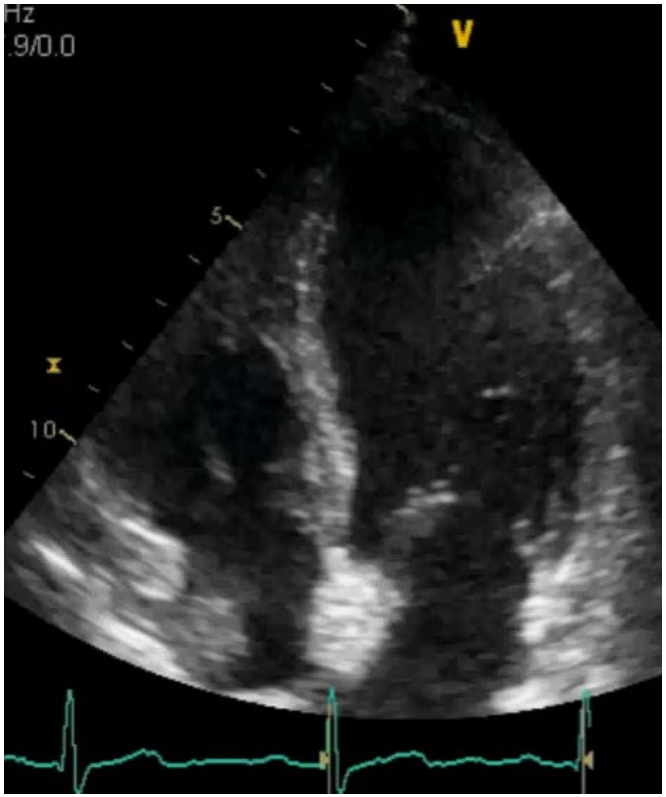
- Ridge between the smooth & trabeculated RA walls
- When prominent it may be mistaken for a RA mass




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

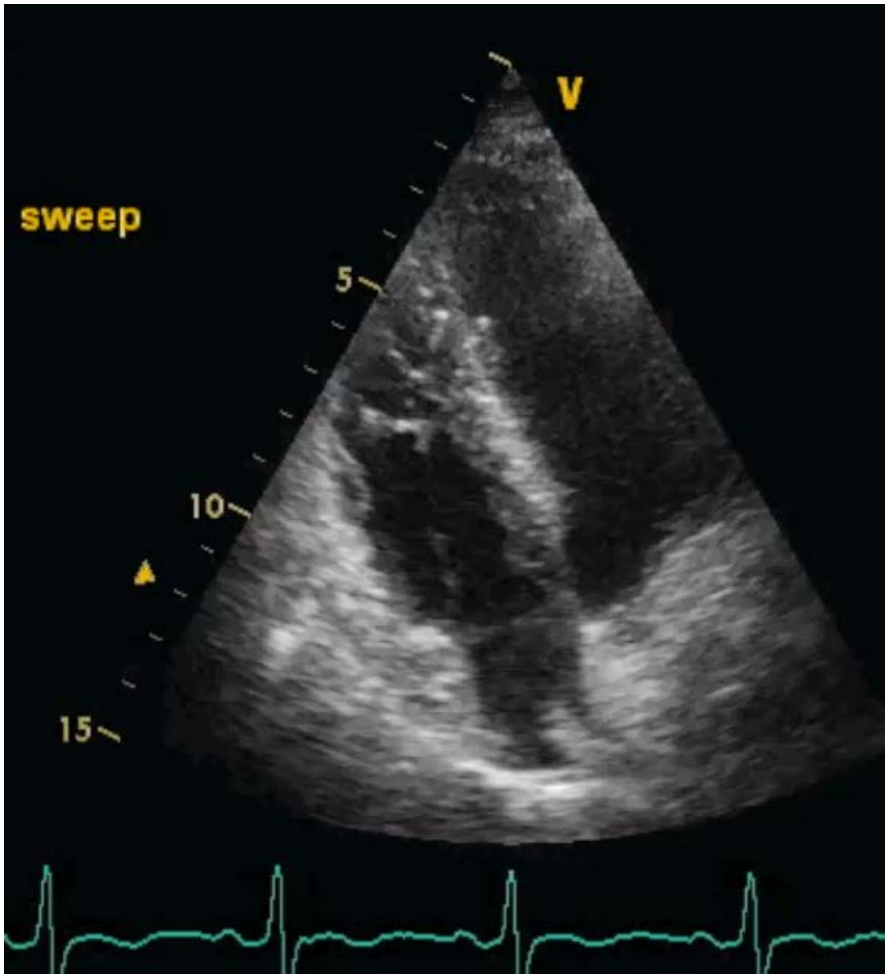
# *Crista terminalis*



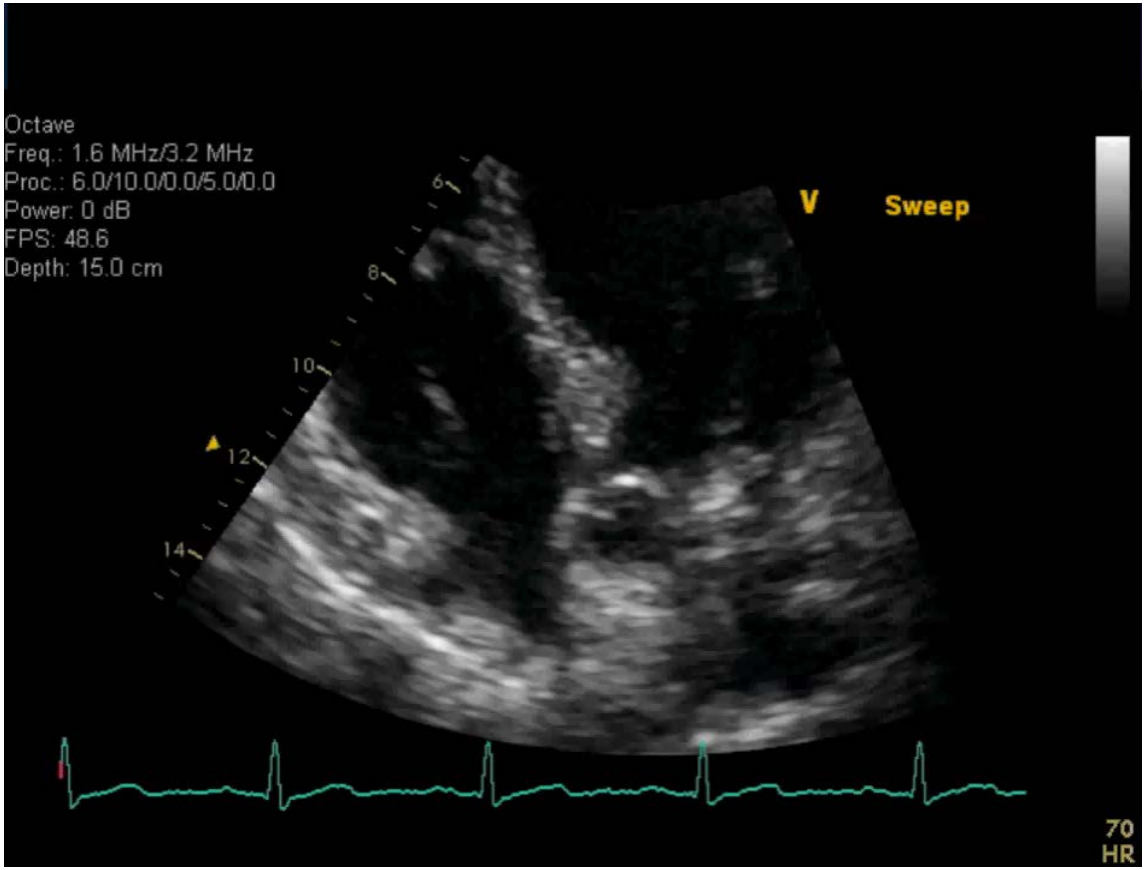



# *Crista terminalis*

- Do sweeps
- Shows connections & the extent of anatomy

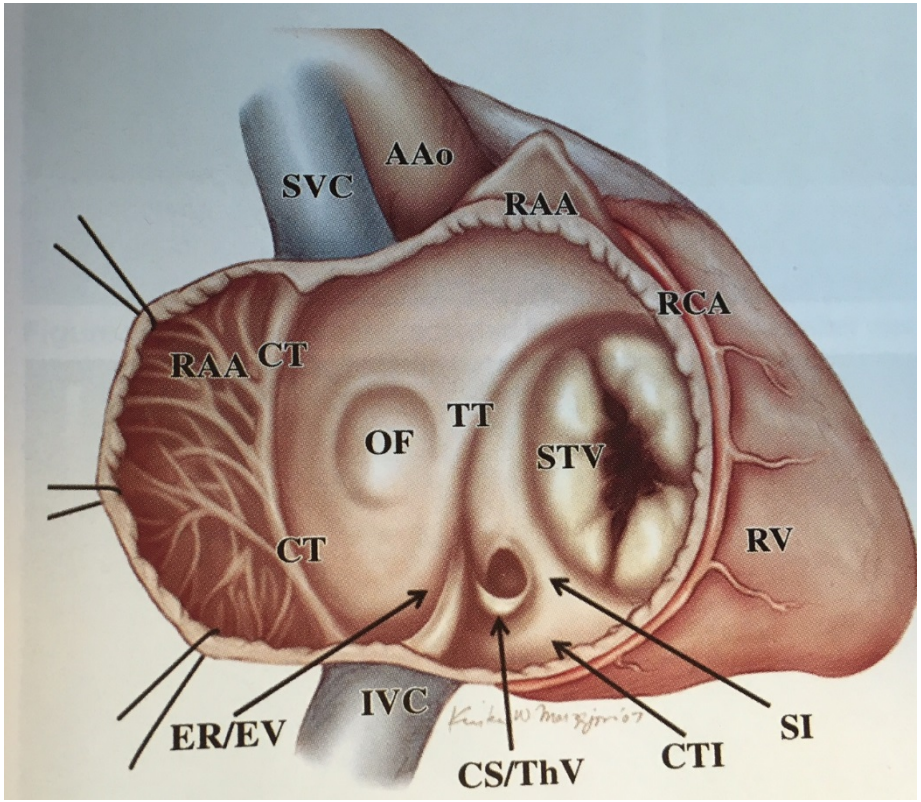


# *Crista terminalis*



# Eustachian Valve

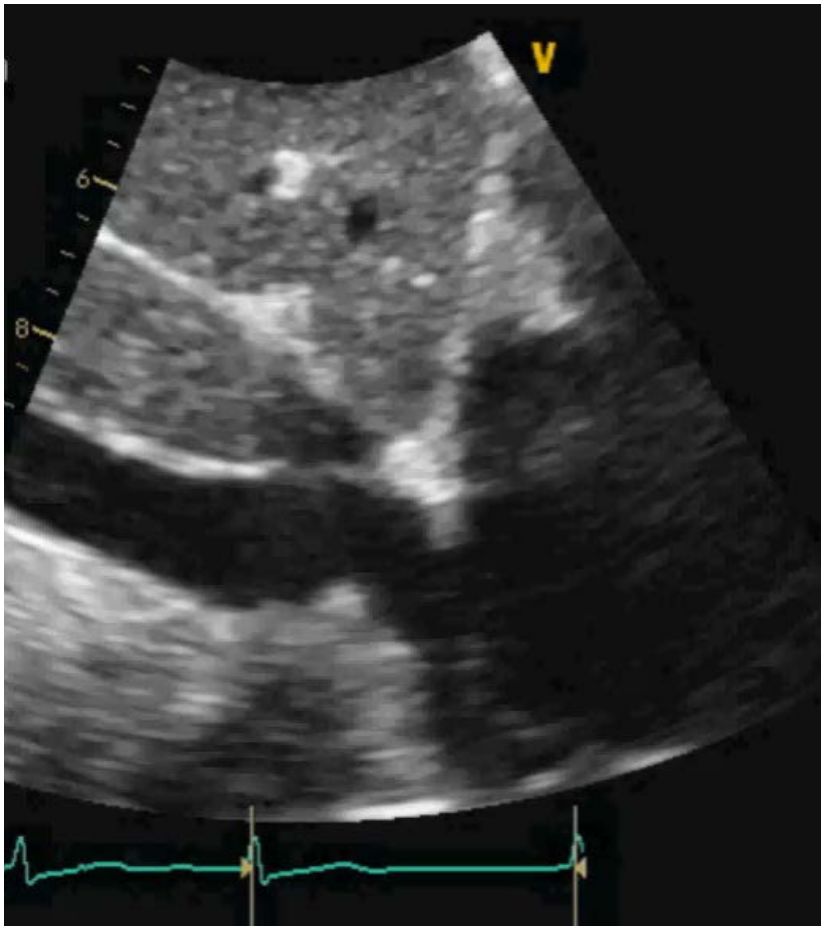
- Valve of the IVC
- Directs flow to the LA in fetal circulation
- Best seen in the subcostal IVC view
- Can be prominent or undulating




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

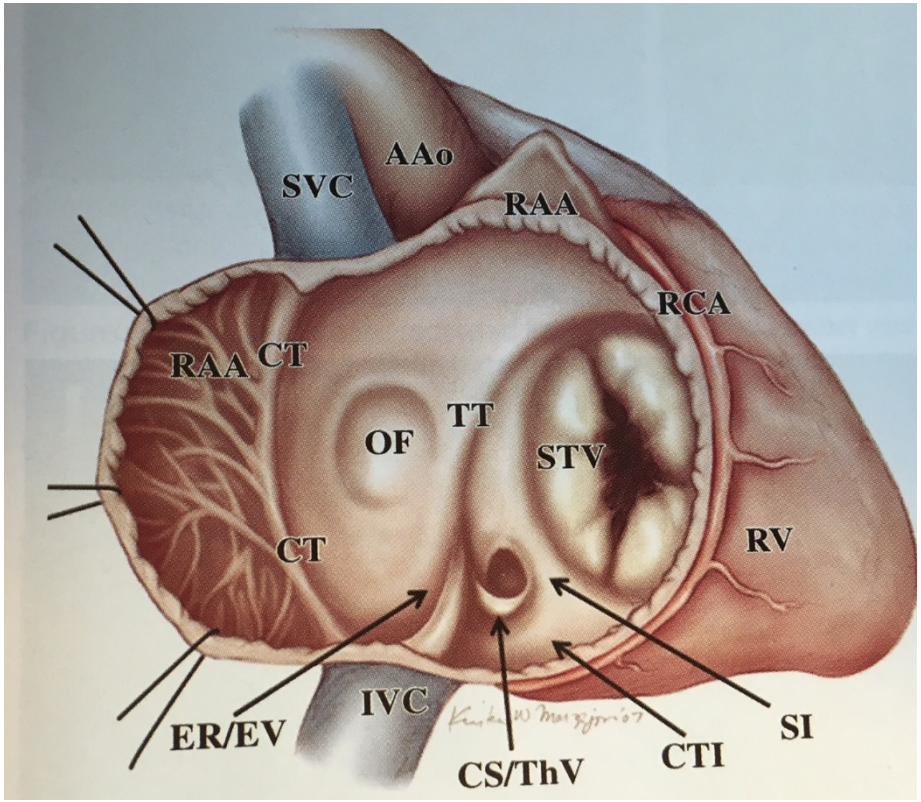
# *Eustachian Valve*

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



# Thebesian Valve

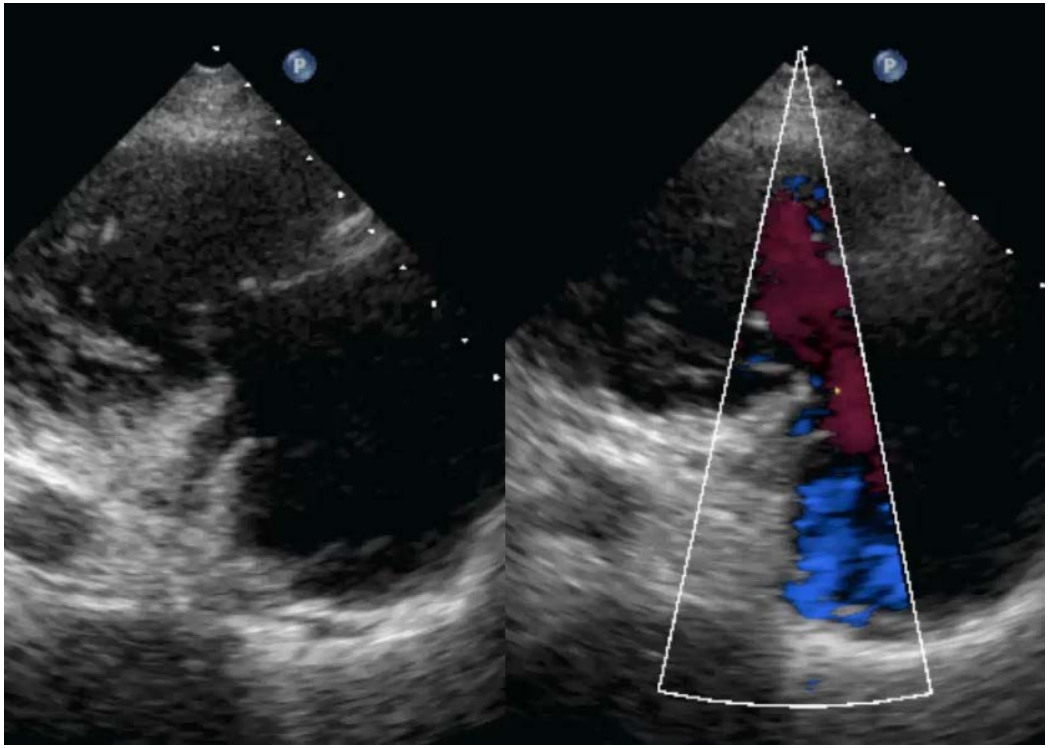
- Valve of the coronary sinus
- Well known to the EP docs for biV lead placement
- Best seen in the parasternal RVIT view




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

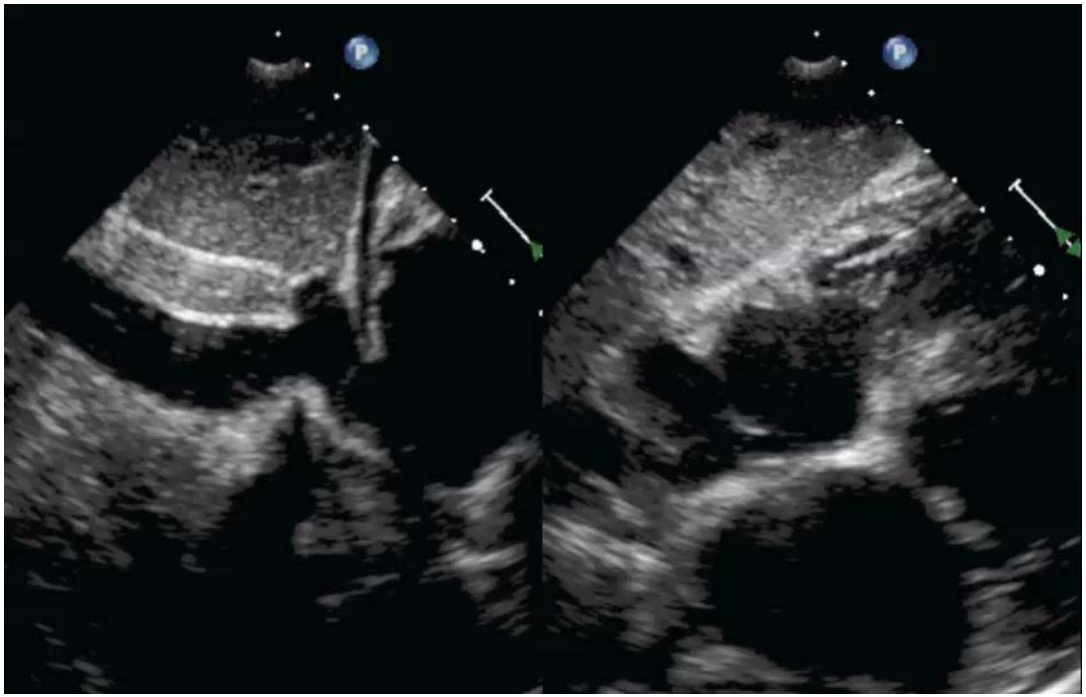
# *Thebesian Valve*

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

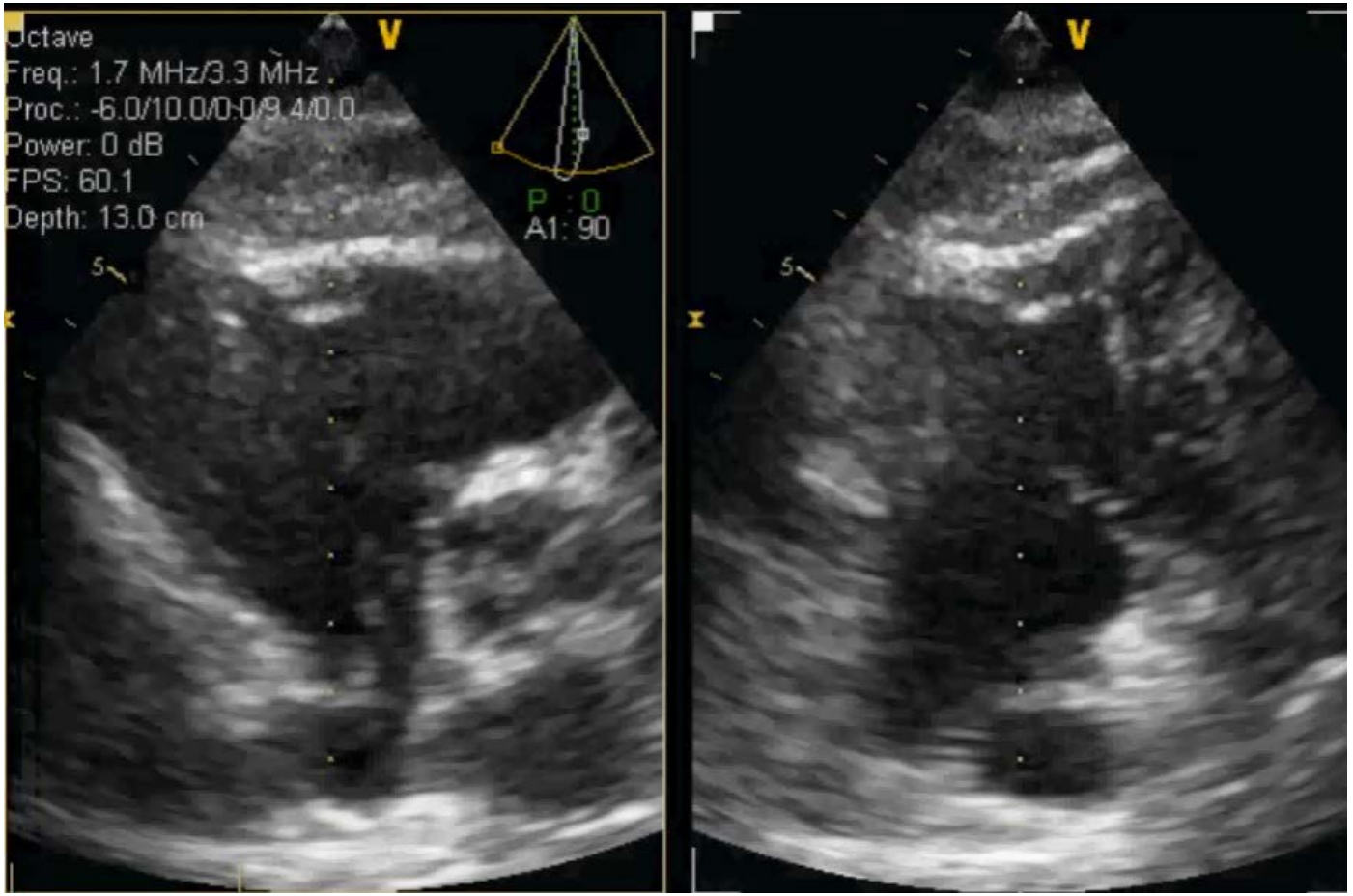


# *Chiari Network*

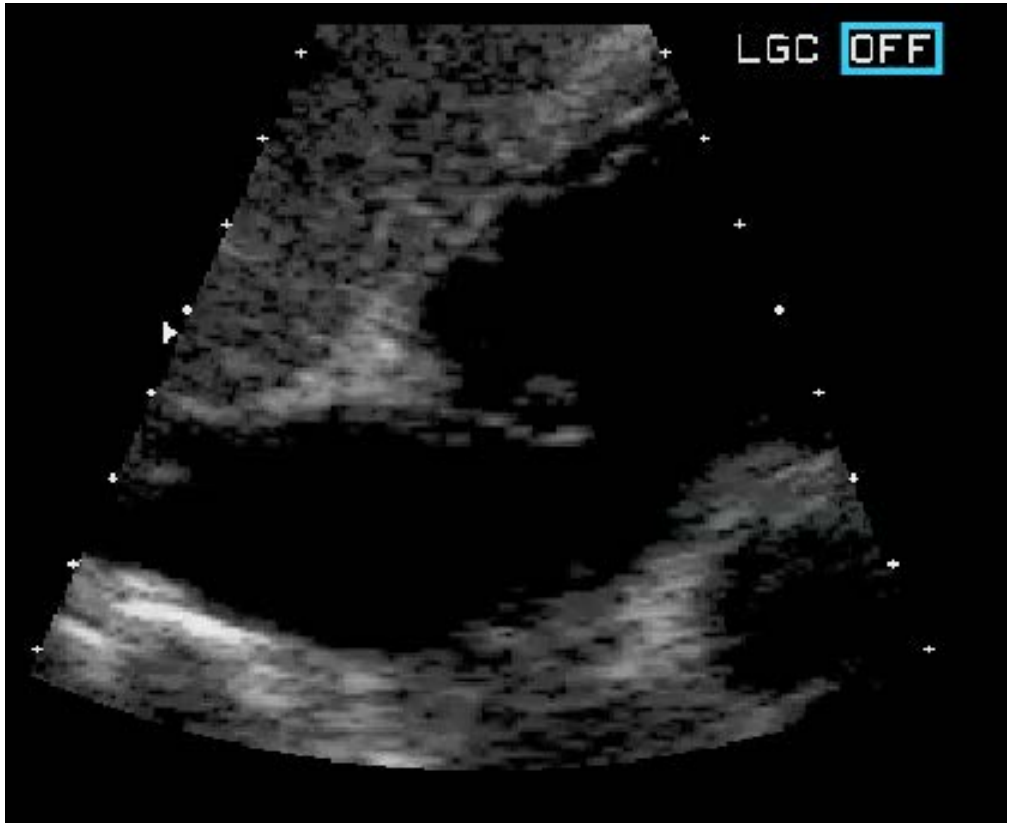
- Mobile filamentous strands in the RA
- Random motion
- Has been associated with PFO's & IAS aneurysms



# Chiari network

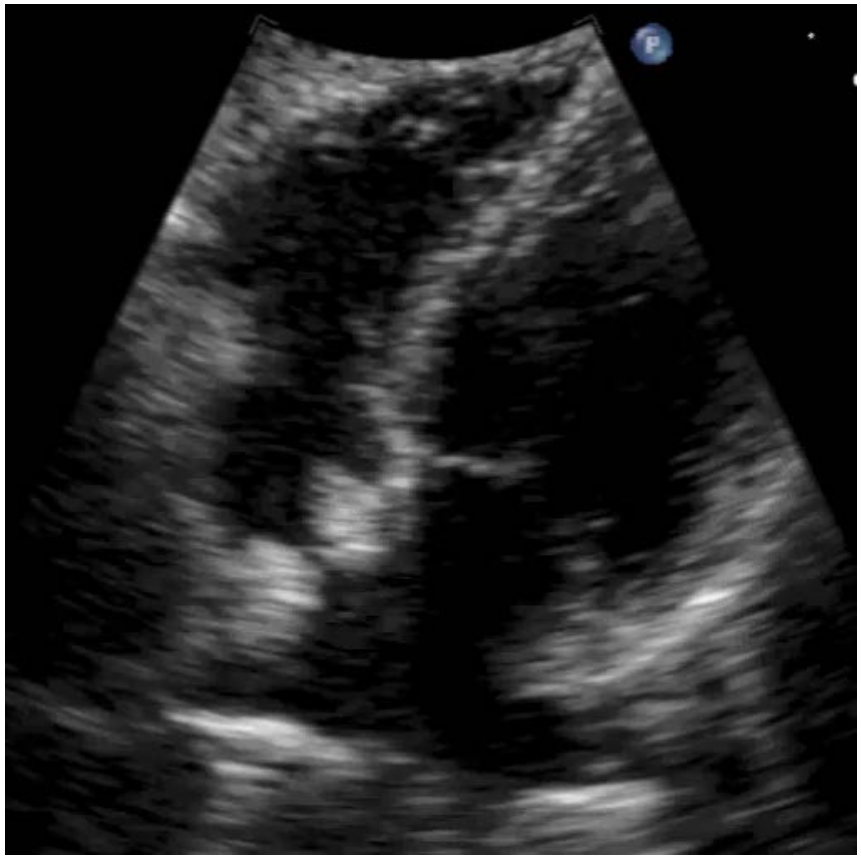


# Chiari network



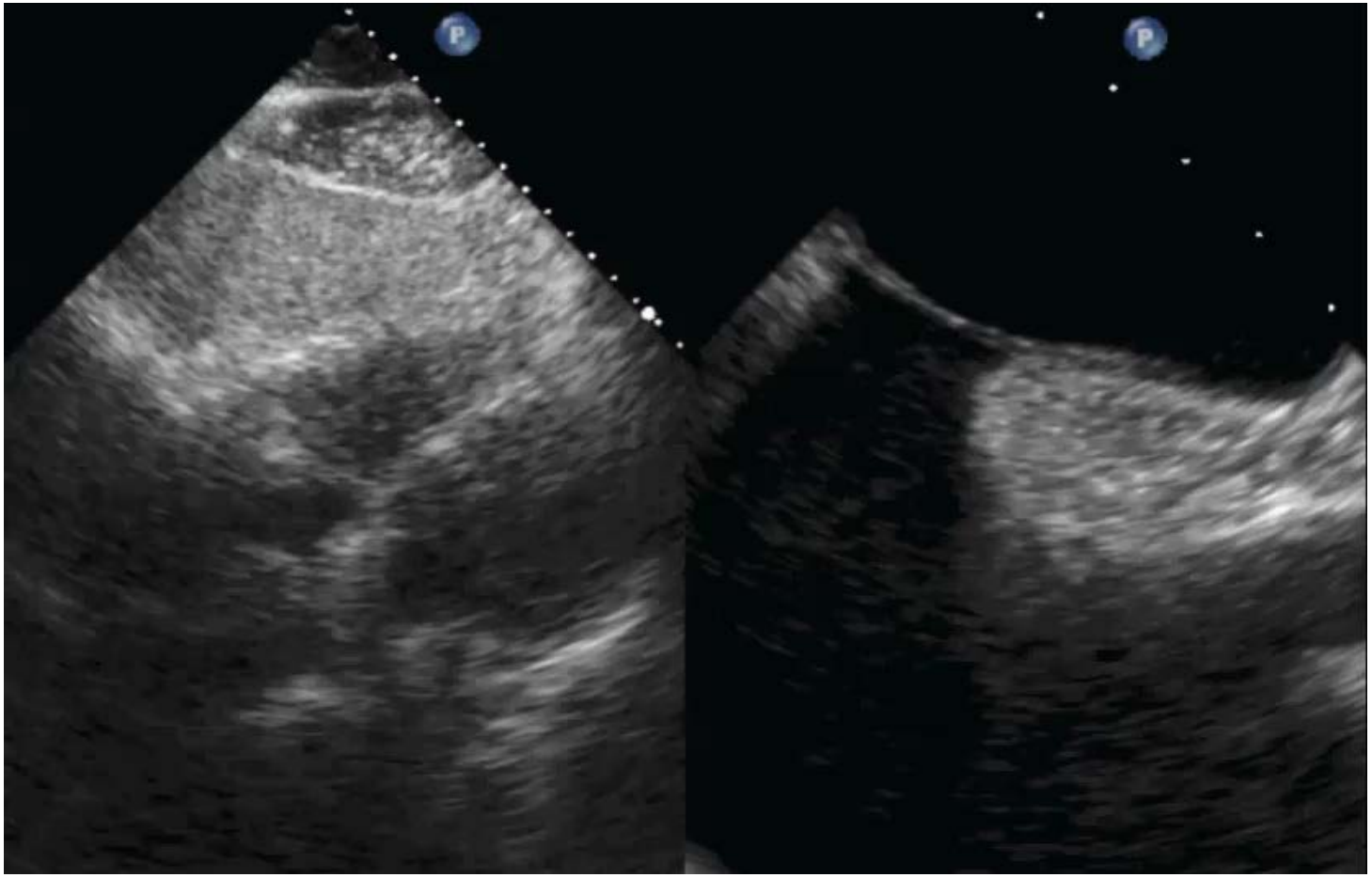

# *Hyperlipomatous IAS*

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



# *Hyperlipomatous IAS*

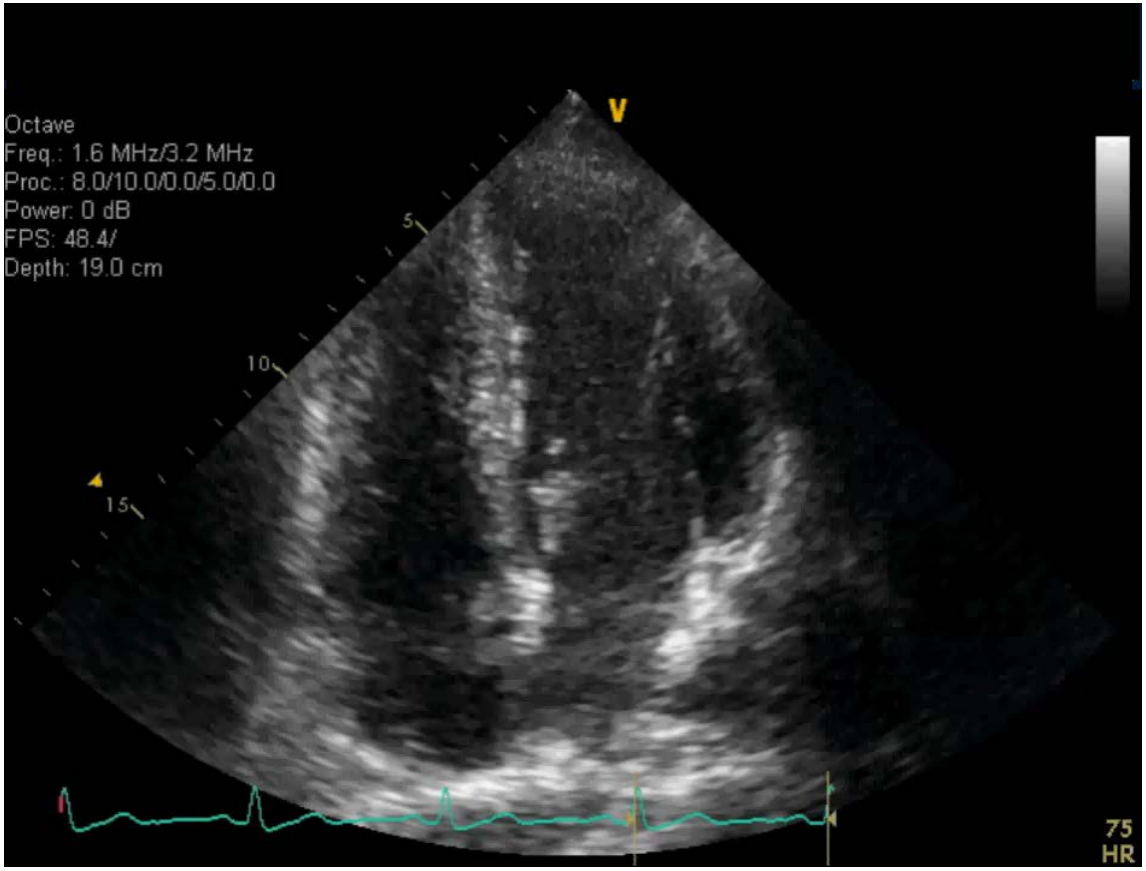
# *Hyperlipomatous IAS*



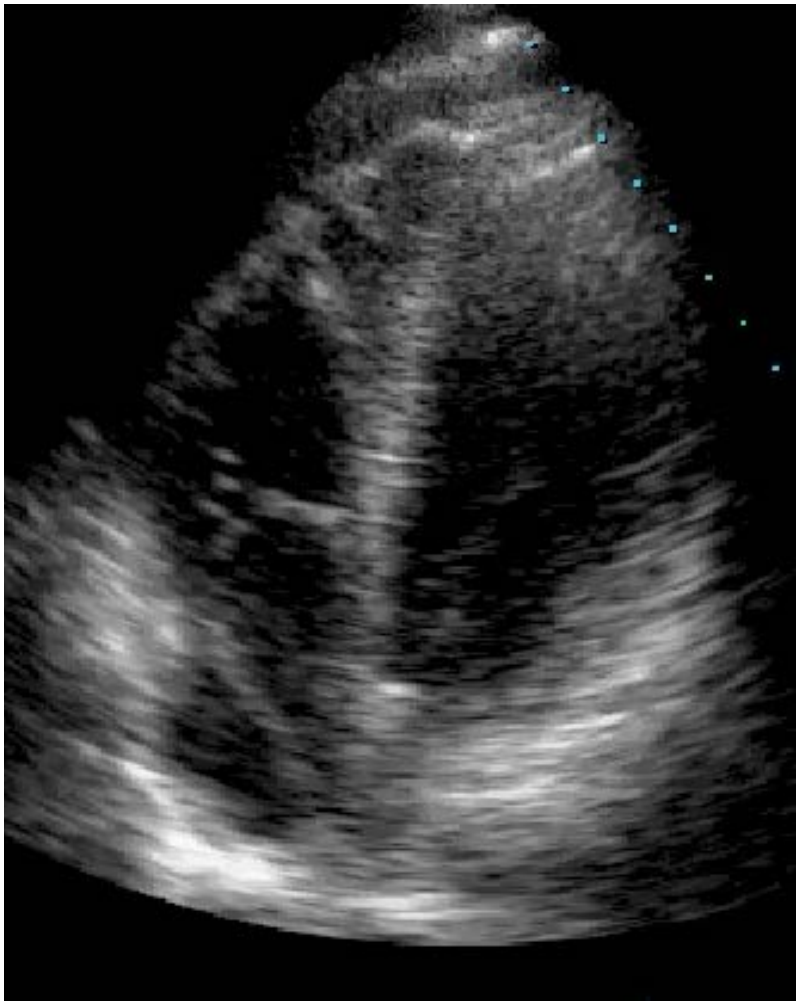
# IAS Aneurysm

- 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


Octave
Freq.: 1.6 MHz/3.2 MHz
Proc.: 8.0/10.0/0.0/5.0/0.0
Power: 0 dB
FPS: 48.4/
Depth: 19.0 cm
V
5
10
15
75
HR

# IASA



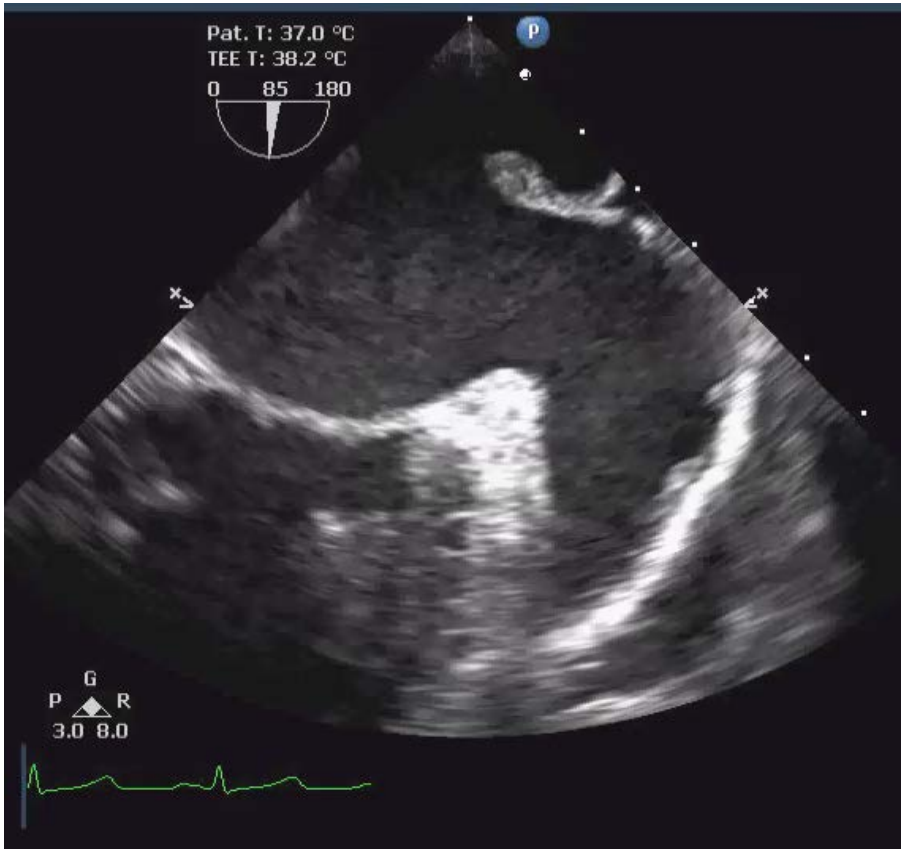
# IASA Gross Pathology

# *Left Atrium*

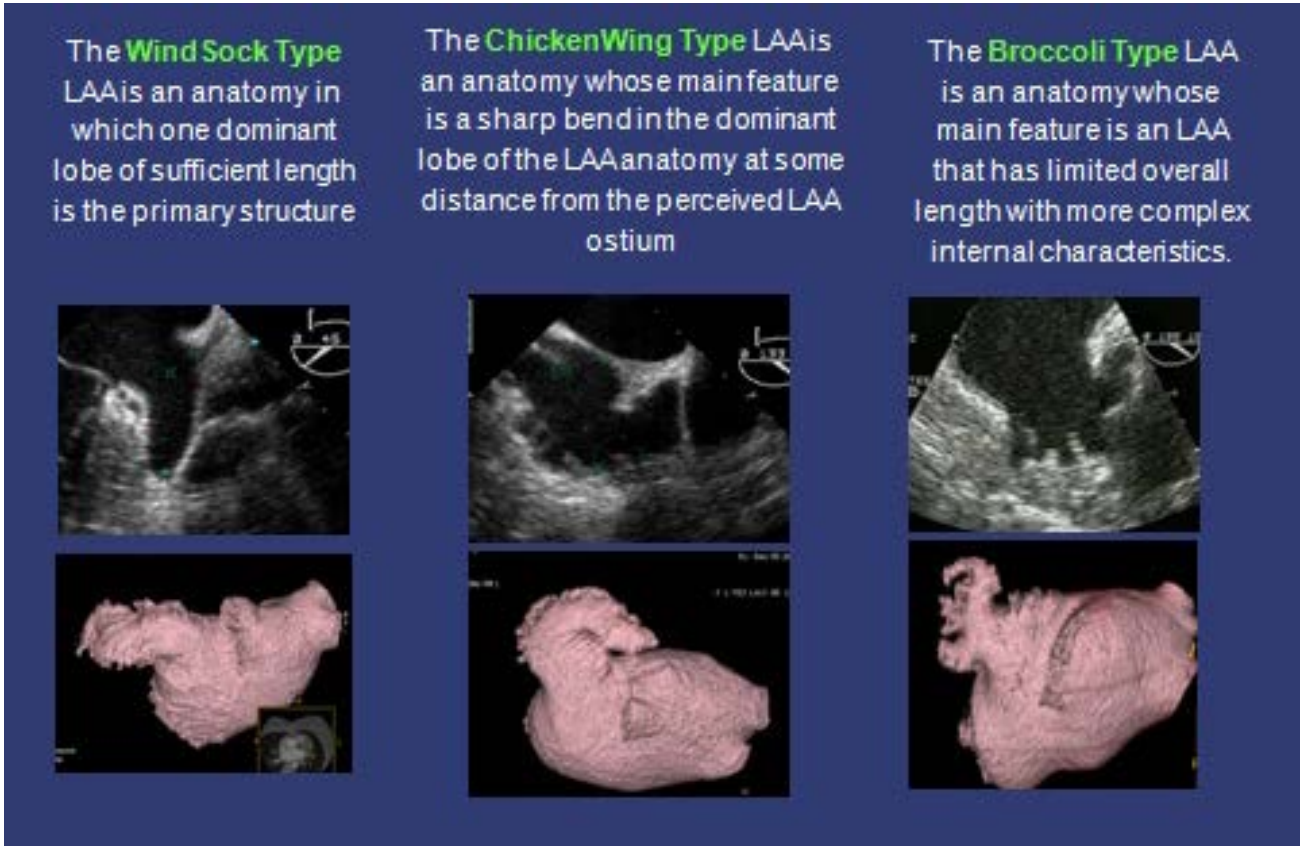
- **LAA & Pectinate Muscle**
- **Ligament of Marshall**
- **Transverse Sinus**

# LA Appendage

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



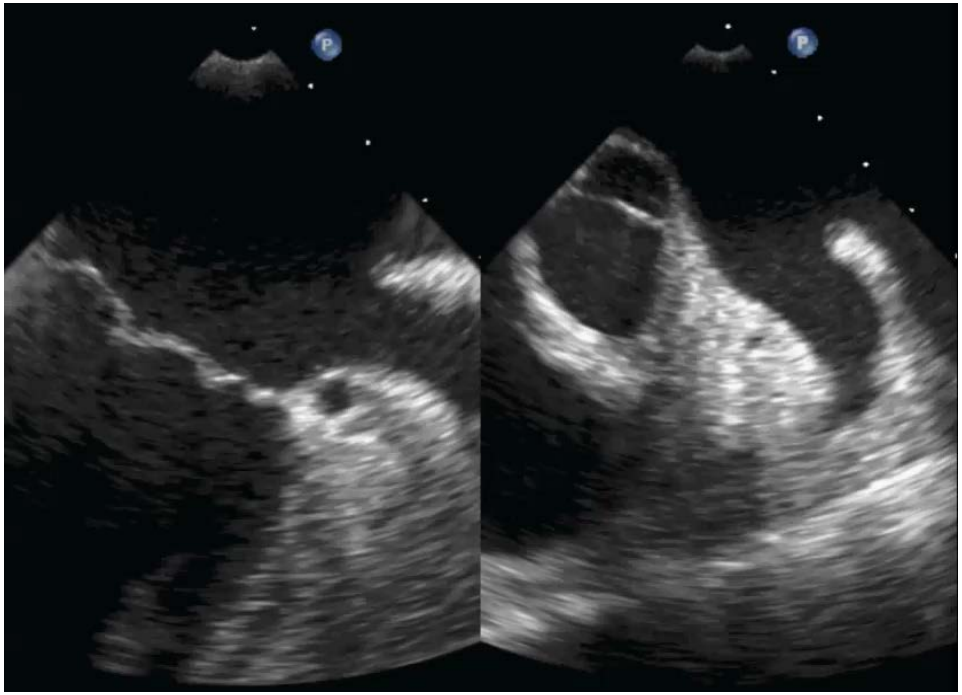
# Major LAA Types




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

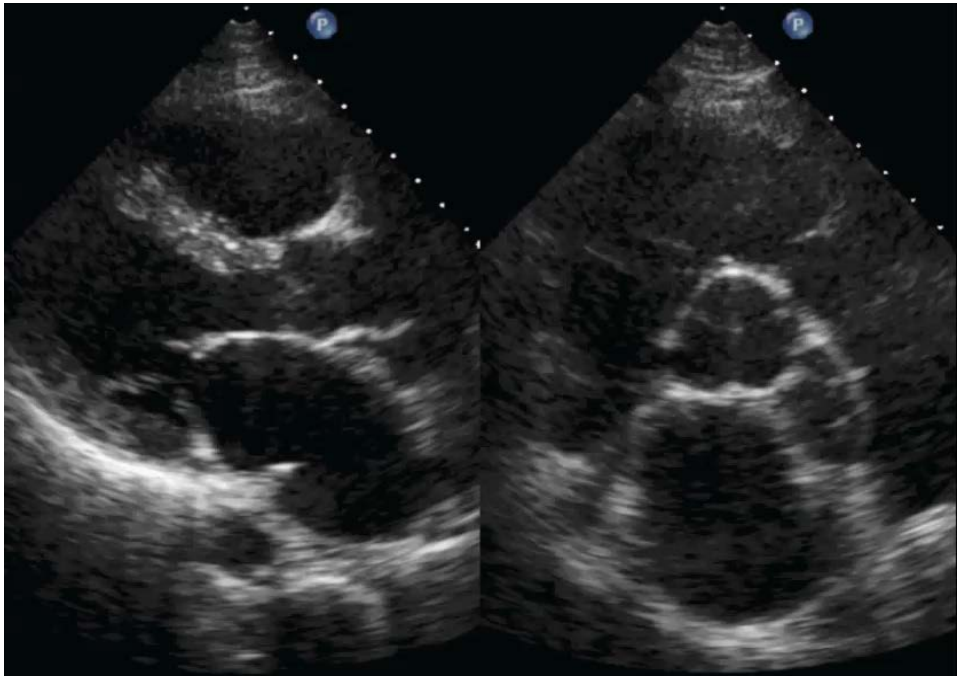
# *Ligament of Marshall*

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



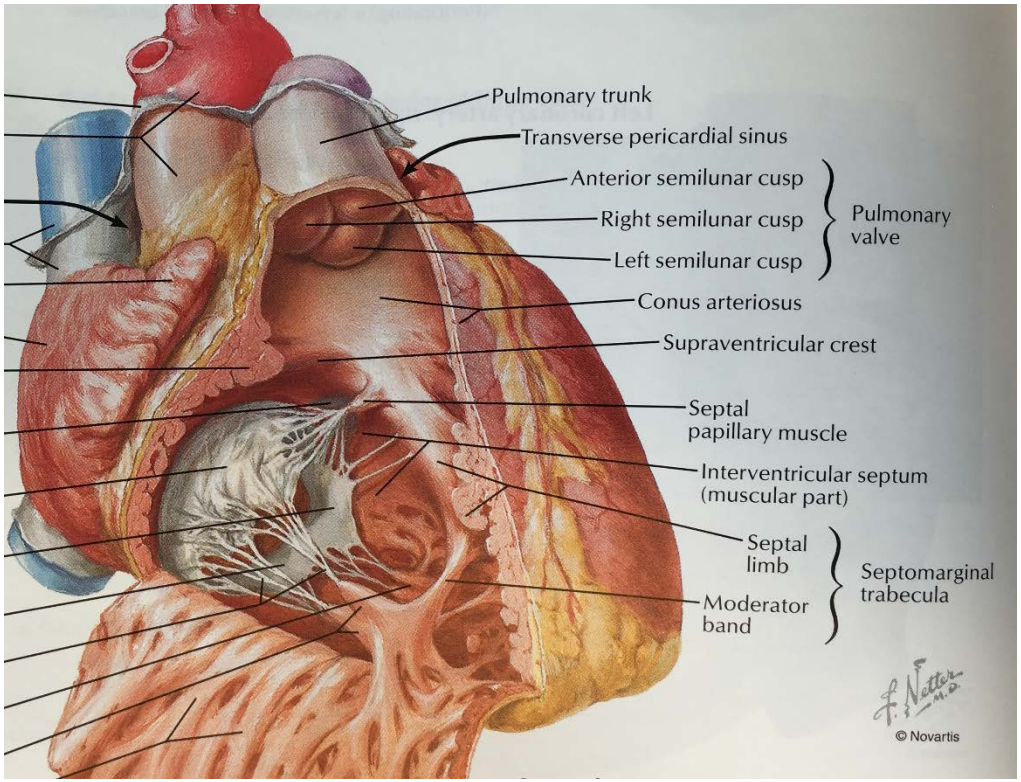
# *Transverse sinus*

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



# Right Ventricle

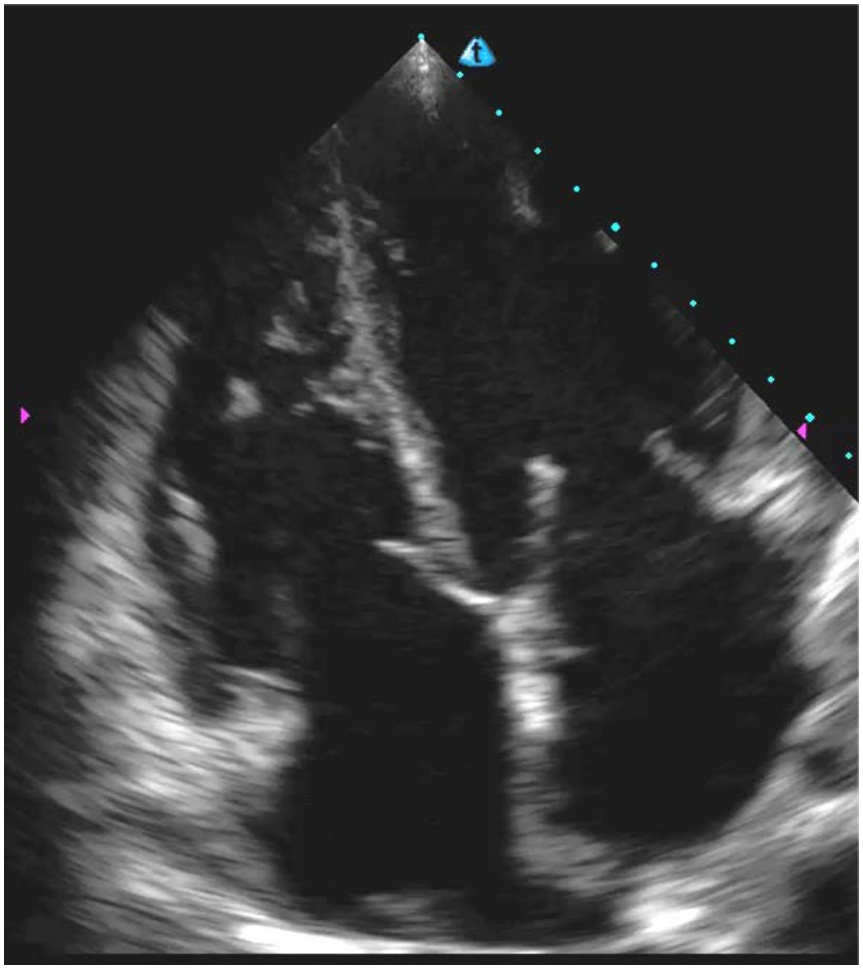
- Trabeculations
- Moderator Band




From *Atlas of Human Anatomy* by Frank Netter

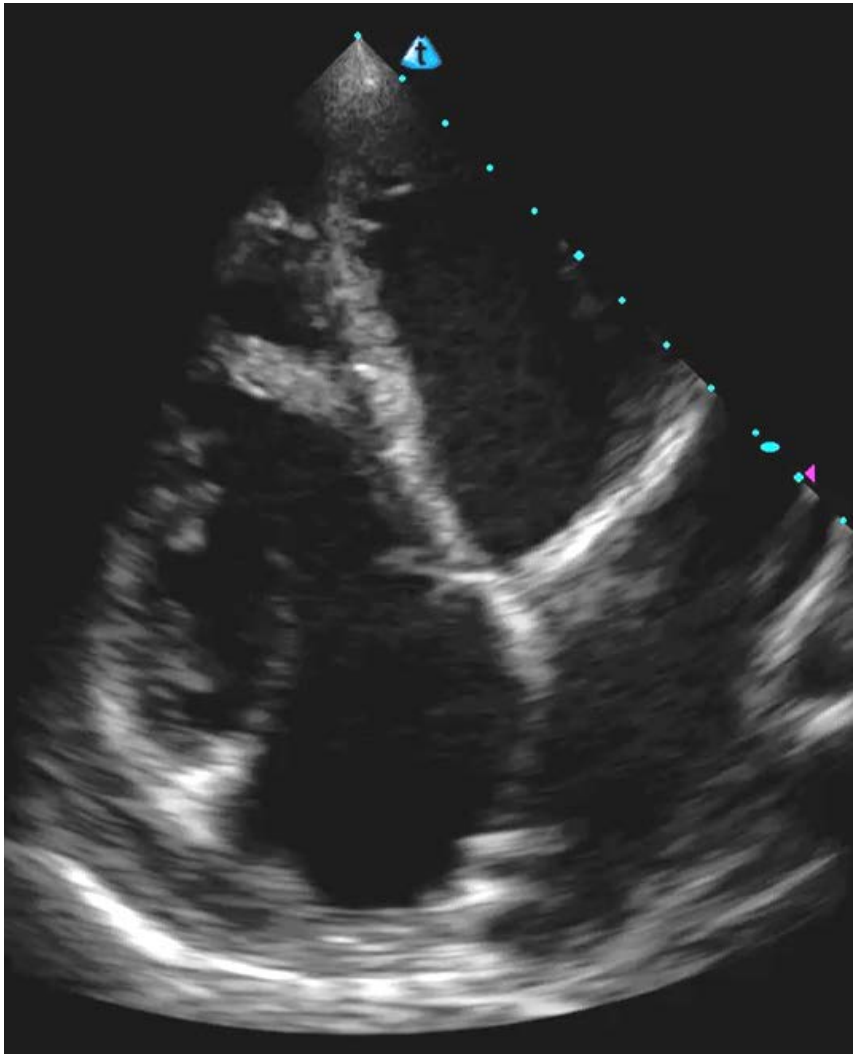
# RV Trabeculations

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

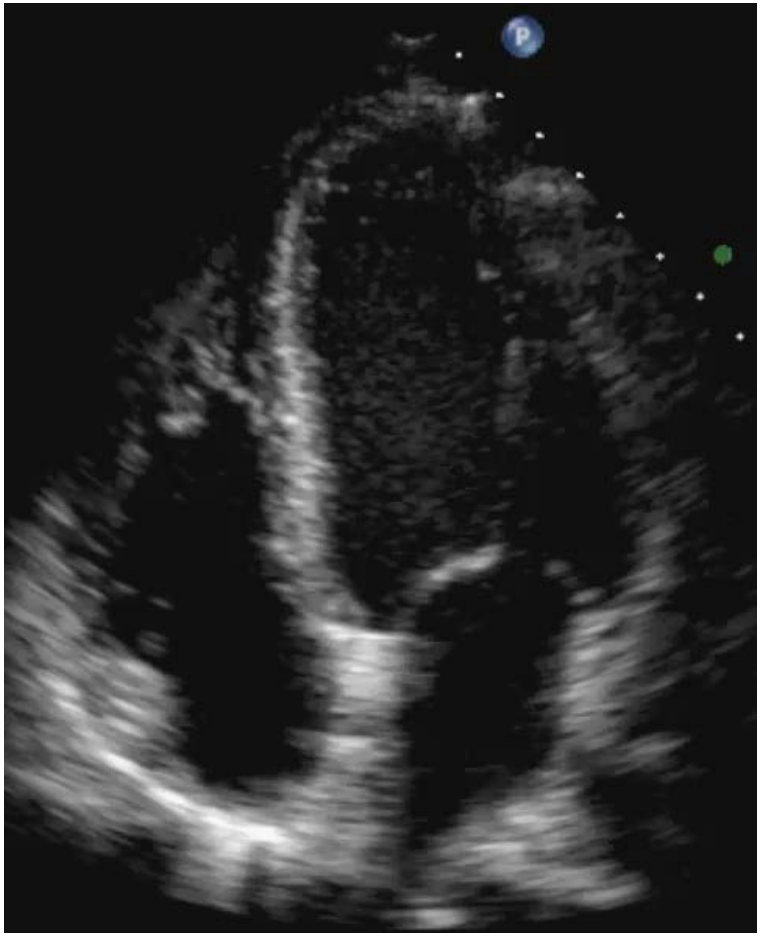


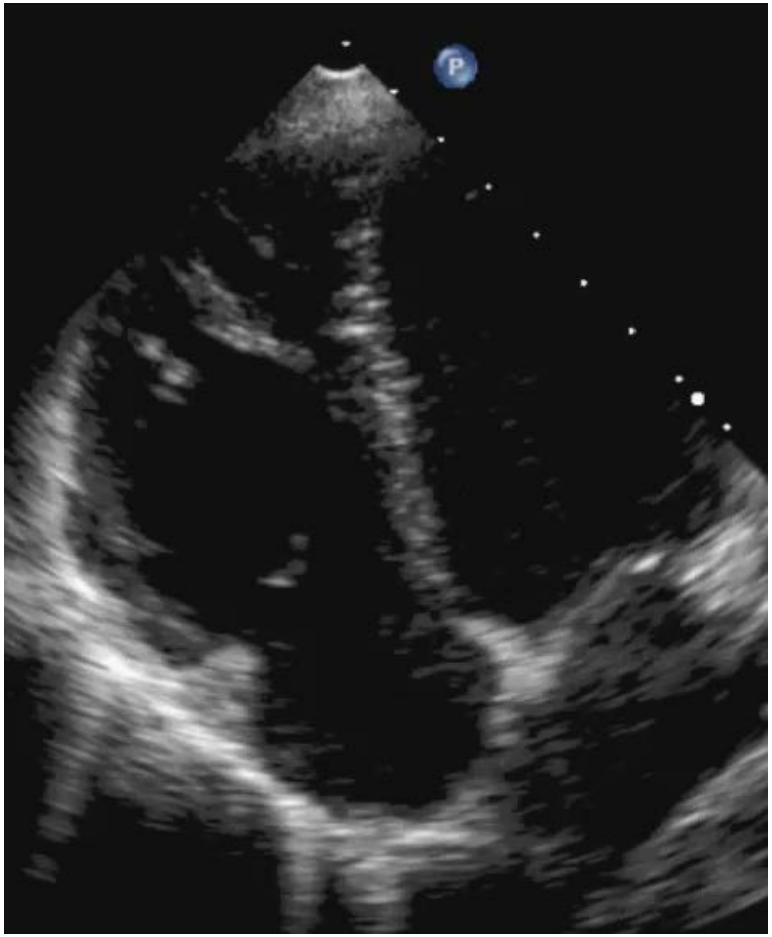
# Moderator Band

- Septomarginal trabecula
- Helps define the anatomic RV in CHD



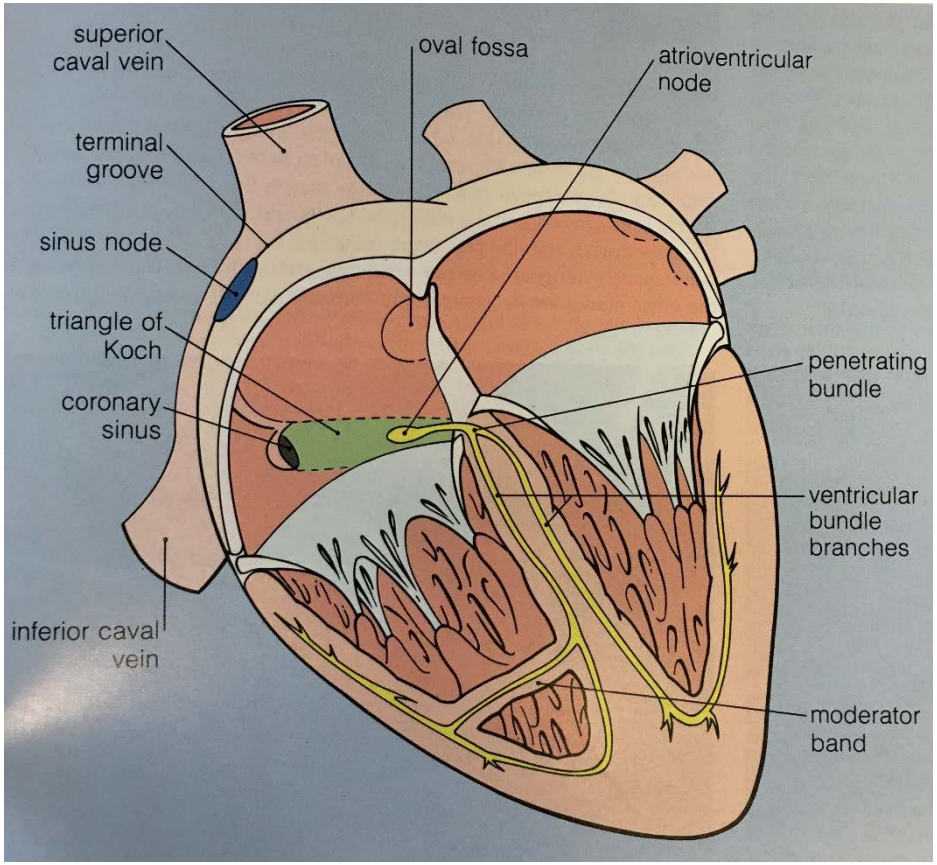
# Moderator Bands





# Moderator Band

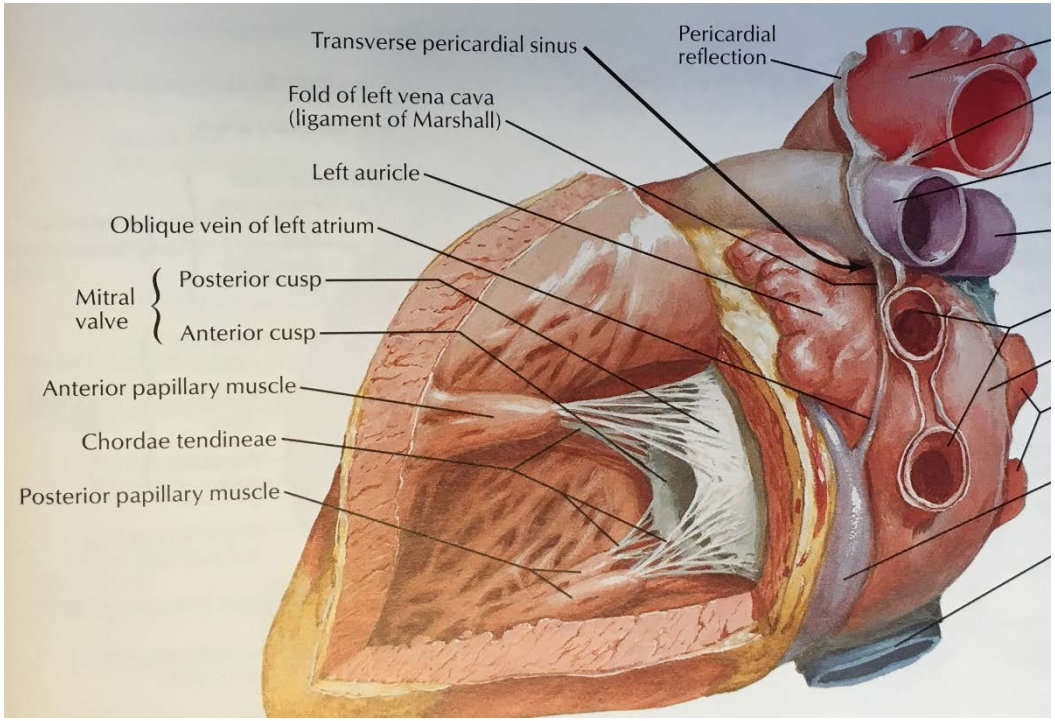
- Septomarginal trabecula
- Helps define the anatomic RV in CHD
- Contains conduction fibers to the anterior pap muscle




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

# *Left Ventricle*

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

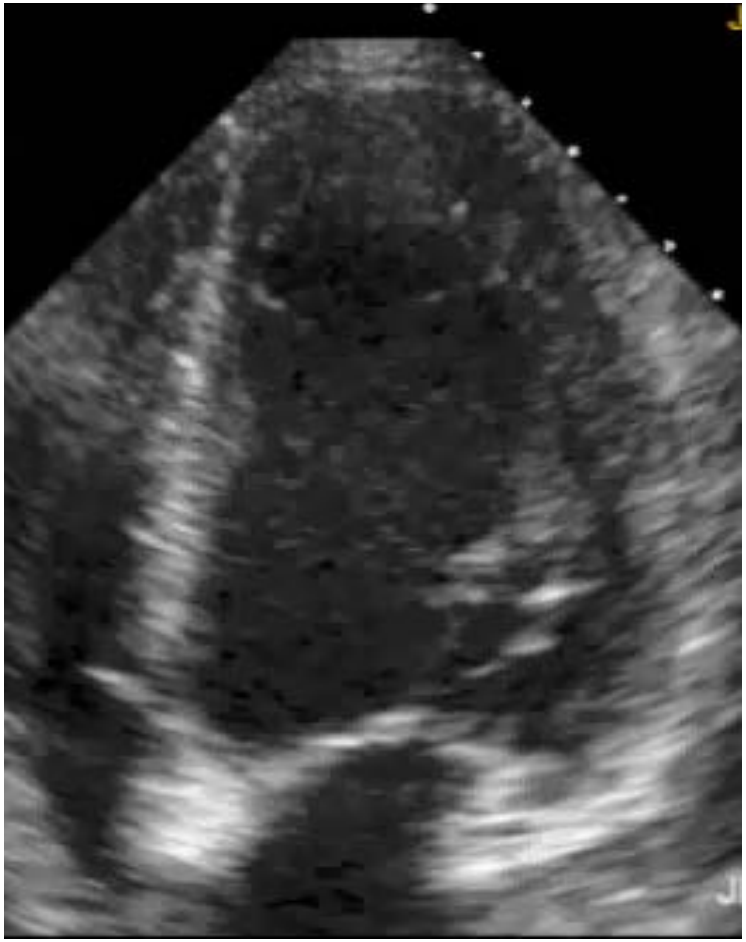


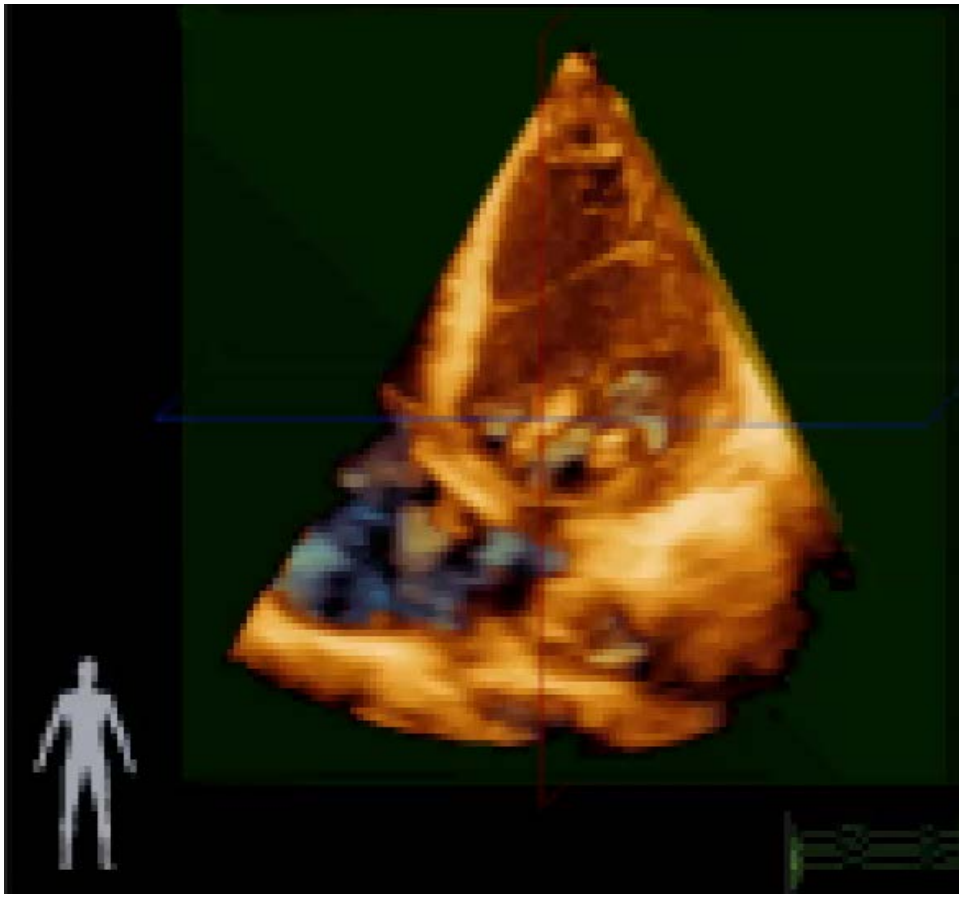

From *Atlas of Human Anatomy* by Frank Netter

# False Tendons

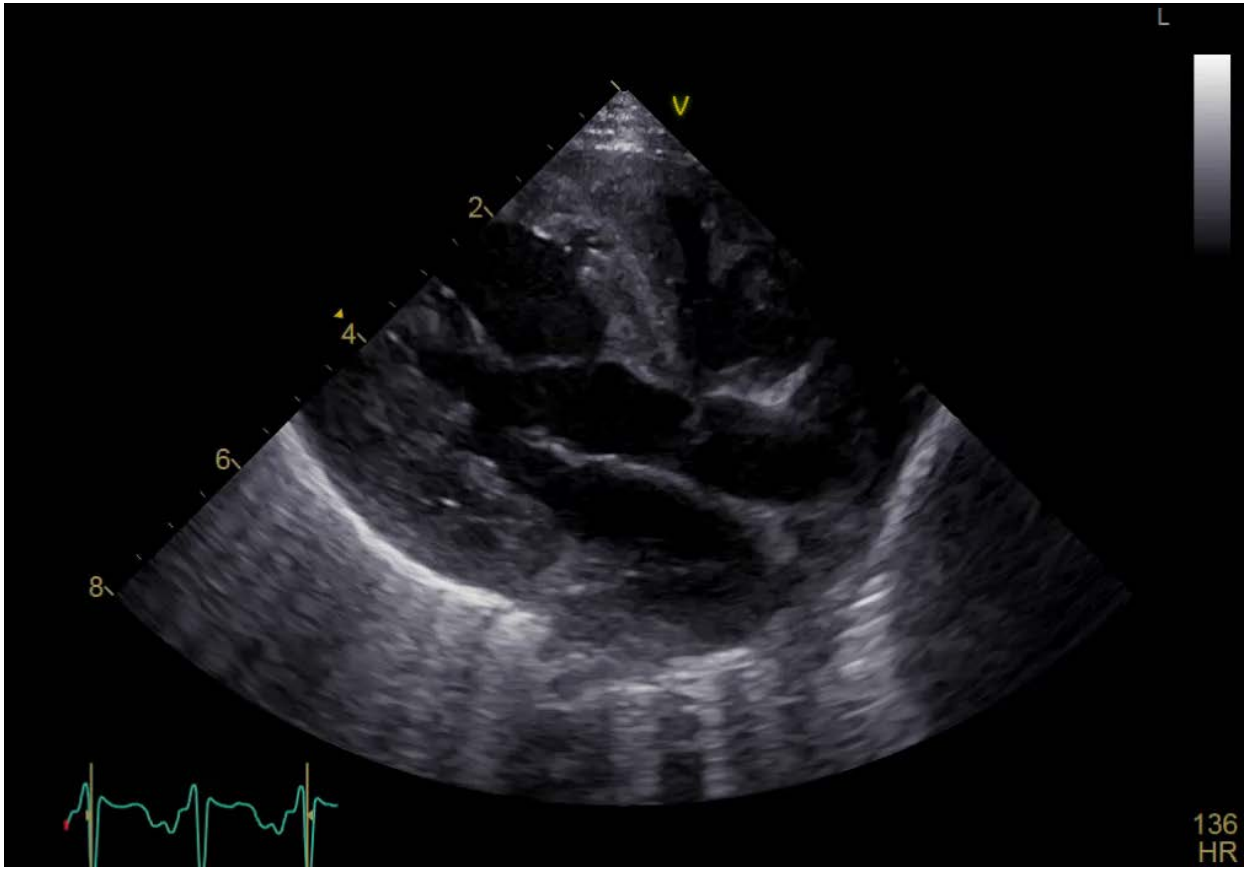
- Usually towards the LV apex
- Also called accessory chords, LV chords, aberrant bands or “heart strings”
- Known to cause a murmur
- May mimic thrombus or the edge of a tumor

# False Tendons (2D & 3D)

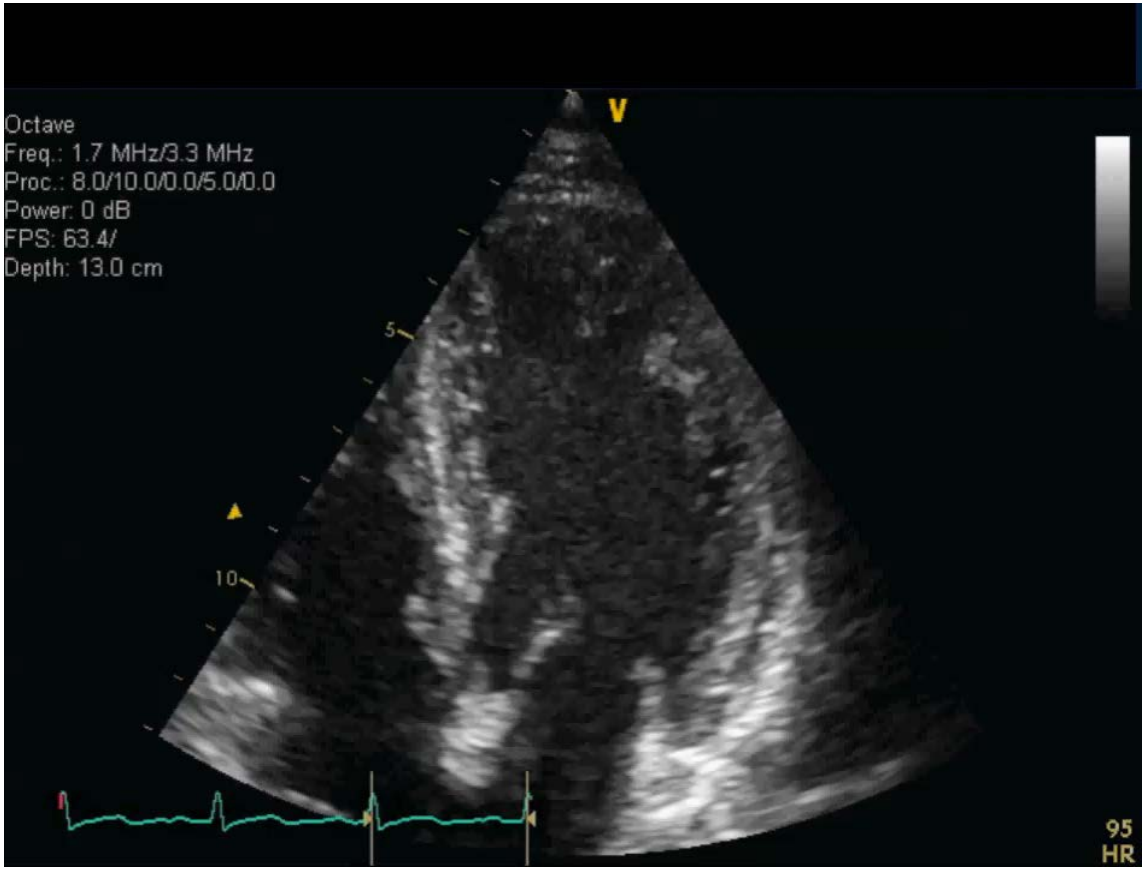




# LV Chord



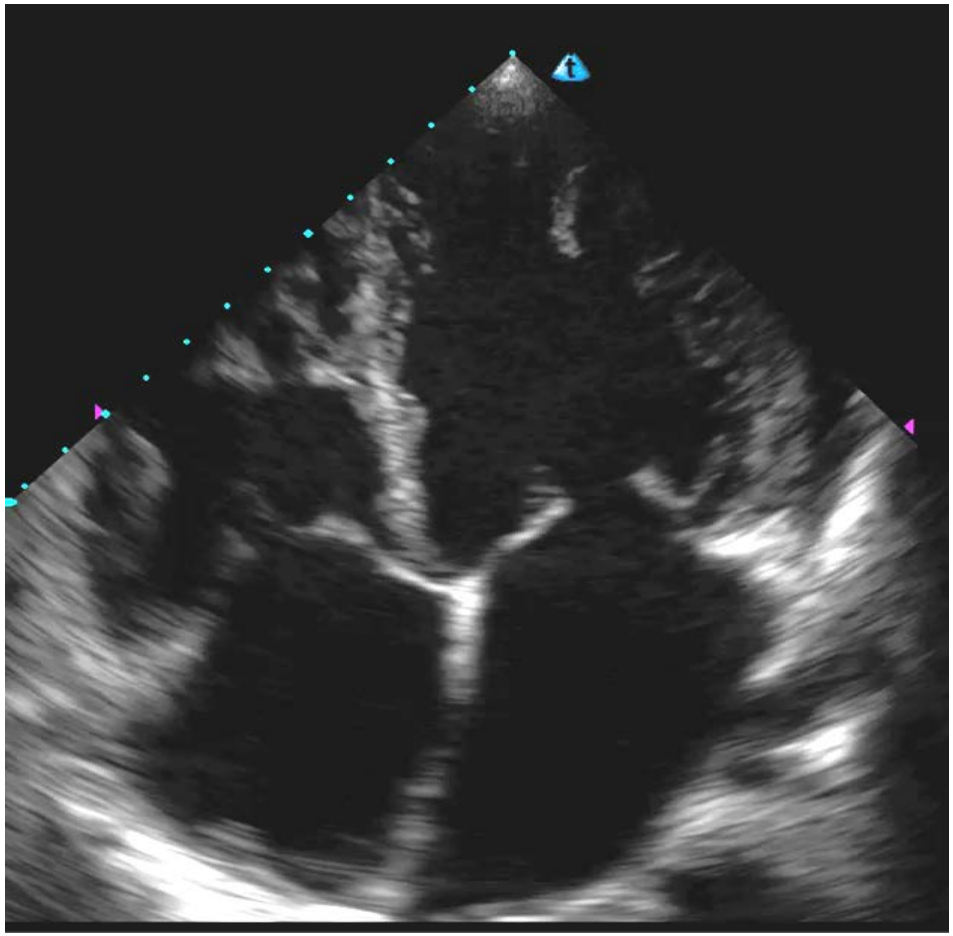
# LV Chord


Octave
Freq.: 1.7 MHz/3.3 MHz
Proc.: 8.0/10.0/0.0/5.0/0.0
Power: 0 dB
FPS: 63.4/
Depth: 13.0 cm
V
5
10
95
HR

# *LV Trabeculations*

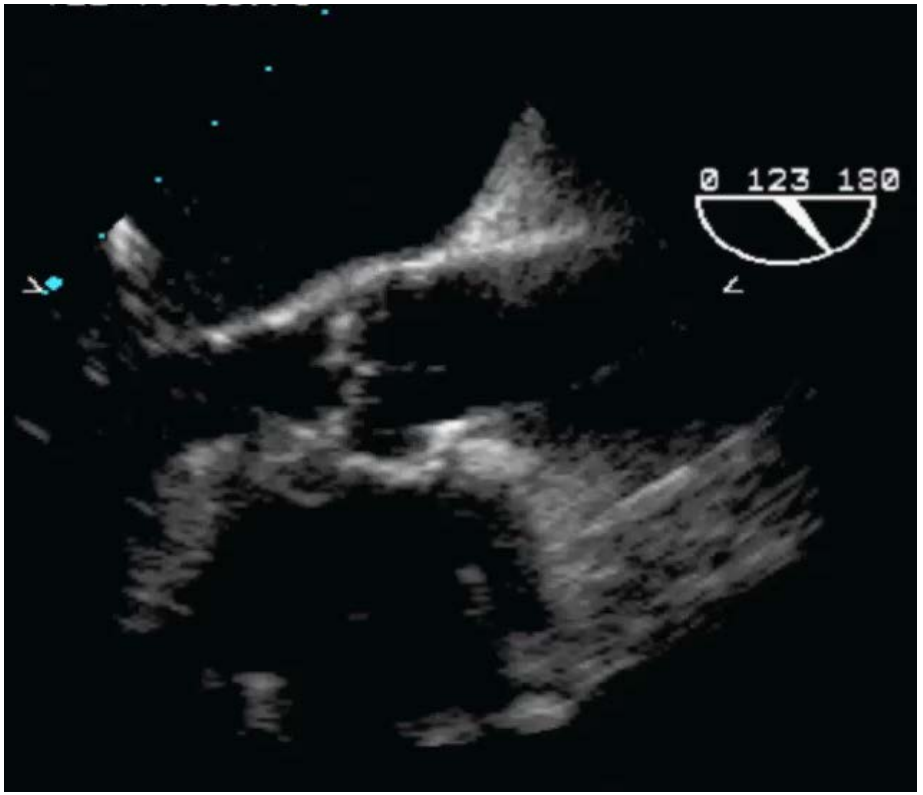
– May be more prominent in remodeled ventricles (LVH)

# *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*