

# Echo Artifacts: The Cause and Solution

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# Disclosures

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None

# My Happy / Sad ratio

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- 20% Sad
  - 1<sup>st</sup> talk on Sunday (post party)
  - Talk about Artifacts

# Artifacts - definition

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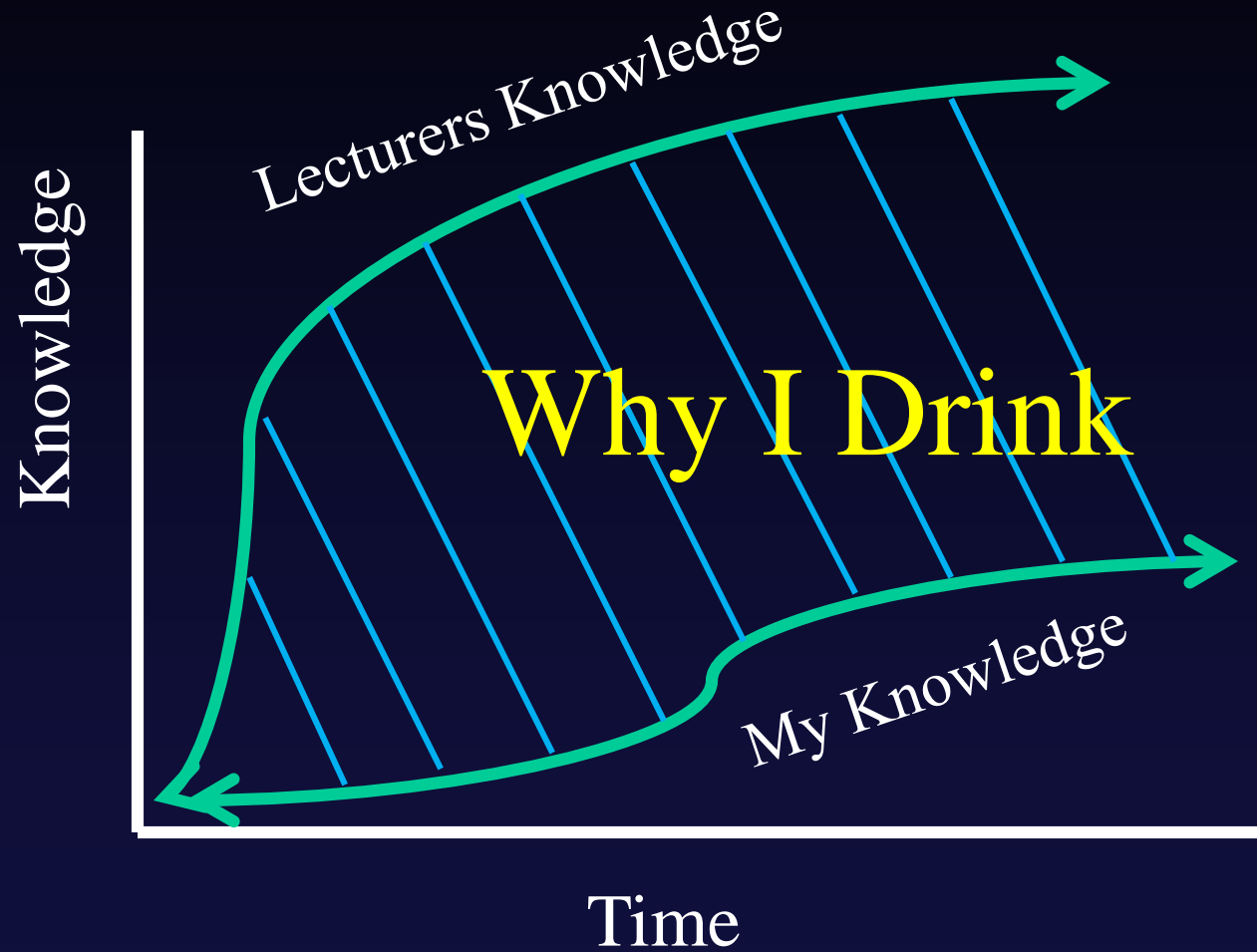
- From 2 Latin words:
  - *arte* = “by skill”
  - *factum* = “to make”
- OLD!!!!

# Happy / Sad ratio

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- 20% Sad
  - 1<sup>st</sup> talk on Sunday (post party)
  - Talk about Artifacts
- 80% Happy
  - Being here
  - Finished the talk Saturday
  - No snow or tornadoes

# Artifact Talks I've Heard

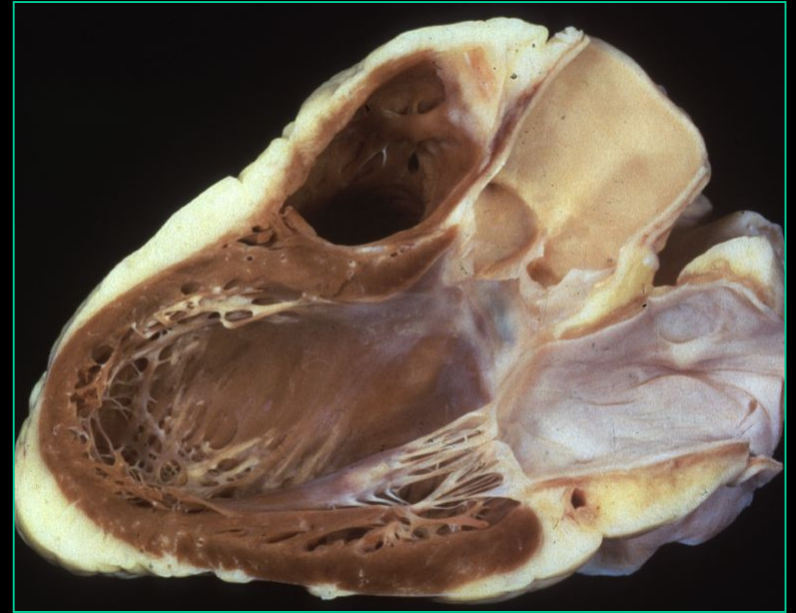
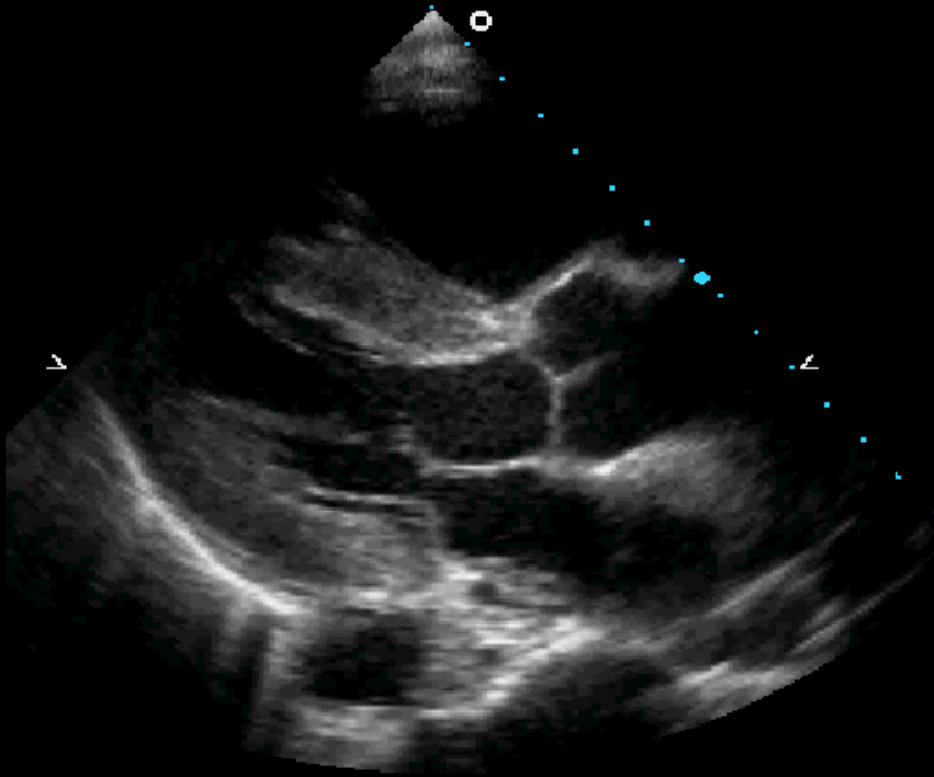


# The Kisslo Rules

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1. If you don't point at it you can't see it.
2. If you don't see it you can't diagnosis it.
3. It's not the heart stupid!

# It's Not the Heart Stupid!





# Kissloisms

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- Artifacts

- Not enough just to know that something is an artifact.
- What is the physics behind it

# ARTIFACTS

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That's our  
goal today.

# ARTIFACTS – My Classification

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- Easy
- Difficult
- Impossible

# DATING – My Classification

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- Easy
- Difficult
- Impossible

# ARTIFACTS

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- Causes:
  - violation of assumptions
  - equipment malfunction or design
  - physics of US
  - operator error

# ARTIFACTS

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- Error in imaging:
  - not real
  - missing reflectors
  - improper size, shape, brightness, position
- ALL ultrasound images contain artifacts!



# BASIC ASSUMPTIONS

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- ASSUME
- ASS U ME

# BASIC ASSUMPTIONS

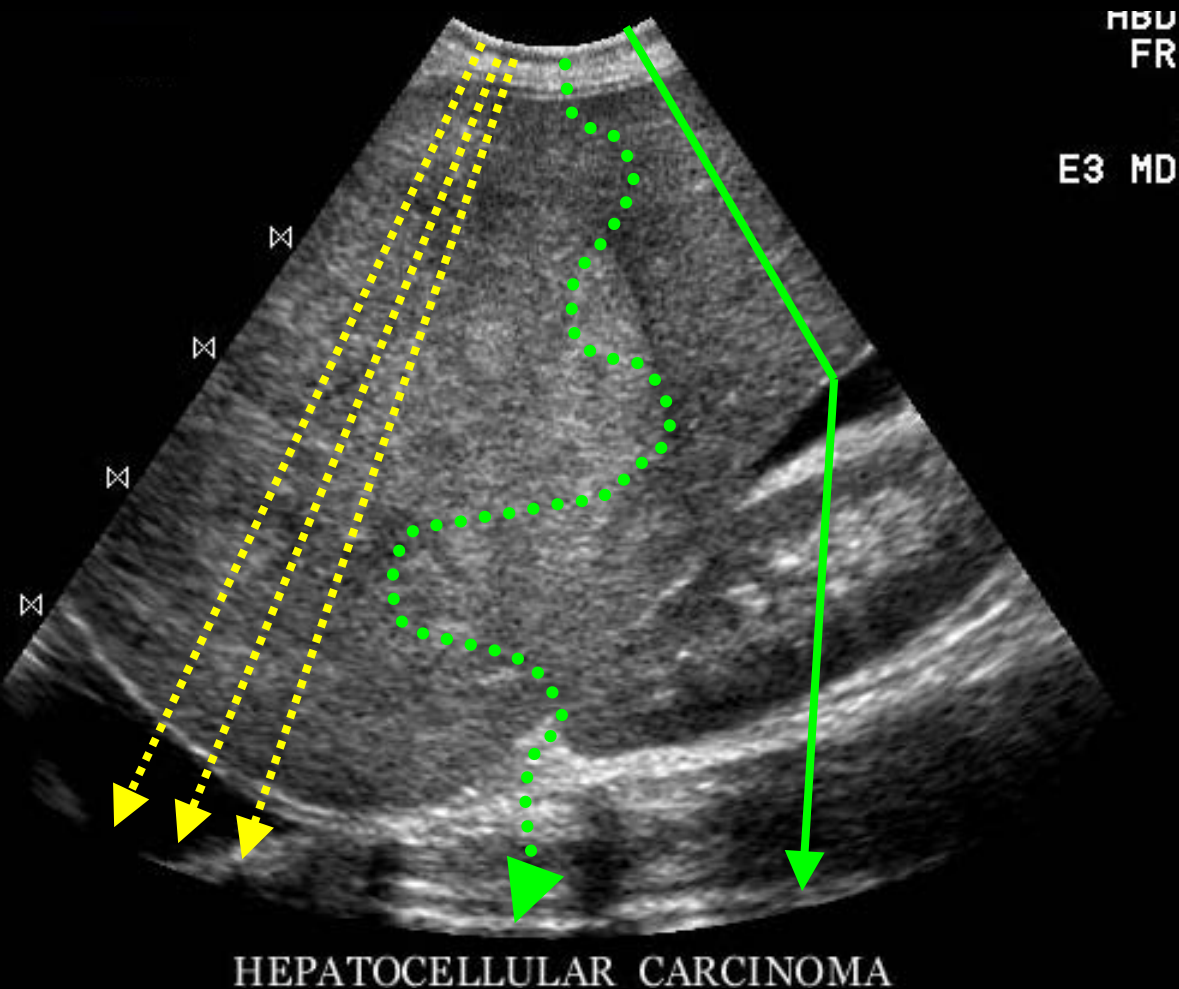
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- sound travels in a straight line
- reflections only arise from structures along the beam's main axis
- sound travels exactly 1540 meters/second
- imaging plane is extremely thin
- sound travels directly to a reflector and back



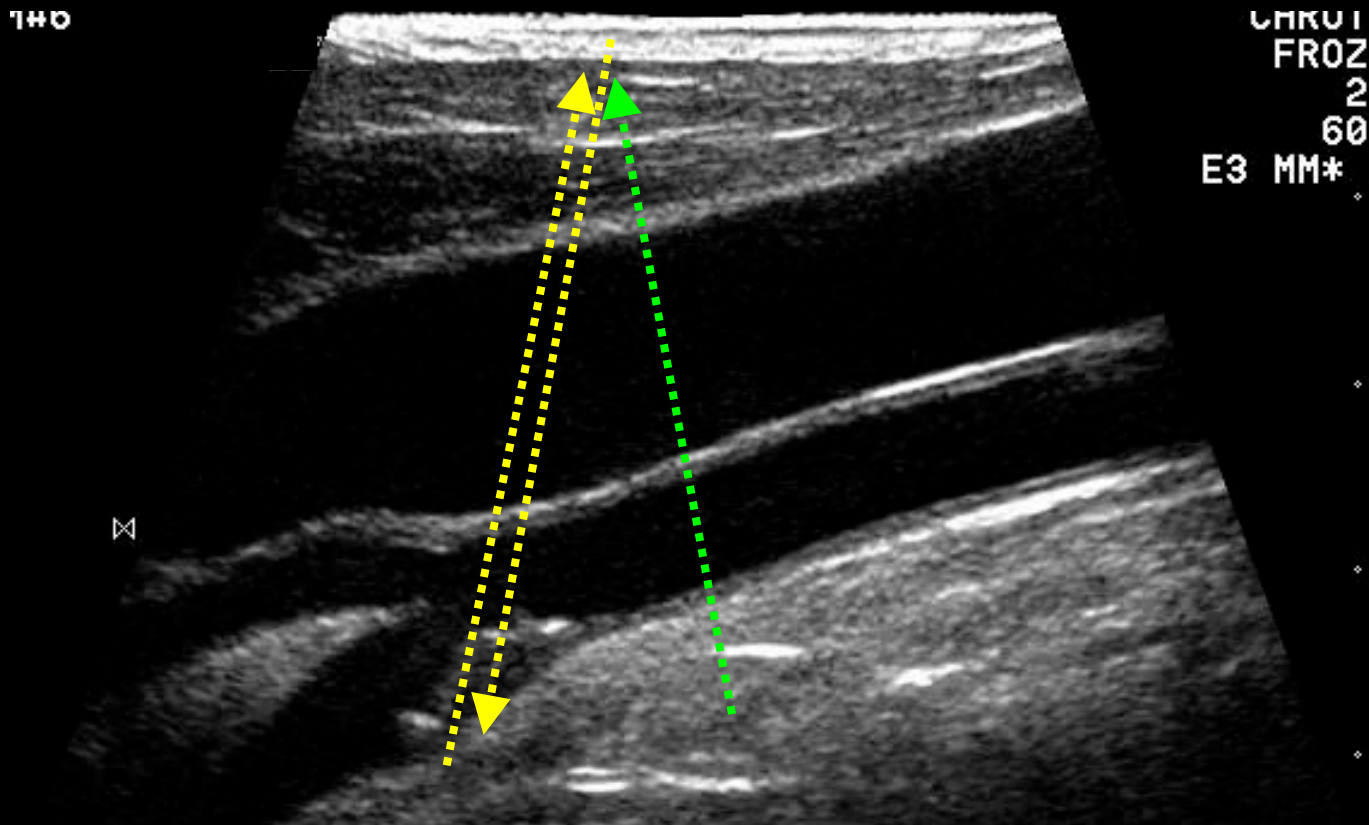
# BASIC ASSUMPTIONS

- sound travels in a straight line



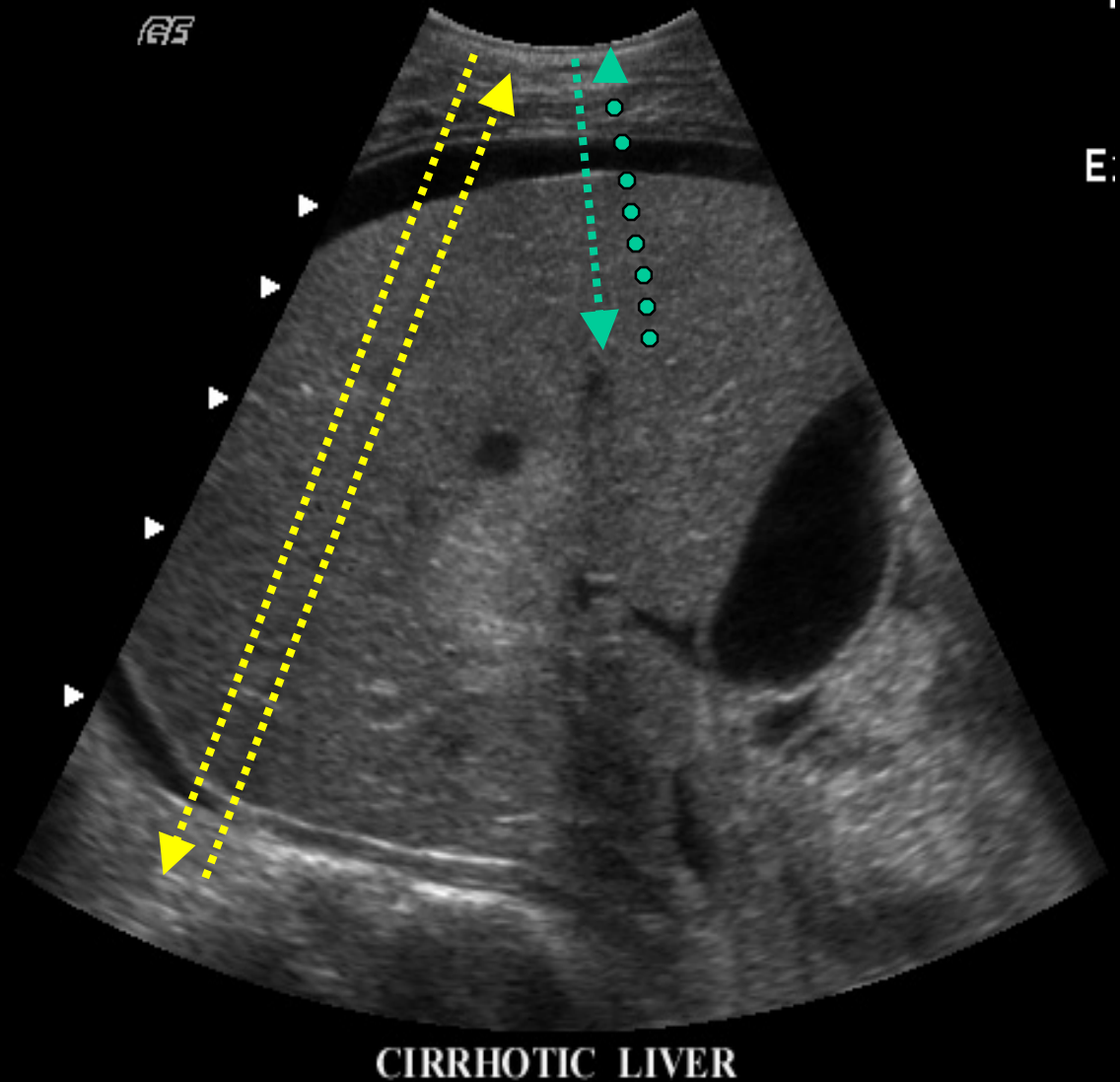
# BASIC ASSUMPTIONS

- reflections only arise from structures along the beam's main axis



# BASIC ASSUMPTIONS

- sound travels exactly 1540 meters/sec



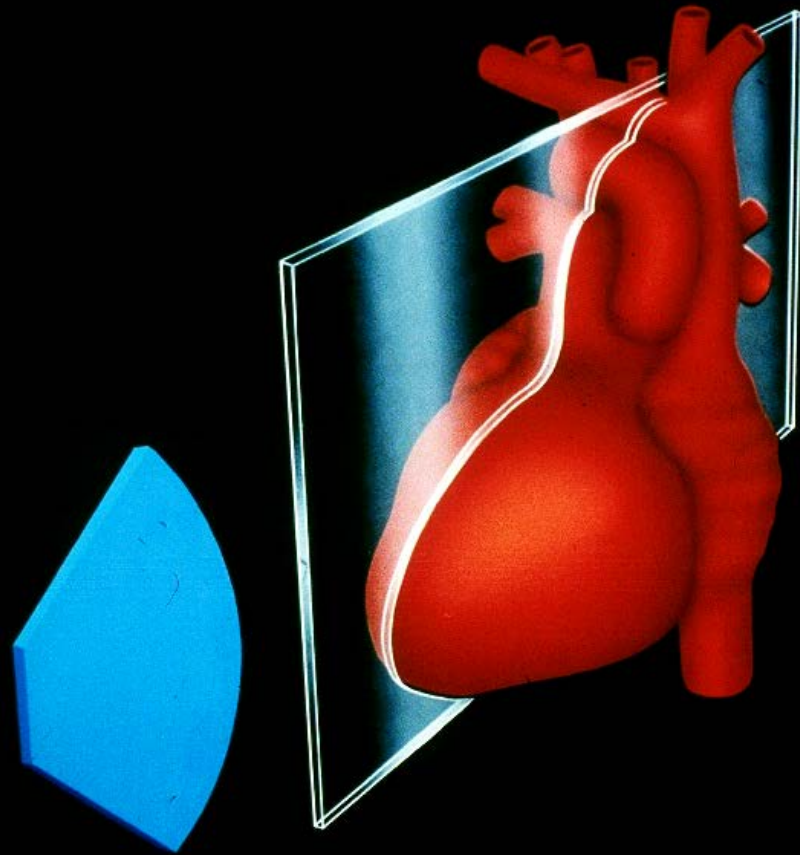
1

E:



# BASIC ASSUMPTIONS

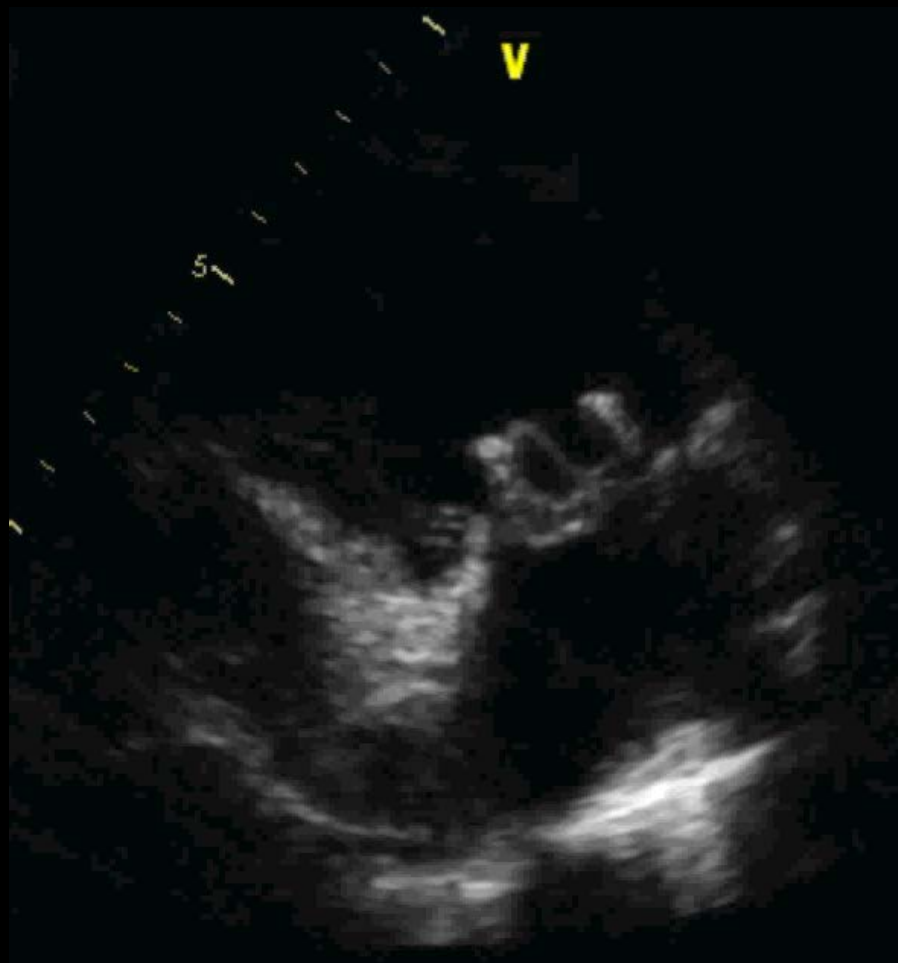
- imaging plane is extremely thin



# BASIC ASSUMPTIONS

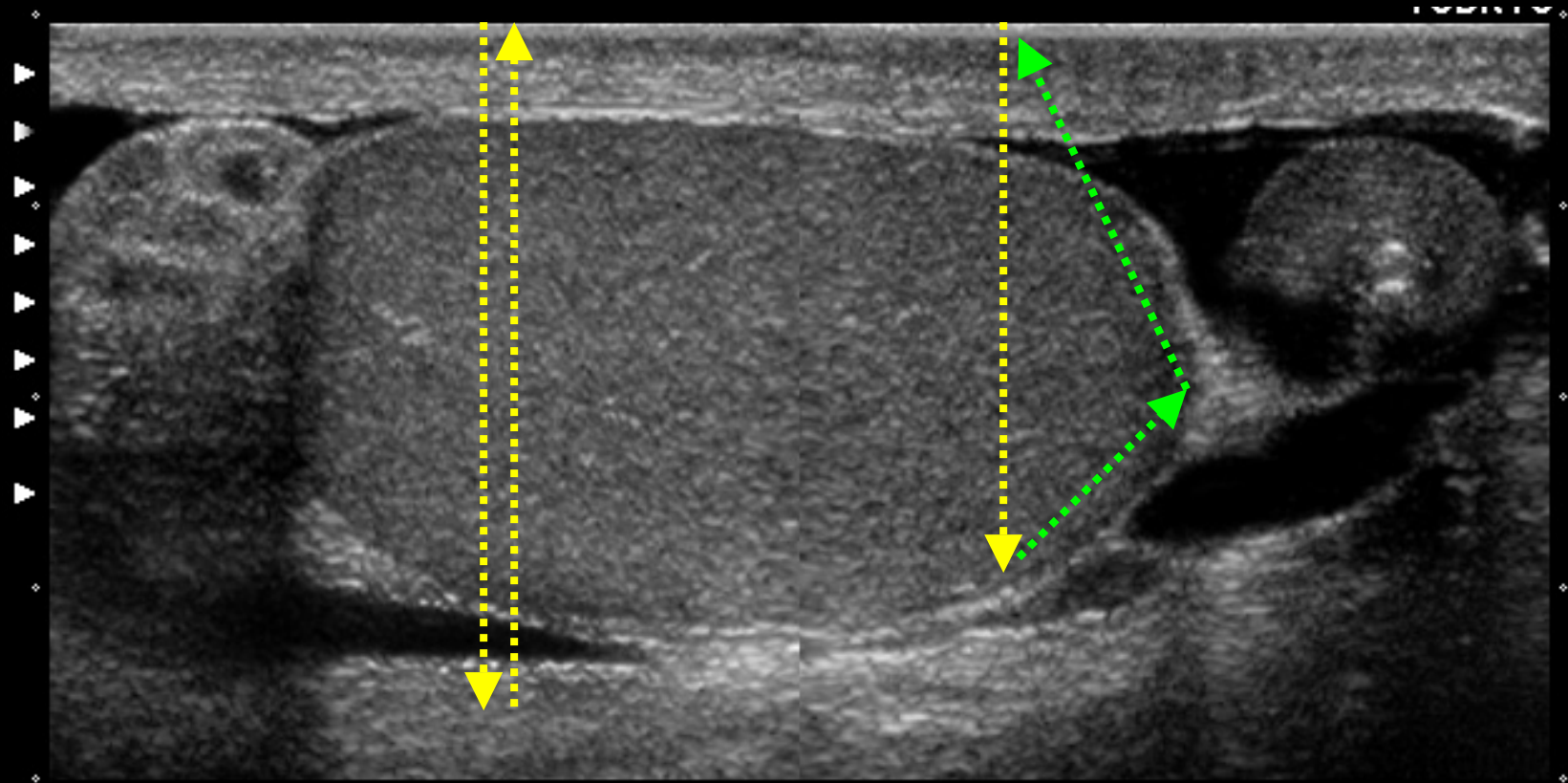
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- imaging plane is extremely thin



# BASIC ASSUMPTIONS

- sound travels directly to a reflector & back



NORMAL TESTICLE  
SMALL HYDROCELE

# ARTIFACTS

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- appear & disappear depending on the view
- disappear when corrective measures are taken
- actual anatomy remains visible
- if obvious artifact remains, call a service person



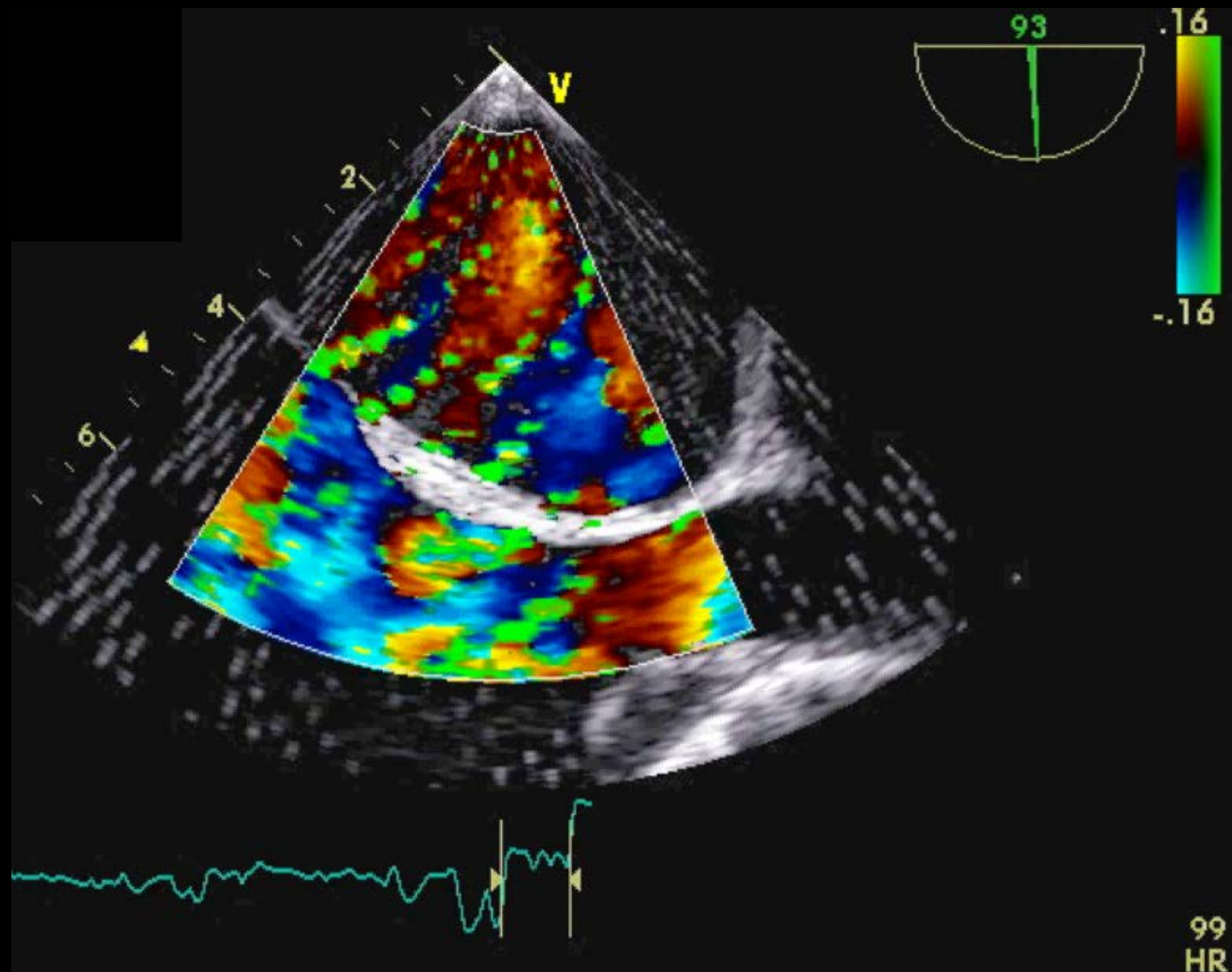
# ARTIFACTS – My Classification

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- Easy
  - common
  - identify
  - explain



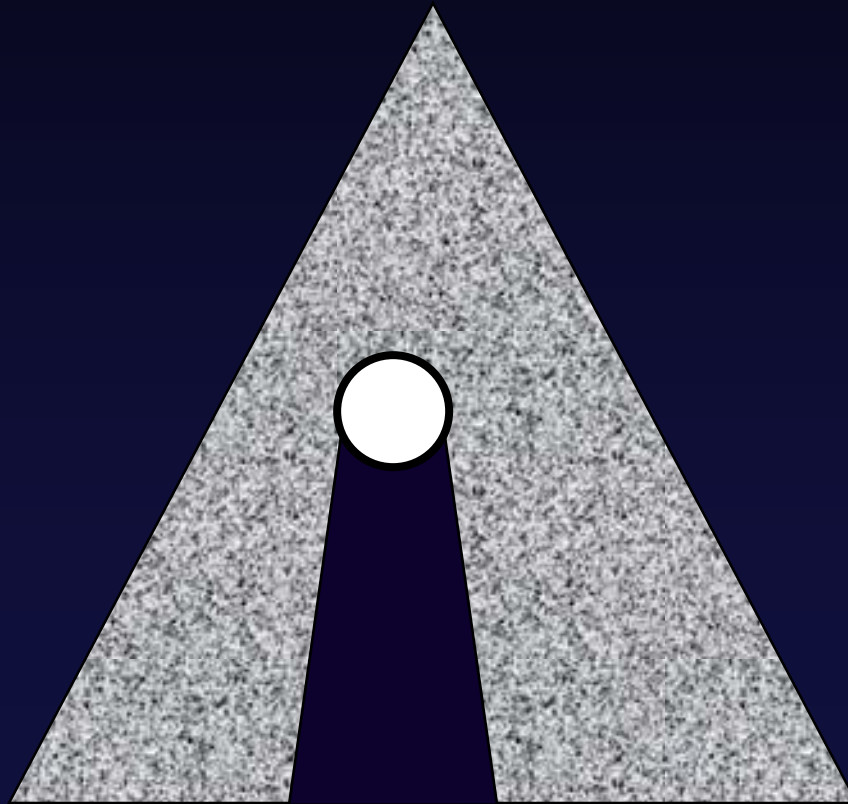
# Bovie Cautery Interference



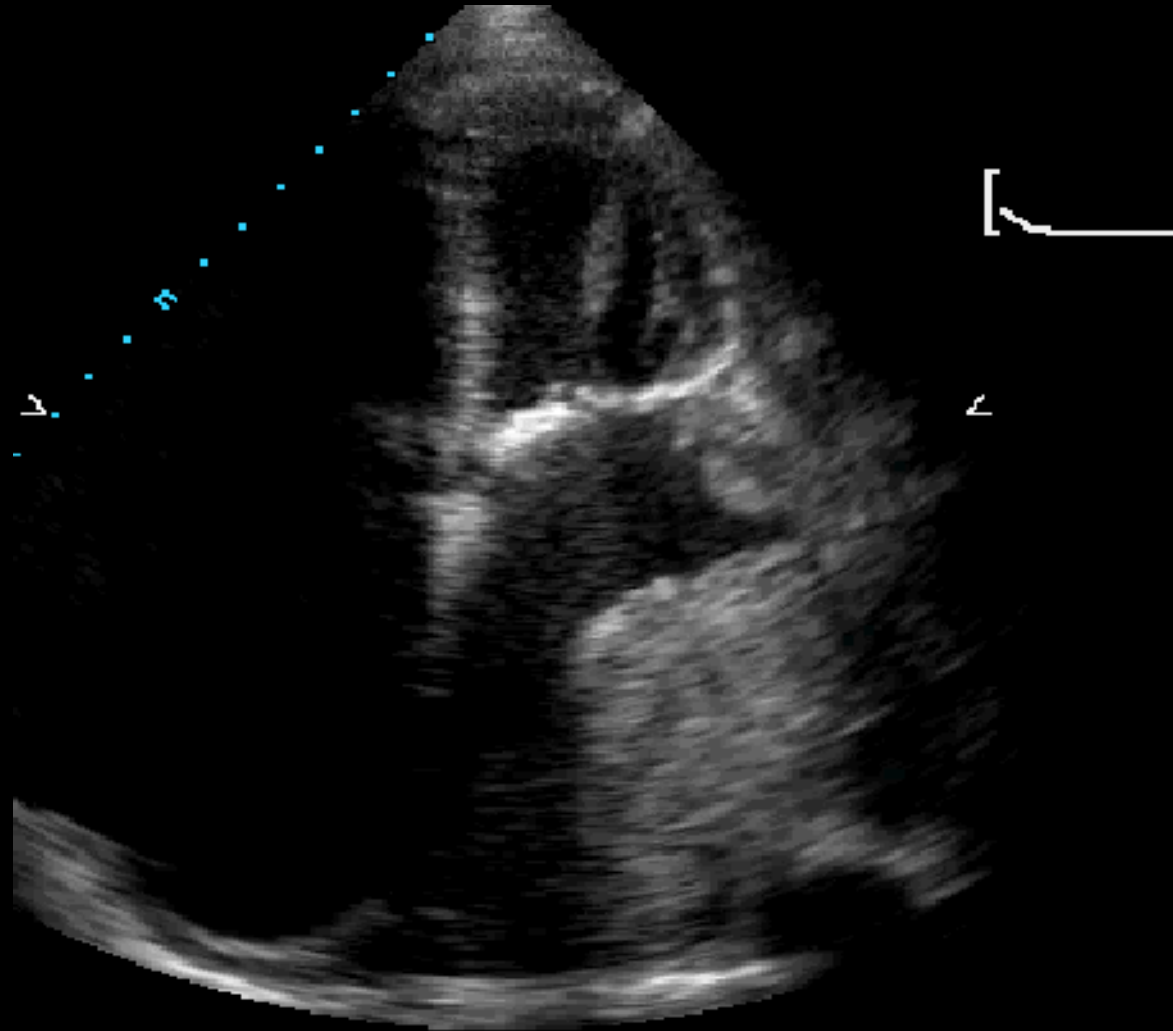
# SHADOWING

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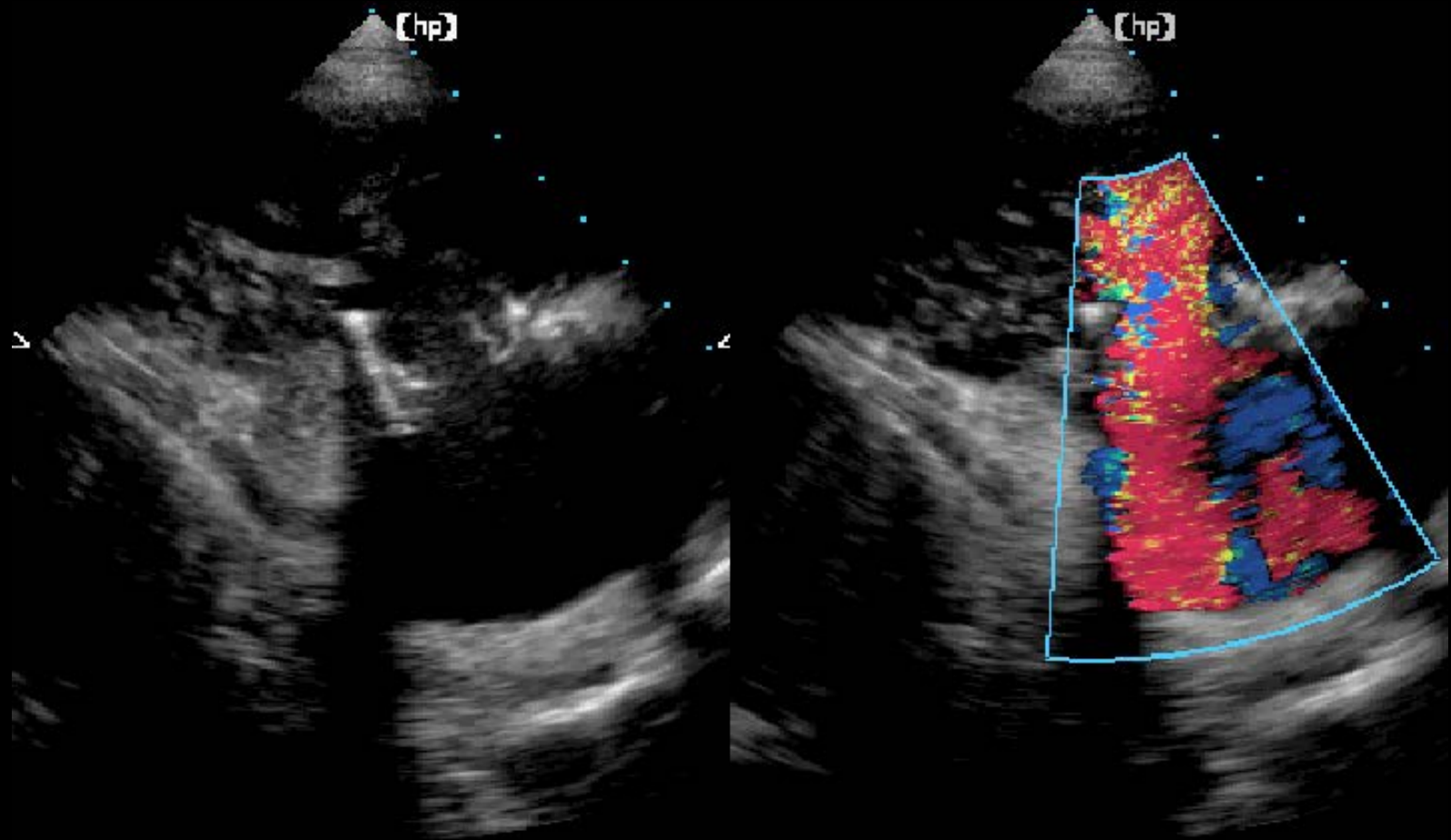
- a hypoechoic region appearing beneath a structure with abnormally high attenuation



# SHADOWING - MS

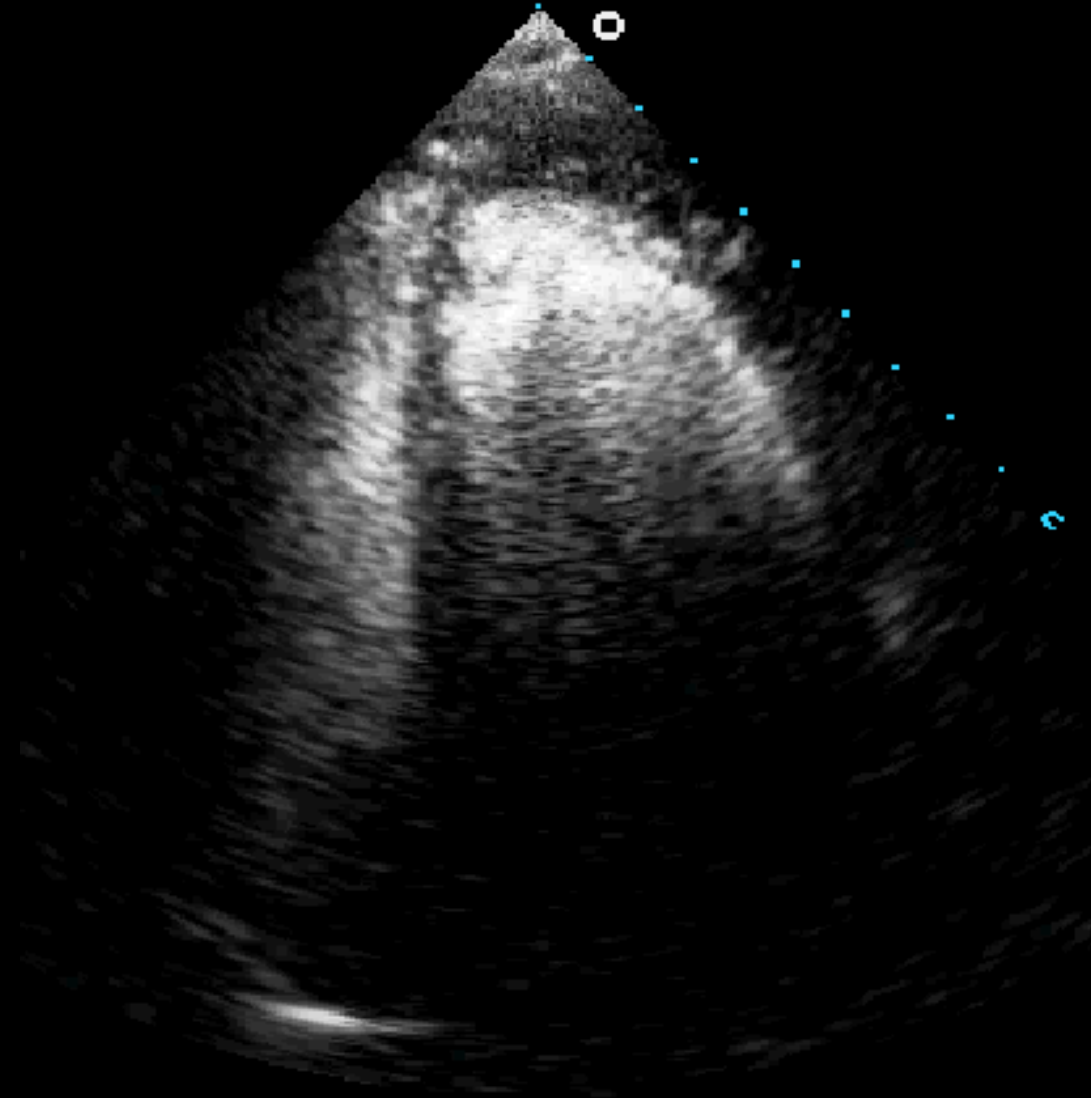


# SHADOWING - TVR

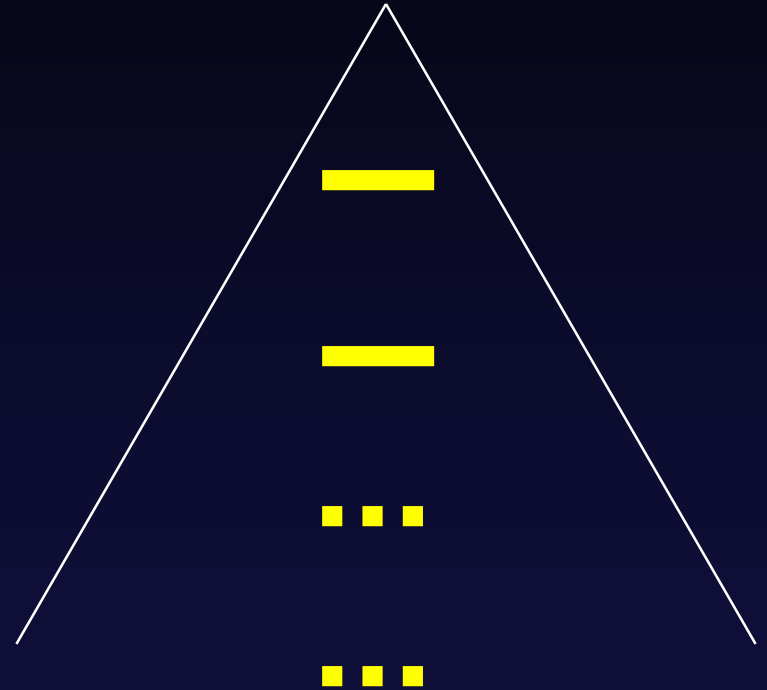
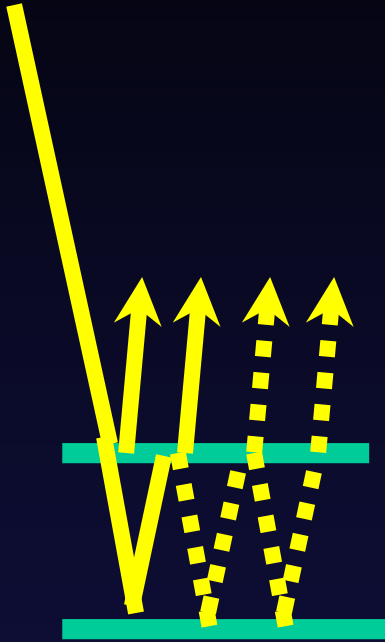


# WHAT CAUSES THIS ARTIFACT?

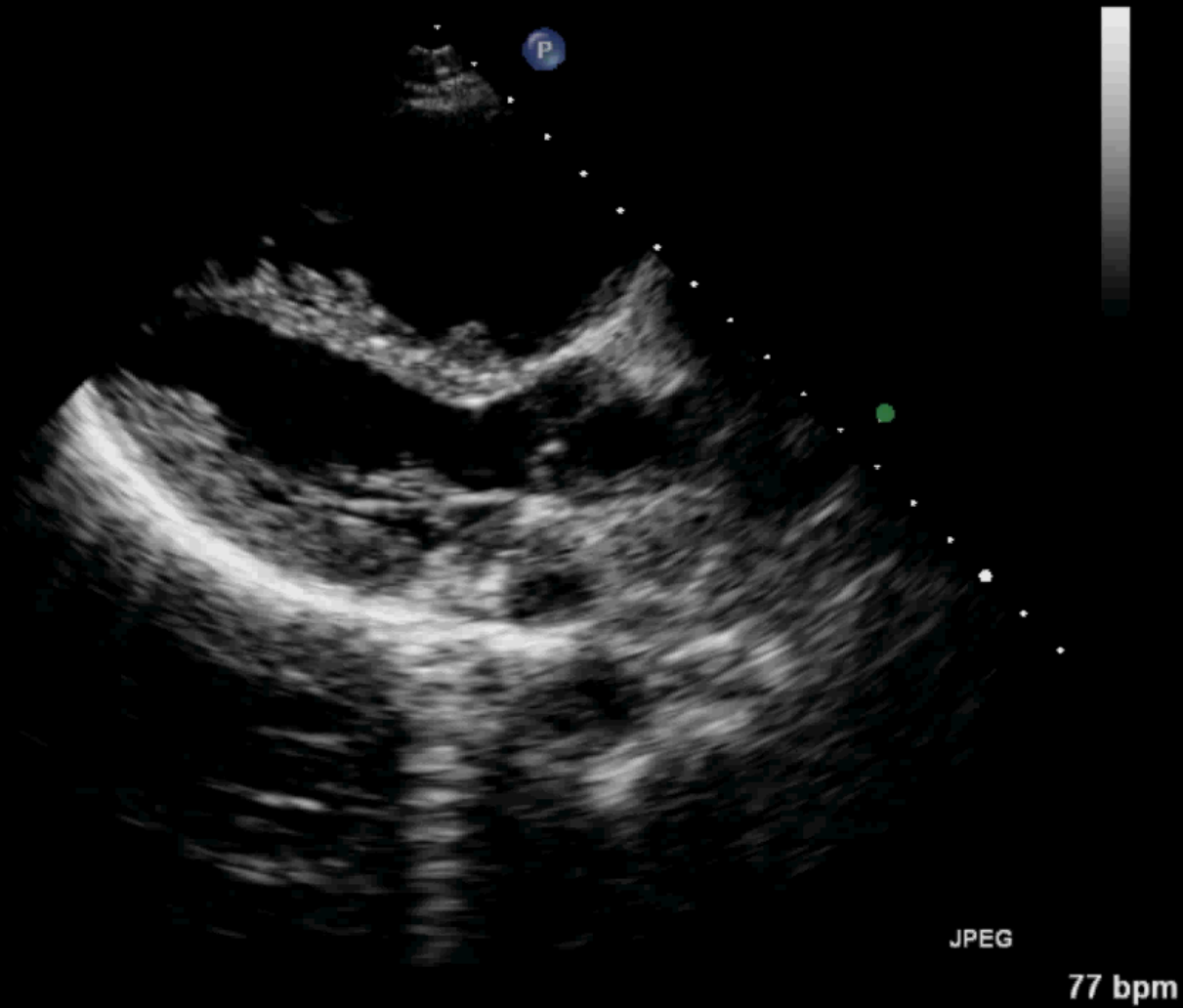
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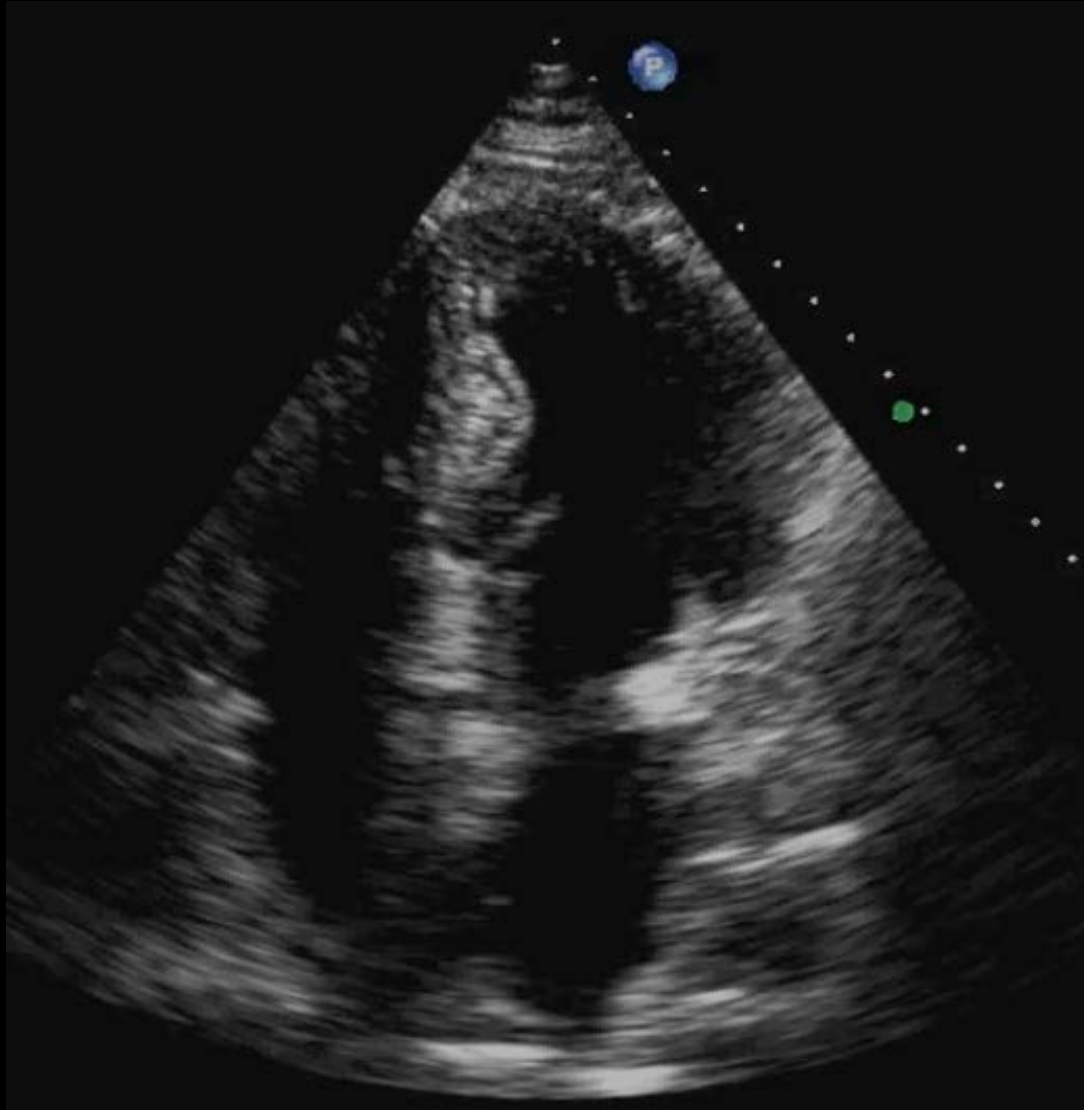
# REVERBERATION



# REVERBERATION



# Main Bang Artifact - Herbie



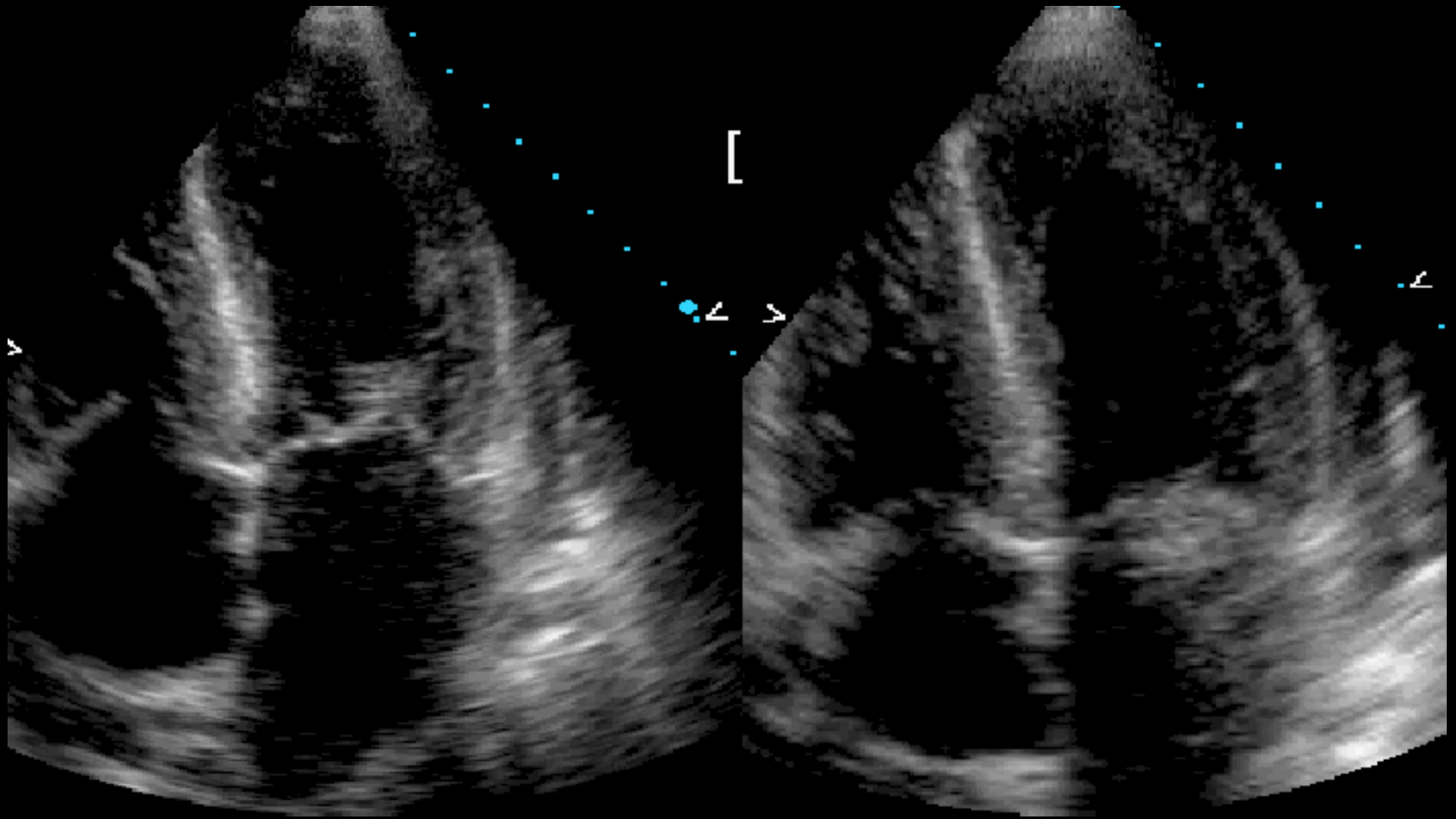


# ARTIFACTS?

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- Change depth

# ARTIFACTS?

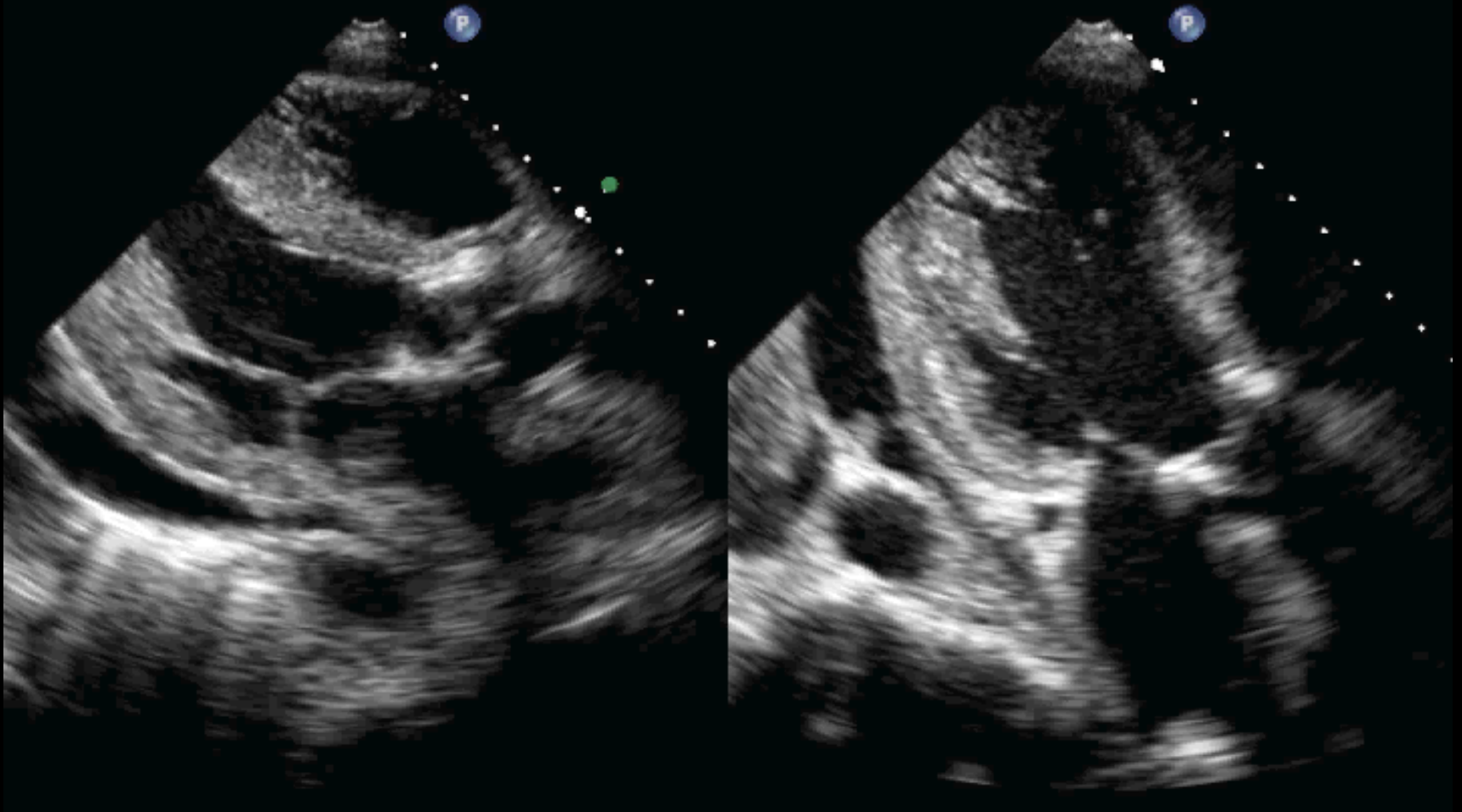


# ARTIFACTS?

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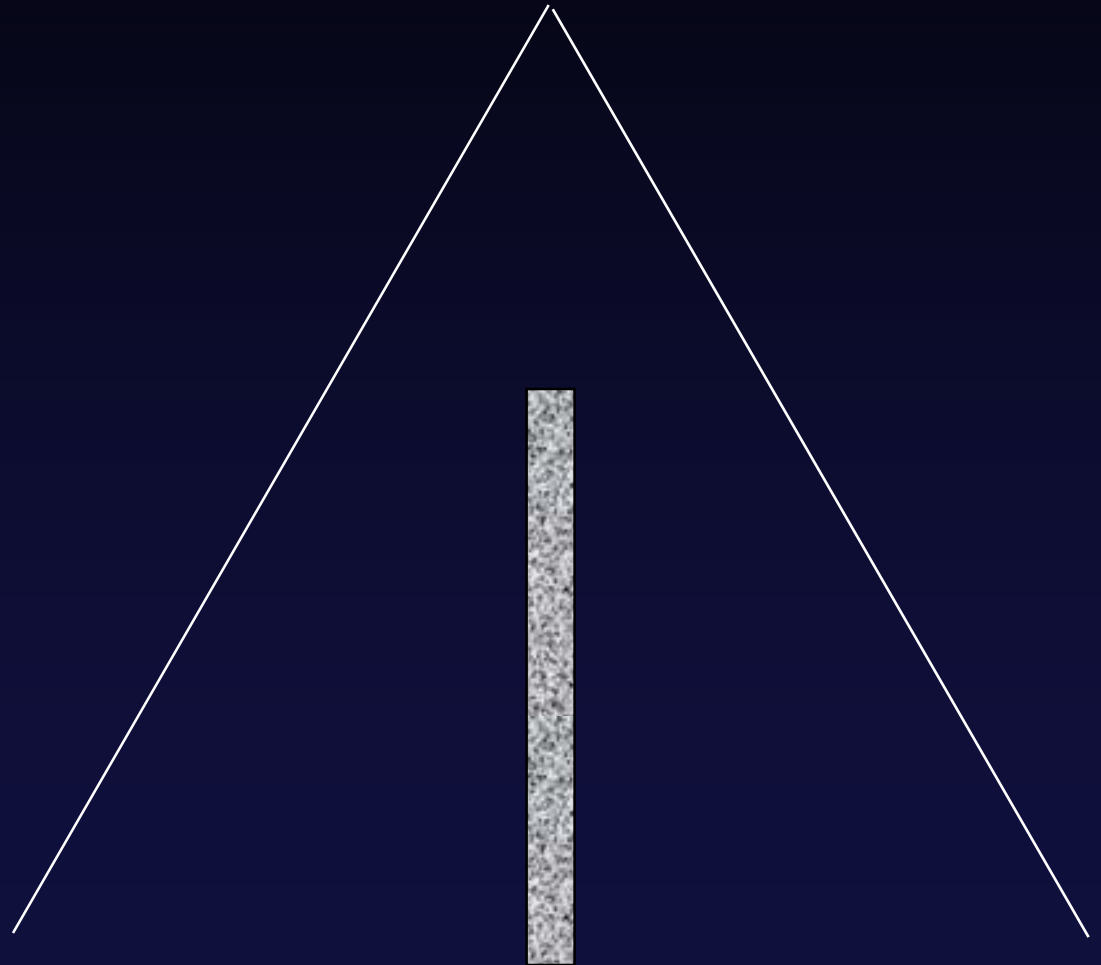
- Change depth
- Change transducer frequency
- See in more than one view

# ARTIFACTS?

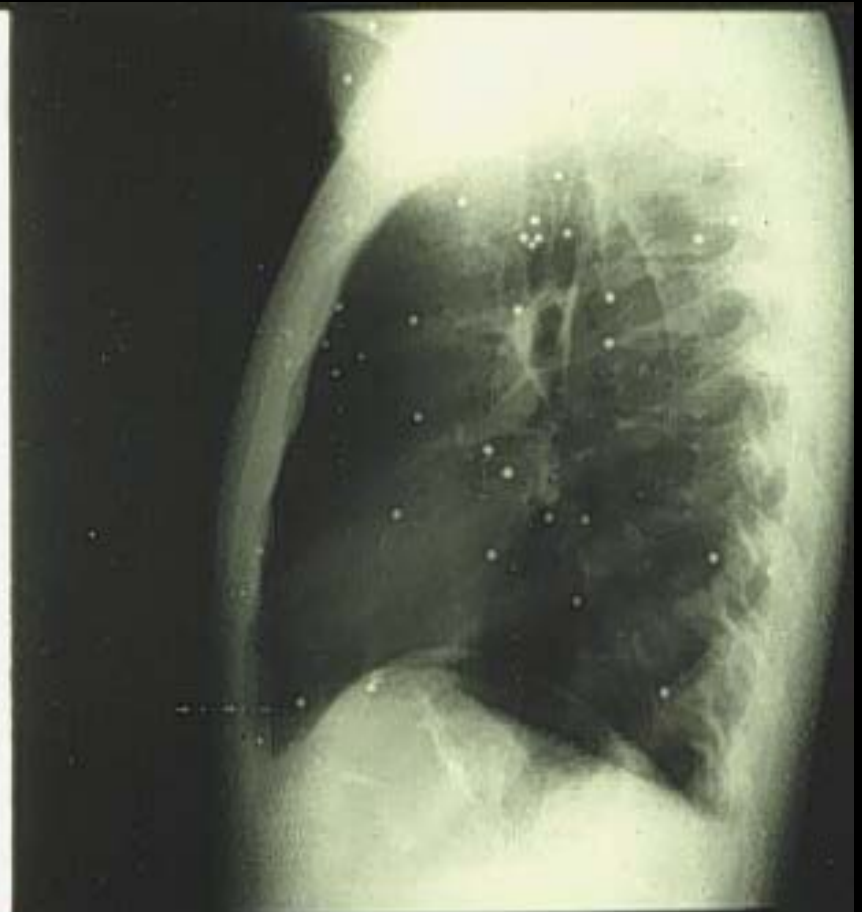
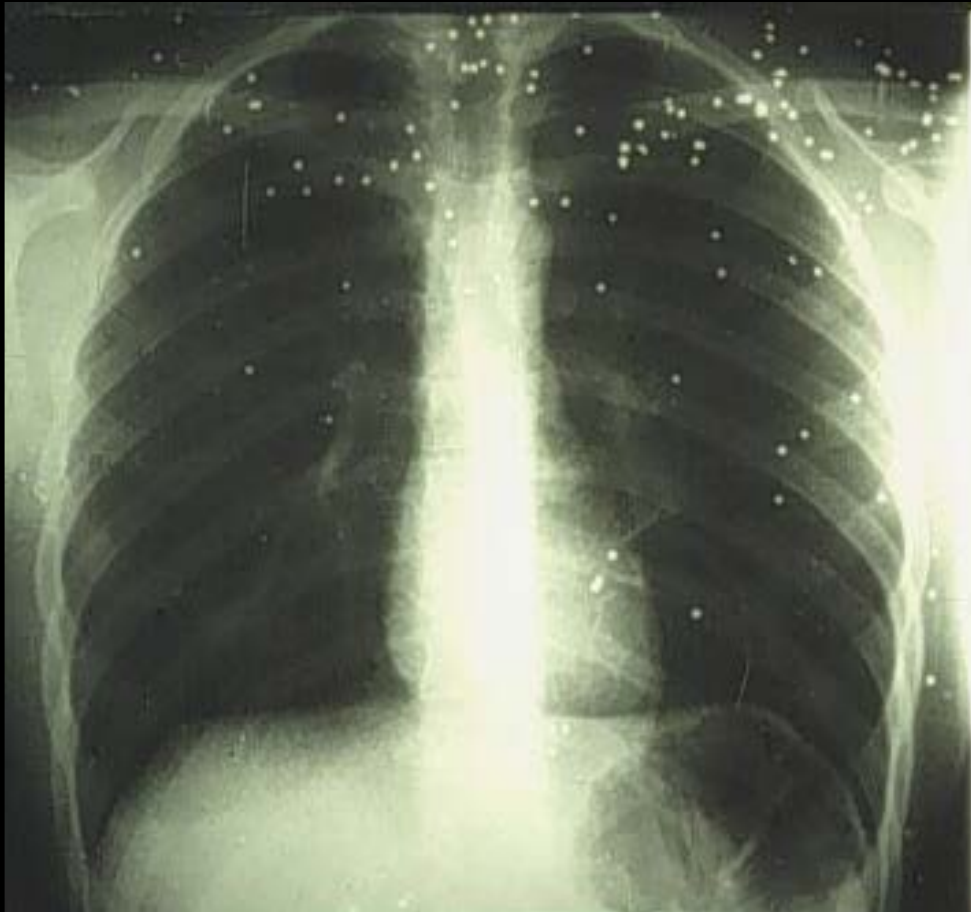


# COMET TAIL

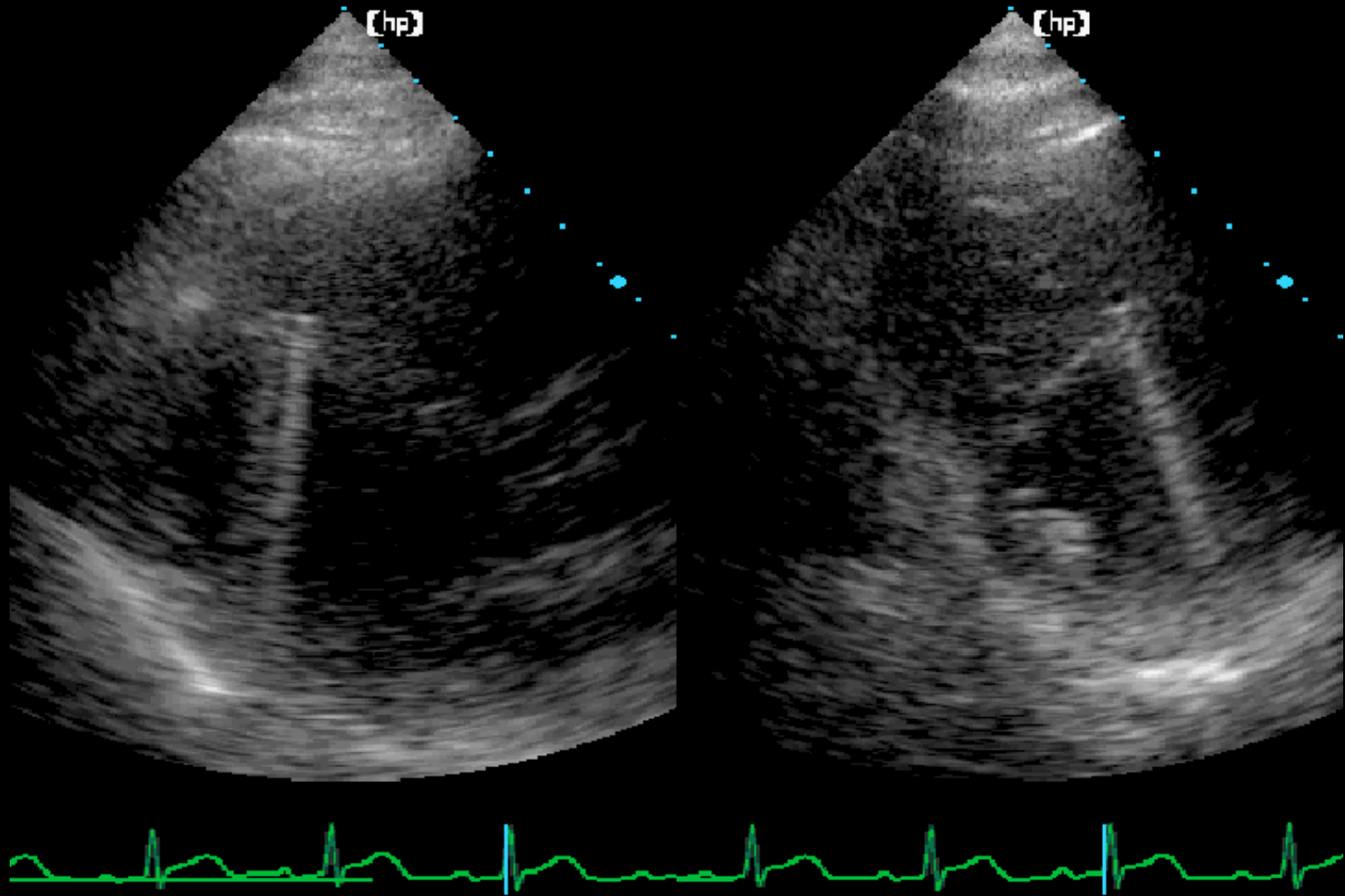
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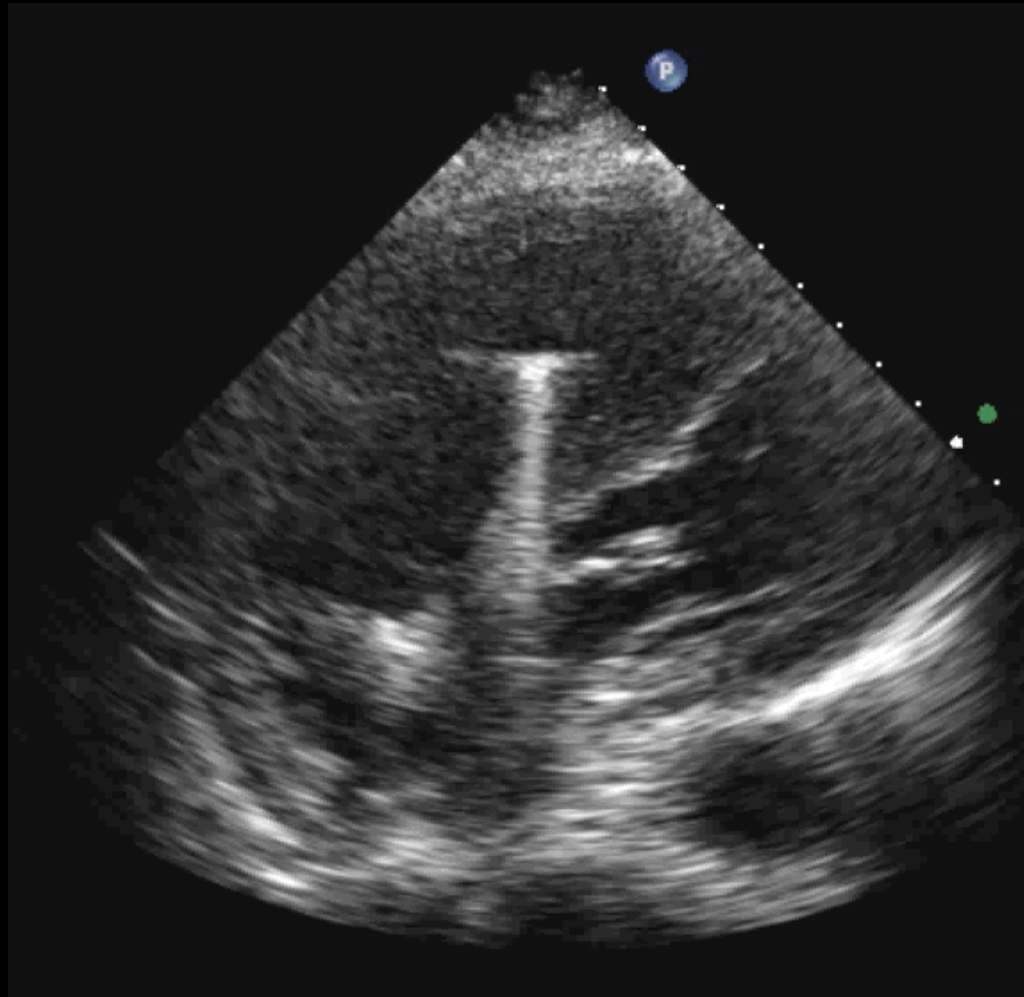
# GSW Upper Chest



# Comet Tail Artifact



# Bioptome – Comet Tail



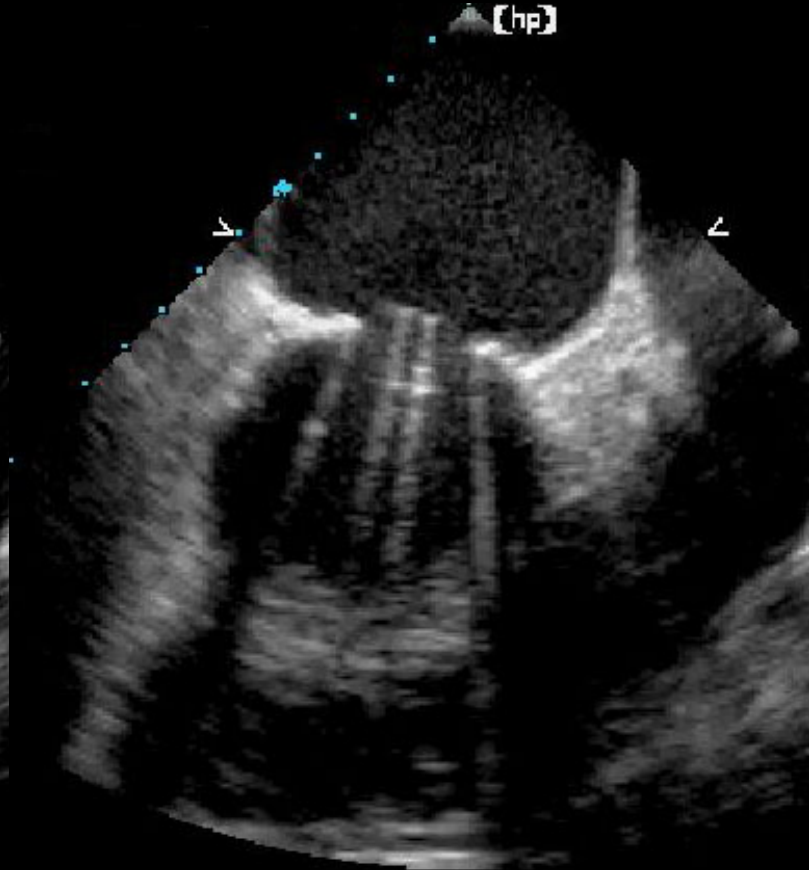
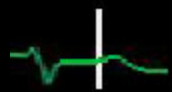
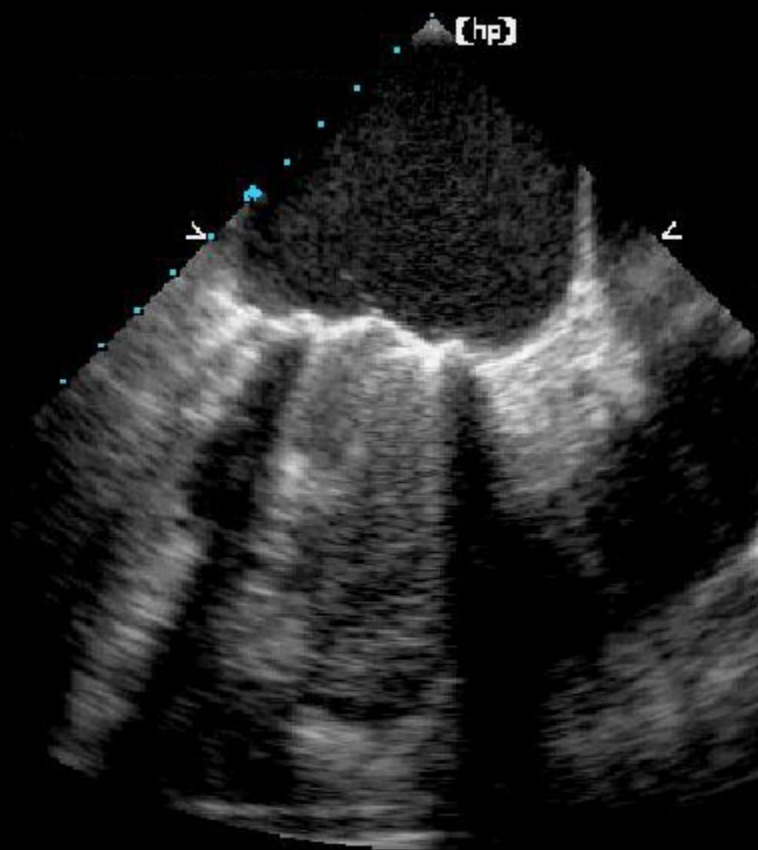


# St. Jude Valve

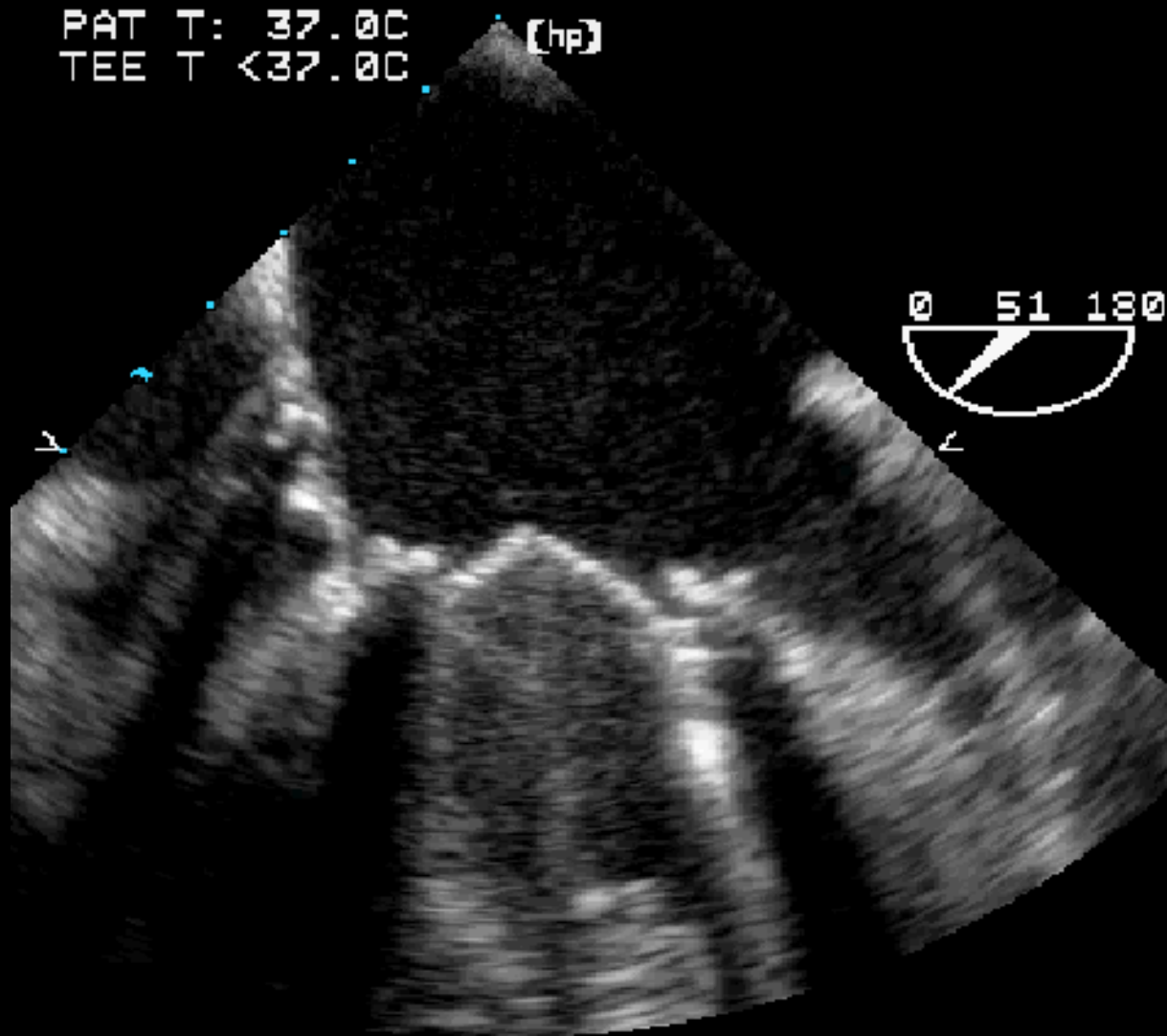
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# Shadowing & Comet Tail



# Shadowing & Comet Tail



# ARTIFACTS – My Classification

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- Difficult

- easy identify

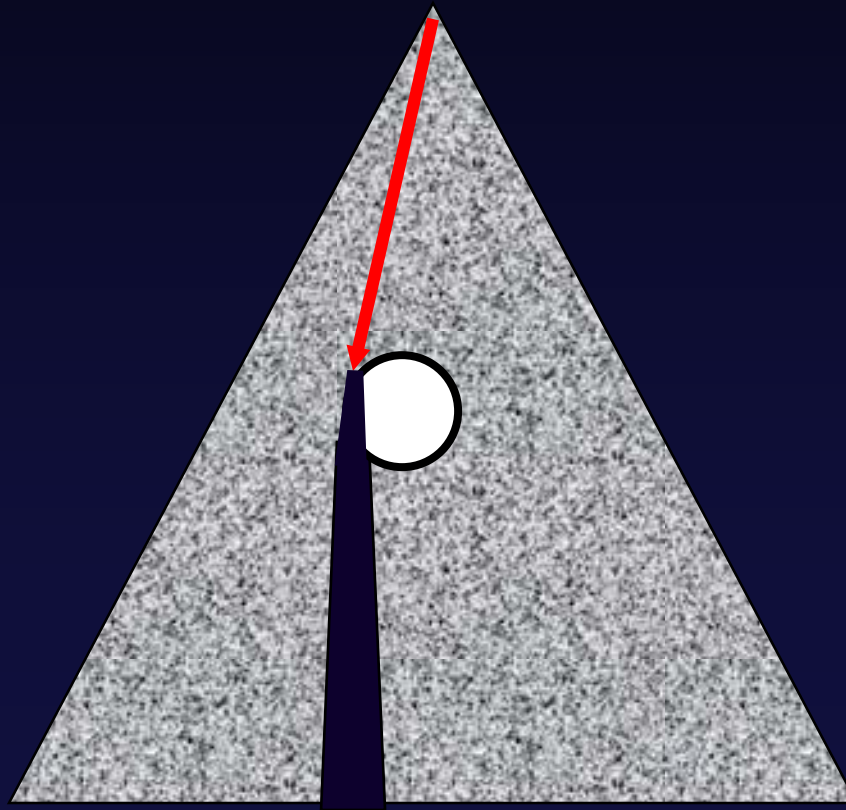
- but explaining??

- I'm sorry

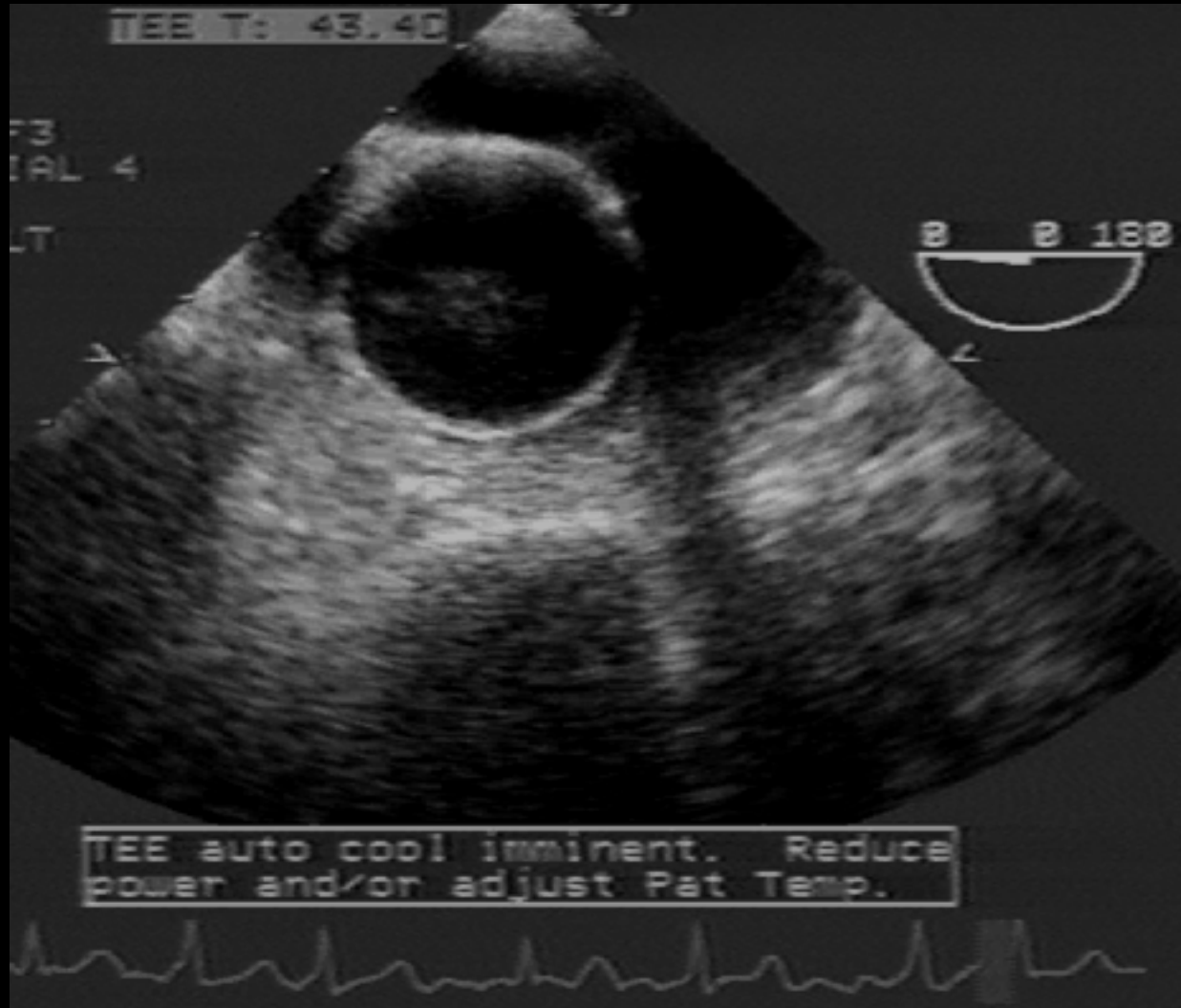
- Can be applied to dating

# Edge Shadow Artifact

- a hypoechoic region appearing beneath the edge of a curved structure

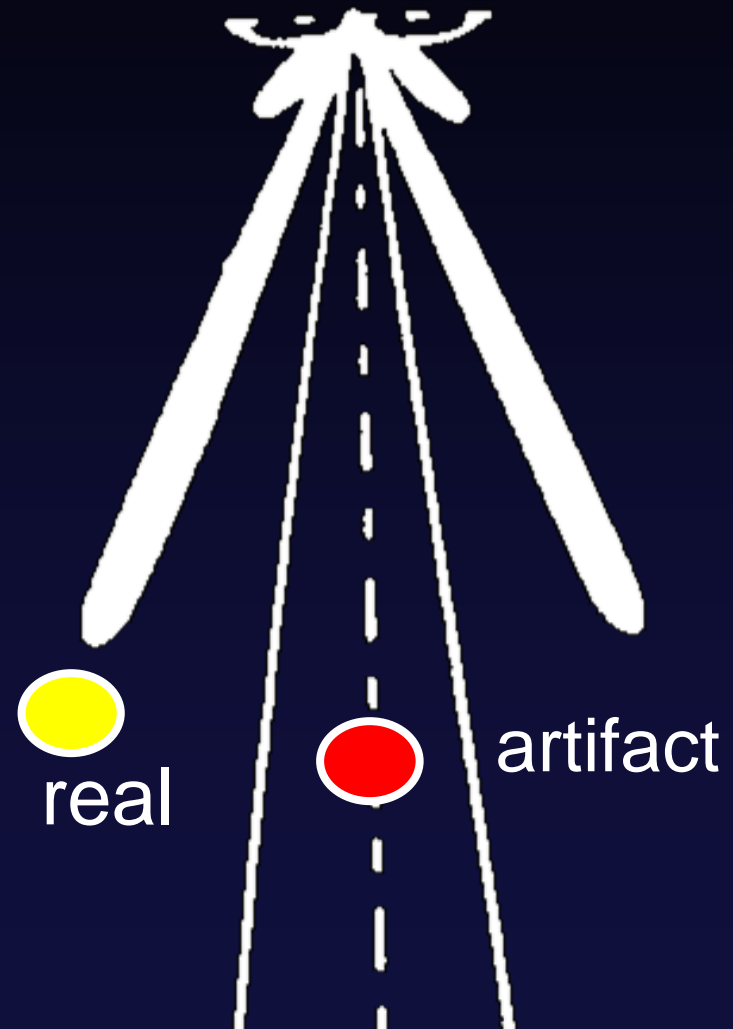


# Edge Shadow Artifact

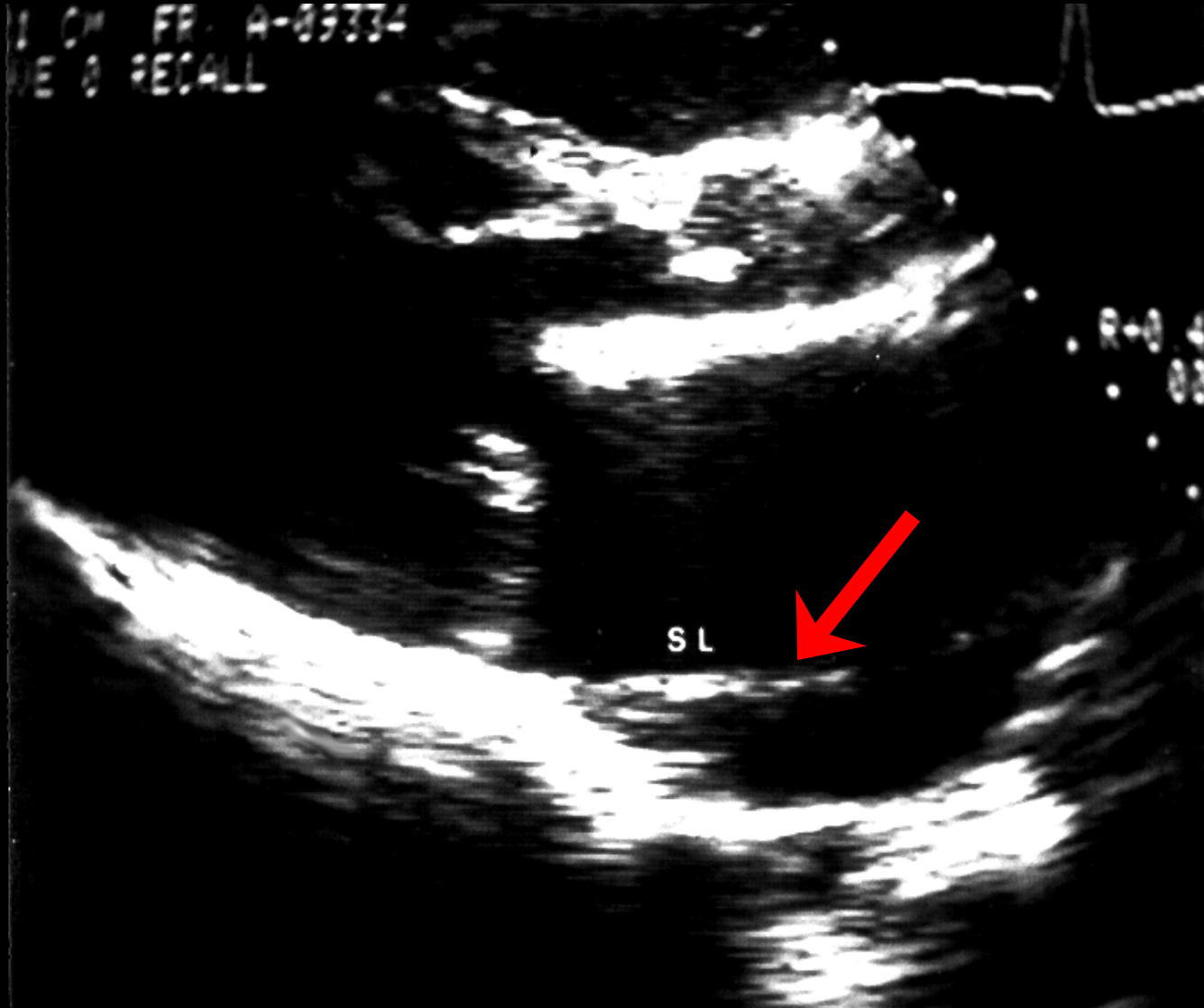


# Side Lobes – Grating Lobes

- sound directed off-axis
- 2<sup>nd</sup> copy of reflector along side of true anatomy



# Side Lobes – Grating Lobes

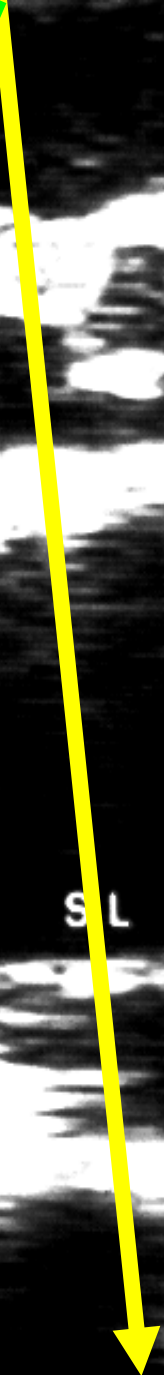
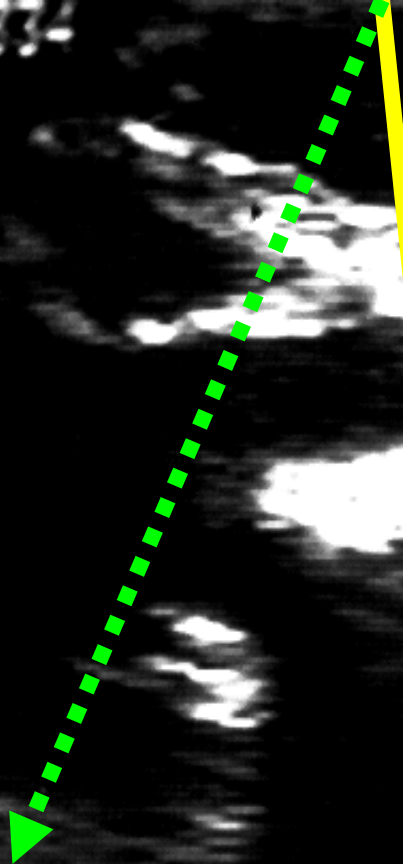




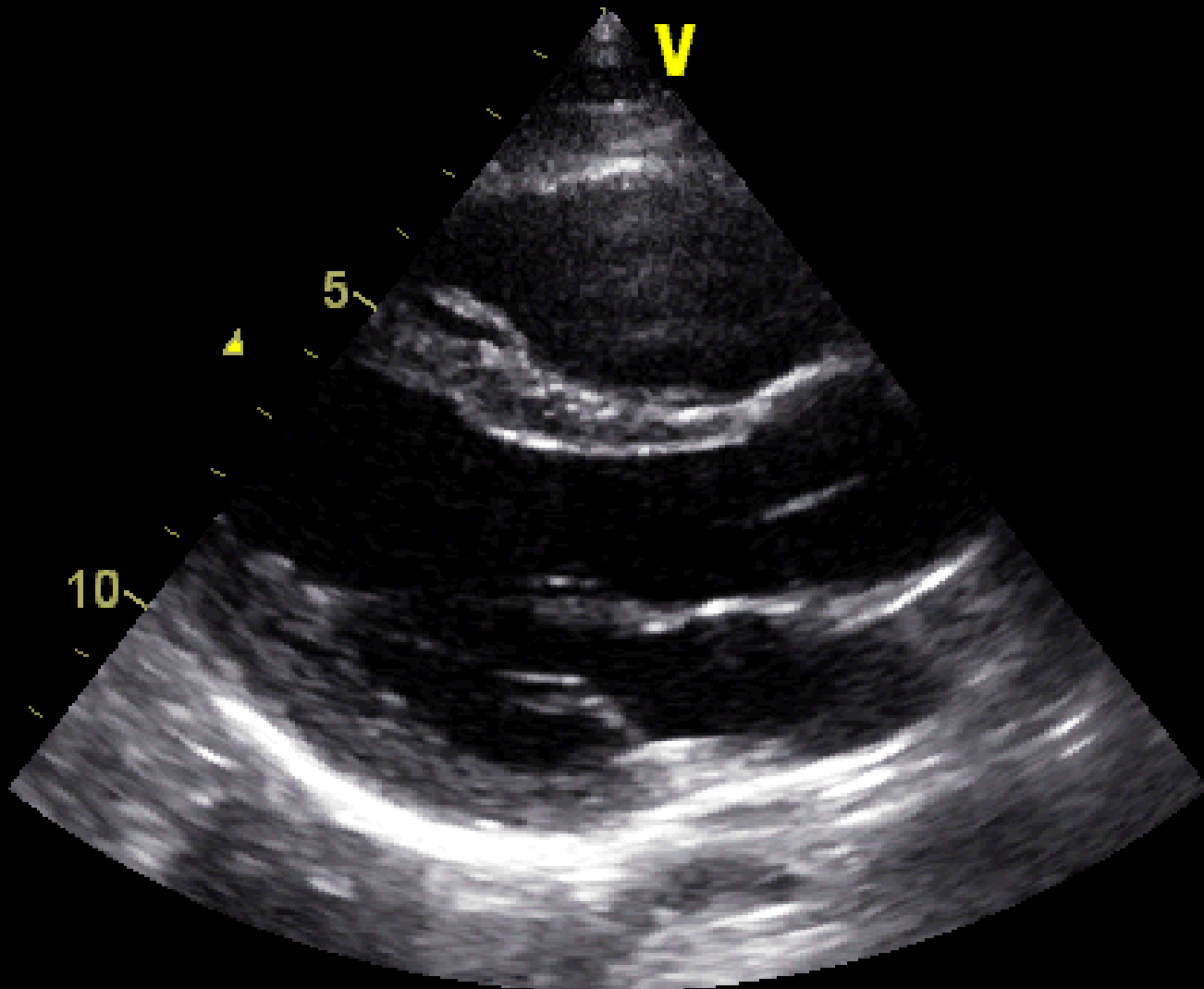
1 CM FR. A-09334  
VE 0 RECALL

R-0 4  
00

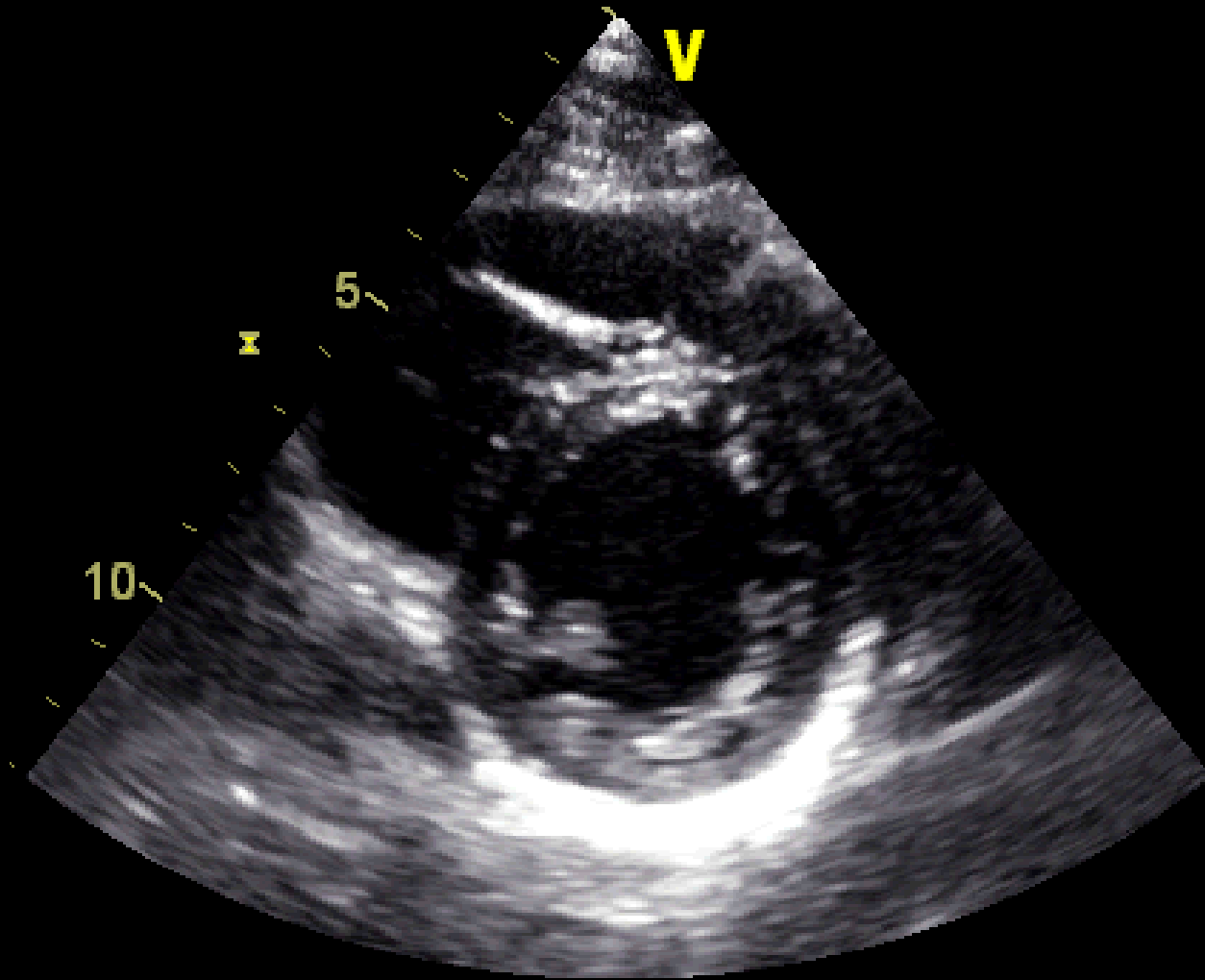
SL



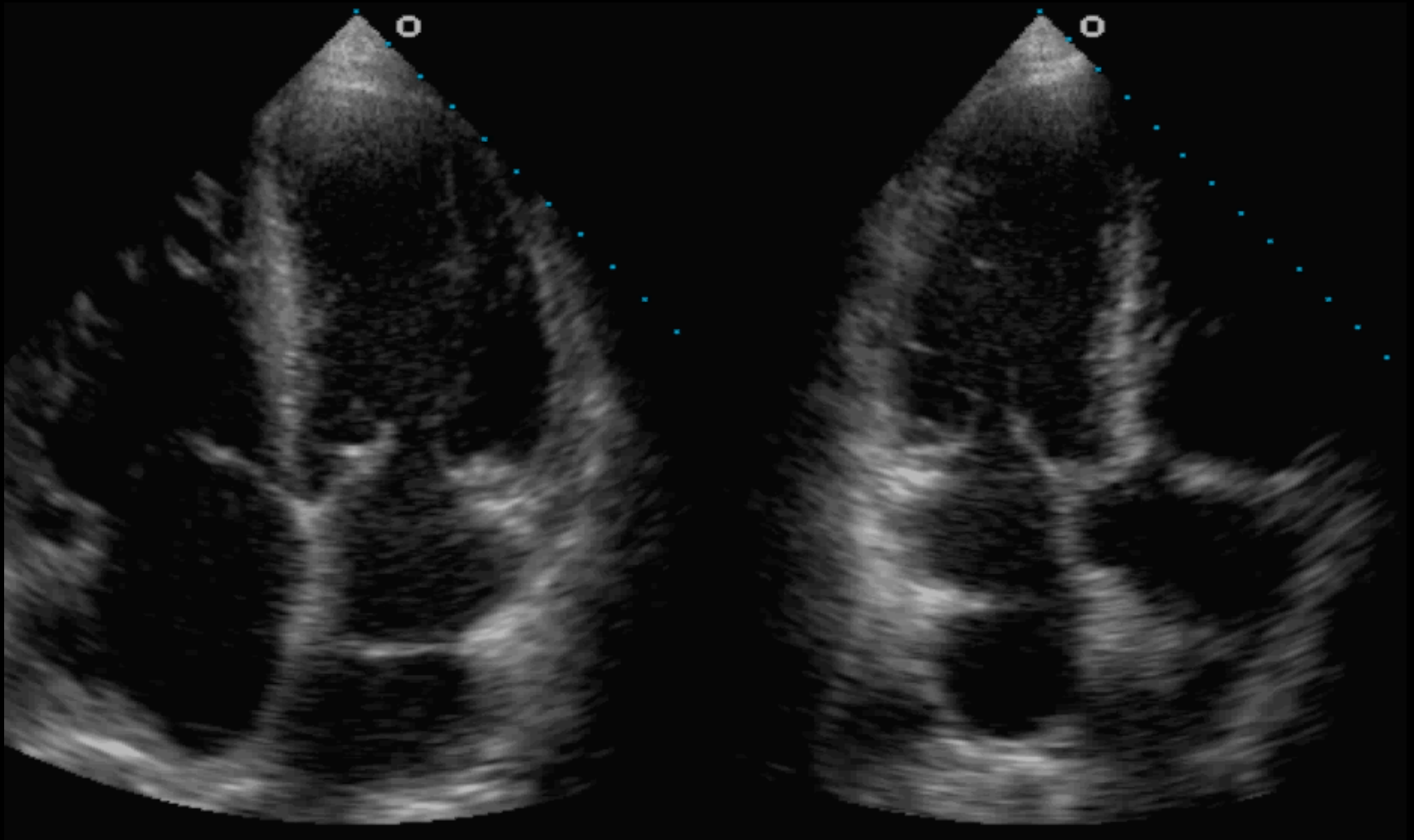
# Grating Lobe



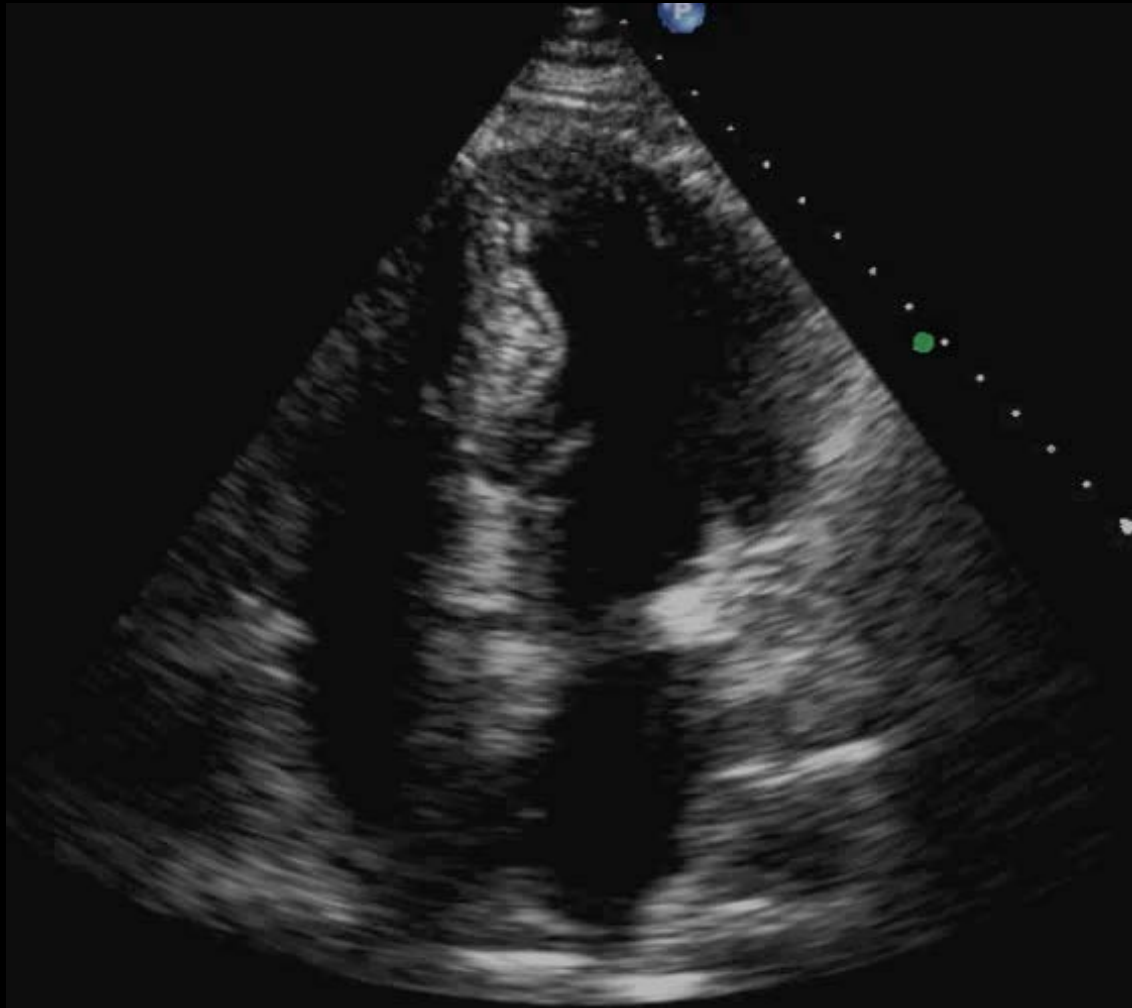
# Grating Lobe



# Cor Triatriatum



# Cor Triatriatum???

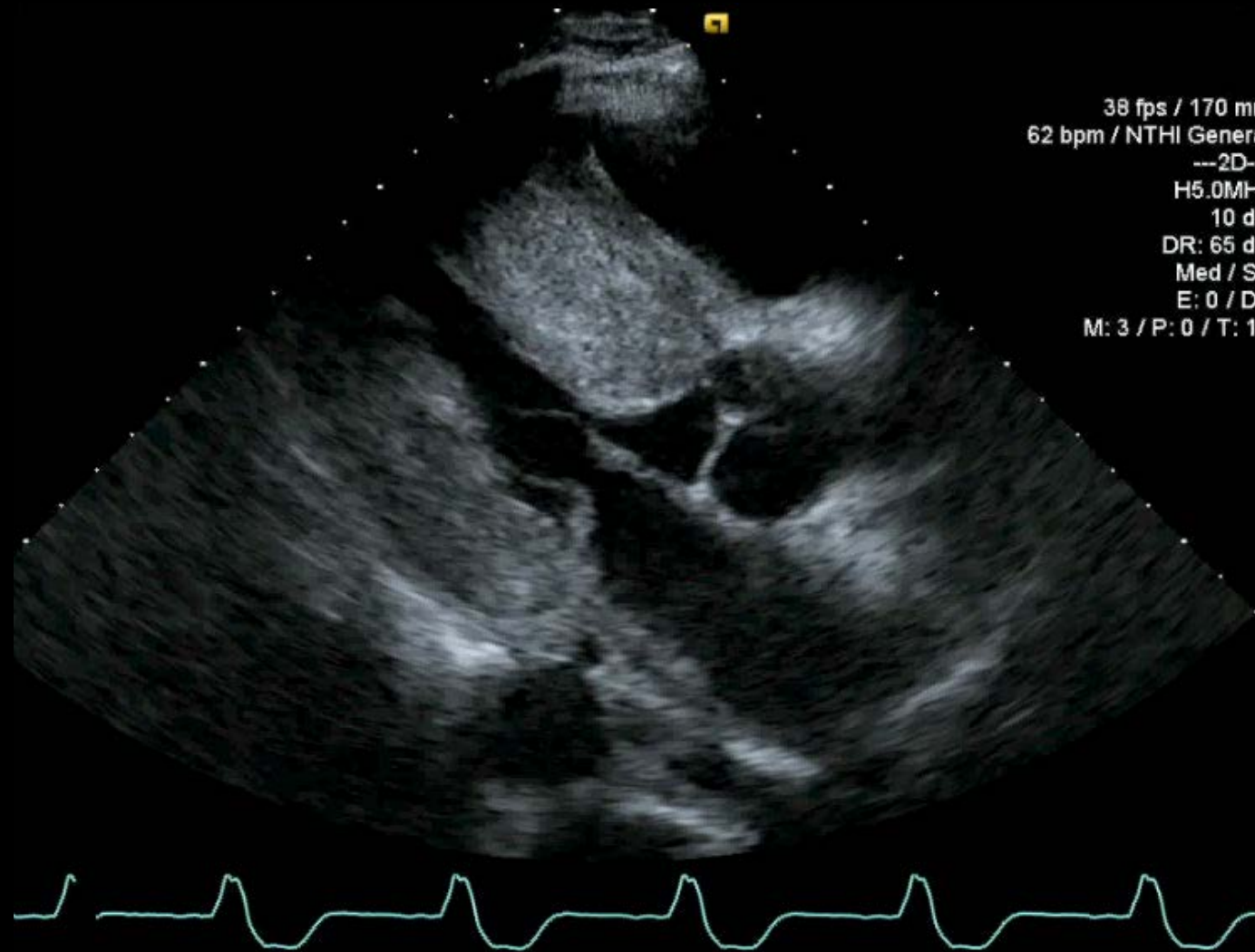


# SPEED ERRORS

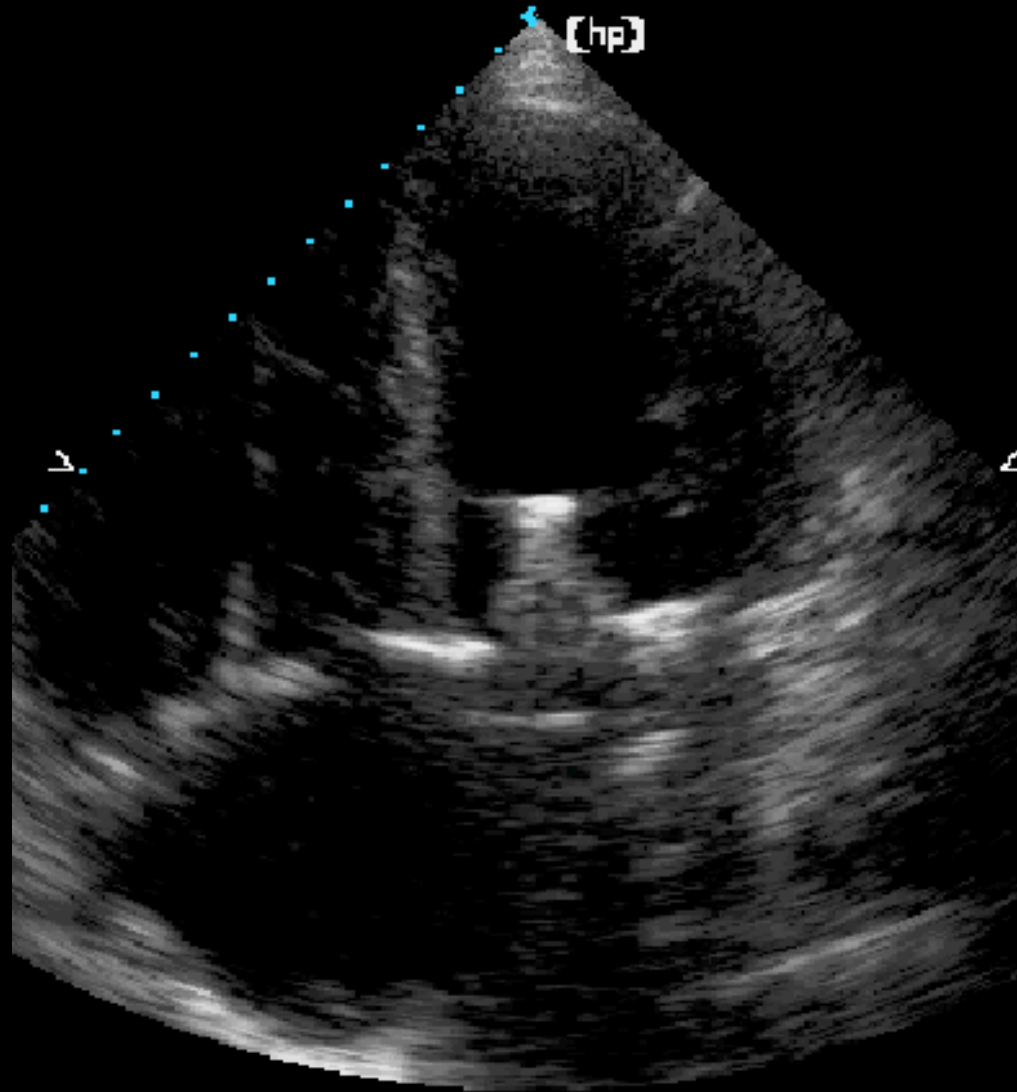
- when sound travels at speeds other than 1,540 m/s, reflectors are placed at incorrect depths
- when speed is greater than 1,540 reflectors appear too shallow on the image
- when speed is less than 1,540 reflectors appear too deep on the image



# Rib or Lung Interference

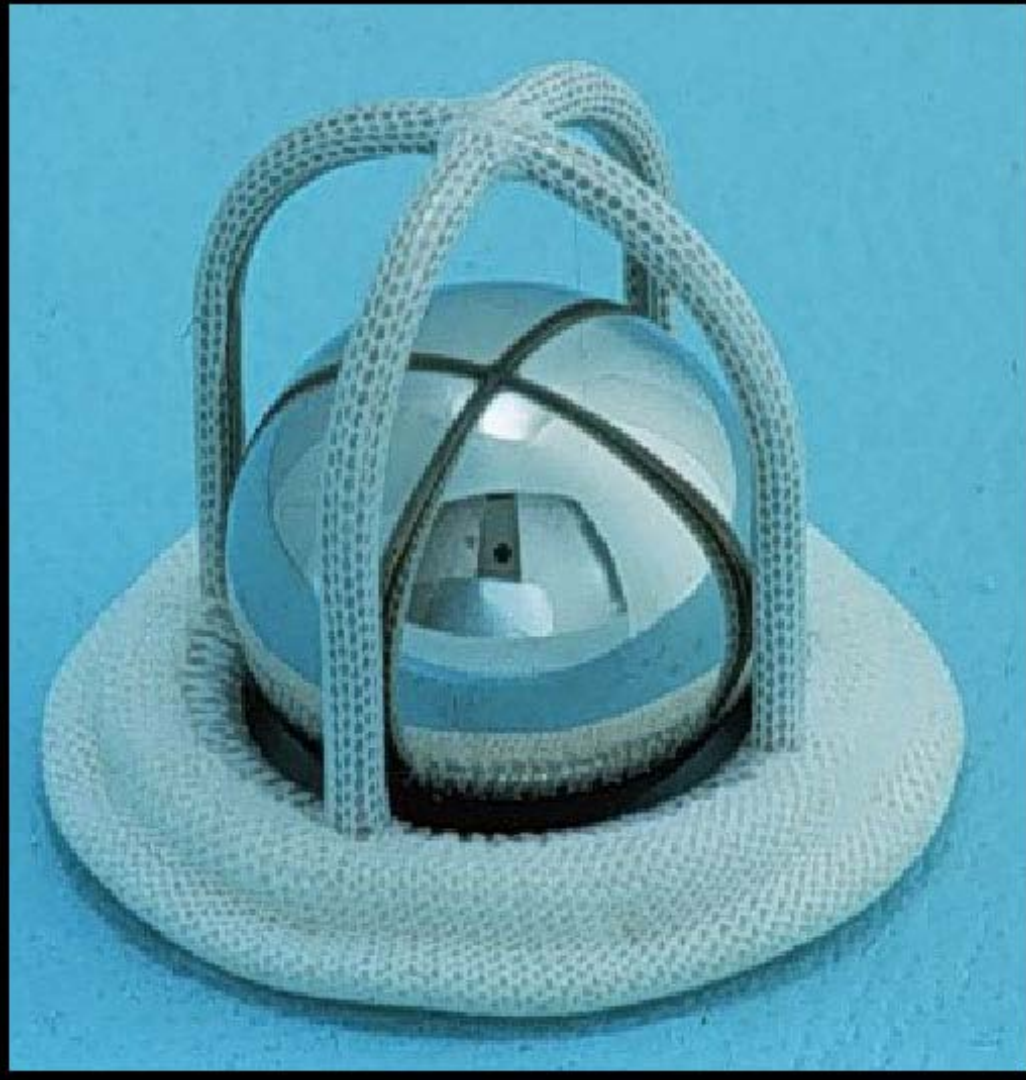


# Starr-Edwards MVR

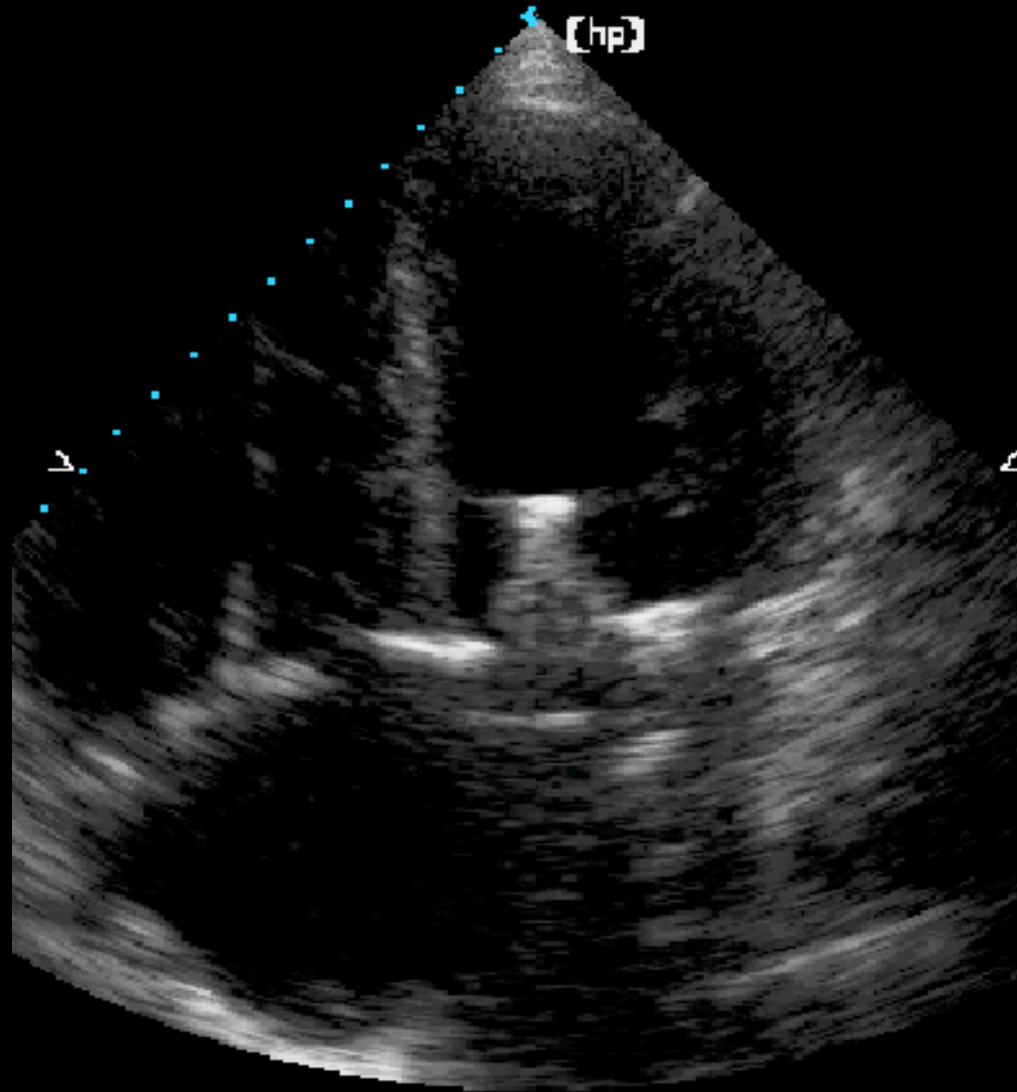




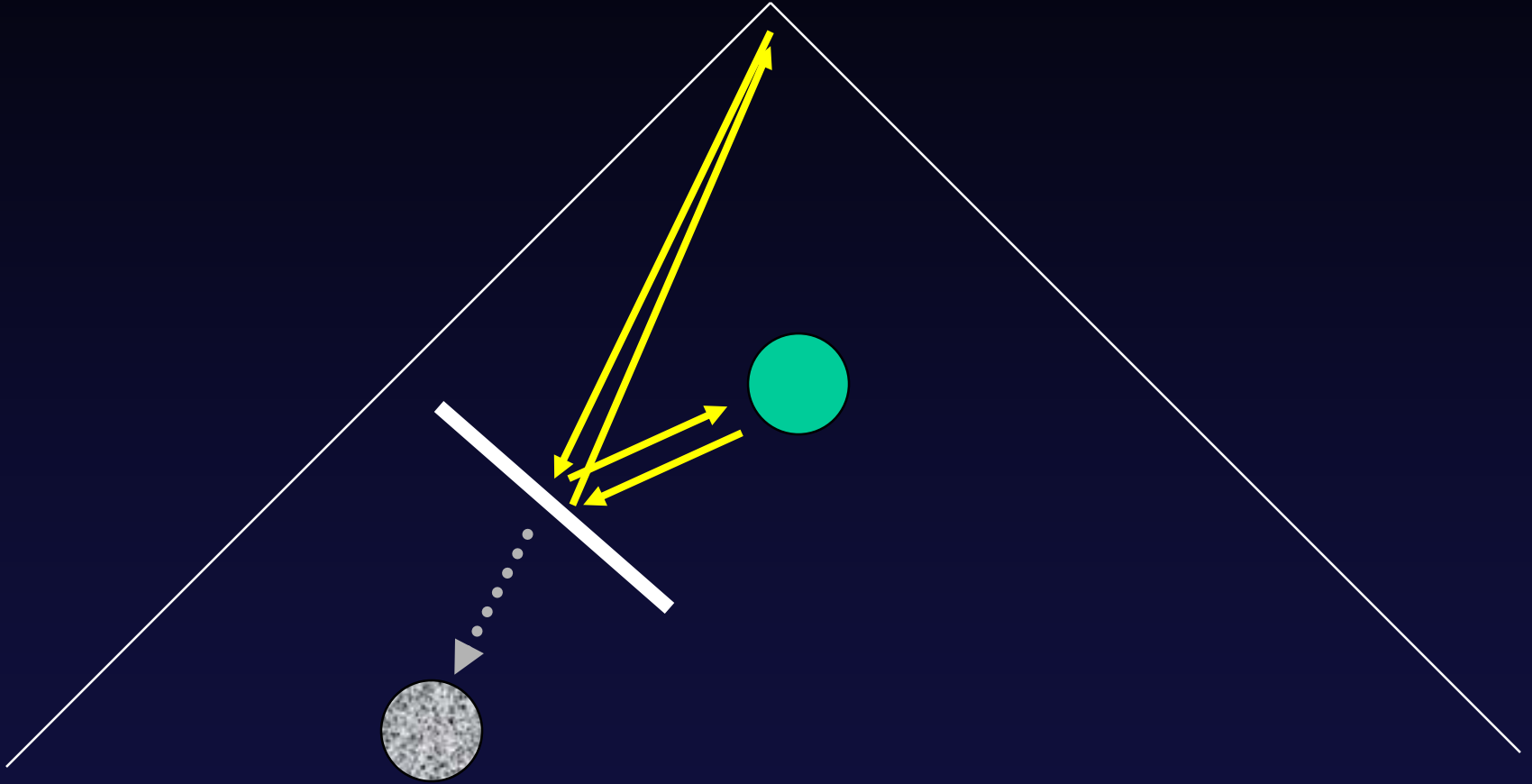
# Starr-Edwards Valve



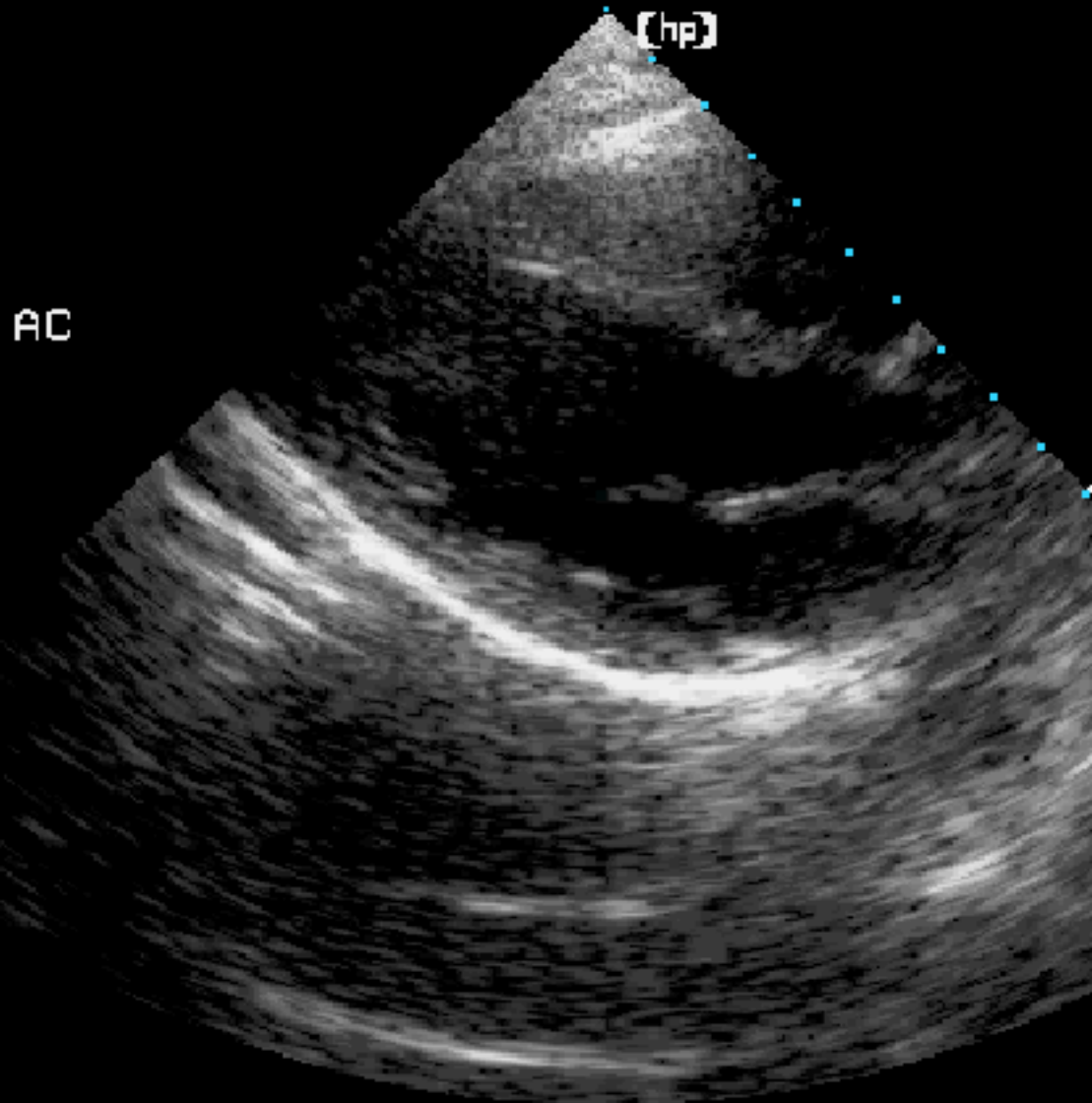
# Starr-Edwards MVR



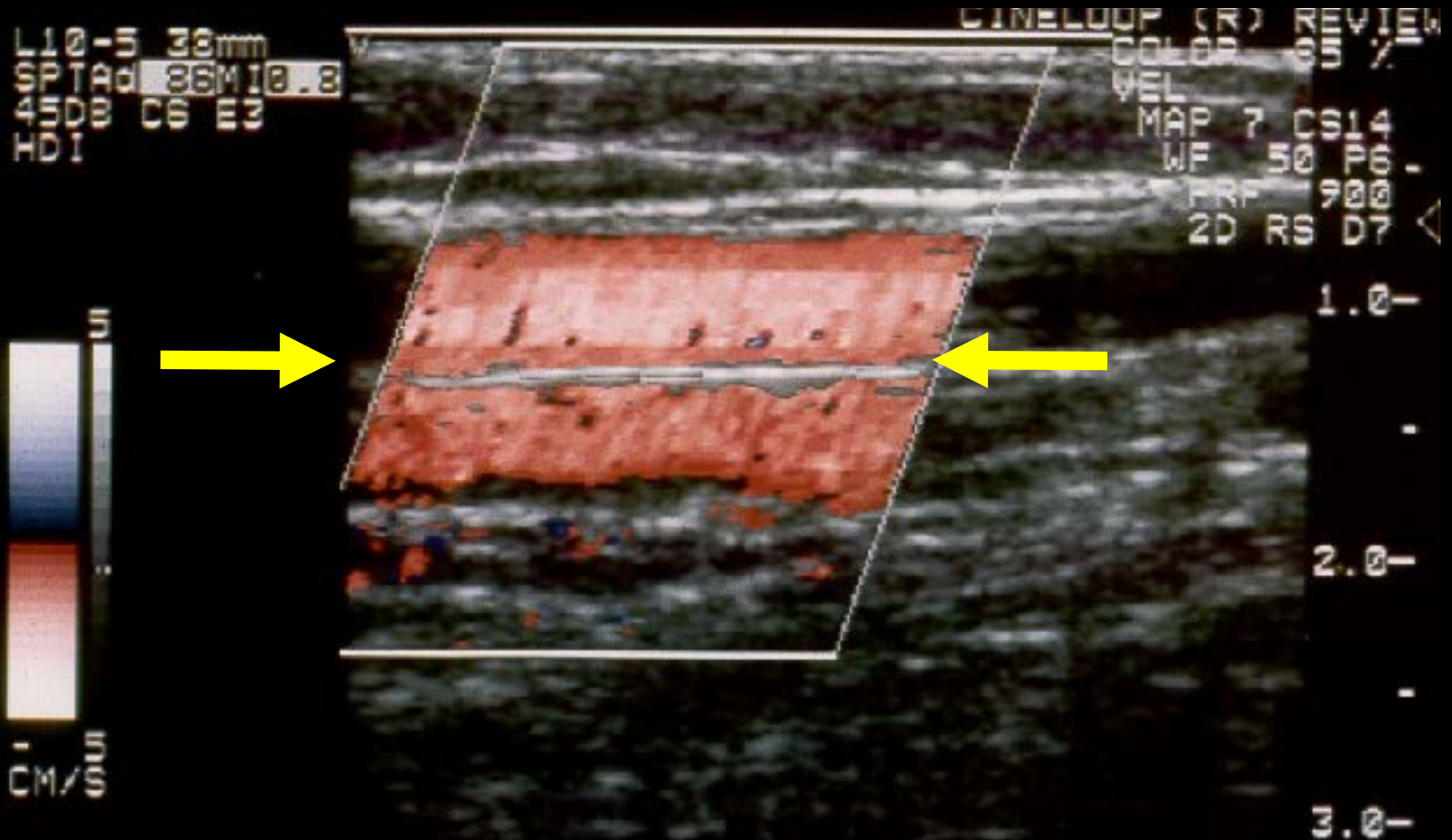
# MIRROR IMAGE



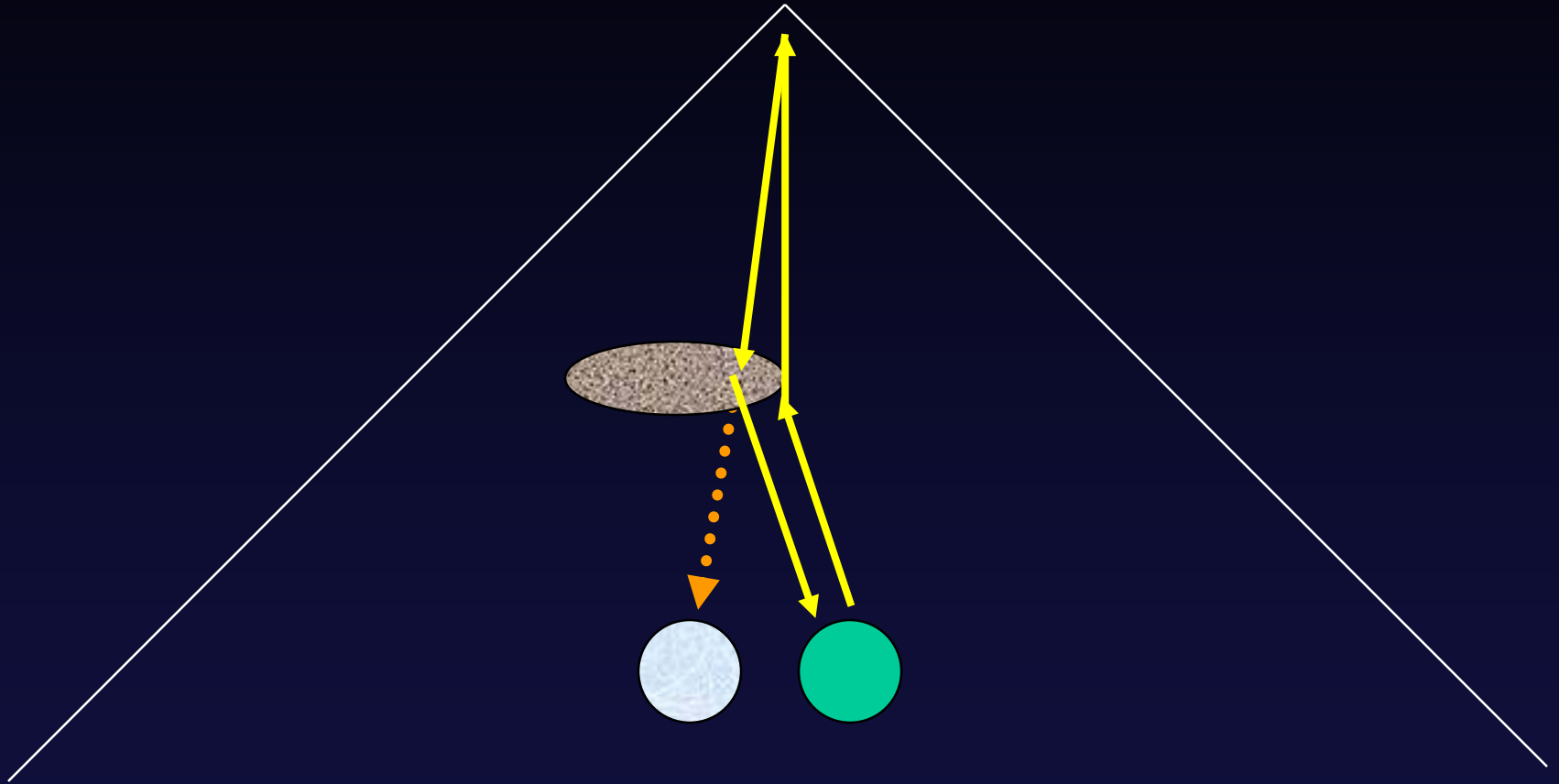
# MIRROR IMAGE



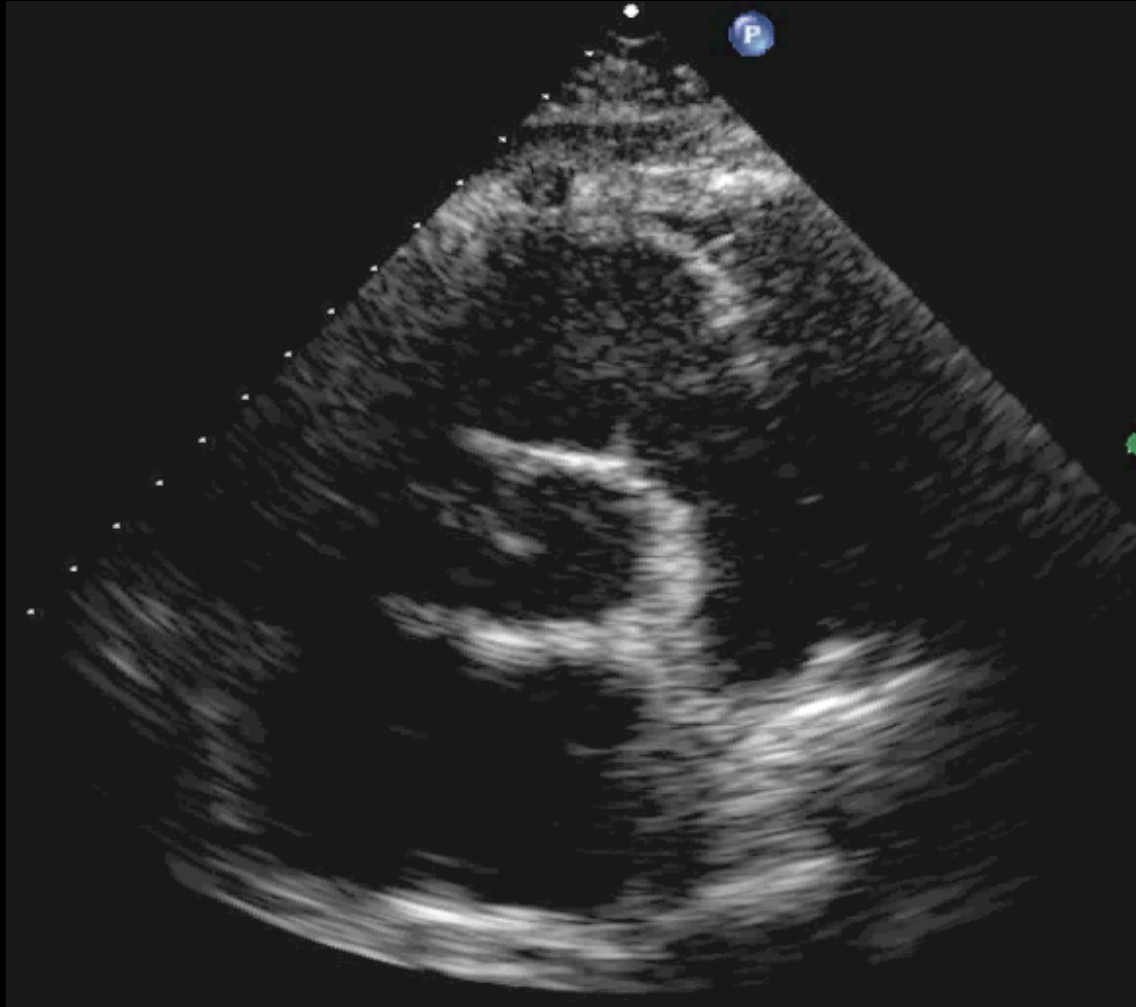
# MIRROR IMAGE



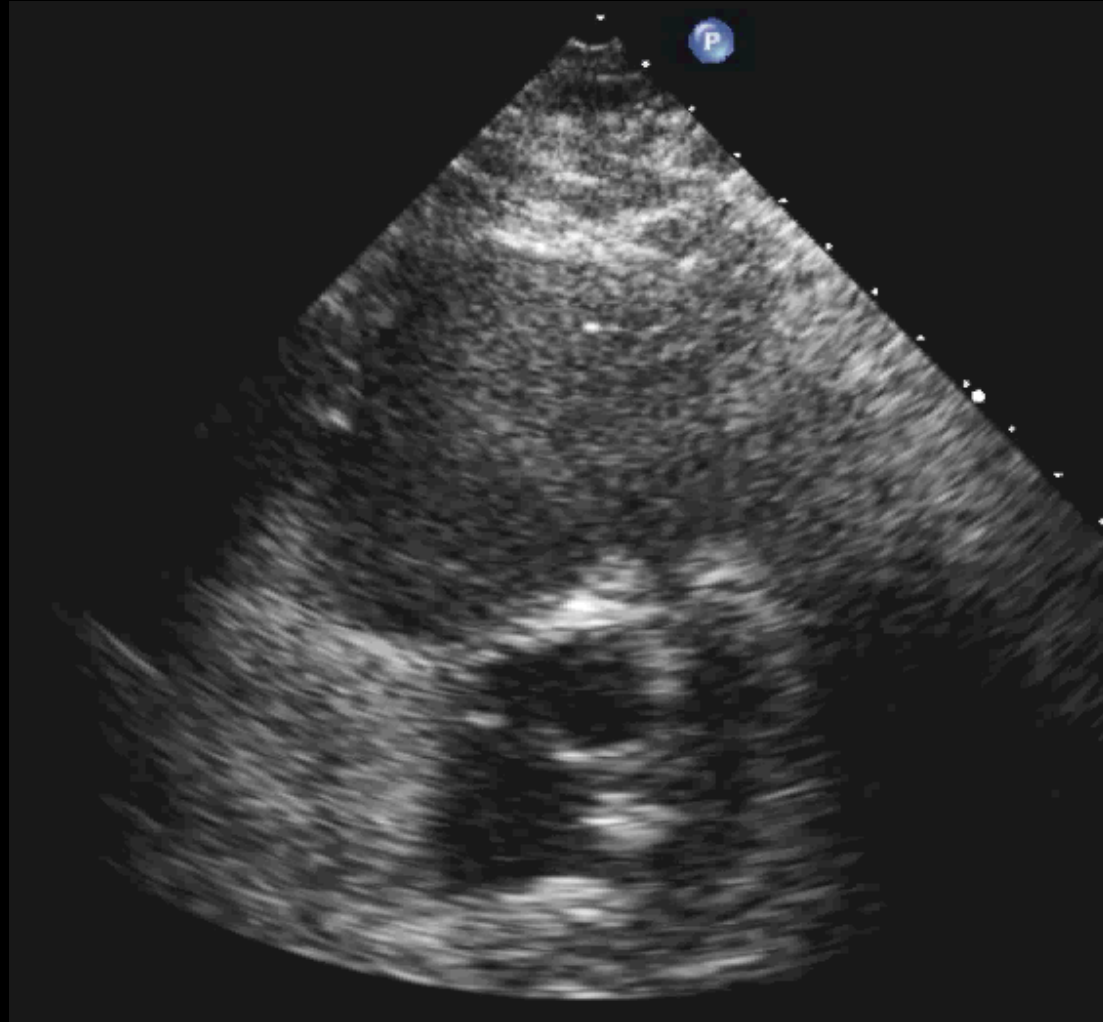
# REFRACTION



# Double Ao - Refraction



# Double Ao - Refraction



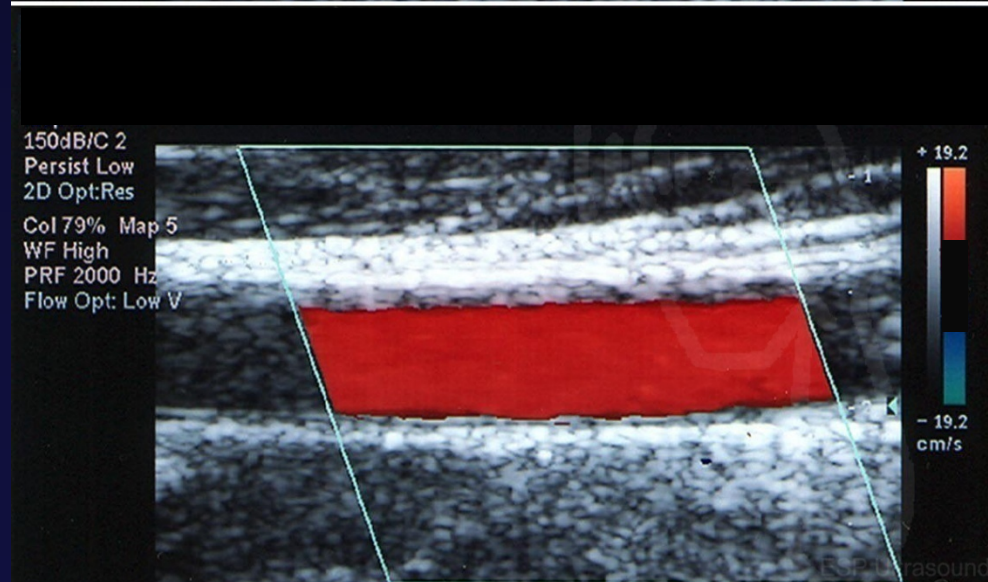
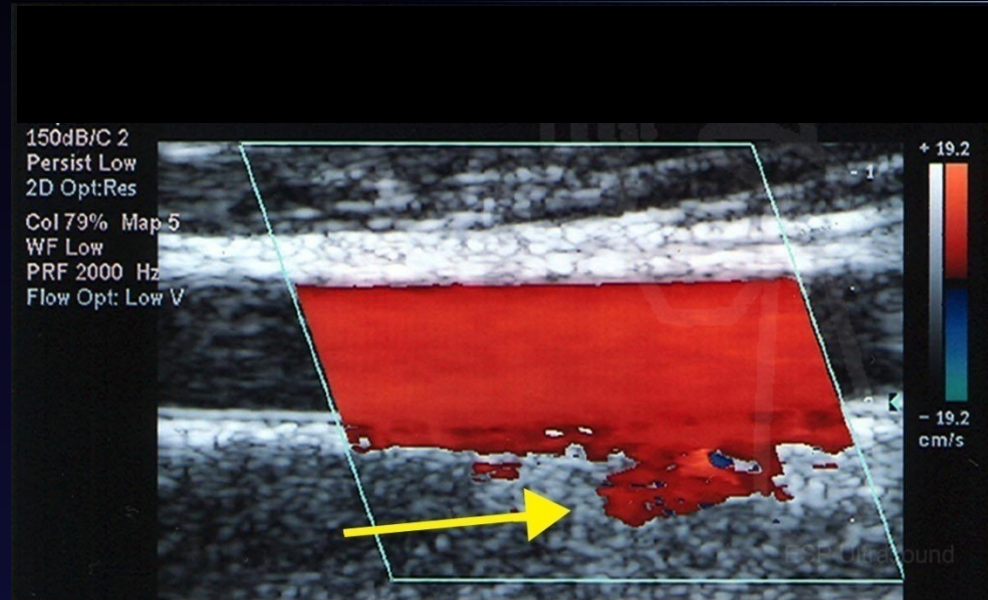


# Double LV - Refraction

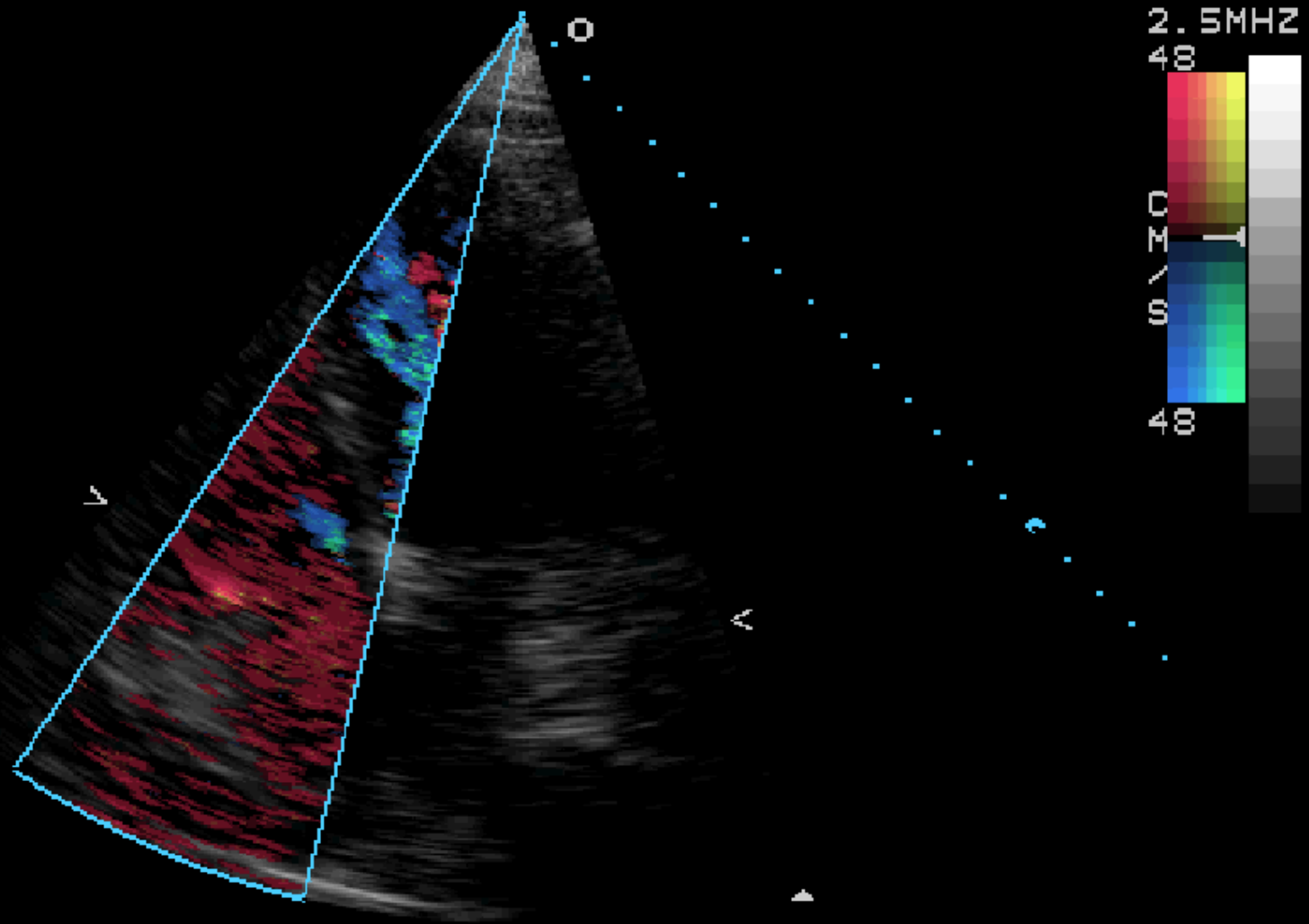


# DOPPLER ARTIFACTS

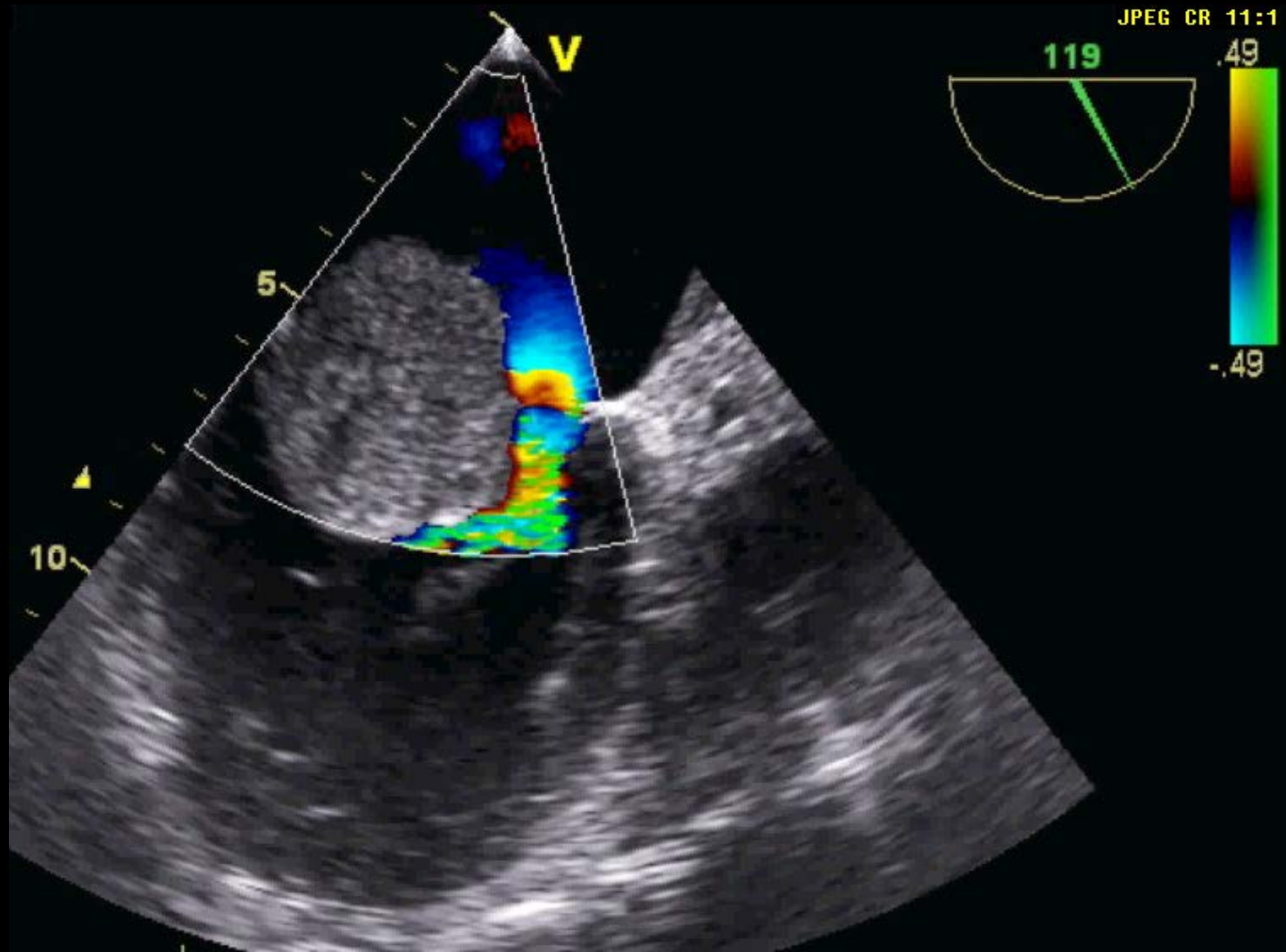
- pulsating vessel walls and moving structures (heart) can create small Doppler shifts – clutter
- color flash or ghosting appears in early systole due to heart motion
- wall filters eliminate color from small Doppler shifts that arise from structure motion



# Ghosting Artifact



# Ghosting Artifact

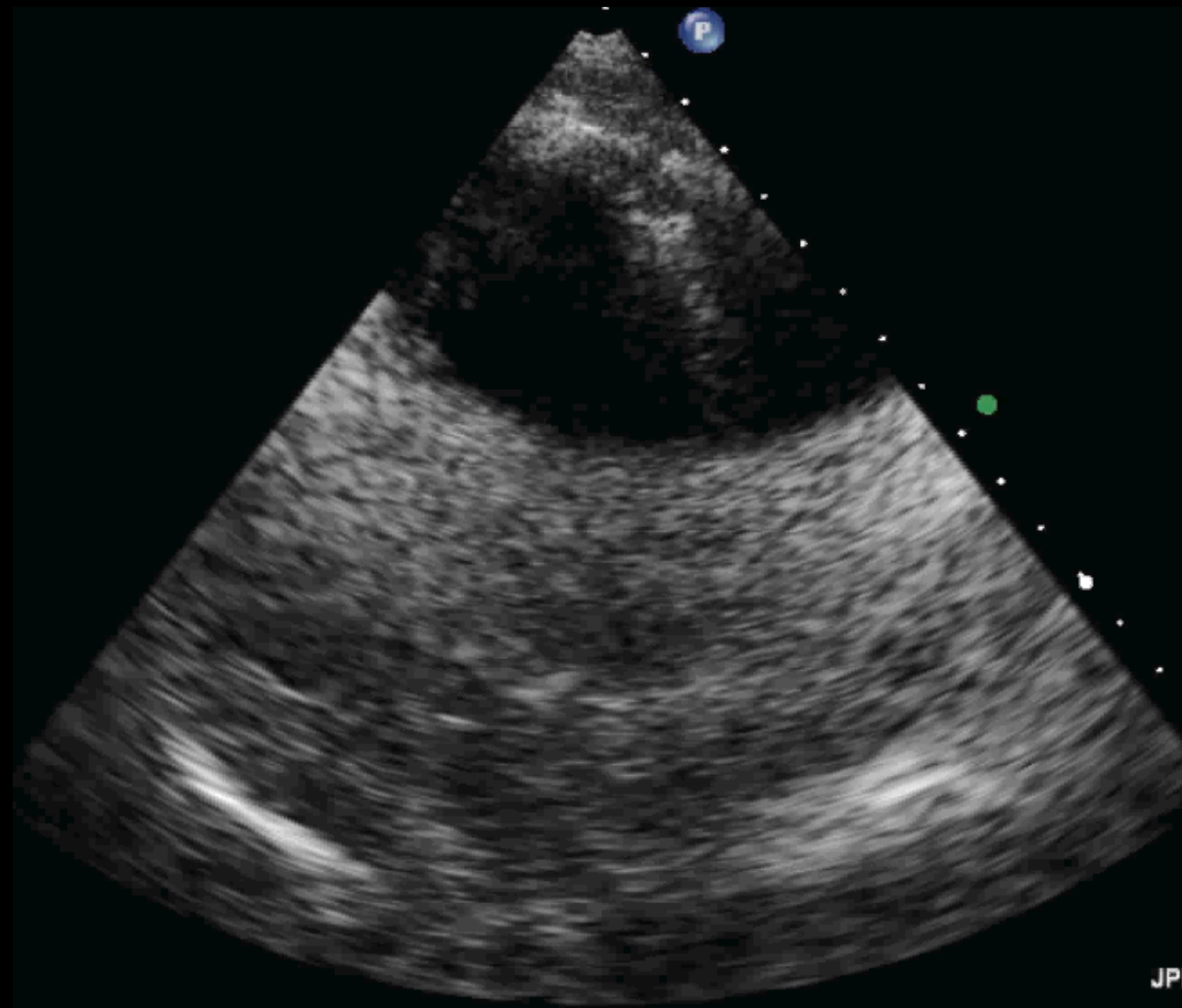


# ARTIFACTS – My Classification

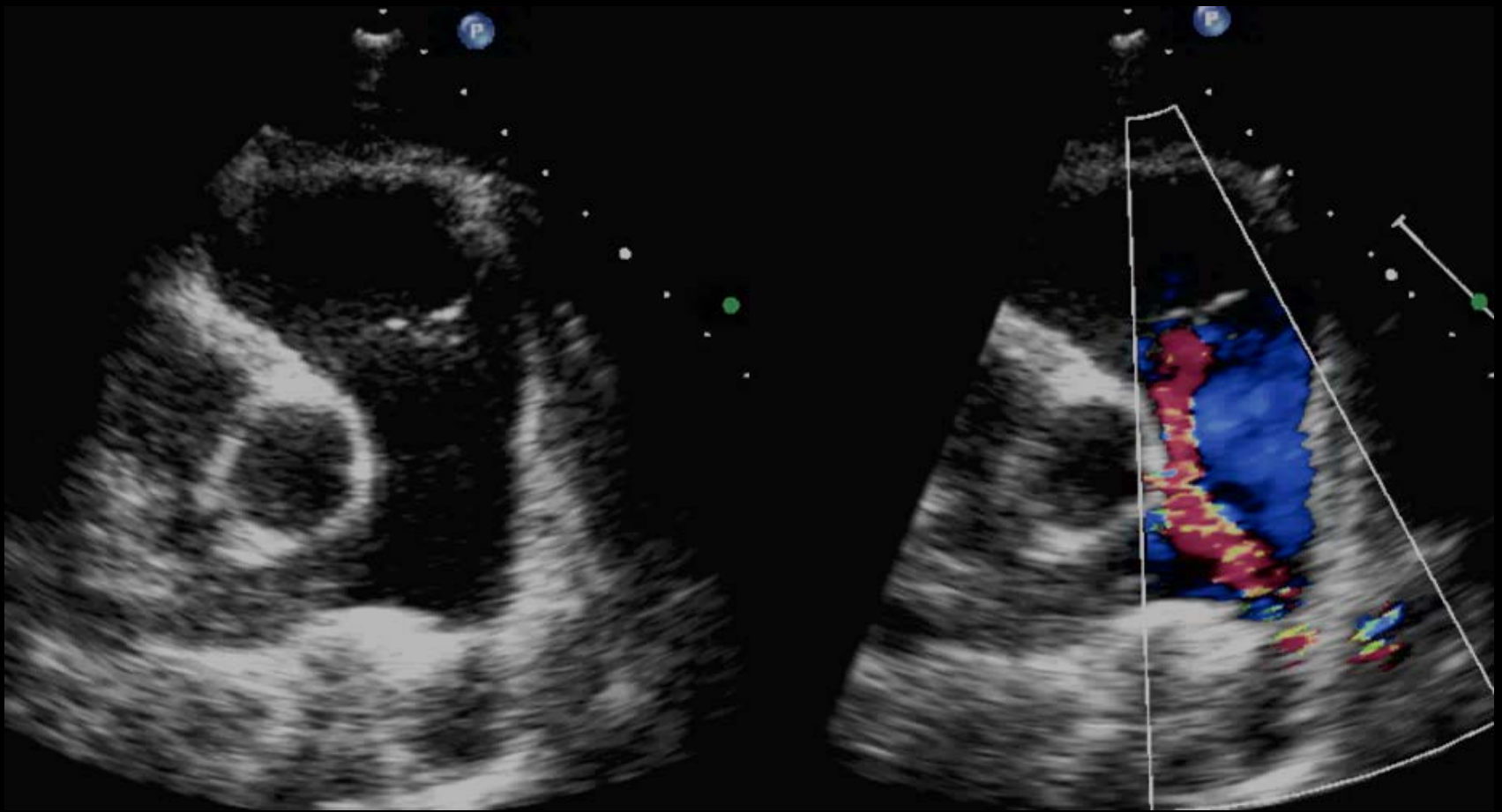
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- Easy
- Difficult
- Impossible
  - Weird things not explained by physics
  - (Don't mention dating / women)

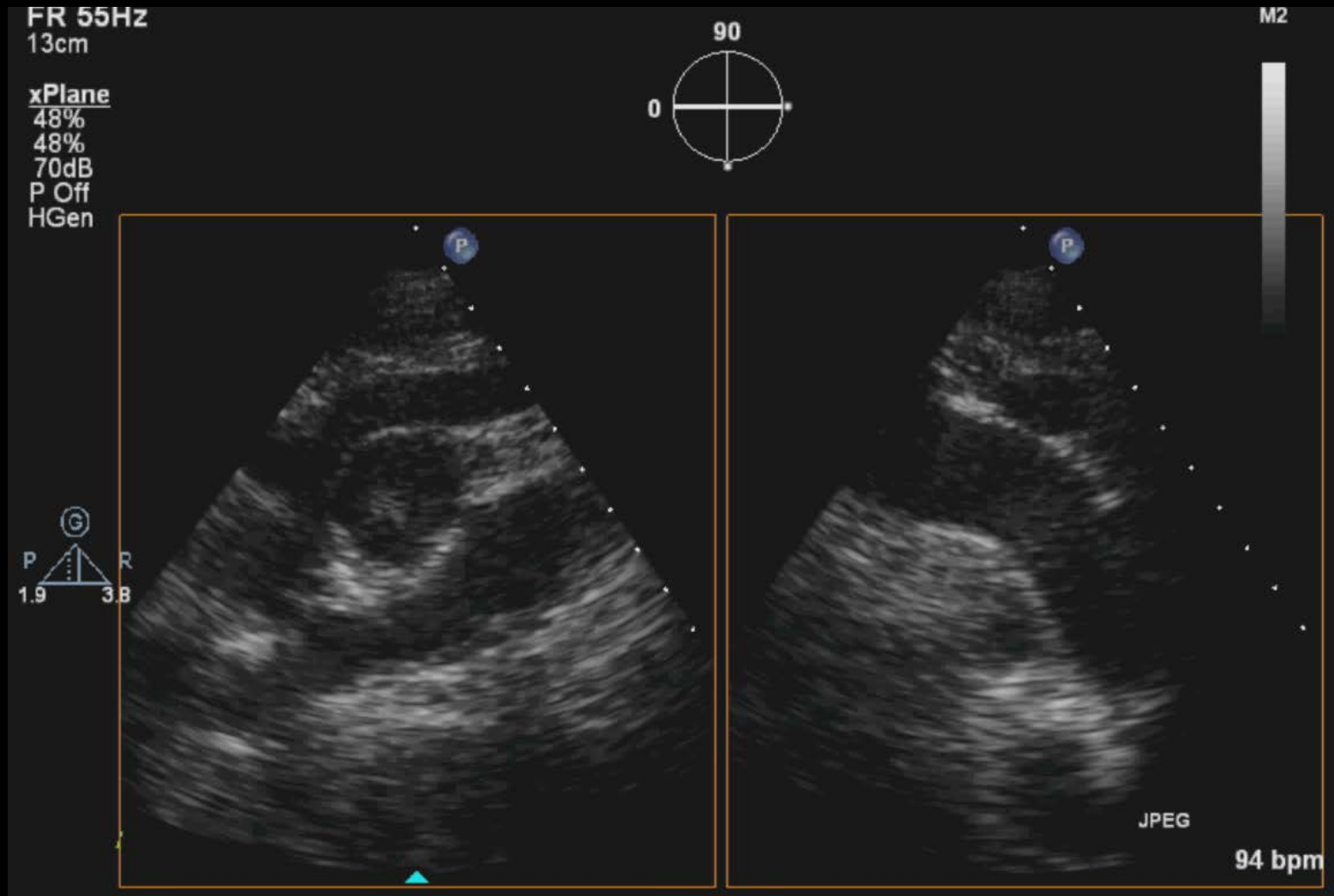
# Breast Implant



# PDA Doppler Artifact

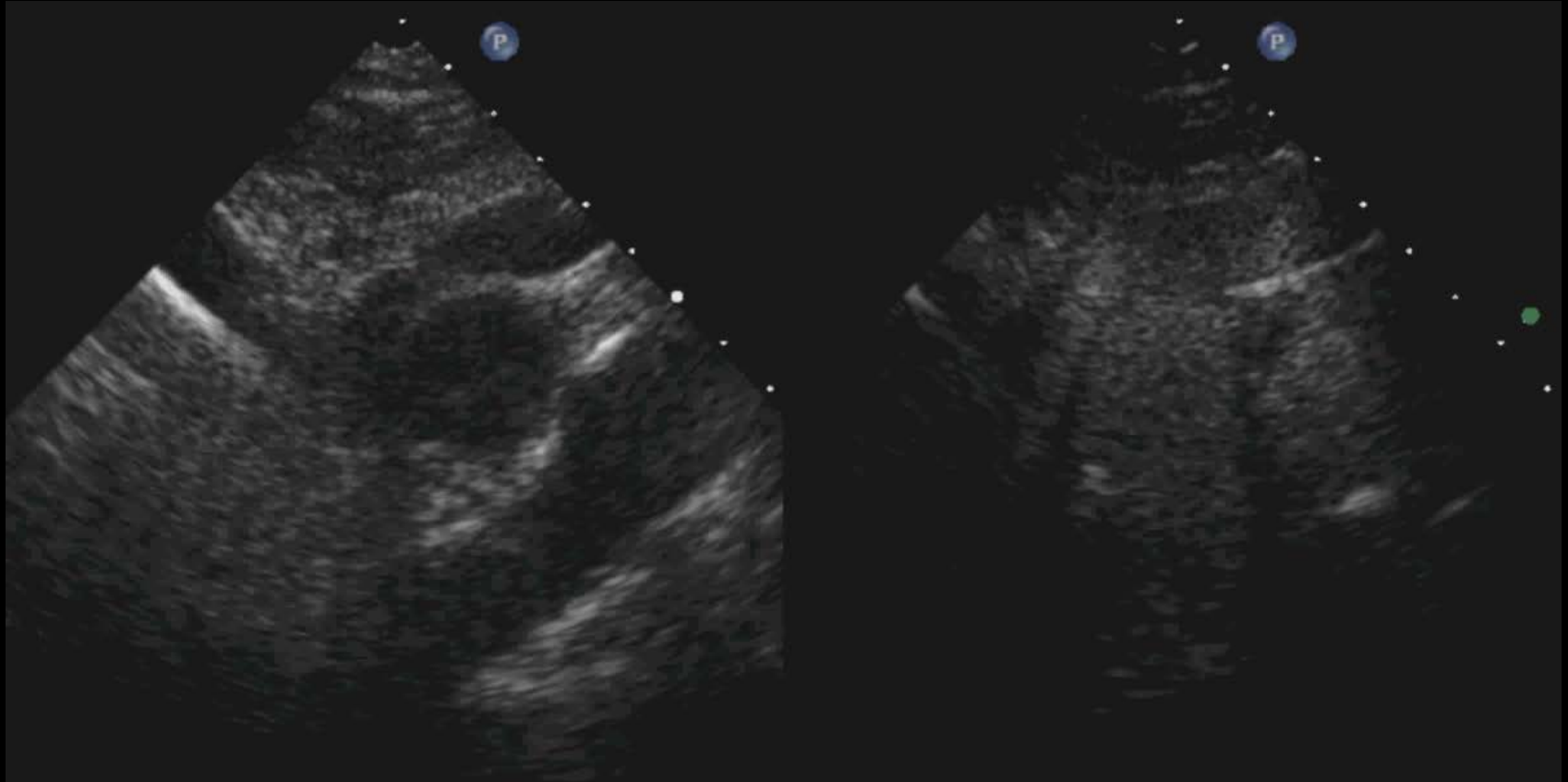


# ? Artifact in the Ao

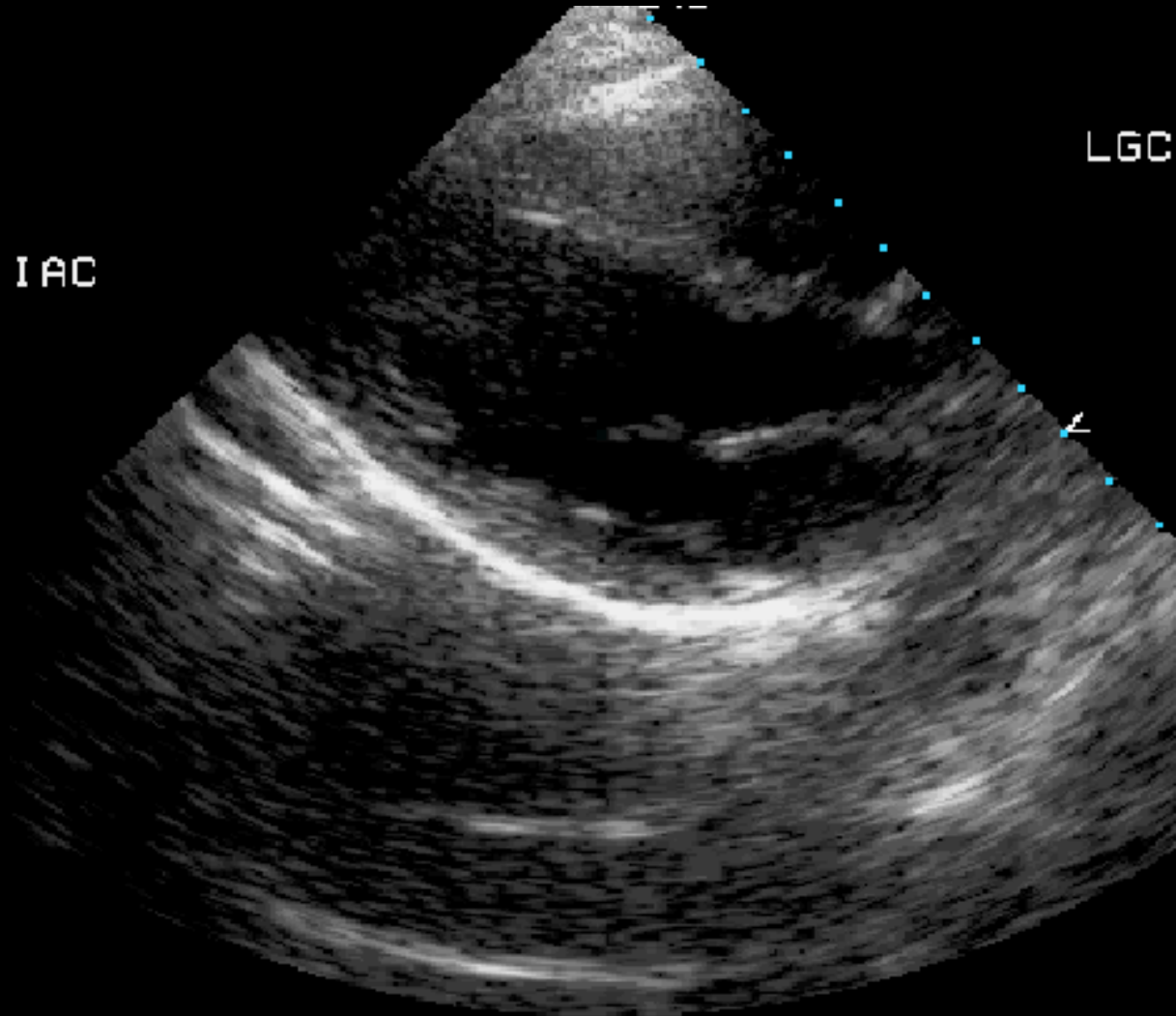




# ? Artifact disproved by contrast



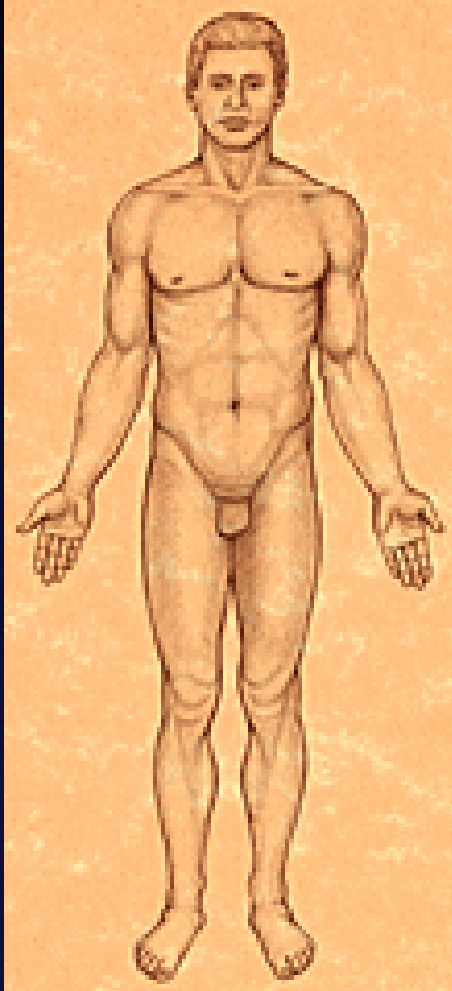
# Multiple Artifacts (4)



# ARTIFACTS

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- In all Images
- Most can be explained
- If you think its real – change depth or xducer & document in more than one view.



Duke ER

The End