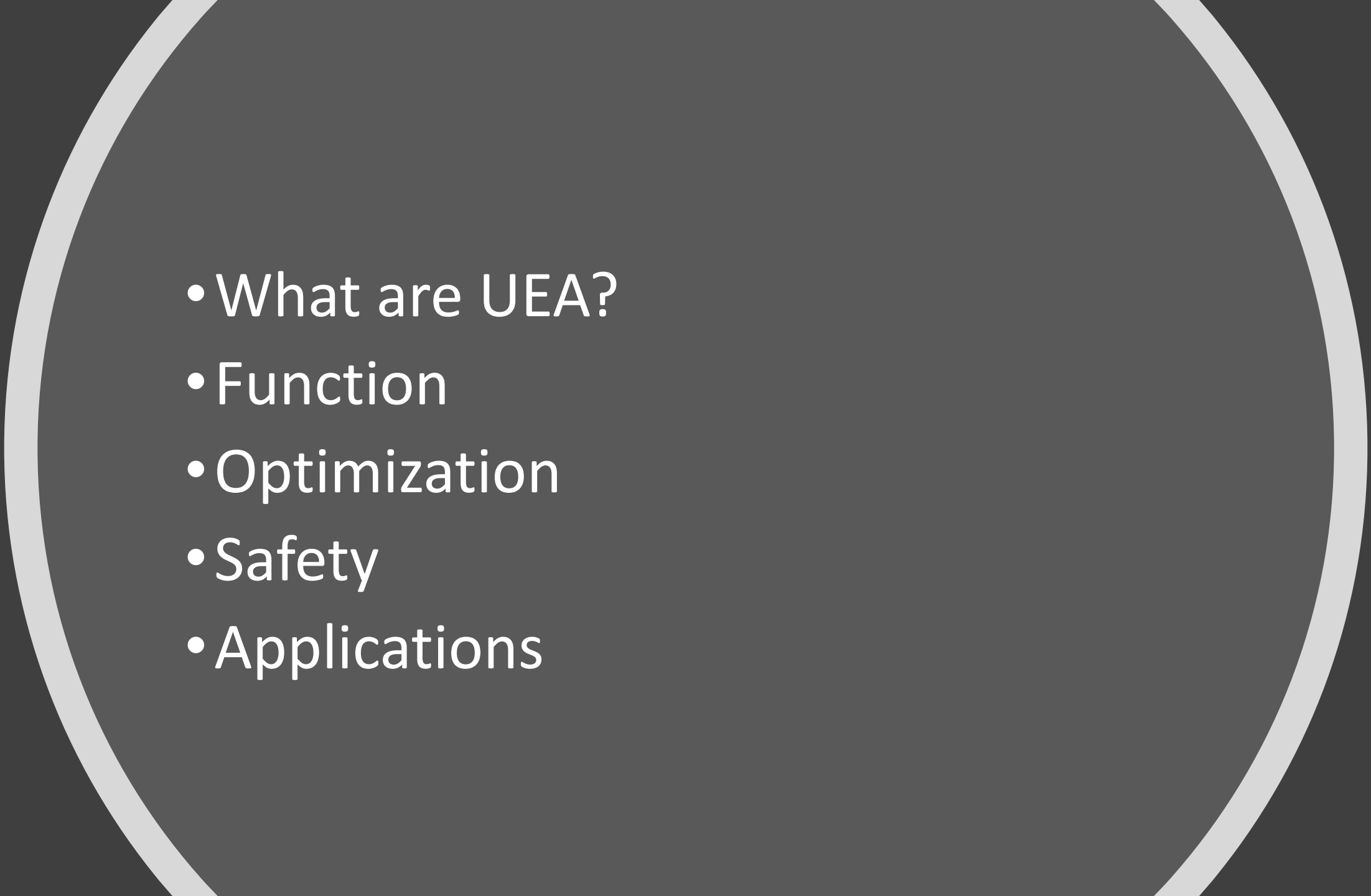


A Guide to Ultrasound Enhancing Agents (UEA)

Kane Smith, RDCS

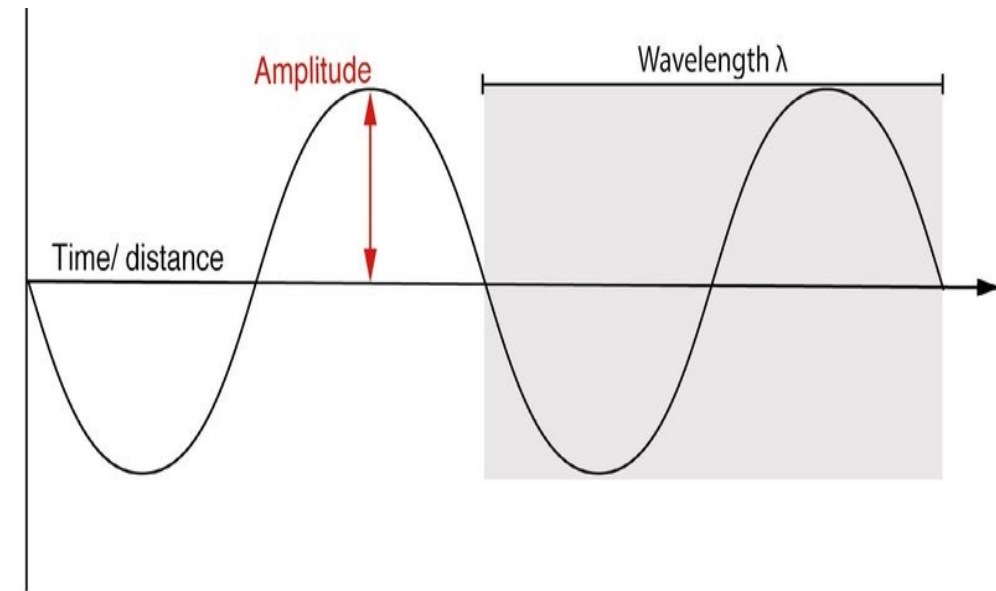
- 
- What are UEA?
 - Function
 - Optimization
 - Safety
 - Applications

What are UEA?

- 1st generation contrasts
 - Agitated saline/bubble study
 - Uses air to create microbubbles
 - Unable to pass through pulmonary capillary bed
 - Can only enhance the right heart
 - Primary use is testing for shunts
- 2nd generation contrasts
 - Three FDA approved agents: Definity, Lumason, and Optison
 - Uses high density gas coated with a shell to create microbubbles
 - Small transpulmonary microbubbles
 - Can enhance right and left heart

How do UEA work?

- High molecular weight gas with low solubility
- Lipid or albumin shell to provide stability
- Compression and rarefaction of sound waves cause compression and expansion of gas bubbles
- Bubbles create non-linear signal, myocardium creates linear signal
- Software distinguishes these signals, increasing signal to noise ratio



Optimizing images

- Key Factors
 - Mechanical index (MI)
 - Low MI < 0.2 enhances signal
 - Higher MI destroys bubbles
 - Frame Rate
 - Higher frame rate can destroy bubbles due to increased signal exposure
 - Alter sector size
 - Focus
 - Increases signal in focused area, causing destruction
 - Keep at level of mitral valve
- Each contrast agent will be optimized differently
- Inject contrast slowly, 2mL diluted solution in 30 seconds

KDMC PEN

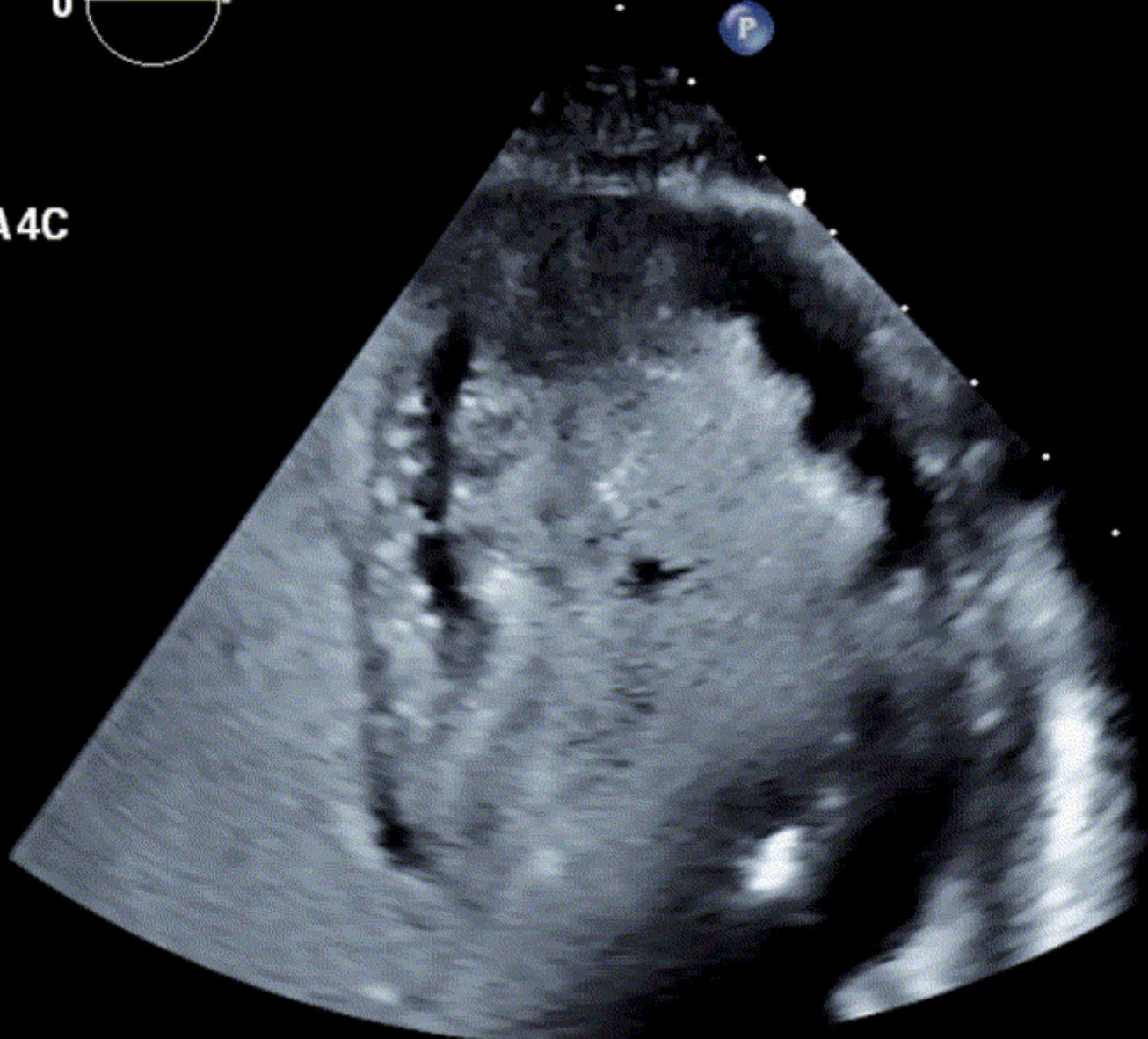
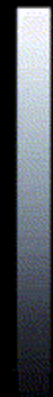
X5-1c
55Hz
10cm



2D
56%
C 52
P Med
HPGen

A4C

M4



63 bpm

KDMC PEN

X5-1c

37Hz

10cm



TIS0.0

MI 0.10 L

MI 0.48 F

M4

Contrast LVO

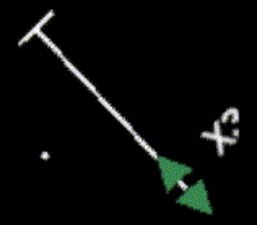
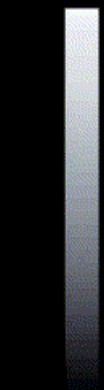
70%

C 50

P Med

CPen

A4C



61 bpm

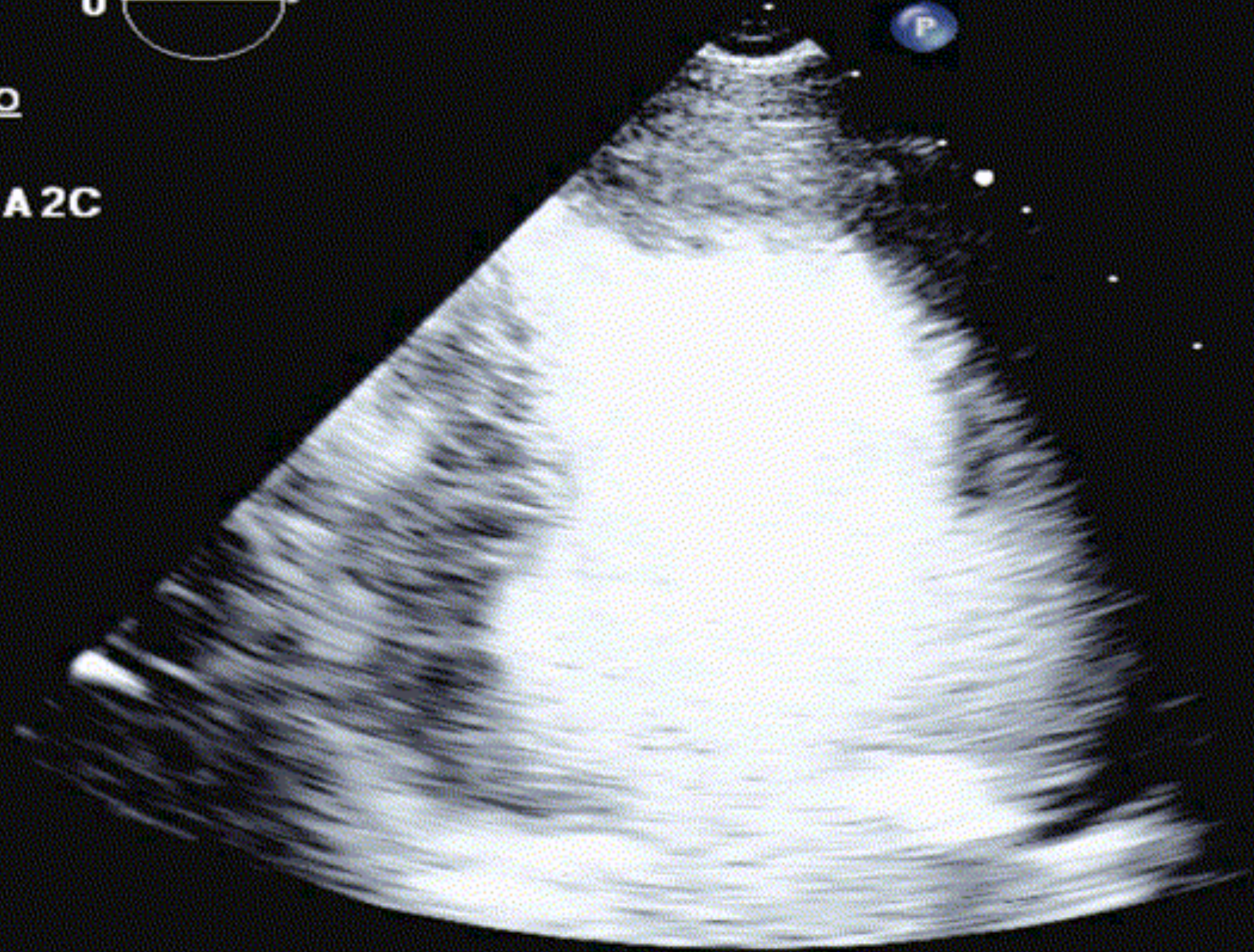
KDMC PEN
X5-1c
37Hz
10cm



TIS 0.0 MI 0.30 L
MI 0.48 F
M4

Contrast LVO
65%
C 47
P Med
CPen

A2C



G
P (()) R
1.6 1.6



61 bpm

Adult Echo

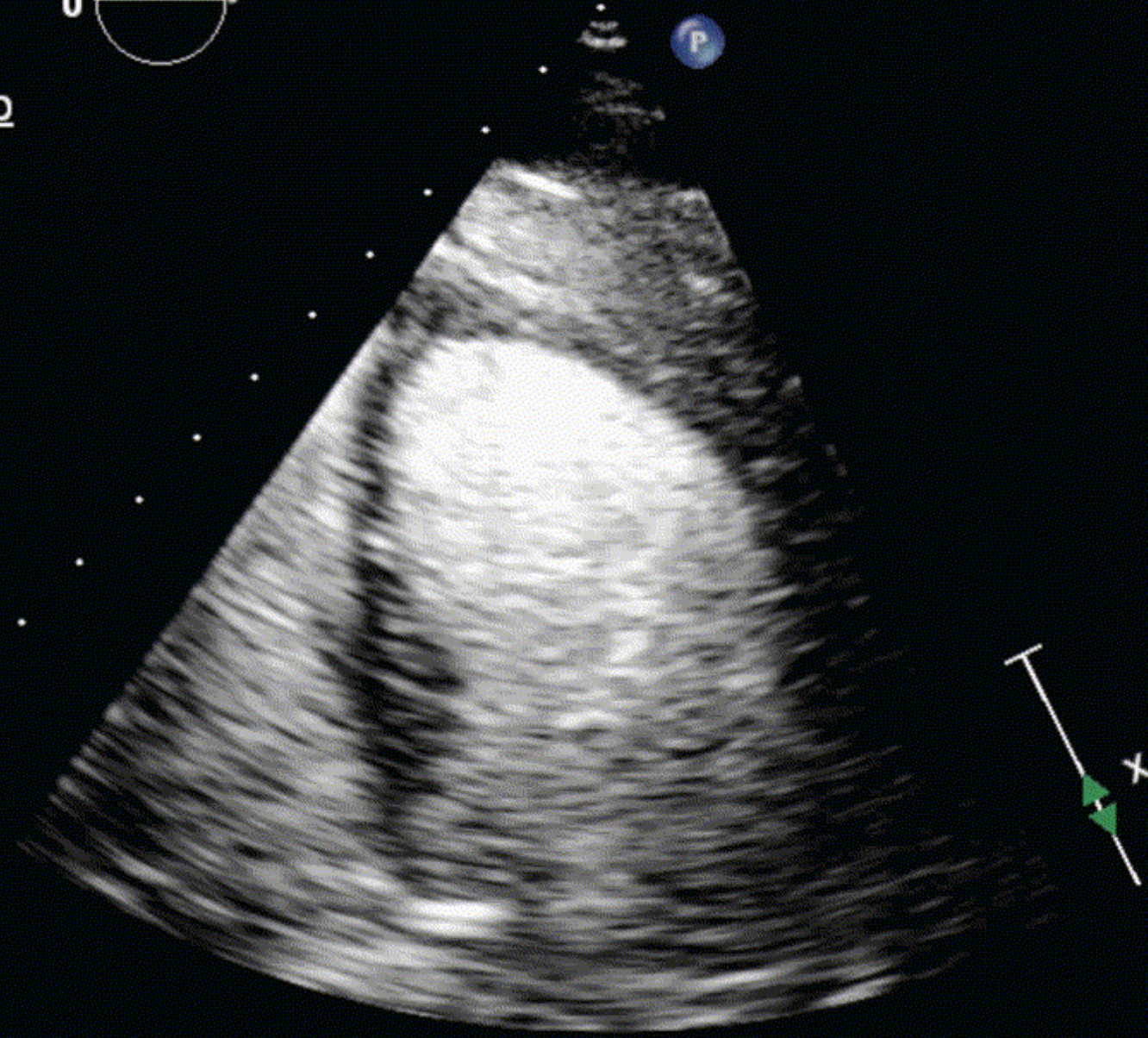
X5-1
40Hz
12cm



TISO.0 MI 0.12 L
MI 0.48 F
M4

Contrast LVO

76%
C 50
P Low
CPen



G
P(((O))) R
1.6 1.6



82 bpm

Safety

Name	Gas	Shell	Mean bubble size	Contraindication
Definity	Octafluoropropane/ perflutren	Phospholipid	1.1-3.3 μm	Polyethylene glycol (PEG) hypersensitivity
Lumason	Sulfur hexafluoride	Phospholipid	2.0-3.0 μm	Polyethylene glycol (PEG) hypersensitivity
Optison	Octafluoropropane/ perflutren	Human albumin	3.0-4.5 μm	Albumin or blood product allergy

Safety

- Excellent safety profiles
 - Severe reactions ~ 1 in 10,000
- Shunts no longer a contraindication
- Many former warnings have been removed due to years of data
- Reactions
 - Data shows rare risk of anaphylactic reaction
 - Most common reaction is back pain or headache
 - Half-life is ~1-2 minutes
 - High MI ultrasound can be used to destroy bubbles

Patient questions/remarks

- "Is it radioactive?"
- "Is it like that MRI/CT stuff?"
- "Does it have iodine in it? I'm allergic to iodine."
- "No, really. If it has iodine in it, you'll have to get the crash cart."
- "Does it make your heart beat fast? I don't like that stress test stuff."
- "I have bad kidneys. I can't have things that are hard on my kidneys."
- "Will this make me feel hot/like I'm peeing?"
- "Just do whatever. You know what you're doing."

Answers

- "No, it is not radioactive."
- "No, it is very different from what is used during MRI/CT exams."
- "This does not contain iodine. There is no need to worry."
- "Yes, I am absolutely sure this does not contain any iodine."
- "This won't affect your heart rate. This is a very different medication."
- "Luckily, this medicine is not damaging to the kidneys, so there is no need for you or your kidney doctor to worry."
- "No, it won't make you feel that way, so if you feel that you are peeing, it is almost certainly because you are."
- "Thank you. I would like to think I know what I'm doing too."

FDA approved uses

- Opacification of the left ventricle
- Delineation of the left ventricular endocardial border
- Advisable to use contrast when two or more contiguous wall segments are not visualized

Adult Echo

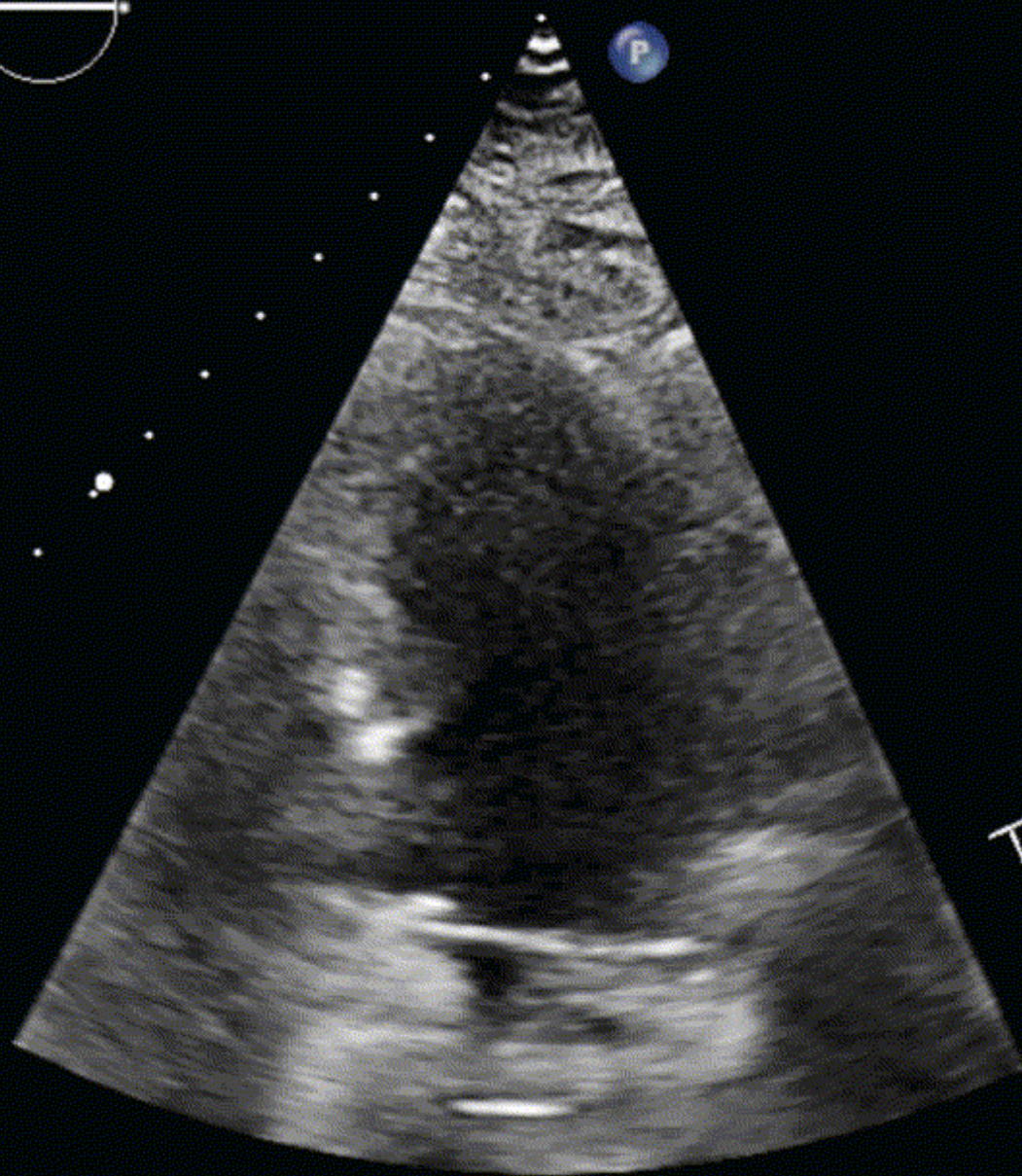
X5-1
80Hz
14cm



TISO.4 MI 1.2

M3

2D
64%
C 50
P Low
HPen



85 bpm

Adult Echo

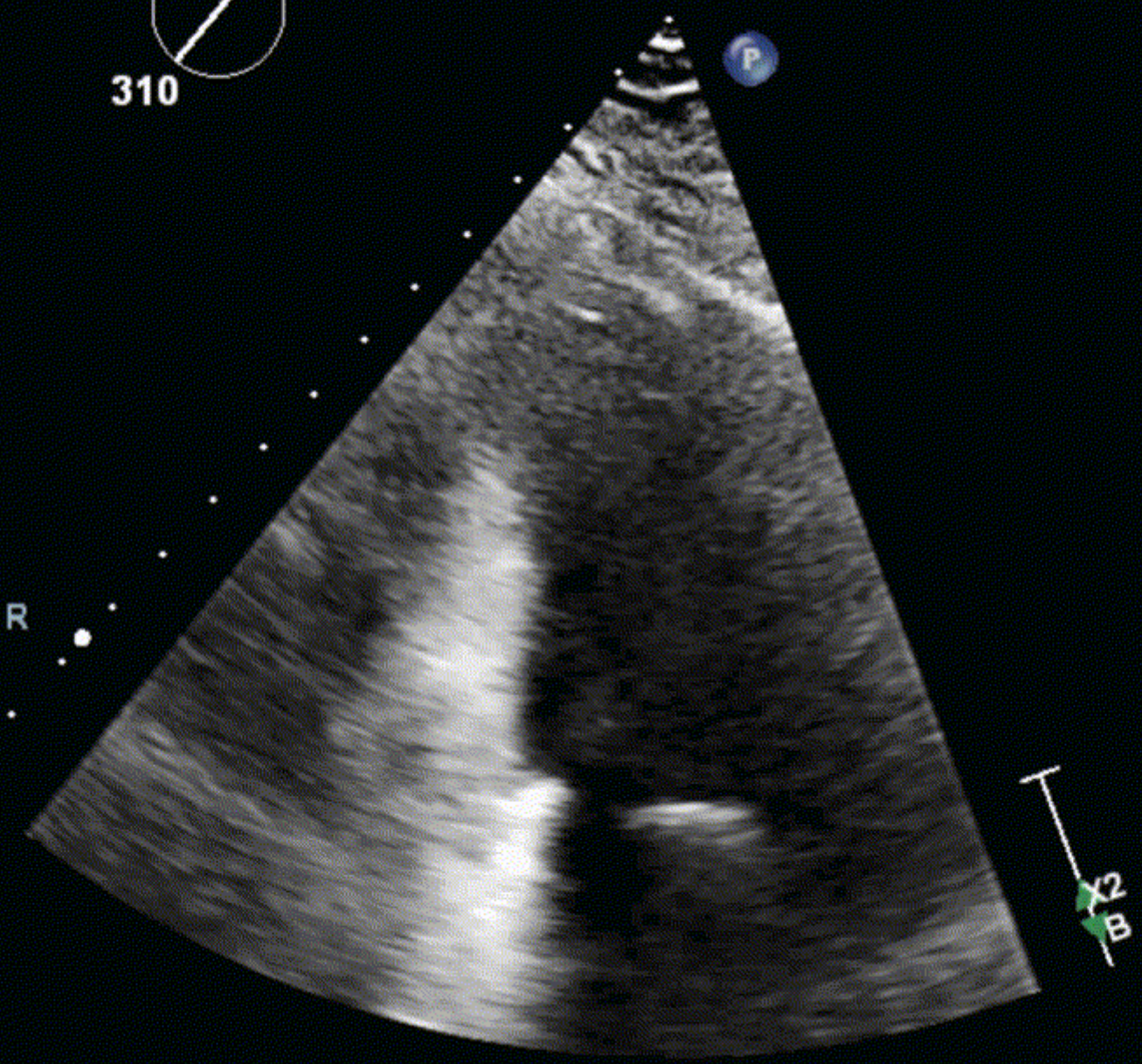
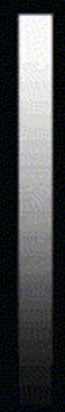
X5-1
71Hz
14cm

TISO.4 MI 1.2



2D
64%
C 50
P Low
HPen

M3



82 bpm

Adult Echo

X5-1
40Hz
12cm



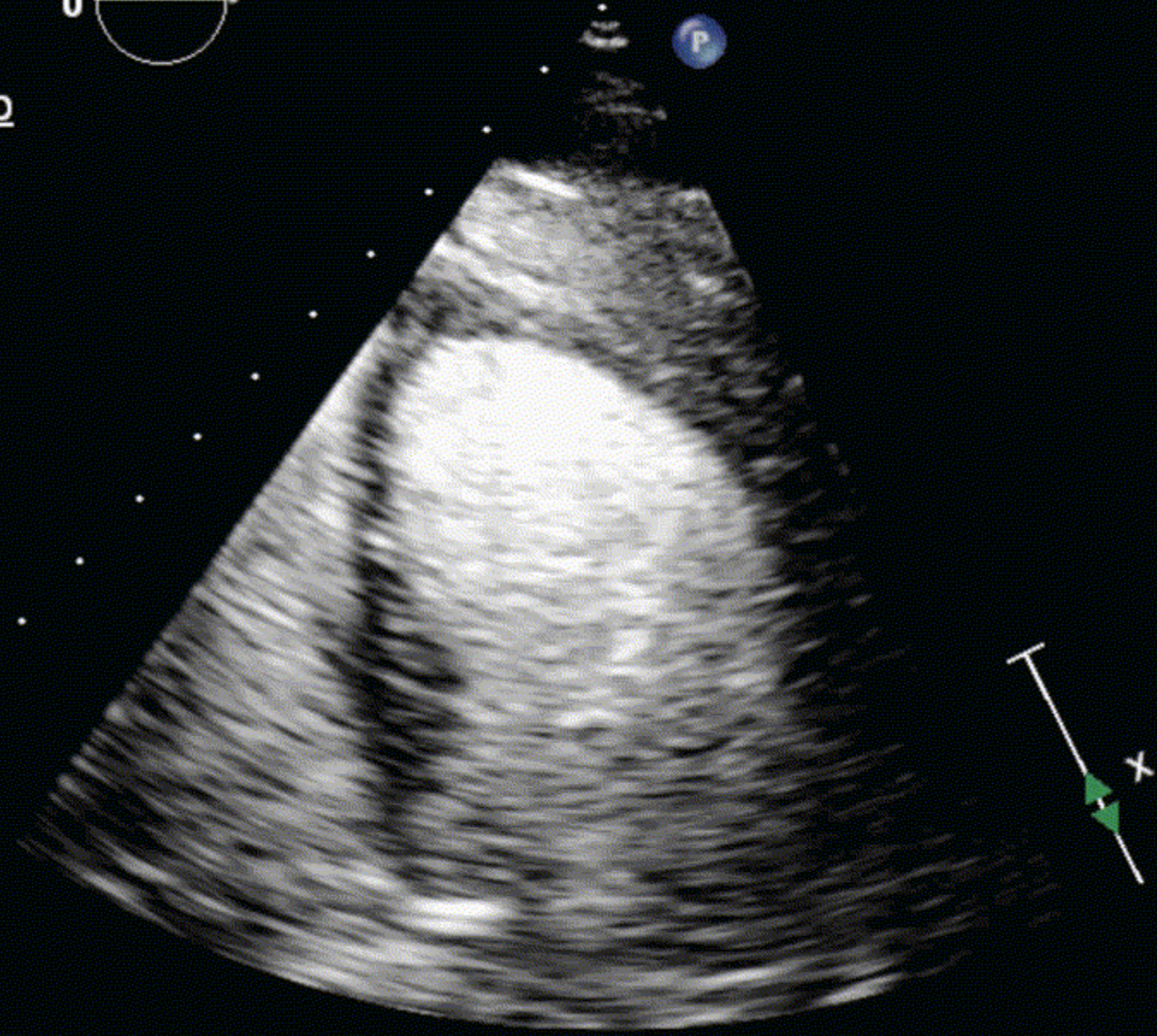
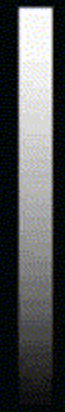
TISO.0 MI 0.12 L

MI 0.48 F

M4

Contrast LVO

76%
C 50
P Low
CPen



G
P(((O))) R
1.6 1.6



82 bpm

Adult Echo

X5-1
41Hz
12cm



TISO.0 MI 0.12 L

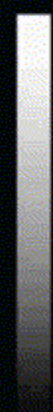
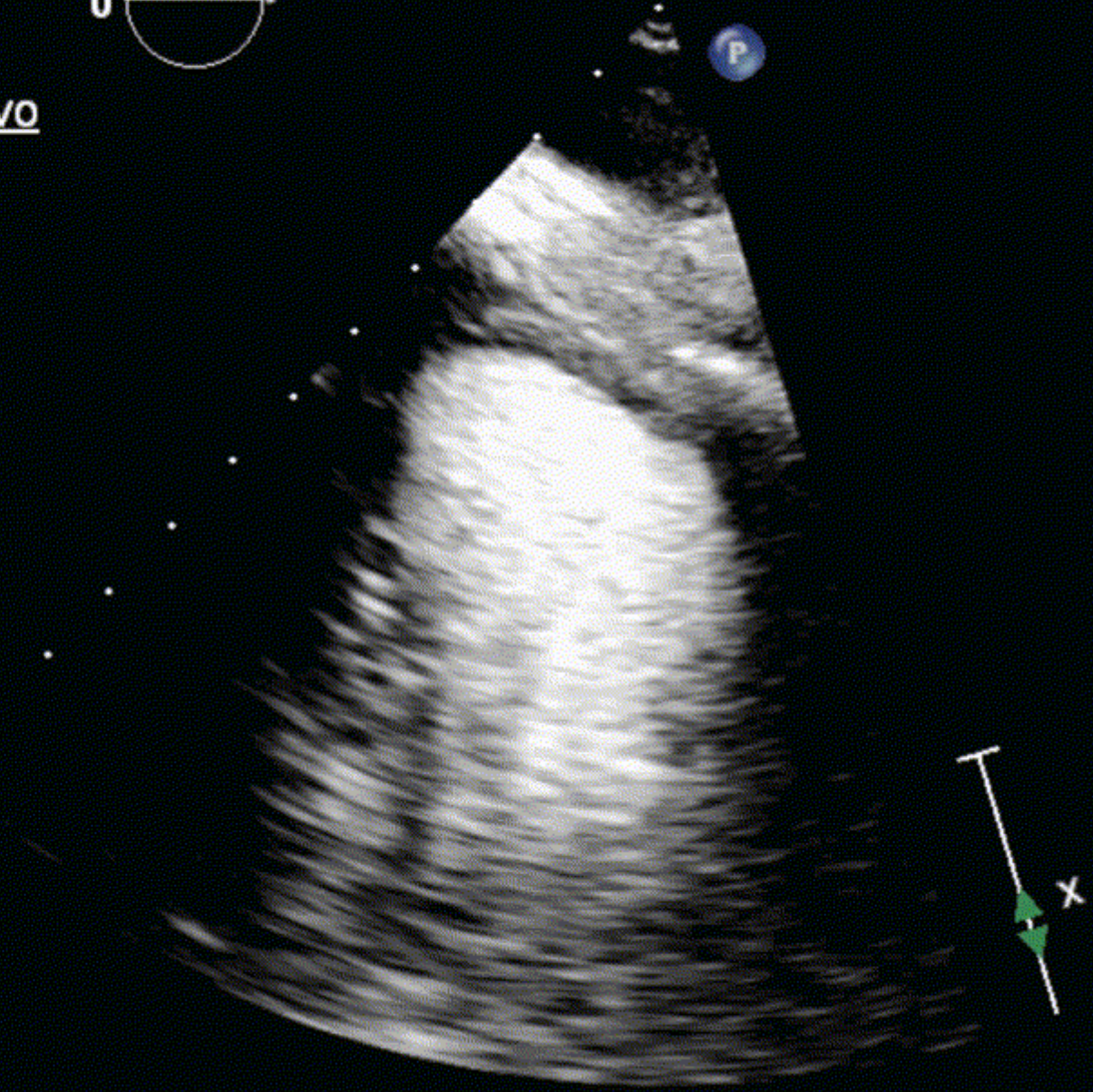
MI 0.48 F

M4

Contrast LVO

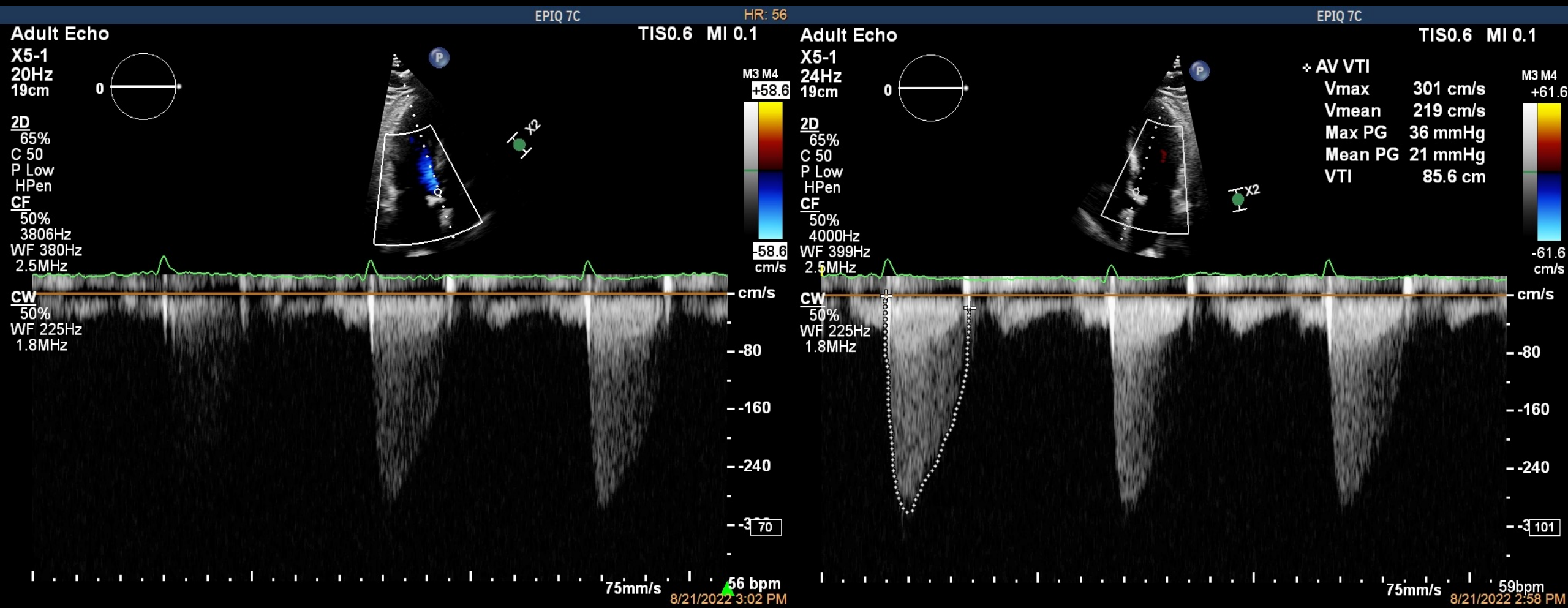
76%
C 50
P Low
CPen

G
P(((O))) R
1.6 1.6



82 bpm

Enhance doppler signals

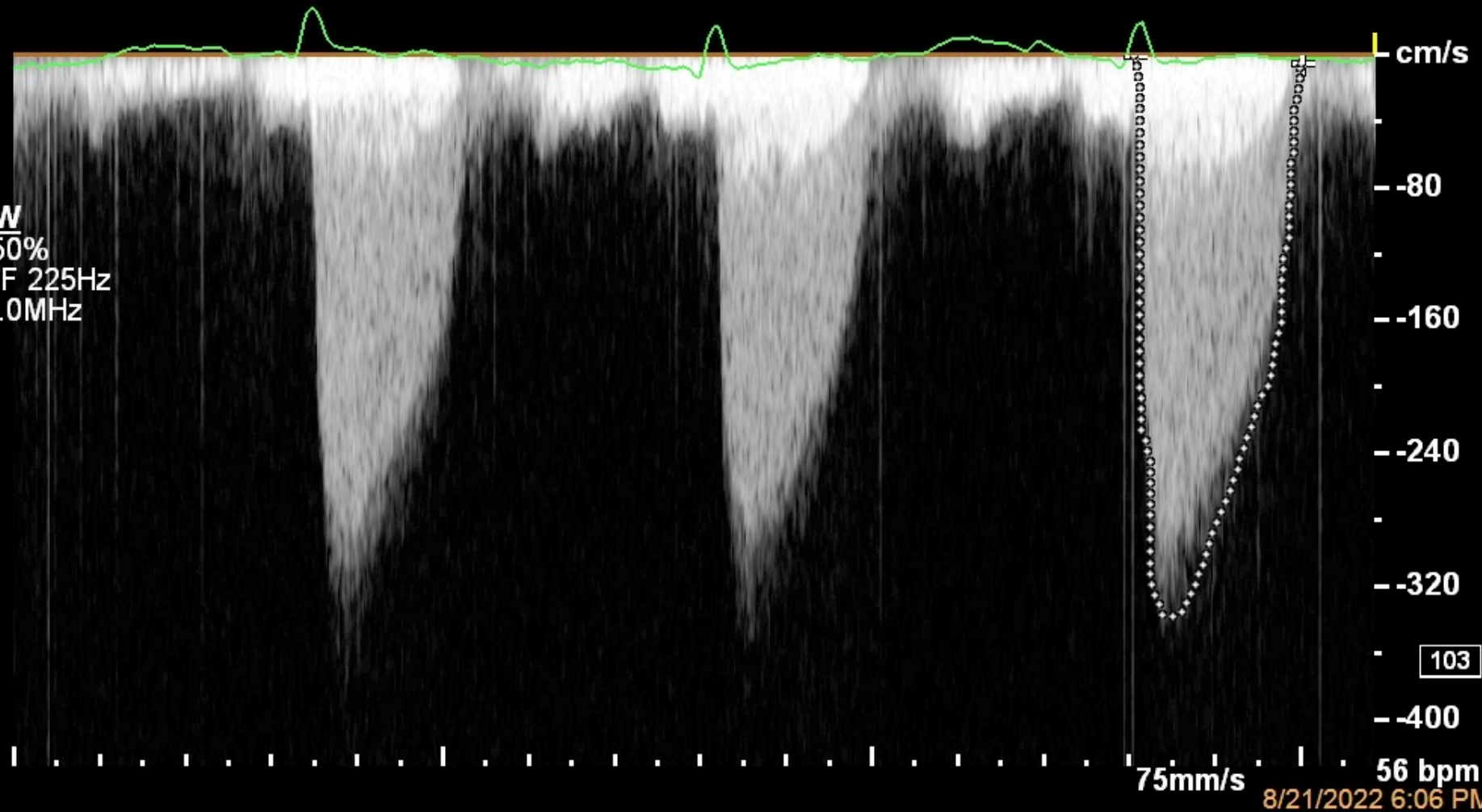


Adult Echo
D2cwc

TIS0.7 MI 0.1

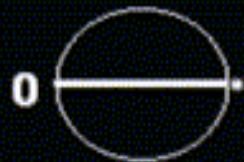
✦ AV VTI
Vmax 336 cm/s
Vmean 235 cm/s
Max PG 45 mmHg
Mean PG 26 mmHg
VTI 92.5 cm

CW
50%
WF 225Hz
2.0MHz



Adult Echo

X5-1
80Hz
17cm



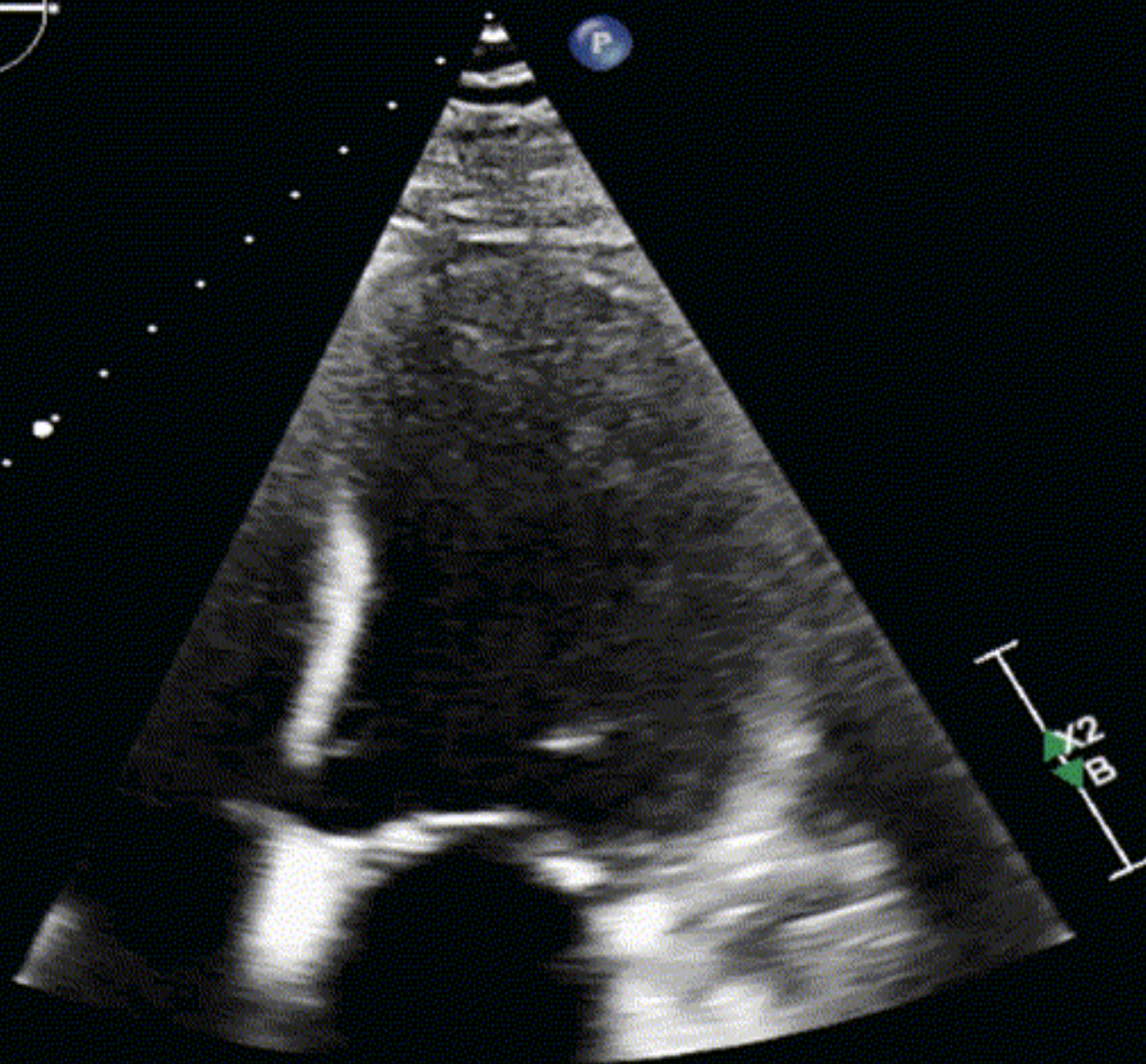
2D

64%
C 50
P Low
HPen

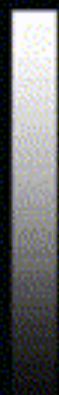
M3



Increase
sensitivity
of
thrombus
detection



X2
B



Adult Echo
X5-1
63Hz
18cm



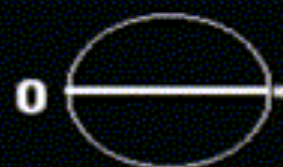
2D
64%
C 50
P Low
HPen

A2C



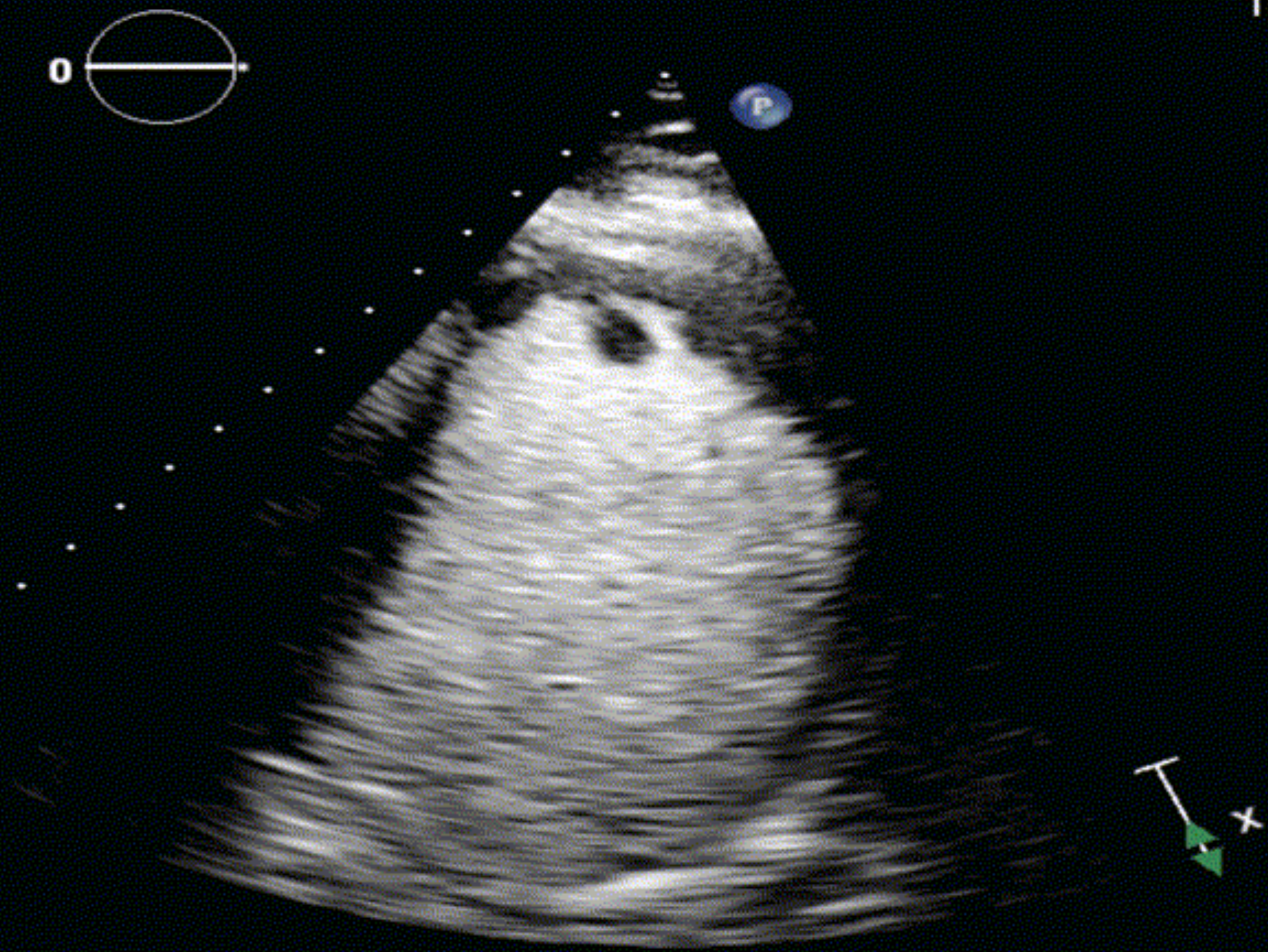
Adult Echo
X5-1
34Hz
16cm

TISO.0 MI 0.12 L
MI 0.48 F
M4



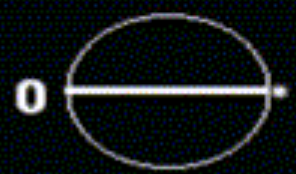
Contrast LVO
77%
C 50
P Low
CPen

G
P ((O)) R
1.6 1.6



76 bpm

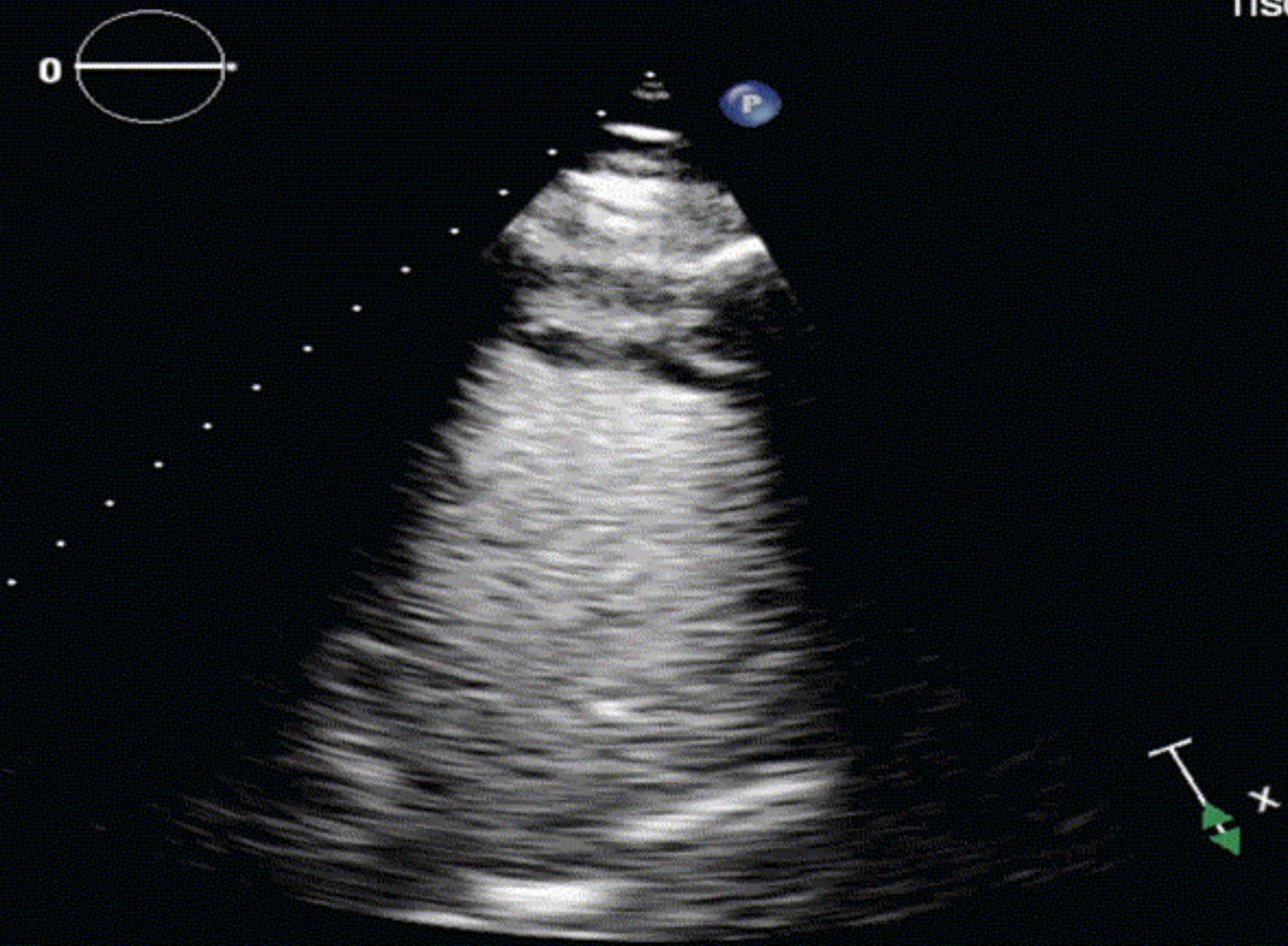
Adult Echo
X5-1
33Hz
16cm



TISO.0 MI 0.12 L
MI 0.48 F
M4

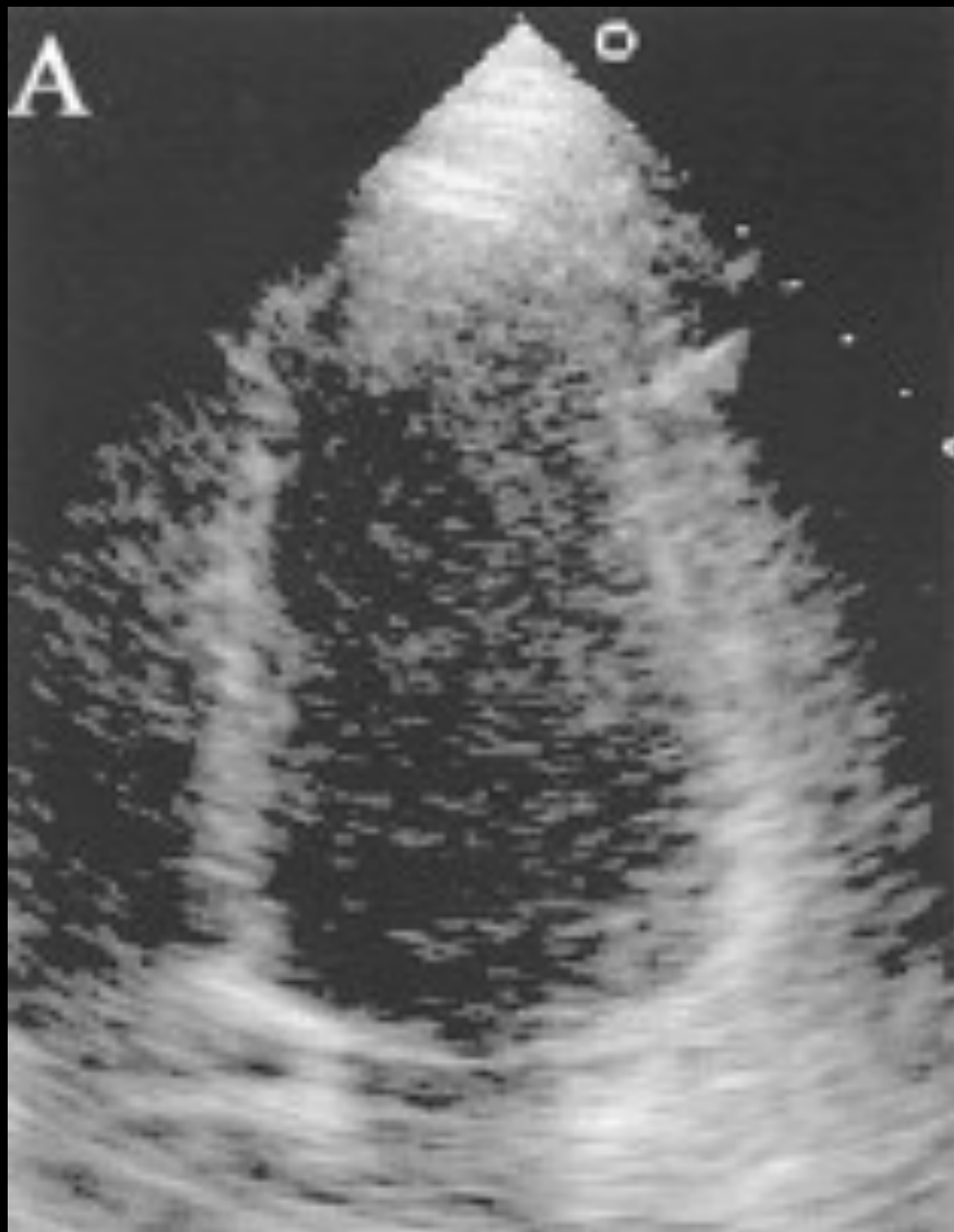
Contrast LVO
77%
C 50
P Low
CPen

G
P ((O)) R
1.6 1.6



77 bpm

Better assess
hypertrophy



ECHO/RAH1

X5-1
50Hz
20cm

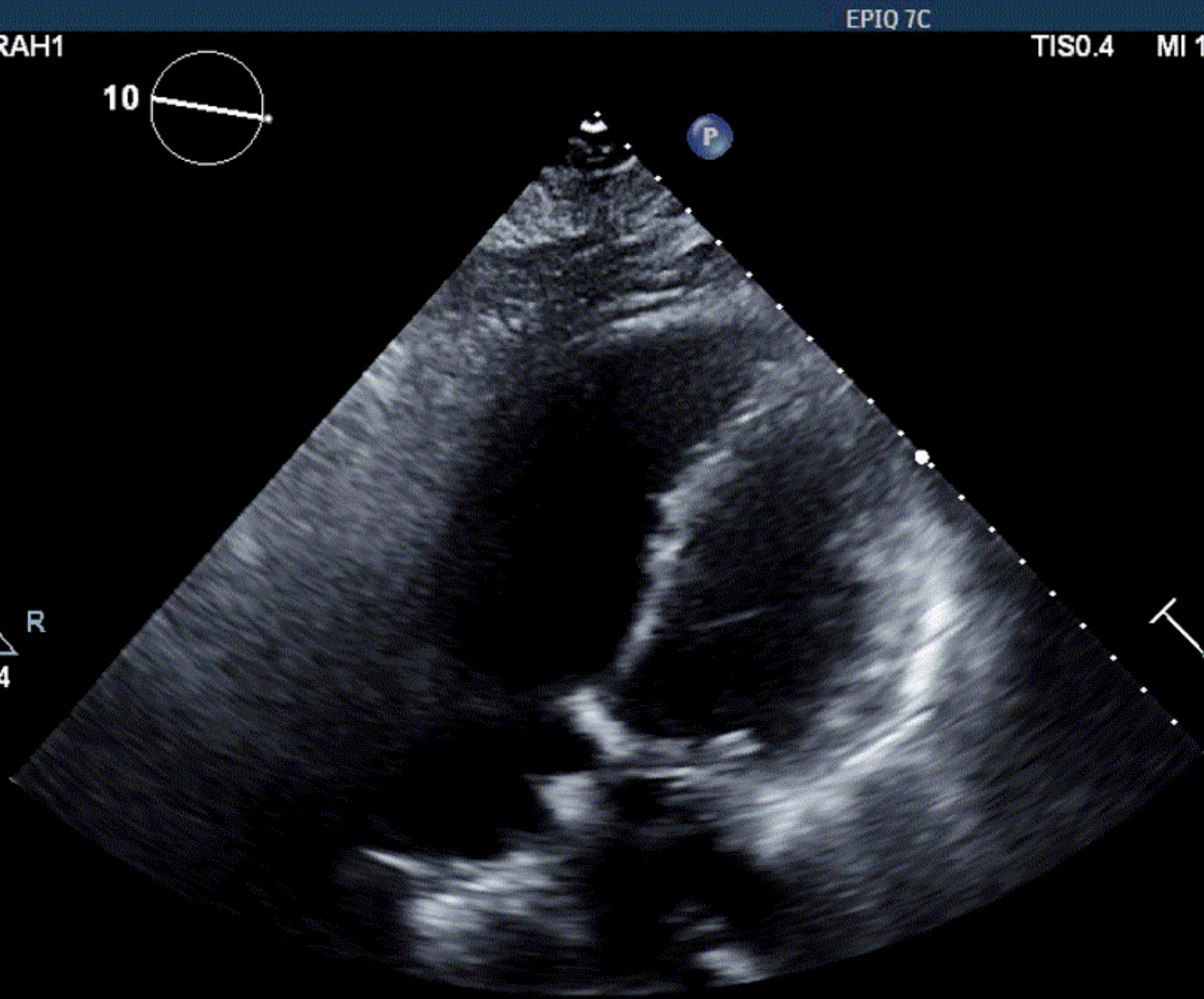


2D
68%
C 49
P Low
HPen

M1



Enhance the right heart



ECHO/RAH1

X5-1

16Hz

24cm

Z 1.1

Contrast LVO

78%

C 50

P Low

CPen

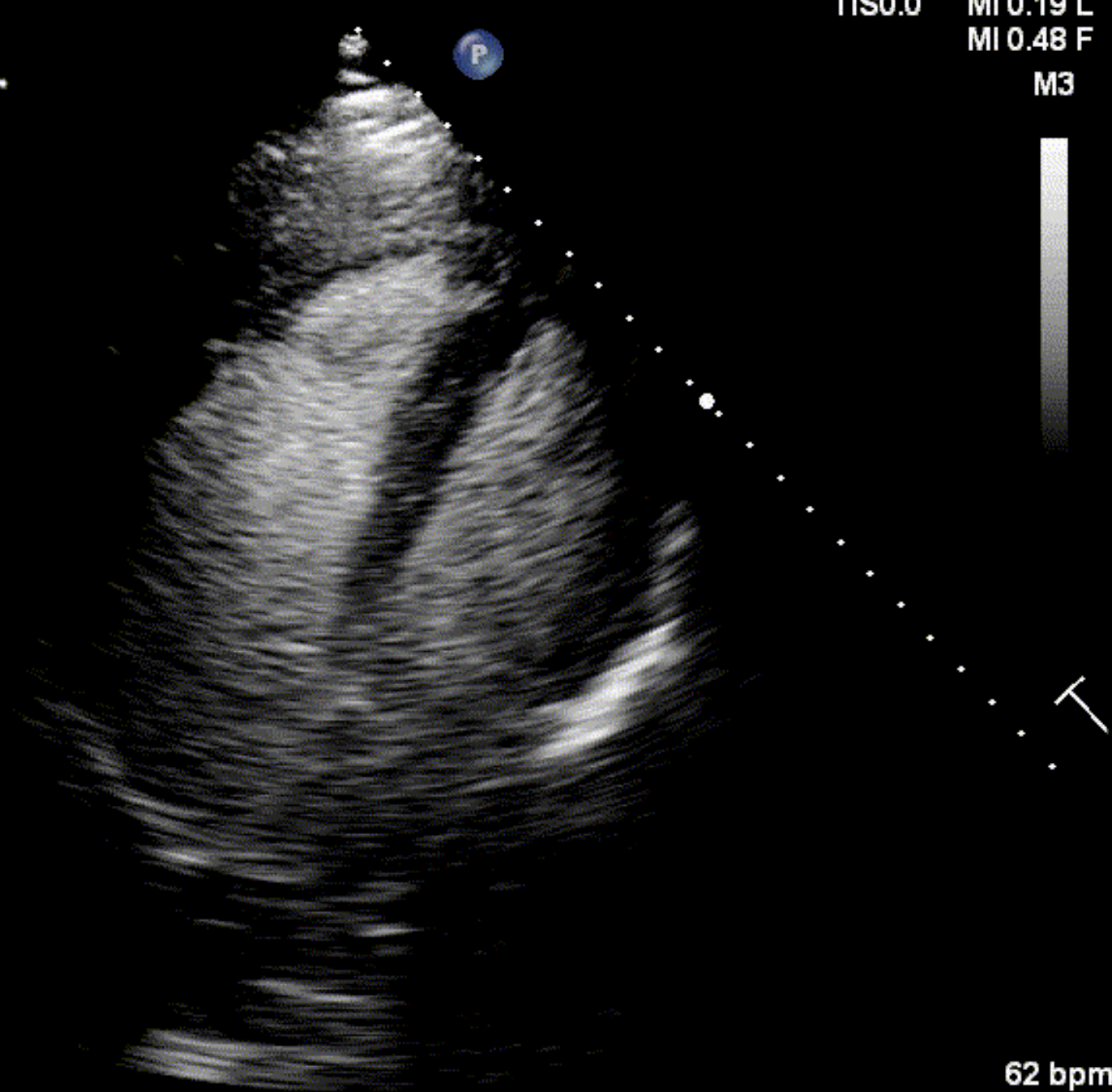
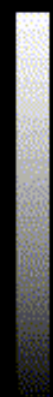


TISO.0

MI 0.19 L

MI 0.48 F

M3



JPEG

Additional uses

- Detect noncompaction
- Assess myocardial perfusion
- Detect vascularity/lack of vascularity in cardiac tumors
- Identify nature of perforation in cath lab

Conclusions

- Years of safety data to provide confidence
- Decrease number of unreadable studies
- Limit need for additional tests
- Increase sensitivity for various findings
- Flexible in application

References

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