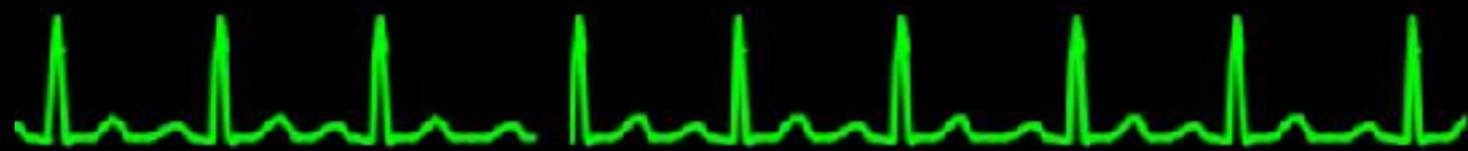


Emergency Ultrasound in Hypotension

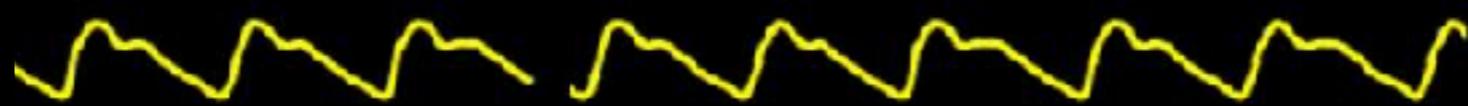
Piyachat Sasipattarapong, MD
Emergency Medicine, Khon Kaen Hospital

Emergency Ultrasound Fellowship
University of Southern California



132

HR



92%

Sat



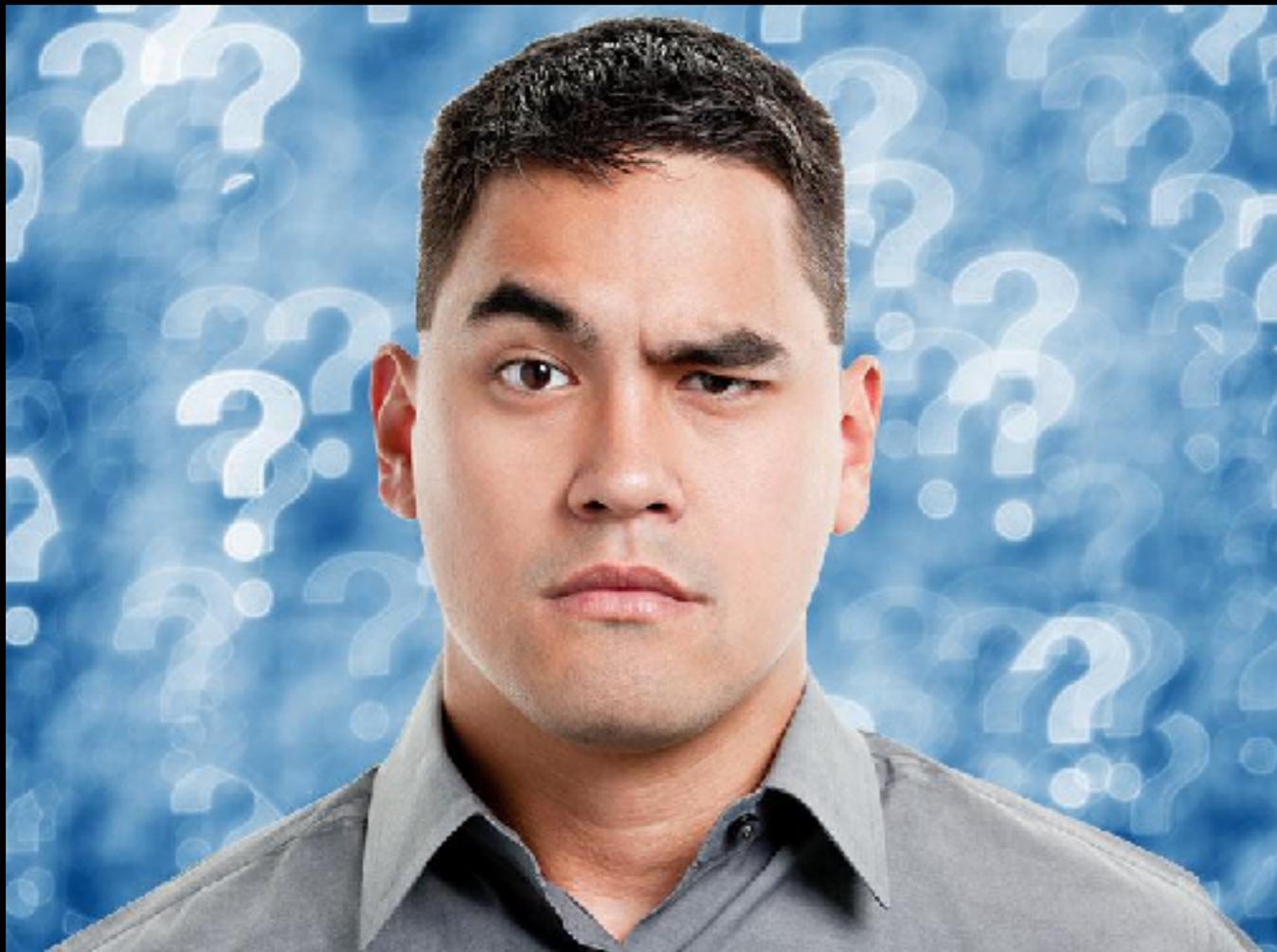
84/43

BP

SHOCK

DDx?

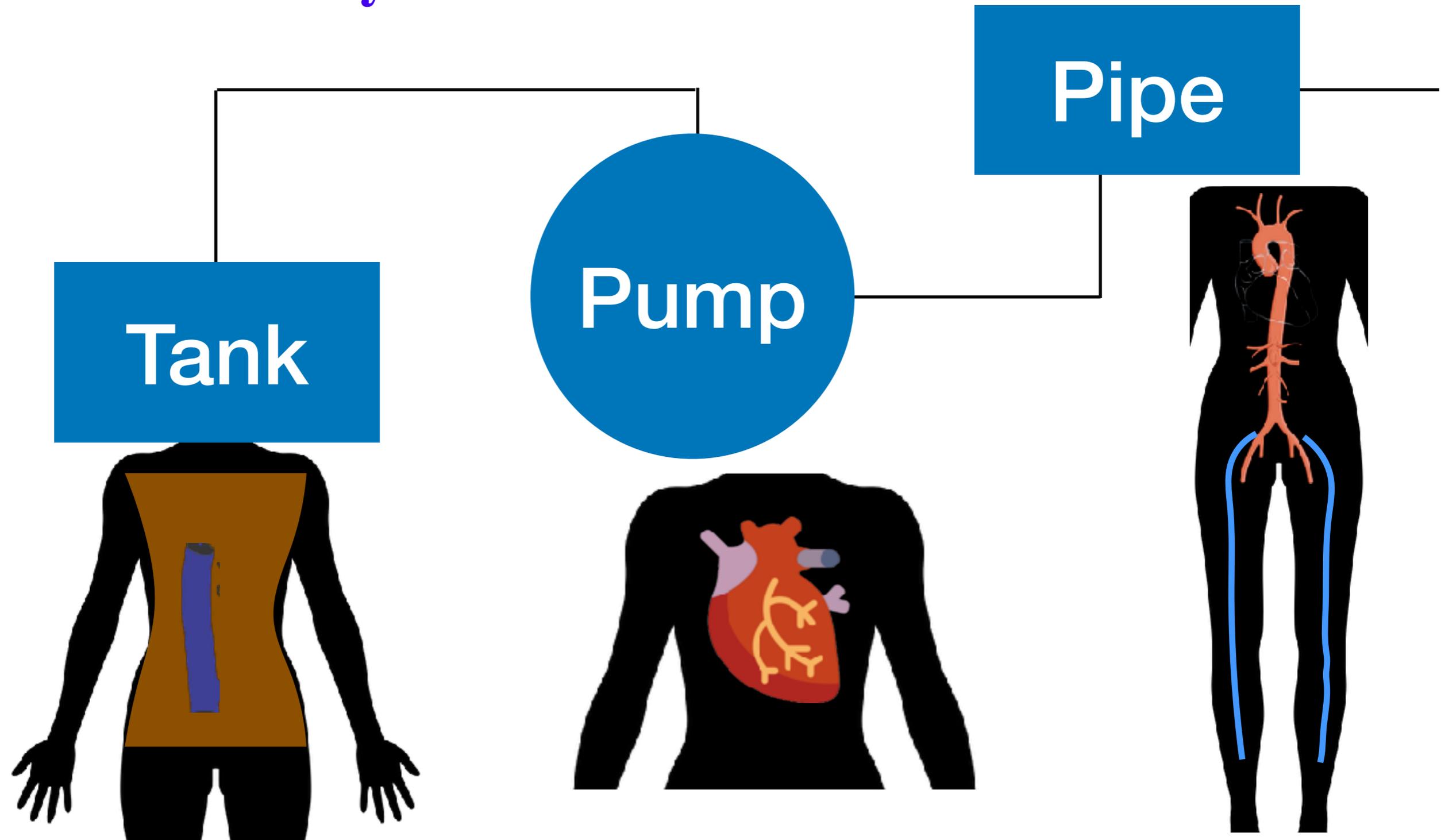
- **Hypovolemic?** Ruptured AAA? Aortic dissection? Intraabdominal bleeding? Intrathoracic bleeding?
- **Cardiogenic?** MI?
- **Obstructive?** Cardiac tamponade? Pulmonary embolism? PTX?
- **Distributive?** Sepsis? Empyema? Peritonitis?



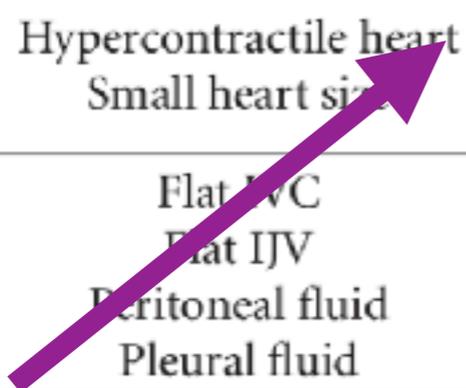


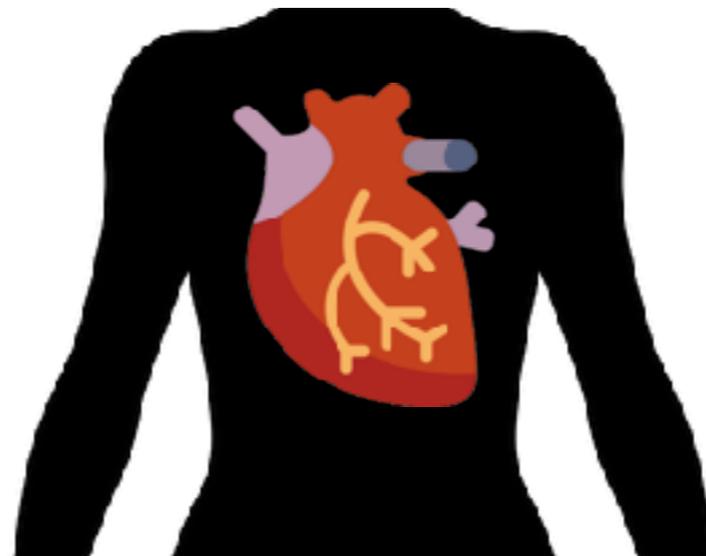
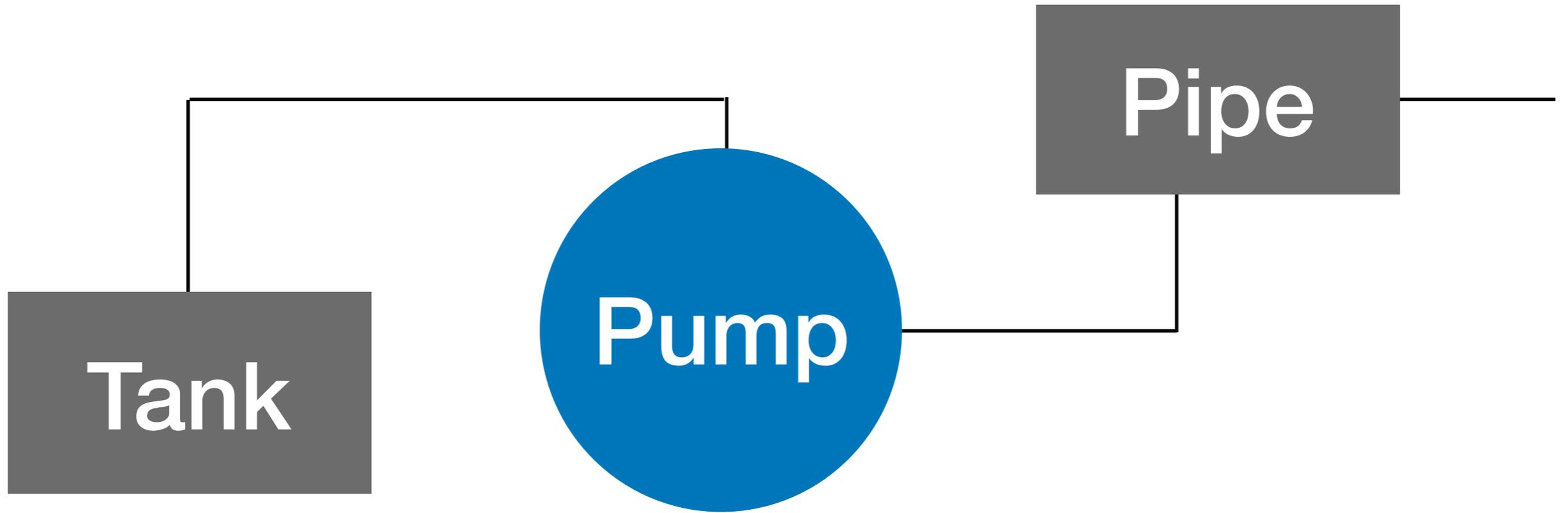
RUSH Exam

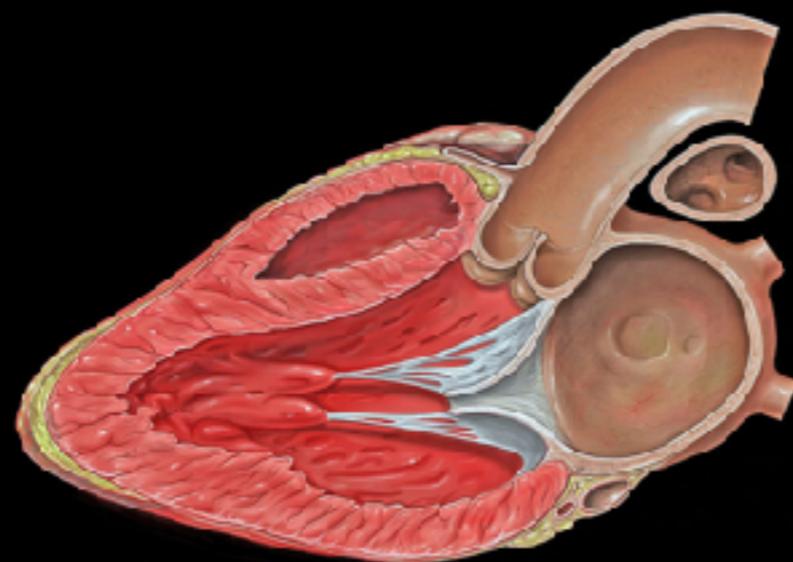
Rapid Ultrasound in SHock in the Evaluation of the Critically Ill



RUSH exam	Hypovolemic shock	Cardiogenic shock	Obstructive shock	Distributive shock
Pump	Hypercontractile heart Small heart size	Hypocontractile heart Dilated heart size	Pericardial effusion, RV strain Hypercontractile heart	Hypercontractile heart (early sepsis) Hypocontractile heart (late sepsis)
Tank	Flat IVC Flat IJV Peritoneal fluid Pleural fluid	Distended IVC Distended IJV Lung rockets Pleural effusions, ascites	Distended IVC Distended IJV Absent lung sliding (PTX)	Normal/small IVC Normal/small IJV Pleural fluid (empyema) Peritoneal fluid (peritonitis)
Pipes	AAA Aortic dissection	Normal	DVT	Normal



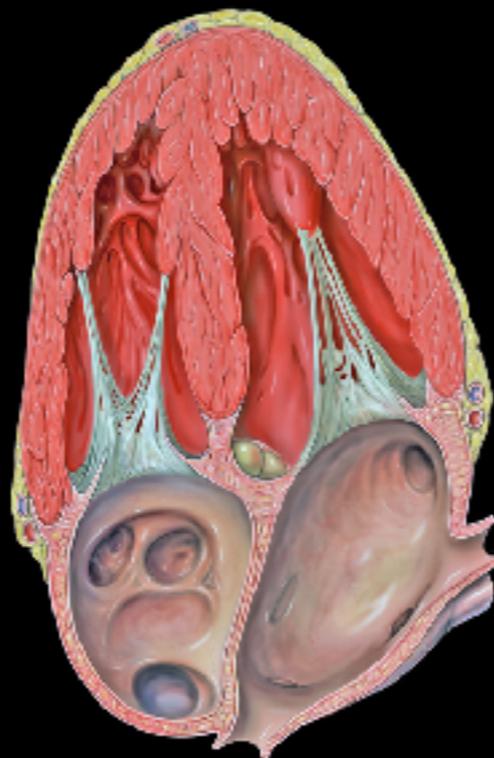




Parasternal Long Axis



Parasternal Short Axis

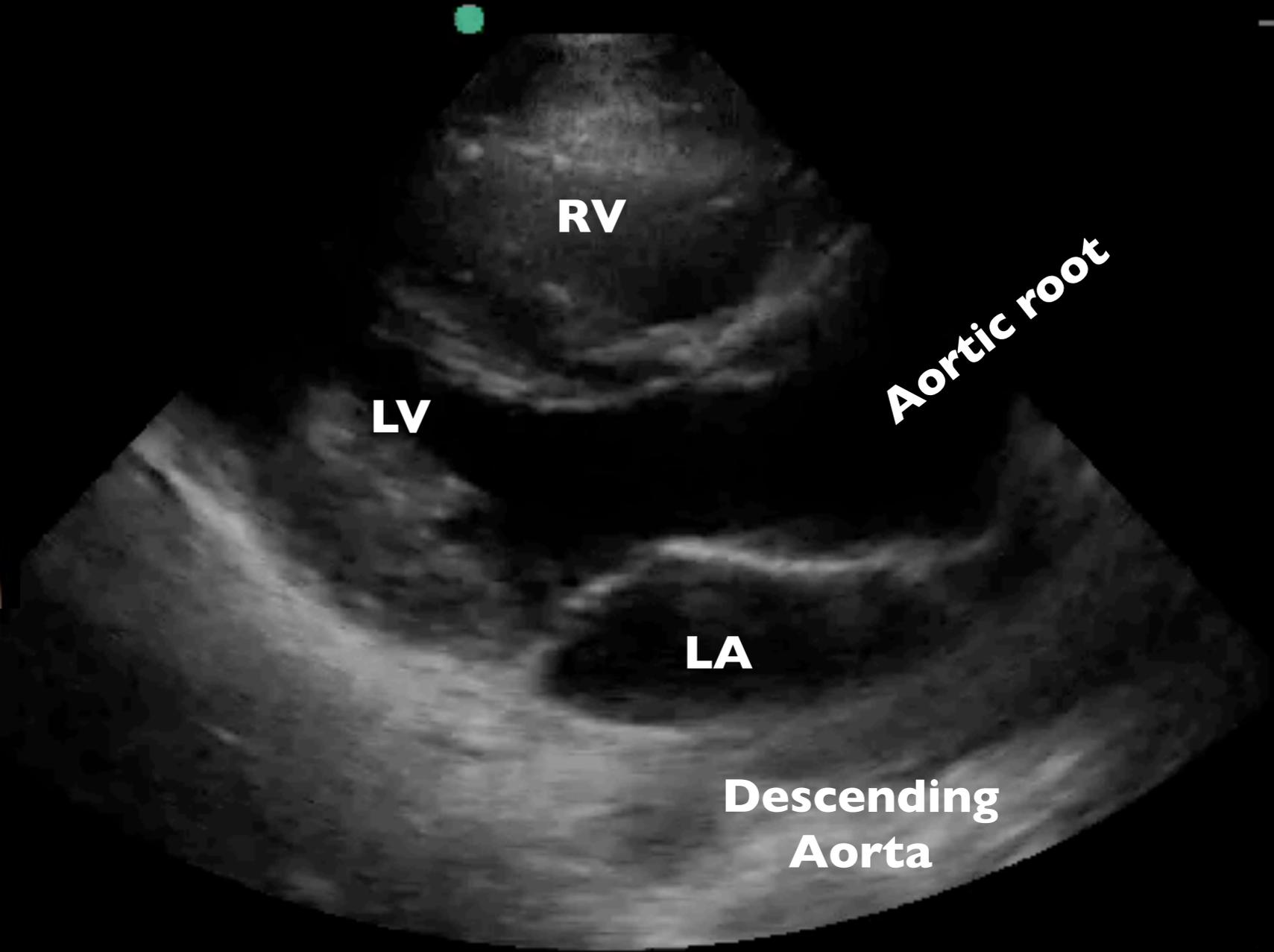


Apical 4 Chamber

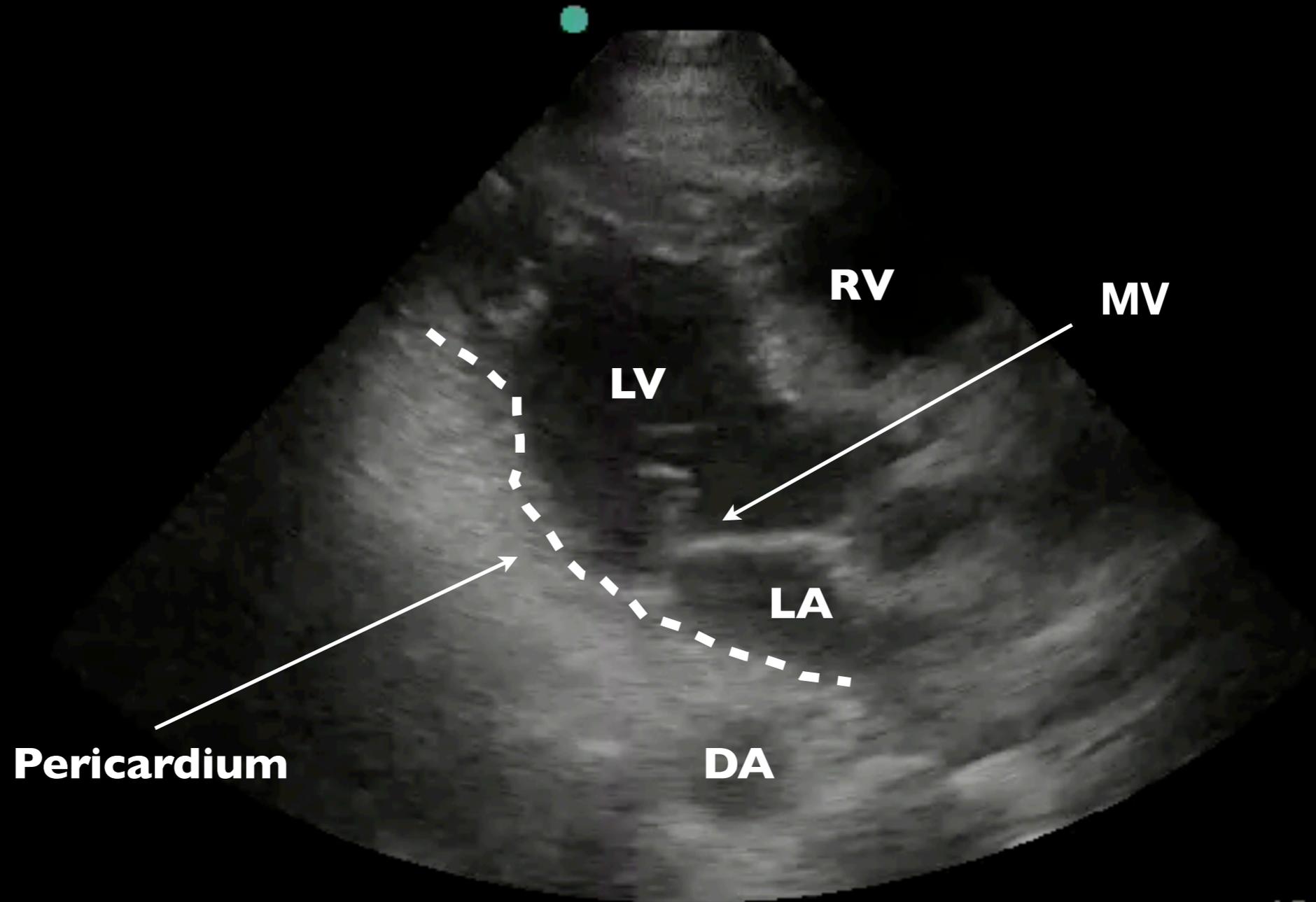


Subxiphoid

Parasternal Long Axis



Parasternal Long Axis



16



Gen



0



Sector



MB Off

THI

On

Page 1/3



Parasternal Long Axis



Parasternal Short Axis



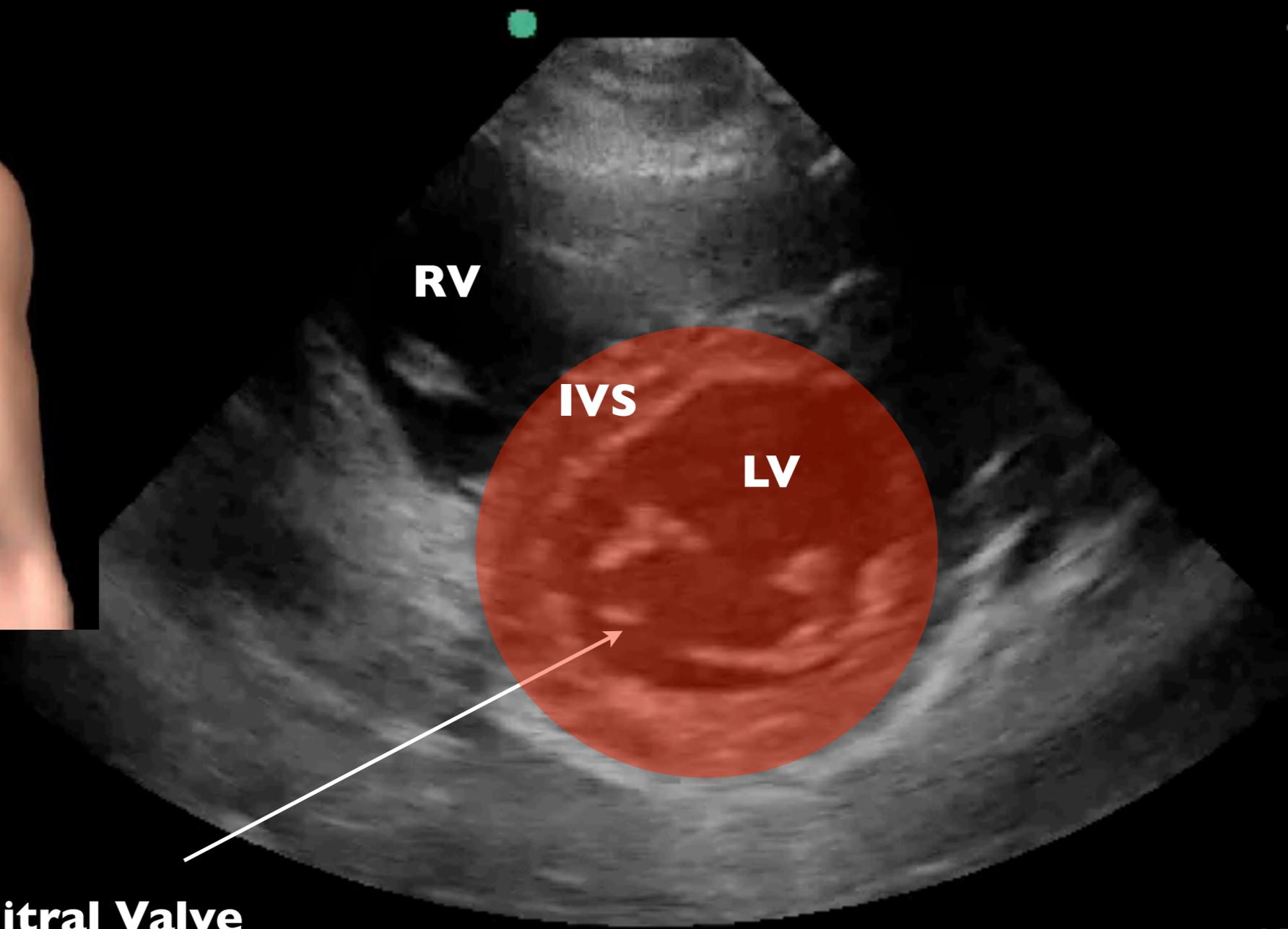
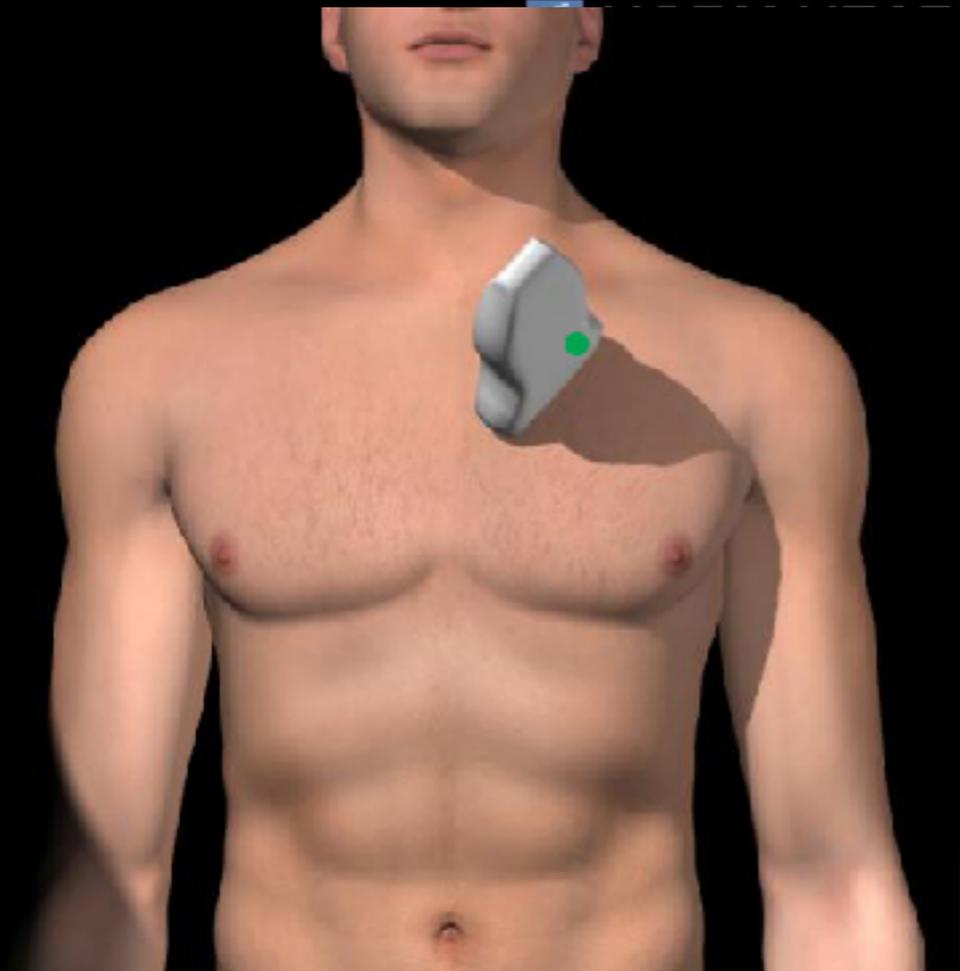
Apical 4 Chamber



Subxiphoid

Parasternal Short Axis

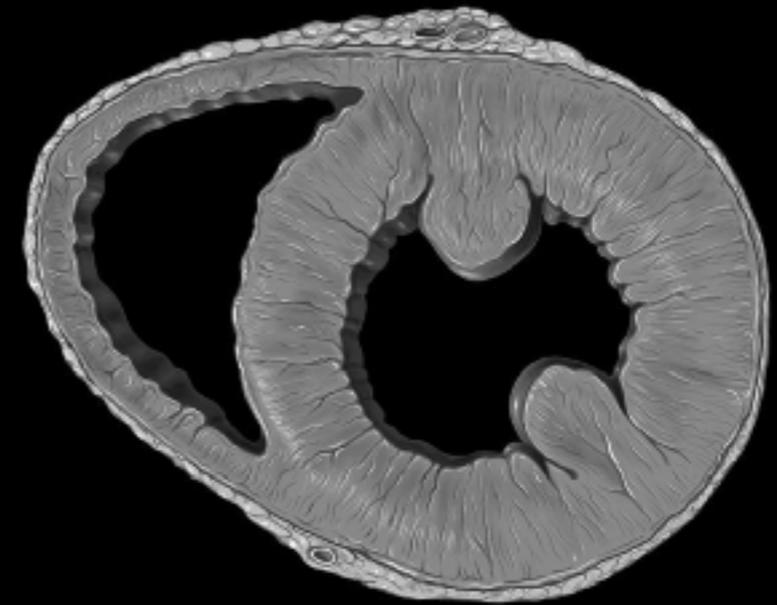
2011Oct25



Mitral Valve



Parasternal Long Axis



Parasternal Short Axis

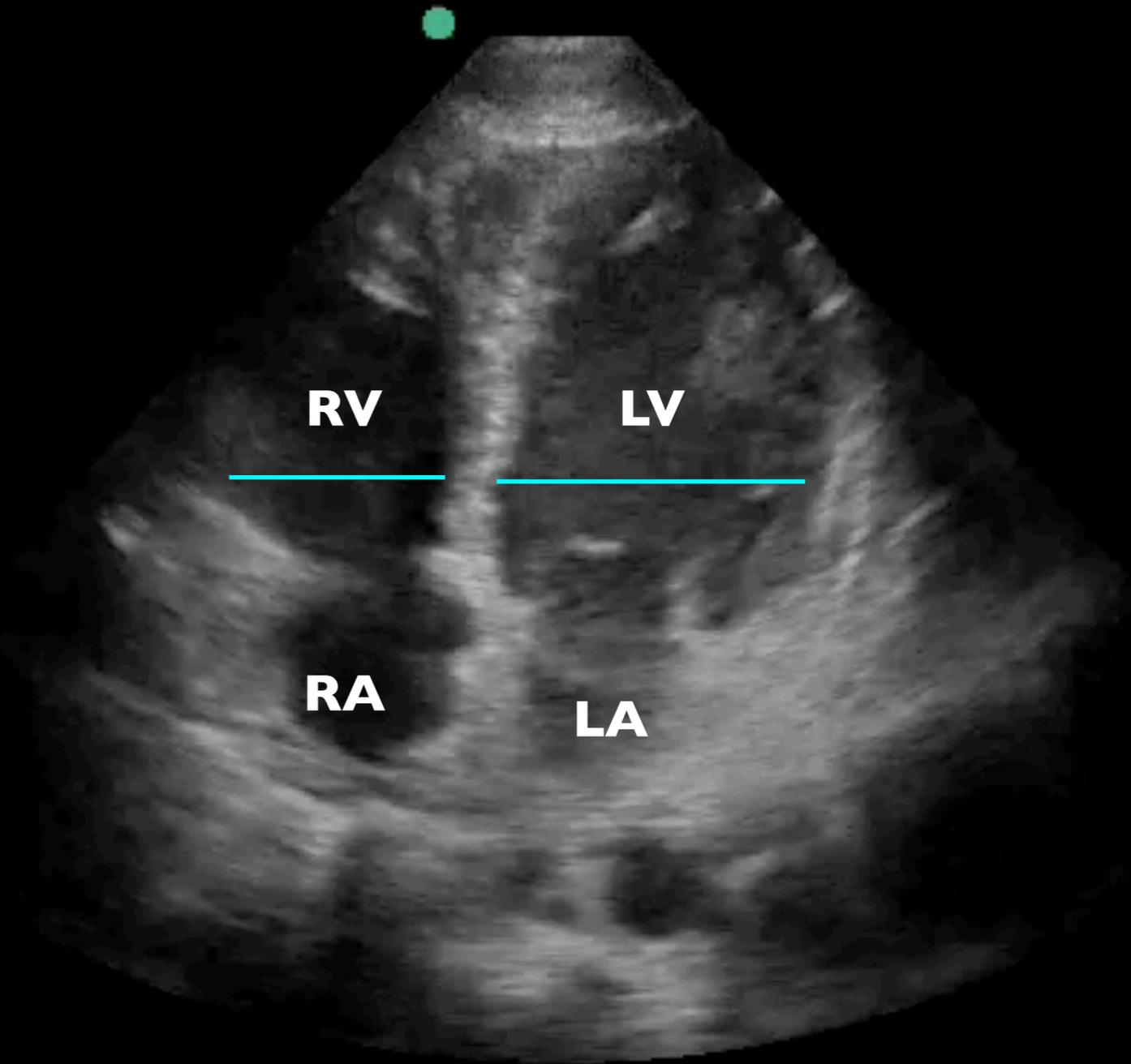


Apical 4 Chamber



Subxiphoid

Apical View



RV : LV ratio 0.6:1



Parasternal Long Axis



Parasternal Short Axis



Apical 4 Chamber

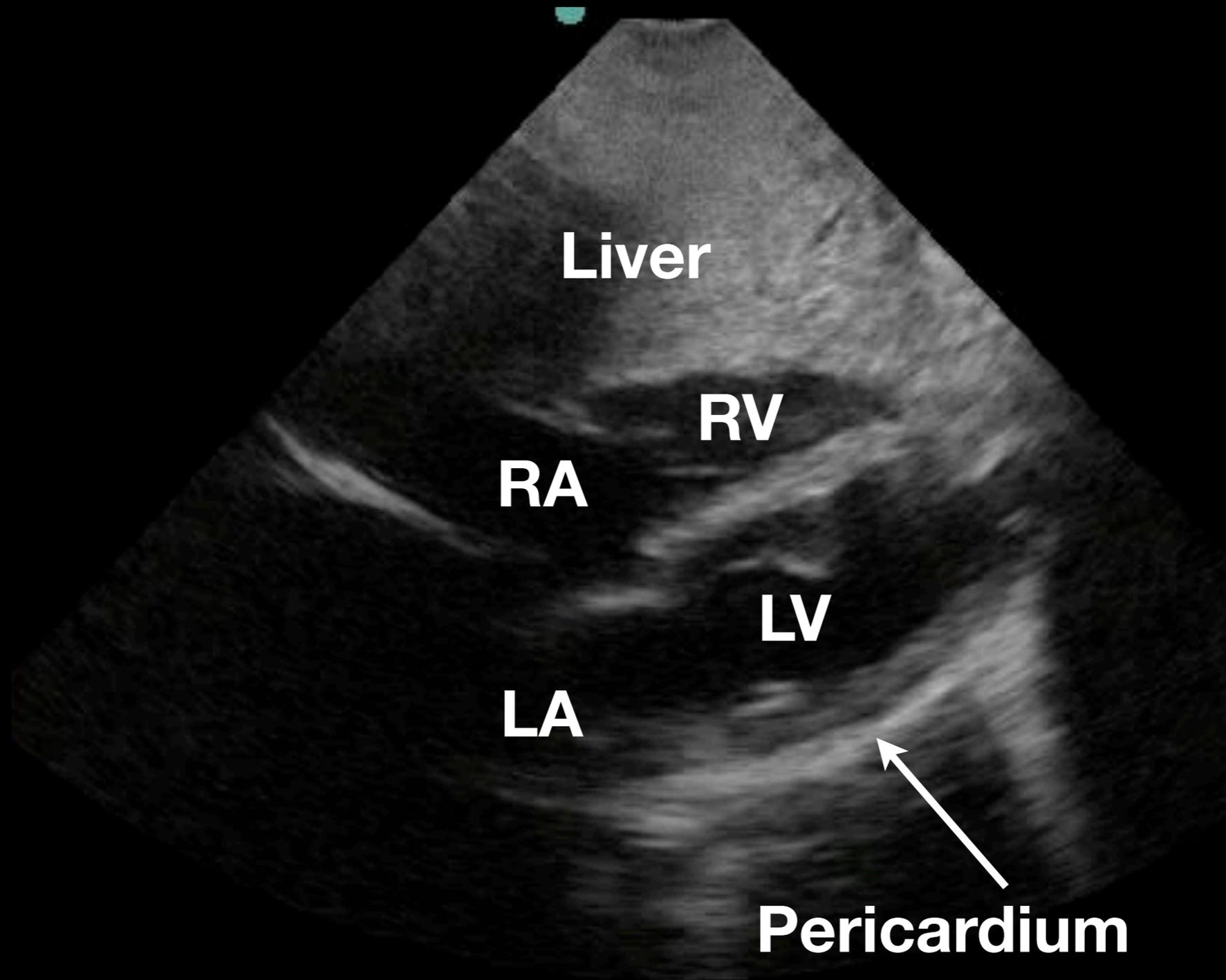


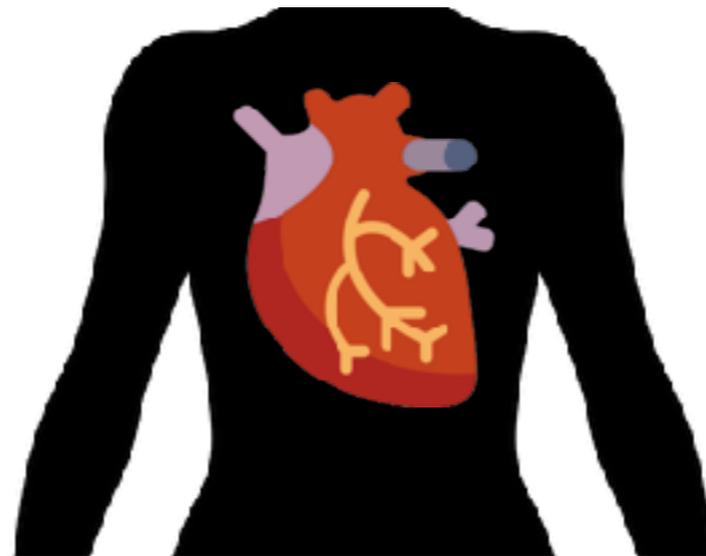
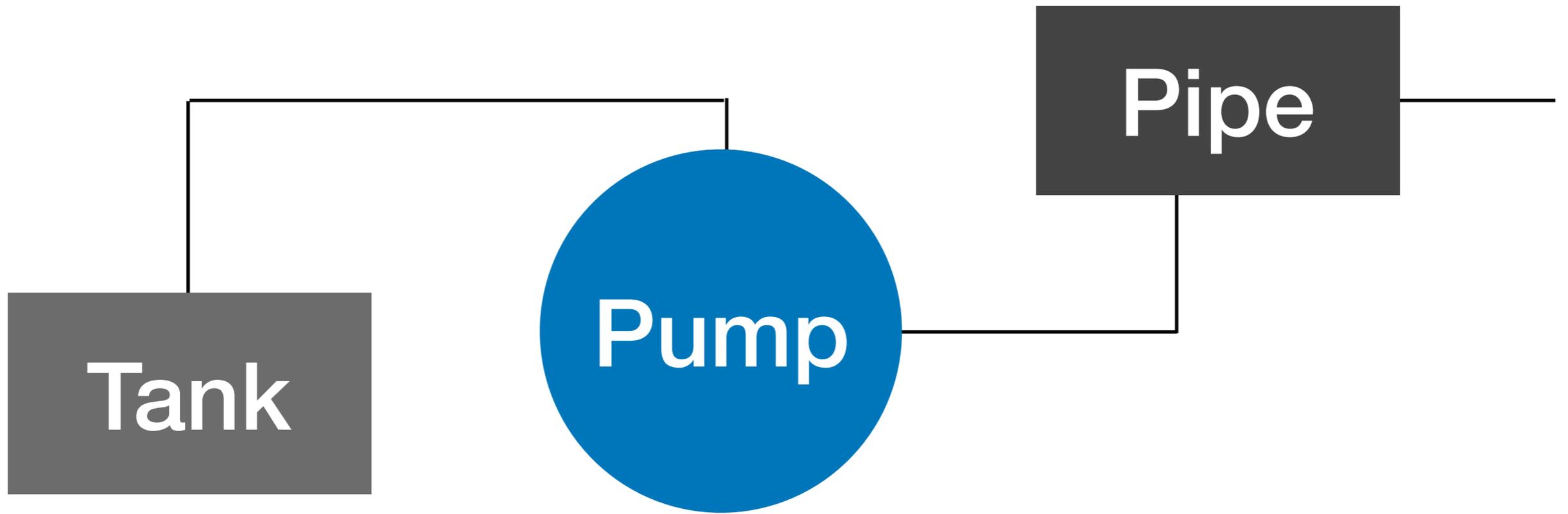
Subxiphoid

Subxiphoid



Subxiphoid



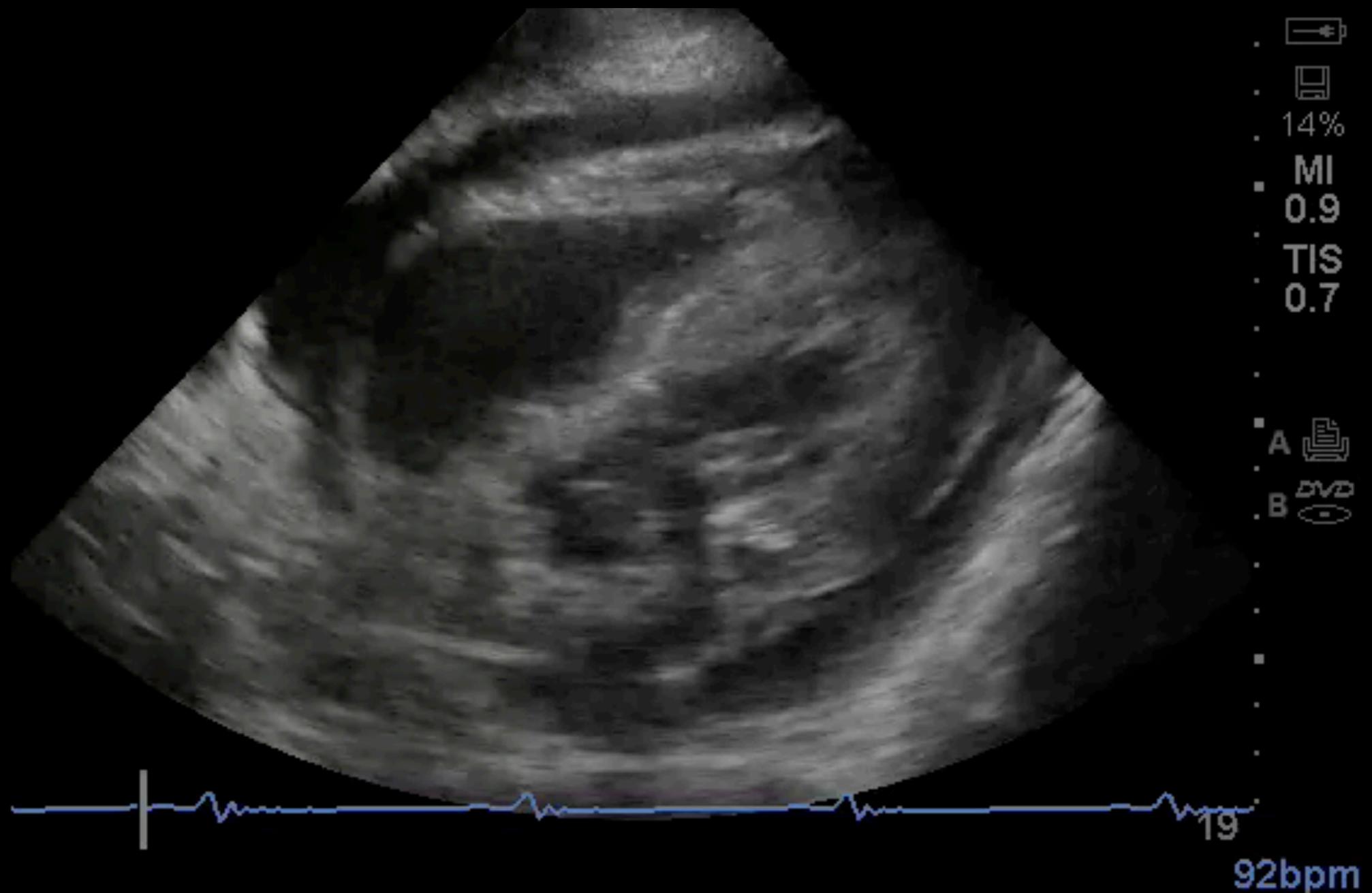


Pericardial Effusions & Cardiac Tamponade

Left Ventricular Contractility

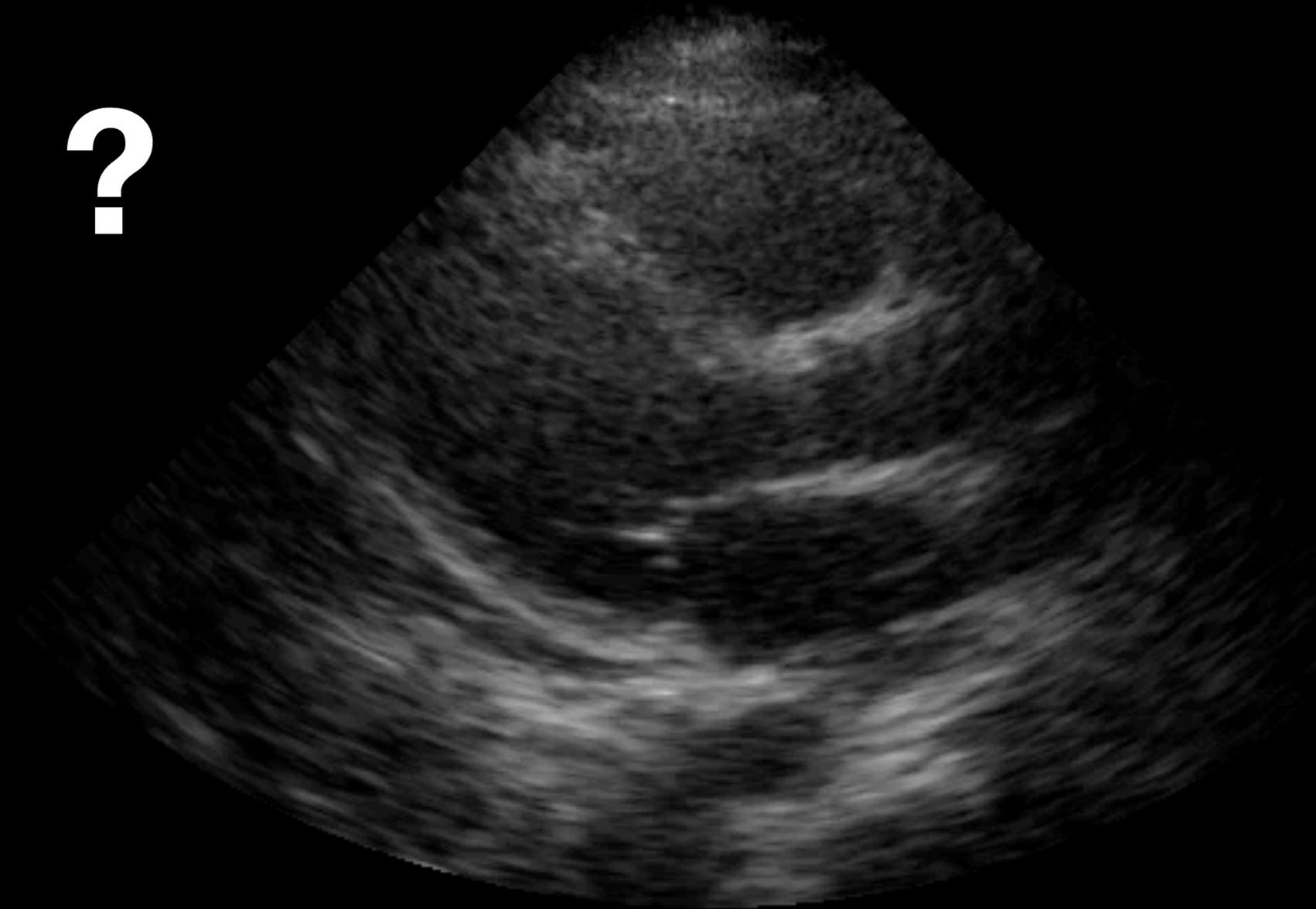
Right Ventricular Size

SX: Pericardial Effusion



PLAX: Pericardial Effusion

?



Pen



-1



Dual



U/L

Clips...

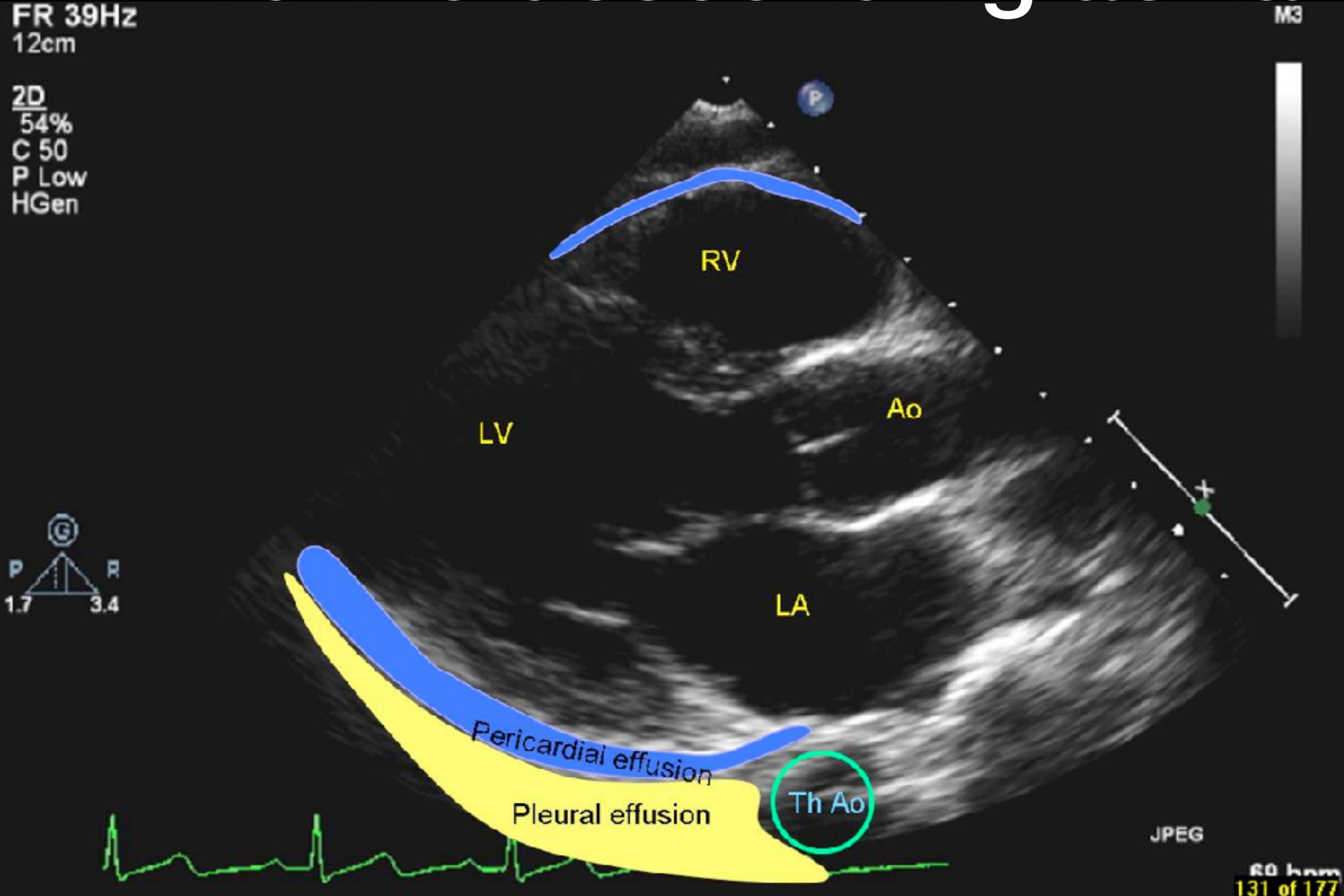
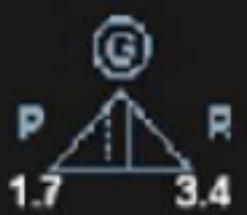
Page 2...

Find the descending aorta

FR 39Hz
12cm

M3

2D
54%
C 50
P Low
HGen



Pericardial effusion
Pleural effusion

Th Ao

JPEG

Pleural Effusion

?



1



Gen



0



Sector



MB Off

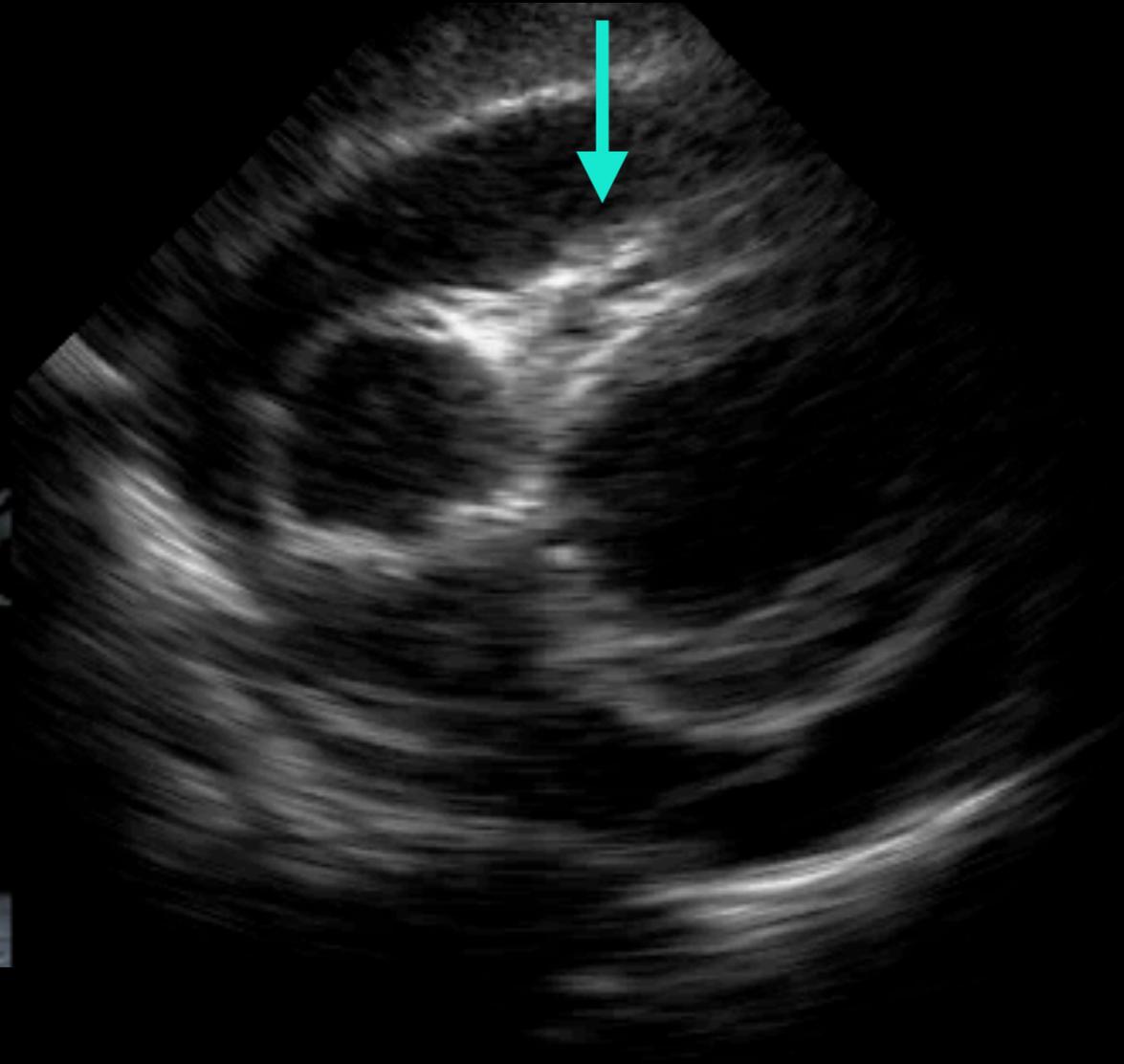


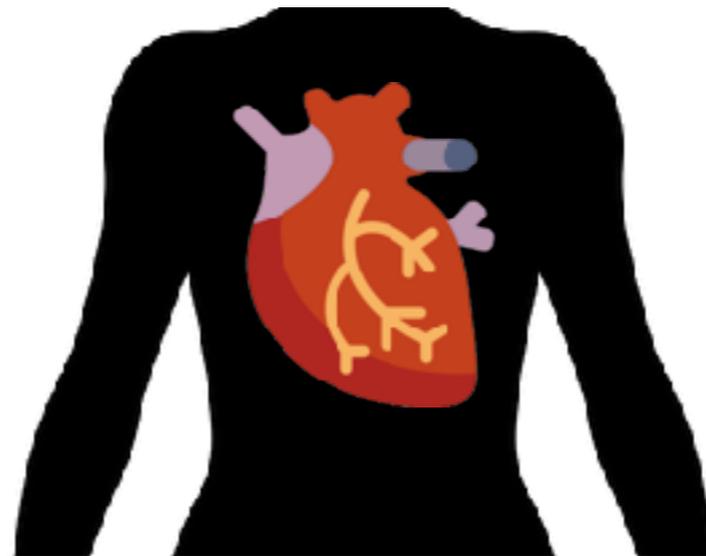
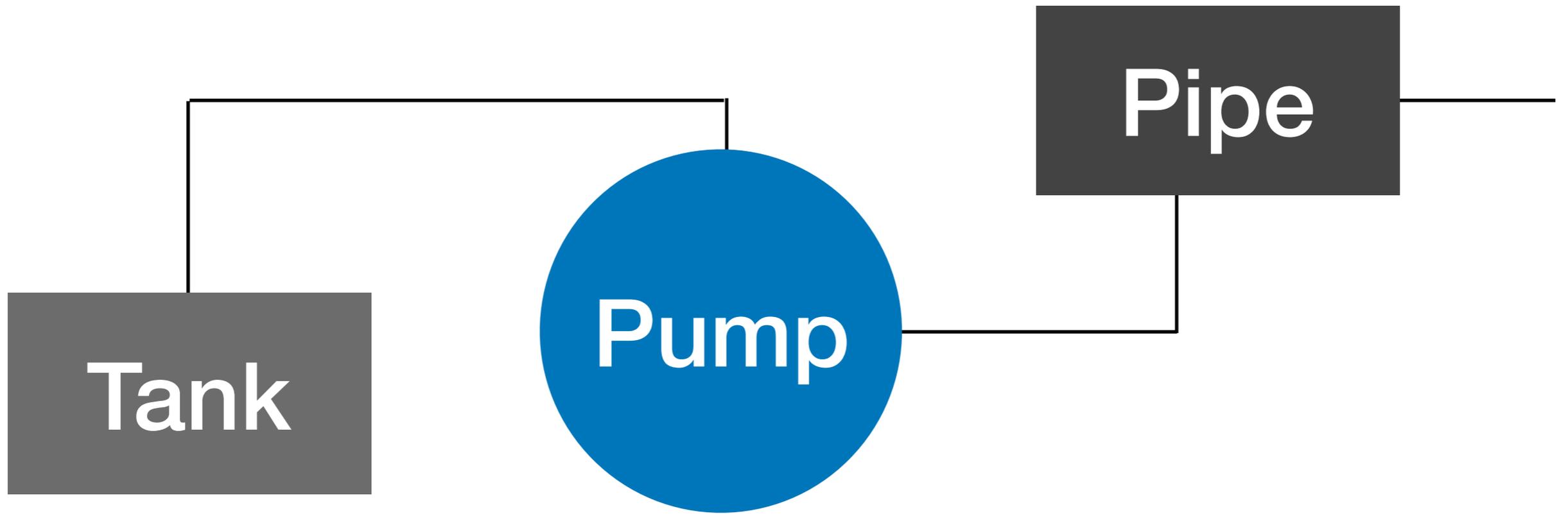
On

Page 1/3

Cardiac Tamponade

collapse of the RV during diastole





Pericardial Effusions & Cardiac Tamponade

Left Ventricular Contractility

Right Ventricular Size

Normal LVEF



Gen



0



Sector



MB Off



On

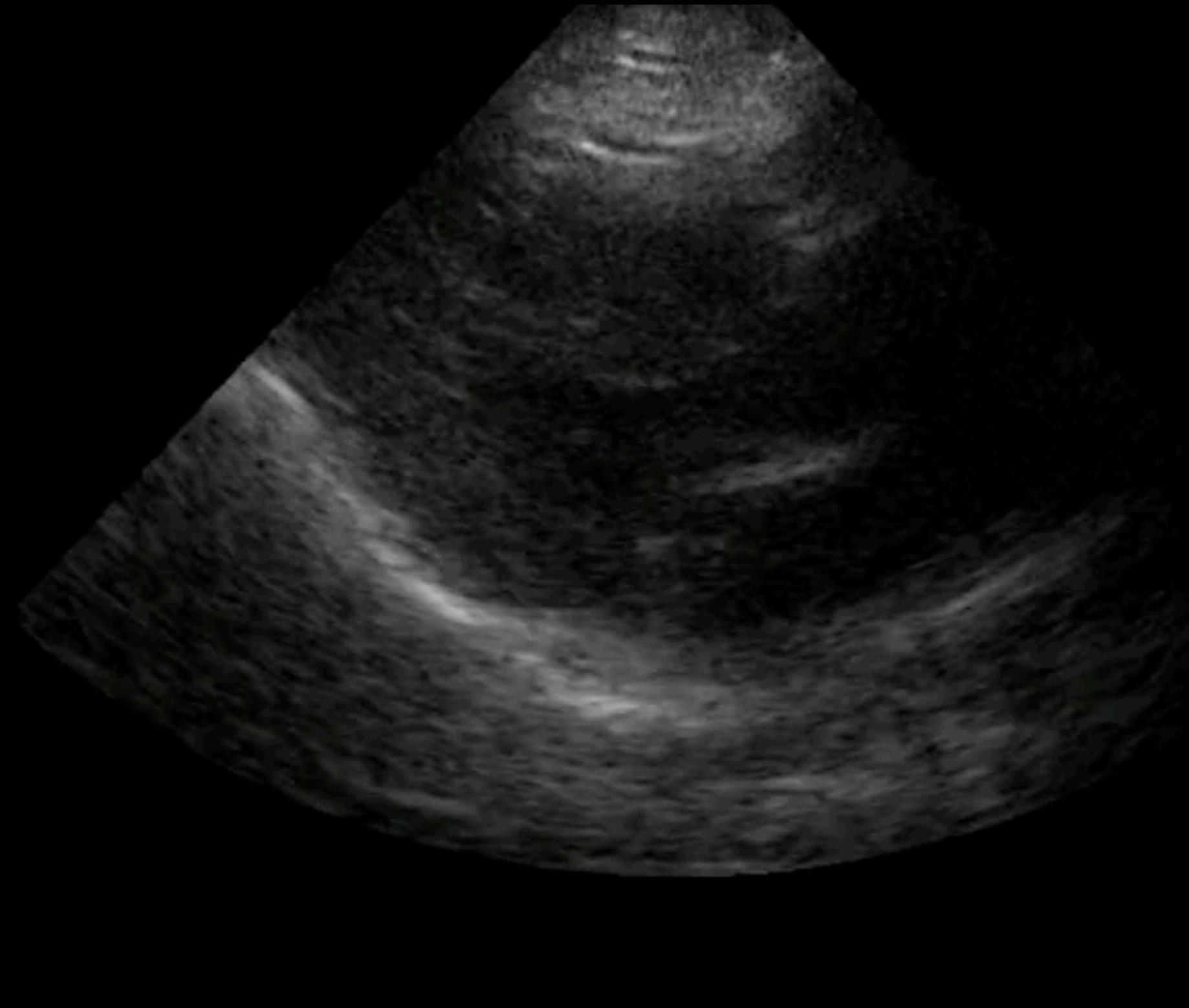
Page 1/3

Decreased LVEF

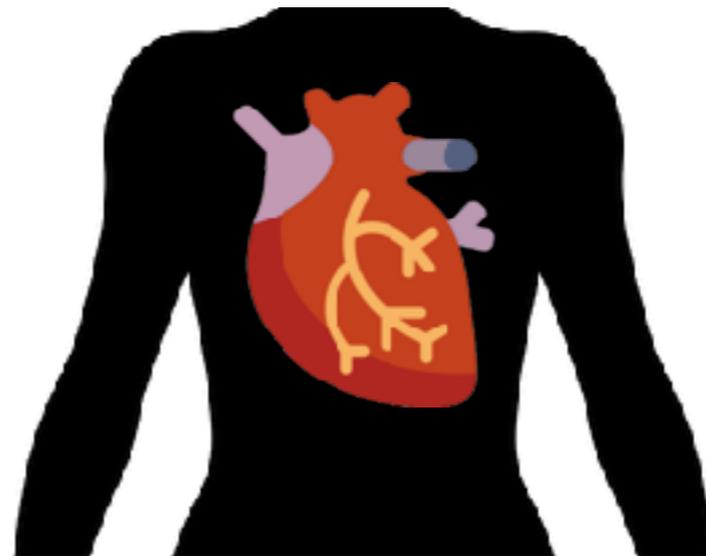
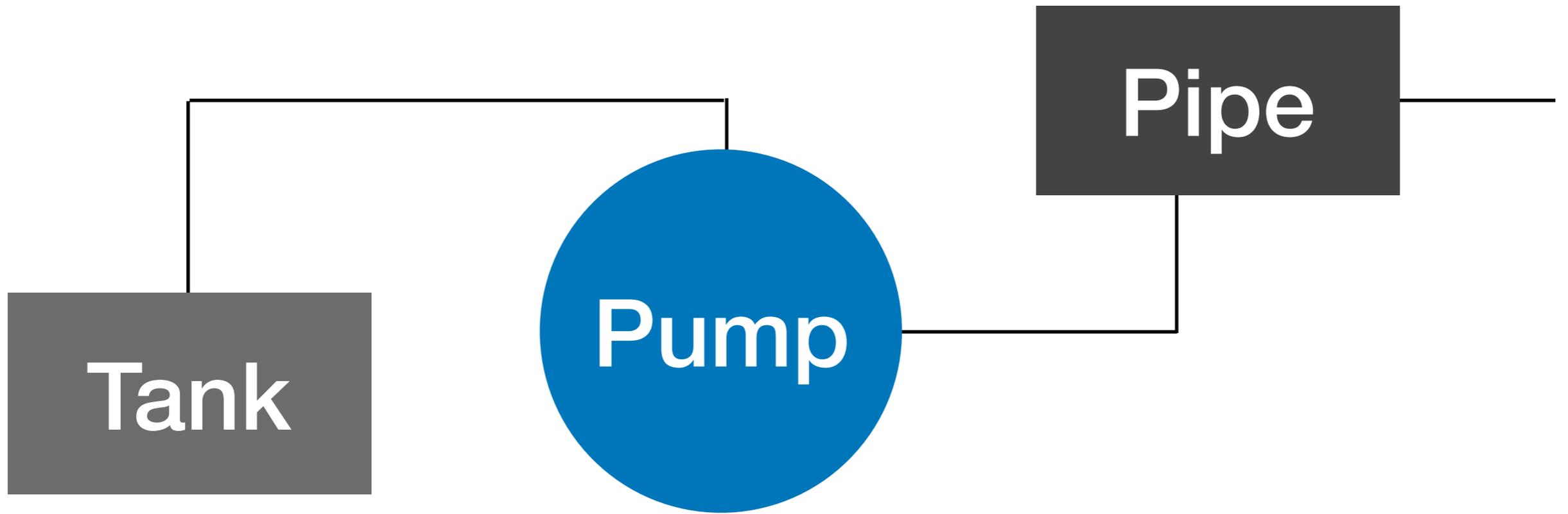


16

Hyperdynamic Heart



- **Hypovolemia**
- **Sepsis**
- **Tachycardia**
- **Small, empty heart**
- **Supra-normal LVEF**



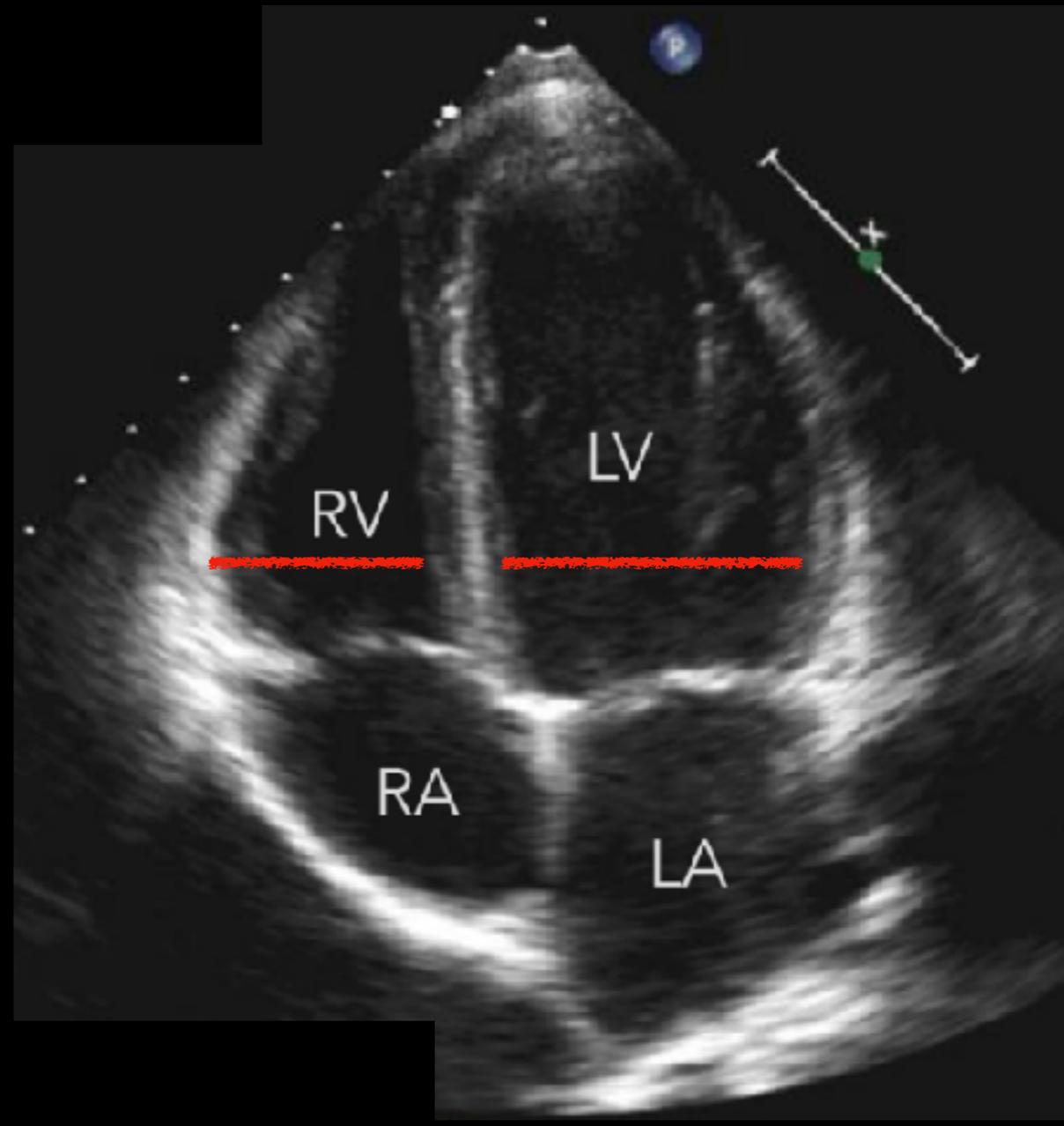
Pericardial Effusions & Cardiac Tamponade

Left Ventricular contractility

Right Ventricular Size

RV dilation

- **Pulmonary embolism****
- **Normal RV:LV ratio 0.6:1**
- **Best views: everything**
except PLAX



RV dilation



> 1:1



19.0 cm

2D: G: 55
Pen DR: 0

SonoSite

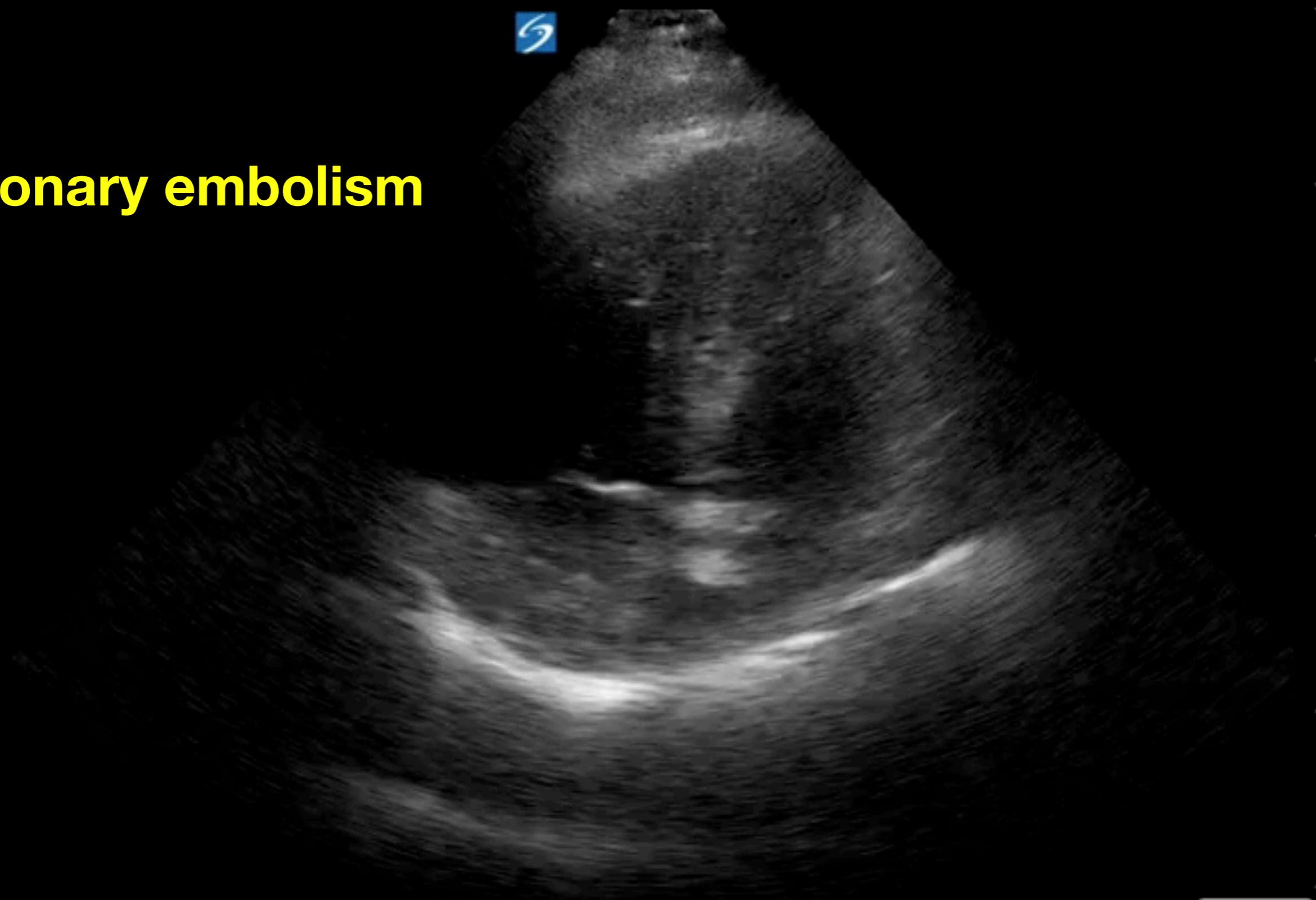
rP19xp/5-1 Cardiac
MI: 0.9 TIS: 0.8

LAC USC

THI



Pulmonary embolism



21.0 cm

SonoSite
P21xp/5-1 CARDS
MI: 0.9 TIS: 0.6

2D: G: 64
Gen DR: -1

THI

Normal PSAX



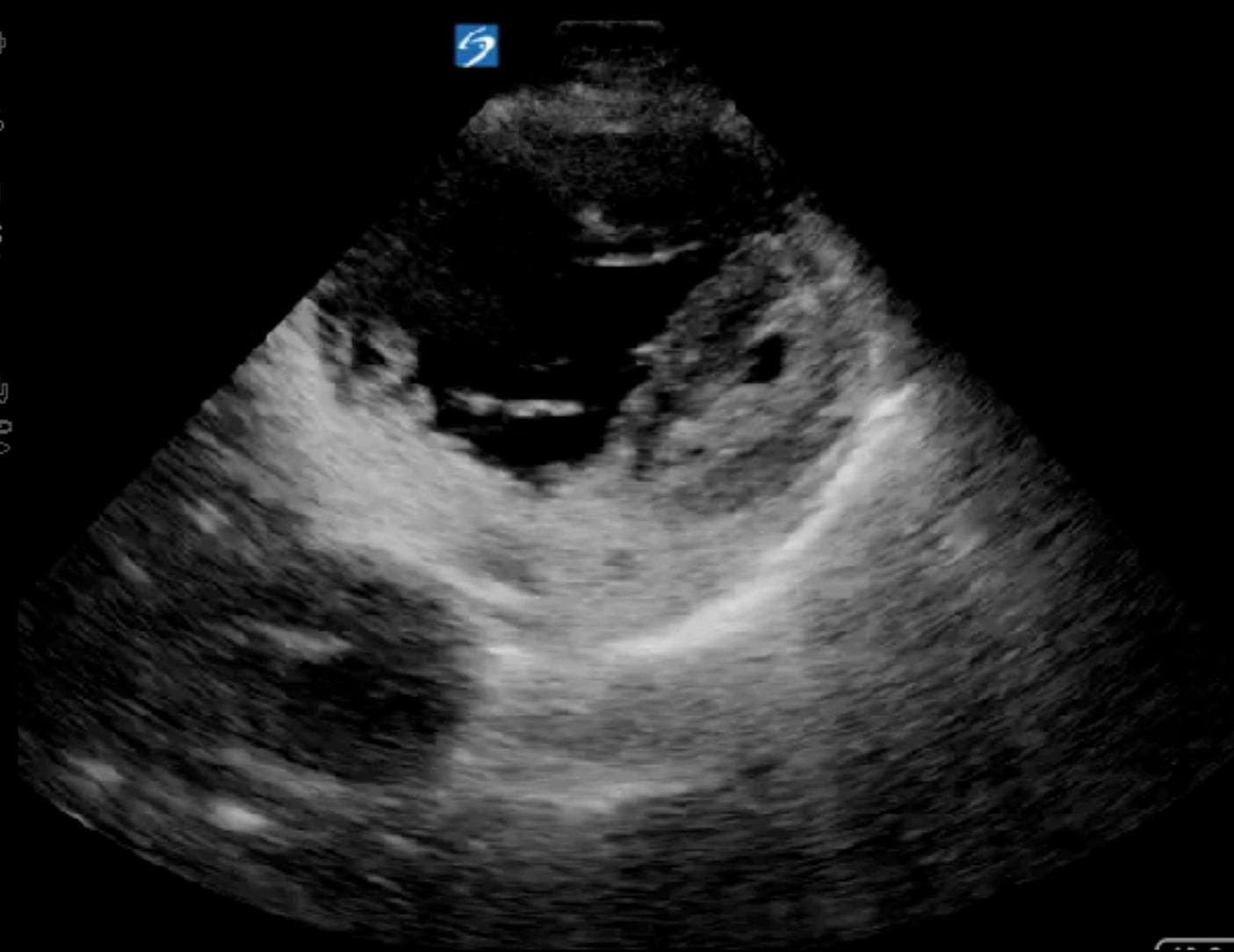
Flattening of
interventricular septum

LV D shape

RV dilation

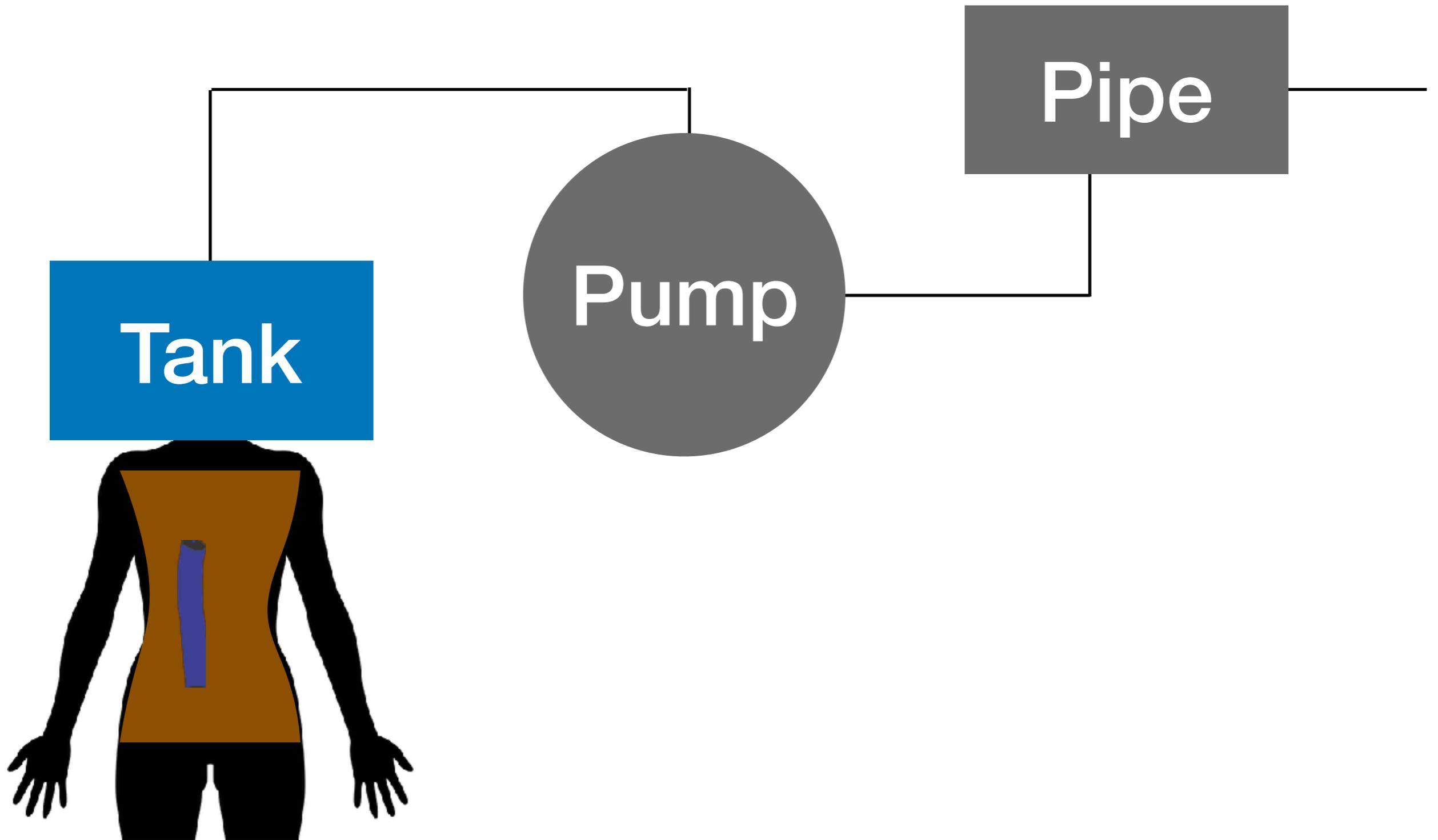
16%
MI
1.0
TIS
0.7

A
B

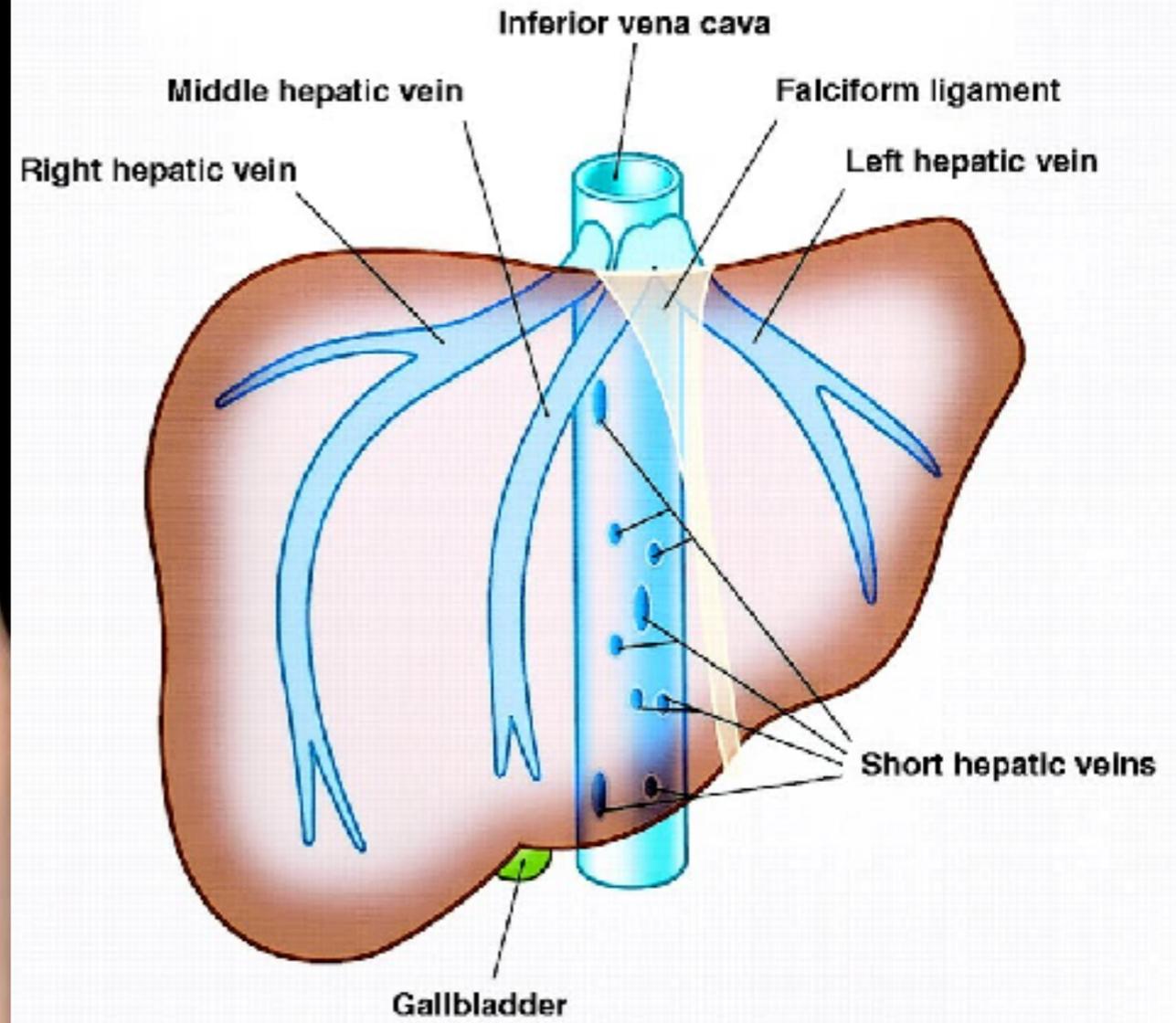
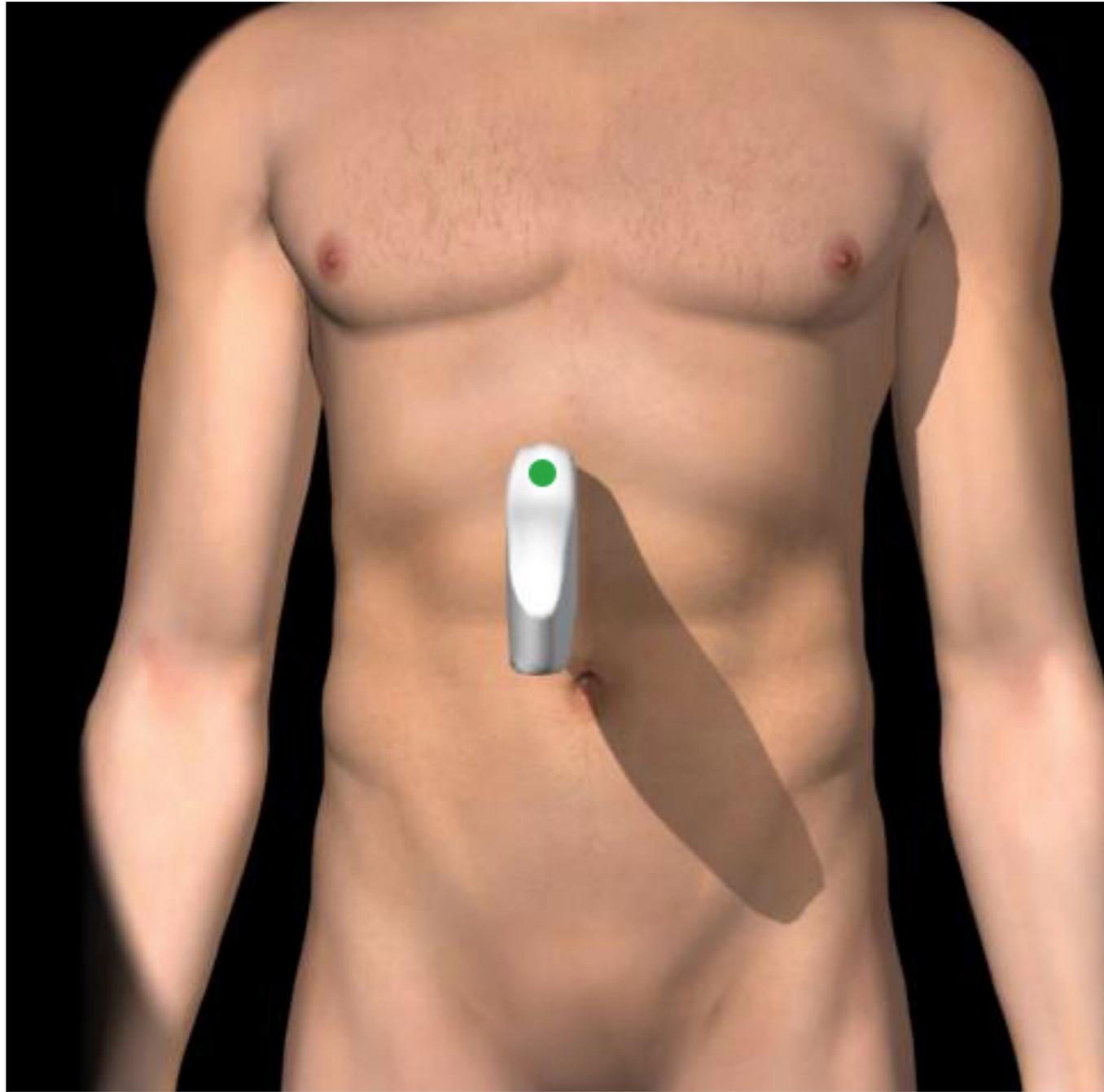


RV dilation - etiologies

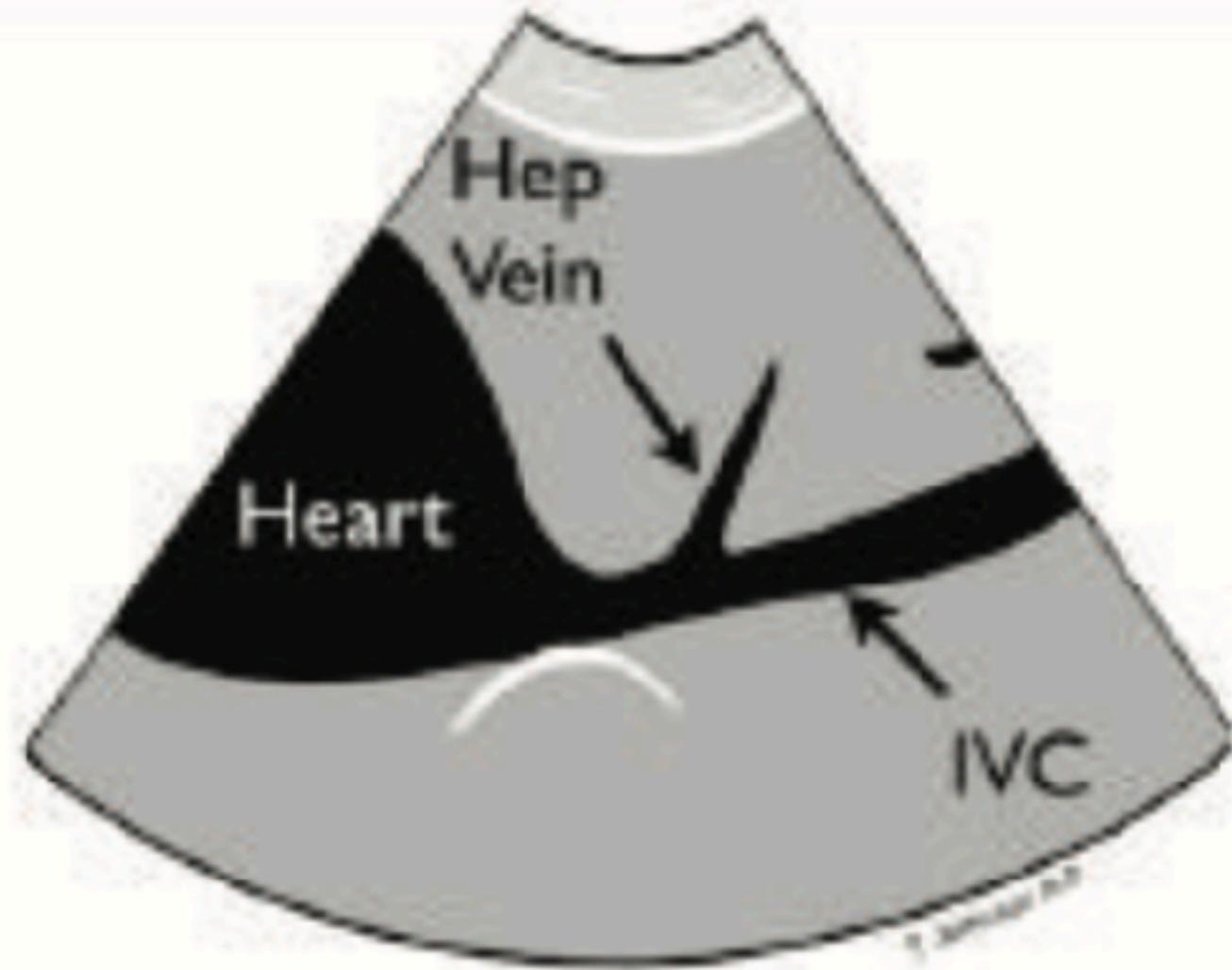
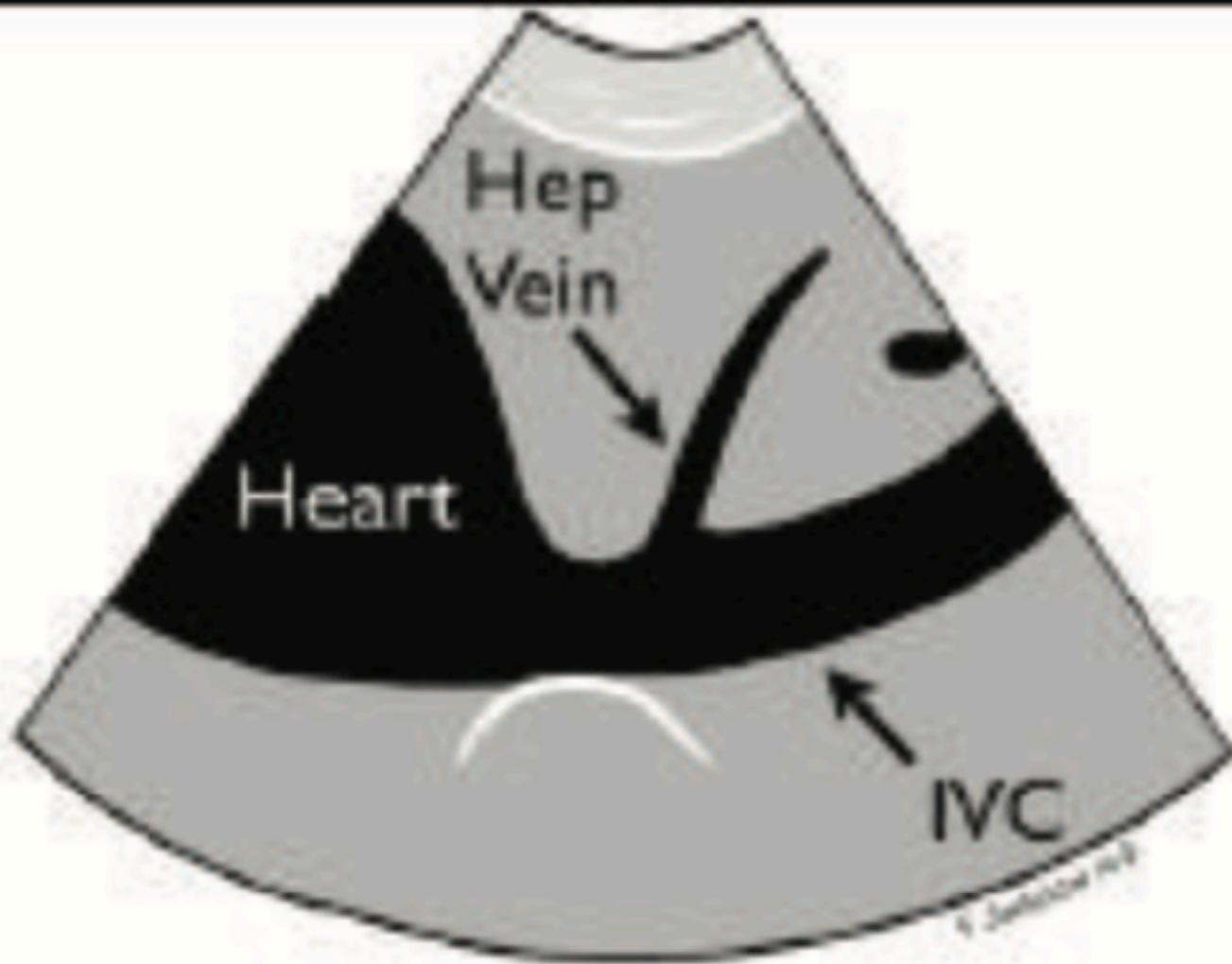
- **Pulmonary embolism****
- **RV infarction***
- **Pulmonary HTN**
- ▶ **OSA**
- ▶ **Congenital heart disease**
- ▶ **ASD/VSD**
- **Valvular disease**



IVC



Inspiration





90%

MI

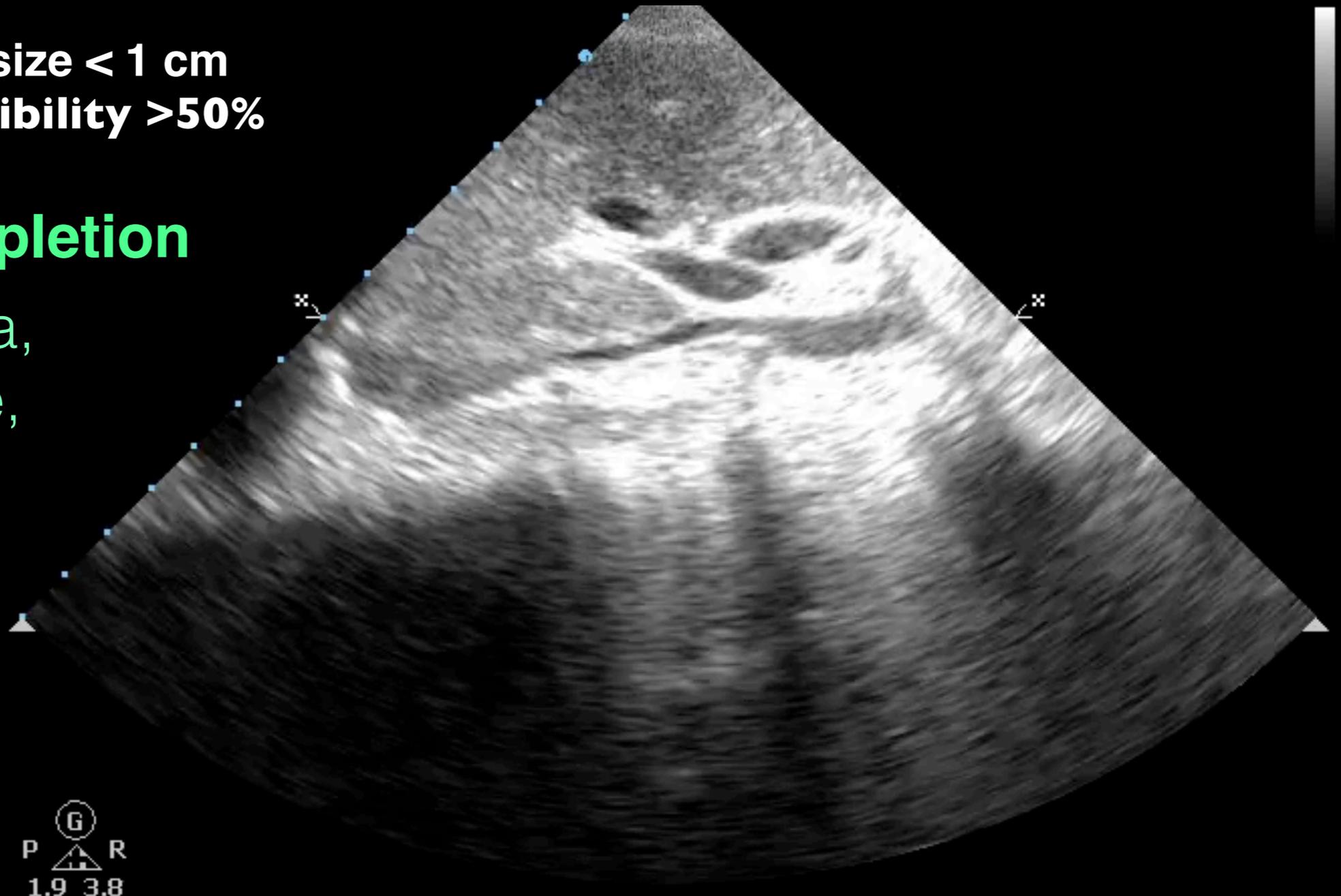
1.1

Collapsing IVC

Small size < 1 cm
Collapsibility >50%

Volume Depletion

hypovolemia,
hemorrhage,
sepsis,
anaphylaxis



Plethoric IVC

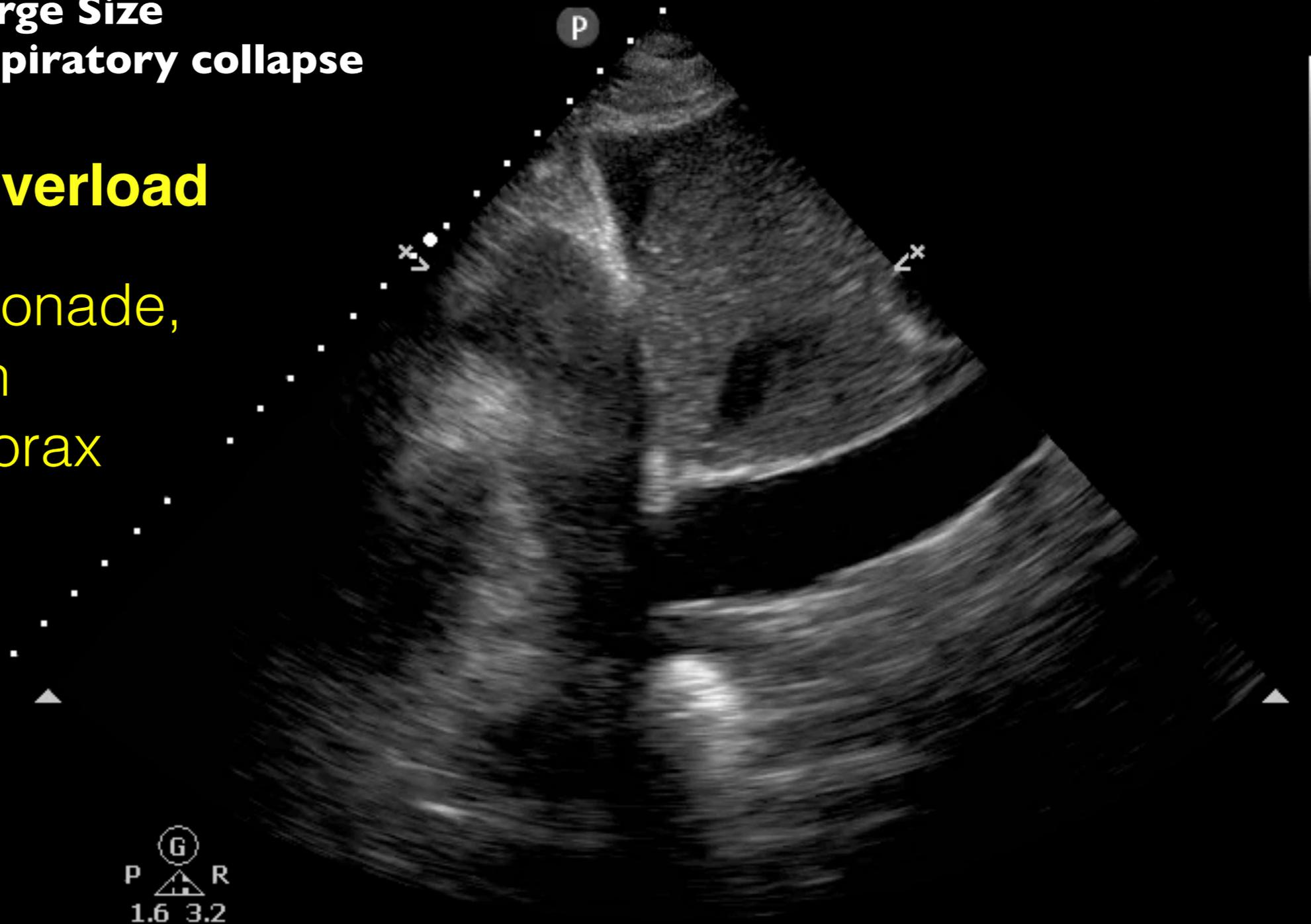
MI 1.3 6/20/2013
TIS 0.4 1:29:21 PM

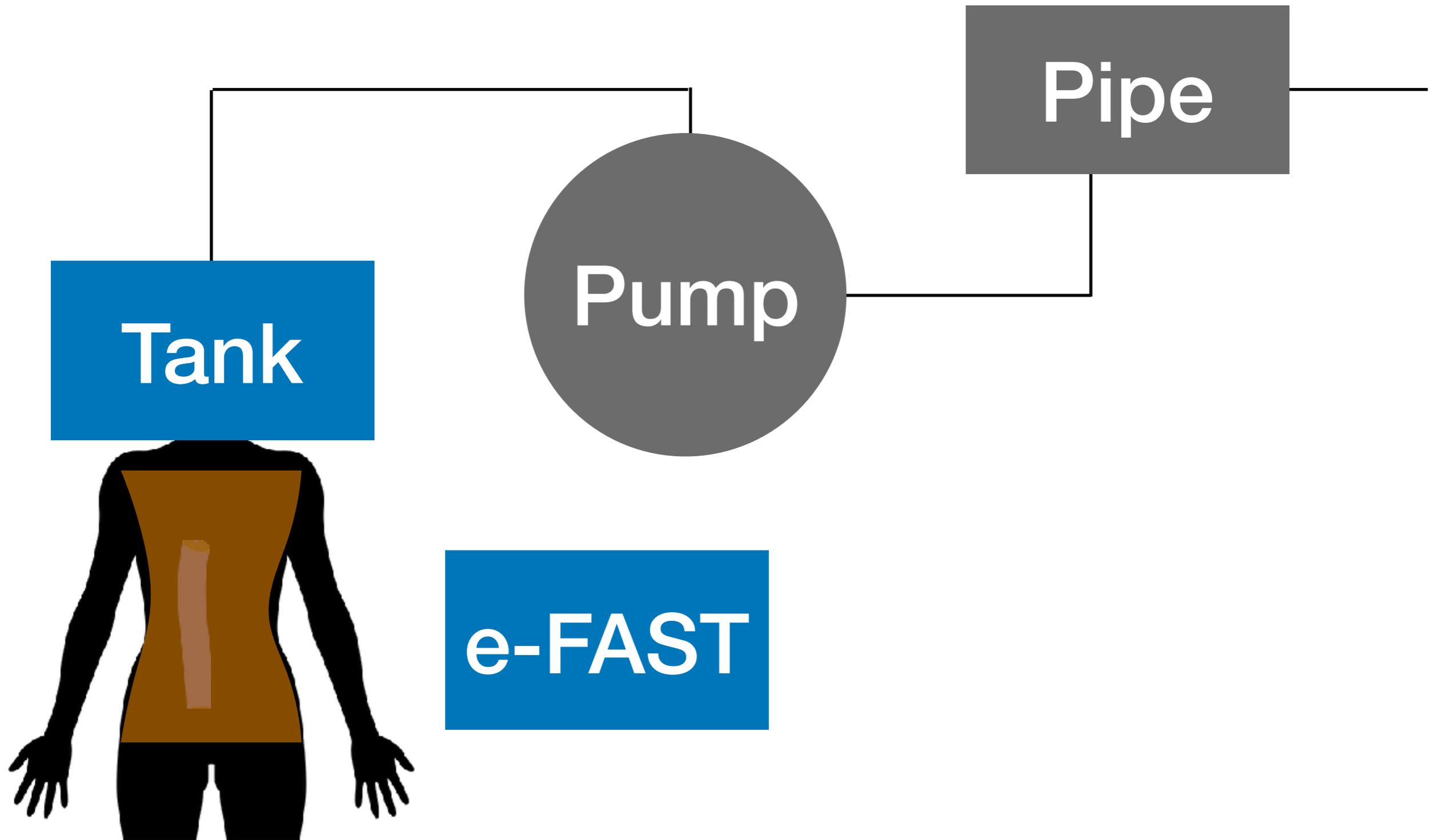
YALE EMERGENCY MEDICINE

Large Size
Minimal inspiratory collapse

Volume Overload

CHF, tamponade,
PE, Tension
pneumothorax





Extended FAST

RUQ

Morison's pouch & Pleural fluid

LUQ

Perisplenic & Pleural fluid

Pelvis

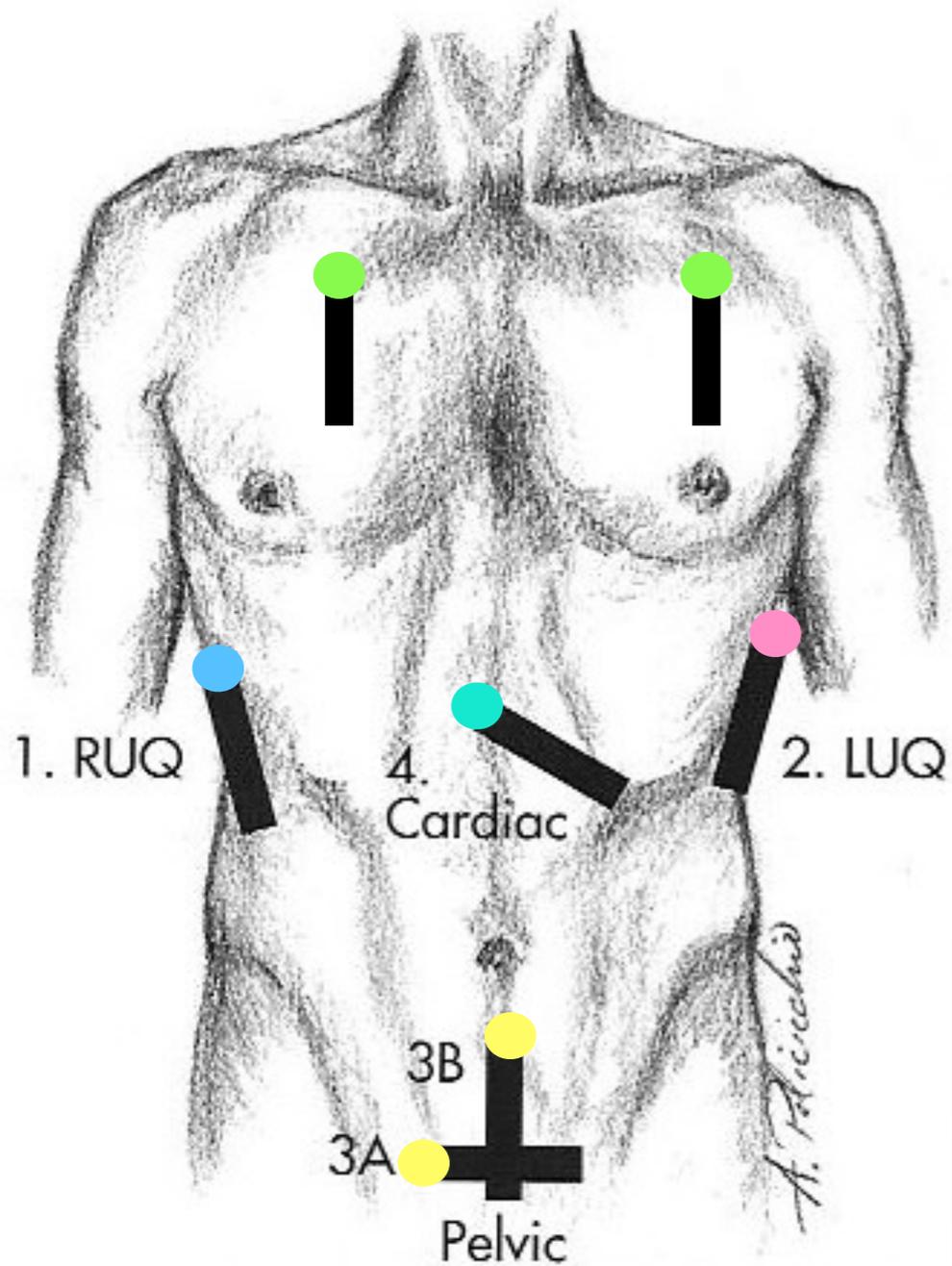
Rectovesical & Rectouterine pouch
Transverse & Longitudinal

Subxiphoid

Hemopericardium

Lungs

Pneumothorax



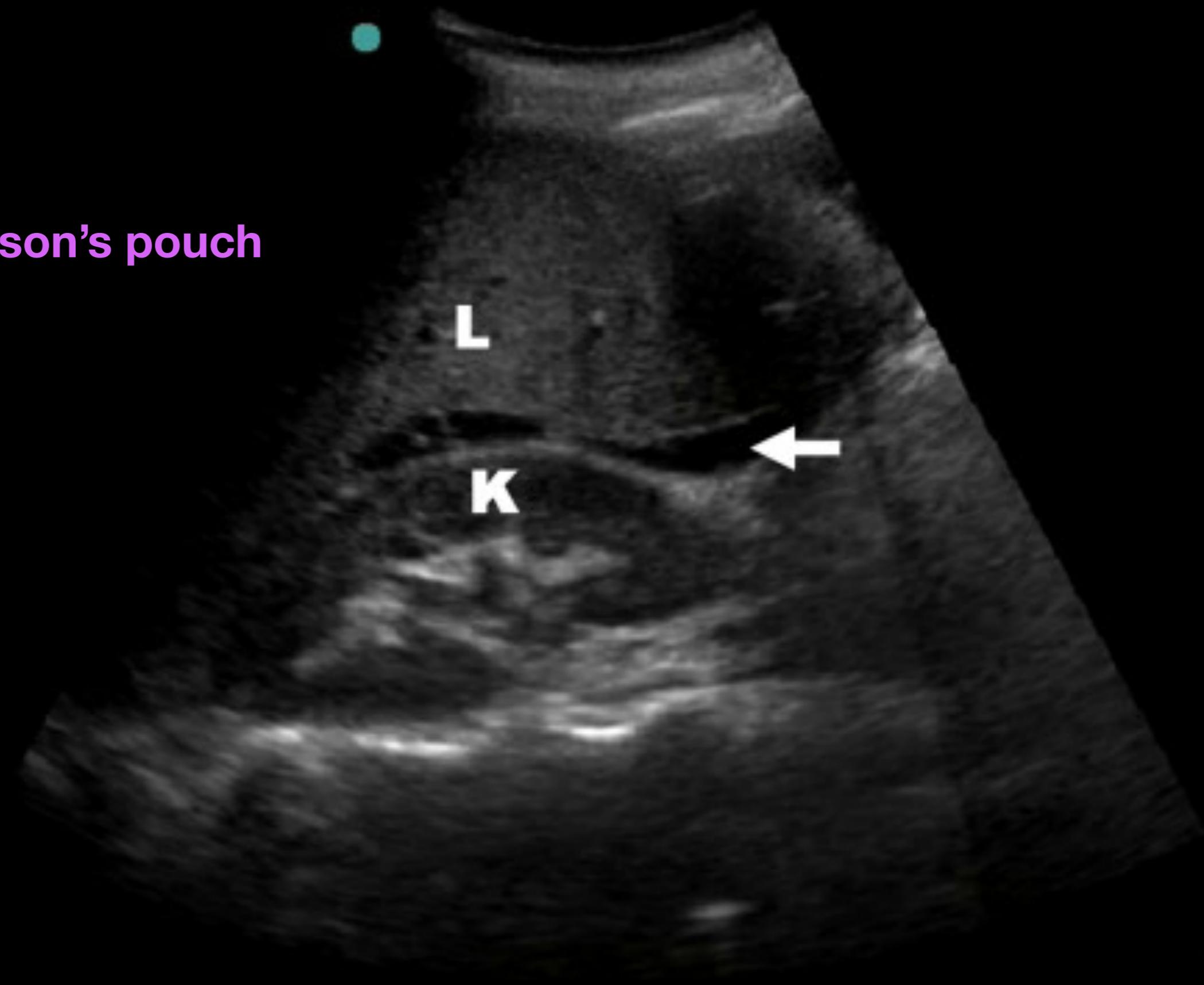
Indicator facing patient's *right* (transverse) or *head* (longitudinal)

RUQ



Mid-axillary line, 8th – 11th
ICS

FF in Morison's pouch





GenTHI MB

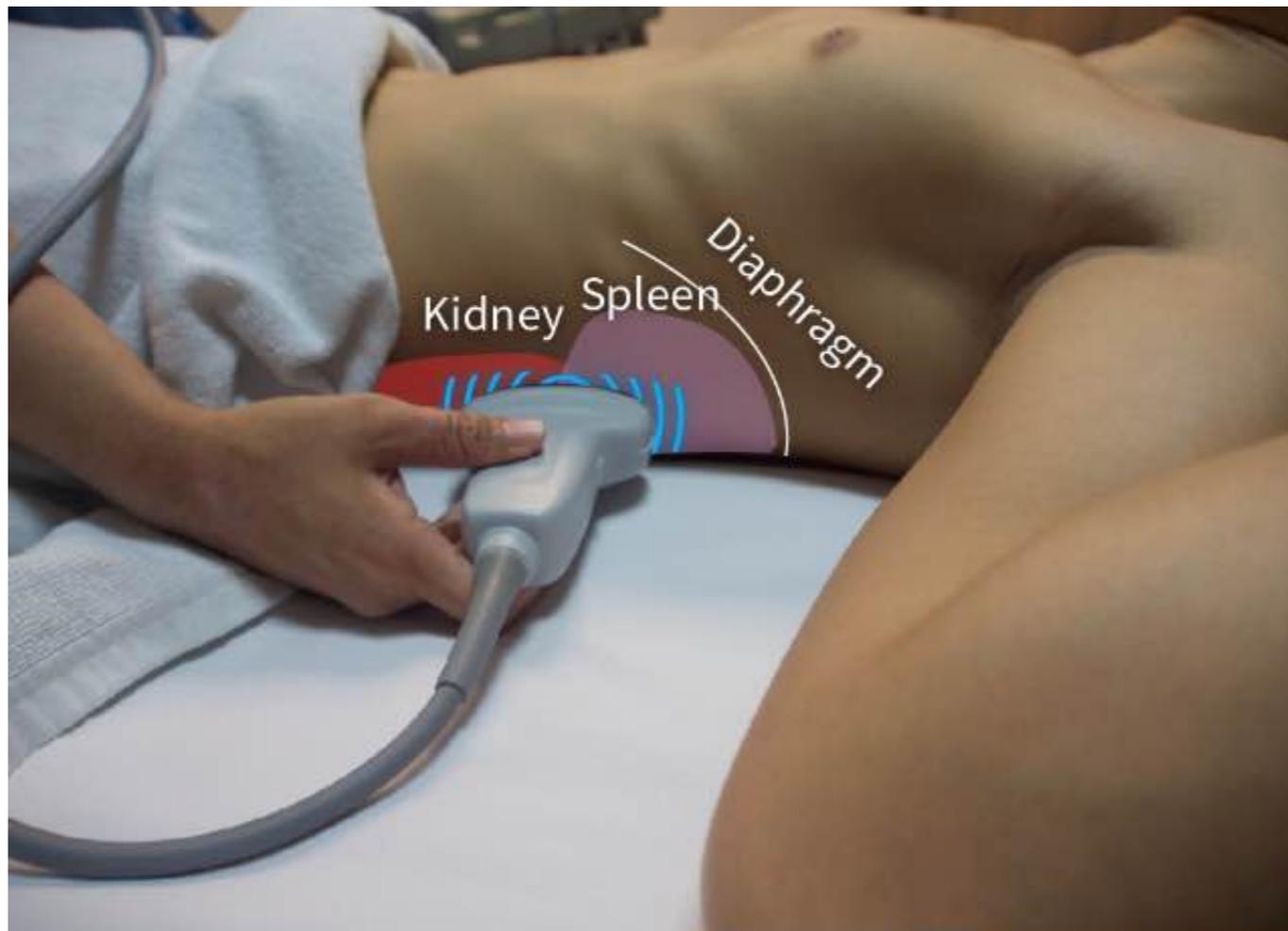
2017Jul14 03:14

Abd
P21
95%
MI
1.1
TIS
0.8



Liver tip

LUQ

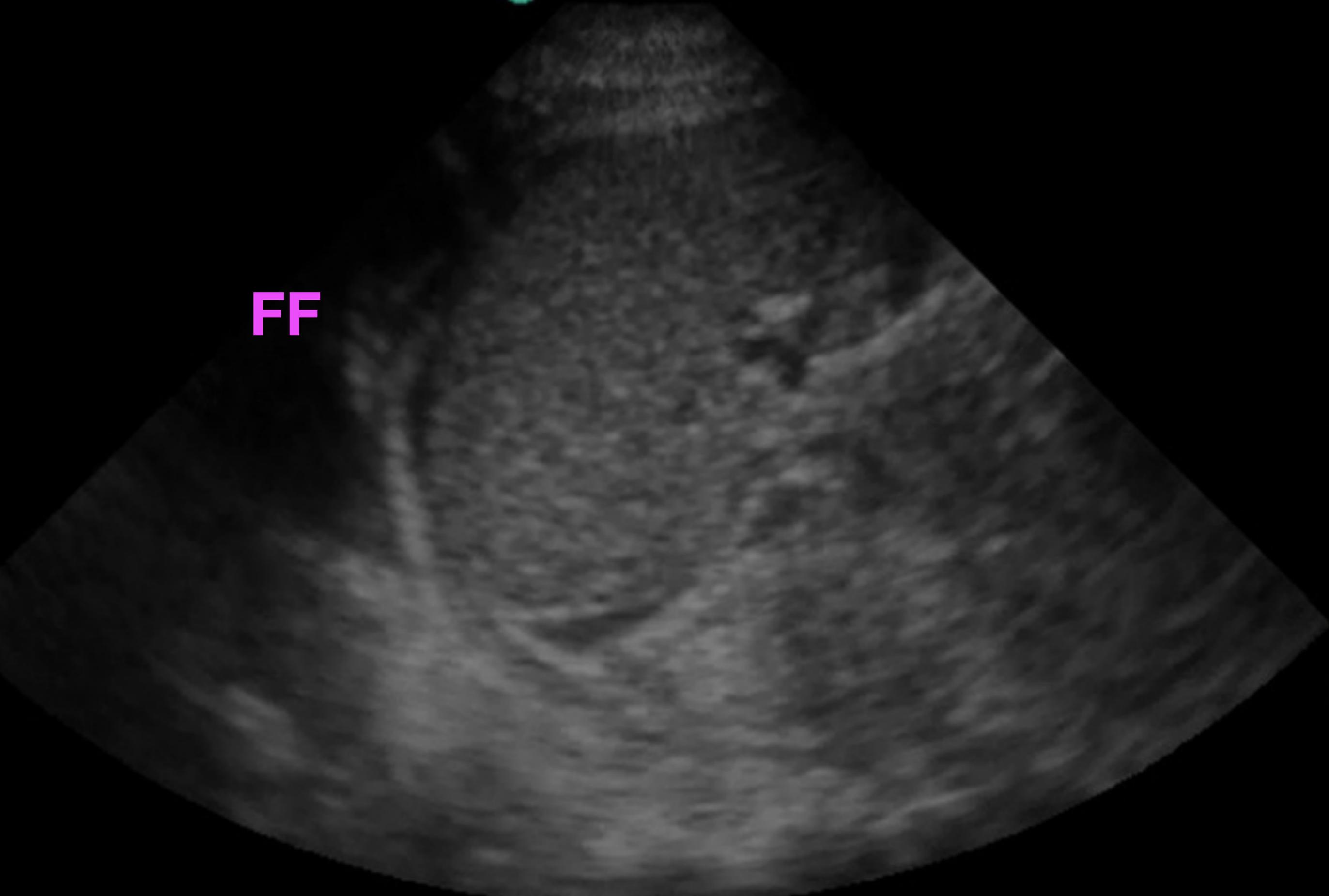


- **Posterior axillary line**
- **6th - 9th ICS**

LUQ

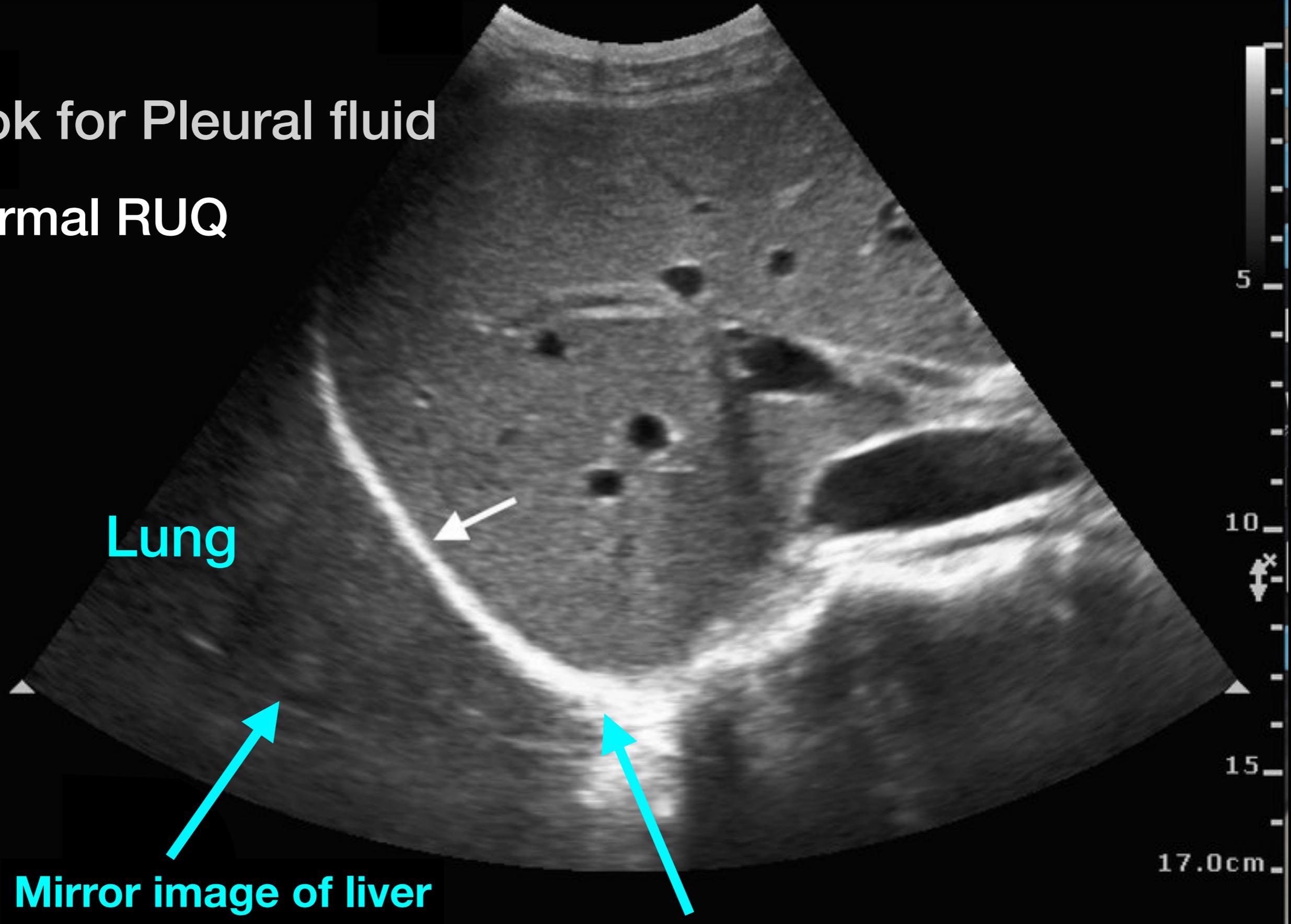


FF



Look for Pleural fluid

Normal RUQ

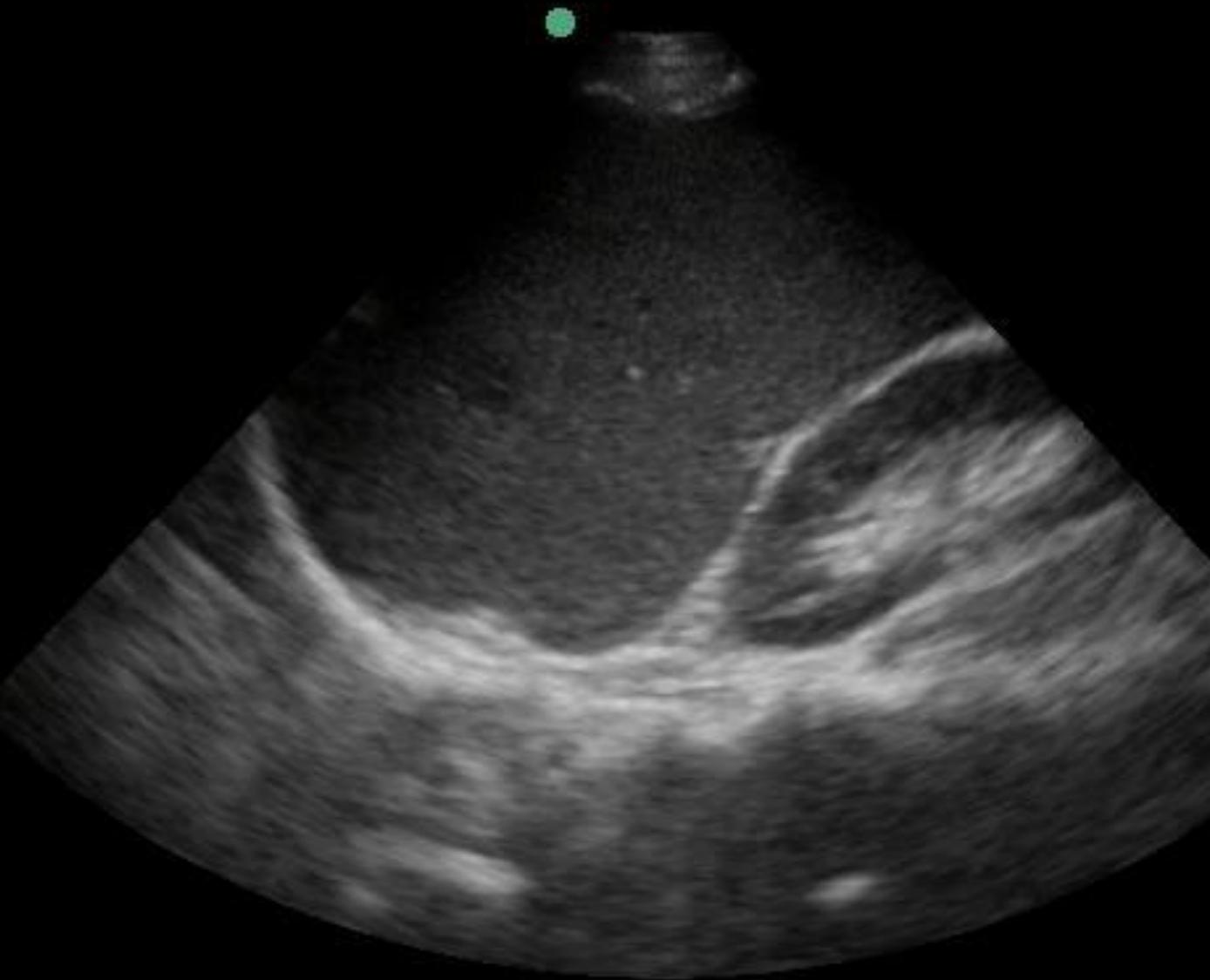


Lung

Mirror image of liver

Spine shadow stops at diaphragm

Normal

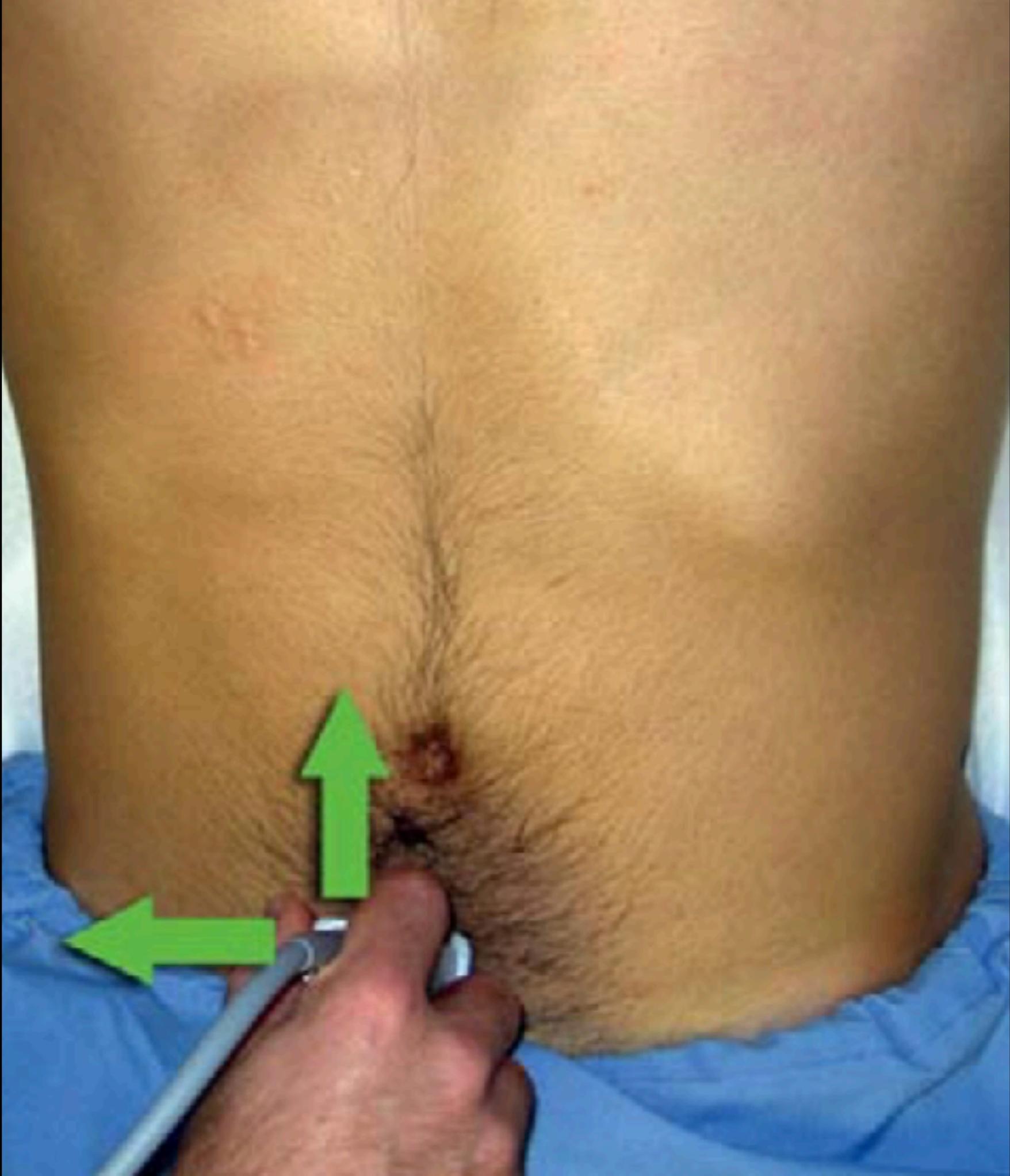


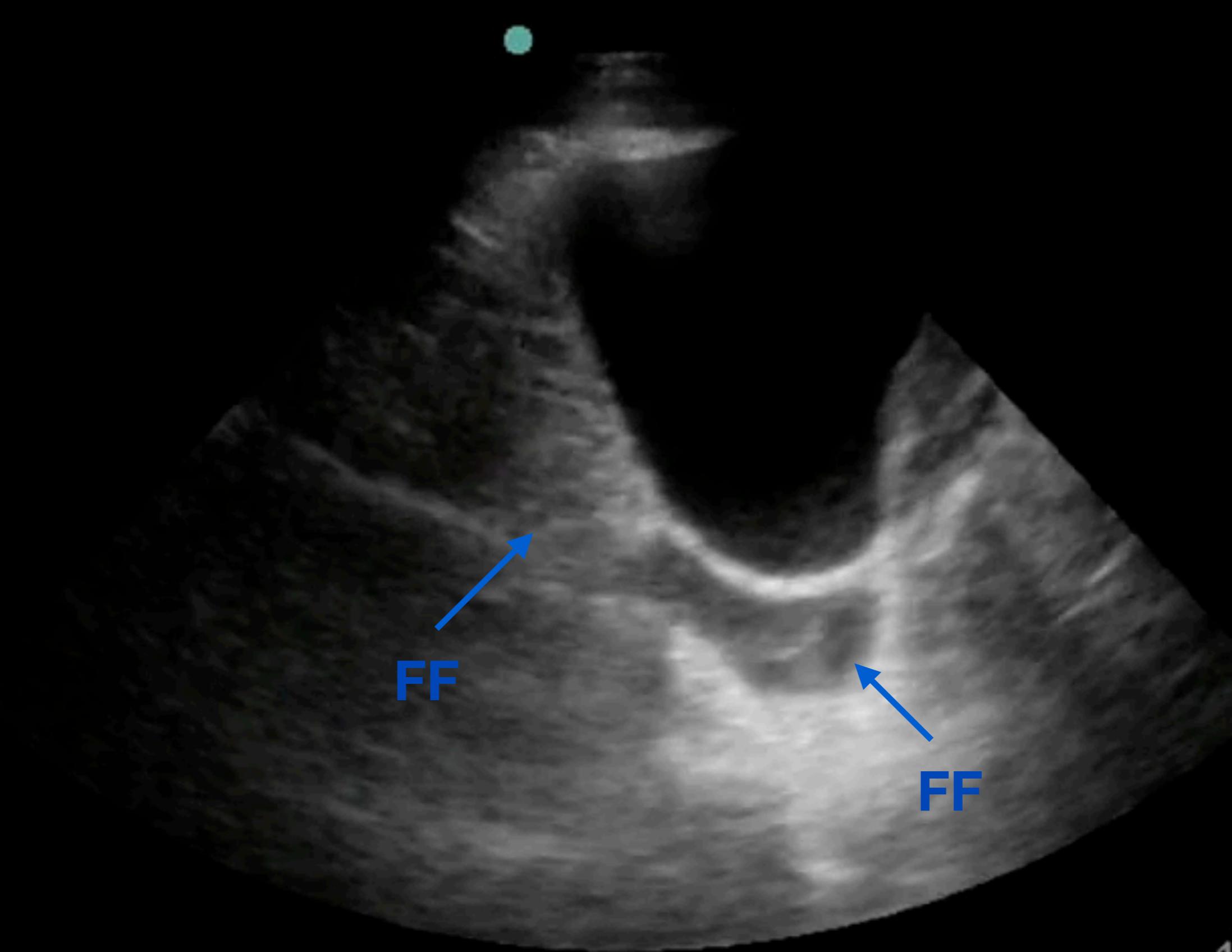
Pleural fluid



Spine Sign

Pelvis





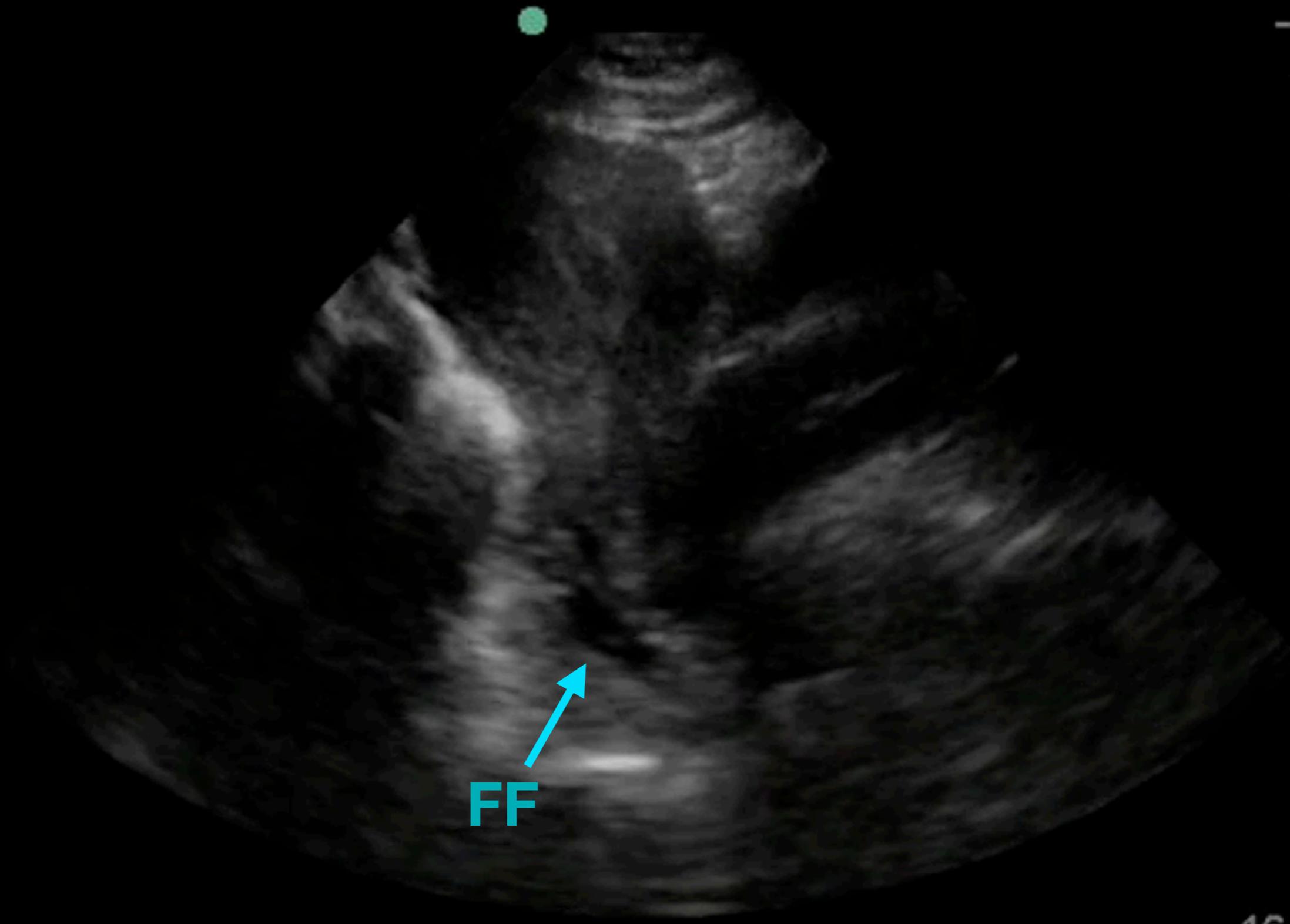
FF

FF



Gen THI
S MB

Abd
P21



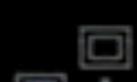
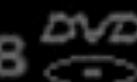
28%

MI

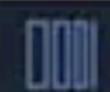
1.1

TIS

0.8



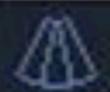
Gen



0



Guide

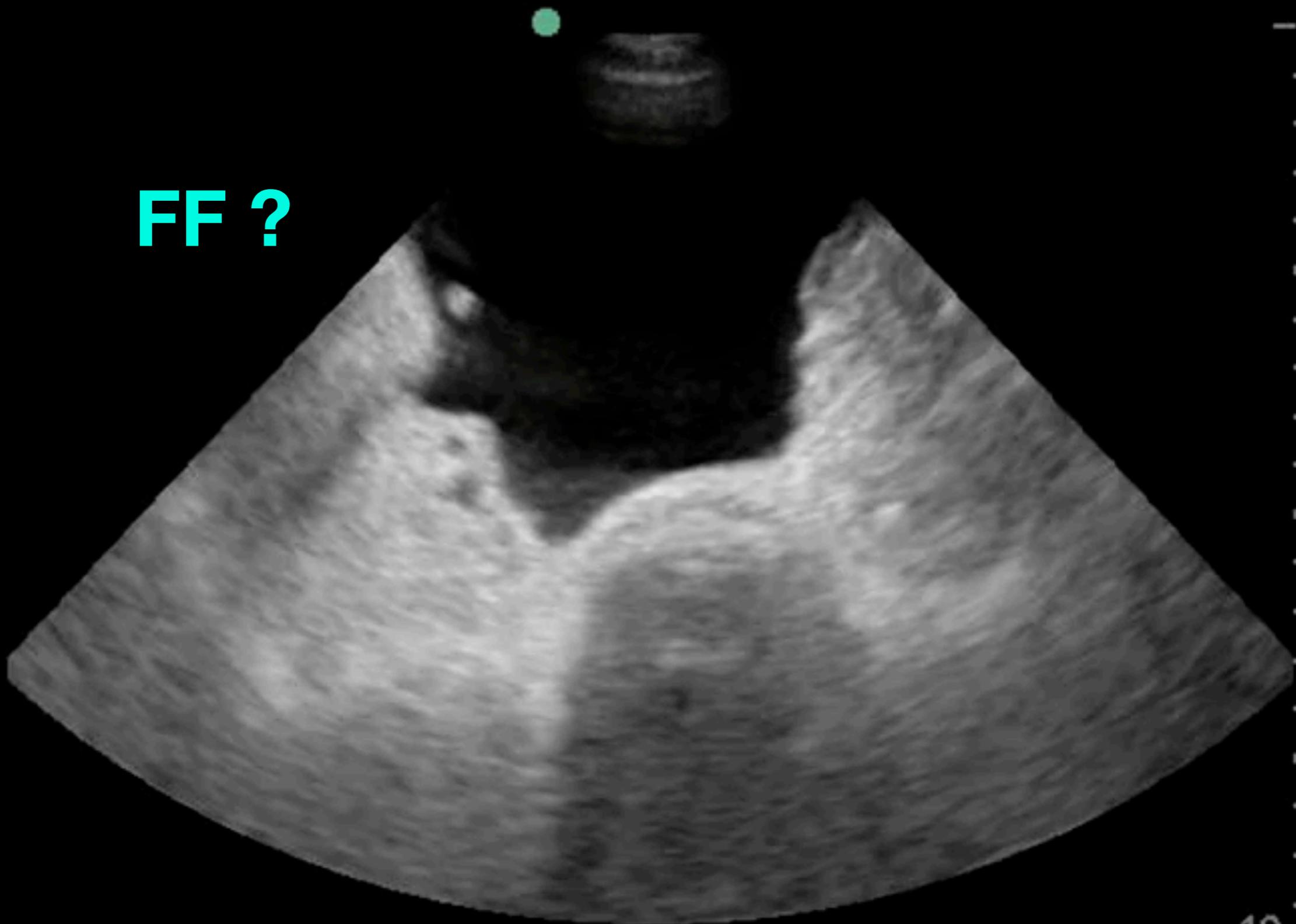


MB On



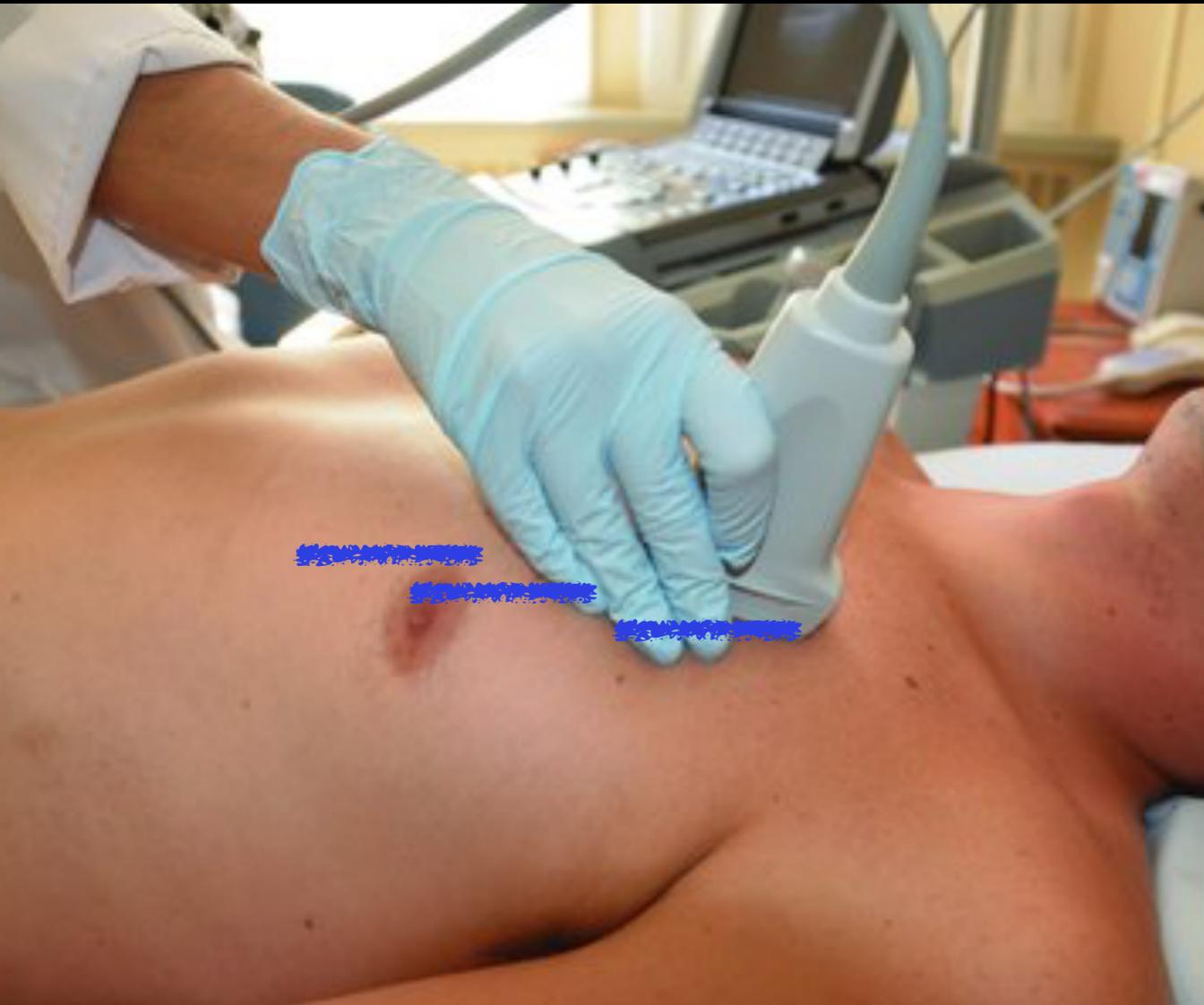
On

FF ?



Lung

Normal lung sliding



Normal lung sliding



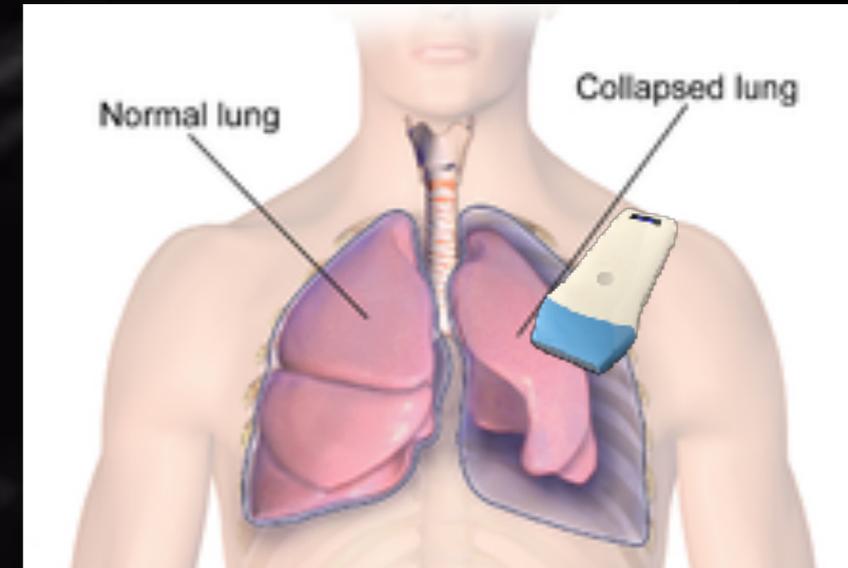
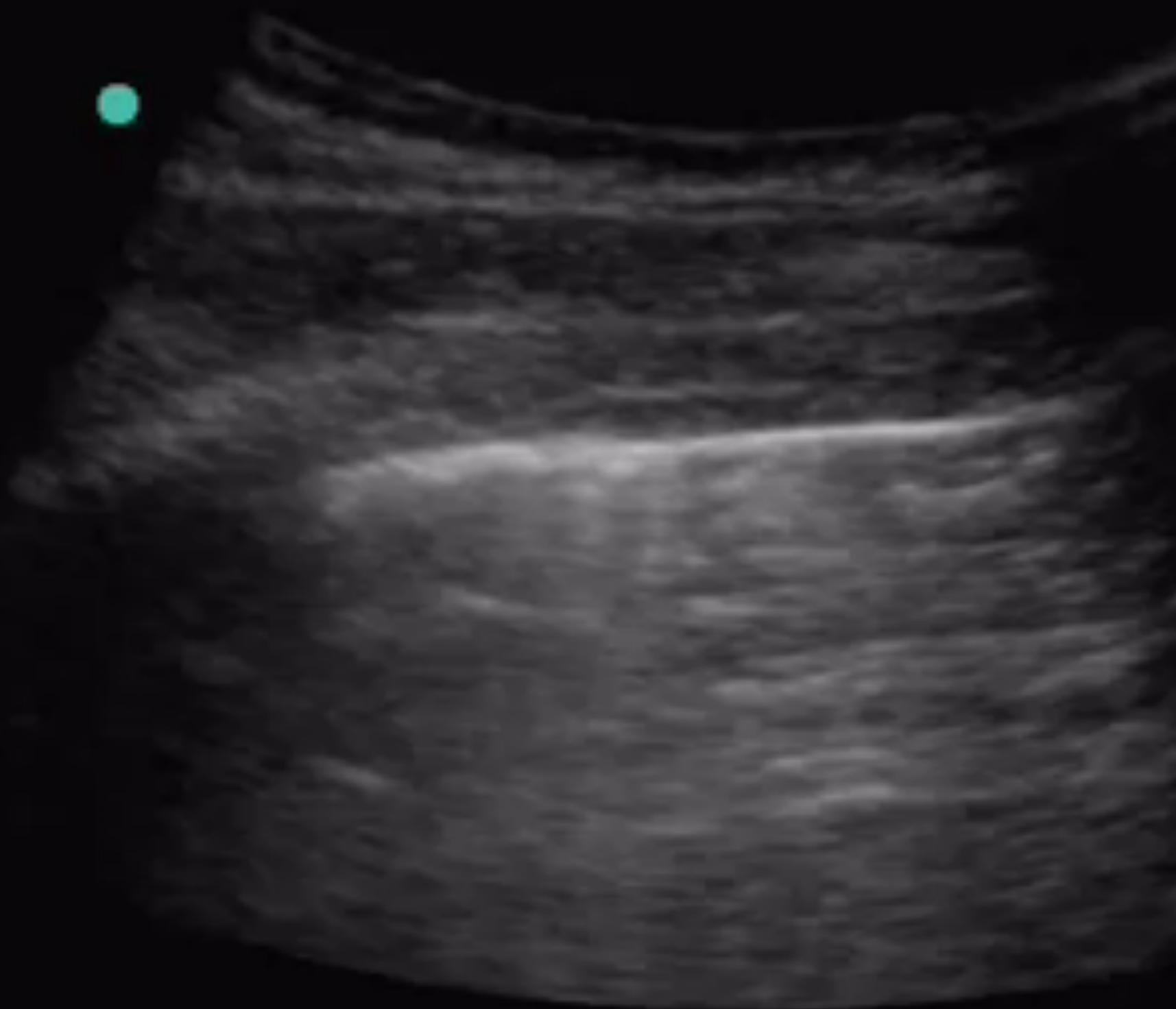
PNX
Res
S MB

Loss of lung sliding sign

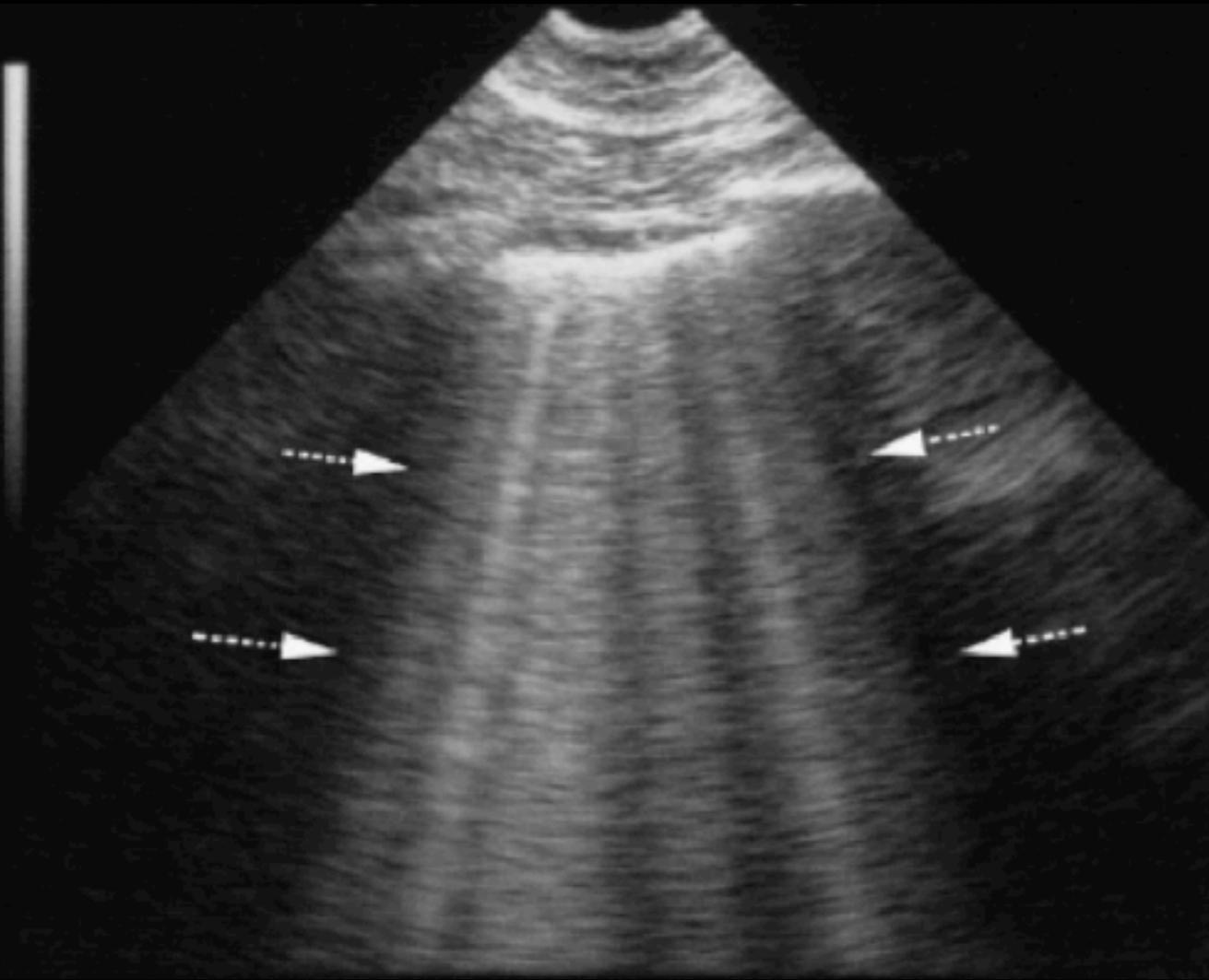


Mainstem intubation, esophageal intubation
Lung and pleura adhering together
(ARDS, chronic pleurodesis, cancer)
Pulmonary fibrosis

Lung point = Pneumothorax

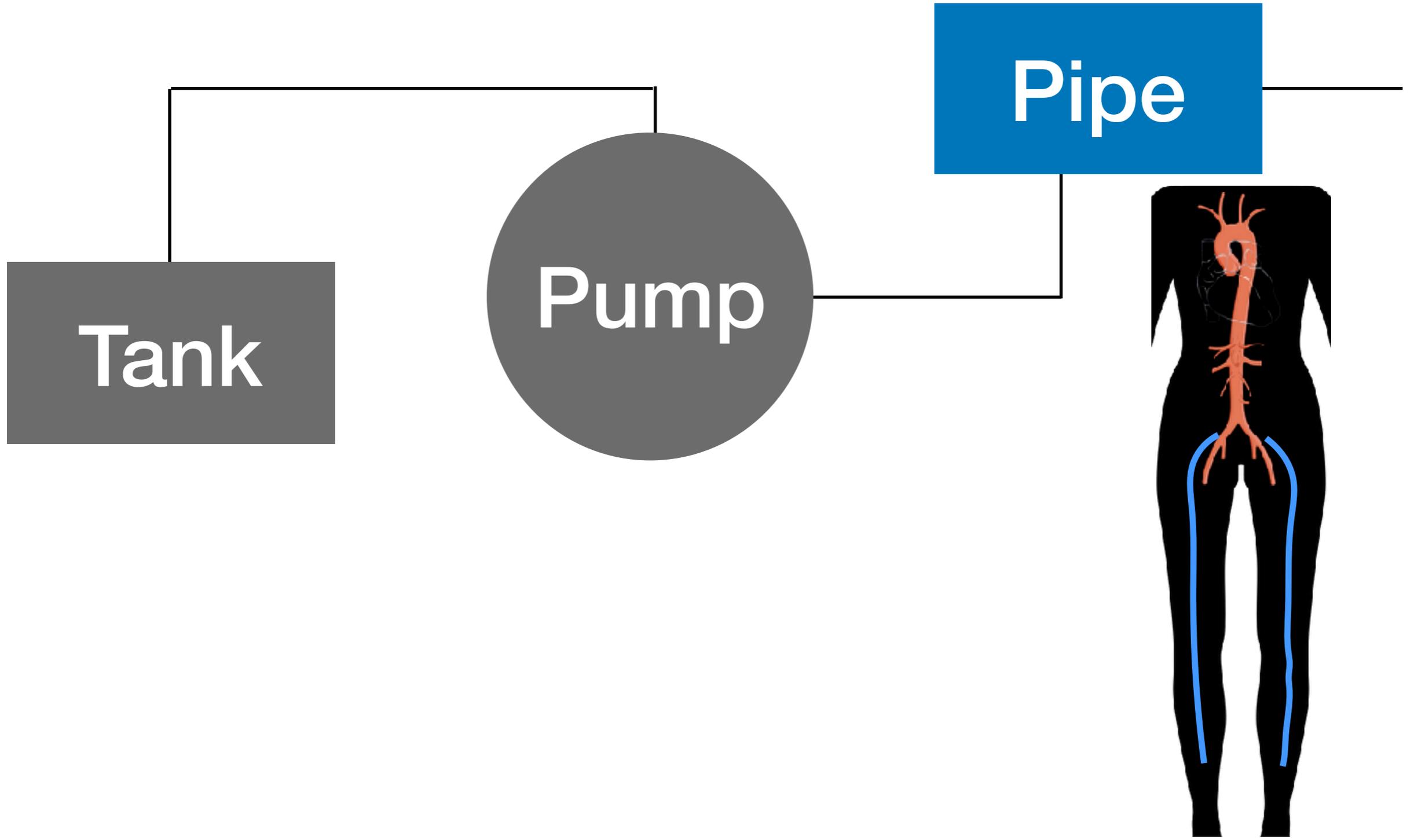


B-lines

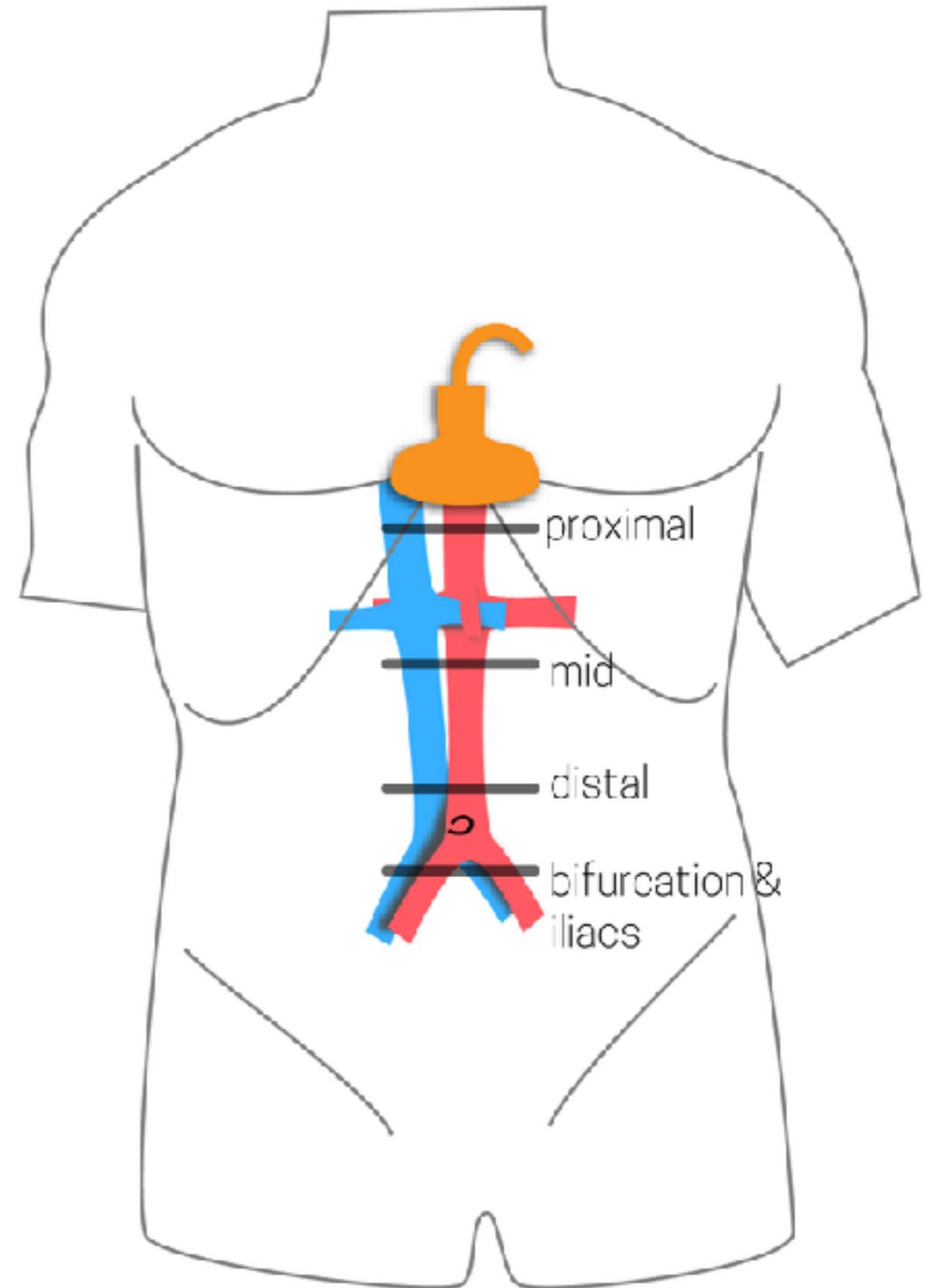
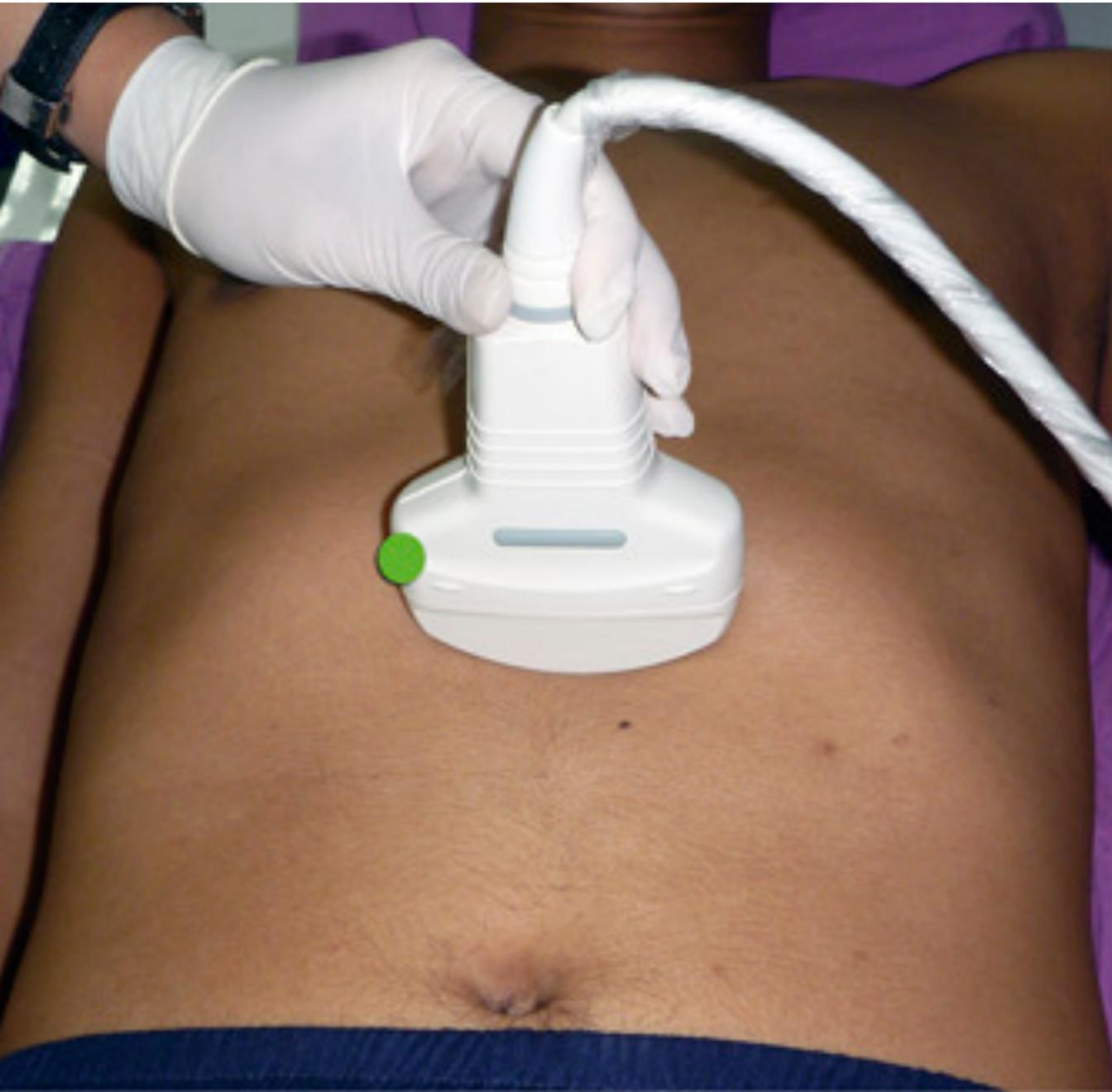


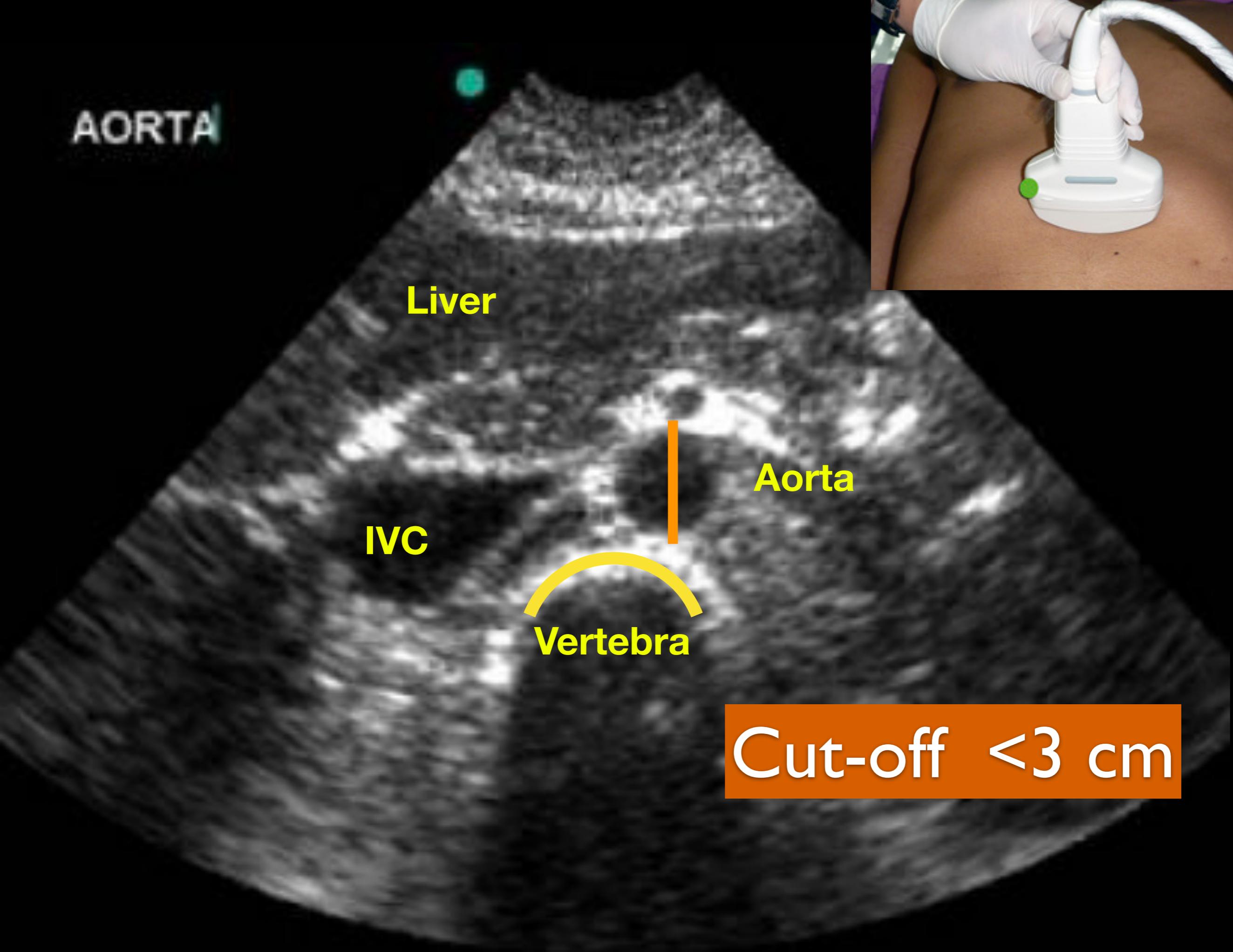
> 3 = wet lung
Pulmonary edema





Aortic Aneurysm & Dissection





AORTA

Liver

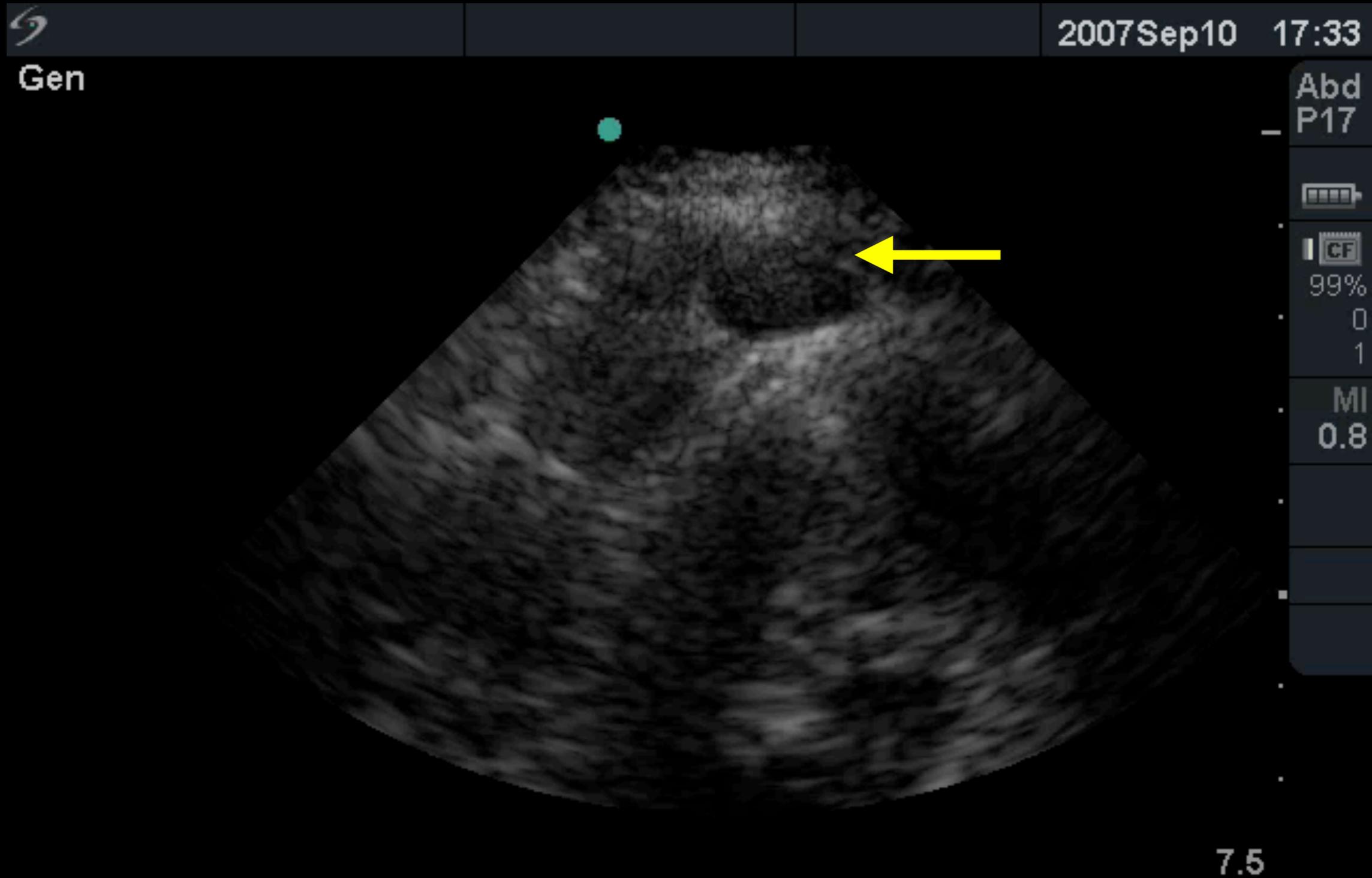
IVC

Vertebra

Aorta

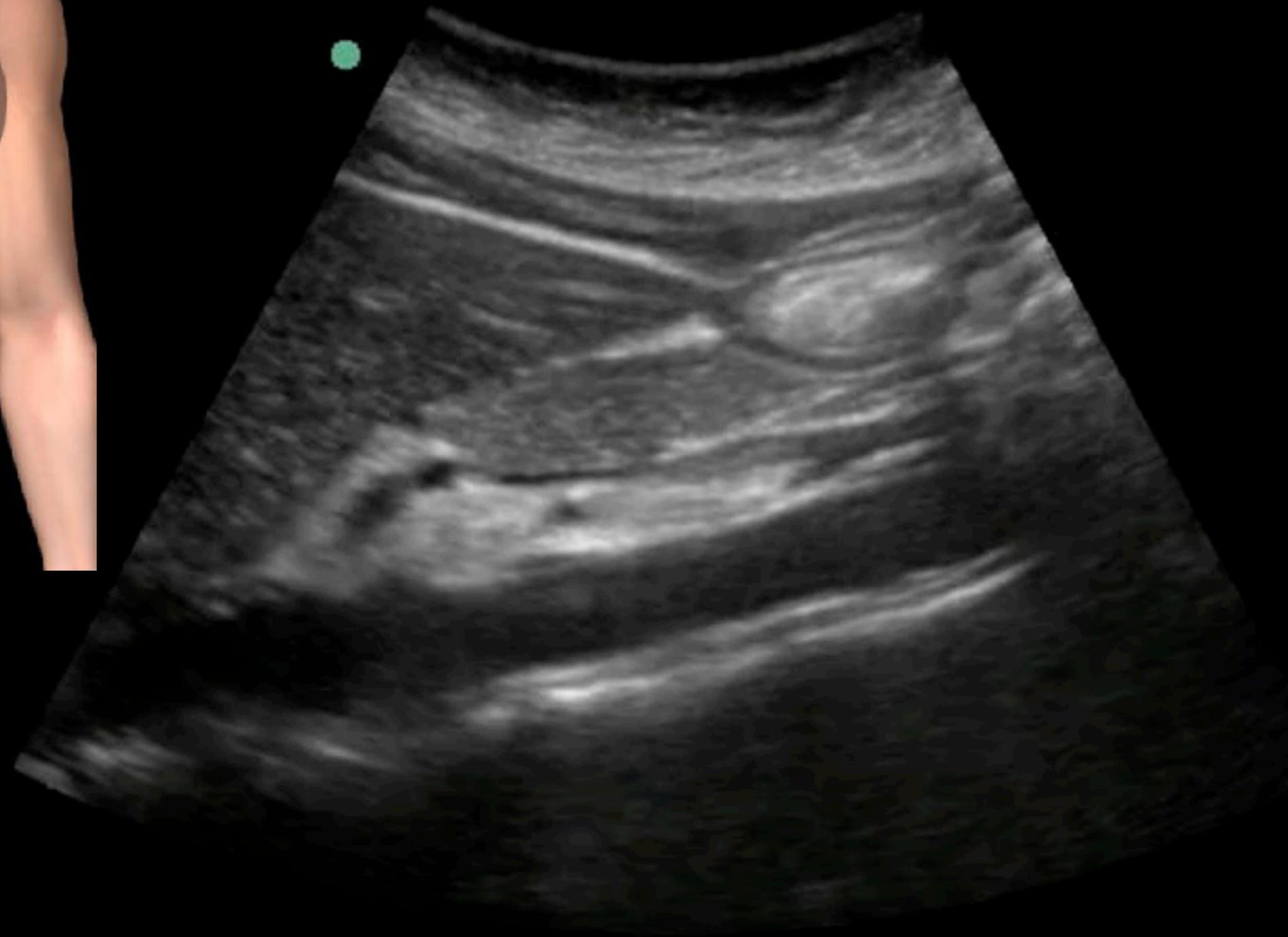
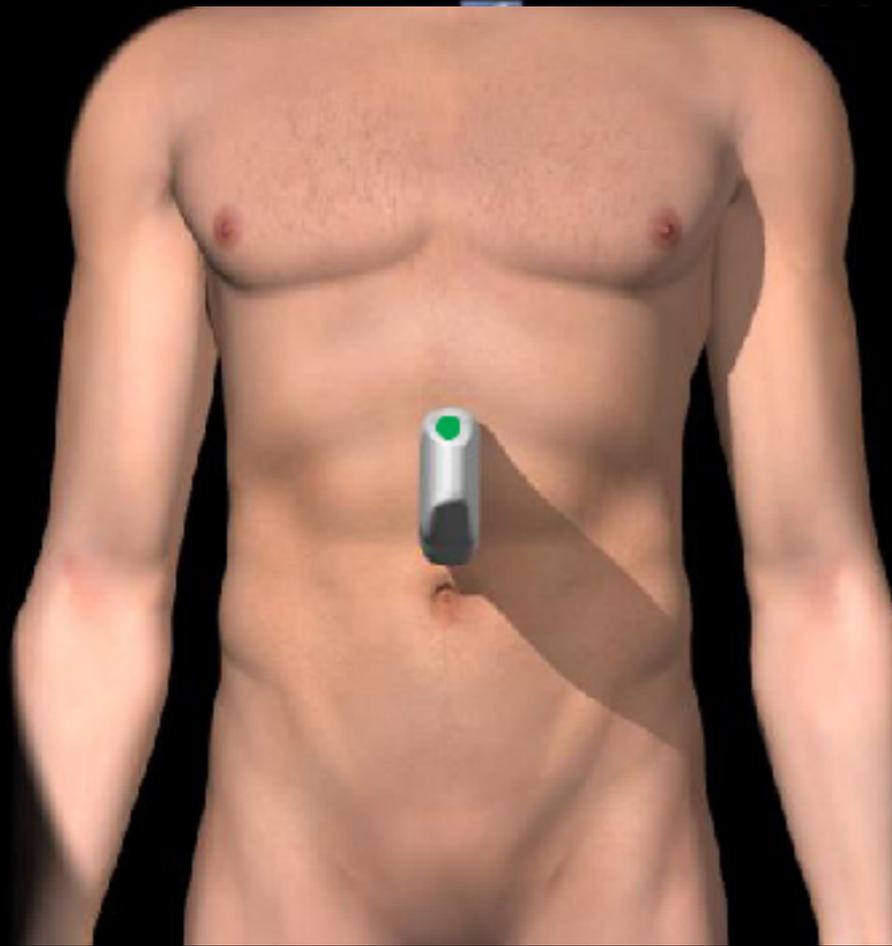
Cut-off < 3 cm

Bifurcation

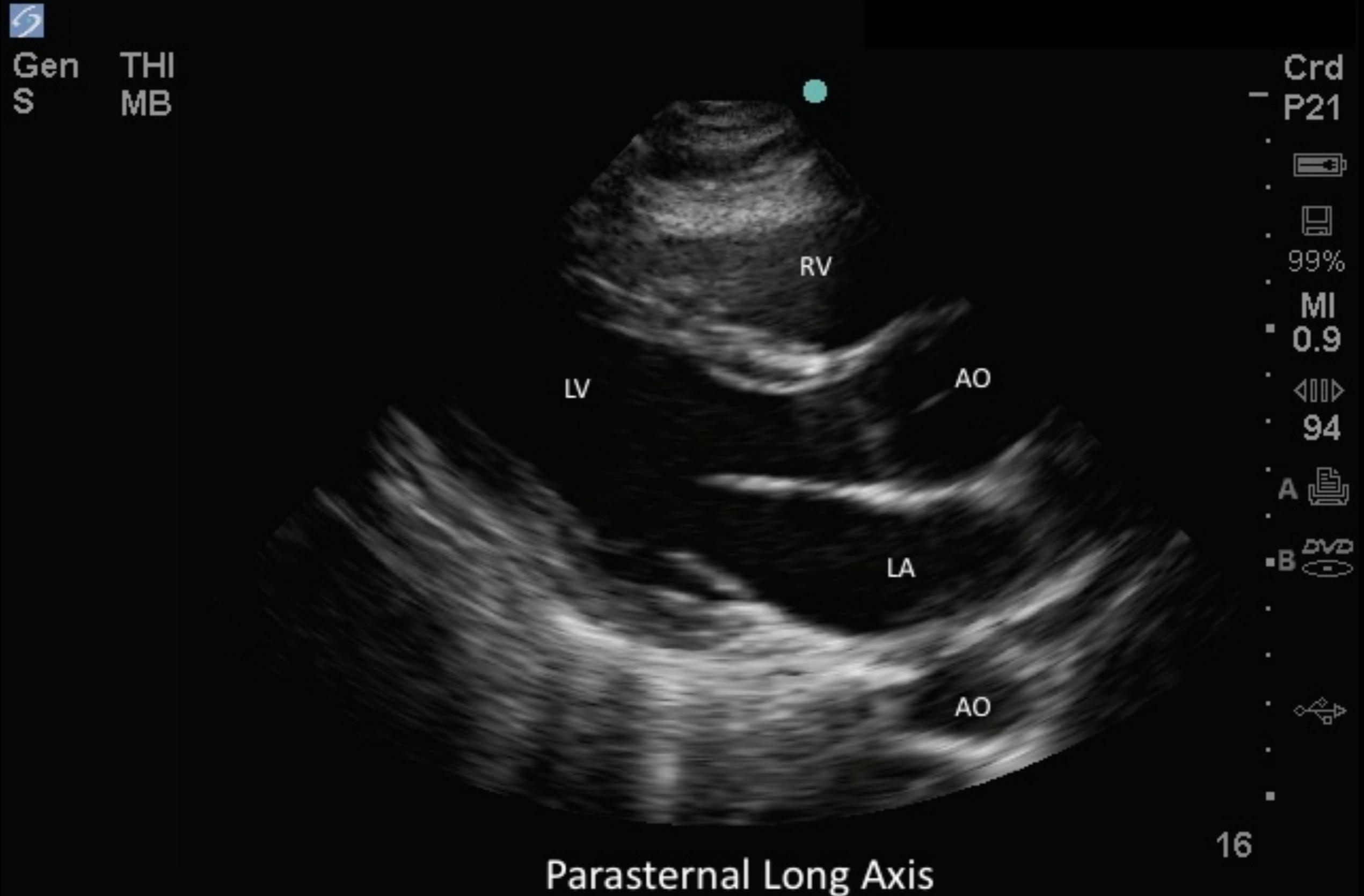


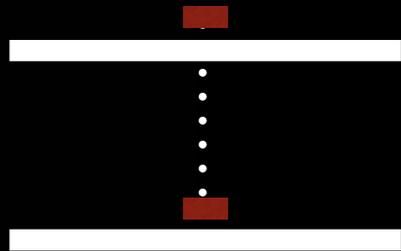
Long Axis Aorta

2014Dec09



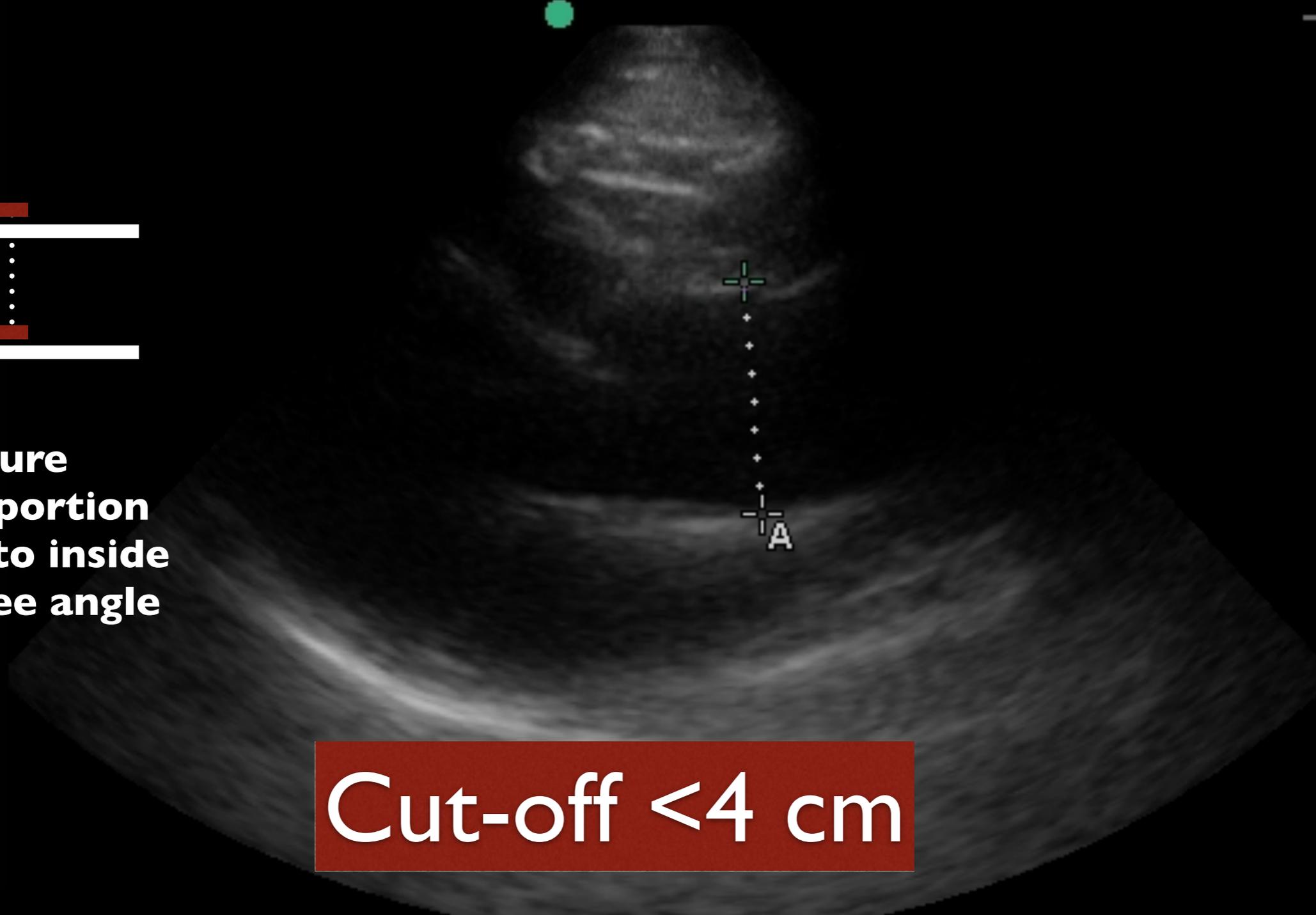
Aortic root





Measure

- widest portion
- outside to inside
- 90 degree angle



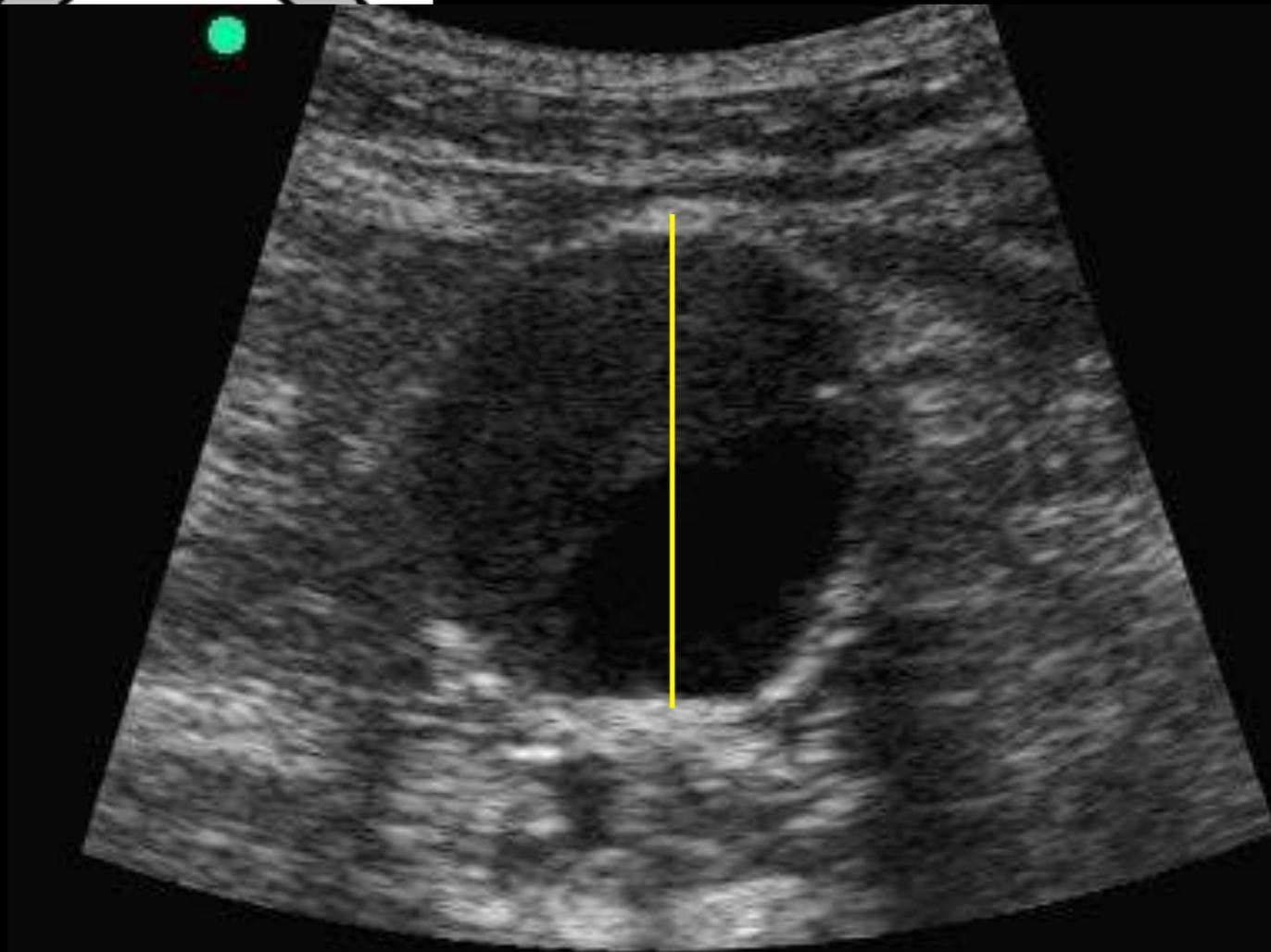
63%
MI
1.1
TIS
0.8
252
A
B

Cine

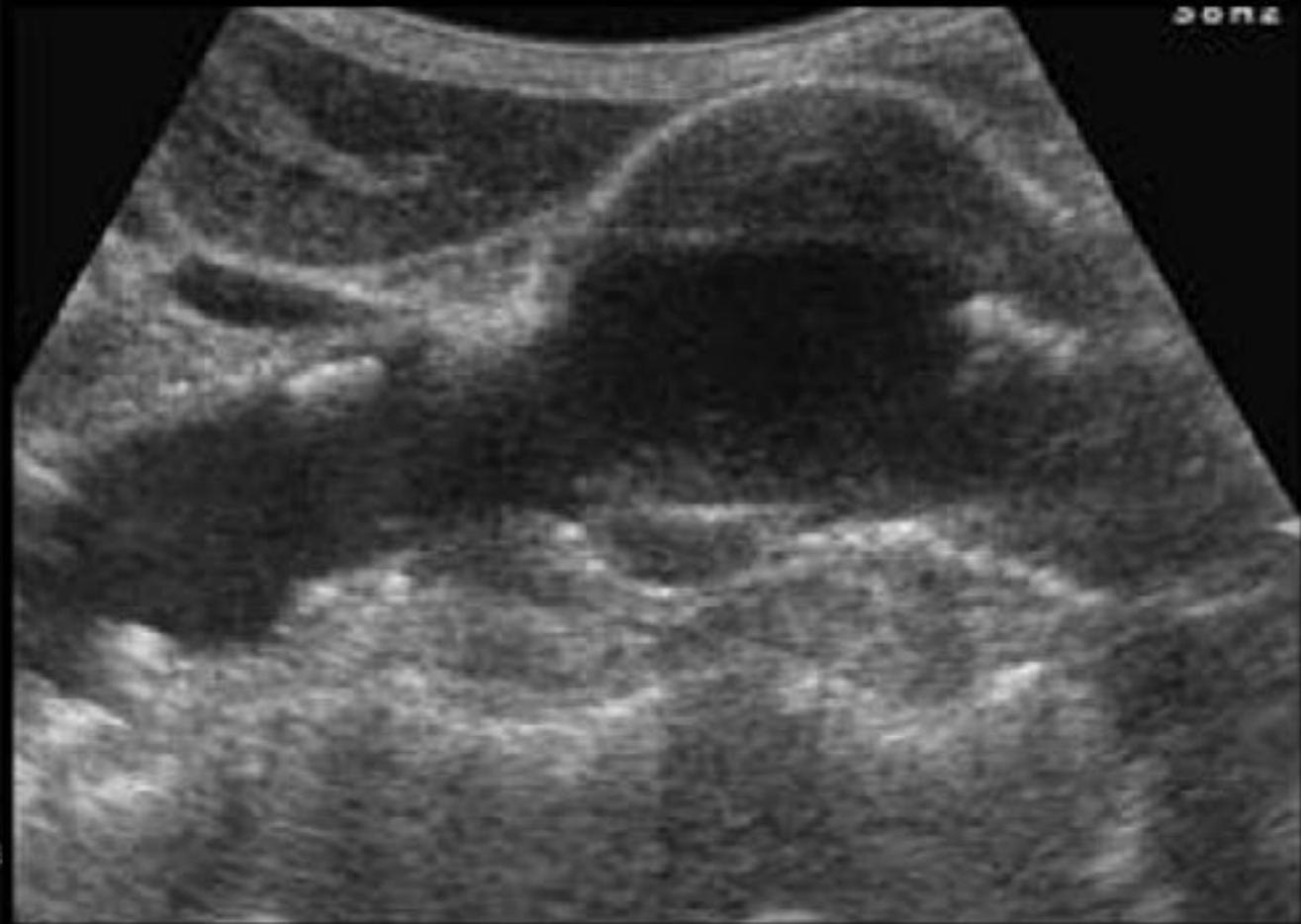


Abdominal aortic aneurysm

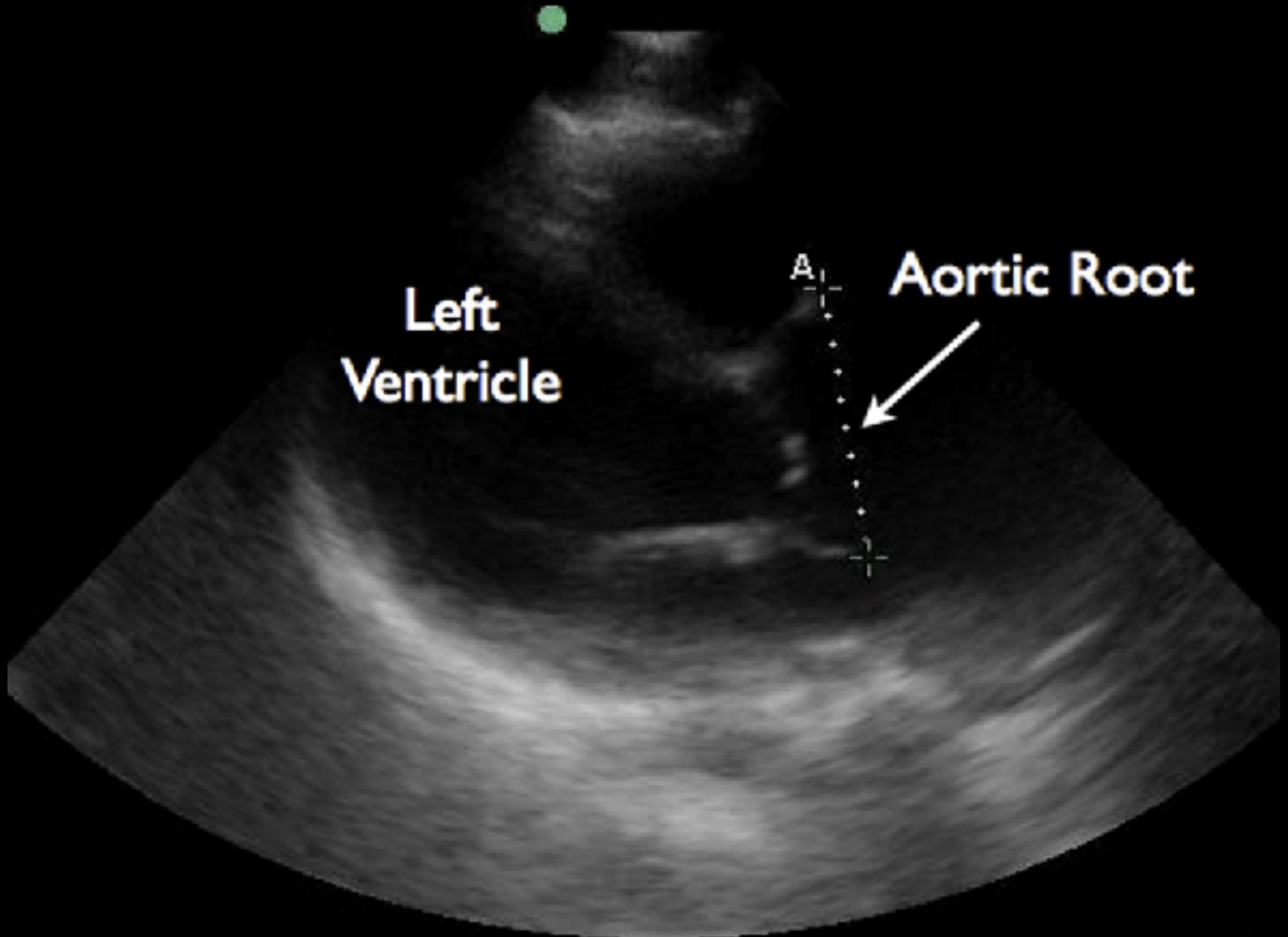
Mural thrombus



6.0 cm

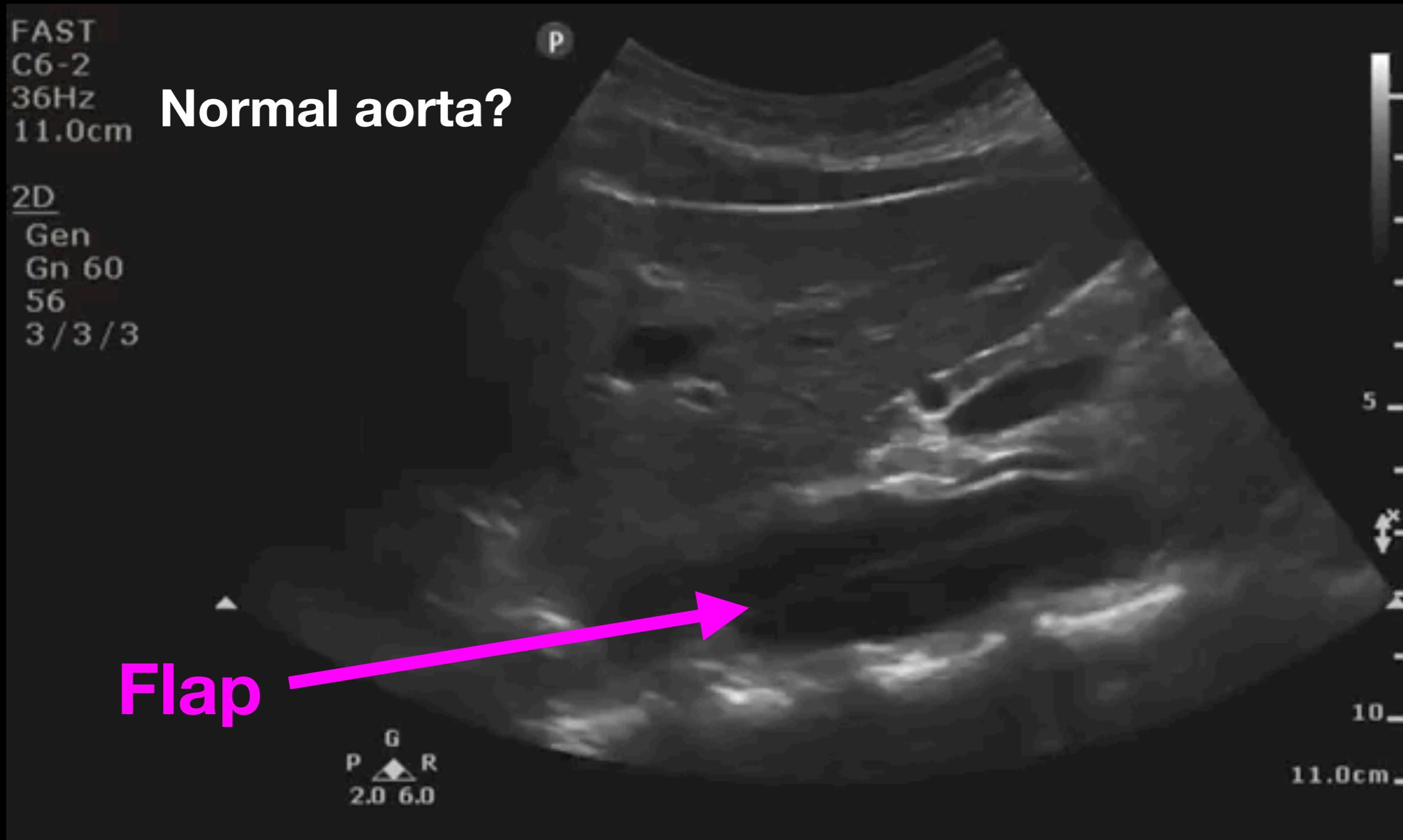


Thoracic aortic aneurysm

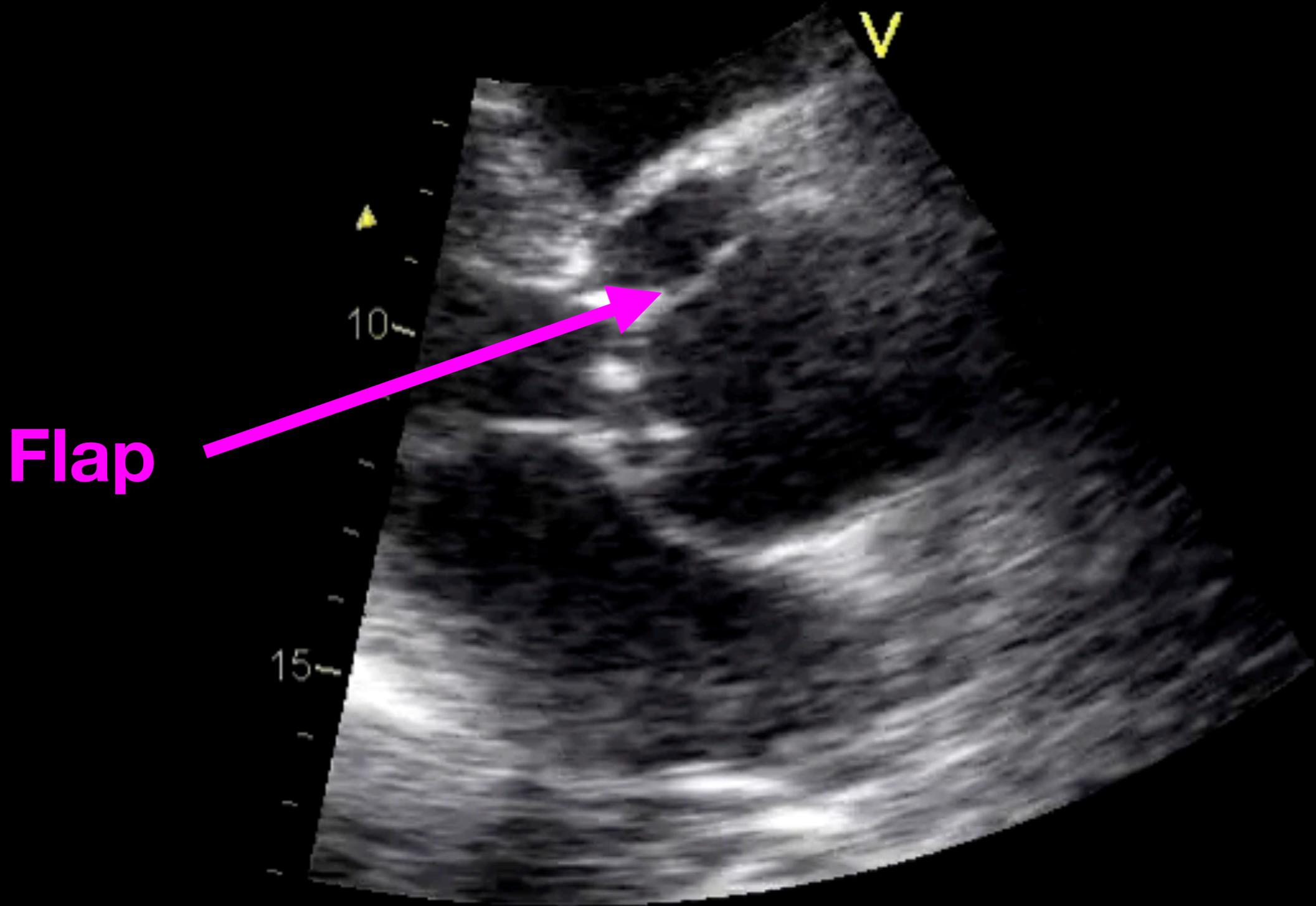


A 5.49cm

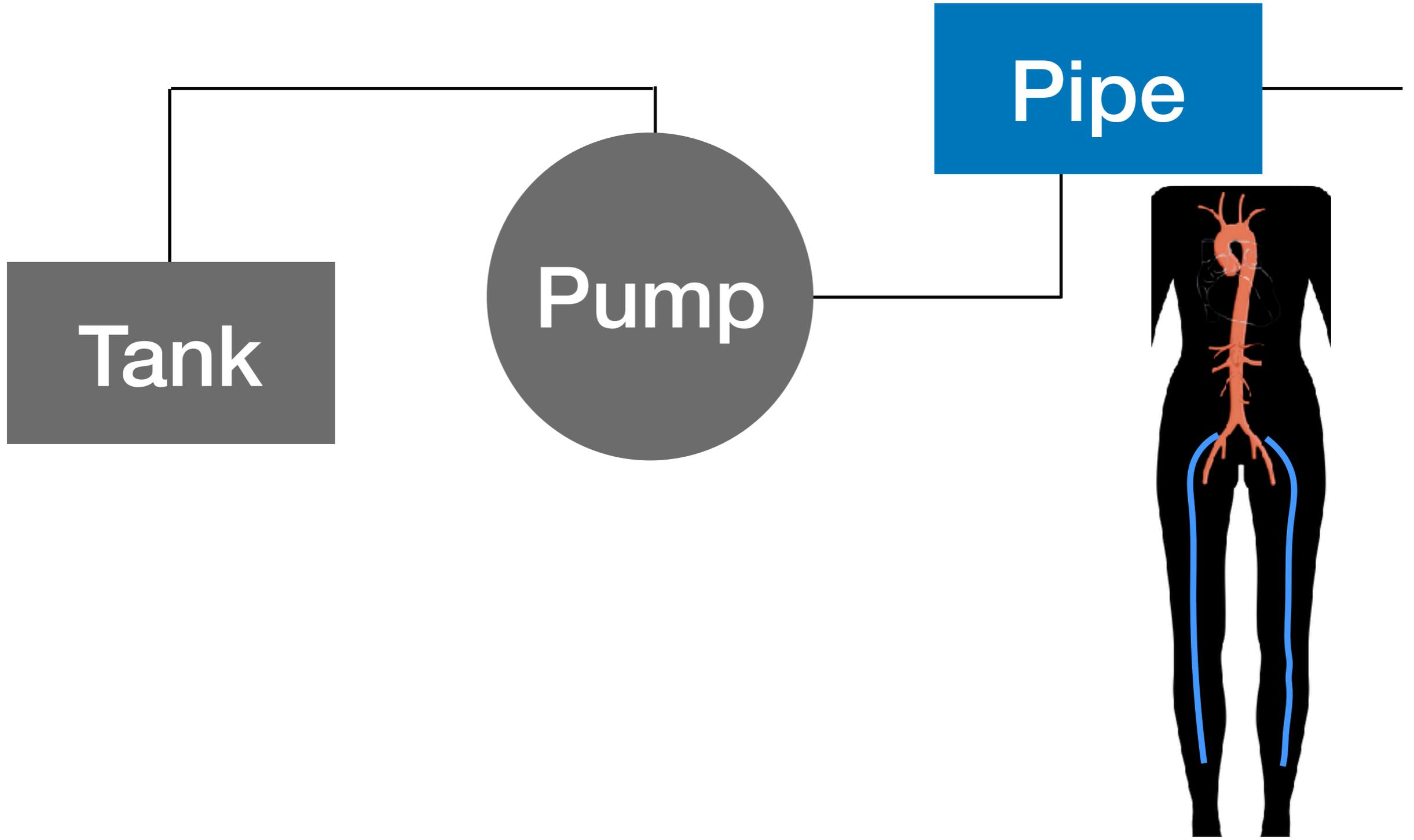
Abdominal aortic dissection



Thoracic aortic dissection

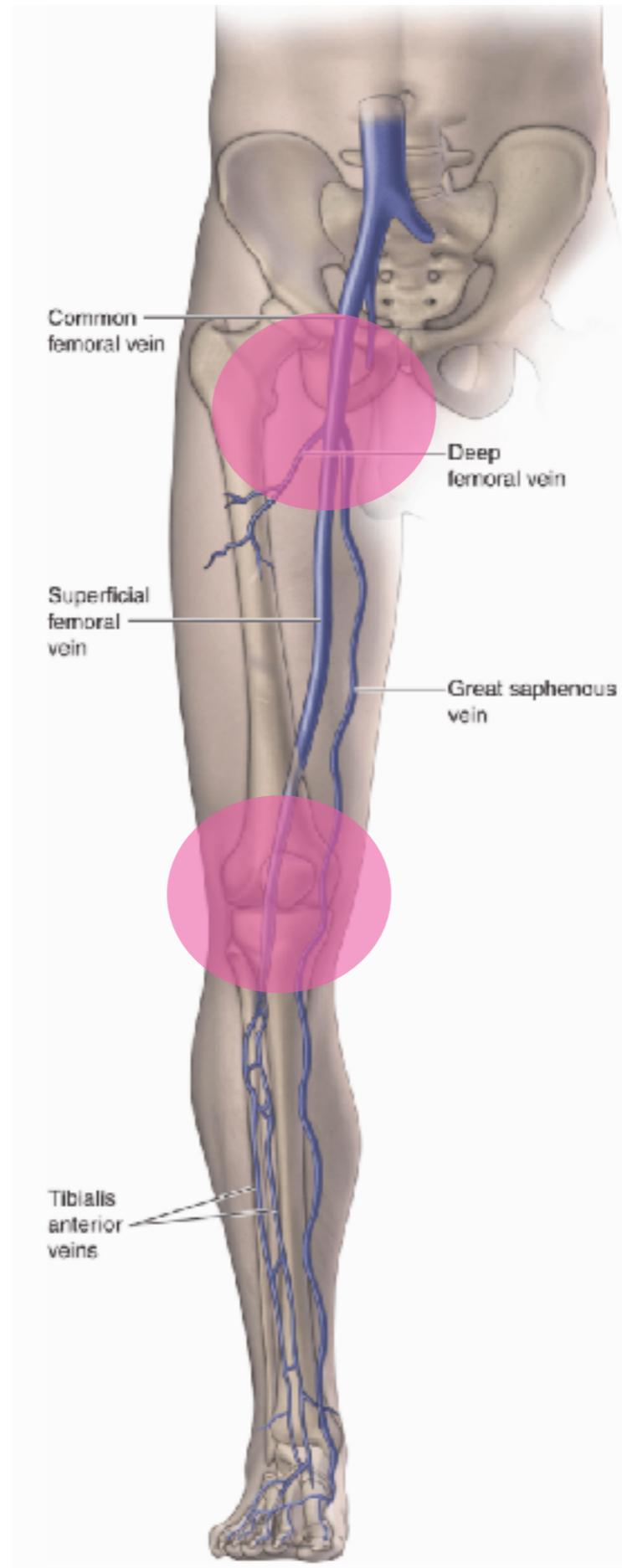


Flap

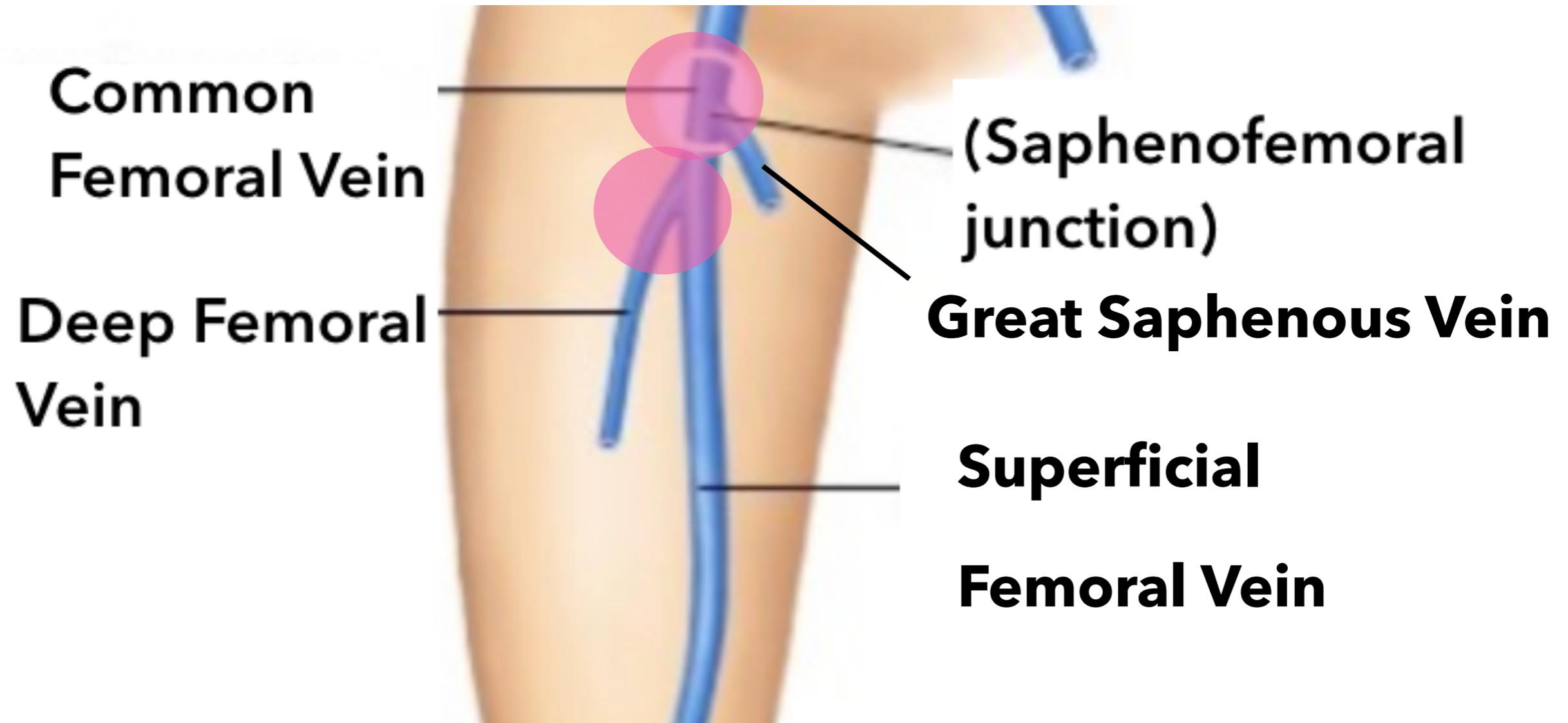


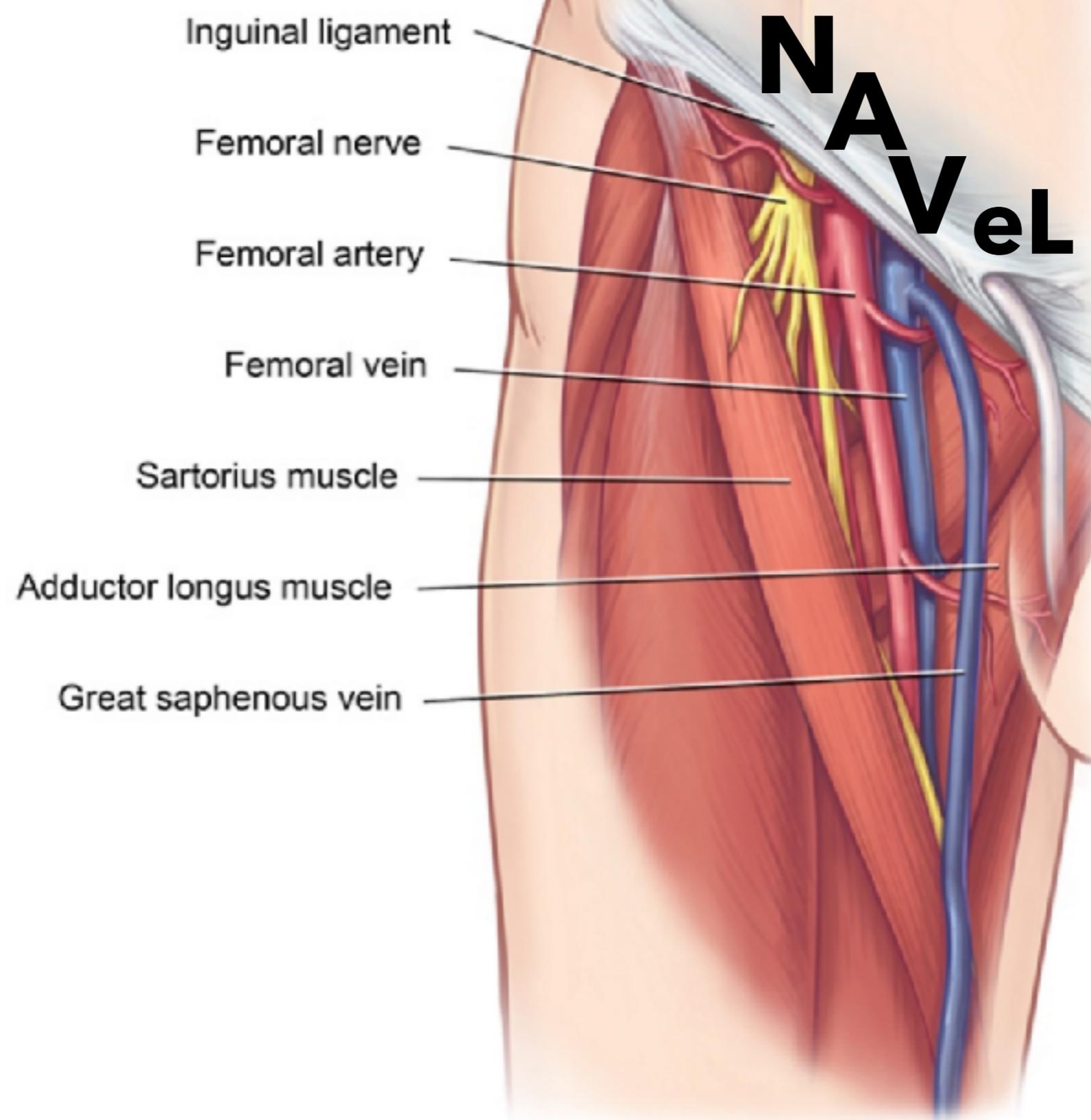
2-point compression

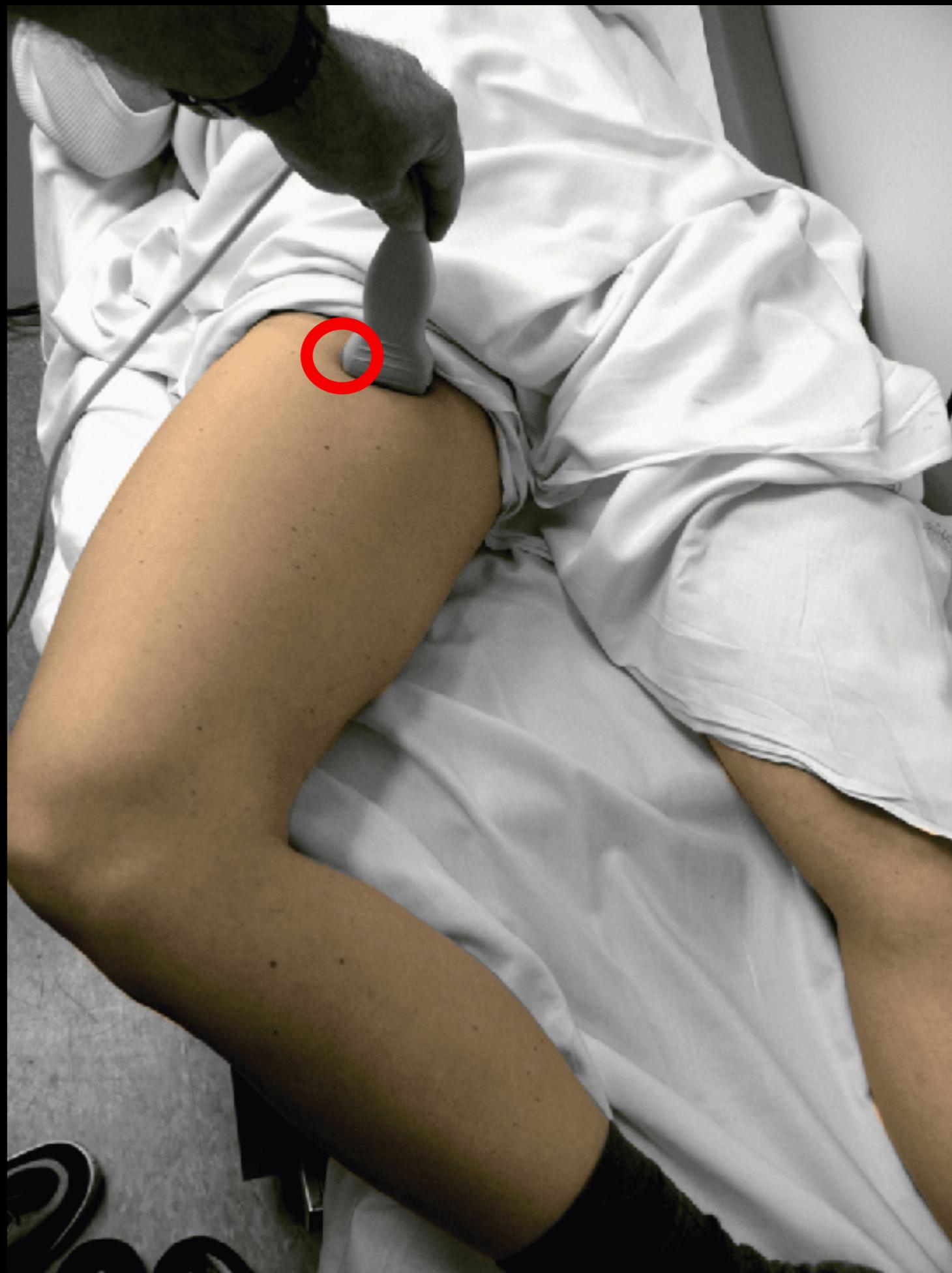
- Inguinal
- Popliteal



Inguinal

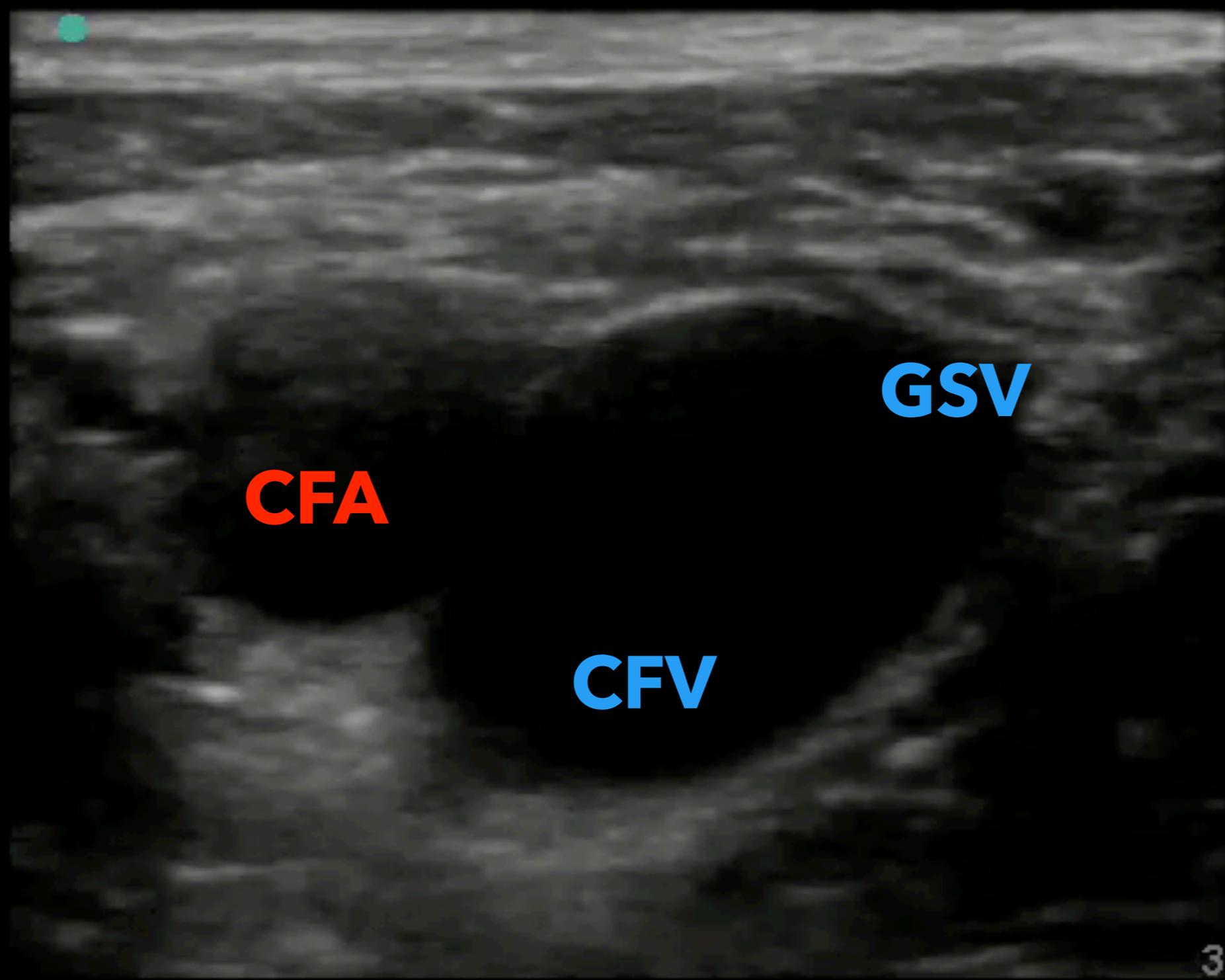






2013Mar01

MB

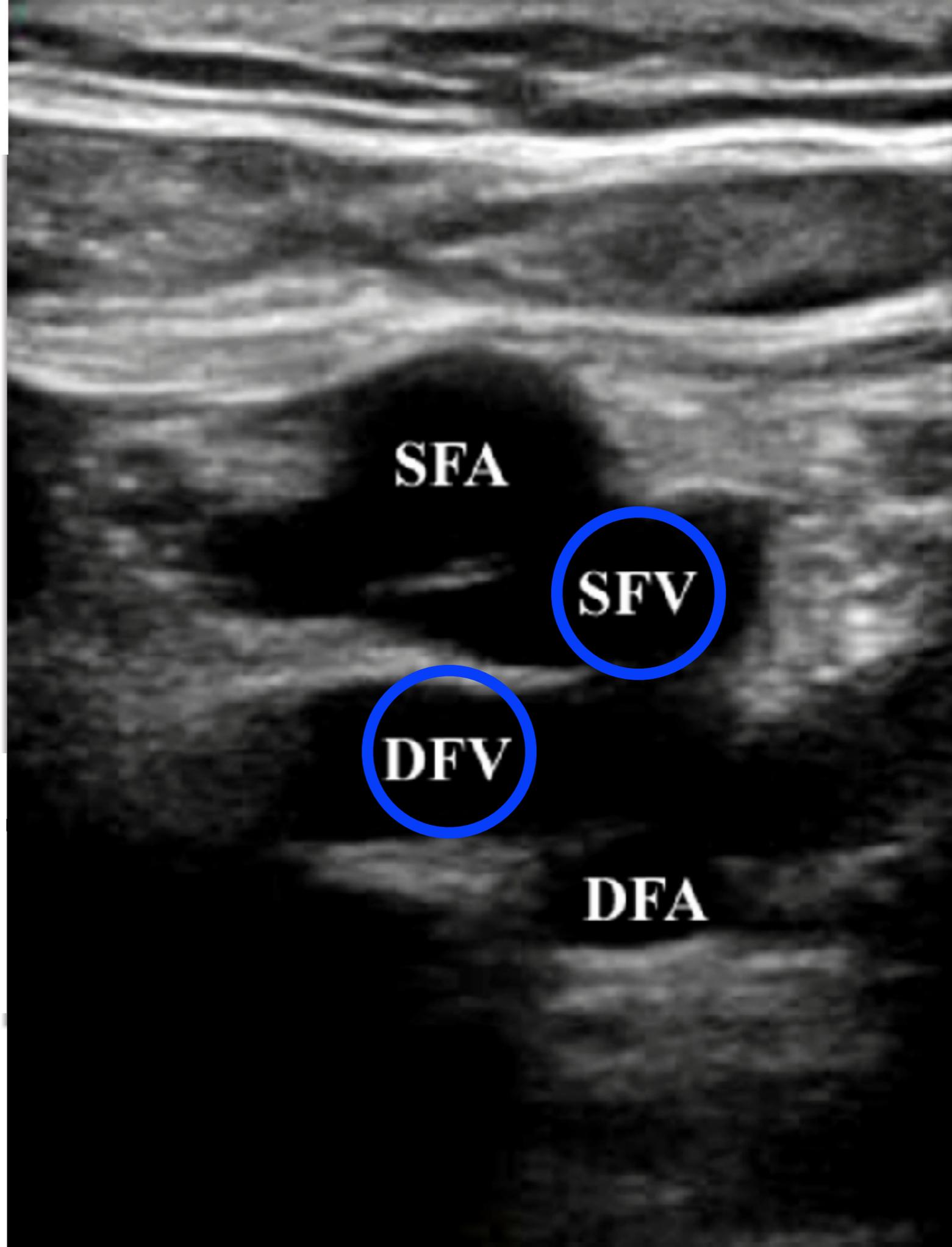
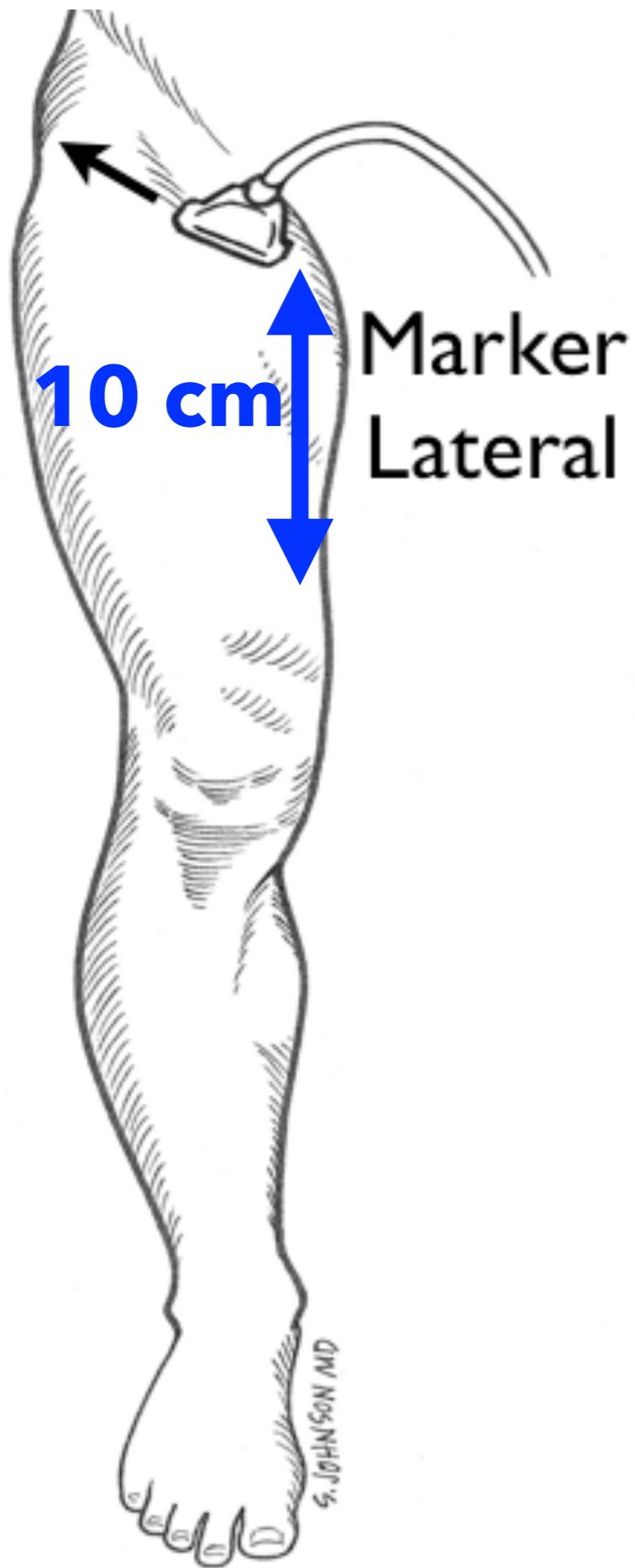


0.2

A 
B 



3.1



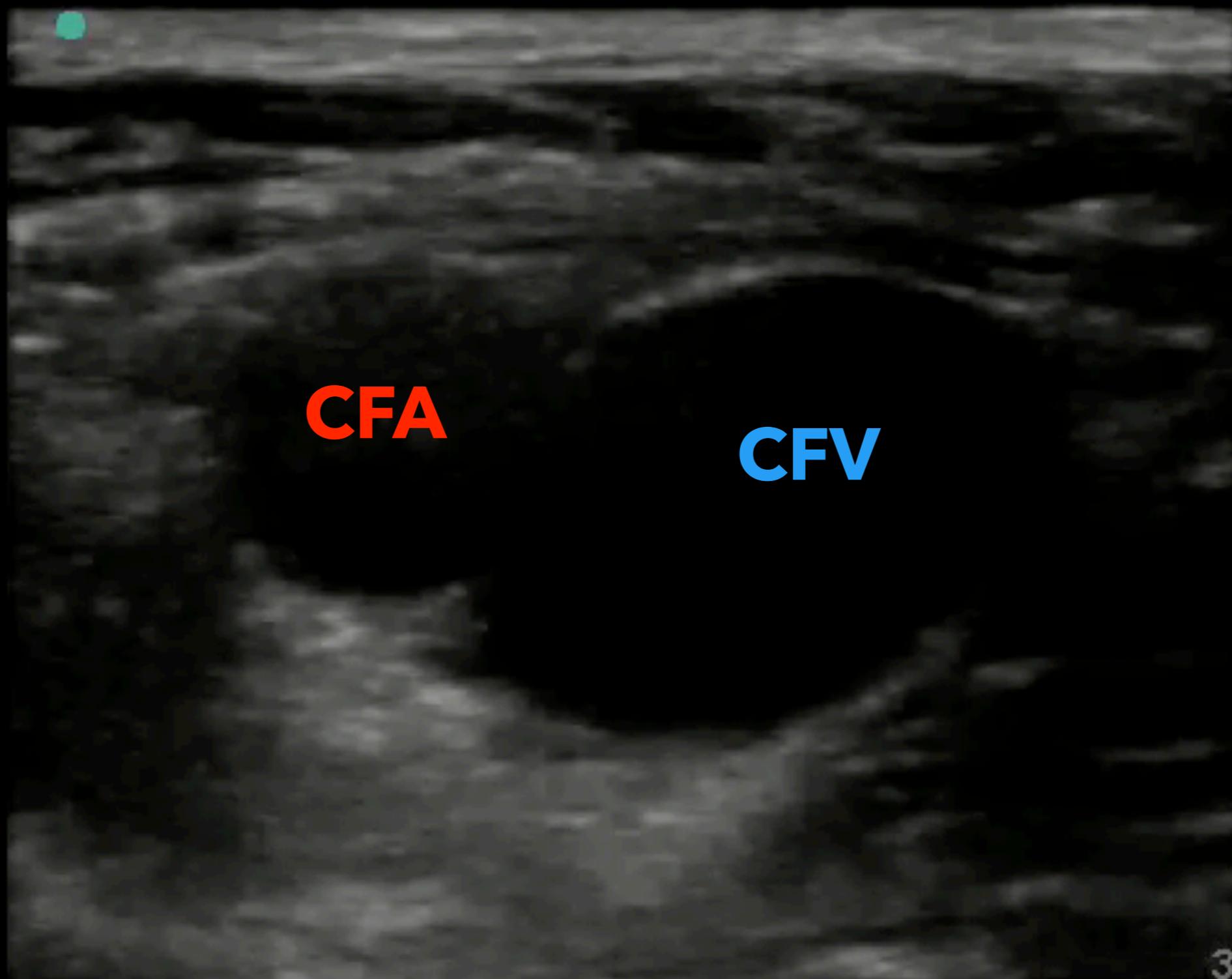
Compression Test

Normal



2013Mar02 00:08

Gen
S MB



CFA

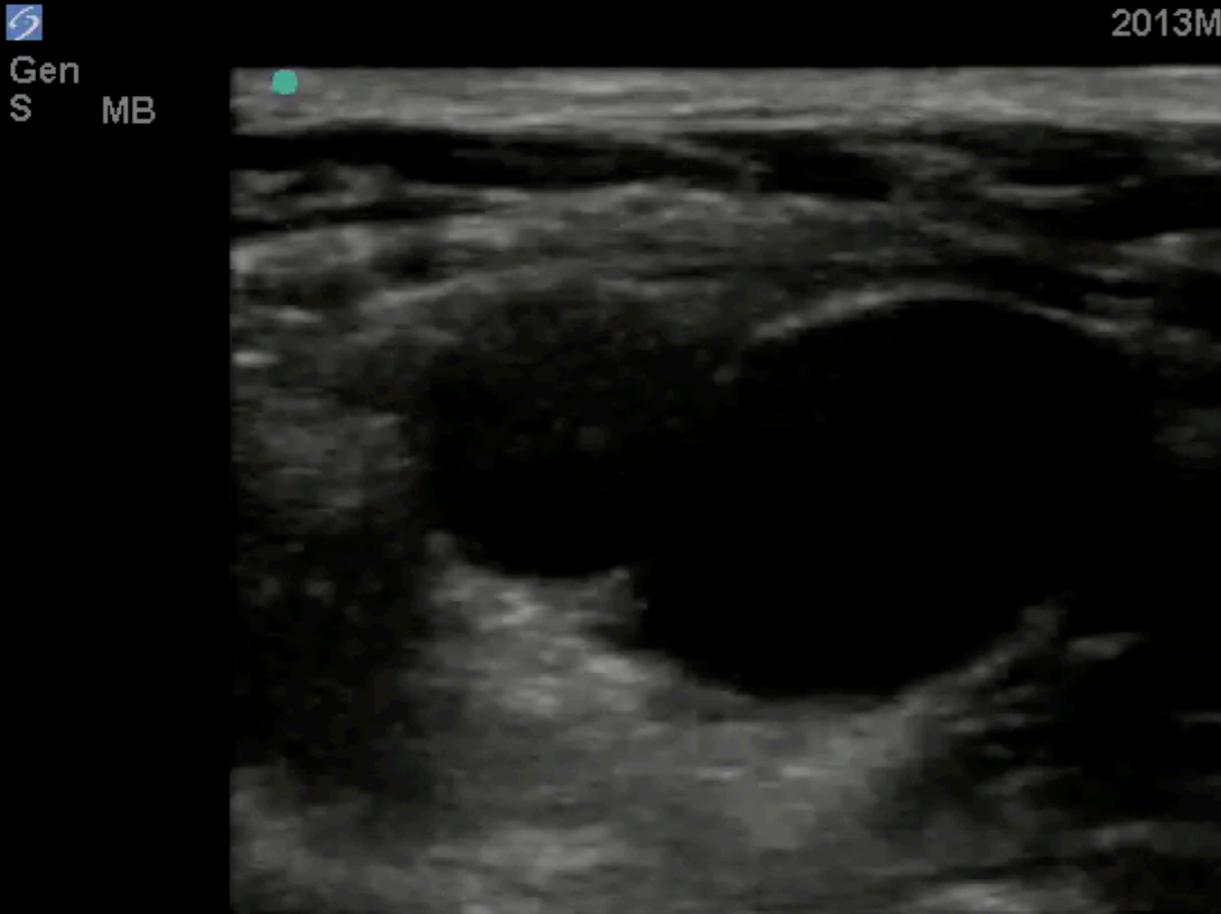
CFV

Ven
L38
56%
MI
1.5
TIS
0.2

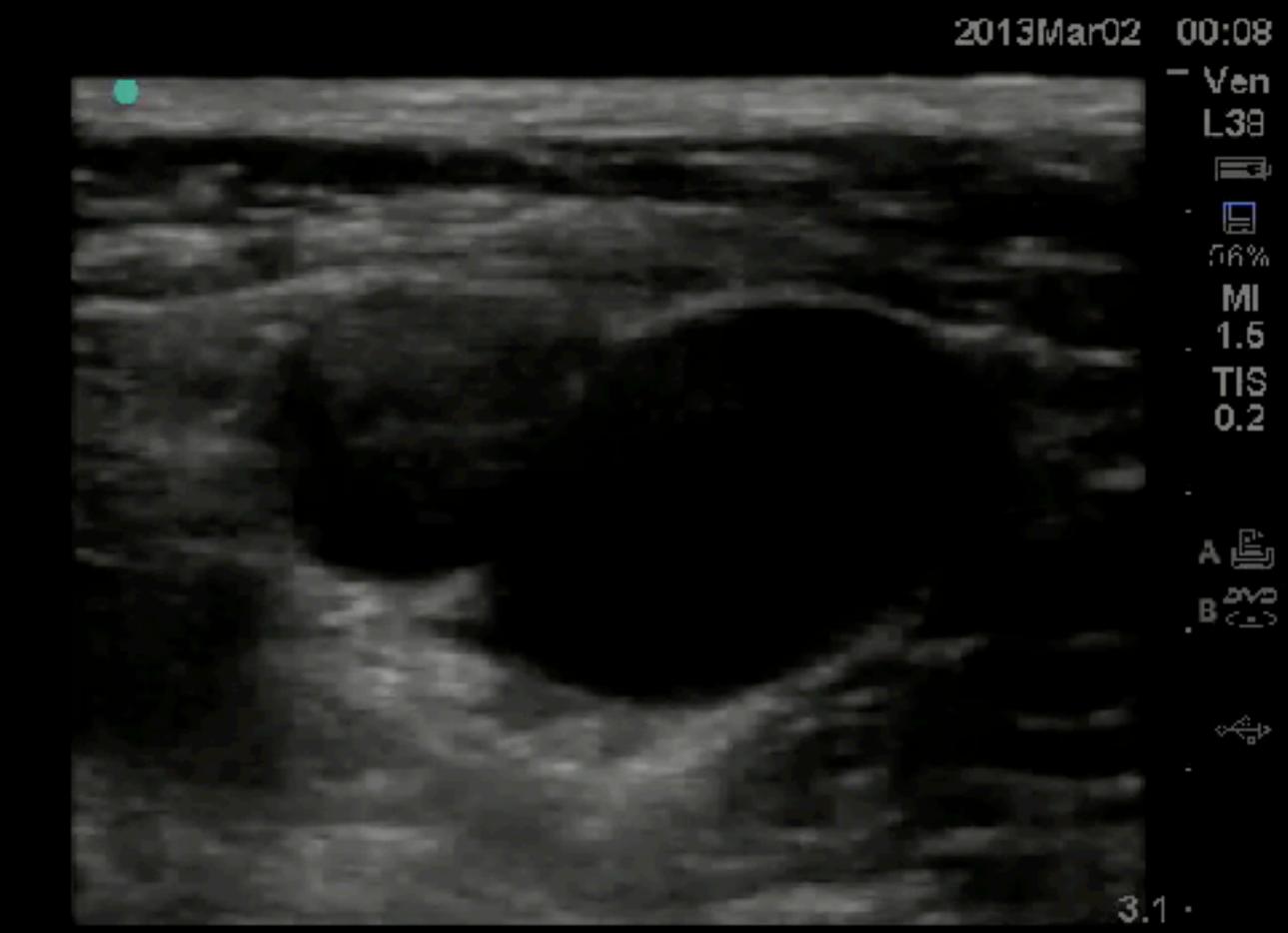
A
B DVD

3.1

How much Compression?

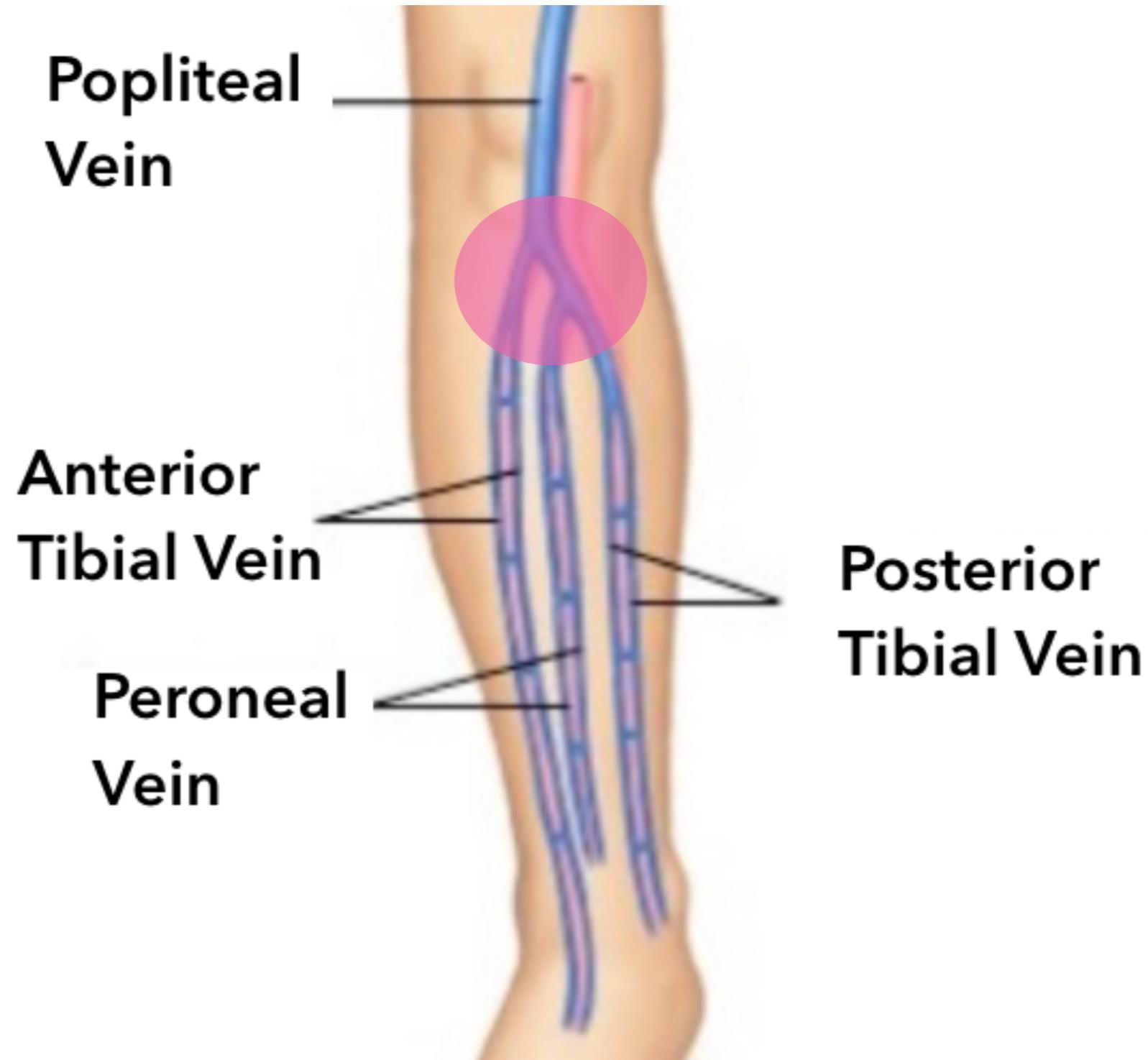


Good

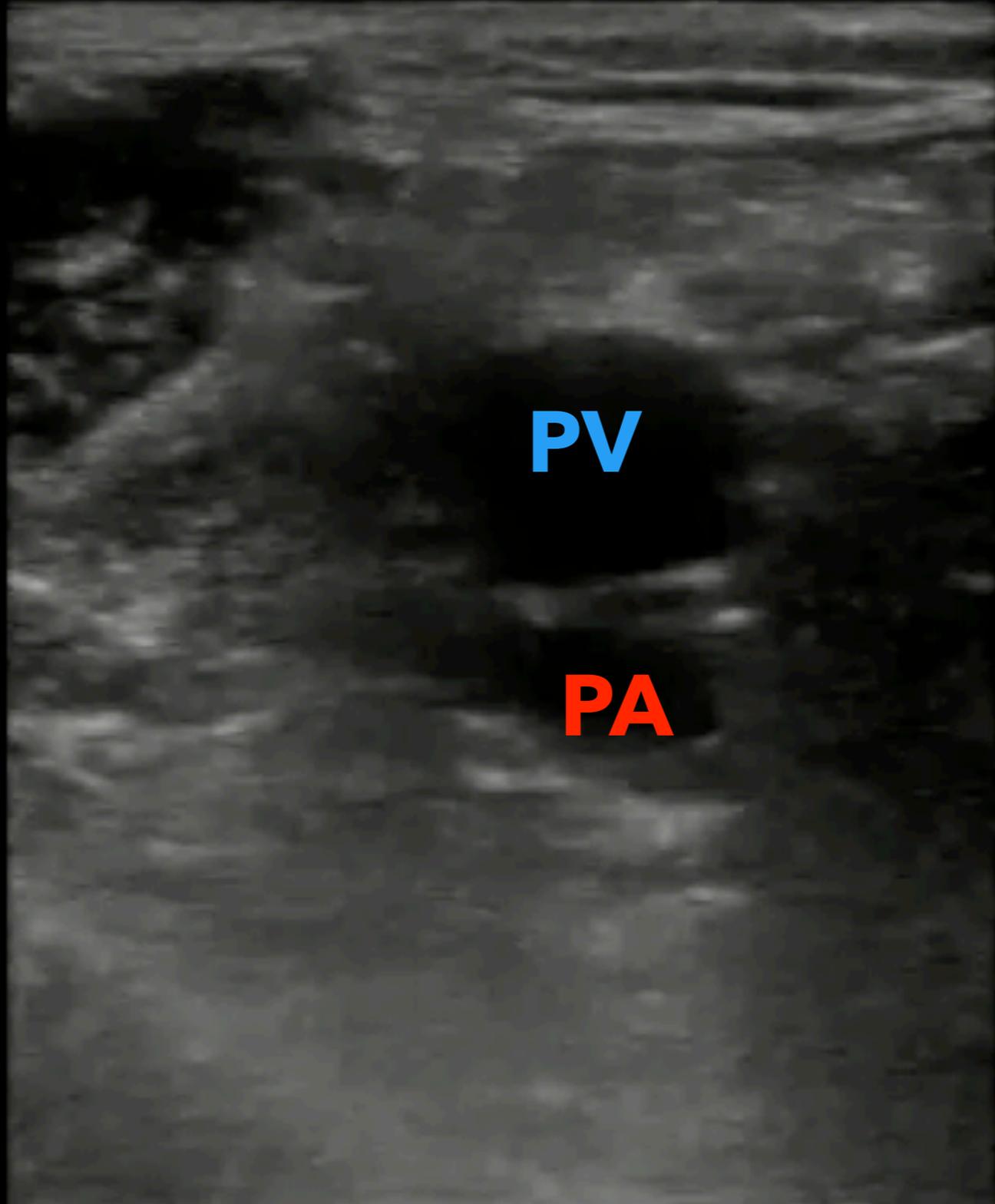


Too much

Popliteal



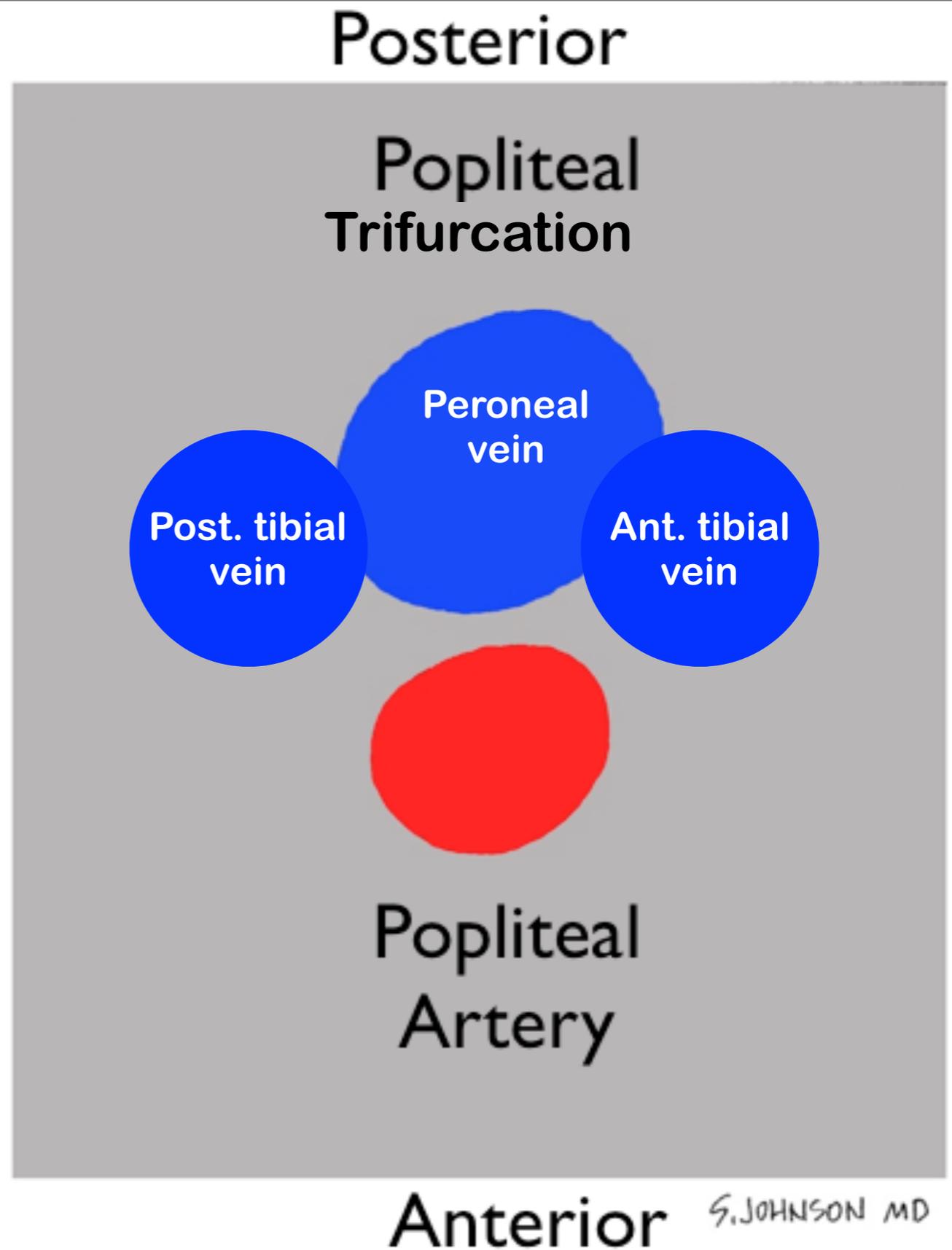
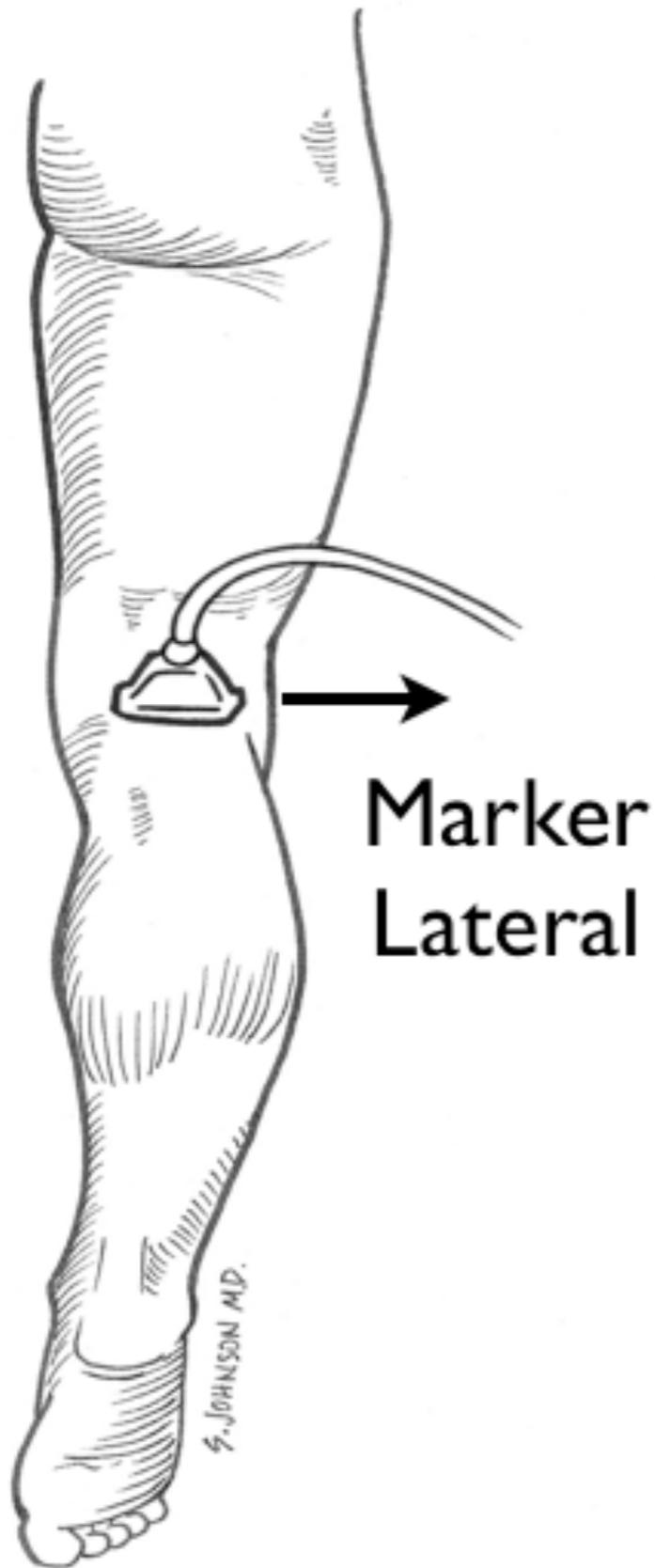




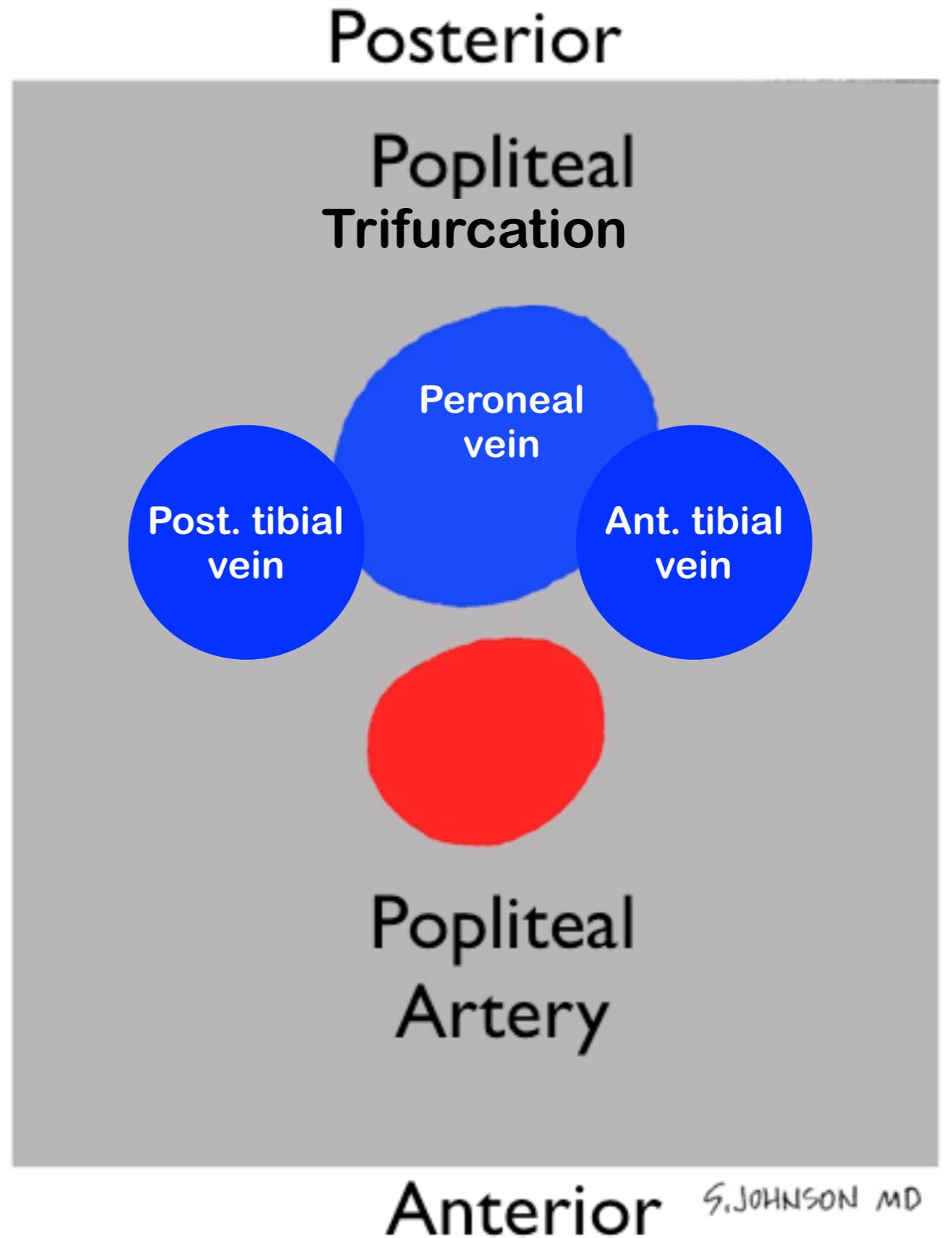
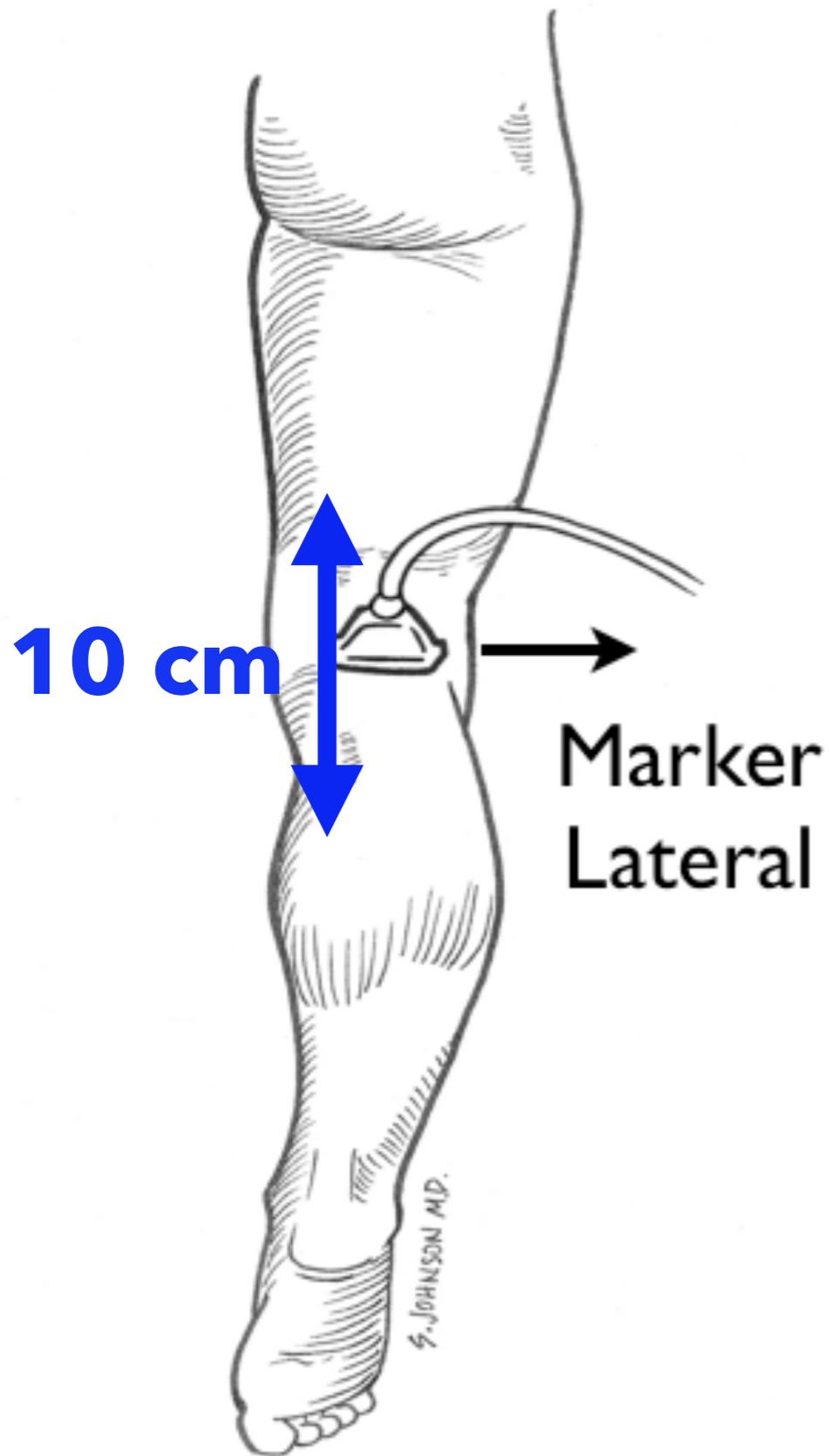
V
L
5
T
C
A
.B

4.7

Ultrasound of Popliteal Vessels:



Ultrasound of Popliteal Vessels:





Gen
S MB

Ven
L38



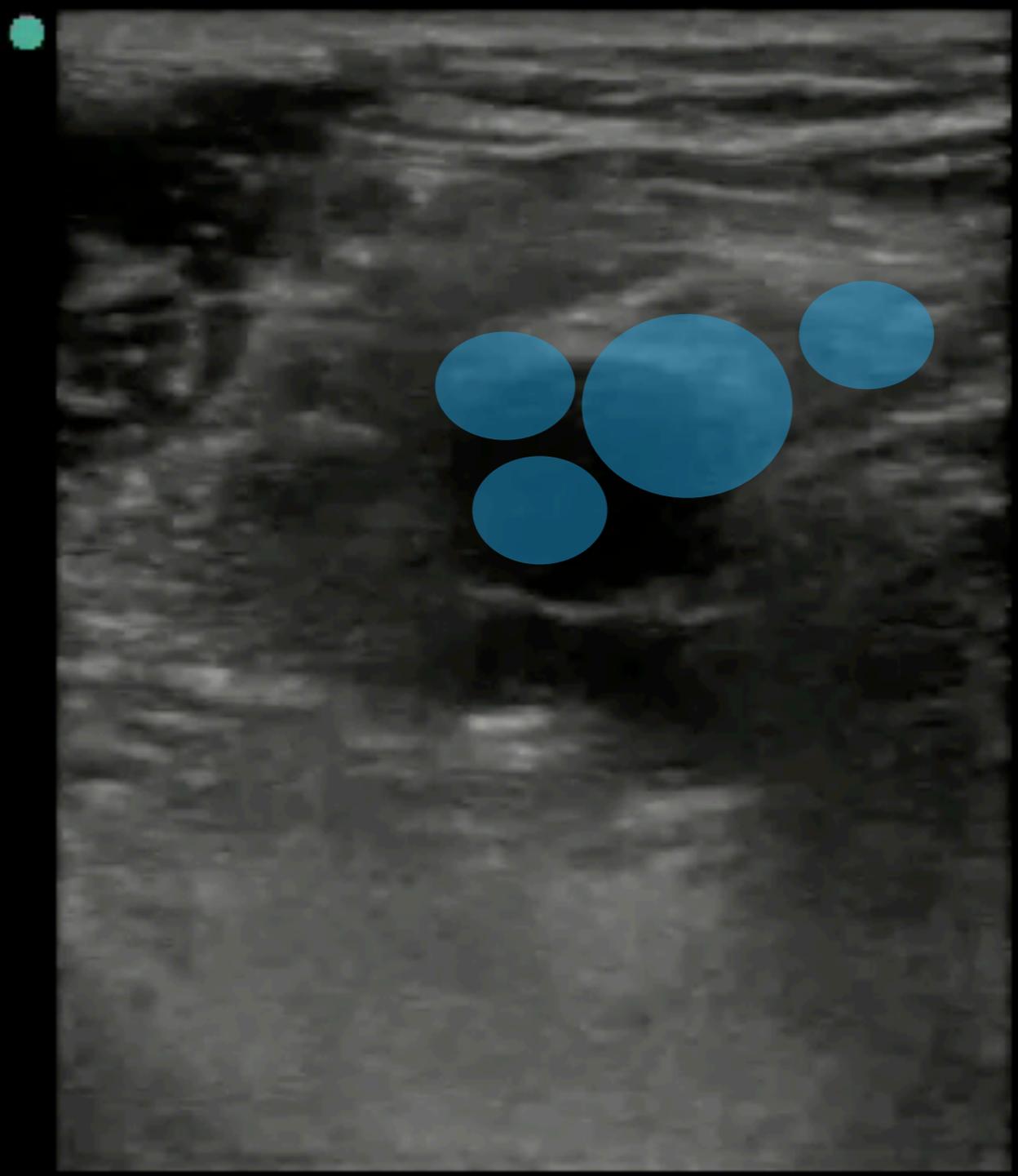
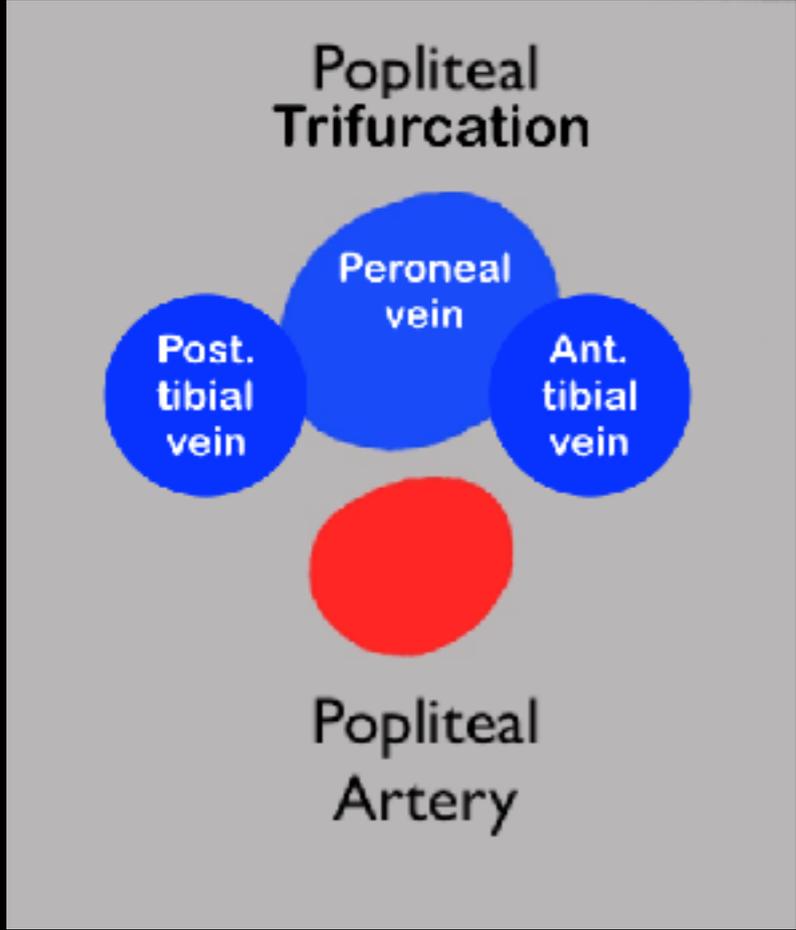
54%

MI

1.1

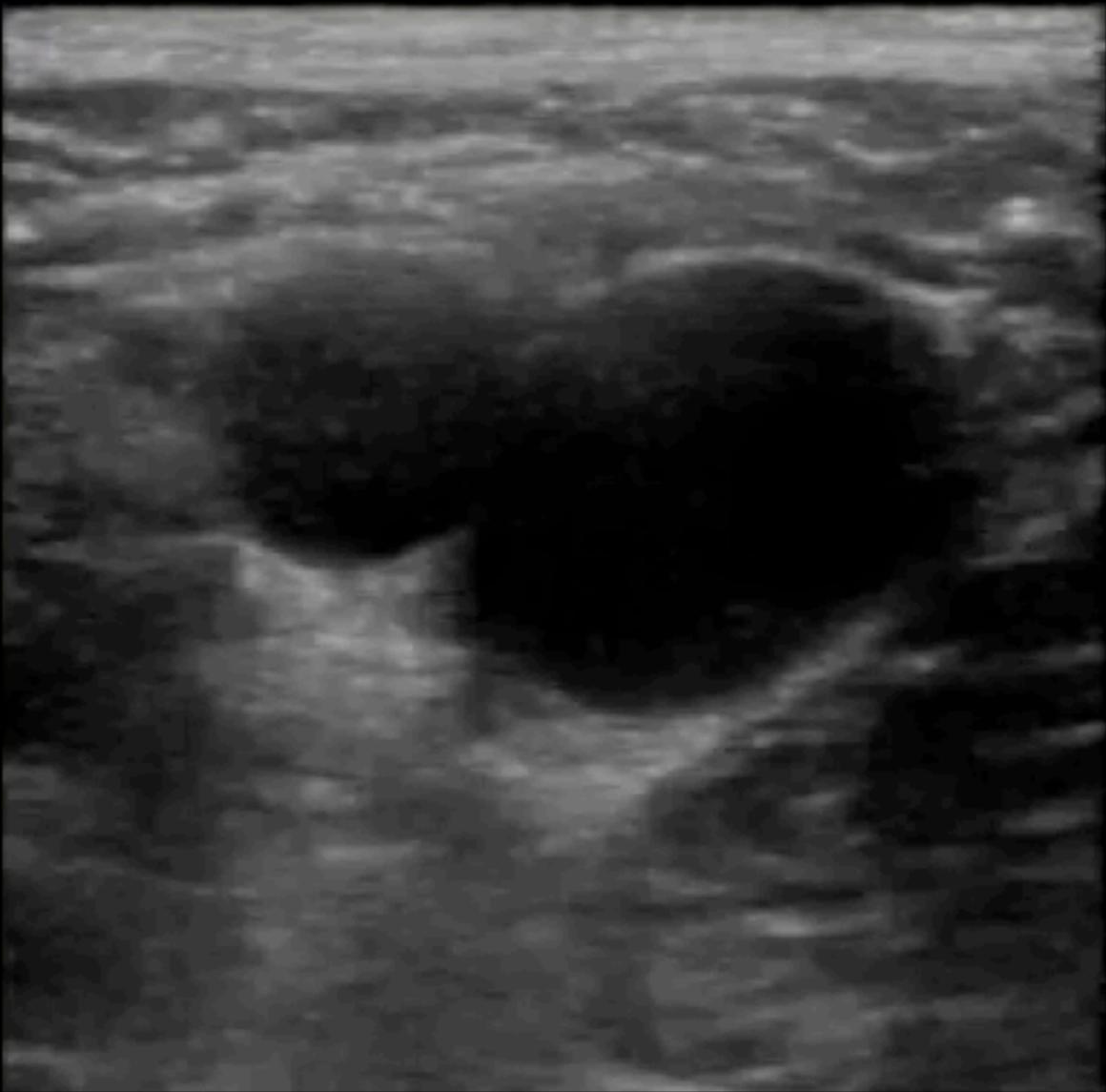
TIS

0.3



4.7

Normal - Right



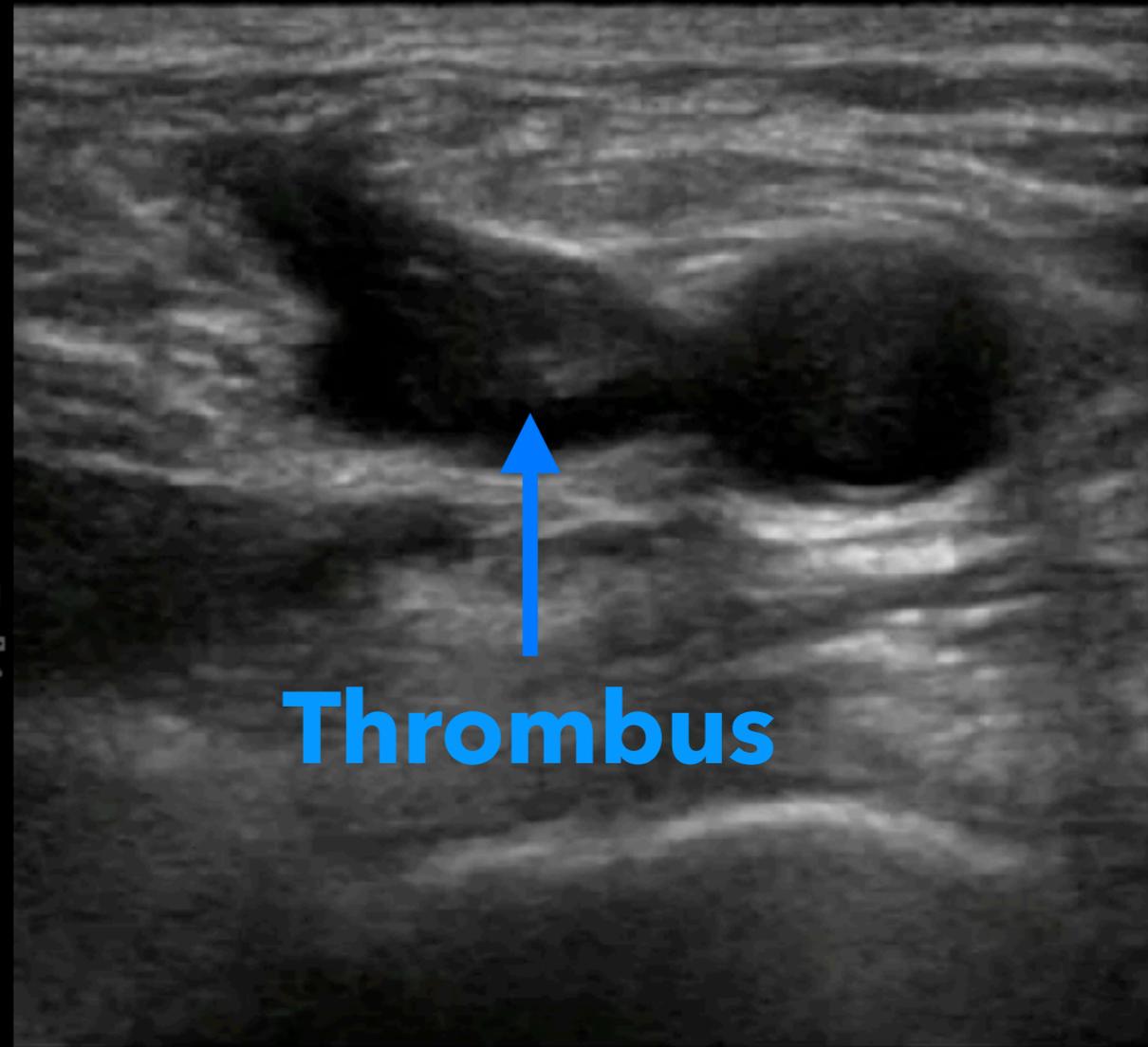
2013Mar01 23:53

- Ven
L38
66%
MI
1.3
TIS
0.3

A
B

3.8

DVT- Left



2016Dec2

Thrombus

Inguinal region

Normal

DVT

Anechoic thrombus

2015Oct



4.7

Popliteal fossa

Hypovolemic shock

Pump

Hypercontractile heart
Small heart size

Tank

Flat IVC

Peritoneal fluid
Pleural fluid

Pipes

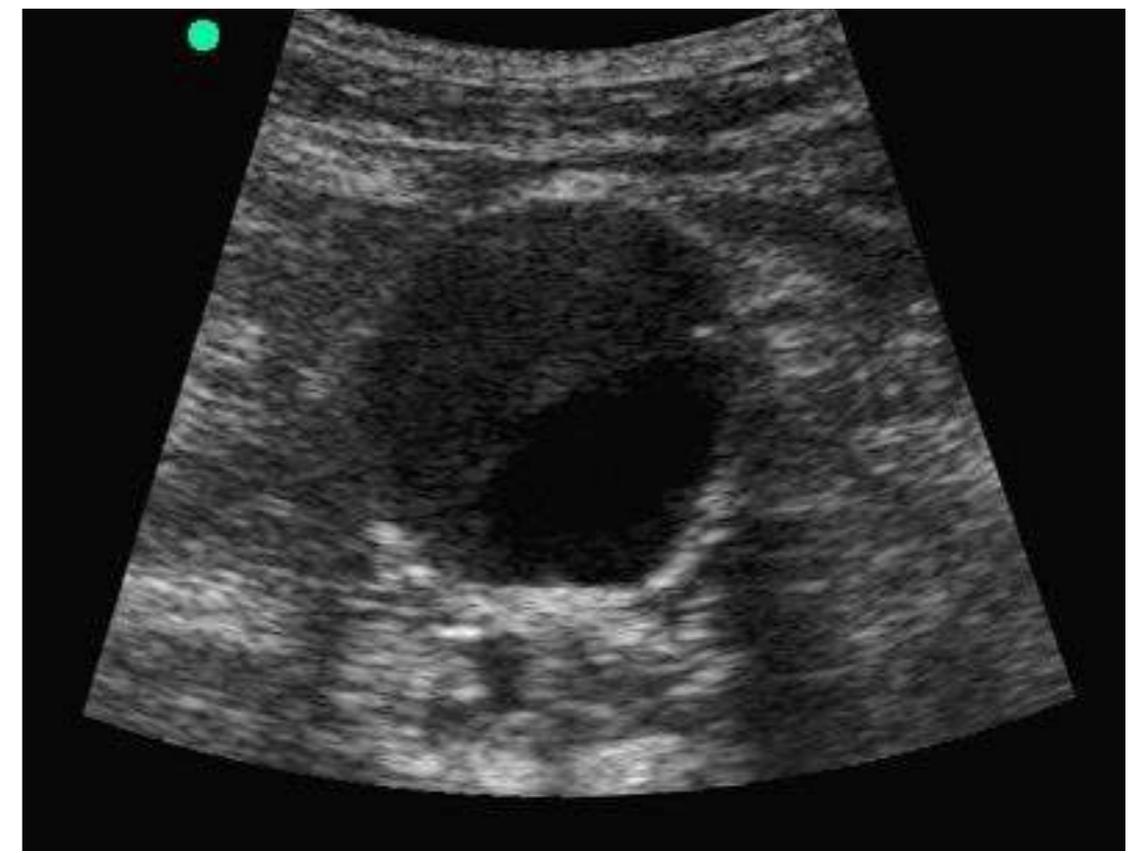
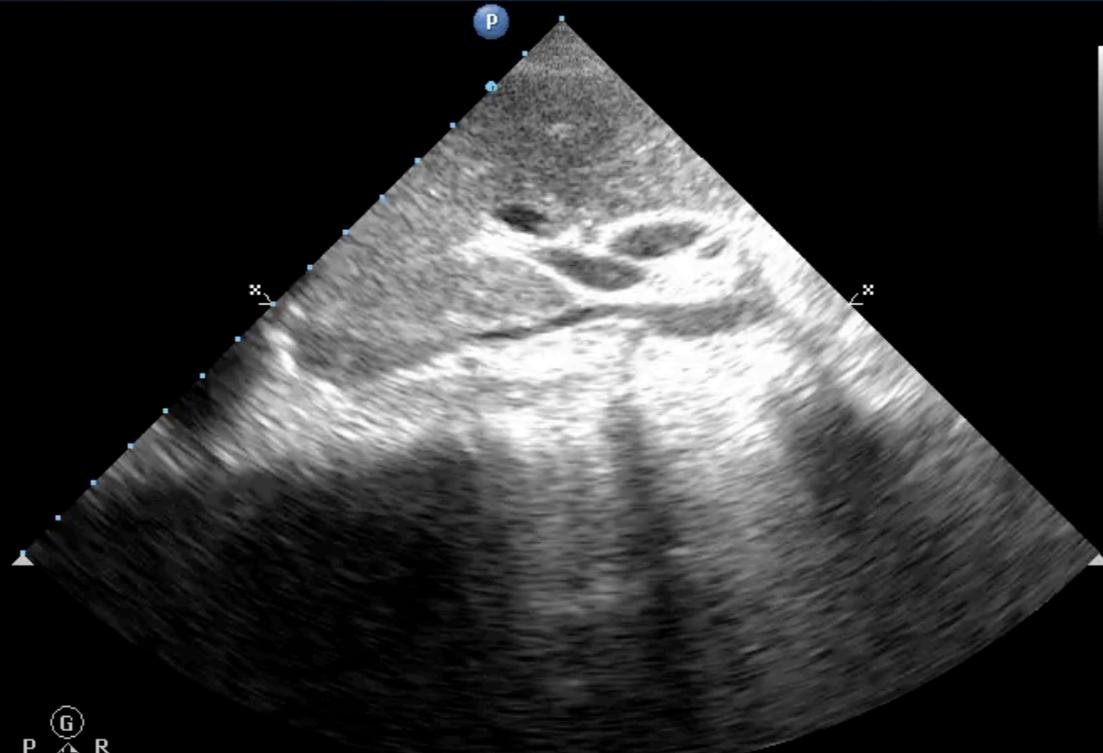
AAA
Aortic dissection



PHILIPS NEWMAN, BRENDA 08/09/1949 MI 1.4 12/16/2011
0736157 Philips Healthcare TIS 0.8 2:12:02 PM

ED ECHO
S4-2
34Hz
15cm

2D
H3
Gn 60
232dB/C5
D/2/0



Cardiogenic shock

Pump

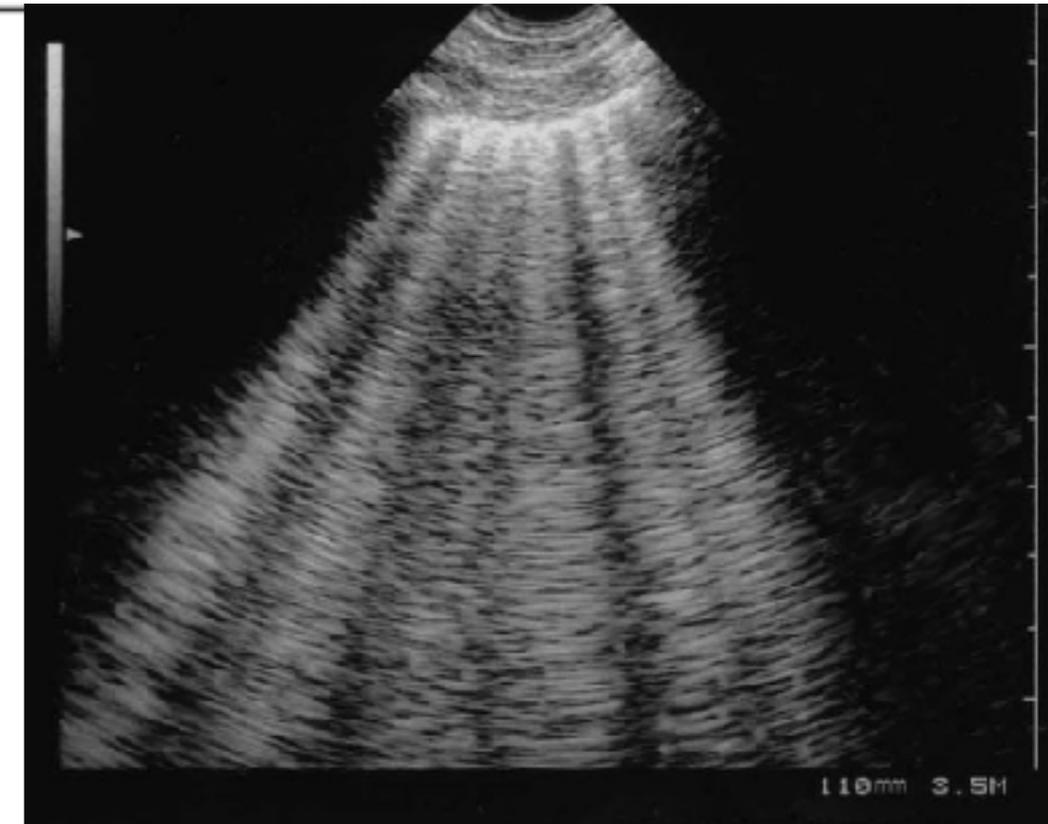
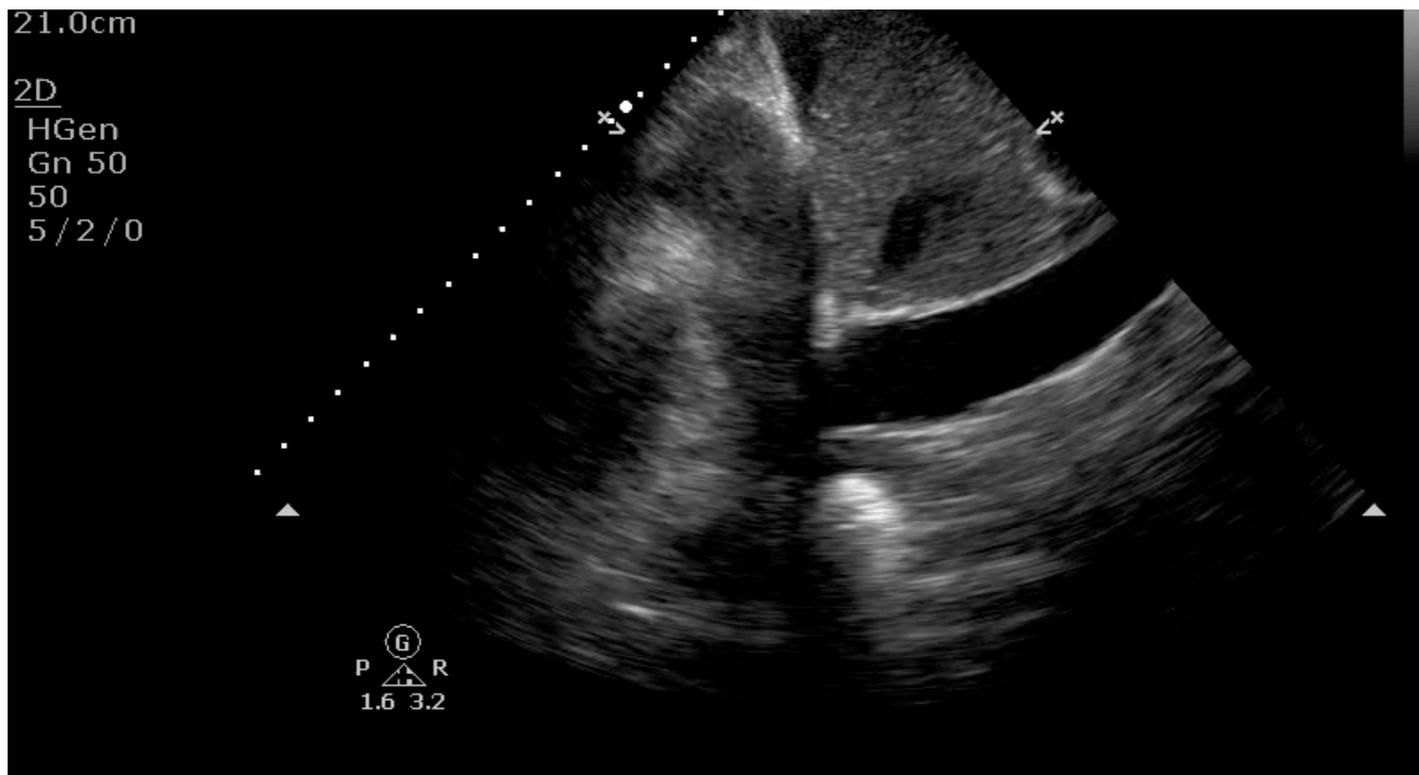
Hypocontractile heart
Dilated heart size

Tank

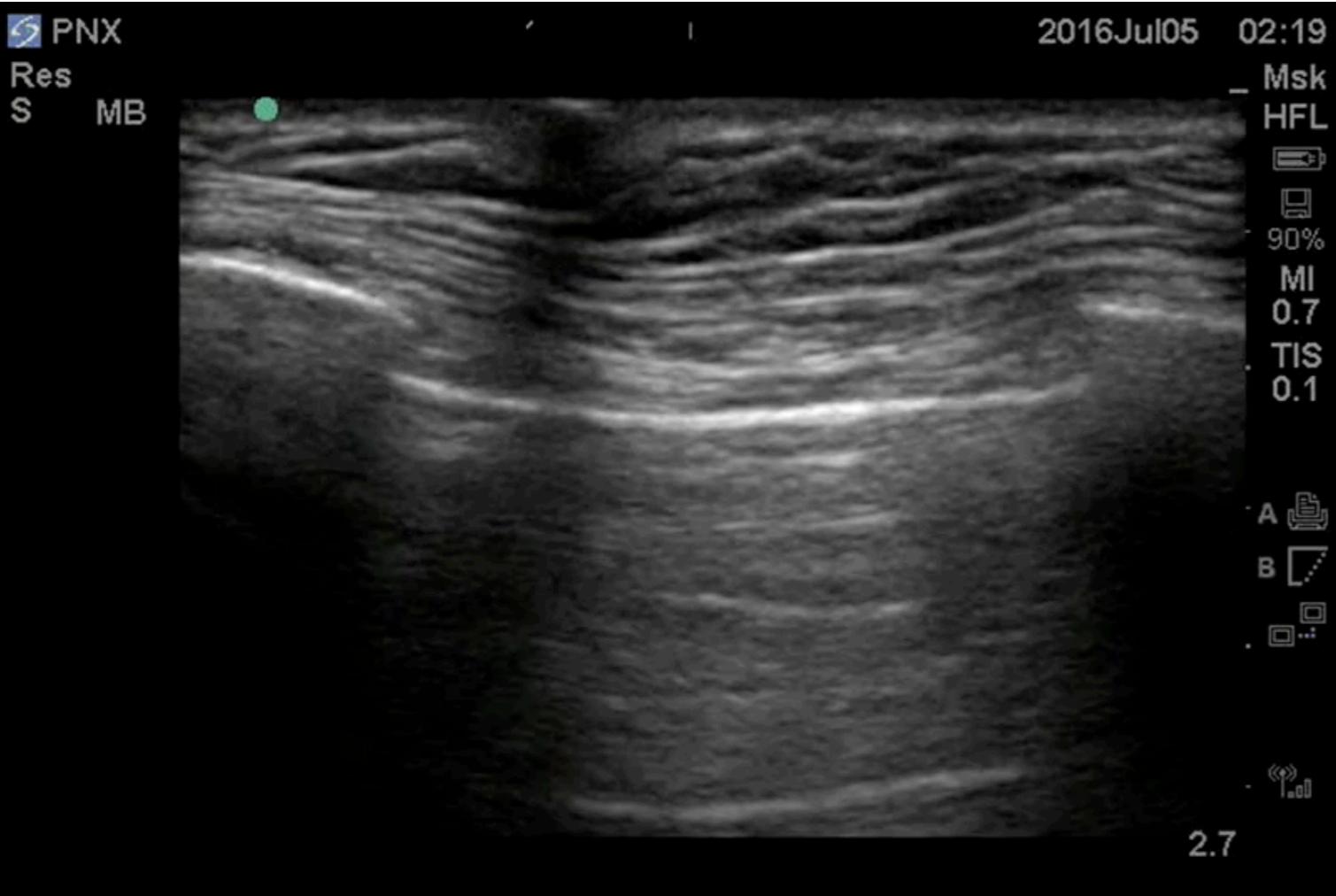
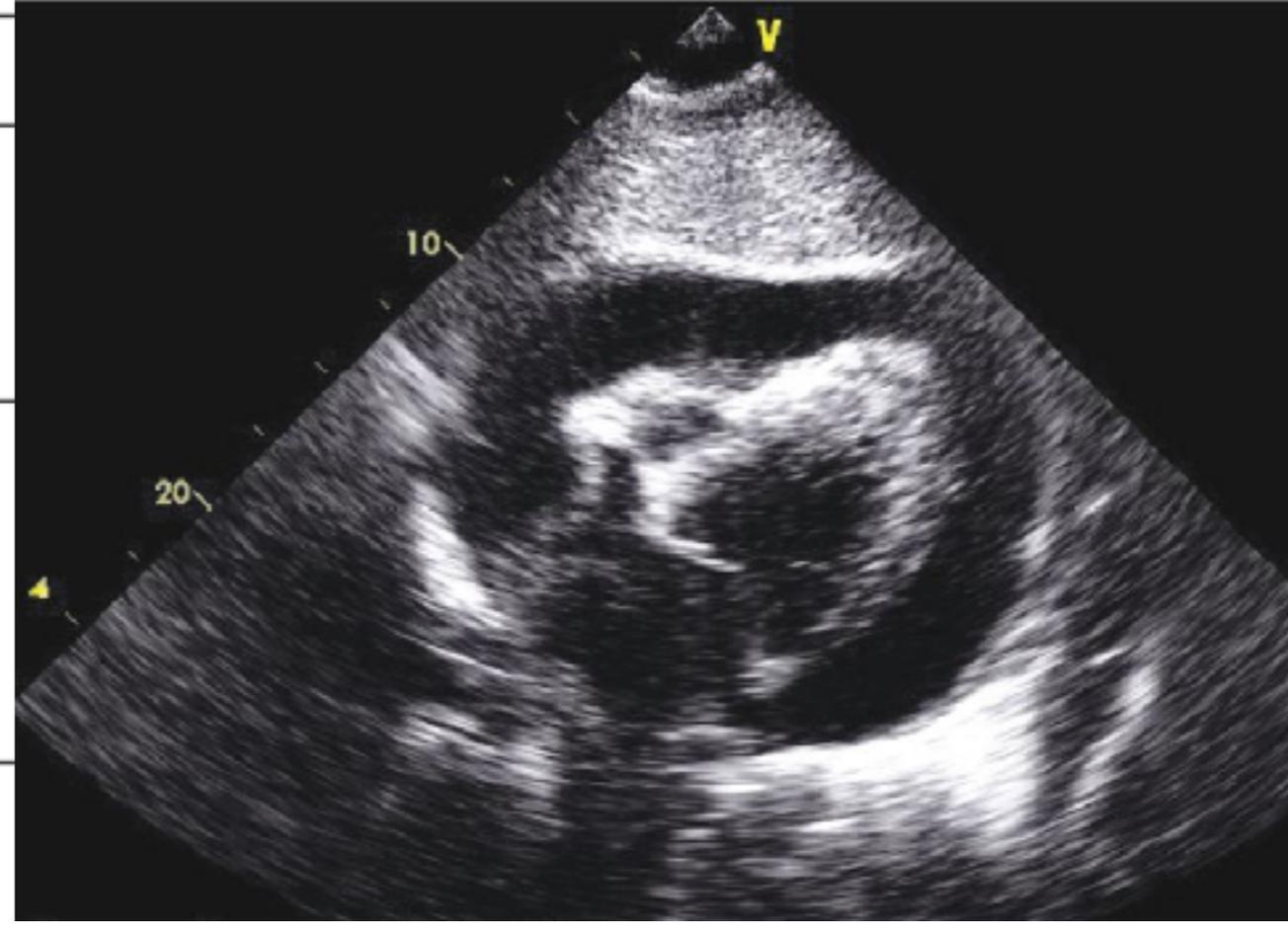
Distended IVC
Lung rockets
Pleural effusions, ascites

Pipes

Normal



	Obstructive shock
Pump	Pericardial effusion, RV strain Hypercontractile heart
Tank	Distended IVC Absent lung sliding (PTX)
Pipes	DVT



Distributive shock

Pump

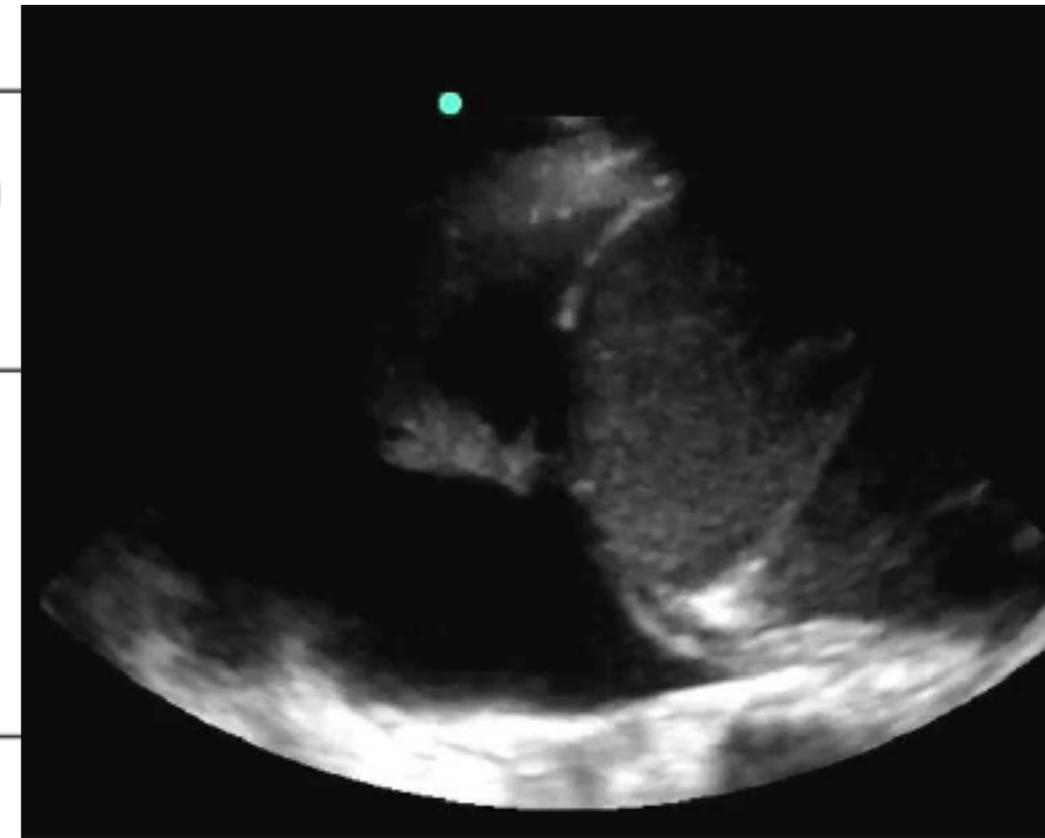
Hypercontractile heart (early sepsis)
Hypocontractile heart (late sepsis)

Tank

Normal/small IVC
Pleural fluid (empyema)
Peritoneal fluid (peritonitis)

Pipes

Normal



emerg.ultrasound@gmail.com



**THANK YOU
FOR
YOUR
ATTENTION!
ANY QUESTIONS?**