



ULTRASOUND
PROGRAM



三軍總醫院

Wholehearted, Holistic Care
全 心 三 總 · 全 人 照 護

POCUS

急重症超音波應用
2020/11/21

陳國智醫師 西園急診



急救加護重症超音波工作坊

PAIN - Module (1) 工作坊

AEACUS Network President

前急診超音波委員會主委

Faculty

-WINFOCUS, PERCUSS, WFPICC

-台灣疼痛醫學會

POCUS Academy

FB: Emergency Ultrasound Training Center

POCUS

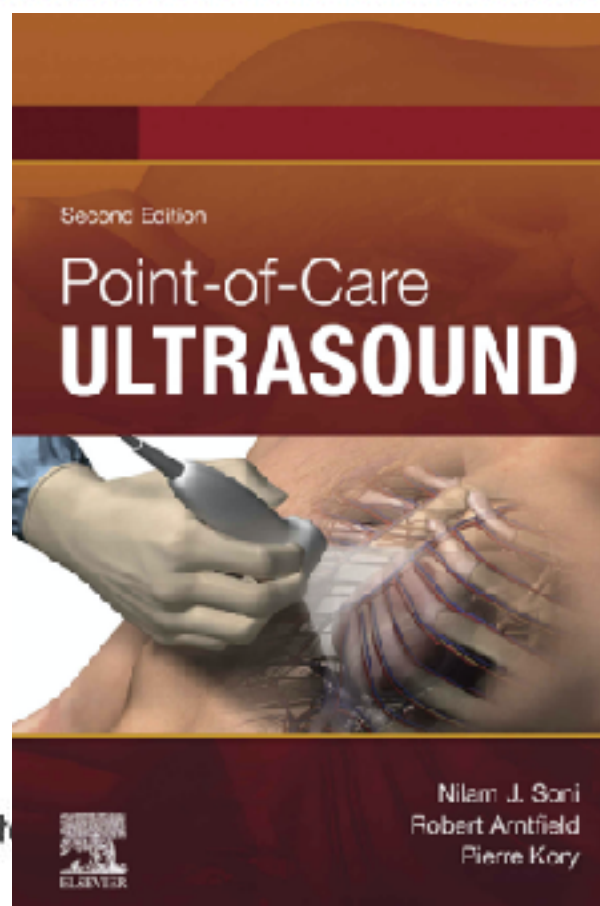


Ultrasound in Med. & Biol., Vol. ■, No. ■, pp. 1–10, 2016
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0301-5629/\$ - see front matter

<http://dx.doi.org/10.1016/j.ultrasmedbio.2016.06.021>

POINT OF CARE ULTRASOUND: A WFUMB POSITION PAPER

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CHRISTIAN PÁLLSON NOLSØE,^{‡‡} YI-HONG CHOU,^{§§} and MICHAEL BLAIVAS^{¶¶}



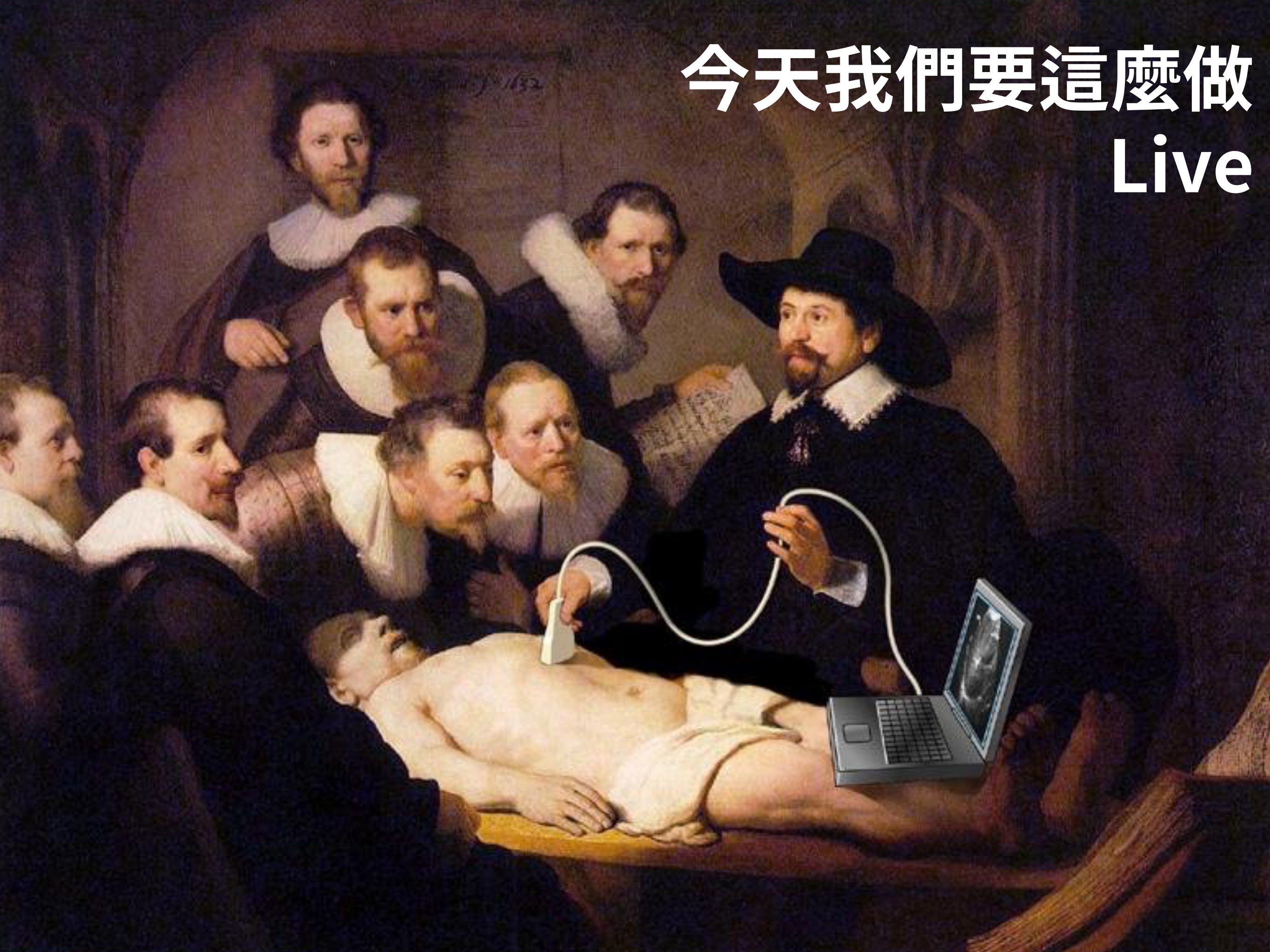
The Anatomy Lesson of Dr. Nicolaes Tulp

How Our Muscles Work

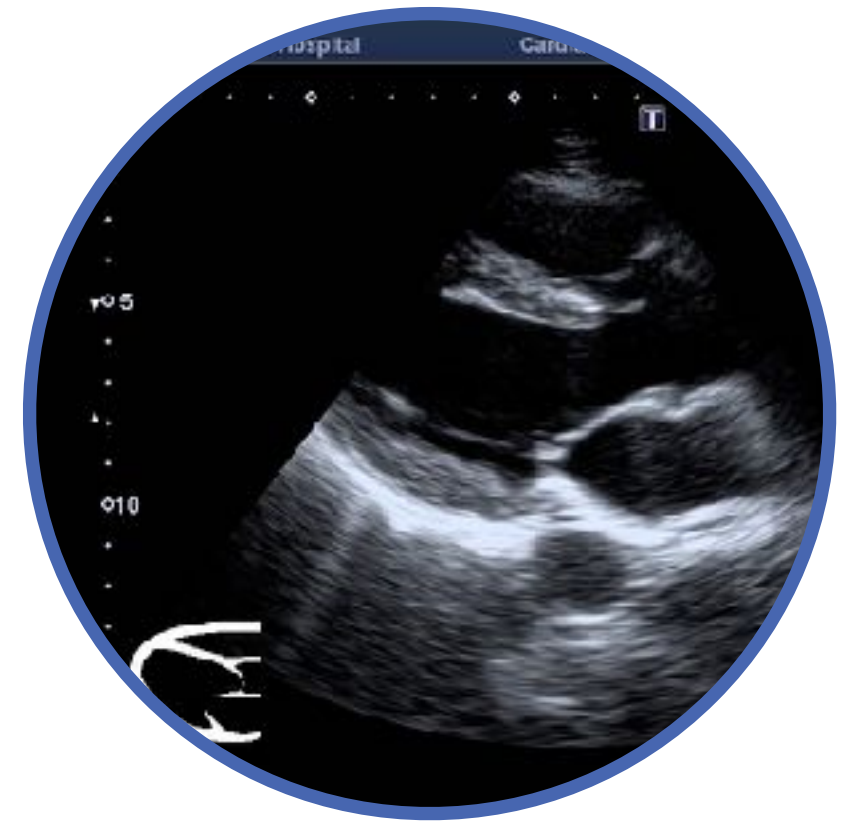
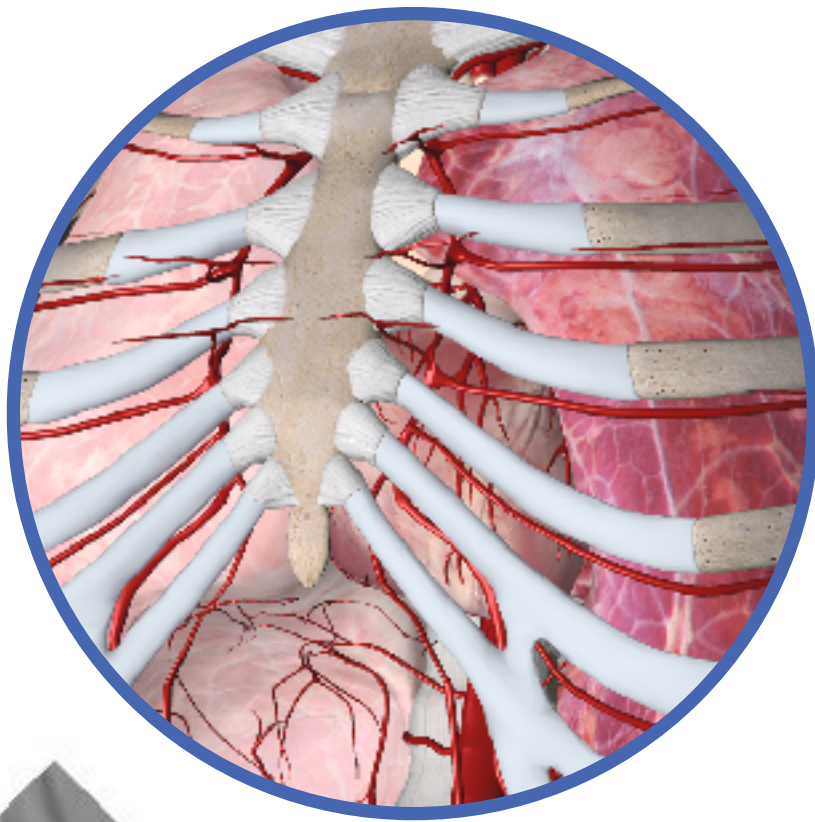
林布蘭 1632



今天我們要這麼做
Live



POCUS



POCUS

Point-of-Care Ultrasound

“ultrasonography brought to
the patient and performed by
the provider in real time”

Moore, C. L., & Copel, J. A. NEJM 2011

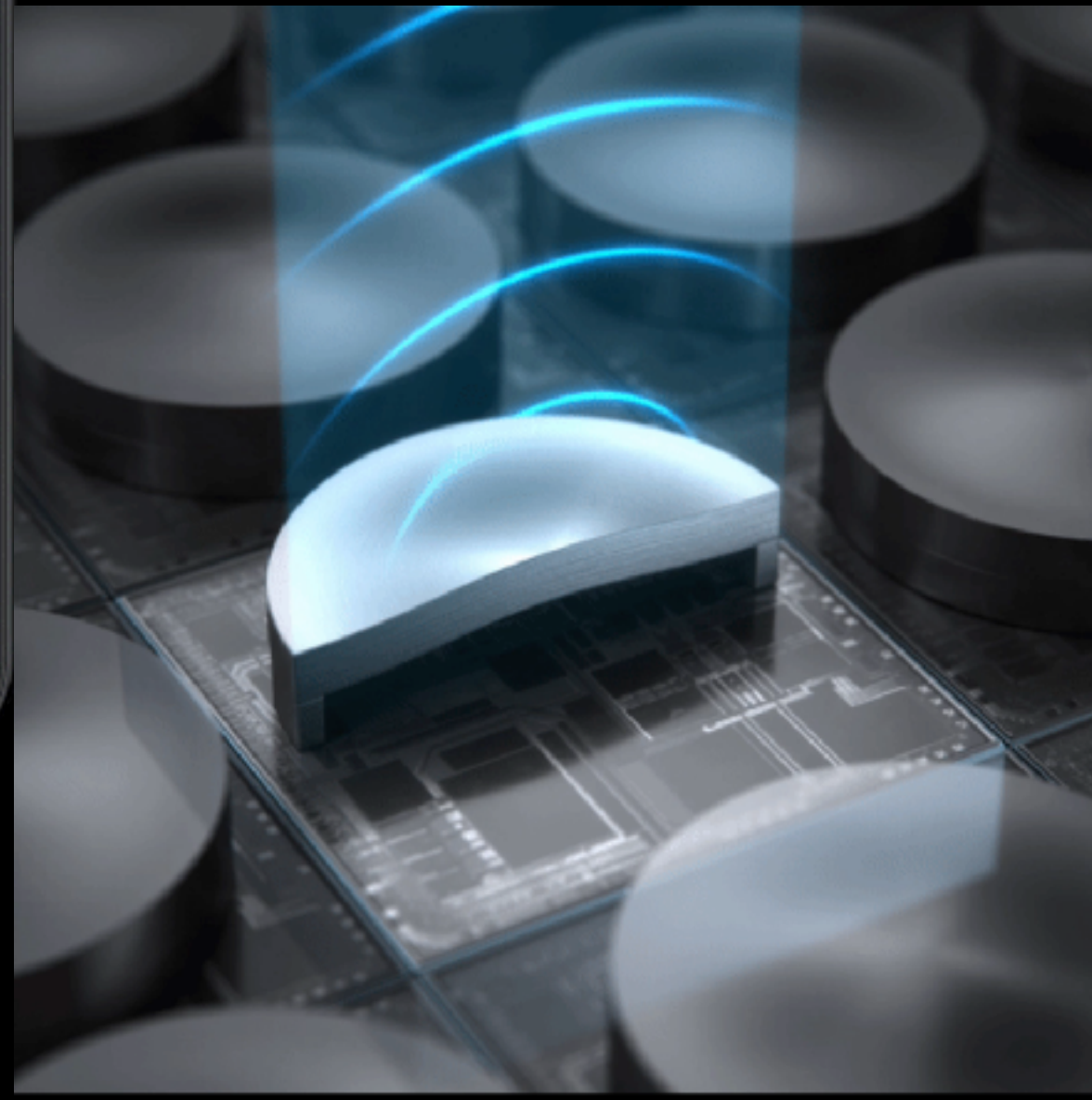


Disruptive Innovation





Butterfly iQ
\$ 2000





I-AIM

Indication (point)



Acquire



Interpret



**Make
decision**



Acute abdomen

Internal bleeding ?



FAST



Fluid



CT/TAE/OP



熟悉操控 6 大技巧

X

Sweep

Fan/
Tilt

Y

Slide

Rock

Z

Rotate

Compress

熟悉操控 6 大技巧

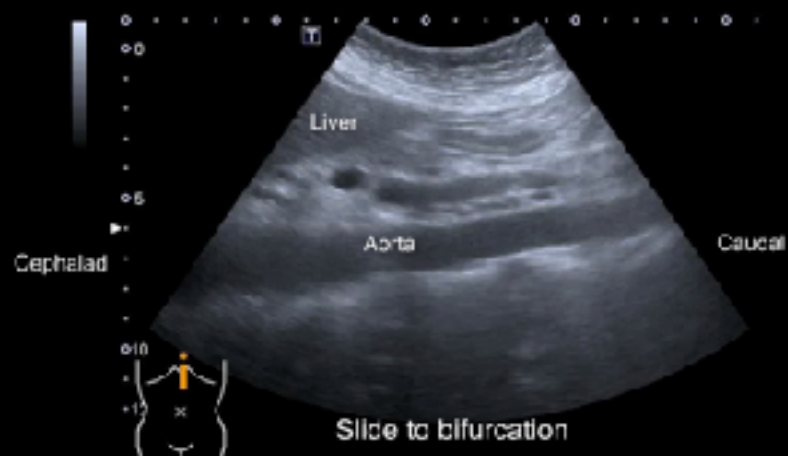
X

Sweep



Y

Slide



Z

Rotation



Fan



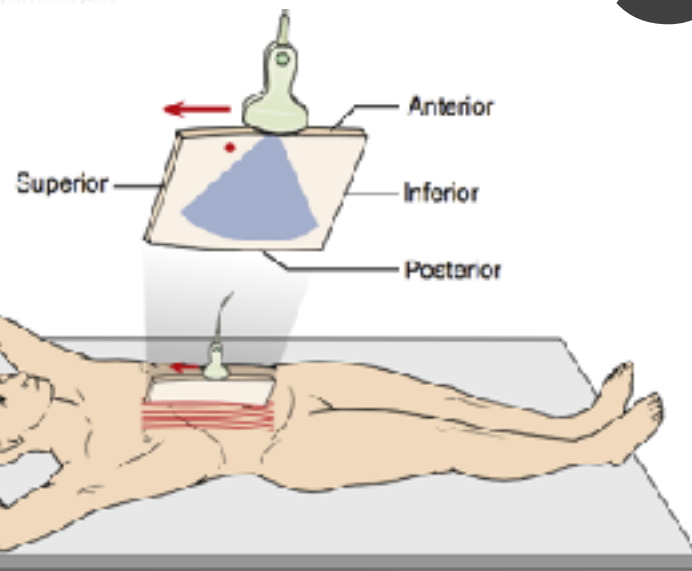
Rock



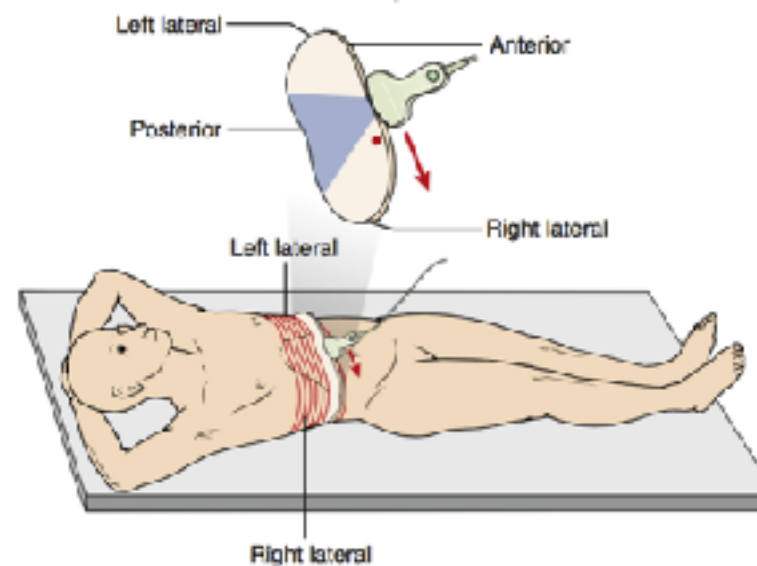
Compression



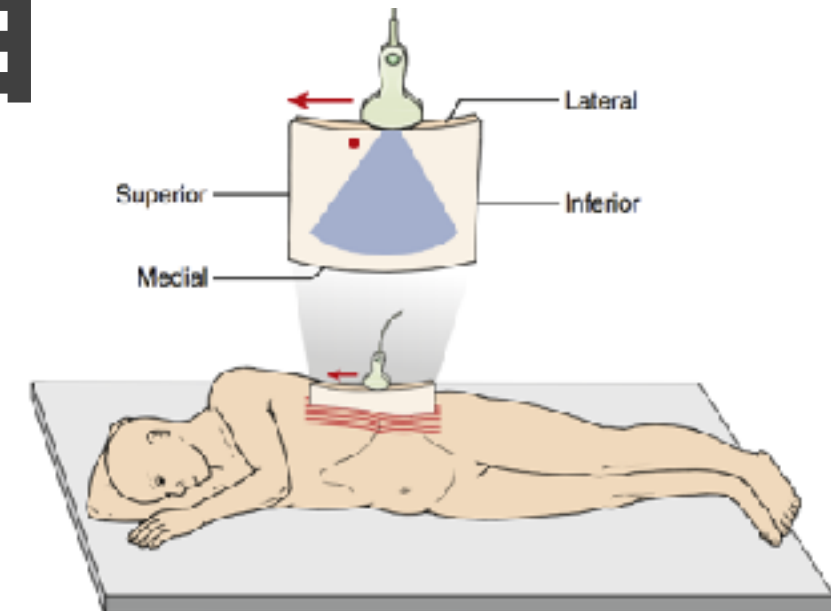
3D 立體掃描



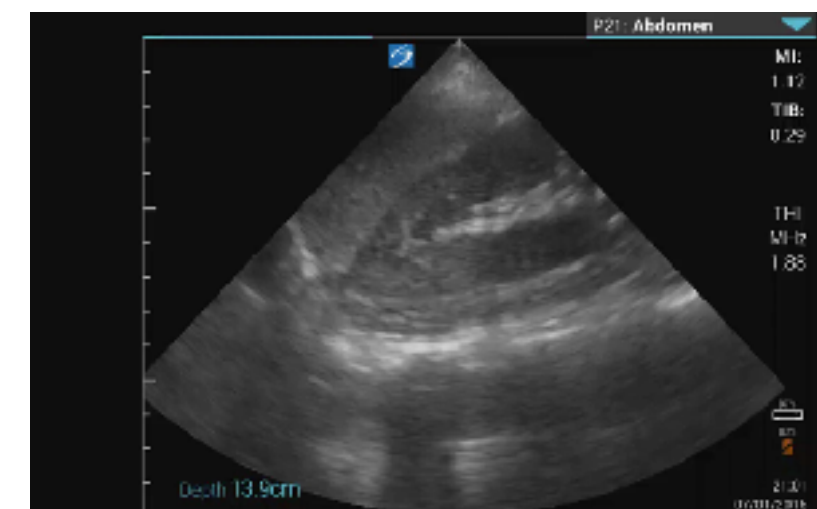
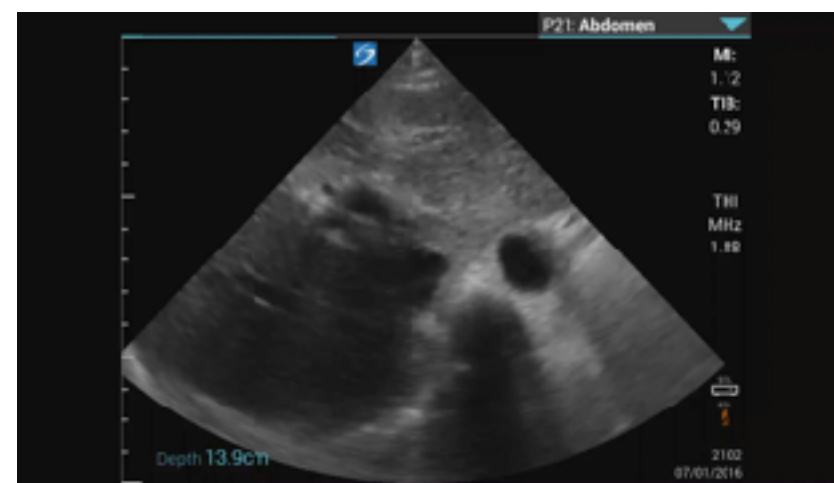
Sagittal 縱



Transverse 橫



Coronal 側



POCUS常用探頭



弧

線

扇



POCUS常用探頭



表面



頻率



深度





可以
同步

病史詢問



理學檢查

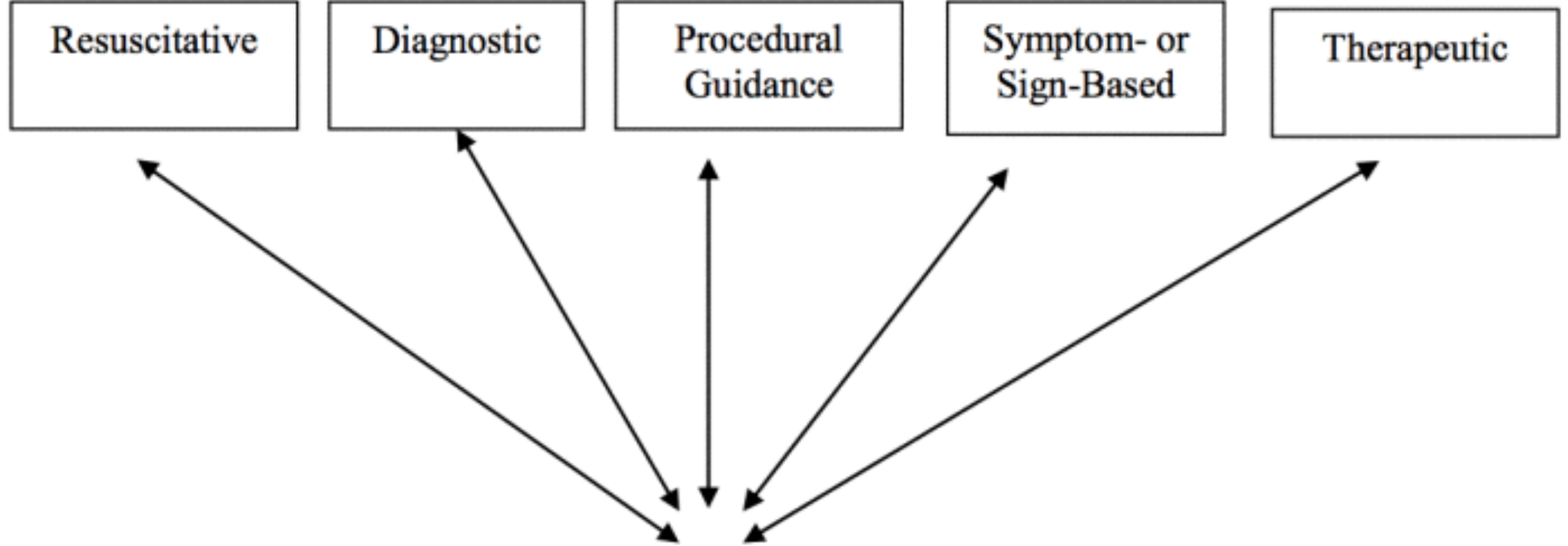
不可
省略



Y

POCUS

N



ACEP
2016

Core Applications

Trauma
Intrauterine Pregnancy
AAA
Cardiac/HD Assessment
Biliary
Urinary Tract
DVT
Soft-tissue/Musculoskeletal
Thoracic/Airway
Ocular
Bowel
Procedural Guidance

12 核心

5大應用

POCUS for better Airway management

插對了嗎

插不上時

Tracheal tube placement assessment

2015 CPR & ECC guidelines

Continuous waveform Capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an ETT.
(Class I, LOE C-LD)

If continuous waveform capnometry is not available, a nonwaveform CO₂ detector, esophageal detector device, or **ULTRASOUND** used by an experienced operator is a reasonable alternative.
(Class IIa, LOE C-LD)

Systematic Review

TAKE-HOME MESSAGE

During emergency intubations, transtracheal ultrasonography can be used to assess endotracheal tube placement before confirmation with capnography.

Outcome Measure	Sensitivity (95% CI)	Specificity (95% CI)	Number of Studies (Number of Patients)
Pooled data	0.98 (0.97–0.99)	0.98 (0.95–0.99)	11 (969)
Emergency intubations	0.98 (0.97–0.99)	0.94 (0.86–0.98)	8 (713)

CI, Confidence interval.

Dynamic

Fast

Accurate

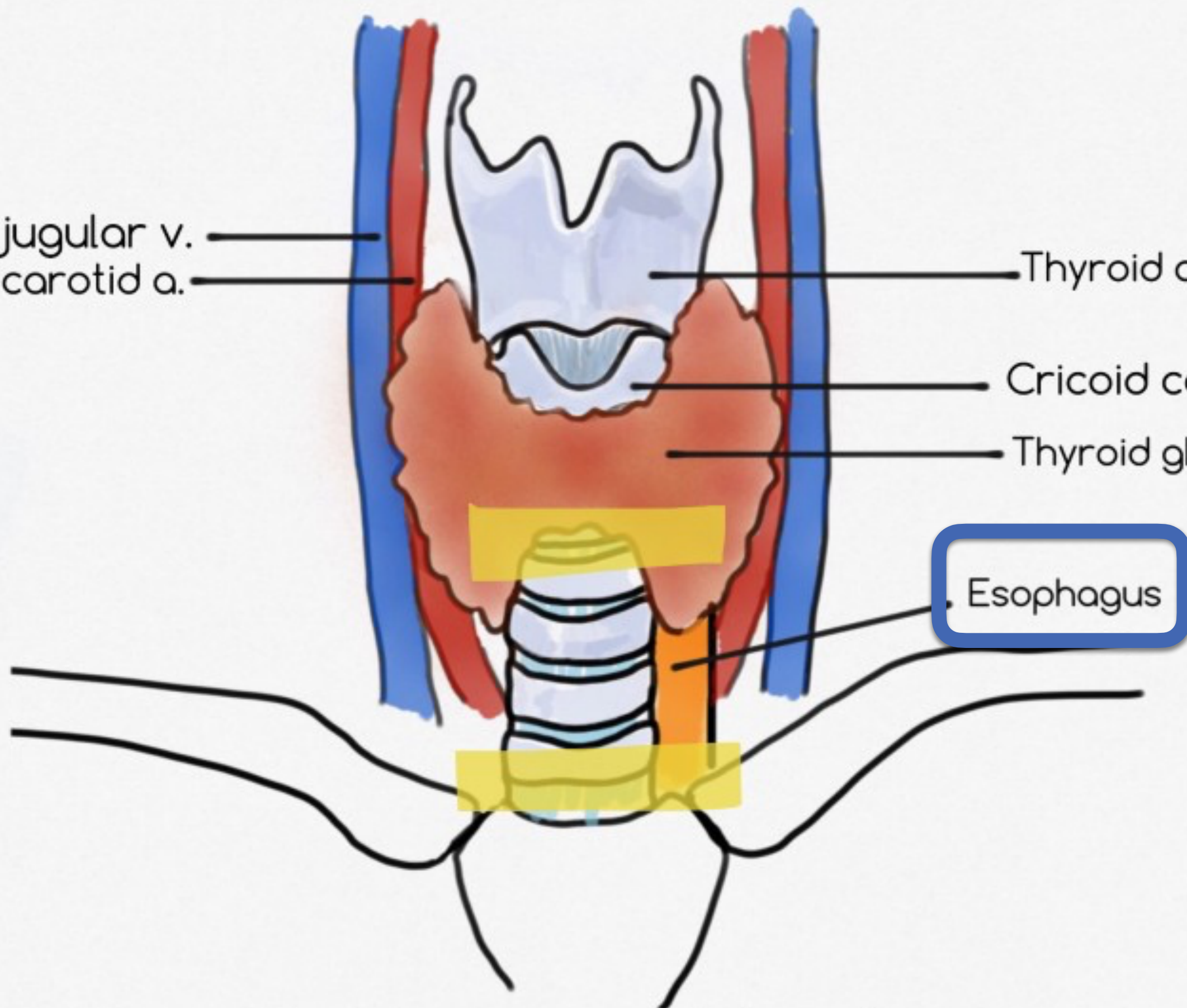
Internal jugular v.
Common carotid a.

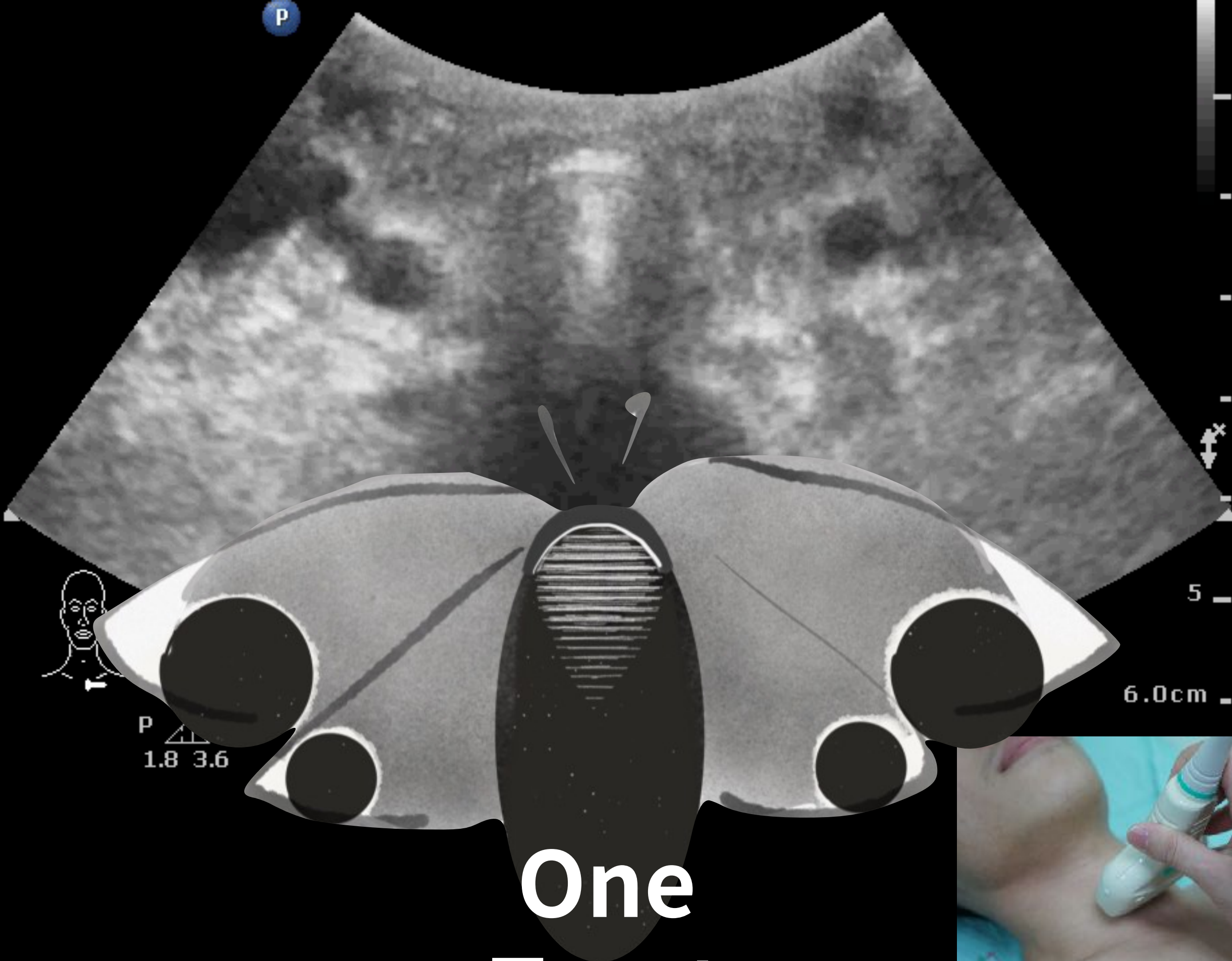
Thyroid cartilage

Cricoid cartilage

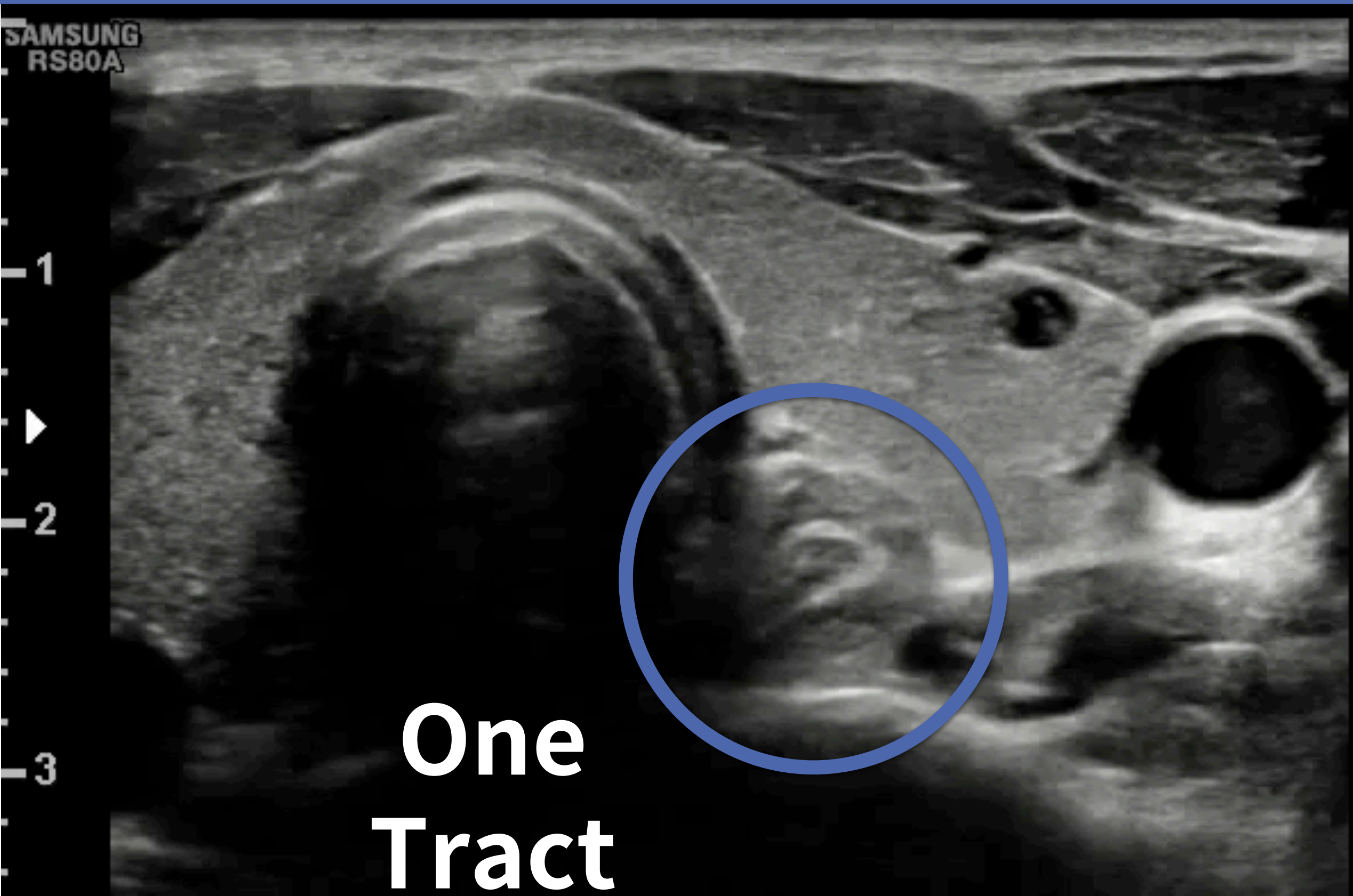
Thyroid gland

Esophagus





Find esophagus



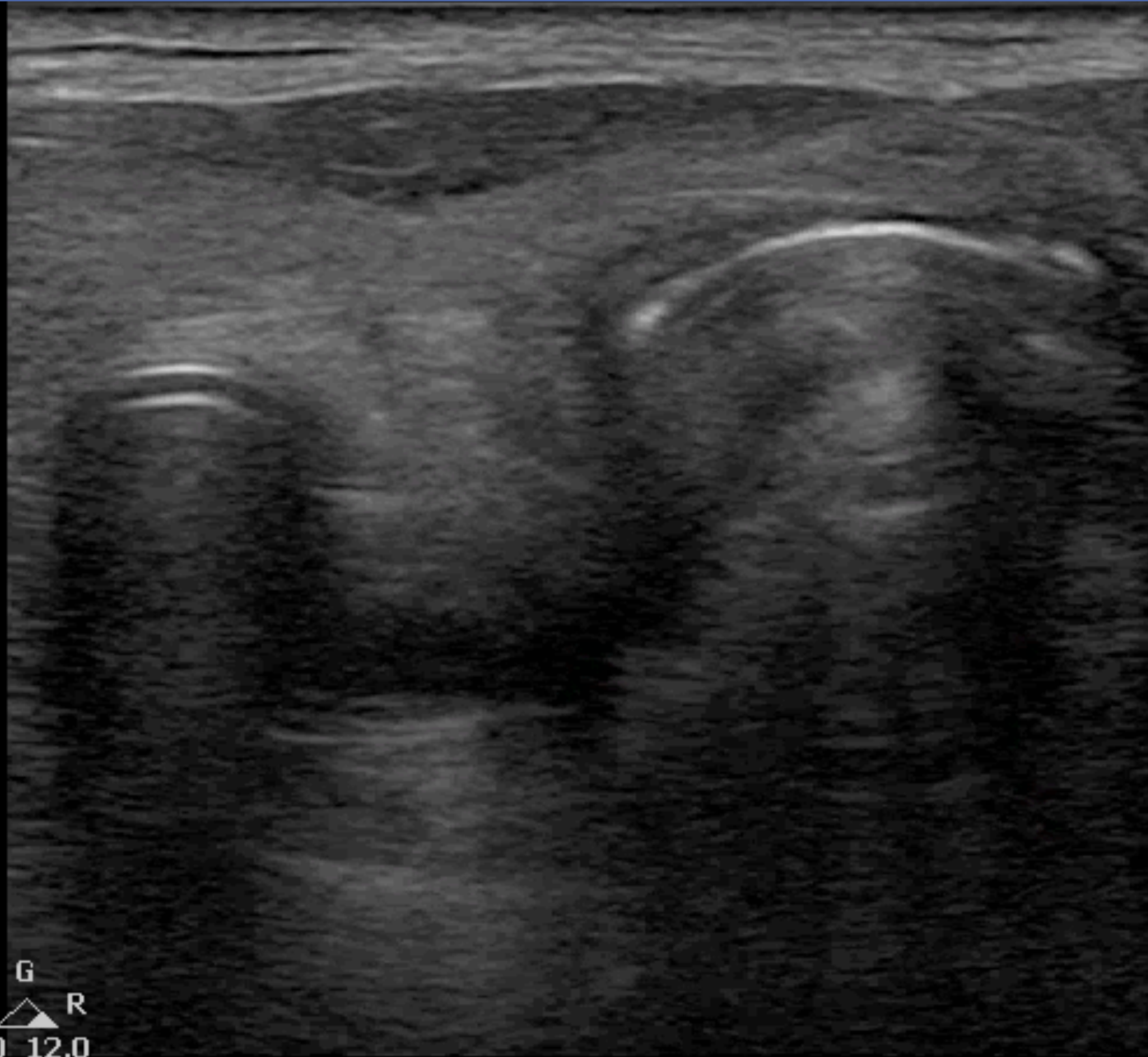
Double tract sign ?

Superficial
L12-3
46 Hz
3.5cm

2D
Res
Gn 60
C 56
3 / 2 / 1



G
P R
3.0 12.0



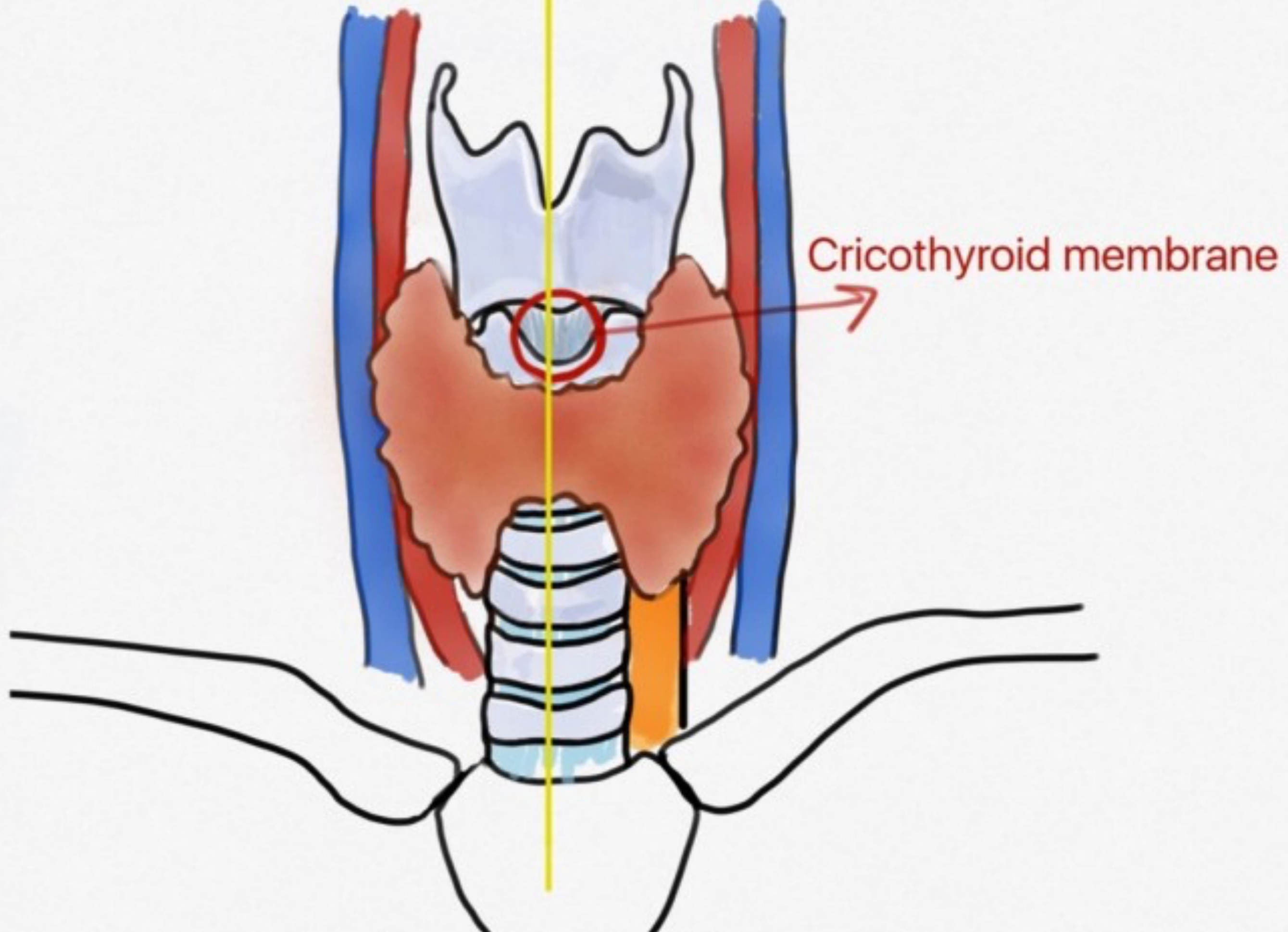
3.5cm

POCUS for better Airway management

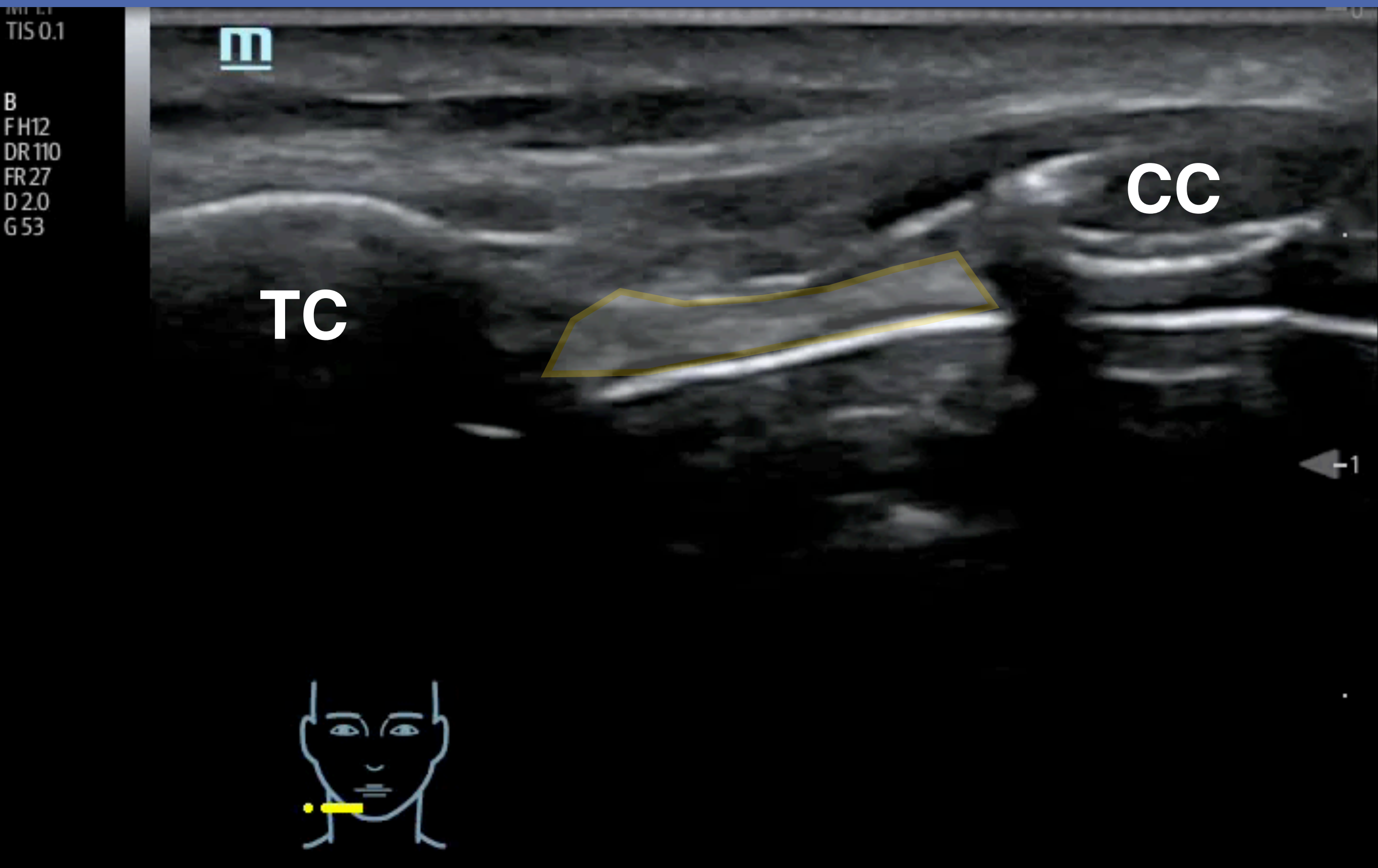
插對了嗎

插不上時

1 v.s. 2



Cricothyroid membrane



POCUS for better Airway management

插對了嗎

插不上時

1 v.s. 2

CTM

Tracheal compression

Direct visualization of ETT

Superficial : P

L12-3

46 Hz

3.0cm

2D

Res

Gn 60

C 56

3 / 2 / 1



G
P R
3.0 12.0

2

3.0cm

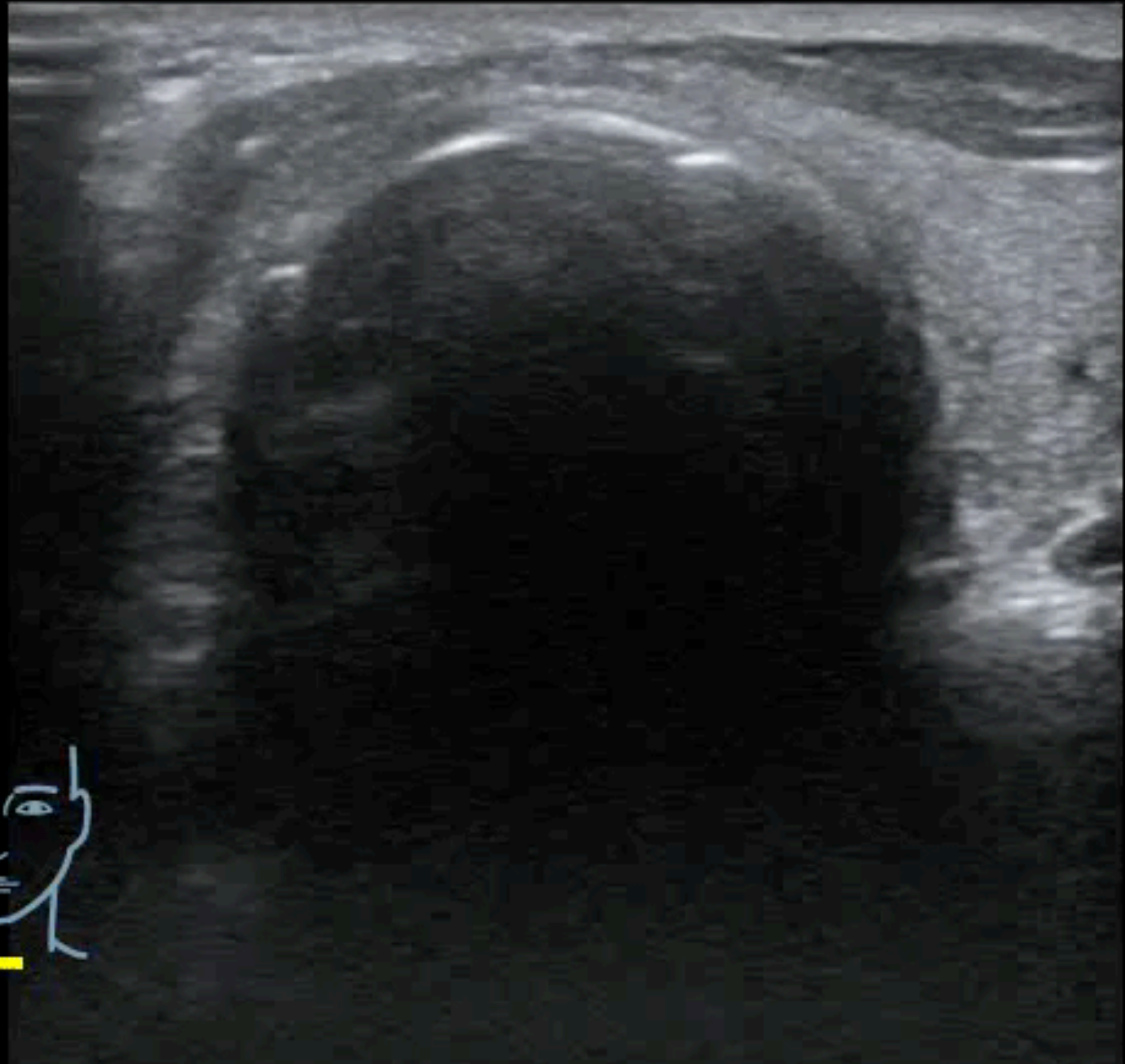
Kao JS, et al. Anaesth Crit Care Pain Med 2018

Cuff compression

Direct visualization of ETT

MI 1.4
TIS 0.1

B
FH10.0
DR100
FR31
D 4.0
G 67



-0

.

-1

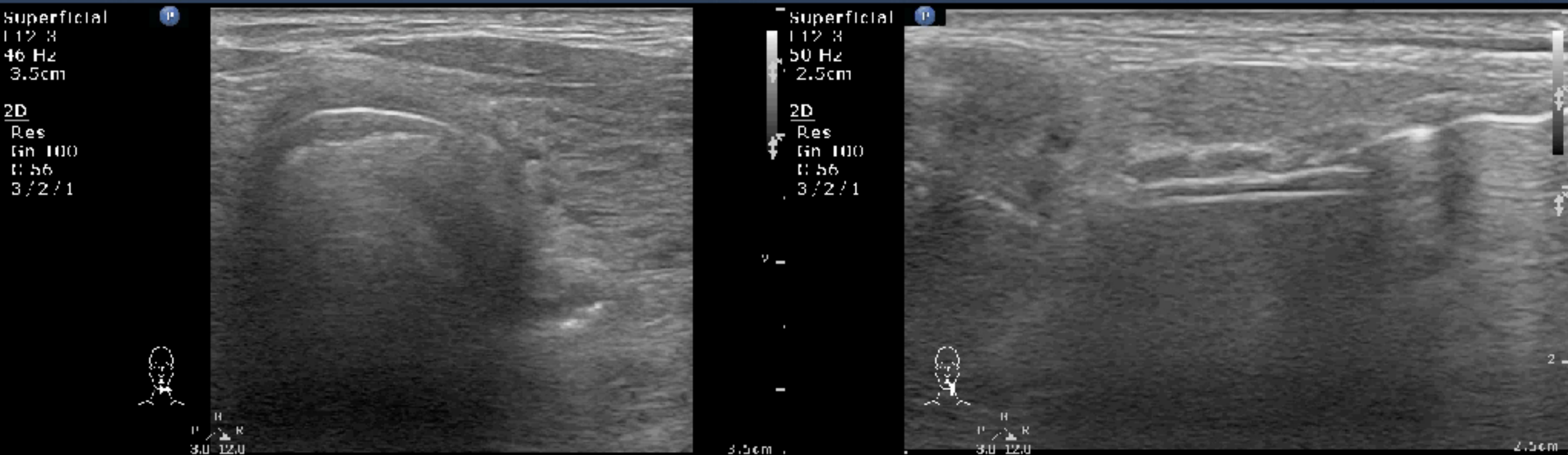
-2

.

-3

.

EVB_Airway protection Compression test

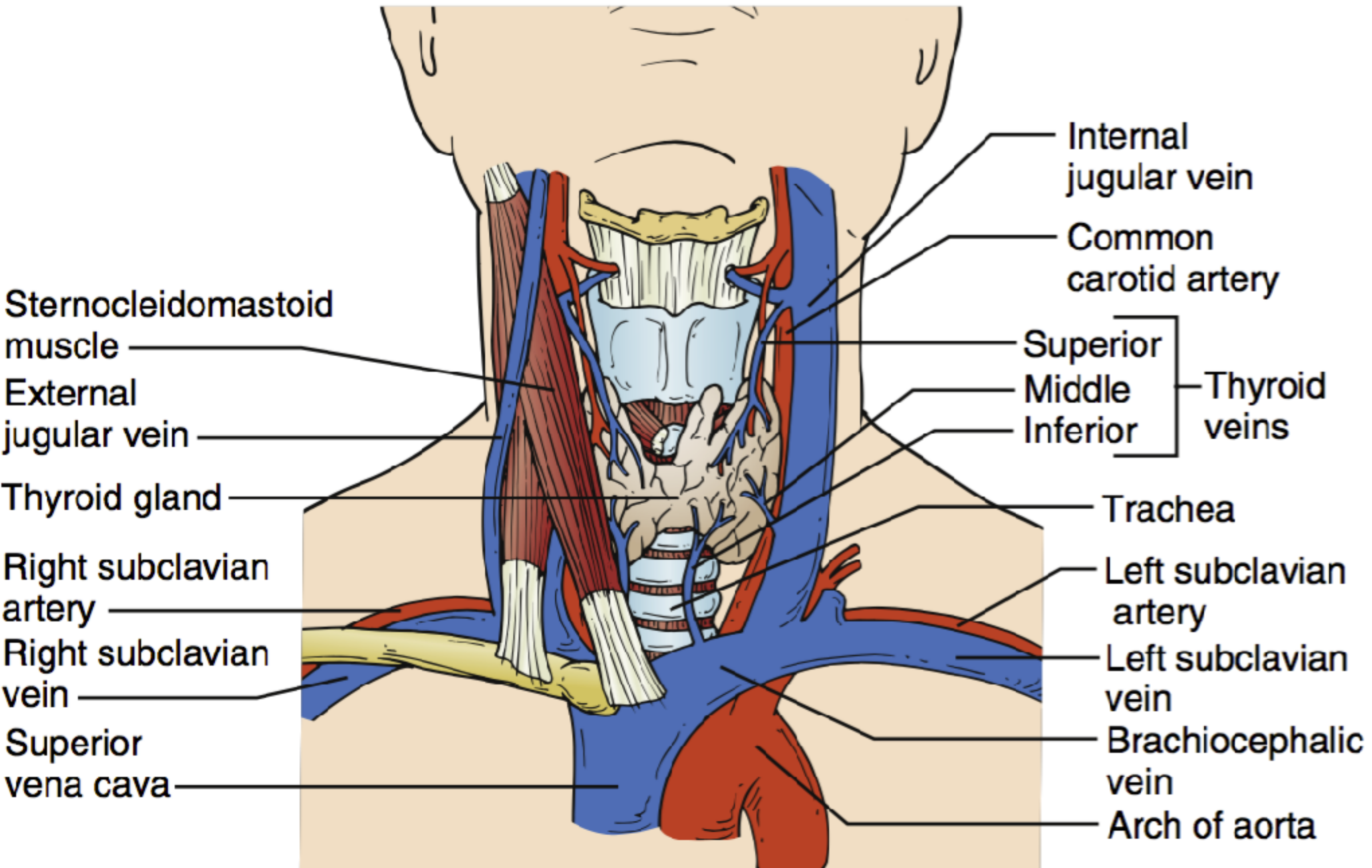




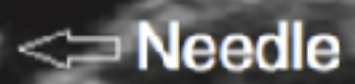
Success rates ↑

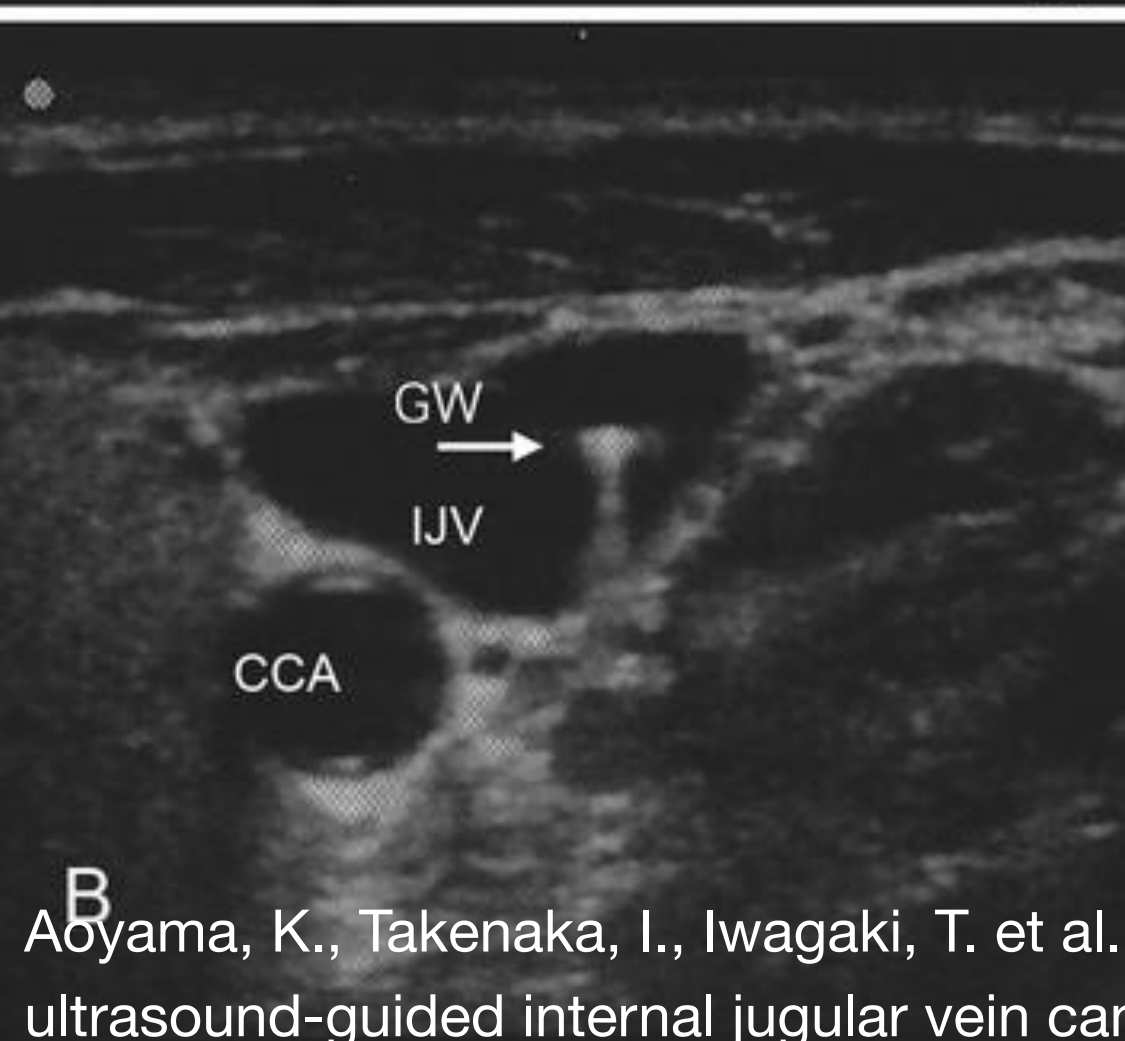
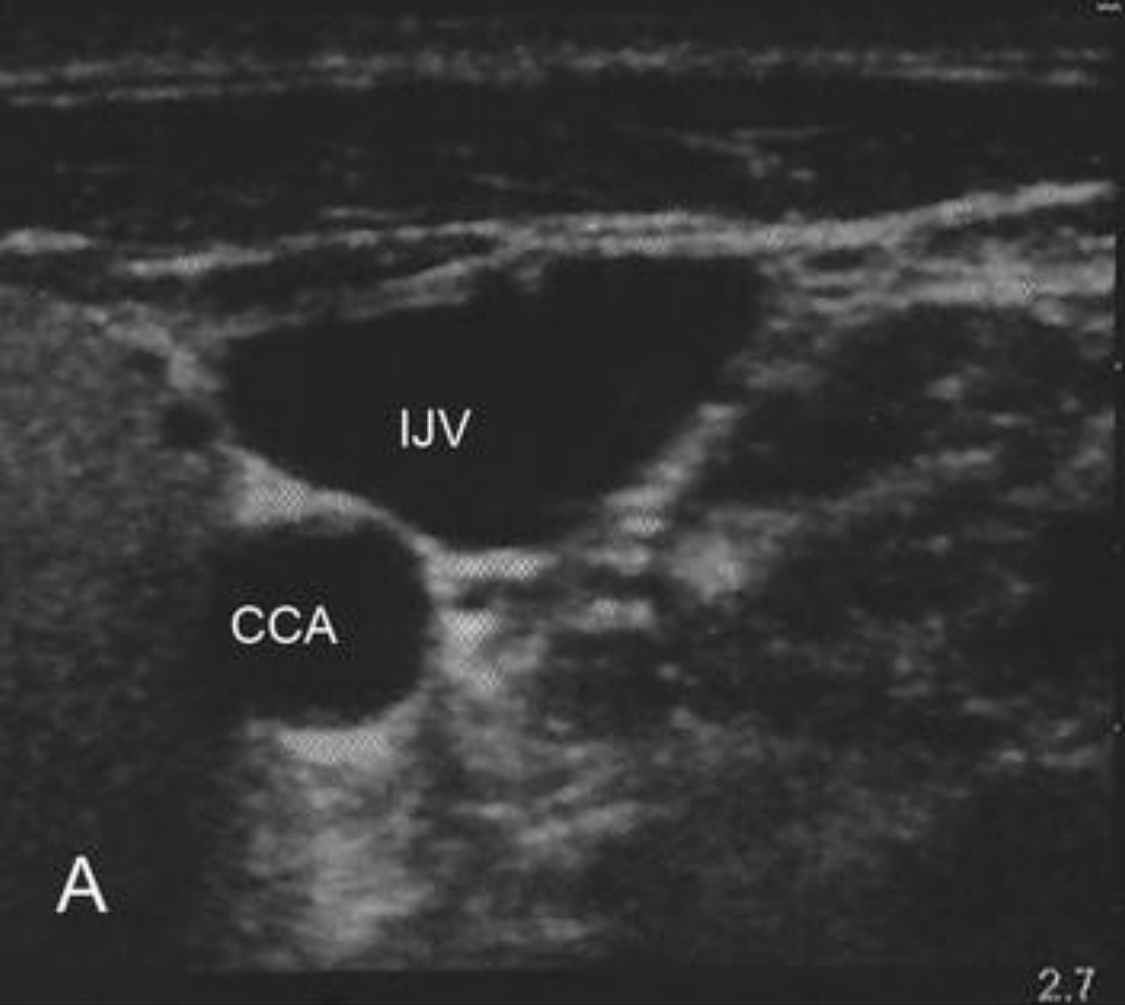
Mechanical complications ↓

Neck Vascular Structure

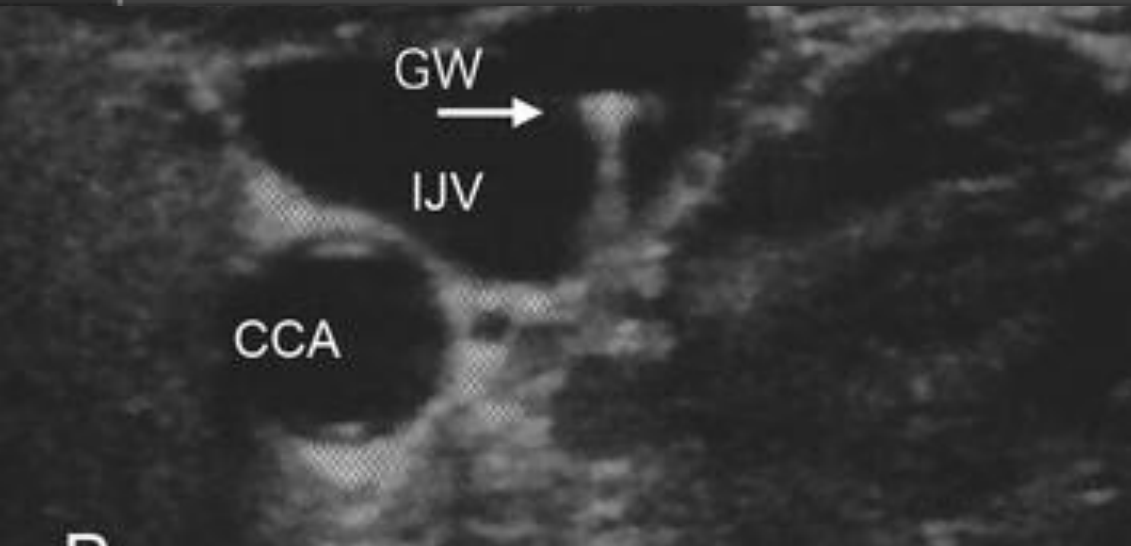


4/3/2
11/27
Gen
20
+20m
22 Hz





Aoyama, K., Takenaka, I., Iwagaki, T. et al. A simple maneuver for confirmation of the guidewire during ultrasound-guided internal jugular vein cannulation. *Can J Anesth/J Can Anesth* 62, 839–840 (2015)

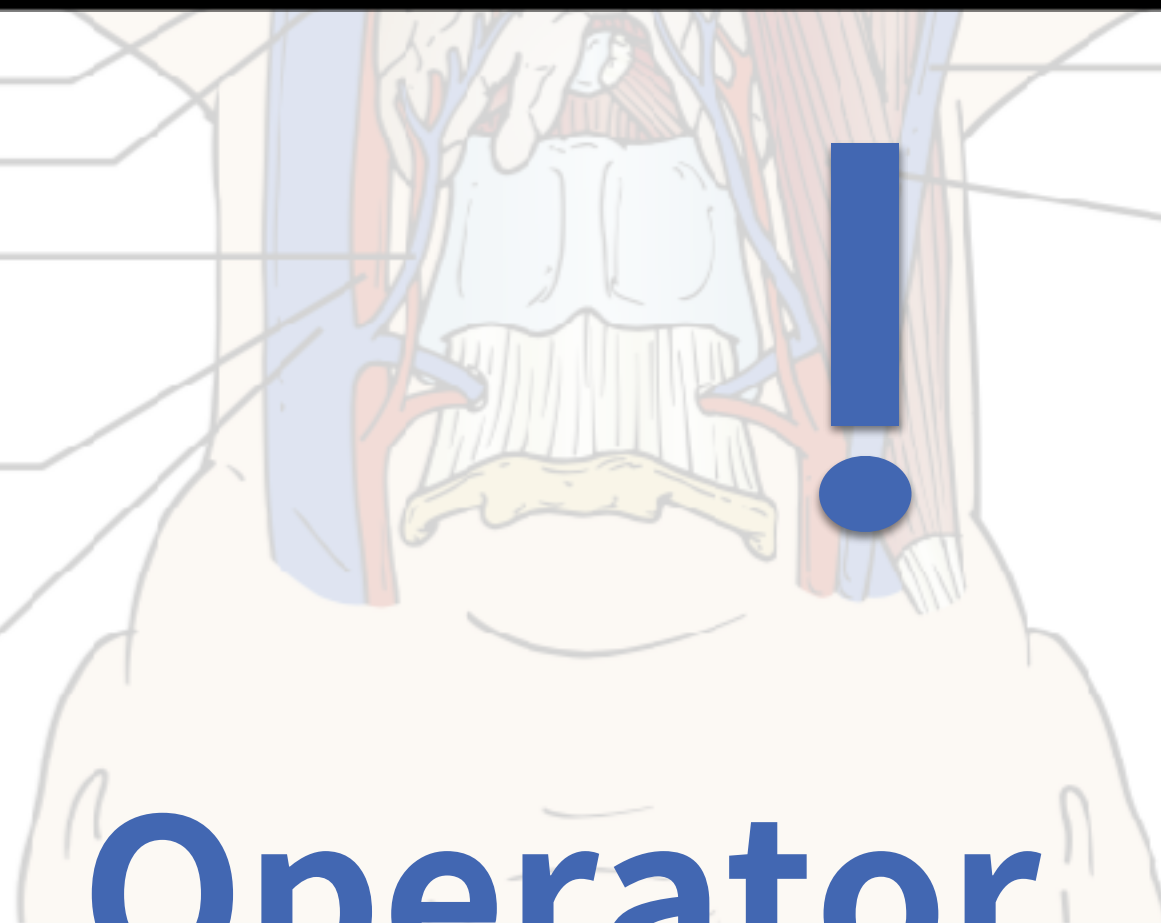


Aoyama, K., Takenaka, I., Iwagaki, T. et al. A simple maneuver for confirmation of the guidewire during ultrasound-guided internal jugular vein cannulation. *Can J Anesth/J Can Anesth* 62, 839–840 (2015)

Longitudinal approach



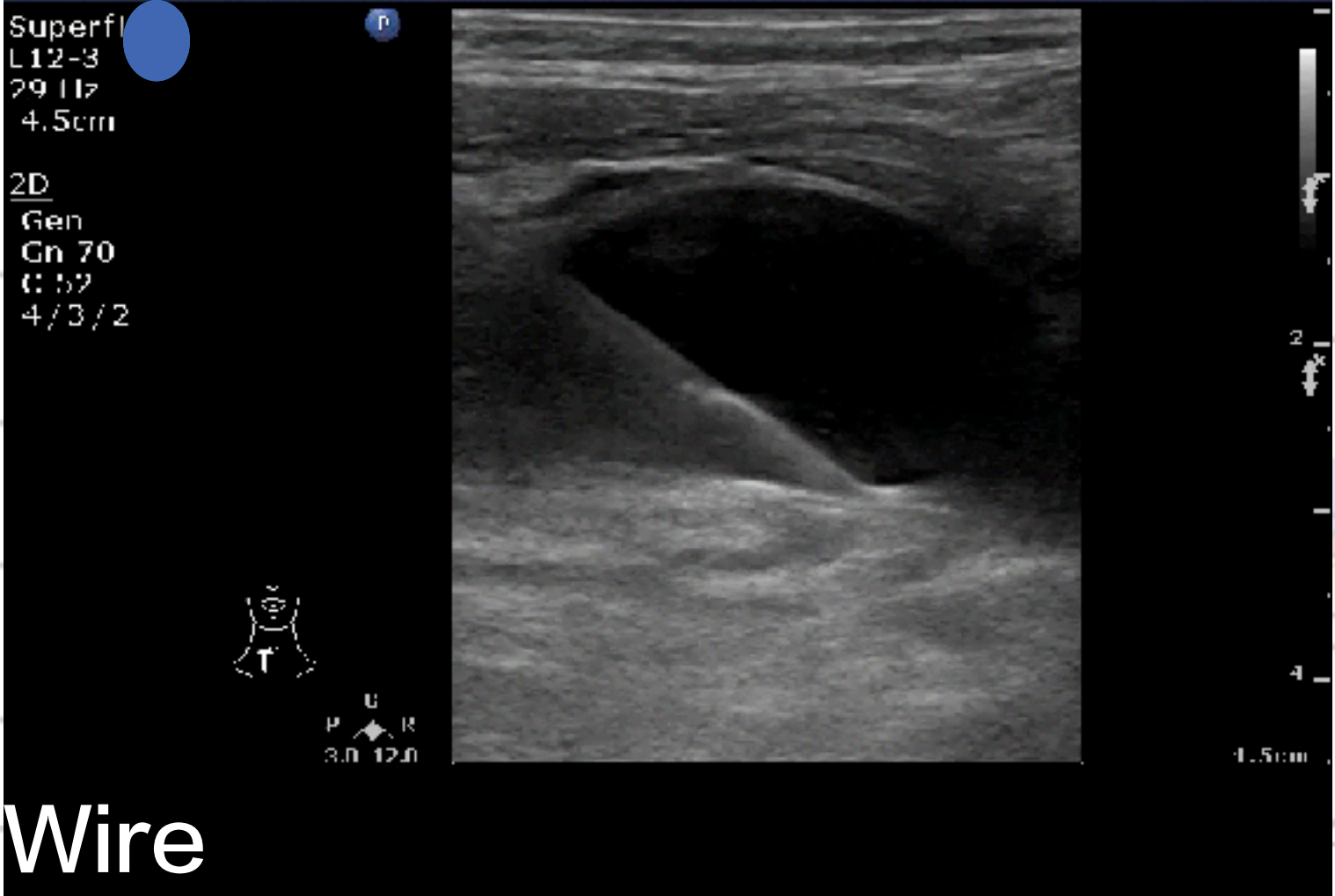
[illegible]



Operator

L

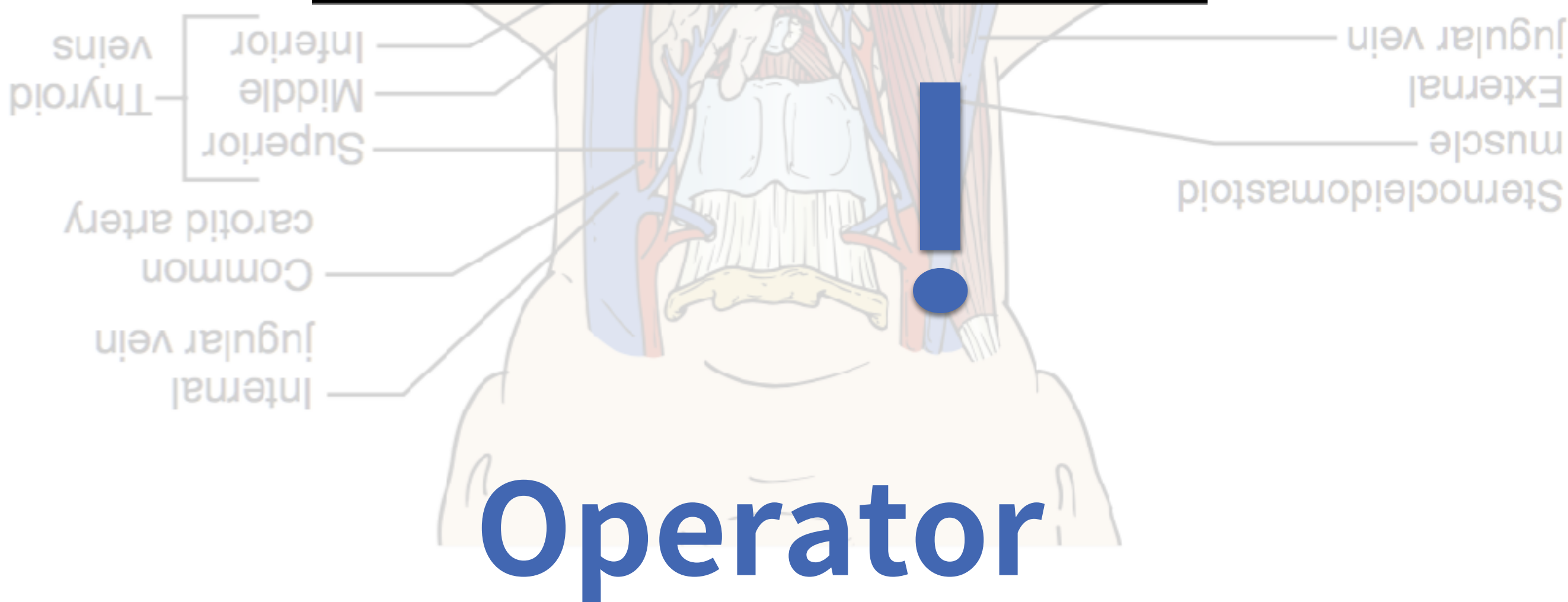
R



Operator

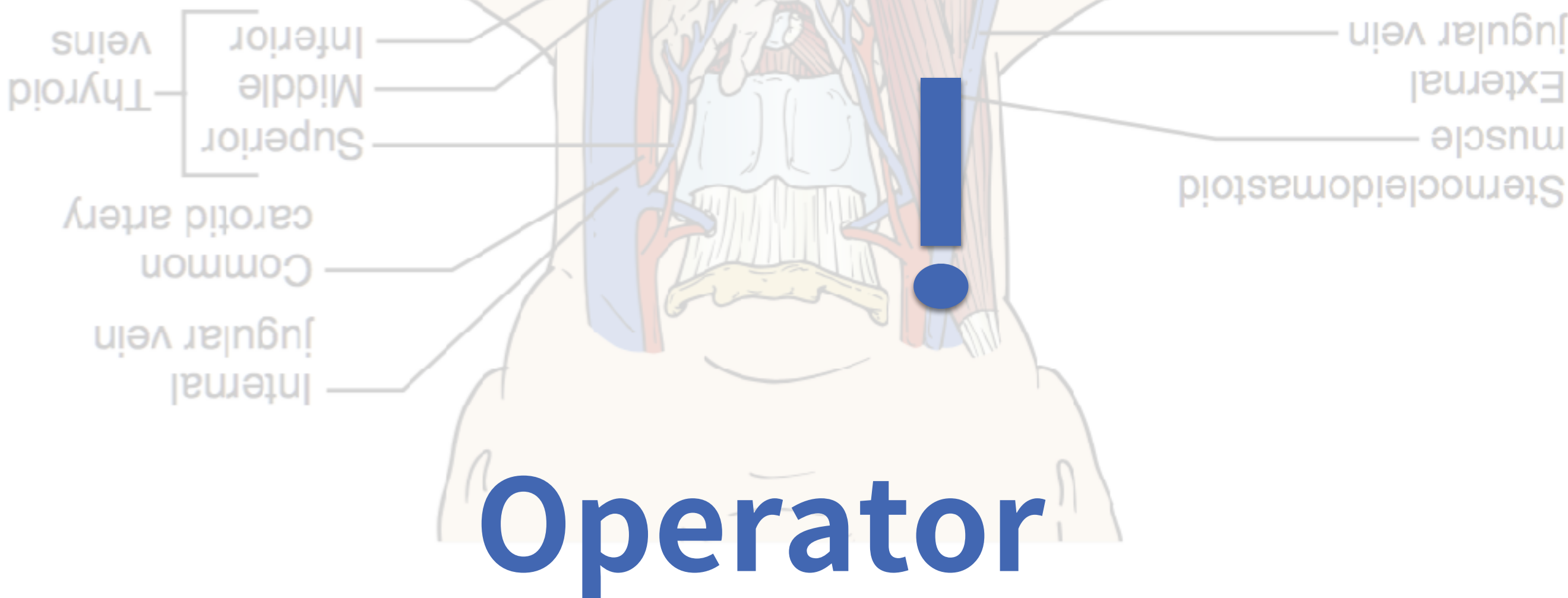
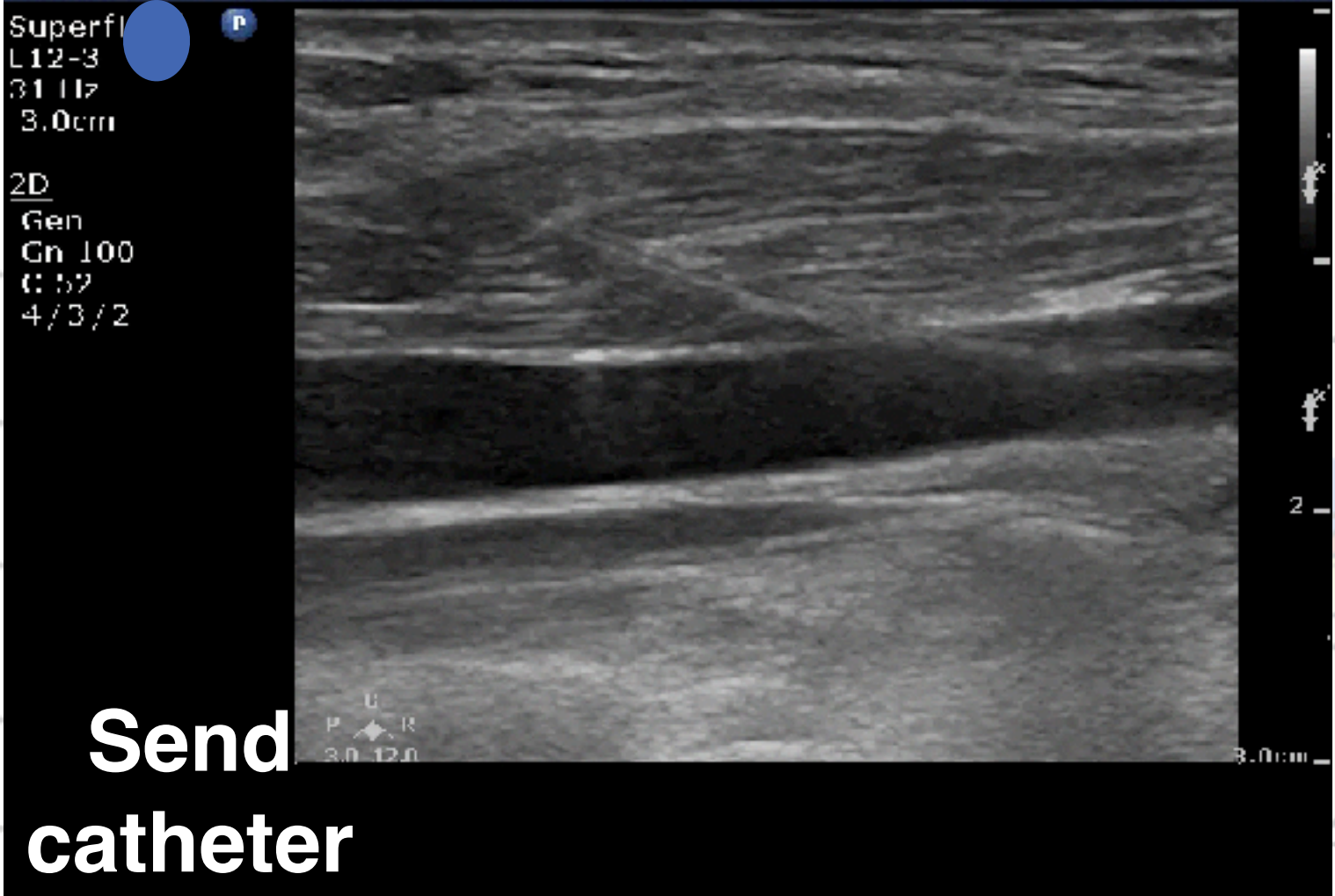
L

R



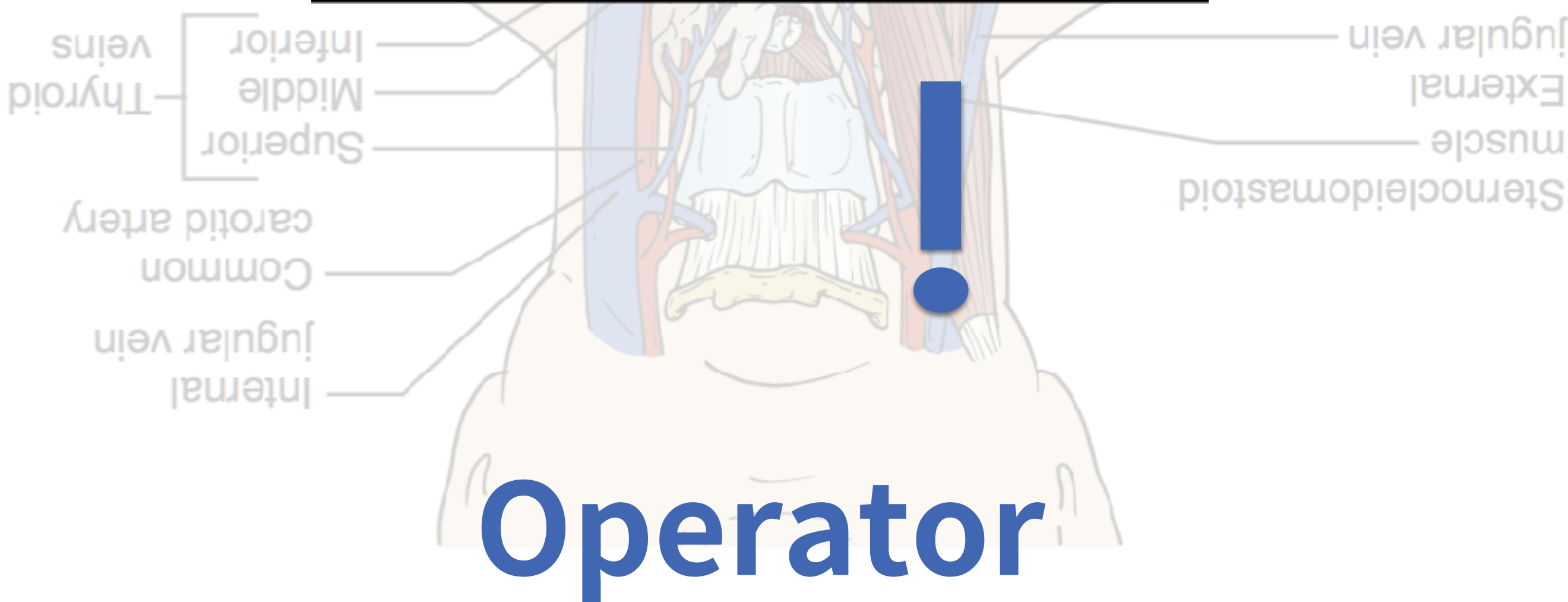
L

R



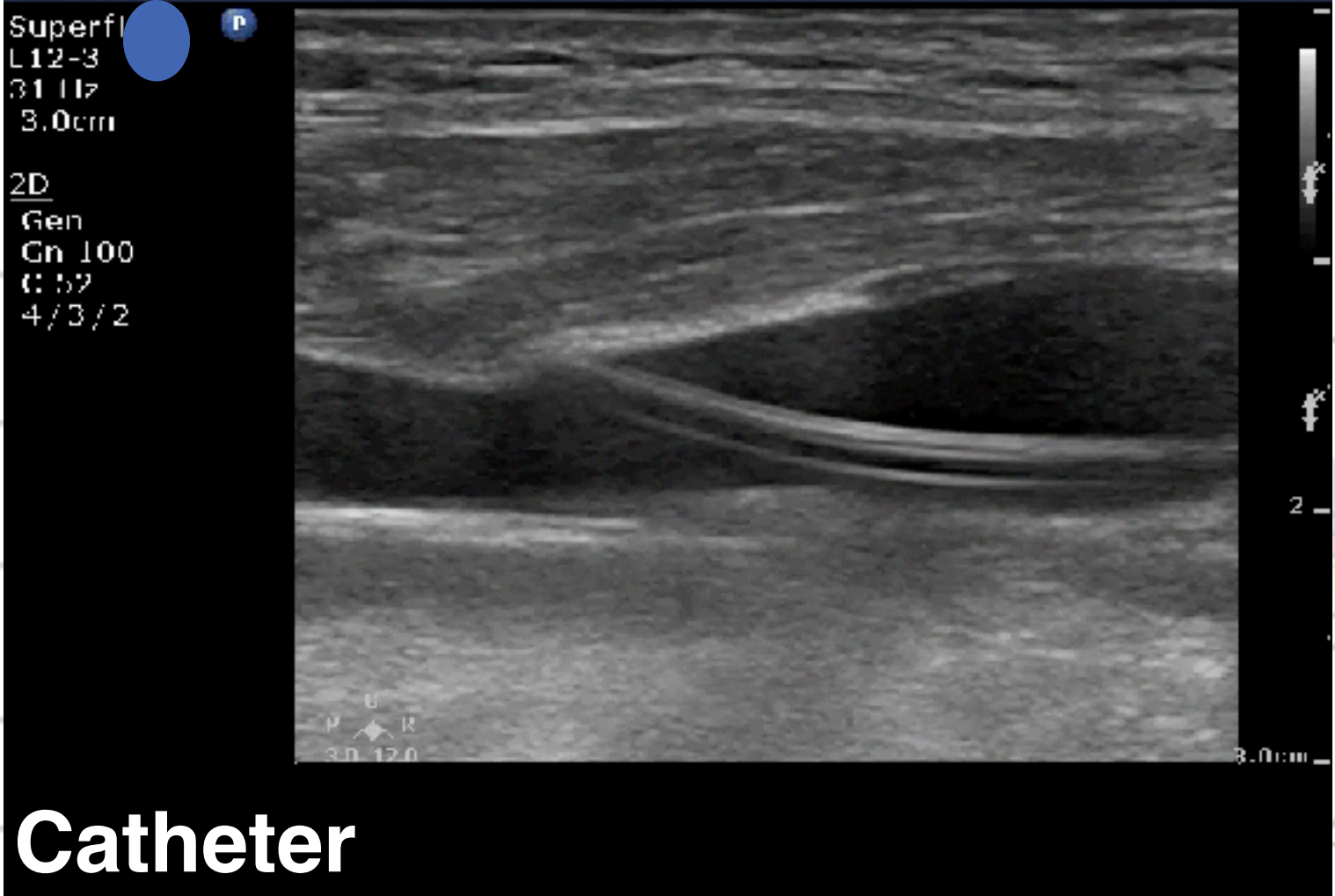
L

R



L

R

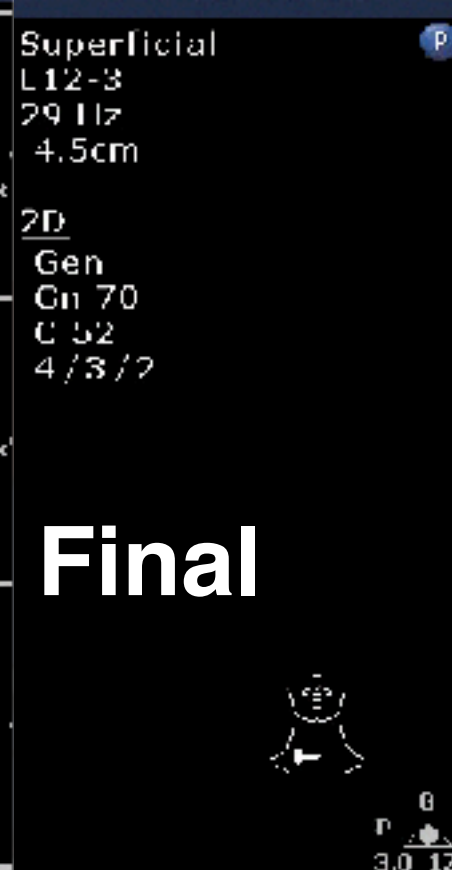
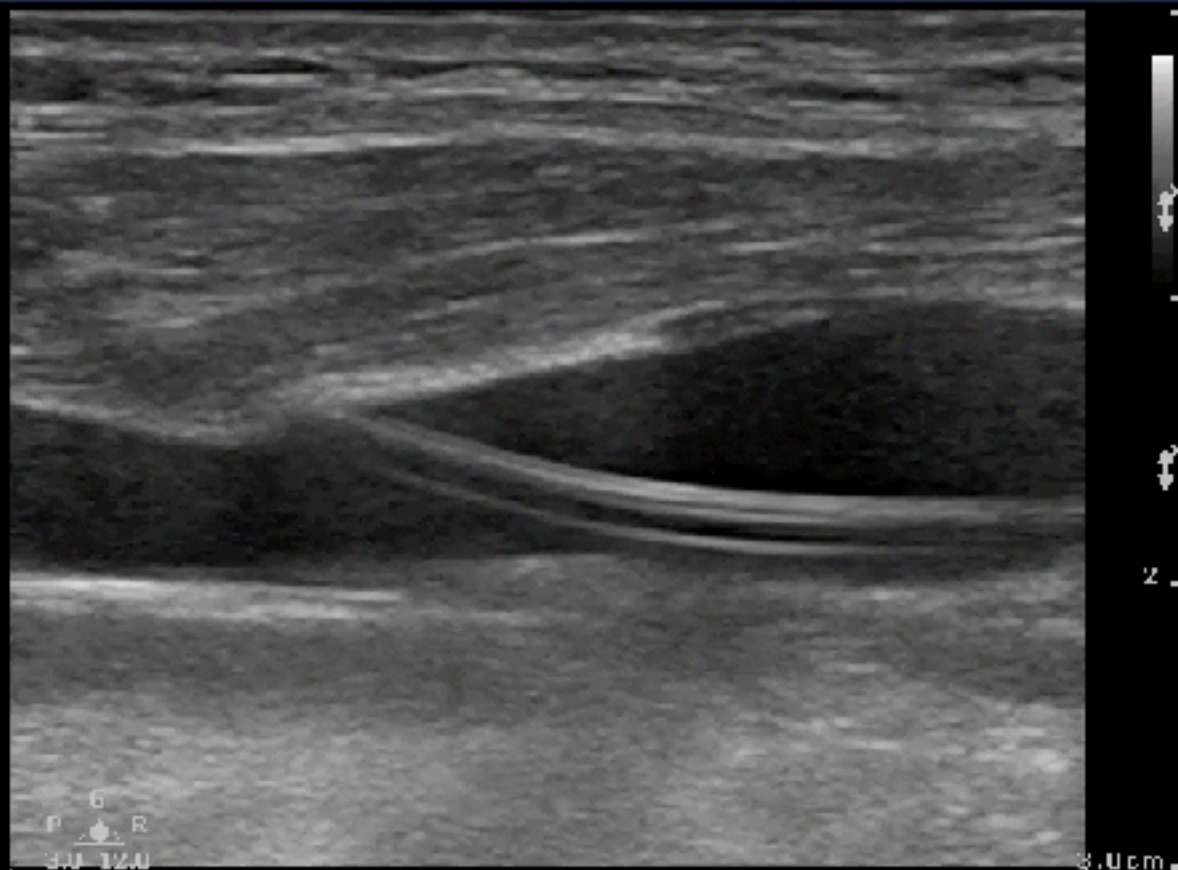


Operator

cial

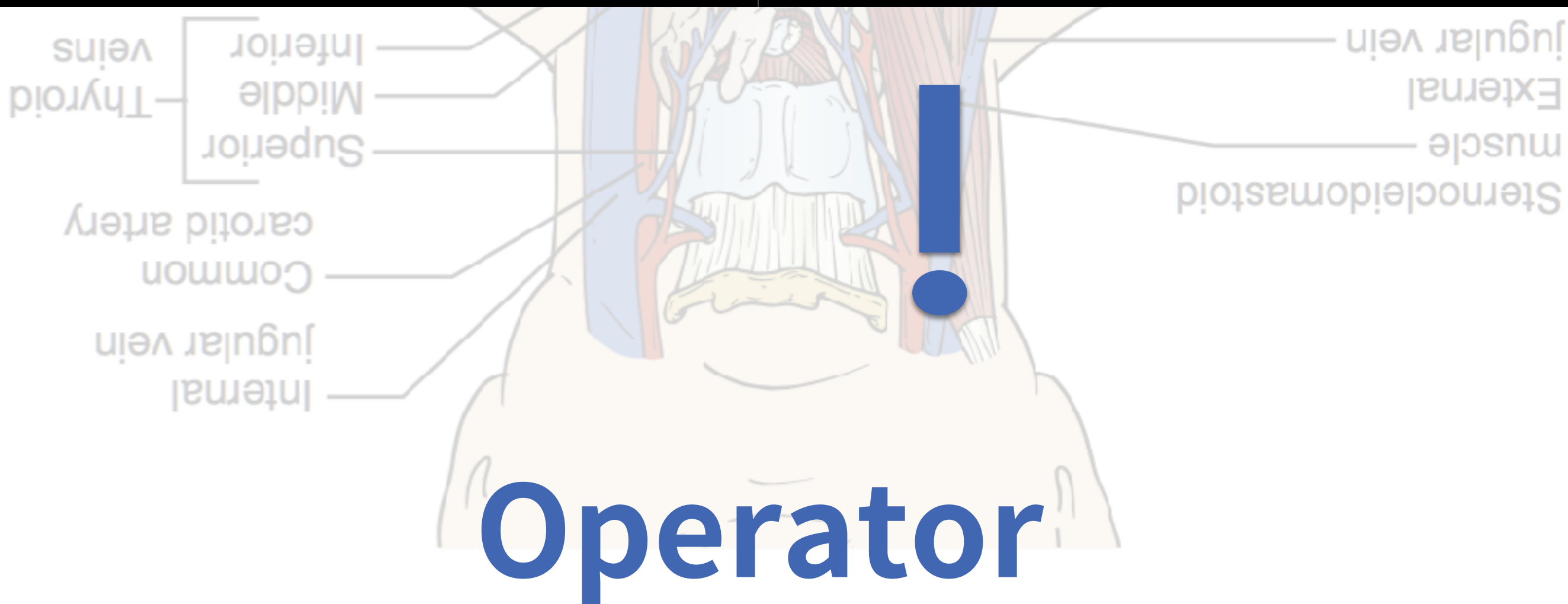
P

L

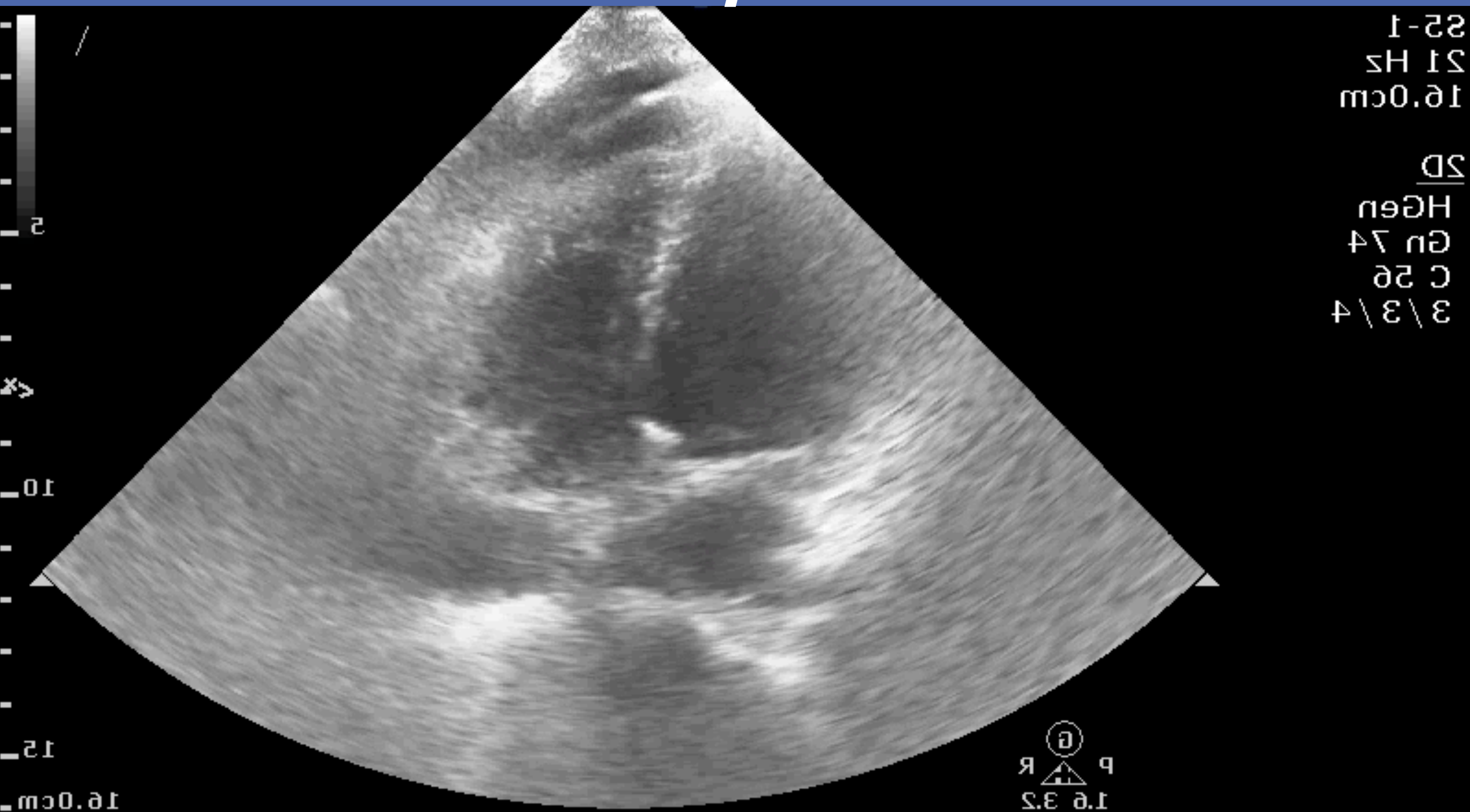


R

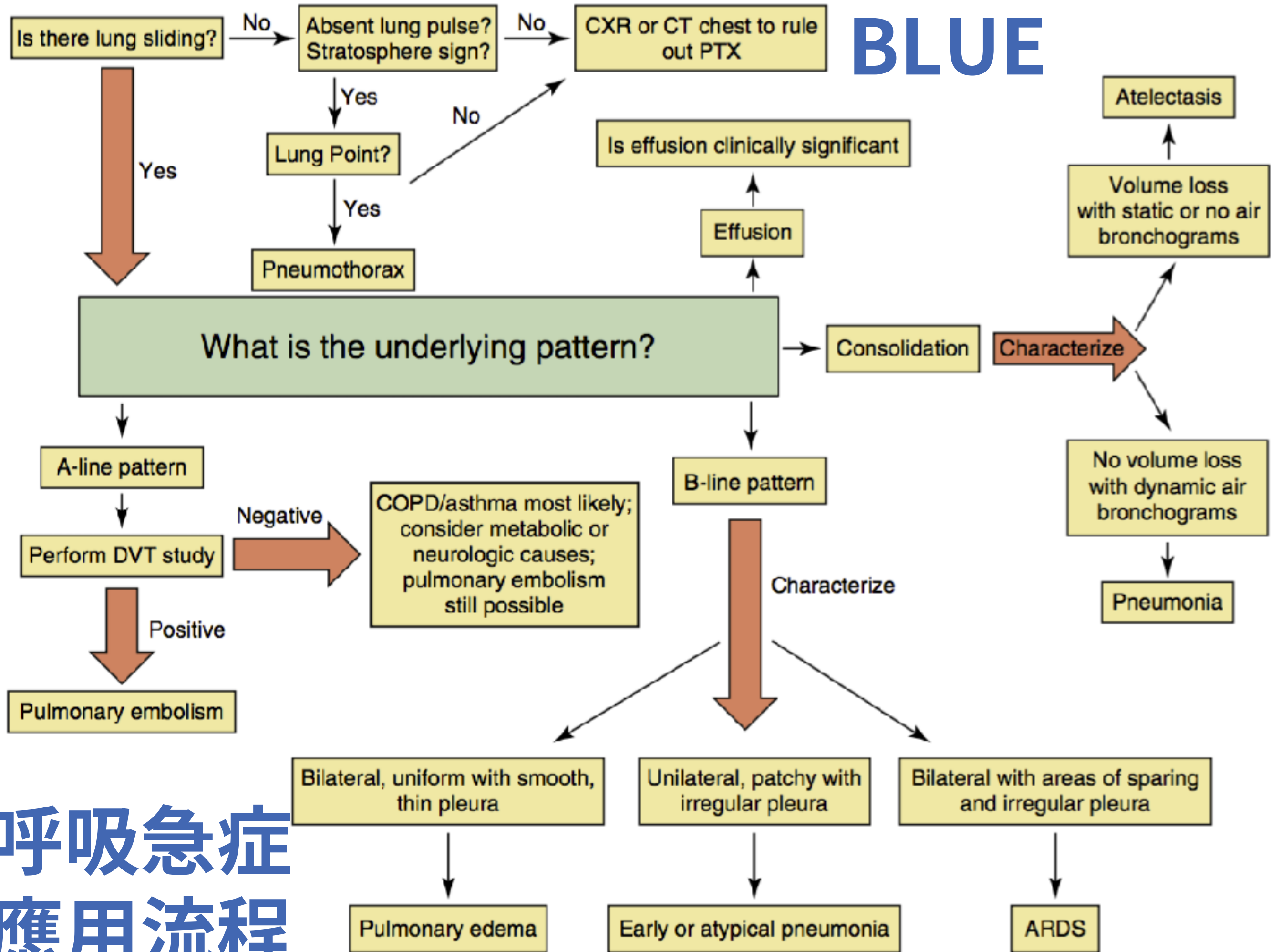
Final



Bubble test /Subcostal 4

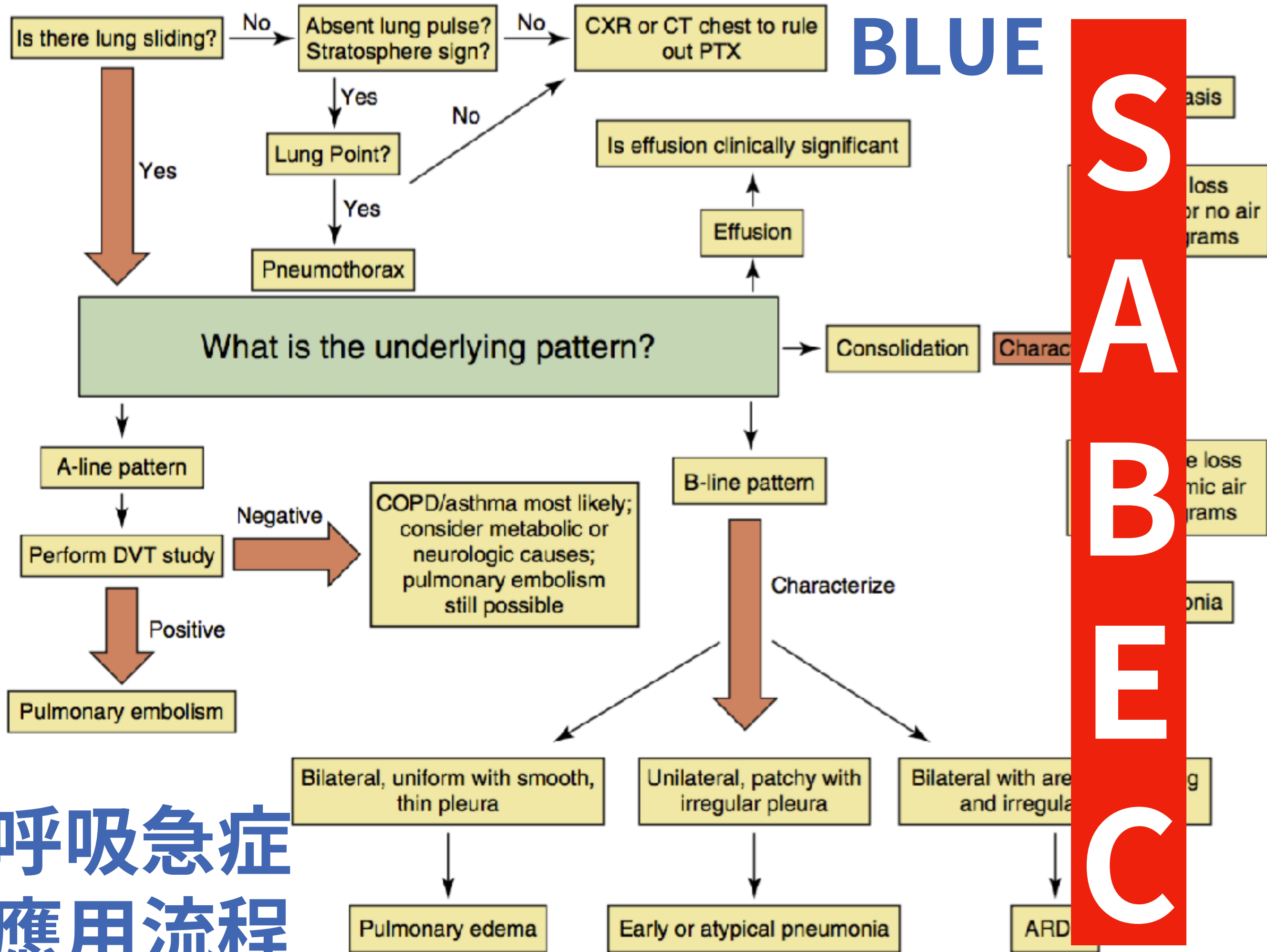


BLUE



呼吸急症
應用流程

呼吸急症 應用流程



BLUE 4 points

Point 1



Point 2



Head <<<<< **Sagittal view** >>>>> Toe

Point 3

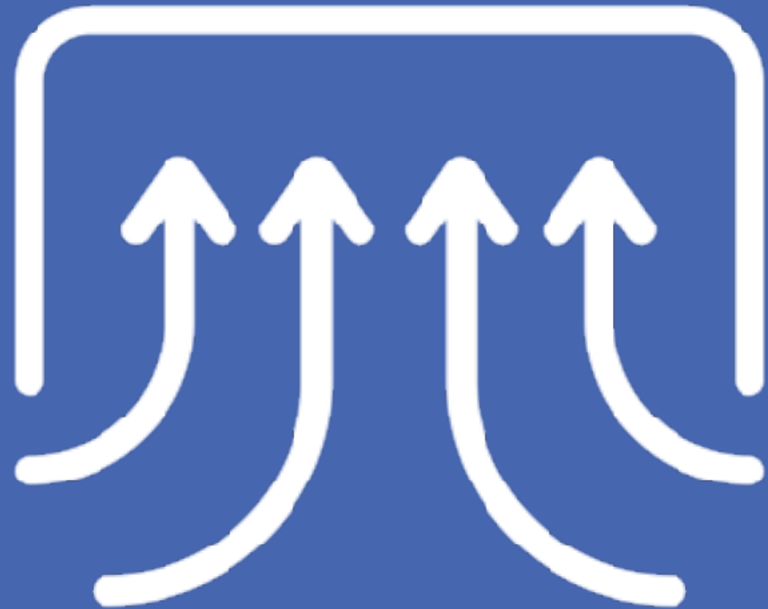


Point 4



Principle

Air 100%



Pneumothorax

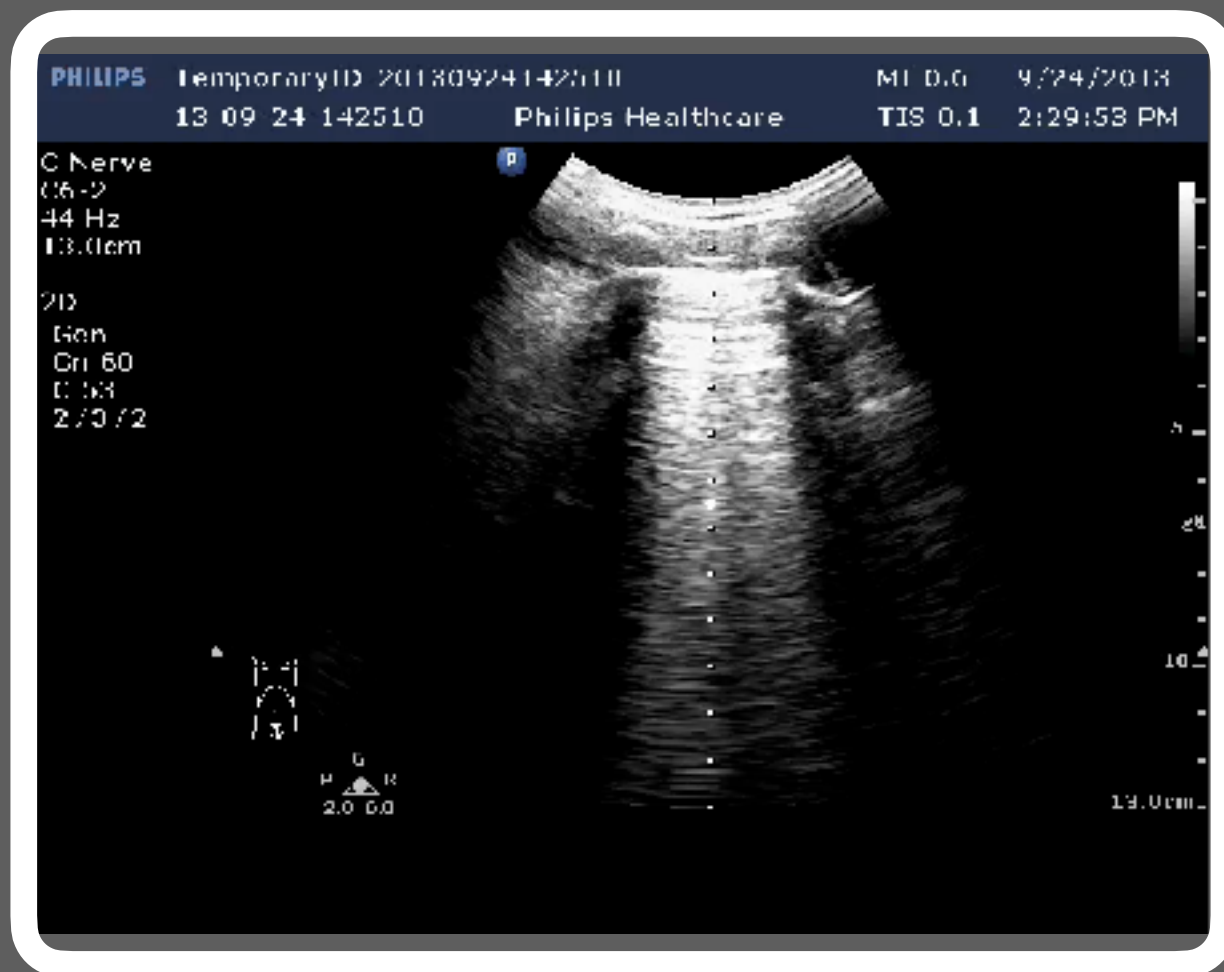
Fluid 100%



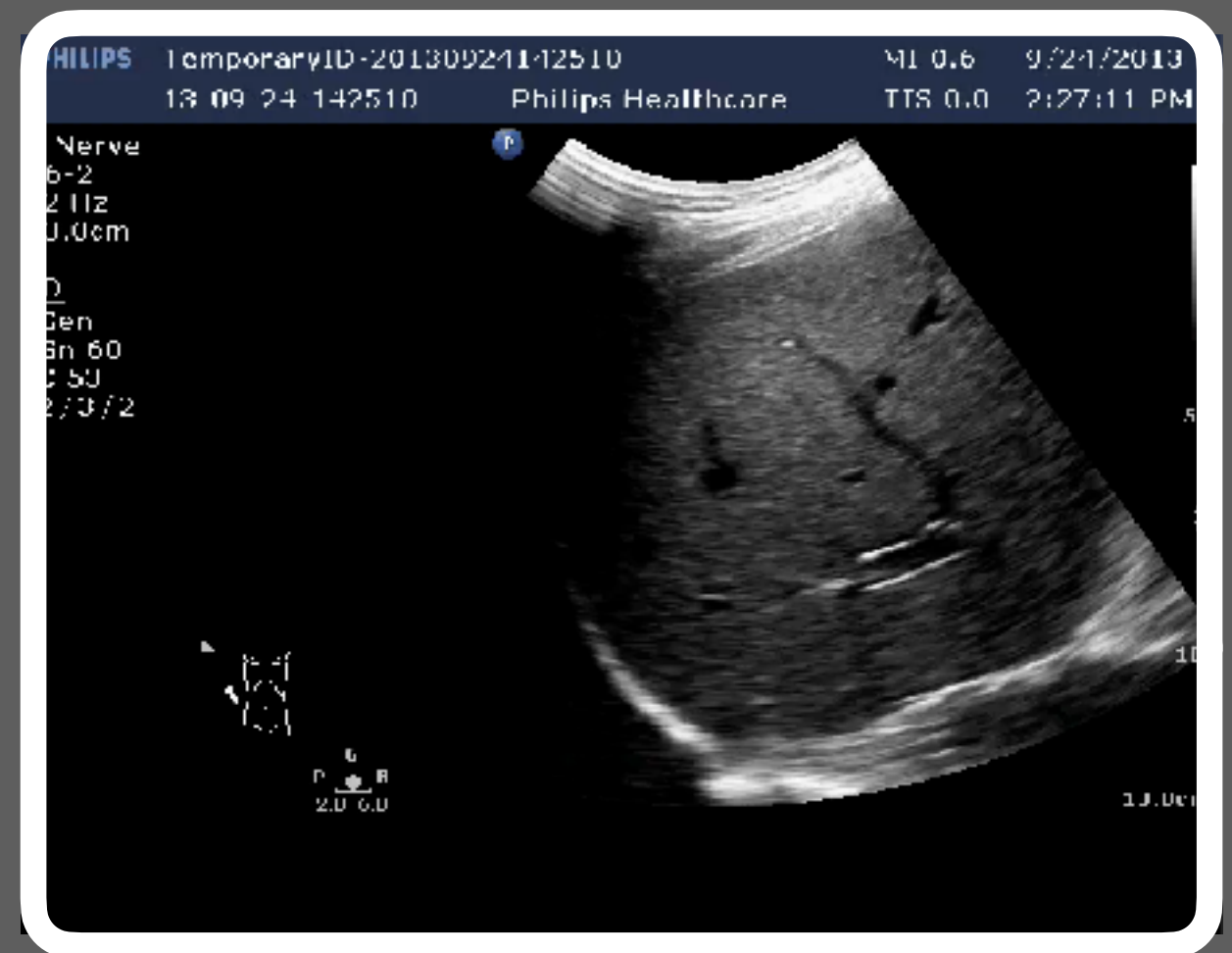
Pleural effusion

Principle

Air



Fluid



Principle

True

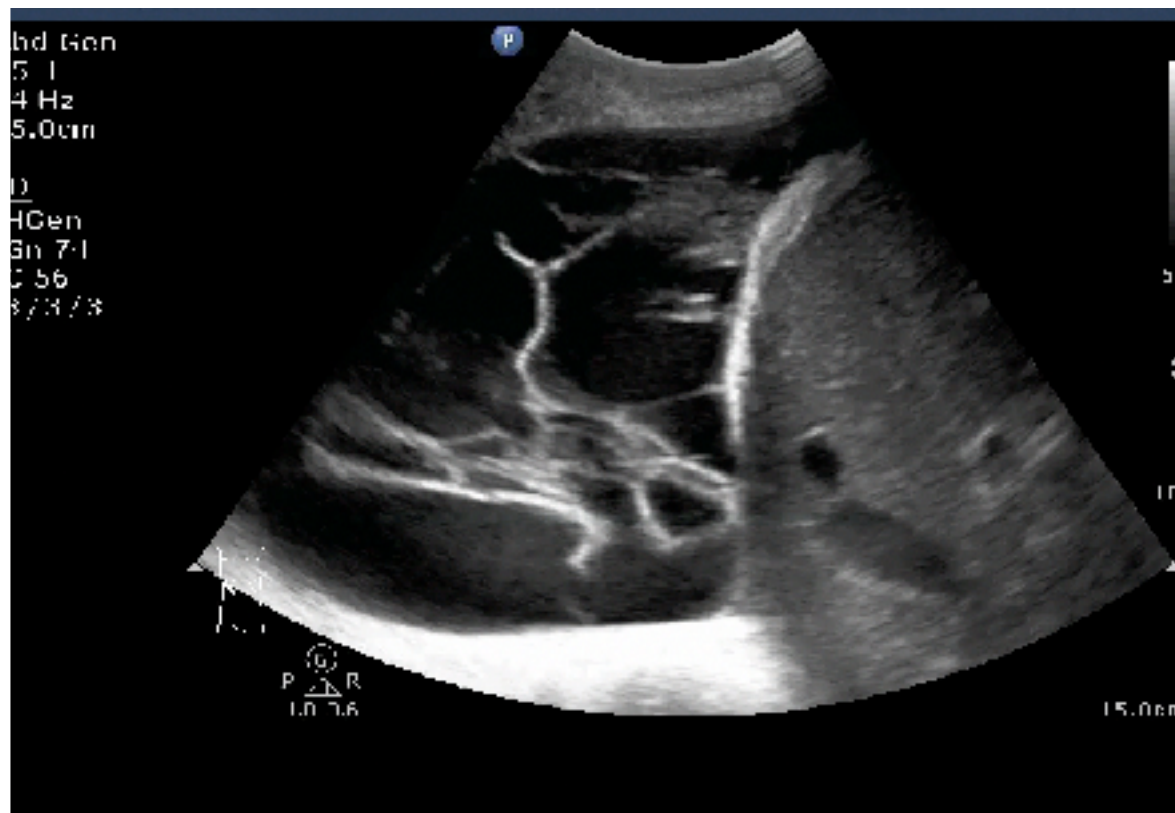
Pneumonia
Pleural effusion
Pleural mass

Artifact

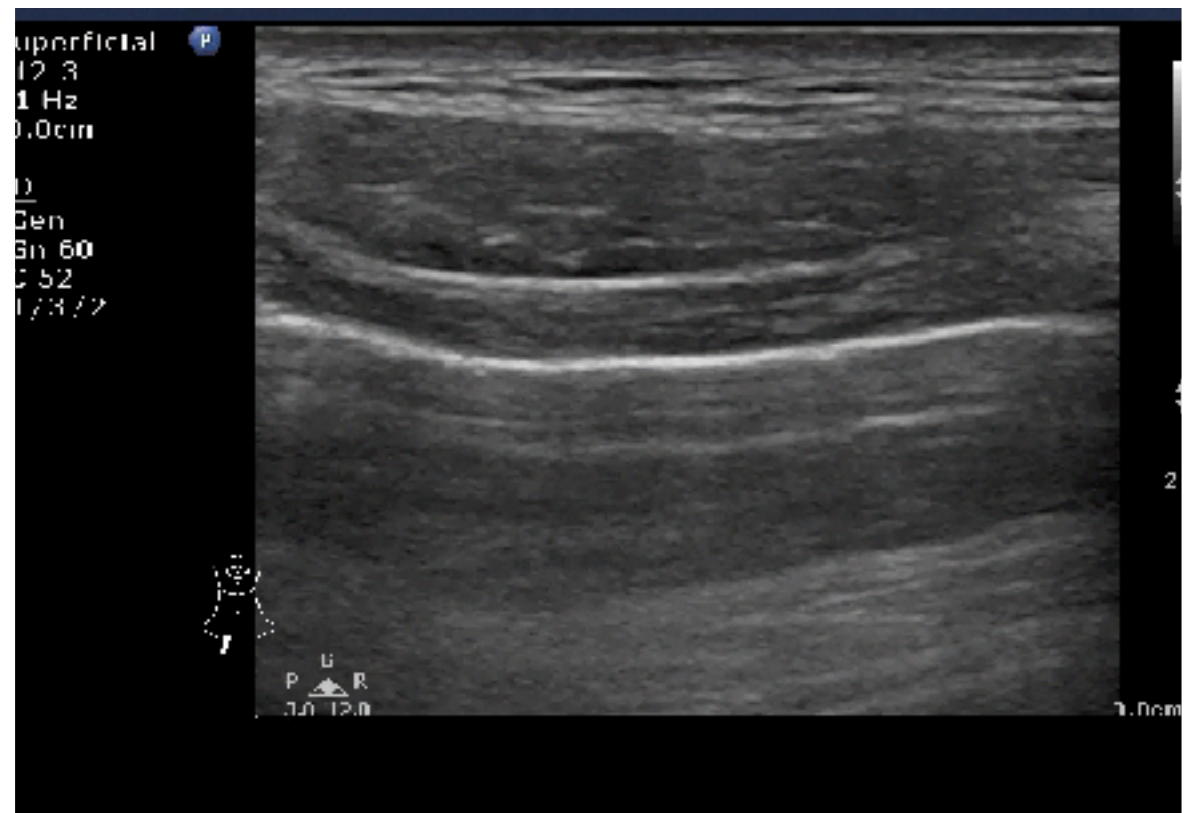
Normal lung
Pneumothorax
AIS

Principle

True

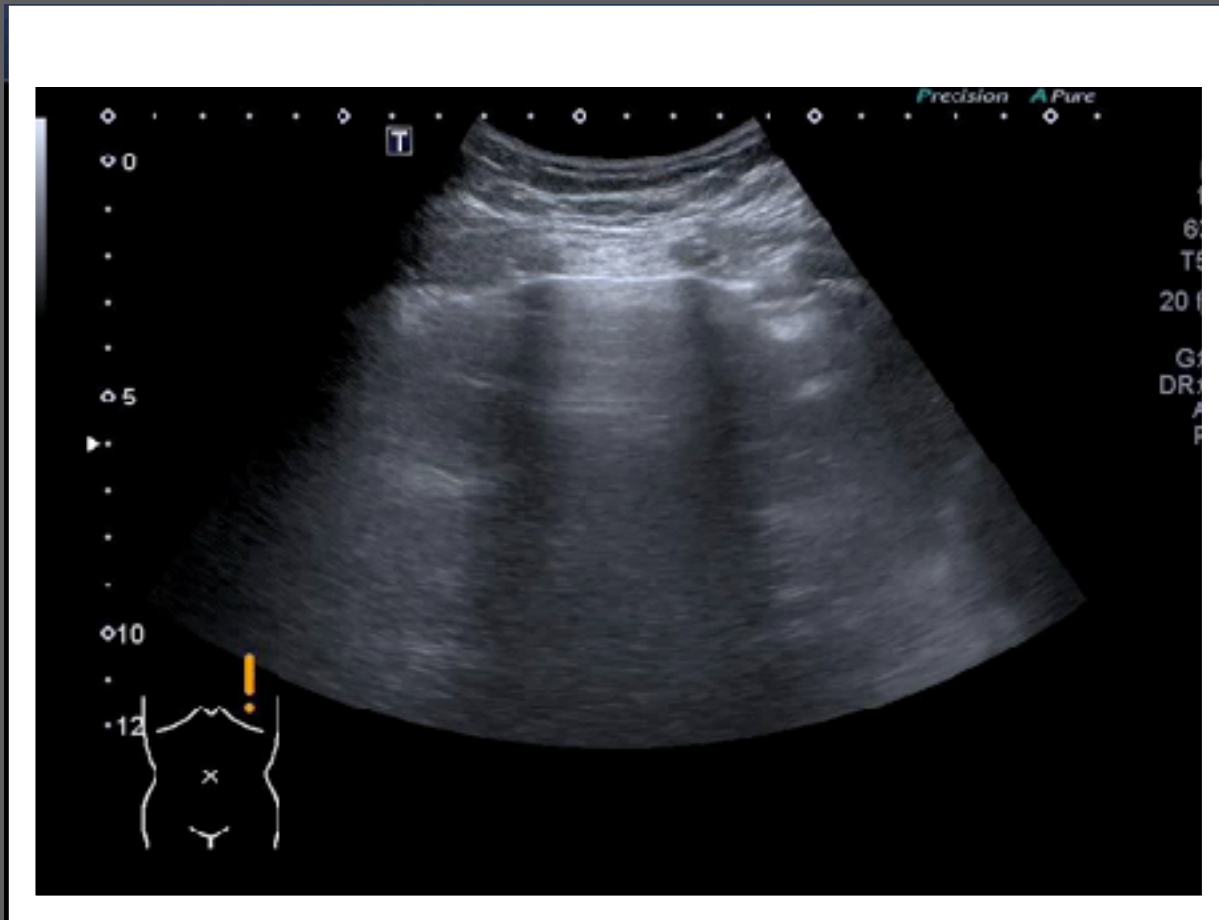


Artifact



Artifact

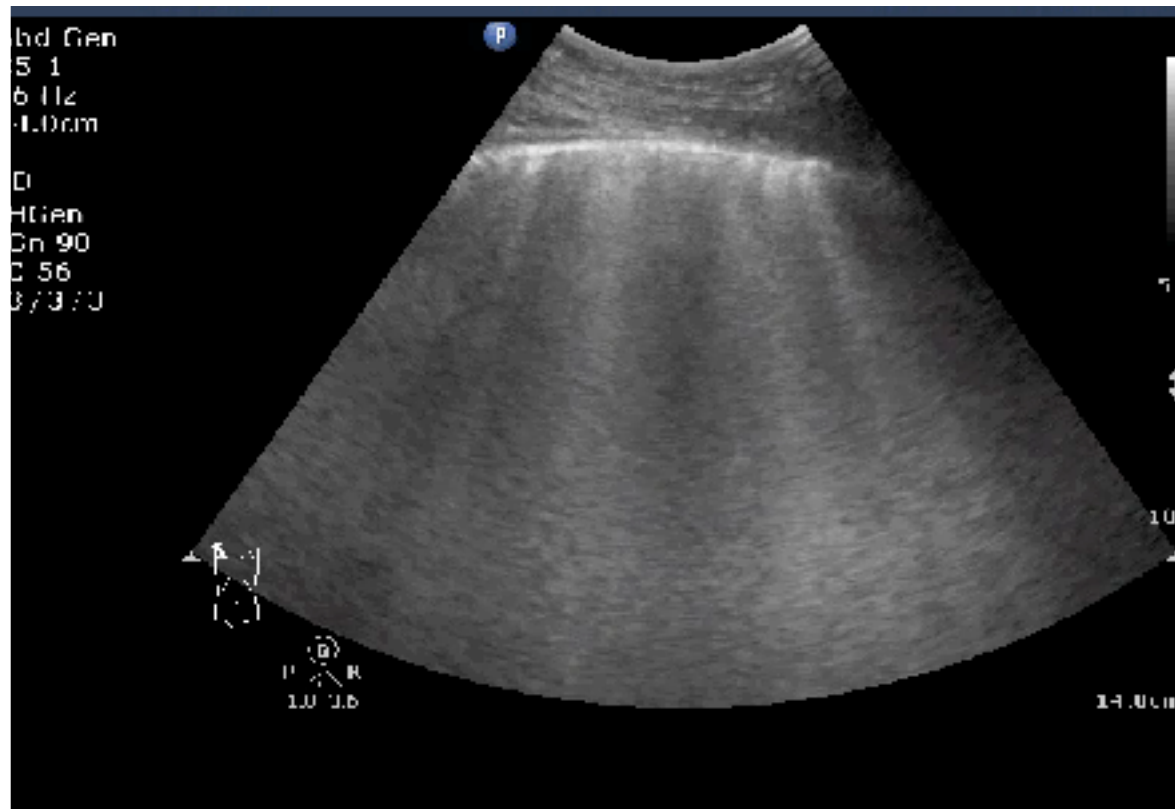
A lines



Pleural
Equal
Horizontal

Artifact

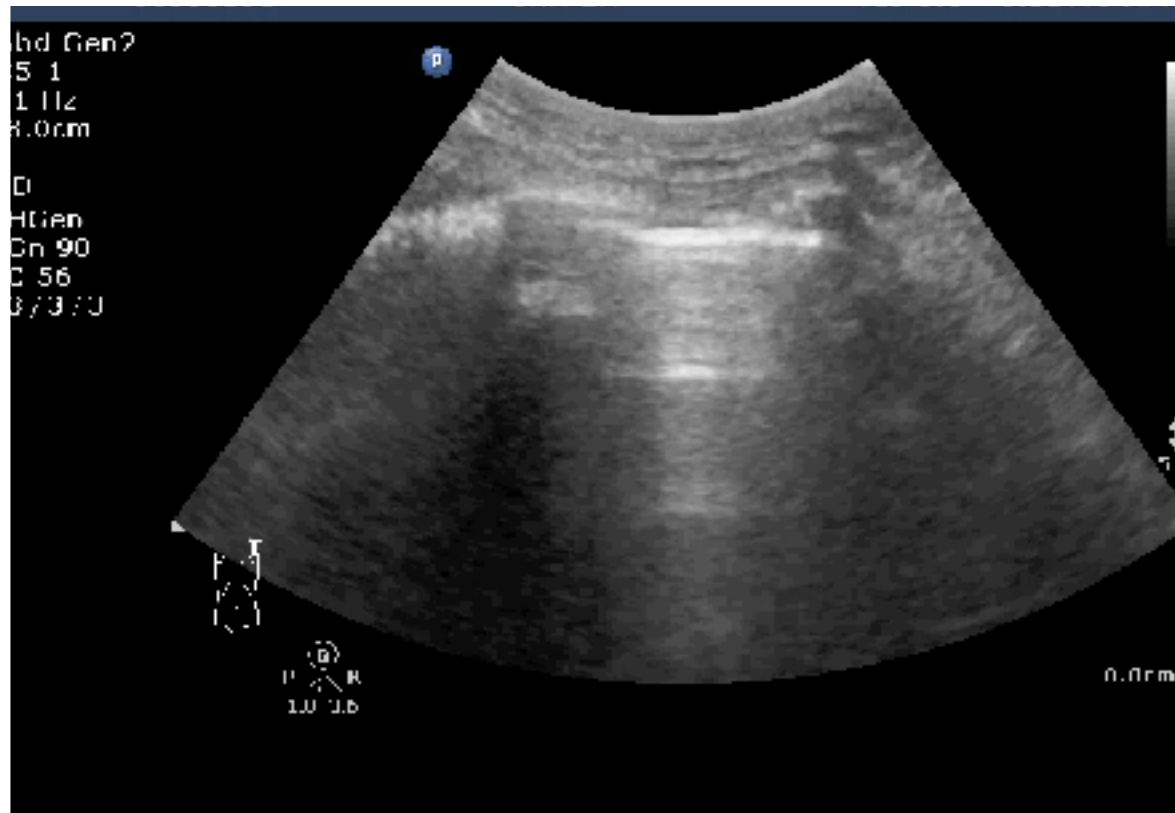
B lines



Pleural
Vertical
> 3 in ICS

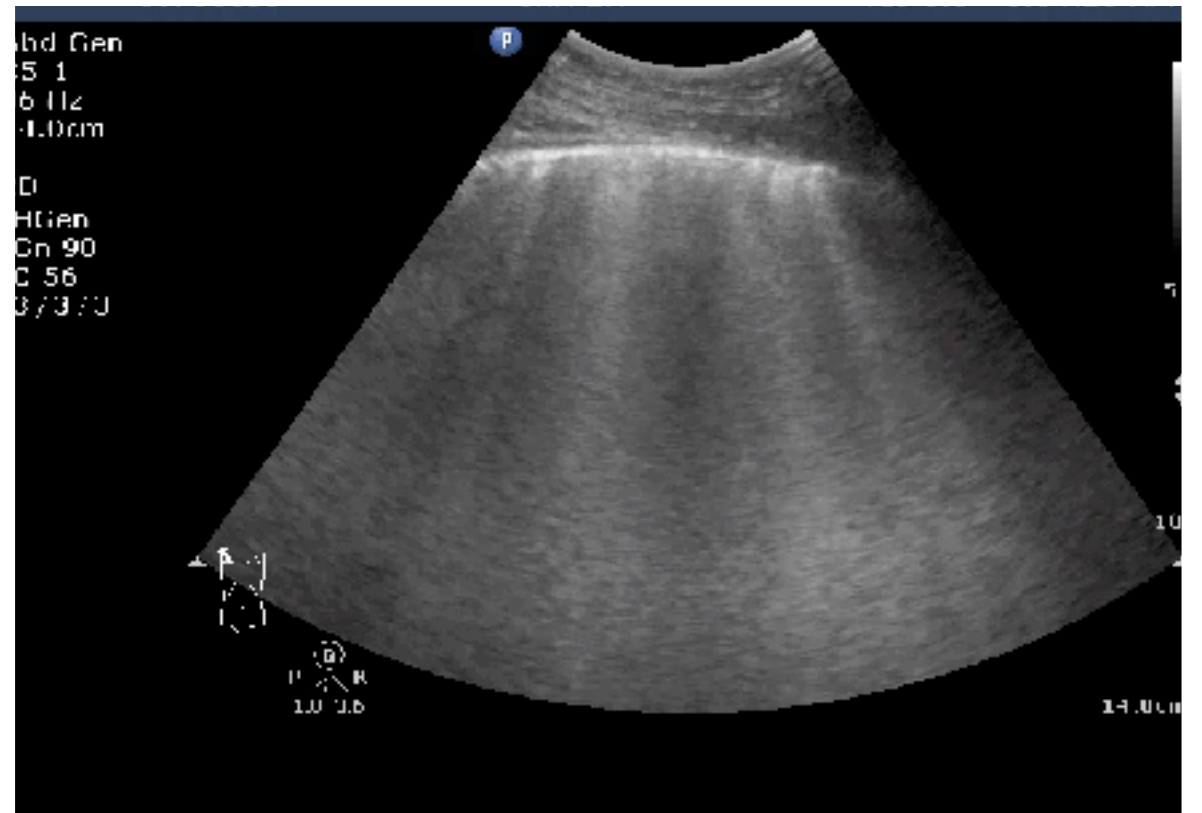
那一段影片正常？

A



No sliding

B



Sliding

Normal Lung

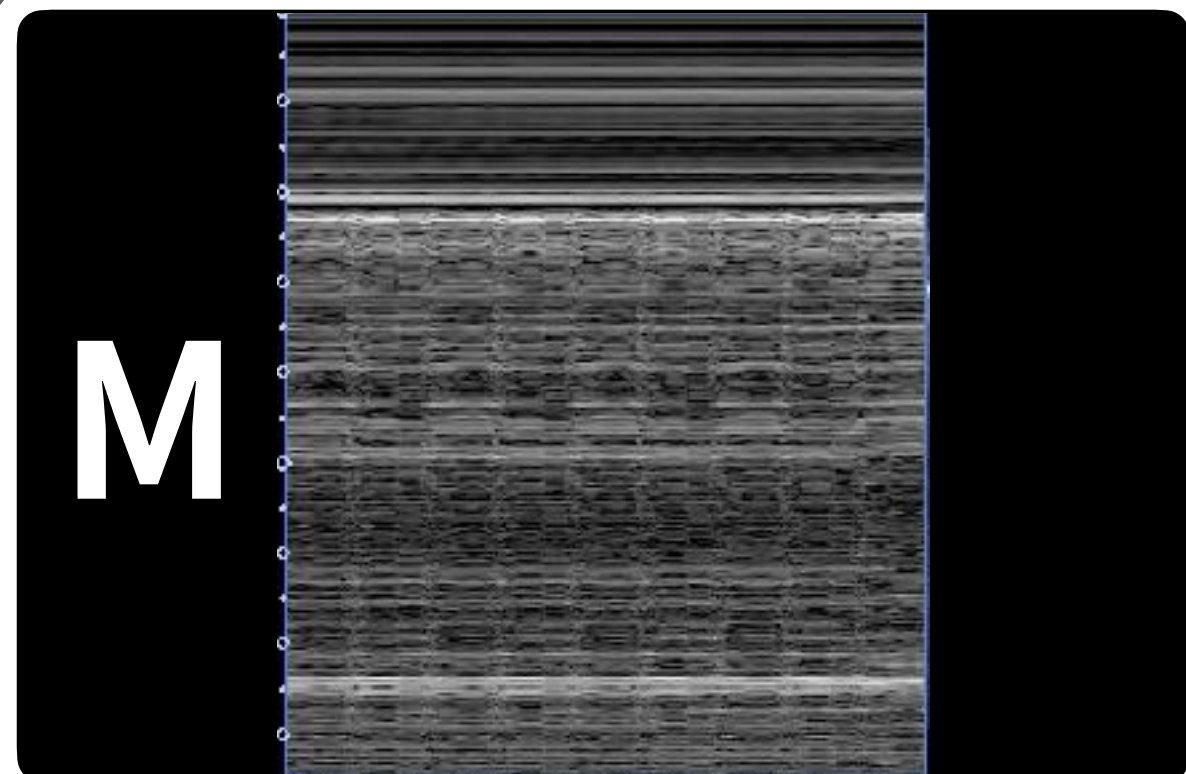
Static

B



Dynamic

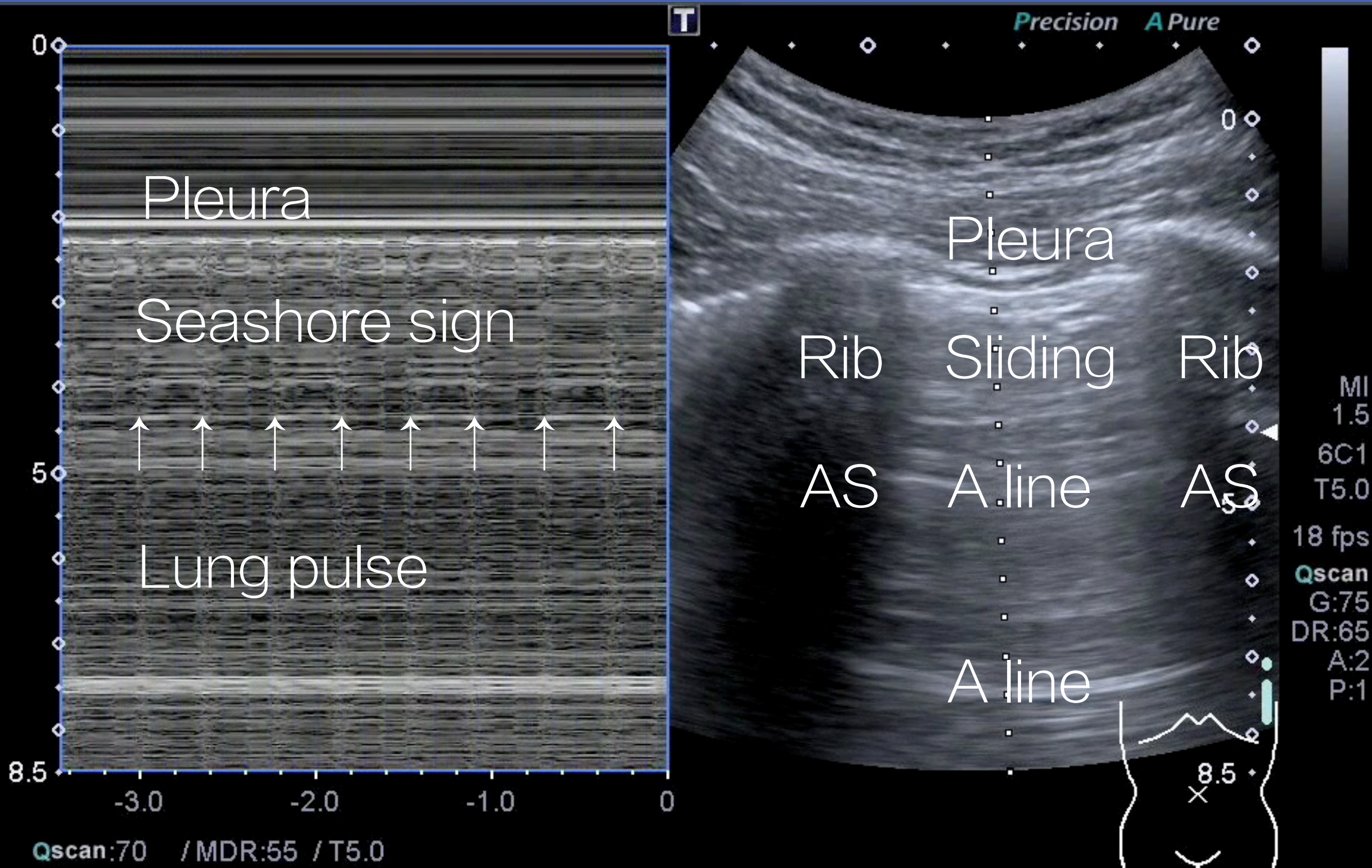
M



Normal Lung



Normal Lung



PLUS for PAP

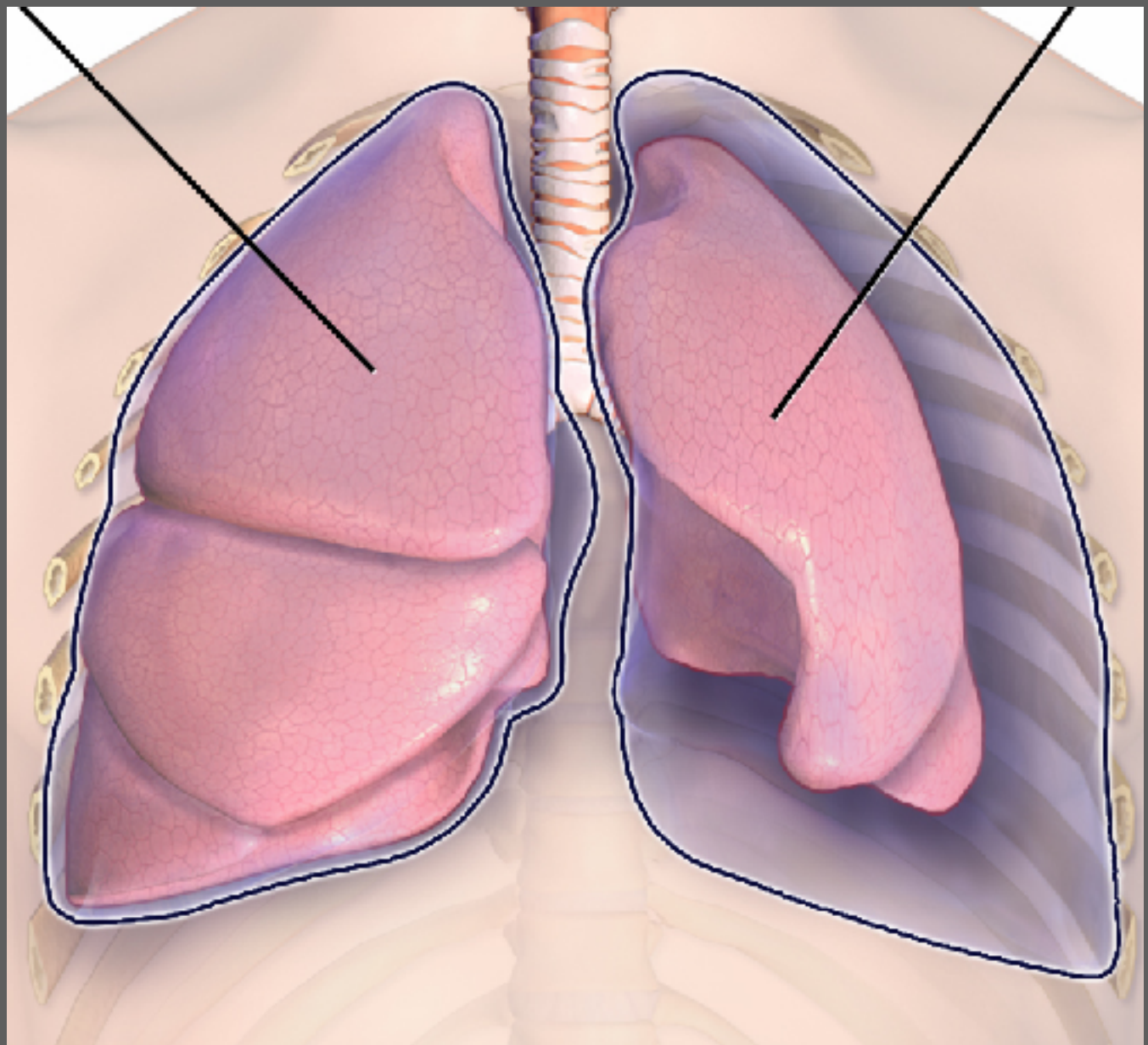
PTX

AIS

PLE

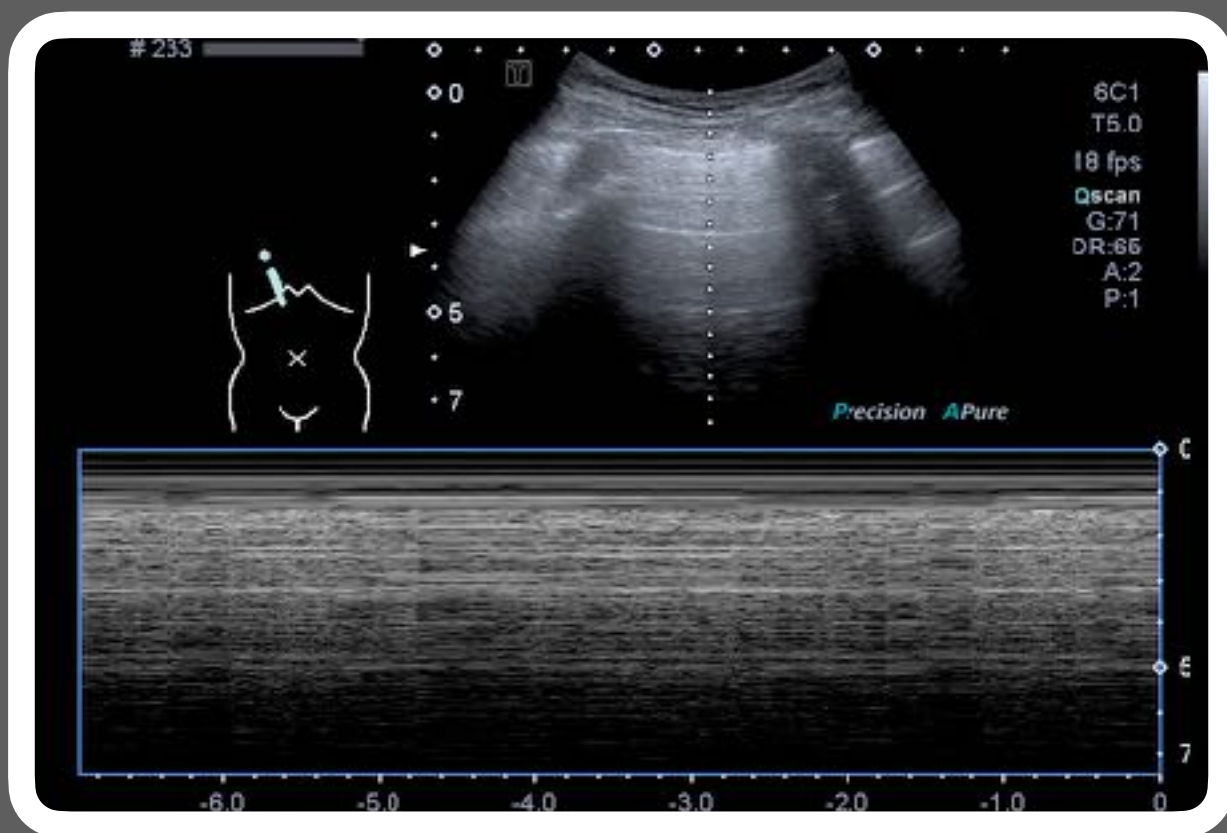
PLUS for PAP

PTX



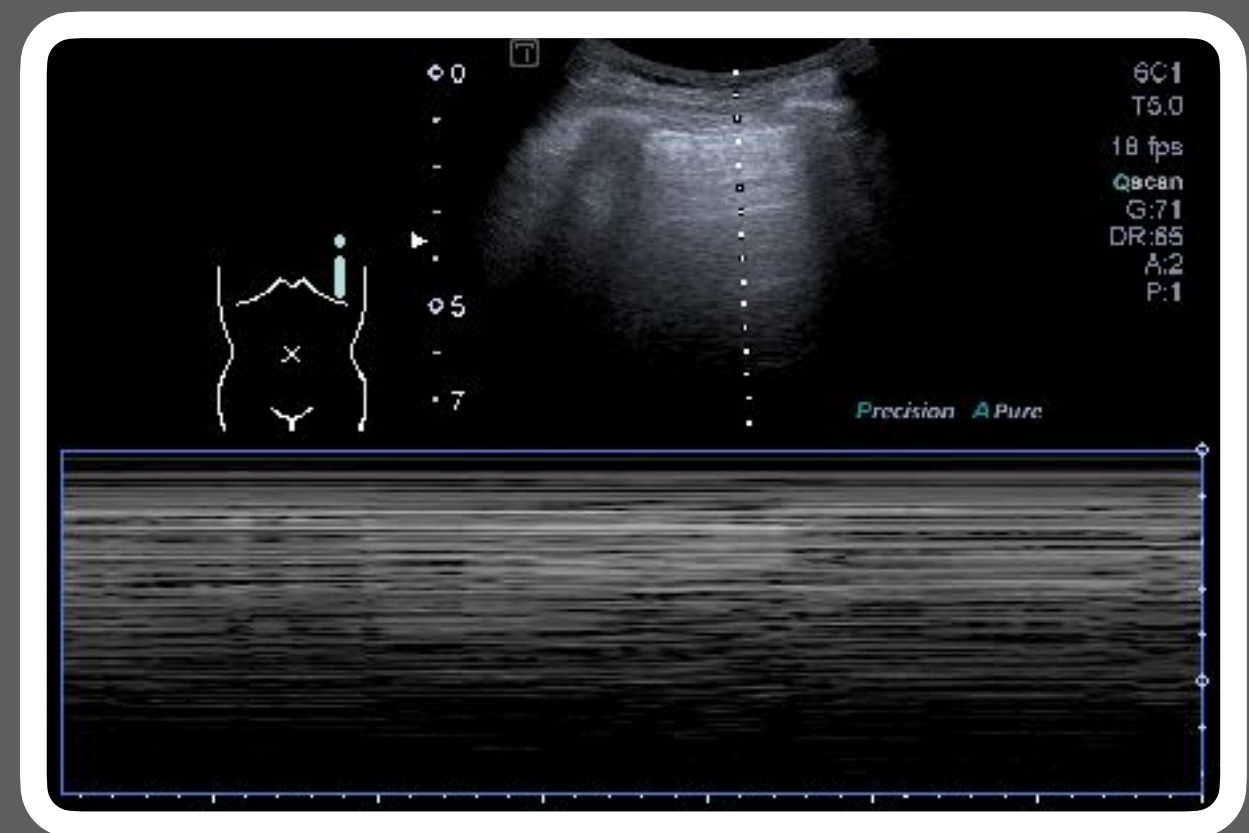
Pneumothorax

Normal



Seashore sign

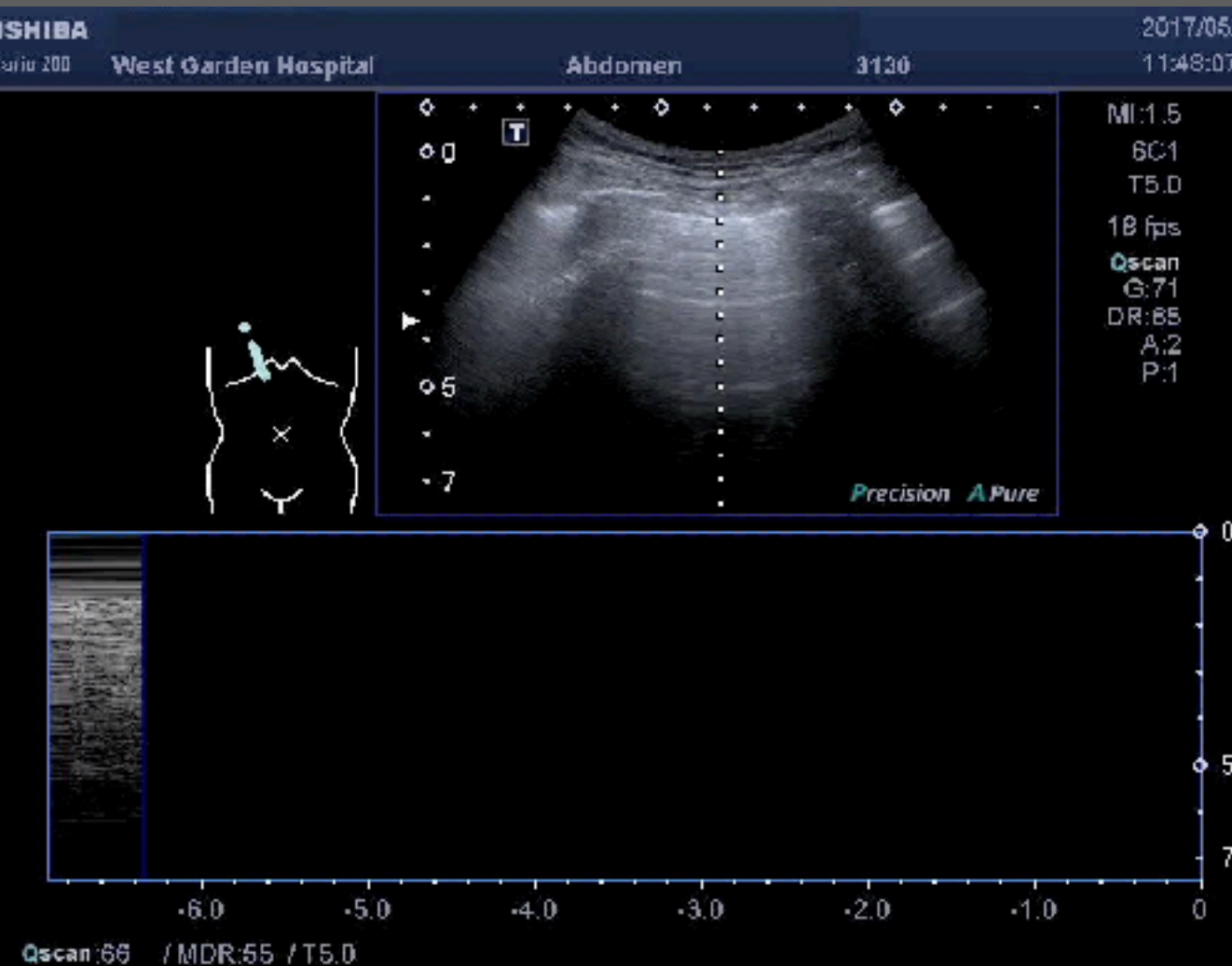
Pneumothorax



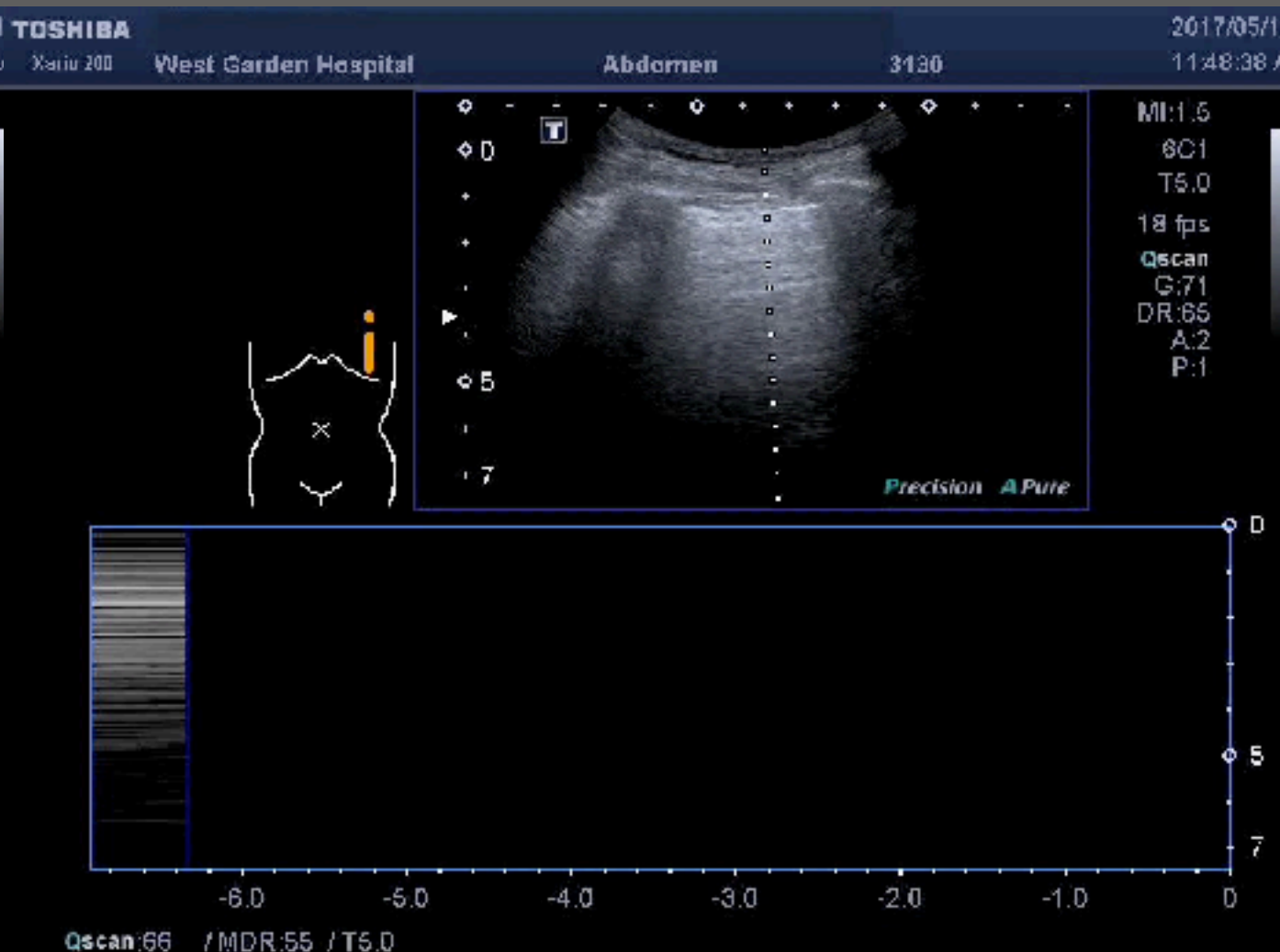
Stratosphere sign

Pneumothorax

Normal

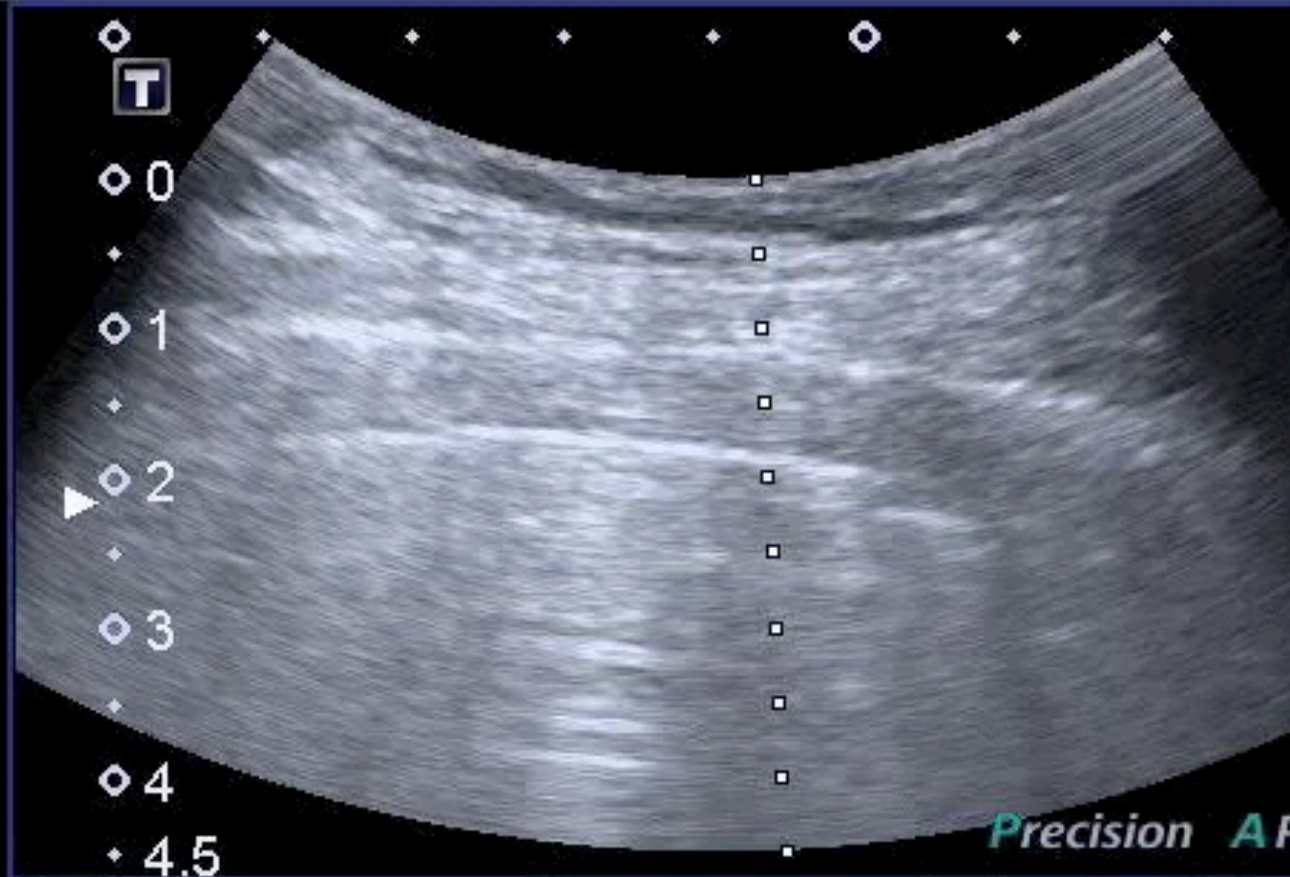


Pneumothorax



Lung Point

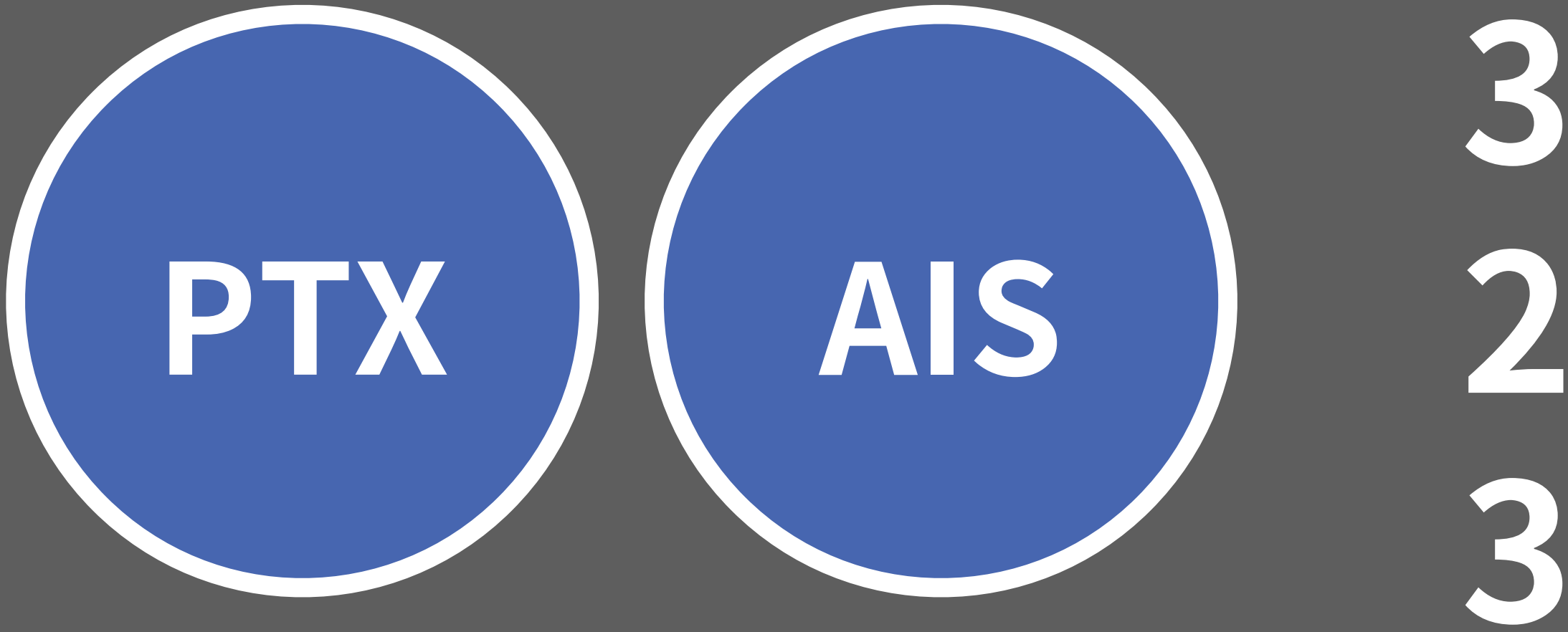
A



B



PLUS for PAP



PTX

AIS

3

2

3

AIS

Point 1



BLUE 4 points

Point 2



Point 3



Point 4

3x2

Alveolar Interstitial Syndrome



AIS

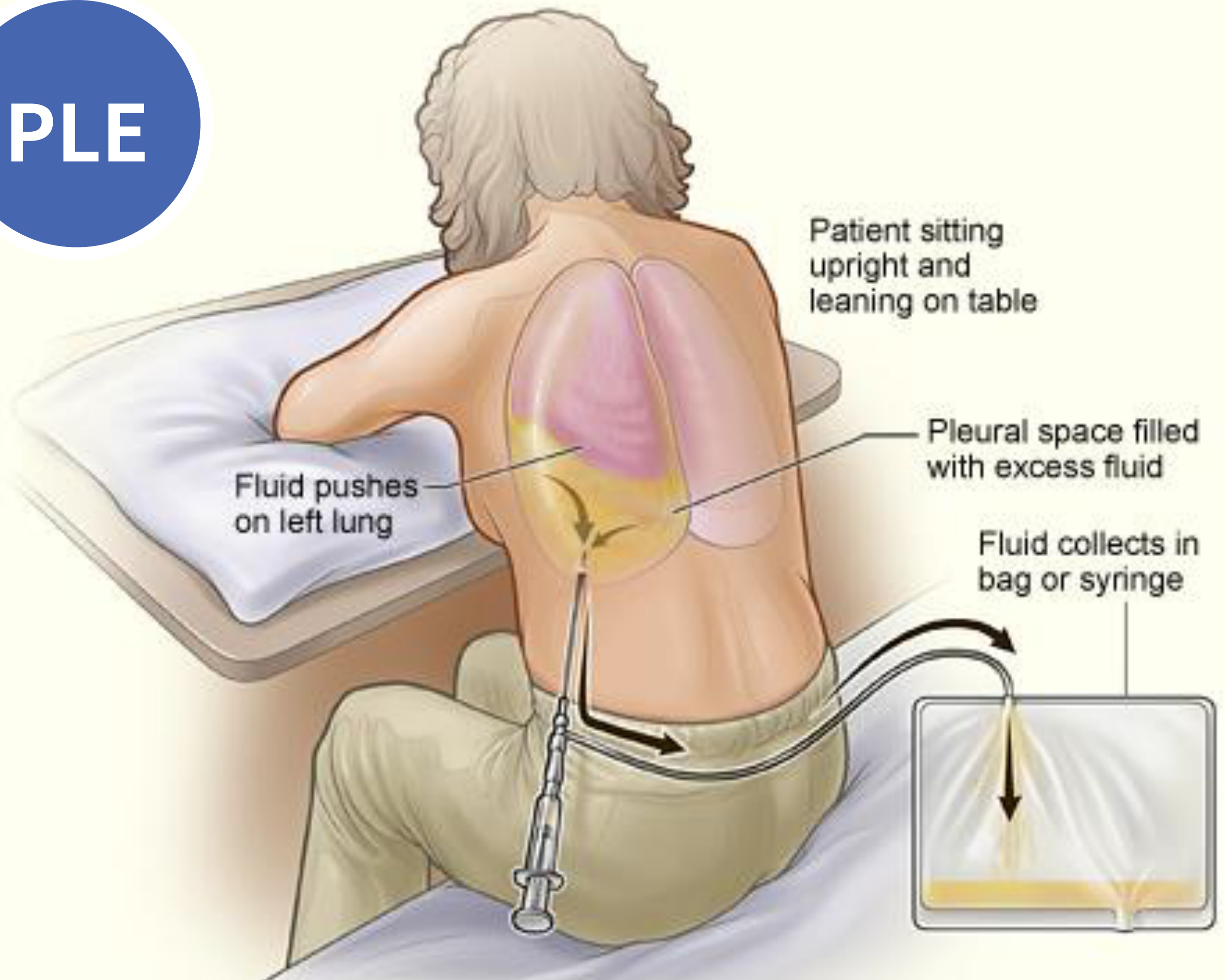
3

15.12

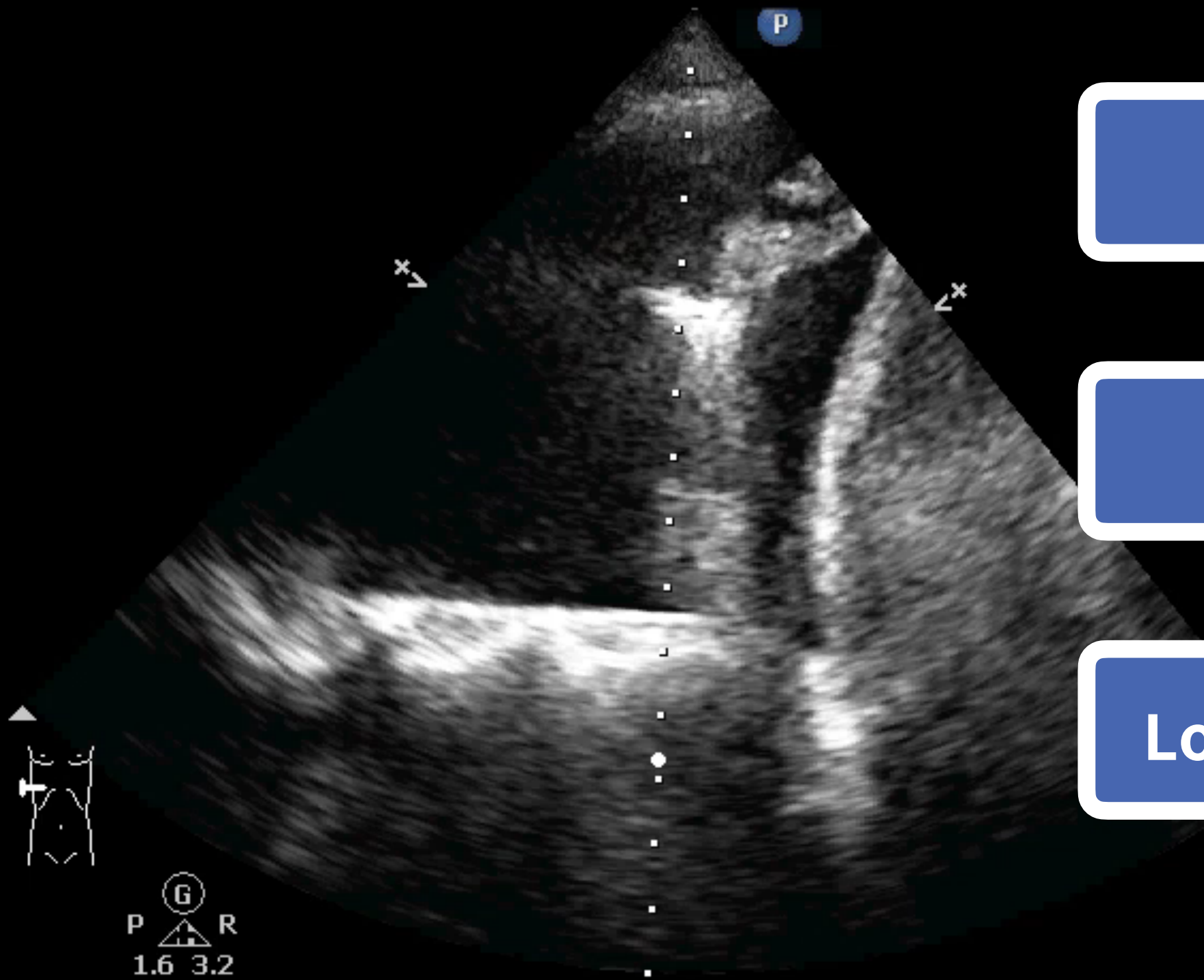
AIS



PLE



SKH-EUTC©ChenKC



Jellyfish sign

Spine sign

Loss of curtain sign

Parasternal



SPA



Subcostal



Apical

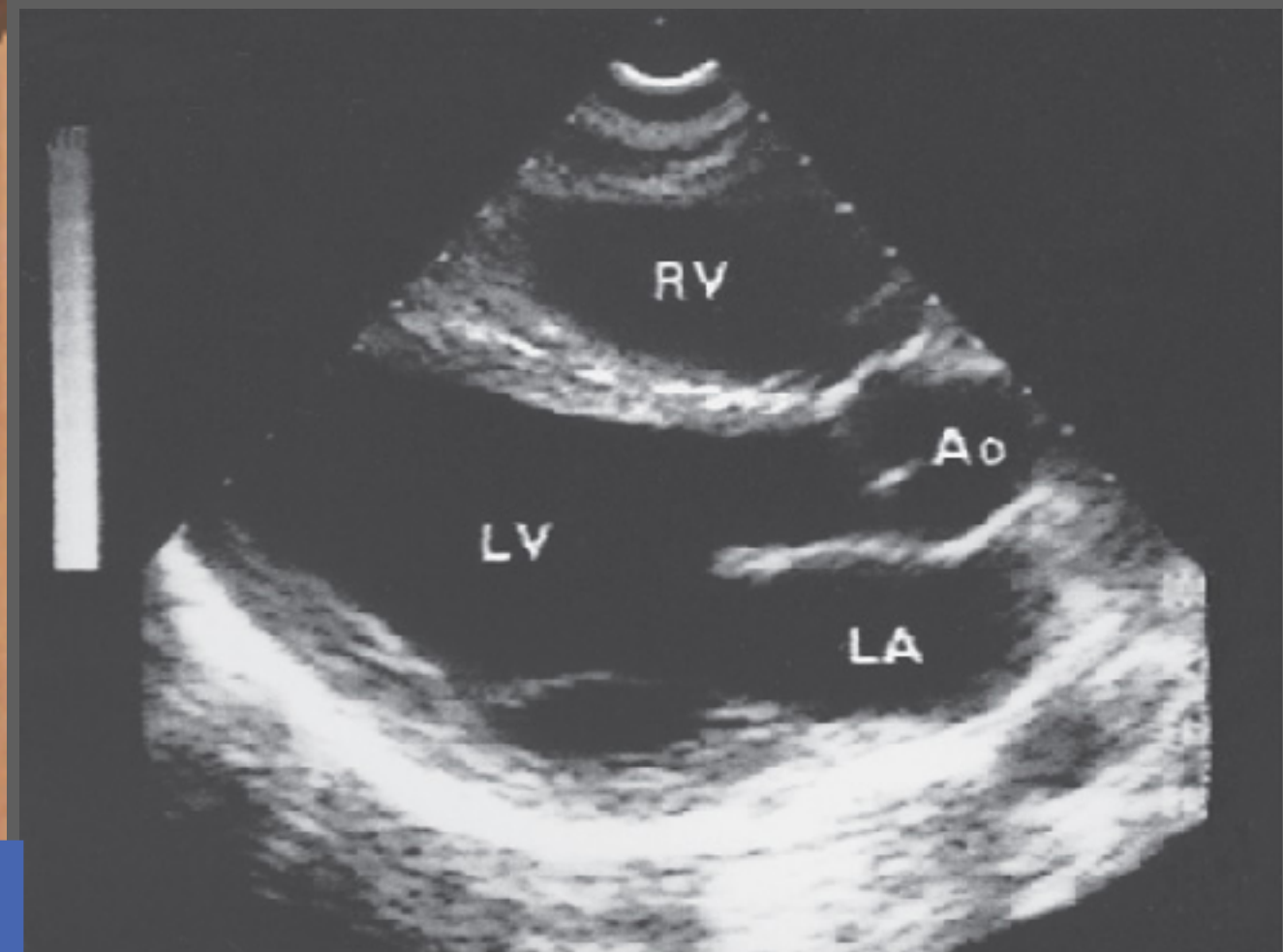
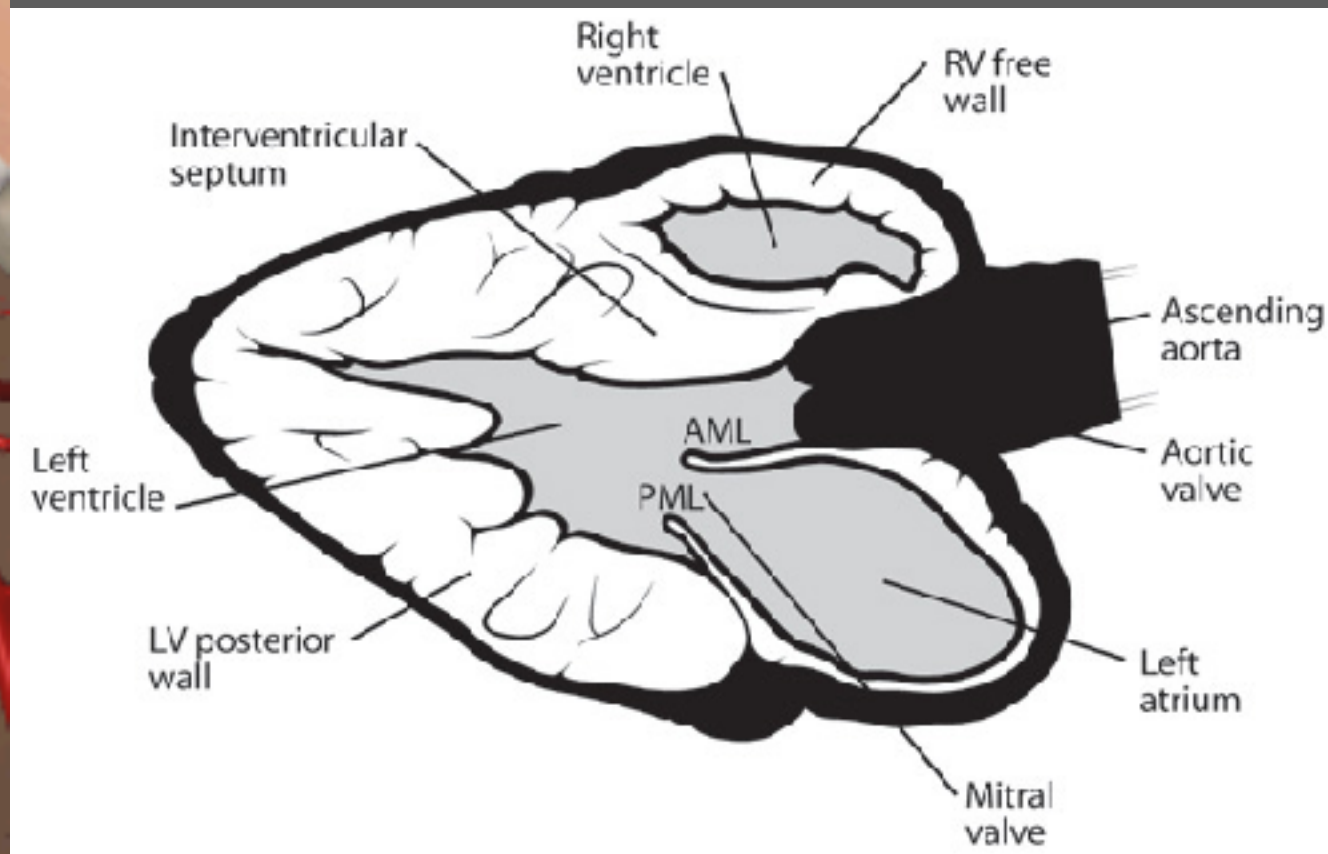
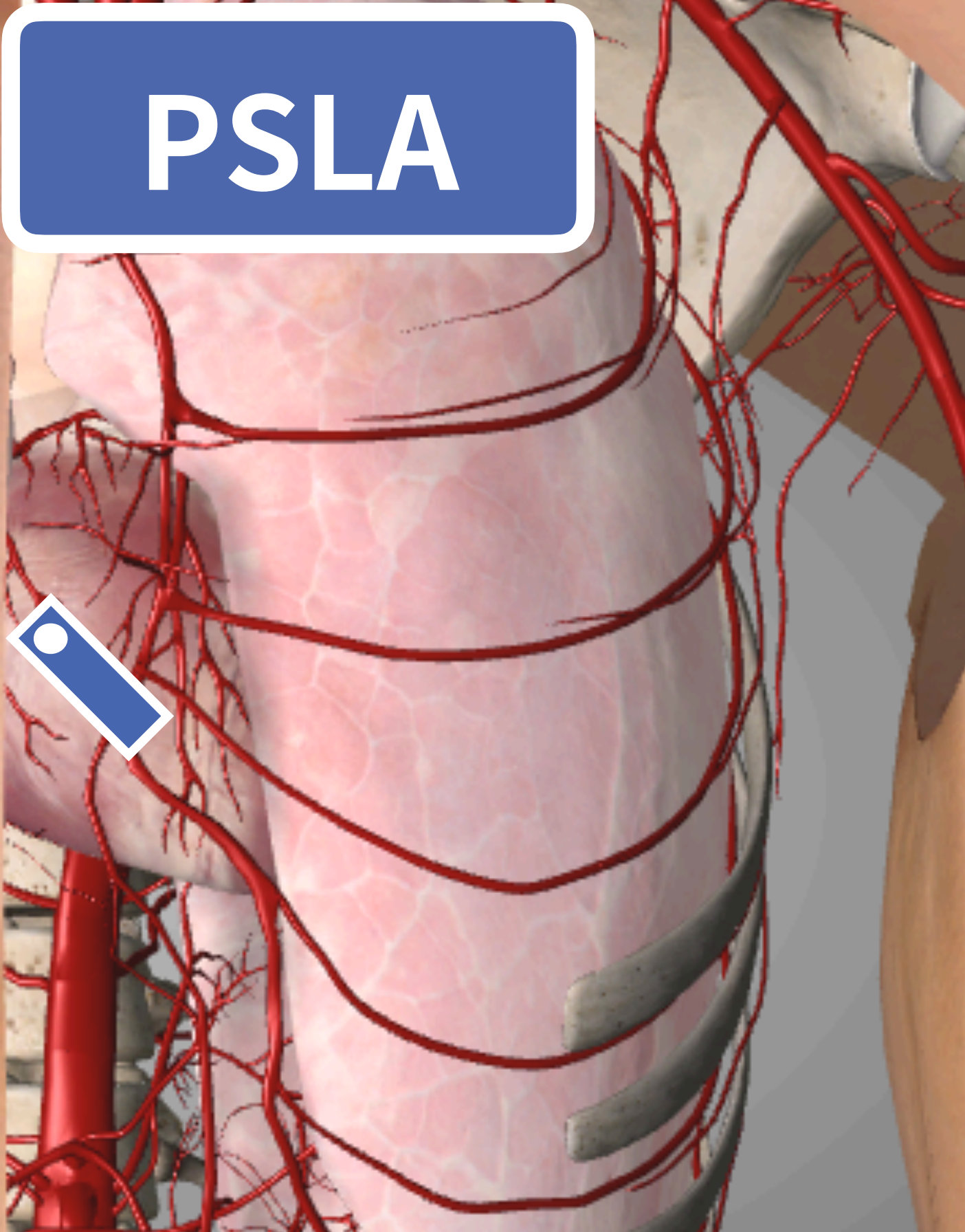


Focused Cardiac Ultrasound in the Emergent Setting:
A Consensus Statement of the American Society of
Echocardiography and American College of
Emergency Physicians

2010

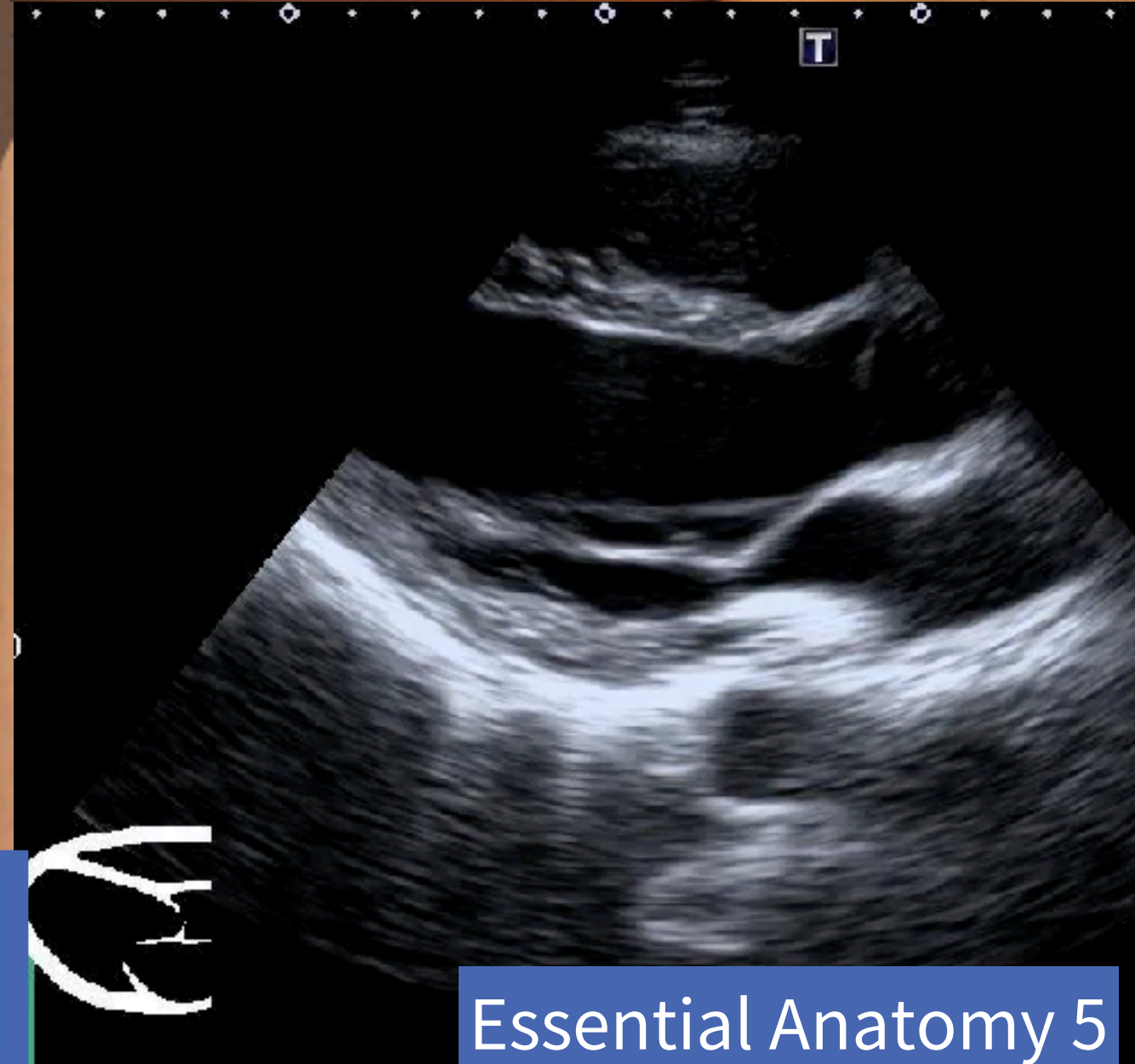
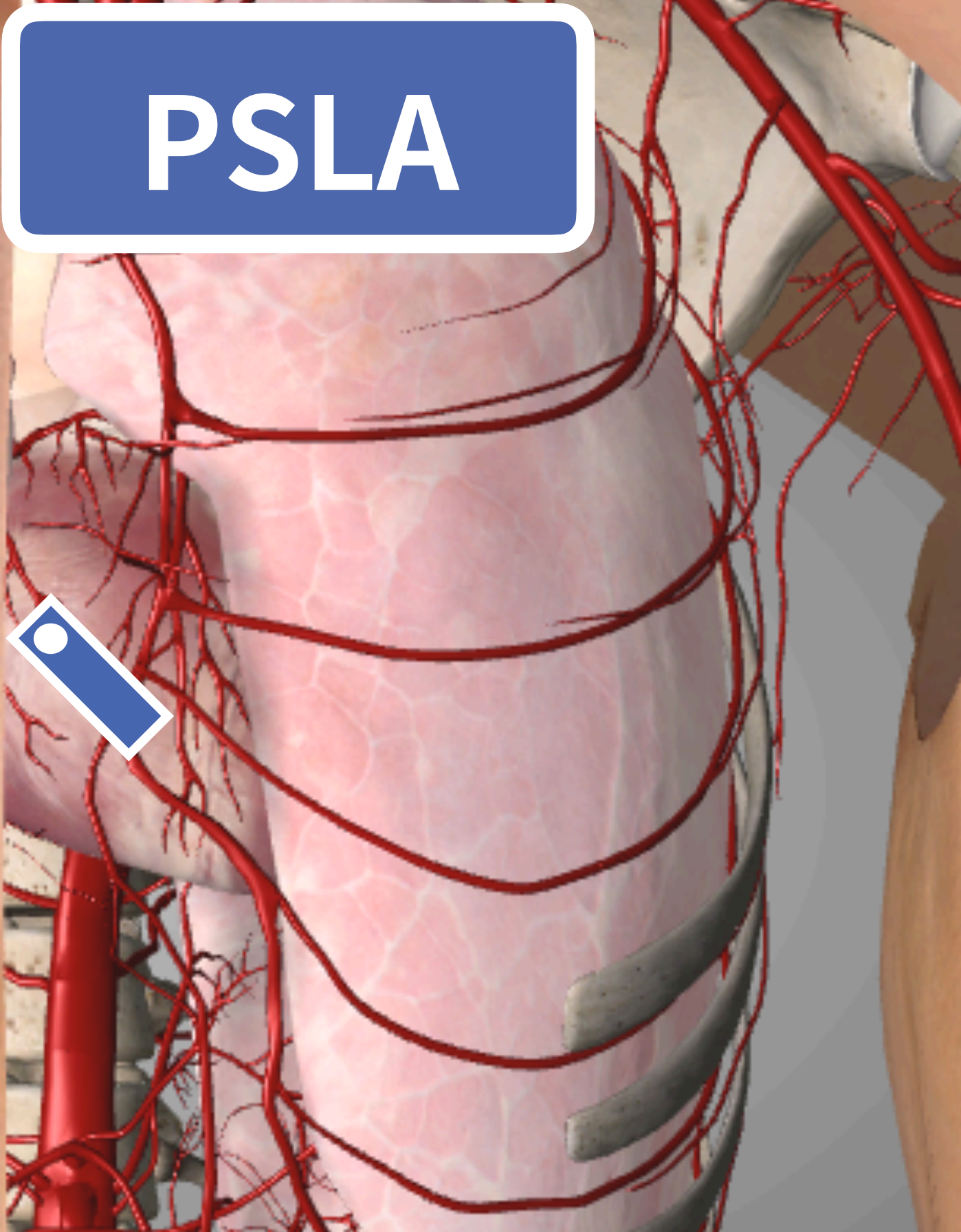
Pericardial effusion
Global systolic function
Marked RV & LV enlargement
Volume assessment
Pericardiocentesis
TVP wire confirmation

PSLA

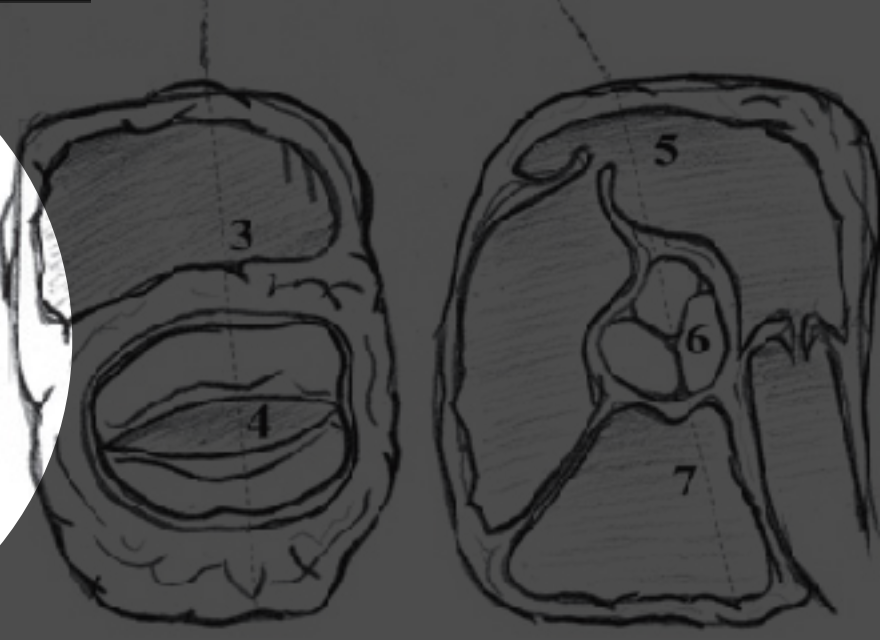
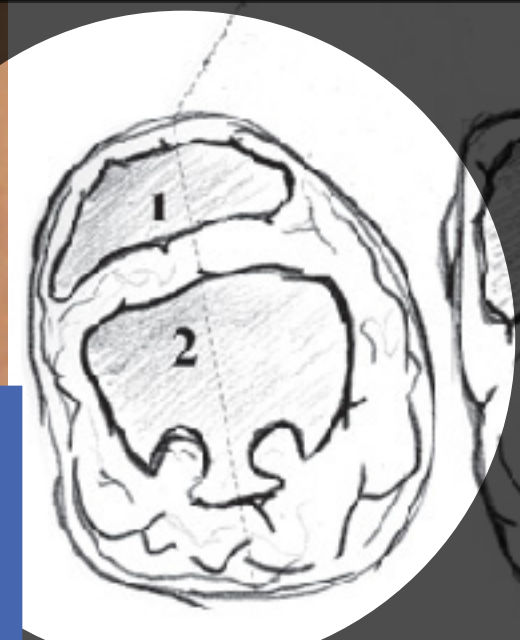
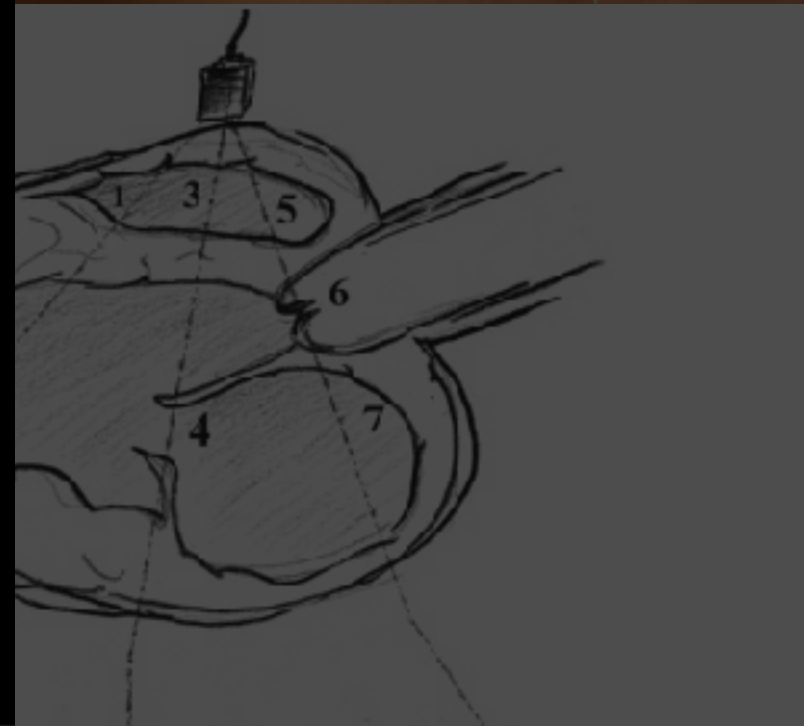
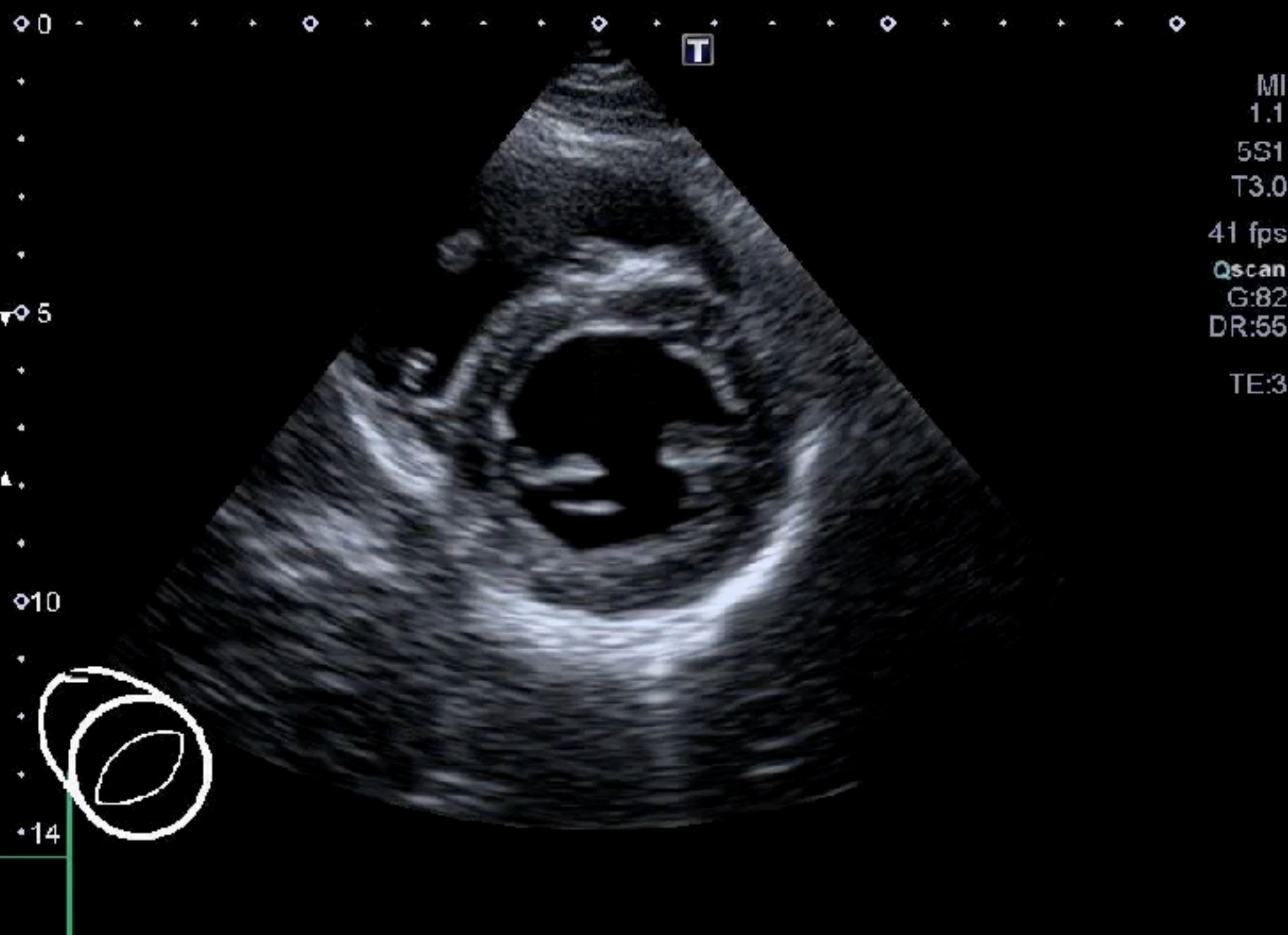


Parasternal long axis

PSLA

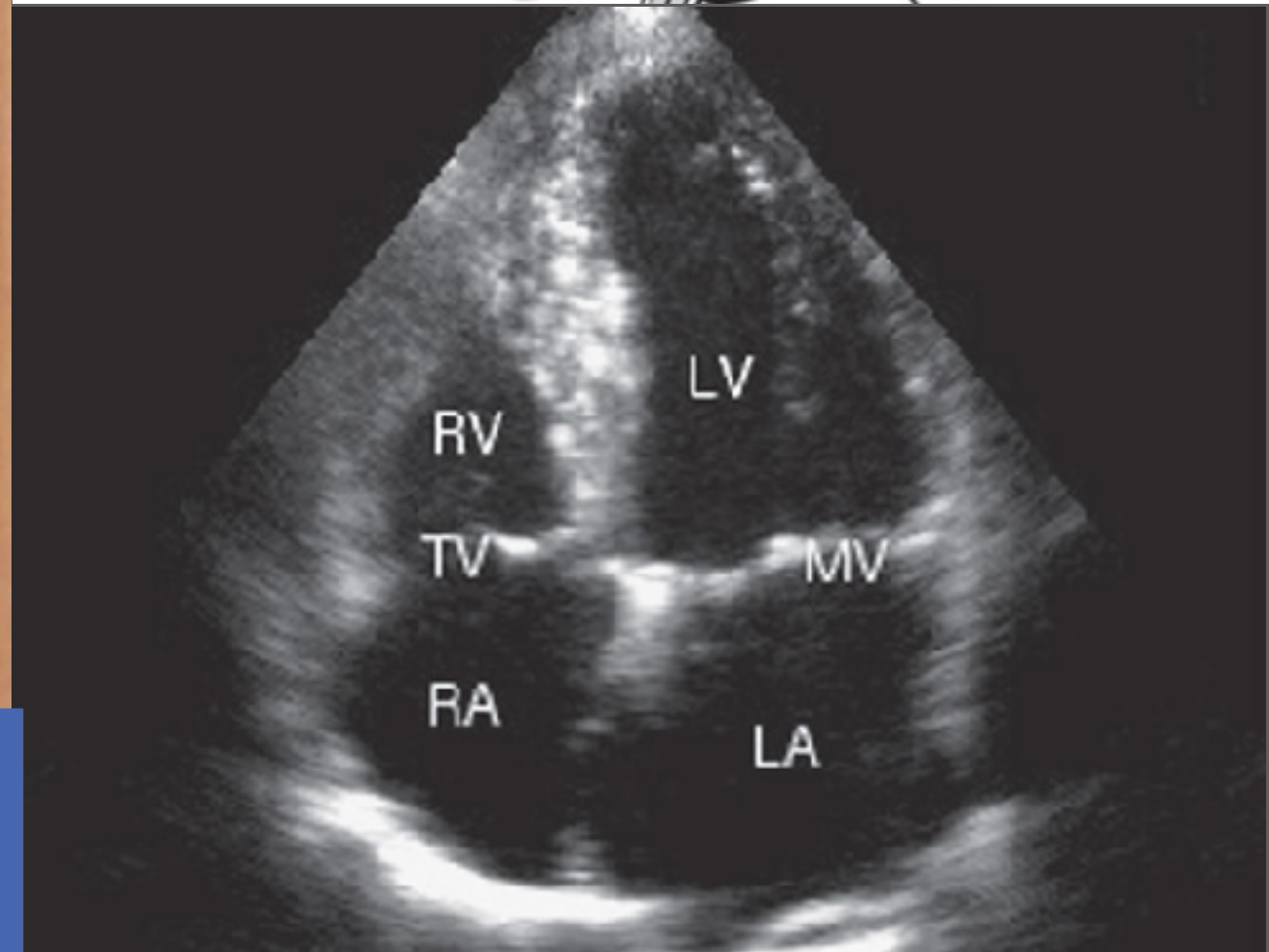
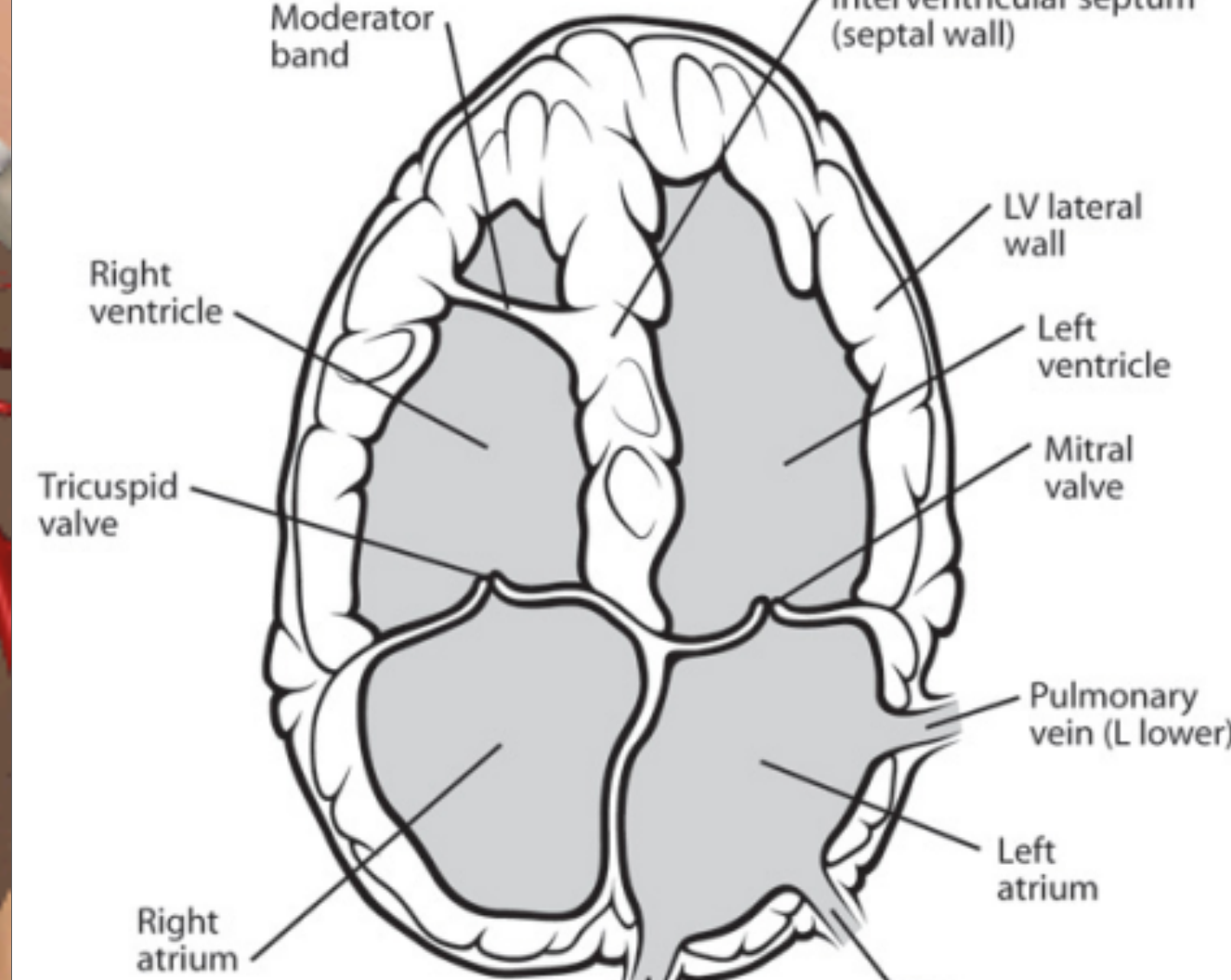
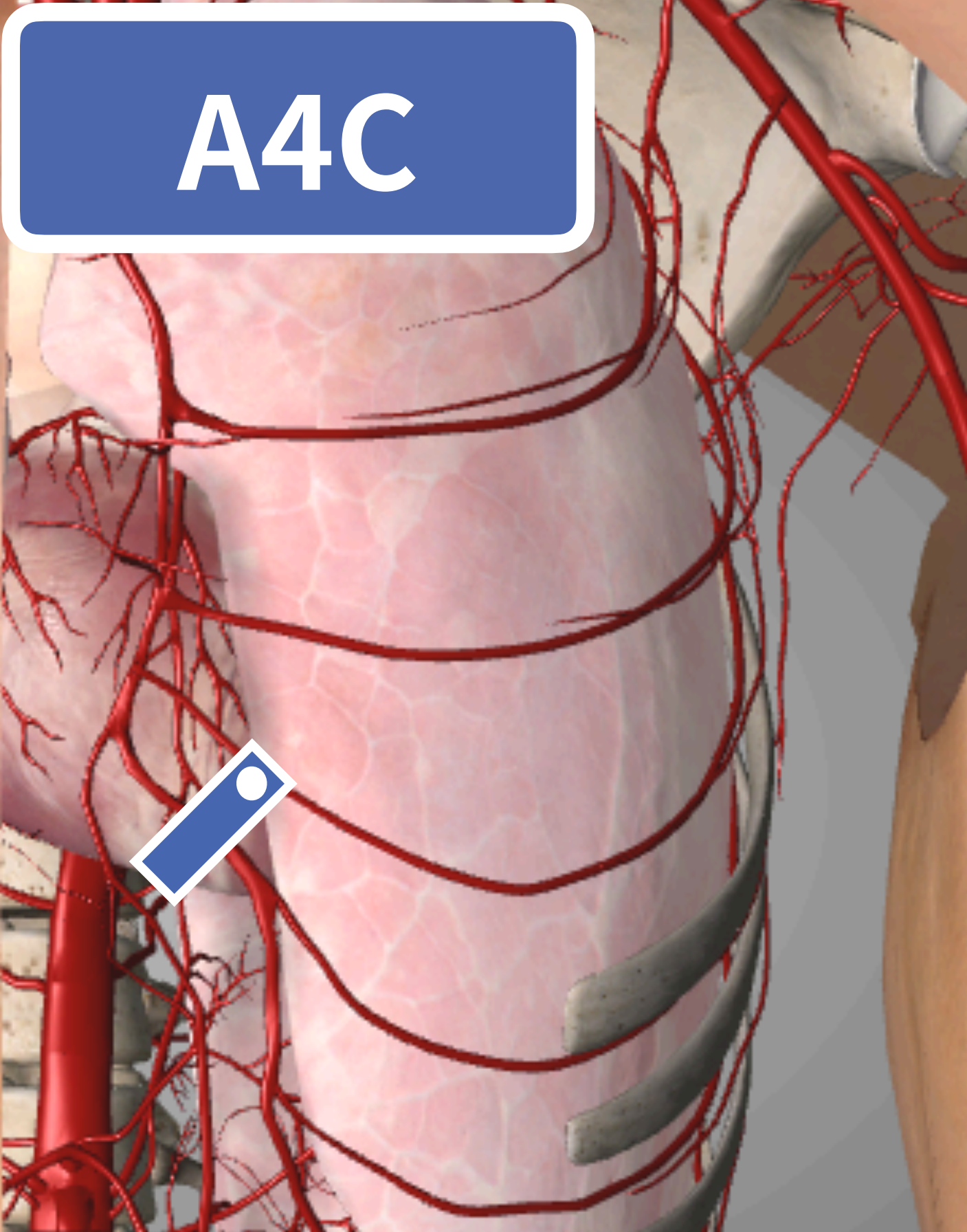


Parasternal long axis



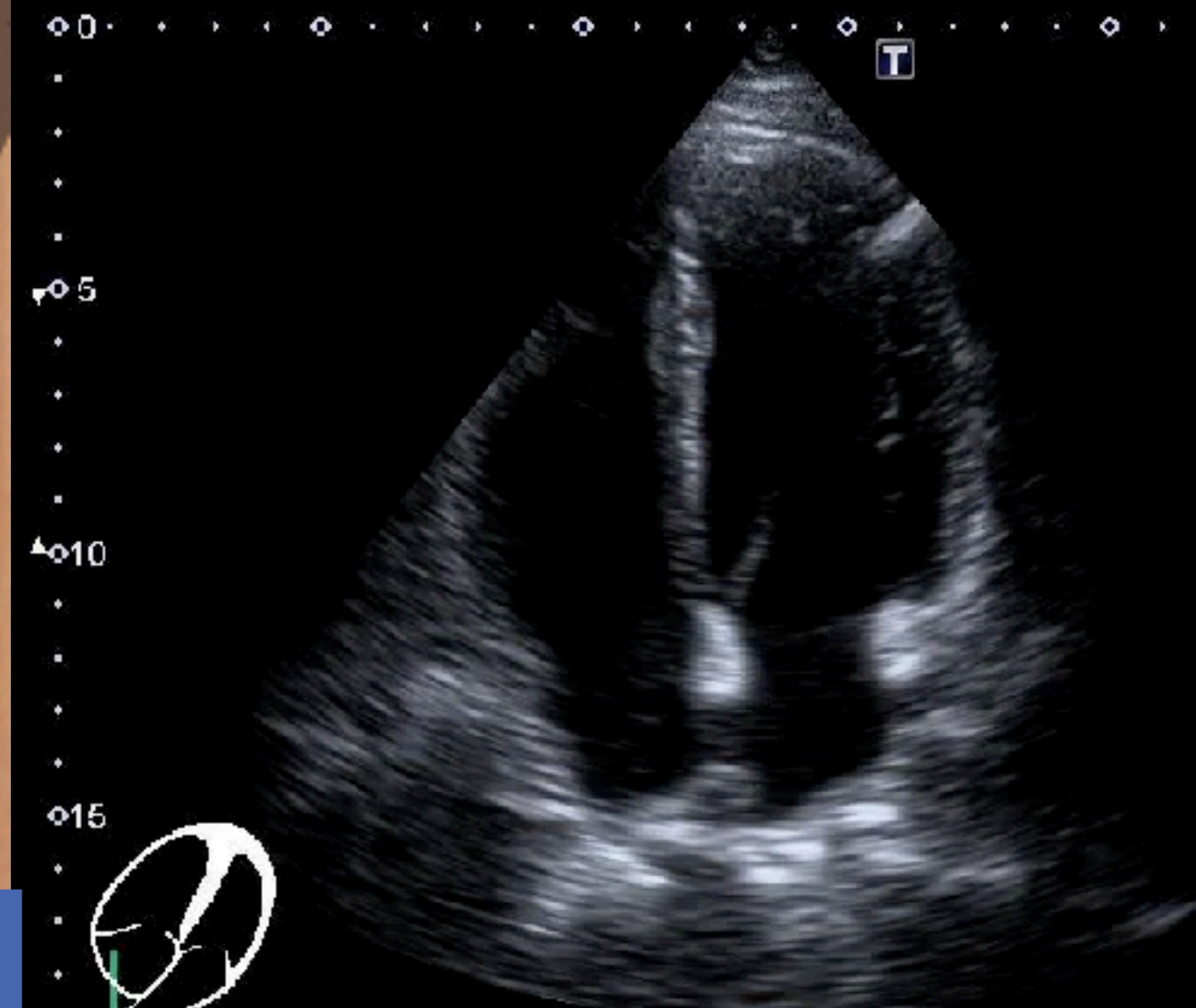
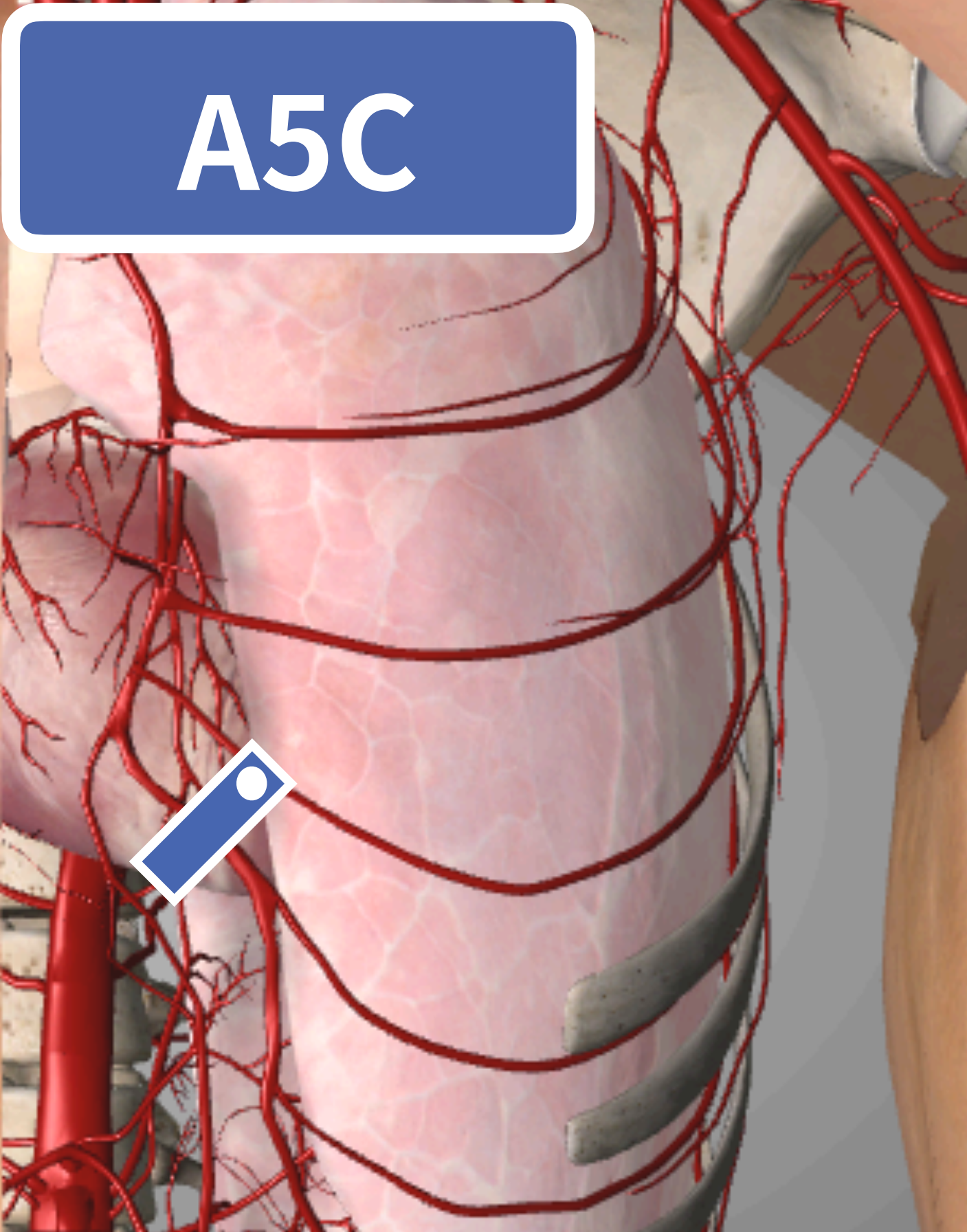
Parasternal short axis

A4C



Apical 4 Chambers

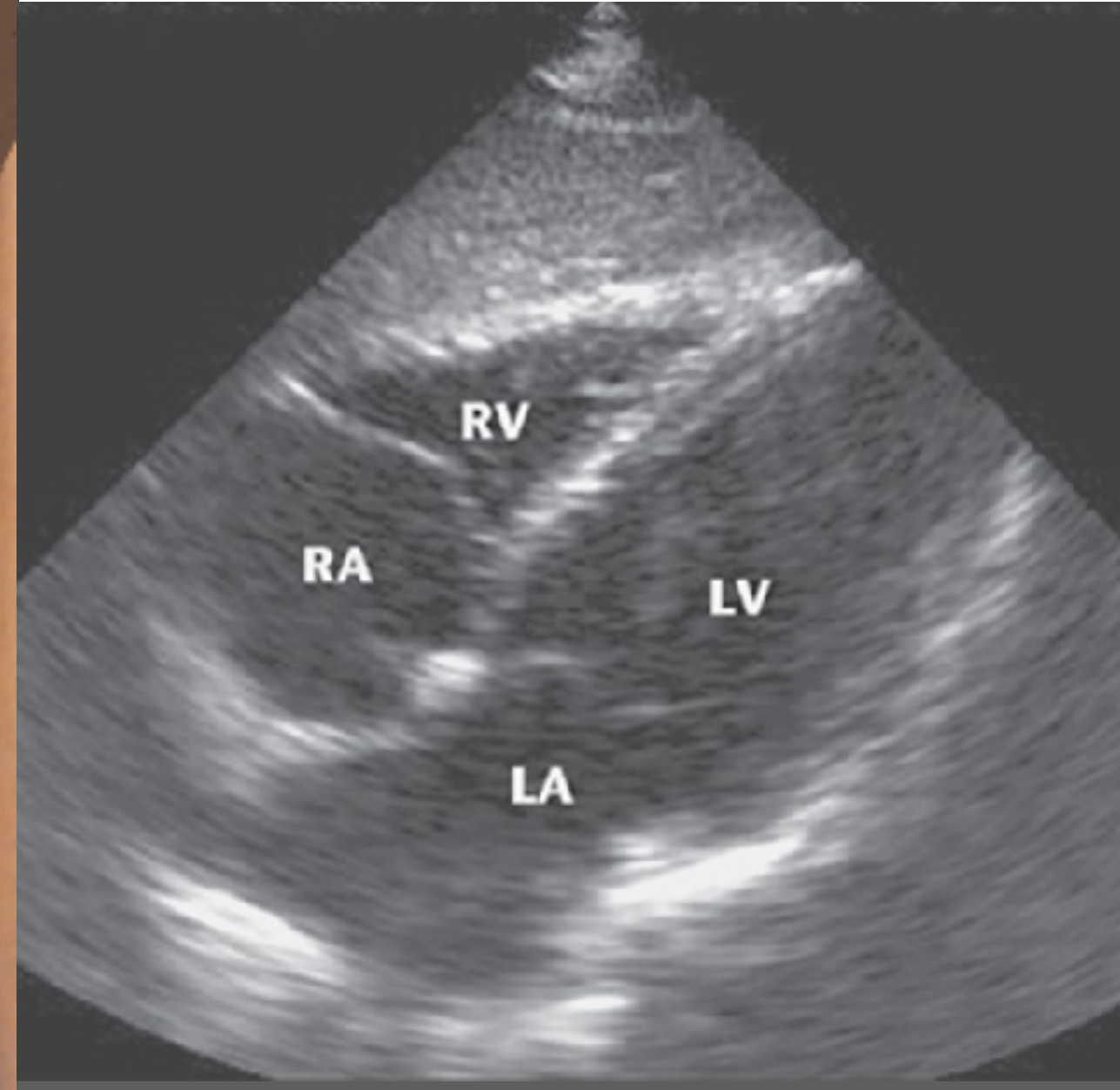
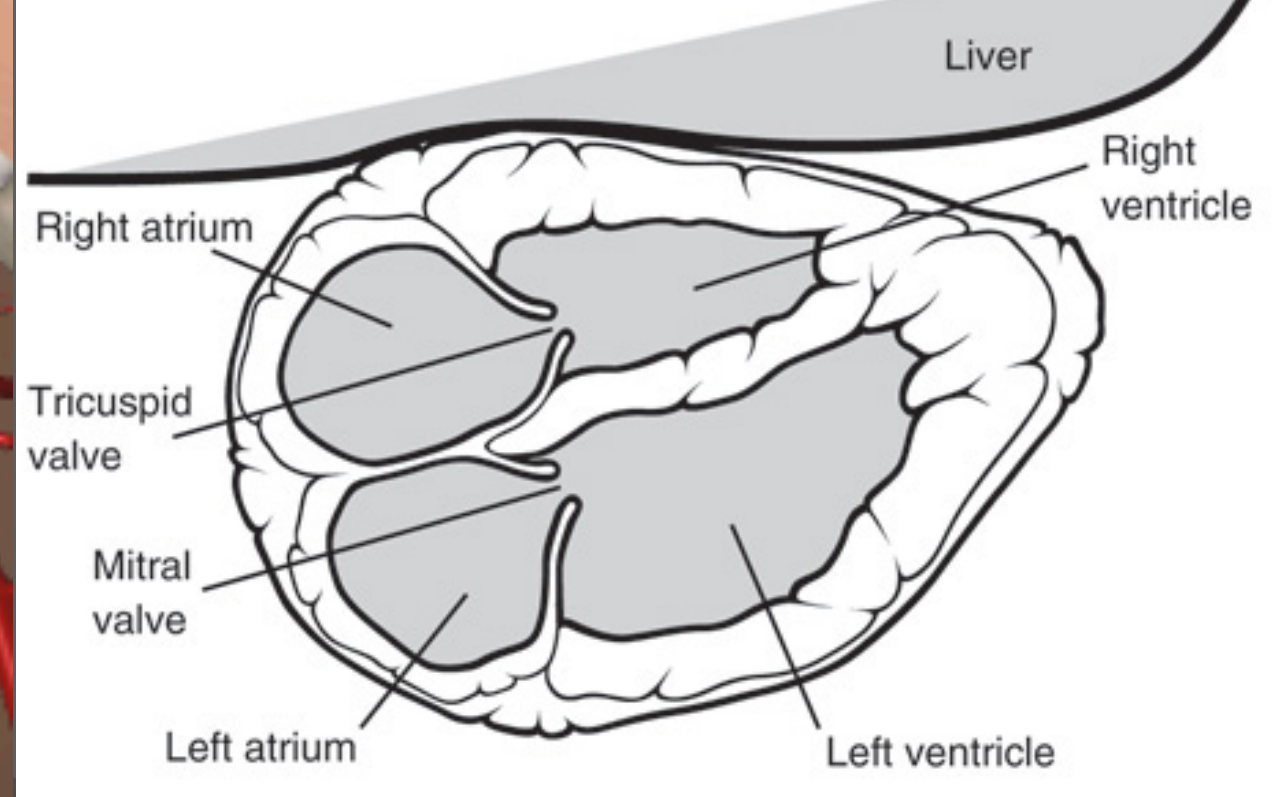
A5C



Apical 5 Chambers

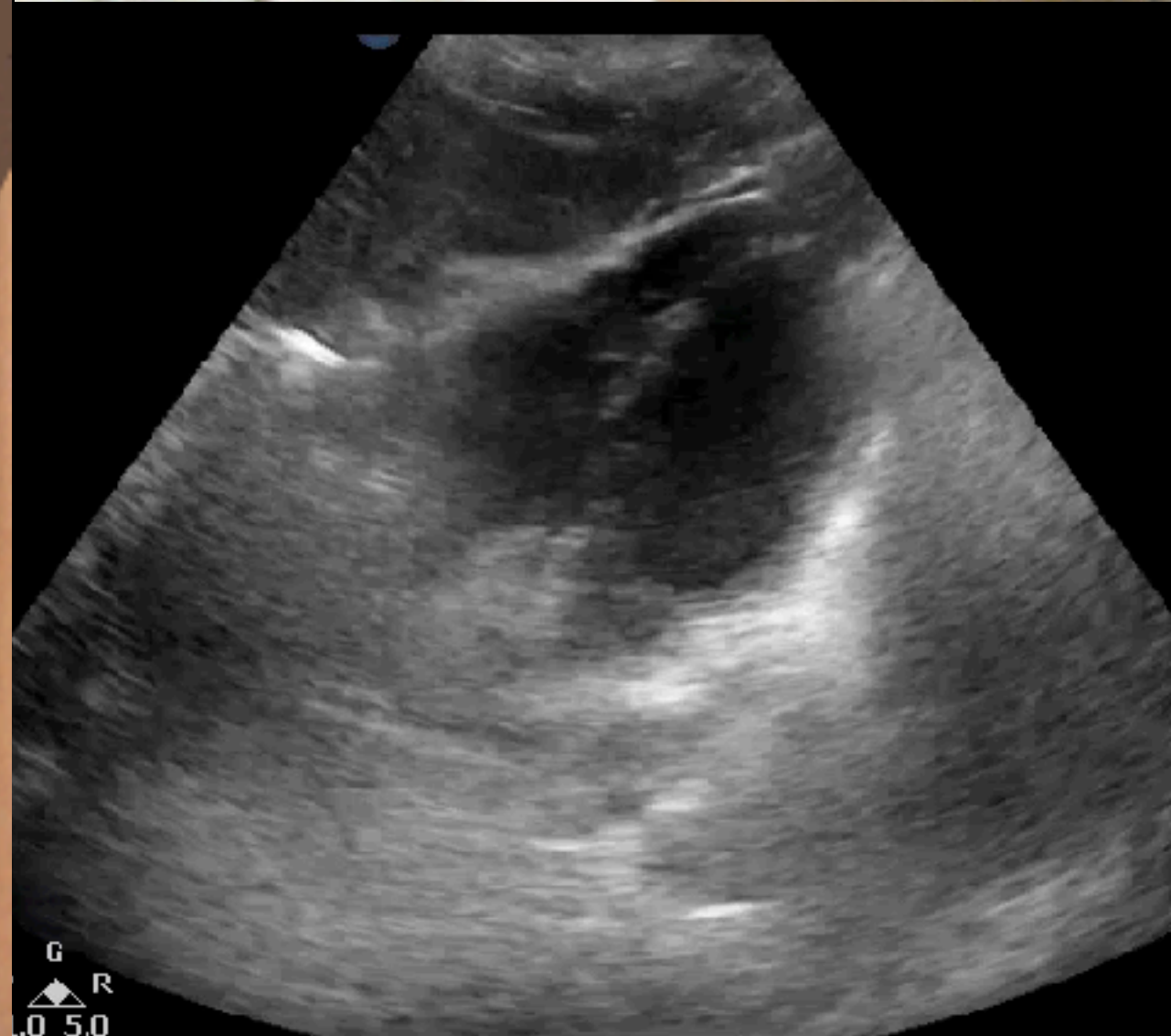
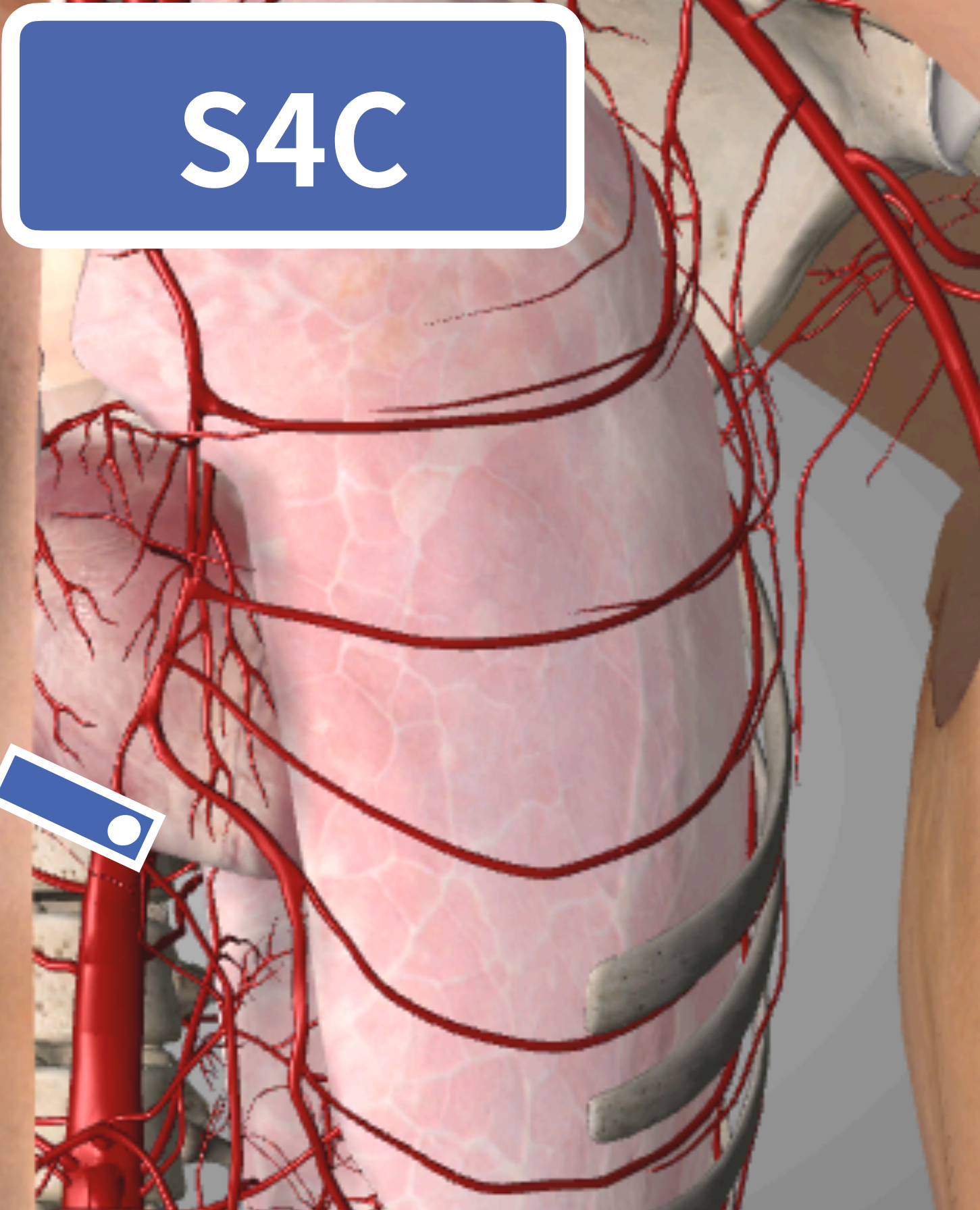
Essential Anatomy 5

S4C



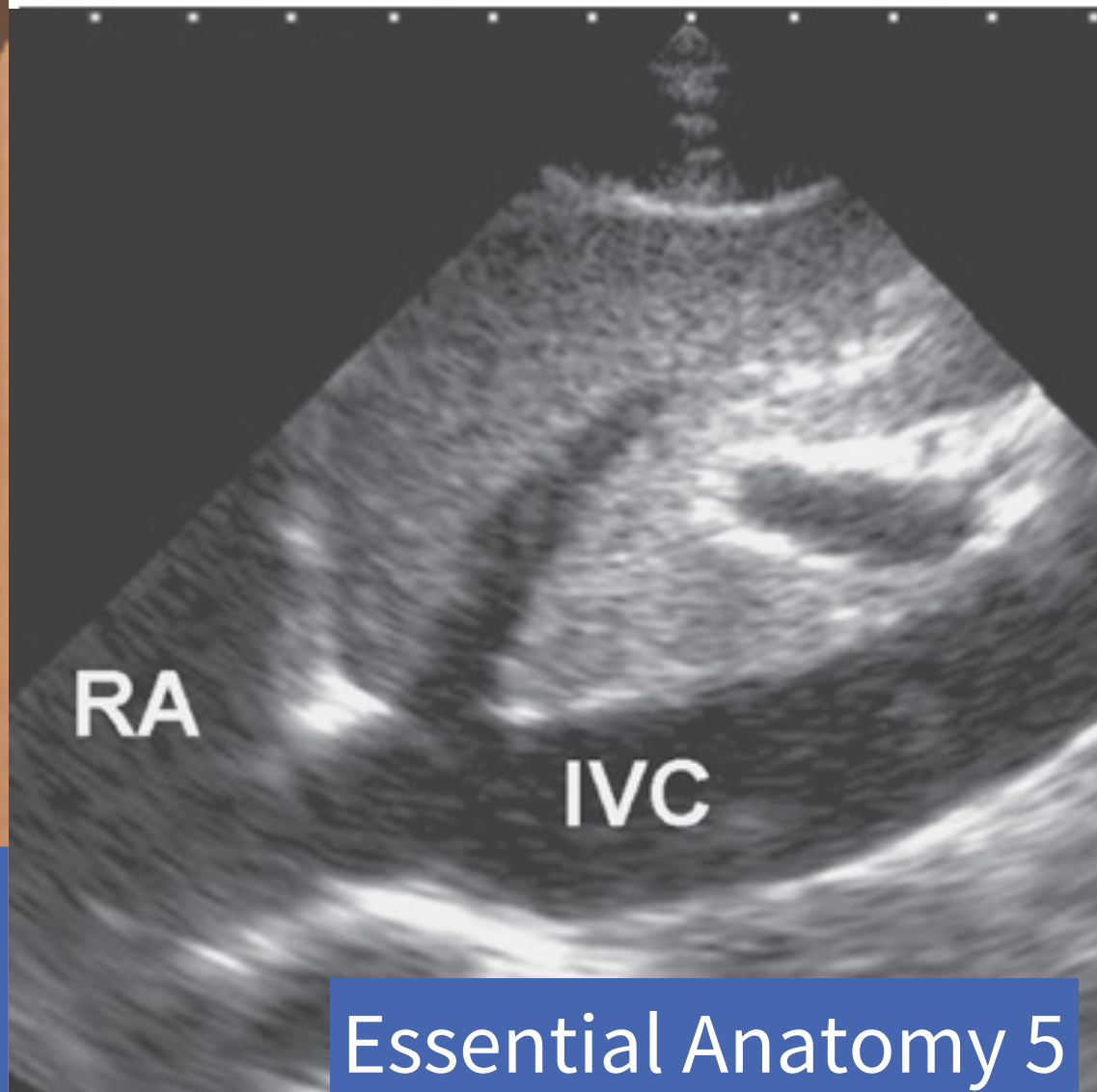
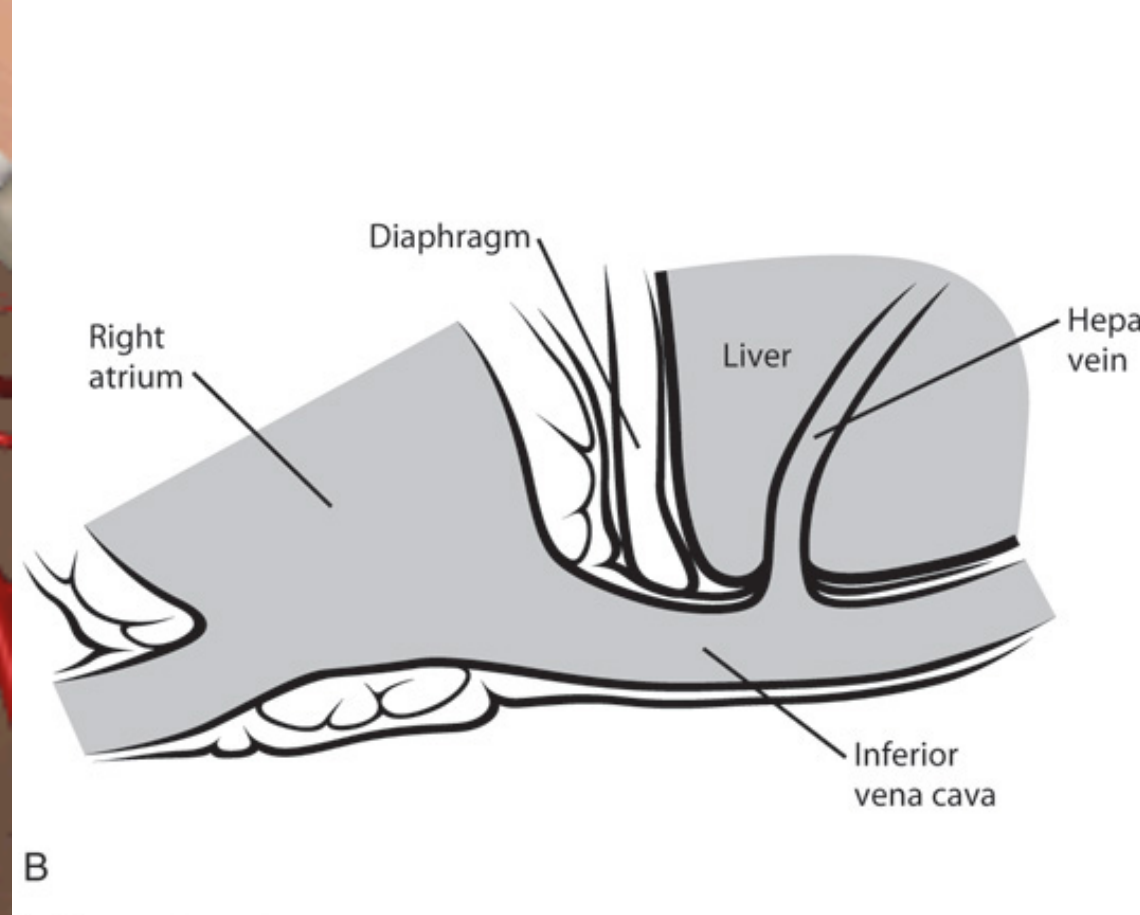
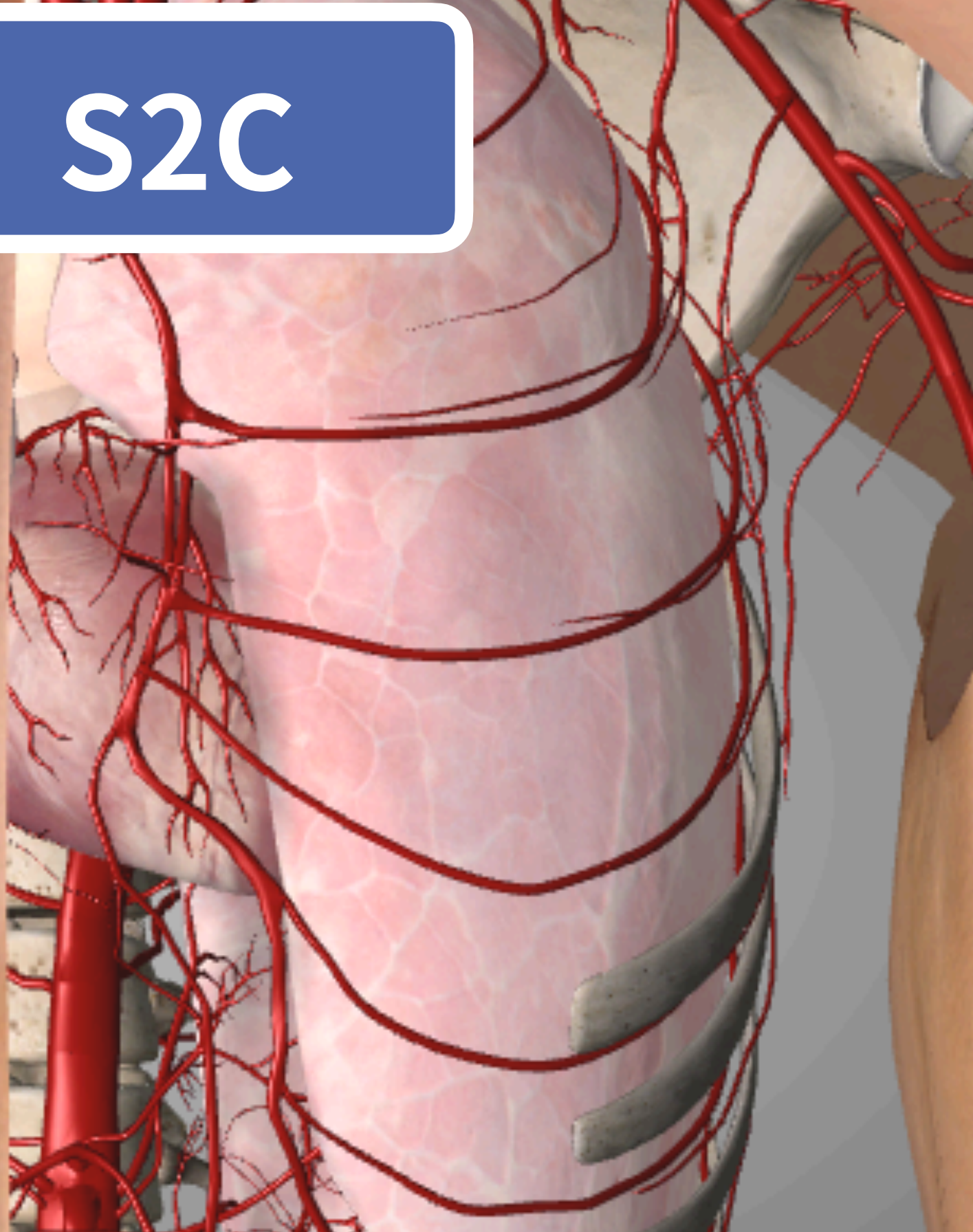
Subcostal 4 Chambers

S4C



Subcostal 4 Chambers

S2C



Subcostal 2 Chambers

Essential Anatomy 5

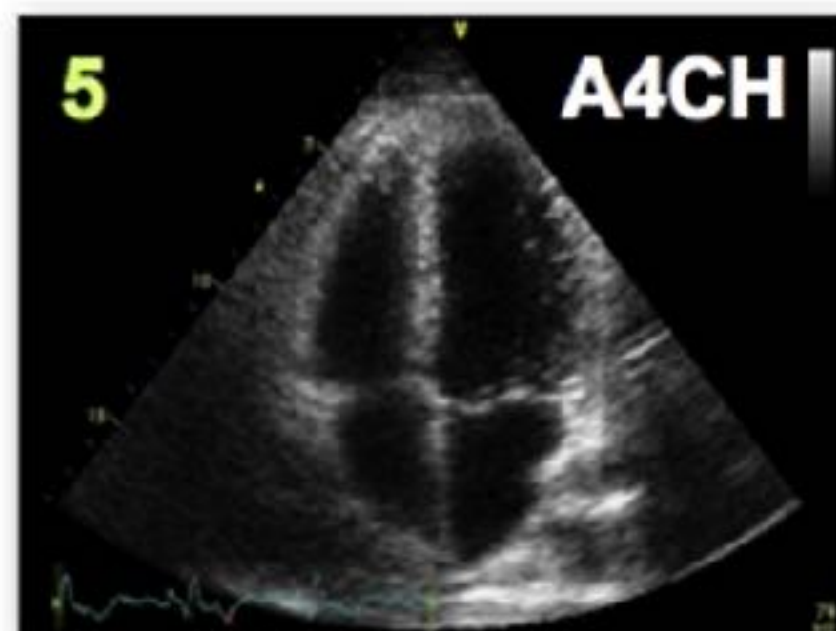
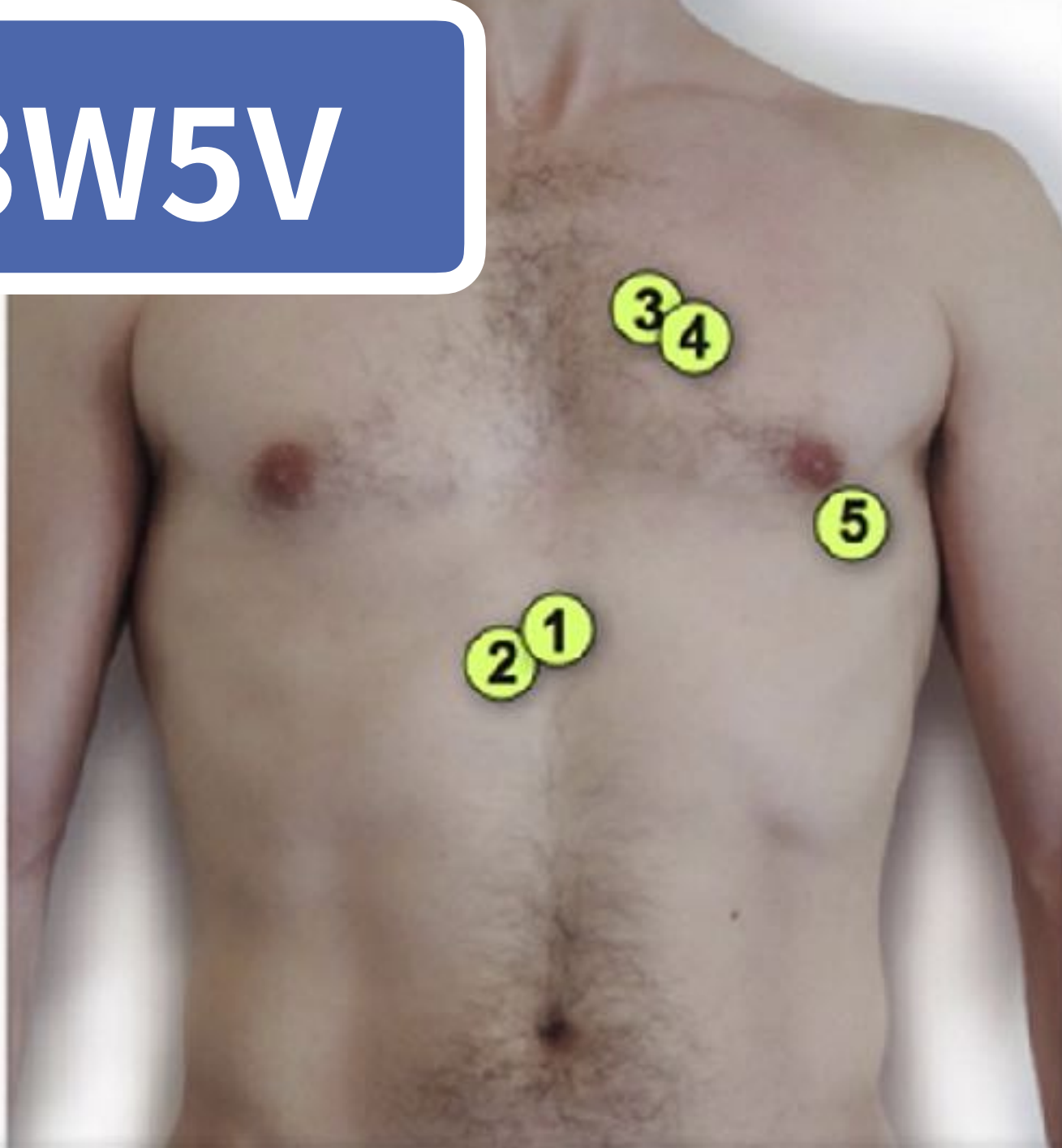
S2C



Subcostal 2 Chambers

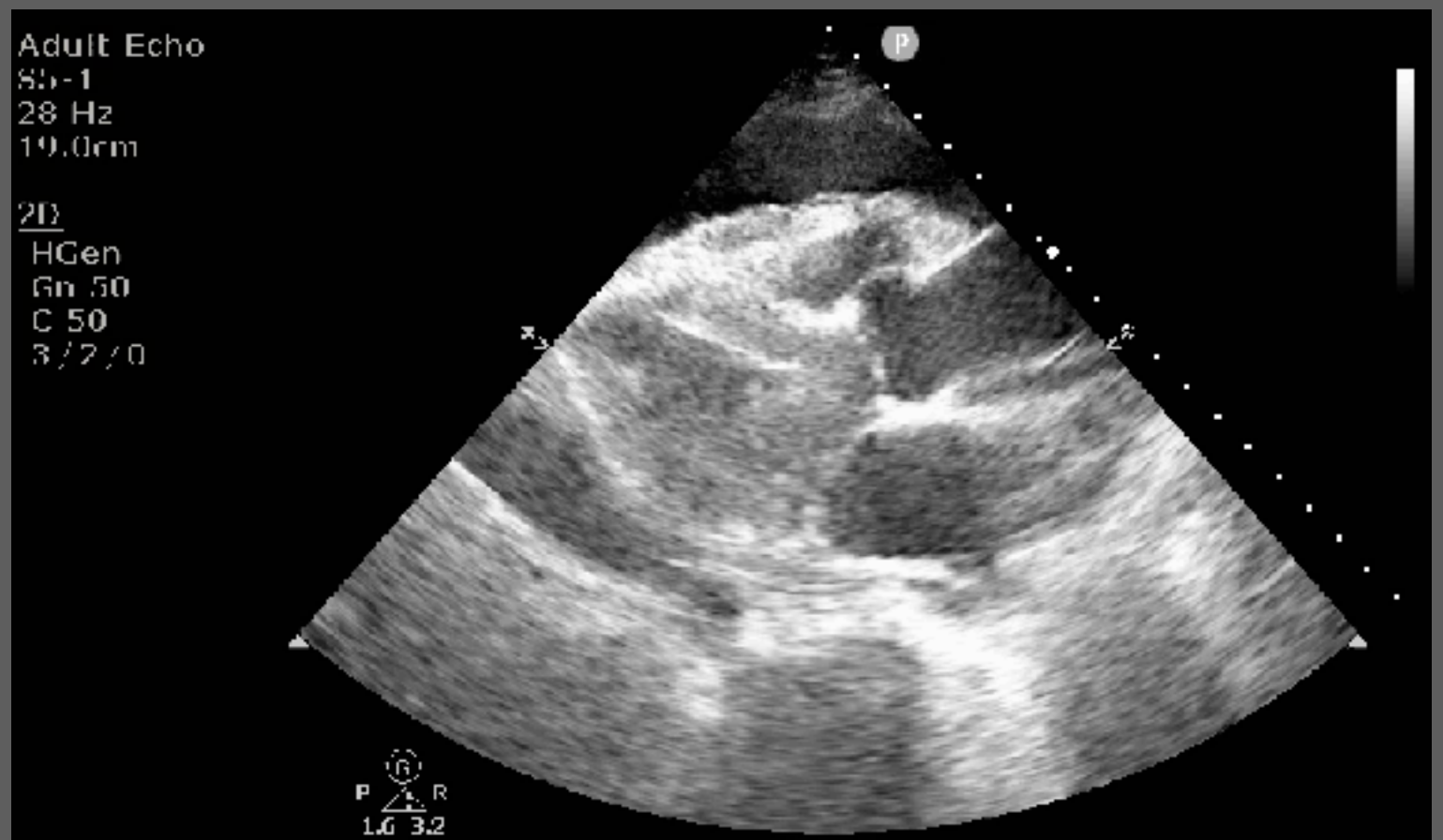
Essential Anatomy 5

3W5V



Pericardial effusion

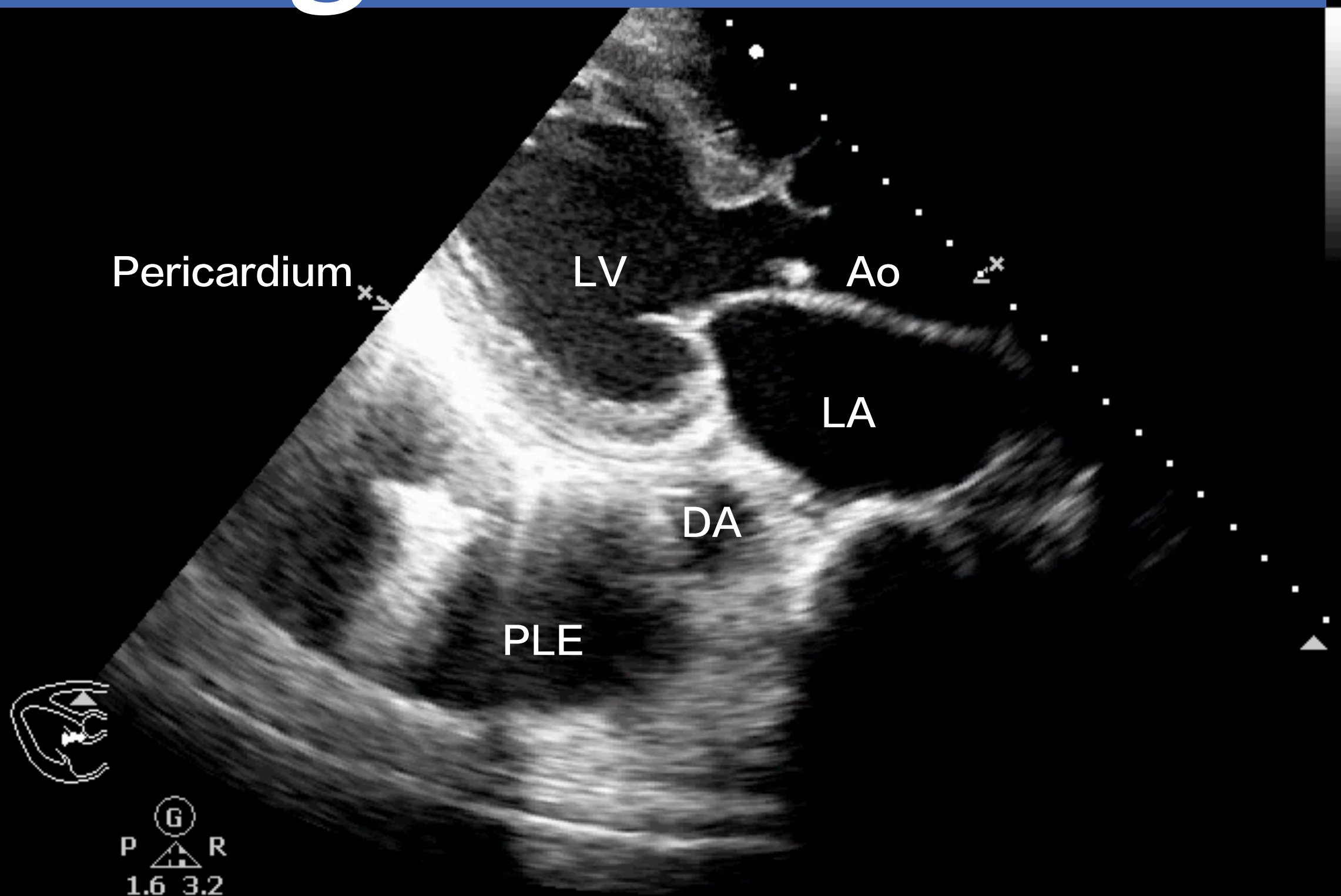
1 ~ 2 cm



DA as a good reference

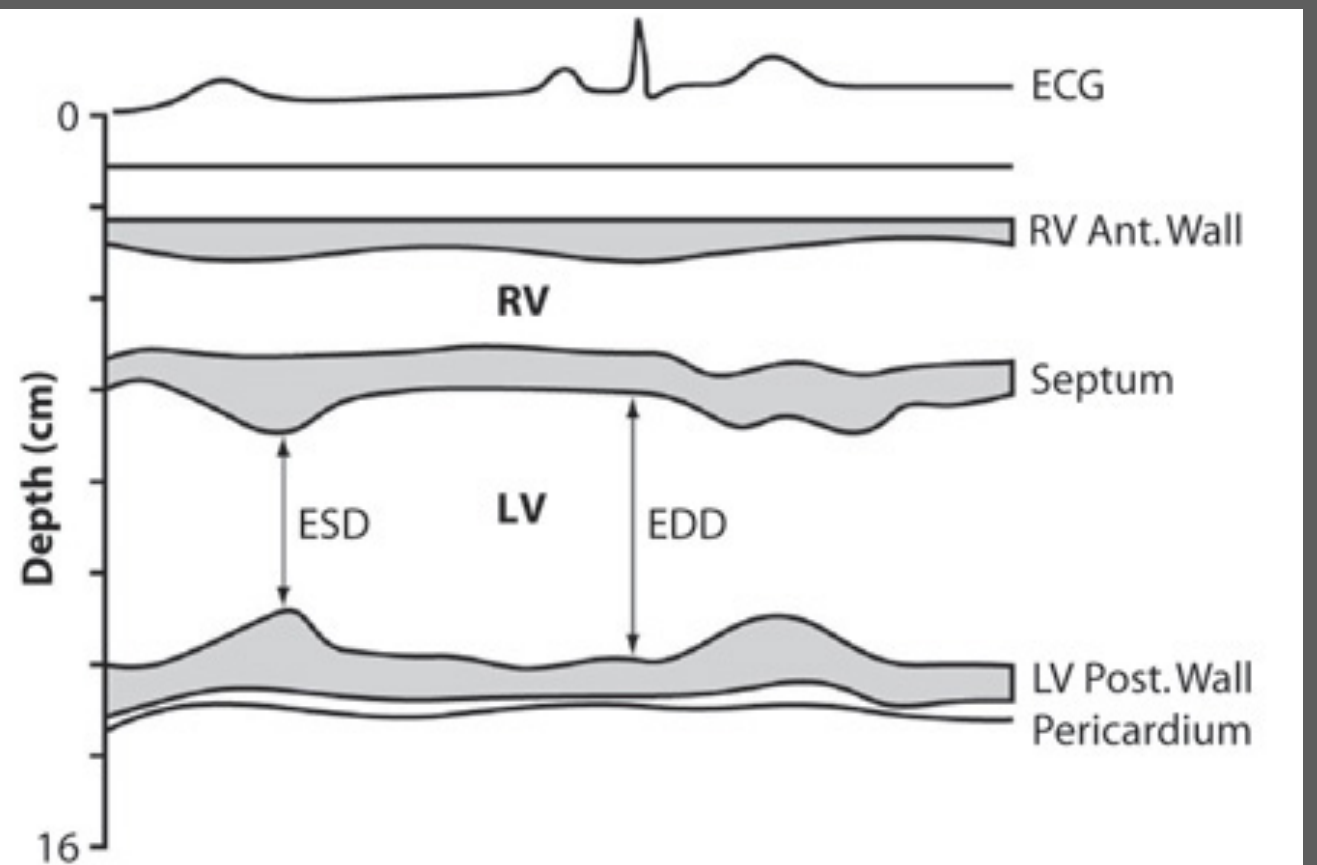
35-1
25 Hz
21.0cm

2D
HGen
Gn 31
C 50
3/2/0



Fraction shortening

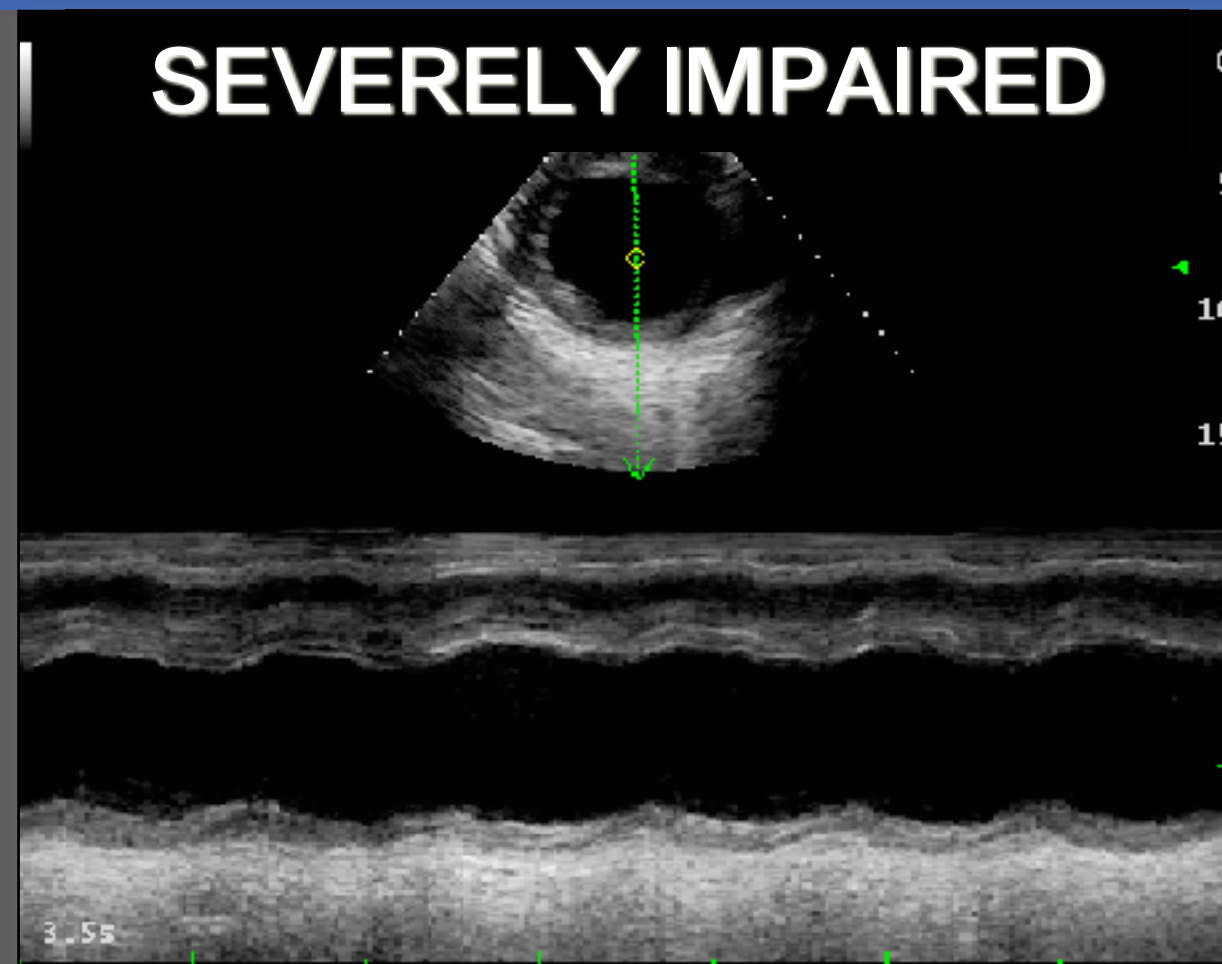
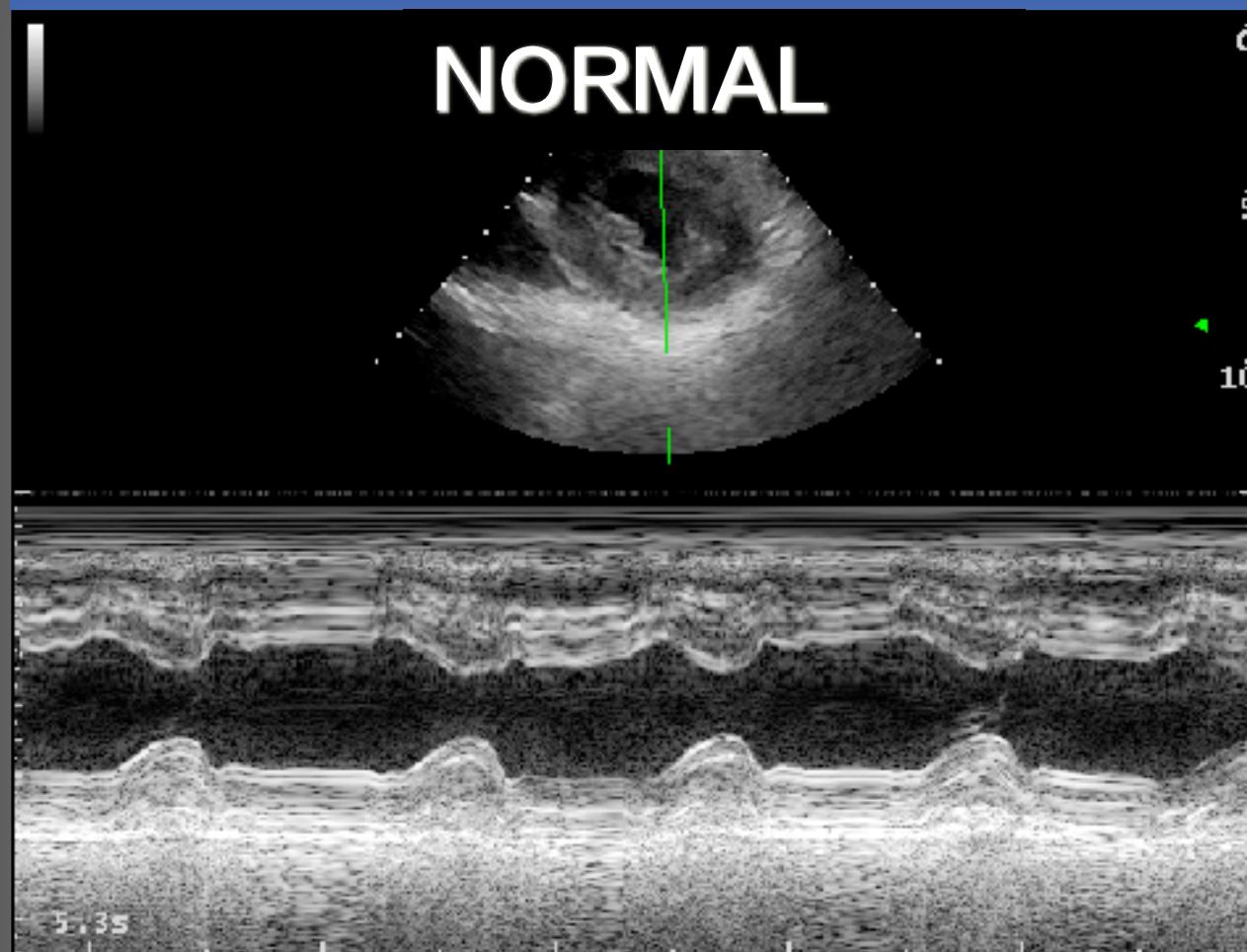
$$FS (\%) = 100 \times \frac{(LVEDD - LVESD)}{LVEDD}$$



NORMAL $\geq 30\%$

SEVERELY IMPAIRED $< 20\%$

FS

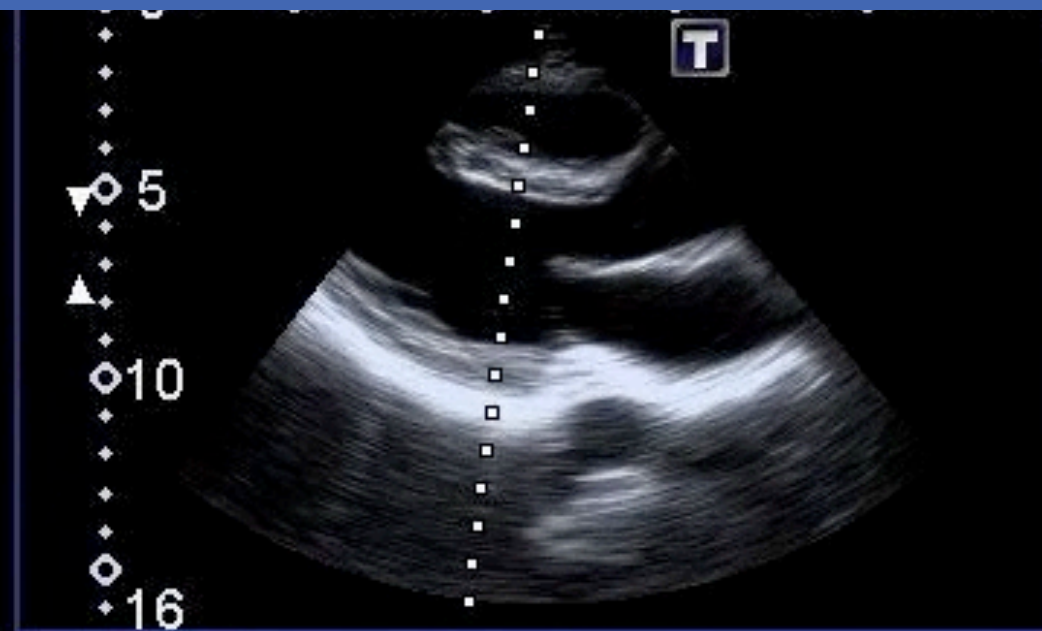


$$EF(\%) \approx FS(\%) \times 2 \quad (\text{ex. FS } 30\% \approx EF \text{ } 60\%)$$

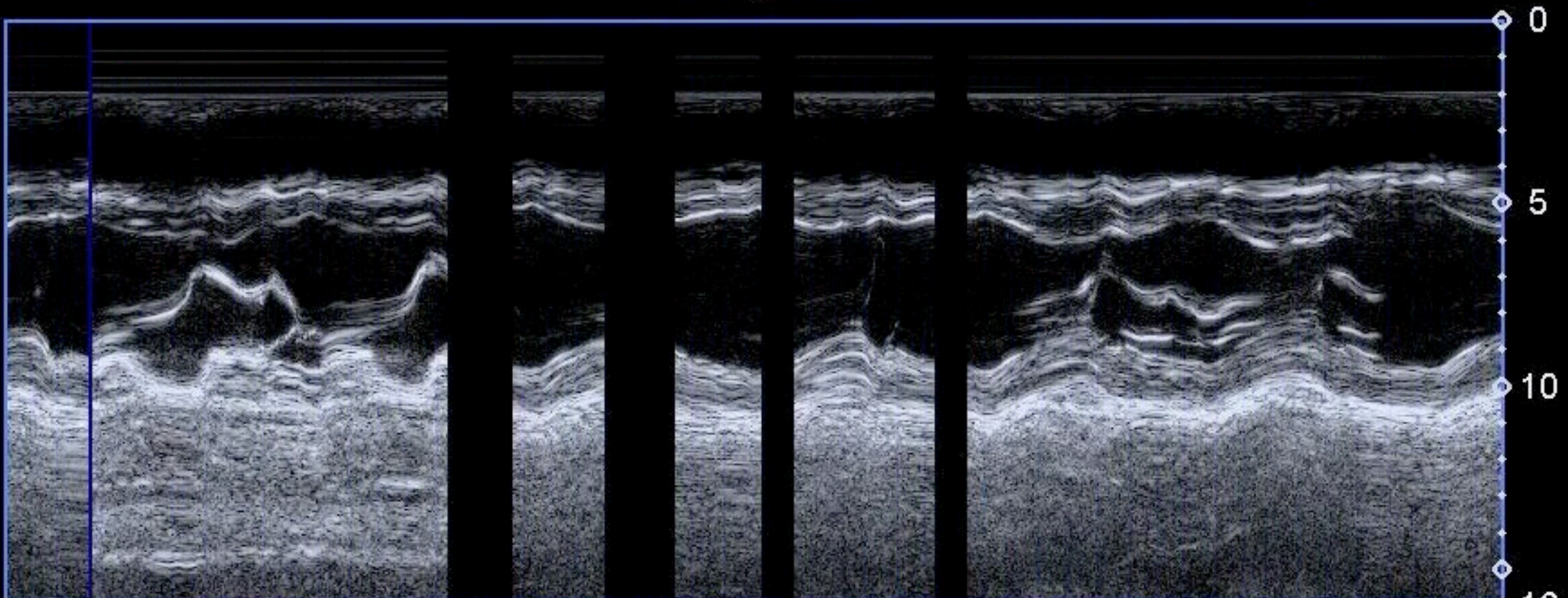
(Simplification of Teicholz method)

FS

G:82
DR:55
TE:3

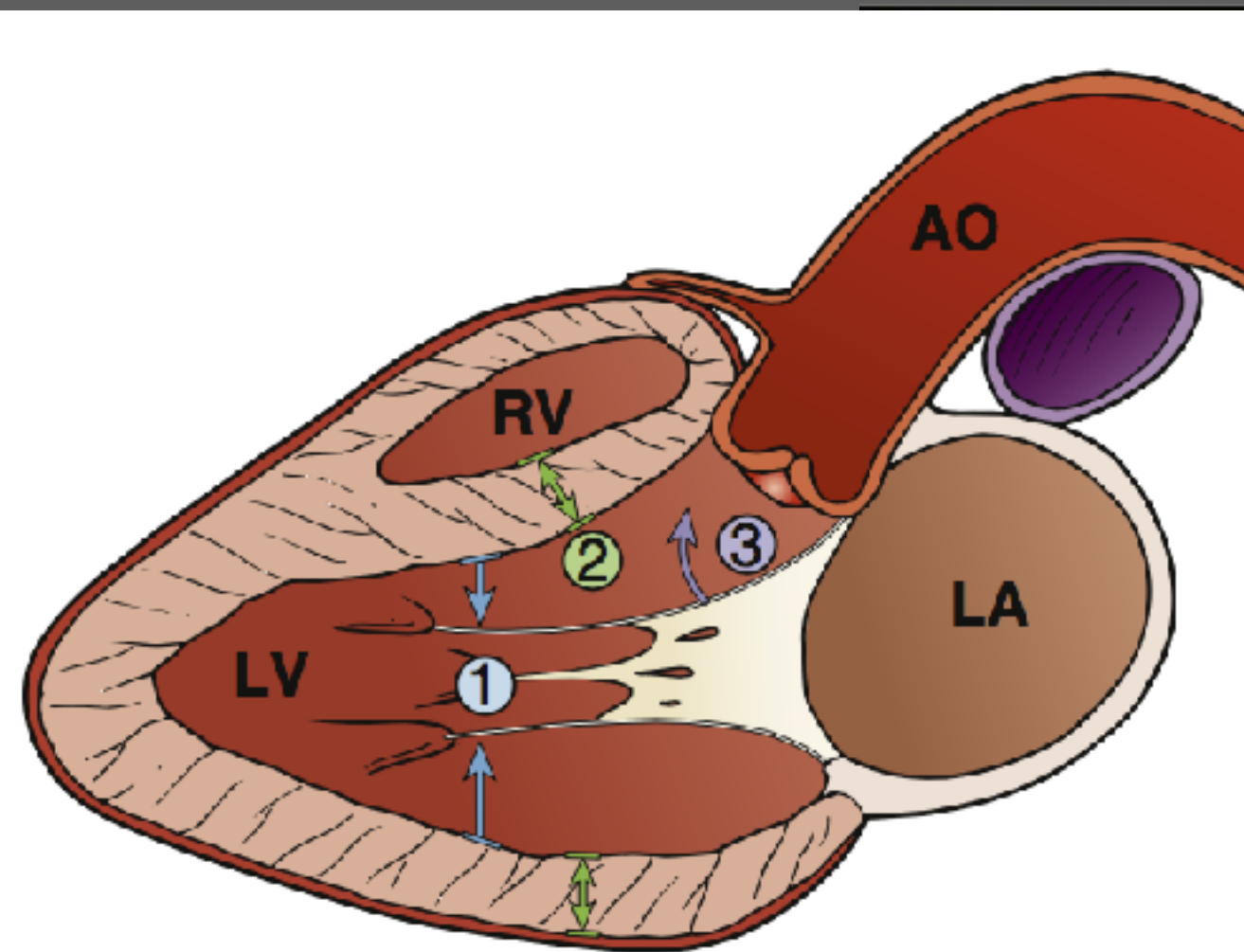


MI:1.5
5S1
T3.0
32 fps

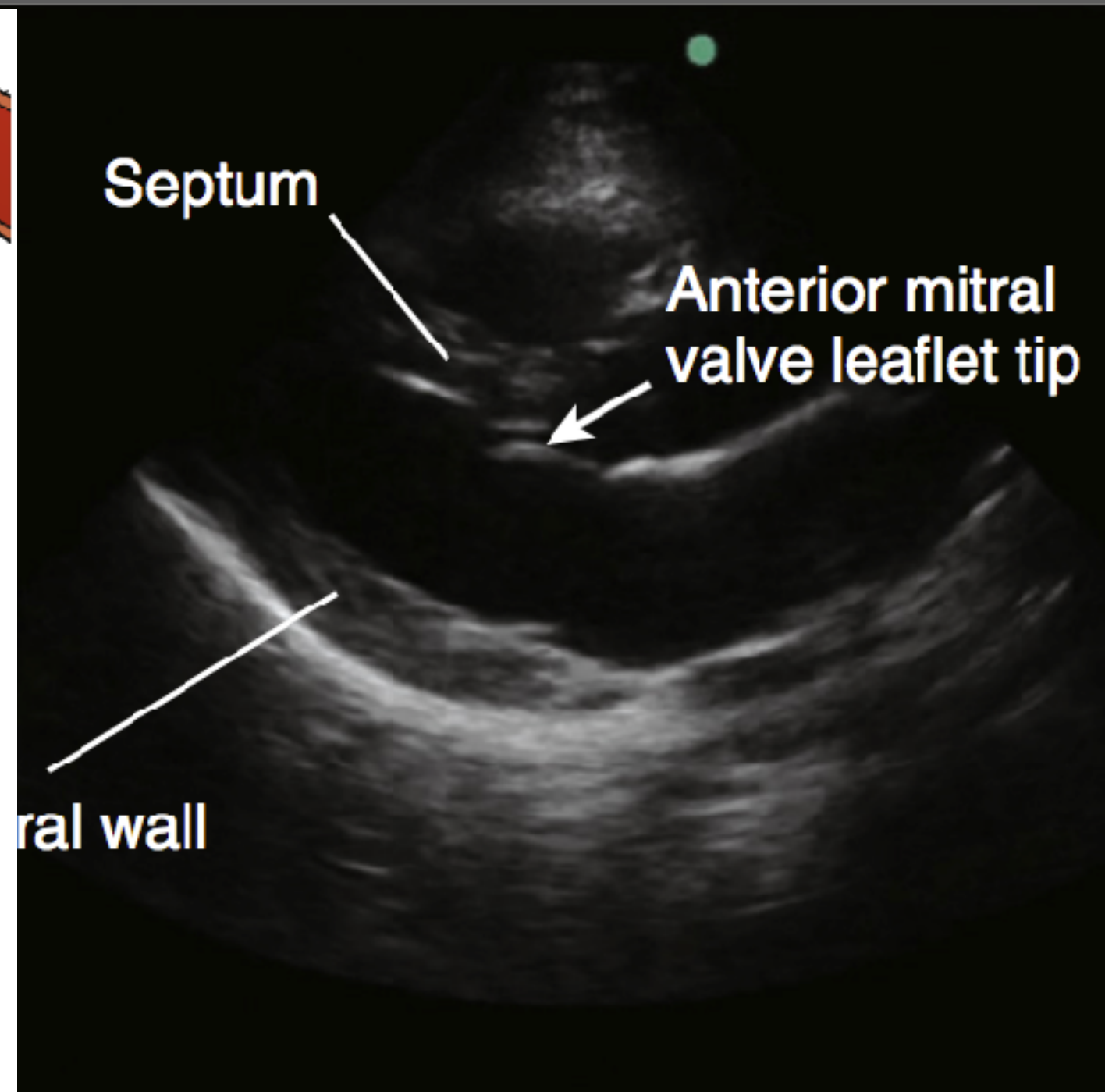


EPSS

E-point septal separation $>7\text{mm}$: LVEF $< 30\%$



- 1 - Endocardial excursion
- 2 - Myocardial thickening
- 3 - Septal motion of anterior leaflet of mitral valve

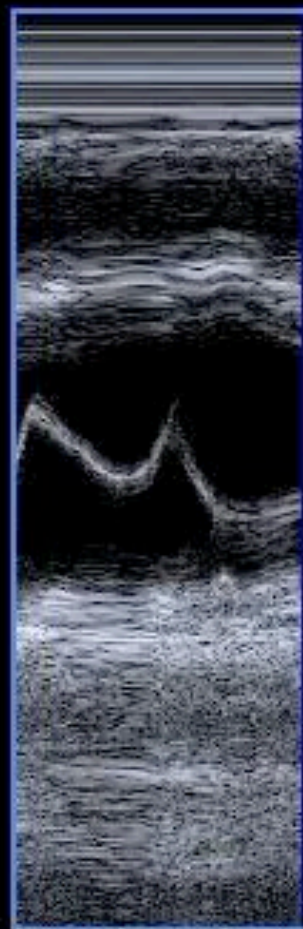


EPSS

Qscan
G:91
DR:55
TE:3



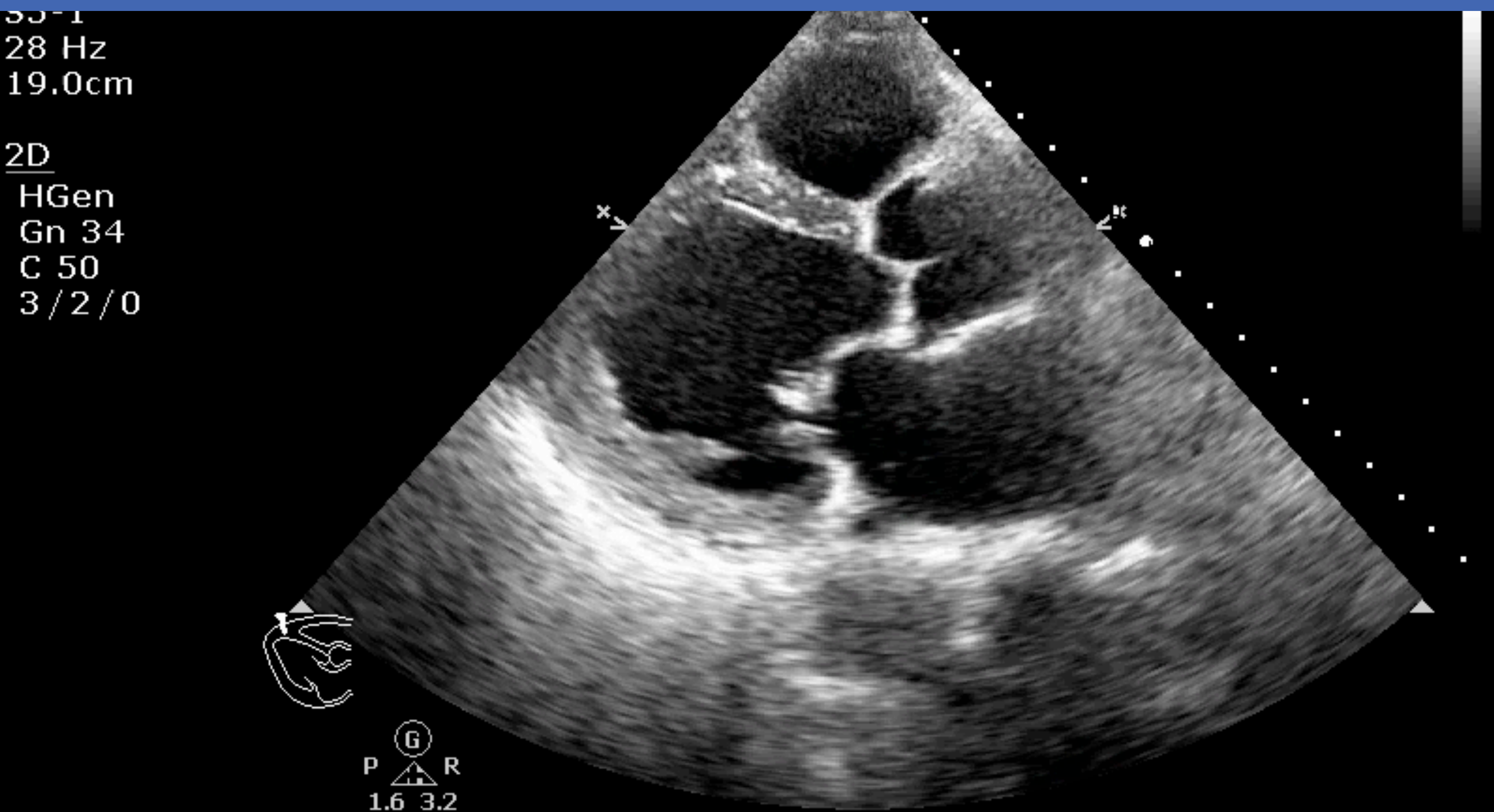
MI:1.5
5S1
T3.0
25 fps

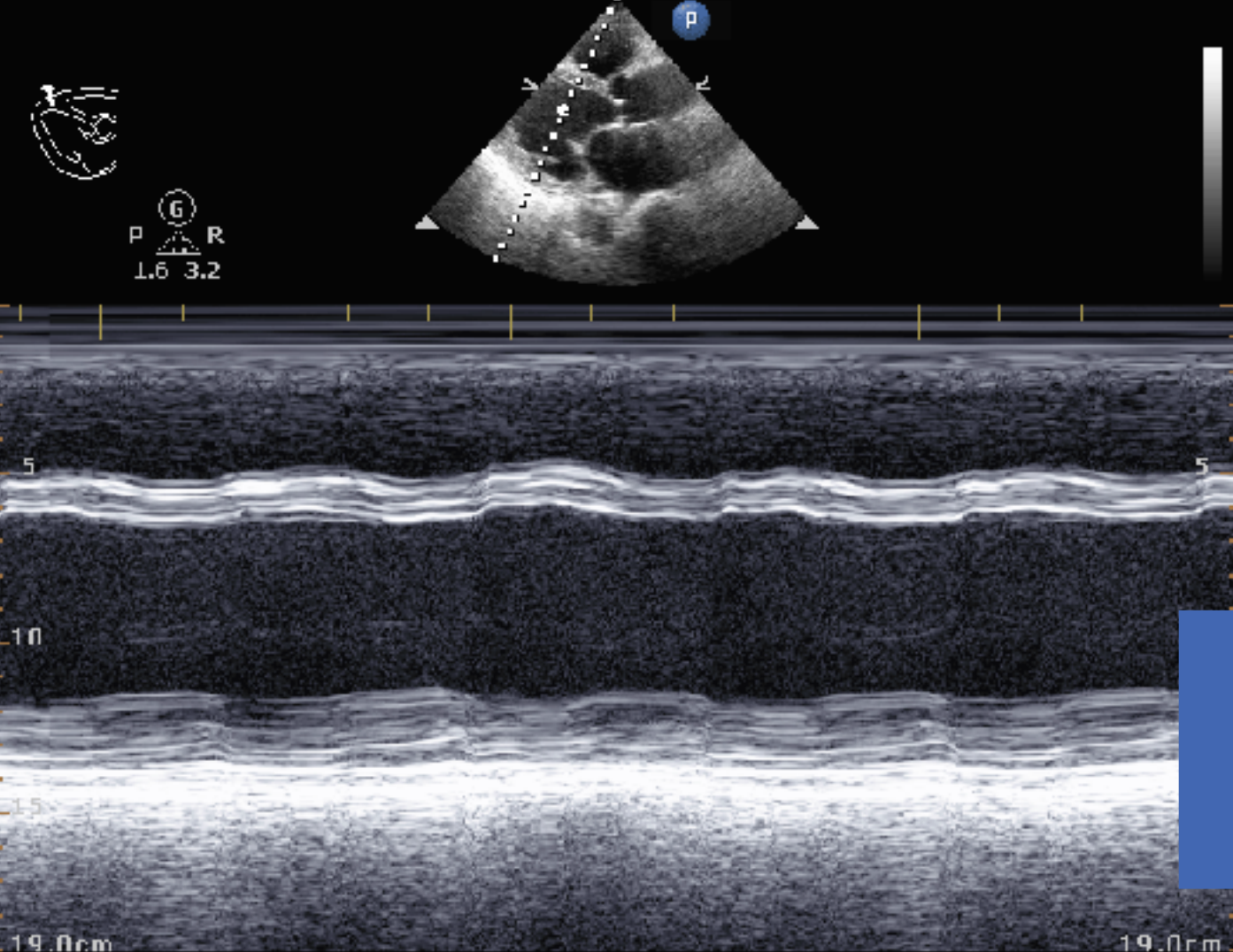


Qscan:86 / MDR:50 / T3.0

0
5
10
15
18

Heart failure ?

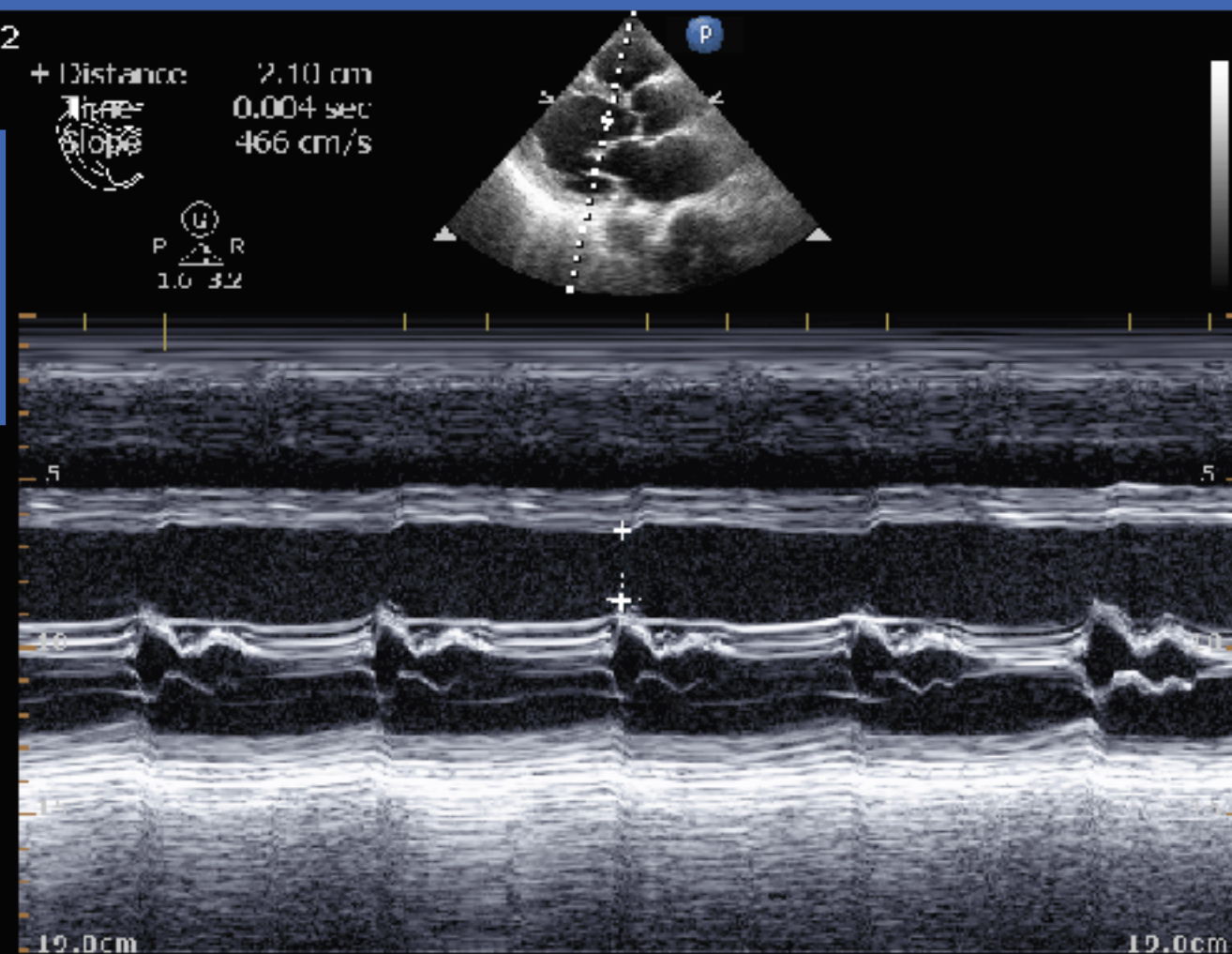




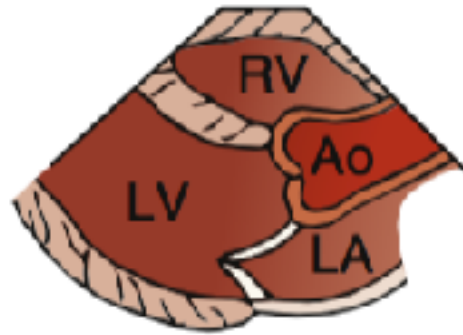
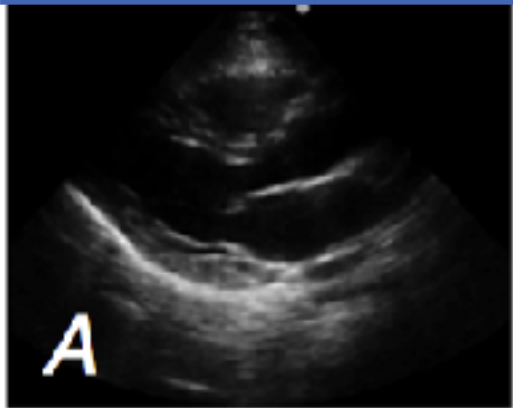
EF/FS

EPSS

M mode
3/3
75 mm/s

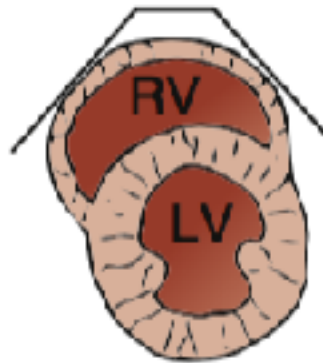
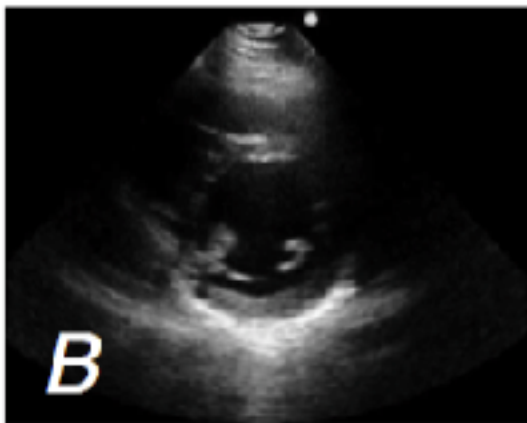


RV evaluation



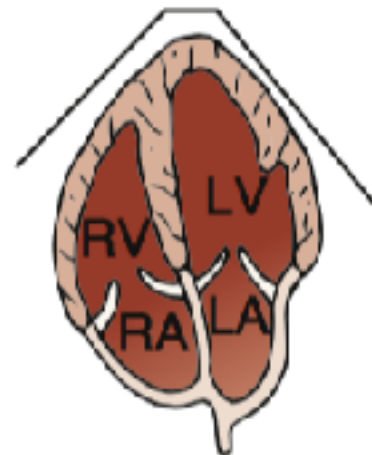
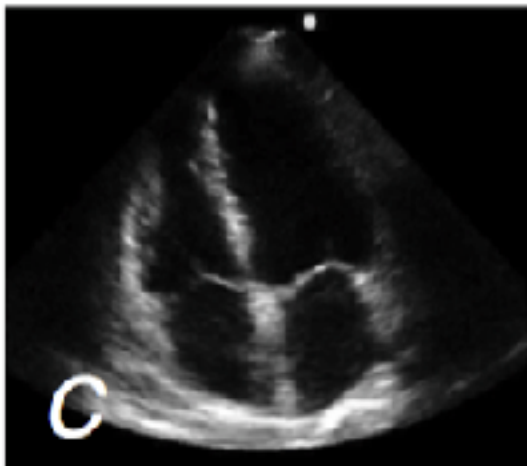
Parasternal long-axis view

- Only RVOT visible in the near field
- Only gross RV size or function abnormalities detectable



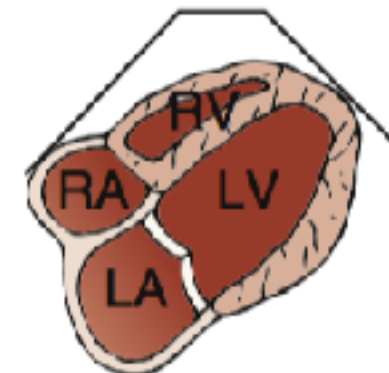
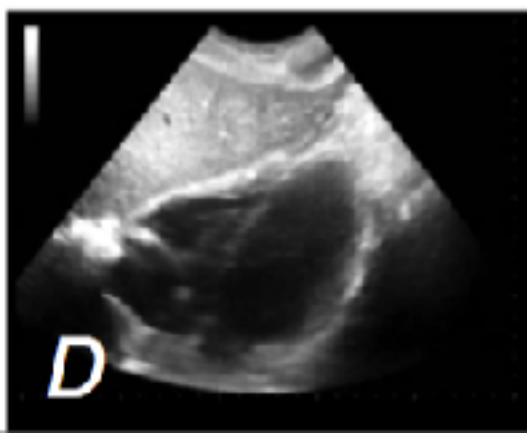
Parasternal short-axis view

- Crescentic RV adjacent to the circular LV
- Look for RV>LV size and septal kinetics or flattening



Apical 4-chamber view

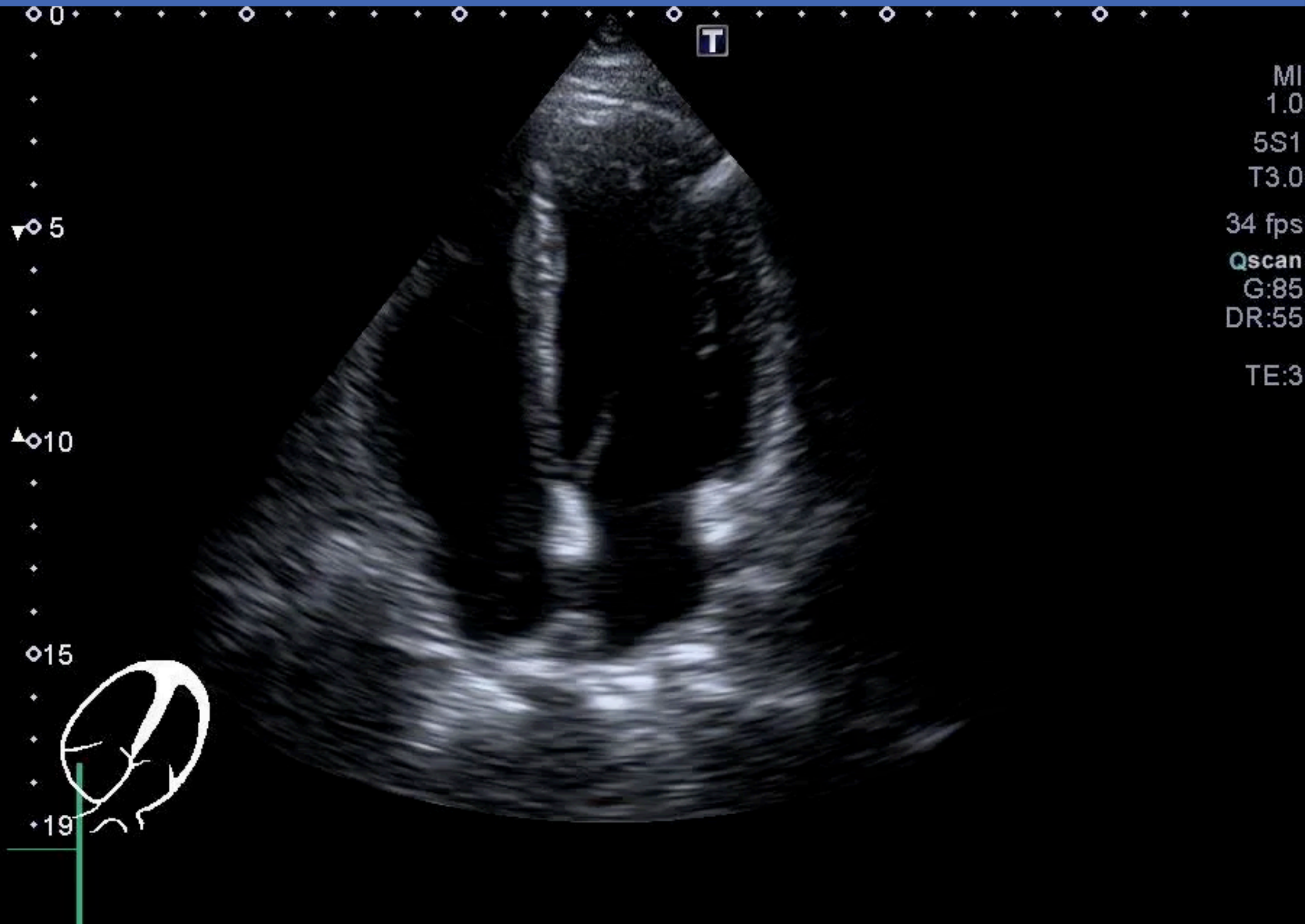
- Triangular RV seen adjacent to the LV
- Ideal view for RV size and systolic function assessment



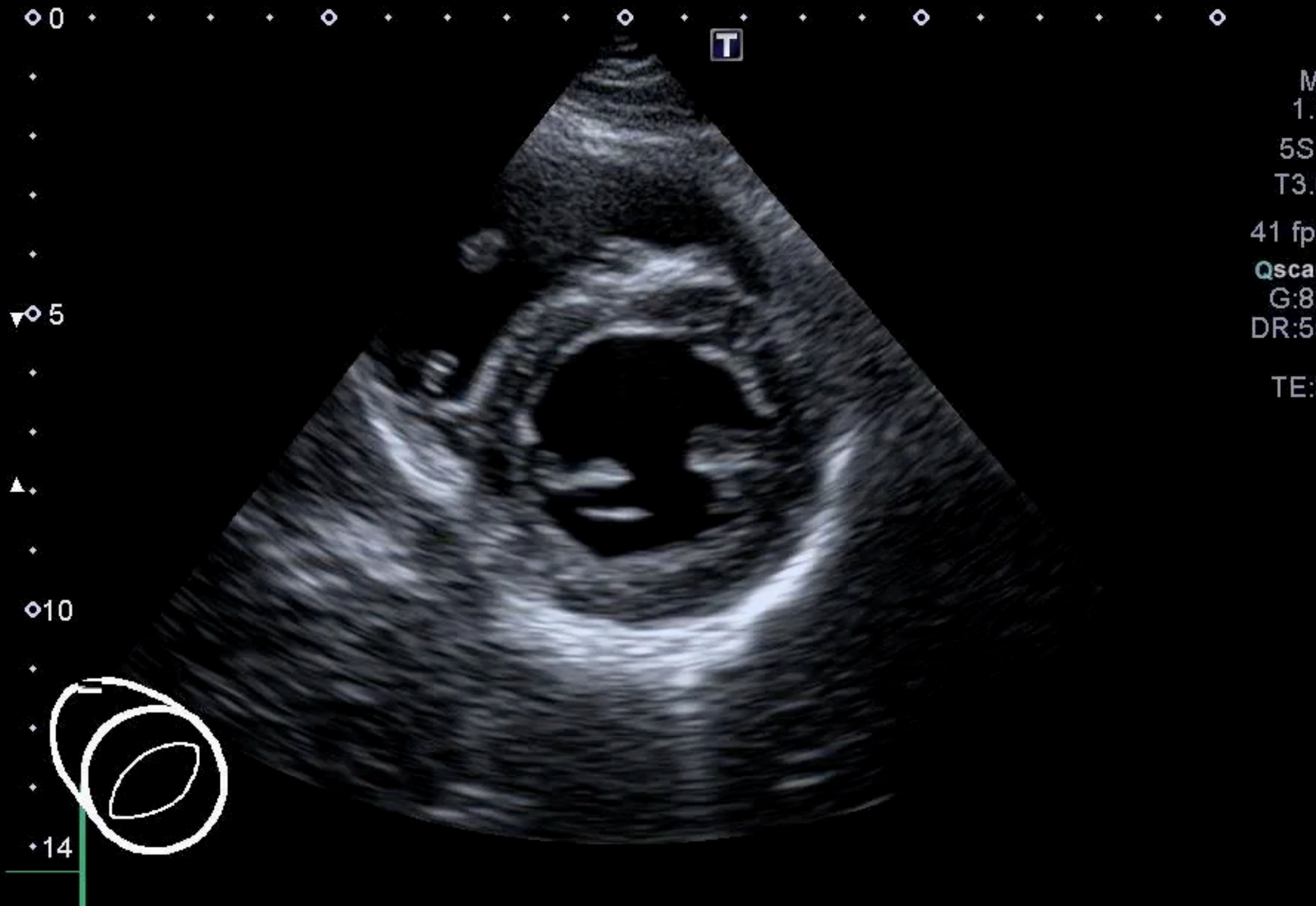
Subcostal 4-chamber view

- Triangular RV in the near field
- May assess RV size, systolic function, and wall thickness

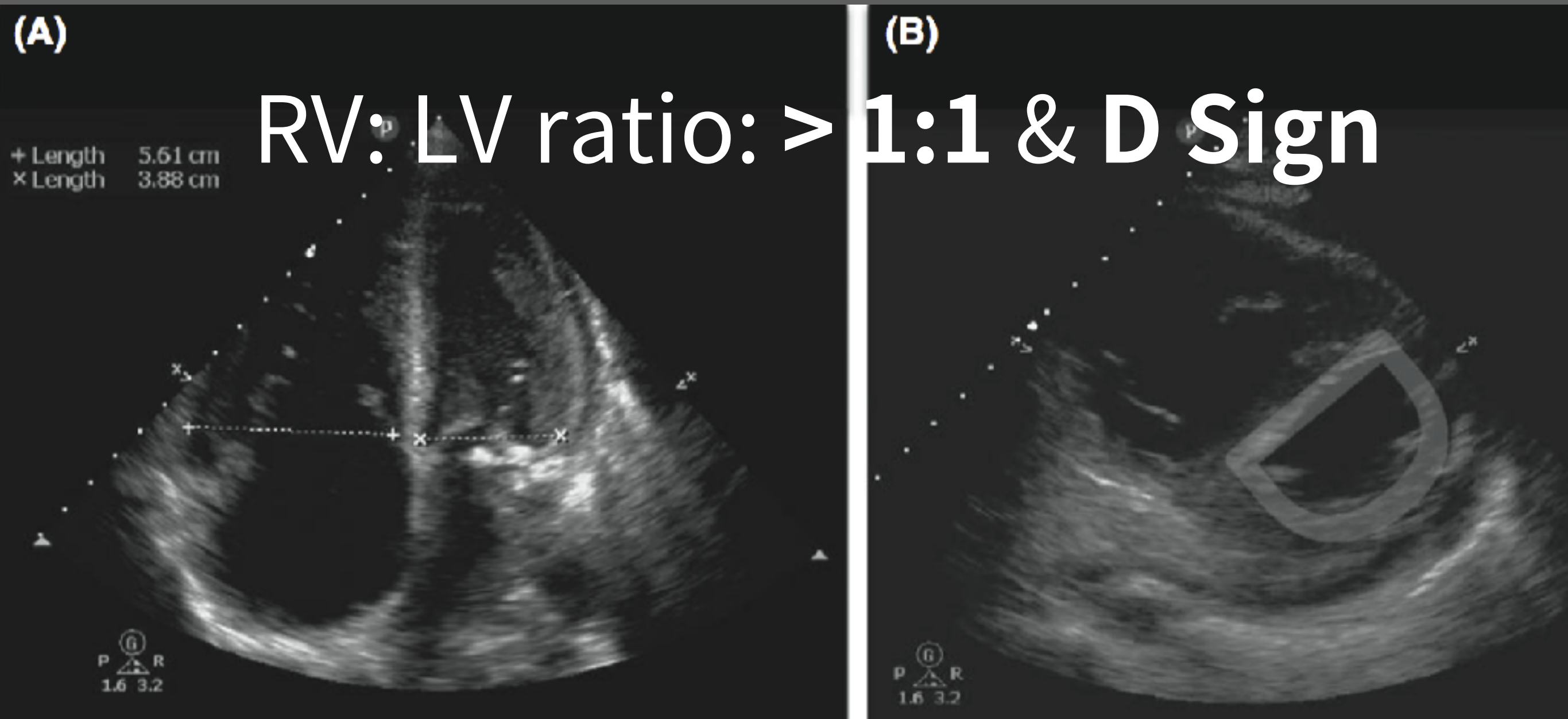
RV: LV = 0.6 : 1



Crescent & Doughnut

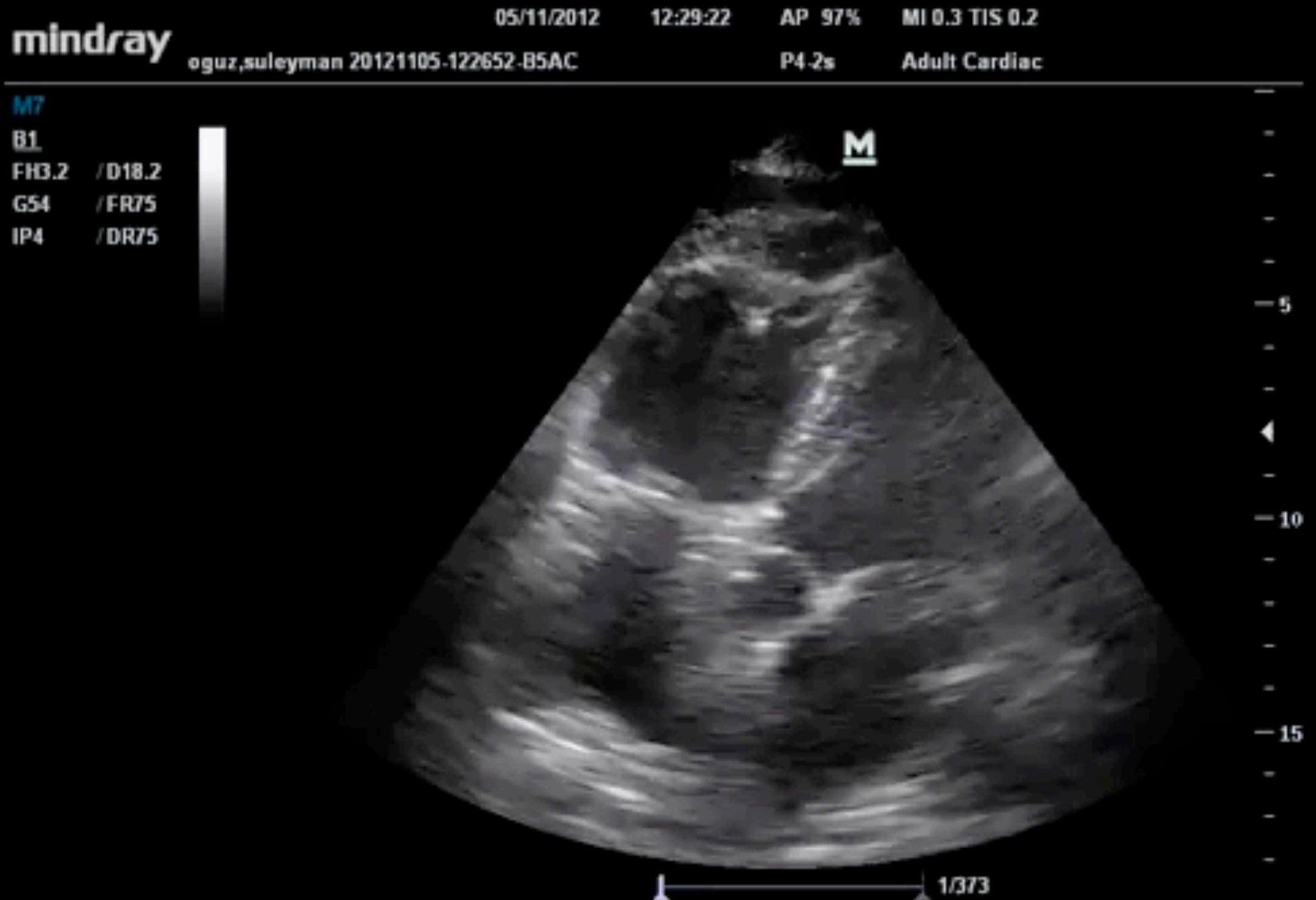


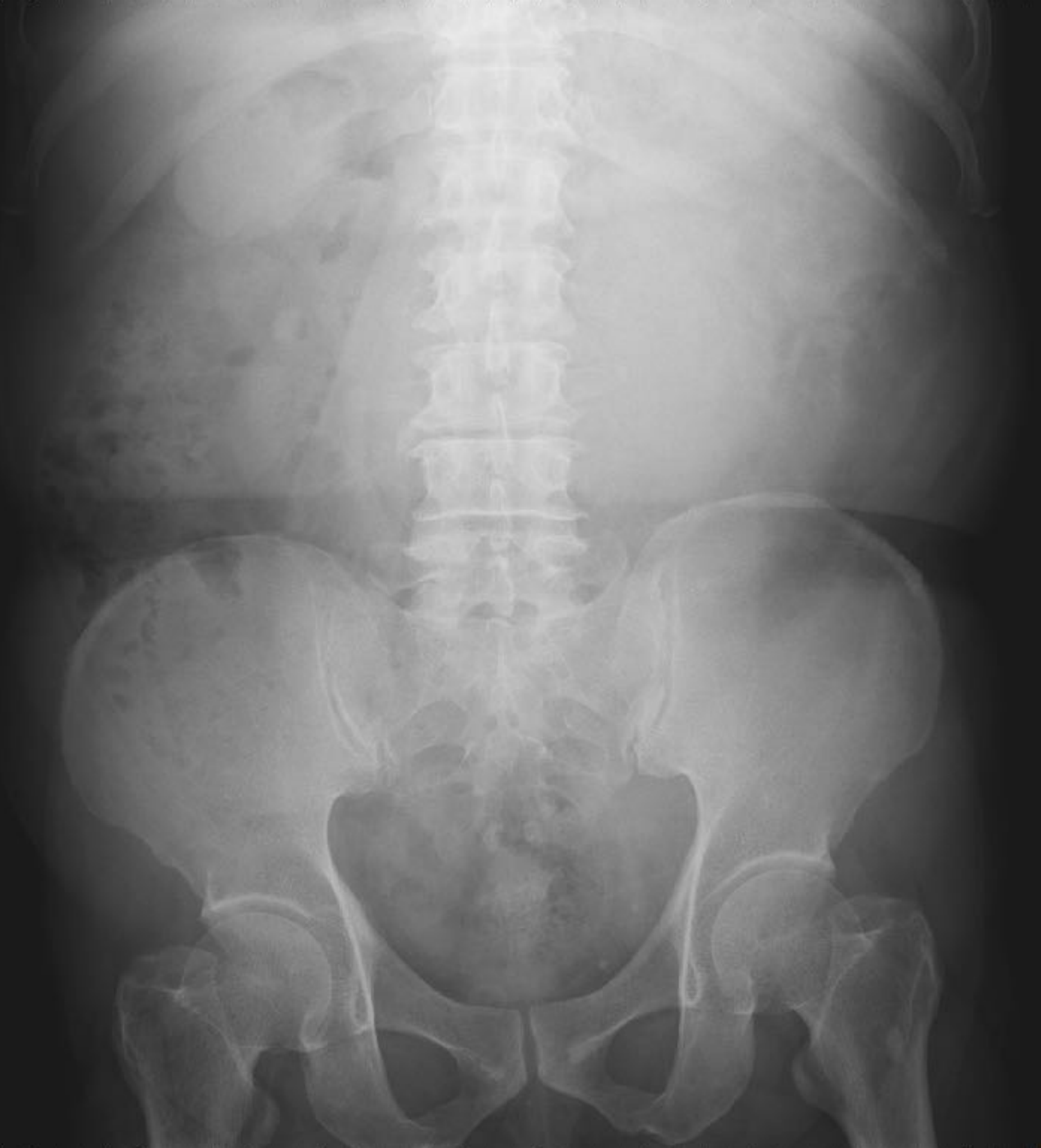
Equality (PSSA)



McConnell's sign

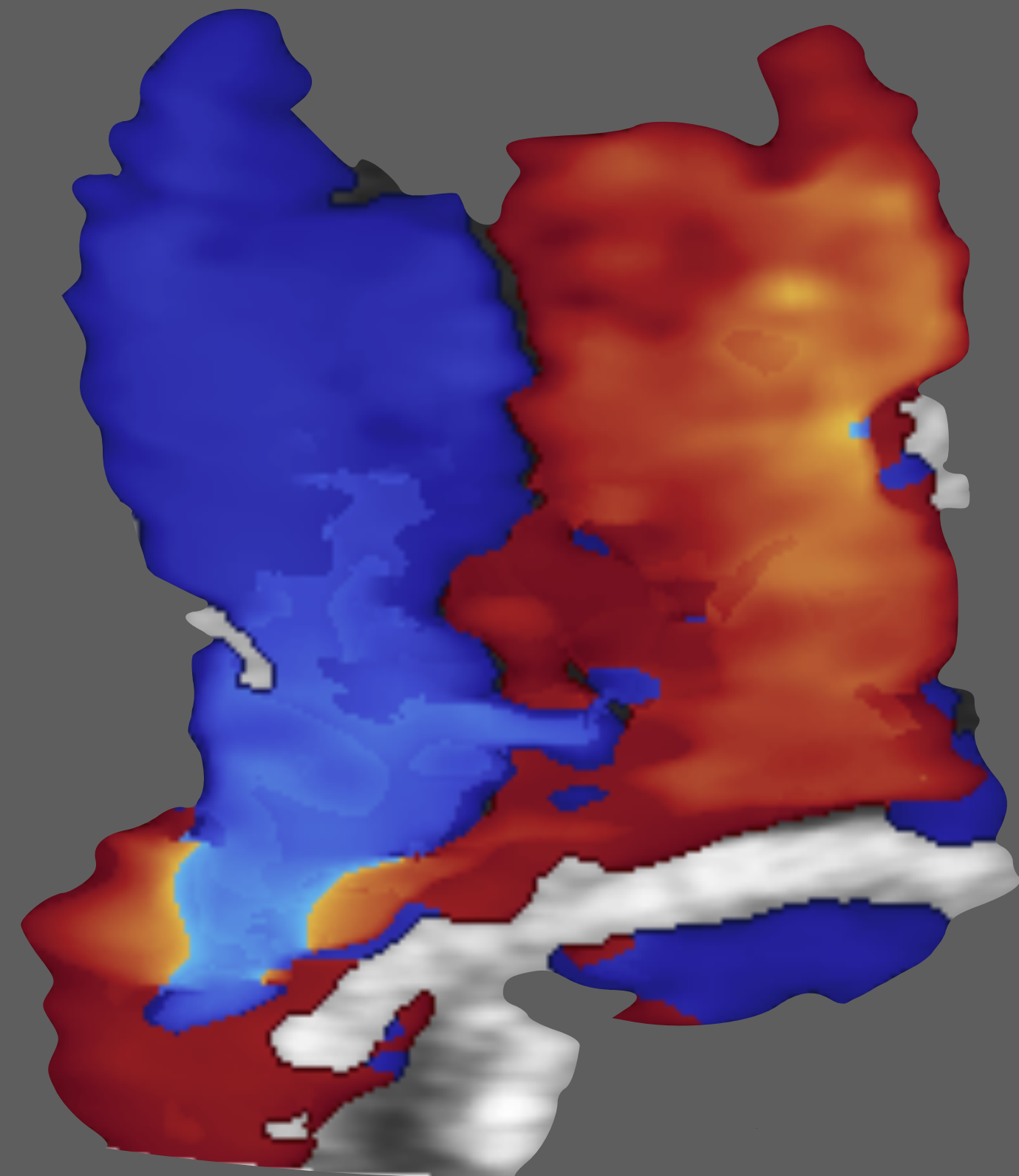
Acute RV strain



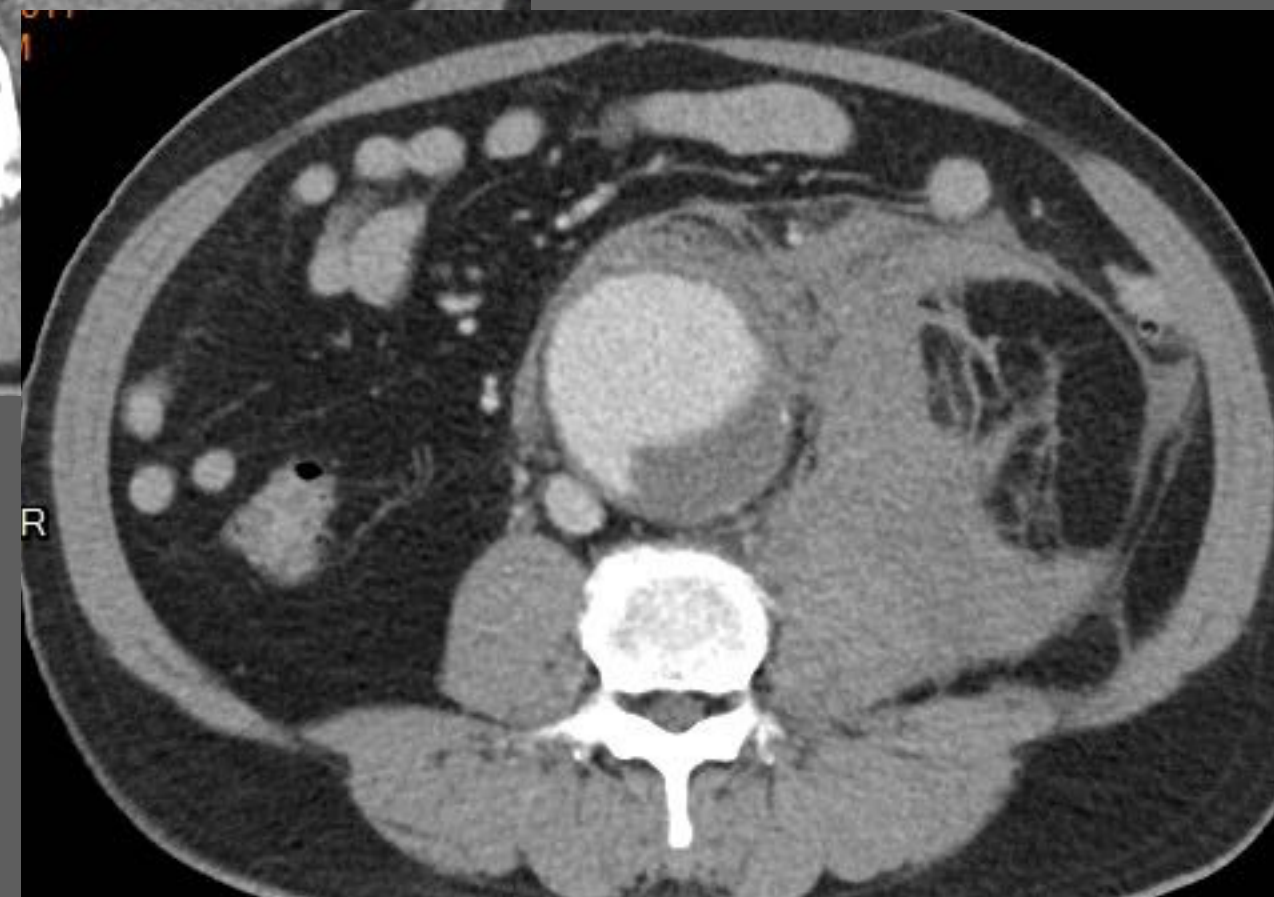
A grayscale KUB (Kidney, Ureter, Bladder) X-ray showing the lumbar spine and pelvic bones. The kidneys are visible in the upper half of the image, and the bladder is in the lower half. There is a subtle area of increased density in the right lower quadrant (patient's left side) that could represent a calcified mass or a fecal impaction.

**64M,
左下腹痛
1小時
冒冷汗
結石病史**

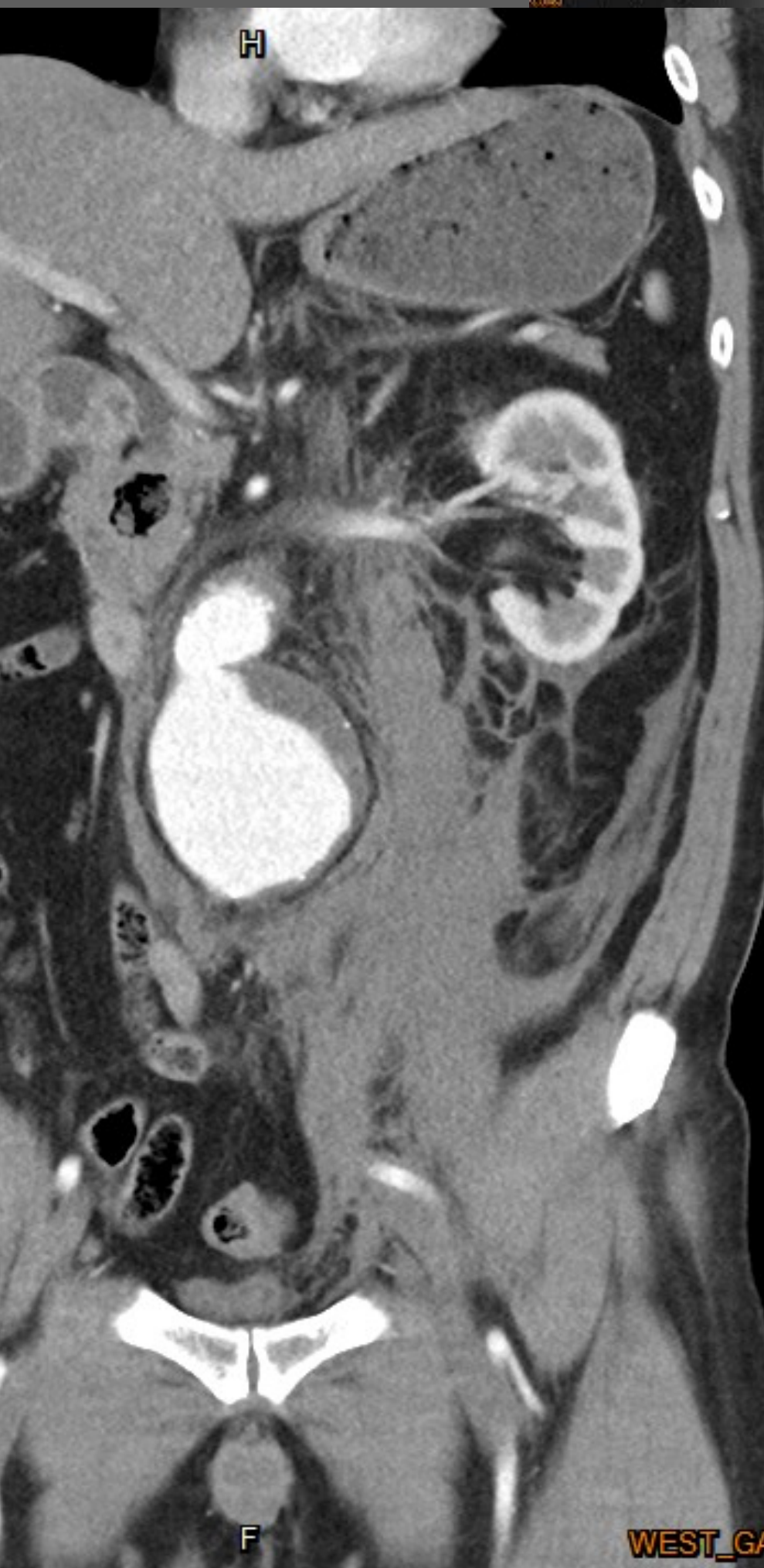
**PR 117
BP
88/62**



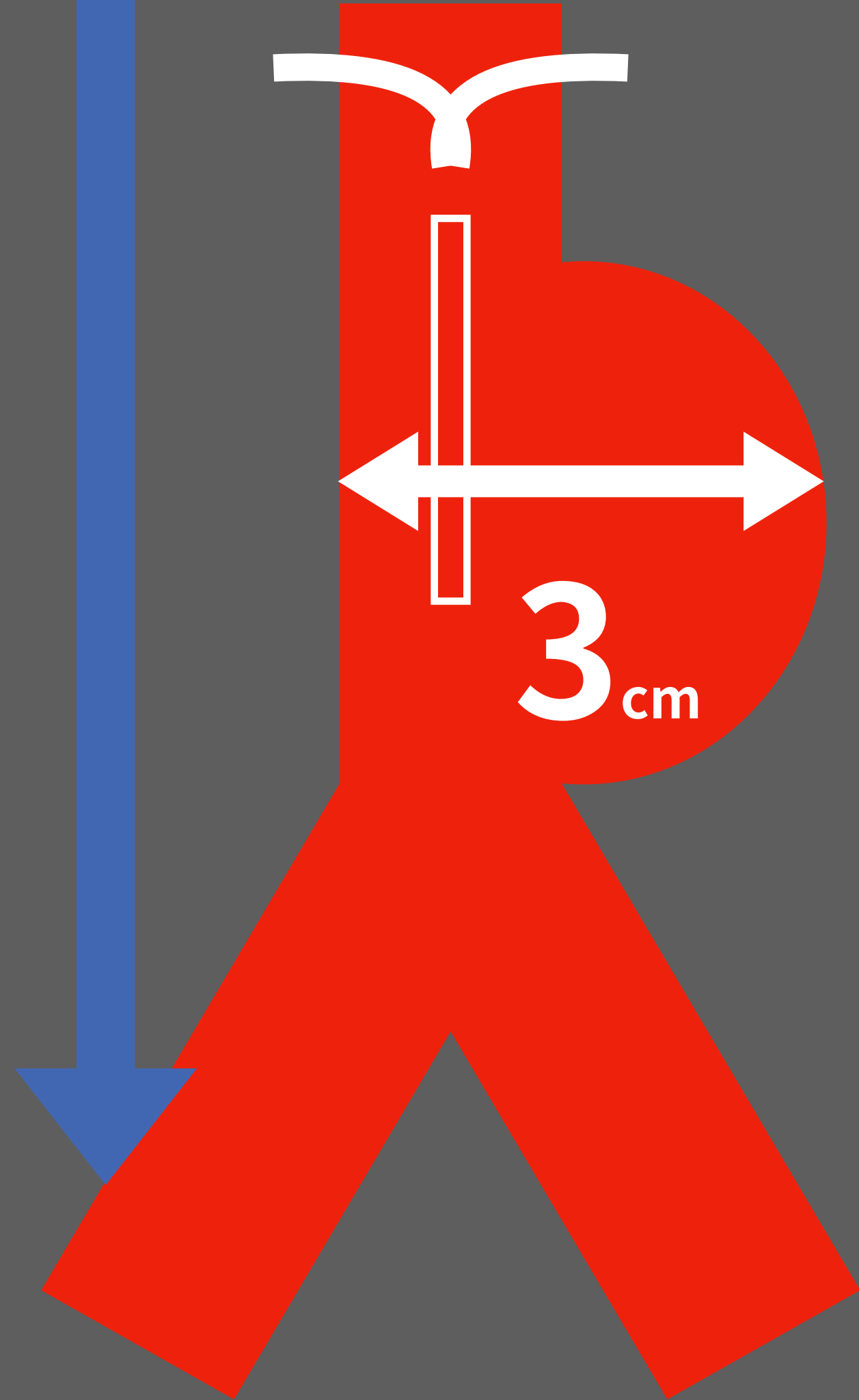
腰痛 + 冒冷汗，
我的病人可能是
主動脈瘤破裂？







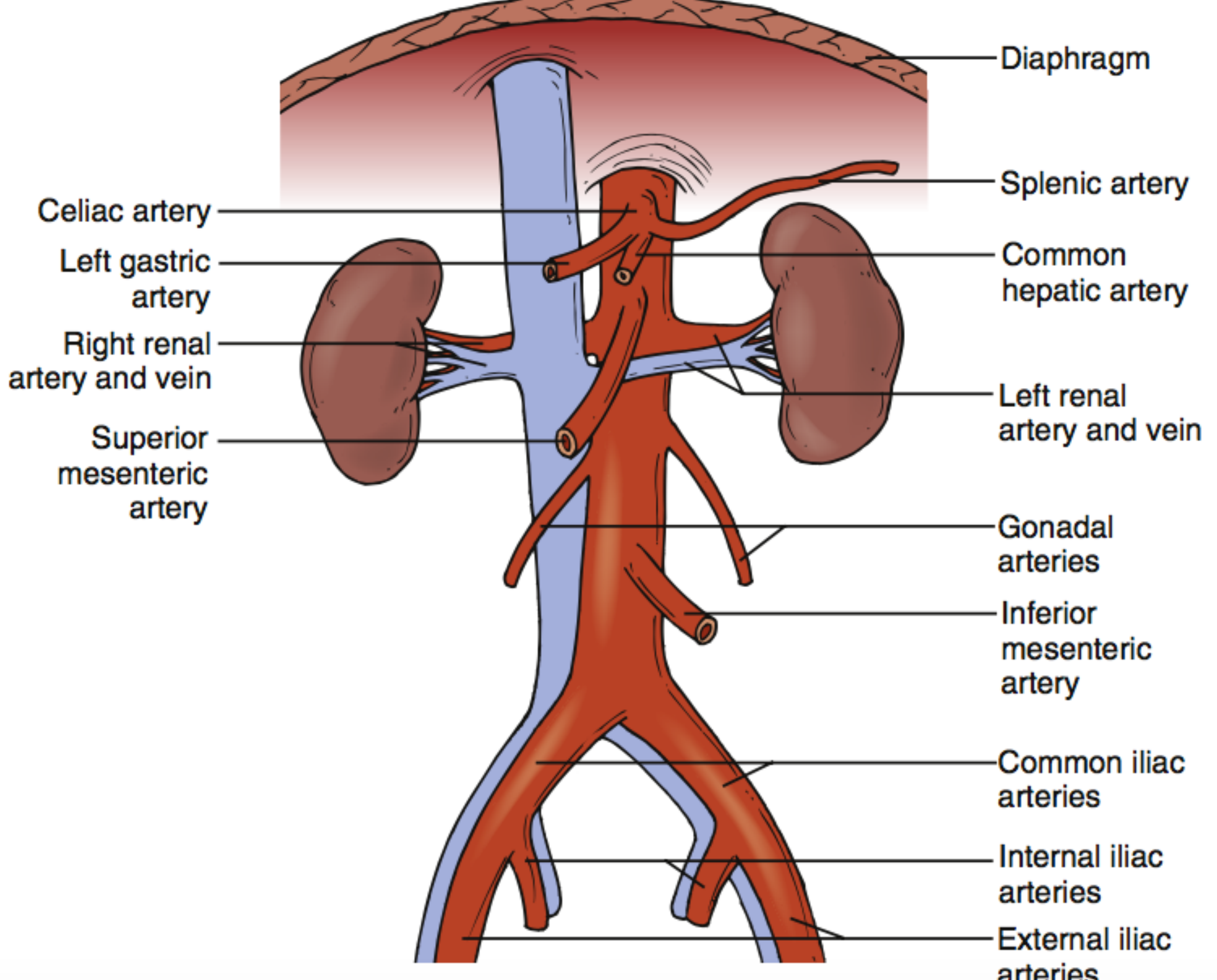
AAA



3_{cm}

> 50 y/o
Syncope
Hypotension
ABD/Flank/Back/Groin

Sensitivity **97.5-100%**
Specificity **94.1-100%**



Eyeballing

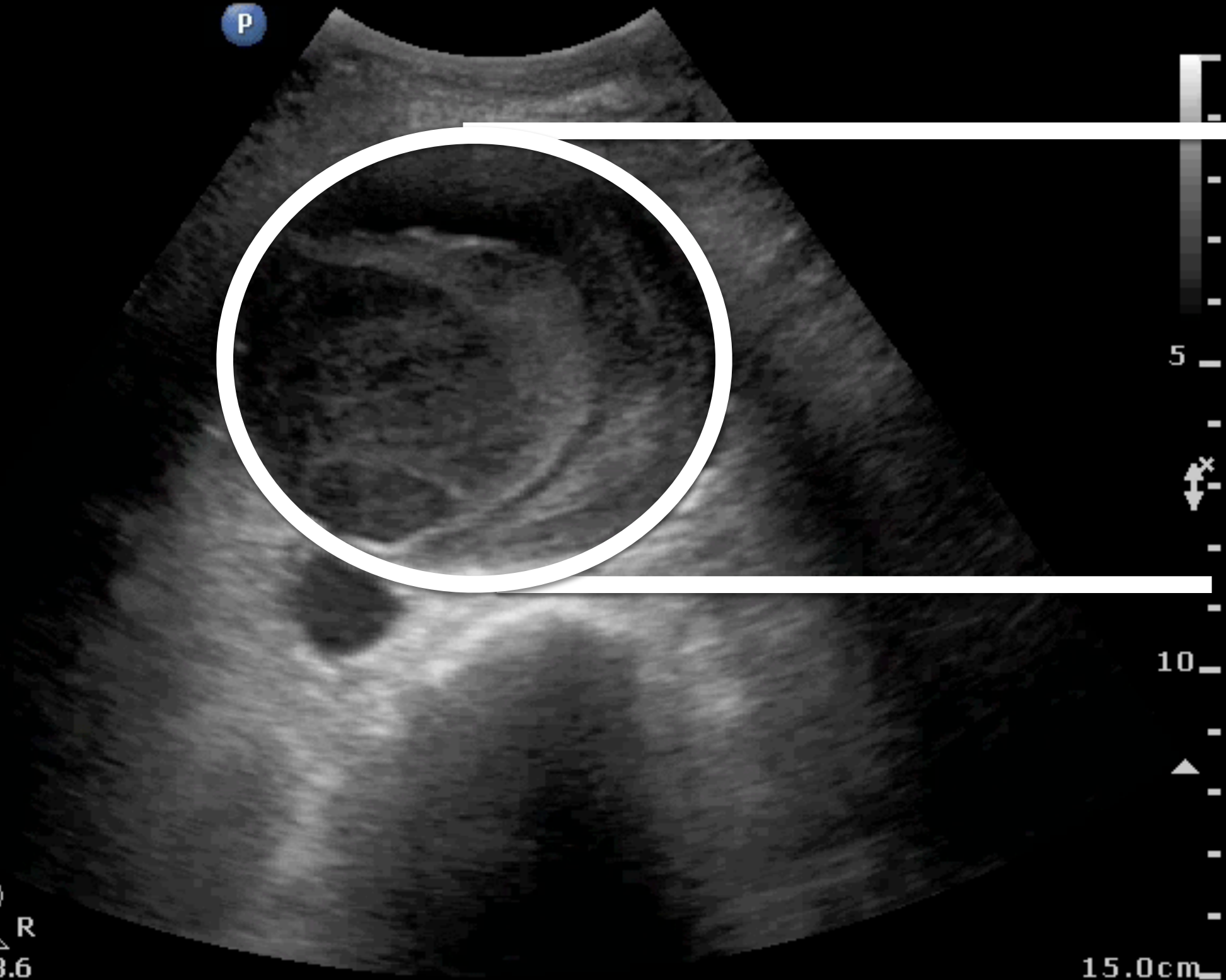
Abd Gen
C5-1
34 Hz
15.0cm

2D

HGen
Gn 57
C 56
3 / 3 / 3

P  R
1.8 3.6

15.0cm



65M, epigastric pain after dinner

SHIN KONG HOSPITAL ER IDI

: Y1 : 11 OCT. 28, 10
20:33:03

18Hz 3.5M S-H
DVA: 100%
MI = 0.6



1: Abdomen

IVC

Volume responsiveness

Central venous pressure

Pericardial effusion

Right heart failure

Intra-abdominal hypertension

Volume status

Diameter 1~2 cm

Collapse index 50%

IVC diameter (cm)

Collapse (%)

CVP (mean)mmHg

<1

> 50

0-5 (3)

1-2

NA

5-10 (8)

>2

<50

10-20 (15)

Small & CI > 50%

36 Hz
14.0cm

2D

HGen

Gn 61

C 56

3 / 3 / 3



P G R
1.8 3.6

5.

10.

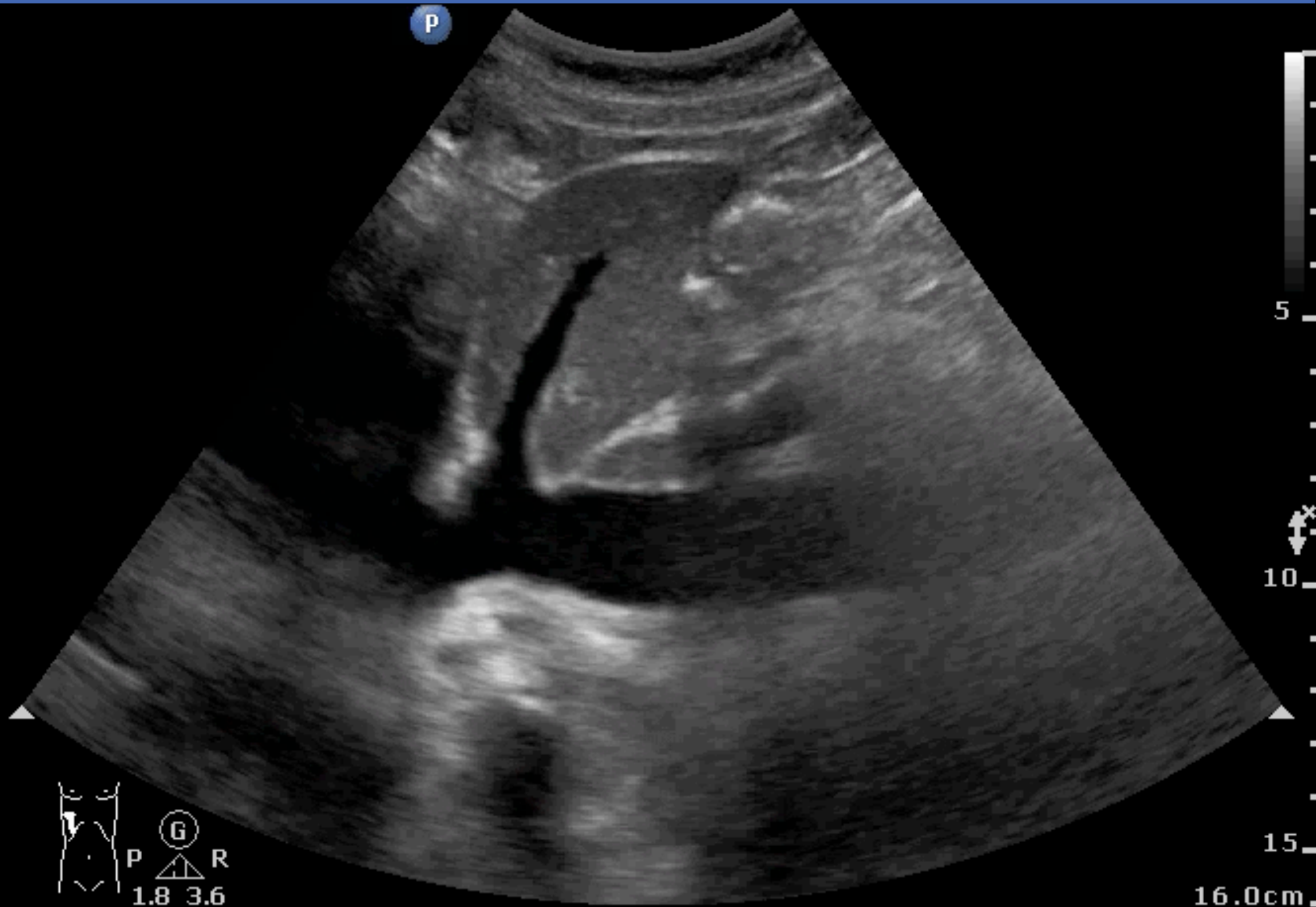
14.0cm

Large & $CI < 50\%$

Abd Gen2
C5-1
32 Hz
16.0cm

2D

HGen
Gn 60
C 55
3/3/3



Liver & GB



3 mm

7 mm

11 mm

讀讀看，你看到了什麼？

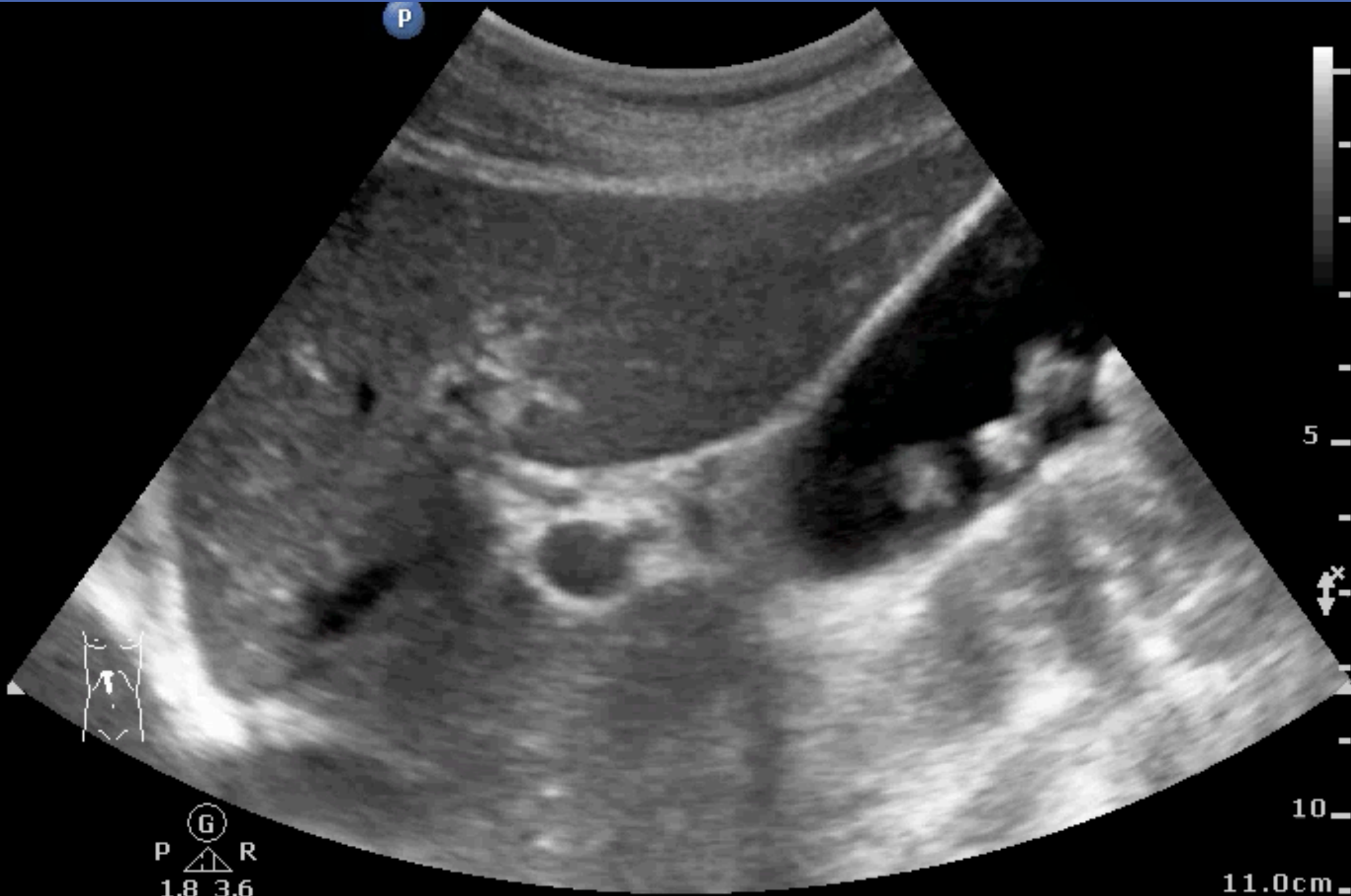


讀讀看，你看到了什麼？

Abd Gen
C5-1
42 Hz
11.0cm

2D

HGen
Gn 80
C 56
3 / 3 / 3



P G R
1.8 3.6

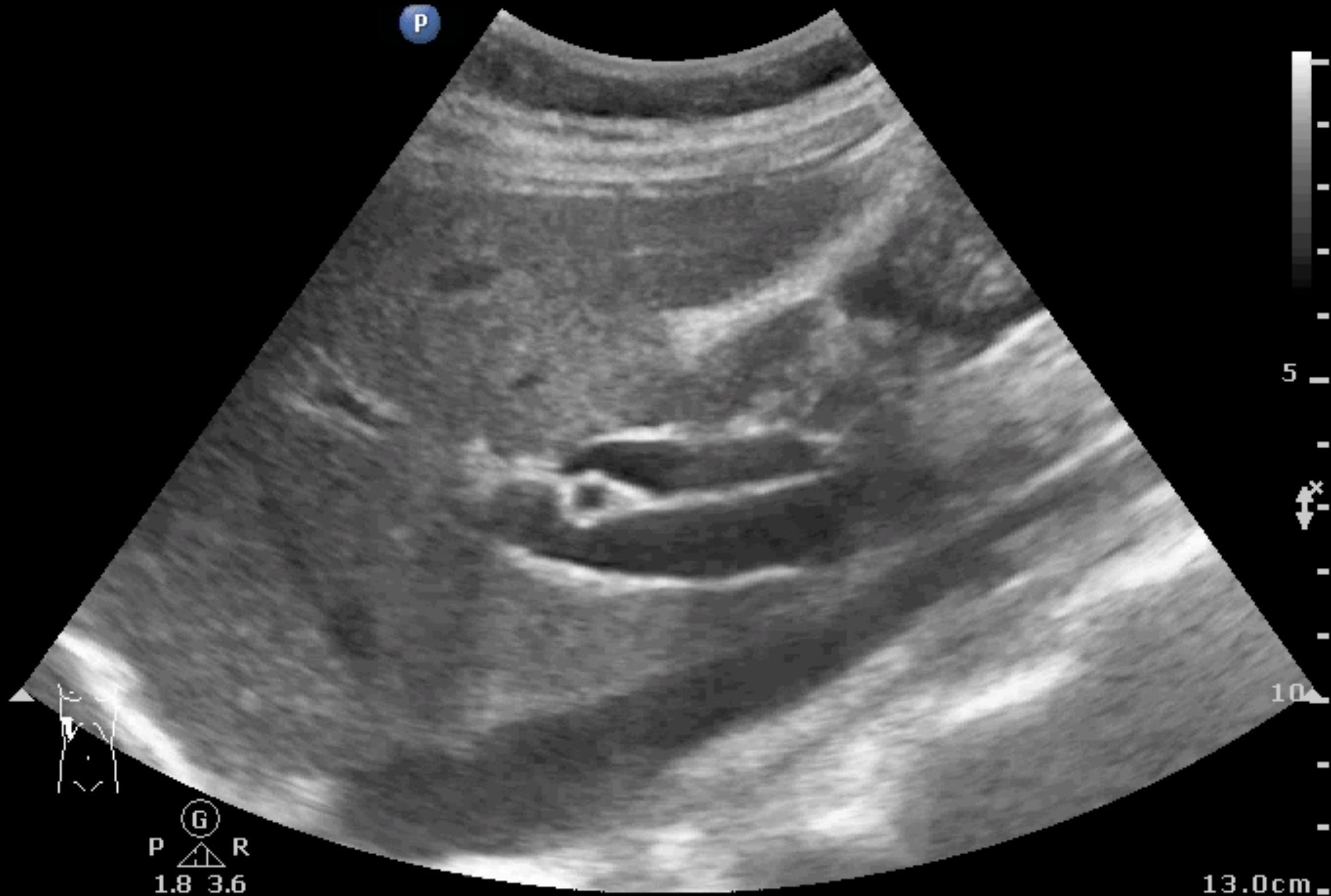
11.0cm

讀讀看，你看到了什麼？

Abd Gen
C5-1
38 Hz
13.0cm

2D

HGen
Gn 82
C 56
3 / 3 / 3



P G R
1.8 3.6

13.0cm

讀讀看，你看到了什麼？

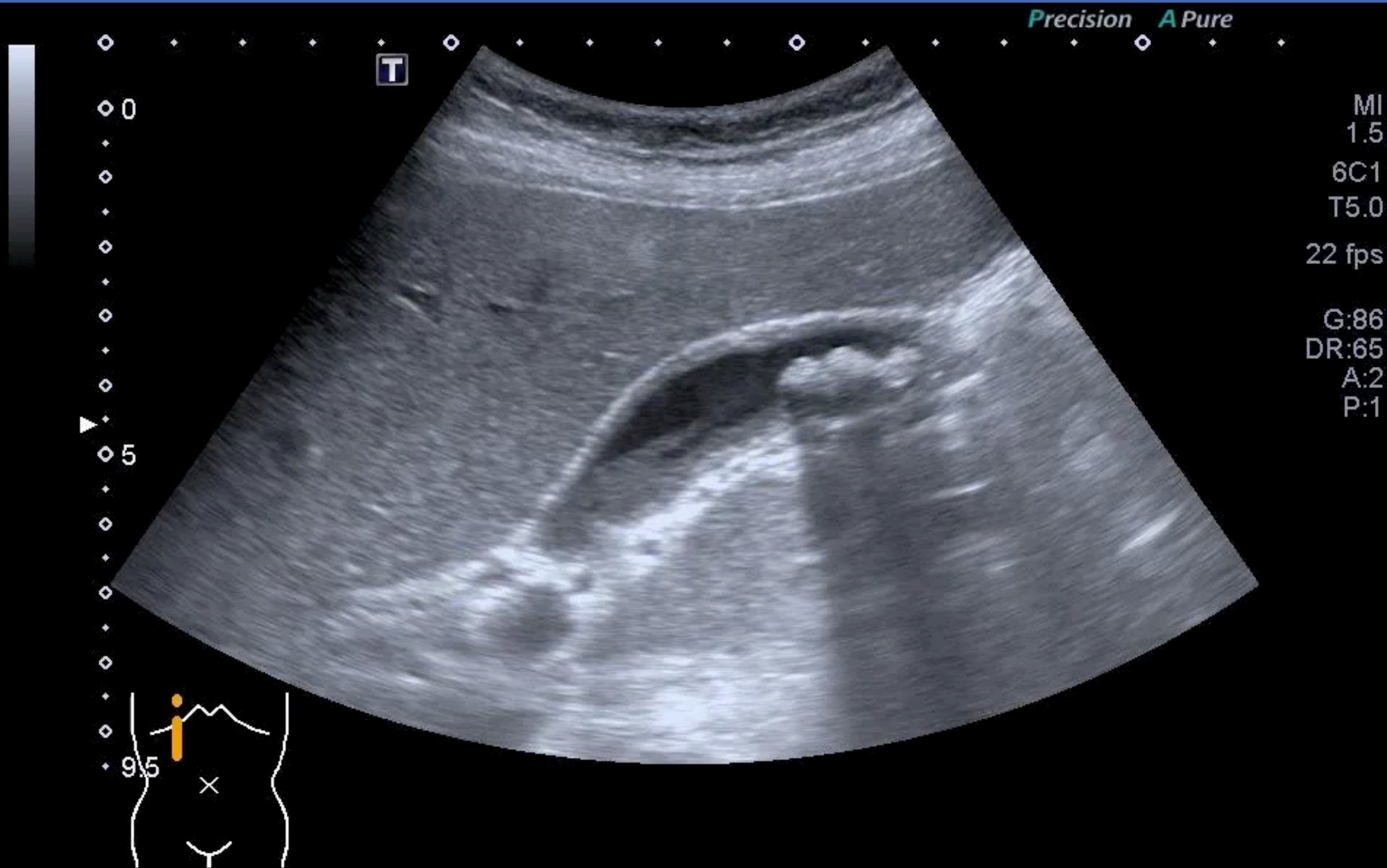
Abd Gen
C5-1
38 Hz
13.0cm

2D

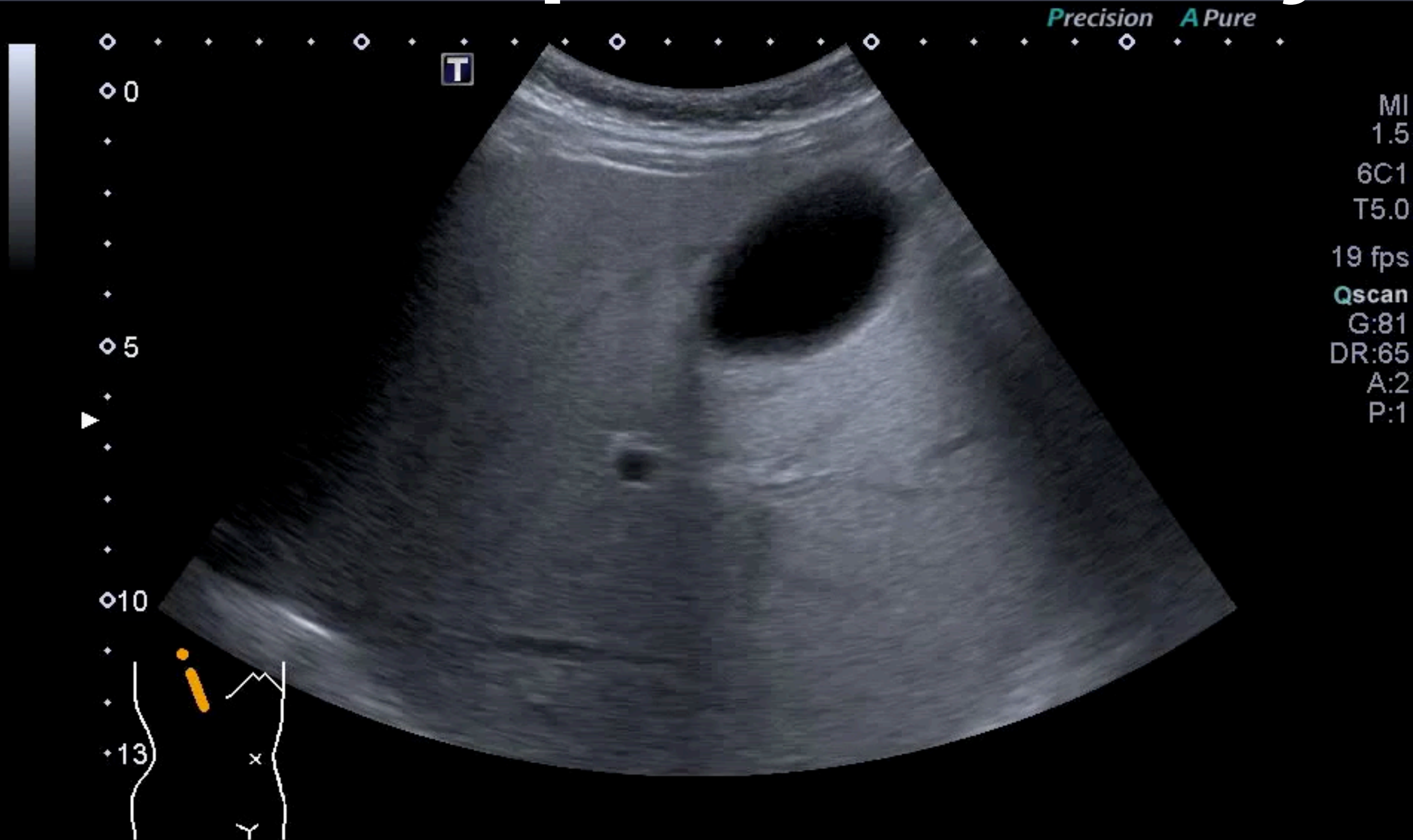
HGen
Gn 82
C 56
3/3/3



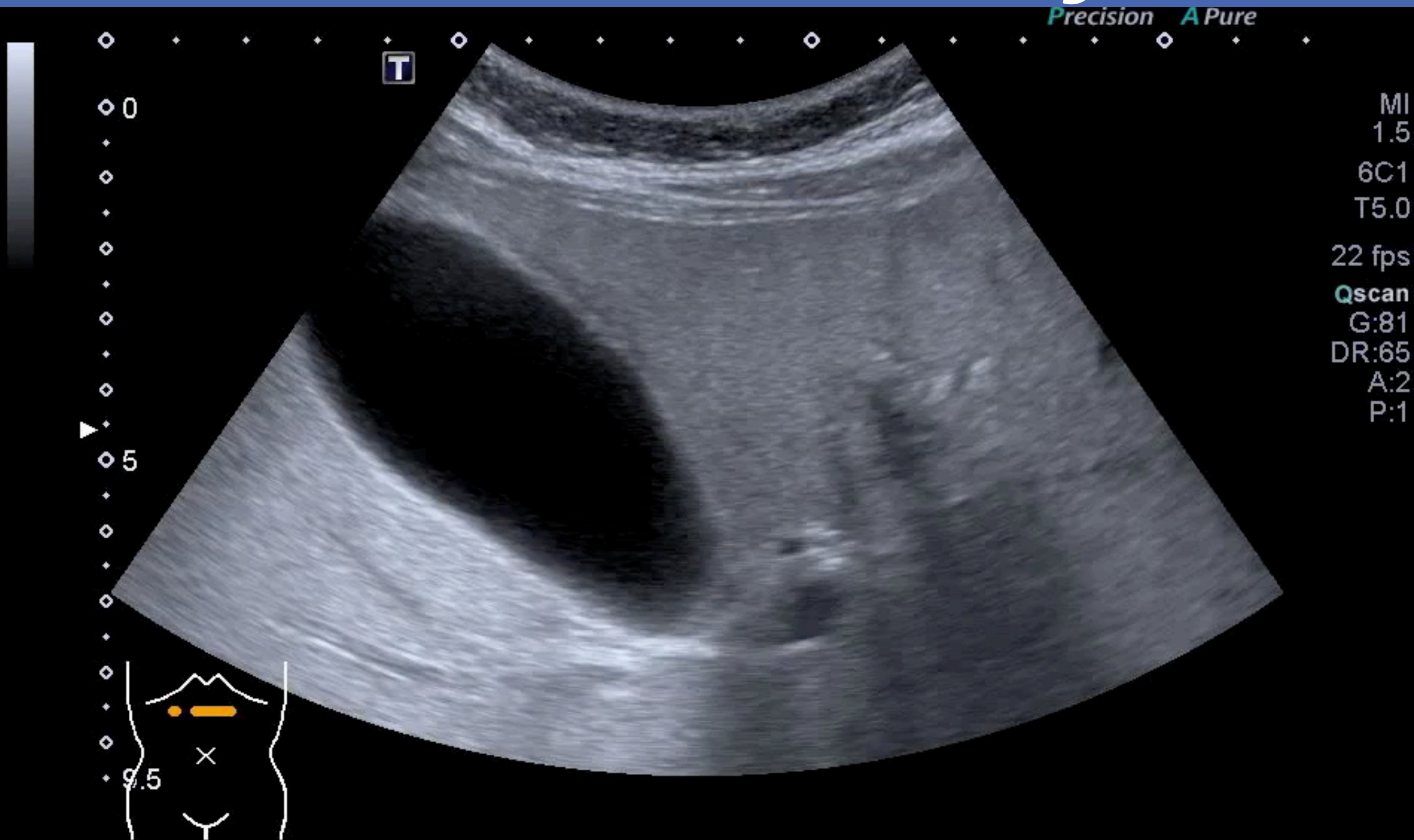
讀讀看，你看到了什麼？



61F , ABD pain for 3-4 days



GB stones & Cholecystitis

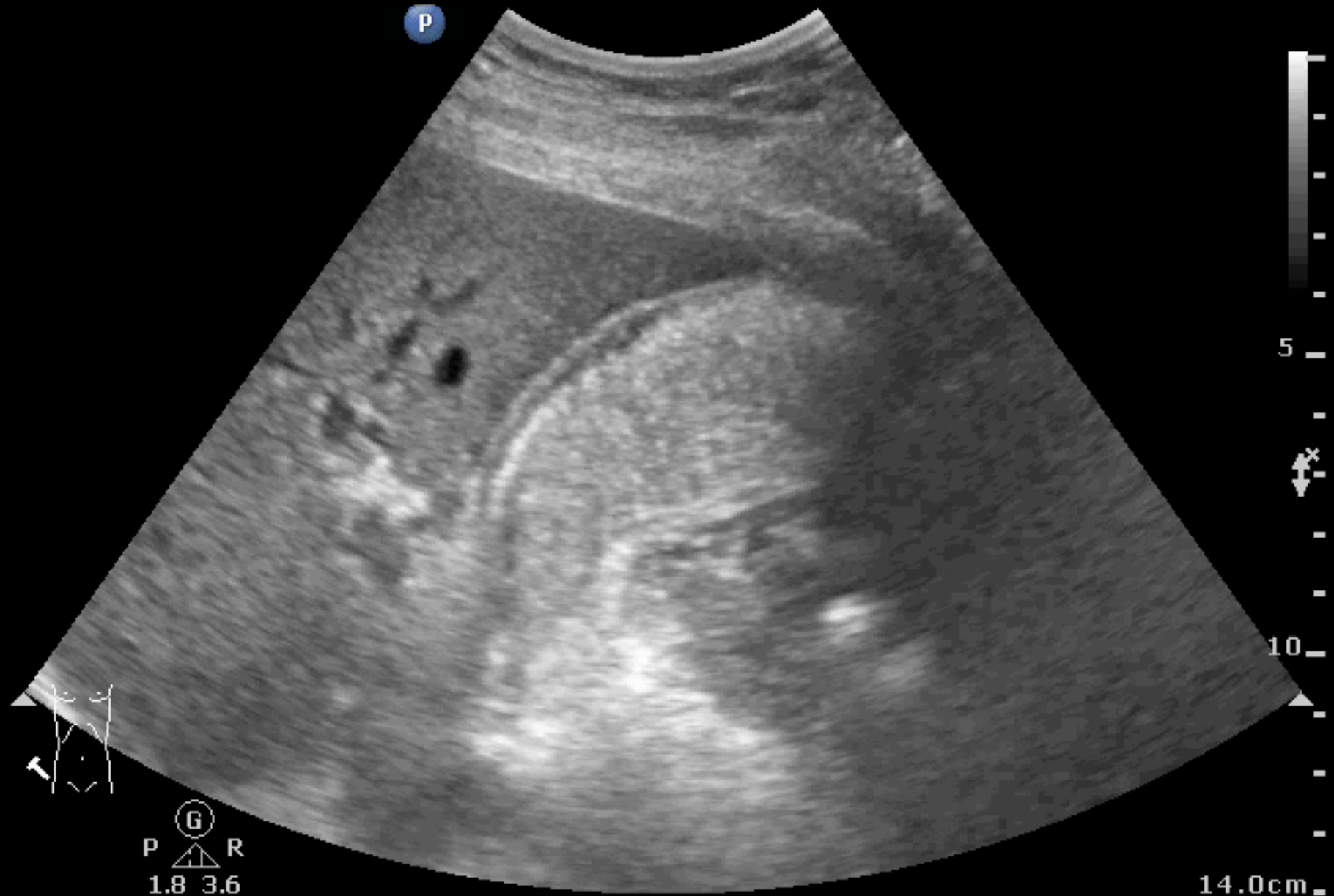


59M, epigastric pain at midnight

PHILIPS

Abd Gen2
C5-1
36 Hz
14.0cm

2D
HGen
Gn 100
C 56
3/3/3

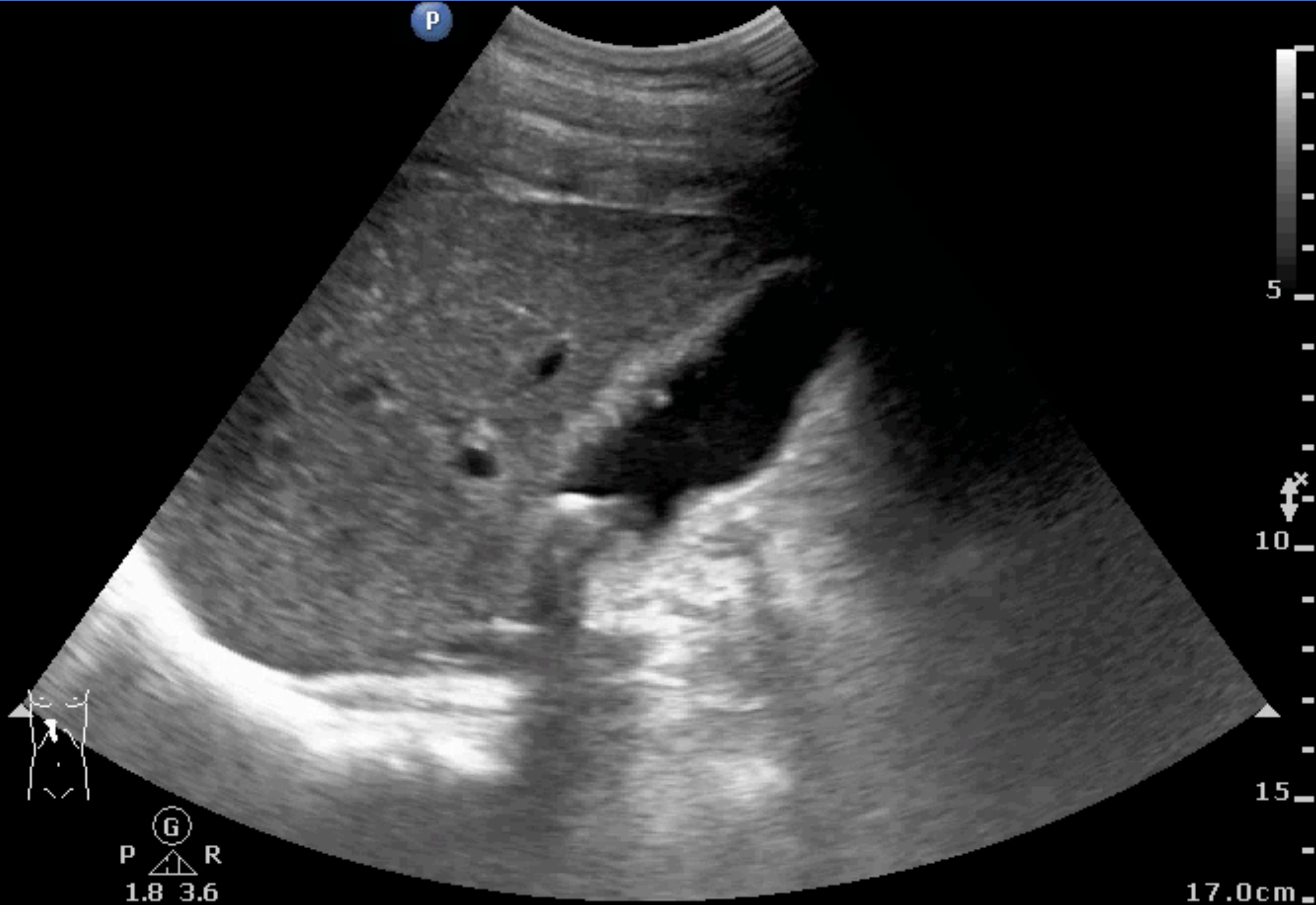


52M, RUQ pain

Abd Gen2
C5-1
31 Hz
17.0cm

2D

HGen
Gn 86
C 56
3/3/3

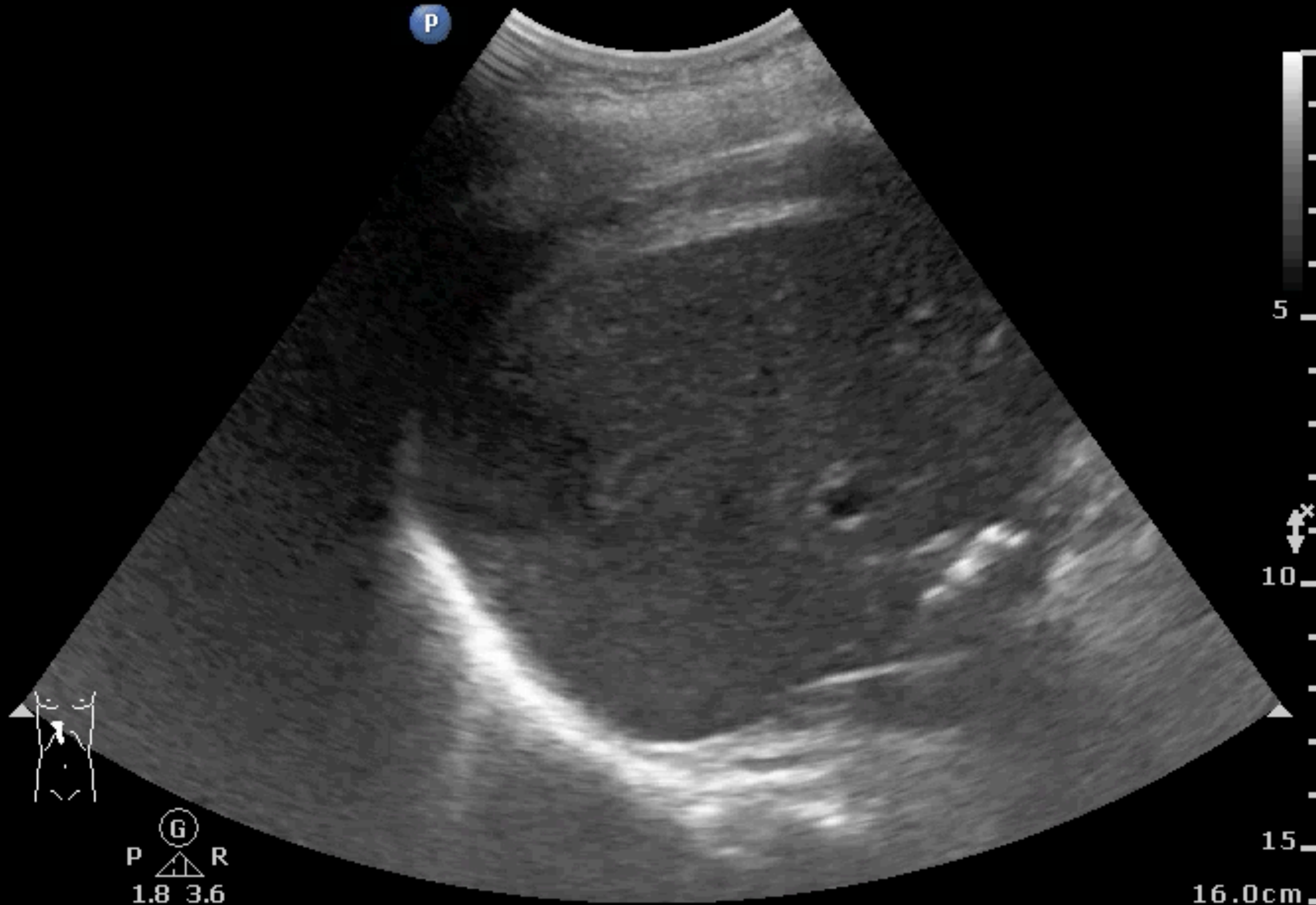


讀讀看，你看到了什麼？

Abd Gen2
C5-1
32 Hz
16.0cm

2D

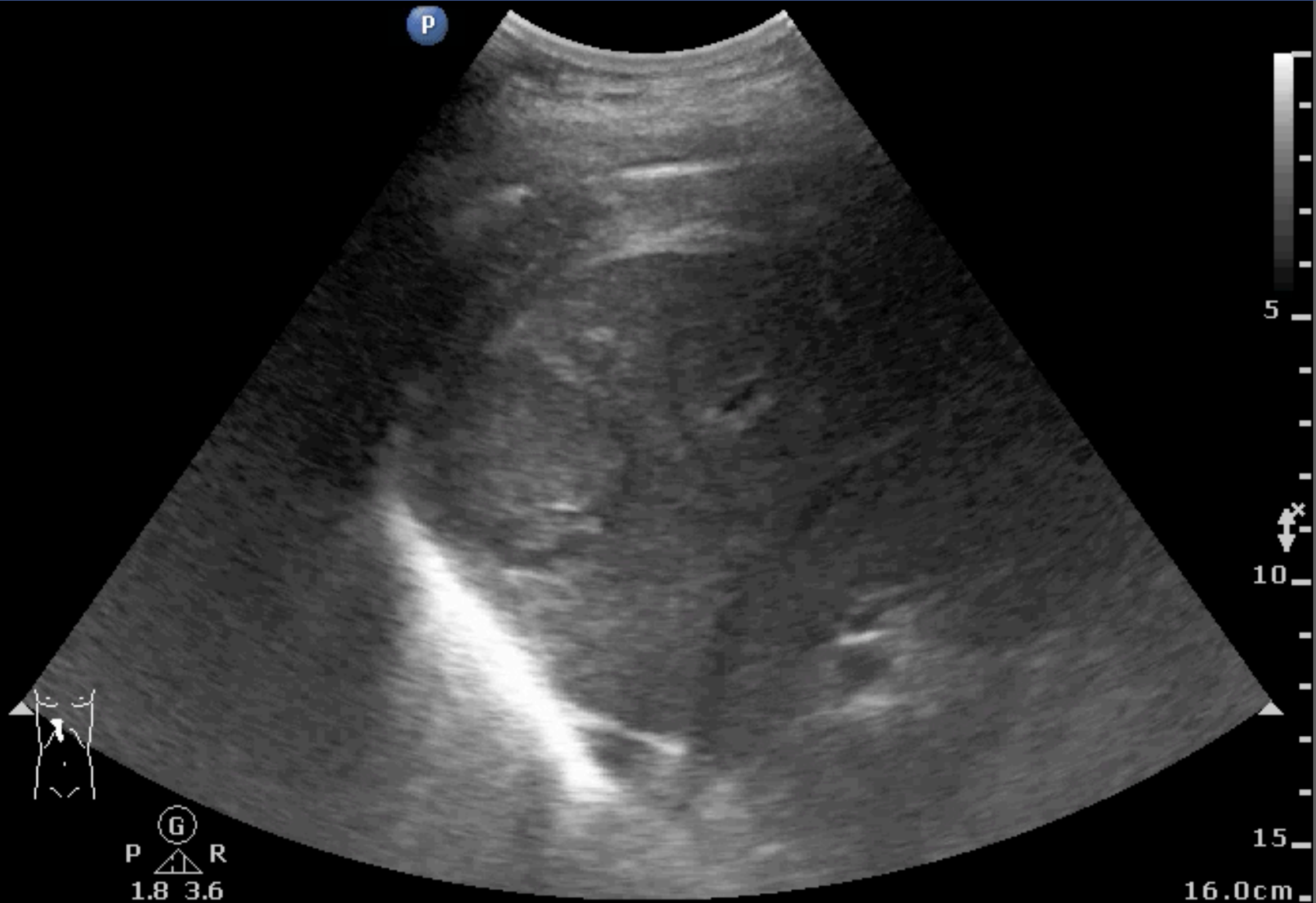
HGen
Gn 100
C 56
3 / 3 / 3

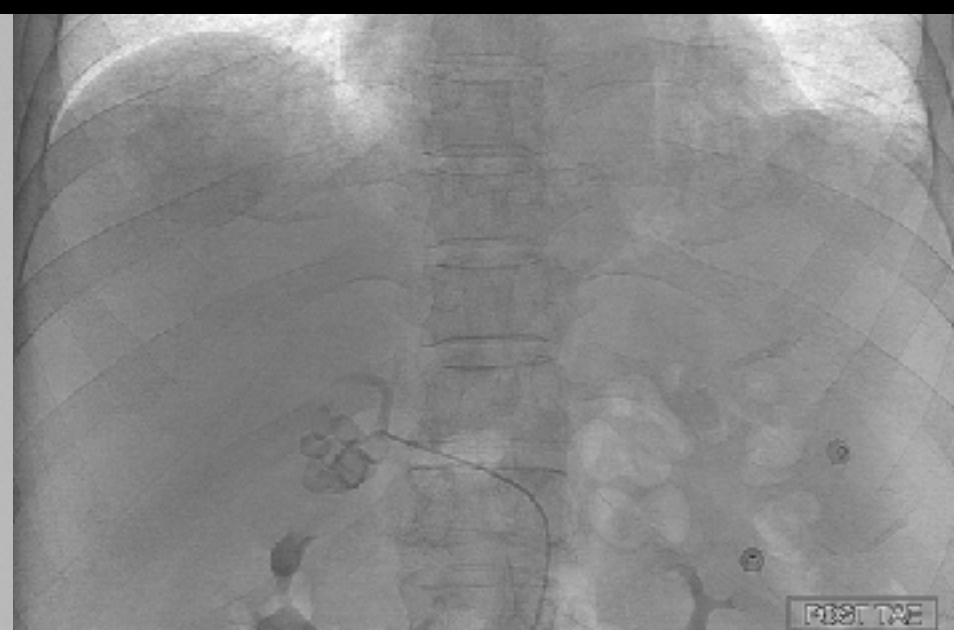
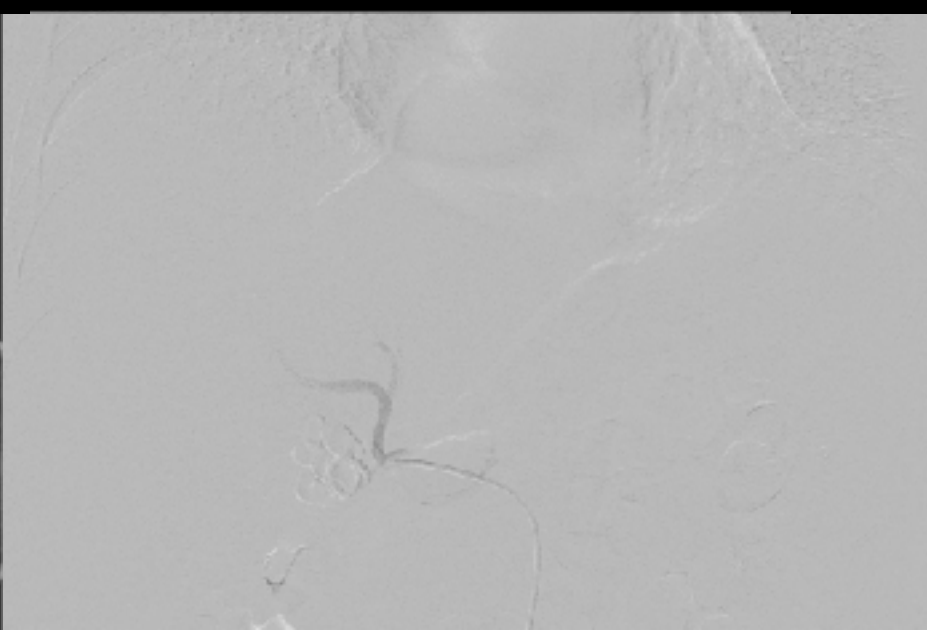
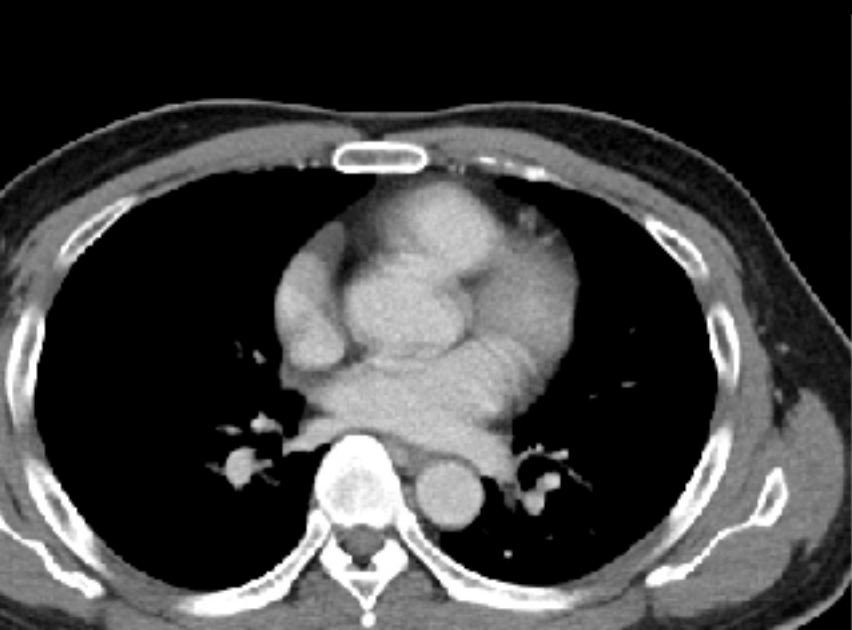
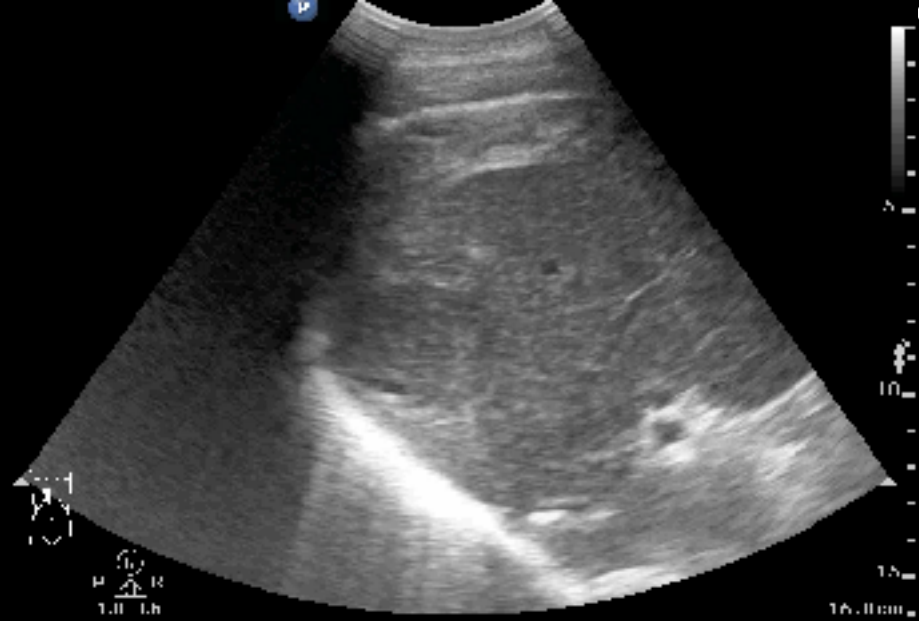


讀讀看，你看到了什麼？

Abd Gen2
C5-1
32 Hz
16.0cm

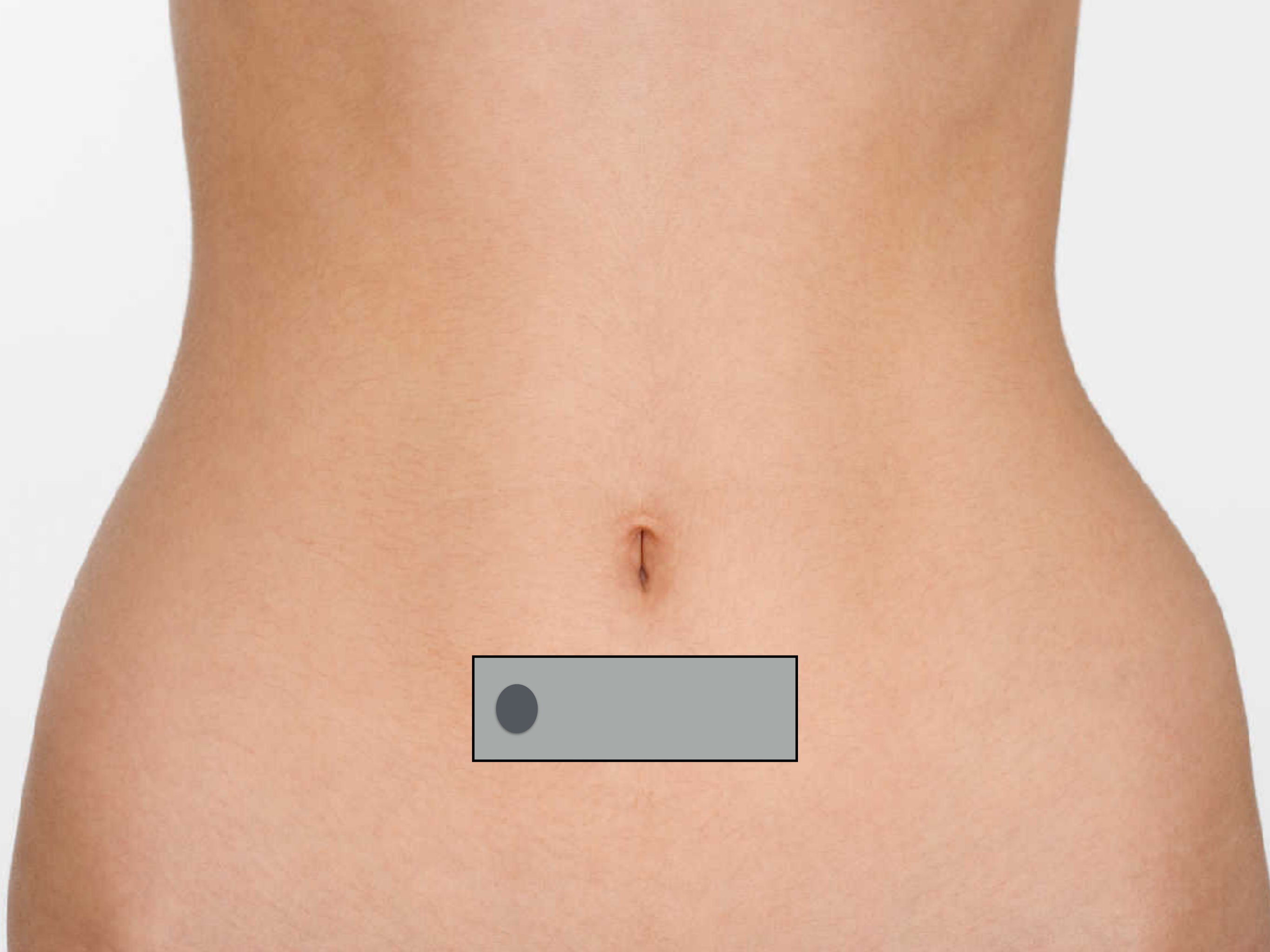
2D
HGen
Gn 100
C 56
3/3/3

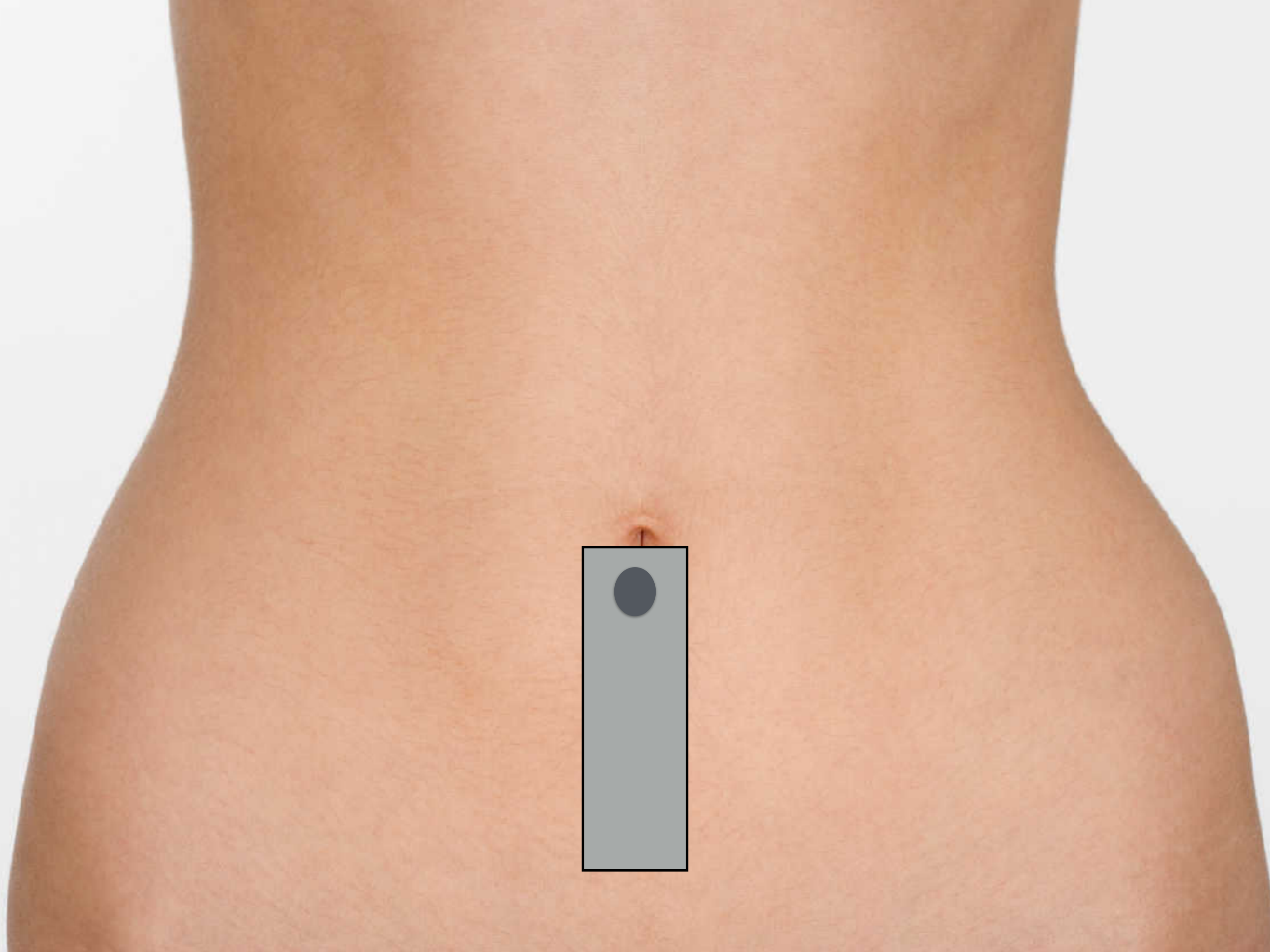










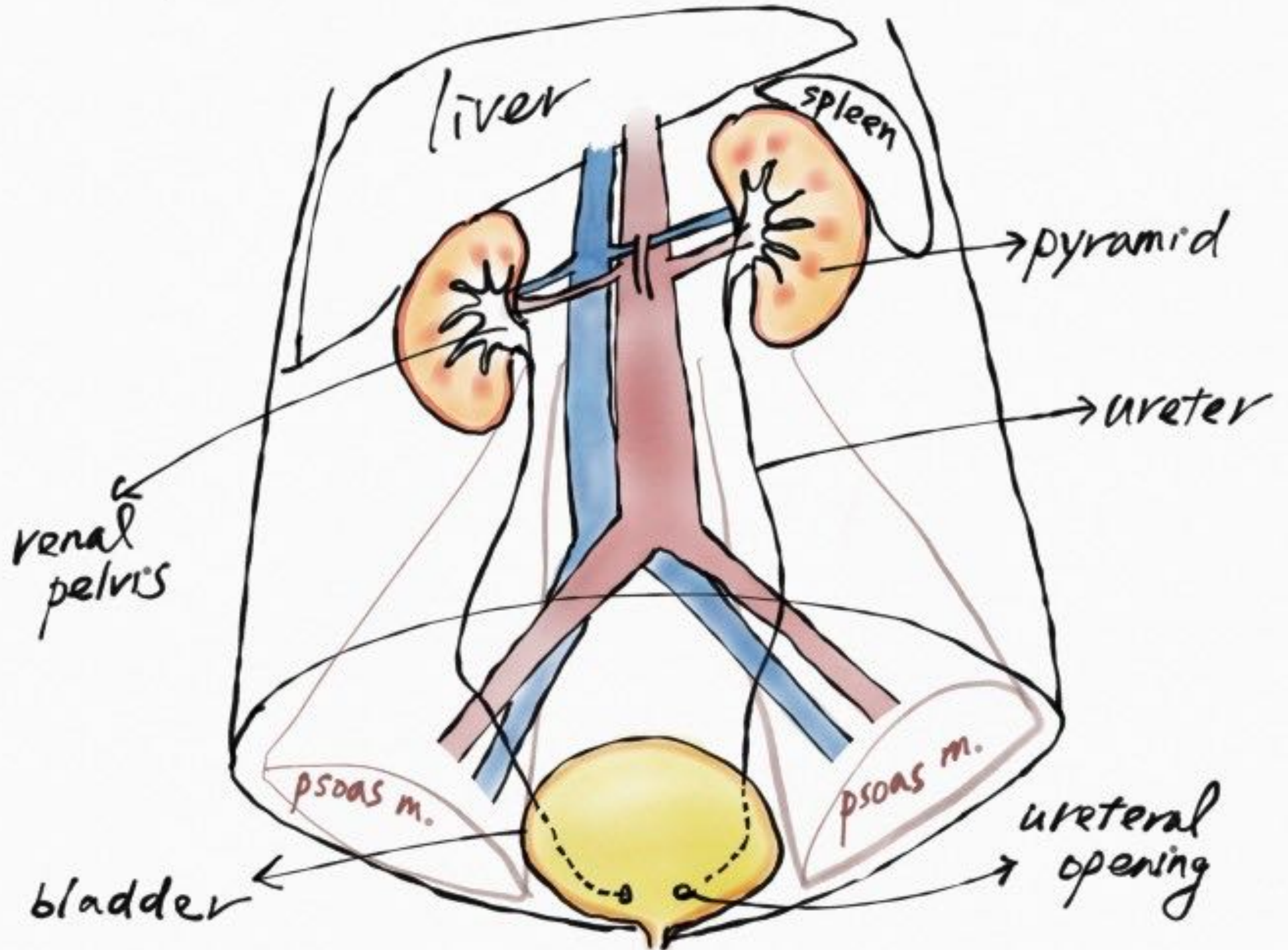


33F, low abdominal pain & shock



FAST for moving fluid

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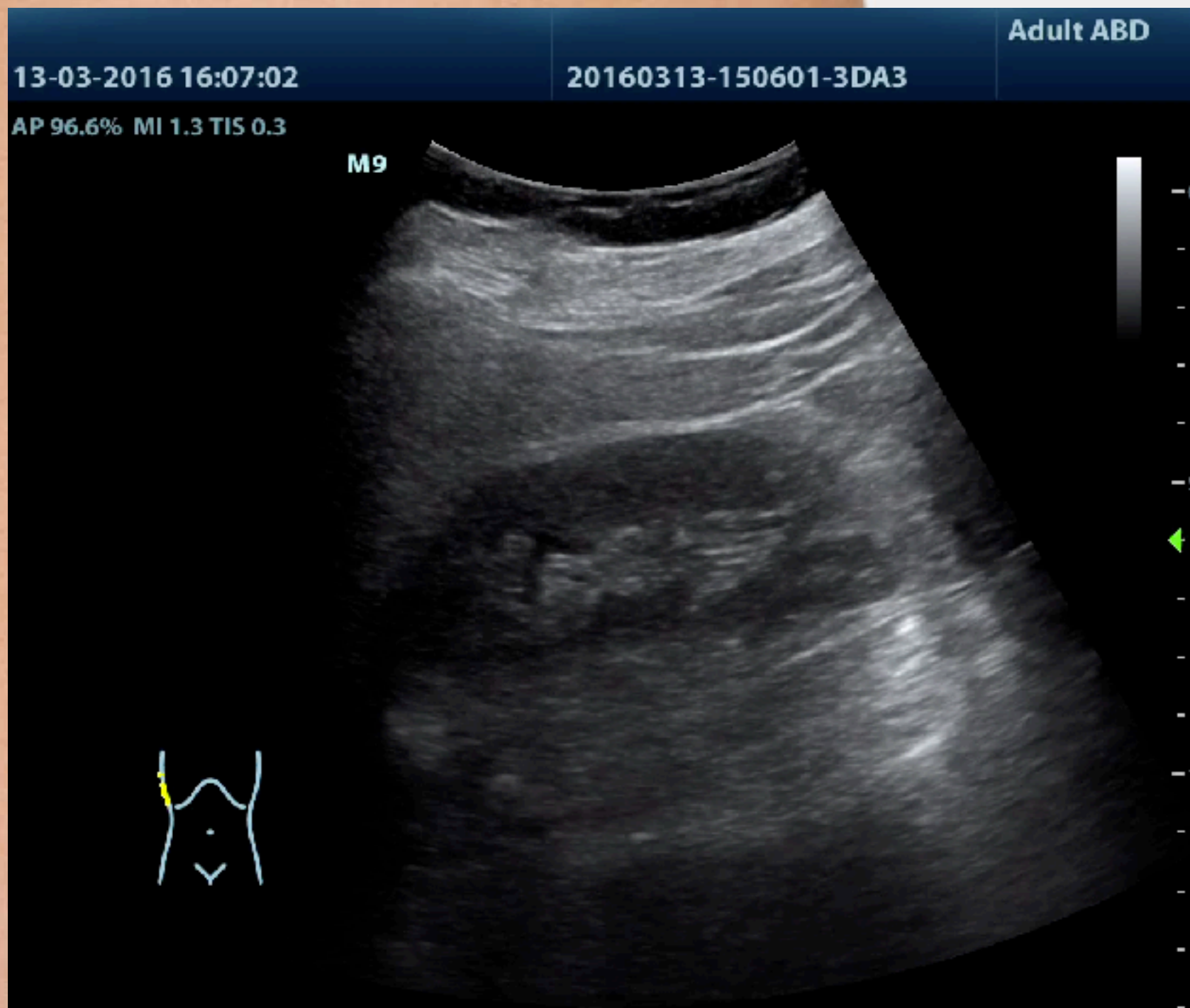
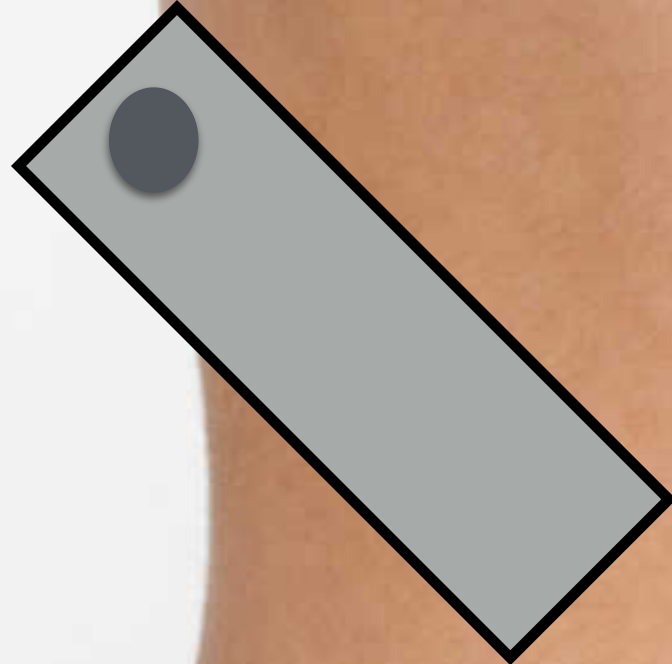


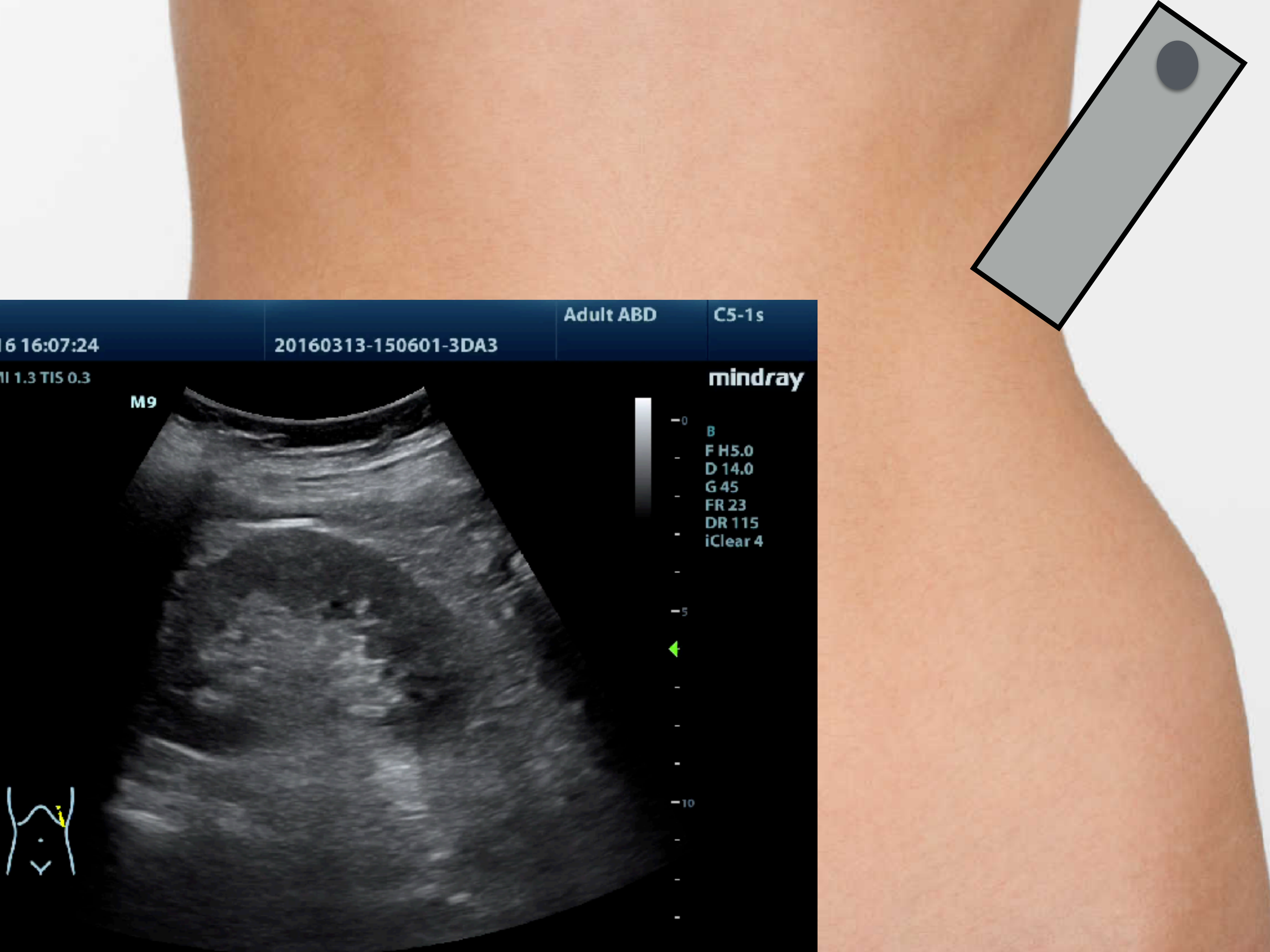
Where ?

K

u

B





16 16:07:24 20160313-150601-3DA3 Adult ABD C5-1s

11 1.3 TIS 0.3

M9

mindray

-0
B
F H5.0
D 14.0
G 45
FR 23
DR 115
iClear 4

-5

-10

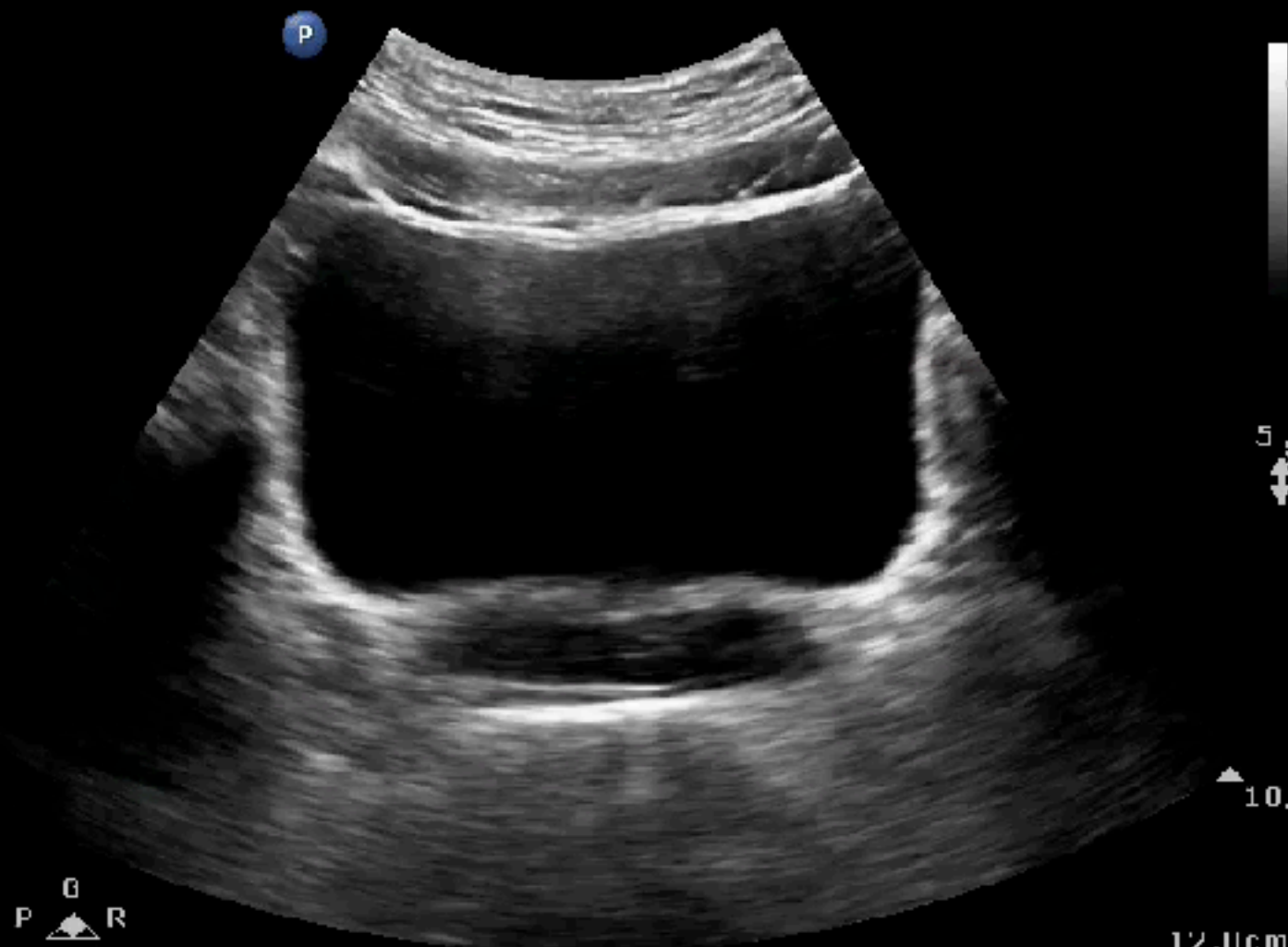
C. Nerve
C6-2
22 Hz
12.0cm

2D

Gen
Gn 60
C 53
2/3/4



0
P R
2.0 6.0



12.11cm



C. Nerve
C6-2
22 Hz
12.0cm

2D

Gcn
Gn 60
C 53
2 / 3 / 4



0
P R
2.0 6.0

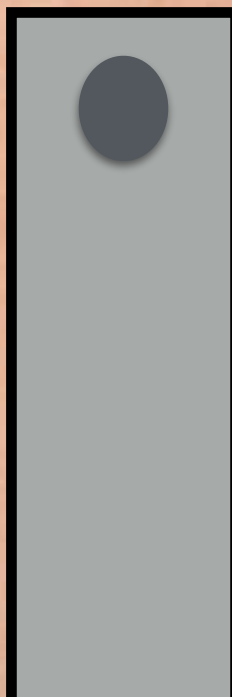
P



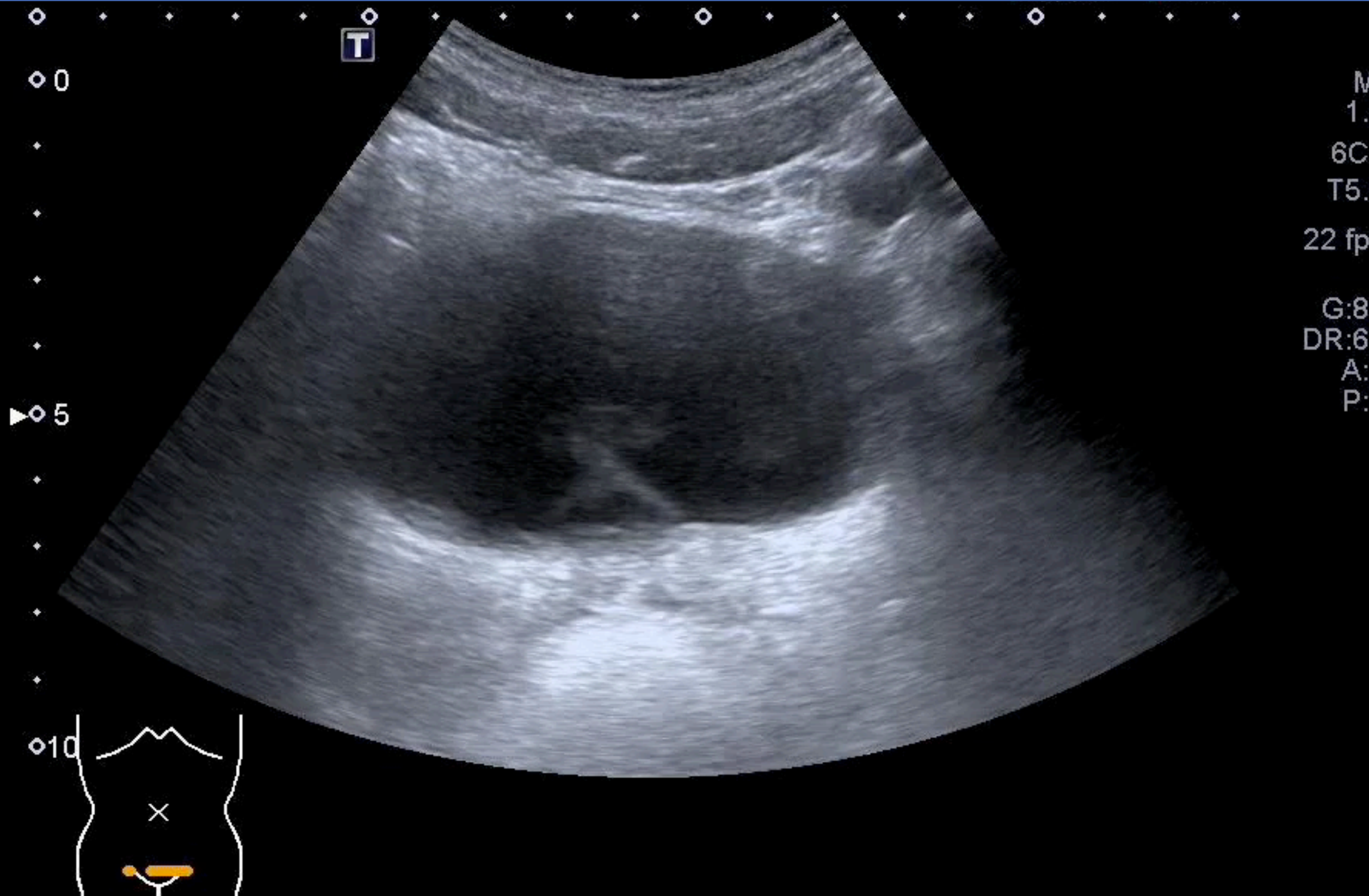
5

10

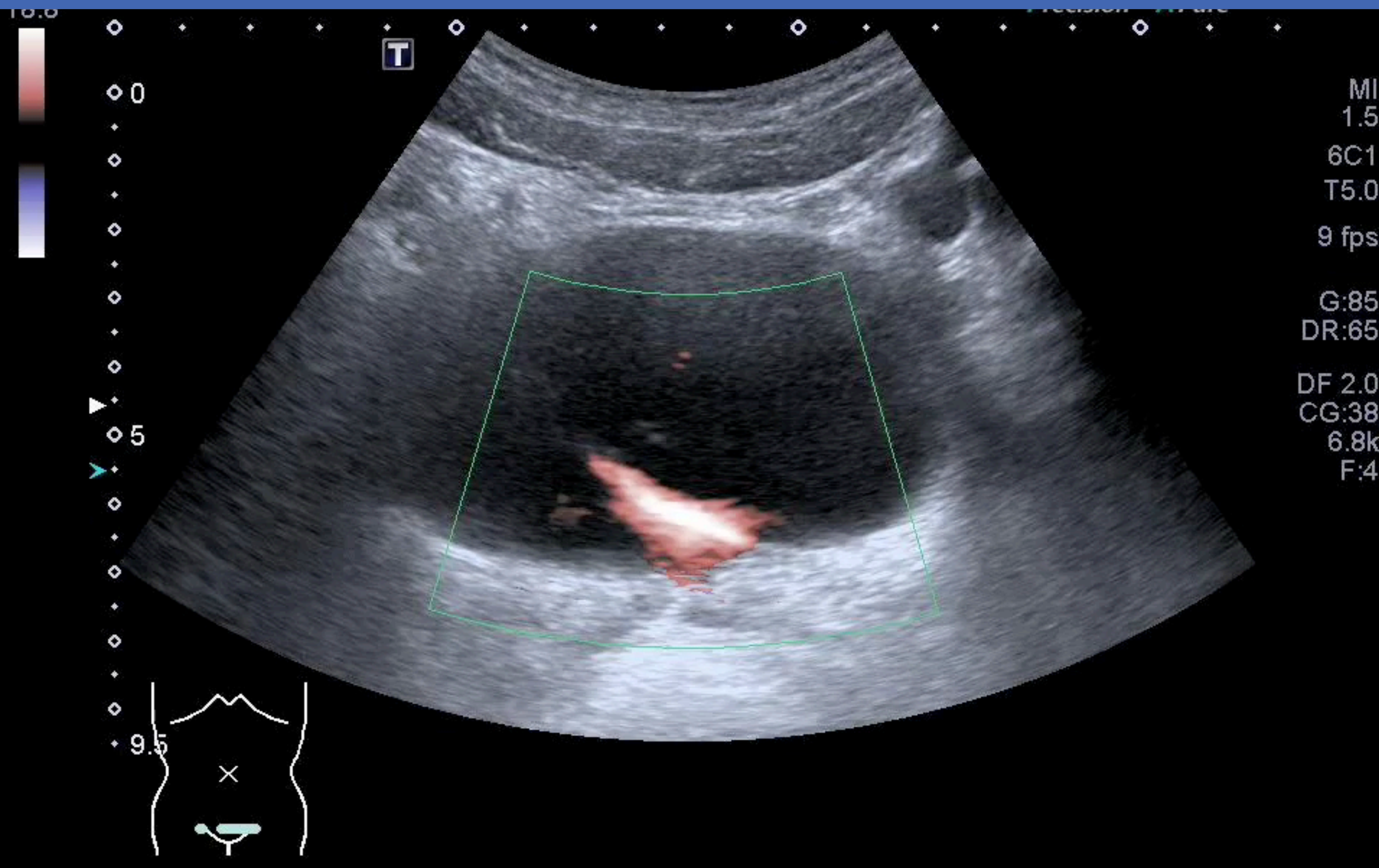
12.0cm



Urinary jet



Urinary jet



When will you use US ?



Pain

Infection

Failure

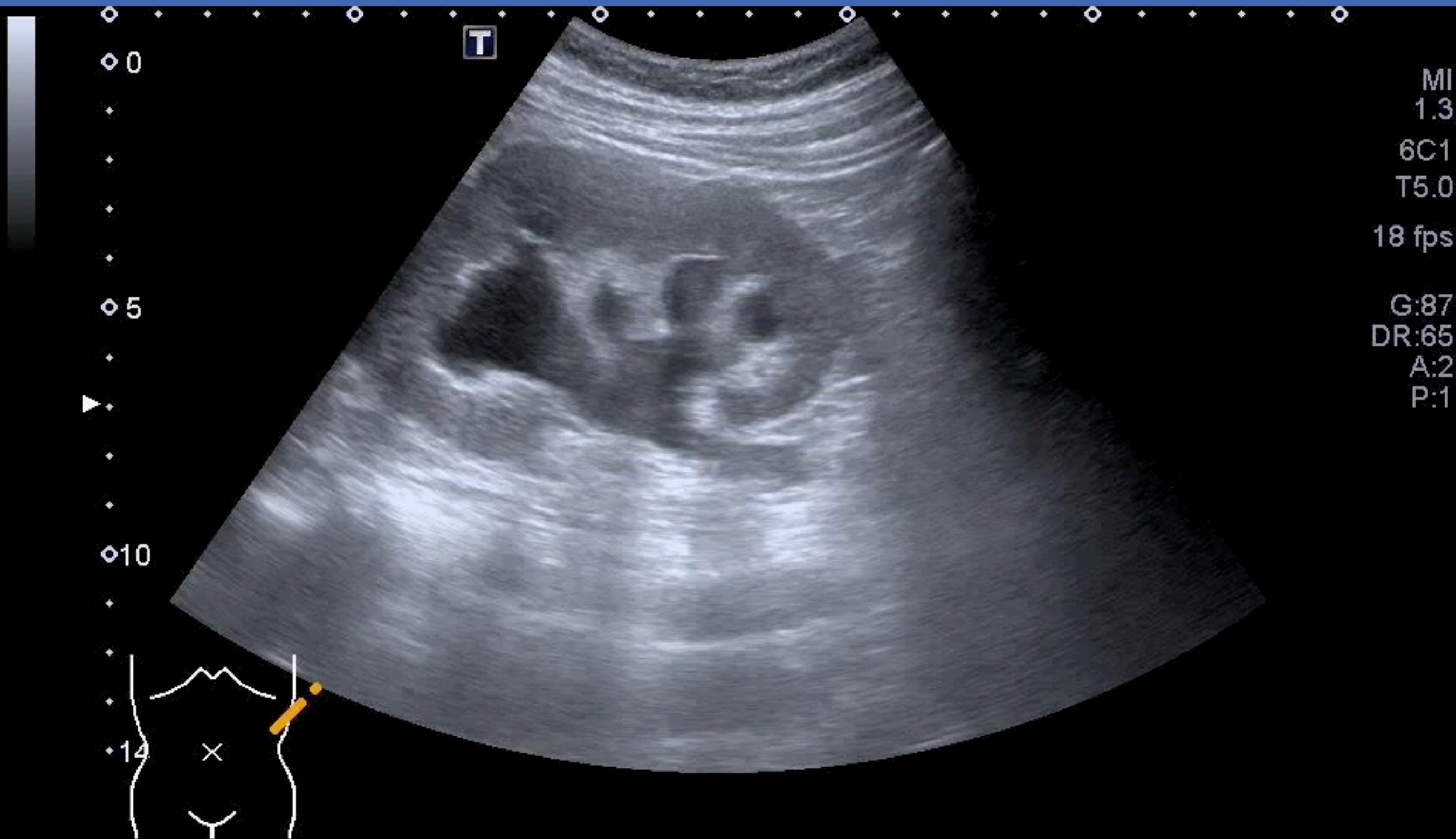
GU emergency

POCUS first

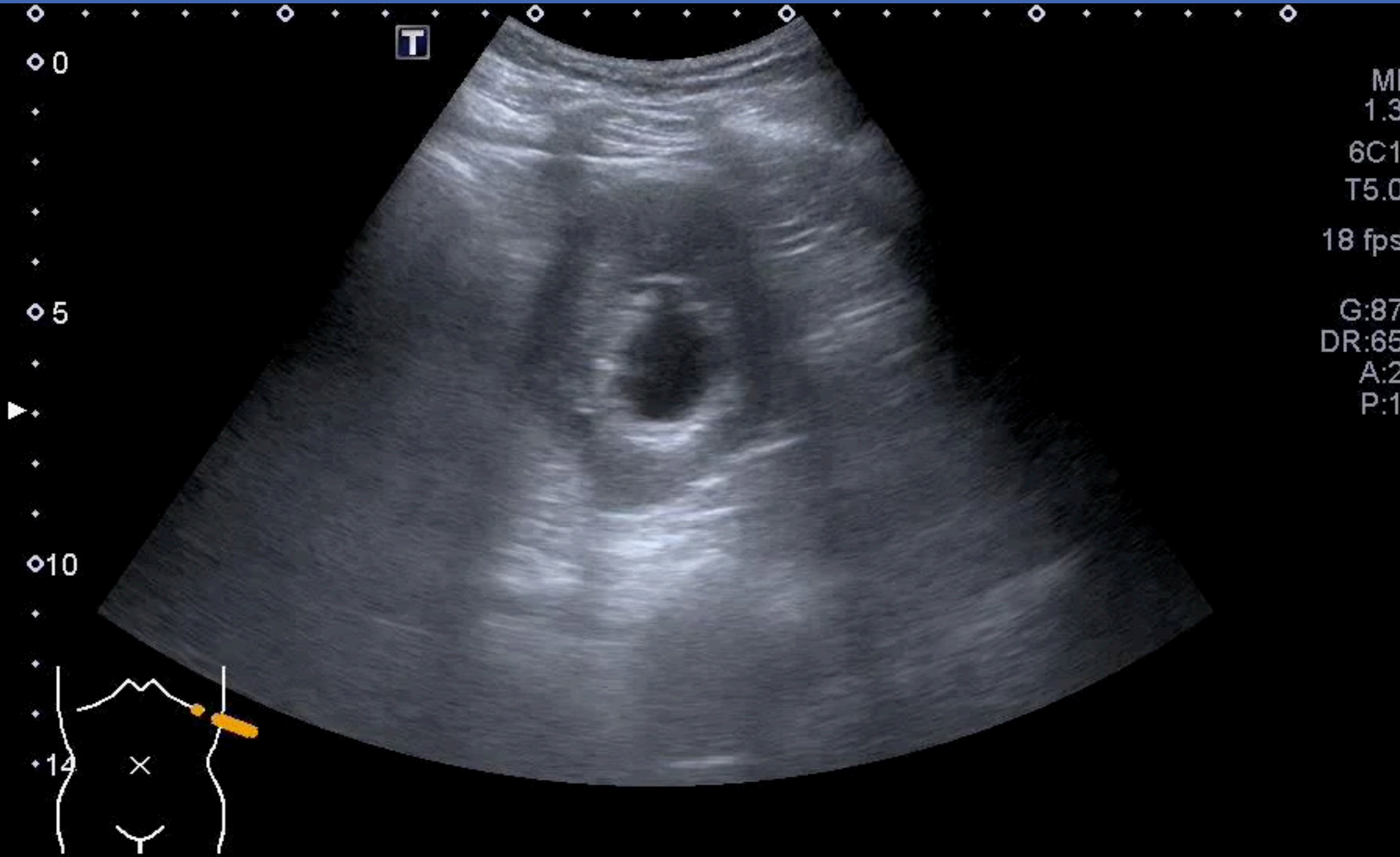
or

Urine first

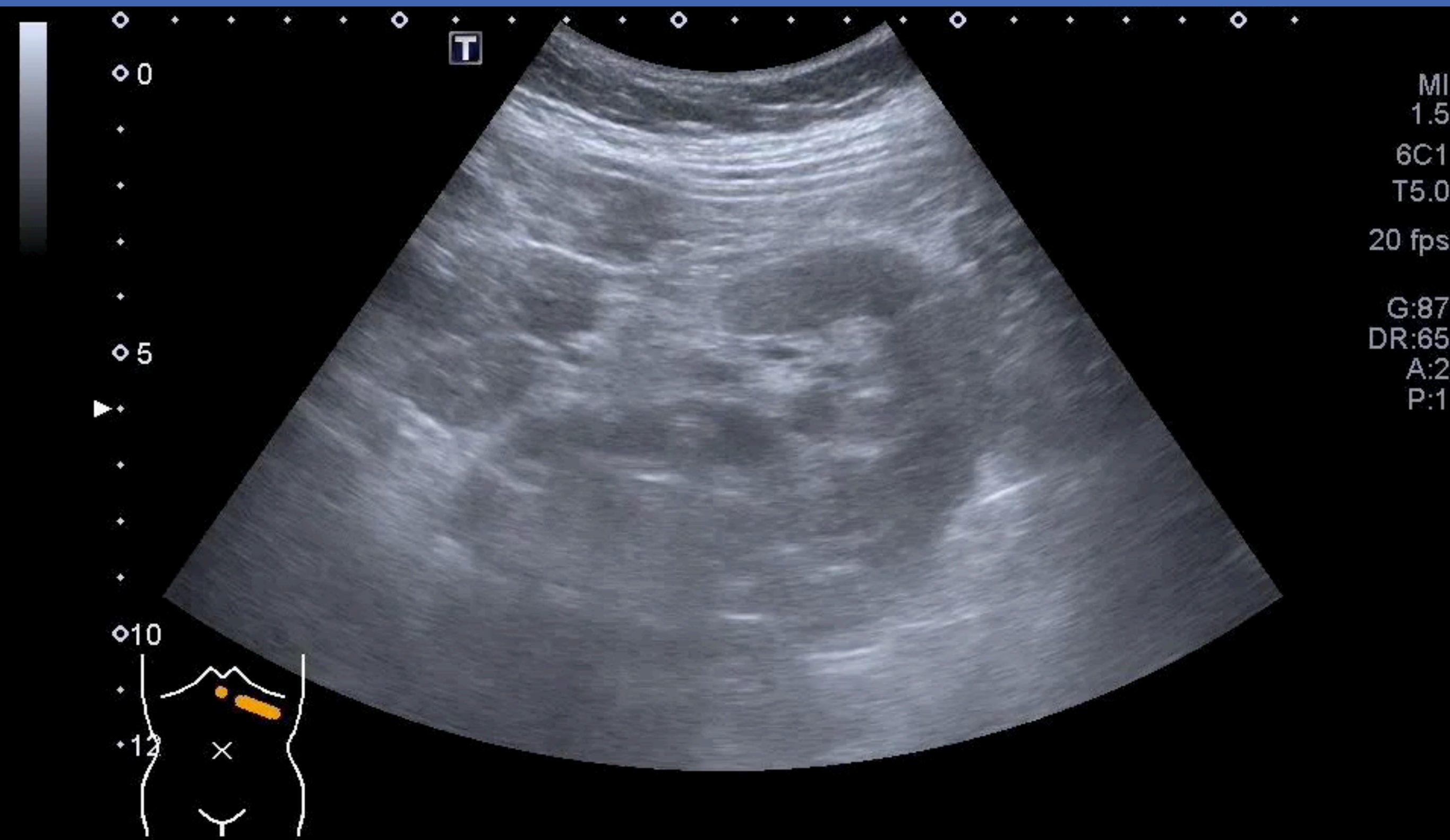
What do you see ?



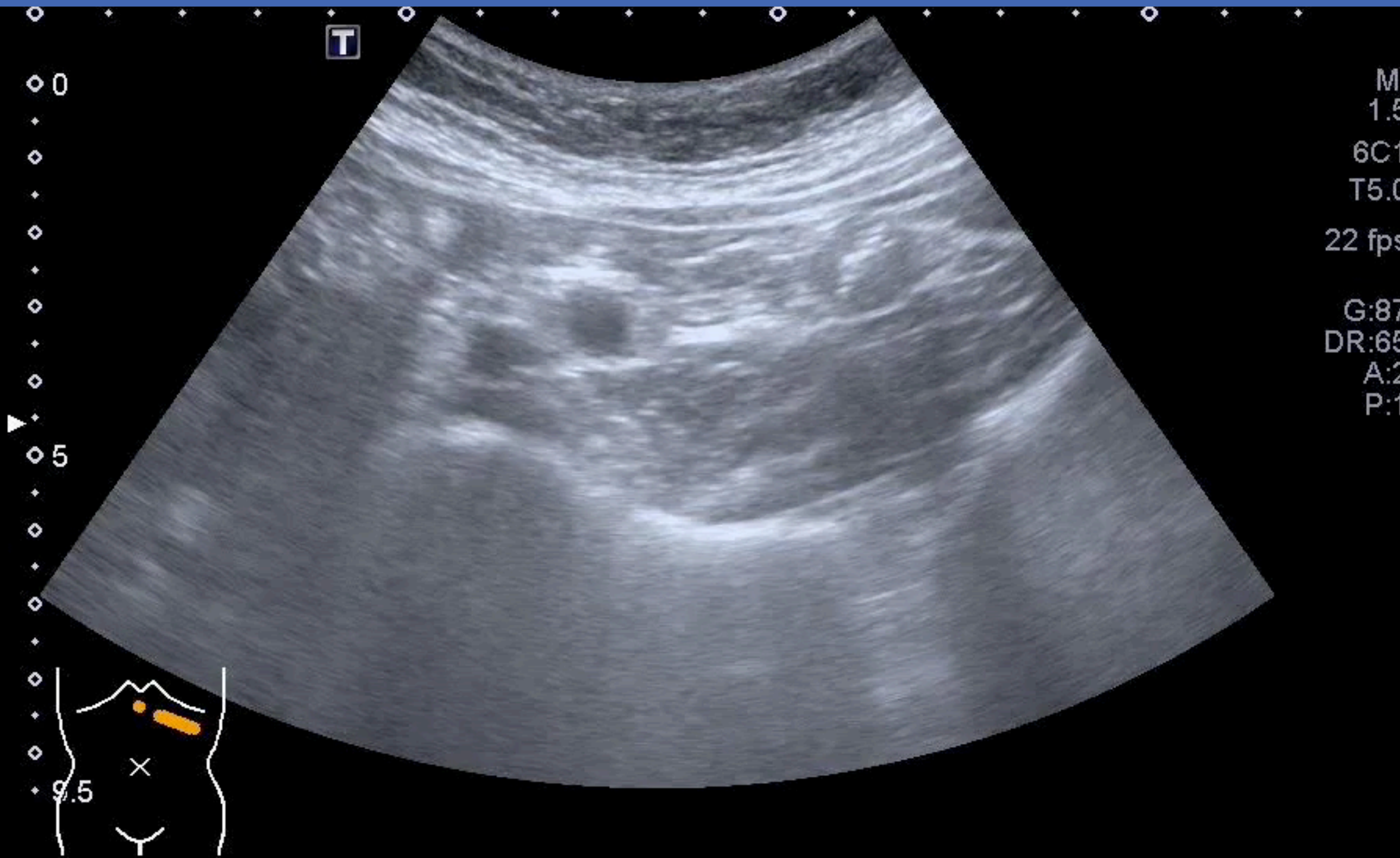
Where is ureter ?



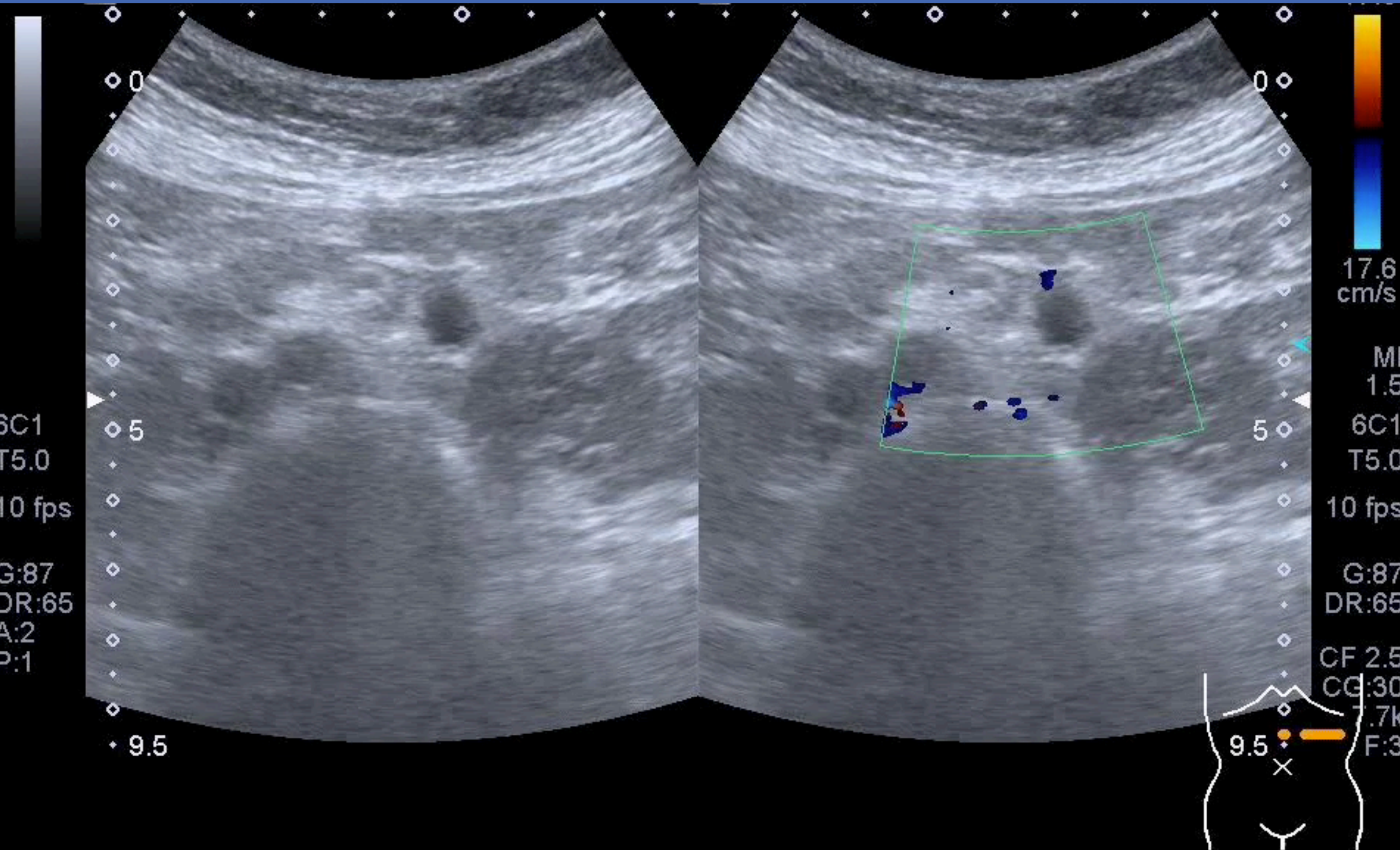
Position !!!



3 points search



Twinkling artifact





**A swollen leg,
what will you do
??**



Cellulitis

Abscess

N.F.

DVT

Others ?



Cellulitis

Abscess

N.F.

DVT

Others ?



Wells score for DVT assessment

Active cancer (patient receiving treatment for cancer within the previous 6 months or currently receiving palliative treatment)	1
Paralysis, paresis, or recent plaster immobilization of the lower extremities	1
Recently bedridden for ≥ 3 days, or major surgery within the previous 12 weeks requiring general or regional anesthesia	1
Localized tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3 cm larger than the asymptomatic side (measured 10 cm below the tibial tuberosity)	1
Pitting edema confined to the symptomatic leg	1
Collateral superficial veins (nonvaricose)	1
Previously documented deep venous thrombosis	1
Alternative diagnosis at least as likely as deep venous thrombosis	-2

≥ 2

Pretest <
2

+

D-dimer
-ve





Likely

+ve D

US

Transducers



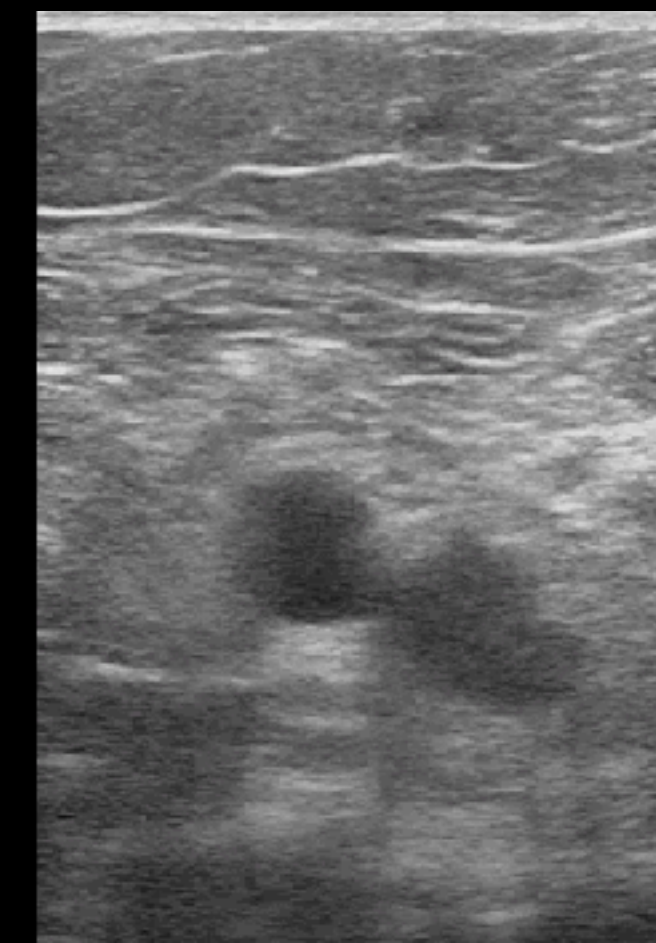
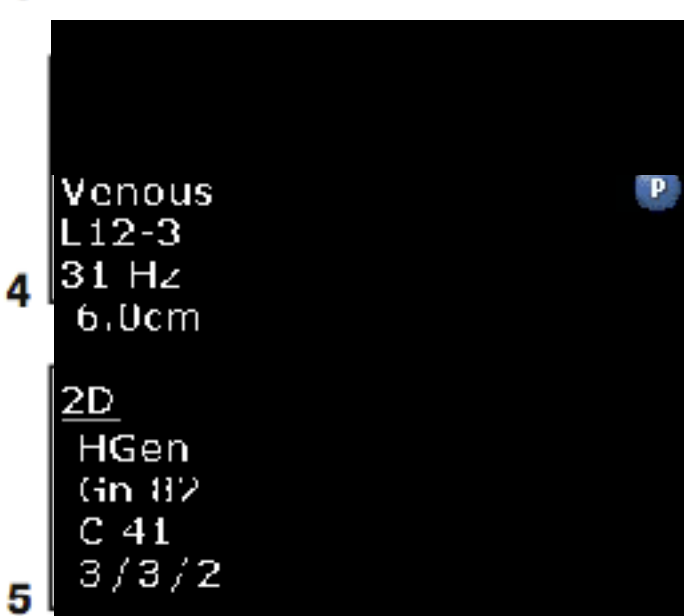
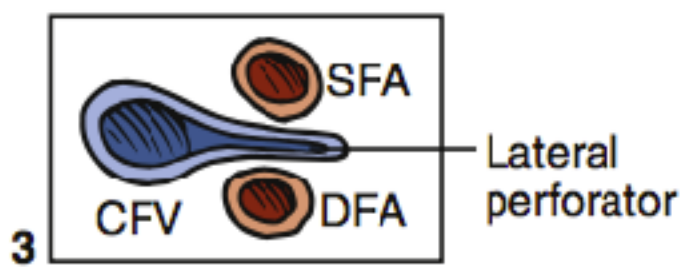
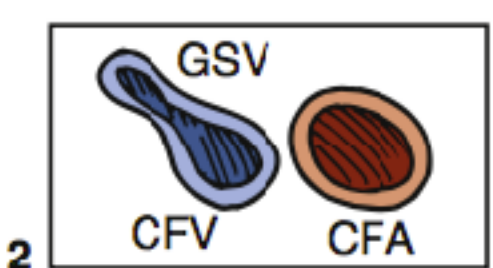
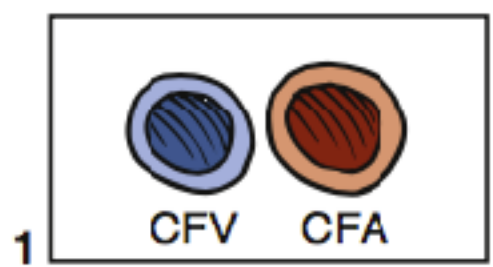
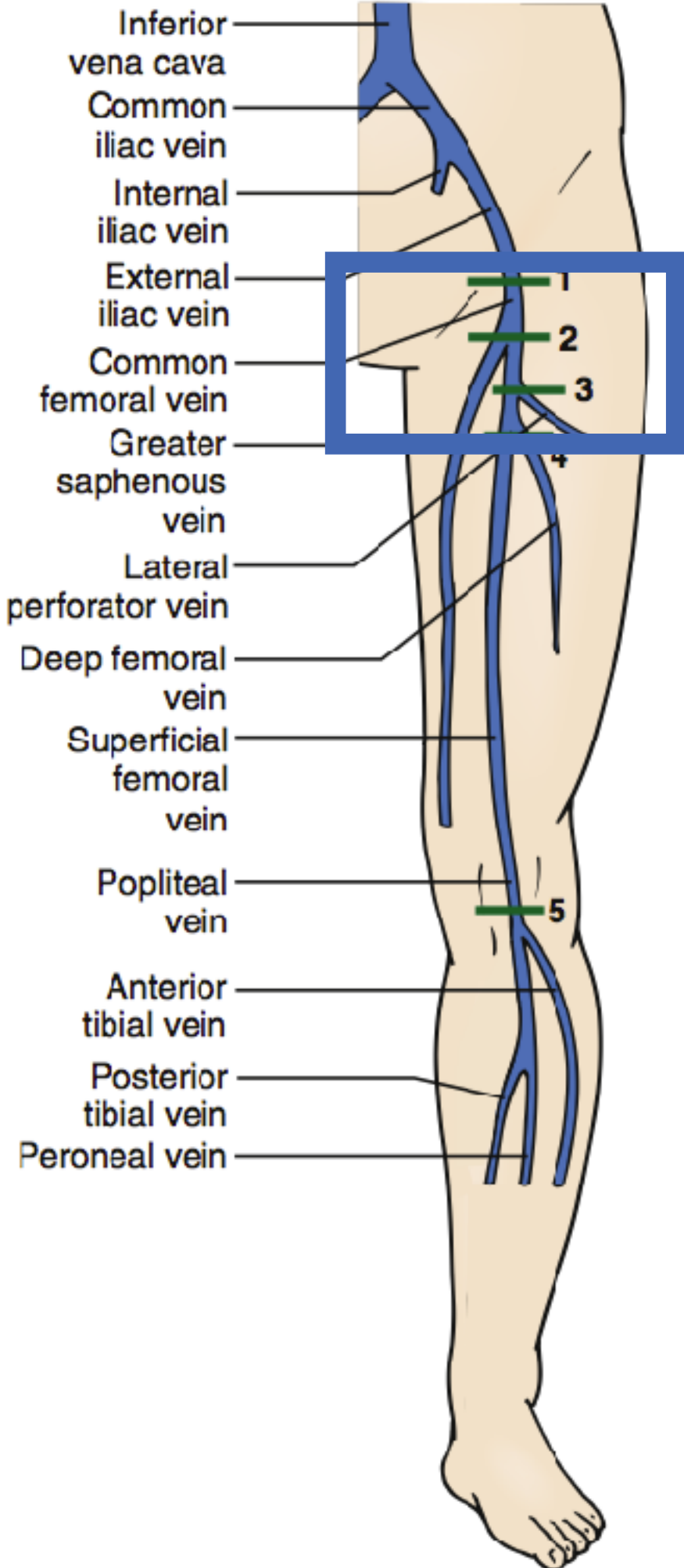
Transverse

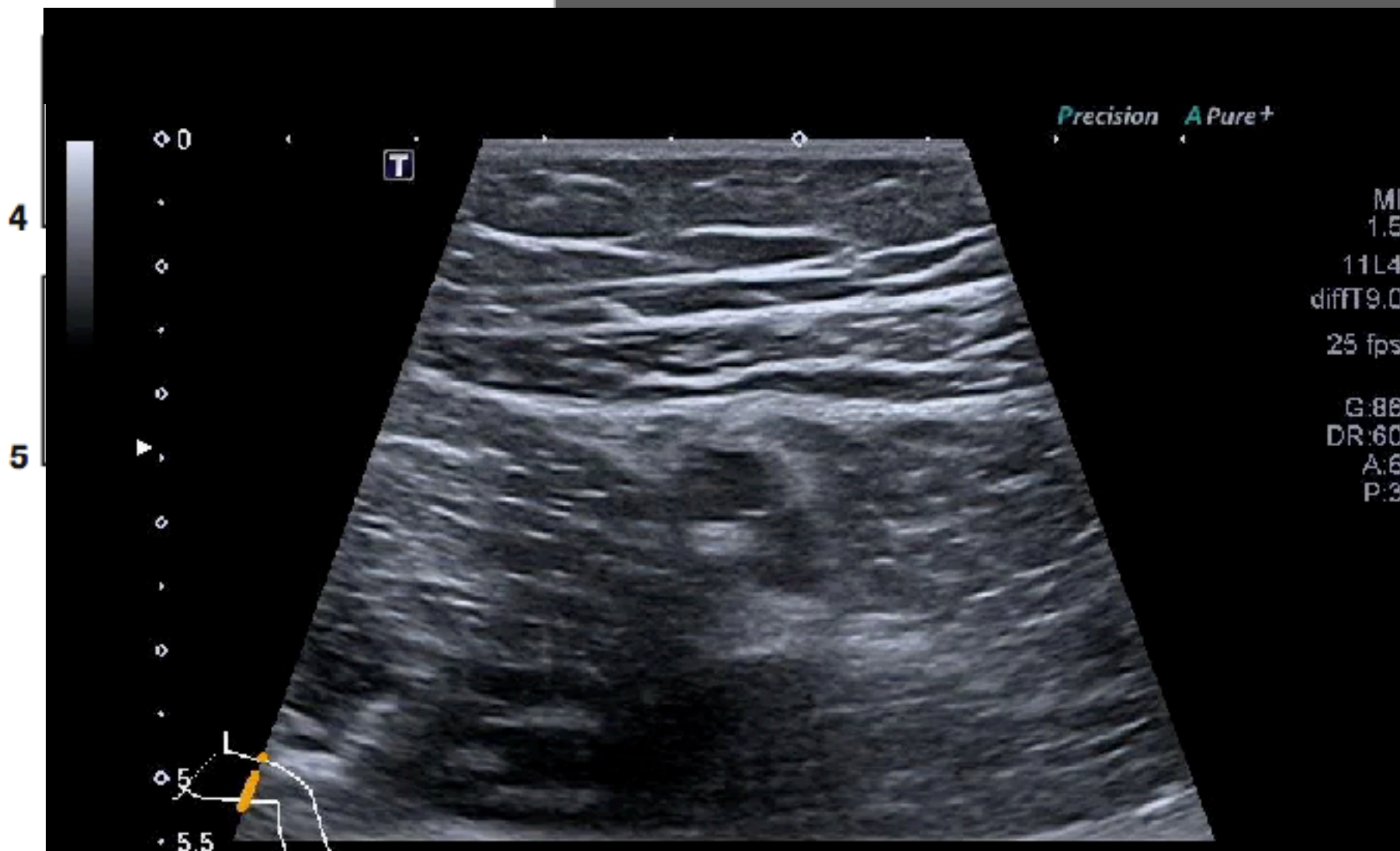
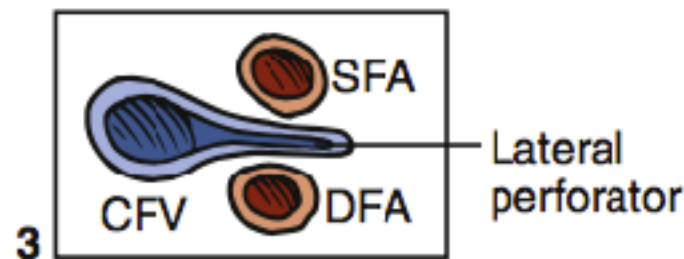
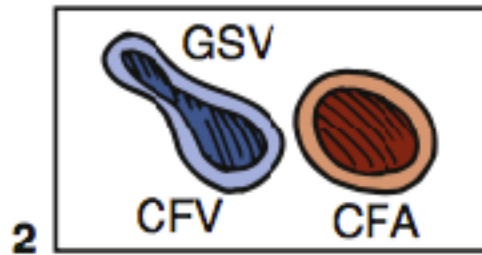
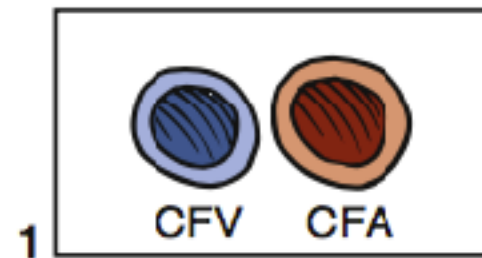
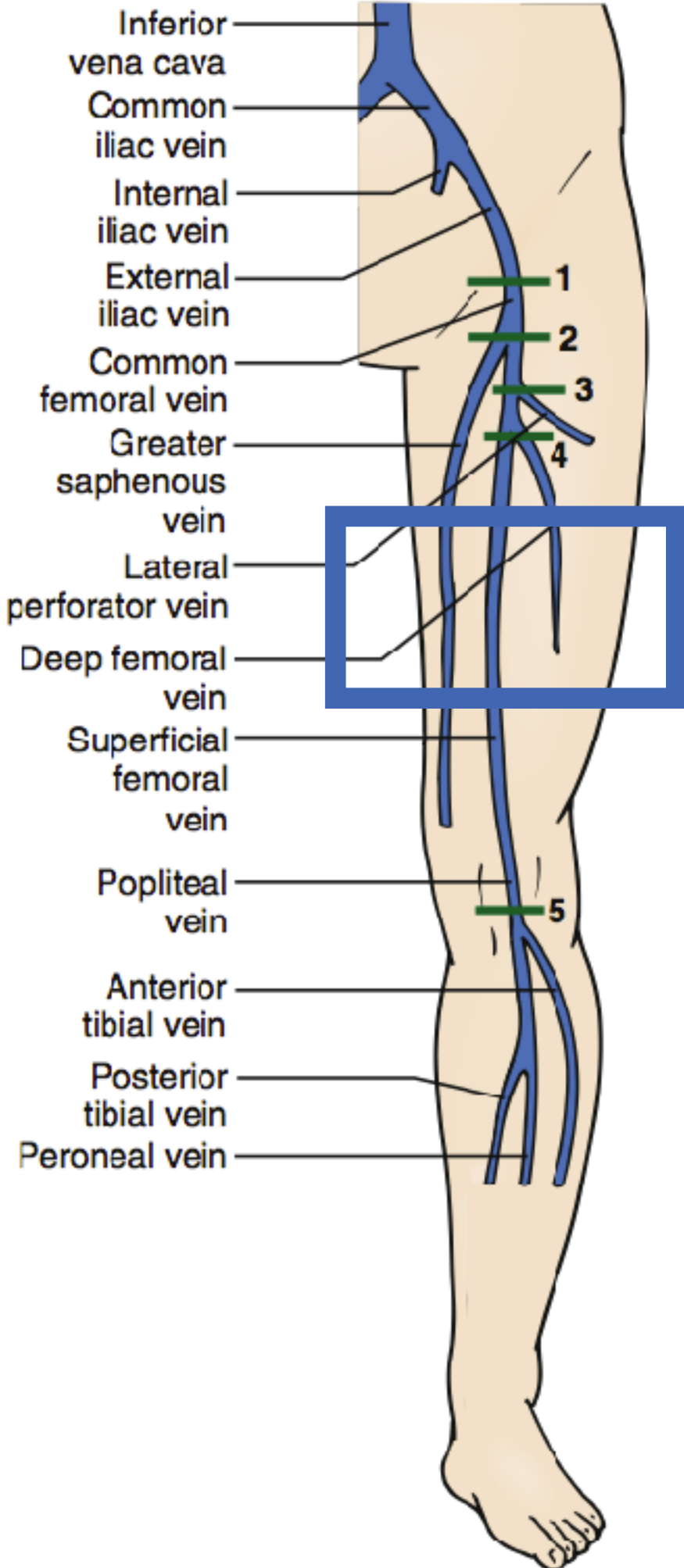
Compression

3 regions

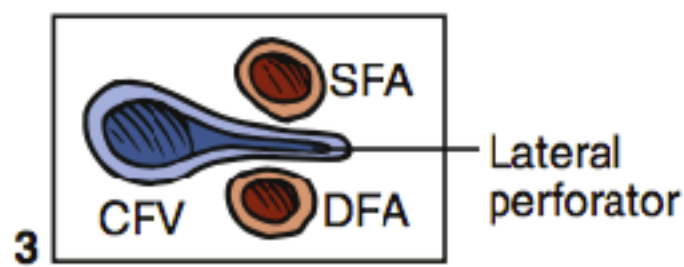
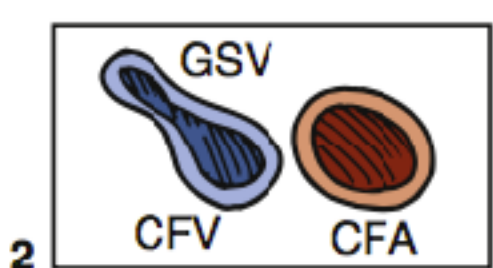
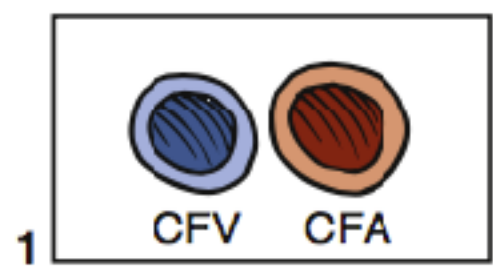
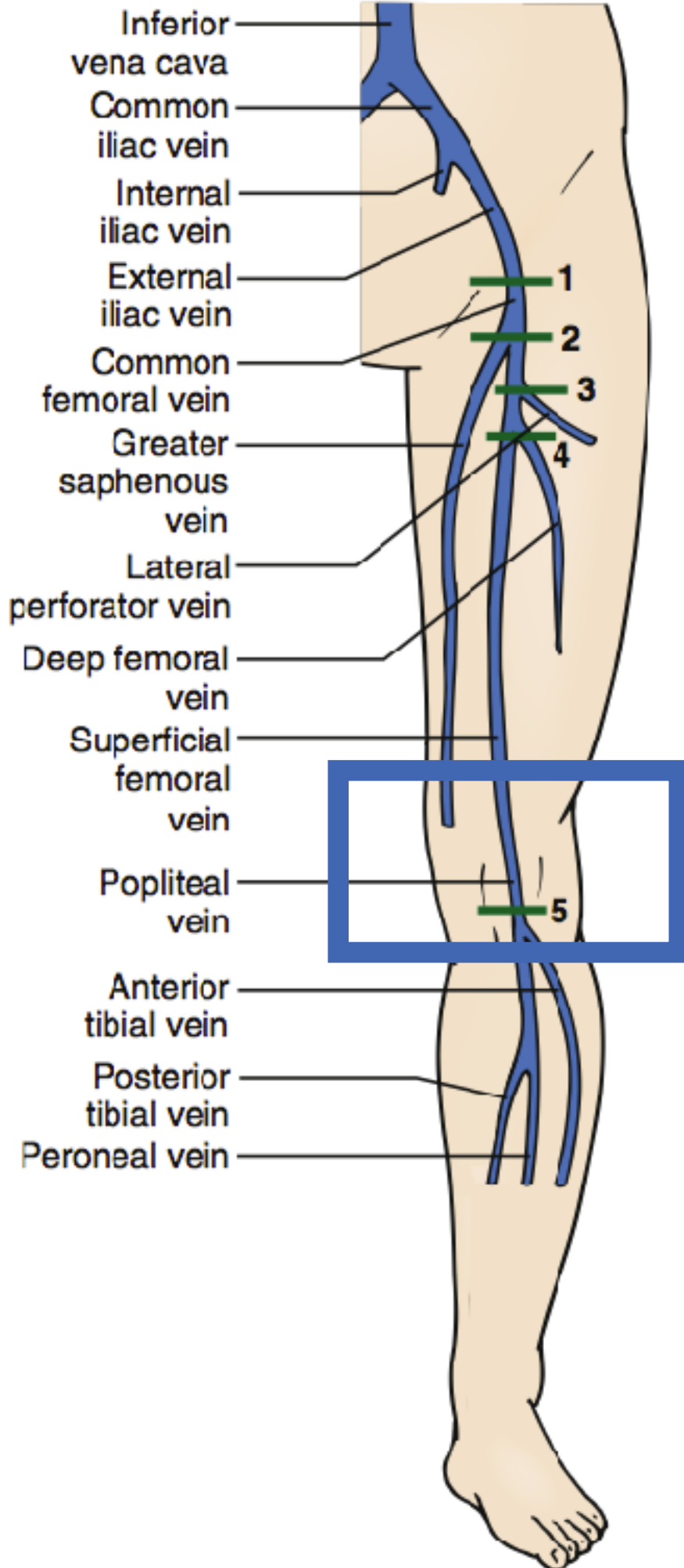
Position







3



3

Inability to **completely compress** the venous lumen

Presence of a clot

Inadequate position or pressure

CFV

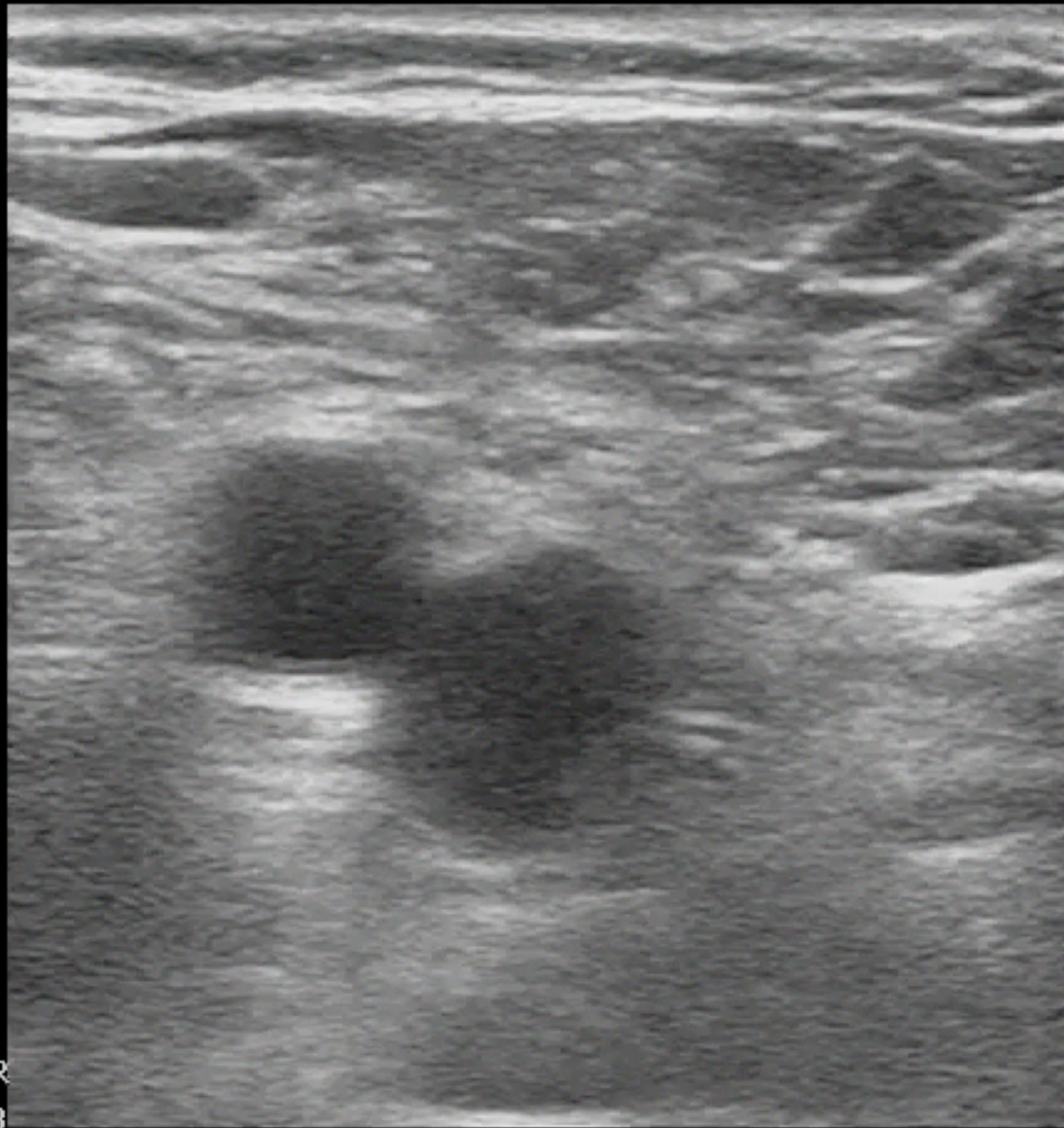
Venous
L12-3
37 Hz
4.0cm

2D

HGen
Gn 96
C 41
3/3/2



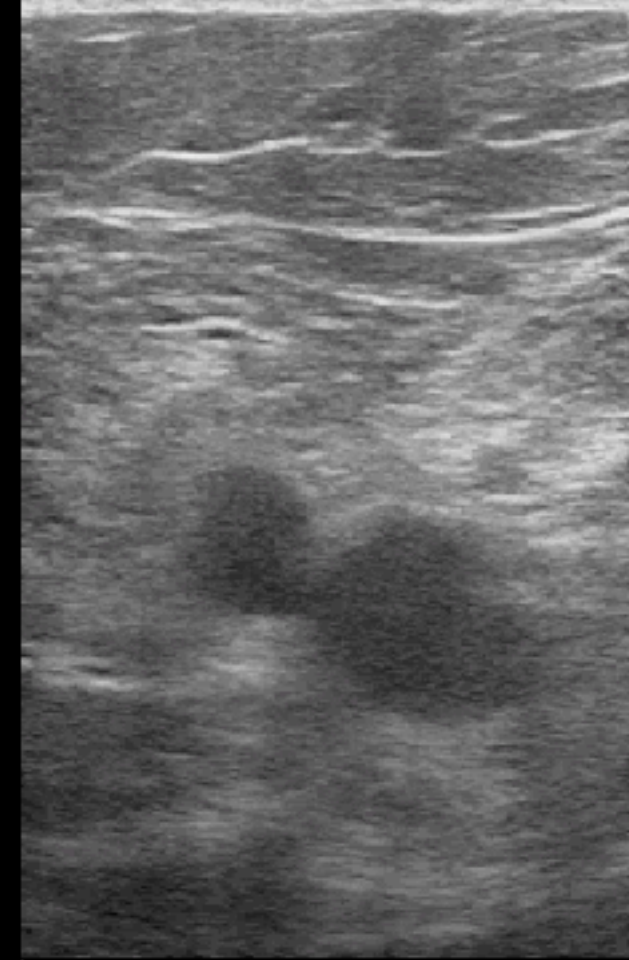
P  R
4.4 8.8



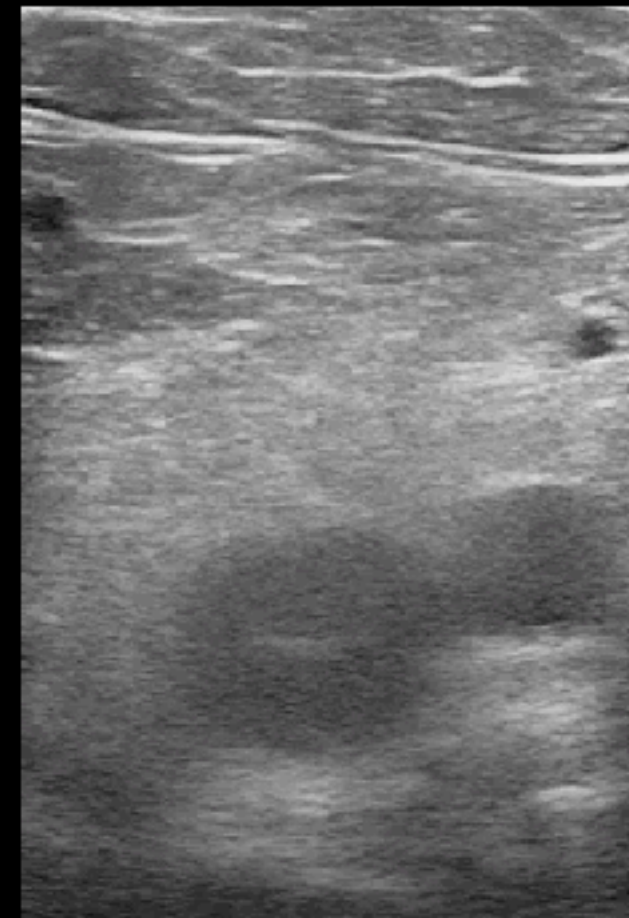
4.0cm



P
R
4.4 8.8



5.0
6.0cm



5.0

P
R



DVT assessment

3 regions

Collapse 100%

Proximal only

3

ST-MSK

Infection

Effusion

Fracture

SonoAnatomy

Skin

Subcutaneous tissue

Lymph nodes

Fascia

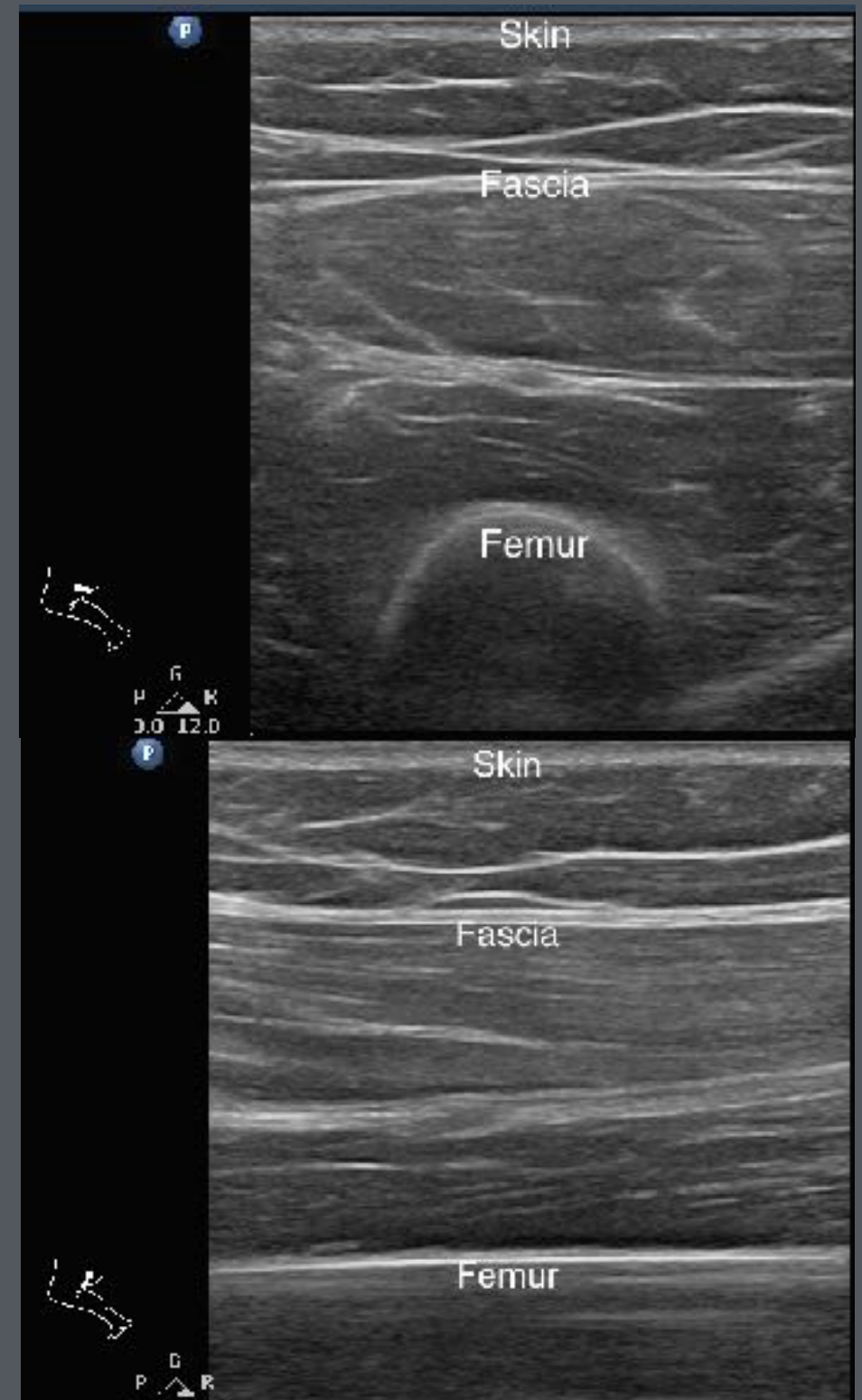
Muscles

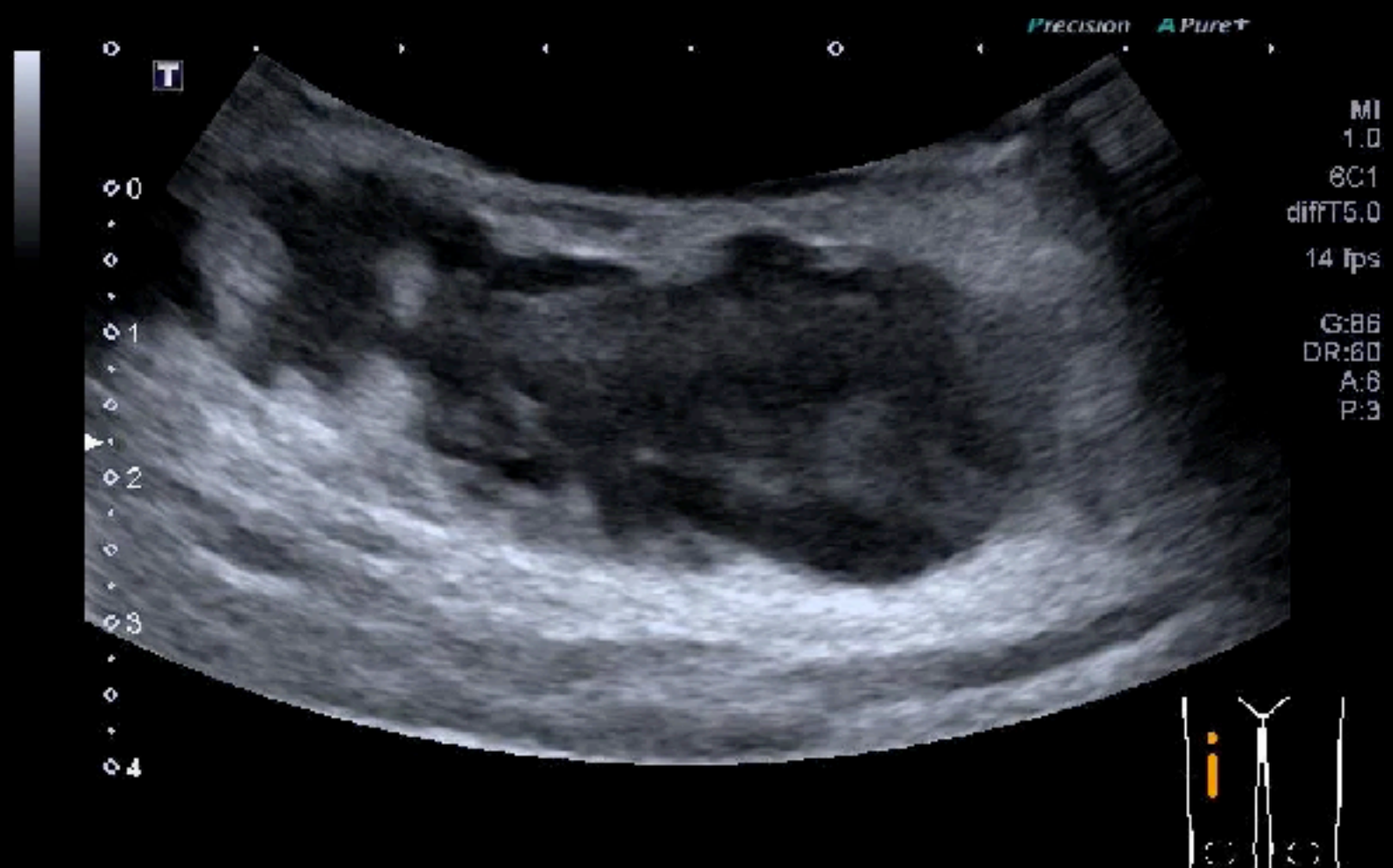
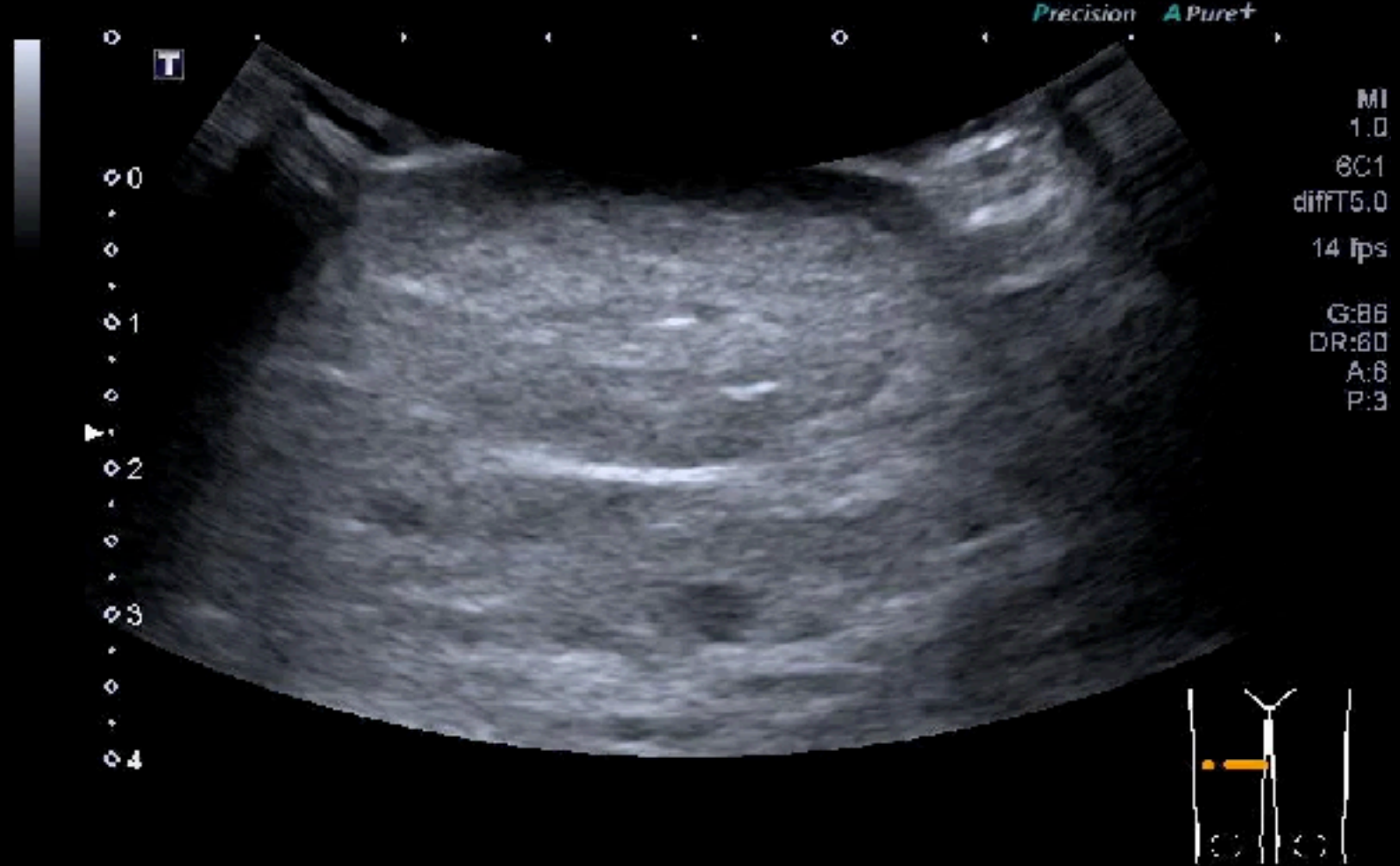
Tendon

Vascular structures

Bone

3





P

QT

Patella

Fat

Femur



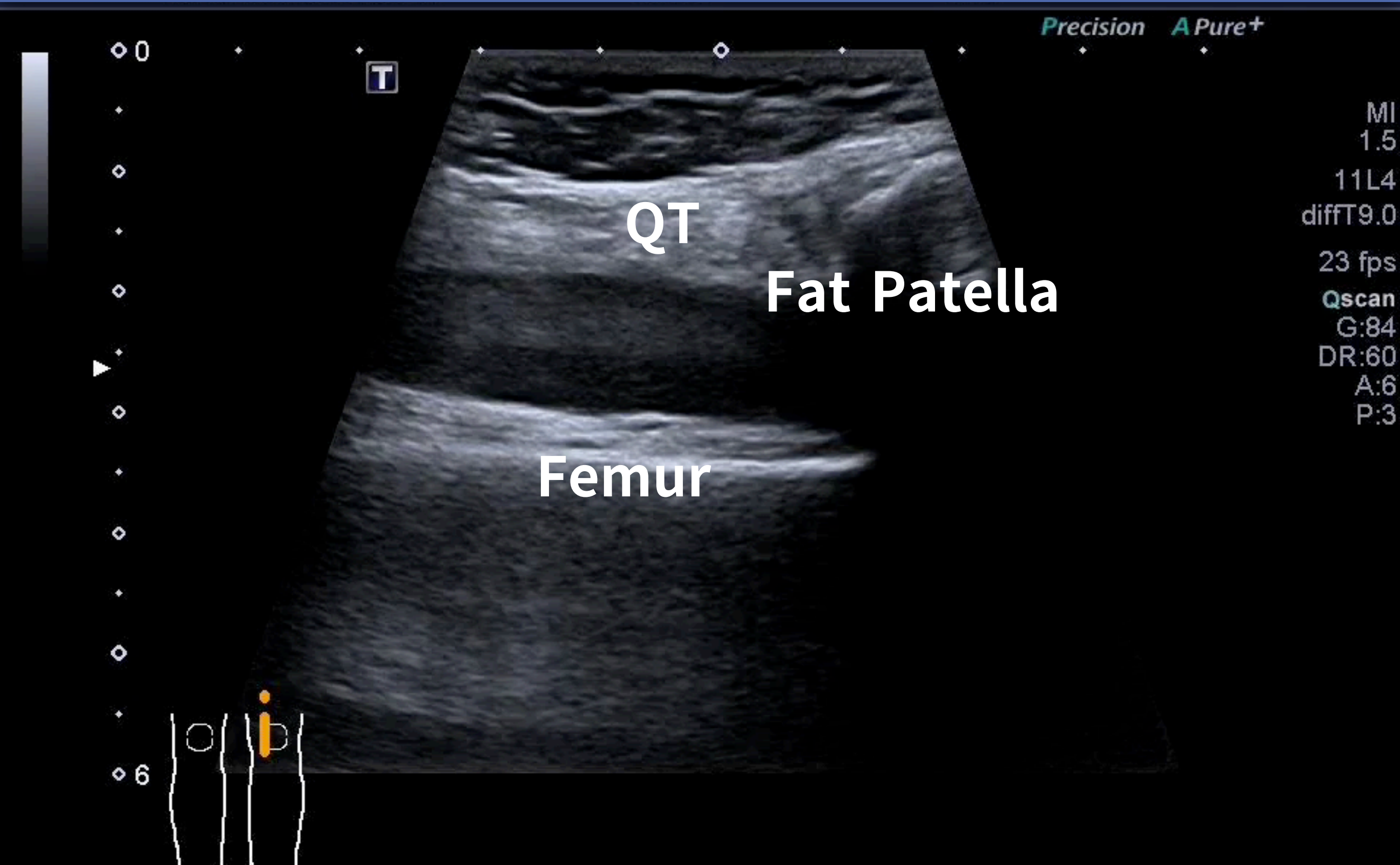
P G R
3.0 12.0

2.5cm

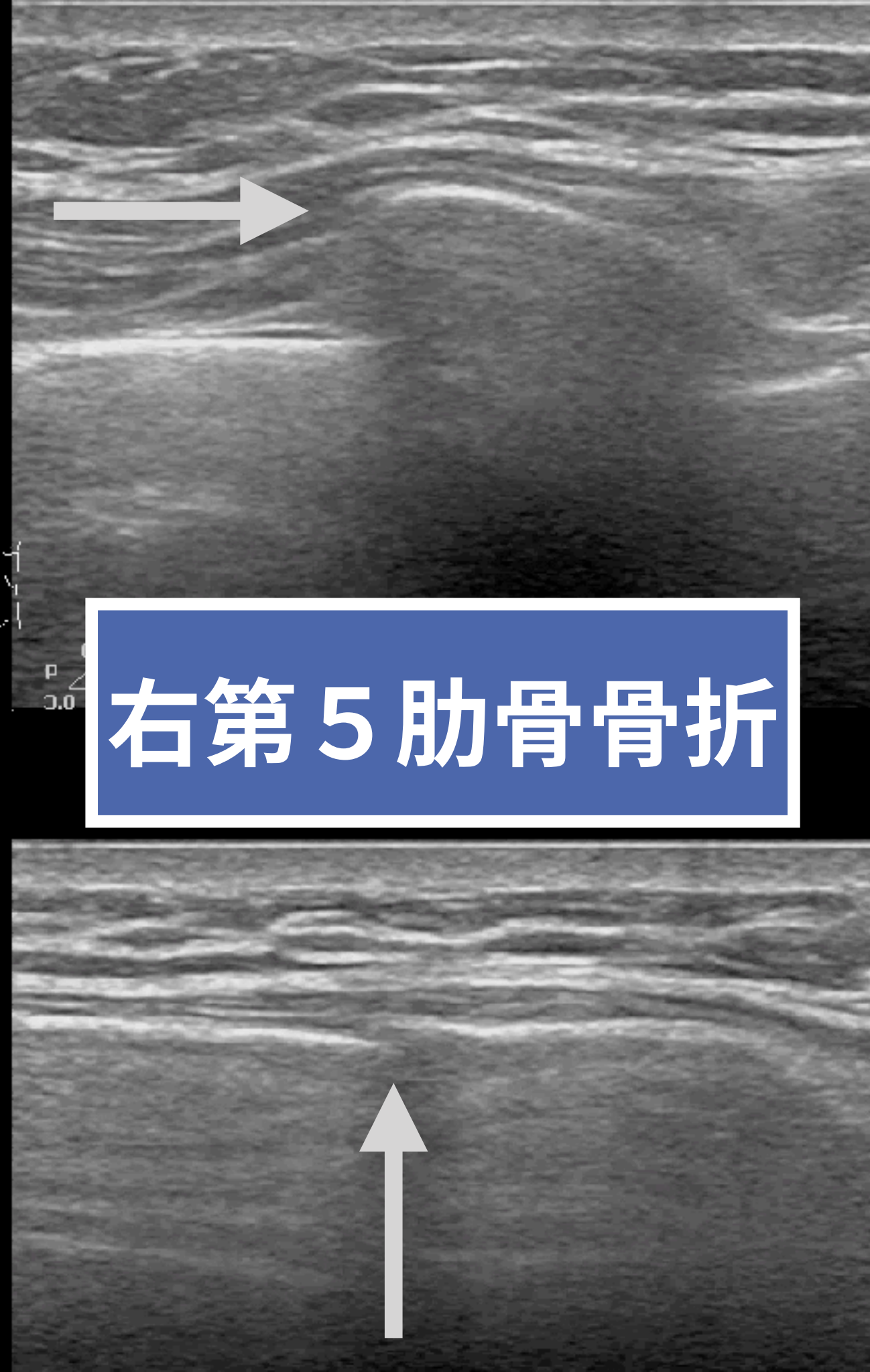
膝蓋很腫，無法彎也無法站



Knee hemarthrosis



BAT & R chest pain



POCUS Academy

Let's transform practice today



juice119@gmail.com

FB: Emergency Ultrasound Training Center

