



ULTRASOUND  
PROGRAM



# How to enhance **T**rauma **M**anagement with **U**ltrasound ?

陳國智 西園急診



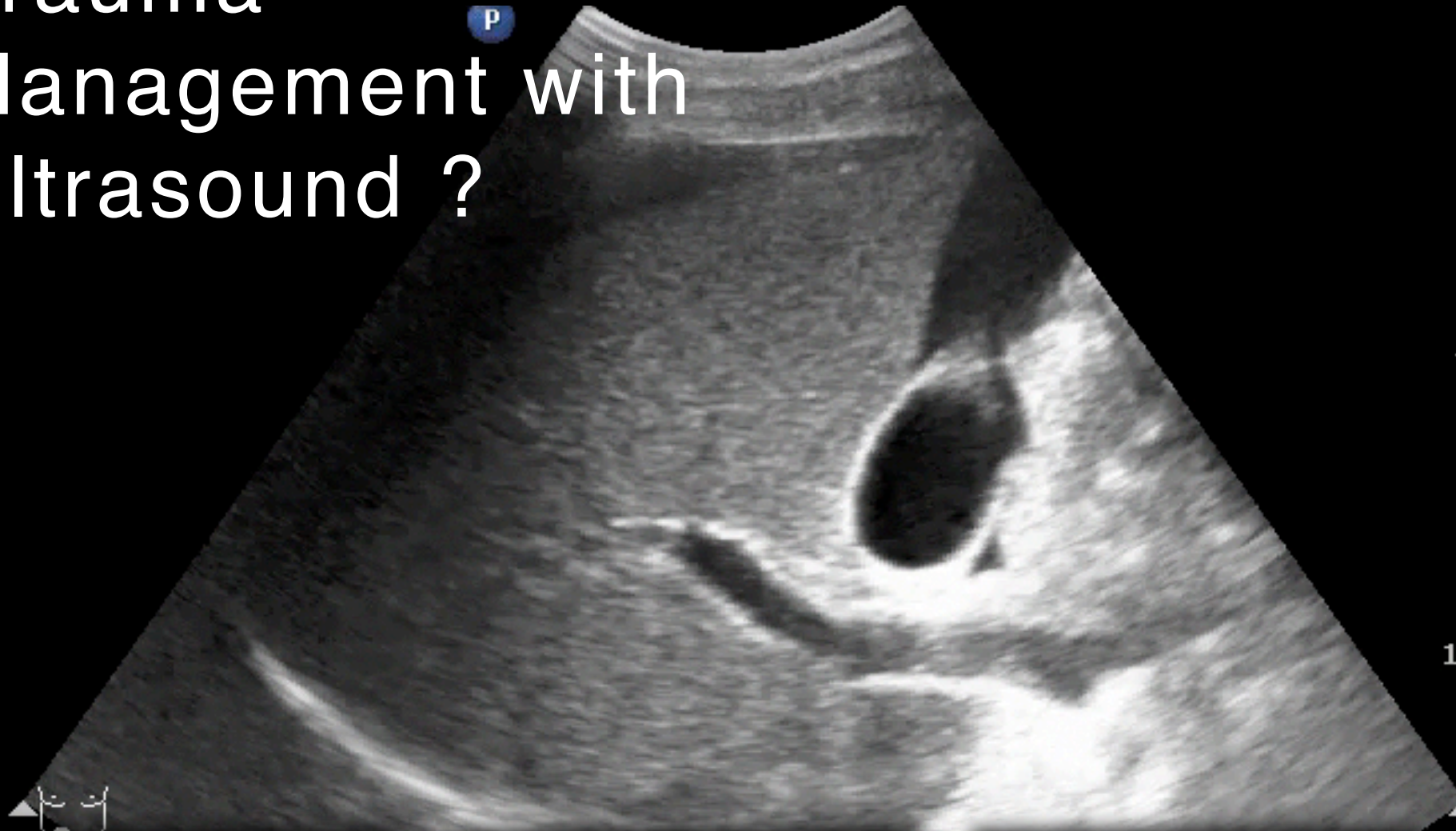
前急診超音波委員會主委  
急救加護重症超音波工作坊負責人  
AEACUS Network President

Faculty

-WINFOCUS, PERCUSS, WFPICC  
201803 Mindray APUSF, Bali

POCUS Academy

# Trauma Management with Ultrasound ?



**Treatment**

**Diagnosis**

**Monitoring**

# TSEM milestone

## 12. Patient Care 12(PC12). 急診超音波 (Emergency Ultrasound)

利用目標導向重點式超音波在床邊進行緊急醫療狀況的評估和診斷、輔助急重症或外傷病人的急救以及協助臨床技術之執行

Has not Achieved Level 1	Level 1	Level 2	Level 3	Level 4	Level 5
	103.描述急診超音波 (emergency ultrasound)之適應症。	104.說明如何取得最佳化的超音波影像，能針對各類重點式超音波的應用，選擇最適當的探頭。  105.具備基本超音波掃描能力(辨識各種器官組織)。  106.執行創傷超音波 (eFAST)檢查。	107.執行目標導向重點式超音波檢查。  108.正確判讀所得影像。  109.執行急診超音波檢查至少 150 例。	110.熟練執行目標導向重點式超音波，在床邊進行緊急醫療狀況的評估和診斷、輔助急重症或外傷病人的急救以及協助臨床技術之執行。	111.進階使用急診超音波，發展新的應用模式。  112.教導急診超音波。
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

25

建議：Case observation direct evaluation CODE/ case-based milestone direct observation/ direct observation with check list



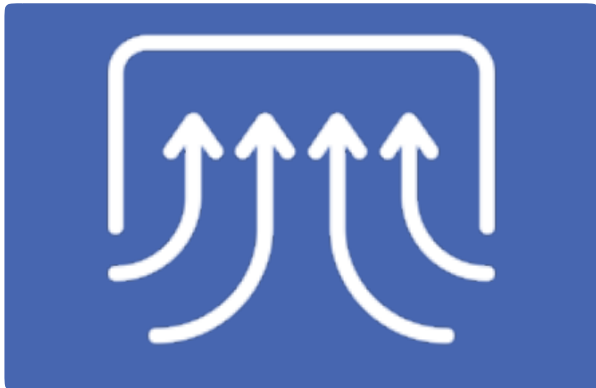
# EFAST

Extended Focused Assessment with  
Sonography for Trauma

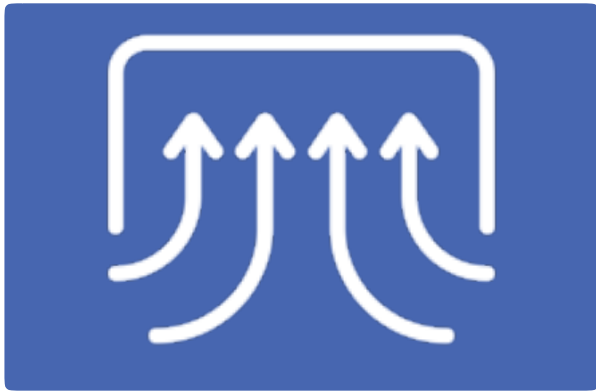
**Life Threatening**

# EFAST

Extended Focused Assessment with  
Sonography for Trauma



# EFAST

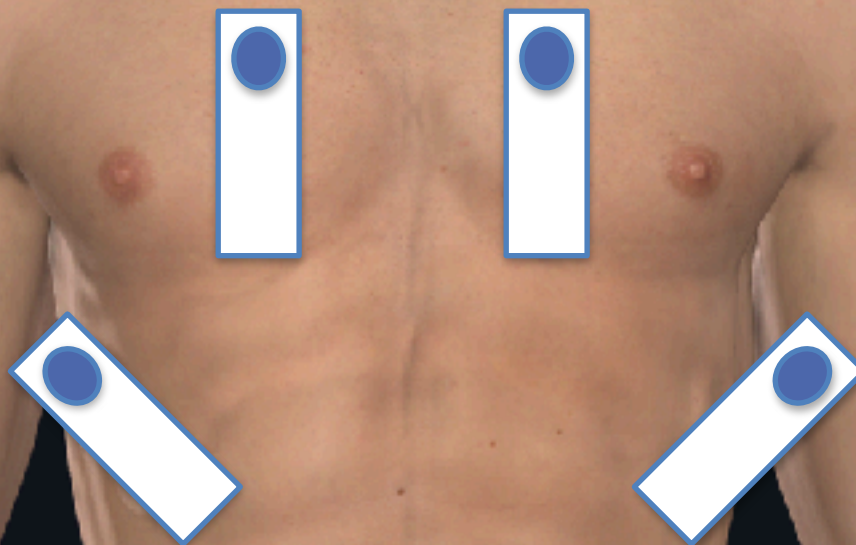


PTX



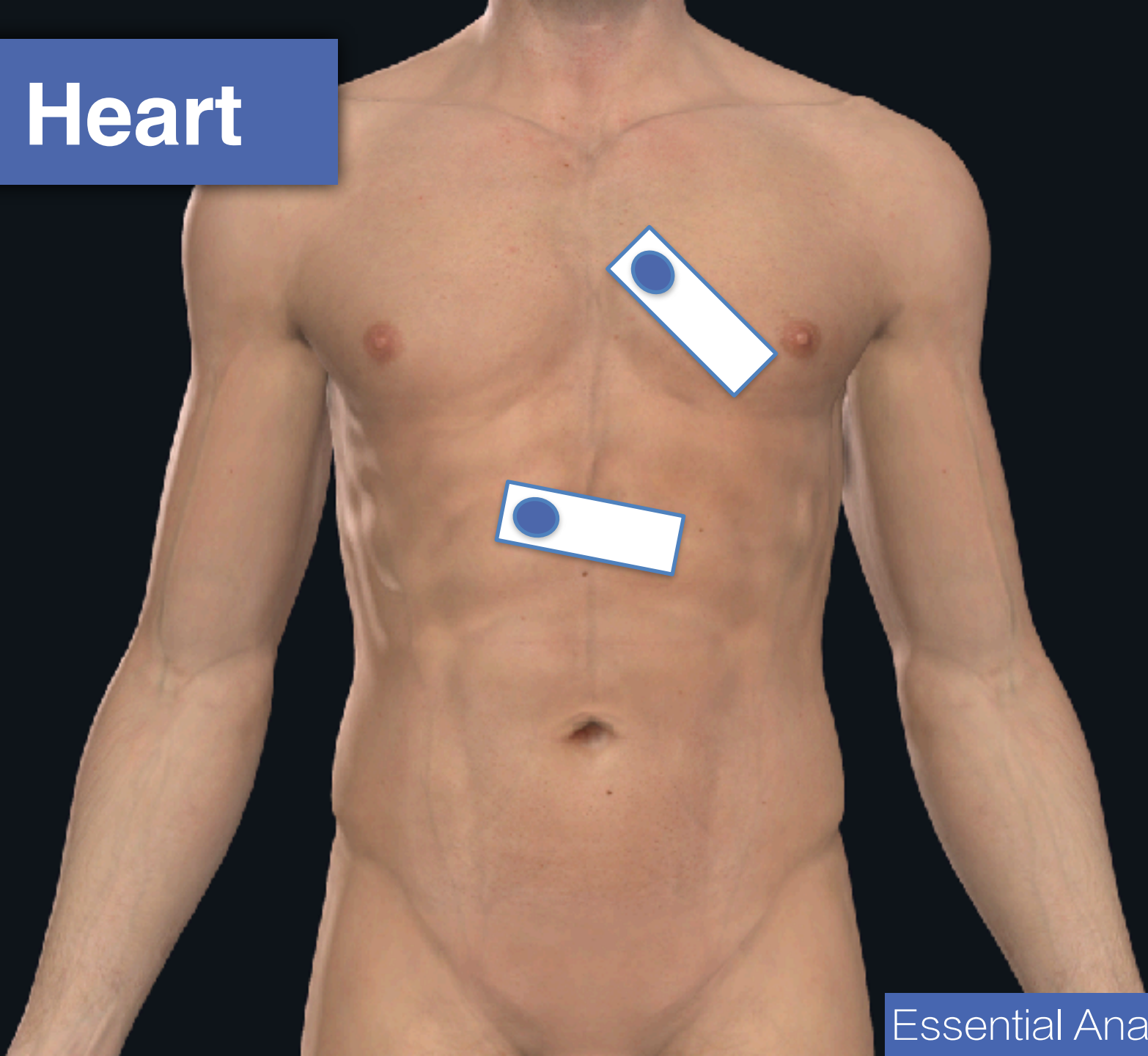
Hemopericardium  
Hemothorax  
Hemoperitoneum

# Thorax

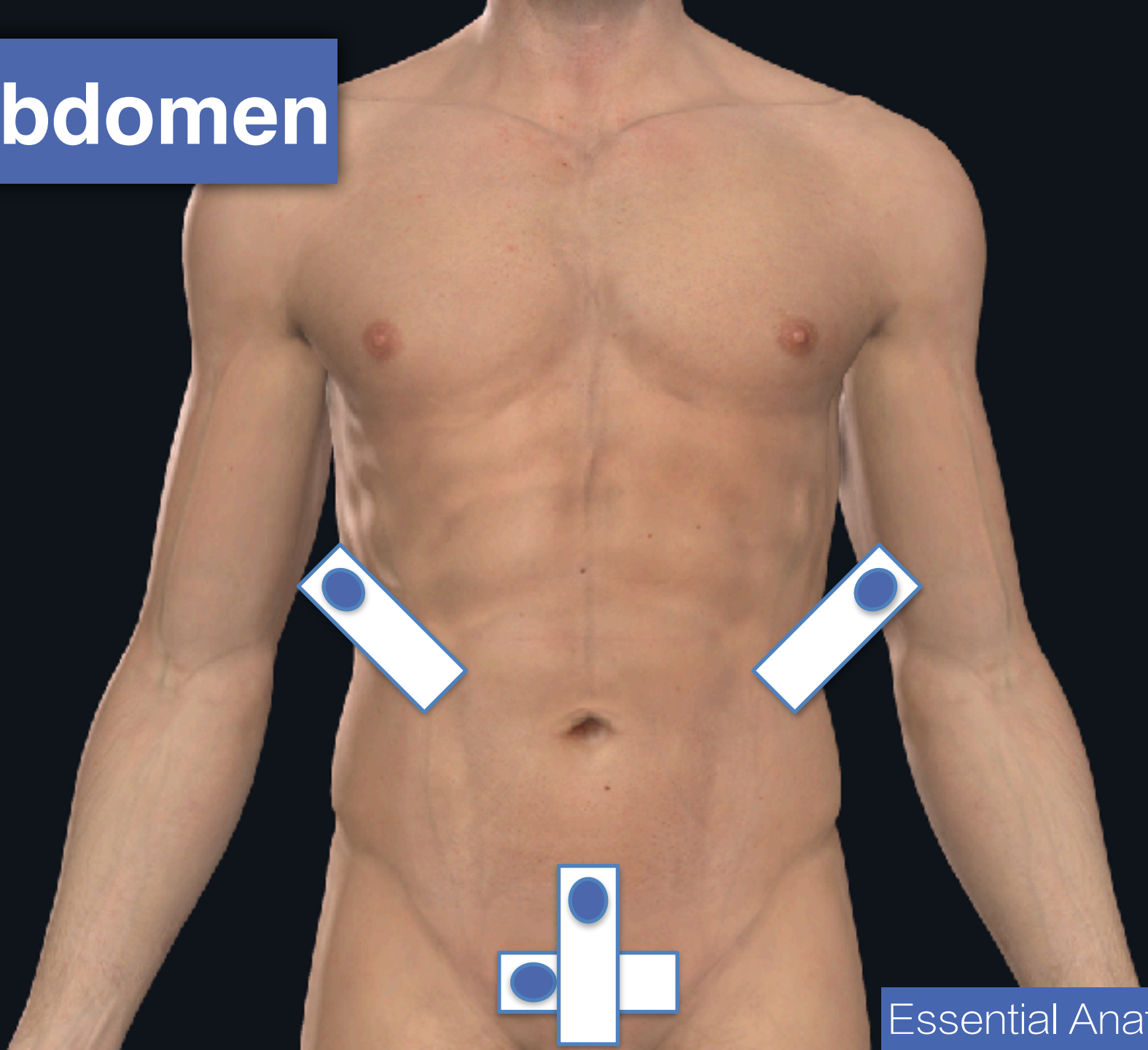




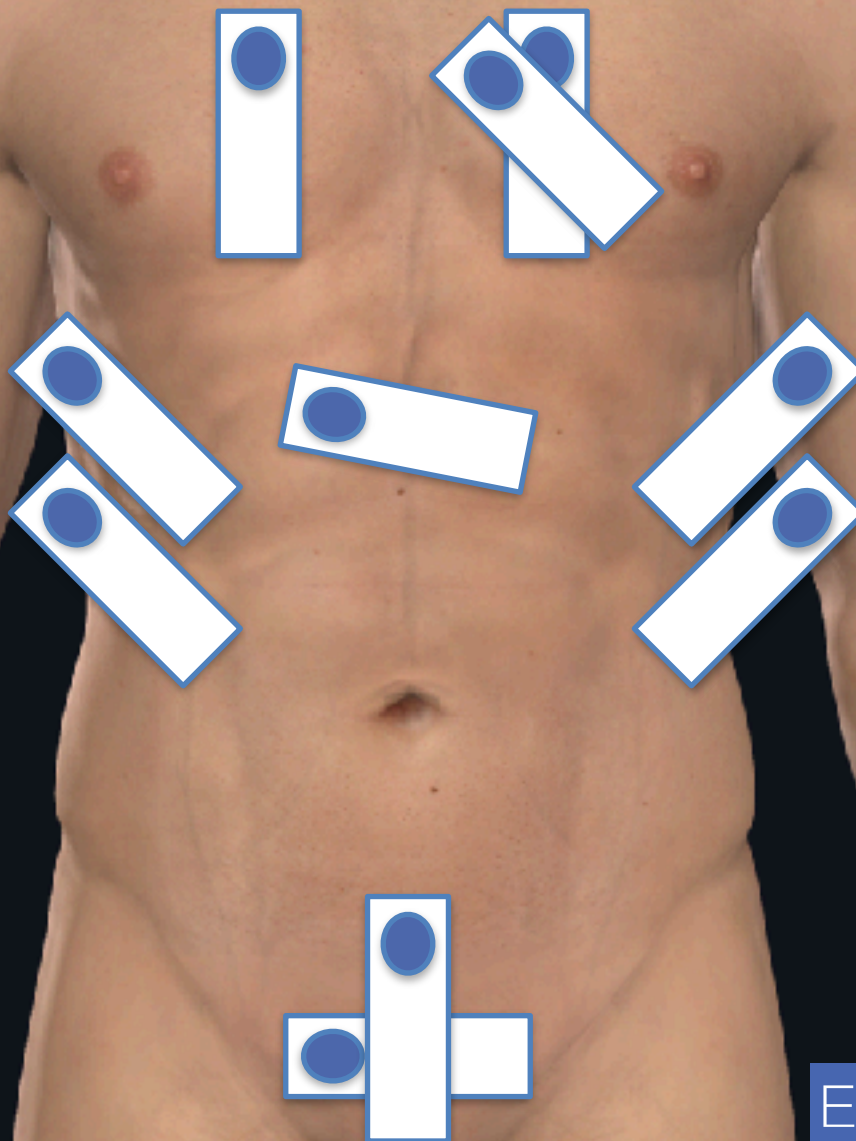
# Heart



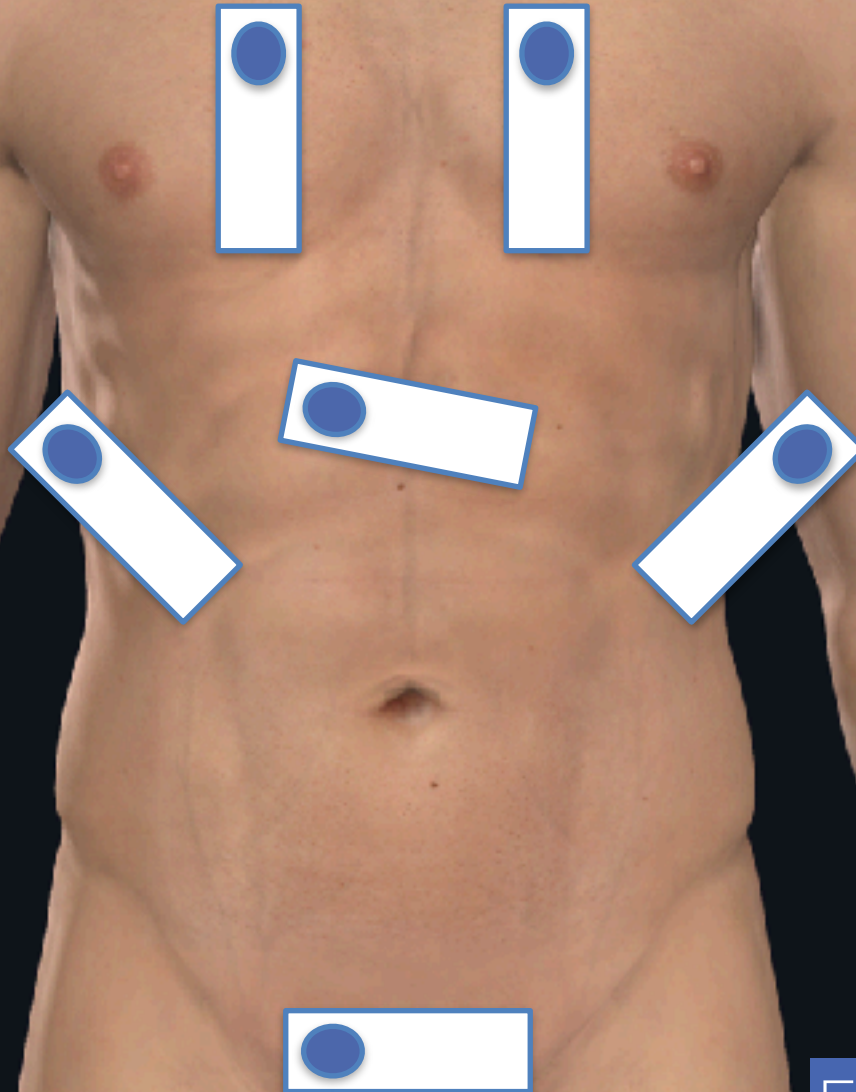
# Abdomen



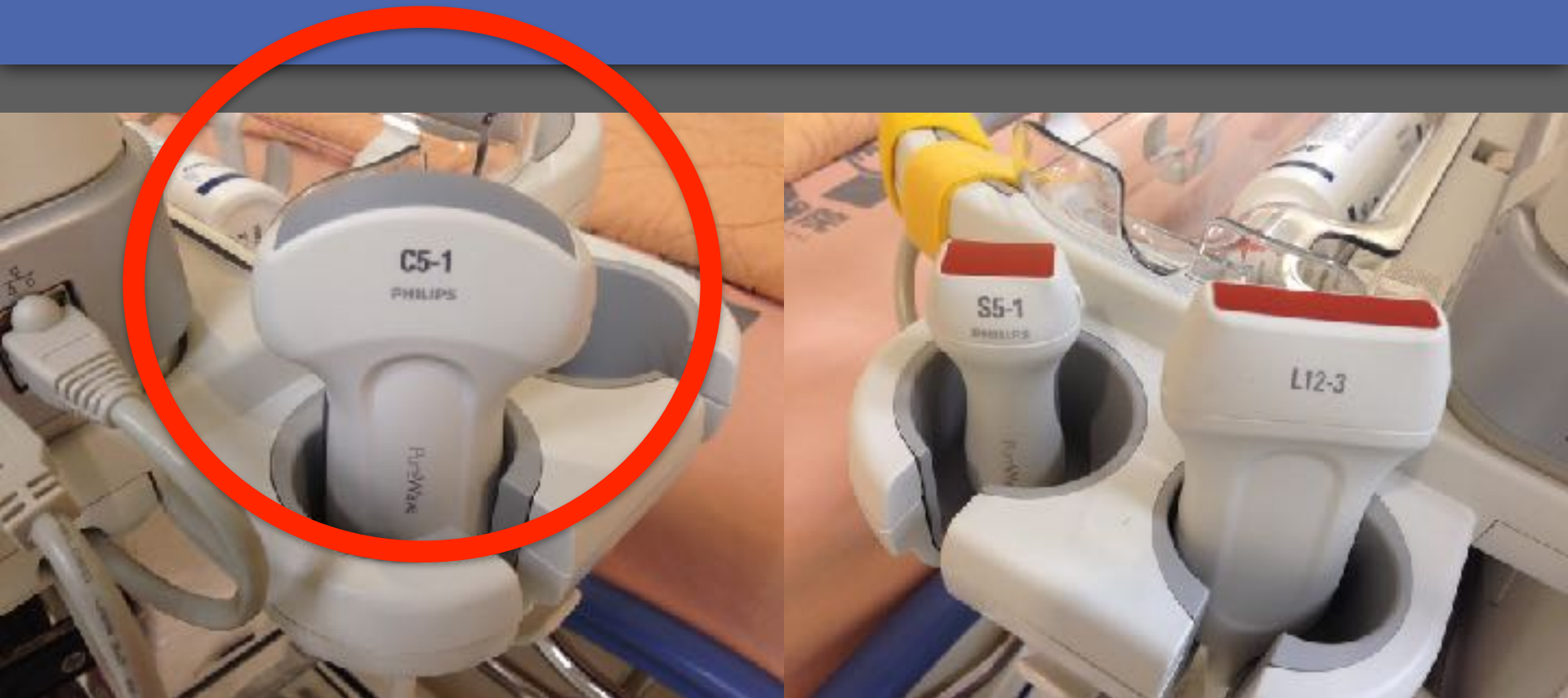
# EFAST



# Rescue



# Transducers



**Target**

**Plane**

**Window**

# Snot vs Spin

**Table 1** Diagnostic performance of FAST in the ED

Studies	Number of patients	Sensitivity, %	Specificity, %	PPV, %	NPV, %
Boulanger et al <sup>1</sup>	460	96	99.7	98.7	99.2
Brenchley et al <sup>4</sup>	153	78	99	NA	NA
Hsu et al <sup>5</sup>	463	78	97	91	93
Tayal et al <sup>6</sup>	96	80.8	86.9	72.4	91.4
Gaarder et al <sup>7</sup>	104	62	96	84	89
Verbeek et al <sup>8</sup>	120	64	94	84	83

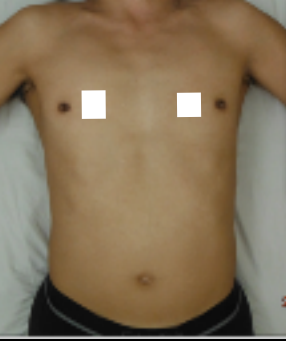
**Abbreviations:** ED, emergency department; FAST, focused assessment with sonography for trauma; NA, not applicable; NPV, negative predictive value; PPV, positive predictive value.

**Table 2** Diagnostic performance of E-FAST for identification of pneumothorax

Studies	Sensitivity, %	Specificity, %	PPV, %	NPV, %
Nandpati et al <sup>22</sup>	95	99	95	99
Ianniello et al <sup>23</sup>	77	99.8	98.5	97

**Abbreviations:** E-FAST, extended focused assessment with sonography for trauma; NPV, negative predictive value; PPV, positive predictive value.

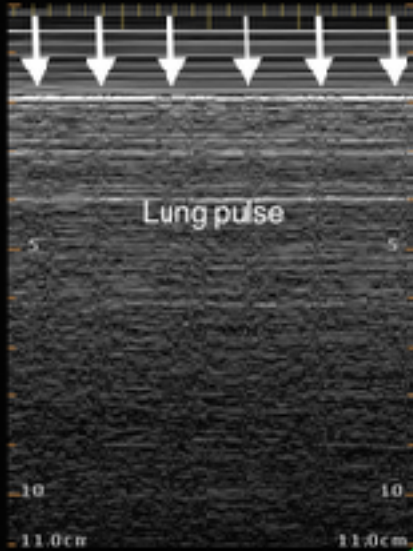
# Anterior lung – Air



FAST  
CS-1  
40 Hz  
11.0cm

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

M-mode  
4/2  
25 mm/s



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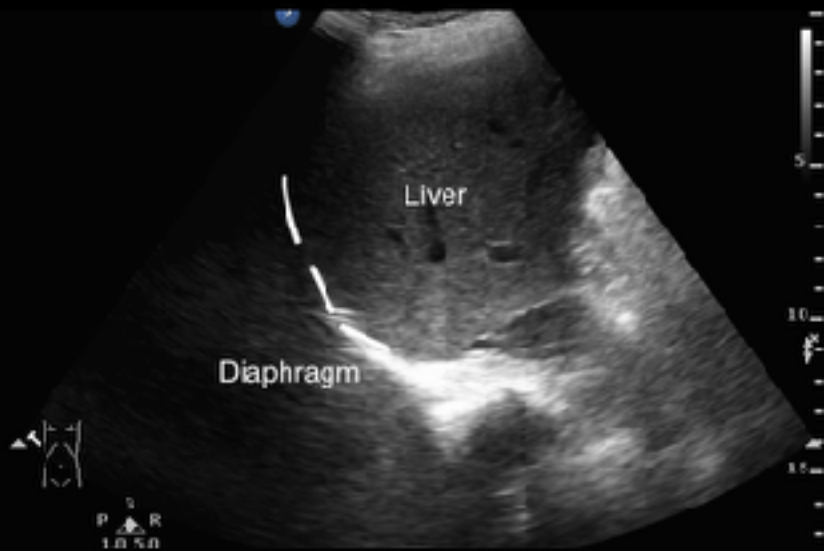


# Basal lung – Fluid



FAST  
C5-1  
30 Hz  
13.0cm

2D  
Gen  
Gn 82  
C 56  
1/3/3



PHILIPS

FAST  
C5-1  
30 Hz  
13.0cm

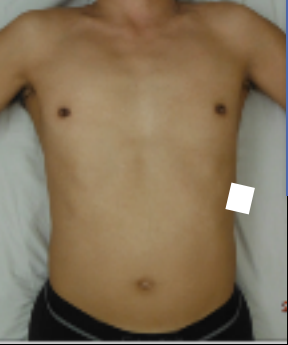
2D  
Gen  
Gn 82  
C 56  
1/3/3

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# Basal lung – Fluid



FAST  
C5-1  
30 Hz  
13.0cm  
2D  
Gen  
Gn 99  
C 56  
1/3/3



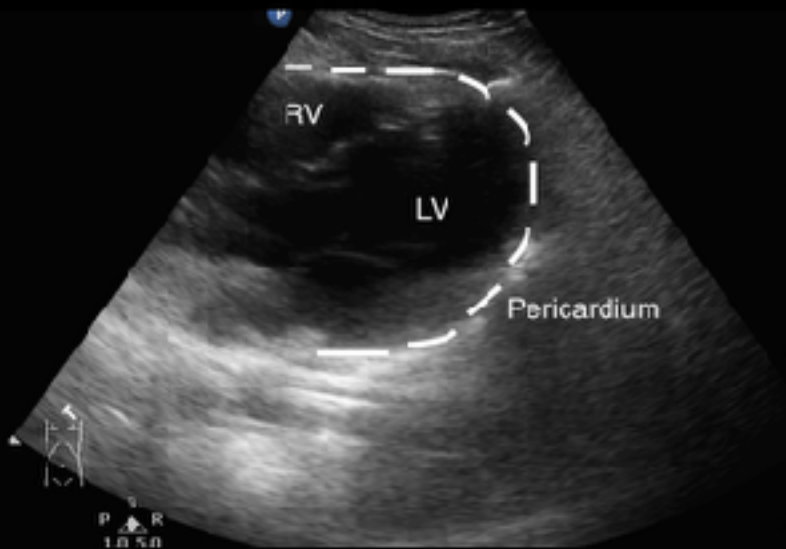
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# Pericardium – PSLA



FAST  
C5-1  
33 Hz  
15.0cm  
2D  
Gen  
Gn 60  
C 56  
1/3/3



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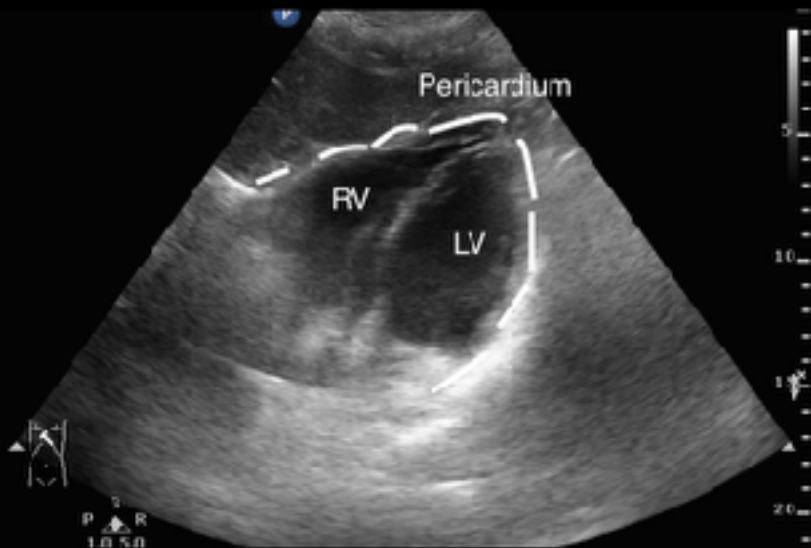


# Pericardium – Subcostal 4



FAST  
C5-1  
26 Hz  
22.0cm

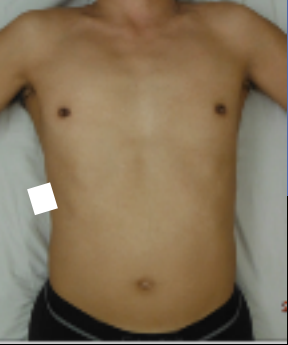
2D  
Gen  
Gn 76  
C 56  
1/3/3



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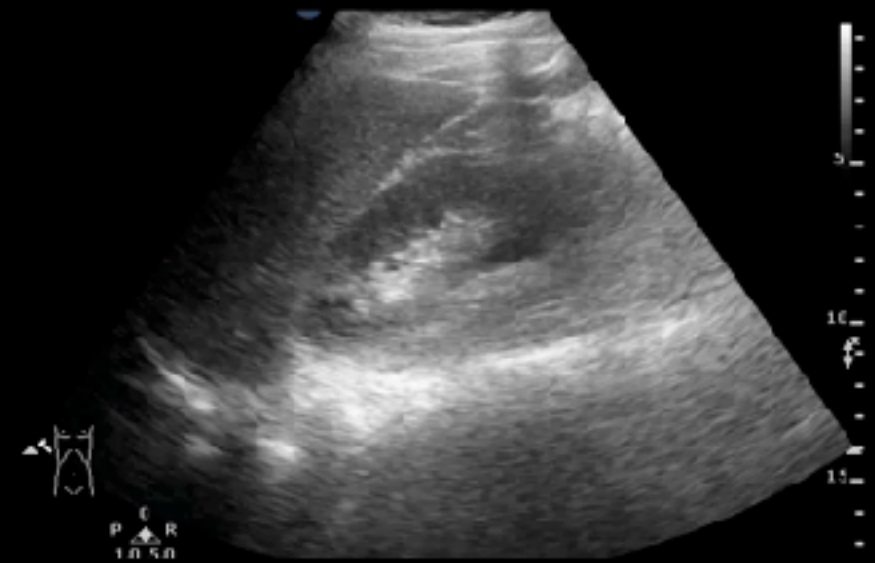
# Abdomen – Morrison



FAST  
C5-1  
30 Hz  
13.0cm  
2D  
Gen  
Gn 99  
C 56  
1/3/3



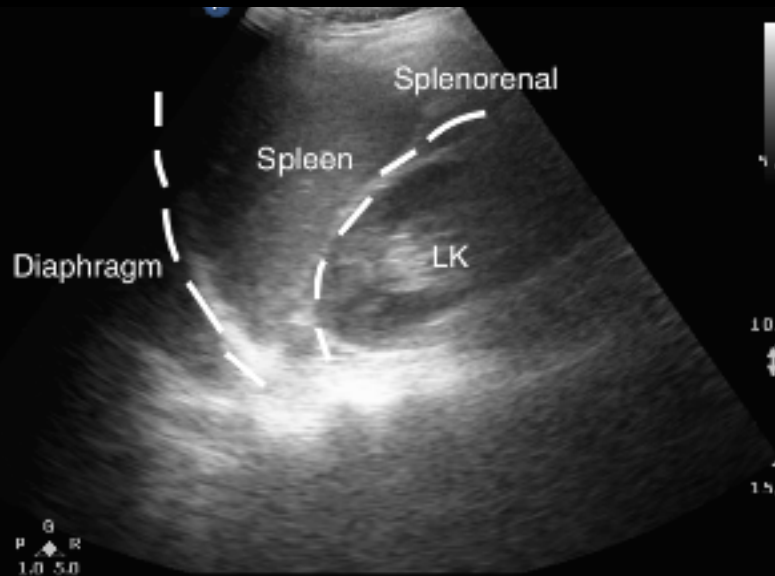
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# Abdomen – Splenorenal



LOG1  
CS-1  
30 Hz  
10.0cm  
2D  
Gen  
Gn 99  
C 56  
1/3/3



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# Pelvis – transverse



FAST  
C5-1  
30 Hz  
13.0cm  
2D  
Gen  
Gn 99  
C 56  
1/3/3



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# Pelvis – longitudinal



FAST  
C5-1  
3.3 Hz  
15.0cm  
2D  
Gen  
Gn 99  
C 56  
1/3/3

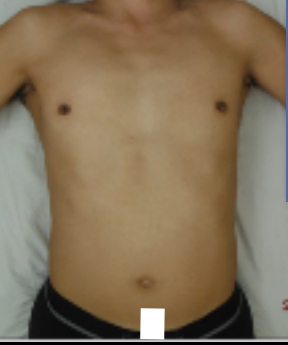


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FAST  
C5-1  
3.3 Hz  
15.0cm  
2D  
Gen  
Gn 99  
C 56  
1/3/3



# Pelvic view-transverse , for PS



2D  
Gen  
Gn 84  
C. 56  
1 / 3 / 3



## Pubic Symphysis



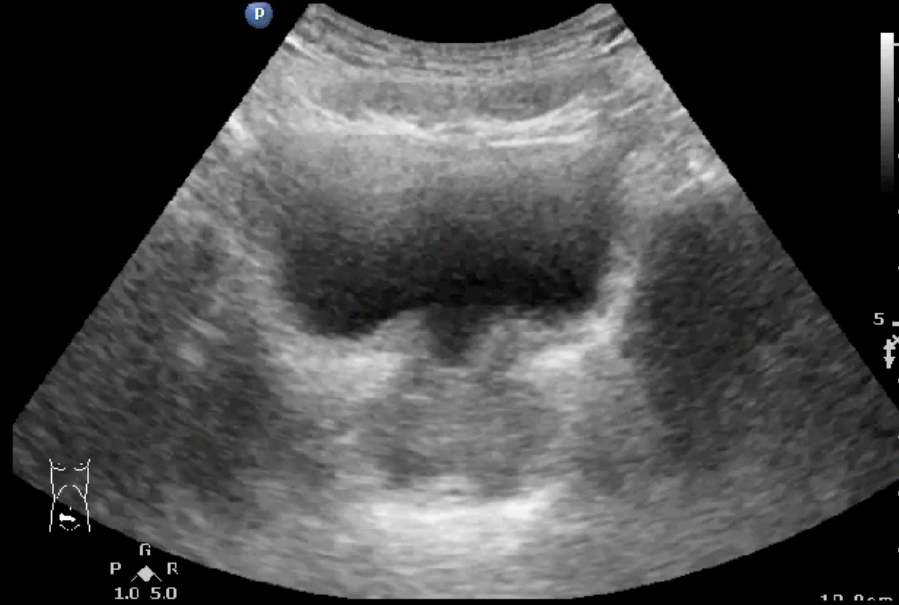


# Open Book Fx



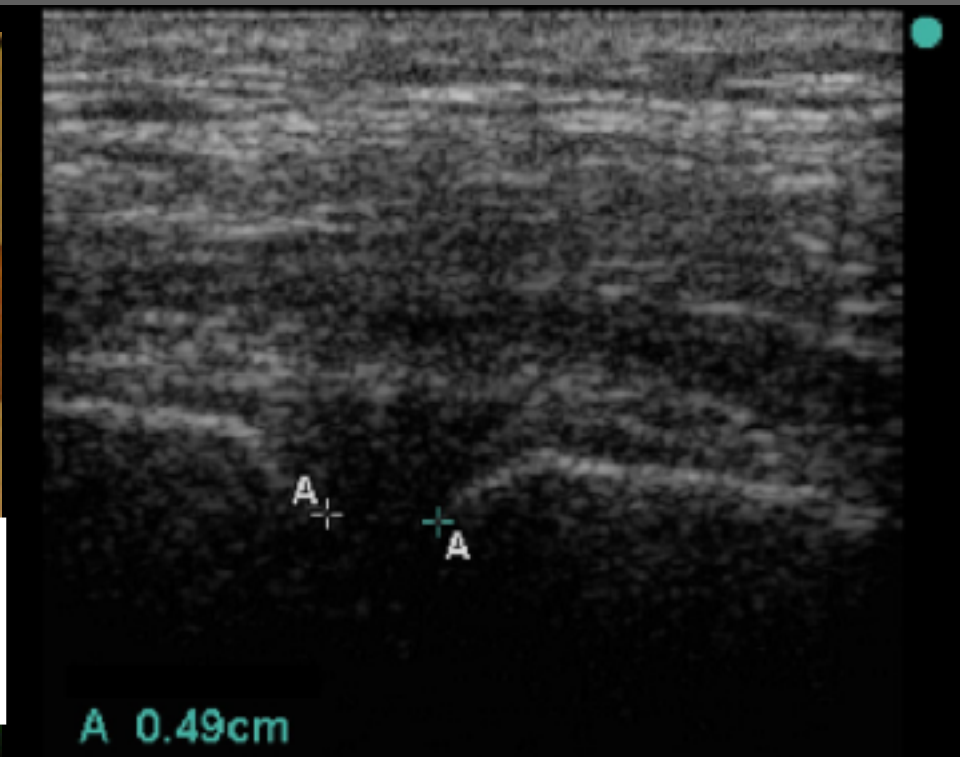
FAST  
C5-1  
45 Hz  
10.0cm

2D  
Gen  
Gn 84  
C. 56  
1/3/3





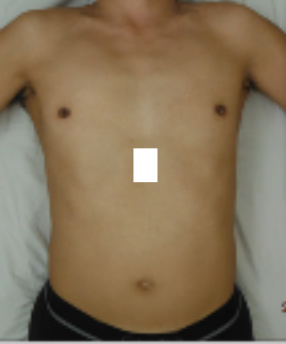
# FAST-PS study



Cutoff : > 25mm

Sensitivity: 100% Specificity: 100%

# Subcostal long axis-IVC



12.0cm

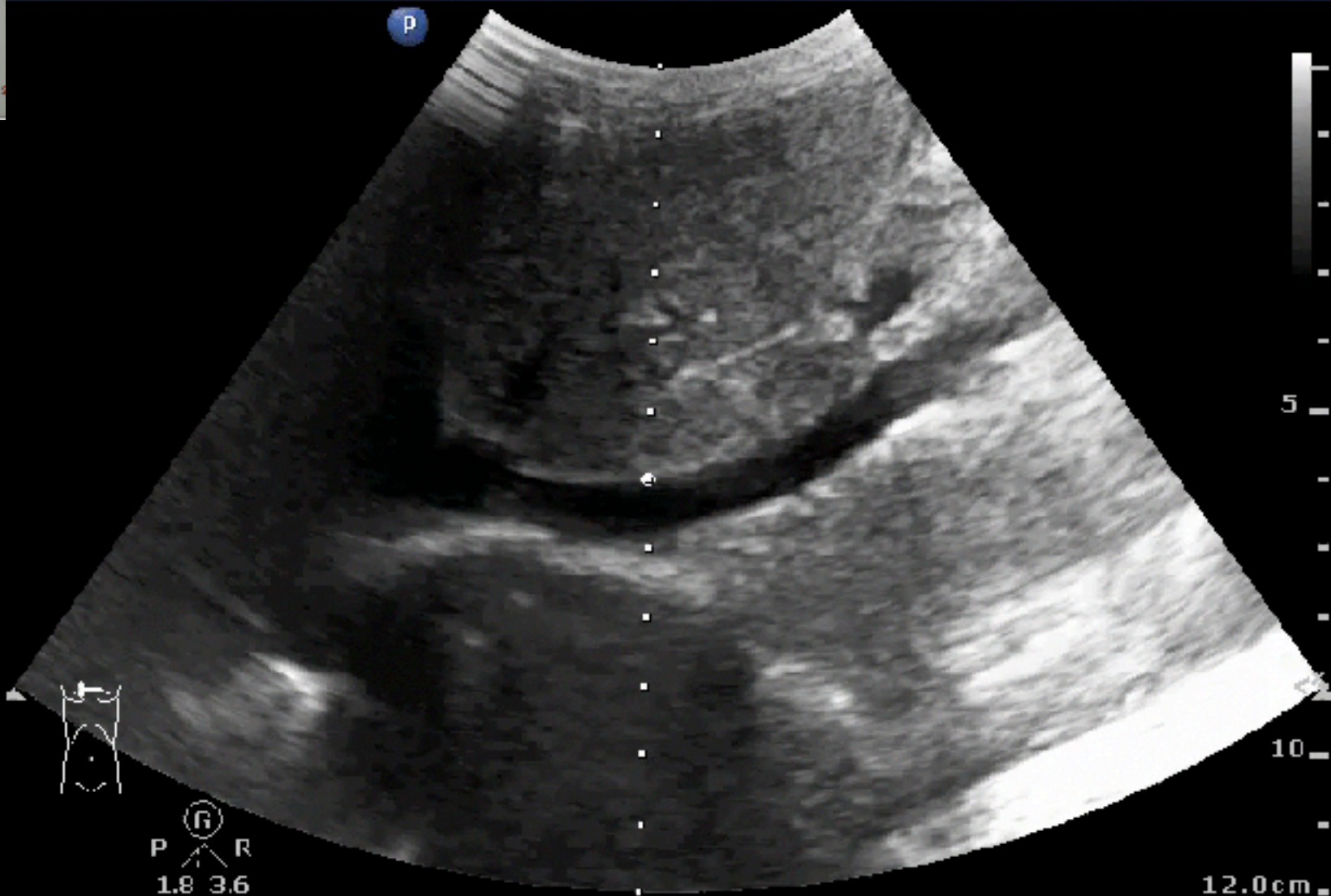
2D

HGen

Gn 87

C. 57

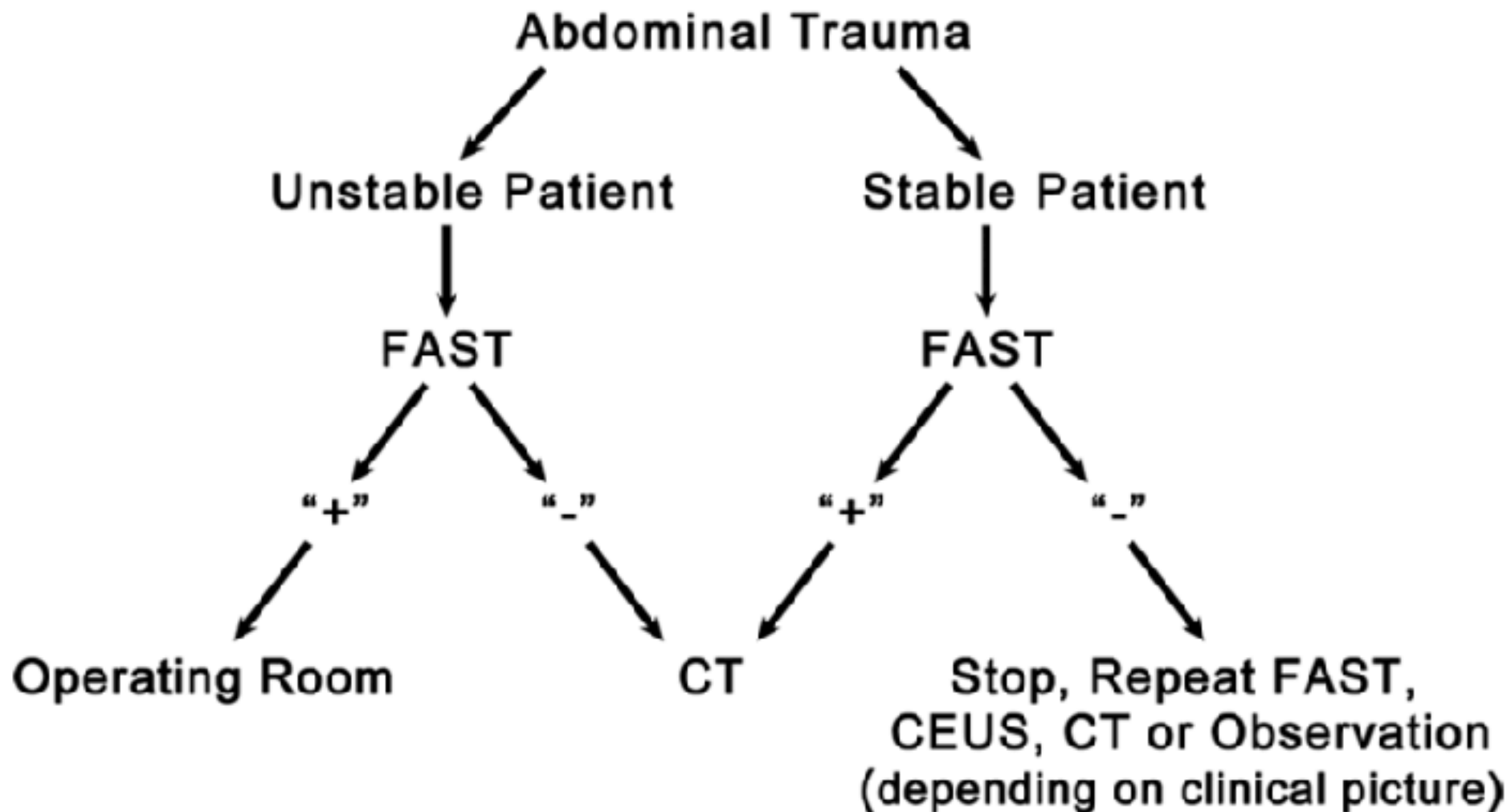
3/3/3



P R  
1.8 3.6

12.0cm

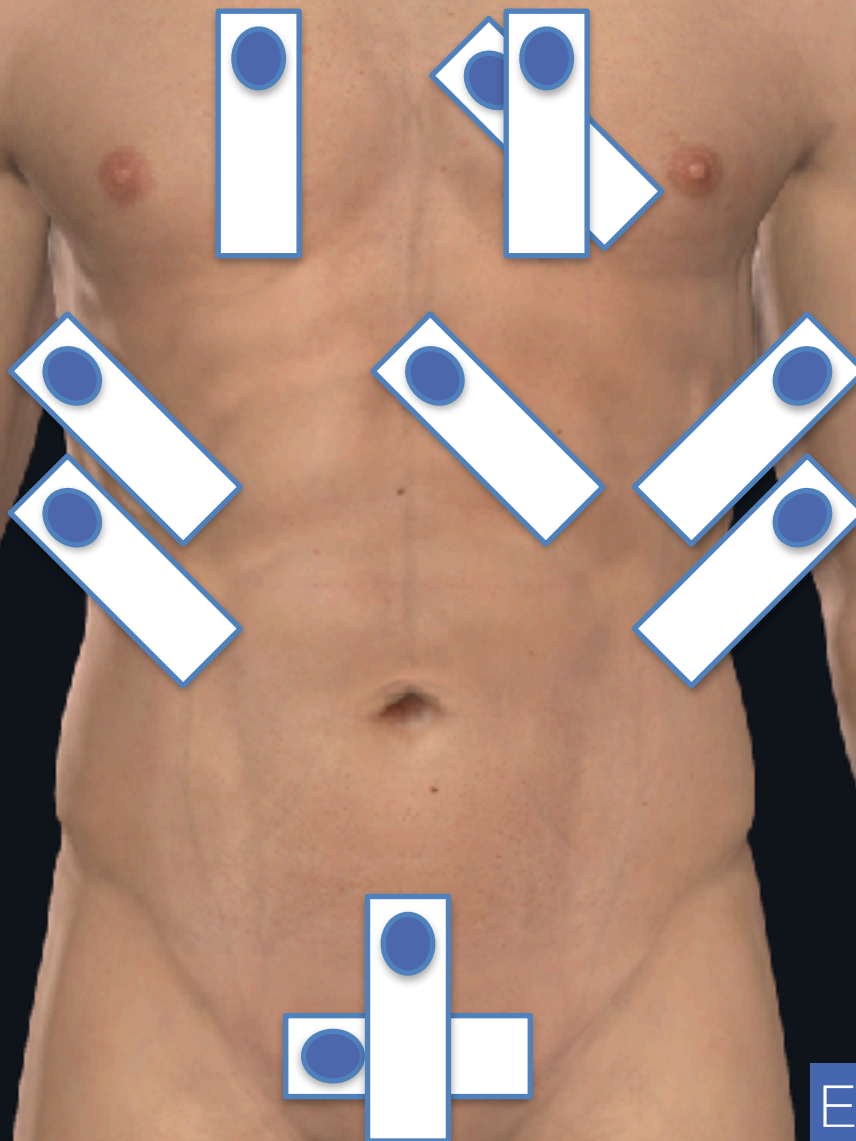
# Focused Assessment with Sonography in Trauma (FAST) in 2017: What Radiologists Can Learn<sup>1</sup>

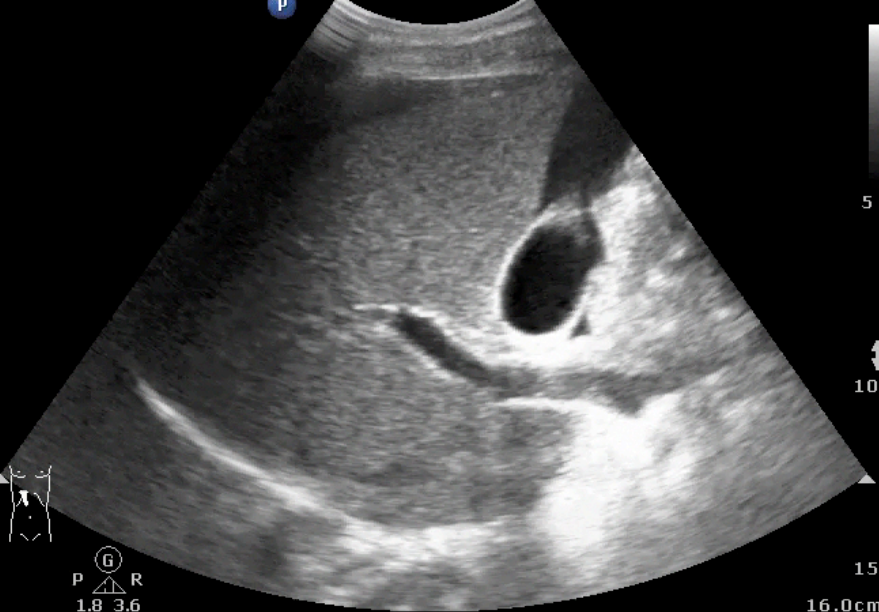


36M, Traffic accident  
Tachycardia & Low BP  
LUQ pain & bruise

Where ?

10



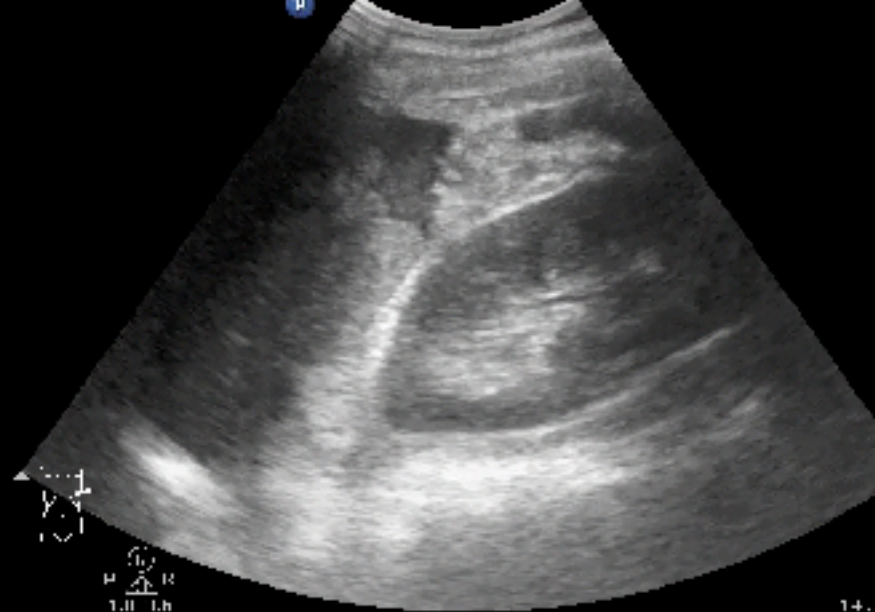


Abd Gen  
C5-1  
36 Hz  
14.0cm  
2D  
11Gen  
Gn 90  
C 56  
3:0:0

10.

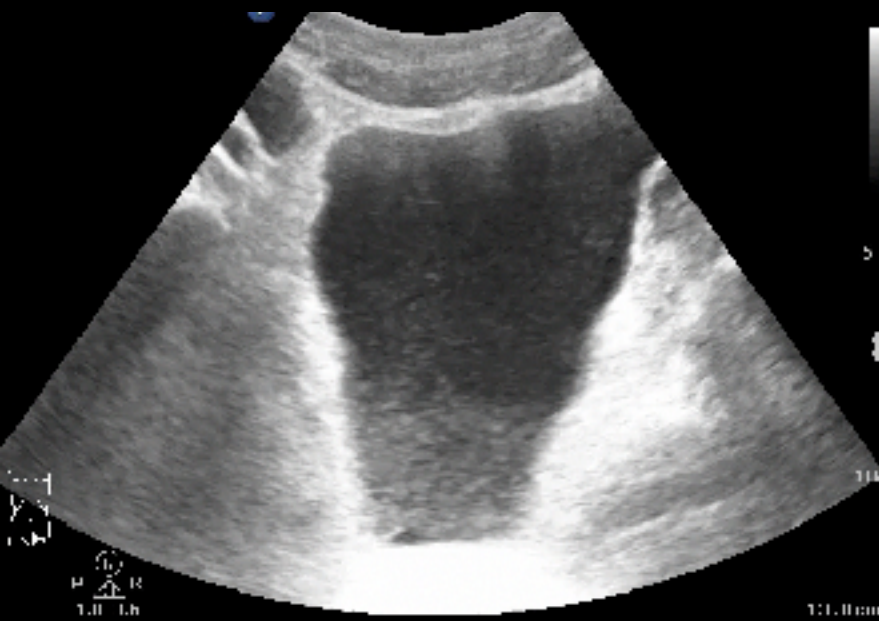
P R  
1.8 3.6

15.  
16.0cm



P R  
1.8 1.8

14.

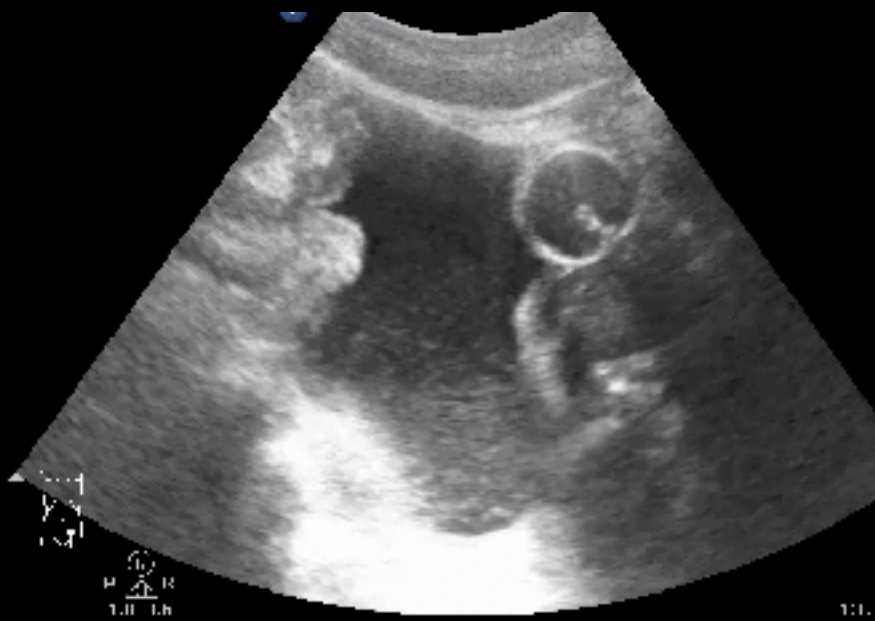


Abd Gen  
C5-1  
38 Hz  
13.0cm  
2D  
11Gen  
Gn 90  
C 56  
3:0:0

10.

P R  
1.8 1.8

11.0cm



P R  
1.8 1.8

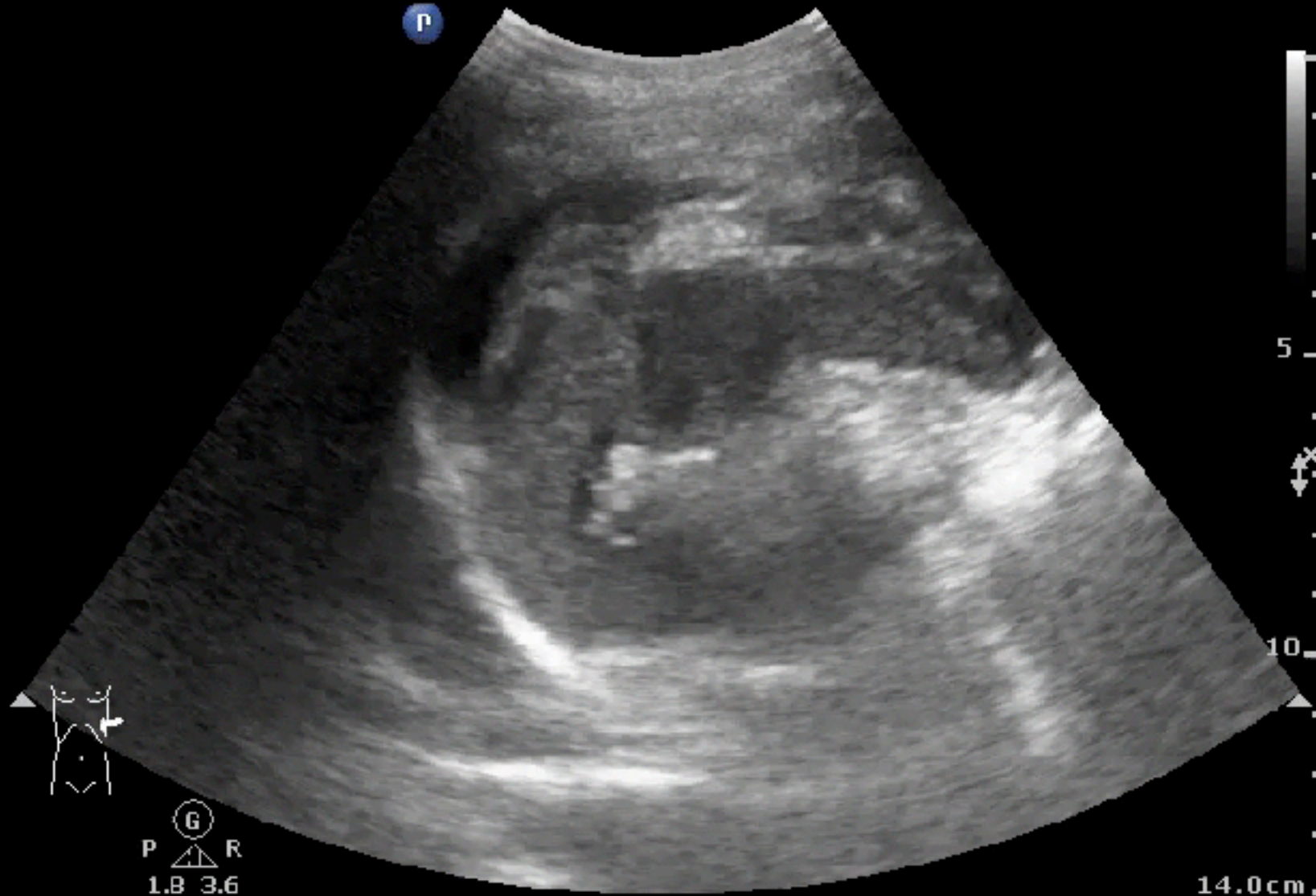
11.



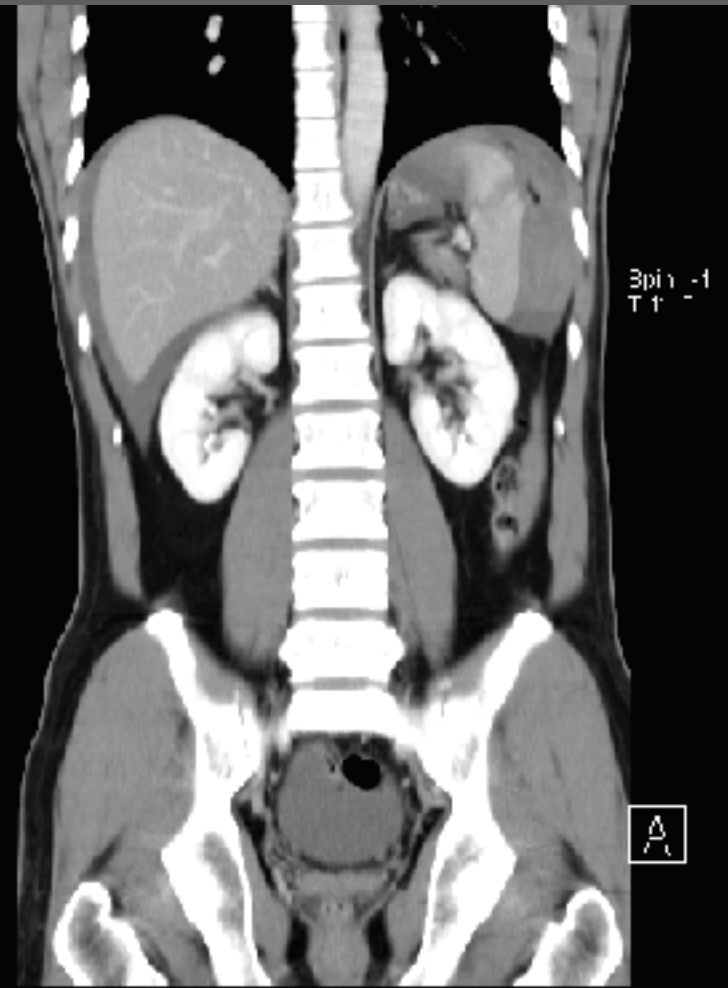
# Various echogenicity

Abd Gen  
C5-1  
3.5 Hz  
14.0cm

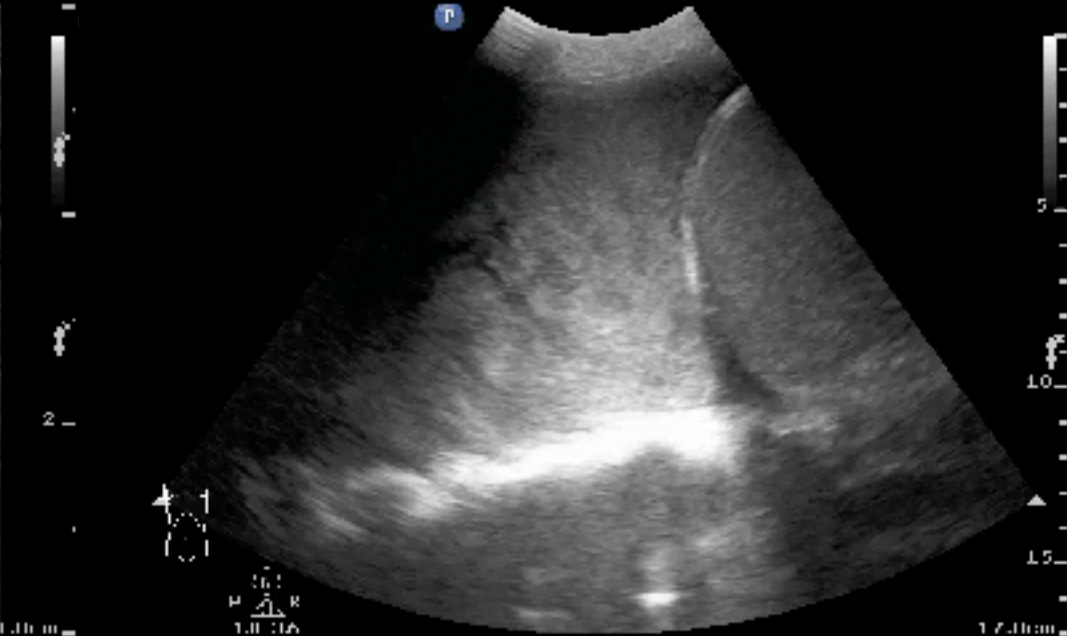
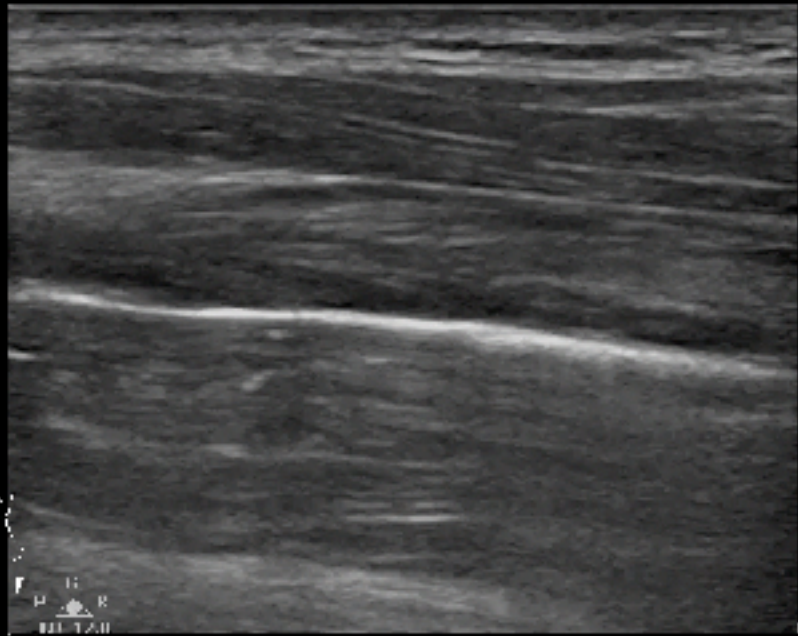
2D  
HGen  
Gn 90  
C 56  
3/3/3



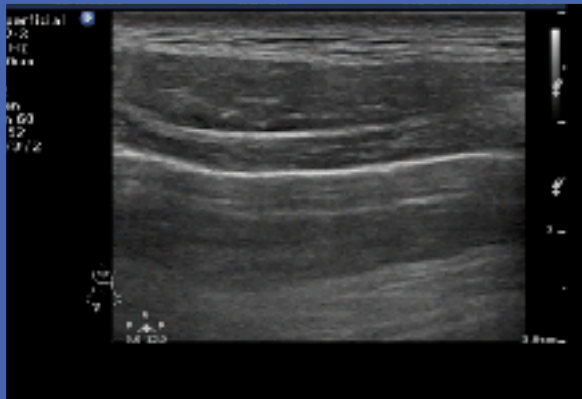
# Splenic laceration



# Artifact & True



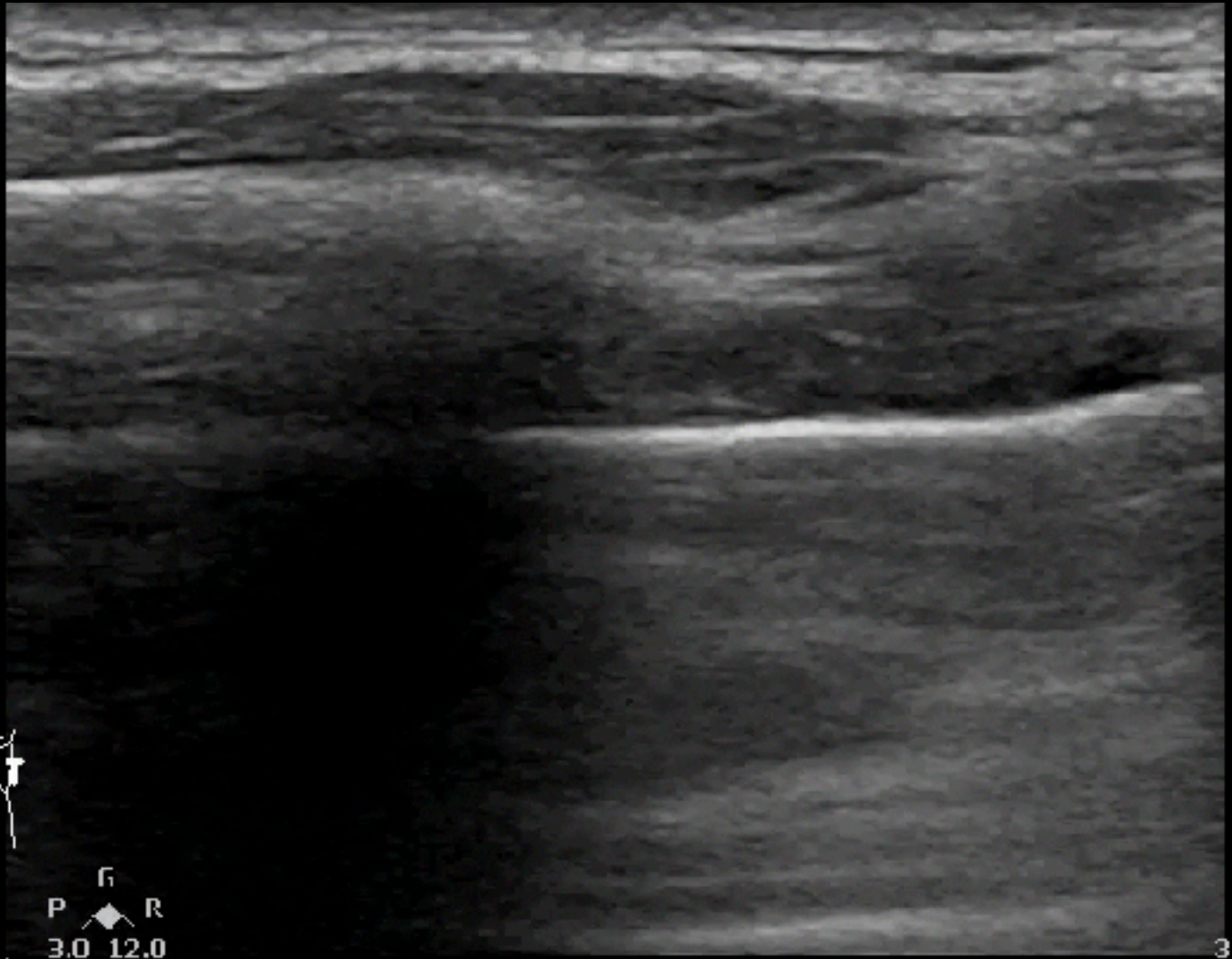
# Transducers



# Sliding - Point - Barcode

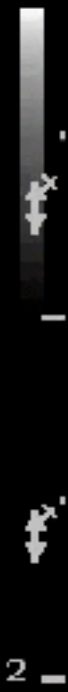
superficial  
L12-3  
31 Hz  
3.0cm

2D  
Gen  
Gn 91  
C. 57  
4/3/2



P R  
3.0 12.0

3.0cm

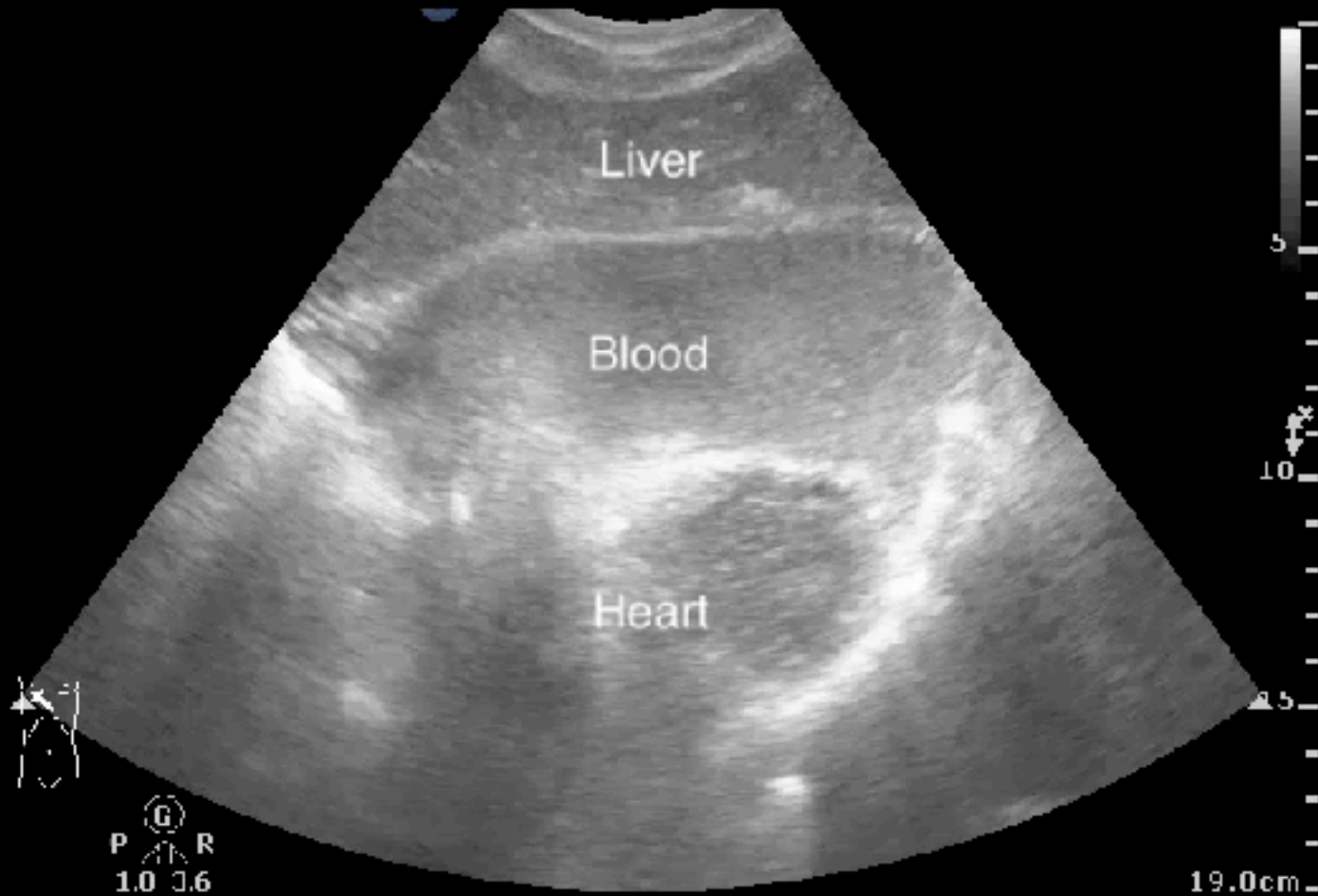


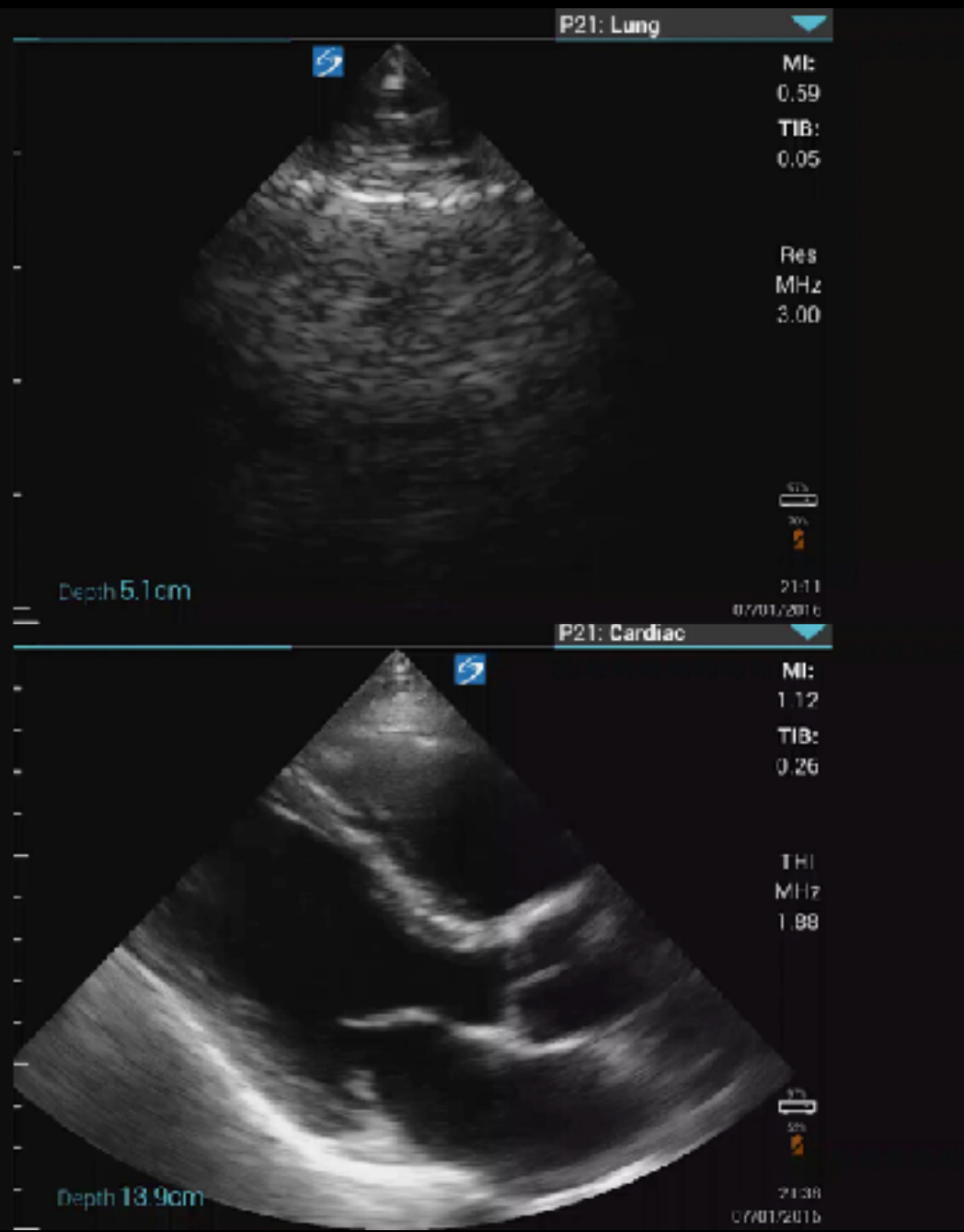
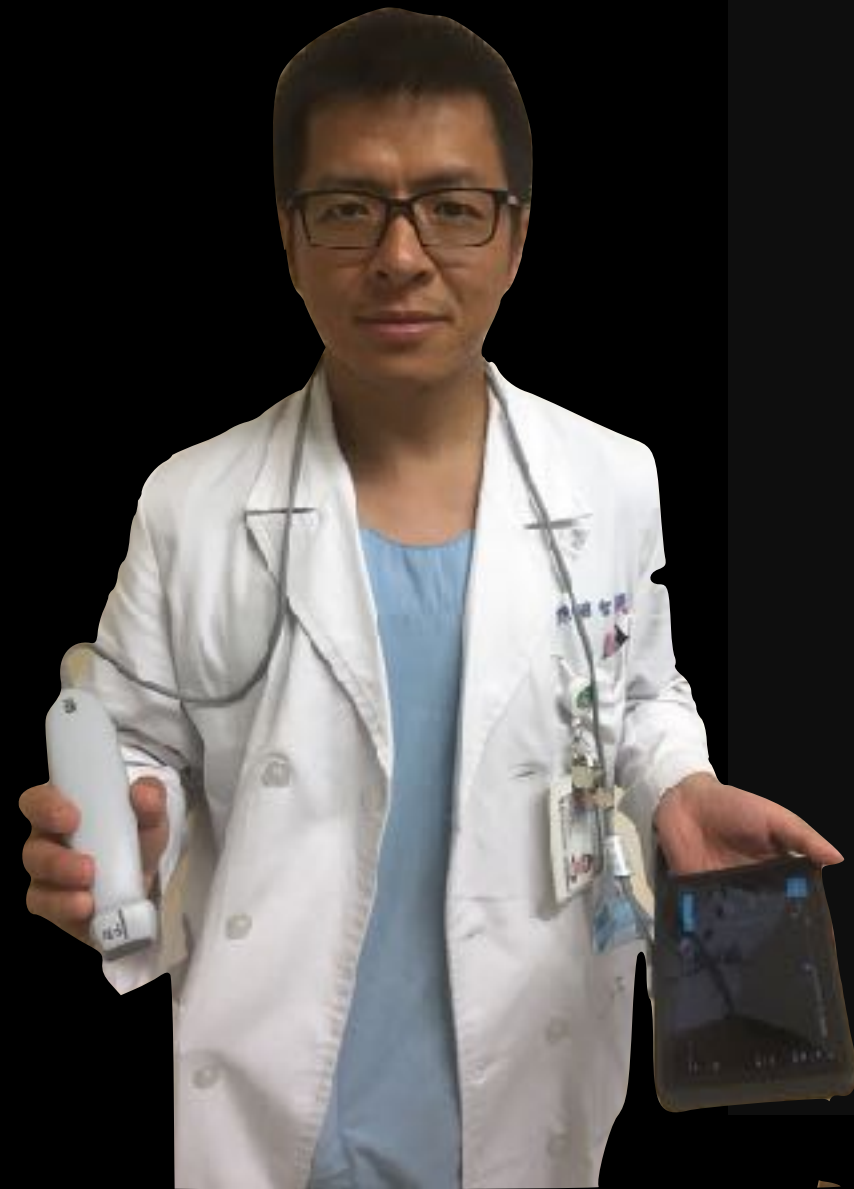
# US Tamponade signs ?

Abd Ger.  
C5-1  
29 Hz  
19.0cm

2D

HGen  
Gn 100  
C 69  
3/3/3



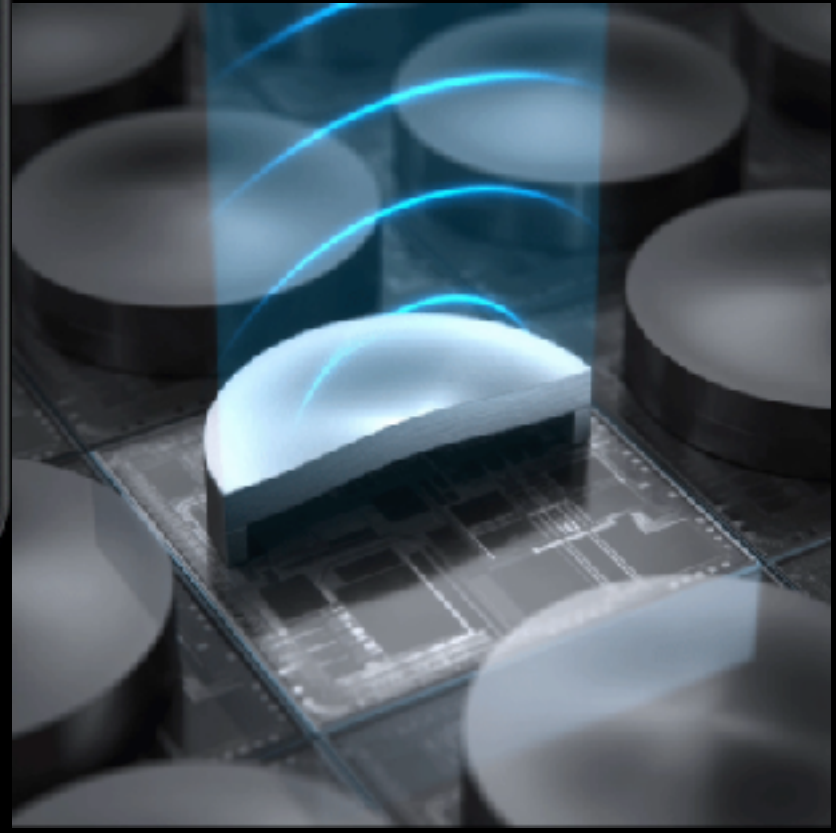




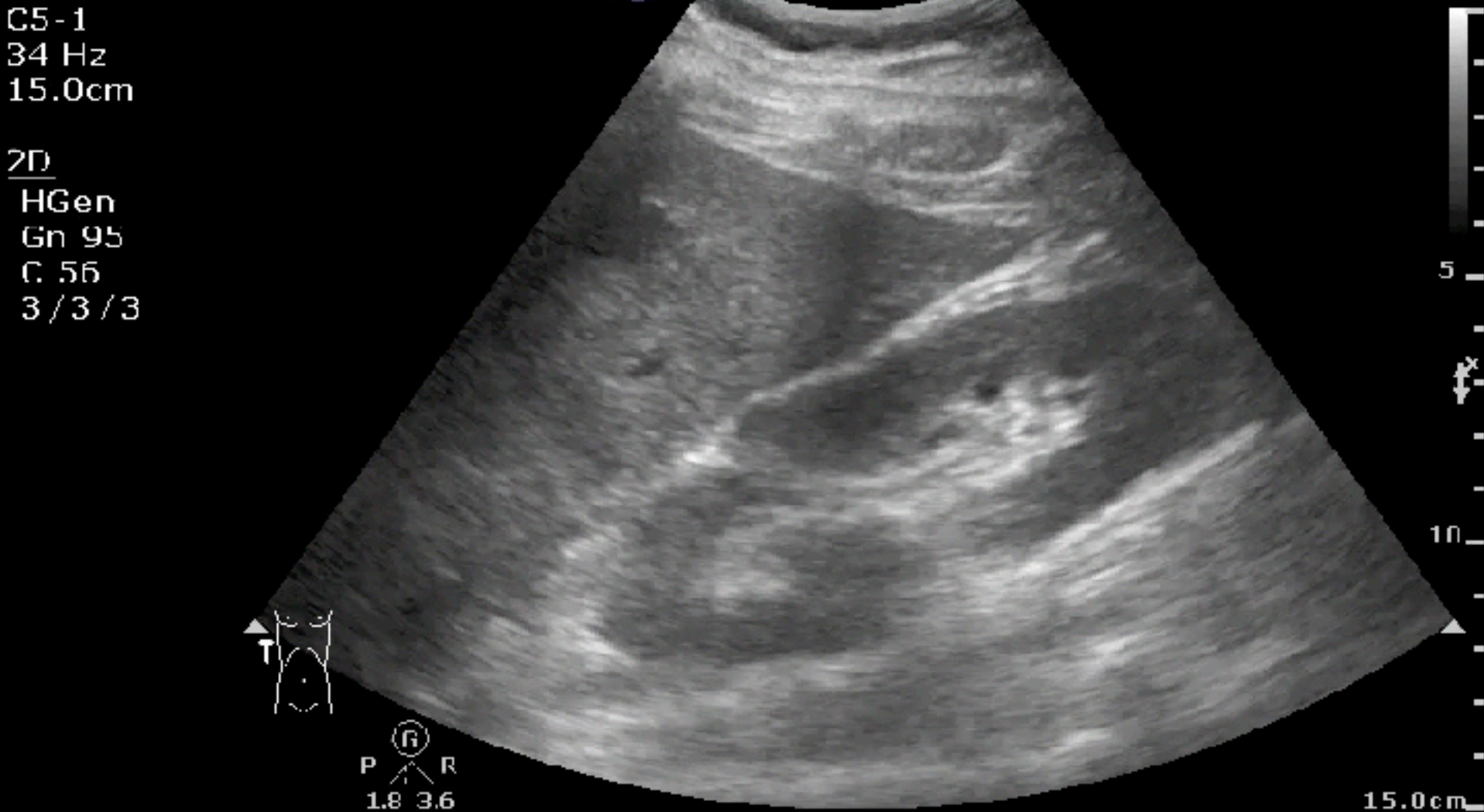




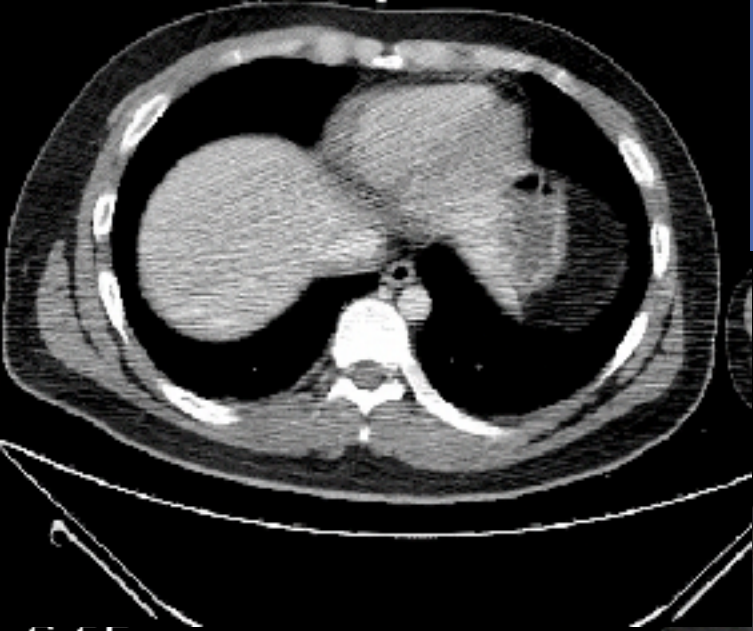
Butterfly iQ  
\$ 2000



# RUQ Injury: Free fluid Y/N ?



# Liver laceration



C: 65  
3/3/3



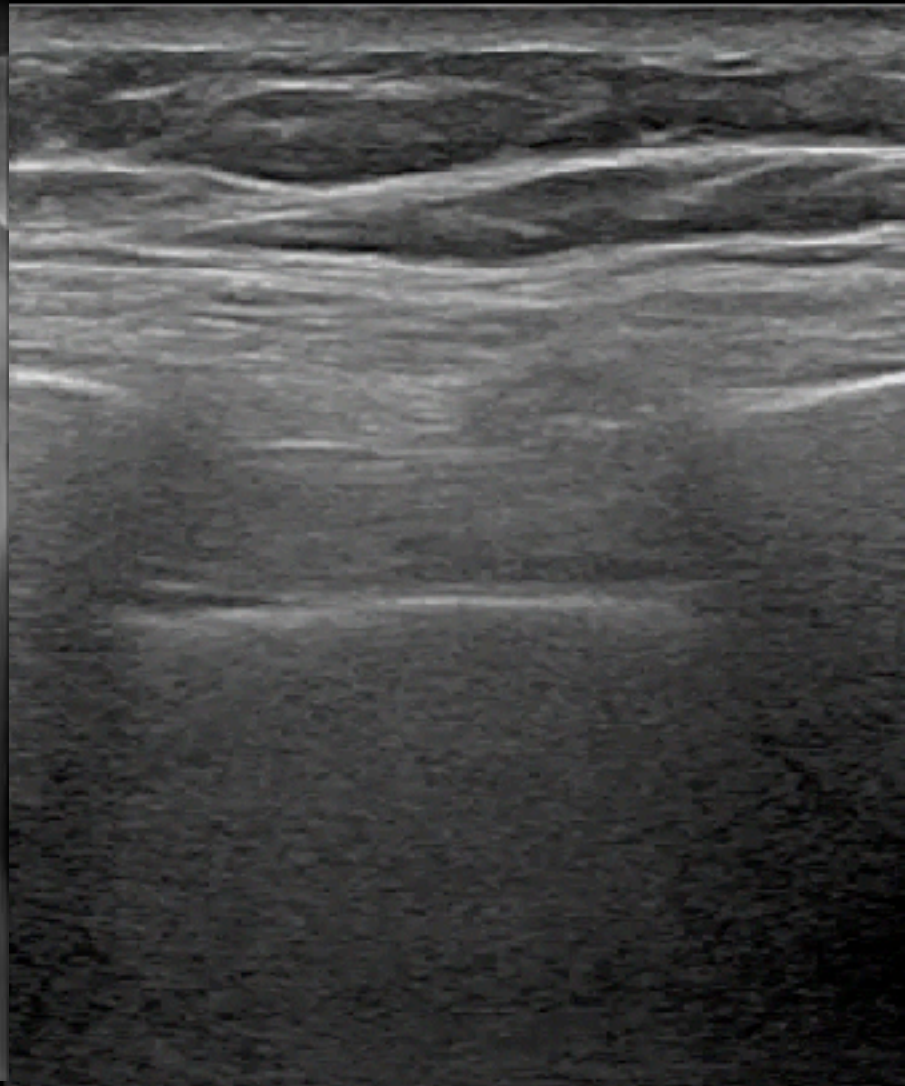
T  
P R  
1.8 3.6

16.0cm

# Subcutaneous Emphysema



3.0 12.0



# Pearls

Ask right question  
Non trauma shock  
Predict laparotomy  
Faster in unstable pt

# Pitfalls

Organ injury  
Echogenic blood  
Subcutaneous air  
Operator dependent

**Spin** or **Snot**



# EFAST

**Holistic Ultrasound**

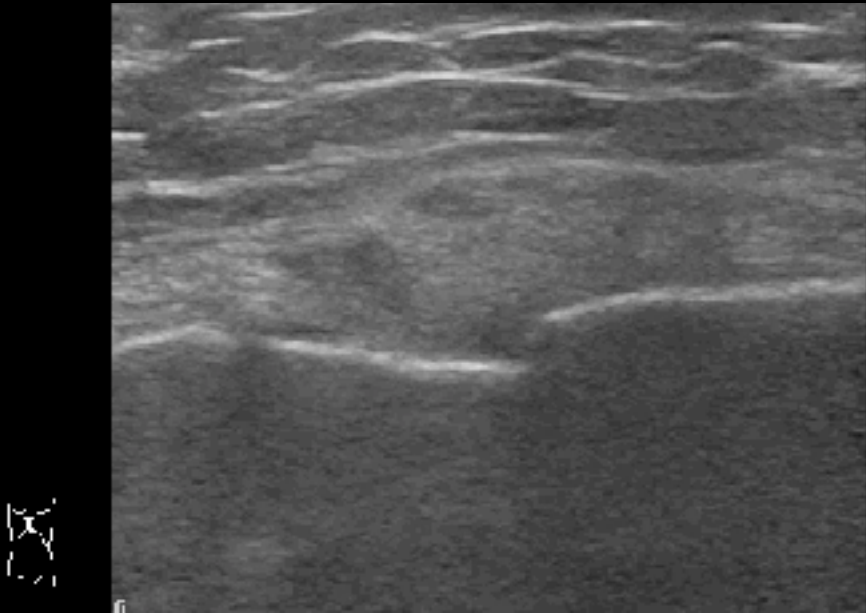
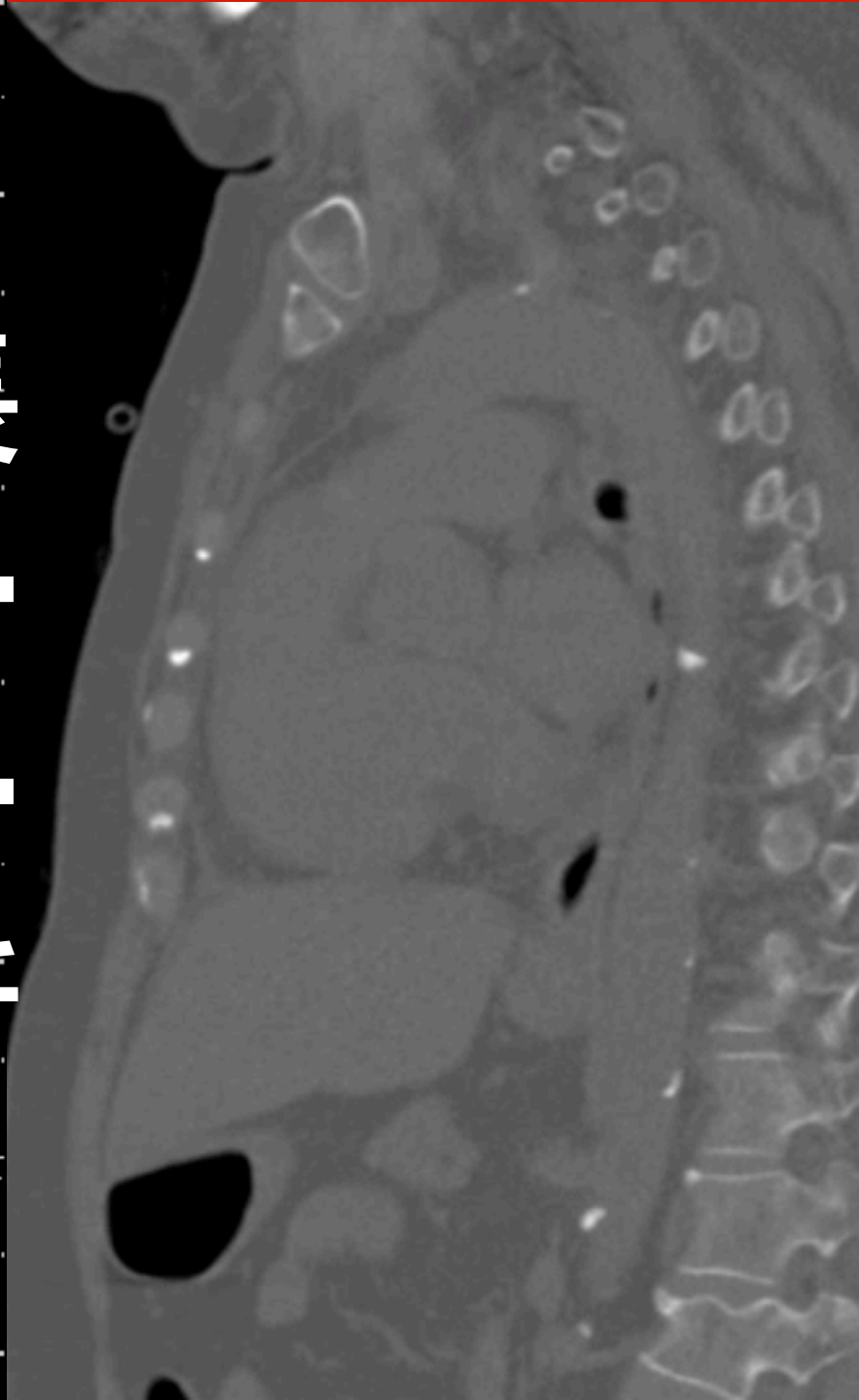
**Useful applications**

# 緊急處置



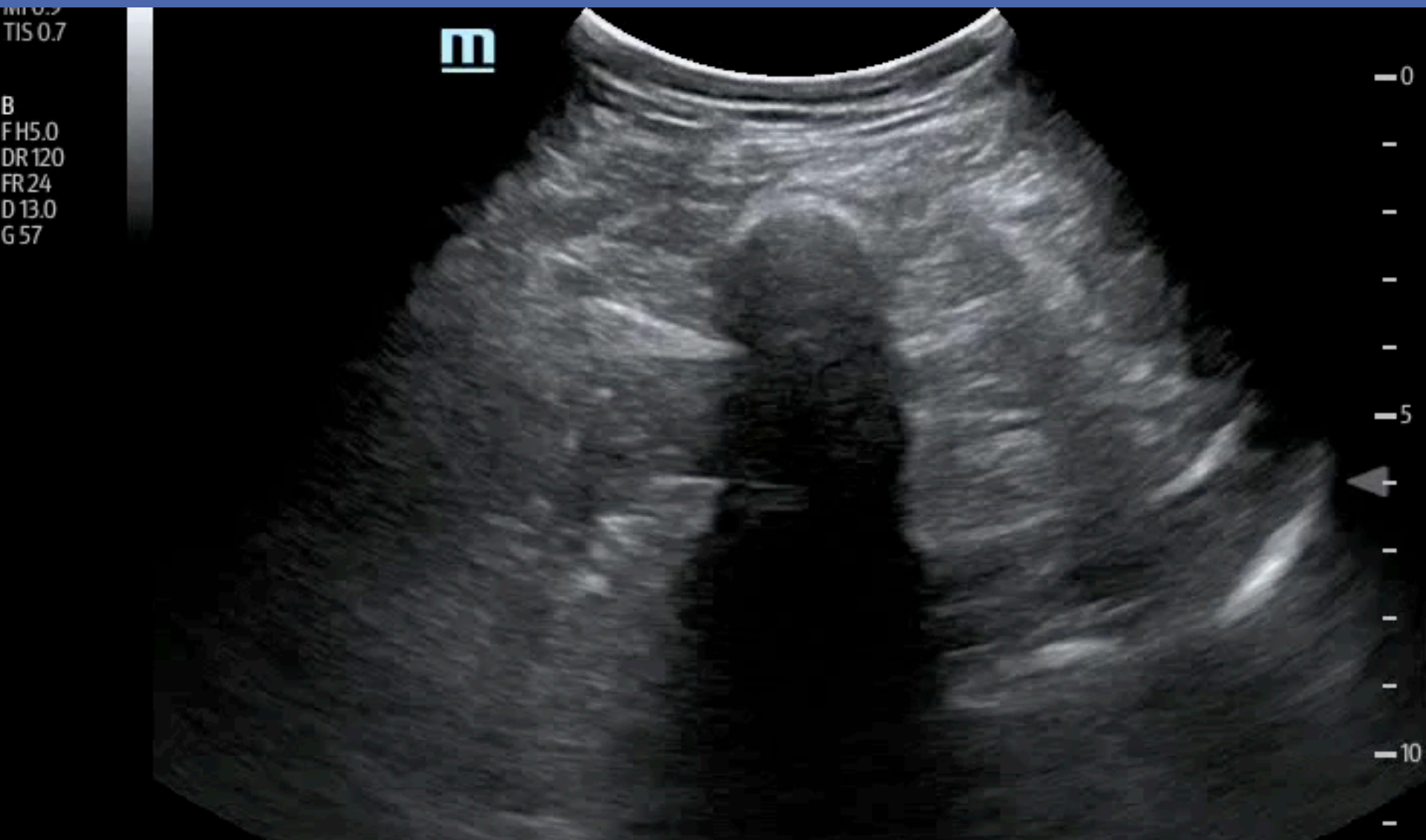


# 長骨骨折

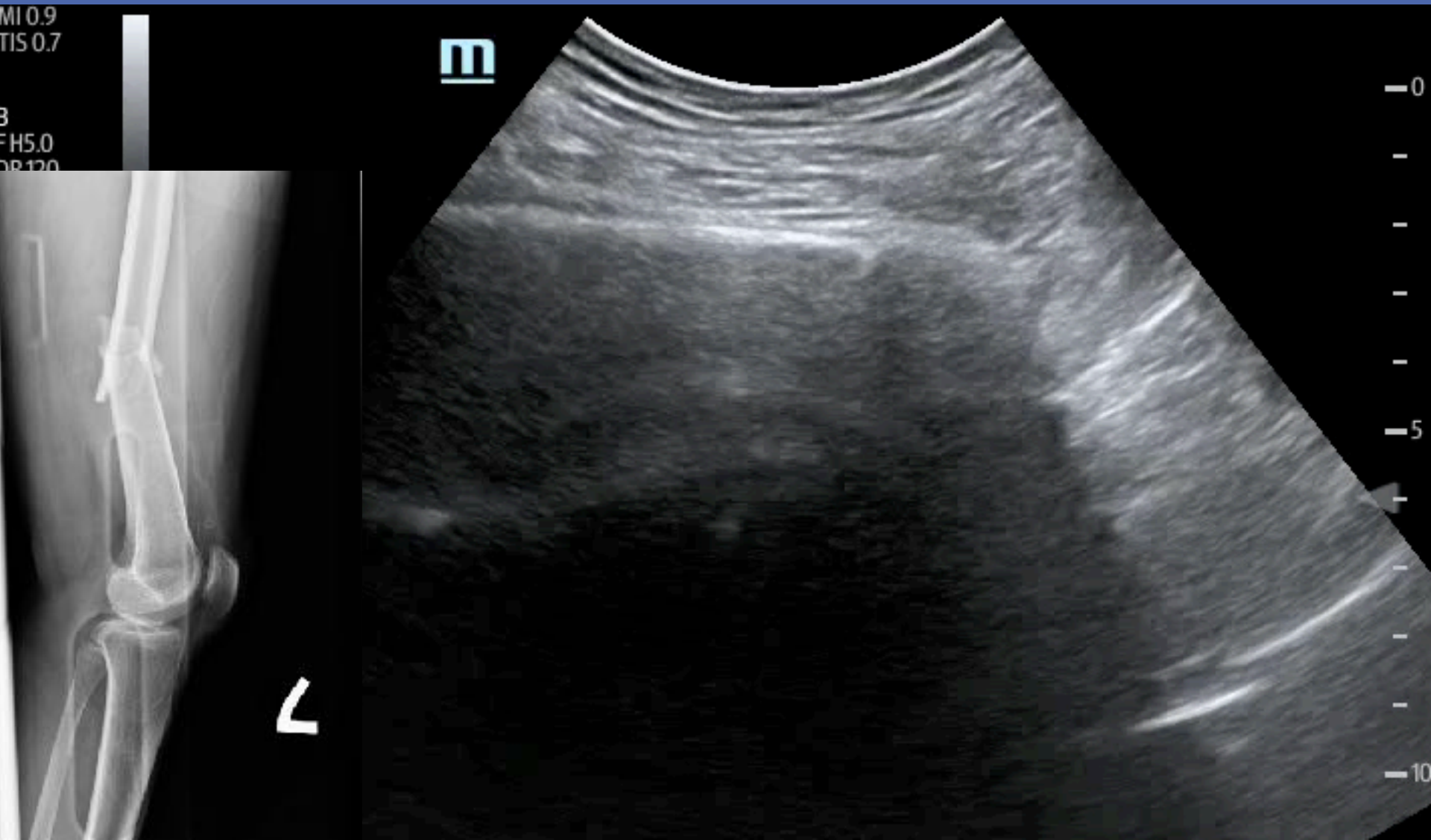




# Major trauma, deformed thigh

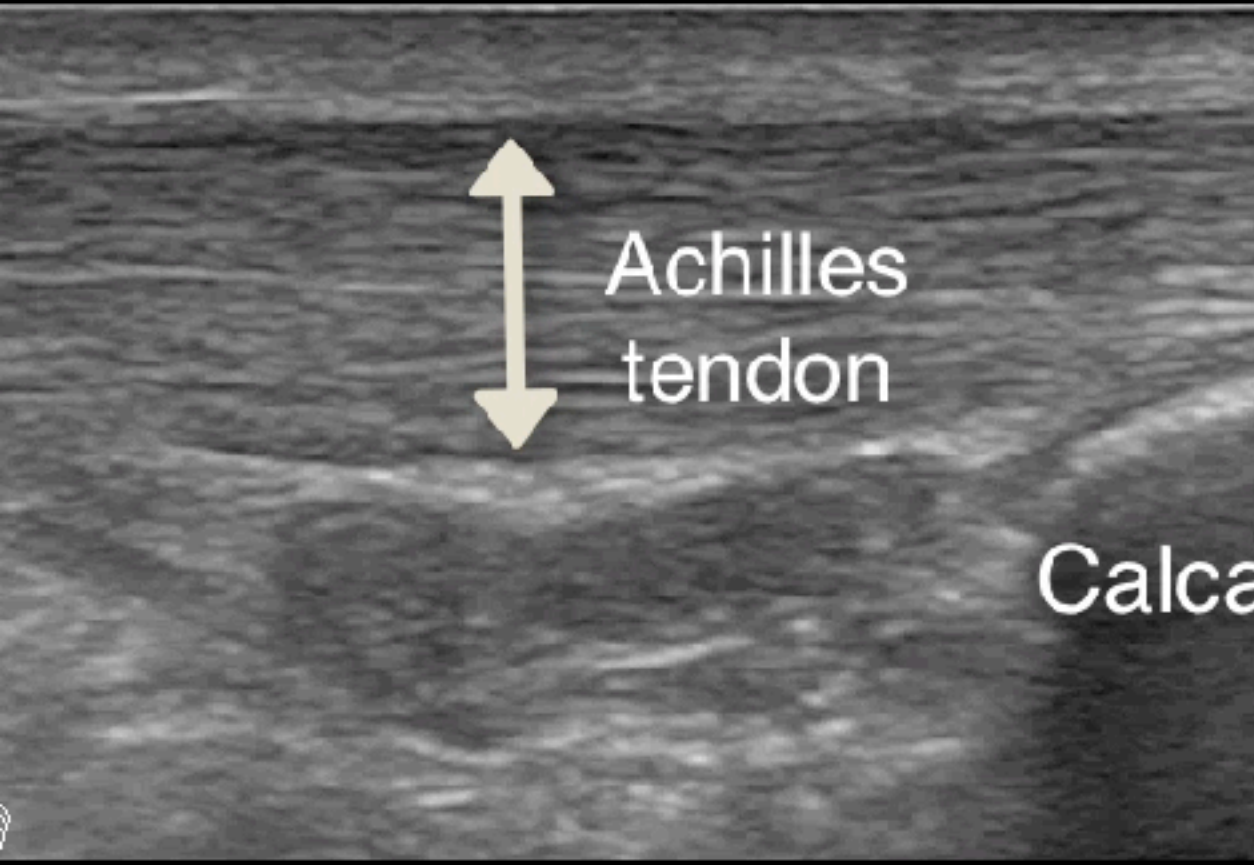


# Major trauma, deformed thigh



# Thompson test

## Achilles tendon rupture



59.1 km



3 

10'24"



# Knee cap



60Km

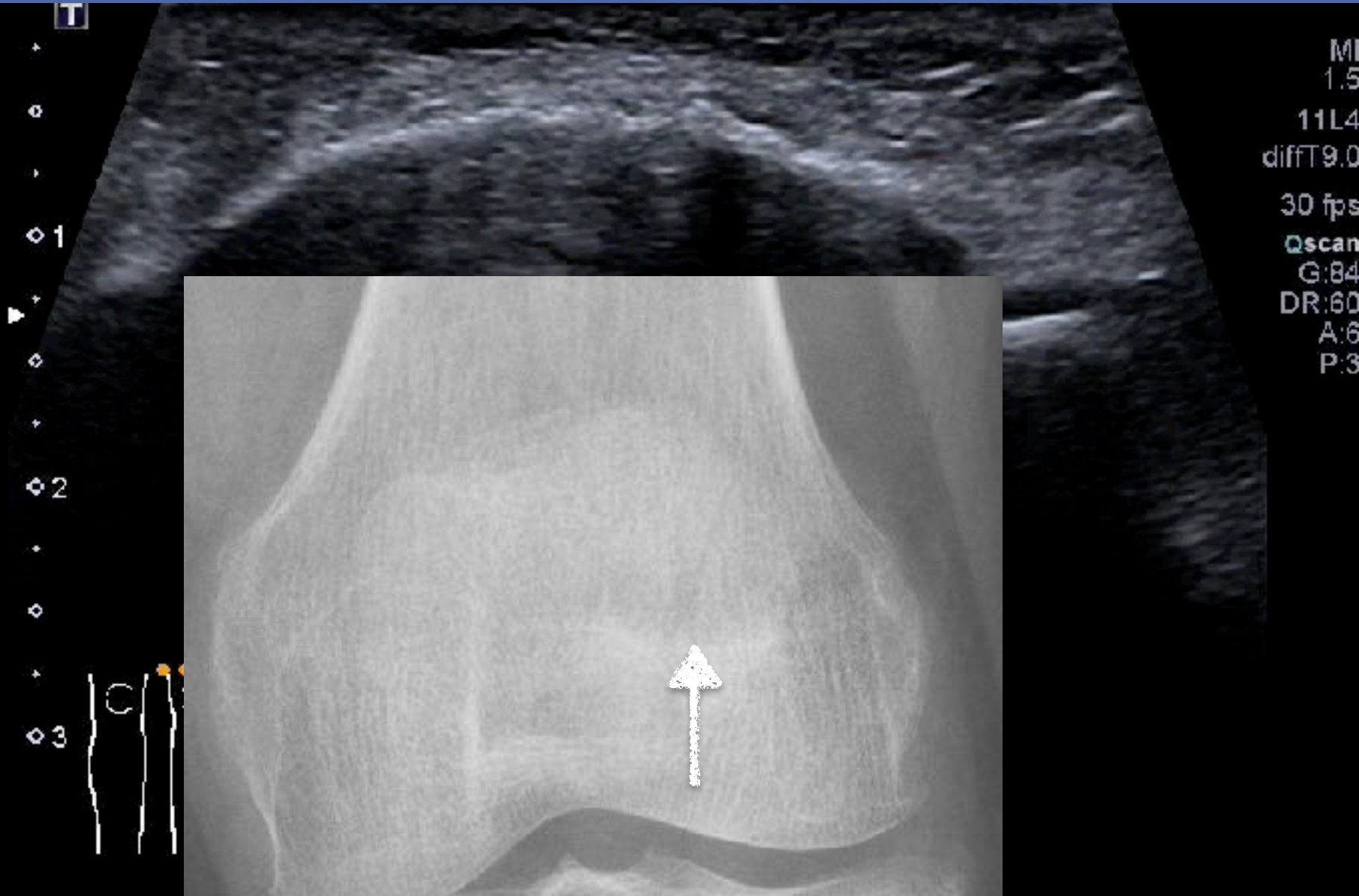




# Lipohemarthrosis

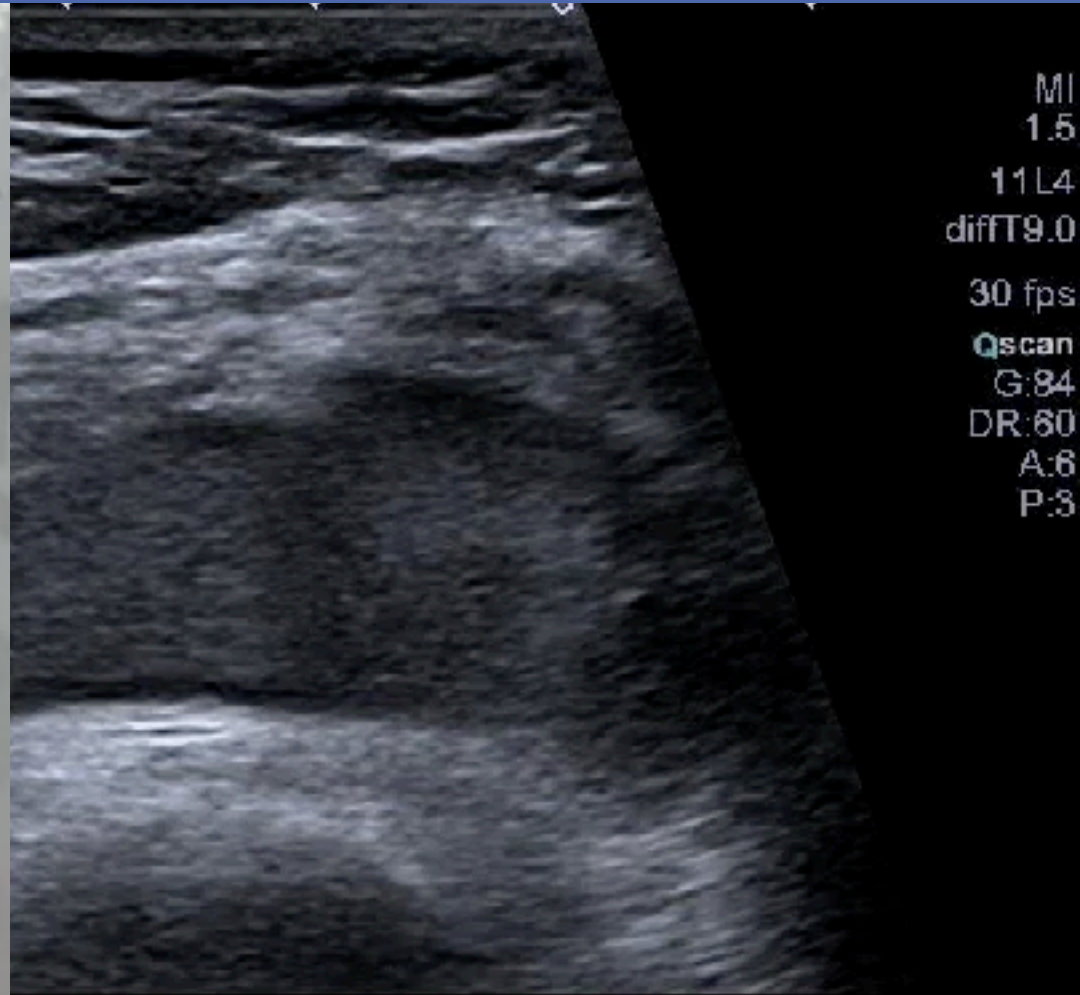


# Knee cap fracture



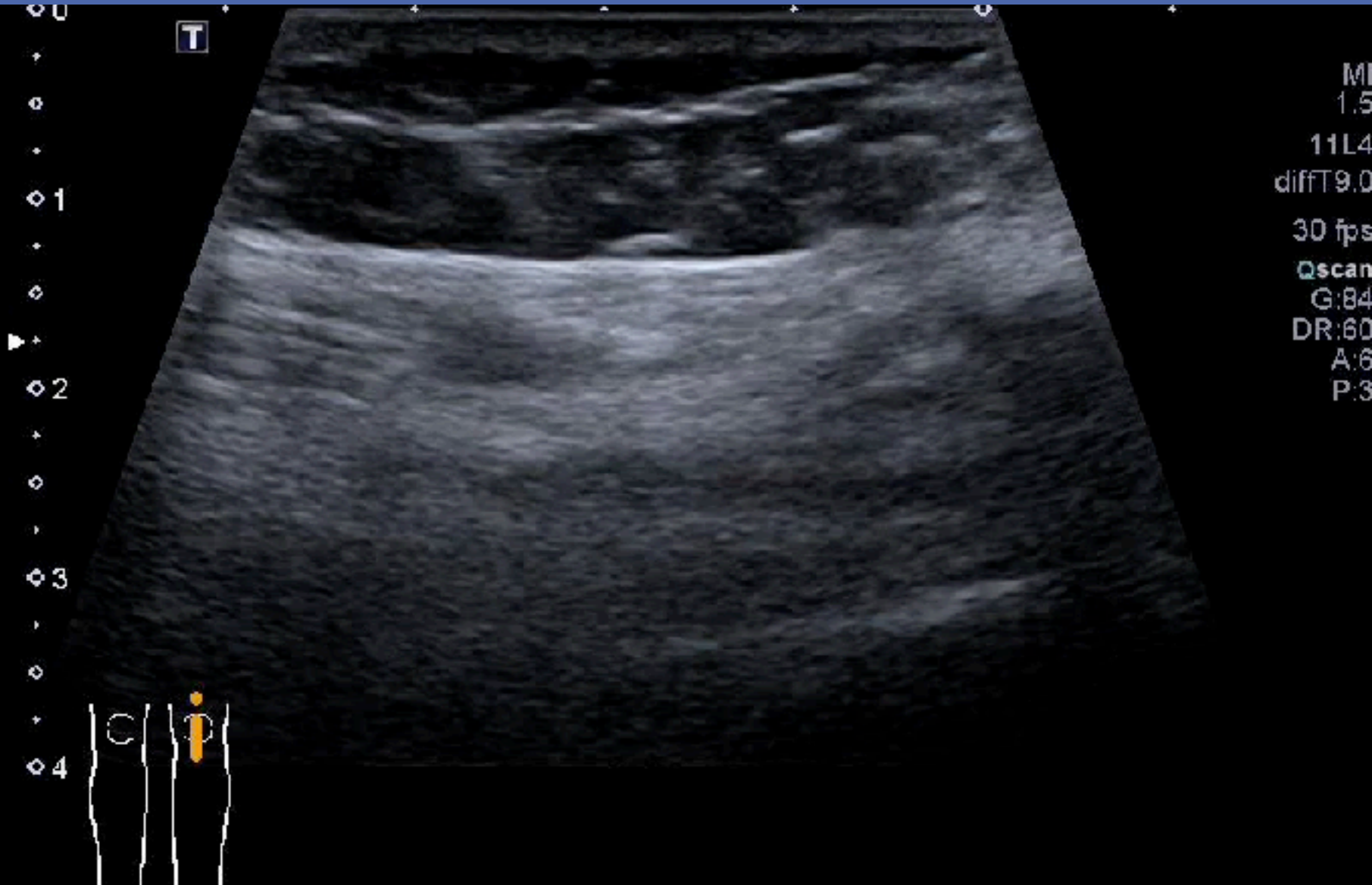


# Arthrocentesis



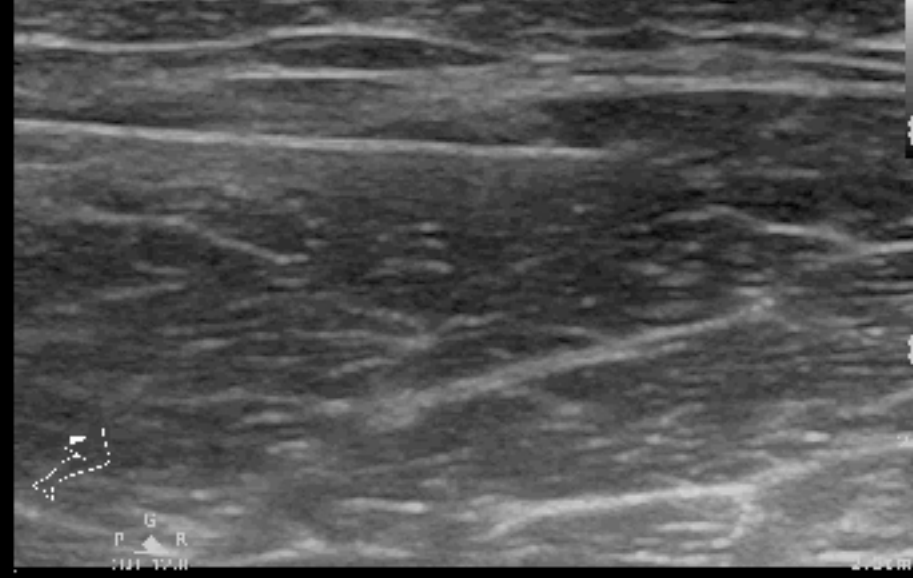
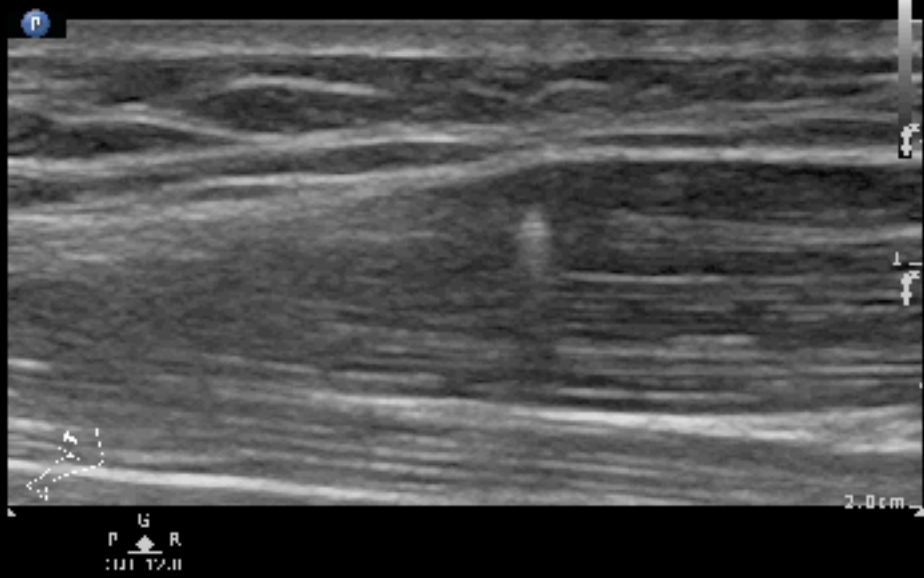
MI  
1.5  
11L4  
diffT9.0  
30 fps  
Qscan  
G:84  
DR:60  
A:6  
P:3

# Post aspiration



al

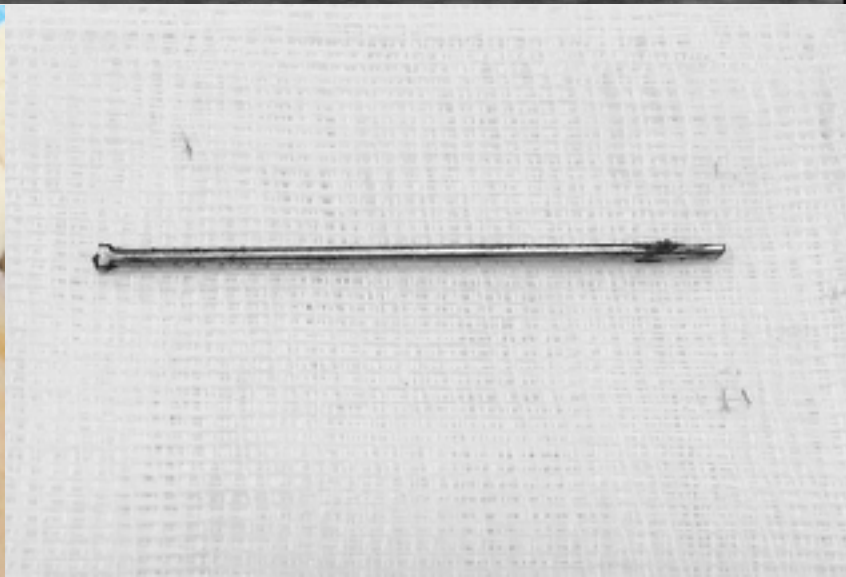
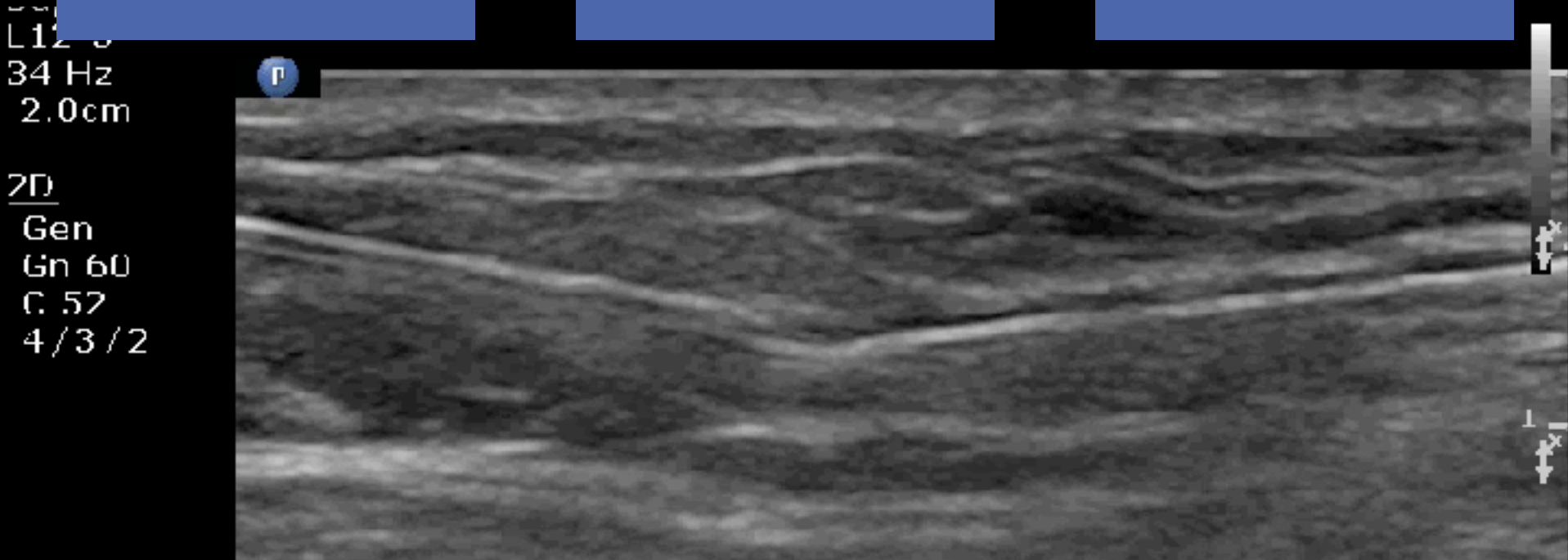
icial



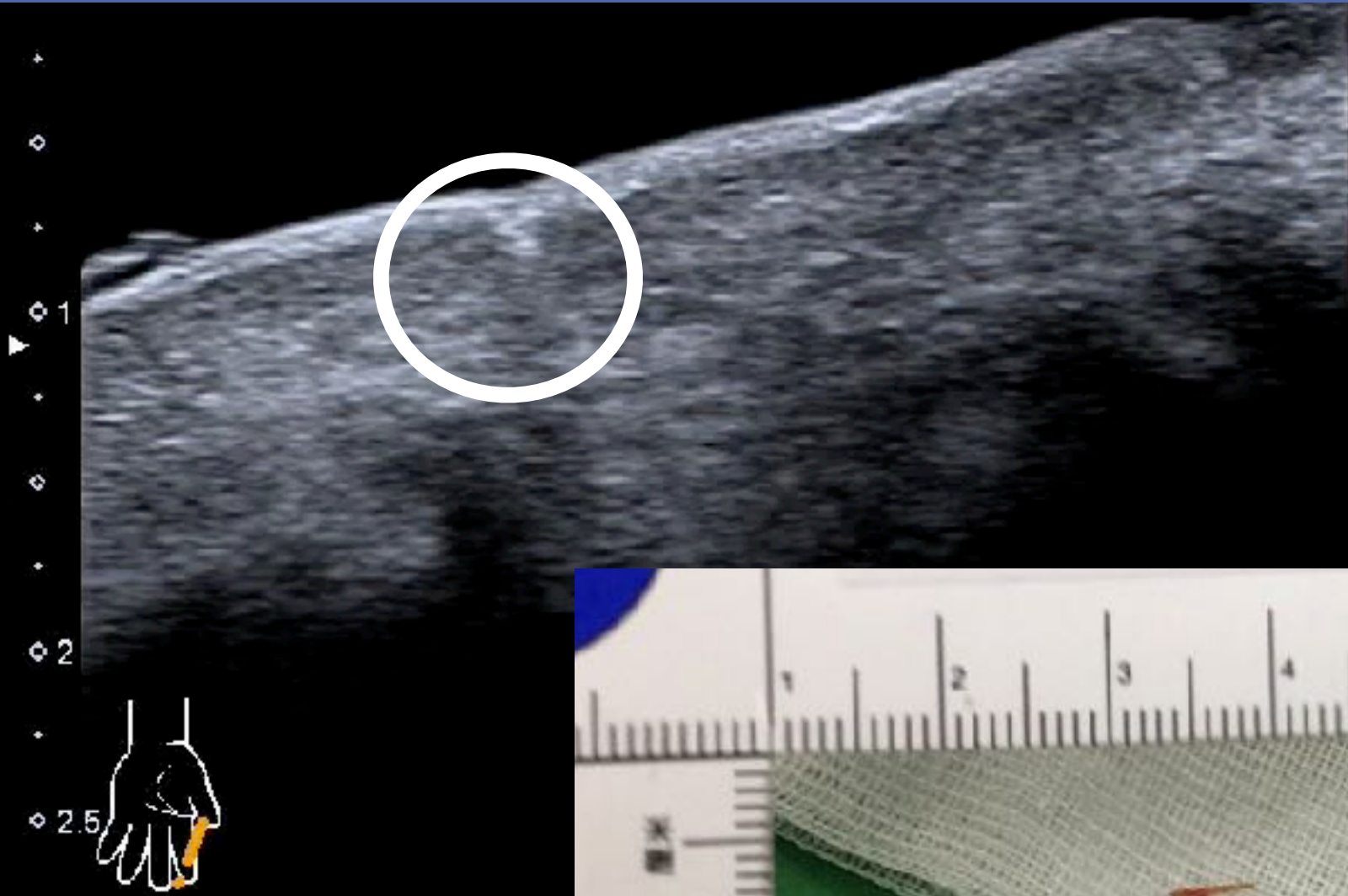
Localization

2 needle

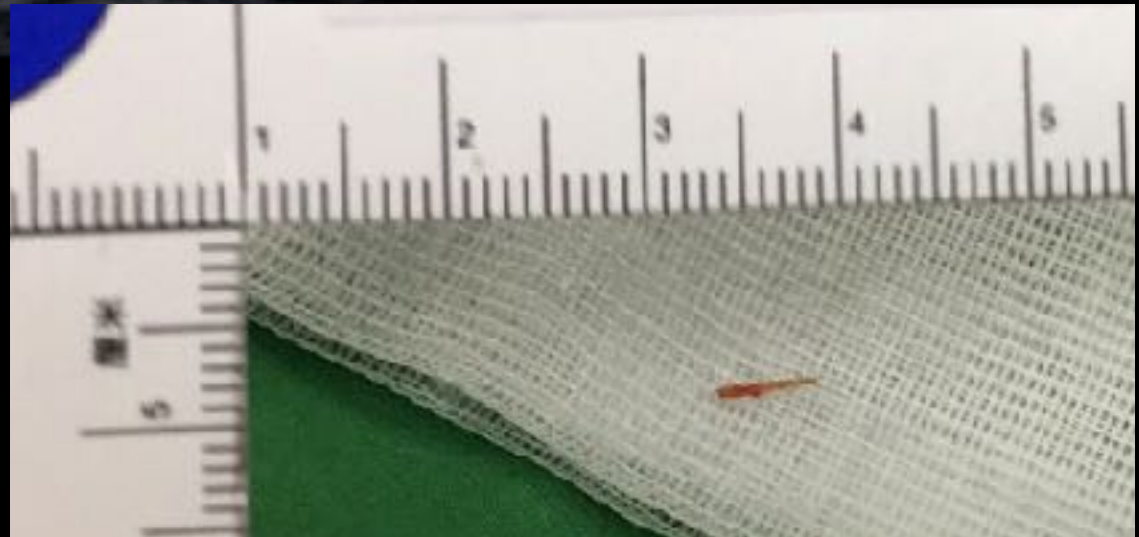
Incision



# Water bath

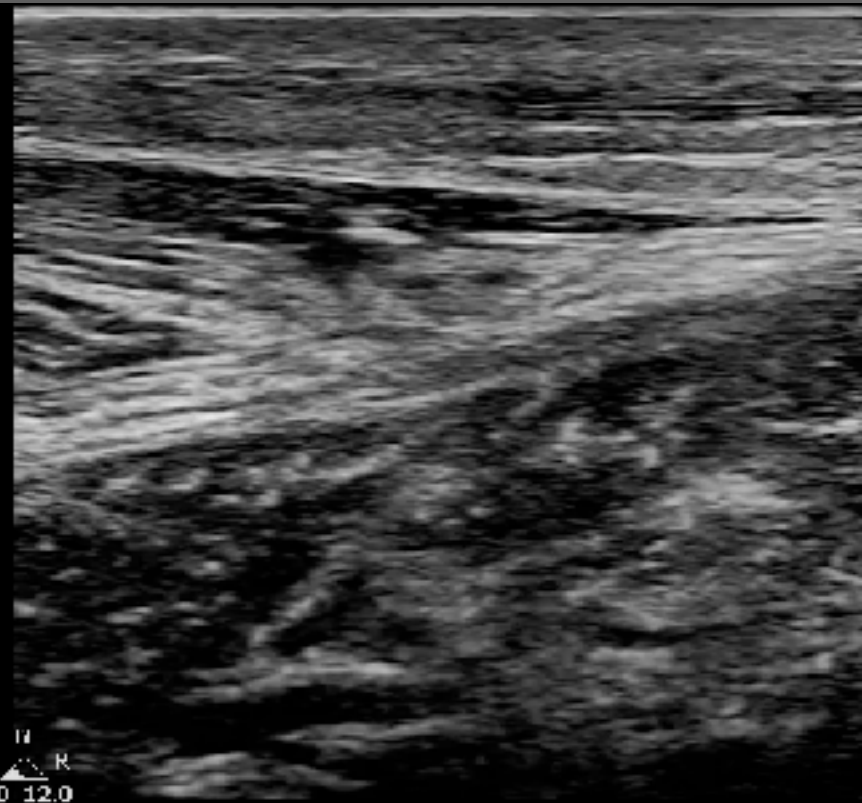


M  
1.5  
11L4  
diffT9.0  
30 fps  
G:86  
DR:60  
A:6  
P:3

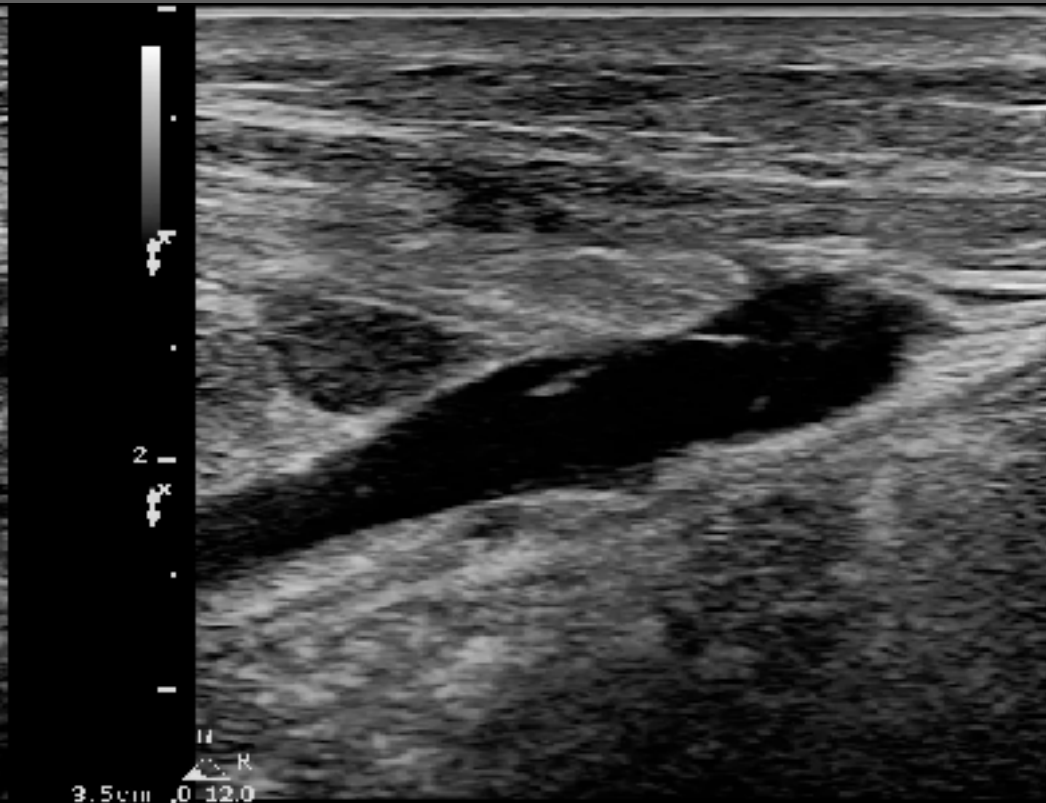


# Calf muscle tear

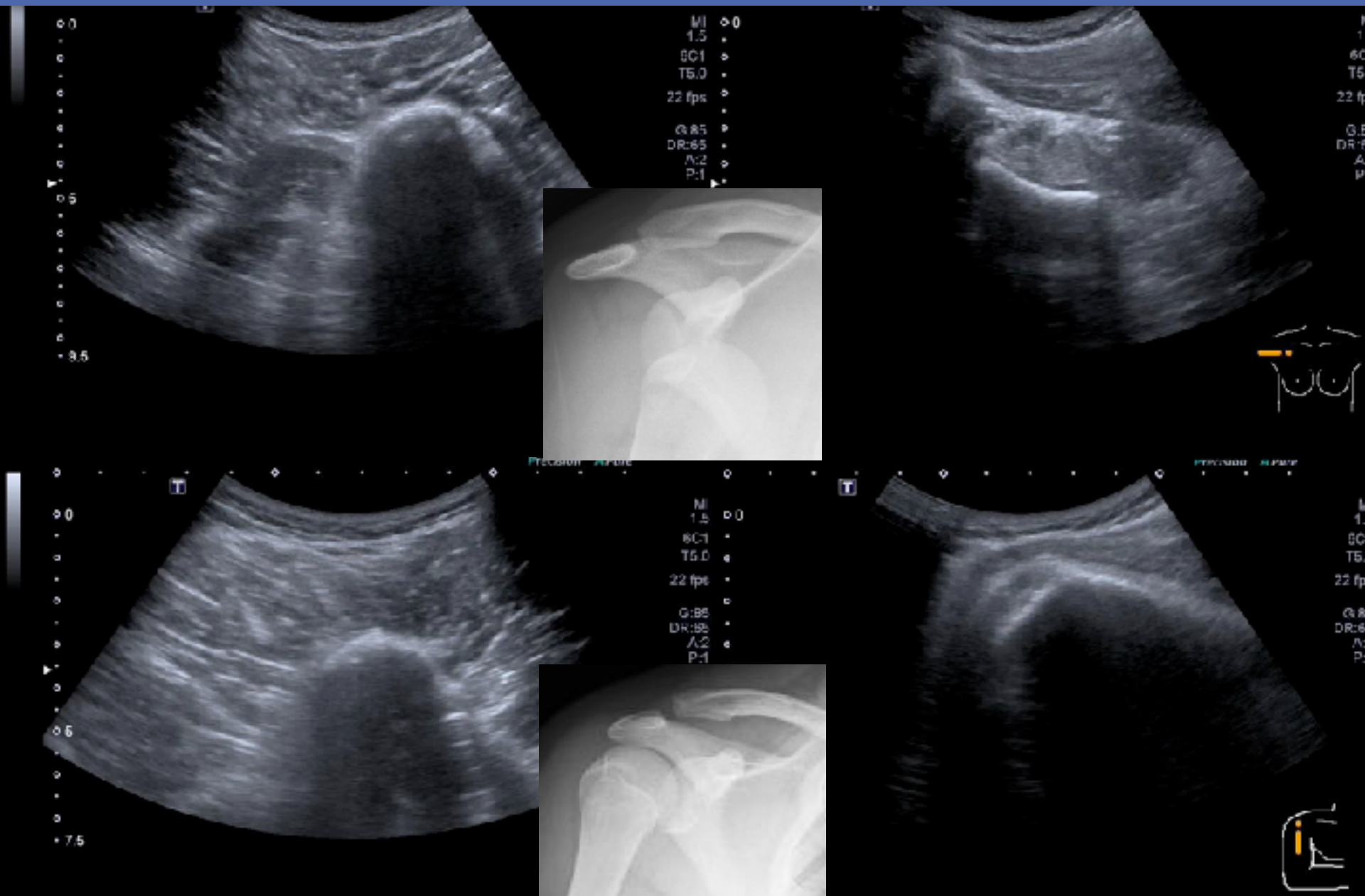
Left calf



Right calf



# Diagnosis & Confirmation



# Acute Pain Management







## EFAST的核心目標 1P + 3 H

看到恭喜你，沒看到不要太難過

界面多一點、次數多一點 (存証)

CTA永遠是最好的朋友

往全能超音波技術師邁進