衛生福利部雙和醫院
(委託臺北醫學大學興建經營)
Taipei Medical University - Shuang Ho Hospital,
Ministry of Health and Welfare

專科護理師POCUS工作坊

POCUS for Nurse Practitioners

陳國智醫師

雙和醫院急診醫學科

陳國智 醫師 / POCUSacademy.com

台灣疼痛醫學會專科醫師
急診超音波臨床評核醫師
醫用超音波學會指導醫師
WINFOCUS director / instructor
Certified Interventional Pain Sonologist

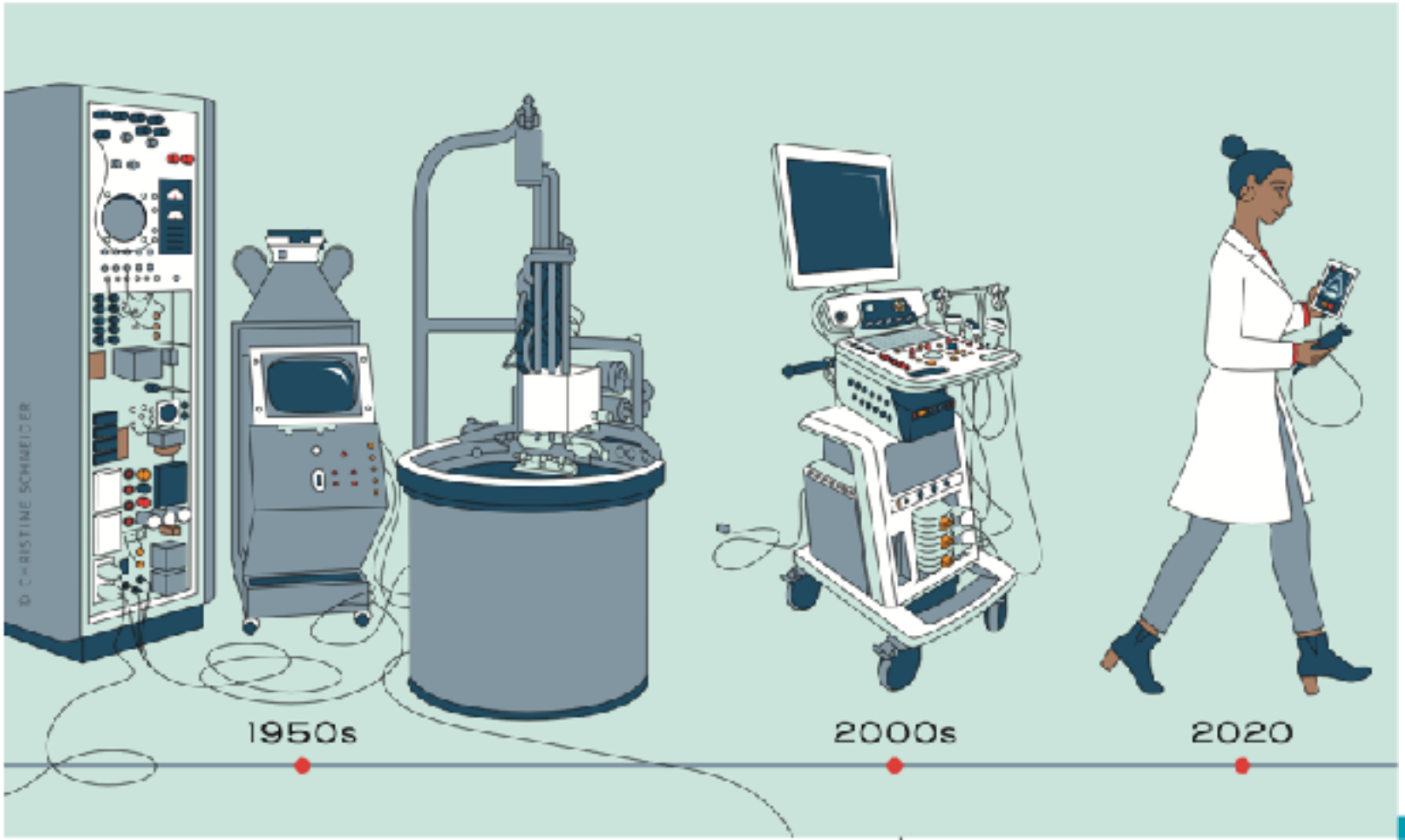
急診 / 重症 / 介入 / 急性疼痛

經歷
新光急診超音波訓練中心主任
西園醫院急診醫學科主任
急診醫學會超音波委員會主委
台灣疼痛醫學會大體模擬手術講師
急救加護醫學會重症超音波負責人

juice119@gmail.com

JOY SHEN-WAGNER, MD, FAAFP, AND MARK DEUTCHMAN, MD, FAAFP

Point-of-Care Ultrasound: A Practical Guide for Primary Care



Tools of the Trade: Point-of-Care Ultrasonography as a Stethoscope

Hiroshi Sekiguchi, MD[1]

[1] Division of Pulmonary and Critical Care Medicine, Mayo Clinic, Rochester, Minnesota

Address for correspondence Hiroshi Sekiguchi, MD, Division of Pulmonary and Critical Care Medicine, Mayo Clinic, 200 First St SW, Rochester, MN 55905 (e-mail: sekiguchi.hiroshi@mayo.edu).

Semin Respir Crit Care Med 2016;37:68–87.

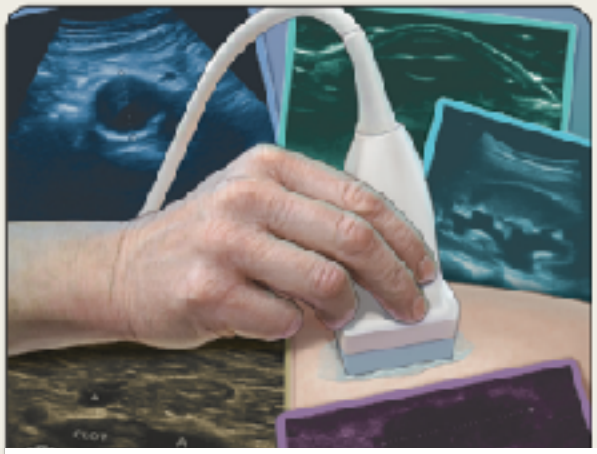
Inspection Palpation Percussion Auscultation Insonation

JAMA cardiology 2018

Point-of-Care Ultrasonography

Michael J. Arnold, MD, and Christopher E. Jonas, DO
Uniformed Services University of the Health Sciences, Bethesda, Maryland
Rachel E. Carter, MD, Naval Hospital Jacksonville, Jacksonville, Florida

Point-of-care ultrasonography (POCUS) is performed by a physician at the bedside and is standard practice in obstetric, emergency, and musculoskeletal medicine. When compared with formal sonography, POCUS is equivalent in screening for abdominal aortic aneurysm and as accurate in diagnosing deep venous thrombosis. POCUS has high accuracy for diagnosing pneumonia and detecting acute decompensated heart failure but is less accurate than computed tomography for identifying pulmonary embolism. POCUS confirmation of intrauterine pregnancy rules out an ectopic pregnancy. In the third trimester of high-risk pregnancies, umbilical artery Doppler ultrasonography can improve perinatal outcomes. Musculoskeletal POCUS is used to diagnose and guide treatment of many joint and soft tissue conditions. It is as accurate as magnetic resonance imaging in the diagnosis of complete rotator cuff tears. Ultrasound guidance improves outcomes in the placement of central venous catheters and fluid drainage from body cavities and lumbar punctures. Ultrasonography can reduce the use of CT for diagnosis of appendicitis; however, negative scan results do not rule out disease. POCUS can accurately diagnose and rule out gallbladder pathology, and is effective for diagnosing urolithiasis. Focused cardiac ultrasonography can detect pericardial effusion and decreased systolic function, but is less accurate than lung ultrasonography at diagnosing acute heart failure. Limited evidence demonstrates a benefit of diagnosing testicular and gynecologic conditions. The American Colleg Institute of Ultrasound in Medicine, the Society for Academic Emergency Medicine others offer POCUS training. Training standards for POCUS have been defined for re for credentialing. (*Am Fam Physician*. 2020;101(5):275-285. Copyright © 2020 Ameri



The hands-on, "showing while telling" nature of POCUS advances physical diagnosis skills, fosters doctor-patient communication, and increases patient satisfaction.

POINT-OF-CARE ULTRASOUND USES

POCUS uses	Scope of use	Example questions
Physical exam extension	Focused	"Is this palpable mass a cystic or solid structure?" "Is the baby in the cephalic or breech presentation?"
Procedural	Focused	"Where is the best location to insert a needle?" "Where is the foreign body?"
Diagnostic	Focused	"Are there stones in the gallbladder?" "Is there a pregnancy in the uterus?"
Multi-organ scans	Extended	"Is the patient's hypotension due to sepsis, heart failure, or acute blood loss?" "What is causing the patient's dyspnea?"

N Engl J Med 2021;385:1593-602.

POCUS FOR BEGINNERS

The best procedures for point-of-care ultrasound (POCUS) beginners are impactful for the patient, easy to perform (require a small number of quickly obtained views), simple to interpret (limited diagnostic endpoints), and low liability for patient and physician.

Tissue/system	Learn this first	Then proceed to	Transducer type
Skin and soft tissue	Cellulitis vs. abscess	Lumps and bumps	High frequency
Musculoskeletal	Knee effusions	Needle guidance	High frequency
Pelvis and obstetrics	Bladder obstruction	Intrauterine pregnancy labor and delivery	Low frequency
Abdomen	Abdominal ascites	Hydronephrosis	Low frequency
Chest	Pleural effusion	Pulmonary edema	Low frequency

POCUS MULTI-ORGAN SCANS

Name	Clinical use	Diagnostic targets
EFAST (Extended Focused Assessment with Sonography for Trauma)[1]	Blunt trauma of the abdomen and chest	Free fluid in the abdomen and pelvis, pericardial fluid, and pneumothorax and pleural fluid
Labor and delivery[2]	Late third trimester exams and labor and delivery	"5 Ps" of pregnancy: • Parity (number) • Pulse (fetal heartbeat) • Pocket (fluid) • Placenta (location) • Presentation (cephalic vs. breech)
RUSH (Rapid Ultrasound for Shock and Hypotension)[3]	Undifferentiated hypotension or signs of shock	Multi-organ protocol to assess for etiology of shock and hypotension
CLUE (Cardiopulmonary Limited Ultrasound Exam)[4]	Cardiopulmonary dysfunction	Heart, inferior vena cava, and lung views to determine heart failure physiology
PLAPS (Parasternal, Epigastric, Anterior lung, Right upper quadrant, Left upper quadrant, and Suprapubic)[5]	Core physical exam for generalist (routine inpatient or outpatient use)	A layered, window-based approach to teaching and learning core ultrasound exam

Point-of-care ultrasound: An emerging clinical tool to enhance physical assessment

Abstract: Point-of-care ultrasound (PoCUS) is a cost-effective diagnostic technology that, with training, is accessible, portable, and a convenient diagnostic modality to complement physical assessments. PoCUS is beneficial in that it can reduce the number of imaging tests required, while also mitigating barriers to healthcare for rural and remote communities.

By Courteney D.M. Fraleigh, BN, RN and Elsie Duff, PhD, NP

As a primary care clinical tool, PoCUS can be used to complement physical assessments to expedite diagnosis, reduce time to treatment, and precipitate timely referrals by trained healthcare professionals.

Nurse Pract 2022 Aug; 47(8): 14–20.

居家POCUS應用

胸腔　　泌尿　　IVC

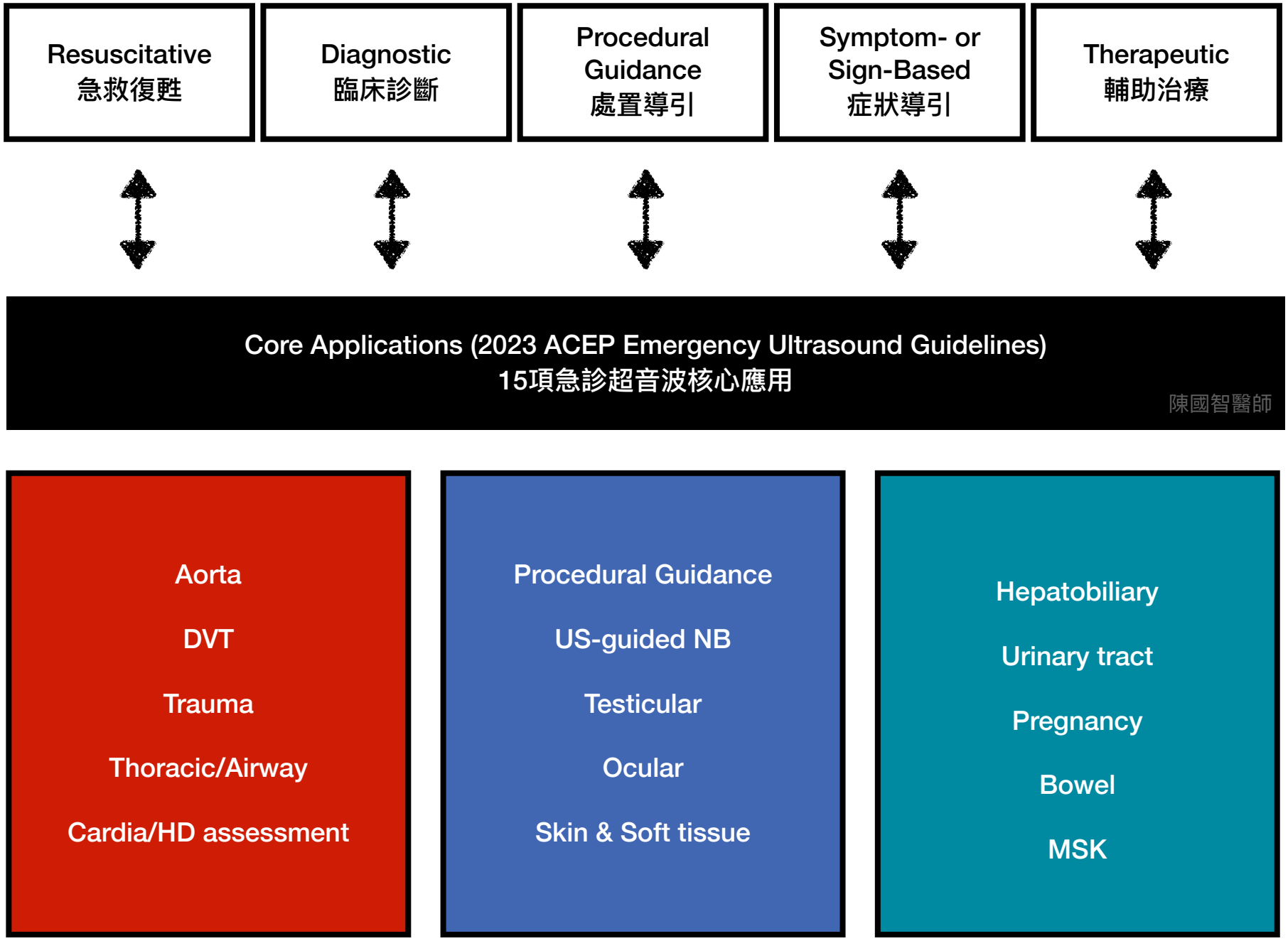
台灣在宅醫療學會

Taiwan Society of Home Health Care

POINT OF CARE ULTRASOUND

Provider - Probe - Patient

~ 存在於臨床需求之所在 ~


Resuscitative
急救復甦
Diagnostic
臨床診斷
Procedural Guidance
處置導引
Symptom- or Sign-Based
症狀導引
Therapeutic
輔助治療
Core Applications (2023 ACEP Emergency Ultrasound Guidelines)
15項急診超音波核心應用
陳國智醫師
Aorta
DVT
Trauma
Thoracic/Airway
Cardia/HD assessment
Procedural Guidance
US-guided NB
Testicular
Ocular
Skin & Soft tissue
Hepatobiliary
Urinary tract
Pregnancy
Bowel
MSK

POCUS應用/學習模板: I-AIM

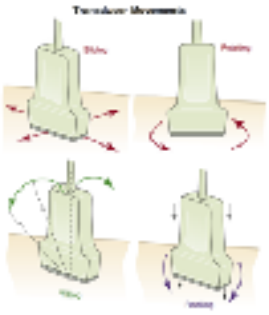
Indication
Point / 掃描目的

Acquire
取得影像

Interpret
判讀影像

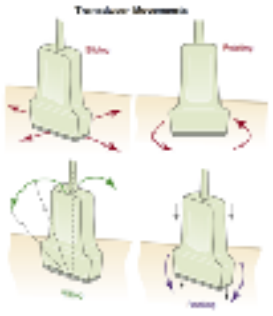
Make decision
臨床決策

Bahner DP, et al. J Ultrasound Med 2012



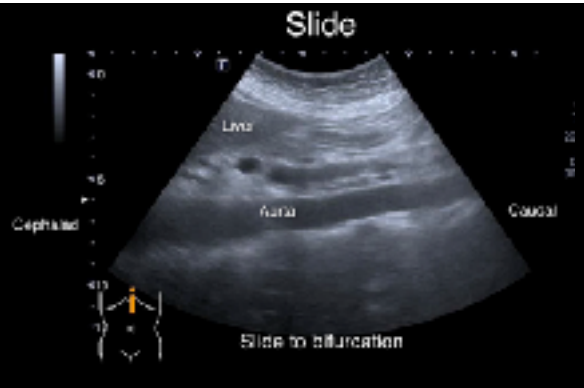
探頭掃描 6 大技巧

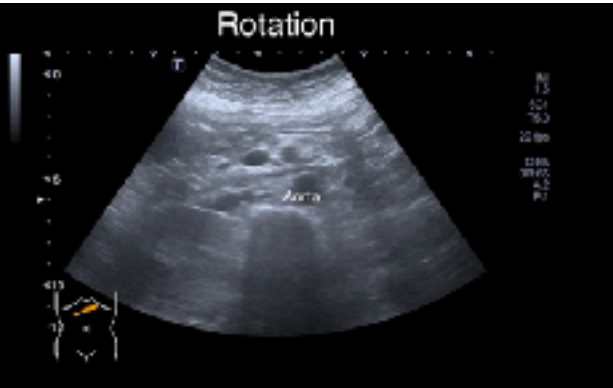
X	Y	Z
掃 Sweep	滑 Slide	轉 Rotate
傾 Fan/ tilt	搖 Rock	壓 Compress

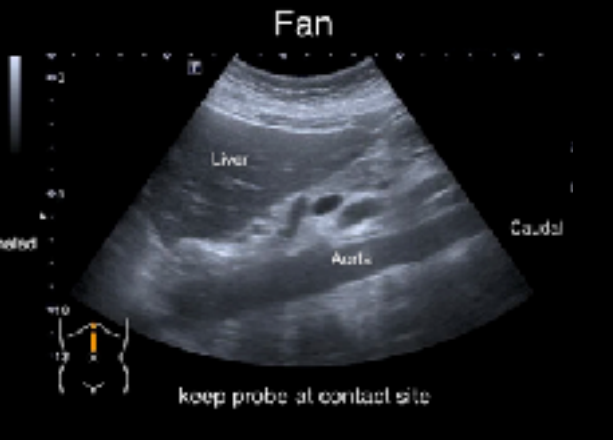


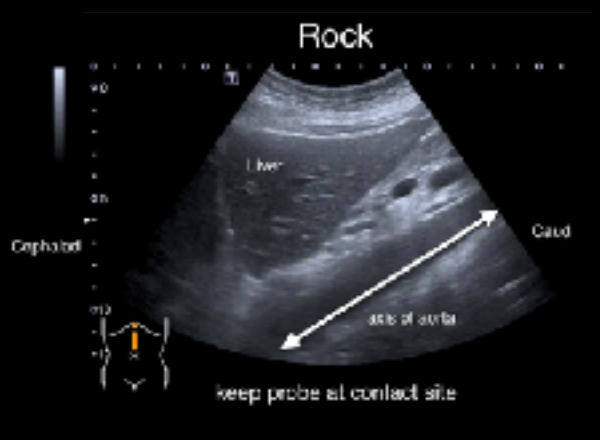
探頭掃描 6 大技巧

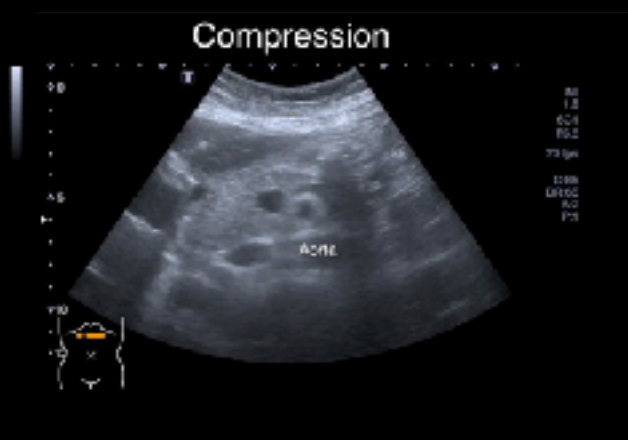
X　　Y　　Z



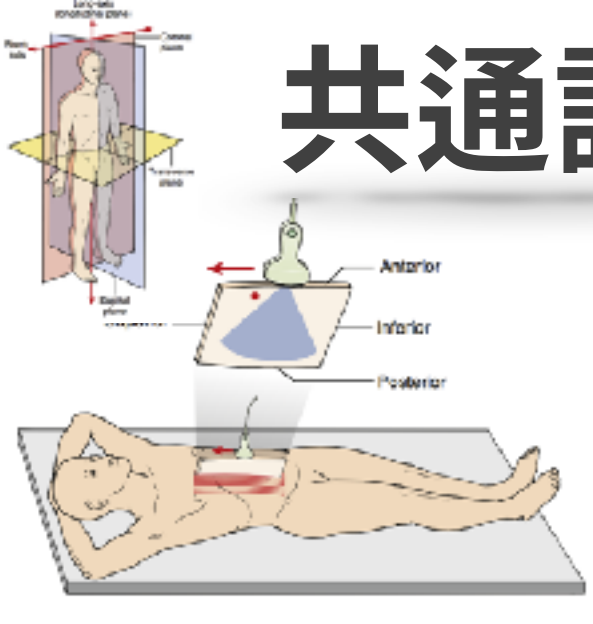


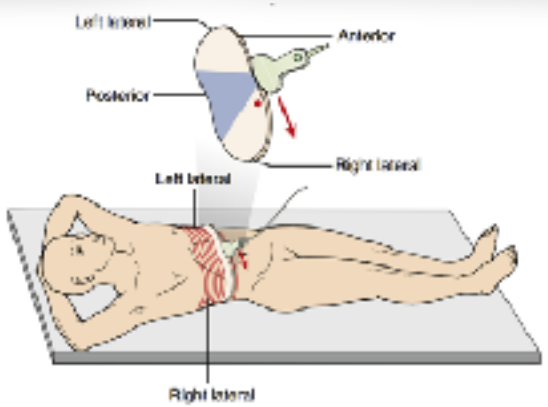


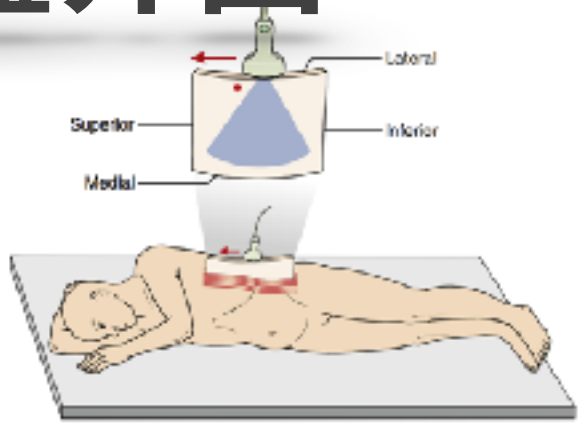




共通語言: 3D立體介面



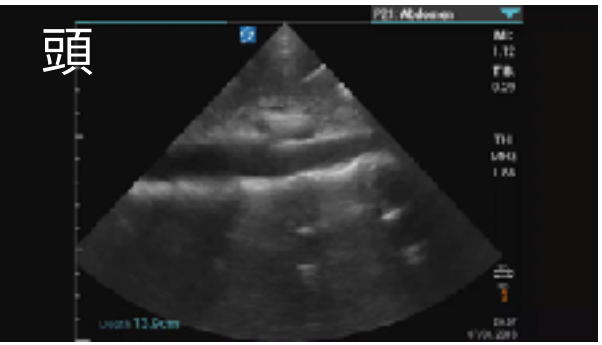


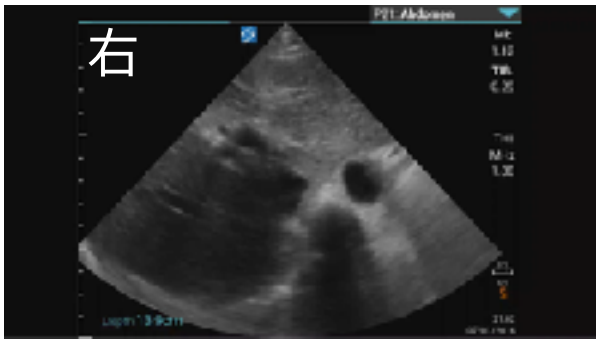


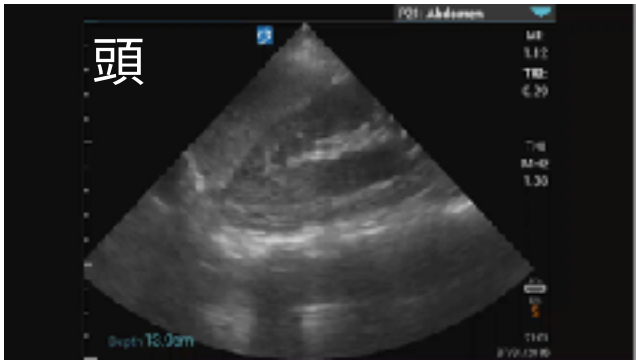
Sagittal 縱

Transverse 橫

Coronal 側







掃描前用手指碰觸探頭表面確認方向

掃描前先想探頭該怎麼擺效果最好

GAIN DEPTH RECORD

最佳視野

最大視窗

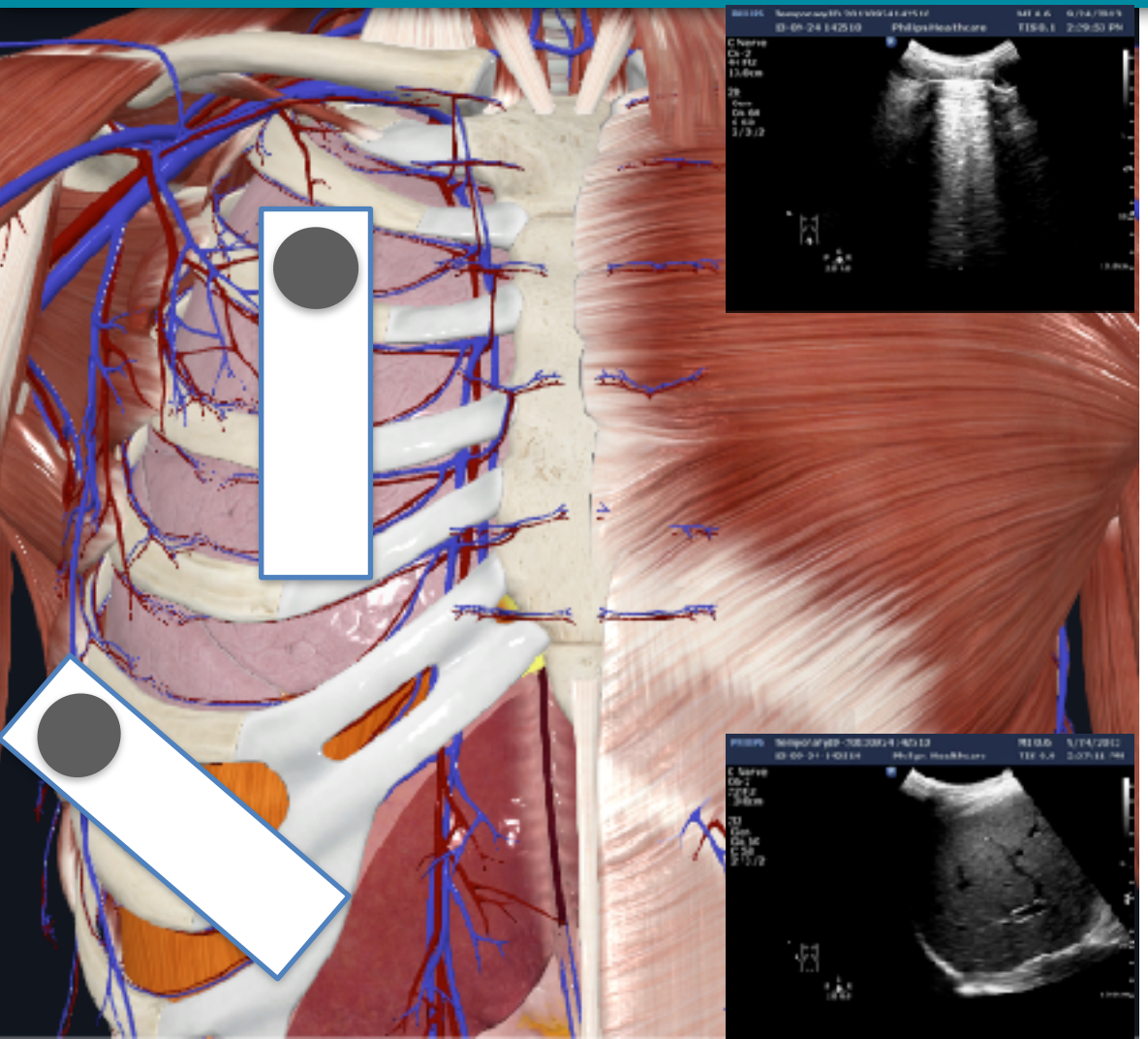
最好路線

最小調整

最適探頭

隨身設備用來看最重要發現

Lung (胸腔POCUS)



肋膜

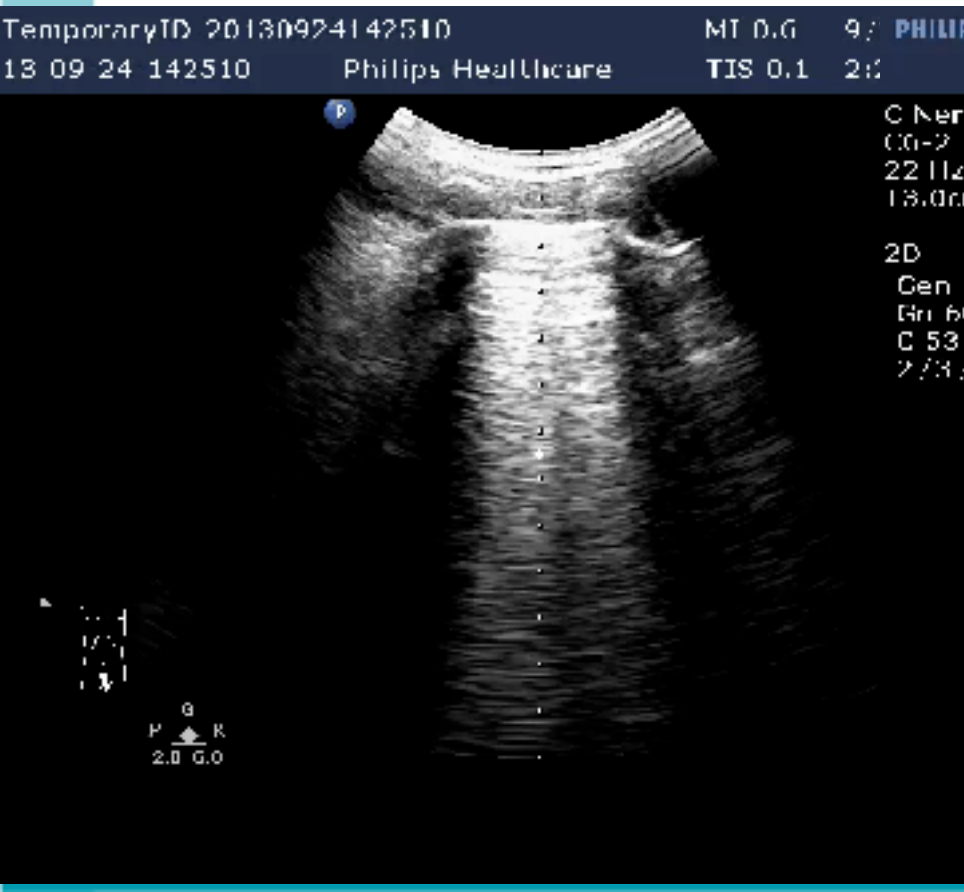
高回音
有滑動
縱向掃描
鎖骨中線之最高點

橫膈膜

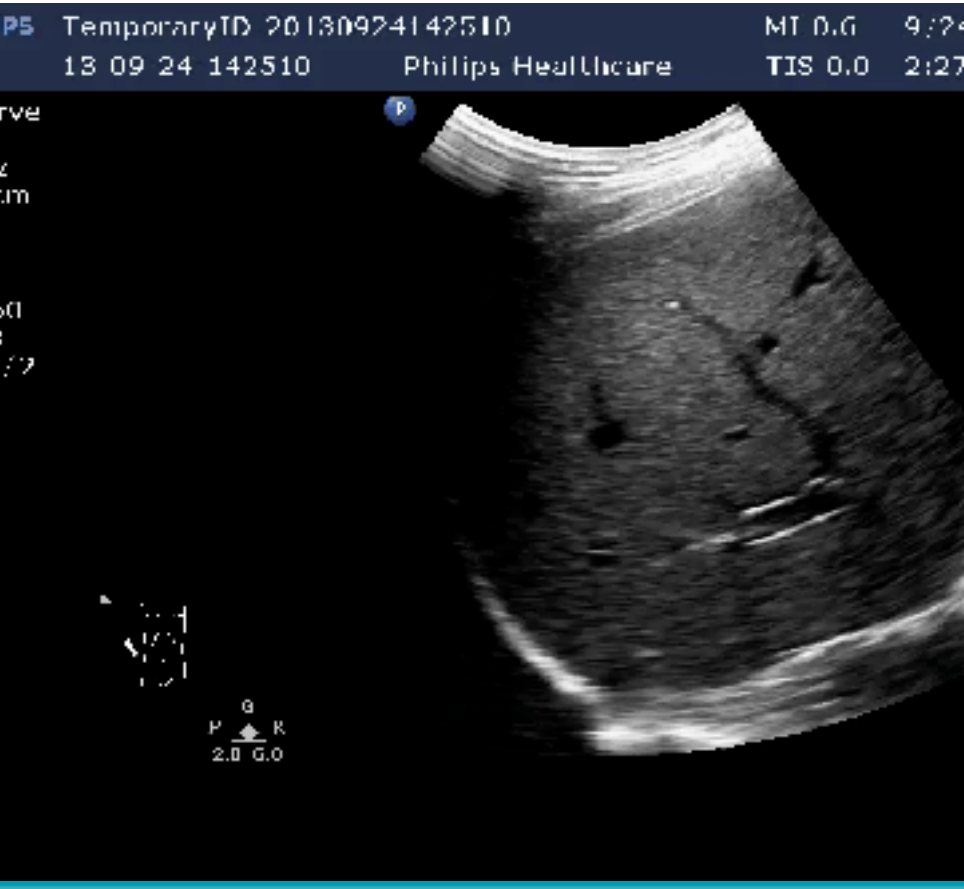
高回音
有移動
肋間掃描
劍突腋前/後線交界

NORMAL LUNG (隨呼吸而動)

肋膜/滑動

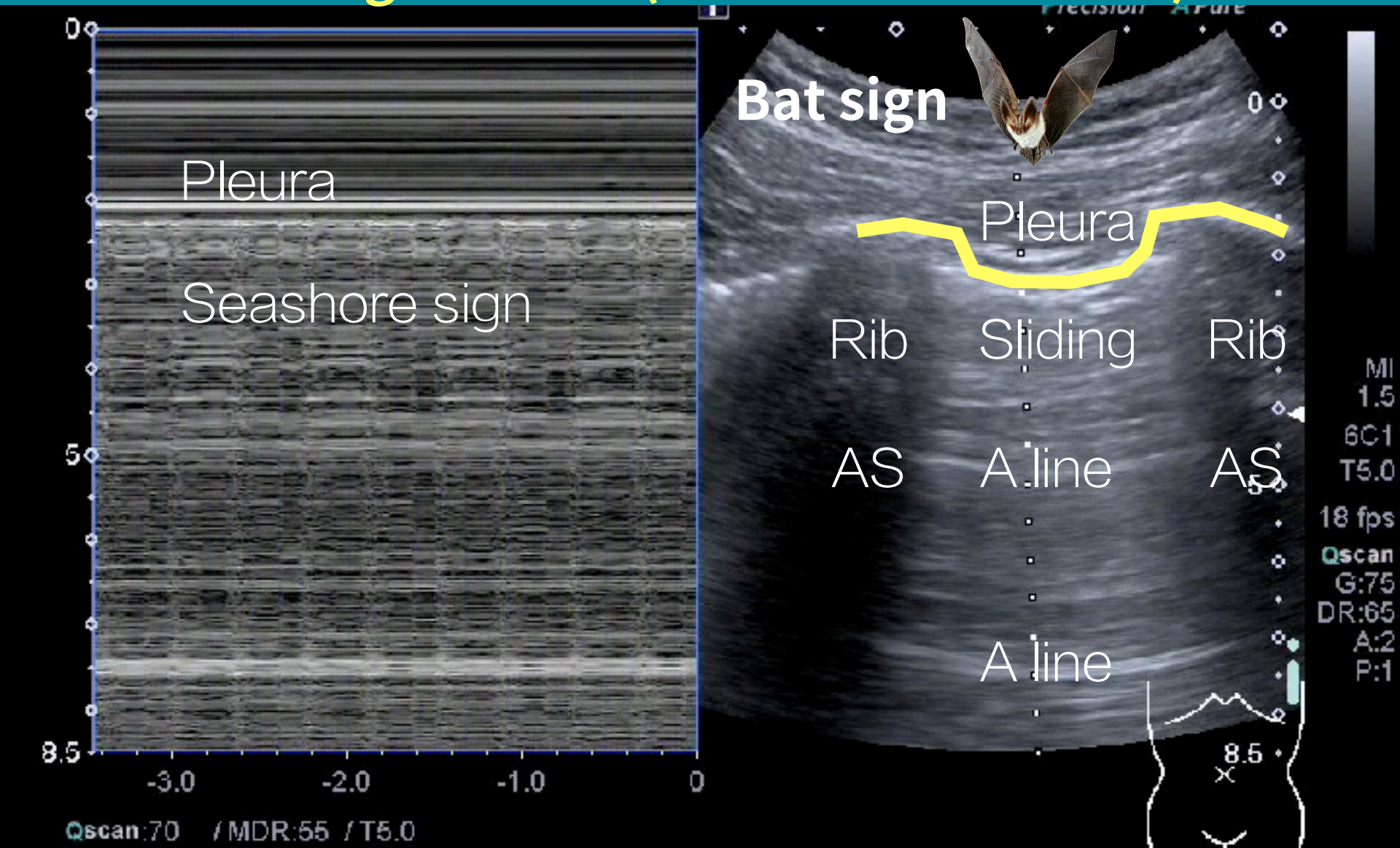


橫膈膜/移動



NORMAL LUNG

Sliding + A lines (皮膚-肋膜的等距假影)



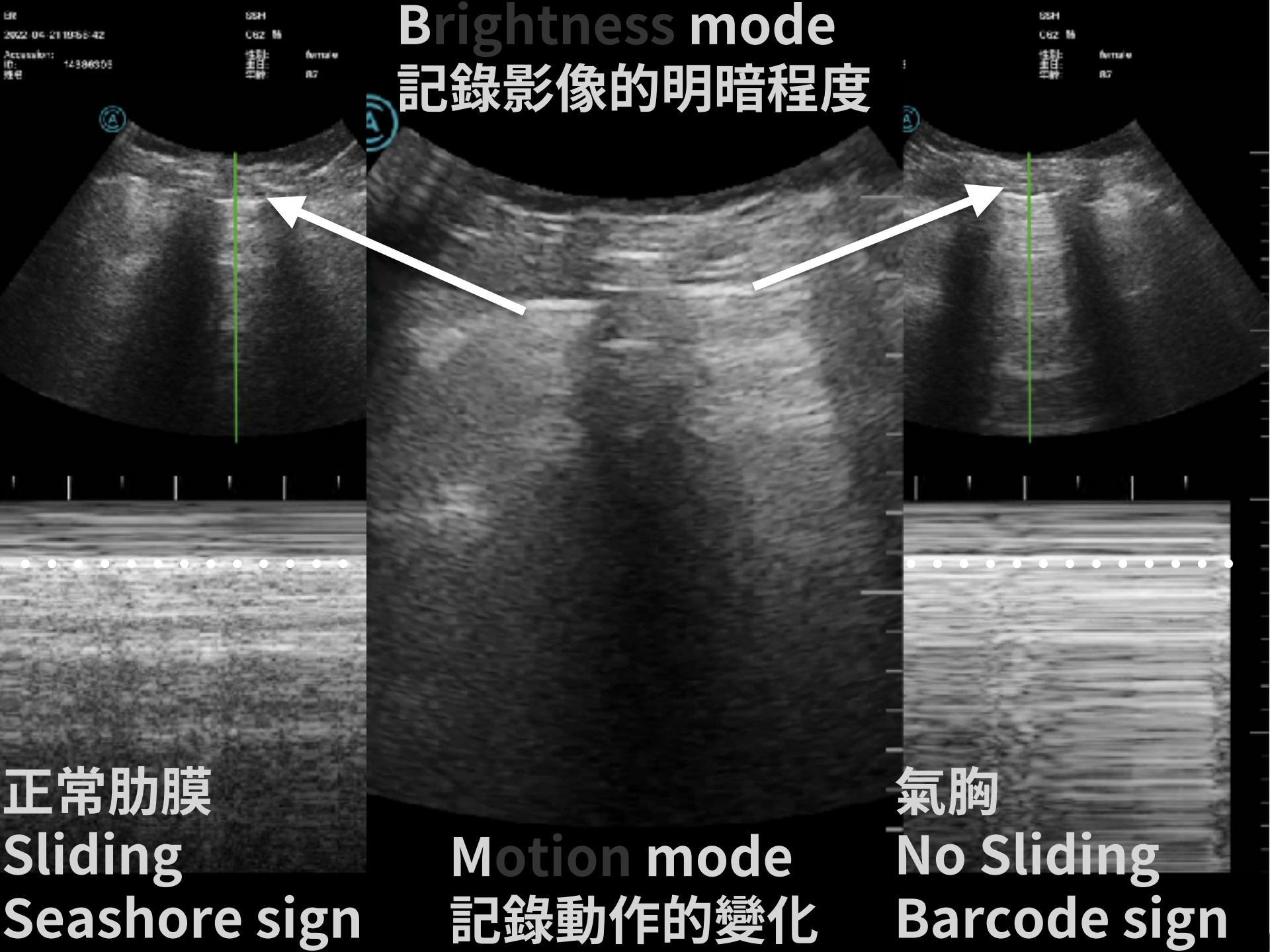
SLIDING FIRST

先看有無肋膜滑動

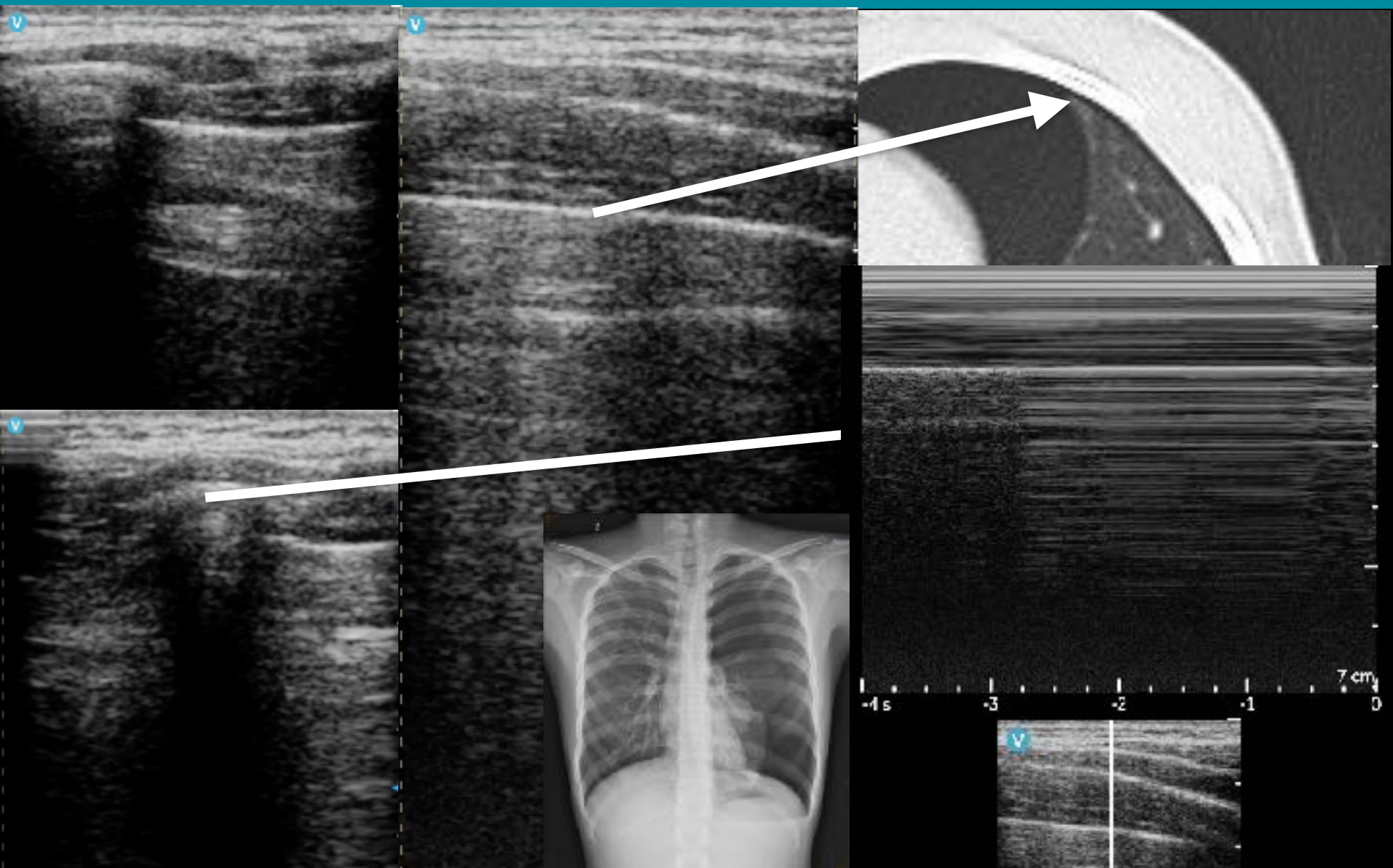
肋膜下
水平線
等距離

乾---溼

肋膜下
垂直線
大於三


Brightness mode
記錄影像的明暗程度
正常肋膜
Sliding
Seashore sign
Motion mode
記錄動作的變化
氣胸
No Sliding
Barcode sign

LUNG POINT & SUBCUTANEOUS EMPHYSEMA
LUNG POINT可用來確診PNEUMOTHORAX



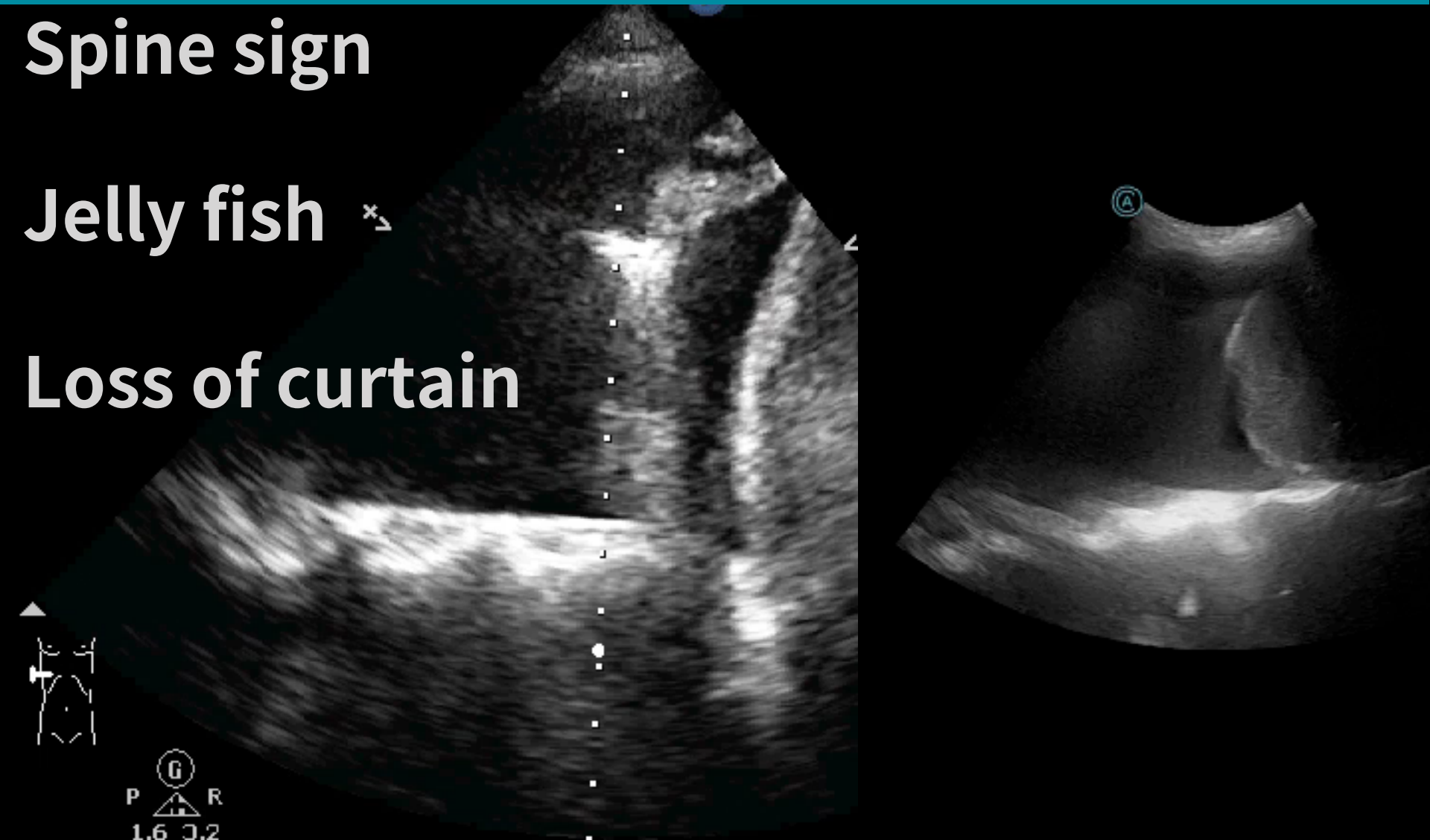
ALEVOLAR INTERSTITIAL SYNDROME

PLEURAL EFFUSION (肋膜積液)

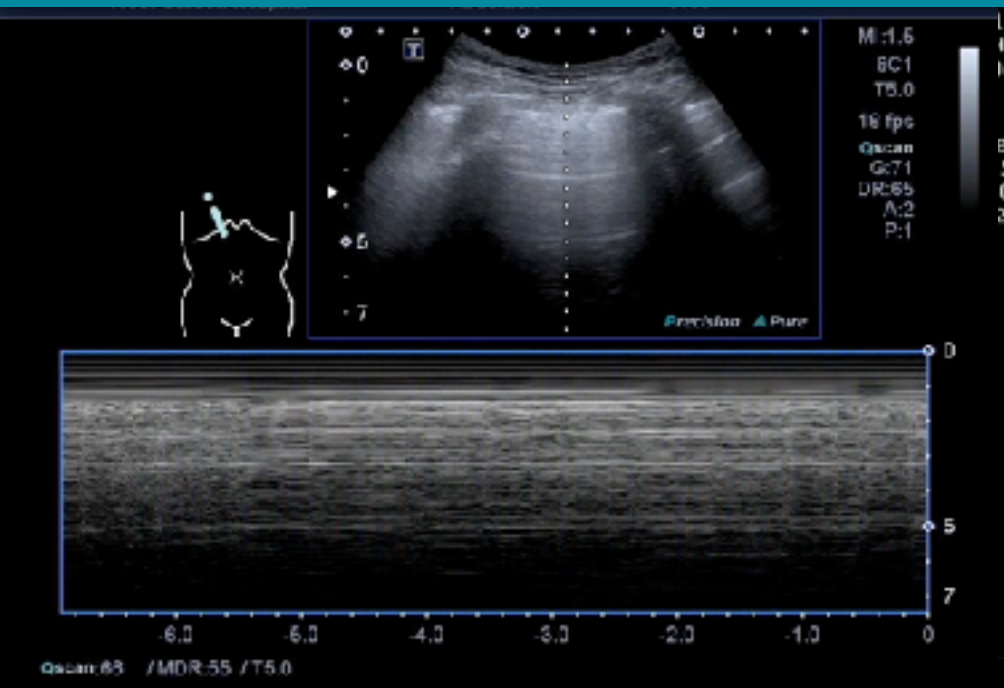
Spine sign

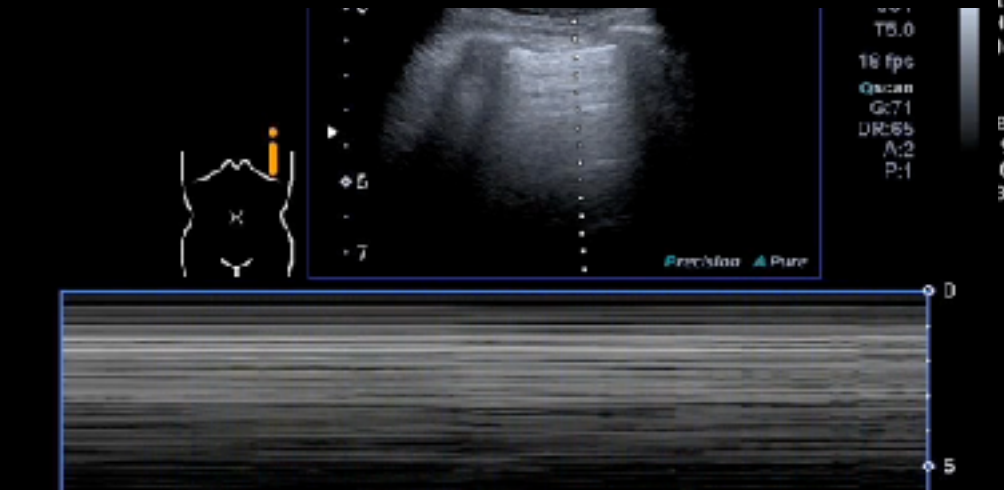
Jelly fish

Loss of curtain

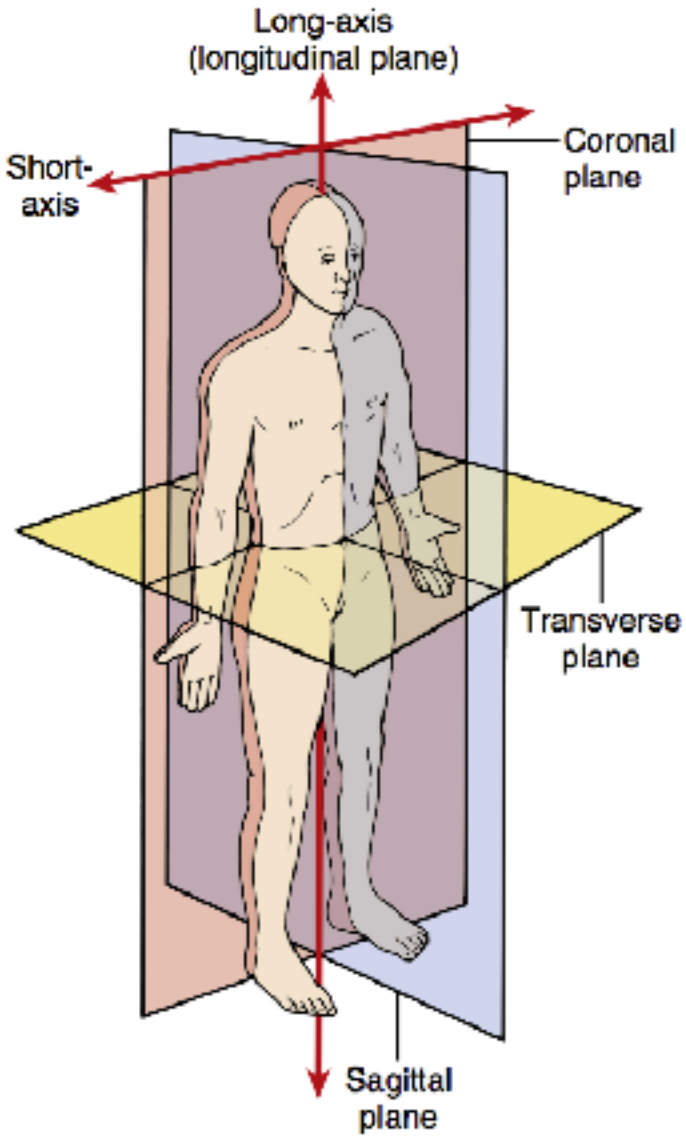


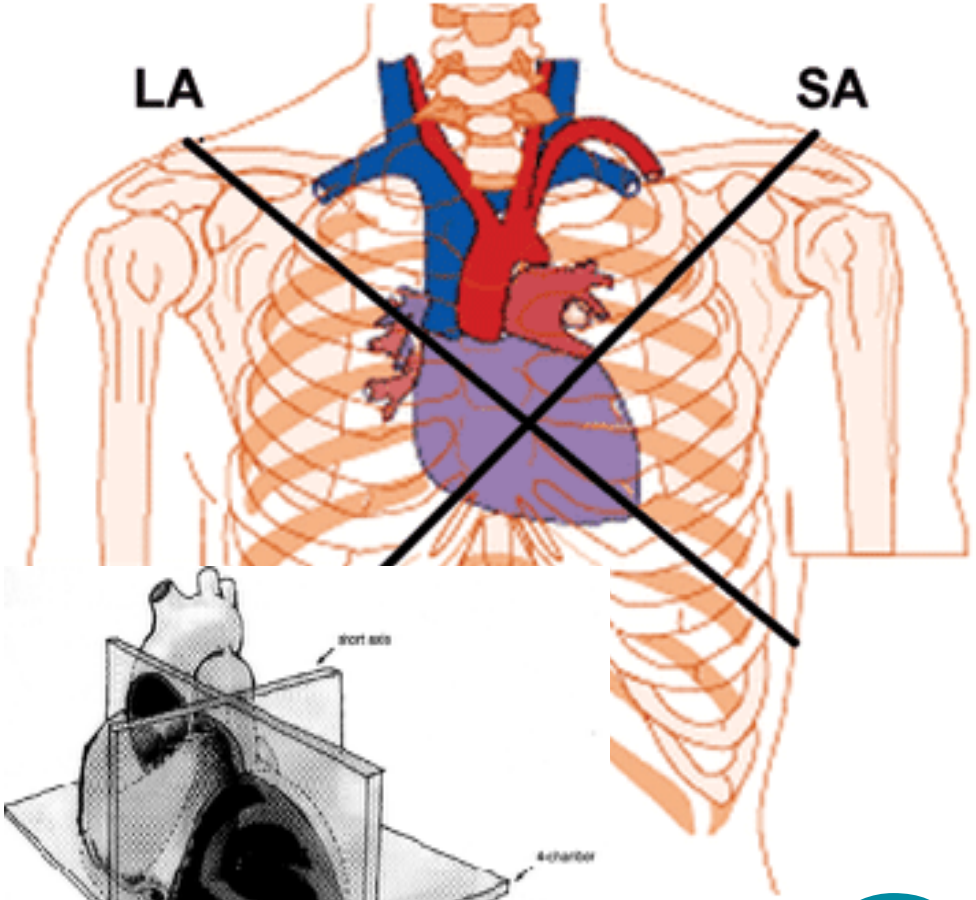
胸腔POCUS >> 肋膜 + 橫膈膜

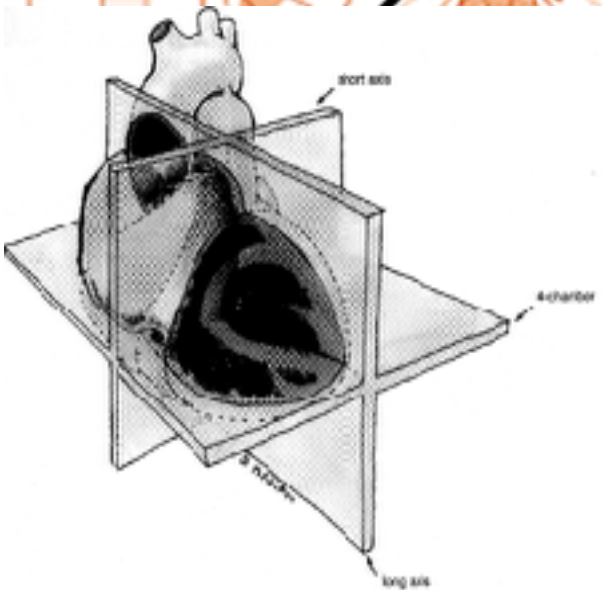


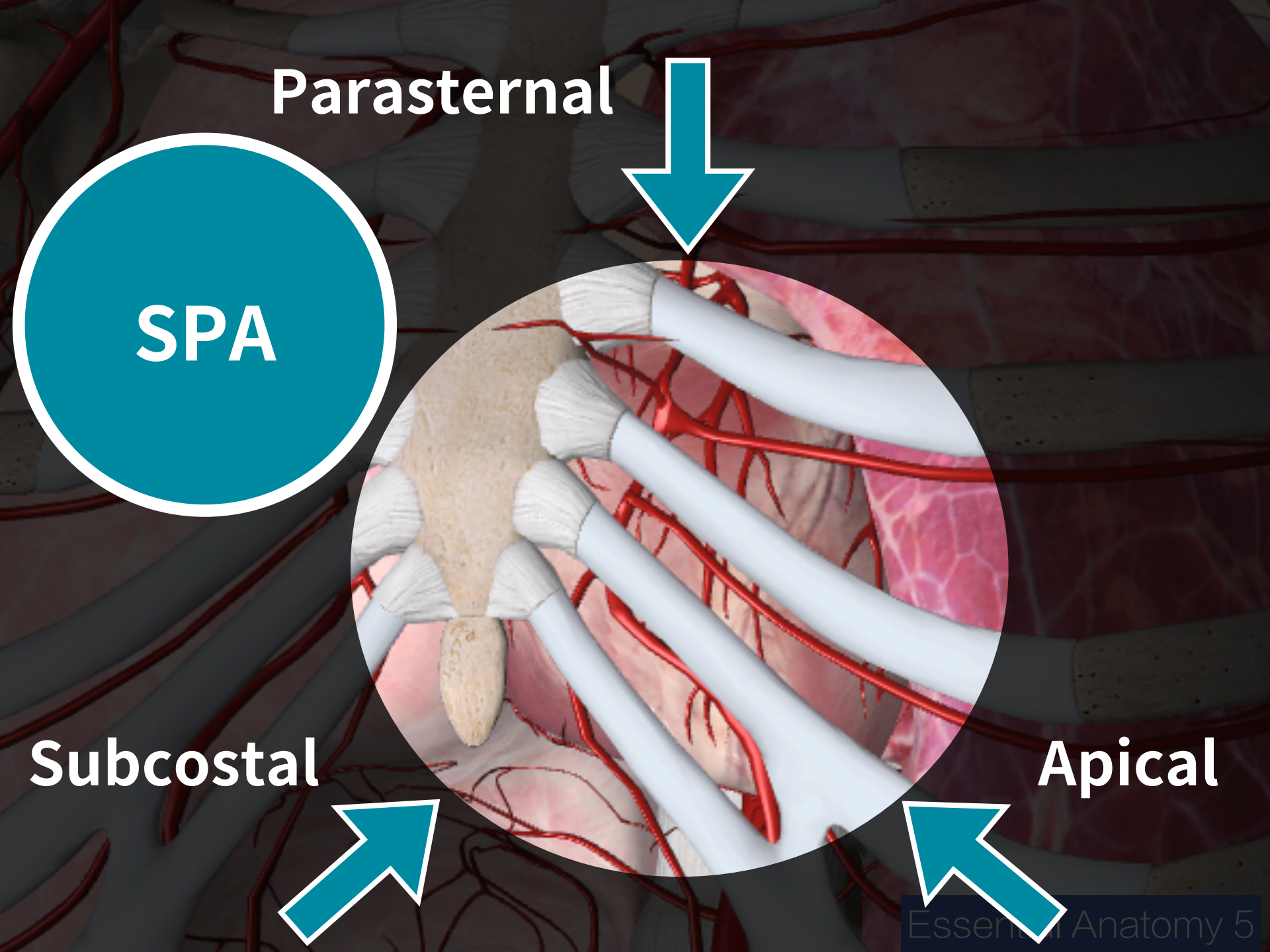


基本掃描介面 和 心臟掃描介面

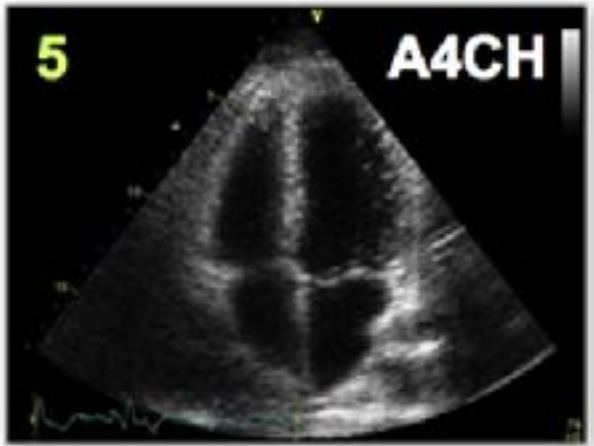






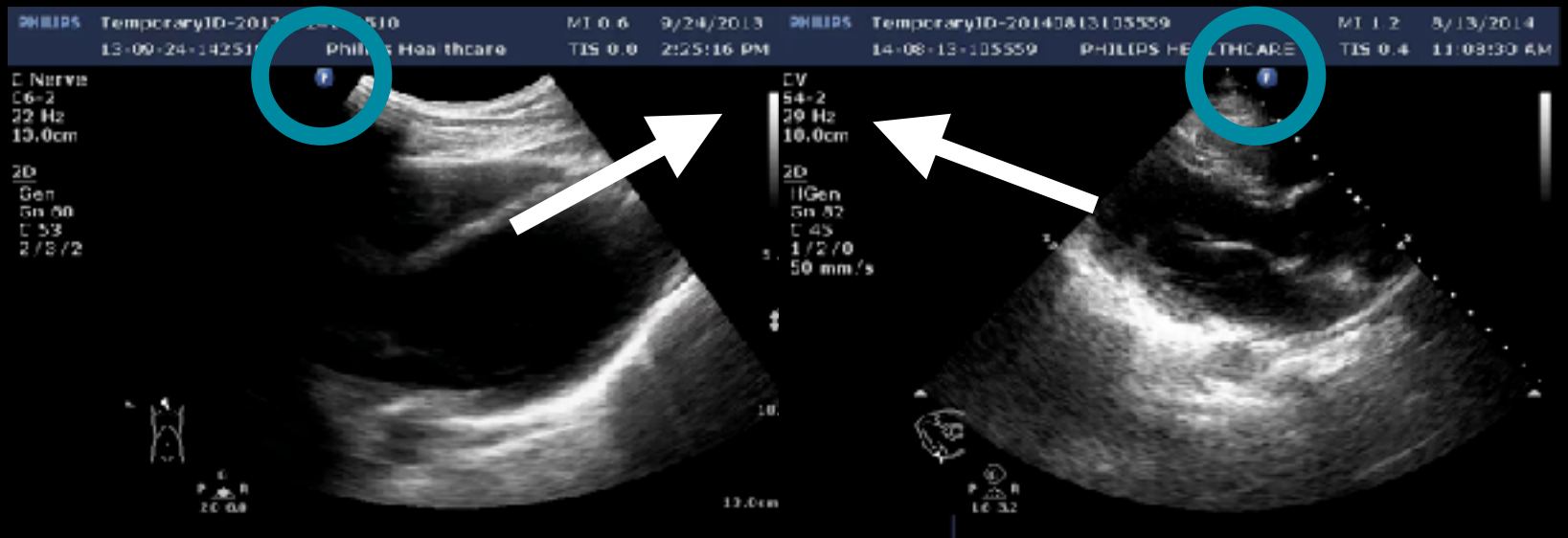

Parasternal
SPA
Subcostal
Apical

標準影像
3W5V



腹超 vs 心超: 鏡像影像

Indicator
Apex



ASE practice guideline 2020

J Am Soc Echocardiogr. 2020 Apr;33(4):409–422.e4.

Table 1 Definitions of cardiac ultrasound categories

	UAPE	Cardiac POCUS	CCE	Limited echo	Comprehensive echo
Diagnostic expectations	"Routine" performance of a single imaging protocol to augment bedside examination	Focused exams with specific imaging protocols based upon suspicion of a specific disease (e.g., rule out tamponade)	Focused on a collection of specific views/findings pertinent to the care of the critically ill (e.g., cardiac output, fluid responsive)	Focused on previously delineated findings as a follow-up exam; limited imaging protocol applied to answer a specific question	Comprehensive, all findings, quantification; increasingly use advanced techniques
Application frequency	Frequent, daily, multiple physicians	Usually once, per disease, but more frequently if change in clinical status	On admission or change in clinical status, potentially frequently	As follow up to comprehensive echo; potentially multiple times over weeks to months	Once (per admission, change in clinical status)
Interpretation of findings	Presence or absence of ultrasound "signs" indicative of cardiac abnormality	Findings related to the diagnosis sought in protocol	Primary and incidental findings recorded in views	All findings, primary and incidental, recorded in limited views	All findings, primary and incidental recorded in comprehensive imaging
Quantification	Usually Absent	Optional	Typically	Typically	Mandatory
Indication	Physical exam	Clinical suspicion	Medical necessity	Medical necessity	Medical necessity
Documentation	Images not recorded (except for QA), findings reported in physical exam	Image archiving and formal reporting controversial	Images archived, formal report	Images archived on PACS, formal report	Images archived on PACS, formal report
Teaching required	Introductory and modest (weeks)	Modest (weeks to months)	Advanced (months)	Advanced (years)	Advanced (years)
Notes	Used "in the manner and intent" of cardiac physical examination	Similar to UAPE, but disease specific	Imaging protocols specific to issues in the critically ill; comparison to available prior studies as indicated	Reading all findings increases training burden. Comparison to available prior studies is standard practice. Must be able to convert to comprehensive at bedside	Completely evaluates all findings, regardless of referral question or incidental nature. Comparison to available prior studies is standard practice.

CCE, critical care echocardiography; *PACS*, Picture Archival and Communication System; *POCUS*, point of card ultrasound; *UAPE*, ultrasound assisted physical examination.
Adapted from: Kimura BJ. Point-of-care cardiac ultrasound techniques in the physical examination: better at the bedside. Heart 2017;103:987-994. https://doi.org/10.1136/heartjnl-2016-309915.

	UAPE	Cardiac POCUS	CCE
Diagnostic expectations	"Routine" performance of a single imaging protocol to augment bedside examination	Focused exams with specific imaging protocols based upon suspicion of a specific disease (e.g., rule out tamponade)	Focused on a collection of specific views/findings pertinent to the care of the critically ill (e.g., cardiac output, fluid responsive)
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Notes	Used "in the manner and intent" of cardiac physical examination	Similar to UAPE, but disease specific	Imaging protocols specific to issues in the critically ill; comparison to available prior studies as indicated

急診心超三部曲

理學檢查 UAPE

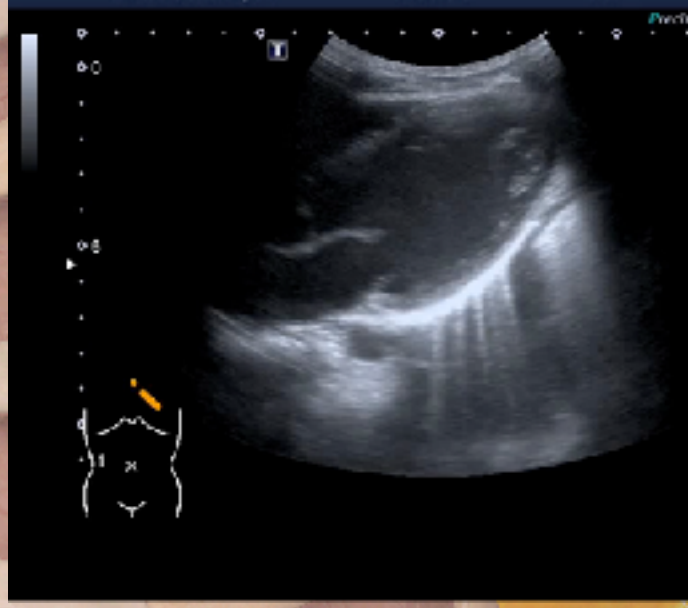
快速判定 Cardiac POCUS

進階測量 CCE

掃描介面 (探頭)

PSLA 胸骨旁長軸

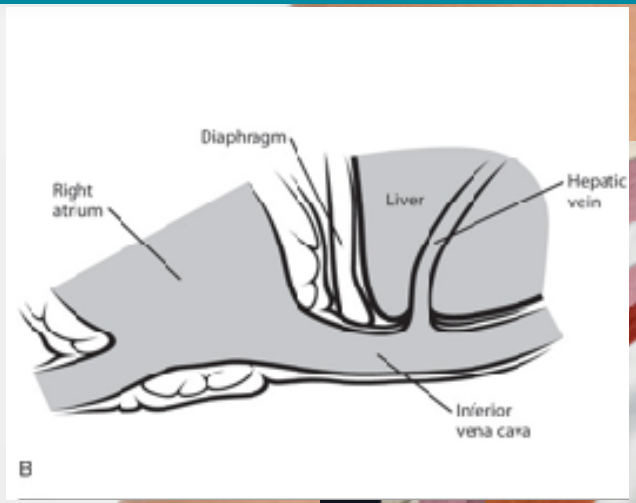
S4C 劍突下4腔室

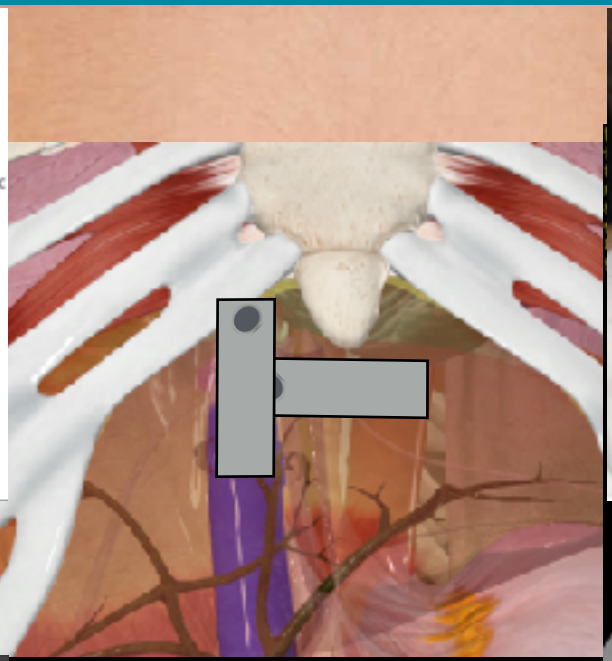


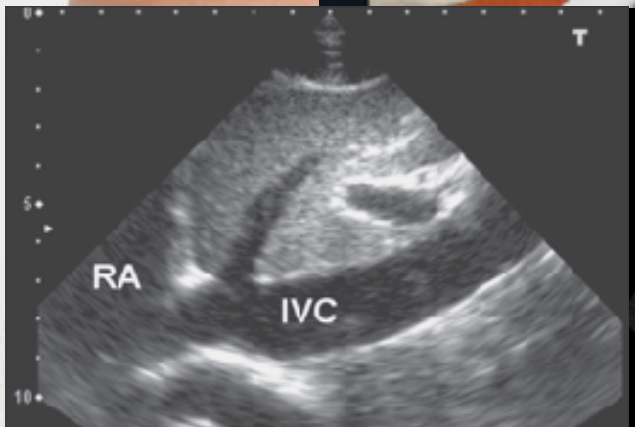
心包膜積液 / 心衰竭

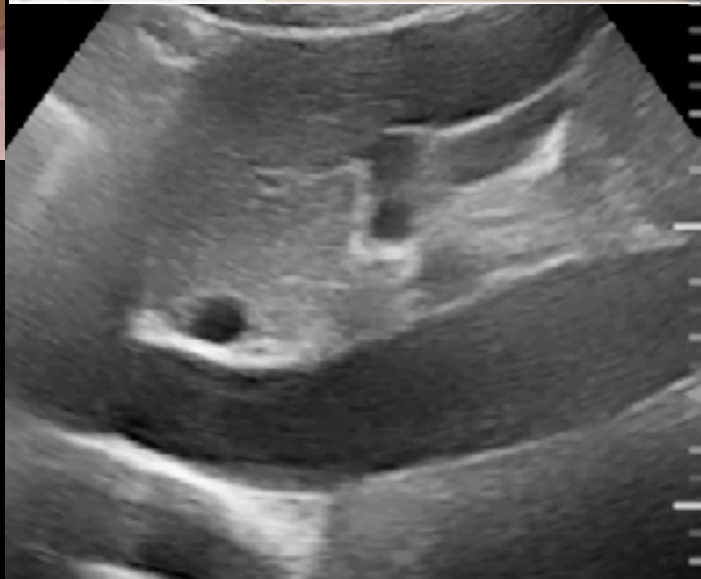
CRP時的首選介面

IVC
劍突下 / 利用肝的視窗

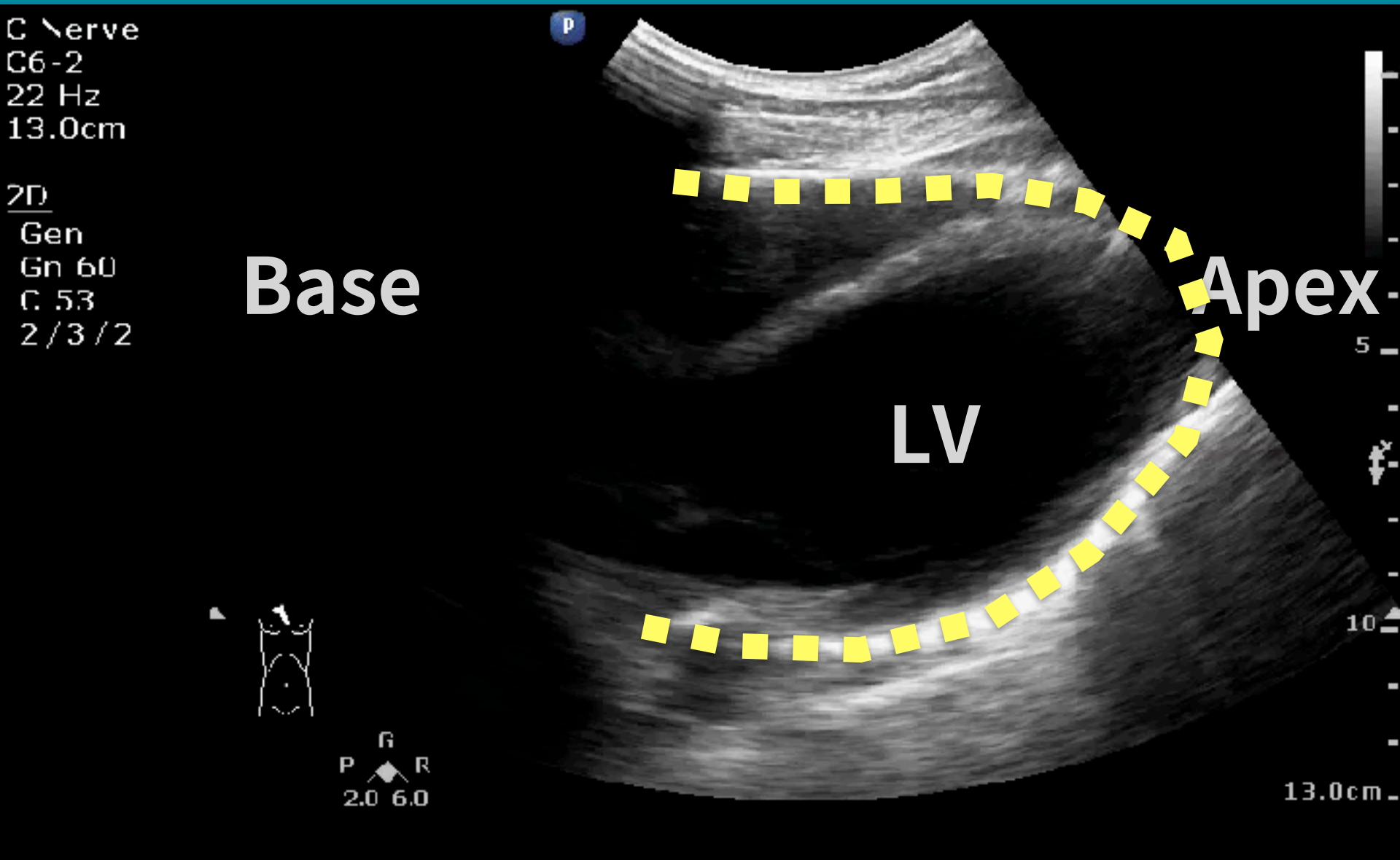


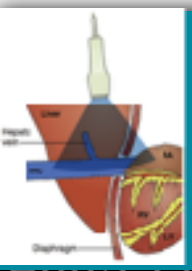






UAPE-Quick check





UAPE-Quick check

S1-1
77 Hz
15.0cm

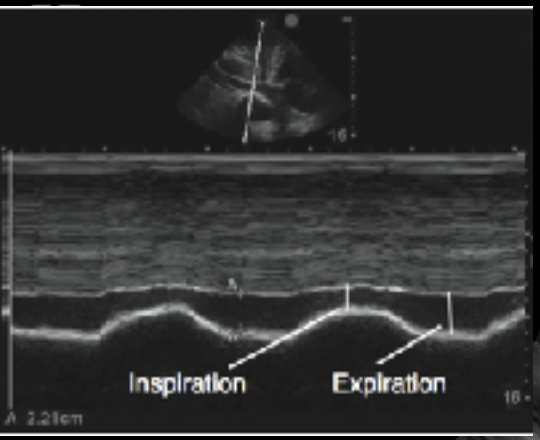
2D
HGen
Gn 100

Leg

Liver

Head

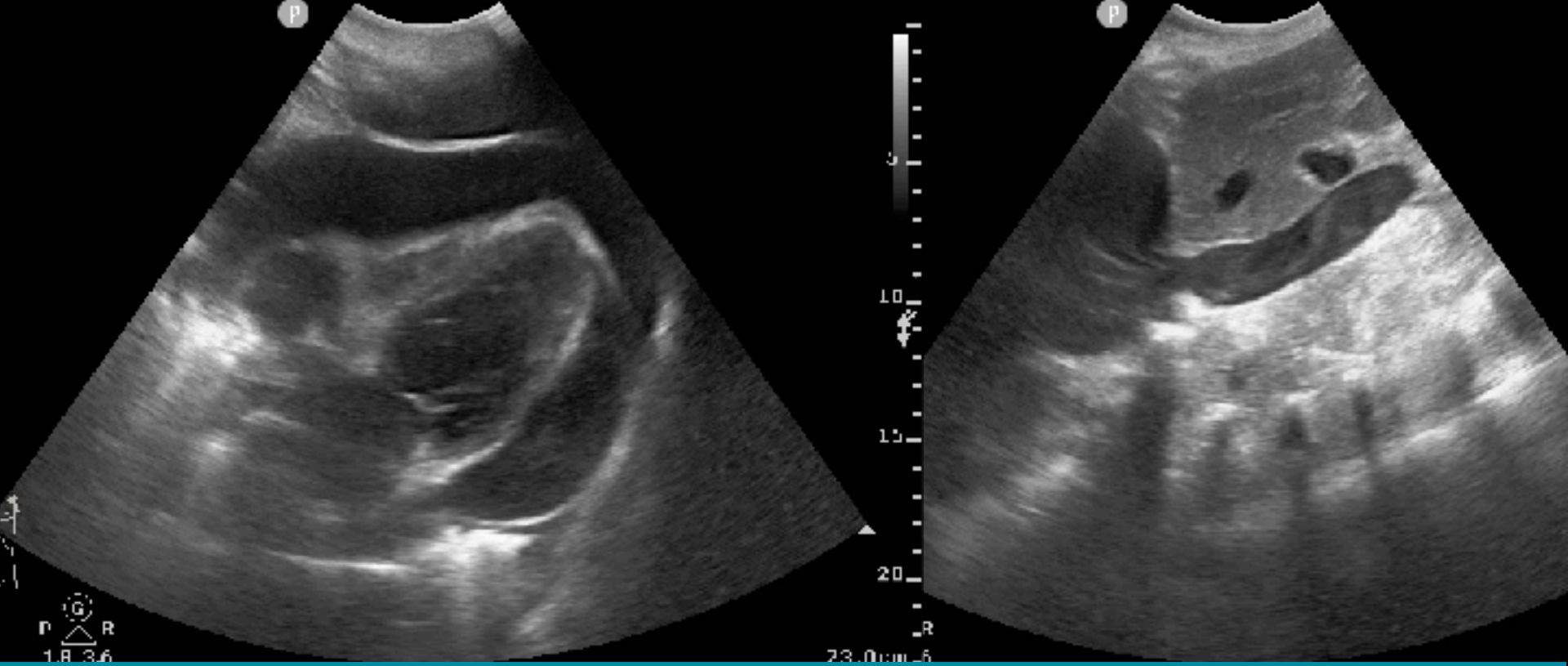
IVC



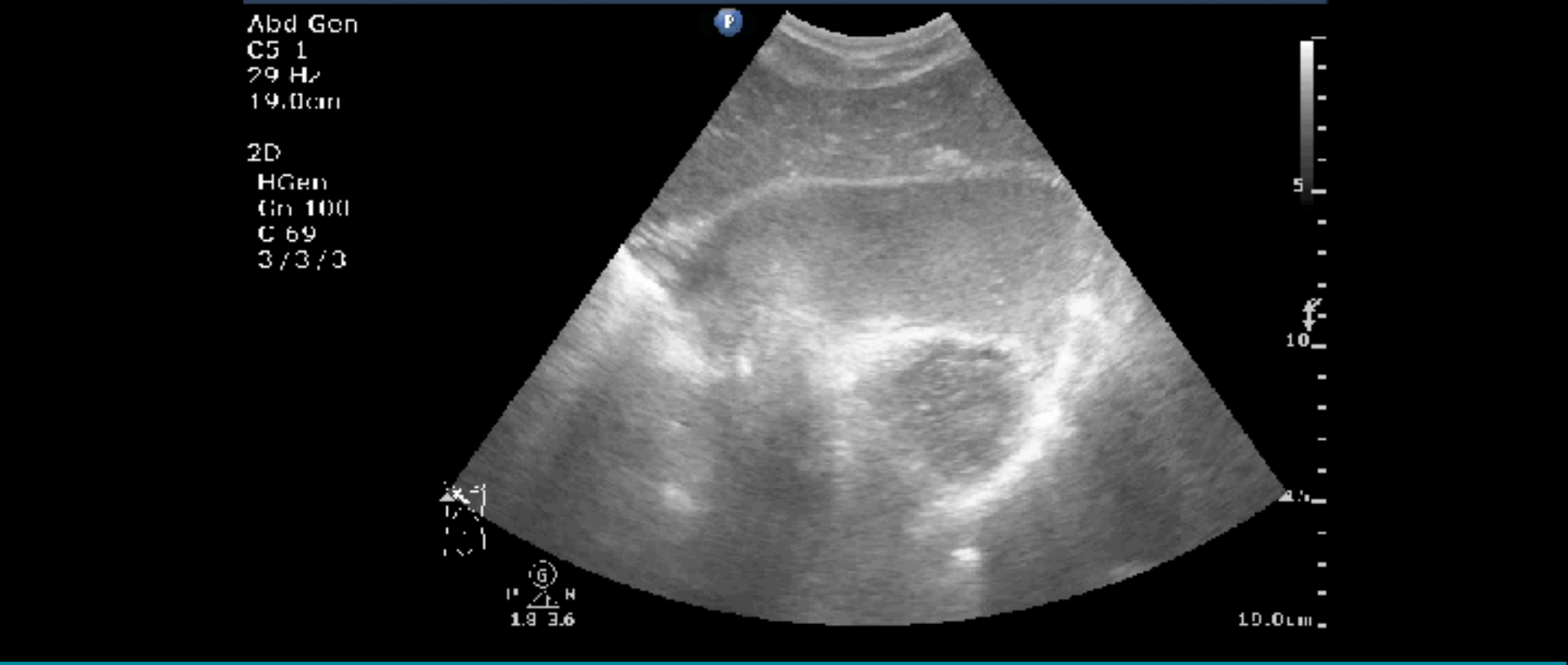
Diameter (1-2cm) / Variation (50%)

P R
1.7 3.1

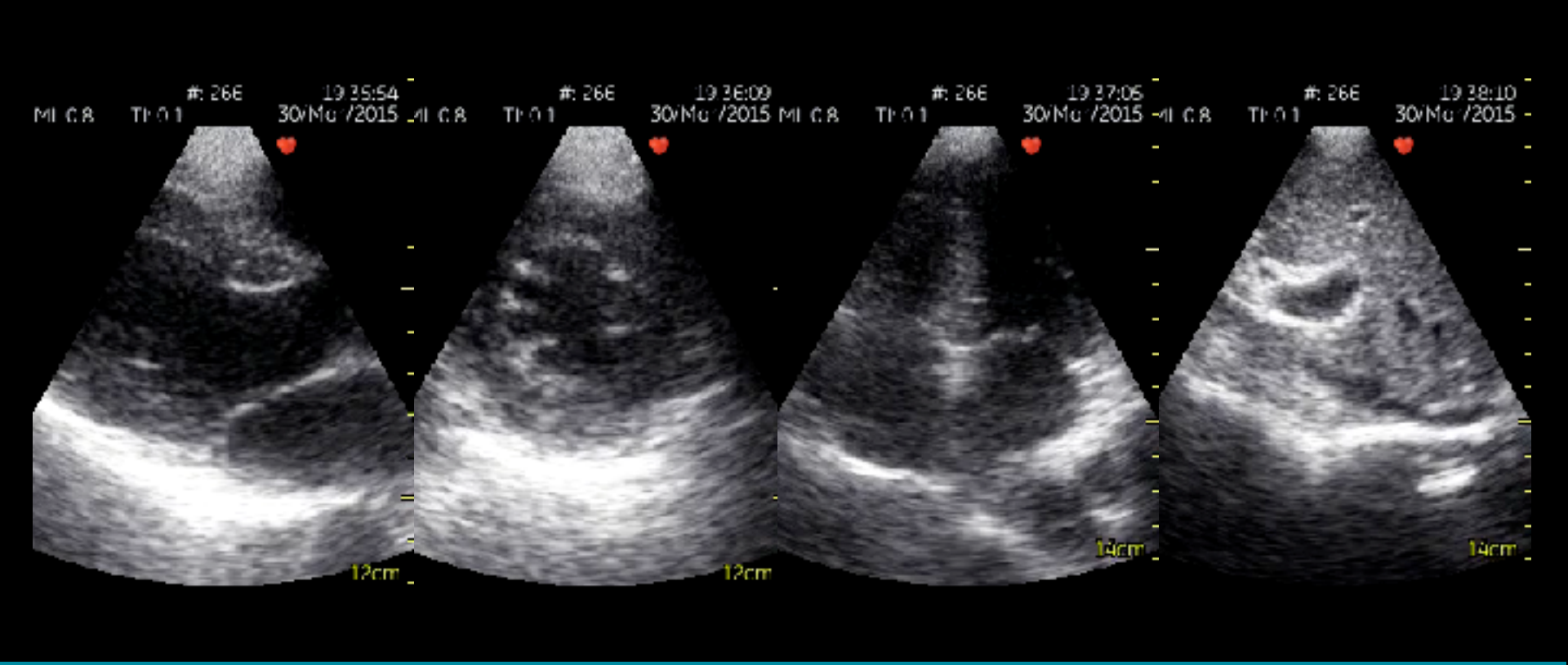
53
BPM



I-AIM - 心包膜填塞



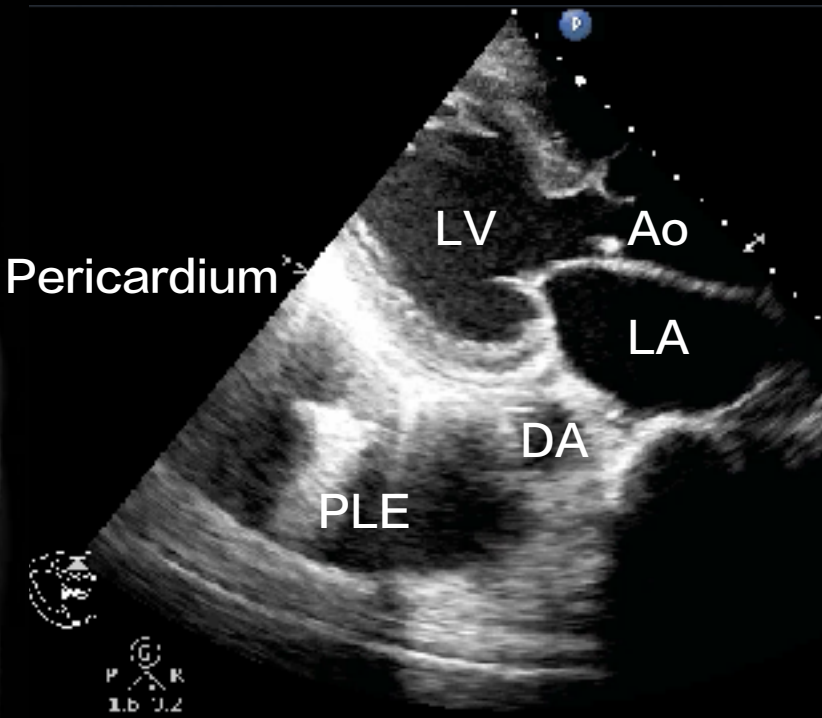
I-AIM - 心包膜積血



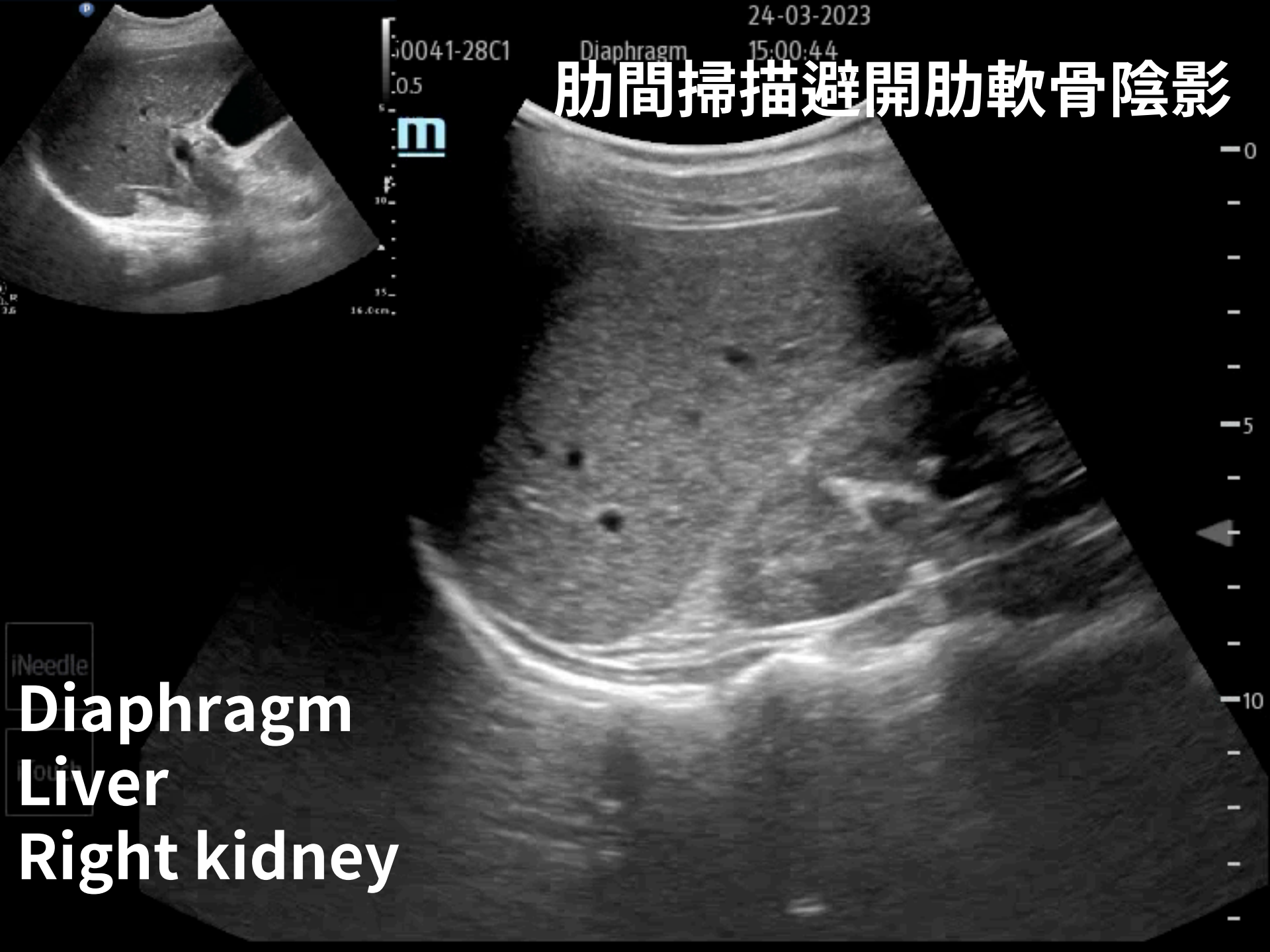
I-AIM - 低血容性休克

D aorta

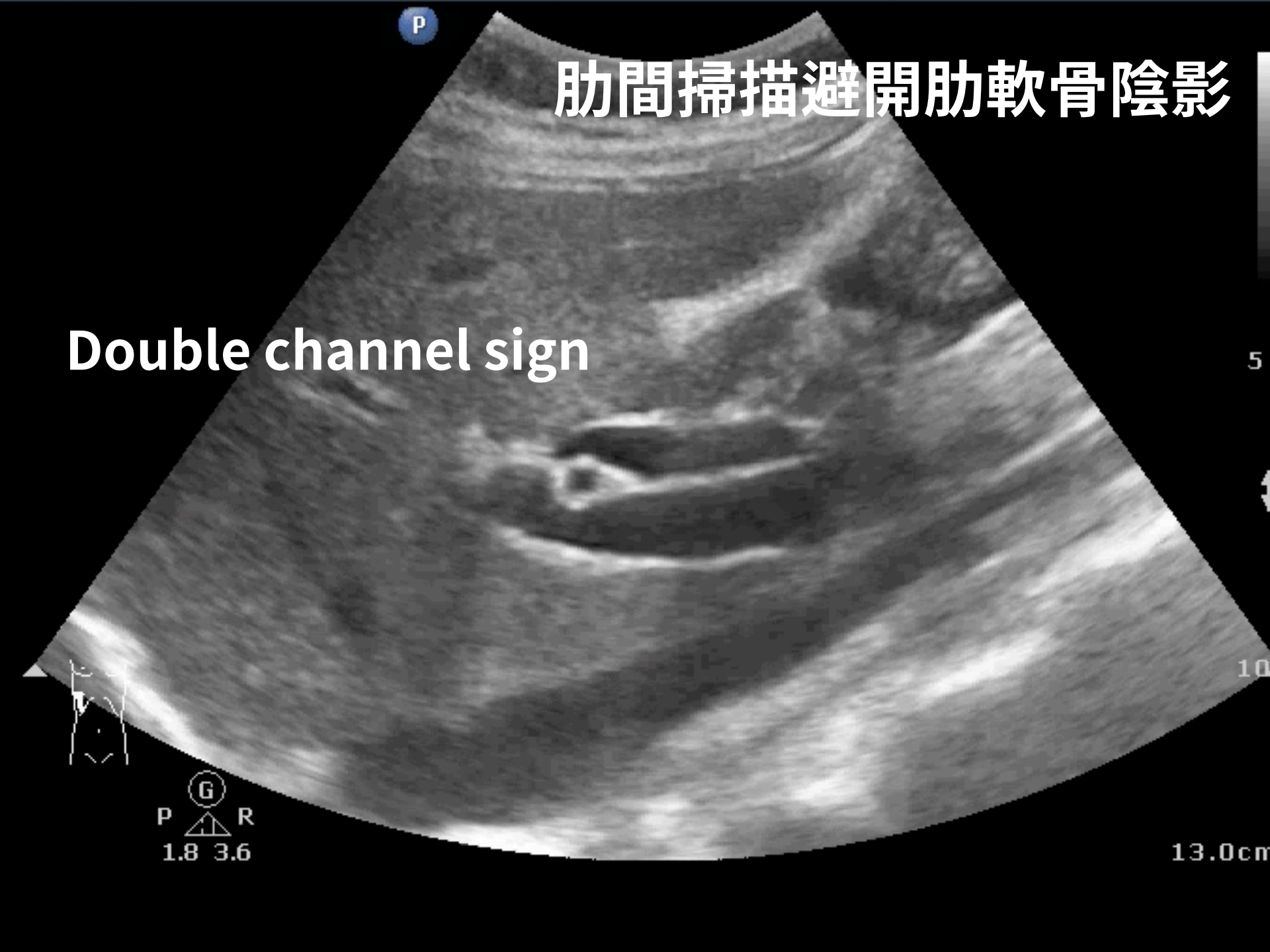
Pericardial
vs
Pleural




劍突---腋前線
肋間擺位微調

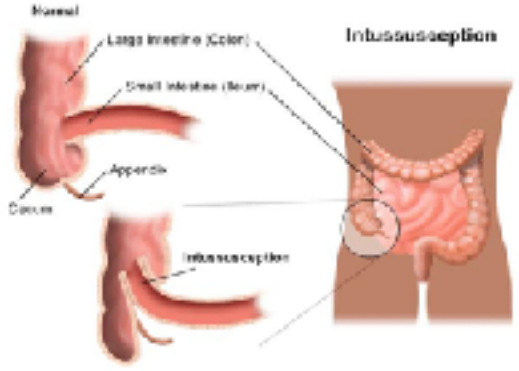

24-03-2023
0041-28C1
Diaphragm
15:00:44
肋間掃描避開肋軟骨陰影
Diaphragm
Liver
Right kidney

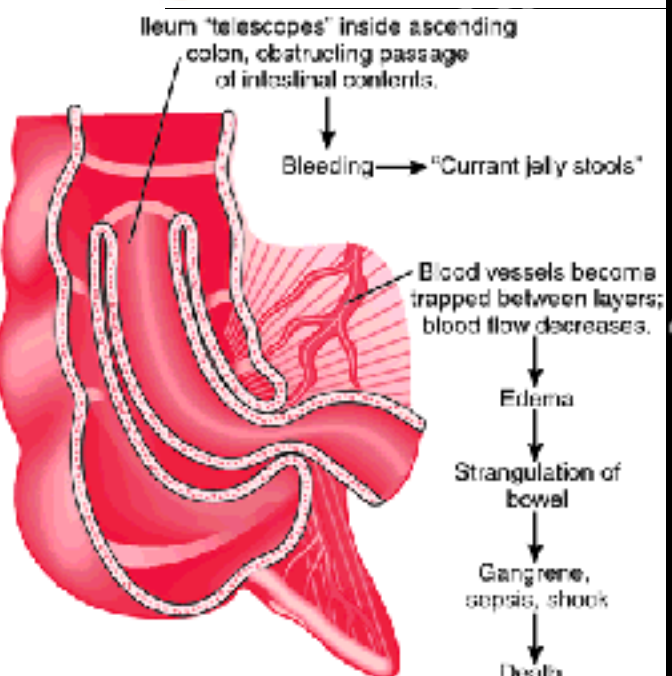

肋間掃描避開肋軟骨陰影
Hepatic vein
Mickey mouse sign
Portal triad:
Portal vein
Biliary tree
Hepatic artery
P
R
1.8 3.6
5
10
11.0cm

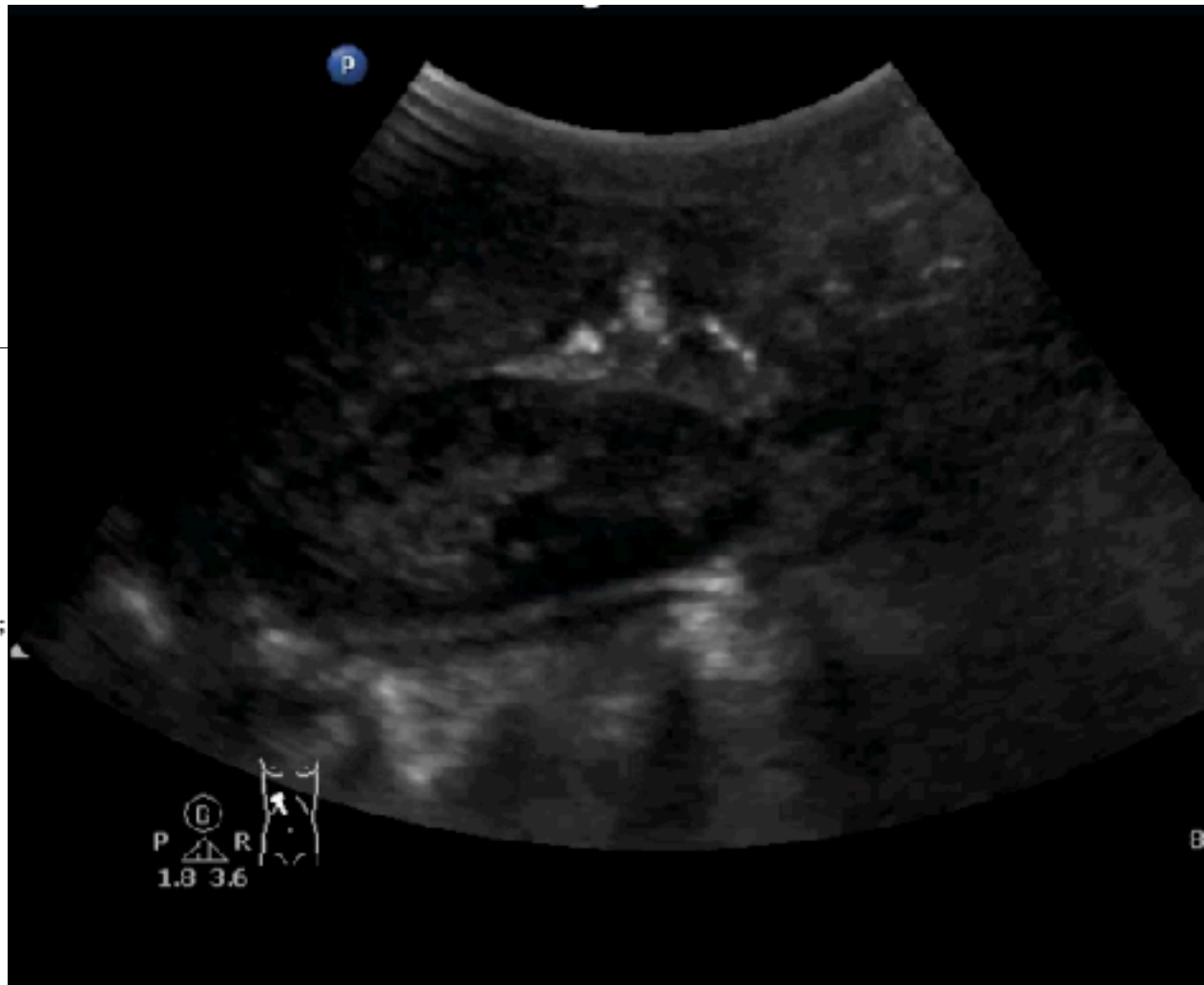

肋間掃描避開肋軟骨陰影
Double channel sign
P
G
P
R
1.8 3.6
5
10
13.0cm

Intussusception

小孩優先找右上腹

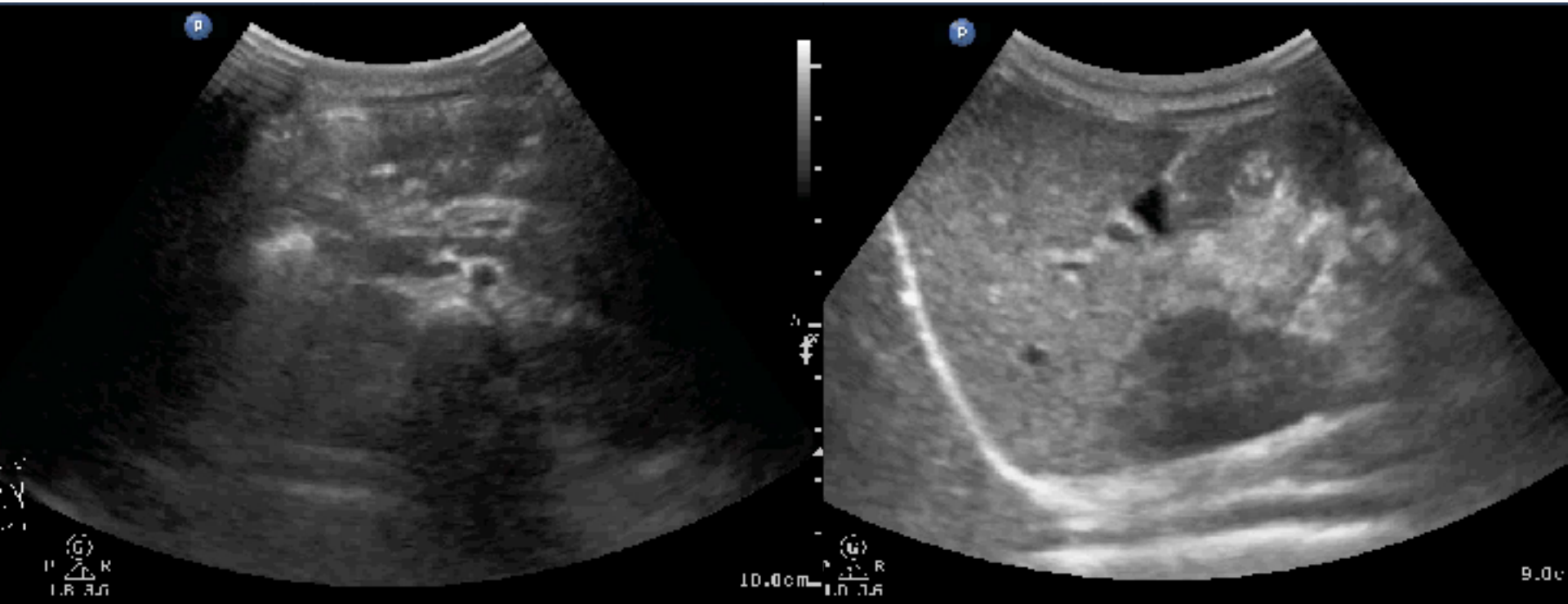






7個月大男童，間歇性溢奶

間歇性或周期性都要小心



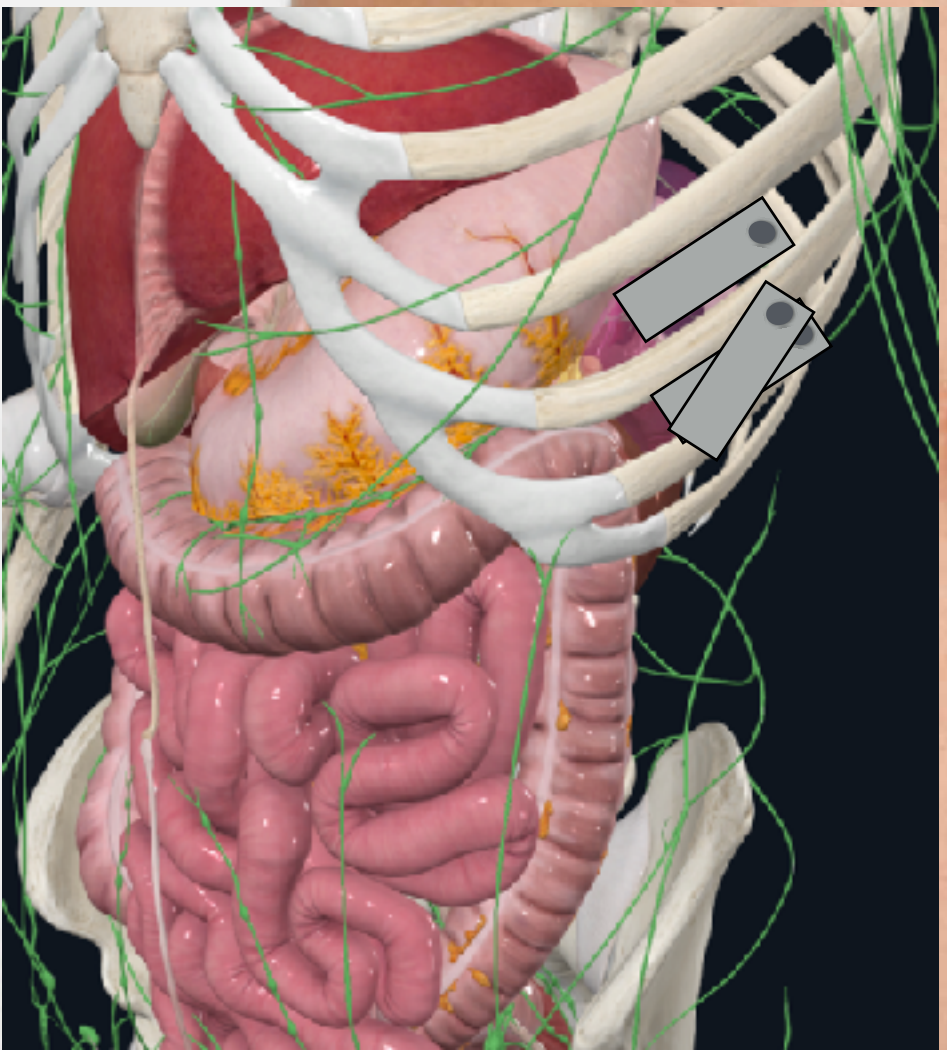

TE7 ACE
24-03-2023
20230324-150041-28C1
Diaphragm
15:00:53
C5-1s
AP 96.6%
MI 1.30
TIS 0.5
B
FH 6.0
DR 130
FR 18
D 16.0
G 71
Z 1.10
肋間掃描避開肋軟骨陰影
再些許轉動至腎臟長軸
iNeedle
Right kidney
Psoas muscle

劍突下
利用肝的視窗

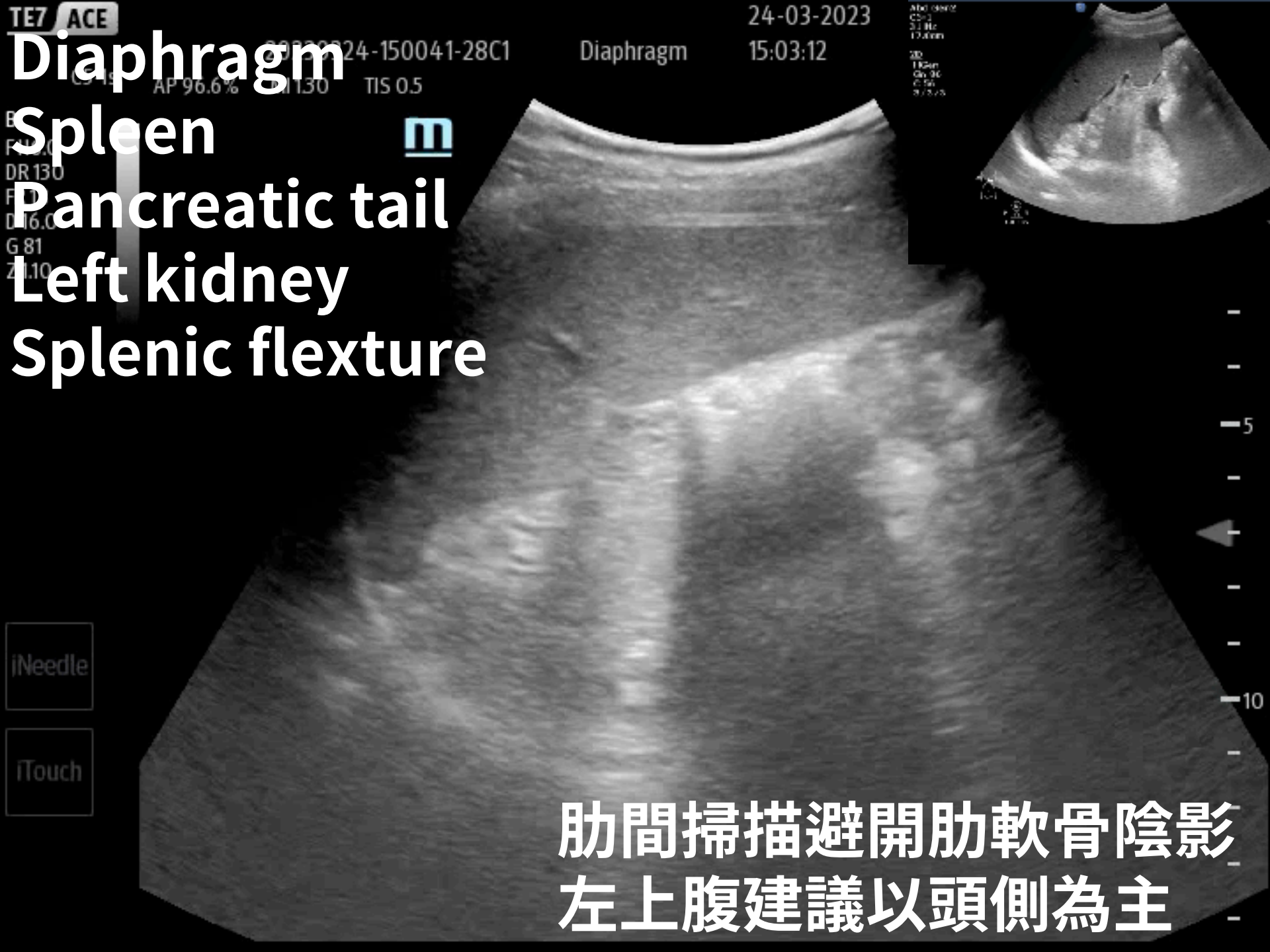

TE7 ACE
20230324-150041-28C1
Diaphragm
24-03-2023
15:02:13
C5-1s
AP 96.6%
MI 1.3 0
TIS 0.5
B
FH6.0
DR 130
FR 18
D 16.0
G 81
Z 1.10
劍突下縱向掃描
利用肝臟當視窗
Diaphragm
Liver
EC junction
Abdominal aorta
Pancreas
Antrum


Liver
IVC / Hepatic veins
Portal veins
Biliary tree
Abdominal aorta
Pancreas
劍突下縱向掃描
利用肝臟當視窗
TE7 ACE
24-03-2023
20230324-150041-28C1
Diaphragm
15:02:36
C5-1s
AP 96.6%
MI 1.3 0
TIS 0.5
FH6.0
D 16.0
iNeedle
iTouch

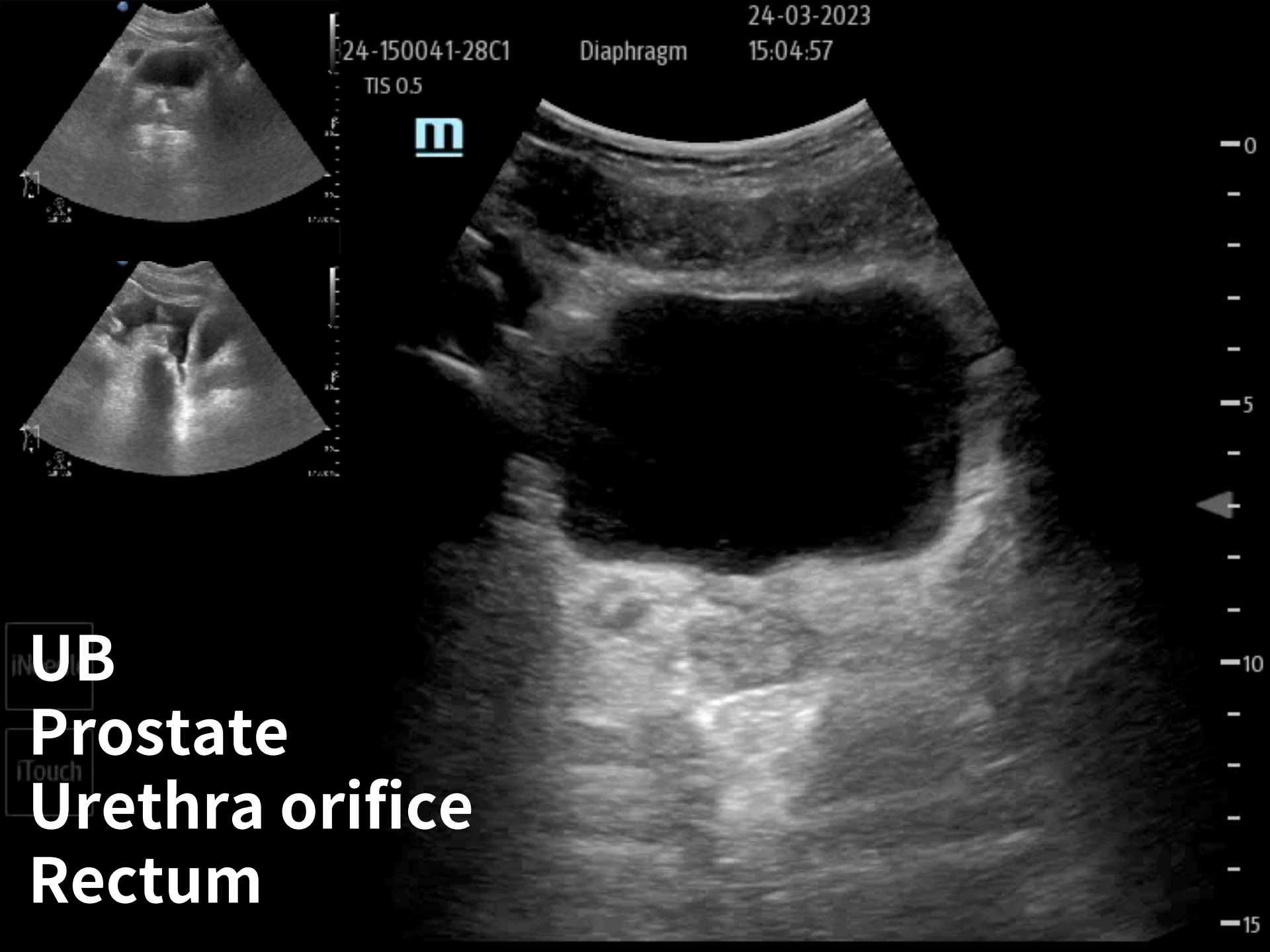
Aorta/ branches Sweep



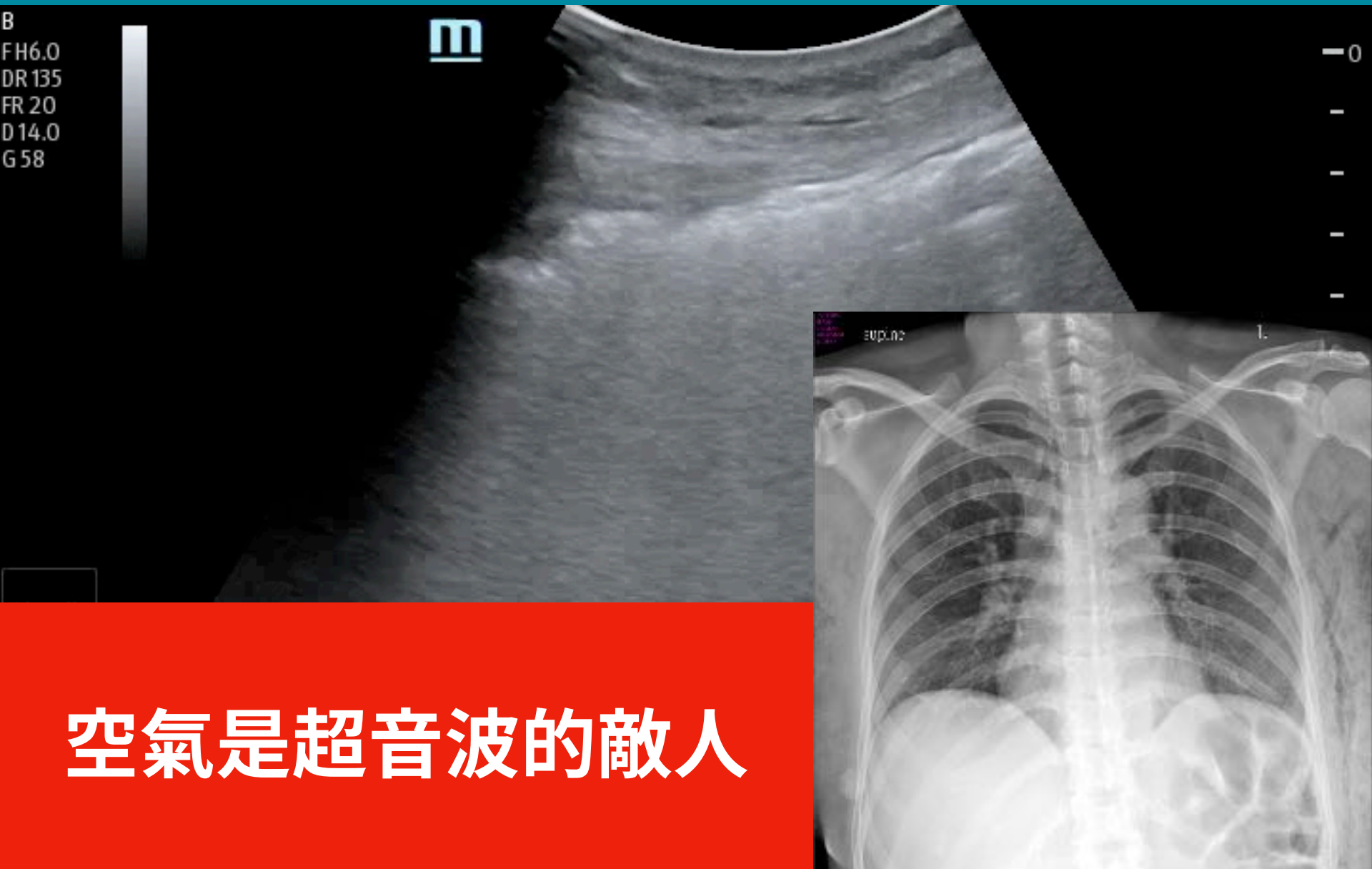
剣突---腋後線
平行肋間微調


Diaphragm
Spleen
Pancreatic tail
Left kidney
Splenic flexture
TE7 ACE
24-03-2023
Diaphragm
15:03:12
肋間掃描避開肋軟骨陰影
左上腹建議以頭側為主

恥骨聯合上
先横-後縦


24-150041-28C1
TIS 0.5
Diaphragm
24-03-2023
15:04:57
0
5
10
15
UB
Prostate
Urethra orifice
Rectum

50F, L chest pain, fever



空氣是超音波的敵人

liver

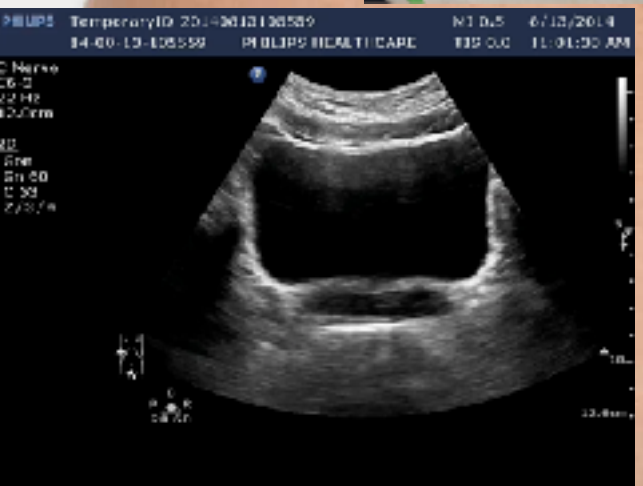
spleen

pyramid

ureter

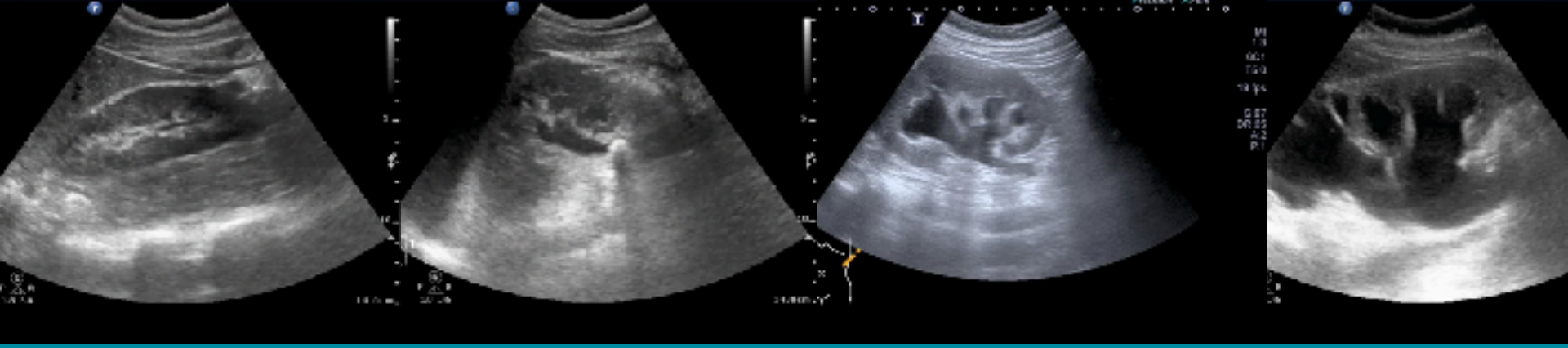
renal pelvis

恥骨聯合上
先横-後縦

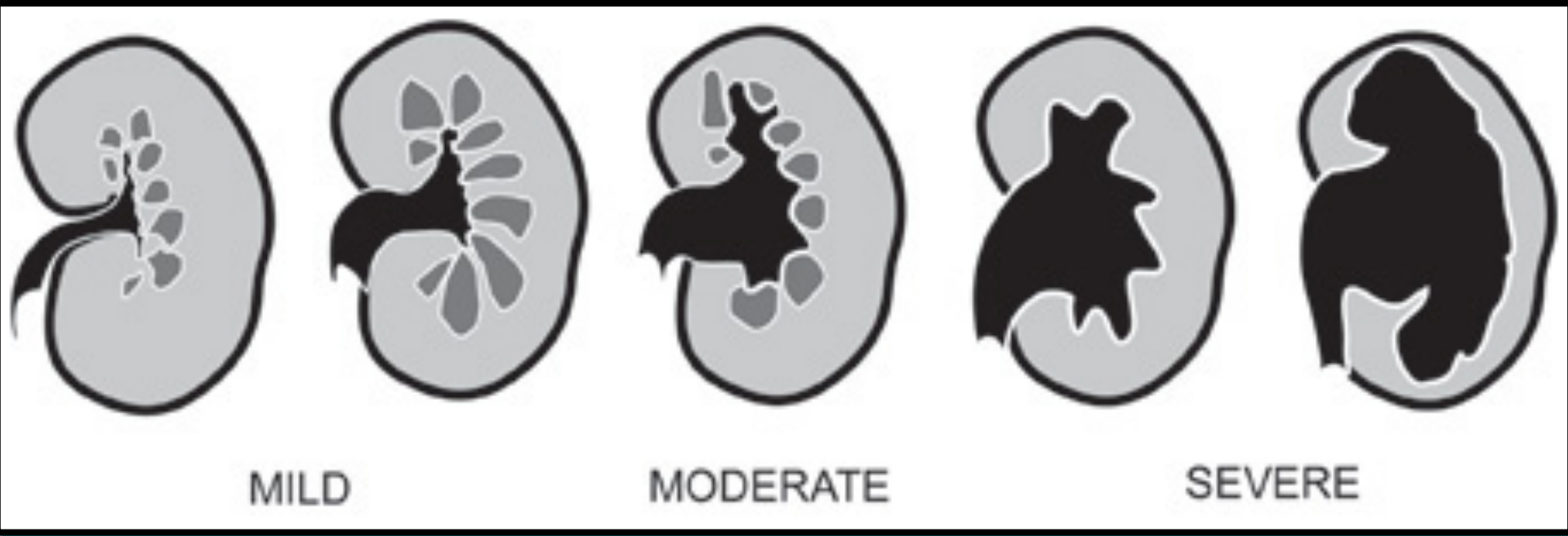


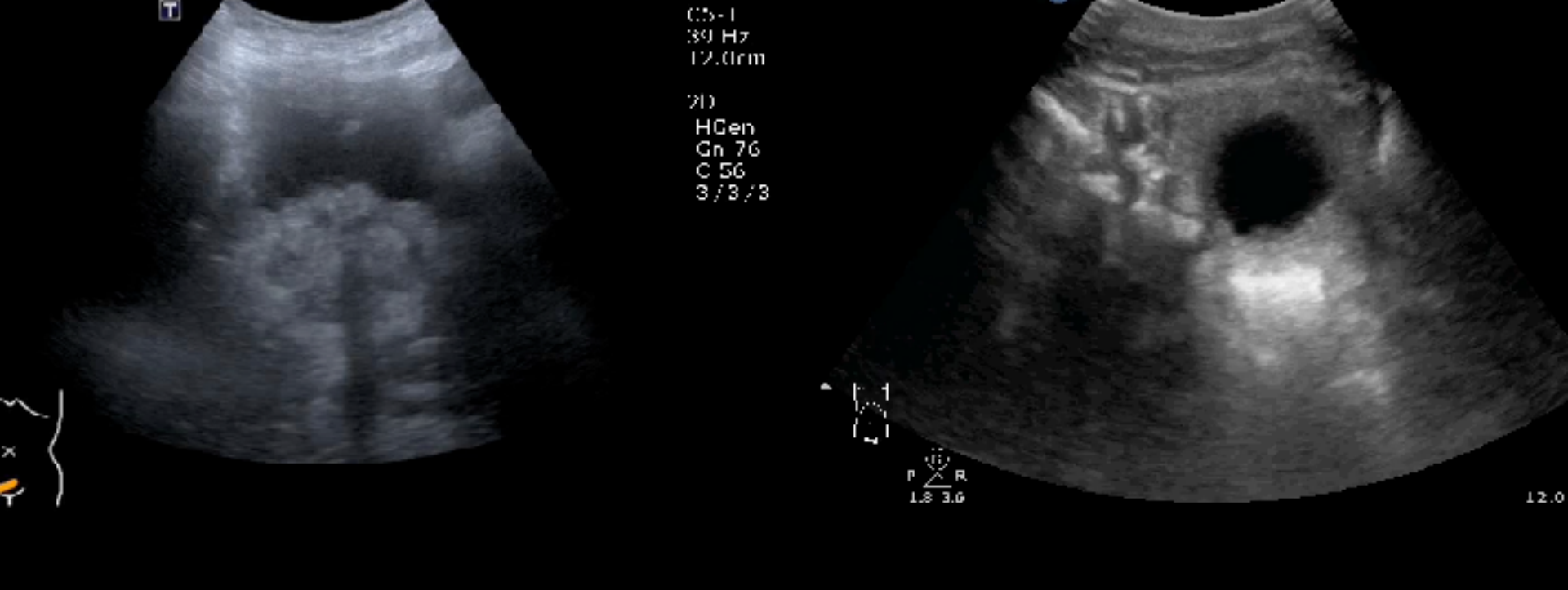
劍突---腋前線
肋間擺位微調

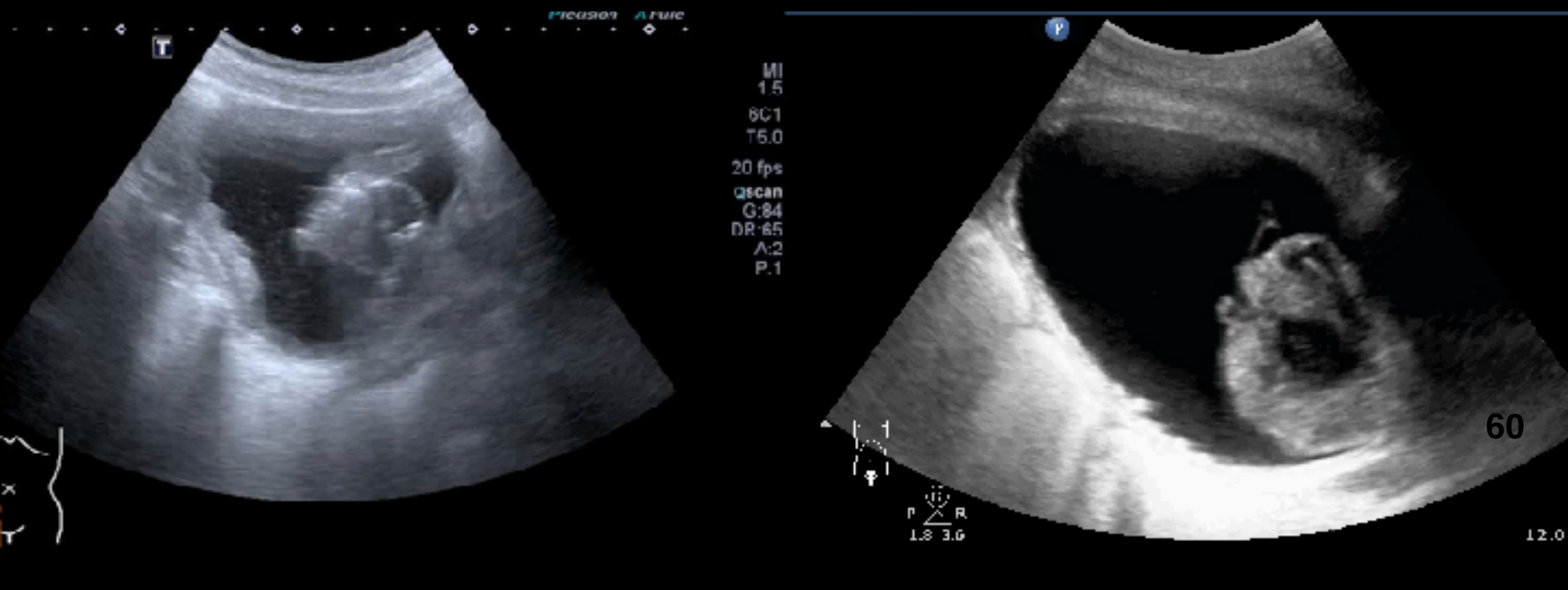
劍突---腋後線
平行肋間微調



HYDRONEPHROSIS嚴重度

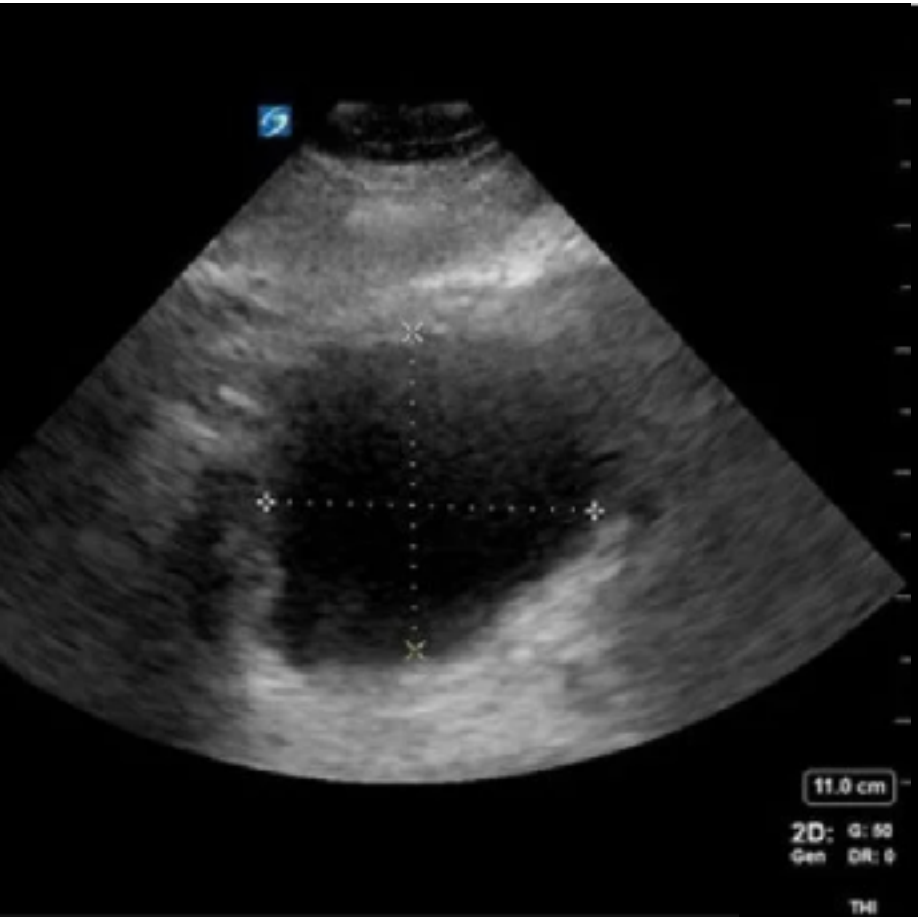


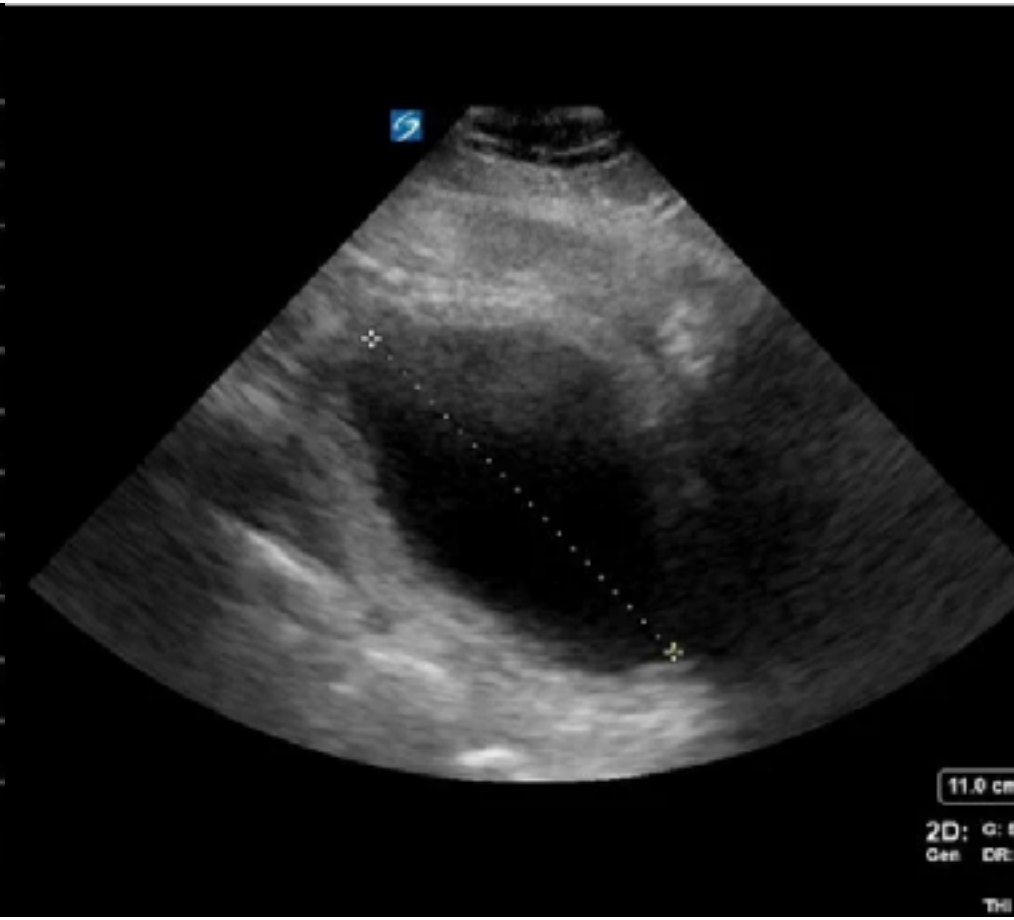

C5-1
39 Hz
12.0cm
2D
HGen
Gn 76
C 56
3 / 3 / 3
1.8 3.6
12.0


MI
1.5
6C1
T5.0
20 fps
qscan
G:84
DR:65
A:2
P.1
1.8 3.6
12.0

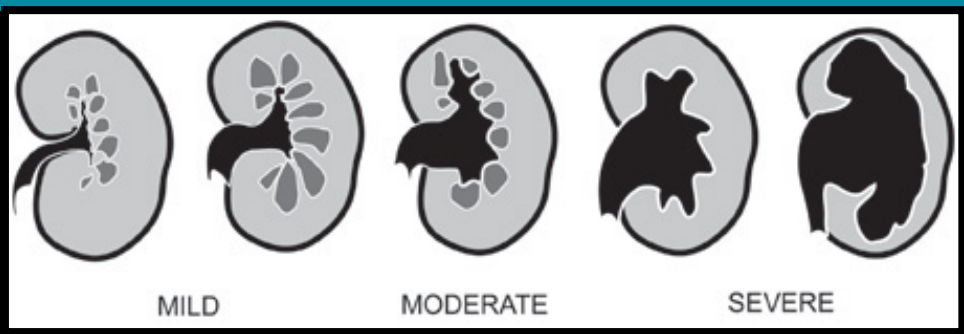
BLADDER URINE VOLUME

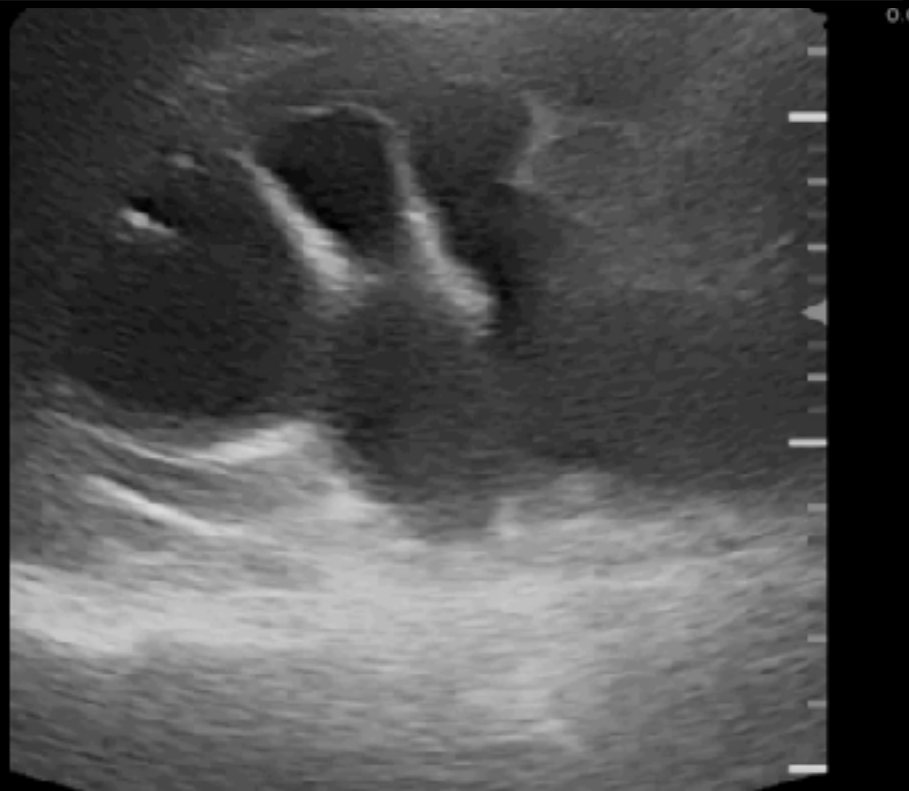
L (長) * W (寬) * H (高) * 0.52 = ML



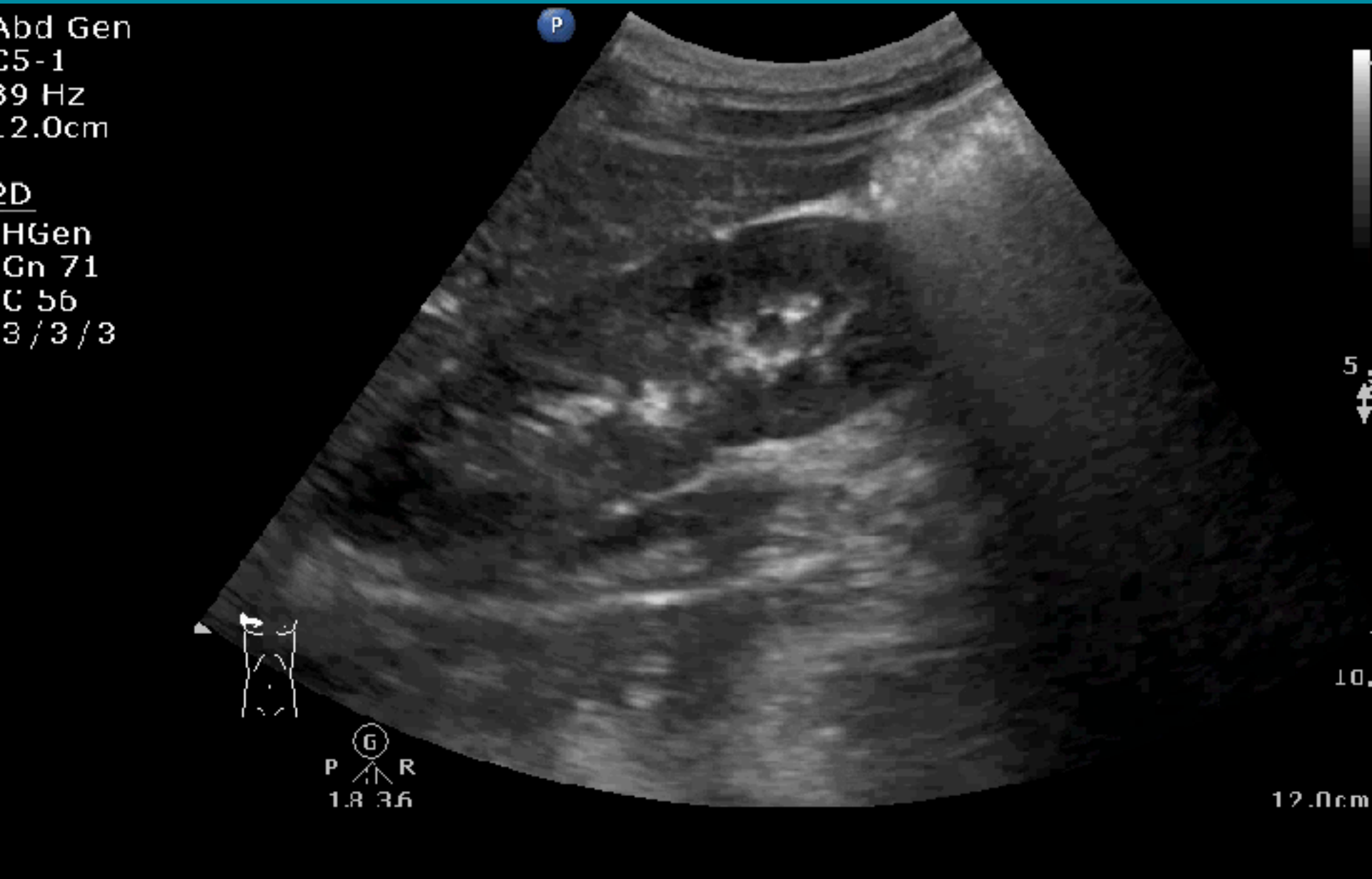


71F，居家個案，高燒畏寒



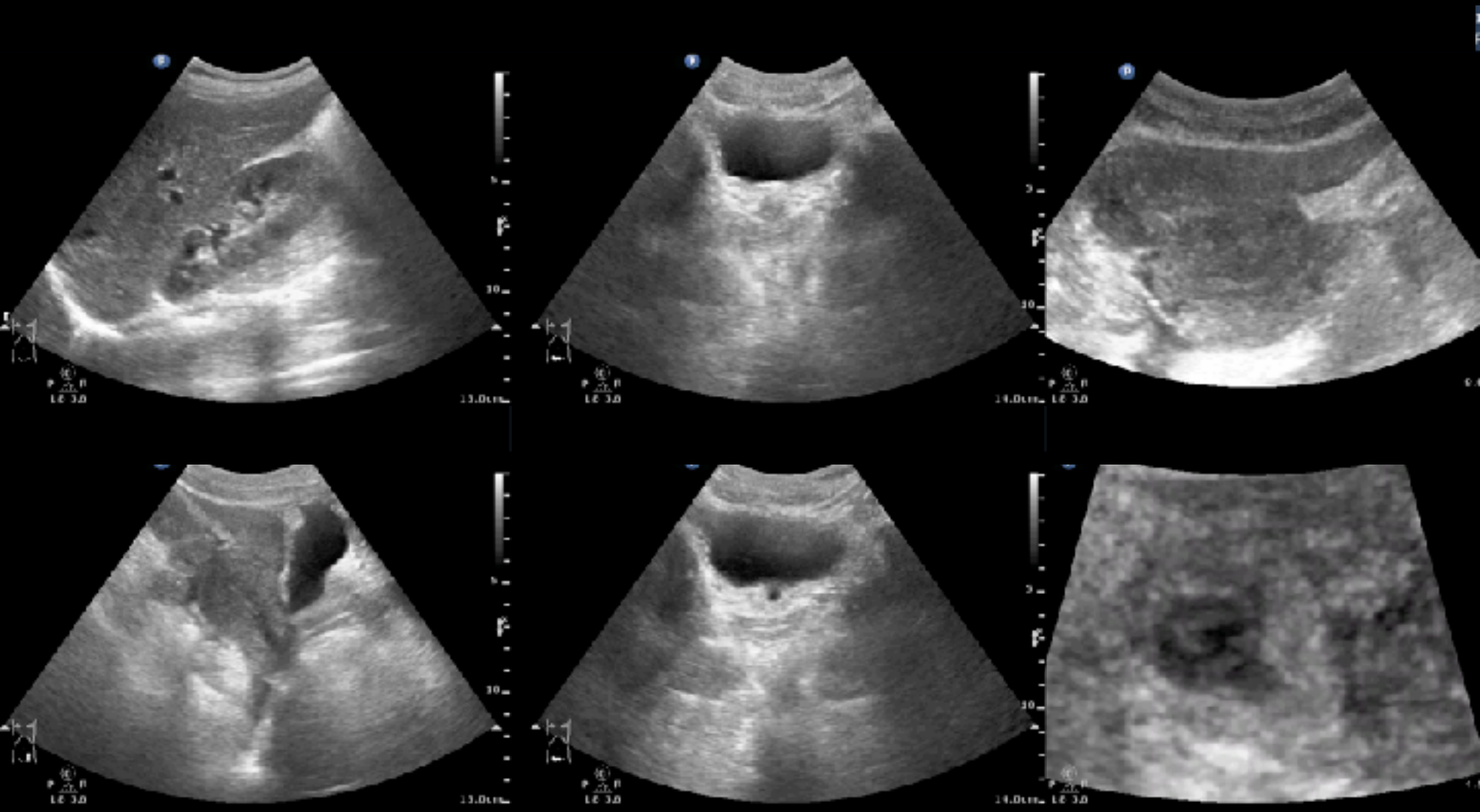


33F, low abdominal pain & shock



25F, abdominal pain

ECTOPIC PREGNANCY

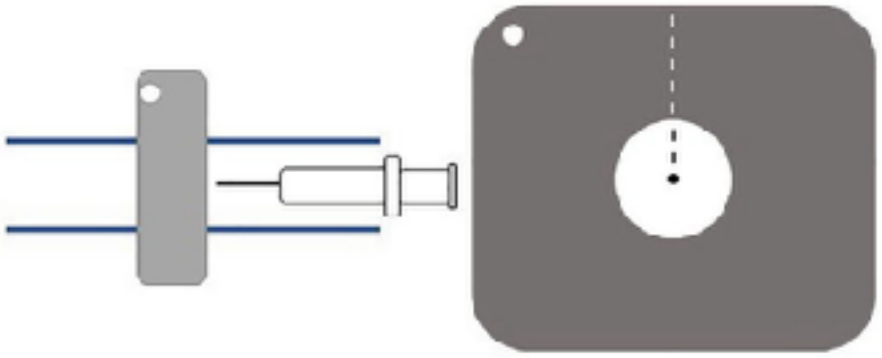


14F, acute lower abdominal pain with cold sweating

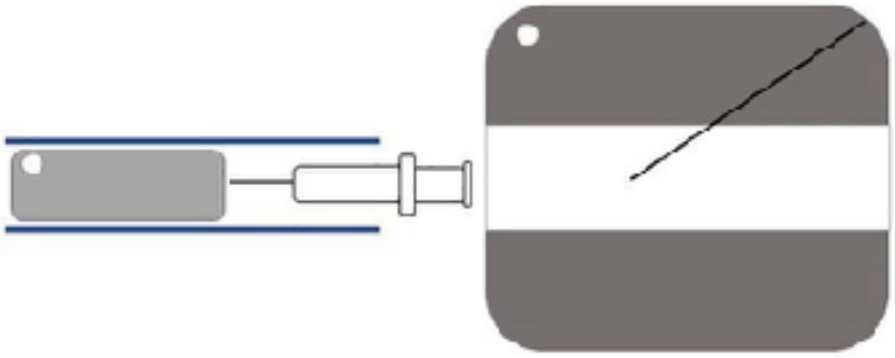
Female acute abdomen or shock
cosider **ovarian cyst rupture**

Echo first then Urine pregnancy test

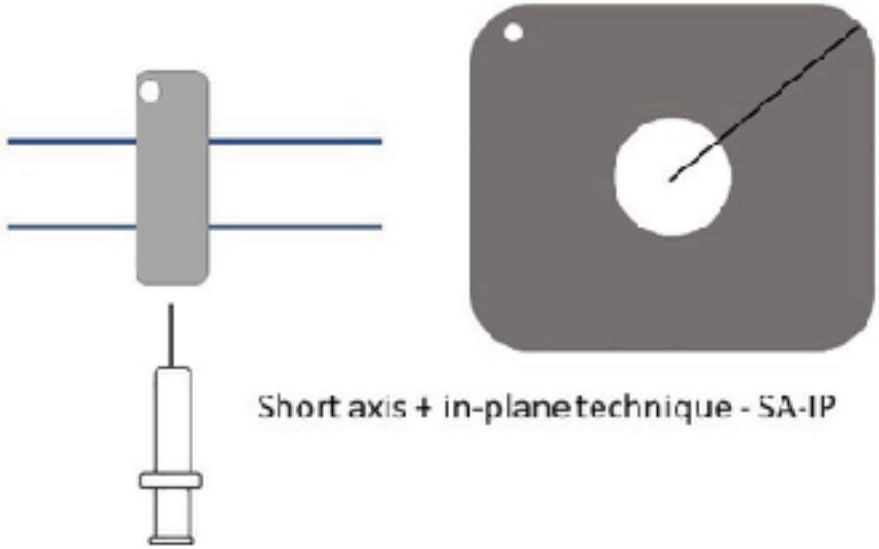
US guided cannulation



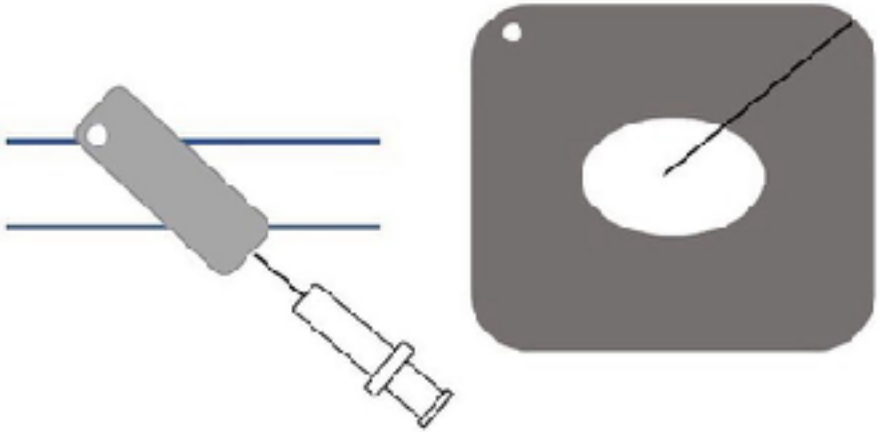
Short axis + out-of-plane technique - SA-OP



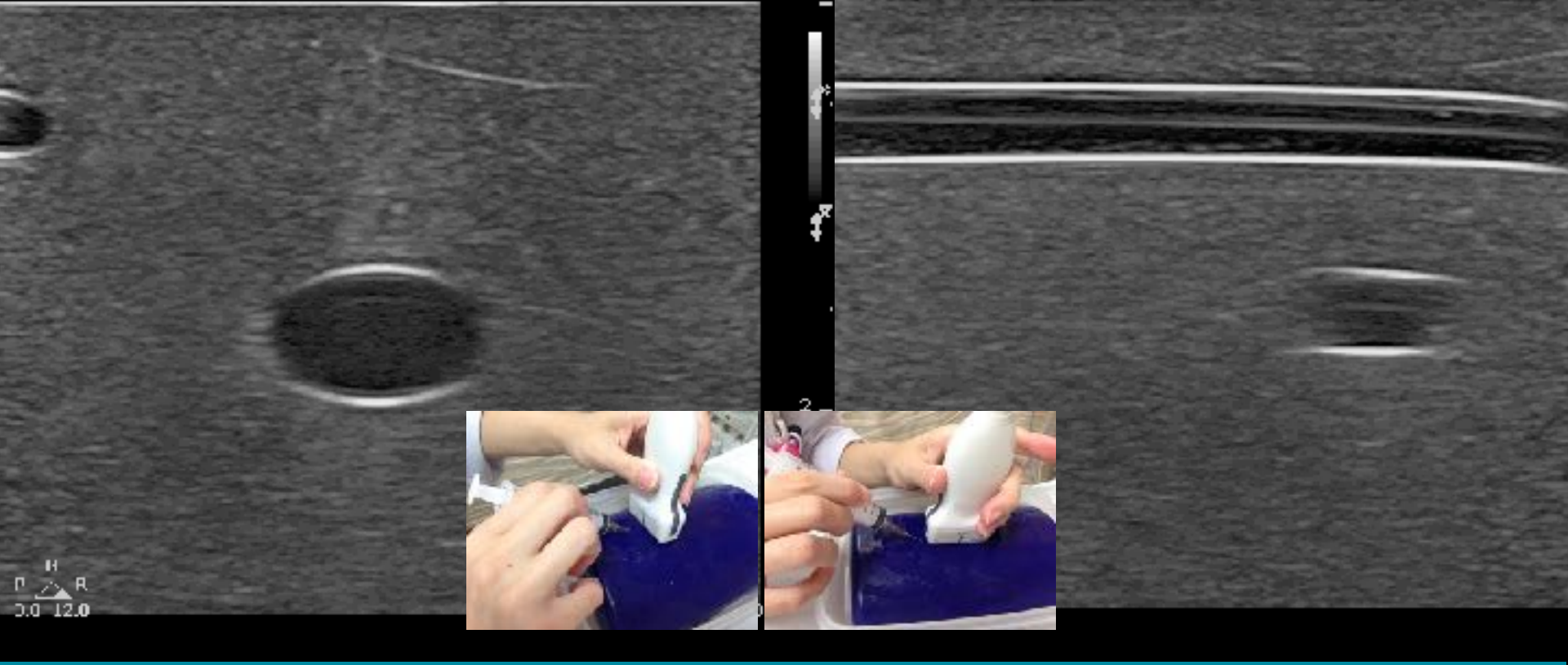
Long axis + in-plane technique - LA-IP



Short axis + in-plane technique - SA-IP



Oblique axis + in-plane technique - OA-IP



MASTER NEEDLING (基本功)

Off-plane

In-plane

Success rates ↑

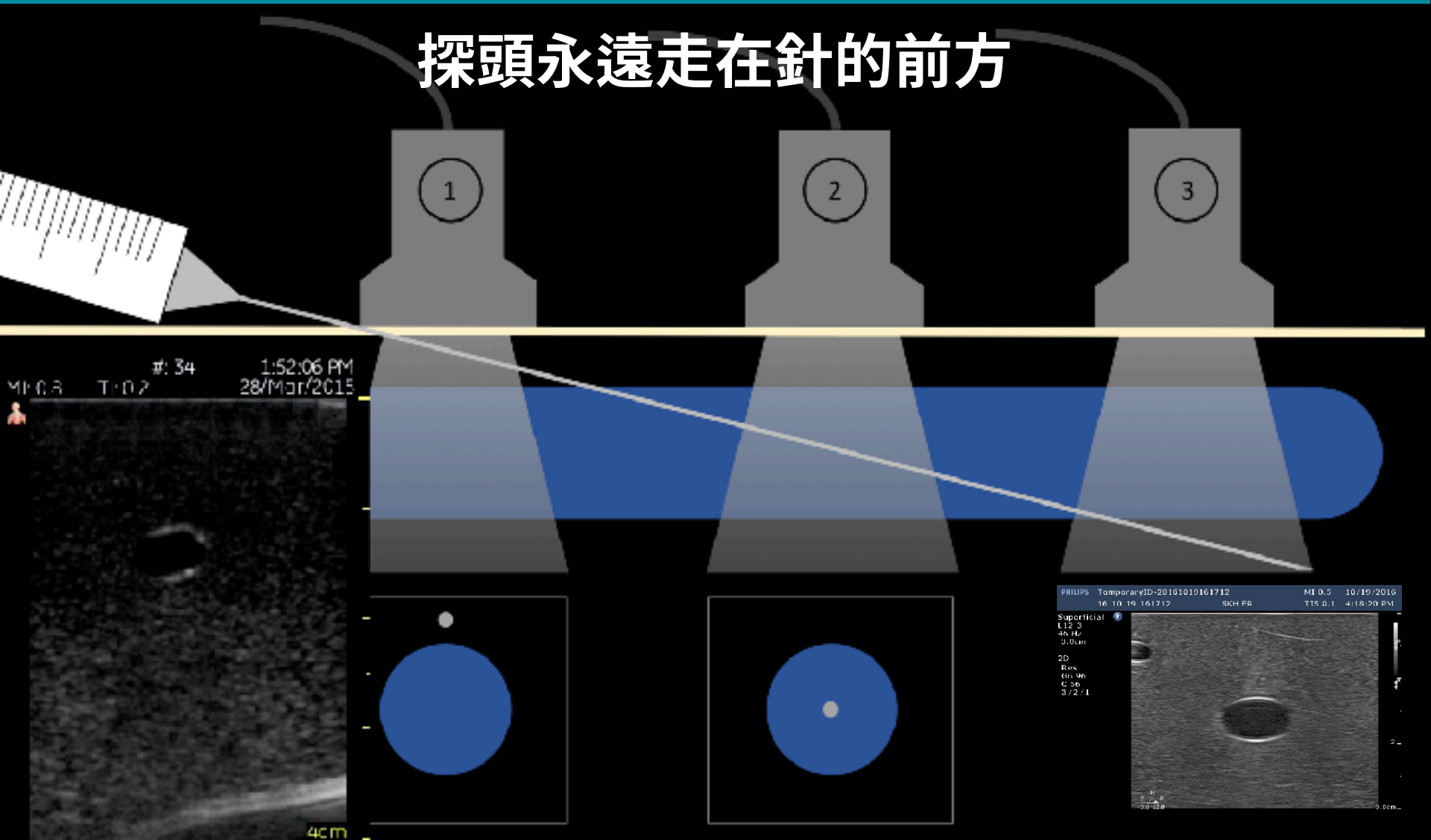
Mechanical complications ↓

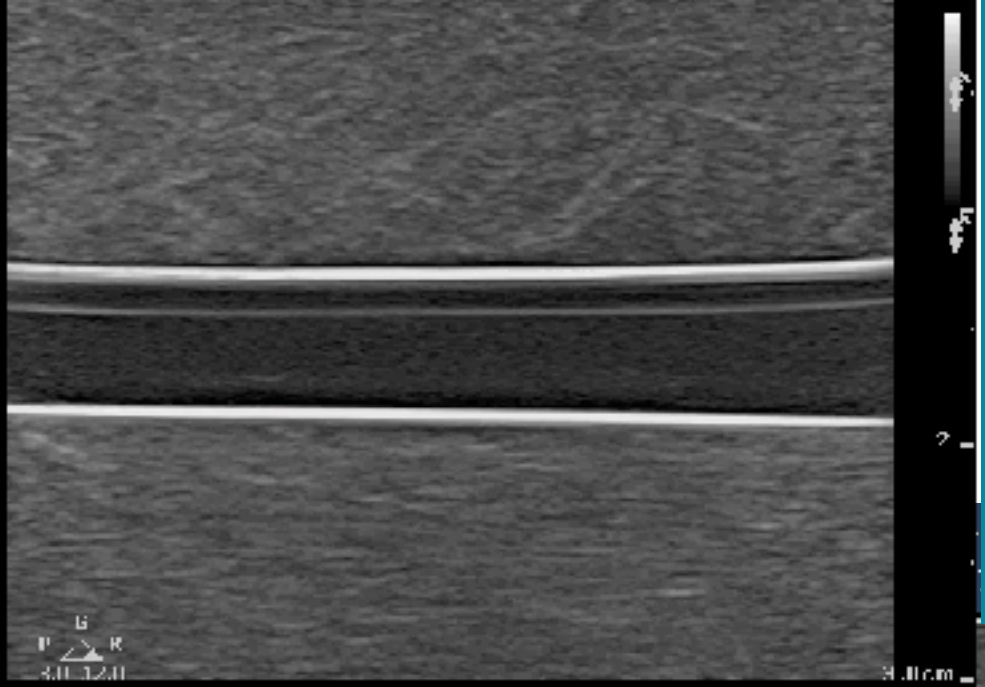
Cochrane 2011. US for **HD catheters**

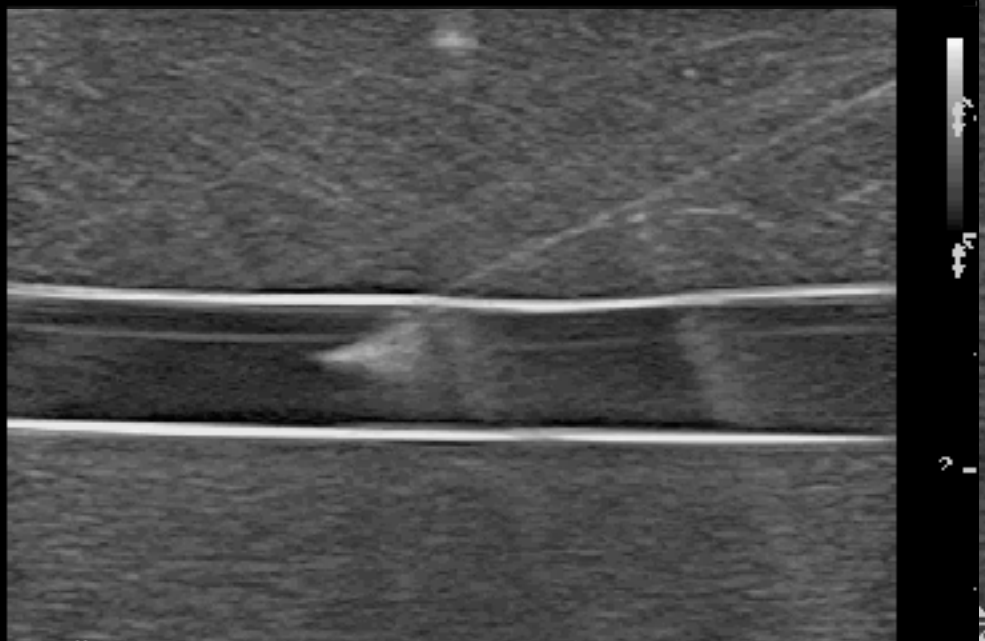
Cochrane 2015. US v.s. landmarks for **IJVC**

2015 ELSO guideline

OFF-PLANE首重針尖

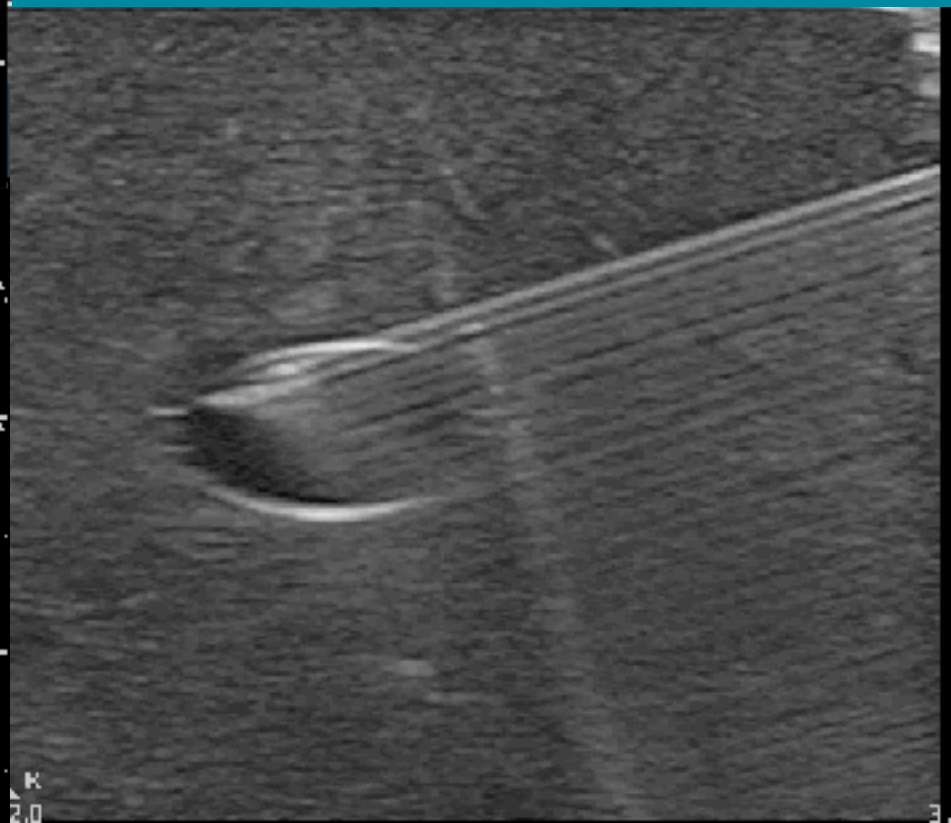




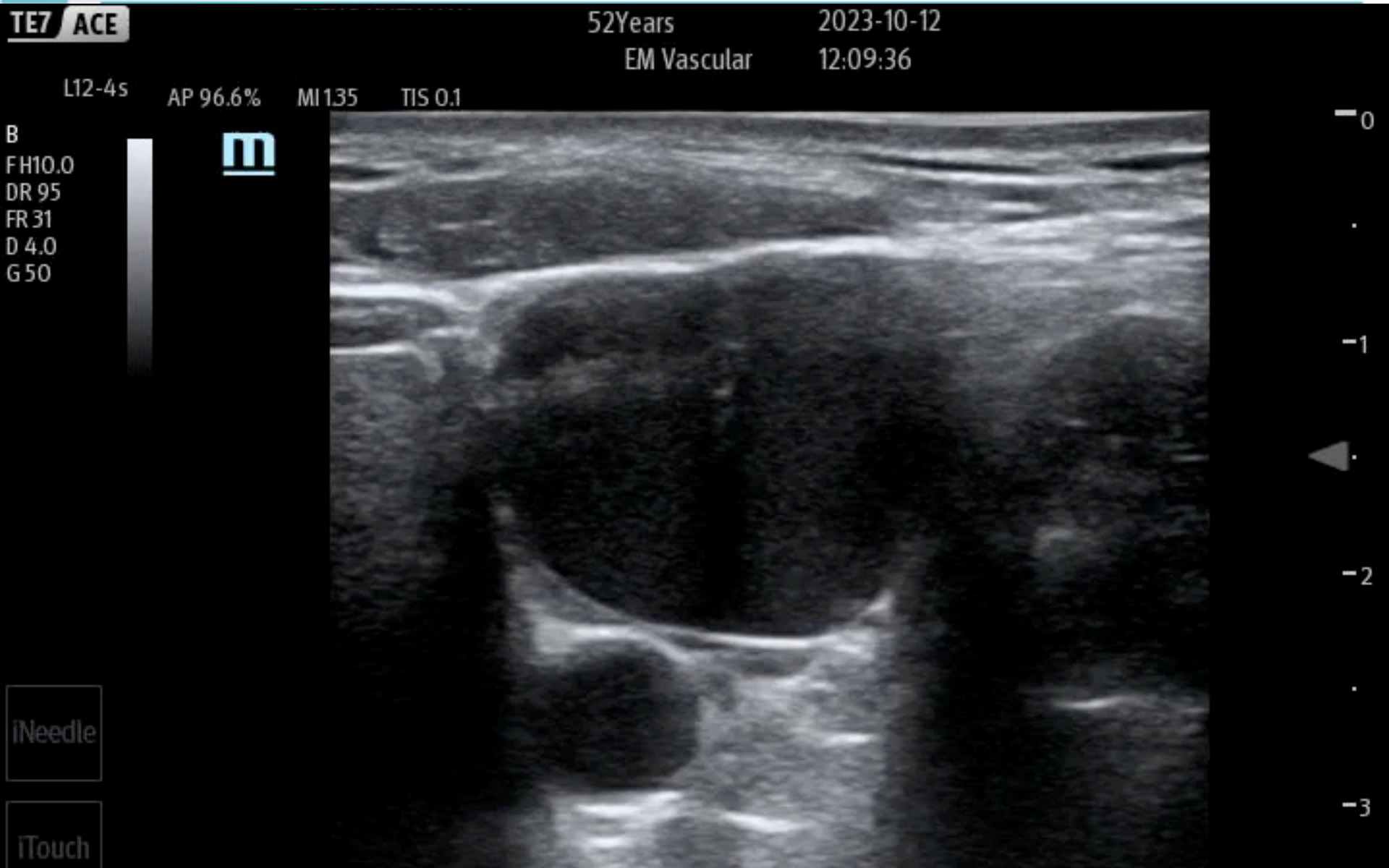


NEEDLE OPTIMIZATION

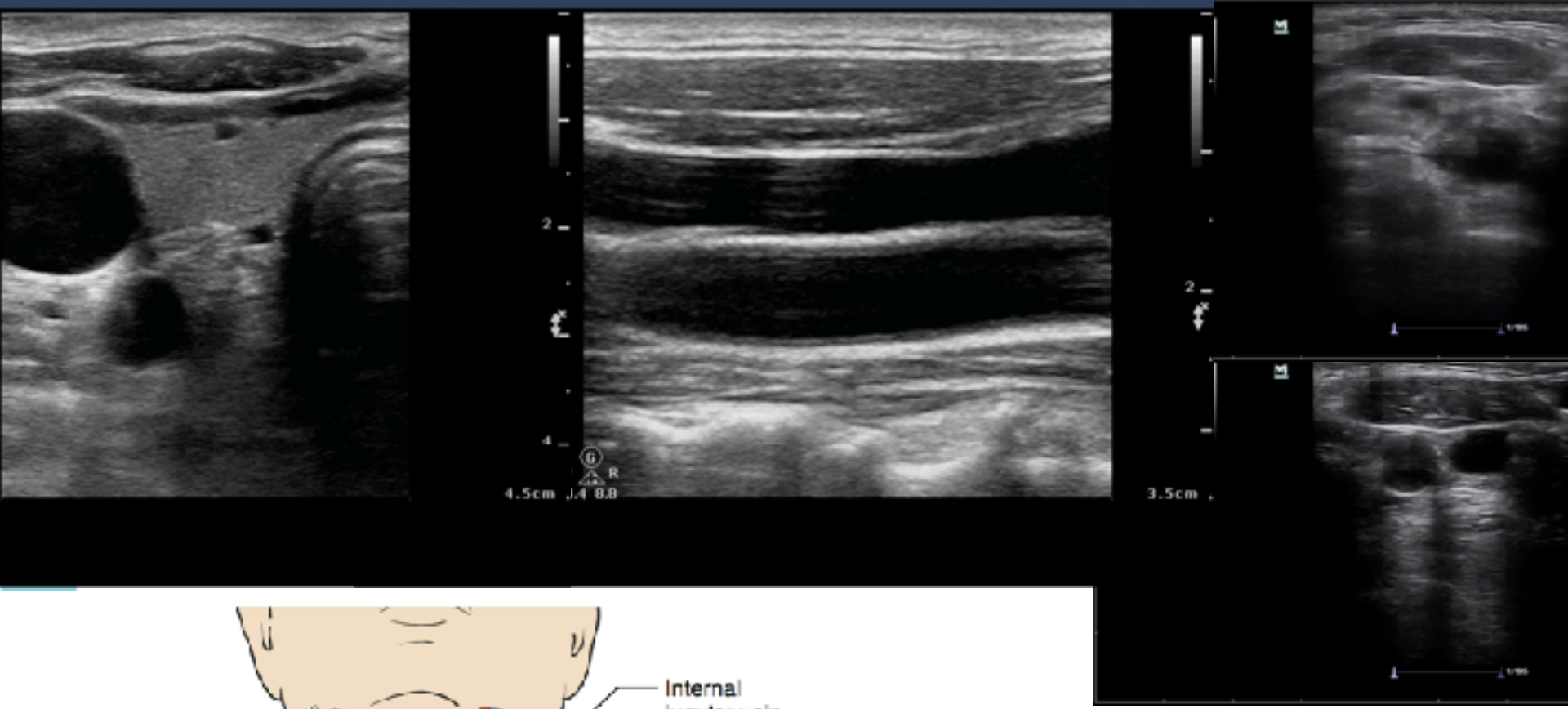
探頭要垂直針身

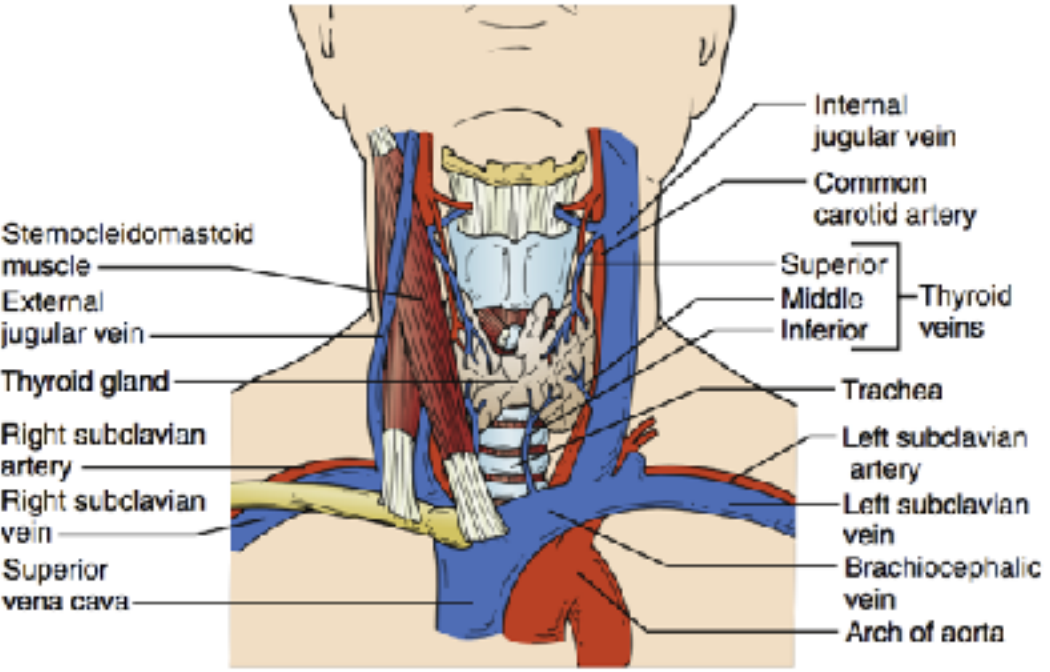


CVC IN SEPTIC SHOCK PATIENT



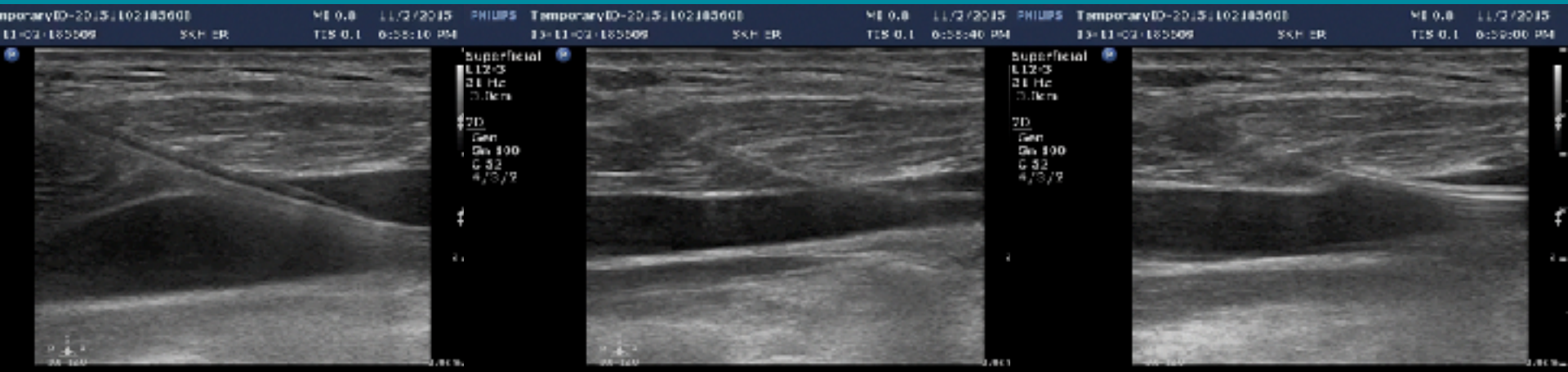
US-GUIDED CVC

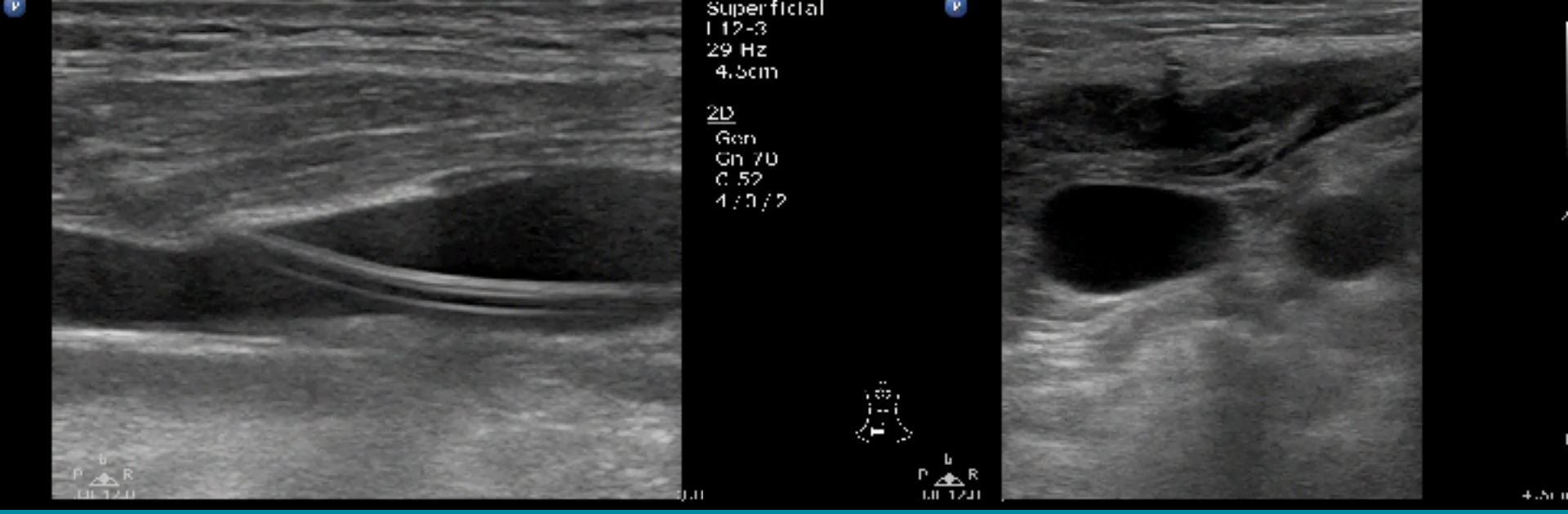




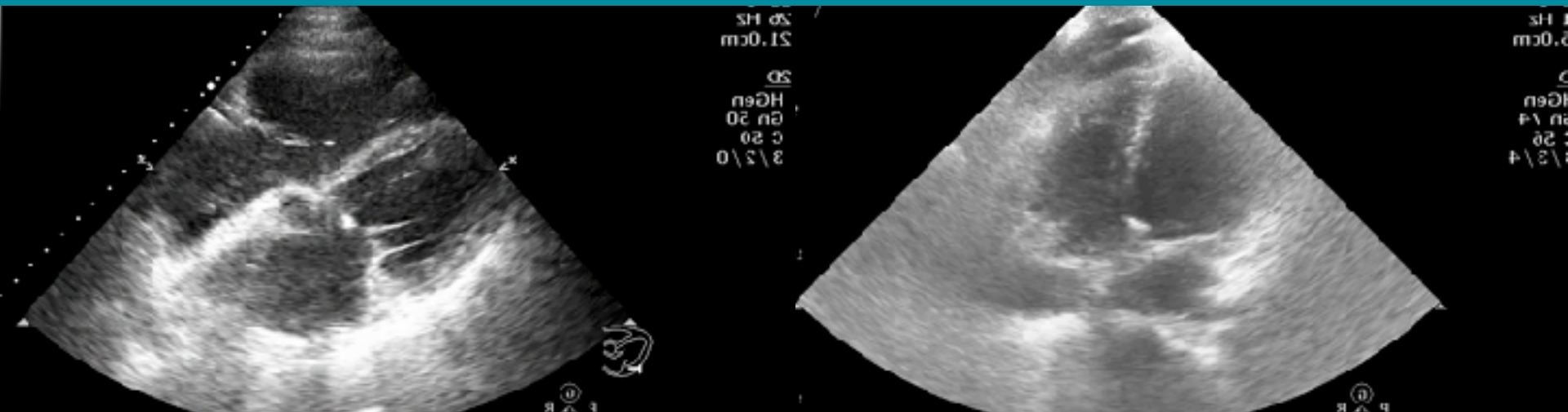
Size
Shape
Depth
Compressibility
Proximity to CCA
Distal anastomosis with SCV
Respiratory variation

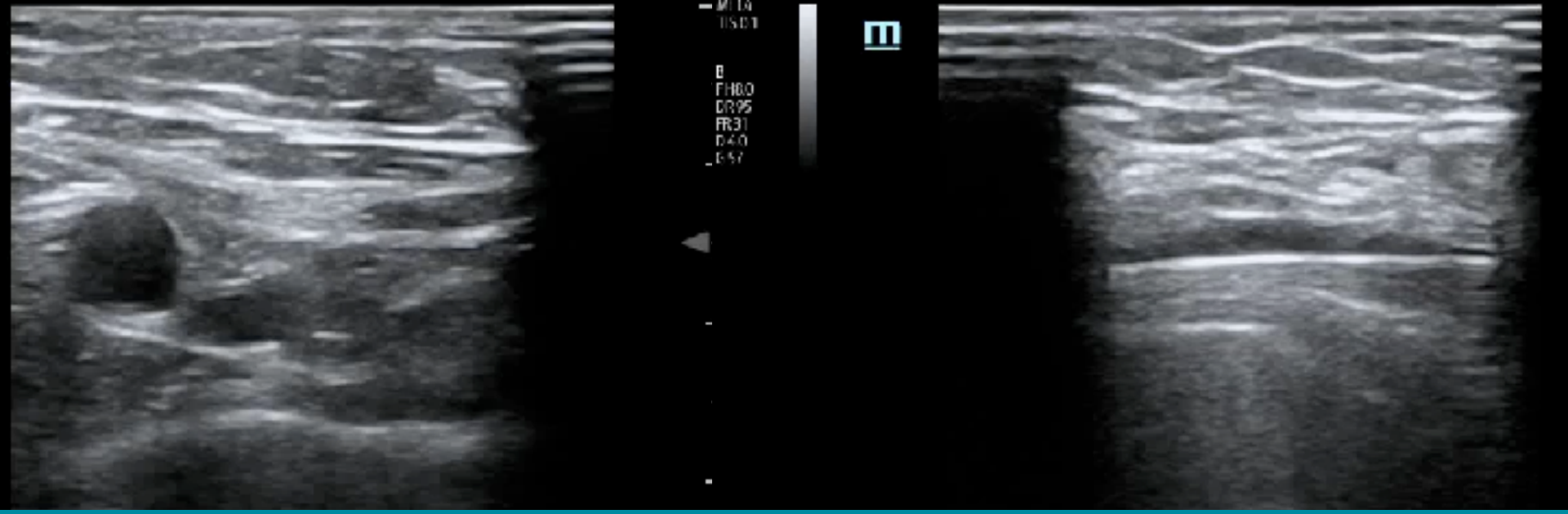
US-GUIDED CVC (IN-PLANE)





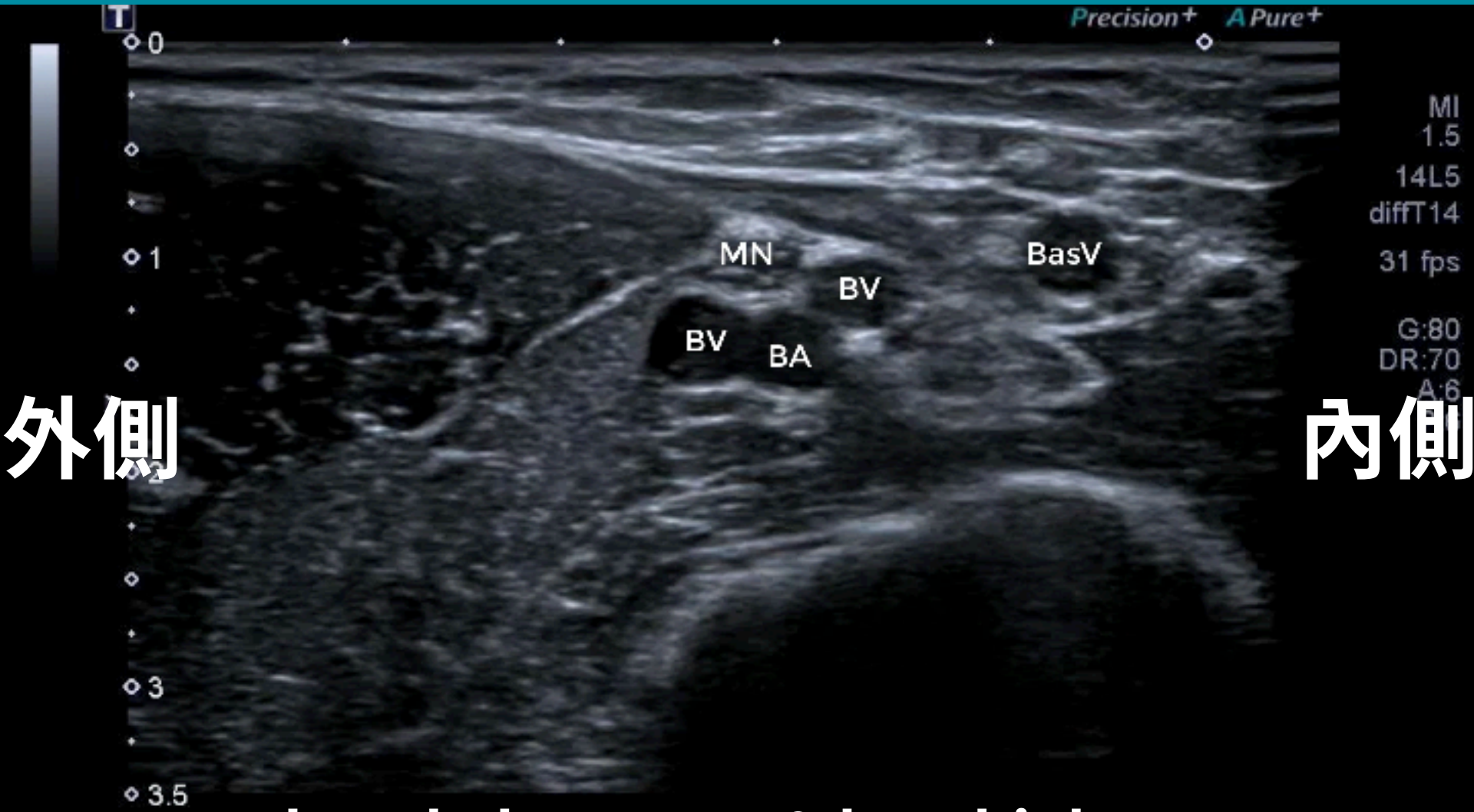
CVC CONFIRMATION





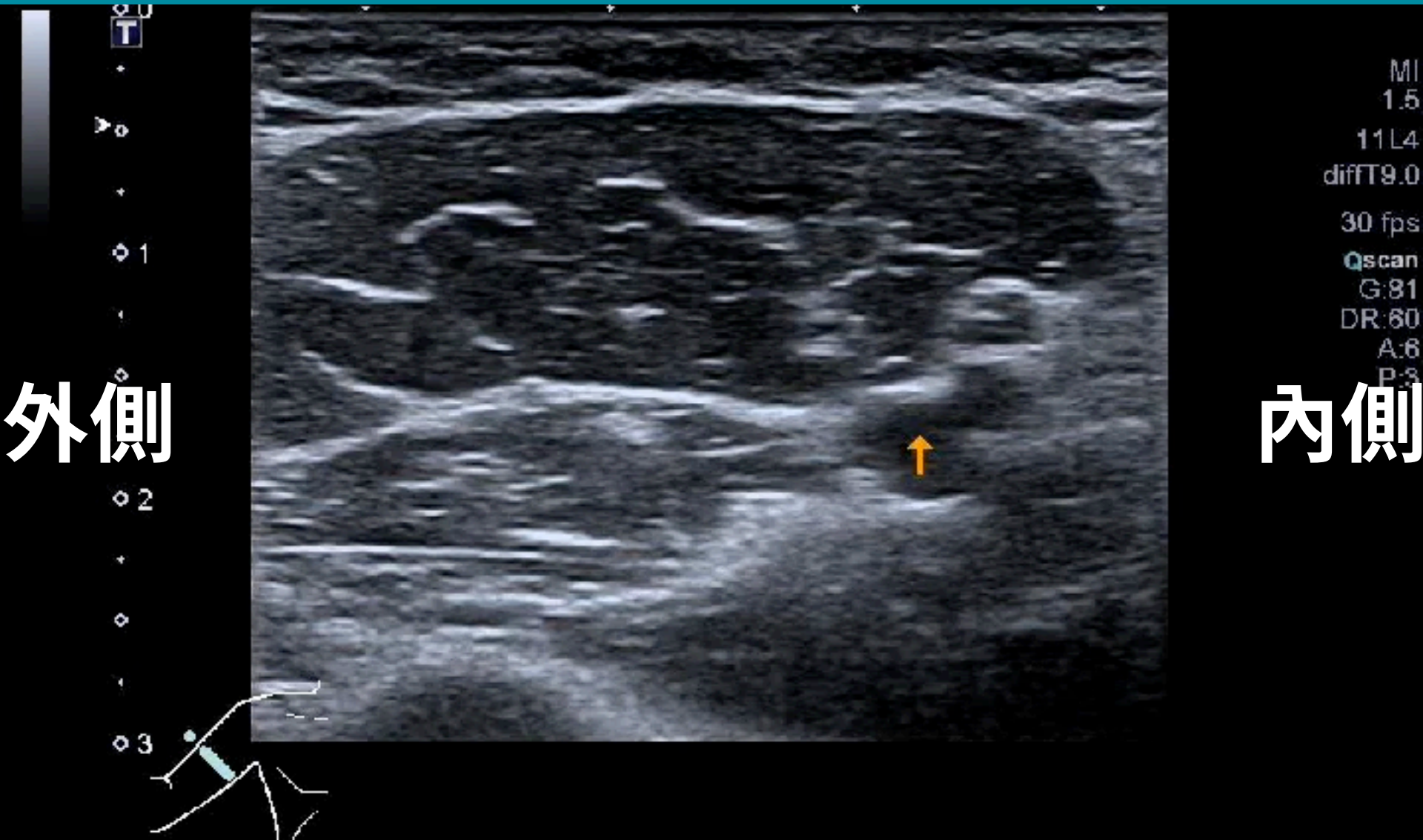
CVC CONFIRMATION

BASILIC VEIN & BRACHIAL VEIN

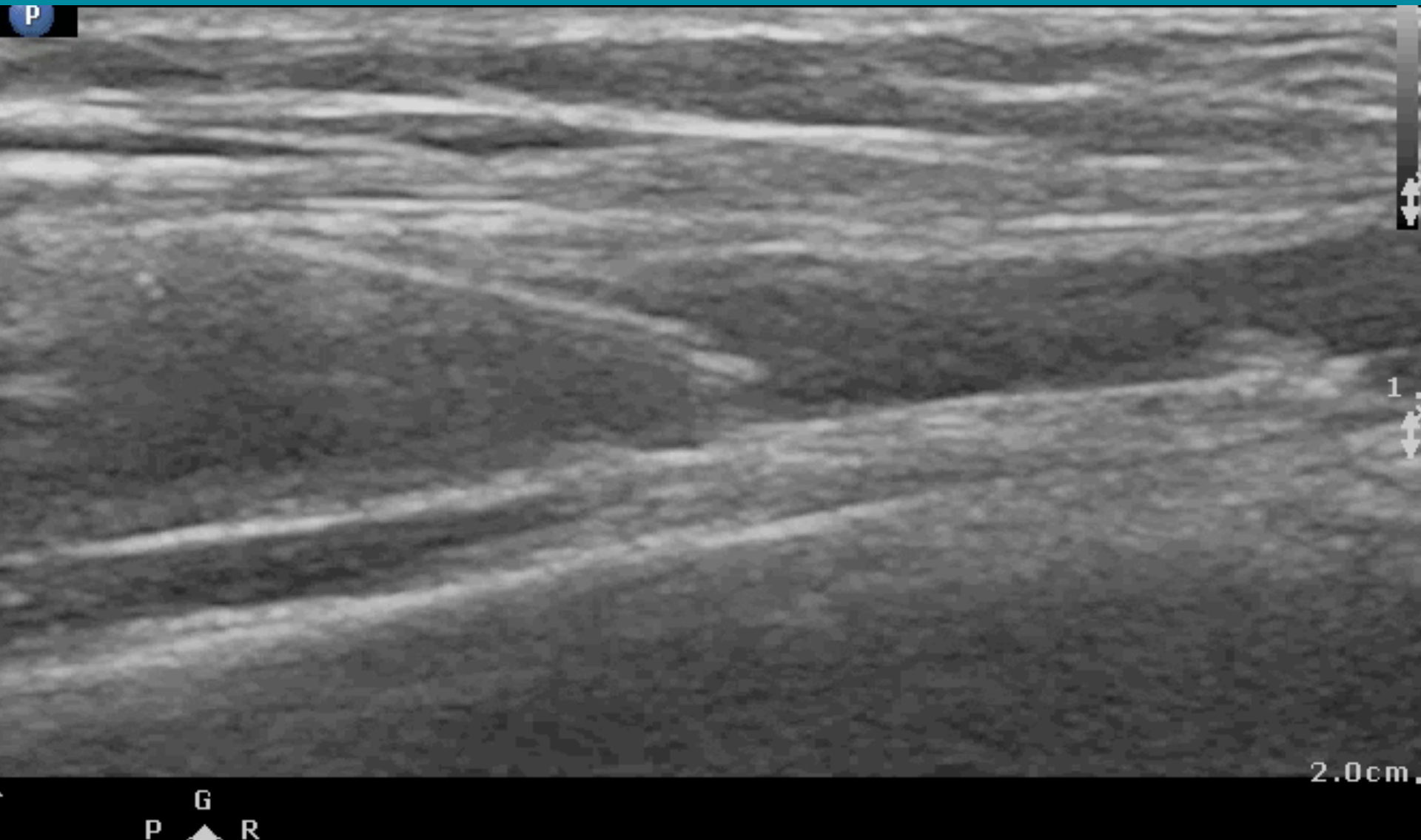


Landmark: humerus & brachial aretery

CEPHALIC VEIN

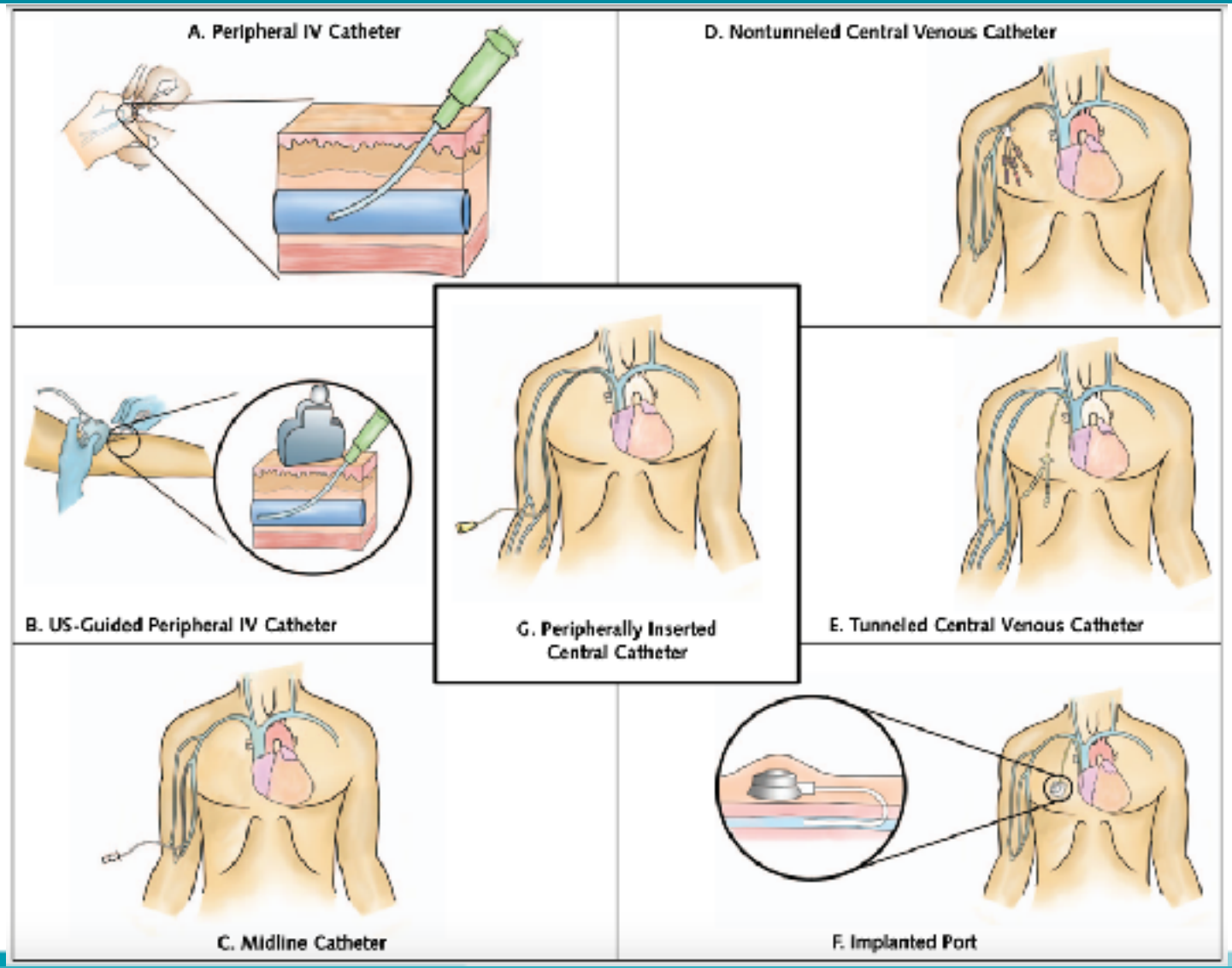


PIV: IN-PLANE APPROACH



VASCULAR ACCESS DEVICES

Chopra V, Ann Intern Med, 2015



常用的靜脈導管比較

黃耀廣醫師網站 HTTPS://WWW.CVSDOCTOR.COM/PICC-INTRODUCTION/

輸液導管	週邊靜脈留置針	週邊置入中心靜脈導管	中央靜脈導管
			
留置時間	需要每3天更換	半年以上	每7至10 天需更換
置放者	由護理師置放	由醫師置放	由醫師置放
功能	當靜脈輸液的酸鹼值和滲透壓值和血液不同時，容易刺激血管內皮細胞而造成損傷，進而形成化學性的血栓	可監測中心靜脈壓(威力週邊置入中心導管、中央靜脈導管) 有雙腔、三腔管路，可同時提供病人多種或大量輸液 具刺激性之化學治療藥物建議應由中心靜脈導管給予，尤其是起皰性的化學治療藥物，為了避免藥物外滲時所造成的重大傷害	
合併症	無重大併發症 可能引起靜脈炎、藥物外滲、皮膚壞死	無重大併發症	放置過程可能會產生氣、血胸、大動脈穿刺、血栓感染機率較高
抽血	每次抽血均需重覆扎針	放置後**不需重覆紮針**， 自外露管路抽血即可	放置後**不需重覆紮針**， 自外露管路抽血即可
電腦斷層	由留置針施打顯影劑 可能會造成顯影劑外滲	自管路直接施打顯影劑即可 (威力週邊置入中心導管)	仍需另放置週邊靜脈留置針 (可能會造成顯影劑外滲)
放置部位	前臂或手易影響活動	手臂上段內側，**不會影響活動**	頸部或鼠蹊部，易影響活動

第六卷第四期
刊登日期：2023/08/31
Taiwan Emergency Medicine Bulletin 6(4) : e2023060408

How I do it: 如何在急診開始第一隻PICC？

下載PDF 分享 分享

王鎮玭、范閎皓、陳國智、翁健瑞

衛生福利部雙和醫院 急診醫學科

台灣急診醫學通訊

PICC健保支付標準 - 4適應症

47065B 點數 3101 (111.3.1 ~)

癌症化學治療及癌症末期之疼痛治療

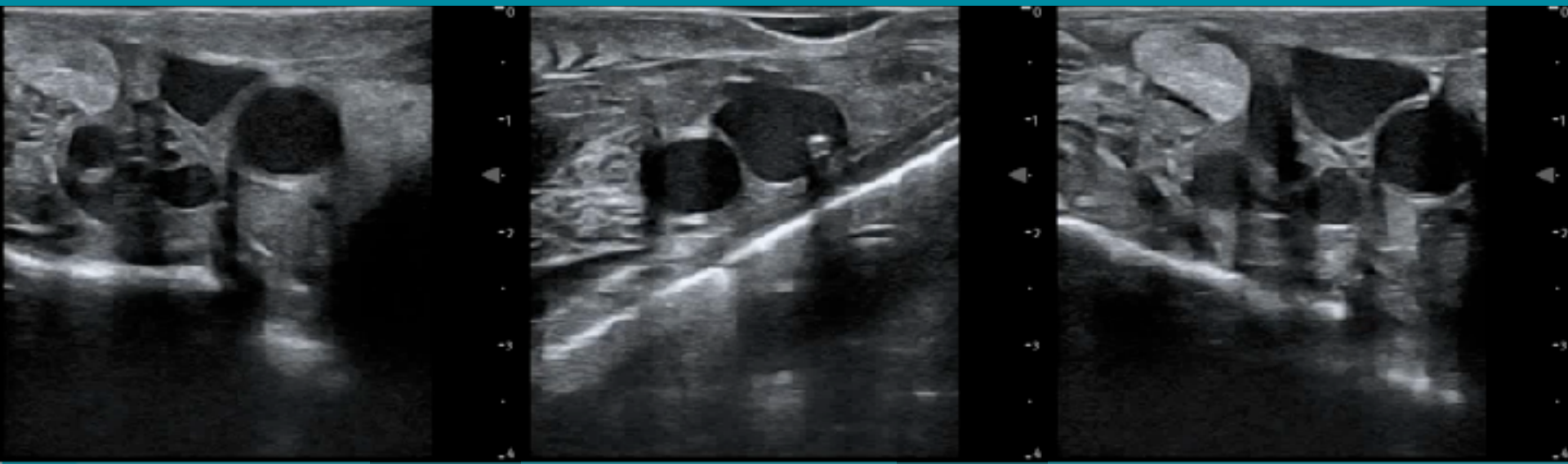
下列三項適應症且預期同時治療達二週以上之病人

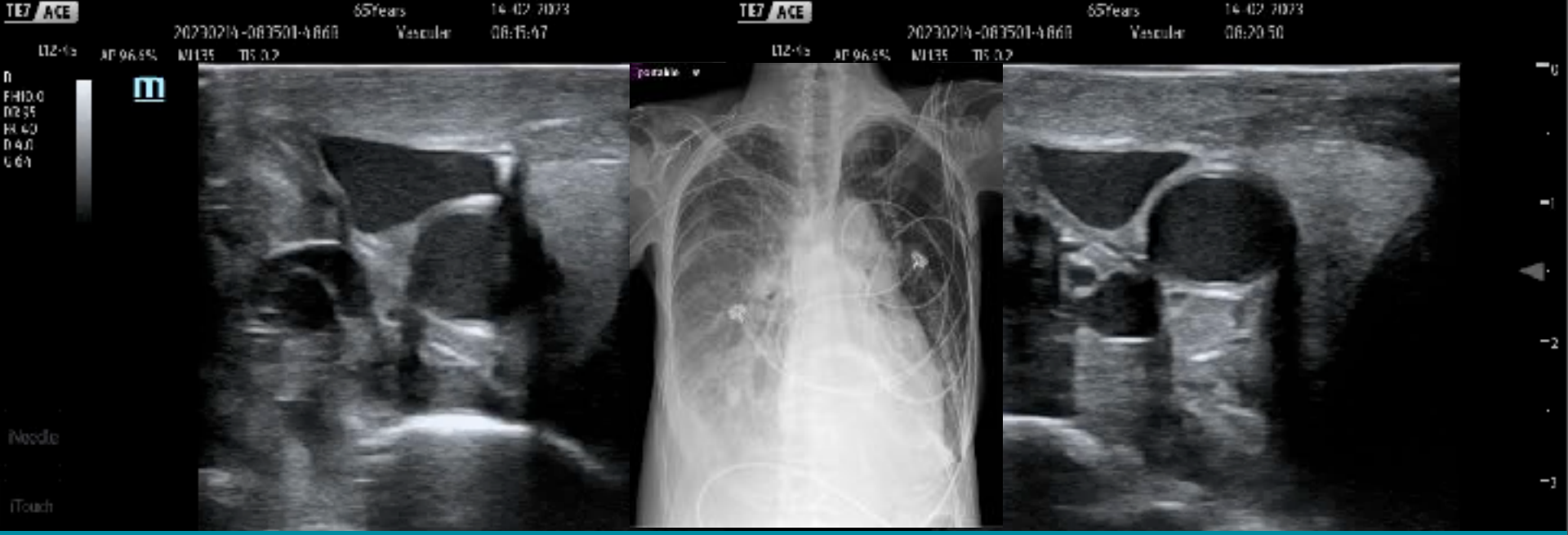
-使用全靜脈營養輸液(TPN)(1歲以下嬰兒本項為靜脈營養輸液，不限TPN)

-免疫不全與使用免疫抑制劑

-須接受中心靜脈導管置入(CVC)

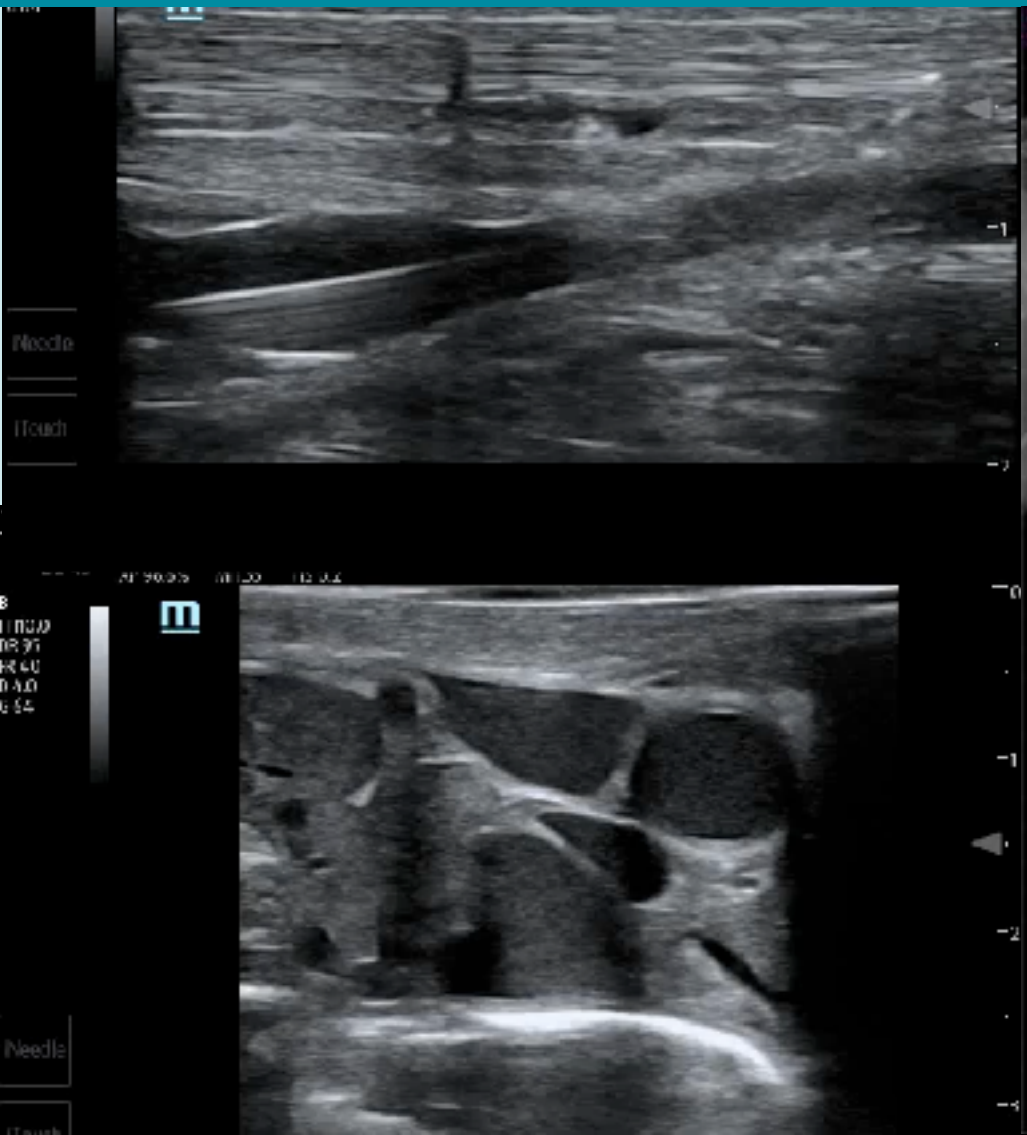
US-GUIDED PICC TIP NAVIGATION



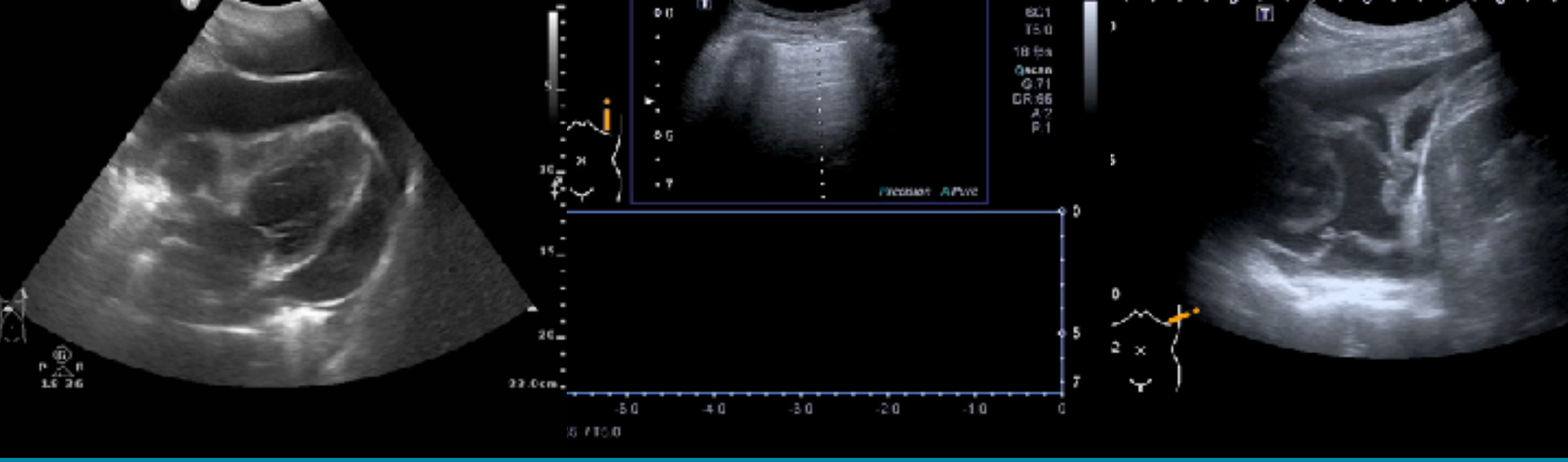


ECHOTIP PROTOCOL
TIP NAVIGATION

PICC確認位置 (ECHO + CXR)



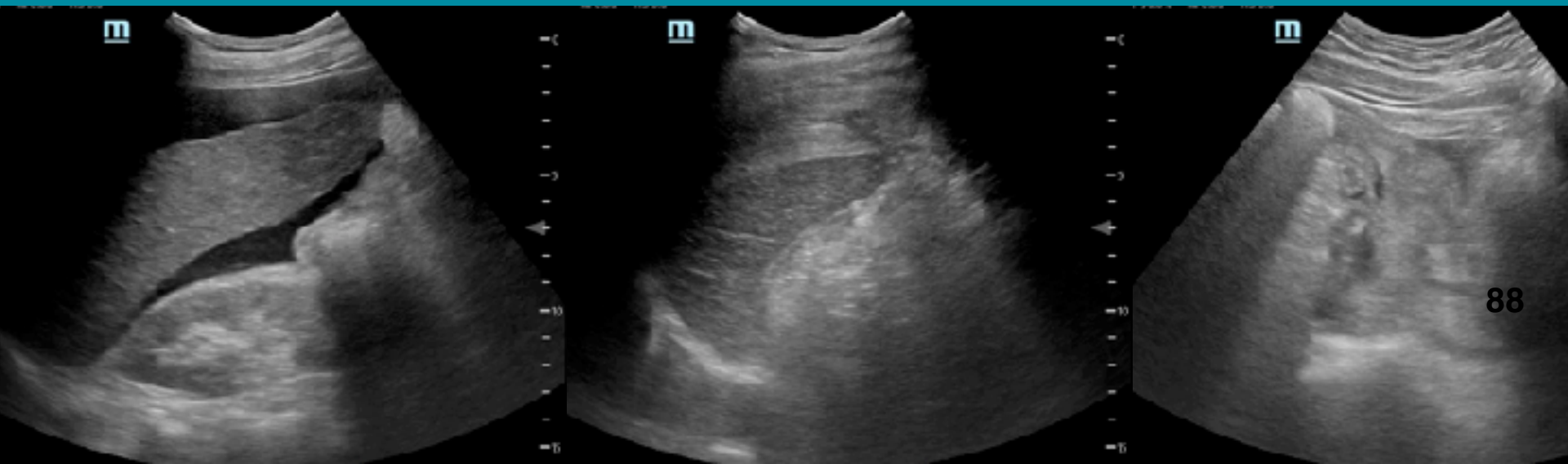

EFAST
介面性為主的掃描



EFAST

EXTENTED FOCUSED ASSESSMENT WITH SOGOGRAPHY FOR TRAUMA

探查心包膜、肋膜腔、腹腔的游離液體和大量氣胸



POCUS FOR NP工作坊查核表

右/左上腹	下腹/膀胱	心臟/胸腔	管路/介入
Diaphragm (R/ L)	Pubic symphysis	Bat sign & A lines	CCA - Intima
Liver / RPV / GB	UB - transverse	Sliding/ Seashore sign	IVJ - compresion
Morrison’s pouch	UB - longitudinal	Diaphragm R/L	Brachial artery & vein
Spleen	Prostate or Uterus	PSLA	Basilic vein
Splenorenal fossa	Bladder volume	S4C	Needling-off plane
Kidney (R / L)	Ascites location	IVC	Needling-in plane