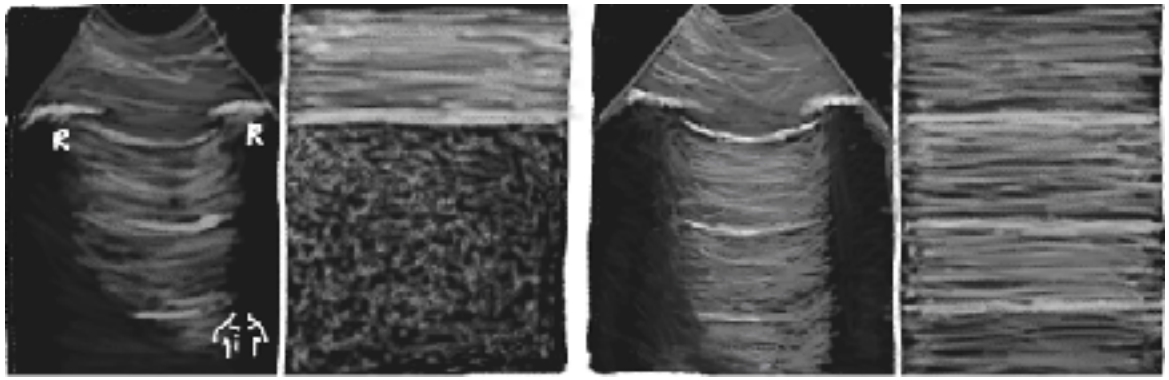
衛生福利部雙和醫院
(委託臺北醫學大學興建經營)
Taipei Medical University - Shuang Ho Hospital,
Ministry of Health and Welfare

Lung US & Diaphragm



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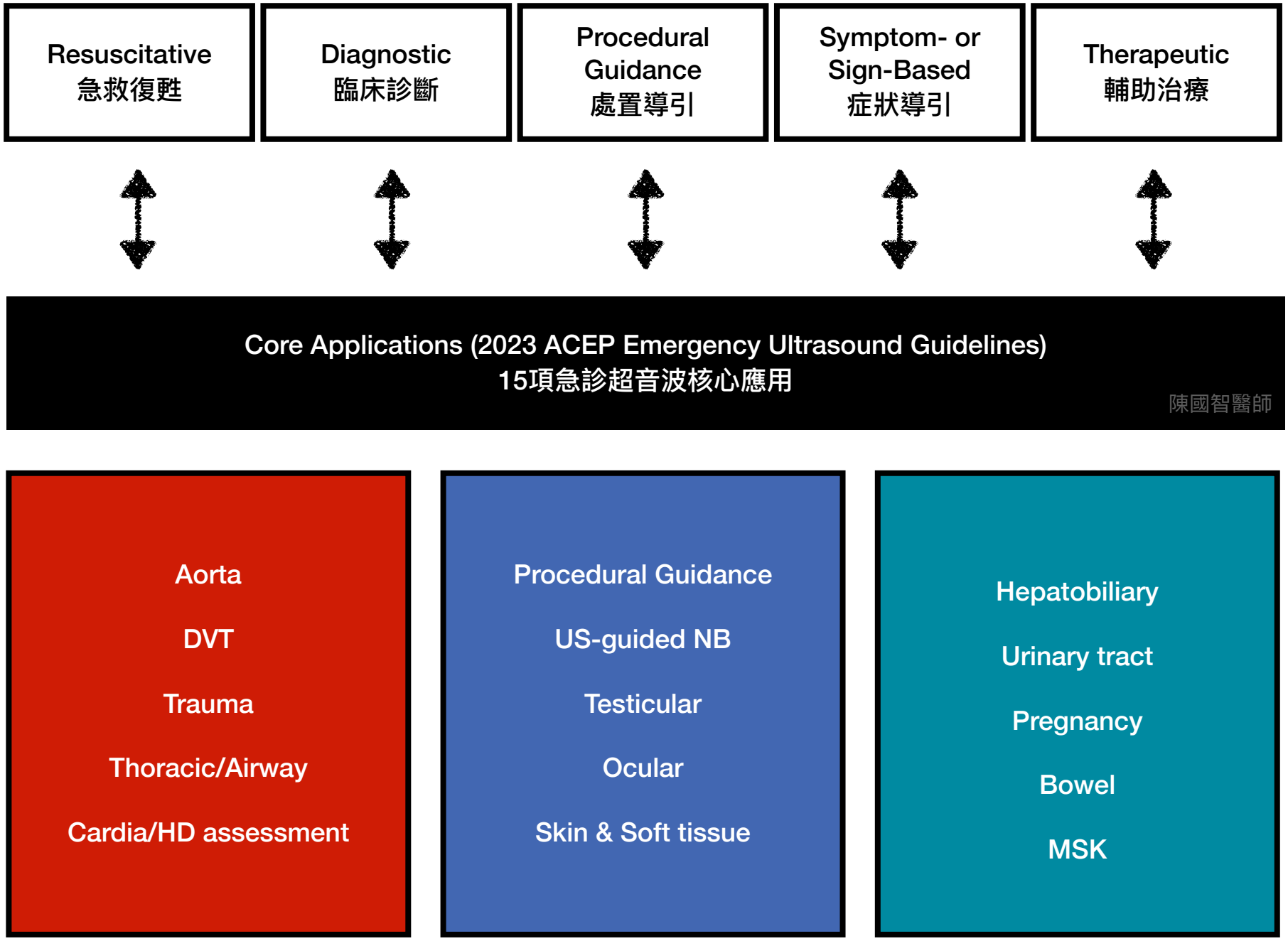
雙和醫院 急診醫學科
juice119@gmail.com

陳國智 醫師 / POCUSacademy.com

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

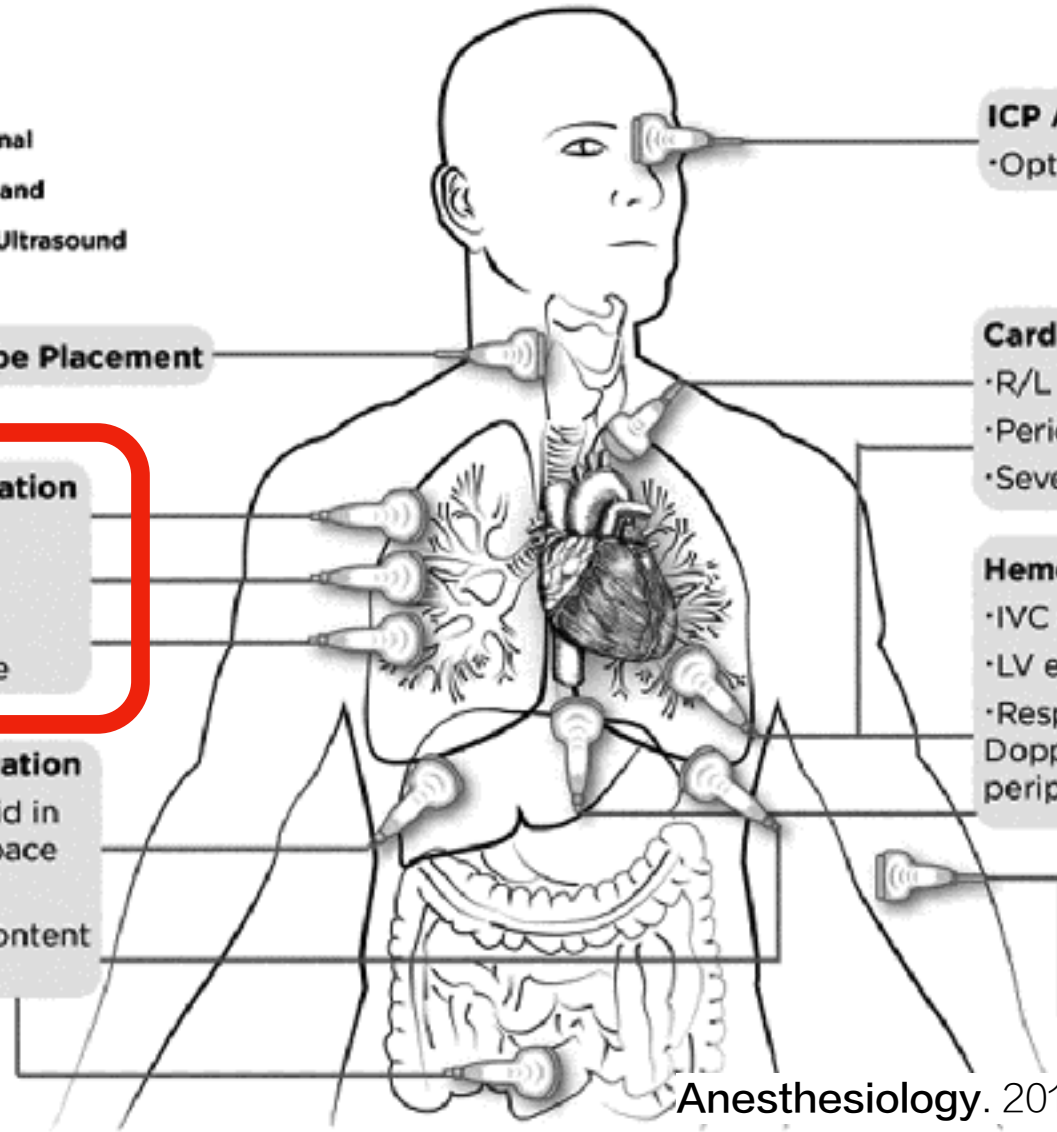
急診 / 重症 / 介入 / 急性疼痛

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


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

F.O.R.E.S.I.G.H.T. Comprehensive Perioperative Ultrasound Examination

Focused
Peri**O**perative
Risk
Evaluation
Sonography
Involving
Gastro-Abdominal
Hemodynamic, and
Trans-Thoracic Ultrasound



ICP Accessment
·Optic sheath diameter

Endotracheal Tube Placement

Cardiac Evaluation
·R/L ventricular function
·Pericardial effusion
·Severe valvular abnormalities

Pulmonary Evaluation
·Pneumothorax
·Pleural effusion
·Severe alveolar interstitial disease

Hemodynamics
·IVC collapsibility
·LV end diastolic area
·Respiratory variation on Doppler flow across LVOT/ peripheral arteries

Abdominal Evaluation
·Evaluate free fluid in interperitoneal space via 3 windows
·Assess gastric content and volume

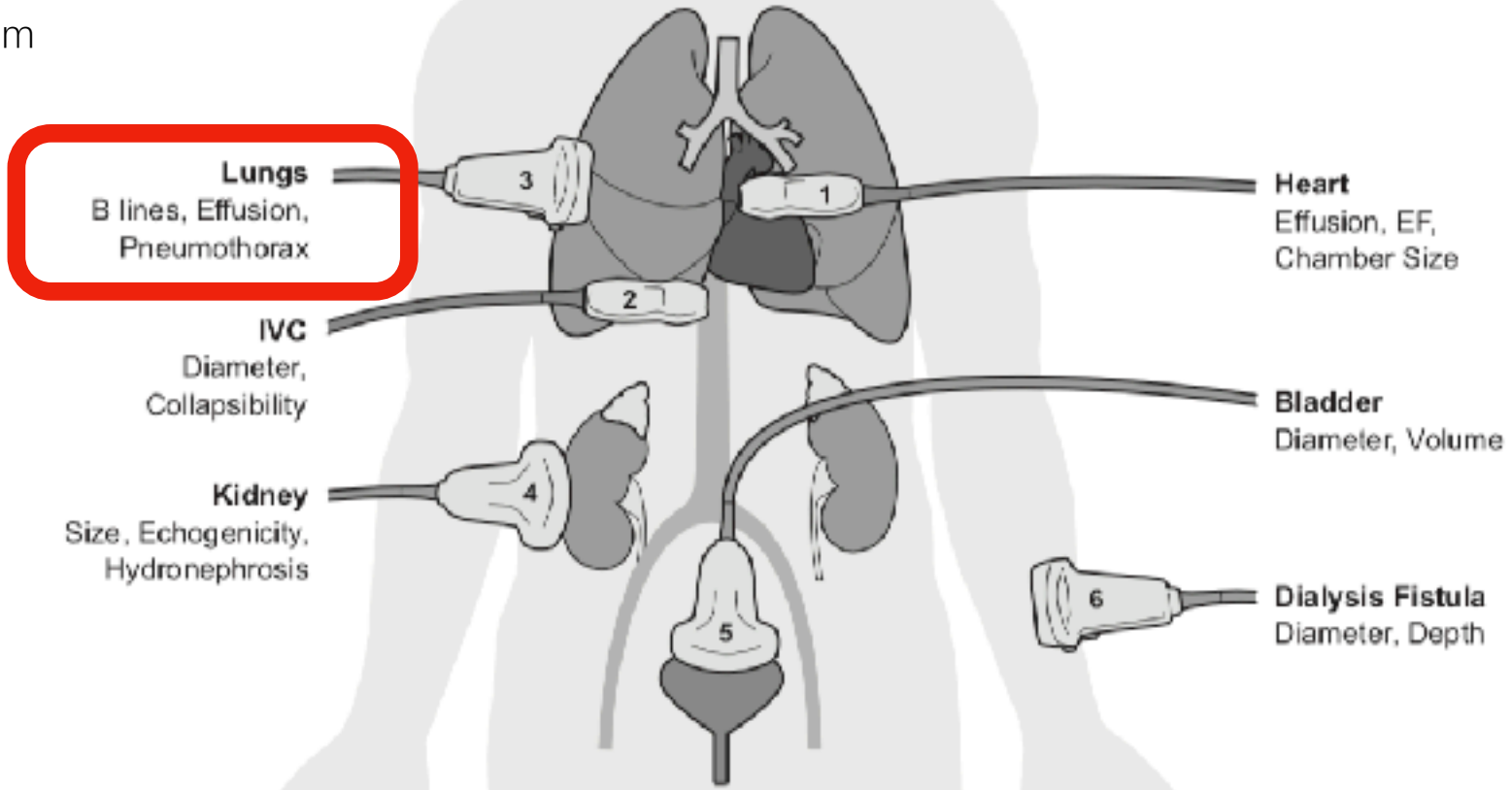
Vascular Access
·Demonstrate image acquisition of peripheral veins/arteries

Anesthesiology. 2015 Sep;123(3):670–82

	IMAGE AREA	IMAGE ACQUISITION	PROBE
1	Heart	Parasternal Long Axis (PLAX)	Phased
2	Inferior Vena Cava	Subcostal	Phased
3	Lung	Anterior, Lateral, Posterior	Linear
4	Kidney	Longitudinal, Transverse	Curved
5	Bladder	Suprapubic	Curved
6	Dialysis Fistula	Longitudinal and Transverse	Linear

Johns Hopkins **Nephrology** fellowship

POCUS curriculum



Semin Dial. 2018 Mar;31(2):154–162

Lung Ultrasound: The Essentials

Thomas J. Marini, MD • Deborah J. Rubens, MD • Yu T. Zhao, BA • Justin Weis, MD • Timothy P. O'Connor, MD • William H. Novak, MD • Katherine A. Kaproth-Joslin, MD, PhD

From the Departments of Imaging Sciences (T.J.M., D.J.R., Y.T.Z., K.A.K.J.), Medicine (J.W., W.H.N.), and Emergency Medicine (T.P.O.), University of Rochester Medical Center, School of Medicine and Dentistry, 601 Elmwood Ave, Box 655, Rochester, NY 14642. Received October 24, 2020; revision requested January 5; revision received January 16; accepted February 5. **Address correspondence to** T.M. (e-mail: *RochesterRadiology2021@gmail.com*).

Conflicts of interest are listed at the end of this article.

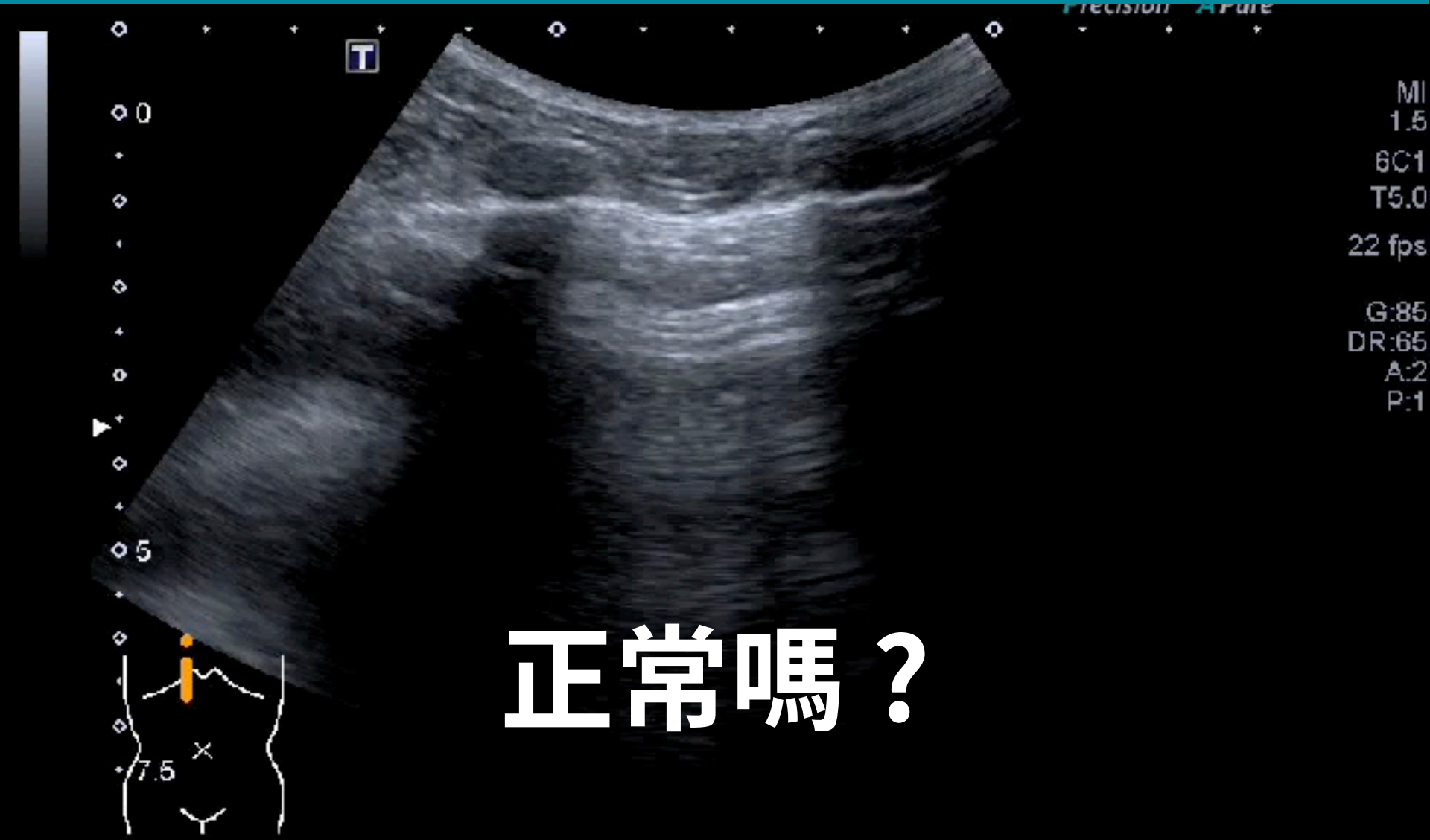
Radiology: Cardiothoracic Imaging 2021; 3(2):e200564 • https://doi.org/10.1148/ryct.2021200564 • Content codes: CH US

Sensitivity and Specificity of Lung US versus Chest Radiography

			Lung US		Chest Radiography	
Indication	Study Type	No. of Patients	Sensitivity (%)	Specificity (%)	Sensitivity (%)	Specificity (%)
Pleural effusion (5)	Prospective	32	92	93	39	85
Pneumonia (7)	Systematic review with meta-analysis	742	95	90	77	91
Pneumothorax (4)	Systematic review with meta-analysis	5314	87	99	46	100
Pulmonary edema (6)	Systematic review with meta-analysis	1827	88	90	73	90

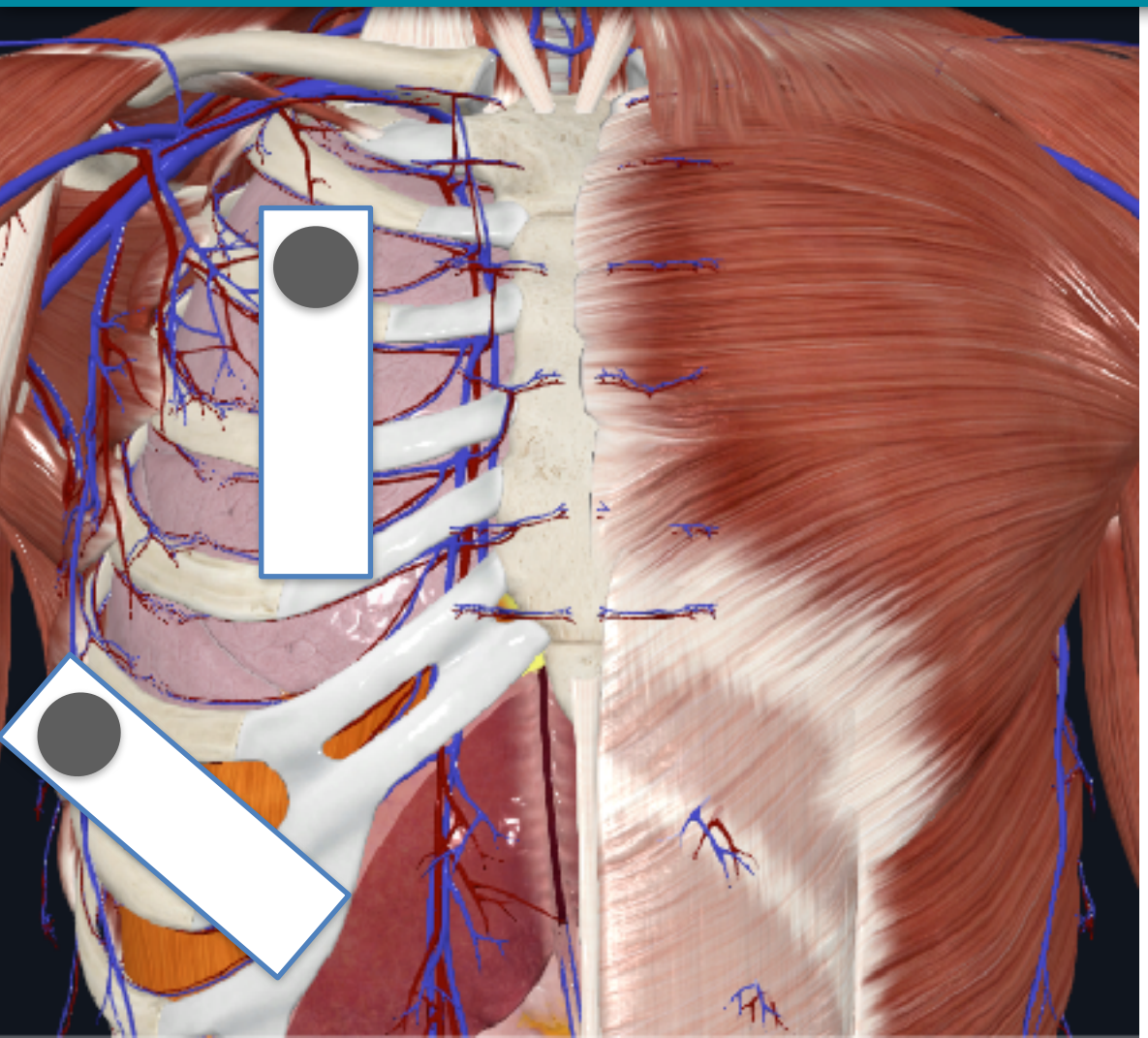
Note.—Sensitivity and specificity values vary slightly from study to study. The pleural effusion statistics are drawn from a sample of critically ill patients.

LUNG



正常嗎？

Lung



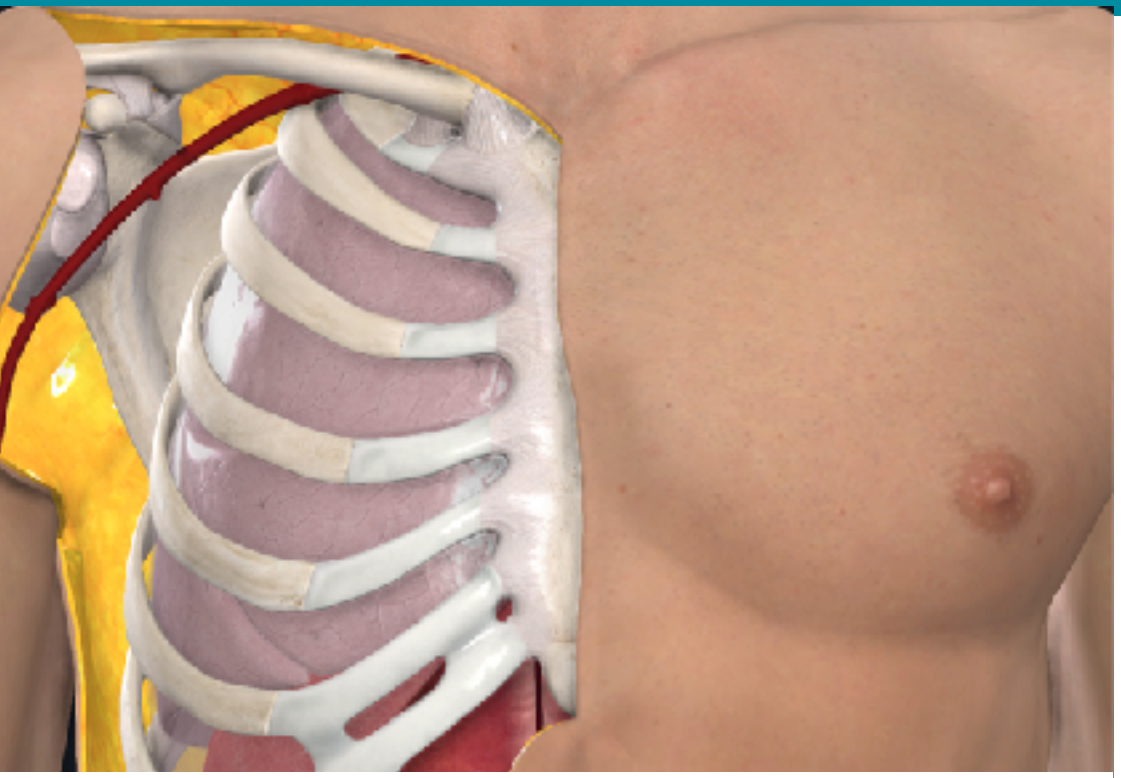
肋膜

- 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

LUNG USG APPLICATIONS



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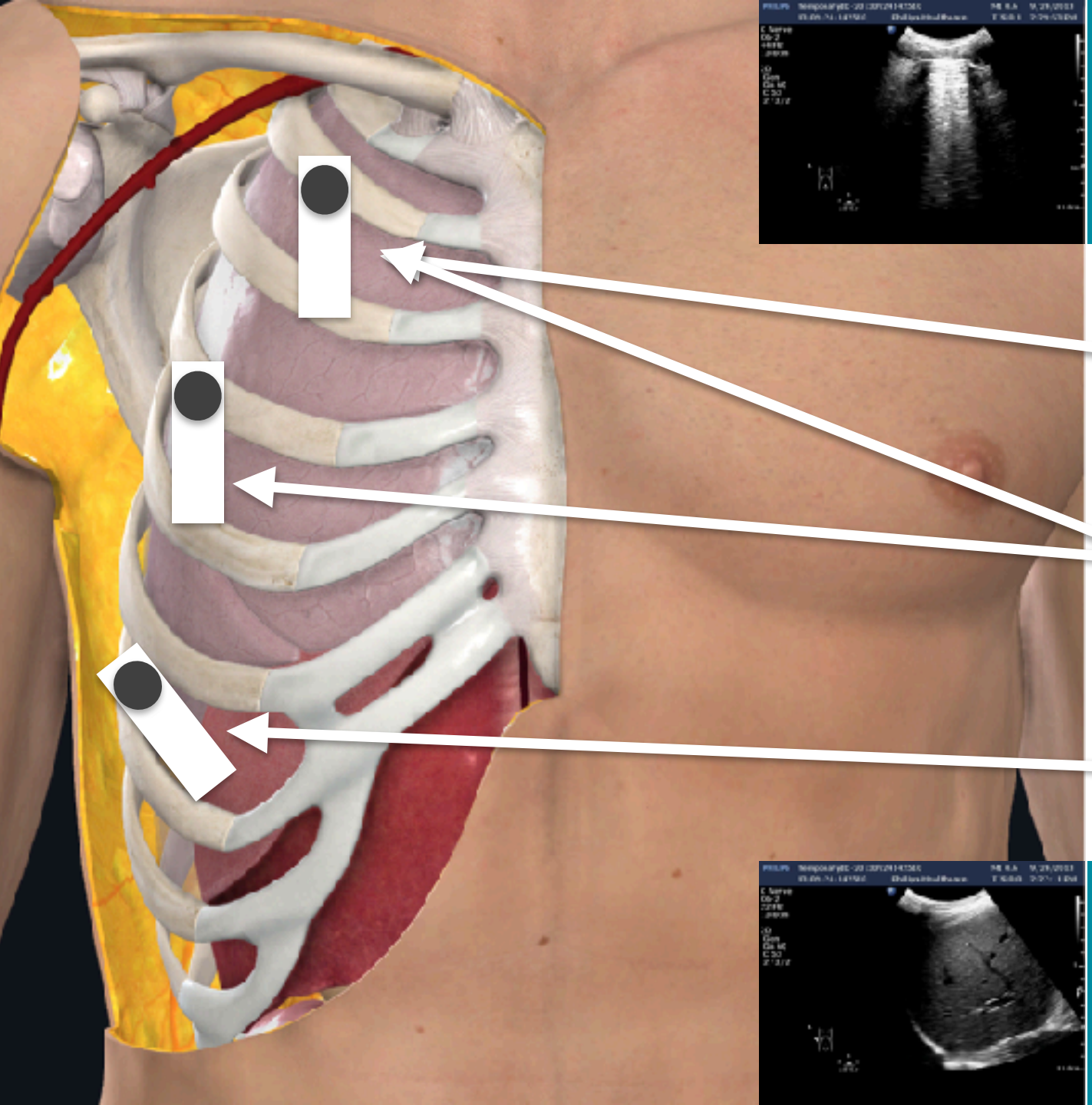
Note.—Sensitivity and specificity values vary slightly from study to study. The pleural effusion statistics are drawn from a sample of critically ill patients.

Dyspnea
Chest pain
Infections

PTX
AIS
PLE

Consolidation



AIR

PTX

AIS

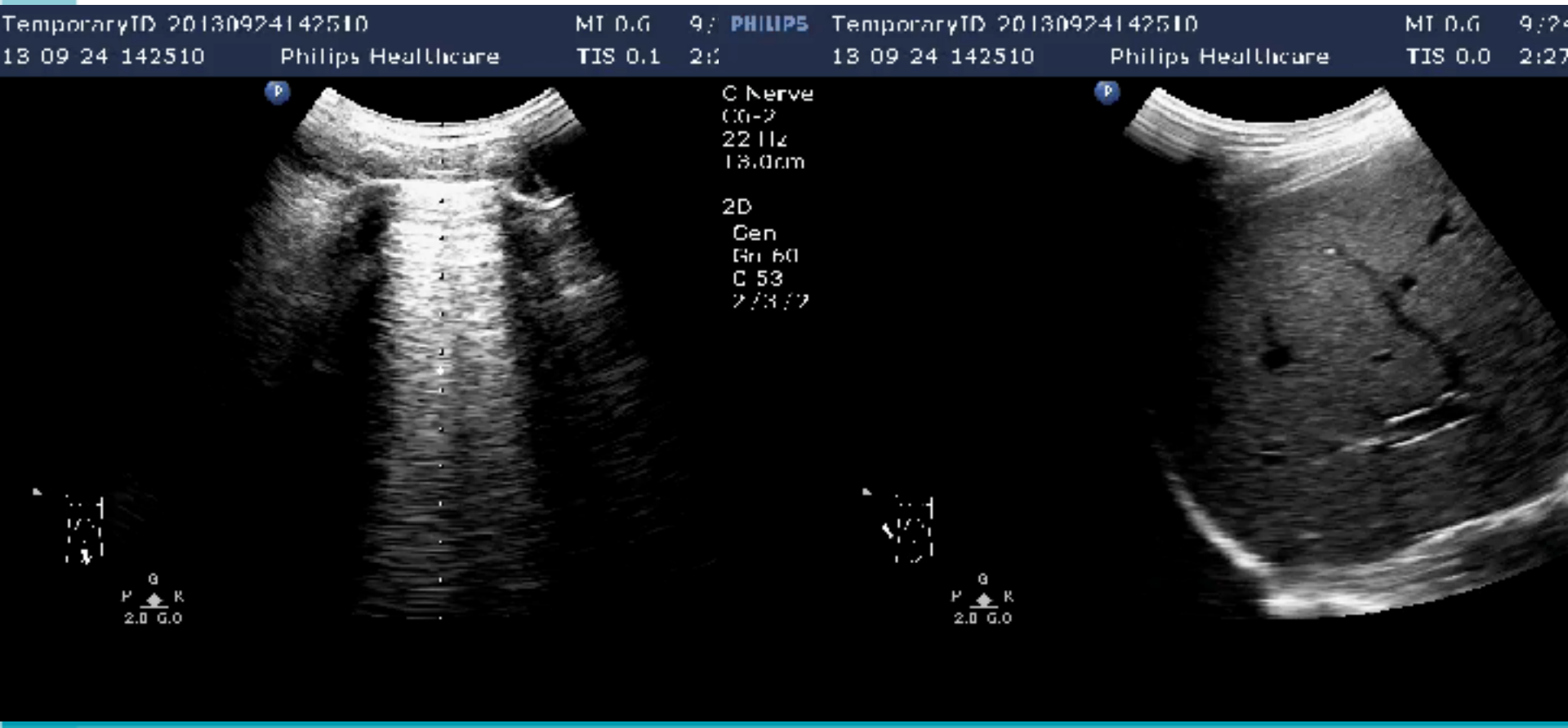
PLE

FLUID

NORMAL LUNG

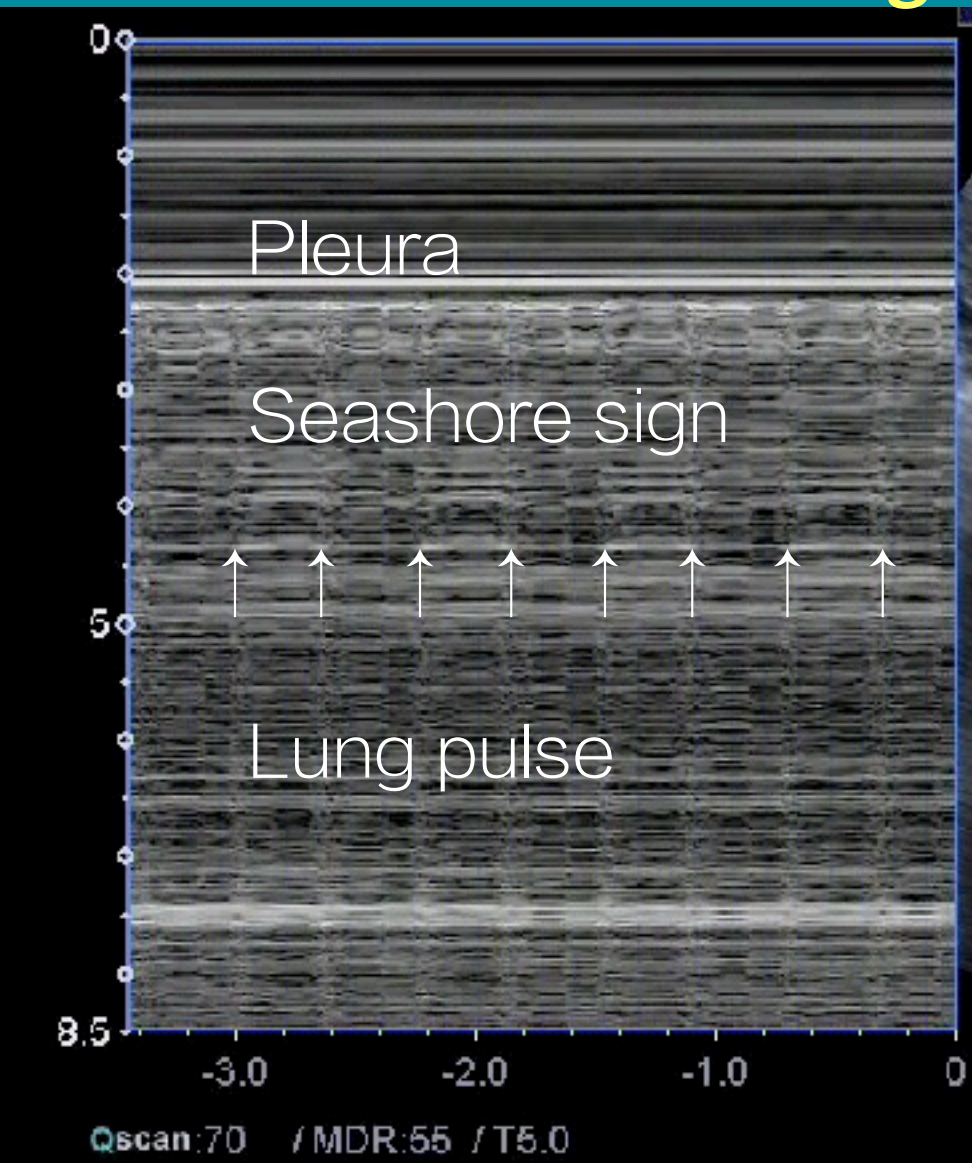
肋膜/滑動

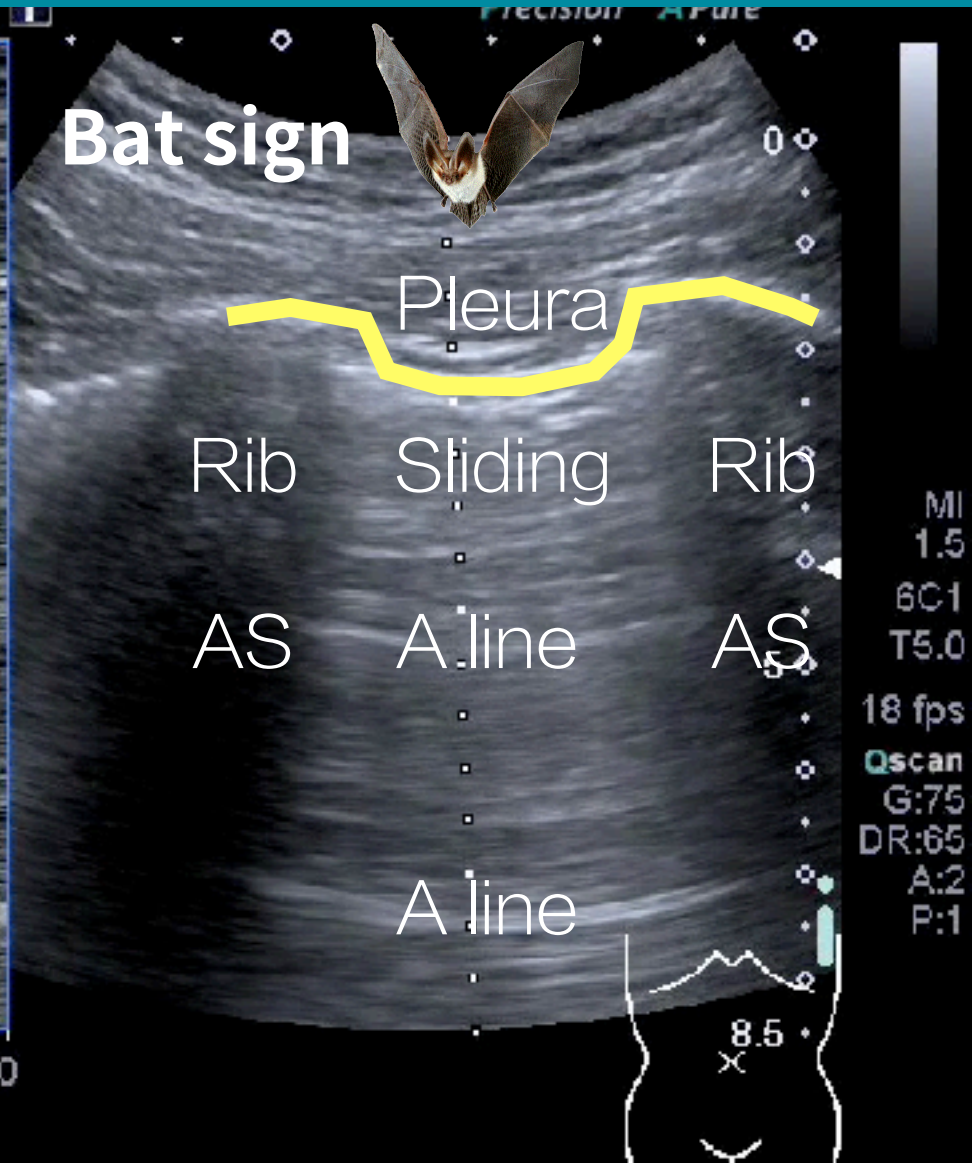
横膈膜/移動



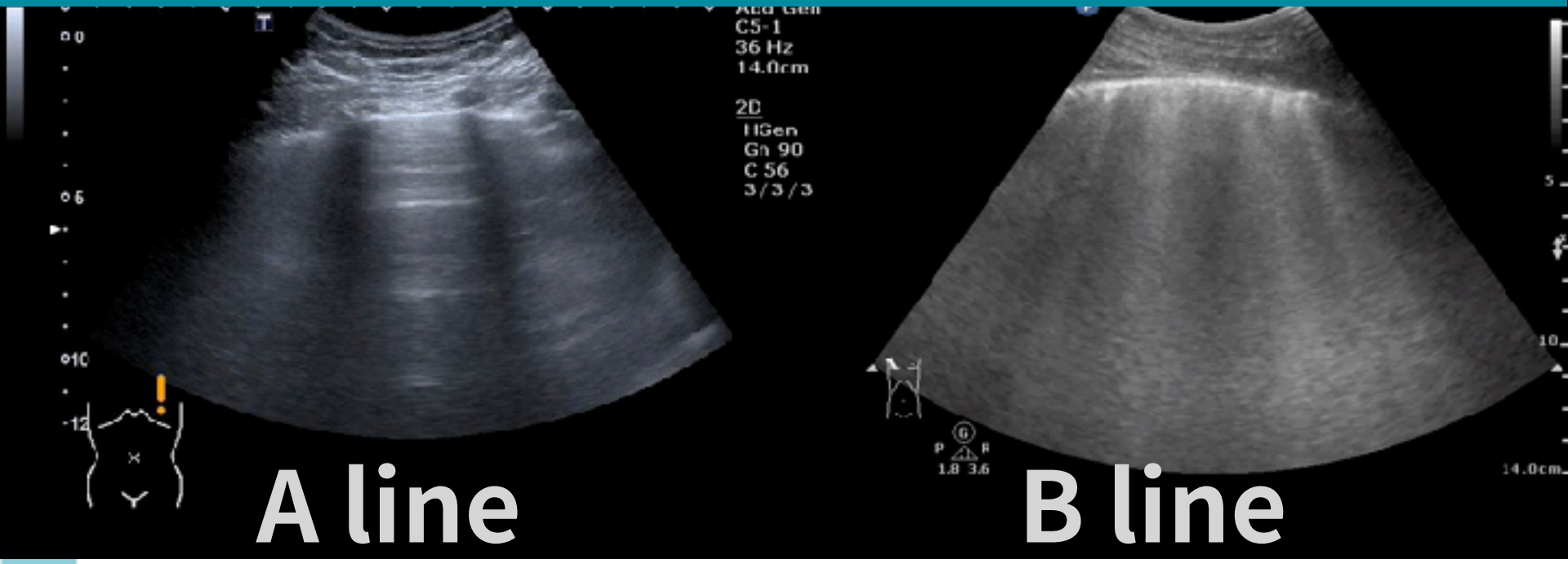
NORMAL LUNG

Sliding + A lines





SLIDING FIRST



肋膜下
水平線
等距離

肋膜下
垂直線
大於三

Intensive Care Med (1999) 25: 383–388
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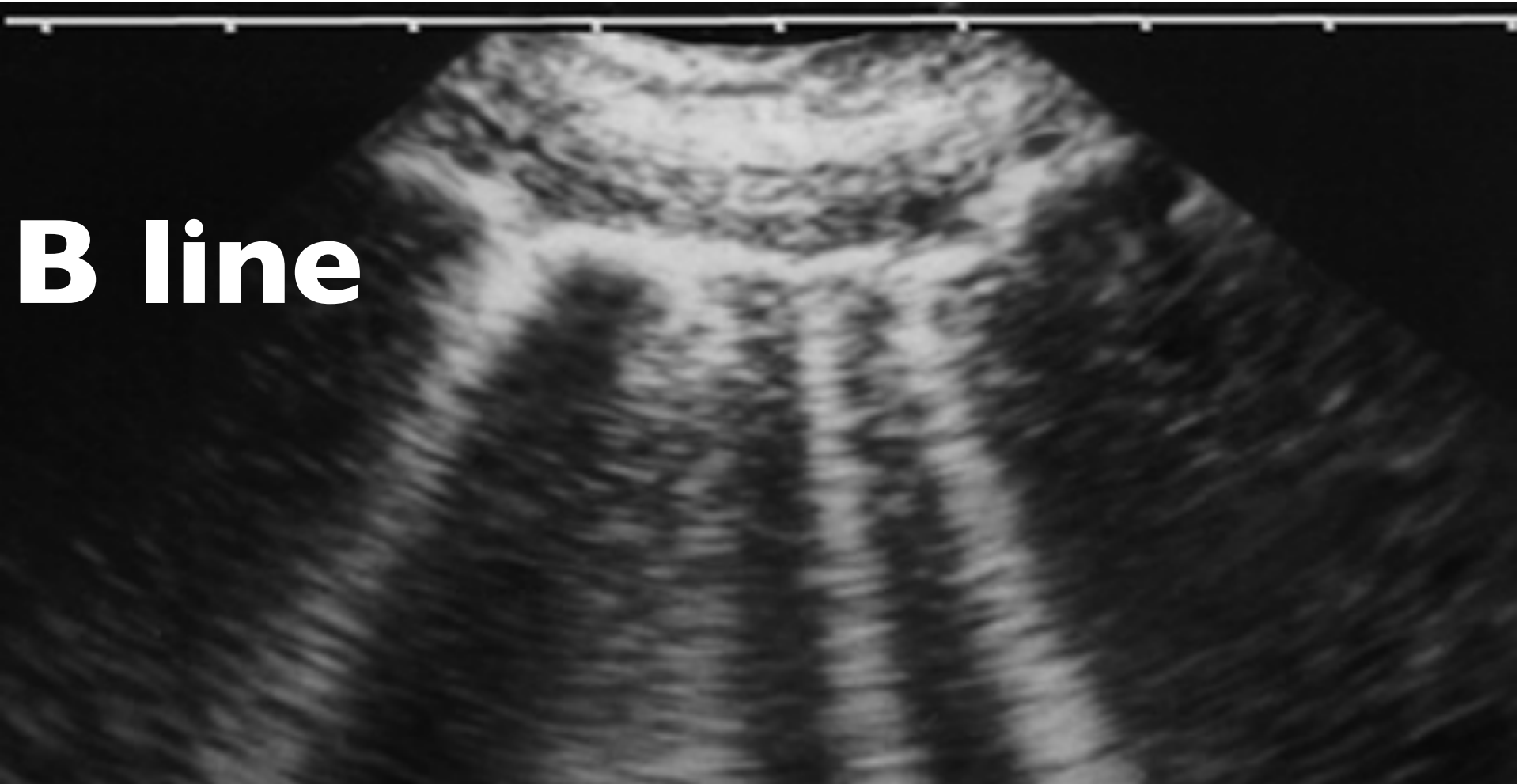
ORIGINAL

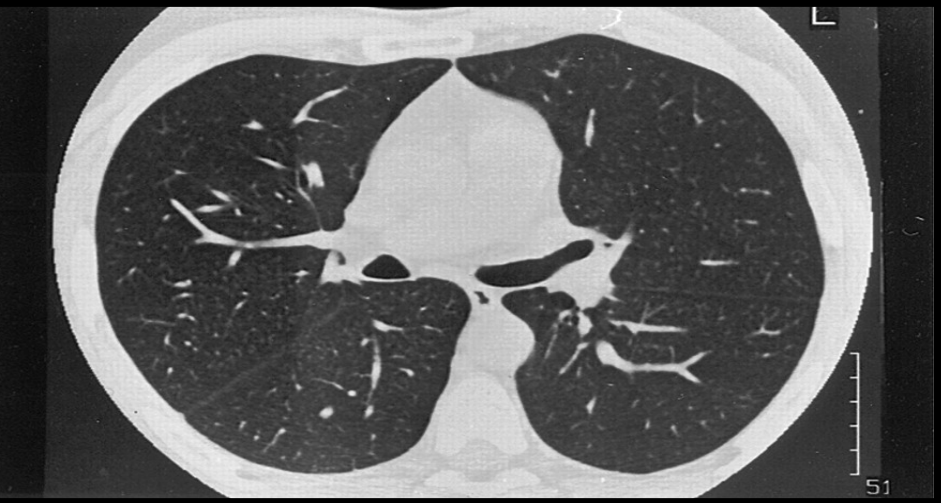
D. Lichtenstein
G. Mezière
P. Biderman
A. Gepner

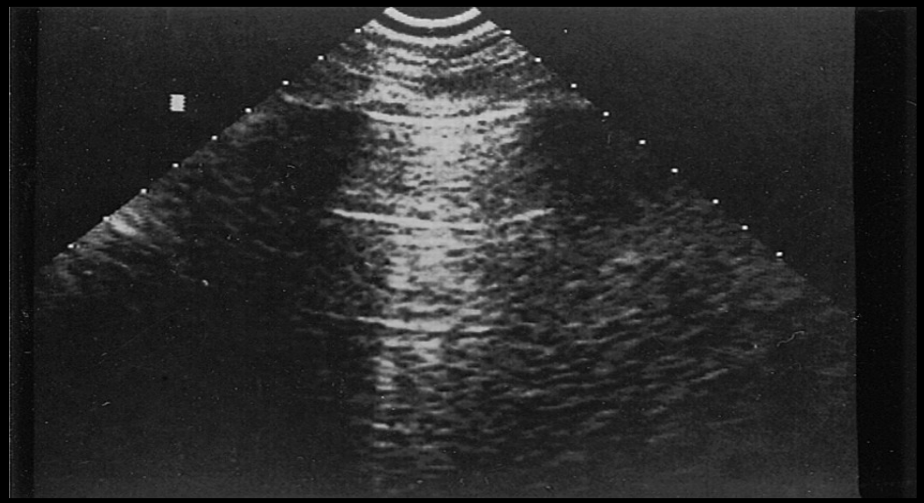
The comet-tail artifact: an ultrasound sign ruling out pneumothorax

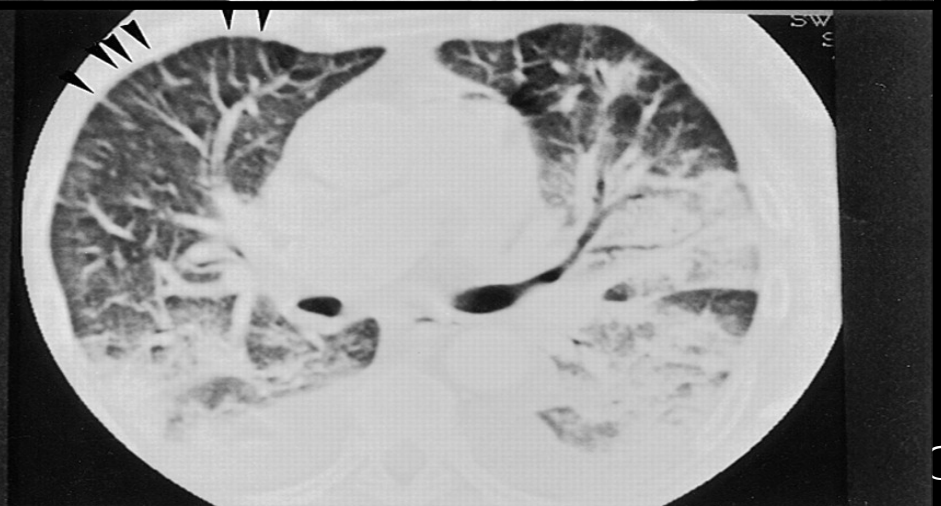


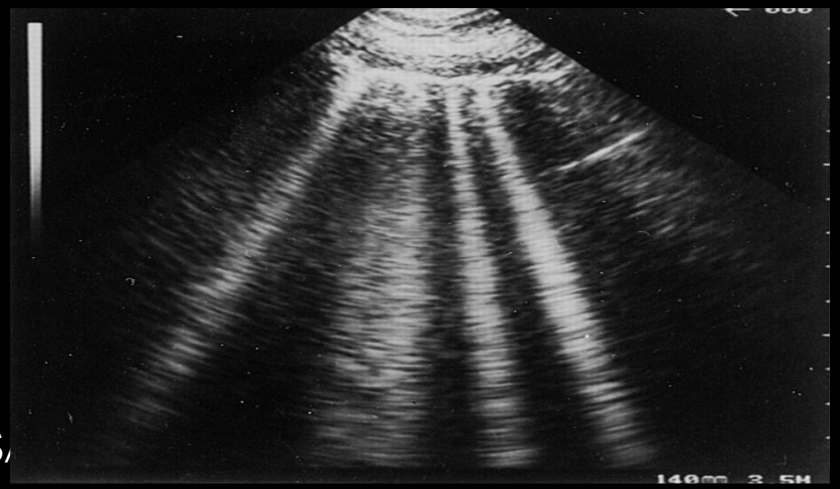
基本假影：A lines & B lines

US B lines ～ Kerley B lines

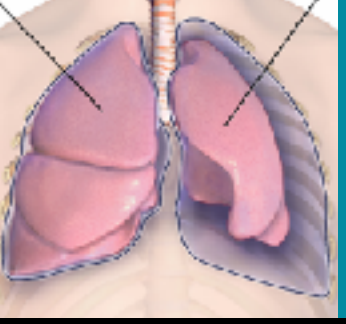








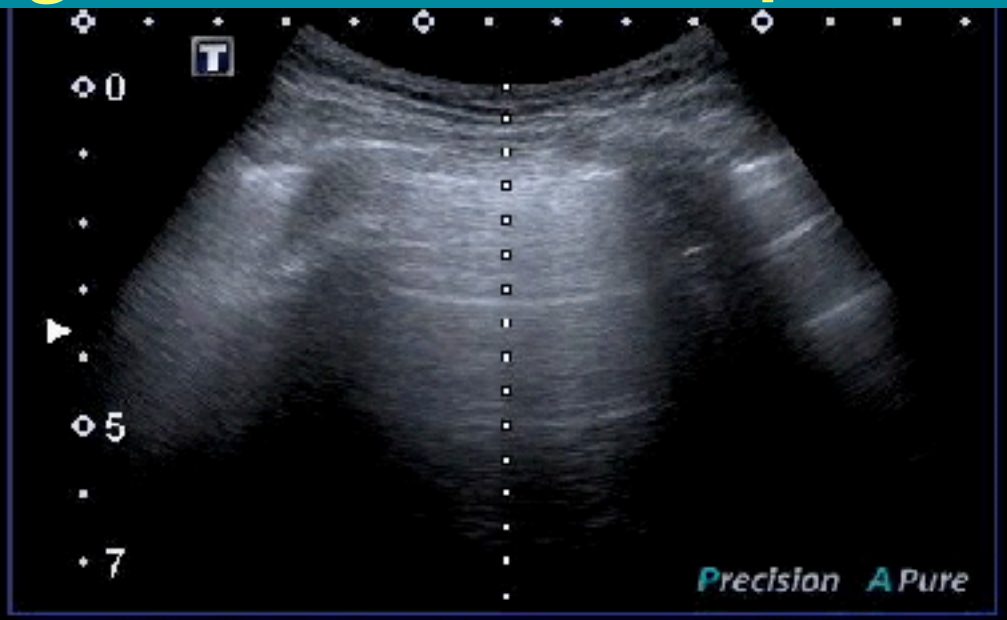
OCUS/

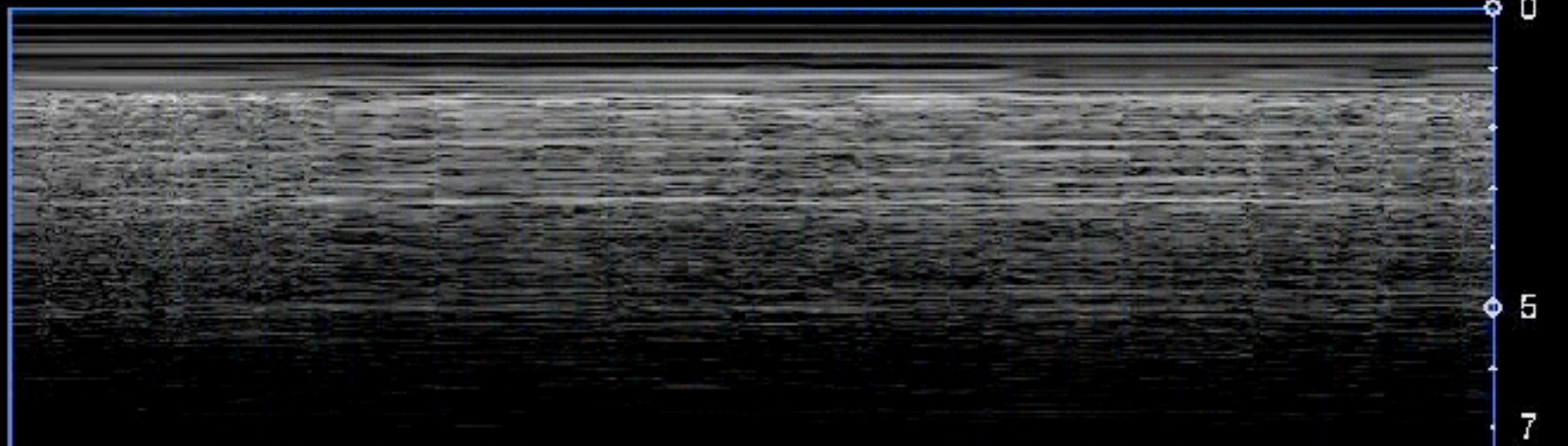


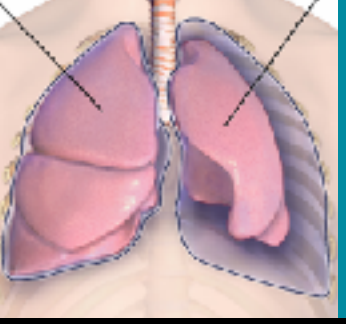
PNEUMOTHORAX ?

Sliding + A lines = Normal pleura

Seashore sign



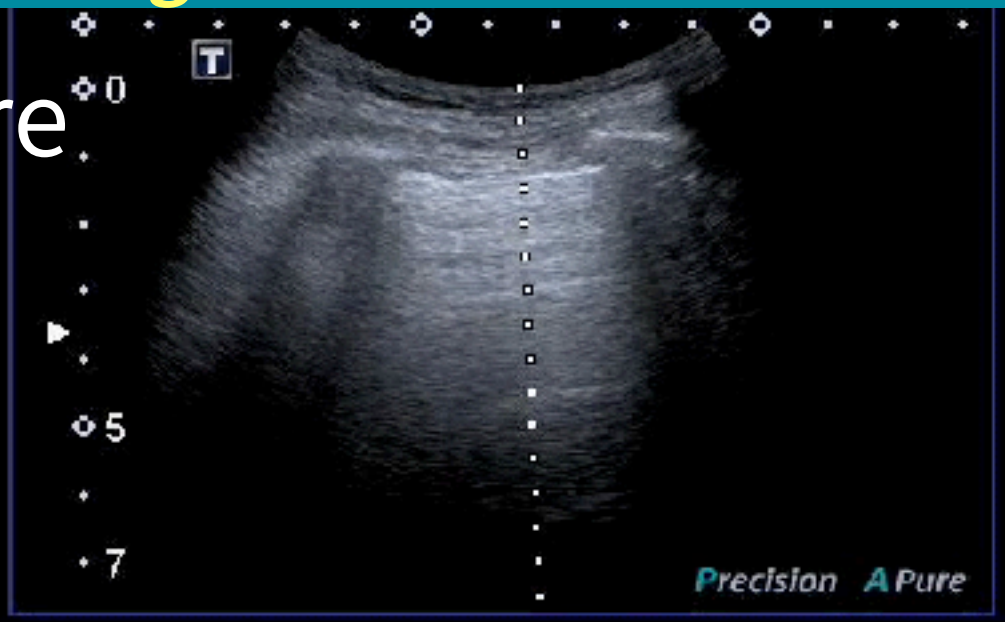


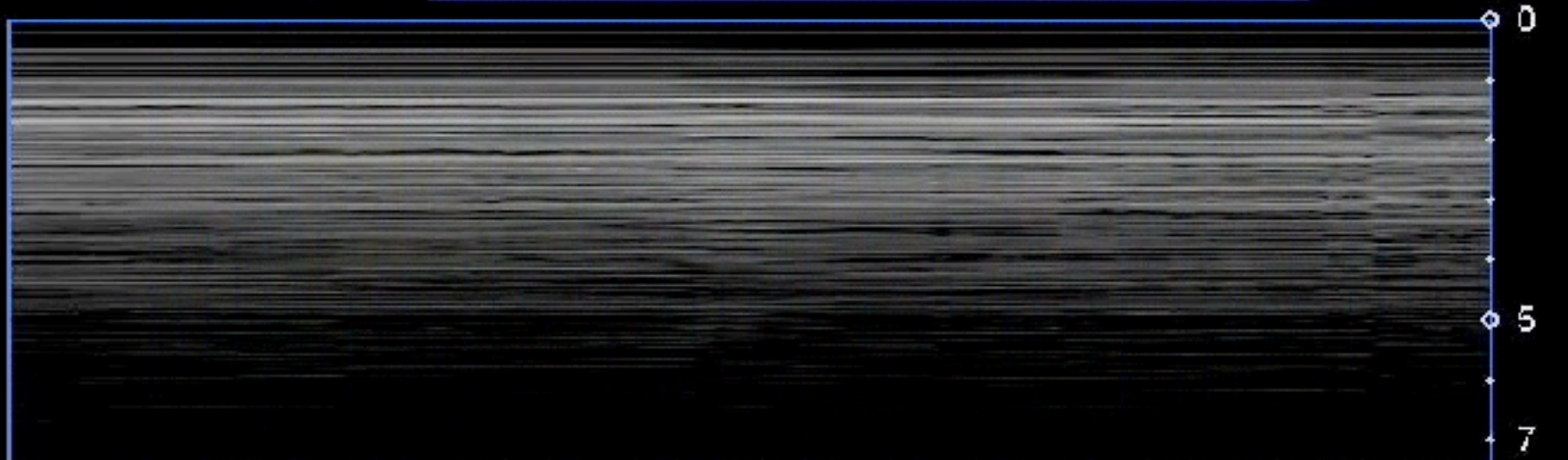


PNEUMOTHORAX ?

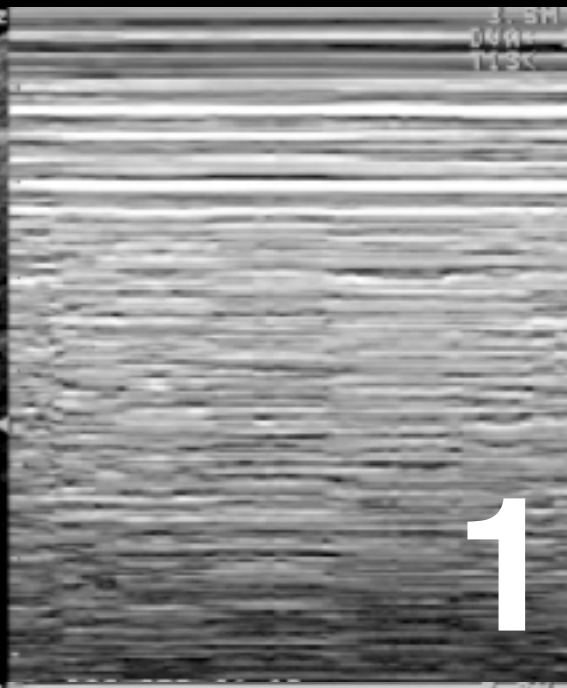
No Sliding + A lines >> Consider PTX

Stratosphere sign

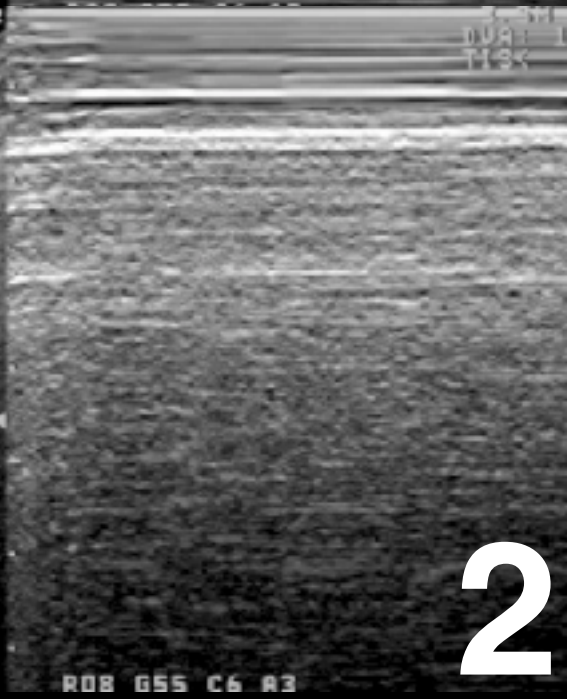




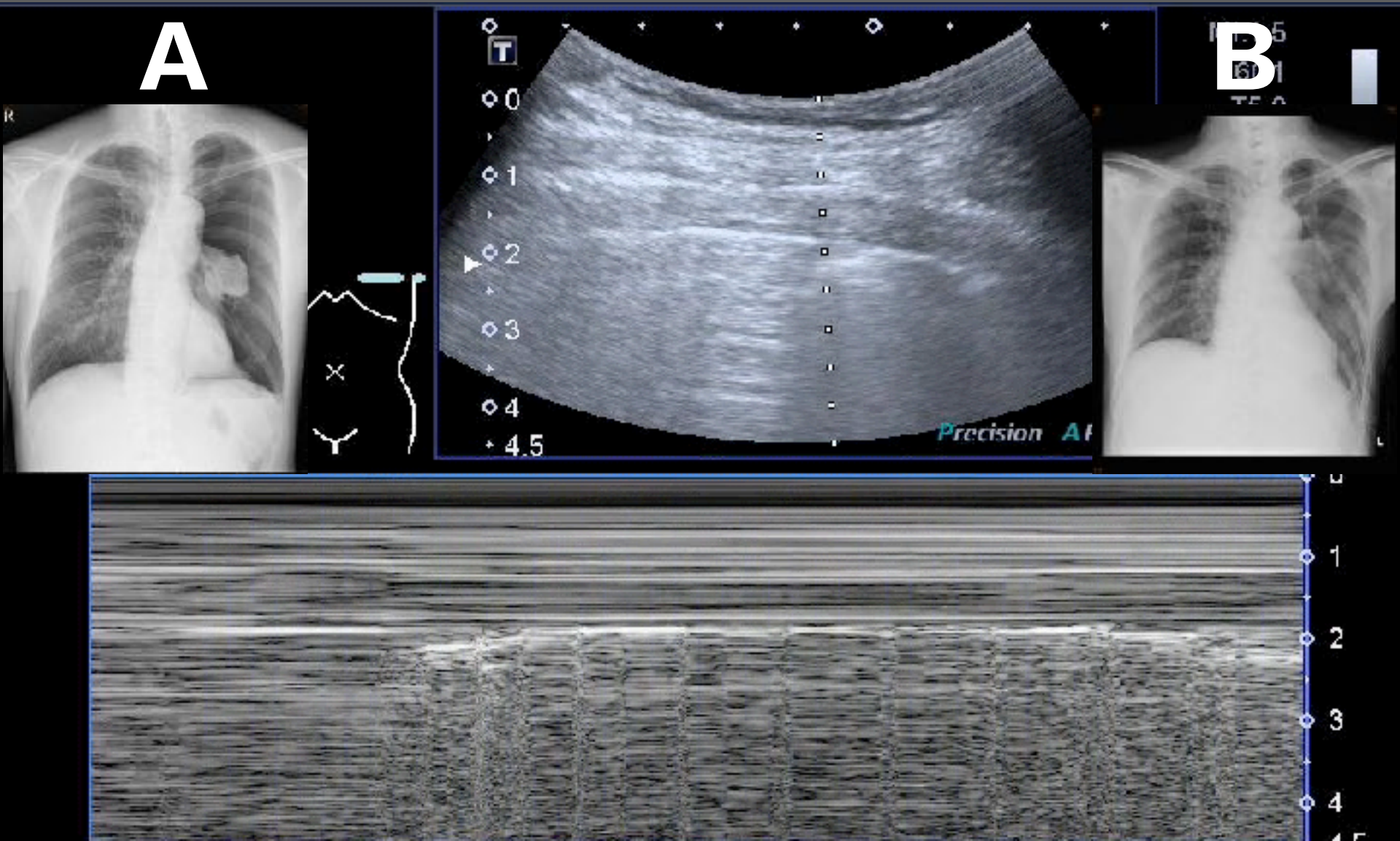
16Hz

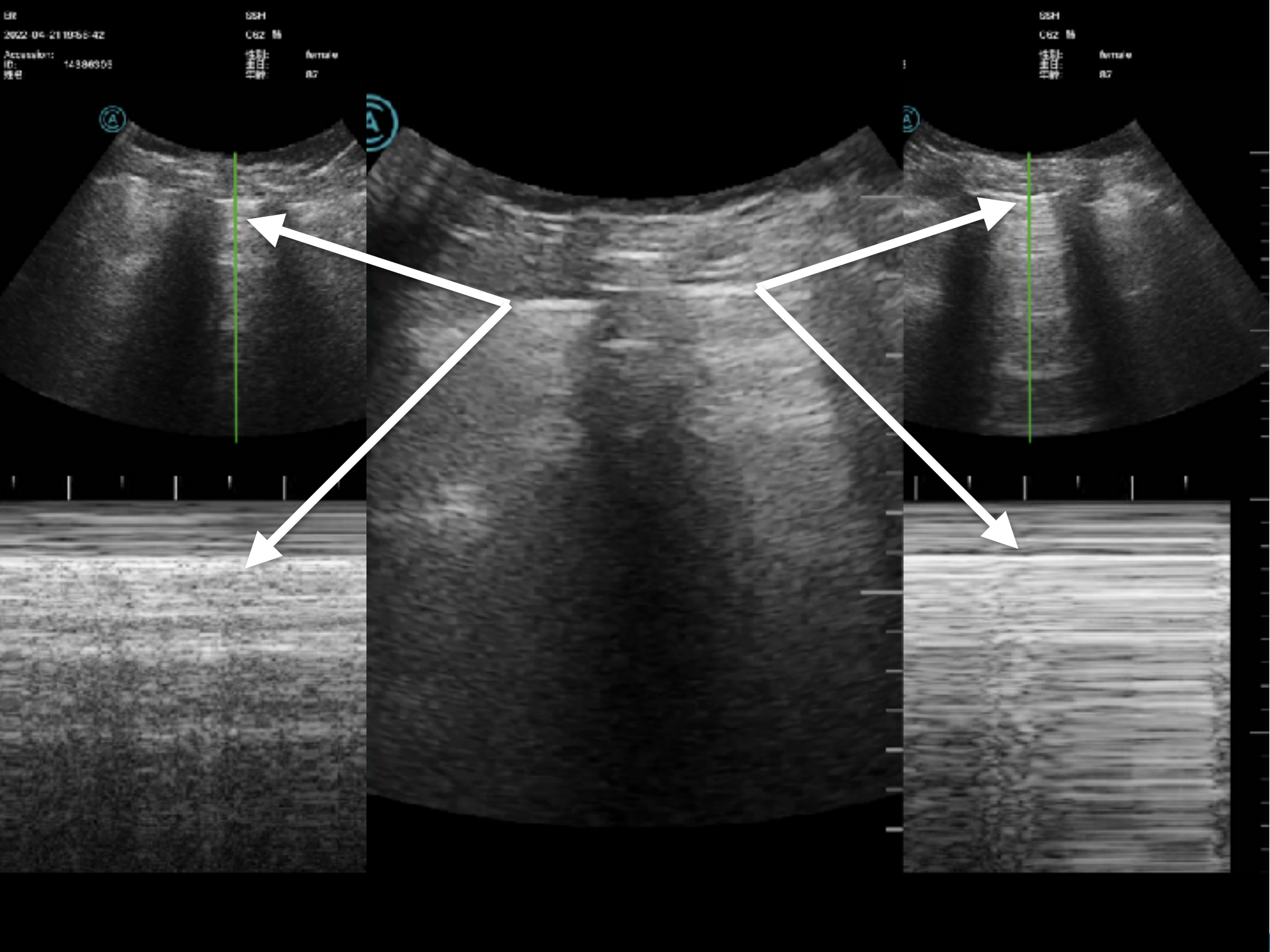

1

16Hz
R08 G55 C4

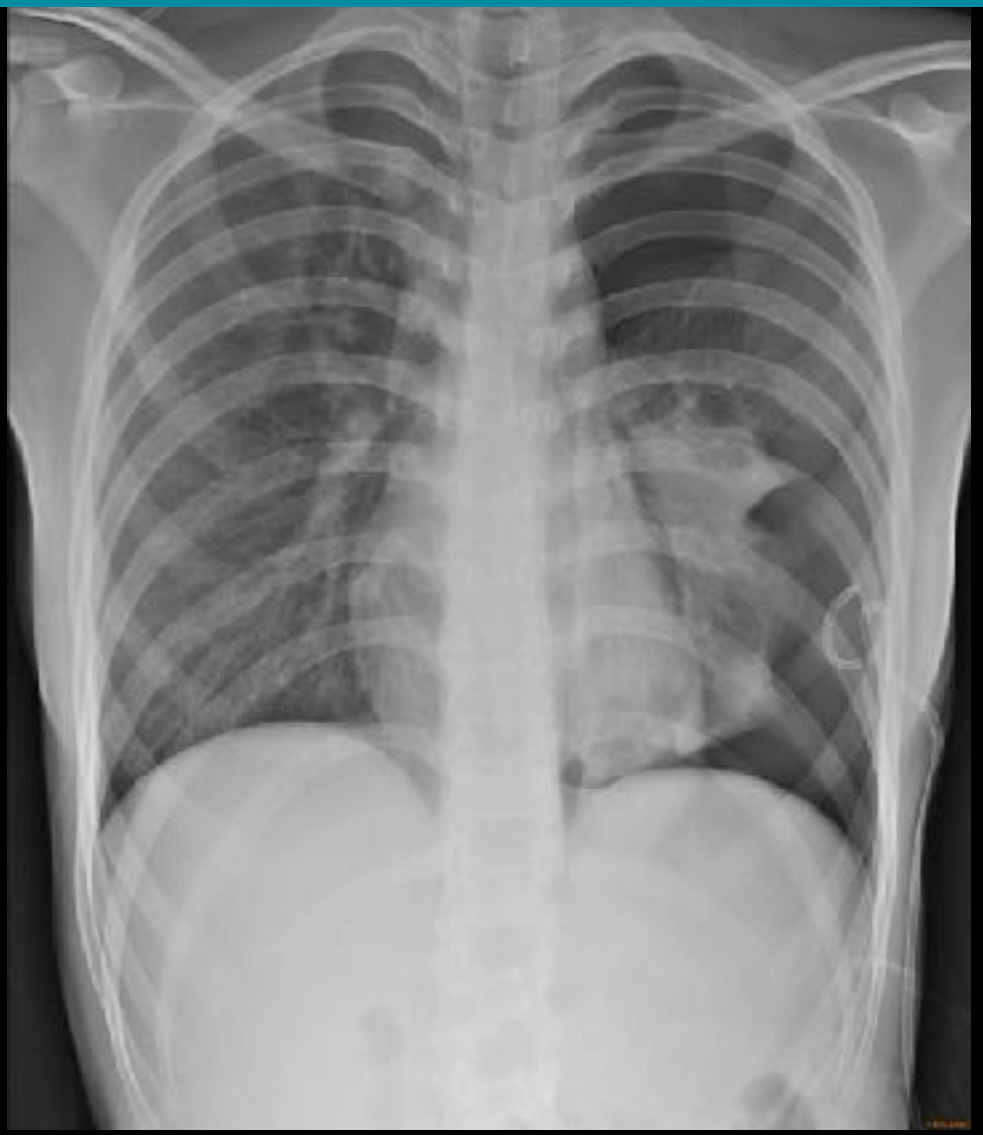

R08 G55 C6 A3
2

Lung Point

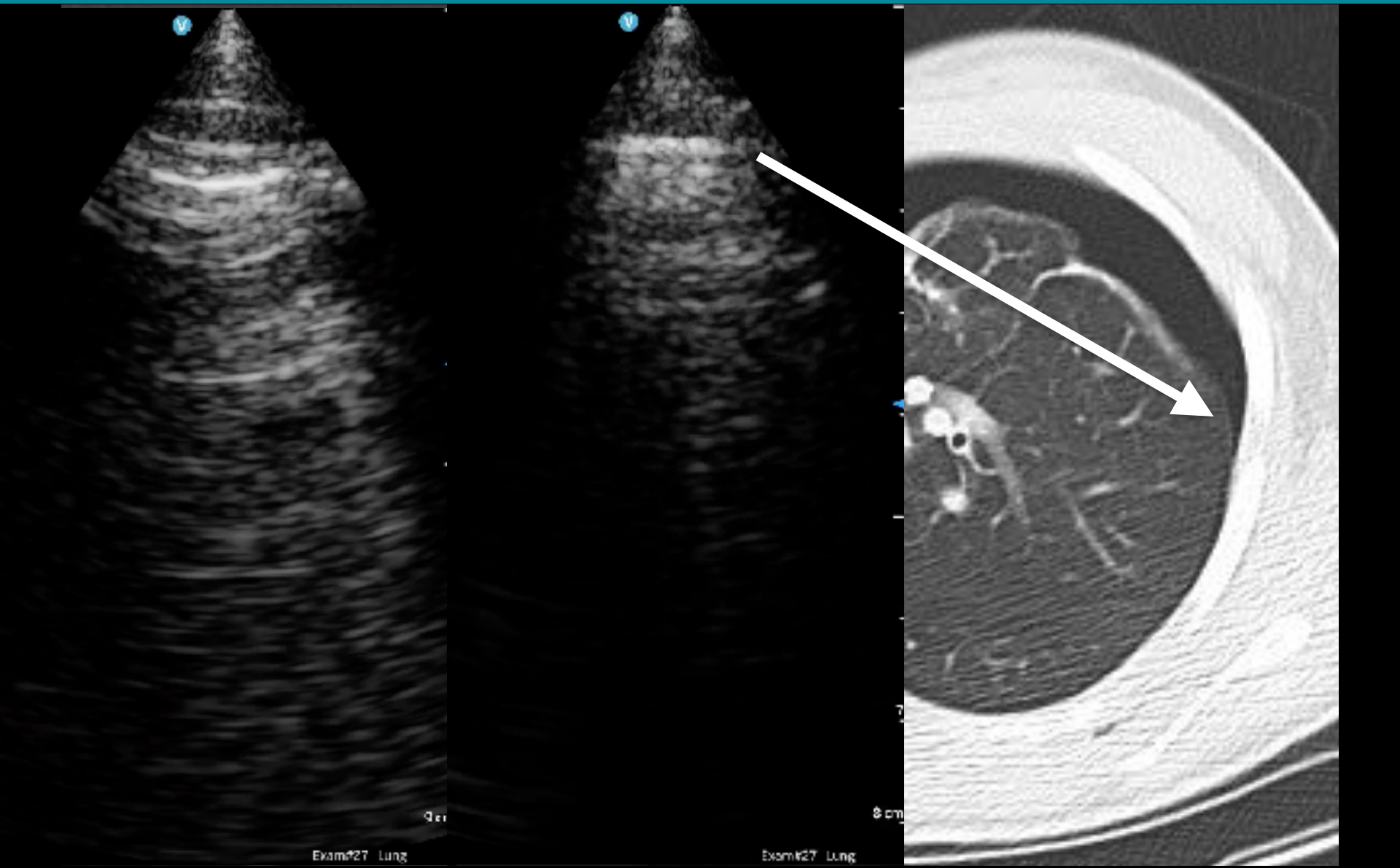



female

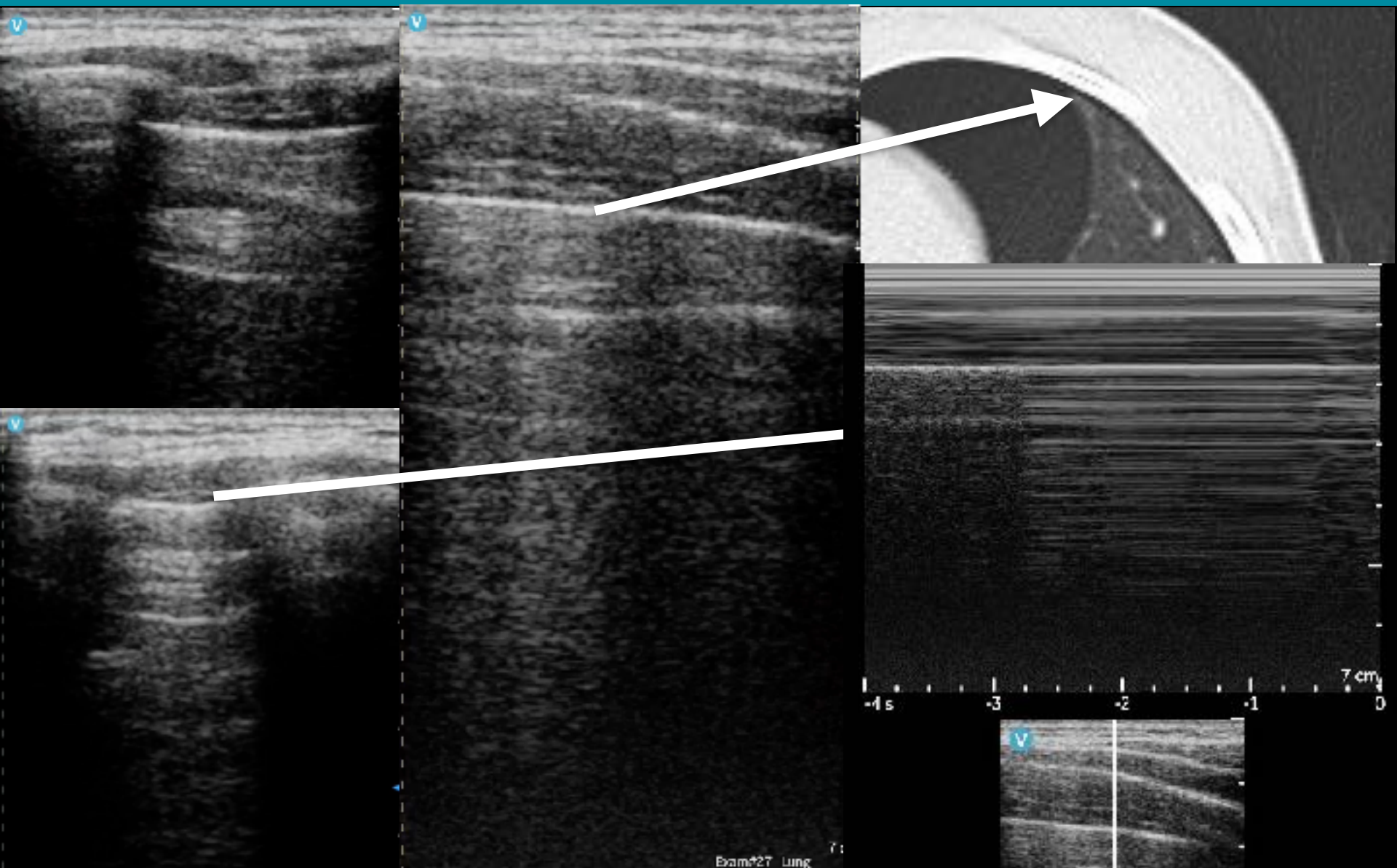
15F, ASTHMA HX , DYSPNEA



15F, ASTHMA HX , DYSPNEA



LUNG POINT & SUBCUTANEOUS EMPHYSEMA



PTX

4

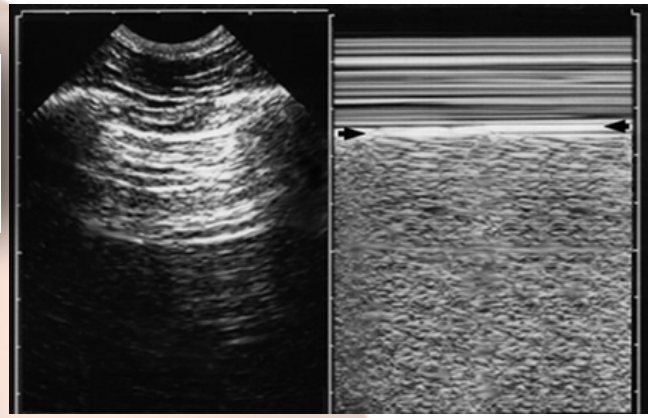
SBP Point

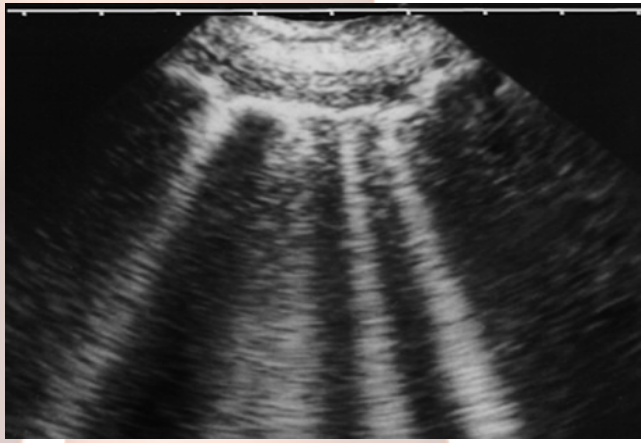
No sliding

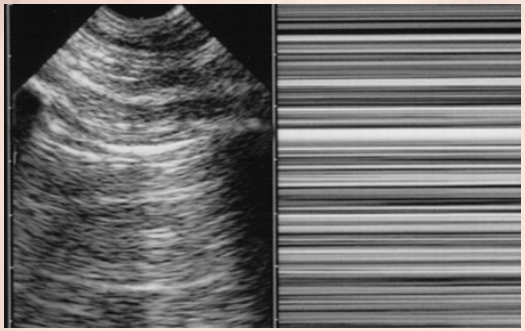
No B lines

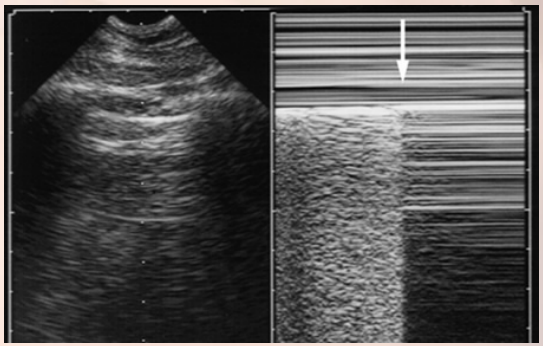
No pulse

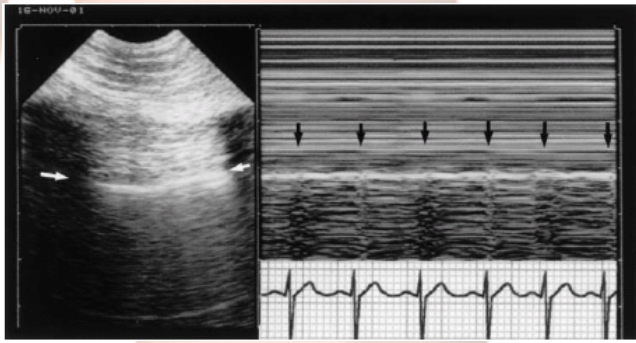
Lung point







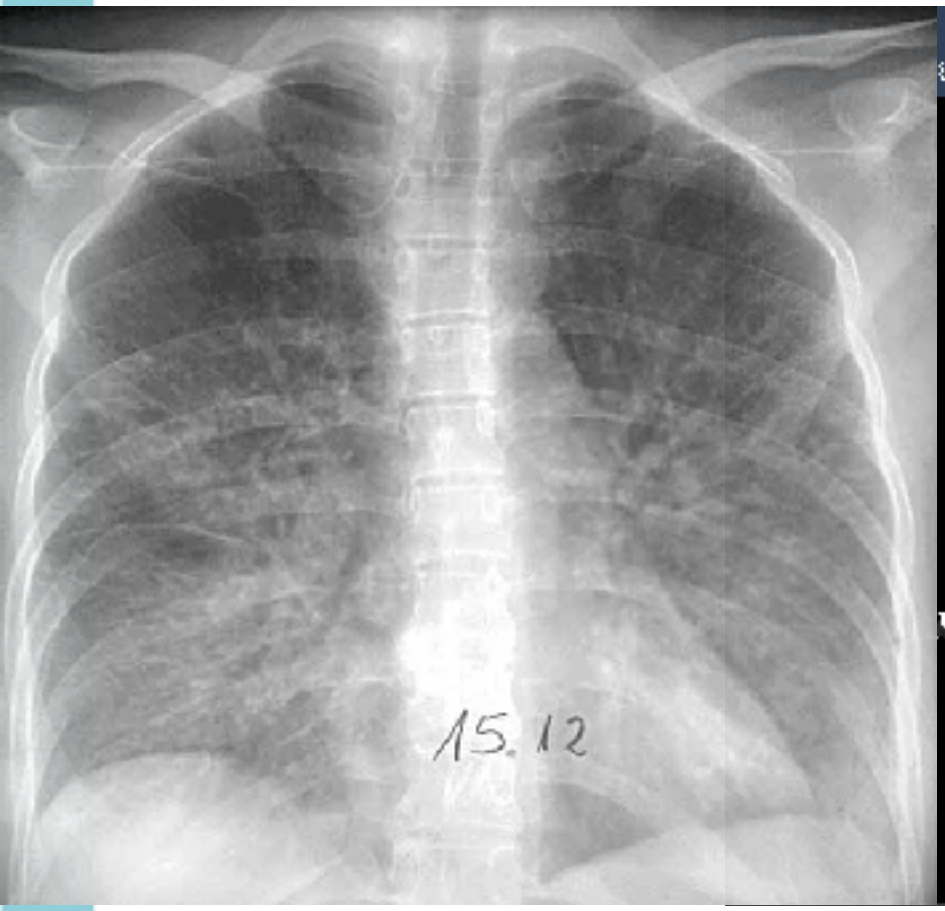


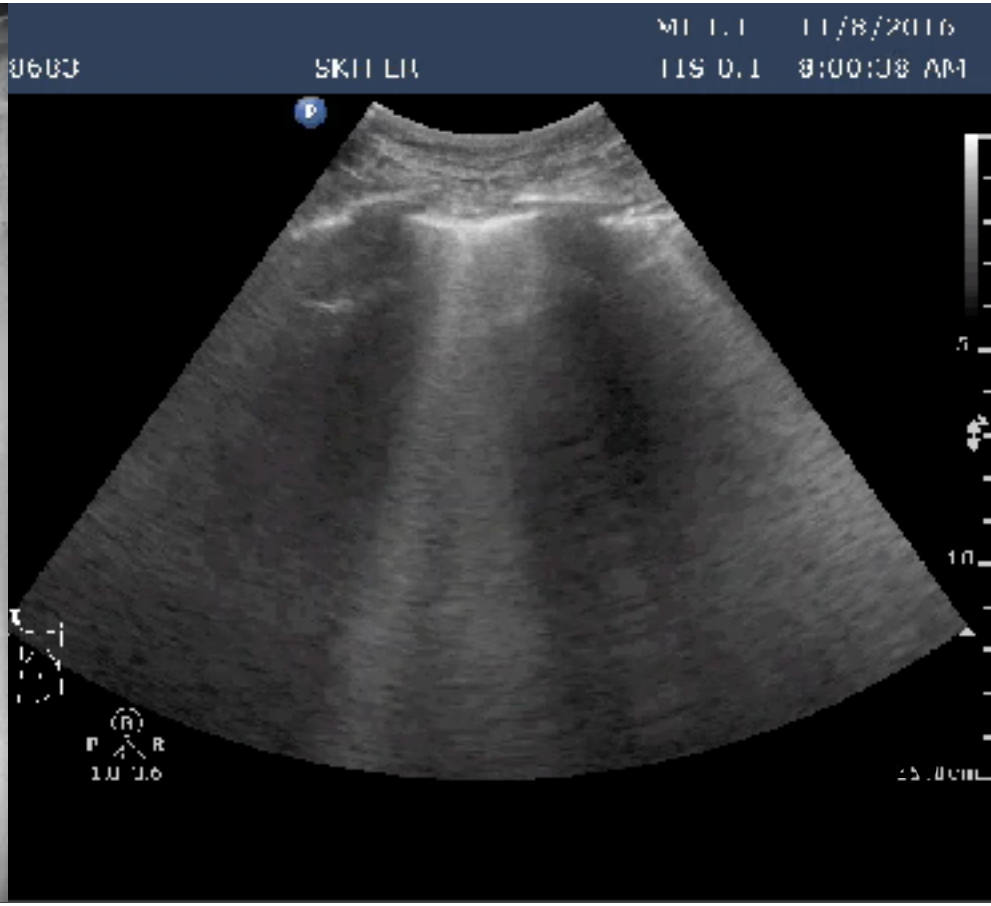


AIS
Point 1
BLUE 4 points
Point 2
Point 3
Point 4
3x2
Alveolar Interstitial Syndrome

LUNG ROCKETS

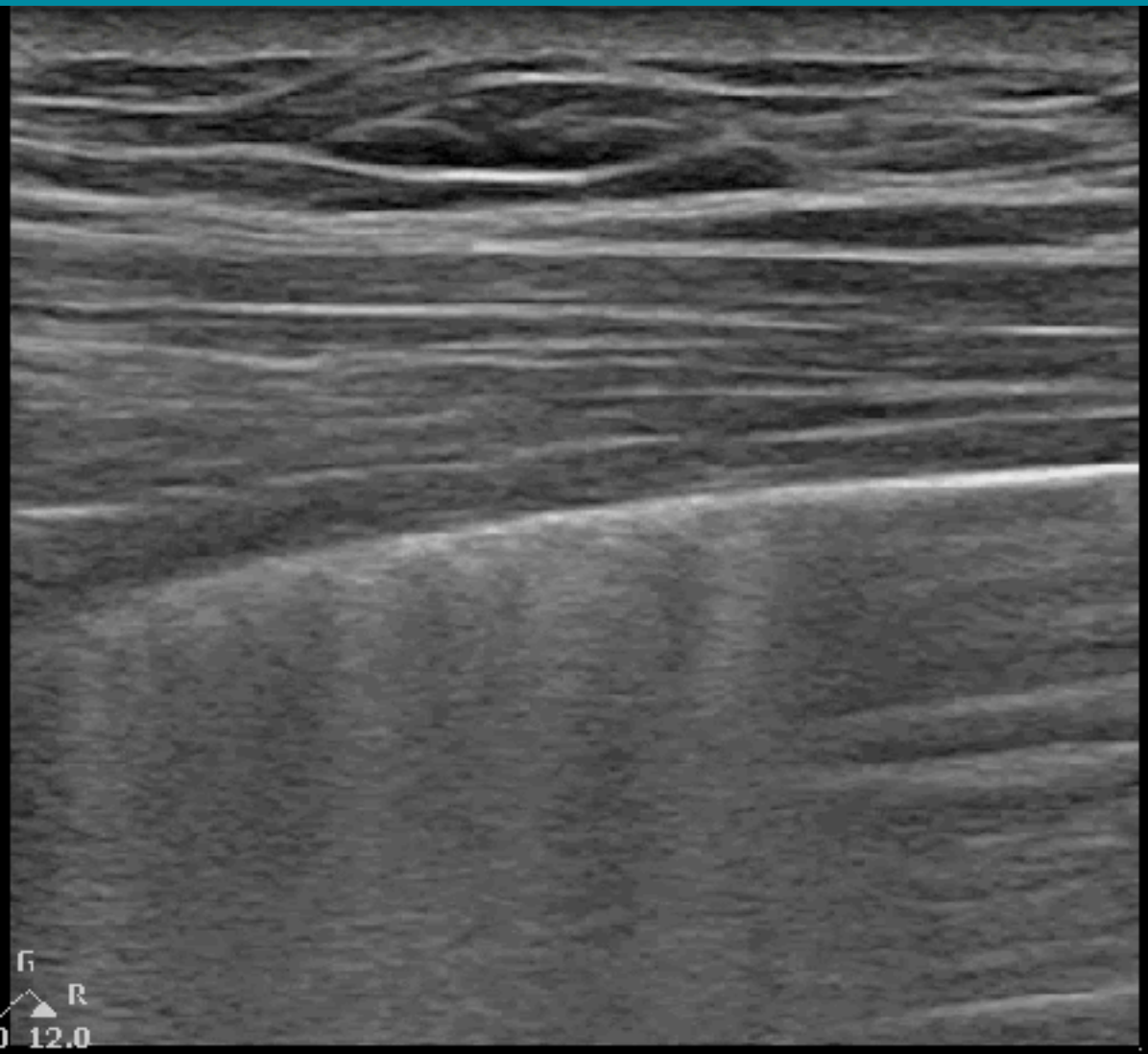
ICS > 3 B lines





ALEVOLAR INTERSTITIAL SYNDROME

AIS: Localized



Pneumonia

Pneumonitis

Atelectasis

Contusion

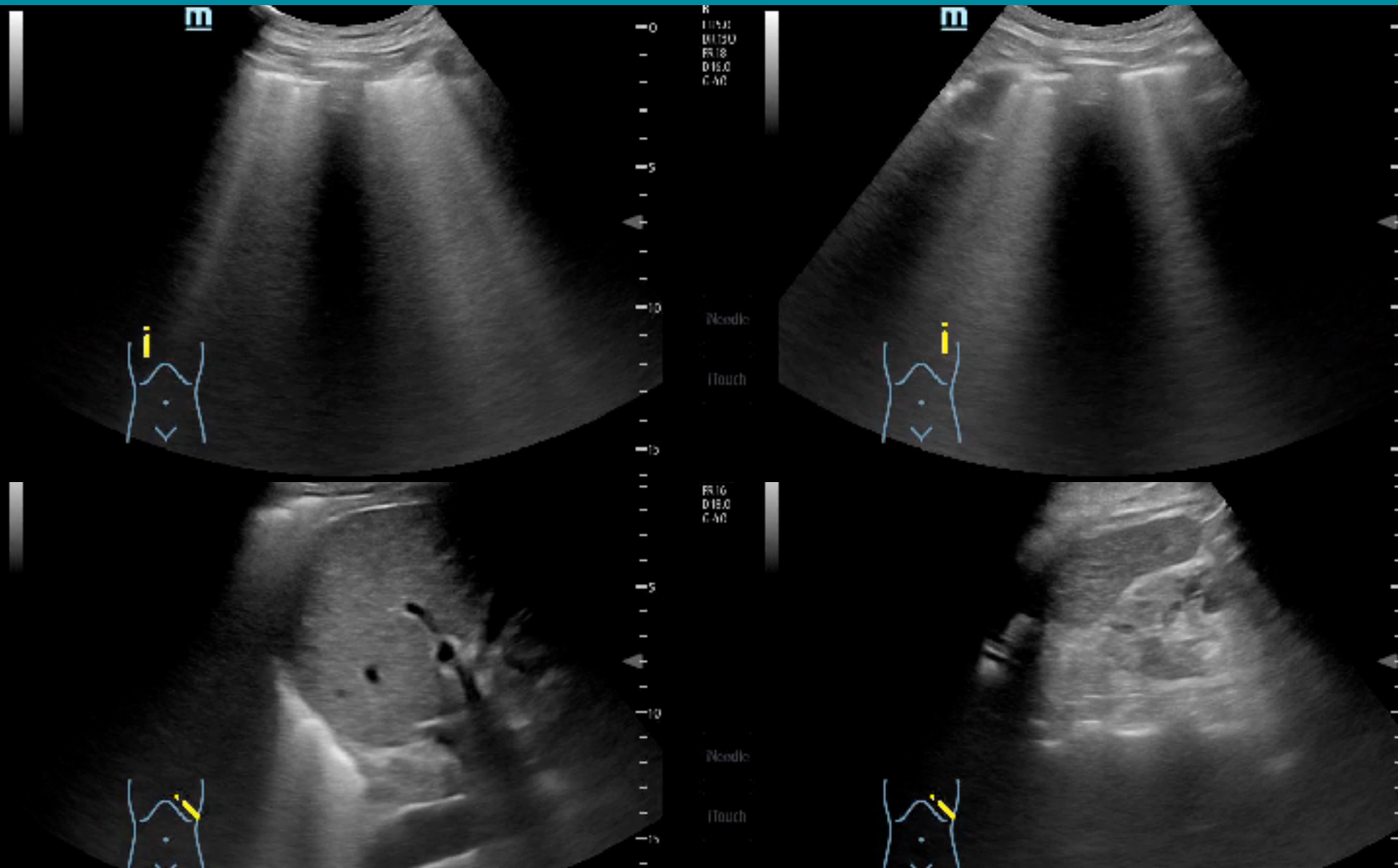
Infarction

Pleural disease

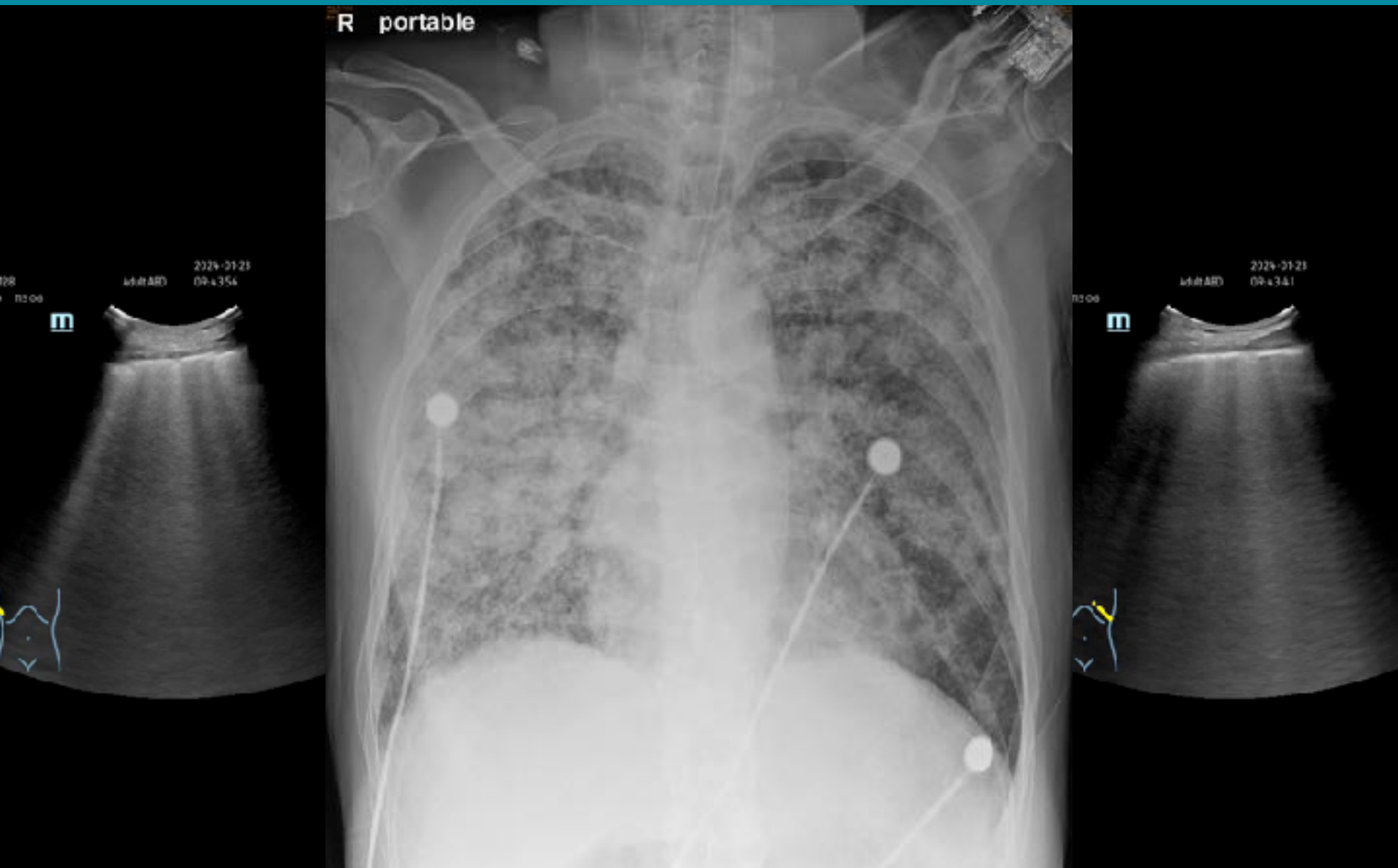
Neoplasia

Normal lung

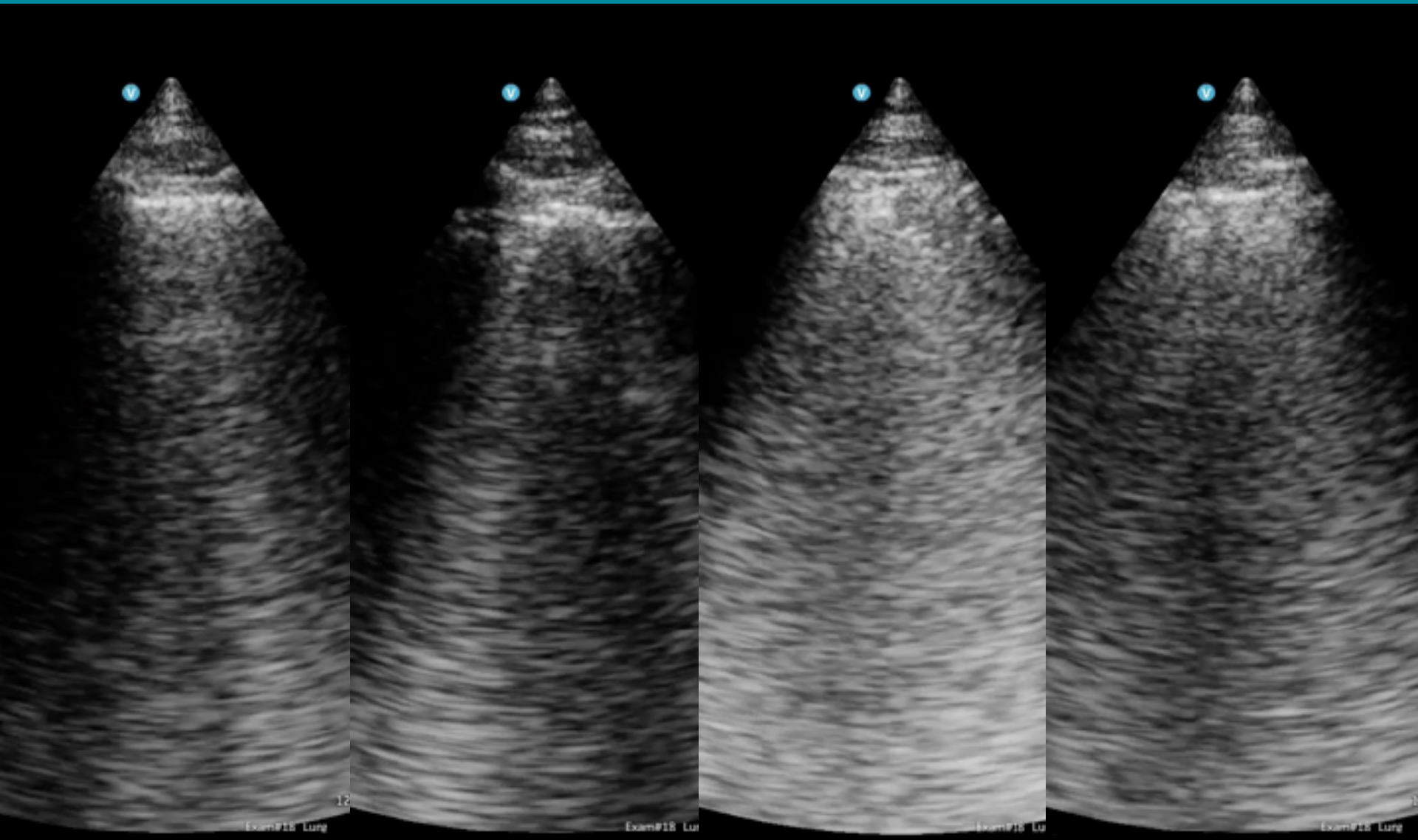
68M, ESRD ON HD QW246
APE > AAD > CPR 10’ > ROSC > SHH

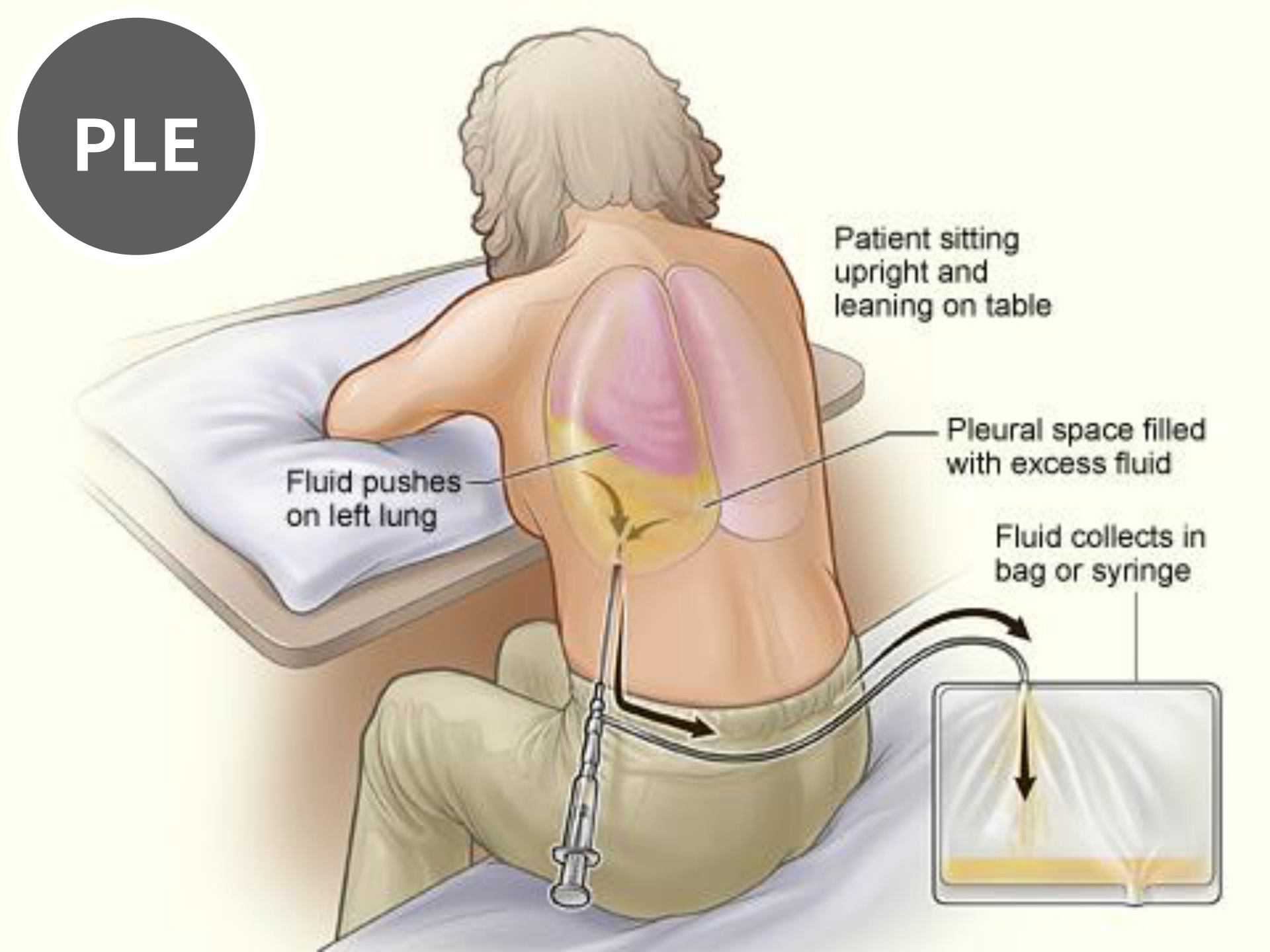


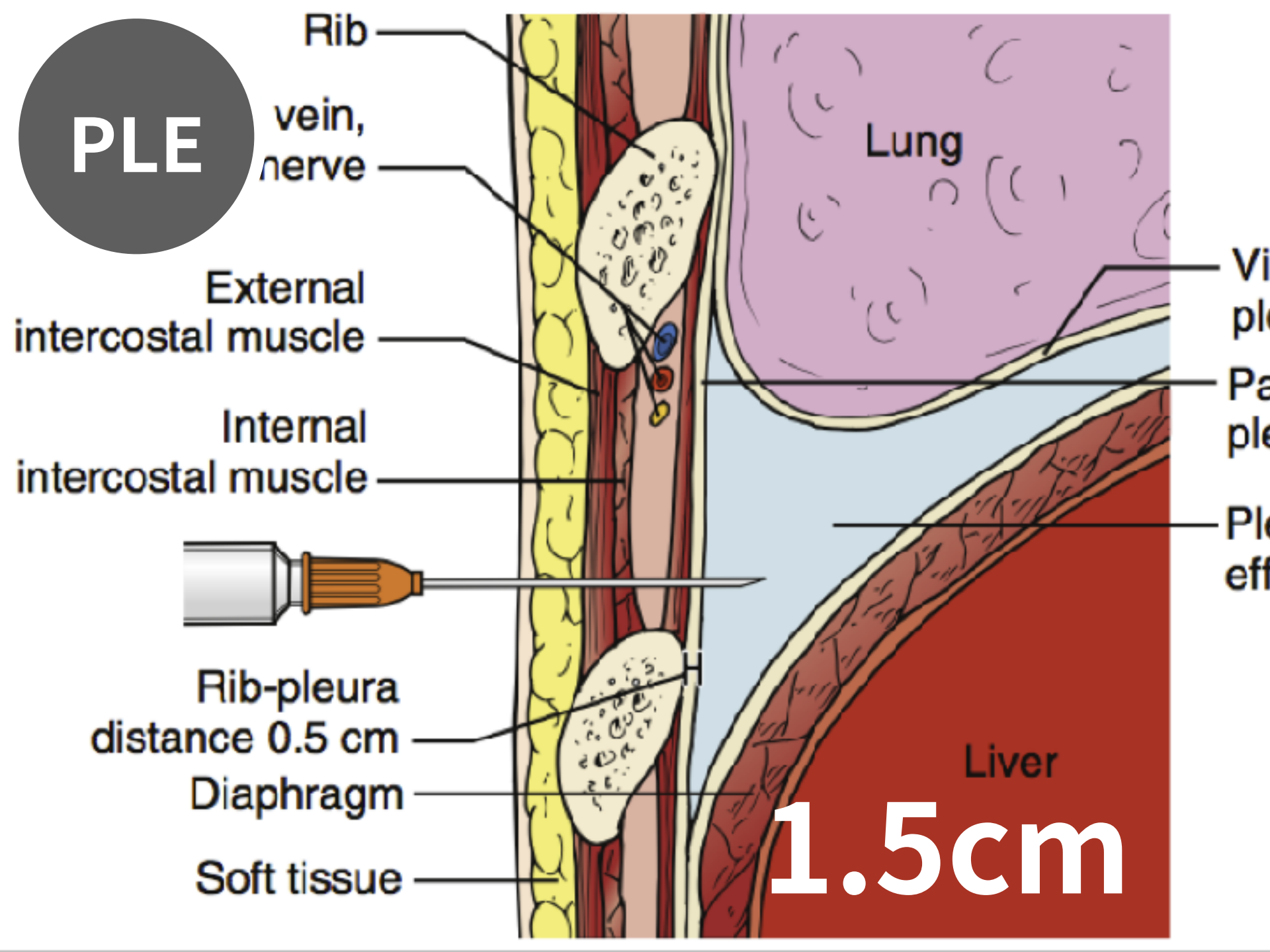
ALVEOLAR INTERSTITIAL SYNDROME



ALVEOLAR INTERSTITIAL SYNDROME




PLE
Patient sitting upright and leaning on table
Pleural space filled with excess fluid
Fluid pushes on left lung
Fluid collects in bag or syringe

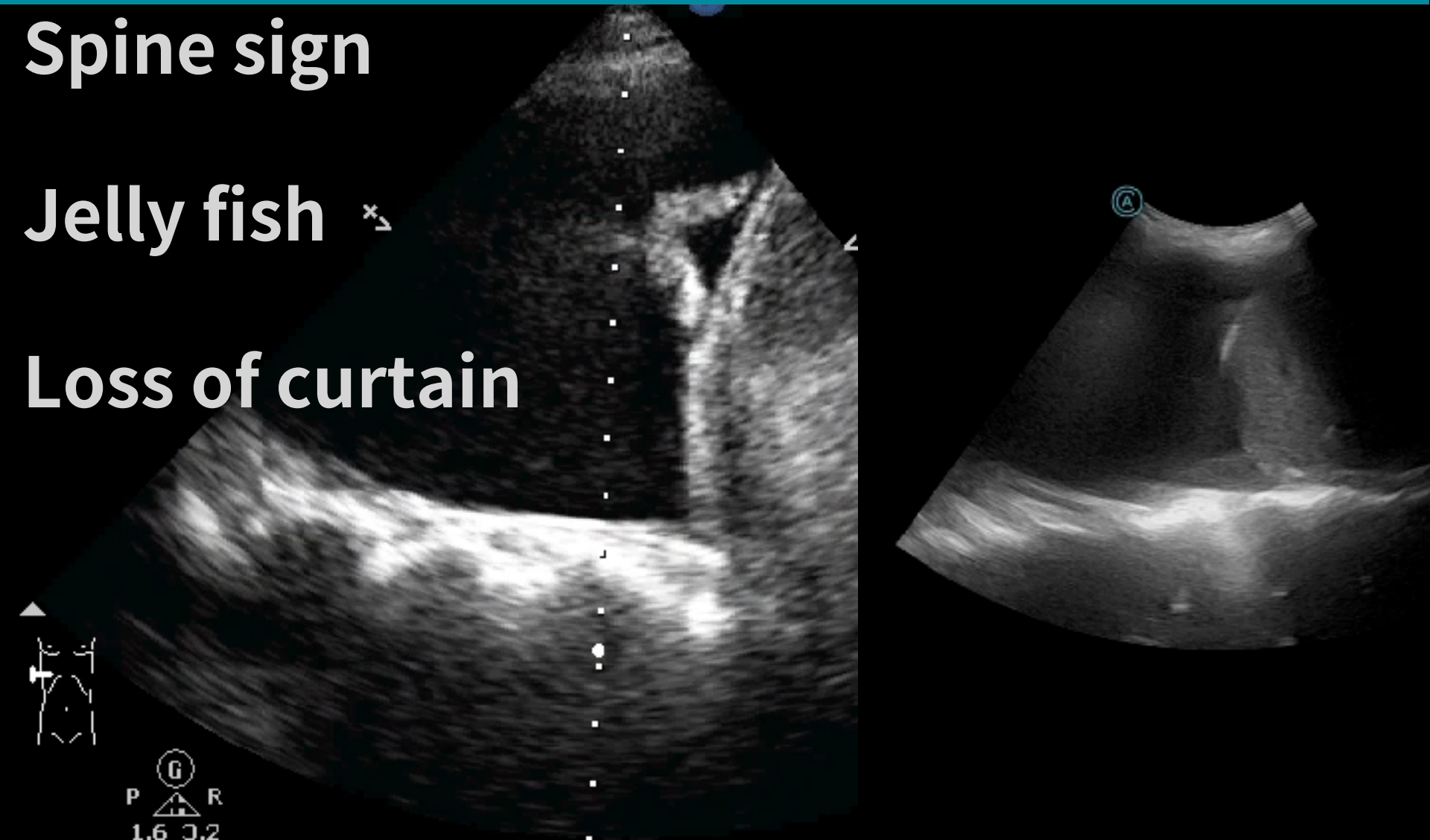

PLE
Rib
vein,
nerve
External
intercostal muscle
Internal
intercostal muscle
Rib-pleura
distance 0.5 cm
Diaphragm
Soft tissue
Lung
Liver
1.5cm

PLEURAL EFFUSION

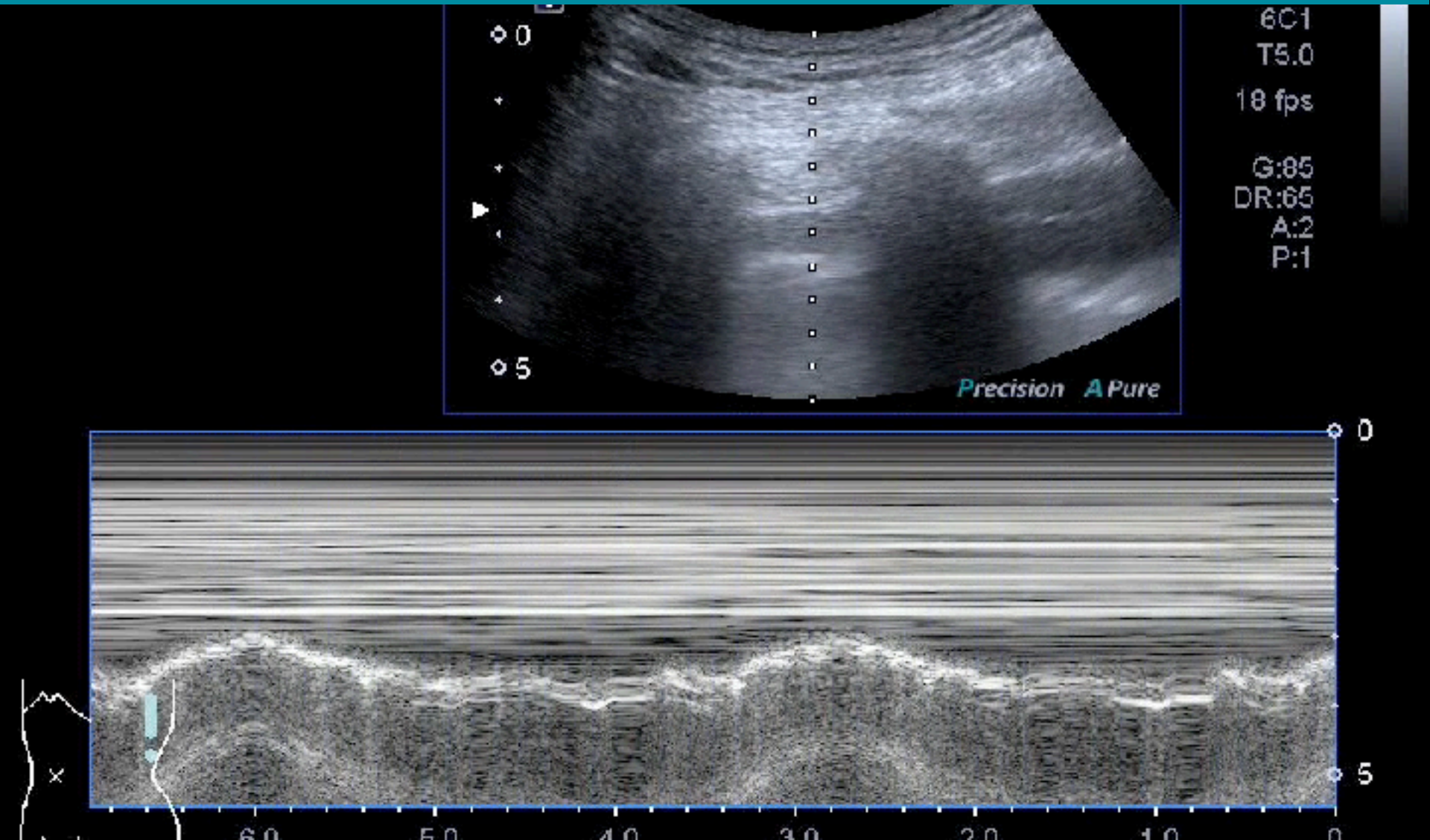
Spine sign

Jelly fish

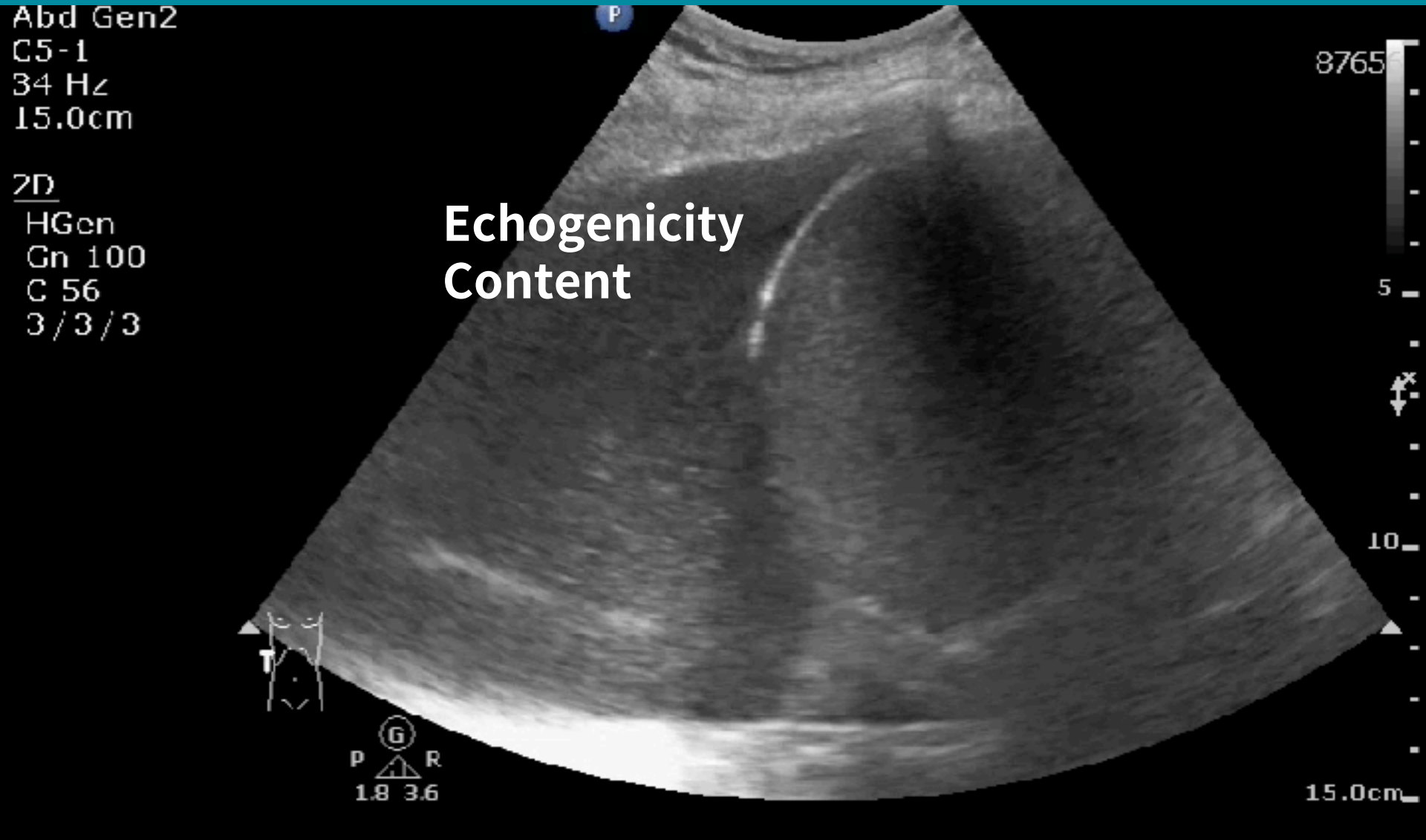
Loss of curtain



Sharp sign / Sinusoid sign

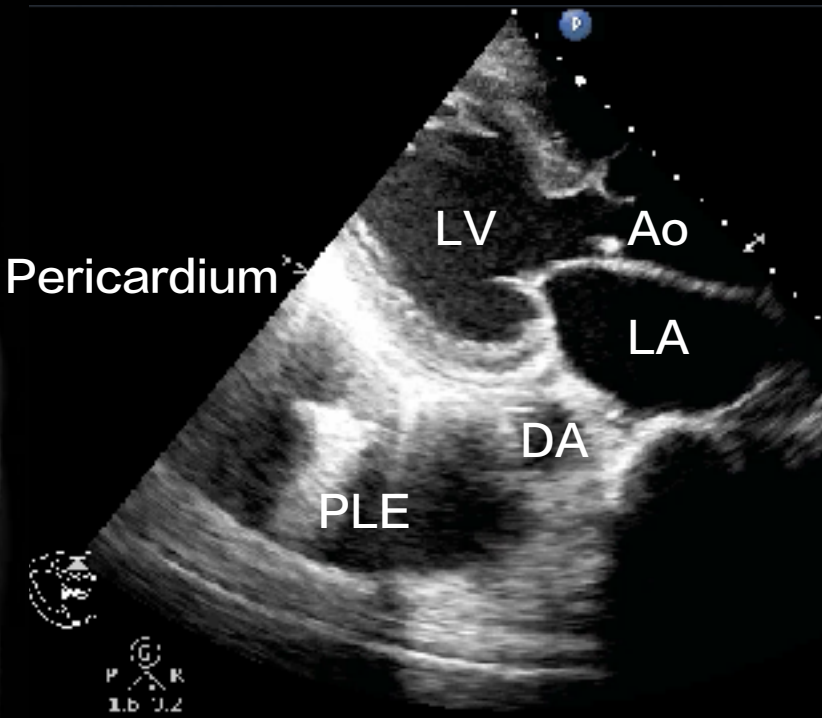


Plankton sign



D aorta

Pericardial
vs
Pleural

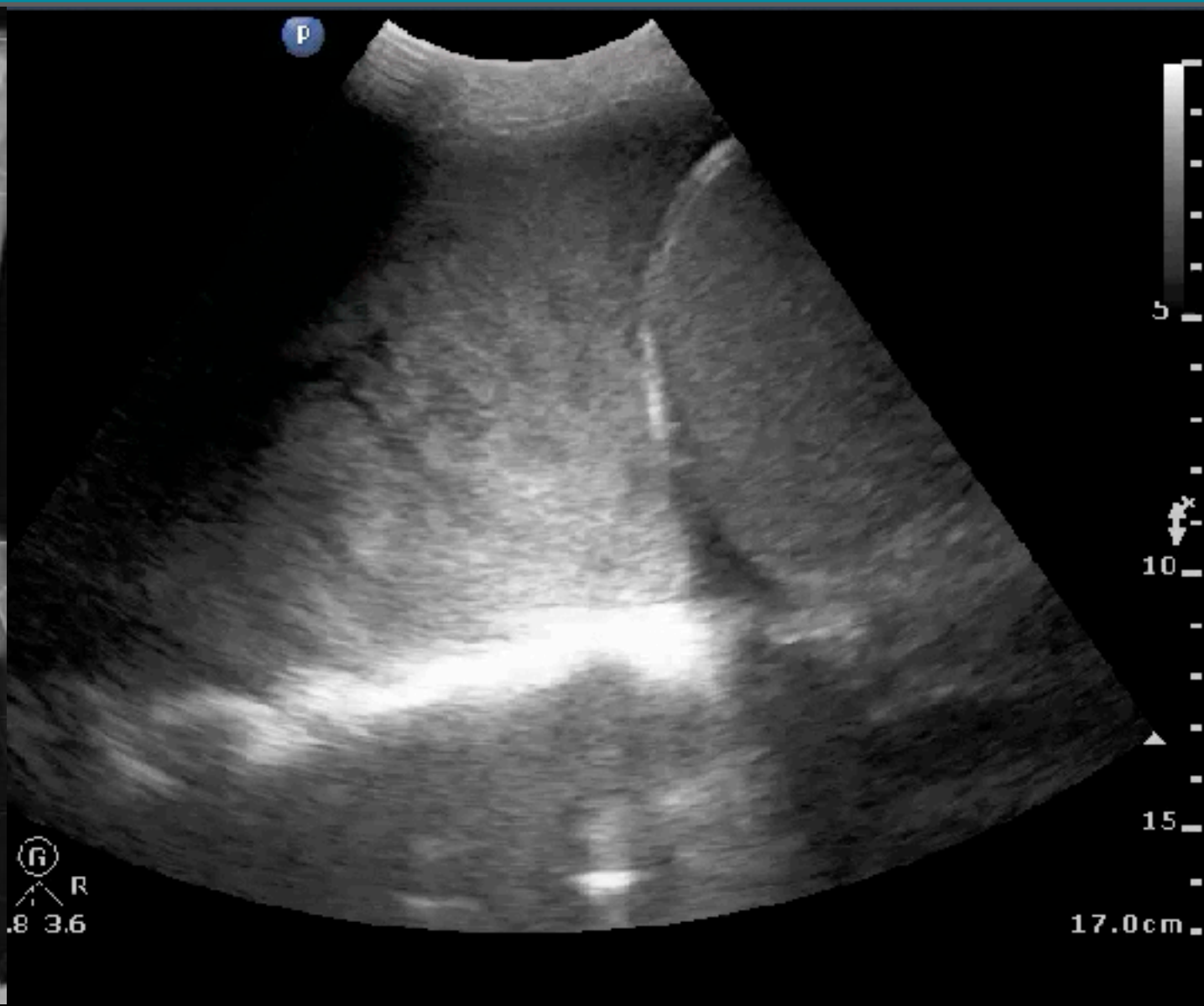


73M, F & Dyspnea

Septation
Fibrin
Particles

Empyema

What do you see ?



US for PLE

Detection

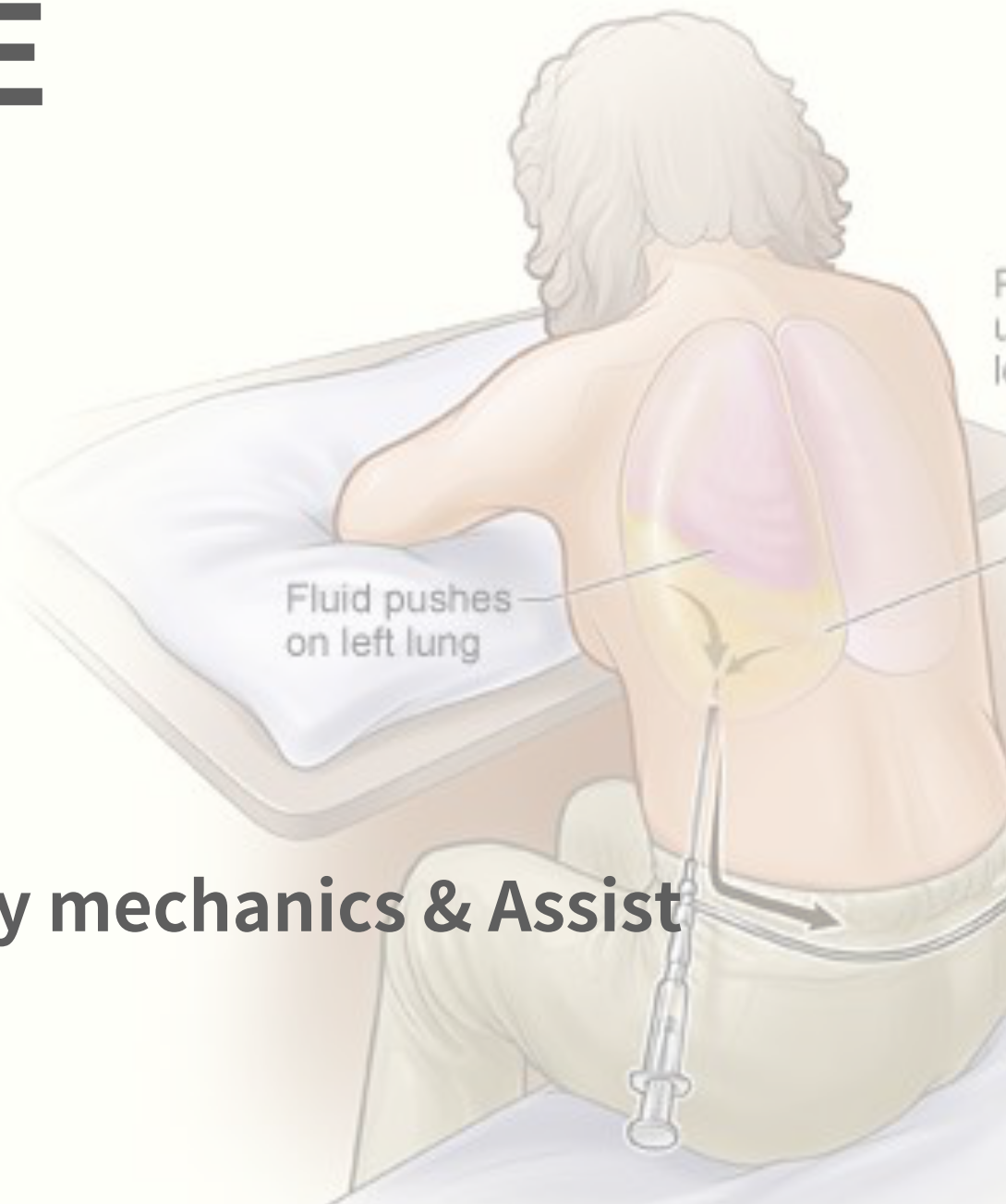
Volume

Nature

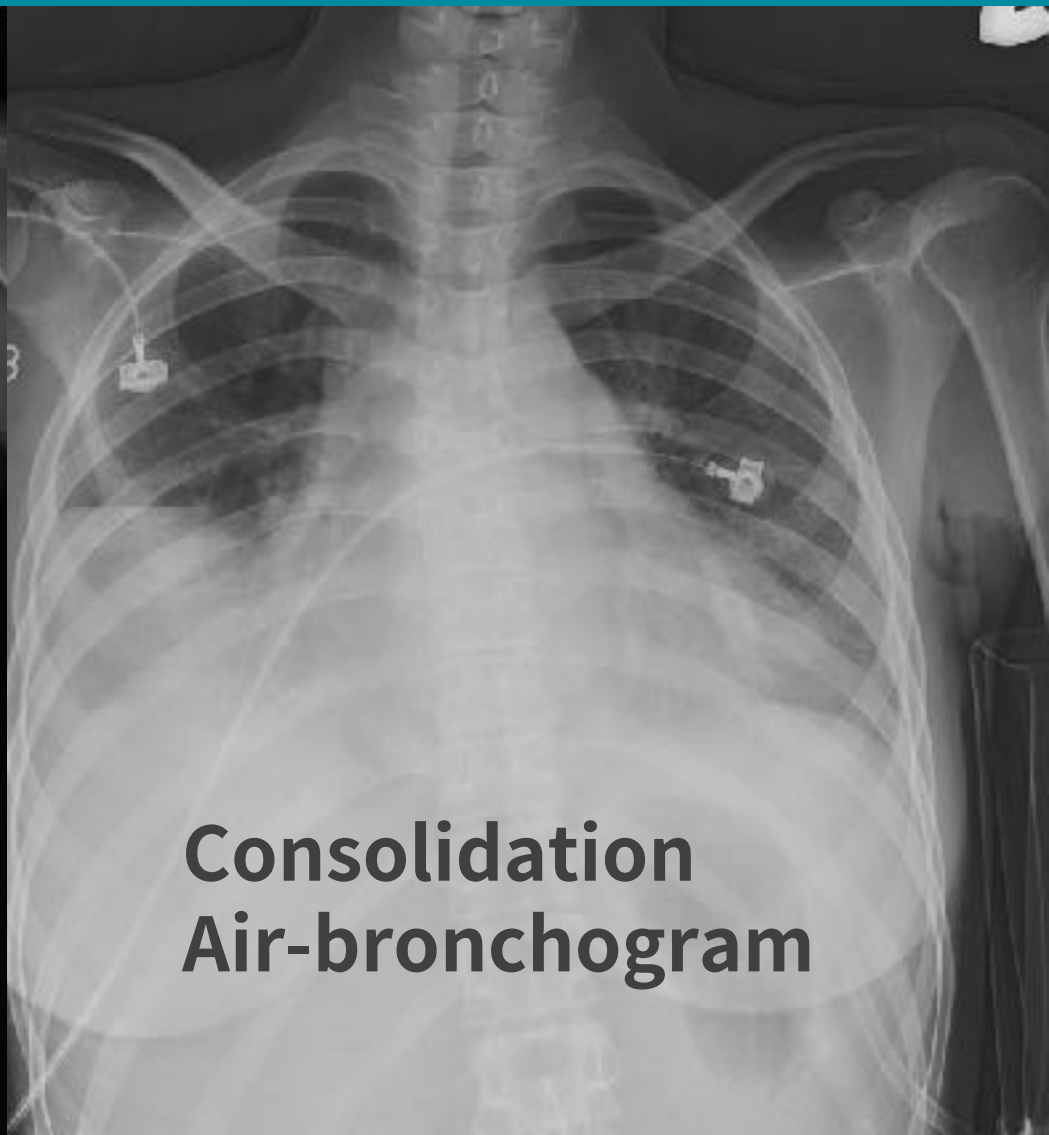
Safety

Drainage

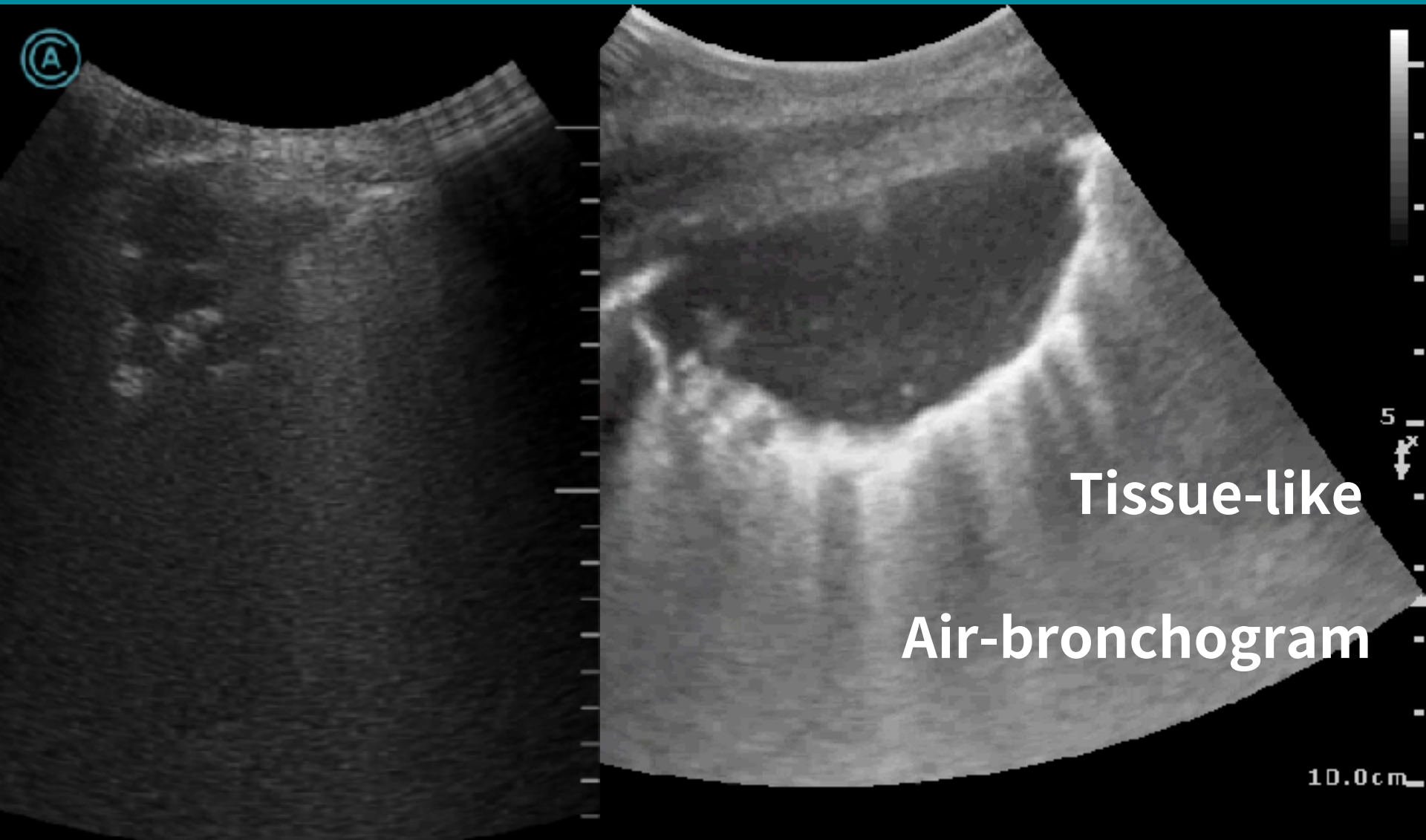
- Improve ventilatory mechanics & Assist weaning



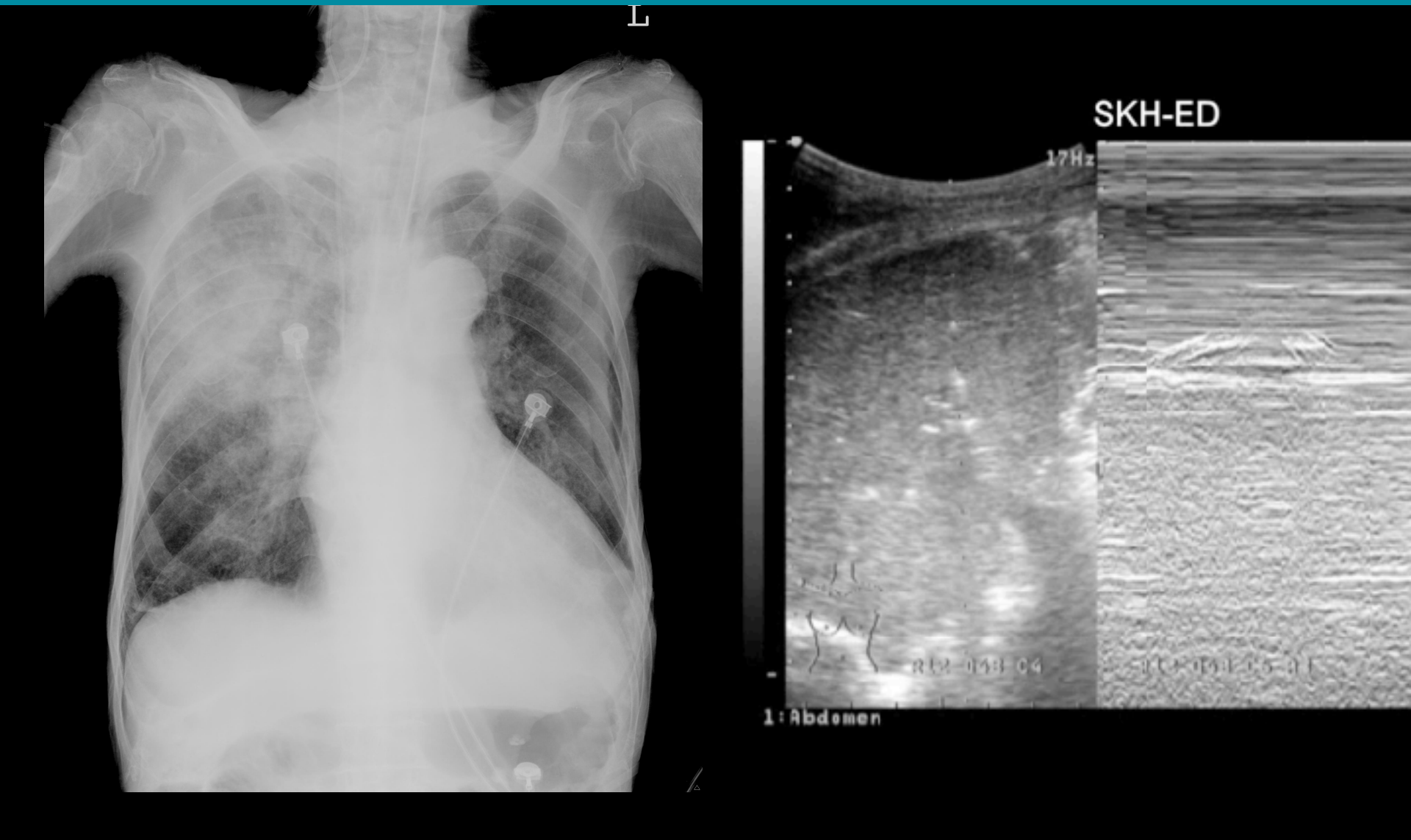
28F, 來抽肋膜積液吧 !?



C profile

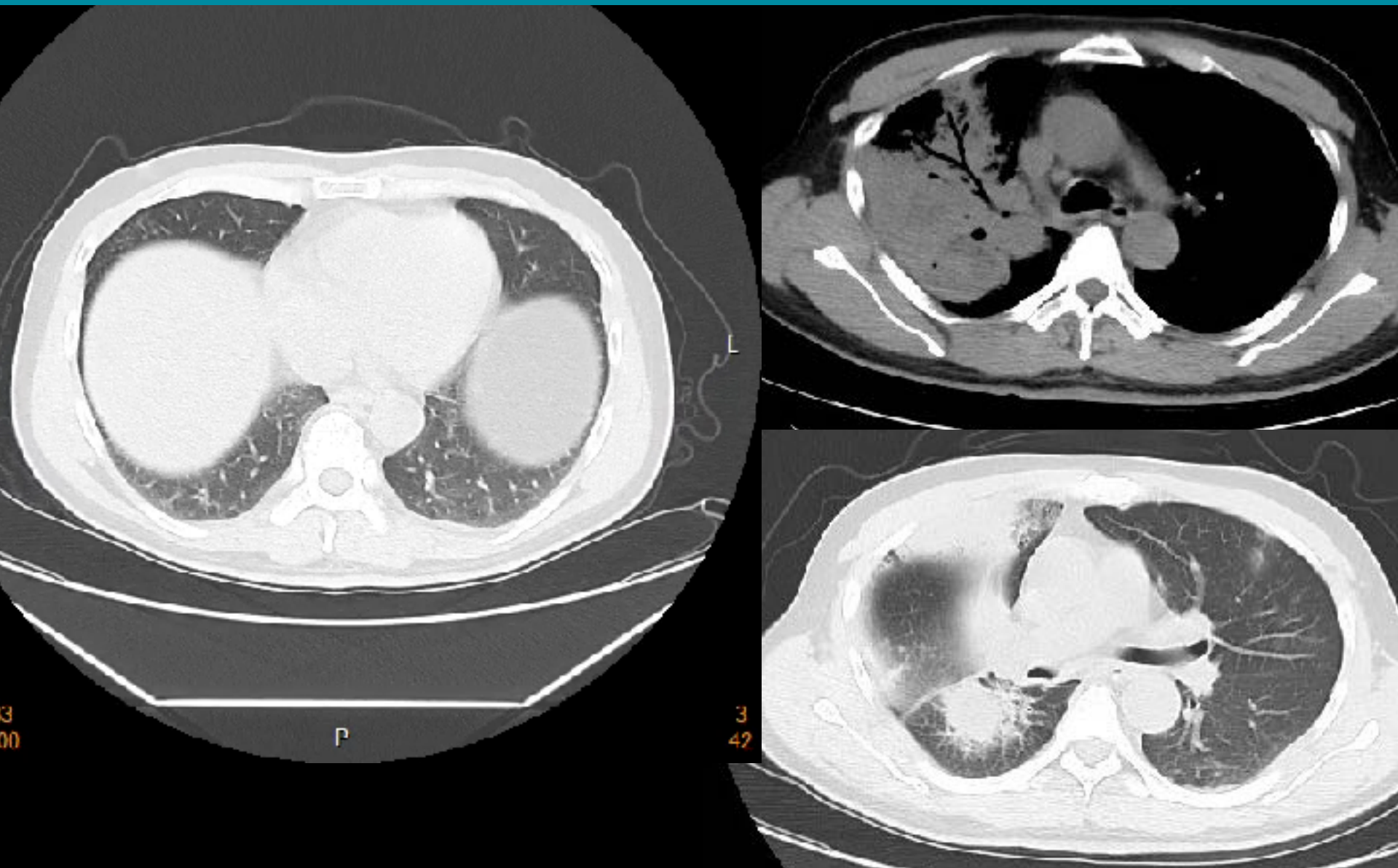


Dynamic air-bronchogram

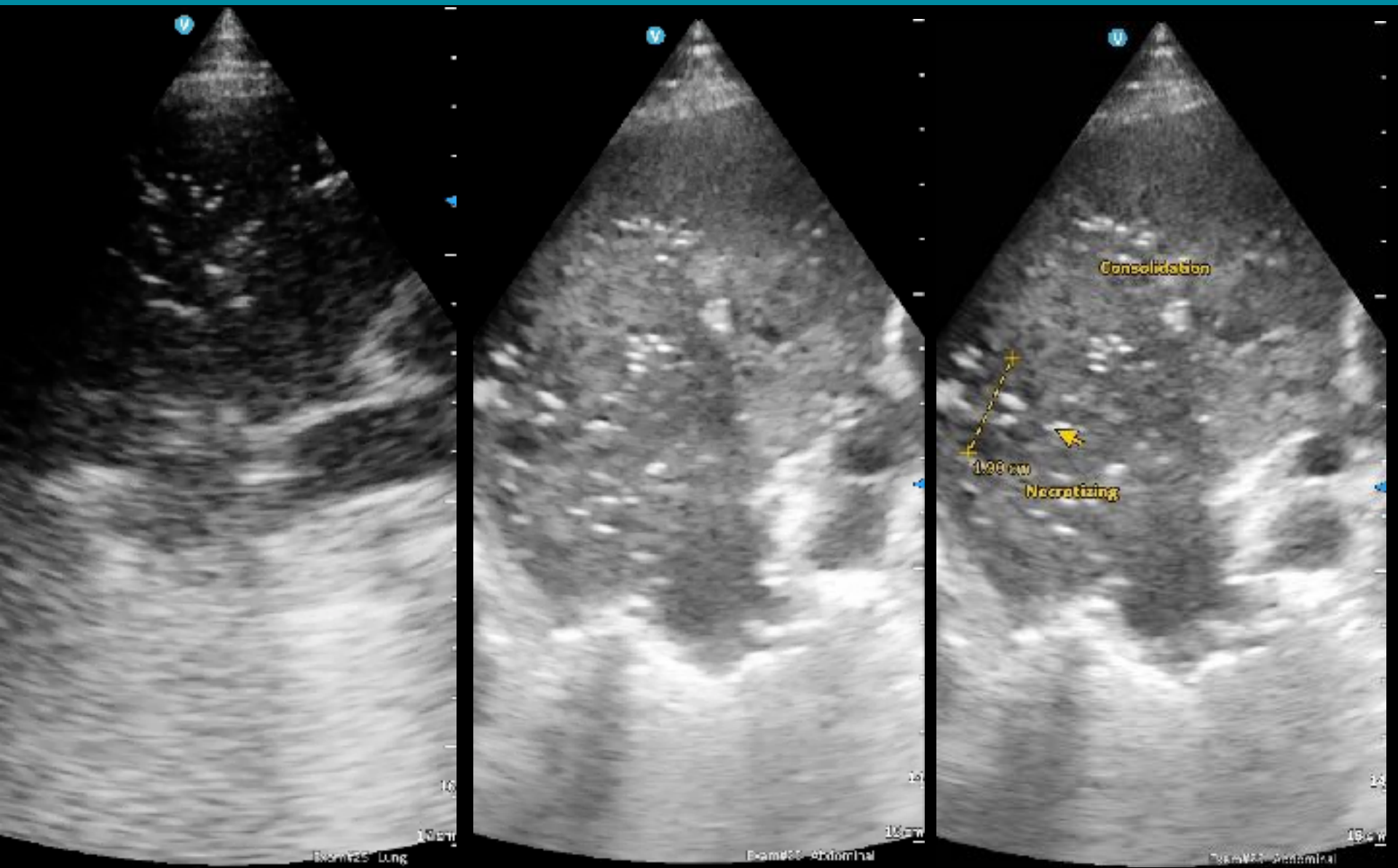


49M, FEVER & COUGH FOR 2 WEEKS

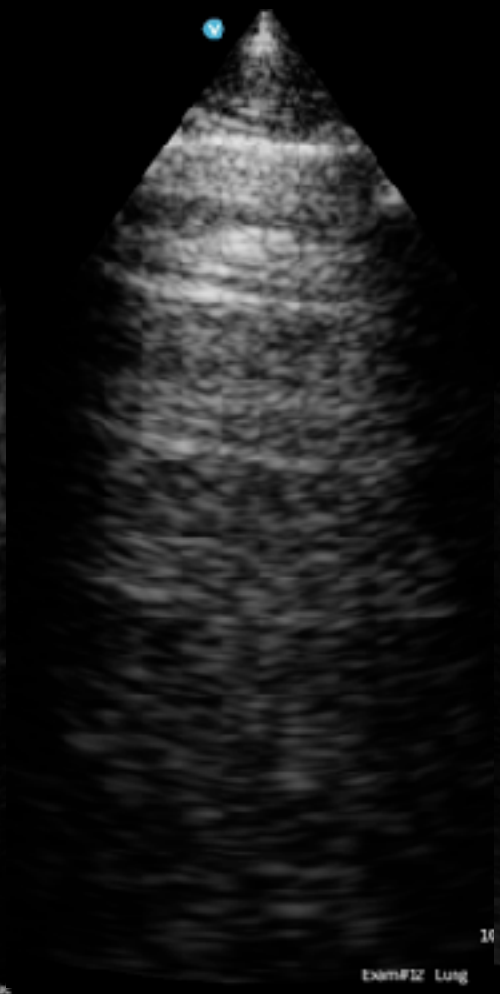
RUL PNEUMONIA

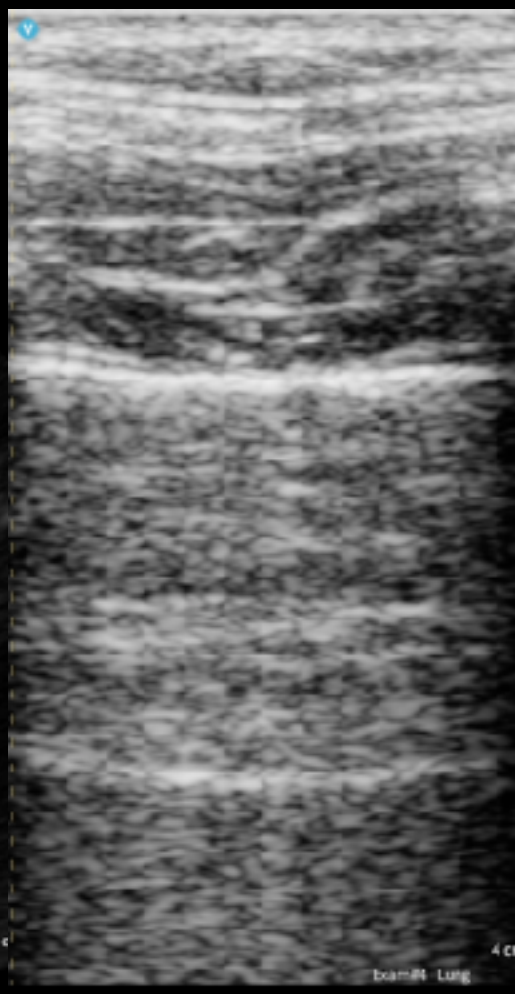


PNEUMONIA



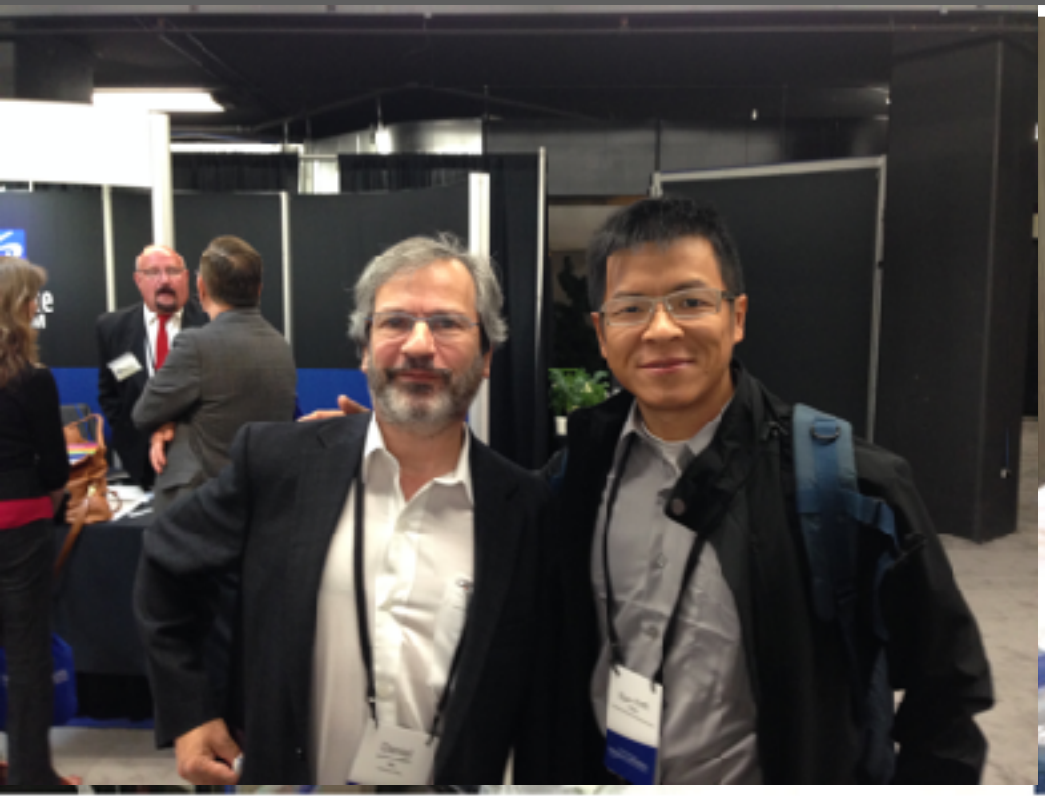
NORMAL PLEURA (CL / SL)





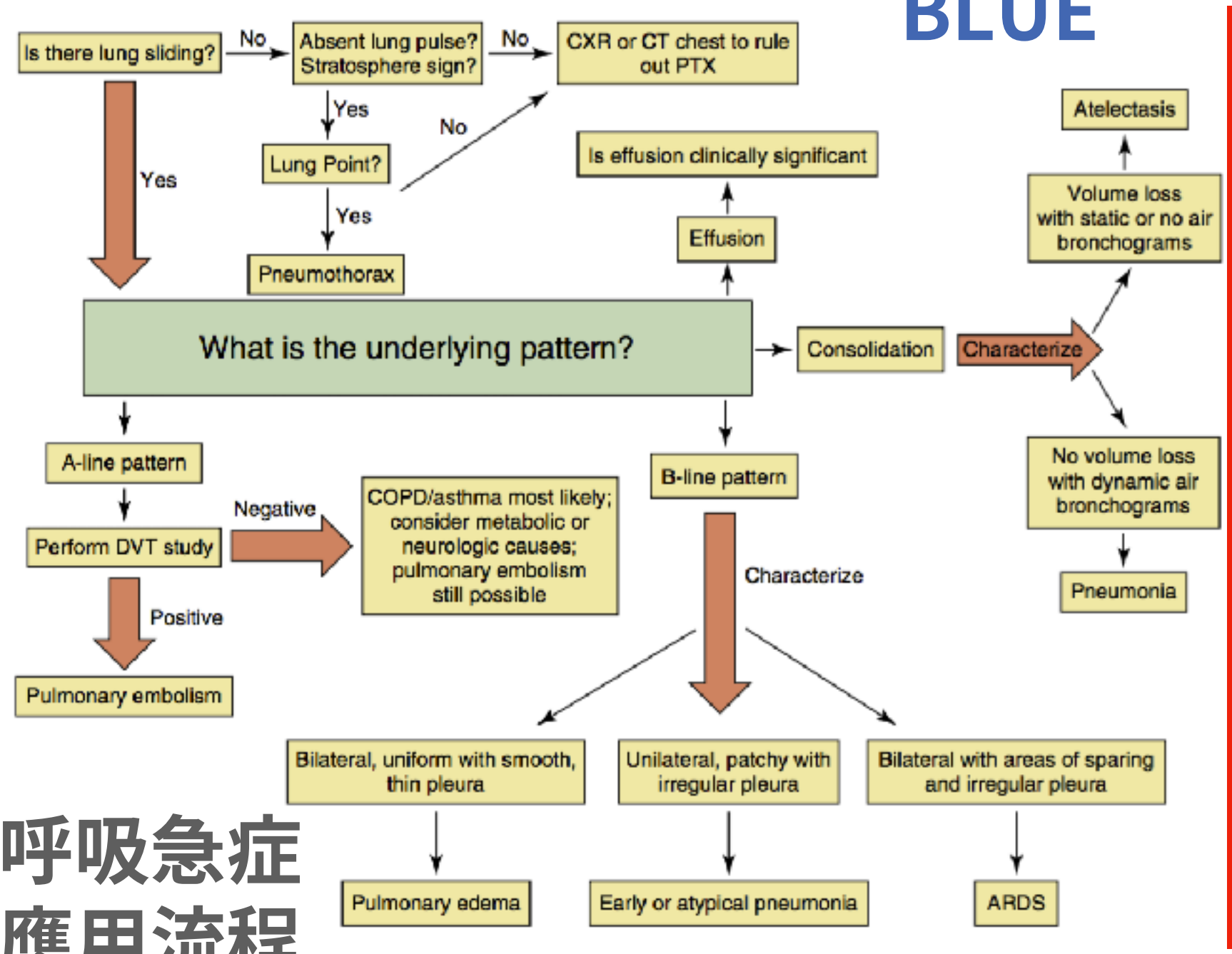
BLUE Protocol

(Bedside Lung Ultrasound in Emergency Protocol)



Daniel Lichtenstein

BLUE



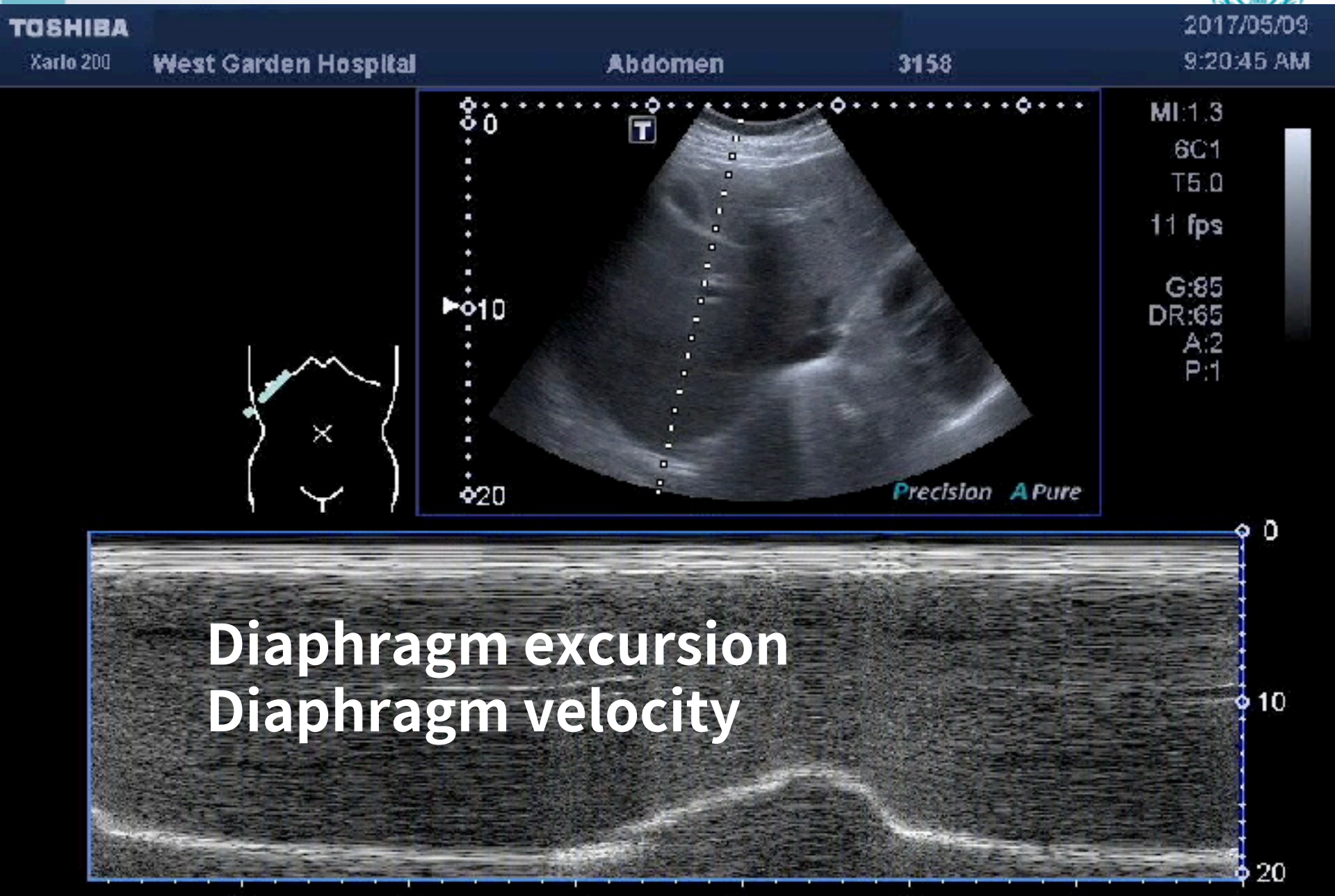
S A B E C

呼吸急症應用流程

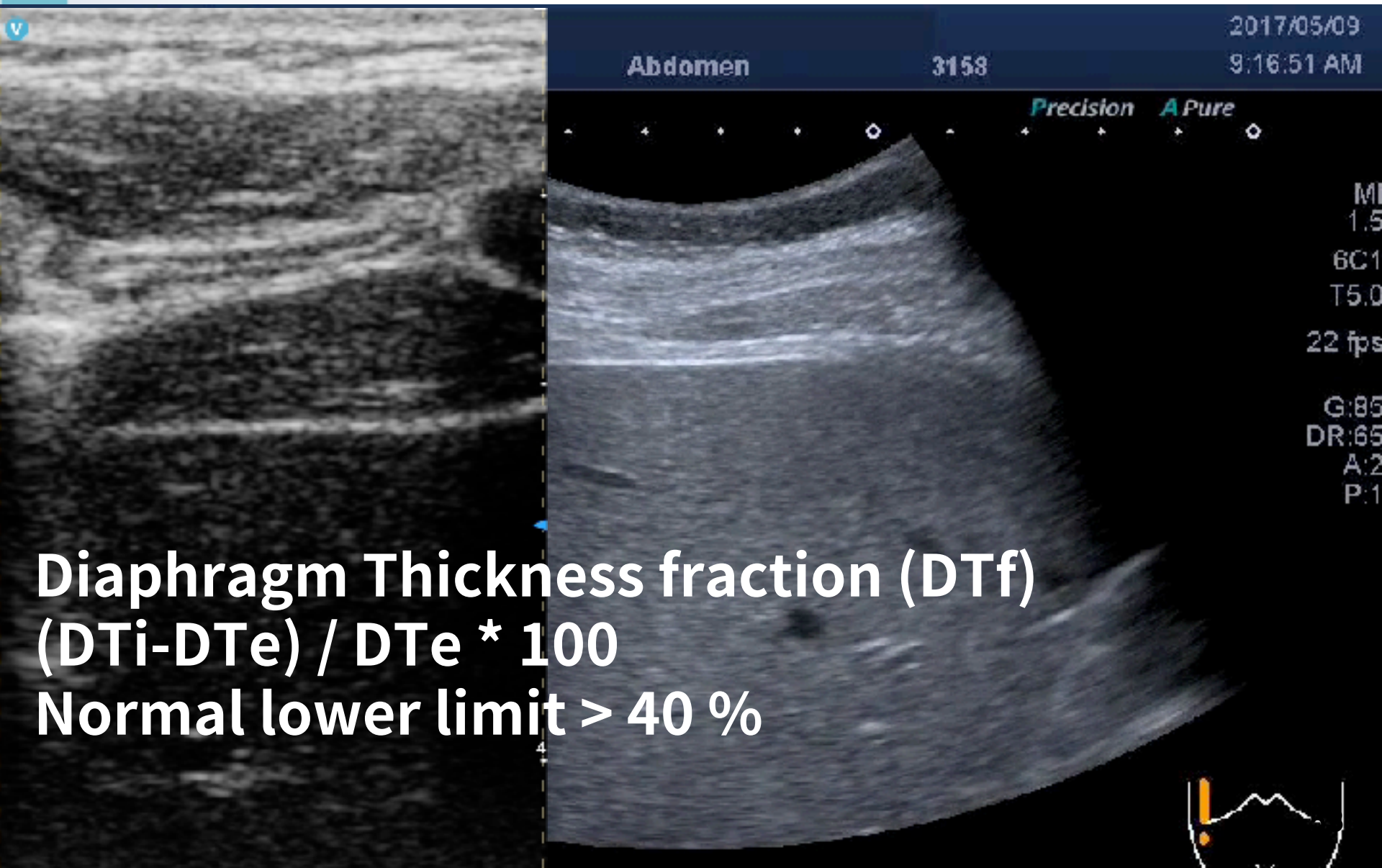
Curtain sign & Diaphragm movement

Greatest motion of sliding

Respiratory drive



Respiratory drive



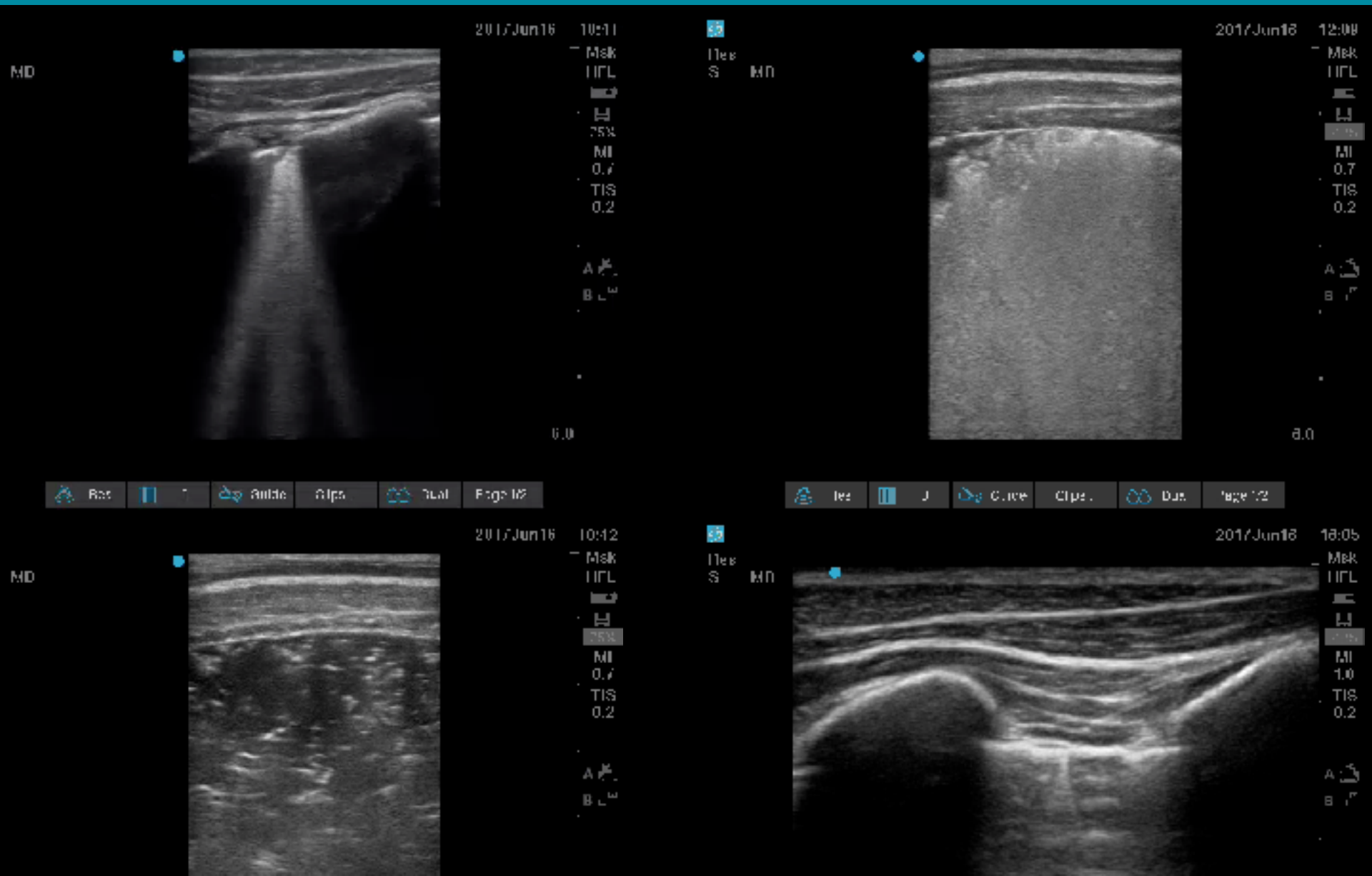
Diaphragm Thickness fraction (DTf)
(DTi-DTe) / DTe * 100
Normal lower limit > 40 %

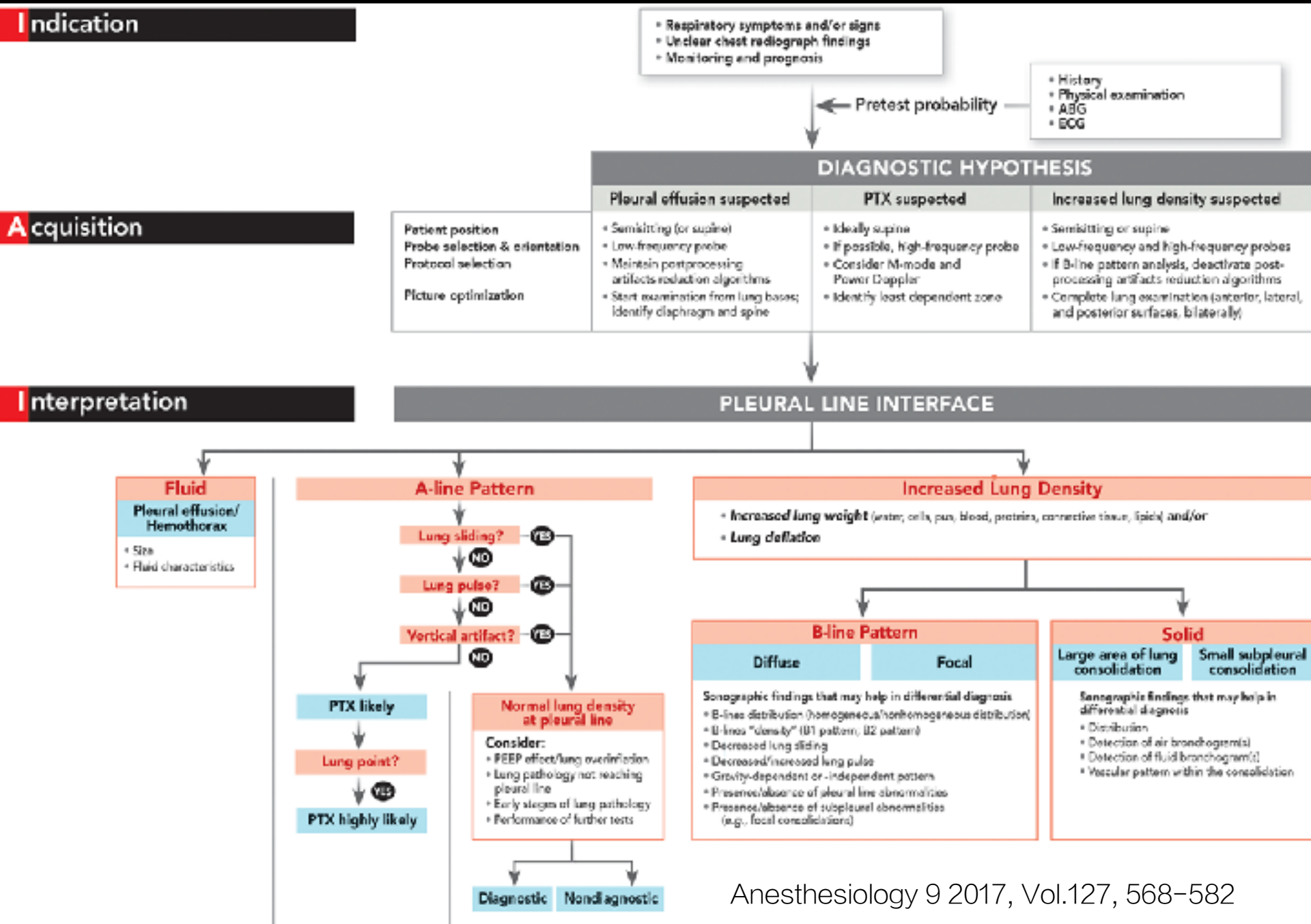
Back !!!

Abd Gen2
C5-1
39 Hz
12.0cm
2D
HGen
Gn 100
C 56
3/3/3
P
R
1.8 3.6
10
12.0cm

d Gen2
-1
Hz
.0cm
Gen
n 100
56
/3/3
P
R
1.8 3.6
10.0cm

Atelectasis





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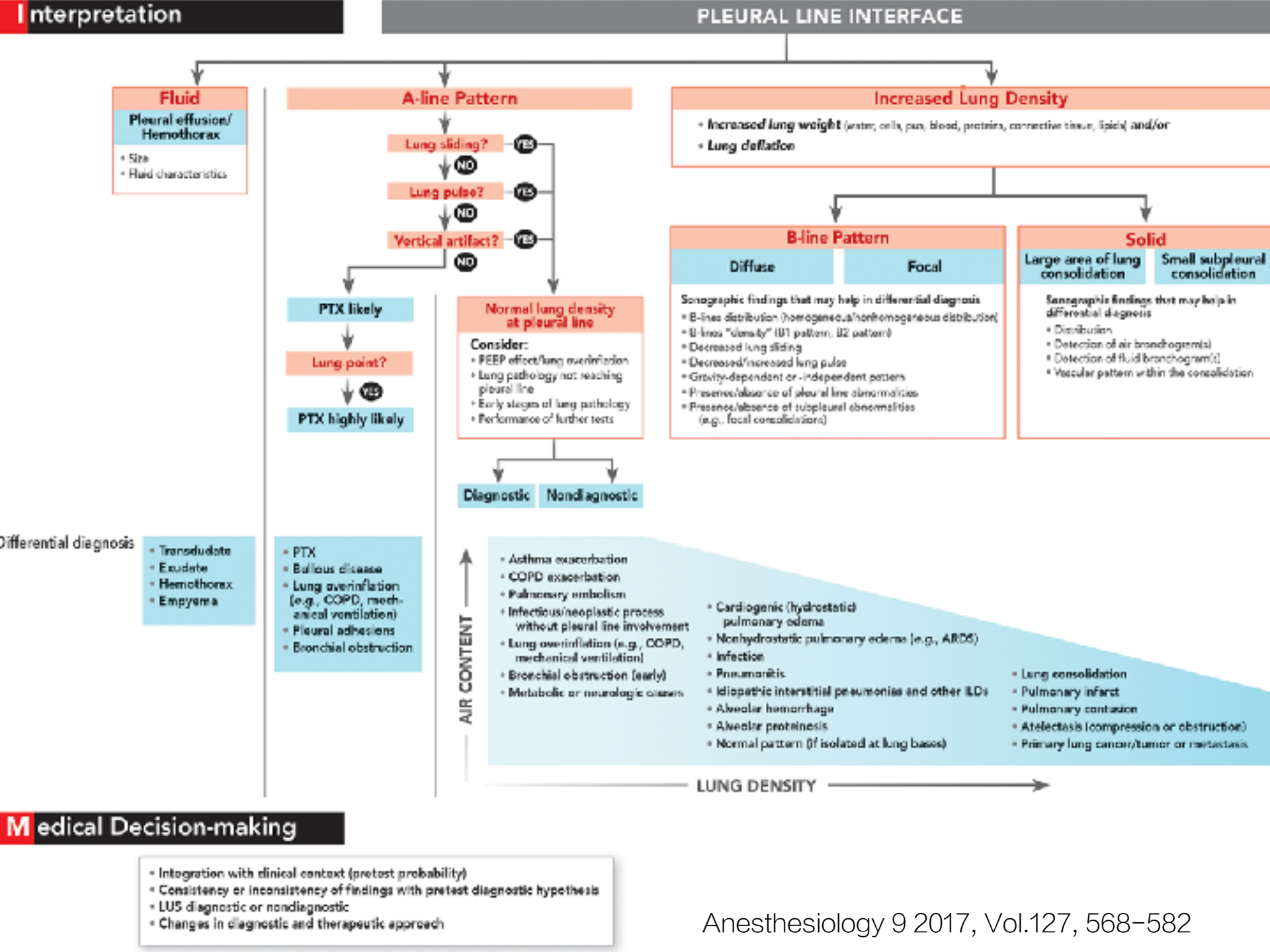

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A

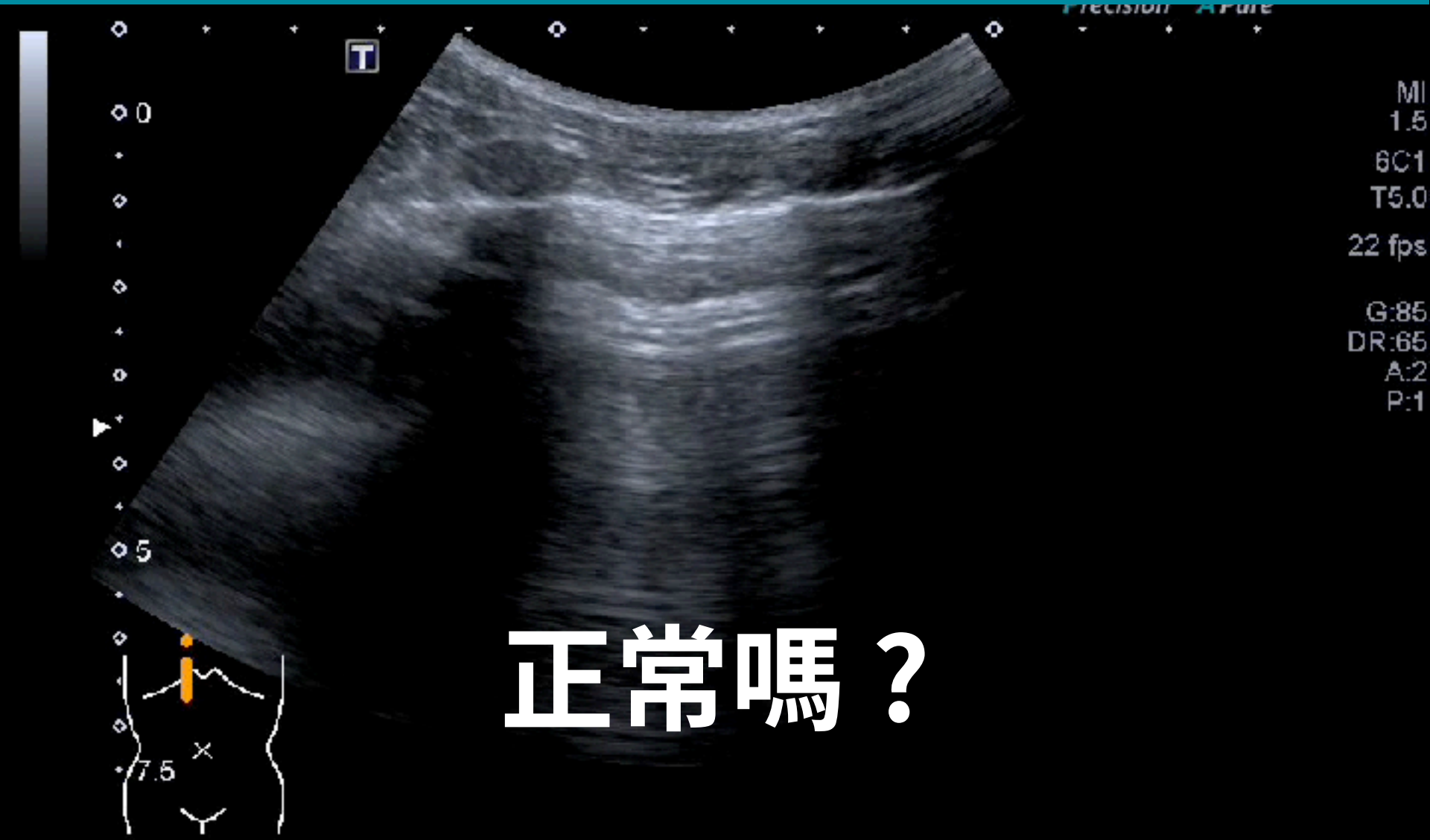
B

C

D

E

LUNG USG : S - ABCDE



LUNG USG : S - ABCDE

Dyspnea
Chest pain
Infections

PTX
AIS
PLE
Consolidation