1. PREPARATION

Necessities:

- Ultrasound gel
- Phone with LUS4TB app
- Ultrasound probe

DA0078

Inclusion criteria:

- Age ≥ 18 years
- Admitted to ICU/ED AMC
- Clinical suspicion of
- pneumonia and/or presence of respiratory insufficiency
- Patient can be scanned in the upright position
- Written informed consent provided by patient

Data collection:

- PIF *
- Lung ultrasound *
- Castor *

** please use the same identifier (ID) for all data!*

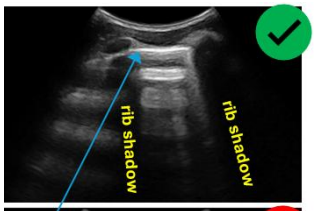
2. APP

1. Turn on phone and open LUS4TB app
2. Go to settings and select protocol
3. Press NEW SCAN
4. Add your own initials in Health Worker and register new study participant with **ALERT ID** *
5. Connect the probe to the phone's USB-C port
6. Ask study participant to remove clothing and assess chest abnormalities -> if no exclusion continue
7. Start protocol (see back for PROTOCOLS)

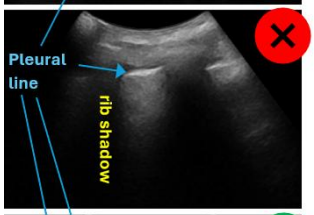
	BLUE	4-Sweep
8.	Ask study participant to lay in **supine** position	
9.	Apply gel and perform **8 scans anteriorly**	Apply gel and perform **sweeps 2-3 anteriorly**
10.	Ask study participant to **sit upright**	
11.	Apply gel and perform **4 scans posteriorly**	Apply gel and perform **sweeps 4-5 posteriorly**

12. Save scan and repeat steps for second protocol
13. Disconnect probe. The ultrasound machine, probes and the probe holders should always be cleaned after each examination. The probes should be dried from gel before disinfection. Allow spontaneous air drying
14. Transfer LUS data to local AMC folder.

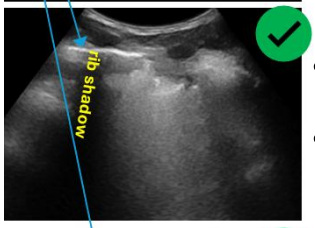
3. SCAN QUALITY



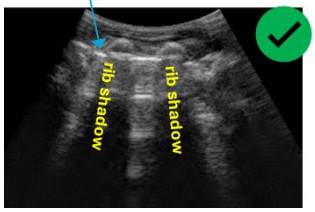
- Sharp pleural line
- A-lines (multiple horizontal lines above each other)



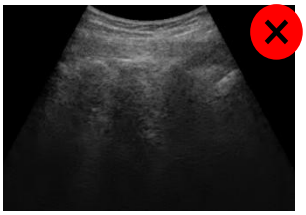
- Faded, unsharp pleural line
- No A-lines



- Sharp pleural line where visible
- Abnormality removing A-lines

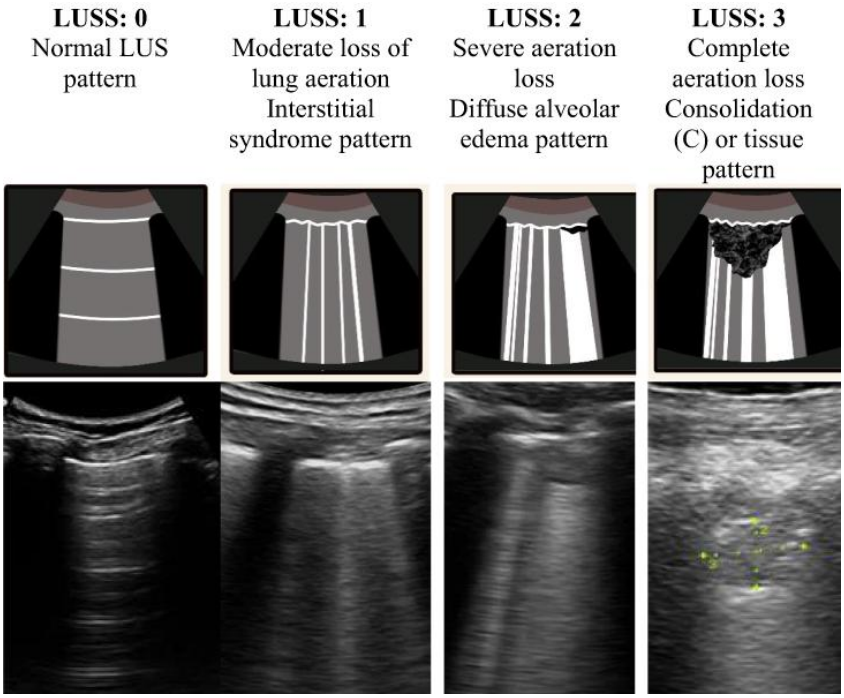


- Sharp pleural line
- A-lines



- Vague image, no clear identifiable structures

4. CLASSIFICATION



A-pattern (normal | 0): repeating horizontal lines parallel to the pleural line.	B1-pattern (≥3 B-lines | 1): ≥3 vertical, separated B-lines starting from pleural line and reaching bottom of screen.	B2-pattern (confluent B-lines | 2): numerous confluent vertical B-lines covering > 50% of the screen.	C-pattern (consolidation | 3): hypo-echoic structure diameter of ≥ 2cm.

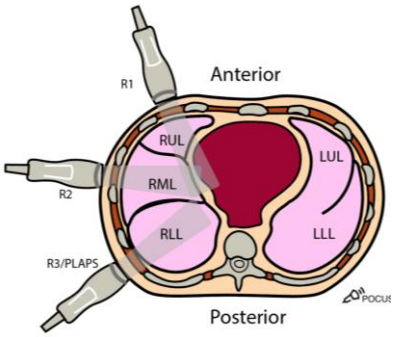
E-pattern (effusion | 4): pleural effusion.

5. LUS PROTOCOLS

- Tilt (in direction perpendicular to sweep movement) the probe until you see a sharp, bright white line = pleural line. Keep adjusting the tilt during the sweep so the pleural line remains clearly visible throughout, if possible.
- Each scan starts once you press play and the countdown has finished.
- Try to match the sweep speed shown in the app.
- Let the hand holding the probe rest on the patient's chest to acquire a stable view
- Repeat the scan if sweep not finished/satisfied.

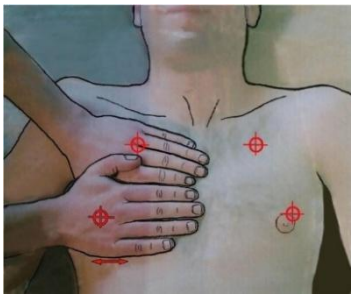
BLUE PROTOCOL

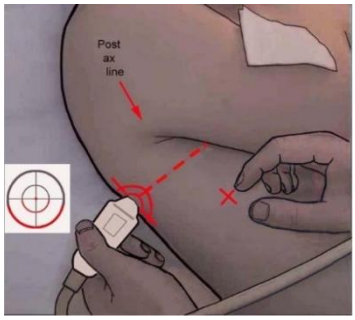
Perform TWO scans at ALL SIX BLUE points. First **longitudinal** and second **transversal orientation (rotate anti-clockwise).**



Anterior:

1. R1: place the probe (longitudinal) in an intercostal space in the middle of the anterior superior quadrant. Pres play. Repeat for transversal orientation.
2. R2: place the probe (longitudinal) in an intercostal space in the middle of the anterior inferior quadrant. Pres play. Repeat for transversal orientation.
3. L1 and L2: repeat step 1 and 2 on the left side. L2 try to avoid the heart.



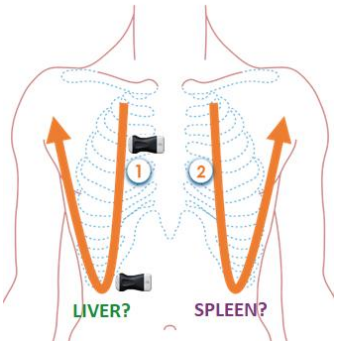


Posterior:

4. R3: place the probe longitudinally in an intercostal space in the middle of the inferior lateral quadrant. First find liver/spleen and diaphragm then slide upwards until you obtain 1/3 of the screen occupied by the liver/spleen and 2/3 by lung. Then obtain a transversal scan.
5. L3: repeat 4 on the left side.

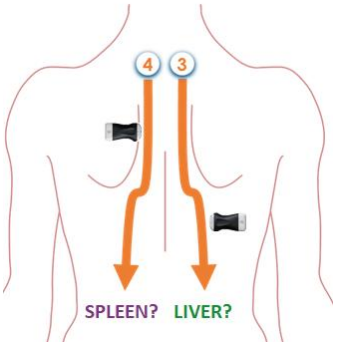
4-SWEEP PROTOCOL

Anterior:
Sweep 1 and 2

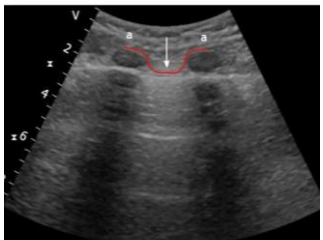


1. Ask participant to rest their right **arm behind their head**. Place the probe longitudinally at the right apical mid-clavicular line. After pressing play, move the probe down over the ribs towards the liver. Once the liver comes into view, move the probe laterally to **mid-axillary line** and continue upward toward the armpit.
2. Repeat step 1 on the left side.

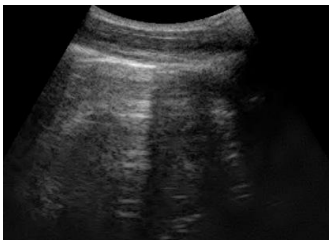
Posterior:
Sweep 3 and 4



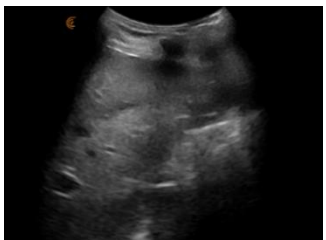
3. Place the probe longitudinally between scapula and spine at the right posterior apex. Sweep downward toward liver.
4. Repeat 4 on the left side.



Bat Sign



Lung | Spleen



Liver