Lung ultrasound in the critically ill patient

Pulmonary Edema

Rohit Patel, MD
University of Florida Health
Director, Critical Care Ultrasound Surgical ICU
Center for Intensive Care
Gainesville, Florida
Critical Care Ultrasound

A lines  Bat sign  B lines

B3 lines  B7 lines  BLUE protocol

BLUE points  Comet tails  Sinusoid sign

Jellyfish sign  Lung point  Merlin's space

PLAPS Point  Quad sign  Seashore sign

Shred sign  Stratosphere sign

Tissue like sign  Z lines
What can I find?

Pneumothorax
Hemothorax
Other pleural effusions
Alveolar consolidation

Pulmonary edema and/or extravascular lung water
Pulmonary embolism?
What are the questions?

System based?

Focused abdominal sonography in trauma

Cause?

Problem based?

Focused assessment with sonography in trauma

Shock, hypoxia, oligoanuria, fever, etc.?
Interstitial edema

Focused Questions:

Are B lines found bilateral anterior chest fields?

Probe: Abdominal probe
Principles of lung ultrasound

Anterior zone = "BLUE hands"

Lateral zone

Posterior zone

Lichtenstein. Textbook. Whole body ultrasonography in the critically ill.
Upper BLUE point: between third and fourth finger of BLUE hand, at palmar insertion

Lower BLUE point: middle of palm of lower BLUE hand; allows for avoidance of heart in most cases

Phrenic line: continuation of this line locates the lateral place

PLAPS point: "posterior and/or lateral alveolar and/or pleural syndrome" -- intersection between the posterior axillary line and the transversal line continuing posteriorly to the lower BLUE point; also can have extended PLAPS points
Principles of lung ultrasound

**Stage 1:** anterior wall

**Stage 2:** adds lateral wall from anterior to posterior axillary line

**Stage 3:** external part of the posterior wall; aim from back towards sky; no visual control of probe so need to hold with whole hand; can depress bed if need to

**Stage 4:** patients must be positioned laterally or sitting; can also study the apex
Principles of lung ultrasound

*B lines* arise from fluid air artifacts and give hyperechoic patterns and up to a completely diffuse white pattern called Birolleau variant.

Conclude that fluids traditionally described as anechoic make hyperechoic tones when small and surrounded by air.
BLUE profiles
hemodynamic pulmonary edema

**B profile** - bilateral anterior predominant B lines with lung sliding = **pulmonary edema**

WITHOUT lung sliding bilateral could be ARDS

**A/B-** unilateral B lines = aspiration or early pneumonia

**B line:** thickened interlobular septum --> then alveolar fluid

Pressurized transudate, includes all interlobular septa up to anterior wall against gravity = lung rockets

Transudates are supposed to not impair lung dynamics and explains preserved lung sliding

Posterior can be physiologic and leaky states (sepsis)

Staub. Physiology Rev. 1974
Principles of lung ultrasound

B line

B7 lines

B3 lines

Birolleau Variant
Principles of lung ultrasound
B line video
Principles of lung ultrasound

B line video
Interstitial edema

Focused Questions:

Are B lines found bilateral anterior chest fields?

Probe: Abdominal probe