Ultrasound for Critical Care Physicians: Tiny Bubbles

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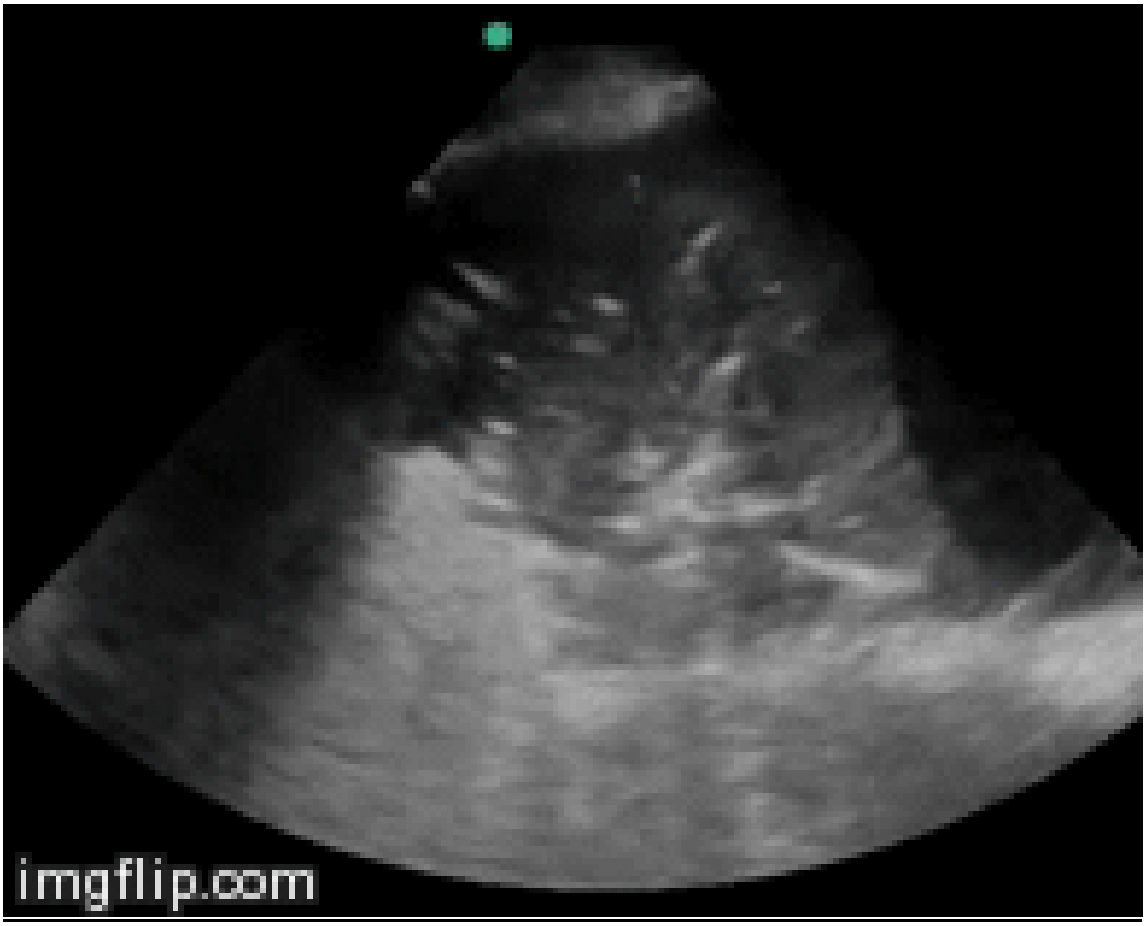
A 59 year old woman with a past medical history significant for stage IV MALT lymphoma (after chemotherapy and in remission) presented from a long term care facility for respiratory distress and altered mental status. The patient was in hypercarbic respiratory failure with a severe lactic acidosis. Her blood pressure deteriorated, she was begun on vasopressors and intubated. Pertinent labs demonstrated a white blood cell count of 0.9 $X10^6$ /ml, a hemoglobin of 7.1 g/dl, and a platelet count 66 $X10^6$ /ml. The patient was started on Cefepime and Linezolid presumptively for septic shock. Ultrasounds of her thorax were performed (Videos 1 & 2).

Video 1. Ultrasound of the right thorax in the mid-axillary line.



Video 2. Ultrasound of the right thorax in the mid-axillary line (slightly more caudad).

What is the ***best*** explanation for the ultrasound findings shown above?

1. Large pleural effusion
2. Pneumothorax
3. Consolidation due to pneumonia
4. Ruptured diaphragm
5. Lung abscess

Correct!

3. Consolidation due to pneumonia

The ultrasound of the right chest reveals a large consolidation of the right lower lobe. The patient was in septic shock due to bacterial pneumonia. The sputum cultures grew *Staphylococcus aureus* and *Klebsiella pneumoniae*. The ultrasound of the thorax presented is remarkable for the demonstration of a large consolidation with air moving within the bronchi. This is visualized as hyperechoic moving “bubbles” that represent air bubbles moving in and out of consolidated lung within the bronchial tree. Presumably the bronchi are also partly filled with fluid. The moving air within the bronchi is termed by Lichenstein as a “dynamic air bronchogram" (1).

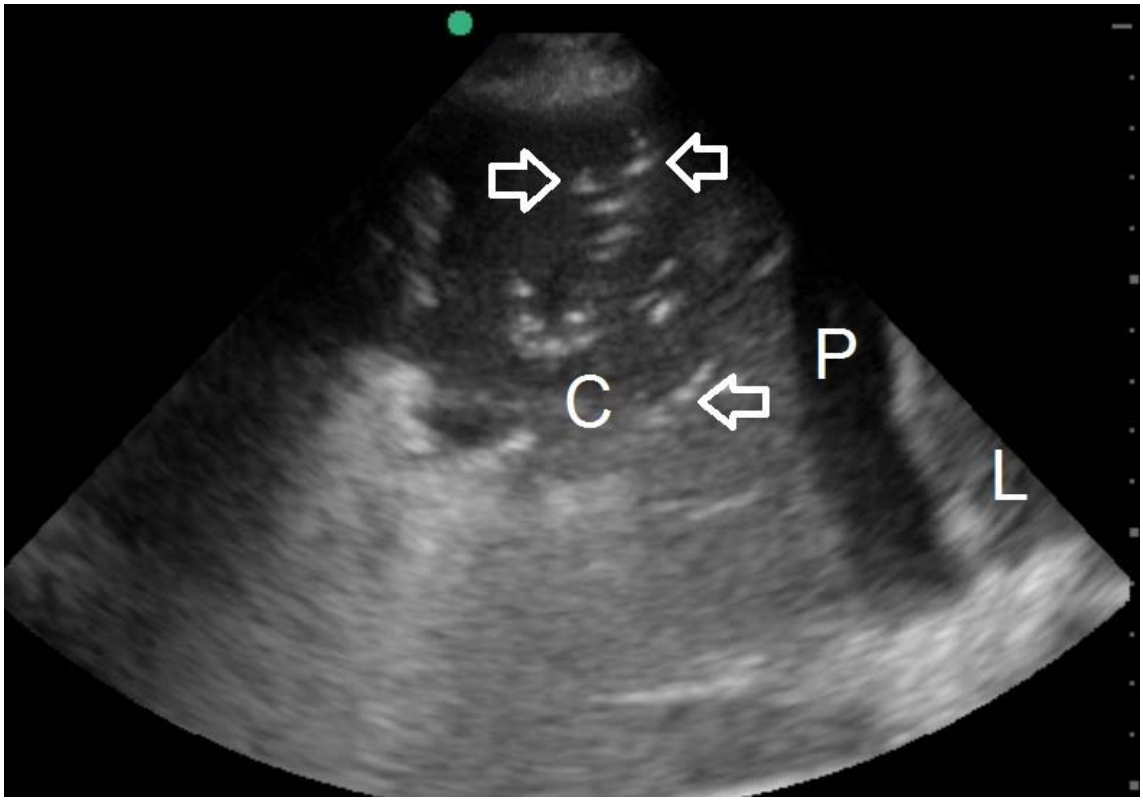


Figure 1. Static image of Video 2 demonstrating areas where dynamic air bronchograms are seen (Arrows). Also marked is the consolidation (C), pleural effusion (P), and liver (L).

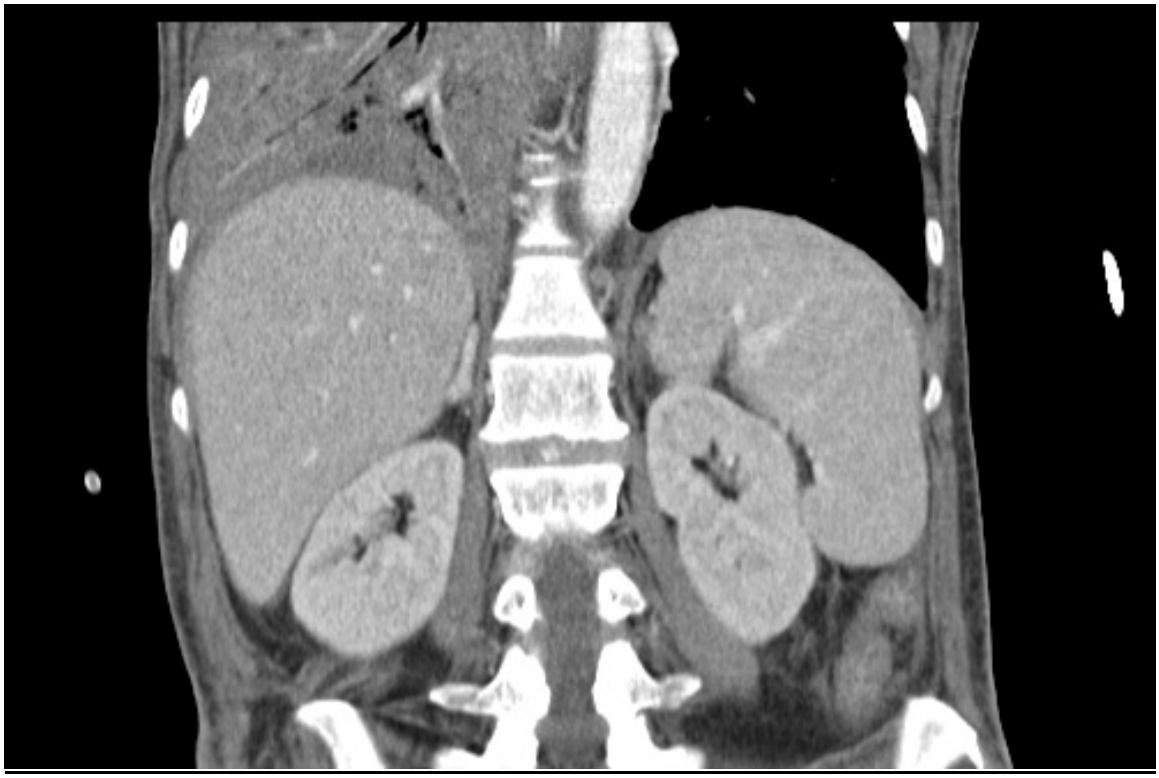


Figure 2. Coronal computerized tomogram of the abdomen in the same patient demonstrating the lung consolidation with air bronchogram.

This case illustrates that ultrasonography is advantaged by the ability to image dynamic findings, and this is relevant for lung ultrasound. The clinical significance of a dynamic air bronchogram was originally described by Lichtenstein et al. (1) who demonstrated it had a high sensitivity and specificity for lung consolidation and pneumonia. In the author's smaller series of consecutive lung ultrasounds, dynamic air bronchograms, while rare, were always associated with bacterial (lobar) pneumonia (2). This case was no exception.

References

1. Lichtenstein D, Mezière G, Seitz J. The dynamic air bronchogram. A lung ultrasound sign of alveolar consolidation ruling out atelectasis. Chest. 2009;135(6):1421-5. [CrossRef] [PubMed]
2. Frizzell J, Battah S, Boivin MA. Bronchial Effervescence, a new sonographic sign of pneumonia? Chest. 2011;140:499A [Abstract]. [CrossRef]