

# Dynamic Air Bronchogram Ultrasound Sign in a Noninvasive Ventilated Patient

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## Abstract

Acute dyspnea is one of the most common complaints in any emergency department. Physical examination and chest radiography have been insufficient to diagnose these patients accurately and quickly. We present a clinical case of a dyspneic patient presenting to the emergency department, who was promptly diagnosed with lobar pneumonia by point-of-care pulmonary ultrasonography. This permitted the rapid onset of adequate treatment. Furthermore, we describe a dynamic air bronchogram sign in a noninvasive ventilated patient. Chest computed tomography scan was performed confirming consolidation of the middle lobe. The advent of handheld point-of-care ultrasonography is revolutionizing practical care enabling physicians with a high-accuracy, low-cost, fast, safe, and repeatable diagnostic tool.

**Keywords:** Dynamic air bronchogram, lung ultrasound, point-of-care ultrasound

## INTRODUCTION

Acute dyspnea is one of the most common complaints in any emergency department. Physical examination and chest radiography have been insufficient to diagnose these patients accurately and quickly.<sup>[1-3]</sup> This may delay the treatment and unnecessarily expose patients to radiation.

The role of point-of-care ultrasonography is becoming a powerful diagnostic tool within reach of physicians.<sup>[1,2]</sup> Plus, the advent of last-generation handheld devices makes it possible to perform a fast, safe, and reliable ultrasonographic assessment at bedside.

Static air bronchogram and lung consolidation are well-established ultrasonographic findings that can be found in case of pneumonia or atelectasis.<sup>[2,3]</sup>

Dynamic air bronchogram, however, has a specificity and sensitivity of 94% and 61%, respectively, to diagnose alveolar consolidation.<sup>[4]</sup> This sign had been described mostly in patients under invasive ventilation.<sup>[4,5]</sup> Some case reports have been relating this finding,<sup>[6,7]</sup> although further elucidation and description of dynamic air bronchogram in noninvasive ventilated patients is lacking.

Thus, we present a case of lobar pneumonia which was diagnosed using point-of-care pulmonary ultrasonography with a handheld device displaying dynamic air bronchogram in a patient under noninvasive ventilation.

## CASE REPORT

We present the case of a 69-year-old female who recurred to the emergency department due to dyspnea, cough, and pleuritic chest pain which began 3 days earlier. There were no other symptoms reported.

At the first evaluation, she had fever (T 38.7°C), her blood pressure was 123/75 mmHg, pulse rate was 97 beats per min, respiratory rate was 30/min, and oxygen saturation was 84% in room air. On physical examination, she was alert on her pulmonary auscultation crackles, and vocal transmissions were identified in the right hemithorax.

Her medical history was unremarkable other than active tobacco abuse.

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Initial evaluation showed leukocytosis (12.100/uL, 96.8% neutrophils), elevated C-reactive protein of 50.09 mg/dL, slightly elevated liver enzymes, and blood urea nitrogen (GOT: 98U/L, GPT: 64U/L, and BUN: 67 mg/dL). Arterial blood gas analysis revealed hypoxemia (pO<sub>2</sub>: 46.2 and pCO<sub>2</sub>: 30.0).

With the hypoxia worsening, noninvasive ventilatory support was started to stabilize the patient. Blood cultures were taken, and antibiotic therapy with ceftriaxone and azithromycin was initiated.

A point-of-care ultrasound was performed using a handheld device, with a phased-array probe. In the sonographic evaluation, consolidation of the middle right lobe was identified alongside with dynamic air bronchogram and “shred sign” [Videos 1 and 2].

A chest CT scan was later performed, confirming right lobar pneumonia, with consolidation of middle lobe and excluding complications as pulmonary abscess. The patient was admitted to the intermediate care unit.

Blood cultures turned out to be positive for *Streptococcus pneumoniae* permitting to adjust antibiotic therapy.

The patient had a favorable response with progressive resolution of respiratory failure; noninvasive ventilatory support was discontinued after 48 h. The patient concluded 14 days of antibiotic therapy being discharged with complete resolution of hypoxemia.

## DISCUSSION

Chest radiograph is a diagnostic tool that is widespread in emergency departments and its importance and diagnostic value in case of dyspnea are well known. Despite that, chest radiograph and physical examination are often inconclusive, requiring further tests, exposing patients to more radiation, and delaying diagnoses and treatment.

Point-of-care ultrasonography on the other hand is a nonionizing diagnostic tool which can rapidly diagnose the cause of dyspnea in 90.5% of cases.<sup>[1]</sup> Thus, its diagnostic value cannot be overstated. The new-generation handheld devices are further revolutionizing clinical practice since they permit rapid assessment at any time or place.

Point-of-care ultrasonography can identify acute alveolar consolidations with a sensitivity of 90% and a specificity of 98%.<sup>[4]</sup>

There are two characteristic patterns that define a consolidation on pulmonary ultrasound. The consolidated lung has a tissue-like pattern (echoic pattern, like a liver). The second is the shred sign, which is a shredded deep

border of the tissular image in a connection with aerated lung.

On top of these two signs, a dynamic air bronchogram sign indicates continuity with inspired air, therefore excluding retractile atelectasis.<sup>[4]</sup> However, this finding has been described mainly in patients admitted to intensive care units and under invasive ventilation.<sup>[4,5]</sup>

Our case highlights the major importance of bedside ultrasonography by permitting high-accuracy, low-cost, fast, and safe assessment. Point-of-care ultrasound evaluation empowered the team to quickly diagnose the patient avoiding delays in treatment initiation. Furthermore, ultrasonography can be repeated to assess clinical and sonographic evolution.

This case documents the presence of dynamic air bronchogram sign in the patient under noninvasive ventilation.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent form. In the form the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Lichtenstein DA, Mezière GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: The BLUE protocol. *Chest* 2008;134:117-25.
2. Lichtenstein D, Goldstein I, Mourgeon E, Cluzel P, Grenier P, Rouby JJ. Comparative diagnostic performances of auscultation, chest radiography, and lung ultrasonography in acute respiratory distress syndrome. *Anesthesiology* 2004;100:9-15.
3. Reissig A, Copetti R. Lung ultrasound in community-acquired pneumonia and in interstitial lung diseases. *Respiration* 2014;87:179-89.
4. Lichtenstein D, Mezière G, Seitz J. The dynamic air bronchogram. A lung ultrasound sign of alveolar consolidation ruling out atelectasis. *Chest* 2009;135:1421-5.
5. Lichtenstein DA. Lung ultrasound in the critically ill. *Ann Intensive Care* 2014;4:1.
6. Unlüer EE, Karagöz A. A dynamic sign of alveolar consolidation in bedside ultrasonography: Air bronchogram. *Interv Med Appl Sci* 2014;6:40-2.
7. Shah A, Oliva C, Stem C, Cummings EQ. Application of dynamic air bronchograms on lung ultrasound to diagnose pneumonia in undifferentiated respiratory distress. *Respir Med Case Rep* 2022;39:101706.