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MedEst|2026 | Vol.6: e589| ISSN: 2789-7567 |RNPS: 2524| OPINION ARTICLE

Lung ultrasound in acute respiratory distress: diagnostic and prognostic utility in intensive care

Ecografía pulmonar en el distrés respiratorio agudo: utilidad diagnóstica y pronóstica en cuidados intensivos

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RESUMEN

La ecografía pulmonar ha emergido como herramienta de cabecera en el manejo del paciente crítico con distrés respiratorio agudo. El objetivo de este artículo es argumentar por qué debe ser considerada una herramienta diagnóstica y pronóstica de primer nivel en todo paciente con distrés respiratorio agudo ingresado en cuidados intensivos. Su capacidad para diferenciar rápidamente entre edema cardiogénico, síndrome de dificultad respiratoria aguda (SDRA), neumonía, derrame y neumotórax la convierte en un complemento insustituible de la exploración clínica y la radiografía de tórax. Sin embargo, pese a la evidencia internacional que respalda su alta sensibilidad y especificidad, su implementación sistemática en las unidades de cuidados intensivos (UCI) es heterogénea y no siempre protocolizada. El artículo sostiene que la ultrasonografía pulmonar no solo mejora la precisión diagnóstica a pie de cama, sino que también permite cuantificar la pérdida de aireación mediante la escala de ecografía pulmonar (LUS), la cual se correlaciona con parámetros de oxigenación como la PaO_2/FiO_2 y con desenlaces clínicos, como días de ventilación mecánica y mortalidad. Se argumenta que la integración de un algoritmo ecográfico estándar en la evaluación inicial del paciente con distrés respiratorio agudo es costo-efectiva, reduce la exposición a radiación, acorta los tiempos diagnósticos y guía decisiones terapéuticas, como la titulación de la presión positiva al final de la espiración (PEEP) o drenaje pleural. No obstante, se requiere formación específica del personal intensivista y validación local de los patrones ecográficos. Se concluye que la ecografía pulmonar debe ser considerada una competencia esencial en Medicina Intensiva.

ABSTRACT

Lung ultrasound has emerged as a bedside tool for managing critically ill patients with acute respiratory distress. This article argues that it should be considered a primary diagnostic and prognostic tool for any patient with acute respiratory distress admitted to the intensive care unit. Its ability to rapidly differentiate between cardiogenic edema, acute respiratory distress syndrome (ARDS), pneumonia, pleural effusion, and pneumothorax makes it an indispensable complement to clinical examination and chest radiography. However, despite international evidence supporting its high sensitivity and specificity, its systematic implementation in intensive care units (ICUs) varies and is not always standardized. The article maintains that lung ultrasound not only improves bedside diagnostic accuracy but also allows for the quantification of aeration loss using the lung ultrasound (LUS) score; this score correlates with oxygenation parameters—such as the PaO_2/FiO_2 ratio—and clinical outcomes, including duration of mechanical ventilation and mortality. It is argued that integrating a standard ultrasound algorithm into the initial assessment of patients with acute respiratory distress is cost-effective, reduces radiation exposure, shortens diagnostic times, and guides therapeutic decisions, such as positive end-expiratory pressure (PEEP) titration or pleural drainage. Nevertheless, specific training for intensive care staff and local validation of ultrasound patterns are required. The article concludes that lung ultrasound should be considered an essential competency in intensive care medicine.

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Acute respiratory distress constitutes one of the main causes of admission to intensive care units (ICU) and is associated with mortality ranging between 30 % and 50 % in its severe forms [1]. Conventional evaluation is based on clinical findings, arterial blood gases, and portable chest radiography. However, the latter has well-documented limitations: low sensitivity (40–60 % for the diagnosis of ARDS), poor ability to differentiate between cardiogenic and non-cardiogenic edema, and lack of quantification of regional lung aeration [2]. Furthermore, computed tomography, considered the gold standard, involves transfer out of the ICU, radiation exposure, and high costs, which prevents its routine use [3].

In this context, lung ultrasound has emerged as a bedside tool that is safe, reproducible, radiation-free, and with an acceptable learning curve for the intensivist [4]. The BLUE protocol (Bedside Lung Ultrasound in Emergency) has demonstrated a sensitivity greater than 90 % for identifying the cause of acute respiratory failure in less than three minutes [5]. Beyond qualitative diagnosis, the lung ultrasound score (LUS), which quantifies the loss of aeration in 12 lung zones, has shown excellent correlation with PaO_2/FiO_2 and lung weight estimated by tomography [6].

However, in many hospitals in Latin America and specifically in Cuba, the implementation of lung ultrasound in the ICU remains optional and non-standardized. There is a false belief that its learning is complex or that it requires high-end equipment [7].

The objective of this opinion article is to argue, based on current evidence, why lung ultrasound should be considered a first-level diagnostic and prognostic tool in every patient with acute respiratory distress admitted to the ICU, and to propose a model for practical integration.

Lung ultrasound as a differential diagnostic tool

The first clinical gain of lung ultrasound is its ability to distinguish, immediately, between causes of hypoxemia that require radically different treatments. Pattern A (horizontal A-lines with preserved lung sliding) points to a normal airway (asthma or COPD) [5]. The presence of bilateral and symmetric diffuse B-lines suggests cardiogenic edema or ARDS; the distribution and presence of associated pleural effusion help differentiate them [8, 9].

Consolidations with dynamic air bronchogram are typical of pneumonia, while the lung point (loss of sliding in a defined area) establishes the diagnosis of pneumothorax [10]. In multicenter

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studies, lung ultrasound has shown a sensitivity of 90,5 % and a specificity of 98,4 % for the diagnosis of ARDS when compared with tomography [11].

Quantification: LUS score and its prognostic value

Beyond etiological diagnosis, lung ultrasound allows measuring the extent of aeration loss through the LUS score (0 to 36 points). Wang and Qi, in a 2024 meta-analysis that included more than 1200 patients, found that an elevated LUS score (>24) in the first 24 hours was associated with a significantly higher risk of in-hospital mortality [12]. Furthermore, the evolution of the score (decrease >6 points in 72 hours) predicts a better response to alveolar recruitment and a greater probability of successful extubation [13]. Therefore, the LUS score is not only a descriptor of severity but a true dynamic imaging biomarker.

Ultrasound-guided therapeutic applications

The intensivist who handles the ultrasound machine can make real-time decisions: adjust PEEP to recruit collapsed zones (evidenced by consolidations or coalescent B-lines), decide the need for diagnostic and evacuative thoracentesis, monitor the response to diuretics in cardiogenic edema (disappearance of B-lines), and even guide weaning from mechanical ventilation by evaluating lung reaeration [14]. The FALLS protocol (Fluid Administration Limited by Lung Sonography) has been shown to reduce fluid overload in patients with septic shock by stopping fluid therapy when diffuse B-lines appear in previously aerated zones [15]. These ultrasound-based interventions have the potential to reduce complications and shorten stays [16].

Barriers and solutions for local implementation

Despite the evidence, barriers persist: lack of systematic training, variable availability of ultrasound machines, and cultural resistance to replacing daily chest radiography. However, the learning curve for basic lung ultrasound is short: with 25 supervised examinations, acceptable interobserver agreement is achieved (kappa >0.8) [17]. It is feasible for Intensive Care residents to acquire these competencies during their training, integrating ultrasound into the daily evaluation of patients with respiratory distress. Furthermore, current portable ultrasound machines (such as those available in many provincial hospitals) are sufficient for lung examination, as they do not require special high-frequency probes [18].

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It is worth being realistic: lung ultrasound has limitations in patients with extensive subcutaneous emphysema, morbid obesity (reduced acoustic window), or occlusive dressings. It also does not completely replace tomography in cases of complex diffuse interstitial lung disease or suspected massive pulmonary embolism [19]. However, in daily ICU practice, the combination of lung ultrasound + echocardiography + inferior vena cava evaluation resolves most scenarios of acute hypoxemia [20].

Lung ultrasound is a high-value diagnostic and prognostic tool in patients with acute respiratory distress in the ICU. Its ability to identify etiologies and quantify aeration loss through the LUS score correlates with severity and predicts adverse outcomes such as mortality and days of mechanical ventilation. Its systematic implementation, together with structured training of intensive care personnel, is cost-effective and improves therapeutic decision-making at the bedside. It is recommended that Intensive Care services in Cuba incorporate lung ultrasound as a standard of initial evaluation in every patient with acute respiratory distress, and that institutional protocols be developed that integrate the LUS score into routine clinical records. Current evidence no longer allows this technology to be considered a luxury; it is a necessity, provided it is adapted to the resource conditions of each institution.

BIBLIOGRAPHIC REFERENCES

1. Bellani G, Laffey JG, Pham T, Fan E, Brochard L, Esteban A, et al. Epidemiology, patterns of care, and mortality for patients with acute respiratory distress syndrome in intensive care units in 50 countries. JAMA. 2016;315(8):788-800. doi:10.1001/jama.2016.0291

2. Lichtenstein DA, Mezière GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: the BLUE protocol. Chest. 2008;134(1):117-25. doi:10.1378/chest.07-2800

3. Pesenti A, Musch G, Lichtenstein D, Mojoli F, Amato MBP, Cinnella G, et al. Imaging in acute respiratory distress syndrome. Intensive Care Med. 2016;42(5):686-98. doi:10.1007/s00134-016-4328-1

4. Robba C, Wong A, Poole D, Al Tayar A, Arntfield RT, Chew MS, et al. Basic ultrasound head-to-toe skills for intensivists in the general and neuro intensive care unit population: consensus and expert recommendations of the European Society of Intensive Care Medicine. Intensive Care Med. 2021;47(12):1347-67. doi:10.1007/s00134-021-06486-z

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5. Lichtenstein DA. BLUE-protocol and FALLS-protocol: two applications of lung ultrasound in the critically ill. Chest. 2015;147(6):1659-70. doi:10.1378/chest.14-1313

6. Mongodi S, De Luca D, Colombo A, Stella A, Santangelo E, Corradi F, et al. Quantitative lung ultrasound: technical aspects and clinical applications. Anesthesiology. 2021;134(6):949-65. doi:10.1097/ALN.0000000000003757

7. Saura Cuesta LM, Borroto Pérez Y, Águila-Carbelo M. Ecografía pulmonar en la evaluación del paciente crítico. Medicentro Electrónica. [Internet] 2023 [cited 10/06/2026];27(1):1-20. Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1029-30432023000100020

8. Copetti R, Soldati G, Copetti P. Chest sonography: a useful tool to differentiate acute cardiogenic pulmonary edema from acute respiratory distress syndrome. Cardiovasc Ultrasound. 2008;6:16. doi:10.1186/1476-7120-6-16

9. Chiumello D, Mongodi S, Algieri I, Vergani GL, Orlando A, Via G, et al. Assessment of lung aeration and recruitment by CT scan and ultrasound in acute respiratory distress syndrome patients. Crit Care Med. 2018;46(11):1761-8. doi:10.1097/CCM.0000000000003340

10. Volpicelli G, Elbarbary M, Blaivas M, Lichtenstein DA, Mathis G, Kirkpatrick AW, et al. International evidence-based recommendations for point-of-care lung ultrasound. Intensive Care Med. 2012;38(4):577-91. doi:10.1007/s00134-012-2513-4

11. Martínez-Redondo J, Comet R, García de Casasola G, Luordo D, García-Gómez M, et al. Diagnostic accuracy of lung ultrasound in diagnosis of ARDS and identification of focal or non-focal ARDS subphenotypes: a systematic review and meta-analysis. Crit Care. 2024;28(1):224. doi:10.1186/s13054-024-05007-9

12. Wang D, Qi Y. Lung ultrasound score and in-hospital mortality of adults with acute respiratory distress syndrome: a meta-analysis. BMC Pulm Med. 2024;24(1):62. doi:10.1186/s12890-023-02826-5

13. Zhao Z, Jiang L, Xi X, Jiang Q, Zhu B, Wang M, et al. Prognostic value of extravascular lung water assessed with lung ultrasound score by chest sonography in patients with acute respiratory distress syndrome. BMC Pulm Med. 2015;15:98. doi:10.1186/s12890-015-0091-2

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14. Xirouchaki N, Kondili E, Prinianakis G, Malliotakis P, Georgopoulos D. Impact of lung ultrasound on clinical decision making in critically ill patients. Intensive Care Med. 2014;40(1):57-65. doi:10.1007/s00134-013-3133-3

15. Lichtenstein DA, Bar S. Lung ultrasound for causal diagnosis of shock (FALLS-protocol), a tool helping to guide fluid therapy while approaching fluid tolerance. Some comments on its accuracy. Ann Intensive Care. 2024;14(1):88. doi:10.1186/s13613-024-01329-8

16. Mayo PH, Copetti R, Feller-Kopman D, Mathis G, Maury E, Mongodi S, et al. Thoracic ultrasonography: a narrative review. Intensive Care Med. 2019;45(9):1200-11. doi:10.1007/s00134-019-05725-8

17. See KC, Ong V, Wong SH, Leanda R, Santos J, Taculod J, et al. Lung ultrasound training: curriculum implementation and learning trajectory among respiratory therapists. Intensive Care Med. 2016;42(1):63-71. doi:10.1007/s00134-015-4102-9

18. Fentress M, Henwood PC, Mahony M, et al. A lung ultrasound scanning technique for children and adults in low-resource settings: preliminary experiences in sub-Saharan Africa. Am J Trop Med Hyg. 2021;105(5):1148-51. doi:10.4269/ajtmh.20-0272

19. Mojoli F, Bouhemad B, Mongodi S, Lichtenstein D. Lung ultrasound for critically ill patients. Am J Respir Crit Care Med. 2019;199(6):701-14. doi:10.1164/rccm.201802-0236CI

20. Cucciolini G, Corradi F, Marrucci E, Ovesen SH. Basic lung ultrasound and clinical applications in general medicine. Med Clin North Am. 2025;109(1):11-30. doi:10.1016/j.mcna.2024.07.006

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DdlCRF: conceptualization, formal analysis, methodology, project administration, writing – original draft, writing – review and editing.

JLVG: conceptualization, data curation, investigation, supervision, writing – original draft.

EDV: conceptualization, methodology, supervision, writing – review and editing.

MNH: conceptualization, methodology, supervision, writing – review and editing.

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CONFLICT OF INTERESTS

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