Lung ultrasound for predicting and diagnosing acute respiratory distress syndrome: a systematic

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Introduction:
Acute respiratory distress syndrome (ARDS) is characterized as a condition that shows a rapid onset of widespread inflammation in the lungs. Diagnosing this critical condition early and accurately is crucial for improving overall patient outcomes, as delayed intervention can lead to severe complications and increased mortality rates. Lung ultrasonography (LUS) has proven to be a promising non-invasive strategic tool in the early identification and management of patients with ARDS, particularly in clinical settings where traditional screening modalities are limited. Its portability, ease of use, and ability to provide real-time dynamic imaging make LUS an invaluable asset in resource-constrained environments. Additionally, LUS has demonstrated reliability in detecting hallmark features of ARDS, such as interstitial syndrome and alveolar consolidations, thereby enhancing diagnostic precision and guiding therapeutic decisions.

Aims /Objectives:
This systematic review aims to further evaluate the diagnostic and predictive values of the LUS in relation to ARDS across a variety of clinical settings and patient populations.

Materials /Methods:
A comprehensive literature search was conducted across multiple databases, which included PubMed, Scopus, and CINAHL, to help identify studies that assessed the utility of LUS in relation to the development of ARDS. A total of 24 studies were included, which encompass prospective cohorts, observational studies, and systematic reviews. Data was extracted on study designs, population characteristics, LUS protocol used, key findings in relation to ARDS prediction and diagnosis, primary and secondary outcomes, as well as study limitations.

Results:
The studies that underwent review included a diverse range of patient populations, which ranged from critically ill COVID-19 patients to those with blunt thoracic trauma. The sample sizes also varied from small pilot studies to larger multi-center trials. A plethora of LUS protocols were implemented. Key findings consistently showed that LUS had high sensitivity and specificity in diagnosing ARDS. Predictive indicators were identified through LUS, which included B-lines, pleural line abnormalities, and lung aeration scores. Early diagnosis of ARDS with the use of LUS was associated with improved overall clinical outcomes and guided effective management decisions. Secondary findings highlighted the importance of the noninvasive, repeatable nature of LUS, which makes it suitable for continuous monitoring.

Discussion:
The studies reviewed demonstrate the high sensitivity and specificity of LUS in diagnosing ARDS, with predictive markers such as B-lines and pleural abnormalities proving effective. LUS offers the advantage of non-invasive, repeatable monitoring, which is particularly beneficial in resource-limited settings. Future research should focus on standardizing LUS protocols and validating predictive markers across diverse patient populations to enhance its clinical utility.

Conclusion:
Lung ultrasound is a valuable diagnostic tool in the early prediction of ARDS, offering high accuracy and practical advantages over traditional imaging methods. Its application in the clinical setting can lead to timely and effective clinical interventions, particularly in resource-limited clinical settings across the globe. We recommend further large-scale studies to standardize the LUS protocols and validate the predictive markers it offers in diverse patient populations.

Keywords:
Lung ultrasound, POCUS, critical care, acute respiratory distress syndrome, ARDS.