

INPLASY PROTOCOL

To cite: Chen et al. Lung ultrasound in diagnosis of acute heart failure: Systematic review and meta-analysis. Inplasy protocol 2022100069. doi: 10.37766/inplasy2022.10.0069

Received: 17 October 2022

Published: 17 October 2022

Corresponding author:
Hao Chen

1605821351@qq.com

Author Affiliation:
The First School of Clinical
Medicine, Lanzhou University.

Support: None.

Review Stage at time of this submission: The review has not yet started.

Conflicts of interest:
None declared.

Lung ultrasound in diagnosis of acute heart failure: Systematic review and meta-analysis

Chen, H¹; Song, B²; Chen, Y³.

Review question / Objective: Lung ultrasound has been used more and more in clinical diagnosis of acute heart failure in recent years. The purpose of this paper is to evaluate the diagnostic value of lung ultrasound in acute heart failure patients based on the existing studies, and to provide a reference for clinical practice.

Information sources: PubMed, Cochrane Library, Web of Science, EMBase, CNKI, Wanfang Data and VIP databases were searched. The time limit for retrieval is from the establishment to November 2022. The keywords including “Cardiac Failure”, “Heart failure”, “Diagnostic Ultrasound”, “Ultrasonography”, “Lung”. Further, we manually searched for relevant studies in a reference list of potentially eligible publications.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 17 October 2022 and was last updated on 17 October 2022 (registration number INPLASY2022100069).

INTRODUCTION

Review question / Objective: Lung ultrasound has been used more and more in clinical diagnosis of acute heart failure in recent years. The purpose of this paper is to evaluate the diagnostic value of lung ultrasound in acute heart failure patients

based on the existing studies, and to provide a reference for clinical practice.

Condition being studied: Acute heart failure has become an increasingly serious public health problem in recent years as the population over the age of 65 continues to grow. Acute heart failure is also a common cause of emergency admissions, and the

2016 European Society of Cardiology Guidelines for the Diagnosis and Treatment of Acute and chronic Heart Failure state that echocardiography remains the most useful and widely used diagnostic method. However, other traditional diagnostic methods, such as medical history and physical examination, electrocardiogram, chest X-ray, serum N-terminal precursor brain natriuretic peptide, lack specificity or sensitivity, and have high requirements on equipment, time and other factors, or are limited by radiation to the applicable population, so they cannot make a rapid and accurate diagnosis of acute heart failure. At present, lung ultrasound is more and more used in the diagnosis of acute heart failure. This paper aims to systematically evaluate the diagnostic value of lung ultrasound in acute heart failure through existing studies and obtain reasonable comprehensive data, in order to provide a reference for clinical practice.

METHODS

Participant or population: Adults with symptoms of acute heart failure were included.

Intervention: Lung ultrasound was first proposed in the 1990s and has been used in a number of clinical critical cases. Studies have shown that lung fluid accumulation in patients with AHF leads to a decrease in the ratio of air to fluid in the lung, resulting in an increase in acoustic impedance, which is different from surrounding tissues. Sound waves will generate multiple reflection. Therefore, there are multiple acoustic interfaces between fluid and alveoli, comet tail signs (B-lines) can be seen on ultrasound scans of the lungs. Through continuous development and application, lung ultrasound has been proved to be of value in the study of undifferentiated dyspnea and the diagnosis of acute heart failure in recent years, providing clinicians with a simple, rapid, mobile and non-invasive tool. So in this study lung ultrasound was used to evaluate patients to make a diagnosis.

Comparator: The gold standard was the clinical diagnosis of heart failure by cardiologists or experienced physicians combined with history and relevant clinical examination.

Study designs to be included: Cohort studies and randomized controlled trial.

Eligibility criteria: Literature screening was conducted independently by two researchers. All qualifying studies should meet the following criteria: (1) Adults with symptoms of acute heart failure were included. (2) The types of studies included were cohort studies. (3) The gold standard for inclusion was the clinical diagnosis of heart failure by cardiologists or experienced physicians combined with history and relevant clinical examination. (4) The languages of the included literature were Chinese and English. (5) There is no restriction on the type of ultrasound instrument and the method of zonal lung ultrasound scanning, and the location of pulmonary ultrasound examination is not limited to the emergency department. Studies were excluded if they met the following criteria: (1) Duplicate publications. (2) Conference reports, reviews, meta-analyses, editorials, letters, and case reports were excluded. (3) Studies with a sample size of less than 20 were excluded. (4) Excluded studies where data could not be extracted or were incomplete.

Information sources: PubMed, Cochrane Library, Web of Science, EMBASE, CNKI, Wanfang Data and VIP databases were searched. The time limit for retrieval is from the establishment to November 2022. The keywords including "Cardiac Failure", "Heart failure", "Diagnostic Ultrasound", "Ultrasonography", "Lung". Further, we manually searched for relevant studies in a reference list of potentially eligible publications.

Main outcome(s): True positive value (TP), false positive value (FP), false negative value (FN), true negative value (TN).

Quality assessment / Risk of bias analysis: Quadas-2 tool was used for quality evaluation of the included studies. Funnel plot and asymmetry test are used to visually assess publication bias. $P < 0.05$ indicates a statistically significant difference.

Contributions of each author:

Author 1 - Hao Chen.

Author 2 - Bing Song.

Author 3 - Yang Chen.

Strategy of data synthesis: Statistical analysis was performed using Stata 16.0 software, and Bivariate mixed effects model was applied. Firstly, the meta-disc 1.4 software was used to evaluate the threshold effect by Spearman correlation analysis. If there is no threshold effect among studies, evaluation indexes can be directly combined. The Sensitivity, Specificity, positive likelihood ratio, negative likelihood ratio and diagnostic odds ratio were calculated. Forest plot of sensitivity and specificity were also drawn. SROC curve can also be fitted. On the contrary, if there is threshold effect between studies, SROC curve should be fitted directly. Deeks' funnel plot asymmetry test was used to determine whether there was publication bias. $P < 0.05$ was considered statistically significant. If the heterogeneity test $I^2 > 50\%$, significant heterogeneity exists, and meta-regression was performed to further explore the source of heterogeneity. Using Fagan's plot to display the posterior probability.

Subgroup analysis: Meta-regression was used to further find the source of heterogeneity, and regression analysis was conducted with whether it was a prospective study, whether blind method was used and whether diuretic pretreatment was implemented as variables.

Sensitivity analysis: Sensitivity analyses were subsequently performed to assess the stability of the pooled effects by omitting each study sequentially.

Country(ies) involved: The First School of Clinical Medicine, Lanzhou University.

Keywords: heart failure; ultrasonography; lung; diagnosis; Meta-analysis.