INPLASY PROTOCOL

To cite: Yang et al. Prediction of weaning outcome in mechanically ventilated patients by bedside ultrasound: An updated Systematic Review and Meta-Analysis. Inplasy protocol 202040008. doi: 10.37766/inplasy2020.4.0008

Received: 02 April 2020

Published: 02 April 2020

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Support: **None**

Review Stage at time of this submission: **Piloting of the study selection process.**

Conflicts of interest:
None.

Prediction of weaning outcome in mechanically ventilated patients by bedside ultrasound: An updated Systematic Review and Meta-Analysis

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ABSTRACT

Objective: **To judge the predictive value of weaning outcome by ultrasonic examination of lung, diaphragm, heart and larynx at bedside. Unlike previous reviews, we will include all possible ultrasound examination methods, including diaphragmatic excursion (DE), diagram thickening fraction (DTF), B-predominance, lung ultrasound score (LUS), pleural effusion, Examination of cardiac systolic and diastolic function, air column width differences (ACWD) and air column width ratio (ACWR).**

Information sources: **We will search the target study from MEDLINE, Embase, CENTRAL, the Web of Science, and reviews of grey literature on Open Grey. There is no restriction will be imposed on the data of publication, and all studies published before March 2020 will be included. And no language restrictions on retrieval at the same time.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 02 April 2020 and was last updated on 02 April 2020 (registration number INPLASY202040008.

INTRODUCTION

Objectives / Review question: **To judge the predictive value of weaning outcome by ultrasonic examination of lung, diaphragm, heart and larynx at bedside. Unlike previous reviews, we will include all possible ultrasound examination methods, including diaphragmatic excursion (DE), diagram thickening fraction (DTF), B-predominance, lung ultrasound score (LUS), pleural effusion, Examination of cardiac systolic and diastolic function, air column width differences (ACWD) and air column width ratio (ACWR).**

Condition being studied: Mechanical ventilation is an intervention to provide respiratory support, which is used by an estimated 15 million patients worldwide each year, but about 30% of patients have difficulty weaning. Long-term mechanical ventilation is associated with an increased risk of death and significantly higher medical costs, so we need to reduce the number of offline failures. Therefore, it is necessary to find out the cause of patients' weaning failure, which is a difficult problem faced by clinicians. It is known that the factors of weaning failure include thinning of diaphragm, decreased range of motion of diaphragm, pulmonary edema, pulmonary consolidation, pleural effusion, poor cardiac function, laryngeal edema and so on. The purpose of this study is to analyze the ability of existing studies to predict weaning failure and to provide ideas for further research.

METHODS

Participant or population: Inclusion: Adults with mechanical ventilation who are ready to weaning. Exclusion: The date were incomplete, study with less than 20 patients, and ultrasound examination of other parts.

Intervention: There are several ultrasound methods to predict weaning results. Lung ultrasound: Weaning-included pulmonary oedema is a common cause of weaning failure. Some studies suggested that when LUS higher allows the diagnosis of spontaneous breathing trial failed. Other studies have suggested that pleural effusion will affect the outcome of weaning. Diaphragm ultrasound: a. The diaphragmatic excursion(DE): Mearsure the distance that the diaphragm is able to move during the respiratory cycle. b. The diaphragm thickening fraction(DTF): the variaion in the thickness of the diaphragm during respiratory effort. And we will find the connection between DE, DTF and weaning outcome. Laryngeal ultrasound: The vocal cords, surrounding soft tissues and the air passage through the vocal cords were observed. Cardiac ultrasound: To judged the ability of cardiac function to predict the outcome of weaning.

Comparator: To evaluate the predictive value of ultrasound in weaning results.

Study designs to be included: Observational studies, especially cohort studies.

Eligibility criteria: Adults with mechanical ventilation who are ready to weaning.

Information sources: We will search the target study from MEDLINE, Embase, CENTRAL, the Web of Science, and reviews of grey literature on Open Grey. There is no restriction will be imposed on the data of publication, and all studies published before March 2020 will be included. And no language restrictions on retrieval at the same time.

Main outcome(s): Weaning failure. (Such as SBT failure, reintubation, NIMV, death, and inability to maintain spontaneous breathing after weaning).

Additional outcomes: None.

Data management: The data will include study design methods, sample size, demographic and baseline characteristics, diagnostic criteria for offline failure, and ultrasonic measurement limits. The data will be recorded in the EXCEL sheet, and the records of the details will be recorded in a separate WORD document.

Quality assessment / Risk of bias analysis: The literature quality evaluation method adopts the QUADAS-2 diagnostic test quality evaluation form, which is evaluated independently by two participants. If the conclusions are inconsistent, the final decision will be made by the third-party experts.

Strategy of data synthesis: At least 4 studies can be used for data merging calculation. If there are less than 4 studies using this ultrasonic measurement method, a systematic evaluation will be carried out. We will use the bivariate model proposed

by Reitsma to obtain the comprehensive evaluation values of sensitivity and specificity of each study are changed by logit, and the diagnostic test meta analysis will be carried out.

Search strategy: Search ((((((((((((((((((((((((((((((("Ultrasonography, Doppler"[Mesh]) OR "Ultrasonic Waves"[Mesh]) OR "Ultrasonics"[Mesh]) OR "Ultrasonography"[Mesh]) OR Diagnostic Ultrasound[Title/Abstract]) OR Diagnostic Ultrasounds[Title/Abstract]) OR Ultrasound, Diagnostic[Title/Abstract]) OR Ultrasounds, Diagnostic[Title/Abstract]) OR Ultrasound Imaging[Title/Abstract]) OR Imagings, Ultrasound[Title/Abstract]) OR Echotomography[Title]) OR Ultrasonic Imaging[Title]) OR Sonography, Medical[Title/Abstract]) OR Medical Sonography[Title/Abstract]) OR Ultrasonographic Imaging[Title/Abstract]) OR Imagings, Ultrasonographic[Title/Abstract]) OR Ultrasonographic Imagings[Title/Abstract]) OR Echography[Title]) OR Diagnoses, Ultrasonic[Title/Abstract]) OR Ultrasonic Diagnoses[Title/Abstract]) OR Ultrasonic Diagnosis[Title/Abstract]) OR Echotomography, Computer[Title/Abstract]) OR Computer Echotomography[Title/Abstract]) OR Tomography, Ultrasonic[Title/Abstract]) OR Ultrasonic Tomography[Title/Abstract]) OR Doppler Ultrasound[Title/Abstract]) OR Doppler Ultrasounds[Title/Abstract]) OR Ultrasound, Doppler[Title/Abstract]) OR Ultrasounds, Doppler[Title/Abstract]) OR Doppler Ultrasonography[Title/Abstract]) OR Doppler Ultrasound Imaging[Title/Abstract]) OR Doppler Ultrasound Imagings[Title/Abstract]) OR Imagings, Doppler Ultrasound[Title/Abstract]) OR Ultrasound Imaging, Doppler[Title/Abstract]) OR Ultrasound Imagings, Doppler[Title/Abstract]) OR Ultrasonic[Title]) OR Ultrasound[Title]) OR Ultrasonography[Title]) OR Echocardiography[Title]) OR Bedside-ultrasound[Title])) AND ((((((((((((((("Ventilator Weaning"[Mesh]) OR Weaning, Ventilator[Title/Abstract]) OR Respirator Weaning[Title/Abstract]) OR Weaning, Respirator[Title/Abstract]) OR Mechanical Ventilator Weaning[Title/Abstract]) OR Ventilator Weaning, Mechanical[Title/Abstract]) OR Weaning, Mechanical Ventilator[Title/Abstract]) OR Extubation[Title]) OR Weaning[Title]) OR difficult-to-wean[Title/Abstract]) OR Discontinuation of mechanical ventilation[Title/Abstract]) OR spontaneous breathing trial[Title/Abstract]) OR Postextubation[Title])) OR ((((((Liberation[Title]) OR liberate[Title]) OR weaning[Title]) OR wean[Title])) AND ((((((((((((((((("Respiration, Artificial"[Mesh]) OR Artificial Respiration[Title/Abstract]) OR Artificial Respirations[Title/Abstract]) OR Respirations, Artificial[Title/Abstract]) OR Ventilation, Mechanical[Title/Abstract]) OR Mechanical Ventilation[Title/Abstract]) OR Mechanical Ventilations[Title/Abstract]) OR Ventilations, Mechanical[Title/Abstract]) OR "Interactive Ventilatory Support"[Mesh]) OR Interactive Ventilatory Support[Title/Abstract]) OR "Positive-Pressure Respiration"[Mesh]) OR Positive-Pressure Respiration[Title/Abstract]) OR "Continuous Positive Airway Pressure"[Mesh]) OR Continuous Positive Airway Pressure[Title/Abstract])) OR Ventilator[Title/Abstract]) OR "Ventilators, Mechanical"[Mesh]) OR Respirator[Title/Abstract]) OR Intubated[Title]) OR mechanically ventilated[Title/Abstract])))).

Subgroup analysis: We will conduct a subgroup analysis, including trial types, patient types, ultrasound measurements, and different methods for determining clinical outcomes.

Sensibility analysis: We will evaluate the stability of the meta analysis results at the end, that is, conduct a sensitivity analysis. It includes changing the criteria for selecting literature (conference abstracts or articles), choosing non-English articles or not, changing different observation outcomes (SBT failure only or SBT and weaning failure), and changing statistical models. Then re-conduct the meta analysis to see if the decision of each step will affect the result.

Language: There are no language restrictions.

Coutries involved: All the authors are from China.

Keywords: Bedside ultrasound. Intensive care unit. Mechanical ventilation. Ventilator weaning.

Contributions of each author:

Author 1 - Raise clinical questions and design this meta-analysis. Formulate the retrieval strategy, find the relevant literature, and determine the inclusion and exclusion criteria of the literature. Search the literature and screen the required literature. Evaluate the quality of the research. Extract data. Meta analysis was performed. Write the article.

Author 2 - Search the literature and screen the required literature. Evaluate the quality of the research. Extract data. Meta analysis was performed. Write the article.

Author 3 - Inspectors. Responsible for providing advice when other authors disagree. Modify and submit the article.