Heart & Lung 45 (2016) 132–139

Contents lists available at ScienceDirect

Heart & Lung

journal homepage: www.heartandlung.org

Care of Critically Ill Adults

Efficacy of two noninvasive weaning strategies in intubated patients with chronic obstructive pulmonary disease: A meta-analysis and indirect treatment comparison

Pei-Jun Li, PhD [a], Ting Wang, PhD [a], Jun Xiao, PhD [b], Fa-Ming Jiang, PhD [a], Jian Luo, PhD [a], Chao-Li Shi, MD [a], Guan-Jian Liu, PhD [c], Zong-An Liang, MD [a,*]

[a] Department of Respiratory and Critical Care Medicine, West China School of Medicine/West China Hospital, Sichuan University, No. 37 Guoxue Road, Chengdu, Sichuan 610041, PR China
[b] Department of Intensive Care Unit, West China School of Medicine/West China Hospital, Sichuan University, 37 Guoxue Road, Chengdu 610041, PR China
[c] Chinese Evidence-Based Medicine Center, West China School of Medicine/West China Hospital, Sichuan University, 37 Guoxue Road, Chengdu 610041, PR China

ARTICLE INFO

Article history:
Received 7 October 2015
Received in revised form
26 December 2015
Accepted 29 December 2015
Available online 21 January 2016

Keywords:
Chronic obstructive pulmonary disease
Noninvasive ventilation
Weaning
Meta-analysis
Indirect treatment comparison

ABSTRACT

The purpose of our indirect comparison was to explore the optimal switching time to noninvasive ventilation for further weaning in patients with chronic obstructive pulmonary disease (COPD) undergoing invasive mechanical ventilation. A comprehensive literature search was performed to identify randomized controlled trials comparing noninvasive weaning at spontaneous breathing trial (SBT) failure after meeting simple weaning criteria or at the pulmonary infection control window (PIC window) with conventional invasive weaning in COPD patients. Using conventional invasive weaning as a bridge, we indirectly compared the two noninvasive weaning strategies using the Bucher approach. Noninvasive weaning at SBT failure after meeting simple weaning criteria was associated with an extended duration of endotracheal mechanical ventilation (standardized mean difference 1.90, 95% CI 1.27–2.53, $P < 0.001$) compared with noninvasive weaning at the PIC window. No significant differences in mortality or the rate of ventilator-associated pneumonia were observed. Our study suggests that the PIC window may be a promising switching time for noninvasive weaning in COPD patients.

Introduction

Prolonged invasion ventilation may increase the risk of ventilator-associated pneumonia (VAP) and airway trauma,[1–3] which are closely linked with increased morbidity and mortality.[4] Discontinuing mechanical ventilation presents a challenging period. Esteban et al have analyzed the evolution of mechanical ventilation practices over time among a large and diverse group of patients with respiratory failure and concluded that 40% of the total ventilator time is dedicated to the weaning process.[5] To reduce intubation-associated complications and mortality in critically ill, mechanically-ventilated patients, investigators have explored the effect of noninvasive weaning, which involves early extubation before meeting conventional weaning criteria and the direct application of noninvasive ventilation. A recent Cochrane systematic review suggested that noninvasive weaning may reduce mortality and the rate of VAP predominantly in intubated patients with chronic obstructive pulmonary disease (COPD) compared with conventional invasive weaning.[6]

Choosing the appropriate time to switch to noninvasive ventilation plays a crucial role in promoting successful noninvasive weaning. Nava et al first conducted a randomized controlled trial (RCT) on the application of noninvasive weaning in intubated COPD patients, which considered spontaneous breathing trial failure after meeting simple weaning criteria (Pre-SBT success) as the switching time.[7] Pre-SBT success means meeting the

Abbreviations: CIs, confidence intervals; COPD, chronic obstructive pulmonary disease; ETMV, endotracheal mechanical ventilation; ICU, intensive care unit; PIC window, pulmonary infection control window; RCT, randomized controlled trial; RR, risk ratio; SBT, spontaneous breathing trial; SMD, standardized mean difference; VAP, ventilator associated pneumonia.

* Corresponding author. Tel.: +86 18980601259; fax: +86 028 85422377.
E-mail address: za_liang319@163.com (Z.-A. Liang).

0147-9563/$ – see front matter © 2016 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.hrtlng.2015.12.008

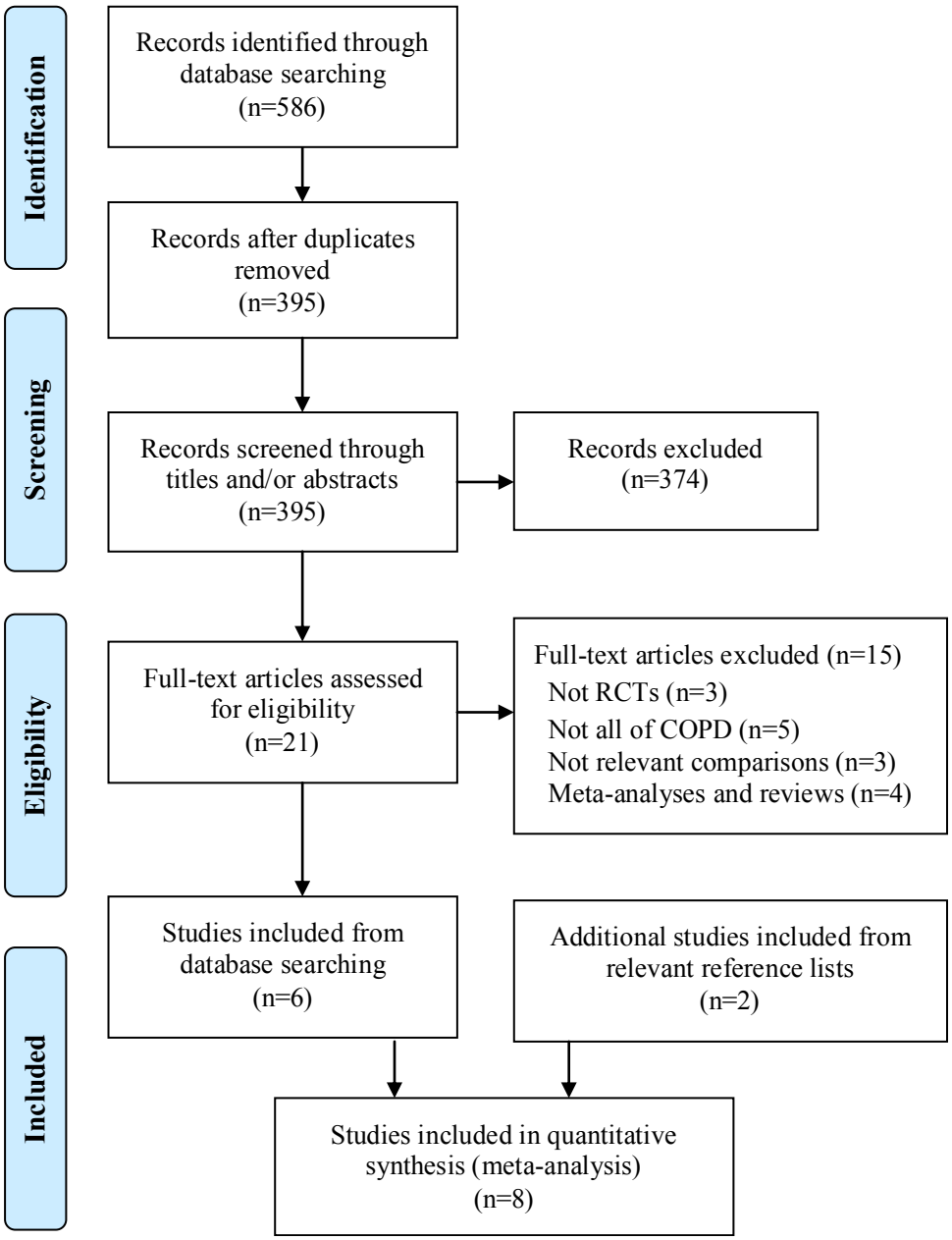

Fig. 1. Study flow diagram. COPD, chronic obstructive pulmonary disease; RCT, randomized controlled trial.

simple weaning criteria as assessed by oxygenation status, mental status, cough ability, and clinical condition, but failing an SBT. The trial concluded that sequential noninvasive weaning during this period may decrease the weaning time and reduce mortality and the rate of VAP compared with conventional invasive weaning.

Similar clinical benefits have also been demonstrated with another noninvasive weaning strategy of adopting the pulmonary infection control window (PIC window) as the switching time for intubated COPD patients.[8] The PIC window involves significantly reduced radiographic infiltrations, decreased respiratory secretions, a normal or near-normal body temperature, and a normal leukocyte count. The exact and optimal time as a generally accepted boundary of standard switching, however, has not been determined. To date, there are no published RCTs on a head-to-head comparison of clinical efficacy of the two noninvasive weaning strategies.

Indirect treatment comparison has become a promising method to resolve such issues, when there is no direct evidence from randomized trials.[9,10] If direct evidence of both A versus C and B versus C are available, an adjusted indirect comparison of A versus B will be conducted using the same intervention C as a bridge.[11,12] Therefore, we searched RCTs comparing noninvasive weaning at the two switching times with conventional invasive weaning in intubated patients with COPD. Then, a relevant adjusted indirect comparison was performed to explore the optimal time for noninvasive weaning to further reduce mortality and the rate of VAP.