



ORIGINAL ARTICLE

Different spontaneous breathing trials in patients with atrial fibrillation



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Ventilator weaning

Abstract

Introduction: Weaning from mechanical ventilation is one of the most important and challenging problems for most intensive care unit (ICU) patients. Spontaneous breathing trial (SBT) is the most common method used to evaluate patients' ability to breathe by themselves and plays an important role in decision making for weaning. The aim of our study was to investigate the effect of different methods of SBT in respiratory care unit (RCU) patients with atrial fibrillation (AF) on weaning outcome.

Methods: We retrospectively analyzed different methods of SBT in patients with and without AF. We enrolled RCU patients who required mechanical ventilation and had undergone transthoracic echocardiography from January 2011 to January 2012.

Results: There was a higher SBT passing rate among AF patients who received pressure support ventilation (PSV) trial than in those who received T-piece trial (92.5% vs. 73.1%, $p=0.041$). The weaning rates between these two groups were not significantly different (83.8% vs. 94.7%, $p=0.403$). Total ventilator days were longer in T-piece group than in PSV group (median 40.0, IQR: 18.2–125.1 days vs. 33.0, IQR: 29.6–51.0 days respectively, $p=0.580$), but this difference was not statistically significant. These results were not found in patients without AF.

Conclusions: The use of PSV trial might be considered first instead of T-piece trial for SBT when AF patients were ready to wean.

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Introduction

Weaning from mechanical ventilation is one of the most important and challenging problems for most intensive care unit (ICU) patients. Prolonged mechanical ventilation is associated with higher mortality and varied morbidity.¹ It

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is well known that weaning failure is associated with longer use of mechanical ventilation, higher infection rate, longer ICU stay, longer hospital stay, and higher mortality rate.² Up to the present time, spontaneous breathing trial (SBT) is the most common method used to evaluate patients' ability to breathe by themselves and plays an important role in decision making for weaning.³ When patients are ready to wean, the weaning process should be initiated with the first SBT as soon as possible. Nevertheless, about 15–30% of the patients will be re-intubated even if they are able to tolerate (or pass) the SBT.^{4,5}

The most commonly performed SBT uses either T-piece or pressure support ventilation (PSV). Since weaning failure is very complex and may involve cardiac, pulmonary, musculoskeletal, and even autonomic problems, different SBT may play different role in the weaning process. The studies of different SBT on different patients are relatively uncommon. However, according to the statement of the sixth international consensus conference on intensive care medicine, performing SBT with either PSV or T-piece is recommended when the patients are ready to wean because the rates of passing the SBT and successful extubation are comparable between PSV and T-piece trial. However, there is no further subgroup analysis for patients with various causes of cardiac dysfunctions.³ Belén Cabello et al. monitored cardiovascular and respiratory responses in difficult-to-wean patients. They used Swan-Ganz and tried three different methods of SBT, including PSV + PEEP (post-end-expiratory pressure), PSV + ZEEP (zero post-end-expiratory pressure), and T-piece. PAOP (pulmonary artery occlusion pressure) and respiratory rate measured when patients used T-piece were significant higher as compared with those used PSV + PEEP or PSV + ZEEP. They concluded that compared with T-piece, PSV + PEEP and PSV + ZEEP might improve more in breathing pattern, inspiratory muscle effort, and cardiovascular response.

Atrial fibrillation (AF) is the most common arrhythmia. There is a higher rate of AF in ICU patients than in the general population. AF can be considered to be either a cardiac or a non-cardiac disease. AF associated with heart failure, ischemic heart disease, and significant valvular heart disease is usually considered to have a cardiac component. On the other hand, age and inflammation related with AF is usually considered to be of non-cardiac origin.⁶ AF is known to result in a prolonged ICU stay, prolonged hospital stay, and prolonged use of mechanical ventilation. AF is common in ICU patients and may impair cardiac function. In this context, it is clinically relevant to investigate the effect of AF on the weaning from mechanical ventilation among ICU patients.

To the best of our knowledge, the effect of AF on SBT and successful weaning has not yet been well investigated. In this study we would like to research the effect of AF on the rates of passing SBT and of successful weaning among ICU patients.

Materials and methods

Study population

This retrospective observational study was conducted in the respiratory care unit (RCU) at Taipei Veterans General

Hospital in Taiwan. From January 2011 to January 2012, all patients admitted to RCU were reviewed. Patients were excluded in cases where one of the following conditions applied: (1) invasive mechanical ventilation was not used (2) did not undergo SBT, e.g. self-extubated, they had died, or refused extubation, (3) did not undergo transthoracic echocardiography, (4) patients with new onset AF or paroxysmal AF (Fig. 1). This study was approved by the Institutional Review Board of Taipei Veterans General Hospital (VGHTPE-IRB No. 2013-05-16BC), and informed consent was waived.

Weaning protocol

In our RCU, physicians screened patients twice daily. When patients were considered to be ready for weaning, the rapid shallow breathing index (RSBI) would be checked first. The patients usually received SBT when there was (1) significant improvement or resolution of the underlying causes of respiratory failure, (2) the fraction of inspired oxygen (F_{iO_2}) $\leq 40\%$, (3) PEEP ≤ 8 cmH₂O, (4) PaO₂/FIO₂ ≥ 200 mmHg, (5) stable hemodynamic without the use of inotropic agents, and (6) RSBI ≤ 105 /min/L. We started SBT with either T-piece or PSV for 30 min. The decisions for SBT method were based on a lottery draw. Once SBT failed, the patient would receive mechanical ventilation as soon as possible. SBT was considered to have failed when (1) respiratory rate ≥ 30 per minute, (2) blood pressure increased by 10%, (3) presence of diaphoresis, (4) marked use of accessory respiratory muscles, (5) respiratory rate divided by tidal volume ≥ 105 breaths per liter per minute, and (6) persistent arterial oxygen saturation $\leq 88\%$ measured by pulse oximeter.

Definitions

In our study, the AF group was defined by electrocardiographical changes for more than 7 days, which was persistent AF, of each patient.⁷ Patients with paroxysmal AF and new onset AF were excluded. Heart failure was defined according to the echocardiogram of each patient. Our patients had echocardiography during admission at RCU before weaning. The definition of impaired cardiac function was LVEF $< 50\%$ or significant valvular heart disease. We consulted the cardiologist for echocardiography and evaluation of cardiac dysfunction. The measurement of E/Ea ratio, clinical symptoms/signs, and LVEF were used for the diagnosis for diastolic dysfunction according to the guidelines.⁸ When the patient passed SBT, weaning would be performed immediately. Weaning failure was defined as re-intubation within 48 h after coming off mechanical ventilation.³ The criteria for re-intubation included (1) respiratory rate ≥ 35 breaths per minute, (2) labored breathing as evidenced by overuse of accessory muscles or paradoxical movement, (3) persistent arterial oxygen saturation $\leq 88\%$ measured by pulse oximeter, (4) blood pressure increased by 10%, and (5) heart rate ≥ 120 beats per minute

Data collection

The demographic characteristics and clinical data including age, sex, body mass index (BMI), preexisting diseases,

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