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Patients' weaning from mechanical ventilation: Complete versus incomplete ventilator bundle implementation

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ABSTRACT

Aims and objectives: To examine the effect of complete versus incomplete ventilator bundle implementation on weaning scores among mechanically ventilated patients.

Background: Implementation of the elements bundle alone or with other preventive measures is associated with reducing ventilator-associated pneumonia (VAP) rates. Few research studies were conducted nationally and internationally on the ventilator bundle practices and its effect on weaning from mechanical ventilation.

Design: Quasi-experimental design was utilized in this study.

Methods: A convenient sample of 60 mechanically ventilated patients including all modes except continuous positive airway pressure (CPAP) mode were enrolled and then divided randomly into study and control group. The study group included patients for whom all elements of the ventilator bundle were implemented completely by the trained nurses while the control group included patients who received traditional care where ventilator bundle elements were not done completely. Sociodemographic, medical data, ventilator bundle compliance checklist, and Burns' wean Assessment Program (BWAP) checklist were collected and evaluated.

Results: There was a significant statistical difference between study group and control group regarding the duration of mechanical ventilation and weaning scores. As most of the study group demonstrated shorter duration of the connection to mechanical ventilation when compared to the control group. As well, the study group obtained higher weaning scores than the control group.

Conclusion: The study group who received complete ventilator bundle practices has got higher weaning scores and shorter duration of the connection to mechanical ventilator than the control group.

Relevance to clinical practice: implementation of complete ventilator bundle elements together among mechanically ventilated patients by the trained nurses could be effective in accelerating the safe weaning of patients and decreasing the duration of the connection to mechanical ventilation.

1. Introduction

Mechanical ventilation is a lifesaving procedure which is indicated in critically ill patients for many reasons. These reasons include managing the patient's respiration during treatment of severe traumatic brain injury, oxygenating the patients' lung when the ventilator efforts are deficient (Suzanne & Bare, 2010). Although most of the patients need mechanical ventilation for a short period of time, some patients may need ventilator support for a long time. This prolongation of ventilator support may potentiate the risk of lethal complications (Figueroa-Casas et al., 2015). These complications include barotraumas, aspiration, ventilator-associated pneumonia, stress ulcer, gastrointestinal bleeding, deep venous thrombosis (Jones & Fix, 2014) and weaning failure (Grap, 2009). Weaning process aims to disconnect the patients from ventilator support to breathing without assistance from ventilation (Epstein & Walkey, 2013.

Readiness for weaning from mechanical ventilation may include many criteria that include treating the cause that made the patient requires mechanical ventilation, adequate respiratory efforts, cough reflex, and absence of profuse bronchial secretions; stabilization of hemodynamic status, stabilization of metabolic functions; adequate oxygenation and no sedation to ensure patient's cooperation effectively (Pu et al., 2015). Mechanical ventilation is a lifesaving procedure which is indicated in critically ill patients for many reasons. These reasons include managing the patient's respiration during treatment of severe traumatic brain injury, oxygenating the patients' lung when the ventilator efforts are deficient (Suzanne & Bare, 2010). Although most of the patients need mechanical ventilation for a short period of time, some patients may need ventilator support for a long time. This prolongation of ventilator support may potentiate the risk of lethal complications

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The Institute for Healthcare Improvement (IHI) developed and implemented the evidence-based ventilator bundle practices for healthcare-related infections that delay weaning (Evans, 2005). The Ventilator Bundle encompasses maintaining of 30–45° head of the bed elevation, mouthwash with chlorhexidine, daily sedation interruption and daily assessment of readiness to extubate, peptic ulcer disease prophylaxis, and deep venous thrombosis prophylaxis. Implementation of ventilator bundle aimed to improve mechanically ventilated patients' condition that facilitates the early weaning and decrease the length of the ICU stay (O'Keefe-McCarthy, Santiago, & Lau, 2008).

Previous studies have illustrated that implementation of the ventilator bundle individual element alone or with other preventive measures are accompanied by a reduction of VAP rates. But few researchers studied the impact of complete ventilator bundle practices compliance on patients' weaning from mechanical ventilator and revealed that implementation of these practices may reduce the complications and improve the patient condition (Keyt, Faverio, & Restrepo, 2014). The IHI had defined operationally the ventilator bundle compliance as the percentage of mechanically Ventilated patients in the ICU for whom all Ventilator Bundle elements are performed and documented on daily basis in the medical record with a target compliance of 95% (Resar et al., 2005). Therefore, the researchers aimed to examine and compare the effect of complete versus incomplete VAP bundle implementation on weaning and duration of patients' connection to mechanical ventilation among critically ill patients in adult ICU.

2. Problem statement

Patients who experience difficulty in weaning need a longer hospital stay and have higher morbidity and mortality. Consequently, trials to decrease the duration of weaning are desirable to reduce the length of mechanical ventilation and related complications. Standardized weaning practices are safe and effective in reducing the time spent on mechanical ventilation. However, the evidence supporting their use in practice is inconsistent. The discordant results of studies may reflect the fact that weaning protocols differ in composition and are implemented in different environments by various healthcare providers (Blackwood et al., 2009).

3. Purpose of the study

To compare the effect of complete versus incomplete ventilator bundle implementation on weaning and duration of mechanical ventilation among patients in medical ICU.

4. Objectives of the study

4.1. The objectives of the study were to

1. to assess weaning score in the study and control group
2. to assess length of mechanical ventilation in the study and control group
3. to compare the weaning scores between the study and control group
4. to compare the length of mechanical ventilation in the study and control group

5. Research methodology

5.1. Study design

The quasi-experimental two-group design was utilized among critically ill patients in medical ICU affiliated to private health sector at El Maadi District in Egypt. The rationale for that selection is to determine causal relationships by applying a treatment or condition to one group and comparing the outcome with a control group. Moreover, the validity of quasi-experimental research can be improved by specific methods that help in identifying a comparison group, controlling bias, and using suitable statistical analyses (Campbell & Stanley, 2015).

5.2. Research hypothesis

The study groups of patients who receive complete ventilator bundle practices together by the trained nursing personnel will get higher weaning scores and shorter duration of the connection to mechanical ventilation than the control group who will receive traditional (incomplete) ventilator bundle practices.

5.3. Study setting

The study was conducted in a critical care unit in Maadi District private hospital. The nurse-patient ratio was 1:2. That hospital provides other various services including various outpatient clinics, maternity, and obstetrics, medical, surgical and anesthetics.

5.4. Sample and sampling technique

A convenient sample of 60 adult medical and surgical mechanically ventilated patients from September 2013 to September 2015 was included in the study. The exclusion criteria included those patients who were diagnosed with pulmonary embolism or had gastrointestinal bleeding prior to admission. After selection of all eligible patients who met the inclusion criteria, they were divided randomly into the study and control groups. The random assignments were generated by computer and then concealed in sealed envelopes. Patients' assignment to the intervention group or the control group was known only to the study investigators. One investigator accompanied the study group of patients with their trained nurses and the other accompanied the control group with their nurses all over the extended period of research.

5.4.1. Baseline data sheet

It included patient's age, gender, and smoking status, current medical diagnosis, and co-morbidities.

5.4.2. Ventilator bundle compliance checklist

It was adopted based on Institute for Healthcare Improvement guidelines (Resar et al., 2005) to assess the compliance with ventilator bundle practices. This tool was examined by a panel of three medical and three nursing experts to assess its validity and reliability. The principal components of the ventilator bundle checklist were as follows; elevation of the head of the bed, mouth care with chlorhexidine, daily sedation interruption, and assessment of readiness to extubate, peptic ulcer prevention and deep venous thrombosis prophylaxis. The entire bundle was considered only compliant if all 5 items were completed. All the critical care nurses were educated in a seminar conference about the complete implementation of ventilator bundle 2 times on a daily basis and maintaining compliance throughout the mechanical ventilation period. If the compliance with the bundle implementation was less than 95%, it would be considered noncompliant and these cases were excluded from the study group.

The compliance rate was calculated by dividing actual daily compliance with the number of times the patient has been receiving ventilation. This figure was multiplied by 100 to calculate percentage of