The Brazilian Journal of
INFECTIOUS DISEASES

www.elsevier.com/locate/bjid

Original article

The effectiveness of a bundle in the prevention of ventilator-associated pneumonia

Cléria Rodrigues Ferreira[a], *Denis Fabiano de Souza*[a], *Thulio Marques Cunha*[a], *Marcelo Tavares*[b], *Samir Seme Arab Reis*[c], *Reginaldo Santos Pedroso*[d], *Denise Von Dolinger de Brito Röder*[e,*]

[a] *Faculdade de Medicina, Universidade Federal de Uberlândia, Uberlândia, MG, Brazil*
[b] *Faculdade de Matemática, Universidade Federal de Uberlândia, Uberlândia, MG, Brazil*
[c] *Instituto do Coração do Triângulo Mineiro, Uberlândia, MG, Brazil*
[d] *Escola Técnica de Saúde, Universidade Federal de Uberlândia, Uberlândia, MG, Brazil*
[e] *Instituto de Ciências Biomédicas, Universidade Federal de Uberlândia, Uberlândia, MG, Brazil*

ARTICLE INFO

Article history:
Received 25 July 2015
Accepted 4 March 2016
Available online 18 April 2016

Keywords:
Ventilator-associated pneumonia
Checklist
Cost
Mortality

ABSTRACT

Objectives: The aim of this study was to evaluate the impact of a bundle called FAST HUG in ventilator-associated pneumonia, weigh the healthcare costs of ventilator-associated pneumonia patients in the intensive care unit, and hospital mortality due to ventilator-associated pneumonia.

Material and methods: The study was performed in a private hospital that has an 8-bed intensive care unit. It was divided into two phases: before implementing FAST HUG, from August 2011 to August 2012 and after the implementation of FAST HUG, from September 2012 to December 2013. An individual form for each patient in the study was filled out by using information taken electronically from the hospital medical records. The following data was obtained from each patient: age, gender, reason for hospitalization, use of three or more antibiotics, length of stay, intubation time, and outcome.

Results: After the implementation of FAST HUG, there was an observable decrease in the occurrence of ventilator-associated pneumonia ($p < 0.01$), as well as a reduction in mortality rates ($p < 0.01$). In addition, the intervention resulted in a significant reduction in intensive care unit hospital costs ($p < 0.05$).

Conclusion: The implementation of FAST HUG reduced the number of ventilator-associated pneumonia cases. Thus, decreasing costs, reducing mortality rates and length of stay, which therefore resulted in an improvement to the overall quality of care.

* *Corresponding author.*
E-mail address: denise.roder@ufu.br (D.V.D.d.B. Röder).
http://dx.doi.org/10.1016/j.bjid.2016.03.004

Introduction

Ventilator-associated pneumonia (VAP) is the second most common health care-associated infections (HAI) in the United States and is responsible for 25–42% of all infections that occur in intensive care units (ICUs). Among those patients requiring mechanical ventilation, mortality rates are 46% in patients with VAP.[1–3] Patients with VAP have significantly increases the length of hospital stay and thus healthcare costs. This however could be reduced if steps are taken to improve the care provided for the ventilated patient. Therefore, the prevention of VAP must be a priority in the care of critically ill patients.[4–6]

Health professionals continually strive to improve the care provided for patients admitted to ICU.[3] The results of recent quality improvement initiatives suggest that many cases of VAP could be prevented by paying careful attention when delivering care, which is the primary role of the FAST HUG checklist. FAST HUG is a mnemonic aid to ICU healthcare professionals to prepare for patient rounds, help identify and prevent medication errors, promote patient safety, and maximize therapeutic interventions.[3,7]

In this study, we evaluate the impact of FAST HUG in the occurrence of VAP, weigh the healthcare costs of VAP patients in the ICU, and hospital mortality due to VAP.

Materials and methods

Study design

The study was performed in a private hospital in the city of Uberlandia, Minas Gerais-Brazil that has an 8-bed ICU. It was divided into two phases: before implementing FAST HUG, from August 2011 to August 2012 and after the implementation of FAST HUG, from September 2012 to December 2013. The research was conducted after the approval of the Ethics Committee on Human Research of the Federal University of Uberlandia, according to the registry protocol CEP/UFU: 442.151/2013.

An individual form for each patient in the study was filled out by using information taken electronically from the hospital medical records. The following data was obtained from each patient: age, gender, reason for hospitalization, use of three or more antibiotics, length of stay, intubation time, and clinical outcome. Furthermore, the FAST HUG checklist, which corresponds to 10 items, was followed and printed out daily by the nursing staff.

The study inclusion criteria were age over 18 years, be hospitalized at the study hospital, and using a mechanical ventilator (MV) for over 48 h.

Definitions

FAST HUG is a checklist that highlights key aspects of general care for critically ill patients. The mnemonic aid stresses the importance of the following clinical practices: feeding, analgesia, sedation, thromboembolic prophylaxis, head of bed elevation, stress ulcer prophylaxis, and glycemic control. FAST HUG can be applied to all ICU patients.[3] According to scientific literature, there are also three important actions to be taken in order to reduce VAP, which are: oral hygiene with 2% chlorhexidine, monitoring cuff pressure between 20 and 25 cm of water, and subglottic suction every six hours or whenever necessary.[2,3]

VAP: mechanically ventilated patients whose condition has evolved to the point where a new or progressive pulmonary infiltrate in a chest X-ray. The definition also requires at least two clinical signs and/or laboratory abnormalities that suggest an infectious process such as: fever (>38 °C); leukocytosis (>10,000 mm^{-3}) or leukopenia (<4000 mm^{-3}); presence of purulent tracheal secretion after 48 h of ventilation.[1,3,8]

Statistical analysis

The Kolmogorov–Smirnov and Shapiro–Wilk tests were used to test the normality of all the variables. The Mann–Whitney test was used for the continuous variables with non-parametric distribution and the Wilcoxon test for analyzing the intra-group. Kaplan Meier and Cox regression survival analyses was also used. The chi-square test was applied to compare categorical variables. Furthermore, a binary logistic regression analysis was performed among the groups.

Results

In total 188 patients were included in the survey, with 56 patients in 2011, 79 patients in 2012 and 53 patients in 2013, of which 37 patients had VAP, 20 of whom were diagnosed clinically and 17 clinically and microbiologically.

Table 1 shows the statistical comparison of the patients' clinical characteristics of those with and without VAP. The variables associated with VAP in univariate analysis were use three or more antibiotics prior to infection ($p < 0.001$); enteral nutrition while in the ICU ($p < 0.01$); and tracheostomy ($p < 0.01$). VAP associated mortality rate was 64% ($p < 0.05$) and lastly, the presence of infection represented an additional hospital cost of R$ 7302.70 per day ($p < 0.01$). Through multivariate analysis (Table 2), it was observed that age was an independent factor for VAP ($p < 0.05$; OR 26.99).

The demographic and clinical characteristics of the group of patients with and without the FAST HUG checklist are shown in Table 3. In univariate analysis, the number of antibiotic-therapy days was significantly higher for those who used three or more antibiotics ($p < 0.001$). Furthermore, by using APACHE II, patients undergoing FAST HUG had more severe clinical conditions at admission ($p < 0.01$), which increased the mortality risk ($p < 0.05$). However, after the implementation of FAST HUG, there was a decreased occurrence of VAP among these patients ($p < 0.01$), as well as a mortality reduction ($p < 0.01$). Additionally, the intervention performed in the study resulted in a significant reduction in ICU hospital costs ($p < 0.05$).

Through logistic regression analysis, significantly less days of antibiotic use ($p < 0.0001$) and a lower mortality rate ($p < 0.05$) could be seen as a result of FAST HUG.