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ORIGINAL ARTICLE

Evaluation of risk factors of ventilator associated pneumonia on outcome of acute exacerbation of chronic obstructive pulmonary disease

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KEYWORDS

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Abstract *Background:* Ventilator associated pneumonia (VAP) remains an area of active clinical research with little data about effect of (VAP) on outcome among patients with acute exacerbation of chronic obstructive pulmonary disease.

Materials and methods: A prospective study included patients with COPD exacerbation requiring endotracheal intubation for more than 48 h. Clinical assessment and Quantitative culture done for all patients for the occurrence of VAP.

Results: Out of one hundred fifty two patients 92 patients (60.5%) were with VAP diagnosis. Their mean age was 56.1 ± 15.02 (38 cases developed early while 54 cases developed late VAP). Forty eight cases were discharged (54%) while 44 cases (46%) died. In comparing mean age of both groups 45.08 ± 15.52 and 57.41 ± 16.34 with *P* value 0.003. Prolonged use of antibiotics, re-intubation and steroid use are possible risk factors for VAP with significant *P* values 0.03, 0.001, 0.05 respectively. Age above vs. below 60 showed adjusted odds ratio 5.33; 95% confidence interval 1.59–7.83 with *P* value 0.007. Early vs. late VAP, and prolonged use of antibiotics vs. none showed significant odds ratio 0.32; 95% CI 0.13–0.76, odds ratio 2.85; 95% CI 1.07–7.59 with *P* values 0.01, 0.04 respectively.

Conclusions: Old age, late onset VAP, re-intubation and prolonged use of antibiotics were predictors of mortality in VAP patients with AECOPD.

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Introduction

Ventilator-associated pneumonia (VAP) is defined as pneumonia occurring more than 48 h after initiation of endotracheal intubation and mechanical ventilation [1]. It is the commonest nosocomial infection in the intensive care unit with an incidence ranging from 8–28% in mechanically ventilated patients and was associated with high morbidity and mortality [2,3]. VAP is usually classified as early onset when it develops 4 days from intubation and late onset when it develops after 5 days and this distinction is significant when considering etiological agents, seriousness, prognosis and therapeutic implications [4].

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of morbidity and mortality [5]. Its natural course is characterized by exacerbations which lead to acute respiratory failure and hospitalization [6]. Although non-invasive mechanical ventilation (NIV) is "the standard of care" for management of acute exacerbation of COPD; mechanical ventilation has a role in large number of cases because of clinical condition or no improvement on NIV [7].

Endotracheal intubation is performed among these patients to save life; however, it may be complicated by VAP. Also COPD is a known risk factor for nosocomial lower respiratory infections [8,9]. Various factors which may contribute to the increased risk of lower respiratory infections among these patients include presence of structural lung damage, repeated hospitalization, usage of antibiotic, and corticosteroids. Invasive devices and procedures and antimicrobial therapy create favorable media for antimicrobial resistant pathogen to colonize the aerodigestive tract.

Considering the risk factor of these patients, VAP is expected to have significant adverse outcome on the clinical course of COPD patients. VAP is still good field of clinical research with little data about effect of VAP on outcome among patients with acute exacerbation of chronic obstructive pulmonary disease.

Patients and methods

A prospective, single-center, observational, clinical study in medical intensive care unit (MICU) and respiratory intensive care unit over a 12 months period from July 2012 to March 2014. The study was approved from faculty ethics committee. Because it was an observational study, the requirement for written informed consent was waived.

Inclusion criteria

Patients with acute exacerbation of COPD were eligible for the study if placed on mechanical ventilation (MV) for $\geqslant$48 h.

Exclusion criteria

All patients with clinical and radiological signs suggestive of pneumonia or acute respiratory distress syndrome (ARDS) secondary to pneumonia on admission were excluded.

Data collection

For each patient the following data are collected: demographic data, admission diagnosis, co morbid condition, date of MV, date of VAP diagnosis, clinical pulmonary infection score at the day of VAP diagnosis, possible risk factors for VAP; prior use of antibiotics >7 days, re-intubation, diabetes mellitus, recent surgery, oral steroid use >2 weeks. Result of quantitative cultures of endotracheal aspirates in term of identified organism and their antimicrobial resistance patterns, duration of mechanical ventilation, intensive care unit length of stay (ICU LOS) and patient outcome with either discharge from ICU or died.

The eligible patients were carefully followed up for signs of VAP. This included apart from clinical examination, regular recording of body temperature, observance of tracheal aspirate appearance, leukocyte count and chest radiograph.

The diagnosis of VAP was based on the American College of Chest Physicians criteria as an association of a new or progressive consolidation on chest radiology plus at least two of the following variables: fever greater than 38 °C, leukocytosis or leukopenia, and purulent secretions (ATS, 2005) [10].

VAP is classified as follows

Early onset when it develops 3–5 days from intubation; and late onset when it develops after 5 days. Modified clinical pulmonary infection score is calculated at the day of VAP diagnosis [11]. Patients with clinical diagnosis of VAP (based on the above criteria) underwent endotracheal aspirate (ETA). Quantitative culture done for all patients and the threshold for ETA was considered as 10^5 cfu/ml. Growth of any organism below this threshold was assumed to be colonization or contamination.

Statistical analysis

All statistical analyses were performed using SPSS version 14.0 software (Chicago, IL, USA). Categorical variables were analyzed using the c2 test or Fisher's exact test. Continuous variables were compared using Student t test or the Mann–Whitney U test. Multivariate logistic regression analyses were performed to identify the risk factors. Statistical significance was set to a value of $P \leqslant 0.05$.

Results

During the study period 152 patients were enrolled and divided into two groups VAP group 92 patients (60%) and without VAP group 60 patients (40%). The mean age was lower in VAP patients and most of them were in middle age (52.3%) and of male gender (63%). ICU length of stay and duration of mechanical ventilation were statistically significantly longer in VAP group, and so CPIS. Mortality was more in VAP patients as shown in Table 1.

There were 38 patients (41%) developed early VAP while 54 patients (59%) developed late VAP. Late one was associated with longer ICU length of stay, duration of MV, higher CPIS and higher mortality than early VAP and the P value was highly significant as shown in Table 2.

As regards possible risk factors for early vs. late VAP, prolonged antibiotic use was more in late VAP with significant P value; also re-intubation was recorded more in late VAP patients as shown in Table 3.