Ventilator Associated Pneumonia-Incidence and Outcome in Adults in Medical Intensive Care Unit of a Tertiary Care Hospital of North India

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Abstract

Background: Various studies reveal that pneumonia complicates a majority of patients in intensive care units (ICUs) who are on invasive mechanical ventilation (MV). Up to 50% of such patients die of this disease, however, the mortality varies in different population groups, different underlying indicator diseases and also among different ICUs. This study was carried out to observe the profile of ventilator associated pneumonia (VAP) and its mortality among our patients, as per age and sex, admitted in the ICU of a tertiary care hospital.

Methods: A 14 months study of admitted patients was conducted in our ICU to see the pattern of pneumonia among ventilated patients. VAP was diagnosed according to clinical pulmonary infection score (CPIS) scoring system where a score > or =6 was taken as significant.

Results: The study showed that among a total of 178 patients admitted in the ICU, 92 (51.68%) were managed with invasive MV. Out of these 92 patients, 12 (13.04%) developed VAP as per CPIS scoring system. Out of 12 patients, 6 died, revealing 50% mortality among VAP patients.

Conclusion: VAP occurred in our ICU setup in 13.04% patients on MV over a period of 13-month with a VAP rate of 17.09/1000 days on MV. The mortality among VAP patients in our ICU was 50% in comparison to overall mortality of 48.91% in all mechanically ventilated patients.

Key words: Incidence, Intensive care unit, Mechanical ventilation, Mortality, Ventilator associated pneumonia

INTRODUCTION

Ventilator-associated pneumonia (VAP) is defined as pneumonia occurring more than 48 h after patients have been intubated and received mechanical ventilation (MV). However, the appropriate definition of VAP is subjective as significant variability among observers is noted.¹² VAP is classified as early- and late-onset disease occurring during the first 4 days or beyond 4 days of patient admission. Pneumonia is the second most common nosocomial infection in critically ill patients, affecting 27% of all critically ill patients.³ 86% of nosocomial pneumonia are associated with MV and are termed VAP. VAP typically affects critically ill persons that are in an intensive care unit (ICU).⁴ Persons with VAP have increased lengths of ICU hospitalization and have up to a 20-30% death rate.⁵ The mortality attributable to VAP has been reported to range between 0% and 50% in various studies.⁶¹⁰ As shown by Hunter, VAP occurs in 9-27% of mechanically ventilated patients, with about five cases per 1000 ventilator days.¹¹ The condition is associated with increased ICU and hospital stay and has an estimated attributable mortality of 9%.¹¹ According to Chastre and Fagon, despite major advances in techniques for the management of ventilator-dependent patients and the routine use of effective procedures to disinfect respiratory equipment, VAP continues to
complicate the course of 8–28% of the patients receiving MV. Rates of pneumonia are considerably higher among patients hospitalized in ICUs compared with those in hospital wards, and the risk of pneumonia is increased 3- to 10-fold for the intubated patient receiving MV. The chance of getting VAP has been described as 3% per day during the first week of MV, 2% per day during the second week and 1% per day in the ensuing weeks. VAP occurrence is also increased with prolonged length of ICU stay. A method to reduce the risk of VAP is to extubate patients as soon as possible as various randomized, and observational studies have shown that the risk of developing VAP increases with the duration of an endotracheal tube remaining in place. The use of appropriate weaning protocols and the regular assessment of sedation requirements are effective in reducing the duration of MV and hence the incidence of VAP. VAP must be suspected clinically in an ICU setting, and quick assessment must be done for its diagnosis as the delay can increase both morbidity and mortality among such patients. Delays in the administration of appropriate antibiotic therapy for VAP have been associated with excess mortality. In one study, a delay in appropriate therapy for 24 h or more was associated with a 69.7% mortality, compared to 28.4% in patients treated without the delay (P < 0.001). Hence, a prompt decision needs to be taken, and antibiotics must be started empirically, which can later be changed as directed by the culture and sensitivity reports. According to Luna et al., mortality rates vary with patient population and infecting organism, mortality increasing when the infecting organism is multidrug resistant. The probability for multi-drug resistant pathogens is higher in the subset of patients including those recently hospitalized in acute care facility (<90 days), residents in a nursing home or long-term care facility; recipients of recent intravenous antibiotic therapy, chemotherapy, or wound care within the last 30 days of the current infection; or who have attended a hospital or hemodialysis clinic. Starting appropriate antibiotics is a simple and effective way to improve clinical outcomes while minimizing side effects and maintaining quality of care. Above all, education of health-care personnel is important and is widely viewed as a fundamental step in reducing the occurrence of VAP.

**METHODS**

A prospective observational study of admitted patients was conducted in our medical ICU over a period of 14-month from October 2014 to December 2015 to see the pattern of pneumonia among ventilated patients. Besides routine investigations, we did the tracheal aspirate cultures with sensitivity in these patients. The progressive monitoring of chest radiographs was also performed. VAP was diagnosed according to clinical pulmonary infection score (CPIS) scoring system where a score > or = 6 was taken as significant. The calculation of CPIS is shown in Table 1.

**Statistical Analysis**

Data were analyzed using EpiInfo 7.0. Relationship between two categorical variables was analyzed using Chi-square test. Two-sided P-values were reported and a P < 0.05 was considered statistically significant.

**RESULTS**

The study showed that among a total of 178 patients admitted in the ICU, 92 (51.68%) were managed with invasive MV. Out of these 92 patients, 12 (13.04%) developed VAP as per CPIS scoring system with a VAP rate of 17.09/1000 days on MV. Out of 12 patients, 6 died, revealing 50% mortality among VAP patients. The results obtained are tabulated in Table 2. A total number of patients admitted to the ICU were 178 out of whom 92 (51.68%) were put on invasive MV. Out of the admitted patients, 100 were males and 78 were females. 44 male patients and 48 females were put on MV. VAP

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Points</th>
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<tbody>
<tr>
<td>Temperature, °C</td>
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<tr>
<td>≥36.1 and ≤38.4</td>
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</tr>
<tr>
<td>≥38.5 and ≤38.9</td>
<td>1</td>
</tr>
<tr>
<td>≥39.0 and ≤36.0</td>
<td>2</td>
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<tr>
<td>Blood leukocytes, mm³</td>
<td></td>
</tr>
<tr>
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<td>0</td>
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<tr>
<td>&lt;4,000 or &gt;11,000</td>
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</tr>
<tr>
<td>+Band forms ≥50%</td>
<td>Add 1</td>
</tr>
<tr>
<td>Tracheal secretions</td>
<td></td>
</tr>
<tr>
<td>Absence of tracheal secretions</td>
<td>0</td>
</tr>
<tr>
<td>Presence of non-purulent tracheal secretions</td>
<td>1</td>
</tr>
<tr>
<td>Presence of purulent tracheal secretions</td>
<td>2</td>
</tr>
<tr>
<td>Oxygenation: PaO₂/FiO₂, mmHg</td>
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<tr>
<td>&gt;240 or ARDS (defined as PaO₂/FiO₂≤200, PCWP ≤18, and acute bilateral infiltrates)</td>
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<tr>
<td>Pulmonary radiography</td>
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<td>No infiltrate</td>
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<tr>
<td>Diffuse (or patchy) infiltrate</td>
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<tr>
<td>Localized infiltrate</td>
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<tr>
<td>Progression of pulmonary infiltrate</td>
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<tr>
<td>No radiographic progression</td>
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<tr>
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<tr>
<td>Culture of tracheal aspirate</td>
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<tr>
<td>Pathogenic bacteria cultured in rare or light quantity or no growth</td>
<td>0</td>
</tr>
<tr>
<td>Pathogenic bacteria cultured in moderate or heavy quantity</td>
<td>1</td>
</tr>
<tr>
<td>+Same bacteria seen on Gram-stain</td>
<td>Add 1</td>
</tr>
</tbody>
</table>

Table 1: CPIS calculation

developed in 6 out of 44 males and in 6 out of 48 females. Tracheal aspirates were taken in the 12 patients who developed VAP. Out of these 12, 7 aspirates were positive, of which 5 grew *Acinetobacter* species, 1 was positive for *Pseudomonas aeruginosa* and other for *Klebsiella*. The sensitivity patterns showed maximum sensitivity for colistin and amikacin. 4 males and 2 females with VAP died. Thus, a total of 12 out of 92 ventilated patients developed VAP and 6 died. VAP was seen in patients who were on MV for at least 1 week.

**DISCUSSION**

This study showed that among patients admitted in the ICU, 51.68% were managed with invasive MV. Out of these, 13.04% developed VAP with a VAP rate of 17.09/1000 MV days, and 50% was the mortality among VAP patients.

The duration of MV affects the occurrence of VAP. As per the study by Cook in 2000, VAP occurs most often in the first week of MV. Fagon et al. suggested that the incidence of VAP increases by 1% per day of IMV. However, Cook et al., in 1998, found that the incidence per day varies over time, with 3% per day during first 5 days of IMV, 2% for the second 5 days, and 1% for the subsequent 5-day period. This observation is supported by Ibrahim et al., who identified an incidence rate of VAP of 11.5%, 56% of which were early onset (≤5 day). Hence, the greatest attack rates appear to be during the initial days of MV. In addition, significant risk factors for early-onset VAP include cardiopulmonary resuscitation and continuous sedation. In our study, VAP was seen in patients who were on MV for at least 1 week, and VAP occurrence showed an increasing trend with the increase in duration of ventilation (Table 3). There is some evidence for gender differences in the course of VAP. Men have been found to get VAP more often, but women are more likely to die after contracting VAP. In our study, 44 male patients (out of 100) and 48 females (out of 78) were put on MV. VAP developed in 6 out of 44 males and in 6 out of 48 females. 4 males and 2 females with VAP died (Table 4).

In summary, all possible steps should be taken to decrease the incidence of VAP in ICUs. Clinicians must focus on eliminating or minimizing the incidence of VAP through preventive techniques. The focus should be addressing modifiable risk factors. Zack et al. have demonstrated that a multifaceted and multidisciplinary approach to VAP prevention can indeed reduce the incidence.

**CONCLUSION**

In our ICU setup, VAP occurred in 13.04% of mechanically ventilated patients admitted over a period of 14-month with a VAP rate of 17.09/1000 days on MV. The mortality among VAP patients in our ICU was 50%. VAP was seen in patients who were on MV for at least 1 week and VAP occurrence showed an increasing trend with the increase in duration of ventilation. More males developed and died from VAP as compared to females. Keeping into consideration the burden of increased morbidity, lengthening of ICU stay and increased mortality due to VAP, We recommend that appropriate measures ensuring application of VAP bundle, hand hygiene, and proper suctioning methods be employed to reduce the prevalence of VAP in ICU.

**REFERENCES**

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Maqbool, et al.: Ventilator Associated Pneumonia-incidence and Outcome


How to cite this article: Maqbool M, Shabir A, Nasqash H, Amin A, Koul RK, Shah PA. Ventilator Associated Pneumonia-Incidence and Outcome in Adults in Medical Intensive Care Unit of a Tertiary Care Hospital of North India. Int J Sci Stud 2017;4(10):73-76.

Source of Support: Nil, Conflict of Interest: None declared.