Original Research Article

Attributable morbidity and mortality of ventilator-associated pneumonia in patients of respiratory failure

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Abstract

Background: Patients who are intubated and on mechanical ventilation are more prone to develop ventilator associated pneumonia (VAP). Comorbidities and other risk factors contribute to the mortality due to VAP in mechanically ventilated patients. **Aim:** To assess the attributable morbidity and mortality of ventilator-associated pneumonia in patients of respiratory failure. **Material and Methods:** A total of 216 critically ill patients admitted in intensive respiratory care unit and who stayed for at least 2 days and received mechanical ventilation within 48 hours after ICU admission were studied. Laboratory investigations and microbiological culture was done. **Results:** Out of 182 patients who received invasive mechanical ventilation, 47 (25.8%) patients developed ventilator associated pneumonia. Early-onset VAP were developed in 13 (27.6%) patients and late-onset VAP developed in 34 (72.3%) patients. The mortality in patients those developed VAP was 40.4%. **Conclusion:** Every effort should be taken to decrease the incidence of VAP in ICUs. Clinicians must focus on modifiable risk factors to minimize the incidence of VAP.

Key Words: Respiratory failure, mechanical ventilation, ventilator associated pneumonia, mortality.

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INTRODUCTION

Patients who are intubated and on mechanical ventilation are more prone to develop ventilator associated pneumonia (VAP). It is defined as "pneumonia occurring after 48 hours of endotracheal intubation and initiation of mechanical ventilator".[1] VAP is the most commonly reported infection in ICUs, with mechanically ventilated patients being at highest risk. The incidence of VAP has ranged from 8 to 28%.[2] VAP is associated with significant increases in hospital stay length and morbidity.[3] The mortality rate of VAP patients is thought to depend on several factors, such as admission diagnosis, severity of illness at the time of VAP, type of microbial pathogen and resistance, and whether appropriate antibiotic treatment is provided in an adequate time. Late-onset VAP is often reported to be associated with higher mortality rates than early-onset VAP.[4-6] Comorbidities such as chronic obstructive pulmonary disease, immunocompromised,[4] chronic heart failure, chronic hepatopathy, or chronic renal failure, are usually reported to increase the risk of death.[4,7] The number of organ dysfunctions[6] has been repeatedly associated with VAP prognosis. In this study, an attempt was made to assess the attributable morbidity and mortality of ventilator-associated pneumonia in patients of respiratory failure.

MATERIAL AND METHODS

In this prospective observational study, a total of 216 critically ill patients admitted in intensive respiratory care unit (IRCU) at a tertiary referral and teaching institute who developed respiratory failure due to various conditions and diseases were studied. The present study was approved by the institute ethics committee. Patients

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who stayed in the ICU for at least 2 days and received mechanical ventilation within 48 hours after ICU admission were included in the study. VAP was defined as persistent pulmonary infiltrates on chest radiographs combined with purulent tracheal secretions, and/or body temperature greater than or equal to 38.58 C or less than or equal to 36.58 C, and/or peripheral blood leukocyte count greater than or equal to 10^3-10^9/L or less than or equal to 10^9/L. A definitive diagnosis of VAP required microbiological confirmation by culture from a protected specimen brush (>10^3 cfu/ml), plugged telescopic catheter specimen (> 10^3 cfu/ml), bronchoalveolar lavage (BAL) fluid specimen (> 10^4 cfu/ml), or endotracheal aspirate (> 10^5 cfu/ml).

RESULTS

A total of 216 critically ill patients admitted in intensive respiratory care unit (IRCU) at a tertiary referral and teaching institute who developed respiratory failure due to various conditions and diseases were studied. Distribution of patients according to underlying disorder who required mechanical ventilation as below:

Table 1: Disease distribution and duration of mechanical ventilation

Disease	1 -3 days	4-7 days	8-14 days	>2 Week
Acute Respiratory Failure (n=150)				
Poisoning (n=82)	23 (28%)	39 (47.6 %)	14 (17.1 %)	6 (7.3%)
ARDS (n=44)	20 (45.5 %)	22 (50%)	2 (4.5%)	-
Snake Bite (n=24)	19 (79.2 %)	5 (20.8 %)	-	-
Acute Exacerbation of Chronic respiratory failure (n=29)				
COPD (n=21)	10 (47.6 %)	7 (33.3 %)	4 (19%)	-
Bronchial Asthma (n=5)	4 (80%)	1 (20%)	-	-
Tuberculosis destroyed Lung (n=3)	1 (33.3 %)	1 (33.3 %)	-	1 (33.3 %)
Coma (n=27)				
Meningoencephalitis (n=18)	-	6 (33.3 %)	7 (38.9 %)	5 (27.8 %)
CVA (n=9)	-	-	2 (33%)	7 (77.7 %)
Neuromuscular disease (n=6)				
Guillain-Bare syndrome (n=6)	-		2 (33.3 %)	4 (66.7 %)
Others (n=4)				
Hanging (n=2)	1 (50%)	-	1 (50%)	-
Valvular Heart Disease (n=2)	1 (50%)	1 (50%)	-	-
Total	**79 (36.6 %)**	**82 (38%)**	**32 (14.8 %)**	**23 (10.6 %)**

Out of 216 patients put on mechanical ventilation, commonest duration of mechanical ventilator stay was 4-7 days in 82 (38%) of patients followed by 1-3 days in 79 (36.6%) patients. Shorter duration of mechanical ventilation (1-3 days) were required in 19 (79.2%) patients of acute respiratory failure due to neuroparalytic snake bite and 4 (80%) patients of acute exacerbation of bronchial asthma. Prolonged mechanical ventilation were required in 7 (77.7%) patients of cerebrovascular accident (CVA) and 4 (66.7%) patients of Guillaine-Bare Syndrome. Out of 182 patients who received invasive mechanical ventilation, 47 (25.8%) patients developed ventilator associated pneumonia.

Table 2: Ventilator associated pneumonia and causative organism

Causative Organism	Early onset pneumonia <5 Days	Late onset pneumonia >5 Days	Total
Pseudomonas aeroginosa	3	16	19
Klebsiella pneumoniae	3	14	1i7
Staphylococcus aureus	4	3	7
E. coli and *Proteus* Spp.	1	1	2
Acinetobacter Spp.	1	1	2
Total	**13**	**34**	**47**

Out of 182 patients who required invasive ventilation 47 (25.8%) patients developed ventilator associated pneumonia (VAP). Early-onset VAP were developed in 13 (27.6%) patients and late-onset VAP developed in 34 (72.3%) patients. Most common offending organism isolated in patients of VAP were *Pseudomonas aeruginosa* (40.4%) followed by Klebsiella pneumoniae (36.2%). *Staphylococcus aureus* 4 (30.8%) was the most common organism isolated in patients with early onset ventilator associated pneumonia, whereas, *Pseudomonas aeruginosa* 16 (47%) was the most common organism isolated in patients with late onset ventilator associated pneumonia.

Table 3: Ventilator Associated Pneumonia and Mortality

Condition	No. of patients	Survivors	Non survivors
VAP	47	29	19 (40.4%)
Non - VAP	135	90	44 (32.6%)
Total	**182**	**119**	**63 (34.6%)**

Overall mortality amongst 182 patients required invasive ventilator was 34.6%. The mortality in patients those developed VAP was 40.4% while 32.6% in patients those were not developed VAP.

DISCUSSION

In present study, the mortality in patients those developed VAP was 40.4% while 32.6% in patients those were not developed VAP. Kollef *et al*,[8] reported estimated incidences of VAP ranges from 10 to 65% with fatality rates of 13% to 55%. Risk factors for development of VAP are longer duration of mechanical ventilation, advanced age, depressed level of consciousness, pre-existing lung disease, immune suppression from disease or medication, malnutrition. Persons with VAP have increased lengths of ICU hospitalization and have up to a 20-30% death rate.[9] The mortality attributable to VAP has been reported to range between 0% and 50% in various studies.[10-14] As shown by Hunter, VAP occurs in 9-27% of mechanically ventilated patients, with about five cases per 1000 ventilator days.[15] The condition is associated with increased ICU and hospital stay and has an estimated attributable mortality of 9%.[15] Out of 182 patients who required invasive ventilation 47 (25.8%) patients developed ventilator associated pneumonia. Early-onset VAP were developed in 13 (27.6%) patients and late-onset VAP developed in 34 (72.3%) patients. Cook found that, VAP occurs most often in the first week of MV.[9] Fagon *et al*. suggested that the incidence of VAP increases by 1% per day of IMV.[16] However, Cook *et al*., 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.[17] 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).[18] Hence, the greatest attack rates appear to be during the initial days of MV. In our study, most common offending organism isolated in patients of VAP were *Pseudomonas aeruginosa* (40.4%) followed by *Klebsiella pneumoniae* (36.2%). *Staphylococcus aureus* 4 (30.8%) was the most common organism isolated in patients with early onset ventilator associated pneumonia, whereas, *Pseudomonas aeruginosa* 16 (47%) was the most common organism isolated in patients with late onset ventilator associated pneumonia. Trivedi *et al*,[19] reported an incidence of 9.38% of nosocomial pneumonia and 38% had ventilator associated pneumonia. Commonest organisms isolated in VAP were Pseudomonas (55%), Acinetobacter (20%), Staph. aureus (14.5%) and Klebsiella (75%). Violán *et al*[50] reporated mortality rate of 34% for patients with nosocomial pneumonia compared to 17% in those without nosocomial and mortality as a result of VAP was especially high when it was caused by multi-drug resistant organisms like Pseudomonas or Acinetobacter species. To conclude, every effort should be taken to decrease the incidence of VAP in ICUs. Clinicians must focus on modifiable risk factors to minimize the incidence of VAP.

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