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RESEARCH ARTICLE

A STUDY ON FACTORS ASSOCIATED WITH VENTILATOR ASSOCIATED PNEUMONIA AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Ventilator-associated pneumonia (VAP), an important form of hospital-acquired pneumonia (HAP), specifically refers to pneumonia developing in a patient on mechanical ventilator for more than 48 h after intubation or tracheostomy. Despite the advancements in antimicrobial regimes, VAP continues to be an important cause of morbidity and mortality. VAP requires a rapid diagnosis and initiation of appropriate antibiotic treatment, as there is adverse effect of inadequate antibiotic treatment on patient's prognosis and the emergence of multidrug-resistant (MDR) pathogens. **Objective**: 1) To study microorganism pattern of VAP. 2) To identify associated factor for VAP. **Methods:** A prospective cross-sectional study was carried out in tertiary care hospital, Ahmedabad, over a period of 1 year. Total 40 patients selected by convenient sampling who were admitted in medical ICU during study period. Analysis was done by using statistical methods to identify the risk factors for morbidity and mortality associated with VAP. **Results:** Incidence was found to be higher amongst male patients (65%).Present study showed that out of 40 patients 21 (52.5%) patients died. Average duration of stay in ICU was 9 days. The most common organism found was Acinetobacter in 11 (27.5%) of patients. The major risk factor for VAP was Diabetes mellitus (15, 37.5%) followed by tracheostomy (12, 30.0%), re-intubation (9, 22.5%), elder patients (6, 15.0%), and shock in first two days (4, 10.0%). **Conclusion:** The incidence of VAP remains high and varies depending on the cause and period of intubation and underlying morbidity. Greater efforts should be made to prevent, diagnose and manage infection early and appropriately to reduce patient suffering and reduce the burden on hospitals providing services. Proper knowledge of risk factors can help identify high-risk groups.

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INTRODUCTION

Ventilator-associated pneumonia (VAP) refers to bacterial pneumonia developed in patients who have been mechanically ventilated for duration of more than 48 h (Davis, 2006). Pneumonia is the second most common intensive care unit (ICU) acquired infection and 86% of nosocomial pneumonias are VAP. (Koenig, 2006) Around 10-20% of patients on MV for longer than 48 hours, develop VAP (Morehead, 2000; Joseph, 2009). Hospital-acquired pneumonia (HAP) is the pneumonia after 48 h or more after admission, which did not appear to be incubating at the time of admission. The presence of HAP increases hospital stay by an average of 7–9 days per patient (Chastre, 2002; Rello, 2002) also imposes an extra financial burden to the hospital.

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The risk of VAP is highest early in the course of hospital stay, and is estimated to be 3%/day during the first 5 days of ventilation, 2%/day during days 5–10 of ventilation and 1%/day after this (Cook *et al*., 1998). Pneumonia is usually mild or low in severity if it occurs in the early period of invasive ventilation and the organisms are most responsive to the antibiotics administered, whereas after a few days (late onset), pneumonia is more severe in its course, with fewer organisms responding to antibiotics and increased rate of morbidity and mortality among those with late onset infection (Joseph, 2009). The common pathogens causing VAP include aerobic gram negative rods such as Pseudomonas aeruginosa, Acinetobacter species, Klebsiella pneumoniae, and Escherichia coli (Koenig, 2006; Rakshit, 2005; Joseph, 2010) VAP due to methicillin resistant Staphylococcus aureus (MRSA) has been rapidly emerging. [8,9] Treatment of VAP is usually supportive, along with administration of proper antibiotic.

The selection of proper antimicrobial agents, active against the VAP pathogens is an important determinant for reducing morbidity and mortality. Appropriate antimicrobial therapy, when initiated early, has shown to reduce mortality among critically ill patients with VAP. Late onset VAP is commonly associated with administration of inappropriate antibiotics and caused by MDR pathogens like Pseudomonas species and Acinetobacter species. The incidence of VAP in ICUs in developed countries differs significantly from that in developing ones ICUs [10]; this is because of many reasons such as the prudent use of specific antibiotics, better management of possible risk factors, and good prophylactic measures to decrease hospital-acquired infections.

MATERIALS AND METHODS

This was a prospective cross-sectional study in patients with VAP, was carried out in SVPIMSR, a tertiary care hospital affiliated to Smt. NHLMMC, Ahmedabad, India after getting approval from institutional ethic committee. 40 patients were selected for study according to convenient sampling, who was admitted to the medical ICU for various causes during January 2018 to December 2019. A written informed consent was obtained from each patient. Among 40 patients diagnosed to have ventilator associated pneumonia based on the clinical pulmonary infection scoring system, were involved in the study, after satisfying inclusion and exclusion criteria. Detailed history of patients involving past respiratory infections, antibiotic use and co-morbid conditions like hypertension, type 2 DM were included. All patients were evaluated with thorough clinical examination, routine investigations, specific laboratory and radiological investigations. All patients received protocol line of treatment with empirical antibiotics regimen and was later changed after obtaining the culture and sensitivity report. Co-morbid conditions and other complications due to VAP were managed aggressively. Regular blood culture, ET tube sample for c/s were done. Non-responders were identified and were re-evaluated with fresh investigations. All patients were then followed up till discharge/death.

STATISTICAL ANALYSIS: Collected Data were Microsoft Excel and analyzed using Epi info 7.1. Continuous data was analyzed in terms of mean and standard deviation. Categorial data was expressed in frequency and percentage (%). Unpaired T test for continuous data and Chi-square test or Fisher's Exact Test were used to compare categorical data. "P" values equal to or less than 0.05 was considered as significant.

RESULTS

Table 1 shows that out of 40 patients, 26 (65%) were male and 14 (35%) female. Mean age of our sample was 40.82±15.3 years. Out of 40 patients 21 (52.5%) were died and 19 (47.5%) were survived. 52.5% mortality was found in our study. Most cases of VAP were caused by Gram negative bacilli (28, 70.0%). Acinetobacter (11, 27.5%), Klebseilla pneumonia (8, 20.0%), Pesudomonasaeruginosa (9, 22.5%) and Proteus (2.5%) were the most common Gram negative bacilli associated with VAP. Gram positive cocci (MRSA) was found in 4 patients (10.0%). VAP was poly microbial in 8 patients (20.0%).

Table 1. Demographic characteristics of study population

No. of Patients	40
Age (in years)	40.82±15.3
Gender (M/F)	26/14
Died	21
Survived	19
Length of ICU stay	8.7±5.1
Mortality	52.5%

Table 2. Profile of isolated microorganism

Organism	Frequency	Percentage (%)
Gram negative bacilli	28	70.0
Gram positive cocci	4	10.0
Poly microbial	8	20.0
Type of micro organism		
Acinetobacter	11	27.5
Klebseilla pneumonia	8	20.0
Pesudomonas aeruginosa	9	22.5
Polymicrobial	7	17.5
MRSA	3	7.5
Proteus	1	2.5
Total	40	100.0

Table 3. Distribution of patients according to risk factors

Risk Factor	Frequency	Percentage (%)
Diabetes	15	37.5
Tracheostomy	12	30.0
Re-intubation	9	22.5
Elderly	6	15.0
Shock in the first two days of admission	4	10.0
Immunosuppressive drug/s	2	5.0

The major risk factor for VAP was Diabetes mellitus (15, 37.5%) followed by tracheostomy (12, 30.0%), re-intubation (9, 22.5%), elder patients (6, 15.0%), and shock in first two days (4, 10.0%).

DISCUSSION

In the present study, majority of patients (65.0%) were male. SarojGolia *et al*[11] conducted a study among 148 patients over period of 12 months in a tertiary care ICU of Bangalore. They observed that the incidence of VAP was more common in men (58.10%). In the present study, there was 52.5% mortality among VAP patients. Riddhi Pradhan *et al* [12] documented 32.2% mortality among VAP patients. Whereas HinaGadani *et al*. (2010) reported 54.0% mortality and 20% in early-onset type and 66.7% in late-onset VAP. In present study, most cases of VAP were caused by Gram negative bacilli (28, 70.0%). Acinetobacter (11, 27.5%), Klebsiella pneumonia (8, 20.0%), Pseudomonas aeruginosa (9, 22.5%) and Proteus (2.5%) were the most common Gram-negative bacilli associated with VAP. Acinetobacter infection is due to its great resistance to the environment which enables it to spread, its limited virulence and its extraordinary ability to develop resistance to all the antimicrobials and spread by aerosols (Rathod, 2017). Microorganism pattern found in present study was similar to study conducted by NM Josep*et al*.[4] They performed a prospective study over a period of 15 months among patients of VAP adult patients admitted in ICU of Jawaharlal Institute of Post-graduate Medical Education and Research (JIPMER), Pondicherry, India. Most cases of VAP were caused by Gram-negative bacteria (80.9%).

Pseudomonas aeruginosa (21.3%) and Acinetobacterbaumannii (21.3%) were the most common Gram-negative bacteria associated with VAP and Staphylococcus aureus (14.9%) was the most common Gram-positive bacteria among patients with VAP. MRSA accounted for 42.9% of the VAP due to Staphylococcus aureus. VAP was polymicrobial in 10 patients (27.8%).

Conclusion

Ventilator-associated pneumonia is a common disease and serious complication in intensive care, which is associated with increased duration of mechanical ventilation, stay in ICU / hospital and increases morbidity and mortality in the hospital that can lead to higher treatment costs. This study gives an idea of the clinical picture of ventilator-associated pneumonia in India and associated prognostic factors that result in an increase morbidity and mortality in VAP.

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Declarations

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Conflict of interest: None

Keypoint

Most cases of VAP were frequently caused by Acinetobacter, Klebseilla pneumonia, Pesudomonasaeruginosa. The major risk factor for VAP was Diabetes mellitus followed by tracheostomy and re-intubation.

List of abbreviation

VAP	Ventilator-Associated Pneumonia
HAP	Hospital-Acquired Pneumonia
MDR	MultiDrug-Resistant
ICU	Intensive Care Unit
MV	Mechanical Ventilation
MRSA	Methicillin Resistant Staphylococcus Aureus
DM	Diabetes Melitus

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