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Original Article

Evaluation of ICU Patients with Ventilator Associated Pneumonia at a Tertiary Care Teaching Centre

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ABSTRACT

Introduction: Ventilator Associated Pneumonia (VAP) refers to a type of pneumonia that occurs more than 48-72 hours after endotracheal intubation, and is one of the most common nosocomial infections in patients receiving mechanical ventilation. Present study was carried out to determine etiological profile and infection rate of ventilator associated pneumonia (VAP) in ICU settings.

Materials and Methods: A prospective hospital based study was carried out in the Department of General Medicine, Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Vijayawada, Andhra Pradesh (India). The study was carried out amongst inpatients admitted to ICU and who were on ventilator. A total of 379 patients were admitted in ICU over a period of one year. Among them 113 patients were on ventilator in ICU. In our study 36 patients developed ventilator Associated pneumonia.

Results: VAP infection rate was 31.8%. Pseudomonas aeruginosa & Staphylococcus aureus (MSSA) were commonest in VAP.

Conclusion: VAP is the commonest nosocomial infection amongst patients receiving mechanical ventilation in ICU. The incidence of VAP in our setting was 31.8%. The common pathogens which were isolated were the aerobic gram-negative bacilli such as Pseudomonas aeruginosa, Acinetobacter baumannii, Klebsiella pneumonia, Escherichia coli and gram-positive cocci like Staphylococcus aureus. The emergence of MDR pathogens can be prevented by adopting an antibiotic institutional policy and dose de-escalation regimens. The early diagnosis and institution of appropriate antimicrobial therapy can reduce patient mortality.

KEYWORDS: Endotracheal Aspirates, Ventilator Associated Pneumonia (VAP), VAP Infection Rate.

INTRODUCTION

Nosocomial infections results in extended hospitalization periods, escalated health care costs, and the requirement of potent, broad spectrum antimicrobial agents often used in expensive combination regimens.[1] Hospital Acquired Pneumonia (HAP), Ventilator Associated Pneumonia (VAP) and Health Care Associated Pneumonia (HCAP) may be caused by a wide spectrum of bacterial pathogens, may be polymicrobial, and are rarely due to viral or fungal pathogens in immunocompetent hosts.[2]

Ventilator Associated Pneumonia (VAP) refers to a type of pneumonia that occurs more than 48-72 hours after endotracheal intubation, and is one of the most common nosocomial infections in patients receiving mechanical ventilation.[3]

VAP is the commonest complication associated with Mechanical Ventilation (MV) reported at the rate of 1-3% per day of MV. Prevalence ranges from 10% to 65% in tertiary-care hospitals.[3] VAP occurs approximately in 9-27% of all intubated patients.[4,5]

The incidence of VAP varies greatly, ranging from 6 to 52% of intubated patients depending on patient risk factors. The cumulative incidence is approximately 1-3% per day of intubation. Overall, VAP is associated with an attributable mortality of up to 30%. Attributable mortality approaches 50% when VAP is caused by the

more virulent organisms that typify late-onset VAP (occurring 4 or more days into mechanical ventilation).[4,5] Colonization of the aerodigestive tract with pathogenic bacteria and subsequent aspiration of contaminated secretions into the lower airways appear to be the most important mechanisms for the development of ventilator-associated pneumonia.[6] Tracheal intubation interrupts the body's anatomic and physiologic defenses against aspiration, making mechanical ventilation a major risk factor for VAP. The accumulation of contaminated oropharyngeal secretions above the endotracheal tube cuff may contribute to the risk of aspiration.[4]

Among the causes of hospital acquired pneumonias, Ventilator Associated Pneumonia (VAP) is important as it worsens the outcome and the cost of in-hospital treatment. Common pathogens include aerobic gram-negative bacilli, such as P. aeruginosa, Escherichia coli, Klebsiella pneumoniae, and Acinetobacter species. Infections due to gram- positive cocci, such as Staphylococcus aureus, particularly methicillin resistant S. aureus (MRSA), have been rapidly emerging. Pneumonia due to S. aureus is more common in patients with diabetes mellitus, head trauma, and those hospitalized in ICUs. The use of appropriate antibiotics which are directed towards the most prevalent organism improves the cure rate and survival, and also reduces the emergence of resistant strains. Present study was carried out to determine etiological profile and infection rate of ventilator associated pneumonia (VAP) in ICU settings.

MATERIALS AND METHODS

A prospective hospital based study was carried out in the Department of General Medicine, Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Vijayawada, Andhra Pradesh (India). The study was carried out amongst inpatients admitted to ICU and who were on ventilator.

History and clinical examination was taken as well as laboratory investigations were carried out. This included the blood counts, renal function tests, blood glucose, liver function tests, electrocardiogram, endo-tracheal aspirates for gram staining and culture, blood culture, ABG and chest x-rays or any other relevant investigations as and when required.

The clinical pulmonary infection score (CPIS) was tabulated from the available data (includes temperature, leukocytes, tracheal aspirate volume and the purulence of tracheal secretions, chest X-ray, oxygenation-PaO2/FiO2 and the semi-quantitative culture of the tracheal aspirates). The patients with CPIS which was more than 6, were considered to have developed VAP. VAP was diagnosed by the growth of pathogenic organisms.[7]

Adult patients on mechanical ventilation at the time of or within 48 hours before onset of the event and showing radiological evidence of pneumonia and Any 2 of the following findings were included as Ventilator Associated Pneumonia (VAP):

- Temperature ≥ 38C or ≤35C.
- WBC>12000/mm3 or <4000/mm3.
- Purulent sputum.
- Pathogenic bacteria isolated from endotracheal aspirate.

Patients having Pneumonia prior to Mechanical Ventilation as well as patients intubated outside were excluded from study.

Table 1: Profile of patients in present study.

No of patients admitted to ICU	**379**
No of patients eligible for study (on ventilator for more than 48hrs)	113
No of patients positive for Ventilator associated pneumonia (VAP)	36
Infection rate of VAP	31.8%

Table 2: Etiological profile of VAP in present study.

Organisms	**VAP (%)**
Pseudomonas aeruginosa	14 (38.9%)
Staphylococcus aureus(MSSA)	9 (25%)
Acinetobacter baumannii	7 (19.4%)
Klebsiella pneumoniae	3 (8.3%)
Escherichia coli	3 (8.3%)
Total	36

RESULTS

A total of 379 patients were admitted in ICU over a period of one year. Among them 113 patients were on ventilator in ICU. In our study 36 patients developed ventilator Associated pneumonia [Table 1]. VAP infection rate was 31.8%. Pseudomonas aeruginosa & Staphylococcus aureus (MSSA) were commonest in VAP [Table 2].

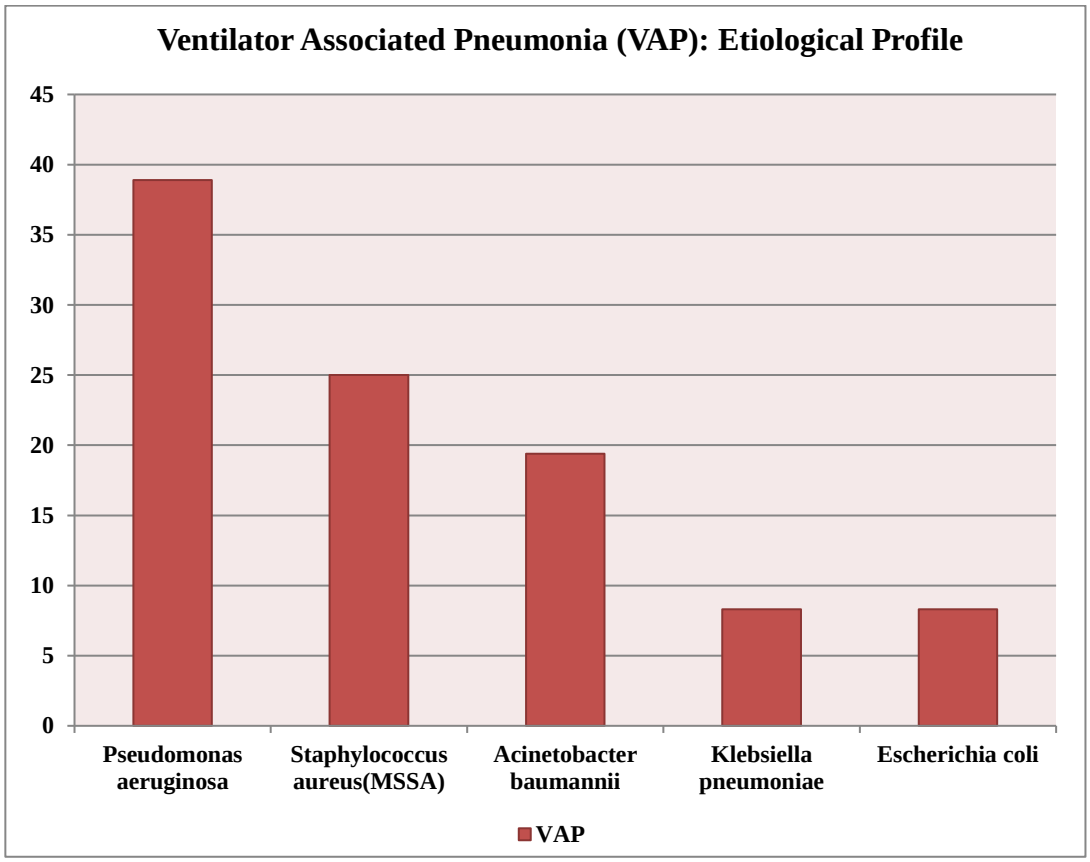

Table 3: Comparison with other studies: Infection rate of VAP.

Study	No. of Patients	Infection rate of VAP
Kollef et al.	277	15.5
Torres et al.	322	24
Kerver et al.	39	67
Rakshit.P et al	51	47
Anil Mudda	173	23
Fagon et al.	1118	27.5
Present Study	113	31.8

Table 4: Comparison with other studies: Etiological profile of VAP.

Causative Organisms	Torres et al.,	Fagon et al.,	Anil Mudda	Rakshit et al.,	Present Study
P. Aeruginosa	7(28%)	16(31%)	13(23%)	11(46%)	14 (38.9%)
Staphylococcus	5(20%)	17(33%)	2(3.5%)	6(25%)	9(25%)
Acinetobacter	6(24%)	8(15%)	28 (49%)	2(8%)	7(19.4%)
Klebsiella	3(12%)	2(4%)	9(16%)	7(29%)	3(8.3%)
E. coli	3(12%)	4(8%)	4(7%)	3(12%)	3(8.3%)

DISCUSSION

VAP is the commonest nosocomial infection amongst patients receiving mechanical ventilation in ICU. The incidence of VAP in our setting was 31.8%. Table 3 and 4 shows the comparison of our study with other similar studies conducted with respect to incidence of VAP and etiological profile. Infection rates in studies conducted by Torres et al. was 24%, Kerver et al 67%, Kollef et al 15.5%, Fagon et al 27.5%, Anil Mudda et al. 23%, Rakshit et al 47% respectively.[6,8-10]

VAP accounts for 13-18% of all hospital acquired infections. Data from recent studies shows that VAP was the most common infectious complication among patients who were admitted to the ICU. The complications and treatment cost significantly rises with VAP caused by resistant organisms, due to the cost of newer broad spectrum anti microbials and supportive measures. In various studies, the incidence of VAP was found to vary from 7% to 70%.[10,11] In our study it was 31.8%.

A presumptive clinical diagnosis of pneumonia is often made when a patient develops a new radiographic infiltrate associated with fever, leukocytosis, and purulent tracheal secretions and when microorganisms are isolated by nonquantitative analysis of endotracheal aspirates.[12] This "clinical" approach leads to overestimation of the incidence of ventilator-associated pneumonia because cases of tracheobronchial colonization and noninfectious processes mimicking it are included.[13-15] The nonspecificity of a strategy based on clinical evaluation has potentially deleterious consequences:

Many patients may receive unneeded antibiotics; this exposes them to unnecessary toxicity, increases hospital costs, and favors the emergence of resistant microorganisms. In addition, antibiotic overuse in such patients delays diagnosis of the true cause of fever and pulmonary infiltrate.

The diagnostic criteria for VAP in patients receiving mechanical ventilation is the presence of two or more of the following clinical features: Temperature of > 38°C or <36°C; leukopenia or leukocytosis; purulent tracheal secretions and decreased PaO_2. If two or more of these abnormalities are present, a chest radiograph should be evaluated for alveolar infiltrates or an air bronchogram sign. Quantitative procedures for adequate sampling of the respiratory aspirates should be done, based on the local expertise and the cost considerations. Empirical anti-microbial therapy and supportive care should be initiated by the subject's clinical state, clinical suspicion, and the available investigations.[7]

The common pathogens which were isolated were the aerobic gram-negative bacilli such as Pseudomonas aeruginosa, Acinetobacter baumannii, Klebsiella pneumonia, Escherichia coli and gram-positive cocci like Staphylococcus aureus.

Recent studies have shown the increasing incidence of multidrug resistant pathogens among the patients with VAP. A study by Dey et al showed the increased incidence of MDR pathogens in endo-tracheal aspirates.[16] Earlier studies have shown that Pseudomonas was the most common organism. In present study also, Pseudomonas species found to be the most common organism causing VAP, followed by Staphylococcus aureus(MSSA). Staphylococcus was the most common organism in a study by Fagon et al, p. aeruginosa in a study by Torres et al and Rakshit et al. [6,8-10]

Due to the increasing incidence of MDR organisms in ICUs, an early and correct diagnosis of VAP is a challenge for optimal antibiotic treatment. The emergence of MDR pathogens can be prevented by adopting an antibiotic institutional policy and dose de-escalation regimens. Isolation of the causative organism from ET secretions and its culture sensitivity is crucial in the management of VAP. The early diagnosis and institution of appropriate antimicrobial therapy can reduce patient mortality.

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