ETIOLOGICAL PROFILE IN PATIENTS WITH VENTILATOR ASSOCIATED PNEUMONIA IN ICU AT A TERTIARY CARE HOSPITAL

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ABSTRACT: AIM AND OBJECTIVES: The aim and objectives of the study is to know the etiological profile and infection rate of ventilator associated pneumonia(VAP) in ICU over one year period. **MATERIALS AND METHODS:** A hospital based study was carried out in the ICU in ESICMC & PGIMSR Bangalore. This study was conducted from October 2011 to August 2012. The study was carried out amongst inpatients admitted to ICU and who were on ventilator.VAP was defined according to CDC criteria & endotracheal aspirates were collected from eligible patients on ventilator. Identification of pathogens were performed as per guidelines. The data was analysed for determining VAP infection rate. **RESULTS:** A total of 173 patients were on ventilator in ICU. Among them 57 developed ventilator Associated pneumonia. VAP infection rate was 23%. *Acinetobacter baumannii* & *Pseudomonas aeruginosa* were commonest in VAP. The bacterial profile was found to be *Acinetobacter baumannii* 28 (49%), *Pseudomonas aeruginosa* 13 (23%), *Klebsiella pneumoniae* 9 (16%), *Escherichia coli* 9 (16%) *Staphylococcus aureus*(MSSA) 2 (3.5%) *Enterobacter aerogenes* 1 (1.75%). **CONCLUSION:** The following conclusions were reached

1. VAP infection rate was 23%.
2. *A. baumannii* & *Pseudomonas aeruginosa* were predominant organisms.

KEY WORDS: VAP, endotracheal aspirates, VAP infection rate.

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.¹

Hospital Acquired Pneumonia (HAP), 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.²VAP 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}Due to increasing incidence of multidrug-resistant (MDR) organisms in ICUs, early and correct diagnosis of VAP is an urgent challenge for optimal antibiotic treatment. Common pathogens include aerobic gram-negative bacilli, such as *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*, and

Acinetobacter species. Infections due to gram-positive cocci, such as Staphylococcus aureus, are more common in patients with diabetes mellitus and head trauma.⁶

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.

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. VAP is a nosocomial pneumonia developing in a patient after 48 hours of mechanical ventilation, and could be early or late depending on the onset. The mortality and the morbidity associated with VAP depend on the early identification of the disease and the initiation of appropriate therapy. 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.

AIM OF THE STUDY: The aim of the study is to know the etiological profile and infection rate of ventilator associated pneumonia (VAP) in ICU.

Method of collection of data: Study design. A hospital based study was carried out in the ICU in ESICMC & PGIMS BANGALORE. : This study was conducted from October 2011 to August 2012. The study was carried out amongst inpatients admitted to ICU and who were on ventilator.

We assessed the clinical parameters (history and clinical examination) and investigations. 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.

INCLUSION CRITERIA: According to CDC definitions Ventilator Associated Pneumonia (VAP) : Adult patient 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:

1. Temperature $\geq 38^{\circ}\text{C}$ or $\leq 35^{\circ}\text{C}$.
2. WBC $>12000/\text{mm}^3$ or $<4000/\text{mm}^3$.
3. Purulent sputum.
4. Pathogenic bacteria isolated from endotracheal aspirate.

EXCLUSION CRITERIA

1. Patients having Pneumonia prior to MV
2. Patients intubated outside.

DATA ANALYSIS:

The data were analyzed by using the Chi square test. The level of significance was set at $P < 0.05$.

RESULTS: A total of 440 patients were admitted in ICU over a period of one year. Among them 173 patients were on ventilator in ICU. In our study 57 patients developed ventilator Associated pneumonia [Table 1].

VAP infection rate was 23%. *Acinetobacter baumannii* & *Pseudomonas aeruginosa* were commonest in VAP [Table 2].

The bacterial profile was found to be *Acinetobacter baumannii* 28 (49%), *Pseudomonas aeruginosa* 13 (23%), *Klebsiella pneumoniae* 9 (16%), *Escherichia coli* 9 (16%), *Staphylococcus aureus* (MSSA) 2 (3.5%), *Enterobacter aerogenes* (1.75%). Fig 1.

DISCUSSION: Diagnosis and treatment of ventilator-associated pneumonia, a nosocomial infection that develops in mechanically ventilated patients and causes considerable morbidity and mortality, remain a challenge.⁷ Pathogenic organisms causing VAP, along with complicating risk factors and comorbidities, result in extended hospitalization periods, escalated health care costs, and the requirement of potent, broad spectrum antimicrobial agents often used in expensive combination regimens.⁸

VAP is the commonest nosocomial infection amongst patients receiving MV in ICU. The incidence of VAP in our setting was 23%. 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%, Rakshit et al 47% respectively.⁹ VAP infection rate in our study was 23%.

The estimated prevalence of VAP ranges from 10 to 65%, with a 20% case fatality. Ventilator-associated pneumonia is an important ICU infection in mechanically ventilated patients. It 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%. A similar incidence was found in studies done by Rakshit et al and Andrade et al.^{10,11} In our study it was 23%.

The diagnostic criteria for VAP in patients receiving mechanical ventilation is the presence of two or more of the following clinical features: Temperature of $> 38^{\circ}\text{C}$ or $< 36^{\circ}\text{C}$; 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.

The common pathogens which were isolated were the aerobic gram-negative bacilli such as *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae* and *Acinetobacter* species and gram-positive cocci like *Staphylococcus aureus*. Fungal pathogens are also not significant agents causing VAP.^{12,13}

Recent studies have shown the increasing incidence of multidrug resistant pathogens (MDR) among the patients with VAP. A study by Dey et al showed the increased incidence of MDR pathogens in endo-tracheal aspirates.⁶ Earlier studies have shown that *Pseudomonas* was the most common organism. *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. But in our study

Acinetobacter found to be the most common organism causing VAP, followed by Pseudomonas species. Although the Acinetobacter species is less virulent than Pseudomonas, they are acquiring more and more resistance to the commonly used antimicrobial agents. 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 has shown reduced patient mortality. The mortality rates in VAP varied from 20-75%, in different studies done by Rakshit et al and Andrade et al.^{10,11}

The incidence of VAP can be prevented by adopting careful intubation techniques, oral tuba tion, avoiding gastric over- distension, maintaining adequate endo tracheal cuff pressure and efficient tracheal toileting. Infection rate with MDR organisms are increasing in ICU set up. The mortality rate which was associated with VAP, was higher in patients aged above 60 years. The infection rates could possibly be reduced by practicing aseptic measures in the ICU. The overall outcome of VAPs could improve with the anti-microbial policies of individual centers.

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Table 1

Months	No of patients admitted to ICU	No of patients eligible for study (on ventilator for more than 48hrs)	No of patients positive for Ventilator associated pneumonia(VAP)
October	35	14	6
November	39	13	5
December	50	15	6
January	42	22	4
February	37	15	4
March	36	18	7
April	34	08	3
May	49	18	6
June	48	20	7
July	29	13	5
August	38	17	4
Total	440	173	57

Table 2

Organisms	VAP (%)
Acinetobacter baumannii	28 (49%)
Pseudomonas aeruginosa	13 (23%)
Klebsiella pneumoniae	9 (16%)
Escherichia coli	4 (7%)
Staphylococcus aureus(MSSA)	2 (3.5%)
Enterobacter aerogenes	1 (1.75%)
Total	57

ORIGINAL ARTICLE

Figure 1

Table-3

Authors No. of Patients Infection rate of VAP		
Kerver et al.	39	67
Torres et al.	322	24
Kollef et al.	277	15.5
Fagon et al.	1118	27.5
Rakshit.P et al	51	47
Our study	173	23

Table 4

Etiological profile of VAP(a comparison study)				
Causative Organisms	Fagon et al.,	Torres et al.,	Rakshit et al.,	our study
Acinetobacter	8(15%)	6(24%)	2(8%)	28 (49%)
P. Aeruginosa	16(31%)	7(28%)	11(46%)	13(23%)
Klebsiella	2(4%)	3(12%)	7(29%)	9(16%)
E. coli	4(8%)	3(12%)	3(12%)	4(7%)
Staphylococcus	17(33%)	5(20%)	6(25%)	2(3.5%)