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ORIGINAL ARTICLE

Antimicrobial Sensitivity Pattern Among Organisms Which Were Isolated From The Endotracheal Aspirates Of Patients With Ventilator Associated Pneumonia

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ABSTRACT

Ventilator associated Pneumonia (VAP) is seen in 9 to 27% of all endo-trachealy intubated patients.

Aim and objectives: To study antimicrobial sensitivity among organisms isolated from endo-tracheal (ET) aspirates of patients with VAP.

Materials and methods: This retrospective study is designed to collect with data from medical records of patients admitted to the ICU of a tertiary referral hospital in the previous calendar year. 50 cases with VAP admitted to ICU were randomly selected and assessed for their clinical parameters (history and clinical examination) and investigations.

Results: ET aspirate culture and sensitivity sampling done in 50 subjects, only 32 samples yielded significant growth. Acinetobacter were isolated in 37.5%(12), Pseudomonas in 21.87%(7), Klebsiella in 15.6%(5), Enterobacter in 12.5%(4), Citrobacter in 6.25%(2)and Staphylococcus in 6.25%(2). Acinetobacter were sensitive to Amikacin (44.66 %), Gatifloxacin & Imipenem (33.33%), Meropenem &Cefaperazone (25 %). Pseudomonas were sensitive to Amikacin, Pipercillin, Cefaperazone (85.71%), Ceftriaxone (71.42 %), Imipenem, Meropenem and Gatifloxacin (57.14 %).

Conclusion: The commonest organism isolated ET aspirate cultures were Acinetobacter, as seen in similar Indian studies. The infections can be reduced by practicing aseptic measures in ICU. The overall outcome of VAP varies with the antibiotic policies of individual centers.

Keywords: Multidrug-resistant organisms, Ventilator associated pneumonia, VAP, Mechanical Ventilation, Endo-tracheal aspirates.

Key messages: The advent of many newer antibiotics in the past decade has not brought down the mortality in the critical care facilities across the world, associated with ventilator associated pneumonias. Due to the high incidence of VAP in our critical care facility we did this study to identify the culture sensitivity pattern of microbial isolates from endotracheal aspirates.

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INTRODUCTION:

Pneumonia is the commonest infection among patients in intensive care facilities across the world. It ranks worst among patient morbidity and mortality cases in hospital acquired infections. 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. However, there are many controversies in Indian centres regarding the epidemiology, aetiology, diagnosis, therapy, anti microbial resistance and the outcome of VAP.

AIM OF THE STUDY

To study the antimicrobial sensitivity among organisms which were isolated from the endo-tracheal aspirates of patients with ventilator associated pneumonias.

MATERIALS AND METHODS:

Source of data: The data was collected from medical records of the patients who were admitted to the ICU of a tertiary care centre in the past one year, and who were on mechanical ventilation for more than 48 hours.

Method of collection of data:

Study design: This was a retrospective study. The data were collected from the case records of the patients who were admitted to the tertiary care centre. From the patients who were admitted to the ICU during the past one year, 50 case records were randomly selected.

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.

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 > or $=10^5$CFU/ml.

Inclusion Criteria

All patients were subjected to mechanical ventilation for more than 48 hours in the ICU in the past one year.

Exclusion Criteria

- Patients having Pneumonia prior to MV.
- Patients having pulmonary oedema.
- Patients having Adult respiratory distress Syndrome (ARDS).

Data Analysis:

The data were analyzed by using the Chi-square test.

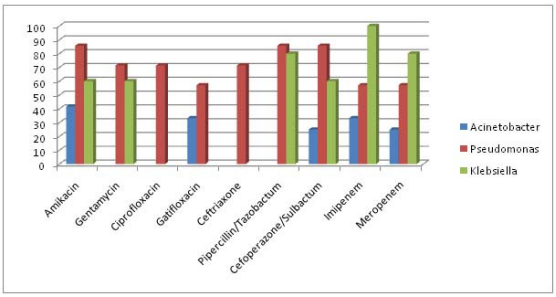
RESULTS:

The present study shows that VAP was more common in patients who were aged more than 60 years. The mortality rate was high among them. Gender had no relationship with VAP. In this study, patients with more than two associated comorbid factors developed VAP and the mortality rate was high among them.

A total of 50 VAP patients were studied, out of which 32 were positive for culture. Acinetobacter was the most common organism which was found to cause VAP, followed by Pseudomonas .Other organisms are Klebsiella, Citrobacter, Enterobacter and MRSA. Acinetobacter was isolated in 37.5% samples, followed by Pseudomonas (in 21.87% samples), Klebsiella (in 15.6% samples), Enterobacter (in 12.5% samples) and Citrobacter and Staphylococcus (in 6.25% samples).

Acinetobacter was sensitive to Amikacin (44.66%), Gatifloxacin and Imipenem

(33.33%), Meropenem and Cefaperazone (25%). Pseudomonas was sensitive to Amikacin, Pipercillin, Cefaperazone (85.71%), Ceftriaxone (71.42%), Imipenem, Meropenem and Gatifloxacin (57.14%). Klebsiella was sensitive to Imipenem (100%), Piperacillin, Meropenem (80%) and Cefaperazone(60%). The antibiotic sensitivity patterns of various isolated organisms are depicted in [Table/Fig 1].



[Table/Fig 1]: Antibiotic sensitivity pattern of Acinetobacter, Pseudomonas, Klebsiella

The clinical diagnosis of the patients who developed VAP at the time of admission was widely varying. Among the VAP patients, nine had diabetes (18%), six had IHD (12%), eight had CRF (16%), 6 had COPD with respiratory failure (12%), one had stroke (2%), three had sepsis (6%) and 5 had OP poisoning (10%).

DISCUSSION

VAP is defined as nosocomial pneumonia [1], [2] developing in a patient after 48 hours of mechanical ventilation. The incidences of VAP tend to increase with the duration of mechanical ventilation (MV) [1].

The estimated prevalence of VAP ranges from 10 to 65%, with a 20% case fatality [2], [3]. Ventilator-associated pneumonia is an important ICU infection in mechanically ventilated patients. It accounts for 13-18% of all hospital acquired infections. From recent studies, it was shown 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 [1] and Andrade et al [2].

The diagnostic criteria[5] 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; leukopaenia 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 causative organisms vary with the patients' demographics in the ICU, the method of diagnosis, the duration of hospital stay, and the institutional antimicrobial policies. VAP may be caused by a wide spectrum of bacterial pathogens. In the present study, gram negative bacteriae were the most common pathogens of VAP, as also observed in other studies. 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* [1], [2].

Recent studies have shown the increasing incidence of multidrug resistant pathogens (MDR) among the patients with VAP [1], [4], [5]. A study by Dey [6] showed the increased incidence of MDR pathogens in endo-tracheal aspirates.

Multidrug resistant organisms are increasing in our ICU's. Earlier studies have shown that Pseudomonas is the most common organism [1]. In the present study, Acinetobacter species was found to be the most common organism causing VAP, followed by Pseudomonas species. Although the Acinetobacter species is less virulent than Pseudomonas, they are becoming more and more resistant to the commonly used antimicrobial agents. Acinetobacter and Pseudomonas [1], [3], [7] were the most common organisms which were isolated in their study. 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 [5], [6].

Isolation of the causative organism from ET secretions and its culture sensitivity is crucial in the management of VAP. The sample can either be collected by invasive (broncho-alveolar lavage [BAL]) or non-invasive (endo-tracheal aspirate [ETA]) techniques [8], [9], [10], [11]. Aerobic and anaerobic cultures may be done to isolate the microbe. Heyland [8] and his colleagues showed that there was no significant difference between broncho-alveolar lavage and endo-tracheal aspiration, when they were used as diagnostic techniques for culturing microorganisms which cause VAP. Similar findings were seen in a study done by Peter et al in Vellore [9].

The early diagnosis and institution of appropriate antimicrobial therapy has shown reduced patient mortality [12]. The mortality rates in VAP varied from 20-75%, in different studies done by Rakshit et al and Andrade et al. The mortality rate in the present study among patients who developed VAP was found to be 50% [12], [13].

A study by Katherason SG and associates, observed that the device-related VAP infection rate was 27.0 %, with a mechanical ventilator utilization rate of 88.7% [15]. The most common causative pathogens in this study were *K pneumoniae* and Acinetobacter [16]. Age, gender and race were not identified as the risk factors in this study. In our study, patients aged more than 60 had a higher incidence of VAP and gender had no significant role in VAP.

The incidence of VAP can be prevented by adopting careful intubation techniques, oral tubation, avoiding gastric over- distension, maintaining adequate endo tracheal cuff pressure and efficient tracheal toileting [17]. This study helped us in the early diagnosis of VAP and also to determine the incidence of MDR organisms which cause VAP. The antibiotic susceptibility pattern helped the clinicians to choose the appropriate antibiotics for prophylactic and treatment purposes [17].

CONCLUSION:

The commonest organism which was isolated from the ET aspirate cultures were Acinetobacter, as seen in various studies done in India. A majority of the organisms which were isolated, were sensitive to amikacin. Multidrug resistant organisms are increasing in our ICU. 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. However, there are many controversies in the Indian centres, regarding the epidemiology, aetiology, diagnosis, therapy, resistance and the prognosis of VAP. Hence, there is a need for larger studies.

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