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Original Research Article

Organisms isolated from endotracheal aspirate and their sensitivity pattern in patients suspected of ventilator associated pneumonia in a tertiary care hospital

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ABSTRACT

Background: Ventilator associated pneumonia in critically ill patients are associated with high morbidity and mortality. Patients who are mechanically ventilated are at high risk of acquiring respiratory infections due to complex interplay between the endotracheal tube, host immunity and virulence of invading bacteria. To start empiric antimicrobial therapy knowledge of local antimicrobial resistance patterns are essential. Objectives of our study was to study antimicrobial sensitivity among organisms isolated from endotracheal aspirates of patients with VAP.
Methods: This is a prospective observational study, done in 100 patients who were mechanically ventilated for various reasons in ICU of our hospital over a period of one year. Clinical parameters, investigation, microbiological profile and sensitive characteristics of endotracheal aspirate was recorded and analyzed.
Results: Endotracheal aspirate culture and sensitivity was done in 100 patients.70 samples showed significant growth. Acinetobacter were isolated in 30 samples, *Pseudomonas* in 24, *Klebsiella* in 8, *Enterobacter* in 1, *Citrobacter* in 1 and *Staphylococcus* in 6 samples. *Acinetobacter*, *Pseudomonas* and *Klebsiella* were highly sensitive to colistin and polymyxin B, intermittently sensitive to meropenem and showed resistance to most of commonly used antibiotics.
Conclusions: The commonest organism isolated endo-tracheal aspirate cultures were Acinetobacter and Pseudomonas which was highly sensitive to colistin and polymyxin B. A local antibiogram for each hospital, based on bacteriological patterns and susceptibilities is essential not only to initiate empiric therapy but also to prevent poor outcomes and help in framing the appropriate institutional antibiotic policy.

Keywords: Endotracheal aspirate, Mechanical ventilation, Sensitivity, Ventilator associated pneumonia

INTRODUCTION

Ventilator associated pneumonia (VAP) may occur after 48 h of orotracheal intubation. It has become one of the major Intensive Care Unit (ICU)-acquired infections worldwide.[1] Accurate and rapid diagnostic methods are key to initiate appropriate antimicrobial treatment and to reduce VAP relapse, healthcare costs and mortality. It has also an indirect effect on the emergence of bacterial resistance.[2] As ventilator support is an essential part of respiratory care in intensive care unit, ventilator-associated pneumonia can be a serious complication. National Nosocomial Infections Surveillance system (NNIS) data (2004) from USA reported pooled mean VAP rate of 1.4-3.5/1000 ventilator days. In developing countries, the reported rates of VAP are significantly

higher, ranging from 16.1 to 89 episodes per 1,000 ventilator days.[3]

Center for Disease Control and Prevention (CDC) criteria for diagnosis of VAP includes multiple parameters which are observer dependent, and does not include cultures, which are important for appropriate antibiotic therapy.[4] Patients with inadequate antibiotic therapy may have a poor prognosis if a change in regimen is delayed while awaiting microbiological results. Bronchoalveolar lavage and protected specimen brush have been reported to have high sensitivity and specificity for the diagnosis of VAP, but are invasive and difficult to perform.[5] Endotracheal aspirate is relatively noninvasive method that can be easily performed. We aimed to study the organisms in endotracheal aspirate microscopy and their sensitivity pattern.

METHODS

It was a prospective observational study done from Jan 2016 to Jan 2017 at ICU of a tertiary care hospital. Study was conducted after approval of ethical committee and informed consent was obtained. Diagnosis of VAP was done when clinical pulmonary infection score was > 6.

Inclusion criteria

patients under mechanical ventilation for more than 48 hours in the ICU.

Exclusion criteria

Patients having Pneumonia prior to mechanical ventilation, Patients having pulmonary edema, Patients having Adult respiratory distress Syndrome (ARDS). Data Analysis: The data were analyzed by using the Chisquare test.

The endotracheal aspirate was collected by nonbronchoscopic method. The endotracheal aspirate was collected using a 22-inch Ramson's 12-F suction catheter with a mucus extractor, which was gently introduced through the endotracheal tube (for a distance of approximately 25-26cm. Gentle aspiration was then performed without instilling saline, and the catheter was withdrawn from the endotracheal tube.

After the catheter was withdrawn, 2ml of sterile 0.9% normal saline was injected into it with a sterile syringe to flush the exudates into a sterile container for collection and transported to microbiology laboratory. Endotracheal aspirate samples were immediately processed. for Gram's stain and cultures. For definite diagnosis of VAP, 10 5CFU/ml was considered as threshold.[6] Growth of any organism below the threshold was assumed to be due to colonization or contamination. Any significant growth was identified, and antibiotic sensitivity testing was performed on Mueller-Hinton agar plates by Kirby-Bauer disc diffusion method.[7]

RESULTS

A total number of 330 patients were on mechanical ventilator during the study period. Out of 330, only 100 patients were included in the study as their Clinical Pulmonary Infection Score (CPIS) >6 after 48h of MV. Out of 100 patients 70% had significant growth. Occurrence of VAP was common in men (64%) than women (36%) among the patients studied. Out of 100 VAP patients, 46 (46%) patients expired, and 54 (54%) improved and got discharged (Table 1).

This high mortality rate for the patients on ventilator may be due to any underlying disease rather than pneumonia in critically ill patients. So, VAP alone is not the cause for such a high mortality rate. The maximum number of cases were seen in the age more than 50 years (Table-2).

Table 1: Gender distribution and no of patients survived.

Sex	No of patients with VAP (%)
Male	64 (64)
Female	36 (36)
Survived	54 (54)

Table 2: Age distribution of patients.

Age in years	No of patients with VAP (%)
15-20	3
21-30	7
31-40	8
41-50	12
51-60	21
61-70	25
>70	24

Table 3: Comparison of diseases with VAP.

Disorder/disease	No. of patients with VAP (%)
Acute exacerbation of COPD	20
Cerebrovascular accident	17
Cardiogenic shock	10
Meningitis	10
Abdominal sepsis	12
Chronic renal failure	6
GBS	6
Malaria	5
Dengue shock syndromes	5
Poisoning/snakebite	4
Pancreatitis	3
Hepatic failure	2
Total	100

Table 3 shows that the occurrence of VAP was more common in patients with acute exacerbation of chronic obstructive pulmonary disease (COPD), followed by cerebro vascular accidents and abdominal sepsis. A total

of 100 VAP patients were studied, out of which 70 were positive for culture.

Acinetobacter was the most common organism which was found to cause VAP, followed by Pseudomonas. Other organisms are *Klebsiella, MRSA, Citrobacter and Enterobacter*. *Acinetobacter* was isolated in 30 samples, followed by *Pseudomonas* in 24 samples, *Klebsiella* in 8 samples, *Enterobacter* in 1 samples, Citrobacter in 1 samples and *Staphylococcus*(MRSA) in 6 samples (Table 4). *Acinetobacter* was sensitive to *colistin* and *polymyxin B*. *Pseudomonas* was sensitive to *colistin*, *polymyxin B Imipenem* and *Meropenem Klebsiella* was sensitive to *colistin* and *polymyxin B* (Table 5).

Table 4: Causative organisms in VAP- frequency, type of VAP, and associated mortality.

Organism isolated	No. of isolates
Acenetobactor	30
Pseudomonas	24
Methicillin resistant staph aureus	6
Klebsilla	8
Enterobactor	1
Citrobactor	1
Total	70

Table 5: Antibiogram of the isolates.

Organism isolated	Highly sensitive	Intermediate	Resistant
Pseudomonas	Polymyxin, colistin, meropenem, imipenem	Piperacilin +tazobactam, Gatifloxacin	Levofloxacin, ceftazidime, Cefoperazone+sulbactam
Methicillin resistant staph aureus	Vancomycin, linezolid	Clindamycin, levofloxacin, gatifloxacin	Oxacillin,methicillin, amoxicillin+clavulanate, erythromycin
Klebsilla	Polymyxin b, colistin,	Imipenem, meropenem, gatifloxacin	Ceftriaxone,ceftazidime, cefotaxime
Acenetobactor	Polymyxin b, colistin,	Imipenem, meropenem	Levofloxacin, cefoperazone+sulbactam, piperacilin+tazobactam
Citrobacter	Polymyxin b, colistin,	Levofloxacin Amikacin Amoxycillin	Cefixime,ceftazidime Ceftriaxone
Enterococci	Vancomycin, linezolid	Penicillin's, cephalosporin	Ofloxacin, gentamycin

DISCUSSION

Endotracheal intubation and mechanical ventilation are life-saving procedures needed in clinical conditions like sepsis, acute respiratory distress syndrome and neurological dysfunctions. While mechanical ventilation helps to prevent deaths due to respiratory failure, it poses great threat, by leading to life threatening lung infections like VAP. Ventilator associated pneumonia is defined as nosocomial pneumonia, developing in a patient after 48hours of mechanical ventilation. The incidences of VAP tend to increase with the duration of mechanical ventilation.[8] The estimated prevalence of VAP ranges from 10 to 65%, with a 20% case fatality. It accounts for 13-18% of all hospital acquired infections.[9] The complications and treatment cost significantly rise with VAP caused by resistant organisms, due to the cost of newer broad spectrum anti microbials and supportive measures. According to a recent review by Morehead et al, the incidence of ventilator associated pneumonia was 9 to 24% for patients intubated longer than 48hrs.[10] They found that culture positivity was more common in elderly male patients who were smokers, and who were admitted for respiratory causes or patients who had pre-existing lung diseases. This is in coherence with the study by Ferrer et al.[11] The causative organisms vary with the patients' demographics in the ICU, the method of diagnosis, the duration of hospital stays, and the institutional antimicrobial policies. In the present study, gram negative bacteria 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 *Acenetobactor*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae* and gram-positive cocci like *Staphylococcus aureus*. Recent studies have shown the increasing incidence of multidrug resistant pathogens (MDR) among the patients with VAP.[12,13] Summaiya et al, found that most common organisms isolated in endotracheal tube which produce strong biofilm are *Pseudomonas aeruginosa* and *Acinetobacter* species.[14] Trilok Patil et al, in their study noted that Pseudomonas aeruginosa was the most commonly isolated organism, followed by *Klebsiella pneumoniae*.[15] In another study by George et al, *Acinetobacter* was the most common isolate (37.5%), followed by *Pseudomonas* (21.8%) and *Klebsiella* (15.6%) and Amikacin, Gatifloxacin and Imipenem were the common sensitive antibiotics in their study.[16] The findings of the present study are consistent with the above studies, except for the antimicrobial sensitivities where most of the gram negative isolates are resistant to ampicillin, cotrimoxazole, amoxyclav, cephalosporins. A significant number of *Acinetobacter* and *Pseudomonas* isolates are also resistant to not only fluoroquinolones and

aminoglycosides but also to meropenem and imipenem. Multidrug resistant organisms are increasing in our ICU's. Earlier studies have shown that *Pseudomonas* is the most common organism. 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. 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.[17] Most of the isolates are becoming resistant to meropenem which is an alarming trend. Resistance to beta lactam class of antibiotic is a common occurrence and pan-drug-resistant strains are beginning to emerge. The mortality rates in VAP varied from 20-75%, in different studies done by Rakshit et al and Andrade et al.[18,19] The mortality rate in the present study among patients who developed VAP was found to be 46%. The incidence of VAP can be prevented by adopting careful intubation techniques, oral intubation, avoiding gastric over-distension, maintaining adequate endo tracheal cuff pressure and efficient tracheal toileting.[20] This study can help in the early diagnosis of VAP and also to determine the incidence of MDR organisms which cause VAP. The antibiotic susceptibility pattern can help the clinicians to choose the appropriate antibiotics for treatment.

CONCLUSION

The commonest organism which was isolated from the endotracheal aspirate cultures were *Acinetobacter*, followed by *Pseudomonas* which were sensitive to colistin and polymyxin B. Multidrug resistant organisms are increasing in our ICU. The infection rates could possibly be reduced by practicing aseptic measures in the ICU. The overall outcome of VAPs can be improved with the anti-microbial policies of each hospital.

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REFERENCES

1. Alp E, Voss A. Ventilator associated pneumonia and infection control. Annals Clinical Microbio Antimicro. 2006;5(1):7.
2. Erbay R H, Yalcin A N, Zencir M, Serin S, Atalay H. Costs and risk factors for ventilatorassociated pneumonia in a Turkish University Hospital's Intensive Care Unit: A case-control study. BMC Pulm Med. 2004;4:3.
3. National Nosocomial Infections Surveillance System Report: Data summary. Am J Infect Control. 2004;32:470-85.
4. Foglia E, Meier M, El-ward A. Ventilator-associated pneumonia in neonatal and pediatric intensive care units. Clin Microbiol Rev. 2007;20:409-25.
5. Miles RS, Amyes SG. Laboratory control of antimicrobial therapy. Mackie and McCartney practical medical microbiology. 1996;14:151-78.
6. Cinical and Laboratory Standards Institute. Performance Standards for Antimicrobial Susceptibility Testing; 17th informational supplement. CLSI document M100-S17(ISBN1-56238-625-5). Clinical and Laboratory Standards Institute USA, 2014.
7. Sanjai, N, Paul, B, Stephen, B, Michael D, Mark, L, Gary D. Sampling variability in the microbiological evaluation of expectorated sputa and endotracheal aspirates. J. Clin. Microbiol. 2001;39:2344-7.
8. Tripathi S, Malik GK, Jain A. Study of ventilator associated pneumonia in neonatal intensive care unit: characteristics, risk factors and outcome. Internet J Med Update. 2010;5:12-9.
9. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. Am J Infect Control. 1988;16:128-40.
10. Morehead RS, Pinto SJ. Ventilator-associated pneumonia. Archives Internal Medici. 2000;160(13):1926-36.
11. Ferrer M, Ioanas M, Arancibia F, Marco MA, de la Bellacasa JP, Torres A. Microbial airway colonization is associated with noninvasive ventilation failure in exacerbation of chronic obstructive pulmonary disease. Critical care Medic. 2005;33(9):2003-9.
12. Kumar AV, Pillai VS, Dinesh KR, Karim S. The phenotypic detection of Carbapenemase in meropenem resistant Acinetobacter calcoaceticus baumannii complex in a tertiary care hospital in south India. J Clin Diagn Res. 2011;5(2):223-6.
13. Drakulovic MB, Bauer TT, Torres A, Gonzalez J, Rodríguez MJ, Angrill J. Initial bacterial colonization in patients admitted to a respiratory intensive care unit: bacteriological pattern and risk factors. Respiration. 2001;68(1):58-66.
14. Mulla Summaiya A. Assessment of biofilm formation by the causative organisms of ventilator associated pneumonia at intensive care unit of a tertiary care hospital. Nat J Medic Res. 2012;2(1):15-8.
15. Patil, T. The Study of the organisms colonising trachea in mechanically ventilated patients admitted in the intensive care unit (ICU). International J Med Sci Edu. 2014;1(1):6.
16. George, P, Sequiera, A. Antimicrobial sensitivity pattern among organisms isolated from the endotracheal aspirates of patients with ventilator associated pneumonia. J Clin Diag Res. 2010;4: 3397-3401.

17. Standard Operative Procedures-Bacteriology. Antimicrobial Resistance Surveillance and Research Network, ICMR, New Delhi India. 2015:37.
18. Rakshith P, Nagar V S, Deshpande A K. Incidence, clinical outcome and risk stratification of VAP- A prospective cohort study. Indian J of Crit Care Med. 2005;9:211-6.
19. Andrade L, Vilela CAP, Cezario RC, Almeida AB, Filho PG. Ventilator Associated Pneumonia in an Adult Clinical- Surgical Intensive Care Unit of a Brazilian University Hospital: Incidence, Risk Factors, Etiology, and Antibiotic Resistance. Brazilian J Inf Dis. 2008;12:80-5.
20. Deja M, Spies C. Prevention measures of ventilator-associated pneumonia. Crit Care Med. 2009;37:330-2.

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