Volume : 2 | Issue : 7 | July 2013 • ISSN No 2277 - 8179

Bacteriological Profile and Antimicrobial Resistance Pattern in Patients Undergoing Mechanical Ventilation in a Tertiary Care Hospital, Navi Mumbai

Medical Science

KEYWORDS : Ventilator Associated Pneumonia; quantitative culture, Antibiotic sensitivity pattern.

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ABSTRACT

The objective of this study was to know the frequency of VAP, causative bacteria and antibiotic sensitivity pattern of patients undergoing mechanical ventilation in hospital ICU. Total 125 clinically suspected VAP cases were studied. The frequency of VAP in the study is 36%. The most common bacteria isolated were Gram-negative organisms i.e. Acinetobacter species, Pseudomonas species, Klebsiella species and Escherichia coli. Susceptibility pattern of all Gram-negative organisms isolated from ETA (endotracheal aspirates) of VAP cases showed sensitivity to Amikacin and Ceftazidime (62.3%), Gentamycin (57.4%). Susceptibility pattern of all Gram-positive organism isolated from ETA of VAP cases showed 100% sensitivity to Vancomycin, Co-trimazole, Linezolid and Gentamicin. The overall outcome of VAPs could improve with the anti-microbial policies of individual centers. However, there are many controversies regarding the epidemiology, aetiology, diagnosis, therapy, resistance and the prognosis of VAP. Hence there is a need for larger studies.

INTRODUCTION

Ventilator Associated Pneumonia (VAP) is a sub-type of hospital acquired pneumonia (HAP) which occurs in patients who are receiving mechanical ventilation (MV) for at least 48 hours or more [1]. Ventilator Associated Pneumonia is classified into 2 types. Early-onset VAP, which occurs during first 4 days of MV, usually is less severe, associated with a better prognosis, and is more likely to be caused by antibiotic sensitive bacteria. Late-onset VAP, which develops after 5 days or more after initiation of MV, is caused by multidrug-resistant (MDR) pathogens, and is associated with increased morbidity and mortality rate [2].

Upper airway colonization is considered an important predisposing factor for the development of VAP. Secretions of the lower respiratory tract obtained by bronchoscopy may accurately diagnose the pathogens. Therefore, culture of endotracheal aspirates (EA) is more relied on as it is less invasive and can be obtained early in the course of infection. Routine endotracheal aspirate cultures of critically ill patients in ICUs may be predictive of patients who are at high risk of invasive disease, and may guide the selection of appropriate empirical therapy based on the predominant pathogens identified in these cultures in the event of the development of VAP [3].

The most common bacterial causes of hospital acquired pneumonia are Gram-negative bacteria in 50% to 70% of cases with the predominant organisms being Pseudomonas aeruginosa and various Enterobacter Species including Acinetobacter species, Klebsiella species, E. coli, Citrobacter species, Staphylococcus aureus and streptococcus species account for 15% to 30% of hospital acquired pneumonia. These organisms account for approximately 60% of all cases of pneumonia [4].

MATERIALS AND METHODS

The study was conducted at the Department of Microbiology, M.G.M. Medical College, Kamothe, Navi Mumbai. The duration of the study was 1 year (from February 2012 to February 2013). The cases were from M.G.M. Hospital, Kamothe, Navi Mumbai. A total of 125 clinically suspected VAP cases were studied, sample collected was endotracheal aspirate

Microbiological Processing of sample:

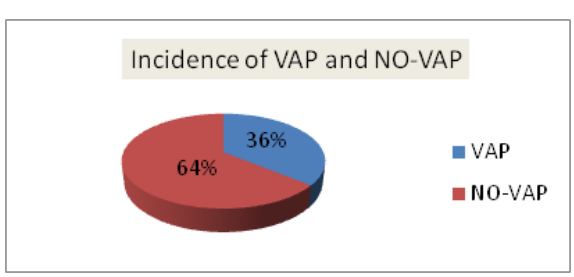
ETA samples were immediately processed. A smear was prepared from the sample and stained by Gram stain. The results of Gram's stain were obtained and quantitative cultures were performed immediately. The plates were incubated overnight at 37°C. Colony count was obtained from blood agar plate. For definitive diagnosis of VAP, quantitative culture threshold was considered as 10^4 CFU/ml. Growth of any organism below the threshold were assumed to be due to colonization or contamination. The growth of organism was characterized by colony morphology and Gram's staining from the culture plates. A detailed biochemical testing was performed and antibiotic sensitivity testing was performed on Mueller-Hinton agar plates by Kirby-Bauer's disc diffusion method using suitable antibiotics as per CLSI (Central Laboratory Standard Institute) guidelines [5, 6].

OBSERVATIONS AND RESULTS

A total of 125 clinically suspected VAP patients were enrolled for the study who fulfilled the study's criteria. Among 125 VAP patients, $\geq 10^4$cfu/ml indicating pathogenic bacteria causing VAP was seen in only 45 patients.

1. Incidence of VAP.

Out of total 125 patients studied, 45 patients showed quantitative culture threshold of $\geq 10^4$ cfu/ml on culture plates and were grouped under VAP accounting for 36%.



2. Risk factors of VAP.

The commonest risk factors in these VAP cases were preterm with LBW, COPD, post operative cases, viral infections, OP poisoning, alcoholic liver disease and DM.

3. Association of age with VAP.

The highest percentage of VAP was seen in the age group children <1 years 31.1% and 61 to 70 years 22.2%.

4. Association of gender with VAP.

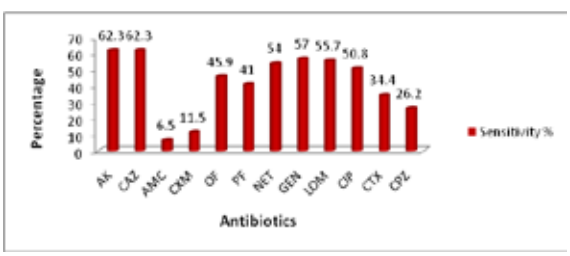
Maximum numbers of cases were from the male group 71.1% and males were affected more than females 28.9%.

5. Gram stain of endotracheal aspirate.
In our study out 45 VAP cases, Gram stain smear showed plenty pus cells 28.9%, few pus cells 57.8% and no pus cells 13.3% and all of them showed quantitative culture threshold of $>10^4$ cfu/ml on culture plate.

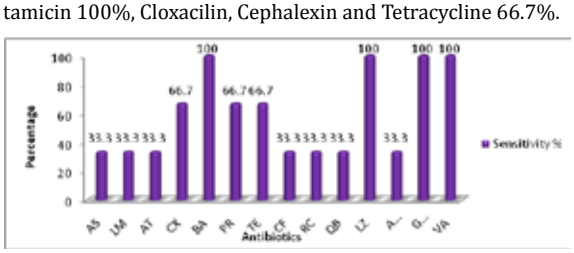
6. Association of growth pattern in VAP cases.
Out of 45 VAP cases, 57.8% showed single isolate and 42.2% showed multiple isolate of two or more bacteria's.

7. Organisms isolated from endotracheal aspirates.
In VAP group total 65 bacteria were isolated. Acinetobacter species 19 isolates, Pseudomonas species 19 isolates, Klebsiella species 10 isolates, Escherichia coli 8 isolates were the most common Gram-negative organisms isolated followed by Staphylococcus aureus 3 isolates.

8. Antibiotic sensitivity pattern of all Gram-negative organisms isolated from endotracheal aspirates of VAP cases.
Gram-negative organisms isolated from ETA of VAP cases showed sensitivity to Amikacin and Ceftazidime 62.3%, Gentamicin 57.4%, Lomefloxacin 55.7%.



9. Antibiotic sensitivity pattern of all Gram-positive organisms isolated from endotracheal aspirates of VAP cases.
Gram-positive organism isolated from ETA of VAP cases showed sensitivity to Vancomycin, Co-trimoxazole, Linezolid and Gentamicin 100%, Cloxacilin, Cephalexin and Tetracycline 66.7%.



DISCUSSION:
Out of 125 patients subjected to Mechanical Ventilation, 45 of them developed VAP hence the frequency of VAP in the present study is 36%. The present study frequency correlates with the other Indian studies as shown in table below.

Study	Place and study	Year	Incidence
Arindam Dey et al [6]	Kasturba College, Manipal.	2007	45.4%
Dr. Shalini Tripathi et al [7]	CSM Medical University, Lucknow.	2010	30.6%
R.M. Saldanha Dominic et al [8]	Kasturba Medical College, Manglore.	2012	38.5%
Present study	M.G.M. Medical College, Kamothe.	2013	36%

In our study patients receiving mechanical ventilation shows the maximum number of cases were from the age group <1 Year (41.6%) and 41 to 50 years (20%). Also the incidence of VAP cases was maximum in the age group child <1 year (31.1%) and 61 to 70 years (22.2%). This correlates with Kollef et al. who have reported a mean age of 68 years [9]. Even Quintana et al. in their study reported a mean age of 50 years of VAP [10].

The present study shows (71.1%) males and (28.9%) females out of 45 patients who developed VAP. Our results are comparable with Kollef, who in his study reported 24 males and 19 females [9]. Quintana et al in their study reported 82.7% males and only 17.3% females [10].

In our study out of 45 VAP positive cases, (57.8%) showed single isolate growth pattern and (42.2%) showed multiple isolate growth pattern in which 1 case shows the growth of 3 different bacteria. Figliolini et al. in their studies reported an incidence of 52% monomicrobial infections and 48% polymicrobial infections [11].

In the present study the most common bacteria isolated from the ETA of VAP cases were Acinetobacter species, Klebsiella species, Pseudomonas species, Escherichia coli and Staphylococcus aureus. The incidence of Pseudomonas species and Acinetobacter species were same i.e. 29.2% in our study. Quintana et al. has reports 40% incidence of Pseudomonas species [10]. The present study correlates with other Indian studies shown in table below.

Study	Place and study	Year	Organism isolated
K.H. Raghwendra et al [12]	Indra Gandhi Institute, Patna.	2002	Pseudomonas species, Staphylococcus aureus, Klebsiella species, CONS.
T. Rajshekar et al [5]	Nizams Institute, Hyderabad.	2006	Acinetobacter species, Pseudomonas species, Klebsiella Species.
Reena Set et al [13]	Mumbai.	2011	Klebsiella Species, Pseudomonas species, Acinetobacter species.
Present study	M.G.M Medical College, Kamothe.	2013	Acinetobacter species, Klebsiella Species, Pseudomonas species, Escherichia coli.

Gram-negative organisms isolated from ETA of VAP cases showed sensitivity to Amikacin and Ceftazidime (62.3%), Gentamicin (57.4%), Lomefloxacin (55.7%). Gram-positive organism isolated from ETA of VAP cases showed sensitivity to Vancomycin, Co-trimoxazole, Linezolid and Gentamicin (100%), Cloxacilin, Cephalexin and Tetracycline (66.7%).

CONCLUSION:
The incidence of VAP in the present study is 36%. The incidence of VAP was maximum in the age group child <1 year and elderly age group of 61 to 70 years which shows that very small children and elderly people are more prone to infection because of lack of their immunity. Gram negative bacteria such as Acinetobacter species, Pseudomonas species were the most common organism causing VAP and were the most frequently isolates from ETA. Gram-negative organisms isolated from ETA of VAP cases showed sensitivity to Amikacin and Ceftazidime (62.3%), Gentamicin (57.4%), Lomefloxacin (55.7%). Gram-positive organism isolated from ETA of VAP cases showed 100% sensitivity to Vancomycin, Co-trimoxazole, Linezolid and Gentamicin. The overall outcome of VAPs could improve with the anti-microbial policies of individual centers. However, there are many controversies regarding the epidemiology, aetiology, diagnosis, therapy, resistance and the prognosis of VAP. Hence there is a need for larger studies.

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