Original Research Article

Etiology and antibiotic resistant pattern in ventilator associated pneumonia patients in tertiary care hospital in Maharashtra

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Abstract

Background: Ventilator associated pneumonia (VAP) refers to hospital acquired pneumonia that occurs within 48 hours or longer after mechanical ventilation (MV). It is characterized by the presence of new or progressive infiltrate, sign of systemic infection (fever, altered white cell count), changes in sputum characteristics. **Aims and Objectives :**To study etiology and antibiotic resistant pattern in ventilator associated pneumonia patients in tertiary care hospital in Maharashtra. **Methodology:** This was a cross-sectional study carried out in the patients admitted to ICU with ventilator and later they developed complication like VAP (Ventilator associated Pneumonia) during the one year period i.e. July 2018 to July2019. The endotracheal aspirate samples were subjected to quantitative culture technique. The data was entered to excel sheet and analyzed percentage and proportions by excel software for windows 10. **Result:** In our study we have found that The majority of the patients were in the age group of >70 were 38.4% followed by 60-70 . The majority of the patients were Male i.e. 62.40% and Female were 37.60% ; In Gram –ve the most common organism were NFGNB -25%, Pseudomonas -21%, Kl.Spp-18%; In Gram +ve the most common organism were Staph aureus-35%, CONS-29%, Strept.Spps-15%. The most common etiological factors of VAP were Older age i.e. 68.8%, followed by Head injury with low GCS in 25.6%, Diabetes in 23.2%, Respiratory disease in 20%, H/o Diabetes in 16.8%, H/o smoking in 15.2%, H/o Chronic alcoholism in 12%, H/o Chronic renal failure in 10.4%. **Conclusion:** This pattern of the antibiotic resistance and etiological factor very helpful for the treatment of the patients and control of hospital acquired infections especially VAP.

Key Words: VAP (Ventilator Acquired Pneumonea), Gram + ve organism, Gram-ve organism,

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INTRODUCTION

Ventilator associated pneumonia (VAP) refers to hospital acquired pneumonia that occurs within 48 hours or longer after mechanical ventilation (MV). It is characterized by the presence of new or progressive infiltrate, sign of systemic infection (fever, altered white cell count), changes in sputum characteristics. [1] Ventilator-associated pneumonia (VAP) is the most commonly seen nosocomial infection among mechanically ventilated patients and is the biggest concern for critical care specialists. Eighty-six percent of nosocomial pneumonias are associated with mechanical ventilation. Though the incidence of VAP has declined in the developed countries, it continues to be unacceptably high in the developing world.[2,3] VAP that occurs within 48 to 72 hours of MV is termed as early onset VAP. VAP that occurs after this period is considered late onset VAP. VAP is the second most common nosocomial infection in the intensive care unit (ICU) and the most common in mechanically ventilated patients. [4] The incidence of VAP

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increases with the duration of MV.[5] Ventilator-associated pneumonia (VAP) is important cause of hospital morbidity and mortality in Intensive Care Unit (ICU) patients despite recent advances in diagnosis and accuracy of management. VAP is the most frequent ICU acquired infection, occurring in 25% of patients intubated for longer than 48 h. The incidence of VAP ranges from 13 to 51 per 1000 ventilator days.[6] usually less severe, associated with a better prognosis, and is more likely to be caused by antibiotic-sensitive bacteria. Late-onset VAP, is usually caused by multi-drug resistant (MDR) pathogens and is associated with increased morbidity and mortality.[7,8] So, being this problem much common in the patients on ventilator we have studied the etiology and antibiotic resistant pattern in ventilator associated pneumonia patients in tertiary care hospital in Maharashtra.

METHODOLOGY

This was a cross-sectional study carried out in the patients admitted to ICU with ventilator and later they developed complication like VAP (Ventilator associated Pneumonia) during the one year period i.e. January 2018 to January 2019; the details of the information like age, sex or any associated finding of it was noted. The endotracheal aspirate samples were subjected to quantitative culture technique as described by 9 . A colony count of ≥105 colony forming units (cfu)/ml was considered significant . Any growth below this was considered as colonization or contamination. Identification of the isolates was done by standard biochemical tests13, and antimicrobial susceptibility test was performed and interpreted as per the Clinical and Laboratory Standards Institute (CLSI) guidelines14. For the Enterobacteriaceae members and non-fermenters, the antibiotics used were amikacin (AK), ampicillin (AMP), amoxicillinclavulanate (AXV), aztreonam (AZT), cefotaxime (CTX), cefepime (CPM), ceftazidime (CTZ), cefoperazone-sulbactam (CFS), chloramphenicol (CHL), ciprofloxacin (CIP), co-trimoxazole (COT), gentamicin (GEN), imipenem (IPM), piperacillintazobactam (PTZ), netilmicin (NET), polymyxin-B (PB) and tigecycline (TGC). For Pseudomonas isolates, AMP, AXV, cefoxitin (CXT), CHL, COT and TGC were excluded from the panel. For the Gram-positive pathogens, the panel included AMP, AXV, penicillin (PEN), CXT, COT, CIP, GEN, erythromycin (ERY), vancomycin (VAN) and linezolid (LIZ). CXT (30 µg) disc was used as a surrogate marker for determining methicillin resistance amongst the staphylococci. Control strains of Escherichia coli ATCC 25922, Staphylococcus aureus ATCC 25923 and Pseudomonas aeruginosa ATCC 27853 were used for antimicrobial susceptibility tests. In selected instances, where CLSI guidelines for disc diffusion technique are not available, the following strategies were adopted: (i) for CFS, the CLSI interpretative guideline for cefoperazone was used; (ii) for PB, the recommendation of Galani *et al*15 was adopted; (iii) and VAN susceptibility for Staphylococcus spp. and Enterococcus spp. were interpreted as per the British Society for Antimicrobial Chemotherapy guidelines .The data was entered to excel sheet and analyzed percentage and proportions by excel software for windows 10.

RESULT

Table 1: Distribution of the patients as per the age

Age	No.	Percentage (%)
20-30	5	4
30-50	11	8.8
50-60	23	18.4
60-70	38	30.4
>70	48	38.4
Total	**125**	**100**

The majority of the patients were in the age group of >70 were 38.4% followed by 60-70 were 30.4%, 50-60 were 18.4%, 30-50 were 8.8 , 20-30 -4%.

Table 2: Distribution of the patients as per the sex

Sex	No.	Percentage (%)
Male	78	62.4
Female	47	37.6

The majority of the patients were Male i.e. 62.40% and Female were 37.60%

Table 3: Distribution of the patients as per the Bacteriological profile among the patients of VAP

Gram -ve	No.	Percentage (%)
NFGNB	31	25%
Pseudomonas	26	21%
Kl.Spp	23	18%
Enetrobacter	21	17%
E.Coli	15	12%
Gram +ve	0	
Staph aureus	44	35%
CONS	36	29%
Strept.Spps	19	15%
Candida Spp	20	16%

In Gram –ve the most common organism were NFGNB -25%, Pseudomonas -21%, Kl.Spp-18%

In Gram +ve the most common organism were Staph aureus-35%, CONS-29%, Strept.Spps-15%

Table 4: Distribution of the patients as per the Antimicrobial resistance pattern among Gram –ve organism

Antimicrobial Agent	E.Coli	Kl.Spp	Enterobacter.spp	Other Enterobacter.spp	Pseudomonas Spp	NFGNB
AMP	93.21	95.12	89.36	86	100	95
AXV	94.78	84.21	81.24	75	100	86
CTX	88.73	79.34	66.23	68	32	87
CFS	19.32	34.52	31.24	19	21	41
PTZ	22.32	30.41	31.24	12	16	56
IPM	9.58	19.24	17.95	19	14	34
CHL	11.47	19.84	30.24	34	91	35
COT	75.36	75.82	65.48	79	96	81
CIP	86.32	53.69	57.28	70	25	79
PB	2.32	0	0	0	6	4
CPM	26.54	33.21	40.25	45	15	71
AZT	26.57	33.69	27.89	19	13	53
GEN	49.36	40.58	57.89	75	24	74
NET	18.32	24.87	32.21	30	16	47
CTZ	26.39	32.56	42.58	38	31	59
AK	32.58	24.57	44.56	68	19	69

All gram negative species like E.Coli, Kl.Spp, Enterobacter.spp, Other Enterobacter.spp, Pseudomonas Spp, NFGNB were almost resistant to AMP i.e. -93.21, 95.12, 89.36, 86, 100, 95 and to AXV-94.78, 84.21, 81.24, 75, 100, 86 etc.

Table 5: Distribution of the patients as per the Antimicrobial resistance pattern among Gram +ve organism

Antimicrobial Agent	Staph	CONS	Strep	Enterococcus
AMP	95	85	28	69
GEN	52	39	NT	NT
PEN	95	93	35	35
COT	53	60	68	10
ERY	50	47	18	51
LIZ	Nil	Nil	Nil	Nil
VAN	Nil	Nil	Nil	10
CXT	53	43	86	NT
AXV	63	64	12	18
CIP	67	51	12	69

Majority of the organisms Staph, CONS, Strep, Enterococcus were resistant to AMP i.e. 95, 85., 28, 69, 100 95 and to AXV were 63, 64, 12., 18, 100, 86 respectively.

Table 6: Distribution of the etiological factors of VAP

Associated factors	No.	Percentage (%)
Older age	86	68.8
Head injury with low GCS	32	25.6
Diabetes	29	23.2
Respiratory disease	25	20
H/o Diabetes	21	16.8
H/o smoking	19	15.2
H/o Chronic alcoholism	15	12
H/o Chronic renal failure	13	10.4

The most common etiological factors of VAP were Older age i.e. 68.8%, followed by Head injury with low GCS in 25.6%, Diabetes in 23.2%, Respiratory disease in 20%, H/o Diabetes in 16.8%, H/o smoking in 15.2%, H/o Chronic alcoholism in 12%, H/o Chronic renal failure in 10.4%.

DISCUSSION

Many studies from India have investigated the causative organisms of VAP. Pseudomonas spp., Acinetobacter spp., Escherichia coli, Klebsiella pneumoniae, and Staphylococcus aureus were identified as the common VAP pathogens, with varying prevalence. Up to 40% of these infections can be polymicrobial. Pseudomonas spp., Acinetobacter spp. and even Enterobacteriaceae are quite often MDR. [10,11] Therefore, the local microbial flora causing VAP needs to be studied in each setting to guide

more effective and rational utilization of antimicrobial agents. So for there is scanty literature about incidence, bacteriology, and antibiotic susceptibility pattern about VAP in India. Both Gram-positive and Gram-negative bacteria are implicated in VAPs, and ESKAPE organisms (Enterococcus faecium, S. aureus, Klebsiella pneumoniae, Acinetobacter baumannii, P. aeruginosa and Enterobacter spp.) constitute 80 per cent of the VAP epoisodes [12]. Contrary to this, in a large international study of the 606 cases of VAP, Gram-positive pathogens were the predominant isolates (72.8%) with methicillin-resistant S. aureus (MRSA) constituting 42.7 per cent [13]. This finding was in contrast to other reports, where Gram-negative bacteria (particularly Pseudomonas spp., Acinetobacter spp., E. coli and Klebsiella spp.) were the predominant isolates from VAP23,[15]. In our study, the Gram-negative bacilli were the principal isolates, and Pseudomonas spp., non-fermenters and Klebsiella spp. were the most common pathogens with almost similar proportion frequency, and these findings were corroborated by other Indian studies [16]. The introduction of extended spectrum third generation cephalosporins about three decades back resulted in mutations which were mainly reported amongst the Klebsiella spp [17]. However, in the last 10 years, there has been a rise in the prevalence of CTX-M phenotype which has spread to E. coli [18]. In our study the resistance to CTX rose to 78.8 per cent in Klebsiella spp. and almost 90 per cent in E. coli. Although these inactivating agents can be inhibited by β-lactamase inhibitors, nonsusceptibility to PTZ in CTX-M-producing E. coli and Klebsiella spp. was 27.4 and 38.1 per cent, respectively, in a European study [19] In our study we have found that The majority of the patients were in the age group of >70 were 38.4% followed by 60-70 were 30.4%, 50-60 were 18.4%, 30-50 were 8.8 , 20-30 -4%. The majority of the patients were Male i.e. 62.40% and Female were 37.60% In Gram –ve the most common organism were NFGNB -25%, Pseudomonas -21%, Kl.Spp-18% In Gram +ve the most common organism were Staph aureus-35%, CONS-29%, Strept.Spps-15% All gram negative species like E.Coli, Kl.Spp, Enterobacter.spp, Other Enterobacter.spp, Pseudomonas Spp, NFGNB were almost resistant to AMP i.e. -93.21, 95.12, 89.36, 86, 100, 95 and to AXV-94.78, 84.21, 81.24, 75, 100, 86 etc. Majority of the organisms Staph, CONS, Strep, Enterococcus were resistant to AMP i.e. 93.21, 95.12, 89.36, 86, 100, 95 and to AXV were 94.78, 84.21, 81.24, 75, 100, 86 respectively. The most common etiological factors of VAP were Older age i.e. 68.8%, followed by Head injury with low GCS in 25.6%, Diabetes in 23.2%, Respiratory disease in 20%, H/o Diabetes in 16.8%, H/o smoking in 15.2%, H/o Chronic alcoholism in 12%, H/o Chronic renal failure in 10.4%. These findings are similar to Abhijit Chaudhury *et al* 9they found VAP rates of 44.1; non-fermentative Gram-negative bacilli were the predominant organisms, followed by Pseudomonas spp. and Klebsiella spp. Staphylococcus aureus exhibited a downwards trend in prevalence from 50.0 per cent in 2011 to 34.9 per cent in 2013. An increase in vancomycin-resistant enterococci was seen from 4.3 per cent increasing trend in resistance was shown by Pseudomonas spp. for piperacillin-tazobactam (PTZ), amikacin and imipenem (IPM). For the non-fermenters, resistance frequency remained very high except for IPM (33.1%) and polymyxin-B (2.4%).

CONCLUSION

This pattern of the antibiotic resistance and etiological factor very helpful for the treatment of the patients and control of hospital acquired infections especially VAP.

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