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Clinical Investigation

Microbial profile of ventilator associated pneumonia at a rural tertiary care centre

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Abstract

Background: Ventilator associated pneumonia (VAP) is one of the most important form of hospital acquired infections which is associated with increased mortality and morbidity. VAP occurs in about 9 to 27% of all intubated patients. Intubation is associated with 3 to 10 fold increase in the incidence of VAP among all patients receiving mechanical ventilation. In contrast to other nosocomial infections, the crude mortality rate occurring due to VAP ranges from 24% to 76%. ICU patients with VAP have a 2 to 10-fold higher risk of death when compared with patients without pneumonia. The present study is undertaken to find out the frequency of occurrence of VAP in clinically suspected patients who are mechanically ventilated for more than 48 hours at R. L. Jalappa Hospital and Research Centre, Kolar and the major pathogens causing VAP and their antibiotic sensitivity pattern. ***Methods:*** A total of hundred patients who are mechanically ventilated for more than 48 hours with clinical suspicion of VAP were included in the study. Endotracheal aspirate was collected and subjected to Grams stain and culture. Culture was performed by quantitative culture technique. Growth on the culture plate was identified by standard biochemical reactions and subjected to antibiotic sensitivity testing by Kirby Bauer disc diffusion method. ***Results:*** Among the 100 clinically suspected VAP patients enrolled in the study 71% patients were diagnosed with VAP as per the CPIS score with a VAP rate of 17-22/1000 patient ventilated days. The most common age group affected was 31- 40 years with male preponderance. The mean duration of ventilation was 5.38 days. 26.76% of the infections were categorized as early onset VAP while 73.3% as late onset VAP. ***Conclusion:*** Acinetobacter was the most common organism causing both early onset and late onset VAP.

Key words: Early onset, Late onset, VAP

Introduction

Ventilator associated pneumonia (VAP) is an important ICU infection in mechanically ventilated patients and is the 2nd most common nosocomial infection accounting to 15% of all hospital acquired infections[1]. Approximately 10-28 % of critical care patients develop VAP [1,2]. Prevalence ranges from 10-65 % in tertiary care hospitals and a case fatality rate of more than 20% [3]. It is an important cause of morbidity and mortality and increased health-care cost in ICU set-up.

It is classified as either early onset (occurring within 96 hours mechanical ventilation) or late onset (>96 hours of mechanical ventilation [1]). Early onset VAP is causing VAP needs to be studied in each setting to guide an effective and rational utilization of antimicrobial agents. Hence this study was undertaken to study the frequency of occurrence of VAP and to evaluate the quantitative bacterial and fungal isolates causing early and late onset VAP and their antibiotic sensitivity pattern.

Materials and Methods

A prospective study was conducted at ICU of R.L.Jalappa Hospital and Research Centre Kolar over a period of 1 year 7 months (Jan 2011 – Aug 2012)

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those who were on mechanical ventilation for < 48 hours were excluded. Clinically suspected patients according to CDC [1]criteria were scored by the Chronic Pulmonary infection Score (CPIS) [(4)] according to the clinical, microbiological and radiological signs. Patients with the CPIS> 6 were considered as confirmed VAP cases and microbiological processing was done. All relevant data including age, gender, and clinical diagnosis were recorded. The procedure of collection and informed consent was taken from the patients. Endotracheal aspirate was collected from clinically diagnosed cases. ETA was collected using two catheters where-in a Ramson's 8F suction catheter was guided through a Ramson's 14f suction catheter and gently introduced through the endotracheal tube for approximately 24 cm. The sample was gently aspirated without installing saline and the suction catheters were withdrawn. The sample was transferred into a clean labelled container. The sample was immediately transported to the laboratory for microbiological processing. On Microbiological processing, Gram's stain was performed on all samples before dilutions**.** Samples were mechanically liquefied and homogenised by vortexing for 1 min and then serially diluted in 0.9% sterile saline solution with final dilutions of 10^{-1}, 10^{-2}, 10^{-3} . The growth from the final dilution of 10^{-3} was considered as pathogens and processed. The samples were then plated on blood agar, chocolate agar, Mac-Conkey agar and incubated overnight at 37^{0}C. Sample was plated on Saborauds dextrose agar if fungal elements were seen in Gram's smear. Growth was identified by colony morphology, grams stain and by standard biochemical reactions[6]. Antibiotic sensitivity testing was done according to the CLSI guidelines.

Results

Of the 100 clinically suspected cases included in the study, 71 were confirmed as VAP according to the CPIS score, among which 66% were males and 34% were females with a mean age of 41.13 ±1 5.38 years (range 18 to 70 years) and a VAP rate ranging between 17 – 22/1000 patient ventilated days during the various months of the study period. Patients who developed VAP within 96 hours were categorized as early onset VAP, while after 96 hours were categorized as late onset VAP. The incidence of early onset VAP was 27% while late onset VAP was 73%. Late onset VAP is more common than early onset VAP. Acinetobacter species followed by Pseudomonas aeruginosa were the most common organisms causing early onset and late onset VAP. Among the fungal isolates Non albicans Candida was the common isolate in the late onset VAP (6.18%), while the early onset VAP was associated with Candida albicans (5%). The organism causing early onset and late onset VAP are shown in table 1.

Organism	Early onset VAP	Late onset VAP
Acinetobacter species	10(25%)	29(29.89%)
Pseudomonas aeruginosa	8(20%)	24(24.74%)
Klebsiella pneumonia	6(15%)	17(17.52%)
MRSA	2(5%)	7(7.21%)
Non Albicans Candida	1(2.5%)	6(6.18%)
Enterobacter species	4(10%)	5(5.15%)
MSSA	4(10%)	3(3.09%)
E. coli	1(2.5%)	3(3.09%)
Citrobacter diversus	2(5%)	2(2.06%)
Candida albicans	2(5%)	1(1.03%)
Total	40(100%)	97(100%)

Table:1 – Showing the organisms causing early and late onset VAP

EARLY ONSET GROUP:

	Acinetobacter Species	Pseudomonas aeruginosa	K.Pneumoniae	MRSA	MSSA	E.coli	Enterobacter Species	Candida species	Citrobacter diversus
Respiratory diseases	4	3	5	1	2	0	3	3	1
Head trauma & Neurosurgery	1	0	0	0	1	0	0	0	0
OP Poisoning	4	2	0	1	0	0	1	0	0
Encephalopathy		1	0	0	0	0	0	0	0
Cardiac causes	1	1	1	0	0	0	0	0	0
Exploratory Lap	0	0	0	0	0	1	0	0	1
Others	0	1	0	0	1	0	0	0	0
Total	10	8	6	2	4	1	4	3	2

LATE ONSET GROUP:

	Acinetobacter Species	Pseudomonas aeruginosa	K.Pneumoniae	MRSA	MSSA	E.coli	Enterobacter Species	Candida species	Citrobacter Diversus
Respiratory causes	7	7	6	3	0	0	1	4	1
Head trauma & Neurosurgery	10	9	6	2	2	1	1	1	1
OP Poisoning	4	5	2	1	0	0	3	0	0
Encephalopathy	3	1	1	1	0	1	0	0	0
Cardiac causes	2	1	1	0	0	0	0	0	0
Exploratory Lap	2	0	0	0	0	1	0	0	0
Others	1	1	1	0	1	0	0	2	0
Total	29	24	17	7	3	3	5	7	2

Table:2 – Showing the association of organisms with clinical disease in early onset and late onset VAP

In the early onset group *Klebsiella pneumoniae* was most commonly associated with Respiratory causes. Acinetobacter was associated with Respiratory causes and OP Poisoning. All the Candida species isolated was associated with respiratory causes. In the late onset group head trauma and neurosurgery was commonly associated with Acinetobacter species followed by *Ps.aeruginosa* and *K.pneumoniae*. MRSA was the predominant gram positive cocci associated with respiratory causes. Candida species was most commonly associated with underlying Respiratory diseases. (table 2).

Discussion

VAP is the second most common nosocomial infection and one of the most common nosocomial infections in the Intensive care unit. . In contrast to other nosocomial infections the crude mortality rate occurring due to VAP ranges from 24% to 76%[3]. A total of 100 clinically suspected VAP patients admitted in the ICU were enrolled in the study as per the inclusion criteria. Of the 100 patients analysed VAP was diagnosed in 71% patients as per the CPIS score. Out of 71 diagnosed VAP cases, 66% were males and 34% were females with a mean age of 41.13 ±1 5.38 (range 18 to 70 years). The risk of pneumonia in patients receiving mechanical ventilation increases with the duration of ventilation. Fagon et al showed that incidence of VAP rises with number days of mechanical ventilation[7]. In our study 26.76% (19) were categorized as early onset VAP while 73.23% (52) were categorized as late onset VAP with a mean duration of ventilation of 5.32 ± 1.36 days. In our ICU set up late onset VAP was most common when compared to early onset VAP, which correlated with the findings by Valles J et al[8] where 27.5% of the patients had early-onset VAP and 72.5% had late-onset VAP. While in a study by Rello et al[9], the incidence of early onset VAP was 12.8% which is lower than our study.

Early-onset VAP is usually due to the underlying pathology. On the other hand, late-onset VAP could be due to prolonged ventilation, evolution of the underlying disease, quality of nursing care, duration of antibiotic exposure or environmental ecology of the hospital. Studies have shown that previous antibiotic usage decreases early-onset VAP but markedly increases multidrug-resistant (MDR) pathogens. Colonization of organism was commonly seen in our patients with underlying respiratory disease (36.6%) which included ARDS, Bronchopneumonia and COPD, followed by head trauma and neurosurgical cases (21.12%) and OP poisoning (19.71%). Cook et al reported an incidence of VAP in 17.8% of trauma and neurosurgical patients[10]. In a study by Joseph et al incidence of VAP was more in OP poisoning followed by neurological disorders and CNS infections (*P* value 0.0046 and 0.0249 respectively)[11] .

In our study *Acinetobacter species* (27.44%), *Pseudomonas aeruginosa* (22.37%) and *Klebsiella pneumoniae* (16.26%) were the most common organisms causing early and also late onset VAP, which is similar to Dey et al, where *Acinetobacter species* and *Pseudomonas aeruginosa* accounted to 48.94% and 25.53% respectively[5]. In a study by Rello et al, *Staphylococcus aureus* (23.7%) and *Pseudomonas species* (19.7%) were the most common organisms causing early and late onset VAP respectively[12]. According to Fagon et al, the members of the *Enterobacteriaceae* accounted for 14% of infections which included *Escherichia coli*, *Proteus* species, *Enterobacter* species, and *Klebsiella* species and smaller numbers of *Citrobacter* and *Hafnia* species. In our study 30.11% of the infections were caused by members of the family *Enterobacteriaceae* which included Klebsiella pneumonia (16.26%), Enterobacter species (7.57%), *Citrobacter diversus* (3.53%) and *E.coli* (2.75%).

Among the Gram positive cocci , 13.09% of MSSA was associated with an early onset VAP, while MRSA was associated with late onset VAP with 12.21%, which is similar to a study by Joseph et al wherein, 13% of MSSA was associated with early-onset VAP and 50% of MRSA was associated with late -onset VAP [13]. Though Candida species are isolated commonly from endotracheal aspirates, it usually represents colonization of the airways, prolonged exposure to steroids or antibiotics and chronic debilitating diseases. In our study, we found that 4.34% were non *albicans Candida* and 3.0% were *Candida albicans*. Treatment with antifungal agents is controversial and is rarely required[14]. A variation in the microbial flora was noted at various centres. This variation is due to the diversity of the patient population studied, ecology of the organisms and previous antibiotic exposure thus emphasizing the need of timely surveillance. Therefore the microbial flora when studied in each setting can guide the clinician in more effective and rational use of anti-microbial agents and also helps to develop an antibiotic policy for empiric therapy in VAP patients. Thus VAP is polymicrobial in nature and is associated with increased mortality. Hence timely surveillance of the organisms and their sensitivity pattern will guide the clinician in appropriate and effective management thereby preventing drug abuse and development of MDR strains. Use of appropriate preventive measures and good nursing care can reduce the incidence of VAP.

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