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A STUDY ON VENTILATOR ASSOCIATED PNEUMONIA (VAP) IN THE ADULT INTENSIVE CARE UNIT AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: VAP requires a rapid diagnosis and initiation of appropriate antibiotic treatment, as there is adverse effect of inadequate antibiotic treatment on patients' prognosis and the emergence of multidrug-resistant (MDR) pathogens. **Aims &Objectives:** To know incidence of VAP infection, the bacterial profile of VAP and the antibiotic resistance pattern from VAP infection. **Material & methods:** This prospective study was done from 6 bedded adult ICU and included all patients admitted to ICU with devices mechanical ventilator [MV] for>48 h between October 2011 and May 2013. Quantitative culture of endotracheal aspirate was done. **Results:** Two hundred and eighty four adult patients, on MV for 48 h and more, were included and 64 (22%) developed VAP. Most of the patients had late onset VAP (92%). Non fermenters ,*Acinetobacterbaumannii*mainly were most common causative agents of early onset & late onset VAP. In late onset VAP, most *Acinetobacter baumannii* & *Pseudomonas aeruginosa* were MDRs. Even most of isolates of *Enterobacteriaceae* family were MDRs. Only one MRSA isolate was seen. **Conclusion:** Knowledge of the resident microbial flora and their antimicrobial susceptibility pattern with common resistance mechanism is necessary for formulating a rational antibiotic policy in a hospital.

KEYWORDS: VAP, ICU, MDR, MRSA.

1. INTRODUCTION

Nosocomial Infection(NI) is defined as infection that is acquired in a hospital (i.e., the infection was not present/ incubatory at the time of admission).For most bacterial infections,

an onset of symptoms more than 48 hrs after admission is evidence of nosocomial acquisition. Between 5 and 10% of patients admitted to acute care hospitals acquire an infection during hospitalization. [1] The American Thoracic Society (ATS) consensus statement suggests the categorization of NP as. [2]

a)Early-onset NP: Nosocomial pneumonia occurring within 4 days after hospital admission
b)Late-onset NP: Nosocomial pneumonia occurring 5 or more days after hospital admission
This categorization helps predict the implicated pathogens and guides us in the initial empiricthерapy with antibiotics, which is known as the epidemiological approach.[3]

Early-onset pneumonia commonly results from aspiration of endogenous community acquired pathogens colonizing the oropharynx, with endotracheal intubation and impaired consciousness being the main risk factors. Conversely, late-onset VAP may be caused by more unusual or multidrug-resistant (MDR) pathogens following aspiration of oropharyngeal and gastric secretions. [4]

Most cases of nosocomial pneumonia in the intensive care unit occurs in patients who are tracheally intubated and are receiving mechanical ventilation. These factors have been linked to a 6 to 20 fold increased risk for nosocomial pneumonia. [5]

More recently, Multidrug resistance(MDR) gram negative rods have become increasingly prevalent in many hospitals. E.g; 2006-2007 NHSN data reveals Acinetobacter baumannii was 3rd important cause for Ventilator associated pneumonia(VAP) & 30 % isolates were resistant to carbapenems. This represents an astonishing increase from the 1990s, when Acinetobacter didn't even make the list of top eight causes of nosocomial pneumonia. [6]

The frequency of such infections, particularly in ICUs & the agents & their resistance rates should be identified in order to better control infections. [7]

2. MATERIALS & METHODS

This prospective study was done from 6 bedded ICU of ESIC MC PGIMSR Teaching Hospital , Rajajinagar, Bengaluru and included all patients admitted to ICU with devices mechanical ventilator [MV] for >48 h between October 2011 and May 2013.

2.1 Source of Data

Data was collected from the patient's case sheets admitted to 6 bedded recently established intensive care unit of ESIC MC PGIMSR Teaching Hospital, Rajajinagar, Bengaluru.

2.2 Study Period: One year & 8 months from October 2011 to May 2013.

2.3 According to CDC definitions [8]

Inclusion Criteria

Ventilator Associated Pneumonia (VAP)

Adult patient on mechanical ventilation at the time of or within 48 hours before onset of the event and showing radiological evidence of pneumonia and any 2 of the following:

Temperature $\geq 38^0$C or $\leq 35^0$C

WBC >12000/mm^3 or <4000/mm^3

Purulent sputum

Pathogenic bacteria isolated from endotracheal aspirate.

Exclusion Criteria

Patients not on ventilator

Patients intubated outside

2.4 Methods of Collection of Data

Sampling Technique

The Endo-Tracheal Aspirate (ETA) 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 25-26 cm. Gentle aspiration was then performed without instilling saline, and the catheter was withdrawn from the endotracheal tube. After the catheter was withdrawn, 2 ml 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. ETA samples were immediately taken to the laboratory for processing. The results of the Gram's stain were obtained within the first hour and quantitative cultures were performed immediately as proceeded by Rajashekar and co-workers.[9]

Processing of Sample

Samples were mechanically liquefied and homogenized by vortexing for 1 min. The 0.01 ml of sample solution were then plated on Blood agar (BA), Chocolate agar (CA), MacConkey agar (MA) by using 4 mm Nichrome wire loop (Hi-media, Mumbai, India). All plates were incubated overnight at 37°C .All plates were checked for growth overnight and then after 24 and 48 h of incubation. For definite diagnosis of VAP, 10^5 CFU/ml was considered as threshold. Growth of any organism below the threshold was assumed to be due to colonization or contamination.[9] Any significant growth was characterized by colony morphology and Gram's staining from the plates. Detailed biochemical testing for identified any significant growth, and antibiotic sensitivity testing was performed on Mueller-Hinton agar (MHA) plates by Kirby-Bauer's disc diffusion method. Escherichia coli strain ATCC 25922, Staphylococcus aureus ATCC 25923 and Pseudomonas aeruginosa ATCC 27853 were used as control strains. [10] [11] Interpretation of antibiotic as sensitive & resistant as per CLSI guidelines.[12]

2.5 Statistical analysis

The results were expressed as percentages for the analysis of various data. Microsoft excel was used for the interpretation of these results.

3 RESULTS

Two hundred and eighty four adult patients, on MV for 48 h and more, were included and 64 (22%) developed VAP. So incidence of VAP was 22%.

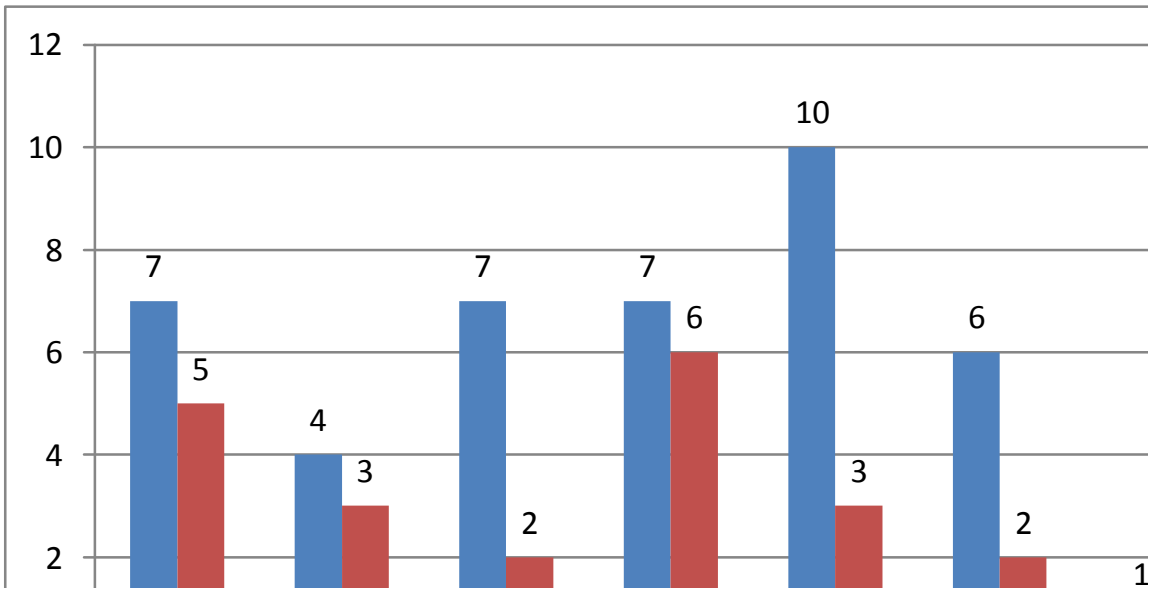

Figure no 1: Age wise & sex wise distribution of VAP

Most common age group for VAP was 60-69 year for male & 50-59 year for female.

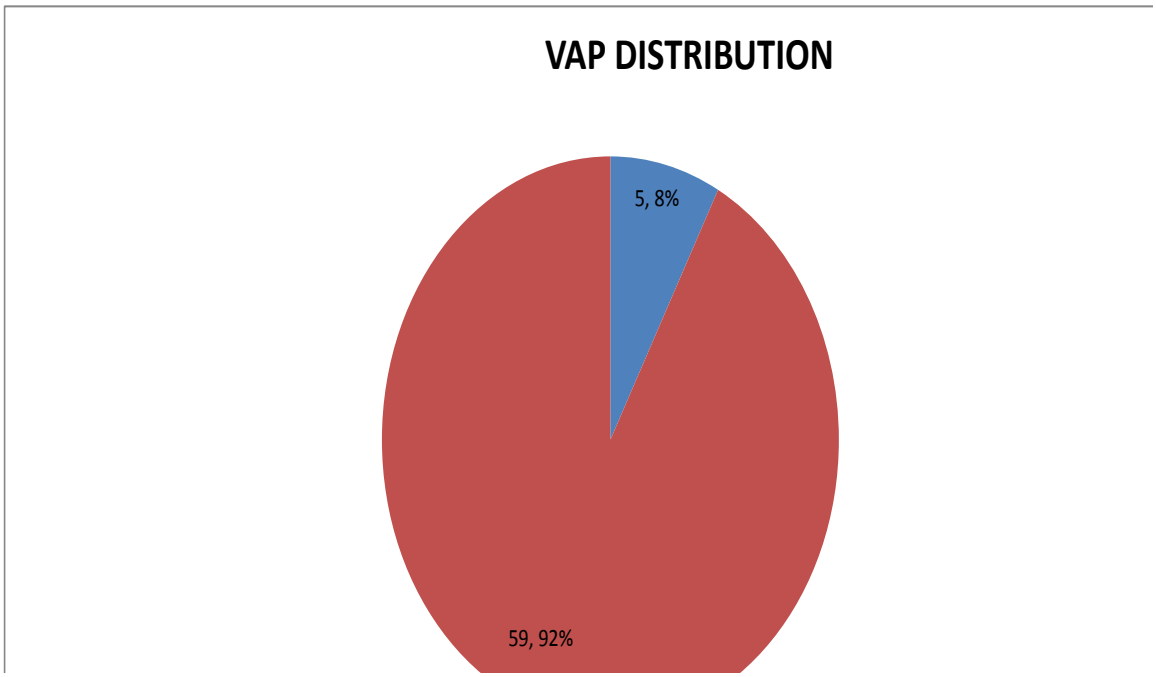

Figure no 2: Distribution of VAP solates

Late onset VAP was most common Ventilator associated pneumonia (VAP) , accounting for 92% of VAP isolates. VAP categorized as early onset VAP, which occurs within four days of endotracheal intubation , whereas late-onset VAP occurs after four days of endotracheal intubation.

4. DISCUSSION

4.1 Incidence of VAP

In present study, incidence of VAP was 22% & out of 64 cases, 8% (5/64) were categorized as had'early onset VAP group,' and the remaining 92% (59/64) under the 'late onset VAP group' . In Dey ,et al study ,incidence of VAP was found to be 45.4% & out of 44 cases, 47.7% (21/44) were categorized as had'early onset VAP group,' and the remaining 52.3% (23/44) under the 'late onset VAP group'.[13] Saroj Golia, et al study incidence of VAP was found to be 35.14%, out of which 44.23% had early-onset VAP and 55.77% had late-onset VAP.[14]

Table no 1: Etiological agents of early onset VAP with antibiotic resistance pattern

Etiological agents(no of isolates)	**Antibiotic resistance pattern (%)**												
Gram negative bacteria	**AMC**	**AK**	**GEN**	**COT**	**CIP**	**CTX**	**CAZ**	**CPM**	**PI**	**IPM**	**CAC**	**PIT**	**CL**
Non fermenters													
Acinetobacter baumannii(3)	100	67	67	67	67	67	67	67	67	67	67	67	0
Pseudomonas aeruginosa(2)	50	50	50	50	50	50	50	50	50	50	50	0	0
Enterobacteriaceae													
Klebsiella pneumoniae(1)	100	100	0	100	100	100	0	0	0	0	0	0	0
Escherichia coli(1)	100	100	100	100	100	100	100	100	100	0	0	0	0
Gram positive bacteria	P	AMC	COT	TE	CIP	E	CD	CX	G	LZ	VA		
MSSA(1)	100	0	0	0	0	0	0	0	0	0	0		

Non fermenters ,*Acinetobacterbaumannii* mainly were most common causative agents of early onset VAP. Most *Acinetobacter baumannii* & *Pseudomonas aeruginosa* were MDRs.

Table no 2: Etiological agents of late onset VAP with antibiotic resistance pattern

Etiological agents(no of isolates)	**Antibiotic resistance pattern (%)**												
Gram negative bacteria	AMC	AK	GEN	COT	CIP	CTX	CAZ	CPM	PI	IPM	CAC	PIT	CL
Non fermenters													
Acinetobacter baumannii(31)	100	100	97	94	97	97	97	94	94	90	94	87	0
Pseudomonas aeruginosa(14)	100	64	71	64	64	64	64	64	71	64	64	50	0
Enterobacteriaceae													
Klebsiella pneumoniae (11)	100	73	64	90	82	73	82	82	82	55	55	55	0
Escherichia coli(7)	100	43	57	57	85	85	85	57	85	57	57	43	0
Enterobacteraerogenes(3)	100	33	67	67	67	67	33	33	33	33	33	0	0
Citrobacterfreundii(1)	100	100	100	100	100	100	100	100	100	100	100	100	0
Gram positive bacteria	P	AMC	COT	TE	CIP	E	CD	CX	G	LZ	VA		
MRSA(1)	100	100	100	0	100	0	0	100	0	0	0		
MSSA(1)	100	0	0	0	0	0	0	0	0	0	0		

Non fermenters , Acinetobacter baumannii mainly were most common causative agents of late onset VAP. Most *Acinetobacter baumannii* & *Pseudomonas aeruginosa* were MDRs. Even most of isolates of Enterobacteriaceae family were MDRs. Only one MRSA isolate was seen in late onset VAP.

4.2 Early & late VAP bacterial profile

In present study, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* & *Klebsiella pneumoniae* were most common isolates for both early & late onset VAP. Only one MRSA isolate was seen in late onset VAP.

Dey, et al study showed *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* were most common isolates for both early & late onset VAP.[13]

Panwar,et al study showed *Pseudomonas aeruginosa* (60%), *Klebsiella spp*&*Escherichia coli* in early-onset VAP. While late onset VAP, *Staphylococcus aureus* (26%), followed by *Pseudomonas aeruginosa, Klebsiella spp, Escherichia coli*&*Acinetobacter spp*. [15]

Rit K, et al showed early onset VAP were members of *Enterobacteriaceae* (35.2% or 6/17) and Acinetobacter spp (17.6% or 3/17). Methicillin sensitive *S. aureus* (MSSA), were the most common gram positive bacteria (11.7% or 2/17) associated with early onset VAP, whereas in late onset VAP, MRSA (7.6% or 2/26) were more commonly isolated than MSSA (3.8% or 1/26). Acinetobacter spp (34.6% or 9/26) and *P. aeruginosa* (30.7% or 8/26) were the most common pathogens causing late onset VAP, whereas Enterobacteriaceae, *H. influenzae, S. aureus, S. pneumoniae*, and *Candida spp* were more common in early onset VAP. [16]

4.3 Antibiotic Resistance

Regarding the susceptibility profiles of the etiological agents of early onset VAP colistin was found to be most effective antibiotic followed by piperacillin/tazobactum combination and the imipenem. Amoxyclav was least effective drugs. Regarding the susceptibility profile of the etiological agents of late onset VAP colistin remain the drug of choice against all isolated GNB followed by piperacillin/tazobactum combination and the imipenem. Both MSSA and MRSA strains showed 100% susceptibility to vancomycin.

Rit K, et al study also show same pattern of antibiotic resistance except Colistin resistance of 33 % for *Acinetobacter baumanni* seen in that study.[16]

5. CONCLUSION

Late onset VAP was most common type. Non fermenters Gram negative bacteria, mainly Acinetobacter baumannii was most common isolate.

For non-fermenters Gram negative bacteria, Amikacin was most common resistant & Piperacillintazobactum was least resistant. While for Enterobacteriaceae, cefatazidime was most common resistant & Imipenem was least resistant.

All gram negative isolates were sensitive for Colistin, while for all gram positive isolates were sensitive for Gentamycin, Linezolid & Vanomycin.

Knowledge of the resident microbial flora and their antimicrobial susceptibility pattern with common resistance mechanism is necessary for formulating a rational antibiotic policy in a hospital.

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