ORIGINAL ARTICLE

A STUDY ON VENTILATOR ASSOCIATED PNEUMONIA IN PEDIATRIC AGE GROUP IN A TERTIARY CARE HOSPITAL, VADODARA

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ABSTRACT

Introduction: Approximately 10-28% of critical care patients develop Ventilator Associated Pneumonia (VAP). It increases length of stay in ICU up to 28% and each incidence ofVentilator-associated pneumonia(VAP) is estimated to generate an increased cost of £6000-£22000. Mortality rate is 24%-71%.

Objectives: To determine the incidence rate, bacteriological profile and antibiotic sensitivity pattern of ventilator-associated pneumonia in pediatric intensive care unit (PICU) & Neonatal intensive care unit(NICU)

Methods: In this study total 125 patients of pediatric age group admitted in ICU & put on ventilator at SSGH from November 2010 to November 2011 were enrolled. After the clinical confirmation according to CDC criteria, the endotracheal secretion were collected and processed as per standard microbiological methods and antibiotic sensitivity pattrn of each were recorded.

Results: Of total 125 samples 58 samples were positive. Most common Organism isolated are Klebseilla spp.(35%), Acinetobactor spp.(26%), Psedomonas spp.(15%),other enterobactriacae(13%), Gram positive cocci(8%) and candida spp(3%). Among the isolates for Gram Negative Bacilli – Imipenem and Vancomycin for Gram Positive Cocci is recommended.

Conclusion: Among the isolates for Gram Negative Bacilli – Imipenem and Vancomycin for Gram Positive Cocci is recommended

Key words: ventilator associated pneumonia, CDC guidelines of VAP, Endotracheal aspirate culture

INTRODUCTION

Approximately 10-28% of critical care patients develop VAP[1]. It increases length of stay in ICU up to 28% and each incidence ofVentilator-associated pneumonia(VAP) is estimated to generate an increased cost of £6000-£22000[1]. Mortality rate is 24%-71%[2]

VAP is the second most common cause of the nosocomial infection after urinary tract infection among pediatric and neonatal intensive care unit (NICU) patients.[3] Infants mechanically ventilated in the NICU are at a particularly high risk of developing Ventilator-associated pneumonia because of poor host factors, severe underlying diseases, prolonged use of mechanical ventilation, inadequate pulmonary toilet and extensive use of invasive devices and procedures[4]

VAP is defined as nosocomial pneumonia in mechanically ventilated patients that develops with in 48 hours or more , after initiation of mechanical ventilation . The pneumonia was neither present nor incubating at the time of intubation.[5]

This study was conducted to determine the incidence rate, bacteriological profile and antibiotic sensitivity pattern of ventilator-associated pneumonia in pediatric intensive care unit (PICU) & Neonatal intensive care unit(NICU) in a teaching hospital.

METHODOLOGY

Study area and Duration: This study is carried out at Department of Microbiology, in S.S.G.Hospital, from November 2010 to November 2011.

Study sample: The review of literature showed prevalence of VAP in 0-12 years of age group was around 30%[10-14]. In our study we expected prevalence to be around 50%. With the Type-I error fixed at 0.01 and type–II error at 0.10, we found sample size 83 , using MEDCALC software version 11.5.0. As this

study starts from November 2010 to November 2011, total 125 pediatric patients who were kept on mechanical ventilator were enrolled.

Study population: All children below 12 years of age kept on mechanical ventilation & admitted in Intramural NICU (patient directly admitted in NICU, S.S.G.Hospital), Extramural NICU (patients reffered from other hospital) and PICU included in study population.

Inclusion criteria: Patients aged between 0-12 years; Patients admitted in Intensive Care Unit or transferred to the unit from paediatric wards for any medical conditions/complications; Patients kept on mechanical ventilator for >48 hours.

Exclusion criteria: Patients already having pneumonia at the time of ICU admission and Patients who developed pneumonia in the first 48 hours of mechanical ventilation.

For the diagnosis of VAP Criteria of Centers for Disease Control and Prevention (CDC)[7] was used.

Radiology signs: Two or more serial chest radiographs with at least one of the following
- new or progressi ve and persistent Infiltrate
- consolidation
- cavitation

Clinical signs: At least 1 of the following:
-fever (temperature > 38 C)
-leukopenia (< 4000 WBC) or leukocytosis (> 12000 WBC)
- altered mental status, for adults 70 years or older, with no other recognized cause

Plus at least 2 of the following
- new onset of purulent sputum, or change in character of sputum
- increased respiratory secretions, or increased suctioning requirements new-onset or worsening cough, or dyspnea, or tachypnea
- rales or bronchial sounds
- worsening gas exchange
- increased oxygen requirements

Microbiological criteria: At least one of the following:
- positive growth in blood culture not related to another source of infection
- positive quantitative culture from broncho alveolar lavage (> 10^4) or protected specimen brushing (> 10^3)
- five percent or more of cells with intracellular bacteria on direct microscopic examination of Gram-stained bronchoalveolar lavage fluid
- histopathological evidence of pneumonia

As for the diagnosis we are following CDC guidelines[9] clinical criteria are satisfied and after than evaluation of microbiological criteria is done. After proper hand washing and wearing sterile gloves before suctioning, the endotracheal aspirates were collected from the endotracheal tube with the help of sterile Dele's mucous trap. The specimen collected was immediately transported aseptically to the laboratory within one hour of collection. Sample collected at night was stored at 4 degree centigrade overnight and send to the laboratory by 10 am next day morning. Endotracheal aspirate culture were collectedbefore putting the patient on ventilation and also after 48 hrs of ventilaton, received in our department. Samples were processed as per the standard methods.Specimens are taken prior to start next scheduled antibiotic dose.In case of Endotracheal aspirate culture, $>10^6$ cfu/ml was considered significant for the diagnosis of VAP. After achiving the growth sensitivity was also done as per CLSI(Clinical and Laboratory Standard Institute) guidelines.

RESULTS

Incidence of VAP in present study was 46.4%.(From 125 samples, 54 samples showed monomicrobial growth while only 4 samples showed polymicrobial growth and 67 samples were showing no growth.)

Maximum number of patients having VAP belongs to early neonatal age group (0-7 days) that is 73%(91) and followed by 1-12 years of age group 12%(15) followed by infants of age group 8% (10)and lastly late neonatal age group 7%(9)

Table 1: Different organisms isolated in this study

Name of Organism	No. of isolates (n=62) (%)
Klebseilla spp.	22 (35.5)
Acinetobacter spp.	16 (25.8)
E.coli	5 (8.1)
Pseudomonas spp.	9 (14.5)
Proteus spp.	1 (1.6)
Providentia spp.	1 (1.6)
Morgenella	1 (1.6)
Enterococcus	2 (3.2)
Coagulase Negative Staphylococcus	2 (3.2)
Staphylococcus aureus	1 (1.6)
Candida spp.	2 (3.2)

Follow up of the patients, from whom the samples were isolated, revealed 65 (52.0%) patient died in the hospital while remaining 60 (48.0%) patients either discharges or DAMA (Discharge Against Medical Advice) or transferred to wards or absconded)

DISCUSSION & CONCLUSION

There are very few studies on VAP in pediatric age group. Incidence varies in different studies[10-14]. Such large variation in incidence is due to case-mix differences, differences in the diagnostic criteria used, the variable sensitivity and specificity of the available diagnostic tests, lack of gold standard test for diagnosis of VAP, condition of ICU, nursing care, variability in

the presence of Hospital flora, Policy of Hospital for fumigation of ICU, care and maintenance of various equipments (warmer, ventilator machine) and in different studies difference in age group (neonates, infants & children).

Table 2: Antibiotic sensitivity pattern of Gram Negative Bacilli

Antibiotic	Klebseilla spp. (n=22) (%)	Acinetobacter spp. (n=16) (%)	E.coli (n=5) (%)	Proteii gp. (n=3) (%)
Amika	13 (60)	7 (41)	3 (50)	3 (100)
Genta	3 (13)	2 (14)	1 (13)	1 (33)
CTX	4 (18)	2 (10)	1 (25)	1 (33)
Imi *	21 (93)	16 (100)	5(100)	3 (100)
Ampi +sulb	4 (20)	2 (10)	2 (38)	0 (0)
Pipera	5 (22)	2 (14)	2 (38)	0 (0)
Pipera + Tazo	8 (38)	3 (21)	3 (50)	1 (33)
Oflox	9 (42)	5 (31)	3 (50)	3 (100)
Netil	9 (40)	2 (14)	1 (13)	0 (0)
Cipro	10 (47)	4 (28)	3 (50)	0 (0)
Tobra	9 (42)	4 (24)	1 (25)	0 (0)
Gati	12 (53)	13 (79)	5(100)	3 (100)

Amika –Amikacin, Genta- Gentamycin, CTX- Cefotaxime, Imi-Imipenem, Ampi+Sulb- Ampicillin+Sulbectum, Pipera- Piperacillin, Pipera+Tazo-Piperacillin+Tazobactum, Oflox-Ofloxacin, Netil-Netilmycin, Cipro-Ciprofloxacin, Tobra-Tobramycin, Gati- Gatifloxacin (* good sensitivity)

Table – 3 Antibiotic sensitivity of Gram Positive Cocci.

Antibiotic	Enterococcus Spp. (n=2) (%)	Coagulase Neg Staphy. (n=22) (%)	Staphy.aureus (n=1) (%)
Cefazolin	1 (50)	1 (50)	1 (100)
Chloramphenicol	1 (50)	1 (50)	1 (100)
Erythromycin	1 (50)	1 (50)	1 (100)
Vancomycin*	2 (100)	2 (100)	1 (100)
Cefotaxime*	2 (100)	2 (100)	1 (100)
Ciprofloxacin*	2 (100)	2 (100)	1 (100)
Ofloxacin*	2 (100)	2 (100)	1 (100)
Penicillin	1 (50)	1 (50)	1 (100)
Amoxycillin + Clavulanic acid	1 (50)	1 (50)	1 (100)
Cloxacillin	1 (50)	1 (50)	1 (100)
Oxacillin	1 (50)	1 (50)	1 (100)
Linezolid*	2 (100)	2 (100)	1 (100)

***Good sensitivity**

In summary, ventilator-associated pneumonia (VAP) is a leading cause of morbidity and mortality in ICU patients, leading to lengthened ICU and hospital stays and higher health care costs[16-17]. VAP continues to be an important challenge to the critical care physician and is the most common nosocomial acquired infection among patients with acute respiratory failure. It is difficult to diagnose accurately, and a high index of suspicion is required. The mortality caused by VAP increases if it is caused by resistant bacteria.Since some clinical interventions increase the development of VAP, clinical guidelines for the treatment of VAP should be developed, pediatricians should understand its epidemiology and participate in control measures, by reducing the risk of cross-contamination during mechanical ventilation, preventing colonization and aspiration.

Table 4: Antibiotic sensitivity of Psuedomonas

Antibiotic	Psuedomonas
Piperacillin	4 (43)
Piperacillin + Tazoactum	4 (43)
Cabencillin	3 (29)
Amikacin	7 (78)
Ticarcilli+ Clavlunic acid	3 (29)
Cefazidime	4 (43)
Imipenem*	8 (86)
Polymyxin –B*	8 (86)
Lomefloxacin	4 (43)
Ciprofloxacin	5 (57)
Ofloxacin	4 (43)
Tobramycin	5 (50)

***Good sensitivity**

RECOMMENDATION

Good management strategies for VAP like adequate infection control practices and better nursing care, early and accurate diagnosis and more specific antimicrobial use may significantly improve patient's outcome. If VAP is suspected empirical antibiotics, in combination of Vancomycin (for gram positive organism including MRSA(Methicillin Resistant S. aureus)), imipenem (for pseudomonas) and aminoglycosides or imipenem (for gram negative organisms) should be given immediately. Although bacteriological sampling is important, it should not significantly delay the start of treatment. As the appropriateness of the initial antibiotic regimen is a

vital determinant of outcome, microbiological advice should be sought. There is an increasing prevalence of MRSA and multidrug resistant pathogens in late onset VAP, and antimicrobial therapy should take account of this. Subsequent microbiological findings should be used to tailor antibiotic therapy.

Table 5: Common organisms isolated in various studies

Various Studies	Organisms isolated (%)						
	Pseudo Monas	E. coli	Klebsiella	Acinetobacter	Proteii. gp	GPC	Candida
Shalini Tripathi et al.[3]	11%	23%	33%	18%	NM	10%	3%
Anucha A et al.[15]	10%	7%	31%	12%	7.7%	12%	2%
Alexis M. Elward et al.[12]	29.4%	3%	14%	NM	NM	21%	9%
Elizabeth Foglia et al.[7]	38.4%	NM	23%	NM	NM	23%	NM
Witaya Petdachai et al.[4]	38.2%	NM	27.3%	25.4%	NM	3.6%	NM
Ramya Srinivasan et al.[14]	2.6%	10.3%	NM	NM	NM	33%	2.3%
Present study	15%	8%	35%	26%	6%	8%	3%

LIMITATIONS

There was a limitation in the sampling procedures used to obtain microbiologic specimens from the small respiratory tract in our study, in that invasive techniques to distinguish infection from colonization are not practical or feasible and may be harmful in small infants. They can impair blood-gas exchange, delay treatment, and lead to sepsis. So the techniques which are more sensitive and specific like BAL(Broncho Alveolar Lavage), B-PSB (Blind-Protected Specimen Brushing), NB-PSB(Non Blind-Protected Specimen Brushing), MINI BAL could not be possible which is possible in higher age group. Though pediatric studies were very few, most of the data are available for only adult patients.

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