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MICROBIOLOGICAL PROFILE OF VENTILATOR ASSOCIATED PNEUMONIA

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Abstract

Introduction: Ventilator associated pneumonia (VAP) is an important form of hospital acquired pneumonia, specifically refers to pneumonia developing in mechanically ventilated patients for more than 48 hours after tracheal intubation or tracheostomy. The aim of the study to find out organisms associated with VAP and their antimicrobial susceptibility pattern.

Materials and Methods: A prospective study in patients undergoing mechanical ventilation (MV) for >48 h. Endotracheal aspirates (ETA) were collected from patients with suspected VAP cases and quantitative cultures were performed on all samples. All data were analyzed by Epi-info software.

Results: Quantitative culture results showed significant growth (>10^5 cfu/ml) of pathogenic organisms causing VAP in 88 (88%) patients, while 12(12%) patients showed insignificant growth (<10^5 cfu/ml) considered as non VAP. Acinetobacter spp. was found to be the commonest organism 36 (35.29%) followed by Pseudomonas aeruginosa and Klebsiella pneumoniae 24 (23.53%) and 21 (20.59%) respectively.

Conclusion: Acinetobacter spp., P. aeruginosa and Klebsiella spp. were the most common agents responsible for VAP and showed multidrug resistance. The knowledge of prevalent local pathogens and their antibiogram will help the clinician to choose the appropriate antimicrobial agent for effective and rationale treatment.

Keywords: Ventilator-associated pneumonia, Intensive care unit, Gram Negative bacilli

Introduction

Ventilator associated pneumonia (VAP) is an important form of hospital acquired pneumonia, is defined as pneumonia that develops while a patient is receiving mechanical ventilation, usually positive pressure delivered via an endotracheal tube for support during respiratory failure in intensive care units and also defined as pneumonia occurring more than 48 hours after the initiation of endotracheal intubation and mechanical ventilation (MV).[1]

The incidence of VAP varies among different studies, depending on the definition, type of hospital or ICU, the population studied and the level of antibiotic exposure. The lack of consensus regarding the most appropriate method to diagnose VAP also partly explains why incidence rates vary widely from one study to another.[2]

The etiological agent of VAP differ substantially from that of community acquired pneumonia; VAP is more likely due to Pseudomonas aeruginosa or other multidrug resistant (MDR) organisms. However there is significant geographic variability in the prevalence and incidence of these high risk pathogen as a cause of VAP. It has also been suggested that MDR organisms or Pseudomonas species are high risk pathogens and the patient who develop VAP due to these organisms are at high risk of poor clinical outcome.[3]

Material and Method

Study design: This is haospital based cross-sectional study.

Study population:-Clinical cases

Sampling technique: Random Sampling

Sample size: 100 or number of patients to be sampled within study duration.

Inclusion Criteria:

1. ICU patients who was intubated and on mechanical ventilation for more than 48 hours.

2. Patients in whom VAP is clinically suspected. Patients with Modified Clinical Pulmonary Infection Score (CPIS) of more than 6.[4]

Exclusion Criteria:

Patients who have developed pneumonia within 48 hours of mechanical ventilation was excluded.

Specimens collected: Endotracheal aspirate

Method of specimen collection:

Endotracheal Aspirate: Endotracheal Aspirate (ETA) was collected using a 22 inch Ramson's 12 F suction catheter

and gentle aspiration was done without instilling saline. After withdrawal of catheter, 2ml of sterile 0.9% normal saline was injected into the catheter with a sterile syringe to flush the exudates into a sterile container for collection.[5]

Quantitative Culture

Samples were mechanically liquified and homogenized by vortexing for 1 min and then serially diluted in 0.9% sterile normal saline solution with final dilutions of 10^{-2}, 10^{-3} and 10^{-4}. Primary inoculation of the samples was done blood agar (BA), and MacConkey agar (MA) by using 4 mm Nichrome wire loop, which holds 0.01 ml of sample. All plates were incubated overnight at 37°C and observed for growth after 24 hr. For definite diagnosis of VAP in this study, quantitative culture threshold9 was considered as 10^5 cfu/ml. Growth of any organism below the threshold was assumed to be due to colonization or contamination. Significant Isolates characterized by colony morphology and Gram stain.

Identification and determination of antimicrobial susceptibility[6]

A detailed biochemical testing was done to identified any significant growth, and antibiotic sensitivity testing was performed on Mueller–Hinton agar plates by Kirby—Bauer disc diffusion method. Zone diameter was measured and interpreted as per the Clinical and Laboratory Standards Institute (CLSI) guidelines.

Statistical analysis

Chi square test was done for comparison of proportions. The level of significance was set as 5% in all analysis. All Statistical test were performed using Epi-info software.

Observation

During study period 100 suspected VAP cases enrolled for the study according to inclusion criteria.

Table 1: Age and Sex Distribution of Total cases

Age Years	Total Cases (100)	
	Male	Female
0-15	12 (40%)	18 (60%)
16-30	14 (73.68%)	5 (26.32%)
31-45	19 (86.36%)	3 (13.64%)
46-60	10 (52.63%)	9 (47.37%)
>60	6 (60%)	4 (40%)

Out of total 100 cases included in this study, 61 (61%) were male and 39 (39%) were female, hence male and female ratio was 1.56:1. Majority of cases belongs to the age group 0-15 years (30%) followed by 31- 45 (22%) with mean age 30.746 years.

Table 2: Distribution of sample according to Culture Result

Total samples	100	100%
Significant growth (VAP)	88	88%
Insignificant Growth (Non VAP)	12	12%

Quantitative culture result showed significant growth (>10^5cfu/ml) for pathogenic organism causing VAP in 88 (88%) patients, while 12 (12%) patients showed insignificant growth (≤10^5cfu/ml) considered as NON VAP.

Table 3: Distribution of Early and Late onset VAP Cases

Duration of Ventilation	No. of VAP Cases
Early onset VAP (<5 Days)	**39(44.32%)**
Late onset (>5 Days)	**49(55.68%)**

Out of 88 VAP cases, 39 (44.32%) were categorized under early onset VAP and 49 (55.68%) under late onset VAP.

Table 4: Microbial Profile of VAP Cases

Isolates	Total No. (%)
Acinetobacter baumannii	36 (35.29)
Pseudomonas aeruginosa	24 (23.53)
Klebsiella pneumoniae	21 (20.59)
Escherichia coli	8 (7.84)
Staphylococcus aureus	8 (7.84)
Coagulase negative Staphylococci	3 (2.94)
Candida spp.	2 (1.96)
Total	102 (100)

The most common organism isolated was Acinetobacter baumannii 36 (35.29%), followed by Pseudomonas aeruginosa 24 (23.53%) Klebsiella pneumoniae 21 (20.59%), Staphylococcus aureus 8 (7.84), E.coli 8 (7.84%), Coagulase negative Staphylococci 3 (2.94%) and Candida spp 2(1.96%).

Table 5: Antibiotic Resistant Pattern of Gram negative isolates

Antibiotics	Acinetobacter	K.Pneumoniae	E.coli
AMPICILLIN	36(100%)	19(90.47%)	7(87.5%)
AMOXYCLAV	18(50%)	15(87.5%)	4(50%)
CEFTRIXONE	32(88.88%)	18(85.71%)	5(62.5%)
COTRIMOX	32(88.88%)	17(80.95%)	5(62.5%)
CIPROFLOXACIN	30(83.33%)	17(80.95%)	7(87.5%)
CEFOPERAZONE	30(83.33%)	16(76.19%)	5(62.5%)
GENTAMYCIN	9(25%)	13(61.90%)	5(62.5%)
MEROPENEM	9(25%)	3(14.28%)	2(25%)
COLISTIN	0	0	0

The resistance pattern in gram- negative bacteria isolated in this study. All the isolates of Acinetobacter species, nearly 90% of K.pneumoniae and 87.5% of E.coli isolates were resistant to ampicillin. While all gram-negative bacteria isolated in this study were 100% sensitive to colistin.

Discussion

Ventilator - associated pneumonia (VAP) is an important nosocomial infection among ICU patients receiving mechanical ventilation (MV). It is the second most common nosocomial infection in the intensive care unit (ICU) and the most common nosocomial infection in mechanically ventilated patients.[7]

Despite major advances in techniques for the management of ventilator -dependent patients and the routine use of effective procedures to disinfect respiratory equipment, ventilator - associated pneumonia continues to complicate the course of 8 to 28% of the patients receiving mechanical

ventilation.[8]

It is a common condition, difficult to diagnose accurately and expensive to treat. It's development, prolongs patient's stay in the intensive care unit, and is associated with significant morbidity and mortality.

A favourable outcome seems to be more likely if appropriate antibiotics are given in a timely manner.

We observed that non -fermenters such as Acinetobacter spp. 36 (35.29%) and Pseudomonas aeruginosa 24(23.53%) was the most predominant VAP pathogens, followed by Klebsiella pneumoniae 21 (20.59%), Escherichia coli 8(7.84%), gram-positive bacteria 11 (12.50%) and yeast 2 (1.96%) microbial profile of VAP. The pathogens which was responsible for VAP vary, depending on the duration of the mechanical ventilation, prior antibiotic exposure and the length of stay in the hospital. Airway intubation is associated with increased frequency of gram-negative bacterial colonization of upper and lower respiratory tract with subsequent overgrowth and pneumonia.

In the present study Acinetobacter spp. was found to be the commonest 36 (35.29%) isolate, which co - relates to the study conducted by A. Dey et al.(48.94%)[5], and N. Ranjan et al 24 (34.28%)[9], Earlier reports had showed that among the gram-negative organisms, Pseudomonas aeruginosa was the commonest causative agent for VAP.[10] The increase of Acinetobacter baumannii infections could be due to its greater resistance to the environment which enables its spread, its extraordinary ability to develop resistance to commonly used antimicrobials and its spread by aerosols.

In our study second commonest organism isolated was Pseudomonas aeruginosa 24 (23.53%) followed by Klebsiella pneumoniae 21 (20.59%), which co-relates to the study conducted by A Dey et.al[5] and V. Goel et al.[11]

Microorganisms responsible for VAP may differ according to the population of patients in the ICU, the durations of hospital and ICU stays, and the specific diagnostic method(s) used. Other organisms isolated in our study were Escherichia coli 8 (7.84%), Staphylococcus aureus 8 (7.84%), coagulase negative Staphylococci (CONS) 3 (2.94%), and Candida species 2 (1.96%), which is similar to other studies conducted by K. Saravu et al 1 (1.16%) [12]and P. Sharma et al 3.70%.[13]

In our study the resistance to meropenem was reported to be 25% while other studies showed 100%, 89.7%, 87% and >80% resistance as reported by Naveed et al[14], Namita et al[15], U. Jethwani et al[16] and ML Medell et al[17] respectively. This controversy of the result is might be due to conservative use of meropenem, and use of it as 2nd line drug in ICU setup.

Colistin was the most effective drug against Acinetobacter spp. showing 100%, sensitivity, which correlate with the studies conducted by Naveed et al[14]and jethwani et al[16],each showing 100% colistin sensitivity and Namita et al[15] showing 98.8% colistin sensitivity.

Conclusion

Acinetobacter spp., P. aeruginosa and Klebsiella spp. were the most common agents responsible for VAP and showed multidrug resistance. The knowledge of prevalent local pathogens and their antibiogram will help the clinician to choose the appropriate antimicrobial agent for effective and rationale treatment.

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