ORIGINAL ARTICLE

MICROBIOLOGICAL PROFILE AND SENSITIVITY PATTERN OF ENDOTRACHEAL SECRETIONS IN MECHANICALLY VENTILATED PATIENTS IN ICU

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HOW TO CITE THIS ARTICLE:
Anusha N, Madhu K. P, B. J. Arun, B. Vidyasagar. "Microbiological Profile and Sensitivity Pattern of Endotracheal Secretions in Mechanically Ventilated Patients in ICU". Journal of Evidence Based Medicine and Healthcare; Volume 1, Issue 9, October 31, 2014; Page: 1177-1184.

INTRODUCTION: Respiratory infections in critically ill patients are associated with high morbidity and mortality. Patients who are mechanically ventilated are at high risk of acquiring respiratory infections due to complex interplay between the endotracheal tube, host immunity and virulence of invading bacteria. To initiate empiric antimicrobial therapy knowledge of local antimicrobial resistance patterns are essential. **MATERIAL AND METHODS:** A prospective observational study of 45 adult patients who were mechanically ventilated for various reasons in ICU of our hospital over a period of- 6 months (Jan-June 2013) was undertake to study microbiological profile and sensitive characteristics of endotracheal aspirate obtained on day one of intubation. **RESULTS:** Culture showed growth in 34(75.5%) patients. Gram negative enteric aerobic bacteria were isolated from most of the patients. The most common being Klebsiella species in 13(38.23%), followed by Pseudomonas in 8 (23.52%), Aerobic gram positive cocci i.e., staphylococcus aureus isolated in 2(5.88%) patients. Most of these organisms were susceptible to aminoglycoside and carbapenem antibiotics. **CONCLUSIONS:** Gram negative organisms susceptible mostly to aminoglycoside & Carbapenem group of antibiotics form the predominant isolates in our critical care setup. A local antibiogram for each hospital, based on bacteriological patterns and susceptibilities is essential to initiate empiric therapy, to prevent poor outcomes and help in framing the appropriate institutional antibiotic policy.
KEYWORDS: Endotracheal Aspirate, Mechanical Ventilation, Culture & Sensitivity, Ventilator Associated Pneumonia.

INTRODUCTION: Respiratory infections in critically ill patients are associated with high morbidity and mortality. Rapid diagnosis and initiation of appropriate antibiotic therapy is essential for better outcomes. Patients who are intubated and mechanically ventilated are further at risk of acquiring respiratory infections due to complex interplay between the endotracheal tube, host immunity and virulence of invading bacteria, which may lead to Ventilator Associated Pneumonia (VAP). The etiologic agents vary according to the population of patients in an ICU, duration of hospital stay, pre-existing illness and prior antimicrobial therapy. To initiate an empiric antimicrobial therapy we should have the knowledge of microbial flora of the locality and their sensitivity and resistance patterns, such information needs to be analyzed periodically and institution based antibiotic policies formed from time to time and made available to all consultants treating infectious diseases, hence the need for this study.

AIM OF THE STUDY:

1. To study the culture and sensitivity characteristics of endotracheal aspirate obtained from patients on mechanical ventilation in ICU of our institute for proper selection of antibiotic.
2. To frame an institution based local antibiotic policy for our future use.

MATERIAL AND METHODS: A prospective observational study of adult patients who were mechanically ventilated for various reasons in ICU of our hospital over a period of- 6 months (Jan-June 2013). After obtaining consent from guardians (patients where relevant), endotracheal secretions were obtained on the day of intubation by sterile suctioning and the suction catheter tip was subjected for gram stain and culture. The positive culture samples were subjected to drug susceptibility testing.

Inclusion criteria: Adult patients aged above 18 years, who were mechanically ventilated for various reasons.

Exclusion Criteria: HIV positive patients, Post-op ventilated patients and Sputum smear acid fast bacilli (AFB) positive patients, patients not willing to consent were excluded in our study.

RESULTS: In our study a total of 45 patients were included, 30(66.6%) male and 15(33.3%) female patients.

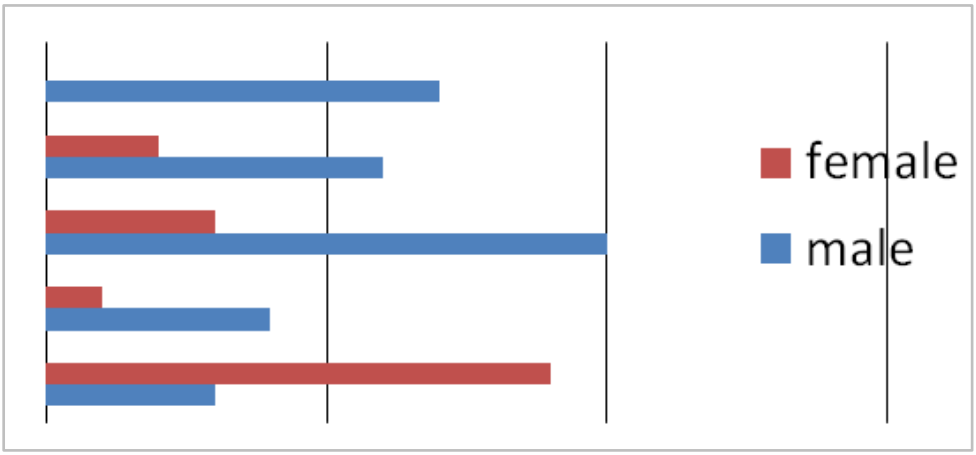

Fig. 1: Majority of the patients were intubated and ventilated for respiratory related illness

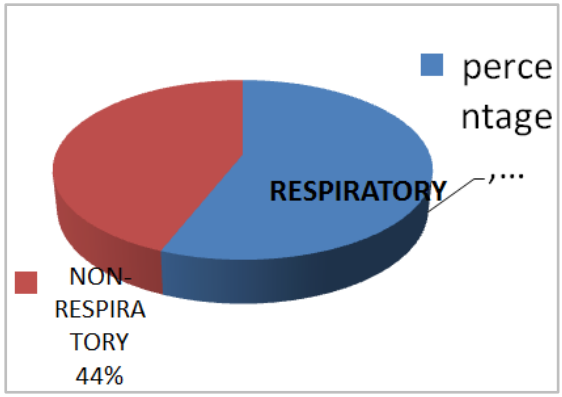

Fig. 2: Among the endotracheal aspirate culture, growth was positive in 34(75.5%) patients and no growth or commensals in 11(24.5%) patients

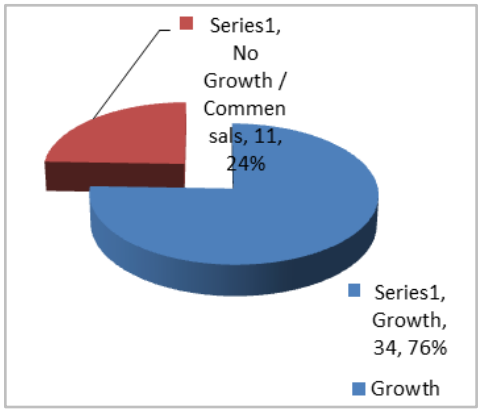

Fig. 3

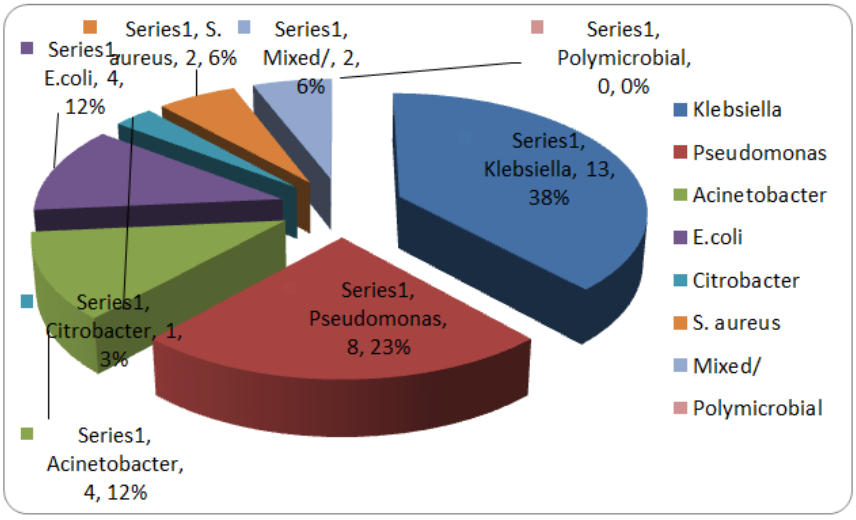

Fig. 4

Fig. 3. & Fig. 4: And cultures were positive predominantly in male patients with pre-existing lung diseases as shown in the following diagram.

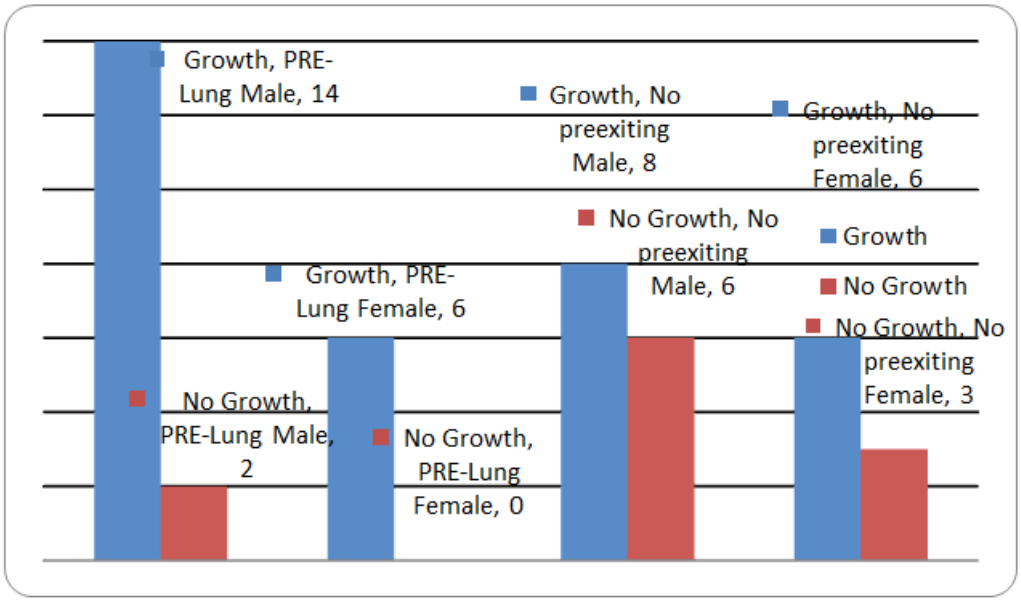

Fig. 5

Sl. NO	Organism	patients	% Among Positive	Sensitive	Resistant
1.	Klebsiella	13	38.23	AMK, GEN, CIP	AMP, AMC, COT,
2.	Pseudomonas	8	23.52	AMK, GEN, CIP, COT, IMI	CTX, CPZ,
3.	Acinetobacter	4	11.76	IMI, CIP	AMK, GEN, CTX
4.	E.coli	4	11.76	AMK, GEN, IMI	AMC, CTX, CIP, COT
5.	Citrobacter	1	2.94	AMK, IMI	AMC, CTX, CIP, GEN
6.	S. aureus	2	5.88	IMI	AMK, GEN, CTX, CIP, COT
7.	Mixed/ Polymicrobial	2	5.88		
8.	No growth / commensals	11			

Table 1

AMK=Amikacin, GEN=Gentamycin, CIP=Ciprofloxacin, IMI=Imipenem, AMC=Amox-co-Clavulanate, COT=Co-trimoxazole, CTX= Cefotaxime, CPZ=Cefperazone

Gram negative enteric aerobic bacteria were isolated from most of the patients, common being Klebsiella species - 13(38.23%) followed by Pseudomonas - 8(23.52%), Acinetobacter - 4 (11.76%) and E.coli - 4 (11.76%), Citrobacter - 1(2.94%). Aerobic gram positive cocci i.e., staphylococcus aureus was obtained in 2 (5.88%) patients. Polymicrobial (more than 2 organisms) in 2 (5.88%) patients.

Among gram negative bacteria- Klebsiella, Pseudomonas and E.coli species were sensitive to aminoglycoside and fluoroquinolones or carbapenem antibiotics. Acinetobacter, Citrobacter and S. aureus species were sensitive to carbapenem antibiotics.

DISCUSSION: Endotracheal intubation and mechanical ventilation are life-saving procedures done on emergency or elective basis to prevent or combat respiratory failure. Many clinical conditions warrant need for ventilatory support like, life threatening infections, sepsis and acute respiratory distress syndromes, neurological dysfunctions due to poisoning, drug toxicity, cerebro-vascular accidents, trauma and others. On one hand while mechanical ventilation helps to prevent deaths due to respiratory failure on the other hand it poses great threat, by leading to life threatening lung infections by itself due to various reasons that by passes host immune responses and infectious organisms getting access either by endogenous or exogenous route resulting in ventilator associated pneumonia (VAP). The presence of an endotracheal tube in the airway, although critical for the management of the mechanically ventilated patient, also contributes to the development of ventilator associated pneumonia by disrupting normal protective mechanism which is associated with the intraluminal formation of biofilm by multidrug resistant organisms.[(1)] These infections may result from ongoing growth of an agent that existed prior intubation which depend on various factors including pre-existing lung disease, prior colonizing organisms and oral commensals, as a part of systemic dissemination etc. Hence in our study endotracheal secretions were sent for bacteriological culture and sensitivity on the first day of intubation to identify the organisms that already existed at the time of intubation which would help in initiating and or modifying antibiotic therapy appropriately and help in preventing the occurrence of ventilator associated pneumonia (VAP) or Hospital acquired pneumonia (HAP) and help bring about favorable outcome.

In our study gram negative enteric bacteria was the most common isolate with Klebsiella being the most common organism followed by Pseudomonas and Acinetobacter which were sensitive to aminoglycosides. Culture positivity was more common in elderly male patients who were smokers, and who were admitted for respiratory causes or patients who had pre-existing lung diseases. No growth or commensals were obtained in predominantly female patients and patients ventilated for other than respiratory causes indicating near normal lung.

On review of literature to identify the role of pre-existing organisms as oral commensals or airway colonizing agents in the development of future VAP, a study by Ferrer et al, found airway colonization by potentially pathogenic microorganisms on admission was associated with failure of non-invasive ventilation for exacerbation of COPD.[(2)] In contrast, in a study of patients admitted to a respiratory intensive care unit, initial tracheal colonization was not associated with mortality or length of stay in a study by Drakulovic MB et al.[(3)] In a prospective study of patients with community acquired pneumonia, Ortqvist et al found that respiratory tract colonization was

associated with a significantly increased mortality and length of stay but was not a risk factor for nosocomial pneumonia.[4] Lakshmi Durairaj et al studied patterns and density of early tracheal colonization in intensive care unit patients and they did not find any baseline characteristics that predict patterns of colonization, nor did they find association with outcomes.[5] Corne P et al studied the role of nasal carriage of staphylococcus aureus in respiratory tract infections of critically ill patients by molecular evidence, they found that S. aureus strain isolated from nares was genetically identical to that isolated from the bronchial sample of the same patient in 15 out of 16 cases. This genetic identity demonstrates a link between S. aureus nasal carriage and S. aureus pneumonia or bronchitis in the majority of critically ill patients.[6] In a similar prospective study by Garrouste-Orgeas M et al, who looked at oropharyngeal or gastric colonization and nosocomial pneumonia in adult intensive care unit patients, DNA genomic analysis demonstrated that an identical strain was isolated from oropharyngeal or gastric samples and bronchial samples in all but three cases(out of total 31 cases) of pneumonia, due to S. aureus,[7] In majority of the studies there exists a relationship between the organism causing VAP and pre-existing colonizing microbe. A study by Koeman M et al showed that Topical oral decontamination with either chlorhexidine (CHX, 2%) or CHX/colistin (CHX/COL, 2%/2%) reduces the incidence of VAP.[8]

On further review of studies which looked at microbiological profile of ventilator associated pneumonia (VAP), Summaiya M et al while assessing biofilm formation by causative organisms of VAP found that most common organisms isolated which produce strong biofilm are Pseudomonas aeruginosa and Acinetobacter spp.[1] Trilok Patil[9] in their study examined the organisms colonizing trachea in 265 mechanically ventilated patients, at Government Medical College & Hospital, Aurangabad (Maharashtra), of all total 361 isolates, organisms were identified from the 229 processed samples of endotracheal aspirates (EA). Pseudomonas aeruginosa was the most commonly isolated organism, present in 135(37.4%), followed by Klebsiella pneumonia in 103 (28.5%), Staphylococcus epidermidis in 53(14.7%), Staphylococcus aureus in 10(4.36%), which was nearly similar to our study.[9] In another study by George P et al, Acinetobacter were isolated in 37.5%(12), Pseudomonas in 21.87%(7), Klebsiella in 15.6%(5), Enterobacter in 12.5%(4), Citrobacter in 6.25%(2)and Staphylococcus in 6.25%(2), and Amikacin (44.66%), Gatifloxacin & Imipenem (33.33%), Meropenem were common sensitive antibiotics.[10] Golia S et al[11] and Mukhopadhyay C et al[12] demonstrated that pseudomonas & E.coli were most common isolates in early onset and late onset VAP which was also similar in our study. The etiologic agents vary according to the population of patients in an ICU, duration of hospital stay, pre-existing illness and airway commensals and prior antimicrobial therapy. To initiate an empiric antimicrobial therapy, knowledge of microbial flora of the locality and their sensitivity and resistance patterns are essential. Such information needs to be analyzed periodically and institution based antibiotic policies formed from time to time and made available to all consultants treating infectious diseases to facilitate better outcomes.

LIMITATIONS: Small sample size limits the generalization, Outcome of all the patients studied could not be monitored. Anaerobic organisms, fungal elements and all antibiotic groups could not be studied because of technical limitations.

CONCLUSION: Gram negative organisms susceptible mostly to aminoglycoside & carbapenem group of antibiotics form the predominant isolates in our critical care setup and the risk is higher in patients with pre-existing lung diseases. Initial appropriate empiric antibiotic therapy within few hours of admission to ICU helps in decreasing the mortality and duration of ICU stay. An updated local antibiogram for each hospital and ICU based on local bacteriological patterns and susceptibilities is essential to guide optimally dosed initial empiric therapy. With an empiric antibiotic regimen, de-escalation is the key to reduce emergence of resistance. Culture of ET aspirate is easy, cost-effective procedure which helps in identifying the organism. Delays in initiation of antibiotic treatment may lead to poor outcomes. There is a risk of emergence of MDR pathogens with inadequate, inappropriate antibiotic treatment. Thus the microbiological profile & sensitivity pattern of the local community helps in framing the appropriate institutional antibiotic policy for better outcomes.

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Date of Submission: 07/10/2014.
Date of Peer Review: 08/10/2014.
Date of Acceptance: 13/10/2014.
Date of Publishing: 21/10/2014.