Identification and isolation of various pathogens from endotracheal tip secretions and their antibiotic susceptibility pattern at tertiary care hospital, Kanpur, Uttar Pradesh.

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Abstract:

Background: Nosocomial infections are most common in intubated patients and it is the leading cause of morbidity and mortality among the patients admitted in the intensive care unit (ICU).

Aim and Objective: The aim of our study is to identify the etiological agent and their antibiotic susceptibility pattern from the intubated patients.

Materials & Methods: This was a prospective study for a period of 6 months i.e, from January to June 2023 among mechanical ventilated patients admitted in the ICU ward. Microbiological culture and AST was performed from the endotracheal secretions samples which were transported in the microbiology laboratory according to the CLSI guidelines.

Results: A total of 37 endotracheal secretions samples were cultured in 6 months in which Acinetobacter baumanii (62%) was the most common isolate followed by Klebseilla pneumonia (24%). It was observed that no gram positive bacteria were isolated.

The AST pattern showed that only polymyxin B and colistin were 100 % sensitive followed by tigecycline and aztreonam.

Conclusion: Our observation provides the useful information about the endotracheal tip culture and the most common etiological agent associated with it. Endotracheal tip culture could be a useful and reliable tool in the identification and diagnosis of respiratory tract infections in ICU patients.

Keywords: Endotracheal aspirates, AST, tip culture, Acinetobacter baumanii.

Introduction

Nosocomial infections are the leading cause of mortality and morbidity among the patients admitted in ICU in the present time. One of the most important types of this infection is pneumonia which commonly occurs in relation to the endotracheal tube and mechanical ventilation named ventilator associated pneumonia. Ventilator-associated pneumonia (VAP) is the most frequent intensive care unit (ICU)-acquired infection, occurring in 9–24% of patients intubated for longer than 48 hours [1]. Nosocomial pneumonia represents approximately one quarter of all nosocomial infections and tracheal intubation increases the risk of infection from 6 to 20 times [2]. In the literature, the incidence of respiratory tract infection in relation to intubation and/ or mechanical ventilation has been reported to vary from 4% to 28% and this rate has been thought to be 21 times higher than in patients without endotracheal tube [3]. Patients with mechanical ventilation have an increased risk for respiratory tract infection because the tube which has been inserted in trachea reduces the clearance of bacteria and increases the leakage of secretion around the cuff of tube and disable the cilliary tract by damaging it[1,2,3]. Microbial adhesion on the tube itself results in biofilm formation is one of the major cause of infection.

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By micro-aspiration along the In long-term ventilated patients subglottic secretions can accumulate above the cuff of the ETT and hence present as an ideal growth medium for bacteria [4].cuff, these contaminated secretions might pass into the lower respiratory tract and become a potential cause of lower airway-infection including VAP. Artificial airways generally are colonized with potentially pathogenic microbes. Colonizing bacteria may arise from the upper airway, ventilator tubing or reservoirs [5]. Lower respiratory tract infections in intubated patients include ventilator-associated tracheobronchitis (VAT) and ventilator associated pneumonia (VAP), these infections are increasingly caused by multidrug-resistant bacteria, which colonize the patient's oropharynx and enter the lower respiratory tract around the endotracheal tube cuff or through the lumen. Progression of colonization to VAT and, in some patients, to VAP is related to pathogenesis and virulence of invading bacteria [6]. Over the past decade, the incidence of lower respiratory tract infection due to multidrug resistant (MDR) pathogens, such as methicillin-resistant Staphylococcus aureus (MRSA) and gram-negative bacilli (eg, Klebsiella pneumonia, Escherichia coli, Pseudomonas aeruginosa, and Acinetobacter baumannii) has been increasing [7]. Understanding the pathogenesis of VAT (ventilator- associated tracheobronchitis) and VAP (ventilator associated pneumonia) is crucial for establishing principles for therapy and prevention. Hence intubation with mechanical ventilation increases the risk of bacterial pneumonia [7, 8]. Widespread use of antibiotics in intensive careunits is a potential cause of the emergence of nosocomial infections caused by

antibioticresistant bacteria [9, 10]. Current guidelines for the management of VAP strongly recommend the use of early, appropriate empirical antibiotic therapy based on patient risk factors for multidrug-resistant pathogens [7, 9, and 10]. Routine endotracheal aspirate cultures of critically ill patients in ICUs may be predictive of patients who are at high risk of invasive disease, and may guide the selection of appropriate empirical therapy based on the predominant pathogens identified in microbial cultures in the event of the development of VAP [11]. Therefore there is a need to identify the pathogens and their antibiotic susceptibility pattern by performing microbiological techniques.

Material and Methods

This was a 6 months prospective study from january to June 2023 conducted in the department of microbiology of RMCH&RC mandhana, Kanpur.

All the patients on the mechanical ventilation in the intensive care unit and in the neuro intensive care unit of all age groups are included in this study. Patients with pneumonia before mechanical ventilation were excluded from this study.

All the endotracheal secretions (ET) samples were transported to the microbiological laboratory and immediately cultured on the blood agar, MacConkey agar and chocolate agar and were incubated at 370C for 24 to 48 hrs before giving no growth report.

Any growth on the culture plates was identified by observing the colony morphology, gram staining, and biochemical tests.

Statistical analysis

Data recorded on the case report form and structural proforma were subsequently entered into a spreadsheet. Data management and analysis were performed using Microsoft excel sheet.

Antibiotic susceptibility testing of isolated organisms was performed by kirby-bauer disk diffusion method on muller hinton agar (MHA) as per latest CLSI guidelines 2022.

Ethical considerations

The ethical committee clearance certificate was taken before starting of study by institutional medical ethical committee.

Results

In this study a total 37 endotracheal recreations samples were collected and all were culture positive in which 25(68%) were males and 12(32%) were females. Table No.1 showing distribution of male and females. Out of 37 culture positive samples 2(5.4%) were belongs to 11-20 years of age group followed by 4(10.8%) from 21-30 years, 7 (18.9%) from 31-40 years, 9(24.3%) from 41-50 years and 15(40.5%) in > 50 years of age group. Table no.2 showing age wise distribution.

Table No1: Gender wise distribution of the case

Gender	No. of Isolates	Percentage
Male	25	68%
Female	12	32%

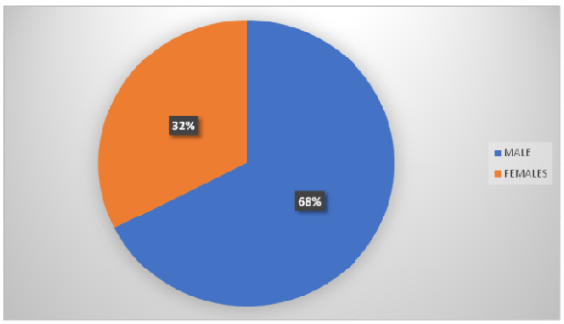

Figure no 1: Gender wise distribution

Table no 2: Age wise distribution.

Age	Numbers	Percentage
11-20	2	5.4%
21-30	4	10.8%
31-40	7	18.9%
41-50	9	24.3%
>50	**15**	**40.5%**

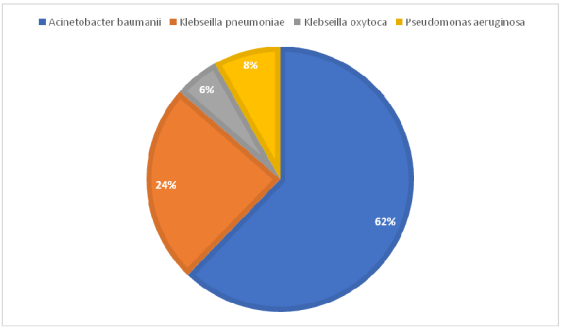

Figure 2: Distribution of isolated organisms

Table 3: Sensitivity pattern of all the sensitive drugs

Sensitive antibiotics	Numbers	Percentage
PB	**100**	**100%**
CL	100	100%
TGC	21	56.7%
MRP	11	29.2%
IMP	8	21.6%
AT	21	56.7%
AK	11	29.2%
CFS	9	24.3%
COT	9	24.3%
CPT	9	24.3%

In 37 culture positive isolates , the frequency of isolation of gram negative bacilli (n=37) was found to

be higher (100%) than gram positive cocci. There was no gram positive cocci were isolated.The most common gram negative isolates isolated was *Acinetobacter baumanii* 23 (62.16%) followed by *Klebseilla pneumoniae* 9(24.3%), *Pseudomonas aeruginosa* 2 (5.4%), *Klebseilla oxytoca* 1(2.7%) and *Candida spp* 2 (5.4%). The antibiotic susceptibility pattern of gram negative bacilli: *Acinetobacter baumanii* showed maximum resistance against 3rdgreneration cephalosporins, Carbapenems and Aminoglycosides and showed least resistant to polymixin B, colistin followed by tigycycline and aztreonam.*Klebseilla pneumoniae* was found to be sensitive against Meropenem, imipenem, aztreonam and polymyxin B and colistin.

Pseudomonas aeruginosa were also found to be more sensitive against meropenem, imipenem, Polymixin B and colistin. Table no.2 showing sensitivity pattern of all the sensitive drugs. All the isolates were found to be resistant against penicillin class, cephalosporins and aminoglycosides and none of the isolates showed resistant against carbapenems, monobactum and polymyxin.

Discussion

Respiratory tract infections due to the mechanical ventilation or tracheal intubation are the most important and leading cause of morbidity in ICU, NICU and emergency. The key treatment is early identification of the causative microbial agents, antibiotic sensitivity profile and administration of selected antibiotics. Endotracheal tubes are susceptible to impaction and attachment of micro-organisms therefore it is important to be aware of the relevant factors and responsible organisms to take prompt action.

In our study, 37 positive cultures obtained from the ET secretions cases were considered for the identification of pathogenic micro-organisms and their antibiotic susceptibility pattern. In our study, of all the culture positive patients 25 were males and 12 were females. Joseph et al., also reported quite similar gender ratio in his prospective observational study [11].

We found the frequency of isolation of Gram-negative bacteria to be higher than, similarly Abdollahi et al., and Ferreira et al., had also shown high frequency of Gram-negative microorganisms isolated in ET secretions culture [2, 12].

In our study, the most common micro-organism was Acinetobacter baumanii among all isolates followed by Klebseilla pneumoniae and Pseudomonas aeruginosa and Candida spp. This finding is in accordance with the results of Bassant et al., who found that the most prevalent isolates in quantitative ETA cultures were GNBs (77.3%) such as Klebsiella, Acinetobacter, Pseudomonas and Proteus spp., whereas Gram- positive organisms accounted for 22.7% represented by CONS [13].

Antibiotic resistance pattern among Gram negative bacteria: the highest resistance was found in two major beta-lactam antibiotics including 3rd generation cephalosporins and Penicillin group of antibiotics. Acinetobacter spp also showed high resistance against these drugs and least to imipenem, meropenem and polymyxin B. Our findings were similar when compared to the Kiran Tandia et al., and Abdollahi et al., who reported high degree of resistance in cephalosporins and Penicillin group of antibiotics in their studies [1, 12].

The micro-organisms that have been documented to colonize ETTs and grow in the form of a biofilm are numerous, including the multidrug-resistant bacteria Acinetobacter baumanii, Klebseilla pneumoniae. Therefore, making effective antibiotic policy directed at reducing such colonization could help to reduce the rates of antibiotic-resistant infections.

Conclusion

Our study provides the important information about the micro-organisms causing infections in intubated patients. This study also shows that the antibiotic resistant rate was alarming in the culture of endotracheal secretions from ICU patients.

This study also highlighted the importance of using empirical antimicrobial therapies to target multidrug-resistant micro-organisms at early-stage of ventilator associated pneumonia. Therefore, ET secretions culture provides accurate and reliable information in respect to early antibiotic treatment.

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