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Original Research Article

Bacteriological Profile and Antibiogram of Endotracheal Aspirates in Intubated Patients at a Tertiary Care Hospital

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ABSTRACT

Introduction - Use of invasive drugs and therapeutic methods have saved many lives but on the other hand it has caused life threatening consequences due to severe, persistent, resistant infections. There is a dire need of epidemiological studies for ventilated patients, to know the local microbial flora and their antibiotic profiles for rational use of antibiotics. Hence, this study was undertaken to determine the prevalence of pathogenic bacteria in respiratory secretions of ventilated patients and their antibiotic susceptibility patterns.

Materials and Methods - Analysis of Endotracheal Aspirates of 123 intubated patients over a period of 1yr (June 2015 to May 2016) was done. Aspirates were cultured on Blood, McConkey and Chocolate Agar. Isolation and identification was done using conventional techniques and Biochemical reactions. Antibiotic Sensitivity testing was done by Kirby-Bauer disc diffusion method as per CLSI guidelines.

Results and discussion - Out of 123 samples 105 were culture positive. 13 cases were found to be polymicrobial. 18 samples showed no growth. Klebsiella sp.(34.28%) was the most common isolate followed by Pseudomonas sp.(20%), Acinetobacter(15.2%), E. coli (10.47%), S. aureus (12.3%) and CoNS (7.6%). The gram Negative bacilli were mostly sensitive to Imipenem, Meropenem, Piperacillin Tazobactam. The Gram Positive cocci were mostly sensitive to Vancomycin and Linezolid.

Conclusion - Endotracheal intubation is a major risk factor in causing iatrogenic infections to patients which lead to an increase in the morbidity and mortality. Inappropriate and inadequate antibiotic treatment causes emergence of drug resistance in pathogens and poor prognosis in patients. Hence the isolation and antibiotic susceptibility of the microorganisms is necessary for their effective management.

Key Words: Endotracheal Aspirates, Intubated Patients, Antibiogram

INTRODUCTION

Uses of invasive drugs and therapeutic methods have saved many lives but on the other hand it has caused life threatening consequences due to severe, persistent, resistant infections. These invasive therapeutic and diagnostic methods the may lead to nosocomial infections particularly in Intensive Care Units'(ICU) and Critical Care Units'(CCU). There is documented evidence that hospital personnel and environment are the microbial source, and prolonged hospital stay& overuse of antimicrobial agents has led to multidrug resistance of these microbes. [1] The tracheostomized patients are colonized mostly by gram negative bacteria which may cause either tracheobronchitis or bronchopneumonia. [2] Lower respiratory tract infections (LRTI)

are the most common bacterial infections among patients in neurological intensive care units, resulting in high overall mortality, which may range from 22% to 71%. [3] There is a dire need of epidemiological studies for ventilated patients, to know the local microbial flora and their antibiotic profiles for rational use of antibiotics. Hence, this study was undertaken to determine the prevalence of pathogenic bacteria in respiratory secretions of ventilated patients and their antibiotic susceptibility patterns. [4]

Aims & Objectives

1. To study the bacterial pathogens in the endotracheal tubes of the intubated patients.
2. To study the Antimicrobial Susceptibility pattern of bacterial isolates.

MATERIALS AND METHODS

The study was conducted in the department Of Microbiology at Dr. Shankarrao Chavan Govt. Medical College, Nanded. Analysis of Endotracheal Aspirates of 123 intubated patients over a period of 1yr (June 2015 to May 2016) was done. Out of these 82 were male and 41 female. The samples were collected aseptically and processed immediately following collection. The clinical samples were cultured Sheep's Blood Agar, MacConkey, and Chocolate Agar for routine bacterial isolation following the standard operating procedures. Isolates were identified using conventional methods based on their reaction in biochemical tests. Antimicrobial susceptibility testing was performed by Kirby-Bauer disc diffusion method strictly adhering to the standards stipulated in CLSI 2015 guidelines. The following antibiotics (Hi-Media Disc in µg) were tested for AST - Amikacin (30 μg), Co-trimoxazole (20/10 μg), Cefepime (30 μg), Cefoxitin (30 μg), Cefotaxime (30 μg), Ceftriaxone (30 μg), Ceftazidime (30 μg), Gentamicin (10 μg), Imipenem (10 μg), Meropenem (10 μg), Tazo. Piperacillin (100/10 μg), Tobramycin (10 μg), Ampicillin (25 μg), Ciprofloxacin (5 μg), Vancomycin (30μg), Linezolid (10 μg) and Levofloxacin (5 μg).

RESULTS

A total of 123 samples were processed, out of these 82 were male and 41 female [fig.1]. Out of the 123 samples 105 were culture positive [fig.2]. 19 out of 105 positive samples were found to be polymicrobial and 18 samples showed no growth.

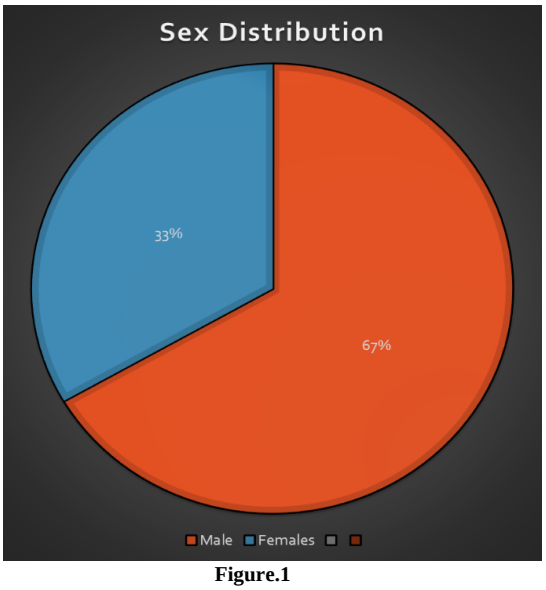

Figure.1

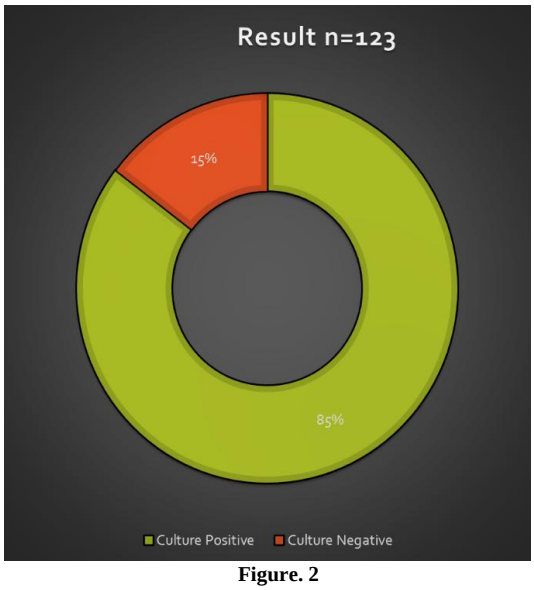

Figure. 2

Among these clinical isolates Klebsiella pneumoniae (34.28%) was the most common isolate followed by *Pseudomonas aeruginosa* (20%), *Acinetobacter baumanii* (15.2%), *Escherichia coli* (10.47%), *Staphylococcus aureus* (12.3%) and Coagulase Negative Staphylococcus (CoNS) (7.6%) [Table No.1].

Table No.1 Microorganisms Isolated and percentage n=123

Microorganism	Number (%)
K. pneumoniae	36(34.28%)
P. aeruginosa	21(20%)
A. baumannii	16(15.2%)
E. coli	11(10.47%)
S. aureus	13(12.3%)
Coagulase Negative Staphylococcus (CoNS)	8(7.6%)
No Growth	18
TOTAL	123

All isolates of *P. aeruginosa* were sensitive to Imipenem (100%) followed by Amikacin (90%), Tobramycin (76%), Ceftazidime (62%). Enteric Gram Negative bacteria (*Klebsiella & E.coli*) were sensitive to Amikacin (80%), Imipenem (100%), Meropenem (100%), Piperacillin Tazobactam (85%) followed by Gentamicin (74.45%), Ceftriaxone (59.57%), Ciprofloxacin (21.27%).

Acinetobacter baumanii was the most resistant of all. It was sensitive to Imipenem (81%), Ciprofloxacin (12.5%), Amikacin (31.2%), Ceftazidime (12.5%), Gentamicin (31.2%), Cefepime (18.75%), Ceftriaxone (12.5%) [Table No.2].

All the gram positive bacteria isolates were sensitive to Vancomycin and Linezolid. 38.46% of S. aureus Isolated were Methicillin Resistant whereas 75% CONS isolated were Methicillin Resistant. Almost all Isolates were resistant to Penicillin (Sensitive 14.2%) [Table No.3].

Table No 2. Antibiotic Sensitivity of Gram Negative clinical Isolates

Antibiotics	*P. aeruginosa* n=21	GNB (*K. pneumoniae* + *E. coli*) n=47	*A. baumannii* n=16
Imipenem	100%(21)	100%(47)	81.2%(13)
Ceftazidime	62%(13)	68%(32)	12.5%(2)
Amikacin	90%(18)	80%(38)	31.25%(5)
Tobramycin	76%(16)	--	--
Piperacillin-Tazobactam	71%(15)	85%(40)	50%(8)
Ciprofloxacin	38%(8)	21%(10)	12.55(2)
Meropenem	100%(21)	100%(47)	68.75%(11)
Gentamicin	76%(16)	74.4%(35)	31.25(5)
Ceftriaxone	--	59.5%(28)	12.5%(2)
Cefepime	--	48.9%(23)	25%(4)
Levofloxacin	--	42.25%(20)	12.5%(2)
Ampicillin	--	31.9%(15)	18.75%(3)

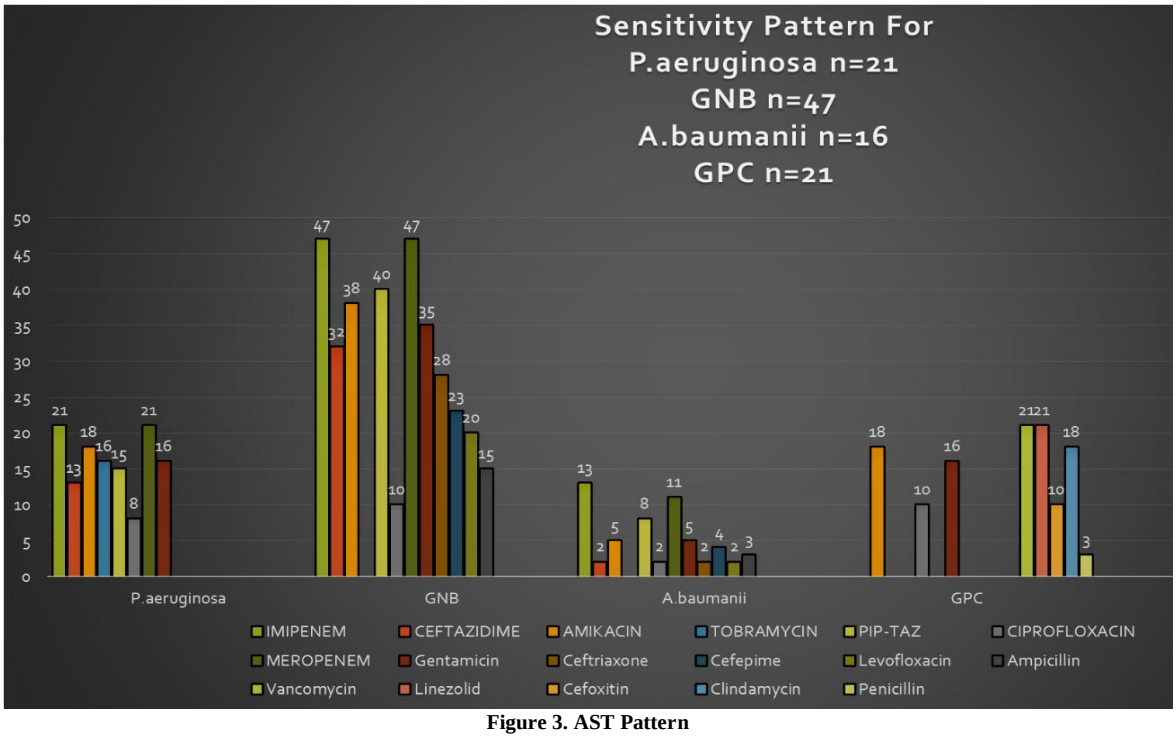

Figure 3. AST Pattern

Table No 3. Antibiotic Sensitivity of Gram Positive clinical Isolates

Antibiotics	*S.aureus* n=13	CoNS n=8
Amikacin	84.6%(11)	87.5%(7)
Gentamicin	76.9%(10)	75%(6)
Clindamycin	84.6%(11)	87.5%(7)
Cefoxitin	61.5%(8)	75%(6)
Vancomycin	100%(13)	100%(8)
Linezolid	100%(8)	100%(8)
Penicillin	15.3%(2)	12.5%(1)
Ciprofloxacin	46.15(6)	50%(4)

DISCUSSION

Health care associated infections (HCAI) continue to be a major cause of morbidity and device associated infections contributes a maximum towards Healthcare Associated Infections. The mechanically ventilated and tracheostomized patients are colonized with bacteria of either endogenous or exogenous origin which might end up in Ventilator Associated Tracheobronchitis or Ventilator Associated Pneumonia. [1] Bypassing of the upper respiratory tract and imperfect functioning of mucociliary escalator (due to insertion of tube in trachea) impair the immune system. Besides, leakage of secretion around the tube and opening of the binding site for gram negative bacteria may have cause high rate of colonization. [2] Our study showed 85% growth from endotracheal aspirates which is concurrent with the studies of Bhaskar Thakuria et al. [5] Santosh Khanal et al, [6] da Silva Júnior et.al. [7] and Koirala et. al [2] (78-92%) and higher than the study of Vadivoo et. al. [1] (73%) and Shalini S et.al. [8] Out of 105 isolates clinical 80% were Gram negative Bacilli and only 20% were Gram positive cocci. Our study correlates with many studies and particularly as shown in one systematic review article by YaseenArbi et. al. [9] where GNB's range from 41-92% and Gram positives between 6-58%. In our study *Klebsiella pneumoniae* (34.28%) was the most common isolate followed by *Pseudomonas aeruginosa* (20%) and *Acinetobacter baumannii* (15.2%). This correlates with the study by Vadivoo et. al. [1] with *Klebsiella* at 35.9% followed by *Acinetobacter spp* at 17.9% and *Pseudomonas* at 16.8%, Jakirbettu et.al. [10] with K. pneumoniae (34%), P. aeruginosa (20%) and Acinetobacter species (18%) and Patil et. al [11] with *Klebsiella* (23.%), Pseudomonas (21.%), *Acinetobacter* 24(19%). It was found that 15% of the specimens showed no growth culture probably due to previous antibiotic therapy or being non-representative specimens.

In our study *P. aeruginosa* and the EGNB were the most predominant bacteria. The high frequency of Pseudomonas can be justified in terms of favourable condition of binding for the bacteria. Mechanical injury to the tracheal surface may expose binding site for the Pseudomonas (Yamaguchi and Yamada 1991), the binding is further enhanced by Carbohydrate produced by novel tracheobronchial cell when repairing the injury (Plotkowski et. al., 1991). The bio-film inside the endotracheal tube itself may be a surface where bacteria bind avidly (Inglis et. al., 1989). High frequency of EGNB can be referred to entry of these bacteria from gastrointestinal tract to tracheobronchial tree (Craven et. al., 1991) and increased abdominal volume (as could occur from nasogastric feeding) which refluxes colon bacteria to respiratory tract (Jacob et. al., 1990).

In our study enteric GNB showed 100% sensitivity to Imipenem, whereas they were less sensitive to Cephalosporins. Amongst amynoglycosides they were most sensitive to Amikacin than Gentamicin. They were sensitive to Piperacillin-tazobactam at 85%. The sensitivity to Ciprofloxacin was 21%and to Levofloxacin 42%. They were least sensitive to Ampicillin at 31%. This is in accordance with Jakirbettu et. al [6] and Juayang et. al [12] where carbapenems were the most sensitive antibiotics and Koirala et.al [2] where Amikacin was found to be more sensitive than gentamicin.

In the study Pseudomonas was 100% sensitive to Imipenem which is in accordance the study conducted by Vadivoo et.al. [1] It also showed very good sensitivity to many antimicrobial agents except Ciprofloxacin (38%).

In our study Acinetobacter species showed overall good sensitivity to Imipenem at 81%, whereas its sensitivity to all other drugs were very poor.

In the case of S. aureus, all isolates were found sensitive to Vancomycin and almost all were resistant to Penicillin (sensitivity 15%). However, finding of nearly (40%) of isolates as Methicillin resistance indicated a precarious situation. Similar findings were seen by Koirala et.al. [2]

A high burden of the multi-drug bacteria were reported, this may be ascribed either to selective decontamination of digestive tract with different antibiotics or empirical use of broad spectrum antibiotics and non-adherence to hospital antimicrobial position.

CONCLUSION

Endotracheal Intubation is a major risk factor in causing iatrogenic infections to patients which lead to an increase in the morbidity and mortality.

Our study reported a high percentage resistance among gram negative bacilli to third generation cephalosporins. In comparison, Imipenem, Amikacin and Piperacillin-Tazobactam were found to be effective.

For gram positive cocci significantly high resistance was seen for Penicillin and Cefoxitin. However, vancomycin was found to be 100% sensitive.

Inappropriate and inadequate antibiotic treatment causes emergence of drug resistance in pathogens and poor prognosis in patients.

Hence the isolation and antibiotic susceptibility of the microorganisms is necessary for their effective management.

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