Original Research Article

A Retrospective study on ICU isolates on Tracheostomy tube and their antimicrobial profile

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Abstract

Introduction: The tracheostomized patients are likely to develop pneumonia causing life threatening consequences due to severe, persistent, resistant infections. **Objective:** This study was done with the aim to identify the common organisms which cause Respiratory Tract Infections (RTI) and their resistant pattern of ventilated patients in Intensive Care Unit (ICU). **Methods**: This retrospective study was conducted on the patients who underwent tracheostomy in ICU of Government Medical College, Jammu. The samples were processed according to established departmental protocols. **Results**: Out of 54 samples, 50(93%) were culture positive. 6samples were found to be polymicrobial. 4 samples showed no growth. *Citrobacter sp., Escherichia coli, Pseudomona*s sp. being the commonest species isolated. *Citrobacter sp. and Klebsiella sp., Proteus sp*. and *Staphylococcus aureus* showed high degree of resistance while *Pseudomonas sp.* and *Escherichia coli* showed moderate resistance. The gram negative bacilli were all sensitive to Colistin and Polymixin B. *Staphylococcus aureus* was 100% sensitive to Vancomycin. **Conclusions**: Intubated patients are the risk factor for development of RTI and to the increase in morbidity and mortality. Inappropriate and inadequate antibiotic treatment causes emergence of drug resistance in pathogens and poor prognosis in patients. The study reported the alarming condition of MDR in tracheal aspirates. Hence, surveillance for source of Multi Drug Resistant bacteria would be beneficial for intervention of infection related to it.

Keywords: Ventilated patients, Multi Drug Resistant (MDR), Antibiogram.

Introduction

Tracheostomy is a life saving surgical procedure to provide a patent airway in patients prone to upper airway obstruction, and to provide access to the lower respiratory tract for airway clearance[1]. But presence of this invasive device to help critically ill patients acts as a type of risk factor for the development of Respiratory Tract Infections because of the increased leakage of secretions around the tracheostomy tube cuff and also reduction in the clearance of bacteria because of inhibition of the ciliary movement. There is a 20 fold increase in the development of respiratory tract infection following mechanical ventilation in tracheotomised or mechanically ventilated patients[2].

Also, with the excessive and indiscriminate use of broad spectrum antibiotics, the rise of Multi- Drug Resistant (MDR) pathogens is a major problem and it has become the menace in treating these nosocomial infections which leads to increase in morbidity and mortality in these patients.

The main objective of our study is to find out the type of bacteria colonising the tracheostomy tube and also to determine the antibiotic sensitivity pattern in patients who had tracheostomy in Intensive Care Unit (ICU) set up.

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So that a timely and proper empirical treatment can be started in such patients.

Material and methods

This study is the retrospective observational study of the patients who underwent tracheostomy in ICU of Government Medical College, Jammu. Ethical clearance was not applicable in this study. Samples of tracheostomy tip were received in the Microbiology Department in a test tube for culture and sensitivity. They were processed according to established departmental protocols and antimicrobial susceptibility testing was performed using Kirby Bauer Disk diffusion method on Mueller Hinton agar (HiMedia Labs) according to the Clinical Laboratory Standard Institute (CLSI 2021) guidelines[3].

Results

54 samples were received in this 1 year retrospective study. No growth was obtained in 4 samples and polymicrobial growth was observed in 6 samples. Seven different microorganisms were isolated during our study which included *Citrobacter sp.* (*n* = 12), *Escherichia coli* (*n* = 12), *Pseudomona*s sp. (*n* =12) and many other organisms as included in the Figure 1. The most common organisms in both genders were *Citrobacter sp.*, *Escherichia coli* and *Pseudomona*s sp. Regarding antibiogram (detail in table 1), high degree resistance was observed in case of Klebsiella sp. where it was resistant to every antibiotic used except for second line antibiotic like Colistin and Polymixin B.

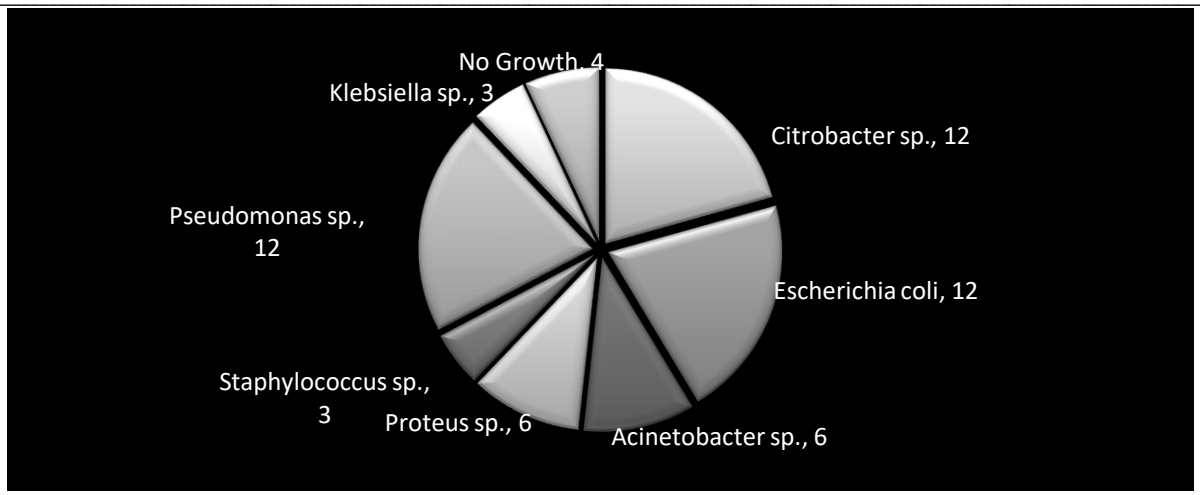

Fig.1: Different types of Microorganisms isolated

Table 1: Resistant pattern (in percentage) of different bacteria isolated

	Citrobacter sp. (N=12)	Escherichia coli (N=12)	Pseudomonas aeruginosa (N=12)	Acinetobacter sp. (N=6)	Proteus sp. (N=6)	Klebsiella sp. (N=3)	Staphylococcus aureus (N=3)
AMIKACIN	100%	25%	50%	100%	100%	100%	100%
AMPICILLIN	100%	25%	-	-	100%	-	100%
AMOXY-CLAVULINIC ACID	-	100%	-	-	-	100%	100%
CEFEPIME	100%	100%	-	-	100%	100%	100%
CEFTRIAXONE	-	100%	-	100%	-	100%	100%
CIPROFLOXACIN	-	100%	50%	100%	-	100%	100%
DOXYCYCLINE	100%	50%	-	-	100%	100%	70%
GENTAMYCIN	100%	25%	50%	100%	100%	100%	100%
MEROPENEM	-	25%	50%	50%	-	100%	100%
PIPERACILLIN-TAZOBACTAM	100%	25%	25%	50%	50%	100%	100%
TRIMETHOPRIM-SULFAMETHOXAZOLE	80%	100%	-	100%	100%	100%	100%
CEFTAZIDIME	-	-	50%	100%	-	-	-
VANCOMYCIN	-	-	-	-	-		0%
POLYMIXIN B	0%	0%	0%	0%	0%	0%	-
COLISTIN	0%	0%	0%	0%	0%	0%	-

Discussion

The rate of nosocomial infection is slowly increasing in the patients admitted in the ICU due to excessive invasive procedures performed including artificial ventilator support along with the increase in antibiotic resistance[4]. The findings of this study would be helpful in selection of appropriate antibiotics.

Our study showed positive growth in 93% of the samples. In a study conducted by Malik *et al*[5], the positive cultures came out to be 83%. This is in contrast to the study of Ahmad H *et al*[6], who observed growth in 45.2% of samples. The high positivity can be attributed to the poor infection control practices in our hospital or due to the efficient sampling technique adopted in our hospital.

In our study, gram-negative bacilli were the common causative agents (94%) as compared to gram-positive cocci, which were 6% of the total positive cultures. This was consistent with the study of Gupta *et al*[7] in which 86% of the samples were gram-negative bacilli. This can be because of the fact that majority of the nosocomial infections are caused by gram negative bacteria are more dangerous and difficult to treat. Thus strict measures against the spread of gram-negative bacilli should be taken.

The most common organisms isolated were *Citrobacter sp.* (*22%*), *Escherichia coli* (*22%*), *and Pseudomonas sp.* (*22%*). A study by Malik *et al* [5] observed *Klebsiella sp.* (35.4%) as the common organism and a study by S.H.A. Cader *et al*[8] isolated *Pseudomonas sp.* (37%) as the most common agent. This can be attributed to the geographical and regional differences.

Regarding antibiogram, *Klebsiella* sp. was found to be pan resistant to every first line antibiotics used and was only sensitive to second line drugs i.e. Polymixin B and Colistin. *Citrobacter* sp. showed 20% sensitivity towards trimethoprim-sulfamethoxazole and was resistant to other first line antibiotics. This high degree of resistance to multiple drugs in gram-negative bacteria can be associated with cross-infections and other factors like the unjust use of antibiotics, biofilm formation. This is an alarming situation as the emergence of MDR and Extensive Drug Resistant (XDR) pathogens in tracheal secretion leads to increase in morbidity and mortality in patients, making treatment difficult and expensive.

The other gram-negative bacilli of our study, *Escherichia coli* was sensitive to amikacin (75%) and ampicillin (75%), gentamicin (75%), meropenem (75%) similar to the study of Ahmad H *et al*[6], which showed 80% sensitivity to amikacin. In our study, *Acinetobacter* sp. was most sensitive to meropenem (50%) and Piperacillin-tazobactam (50%) and resistant to all other first line antibiotics. A study by S.H.A. Cader *et al*[8] showed 91% sensitivity to Piperacillin-tazobactam in case of *Acinetobacter* sp. *Pseudomonas* sp. has shown 75% sensitivity to Piperacillin- tazobactam. Rajkumari S *et al*[9] observed 80% sensitivity to Piperacillin- tazobactam. *Pseudomonas* sp. showed a gradual increase in sensitivity to the drugs. Proteus showed only 50% sensitivity to Piperacillin-

tazobactam whereas in a study by S.H.A. Cader *et al*[8] this was around 93%. The only gram-positive cocci, *Staphylococcus aureus* was sensitive to vancomycin (100%). This was consistent with the study of Rajkumari S *et al*[9] which also showed 100% sensitivity to vancomycin.

Conclusion

Gram-negative bacilli were predominant in tracheal secretions with *Citrobacter sp.*, *Escherichia coli*, *Pseudomona*s sp. being the commonest species isolated. *Citrobacter sp. and Klebsiella sp., Proteus sp*. and *Staphylococcus aureus* showed high degree of resistance while *Pseudomonas sp.* and *Escherichia coli* showed moderate resistance. The main concern related to nosocomial infections is the upsurge of MDR pathogens among the respiratory secretions which have extended into the community also.

Recommendations

Judicious use of antimicrobial therapy, institution of contact precautions, enhanced hand washing, and staff education is needed in order to control the antimicrobial resistance.

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