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Original Article

Bacterial Isolates from Blind Tracheal Aspirates and Their Anti-Microbial Sensitivity: An Observational Study in ICU of a Tertiary Care Hospital in Bangladesh

Uzzwal Kumar Mallick*[1], Md Sirajul Islam[1], Mohammad Asaduzzaman[2], Mohammad Abdullah Yusuf[3], Mohammad Omar Faruq[4]

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Abstract:

Background: *The number of organisms developing resistance to commonly used antibiotics is increasing day by day. The exact national scenario of antimicrobial sensitivity pattern is not well known in Bangladesh owing to the absence of proper guideline for prescribing antibiotics.*

Aims: *The aim of this study is to identify the group of organisms developing resistanceso that antibiotic policy can be formulated for the proper and effective use of antibiotics.*

Settings and Design: *This observational study was conducted for a period of 1 year from January 2018 to December 2018 in a tertiary care hospital in Bangladesh.*

Materials and methods: *This descriptive cross-sectional study was conducted in the Department of Microbiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh from January 2018 to December 2018, using the convenient sampling technique. Tracheal secretions from patients in the intensive care unit (ICU), tested in Department of Microbiology, National Institute of Neurosciences and Hospital, were included in the study. The culture was done on blood and MacConkey agar and the sensitivity pattern was performed on Muller Hinton agar. Data were analyzed using SPSS version 23.0.*

Results: *Out of the microorganisms isolated from positive growth cultures, Acinetobacter (57.8%) was the most common isolate followed by Klebsiella (22.9%). Acinetobacter, pseudomonas and klebsiella had good sensitivity to colistin(87.80%, 82.40% and 77.80% respectively), where as they showed less sensitivity to higher generationcephalosporin, penicillin and aminoglycosides.*

Conclusion: *The commonest organism which was isolated from the endotracheal aspirate cultures were Acinetobacter, followed by Pseudomonas and Klebsiella and antimicrobial susceptibility testing showed sensitivity to Colistin, Tazobactam/piperacillin, Meropenem and aztreonam. Whereas coagulase negative staphylococci was isolated only in minority cases with highest sensitivity to vancomycin and linezolid.*

Keywords: *Gram-negative bacteria (GNB), Drug sensitivity, Tracheal aspirate.*

Introduction:

An intensive care unit (ICU) provides the critical care and life support for acutely ill and injured patients in a specialized hospital. Hospital acquired infection (HAI) are the major cause of mortality and morbidity among the intubated patients in ICU. It is reported that mortality and morbidity rate by HAI is more among intubated patients in ICU (50%) than among patients in general wards (5%-10%).[1]

Equipment frequently used in ICU such as endotracheal tube, intra venous catheter etc. are mostly responsible for HAI.[2]Tracheal intubation also causes colonization in trachea by different bacteria that may be responsible for increases the risk of mortality due to superinfections.[3]This situation is causing concern regarding the rise of bacterial resistance to various antimicrobial agents and is becoming a major public health issue. Now a days, the major concern is inappropriate treatment against MDR (Multi-drug resistance) GNB (Gram-negative bacteria) due to unavailability of newer antibiotics.[4,5] As a result, there is reemergence of older antibiotics like colistin.[6,7,8] The excessive and indiscriminate use of broad-spectrum antibiotics has led to the development of these resilient microbes which are difficult to treat[9].

The aim of this study was to identify the common pathogens in tracheal secretions on patients with endotracheal tube in

1 Assistant professor, Department of Critical Care Medicine, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh;

2 Assistant Professor,Critical Care, Kuwait Bangladesh Friendship Hospital, Uttara, Dhaka, Bangladesh.

3 Assistant Professor,Department of Microbiology, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh

4 Professor andChief Consultant, General ICU and Emergency Dept., United Hospital, Dhaka, Bangladesh.

*** Corresponding Author:**

Dr. Uzzwal Kumar Mallick, MD (CCM)
Assistant Professor
Dept. of Critical Care Medicine
National Institute of Neurosciences and Hospital
Dhaka, Bangladesh
Cell: +8801712715180
E-mail: ukm1980@gmail.com

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situ and to study the patterns of their sensitivity and resistance to various antibiotics, which can serve as guidelines to physicians for empirical treatment with proper antibiotics.To formulate an antibiotic policy for the ICU, knowledge ofthe antibiotic susceptibility of the organisms isolated in theICU is essential. This also avoids unnecessary use of broad-spectrum antibiotics and prevents emergence of drug resistant bacterial strains. The data on the changing antibioticsusceptibility trends is important for infection controlactivities in ICU settings. Therefore, the present study wasundertaken to determine the antimicrobial resistance patternof bacterial isolates from National Institute of Neurosciences and Hospital over a 1-year period. The results of this study is expected to help clinicians to plan the antibiotic guidelines aswell as antibiotic cycling in ICU settings.

Material and Methods

This descriptive cross-sectional study was conducted in the Department of Microbiology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh from January 2018 to December 2018. All patients with endotracheal tube in situ whose tracheal secretion samples obtained from blind tracheal aspiration were tested in the department of Microbiology, National Institute of Neurosciences and Hospital, were included in the study. In total, 332 samples were collected, regardless of age and gender, by using the convenient sampling technique. Tracheal secretions from patients admitted in the intensive care unit (ICU) for more than 48 hours were obtained by sterile suctioning through an endotracheal tube and suction catheter tip. Samples were inoculated on agar plates. The culture was done on blood and MacConkey agar and was incubated at 37°C for 24 to 48 hours. Microbes were identified under a microscope by observing morphological characteristics after gram staining and applying biochemical tests. Antibiotic sensitivity pattern was done on Muller Hinton agar using the Kirby Bauer disk diffusion method. Antibiotic discs containing amikacin,amoxicillin, aztreonam, ceftazidime, ciprofloxacin, Levofloxacin, Co-trimoxazole, ceftriaxone, cefepime, meropenem, piperacillin + tazobactam, vancomycin, penicillin, gentamicin, linezolid, chloramphenicol, erythromycin, methicillin, ampicillin, and Colistin sulfate were obtained and used as per the manufacturer's instructions.

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) v.23.0 (IBM, Armonk, US). Descriptive statistics were applied to find frequencies and percentages. Charts and tables were constructed.

Results: A total of 332 samples were collected during this study period. Positive growth was observed in 76.5% samples (Figure-1). The gram-negative bacilli contributed a major number of isolates (97.6%), the remaining nine (1.2%) were caused by gram-positive cocci and candida was 1.2% (Figure-2).

The gram-negative bacilli such as Acinetobacter (57.8%) was the most common isolate followed by Klebsiella (22.9%). Acinetobacter, pseudomonas and klebsiella had good sensitivity to colistin (87.80%, 82.40% and 77.80% respectively), where as they showed less sensitivity to higher generation cephalosporins, penicillin and aminoglycosides. The susceptibility pattern of Gram-negative bacilliare shown in Figure-3 and susceptibility pattern of Gram-positive staphylococcus is shown in Figure-4 shows good sensitivity to vancomycin and linezolid (82.20% and 87.80% respectively) and less sensitivity to cephalosporine, quinolones and co-trimoxazole.

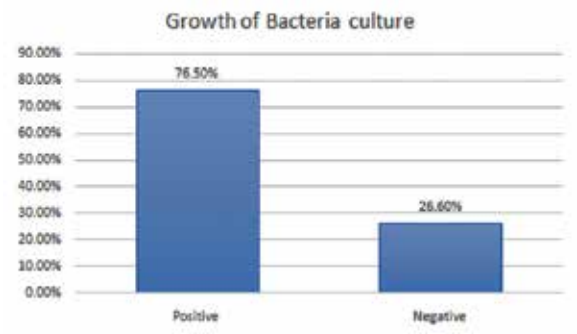

Fig 1

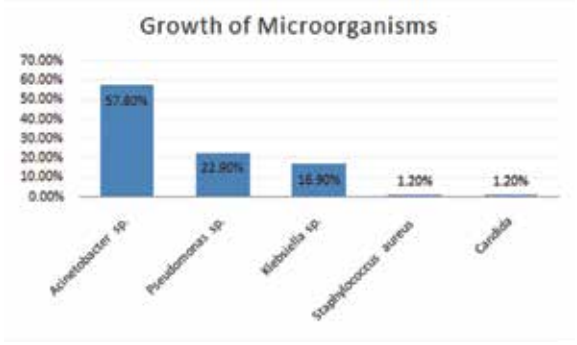

Fig 2

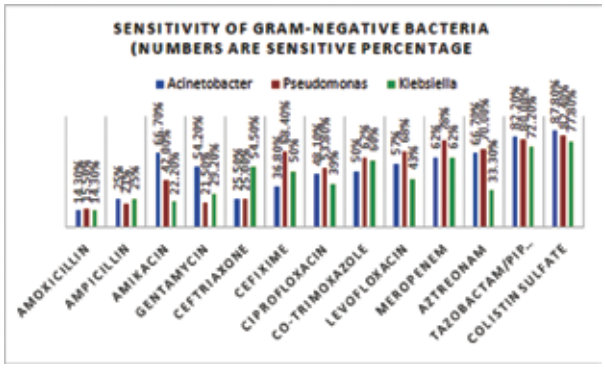

Fig 3

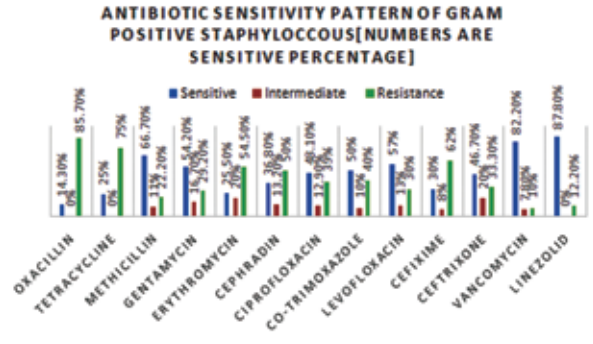

Fig 4

Table 1

References	Acinetobacter	Pseudomonas	Klebsiella
Our study (2018)			
Bacteria Positivity	**57.8%**	**22.9%**	**16.9%**
Antibiotic Sensitivity			
Colistin	87.8%	84.3%	77.8%
Tazobactam/ piperacillin	82.2%	80%	72.2%
Carbapenem	62%	70.4%	78%
Amikacin	66.7%	42%	22.2%
Karim et al.Bangladesh Critical Care Journal,2019. 7(2), 73-76.[20]			
Bacteria Positivity	**31.6%**	**21.05%**	**10.05%**
Antibiotic Sensitivity			
Colistin	100%	80%	60%
Tazobactam/ piperacillin	62%	80%	80%
Carbapenem	18%	20%	80%
Amikacin	45%	20%	40%
Mallick et al Bangladesh Critical Care Journal, 2015. 3(1), 9-13[13]			
Bacteria Positivity	**38-66.6%**	**20-42%**	**15-16%**
Antibiotic Sensitivity			
Colistin	38-61%	42%	15%
Tazobactam/piperacillin	38-42%	15%	15%
Carbapenem	42%	7-15%	7-15%
Amikacin	30%	15%	7%
Ahsan et al. Bangladesh Crit Care J September 2016; 4 (2): 69-73[12]			
Bacteria Positivity	**37.5%**	**13.6%**	**22.7%**
Antibiotic Sensitivity			
Colistin	100%	100%	100%
Tazobactam/piperacillin	16.2%	37.8%	12.8%
Carbapenem	13.1%	10.1%	40%
Amikacin	10.1%	19.2%	30%
Jamil et al. Journal of Medicine, 2016. 17(2), 91-94.[21]			
Bacteria Positivity	**64%**	**15%**	**9%**
Antibiotic Sensitivity			
Colistin	98.6%	84.3%	100%
Tazobactam/ piperacillin	11.5%	27.8%	43.3%
Carbapenem	17.4%	48%	29.1%
Amikacin	22%	19.1%	19.2%

Discussion

According to literature the rate of nosocomial infections are increasing in the patients admitted in the ICU due to excessive invasive procedures performed including artificial ventilator support[10]. Bacterial sensitivity to conventional antibiotics are decreasing day by day[11].In our study, percentage of samples showing positive growth in our study was 76.5%. In a study conducted by Hassaan et al., the positive samples were 72.3%[12]. In a study conducted in the setting of Pakistan by Malik et al., the positive cultures came out to be 83%[13]. The lower positive growth in our study can be attributed to the better infection control measures in the ICU setup of our hospital. However, the convenient sampling technique used in our study might be a limiting factor for the decreased percentage of positive growth.

In our study, gram-negative bacilli were more common causative agents (97.6%) as compared to gram-positive cocci, which were 1.2 % of the total positive cultures. Another research in Bangladeshdone by Ahsan et al. and Mallick et al., in which the gram-negative bacilli were 76.13% and 86% respectively.[12,13](Table-1). This can be attributed to the fact that the majority of the nosocomial infections are caused by gram-negative bacteria which are more dangerous and difficult to treat. This calls for strict measures against the spread of gram-negative bacilli, especially in the ICU setting.Table 1shows comparison of our study with some similar studies done in Bangladesh

In our study, Acinetobacter (57.8%) was the most common isolate. In a study by Ahsan et al., the commonest bacterium isolated from tracheal secretions was Acinetobacter (37.5%%)[12](Table-1). In a study by Mallick et al., Acinetobacter (32.35%) was the most common isolate both in early and late onset Ventilator-associated pneumonia[13](Table-1). However, in one study by Shahunja et al. in Bangladesh, Klebsiella was the most common isolate (45%), followed by Acinetobacter (36%) and Pseudomonas (14%)[14]. The rise in Acinetobacter in our study, especially in the ICU setup, can be attributed to the dramatic increase in the occurrence of multi-drug resistant isolates. In addition, this organism has the ability to survive in humid and dry conditions for longer periods, resulting in nosocomial outbreaks[15].

In our study, Acinetobacter was most sensitive to Colistin (87.8%) followed by Tazobactam/Piperacillin (82.2%). A study by Rani et al. reported Acinetobacter 80%–90% sensitivity to Colistin [16]. In another study by Study done by Saha, et al showed Acinetobacter was highly sensitive only to colistin 98% but only 9 - 20% to Piperacillin and Klebsiella were moderate to highly sensitive to colistin 63.15%[17]. In our study klebsiella sensitivity to colistin, Tazobactam/piperacillin, aztreonam and meropenem was 77.8%, 72.2%, 70% and 62% respectively. But in the study done by Haque L et al. klebsiella was more than 40% to 60% sensitivity to colistin, ciprofloxacin, amikacin and meropenem[18]. Our study revealed that pseudomonas had sensitivity to colistin, Tazobactam/piperacillin, aztreonam and meropenem and it was 82.4%, 80%, 78% and 70% respectively. But study done by Saha, et al showed pseudomonas sensitive to colistin, carbapenem were 100% and 50%- 60% respectively[17]. Study done by Karim et al. and Jamil et all also showed near similar result [20, 21].

In our study high sensitivity of S. aureus was observed for linezolid (87.8%) and vancomycin (82.2%) showed less sensitivity to commonly used antibiotics such as gentamycin, erythromycin, levofloxacin, tetracycline and cephradine which is similar to study done by Gitau et al[19]. In our study candida was isolated from 1.2 % of tracheal aspirate culture, which maybe due to the presence of underlying conditions like poor nutritional status, diabetes mellitus, use of steroid and broad-spectrum antibiotics. This may, however, also indicate an overuse of antibiotics.

Conclusion: The commonest organism which was isolated from the endotracheal aspirate cultures were Acinetobacter, followed by Pseudomonas and Klebsiella which were sensitive to colistin, meropenem, aztreonam and Tazobactam/piperacillin**.** Bacterial Sensitivity to major antibiotics are decreasing day by day and complicating empirical selection of antibiotics in the ICU. Our dataindicate an alarming pattern of poor antibiotic-sensitivity ofmajority of ICU isolates to most of broad-spectrum antibiotics. So, strategies must be taken to prevent the emergence of multidrug resistant bacteria in ICU immediately. These include: knowledge of the infection rates and common pathogens and judicious use of older and newer antimicrobial agent according to antibiogram. Our data will help clinicians in choosing appropriate empiric antibiotics to maximize the patient's chances of receiving early and effective therapy.

Study Limitation: Study samples obtained from blind tracheal aspirates often could not distinguish colonization from true infections. Consecutive three days sampling were not done in this study patients. Clinical corelation were not done. As such absence of clinical corelation could not point to colonization.

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