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Isolation of *Acinetobacter* and Antimicrobial Resistance Pattern in an Intensive Care Unit of a Tertiary Care Hospital in Sylhet, Bangladesh

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ABSTRACT

Critically ill patients acquire infections during their stay in an intensive care unit (ICU), and the frequency of these infections varies considerably in different populations and clinical settings. The purpose of this study was to determine the antimicrobial sensitivity patterns of Acinetobacter isolated from tracheal aspirate, blood from central venous catheter, peripheral blood, and central venous line swab of patients admitted to the inpatients department at Sylhet MAG Osmani Medical College Hospital (SOMCH), Sylhet, Bangladesh over a one-year period from July 2016 to June 2017. A total of 60 samples were studied, of which 9 (15%) were Acinetobacter. Acinetobacter isolated from tracheal aspirates was 21.6%, and blood from a central venous catheter was 16.6%. Isolated Acinetobacter were 100% resistant to Amoxycillin, Cefuroxime, Ceftazidime, Cefepime, and Aztreonam, followed by 88.8% resistant to Ciprofloxacin, Ceftriaxone, and Tazobactam and piperacillin. The rate of resistance to Gentamicin, Amikacin, and Imipenem was found to be 77.7%, 77.7%, and 66.66%, respectively. But all the isolated Acinetobacter were 100% sensitive to Colistin. Antibiotic resistance in isolated Acinetobacter from tracheal aspirates and central venous catheter emphasizes the importance of rationale and judicious antibiotic use based on that institution's antibiotic resistance patterns. The findings of this study will help with a better understanding of the resistance patterns of isolated Acinetobacter and can help in managing patients effectively as well as play a role in developing a strategy to reduce the emergence and spread of antimicrobial-resistant pathogens in medical units.

Keywords: *Acinetobacter, Antimicrobial resistance, Intensive care unit.*

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INTRODUCTION

Acinetobacter is a collection of ever-evolving opportunistic infections that affects various group of people, particularly ICU patients. *Acinetobacter* is found as a normal flora in the oropharynx of healthy people and has recently been identified as a major cause of hospital infection[1]. Presently, this organism is considered to be responsible for 9 to 10% of all hospital acquired infection[2]. Rates of nosocomial infections range from 5% to 30% among ICU patients. Although ICUs generally comprise <5% of all hospital beds, they account for 20% to 25% of all nosocomial infections. The increased risk of infection is associated with the severity of the patient's illness, length of exposure to invasive devices and procedures, increased patient contact with healthcare personnel, and length of stay in the ICU[3]. During the last two decades, clinicians in various countries have witnessed a growing number of critically ill patients who suffer from infections due to

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microorganisms that belong to the *Acinetobacter* genus, mainly strains of the species *Acinetobacter baumannii*. The genus *Acinetobacter* is a gram-negative, obligatory aerobic, catalase positive, oxidase negative, non-fermentative, non-motile, encapsulated coccobacilli. They are widely distributed in nature making them ubiquitous in the environment (e.g. soil, water, milk, frozen soups) and in the hospital (e.g. ventilators, humidifiers, catheters). They have minimal nutritional requirements and can survive on a variety of surfaces and aqueous environments[4]. It mostly infects patients with impaired host defense, leading to an increase in mortality and morbidity. It is responsible for a wide range of infections like nosocomial pneumonia, meningitis, endocarditis, skin and soft tissue infections, urinary tract infections, conjunctivitis, burn wound infections, and bacteraemia[5]. It frequently causes severe infections in high-risk populations, such as the elderly, premature children, newborns, operated patients, peritoneal dialysis patients, tracheostomy tube patients, severely burned patients, those with tracheal intubations, mechanical ventilations, intravenous catheters, and those on extended-spectrum antibiotics or immunosuppressives[6]. According to a study conducted at the Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine, and Metabolic Disorders (BIRDEM) Dhaka, the most common isolated organisms from intensive care units were *Pseudomonas* species, *Acinetotebacter* species, *Candida* species, *Escherichia coli*, and *Klebsiella* species[7]. Multidrug resistant *Acinetobacter* isolates are a growing problem and have been widely reported[8]. *Acinetobacter* resistance to the majority of commercially available antimicrobials (Aminoglycosides, Cephalosporins, Quinolones, and Imipenem) poses a significant therapeutic challenge[9]. Based on the increasing reports of *Acinetobacter* species isolated from patients, especially in ICU, and the growth of *Acinetobacter* strains' resistance to new and available antibiotics and the high cost of using antibiotics, recognizing the resistance patterns is necessary in every center. In this situation, choosing the right method of treatment requires knowledge of the periodic pattern of the resistance. In this study, we aimed to examine the antimicrobial sensitivity pattern of *Acinetobacter* isolated from patients admitted in the ICU at Sylhet MAG Osmani Medical College Hospital (SOMCH), Sylhet, Bangladesh over a one-year period from July 2016 to June 2017.

MATERIALS AND METHODS

This descriptive cross-sectional study was carried out in the department of Microbiology in collaboration with the ICU at Sylhet MAG Osmani Medical College Hospital from July 1st, 2016 to June 30th, 2017. A total of 60 ICU samples were enrolled in this study. Samples for culture were taken from blood (From central venous catheter and peripheral blood), tracheal aspirates and CV line swab. Standard microbiological methods were used for the isolation and identification of *Acinetobacter*. The Kirby Bauer's modified disc diffusion test was used to determine the antimicrobial resistance patterns of the isolated *Acinetobacter.*

Isolation and identification of *Acinetobacter*

Suspected colonies of *Acinetobacter* species after inoculation were identified by (a) gram staining *(Acinetobacter* species are short gram negative cocco bacilli, typically 1.0 to 1.5 by 1.5 to 2.5 µm in diameter, but often found in pairs or clusters), (b) colony morphology (On blood agar, it has a smooth, opaque, raised, gray or brownish colony and is smaller than Enterobacteriaceae. Most of them are non-haemolytic, but some genospecies are beta-haemolytic. On Mac Conkey agar, it has a smooth, opaque, smaller, mucoid, non lactose fermenting colony), (c) activity in the motility indole urease test (MIU) (Motility was observed under a microscope. *Acinetobacter* was a non-motile organism), (d) TSI agar test (Red-pink slant and butt indicate no fermentation of glucose or lactose, yellow butt indicates acid production, and a red-pink slope indicates only glucose fermentation, while a yellow slope and butt indicates lactose fermentation. Cracks in the media indicate gas production, blackening along the stab line or through the media indicates hydrogen sulfide production) and (e) biochemical tests like oxidase test (Blue-purple colour-positive reaction, no blue colour- negative reaction. *Acinetobacter* showed a negative reaction in the oxidase test) and the catalase test (Active bubbling-positive catalase test, no bubbling- negative catalase test. *Acinetobacter* showed a positive catalase test). Samples which showed growth in culture were taken into consideration, and the sensitivity pattern of the isolated *Acinetobacter* was tested for antimicrobial susceptibility.

Antimicrobial susceptibility test

All the *Acinetobacter* isolates were tested for antimicrobial susceptibility by the modified Kirby-Bauer disc diffusion technique as described by the Clinical and Laboratory Standards Institute (CLSI, former NCCLS)[10]. Antimicrobial disks used for sensitivity tests were Amoxycillin (10 µg), Gentamicin (15 µg), Amikacin (30 µg), Ciprofloxacin (5 µg),

Cefuroxime (30 µg), Ceftriaxone (30 µg), Ceftazidime (30 µg), Aztreonam (30 µg), Imipenem (10 µg), Cefepime (30 µg), Colistin (10 µg), Tazobactam & piperaicilin(100/10 µg).

RESULTS

Out of 60 samples, 9 (15%) were positive for *Acinetobacter* by culture and microscopy. *Acinetobacter* isolates were predominant in the tracheal aspirate. *Acinetobacter* isolates were resistant to frequently used antibiotics (Amoxycillin, Gentamicin, Ciprofloxacin, Cefuroxime, Ceftriaxone, Ceftazidime, Cefepime). After susceptibility testing, Colistin was found to be a more efficacious drug against *Acinetobacter.*

Table-I: *Acinetobacter isolated from ICU samples, n=60*

Types of samples	Number of samples	Number of isolates	Percentage
Tracheal aspirates	37	8	21.6
Blood CVC	6	1	16.6
Peripheral blood	6	0	0.0
CV line swab	8	0	0.0
IV canula swab	3	0	0.0
Total	60	9	15

Isolated *Acinetobacters* from ICU samples were highly resistant to Amoxycillin, Cefuroxime, Ceftazidime, Cefepime, and Aztreonam (100%), followed by Ciprofloxacin, Ceftriaxone, and Tazobactam and piperacillin (88.8%). A moderate rate of resistance to Gentamicin, Amikacin, and Imipenem was found to be 77.7%, 77.7%, and 66.66%, respectively. But all the isolated *Acinetobacter* (100%) were sensitive to Colistin (Table II).

Table-II: *Showing antimicrobial resistance pattern of isolated Acinetobacter, n=9*

Antibiotic	*Acinetobacter*	
	Sensitive n (%)	Resistant n (%)
Amoxycillin	0	9 (100)
Gentamicin	2 (22.22)	7 (77.7)
Amikacin	2 (22.22)	7 (77.7)
Ciprofloxacin	1 (11.11)	8 (88.8)
Cefuroxime	0	9 (100)
Ceftriaxone	1 (11.11)	8 (88.8)
Ceftazidime	0	9 (100)
Cefepime	0	9 (100)
Colistin	9 (100)	0
Imipenem	3 (33.33)	6 (66.66)
Aztreonam	0	9 (100)
Tazobactam & piperacillin	1 (11.11)	8 (88.8)

DISCUSSION

The severity and extent of disease caused by multidrug resistant pathogens varies by the populations affected and by the health care setting in which they are found. The prevention and control of multidrug resistant organisms should be a national priority[11]. Multi-approach hospitals are used to dealing with patients with various kinds of ailments who are congregated under the same roof and served by the same hospital staff. Critically ill patients in the intensive care unit are at a higher risk of health care associated infection due to multiple causes, including disruption of barriers to infection by endotracheal intubation and tracheostomy, urinary bladder catheterization, and central vascular catheterization[12]. This research work was designed to isolate and identify *Acinetobacter* and to determine the antimicrobial sensitivity pattern of isolated *Acinetobacter.*

In this study, 15% of *Acinetobacter* were isolated from different ICU samples. The findings were consistent with a study by Patwardhan et al.[13], where *Acinetobacter* was reported to be responsible for about 13.2% of nosocomial infections in ICU patients. Nahar et al.[14] found the isolation rate of *Acinetobacter* in ICUs was 33.3%, and in BIRDEM hospital, 27.5% of *Acinetobacter* species were isolated from different ICU samples[7].

In this study, out of 60 ICU samples, *Acinetobacter* was isolated in 9 (15%) of the total identified organisms. Among the isolated *Acinetobacter,* 8 (21.6%) were isolated from tracheal aspirate collected in the ICU, and 1 (16.6%) was isolated from blood taken from the central venous catheter (CVC). But no *Acinetobacter* was isolated from the CV canula swab and peripheral blood. These findings were consistent with the study done by Wankhede et al[5]. In that study, out of 100 samples, 9 *Acinetobacter* were isolated. Among the isolated *Acinetobacter,* 7 (20%) were isolated from endotracheal secretions, 1 (3%) from blood, and 1 (4%) from urine.

In their study, Nahar et al.[14] found that out of 95 ICU samples, *Acinetobacter* species were isolated from 32 (33.7%) samples. The *Acinetobacter* species isolated were 19 (54%) from tracheal aspirates, 4 (36.4%) from blood taken from a central venous catheter, 3 (13.6%) from peripheral blood, 3 (12.5%) from urine, and 3 (100%) from a tracheostomy tube.

Shaikh et al.[15] studied ICU samples and found that the frequency of respiratory tract infection by *Acinetobacter* was 30.1%, blood stream infection was 23.7% and urinary tract infection was 39.1%.

In our study, the majority of the *Acinetobacter* isolated

from different samples showed resistance to more than one group of antibiotics. A study from India revealed 87% isolates were multidrug resistant and 20% were Carbapenem resistant[16]. A study from ICUs in Mazandaran, Northern Iran revealed the resistance rate of *Acinetobacter* to Meropenem was 96% and 76% was resistant to Imipenem. Another study from India, conducted in Uttarakhand hospital, showed that 74% was Carbapenem resistance, which was 66.66% in our study.

In our study, 88.8% resistance was observed to Ceftriaxone, Piperacillin-Tazobactum. These findings are similar to those of Ghasemia et al.[1] who observed 86% resistance to these drugs. In the ICU-based study by Patwardhan et al., the resistance was 96% to these drugs[13]. This indicates that there is more resistance in ICU strains. High levels of resistance were seen in our study for Amoxycillin (100%), Aztreonam (100%), Cefuroxime (100%), Cefepime (100%) and Ceftazidime (100%). Significant levels of resistance were also recorded for Tazobactam and Piperacillin (88.8%), Ceftriaxone (88.8%), Ciprofloxacin (88.8%), Gentamicin (77.7%) and Amikacin (77.7%). In a study conducted in our country, Nahar et al. reported resistance rates of 81%, 85%, 98%, 96%, 100%, and 82% for Imipenem, Amikacin, Piperacillin-Tazobactam, Ceftriaxone, Gentamicin and Ciprofloxacin respectively[13]. Another study in BIRDEM hospital showed that, *Acinetobacter* species were 100% resistant to Piperacillin. Higher resistance was seen for Ceftriaxone (98.2%), Gentamicin (93.2%), Aztreonam (91.6%), Amikacin (81.4%), and Imipenem (72.4%)[17].

Colistin sensitivity was 100% in ICU samples in our study. These findings were consistent with the studies done by Dimple et al.[18], Nahar et al.[13] and Ghasemian et al[1]. Because *Acinetobacter* susceptibilities to various antimicrobials varied significantly between nations, centers, and even different wards within the same hospital, local surveillance studies are critical in determining the most appropriate treatment for *Acinetobacter* infections[19].

CONCLUSION

Acinetobacter is now a common threat in hospital acquired infections, especially in critically ill patients admitted to intensive care units. *Acinetobacter* was found to be resistant to the most commonly used antibiotics. Only lower resistance was seen in colistin. Treating multidrug-resistant *Acinetobacter* species is a significant challenge for physicians. So, nationwide antibiotic policies and guidelines are necessary due to increasing resistance patterns. Producing a local antibiogram will improve the knowledge of antimicrobial resistance patterns in the Sylhet region in Bangladesh and will also help to improve treatment strategies. So, these results may change the attitude of physicians using antibiotics and encourage them to follow antibiotic policy as an effective strategy to control antibiotic resistance.

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