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Original Article

Isolation of *Acinetobacter* species and their antimicrobial resistance pattern in an Intensive care unit (ICU) of a tertiary care hospital in Dhaka, Bangladesh

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Abstract

Critically ill patients acquire an infection 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 know the antimicrobial sensitivity pattern of *Acinetobacter* isolates from tracheal aspirate, blood from central venous catheter, peripheral blood, urine and endotracheal tube of patients admitted in ICU at BSMMU(Bangabandhu Sheikh Mujib Medical University) hospital, Dhaka, Bangladesh over a one year period from January 2010 to December 2010. A total 95 ICU samples were studied of which 32(33.7%) were Acinetobacter species. Acinetobacter species isolated from endotracheal tube (100%), tracheal aspirate (54.3%), blood from central venous catheter (36.4%), peripheral blood (13.6%), and urine (12.5%). Acinetobacter isolates were 100% resistant to amoxicillin, ceftriaxone cefuroxime and gentamicin. Higher level of resistance was recorded for amikacin (68.4%) and imipenem (66.7%). Lower resistance only showed in colistin (10.5%). The findings of this study will help our clinician to apply antibiotics for treatment of the patients admitted in ICU. Producing a local antibiogram database will improve the knowledge of antimicrobial resistance patterns in Bangladesh and will also help to improve treatment strategies.

Key words: *Acinetobacter,* intensive care unit, antimicrobial sensitivity pattern.

Introduction

Critically ill patients acquire an infection during their stay in an intensive care unit (ICU) and the frequency of these infections varies considerably in different populations and clinical settings[1-3]. Patients in the ICU have encountered an increasing emergence and spread of antibiotic- resistant pathogens. 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 patient's illness, length of exposure to invasive devices and procedures, increased patient contact with healthcare personnel and length of stay in the ICU [4].

During the last two decades clinicians in various countries have witnessed a growing number of critically ill patients who suffer from infections due to microorganisms that belong to the *Acinetobacter* genus, mainly strains of the species *Acinetobacter baumannii. Acinetobacter* are a group of non-fermentative Gram-negative bacteria that have minimal nutritional requirements and can survive on a variety of surfaces and aqueous environments[3,5]. Apart from ICU patients it has been shown to be a cause of nosocomial pneumonia, meningitis, endocarditis, skin and soft tissue infections, urinary tract infections, conjunctivitis, burn wound infections and bacteraemia[6]. Outbreaks of Acinetobacter infections are linked to contaminated respiratory equipment, intravascular access devices, bedding materials and transmission via hands of hospital personnel[7]. An ICU study from BIRDEM(Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorder) hospital, Dhaka showed that major isolated organisms were *Pseudomonas sp, Acinetobacter sp, Candida sp, Escherichia coli, Klebsiella sp*[8]. An Indian ICU study showed that, most common organisms were *Acinetobacter, Escherichia coli, Klebsiella, Pseudomonas, Staphylococcus, Streptococcus*[9]. Multidrug resistance of

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Acinetobacter isolates is a growing problem and has been widely reported[10]. Resistance in Acinetobacter to majority of commercially available antimicrobials (aminoglycosides, cephalosporins, quinolones and imipenem) raises an important therapeutic problem[11,12].

In ICU, monitoring of bacterial etiologies and infection patterns prevent development of drug resistance. Knowledge of sensitivity pattern of the organism isolated in the ICU is helpful in selecting empirical therapy. There are few data about *Acinetobacter* isolation and their antibiotic susceptibility pattern from ICU samples of our country. Therefore, the purpose of this study was to examine the antimicrobial sensitivity pattern of *Acinetobacter* isolates from tracheal aspirate, blood from central venous catheter, peripheral blood, urine and endotracheal tube of patients admitted in ICU at BSMMU (Bangabandhu Sheikh Mujib Medical University) hospital, Dhaka, Bangladesh over a one year period from January 2010 to December 2010.

Material and methods

Clinical samples were collected from patients admitted in Intensive Care Unit (ICU) of Bangabandhu Sheikh Mujib Medical University (BSMMU). Samples were tracheal aspirates, blood from central venous catheter, peripheral blood, endotracheal tubes and urine collected from patients having catheter. Laboratory works were performed in the department of Microbiology & Immunology, Bangabandhu Sheikh Mujib Medical University (BSMMU) Dhaka between a period of January 2010 to December 2010.

Isolation and identification of Acinetobacter

Typical colonies were enumerated, selected and examined further. Acinetobacter was identified by Gram staining, motility, oxidase, catalase, citrate utilization, indole and urease tests, glucose oxidation in Krigler Iron Agar (KIA) media and biochemical tests in oxidation and fermentation media (OF media). These identification scheme were done as per standard technique[13,14].

Antimicrobial susceptibility tests

All the Acinetobacter isolates were tested for antimicrobial susceptibility testing by disc diffusion method using the Kirby-Bauer technique[15] and as per recommendations of the National Committee for Clinical laboratory Standards (NCCLS)[16]. Antimicrobial disks used for sensitivity tests were amoxicillin(10mg), gentamicin(10mg), ceftriaxone(30mg), cefuroxime(30mg), amikacin(30mg), imipenem(10mg) and colistin(10mg).

Rusults

A total 95 ICU samples were studied which included tracheal aspirates (35), blood from central venous catheter (11), peripheral blood (22), urine (24), endotracheal tube (3). Out of 95 samples, 32(33.7%) *Acinetobacter* species were isolated. *Acinetobacter* species isolated from endotracheal tube 3 (100%), tracheal aspirate 19 (54.3%), blood from central venous catheter 4 (36.4%), peripheral blood 3 (13.6%), and urine 3(12.5%) (Table I).

Table I: *Acinetobacter* species isolated from different samples

Samples	Total number	Positive for Acinetobacter species N (%)
Tracheal aspirate	35	19 (54.3%)
Blood from central venous catheter	11	4 (36.4%)
Peripheral blood	22	3 (13.6%)
Urine	24	3 (12.5%)
Endotracheal tube	3	3 (100%)
Total	95	32 (33.7%)

Acinetobacter isolates were 100% resistant to amoxicillin, ceftriaxone, cefuroxime and gentamicin. Higher level of resistance was recorded for amikacin (68.4%) and imipenem (66.7%). Colistin showed lower resistance (10.5%) in Acinetobacter isolates (Table II).

Table II: Antibiotic resistance pattern of *Acinetobacter* species isolated from different site of infection

Name of drugs	Name of Different samples				
	Tracheal aspirates	Blood from central venous catheter	Peripheral blood	Urine	Endotracheal tube
Amoxycillin	100%	100%	100%	100%	100%
Cefuroxime	100%	100%	100%	100%	100%
Ceftriaxone	100%	100%	100%	100%	100%
Gentamicin	95.0%			100%	100%
Amikacin	68.4%			33.3%	66.7%
Imipenem	63.1%	50%	33.3%	0.0%	66.7%
Colistin	10.5%	0.0%	0.0%	0.0%	0.0%

Discussion

The severity and extent of disease caused by multidrug-resistant pathogens varies by the populations affected and by the institutions in which they are found, but the prevention and control of multidrug resistant organisms should be a national priority[17]. Critically ill patients in intensive care unit are at a higher risk of nosocomial infection due to multiple

causes including disruption of barriers to infection by endotracheal intubation and tracheostomy, urinary bladder catheterization and central venous catheterization[18]. This study included antibiotic susceptibility pattern of Acinetobacter species isolated from different samples from ICU patients but the source of infection and underlying disease condition of the patients were not included.

In this study, 33.7% *Acinetobacter* species were isolated from different ICU samples. In BIRDEM hospital, 27.5% Acinetobacter species were isolated from ICU samples[8]. In India, Acinetobacter is reported for about 13.2 % of nosocomial infections in ICU patients[9]. High isolation rates of *Acinetobacter* species of about 100% from endotracheal tube, followed by 54.3% from tracheal isolates, 36.4% from central venous catheter blood, 13.6% from peripheral blood and 12.5% from urine. *Acinetobacter* is commonly isolated from skin and throat of healthy people[19]. The respiratory tract is an important site of colonization and is the most frequent site of infection. *Acinetobacter* colonization has been reported from the nares, nasopharynx, and tracheostomy sites. Rates of colonization increase during ICU stays[20-22]. In BIRDEM hospital, *Acinetobacter* species were isolated from blood(18.4%), urine(4.7%) and respiratory secretions(40.9%). In India, a study reported that, the high isolation rate of Acinetobacter species of about 24% were from tracheal aspirates, 12% from endotracheal tube, and 6% from blood[23].

This study showed, *Acinetobacter* species were 100% resistant to amoxicillin, cefuroxime, ceftriaxone and gentamicin. High level of resistance was recorded for amikacin (68.4%), imipenem (66.7%) and maximum activity with an overall low resistance showed in colistin (10.5%). BIRDEM hospital showed that, *Acinetobacter* species were 100% resistant to pipercillin, higher resistance was seen for ceftriaxone(98.2%), gentamicin(93.2%), aztreonam(91.6%), amikacin(81.4%) and imipenem(72.4%)[8]. Susceptibilities of *Acinetobacter* against various antimicrobials are considerably different among countries, centers and even among different wards of the same hospital, therefore, such type of local surveillance studies are around important in deciding the most adequate therapy for *Acinetobacter* infections [24].

In conclusion, *Acinetobacter* is now a day a common threat in hospital acquired infection especially in critically ill patients admitted to intensive care unit. *Acinetobacter* species were found to be resistant to most commonly used antibiotics. Only lower resistance was seen in colistin. However colistin resistant *Acinetobacter* species are emerging slowly. It is a great challenge for the physician to treat multidrug resistant *Acinetobacter* species. So, nationwide antibiotic policy and guidelines is necessary due to increase resistance patterns. Producing a local antibiogram database will improve the knowledge of antimicrobial resistance patterns in Bangladesh and will also help to improve treatment strategies.

References:

1. Alberti C. *et al*. Epidemiology of sepsis and infection in ICU patients from an international multicenter cohort study. Intensive Care Medicine. 2002;28:108-121.

2. Trilla A. Epidemiology of nosocomial infections in adult intensive care units. Intensive Care Medicine. 1994;20:1-4.

3. Fournier PE, Richet H. The epidemiology and control of Acinetobacter baumannii in health care facilities.Clinical Infectious Diseases. 2006;42:692-699.

4. Fridkin SK. Increasing prevalence of antimicrobial resistance in intensive care units. Crit Care Med 2001; 29: 64-68.

5. Warskow AL, Juni E. Nutritional requirements of Acinetobacter strains isolated from soil, water, and sewage.Journal of Bacteriology. 1972;112:1014-1016.

6. Bergogne-Berezin E, Towner KJ. *Acinetobacter* spp. as nosocomial pathogens: microbiological, clinical and epidemiological features. Clin Microbiol Rev 1996; 9:148 65.

7. Wisplinghoff H, Edmond MB, Pfaller MA, Jones RN, Wenzel RP, Selfert H. Nosocomial blood stream infections caused by *Acinetobacter* species in United States hospitals: Clinical features, molecular epidemiology and antimicrobial susceptibility. Clin Infect Dis 2000; 3 : 690-7.

8. Barai L, Fatema K, Haq A, Faruq MO, Ahsan ASM A, Morshed Md. AH, hossain B Md. Bacterial profile and their antimicrobial resistance pattern in an Intensive Care unit of a tertiary care hospital in Dhaka. Ibrahim med. Coll. J. 2010; 4(2): 66-69.

9. Patwardhan RB, Dhakephalkar PK, Niphadkar KB, Chopade BA. A study on nosocomial pathogens in ICU with special reference to multiresistant Acinetobacter baumannii harbouring multiple plasmids. Indian J Med Res 2008; 128: 178-187.

10. Matthew EF, Patra KK, Ioannis AB. The diversity of definitions of multidrug resistant (MDR) and pandrug resistant (PDR) *Acinetobacter baumannii* and *Pseudomonas aeruginosa.* J Med Microbiol 2006; 55 : 1619-29.

11. Smolyakov R, Borer A, Riesenberg K, Schlaeffer F, Alkan M, Porath A, et al. Nosocomial multidrug resistant *Acinetobacter baumannii* bloodstream infection: risk factors and outcome with ampicillin-sulbactam treatment. J Hosp Infect 2004; 56 : 165-6.

12. Towner KJ. Clinical importance and antibiotic resistance of *Acinetobacter* spp. Proceedings of a symposium held on 4-5 November 1996 at Eilat. Israel J Med Microbiol. 1997; 46 : 721-46.

13. Forbes BA, Sham DF, Weissfeld AS. Bailey and Scott's diagnostic Microbiology, 10th Edition. Mosby, New York, 1998; 167-87.

14. Collee JG, Miles RS, Watt B. Tests for the identification of bacteria. Mackie and McCartney Practical Medical Microbiology, EDs: Collee, Marmion, Fraser, Simmons , 14th Edition. Churchill Livingstone, NY, 1996;131-149.

15. Bauer AW, Kirby WMM, Sherris JC, Turek M. Antibiotic sensitivity testing by a standardized single disk method. American Journal of Clinical Pathology 1966; 45:493-496.

16. National Committee for Clinical Laboratory Standards. (2001) Performance standards for Antimicrobial Susceptibility Tests. Eleventh informational supplement. NCCLS document M100-S11 NCCLS. Wayne, Pennsylvania, USA.

17. Chopra I, Schofield C, Everett M, O'Neill A, Miller K, Wilcox M, et al. Treatment of health-care-associated infections caused by gram negative bacteria: A consensus statement. Lancet Infect Dis 2008:8:133-9.

18. Shannon SC, Chronic critical illness. In Jesse BH, Gregory AS, Lawrence DH, eds. Principles of Critical Care. 3rd ED, McGraw Hill, 2005;p.207-15.

19. Mulvey MR, Simor AE. Antimicrobial resistance in hospitals: How concerned should we be? Canadian Med Assoc J 2009; 180:408-415.

20. Glew RH, Moellering RC, Jr, Kunz LJ. Infections with Acinetobacter calcoaceticus: Clinical and laboratory studies. Medicine. 1977;56:79-797.

21. Ayats J, Corbella X, Ardanuy C. Epidemiological significance of cutaneous, pharyngeal, and digestive tract colonization by multiresistant Acinetobacter baumannii in ICU patients. J Hosp Infect. 1997; 37: 287-295.

22. Peacock JE, Jr, Sorrell L, Sottile FD, Price LE, Rutala WA. Nosocomial respiratory tract colonization and infection with aminoglycoside-resistant Acinetobacter calcoaceticus var anitratus: epidemiologic characteristics and clinical significance. Infect Control Hosp Epidemiol. 1998; 9: 302-308.

23. Dheepa M, Vinitha L, Appalaraju B. Comparision of biofilm production and multiple drug resistance in clinical isolates of Acinetobacter baumannii from a tertiary care hospital in South India. Int J Pharm Biomed Sci. 2011: 2(4); 103-107.

24. Josh SG, Litake GM, Satpute MG. Clinical and demographic features of infection caused by Acinetobacter species. Ind J Med Sci 2006; 60:351-60.