Prevalence and Resistance Profile of Acinetobacter baumannii Isolated from Clinical Specimens at a Tertiary Care Hospital in Bangladesh

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Abstract

Background: *Acinetobacter baumannii* is one of the significant pathogens to cause healthcare-associated infections worldwide. It is difficult to control and the infections caused by it are difficult to treat, because it is multidrug resistant. **Objective:** This study was conducted to determine the prevalence and antimicrobial resistance pattern of Acinetobacter baumannii at Dhaka Medical College Hospital, Dhaka, Bangladesh over a 12 months period. **Methodology:** This retrospective study was carried out over a period of one year from July 2014 to June 2015 in the department of Microbiology at Dhaka Medical College Hospital, Dhaka, Bangladesh. Antimicrobial susceptibility testing of the isolates was performed by the disk diffusion method as recommended by Clinical Laboratory and Standards Institute CLSI. **Results:** Non duplicate 28 *A. baumannii* were isolated out of a total 191 pathogenic Gram negative isolates (14.66% prevalence). The most frequently isolated *A. baumannii* was from ICU patients (75%) followed by inpatients (18%) and outpatients (7%). Most of the isolates were recovered from tracheal aspirates (75%). The resistance rates were higher than most of the internationally reported levels. Cephalosporins, aminoglycosides, fluoroquinolones and even carbapenems are becoming practically ineffective, where the colistin elicited the highest susceptibility levels. **Conclusion:** This study has guided the empirical therapy and suggest that surveillance of antimicrobial resistance of Acinetobacter baumannii is necessary. *[Journal of National Institute of Neurosciences Bangladesh, July 2021;7(2):177-180]*

Keywords: Acinetobacter baumannii; antibiogram; antimicrobial resistance

Introduction

Acinetobacter baumannii is a Gram negative, ubiquitous, aerobic and coccobacillus that causing nosocomial infections which includes pneumonia, wound infections, urinary infections and septicemia. It is frequently involved in outbreaking infection. These bacteria have a high tendency to acquire resistance against different classes of antibiotics[1]. *Acinetobacter baumannii* is one of the important pathogens to cause healthcare-associated infections (HAI) worldwide, and which mainly infects critically ill and immunosuppressive patients admitted in intensive care unit[2]. Antimicrobial resistance among Acinetobacter baumannii isolates cause difficulty in treatment as well as increase treatment cost[3].

Acinetobacter baumannii has multidrug resistant phenotypes. Resistance to broad spectrum β-lactams,

carbapenems, aminoglycosides and fluroquinolones are frequently seen in this bacteria which causing complicate the treatment of this pathogen. In the last decade, *Acinetobacter baumannii* became more prevalent as an opportunistic pathogen, especially as a multidrug resistant agent (MDR) using different mechanisms of drug resistance. The emergence of extensively drug resistant *Acinetobacter baumannii* (XDRAB) complicates the treatment options which causing a serious threat to hospital acquired infections (HAI) control[4].

Due to increasing the numbers of *Acinetobacter baumannii* infections and lacking of newer classes of antibiotics to treat the infections, few studies are focused to assess the in vitro combination activity of different types of currently used antibiotics against carbapenem-resistant *Acinetobacter baumannii* such as carbapenem/sulbactam combination and colistin/rifampicin combination. Few reports showed that the in vitro combinations of antibiotics such as imipenem/sulbactam and colistin/tigecycline showed significant efficacy against carbapenem resistant *Acinetobacter baumannii*[5].

In this literature, some terms have been used to describe the resistance pattern of *A. baumannii* to antibiotics like Multidrug Resistant *Acinetobacter baumannii* (MDR-AB) is used to describe the isolates which are resistant to at least three classes of antibiotics including Penicillins, cephalosporins, fluroquinolones and aminoglycosides. Another term Extreme Drug Resistant (XDR) is used when the isolates are resistant to the three above mentioned families plus carbapenems. Finally the term Pandrug-Resistant (PDR) which is used to describe the *Acinetobacter baumannii* which are (XDR) with resistance to polymyxins[6].

The susceptibility pattern of *Acinetobacter baumannii* to antimicrobials is shown different among countries, among centers and even among the wards of a given hospital. These differences showing different patterns of antibiotics usage and different epidemiological situations which includes antimicrobial control measures and policies[7]. The growing number of healthcare associated infection and rapid increase in antimicrobial resistant isolates have prompted us to analyses the antimicrobial resistance profile of *Acinetobacter baumannii* isolated from different clinical samples in patients during one year at a tertiary care centre.

This retrospective study was conducted to determine the prevalence and antimicrobial resistance pattern of *Acinetobacter baumannii* at Dhaka Medical College Hospital, Dhaka, Bangladesh over a 12 months period.

Methodology

This retrospective study was carried out over a period of one year from July 2014 to June 2015 in the department of Microbiology, Dhaka Medical College Hospital, Dhaka, Bangladesh. Two hundred and seventy samples were collected. Among them, 191 were isolated as Gram negative organisms. Twenty eight were *Acinetobacter baumannii* among those one hundred and ninety one Gram negative isolates. The *Acinetobacter baumannii* strains were cultured from Tracheal aspirate (21 or 75%), Blood (3 or 10.7%), pus (3 or 10.7%) and Urine (1 or 3.6%). The samples were collected and processed during the course of routine diagnostic work up from patients in the ICU, wards and outpatient departments of the hospital. The specimens received in the laboratory were inoculated on 5% Blood agar and MacConkey Agar and incubated overnight aerobically at 37ºC. Blood specimens were inoculated on tryptone soya broth and then sub cultured on Chocolate agar and MacConkey agar. *Acinetobacter baumannii* isolates were initially identified by colonial morphology, Gram staining, growth at 37 , a negative oxidase test and oxidation of glucose. Antimicrobial susceptibility was done by disc diffusion method as per the (CLSI) guideline[8], using Mueller- Hinton agar and antimicrobial discs. The diameter of inhibition zone was measured and data were reported as susceptible and resistant. Quality control of the disks was checked by using reference strains.

Results

During this study period the total number of pathogenic Gram negative isolates, was 191, of which 28 were *Acinetobacter baumannii* (14.66%). The majority of *Acinetobacter baumannii* was isolated from tracheal aspirate 75% followed by blood 10.7%, pus 10.7% and urine 3.6% (Table 1).

Table 1: The Numbers and prevalence of *Acinetobacter baumannii* clinical isolates from various clinical samples

Sample	Frequency	Percent
Tracheal aspirate	21	75.0
Blood	3	10.7
Pus	3	10.7
Urine	1	3.6

Of the 28 *Acinetobacter baumannii* isolates, 21 were isolated from ICU patients (75%), while 5 (18%) were from inpatients and 2 (7%) from outpatients department (Figure I).
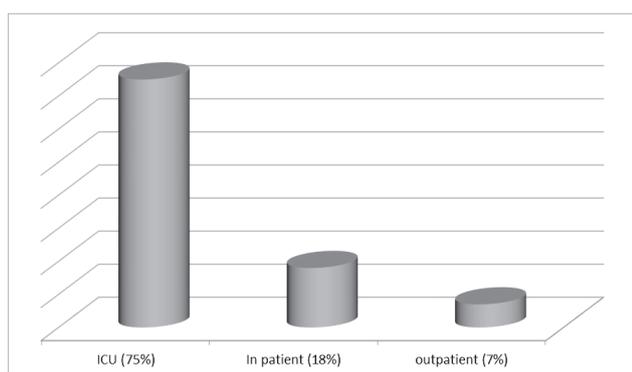
Figure I: Prevalence of the *A. baumannii* among ICU, in patient and out patients at DMCH

In this study most of *Acinetobacter baumannii* isolates were highly resistant to the different antibiotics. Among the isolated *Acinetobacter baumannii,* 85.71% were resistant to imipenem, 82.14% to meropenem, 92.86% to ceftriaxone, cefotaxime, cefepime, amoxiclav, amikacin, and gentamicin, 96.43% to ceftazidime and ciprofloxacin, 14.28% to tigecycline and 7.14% to colistin (Figure II).
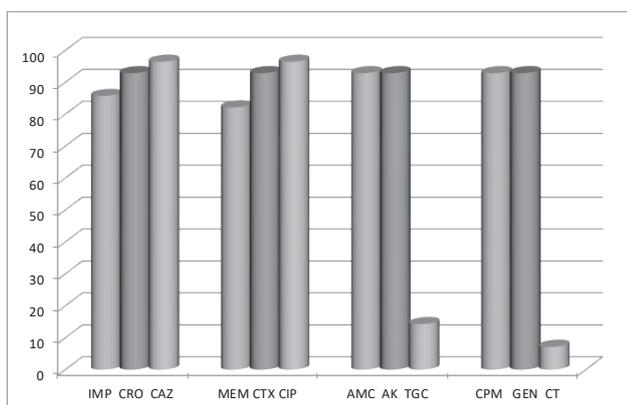

Figure II: Resistance pattern of *A. baumannii* isolates against different antibacterial agent (Imp= Imipenem, CRO= Ceftriaxone, CAZ= Ceftazidime, MEM=Meropenem; CTX= Cefotaxime, CIP= Ciprofloxacin, AMC= Amoxyclav, Ak= Amikacin; TGC= Tigecycline, CPM= Cefepime, GEN= Gentamicin, CT= Colistin)

Discussion

Acinetobacter baumannii is an opportunistic pathogen which is associated with various types of diseases which includes hospital acquired pneumonia, bacterial meningitis, burn wound infections, skin and soft tissue infections, urinary tract infections and bacteremia[9]. *A. baumannii* can survive in the environment for a long time such as in tape water, normal saline and distilled water[10].

Over the last few years, *Acinetobacter baumannii* has gained importance as one of the important cause of hospital acquired infection. It occurs partly due to its tremendous genetic capabilities to acquire resistance and partly due to high selective pressure[11]. Though it is a low virulence organism but it is going to be turned into a multidrug-resistant organism. *Acinetobacter baumannii* contributes about 80% off all Acinetobacter hospital acquired infection[11].

Infections which are caused by Acinetobacter species are associated adverse clinical outcomes. This bacteria also causes high rates of morbidity and mortality, increases duration of hospital stay and increase health care expenses. During the last few years, increasingly resistant strains of *Acinetobacter baumannii* have emerged, causing necessity of broad spectrum antibiotics, such as imipenem and ampicillin-sulbactam. Those resistant *Acinetobacter baumannii* strains are susceptible only to colistin and tigecycline[12]. In this study most of the *Acinetobacter baumannii* isolates are resistant to multiple antibiotics and sensitive to mainly colistin and tigecycline.

In this study, The prevalence of *Acinetobacter baumannii* in DMCH, Bangladesh was about 14% which is bit higher to those from developing countries like India where the rate were 9.5%[13], 9.4%[14] and 11%[15] respectively. In Japan the prevalence rate was 18%[16], in Kuwait 22.1[17] and in Saudi Arabia 31.7[18] which are higher than that in the current study.

In the present study, the highest number of isolates was obtained from ICU; *Acinetobacter baumannii* was mostly found in trachea samples. Almost similar results were observed in a study by Sana Islahi in India[19]. Most of the strains were highly resistant to the antibiotics. Therefore, treatment of these infections are difficult and complicated[20].

In this study the *Acinetobacter baumannii* was mostly isolated from ICU patients (75.0%) followed by inpatient (18.0%) and outpatient (7.0%). This is in agreement with most of the global studies that reported the predominance of *Acinetobacter baumannii* isolated from ICU patients[21-23]. They concluded that Acinetobacter baumannii is the ICU superbug.

The resistance profile of the *Acinetobacter baumannii* isolates at (DMCH) hospital showed that 96% were MDR which resistant to three groups of antibiotics include cephalosporins, aminoglycosides and fluoroquinolones; 85.0% were XDR. This must be considered as high resistance rate when compared to two other studies in one of which MDR were 82.4% of this isolates and XDR 65.0%[24] and in the other MDR were

72.0% and XDR 58.0%[25]. Currently Colistin is the most sensitive antibiotic against *Acinetobacter baumannii* with a sensitivity of 96.07% which is almost same with various other studies[26]. In this study, *Acinetobacter baumannii* showed resistance to multiple antibiotics, including higher resistance to carbapenems which is very alarming! Unfortunately, new and effective antibiotics are currently still not available, so a productive effort by our government, industry and institutions is required to handle the situation[27]. The etiology behind the emergence of drug-resistant bacteria can have multiple causes including selective pressure from the widespread use of antibiotic agents, so adequate application of infection control measures are required, and particularly hand hygiene as well as better antibiotic stewardship in order to slow the development of resistance and to decrease high resistance rates[27].

Conclusion

In this study, we concluded that *Acinetobacter baumannii* is highly resistant to a majority group of antibiotics, including carbapenems. Most isolates are however sensitive to colistin. Tigecycline is the other choice of drug. So, if *Acinetobacter baumannii* bacteremia is suspected, empiric therapy with these drugs can be used.

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