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Study of Antibiotic Resistance of *Acinetobacter baumannii* in Intensive Care Units (I.C.Us) and Burn Patients

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Abstract: The genus *Acinetobacter* is a major cause of nosocomial infections; it is increasingly being associated with various epidemics and has become a widespread concern in a variety of hospitals worldwide. Multi-antibiotic resistant *Acinetobacter baumannii*, is now recognized to be of great clinical significance. Numerous reports relay to the spread of *A. baumannii* in the hospital settings which leads to enhanced nosocomial outbreaks associated with high death rates. However, many other *Acinetobacter* spp. also can cause nosocomial infections. This study focused on the role of *Acinetobacter* spp. as nosocomial pathogens in addition to their persistence, antimicrobial resistance patterns and epidemiology.

Keywords: *Acinetobacter baumannii*, Nosocomial Infection.

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Introduction:

Nosocomial infections have become increasingly a major health concern in many hospitals worldwide(1,2). Nosocomial infections account for about 1.4 million infections every year (3). *Acinetobacter* infections have frequently been reported as a major of nosocomial infections (1,4,5). *Acinetobacter* species, ubiquitous gram-negative coccobacilli, are widespread in nature, water and soil (5, 6). More than 20 species of *Acinetobacter* have been characterized but only few species including *Acinetobacter baumannii*, A. *calcoaceticus* and *A. lwoffii* play a significant role in nosocomial infections (6). However, *Acinetobacter baumannii* has the greatest clinical significance and identified as the causative agent of the majority of nosocomial infections especially in intensive care units (ICUs) (6–8). *Acinetobacter baumannii* can cause a wide range of infections including bacteremia, meningitis, urinary tract, bloodstream or surgical wound infections and ventilator associated pneumonia (5, 6). However, the emergence of antibiotics-resistant *A. baumannii* especially, multiresistant strains seriously challenges the treatment of these infections (9). This is of special concern in developing countries, since antibiotic prescription rates and intake without prescription is markedly higher (9). Antibiotic resistance causing increased morbidity, mortality, and economic impacts on health services (2). Vulnerable groups of inpatients such as people with impaired host defenses are especially at high risk (4,10). *Acinetobacter baumannii* has the ability to survive for long periods and could easily spread in hospital environments (5). These traits could define its propensity for causing extended outbreaks (5,6). *Acinetobacter baumannii* is mainly transmitted by direct contact with infected persons or

indirect contact with contaminated environments. However, airborne route also plays an important role in transmission of *A. baumannii* infections in hospitals (2,11). Although, airborne transmission was considered as a route for acquisition of *A. baumannii* infections; there are very few studies in the field (11–14).

Prevention and control of hospital infections require knowledge about the sources and reservoirs of nosocomial infection agents (5). In other words, identification of *A. baumannii* sources in hospital environments improves the knowledge of potential routes of *A. baumannii* transmission. Such information would also allow implementing more appropriate control policies against the spreading of *A. baumannii* infections. Based on these premises, the present study was carried out in order to 1) determine the occurrence of *A. baumannii* in air, water and inanimate surface samples in different wards of four educational hospitals 2) evaluate the antibiotic resistance of isolated *A. baumannii*.

Materials and Methods:

A total of twenty clinic isolates of *A. baumannii* were collected during April 2017 to September 2018 from patients admitted hospitals. This isolates obtained from wounds burn were identified using biochemical tests such as oxidase test, and TSI medium and Kit API 20 E to verify the *A. baumannii* strains that are grown at 44°C.

Antibiotic Susceptibility Test:

Disc Diffusion method:

Kirby-Bauer method to carry the antibiotic susceptibility test for many different antibiotics. Bacterial suspension was prepared 20 clinical and environmental by picked 4-5 colonies of each bacterial isolate from original culture and was suspended into a test tube containing 4 ml of normal saline, then turbidity was adjusted to obtain approximately 1.5 x10^8 CFU/ml.

By a sterile cotton swab a portion of bacterial suspension was transferred carefully and evenly spread on Mueller - Hinton agar medium, and then it was left for 10 min.

Thereafter the antimicrobial discs were placed on the agar with a sterile forceps pressed firmly to ensure contact with the agar. Later the plates were inverted and incubated at 37˚C for 24 hr. Inhibition zones that developed around the discs were measured by millimeter (mm) unit by using a metric ruler according to Clinical Laboratories Standards Institute (15). The isolate was interpreted as susceptible, intermediate, or resistant to particular antibiotic according to (15). *Acinetobacter Spp.* were used as a quality in susceptibility determination as susceptible isolates.

Results and Discussion:

The finding in the Table (1) clarified the susceptibility of *A. baumannii* to 16 antibiotics by using Kirby – Bauer disk diffusion method, growth on Mueller-Hinton agar (MHA) showed the *A. baumannii* had high resistance to many antibiotics to: Ceftazidime, Amoxillin, Carbencillin, Ertapime, cefepime, Meropenem, cefoxitin, Azetronam, Tobramycin, Oxacillin and Cefotaxime (100%, 85 % ,90 %, 80 %, 75%, 90 %, 90 % 80 %, 70 %, 80 % and 80) respectively, while other isolates revealed moderate resistance to some antibiotics such as:

Tetracycline (55%) and Ciprofloxacin (40 %).

The current study indicated that *A. baumannii* possessed a low-level resistance against Doxycycline and Imipenem (10 % and 5 %) respectively in addition the isolates showed no any resistance to colistin. The result were interpreted according to the diameter of inhibition zones of bacterial growth around the disc of antibiotic and compared with inhibition zones determined by (16).

Many local study conducted in this field and found high resistance of *A.baumannii* isolated to wide spectrum of antibiotics and that support present result as study of (17) which was found that the clinically.

Table (1): Percentages of antimicrobial susceptibility rate of *A. baumannii* (20) isolates against 16 antimicrobial agents.

Antibiotic	Resistant	Intermediate	Sensitive
PY	18 (90%)	1 (5 %)	1 (5 %)
AMC	17 (85%)	0 (0%)	3 (15 %)
FEP	15 (75 %)	2 (10 %)	3 (15 %)
MEM	18 (90 %)	1 (5%)	1 (5%)
CAZ	20 (100 %)	0 (0 %)	0 (0 %)
CTX	16 (80 %)	3 (15 %)	1 (5 %)
CIP	8 (40%)	1(5 %)	11 (55%)
FOX	18 (90%)	1 (5 %)	1 (5 %)
TE	11 (55 %)	0 (0%)	9 (45%)
DO	2 (10%)	3 (15 %)	15(75 %)
ATM	16 (80%)	2 (10 %)	2 (10 %)
ETP	16 (80 %)	1 (5%)	3 (15%)
OX	16 (80 %)	2 (10 %)	2 (10%)
IMP	1 (5 %)	1 (5 %)	18 (90 %)
TOB	14 (70%)	2 (10 %)	4(20 %)
CT	0 (0 %)	0 (0 %)	20 (100%)

*** Ceftazidime (CAZ), Amoxi-clav (AMC), Carbencillin (PY), Ertapime (ETP), cefepime (FEP), cefoxitin (FOX), Tobramycin (TOB), Doxycycline (DO), Imipenem (IPM), Meropenem (MEM), Cefotaxime (CTX), Ciprofloxacin (CIP), Tetracycline (TE), Aztreonam (ATM), Oxacillin (OX) and Colistin (CT).**

Many local study conducted in this field and found high resistance of *A.baumannii* isolated to wide spectrum of antibiotics and that support present result as study of (17) which was found that the clinically.

Identified *A. baumannii* isolates were moderate resistant to Imipenem and Meropenem (58.26 %), Moreover, she found that the highest resistance was to most antibiotics used especially cephalosporins, and they were 100% resistant to Amoxicillin-clavulanic acid, Cefepime and Cefotaxime. Also (18) showed that clinical isolates of *A.baumannii* were high resistant to aztreonam, ceftriaxone and ceftazidime elsewhere meropenem. The study done by (19) revealed that, the isolates of *A.baumannii* appeared highest resistance to cefotaxime, ceftazidime, ceftriaxone and cefepime, and low resistance to imepenem.

The study by (20) in Jordnian hospitals showed that the result of susptiblity of *A.baumannii* indicated high rate resistance to most antibiotics.

Other study by (21) reported that all of *A. baumannii* isolates gained by researcher were seemed high resistance

to Nitrofurantion, Amoxillin, Carbencillin, ceftazidime, cefepime and aztreonam, but low and no resistance to carbapenems and colistin respectively.

The differences of susceptibility patterns may be due to the type of patients recruited for the study, and difference in geographical regions, as this study was conducted in different hospitals in AL-Najaf AL-Ashraf Governorate. Likewise current results showed that, resistance to Doxycycline and Imipenem were low compared with other antimicrobial agents, and no resistance to colistin, which should be used for treatment of *A. baumannii* as first choise.

New drugs are required to be replaced for the treatment of MDR *A. baumannii*, however many studies reported that the effective antibiotic used to treat the imipenem- resistant *A. baumannii* isolate was colistin, which appeared in present study the most effective antibiotic and the best.

The results of this study showed that 100 % of the isolates were sensitive to Colistin, and that concide with other study, by (22) in Saudi Arabia which was found that 100% of *A. baumannii* were sensitive to Colistin. Also in Egypt (23) recorded that 95.9 % of their *A. baumannii* isolates were sensitive to colictin.

Another study in Turkey on antibiotic sensitivity of bacteria isolated from burn wounds, multidrug-resistant *Acinetobacter* were the most common cause of wound infection in the burn unit and the most active drugs against *Acinetobacter baumannii* were Tigecyclin and Colistin (24).

Whereas findings of (25) indicated to the highest susceptibility rates of *A.baumannii* isolated from burns in Tehran hospitals to Colistin (88.7 %) and Tigecyclin (82.2%).

Colistin has proved effective in the treatment of wound and bloodstream infections. Although use of Colistin has limitations due to toxicity, it is often used for the treatment of life-threatening infections (26).

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