

## RESEARCH PAPER

# Prevalence of infections with antibiotic-resistant *Acinetobacter baumannii* in different clinical samples from hospitals in Erbil

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### ABSTRACT:

Drug-resistant *Acinetobacter baumannii* is one of the important pathogen causing nosocomial infections. This pathogen is becoming resistant to a large group of antimicrobial agents, leading to a high rate of mortality and morbidity. The aim of the study was to determine the prevalence of *Acinetobacter baumannii* isolates from different clinical samples and analyze its antibiotic susceptibility profiles, and pathogenic perspective. During the period of study from November 2016 to December 2017, different clinical specimens including (urine, wound swab, burn, sputum and blood) obtained from patients hospitalized in Par private hospital and Rizgari teaching hospital in Erbil city. Conventional microbiological methods were used for identification of *A. baumannii*. Antibiotic susceptibility testing was performed by the method commended by the Clinical Laboratory and Standards Institute (CLSI). *A. baumannii* nosocomial infection was increasing especially in patients with risk factors, the current study showed that sputum isolates are the most frequently encountered 20 (51.3%) followed by others. The prevalence of *A. baumannii* according to person's gender among the 39 positive growth 25(17.1%) were from males and 14(12.3%) from females. The study revealed that there was an increase in antimicrobial resistance, most of the isolates even non susceptible to carbapenems with the exception of colistin that had an effective rule in comparison with the others. The study showed that the incidence of multi-drug resistance *A. baumannii* was high and the rate of resistance in *A. baumannii* to carbapenems was rising. Most isolates of *A. baumannii* were multi-resistance against antibiotics.

KEY WORDS: *Acinetobacter baumannii*, Carbapenems, Multi-drug resistance, Nosocomial infections

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## 1. INTRODUCTION

*Acinetobacter baumannii* has emerged as a prominent cause of nosocomial infections, particularly in intensive care units (ICUs), initiating a variety of infections including respiratory tract infection, septicemia, urinary tract infections and wound infections (Al-Dabaibah *et al.*, 2012, Aljindan *et al.*, 2015)

The nosocomial infection is the infection that happens after 48 hours of admission of patients in the hospital, shortly after hospitalization, and on entrance moment the patient did not have such an infection (Amini *et al.*, 2012, Khaledi *et al.*, 2017). Hospital-acquired infections can cause increased patient morbidity and mortality, affect the achievement of initial illness treatment, prolonged hospital stay which then causes additional budgets for the health care system (Ozdemir *et al.*, 2011, Armin *et al.*, 2015). The opportunity of *A. baumannii* isolation from hospitalized patients is related to some essential factors, such as colonization of bacteria in the environment, medical staff-to-patient and patient-to-patient proportion (Almaghrabi *et al.*, 2018).

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*Acinetobacter* spp. has been everywhere especially in healthcare set up. This microorganism inhabits mucous membranes and human soft tissues and can infect the patient's skin, nervous system, respiratory tract, blood, and urinary tract (Begum *et al.*, 2013, Sarhaddi *et al.*, 2017). Over recent decades *Acinetobacter* spp. acquired resistance to multiple antimicrobial agents and displayed extraordinary capability to develop different mechanisms of resistance that lead to multidrug resistance (MDR) and cause extended outbreaks (Farshadzadeh *et al.*, 2015). The resistant to multiple classes of antibiotics becoming unsuccessful in the treatment of numerous *A. baumannii* isolates (Xie *et al.*, 2018). The aim of the current study was to estimate the occurrence of in *A. baumannii* isolated from the patients at two hospitals in the Erbil city. In addition, we also aimed to characterize to antibiotic resistance patterns of *A. baumannii*.

## 1. MATERIALS AND METHODS

A total of 260 consecutive clinical specimens were recovered during November 2016 to December 2017 from different specimens including sputum, wound swab, burn, urine, blood and body fluids submitted to the microbiology laboratory in Rizgari teaching hospital and Par private hospital. All isolates were identified to the species level by conventional biochemical and microbiological methods and confirmed using Vitek II techniques. Patients who were hospitalized with signs and symptoms of infection were involved in the study. The demographic data of patients concerning gender, signs, and symptoms were collected (Dhabaan *et al.*, 2011, Lusignani *et al.*, 2017). The antimicrobial susceptibility testing was accomplished by the Kirby–Bauer disc diffusion method on Mueller–Hinton agar with colistin (10µg), imipenem (10µg), amikacin (30µg), ciprofloxacin (5µg), meropenem (10µg), ceftazidime (30µg), gentamicin (10µg), tobramycin (10µg), cefepime (30µg), and piperacillin/tazobactam (TZP) (100/10µg), according to the Clinical and Laboratory Standards Institute CLSI, 2017 guidelines (CLSI, 2017).

### Statistical Analysis:

The statistical analysis was performed using the SPSS Statistics [version22]. The data were presented as percentages; Chi-square was used to calculate significance for frequencies. A *p* value of less than 0.05 was regarded as statistically significant.

## 2. RESULTS AND DISCUSSION

Among 260 patients with a nosocomial infection which were detected during this period 39 patients were infected by *A. baumannii*. In the current study, patients who received aggressive antimicrobial agents were more disposed to infection with *A. baumannii* than other patients. This study showed that sputum isolates are the most frequently encountered 20 (7.7%), burn 7(2.7%), wound swab 5(1.9%), blood 4(1.5%), 2(0.8%) for urine finally 1(0.4%) was for pus.

Out of (260) isolates the proportion of male were (146) and females were (114) There is no significant difference between male and female among all (260) isolates *p* 0.182. After the interpretation of the data we found that the prevalence of *A. baumannii* according to person's gender among the 39 positives, 25(17.1%) were from males and 14(12.3%) from females. In the present study, the higher rate of *A. baumannii* was found in male compared to females.

**Table 1:** The Prevalence of *A. baumannii* in different clinical specimens

Patient	No and % <i>A. baumannii</i> isolates						Total
	Sputum	Burn	Wound swab	Blood	Urine	Pus	
<b>Infected</b>	20	7	5	4	2	1	39
	7.7%	2.7%	1.9%	1.5%	0.8%	0.4%	15 %
<b>Uninfected</b>	39	30	40	31	48	33	221
	15%	11.5%	15.4%	11.9%	18.4%	12.7%	85 %
<b>Total</b>	59	37	45	35	50	34	260

**Table 2:** Distribution of *A. baumannii* in relation with gender in different clinical specimens among infected and uninfected specimens:

	Infected	Uninfected	Total	P Value
<b>Male</b>	25 9.6%	121 46.5%	146 56.1%	0.182
<b>Female</b>	14 5.4%	100 38.5%	114 43.9%	
<b>Total</b>	39 15%	221 85%	260 100%	

**Table 3:** Distribution of *A. baumannii* isolates from different samples, by patient's gender

Patient	No. and % <i>A. baumannii</i> isolates						Total
	Sputum	Burn	Wound swab	Blood	Urine	Pus	
<b>Male</b>	15 5.75%	3 1.15%	3 1.15%	3 1.15%	1 0.4%	0 0%	25 9.6%
<b>Female</b>	5 1.9%	4 1.5%	2 0.8%	1 0.4%	1 0.4%	1 0.4%	14 5.4%
<b>Total</b>	20 7.7%	7 2.7%	5 1.9%	4 1.5%	2 0.8%	1 0.4%	39 15%

The results of the susceptibility profile of 39 *A. baumannii* clinical isolates to the examined antibiotics were obtained. In the present study, most isolates of *A. baumannii* showed nonsusceptible against routine antimicrobial agents, although colistin was more effective. Interestingly carbapenem presents as the non-effective antibiotics during the study. It is obvious that *A. baumannii* isolates showed high resistance (97.4%) to ciprofloxacin, (89.74%) to amikacin and (87.17%) to imipenem

The resistance pattern differed across samples of different sources. In addition, antibiotic resistance was lowest with colistin 100% susceptible Table 4.

**Table 4:** Resistance pattern of *Acinetobacter baumannii* isolates from different clinical samples

Antibiotics	Sputum (n=20)	Burn (n=7)	Wound (n=5)	Blood (n=4)	Urine (n=2)	Pus (n=1)	Total (n=39)
Piperacillin/tazobuctum	20 (100%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	39 (100%)
ceftazidime	20 (100%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	39 (100%)
imepinem	17 (85%)	6 (85.8%)	5 (100%)	3 (75%)	2 (100%)	1 (100%)	34 (87.1%)
meropenem	19 (95%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	38 (97.5%)
amikacin	18 (90%)	6 (85.8%)	5 (100%)	3 (75%)	2 (100%)	1 (100%)	35 (89.8%)
tobramycine	20 (100%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	39 (100%)
trimeth/sulfam	20 (100%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	39 (100%)
colistin	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
cefepeme	20 (100%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	39 (100%)
gentamicin	20 (100%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	39 (100%)
ciprofloxacin	19 (95%)	7 (100%)	5 (100%)	4 (100%)	2 (100%)	1 (100%)	38 (97.5%)

The increase in global reports of *A. baumannii* and antimicrobial resistance accompanying, particularly in the health-care-associated infections and the majority of hospital infections has elevated an alarm (Pourhajibagher *et al.*, 2016, Odsbu *et al.*, 2018), specifically in critical care areas, which are responsible for the most severe nosocomial outbreaks (Moradi *et al.*, 2015) Many studies have revealed that *A. baumannii* which has emerged worldwide as a pathogen causing serious infections in the hospital has the capability to persist in the hospital milieu for a long period of time, colonize subjects and can progress into a true pathogen at any time (Uwingabiye *et al.*, 2016). Infections caused by *A. baumannii* have an undesirable impression on clinical consequences and treatment expenses. *A. baumannii* creates many health problems in hospitals (Armin *et al.*, 2015). Results of our study indicated that respiratory tract infections were the most common type of clinical isolates of *A. baumannii*, which has also been observed in earlier studies (Saed *et al.*, 2015). Frequently of respiratory infection associated with mechanical ventilation, endotracheal intubation, and intra vascular catheter (Raka *et al.*, 2009).

Developing of multi-drug resistant *A. baumannii* in the hospital could be due to lack of proper infection-control performance, the patient's normal bacterial flora under the aggressive antibiotics, or contaminated instruments, and overcrowding situations in the hospitals. In the present study, the higher rate of *A. baumannii* was found in male compared to females as in Table 2, 3, which is in agreement with observations in previous studies due to their exposing to the bacteria in environments (Oncul *et al.*, 2009, Batarseh *et al.*, 2015, Hatami, 2018). The predominance of male patients infected with *Acinetobacter* has been confirmed in other studies but the cause is not justified (Uwingabiye *et al.*, 2016).

Our Laboratory results displayed isolates of *A. baumannii* have become resistant against most of frequently prescribe antimicrobial agents including aminoglycosides, cephalosporins, quinolones, and extended-spectrum penicillins Figure 1. As described by other researchers (Begum *et al.*, 2013, Xie *et al.*, 2018). These findings which are in general similar to the results of studies in Jordan, Iran, and China (Dhabaan *et al.*, 2011, Sarhaddi *et al.*, 2017, Jiang *et al.*, 2014). In our study, according to antimicrobial susceptibility test results, a considerable amount of *A. baumannii* isolates over (85%) were resistant to imipenem and meropenem suggesting that carbapenems are inappropriate for the treatment of *A. baumannii* infections anymore.

Over the decades, carbapenems have been measured as the best therapeutic choice for infections caused by drug-resistant *A. baumannii*. In this research, 87.1 % and 97.4% of the isolates were resistant to imipenem and meropenem respectively, which was the great resistance rate compared with other studies. Many researchers described Carbapenems (imipenem, meropenem) remain one of the most important therapeutic options for these infections despite carbapenem-resistant *A. baumannii* reaching an alarmingly high level in some countries (Uwingabiye *et al.*, 2016), such as China (97.6%), Islamic Republic of Iran (97.7%), and Morocco (87.7%) (Jiang *et al.*, 2014, Amini *et al.*, 2012, Uwingabiye *et al.*, 2016). However, *A. baumannii* resistance to imipenem and meropenem is still low in other investigations as Turkey 53.3% and 46.7% respectively (Ozdemir *et al.*, 2011). Jordan (70.1

and 71.6%, respectively) (Dhabaan *et al.*, 2011) for imipenem and meropenem.

In general, the resistance rate usually varies over time, even in countries. Further studies are needed to elucidate the cause of these differences. The resistant of *A. baumannii* to carbapenem in clinical isolates is a serious threat, suggesting that if carbapenem is overused, early interruption of treatment, lead to rapid increase in resistance and treatment failure are likely to happen (Ganjo *et al.*, 2016). For carbapenem-resistant *A. baumannii*, colistin is one of the most persistently used alternative agents according to the Behera (Behera *et al.*, 2017). Colistin is still considered to be the most effective single antimicrobial agents against multi-drug resistant *A. baumannii*, and is always reserved as a last resort of antibiotic (Hatami, 2018).

In the present study, the resistance rate of isolates to colistin was (0%), studies in Turkey and Iran (Ozdemir *et al.*, 2011, Sarhaddi *et al.*, 2017), reported the antibiotics with the highest *in vitro* susceptibility was colistin, 100 % susceptible against *A. baumannii* other data reported from Jordan (1.7%), and (0.5%) in Saudi Arabia (Batarseh *et al.*, 2015, Al-Mously, 2013). In contrast, a study from Iran (Sepahvand *et al.*, 2015) reported that 6% of the isolates were resistant to colistin which was a higher rate of resistance when compared with our result.

Resistance pattern of each antimicrobial agent (except for colistin) for *A. baumannii* in different clinical specimens was all above 50% (Table 4). The sensitivity of all clinical isolates was 100% for colistin. Indiscriminate use of antibiotics in the hospitalized patients, delay in hospital discharge, prolonged use of catheters, organ implants lead to extent resistant bacteria that colonized in susceptible patients (Amini *et al.*, 2012).

An appropriate strategy required to manage protocols of infection control or encourage medical staffs to use the best therapeutic choices, that resulting in short hospitalization, increase survival rate, reduced financial cost, and control the spread of multi- drug resistant *A. baumannii*.

### 3. CONCLUSIONS

This study highlights the extraordinary incidence of drug resistance among clinical *A. baumannii* isolates in our hospitals. The occurrence of drug resistance *A. baumannii* is a serious worldwide threat to community and



healthcare settings that indications to increased length of hospitalization, mortality and medical costs. The surveillance data, as well as strict control of infection in the hospital environment, are necessary to struggle infections caused by resistance strains of *A. baumannii*.

### Conflict of interest

None declared conflicts of interest.

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