



Prevalence of *Acinetobacter* infections among Intensive Care Unit's patients in Najran

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Abstract

The rising prevalence of *Acinetobacter* infections in the intensive care units (ICUs) causes a great concern due their extraordinary ability to develop resistance to multiple classes of antimicrobial agents. This is a cross-sectional and facility based study that conducted in King Khalid hospital in Najran, Saudi Arabia. The aim of this study is to estimate the prevalence of *Acinetobacter* infections in the ICU patients, and to identify antibiotic susceptibility of the *Acinetobacter* isolates. 180 ICU patients were studied during the period from Aug. 2016 to April 2017. *Acinetobacter* was isolated in 21(11.7%) of patients. It was isolated from tracheal secretions in 43% of the isolates, followed by sputum (23%), wounds (14%), Central Venous Line (CVL) (9%), urine and blood (6%) for each respectively. *Acinetobacter* infection was increased significantly in patients with old ages, patients with chronic diseases and those undergoing invasive procedures ($P=0.001$). *Acinetobacter* sensitivity tests were performed, they showed that the isolates were resistant to many antibiotics in terms of Ampicillin, Cephalothin, Cefuroxime, Gentamycin, Amikacin, Tobramycin, Ofloxacin, Rifampicin and Colistin was respectively 87%, 86%, 79%, 76%, 52%, 43%, 33%, 32% and 8%.

It was concluded that *Acinetobacter* is an important nosocomial infection pathogen in the ICU patients. Few treatment options are currently available, and for this reason, prevention and infection control measures are essential, including antibiotic control strategies in the ICUs.

Keywords: ICU patients, Prevalence, *Acinetobacter*, antibiotic resistance,

1. Introduction

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*.^{1,2} *Acinetobacter* are a group of non-fermentative, Gram-negative cocco-bacillus

that has emerged as an important nosocomial pathogen. It is water organism and preferentially colonizes aquatic environments.³

When *Acinetobacter* infections occur, they usually involve organ systems that have a high fluid content (eg, respiratory tract, CSF,

peritoneal fluid and urinary tract).⁴ They are increasingly implicated as a cause of healthcare-associated infections (HAI), which confer a high risk of morbidity and mortality to patients.⁵

Acinetobacter can cause serious and sometimes life-threatening infections. It is an opportunistic pathogen known for its intrinsic resistance to antibiotics and greater ability to rapidly acquire resistance genes as mobile genetic elements (plasmids, transposons, integrons cassettes and insertion sequences).^{6,1} In addition, their ubiquitous nature in the ICU environment coupled with inadequate infection-control practices have continuously raised the incidence of *Acinetobacter* infections over the past two decades.⁷

The precise mechanisms that explain how multiple-drug resistance occurs are not fully known. However, recent studies have shown that *Acinetobacter* can produce great diversity of chromosomal and plasmid-mediated enzymes.⁸ They can produce aminoglycoside-modifying enzymes to neutralize aminoglycosides and thus become resistant to this class of antimicrobial agents. β -lactamases are another type of modifying enzymes that give them potential to become resistant to penicillins, cephalosporins, and carbapenems.⁹ More interestingly, they can also diminish uptake of antibiotics into their cells by either changes in the outer membrane porins to decrease permeability to the agents or by creating active antimicrobial efflux systems.¹⁰

Risk factors for multi-drug resistant *Acinetobacter* colonization and infection include prolonged length of hospital stay, exposure to central venous catheterization, urinary catheterization, prior exposure to strong antimicrobials, greater severity of illness, surgery and receipt of invasive procedures.^{3,8,11} Although, risk factors for antibiotic-resistant *Acinetobacter* infection have been explored in many patient populations, fewer studies have assessed potential differences in risk factors for those infected with antimicrobial-resistant versus susceptible strains.^{4,12}

2. Material and Methodology

This study was performed at King Khalid hospital in Najran city-Saudi Arabia, a tertiary teaching hospital. The study population consists of 180 patients who were admitted in the intensive care unit. This population of patients comprises of patients who have had surgery, on ventilators or intubation, beside prior history of antibiotic usage.

2.1. Methods of data collection

Verbal informed consent was obtained from spouse, parents or caregiver of each subject. Therefore, relevant medical history, socio-demographic data and other information obtained from the care giver and case files were entered into a semi-structured close-ended questionnaire.

2.2. Specimen collection and analyses

Tracheal aspirate, sputum, blood and urine specimens were collected from all recruited subjects who spent at least 72 hours in the ICU for microscopy, culture and sensitivity tests. Specimens were collected using aseptic technique to prevent contamination. For optimal results, specimens were collected in clean sterile, wide bore containers.

Isolation of *Acinetobacter* was performed on blood agar and Herellea agar. Identification of clinical isolates were performed by classical bacteriological techniques (direct examination, biological test of orientation). Cultural characteristics observed after an incubation at 36°C for 24 hours.

The study of antibiotic susceptibility was performed by the disc diffusion method on Mueller –Hinton agar plates that contained Ampicillin (10µg), Cephalothin (30 µg), Cefuroxime (30 µg), gentamycin (10µg), Amikacin (30 µg), Tobramycin (10 µg), Ofloxacin (5 µg), Rifampicin (10 µg) and Colistin (5 µg).

2.3. Data analysis

All data were analyzed using Statistical Package for Social Science (SPSS) version 18.0. Data were presented using frequency tables, charts, as appropriate and cross tabulation to study relationships and association between variables. Statistical significance was set at 5%.

3. Results

A total of 180 patients were recruited to participate in the current study over a period of 9 months, from Aug. 2016 to April 2017. The age of the participants ranged from 11 to 82 years old. The mean patients' age was 46.6 ± 15.3 years. The

median duration of ICU stay was 5 days (range, 1-170 days).

Majority of the patients (31.67%) were falling in 41-55 years age group, while the 10-25 years age group constituted the least age group (10.56%). There were 98 male (54.4%), and 82 (45.6%) females, giving a male to female ratio of 1.2:1.

One hundred twenty four (68.89%) of the patients were admitted from the emergency department (ER). While the rest were from other wards in the hospitals. More than 43% of the admitted cases are having chronic illnesses and almost 57% of them had past history of hospitalization (table 1).

Table (1): Represents socio-demographic characteristics of the selected sample (n=180)

Variable	Category	Frequency	%
Sex	Male	98	54.4%
	Female	82	45.6%
Age in years	10 – 25	19	10.56%
	26 – 40	32	17.78%
	41 – 55	57	31.67%
	56 – 70	42	23.33%
	71 - 85	30	16.67%
Source of admission	Emergency department (ER)	124	68.89%
	Other departments in the hospital	56	31.11%
Causes of admission	Chronic illnesses	78	43.33%
	Surgical operations	40	22.22%
	Accidents	62	34.44%
Previous hospitalization	Yes	102	56.67%
	No	78	43.33%

The result of the laboratory studies shows that 55 cases (30.6%) were detected positive for various microbial agents in terms of *Acinetobacter*, *Pseudomonas*, *E-coli*, *Staphylococci*, *Klebsiella pneumonia*, *Fungus* and others. Within the 55 positive patients 44 (80%) had underlying chronic diseases.

Out of the 180 patients studied, *Acinetobacter* spp was isolated from 21(11.7%) patients giving a prevalence rate of 11.7%. It was isolated from tracheal secretions in (42.86%), followed by sputum (22.86%), wounds (14.29%), central venous line (CVL) in (8.57%), urine (5.71%) and blood (5.71%) as displayed in figure (1).

Figure (1): displayed the sites from where specimens were extracted among positive cases (n=21)

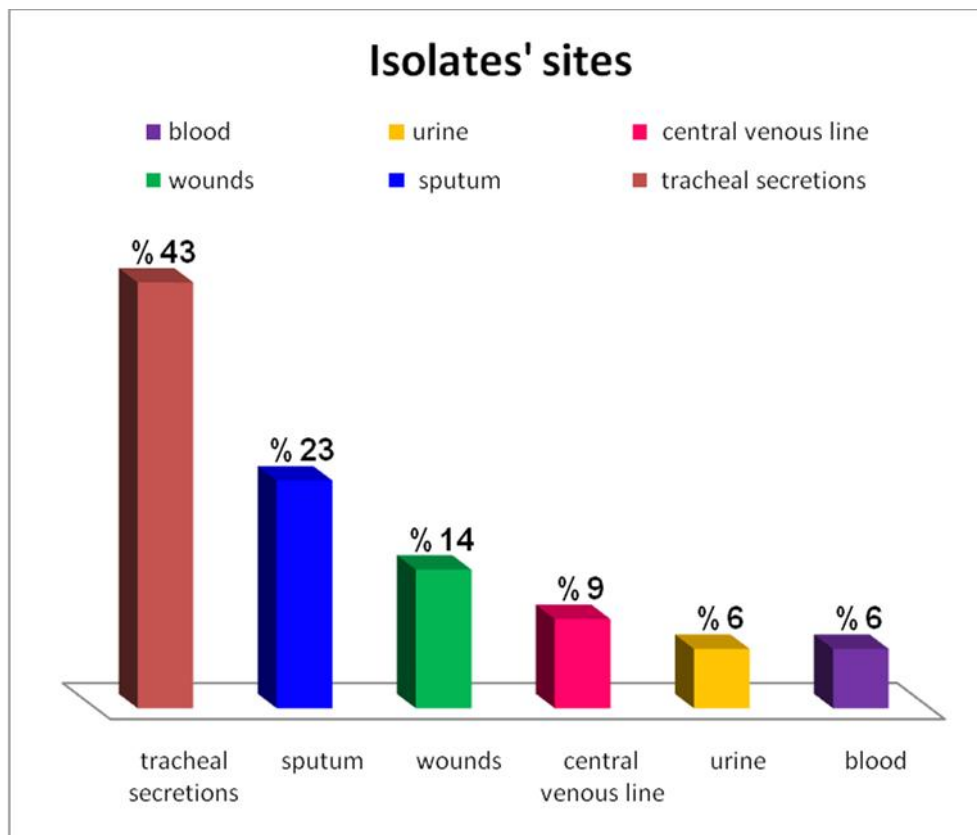


Table 2 shows risk factors related to prior antimicrobial therapy. The average number of prior antimicrobials used was 3.8 in bacteremic

patients and 2.7 in non-bacteremic patients ($P < 0.001$).

Table (2): Shows risk factors related to prior antimicrobial therapy

Mean standard deviation of prior exposure to antibiotics	Non-bacteremic (n=125)	Bacteremic (n=55)	Odds Ratio	95% CI	P-value
	2.7±1.1	3.8±1.4	2.09	1.6 – 2.74	<0.001

Acinetobacter sensitivity tests were performed, in which the isolates were resistant to many antimicrobial. They showed high resistance to Ampicillin (87.36%), followed by Cephalothin

(86.64%), Cefuroxime (79%), Gentamycin (75.6%), Amikacin (51.7%), Tobramycin (42%), Ofloxacin (32.7%), Rifamicin (31.1%) and Colistin (8%) respectively. (table3).

Table (3): shows *Acinetobacter* sensitivity tests (n=21)

Antibiotic agent	Resistance (%)
Ampicillin	87.36%
Cephalothin	86.64%
Cefuroxime	79%
Gentamycin	75.6%
Amikacin	51.7%
Tobramycin	42%
Ofloxacin	32.7%
Rifamicin	31.1%
Colistin	8%

4. Discussion

In recent years, *Acinetobacter* has become an important pathogen especially in the ICUs. Patients admitted to ICUs have been shown to be at particular risk of acquiring nosocomial infection with a prevalence rate as high as 30%.¹³ Several studies on the epidemiological and clinical features of *Acinetobacter* infections have been published.^{5,11,12}

In the current study, *Acinetobacter* Spp prevalence rate was 11.7% in the ICU. This prevalence is near to similar studies carried out by Jang et al who reported 12%, Joly who reported 9%, and Ugochukwu who reported 14% respectively.^{6,13,14} This result in our study is higher than what concluded by Iregbu et al who reported a prevalence of 4.6% in Lagos.¹⁵ The majority of positive samples in this study were isolated from the respiratory tract, this finding was in consistent with studies carried out by Garnacho et al.¹⁶ and Ugochukwu et al.¹⁴ This high rate of recovery from the respiratory tract may be due to the invasive procedures that are carried out during the process of maintaining airways.

Moreover, the recovery rate of *Acinetobacter* Spp from urinary tract was almost 6%, this rate is slightly higher than what was concluded by Playford et al who reported 3.2%.¹⁷ and 1% as reported by Ugochukwu et al.¹⁴ who suggested that this finding confirms the popular report that *Acinetobacter* is no longer a common uropathogen.

The incidence of *Acinetobacter* blood stream infection in this study almost 6% which is higher than what reported by Falagas et al.¹⁸ who reported 2% and Ugochukwu et al.¹⁴ who reported 1.3%, while it was slightly lower than Maragakis and Perl.¹⁹ who reported 8.8% incidence in blood.

In the present study, *Acinetobacter* infection were higher in the patients above 50 years old, patients undergoing chronic diseases and patients that undergoing invasive procedures. This fact in agree with finding of Amini et al.²⁰ In contrast, in the current study it was concluded that there was no differences in relation to surgical operations and current antibiotic therapy.

The recent emerging of drug resistant *Acinetobacter* has caused a great concern worldwide. In the present study, most of *Acinetobacter* isolates were highly resistant to Ampicillin (87%), Cephalothin (86.64%), Cefuroxime (79%), Gentamycin (76%), Amikacin (51.7%), Tobramycin (42%), Ofloxacin (32.7%), Rifampicin (31.1%) and Colistin (8.21%).

Navon-Venezia et al showed that most of *Acinetobacter* isolates were resistant to all standard antibiotics.²¹ Other studies concluded that up to 80% of *Acinetobacter* isolates were resistant to all aminoglycosides.^{14,15} Moreover, other studies reported Imipenem sensitivity in 89% and up to 70% were sensitive to -lactam and -lactamas inhibitor combination.^{21,22}

5. Conclusion and Recommendation

There has been increasing concern regarding the rise *Acinetobacter* infections among critically ill patients. They most frequently involve the respiratory tract of intubated patients.

Acinetobacter infection was increased significantly with old ages, patients with chronic underlying diseases, and among patients who undergoing invasive procedures.

As far as resistance to Colistin was estimated in this study to 8%, therefore, Colistin can be considered one of the most effective treatment option for *Acinetobacter* infection.

The emergence resistant strains of *Acinetobacter* infections has led to fewer treatment options. Due to these limited therapeutic options, prevention and infection control measures are essential, including not only traditional measures but also antibiotic control strategies in the ICUs. Moreover, to prevent the occurrence and transmission of this organism in the ICUs, infection control measures crucial. Measures described in the clinical trials include hand disinfection by using either alcohol hand-gel or Chlorhexidine.²³ Barrier and contact precautions such as wearing gloves, gowns, and masks are so essential. Additionally, restricted use of third generation cephalosporins along with other antibiotics control strategy could be useful.

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