

Clinical and Epidemiological Study on *Acinetobacter* Isolates from Aseer Region, Saudi Arabia

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Abstract: The study aimed at analysing the epidemiology, demographic and clinical aspects of *Acinetobacter* species in Aseer Central Hospital, Abha, Aseer region South-West Saudi Arabia. This study was conducted from December 2011 to June 2012 at Aseer Central Hospital. One hundred fifty patients were identified. Demographic, epidemiological and clinical data were collected using a special questionnaire. The isolates were identified using bacteriological tests; direct microscopy, culture in blood agar media, fermentation test in MacConkey media and Chemical test using API 20. Significant risk factors were working age (16-60 years), 58.7% males and 41.3% females. The 97% of the patients were Saudi; one-third of those were unemployed, 18% employed worked in military and only 3.3% worked as health personnel. Sputum (47.3%), blood (22.7%), skin (14%), urine (6%) and fewer samples were eye swap, endotracheal tube and wound swap samples were collected. The 41.3% of patients were from the medical ward and 22.7% were from the Intensive Care Unit (ICU). The average of inpatients hospital day stay was around 4 days. *Acinetobacter* bacteria are the important cause of the nosocomial infections. The risk factors for *Acinetobacter* species infections involved the improper and irrational use of broad-spectrum antimicrobials and invasive procedures.

Key words: *Acinetobacter*, multidrugs resistance, nosocomial infections, sputum, Aseer

INTRODUCTION

Acinetobacter species is a glucose non-fermentative Gram-negative cocco-bacillus which have been grown from numerous human sources and are wide spread in the environment (Seifert *et al.*, 1993b; Seifert, 1995).

Although, these organisms are normally considered to be of low virulence, they have been increasingly implicated as a cause of a wide spectrum of infections, including community and hospital-acquired infections associated with intravenous catheters and contaminated respiratory therapy equipment among patients with impaired host defenses in intensive care units (Mahmood *et al.*, 2002). *Acinetobacter* species is an important opportunistic pathogen responsible for a variety of nosocomial infections including bacteremia, urinary tract infection, secondary meningitis, surgical-site infection and nosocomial ventilator-associated pneumonia, especially in Intensive Care Unit (ICU) patients (Valencia *et al.*, 2009). Using of invasive tools such as endotracheal tube, blood cannula and urinary catheter will facilitate nosocomial infections caused by this bacterium as it adhered to the solid surfaces and difficult to be removed. Such infections are often extremely difficult for the clinician to treat because of the widespread resistance of these bacteria to the major groups of antibiotics. Deferent mechanisms of antibiotic

resistance have been recognized in these bacteria (Seifert *et al.*, 1993a, b) and combination therapy is usually required for effective treatment of *Acinetobacter* nosocomial infections. These therapeutic difficulties are coupled with the fact that this bacterium has a significant capacity for long-term survival in the hospital environment with corresponding enhanced opportunities for transmission between patients either via human reservoirs or via inanimate materials. Despite the increasing significance and frequency of multi-drugs resistant *Acinetobacter* infections, many clinicians still lack an appreciation of the potential importance of these organisms in hospitals and health care units (McDonald, 2006) because of the confused taxonomic classification of these organisms until recently.

In Saudi Arabia, only few hospital-based studies have been conducted in the field of identification and drug resistant of *Acinetobacter* (Balkhy *et al.*, 2012; Abdalla, 2011). A study done in the Northern region of Saudi Arabia showed that the overall rate of nosocomial infections in the hospital was 2.2%. The rates in the different services varied and the highest were in the Special Care Baby Unit (13.5%) and Intensive Care Unit (6%). In the other services, it ranged from 1-3.5%. One of the causal agents of documented infections was *Acinetobacter* sp. (Babay *et al.*, 2003; Al-Tawfiq and Mohandhas, 2007).

The control of hospital-acquired infection caused by multiple resistant Gram-negative bacilli has proven to be a particular problem over the last 20 years in developed countries (Pfaller *et al.*, 2006). An increasing incidence during the 1970s of resistant members of the family Enterobacteriaceae involved in nosocomial infections was followed by the therapeutic introduction of newer broad-spectrum antibiotics in hospitals and a subsequent increase in the importance of strictly aerobic Gram-negative bacilli including *Pseudomonas aeruginosa* and *Acinetobacter* sp. (Eltahawy and Khalaf, 2001).

This study was conducted in Aseer Central Hospital with a capacity of 600 beds. It is accredited from The Central Board of Arab Health. Moreover, it is the only tertiary care facility in the Aseer region in Saudi Arabia with a population above a million. The laboratory is a regional referral hub that serves the hospital as well providing consultation for the rest of the region. On the other hand, the hospital is affiliated to the Medical College of King Khalid University.

Aim of this study: The objective of this study was to clarify the epidemiological aspects of *Acinetobacter* species in Aseer region South-West Saudi Arabia.

Specific objectives: To assess the role of demographic and clinical aspects of *Acinetobacter* species in the study area.

Rational of the study: This area was not subjected to previous studies for *Acinetobacter* nosocomial infections. Clarification of the magnitude and amplification of this problem is not well recognized.

MATERIALS AND METHODS

This a hospital base cross sectional study was conducted in Aseer Hospital, Abha City, Aseer Region, South-Western part of Saudi Arabia. Study population is the positive cases of *Acinetobacter* isolates among patients admitted to Aseer Hospital to different departments during the period Dec. 2011 to June 2012. A total of 150 positive *Acinetobacter* infection samples were collected from patients admitted in different departments in Aseer Hospital, Abha City. The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (Research Center For Medical Colleges, King Khalid University) and with the Helsinki Declaration of 1975 as revised in 2000. Informed consent was obtained from each subject or subject's guardian after approval of the

experimental protocol by the local human ethic committee (Research Center For Medical Colleges, King Khalid University). The study aimed at identifying the personal characteristic, clinical conditions of positive nosocomial and community-acquired *Acinetobacter* infections and the epidemiological factors. Samples were taken from patients according to their presentation which included blood, sputum, skin, urine, eye swab, endotracheal swab and wound swab. The isolates were identified using bacteriological tests; direct microscopy, culture in blood agar media, fermentation test in MacConkey media. Chemical test using API 20. Demographic, epidemiological and clinical data were collected using a special questionnaire which includes personal characteristics of the patients, sex, age, nationality marital status and occupation were taken, another information like immunosuppressive factors, duration of the disease, antibiotics used were elicited, type of sample, departments where the patients admitted, duration of the disease, existence of immunosuppressive disease, medication used instrumentation used for the patients and clinical presentation of the patients. Descriptive and analytical statistics using correlation were made using SPSS Program.

RESULTS

Personal characteristics of positive *Acinetobacter* patients showed gender distribution, 58.7% were male and 41.3% were female. Age of the patients was divided into four groups; <5, 5-15, 16-60 and above 61 years. The majority of the patient was from 16-60 years age group (45%). Regarding patient's nationality, around 97% were Saudi. Almost half of the patients were married (46%) while single patients were (29.3%). One-third of the patients were unemployed. Among the employed patients, 18% worked in military and only 3.3% worked as health personnel (Table 1). Samples were collected from patients admitted to different departments in Aseer Hospital; it includes sputum 47.3%, blood 22.7%, skin 14%, urine 6% and fewer samples were eye swab, endotrachial tube and wound swab. These samples were correspondence to the clinical conditions of the patients so the majority of clinical conditions were respiratory tract infection followed by Blood Bacteremia Infection (BBI) then wound sepsis (Table 2). The 75% of patients had no family history of similar illness. The 31% of patients have past history of antibiotics usage. The patients involved in study were admitted to different departments in the hospital, the majorities were from medical ward 41.3% followed by Intensive Care Unit (ICU)

Table 1: Personal characteristics of the study population

Personal characteristics	No.	Percentage
Sex		
Male	88	58.7
Female	62	41.3
Age (years)		
>5	12	8.0
5-15	28	18.7
16-60	68	45.3
61 and more	42	28.0
Nationality		
Saudi	145	96.7
Non Saudi	5	3.3
Marital status		
Single	44	29.3
Married	69	46.0
Widow	19	12.7
Divorce	18	12.0
Occupation		
Farmer	12	8.0
Office work	4	2.7
Teacher	23	15.3
Household	9	6.0
Military	27	18.0
Unemployed	50	33.3
Health personnel	5	3.3
Students	20	13.3

Table 2: Types of the samples

Types of sample	Frequency	Percentage
Sputum	71	47.3
Blood	34	22.7
Skin	21	14.0
Urine	9	6.0
Eye swab	7	4.7
Endotracheal tube	6	4.0
Wound swab	2	1.3
Total	150	100.0

Table 3: Patients distribution from different hospital departments

Name of the department	Frequency	Percentage
ICU	34	22.7
Medical ward	62	41.3
Surgical ward	24	16.0
Renal dialysis	8	5.3
Pediatric	16	10.7
CCU	4	2.7
Burn unit	2	1.3

22.7% (Table 3). In this study, the devices that facilitate the Acinetobacter nosocomial infections were ventilator 21.3%, intravenous cannula 6.7% and urinary catheter 4.7%. No use of devices encountered in 67.3%. The average of inpatients hospital day stay was around 4 days. Types of Acinetobacter infections among the study group were 88 (58.7%) patients were nosocomial and the rest were community-acquired infections. All patients were under treatment and there was no mortality. 32% of the patients exert no immune suppressive condition. Two patients have tumors and other two have Myocardial Infarction (MI) while chronic illnesses leading to immune suppressive were mainly; diabetics (66 patients) 44%, hypertension 15.3% and asthmatics 6%

Table 4: Sex, chronic disease and instrumentation crosstabulation

Immune deficiency factors	Instruments				Total
	Nil	Catheter	Ventilator	Canula	Nil
Pregnancy (sex)					
Female	1	-	-	-	1
Total	1	-	-	-	1
Diabetes (sex)					
Male	21	4	12	1	38
Female	15	2	5	1	23
Total	36	6	17	2	61
2.3 (sex)					
Male	2	-	2	1	5
Total	2	-	2	1	5
Hypertension (sex)					
Male	11	-	2	1	14
Female	4	-	4	0	8
Total	15	-	6	1	22
3.4 (sex)					
Male	-	-	1	-	1
Total	-	-	1	-	1
Asthma (sex)					
Male	4	0	0	1	5
Female	1	1	1	0	3
Total	5	1	1	1	8
Tumors (sex)					
Male	1	-	-	-	1
Female	1	-	-	-	1
Total	2	-	-	-	2
MI (sex)					
Male	1	-	-	0	1
Female	0	-	-	1	1
Total	1	-	-	1	2
Others (sex)					
Male	18	-	3	1	22
Female	21	-	2	3	26
Total	39	-	5	4	48

2.3: Diabetes and hypertension; 3.4: Hypertension and asthma; MI: Myocardial Infarction

of all patients. The predominant clinical condition among the study group was found to be diabetes which can play a role as immune deficiency factor. The most used instrumentation was ventilator. The relationship between sex, chronic disease and instrumentation was shown in (Table 4).

DISCUSSION

Nosocomial infections cause substantial morbidity and mortality; the availability of timely and accurate epidemiological information on nosocomial pathogens is essential to the appropriate selection of empirical therapy (Diancourt *et al.*, 2010). In a study done to analyze Nosocomial Bloodstream Infections (NBSIs) surveillance data to determine trends in the distribution of pathogens and antimicrobial susceptibilities of these pathogens during the period from 1996 to 2003 at National Cheng Kung University Hospital, China patients with NBSIs were enrolled in the study and the ranking of pathogens

and status of antimicrobial resistance were determined. There were 4,038 episodes of NBSIs. The overall incidence was 1.79 episodes per 1,000 inpatient days. The 5 leading pathogens were coagulase-negative staphylococci (16% of NBSIs) *Staphylococcus aureus* (13%), *Candida* sp. (10%), *A. baumannii* (8%) and *Escherichia coli*. (8%). The emerging antimicrobial-resistant Gram-negative pathogens included multidrug-resistant *Acinetobacter* species (Wu *et al.*, 2006). The number of nosocomial infections caused by *Acinetobacter* species has increased in recent years. During a 12 months study, there were 1.8 episodes of *A. baumannii* bacteremia per 1,000 adults admitted to a hospital in Seville, Spain. Seventy nine patients were included in the study. *A. baumannii* bacteremia occurred after a hospitalization of 18-20 days. In all cases, the infections were acquired nosocomially; 71% were acquired in intensive care units. Ampicillin was found to be the most active agent against *A. baumannii*. The common source of the bacteremia was the respiratory tract (32 cases (71%)). Twenty patients (25%) had septic shock and 24 (30%) had Disseminated Intravascular Coagulation (DIC). Treatment with imipenem or ampicillin was most effective (cure rates, 87.5 and 83%, respectively). The deaths of 27 patients (34%) were related to *A. baumannii* bacteremia. The presence of DIC and inappropriate antimicrobial treatment were independently associated with mortality. The study concluded that most *A. baumannii* isolate are multiresistant and that nosocomial *A. baumannii* bacteremia may cause severe clinical disease that is associated with a high mortality (Cisneros *et al.*, 1996).

A. baumannii is an important cause of nosocomial infections in many hospitals which is difficult to control and difficult to treat due to its high resistance in the environment and its ability to develop resistance to antimicrobials. Bacteremia, followed by respiratory tract and surgical wound infections is the most significant infection caused by *A. baumannii* (Cisneros and Pachon, 2003). The usage of invasive devices is the main risk factor identified in this study which involved; chest infection, the predominate type of nosocomial infections (>51%) followed by Blood Infection BBI 24%, skin infection 15% then urinary tract infection 10%. Least of infections were eye's infections. Accordingly, the usage of the appropriate device; ventilator, camula, needles and catheters have facilitated the spread of the nosocomial infections caused by this bacterium (Cisneros *et al.*, 2005). The clinical manifestations of bacteremia by *Acinetobacter* species are not specific. The most common sources of bacteremia are intravascular catheters and the respiratory ventilators which is associated with a high

crude mortality rate although, it is difficult to distinguish morbidity and mortality attributable to *Acinetobacter* species from that attributable to the common and severe co-morbidity nosocomial infections caused by common type of bacteria in these patients (Seifert, 1992). *Acinetobacter* species is a bacterium that appears to have a propensity for developing multiple antimicrobial resistance extremely rapidly. This fact is disturbing because the therapeutic possibilities decrease while inappropriate antimicrobial treatment contributes to patient mortality. Generally, imipenem is the most active agent against *Acinetobacter* species. However, the description of imipenem-resistant *Acinetobacter* species strain is becoming increasingly common. The usual treatment for *Acinetobacter* species bacteremia is an active beta-lactam alone, preferably one with a limited spectrum. Before beginning treatment of a bacteremia by *Acinetobacter* species, it is very important to carry out a clinical evaluation of the patient to eliminate the possibility of a pseudobacteremia and thereby avoid unnecessary treatment (Cisneros and Rodriguez-Bano, 2002).

In this study, the nosocomial infections caused by *Acinetobacter* species were mainly in extremes of age; paediatrics and elder's patients mainly admitted to intensive care units predominantly presented with chest infection (>51%) and urinary tract infection in 10%. These findings are similar to that deduced from a study performed to investigate the clinical features and the epidemiology of *Acinetobacter baumannii* in Spanish hospitals which involved twenty seven general hospitals; all cases of *Acinetobacter* species infections detected by clinical samples during the study period were included. The results showed: 25 (89%) of the hospitals had 221 cases (respiratory tract, 51%; surgical site, 16% and urinary tract, 11%). The pooled rate in general hospitals, 0.39 case per 1,000 patient days; range, 0-1.17. The rate was highest in Intensive Care Units (ICUs). Only 3 cases were pediatric. The mean age of the patients in the general hospitals was 63 years; 69% had a chronic underlying disease and 80% had previously received antimicrobial treatment. Epidemic and sporadic *Acinetobacter* species nosocomial infections coexisted in many hospitals (Rodriguez-Bano *et al.*, 2004).

The *Acinetobacter* species nosocomial infection among health personnel in this study was 3.3% of total cases. This is an important risk factor in transmission of infections. The contaminated hands of medical personnel with bacteria then transmitted to patients (Su *et al.*, 2001). Surveillance study of nosocomial infection in the Intensive Care Unit (ICU) received a high level of attention and outcome indicators are now used in

benchmarking the quality of patient care. Since 1999, the surveillance has targeted three site-specific, device-associated infections including Ventilator-Associated Pneumonia (VAP), Central-Line-Related Bloodstream Infection (CR-BSI) and Catheter-Related Urinary Tract Infection (CR-UTI). A 2 years prospective study on the incidences of these infections acquired in an ICU and report herein, together with the antibiotic susceptibility patterns of the microorganisms isolated from patients admitted to an adult medical-surgical ICU of a university hospital in Thailand from June 2000 to May 2002. Results comprise: a total 1422 patients with a total of 9370 patient days were enrolled in the study. The incidence of VAP, CR-BSI and CR-UTI were 10.8/1000 ventilator days (95% CI: 8.5-13.6), 2.6/1000 central line days (95% CI: 1.5-4.4) and 13.8/1000 urinary catheter days (95% CI: 10.7-17.5), respectively. The most common causative pathogens were *Acinetobacter* species, *Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*. The study showed that the incidences of VAP and CR-BSI were comparable to the National Nosocomial Infection Surveillance (NNIS) report. However, the incidence of CR-UTI was over the 90th percentile. The antibiotic resistance became a serious problem (Thongpiyapoom *et al.*, 2004).

CONCLUSION

In this study, no gender variation and few devices were used among the study group which might play a role in *Acinetobacter* nosocomial infections while diabetics were highly encountered. *Acinetobacter* species predominated among pathogens causing Nosocomial Blood Stream Infections (NBSIs) and an upsurge in the threat of antimicrobial resistance in the hospital occurred. Surveillance of the characteristics of NBSIs and antimicrobial resistance patterns, together with appropriate antibiotic and infection-control measures should be reinforced.

RECOMMENDATION

Further, Prolong studies are highly recommended to provide useful clinical and epidemiological information of the disease in the study area which can aid in diseases control strategies.

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