Original Article

Frequency of Nosocomial Infections with Antibiotic Resistant Strains of *Acinetobacter* spp. in ICU Patients

Maryam Amini[1], Ali Davati[2], Mahdieh Golestanifard[1]

1. Dept. of Infectious Diseases and Tropical Medicine, Shahed University, Tehran, Iran
2. Dept. of Social Medicine, Shahed University, Tehran, Iran

ABSTRACT

Background and Objective: ***Acinetobacter*** **spp. a Gram-negative coccobacillus is increasingly reported as important cause of nosocomial infections. Multi-drug resistance (MDR) of** ***Acinetobacter*** **spp., raises concerns over our ability to treat serious infections with these organisms. The aim of this study was to determine the frequency and associated risk factors for infections with MDR** ***Acinetobacter*** **spp. in ICU patients of Shahid Mostafa Khomeini Hospital, Tehran, Iran.**

Patients and Methods: **This descriptive-analytical and cross-sectional study was designed in 3 years period from April 2008 to March 2010 on 130 patients. For bacteriological analysis, sputum, blood, urine and wound specimens were used from patients within >48 hr after admission. Patient's clinical and epidemiologic data were collected, from recorded file, and correlated to** ***Acinetobacter*** **spp. infection. The data were analyzed using SPSS16 statistical software, chi-square, and Mann-Whitney test.**

Results: **The frequency of** ***Acinetobacter*** **spp. infection separately by years was 21.5%, 30.8% and 47.7% in 2008, 2009, 2010, respectively. All isolates were resistant to carbnicillin, piperacillin, cefotaxime and cephalotin, 99.2% to ciprofloxacin, cotrimoxazole and chloramphenicol, 97.7% to imipenem, 95.4% to tetracycline and 91.5% to gentamicin. The highest sensitivity was to amikacin 14.6%.**

Conclusion: **Nosocomial infections with** ***Acinetobacter*** **spp. during the three years, was a growing trend, and all isolates were MDR and highest susceptibility was to** ***Amikacin*****. Most important risk factors were incorrect diagnosis, inappropriate usage, doses, and time of antibiotic therapy, inappropriate formulation of some antibiotics.**

Key words: ***Acinetobacter*** **Infection, Multidrug Resistance, Intensive Care Unit**

Received: 11 January 2012
Accepted: 02 March 2012
Address communications to: Dr Maryam Amini, Department of Infectious Disease and Tropical Medicine, Shahed University, Tehran, Iran.
E-mail: mmamini55602@gmail.com

Introduction

Nosocomial infection refers to infection that develops during hospitalization and, there has not been during the incubation period at admission (1). It is well known that hospital infection is a health problem of modern societies. The important causes of nosocomial infections are *Acinetobacter* spp. (2). They are gram-negative, aerobic, non-mandatory, and encapsulated coccobacillus within family Moraxellaceae. They do not require to special conditions to grow and grow in the any pH and temperature. Transmission occurs from person to person (colonized or patient) or after contact with contaminated environment.

Acinetobacter spp. are the most common gram-negative microorganisms that are constantly on the levels and health care worker skin (2,3). Risk factors for nosocomial *Acinetobacter* spp. infection include increased length of hospital stay, surgery, wounds, broad-spectrum antibiotic therapy, parenteral nutrition, intravascular or urinary catheter, hospitalization in the ICU or burn unit, intubation and mechanical ventilation. Risk factors for community-acquired *Acinetobacter* spp. infection include alcoholism, smoking, renal failure, chronic lung disease and diabetes (3,4).

Acinetobacter spp. infections are detectable by blood, sputum, urine, wounds, and cerebrospinal fluid culture. Antimicrobial susceptibility can be investigated by various methods in which the method considered the gold is standard agar dilution (3). However, one major problem is the ability of microorganisms by variety mechanisms to gain resistance to antibiotics and the emergence of strains that are resistant to all commercially available antibiotics (5). The main concern there is that beta-lactamase producing *Acinetobacter* spp. includes serine and metallobeta-lactamase, which are resistant to carbapenems (6,7). Carbapenem resistant *Acinetobacter* spp. can cause treatment problem because carbapenems is the core of treatment for resistant gram-negative infections (8). According to Patwardhan (2008) MRAB (multi drug resistance strain of *A. baumannii*) resistant to all beta-lactams, fluoroquinolones and aminoglycoside, although it usually is polymyxin-sensitive,, but the pan resistant (resistant to all antibiotics except colistin) has been reported (9). The emergence of resistant strains of *Acinetobacter* spp. leading to increased length of hospital stay, mortality, and healthcare costs (10, 11).

The prevalence of infections with antibiotic resistant *Acinetobacter* spp. and their association with some factors such as length of hospital stay, recent hospital admission, and surgery, history of previous antibiotic use has not been determined in ICU patients of Shahid Mostafa Khomeini Hospital in Tehran. Therefore, to describe the prevalence and risk factors of *Acinetobacter* spp. in more details we conducted the present study on all of ICU patients with culture positive sample for *Acinetobacter* spp. during a three-year period. To take away from understanding underlying factors, the overall prevalence, antibiotic resistance, length of hospital stay, overall mortality rates and hospital costs resulting from hospital infections to be reduced.

Materials and Methods

This was a descriptive-analytical and cross-sectional study of 130 patients with *Acinetobacter* spp. culture positive sample and aged between 12-92 years admitted to ICU ward of Shahid Mostafa Khomeini Hospital, Tehran Iran from 2008-2010. All samples (including blood, urine, wound, sputum) culture grown by standard methods bacteriology were positive for *Acinetobacter* spp. of patients in at least two to three days of admission to the hospital has selected and studied over a three-years period (April 2008 to March 2010). Disk diffusion method was used for antibiogram to determine antibiotic resistance of *Acinetobacter* spp. Antibiotics has been used for antibiogram include amikacin, gentamicin, carbnicillin,, piperacillin, imipenem, cotrimoxazole, tetracycline, cefotaxime, cephalotine, ciprofloxa-

cin and chloramphenicol.

For patients with positive cultures of *Acinetobacter* spp. factors such as length of hospital stay, underlying disease, history of hospitalization, recent surgery, and antibiotic therapy, was obtained. Based on the definitions of NNIS (National Nosocomial Infection Surveillance) those patients had no symptoms of infection or their cultures were less than two to three days of admission or was incomplete information on their records, and all patients with negative culture or culture positive with another bacteria were excluded. The data were analyzed by using SPSS16 statistical software and chi-square and Mann-Whitney test We considered differences significant at $P<0.05$.

Results

Of 130 patients with positive cultures of *Acinetobacter* spp. were 70 males (53.8%) and 60 females (46.2%). The average age was 17.19 ± 68.8 years with range between 92-12 years. The most infection rates observed at ages above 50 years. The prevalence of infection with *Acinetobacter* spp. based on year was as follows: of 130 samples, 28 (21.5%), 40 (30.8%) and 62 (47.7%) were in 2008, 2009, and 2010 year, respectively. Of the total patients, 117(90%) case had healthcare associated pneumonia (HAP) and sample was sputum, 9 (6.9%) case had wound infection, 3(2.3%) had UTI and sample was urine and 1(0.8%) had bacteremia (BSI) and sample was blood. Average length of stay in hospital is 31.7 days. Of the total patients studied, 91 patients (70%) had a history of hospitalization during the past 6 months and 39 (30%) had not history of previous hospitalizations. Totally, 103 patients (79.2%) had underlying disease and 27 cases (20.8%) had not any underlying disease. Similarly, 41 patients (31.5%) had a history of surgery within the past 6 months and 89 cases (68.5%) had no such history.

In 95 patients (73.1 percent), history of previous antibiotic therapy was seen and 35 patients (26.9%) had no such history. Of 117 sputum samples, in 112 cases (95.7 percent) patient were connected to the ventilator (VAP). Antibiotic resistance of *Acinetobacter* spp. was high compared to most antibiotics that are given in Table 1.

Table 1 - The frequency of resistance and sensitivity to various antibiotics against *Acinetobacter* spp.

Resistance (%)	Sensitivity (%)	Resistance (N)	Sensitivity (N)	Antibiotic
100	0	130	0	Carbnicillin
100	0	130	0	Piperacillin
100	0	130	0	Cefotaxime
100	0	130	0	Cephalotine
99.2	0.8	129	1	Ciprofloxacin
99.2	0.8	129	1	Cotrimoxazole
99.2	0.8	129	1	Chloramphenicol
97.7	2.3	127	3	Imipenem
95.4	4.6	124	6	Tetracycline
91.5	8.5	119	11	Gentamicin
85.4	14.6	111	19	Amikacin

The highest sensitivity was to *amikacin* (14.6%). In addition, all isolates were resistant to three classes of antibiotics is the indicator for multi-drug resistance. Antibiotic resistance with an underlying disease, length of hospital stay, history of admission, recent surgery, and antibiotic treatment before infection, had no meaningful relationship.

Discussion

Our study demonstrated that the prevalence of hospital infection with *Acinetobacter* spp. in three years was on a growing trend, and all isolates had multiple drug resistance. The most probable explanation for this increasing trend is incorrect use of antibiotics to treat viral infections, incorrect diseases identifying, incorrect doses of antibiotics, inappropriate treatment duration (less or more than been recommended time), arbitrary use of antibiotics, prescription of antibiotics by unaware persons, inappropriate formulation, and low quality of some of antibiotics.

Results of our study indicate that respiratory infections were the most common source of clinical isolates of *Acinetobacter* spp., which has also been observed earlier (12). However, after urinary tract infection, pneumonia was the second most common infection in hospitals. (13). Elderly people (aged above 50 years) due to a weak immune system, were most at risk to infections and risk of nosocomial infections by opportunistic microorganisms. In ICU admitted patients due to severe illness, long-term hospitalization and use of invasive procedures risk for infection is high (12).

In our study, average age 17.19 ± 68.8 years were infected with *Acinetobacter* spp. and most of these infections were age over 50 years. Based on our findings, the prevalence of infection with *Acinetobacter* spp. from 21.5 % in 2006 increased to 47.7% in 2008. Today it is proven that the majority of *Acinetobacter* spp. resistance to beta lactam antibiotics, quinolones, and aminoglycosides resistance that is growing (14). According to the results of this study, most of *Acinetobacter* spp. were resistant to carbnicillin, piperacillin, cefotaxime, cephalotin, although mostly were susceptible to amikacin and gentamicin. In another study, all Acinetobacter spp. isolates were resistant to cephalosporins, carbnicillin and ticarcillin, but 44% were susceptible to amikacin (15). However, the results are in disagreement with those of another study where all isolates of *A. bomany* were susceptible to *wmipenem* (16). One of the important characteristics of *Acinetobacter* spp. strains is resistance to multiple classes of antibiotics, which creates many problems in the treatment of hospital infections (17). In our study, all isolates had multiple drug resistance while in Hujer *et al.* study (18), 89% of isolates were resistant to at least three classes of antibiotics. However, in Sadeghifard *et al.* study, 100% of isolates had multiple drug resistance, which was in agreement with our results (15). Hospital infections are important because of increasing incidence, mortality, cost, and economic losses (12).

Conclusion

Hospital infection control, although a costly, difficult and time consuming but is necessary and affordable. The emergence of resistant strains of *Acinetobacter* spp. leads to increased length of hospitalization, medical expenses, and mortality (10, 11). So recognition, inhibition and the introduction of various resistance mechanisms used by strains of hospital acquired *Acinetobacter* spp., would be of importance.

Acknowledgement

This article extracted from medical student thesis by Miss Mahdiyeh Golestanifard. Authors would like to thank Miss Mahdiye Golestanifard and Dr. Jalali nadoushan, chairperson of laboratory ward, and other staff of Shahid Mostafa Khomeini Hospital for their kind attention and cooperation. The authors declare that there is no conflict of interests.

References

1. Akbari M, Davoudzade M, Rozbahani H, Tarhi M, Bayat A, Radsari E. Types of pathogens isolated from hospital staff gowns Martyrs Khorramabad tribes in 2003-2004 years. Lorestan University of Medical Sciences Journal 2005;7(2):11-6.

2. Khosroshahi N, Sharifi M. Carbapenem resistant *Acinetobacter* strains isolated from patients in intensive care units and equipment of health centers in Qazvin in 2006-2007. Iranian Journal of Medical Microbiology 2007;3(1):33-8.

3. *Acintobacter*. Available at: http:// www.infectious disease. Louisiana.dhh.gov. Accessed 2008.

4. Bennani B, Selmani R, Mahmoud M, Nejjari C, Kanjaa N. Nosocomial pneumonia in mechanically ventilated patients: prospective study in intensive care unit of Fez university hospital. Saudi journal of Anaesthesia 2008;2(2):46-51.

5. Wareham D, Bean D, Khanna P, Hennessy E, Krahe D, Ely A, *et al*. Blood stream infection due to *Acintobacter* spp: epidemiology, risk factor and impact of multi drug resistance. Eur J Clin Microbiol Infect Dis 2008;27(7):607-12.

6. Munoz-price LS, Weinstein RO. Acintobacter infection. N Engl J Med. 2008; 358(12):1271-81.

7. Mshana ST, Kamugisha ER, Mirambo MA, Chakraborty TR, Lyamuya EL. Prevalence of multi resistant gram negative organisms in a tertiary hospital in Mwanza,Tanzania. BMC Res Notes 2009; 2: 49-54.

8. Zarrilli RA, Crispino MA, Bagattini MA, Barretta EL, Di Popolo AN,Triassi MA, *et al*. Molecular epidemiology of sequential out breaks of A.baumannii in ICU shows the emergence of carbapenem resistance. J Clin Microbial 2004;42(3):946-53.

9. Patwardhan R, Dhakephalkar P, Niphadkar K, Chopade B. A Study of nosocomial pathogen in ICU with special reference to multi resistant *Acintobacter baumannii* harbouring multiple plasmids. Indian J Med Res 2008;128(2):178-87.

10. Jen shih MU, Yao lee NA, Chun lee HS, Ming chang CH, Jung wu CH, Ling chen PO, *et al*. Risk factor of multi drug resistance in nosocomial bacteremia due to *Acinetobacter baumannii*. J Microbiol Immunol Infect 2008;41(2):118-23.

11. Sunenshine RE, Wright MA, Maragakis LI, Harris AN, Song XI, Hebden JO, *et al*. Multi drug resistant *Acintobacter* infection mortality rate and length of hospitalization. Emerg Infect Dis 2007; 13(1):97-103.

12. Ghorbanalizadegan M, Ranjbar R, Izadi M, Esmaili D, Ahmadi A, Goudarzi Z. Prevalence of *Pseudomonas aeruginosa* and *Acinetobacter* with multi drug resistance in patients admitted to hospital Baghiatollah. Ilam university of Medical Sciences Journal 2007;15(1):1-5.

13. Flanders S, Collard H, Saint S. Nosocomial *pneumonia*: state of the science. Am J Infect Control 2006;34(2):84-93.

14. Van Looveren M, Goossens H. Antimicrobial resistance of *Acinetobacter* spp. in Europe. Clin Microbiol Infect 2004;10(8):684–704.

15. Sadeghifard N, Ranjbar R,Ghasemi A, Pakzad I, Zaimi J,Zameri A, *et al.* Evaluation of drug resistant strains of *Acinetobacter baumannii* and other species isolated from three hospitals, Tehran. Ilam university of Medical Sciences Journal 2006;14(3):29-36.

16. Basustaoglu AC, Kisa O, Sacilik SC. Epidemiological characterization of hospital-acquired *Acinetobacter baumannii* isolates from a 1500-bed teaching hospital by phenotypic and genotypic methods. J Hospital Infect 2001;47(3):246-49.

17. Khaltabadi R, Moniri R, Shajari G, Nazem M,Mousavi G, Ghasemi A, *et al.*The pattern of antibiotic resistance and spread of antibiotic resistance genes in *Acinetobacter* strains isolated from Kashan. Faiz J Med Res 2009;12(4):60-6.

18. Hujer KM, Hujer AM, Hulten EA, Bajaksouzian S, Adams JM, Donskey CJ, *et al.* Analysis of antibiotic resistance genes in multi drug resistant *Acintobacter* spp. isolates from military and civilian patients treated at the Walter Reed Army Medical Center. Antimicrob Agent Chemother 2006;50(12): 4114-23.