Full Length Research Paper

Frequency of nosocomial infections with antibiotic resistant *Acinetobacter* spp*.* in intensive care unit (ICU) patients

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Acinetobacter is a Gram-negative coccobacillus and one of the most nosocomial infections. *Acinetobacter* spp resistant strains in the world have created health problems. The aim of this study was to determine the prevalence and associated risk factors for infections with multi drug resistance (MDR) of *Acinetobacter* spp. in patients admitted to the ICU of Shahid Mostafa Khomeini Hospital, Tehran, Iran, 2008 to 2010. This descriptive-analytical and cross-sectional study was designed on all of the 130 patients with culture positive for *Acinetobacter* spp*.* Microbiologic and specific demographic data were extracted from patient's laboratory and archive file. The data were analyzed by using SPSS16 statistical software and chi-square and Mann-Whitney test. The prevalence of infection with *Acinetobacter* spp. separately by years was: 21.5, 30.8 and 47.7% in 1386, 1387 and 1388, respectively. 100% isolates were resistance 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*. Highest percentage sensitivity was to *Amikacin* 14.6%. Nosocomial infections with *Acinetobacter* spp*.* during the three years, was a growing trend and all isolates were MDR and the highest susceptibility was to *Amikacin*. It seems that the incorrect diagnosis, use of antibiotics for viral infections, inappropriate doses and time of antibiotic therapy (less or more), inappropriate formulation and low quality of some of antibiotics, are the most important cause of MDR. The proper use of antibiotics to prevent MDR bacterial nosocomial infections is recommended.

Key words: *Acinetobacter* spp*,* intensive care unit (ICU), multi drug resistance (MDR), nosocomial infections*.*

INTRODUCTION

Nosocomial infection refers to infection that developed during hospitalization and not during the incubation period at admission (Akbari et al., 2005). It is well known that hospital infection is a health problem of modern societies. The important causes of nosocomial infections are *Acinetobacter* spp. (Khosroshahi and Sharifi, 2007). *Acinetobacter* spp*,* are Gram-negative, aerobic, non-mandatory and encapsulated coccobacillus within family Moraxellaceae. Bacteria do not require special conditions

to grow and grows in 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 are constantly on the levels and health care worker skin (Khosroshahi and Sharifi 2007; www.infectious disease, accessed 2008). Previous studies showed that 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 intensive care unit (ICU) or burn unit, intubation and mechanical ventilation and risk

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factors for community-acquired *Acinetobacter* spp. infection include: Alcoholism, smoking, renal failure, chronic lung disease and diabetes (Bennani et al., 2008). *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 dillusion (www.infectious disease, accessed 2008). .But one major problem is, the ability of microorganisms by the variety mechanisms to gain resistance to antibiotics and the emergence of strains that are resistant to all commercially available antibiotics (Wareham et al., 2008). The main concern there is that beta-lactamase producing *Acinetobacter spp.* include serine and metallobeta-lactamase which are resistant to *Carbapenems* (Munoz-price and Weinstein 2008; Mshana et al., 2009). *Carbapenem* resistant *Acinetobacter* spp. can cause treatment problem because *Carbapenems* is the core of treatment for resistant Gram-negative infections (Zarrilli et al., 2004). According to Patwardhan et al. (2008) multi drug resistance strain of *A. baumannii* (MRAB) 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 by Patwardhan et al. (2008). The emergence of resistant strains of *Acinetobacter* spp. leading to increased length of hospital stay, mortality and healthcare costs (Jen et al., 2008; Sunenshine et al., 2007). 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. So 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 to 92 years admitted to ICU ward of Shahid Mostafa Khomeini Hospital, Tehran Iran from 2008 to 2010. All culture samples (including blood, urine, wound, sputum) grown by standard methods bacteriology were positive for patients with *Acinetobacter* spp. who have been admitted into the hospital for at least two to three days. The samples were selected and studied over a three-year period (from 2008 to 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*, *Ciprofloxacin* and

Chloramphenicol.

Then, in 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 National Nosocomial Infection Surveillance (NNIS) those patients had no symptoms of infection or were cultures in the hospital 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 and 12 years. The most infection rates was observed at ages above 50 years. The prevalence of infection with *Acinetobacter* spp. based on year was as follows: Of 130 samples, about 28 (21.5%), 40 (30.8%) and 62 (47.7%) in 2008, 2009 and 2010, year, respectively. Of the total samples, 117 (90%) samples were sputum, 9 (6.9%) wound, 3(2.3%) urine and blood 1(0.8%). 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 no history of previous hospitalizations.

103 patients (79.2%) had underlying disease and 27 case (20.8%) had no underlying disease. Similarly, 41 patients (31.5%) had a history of surgery within the past 6 months and 89 case (68.5%) had no such history.

In 95 patients (73.1%), 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%) patient were connected to the ventilator. Antibiotic resistance of *Acinetobacter* spp was high compared to most antibiotics that are given in Table 1.

Highest sensitivity was to *Amikacin* (14.6%). Also, 100% of isolates were resistant to three classes of antibiotics is the indicator for multi drug resistance. The results showed that 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 the prevalence of hospital infection with *Acinetobacter* spp. in three years on a growing trend, and all isolates had multiple drug resistance. The most probable explanation for this increasing trend is the 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

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

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

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 in the Qorban Ali and colleagues study's (Ghorbanalizadegan et al., 2007). But in studies by other researchers, after urinary tract infection, pneumonia was the second most common infection in hospitals (Flanders et al., 2006). 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 (Ghorbanalizadegan et al., 2007). 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 the findings of this study, the prevalence of infection with *Acinetobacter* spp*.* increases from 21.5% in year 2008 to 47.7% in year 2010. Today it is proven that the majority of *Acinetobacter* spp*.* resistance to beta lactam antibiotics, quinolones, and aminoglycosides resistance that is growing (Van Looveren and Goossens, 2004). According to the results of the study, *Acinetobacter* spp*.* was most resistance to *Carbnicillin*, *piperacillin, cefotaxime*, *cephalotin* and most low-level resistance to *amikacin* and *gentamicin*, respectively; our results support those of Sadeghifard et al. in years 2004 to 2006, in which was determined that all *Acinetobacter* spp*.* isolates, were resistant to *cephalosporins, Carbnicillin* and *Ticarcillin* and 44% of isolates were susceptible to *amikacin* (Sadeghifar et al., 2006). However the results are in disagreement with those of Basustaoglu et al. (2001) in which all isolates of the strains of *Acinetobacter bomany* showed susceptibility to *Imipenem*, which is in sharp contrast with the results of this study (Basustaogl et al., 2001). One of the important characteristics of *Acinetobacter* spp. strains resistant to multiple classes of antibiotics creates many problems in the treatment of hospital infections (Khaltabadi et al., 2009). In our study,

all isolates had multiple drug resistance which is more than the results of the study done by Hujer et al. (2006) in which 89% of isolates were resistant to at least three classes of antibiotics which is the standard for multi drug resistance. But, in Sadeghifard et al. (2006) study, 100% of isolates had multiple drug resistance, which is agreement with our results. Hospital infections are important because of increasing incidence, mortality, cost and economic losses (Ghorbanalizadegan et al., 2007). Hospital infection control, though costly, difficult and time consuming, it is necessary and affordable. The emergence of resistant strains of *Acinetobacter* spp. lead to increased length of hospitalization, medical expenses and mortality (Jen et al., 2008; Sunenshine et al., 2007). So recognition, inhibition and the introduction of various resistance mechanisms used by strains of hospital acquired *Acinetobacter* spp, would be of importance. We recommend further studies using a larger sample to investigate global prevalence and risk factors of *Acinetobacter* spp*.* infections.

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REFERENCES

Akbari M, Davoudzade M, Rozbahani H, Tarhi M, Bayat A, Radsari E (2005). Types of pathogens isolated from hospital staff gowns Martyrs Khorramabad tribes in 2003-2004 years. Lorestan Univ. Med. Sci. J. 7(2):11-16.
Acintobacter (2008). Available at: http://www.infectiousdisease. Accessed (2008). Louisiana.dhh.gov.
Bennani B, Selmani R, Mahmoud M, Nejjari C, Kanjaa N (2008). *Nosocomial* pneumonia in mechanically ventilated patients: prospective study in intensive care unit of Fez university hospital. Saudi J. Anaes. 2(2):46-51.
Basustaoglu AC, Kisa O, Sacilik SC (2001). Epidemiological

characterization of hospital-acquired *Acinetobacter baumannii* isolates from a 1500-bed teaching hospital by phenotypic and genotypic methods. J. Hosp. Infec. 47:246-249.

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

Ghorbanalizadegan M, Ranjbar R, Izadi M, Esmaili D, Ahmadi A, Goudarzi Z (2007). Prevalence of *Pseudomonas aeruginosa* and *Acinetobacter* with multi drug resistance in patients admitted to hospital Baghiatollah. Ilam Univ. Med. Sci. J. 15(1):1-5.

Hujer KM, Hujer AM, Hulten EA, Bajaksouzian S, Adams JM, Donskey CJ (2006). Analysis of antibiotic resistance genes in multi drug resistant *Acinetobacter* spp. isolates from military and civilian patients treated at the walter reed army medical center. J. Antimicrob. Chemother. 50(12):4114-4123.

Jen SMU, Yao INA, Chun IHS, Ming CCH, Jung WCH, Ling CPO (2008). Risk factor of multi drug resistance in *nosocomial bacteremia* due to *Acinetobacter baumannii*. J. Microb. Immunol. Infect. 41:118-123.

Khosroshahi N, Sharifi M (2007). Carbapenem resistant *Acinetobacter* strains isolated from patients in intensive care units and equipment of health centers in Qazvin in 2006-2007. Iran. J. Med. Microb. 3(1):33-38.

Khaltabadi R, Moniri R, Shajari G, Nazem M, Mousavi G, Ghasemi A, (2009). The pattern of antibiotic resistance and spread of antibiotic resistance genes in *Acinetobacter* strains isolated from patients, Kashan. Faiz J. Med. Res. 12(4):60-66.

Munoz-price LS, Weinstein RO (2008). *Acintobacter* infection. N. Eng. J. Med. 358:1271-281.

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

Patwardhan R, Dhakephalkar P, Niphadkar K, Chopade B (2008). A Study of *nosocomial* pathogen in ICU with special reference to multi resistant *Acintobacter baumannii* harbouring multiple plasmids. Ind. J. Med. Res. 128:178-187.

Sunenshine RH, Marc-Oliver W, Lisa LM, Anthony DH, Xiaoyan S, Joan H, Sara EC, Ashley A, Jennifer C, Daniel BJ, David GK, Trish MP, Harold CS, Arjun S (2007). Multi drug resistant *Acintobacter* infection mortality rate and length of hospitalization. J. Emer. Infect. Dis. 13(1):97-103.

Sadeghifard N, Ranjbar R, Ghasemi A, Pakzad I, Zaimi J, Zameri A (2006). Evaluation of drug resistant strains of *Acinetobacter baumannii* and other species isolated from three hospitals, Tehran. Ilam Univ. Med. Sci. J. 14(3):29-36.

Van LM, Goossens H (2004). Antimicrobial resistance of *Acinetobacter spp* in Europe. J. Clin. Microb. Infect. 10:684-704.

Wareham D, Bean D, Khanna P, Hennessy E, Krahe D, Ely A (2008). Blood stream infection due to *Acintobacter spp*: epidemiology, risk factor and impact of multi drug resistance. Eur. J. Clin. Microb. Infect. Dis. 27:607-612.

Zarrilli RA, Crispino MA, Bagattini MA, Barretta EL, Di Popolo AN, Triassi MA (2004). Molecular epidemiology of sequential out breaks of *A. baumannii* in ICU shows the emergence of carbapenem resistance. J. Clin. Microb. 42(3):946-953.