

Hospital Acquired Antibiotic-Resistant *Acinetobacter Baumannii* Infections in a 400-Bed Hospital in Tehran, Iran

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ABSTRACT

Objectives: *Acinetobacter baumannii* is an omnipresent pathogen known as a major agent in healthcare and nosocomial-associated infections. Its ability to develop resistant pattern to the major and broad spectrum antibiotics is an important issue to be studied.

Methods: In this study, 101 strains of *Acinetobacter baumannii* were isolated from the hospitalized patients during July 2007 to June 2009 in one teaching hospital in the southern Tehran. The identification of *Acinetobacter baumannii* and resistant pattern was performed by using conventional bacteriological methods and Clinical Laboratory and Standards Institute (CLSI).

Results: Respiratory tract specimens were the most common place of *Acinetobacter* isolation. The organism was resistant to ceftazidime (96%), ceftizoxime (95%), ceftriaxone (93%), amikacin (58%), gentamicin (68%), co-terimoxazole (85%), and ciprofloxacin (85%). This pattern also pointed that imipenem had the lowest resistance rate (9%).

Conclusions: Susceptibility rates of *Acinetobacter baumannii* isolates to third-generation cephalosporins, fluoroquinolones, amikacin, gentamicin, and trimethoprim/sulfamethoxazole (SXT) were very low and the rate of resistant *Acinetobacter baumannii* to imipenem was significant. It would be a good idea to consider surveillance of antibiotic usage and restriction of using broad spectrum antibiotics before development of resistance to these agents.

Keywords: *Acinetobacter Baumannii*, Resistance, Susceptibility, Imipenem

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INTRODUCTION

Acinetobacter (*A.*) *baumannii* can be found in various environmental sources such as soil and foods, including vegetables, meat, and fish. *A. baumannii* may infrequently colonize the skin of healthy human, typically at a low-density and for short-term duration. Colonization of other body sites, such as the throat, nares, and the intestinal tract, was seen rarely in healthy individuals.¹⁻⁵

The organism has known as an important and common pathogen creating nosocomial pneumonia and bacteremia among patients who admitted in the intensive care unit (ICU) worldwide,⁶⁻⁹ followed by skin, soft tissue, and urinary tract infection,^{6,10,11} and secondary meningitis^{12,13} over the past few decades.

The incidence of *A. baumannii* infections has raised over the past decades,^{6,8} which could be related to a rise in the proportion of the susceptible population as a result of advancements in medical support of critically ill and frail patients.¹¹ The rate of multidrug resistance *A. baumannii* strains accounted for non-ICU inpatients (27.6 to 32.5%) and ICU patients (11.6 to 24.2%) between 1998 and 2001.¹⁵

The rate of multidrug-resistant *A. calcoaceticus-baumannii* complex was 29.3% of isolates in the Middle Atlantic and East South Central regions.¹⁶ This seems very difficult to treat *A. baumannii* infections due to the increasing number of multi-drug resistant and the outcome in patients without commencing on appropriate empiric therapy might be worse.¹⁷⁻¹⁹ The mortal-

ity rate of 7.8% to 23% accounted for hospitalised patients with *A. baumannii* infection and the rate was 10% to 43% among ICU admitted patients with *A. baumannii* infection.¹⁶ The outcomes of patients with *A. baumannii* infections seem to be poorer if caused by isolates with resistance to multiple classes of antimicrobial agents.⁸

The aim of this study was to determine the prevalence of drug resistance in *A. baumannii* and predisposing factors for acquisition of infection caused by this organism in one teaching hospital in the southern Tehran.

METHODS

This study was conducted in Loghman Hakim hospital with 400 beds located in the south of Tehran, Iran. Between July 2007 and June 2009, *A. baumannii* isolates of patients admitted at least 48 hours in the hospital were tested. The specimens of patients included respiratory tube, urine, wound, and blood. The identification of *A. baumannii* and resistant pattern was performed by using Conventional bacteriological methods and Clinical Laboratory and Standards Institute (CLSI).

This study included two parts: filling a questionnaire form up and taking laboratory tests. The questionnaire included demographic characteristics (age and gender), underlying diseases, presence of catheters (such as intravenous and intraurethral catheters), the name of admission ward, history of being in intensive care unit (ICU), the length of ICU admission, using mechanical ventilation, taking antibiotic therapy in the past history of recent hospitalization and recent operation.

Recent hospitalization was meant as an admission in any hospital ward over the last year. Recent operation was defined as any major surgical procedure performing in the operating room within current admission. Taking antibiotic therapy was noticed if patient was given any antibiotics for at least 2 days within 3 months before isolating the organism.

Laboratory tests were performed including MacConkey and blood agar plates for all specimens as routine, Trypticase Soy Broth (TSB), and sub-cultured on chocolate agar for blood specimens, and chocolate agar for specimens other than urine. All of the suspected colonies were assessed by Gram-staining, colonial morphology, negative oxidize, and other biochemical reactions.²⁰

Disk diffusion method recommended by clinical laboratory and standards institute (CLSI) was used to evaluate antimicrobial susceptibility of the isolated organisms.²¹ The brand of all antibiotic disks used in this research were Oxoid Ltd. (Basingstoke, UK). Briefly, a suspension of each isolate was prepared; so that the turbidity was equal to 0.5 McFarland standards and then plated onto Mueller-Hinton agar. After incubation at 35°C for 18-24 hours, diameter of inhibition zones was measured and data were reported as susceptible, intermediate, and resistant. The study was approved by the ethics committee of School of Medicine, Shaheed Beheshti University of Medical Sciences.

Statistical analysis was performed by using version 11.5 SPSS software (SPSS Inc., Chicago, IL). A two-tailed P-value < 0.05 was considered statistically significant.

RESULTS

Overall, 101 strains of *A. baumannii* were isolated from the hospitalized patients between July 2007 to June 2009 from different wards of Loghman Hakim Hospital, Tehran, Iran. The mean age of patients with *A. baumannii* isolates was 42 ± 19.4 year.

The men were 80 (70%), 77 (67%) patients had mechanical ventilation, 15% had diabetes mellitus, 85 (74%) patients were admitted in ICU wards and 60 (52%) had surgical procedures, 87 (76%) took antibiotic, 85 (74%) were discharged from hospital and 30 (26%) died.

Respiratory tract was the most common place (39%) of *Acinetobacter* isolation including tracheal secretion (31.3%), sputum (7%), and bronchoalveolar lavage (0.9%); Other common sites were urine (22%), blood (5%), CSF (17.5%), wound (9.5%), catheter (4.5%), and other (1.5%).

The rate of resistance was 93% for ceftriaxone, 95% for ceftizoxime, 96% for ceftazidime, 58% for amikacin, 68% for gentamicin, 85% for co-trimoxazole, 83% for norfloxacin, 85% to ciprofloxacin, and 19% for Imipenem.

Statistical analysis showed that ICU admission and length of using mechanical ventilation were confounding factors significantly associated with the acquisition of resistant *A. baumannii* isolates. *Acinetobacter baumannii* isolated from tracheal aspirate had also higher rates of resistance to tested antibiotics.

DISCUSSION

Present study showed that most of the isolates of *A. baumannii* were obtained from tracheal tube aspiration; and mechanical ventilation was the most important risk factor for these infections. This organism has been known as the most frequent cause of respiratory tract infections, with strains being isolated from 3 to 5% of patients with nosocomial pneumonia.²²

A substantial increase in the rates of antibiotic resistance of *A. baumannii* has also been documented during the past decades.^{6,8} In our study, more than 90% of *A. baumannii* isolates were resistant to the third-generation cephalosporins and 80% of isolates were resistant to fluoroquinolones.

Rahbar and Hajian²³ showed that the rate of resistance of *A. baumannii* to imipenem was low in 2005-2006. Present study revealed that imipenem resistant isolates is increasing. The important risk factors for acquiring an imipenem-resistant *A. baumannii* include previous carbapenem use, longer duration of hospital admission before occurring infection, ICU admission, urgent surgery, being on total parenteral nutrition, and using tubes and catheter such as central venous catheter, endotracheal tube, urinary catheter, and nasogastric tube.^{24,25} Furthermore, improved adherence of health-care workers to hand-hygiene protocols is of paramount importance for the containment of *A. baumannii* transmission.^{26,27} Mortality rate in this study was 26%. Other researchers have reported a wide range of mortality from 7% to 43%.^{16,19}

CONCLUSION

There was a high resistant rate to available and common antibiotics and also imipenem. It seems that infection control strategies may help to control the evolving problem of *A. baumannii* infections and prevent an epidemic nosocomial life threatening infections.

Conflict of interest statement: All authors declare that they have no conflict of interest.

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