Original Article

A. baumannii, Infection Rate and Antimicrobial Susceptibility in an Iranian Tertiary Care Hospital

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ABSTRACT

Background and Objectives: A. baumannii is a cause of various infections with significant morbidity and mortality in the world. The aim of this study was to determine infection rate and antimicrobial susceptibility of *A. baumannii* in an Iranian tertiary care Hospital.

Materials and Methods: This study was performed on 166 positive blood cultures for *A. baumannii*, received from different wards of Imam Hospitals complex in Tehran, during two years. Disk diffusion method was used to survey several antibiotics resistance. Data were analyzed by spss software, chi square test.

Results: A. baumannii was resistant to imipenem (26.9%), gentamicine (32.2%), carbenicillin (36.4%), cephotaxime(41.7%), ampicillin (66.7%), amikacine (69.4%), ciprofloxacin (74.3%), cotrimoxazol (86.3%),piperacillin (91%), Ceftriaxone (92.5%), cefixime (99.2%), amoxiclave (100%), cefepime(100%), ceftazidime (100%). ICUs (50.6%) and Pediatrics Wards (2.4%) were the most and the least frequent wards in which *A. baumannii* were isolated.

Conclusions: Due to antibiotic resistance pattern change among *A. baumannii* and its consequences, it is recommended to control infection associated risk factors as well as further researches aiming identification of different of patterns in resistance and sensitivity to antibiotic.

Key Words: *A. baumannii*, Infections, Microbial Sensitivity Test

Introduction

Nosocomial infections have become one of the most important problems of health care providing systems in many countries especially in developing countries. They rise mortality and morbidity among admitted patients (1).

A. baumannii is one of the most important organisms in nosocomial infections in particularly with pneumonia, septicemia, and infections among ill and immune-suppressed patients (1). *A. baumannii* causes various infections such as pneumonia, urinary tract infections (UTI), meningitis, and septicemia and leads to high mortality rate in patients with serious underlying diseases. They are not commonly part of the human flora; and their relatively high prevalence in hospital environment frequently results in colonization of the skin and respiratory tract (2). *A. baumannii* is aerobic non-fermentative gram-negative coccobacilli (3).

Nowadays *A. baumannii* is seen more prevalent and it is seen in different hospital wards predominantly in ICU, NICU, transplant, and burn wards. Multi-Drug-Resistance (MDR) types of this organism have become a serious problem in nosocomial infections in burn wards due to long and imprecise administration of antibiotic drugs (4). In one study, 11.8% of obtained organisms were *A. baumannii*, 98.7% of which were ceftazidime resistant and unexpectedly 59.5% imipenem resistant(4). Within years 2003 to 2006, a rising prevalence of *A. baumannii* as MDR organism has been observed in burn wards (5).

In one study, 31 neonates in one year were admitted in NICU due to *MDR-A. baumannii* nosocomial infection which leads to 10% mortality(6). Mechanical ventilation and use of carbapenem were seen more in these infected neonates (7).

Underlying diseases such as malignancies and end stage renal disease, imprecise usage of antibiotics and even high blood creatinine concentration are reported as high mortality risk factors in these patients(8).

Due to the high prevalence rate of this infection as well as various patterns of antibiotic resistance in different studies, an investigation on prevalence rate and antibiotic sensitivity pattern in various sites is essential.

In this study, we decided to determine more accurate tools for the selection of Suit *A. baumannii* antimicrobial therapy for patients and the infection rate, risk factors for its multi drug resistance, also resemble it in several wards of a hospital.

Materials and Methods

We made a descriptive cross-sectional study from Aug 2006 to Aug 2008.This study was performed at the Imam Hospitals Complex that is one of the teaching hospitals of Tehran University of Medical Sciences, Iran. The wards included in our study are defined as below:

G1: ICUs. G2: Infectious Department. G3: Internal Department. G4: Emergency Room G5: Pediatrics Department. G6: NICU and Infants ward. G7: Surgical Department.

A case was described as any patient who developed *A. baumannii* after 48 h of admission into the hospital.

Venous blood was obtained from patients by nursing personnel throw aseptic techniques. (3-5 ml of blood into bottles containing 5-10 ml of supplemented trypticase soy broth in children and 10 ml of blood into bottles with 15-20 ml of supplemented trypticase soy broth in adult) and incubated at 37 °C. Blood from bottles showing positive growth index was gram stained and those with gram-negative rods or coccobacilli were subcultured on 5% sheep blood and Mac- Conkey agar plates and incubated aerobically for 24h at 37 °C. Isolates were identified as *A. baumannii* by an oxidase negative, catalase positive (Compliance with National Committee for Clinical Laboratory Standards (NCCLS) guidelines) .Multiple blood culture yielding the same organism from the same patient was considered to be a single infection.

Data recorded of these patients such as age, sex, detailed information about intensive procedures and treatment before and after the onset of blood stream infection were based on definition of CDC.

The antibiotic susceptibility of *A. baumannii* isolates were determined by the disk diffusion method on Muller Hinton agar plates with using calibrated inoculums of the isolates based on McFarland standard with the following antibiotics: (Mast group company Ltd., Merseyside, U.K.) (Compliance with National Committee for Clinical Laboratory Standards(NCCLS) guidelines) amikacine, gentamicine, amoxiclave, ampicilline, carbenicillin, piperacilline, cefepime,

cefixime, cephotaxime, ceftazidime, ceftriaxone, ciprofloxacin, trimethoprime-sulfamethoxazole and imipenem.

We explained *A. baumannii* as MRD when the organism was resistant to three antibiotics out of the following four: ceftazidime, ciprofloxacin, gentamicin and imipenem. Analyses for comparing antibiotic resistance were performed on the ward groups which contain more than 10 patients (ICUs, Emergency, Internal department).

Statistical analysis was carried out using SPSS version 11.5 and resembled with Chi-square test.

All tests were two-tailed with *P*<0.05 considered significant. This study accepted by Ethical Committee of Tehran University of Medical Sciences.

Results

A total of 166 cases with *A. baumannii* blood stream infection were reported from 7 different wards (ICU, Internal ward, surgical ward, Pediatrics, NICU and infants, Infectious ward, Emergency) during 2 years of study out of 5760 (2.8%) positive blood culture in our hospitals complex. The average age of patients was 54± 6 of years with median age 51 years. Table No I shows the frequency of *A. baumannii* in each ward group.

Table 1: Frequency of *A. baumannii* in each ward group (In total positive blood culture).

Ward groups	Frequency (%)
G1	51.2
G2	5.5
G3	18.3
G4	13.4
G5	2.4
G6	3.0
G7	6.1
Total	**100.0**

G1:ICUs.
G2:Infectious Department.
G3:Internal Department.
G4:Emergency.
G5:Pediatrics Department.
G6:NICU and Infants ward.
G7:Surgical Department

Evaluation of *A. baumannii* antibiotic resistancy to different antibiotics (Amikacine, gentamicine, amoxiclave, ampicilline, carbenicillin, piperacilline, cefepime, cefixime, cephotaxime, ceftazidime, ceftriaxone, ciprofloxacin, trimethoprime-sulfamethoxazole and imipenem) shows the most resistance to cefepime, ceftazidime and amoxiclave (100%) and the least resistance to imipenem(26.9%) and intermediate resistant was observed to aminoglycosides, carbenicillin (Table 2).

There was a significant relationship between the ward in which *A. baumannii* was isolated and the rate of antibiotic resistance, such as: ciprofloxacin (*P* = 0.005), imipenem (*P* = 0.005), piperacillin (*P* = 0.002) amikacine (*P* = 0.02), cotrimoxazole (*P* = 0.00) and gentamicine (*P* =0.00) (Table 2).

The cases of statistical significance were more likely to have received mechanical Ventilation, to receive antibiotics and to have central venous catheter (CVC).

Discussion

Nasocmial infections are a prevalent cause of mortality along with hospitalized patients, which can be controlled by identification of casual organisms, restriction, and limitation of its spread. *A. baumannii* is the dominant species of *Acinetobacters* which is obtained from clinical samples in hospitals(9). Wisplinghof *et al.*, has reported 166 episodes of *A.* BSI occurrence during 3 years in a study of 149 hospitals in the Unites States (10). It was notice that in this study, 86% of *A.* species was *A. baumannii* (11).

The infection rate in this study was 2.8% of the total positive blood stream infection (BSI) recorded in our hospital complex during two years. The highest resistance in this study was registered to cefepime, ceftazidime and amoxiclave (100%) and the lowest to imipenem (26.9%).The same Iranian study in 2008 reported 95.3% resistance to cetazidime (11).

In another study, it was reported that *A. Baumannii* microorganisms were seen more dominantly during these following months: January, April, May and June, which are mostly in septicemias (2). In our study, however, no relation between infection prevalence and months was seen while the most type of infection was septicemia, which was consistent with previous report. Catheterization and mechanical ventilation were reported as the major risk factors of this infection (2)

Table 2: *A. baumannii* antimicrobial resistance patterns among different ward groups

Antibiotics	Ward groups								
	G 1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**	**Total**	***P*-Value**
Amikacine	42	3	10	7	3	0	3	68	0.002
Amoxiclave	5	-	5	-	-	-	-	10	-
Ampicilline	6	2	-		0	-	3	10	0.2
Carbenicilline	1	0	1	2	0	0	-	4	0.1
Cefepime	2	1	12	5	2	-	6	46	-
Cefixime	66	5	20	15	2	2	8	118	0.1
Cephotaxime	2	0	3	-	0	0	-	5	0.51
Ceftazidime	45	4	19	12	-	1	7	88	-
Ceftriaxone	59	8	10	12	1	2	6	98	0.058
Ciprofloxacin	57	-	15	6	-	-	-	78	0.005
Cotrimoxazole	77	-	21	9	-	-	-	107	0.000
Gentamicine	17	-	0	2	-	-	-	19	0.000
Imipenem	15	-	3	11	-	-	-	29	0.005
Piperacilline	66	7	18	13	0	3	4	111	0.002

G1:ICUs; G2:Infectious Department; G3:Internal Department; G4:Emergency; G5:Pediatrics Department; G6:NICU and Infants ward; G7:Surgical Department;

-: no avail*A. Baumanniile* data.

which is consistent with our results. The most separated *A. baumannii* organisms were MDR organisms and resistance against imipenem, mepropenem, gentamicin, amikacin, ampicillin sulbactam, cotrimoxazole and ciprofloxacin was 44%, 47%, 84.8%, 62.1%, 57.6% and 95.7% respectively (2).

In another study *A. baumannii-MDR* infections were prevalently seen as pneumonia (associated with ventilator utilization) 56.7%, septicemia 25.4%, surgery sites infections 25.4%, central vein catheter infections 20.9% and UTI 10.4(12). It is reported that the entire separated *A. baumanni* was resistant to all types of β-lactam and at the same time, 94.9% was resistant to gentamicin and 82.7% to cotrimoxazole, 40% to netilmicin and 5.1% to tobramycine and all were sensitive to colistin(6).

In another report, 98.7% resistance to ceftazidime, 59.5% to imipenem, 87.5% to ciprofloxacin in these microorganisms were seen (4). The most active antibiotic in this study was imipenem, the same as

an Iranian study in 2007 (13) in clinical practice, *A. baumannii* infections are influenced by various risk factors: The use of medical devices (such as Endotracheal tubes, intravascular and urinary catheters),the exposure to broad spectrum antibiotics and the type of ward where a patient is admitted for example in ICUs the infection rate is often higher than other wards. These different patterns of bacterial resistance can be justified by dissimilarity of personal sterilization conditions such as hand washing, usage, or lack of utilization of precise antibiotic in proper time and proper treatment duration, clinician and microbiologist cooperation etc. Sterilization and proper utilization of medical devises as well as consulting with clinical pharmacist for accurate and with enough duration antibiotic prescription is seemed to be necessary.

Conclusion

According to antibiotic resistance pattern change

among *A. baumannii* and its consequences, it is recommended to control infection-associated risk factors as well as further researches aiming identification of different of patterns in resistance and sensitivity to antibiotic.

Acknowledgements

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