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Investigation of the resistance of *Acinetobactor baumanii* strains isolated from Tehran's hospital inpatients in terms of selected antibiotics

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Abstract

Background and Objective: The presence of the resistant bacteria in different wards of hospitals and problems which are thereby made by these organisms in treating patients specify the necessity to identify this type of bacteria and their antibiotic resistance pattern.

Materials and Methods: In this cross-sectional study, the resistance related to 60 samples of the isolated Acintobacter baumanii was gathered from three different hospitals of Tehran and they were studied in relation to six new antibiotic groups. Antibiotic sensitivity of the selected samples were also measured based on the disk diffusion method, and then it was reviewed by the CLSI table. The studied data were finally examined using the software SPSS 16 and Reference tests.

Results: The study findings showed that piperacillin-tazobactam antibiotic has the minimum rate of sensitivity with 86.7% resistance, and with 30% resistance, a combination of ampicillin-sulbactam is of the maximum sensitivity.

Conclusion: In this study, strains isolated from the patients showed a high resistance as compared to three antibiotics, and they were placed in species resisted to some drugs. Treating such infections can be considered as a great challenge to physicians.

Key words: Acinetobactor baumanii, Antibiotic resistance, Tigecycline, Piperacillin-tazobactam.

1. Introduction

As a major hospital-derived (nosocomial) pathogen, an *Acinetobacter baumanii*, mainly in ICU, involves patients, especially burned, traumatic ones, and who need a mechanical ventilation (MV) (1-5) Additionally, the risk of infecting with *Acinetobacter baumannii* is higher in immunocompromised patients such as chronic pulmonary diseases and diabetes (2). *Acinetobacter baumannii* is identified as an opportunistic pathogen and it is not usually considered a threat to healthy people. This bacteria can colonize on the skin of healthy people, but, it generally cause no infection (1-4, 6). In immunocompromised patients and ICU inpatients, however, *Acinetobactor baumannii* can cause different forms of infections. According to recent studies, some infections related to *Acinetobactor baumannii* include pneumonia as using mechanical ventilation, soft tissue and skin infections, secondary meningitis, urinary infections, blood circulation and wound ones, endocarditis, intra-abdominal abscess and surgery-derived infections (7, 4). The study conducted by Ardabili et al (2011) showed that colistin is the only antibiotic option to treat infections caused by *Acinetobacter baumannii* (8). Having examined treating *Acinetobacters* resistant to treatment, Due et al (2015) stated that a combination of tigecycline and colistin can be used in order to control *Acinetobactors* resistant to karbapenems (9).

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2. Materials and Methods

In this study, 60 samples of isolated *Asinetobactor baumannii* were selected from inpatients in different sections including internal, infection disease, burn and ICU centers from Tehran's hospitals, Shadid Mostafa Khomaini, Shadid Motahari and Imam Khomaini. The obtained samples include sputum, urine, wound exudates and blood which were collected observing sterile conditions.

In the transmission setting, the isolated samples were transferred to the laboratory, and having cultivated and diagnosing differentially in Shahed University Medical School microbiological laboratory, they were then confirmed in regard to genus and species. The experiments were carried out in 6 groups as follows: ampicillin–sulbaktam, piperacillin-tazobactam, tigecycline, nitilmayesline, doripenem, cefotaxime-clavet. These antibiotics are provided and used as sterile disks made by MAST Co. in UK. Using the disk diffusion method, the strain *Acinetobactor baumannii* isolated from patients who were on culture setting such as Hinton agar was provided by chemicals and consumer equipment, and they were subsequently examined under suitable conditions in the microbiological laboratory. Indeed, the experiments were conducted through the disk diffusion method. The criteria to judge was the degree of growth inhibition zone around the disks which measured and recorded by an especial ruler after going through incubation stages. The obtained results were compared with findings resulted from the standard strains of *Acinetobacter baumannii* (ATCC17978). Having compared with Clinical & Laboratory Standards Institute (CLSI), the results were obtained and analyzed.

2.1. Methods of analysis

Results of determining the antibiotic sensitivity were obtained regarding the diameter of inhibition zone around any disk, and comparing it with the CLSI table which described resistant, susceptible and interstitial. Having processed, data was entered into SPSS 16. To describe data, tables and graphs suited to the type of variation were used. Additionally, in order to statistically analyze the data according to the mentioned purposes and types of the variables, appropriate tests including Chi-square were used.

3. Results

The highest number of isolates from sputum samples, intensive care units and for patients with pneumonia (27 isolates) and the lowest number of isolates from urine, the domestic sector and the UTI (5 samples) were collected. The highest number of isolates have been gathered from sputum samples, ISU, and related to patients pneumonia (27 isolates), and the lowest number of isolated from urine, internal sector UTI, urinary tract infection (5 samples) were collected (Table 1).

Table 1. Frequency and the percentage of collected isolates in terms of the sampling location and section

Frequency (%)	the part	Frequency (%)	Sample place	Frequency (%)	Type of disease
(45%) 27	Special care	(45%) 27	Sputum	(45%) 27	Pneumonia
(3.8%)5	Internal	(3.8%)5	Urinary	(3.8%) 5	urinary tract infection
(3.23%) 14	Infectious disease	(3.23%) 14	Blood	(3.23%) 14	Sepsis
(23.3%) 14	Burns	(23.3%) 14	Lesions	(3.23%) 14	skin infection
(100%) 60	Total	(100%) 60	Total	(100%) 60	Total

In this study, 6 antibiotic groups were selected to perform this test. The test results showed that an antibiotic combination of piperacillian-tazobactam with 52 isolates and 86.7% has the minimum sensitivity, and the maximum sensitivity was related to an antibiotic combination of ampicillian-sulbaktam with 18 isolates and 30% resistance. In the Table 2, the sensitivity amount of *Acinetobacter baumannii* isolates has been highlighted in relation to any sextuple antibiotic combinations.

Table 2. Frequency and sensitivity percentage of bacterial isolates to any antibiotics

Degree of sensitivity / Antibiotics	Resistant	Interstitial	sensitive
Piperacillin-tazobactam	(%86.7) 52	(%8.3) 5	(%5) 3
Ampicillin-sulbactam	(%30) 18	(%33.3) 20	(%36.7) 22
Tygsyklyn	(%43.3) 26	(%35) 21	(%21.07) 13
Ntylmaysyn	(%56.7) 34	(%15) 9	(%28.03) 17
Dvrypnm	(%61.7) 37	(%20) 12	(%18.03) 11
Cefotaxime-Klavnat	(%67.7) 46	(%11.07) 7	(%7.11)7

In order to explore the relationship between antibiotics and the body point of which the bacterial sample has been removed, some part of the hospital where the strains (isolated) have been collected of, and the type of disease caused by *Acinerobactor baumannii* strains was determined by using Qi square method. Statistical analysis results showed that there was no significant relationship between the intensity of antibiotic resistance and location, section and the type of disease in any group of antibiotic combinations mentioned (Table 3).

Table 3. The degree of significance (p value); the relationship among the intensity of antibiotic resistance in any antibiotic combinations, location and sampling section and the type of disease caused by *Acinetobactor baumannii*.

Antibiotics	The local body of the sample taken from it	A part of the hospital where the sample is taken	Type of disease
Piperacillin-Tazobactam	0.448	0.448	0.448
Ampicillin-Sulbactam	0.282	0.282	0.282
Tigecyclin	0.157	0.157	0.157
Netilmicin	0.496	0.496	0.496
Doripenem	0.729	0.729	0.729
Cefotaxime-clavulanic acid	0.297	0.297	0.297

4. Discussion

Hospital infections are one of the serious problems in the realm of health. The reason for most of the hospital infections is gram-negative bacteria. *Acinetobacter* strains are among gram-negative bacteria which cause hospital infections. *Acinetobacter baumannii* has the most amount of pathogenesis. Controlling hospital infections and obtained infections caused by gram-negative bacilli which have multiple resistance has been one of the most serious problems in the developing countries in the last 20 years. Most of the separated isolated belong to sputum and ICU and the most widespread illness caused by separated isolated is pneumonia. All the findings show that using medical apparatus such as ventilator is a dangerous factor in catching infections caused by this organism. The other conclusion is the effect of hospitalization period in catching this illness; the more the hospitalization period, the more the risk of catching this illness.

After sputum, the most common place from which the most isolated were separated belonged to blood and wound. Prevalence of clinical isolates of *Acinetobacter* is different among countries and place of sampling in our body. However, an increase is seen in the amount of their severance. Data obtained from "Center of Control and Prevention of Illness" and " Center of Supervising Hospital Infections' show that *Acinetobacter* is the cause of 1 percent of all the hospital infections related to system of respiration and blood circulation in the Unites States. This amount has soared to 5% in Latin America countries (10).

About 90% of isolates, in our study, were resistant to Piperacillin-Tazobactam. This finding has also been approved in the research of Kamal Beik and Niyakan (11). However, this resistance has been reported as average in the study of Mirnejad. Hasheminejad has shown that the resistance to Piperacillin is 8%. This contradiction can be attributed to the time of experience. The result shows that in recent years because of the excessive use of wide-ranging antibiotics, new strains of *Acinetobacter* have come into existence which are resistant to these antibiotics Comparing the amount of resistance in the studies of Hasheminejad and ours shows an 80 percent of increase in the period of 7 years and denotes the necessity of paying attention to it. The results of this research also showed that the amount of resistance to Cefotaxime-clavulanate and Doripenem is high (61.7% and 76.7%, respectively). Therefore, all the separated isolates showed the resistance of multi-medicine. Results of the antibiogram showed an amount of 50 percent (or less than this amount) of resistance in three antibiotics of Ampicillin-Sulbactam, Netilmicin and Tigecycline. The percentage of sensitive isolates for these antibiotic is 38.7, 28.3, and 21.7, respectively. The study of Mirnejad (12) has also showed the resistance to the composition of Ampicillin-Sulbactam. In the study of Persin (13), 80% and in the study of Van (14) 60% of isolates were sensitive to Netilmicin. Devy et al. (15) showed that a composition of Tigecycline and Colistin can be used for treating Acinetobacter resistant to carbapenem. In the research of Ozdem (16), Tigecycline and Sulbactam accompanied by another antibiotics have been introduced as effective medicine for treating the infection of *Acinetobacter baumannii*. Based on the definition, isolates of *Acinetobacter baumannii* are classified in the category of types resistant to several medicines. Strains separated from the patients in this study showed a high level of resistance to the three antibiotics of Piperacillin-Tazobactam, Cefotaxime-clavulanate and Doripenem. Therefore, these types are classified in the category of types resistant to several medicines. Treating these infections is a great challenge for the doctors but the point making us hopeful is that these isolates to be tested for new antibiotics. Using these antibiotics, especially in combination form, is strongly advised for treating infections caused by these bacteria. The findings of this research also showed that there is not a significant relationship between different parts of the hospital and the level of resistance; the reason may be the low amount of samples studied in this research. The same is true for the relationship between the place from which the sampling has been done, type of infection and the level of resistance.

References

1. Struelens MJ, Carlier E, Maes N, Serruys E, Quint WG, van Belkum A. Nosocomial colonization and infection with Multidrug-resistant t Acinetobacter baumannii: Outbreak delineation using DNA macro restriction analysis and PCR-fingerprinting. Journal of Hospital Infection 1993; 25:15–32.

2. Centers for Disease Control. Overview of Drug-resistant Acinetobacter Infections in Healthcare Settings. Centers for Disease Control and Prevention. Available at: www.cdc.gov/ncidod/dhqp/ar_acinetobacter.html. Accessed October 26, 2009.
3. Towner KJ. Acinetobacter: An old friend, but a new enemy. Journal of Hospital Infection 2009; 73:355–363.
4. Davis KA, Moran KA, McAllister CK, Gray PJ. Multidrug-resistant Acinetobacter extremity infections in soldiers. Emerging Infectious Diseases journal 2005; 11:1218–1224.
5. Oncul O, Keskin O, Acar HV, Kuçukardali Y, Evrenkaya R, Atasoyu EM, et al. Hospital-acquired infections following the 1999 Marmara earthquake. Journal of Hospital Infection 2002; 51:47–51.
6. Young LS, Sabel AL, Price CS. Epidemiologic, clinical, and economic evaluation of an outbreak of clonal Multidrug-resistant Acinetobacter baumannii infection in a surgical intensive care unit. Infection Control & Hospital Epidemiology 2007; 28:1247–1254.
7. Van Looveren M, Goossens H; ARPAC Steering Group. Antimicrobial resistance of Acinetobacter spp. in Europe. Clinical Microbiology and Infection 2004; 10:684–704.
8. Ardabili A, Azimi L, Mohammadzaliqi H, Olaia P, Beheshti M. Determination of resistance pattern of Acinetobacter baumannii isolated from wound burn patients hospitalized in Motahari Hospital of Tehran Journal of Zanjan University of Medical Sciences 2012; 83(20): 112-119
9. Doi Y, Murray GL, Peleg AY. Acinetobacter baumannii: Evolution of Antimicrobial Resistance-Treatment Options. Seminar Respiratory Critical Care Medicine 2015; 36(1):85-98.
10. Gerald L, Mandell J. Principles and practices of infection disease. 8th edition 2010; Elsevier, Churchill, Livingstone.
11. Kamalbeik S, Talaie H, Mahdavinejad A. Multidrug-resistant Acinetobacter baumannii infection in intensive care unit patients in a hospital with building construction: is there an association? Korean Journal of Anesthesiology 2014; 66(4): 295-299.
12. Mirnezhad R, Mostofi S, Masjedian F. Investigating the role of class II integron in the antibiotic susceptibility pattern of Acinetobacter baumannii strains. Journal of Hamadan University of Medical Sciences 2011;22-28
13. Percin D, Akyol S, Kalin G, In vitro synergism of combinations of colistin with selected antibiotics against colistin-resistant Acinetobacter baumannii. GMS Hygiene and Infection Control 2014; 9(2).
14. Van TD, Dinh QD, Vu PD. Antibiotic susceptibility and molecular epidemiology of Acinetobacter calcoaceticus-baumannii complex strains isolated from a referral hospital in northern Vietnam. The Journal of Global Antimicrobial Resistance 2014; 2(4):318-21.
15. Doi Y, Murray GL, Peleg AY. Acinetobacter baumannii: Evolution of Antimicrobial Resistance-Treatment Options. Seminar Respiratory Critical Care Medicine 2015; 36(1):85-98.
16. Ozdem B, gurelic FC, Celikbilen N, Balikci H, Acikgoz ZC. Antibiotic resistance profiles of Acinetobacter species isolated from several clinical samples between 2007-2010. Mikrobiyoloji Bulteni 2011; 45(3):526-34