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Comparision of Antibiotic Susceptibility Percentage of Acinetobacter spp. Strains Obtained From Clinical Samples in Muğla, Turkey

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Abstract

Background: *Acinetobacter spp*. is a gram negative bacilli and very important hospital environment especially treating of Acinetobacter infections. Purpose: The objective of this work was to determine the antibiotic resistance rates of *Acinetobacter spp*. isolated from various clinical specimens (tracheal aspirates, blood and urine) between January 2015 and December 2015. Methods: The new BD Phoenix automated microbiology system is designed for automated rapid antimicrobial susceptibility testing and identification of clinically relevant bacteria. The microdilution method was used to the MIC values. Susceptibility results were evaluated using 2012 EUCAST criteria. Results: The recent results revealed that susceptibilities of the isolates to ampicillin-sulbactam, imipenem, meropenem, cefepime and ciprofloxacin were highest (71 %) while susceptibilities to trimetroprim/sulfamethoxale and gentamycin (25 %) were lowest. Colistin was found to be the most effective drug. All of 7 *Acinetobacter spp*. strains showed Multiple Antibiotic Resistance (MAR) to ten antibiotics. Conclusion: Antibiotic susceptibility testing results should be considered for selecting optimal antimicrobial therapy. High antibiotic resistance demands a good knowledge of resistance profile in order to determine empirical treatment.

Key words: *Acinetobacter spp*., antibiotic susceptibility pattern, clinical isolates, various clinical samples

INTRODUCTION

Members of the genus *Acinetobacter* are Gram negative non fermentative bacteria commonly present in soil and water as free living saprophytes [1]. They can be obtained easily from soil, water, food and sewage with appropriate enrichment techniques [2,3].

Acinetobacter has emerged as an important nosocomial pathogen. Although obvious in nature, it is commonly seen in hospital environment causing many outbreaks of diseases [3], including skin and wound, septicaemia, pneumonia, bacteremia, endocarditis, meningitis and UTI (urinary system infection) [4,7].

Acinetobacter spp. isolates exhibiting multidrug, sometimes pandrug, resistance are emerging in clinical settings. Due to easily developing resistance to antimicrobial agents by various mechanisms, difficulties are experienced in its control and treatment [8,14].

Resistance mechanism	Genetic mechanism	Antimicrobials affected
A. Antimicrobial inactivating (hyrolysing) enzymes -Amp C Beta-lactamases [*Acinetobacter*-derived cephalosporinases (ADCs)]	Chromosomal mediated insertion sequences $ISAb_{a1}$ and IS_{1135}	Extended spectrum cephalosporins (including 3rd generation and cephamycin group); cefepime and carbapenems are spared
	Chromosomal and Plasmid mediated	Carbapenems
-Ambler class D OXA-type enzymes	Mobile genetic elements	Carbapenems
-Ambler class B metallo-b-lactamases (MBLs), such as VIM and IMP -Ambler class A ESBLs (TEM,SHV)	Plasmid, chromosomal and mobile genetic elements	All cephalosporins (including 3rd generation) except cephamycin group
B. Reduced Access to bacterial targets -Altered porin channels and other outer membrane proteins	Point mutations	Carbapenems
C. Mutations that change targets or cellular functions -DNA topoisomerase mutations		
	Point mutations in the bacterial targets gyrA and parC topoisomerase enzymes	Quinolones
	Plasmid, transposons	Aminoglycosides
-Aminoglycoside-modifiying enzyme -Production of efflux pumps	Point mutations	Tigecycline, aminoglycosides, quinolones, tetracyclines
-Modification of cell membrane lipopolysaccharides	Point mutations	Colistin

Table 1. Antibiotic resistance mechanisms in *Acinetobacter spp*

The aim of this study was to determine antibiotic resistance pattern of *Acinetobacter spp*. strains recovered from different clinical samples (tracheal aspirates, blood and urine) in the microbiology laboratory of Muğla Sıtkı Koçman University Research Hospital.

MATERIALS AND METHOD

Identification of bacterial isolates

We retrospectively reviewed various culture samples (tracheal aspirates, blood, urine) sent from various clinical specimens from microbiology laboratory. A total of 7 *Acinetobacter spp*. strains were isolated. Bacterial isolates were identified to level of species and subspecies by using the morphological and conventional methods (Gram staining, oxidase test, glucose, lactose fermentation, urea test, indole test, citrate test, motion characteristics etc.)and automatic diagnostic systems currently present in the market and commonly used for AST in clinical laboratories will therefore have to incorporate these criteria in their instruments to meet the needs of European Microbiology Laboratories according to standard methods [15].

All isolates were obtained from patients at intensive care units and detected by the Phoenix (Becton Dickinson,USA) at the microbiology laboratory of our hospital between from January to December 2015. The PhoenixTM Automated Microbiology System (BD Diagnostics, Sparks, USA) is designed for the rapid bacterial identification at the species level and determination of AST of clinically significant human bacterial pathogens [16].

Antibiogram Pattern of *Acinetobacter spp.*

MIC results previously obtained in recent clinical isolates with well-defined in isolates with well-characterized

resistance mechanisms with microdilution method were re-interpreted for the susceptible, intermediate and resistant categories using the 2012 EUCAST breakpoints [17].

Eleven different antibiotics were used for antibiotic susceptibility testing as follows: Ampicillin/Sulbactam (SAM, 20 µg/ml), Imipenem (IPM, 10 µg/ml), Meropenem (MEM, 10 µg/ml), Cefepime (FEP, 5 µg/ml), Gentamycin (GM, 30 µg/ml), Ceftazidime (CAZ, 10 µg/ml), Trimetroprim/Sulfamethoxale (SXT, 30 µg/ml), Amikacin (AN, 30 µg/ml), Colistin (CL, 10 µg/ml), Ciprofloxacin (CIP, 30 µg/ml) and Tazobactam/ Piperacillin (TZP, 10 µg/ml).

The isolates those grown in inoculation were evaluated as resistant and the others were evaluated as susceptible.

Multiple Antibiotic Resistance index (MAR index):

For all isolates, we calculated the MAR index values (a/b, where a represents the number of antibiotics the isolate was resistant to, b represents the total number of antibiotics the isolate tested against). A MAR index value ≥ 0.2 is observed when isolates are exposed to high risk sources of human or animal contamination, where antibiotics use is common; in contrast a MAR index value <or = 0.2 observed when antibiotics are seldom or never used [18].

RESULTS AND DISCUSSIONS

Seven *Acinetobacter spp*. isolates were recruited from tracheal aspirates samples (42.86%), blood (42.86%) and urine (14.28%). The resistance rates for ampicillin-sulbactam, imipenem, meropenem, cefepime and ciprofloxacin were 71%. No resistance to colistin was determined. Antibiotics sensitivity rate of *Acinetobacter spp*. clinical isolates to each antibiotic used in this study were given in Table 2. Because of the differences of antibiotic resistance rates between the hospitals; to develop own infection control programme is necessary to decrease antibiotic.

Antibiotics	R	S	I
SAM	71%	29%	0%
IPM	71%	29%	0%
MEM	71%	29%	0%
FEP	71%	29%	0%
CIP	71%	29%	0%
TZP	57%	43%	3%
CAZ	57%	43%	3%
AN	57%	29%	14%
SXT	25%	72%	3%
GM	25%	72%	3%
CL	0%	100%	0%

Table 2. Antibiotics sensitivity rate of *Acinetobacter spp*. clinical isolates.

Many researchers reported that antibiotic resistance of *Acinetobacter baumannii* strains in their study [11,15]. In terms of meropenem and tazobactam/piperacillin resistance rate, the results of our work were similiar to Evren et al. (2013) and Ahmed et al. (2015) who also reported resistance to meropenem and tazobactam/piperacillin was 96% and 9%, respectively [22,7]. Some researchers have reported meropenem and tazobactam/piperacillin sensitivity rate to *A.baumanii* in clinical samples [23,26].

Amikacin was found to be the most susceptible agents among nine antimicrobial agents against Acinetobacter baumannii clinical isolates from Korea in another study [27], whereas in the work colistin was determined as the most effective drug.

All of the Acinetobacter spp. isolates, 7 (100%) isolates showed MAR to ten antibiotics (Table 3). In our study, multidrug resistance except colistin was detected in *Acinetobacter spp*. strains.

Sources of isolates	Number of isolates	MAR index
Tracheal aspirates	3	0,6 and 1 (Two isolates)
Blood	3	0,6 0,7 0,9
Urine	1	1

Table 3. Number of clinical samples and MAR index value of *Acinetobacter spp*. strains

It is commonly known that MDR and PDR strain rates are high in nosocomial Acinetobacter strains infections. [28,30] Many researchers reported that MDR and PDR strain rates Joung et al. (2010) [31] and Aimsaad et al.(2009) [32] In an investigation performed in Turkey, it was reported the MDR Acinetobacter antibiotic resistance rate to be 41%. It can be suggested that indicators of a gradual increase in difficulties treating Acinetobacter infections[33,34].

As a result of the study, no resistant strains were detected to colistin and it was found to be the preferred empirical treatment for Acinetobacter infections.[34,35]

CONCLUSIONS

In conclusion, this work data suggested resistance to antibiotics, particularly to ampicillin/sulbactam, imipenem, meropenem, cefepime and ciprofloxacin. High antimicrobial resistance and multi-resistance characteristics is observed in Acinetobacter spp. strains isolated from our hospital as concordant with the other studies. The infection control program and the development of effective policy should used for rational use of antibiotics.

ABBREVATION USED

SAM: Ampicillin/Sulbactam; IPM: Imipenem; MEM: Meropenem; FEP: Cefepime; GM: Gentamycin; CAZ: Ceftazidime; SXT: Trimetroprim/Sulfamethoxale; AN: Amikacin; CL: Colistin; CIP: Ciprofloxacin; TZP: Tazobactam/Piperacillin; R: Resistant; S: Sensitive; I: Moderately sensitive; EUCAST: European committee on antimicrobial susceptibility testing; MIC: Minimum inhibitory concentration; AST: Antimicrobial susceptibility testing; MAR: Multiple antibiotic resistance; MDR: Multidrug resistance; PDR: Pandrug resistance

REFERENCES

[1] Mindolli PB, Salmani MP, Vishwanath G, Hanumanthapa AR. Identification and speciation of Acinetobacter and their antimicrobial susceptibility testing. Al Ameen J Med Sci 2010;3:3459.

[2] Aral M, Doğan S, Paköz NIE. Investigations of antibiotic resistance of Acinetobacter baumannii strains isolated from various clinical samples. Ankem Derg 2010; 24: 215-219.

[3] Koneman EW, Allen SD, Janda WM, Schreckenberger PC, Winn WC. The non-fermentative gram negative bacilli. In: Allen A, Deitch S, editors. Colour Atlas and Textbook of Diagnostic Microbiology. 5th ed. Philadelphia: Lippincott -Raven Publishers; 1997; 253–309.

[4] Munoz-Price LS, Robert AW. Acinetobacter Infection: Current concepts. N Engl J Med 2008; 358:1271-1281.

[5] Ozdem B, Gürelik FC, Celikbilek N, Balıkcı H, Acıkgöz Z. Antibiotic resistance profiles of Acinetobacter species isolated from several clinical samples between 2007-2010. Bulletin of Microbiology 2011; 45: 526-534.

[6] Oberoi A, Aggarwal A, Lal M. A decade of underestimated nosocomial pathogen-Acinetobacter in a tertiary care hospital in Punjab. JK Sci 2009;11:24–6.

[7] Ahmed A, Zeb M, Jilani M, Tanvir SB. Susceptibility pattern of Acinetobacter isolates in quantitative tracheal aspirates. European Journal of Biotechnology and Bioscience, 2015; 3(8):22-275

[8] Jaggi N, Sissodia P, Sharma L. Acinetobacter baumannii isolates in a tertiary care hospital: Antimicrobial

resistance and clinical signifcance. J Microbiol Infect Dis. 2012; 2(2); 57-63.

[9] Yıldız İ, Bayır H, Küçükbayrak A, Yoldaş H, Balcı M, Erkuran MK, Akkaya KK, Yaşayacak A. Acinetobacter infection and resistance profile of intensive care units in a city of Northwestern Anatolia. Acta Medica Anatolia 2016; 4(3), 98-100.

[10]Coyne S, Courvalin P, Périchon B. Efflux-mediated antibiotic resistance in Acinetobacter spp. Antimicrobial Agents and Chemotherapy 2011; 55(3):947-53

[11]Manchanda V, Sanchaita S, Singh NP. Multidrug resistant Acinetobacter. Symposium on infectious agents in a multidrug-resistant globe 2010; 2(3):291-304.

[12] Fournier PE, Vallenet D, Barbe V, Audic S, Ogata H, Poirel L, Richet H, Robert C, Mangenot S, Abergel C, Nordmann P, Weissenbach J, Raoult D, Claverie JM. Comparative genomics of multidrug-resistance in Acinetobacter baumannii. PLoS Genet 2006; 2(1):62-72.

[13] Hujer KM, Hujer AM, Hulten EA, Bajaksouzian S, Adams JM, Donskey CJ. Analysis of antibiotic resistance genes in multidrug-resistant Acinetobacter sp. isolates from military and civilian patients treated at the Walter Reed Army Medical Center. Antimicrob Agents Chemother 2006; 50:4114-23.

[14] Prashanth K, Badrinath S. In vitro susceptibility pattern of Acinetobacter species to commonly used cephalosporins, quinolones, and aminoglycosides. Indian J Med Microbiol 2004; 22:97–103.

[15] Holt JR, Krieg NR, Sneath HA, Stanley JT, Williams ST. Bergeys Manual of Determinative Bacteriology. (9th ed), Baltimore; Wiliams and Wilkins, USA. 1994; 120-134.

[16] Macfaddin JF. Biochemical tests for identification of medical bacteria. 3rd ed. Lippincott Williams and Wilkins; USA, 2000.

[17] O'Hara CM. Manual and automated instrumentation for identification of Enterobacteriaceae and other aerobic gram-negative bacilli. Clinical Microbiology Reviews 2002; 18:147-162.

[18] Sinha M, Srinivasa H, Macaden R. Antibiotic resistance profile& extended spectrum beta-lactamase (ESBL) production in Acinetobacter species. Indian J Med Res 2007; 126:63–7.

[19] Dede B, Kadanalı A, Karagoz G, Comoğlu Ş, Bektaşoğlu MF, Yucel FM. Investigation of antibiotic resistance of Acinetobacter baumannii strains isolated from various clinical samples in intensive care unit. Medical Journal of Bakırköy 2013; 9(1): 20-3.

[20] Dogan M, Tasbent FE, Feyzioglu B, Baykan M. Investigation of colistin, tigecycline and other antibiotic resistance profiles of Acinetobacter species isolated from several clinical specimens. Ankem Journal 2014; 28:138-143.

[21] Peterson A, Fesik S, McGroarty E. Decreased binding of antibiotics to lipopolysaccharides from polymyxin-resistant strains of Escherichia coli and Salmonella typhimurium. Antimicrobial Agents and Chemotherapy 1987; 31(2):230-237.

[22] Evren E, Göçmen SJ, Demirbilek M, Alışkan HE. Imipenem, meropenem, colistin, amikacin and fosfomycin susceptibilities of multidrug resistant Acinetobacter baumannii different clinical isolates. GMJ 2013; 24:1-4.

[23] Atasoy AR, Karakeçe E, Terzi HA, Çiftçi IH. Antibiotic resistance of Acinetobacter baumannii strains isolated from clinical samples. J Surg Arts 2014; 7(1):7-10.

[24] Guven T, Yilmaz G, Guner HR, Kaya-Kalem A, Eser F, Tasyaran MA.Increasing resistance of nosocomial Acinetobacter baumannii: are we going to be defeated? Turkish Journal of Medical Science. 2014; 44: 73-78.

[25] He R, Luo B, Hu CLY, Niu R. Differences in distribution and drug sensitivity of pathogens in lower respiratory tract infections between general wards and RICU. J Thorac Dis 2014; 6(10):1403–1410.

[26] Direkel S, Uzunoglu E, Keles S, Yapar K. Antibiotic resistance rates of Acinetobacter baumannii strains isolated from various clinical samples in Giresun, Dr. Atilla Ilhan Ozdemir State Hospital. GMJ 2015; 26:92-96.

[27] Hoe Koo S, Kwon KC, Cho HH, Sung JY. Genetic Basis of multidrug-resistant Acinetobacter baumannii clinical isolates from three university hospitals in Chungcheong Province, Korea. Korean J. Lab. Med 2010; 30:498-506.

[28] Souli M, Galani I, Giamarellou H. Emergence of extensively drugresistant and pandrug-resistant Gram-negativebacilli in Europe. Euro Surveill 2008; 20:13.

[29] Deveci A, Coban AY, Acicbe O. In vitro effects of sulbactam combinations with different antibiotic groups against clinical Acinetobacter baumannii isolates. J Chemother 2012; 24:247-252. 2.

[30] Zhang Y, Chen F, Sun E. In vitro antibacterial activity of combinations of fosfomycin, minocycline and polymyxin B on pan-drug resistant Acinetobacter baumannii. Exp Ther Med 2013; 5:1737-1739.

[31] Joung MK, Kwon KJ, Kong CI. Impact of in appropriate antimicrobial theraphy on outcome in patients with hospital acquired pneumoniae caused by Acinetobacter baumannii. J Infect 2010;61:212-218.

[32] Aimsaad L, Diraphat P, Utrarachkij F. Epidemiological characteristics of Acinetobacter baumannii infections at Phramongkutklao Hospital. J Med Assoc Thai 2009; 92:164- 172.

[33] Eser ÖK, Ergin A, Hasçelik G. Antimicrobial resistance and existence of metallo-beta-lactamase in Acinetobacter species isolated from adult patients. Microbiol Bul 2009; 43:383- 390.

[34] Lone R, Shah A, Kadri SM, Lone S, Shah F. Nosocomial multi-drug resistant Acinetobacter infections-clinical findings, risk factors and demographic characteristics. Bangladesh J Med Microbiol 2009; 03:34–8.

[35] Şay Coşkun US, Coşkun G. Determination of antibiotic resistance of Acinetobacter spp. strains isolated from variety of clinical samples. Journal of Duzce University Health Sciences Institute / J DU Health Sci Inst 2015; 5(3): 1-4.