

Journal of Surgery and Medicine

e-ISSN: 2602-2079

Antimicrobial resistance pattern of Klebsiella spp isolated from patients in Tehran, Iran

İran, Tahran'daki hastalarda izole edilen Klebsiella suşunun antimikrobiyal direnç paterni

Mohammad Mehdi Soltan Dallal^{1,2}, Mohammad Khalifeh-Gholi³, Sara Sharifi Yazdi⁴, Fariborz Mehrani⁵, Azim Hadayatpour⁶,
Mohammad Kazem Sharifi Yazdi⁷

¹ Food Microbiology Research Center, Tehran University of Medical Sciences, Tehran, Iran
² Division of Microbiology, Department of Pathobiology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
³ Department of Microbiology and Immunology, Faculty of Medicine, Cellular and Molecular Research Center, Qom University of Medical Sciences, Qom, Iran
⁴ School of Medicine, Tehran University of Medical Sciences, Tehran, Iran
⁵ Department of Anesthesia, School of Allied Medicine, Tehran University of Medical Sciences, Tehran, Iran
⁶ Department of Anatomical Department, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran
⁷ Zoonosis Research Center, Department of Medical Laboratory Sciences, Tehran University of Medical Sciences, Tehran, Iran

Abstract

Aim: The majority of clinical specimens infected can be by Klebsiella species. Furthermore the incidence of drug resistant Klebsiella is increasing, therefore drug resistance sensitivity test it seems necessary before prescribing antibiotics. The aim of this research was to determine the pattern of antimicrobial resistance of Klebsiella species from clinical.

Methods: The present research was performed on 300 specimens of Klebsiella collected from hospitalized patients between 2016 and 2017. Identification was carried out according to standard procedure, and drug sensitivity test was determined by Kirby-Bauer method.

Results: The frequency rates of the isolated Klebsiella species were: pneumonia (94%), oxytoca (4%), ozaenae (1%), and rhinoscleromatis (1%). The collected samples in order of frequency were: urine, sputum, vagina, scar, stool, and blood respectively. The percentage rates of resistance were as follows: Ampicillin (97%), amoxycillin (97%), cephalothin (39%), gentamicin (30%), colistin (55%), nalidixic acid (2%), chloramphenicol (26%), kanamycin (17%), tetracycline (28%), nitrofurantoin (44%), ceftazidime (2%), and amikacin (0%).

Conclusion: The lowest resistance rate obtained with amikacin in all tested Klebsiella; which can be recommended as the most effective antibiotic.

Keywords: Klebsiella, Infection, Antibiotic resistance

Öz

Amaç: Klinik örneklerin çoğu Klebsiella türleri ile enfekte olabilmektedir. Ayrıca ilaca dirençli Klebsiella insidansı artmaktadır, bu nedenle antibiyotik reçete edilmeden önce ilaç direnci duyarlılık testi gerekli görünmektedir. Bu araştırmanın amacı Klebsiella türlerinin antimikrobiyal direncini klinik olarak belirlemektir.

Yöntemler: Bu araştırma, 2016 ve 2017 yılları arasında hastanede yatan hastalardan toplanan 300 Klebsiella örneği üzerinde gerçekleştirilmiştir. Tanımlama standart yönteme göre gerçekleştirilmiş ve ilaç duyarlılık testi Kirby-Bauer yöntemi ile belirlenmiştir.

Bulgular: İzole Klebsiella türlerinin sıklık oranları: pnömoni (% 94), oksitoka (% 4), ozaenae (% 1) ve rinososkromatis (% 1). Sıklık sırasına göre toplanan örnekler: idrar, balgam, vajina, skar, dışkı ve kan idi. Rezistans yüzdesi şöyledir: Ampisilin (%97), amoksisilin (%97), cefalotin (%39), gentamisin (%30), kolistin (%55), nalidiksik asit (%2), kloramfenikol (%26), kanamisin (%17), tetrasiklin (%28), nitrofurantoin (%44), seftazidim (%2) ve amikasin (%0).

Sonuç: Test edilen Klebsiella türlerinde en düşük direnç oranı Amikasin ile elde edilmiştir ve en etkili antibiyotik olarak önerilebilir.

Anahtar kelimeler: Klebsiella, Enfeksiyon, Antibiyotik direnci

Introduction

During the past decade given importance to nosocomial infections caused by Staphylococcus aureus. These days, gram-negative bacilli also were under consideration [1-3]. One of the major problems of small hospitals and large hospital were the large epidemics by these bacteria in recent years.

The positive (VP) gram-negative bacteria including Klebsiella are normal flora of the intestine and are known as Saprophytic in the digestive and respiratory tract of human and healthy infants [4]. In recent years it has become clear that Klebsiella have caused many infections in different cases. The importance of this group of organisms to cause a serious infections in patients admitted to hospital are well understood [5,6]. The ability of this organism to cause disease due to decreased host defenses from long and complex surgeries, as well as. Consumption of different drugs is growing [7,8].

Corresponding author / Sorumlu yazar:
Mohammad Kazem Sharifi Yazdi
Address / Adres: Zoonosis Research Centre,
Tehran University of Medical Sciences, Tehran,
Iran
Tel: +982188983919
E-mail: mksharifi@tums.ac.ir

Ethics Committee Approval: The study was
approved by Ethics Committee.
Etik Kurul Onayı: Çalışma için onay Etik
Kurulundan alınmıştır.

Conflict of Interest: No conflict of interest was
declared by the authors.

Çıkar Çatışması: Yazarlar çıkar çatışması
bildirmemişlerdir.

Financial Disclosure: The authors declared that
this study has received no financial support.
Finansal Destek: Yazarlar bu çalışma için finansal
destek almadıklarını beyan etmişlerdir.

Received / Geliş Tarihi: 13.03.2018
Accepted / Kabul Tarihi: 20.03.2018
Published / Yayın Tarihi: 20.03.2018

Copyright © 2018 The Author(s)
Published by JOSAM

This is an open access article distributed under the terms of the Creative
Commons Attribution-NonCommercial-NoDerivatives License 4.0 (CC
BY-NC-ND 4.0) where it is permissible to download, share, remix,
transform, and build up the work provided it is properly cited. The work
cannot be used commercially without permission from the journal.



How to cite / Atf için: Soltan Dallal MM, Khalifeh-Gholi M, Yazdi SS, Mehrani F, Hadayatpour A, Yazdi MKS. Antimicrobial resistance pattern of Klebsiella spp isolated from patients in Tehran, Iran. J Surg Med. 2018;2(2):84-86.

In a study in China during 1996 to 2002 the susceptibility of Klebsiella to imipenem from 94% to 100% has been reported [9]. In another study the susceptibility of Klebsiella to imipenem of 100% was reported [10]. There have been several reports in development of resistance to imipenem in gram negative pathogens in recent years [11]. There are not much information in distribution and the source of these bacteria in hospital infection. The epidemiological studies of Klebsiella infections did not had much success due to variation of methods and distribution of these bacteria as well as lack of generalized methods in all laboratories, due to the large number of antisera and difficulty in its preparation. These methods are applicable only a few research laboratories and capsular swelling (Quellung reaction) test are used for typing Klebsiella. To determine the type and evaluation of drug resistance of these gram-negative organisms isolated from clinical specimens are important in identification of virulence factors [12]. The aim of this study was to determine antibiotic susceptibility patterns of Klebsiella spp from hospitalized patients in Imam Khomeini Hospital between 2016 and 2017.

Materials and methods

This was a descriptive study carried out in 2016 on 1200 clinical samples, including urine, blood, feces, wounds, sputum and vaginal secretions. All the samples cultured on Hektone agar medium and incubated at 37°C for 24 hours. The suspected yellow colonies were cultured on Simon citrate, urease, Triple Sugar Iron Agar (TSI), Lysine Iron Agar, arginine, ornithine, and Lysine decarboxylase as well as Voges-Proskauer and Methyl Red (MRVP) test. The drug sensitivity test was determined for all of the 12 antibiotics as follow, imipenem, amoxicillin, colistin, nalidixic acid, cephalothin, chloramphenicol, kanamycin, gentamycin, tetracycline, nitrofurantoin, amikacin, and ceftazidime using standards disk diffusion by Kirby-Bauer method [13].

Results

Out of 1200 tested samples 300 samples (25%) were infected with Klebsiella types. The order of frequency include: Klebsiella pneumoniae, Klebsiella oxytoca, Klebsiella ozonae and Klebsiella rhinoscleromatis table 1.

Table 1: Frequency distribution of Klebsiella spp

Species	No. of Isolate	Percentage
Klebsiella pneumoniae	282	94
Klebsiella oxytoca	12	4
Klebsiella ozonae	3	1
Klebsiella rhinoscleromatis	3	1

The number of Klebsiella spp isolated from urine the most followed by sputum, vagina, wounds, feces, and blood respectively table 2. The results showed that the most effective antibiotic in treatment of Klebsiella spp was Imipenem as it shown in table 3.

Table 2: Frequency distribution of Klebsiella spp from different clinical sources

Clinical sources	Number of isolate	Percentage
Urine	219	73
Sputum	42	14
Vagina	18	6
Wounds	12	4
Feces	6	2
Blood	3	1

Table 3: Number and percentage of antimicrobial resistances to tested antibiotics

Antibiotics	R	I	S	Resistance
Imipenem	6	0	298	2
Amoxicillin	291	6	3	97
Colistin	165	18	117	55
Nalidixic acid	6	6	288	2
Cephalothin	117	120	63	39
Chloramphenicol	78	33	189	26
Kanamycin	51	90	159	17
gentamicin	9	11	177	30
Tetracycline	84	87	153	44
Nitrofurantoin	132	15	46	46.88
Amikacin	0	3	297	0
Ceftazidime	6	4	291	2

R: Resistance, I: Intermediate, S: Sensitive

Discussion

The genus Klebsiella species had various species based on biochemical classification. Exact identification of Klebsiella is necessary for epidemiological research in order to find the source and way of spreading of this microorganisms, is very important [13]. There are many reports of nosocomial infection and drug resistance caused by Klebsiella species. But the relationship between different species of Klebsiella for their pathologic properties is still unknown [14-17]. In this study out of 300 strains of Klebsiella isolates, 282 strains were Klebsiella pneumoniae isolated from different parts of bodies with different clinical symptoms. This means that they did not targeted specific organ and in different circumstances could create variable infections. In this study apart from Klebsiella pneumoniae we isolated 12 strains of Klebsiella oxytoca, 3 strains of Klebsiella ozonae, and 3 strains of Klebsiella rhinoscleromatis. This means apart from Klebsiella pneumoniae, other Klebsiella` species also could cause serious infectious diseases.

The results of the antibiotic susceptibility test to 12 antibiotics showed high resistance to some used antibiotics, except to imipenem, amikacin, ceftazidime and nalidixic acid. In general 99% of isolates were sensitive to amikacin followed by 98% to imipenem, ceftazidime and nalidixic acid. In study carried out by Pakestan [18] 57.5% were found susceptible to nalidixic acid and 92.5% to imipenem. Other researchers reported of 38% of isolate were resistance to amikacin, 57% to ceftazidime and 33.6% to nalidixic acid although 90.9% of their Klebsiella pneumoniae isolate were sensitive to imipenem. These results apart from imipenem were in contradiction with our results, this might be due to variation of strains in their environments [19]. Considering the high percentage of strains Klebsiella resistant to the amoxicillin, therefore to use of this antibiotic in treatment of Klebsiella infections is not only useless, also it might prolong the treatments and increase the resistance strains [20]. In the case of gentamicin, the majority of species were sensitive; these results correlate with other results of other research workers [12]. The results of this study showed relatively high resistance of isolated strains to colistin, tetracycline, chloramphenicol and nitrofurantoin, and these results are in correlation with other researches [9,16,21]. The results of this study and comparison with other reports might be differences in some cases. This might to an error during testing. Factors such as disc, type and depth of culture medium play a major role and can changes the results. The standard depth of medium is 4 mm; thin depth can increase the sensitivity of antibiotic.

Resistant strains may occur due to geographic regions, climatic conditions, overuse of antibiotics [4,13,22]. The lowest

resistance rate is obtained with amikacin in *Klebsiella* spp, therefore it can be recommended as the most effective antibiotic.

Acknowledgment

This research was supported by Tehran University of Medical Sciences (TUMS) under contract number 11254. The authors thank the TUMS for their support.

References

- Ackermann RJ, Monroe PW. Bacteremic urinary tract infection in older people. *J Am Geriatr Soc.* 1996 Aug;44(8):927-33.
- Chen CY, Chen YH, Lu PL, Lin WR, Chen TC, Lin CY. *Proteus mirabilis* urinary tract infection and bacteremia: risk factors, clinical presentation, and outcomes. *J Microbiol Immunol Infect.* 2012 Jun;45(3):228-36.
- Pouladfar G, Basiratnia M, Anvarinejad M, Abbasi P, Amirmoezi F, Zare S. The antibiotic susceptibility patterns of uropathogens among children with urinary tract infection in Shiraz. *Medicine (Baltimore).* 2017 Sep;96(37):e7834.
- Karimian M, Kermani R, Khaleghi M, Kelishadi R, Ataei B, Mostafavi N. Antibiotic susceptibility patterns of isolates from children with urinary tract infection in Isfahan, Iran: Impact on empirical treatment. *J Glob Antimicrob Resist.* 2017 Jun;9:3-7.
- Gomez-Simmonds A, Greenman M, Sullivan SB, Tanner JP, Sowash MG, Whittier S, et al. Population Structure of *Klebsiella pneumoniae* Causing Bloodstream Infections at a New York City Tertiary Care Hospital: Diversification of Multidrug-Resistant Isolates. *J Clin Microbiol.* 2015 Jul;53(7):2060-7.
- Lin MY, Lyles-Banks RD, Lolans K, Hines DW, Spear JB, Petrak R et al. The importance of long-term acute care hospitals in the regional epidemiology of *Klebsiella pneumoniae* carbapenemase-producing Enterobacteriaceae. *Clin Infect Dis.* 2013 Nov;57(9):1246-52.
- Azimi L, Rastegar Lari A, Alaghebandan R, Alinejad F, Mohammadpoor M, Rahbar M. KPC-producer gram negative bacteria among burned infants in Motahari Hospital, Tehran: first report from Iran. *Ann Burns Fire Disasters.* 2012 Jun 30; 25(2):74-7.
- Moayednia R, Shokri D, Mobasherizadeh S, Baradaran A, Fatemi SM, Merrikhi A. Frequency assessment of β -lactamase enzymes in *Escherichia coli* and *Klebsiella* isolates in patients with urinary tract infection. *J Res Med Sci.* 2014 Mar; 19(Suppl 1):S41-5.
- Soo-Young Kim, Yeon-Joon Park, Jin-Kyung Yu, Han Sik Kim, Yong Sung Park, Jong-Bok Yoon et al. Prevalence and mechanisms of decreased susceptibility to carbapenems in *Klebsiella pneumoniae* isolates. *Diagn Microbiol Infect Dis.* 2007;57:85-91.
- Jeong SH, Bae I, Lee JH, Sohn SG, Kang GH, Jeon GJ, et al. Molecular characterization of extended-spectrum Beta-Lactamases produced by clinical isolates of *Klebsiella pneumoniae* and *Escherichia coli* from a Korean nationwide survey. *J Clin Microbiol* 2004;42(7):2902-6.
- Khety Z, Mohanta G, Jain S, Dawoodi S. Changing Antimicrobial Resistance Pattern of Isolates from an ICU Over a 3 Year period. *J Assoc Physicians India.* 2017 Feb;65(2):13-16.
- Norihiko Tou, Ryohei Nejima, Yoshifumi Ikeda, Yuichi Hori, Kaoru Araki-Sasaki, Kazunori Miyata et al. Clinical utility of antimicrobial susceptibility measurement plate covering formulated concentrations of various ophthalmic antimicrobial drugs. *Clin Ophthalmol.* 2016;10:2251-7.
- CLSI. National Committee for Clinical Laboratory Standards. Performance standards for antimicrobial susceptibility testing: fifteenth informational supplement. Wayne, PA: Clinical and Laboratory Standards Institute; 2008. M100- S15.
- Mohamed ER, Aly SA, Halby HM, Ahmed SH, Zakaria AM, El-Asheer OM. Epidemiological typing of multidrug-resistant *Klebsiella pneumoniae*, which causes paediatric ventilator-associated pneumonia in Egypt. *J Med Microbiol.* 2017 May;66(5):628-34.
- Bagshaw SM, Laupland KB. Epidemiology of intensive care unit-acquired urinary tract infections. *Curr Opin Infect Dis.* 2006 Feb;19(1):67-71.
- Akkoyun S, Kuloğlu F, Tokuç B. Etiologic agents and risk factors in nosocomial urinary tract infections. *Mikrobiyol Bul.* 2008 Apr;42(2):245-54.
- Fukigai S, Alba J, Kimura S, Iida T, Nishikura N, Ishii Y, Yamaguchi K, Nosocomial outbreak of genetically related IMP-1 Beta-lactamase-producing *Klebsiella pneumoniae* in a general hospital in Japan. *Int J Antimicrob Agents.* 2007;29:306-10.
- Soltan Dallal MM, Sharifi Yazdi MK, Rajabi Z. Antimicrobial resistance patterns among *Klebsiella* spp. isolated from nosocomial infection. *Payavarde Salamat.* 2012;6(4):275-28.
- Chan RK, Lye WC, Lee EJ, Kumarasinghe G, Lim HY. Community acquired UTI in Singapore. *Ann-Acad Med Singapore.* 1992 May;21(3):361-3.
- Mansury D, Motamedifar M, Sarvari J, Shirazi B, Khaledi A. Antibiotic susceptibility pattern and identification of extended spectrum β -lactamases (ESBLs) in clinical isolates of *Klebsiella pneumoniae* from Shiraz, Iran. *Iran J Microbiol.* 2016 Feb;8(1):55-61.
- Shaikh S, Fatima J, Shakil S, Rizvi SM, Kamal MA. Antibiotic resistance and extended spectrum beta-lactamases: Types, epidemiology and treatment. *Saudi J Biol Sci.* 2015 Jan;22(1):90-101.
- Winters HA, Parbhoo RK, Schafer JJ, Goff DA. Extended-spectrum beta-lactamase-producing bacterial infections in adult solid organ transplant recipients. *Ann Pharmacother.* 2011 Mar;45(3):309-16.