Scientific Journal of Medical Sciences
Volume 1, Issue 2, Spring 2022
Pages: 83-86
Type: Descriptive Study

Determining the Frequency of Community-Acquired Urinary Tract Infection and Their Antibiotic Resistance in the Laboratories of Ahvaz City for One Year

Nashibi R.[1] *PhD*, Ahmadi F.[2] *PhD*, Amiri Kondari A.[3]* *MD*

[1] Infectious and Tropical Diseases Research Center, Health Research Institute, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran
[2] Department of Infectious and Tropical Diseases, Faculty of Medicine, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran
[3] Student Research Committee, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran

Abstract

Aims: Urinary tract infection is one of the most common infections in humans, and despite the proper response to treatment, improper use of antibiotics has created resistance among some bacterial strains. This study examines the contribution of each of these strains to the resistance created by each of them.

Instrument & Methods: In this study, 3480 results of urine culture tests were collected, and their antibiograms and ages and gender of the patients were analyzed. The information was collected for 1 year in Ahvaz city. The antibiotic resistance of each urinary tract infection was evaluated separately.

Findings: The urinary tract infections had a higher prevalence among women (77.2%) than men (22.8%). Urinary tract infections were more common in people aged 26-35. Among the organisms that cause urinary tract infections, Escherichia Coli and Coagulase-negative staphylococcus had the largest share. The resistance of Escherichia Coli to Cefalotin, Cefixime, Ceftriaxone, Tobramycin, and Gentamicin was 62.5%, 62.2%, 57.4%, 21.7%, and 20.6%, respectively.

Conclusion: Due to the higher prevalence of urinary tract infections among women, a woman with suspicious symptoms should be treated more rigorously, and according to the status of the urine culture, the treatment will change. Escherichia Coli has been reported to be the most common cause of urinary tract infections, and the best response was observed in patients with Ciprofloxacin or Ofloxacin, Ceftazidime, and Amikacin.

Keywords

Urinary Tract Infection [https://www.ncbi.nlm.nih.gov/mesh/?term=Urinary+Tract+Infection];
Antibiotic Resistance [https://www.ncbi.nlm.nih.gov/mesh/68004352];
Anti-Bacterial Agents [https://www.ncbi.nlm.nih.gov/mesh/82000900];
Iran [https://www.ncbi.nlm.nih.gov/mesh/68007492]

*Corresponding Author
Tel: +98 (933) 1103033
Fax: +98 (61) 33361544
Post Address: Student Research Committee, Ahwaz Jundishapur University of Medical Sciences, Golestan Blvd, Ahwaz, Iran.
Postal Code: 61357-15794
amirii.ali72@gmail.com
Received: January 6, 2022 Accepted: February 22, 2022 ePublished: March 15, 2022

Introduction

Urinary tract infections are one of the most common bacterial infections that affect more than 150 million people worldwide each year [1, 2]. Urinary tract infections are mainly bacterial, but can also be caused by fungal, viral, or parasitic agents [3]. These infections appear with a wide range of severity, with symptoms ranging from Dysuria to life-threatening pyelonephritis [4]. Therefore, the diagnosis and treatment of these infections are of great importance. Today, antibiotics play an important role in treating bacterial infections and preventing their side effects. In the twentieth century, there have been many advances in the development of antibiotics that have made humans resistant to infections; on the other hand, different species of bacteria have become resistant with the widespread use of antibiotics [5]. Resistance to a wide range of antibiotics has raised many concerns about the general health of people in different countries and has attracted the attention of various governments to this threatening factor of modern medical science [6]. Concerns include the higher prevalence of infections with resistant agents in medical centers, the failure of experimental therapies, the increasing incidence of complications due to the ineffectiveness of treatment, increasing the duration of treatment and mortality [2].

Today, the use of antibiotics is considered to be the main cause of resistance [7]. Accuracy in the diagnosis and treatment of urinary tract infections, in addition to reducing the course of treatment, also prevents the progression of the disease and its spread to the blood circulation [8, 9].

Given that the basis of appropriate treatment for urinary tract infections is the selection of appropriate antibiotics, today, antibiotic resistance has become a serious problem [10].

Treatment of urinary tract infections is mostly experimental [8] and knowing the contribution of each microorganism in causing urinary tract infection in any geographical area and having information about their antibiotic resistance and susceptibility plays an important role in the effective treatment. Inappropriate prescription of antibiotics in Iran led us to conduct this study to identify the best way to treat urinary tract infections and prescribe appropriate antibiotics.

Hoping that the information obtained from this study, reduce treatment complications and antibiotic resistance by affecting the proper treatment of urinary tract infections; this study aimed to identify the common organisms causing urinary tract infections and its antibiograms which is one of the factors to reduce improper administration of antibiotics and increase awareness to prescribe appropriate antibiotics.

Instrument and Methods

In this research, the results of urine culture of patients referred to 4 laboratories in different parts of Ahvaz city (Imam Khomeini Hospital, Golestan Hospital, University Jihad Laboratory, and Farokhnia Laboratory), their ages, genders, and urinary tract infection-causing microorganisms and antibiograms of positive cultures were registered. The antibiogram method was disk diffusion. Data were collected for one year and the data of the cases that matched the positive definition were included in the study. Data were analyzed using SPSS 23 software.

Findings

3480 cases with positive criterion urine culture were included in the study, of which 2685 (77.2%) were female, and 795 (22.8%) were male.

The p-value was lower than 0.05, which showed the significant relationship between gender and urinary tract infection.

Among the studied cases, the age of 458 patients was registered, and most cases were in the age range of 26-35 years (Table 1).

The P-value in this section was less than 0.05 (0.0001), which indicated a significant relationship between age range and urinary tract infection (Table 2).

As can be seen in the table, Escherichia Coli and then Coagulase-negative staphylococcus have the largest share of urinary tract infections.

Escherichia coli has been the most common cause of infection in both genders.

13% of the sample size was mixed growth which was excluded from the study.

Escherichia Coli is the most resistant to Cefalotin and Cefixime (Table 3), and after that Ceftriaxone, Co-trimoxazole, Cefotaxime, Ciprofloxacin, Ofloxacin, Ceftazidime, Tobramycin, Gentamicin, Imipenem, Nitrofurantoin, and Amikacin have been shown to be resistant, respectively.

In all cases of positive culture, the discs used were not the same.

Table 1) Number of positive urine cultures by age groups

Age range	Number	Percentage
<15	**44**	**9.6**
16-25	80	17.5
26-35	121	26.4
36-45	78	17
46-55	34	7.4
26-65	33	7.2
>65	68	14.8
Total	458	100%

Table 2) Rate of positive urine culture by functional microorganisms, including mixed growth

Bacteria	Female		Male		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Escherichia Coli	1363	50.8	422	53.1	1785	51.3
Coagulase negative staphylococcus	330	12.3	62	7.8	392	11.3
Entrobacter spp	237	8.8	95	11.9	332	9.5
Streptococcus	247	9.2	21	2.6	268	7.7
Klebsiella	105	3.9	30	3.8	135	3.9
Pseudomonas	30	1.1	23	2.9	53	1.5
Coagulase positive staphylococcus	33	1.2	8	1	41	1.2
Proteus	16	0.6	5	0.6	21	0.6
Mixed growth	234	12.1	129	16.2	453	13
Total	2685	100	795	100	3480	100

Table 3) Evaluation of antibiotic resistance and susceptibility to Escherichia Coli

Bacteria	Susceptible		Resistant		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Cefalotin	515	37.5	858	62.5	1373	100
Cefixime	200	37.8	329	62.2	529	100
Ceftriaxone	258	42.6	347	57.4	605	100
Co-trimoxazole	665	42.7	890	57.3	1555	100
Cefotaxime	722	48.8	755	51.2	1477	100
Ciprofloxacin	457	57.1	342	42.9	799	100
Ofloxacin	357	62.6	213	37.4	570	100
Ceftazidime	158	65.2	84	34.8	242	100
Tobramycin	76	78.3	21	21.7	97	100
Gentamicin	1295	79.4	334	20.6	1629	100
Imipenem	69	83.1	14	16.9	83	100
Nitrofurantoin	1519	90.7	154	9.3	1673	100
Amikacin	600	92.7	47	7.35	647	100

Discussion

According to the results, females were affected by urinary tract infections (77.2%) more than males (22.8%). These findings are in accordance with other studies and the difference of this research with them is in the different percentage number of the genders which the higher percentage of urinary tract infections in women than men can be due to differences in the anatomical system of the urinary tract and shorter distance from the urethra to the anus in women. Linhares *et al*. [11] in a study in Portugal, found this ratio by 78.5% in women and 21.5% in men. Rostamzadeh *et al*. [12] found the ratio by 81.6% in women and 18.4% in men. Contrary to the mentioned results, Mirsoleymani *et al.* [13] in a study on 1513 urine culture samples in Bandar Abbas, has obtained this ratio 45.1% in women and 54.9% in men, and it could be due to the different population and more the proportion of men in the study group.

The most common cause of urinary tract infection in this study was Escherichia Coli by 59%, and the same organism has been common in similar studies. After that, Coagulase-negative staphylococcus was the leading cause of urinary tract infection with 12.9%. It should be noted that the mentioned results were the results of 3480 positive urine cultures of outpatients in Ahvaz. Escherichia Colis and Klebsiella percentage were reported to be 61% and 22%, respectively by Akram *et al.* [14] in a similar study on 100 positive urine cultures. Kothari & Sagar [15] also reported 68% Escherichia Coli, 16.9% Klebsiella, and 5.3% Enterobacter. Amin *et al.* [16] in a study in 2009 on patients hospitalized at Imam Khomeini Hospital in Ahvaz city, reported the percentages of Escherichia Coli, Klebsiella, and Enterobacter by 59%, 11.6%, and 9.8%, respectively. The reasons for the discrepancy between the reported results can be the differences in a geographical area, hospitalization or outpatient status of patients, and the number of sample sizes.

In this study, the highest antibiotic resistance in the antibiogram assay was observed in Escherichia Coli to Cefalotin with 62.5%, Cefixime with 62.2%, Ceftriaxone with 57.4%, and Co-trimoxazole with 57.3%. The lowest resistance was observed with Amikacin with 7.3% and Nitrofurantoin with 9.3%. Ofloxacin also showed 37.4% resistance. In a study by WHO [17], the resistance was 54% for fluoroquinolones and 41% for Cephalosporins.

Akram *et al.* [14] found the resistance to Escherichia Coli in Ceftazidime, Cefotaxime, Ceftriaxone, and Co-trimoxazole by 65%, 56%, 55%, and 76%, respectively. Quinolones have also been tested for Ciprofloxacin, with a resistance of 69%. But the difference between the findings by Mohammad Akram *et al.* [14] and this study is in the percentage of resistance to Amikacin, which in his study, it was 51%, and in this study, it was 7.3%, which could be due to the difference in sample size and measured less sample size than the antibiotic. Amin *et al.* [16] also reported that Escherichia Coli is very sensitive to Amikacin as a recommendation for treating urinary

tract infections. In a study by Rostamzadeh Khameneh *et al*. [12] on the outpatients, the resistance of Escherichia Coli was measured to fewer antibiotics and they resulted in that Resistance to Ceftizoxime, Gentamicin, and Ciprofloxacin were 89.5%, 83.9%, and 83.2%, respectively. Even though the mentioned antibiotics were correlated with the antibiotics of this study, there was no compatibility between the measured antibiotics, so the studies cannot be compared accurately and reliably. Mirsoleymani *et al.* [13] also reported the highest resistance of Escherichia Coli to Co-trimoxazole by 76% and the lowest resistance to Nitrofurantoin. Also, he reported the resistance to Cefotaxime, Cefixime, and Ceftriaxone by 58.6%, 72.2%, and 58.2%, respectively, which is in accordance with this study.

In this study, Klebsiella had a 4.5% share and was resistant by 58.3%, 41.1%, and 34.9% to Cephalotin, Cefotaxim, and Ceftriaxone, respectively, which was relative concordance with a study by WHO [17] reporting resistance to Cephalosporin, Carbapenem, and Methicillin by 48%, 54%, and 53%, respectively. Akram *et al.* [14] mentioned the resistance of this bacteria to Ceftriaxone and Cefotaxime by 47% and 41%, respectively, however, its difference with the present study was the resistance of Amikacin and Gentamicin by 35% and 53%, respectively due to the different geographical areas, smaller sample sizes, and differences in antibiotic resistance.

According to the results, it is recommended to use Nitrofurantoin and Ciprofloxacin antibiotics in outpatient treatment and Ceftazidime, Amikacin, or Gentamicin in hospitalized cases. It is recommended that Ceftriaxone, Cefixime, and Co-trimoxazole antibiotics not be used experimentally. On the other hand, due to the higher prevalence of this disease in the age range of 26-35 years and the higher prevalence of urinary tract infections in women, it is better to pay more attention to the history and test results at the mentioned age group.

Study limitations was incomplete details of patients.

Conclusion

Escherichia coli is the most common organism that causes urinary tract infections in men and women. This bacterium has shown the highest resistance to Cefalotin, Cefixime and Ceftriaxone, and Co-trimoxazole, as well as has shown most sensitivity to Amikacin, Nitrofurantoin, and Gentamicin.

Acknowledgments: This article is extracted from the thesis of Ali Amiri Kondari with registration number 3216/AS in Ahvaz Jundishapur University of Medical Sciences, and all rights of this research belong to Ahvaz Jundishapur University of Medical Sciences.

Ethical Permissions: IR.AJUMS.REC.1396.886

Conflicts of Interests: we declare this study has not any conflict of interest.

Authors' Contribution: Nashibi R (First Author), Introduction Writer/Main Researcher/Discussion Writer (50%); Ahmadi F (Second author), Introduction Writer Writer/Methodologist/Main Researcher/Discussion Writer (40%); Amiri Kondori A (Third author), Assistant Researcher/Statistical Analyst (10%)

Funding/Support: This work was supports by student research committee of ahvaz jundishapur university of medical science by number: GP96091.

References

1- McLellan LK, Hunstad DA. Urinary tract infection: Pathogenesis and outlook. Trends Mol Med. 2016;22(11):946-57.

2- Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. Nature Rev Microbiol. 2015;13(5):269-84.

3- Lee JB, Neild GH. Urinary tract infection. Medicine. 2007;35(8):423-8.

4- Osamwonyi B, Foley C. Management of recurrent urinary tract infections in adults. Surgery (Oxford). 2017;35(6):299-305.

5- Tenover FC. Mechanisms of antimicrobial resistance in bacteria. Am J Med. 2006;119(6):S3-10.

6- World Health Organization. Antimicrobial resistance: Global report on surveillance. Switzerland: World Health Organization; 2014 May. Report No.: WHO/HSE/PED/AIP/2014.2. Contract No.: 9789241564748.

7- Goossens H, Ferech M, Vander Stichele R, Elseviers M, ESAC Project Group. Outpatient antibiotic use in Europe and association with resistance: A cross-national database study. Lancet. 2005;365(9459):579-87.

8- Farajnia S, Alikhani MY, Ghotaslou R, Naghili B, Nakhlband A. International Journal of Infectious Diseases. 2009;13(2):140-4.

9- Varaldo PE. Antimicrobial resistance and susceptibility testing: An evergreen topic. J Antimicrob Chemother. 2002;50(1):1-4

10- Jarsiah P, Alizadeh A, Mehdizadeh E, Ataee R, Khanalipour N. Evaluation of antibiotic resistance model of escherichia coli in urine culture samples at kian hospital lab in Tehran. J Mazandaran Univ Med Sci. 2014;24(111):78-83. [Persian]

11- Linhares I, Raposo T, Rodrigues A, Almeida A. Frequency and antimicrobial resistance patterns of bacteria implicated in community urinary tract infection s: a ten-year surveillance study (2000-2009). BMC Infect Dis. 2013;13(1):19.

12- Khameneh ZR, Afshar AT. Antimicrobial susceptibility pattern of urinary tract pathogens. Saudi J Kidney Dis Transpl. 2009;20(2):251-3.

13- Mirsoleymani SR, Salimi M, Shareghi Brojeni M, Ranjbar M, Mehtarpoor M. Bacterial pathogens and antimicrobial resistance patterns in pediatric urinary tract infections: a four-year surveillance study (2009–2012). Int J Pediatr. 2014;2014:126142.

14- Akram M, Shahid M, Khan AU. Etiology and antibiotic resistance patterns of community-acquired urinary tract infections in J N M C Hospital Aligarh, India. Ann Clin Microbiol Antimicrob. 2007;6:4.

15- Kothari A, Sagar V. Antibiotic resistance in pathogens causing community-acquired urinary tract infections in India: a multicenter study. J Infect Dev Ctries. 2008;2(5):354-8.

16- Amin M, Mehdinejad M, Pourdangchi Z. Study of bacteria isolated from urinary tract infections and determination of their susceptibility to antibiotics. Jundishapur J Microbiol. 2009;2(3):118-123. [Persian]

17- World Health Organization. Antimicrobial resistance: global report on surveillance. Geneva: World Health Organization; 2014.