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*Original Article*

# Prevalence and Pattern of Antibiotic Resistance of *Escherichia Coli* Causing Urinary Tract Infections in Patients Referring to a Laboratory in Kermanshah

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**Introduction:** Uropathogenic *Escherichia coli* (UPEC) is among the primary cause of urinary tract infections (UTIs). This study was conducted to determine the antibiotic resistance pattern of *E. coli* isolates from UTIs in Kermanshah. **Methods**: In this study, 180 midstream urine samples were collected from outpatients for five months. Based on differential biochemical tests such as oxidase, Indole, and movement, one hundred *E. coli* isolates were obtained. In order to determine the antibiotic susceptibility of the *E. coli* isolates, Kirby-Bauer method on the Müller Hinton Agar (Merck, Germany) was performed according to the CLSI instruction, using nalidixic acid (30 mcg), gentamicin (10 mcg), cefalotin (30 mcg), co-trimoxazole (10 mcg), and co-amoxiclav (20 mcg) disks provided by a commercial company (Padtan Teb, Iran). **Results**: The mean age of the patients was 43.69 years. Out of 100 *E. coli*-infected patients, 74 were women with an average age of 42.77 years and 26 men with an average age of 45.88 years. The highest rate of UTI was in women aged 61-70 years and the lowest in men aged 71-80 years. The youngest patient was a one-year-old boy, and the oldest was a 95-year-old woman. The highest resistance was found to cefalotin (82%), and only one sample was resistant to gentamicin (1%). **Conclusion**: Gentamicin and co-amoxiclav are still effective drugs for the empirical treatment of urinary tract infections in Kermanshah. In contrast, cephalothin and possibly the first-generation cephalosporins are not recommended in this province. *J Med Microbiol Infec Dis, 2018, 6 (4): 99-102.*

**Keywords:** *Escherichia coli*, Urinary tract infection, Antibiotic resistance, Iran.

## INTRODUCTION

Uropathogenic *Escherichia coli* (UPEC) is among the primary causes of urinary tract infections (UTIs). The *E. coli* strains associated with UTIs cause a wide range of disorders including cystitis, urethritis, and pyelonephritis. The prevalence of the infection is 1% and 3-8% in boys and girls, respectively. The UPECs account for 70-90% of urinary tract infections [1-3]. The diagnosis and treatment of UTI is a major concern in the field of health care. Annually, around 150 million people worldwide are diagnosed with UTI, with an estimated 6 billion dollars in health care costs [4].

Antibiotic susceptibility testing is usually recommended after the identification of the urinary tract causative agent and before starting treatment [5]. However, despite repeated recommendations of the World Health Organization in the rational and appropriate use of antibiotics (the only weapons available to combat pathogenic microorganisms) the pattern and rate of their use are not the same in different parts of the world. In this regard, variations in the resistance rate of bacteria are reported from different regions of the world [6].

This study was conducted to determine the antibiotic resistance pattern of *E. coli* isolates originated from urinary tract infections in Kermanshah, Iran.

## MATERIAL AND METHODS

We collected 180 midstream urine samples from outpatients with suspected urinary tract infections during a period of 5 months from February 2015 to June 2015. Samples were cultured on blood agar and EMB agar and incubated at 37°C for 24 h. The cultures were checked for colonies and those with colony counts $\geq 10^5$ were considered positive for urinary tract infection and were subjected to biochemical tests such as oxidase, fermentation of sugars, movement, indole, urease, nitrate reduction, MR, VP, $H_2S$, Simmon's citrate, amino acid metabolism (lysine, arginine, phenylalanine, and ornithine) and culture on KIA medium.

**Antibacterial susceptibility test.** The antibiotic susceptibility of the *E. coli* isolates was checked by Kirby-Bauer method on the Müller Hinton Agar (Merck, Germany)

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according to the CLSI guidelines, using nalidixic acid (30 mcg), gentamicin (10 mcg), cefalotin (30 mcg), cotrimoxazole (10 mcg), and co-amoxiclav (20 mcg) disks produced by a commercial company (PadtanTab, Tehran, Iran). After incubation at 37°C for 18-24 h, the growth inhibition halos were measured and compared to the standard table, and the strains were defined as resistant (R), intermediate (I) and sensitive (S) accordingly [5].

## RESULTS

The average age of the patients was 43.69 years. Out of 100 *E. coli*-infected patients, 74% were women with an average age of 42.77 years and 26% males with an average age of 45.88 years. The highest rate of urinary tract infection was observed in women aged 61-70 years, and the lowest in men aged 71-80 years. The youngest patient was a one-year-old boy, and the oldest a 95-year-old woman (Fig. 1)

**Antibiotic susceptibility test.** The *E. coli* isolates (n=100) exhibited the highest resistance to cefalotin (82%), and the lowest to gentamicin (1%). The antibiotic resistance pattern of the *E. coli* isolates to the antibiotics commonly used for the treatment of urinary tract infections, *i.e.*, nalidixic acid, gentamicin, cefalotin, cotrimoxazole, and co-amoxiclav, are reflected in Table 1.

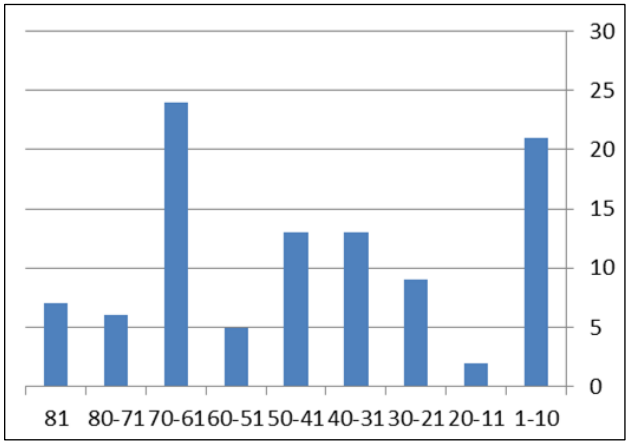


**Fig. 1.** Age distribution of the patients with UTI.

**Table 1.** Antibiotic resistance percentage to five common antibiotics

| Antibiotic | Resistance Percentage |
|---|---|
| Nalidixic acid (NA) | 35 |
| Gentamicin (GM) | 1 |
| Cefalotin (CF) | 82 |
| Co-trimoxazole (SXT) | 47 |
| Co-amoxiclav (CAC) | 18 |

## DISCUSSION

In the present study, most isolates were resistant to cefalotin, and the least (1%) were resistant to gentamicin. Our results were almost similar to a another study in Ahwaz on *E. coli* isolates from patients with catheter-associated urinary tract infection that showed relatively high sensitivity to nalidixic acid and gentamicin [7]. In Ilam, *E. coli* isolates were highly resistant to co-trimoxazole and susceptible to nitrofurantoin, gentamicin, and ciprofloxacin [8]. In Fasa, *E. coli* isolates recovered from urine cultures exhibited the highest sensitivity to amikacin (89.8%), nitrofurantoin (83.6%) and gentamicin (65.6%) and the highest resistance to ampicillin (100%), cefalexin (69.6%) and co-trimoxazole (68.7%) [9]. In Sanandaj, a study showed *E. coli* as the most common cause of UTI, with the highest resistance to ampicillin (43.87%) and the lowest resistance to nitrofurantoin (3.62%) [10], while in a similar study in the same city the highest resistance rate was to sulfamethoxazole (28%), cefalexin (22%), tetracycline (23%), gentamicin (27%), and the lowest to nitrofurantoin (33%), cefpodoxime (24%), ciprofloxacin (23%), amikacin (20%) [11]. In Tabriz, the highest sensitivity was to imipenem (90.95%), nitrofurantoin (85.97% %) and cefotaxime (71.02%), and the highest resistance to ampicillin (83.95%), tetracycline (80.97%) and co-trimoxazole (63.92%) [5]. In Kashan, UPECs as the most common cause of UTI in children showed the highest resistance to ampicillin (90.4%), followed by amoxicillin (88.6%), cefalexin (78.9%), trimethoprim-sulfamethoxazole (64.9%), cefixime (54.4%), nitrofurantoin (49.1%), ceftriaxone (41.2%), nalidixic acid (25.4%) and cefuroxime (16.7%) [6]. Also, *E. coli* isolates from children with pyelonephritis and cystitis in Tehran exhibited the highest resistance to gentamycin (95.1%) and ampicillin (91.9%) and the least resistance to imipenem (6.4%) and ofloxacin (16.1%) [12].

The antibiotic-resistant pattern obtained in Kermanshah province was almost similar to some areas and different from some other ones. This variation is due to the practice of different therapeutic regimens in the different areas.

Other contributing factors might be population genetics, variation in genetic components of strains, inappropriate or excessive use of antibiotics [13], the health status of individuals, time of the study [14], and antibiotic metabolism in the different populations [15]. Table 2 compares the antibiotic resistance of the UPECs in Kermanshah in different studies. In Kermanshah, the antibiotic-resistant pattern of UPECs examined at the intervals (2008, 2011, 2014 and this study), seems to be stable, at least for the antibiotics examined. In this study, the UPECs showed no changes in resistance to nalidixic acid and reduced resistance to gentamicin. The reduced resistance may be due to the lack of access to this medication for the treatment of UTIs in this city. In the other hand, although it seems that the resistance to cephalothin has increased, a decrease was observed to co-trimoxazole. In the case of co-amoxiclav, due to lack of previous data from Kermanshah, the comparison could not be made, but our results showed that the isolated UPEC were highly resistant to the tested antibiotics.

**Table 2.** Antibiotic resistance pattern of *E. coli* strains isolated from UTI in Kermanshah

| Antibiotic name | RESISTANCE (%) | | | |
|---|---|---|---|---|
| | This study (2015) | Jalilian *et al.* (2014) [16] | Mohajeri *et al.* (2011) [17] | Madani *et al.* (2008) [18] |
| **Nalidixic acid** | 35 | 51.4 | - | 38.5 |
| **Gentamicin** | 1 | 21.2 | 15 | 43.3 |
| **Cephalothin** | 82 | 58.9 | - | 66.7 |
| **Co-trimoxazole** | 47 | 65.2 | 62.5 | 61.1 |
| **Co-amoxiclav** | 18 | - | - | - |

Since the decreased administration of antibiotics can prevent or limit the spread of resistance [13, 16, 19], the implementation of a comprehensive program to monitor antibiotic resistance in different geographical areas is crucial. Consequently, according to the results of this study and the comparison between previous studies in this region, gentamicin and co-amoxiclav are still effective drugs for the empirical treatment of urinary tract infections in Kermanshah. In contrast, cephalothin and possibly the first-generation cephalosporins are not recommended in this province.

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## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this manuscript.

## REFERENCES

1. Riccabona M. Urinary tract infections in children. Curr Opin Urol. 2003; 13 (1): 59-62.

2. Schalger TA. Urinary tract infections in children younger than 5 years of age. Pediatr Drugs. 2001; 3 (3): 219-27.

3. World Health Organization (WHO). Urinary Tract Infections in Infants and Children in Developing Countries in the Context of IMCI. World Health Organization. Geneva, Switzerland. 2005.

4. Akoachere JF, Yvonne S, Akum NH, Seraphine EN. Etiologic profile and antimicrobial susceptibility of community-acquired urinary tract infection in two Cameronian towns. BMC Res Notes. 2012; 5 (1): 219-26.

5. Molaabaszadeh H, Hajisheikhzadeh B, Mollazadeh M, Eslami K, Mohammadzadeh-Gheshlaghi N. The study of Sensibility and Antimicrobial Resistance in *Escherichia coli* Isolated from urinary tract infection in Tabriz City. J Fasa Uni Med Sci. 2013; 3 (2): 149-54 [In Persian].

6. Sharif MR and Nouri S. Frequency and Pattern of Antibiotic Resistance of Organisms Causing Urinary Tract Infection in Children in Shahid Beheshti Hospital of Kashan. 1391-1392. Iran J Infect Dis Trop Med. 2014; 19 (65): 47-51 [In Persian].

7. Mousavian SM, Mashaalli. Evaluation of bacterial infections of the urinary tract after catheterization and determination of antibiotic resistance pattern of bacteria isolated from patients. Sci J Hamdan Univ Med Sci. 2004; 32 (2): 29-34 [In Persian].

8. Mohammadi S, Argha K, Akhzarifar N, Panahi Z, Pakzad I, Sayehmiri K. Analysis of Antibiotic Resistance in Bacterial Strains Isolated from Urine Cultures of Patients Referred to Clinical Laboratories of Ilam City during 2012. J Ilam Univ Med Sci. 2016; 24 (2): 179-85 [In Persian].

9. Molazade A, Gholami MS, Shahi A, Najafipour S, Mobasheri F, Ashraf- Mansuri J, et al. Evaluation of Antibiotic Resistance Pattern of Isolated Gram-Negative Bacteria from Urine Culture of Hospitalized patients in Different Wards of Vali-Asr Hospital in Fasa During the Years 2012 and 2013. J Fasa Uni Med Sci. 2014; 4 (3): 275-83 [In Persian].

10. Mohammadi S, Ramazanzadeh R, Zandi S, Rouhi S, Mohammadi B. Isolation and antibiotic resistance pattern determination of bacteria causing urinary tract infections in patients referred to Sanandaj`s Tohid Hospital, 2013-2014. Sci J Kurdistan Univ Med Sci. 2015; 16 (50): 55-62 [In Persian].

11. Raeeszadeh M, Ahmadi E, Shafiee M. Identification of the antibiotic resistance patterns in bacteria isolated from urinary tract infections in patients admitted to Shahid Ghazi Hospital Sanandaj in the first 6 months of 2014. Razi J Med Sci. 2016; 23 (147): 11-7 [In Persian].

12. Dormanesh B, Mirnejad R, Khodaverdi-Darian E, Momtaz H, Yahaghi E, Safarpour-Dehkordi F, et al. Evaluation of

virulence factors, serogroups and resistance to the antibodies of *E. coli* strains isolated from children with pyelonephritis and bladder inflammation. Iran J Microbiol. 2013; **7** (2): 27-39 [In Persian].

13. Farajnia S, Alikhani MY, Ghotaslou R, Naghili B, Nakhlband A. Causative agents and antimicrobial susceptibilities of urinary tract infections in the northwest of Iran. Int J Infect Dis. 2009; 13: 140-4.

14. Amiri P, Pournajaf A, Shavalipour A, Tayebi Z, Goudarzi1 H, Eslami G, et al. Evaluation of Antimicrobial Resistance in the Beta-lactamase Producing *Escherichia Coli* Isolated from Urinary Tract Infection in the Patients Referring to Taleghani Hospital of Tehran. Tabari J Prev Med 2015; 1 (2): 11-9 [In Persian].

15. Issazadeh Kh, Naghibi SN, Khoshkholgh-Pahlaviani MRM. Drug Resistance and Serotyping of Uropathogenic *Escherichia coli* among Patients with Urinary Tract Infection in Rasht, Iran. Zahedan J Res Med Sci. 2015; 17 (6): 1-5.

16. Jalilian S, Farahani A, Mohajeri P. Antibiotic resistance in uropathogenic *Escherichia coli* isolated from urinary tract infections out-patients in Kermanshah. Int J Med Public Health. 2014; 4 (1): 75-7.

17. Mohajeri P, Izadi B, Rezai M, Falahi B, Khademi H, Ebrahimi R. Assessment of the frequency of Extended Spectrum Beta lactamases Producing *Escherichia coli* Isolated from Urinary Tract Infections and its Antibiotic Resistance Pattern in Kermanshah. J Ardabil Univ Med Sci. 2011; 11 (1): 86-94 [In Persian].

18. Madani SH1, Khazaee S, Kanani M, Shahi M. Antibiotic Resistance Pattern of *E. coli* Isolated from Urine Culture in Imam Reza Hospital Kermanshah-2006. J Kermanshah Univ Med Sci. 2008; 12 (3): 287-95 [In Persian].

19. Habibi-Asl B, Asghari R, Ahangarzadeh Rezaee M, Mohammad-Zadeh A, Abri R. Evaluation of etiologic agents and antimicrobial resistance pattern of urinary tract infections in the northwest of Iran. J Anal Res Clin Med. 2018; 6 (1): 7-12.