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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.

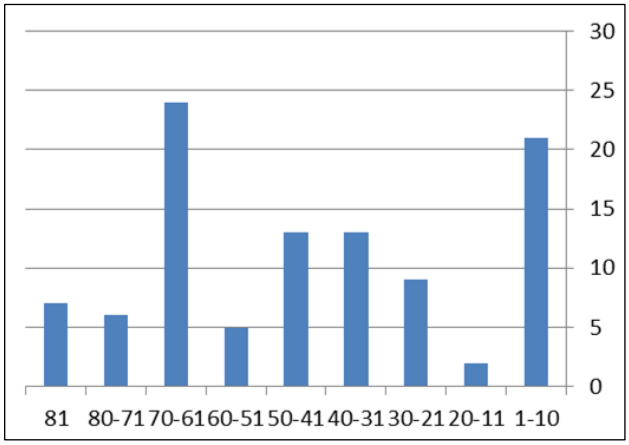


Fig. 1. Age distribution of the patients with UTI.

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.

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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.

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