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The prevalence of bacterial sensitivity and resistance in non-complicated urinary tract infection in outpatient with urinary tract infection in Kermanshah city

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ABSTRACT

Background: Urinary tract infections (UTIs) are one of the most well-known infections in inpatients and outpatients of the Hospital. This study checked the prevalence of bacterial sensitivity and resistance in non-complicated UTIs in outpatients.

Materials and Methods: In this cross-sectional study, the morning urine samples was collected from 600 patients with regard to criteria over 16 years old who referred to the reference laboratories in 2015.

Results: The prevalence of UTI was higher in women in contrast men (91/8% versus 8.2%). *Nitrofurantoin* had the most sensitivity (91.3%) and Nalidixic acid had the most resistance (52.7%). There were significant differences between sex with antibiotic sensitivity and resistance for Ciprofloxacin, Cefixime, Co-trimoxazole, and *Nitrofurantoin*. Escherichia coli had the most resistance to Nalidixic acid and the least resistance to *Nitrofurantoin*.

Conclusions: In the present study, the most sensitivity was to Nitrofurantoin (91.3%) and the most resistant was to Nalidixic acid (52.7%).It is recommended that periodically, every few years and in each region, an antibiotic resistance pattern of pathogens be checked in order to obtain the best drug in the treatment of UTIs.

Keywords: Urinary tract infection, bacterium, antibiotic, sensitivity, resistance

1. INTRODUCTION

Uncomplicated urinary tract infections (UTIs) are common in primary care [1] and are the most common bacterial infection seen in the community [2]. The current treatment of uncomplicated UTI is empirical, based on the limited and predictable spectrum of etiological microorganisms [3]. They occur in healthy individuals with either no structural or functional abnormalities of the urinary tract [4]. More than 90% of uncomplicated UTIs are monomicrobial *[5]*. *Escherichia coli* is the most common pathogen isolated in around 75% of uncomplicated UTI [6,7], to a lesser extent by other Enterobacteriaceae, Enterococci and Staphylococci [8]. Antibiotics have always been considered one of the wonder discoveries of the 20th century. The successful use of any therapeutic agent is compromised by the potential development of tolerance or resistance to that compound from the time it is first employed [9]. Knowledge of the actual local rates of antibiotic resistant pathogens as well as the underlying mechanisms are important factors in addition to the geographical location and the health state of the patient for choosing the most effective antibiotic treatment [10]. In this study, the common organisms in non-complicated UTI and their sensitivity and resistance to existing antibiotics have been identified which can be a good guide for physicians to choose appropriate treatment for patients and prevent the increased resistance of strains of the disease agent.

2. MATERIALS AND METHODS

This study was approved by the Ethics Committee of Kermanshah University of Medical Sciences, Kermanshah, Iran (Code: KUMS.REC.1395.715; Link: http://vc-research.kums.ac.ir/fa/researchmattersmanagement/akhlagh/fehrestpajaheshha). The target population of this cross-sectional study included all outpatients in 2015 with UTI over 16 years old referring to reference laboratories in Kermanshah city, Iran.At first, patients' information was entered in the questionnaire and patients who did not have entry requirements were excluded from the study. Exclusion criteria included the patients with a history of underlying illness (such as diabetes), urogenital diseases (such as kidney stones, urinary tract surgery, or anatomical diseases of the urinary tract), neurological diseases (such as spinal canal injuries), having fever, having urinary catheter, pregnant women, and antibiotic use within days before the starting the study.

In this study, morning urine specimens of patients referring to the labs specified in the city were collected with the consent of the patient. The method of collecting was that the urinary tract was washed and dried with water and soap and then the primary and the end of the urine were discarded and in the middle of the sterile container collected, the samples collected quickly returned to the Microbiology Laboratory was delivered. Samples were cultured in laboratory or immediately on synthetic culture media and stored for antibiotic resistance (antibiotic disks) or stored in a refrigerator at 4 ° C until they were cultured. An antibiotic sensitivity test was performed using disk diffusion method, and the antibiotic resistance results of the bacteria were placed in two groups: sensitivity (with semi-sincerity) and resistant. Bactria included were Escherichia coli, Klebsiella, Aureus, Epidermis, Proteus, Pseudomonas, and Saprophyticus. Antibiotics used were Ciprofloxacin, Cefixime, Co-trimoxazole, *Nitrofurantoin*, Nalidixic acid, Gentamicin, and Amikacin.

The results of the laboratory tests were entered in an information form and entered into SPSS software version 16 after the encryption to perform statistical analyses.

3. RESULTS

Out of 600 patients, 551 patients (91.8%) were females and 49 (8.2%) males. The mean age ± SD (range) of females was 48.74 ± 18.67 years (16-92 years) and for males was 60.1 ± 14.59 years (23-84 years). The mean age ± SD (range) of all patients was 49.67 ± 18.62 years (6-92 years). Figure 1 shows the results of urine culture on a synthetic laboratory environment.

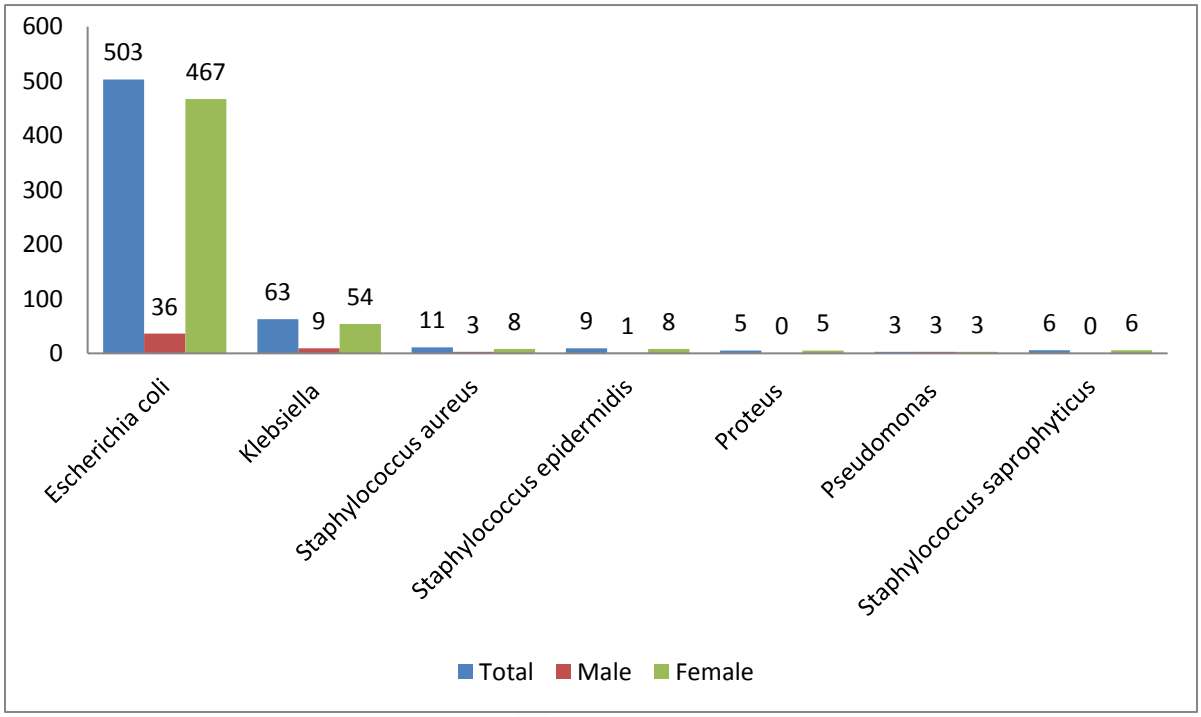

Figure 1
The prevalence of types of bacteria in urine culture of patients

Table 1 Results of sensitivity and resistance to antibiotics based on sex

Sex / Antibiotic		**Male**, n= 49	**Female**, n= 551	**Total**, n=600	**P-value**
Ciprofloxacin	S%	46.9	70.4	68.5	<0.001
	R%	53.1	29.6	31.5	
Cefixime	S%	32.7	57	55	<0.001
	R%	67.3	43	45	
Co-trimoxazole	S%	46.9	66.6	65	0.006
	R%	53.1	33.4	35	
Nitrofurantoin	S%	83.7	92	91.3	0.006
	R%	16.3	8	8.7	
Nalidixic acid	S%	36.7	48.3	47.3	0.121
	R%	63.3	51.7	52.7	
Gentamicin	S%	87.8	82	82.5	0.312
	R%	12.2	18	17.5	
Amikacin	S%	93.9	89.8	90.2	0.461
	R%	6.1	10.2	9.8	

Abbreviations: S, sensitivity; R, resistance.

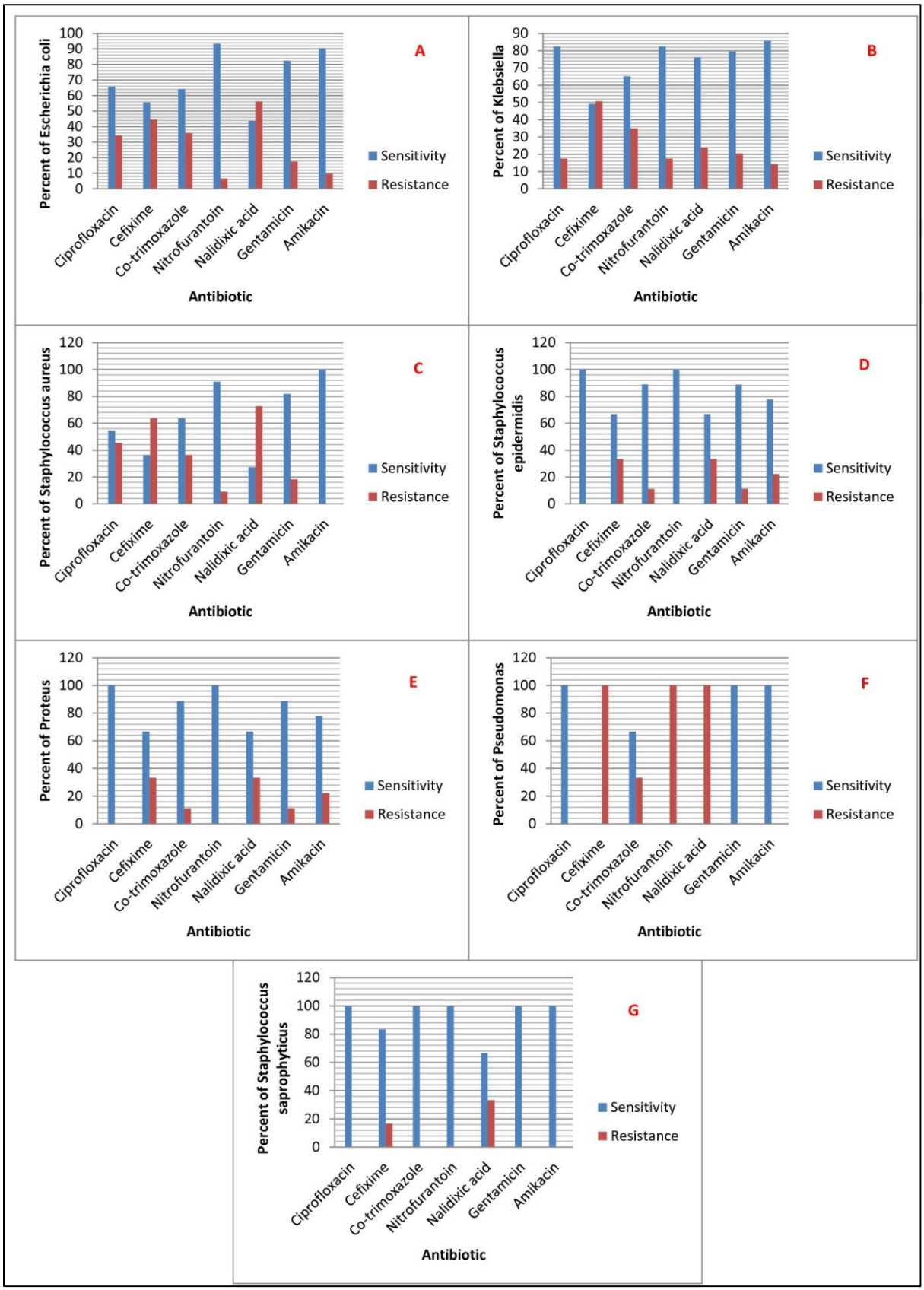

Figure 2

Antibiotic sensitivity and resistance to: (A)Pseudomonas aeruginosa, (B)Klebsiella, (C) Staphylococcus aureus, (D) Staphylococcus epidermidis, (E) Proteus, (F) Pseudomonas, and (G) Staphylococcus saprophyticus.

Table 1 shows the results of sensitivity and resistance to antibiotics studied in this study in both sexes and also the relationship between sex and sensitivity and resistance to antibiotics in uncomplicated UTIs. *Totally Nitrofurantoin* had the most sensitivity (91.3%) and Nalidixic acid had the most resistance (52.7%). The most sensitivity in males and females were to Amikacin (93.9% and 89.8%, respectively). The most resistance in males was to Cefixime (67.3%) and in females was to Nalidixic acid (51.7%). There were significant differences between sex with antibiotic sensitivity and resistance for ciprofloxacin (P<0.001), Cefixime (P<0.001), Co-trimoxazole (P=0.006), and *Nitrofurantoin* (P=0.006).

Figure 2 shows the findings of the simultaneous culture of the bacterium and antibiotics selected in this study to determine the sensitivity and resistance of each bacterium to the antibiotics studied. Escherichia coli had the most resistance to Nalidixic acid and the least resistance to *Nitrofurantoin*, Klebsiella had the most resistance to Cefixime and the least resistance to Amikacin, Aureus had the most resistance to Nalidixic acid and the least resistance to Amikacin, Epidermis had the most resistance to Cefixime and the least resistance to Nalidixic acid, Epidermis had the most resistance to Cefixime and Nalidixic acid and the least resistance to Ciprofloxacin and *Nitrofurantoin*, Proteus had the most resistance to *Nitrofurantoin* and the least resistance to Ciprofloxacin, Amikacin, and Cefixime; Pseudomonas had the most resistance to *Nitrofurantoin* and Cefixime and the least resistance to Ciprofloxacin, Amikacin, and Gentamicin; and Saprophyticus had the most resistance to Nalidixic acid and the least resistance to Ciprofloxacin, *Nitrofurantoin*, Amikacin, and Gentamicin.

4. DISCUSSION

Considering that the ability to create resistance to the causative organisms of the disease is due to several factors such as the pattern of antibiotic use in each country or organism's virulence in the region. Therefore, testing and determining the pattern of antibiotic resistance in each region is a valuable tool for treatment of better of native patients. Out of 600 patients in this study, 91.8% were females that the mean age of women with UTIs was 48.14 years and the mean age of men was 60.1 years. Jalilian et al. [11] in Kermanshah, Iran in 2014 showed that the prevalence of women with UTI was 85.7%. One study on 1494 isolates collected from the USA and 496 from Canada showed that the mean age of the patients was 48.3 years (range 1 month to 99 years), and 79.5% and 20.5% of isolates were obtained from women and men, respectively [12]. Other studies [13,14] confirmed the result of the present study and previous study that UTIs in women is more than men.

In the present study, the most prevalence of strains of UTIs was Escherichia coli, followed by Klebsiella, Aureus, Epidermis, Proteus, Pseudomonas, and Saprophyticus, respectively. One study [15] in 2008 in East Azarbaijan, Iran reported that 504 samples of Escherichia coli, 79 Enterococci, and 8 Klebsiella were Isolated from urine samples of patients. Jalilian et al. [11] reported 65.2% Escherichia coli from positive urine samples, while other members of the Enterobacteriaceae family were 7.2%. One study by Kashef et al. [16] checked antimicrobial susceptibility patterns and showed that Escherichia coli (68.8%), Proteus (12.4%), and Klebsiella (9.6%) had the most prevalence and was consistent with the result of the present study. Wong et al. [17] showed that out of 298 patients included in the study, Escherichia coli was detected in 107 (76%) out of the 141 positive urine samples.

According to the present study about the resistance of strains to antibiotics, Aghamahdi et al. [18] in Rasht, Iran, reported that Ciprofloxacin was the most effective antibiotic against bacterial isolates. Another study [2] in Tabriz, Iran, showed that Antibiotic ciprofloxacin in Escherichia coli in third place after Gentamicin (97%) and Amikacin (96.8%), in the Klebsiella, the first place with Amikacin (98.7%), and in the Enterobacter with Amikacin and Nalidixic acid (100%) were the most effective antibiotics. In France [19], was reported that 98.3% isolates of Escherichia coli and 97.5% Klebsiella were sensitive to ciprofloxacin. Also, these isolates have a high sensitivity to Nalidixic acid and Gentamicin (90 to 100%). In Saudi Arabia [3], 86.3% isolates of Escherichia coli, 97% Klebsiella, and 92.1% Enterobacter were sensitivity to Ciprofloxacin. During 2000 to 2010, one study by Sanchez et al. [20] from standard urine specimens of 12,253,679 outpatients showed the greatest increases in Escherichia coli resistance for ciprofloxacin (3% to 17.1%). In the present study, the most sensitivity was to Nitrofurantoin (91.3%) and the most resistant was to Nalidixic acid (57.2%). Zhanel et al. [12] showed that among all 1990 isolates, the most common organisms were Escherichia coli (57.5%), Klebsiella pneumoniae (12.4%), Enterococcus spp. (6.6%), Proteus mirabilis (5.4%), Pseudomonas aeruginosa (2.9%), Citrobacter spp. (2.7%), Staphylococcus aureus (2.2%), Enterobacter cloacae (1.9%), coagulase-negative staphylococci (1.3%), Staphylococcus saprophyticus (1.2%), Klebsiella spp. (1.2%), Enterobacter aerogenes (1.1%) and Streptococcus agalactiae (1.0%) that 45.9% were resistant to Ampicillin, 14.3% to Nitrofurantoin, and 9.7% to ciprofloxacin. Also, for Escherichia coli only, resistance rates were significantly higher in US compared with Canadian medical centers [12]. Gangcuangco et al. [21] reported that for the 179 E. coli, resistance rates were highest for Ampicillin (64.3%) and Trimethoprim-sulfamethoxazole (41.3%). A multicenter surveillance study in the US and Canada, reported that overall resistance rates to ciprofloxacin and Levofloxacin were 5.5% and 5.1%, respectively [22]. A total of 69 *Escherichia coli* isolates from human urine specimens were obtained and screened for their antibiograms that a high resistance level was detected against Augmentin (87.5%) [23]. Antibiotic resistance of Escherichia coli from community-acquired UTIs is in relation to demographic and

clinical data and therefore it is necessary to take into account the type of UTI (uncomplicated versus complicated), previous antimicrobial therapy, and the sex and age of each patient [24]. The results were different in studies that can be because difference in race, area, age, sex, the type of UTI and etc. Apart from many factors involved in UTIs, local knowledge of sensitivity rates of uropathogens is essential for therapeutic decision making regarding patients with UTIs [25].

5. CONCLUSION

In the present study, the most sensitivity was to Nitrofurantoin (91.3%) and the most resistant was to Nalidixic acid (52.7%). Given that antibiotic resistance patterns are different in different regions and resistance to newer antibiotics is also increasing, it is recommended that periodically, every few years and in each region, an antibiotic resistance pattern of pathogens be checked in order to obtain the best drug in the treatment of UTIs. Naturally, this protocol so will play a significant role in reducing the length and costs of treatment of patients and also the bacterial resistance to antibiotics.

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CONFLICT OF INTEREST

The authors have declared that there was no conflict of interest.

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