



## Antibiotic resistance in patients referred to Ali-ebn Abi-Taleb Hospital, Qom, Iran (2014-2015)

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### Abstract

**Background:** In recent years, the risk of acquiring antibiotic resistance has been increasing due to the widespread use of antibiotics. This study aims to evaluate the antibiotic resistance pattern in patients referred to Ali-ebn Abi-Taleb hospital.

**Materials and Methods:** In a descriptive study, samples of urine, blood, cerebrospinal fluid, and body fluid were collected from patients referred to Ali-ebn Abi-Taleb Hospital from September 2014 to February 2015. Of these, 687 isolates identified as *E. coli* were tested for antibiotic susceptibility against 15 antibiotics by the Kirby- Bauer method based on CLSI 2015. The relevant prevalence, percentage, and mean were reported using SPSS (version 16).

**Results:** A total of 10824 samples were collected. A total of 866 isolates were grown on an agar medium, and 80.3% of the samples were isolated from women. The highest rate of antibiotic resistance was reported to be for Amoxicillin (82.2%). The lowest rate of antibiotic resistance was reported against Nitrofurantoin (14%).

**Conclusions:** We concluded there is an increasing rate of antibiotic resistance among *E. coli* isolates. Therefore, the necessity of identifying drug resistance is apparent using precise and straightforward methods to prevent the extensive distribution of antibiotic resistant agents.

**Keywords:** Antibiotic Resistance, *E. coli*, Drug Resistance

### Introduction

Gram-negative and Gram-positive bacteria can cause urinary tract infections (UTIs), such as *Escherichia coli*, *Staphylococcus aureus*, *Staphylococcus saprophyticus*, *Pseudomonas aeruginosa*, *Klebsiella spp.*, *Enterobacter spp.*, *Proteus spp.*, *Haemophilus spp.*, and Coagulase-Negative Staphylococci (CoNS). These organisms colonize anal and perineal sections. Furthermore, resistance to antibiotics is increasing and can

create multidrug-resistant (MDR) as well as extensively drug-resistant (XDR) strains [1, 2].

*E. coli* are gram-negative and opportunistic bacteria most common in nosocomial infections, such as meningitis, sepsis, gastroenteritis, and UTI. In addition, they are the first pathogens causing nosocomial infections and the most common bacteria inducing community-acquired genital tract infections (UTIs) [3, 4]. Among antibiotic candidates for treating infections caused by *E. coli* are beta-lactam antibiotics, including

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cephalosporins and carbapenems, which can destroy bacterial cell walls [5, 6].

The treatment of *E. coli* in nosocomial infections is a global concern [7, 8]. Due to the presence of MDR and XDR *E. coli* in UTI patients, the costs of treatment, morbidity, and mortality are increasing, especially in developing countries, such as Iran [9, 10].

The extensive use of antimicrobial agents in the fields of human medicine, aquaculture, veterinary medicine, and horticulture has turned them into the sources of antibiotic-resistant bacteria [11]. As the risk of antibiotic resistance is high [12], the emergence of antibiotic resistance in nosocomial pathogens capable of causing nosocomial infections is a global concern.

This study was conducted to evaluate the antibiotic resistance pattern in patients referred to Ali-ebn Abi-Taleb Hospital from September 2014 to February 2015.

### Materials and Methods

In a cross-sectional study, samples of urine, blood, cerebrospinal fluid, and body fluid were collected from patients referred to Ali-ebnAbi-Taleb Hospital (Qom) from September 2014 to February 2015.

At the first stage, the identification task was conducted based on biochemical and bacteriological standard tests, in which the samples were cultured on EMB agar, Blood agar, and Mac Conkey agar (13). At the next stage, the isolates were cultured in different media, including Triple Sugar Iron (TSI), Sulphide Indole Motility (SIM) (Merck-Germany), Methyl Red VogesProskauer (MR/VP) (Merck-Germany), and the Simmon Citrate medium (Merck-Germany), and they were then incubated at 37 °C for 18-24 hours [13].

Antimicrobial resistance rates were determined by the disc diffusion method, according to CLSI 2015. *E. coli* ATCC 25922 was used as a control for all testes. Next, antibiogram evaluations were carried out in Muller Hinton Agar (MHA), according to the CLSI protocol with PATANTEB (PatanTeb-Iran) antibiotic discs, including Ceftazidime (30 µg), Cefotaxime (30 µg), Ceftriaxone (30 µg), Imipenem (10 µg), Gentamicin (10 µg), Ciprofloxacin (5 µg), Amikacin (30 µg), Nalidixic acid (30 µg), Nitrofurantoin (300 µg), Cefixime (5 µg), Ceftizoxime (30 µg), Cotrimoxazole (25 µg), Amoxicillin (25 µg), and Azithromycin (15 µg). The plates were then incubated at 37 °C for 18-24 hours. The diameter of the inhibitory growth zone was measured and the resistance rates were determined based on CLSI 2015 [14]. The relevant prevalence, percentage, and mean were reported by SPSS Statistics 16.

### Results

In this study, a total of 10,824 samples of urine, blood, cerebrospinal fluid, and body fluid were collected from patients referred to Ali-ebnAbi-Taleb Hospital (Qom) in a 6-month period. The patients' ages ranged from one-month infants to 92-year old people. The 866 isolates were grown on an agar medium. There were 687 isolates identified as *E. coli*, among which, 552 (80.3%) isolates belonged to women. These isolates were tested for antibiotic susceptibility to 15 antibiotics by the Kirby- Bauer method, based on CLSI 2015. There were 495 (72%) samples taken from outpatients and 192 (18%) samples taken from the admission part. Approximately 99.5% of the *E. coli* bacteria were isolated from urine samples. Table 1 shows the characteristics of the clinical specimens.

**Table 1:** Characteristics of a total of 687 samples collected from outpatients and those at the admission part

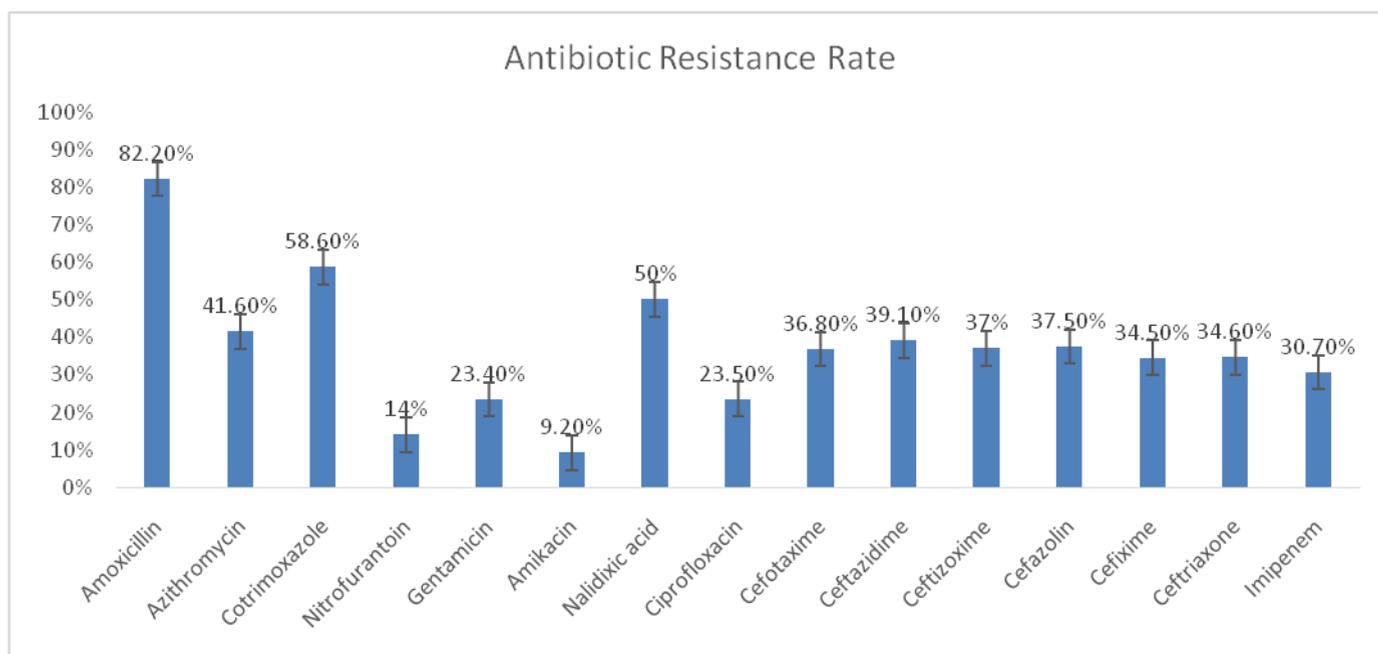
Variables	Sex		Patients	
	Women	Men	Outpatients	Admission
<i>E. coli</i> isolates	552	135	495	192
Percentage (%)	80.3	19.7	72	18

In this study, the highest resistance rate was determined to be for Amoxicillin (82.2%) and Cotrimoxazole (58.6%). In contrast, the lowest resistance rate was identified to belong to Amikacin (9.2%) and Nitrofurantoin (14%). In addition, the rate of two-drug resistance

(Amoxicillin, Cotrimoxazole) was 53.2%, and that of three-drug resistance (Azithromycin, amoxicillin, and Cotrimoxazole) was 39.6%. Table 2 shows the rate of resistance to other antibiotics. Chart 1 represents the antibiotic resistance pattern.

**Table2:**The pattern of resistance to 15 antibiotics in UTI

Antibiotic	Sensitive (mm)	Intermediate (mm)	Resistance (mm)	Percentage of Resistance
Amoxicillin (25 µg)	≥18	14-17	≤13	82.2 %
Azithromycin (15 µg)	≥18	14-17	≤13	41.6 %
Co-trimoxazole (25 µg)	≥16	11-15	≤10	58.6 %
Nitrofurantoin (300 µg)	≥17	15-16	≤14	14 %
Gentamicin (10 µg)	≥15	13-14	≤12	23.4 %
Amikacin (30 µg)	≥17	15-16	≤14	9.2 %
Nalidixic acid (30 µg)	≥19	14-18	≤13	50 %
Ciprofloxacin (5 µg)	≥21	16-20	≤15	23.5 %
Cefotaxime (30 µg)	≥26	23-25	≤22	36.8 %
Ceftazidime (30 µg)	≥21	18-20	≤17	39.1 %
Ceftizoxime (30 µg)	≥25	22-24	≤21	37 %
Cefazolin (30 µg)	≥23	20-22	≤19	37.5 %
Cefixime (5 µg)	≥19	16-18	≤15	34.5 %
Ceftriaxone (30 µg)	≥23	20-22	≤19	34.6 %
Imipenem (10 µg)	≥23	20-22	≤19	30.7 %



**Figure1:** Antibiotic resistance rates for isolates collected from patients referred to Ali-ebnAbi-Taleb Hospital (Qom) from September 2014 to February 2015.

**Discussion**

Antibiotic resistance in bacteria is usually caused by mechanisms, such as the production of drug-degrading enzymes, changes in membrane permeability, variations in drug side effects, and efflux pumps. *E. coli* are among the most prevalent bacteria detected in soil, water, etc. Correspondingly, *E. coli* are among the most opportunistic bacteria in nosocomial infections, especially in UTI patients. In fact, the antibiotic resistance of *E. coli* is important, particularly in outpatients and UTI patients. *E. coli* have a plasmid that could transfer Beta-lactamase genes. Hence, the diagnosis and treatment of UTI are global concerns.

In this study, a total of 10,824 samples of urine, blood, cerebrospinal fluid, and body fluid were collected from patients referred to Ali-ebnAbi-Taleb Hospital (Qom) from September 2014 to February 2015. The patients' ages ranged from one-month

infants to 92-year old people. The 866 specimens were grown on a common bacteriological medium, among which 687 isolates were identified as *E. coli*, based on the common microbial culture and the biochemical test. Pourmand et al [15] studied UTIs in renal transplant patients at Sina University Hospital and reported that *E. coli* were the first cause of infections in UTI patients. Asadimanesh et al [16] explained that *E. coli* were the most prevalent bacterial factor in primary and recurrent UTIs. In addition, according to them, *E. coli* were the most prevalent bacteria in UTIs, which confirms the results of the present study.

Women are more likely to develop UTIs than men. Chuang et al [17] reported that the prevalence of UTIs was more in women (68%) than in men (30%). Besides, in the study of Asadimanesh et al [16], 60.68% of the samples were women, and 39.31% of them were men. According to these results, UTIs are more prevalent in women than in

men, yet the results of other studies showed that there were no differences between women and men in terms of developing UTIs [18]. According to the results of the present study, UTIs are more prevalent in women (80%) than in men. One of the reasons of the increase in UTIs in women compared to men could be the shortness of the urinary tract in women compared to men.

Manouchehri et al [19] reported that *E. coli* had the highest rate of resistance to Ceftazidime and Cefotaxime; however, in the other study, the isolates had the highest rate of resistance to Amoxicillin and Ampicillin [20]. According to the results of the present study, *E. coli* show the highest rate of resistance to Amoxicillin and Cotrimoxazole. Asadu Khan et al [21] reported that *E. coli* isolated from UTIs had the highest rate of resistance to Ampicillin and the lowest rate of resistance to kanamycin, yet our results showed that *E. coli* had the highest rate of resistance to Amoxicillin and Cotrimoxazole, but the lowest rate of resistance to Amikacin and Nitrofurantoin. These differences could be attributed to the different sources of the samples. In addition, in our study, resistance to antibiotics (the Cephalosporin group) was not significant in men and women. Karlowky et al [22] reported that *E. coli* isolated from female outpatients in the United States showed the lowest rate of resistance to Nitrofurantoin, with this result having been consistent with the results of the present paper. To produce an antibiotic resistance pattern, the use of accurate methods, such as Minimum Inhibitory Concentration (MIC) is recommended.

### Conclusion

Due to the high rate of antibiotic resistance in *E. coli*, the results of similar studies in recent years have shown that antibiotic resistance has been on the rise so rapidly in developing countries. Given the antibiotic use pattern in developing countries in treating various infections, especially urinary tract infections (UTIs), mortality rates and economic damage have been increasing year after year. In addition, it is recommended that more accurate methods, such as Minimum Inhibitory Concentration (MIC), be used to evaluate the antibiotic resistance pattern. The results obtained from this study and similar ones could be used by physicians in selecting appropriate antibiotics for experimental treatments.

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**Conflict of interest:** None declared.

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