

Evaluation of Antibiotic Susceptibility of *Escherichia coli* and *Klebsiella* spp. Isolated from Urinary Tract Infections of Patients Attending a University Hospital in Tehran

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ABSTRACT

Background and Objectives: *E. coli* and *Klebsiella* spp. are recognized as most prevalent bacteria causing urinary tract infection (UTI), the most common bacterial infection. Decreasing of antimicrobial susceptibility in urinary pathogens has made difficulty in treatment of UTI. The aim of this study was to determine antibiotic susceptibility of *E. coli* and *Klebsiella* spp. isolated from urine of patients with UTI attending a university hospital in Tehran (Iran) to guide the choice of empiric antibiotic treatment.

Materials and Methods: All midstream urine samples obtained from patients with UTI from 23 October 2012 to 20 June 2013 at Shahid Mostafa Khomeini hospital in Tehran were cultured and bacterial isolates were identified by standard methods. Susceptibility pattern of *E. coli* and *Klebsiella* spp. isolates were determined by the disk diffusion method in accordance with CLSI guideline against ampicillin, amikacin, co-amoxiclav, cephalothin, cefotaxime, ciprofloxacin, cotrimoxazole, gentamicin, tetracycline, nalidixic acid and nitrofurantoin.

Results: During 8 month study period, altogether 331 samples of urine had produced positive culture, which most common isolates were *E. coli* (n=216) and *Klebsiella* spp. (n=50). *E. coli* showed maximum susceptibility to amikacin (97%) and nitrofurantoin (92.5%), while *Klebsiella* spp. isolates had shown maximum susceptibility to amikacin (95.8%) and gentamicin (83.8%). Susceptibility to ampicillin and co-amoxiclav were very low.

Conclusion: Decreased susceptibility to most common antibiotics in urine prevalent isolates in this study should be considered in treatment of UTI.

1. Introduction

Urinary tract infection (UTI) is one the most common kind of infectious diseases in humans that can affect at least 250 million individuals annually (1). Many different types of bacteria can cause UTI, in the meantime *Escherichia coli* has been identified as first predominant bacteria and *Klebsiella* spp. accounts for second frequent bacteria causes this

infection (2). The early correct treatment of UTI reduces the morbidity and mortality rates of UTI patients (3). The prevalence rate of resistance to common antibiotics used in the treatment of UTI has been increasing worldwide and remains a common health problem (1, 4). Most cases of UTI need to begin empiric antimicrobial therapy before reporting of microbiology results such as of bacteriology and antimicrobial susceptibility test (5, 6).

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Due to the misused antibiotics, resistance to commonly used antibiotics is rising among bacteria responsible for UTI. Therefore, understanding antimicrobial susceptibility patterns of these bacteria is essential in selecting the appropriate drug for treatment of UTI (7).

The aim of this study was to evaluate the antimicrobial susceptibility pattern of *Escherichia coli* and *Klebsiella* spp. isolates as the main bacteria causes of UTI to establish an appropriate empirical therapy.

2. Materials and Methods

This study was carried out using all urine samples from patients with UTI during eight months of study period (23 Oct 2012- 20 June 2013), at Shahid Mostafa Khomeini hospital (Shahed University) in Tehran. Morning midstream clean catch urine samples were collected in a wide mouth sterile container from patients who had not received previous antibiotic therapy. The urine samples were cultured on both blood (Merck, Germany) and MacConkey agar medium (Merck, Germany) and incubated aerobically for overnight at 37°C and for 48 hours in negative cases. A positive culture was defined as the growth of a single organism with colony counts $\geq 10^5$ colony forming unit (CFU)

per milliliter. Bacterial isolates were identified using routine biochemical procedures tests.

The antimicrobial susceptibility test of *E. coli* and *Klebsiella* spp. isolates were done by disk diffusion method following the Clinical and Laboratory Standard Institute protocol CLSI (8) on Mueller Hinton agar (Merck, Germany). Bacterial isolates were tested against eleven antibiotics, including: ampicillin, amikacin, co-amoxiclav, cephalothin, cefotaxime, co-trimoxazole, ciprofloxacin, gentamicin, tetracycline, nalidixic acid and nitrofurantoin. The antibiotic disks were obtained from Padten Teb Co. (Tehran, Iran) and *E. coli* ATCC 25922 was used for quality control, as recommended by CLSI (8).

3. Results

During the study period, out of 331 urine samples that yield bacterial growth, 216 (65.3%) bacterial isolates were identified as *E. coli* and 50 (15.1%) as *Klebsiella* spp. The antimicrobial susceptibility patterns of *E. coli* and *Klebsiella* isolates to eleven antibiotics were shown in Table 1.

Table1: Rate of resistant (R), intermediate (I) and susceptible (S) phenotypes among isolated *E. coli* and *Klebsiella* spp.

Antimicrobials	<i>E. coli</i>			<i>Klebsiella</i> spp.		
	R	I	S	R	I	S
Amikacin	3%	-	97%	4.2%	-	95.8%
Ampicillin	93.2%	-	6.8%	95%	-	5%
Cefotaxime	44.4%	-	55.6%	31.7%	-	68.3%
Cephalothin	51.9%	1.2%	46.9%	45.9%	-	54.1%
Ciprofloxacin	50.5%	-	49.5%	30.6%	-	69.4%
Co-amoxiclav	93.6%	0.5%	5.9%	90.7%	-	9.3%
Co-trimoxazole	55.7%	-	44.3%	62.2%	-	37.8%
Gentamicin	28.8%	0.5%	70.7%	16.7%	-	83.3%
Nalidixic acid	69.8%	0.5%	29.6%	34.2%	-	65.8%
Nitrofurantoin	7.5%	-	92.5%	37.5%	-	62.5%
Tetracycline	61.9%	-	38.1%	30.2%	-	69.8%

Regarding interpretation of antimicrobial susceptibility test results, the most effective antibiotics for the *E. coli* isolates was amikacin (97%) followed by nitrofurantoin (92.5%) and

gentamicin (70.7%) and for *Klebsiella* spp. isolates was amikacin (95.8%) and gentamicin (83.3%). In the cases of antibiotics resistance, both isolates of *E. coli* and *Klebsiella* spp.

showed maximum resistance to ampicillin (93.2% and 95%, respectively) and co-amoxiclav (93.6% and 90.7%, respectively).

4. Discussion

The increasing rate of antimicrobial resistance in bacteria due to the antimicrobial misuse is a matter of serious global concern. Therefore, the evaluation of antimicrobial resistance among bacteria is necessary to improve treatment. Our study provided valuable information on antimicrobial resistance pattern of two major bacteria involved in UTI to help efficiency empirical treatment choices.

Antibiotics susceptibility rate of *E. coli* in this study was comparable with the other findings in Iran, where *E. coli* was found to be sensitive to amikacin (94.2%), nitrofurantoin (90.1%) and gentamicin (71.8%) and India, where *E. coli* was sensitive to nitrofurantoin (87.3%) and amikacin (82.7%) (9, 10). In this study *E. coli* isolates showed the most resistance to ampicillin. This finding is compatible with study of Nozarian *et al.*, Farajnia *et al.* and Shaid *et al.* that reported 60%, 93.1% and 97% resistance to ampicillin, respectively and in contrast with other recent reports from Europe (11-14). The high prevalence rate of resistance to co-amoxiclav was also observed among *E. coli* isolates in this study. This result is similar to earlier study carried out in India by Debnath *et al.* (10). However, there were also some studies reported a low resistance rate to this antibiotic in India, Italy and Croatia (5, 15, 16).

High efficacy of gentamicin and amikacin was observed against *Klebsiella* spp. isolates in the present study, similar findings were reported by Debnath *et al.*, Kumar *et al.*, and Magliano *et al.* (2, 10, 15). Whereas, high rate of resistance to ampicillin and co-amoxiclav were observed among *Klebsiella* spp. isolates, similar results were obtained in study of Khan *et al.* that showed 100% of isolates had resistance to ampicillin and 71.8% of isolates had resistance to co-amoxiclav (5). In contrast to the high resistance rate to co-amoxiclav in our study, the resistance rate of this antibiotic was very low in Magliano *et al.* study (18.6%) (15).

High level of antimicrobial resistance percentage in this study indicates the appearance of resistance in commonly used antimicrobials agent such as first line drugs (ampicillin and co-amoxiclav), this may be due to the widespread and prolonged use of these drugs for empirical therapy that may have an impact on the antibiotic treatment of UTI patients. In this study, the antimicrobial resistance rate of *E. coli* and *Klebsiella* spp. isolates were too high. Recommended therapy for urinary tract infection caused by *E. coli* and *Klebsiella* is removing of ampicillin and co-amoxiclav as a first line drug for empirical therapy of patient.

Taken together, decreased susceptibility to most common antibiotics in urine prevalent isolates in this study should be considered in treatment of UTI.

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