

Incidence and Antibiotic Susceptibility Pattern of Most Common Bacterial Pathogen Causing Urinary Tract Infection (UTI) in Tehran, Iran, 2012-2013

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Received: October 19, 2013; Revised: October 27, 2013; Accepted: November 10, 2013

Background: Among the most common infectious diseases, second ranking after respiratory (tract) system infection is urinary tract infection which involve (infects) about 250 million people in developing countries annually.

Objectives: The purpose of this study is to investigate the pattern of antibiotic resistance in common pathogens that cause urinary tract infection. This study is the first to evaluate the incidence of antibiotic resistance is the large number of samples in Iran.

Patients and Methods: The susceptibility of samples obtained from 14,332 patients with urinary tract infections admitted to different medical diagnostic laboratories of Tehran, was measured using disk diffusion method for 18 common antibiotics.

Results: Most of the identified bacteria were *Escherichia coli* (64.56%) and *Klebsiella pneumoniae* (13.78%). The most resistant antibiotics were respectively identified as trimethoprim/ sulfamethoxazole (61.35%) for *E-coli* and (49.6%) for *Klebsiella* sp. Also intermediate resistance to Nitrofurantoin and Chlor tetracycline was observed.

Conclusions: The findings of this study indicate that *E. coli* is the predominant pathogen of this infection. There are also bacteria with high resistance that Interfere with prescription of drugs in order to treat urinary tract system infection. Also increasing of resistance to antibiotics among bacterial pathogens is evolving and requires an inspectoral and research procedure which could provide more information for doctors to treat the infection more efficiently.

Keywords: Drug Resistance; Microbial; Urinary Tract Infections; *E. coli*

1. Background

Among the most common infectious diseases, second ranking after respiratory (tract) system infection is urinary tract infection (1) which involve (infects) about 250 million people in developing countries annually (2). The distribution of these bacteria is different in different parts of the world and studying the microbial factors that cause this infection in all geographical regions, shows it's dispersion. In recent studies microbial species that cause urinary system infection are classified by their target sites, Such as urine infection (bacteriuria), bladder infection (cystitis), kidney infection (pyelonephritis), which can be asymptomatic or associated with symptoms (3, 4). There are several bacteria that could cause urinary tract infections, but *E.coli* is the most common among them. The frequency of pathogens is different, depending on age, gender, catheterization and hospitalization (5). The basis of suitable treatment in urinary infections is selecting a high performance and low cost antibiotic, and The main problem in the treatment of urinary system infec-

tions is the resistance of some bacteria to many common antibiotics (6). In the other hand, the spread of antibiotic resistance is almost always associated with increased use of antibiotics (7). So considering the daily increasing use of antibiotics which will be followed by antibiotic resistance and also different sensitivity of bacteria in different parts of the world, studying the antibiotic resistance in every region is necessary (8).

2. Objectives

This recent study aimed to determine the prevalence of resistance of commonly used antibiotics on common isolated bacteria of urinary system infections in Tehran from 14,322 samples. This study is the first to evaluate the incidence of antibiotic resistance is the large number of samples in Iran.

3. Patients and Methods

In a sectional descriptive study of 14,322 randomly se-

Implication for health policy/practice/research/medical education:

According to the results of this study, we showed that Sulfamethoxazole/trimetoprim is not recommended as the first line of empirical treatment for urinary tract infections in Tehran but Nitrofurantoin and Fleuroquinolone could be used as the first and the second empirical treatment lines. Also this study is the first to evaluate the incidence of antibiotic resistance is the large number of samples in Iran

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lected patients suffering from urinary system infection, referred to medical laboratories in Tehran, from March 2012 to March 2013, urine culture test was performed. Culture was prepared using the median urinary of the patients referred to Tehran's laboratories.

3.1. Isolation and Identification of Bacteria

Isolation of these bacteria was performed using Streak-Plate Method on Blood agar and MacConkey agar culture with standard loop (internal diameter 34.1 mm). Culture plates were incubated at 37 °C for 24 h. The cultures consisting of more than 10⁵ colonies of particular bacteria were considered as positive cultures. The incubation of negative 24 h cultures was extended for another 24 hours. Bacteria were identified through performing biochemical tests (indole, citrate, oxidase, and production of H₂S, lysine decarboxylase, fermentation of lactose, urea hydrolysis, gas production, catalase, coagulase, mannitol fermentation and susceptibility testing Novobiocin).

3.2. Antibiotic Susceptibility Testing

Strains drug resistance evaluation was carried out using disk diffusion method and Kirby Bauer method on Mueller-Hinton medium (Merck, Germany) (9). After inoculating the bacteria on Muller Hinton agar and placing the antibiotic disks, plates were incubated for 24 hours in incubator. Then, according to the size of the growth inhibition zone around the disks and international numbers of (CCLSI), results were categorized and reported in three groups : susceptible and Sensitive (S), intermediate susceptibility or sensitivity (I) and resistance (R).

3.3. Statistical Method

P value was measured by the χ^2 test with Yates' correction.

4. Results

Of 14332 patients that were studied, *E-coli* had the high-

est frequency among bacteria and after that *Klebsiella* had the second place (Figure 1). Of the mentioned bacteria (*E.coli* and *Klebsiella*) 1298 and 347 cases of all samples (2241) belonged to males and 7956 and 1629 cases of all samples (12091) belonged to females, respectively.

4.1. Antibiotic Susceptibility Test Results

The antibacterial strength of 18 classes of antibiotics used in Iran, against species causing urinary tract infections was studied. *E-Coli* as the most common cause of urinary infections showed the highest sensitivity to Nitrofurantoin by 6.85%, the highest average sensitivity to Gentamicin by 40% and maximum resistance to sulfamethoxazole / Trimethoprim by 1.63% (Figure 2). Also *Klebsiella pneumoniae* that is the second ranking bacterium in this study, showed the highest sensitivity towards Norfloxacin by 76.6%, intermediate sensitivity to Gentamicin by 41.9%, and finally the highest resistance was shown towards sulfamethoxazole/ Trimethoprim by 49.6%. Antibiotic susceptibility results are given in Figure 3.

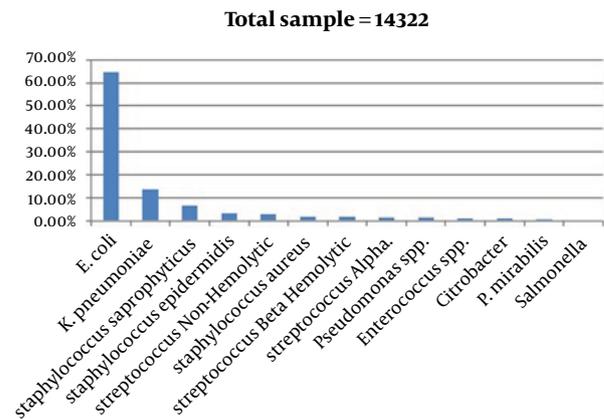


Figure 1. Prevalence of Bacterial Urinary Tract Infections in Tehran 2012-2013

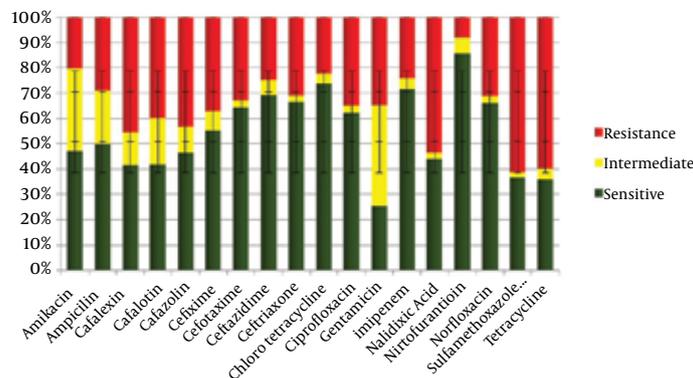


Figure 2 . Antibiotic Resistance Pattern in *Escherichia coli*

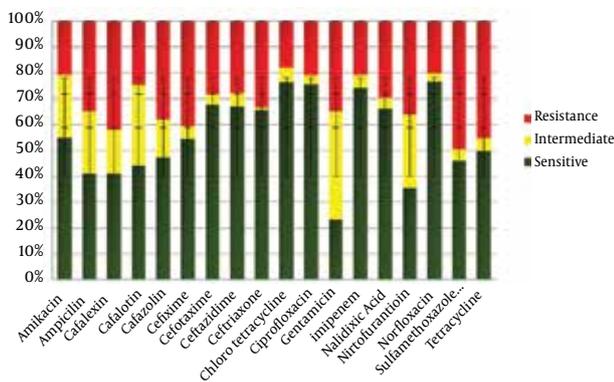


Figure 3. Antibiotic Resistance Pattern in *Klebsiella pneumonia*

5. Discussion

Prevalence of resistance to certain antibiotics in different societies and in different countries varies widely. Generally, in poor and underdeveloped countries, the prevalence of antimicrobial resistance is particularly high, which reflects the irrational and excessive use of antimicrobial agents in modern societies (10). Therefore monitoring antimicrobial resistance of concerning bacteria of urinary tract infection is crucial to improve quality of healthcare. This study provides valuable laboratory data to compare Tehran's antibiotic resistance conditions with other cities.

Recent study was performed using previous samples from a number of clinical laboratories and hospitals in Tehran-Iran. Our data was limited to the number of available patients; hence this study doesn't show the correct distribution of urinary infection pathogens and their resistance pattern for treating all the patients in Iran as well. Urinary tract infection is one of the most common medical problems in females and also in this study a large portion of patients consisted of females (36.84%). This number is very close to pathfinder's and his/her colleagues (11) and Rostam zade khamene (12) results. As we expected based on previous studies (13, 14) *Escherichia coli* has the highest frequency among pathogens (57.64%). The second common micro-organism is *Klebsiella pneumoniae* and then *Staphylococcus saprophyticus*.

Nitrofurantoin, Norfloxacin is recommended for uncomplicated infections. Fluoroquinolones (Norfloxacin and ciprofloxacin) that were tested in this study showed a perfect reaction to *E-coli*. Discoveries indicated that lineages of *E-coli* are sensitive to this antibiotic respectively 66% and 2.62%. These results were the same as other Iranians researches (11). This findings showed that using Fluoroquinolones in treatments should seriously be controlled and an efficient strategy to counter and stop the increased resistance of this antibiotic should be considered. Among these antibiotics Nitrofurantoin showed a better reaction to isolated *E-coli* (6.85%) but this drug is

not recommended for serious upper urinary infections or systemic infections (14, 15). The remarkable point in this study is presence of low level resistance to Ampicillin (29%) in isolated *E-coli* which is not the same with India (15, 16), Taiwan (17) and Spain (18) results. This may be a result of changed way of drug prescription and an increase in drug use culture.

Sulfamethoxazole/trimetoprim is not recommended as the first line of empirical treatment for urinary tract infections in Tehran but Nitrofurantoin and Fluoroquinolone could be used as the first and the second empirical treatment lines. Yet, this approach also needs careful and extensive monitoring at the healthcare centers, so that we wouldn't face the increase of resistance in these bacterial agents (organisms).

Acknowledgements

There are no acknowledgments.

Authors' Contribution

All authors have participated equally in this study.

Financial Disclosure

There is no conflict of interest.

Funding/Support

This study is self funded.

References

- Gribling TL. Urologic diseases in America project: trends in resource use for urinary tract infections in women. *J Urol*. 2005;**173**(4):1281-7.
- El Astal Z. Increasing ciprofloxacin resistance among prevalent urinary tract bacterial isolates in Gaza Strip, Palestine. *J Biomed Biotechnol*. 2005;**2005**(3):238-41.
- Kurutepe S, Surucuoglu S, Sezgin C, Gazi H, Gulay M, Ozbakkaloglu B. Increasing antimicrobial resistance in *Escherichia coli* isolates from community-acquired urinary tract infections during 1998-2003 in Manisa, Turkey. *Jpn J Infect Dis*. 2005;**58**(3):159-61.
- Jha N, Bapat SK. A study of sensitivity and resistance of pathogenic micro organisms causing UTI in Kathmandu valley. *Kathmandu Univ Med J (KUMJ)*. 2005;**3**(2):123-9.
- Farrell DJ, Morrissey I, De Rubeis D, Robbins M, Felmingham D. A UK multicentre study of the antimicrobial susceptibility of bacterial pathogens causing urinary tract infection. *J Infect*. 2003;**46**(2):94-100.
- Erben N, Alpat SN, Kartal ED, Ozgunes I, Usluer G. Analysis of the risk factors in nosocomial urinary tract infections and effect of urinary catheter use on distribution of the causative agents. *Mikrobiyol Bul*. 2009;**43**(1):77-82.
- Stapleton AE, Dziura J, Hooton TM, Cox ME, Yarova-Yarovaya Y, Chen S, et al. Recurrent urinary tract infection and urinary *Escherichia coli* in women ingesting cranberry juice daily: a randomized controlled trial. *Mayo Clin Proc*. 2012;**87**(2):143-50.
- Monzon OT, Ory EM, Dobson HL, Carter E, Yow EM. A comparison of bacterial counts of the urine obtained by needle aspiration of the bladder, catheterization and midstream-voided methods. *N Engl J Med*. 1958;**259**(16):764-7.
- Ali SQ, Zehra A, Naqvi BS, Shah S, Bushra R. Resistance pattern of ciprofloxacin against different pathogens. *Oman Med J*. 2010;**25**(4):294-8.

10. Bitsori M, Maraki S, Kalmanti M, Galanakis E. Resistance against broad-spectrum beta-lactams among uropathogens in children. *Pediatr Nephrol.* 2009;**24**(12):2381-6.
11. Kashef N, Djavid GE, Shahbazi S. Antimicrobial susceptibility patterns of community-acquired uropathogens in Tehran, Iran. *J Infect Dev Ctries.* 2010;**4**(4):202-6.
12. Khameneh ZR, Afshar AT. Antimicrobial susceptibility pattern of urinary tract pathogens. *Saudi J Kidney Dis Transpl.* 2009;**20**(2):251-3.
13. Sharifian M, Karimi A, Tabatabaei SR, Anvaripour N. Microbial sensitivity pattern in urinary tract infections in children: a single center experience of 1,177 urine cultures. *Jpn J Infect Dis.* 2006;**59**(6):380-2.
14. Kothari A, Sagar V. Antibiotic resistance in pathogens causing community-acquired urinary tract infections in India: a multi-center study. *J Infect Dev Ctries.* 2008;**2**(5):354-8.
15. Kothari A, Sagar V. Antibiotic resistance in pathogens causing community-acquired urinary tract infections in India: a multi-center study. *J Infect Dev Ctries.* 2008;**2**(5):354-8.
16. Dash M, Padhi S, Mohanty I, Panda P, Parida B. Antimicrobial resistance in pathogens causing urinary tract infections in a rural community of Odisha, India. *J Family Community Med.* 2013;**20**(1):20-6.
17. Sood S, Gupta R. Antibiotic resistance pattern of community acquired uropathogens at a tertiary care hospital in jaipur, rajasthan. *Indian J Community Med.* 2012;**37**(1):39-44.
18. Lau SM, Peng MY, Chang FY. Resistance rates to commonly used antimicrobials among pathogens of both bacteremic and non-bacteremic community-acquired urinary tract infection. *J Microbiol Immunol Infect.* 2004;**37**(3):185-91.
19. Daza R, Gutierrez J, Piedrola G. Antibiotic susceptibility of bacterial strains isolated from patients with community-acquired urinary tract infections. *Int J Antimicrob Agents.* 2001;**18**(3):211-5.