Assessment of Antimicrobial Susceptibility Patterns in Urine Culture of Patients with Urinary Tract Infection Attending Al-Kindy Teaching Hospital

Saad Baddai Nashtar* PhD

ABSTRACT

Background: Urinary tract Infection is a common and serious health problem affecting millions of people each year around the World, especially females. Urinary tract infection treatment relies on the predictability of the causative agents and knowledge of their antimicrobial susceptibility patterns.

Objectives: To identify the bacterial species causing urinary tract Infection in Iraqi patients and to assess microbial susceptibility towards the commonly used antimicrobials.

Methods: This prospective, observational study was conducted in Al-Kindy teaching hospital. Urine culture and susceptibility reports of 168 urinary tract Infections outpatients collected for one year (2016), the number and percentage of the isolated microorganisms was recorded then the percentage of susceptibility of all these pathogens toward each of the used antimicrobials was calculated.

Results: It was found that *E coli* was the most common bacteria isolated (48.8%) followed by *klebsiella* (11.3%) and *enterococcus fecalis* (8.33%). The most susceptible antimicrobials were carbapenem (95.8%), amikacin (86.8%), nitrofurantoin (80%) and gentamycin (77.4%). Ampicillin and trimethprim were the less susceptible (16.7% and 16.8%, respectively). Second-generation cephalosporin, cephalothin also showed weak susceptibility (23.3%) while third generation ceftriaxon and cefotaxime have shown a better effect (60.9 and 73.1%), respectively.

Conclusion: Although treatment of urinary tract Infection better follow culture and sensitivity test, aminoglycosides or third generation cepaholsporins with nitrofurantoin are the best combination. Ampicillin, amoxicillin and trimethoprim are better avoided. It is better to preserve carbapenem for the resistant cases.

Keywords: Urinary tract infection, Antimicrobials, Culture and sensitivity.

Iraqi Medical Journal Vol. 64, No. 1, January 2018; p. 37-41.

Urinary tract infection (UTI) is a common disease affecting millions of people all over the world especially females. It occurs when bacterial infection affects any part of the urinary system like renal pelvis and urinary bladder. UTI is the most common bacterial infection accounting for 25% of all infections[1]. Bacteruria is not always present, symptomatic UTI mostly associated with dysuria and frequency which are the chief complaint of the vast majority of patients[2]. Urinary tract infection is a heterogeneous disease which can be divided into several types of infections such as acute, uncomplicated bacterial pyelonephritis, complicated UTI, recurrent cystitis and asymptomatic bacteriuria. Acute UTI is one of the most common bacterial infections among women presenting to primary care[3].

The major causative organisms for UTI are Escherichia coli, klebsiella species, proteus species, pseudomonas species and staphylococcus species[4,5].

The introduction of antimicrobial therapy has contributed significantly to management of UTIs[6]. The antimicrobial agents used in treatment of UTI include cell wall inhibitors like penicillins (ampicillin, piperacillin, penicillin), third generation cephalosporin (cefotaxime, ceftazidime, ceftriaxone) DNA gyrase

*Dept. of Pharmacology, Al-Kindy College of Medicine, University of Baghdad.

inhibitors floroquinolones (ciprofloxacin) and aminoglycosides (amikacin, gentamycin)[7]. Area-specific monitoring studies are necessary to understand the types of pathogens responsible for UTIs and their resistance patterns in order to help clinicians to select the best antimicrobial therapy[8]. Continuous assessment of bacterial susceptibility towards antimicrobials is essential since the latter efficacy decrease with time as bacterial resistance get higher.

The aim of this study is to identify the bacterial species causing urinary tract infection in Iraqi patients and to re-assess microbial susceptibility towards the commonly used antimicrobials.

Methods

This cross-sectional, observational study was conducted in Al-Kindy teaching hospital between the 1st of January and 31st December 2016. A total of 168 positive urine culture and sensitivity (C&S) were recorded, culture reports obtained from the microbiology department. Urine samples were collected by a standard loop technique in sterile containers and cultured on blood and MacConkey agar media to know if there is growth of bacteria, then incubated aerobically at 37°C for 24 h and extended up to 48h in cases of G -ve. Identification of isolates was done by standard method depending on observation of colony characteristics and antimicrobial susceptibility test was performed by disc diffusion method using Muller-Hinton agar and choose of antibiotic disks according to type of isolated bacteria. if there is growth of bacteria around antibiotics disc in inhibition zone this means that the bacteria are sensitive to this antibiotic and vice versa if there is no growth[9].

Data were represented as numbers and percentages.

Results

In this study 13 bacterial species were isolated that commonly cause UTI. Figure 1 shows these isolated microbial pathogens.

The most common organism was Escherichia coli 82(48.8%) followed by klebsiella pneumoniae 19(11.3%), enterococcus faecalis 14(8.33%) and least sensitive microorganisms were streptococcus faecalis 5(2.97%), streptococcus agalactiae, staphylococcus spp., Acinetobacter baumanii 1(0.59%) all.

The results have revealed both microbial susceptibility and resistance toward different drugs. The susceptibility was variable according to the species of microbes.

Aminoglycosides like amikacin and gentamycin have shown high susceptibility (86.8%) and (77.4%), respectively. Penicillins has shown a variable range of susceptibility since it is weak as in ampicillin (16.7%), intermediate as in penicillin (35.7%) and amoxicillin-clavulenic acid combination (38.46%) and increase with the antipseudomonal penicillin piperacillin that has shown higher susceptibility (47.8%), the newer beta lactam agent carbapenem has shown a highest susceptibility among all antimicrobials (95.8%).

Cephalosporins also have shown a variable range of susceptibility since the second generation cephalosporin cephalothin was (23.3%) sensitive. Third generation Ceftriaxone and cefotaxime were (60 and 73.1%) sensitive, respectively.

Trimethoprim was shown high resistance (83.2%) and low sensitive toward microorganism (16.8%) while the urinary antiseptic nitrofurantoin approved a high susceptibility (80%), (Table 1).

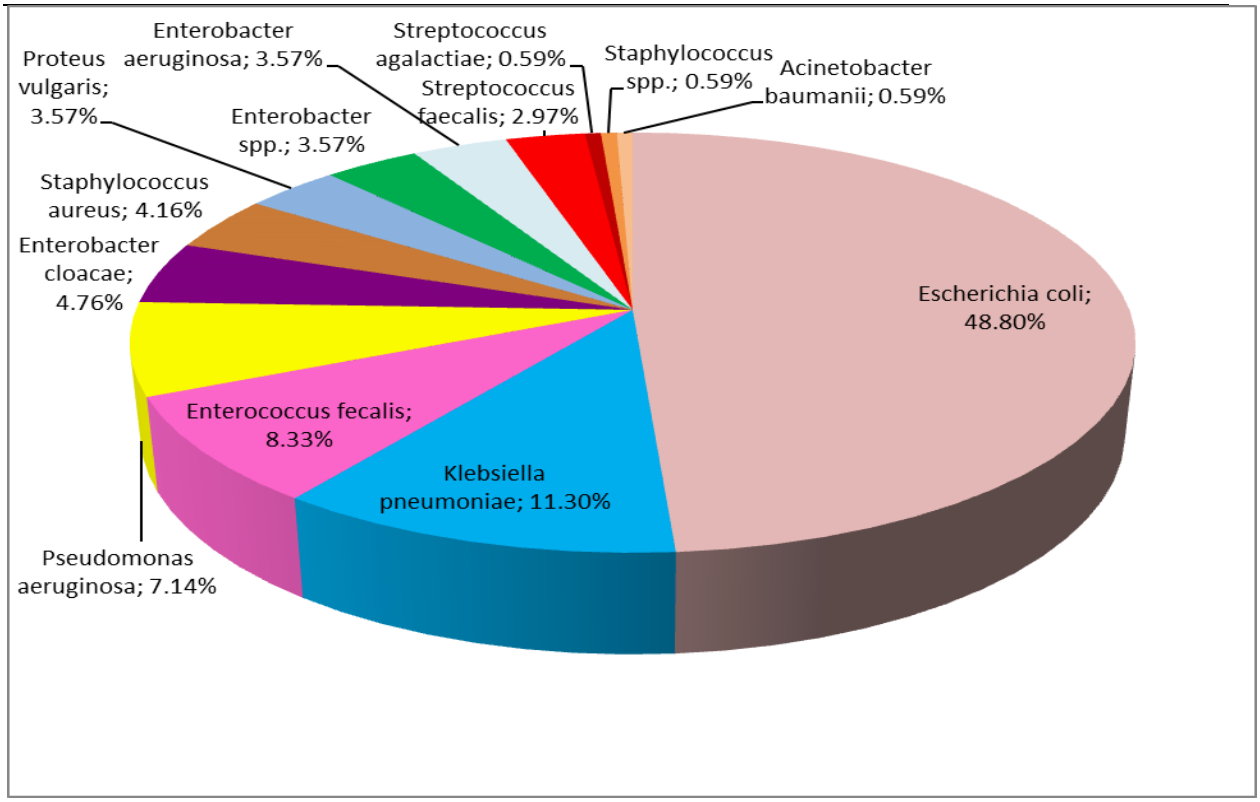

Figure 1: Percentage of bacterial species isolated among UTI patients.

Table 1: Antimicrobial susceptibility percentage against isolated microorganism.

Antimicrobial	Total number of antimicrobial use (100%)	Sensitivity No .(%)	Resistance No. (%)
Amikacin	114	99(86.8)	15(13.2)
Gentamycin	155	120(77.4)	35(22.6)
Nitrofurantoin	150	120(80)	30(20)
Trimethoprim	113	19(16.8)	94(83.2)
Ciprofloxacin	88	43(48.9)	45(51.1)
Cephalothin	43	10(23.3)	33(76.7)
Cefotaxime	67	49(73.1)	18(26.9)
Ceftriaxone	23	14(60.9)	9(39.1)
Penicillin	14	5(35.71)	9(64.28)
Ampicillin	36	6(16.7)	30(83.3)
Amoxicillin + clavulenic acid	13	5(38.46)	8(61.53)
Carbapenem	24	23(95.83)	1(4.16)
Piperacillin	23	11(47.8)	12(52.1)

Discussion

The uropathogens found in this study are similar to uropathogens identified in other studies conducted in different regions of Iraq. The similarities and differences in the type and distribution of uropathogens may result from different environmental conditions and host factors, and practices such as healthcare and education programs, socioeconomic standards and hygiene practices[10].

Among different uropathogens, the most predominant organism was found to be E. coli (48.8%), as compared to (39%) in the study done in Baghdad hospital[11], in Al-Qassim hospital in Babylon was (40%)[12] while in Tikrit hospital study the percentage was (31.1%)[13]. The dominance of E. coli is followed by Klebsiella pneumoniae (11.3%)

in this study while it was (13.3%) in Tikrit hospital, (17%) in Baghdad hospital study, (2.3%) in AL-Qassim hospital in Babylon. enterococcus fecalis account (8.3%) in this study while in Baghdad hospital was (7%). Proteus vulgaris was (3.5%) as compared to (1%) in Baghdad hospital study. Finally, acinetobacter percentage is very low in this study was (0.59%) while in Baghdad hospital study it was (1%).

The present findings were in accordance with many other studies[14,15] which have shown predominance of Gram-negative bacteria specially E. coli with an isolation rates ranged between 40-69%. This was due to the fact that strains of E. coli affecting the urinary tract possess a variety of virulence characteristics hemolysin production and presence of fimbriae that facilitate their intestinal carriage, persistence in vagina and then ascension and invasion of the anatomically normal urinary tract[16].

Bacteria susceptibility towards some of the antimicrobials used in this study has revealed that for amikacin (86.8%), gentamycin (77.4%), ceftriaxon (60.9%), cefotaxime (73.1%), pipracillin (47.8%), ciprofloxacin (48.9 %), while in a study conducted in Baghdad hospital (2012) their susceptibility was for amikacin (94%), gentamycin (36%), ceftriaxon (33%), pipracillin (29%) and ciprofloxacin (46%)[11]. In Al-Qassim hospital study susceptibility of these antimicrobials was amikacin (87.5%), gentamycin (75%), ceftriaxon (40.1%) and ciprofloxacin (80%)[12]. Tikrit study (2013) has shown that amikacin (95.7%), gentamicin susceptibility was (53.5 %) and ciprofloxacin (80.7%)[13]. Trimethoprim susceptibility is (16.8%) while in another study done in Al-Nahrain university (20%)[17].

High level of resistance to trimethoprim may be due in part to misuse of this drug. On the other hand, the most isolates showed high susceptibility to ciprofloxacin. Ciprofloxacin has antibacterial activity due to the ciprofloxacin interferes with nucleic acid synthesis by enzyme which inhibit the bacterial isolates, it has several binding sites on the enzyme and thus decrease the probability of resistance[18]. Ciprofloxacin have frequently been a reliable therapeutic intervention in UTIs because of its broad spectrum of activity as well as strong action on Gram-negatives. However, it is advocated that they should not be used as a first line antibiotic due to its serious side effects profile especially younger patients and it's cost[19].

The present study showed a high elevation in antibiotic resistance of pathogens isolated from the Iraqi patients compared to previous years[20]. But certain agents like gentamicin and nitrofurantoin still show a moderate efficacy against UTI pathogens because of its multiple mechanisms of action seem to have enabled it to retain potent activity against pathogens[21].

Internationally, increasing resistance to third generation cephalosporin was observed both in E. coli and klebsiella pneumoniae, in E. coli rising from 11.9% in 2012 to 13.1% in 2015. While, in klebsiella pneumonia was rising from 25.8% in 2012 to 30.3% in 2015. In addition, an increase in combined resistance to fluoroquinolones, third generation cephalosporins and aminoglycoside was observed also in E. coli and klebsiella pneumonia from 4.9% in 2012 to 5.3% in 2015 to these three drugs. The annual report also shows that antimicrobial resistance levels in Europe continue to vary by geographic region, with countries in northern and western Europe generally having much lower levels of resistance than those in southern and eastern Europe[22].

In conclusion; Urinary tract infection is one of most common medical disease encountered in medical practice with significant morbidity and health costs, occurring from neonate to elderly. In this study, most commonly found organisms were E. coli and Klebsiella.

Penicillins have shown highly resisted except carbapenem. Trimethoprim, second generation cephalosporin (cephalothin) and ciprofloxacin also were highly resisted.

We recommend the followings:

1. Antimicrobial use in treatment of UTI better to be after doing culture and susceptibility to reduce the usage of unneeded drugs and consequently, bacterial resistance.

2. Blind use of antimicrobials for UTI better to include amikacin and nitrofurantoin unless contra-indicated.

3. Carbapenem should be preserved for highly resistant antimicrobials.

4. Pipracillin better to be preserved for pseudomonal UTI only.

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