



PREVALENCE AND ANTIMICROBIAL RESISTANCE PATTERNS OF GRAM NEGATIVE BACTERIA ISOLATED FROM PATIENTS WITH URINARY TRACT INFECTION IN BAGHDAD CITY

Suhad Saad Mahmoud

Department of biotechnology, College of science, University of Baghdad –Iraq

*Corresponding author email: suhadsaad22@gmail.com

ABSTRACT

The goals of this study were to detect the etiological bacterial pathogens associated with urinary tract infection and determine their antibiotic susceptibility patterns. This would be helpful for infectious disease physician toward choosing appropriate antibiotic therapy for the management of UTI. Urine samples were collected from patients who admitted Baghdad hospitals, and antibiotic susceptibility test was performed according CLSI standard procedures. out of 110 urine samples tested, 100 (13.9%) samples were positive, from which 5 different Gram negative isolates were identified, the results were showed that *Escherichia coli* were the most prevalent (55.6%) bacteria, followed by *Klebsiella pneumoniae* (16.3%), *Proteus mirabilis* (6.3%), *Pseudomonas aeruginosa* (5.6%) and *Acinetobacter* spp.(8.3%) consecutively. These isolates showed increased in levels of resistance to most antibiotics that used in this study. Tigecycline was the most effective antimicrobial followed by Imipenem and Meropenem .

KEY WORDS: Urinary tract, Infections, Antibiotic susceptibility, Gram negative bacteria.

INTRODUCTION

Urinary tract infections are considered one of the most common bacterial infections worldwide, it has been estimated about 150 million people with UTI diagnosed each year around world in both sexes of all ages; the high incidence has been recorded among women [Al-Mijalli, 2017]. UTIs are classified to categories based on the site of infection including: lower urinary tracts (cystitis), prostatitis (prostate inflammation) and infection of the upper urinary tracts or the kidneys (pyelonephritis) (Heffner and Gorelick, 2008). UTIs also can be asymptomatic or symptomatic .Infections that occurred in normal genitourinary tracts without instrumentations are considered as uncomplicated infections, in contrary the complicated infections are detected in genitourinary tracts that have structural or functional abnormalities like instrumentation such as indwelling urethral catheters, and are frequently considered asymptomatic [Nerurkar *et al.*, 2012]. Moreover, UTIs (especially uncomplicated cystitis) are occurred in a high incidence in sexually active young women due to certain behavioral factors and their anatomy (short urethra) because the area around urethral opening is colonized with potential pathogens (*e.g. E. coli & E. faecalis*) [Soto, 2014]. However , Recurrent UTIs are diagnosed in more than 20% of a young women with acute cystitis and are categorized into relapse (if the same type of microorganisms are caused the infections and always occurred in women cause the microorganisms formed of biofilm) and reinfection (if the different microorganisms are caused episodes)[Soto *et al.*, 2006]. In general, urinary tracts in healthy individuals are sterile and pathogens always infect the urinary tract by ascending through the urethra, haematogenous or lymphatic spread. Many studies were documented that bacteria is considered the main causative agent of UTIs among human and many published data have been shown that *Escherichia coli* is the most common etiological agent followed by *klebsiella pneumonia*, *Proteus mirabilis* and *Pseudomonas aeruginosa* [Rampure *et al.*, 2013; Thakur *et al.*, 2013]. However, Pathogens are required many virulence parameters to establish infections such as adherence ability to host cells, colonization of tissues,

cellular invasion, followed by intracellular multiplication, dissemination to other tissues, and persistence [Hull *et al.*, 2000; Thakur *et al.*, 2013]. Development of antibiotics resistance among Gram-negative bacteria are increased alarmingly worldwide especially in developing countries where the random usage of antibiotics with use of low standard antimicrobials, unawareness and poor hygienic practices are considered the main etiological factors that elevate the chance to emerge antibiotics resistance among uropathogen. [Abubakar, 2009; Akram *et al.*, 2007]. Hence, the present study performed to identify the changing etiologic trends of UTI and the antimicrobial resistance.

MATERIALS & METHODS

Bacterial collection and antibiotics susceptibility test

Gram-negative bacteria were collected from UTI samples of patients who admitted different hospitals in Baghdad city. All isolates were subjected to antibiotic susceptibility test by Kirby Bauer disc diffusion method and antimicrobial panels were include: Meropenem (10µg), Imipenem (10µg), Amikacin (30µg), Ceftazidime (30µg), Nitro-foration (300µg), Cefadroxil (30µg), Amoxicillin/ clavulanic acid (20/10µg), Colistin (25µg), Aztreonam (30µg), Trimethoprim/ Sulfamethoxazole (1.25/23.75 µg), Gentam-cin (10µg) ,Tigecycline (15µg) and the results were interpreted according to Clinical and Laboratory Standards Institute (CLSI) guidelines [CLSI,2012].

RESULTS

Out of 110 urine samples tested, 84 (76.3%) samples were positive for the presence of bacterial pathogens while 16 (14.5%) were negative; each positive sample was represented by one bacterial isolate. Our data established that *E. coli* was the most common etiological agent of UTIs in percentage 37% of total isolates, followed by *K. Pneumonia* (32.1%), and the frequency of *P. aeruginosa* , *Proteus* spp and *Acinetobacter* spp. were 13% 9.5%, 8.3% consecutively (Table 1).

TABLE 1: Distribution of UTI causative bacteria

Microorganisms	Number (%)
<i>Escherichia coli</i>	31(37)
<i>Klebsiella pneumonia</i>	27(32.1)
<i>Pseudomonas aeruginosa</i>	11(13)
Proteus spp	8(9.5)
Acinetobacter spp.	7(8.3)

The results of antibiotic susceptibility test revealed that *E. coli* isolates were a highly resistant to Cefazidim, Amoxicillin – clavulanic acid, Cefadroxil and Colistin in percentage up to 100 %, followed by Azetronem, Trimethoprim/ Sulfamethoxazole, Nitrofurantoin and Amikacin in 68%, 87%, 32.2%, 45.1% respectively, while the antibacterial activity of Gentamycin, Imipenem and Meropenem towards bacteria were moderate. In addition, the bacterial isolates were sensitive to Tigecycline.

Further that, *K. pneumonia* isolates were showed a highly resistant towards Cefadroxil, Colistin & Amoxicillin /clavulanic, up to 100% and for Trimethoprim/ Sulfamethoxazole, Cefazidim and Azetronem 81.4%, 92.5% and 81.4% respectively, while these isolates showed less resistant to Amikacin, Nitrofurantoin and Gentamycin 48.1%, 55.5 and 37% respectively, On contrary, these isolates were sensitive to Imipenem, Meropenem and Tigecycline. Also, proteus spp isolates showed a highly resistant to Colistin, ceftazidim, Cefadroxil, amoxicillin–clavulanic acid and Trimethoprim/

Sulfamethoxazole up to 100%. While these isolates were showed moderate resistant to Nitrofurantoin, gentamycin, azetronem and amikacin in 87.5%, 50%, 62%, 50% consecutively in contrary, these isolates were sensitive to Meropenem, Imipenem and Tigecycline. In addition, *P. aeruginosa* isolates showed resistant towards Colistin, Amoxicillin–clavulanic acid, Cefadroxil and Trimethoprim/ Sulfamethoxazole in percentage up to 100% and showed moderate resistant to Gentamycin, Azetronem, Cefazidim and Amikacin in 55%, 48%, 67%, 50% and all isolates were sensitive to Meropenem, Imipenem and Tigecycline. Finally, Acinetobacter spp. Isolates showed a highly resistant towards Cefadroxil, Colistin, Amoxicillin–clavulanic acid and Trimethoprim/ Sulfamethoxazole up to 100% while these isolates showed moderate resistant to Cefazidim, Nitrofurantoin, Gentamycin, Azetronem and Amikacin. On contrary all bacterial isolates were exhibited resistant in low percentage to Meropenem, Imipenem whereas sensitive to Tigecycline (Table 2).

TABLE 2: Distribution of resistance of gram negative isolates to tested antimicrobials.

Antibiotics Tested (% R/N)	NIT	ATM	IMP	MEM	CN	AK	AMC	STX	CST	TGC	CAZ	CFR
<i>E. coli</i>	10/31	21/31	2/31	4/31	3/31	14/31	31/31	27/31	31/31	0/31	31/31	31/31
<i>K. pneumonia</i>	15/27	22/27	0/27	0/27	10/27	13/27	27/27	22/27	27/27	0/27	25/27	27/27
proteusspp	7/8	5/8	0/8	0/8	4/8	4/8	8/8	8/8	8/8	0/8	8/8	8/8
<i>P. aeruginosa</i>	11/11	9/11	0/11	0/11	6/11	5/11	11/11	11/11	11/11	0/11	11/11	11/11
Acinetobacter spp	6/7	4/7	3/7	2/7	4/7	5/7	7/7	7/7	7/7	0/7	5/7	7/7

Nitrofurantoin (NIT), Amikacin (Ak), Amoxicillin –clavulanic acid (AMC), Trimethoprim/Sulfamethoxazole (SXT), Colistin (CST), Tigecycline (TGC), ceftazidim (CAZ), Cefadroxil, (CFR), Azetronem (ATM), Imipenem (imp), Meropenem (MEM), Gentamicin (CN)

DISCUSSION

Recently, increasing of antibiotics resistance by UTI causative bacteria (G-ve) was considered a major health problem in different parts of the world. Our study is focused on detection of UTI etiological agent and their antimicrobial susceptibility pattern with a view to assist in assessing and monitoring the continuous changing in mechanism of bacterial resistance and further improvements in UTI treatment. In present study, the results were showed that *E. coli* was the most prevalent bacteria followed by *K. pneumonia* which was the second type in (78.45%) and (21.56 %) respectively, these findings is consistent with the findings of many other researchers [Dibua *et al.*, 2014; Dielubanza and Schaeffer, 2011; Jain and Saxena, 2015]. Although, bacterial isolates in this study, were highly sensitive to Imipenem and Meropenem except *A.baumannii* was showed a low resistance to these antibiotics the isolates showed extreme resistance to Trimethoprim/ Sulfamethoxazole, Cefadroxil, Colistin, Amoxicillin–Clavulanic acid, Cefazidim.

Also, unexpected resistance was detected towards Azetronem, Amikacin and Nitrofurantoin followed by Gentamycin which are commonly used as empirical treatment in most of UTIs. Our findings are consistent with many previously reported studies [Abujnah *et al.*, 2015; Joly-Guillou *et al.*, 2010] which mentioned that Imipenem and Meropenem were highly effective against Gram negative bacteria that showed a highly resistance to Cephalosporins (first, second and somewhat third generations) and Penicillins, hence physicians advised to stop prescribing these agents as an empiric treatment for UTIs. Additionally, all isolated were sensitive to Tigecycline. However, These findings

may related to possess of Enterobacteriaceae and other genera of gram negative bacteria of plasmid mediated extend spectrum - lactamase and a naturally occurring chromosomally mediated lactamase and [Dhillon and Clark, 2012]. In addition, these drugs are used in massive and for a long period especially in developing countries besides they are also purchased directly from the pharmacies without doctors' prescription.

CONCLUSION

Our study revealed that *E. coli* is predominant bacterial isolate, and the most effective antimicrobial agents were impenem, Meropenem and Tigecycline. In order to prevent urinary tract infections the use of antibiotics should be kept under supervision and given in appropriate doses for an appropriate period of time according doctors' prescription.

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