



EPIDEMIOLOGY AND PROFILES OF ANTIBIOTIC RESISTANCE OF BACTERIA ISOLATED FROM URINARY TRACT INFECTIONS IN LEBANON

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ABSTRACT

Urinary tract infections (UTIs) are considered one of the most common global bacterial infections, affecting 150 million people each year worldwide. UTIs are caused by both Gram-negative and Gram-positive bacteria, as well as by certain fungi. Up to 80% of urine infections are caused by gram negative bacteria. The most common pathogen is *Escherichia coli* and resistance rates to some antibiotics depend on the geographical location. The objective of this study is to provide a comprehensive view of the epidemiologic characteristics of UTIs among the Lebanese population living in Beirut. Nine hundred

seventy-eight individuals, aged between 1 to 80 years, had submitted a urine sample. We identified 196 patients with UTI. The results indicated that the overall prevalence of UTI in the area of our study was 20.4%. Our results revealed a significant association between UTI and gender. The women are more common to have UTIs. The *E.coli* bacteria are responsible for up to 85% of UTI. A very significant association was found between resistance and the antibiotic. The most of bacteria are more sensitive to “ipinem” and more resistant to penicillin respect with other antibiotics while the resistance to antibiotic is age dependant with certain antibiotics. Since this study involved only out patients, further studies should be conducted on inpatients in order to find the prevalence of other uropathogenes in the study area.

KEYWORD: Urinary tract infections, antibiotics, epidemiology, Lebanon.

INTRODUCTION

Urinary tract infections (UTI) are the most common bacterial infections worldwide with a high propensity for recurrence. UTI affect 150 million people worldwide each year^[1,2] with an estimated 3,5 billion dollars being spent annually only in the United States.^[3] Urinary tract infection is a significant cause of morbidity in women throughout their lifespan, in infant boys and in older men.^[2]

The UTI is an infection in any part of the urinary system; kidneys, ureters, bladder and urethra. In addition, UTIs are given different names depending on where they occur. It is important to distinguish between complicated and uncomplicated infections for the best management of patients with urinary tract infections.^[5] Most UTIs are uncomplicated that affect healthy individuals with no structural and neurological urinary tract abnormalities.^[7] However complicated urinary tract infections are associated with factors that can lead to serious problems, especially with upper urinary part.^[6, 8] Specific subpopulations at increased risk of UTI include infants, older men and pregnant women, sexually active women, patients with underlying urologic abnormalities, patients with diabetes or multiple sclerosis, patients with urinary obstruction, patients with acquired immunodeficiency disease, patients with bladder and bowel dysfunction and hospitalized patients.^[4]

Many studies have been reported that *Escherichia coli* is responsible for 85 percent of diagnosed urinary tract infection, followed by Klebsiella, Enterococcus, streptococcus and Proteus.^[9,10] *Escherichia coli* is a rod shaped, gram negative, facultatively anaerobic bacteria. It may cause infection in the bladder, kidneys, urethra or ureters. E.coli infection in the kidneys can be dangerous and lead to permanent damage or fatal blood poisoning. The Other pathogens are usually found in patients with complicated UTI. Generally, these pathogens have a decreased susceptibility to many antibiotics.

Due to the high incidence of UTI, it is one of the most common reasons for antibiotic prescription. Usually UTIs are treated with antibiotics for both simple and complicated infections. The type of antibiotic and duration depend on the circumstances. Multidrug resistance of bacterial uropathogens has been determined as an important public health problem. The prevalence of antibiotic bacterial resistance is highly dependent on age and gender. In fact people of any age and sex can develop a UTI; however some of them are more at risk than others.

The aim of this study was determination of prevalence and antimicrobial susceptibility patterns of uropathogens among Lebanese patients in Beirut.

MATERIALS AND METHODS

Our study was based on collecting urinalysis data between 2014 and 2016 from the laboratory of Khalife Advanced Medical Center in Beirut. The total samples collected from the patients of different ages that have been done urine analysis are 978 samples and 196 of the total resulted positive to urine infection with urine culture test that might be more than 10^5 colony forming units (CFUs)/ml.

Various types of bacteria such as *Escherichia coli*, *klebsiella oxytoca*, *klebsiella pneumoniae*, *staphylococcus saprophiticus*, *proteus mirabilis*, *staphylococcus epidermidis*, resulted the cause of UTI. After identification of bacteria, antibiogram was done using disk-diffusing test to evaluate bacterial resistance or/and sensitivity of such bacteria to antibiotics. However, the antibiotics used include ciprofloxacin, augmentin, cephalaxine, bactrim, amoxillin, penicillin, pipracillin, gentamicin, imipenem, norfloxacin, levofloxacin, nalidixic acid, ofloxacin, cefotaxime, cefuroxime, cefixime, nitrofurantoin.

Statistical analysis was performed using graph pad Prism5. The test chi square was used to compare the association between two nominal variables. Pvalue <0.05 was considered as significant.

RESULTS

Our study revealed a significant association between gender and Urinary tract infections UTIs (Pvalue =0.0407). Females are more common to have UTIs (figure 1). They have a significant higher risk of UTIs than males (odds ratio= 1,6 ; IC 1.016 -2.285).

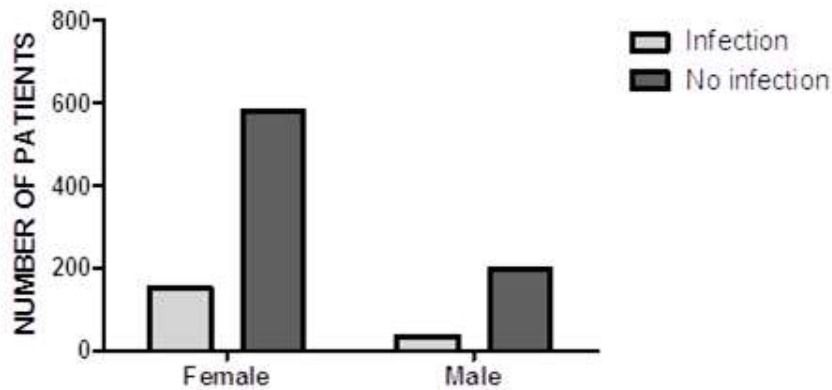


Figure 1: Distribution of patients according to gender and Urinary tract status. The total samples collected from the patients of different ages that have been done urine analysis were 924 samples (701 females and 223 males).

Furthermore, our results show a significant association between age group and UTIs (Pvalue=0,024). (figure 2).

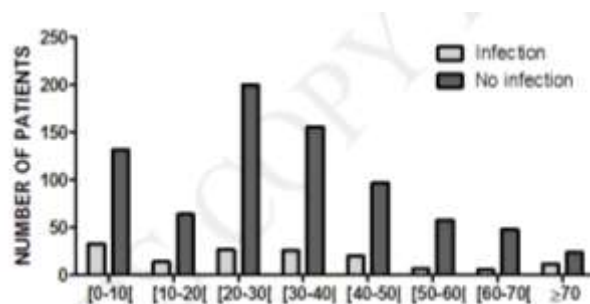


Figure 2: Distribution of patients according to age and Urinary tract status. The total samples collected from the patients of different ages that have been done urine analysis were 924 samples (701 females and 223 males).

E. coli (n = 145, 73,9%) was the most commonly isolated microorganism, followed by *klebsiella oxytoca* (n =20, 11.65%), *klebsiella pneumonia* (n =10, 11.65%), *staphylococcus saprophiticus* (n = 5, 11.65%), *proteus mirabilis* (n = 5, 1.22%) and *staphylococcus epidermidis* (n = 1, 11.65%).

Distribution of patients with *E. coli* urinary tract infection according to gender, age groups and the resistance to antibiotics was done (table 1). The total number of patients was 145 (120 females and 25 males). After identification of bacteria, antibiogram was done using disk-diffusing test to evaluate bacterial resistance or/and sensitivity of such bacteria to the 17 different antibiotics.

Statistical analysis of the patients with UTI by *E.coli* tested by antibiogram showed a very significant association between the type of treatment by antibiotic and the resistance of bacteria (Pvalue<0.0001). The most of bacteria are more sensitive to ipinenem and more resistant to penicillin respect with other antibiotics.

Both males and females show approximately the same sensitivity to the drugs. For example, both have a higher percentage of sensitivity to imipenem (99%) (table 1), however they show the lower percentage of sensitivity to penicillin (10%) and amoxicillin (29,8%). With respect to the percentage of resistance, penicillin appeared to be ineffective and the majority of the patients are resistant to it (table 1). Our results showed that for certain antibiotics, the resistance to antibiotic is age dependant. For example, the age group (30-40) is the more sensitive to cefotaxime comparing to the other age groups (table 1).

Table 1: Percentage of sensitivity to according to gender and group age.

Antibiotics	All patients	Gender		Group age					
		Female	Male	[0-10]	[10-20]	[20-30]	[30-40]	[40-50]	≥50
Amoxillin	29.86	28.32	36.00	29.03	14.29	33.33	38.46	22.22	29.41
Augmentin	48.61	47.27	50.00	45.16	71.43	59.26	61.54	44.44	38.89
Bactrim	70.14	68.10	77.78	58.06	85.71	66.67	80.77	72.22	55.56
Cefixime	63.19	66.97	66.67	64.52	57.14	88.89	88.46	50.00	50.00
Cefotaxime	74.31	77.19	70.37	83.87	71.43	85.19	96.15	44.44	66.67
Cefuroxime	70.14	69.57	74.07	77.42	64.29	85.19	88.46	44.44	50.00
Cephalexine	59.72	59.63	50.00	58.06	71.43	61.54	80.77	38.89	50.00
Ciprofloxacin	74.31	77.39	66.67	83.87	85.71	74.07	76.92	61.11	72.22
Gentamicin	92.36	88.98	92.31	93.55	92.86	88.89	96.15	83.33	88.89
Imipenem	98.61	98.29	100	93.55	100	100	100	100	100
Levofloxacin	74.31	77.48	66.67	93.55	85.71	81.48	73.08	61.11	66.67
Nalidixic acid	50.69	50.89	48.15	74.19	57.14	59.26	53.85	38.89	27.78
Nitrofurantoin	82.64	87.74	80.77	87.10	85.71	96.30	84.62	88.89	82.35
Norfloxacin	82.64	84.21	77.78	93.55	85.71	85.19	84.62	66.67	83.33
Ofloxacin	71.53	77.06	62.96	87.10	85.71	77.78	80.77	66.67	58.82
Penicillin	10.42	9.91	3.70	19.35	21.43	7.41	0.00	16.67	5.88
Pipracillin	60.42	56.90	73.08	61.29	50.00	66.67	73.08	44.44	50.00

50% of the patients between 50 & 80 years old were infected with *klebsiella oxytoca*, this type of bacteria seemed to be mostly resistant to penicillin, amoxillin, pipracillin, cefixime and nitrofurantoin (figure 3). However, they have low resistance to gentamicin (10.53%) and norfloxacin (16.67%).

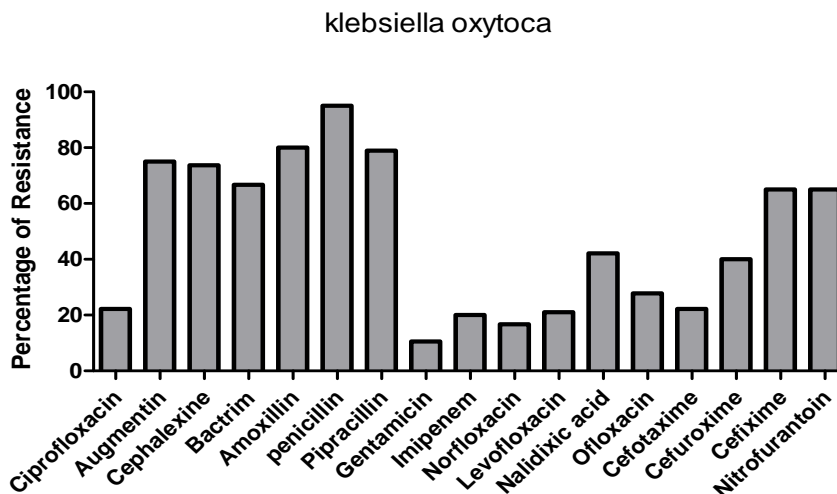


Figure 3: Percentage of resistance to the 17 different antibiotics for klebsiella oxytoca. (male=3; female=17)

In addition to that, 60% of the patients between 30 & 50 years old were infected with *klebsiella pneumoniae* which have high resistance to penicillin and amoxillin and low resistance to gentamicin (0%) and imipenem(10%) (figure 4). *Proteus mirabilis* show no resistance to ciprofloxacin, gentamicin, imipenem, norfloxacin and levofloxacin.

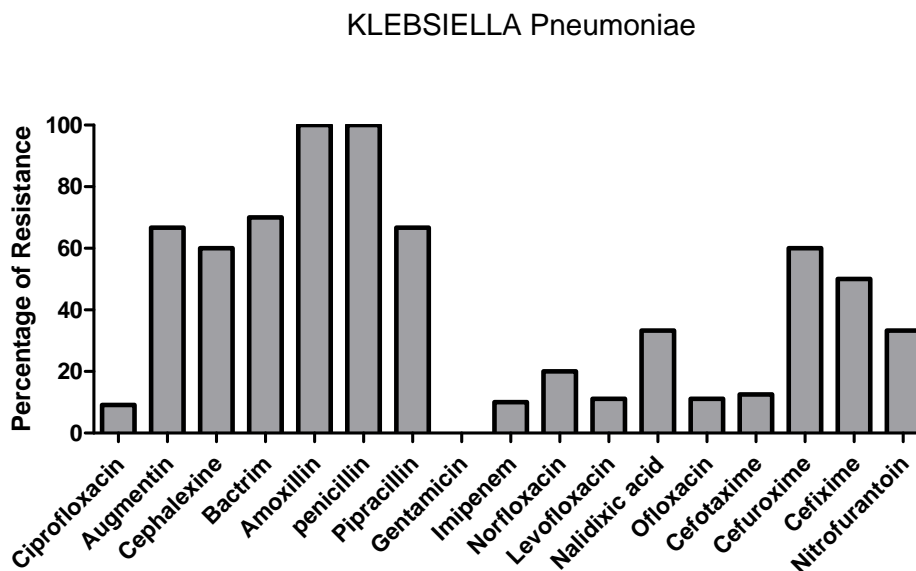


Figure 4: Percentage of resistance to the 17 different antibiotics for klebsiella pneumoniae. (male=3; female=7).

Five patients were infected with *staphylococcus saprophyticus*, 5 by *proteus mirabilis* and one by *staphylococcus epidermidis*.

CONCLUSION AND DISCUSSION

Urine infection is one of the most common medical problems affecting the population. This retrospective study was performed with the aim of surveying the prevalence of antibiotic resistance patterns of bacterial agents, isolated from patients with UTI-positive cultures between 2014 and 2016 in Beirut. In the present study, 196 patients with UTI-positive cultures were identified, 164 cases (83.64%) were female and 32 cases (16.36%) were male. A significant association was found between gender and Urinary tract infections UTIs. In accordance with previous studies in Lebanon and other countries, prevalence of UTI in our study was higher among females than males across all age's group.^[11, 13, 15, 16] The main cause is due to that the urethra in women is shorter than in men and it is closer to the anus making it more likely that bacteria *E.coli* are transferred to the bladder.^[15,16]

E. coli was identified as the predominant cause of UTIs (73,9%), followed by *klebsiella oxytoca* (11.65%), *klebsiella pneumonia* (11.65%). Similar observations have been reported in a previous study.^[11,13,14,15] The most effective antibiotics against *E. coli* were imipenem (98,62%), gentamicin (92,36%), nitrofurantoin (82,64%), and Norfloxacin (82,64%). Imipenem is a carbapenem antibiotic, which is highly stable against lactamase hydrolysis. From the present study, it appears that imipenem is the drug of choice for serious infections with *E. coli* organisms as has been recommended earlier.^[11,15] However, Gentamicin is the most powerful drug against *klebsiella oxotyca* and *klebsiella pneumonia*. In a recent study, they found that *Klebsiella* spp showed a high degree of sensitivity to imipenem, gentamicin and ciprofloxacin.^[16] Penicillin and Amoxillin resistance rate of *E. coli* was 90% and 70% respectively. The present results are similar to previous studies conducted in several countries such as India (88%), Iran (88%) and Taiwan (80%).^[17,18,19] A study in Beirut^[11] showed that the lowest percentage of susceptibility was manifested against piperacillin (between 9 and 24%) followed by ampicillin (between 26 and 38%). Our data show an increase on the resistance of *E.coli* against Penicillin. The reason for the high resistance to some antibiotics observed in this study may due to the improper use of antibiotics.^[20,21] The other is incorrect and unreasonable antibiotics prescription. Considering time, the appropriate dose and manner of administration are the most important aspects of rational drug prescription.^[20, 21] Studies have shown that 30%–60% of the prescribing and use of antibiotics has been improper. However, the overtreatment of antibiotics may result in antibiotic resistance. Knowledge of antibiotic resistance patterns in *E. coli* is very important

in selecting an empirical antimicrobial therapy. In order to reduce the incidence of UTIs, appropriate use of antibiotics is proposed.

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