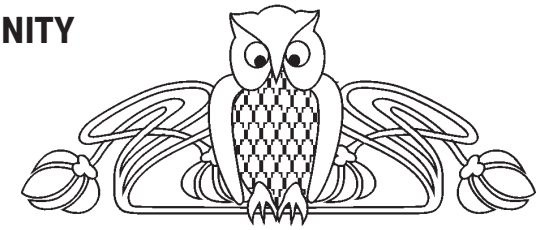
УДК 579.61

ANTIBIOTIC SUSCEPTIBILITY OF PATHOGENS IN URINARY TRACT INFECTIONS IN COMMUNITY



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This study was done to evaluate the bacterial profile and antibiotic susceptibility pattern of urinary tract infections (UTIs) microbial causative agents. For proper identification of causative microbial agents, mid–stream urine (MSU) samples were taken from 325 patients suspected to have UTI. These specimens were cultured and subjected to appropriate biochemical tests. Our results revealed that 200 urine samples showed positive cultures. The most prevalence isolates were *Escherichia coli* with frequency rate of 55.5%, followed by *Klebsiella* spp. (14%), *Enterobacter* spp. (11.5%), *Proteus* spp. (10%), and *Pseudomonas* spp. (6%). However, *Morganella morganii* and *Acinetobacter baumannii* showed similar frequency rate of 1.5%, respectively. All isolates were sensitive to imipenem and amikacin (100%). The majority of isolates were sensitive to nitrofurantion (71%), tobramycin (64%) and ciprofloxacin (58.5%). Whereas, high level resistance was seen against ampicillin (92%), augmentin (86%), trimethoprim – sulfamethoxazole (83%).

Key words: UTI, signs and symptoms, causative agents, antibiotic sensitivity.

Чувствительность к антибиотикам патогенных микроорганизмов при смешанных инфекциях мочевыводящих путей

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Исследование направлено на оценку видового состава патогенных микроорганизмов при смешанных инфекциях мочевыводящих путей (ИМП) и определение их чувствительности к антибиотикам. Для идентификации бактерий были отобраны образцы мочи у 325 пациентов с подозрением на ИМП с дальнейшим выделением патогенов и изучением их биохимической активности. Из 200 образцов мочи были выделены патогенные микроорганизмы – возбудители ИМП. В 55,5% случаев возбудителем являлись бактерии *Escherichia coli*, в 14% – *Klebsiella* spp., в 11,5% – *Enterobacter* spp., в 10% *Proteus* spp., в 6% – *Pseudomonas* spp., в 1,5% – *Morganella morganii* и *Acinetobacter baumannii*. Все выделенные штаммы были чувствительны к имипенему и амикацину (100%). Большинство штаммов проявили чувствительность к нитрофурантоину (71%), тобрамицину (64%) и ципрофлоксацину (58,5%). Высокая устойчивость изолятов наблюдалась по отношению к ампициллину (92%), аугментину (86%), триметоприм – сульфаметоксазолу (83%).

DOI: 10.18500/1816-9775-2015-15-4-63-66

Urinary tract infection represents a serious health problem affecting millions of people annually. It is the most important cause of mortality and morbidity affecting all age groups across the life span worldwide [1]. UTI may involve only the lower urinary tract or the upper or maybe both of them (upper and lower) urinary tracts [2]. The urethra and urinary bladder are the most frequent sites of infections within the urinary tract [3]. Many substances, such as soap, bubbles bath, stool, or clothing can cause soreness of the urethra, which make it easier for bacteria to invade and get into the bladder and multiply [4]. It was found that women were more prone to UTIs than men with the risk of infection related to the frequency of sex [4]. The predominance of Enterobacteriaceae and particularly *Escherichia coli* remain the principle pathogen causing UTI, accounting for (75 – 90%) of all UTIs in both genders in inpatients and outpatients [5]. However, *Klebsiella* spp., *Enterobacter* spp., *Proteus* spp., *Pseudomonas* spp. were found to be more often isolated from inpatients [6, 7].

Antimicrobial agents such as trimethoprim, cephalosporins, nitrofurantion, or a fluoroquinolone substantially shorten the recovery time. All are equally effective for both short and long term cure rates [8]. Resistance has developed in the community to all of these medications due to their widespread use [9]. Worldwide data showed that there was an increasing resistance demonstrated against amoxicillin and lately fluoroquinolone [10]. Some studies have found that quinolone resistance was higher in developing countries than in developed nations, because of the using of less active quinolone, such as nalidixic acid and the use of low dosages of more potent compounds such as ciprofloxacin resulting in selection of mutant isolates [11]. It was also revealed that antibiotic resistance varies according to geographic locations and is directly proportional to the use and misuse of antibiotics [12]. Therefore, it is important to have local hospital based knowledge of the organisms causing UTI and their antibiotic sensitivity patterns, and such knowledge would be relevant not only to the local hospital but would also be a vital regional database [13]. For all of the above reasons, this study was aimed to identify the most

common etiologic agents responsible for UTI with determination the antimicrobial sensitivity pattern to the commonly used antibiotics.

Materials and Methods

A total of 325 urine samples were collected from patients with various ages. These samples were collected from Saratov State Medical University Specimens (MSU), were cultured on MacConkey's agar media, incubated aerobically for 24 hours at 37°C. Urine culture showing a quantitative count ≥ (10^5) colony forming unit (CFU) / ml of single pathogen was considered as significant bacteriuria [14]. Identification of isolates was done by standard method depending on observation of colony characteristics, Gram stain as well as using biochemical tests for further identification. Antimicrobial sensitivity test was performed by Kirby – Bauer's technique (disc diffusion method) [15] using Muller – Hinton agar media. The following commercially available antibiotic discs were used: Amikacin (30 μg), Ampicillin (10 μg), Augmentin (amoxicillin trihydrate – potassium clavulanate) (30 μg), Cefotaxime (30 μg), Cefoxitin (30 μg), Ceftazidime (30 μg), Ciprofloxacin (5 μg), Gentamicin (10 μg), Imipenem (10 μg), Nalidixic acid (30 μg), Nitrofurantion (300 μg), Piperacillin (100 μg), Tobramycin (10 μg), and Trimethoprim – sulfamethoxazole (23.75 μg).

Results and Discussion

As a result this study there were 115 (57.5%) females and 85 (42.5%) males. The overall males to females ratio were (1:14). This finding was consistent with other reported studies from many parts of the world showing a statistically predominance of females [16–19]. This is usually related to the anatomical and pathogenic factors of females [20]. A total of 200 isolates were obtained from the above patients. The frequency of isolated uropathogens was given in table 1. *Escherichia coli* were significantly the most common isolated organism 55.5%. The present finding was in accordance with many other studies [21, 22] showed predominance of gram negative bacteria (especially *Escherichia coli*) with an isolation rates ranged between (40 – 69%). This was due to the fact that strains of *Escherichia coli* affecting the urinary tract possess a variety of virulence characteristics that facilitate their intestinal carriage, persistence in vagina and then ascension and invasion of the anatomically normal urinary tract [10]. A high prevalence of *Klebsiella* spp. (14%) and *Enterobacter* spp. (11.5%) was seen in this work. This is compatible with the results showed by [21, 23]. Other bacteria like *Proteus* spp. (10%), *Pseudomonas* spp. (6%), *Morganella morganii* (1.5%) and *Acinetobacter baumannii* (1.5%) were also isolated in this study. These isolated bacteria have been reported as agents of UTIs and their presence in the sample population was not unusual [18], but the differences in bacterial distribution pattern among different area in the world may be explained by the geographic differences which affect the types of bacterial isolates as well as the changes that occur on bacterial isolates over the years.

Table 1

Percentage of bacterial isolates isolated from urine samples (N = 200)

Bacterial isolates	No. of isolates (%)
Escherichia coli	111 (55.5)
Klebsiella spp.	28 (14)
Enterobacter spp.	23 (11.5)
Proteus spp.	20 (10)
Pseudomonas spp.	12 (6)
Morganella morganii	3 (1.5)
Acinetobacter baumannii	3 (1.5)
Total	200 (100)

The sensitivity and resistance patterns of the all isolates to different antibiotics were demonstrated in Tables 2, 3. The isolated bacteria exhibited wide differences in their susceptibility to the tested antimicrobial antibiotics. Table 2 reveals that all the bacterial isolates showed susceptibility towards imipenem and amikacin (100%). While the majority of them exhibited sensitivity to nitrofurantoin (71%), tobramycin (64%), and ciprofloxacin (58.5%).

Table 2

Antibiotic sensitivity and resistance of 200 uropathogens (irrespective of isolates)

Antibiotics	Sensitivity No. (%)	Resistant No. (%)
Imipenem (IPM)	200 (100)	0 (0)
Amikacin (AK)	200 (100)	0 (0)
Nitrofurantion (F)	142 (71)	58 (29)
Tobramycin (TOB)	128 (64)	72 (36)
Ciprofloxacin (CIP)	117 (58.5)	83 (41.5)
Ceftazidime (CAZ)	72 (36)	128 (64)
Gentamicin (GM)	62 (31)	138 (69)
Cefotaxime (CTX)	61 (30.5)	139 (69.5)
Piperacillin (PIP)	51 (25.5)	149 (74.5)
Cefoxitin (FX)	41 (20.5)	159 (79.5)
Nalidixic acid (NA)	41 (20.5)	159 (79.5)
Trimethoprim – sulfamethoxazole (SXT)	34 (17)	166 (83)
Augmentin (AMC)	28 (14)	172 (86)
Ampicillin (AMP)	16 (8)	184 (92)

However, the majority of isolates revealed resistance against ampicillin (92%), followed by augmentin (amoxicillin trihydrate – potassium clavulanate) (86%), trimethoprim – sulfamethoxazole (83%), nalidixic acid and cefoxitin (79.5%) respectively, piperacillin (74.5%), cefotaxime (69.5%), gentamycin (69%), and ceftazidime (64%). Other tested antibiotics were effective only for less than half of the bacterial isolates.

The results of the antibiotic susceptibility tests showed that imipenem and amikacin were the most effective drugs of choice against the microbial causative agents of UTIs used in this study as 100% of isolates were sensitive to them. Similar result was presented by other studies [20, 24] which demonstrated that imipenem and amikacin have an excellent effect against most uropathogens.

Regarding nitrofurantoin, our results shown that (71%) of the isolates were sensitive to nitrofurantoin, which appeared in accordance with other study [25] that showed strong activity of nitrofurantion against more than 60% of organisms responsible for UTI. With this evidence, nitrofurantion can be suggested as the drug of choice for empirical treatment. The percentage sensitivity of the most isolated organisms to the commonly used antibiotics for UTI, namely ampicillin was low. It is obvious that ampicillin is no more useful against uropathogens as only (8%) of the studied isolates were susceptible to this drug. High incidence of resistance to this drug has also been reported by other worker in developing countries [26, 27]. This observation may due to the irrational use of first line antibiotics at primary health care level which is the leading cause of increasing resistance to these commonly used drugs.

In this study, uropathogens showed resistant also to antibiotics like new quinolones, third generation cephalosporins. This is in accordance with the results of [28] that showed significantly high resistance to ciprofloxacin in the same study setting. High level of resistance to trimethoprim – sulfamethoxazole may due in part to misuse of this drug as it was recommended to be taken at night to ensure maximal urinary concentrations and increase its effectiveness.

Conclusions

Based on the findings of this study, it is concluded that UTI is affected females more than males. The main organism causing UTI is *E. coli* followed by *Klebsiella* spp. Almost all isolates show resistant to commonly prescribed antibiotics. Therefore, antibiotics should only be commenced after performing culture sensitivity test because most of the UTI patients are treated blindly with different antibiotics. A high percentage of resistance was found to ampicillin, augmentin and trimethoprim – sulfamethoxazole. Therefore in blind therapy of suspected UTIs, imipenem, amikacin and nitrofurantion were the drugs of choice. Hence, new antimicrobial should be used with more caution and wide spread use of antibiotic therapy should be stopped.

Table 3

Antimicrobial drugs susceptibility profile of the uropathogens (N = 200)

Antibiotics	Uropathogens													
	E. coli		*Proteus* spp.		*Klebsiella* spp.		*Pseudomonas* spp.		*Enterobacter* spp.		*Morganella morganii*		*Acinetobacter baumannii*	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R
IPM	111	0	20	0	28	0	12	0	23	0	3	0	3	0
AK	111	0	20	0	28	0	12	0	23	0	3	0	3	0
F	101	10	0	20	20	8	2	10	18	5	0	3	1	2
TOB	81	30	15	5	8	20	10	2	10	13	2	1	2	1
CIP	75	36	7	13	3	25	10	2	18	5	2	1	2	1
CAZ	35	76	10	10	12	16	3	9	9	14	3	0	0	3
GM	48	63	5	15	0	28	0	12	7	16	0	3	2	1
CTX	30	81	10	10	11	17	0	12	7	16	3	0	0	3
PIP	24	87	6	14	6	22	6	6	6	17	2	1	1	2
FX	31	80	4	16	0	28	0	12	4	19	2	1	0	3
NA	29	82	5	15	0	28	0	12	7	16	0	3	0	3
SXT	23	88	0	20	0	28	0	12	9	14	1	2	1	2
AMC	15	96	4	16	0	28	1	11	6	17	0	3	2	1
AMP	4	107	12	8	0	28	0	12	0	23	0	3	0	3

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