DOI: 10.4081/aiua.2020.2.146

ORIGINAL PAPER

Microorganisms and antibiotic susceptibilities isolated from urine cultures

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Summary ***Objectives: Urinary tract infection (UTI) is the second most common cause of infection among all infectious diseases at hospitals. Antibiogram results are needed to maintain treatment in patients with suspected UTI. However, empirical antibiotic treatment is initiated in patients since it takes time to obtain the results of antibiograms. The aim of this study was to evaluate the urine culture and antibiogram results of patients who were admitted to our hospital with suspected UTI and compare the results with other studies.***

Methods: Urine cultures requested from the hospital information system database between January of 2018 and 2019 were analyzed. Microorganism-positive urine samples and antibiogram results were evaluated and included in the study.

Results: Of the patients, 748 (61.8%) were female and 463 (38.2%) were male. The average age of all patients was 44.9 years. Escherichia coli was the most frequently isolated microorganisms from urine cultures (n = 828, 68.4%). Among all microorganism-positive urine samples, antibiotic resistance against Cefalexin, Fusidic acid, Ampicillin, Erythromycin, Levofloxacin, Cefuroxime Axetil, Trimethoprim/ Sulfamethoxazole, Ceftriaxone and Ciprofloxacin was 83.9%, 68.4%, 61.8%, 44.7%, 42.7%, 36.4%, 30%, 28.6% and 26.7%, respectively.

Conclusions: High resistance to Cefalexin, Ampicillin, Cefuroxime, Axetil, Trimethoprim/ Sulfamethoxazole, Ceftriaxone and Ciprofloxacin, which are often preferred in empirical antibiotic selection, has been found. We believe that empirical antibiotic selection should not be overlooked in cases of UTI. Our study may help clinicians use appropriate antibiotics for the clinical management of UTIs.

KEY WORDS: Antibiotic resistance; Microorganisms; Urine culture.

Submitted 18 November 2019; Accepted 19 January 2020

INTRODUCTION

Antibiotic-resistant microorganisms are becoming widespread and the emergence of bacteria causing *multidrug-resistant* (MDR) *urinary tract infection* (UTI) has become a major public health problem (1, 2). UTIs are the second most common cause of infection among all infectious diseases at hospitals (3). Around 150 million new UTI cases develop worldwide each year, with an estimated treatment cost of $ 150 billion (4). The urethra is a portal for urine output, but it also allows pathogenic microorganisms to enter the urinary tract. Bacteria live in the vicinity of the urethral opening in both men and women and routinely colonize urine, but women are more likely to develop UTIs resulting from anatomical differences, hormonal effects and behavior (5, 6). Antibiograms are used to maintain treatment in patients with suspected UTIs. However, empirical antibiotic treatment is initiated in patients since it takes time to obtain the results of antibiograms. The causative agent and the selected antibiotic affect the success of the treatment. The choice of drug for empirical antibiotic treatment is very important because of antibiotic resistance. Empirical antibiotic selection should be followed at regular intervals for the sensitivity results of the hospital and the region studied (7). Because the prevalence of UTI pathogens and their resistance to different antibiotics may have changed over the years (8). Antimicrobial resistance is increasing worldwide, leading to infections that are difficult to treat and are associated with high mortality, morbidity and cost (9, 10).

The aim of this study was to evaluate the urine culture and antibiogram results of patients who were admitted to our hospital with suspected UTI and compare the results with other studies. We believe that our study will help physicians select appropriate empirical antibiotics for the clinical management of UTIs. Morever, it may serve as data source for reviews and meta-analysis in future.

MATERIALS AND METHODS

In this study, both urine cultures and antibiogram results of 1211 patients who were admitted to urology outpatients clinic of *Van Regional Training and Research Hospital* between 2018-2019 and who were positive for urine culture were analyzed retrospectively. In the microbiology laboratory urine samples obtained for culture from mid stream by sterile urine containers were evaluated as standard with 0.01 milliliter calibrated flasks with 5% sheep blood and *eosin methylene blue* (EMB) agar and incubated at 37°C for 18-24 hours. Isolated bacteria were identified by fully automated identification with antibiogram device (*VITEK 2 Compact BioMerieux, France*) and antibiotic susceptibility results were determined. Antibiogram results were given in three groups as less sensitive, sensitive and resistant. Data were expressed as mean ± standard deviation and percentage.

RESULTS

Of the patients, 748 (61.8%) were female and 463 (38.2%) were male. The average age of all patients was 44.9 years.

No conflict of interest declared.

It was 38.2 years in female patients whilst 55.8 years in male patients. *Escherichia coli* (*E. coli*) was the most frequently isolated microorganisms (n = 828, 68.4%) from urine cultures. Isolated microorganisms are shown in Table 1 as number and percentage.

When all samples were examined, antibiotic resistance against to *Cefalexin, Fusidic acid, Ampicillin, Erythromycin, Netilmicin, Levofloxacin* was 83.9%, 68.4%, 61.8%, 44.7%, 43.8%, 42.7%, respectively.

Also, antibiotic resistance to *Cefuroxime Axetil, Cefuroxime, Cefixime, Trimethoprim/Sulfamethoxazole, Ceftriaxone, Ciprofloxacin* was found to be 36.4%, 36%, 34.3%, 30%, 28.6% and 26.7%, respectively. No microorganisms were found to be resistant to *Amphotericin B, Chloramphenicol, Colistin, Flucytosine* and *Rifampicin*. However, antibiotic resistance to *Meropenem, Ertapenem, Imipenem* and *Amikacin* was found to be 0.88%, 1.14%, 1.5% and 1.6%, respectively. The data on the resistance status of antibiotics are given in Table 2 as number and percentage.

Table 1.
Microorganisms isolated from urine cultures.

Isolated microorganisms	Number	Percent (%)
Acinetobacter spp	2	0.17
Acinetobacter baumannii	7	0.58
Alcaligenes faecalis	1	0.08
Burkholderia cepacia	1	0.08
Candida albicans	15	1.24
Candida famata	1	0.08
Candida kefyr	2	0.17
Candida krusei	1	0.08
Candida spherica	3	0.25
Candida tropicalis	3	0.25
Citrobacter freundii	2	0.17
Citrobacter koseri	3	0.25
Enterobacter aerogenes	1	0.08
Enterobacter cloacae complex	9	0.74
Enterococcus spp	4	0.33
Enterococcus faecalis	55	4.5
Enterococcus faecium	9	0.74
Escherichia coli	828	68.4
Klebsiella spp	34	2.8
Klebsiella oxytoca	6	0.5
Klebsiella pneumoniae	87	7.2
Morganella morganii	3	0.25
Proteus spp.	4	0.33
Proteus mirabilis	21	1.73
Providencia rettgeri	4	0.33
Pseudomonas aeruginosa	24	1.2
Salmonella spp	1	0.08
Serratia fonticola	2	0.17
Serratia liquefaciens group	2	0.17
Serratia marcescens	1	0.08
Shigella sonnei	1	0.08
Staphylococcus aureus	4	0.33
Staphylococcus epidermidis	23	1.9
Staphylococcus haemolyticus	3	0.25
Staphylococcus hominis	1	0.08
Staphylococcus saprophyticus	6	0.5
Staphylococcus warneri	1	0.08
Stteptococcus spp	2	0.17
Streptococcus agalactiae	26	2.15
Streptococcus constellatus ssp pharyngis	1	0.08
Streptococcus dysgalactiae ssp equisimilis	2	0.17
Streptococcus mitis	3	0.25
Streptococcus salivarius ssp salivarius	1	0.08
Streptococcus sanguinis	1	0.08
Total	1211	100

Table 2.
Antibiotic resistance rates.

Antibiotic	Sensitive	Low sensitive	Resistant	Total	Percent (%)
Amikacin	719	178	15	912	1.6
Amoxicillin/Clavulanic Acid	13	1	7	21	33.3
Amphotericin B	15	0	0	15	0
Ampicillin	362	2	588	952	61.8
Ampicillin/Sulbactam	69	0	15	84	17.9
Aztreonam	5	18	4	27	14.8
Benzylpenicillin	29	5	3	37	8.1
Caspofungin	17	0	1	15	5.6
Cefalexin	5	0	26	31	83.9
Cefepime	25	1	3	29	10.3
Cefixime	574	0	300	874	34.3
Cefotaxime	14	0	1	5	6.7
Cefoxitin	24	769	82	875	9.4
Ceftazidime	625	68	218	911	23.9
Ceftriaxone	609	26	254	889	28.6
Cefuroxime	561	0	316	877	36
Cefuroxime Axetil	557	0	319	876	36.4
Chloramphenicol	4	0	0	4	0
Ciprofloxacin	698	46	271	1015	26.7
Clindamycin	35	0	10	45	22.2
Colistin	37	0	0	37	0
Daptomycin	53	0	3	56	5.4
Ertapenem	865	2	10	877	1.14
Erythromycin	21	0	17	38	44.7
Fluconazole	17	0	1	18	5.6
Flucytosine	17	1	18	36	0
Fosfomycin	847	0	59	906	6.5
Fusidic Acid	12	0	26	38	68.4
Gentamicin	835	5	111	951	11.7
Imipenem	873	24	14	911	1.5
Levofloxacin	46	1	35	82	42.7
Linezolid	130	0	2	132	1.5
Meropenem	891	14	8	913	0.88
Micafungin	17	0	1	18	5.6
Moxifloxacin	17	0	4	21	19
Netilmicin	18	0	14	32	43.8
Nitrofurantoin	798	1	75	874	8.6
Oxacillin	23	0	15	38	39.5
Piperacillin	15	2	10	27	37
Piperacillin/Tazobactam	682	96	124	902	13.7
Rifampicin	0	4	0	4	0
Teicoplanin	92	0	8	100	8
Tetracycline	28	0	13	41	31.7
Tigecycline	113	4	0	117	0
Tobramycin	26	0	16	42	18.8
Trimethoprim/Sulfamethoxazole	677	35	310	1022	30.3
Vancomycin	128	0	4	132	3
Vorikonazol	16	0	0	16	0

Discussion

Bacteria are the most common etiology of UTIs, accounting for more than 95% of cases. *E. coli* is the most common causal organism of UTIs and is responsible for more than 80% of them (11). *Wright et al.* reported that the rate of *E. coli* in urine cultures was 67% (12). Another study conducted by *Akbas et al.* revealed that the rate of *E. coli* in urine cultures was 35-80% (13). In our study, we found the rate of *E. coli* to be 68.4% and this rate is consistent with other studies. Microorganisms and antibiotic susceptibilities isolated from urine cultures may differ among countries due to usage of different agents and multifactorial causes. In our study, a serious resistance to *Cefalexin*, which is one of the most common antibiotics used for the treatment of UTIs, is observed. In a study published in 2019, *Shrestha et al.* reported a 60% resistance to *Cefalexin* (14). *Ganesh and colleagues* also reported 94.1% resistance to *Cefalexin* in their study in the same year (15). In our study, antibiotic resistance rate to *Cefalexin* was found to be 83.9%. All three studies point out that the rate of antibiotic resistance to *Cefalexin* is high. *Zhanel et al.* reported a resistance rate of Ampicillin to 37.7% in 2006 (16). *Bryce et al.* found the resistance rate to Ampicillin as 60.3% in 2016 (17). In our study, the resistance rate to Ampicillin was found to be 61.8%. Antibiotics prescribed for UTIs, most of which are caused by *E. coli*, have a high prevalence of resistance. When we look at the studies conducted worldwide, we found that Ampicillin resistance rate is the highest and Nitrofurantoin resistance rate is at very low levels. In our study, we found the Nitrofurantoin resistance rate to be 8.6%.

Conclusions

Empirical antibiotic selection against *E. coli*, which is the most frequently isolated microorganism in urine cultures of patients with suspected UTI, was highly resistant to most of the antibiotics that are frequently preferred. We think that empirical antibiotic selection in cases of UTI should not be overlooked and that such studies should be repeated frequently to carry out current antibiotic susceptibilities.

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