TYPES OF ORGANISMS CAUSING URINARY TRACT INFECTION AND THEIR ANTIBIOTIC SENSITIVITY PATTERN IN SULAIMANI TEACHING HOSPITAL

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ABSTRACT

Background

Urinary tract infection (UTI) is amongst the most common bacterial infections that prompt patients to seek medical advice. Approximately 10% of human populations get urinary tract infection at some stage of their live.

Objectives

The study was carried out to determine the types of micro-organisms causing UTI and their sensitivity to antibiotics in Sulaimani Teaching Hospital.

Methods

Records of patients admitted in Sulaimani Teaching Hospital, who had complicated UTI, were studied for a period of five years, from 1st December 2006 to 1st December 2010. All study subjects who had positive records of urine sample cultures inoculated on MacConkey and blood agar media were included in the study. The isolated bacteria were identified using biochemical tests. Disk diffusion susceptibility test was used to determine susceptibility of bacterial agents to antibiotics.

Results

A total of 2055 urine samples were found to be positive. The main isolated organism was *Escherichia coli* (*E coli*) 67.69%, followed by *Pseudomonus aeruginosa* 11.24%, then *Proteus* Species 7.15%, Gram negative bacilli 4.53%, *Staphylococcus aureus* 4.23%, *Klebsiella* species 3.55% and lastly *Salmonella* species represented 1.61%.

Conclusion

The commonest microorganism for UTI in this study was *E coli*, followed by *Pseudomonas*, *Proteus*. Resistance of organisms to antibiotics is high probably due to misuse and overuse of antibiotics.

Keywords: *UTI, Sulaimani, Urine culture and sensitivity*

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INTRODUCTION

Approximately 10% of human beings get urinary tract infection (UTI) at some stage during their live [1]. Urinary tract infections (UTI) are common with an estimated annual global incidence of at least 250 million, being costly to patients and health care funding agencies, and controversial with regard to management strategies [2]. UTI is one of the commonest domiciliary and nosocomial bacterial infections[3]. These infections are more common in females than in men, incidence in women in the age 20-40 years ranges from 25-30%, whereas in older women above 60 years of age it ranges from 4 to 43% [1, 4-5].

In the last years, the frequency and spectrum of antimicrobial resistant UTIs have increased in both hospitals and community. Antimicrobial resistance is influenced by the duration and amount of antimicrobial agent used, for instance, floroquinolone resistance of *E. coli* has increased from less than 1% to 10% in hospitalized patients [6-7].

Isolation of organisms causing UTI and their antibiotic susceptibility is very essential for their appropriate management [8]. Up to our knowledge, no published data are available on the types of organisms causing UTI and its sensitivity to antibiotics in Sulaimani governorate. This study was carried out, therefore, to determine the types of microorganisms causing UTI and their sensitivity to antibiotics.

MATERIALS AND METHODS

This study was carried out at Sulaimani Teaching Hospital. It was a retrospective study, by analyzing the records of all admitted patients for a period of five years from 1st of December 2006 to 31st of December 2010. All the records of urine samples collected for culture and sensitivity for the period of the study were reviewed carefully and the positive urine samples were studied and the negative samples were excluded. The data collected from patients' records included name, gender, date, type of isolated organism and the results of antimicrobial susceptibility.

The urine samples were collected from freshly voided mid-stream urine into sterile universal tubes (sterilized in 160 °C for one hour), then a measured amount of urine, using calibrated loop method was inoculated to nutrient agar medium (Merck, Germany) for culture and sensitivity. Urine specimens were cultured for isolation of the microbial agents of UTI on MacConkey and blood agar media following standard bacteriological technique and incubated at 37°C for 24 hours. Pure culture colony counting 100,000 or more was considered significant. The culture characteristics of overnight culture plates with growth and the morphology of the isolated colonies after gram stain were used in differentiating the isolates. All the bacteria isolated from urine in this study were identified using conventional biochemical tests and morphology of the isolated colonies [9-11].

In the present study antimicrobial susceptibility testing was done on Mueller-Hinton agar (Merck, Germany) using disk diffusion (Kirby Bauer's) technique. This method was done according to Clinical and Laboratory Standards Institute (CLSI) guidelines to determine susceptibility of UTIs agents [12]. Antimicrobial sensitivity tests were performed using the dick-diffusion technique of stokes [13], using Oxoids multidisc. The antibiotic disks comprised, ampicillin (10 µg), amoxicillin (30 µg), ceftriaxone (30 µg), rifampicin (µg), amoxicillin/clavulanic acid (10 µg), trimethoprim-sulfamethoxazole (SXT- 25 µg), cephalexin (10 µg), cefotaxime (10 µg), nalidixic acid (30 µg), ciprofloxacin (5 µg), chloramphenicol (10 µg), gentamicin (10 µg), tetracycline (30 µg), streptomycin (µg), nitrofurantoin (100 µg), imipenem (10 µg) and amikacin (30 µg).

The diameter of the zone of inhibition produced by each antibiotic disc was measured and recorded and then the isolates were identified as being resistant or sensitive. Microsoft office excel 2007 was used for data entry and analysis. Data described by conducting tables and estimating percentage and proportions.

RESULTS

A total of 2055 urine samples were found to be positive during the five years of this study. The prevalence of UTI was more common in female (74.65%) than in male (25.35%). Ratio of female to male was approximately 3:1 and this ratio was maintained along the five years as shown in Table 1.

Mainly seven types of organisms were isolated from the cultures. The highest prevalence of infection was caused by *E. coli* (67.69%), followed by *Pseudomonus aeruginosa* (11.24%), then Klebsiella (7.15%), Streptococcus (4.53%),

Proteus (4.23%), unidentified gram negative bacilli (3.55%) and Salmonella species (1.61%) as shown in Table 2.

E. coli was most sensitive to imipenem (100%), followed by amikacin (91.77%), nitrofurantoin (87.7%) and gentamycin (64.84%). Highest resistant antibiotic was ampicillin (100%), followed by amoxicillin (97.91%), Table 3 and 4.

The most effective antibiotic to *Pseudomonas aeruginosa* was imipenem (100%), followed by amikacin (96.49%), and ciprofloxacin (75.14%). This species was 100% resistant to ceftriaxone, amoxicillin, amoxiclave, cotrimoxazole and ampicillin, while it was 81.96% resistant to rifampicin and 77.37% to nalidixic acid.

Proteus species was most sensitive to imipenem (97.72%), followed by tetracycline (74.6%) and was less sensitive to nitrofurantoin (59.3%) amikacin (100%), followed by amikacin (58.2%) and ciprofloxacin (56.4%) as shown in Table 4.

Staphylococcus aureus was highly sensitive to imipenem (94.11%), followed by rifampicin (83.33%), then amikacin (79.31%) and amoxiclave (68.57%). The organisms were mostly resistant to ampicillin (92.84%), followed by amoxicillin (91.67%), cephalexin (89.66%) and cotrimoxazole (89.34%).

Klebsiella species was most sensitive to amikacin (88.9%), followed by nalidixic acid (76.47%) and nitrofurantoin (67.27%). It was most resistant to ampicillin, rifampicin and amoxicillin (100%), followed by ceftriaxone (93.75%) and cotrimoxazole (92. 31%), Table 3.

Other unidentified Gram negative bacilli were most sensitive to amikacin (90%), nitrofurantoin (77.27%) and mostly resistant to ampicillin, amoxicillin, chloramphenicol and streptomycin (100%) then rifampicin (93.75%) and nalidixic acid (86%).

Salmonella species was most sensitive to amikacin (89.28%) and streptomycin (77.77%) and mostly resistant to ampicillin (100%) and cephalexin (71.43%).

Table 1. Proportion of positive urine cultures by year and gender.

Year	Positive cultures		Male		Female	
	No.	%	No.	%	No.	%
2006	480	23.36	108	22.5	372	77.5
2007	518	25.21	115	22.2	403	77.8
2008	428	20.83	123	28.7	305	71.3
2009	319	15.52	89	27.9	230	72.1
2010	310	15.15	86	27.7	224	72.3
Total	2055		521	25.35	1534	74.65

Table 2. Types of isolated microorganisms from urine culture in relation to gender.

Types of microorganism	Total		Male		Female	
	No.	%	No	%	No	%
E. coli	1391	67.69	343	65.83	1048	68.31
Pseudomonas aeruginosa	231	11.24	68	13.05	163	10.63
Klebsiella spp.	147	7.15	18	3.45	55	3.58
Staphylococcus aureus	93	4.53	28	5.37	59	3.85
Proteus spp.	87	4.23	41	7.88	106	6.91
Unidentified G–ve bacilli	73	3.55	15	2.88	78	6.91
Salmonella spp.	33	1.61	8	1.54	25	1.64
Total	2055	100	521	100	1534	100

Table 3. Resistance pattern of bacterial isolated from urine culture in Sulaimani Teaching Hospital.

Organism	**Number of strains (%) resistant to**																
	AP	AC	AM	CEF	RIF	CO	CE	CEF	NA	CI	CL	G	T	S	N	AN	IM
E. coli	1244	1122	122	733	782	830	757	733	808	512	120	489	586	146	171	26	0
(n = 1391)	(100)	(98)	(84)	(67)	(71)	(83)	(80)	(70)	(60)	(48)	(49)	(35)	(76)	(60)	(12)	(8)	(0)
P. aeuroginosa	173	160	15	28	109	159	159	101	147	43	29	101	101	30	130	2	0
(n= 231)	(100)	(100)	(100)	(100)	(82)	(100)	(79)	(78)	(77)	(25)	(50)	(54)	(70)	(52)	(69)	(3.5)	(0)
***Proteus* spp.**	67	54	38	36	27	94	58	60	76	58	27	54	16	40	50	28	1
(n=147)	(100)	(100)	(64)	(45)	((68)	(88)	(73)	(67)	(63)	(45)	(90)	(45)	(25)	(76)	(41)	(42)	(3)
G-ve Bacillus	18	35	7	21	20	49	33	29	44	44	18	35	24	11	15	2	0
(n=93)	(100)	(100)	(78)	(70)	(53)	(85)	(62)	(73)	(86)	(69)	(100)	(50)	(57)	(100	(23)	(10)	(0)
S. aureus	23	77	11	58	2	67	52	38	53	56	18	41	18	13	23	6	1
(n=87)	(93)	(92)	(31)	(84)	(17)	(89)	(90)	(59)	(83)	(79)	(53)	(64)	(39)	(43)	(33)	(21)	(6)
***Klebsiella* spp.**	43	56	15	30	18	60	20	29	16	29	28	35	0	8	18	2	0
(n=73)	(100)	(100)	(65)	(94)	(100)	(92)	(35)	(69)	(24)	(55)	(68)	(50)	(0)	(38)	(33)	(11)	(0)
***Salmonella* spp.**	8	11	9	7	4	7	5	7	9	6	9	4	6	6	9	3	0
(n=33)	(100)	(100)	(50)	(54)	(100)	(30)	(71)	(58)	(60)	(29)	(53)	(33)	(32)	(22)	(64)	(10)	(0)

AP= ampicillin, AC= amoxicillin, CEF= ceftriaxone, RIP= rifampicin, AM= amoxiclav, CO= cotrimoxazole, CE= cephalexin, CEF= cefotaxim, NA= nalidixic acid,CI= ciprofloxacin, CL= chloramphenicol, G= gentamycin, T= tetracycline, S= streptomycin, N= nitrofurantoin, AN= amikacin, IM= imipenem.

Table 4. Sensitivity pattern of bacterial isolated from urine culture in Sulaimani Teaching Hospital

Organism	Number of strains (%) sensitive to																
	AP	**AC**	**AM**	**CEF**	**RIF**	**CO**	**CE**	**CEF**	**NA**	**CI**	**CL**	**G**	**T**	**S**	**N**	**AN**	**IM**
E. coli	0	24	24	25	316	170	194	316	534	561	123	902	170	97	1220	290	100
(n = 1391)	(0)	(2.09)	(16.4)	(20.7)	(28.8)	(17)	(20.4)	(30.1)	(39.8)	(52.3)	(50.6)	(64.5)	(22.5)	(40)	(87.7)	(91.8)	(100)
P. aeuroginosa	0	0	0	0	24	0	43	29	43	130	29	86	43	28	86	55	29
(n= 231)	(0)	(0)	(0)	(0)	(18)	(0)	(21.3)	(22.3)	(22.6)	(75.1)	(50)	(46)	(29.9)	(48.7)	(39.8)	(96.9)	(100)
***Proteus* spp.**	0	0	44	13	21	13	22	30	44	75	3	66	47	13	73	39	43
(n=147)	(0)	(0)	(55)	(33)	(36)	(12)	(27.5)	(33)	(36.6)	(56.4)	(10)	(55)	(74.6)	(24.5)	(59.3)	58.2)	(97.7)
G-ve Bacillus	0	0	9	18	2	9	20	11	7	20	0	35	18	0	51	18	0
(n=93)	(0)	(0)	(30)	(47.4)	(22.2)	(15.5)	(37.7)	(27.5)	(13.7)	(31.3)	(0)	(50)	(42.9)	(0)	(77.3)	(90)	(0)
S. aureus	58	7	24	11	10	8	6	27	11	15	16	23	28	17	47	23	16
(n=87)	(7.2)	(8.3)	68.6)	(16)	(83.3)	(10.7)	(10.3)	(41.5)	(17.2)	(21.1)	(47.1)	(35.9)	(60.9)	(56.7)	(67.2)	(79.3)	(94.11)
***Klebsiella* spp.**	0	0	8	2	0	5	38	13	52	24	13	35	0	13	37	16	0
(n=73)	(0)	(0)	(34.8)	(6.3)	(0)	(7.7)	(65.5)	(31)	(76.5)	(45.3)	(31.7)	(50)	(0)	(61.9)	(67.3)	(88.9)	(0)
***Salmonella* spp.**	0	0	9	6	0	16	2	5	6	15	8	8	13	21	5	25	0
(n=33)	(0)	(0)	(50)	(46.2)	(0)	(69.6)	(28.6)	(41.7)	(40)	(71.4)	(47)	(66.7)	(68.4)	(77.8)	(35.7)	(89.3)	(0)

AP= ampicillin, AC= amoxicillin, CEF= ceftriaxone, RIP= rifampicin, AM= amoxiclav, CO= cotrimoxazole, CE= cephalexin, CEF= cefotaxim, NA= nalidixic acid,CI= ciprofloxacin, CL= chloramphenicol, G= gentamycin, T= tetracycline, S= streptomycin, N= nitrofurantoin, AN= amikacin, IM= imipenem.

DISCUSSION

The offending organisms in this study were the Gram negative *Enterobactriaceae* family, the majority being *E. coli* and a significant minority being salmonella species, similarly to other studies for hospital patients, and long term care facility residents [14-15]. The knowledge of the possible offending pathogens is useful in the initial choice of antibiotics since there is evidence that early treatment before obtaining the results of culture and sensitivity may be associated with less chance of developing renal scarring [16]. It has been advised that physicians should be aware of the rising resistance of urinary pathogens to commonly prescribed antibiotics as well as the profile of antibiotic resistance within their community [17], as shown in this study, therefore, periodic evaluation of sensitivity pattern is essential for rational and appropriate use of antibiotics [6].

This study revealed that the most common organism isolated from urine culture was *E. coli* (67.69%). This finding, however, is similar to that reported in other developed and developing countries [18-21]. *E. coli* were found to be most sensitive to imipenem, amikacin, nitrofurantoin and this is in agreement with a study that found amikacin to be most sensitive antibiotic [19]. While ampicillin, amoxicillin and cotrimoxazole were found to be most ineffective probably due to misuse or over usage of penicillin groups. *Pseudomonas* species was identified as a causative agent for UTIs in (11.24%) of cases in this study and it was found to be most sensitive to imipenem, amikacin. The prevalence of *Klebsiella* species was 3.55%, which is similar to finding of other studies and it was most sensitive to amikacin, nalidixic acid [21]. The only Gram-positive organism isolated in this study was *Staphylococcus aureus*, which constituted (4.23%) of the isolates and it was less sensitive to cloxacillin (10%) [19].

Most of the pathogens were found to be least sensitive to ampicillin and amoxicillin, which seems to be more probably due to over usage or misuse of amino penicillins and cephalosporins.

The most important finding in this study is that most microorganisms were resistant to ciprofloxacin, which raises a considerable alarm of misuse of antibiotics, which is against findings of other studies [22-24].

This study shows that complicated UTI is more common in female; this finding is in agreement with many other studies [15, 25].

In conclusion this study revealed that resistant strains of bacteria against wide spectrum of antibiotics, is a dangerous alarm. The commonest microorganism causing UTIs was *E. coli* followed by *Pseudomonas*, *Proteus* and others, most of these microorganisms were multi-drug resistant. Generally speaking nearly all the microorganisms were sensitive to amikacin and imipenem, however, nearly all of them were resistant to ampicillin and amoxicillin. Present findings are suggestive of the need of periodic monitoring of antibiotic sensitivity pattern of the bacterial isolates to provide effective treatment and thereby to make it more cost effective particularly in the developing countries, as well as the antibacterial therapy is recommended before results of the urine culture are available in order to shorten the duration of the disease and prevent renal complications.

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