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Original Article

Changing trends in Uropathogens and their Antimicrobial sensitivity pattern

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Abstract

In order to monitor changes in the etiologic bacterial agents and as well as antimicrobial resistance of urinary pathogens between five years period and over several years, urinary culture and sensitivity result of patients attending the outpatient departments of Bangabandhu Sheikh Mujib Medical University (BSMMU) in 2003 and in 2008 were analyzed retrospectively. In 2003 and 2008, 668 and 715 cultures respectively were reviewed. The frequency of *Escherichia coil* dropped significantly in the outpatient clinics from 60.02% to 51.75%. The frequency of *Klebsiella spp* increased considerably. The frequency of *Enterobacter* spp. Enterococci spp and Acenatobacter collectively increased from 25.15 to 31.04 ($p<0.0001$). A significant rise in the resistance of *Escherichia coli* to gentamicin and ciprofloxacin ($p<0.0001$) was documented. Urinary pathogens also demonstrated increased resistance to Nalidixic acid and Cefotaxime. In contrast Amoxycillin, Cephradine ($p<0.0001$), Cotrimoxazole ($p<0.0001$), Mecilinam ($p<0.0001$), Ceftriaxone ($p<0.0001$). Nitrofurantoin, Ceftazidime, Cefuroxime, Amikacin and Netilmicin showed consistent sensitivity. Ciprofloxacin showed increase in resistance against Enterococci and Klebsiella. The changing etiologic agents of urinary tract infections and the increasing resistance of organisms clearly dictate regular monitoring and modification of empirical therapy are required.

Key words: Urinary tract infection, Antimicrobial resistance pattern, Changing pattern

Introduction:

In community and hospital settings the etiology of UTIs and the antimicrobial susceptibility of uropathogens have been changing over the years.[4–5] Factors such as the changing patient population, extensive use and misuse of Antimicrobial agents could all contribute to changes in the bacterial profile of UTI.[6]

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Knowledge of the antimicrobial resistance patterns of common uropathogens according to local epidemiology is essential for providing clinically appropriate, cost effective therapy for UTI. [7-8]

Objective of the study was to assess the change in the bacterial profile and pattern of antibiotic resistance of Bacteria associated with urinary tract infections between 2003 and 2008.

Methods

A retrospective study was conducted in the department of Microbiology and Immunology, BSMMU. One thousand three hundred eighty three culture positive results were taken

for study. Of them 668 were in year 2003 and 715 patients in 2008. The distribution of bacterial isolates and their in vitro susceptibility to antibiotics was evaluated.

Results

Sex distribution of present study clearly dictates Female dominance. Study also shows slightly increased male patient in 2008 in comparison to year 2003. (Table-I)

Table-I: Distribution of urine specimens from outpatient clinics and the hospital according to sex

Sex	2003	2008	P value
Male	30 (4.6%)	50 (7.2%)	NS
Female	619 (95.4%)	640 (92.8%)	NS
Total	649 (100%)	690 (100%)	

NS: not significant

Escherichia coli was the most frequently isolated pathogen in both occasions, *Enterobacter spp.* was the second. Frequency *E. coli* declined over time (60.02% in 2003 and 51.75% in 2008), with higher percentage of *Enterobacter spp*., *Enterococci spp*., *Klebsiella spp.* and *Acenatobacter spp*. Isolation rate of *Proteus*, *Pseudomonas* and *Streptococci* remain almost unchanged. (Table-2)

Table-2. Frequency of pathogens causing UTI in patient attending OPD of BSMMU in 2003 and 2008.

Rank order	Organism	Number of Isolate n (%) 2003	2008
1	*E. coli*	401 (60.02%)	370 (51.75%)
2	*Enterococci*	76 (11.38%)	95 (13.29%)
3	*Enterobacter*	76 (11.38%)	98 (13.70%)
4	*Klebsiella*	65 (9.73%)	101 (14.10%)
5	*Acinetobacter*	16 (2.39%)	29 (4.05%)
6	*Pseudomonas*	27 (4.04%)	10 (1.40%)
7	*Proteus*	04 (0.59%)	07 (0.98%)
8	*Streptococci*	02 (0.29%)	05 (0.70%)
9	CNS*	01 (0.15%)	00 (00.00%)
	Total growth	**668 (100%)**	**715 (100%)**

*CNS : Coagulase Negative Staphylococcous, Figure in parenthesis indicate percentages

There was also a considerable change in resistance patterns to antibiotics. An upward trend in the resistance of *E. coli* to Ciproloxacin (16.21% vs 20.94%), to Gentamicin (62.0% vs 45.21%), to Cefotaxime(71.0% vs 53.0%), was observed in 2003 and 2008 respectively. Amikacin, Netilmycin and Imipenem showed consistent sensitivity in both the years. Amoxycillin, Cephradine, Cotrimoxazole, Mecillinam showed an increased sensitivity against *E. coli* in 2008 than in 2003.

Ciprofloxacin (41.25% vs 26.20%), Micellinam (21.05% vs 11.55%), Genatamicin (15.79% vs 9.45%) showed increased resistance against *Enterococci* in 2008 than in 2003. *Enterobacter* isolates were highly resistant to Amoxycillin, Cephradine, Ciprofloxacin and Gentamicin. It also showed increased resistance against Amikacin and Mecillinam (Table-3). *Klebsiella* showed antimicrobial sensitivity almost similar to Enterobacter except having good sensitivity to Amikacin and Netilmicin.

Table 3: Distribution of the bacterial susceptibility to antibiotics

	2003	2008	2003	2008	2003	2008	2003	2008
Drug	***E. coli***		***Enterococci***		***Enterobacter***		***Klebsiella***	
Sensitivity								
	n=401	**n=370**	**n=76**	**n=95**	**n=76**	**n=98**	**n=65**	**n=101**
Amoxycillin	23 (5.74%)	36 (9.89%)	40 (52.63%)	51 (53.68%)	01 (1.31%)	3 (3.05%)	00 (00%)	03 (2.97%)
Cephradine	16 (3.99%)	39 (10.45%)	09 (11.84%)	11 (11.55%)	04 (5.26%)	6 (6.23%)	06 (9.23%)	07 (6.93%)
Cotrimoxazole	79 (19.7%)	101 (27.30%)	12 (15.79%)	18 (18.90%)	11 (14.47%)	10 (10.23%)	10 (15.38%)	04 (3.96%)
Ciprofloxacin	84 (20.94%)	60 (16.21%)	31 (41.25%)	25 (26.20%)	13 (17.10%)	11 (11.57)	35 (53.85%)	18 (18.73%)
Nitrofurantoin	292 (72.82%)	289 (78.02%)	58 (76.31%	63)(66.15%)	21 (27.63%)	38 (38.77%)	16 (24.61%)	29 (28.71%)
Nalidixic Acid	45 (11.22%)	31 (8.34%)	06 (7.89%)	11 (11.55%)	12 (15.79%)	19 (19.38%)	14 (21.53%)	13 (12.87%)
Mecillinam	173 (43.14%)	247 (67.08%)	16 (21.05%)	11 (11.55%)	15 (19.73%)	37 (37.35%)	15 (23.07%)	36 (35.45%)
Ceftriaxone	200 (49.88%)	289 (78.21%)	44 (58.40%)	63 (66.15%)	18 (23.68%)	36 (36.73%)	54 (83.07%)	53 (52.48%)
Gentamicin	249 (62.0%)	167 (45.21%)	12 (15.79%)	09 (9.45%)	14 (18.42%)	12 (12.24%)	27 (41.53%)	30 (29.70%)
Cefotaxime	285 (71.0%)	196 (53.0%)	08 (11.11%)	15 (15.75%)	07 (17.5%)	NT	40 (61.54%)	38 (37.62%)
Ceftazidime	301 (75.01%)	260 (70.20%)	13 (16.67%)	29 (30.45%)	07 (17.5%)	22 (22.44%)	38 (58.46%)	29 (28.71%)
Cefuroxime	261 (67.0%)	229 (61.82%)	04 (22.22%)	NT	06 (15%)	17 (17.34%)	29 (44.61%)	38 (37.62)
Amikacin	341 (85.12%)	304 (82.21%)	16 (44.44%)	31 (32.55%)	30 (75%)	74 (75.51%)	58 (89.23%)	87 (86.14%)
Imepenem	401 (100%)	370 (100%)	76 (100%)	95 (100%)	40 (100%)	97 (98.9%)	65 (100%)	98 (97.02%)
Netilimicin	333 (83.08%)	301 (81.25%)	25 (33.33%)	43 (45.20%)	14 (35%)	55 (56.12%)	65 (100%)	70 (69.30%)
Piperaciline	NT	NT	04 (22.22%)	NT	NT	NT	NT	NT
Linezolid	NT	NT	49 (64.44%)	NT		NT		NT

NT: Not tested Figure in parenthesis indicate percentages

Discussion

UTIs are the most common nosocomial infections, with similar pattern of infection reported in many other countries. They are often associated with significant mortality and

morbidity. Understanding of etiology and antimicrobials susceptibility of major bacteria that cause urinary tract infections will provide essential information regarding the selection of antibiotic therapy for infected patients in the OPD of BSMMU. The sex distribution of patients in the present study is consistent with that of other reported studies, showing a predominance of females with UTI [20,21]. However, the female to male ratio shows a progressive reduction from 2003 to 2008. It is possible that the higher proportion of male patients attending outpatient department of BSMMU.

Although the etiology of UTI has been changing over the past few years [22], *Escherichia coli* remains the most common urinary pathogen. [9,10,11] However, our study showed that its frequency in outpatient specimens has decreased significantly in the last five years, whereas *Enterobacter* spp. and other gram-negative bacteria increased in frequency in this group which is consistent with other studies [12,13,14,23,24].

A high percentage of ciprofloxacin-resistant strains was found as compared with recent publications on nosocomial isolates recovered from various clinical specimens.[15,16] gentamicin and cefotaxime exhibited poorer activity toward *Enterobacter and Klebsiella.* These data are different from those reported by Blondeau *et al.*[17]. In recent years gentamicin and cefuroxime have been used extensively in our hospitals may be a clue for poor activity of the two drugs.

Data presented in this study indicate that antibiotics commonly used in UTIs are loosing effectiveness but species distribution and their susceptibility to antibiotics are changing in general all around the world. It requires regular monitoring in order to make reliable information available for optimal empirical therapy for patients with UTIs.

As discussed previously a high percentage of ciprofloxacin resistance *E. coli* was observed in this surveillance study. Such resistance is reported by many other studies.[18,19] The resistance rate to ciprofloxacin vary from one country to another and depends on local antibiotic prescription practice. Increased resistance in the ciprofloxacin against *E. coli* may reflect the overuse of quinolones for treatment of UTI.

The widespread uses of antibiotics and changes in the spectrum of urinary pathogens have led to a rise in the resistance of urinary pathogens. The association between antimicrobial drug consumption and selection of resistant bacterial strains is widely acknowledged. The trends observed in the last five years in the two populations in this study show important epidemiological changes, reflected also in the rise in antibiotic resistance of these strains. Cefuroxime, gentamicin and ciprofloxacin are loosing effectiveness to treat UTI in the community.

The slow but persistent and significant decrease in sensitivity of gram-negative bacteria to ciprofloxacin and gentamicin is alarming because these antibiotics have been one of the best options for treatment of UTI.

In conclusion the result presented in this study confirm that there is a trend in change of bacterial agents causing UTI and increasing bacterial resistance against commonly used antibiotics.

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