INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 7, No. 5, p. 146-152, 2015

RESEARCH PAPER OPEN ACCESS

Prevalence of urinary tract infection in both outpatient department and in patient department at a medical college setting of Bangladesh

Arunima Moue[1], Syed A.Q.M. Aktaruzzaman[2], Nasrin Ferdous[3], Md. Rabiul Karim[3] M.M.R. Khalil[4], Ashish Kumar Das[4*]

[1]*Anwer Khan Modern Medical College, Dhanmondi, Dhaka-1205, Bangladesh*

[2]*Bangladesh University of Professionals, Mirpur, Dhaka-1221, Bangladesh*

[3]*Department of Biochemistry and Molecular Biology, Rajshahi University, Bangladesh*

[4]*International Centre for Diarrheal Diseases Research, Bangladesh, Mohakahli, Dhaka-1212, Bangladesh*

Key words: Urinary Tract Infection, Uropathogens, OPD, IPD, Antibiotic sensitivity.

http://dx.doi.org/10.12692/ijb/7.5.146-152 Article published on November 30, 2015

Abstract

Urinary tract infection remains one of the most common infections, both in the community and in the hospital. The causative pathogen profile varies from region to region, but *Escherichia coli* (*E. coli*) remain the most common causative pathogen. Organism responsible for the hospital acquired infection may have tendency to develop multiple drug resistance. This study was carried out to identify the causative organism for UTI among outpatient department (OPD) and inpatient department (IPD) patients of Anwer Khan Modern Medical College and Hospital, Dhaka, Bangladesh and also to see the antibiotic sensitivity pattern of the isolate according to age and sex. A total of 376 urine specimens received over the six months study period, 79.5 % (299) of the urine samples were culture positive. The female was more prone to UTI which was 79% (239) rather than male follows 21% (60). IPD patients showed 55.5% (166) positive culture compared to as OPD patients as 44.5 % (133). The age variation according to sex was found for causing UTI. Therefore, 21-30 years aged female group showed 48.5% and 41-50 years aged male group had 46.7% UTI. The most common bacterial isolate was *E. coli* 46.8% (140) followed by *Enterococcus faecalis* 25.9% (77) *Pseudomonas aeruginosa* 11.4% (34), *Staphylococcus saprophyticus* 8% (24). *E. coli* was highly sensitive to Piperacillin (89.24%), Amikacin (85.24%) followed by Imipenem (80.27%). It was also observed that the samples responded effectively to Ampicillin, Amikacin, Gentamycin, Ciprofloxacin, Vancomycin and Linezolid. High degree of resistance was shown for Cefriaxone, Cefepime, Cefrioxne, Norfloxacin, and Cefoxitin on the basis of microbial species. The aim of this study was to raise awareness of UTIs and to expand services for prevention and treatment for UTI. To do this effectively, however, it may be necessary to improve the quality of health care provided at the community-level.

* **Corresponding Author:** Ashish Kumar Das ✉ ashish.jajabor@gmail.com

Introduction

Urinary tract infection (UTI) is most common infectious presentation in hospital acquired and community acquired infections since long time (Peleget *et al.*, 2010). There are an estimated 150 million urinary tract infections per annum worldwide and cost the global economy in excess of 6 Billion US dollars (Gonzalez *et al.*, 1999). A limited and predictable spectrum of organisms is responsible urinary tract infections. Most of the UTI are caused by Gram negative bacteria like *Escherichia coli*, *Proteus spp., Klebsiella spp.*, *Pseudomonas aeruginosa, Acinetobacter, Serratia* and *Morganella margani.* UTI also caused by Gram positive bacteria like *Enterococcus, Staphylococcus* especially coagulase negative *staphylococci* and *Streptococcus agalactiae* (Mohamed *et al.*, 2012). UTI is much more common in women than in men due to anatomical and physiological reason; by virtue of its position urinogenital tract is more vulnerable to bacterial infections caused by both internal and external flora (Shanthi *et al.,* 2012). Among both outpatients and inpatients, *Escherichia coli* are the primary urinary tract pathogen, accounting for 75% to 90% of both sides - hospital acquired. UTIs are often treated with different broad spectrum antibiotics when one with a narrow spectrum of activity may be appropriate because of concerns about infection with resistant organisms. Fluor-quinolones are preferred as initial agents for empiric therapy of UTI in area where resistance is likely to be of concern (Schaeffer, 2002). This is because they have high bacteriological and clinical cure rates, as well as low rates of resistance, among most common uropathogen (Goldstein, 2000). The extensive uses of antimicrobial agents have invariably resulted in the development of antibiotic resistance, which, in recent years, has become a major problem worldwide (Kumar *et al.*, 2006). The Infectious Diseases Society of America also recommends that physicians obtain information on local resistance spectrum of organisms because urinary tract infections and that ongoing surveillance are conducted to monitor changes in susceptibility of uropathogens (Warren *et al.*, 1999).

Increasing antimicrobial resistance complicates uncomplicated UTI treatment by increasing patient morbidity, costs of reassessment and retreatment and use of broader-spectrum antibiotics (Aypak *et al.*, 2009). Patterns of antibiotic resistance in a wide variety of pathogenic organisms vary even over short periods of time. Periodic evaluation of antibacterial activity is needed to update this information (Gupta *et al.*, 2002). For effective treatment and control of UTI in a particular area/hospital, a good knowledge of the antibiotic sensitivity pattern of the causative agents in that area/hospital is of ultimate importance (Uwaezuoke *et al.*, 2006). Furthermore, baseline estimates of the magnitude of the problem and the extent of antimicrobial resistance among the nosocomial pathogens are the minimum essential prerequisites for any hospital infection control program (Kamat *et al.*, 2009).

This study was carried out to determine the prevalent uropathogens according to age and sex at a medical college hospital among outpatient department (OPD) and inpatient department (IPD) and their antibiotic sensitivity pattern to commonly used antibiotics in order to provide a database for reference. We also compared the antibiotic sensitivity pattern of the bacterial isolates between outpatients and inpatients which had positivity of culture. In the present scenario, where the antibiotic resistance pattern is changing, our study aims at outlining the recommendations for empirical treatment of UTI. Moreover, the data would also help authorities to formulate antibiotic prescription policies.

Methods and materials

The present study is a retrospective study, which was carried out in the clinical Microbiology laboratory of Anwer Khan Modern Medical College and Hospital which is located at Dhaka City, Bangladesh. The duration of the study was six months period from January 2014 to June 2014. A total of 376 samples with or without signs to symptoms of UTI who attended the outpatient department (OPD) and in-patient department (IPD) of our hospital were recruited for this study. They consist of 188 OPD and

188 IPD patients. A significant positive culture was taken that was 299 out of 376 samples which belong both OPD and IPD. Unsterile specimen, time delayed specimen for culture (after 30 min of collection), which were not kept refrigerated at 4°C and inadequate sample for urine culture were excluded from the study.

Freshly voided, clean-catch midstream urine was collected from each patient into sterile screw-capped universal container. The specimen was labeled and transported to the microbiology laboratory for processing within 2 hours. Semi quantitative urine culture was done using a calibrated loop. A loopful (0.001 mL) of well mixed un-centrifuged urine was inoculated onto the surface of MacConkey and blood agar media. All plates were then inoculated at 37°C aerobically for 24 hours. The plates were then examined macroscopically for bacterial growth. A significant growth is considered if the number of colony is >105 colony forming unit (cfu)/ml. Colonial appearance and morphological characters of isolated bacteria was noted and isolated colonies were subjected to preliminary tests like Gram staining, motility by hanging drop, catalase test and oxidase test. These preliminary tests were followed by biochemical reactions for identification of the isolated organism. And the isolated organisms subjected for antibiotic susceptibility testing.

Antimicrobial Susceptibility Testing

Antimicrobial susceptibility testing was done by Kirby-Bauer disk diffusion method by using Mueller Hinton agar plates. Commercially available HiMedia discs were used. The bacterial suspension was made by inoculating 4-5 well isolated identical colonies in peptone water. After 2 hours of incubation the turbidity was standardized by using 0.5 McFarland standards. By using a sterile swab a lawn culture was made on the Mueller-Hinton agar plates. The antibiotic discs were placed and inoculated plates were incubated at 37°C. The results were read after overnight incubation and compared with standard chart. The following drugs were used for Antibiotic sensitivity test, [According to CLSI guidelines]. Amikacin (30µg), Gentamycin (10µg), Ciprofloxacin (5µg), Ceftriaxone (30µg), Norfloxacin (10µg), Ampicillin (10µg), Imipenem (10µg), Cefoxitin (30g). Cefepime (30µg), ceftazidime (30µg), Piperacillin (100µg). Erythromycin (15µg), Clindamycin (2µg), Oxacillin (1µg), Linezolid (15µg) and Vancomycin(30µg).

Statistical Analysis

The statistical analysis of data was performed using Graph Pad Prism-5 for Windows (Graph Pad Software, San Diego, CA, USA). The data was analyzed using One Way Analysis of variance (ANOVA) followed by Bonferroni testing. After analyzing the values were used an online software (www.socialscistatistics.com).

Results

A total of 376 urine samples were received, of which 188 (50%) were from OPD patients and rest of the 188(50%)) from IPD. Growth was present in 79.5% (299 out of 376) samples whereas 20.5% samples had no longer growth. The patients ranged from ages 1 year to > 50 years, with a mean age of 46.24 years. The prevalence in female was 79.0 % and the prevalence in male was 20.0%, which is shown in Table: 02. Male and female culture positivity was 22.6% (30 of 133) and 77.5% (103 of 133) in OPD and 18.0 % (30 of 166) and 81.9% (136 of 166) respectively in IPD samples. In OPD male patient positive culture predominantly found high from 16.7 % to 46.7 % in the age range in between 31 to > 50 years which has the relevancy with IPD male patient which range was 13.3 % to 46.7 % in the similar age group. On the other hand, for both in OPD and IPD female patient positive culture found high in age range from 21 to 40 years. Therefore it seems that among females UTI was commonly seen in the age group of 21-40 years and in males it was common between 41-60 years. The age wise distribution of samples and their positivity is shown in table 2. As a whole, the female patients in OPD expressed the highest culture positivity which was 48. 5 % but in the meantime both OPD and IPD male patient showed similar positive culture characteristics like 46.7 %. Fifteen patients presented

a mixed infection with two organisms (10 in OPD and 5 in IPD). Thus, a total of 299 urine isolates were obtained, of which 166 (55.5%) were IPD sample isolates and 133(70.7%) were OPD sample isolates. *E. coli* was the most commonly isolated urinary pathogen (48.1 %), followed by *Enterococcusfaecalis* (26.3%), *Pseudomonas aeuroginosa* (11.3%), *Staphylococcus saprophyticus* (7.5%) and *Klebsiella spp*. (3.8 %). The isolation rates of other organisms are shown in table 1.

Table 1. OPD and IPD organism causing UTI .

Organism	OPD isolates causing UTI			IPD isolates causing UTI			
	Number of growth	Percenge (%)		Number of growth	Percentage (%)	Mean±SD	P-Value
Escherichia coli	64	48.1	19±3.5	76	45.8	23.7±5.9	0.047
Enterococcus faecalis	35	26.3	11.5±4.6	42	25.3	15.0±3.4	0.878
Pseudomonas aeruginosa	15	11.3	6.8±2.0	19	11.4	9.6±3.5	0.575
Staphylococcus saprophyticus	10	7.5	4.7±1.8	14	8.4	7.2±2.7	0.653
Klebsiella Pneumoniae	5	3.8	3.1±1.4	8	4.8	5.0±1.9	0.882
Proteous mirabilis	3	2.3	2.0±1.0	5	3.0	3.5±1.0	0.890
Acinetobacter spp	1	0.8	NA	2	1.2	2.0±0.9	0.956
Total	133	100		166	100		

Legend: P> 0.005 (not significant) and P<0.005 (highly significant), SD= Standard Deviation, NA= Not Applied, UTI= Urinary Tract Infection, OPD= Outpatient Department, IPD=In Patient Department.

Table 2. Age and sex distribution of patients with culture.

Age in year	OPD					IPD					
	Male in number	Percentage (%)	Female in number	Percentage (%)	Meann±SD	Male in number	Percentage (%)	Female in number	Percentage (%)	Mean±SD	P Value
0-01	1	3.3	4	3.9	5.0±4.8	1	3.3	5	3.7	29.3±20.0	0.989
11-20	1	3.3	7	6.8	5.8±4.9	2	6.7	15	11.0	34.0±18.4	0.045
21-30	3	10	50	48.5	7.0±4.8	4	13.3	58	42.7	38.2±18.2	0.033
31-40	5	16.7	15	14.6	8.3±4.9	4	13.3	22	16.1	30.3±11.1	0.057
41-50	14	46.7	14	13.6	10.0±5.6	14	46.7	19	13.0	32.5±14.8	0.987
>50	6	20	13	12.6	6.0±3.8	5	16.7	17	12. 5	22.0±12.0	0.667
Total	30	100	103	100		30	100	136	100		

Legend: SD= Standard Deviation, OPD= Outpatient Department, IPD=In Patient Department.

Discussion

Effective management of patients suffering from bacterial UTIs commonly relays on the identification of type of organisms that caused the disease and selection of an effective antibiotic agent to the organism. Diagnosis of UTIs is a good example of the need for close cooperation between the clinician and the microbiologist. In our study prevalence rate of infection of urinary pathogen was 79.5 %, similar study by (Kattel, 2008) in which 26% of urine specimens showed significant bacterial growth. The prevalence of UTI is more in females when comparing males. This correlates with other study (Momoh, 2005) in which 60.2% were females and 39.8% were males. Women are more prone to UTIs than men because of short urethra and are closer to anus. Among patients with UTI, females were most commonly in the age group between 21-40 years and males were between 41-60 years. This was in consistent with a study of (Nerukar, 2012) in which

52.16% were in the age group 21-40 years, who concluded that most uncomplicated urinary tract infections occurs in women who are sexually active, with far fewer cases occurring in older women, those who are pregnant, and in men. In older men, the incidence of UTI may increase due to prostatic obstruction or subsequent instrumentation. This was in consistent with the study of (Banerjee, 2009). *E.coli* was the predominant bacteria found in our study similar result was found by (Durgesh, 2012) showed that prevalence of *E.coli* was 31.5%. The second isolated pathogen was *Enterococcus faecalis* and count were 26.3% and 25.3 % in OPD and IPD respectively, this correlates with other study of (Shanthi, 2012) in which 28.1% of *Enterococcus faecalis* was isolated as urinary pathogen (Momoh, 2012). In our study *E.coli* was most resistant to Ampicillin, Penicillin and Gentamycin. It was most sensitive to and Amikacin (85.24%), similar finding were seen in a study by (Razak *et al*., 2012), who concluded that the organisms showed resistance to older urinary antimicrobial agents such as Ampicillin which indicates that increased consumption of particular antibiotics can be the pathway to its resistance. *Enterobacter spp*. was mostly sensitive to Linezolid (94.49%) and Vancomycin (87.70%). It was resistant to Ceftriaxone and Cefepime as 100%.. The antibiotic sensitivity pattern is shown in the table 3.

Table 3. In vitro antibiotic sensitivity pattern of most frequent isolated.

Drugs	*E.coli* (%)	*Enterobacter spp*. (%)	*S. prophyticus*(%)	*Klebsiella pneumoniae* (%)	*Pseudomonas spp*. (%)	*Proteus spp*. (%)
Ampicillin	13.90	16.50	20.60	6.42	67.21	75.01
Amikacin	85.24	65	67.57	37.01	53.10	63
Gentamycin	30.03	31	63.41	43.14	37.26	40.22
Ciprofloxacin	21.21	19.30	15.63	75	34.20	37.30
Ceftriaxone	20.31	-	-	27.75	-	25.01
Clindamycin	ND	62.41	63.41	ND	ND	ND
Norfloxacin	16.35	10.52	34.16	23.90	-	50.21
Cefepime	17.25	-	-	17.85	ND	-
Imipenem	80.27	ND	ND	96.42	30.02	45.33
Cefoxitin	ND	ND	17.07	-	-	-
Linezolid	-	94.49	100	-	-	12.23
Vancomycin	-	87.70	87.80	-	52.01	-
Penicillin	-	18.18	7.01	-	24.69	24.23
Piperacillin	89.24	ND	ND	ND	-	-

Legend: P> 0.005 (not significant) and P<0.005 (highly significant), SD= Standard Deviation, NA= Not Applied, ND: Not Detectable; (-): Antibiotic resistant pattern.

Staphylococcus saphrophyticus was sensitive to Linezolid (100%), Vancomycin (87.80%) and highly resistant to Ceftriaxone and Cefepime like *Enterbacter spp*. *Klebsiella pneumonia* was most sensitive to Imipenem (96.42%) and highly resistant to Cefoxitin, Linezolid, Vancomycin and Penicillin. *Psedomonas spp*. showed their best sensitivity to Ampicillin (67.21%) Amikacin (53.10%) and resistant to Ceftriaxone, Norfloxacin, Cefoxitin, Linezolid and Piperacillin whereasproteous spp. was resistant to Cefepime and Vancomycin. Ampicillin demonstrated the highest effectiveness about 75.01% to the *Proteous spp*. among all others isolates.

Conclusion

The high incidence rate of 79.5% reported in this study should be of great concern, as not only do UTIs pose a threat to health, but they also impose an

economic and social burden due to the stigma associated with these infections. *E.coli* was the most frequent causative agent in UTI. Higher prevalence of UTI was seen in females (79%) rather than males (21%). Gram negative organisms were most commonly isolated organisms in UTI among which *E.coli* was the most frequent agent. Urinary pathogens showed resistant to commonly used antibiotics like Cefriaxone, Cefepime, Cefrioxneand Norfloxacin. On the basis of this study we can conclude that the resistance of commonly used antibiotics is very crucial. The antibiotic treatment should be limited to symptomatic UTIs and be initiated after sensitivity testing only. As drug resistance among pathogens in an evolving process, routine surveillance and monitoring studies should be conducted to help physician to start most effective empirical treatment should be carried out in order to prevent the cases becoming symptomatic later with resultant renal damage.

Acknowledgement

Authors are very much thankful to Prof. Dr. Md. Tahminur Rahman, (MBBS, MPhil, PhD), Vice Principal, Anwer Khan Modern Medical College, Dhaka, for providing necessary facilities and support.

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