Bangladesh J Med Microbiol 2009; 03 (01): 18-22

Bangladesh Society of Medical Microbiologists

Original Article

Antimicrobial sensitivity pattern of uropathogens in children.

Sohely Sharmin[1], Farhana Alamgir[1], Fahmida[1], Ahmed Abu Saleh[2]

[1]Department of Microbiology, Bangladesh Medical College, [2]Department of Microbiology & Immunology, Bangabandhu Sheikh Mujib Medical University, Dhaka.

Abstract

Total 60 mid stream urine samples were collected from suspected urinary tract infection patients of 1 to 12 years age from indoor and outdoor of BSMMU. A total 28 (46.66%) cultures yielded significant growth of single organism & 32 (53.33%) yielded no growth. *E. coli* was isolated in 53.57% cases, followed by 17.86% *Klebsiella spp,* 10.71% *Enterococcus spp*, 7.14% *Enterobacter spp,* 7.14% *Pseudomonas aeruginosa* and 3.5% *Proteus mirabilis*. *E. coli* was less sensitive to first line drugs including Amoxycillin, Cotrimoxazole, Cephradin, Nalidexic acid ranging (20-27%), but moderately sensitive to Ciprofloxacin (60%), Gentamicin (60%), Ceftriaxone (60%) and highly sensitive to Ceftazidime (80%) and Imipenem (100%). *Klebsiella & Enterobacter spp* were 100% sensitive to Imipenem and 70% to Amikacin. *Enterococci spp* shows good sensitivity to Nitrofurantoin (67%), and Imipenem (100%). *Pseudomonas spp* was highly sensitive to Imipenem and Netilmicin (100%).

Key words: Uropathogens, Antimicrobial Sensitivity pattern.

Introduction:

Urine is the commonest specimen send to the laboratory from OPD of a hospital as well as from admitted cases. A large laboratory may examine 200-300 urine sample each day.[1] This heavy work load reflects the frequency of UTI both in general practice & in hospital setting. More than 95% of urinary tract infections are caused by a single bacterial species. Most infection at all ages is the result of enteric bacteria, especially *Escherichia coli*, which colonise the perineum and then ascend the urethra to multiply and infect bladder, kidney, and adjacent structure. The most common site of infection is the bladder.[2]

✉ ***Correspondence:***
Dr. Sohely Sharmin
Assistant professor
Department of Microbiology,
Bangladesh Medical College, Dhaka.
E mail: dr.hoquemm@yahoo.com

The increase in resistance of microorganisms to antimicrobial agents, especially in hospitalised patients, demands rapid identification of the pathogen.[3,4,5] Early information enables the selection of the appropriate antibiotic prior to the results of susceptibility tests and may thereby prevent outbreaks.[6]

The aim of the microbiology laboratory in the management of urinary tract infection is to reduce morbidity and mortality through accurate and timely diagnosis with appropriate antimicrobial sensitivity testing. This study was carried out to see the sensitivity pattern of uropathogen in the children.

Methodology

This cross-sectional study was carried out in the Department of Microbiology and Immunology, Bangabandhu Sheikh Mujib Medical University from January 2005 to June 2005. The clean-catch mid-stream urine sample were collected [8] from suspected UTI patients aging 1 to 12 years from outdoor and indoor of BSMMU and examined under microscope.[9]

Samples showing >5 pus cell/HPF were included in the study [7] and cultured into MacConkey agar, CLED agar and Sheep Blood agar media.[10,11] Mueller-Hinton agar was used for sensitivity testing and Nutrient agar for preservation of organism. All isolates were tested for antimicrobial susceptibility against different antibiotics using the disc diffusion method.[12,13] The zone size was translated into the 3 susceptibility categories, namely Susceptible (S) intermediate (I) and Resistant (R) was done according to NCCLS as describe in table.[14] A representative disc from each batch was tested with reference control bacterial standered Viz. *Escherichia coli* ATCC 25922, to check the quality of the disc.

Results:

Total 60 urine samples were tested of which 26 (43.3%) were male and 34 (56.7%) were female (Table I).

Table-I: Sex distribution of the patients (N=60)

Sex	Number of patients	Percentage
Male	26	43.3
Female	34	56.7

Of the 60 urine samples evaluated, a total 28 (46.66%) cultures yielded significant growth of single organism & 32 (53.33%) yielded no growth. Out of these 28 strains *E. coli* was isolated in highest number of cases 15 (53.57%) followed by *Klebsiella spp* 5 (17.86*%), Enterococcus spp* 3 (10.71%), *Enterobacter spp* 2 (7.14*%), Pseudomonas aeruginosa* 2(7.14%), *Proteus mirabilis* 1(3.5%) (Table-II).

Table II: Bacteria isolated from UTI patients (N=28).

Name of bacteria isolated	Number of cases	Percentage
E. coli	15	53.57
Klebsiella spp.	5	17.86
Enterococcus spp.	3	10.71
Enterobacter spp.	2	7.14
Pseudomonas spp.	2	7.14
Proteus spp.	1	3.5
Total	**28**	**100**

Table-III: Antibiotic sensitivity pattern of isolated uropathogens.

Antimicrobial agents	Sensitivity pattern	E. coli n (%)	Klebsiella spp n (%)	Enterococci spp n (%)	Enterobacter spp n (%)	Pseudomonas spp n (%)
Amoxycillin	S	3 (20)	0 (0)	1 (33.3)	0 (0)	-
	I	0 (0)	0 (0)	1 (33.3)	0 (0)	
	R	12 (80)	5 (100)	1 (33.3)	2 (100)	
Cephradine	S	4 (26.66)	0 (0)	0 (0)	0 (0)	-
	I	1 (6.66)	0 (0)	0 (0)	0 (0)	
	R	10 (66.67)	5 (100)	3 (100)	2 (100)	-
Cotrimoxazole	S	4 (26.7)	0 (0)	0 (0)	0 (0)	
	I	0 (0)	0 (0)	0 (0)	1 (50)	
	R	11 (73.3)	5 (100)	3 100)	1 (50)	
Ciprofloxacin	S	9 (60)	2 (40)	1 (33.3)	1 (50)	1 (50)
	I	0 (0)	0 (0)	1 (33.3)	0 (0)	0 (0)
	R	6 (40)	3 (60)	1 (33.3)	1 (50)	1 (50)
Nitrofurantoin	S	10 (66.67)	2 (40)	2 (66.67)	1 (50)	-
	I	0 (0)	1 (20)	0 (0)	0 (0)	
	R	(33.33)	2 (40)	1 (33.33)	1 (50)	
Nalidexic acid	S	3 (20)	0 (0)	1 (33.3)	0 (0)	-
	I	0 (0)	0 (0)	0 (0)	0 (0)	
	R	12 (80)	5 (100)	2 (66.7)	2 (100)	-
Mecillinam	S	6 (40)	2 (40)	1 (33.3)	1 (50)	
	I	1 (6.7)	0 (0)	0 (0)	0 (0)	
	R	8 (53.3)	3 (60)	2 (66.7)	1 (50)	
Ceftriaxone	S	9 (60)	2 (40)	2 (66.67)	0 (0)	0 (0)
	I	1 (6.7)	0 (0)	0 (0)	0 (0)	1 (50)
	R	5 (33.3)	3 (60)	1 (33.33)	2 (100)	1 (50)

S- Sensitive; I- Intermediate; R- Resistant.
Figures within parenthesis indicate percentage

Sensitivity results (Table III) *E. coli* was less sensitive to first line drugs including Amoxycillin (20%), Cephradine (27%), Cotrimoxazole (27%), moderately sensitive to Ciprofloxacin (60%), Gentamicin (60%), Ceftriaxone (60%) but highly sensitive to Ceftazidime (80%) and Imipenem (100%). *Klebsiella & Enterobacter spp* were 100% sensitive against Imipenem and 70% to Amikacin. *Enterococci spp* shows good sensitivity against Nitrofurantoin (67%), and Imipenem (100%). *Pseudomonas spp* was highly sensitive to Imipenem and Netilmicin (100%).

Discussion:

Urine samples are among the most numerous of specimen types sent for microbiology studies. To reduce the morbidity and mortality by UTI, Microbiology laboratories must perform accurate identification of clinical isolates of

organisms specially gram negative bacilli.[15,16] In addition, rapid bacterial identification and susceptibility testing in the microbiology laboratory can have a demonstrable clinical impact as well as provide significant cost savings.

Out of 60 urine samples tested, 28 (38.5%) culture yielded single growth, 32 (57.5%) yielded no growth of bacteria. One study in India showed 20% yielded growth, 4% were mixed growth.[11] In that study all urine samples were cultured irrespective of pus cell which may be the reason for lower percentage of growth than that of ours.

E. coli was isolated from highest number of cases 53.6% followed by *Klebsiella spp* 17.9%, *Pseudomonas aeruginosa* 7.1%, isolated in less number of cases which was similar with the findings of Hassin in Bangladesh showing *E.coli* (74%) followed by *Klebsiella spp* 17.7% & *pseudomonas spp* 2.5%.[17] Another study done in BSMMU, Dhaka by Anis showed, *E. coli* (92%) as the commonest organism responsible for UTI followed by *Pseudomonas, Enterococci, Klebsiella* and *Proteus*..[18] Similar percentage of isolation of *E.coli* were also found in other studies (46.6%).[19] Ronald found in his study that *E. coli* remains the predominant uropathogen (80%) in community acquired infections followed by *Staph. Saprophyticus* (10-15%), *Klebsiella*, *Enterobacter, Proteus spp*.[20]

Therapy against UTI should be guided by antimicrobial susceptibilities as increasing numbers of urinary isolates are developing resistance to commonly use antibiotics. Increasing antimicrobial resistance of uropathogens has led to reconsideration of traditional treatment of recommendations in many areas.[21] In our study antibiogram of isolated uropathogens reveals low sensitivity of *E. coli* to commonly used drugs like, Amoxicillin, Cotrimoxazole, Cephradine, and Nalidexic acid. Sensitivity to Ceftriaxone, Gentamicin, Mecillinam, Ciprofloxacin, Netilmicin and Nitrofurantoin were moderate. Imipenem, Ceftazidime, Amikacin had very good sensitivity against *E. coli*. Akteruzzaman found similar sensitivity/resistance pattern of uropathogens in his thesis.[22] Chowdhury found 93.15% of *E. coli* resistance to Ampicillin, 68.4% to Tetracycline and 61.6% to Chloramphenicol, it also pictured 4.10% resistance towards Nalidixic acid, 9.58% towards Nitrofurantoin and 15.06% towards Cephalexine.[23] Sharif showed maximum resistance of *Escherichia coli* towards Cotrimoxazole (78%) followed by Ampicillin(71%), Nalidixic acid (58%) and Gentamicin (34%) while minimum resistance towards Ceftriaxone and ciprofloxacin (15% both) followed by Ceftazidime (28%).[24] But as the years passing Ceftriaxone and Ciprofloxacin becoming more resistance against *E.coli* as shown in our study and also by Akteruzzaman.[22]

In Canada, resistance among community acquired isolates of *E. coli* varies depending on the antimicrobial agents being tested. Ampicillin has the lowest activity, with resistance rates ranging from 23% to 41%. Trimethoprim-sulphamethoxazole resistance rates range from 8.4% to 19.2%, while resistance to fluoroquinolone ciprofloxacin has remained at 0% to 1.8 % .[25] But in our country resistance to ciprofloxacin is being seen more frequently as shown in our result, probably due to over and irrational use and availability of the drug over the country. A multicentric retrospective study in Tunis found 62.6% of *E. coli* in urine was resistance to Amoxicillin and 37.3% to Trimethoprim-sulphamethoxazole.[26] In the US as a whole, resistance to Trimethoprim-sulphamethoxazole was 16.8% for *E. coli*, 7.8% for *K. pneumoniae,* 12.1% for *P. mirabilis* and 3% for *S. saprophyticus.*[27]

Klebsiella pneumoniae in this study showed no sensitivity to Amoxicillin, Cotrimoxazole, Cephradine, and Nalidixic acid. It had sensitivity to some extent against Mecillinam, Netilmicin, Cefotaxime, Ceftazidime, Ciprofloxacin, Nitrofurantoin, Ceftriaxone and Gentamicin. It showed 100% sensitivity to Imipenem and 60% to Amikacin. Study done in 1976 and 1987 in Bangladesh showed *Klebsiella pneumoniae* was more or less 100% resistance to Ampicillin and Tetracycline but 90-100 % sensitive to Cephalexin and Nitrofurantoin.[23] But this sensitivity pattern is changing gradually as shown by Akteruzzaman and Hassin.[17,22] Hassin found it was highly sensitive to Nalidixic acid (92%), Gentamicin (89%) and Cotrimoxazole (66%). Akteruzzaman found in his study 14% sensitivity to Ampicillin, 25% to Cotrimoxazole, 33% to Tetracycline, 50% to Cephalexin and Ceftriaxone, 65% to Nitrofurantoin, 83% to Ceftazidime 83% to Ciprofloxacin and 100% to Gentamicin. But now a days as in our study showed reduced sensitivity to Ciprofloxacin, Ceftazidime and Gentamicin against *Klebsiella pneumoniae*; only Amikacin and Imipenem are highly sensitive.

Sensitivity pattern of *Pseudomonas spp* is alarming in our study. No antimicrobial agent was highly sensitive against it

except Imipenem. Ceftazidime, Ceftriaxone, Ciprofloxacin and Amikacin were moderately sensitive. Akteruzzaman found 14% sensitivity to Ceftriaxone, Ciprofloxacin, Gentamicin and 67% to Ceftazidime and 83% to Imipenem which is similar to our finding.[22] Sharif found *Pseudomonas spp* isolated from urine were sensitive to Ceftriaxone 71%, Ciprofloxacin 57% and Ceftazidime 86%.[24] Chowdhury from Barishal, Bangladesh reports that *Pseudomonas spp* causing UTI is 100% resistance to Ciprofloxacin and 98% to Gentamicin.[28]

Enterococci and *Enterobacter spp* found in this study showed moderate sensitivity to Netilmicin, Ceftazidime, Ceftriaxone, Ciprofloxacin, Amikacin and 100% sensitivity to Imipenem. Nitrofurantoin had 40% and 33% sensitivity respectively.
Sensitivity pattern is changing day by day and it varies from hospital to hospital even in the same city and country to country. Uropathogens are gaining resistance at an increase rate to commonly used antimicrobials as revealed in our and other studies; Physicians should look for recent trend of sensitivity pattern especially of their hospital when choosing a treatment regimen for treating UTI.

References:

1. Graham JC, Galloway A. The laboratory diagnosis of urinary tract infection. J Clin Pathol 2001; 54: 911-9
2. Sussman M. Urinary tract infections. In Collier T, Balows A, Sussman M, eds. Topley and wilson's microbiology and microbial infections, Vol 3, 9th edition 1998, Arnold, London: 601-21
3. Ashkenizi S, Even-Tov S, Samra Z, and Dinari G. Uropathogens of various childhood populations and their antibiotic susceptibility. Pediatr Infect Dis J 1991; 10: 742-6.
4. Marray BE. Problems and mechanisms of antimicrobial resistance. Infect Dis Clin North Am1990; 3: 423-39
5. Alon U, Davidi G, Brant M, and Merzbach D. Five year survey of changing patterns of susceptibility of bacterial uropathogens to Trimethoprim-sulphamethoxazole and other antimicrobial agents. Antimicrob Agents chemother 1987; 31: 126-8.
6. Schaberg DR, Culvar DH and Gaynes RP. Major trend in the microbiology and etioloigy of nosocomial infections. Am J Med 1991; 91(Suppl 3B): S72-5
7. Fuller CE, Threatte GA, Henry JB. Basic Examination of Urine. In Henry JB, Davey FR, Herman CJ et al., edits Clinical Diagnosis and Management by Laboratory Methods. 20th edition 2001, WB Saunders Company, Philadelphia. pp 367-402.
8. Forbes BA, Sahm DF, Weissfeld AS. Laboratory cultivation and isolation of bacteria. In Bailey & Scott's Diagnostic Microbiology, 10th edition 1998. Mosby, St. Louis, Missouri: pp 150-66
9. Brooks GF, Butel JS, Morse SA. Principles of Diagnostic Medical Microbiolgy. In Jawetz, Melnick,& Adelberg edits Medical Microbiology. 22nd edition 2002. McGraw-Hill, New Delhi: pp 596-622.
10. Collee JG, Marr W. Specimen collection, culture containers and media. In Collee JG, Fraser AG, Marmion BP, Simmons A. edits Mackie & McCartney Practical Medical Microbiology, 14th edition 1996, Churchill Livingstone, New York: 85-111
11. Lakshmi V, Satheeshkumar T, Kulkarni G. Utility of Urochrom ii- A Chromogenic Medium for Uropathogens. Ind J Med Microbiol 2004; 22(3): 153-8.
12. Cheesbrough M. Antimicrobial sensitivity testing. In District Laboratory Practice in Tropical Countries (Part 2) 2000, Cambridge University Press, UK: 132-42.
13. Vandepitte J, Engback K, Piot P, Heuck CC. Basic Laboratory Procedures in clinical Bacteriology. WHO Geneva 1992. pp 47-9.
14. NCCLS. Performance standards for antimicrobial susceptibility disc testing. National Committee for Clinical Laboratory Standards 1987, Villanova, PA, USA, Second International Supplement: M100-S2.
15. Pattyn SR, Sion JP, Verhoeven J. Evaluation of the logic system for the rapid identification f the member of the family *Enterobacteriaceae* in the clinical microbiology laboratory. J Clin Micribiol 1990; 28:1449-50.
16. Perry JD, Ford M, Hjersing N, Gould FK. Rapid conventional scheme for biochemical identification of antibiotic resistant *Enterobacteriaceae* isolates from urine. J Clin Pathol 1988; 41: 1010-2.
17. Hassin SKR. Studies on Urinary Tract Infections. Bangladesh Medical Journal 1991; 20 (1): 29-32
18. Anis Ahmed. Pattern of bacterial etiology and sensitivity of UTI in BSMMU. MPH (Masters of Public Health) Thesis; National Institute of Preventive and Social Medicine 1998.
19. D'Souza HA, Mary C, Ellen JB. Practical Bench Comparison of BBL, CHROM agar Orientation and Standard Two-Plate Media

for Urine Culture. J Clin Microbiol 2004; 42: 60-4.

20. Ronald A. The etiology of urinary tract infection: traditional and emerging pathogens. Dis Mon 2003; 49(2): 71-82.

21. Krieger JN. Urinary tract infections: what's new? J Urol 2002; 168(6): 2351-8.

22. Akhtaruzzaman C. Urinary Tract Infection in pregnancy: a bacteriological study. MPhil (Microbiology) Thesis; Dhaka University 1998.

23. Chowdhury MAQ. Studies of aerobic organisms causing UTI and the incidence of drug resistance and R+ factors among the isolates. MPhil (Microbiology) Thesis; Dhaka University 1987.

24. Sharif MNH. Diagnosis and detection of UTI with special reference to *E.coli* O-serogroup. MD (Nephrology) Thesis; Dhaka University 1999.

25. Mazzulli T. Antimicrobial resistance trends in common urinary pathogens. Can J Urol 2001; 8 (Suppl 1): 2-5.

26. Smaoui H, Mahjoubi F, Boutiha I et al. Antibiotic resistance among *E. coli* isolates from urinary tract infections (1999-2000): a multicenter study. Tunis Med 2003; 81(6): 390-4.

27. Karlowsky JA, Jones MF, Thorusberry C, Critchley I, Kelly LJ, Sahm DF. Prevalence of antimicrobial resistance among urinary tract pathogens isolated from female outpatients across the US in 1999. Int J Antimicrob Agents 2001; 18(2): 121-7.

28. Chowdhury MZ, Muhammad F, Rahman MAK, Ahmed AA. Bacterial aetiology and sensitivity pattern of UTI cases in Sher-E-Bangla Medical College, Barishal. Journal of Preventive and Social Medicine 1994; 13: 62-5.