

Comparison of bacteriological profile and susceptibility patterns to empiric antibiotics in hospital and community acquired urinary tract infection.

Dr. Kavya S.¹, Dr. Anuradha K.²

1(Department of Microbiology, Mysore Medical College, India)

2(Department of Microbiology, Mysore Medical College, India)

I. Introduction

Urinary Tract Infection (U.T.I.) is one of the most important causes of morbidity in the general population and is the second most common cause of morbidity among hospital visitors. It has been estimated that symptomatic UTIs result in as many as 7 million visits to outpatient clinics, 1 million visits to emergency departments, and 100,000 hospitalizations annually.[1] UTIs have become the most common hospital-acquired infection, accounting for as many as 35% of nosocomial infections, and they are the second most common cause of bacteraemia in hospitalized patients [2, 3] Uncomplicated UTI occurs in patients without any anatomic or functional abnormality in the urinary tract and may reach, on average, 6.1 days of symptoms, 2.4 days of restricted activity and 0.4 bed days [4] A limited and predictable spectrum of organisms is responsible for U.T.I., which are often the intestinal flora [5]. Though Urinary Tract Infections are common, it is not always possible to do bacterial culture and antibiotic sensitivity for the treatment, especially in small centres. Even where these are done, in almost all cases, empiric antimicrobial therapy is initiated before the results are available. [6] With the advent of novel antibiotics, though a significant reduction in the prevalence of infectious diseases was seen worldwide in the initial years, eventually infections by drug resistant organisms have evolved.

Thus antibiotic resistance may increase in uropathogens due to frequent misuse of antibiotics. Knowledge of etiological agents causing UTIs and their antimicrobial resistance patterns in specific geographical locations may aid clinicians in choosing the appropriate empirical antimicrobial agent. Hence this study was taken up to study the distribution of uropathogens in Outpatient and Inpatient settings and to compare the susceptibility pattern of isolates to empiric antibiotics.

II. Materials And Methods

Study group comprised of 200 adult patients, 100 each from inpatients and out patients with suspected uncomplicated lower urinary tract infection with matching age and sex. Detailed history was recorded regarding symptoms, duration, previous antibiotic administration, treatment for the current illness etc. Patients with pyelonephritis, urinary tract abnormalities, calculi, catheterisation and pregnant women were excluded. Inpatients who were hospitalized for less than 48hrs were excluded. Clean catch mid-stream urine sample was collected. Uncentrifuged sample was subjected for microscopy and semi-quantitative culture on Blood agar and MacConkey agar. After 24 hours of incubation pure growth of organism with Colony count of $>10^5$ CFU/ml or Colony count of $>10^3$ CFU/ml, if there is history of antibiotic intake were considered as significant and isolates were identified by biochemical tests as per standard methods. [7, 8]

The isolates were tested for susceptibility on Mueller Hinton agar against ampicillin, gentamicin, ceftriaxone, norfloxacin, nitrofurantoin, co-trimoxazole, by Kirby-Bauer disc diffusion method. For Staphylococcus and Enterococcus, cefoxitin and tetracycline were used instead of ceftriaxone. As Acinetobacter is intrinsically resistant to nitrofurantoin, it was not tested. Results obtained was analysed for comparative statistics using SPSS version 16.

III. Results

In both groups majority of patients were in the age group of 18-35 years. Male to female ratio was 1:1.5, showing a female preponderance. Of 200specimens, 125 showed significant growth. 67 were from inpatients and 58 from outpatients. This difference was not found to be statistically significant. Organisms isolated and their susceptibility pattern is as given below.

Escherichia coli was the common pathogen isolated from 61.19% of inpatients and 48.2% of outpatients. Other organisms isolated and their distribution is as given in Table 1.

TABLE 1. Table showing distribution of organisms among the study group.

Organism Isolated	IP (N=67) n(%)	OP (N=58) n(%)
Escherichia coli	41(61.19)	27(46.55)
Klebsiella spp.	10(14.92)	5(8.62)
Enterobacter spp.	2(2.98)	8(13.79)
Citrobacter spp.	1(1.49)	3(5.17)
Acinetobacter spp.	2(2.98)	3(5.17)
Proteus spp.	1(1.49)	1(1.72)
MRSA	6(8.95)	4(6.89)
Enterococcus spp.	4(5.97)	3(5.17)
Staphylococcus aureus	-	3(5.17)
CoNS	-	1(1.72)

E.coli isolates from inpatients showed high rates of resistance to most drugs tested, but was found to be susceptible to nitrofurantoin. However E.coli isolates from outpatients were found susceptible to most drugs with the exception of ampicillin. Antibiogram of isolates from both categories to empiric drugs is as shown in Table 2.

TABLE 2. Table showing antibiogram of organisms isolated for empiric antibiotics.

Organism	Patient group	Antibiogram showing isolates susceptible, n(%)						
		A	G	Nf	Nx	Co	Ci	Te
E.coli	IP (41)	-	22(53.65)	35(85.36)	3(7.31)	3(7.31)	8(19.51)	-
	OP (27)	8(29.63)	27(100)	26(96.3)	19(70.37)	14(51.85)	17(63)	-
Klebsiella spp.	IP (10)	-	3(30)	3(30)	3(30)	1(10)	1(10)	-
	OP (5)	2(40)	5(100)	4(80)	4(80)	5(100)	4(80)	-
Enterobacter spp.	IP (2)	-	-	1(50)	1(50)	-	-	-
	OP (8)	3(37.5)	8(100)	6(75)	5(62.5)	4(50)	8(100)	-
Citrobacter spp.	IP (1)	-	-	1(100)	-	-	-	-
	OP (3)	2(66.67)	3(100)	3(100)	3(100)	1(33.34)	3(100)	-
Acinetobacter spp.	IP (2)	-	1(50)	-	-	-	-	-
	OP (3)	-	3(100)	-	3(100)	1(33.34)	3(100)	-
Proteus spp.	IP (1)	-	-	1(100)	-	-	-	-
	OP (1)	-	1(100)	1(100)	-	-	1(100)	-
MRSA	IP (6)	-	4(66.67)	-	2(33.34)	-	-	4(66.67)
	OP (4)	-	4(100)	3(75)	4(100)	1(25)	-	3(75)
Enterococcus spp.	IP (4)	-	2(50)	2(50)	-	-	-	-
	OP (3)	-	3(100)	2(66.67)	-	1(33.34)	-	3(100)
S.aureus	IP (-)	-	-	-	-	-	-	-
	OP (3)	-	3(100)	3(100)	2(66.67)	2(66.67)	-	3(100)

CoNS	IP (-)	-	-	-	-	-	-	-
	OP (1)		1(100)	1(100)	-	1(100)	-	1(100)

Nitrofurantoin and gentamicin were found to be effective against both Gram positive and Gram negative organisms. Ampicillin and ceftriaxone had poor activity against hospital isolates. Table 3 shows the contrasting difference in overall susceptibility between hospital acquired and community acquired isolates.

TABLE 3. Table showing difference in susceptibility pattern of community and hospital associated isolates.

Antibiotic	Inpatient	Outpatient	P Value (Significant <0.05)
	N (%)	N (%)	
Ampicillin	0	25.9	0.024
Nitrofurantoin	67.8	89.7	0.062
Gentamicin	47.8	100	0.037
Ceftriaxone	19.4	81.1	0.001
Norfloxacin	13.5	68.97	0.021
Cotrimoxazole	6	50	0.029

IV. Discussion

U.T.I. is the most common infectious presentation in both hospital acquired and community settings. It is universally accepted that U.T.I. can only be ascertained on the basis of microscopy and microbial culture of urine. Dipstick methods used in many centers serve only as a screening tool, but culture is needed for final diagnosis. As mentioned before, it is not always possible to do bacterial culture and sensitivity. For initial therapy, we require knowledge about the prevalent sensitivity pattern among the bacterial causes of U.T.I. in our area and also must have a constant watch over the development of resistance. I.D.S.A. also recommends that physicians obtain information on local resistance spectrum of organisms causing U.T.I.s[9]. When investigating the frequency of occurrence of resistance in organisms to antibiotics, it is important to know the time of their application in routine clinical practice. [10]

In our study we found that U.T.I. is common in the age group of 18-35yrs and there is a female preponderance. Similar findings are reported by Dharmishta et al.[11] and Linhares et al.[4] Men are usually less prone to UTI as compared to females, owing to the longer course of the urethra and bacteriostatic properties of prostatic secretions. In the present study we observed that 67% of specimen from inpatients and 58% of specimen from outpatients yielded growth of organisms. This high rate of isolation is significant in contrast to other studies conducted by Dharmishta et al.[11], Linhares et al.[4] and Senad et al.[10]

We found that E.coli was the predominant uropathogen in both community and hospital setting, responsible for UTI in 61.19% and 46.55% patients respectively. It correlates with the studies of Maryam et al.[12], Senad et al.[10], Priya et al. [13] and Singh et al.[14] who has reported the similar finding. Other organisms included members of the Enterobacteriaceae and among the Gram positive organisms MRSA was the commonest organism isolated followed by Enterococcus spp. Similar observations are made by Pragash et al.[15] On the contrary to results by other studies, we isolated Acinetobacter from 2.98% of inpatients and 5.17% of outpatients.[10, 12] As is a known fact, intestinal flora is the common source of organisms producing UTI. Antibiotic resistance is common in intestinal bacteria due to antimicrobial therapy for infections other than U.T.I. Thus inadvertent use of antibiotics has an influence in the spread of antimicrobial resistance among bacteria.

As clinicians struggle with the growing rate of resistance, the need to target empirical antibiotics becomes more challenging. Prior studies demonstrated that empirical antibiotics are often chosen incorrectly based on longstanding prescribing habits. This concept was studied by McGregor et al. when they tracked the increasing prevalence of MRSA in the outpatient setting.[16] Some of the common antibiotics used in the empiric therapy of UTI are ampicillin, cephalosporins, gentamycin, quinolones, cotrimoxazole and

nitrofurantoin [3, 5]. However, bacterial uropathogens show significant levels of resistance to almost all these antibiotics.

In the present study, it is found that ampicillin is a poor choice for empiric therapy of UTI in both community and hospital settings, as none of the isolates from inpatients and only a fourth of isolates from outpatients were susceptible. The other choice of empiric therapy co-trimoxazole was also found to have high resistance rates in hospital isolates and in community isolates as well. Norfloxacin was found to be effective against a significant proportion of isolates from outpatients, while a high rate of resistance was found against isolates from inpatients. High levels of resistance to ampicillin, cotrimoxazole, norfloxacin can be explained by the long time period for which these drugs have been available and in use for UTI. Higher resistance to ceftriaxone, a 3rd generation cephalosporin is a cause of concern, as third generation cephalosporins have become the first line of therapy for many infections in hospital settings and it would have been ideal if resistance to ceftriaxone could have been warded off for a longer time. In our study we found ceftriaxone to be effective against a good population of community isolates, but high rate of resistance was found against hospital isolates.

Gentamicin was found to have excellent activity against isolates from community acquired UTI. However, only a half of the isolates from hospital acquired infection were susceptible. Even though the aminoglycosides have been around for a long while, resistance to them has not developed as rapidly as to others. The chief reason for this appears to be that these drugs have not been over-used. Since gentamicin is administered parentally it would be difficult to use for empiric therapy in outpatient settings. Nitrofurantoin showed good susceptibility in both groups. This might be due to its unique structure and mechanism of action, localizing only in urinary tract. The susceptibility pattern of nitrofurantoin is satisfactory in our study as its activity on the urinary isolates is very effective. Considering its safety profile, ease of administration through oral route, good susceptibility, nitrofurantoin can be a drug of choice for empiric therapy in lower UTI in both outpatients and inpatients.

Dahle et al. recently examined different susceptibility patterns of urinary isolates in a single health care system, comparing a community based uropathogenantibiogram to a hospital based uropathogen antibiogram in Utah. Similar to our findings, they determined that there was a significant difference in resistance patterns between outpatient and inpatient uropathogens.[17] In contrast to this finding, Rajesh et al. reports the resistance among hospital and community isolates to be similar.[5] This might indicate the spread of multi drug resistant strains in the community.

V. Conclusion

E.coli is the most common organism causing urinary tract infection in both hospital and community settings. Uropathogen resistance rates of several antibiotics are higher for urinary specimens obtained from inpatients than outpatients. These differences should be considered when empirically treating patients who present with urinary tract symptoms and awaiting culture reports. Nitrofurantoin can be a drug of choice for empiric therapy of uncomplicated lower urinary tract infection in both community and hospital settings.

References

- [1]. Wilson M.L., Gaido L. Laboratory Diagnosis of Urinary Tract Infections in Adult Patients. *CID* 2004; 38: 1150-8
- [2]. Stamm WE. Scientific and clinical challenges in the management of urinary tract infections. *Am J Med* 2002; 113:1S-4S.
- [3]. Weinstein MP, Towns ML, Quartey SM, et al. The clinical significance of positive blood cultures in the 1990s: a prospective comprehensive evaluation of the microbiology, epidemiology, and outcome of bacteremia and fungemia in adults. *Clin Infect Dis* 1997;24:584-602.
- [4]. Linhares et al.: Frequency and antimicrobial resistance patterns of bacteria implicated in community urinary tract infections: a ten-year surveillance study (2000-2009). *BMC Infectious Diseases* 2013;13: 9.
- [5]. Rajesh K.R., Mathavi S., Priyadarshini R.I. Prevalence of Antimicrobial Resistance in Uropathogens and determining Empirical Therapy for Urinary Tract Infections. *IJBMS* 2010; 1: 5
- [6]. KashefN., Djavid G.E., Shahbazi S. Antimicrobial susceptibility patterns of community-acquired uropathogens in Tehran, Iran. *J Infect DevCtries*2010; 2010; 4(4): 202-6.
- [7]. Forbes, Sahn, Weissfeld. *Bailey and Scott's Diagnostic Microbiology*. 12th edition China. 2007; chapter 5: 256-62.
- [8]. Collee JG, Fraser AG, Marmion BP, Simmons A, editors. *Mackie and McCartney Practical medical microbiology*. 14th edn. Edinburgh: Churchill Livingstone. 1996; chapter 4 and chapter 5: 145- 61.
- [9]. Warren, J. W., E. Abrutyn, J. R. Hebel, J. R. Johnson, A. J. Schaeffer, and W. E. Stamm. 1999. Guidelines for antimicrobial treatment of uncomplicated acute bacterial cystitis and acute pyelonephritis in women. *Clin. Infect.Dis.* 29:745-75.
- [10]. Ljuca S., Zvizdic S., Hamzic S., et al. Antimicrobial susceptibility of Bacteria isolated from Inpatients and Outpatient Urine samples. *Med Arh* 2010; 64(3): 161-4
- [11]. Dharmishta T., Paragi J.G., Kiran N.P. A study on antibiotic related resistance in UTI patients: a comparison between community acquired and hospital acquired E.coli. *National Journal of Community Medicine* 2012; 3(2): 255-8.
- [12]. Anvari MS., Naderan M., Boroumand MA. et al. Microbiologic Spectrum and Antibiotic Susceptibility Pattern among Patients with Urinary and Respiratory Tract Infection. *IJM* 2014; Article ID 682304, 6 pages, 2014. doi:10.1155/2014/682304.
- [13]. Priya P., Radha K., Jennifer G. Urinary tract infections: a retrospective survey of causative organisms and antibiotics prescribed in a tertiary care setting. *Indian Journal of Pharmacology* 2002; 34: 278-80.
- [14]. Singh NP, Goel V, Rohtagi A. et al. Urinary tract infections- a fresh look. *J Assoc Phys India* 1996; 44: 809- 14
- [15]. Dhandapany SP et al. Study of Uropathogens among Type II Diabetic Patients and Their Antimicrobial Resistance Pattern among Rural South Indian Population. *Sch. J. App. Med. Sci.*, 2014; 2(2B):589-91.
- [16]. McGregor JC, Elman MR, Bearden DT, Smith DH. Guiding Therapy for Uncomplicated Urinary Tract Infection (UTI). Podium presentation. 28th International Conference on Pharmaco Epidemiology and Therapeutic Risk Management. Barcelona, Spain. August 24, 2012.
- [17]. Dahle KW, Korgenski EK, Hersh AL, et al. Clinical value of an ambulatory-based antibiogram for uropathogens in children. *J Pediatric Infect Dis Soc.* 2012; 1:333