ORIGINAL RESEARCH PAPER

Volume-6 | Issue-12 | December-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 93.98

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

BACTERIOLOGICAL PROFILE OF UROPATHOGENS AND THEIR SUSCEPTIBILITY PATTERN AT A TEACHING HOSPITAL IN NORTH INDIA: A RETROSPECTIVE STUDY

Microbiology

Sonia Khatter — Associate Professor, Department of Microbiology, ESIC Medical College & Hospital, Faridabad, Haryana,121001

Bhawna Sharma — Specialist, Microbiology, ESI, Okhla , New Delhi

Ashish Bajaj — Senior Resident, Department of Microbiology, GB Pant PG Institute, New Delhi

Kavita Gupta — Assistant Professor, Department of Microbiology, ESIC Medical College & Hospital, Faridabad, Haryana,121001.

Iqbal R Kaur* — Professor &Head, Department of Microbiology, ESIC Medical College & Hospital, Faridabad, Haryana,121001. *Corresponding Author

ABSTRACT

Introduction: Urinary tract infection (UTI) represents one of the most common bacterial infection. Emerging antimicrobial resistance among the predominant uropathogens, limits the available treatment options.

Aims : To study the microbiological etiology and the antimicrobial susceptibility pattern of the uropathogens in a teaching hospital in north India, Faridabad.

Materials and Methods: The study was carried out from April, 2016 to September, 2016. During this period, Antimicrobial sensitivity test was performed on all uropathogens.

Results: 211 isolates included 12.1% gram positive and 87.8% gram negative organisms. The most common organism was *Escherichia coli* (64%) followed by *Entrococcus spp* (11.8%),*Klebsiella spp* (6.6%), *Staphylococcus aureus*(6.1%). Among gram negative organisms, maximum resistance was observed for ampicillin (87-89%), cotrimoxazole (57-63%), cephalosporins (35-82%), fluoroquinolones(35-62%) and nitrofurantion (27-57%). *Enterococcus spp* had high level aminoglycoside resistance as 60%. 32% *S.aureus* isolates were MRSA and 20% were resistant to Glycopeptides.

Conclusion: Emerging bacterial drug resistance has both clinical and financial implications for therapeutic purpose. Spectrum of bacterial drug resistance in an institution is important for epidemiological as well as clinical purposes.

KEYWORDS

Uropathogens; antibiotics; antimicrobial resistance

Introduction

Urinary tract infections (UTIs) are considered to be the most common bacterial infections that lead patients to seek medical care. It is difficult to accurately assess the incidence of UTIs, because they are not reportable diseases. According to a National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey, UTI accounted for nearly 7 million office visits and 1 million emergency department visits, resulting in 100,000 hospitalizations in a year in United States [1]. UTI occurs far more commonly in females than in males, except among infants and elderly. UTI and recurrent UTI are predominantly diseases of females especially between 1 to 50 years of age. 50-80% of women in the general population suffer from at least one episode of uncomplicated cystitis during their lifetime [2]. Catheter-associated UTI is the most common nosocomial infection, accounting for >1 million cases in hospitals and nursing homes. In non institutionalized elderly populations, UTIs are the second most common form of infection, accounting for nearly 25% of all infections. There are important medical and financial implications associated with UTIs. Financially, the annual cost of evaluation and treatment of patients with UTI in 2000 was estimated as $3.5 billion [3]. Even though several different microorganisms can cause UTI, including protozoan parasites, fungi and viruses, bacteria are the major causative organisms accounting for more than 95% of these cases [4]. *Escherichia coli (E.coli)* is responsible for over 80 % of cases of UTI [5].

Antimicrobial resistance (AMR) is a growing threat worldwide in both hospital and community acquired infections and threatens the achievements of the modern medicine [6]. Developing countries face the major brunt of the problem of AMR due to high prevalence of infections, irrational and indiscriminate use of antimicrobials with easy over the counter availability of drugs and lack of clinical microbiology laboratories for antimicrobial susceptibility testing. Infections caused by resistant bacteria adversely impact the treatment outcomes, costs, disease spread and duration of illnesses eventually resulting in gradual narrowing of scope for effective molecules to combat even common community acquired bacterial infections including UTIs[7, 8].

Determining the scope of antimicrobial resistance is essential for formulating and monitoring an effective response. There is a need for hospital based studies in different geographical locations to provide the pattern of sensitivity of the microorganisms to help formulate local empirical treatment guidelines for UTI. The aim of the current study was to determine the microbiological etiology and to study the antimicrobial susceptibility pattern of the uropathogens in a teaching hospital in Faridabad, North India.

Material and Methods

A retrospective study was carried out in the Department of Microbiology from April, 2016 to September, 2016 (6 months period). This hospital caters patients from registered /insured industrial workers under ESI scheme and persons residing in and around Faridabad. The study protocol was approved by the Institute's Ethical committee. Urine samples were received from various outpatient departments (OPDs) and inpatient Departments (IPDs). Mid-stream clean catch, urine samples were collected in sterile universal containers. All urine samples were screened for the presence of pus cells and the probable bacteria by performing a wet mount and a Gram stain smear on un-centrifuged samples. The urine samples were inoculated on Blood agar and Mac Conkey agar (Himedia, Vadhani Ind. Est., LBS Marg, Mumbai, India) by the semi-quantitative plating method using the calibrated loop technique (0.001 mL). Plates were incubated aerobically overnight at 37°C. The bacterial isolates were identified and confirmed using standard protocol [4]. Antimicrobial sensitivity test (AST) was done on Mueller Hinton agar (Himedia, Vadhani Ind. Est., LBS Marg, Mumbai, India) by the Kirby-Bauer technique according to the CLSI guidelines 2016 [9] as well by automated method on Vitek 2. *E. coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 25923) and *Pseudomonas aeruginosa* (ATCC 27853) were used as control strains . The antibiotic discs used for the AST included: Ampicillin (10 µg), Amikacin (30 µg), amoxycillin/clavulanic acid (20/10 µg), cefuroxime (30 µg), cefpodoxime (10 µg), cephoperazone + sulbactam (75/10 µg), chloramphenicol (30 µg), ciprofloxacin (5 µg), norfloxacin (10 µg), nitrofurantoin (300 µg), Imipenem (10 µg), linezolid (30 µg), cefoxitin (10 µg), penicillin G (10 µg), tetracycline (30 µg), and vancomycin (30 µg) from Oxoid(Thermoscientific).

Results

A total of 1445 urine specimens from various departments including inpatients (IPD) and out-patients (OPD) suspected to be having UTI were received. 195 samples (13.49%) showed growth of bacteria with significant count. Of these, 136 (69.75%) were from female patients and 59 (30.25%) from male patients (Male: Female: 1: 2.3). The age of the patients ranged from 5 -84 yrs. Maximum patients with confirmed UTI in this study were from OPD (89.23%). 85.3% of culture positive female cases belonged to the reproductive age group of 20-49 yrs. Higher incidence among males was seen in the >50 yr of age (13.33% males compared to 5.6% females).

211 uropathogens were isolated from 195 samples(16 samples had polymicrobial growth). 170/211(80.5%) were Gram negative bacilli (GNB) and 41/211(19.5%) Gram positive cocci (GPC). Overall *Escherichia coli* (*E. coli*) was the most common uropathogen 135(64%) isolated followed by *Enterococcus spp* 25(11.8) (Table: 1).

Table 1: Distribution of Gram negative and Gram positive Uropathogens

	Organism isolated	No.(%)
1.	*Escherichia coli*	135(64)
2.	*Enterococcus spp.*	25(11.8)
3.	*Klebsiella pneumoniae*	14(6.6)
4.	*Staphylococcus aureus*	13(6.1)
5.	*Pseudomonas aeruginosa*	12(5.6)
6.	*Proteus spp.*	04(1.8)
7.	*Enterobacter spp*	03(1.4)
8.	CONS	03(1.4)
9.	*Citrobacter spp*	02(0.9)
	Total	211

Among gram negative organisms, maximum resistance was observed for ampicillin (87-89%), cotrimoxazole (57-63%), cephalosporins (35-82%), fluoroquinolones(35-62%) and nitrofurantion (27-57%) (Table:2).

Table 2: Resistance pattern of Common Gram negative uropathogens

Antibiotics	*E. coli* N=13 5 R %	*K. pneumoniae* N= 14 R %	*P. aeruginosa* N=12 R%	*Proteus* spp. N=4 R%
Ampicillin	87	89	-	-
Cephalothin	82	60	-	75
Cefuroxime	72	55	-	75
Cefotaxime/Ceftazidime	66	42	35	63
Amikacin	15	28	33	14
Ciprofloxacin	59	42	35	62
Norfloxacin	61	42	35	62
Cotrimoxazole	63	57		63
Cefoperazone + Sulbactam	-	-	29	-
Amoxy+Clav	49	28	53	75
Piperacillin+Tazobactam	-	-	33	-
Imipenem	13	14	12	25
Nitrofurantoin	27	57	-	-
Colistin	0	7	0	-

Among the GPCs, maximum resistance was observed against Ampicillin. 32% *S.aureus* isolates were MRSA and 20% were resistant to Glycopeptides. *Enterococcus spp* had high level aminoglycoside resistance as 60%. Higher resistance against Nitrofurantoin was observed in *Staph. aureus*(Table 3).

Table 3: Resistance pattern of Common Gram positive uropathogens.

Antibiotics	Staphylococcus aureus (n=13)	Enterococcus spp (n=25)
Ampicillin	100	70
Penicillin	100	NA
Chloramphenicol	41	30
MRSA	32	NA*
Norfloxacin	82	80
Ciprofloxacin	82	80
Gentamicin (120)	NA*	60
Vancomycin	20	0
Linezolid	0	0
Teicoplanin	20	0
Nitrofurantoin	68	30
Erythromycin	80	86
Tetracycline	60	68

NA*-Not Applicable

Discussion

UTI is a major public health problem in terms of financial burden, costing global economy in excess of six billion US dollars [10, 11]. In our study, bacterial aetiology could be established in 13. 49% of suspected UTI cases, which is similar to 10.86% as reported by Akram et al [12]. However, higher culture positivity (41.8% to 51.6%) has been reported in other studies [3, 14]. Maximum patients with confirmed UTI in this study were from OPD (89.23%) and hence, infection was mainly community acquired.

It is well documented that UTI is more common in females than in males due to certain anatomical and physiological factors. Our finding is in agreement with other studies [13, 14].

E. coli was the most common isolate constituting 64% of all uropathogens in this study. Most of the studies conducted in India have reported *E. coli* as the most common uropathogen. Studies from community settings have reported isolation rates of *E.coli* between 55-83% [15, 16]. While, studies on inpatients with hospital acquired UTI have reported lesser *E.coli* isolation rates varying between 40-50% [13, 15 & 17].

Enterococci spp were the second most common pathogens and contributed nearly 11.8% (25/211) of all uropathogens in this study. Except for one, rest all *Enterococci spp* were isolated from OPD patients and most likely community acquired. *Enterococci spp* are part of the normal resident flora of the gut, oral cavity, and female genital tract and are well-known as nosocomial pathogens. Most of the published literature from India reports prevalence of *Enterococci* in hospital settings and nosocomial infections such as UTI, intraabdominal or intrapelvic infections. Recently, a rising trend has been observed in isolation of *Enterococci* in community acquired UTIs [11]. This trend probably could be due to extensive use of broad spectrum antibiotics leading to selection pressure on *Enterococci* posing a grave health hazard as they show intrinsic resistance to many commonly used antibiotics and may lead to treatment failure.

Among the Enterobacteriacae, *E.coli* had very high resistance against oral cephalosporins (Cephalothin & Cefuroxime)(Table:2). Though, majority of population in this study was community based, high degree of resistance to higher generation injectable cephalosporins was seen (42-66%). This is an alarming trend and result of indiscriminate use of injectables. Elsewhere also, in *E.coli*, isolated from community samples, resistance of 55-85% has been reported against 3rd generation injectable cephalosporins[12].

Cotrimoxazole and fluoroquinolones , which used to be the drugs of choice to treat common bacterial infections including community acquired UTI in many underdeveloped and developing countries have lost their effectiveness against most frequent uropathogens [14, 18 & 19]. In this study, the resistance of uropathogens to fluoroquinolones was high (57-60%) in Enterobacteriacae and (80-82%) among GPCs. Similar resistance proportions have been reported from other studies [13]. A community based study in rural settings has reported high sensitivity to fluoroquinolones [16]. Resistance to Cotrimoxazole was 57-63%. Easy access, oral mode of intake and indiscriminate usage in all types of infections could explain emergence of drug resistant mutants due to high selective pressures. This finding seriously limits choice of easy and effective therapeutic options available for UTI.

Nitrofurantoin, an oral antibiotic with narrow spectrum of antimicrobial activity with no systemic action, is a popular therapeutic option for UTI treatment. High Nitrofurantoin sensitivity has been reported against all pathogens, including 90.6% against *E.coli* [13]. However, sensitivity to Nitrofurantoin was very variable; 73% in *E.coli* & 43% in *K.pneumoniae*. While 30% *Enterococci* were resistant, 68% *S.aureus* demonstrated resistance. This finding

emphasizes the geographical variability in the susceptibility patterns of uropathogens to different drugs probably due to different prescribing patterns of the clinicians .

Conclusion

Emerging antimicrobial resistance among common uropathogens has assumed alarming proportions. The development of resistance against most of commonly used oral antibiotics is frightening. This is going to make therapeutic options very limited for the treating general practitioners forcing them to rely on injectable antibiotics to treat common infections escalating considerably the healthcare costs. Selection of antimicrobials for UTI by physicians needs to be guided by culture and sensitivity results and empirical therapy must be based on local epidemiological data, which should be constantly updated.

Acknowledgement:

The technical support of the staff of the Department of Microbiology is acknowledged with gratitude.
Conflict of Interest: None
Funding: None Received

References:

1. Foxman B. Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. Am J Med 2002; 8: 5S-13S .
2. Kasper D, Fauci A, Hauser S, Longo D, Jameson JL, Loscalzo J, Gupta K, Trautner BW. Urinary tract Infections, pyelonephritis, and prostatitis. Harrison's Principles of Internal Medicine, 19ed.Mc Graw Hills, 2013; 861-75.
3. Neria J, Mintz M. Urinary Tract Infections.Essential infectious disease topics for primary care. Humana Press; 2008: 259-74.
4. Baron EJ, Peterson LR, Finegold SM. Bailey and Scott's Diagnostic Microbiology; 13th ed pp. 259–83.
5. Goddard J, Turner AN, Cumming AD, Stewart LH. Kidney and urinary tract disease. In: Boon NA, Colledge NR, Walker BR, Hunter JAA, editors. Davidson's principles and practice of Medicine. 20th ed. Edinburgh: Churchill Livinstone; 2006. p. 455–511
6. World Health Organization (2014) Antimicrobial resistance: Global Report on Surveillance. http://http://apps.who.int/iris/bitstream/10665/112642/1/9789241564748_eng.pdf. Accessed on 16 July 2017
7. Mulu W, Abera B, Yimer M, Hailu T, Ayele H, Abate D.Bacterial agents and antibiotic resistance profiles of infections from different sites that occurred among patients at Debre Markos Referral Hospital, Ethiopia: a cross-sectional study. BMC Res Notes 2017; 10: 254.
8. Sood S, Gupta R. Antibiotic resistance pattern of community acquired uropathogens at a tertiary care hospital in Jaipur, Rajasthan. Ind J Comm Med 2012; 37:39-44.
9. Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing; Seventeenth Information Supplement. CLSI document M100-S17, Clinical and Laboratory Standards Institute Wayne Pennsylvania. 2016. no. 1. Vol. 27pp. 5–11
10. Arjunan M, Al-Salamah AA, Amuthan M. Prevalence and antibiotic susceptibility of uropathogens in patients from a rural environment, Tamil Nadu. Am J Infect Dis 2010; 6:29–3.
11. Gupta S, Kapur S, Padmavathi DV. Comparative Prevalence of Antimicrobial Resistance in Community-Acquired Urinary Tract Infection Cases from Representative States of Northern and Southern India. J Clin Diagn Res 2014; 8: 9-12.
12. Akram M, Shahid M, Khan AU. Etiology and antibiotic resistance patterns of community-acquired urinary tract infections in J N M C Hospital Aligarh, India. Ann Clin Microbiol Antimicrob 2007; 6:4.
13. Singhal A, Sharma R, Jain M,Vyas L. Hospital and Community Isolates of Uropathogens and their Antibiotic Sensitivity Pattern from a Tertiary Care Hospital in North West India. Ann Med Health Sci Res 2014; 4: 51–56
14. Haque R, Akter ML, Salam MA. Prevalence and susceptibility of uropathogens: a recent report from a teaching hospital in Bangladesh. BMC Res Notes 2015 ; 8:416-20.
15. Gupta V, Yadav A, Joshi RM. Antibiotic resistance patterns in uropathogens. Indian J Med Microbiol 2002;20:96–8.
16. Chatterjee B, Kulathinal S, Bhargava A, Jain Y, Kataria R. Antimicrobial resistance stratified by risk factor among Escherichia coli strains isolated from the urinary tract at a rural clinic in Central India. Indian J Med Microbiol 2009; 27:329–34.
17. Kamat US, Fereirra A, Amonkar D, Motghare DD, Kulkarni MS. Epidemiology of hospital acquired urinary tract infections in a medical college hospital in Goa. Indian J Urol 2009; 25:76–80.
18. Rangari AA, Sharma S, Tyagi N, Singh P, Singh G,Thakur R. Antibiotic Susceptibility Pattern of Bacterial Uropathogens Isolated from Patients at a Tertiary Care Hospital in Western Uttar Pradesh of India. Int J Curr Microbiol App Sci 2015; 4: 646-57.
19. Murugan K, Savitha T, Vasanthi S. Retrospective study of antibiotic resistance among uropathogens from rural teaching hospital, Tamil Nadu, India. Asian J Pac Trop Dis 2012;2:375-80.