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Urinary Tract Infections: Culture And Sensitivity Patterns: A Two Year Experience At A Peripheral Hospital

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Abstract
Background: Most of the urinary tract infections are treated with empirical antibiotics resulting in increased antibiotic resistance due to indiscriminate and improper use of antimicrobial agents.
Objective: This study was designed to find out the causative microbial agents of UTI and determine the antimicrobial susceptibility and resistance pattern of the bacterial pathogens isolated from urine culture to act as a guide for choosing the correct antibiotic in these patients thereby reducing antibiotic resistance and treating UTI with culture specific antibiotics rather than using a random, empirically selected antibiotic.
Materials and Methods: In this study, 112 urine specimens out of 300 which showed growth of micro-organisms on culture and sensitivity studies were analysed for antibiotic susceptibility pattern. The susceptibility of microbes to Co-trimoxazole, Amikacin, Gentamycin, Ceftriaxone, Ceftazidime, Cefixime, Cefuroxime, Norfloxacin, Ciprofloxacin, Ofloxacin, Co-amoxyclav, Levofloxacin, Linezolid and Nitrofurantoin were tested with disc diffusion agar test.
Results: 112 (37.33%) urine specimens out of 300 showed growth of micro-organisms on culture and sensitivity studies. The most common age group affected of the positive urine culture test report was 31-40 years which affected 36 patients out of 112 patients (32.14%). Females were more commonly affected as compared to males (62 female patients: 55.35% as compared to 50 male **Patients:** 44.64%). E Coli was the most common causative organism as revealed by urine culture tests (104 patients: 92.85%). 88.39% of the isolates were susceptible to Amikacin followed closely by Nitrofurantoin to which 77.67% of microbes were found to be sensitive. Highest antibiotic resistance of 49.10% was seen with Co- amoxyclav.
Conclusion: Use of culture specific antimicrobial agents is recommended which will reduce antibiotic resistance. As per our study, injectable Amikacin and oral Nitrofurantoin have been found to be most effective in the treatment of urinary tract infections.

Keywords: Urinary tract infection, E Coli, urine culture, culture and sensitivity, culture specific antibiotics

Introduction

Urinary tract infection (UTI) is an infection caused by the presence and growth of microorganisms anywhere in the urinary tract. Indiscriminate use of antibiotics has led to antibiotic resistance and drugs belonging to penicillin combination were least effective against UTI-causing *E. coli* from the year 2008 to 2013 [1]. Females are more prone to develop UTI because of short urethra, absence of prostatic secretion and easy contamination of the urinary tract with faecal flora [2]. Urinary tract Infection (UTI) is one of the most common clinical syndromes encountered by a general practitioner [3]. A patient who is clinically suspected to have UTI should be advised urine culture study, the report of which helps the clinician to choose the antimicrobial agent and the duration of antibiotic therapy. Even a single confirmed UTI supported by a positive culture report should be taken seriously and treated adequately [3]. *E. coli* is the major etiologic agent in causing UTI, which accounts for up to 90% of cases. Given that the vast majority of UTIs are treated empirically, the choice of an antimicrobial agent should be guided by local susceptibility pattern. Increasing multi-drug resistant infections makes treatment of these infections choosing empirical antibiotics more complex [4]. Awareness of local antibiotic resistance patterns among microorganisms isolated from urine culture studies is important for physicians so that appropriate and evidence based recommendations for use of empirical antibiotics for treatment of UTI can be followed [5].

Materials and Methods

Sample collection

This study was conducted over a period of two years at a peripheral hospital in Nasik, Maharashtra, India. A total of 300 urine specimens (one specimen per patient) were collected from patients who were being treated as urinary tract infection before starting them on empirical antibiotic therapy. Midstream urine sample was collected using aseptic precautions in a sterile container and was sent to the microbiology laboratory. Urine culture and sensitivity test was performed according to Clinical and Laboratory Standards Institute (CLSI) 2015 guidelines by Kirby Bauer disc diffusion method on Mueller Hinton agar plates.

Inclusion and Exclusion criteria:

Urinary tract infection was defined as recovery of 100 000 CFU/mL or more bacteria in midstream clean-catch method.

Patients who reported to out- patient department with clinical

features suggestive of urinary infection in the form of burning micturition, increased frequency associated with or without fever were included in the study provided urine sample for culture and sensitivity test could be collected prior to starting of empirical antibiotic therapy.
Hospitalised patients and patients with indwelling per urethral catheter were not included in the study.

Antibiotic sensitivity test
Antimicrobial sensitivity test to Nitrofurantoin, Amikacin, Gentamycin, Co-trimoxazole, Norfloxacin, Levofloxacin, Ofloxacin, Co-amoxyclav, Ceftriaxone, Ceftazidime, Cefuroxime, Cefixime and Linezolid was performed with disc diffusion agar method.
Ethical Approval: Approval for the study was granted by Military Hospital Devlali Ethics Committee and permission to analyse the culture and sensitivity reports of urine samples was taken from the Pathologist of the hospital who reported upon these samples.

Results
Out of 300 urine samples which were subjected to culture and antibiotic susceptibility tests, microbial growth was seen in 112 (37.33%) urine samples and 188 (62.66%) urine samples showed no growth. Out of the 112 urine samples which showed microbial growth, 62 (55.35%) patients were females and 50 (44.64%) patients were males. The most common age group affected was between 31-40 years which affected 36 (32.14%) patients followed by the age group between 21-30 years which involved 31 (27.67%) patients. 21 (18.75%) patients were between the age group of 41-50 years whereas 9 (8.03%) patients were in the age bracket of 11 to 20 years.7 (6.25%) patients were in the age group between 51-60 years, 5 (4.46%) patients in the age group between 61-70 years, 2 (1.78%) patients in the age bracket of 1-10 years and 1 (0.89%) patient was in the age bracket between 71-80 years of age (Table 1). *Esherichia coli* was isolated from 104 out of 112 (92.85%) urine specimens which showed microbial growth. Proteus, Klebsiella and Pseudomonas were isolated, each from 2 (1.78%) samples. Serratia and Staphylococcus aureus were isolated each from 1 (0.89%) sample (Table 2).
Antibiotic susceptibility testing was performed and the following results obtained: 99 (88.39%) samples showed susceptibility to Amikacin, 87 (77.67%) of microorganisms grown were susceptible to Nitrofurantoin, 67 (59.82%) susceptible to Gentamycin, 53 (47.32%) susceptible to Ofloxacin, 44 (39.28%) susceptible to Norfloxacin, 42 (37.5%) susceptible to Co-trimoxazole, 39 (34.82%) susceptible to Levofloxacin, 37 (33.63%) were susceptible to Ceftriaxone, 15 (13.39%) susceptible to Ceftazidime, 9 (8.03%) were susceptible to Cefuroxime, 6 (5.35%) susceptible to Co- amoxyclav and 5 (4.46%) to Cefixime (Figure 1).

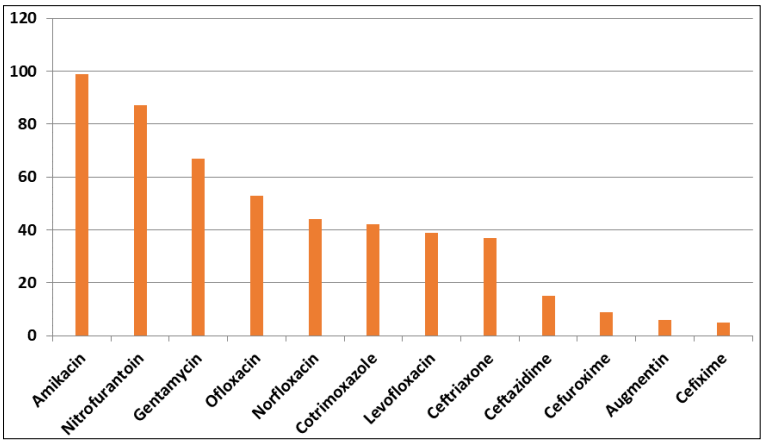

Fig 1: Antibiotic sensitivity

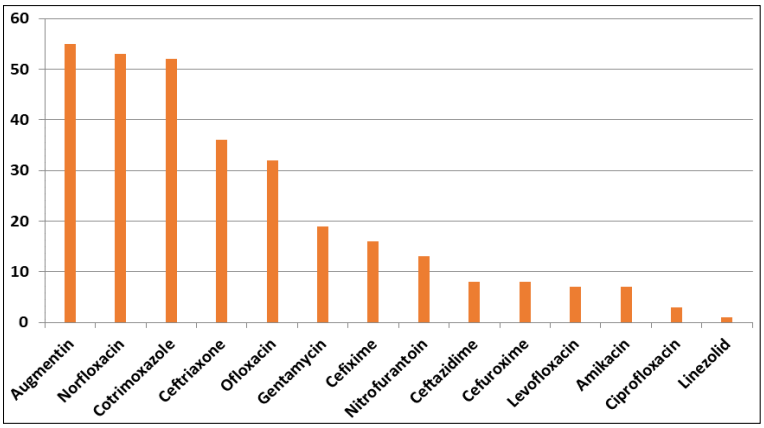

Fig 2: Antibiotic resistance

In disc diffusion agar test, antibiotic resistance of the isolates was highest to Co-amoxyclav in 55 (49.15%) followed by Norfloxacin in 53 (47.32%) and then to Co-trimoxazole in 52 (46.42%) patients. Microbial resistance to Ceftriaxone was seen in 36 (32.14%) patients, Ofloxacin in 32 (28.57%), Gentamycin in 19 (16.96%), Cefixime in 16 (14.28%), Nitrofurantoin in 13 (11.6%), Cefuroxime in 8 (7.14%), Ceftazidime in 8 (7.14%), Levofloxacin in 7 (6.25%), Amikacin in 7 (6.25%), Ciprofloxacin in 3 (2.67%) and Linezolid in 1 (0.89%) patient (Figure 2).

Cefixime obtained the lowest (4.46%) and Amikacin (88.39%) and Nitrofurantoin (77.67%) had the highest sensitivity in our study.

The highest resistance of isolates was seen with Co-amoxyclav (49.10%), Norfloxacin (47.32%), Co-trimoxazole (46.42%) and lowest antibiotic resistance was seen with Linezolid (0.89%) (Figure 2).

All culture specific oral antibiotics were administered for a period of 5 days and patients in whom urine culture showed sensitivity to Amikacin was administered Injectable Amikacin in the dose of 500 mg single daily dose for 3 days on outpatient basis.

Table 1: Patient age and culture positivity distribution

Age	Number of patients affected	Percentage
1-10 years	2	1.78%
11-20 years	9	8.03%
21-30 years	31	27.67%
31-40 years	36	32.14%
41-50 years	21	18.75%
51-60 years	7	6.25%
61-70 years	5	4.46%
71-80 years	1	0.89%

Table 2: Organism grown on urine culture

Organism grown	Number of patients	Percentage
E Coli	104	92.85%
Proteus	2	1.78%
Pseudomonas	2	1.78%
Klebsiella	2	1.78%
Serratia	1	0.89%
Staphylococcus	1	0.89%

Discussion

Urinary tract infection includes patients ranging from asymptomatic bacteriuria to symptomatic bacterial infection with symptoms including burning in micturition, increased frequency of urination, hematuria and/or fever. Dysuria combined with increased urinary frequency as presenting complaints increases the possibility of urinary infection to about 90%, thus clinching the diagnosis by history alone [6].

As history gives a clue and indicates urinary infection it is a general tendency of the physician to initiate empirical antimicrobial treatment in cases of urinary tract infection before the laboratory results of urine culture are available; thus causing an increase in antibiotic resistance in uropathogens due to frequent, indiscriminate, improper use of antibiotics [7]. The incidence of antibiotic resistance in uropathogens is increasing, varies according to geographical and regional location as per the pattern of use of empirical antibiotic [8] and the sensitivity patterns are bound to change over a period of time. Our study revealed that Amikacin and Nitrofurantoin were the most affective antibiotics against the pathogens grown on urinary culture studies with sensitivities of 88.39% and 77.67% respectively. The isolates were found most resistant to Co-amoxyclav, Norfloxacin and Co-trimoxazole with 49.10%, 47.32% and 46.42% resistance respectively (Figure 2).

E Coli is the most common pathogen involved in urinary infections. In our study, 92.85% of urine samples showed E Coli growth on urine culture (Table 2). *Escherichia coli*, *Proteus mirabilis*, *Enterobacter agglomerans*, *Citrobacter frreundii* and *Klebsiella pneumonia* account for over 70% of cases [9]. less commonly G. *vaginalis* and *U. urealyticum* are also known to cause urinary infections. Gram-positive organisms are even less common in which Group B Streptococcus, *S. aureus, S. saprophyticus* and *S. haemolyticus* are recognized organisms [10].

UTI is predominantly a disease of the females due to a short urethra and proximity to vestibule and the anal opening. In our study too, out of the 112 urine samples which showed microbial growth, 62 (55.35%) samples were of female patients. In women, faecal-perineal-urethral contamination is the most probable explanation for infections caused by enteric bacteria, as demonstrated by experiments evaluating the genotype of *E. coli* strains causing UTI in women [11]. Understanding the antibiotic sensitivity pattern of uropathogens is important as the changing antimicrobial susceptibility significantly impacts the treatment protocol of urinary infections.

Amikacin and Nitrofurantoin rank high in culture and susceptibility studies of uropathogens to antibiotics and have been found to have 88.39% and 77.67% sensitivity respectively followed closely by Gentamycin with sensitivity of 59.82% Figure 1). In an Iranian study, Ceftriaxone was reported to have a sensitivity of more than 90% [12]. In our study, sensitivity to ceftriaxone was found to be 33.03%. The reduced sensitivity may be due to indiscriminate and inappropriate use of this agent in outpatient as well as inpatient management of infectious disease leading to reduced efficacy of this cephalosporin [13].

Urolithiasis may be associated with urinary tract infection and flank pain associated with presence of features of urinary tract infection, persistent vomiting and inability to accept oral fluids, or obstruction of a single functioning kidney requires hospitalization and active management in the form of culture specific antibiotics and anti-emetics. Use of α-(1)-adrenoreceptor antagonist drugs such as tamsulosin may hasten passage of stone if the size is small [14].

Conclusion

Urinary tract infection is a common infection for which patients seek consultation. Females in the sexually active age group develop urinary infection more frequently compared to males in the same age bracket. It is a good practise to take a urine sample for culture and sensitivity before starting the patient on antibiotics. More than 60% of urine samples on culture show no growth and E Coli is the most common micro-organism detected in samples found to have a positive

urine culture test report (Table 2). We conclude that antimicrobials such as Amoxycillin- Clavulanic acid, Norfloxacin and Co-trimoxazole which have been used widely in the past have high degree of resistance against uropathogens (Figure 2). On the other hand, less commonly used antimicrobials like Nitrofurantoin, Amikacin and Gentamycin have been found to have high sensitivity against the causative uropathogens (Figure 1). It is recommended that physicians should review antibiotic resistance patterns in their region and periodically identify and revise antibiotic policy against the pathogens causing urinary tract infections. A readily available antibiogram that reports data on E. coli susceptibilities in patients with uncomplicated UTIs and complicated UTIs would increase prescribing of narrow-spectrum antibiotics [15].

References

1. Saha S, Nayak S, Bhattacharyya I, *et al*. Understanding the patterns of antibiotic susceptibility of bacteria causing urinary tract infection in West Bengal, India. *Front Microbiol*. 2014; 5:463. Published 2014 Sep 18. doi:10.3389/fmicb.2014.00463
2. Haider G, Zehra N, Afroze Munir A, Haider A. Risk factors of urinary tract infection in pregnancy. J Pak Med Assoc. 2010; 60:213-216.
3. Kunin CM. Urinary tract infecions and pyelonephrities. In: Bennett JC, Plum F, editors. Cecil Textbook of Medicine. 20th ed. Vol. 2. Philadelphia: W.B. Saunders Company, 1996, 602-5.
4. Steinke DT, Seaton RA, Phillips G, MacDonald TM, Davey PG. Prior trimethoprim use and trimethoprim-resistant urinary tract infection: a nested case-control study with multivariate analysis for other risk factors. J Antimicrob Chemother. 2001; 47:781-787.
5. Dapeng Y. The drug resistance of pathogenic bacteria collected from urinary tract infection patients subjected to the Allied Hospital of Beihua University. China J Misdiagn. 2007; 7:2492-2493.
6. Bent S, Nallamothu BK, Simel DL, Fihn SD, Saint S. Does this woman have an acute uncomplicated urinary tract infection? JAMA. 2002; 287:2701-10.
7. Tambekar DH, Dhanorkar DV, Gulhane SR, Khandelwal VK, Dudhane MN. Antibacterial susceptibility of some urinary tract pathogens to commonly used antibiotics. Afr J Biotechnol. 2006; 5:1562-5.
8. Karlowsky JA, Kelly LJ, Thornsberry C, Jones ME, Sahm DF. Trends in antimicrobial resistance among urinary tract infection isolates of *Escherichia coli* from female outpatients in the United States. Antimicrob Agents Chemother. 2002; 46:2540-5.
9. Mashouf RY, Babalhavaeji H, Yousef J. Urinary tract infections: Bacteriology and antibiotic resistance patterns. Indian Pediatr. 2009; 46:617-20.
10. Loh KY, Sivalingam N. Urinary tract infections in pregnancy. Malaysian Fam Physician. 2007; 2:54-57.
11. Yamamoto S, Tsukamoto T, Terai A, Kurazono H, Takeda Y, Yoshida O. *et al* Genetic evidence supporting the fecal-perineal-urethral hypothesis in cystitis caused by *Escherichia coli*. J Urol. 1997; 157(3):1127-1129.
12. Vaezzadeh F, sharifi-yazdi MK. Laboratory evaluation of urine culture and drug resistance in children clinically suspected of urinary tract infection (UTI) Iran J Public Health. 2001; 30:123-124.
13. Hsueh PR, Chen WH, Luh KT. Relationships between antimicrobial use and antimicrobial resistance in Gram-negative bacteria causing nosocomial infections from 1991–2003 at a university hospital in Taiwan. Int J Antimicrobial Agents. 2005; 26:463-472.
14. Sarla GS. Epidemiology of Urolithiasis. Research & Reviews. Journal of Surgery. 2019; 8(2):8-11.
15. Antibiogram, Clinical Practice Guidelines, and Treatment of Urinary Tract Infection. Velez, Roseann *et al*. The Journal for Nurse Practitioners, 13(9), 617-622