Original Research Article

Antibiotic resistance pattern of uropathogens in patients with urinary tract infection in a tertiary care center, Karnataka

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Abstract

Background: In this era of changing trends in antibiotic susceptibility, it is imperative to create an awareness of regional antibiotic resistance pattern among prescribing doctors. Our study aims to identify the common uropathogens associated with UTI cases and their antibiotic susceptibility pattern. **Materials and methodology:** This was a retrospective hospital based study that included all inpatients of above 18 years of age admitted to Father Mullers medical college with a diagnosis of UTI between August 2011 and July 2012. The data regarding causative uropathogens and their antibiotic susceptibility were retrieved from patient's case record files. **Results:** Of the 124 significant isolates, gram-negative organisms accounted for 86.1% infection. The most predominant uropathogen isolated was E.coli (70.8%) followed by *Klebsiella spp (*9.2%) and others. E.coli showed high resistance to ampicillin (91 %), amoxiclav (66.7 %), and ceftriaxone (76.5%), fluoroquinolones (79.1% to 83%); whereas a low level of resistance was observed with drugs like amikacin, cefoperazone+sulbactam and meropenem. In our study, we observed higher sensitivity to Carbapenems, linezolid and vancomycin among the isolated uropathogens. **Conclusion:** Continuous surveillance of antibiotic resistance pattern would only lead to a more effective prescription and thereby a better treatment outcome.

Keywords: UTI, uropathogens, antibiotic resistance.

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INTRODUCTION

Urinary tract infection (UTI) is one of the common diseases, affecting women more than men.[1] Most acute episodes of urinary tract infections are associated with significant morbidity and there is also a possibility of future recurrent attacks. It is been observed that approximately 25% of females with first UTI, will have an another episode in the same year.[2] There are many factors associated with the occurrence of urinary tract infection. Timely diagnosis and treatment of these predisposing factors is essential for preventing recurrences.[3] Treatment of UTI is usually initiated empirically with antibiotics without performing culture and sensitivity test. This has led to inappropriate usage of antibiotics.[4] It is very important that, as physicians we must identify and practice rational prescription of antibiotics; so as to reduce the emergence of resistant bacterial strains.[6] Recently, there has been a changing trend in the pattern of antibiotic resistance amongst uropathogens.[7,8] Therefore , it's a must to create an awareness of regional antibiotic susceptibility regarding uropathogens. However in India, there is a lacunae of extensive studies regarding antibiotic resistance pattern of UTI pathogens.[9] Our study aims to investigate

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common bacteria associated with UTI cases and their antibiotic susceptibility pattern.

MATERIALS AND METHODOLOGY

This was a retrospective descriptive hospital based study. The study included all in-patients of either gender above 18 years of age admitted to Father Muller medical college, Mangalore with a diagnosis of UTI between August 2011 and July 2012. Data was collected from the patient's case record files, which were retrieved from the medical records department of our hospital. All relevant data regarding the type of clinical presentation, demographic distribution, associated risk factors, co-morbid conditions, microbiology reports, causative uropathogens and its antibiotic resistance pattern were documented into a proforma sheet prepared beforehand.

STATISTICAL ANALYSIS

The relevant data from the case record forms were tabulated in an excel spreadsheet and statistical analysis was done. Data were analysed using descriptive statistics; mean, frequency and percentage. Results were depicted in the form of graphs and tables. Microsoft excel was used to make graphs and tables.

RESULTS

Of the 124 significant isolates, gram-negative organisms accounted for 86.1% while gram-positive organisms accounted for the remaining 11.6% of the total pathogens. Fungal isolates were seen only in 2.3 % of cases. E.coli was the most predominant uropathogen isolated (70.8%) followed by *Klebsiella spp (*9.2%), *Enterococcus fecalis (*6.2%) and *Acinetobacter spp(*3.1%). Other uropathogens included MRSA (2.3%), *Staphylococcus aureus(*2.3%), *Candida spp (*2.3%), *Citrobacter freundii (*1.5%), *Pseudomonas spp (*1.5%) and *Streptococcus spp (*0.8%) *E.coli*, showed considerable resistance to ampicillin (91 %), amoxiclav (66.7 %), cephalexin (84.1%), cefuroxime (77.8%), ceftriaxone (76.5%), fluoroquinolones (79.1 % to 83 %) and cotrimoxazole (64.7 %). However low level of resistance was observed with amikacin (6 %), NFT (6.4 %), piperacillin+ tazobactam (7.8%), cefoperazone+sulbactam (10%) and meropenem (6.5%). *Klebsiella spp,* the second most common uropathogen showed high level of resistance with ampicillin (100%), cephalexin (100%), cefuroxime (75%), ceftriaxone (72.7%) and NFT (81.8%). They were found to be susceptible to amikacin (83.3%), piperacillin + tazobactam (70%), cefoperazone + sulbactam (91.7%), carbapenems (90.9 % to 100 %) and tigecycline (100%).

Table 1 and 2 shows antibiotic resistance pattern of gram-negative and gram positive bacteria isolated from urine culture

Table 1

Antimicrobial Agents	*E.coli*	*Acinetobacter spp*	*Citrobacter freundii*	*Klebsiella spp*	*Pseudomonas spp*
	R (%)	R (%)	R (%)	R (%)	R (%)
Ampicillin	91.0	100	100	100	100
Amoxicillin-Clavulanic Acid	66.7	75	100	45.5	100
Cephalexin	84.1	100	100	100	100
Cefuroxime	77.8	100	50	75	100
Ceftriaxone	76.5	100	50	72.7	100
Ciprofloxacin	83.0	100	50	50	100
Levofloxacin	79.1	100	50	33.3	100
Cotrimoxazole	64.7	100	100	45.5	100
Gentamicin	50.6	100	50	54.5	50
Amikacin	6.0	100	50	16.7	100
Nitrofurantoin	6.4	100	0.0	81.8	100
Piperacillin + Tazobactam	7.8	50	50	30	0.0
Cefoperazone + Sulbactam	10	50	0.0	8.3	50
Meropenam	6.5	75	0.0	9.1	0.0

Table 2

ANTIMICROBIAL AGENTS	*Enterococcus fecalis*	*Staphylococcus aureus*	MRSA	*Streptococcus spp*
	R (%)	R (%)	R (%)	R (%)
Ampicillin	25	33.3	100	0.0
Amoxicillin-clavulanic acid	14.3	0.0	100	0.0
Cephalexin	100	-	100	0.0

Cefuroxime	100	0.0	100	0.0
Ceftriaxone	100	0.0	100	0.0
Ciprofloxacin	28.6	100	100	0.0
Levofloxacin	28.6	0.0	66.7	0.0
Cotrimoxazole	57.1	0.0	66.7	0.0
Gentamicin	71.4	0.0	0.0	100
Amikacin	62.5	0.0	66.7	100
Nitrofurantoin	12.5	0.0	0.0	0.0
Piperacillin+Tazobactam	0.0	-	-	-
Imipenem	16.7	-	-	-
Meropenem	33.3	-	-	-
Vancomycin	0.0	0.0	0.0	0.0
Linezolid	0.0	0.0	0.0	-
Teicoplanin	0.0	0.0	0.0	-
Azithromycin	-	-	100	0.0

DISCUSSION

In our study, the most predominant uropathogen isolated was *E.coli* (n = 92) and this finding was in agreement to results of other studies.[11,12,13] As described earlier, E.coli is the commonest uropathogen causing both complicated and uncomplicated UTI.(10) Second most common uropathogen isolated in our study was *Klebsiella spp* (n = 12) which is similar to studies conducted by Beyene *et al.*[11] and Khameneh *et al.*.[(14)] In contrary, study conducted by Khatri B *et al.* in Nepal observed *Enterococcus fecalis* as second most prevalent uropathogen isolated.[12] Antibiotics have been always considered as one of the wonder discoveries of the 20th century. However the most serious consequence of the usage of antibiotics is the development of antibiotic resistance.[15] Antibiotic resistance is a challenge to our health care system. Our study revealed the prevalence of resistance among the isolated uropathogens to some of the commonly prescribed antimicrobials. *E.coli*, which was the predominant uropathogen isolated showed considerable resistance to ampicillin (91 %), amoxiclav (66.7 %), cephalexin (84.1%), cefuroxime (77.8%), ceftriaxone (76.5%), fluoroquinolones (79.1 % to 83 %) and cotrimoxazole (64.7 %). However low level of resistance was observed with amikacin (6 %), NFT (6.4 %), piperacillin+ tazobactam (7.8%), cefoperazone+sulbactam (10%) and meropenem (6.5%). A resistance rate comparable to our study was observed in a study conducted by Mandal *et al.* in South India.[13] In contrast to our observations, in a study conducted in West Nepal, *E.coli* isolates showed high susceptibility to ampicillin (72.6%) and cotrimoxazole (77.9%).[16] *Klebsiella spp* was the second most common uropathogen isolated in our study. High level of resistance was observed with ampicillin (100%), cephalexin (100%), cefuroxime (75%), ceftriaxone (72.7%) and NFT (81.8%). They were found to be susceptible to amikacin (83.3%), piperacillin + tazobactam (70%), cefoperazone + sulbactam (91.7%), carbapenems (90.9 % to 100 %) and tigecycline (100%). In a retrospective study conducted by Bahadin *et al.*, klebsiella was found to be the second most prevalent isolate and a hundred percent resistance was observed with ampicillin. However, in contrary to our observations, their study noted higher sensitivity to gentamicin (100%), ceftriaxone (86.2%), amoxiclav (82.8%), and ciprofloxacin (72.4%).[17] Another study[(18)] conducted in Southeast part of India showed a higher resistance to gentamicin (83.3%) and cotrimoxazole (82.4%) compared to our study results, which were 54.5% and 45.5% respectively. Among *Acinetobacter spp*, high level of resistance was observed with ampicillin (100%), amoxiclav (75%), cephalexin (100%), cefuroxime (100%), ceftriaxone (100%), fluoroquinolones (100%), cotrimoxazole (100%), aminoglycosides (100%), NFT (100%) and meropenem (75%). A study conducted by Akram *et al.*[19] on patients with symptomatic UTI attending OPD clinics, noted *Acinetobacter spp* showing high rates of susceptibility to fluoroquinolones (100%) and amikacin (100%). Their observations were not comparable to our study results. *Citrobacter freundii* accounted for 1.5% of total uropathogens isolated. We noted 100% resistance rate to ampicillin, amoxiclav, cephalexin and cotrimoxazole; 50% resistance rate to cefuroxime, ceftriaxone, fluoroquinolones, aminoglycosides and piperacillin + tazobactam. Beyene *et al.*[11] in their study also observed a similar resistance rate to ampicillin (100%), cotrimoxazole (100%), ciprofloxacin (50%), and ceftriaxone (50%). A lower level of resistance against ampicillin, ceftriaxone and amikacin was observed in a study[13] conducted in South India. Our study also revealed a high percentage of susceptibility to NFT (100%), cefoperazone+sulbactam (100%) and carbapenems (100%) among *Citrobacter freundii* isolates. Among *pseudomonas spp*, a hundred percent resistance rate was observed with ampicillin, amoxiclav, cephalexin, cefuroxime, ceftriaxone, fluoroquinolones, cotrimoxazole, NFT and amikacin. In a study[20] conducted by Farajnia *et al.* noted a similar resistance pattern to ampicillin, cotrimoxazole,

nitrofurantoin and cephalexin. Previous studies[20,21] reported a lower rate of resistance against amikacin and ciprofloxacin compared to our study results. *Enterococcus fecalis* accounts for 6.2 % of total isolates. We observed considerable resistance to cephalosporins (100%), cotrimoxazole (57.1%), gentamicin (71.4%) and amikacin (62.5%) among them. A lower rate of resistance to amikacin and gentamicin was observed in a study[20] conducted in Iran. Contrary to our observations, in a study conducted by Murugan *et al.*[22] high resistance rate was observed with vancomycin (83.3%). Their study also observed a 50% resistance rate to fluoroquinolones. Our study observed a lower resistance rate of 28.6% with fluoroquinolones and higher susceptibility rate to vancomycin (100%) among them. *Staphylococcus aureus* isolates were found to be sensitive to all tested antibiotics excluding ciprofloxacin. On the contrary, a lower susceptibility rate was observed against cotrimoxazole and ceftriaxone in a study[11] conducted by Beyene *et al.*. In our study, MRSA accounted for 2.3% of total isolates. They were found to be highly susceptible to vancomycin (100%), linezolid (100%), teicoplanin (100%), NFT (100%) and gentamicin (100%). Similar susceptibility rates with vancomycin and linezolid among MRSA isolates was observed by Dalela *et al.*.[23] In our study, we observed higher sensitivity to Carbapenems, linezolid and vancomycin among isolated uropathogens. Henceforth, their future use should be restricted to prevent the development of antibiotic resistance

CONCLUSION

In this wake of antimicrobial resistance, choosing an appropriate antibiotic is very crucial. Our study reinforces the importance of having the knowledge of causative uropathogens and regional antibiotic resistance pattern. Continuous surveillance of antibiotic resistance pattern would only lead to a more effective prescription and thereby a better treatment outcome

REFERENCE

1. Al-Zahrani, J., Al Dossari, K., Gabr, A.H. *et al.*. Antimicrobial resistance patterns of Uropathogens isolated from adult women with acute uncomplicated cystitis. *BMC Microbiol* **19,** 237 (2019). https://doi.org/10.1186/s12866-019-1612-6
2. Foxman B: Epidemiology of urinary tract infections: incidence, morbidity, and economic costs. Am J Med 2002;113(suppl 1A):5–13.
3. *Foxman B, Gillespie B, Koopman J, Zhang L, Palin K, Tallman P, Marsh JV, Spear S, Sobel JD, Marty MJ, Marrs CF.*Risk factors for second urinary tract infection among college women. *Am J Epidemiol. 2000 Jun 15; 151(12):1194-205.*
4. Spellberg B, Bartlett JG, Gilbert DN. The future of antibiotics and resistance. N Engl J Med. 2013;368:299–302.
5. Lee DS, Lee SJ, Choe HS. Community-Acquired Urinary Tract Infection by Escherichia coli in the Era of Antibiotic Resistance. Biomed Res Int. 2018 Sep 26; 2018:7656752. https://doi. org/10.1155/2018/7656752
6. Manges AR, Natarajan P, Solberg OD, Dietrich PS, Riley LW: The changing prevalence of drug-resistant Escherichia coli clonal groups in a community: evidence for community outbreaks of urinary tract infections. Epidemiol Infect. 2006, 134 (2): 425-31. 10.1017/S0950268805005005
7. Kahan NR, Chinitz DP, Waitman DA, Dushnitzky D, Kahan E, Shapiro M: Empiric treatment of uncomplicated urinary tract infection with fluoroquinolones in older women in Israel: another lost treatment option?. Ann Pharmacother. 2006, 40 (12): 2223-7. 10.1345/aph.1H396
8. Goldstein FW: Antibiotic susceptibility of bacterial strains isolated from patients with community-acquired urinary tract infections in France. Multicentre Study Group. Eur J Clin Microbiol Infect Dis. 2000, 19: 112-117. 10.1007/s100960050440
9. Karlowsky JA, Jones ME, Thornsberry C, Critchley I, Kelly LJ, Sahm DF. Prevalence of anti microbial resistance among urinary tract pathogens isolated from female outpatients across the US in 1999. Int J Antimicrob Agents. 2001;18:121–127.
10. Beyene G, Tsegaye W. Bacterial uropathogens in urinary tract infection and antibiotic susceptibility pattern in jimma university specialized hospital, southwest ethiopia. Ethiop J Health Sci. 2011 Jul;21(2):141-6.
11. Khatri B, Basnyat S, Karki A, Poudel A, Shrestha B. Etiology and antimicrobial susceptibility pattern of bacterial pathogens from urinary tract infection. Nepal Med Coll J. 2012 Jun;14(2):129-32.
12. Mandal J, Acharya NS, Buddhapriya D, Parija SC. Antibiotic resistance pattern among common bacterial uropathogens with a special reference to ciprofloxacin resistant Escherichia coli. Indian J Med Res. 2012 Nov;136(5):842-9.
13. Khameneh ZR, Afshar AT. Antimicrobial susceptibility pattern of urinary tract pathogens. Saudi J Kidney Dis Transpl. 2009 Mar;20(2):251-3.
14. Davies J, Davies D. Origins and evolution of antibiotic resistance. Microbiol Mol Biol Rev. 2010 Sep;74(3):417-33.
15. Das RN, Chandrashekhar TS, Joshi HS, Gurung M, Shrestha N, Shivananda PG. Frequency and susceptibility profile of pathogens causing urinary tract infections at a tertiary care hospital in western Nepal. Singapore Med J. 2006 Apr;47(4):281-5.
16. Bahadin J, Teo SS, Mathew S. Aetiology of community-acquired urinary tract infection and antimicrobial susceptibility patterns of uropathogens isolated. Singapore Med J. 2011 Jun;52(6):415-20.
17. Bhargavi PS, Gopala Rao TV, Mukkanti K, Dinesh Kumar B, Krishna TP. Increasing emergence of antibacterial resistance mainly in uropathogens:southeast part of India. Int J Microbiol Res. 2010;2(1):1-6
18. 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 Mar 23;6:4.
19. Farajnia S, Alikhani MY, Ghotaslou R, Naghili B, Nakhlband A. Causative agents and antimicrobial susceptibilities of urinary tract infections in the northwest of Iran. Int J Infect Dis. 2009 Mar;13(2):140-4.
20. Hasan AS, Nair D, Kaur J, Baweja G, Deb M, Aggarwal P. Resistance patterns of urinary isolates in a tertiary Indian hospital. J Ayub Med Coll Abbottabad. 2007 Jan-Mar;19(1):39-41.
21. Murugan K, Savitha T, Vasanthi S. Retrospective study of antibiotic resistance among uropathogens from rural teaching hospital, Tamilnadu, India. Asian Pac J Trop Dis. 2012 Oct;2(5):375–80.
22. Dalela G, Gupta S, Jain DK, Mehta P. Antibiotic resistance pattern in uropathogens at a Tertiary Care Hospital at Jhalawar with special reference to ESβL, AmpC β-Lactamase and MRSA production. J Clin Diagn Res. 2012;6(4):645–51.

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