Antibiotic Resistance Pattern of Uropathogens: An Experience from North Indian Cancer Patient

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ABSTRACT

Empirical treatment of urinary tract infections (UTIs) can be made evidence based if it is governed by the resistance pattern of common uropathogens. A retrospective study was carried out at a tertiary care cancer institute to identify the common uropathogens and to know their resistance profile. 20.82% of the outpatients' urine samples (community-acquired urinary tract infection (CA-UTI)) and 24.83% of the indoor patients' urine samples (hospital-acquired urinary tract infection (HA-UTI)) grew uropathogens. *Escherichia coli* was the predominant pathogen both in CA-UTI (68%) and HA-UTI (45%) followed by *Klebsiella spp* and *Enterococcus spp*. High level of resistance to fluoroquinolones and third generation cephalosporins was noted. Nitrofurantoin was found to be a reliable oral drug for treatment of most of the uropathogens.

Key words: Antibiotic resistance, Community acquired, Hospital acquired, Urinary tract infection, Uropathogens

INTRODUCTION

Urinary tract infections (UTIs) are the most commonly encountered infections in medical practice.[1] It is a major public health problem with an estimated 150 million cases per annum worldwide and with a financial burden of over 6 billion US dollar.[2] About 35% of all the UTIs are of nosocomial origin.[3] Most of the UTIs are treated empirically, the criteria for the selection of antimicrobial agent should be determined on the basis of the most likely pathogen and its expected resistance pattern in a geographical area.[4] Knowledge of infection epidemiology and the institutional resistance pattern can help physicians to select the optimal empirical treatment in critically-ill patients.[5] This retrospective study was designed to know the antibiotic resistance pattern of the uropathogens and to suggest an appropriate empirical treatment.

MICROBIOLOGY REPORT

It was a retrospective study carried out at a tertiary care cancer institute. Patient records were assigned into two categories. The first group comprising of urine samples from patients admitted in the hospital for at least 48 h (hospital-acquired UTI (HA-UTI)) and the second group from patients visiting the hospital on outpatient basis or admitted less than 48 h (community-acquired UTI (CA-UTI)). Records of 13 months (15/7/2013-15/8/2014), of patients having UTI were studied and the uropathogens were recognized. Nonfermenters isolated were confirmed with repeat sample and were recorded when the same isolate with similar antibiotic susceptibility pattern was seen. Identification and antibiotic susceptibility of the bacterial pathogens was done using VITEK®2 Compact (C) system version: 06.01 (Biomeriux, North Carolina, USA). Antibiotic susceptibility results were expressed according to the Clinical Laboratory Standards Institute M100-S23 (2013).[6]

Statistical analysis was done using Fisher’s exact test.

The study involved a total of 1,530 consecutive urine samples, over a period of 13 months. A total of 1,028 (67.19%) samples were from suspected CA-UTI patients, of which 214 (20.82%) grew uropathogens. Four hundred and two (26.27%) samples were from suspected HA-UTI patients of which 98 (24.38%) grew uropathogens.

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Gram negative bacilli accounted for 194 (90.65%), gram positive cocci for 12 (5.6%), and Candida spp for eight (3.74%) of the CA-UTI. Among the HA-UTI, 54 (55.10%) were gram negative bacilli, 18 (18.37%) were gram positive cocci, and 13 (13.27%) were Candida species.

Table 1 shows the uropathogens isolated from CA-UTI and HA-UTI patients.

Escherichia coli was the predominant pathogen both in CA-UTI (68%) and HA-UTI (45%) followed by Klebsiella spp (18% in CA-UTI and 24% in HA-UTI) and Enterococcus spp (6% in CA-UTI and 21% in HA-UTI).

Among Escherichia coli, resistance to piperacillin tazobactum, third generation cephalosporins, carbapenems, ciprofloxacin, ampicillin, amoxycillin-clavulinic acid, and cefepime was more significantly associated with HA-UTI than CA-UTI [Table 1]. A comparison of resistance pattern of HA-UTI and CA-UTI among uropathogenic Escherichia coli from various studies in India is shown in Table 2. In case of Klebsiella spp and Enterobacter spp, resistance to piperacillin tazobactum; third generation cephalosporins, carbapenem, gentamicin, amikacin, ciprofloxacin, cefepime, trimethoprim, and sulfamethoxazole were more significantly associated with HA-UTI than CA-UTI [Table 1].

Among nonfermenters, 80% isolates were resistant to aztreonam in HA-UTI compared to 25% of the isolates being resistant to aztreonam in CA-UTI. 25% of isolates were resistant to piperacillin tazobactum in CA-UTI when compared to 60% in HA-UTI.

### Table 1: Frequency, percentage, and $P$-value of resistance of uropathogens isolated from CA-UTI versus HA-UTI patients

| Bacteria | Escherichia coli | Klebsiella spp | Enterobacter spp | Nonfermenters | Enterococcus spp |
|----------|-----------------|----------------|------------------|---------------|------------------|
| Total number of isolates from CA-UTI and HA-UTI | 140/38 | 37/20 | 7/3 | 4/5 | 12/18 |
| Percentage of the isolates from CA-UTI and HA-UTI | 68/45 | 18/24 | 3/4 | 2/6 | 6/21 |
| Percentage of the pathogens resistant to the antibiotics in CA-UTI versus HA-UTI ($P$-value) | | | | | |
| AMP | 84/100 (0.0048) | 92/100 (0.5448) | | | |
| GEN | 39/55 (0.0946) | 19/85 (0.001) | 0/100 (0.0083) | 100/80 (1.0000) | 100/100 (1.0000) |
| NIT | 8/23 (0.3394) | 47/20 (0.4518) | 57/100 (0.4750) | | |
| P | | | | | |
| TE | | | | | |
| AMC | 33/63 (0.0012) | 16/90 (0.001) | 100/100 (1.0000) | | |
| PTZ | 19/47 (0.0006) | 22/80 (0.001) | 0/100 (0.0083) | 25/60 (0.5238) | |
| CAZ | | | | 50/80 (0.5238) | |
| CXM | 66/95 (0.0003) | 51/100 (0.0100) | 14/100 (0.0333) | | |
| CTR | 69/95 (0.0006) | 51/100 (0.0100) | 14/100 (0.0333) | | |
| CPM | 26/63 (0.0001) | 14/65 (0.0002) | 0/100 (0.0083) | 50/60 (1.0000) | |
| DOR | | | | 25/60 (0.0063) | |
| ETP | 4/26 (0.0001) | 16/70 (0.0001) | 0/100 (0.0083) | | |
| IPM | 4/26 (0.0001) | 11/60 (0.0002) | 0/100 (0.0083) | 75/80 (1.0000) | |
| MRP | 4/26 (0.0001) | 11/60 (0.0002) | 0/100 (0.0083) | 75/80 (1.0000) | |
| AK | 5/23 (0.1349) | 8/40 (0.0016) | 0/100 (0.0083) | 100/80 (1.0000) | |
| CIP | 79/95 (0.0028) | 46/90 (0.0014) | 14/100 (0.0333) | 100/80 (1.0000) | 100/100 (1.0000) |
| LEV | | | | 75/80 (1.0000) | |
| COT | 64/74 (0.0352) | 59/95 (0.0049) | 14/100 (0.0333) | | |
| AZT | | | | 25/60 (0.0063) | |
| LZ | | | | | |
| VA | | | | | |
| TEI | | | | | |
| TIM | | | | | |
| CFP/SUL | 113/7 (0.0001) | 14/70 (0.0001) | 0/100 (0.0083) | 50/60 (1.0000) | |
| NA | 91/100 (0.0734) | 49/90 (0.0033) | 71/100 (1.0000) | | |
| SYN | | | | | |
| TGC | 10 (1.0000) | 14/20 (0.0074) | 0/1 (1.0000) | 25/20 (1.0000) | |
| CL | 0/3 (0.2135) | 0/1 (1.0000) | 14/1 (1.0000) | 25/20 (1.0000) | |

AMP: Ampicillin, GEN: Gentamicin, NIT: Nitrofurantoin, P: Penicillin, TE: Tetracycline, AMC: Amoxicillin-clavulanic acid, PTZ: Piperacillin-tazobactum, CAZ: Cefazidime, CXM: Cefuroxime, CTR: Ceftriaxone, CPM: Cefepime, DOR: Doripenem, ETP: Ertapenem, IPM: Imipenem, MER: Meropenem, AK: Amikacin, CIP: Ciprofloxacin, LEV: Levofloxacin, COT: Trimethoprim-sulfamethoxazole, AZT: Aztreonam, LZ: Linezolid, VA: Vancomycin, TEI: Teicoplanin, TIM: Ticarcillin-clavulanic acid, CFP/SUL: Cefperazone-sulbactum, NA: Nalidixic acid, SYN: Quinpristin-dalfopristin, TGC: Tigecycline, CL: Colistin, HA-UTI: Hospital-acquired urinary tract infection, CA-UTI: Community-acquired UTI. $P$-value less than 0.05 was considered as statistically significant.
None of the Enterococcus spp isolated in CA-UTI was resistant to nitrofurantoin compared to 28% of resistant isolates in HA-UTI.

CONCLUSION

Our data indicates that Escherichia coli is still the most frequent uropathogen, both in HA-UTI and CA-UTI. Ampicillin, cefuroxime, ceftriaxone, nalidixic acid, ciprofloxacin, and cotrimoxazole did not have good in vitro coverage for many of the uropathogens in this study. High level resistance against fluoroquinolones and third generation cephalosporins is a matter of concern, especially in CA-UTI where these are the drugs of choice. This could be due to indiscriminate use and availability of over-the-counter antibiotics. Nitrofurantoin still remains the best oral drug for treatment of most of the uropathogens. Updates on the knowledge of antibiotic resistance pattern of uropathogens is important for timely modifying the drugs of choice for empirical therapy which is required for early and effective treatment of the infection.

REFERENCES

1. Ahmed NH, Hussain T, Biswal I. Comparison of etiological agents and resistance patterns of the pathogens causing community acquired and hospital acquired urinary tract infections. J Glob Infect Dis 2014;6:135-6.

2. Gonzalez CM, Schaeffer AJ. Treatment of urinary tract infection: What's old, what's new, and what works. World J Urol 1999;17:372-82.

3. Mishra MP, Debata NK, Padly RN. Surveillance of multidrug resistant uropathogenic bacteria in hospitalized patients in Indian. Asian Pac J Trop Biomed 2013;3:315-24.

4. Alabi AS, Frielinghaus I, Kaba H, Koster K, Huson MA, Kahl BC, et al. Retrospective analysis of antimicrobial resistance and bacterial spectrum of infection in Gabon, Central Africa. BMC Infect Dis 2013;13:455.

5. Jeena J, Debata NK, Subhadi E. Prevalence of extended-spectrum-beta-lactamase and metallo-beta-lactamase producing multi drug resistant gram-negative bacteria from urinary isolates. Indian J Med Microbiol 2013;31:420-1.

6. Performance Standards for Antimicrobial Susceptibility Testing, 23rd Informational Supplement. Wayne: CLSI; 2013. Clinical and Laboratory Standards Institute.

7. Gupta V, Yadav A, Joshi RM. Antibiotic resistance pattern in uropathogens. Indian J Med Microbiol 2002;20:96-8.

8. Dash M, Padhi S, Mohany J, Panda P, Parida B. Antimicrobial resistance in pathogens causing urinary tract infections in a rural community of Odisha, India. J Family Community Med 2013;20:20-6.

9. Mubarakjee M, Saxena RS. Distribution and antimicrobial susceptibility pattern of bacterial pathogens causing urinary tract infection in urban community of Meerut city, India. ISRN Microbiol 2013 Sept; [13 p]. Available from: http://dx.doi.org/10.1155/2013/749629 [Last accessed on 2014 Sep 15].

10. Sharieff VA, Shenoy MS, Yadav T, MR. The antibiotic susceptibility pattern of uropathogenic Escherichia coli with special reference to the fluoroquinolones. J Clin Diagn Res 2013;7:1027-30.

11. Mukherjee M, Basu S, Mukherjee SK, Majumder M. Multidrug resistance and extended spectrum beta-lactamase production in uropathogenic E. coli which were isolated from hospitalized patients in Kolkata, Indian. J Clin Diagn Res 2013;7:449-53.

12. Niranjan V, Malini A. Antimicrobial resistance pattern in Escherichia coli causing urinary tract infection among inpatients. Indian J Med Res 2014;139:945-8.

Table 2: Comparison of resistance pattern of HA-UTI and CA-UTI among uropathogenic Escherichia coli from various studies in India

| Author                     | Country | Year | AMP | CIP | COT | Nit |
|----------------------------|---------|------|-----|-----|-----|-----|
| Gupta et al.               | India   | 2002 | 74  | 38  | 70  | 12  |
| Ahmed et al.               | India   | 2012 | 85  | 78  | 27  | 54  |
| Dash et al.                | India   | 2012 | 94  | 53  | 53  | 9   |
| Prakash et al.             | India   | 2013 | 69  | 84  | 25  | 76  |
| Sharieff et al.            | India   | 2013 | 66  | 32  | 16  |
| Present study              | India   | 2014 | 84  | 79  | 64  | 8   |
| Gupta et al.               | India   | 2012 | 90  | 52  | 80  | 15  |
| Ahmed et al.               | India   | 2012 | 100 | 94  | 33  | 69  |
| Mukherjee et al.           | India   | 2013 | 97  | 80  | 22  |
| Sharieff et al.            | India   | 2013 | 93  | 98  | 70  | 3   |
| Niranjan et al.            | India   | 2014 | 84  | 75  | 64  | 17  |
| Present study              | India   | 2014 | 100 | 95  | 74  | 13  |

AMP: Ampicillin, CIP: Ciprofloxacin, COT: Trimethoprim-sulfamethoxazole, Nit: Nitrofurantoin, HA-UTI: Hospital-acquired urinary tract infection, CA-UTI: Community-acquired UTI, The shaded rows shows studies on CA-UTI and the nonshaded rows show studies on HA-UTI, The figures indicate percentage of resistant isolates.

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