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# Isolation of Bacteria Causing Urinary Tract Infections and their Antibiotic Susceptibility Profile at Anwer Khan Modern Medical College Hospital

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ABSTRACT

Among hospitalized patients, the most common nosocomial infection is Urinary tract infection (UTI). The knowledge about the type of pathogens responsible for UTI and susceptibility and resistance pattern of the causative agents at a specific area may help the doctors to choose correct treatment regimen. This study was aimed to investigate the antibiotic susceptibility and resistance pattern of isolated urinary pathogens. This study was done at Anwer Khan Modern Medical College Hospital, Dhaka during January- June, 2011. Out of 498 clinical samples of urine collected, 245 (49.19%) showed significant bacterial growth. The most common pathogens isolated were *Escherichia coli* (142, 58.0%), *Streptococcus feacalis* (38, 15.5%), *Pseudomonus* (20, 8.2%), *Klebsiella* species (20, 8.2%) and *Staphylococcus epidermidis* (14, 5.7%). Members of the Enterobacteriaceae were 75%-100%sensitive to Amikacin and Nitrofurantoin while they were found variably sensitive to other commonly used antibiotics. Pseudomonas species were found 90% sensitive to Meropenem and 70% to Amikacin. Strep. feacalis were found 94.7% sensitive to Amoxicillin, 84.2% to Amoxiclave and 78.9% to Ciprofloxacin, 65.5% to Cephalexin, 50% to Ceftriaxone. The clinicians should use Meropenem and Amikacin selectively in cases of un-responsiveness to commonly used antibiotics.

**Key words:** Urinary tract infection, Nosocomial infection, Escherichia coli, Klebsiella species

## Introduction

Urinary tract infection (UTI) 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. Moreover, UTI was found as the most common causes of nosocomial infection among hospitalized patients[1]. With advancing age, the incidence of UTI increases in men due to prostate enlargement and neurogenic bladder[2]. Recurrent UTI are common and can lead to irreversible damage to the kidneys, resulting in renal hypertension and renal failure in server cases[3]. In the community, women are more prone to develop UTI. It has been observed that about 20% of the women experienced a single episode of UTI during their lifetime, and 3% of women had more than one episode of UTI per year[4]. Pregnancy also makes the women more susceptible to the infection[5]. Catheter-associated UTI is a trenchant problem with about 10% of the patients developing bacteriuria[6].

It is universally accepted that UTI can only be ascertained on the basis of microscopy and microbial culture of urine. The dip stick method used in many centres serves only as a screening method but culture is needed for final diagnosis[7]. In almost all cases of nosocomial UTI, there is a need to start treatment before the final microbiological results are available. knowledge about the types of pathogens responsible for UTIs and their resistance pattern may help the clinician to choose the correct empirical treatment.

Studies from India, Bangladesh and Nepal have reported an increased resistance of the urinary pathogens to commonly used antibiotics[8-10]. Any information from similar studies was not available in this hospital. Hence, this study was undertaken to find out the frequency and antibiotic susceptibility pattern of urinary pathogens isolated from urine samples of suspected cases of UTIs at Anwer Khan Modern Medical College Hospital, Dhaka.

## Methods

This was a cross-sectional study conducted at the department of Microbiology, Anwer Khan Modern Medical College Hospital, Dhaka.

The samples of urine were obtained from patients of various clinical wards and outpatients department of Anwer Khan Modern Medical College Hospital, Dhaka, during the period of January, 2011 to June, 2011.

The patients having suggestive symptoms and /or signs were suspected as cases of UTI. Urine samples were collected by standard mid-stream clean-catch method from all the cases. Urine samples were also collected from catheterized patients. The samples were inoculated on the Blood agar and MacConkey agar media by calibrated wire loop and incubated at 370C overnight. The plates were observed for colony morphology, Gram-stain characteristics and relevant biochemical tests[11]. Culture results were interpreted according to the standard criteria and a growth of ?105 colony forming units/ml was considered as significant bacteriuria[12]. Antibiotic susceptibility test was carried out by the Kirby Bauer technique13 and interpretations were made for each bacterial isolate following interpretative criteria recommended by the National Committee for Clinical Laboratory Standards (NCCLS)[14].

Appropriate quality control strains were used to validate the results of the antimicrobial disk. The following were the quality control strains used: Pseudomonas species NCTC-10662, Staphylococcus aureus NCTC-6571, Escheichia coli NCTC-10418.

## Results

Out of 498 samples of urine, 245 (49.19%) showed significant growth of uropathogens. Considering age distribution of the culture-positive case, 49 (20.0%) were children aged 10 years of less, and 64 (26.1%) were aged 41-60 years. In all age groups, females were more frequently affected than males. (Table I)

**Table I.** Age and sex distribution of the culture positive urine samples

| Age groups in | No of samples | | |
|---|---|---|---|
| | male | female | Total |
| 0-10 | 23 | 26 | 49 (20.0%) |
| 11-20 | 4 | 9 | 13 (5.3%) |
| 21-40 | 15 | 54 | 69 (28.2%) |
| 41-60 | 25 | 39 | 64 (26.1%) |
| >60 | 19 | 31 | 50 (20.4%) |
| Total | 86 | 159 | 245 |

The commonest organisms isolated were

Escheriachia coli (142, 58.0%) and Str.fea (38, 15.5%), Pseudomonas species (20, 8.2%), Klebsiella species (20, 8.2%) and others including Coagulase-negative Staphylococcus (14, 5.7%). (Table II)

**Table II:** Distribution of bacterial isolates among 245 culture positive cases.

| Name of isolates | male | female | Total (%) | 95% CI |
|---|---|---|---|---|
| E.Coli | 46 | 96 | 142 (58.0%) | 49.9 - 66.1 |
| Str.fea | 14 | 24 | 38 (15.5%) | 4.0 - 27.0 |
| Ps | 11 | 9 | 20 (8.2%) | -3.8 - 20.2 |
| Kl.pn | 5 | 15 | 20 (8.2%) | -3.8 - 20.2 |
| Sta.epi | 6 | 8 | 14 (5.7%) | -6.4 - 17.8 |
| Proteus | 2 | 2 | 4 (1.6%) | -10.7 - 13.9 |
| Ace | 1 | 2 | 3 (1.2%) | -11.1 - 13.5 |
| Citro | 1 | 2 | 3 (1.2%) | -11.1 - 13.5 |
| Sta.sap | 0 | 1 | 1 (0.4%) | -12.0 - 12.8 |
| Total | 86 | 159 | 245 | |

E.coli and Klebsiella were found highly sensitive to Amikacin and Nitrofurantoin, but almost all were resistant to Amoxiclave, Amoxicillin, Gentamicin and Co-trimoxazole, and variably sensitive to Ceftriaxon, Ceftazidime, Meropenem and Ciprofloxacin.

Proteus species were 100% sensitive to Ceftriaxon, Ceftazidime, Cefixime, Ciprofloxacin, Amikacin and 75% to Meropenem and Nitrofurantoin, while 100% of them were resistant to Amoxicillin and 50% to Co-trimoxazole, Cephalexin, Cephradin. (Tables IIIa and IIIb)

Pseudomonas species were found 90% sensitive to Meropenem and 70% to Amikacin, while 100% of the organism were resistant to Co-trimoxazole,Cephalexin, Cephradin; 95% to Amoxicillin; 80% to Carbenicillin; 75% to Ceftriaxone; 60% to Ceftazidim and Cefixime; 55% to Nitrofurantoin; 45% to Ciprofloxacin. (Tables IIIa and IIIb)

Stap. saprophyticus were 100% sensitive to Co-trimoxazole, Cephradin, Ciprofloxacin, Amoxiclave while 100% were resistant to Amoxicillin, Cephalexin, Cefixime, Ceftriaxon.(Tables IIIa and IIIb)

Citrobacter were 100% sensitive to Ceftriaxon, Ceftazidim, Ciprofloxacin, Amikacin and 66.7% to Cefixime, Nitrofurantoin while 100% were resistant to Amoxicillin, Co-trimoxazole, Cephradin.(Tables IIIa and IIIb)

Strep. feacalis were found 94.7% sensitive to Amoxicillin, 84.2% to Amoxiclave and 78.9% to Ciprofloxacin, 65.5% to Cephalexin, 50% to Ceftriaxone and 97.4% resistant to Co-trimoxazole, 92.1% to Gentamicine, 68.4% to Cephradin, 52.6% to Cefixime.(Tables IIIa and IIIb)

Staph. epidermidis was 85.7% sensitive to Amoxicillin and Cephradin each, 71.4% to Cephalexin, 50% to Amoxiclave, while variably resistant to Co-trimoxazole, Ceftriaxone, Ciprofloxacin, Cefixime and Gentamicin. (Table IIIa and IIIb)

Table-III (a): Antibiotic sensitivity pattern of bacterial isolates

| Isolated bacteria | Sensitivity Pattern | Number (%) of isolates against antimicrobial agents with 95% CI | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Amoxicillin | Carbenicillin | Cotrimoxazol | Cephalexin | Cephradin | Ceftriaxon | Ceftazidime |
| | S | 3 (2.1) | 0 (.0) | 6 (4.3) | 14 | 10 (7.0) | 103 (72.5) | 108 |
| E. coli | IS | 2 (1.4) | 0 (.00 | 9 (6.3) | 4 (2.8) | 5 (3.5) | 11 (7.7) | 8 (5.6) |
| (n=142) | R | 137 | 5 (3.50 | 122 (85.9) | 124 (87.3) | 125 | 23 (16.2) | 18 (12.7) |
| | ND | | 137 | 5 (3.5) | 0 (.0) | 2 (1.4) | 5 (3.5) | 8 (5.6) |
| | S | 36 | 0 (.0) | 1 (2.6) | 23 (60.5) | 10 | 19 (50.0) | 4 (10.5) |
| Str.fea | IS | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 2 (5.3) | 0 (.0) | 1 (2.6) |
| (n=38) | R | 2 (5.3) | 2 (5.3) | 37 (97.4) | 15 (39.5) | 26 | 10 (26.3) | 1 (2.6) |
| | ND | | 36 | 0 (.0) | 0 (.0) | 0 (.0) | 9 (23.7) | 32 (84.2) |
| | S | 1 (5.0) | 2 (10.0) | 0 (.0) | 0 (.0) | 0 (.0) | 5 (25.0) | 8 (40.0) |
| Ps | IS | 0 (.0) | 1 (5.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=20) | R | 19 | 16 | 20 (100.0) | 20 (100.0) | 20 (100.0) | 15 (75.0) | 12 (60.0) |
| | ND | | 1 (5.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | S | 0 (.0) | 0 (.0) | 1 (5.0) | 1 (5.0) | 1 (5.0) | 12 (60.0) | 11 (55.0) |
| Kl.pn | IS | 0 (.0) | 0 (.0) | 1 (5.0) | 1 (5.0) | 0 (.0) | 0 (.0) | 1 (5.0) |
| (n=20) | R | 20 | 0 (.0) | 18 (90.0) | 18 (90.0) | 19 (95.0) | 8 (40.0) | 7 (35.0) |
| | ND | | 20 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 1 (5.0) |
| | S | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 1 (33.3) | 1 (33.3) |
| Ace | IS | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=3) | R | 3 | 0 (.0) | 3 (100.0) | 3 (100.0) | 3 (100.0) | 2 (66.7) | 2 (66.7) |
| | ND | | 3 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | S | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 3 (100.0) | 3 (100.0) |
| Citro | IS | 0 (.0) | 0 (.0) | 0 (.0) | 1 (33.30 | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=3) | R | 3 | 0 (.0) | 3 (100.0) | 2 (66.70 | 3 (100.0) | 0 (.0) | 0 (.0) |
| | ND | | 3 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | S | 12 | 0 (.0) | 1 (7.1) | 10 (71.4) | 12 (85.7) | 4 (28.6) | 1 (7.1) |
| Sta.epi | IS | 2 (14.3) | 0 (.0) | 5 (35.7) | 2 (14.3) | 1 (7.1) | 0 (.0) | 0 (.0) |
| (n=14) | R | 0 (.0) | 0 (.0) | 6 (42 .9) | 2 (14.3) | 1 (7.1) | 1 (7.1) | 0 (.0) |
| | ND | | 14 | 2 (14.3) | 0 (.0) | 0 (.0) | 9 (64.3) | 13 (92.9) |
| | S | 0 (.0) | 0 (.0) | 1 (100.0) | 0 (.0) | 1 (100.0) | 0 (.0) | 0 (.0) |
| Sta.sap | IS | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=1) | R | 1 | 0 (.0) | 0 (.0) | 1 (100.0 ) | 0 (.0) | 1 (100.0) | 0 (.0) |
| | ND | | 1 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 1 (100.0) |
| | S | 0 (.0) | 0 (.0) | 1 (25.0) | 0 (.0) | 0 (.0) | 4 (100.0) | 4 (100.0) |
| Proteus | IS | 0 (.0) | 0 (.0) | 0 (.0) | 1 (25.0) | 1 (25.0) | 0 (.0) | 0 (.0) |
| (n=4) | R | 4 | 0 (.0) | 2 (50.0) | 2 (50.0) | 2 (50. 0) | 0 (.0) | 0 (.0) |
| | ND | | 4 | 1 (25.0) | 1 (25.0) | 1 (25.0) | 0 (.0) | 0 (.0) |

**Table-III (b):** Antibiotic sensitivity pattern of bacterial isolates

| Isolated bacteria | Sensitivity Pattern | Number (%) of isolates against antimicrobial agents with 95% CI | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Ciprofloxaci | Cefixime | Gentamicin | Nitrofurantoin | Meropanum | Amikacin | Amoxiclave |
| | S | 90 | 74 | 3 | 131 | 65 (45.8) | 136 | 2 (1.4) |
| E. coli | IS | 11 | 4 | 1 | 2 (1.4) | 8 (5.6) | 2 (1.4) | 0 (.0) |
| (n=142) | R | 38 | 42 | 4 | 2 (1.4) | 6 (4.2) | 2 (1.4) | 1 (0.7) |
| | ND | 3 | 22 | 134 | 7 (4.9) | 63 (44.4) | 2 (1.4) | 139 |
| | S | 30 | 10 | 0 (.0) | 2 (5.3) | 0 (.0) | 3 (7.9) | 32 (84.2) |
| Str.fea | IS | 3 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 2 (5.3) |
| (n=38) | R | 3 | 20 | 35 | 0 (.0) | 3 (7.9) | 1 (2.6) | 0 (.0) |
| | ND | 2 | 8 | 3 | 36 (94.7) | 35 (92.1) | 34 (89.5) | 4 (10.5) |
| | S | 11 | 1 | 1 | 4 (20.0) | 18 (90.0) | 14 (70.0) | 0 (.0) |
| Ps | IS | 0 (.0) | 0 (.0) | 0 (.0) | 1 (5.0) | 0 (.0) | 3 (15.0) | 0 (.0) |
| (n=20) | R | 9 | 12 | 7 | 11 (55.0) | 2 (10.0) | 3 (15.0) | 0 (.0) |
| | ND | 0 (.0) | 7 | 12 | 4 (20.0) | 0 (.0) | 0 (.0) | 20 |
| | S | 12 | 3 | 0 (.0) | 17 (85.0) | 11 (55.0) | 19 (95.0) | 1 (5.0) |
| Kl.pn | IS | 1 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=20) | R | 7 | 13 | 0 (.0) | 1 (5.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | ND | 0 (.0) | 4 | 20 | 2 (10.0) | 9 (45.0) | 1 (5.0) | 19 (95.0) |
| | S | 1 | 0 (.0) | 0 (.0) | 3 (100.0) | 3 (100.0) | 3 (100.0) | 0 (.0) |
| Ace | IS | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=3) | R | 2 | 3 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | ND | 0 (.0) | 0 (.0) | 3 | 0 (.0) | 0 (.0) | 0 (.0) | 3 (100.0) |
| | S | 3 | 2 | 0 (.0) | 2 (66.7) | 0 (.0) | 3 (100.0) | 0 (.0) |
| Citro | IS | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=3) | R | 0 (.0) | 1 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | ND | 0 (.0) | 0 (.0) | 3 | 1 (33.3) | 3 (100.0) | 0 (.0) | 3 (100.0) |
| | S | 6 | 3 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 7 (50.0) |
| Sta.epi | IS | 8 | 0 (.0) | 2 | 0 (.0) | 0 (.0) | 0 (.0) | 6 (42.9) |
| (n=14) | R | 0 (.0) | 2 | 4 | 0 (.0) | 0 (.0) | 1 (7.1) | 1 (7.1) |
| | ND | 0 (.0) | 9 | 8 | 14 | 14 (100.0) | 13 (92.9) | 0 (.0) |
| | S | 1 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 1 (100.0) |
| Sta.sap | IS | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=1) | R | 0 (.0) | 1 | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | ND | 0 (.0) | 0 (.0) | 1 | 1 (100.0) | 1 (100.0) | 1 (100.0) | 0 (.0) |
| | S | 4 | 4 | 0 (.0) | 3 (75.0) | 3 (75.0) | 4 (100.0) | 1 (25.0) |
| Proteus | IS | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| (n=4) | R | 0 (.0) | 0 (.0) | 0 (.0) | 1 (25.0) | 0 (.0) | 0 (.0) | 0 (.0) |
| | ND | 0 (.0) | 0 (.0) | 4 | 0 (.0) | 1 (25.0) | 0 (.0) | 3 (75.0) |

## Discussion

Identification of the uropathogens and their susceptibility pattern is very important in treating the cases of Urinary Tract Infections (UTI). In the present study, urine specimens were cultured to see pattern of uropathogens and some 245 (49.19%) of the urine showed significant growth of bacteria. So, majority (50.81%) of the cases remaining showed either insignificant bacteriuria or no growth with urine from the suspected cases of UTI. Prior antibiotic therapy before submitting the urine samples, and clinical conditions like non-gonococcal urethritis or others that mimic UTI could be that factors responsible for insignificant bacteriuria or no growth of Coagulase-negative Staphyloco ccuswhich are supposed to be non-pathogenic. This indicates the need for educating the patients about the method of collection of clean catch mid-steam urine specimens.

The age and sex distribution of the patients diagnosed with UTI among the hospitalized patients and those attending the outpatient department followed the natural epidemiological pattern of UTI. There was a predominance of young and middle aged females, whereas in the children and younger age groups, almost equal proportions of male and females had UTI.

In the present study, the most common pathogens isolate was Escherichia coli-58.0%, followed by Strep. feacalis-15.5%, Klebsiella & Pseudomonous species-8.2%, Staphylococcus epidermidis (5.7%), Proteus species (1.6%), Acenatobacter & Citrobacter (1.2%) and Staphylococcus saprophyticus (0.4%). The isolation rate of urinary pathogens of the present study is consistent with reports of the studies published elsewhere recently[9,15,16].

E. coli was the principal pathogen isolated showin a high susceptibility to Amikacin (95.8%), Nitrofurantion (92.3%), but showed variable sensitivity to other commonly used antibiotics. This is consistent with reports from different countries who have reported an increasing resistance to Amoxicillin, Ciprofloxacin, and Ceftrixone[9,16,17.] Another study from Bangladesh reported and increases resistance of the uropathogens to Ciprofloxacin[10].

In the present study, Klebsiella species also showed high susceptibility to Amikacin (95.0%) and Nitrofurantion (80.0%), but were relatively resistant to commonly used antibiotics. Proteus species were 100% sensitive to Ceftriaxon, Ceftazidime, Cefixime, Ciprofloxacin, Amikacin and 75% to Meropenem and Nitrofurantoin. This finding is comparable to Manjula et al of India,18 who found members of Enterobacterieacae variably sensitive to Amoxiclav, Ceftriaxone, Ceftazidmie and Ciprofloxacin but found all isolates sensitive to Imipenem. Similar susceptibility pattern were also reported by other investigators[19].

Pseudomonas species, a common cause of hospital-acquired UTI, was found less sensitive to the common antibiotics but sensitive to Meropenem (90%) and Amikacin (70%).

Similar results were reported by investigators from other countries[16,20]. Pseudomonas species were relatively susceptible to the second line of anti-pseudomonas drugs and most of these were associated with high-level resistance to the first-line antibiotics investigated namely Amoxiclav, Ceftriaxone, Ciprofloxacin and Gentamicin. This may be due to widespread use of common antibiotics in the hospital and cross-resistance among different bacteria.

The results of the present study showed that sensitivity rate of the ruopathogens were low for Co-trimoxazole and Amoxicillin. This low sensitivity could be due to widespread use of the antibiotics in the community. It is possible that the low sensitivity is present among uropathogens of the nosocomial as well as community-acquired UTI. The patients attending outpatient department and some of the hospitalized patients may be having community-acquired UTI. In the present study, community-acquired UTI. In the present study, community-accquired UTI and nosocomial UTI were not been distinguished. This was the main limitation of the study.

A high isolation rate of pathogens from urine samples of clinically suspected UTI shows a good correlation between clinical findings and microbiological methods. Gram-negative bacteria were the commonest organism isolated, among which E.coli was the principal urinary.

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