ORIGINAL ARTICLE

Antibiotic-resistance of Gram-negative Urinary Pathogens in a Tertiary Care Hospital in Dhaka

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Abstract:

Urinary tract infection is one of the most common community-acquired and hospital-acquired infections in Bangladesh as well as around the world. Every year many men and women suffer from UTI and day by day treatment becomes difficult due to the development of antibiotic resistance. Our study aimed to investigate the antibiotic resistance of urinary pathogens isolated at Holy Family Red Crescent Medical College (HFRCMC) from January to December 2018. Out of 4258 urine samples,the total urine-positive samples were 1063. The most common pathogens isolated were Escherichia coli (51.4%), Klebsiella species (38.8%), Pseudomonas species (7.7%), and Acinetobacter species (2.2%%). E. coli and Klebsiella were found highly sensitive to Colistin, Imipenem, Meropenem, Nitrofurantoin, and Amikacin, but almost all were resistant to Cephalosporins and variably sensitive to Amoxiclav, Gentamicin, Ciprofloxacin, Cotrimoxazole, andPiperacillintazobactam. Pseudomonas species were found to havelow-level resistance to colistin, variableresistance to Imipenem and Meropenem, Gentamycin and Amikacin, Ciprofloxacin, and high resistance to Ceftazidime and Cefepime. Acinetobacter was found to be highly sensitive to Colistin and thento Co-trimoxazole. Imipenem, Meropenem, Ciprofloxacin, and Gentamycin showed variable resistance, and Cephalosporine, Amoxiclav, and Piperacillin tazobactam showed high resistance.

Key words: UTI, E.coli, resistance, gram-negative organism.

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Introduction

Urinary tract infection is one of the most common community-acquired and hospital-acquired infections in Bangladesh as well as around the world. UTI affects 250 million people annually with significant morbidity and high medical costs and it is the causeof death of 150 million people worldwide[1].

Community-acquired UTI occurs in many men and women each year, and the costs of caring for those people are very high in Bangladesh. Approximately, 60% of all women experience at least one episode of UTI within their lifetime and roughly 20–30% of women suffer from repeated infections[2,3]. Pregnancy also makes the women more susceptible to the infection[4]. About 20% of the male population is affected by UTI in their lifetime [5]. With advancing age, the risk of UTI increases in men due to the enlargement of the prostate and neurogenic bladder[6]. Recurrent UTIs frequently occur and may lead to irreversible damage to the

kidneys, resulting in renal hypertension and renal failure in severe cases[7]. Another important problem is Catheter-associated UTI which may progress to bacteriuria in 10% of patients[8]. In this one-year study period, a total of 4258 clinically suspected UTI patients' samples were collected.All the samples were cultured according to the proper guidelines and antibiotic sensitivity tests were done according to the CLSI guideline.

This study was conducted to find out the antibiotic resistance pattern of urinary pathogens isolated from urine samples of suspected cases of UTIs at Holy Family Red Crescent Medical College Hospital.Studies from India, Bangladesh, and Nepal have reported an increased resistance of urinary pathogens to commonly used antibiotics.

Some studies of the Asia Pacific region mainly Indonesia, Bangladesh, and India have reported an increased resistance to the urinary pathogens to the antibiotic commonly used for treatment[9].

Methodology:

It was a retrospective study conducted in Holy family Red Crescent Medical College Hospital from January to December 2018. Under aseptic precaution, clean catch mid-stream urine was taken in a wide-mouthflat bottom sterile container.

In this one-year study period, a total of 4258 clinically suspected UTI patients' samples were collected. All the samples were inoculated on Blood agar and Mac Conkey's agar media at 37°C for 48 hours. Then the agar plates were examined carefully for bacterial growth. We isolated the organism by observing the colony morphology, hemolysis property, staining character, any kind of pigment production, and some biochemical tests such as KIA, Simmon citrate test, MIU, and oxidase tests[10].

Antibiotic susceptibly test: Samples that showed significant colony count were taken into consideration and antimicrobial sensitivity testing was performed on Muller Hilton agar medium by using Kirby Bauer disc diffusion method as per CLSI guidelines[11]. The antibiotics discs used for susceptibility testing were Amoxycillin, Ciprofloxacin, Ceftazidime, Ceftriaxone, Gentamicin, Amikacin, Tetracycline Nitrofurantoin, Co-trimoxazole, Imipenem and Meropenem, Colistin and PIT.

Results:

From January – December 2018 we got a total of 6376 samples, among them 1537(23.4%) samples showed a positive result.

A total of 24.11% were positive samples. Among 1537 positive samples total urine positive samples were 1063. Which was 69.16% of the total positive sample. Among 4258 urine samples total urine positive samples were 1063. Which was 24.96% of the total positive sample. Among the positive samples, 80.9% were collected from female patients.

Table 1: Distribution of positive isolates identified from the urine samples (N=1063)

Name of the organisms	Number of Positive isolates	Percentage (%)
E.coli	546	51.4
Klebsiella	412	38.8
Pseudomonas	82	7.7
Acinetobacter	23	2.2

Table 2: Major organisms isolated from outdoor, indoor & ICU patients

Organism	Indoor (N=693)	Outdoor (N=234)	ICU&NICU (N=136)	Total (N=1063)
E. coli	377 (69%)	136 (24.9%)	33 (6%)	546
Klebsiella	236	83	93	412
Pseudomonas	64	15	3	82
Acinetobacter	16	0	7	23

Table 3: Antibiotic resistance pattern of major organisms isolated in HFRCMCH (Jan- Dec 2018) (each cell represents the resistance percentage against the corresponding antibiotic)

Antibiotic	E. coli (N=228)	Klebsiella (N=241)	Pseudomonas (N=46)	Acinetobacter (N=36)
Amoxiclav	68.4	67.6	-	71.4
Cotrimoxazole	52.7	56.7	-	16.7
Tetracycline	48.8	56.3	-	-
Ciprofloxacin	57.6	47.1	35.4	34.8
Ceftriaxone	70.5	667.9	-	54.5
Colistin	6.9	10	8.9	5.9
Gentamycin	18.9	19.1	32.1	30
Amikacin	13.6	12.4	28	43.5
Mecillinam	34	22.4	-	-
Imipenem	7.5	6.6	28	30.8
Meropenem	8.3	7.8	29.3	30.4
Nitrofurantoin	9.1	14.2	-	-
Ceftazidime	55.6	66.7	66.7	63.2
Cefuroxime	76	71.8	-	72.7
Cefepime	75	60	64.2	66.7
Piperacillin-Tazobactam	40.7	46.2	48.1	63.2
Levofloxacin			46.6	

E. coli and Klebsiella were found highly sensitive to Colistin, Imipenem, Meropenem, nitrofurantoin, and Amikacin, but almost all were resistant to Cephalosporin and variably sensitive to Amoxiclav, Gentamicin, and Ciprofloxacin, Cotrimoxazole, Piperacillin tazobactam.

Pseudomonas species were found 8.9% resistant to colistin,28-29% resistant to Imipenem and Meropenem, 28-32 % to Gentamycin and Amikacin, 34.5 % to Ciprofloxacin and 64-66 % to Ceftazidime and Cefepime. Acinetobacter was found highly sensitive to Colistinand then Co-trimoxazole. Imipenem, Meropenem, Ciprofloxacin, and Gentamycin showed 30- 34 % resistance. Cephalosporine, Amoxiclav, and Piperacillin tazobactam showed 60-70% resistance.

Discussion:

Urinary tract infection is a very important burden issue as it occurs in both community and hospital. However, the pattern of antimicrobial resistance varies in different regions. In our center, 24.11% positive culture report was found among all samples, which was nearer to one of the studies done in Sylhet Women Medical College in 2021 which was 28%[12].

In our study, the sex distribution of our patients is similar to those of other reported studies in our country showing a predominance of females (77%) with UTI[13.14,15]. The increased incidence of UTI among females is due to the differences between male and female genitourinary systems in anatomy. The female urethra is relatively short, reducing the distance for bacterial ingress., the proximity of the anus facilitates the colonization of bacteria, and host factors such as changes in normal vaginal flora,pregnancy, and the perinatal period. In the post-menopausal period, falling estrogen levels interfere with the vaginal epithelium, contributing to its gradual atrophy.Pelvic organ prolapse and urinary incontinence also contribute to frequent UTIs[16,17].

In our study, we found the leading uropathogen is E.coli which is 51.4%. indoor 69% and OPD it is 24.9%. One study conducted in DMC showed predominant organism was E. coli (63.28%)[18]. There was another study conducted in BSMMU and the result was E.coli 63.93% (19). All studies showed similar types of results. We found 2nd common organism is Klebsiella 38.8%. One study in BSMMU showed2nd common isolate of UTI was Klebsiella 17.09%19. Pseudomonas and Acinetobacter bacteria are other important isolatesrespectively 7.7% and 2.2%. The study done at BSMMU also found similar types of results[19].

Our data showed in outdoor cases of UTI, E. coli, and Klebsiellaarethe more prominent organisms. This study was slightly similar to a study conducted in Italy.They found E.coli and Klebsiella were the more commonpathogens for outdoor patients[20]. Inindoor patients,E. coli and Klebsiella are major pathogens like in many other hospitals, and then, Pseudomonas and Acinetobacter were the next common pathogens. [21]

We found E. coli and Klebsiella were highly resistant to Ceftriaxone 70.5% and 67.9% respectively, Cefuroxime 76% and 71.8% respectively, Cefepime 75% and 60% respectively,and Amoxiclav 68.4% and 67.6 respectively, variably sensitive to Cotrimoxazole 52.7% and 56.7%, Tetracycline 48.8 and 56.3%, Ciprofloxacin 57.6% and 47.1% but sensitive toImipenem 7.5% and 6.6%, Meropenem 8.3% and 7.8%, Colistin 6.9% and 10% and Nitrofurantoin 9.1% and 14.2%. This study was similar to a study conducted at Chittagong Medical College in 2018 and another tertiary medical hospital.[21, 22, 18]

Pseudomonas species were found 66.7% resistant to Ceftazidime, 64.2 % to Cefepime,35.4% to Ciprofloxacin, 32.1% to Gentamycin, 28 % to Amikacin.Imipenem and Meropenem also showed 28 and 29.3% resistancerespectively. The study was similar to other studies. [21, 22]

Acinetobacter showed 71.4% resistance to Amoxiclav, 72.7% to Cefuroxime, 66.7% to Cefepime,63.2% to Ceftazidime, 63.2% to Piperacillin-Tazobactam, and 54.5% to Ceftriaxone. As a hospital-acquired pathogen, it also showed 30.8%, and 30.45% resistance to Imipenem and Meropenem, 43.5% to Amikacin, 30 % to Gentamycin, and 34.8% to Ciprofloxacin.Some other studies showed similar types of results.[23,24]

Conclusion:

In this study conducted in Holy Family Red Crescent Medical College Hospital, the urine culture positive sample was high among all positive samples and these mainly come from female patients. E. coli was the most common uropathogen and becameresistant to most commonly used drugs. To treat the patients

with UTI we can use Nitrofurantoin. To overcome the challenge of this upcoming problem Imipenem and Meropenem are good choices along with Nitrofurantoin.

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