ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Abedin *et al*., 2022
DOI: 10.21276/SSR-IIJLS.2022.8.4.2

Research Article

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Prevalence and Antimicrobial Susceptibility Pattern of Pathogens Isolated from Different Age Groups with Urinary Tract Infection at Tangail, Bangladesh

Mohammad Zakerin Abedin[1*], Farjana Akter Koly[2], Md. Babul Aktar[1], Muhammad Irfanul Islam[1], Md. Anisur Rahaman[1], Md. Easin Arfat[2], Noor-E-Kashif Farnaz[2], Md. Oyes Quruni[3], Sajjad Hossen Chowdhury[4], Rubait Hasan[5], Jamiatul Husna Shathi[5], Abdullah Aktar Ahmed[1]

[1]Department of Microbiology, School of Biomedical Sciences, Khwaja Yunus Ali University, Sirajganj, Bangladesh
[2]Department of Microbiology, University of Chittagong, Chittagong, Bangladesh
[3]Department of Pathology, Shekh Hasina Medical College, Tangail, Bangladesh
[4]Faculty of Basic Medical and Pharmaceutical Science, University of Science and Technology Chittagong, Bangladesh
[5]Department of Biochemistry and Biotechnology, Khwaja Yunus Ali University, Sirajganj, Bangladesh

***Address for Correspondence:** Mohammad Zakerin Abedin, Assistant Professor & Head, Department of Microbiology, School of Biomedical Sciences, Khwaja Yunus Ali University, Sirajganj, Bangladesh
E-mail: zakerin.du2016@gmail.com

Received: 16 Feb 2022/ Revised: 27 Apr 2022/ Accepted: 19 June 2022

ABSTRACT

Abstract: Urinary tract infections are commonly detected in several hospitals and typical medical health centres. The antibiotic policy must be updated based on current knowledge about causative agents and their antibiotic susceptibility patterns. The goal of this study was to find out exactly how frequently microbes cause urinary infections and their antibiotic susceptibility patterns.

Methods: Mid-stream urine samples were analyzed microscopically for a routine examination, and bacterial pathogens were isolated by conventional culture method using Chromogenic UTI media and MacConkey agar culture media. A group of biochemical parameters were utilized for bacterial identification and characterization. Finally, *in vitro* antimicrobial susceptibility was performed by the Kirby- Bauer disc diffusion methods against 14 commercially available antibiotics.

Results: A total of 1288 clinical samples from UTI patients were obtained aseptically, with 398 showing positive growth with a range of bacteria. Females have a higher prevalence of UTI than males. *E. coli* was the most common pathogen found (82.86%), followed by *Enterococcus faecalis* (8.44%), *Klebsiella pneumoniae* (5.63%), *Pseudomonas aeruginosa* (2.81%), and *Proteus mirabilis* (0.26%). The majority of the bacteria had a high sensitivity to Meropenem (98.25%); moderate sensitivity to Amoxicillin, Azithromycin, Ciprofloxacin, Gentamicin, Levofloxacin, Ceftriaxone, Cefepime, and Nitrofurantoin; and low sensitivity (20%) to Cefixime, Cephradine, Cefuroxime, Clindamycin, and Trimethoprime.

Conclusion: These findings have clinical and epidemiological implications, improving study to identify causative pathogens and pathogen sensitivity patterns in urinary tract infections, as well as clinicians' knowledge of how to choose the best antibiotics and, ultimately, contributing to patient diagnosis and treatment.

Key-words: Antibiotics susceptibility, Bacterial isolates, Diagnosis, Prevalence, UTIs

INTRODUCTION

In ordinary clinical practice and hospital settings, urinary tract infection is one of the most common nosocomial diseases [1].

How to cite this article
Abedin MZ, Koly FA, Aktar MB, Islam MI, et al. Prevalence and Antimicrobial Susceptibility Pattern of Pathogens Isolated from Different Age Groups with Urinary Tract Infection at Tangail, Bangladesh. SSR Inst. Int. J. Life Sci., 2022; 8(4): 3044-3052.

Access this article online
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It refers to the presence of harmful organisms in the urinary system and is usually categorized as the bladder (cystitis), kidney (pyelonephritis), or urine (bacteriuria) depending on the site of infection [2]. The clinical signs are determined by the affected portion of the urinary tract, the causative organisms, the severity of the disease, and the patient's ability to build an immune response. Urinary tract infection, both chronic and acute, can cause high blood pressure, renal damage, and death [3]. UTIs can occur in all age groups of patients and both genders. UTI is 14 times more common in females than

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in males due to clinical reasons such as anatomical variance, hormone influence, and behavioural patterns [4,5]. Antibiotics for UTIs come in various forms, and the best option is determined by several factors, including the severity of the infection and whether it is acute or recurrent [6]. Unfortunately, due to the widespread use of antimicrobial drugs, which has created antibiotic-resistant bacteria [7], this infection may become much more complex. These resistance traits can be easily transferred across bacteria of other genera via plasmids and other non-genetic mechanisms [8]. Uropathogens have a high rate of resistance [9].

The use of antibiotics is frequently connected to establishing antibiotic resistance and drug resistance. In most cases, UTI treatment is initiated on an empirical basis, with therapy based on data derived from the antimicrobial sensitivity pattern of urinary pathogens in a given community [10]. UTI can be caused by various microbes, although *E. coli* and other Enterobacteriaceae are the most frequent culprits, accounting for around 75% of all isolates. In recumbent, complex, and catheterized patients, *Proteus* sp., *Klebsiella* sp., *Enterobacter* sp., *Serratia* sp., and *Pseudomonas* sp. were also isolated [11].

Regular monitoring of resistance patterns is required to update guidelines for empirical antibiotic therapy due to the evolving and continuous antibiotic resistance phenomena. Furthermore, there is an increasing demand for innovative medications. However, there is very minimal data on multidrug resistance among UTI isolates [12], and ongoing monitoring of antibiotic resistance is essential.

The purpose of this study was to establish the prevalence of microorganisms that cause UTIs and assess the current antibiotic susceptibility pattern of these bacterial pathogens. Clinicians will be able to treat and manage patients with UTI symptoms more effectively.

MATERIALS AND METHODS

Study area and population- From June to December 2020, a seven-month study was conducted in the Department of Microbiology, Khwaja Yunus Ali University, and the Lab Zone and Hormone Center, Tangail, Bangladesh. The population investigated was varied, with people of all ages and sex. A total of 1288 clinical urine samples were obtained from patients from Bangladesh who visited the Lab Zone and Hormone Center. This study was included 398 positive instances.

Sample Collection- Tangail's Lab Zone and Hormone Center received clinically suspected UTI patients (both male and female) for this study. Patients with urinary tract infections had their samples taken in clean, sterile, screw-capped vials. The samples were then taken to a laboratory for additional examination.

Isolation and Identification of Microorganisms- A variety of selective media were used to identify bacterial pathogens. All media were sterilized at 121°C for 15 minutes at 15 lb pressure, as directed by the manufacturer. Bacterial inoculums were inoculated onto chromogenic UTI agar and MacConkey media and incubated at 37°C for 24 hours. After 24 hours, the media showing no signs of bacterial development were incubated for another 48 hours before being declared bacterial-free. Cultural, morphological, and microscopic analysis followed standard methods to isolate and identify all bacteria. Catalase, Citrate, Oxidase, Indole, Motility, and Urease biochemical testing supported the findings [13].

***In-vitro* antibiotic susceptibility testing-** Using Mueller-Hinton agar medium, the Kirby-Bauer disc diffusion method was employed to determine antimicrobial susceptibility against a panel of 14 marketed antibiotics. Bacterial isolates from 24-hour culture plates were taken in the nutrient broth, and then a lawn of test pathogen was produced by evenly spreading inoculums on the Muller Hinton agar plate. The antibiotic-impregnated discs were firmly placed on plates with sterile forceps and then incubated at 37°C for 24-hour; susceptibility was classified as sensitive, resistant or intermediate based on the zones size [14].

Statistical Analysis- To evaluate the data, Excel and SPSS were utilized. The statistical evaluation was checked using descriptive statistics and chi-square tests. The p-value examined as a significant value of "0.5."

RESULTS

During the study, 1288 urine samples were obtained, with 398 (30.9%) showing positive results and the rest showing negative results. Following the further investigation of positive growth samples, it was discovered that the majority of infected people (50.5%) were between the ages of 21 and 40, with 41-60 years, 20 years, and >60 years following (Fig. 1), with the majority of infected people (72.6 %) & female (Table 1).

ISSN (O): 2581-8740 | ISSN (P): 2581-8732
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DOI: 10.21276/SSR-IIJLS.2022.8.4.2

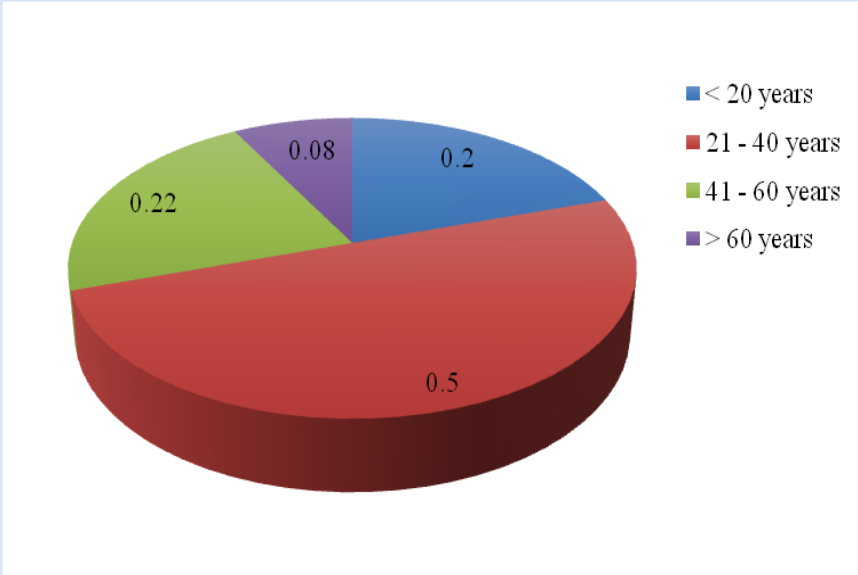

Fig. 1: Distribution of infected persons based on age

Table 1: Prevalence of UTI based on gender

Sex	Number of Samples	Frequency (%)
Female	289	72.6 %
Male	109	27.4 %

The bulk of the organisms detected were *E. coli* (82.86%), followed by *E. faecalis* (8.44 %t), K. *pneumoniae* (5.63%), *P. aeruginosa* (2.81%), and *P. mirabilis* (0.26 %) in biochemical and microbiological testing (Fig. 2).

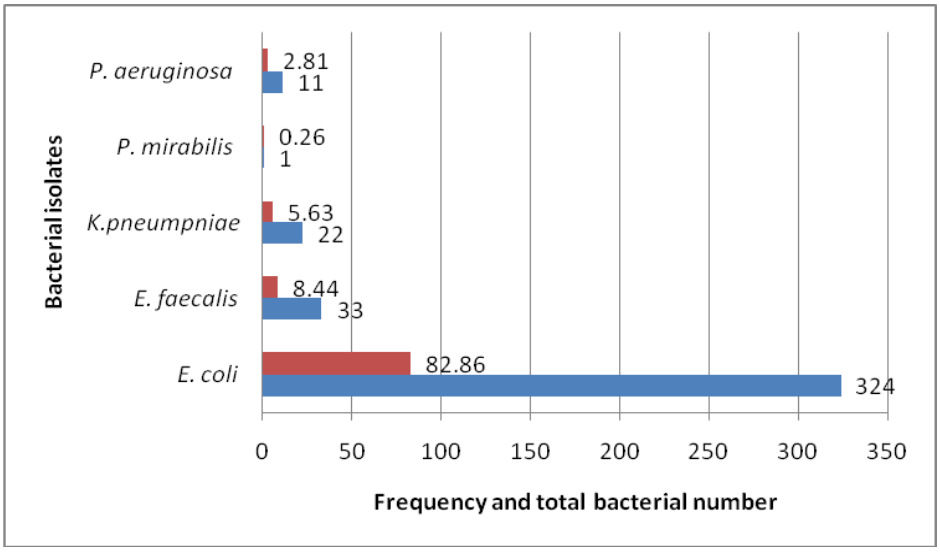

Fig. 2: Prevalence of bacterial pathogens in UTIs

Only Meropenem (97.8%) was shown to be extremely sensitive against *E. coli,* while four antibiotics were found to be extremely resistant: Clindamycin (98.7%), Cefixime (98.4%), Cefuroxime (84.5%), and Cephradine (84.5%). The remaining drugs, Amoxicillin, Azithromycin, Ceftriaxone, Ciprofloxacin, Cefepime, Gentamicin, Nitrofurantoin, Levofloxacin, and Trimethoprim, were moderately sensitive to *E. coli* (Fig. 3).

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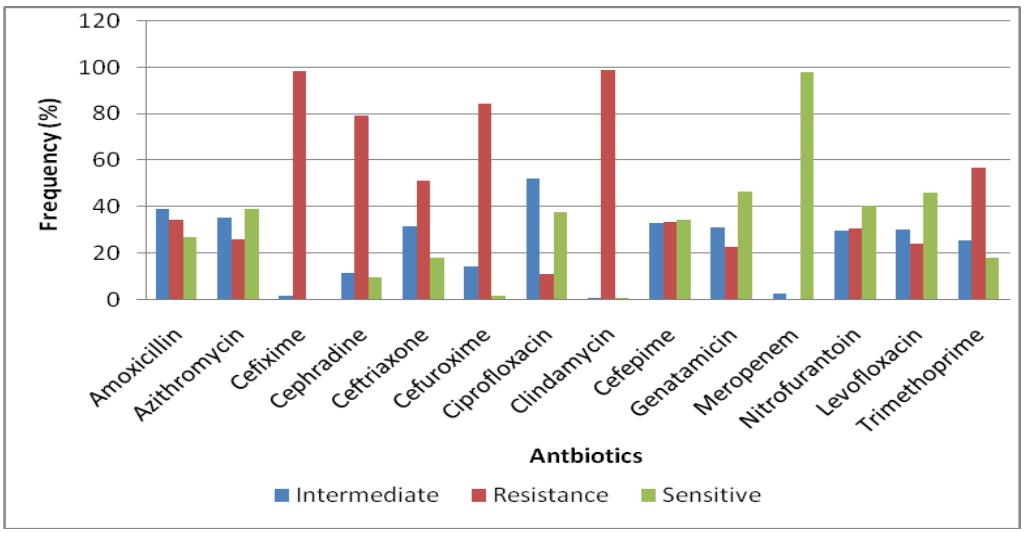

Fig. 3: Antibiotic susceptibility pattern of *E. coli*

Meropenem (100%) was the most sensitive antibiotic against *E. faecalis,* while Cephradine (100%), Clindamycin (100%), Cefixime (96.9%), Ceftriaxone (87.8%), Cefuroxime (78.8%), and Trimethoprim (78.8%) had increased antibiotic resistance (75.7%). Against *E. faecalis*, the remaining drugs were moderately sensitive (Fig. 4).

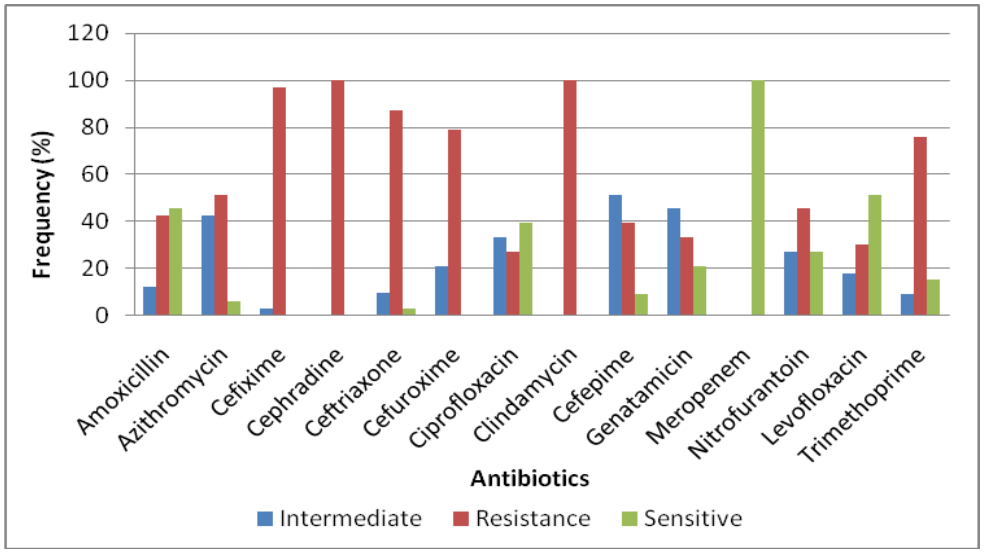

Fig. 4: Antibiotic sensitivity pattern of *E. faecalis*

Meropenem (100%), Cefepime (95.4%), Gentamicin (95.4%), Nitrofurantoin (95.4%), and Ciprofloxacin (95.4%) were found to be susceptible antibiotics against *K. pneumoniae* in our investigation (81.8%). Cefixime (100%), Cephradine (100%), Cefuroxime (100%), Clindamycin (100%), Ceftriaxone (95.4%), Amoxicillin (86.3%), and Levofloxacin (86.3%) were all extremely resistant drugs in this case (86.3%). The antibiotics trimethoprim (90.9%) and azithromycin (86.3%) were moderately effective against *K. pneumoniae* (Fig. 5). Meropenem has a higher sensitivity to *P. aeruginosa* (100%). On the other hand, Cefixime (100%), Cephradine (100%), Cefuroxime (100%), Clindamycin (100%), Nitrofurantoin (100%), Ceftriaxone (90.9%), Trimethoprim (81.8%), and Cefepime (63.6%) were all resistant to *P. aeruginosa*. It was moderately susceptible to Amoxicillin, Azithromycin, Ciprofloxacin, Gentamicin, and Levofloxacin (Fig. 6).

Only Meropenem (100%) and Nitrofurantoin (75%) were highly sensitive to *P. mirabilis*; the majority of the antibiotics used, Cefixime (100%), Cephradine (100%), Ceftriaxone (100%), Cefuroxime (100%), Clindamycin (100%), Cefepime (100%), Trimethoprim (100%), and Levofloxacin (75%), were highly resistant, and the remaining antibiotic (Fig. 7).

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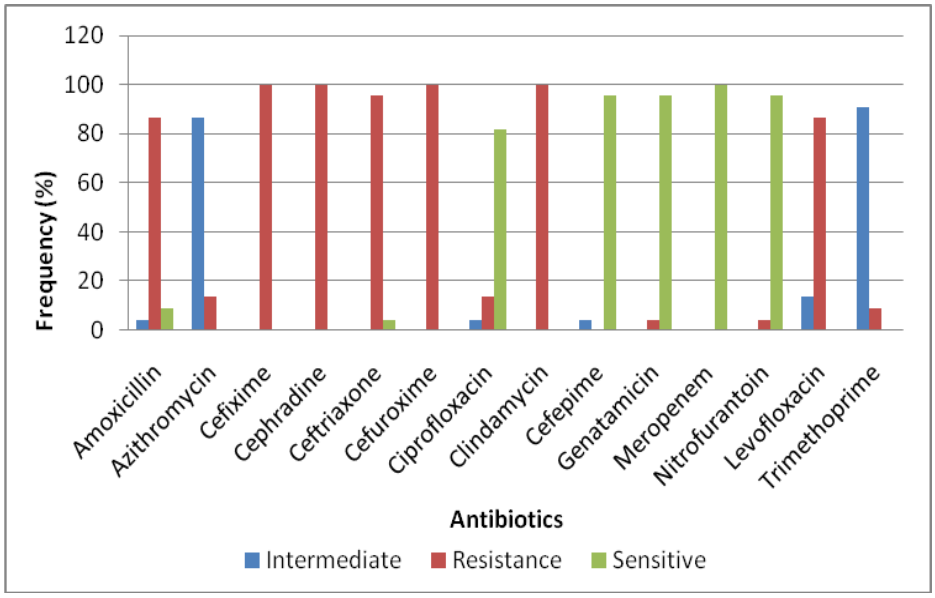

Fig. 5: Antibiotic sensitivity pattern of *K. pneumoniae*

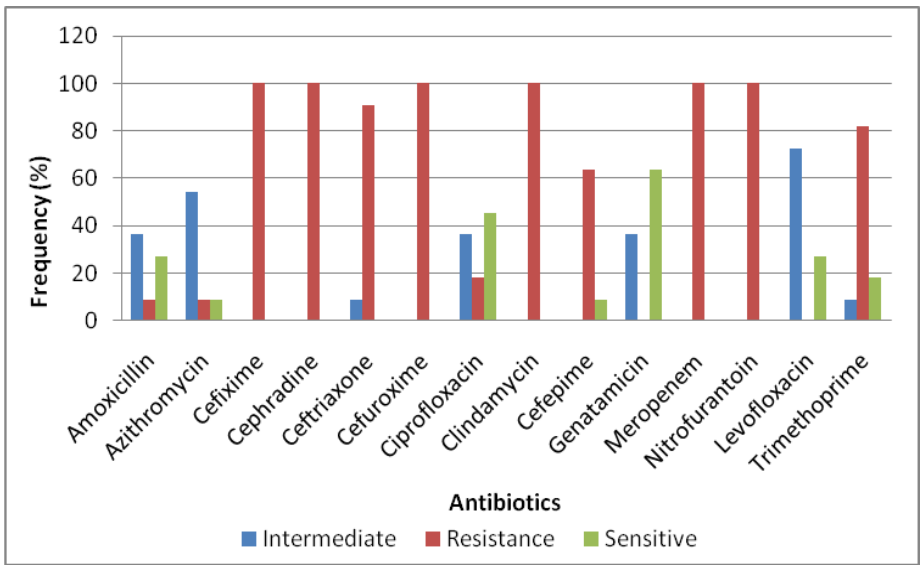

Fig. 6: Antibiotic sensitivity pattern of *P. aeruginosa*

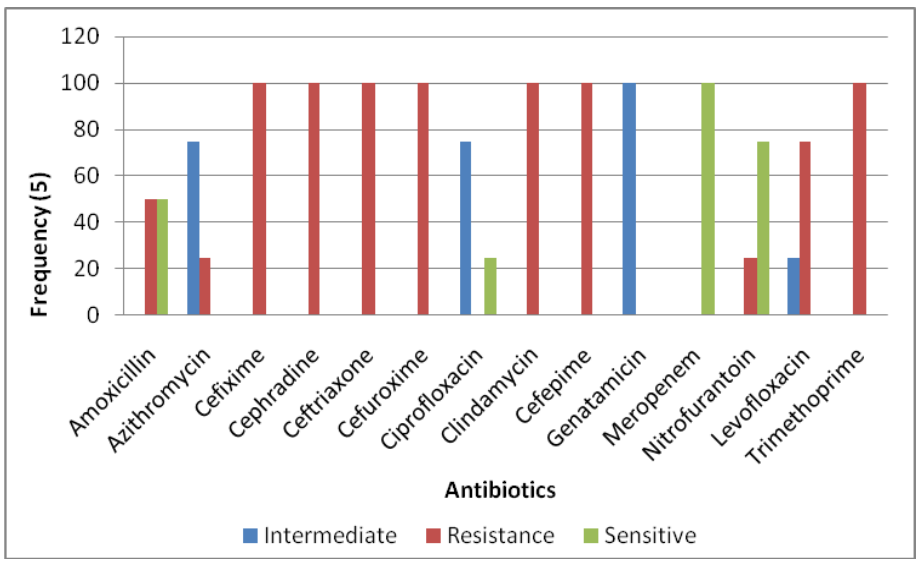

Fig. 7: Antibiotic sensitivity pattern of *P. mirabilis*

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Clindamycin (98.9%), Cefixime (98.50%), Cefuroxime (87.43%), Cephradine (83.1%), Trimethoprim (64.9%), and Ceftriaxone (63.1%) were all highly resistant to *E. coli, E. faecalis, P. aeruginosa, K. pneumoniae,* and *P. mirabilis* in an antimicrobial susceptibility analysis of various isolates from urinary samples. The remaining experimental antibiotics were reasonably responsive to all isolated pathogens, with Meropenem demonstrating the highest sensitivity (98.25%) to all pathogens examined (Table 2).

Table 2: Overall antibiotic sensitivity pattern against UTI pathogens

Antibiotics	Intermediate (I)		Resistance (R)		Sensitive (S)	
	No.	Prevalence (%)	No.	Prevalence (%)	No.	Prevalence (%)
Amoxicillin	120	30.15	170	42.71	108	27.14
Azithromycin	128	32.17	141	35.43	129	32.42
Cefixime	06	1.50	392	98.50	0	0
Cephradine	37	9.30	330	83.1	31	7.78
Ceftriaxone	102	25.7	251	63.1	45	11.30
Cefuroxime	45	11.31	348	87.43	05	1.26
Ciprofloxacin	168	42.2	108	27.2	122	30.65
Clindamycin	02	0.51	394	98.9	02	0.51
Cefepime	106	26.64	182	45.8	110	27.64
Gentamicin	130	32.67	117	29.4	151	37.94
Meropenem	07	1.76	0	0	391	98.25
Nitrofurantoin	95	23.9	168	42.3	135	33.92
Levofloxacin	75	18.85	108	27.13	215	54.0
Trimethoprim	84	21.1	258	64.9	56	14.0

DISCUSSION

Urinary tract infection is one of the most common community-acquired illnesses in Bangladesh, owing to the advent of antibiotic-resistant uropathogens. This study found a greater prevalence of UTIs in females (72.6%) than in males (27.4%), which is consistent with Akhtar *et al*. [15], who found a higher prevalence of UTIs in females (59.3%) than in males (40.7%), which is practically identical to our findings. Even in pediatric patients up to 16 years of age, female UTIs were more prevalent than males to Bitew *et al.* [16]. Unlike us and other regular studies, Isac *et al.* [17] portrayed males (58.07%) as being more predominant than females (41.93%) in being caught by UTIs in their recent study.

Pondei *et al.* [18] found that age groups 21–40 years were more prone to UTIs. The age group of 21–30 years old had the highest incidence in this study.

UTIs are growing more common as people age, with prostate enlargement in males and neurogenic bladder in women being the primary causes [15]. On the other hand, findings by Isac *et al.* [17] about the age distribution of UTIs contradict our current study as they found patients of <1 year of age (46.15%) to be more frequently infected by uropathogens than the three-year-old age group was displayed to be more prevalent in UTIs by Bitew *et al.* [16]. On the contrary, 53% of patients with UTIs were older, ranging from 60 to 90 years, by Alamri *et al.* [19].

Total 324 of the 398 positive samples contained bacteria, with *E. coli* (82.86%) being the most common, followed by *E. faecalis* (8.44%), *K. pneumoniae, P. mirabilis* and *P. aeruginosa* were among the microorganisms recovered from UTI cases. These findings are supported by a recent study by Abedin *et al.* [11]. *E. coli* was the most prevalent

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uropathogen with a considerably high %age of 42.9% and 38.84%, respectively, by Bitew *et al.* [16] and Isac *et al.* [17], which corroborates our current findings. However, the %age of supremacy was quite higher in our study (82.86%). Unlike us, *Klebsiella* sp. was the second most frequent isolate in both studies. Nevertheless, the high prevalence of *E. coli* (79.6%) in our study was also displayed by Unsal *et al.* [20]. Aalpona and Kamrul-Hasan [21] also said that Proteus (21.6% of the time) was the second most common uropathogens.

In our study, the most prevalent uropathogen, *E. coli,* was sensitive only to Meropenem (97.8%). In contrast, other antibiotics were ineffective by a significantly high margin, such as Clindamycin (98.7%), Cefixime (98.4%), Cefuroxime (84.5%), and cephradine (79.0%) against the pathogen. *E. coli* was found to be sensitive to Meropenem (90%) in a study by Aalpona and Kamrul-Hasan [21] at Mymensingh Medical College in Bangladesh; however, the fatal concerns, Gentamycin (83%) and Nitrofurantoin (76%), which were effective against *E. coli* in that study, were found to be impotent to be used as antibiotic therapies in our current study.

Islam *et al.* [22] discovered that *E. coli* was resistant to a large number of first- and second-line antibiotics, including Amoxicillin (100%), Amoxiclav (72%), Co-trimoxazole (89%), Nalidixic acid (78%), Ceftazidime (94%), Ceftriaxone (73%), Cefuroxime (100%), Ciprofloxacin (59%), Cefotaxime (80%), and Cefixime (100%).

In the overall uropathogenic sensitivity pattern, Meropenem had the highest sensitivity (98.25%) against all isolated uropathogens, while Cefixime had no sensitivity. Meropenem had the maximum sensitivity (98.25%), and there was no resistance. This finding was similar to that of Abedin *et al.* [6], who found Meropenem and Imipenem to have the maximum sensitivity against uropathogens. Aalpona and Kamrul-Hasan [21] also found Meropenem (85%) to be the most effective, along with Gentamycin (79%) and Nitrofurantoin (71%). However, Gentamycin (83%) and Nitrofurantoin (76%) were found non-potential as therapeutics in our current study due to developing resistance mechanisms of uropathogens against such antibiotics, which is a matter of grave concern [21]. Clindamycin showed the most significant resistance (98.9%), while Meropenem showed no resistance. Ciprofloxacin had the highest intermediate resistance (42.2%), and Clindamycin had the lowest sensitivity (0.51%). Majumder *et al.* [23] found substantially identical results in Bangladesh. At Mymensingh Medical College, Bangladesh, 80% of the uropathogens were found impractical by Aalpona and Kamrul-Hasan [21] at Mymensingh Medical College, Bangladesh, which was somewhat close to our study. The increasing bacterial resistance to antibiotics in our region could be attributed to a higher prevalence of antibiotic use, even when purchased over-the-counter and without a prescription [24]. As a result of the frequent development of resistance to antibiotics in this certain region, Meropenem (98.25%) was found to be the only considerably effective antibiotic therapy to treat UTIs in that particular area brutally alarming.

CONCLUSIONS

The findings of our current study could provide physicians with guidance in that area when prescribing antibiotics to patients with urinary tract infections. Our future research will focus on the potential causes of antibiotic resistance and ongoing research to determine the diversity of uropathogens and their antibiotic susceptibility patterns, which will help physicians, continue to prescribe appropriately to UTI patients. Eventually, it will play an enormous role in controlling antibiotic resistance development and proper antibiotic therapeutics for urinary tract infections (UTIs).

ACKNOWLEDGMENTS

We would like to appreciate the contribution of Md. Sobur Mia, Lab Zone and Hormone Center, was enormously cooperative during sampling.

CONTRIBUTION OF AUTHORS

Research concept- Mohammad Zakerin Abedin, Abdullah Aktar Ahmed

Research design- Mohammad Zakerin Abedin, Abdullah Aktar Ahmed

Supervision- Abdullah Aktar Ahmed, Md. Babul Aktar, Md. Oyes Quruni

Materials- Md. Babul Aktar, Rubait Hasan, Farjana Akter Koly, Muhammad Irfanul Islam

Data collection- Md. Anisur Rahaman, Farjana Akter Koly, Md. Easin Arfat

Data analysis and Interpretation- Muhammad Irfanul Islam, Noor-E-Kashif Farnaz

Literature search- Sajjad Hossen Chowdhury, Md. Babul Aktar, Md. Anisur Rahaman

ISSN (O): 2581-8740 | ISSN (P): 2581-8732
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DOI: 10.21276/SSR-IIJLS.2022.8.4.2

Writing article- Farjana Akter Koly & Jamiatul Husna Shathi

Critical review- Md. Oyes Quruni. Rubait Hasan, Jamiatul Husna Shathi

Article editing- Md. Easin Arfat, Mohammad Zakerin Abedin

Final approval- All Authors

REFERENCES

[1] Sikora A, Zahra F. Nosocomial infections. Stat Pearls [Internet], 2021.

[2] Ibrahim SA, Mohamed DA, Suleman SK. Microbial causes of urinary tract infection and its sensitivity to antibiotics at Heevi pediatric teaching hospital/Duhok City. Med J Babylon, 2020; 17(1): 109.

[3] Odoki M, AlmustaphaAliero A, Tibyangye J, Maniga JN, Wampande E, et al. Prevalence of bacterial urinary tract infections and associated factors among patients attending hospitals in Bushenyi district, Uganda. Int. J. Microbiol., 2019; 4246780. https://doi.org/10.1155/2019/4246780.

[4] Aydin A, Ahmed K, Zaman I, Khan MS, Dasgupta P. Recurrent urinary tract infections in women. Int Urogynecol J., 2015; 26(6): 795-804.

[5] Tan CW, Chlebicki MP. Urinary tract infections in adults. Singapore Med J., 2016; 57(9): 485.

[6] Abedin MZ, Faruque MO, Sifat Uz Zaman M, Nasim R, et al. Prevalence and *in vitro* Antibiogram Patterns of Urinary Tract Pathogens in Rural Hospitals in Bangladesh. J. Chem Biol Phys Sci., 2020; 3(10): 401-09.

[7] Bungau S, Tit DM, Behl T, Aleya L, Zaha DC. Aspects of excessive antibiotic consumption and environmental influences correlated with the occurrence of resistance to antimicrobial agents. Curr. Opin Environ Sci Health., 2021; 19: 100224.

[8] Yin H, Cai Y, Li G, Wang W, Wong PK, et al. Persistence and environmental geochemistry transformation of antibiotic-resistance bacteria/genes in water at the interface of natural minerals with light irradiation. Crit Rev Environ Sci Technol., 2021; 18: 1-33.

[9] Kot B. Antibiotic resistance among uropathogenic *Escherichia coli*. Pol J Microbiol., 2019; 68(4): 403-15.

[10] Aslam B, Wang W, Arshad MI, Khurshid M, Muzammil S, et al. Antibiotic resistance: a rundown of a global crisis. Infect Drug Resist., 2018; 11: 1645.

[11] Abedin MZ, Yeasmin F, Mia S, Helal HB, Shilpi RY. Bacteriological profile and antimicrobial susceptibility patterns of symptomatic Urinary Tract Infection among patients of different age groups in a tertiary care hospital of Bangladesh. Moroccan J Biol., 2020; 17: 59-66.

[12] Zayyad H, Eliakim-Raz N, Leibovici L, Paul M. Revival of old antibiotics: needs, the state of evidence and expectations. Int J Antimicrob Agents, 2017; 49(5): 536-41.

[13] Kolawole AS, Kolawole OM, Kandaki-Olukemi YT, Babatunde SK, et al. Prevalence of urinary tract infections (UTI) among patients attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa state, Nigeria. Int J Med Med Sci., 2010; 1(5): 163-67.

[14] Bauer AW, Kirby WM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disk method. Am J Clin Pathol., 1966; 45(4): 493-96.

[15] Akhtar N, Rahman R, Sultana S. Antimicrobial sensitivity pattern of *Escherichia coli* causing urinary tract infection in Bangladeshi patients. Am J Microbiol Res., 2016; 4(4): 122-25.

[16] Bitew A, Zena N, Abdeta A. Bacterial and Fungal Profile, Antibiotic Susceptibility Patterns of Bacterial Pathogens and Associated Risk Factors of Urinary Tract Infection Among Symptomatic Pediatrics Patients Attending St. Paul's Hospital Millennium Medical College: A Cross-Sectional Study. Infect Drug Resist., 2022; 6; 15: 1613-24. doi: 10.2147/IDR.S358153.

[17] Isac R, Basaca DG, Olariu IC, Stroescu RF, Ardelean AM, et al. Antibiotic Resistance Patterns of Uropathogens Causing Urinary Tract Infections in Children with Congenital Anomalies of Kidney and Urinary Tract. Children (Basel), 2021; 8(7): 585. doi: 10.3390/children8070585.

[18] Pondei K, Jeremiah I, Lawani E, Nsikak E. The prevalence of symptomatic vulvo-vaginal candidiasis and *Trichomonas vaginalis* infection and associated risk factors among women in the Niger Delta Region of Nigeria. Int Std Res Rev., 2017; 24: 1-10.

[19] Alamri A, Hassan B, Hamid ME. Susceptibility of hospital-acquired uropathogens to first-line antimicrobial agents at a tertiary health-care hospital, Saudi Arabia. Urol Ann., 2021; 13: 166-70.

[20] Unsal H, Kaman A, Tanır G. Relationship between urinalysis findings and responsible pathogens in

ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Abedin *et al*., 2022
DOI: 10.21276/SSR-IIJLS.2022.8.4.2

children with urinary tract infections. J Pediatr Urol., 2019; 15(6): 606. doi: 10.1016/j.jpurol.2019.09.017.

[21]Aalpona FZ, Kamrul-Hasan AB. Study of Bacterial Pathogens in Urinary Tract Infection and their Antimicrobial Sensitivity Pattern in the Setting of Gynecology Outpatient Department. Mymensingh Med J., 2020; 29(4): 838-46.

[22]Islam MR, Hoque MJ, Uddin MN, Dewan A, Haque NB, et al. Antimicrobial Resistance of E Coli Causing Urinary Tract Infection in Bangladesh. Mymensingh Med J., 2022; 31(1): 180-85.

[23]Majumder MI, Ahmed T, Hossain D, Begum SA. Bacteriology and antibiotic sensitivity patterns of urinary tract infections in a tertiary hospital in Bangladesh. Mymensingh Med J., 2014; 23(1): 99-104.

[24]Morgan DJ, Okeke IN, Laxminarayan R, Perencevich EN, Weisenberg S. Non-prescription antimicrobial use worldwide: a systematic review. Lancet Infect Dis., 2011; 11(9): 692-701. doi: 10.1016/S1473-3099(11)70054-8.