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Antibiotic Resistance Pattern of Common Uropathogens among Adult Inpatients of a Tertiary Teaching Hospital

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Authors' contributions

This work was carried out in collaboration between both authors. Author SA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author ASMR managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Introduction: Urinary tract infection is one of the common community and nosocomial problem that we encounter at a daily basis. The mounting problem of emergence of resistant strains of bacteria causing urinary tract infection (UTI) is a great concern. We had tried in this study to outline the local pattern of antibiotic resistance of the commonly found uropathogens.
Materials and Methods: This descriptive study was carried out in the Ad-din Sakina Women's Medical College Hospital, Jashore, Bangladesh on patients attending inpatient Department from January to December 2020. Presence of more than or equal to 10^5 colony forming units/ml in urine culture was considered as significant for UTI. Isolated bacteria were tested by disk diffusion method.
Results: Out of 1170 urine sample tested, 372 (31.8%) were found to be culture positive cases. A clear female preponderance (77.15%) was noted in positive culture rate. *E. coli* was the commonest organism found among all isolates (82.25%) followed by enterococci (4.3%), klebsiella (3.76%), pseudomonas (2.95%), proteus (2.68%), enterobacter (2.15%) and *Staphylococcus aureus* (1.88%). High resistance was noted in *E. coli* isolates against nalidixic acid (77%),

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Cefuroxime (75%), azithromycine (61%), cefotaxime (58%) and ceftazidime (54%). The antibiotic which showed least resistance overall includes imipenem, meropenem, nitrofurantoin and gentamicin.

Conclusions: Antibiotic stewardship in accordance to local resistance and sensitivity pattern of uropathogens is mandatory to prevent the development of multidrug resistant strains.

Keywords: Antibiotic resistance; uropathogens.

1. INTRODUCTION

The discovery of penicillin paved the way of battling infectious disease which was a furious killer in pre-antibiotic era [1]. Till date we are in a maze to fight back the pathogens that infects us. Among all infections encountered by physicians at a daily basis, urinary tract infection (UTI) is very common [2]. Due to the anatomic disposition and host factors, female patients are generally more susceptible to contract UTI than their male counterpart [3]. In a resource constrain country like Bangladesh UTI is usually primarily diagnosed based on patients symptoms and signs followed by urine routine microscopy. The inadvertent empiric treatment with one or more antibiotic, poor compliance, infrequent dosing etc sometimes lead to the development of resistant strains [4]. Despite World health organization's call for antibiotic stewardship, injudicious use of antibiotic is still a widely prevailing issue in this part of the world. The commonest bacteria causing UTI is *Escherichia coli* (*E. coli*) [5]. Almost 80% of all infections can be attributed to *E. coli* [6]. Other common pathogens that are found as a causative agent of UTI are *Proteus, Klebsiella, Enterococcus, and Enterobacter* species [7]. The susceptibility as well as resistance pattern of these uropathogens are changing over the course of time [8]. Dreadfully, the emergence of multi drug resistance organism causing UTI is increasing all around the globe [9]. This has to be stopped as we cannot afford to lose the battle against infection for mare lack of sensible use of the modern miracle: Antibiotic. To ensure this, enough data regarding resistance pattern of common uropathogens should be available to guide the local treatment protocol [10]. The current study thus aimed to delineate the etiological distribution and resistance pattern of common uropathogens which can hopefully help the physicians to decide about guided treatment of UTI.

2. MATERIALS AND METHODS

This descriptive study was conducted in Ad-din Sakina Women's Medical College Hospital, Jashore, Bangladesh from January to December of 2020. Patients who got themselves admitted in inpatient department with suspected UTI cases were included in this study Clean catch midstream sample of urine was collected aseptically for routine microscopic examination and culture sensitivity. Culture plates were incubated at 35 ± 2^0C temperature for about 18–48 hours. A specimen was considered positive for UTI if an organism was cultured at a concentration of more than or equal 10^5 CFU/ml or when an organism was cultured at a concentration of 104 CFU/ml and more than 5 pus cells per high power field were observed on microscopic examination of the urine [11]. Specific bacterial species were confirmed using Gram reactions, morphology, motility test, standard biochemical tests (Citrate, Catalase, Coagulase, bile aesculin test etc) and culture characteristics. Antimicrobial susceptibilities of isolated organisms were determined using Kirby-Bauer disc diffusion system. Antibiotic discs that were used includes: amikacin (30 µg), amoxyclave (30 µg), azithromycin (15 µg), cefepime (30 µg), cefixime (05 µg), cefotaxime (30 µg), ceftazidime (30 µg), cefuroxime (30 µg), ceftriaxone (30 µg), cotrimoxazole (25 µg), cloxacillin (10 µg), cephradine (30 µg), nalidixicacid (30 µg), ciprofloxacin (5 µg), imipenem (10 µg), meropenem (10 µg), nitrofurantoin (300 µg) and gentamicin (10 µg).

3. RESULTS

A total 1170 urine sample were examined and 372 cases were found to be bacteriologically positive cases of UTI. Among the isolates, majority (77.15%) were from female patients and the rest (22.85%) were from male patients. Table 1 showed the demographic distribution of uropathogens.

Escherichia coli was found to be the most frequent organism isolated 306 (82.25%) followed by Enterococci 16 (4.3%), *Klebsiella* 14 (3.76%) *Pseudomonas* 11 (2.95%), *Proteus* 10 (2.68%), *Enterobacte*r 8 (2.15%) and

Staphylococcus aureus 7 (1.88%). This has been presented in Fig. 1.

The antimicrobial resistance pattern of the different microorganisms is shown in Table 2. *E coli* was found to be remarkably resistant to cefuroxime (75%), nalidixic Acid (77%), azithromycin (61%), cefotaxime (58%), ceftazidime (54%), ceftriaxone (49%), Co-trimoxazole (47%), ciprofloxacine (40%), cefipime (33%) and amoxyclav (33%). Better efficacy was found with that of amikacin (2%), Imipenem (1%), nitro furantoin (1%), meropenem (4%) and gentamicin (8%).

In case of Enterococci high level of resistance was found in cefotaxime (95%), cotrimoxazole (93%), azithromycin (89%), ciprofloxacine (87%), ceftazidime (63%), cefixime (61%), ceftriaxone (55%), cefuroxime (53%), cephradine (53%) and meropenem (52%).

Enterococci was found to be 100% resistant to Nalidixic acid. In case of Klebsiella cefuroxime was found to be resistant in 86% cases, ceftazidime in 59%, cefixime in 53%, cotrimoxazole in 51% and cefotaxime in 47% cases. None (0%) of the klebsiella isolates showed resistance to imipenem.

Pseudomonus was found to be highly resistant to nitrofurantoin (92%), cefuroxime (90%), cefixime (82%), nalidixic acid (81%), azithromycine (73%), ceftazidime (72%) and amoxyclav (67%).

Proteus showed low resistance pattern against amikacin (1%), meropenem (1%) and Gentamicin (5%). Imipenem had 0% resistance in Proteus. Enterobacter isolates were fully sensitive to amikacin, cefepime, imipenem and meropenem. It had shown resistance to other antimicrobials in a range of 1 to 7%. Staphylococcus aureus was proved to be highly resistant to nalidixic acid (97%), ceftazidime (91%), cefuroxime (79%), azithromycine (59%), cefepime and cloxacilline (54%). It was fully sensitive to imipenem, nitrofurantoin and gentamicin.

Table 1. Gender distribution of UTI patients

Gender	Sample number	Positive growth	No growth
Male	297 (25.38%)	85 (28.61%)	212 (71.38%)
Female	873 (74.62%)	287 (32.87%)	586 (67.12%)
Total	1170 (100%)	372 (31.8%)	798 (68.2%)

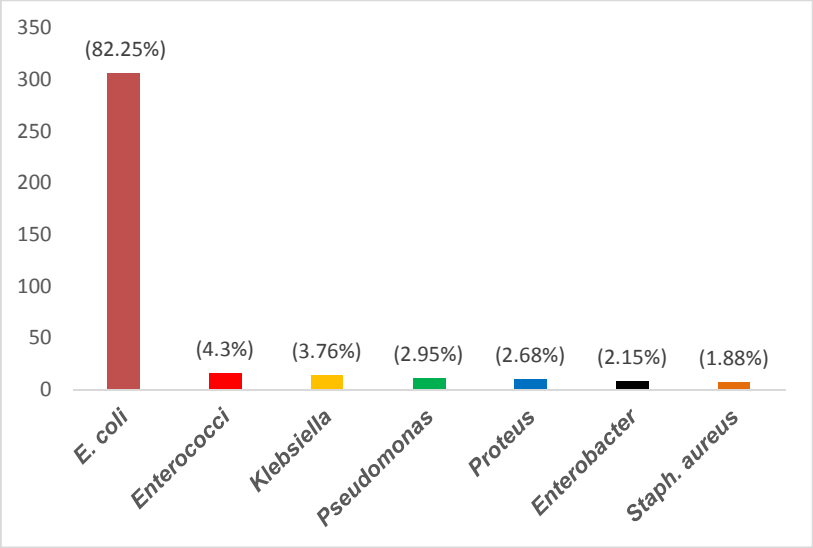

Fig. 1. Distribution of bacterial Isolate in Urine culture

Table 2. Proportion (%) of urinary pathogens resistant to antimicrobial agents

Antimicrobial agent	*E. coli* n=306	Enterococci n=16	*Klebsiella* n=14	*Pseudomonas* n=11	Proteus n=10	*Enterobacter* n=8	*Staph. aureus* n=7
Amikacin	2	14	8	13	1	0	0
Amoxyclave	33	21	51	67	26	2	11
Azithromycin	61	89	43	73	53	7	59
Cefepime	33	77	39	59	21	0	54
Cefixime	41	61	53	82	37	1	93
Cefotaxime	58	95	47	49	29	5	27
Ceftazidime	54	63	59	72	53	6	91
Cefuroxime	75	53	86	90	67	2	79
Ceftriaxone	49	55	44	39	33	4	29
Cotrimoxazole	47	93	51	47	32	3	27
Cloxacillin	-	29	-	-	-	4	54
Cephradine	-	53	-	-	-	3	23
Nalidixic acid	77	100	41	81	75	4	97
Ciprofloxacin	40	87	39	21	17	5	23
Imipenem	1	29	0	10	0	0	0
Meropenem	4	52	18	29	1	0	14
Nitrofurantoin	1	27	26	92	-	1	0
Gentamicin	8	15	16	25	5	1	0

4. DISCUSSION

Urinary tract infection is still a common community problem that can present with a wide range of variable clinical features including acute delirium to life threatening gram negative sepsis [12,13]. The inappropriate, injudicious and sometimes unnecessary use of broad spectrum antibiotic is causing an upsurge of drug resistant strain of uropathogens [14].

In a resource constrain country like ours, many patients get treated by the local, unorthodox village health practitioners who uses antibiotic to treat patient without any knowledge or training. In this current study, we have tried to delineate the resistance pattern of the commonly found bacteria causing UTI.

Majority urinary isolates were found among female participants which is in keeping with the known fact that UTI is more prevalent in women than man [15-17]. This higher preponderance can be explained by the close proximity of the urethral meatus to the anal canal, shorter and straighter urethra and sexual intercourse [18,19].

In our study among all the participants, 31.8% had culture positive UTI. This finding is dissimilar to two other studies done in Bangladesh. Haque et al. [20] have founded a higher (42.66%) and Nahar et al. [21] reported a lower (11.92%) proportion of urinary isolates in their respective studies [20,21]. *E. coli* was by far the commonest organism isolated in our study (82.25%) which is coherent with the study done by Saber et al. [22] (77.8%) in Bangladesh and by Bosch et al. [23] (75%) in South Africa [22,23]. Lower rates (59% and 68%) was reported in two studies conducted in our neighboring country India [24,25]. Unfortunately, we have found high rates of resistance of *E. coli* against commonly used antibiotics including beta lactam, nalidixic acid, azithromycin and ciprofloxacin. This finding is distressing as we commonly use these antibiotics in our country [26].

It is worthy to mention here that, apart from Enterobacter all organisms tested showed remarkable resistance against commonly used cephalosporins. Even third generation cephalosporin were also not satisfyingly sensitive. Drugs that have shown relatively better sensitivity includes injectable like imipenem, meropenem and gentamicin and oral preparations like nitrofurantoin. Carbapenems are not in regular use against uropathogens rather they are kept as reserve drugs. Nitro furantoin was also found to be fairly effective against many uropathogens in studies conducted by others [27-29]. It can be a good empiric treatment while awaiting for drug sensitivity reports to be available [30].

5. CONCLUSIONS

In our country, we are currently facing a real challenge of inadvertent antimicrobial use and as a consequence soaring rate of drug resistant strains causing UTI. If this doesn't stop right now, it will cause a mayhem of multi-drug resistant uropathogens. This issue need to be addressed and we should have our own local guideline to be followed regarding antibiotic use. We hope that, this study will be of some use in determining the appropriate empiric therapy in UTI patients.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICAL APPROVAL

The study was approved by the institutional review board. Informed written consent was collected from every participants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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