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Prevalence Study of Urinary Tract Pathogens in the Patients from a Tertiary Hospital in Bangladesh

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ABSTRACT

Hospitalizations due to urinary tract infections are among the most commonly observed condition throughout the world. The study conducted among a total of 200 positive urine samples comprising male and female patients of different age showed E. coli (120), Klebsiella spp. (56) and Proteus spp. (24). Based on antibiotic susceptibility testing, It was revealed that E. coli showed lowest resistance to cefotaxime (35%) and highest resistance to levofloxacin (60%), whereas, Klebsiella spp. showed resistance to ceftriaxone (30.59%) and amoxicillin (88.33%). Likewise, Proteus spp. observed to have 29.16% (azithromycin) and 70.83% (ciprofloxacin) resistance. Cefotaxime was found to be the best drug for the treatment of E. coli related infections with 66.67% sensitivity. Ceftriaxone (69.41%) sensitive) was also found to be the best drug for the treatment of Klebsiella spp., whereas Proteus spp. could be effectively treated by Azithromycin (70.83% sensitive). Thirty-six (36) Multi drug resistant (MDR) pathogens were found in the sample of the elder males, 29 MDR pathogens were found in the sample of young males, 39 MDR were found in the sample of young females, and 40 MDR were found in the sample of elder females. Sixty eight percent of the isolated strains were highly multidrug resistant. Overall, MDR prevalence was 72%, and E. coli exhibited 54.16% MDR prevalence among isolates. The results revealed a surge in MDR pathogens that could impose major threat among community health.

Keywords: E. coli, Klebsiella, Multi drug resistant, pathogens, UTI.

I. INTRODUCTION

Antibiotic resistance (ABR) is growing significant phenomenon in community health, as it leads to longer hospital stays, increased mortality rate and economic losses. A range of levels of MDR in bacteria has been recognized based on susceptibility to drugs by the terms, multi-resistance (MDR), extensively drug-resistant (XDR) and pan drug-resistant (PDR), viz., characterized as resistance against: at least one of

three classes of antimicrobials (MDR), all antimicrobial classes (PDR) and at least one agent in two or fewer antimicrobial categories (XDR).[1-4]

Urinary tract infections (UTIs) is somehow a serious or complicated clinical problem.[5] It is a frequent type of infection in Bangladesh and other areas of the globe caused by pathogenic and opportunistic microbial colonization.[6] Due to inadequate cleanliness, catheterization, intercourse, pregnancy, and other factors, Bangladesh and other underdeveloped nations suffers from high proportion of UTI patients[7]. Numerous studies have revealed that uropathogens are developing resistance to a wide spectrum of antibiotics despite the fact that they are used to prevent infection of urinary tract[8].

In warm blooded animals, including humans, uropathogenic strains of *E. coli* inhabits the large intestine[9]. The most of community-acquired UTIs are exacerbated by UPEC strains, which are being diagnosed as the etiological agents in 90% of all ambulatory UTI cases[10]. *Klebsiella* spp. is a persistent bacteria that causes urinary tract infection (UTI), creating serious public health concerns across the world. In the recent years, some bacteria became more prevalent with antibiotic resistance specially members of *Klebsiella* genus[11]. *Proteus* spp. are likewise a member of the Enterobacteriaceae family and may be distinguished from other genera by its swarming proliferation over the agar surface[12]. *Proteus* spp. are commonly found in nature as organic matter decomposers and also associated with UTIs especially in individual with structural or functional difficulties, such as those undergoing catheterization[13].

As multi-drug resistant uropathogens become more prevalent, this study aimed to characterize and detect MDR strains of *Escherichia coli*, *Klebsiella* spp. and *Proteus* spp. from urine samples from UTI patients.

II. MATERIAL AND METHODS

A. Sample collection

In a tertiary care facility, while maintaining aseptic condition, 600 urine specimens were collected, transported to laboratory in medium while maintaining the integrity of physiochemical properties.

B. Demographic data of patients

Throughout the study, uniform number of positive samples was included in every age and gender groups (Male and females with 15-30 years and ≥30 years) for maintenance of homogeneity of variance. (Table 1) No diagnosis was made of the underlying diseases.

C. Isolation of Uropathogens

Urine samples (0.01 ml) were inoculated on different media (Blood Agar, MacConkey Agar etc.,) incubated for 24-48 hours at 37°C for detection of uropathogens (such as *E. coli*, *Klebsiella* spp. and *Proteus* spp.) using calibrated sterile inoculating loops[14]. Positive samples with $>10^5$cfu/ml counts were assessed for biochemical assay tests[15].

D. Antimicrobial Susceptibility

Antimicrobial susceptibility test was performed using Kirby-Bauer disk diffusion method. The drugs used during investigation include amikacin (amk), amoxycilin (amc), azithromycin (azm), cefepime (cefe), cefixime (cfx), cefotaxime (cefo), ceftazidime (caz), ceftriaxone (cro), ciprofloxacin (cip), gentamycin (gen), imipenem (imi), levofloxacin (levo), nitrofurantion (NIT), sulfomethoxazole (SXT)[16].

III. RESULTS AND DISCUSSION

Antibiotic misuse and abuse are primary causes of drug resistance. Alternatively, certain pathogens are adapted to their environment in order to gain inherent resistance. It is also possible for antibiotic resistance to emerge due to selective pressure[17]. In this

study, AMR uropathogens were isolated from patients with UTI to determine their prevalence.

The study conducted among a total of 200 positive urine samples comprising male and female patients of different age showed *E. coli* (120), *Klebsiella* spp. (56) and *Proteus* spp. (24) Table 1. Studies indicate that, *E. coli* prevalence among uropathogenic isolates ranged from 42.58% to 61.45%[18-21]. There is an estimated 80% rate of uncomplicated UTIs and 95% rate of infections acquired in the community to be due to uropathogenic *E coli* (UPEC), while 50% of infections acquired in hospitals are caused by it[22]. Based on antibiotic susceptibility testing, it was revealed that *E. coli* showed lowest resistance to cefotaxime (35%) and highest resistance to levofloxacin (60%), whereas, *Klebsiella* spp. showed resistance to ceftriaxone (30.59%) and amoxicillin (88.33%). Likewise, *Proteus* spp. observed to have 29.16% (azithromycin) and 70.83% (ciprofloxacin) resistance (Table 2 and 3, Fig 1 and 2).

Table 1. Prevalence of UTI pathogens in each patient group

Organism	Young Female (50 isolates)	older Female (50 isolates)	Young male (50 isolates)	older Male (50 isolates)	Total (% prevalence)
E. coli	30 (60%)	30/50(60%)	30/50(60%)	30/50(60%)	120/200(60%)
Klebsiella spp.	14/50(28%)	14/50(28%)	14/50(28%)	14/50(28%)	56/200(28%)
Proteus spp.	6/50(12%)	6/50(12%)	6/50(12%)	6/50(12%)	24/200(12%)

The sensitivity to meropenem reported in previous studies in patients approached 91.3%. Akter et al reported the carbepenems, aminoglycoside and pipercillin-tazobactam group antibiotics as the most effective medications against *E. coli*, followed by cephalosporins (cefixime, cefotaxime, ceftazidime, and ceftriaxone) and macrolides (azithromycin). However, it suggests the drug resistance progression of antibiotics during the preceding years[23]. Possibly, changing antibiogram interpretation criteria and antibiotic prescribing habits constantly alter the antimicrobial susceptibility profiles of uropathogens[24].

Cefotaxime was found to be the best drug for the treatment of *E. coli* related infections with 65% sensitivity. Ceftriaxone (69.41%) sensitive) was also found to be the best drug for the treatment of *Klebsiella* spp., whereas *Proteus* spp. could be effectively treated by Azithromycin (70.83% sensitive).

Further, Thirty-six (36) Multi drug resistant (MDR) pathogens were found in the sample of the elder males, 29 MDR pathogens were found in the sample of young males, 39 MDR were found in the sample of young females, and 40 MDR were found in the sample of elder females. Sixty eight percent of the isolated strains were highly multidrug resistant. Overall, MDR prevalence was 72%, and *E. coli* exhibited 54.16% MDR prevalence among isolates (Table 4, Figure 3).

Table 2. Antibiotic resistance of the UTI pathogens

Overall resistance (%)	amc	amk	azm	cfx	cip	caz	cro	cefe	cefo	gen	nit	levo	imi	sxt
E. coli	54.16	43.33	54.16	58.33	38.33	39.16	44.16	50.83	35.00	36.66	52.50	60.00	45.00	38.33
Klebsiella sp.	88.33	50.00	80.12	47.26	53.69	36.54	30.59	50.00	40.35	44.64	50.83	41.19	41.30	61.66
Proteus sp.	45.83	41.66	29.16	50.00	70.83	45.83	54.16	62.50	50.00	33.33	62.50	58.33	58.33	50.00

Table 3. Antibiotic sensitivity of the UTI pathogens

Overall sensitivity (%)	amc	amk	azm	cfx	cip	caz	cro	cefe	cefo	gen	nit	levo	imi	sxt
E. coli	43.33	56.66	47.50	46.66	61.66	66.66	64.16	45	60	65.83	51.66	46.66	60	60
Klebsiella sp.	1.78	46.42	10.71	42.85	30.35	64.28	55.35	48.21	57.14	48.21	33.92	55.35	55.35	28.57
Proteus sp.	54.16	58.33	70.83	50	29.16	54.16	45.83	33.33	50	66.66	37.50	41.66	37.50	50

Table 4. MDR prevalence of UTI pathogens

UTI pathogens	Group	5 Drugs	6 Drugs	7 Drugs	8 or more drugs	
E. coli	Young Female	3	6	4	11	24
	Elder Female	1	3	9	8	21
	Young Male	2	3	6	2	13
	Elder Male	1	1	10	8	20
Klebsiella spp.	Young Female	1	1	0	8	10
	Elder Female	1	3	2	8	14
	Young Male	0	6	2	3	11
	Elder Male	0	5	0	6	11
Proteus spp.	Young Female	0	0	3	2	5
	Elder Female	0	0	1	4	5
	Young Male	0	2	1	2	5
	Elder Male	0	1	1	3	5
Overall MDR		**9**	**31**	**39**	**65**	**144**

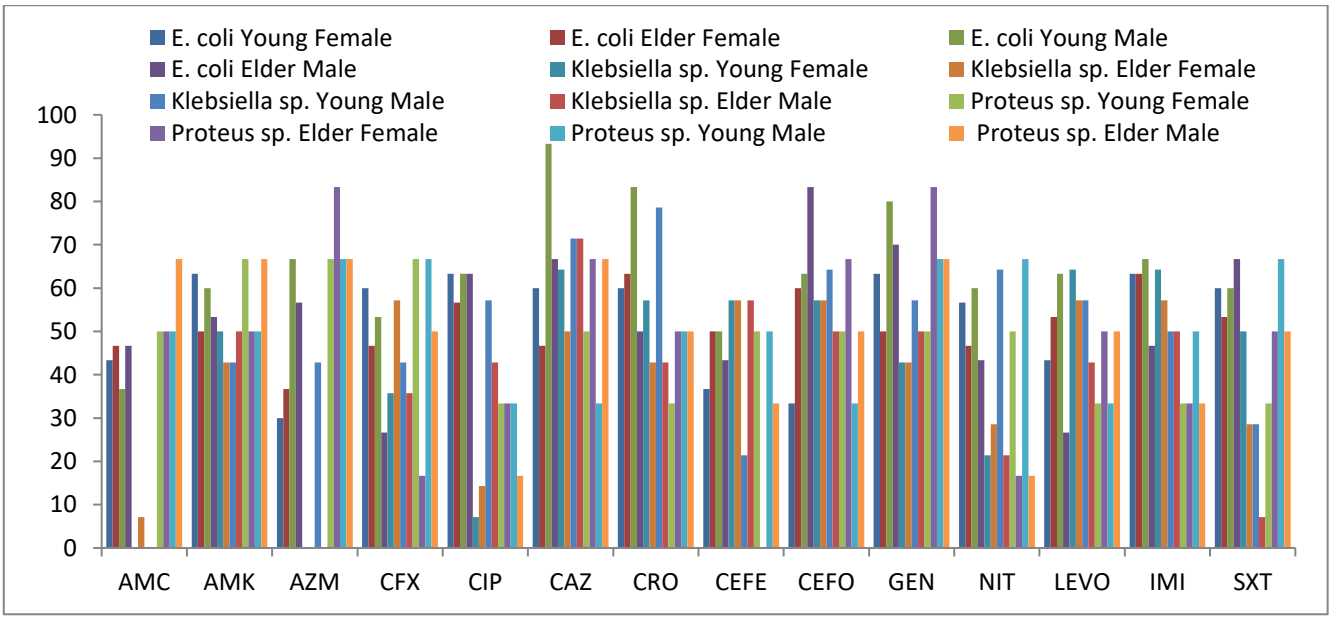

Figure 1. Antibiotic Sensitivity of *E. coli, Proteus sp. & Klebsiella sp.* in different age and sex groups

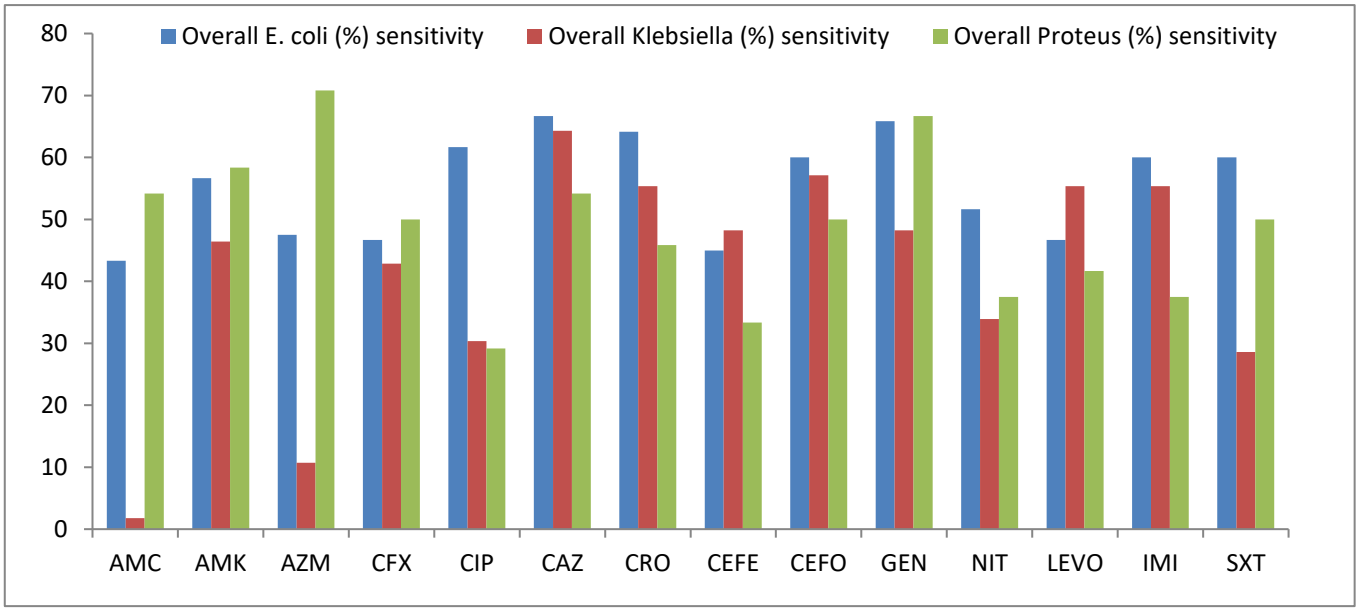

Figure 2. Overall sensitivity (%) of UTI pathogens to each antibiotics

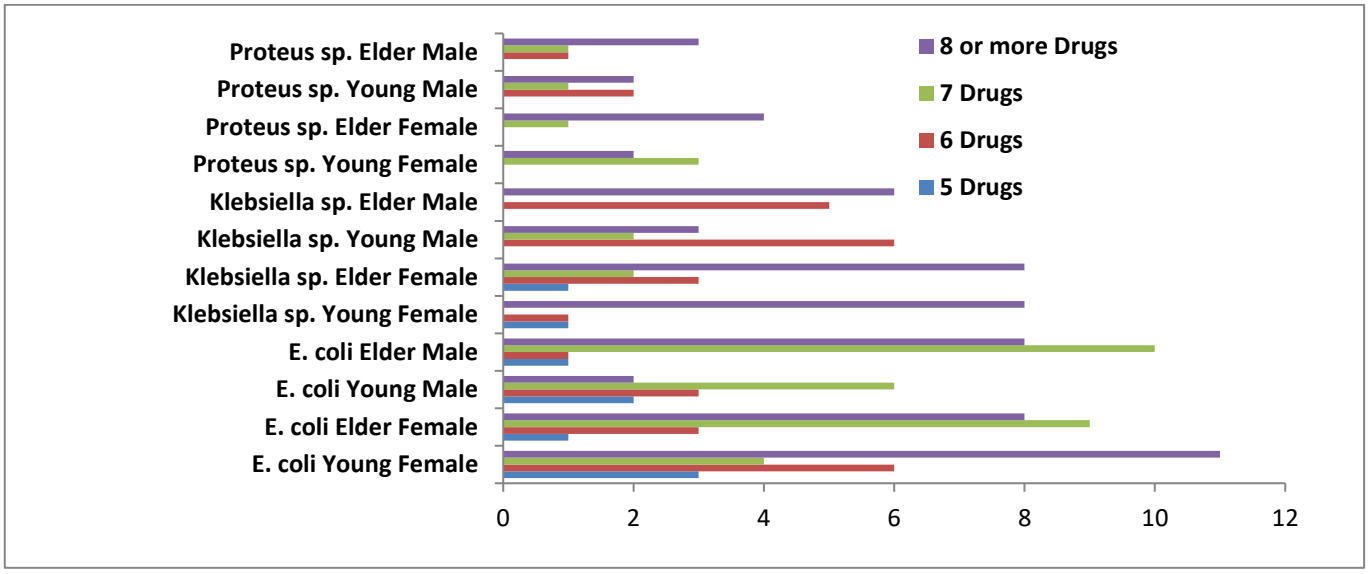

Figure 3. Multi-drug resistance pattern of *E. coli, Klebsiella sp. & Proteus sp.*

Asaduzzaman *et al.,* (2018) reported MDR cases approaching 54.2%, while 70.67% MDR cases reported by Begum and Shamsuzzaman, (2015). An earlier study found *E. coli* to be the most prevalent isolate. (72.4%) and also seen by other authors in their studies.

IV. CONCLUSION

According to a recent study, the number of MDR patients is on the rise. Highly powerful medications have become practically useless against emerging drug-resistant uropathogenic bacteria in the last few years. We may be able to minimize the spread of resistance bacteria by limiting unnecessary and uncontrolled antibiotic usage and also lowering selective pressure from accessible drugs. Health care providers must be aware of the present antimicrobial scenario and emphasis on prescription antibiotics based on culture and sensitivity results.

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