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Antibiotic Susceptibility Patterns in Commonly Isolated Pathogens in East Indian Population

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Abstract

Background and Objective: Urinary tract infection is one of the commonest infections seen in clinical practice. Lack of compliance and unjustified antibiotic prescriptions has resulted in bacterial resistance and is proving as a major challenge in the management of these infections. Our aim was to identify the sensitivity pattern of commonly used antibiotics against urinary tract infections in east Indian population of different age groups.

Method: This was a hospital based cross sectional study extended over a period of four months. Patients were recruited from Out-Patients department of a tertiary care hospital in Department of Microbiology, Narayam Medical College and Hospital, Jamuhar, Sasaram, Bihar, India. Adult patients with symptomatic and documented UTI in urine detailed report (pus cells >10) were enrolled after informed consent. Clean catch midstream urine was collected for culture and sensitivity testing using the standard microbiological procedure.

Results: A total of 180 samples were collected in 4 months. The mean age was 48.5±12 years and patients were between 20-80 years. Most common isolated pathogen was *Eschericia coli* 80 (44.44%) followed by *Klebsiella* 38 (21.11%), *Pseudomonas* 24 (13.33%), *Proteus* 16 (8.88%), *Enterococcus* 13 (7.22%) *Staphylococcus aureus* 9 (5%)

Conclusion: In low socioeconomic environment patients with UTI most of the isolated pathogens have shown resistance to most of the commonly used antibiotics recommended in the guidelines probably because of its unwarranted use. Therefore, a revised line of management should be developed locally in accordance with the susceptibility pattern of the urinary pathogens to avoid further resistance as well as morbidity of the patient.

Keywords: Antibiotic resistance; Culture and Sensitivity; Urinary tract infection

Introduction

Misused of antibiotics are very common in developing countries, due to the lack of a rational antibiotic policy in clinical medicine, which lead to the increased emergence of Multidrug Resistant (MDR) strains of pathogenic bacteria and even of commensals. Not astonishingly, the MDR strains/serotypes of commensals too cause many a disease similar to well-known pathogenic bacteria, and have been spreading alike both in community and hospital settings [1]. *E. coli* is major etiologic agent causing UTI which accounts for up to 90% of cases. *P. mirabilis*, *Klebsiella* species, *P. aeruginosa* and *Enterobacte*r species are less frequent offenders. Gram-positive organisms are less common in which Group *B Streptococcus*, *S. aureus, S. saprophyticus* and *S. haemolyticus* are recognized organisms [2]. Current management of UTI is empirical without the use of a urine culture or susceptibility testing to guide therapy. However, as with many community-based infections, antimicrobial resistance among the pathogens that cause UTI is increasing as a major health-problem in treatment of UTI [3,4]. There is no organized surveillance of drug resistance among common UTI pathogens in India particularly in Bihar, the resistance to commonly prescribed antibiotics for UTI exists. The aim of this study was to identify the prevalent UTI pathogens in individuals attending hospital and investigate their sensitivity

pattern to commonly used antibiotics in the environment.

Materials and Methods

This was a hospital based cross sectional descriptive study. All consecutive patients presenting in the outpatient department of a tertiary care hospital (Department of Microbiology, Narayan Medical College and Hospital, Jamuhar, Sasaram, Bihar, India), catering a population belonging to low socio-economic strata were included as subjects after informed consent. Sampling technique used was non-probability convenience. In patients were not included in the study as the collection might be questionable (e.g. in catheterized patients) because of contamination. Duration of study extends to 4 months from December 2017 till March 2018.

Adult patients with symptomatic and documented UTI in urine detailed report (pus cells >10) were enrolled. A clean catch midstream urine specimen of approx. 50 ml was collected in a sterile screw capped, wide mouthed leak proof container for culture and sensitivity testing using the standard microbiological procedure. Using a calibrated loop method, 10 µL of the un-centrifuged specimen was transferred on to the Mckonkey's agar plate and streak, using the modified Mayo's technique for identifying lactose and non-lactose fermenters and incubated at 35- 37 ˚C for 24 hours. A specimen was considered positive for UTI if a single organism was cultured at a concentration of 105 Colony Forming Units/ ml. CLED (Cystein Lactose Electrolyte Deficient) medium is further used for identification and isolation of urinary pathogens.

In the of presence of any potential growth, antibiotic sensitivity testing was done by the Modified Kirby- Bauer disc diffusion method according to the Clinical Laboratory Standards Institute (CLSI) guidelines. The antibiotic strength of 7 antibiotics were observed against the most frequent UTI pathogens cultured. The antibiotics tested for sensitivity were Gentamicin (30 µg), Amikacin (30 µg), Imipenem (10 µg), Nitrofurantoin (300 µg), Cefixime (30 µg), Ciprofloxacin (5 µg), Ofloxacin (5 µg).

Data analyses for the mean ± SD and frequencies with percentage were done on SPSS version 16. Following Operational. Definitions were used in the present study:

- Microscopic findings of more than 10 WBC per high power field in a urine sample was considered significant for urinary tract infection.
- Significant bacteriuria was defined as culture of a single bacterial species from the urine sample at a concentration of more than 100,000 CFU/ml [5].

Results

A total of 180 samples were collected over a period of 4 months with symptomatic and documented urinary tract infection according to the detailed analysis of urine. However, 184 patients were positive for urine culture and sensitivity which were then analyzed for resistance of the antibiotics tested. Mean age was 48.5±12 years. 80 (44.4%) patients were between 41-60 years. *Eschericia Coli* 80 (44.4%) was found to be the commonest microbial agent identified leading to UTI followed by, *Klebsiella* 38 (21.1%), Pseudomonas 24 (13.3%). In addition, there were some cases reported where more than one organism was found to be the cause of infection. Proteus was found as coinfection in four subjects. Number (%) of strains of each pathogen sensitive to number of antibiotics is tabulated in Tables 1,2.

Serial Number	Age (years)	Male (N)	Female (N)	Total	%
1	20-40	20	30	50	27.8
2	41-60	32	48	80	44.4
3	61-80	24	26	50	27.8
4	Total	76	104	180	

Table 1: Distribution pattern of UTI according to age and sex.

Serial Number	Bacterial pathogens	Frequency (%)
1	*Escherichia coli (E. Coli)*	80 (44.44%)
2	*Klebsiella pneumonia*	38 (21.11%)
3	*Pseudomonas aeruginosa*	24 (13.33%)
4	*Proteus spp*	16 (8.88%)
5	*Enteroccocus*	13 (7.22%)
6	*Staphylococcus aureus*	9 (5%)

Table 2: Distribution of isolated Uropathogens.

Escherichia coli was found to be the dominant bacteria among all isolated pathogens with the prevalence rate of 44.4%. The second most prevalent isolate was *Klebsiella pneumonia* 21.11% followed by *Pseudomonas aeruginosa* (13.3%), *Proteus spp*. 8.8%), and *Staphylococcus aureus* 5% (Table 2).

It was observed that the more resistant pathogens were sensitive to intravenous antibiotics only. We have also observed that 3(1.6%) pathogens had sensitivity to none of the antibiotics tested (Table 3).

Sr.No	Antibiotics	Sensitivity(S)/ Resistant (R)	*E. Coli*	*Klebsiella*	*Pseudomonas*	*Proteus*
1	Amikacin	S	100%	94%	94%	90%
2	Amikacin	R	0%	6%	6%	10%
3	Gentamycin	S	96%	89%	88%	84%
4	Gentamycin	R	4%	11%	12%	16%
5	Imepenem	S	92%	93%	84%	80%
6	Imepenem	R	8%	7%	16%	20%
7	Nitrofurantoin	S	98%	90%	86%	88%
8	Nitrofurantoin	R	2%	10%	14%	12%
9	Ciprofloxacin	S	86%	99%	80%	73%
10	Ciprofloxacin	R	14%	1%	20%	27%
11	Ofloxacin	S	82%	99%	75%	78%
12	Ofloxacin	R	18%	1%	25%	22%
13	Cefixime	S	78%	83%	64%	55%
14	Cefixime	R	22%	17%	36%	45%

Table 3: Antibiotics susceptibility patterns of bacterial agents causing UTI (n=180).

Discussion

Urinary tract infections are the second most common infectious in the Indian community. There are more than 150 million UTIs per year, worldwide [6]. It is predicted that nearly one woman out of three, will have at least one episode of UTI requiring antimicrobial therapy by the age of 23 years, and almost 50% of all women will experience at least one episode of UTI during their lifetime [7]. The World Health Organization (WHO) describes the results of its first global surveillance report on antibiotic resistance as a Cause for high concern. Women have a one-in-three lifetime chance of developing a UTI, which is about 50 times more than for men [8].

Etiology of UTI shows a diverse group of Uropathogens of which the commonest pathogen involved is *E. Coli,* a gram negative facultative anaerobe responsible for 80% of UTI cases in women aged 18-39 years, followed by *Staphylococcus saprophyticus* and the less common *Klebsiella, Enterobacter, Serratia, Proteus, Pseudomonas* and *Enterococcus* [9].

An important fact to be realized is resistance to antibiotics which has been developing with every new discovery of antibiotics, multiple factors are to be blamed but even in the most developed nations the problem of antibiotic resistance is present, as the pathogens have fought for their own survival, newer mutant strains had developed thus making it more difficult to control the infection.

In this study, *E. Coli* showed the highest sensitivity to Amikacin 100% followed by Gentamicin 96%, and nitrofurantoin 98%, interestingly the ofloxacin group showed only 82% sensitivity, also including was cefixime 78%, which explains the failure of response to treatment on empirical basis. *Klebsiella* had also shown similar pattern of sensitivity only the percentages are lower when considering imipenem 93%, amikacin 94%. Response to ofloxacin group was better than *E. coli* although not satisfactory, being the most sensitive to ciprofloxacin 99%, ofloxacin 98%.

Most of the subjects were not literate with unsatisfactory hygiene and although the method of collection was explained

specifically the possibility of contamination cannot be ruled out. The duration of prescribed antibiotics to achieve a favorable outcome also varied in some established data from local studies as compared to what is recommended in international guidelines, as in one study outcome of patient with appropriate antibiotics was higher at 97.3% for five days compared to 83.3% for three days [10]. Another study conducted in India proved that the hospital acquired *E. coli* in UTI was more aggressive and difficult to control needing at least one IV antibiotics preferably cephalosporin along with an oral antibiotic when compared with community acquired *E. coli*, again endorsing the prevalence of resistance in UTI needing inpatient treatment [11].

- We suggest that empirical antibiotic selection should be based on the knowledge of local prevalence of bacterial organisms and antibiotic sensitivities rather than on international guidelines.
- Culture and sensitivity should be done where appropriate. Antibiotic resistance in urinary tract infection
- Floro quinolone use should be reserved because this is the only orally active drug which works against Pseudomonas and other multidrug resistant bacteria [12,13].

Conclusion

Emergence of multidrug resistant organisms poses a great public and therapeutic threat to clinicians all over the world but especially in our geographical region. The problem can only be catered effectively with formulation and strict implementation of local therapeutic guidelines in accordance with the susceptibility pattern of pathogens existing in our own community. In addition, continued surveillance and monitoring of antimicrobial resistance would help in improvising our line of management effectively.

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