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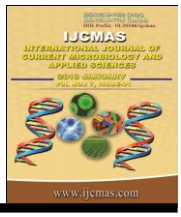

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Antimicrobial Susceptibility Pattern of *Escherichia coli* from Patients with Urinary Tract Infections in a Tertiary Care Hospital

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A B S T R A C T

Urinary tract infection (UTI) is one of the most common bacterial infections in humans after respiratory tract infection. *E.coli* remains the leading uropathogen being responsible for UTI. The aim of the study is to assess the resistance pattern of *E.coli* causing UTI to commonly used antibiotics, so as to aid the clinician in changing the appropriate antimicrobial empirical therapy. *E.coli* isolated from urine samples were identified by conventional biochemical test. Antimicrobial susceptibility test was done by Kirby–Bauer disc diffusion method on Mueller–Hinton agar. Among the 2101 isolates, *E.coli* was the most common pathogen. Majority of the isolates showed high resistance to gentamycin (37.39%), cotrimoxazole (24.20%), ciprofloxacin (26.05%), norfloxacin (27.29%) and cefotaxime (21.73%), and least resistance to Nitrofurantoin (85.89%) and Amikacin (68.89%). Antibiotics such as gentamycin, cotrimoxazole, ciprofloxacin, norfloxcin and cefotaxime have limited value for the treatment of UTI. Nitrofurantoin and Amikacin should be used in empirical therapy of UTI.

Introduction

Urinary tract infection (UTI) is one of the most common bacterial infections in humans affecting all age groups and both genders in the community and hospital (Tekin *et al.*, 2012) after respiratory tract infection (Tekin *et al.*, 2012; Sobel, 2000). UTIs occur in both men and women, clinical studies suggest that the overall prevalence of UTI is higher in women. Uncomplicated UTIs in healthy women have an incidence of 50/1000/year (De Backer *et al.*, 2008). An estimated 50% of women experience at least one episode of UTI at some point in their lifetime and between 20% and 40% of women have recurrent episodes. 20% of all UTIs occur in men (Rock *et al.*, 2007; Vasquez and Hand, 2004; Pearle *et al.*, 2007).

UTI can be caused by both Gram-negative and Gram-positive bacteria, in addition to certain fungi. Gram- negative organisms are the most common pathogens involved in UTI, but almost all known pathogens have been incriminated as possible causative agents for UTI (Wilkie *et al.*, 1993; Bajaj *et al.*, 1999). Among the gram negative organisms, *E. coli* is considered as the most common organism causing UTI in both community and hospitals.

The distribution of uropathogens and their susceptibility pattern to antibiotics vary regionally. The extensive and inappropriate use of antimicrobial agents has invariably resulted in the development of antibiotic resistance which, in recent years, has become a major problem worldwide (Goldstein and Multicentre Study Group, 2000). Urinary pathogens have shown a changed pattern of susceptibility to antibiotics, resulting in an increase in resistance to commonly used antibiotics. Therefore, the knowledge on the frequency of the causative microorganisms and their susceptibility to various antibiotics are necessary. Hence, the aim of the study is to access the resistance pattern of *E. coli* causing UTI to commonly used antibiotics so as to aid the clinician in changing the appropriate antimicrobial empirical therapy.

Materials and Methods

Retrospective analysis was done on *E. coli* isolated from urine samples received during the study period (March 2016 to February 2017). Urine culture was done by standard loop method, a semi quantitative method. The organism isolated from urine culture was identified by conventional biochemical test. Antimicrobial susceptibility was done by Kirby–Bauer disc diffusion method on Mueller–Hinton agar and the interpretations were carried out according to the Clinical and Laboratory Standards Institute guidelines. Quality control of media and discs were performed using ATCC *E. coli* control strain 25922. Antibiotics against which sensitivity was tested included nitrofurantoin, amikacin, gentamycin, cotrimoxazole, ciprofloxacin, norfloxacin and cefotaxime.

Results and Discussion

Of all the urine samples processed, 2101 gave significant growth of pathogens. The patients' age group were between 0 and 90 years of age. The isolates were *Escherichia coli* (45.60%), *Klebsiella species* (28.93%), *Proteus species* (3.05%), *Pseudomonas species* (5.87%), *Candida Non albicans* (6.71%), *Acinetobacter species* (1.22%) and *Enterococci species* (6.29%), Others (2.33%) (Fig. 1).

Among these 2101 isolates, *Escherichia coli* are the most common pathogen accounting for 45.60 % (971) of urinary tract infections.

The prevalence of UTI is high among females 565 (58.18%) than males 406 (41.81%). However, elderly (50-90years) males had a higher incidence of UTI compared to the elderly females due to comorbid conditions like prostatic disease and diabetes (Table 1 and Fig. 2).

The commonest isolates were *Escherichia coli* which showed highest sensitivity to *Nitrofurantoin* (85.89%) and *Amikacin* (68.89%). The sensitivity of gentamycin is (37.39%), *cotrimoxazole* (24.20%), *ciprofloxacin* (26.05%), *norfloxacin* (27.29%) and *cefotaxime* (21.73%).

From all the studies, it is evident that *Escherichia coli* (45.60%) was the most common organism in UTI. *E.coli* was least resistant to *nitrofurantoin* (14.11%) and *amikacin* (31.11%) and was highly resistant to *cotrimoxazole* (75.8%) and *cefotaxime* (78.27%s).

Gram- negative organisms are the most predominant organisms causing UTIs. In the present study, *E. coli* remains the leading uropathogen being responsible for 45.60% of UTIs, which is in accordance with other studies (Dimitrov *et al.,* 2004; Singh *et al.,* 2017; Dimitrov *et al.,* 2004)

The study observes that the prevalence of UTI is high among females (58.18%) than males (41.81%). Females are more prone to develop

UTI, probably due to the characteristic anatomy of the urethra and the effect of normal physiological changes that affect the urinary tract – short urethra, its proximity to the anus, urethral trauma during intercourse dilation of the urethra and stasis of urine during pregnancy (Dash *et al.*, 2013; Kothari and Sagar 2008). UTI was recorded high in elderly males of age group (50-90) probably due to prostate enlargement and neurogenic bladder (Das *et al.*, 2006).

Fig.1 Pie chart showing isolated uropathogens

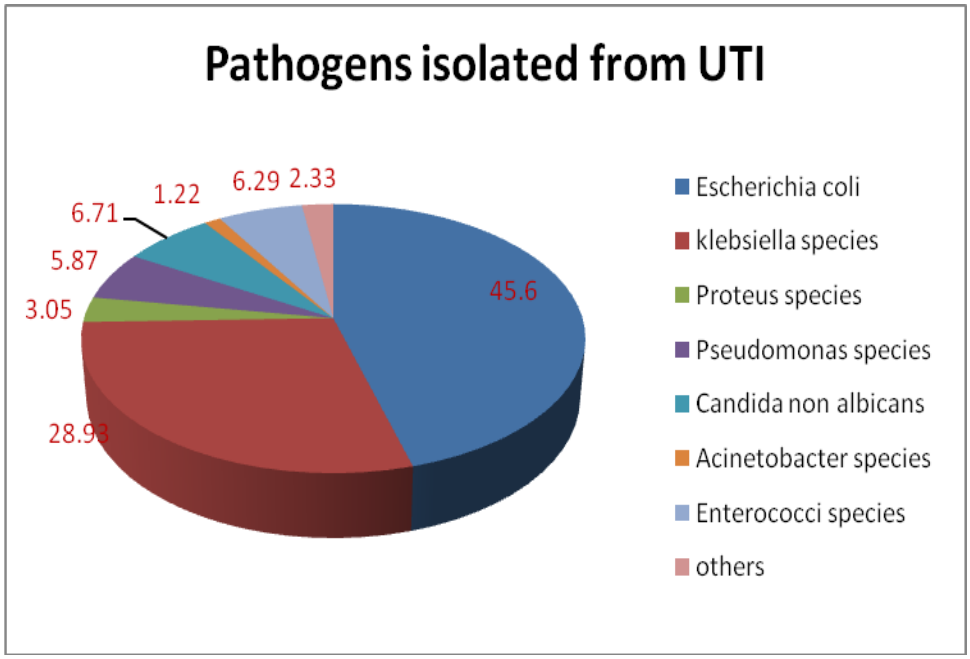

Fig.2 Age and sex distribution of patients with UTI

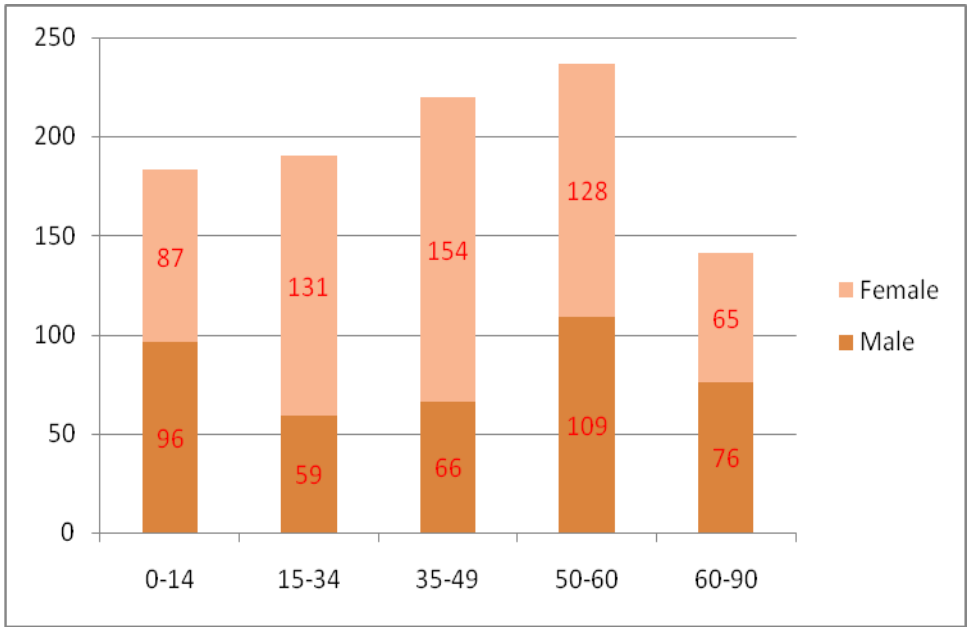

Fig.3 Antibiotic resistance pattern of *E. coli*

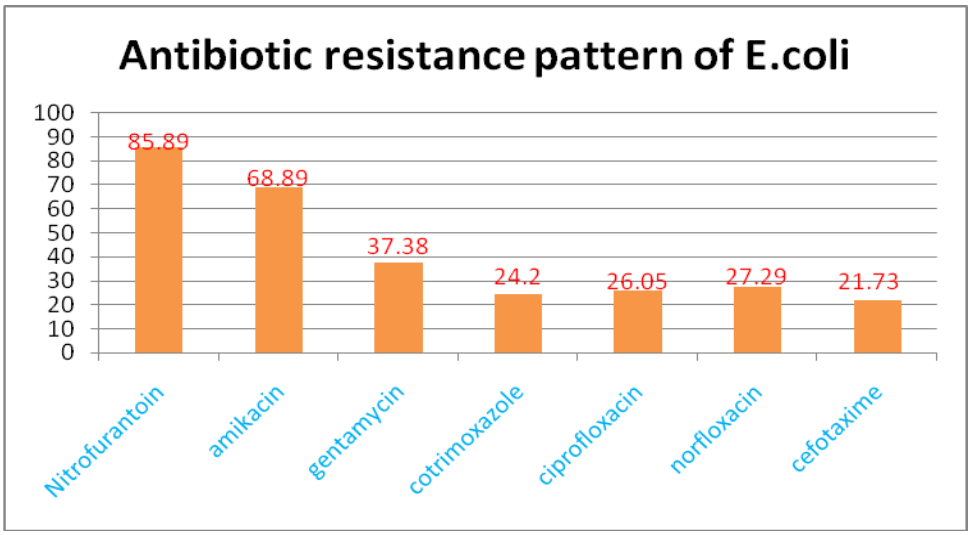

Table.1 Age and sex distribution of patients with urinary tract infections

Age range	Male	Female	Total
0-14	96	87	183
15-34	59	131	190
35-49	66	154	220
50-60	109	128	237
60-90	76	65	141

Table.2 *E. coli* resistance pattern

Drug	Sensitivity (%)	Resistant (%)
Nitrofurantoin	85.89	14.11
Amikacin	68.89	31.11
Gentamycin	37.39	62.62
cotrimoxazole	24.20	75.8
Ciproflox	26.05	73.95
Norflox	27.29	72.71
Cefotaxime	21.73	78.27

The present study shows that *E. coli* causing UTI is highly sensitive to Nitrofurantoin 85.89 % and highly resistant to cotrimoxazole and cefotaxime.

A recent study in India showed that Nitrofurantoin had the best in-vitro susceptibility profile against *E. coli* (Biswas *et al.*, 2006).

The consistent and high level susceptibility of *E. coli* to Nitrofurantoin may be influenced by nitrofurantoin's narrow spectrum of activity, limited indication, narrow tissue distribution and limited contact with bacteria outside the urinary tract (Karlowsky *et al.*, 2002).

In our study we observe that there is increased resistance pattern of *E. coli* to Fluoroquinolones

(Table 2 and fig. 3). This may be due to the widespread use of fluoroquinolones as first- line empirical therapy for UTIs. In various studies performed in developing countries ciprofloxacin showed lower sensitivity of 15% to 43.2% (Aboderin *et al.*, 2009; Lu *et al.*, 2012). In the present study, variable resistance pattern were found for aminoglycosides. Among the Aminoglycosides the sensitivity of *E. coli* to amikacin was 68.89% and gentamycin was 37.39%.The sensitivity of *E. coli* to cotrimoxozole was 24.20%. The Infectious Diseases Society of America has recommended that when resistance to TMP-SMX is greater than 10 to 20%, TMP-SMX should not be used as first-line empirical therapy (Warren *et al.*, 1999).

Our study shows that majority of our isolates have high resistance rates to different classes of antibiotics like fluoroquinolone (ciprofloxacin 73.95 %, norfloxacin 72.71 %), third generation cephalosporins (cefotaxime 78.27 %), and cotrimoxazole (75.8 %) and least resistant to nitrofurantoin (14.11) and amikacin (31.11). Therefore, determining the etiological agents of UTI and their antimicrobial resistance patterns in specific geographical locations may aid clinicians in choosing the appropriate antimicrobial empirical therapy.

The study demonstrates that *E. coli* remains the leading uropathogen with the majority of the isolates from female patients. Antibiotics such as gentamycin, cotrimoxazole, ciprofloxacin, norfloxcin and cefotaxime have limited value for the treatment of UTI. Nitrofurantoin and amikacin should be used in empirical therapy of UTI. Therefore, routine monitoring of antibiotic susceptibility patterns is mandatory. This will help in the empirical treatment of UTI to the clinicians and also for the preparation of antibiotic policy of the individual institute.

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