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Isolation and antimicrobial susceptibility pattern of uropathogens in a tertiary care hospital

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Abstract
Introduction: Urinary tract infections are among the most common infections diagnosed in outpatients as well as hospitalized patients. The sensitivity of uropathogens to different drugs varies in different areas which necessitates frequent studies of the causative uropathogens and their antimicrobial susceptibility pattern. The purpose of this study was to determine the frequency as well as antimicrobial susceptibility pattern of the various pathogens causing urinary tract infections.
Materials & Methods: The study was conducted from April 2015 to September 2015 on 968 urine samples collected aseptically and sent for culture and sensitivity in the Department of Microbiology, SMIMER, Surat. All the urine samples were cultured on MacConkey agar and Blood agar. The isolates were identified by conventional biochemical methods. Antimicrobial susceptibility testing was done using Kirby Bauer's disc diffusion method according to CLSI guidelines.
Results: Out of total 968 urine samples tested, 331 samples (34.19%) were culture positive. The most common bacterial isolate was *E.coli* 163 (49.24%), followed by *Klebsiella spp 59* (17.82%), *Pseudomonas spp 44* (13.29%), *Acinetobacter spp 35*(10.57%), *Proteus Spp.* 19 (5.74%) and *Staphylococcus spp* 11(3.32%). The uropathogens showed a very high level of resistance to Nalidixic acid (83.38%) and Norfloxacin (74.62%) whereas resistance to Nitrofurantoin (23.87%) and Netilmicin (28.10%) was low.
Conclusion: This study revealed that *E. coli* was the predominant bacterial pathogen causing urinary tract infections. The resistance pattern of uropathogens to common antimicrobial agents is changing and must be taken into account when selecting treatment strategies.

Keywords: Uropathogens, Urinary Tract Infection, Antimicrobial susceptibility pattern

1. Introduction

Urinary tract infections (UTI's) are among the most common bacterial infections in humans causing increased morbidity. Urinary tract infections (UTI) are caused by pathogenic invasion of the urinary tract which leads to an inflammatory response of the uroepithelium [1]. UTI's are important complications of diabetes, renal diseases, renal transplantations and structural and neurological abnormalities that interfere with urine output. The causative agents of urinary tract infections vary from place to place and they also vary in their susceptibility and resistance patterns. A variety of organisms are responsible for UTI including bacteria, fungi and viruses; bacteria being responsible for 95% of the cases. Most common etiological agents are *Escherichia coli, Klebsiella species, Pseudomonas aeruginosa, Proteus mirabilis, Acinetobacter species* and *Staphylococcus species*[2]. Treatment of UTI is often started empirically and therapy is determined from the antimicrobial resistance pattern of the urinary pathogens**.** Despite widespread availability of antibiotics, UTIs are difficult to treat due to antibiotic resistance among uropathogens. Antibiotic resistance in uropathogens is due to the increasing misuse of antibiotics. Knowledge of the etiological agents of UTI and their antibiotic susceptibility pattern is essential to ensure appropriate treatment[3]. Thus, the present study was undertaken to know the frequency of uropathogens in our hospital and their antibiotic susceptibility pattern.

2. Materials and Methods

The present study was undertaken from April 2015 to September 2015 in the Department of Microbiology, SMIMER, Surat. A total of 968 clean catch mid-stream urine samples were collected in a wide mouthed sterile universal container from both in patient as well as outpatient departments. Specimens were transported and processed within 2 hours of collection by the standard microbiological technique[4]. Isolation of uropathogens was performed by a surface streak procedure on both MacConkey and blood agar using calibrated loops for semi-quantitative method and incubated aerobically at 37ºC for 24 hours. A specimen was considered positive for UTI if a single organism was cultured at a concentration of 10^5cfu/ml. The pathogens were identified by standard microbiological techniques by studying Gram stain, morphology, their colony characteristics and biochemical reactions [5].
Antibiotic susceptibility testing was carried out by Kirby Bauer Disk Diffusion method. A lawn culture of the causative organism was made on Mueller Hinton Agar and following antibiotic disks were tested: Nitrofurantoin, Cefotaxime, Ceftazidime, Nalidixic acid, Ciprofloxacin, Gentamicin, Netilmicin, Cotrimoxazole, Norfloxacin, Levofloxacin and Ofloxacin. The plates were incubated aerobically at 37ºC for 18-24 hours. Zone sizes were measured and the drugs were interpreted as sensitive or resistant according to CLSI guidelines [18].

3. Results and Discussion

Out of total 968 urine samples tested, 331 samples (34.19%) were culture positive and 637 showed insignificant or no growth.
Figure 1 shows gender distribution. Out of the 331 patients with UTI included in the study 126 (38.07%) were males and

205 (61.93%) were females. Female to male ratio was 1.6:1. Sharma *et al* [6] has reported female to male ratio of 1.8:1 and Orhue *et al*. [2] reported a ratio of 1.6:1. Razak *et al*. [8] and Shah *et al*. [3] have also observed female predominance in their studies. Increased prevalence of UTI in female sex can be attributed to the presence of short urethra, proximity to anus and frequent trauma during intercourse.

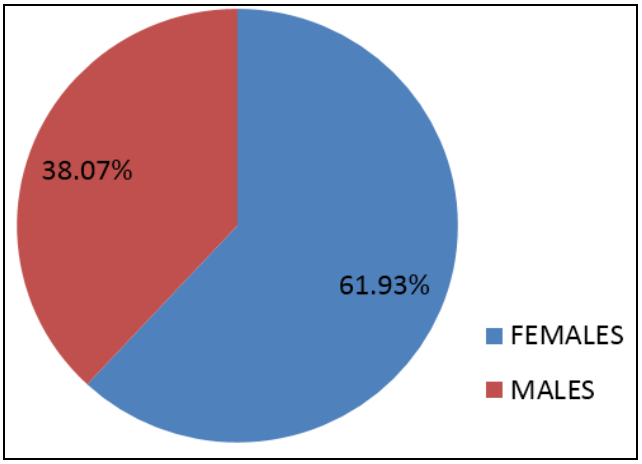

Fig 1: Gender wise distribution

Table 1 shows the age distribution. In the present study, peak in the incidence of UTI was observed in females of age group 21-40 years (38.54%). Ahmad *et al* [9] and Khalil *et al* [10] reported peak in the incidence of UTI in females of similar age groups. Frequent sexual intercourse, pregnancy and lack of urination after intercourse are risk factors for urinary tract infections in women of reproductive age group.

In males, peak in the incidence of UTI was observed in age group of 61-80 years (32.53%). Jadhav *et al*. [11] also reported peak in the incidence of UTI in males of similar age groups. Elderly patients are likely to be predisposed to conditions such as urinary tract obstruction, prostate enlargement, poor bladder emptying, diabetes mellitus, etc. favoring colonization of bacteria and play an important role in UTI.

Table 1: Age wise distribution- prevalence of UTI

Age group (in years)	Males (n=126)	Females (n=205)
<20	17 (13.49%)	37 (18.05%)
21-40	21 (16.67%)	79 (38.54%)
41-60	33 (26.19%)	48 (23.41%)
61-80	41 (32.53%)	25 (12.20%)
>80	14 (11.12%)	16 (7.80%)

Table 2 shows bacterial profile of UTI. The most common bacterial isolate was *E.coli* 163 (49.24%), followed by *Klebsiella spp 59* (17.82%), *Pseudomonas spp 44* (13.29%), *Acinetobacter spp 35* (10.57%), *Proteus Spp.* 19 (5.74%) and *Staphylococcus spp* 11 (3.32%).

The most common isolated organism in our study was *E.coli*. This was in correlation with other studies by Gupta K.D *et al*. [12], Moges *et al*. [13] and Sibi *et al*. [1].

Table 2: Bacterial profile of UTI

Bacteria Isolated	Number	Percentage
E.coli	163	49.24%
Klebsiella spp	59	17.82%
Pseudomonas spp	44	13.29%
Acinetobacter spp	35	10.57%
Proteus spp	19	5.74%
Staphylococcus spp	11	3.32%

Table 3 shows antimicrobial sensitivity pattern of uropathogens. The uropathogens showed maximum sensitivity to Nitrofurantoin (75.22%) followed by Netilmicin (71.30%), Gentamicin (67.67%) and Levofloxacin (62.84%). Maximum resistance was seen to Nalidixic acid (83.38%) followed by Norfloxacin (74.62%), Ofloxacin (73.42%) and Cotrimoxazole (70.39%). This pattern of resistance has also been reported in various studies [11, 12].

Table 3: Antibiotic sensitivity pattern of uropathogens

Antibiotics	Sensitive	Intermediate	Resistant
Nitrofurantoin	249 (75.22%)	3 (0.91%)	79 (23.87%)
Cefotaxime	115 (34.75%)	2 (0.60%)	214 (64.65%)
Ceftazidime	127 (38.37%)	3 (0.91%)	201 (60.72%)
Nalidixic Acid	49 (14.80%)	6 (1.82%)	276 (83.38%)
Ciprofloxacin	121 (36.56%)	4 (1.21%)	206 (62.23%)
Gentamicin	224 (67.67%)	5 (1.51%)	102 (30.82%)
Netilmicin	236 (71.30%)	2 (0.60%)	93 (28.10%)
Cotrimoxazole	94 (28.40%)	4 (1.21%)	233 (70.39%)
Norfloxacin	81 (24.47%)	3 (0.91%)	247 (74.62%)
Levofloxacin	208 (62.84%)	1 (0.30%)	122 (36.86%)
Ofloxacin	86 (25.98%)	2 (0.60%)	243 (73.42%)

In this study the rising resistance pattern among anti-microbial agents has been noted. The selection of antimicrobials for treatment should be based on knowledge of regional data on microbial isolates and their sensitivity to antibiotic according to which regional empirical therapy should be recommended for effective control of infection. It is imperative that indiscriminate use of antibiotics is stopped at all levels to prevent increasing resistance and the choice of effective antibiotics is not limited. The treatment of patients suffering from bacterial UTIs commonly relies on the identification of the causative organisms and selecting an effective antibiotic agent against that organism. The appropriate choice of antibiotic for UTI requires a proper understanding of epidemiology and resistance patterns of the associated uropathogen.

4. Conclusion

Thus we conclude that gram negative organism most commonly *E.coli* is a frequent cause of urinary tract infections. Routine culture and sensitivity of the isolates from

urinary samples should be done before advocating therapy for better therapeutic outcome. As drug resistance is an evolving process, regular surveillance and monitoring is necessary to provide physician's knowledge on the most effective empirical treatment of UTIs. Periodic reassessment of in vitro susceptibility pattern of urinary pathogens should be done to serve as a guide for antibiotic therapy. Hence it becomes very essential to analyse the causative agent for UTI and establish antibiotic policies to ensure effectiveness of the antibiotics. Failing to do so might result in the rise of multi drug resistant bacteria due to irrational use of antibiotics.

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