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Full Length Research Paper

Antibacterial susceptibility of some urinary tract pathogens to commonly used antibiotics

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Urinary tract infection represents one of the most common diseases encountered in medical practice today and occurring from the neonate to the geriatric age group. Despite the widespread availability of antibiotics, it remains the most common bacterial infection in the human being. A total of 174 urine samples were analyzed for isolation and identification, 68 found to be significant bacteriuria with *Escherichia coli* (59%), followed by *Pseudomonas* a*eruginosa* (15%)*, Klebsiella pneumoniae* (10%), *Proteus mirabilis* (9%), *Staphylococcus aureus* (6%) and *Citrobacter freundii* (1%). The urinary tract infections were found to most frequently in female (63%) than male (37%). The isolated uropathogens showed resistant to ampicillin (87%), co-trimoxazole (91%), nalidixic acid (88%) and sensitive to nitrofurantoin (52%), cephotaxime (54%) and norfloxacin (71%).

Key words: Antibiotic susceptibility, uropathogens, MAR Index, bacterial resistance.

INTRODUCTION

Urinary tract infection represents one of the most common diseases encountered in medical practice today and occurring from the neonate to the geriatric age group (Kunin, 1994; Raju and Tiwari, 2004). The incidence of UTI is greater in women as compared to men who may be either due to anatomical predisposition or urothelial mucosa adherence to the mucopolysaccharide lining or other host factors (Schaeffer et al., 2001). *Escherichia coli* is the most frequent urinary tract pathogen isolated from 50 to 90% of all uncomplicated urinary tract infections as it is present in the gastrointestinal tract and provide a pool for initiation of UTI (Steadman and Topley, 1998; Raksha et al., 2003).

Despite the widespread availability of antibiotics, UTI remains the most common bacterial infection in the human population (Sharma, 1997). Antibiotic resistance may develop in uropathogen due to frequent misuse of antibiotics. Antibiotics are usually prescribed empirically before the laboratory results of urine culture are available (Tambekar and Khandelwal, 2005; Tambekar and Dhanorkar, 2005). To ensure appropriate therapy current knowledge of the organisms that cause UTI and there antibiotic susceptibility is mandatory (Grubenberg, 1984). Multidrug resistant pathogens travel not only locally but also globally and newly introduced pathogens spreading rapidly in susceptible host (Gupta et al., 2002). For better decision-making physicians needs more information about local susceptibility pattern of uropathogens. Therefore it was rational approach to do bacteriological examination of urine sample along with their antibiogram to know the trend of antibiogram of uropathogens in the regions.

MATERIALS AND METHODS

A total of 174 midstream urine samples were collected in sterile containers from suspected urinary tract infected cases. With standard calibrated loop delivering 0.01 ml of urine was inoculated on Cysteine Lactose Electrolyte Deficient (CLED) agar and incubated aerobically at 37°C for 18-24 h. After incubation, if the cfu is more than 10^5, it consider as significant bacteriuria and such urine samples further processed for identification and antibiogram of bacterial pathogen. But, if the cfu is less than 10^5, it considers as non–significant bacteriuria or negative.

Identification of bacterial pathogens was made on the basis of gram reactions, morphology and biochemical characteristics. Isolates were tested for antimicrobial susceptibility by disc diffusion technique (Agrawal, 1974) on Muller Hinton agar using the ready-made antibiotics supplied by Hi-media ltd, Mumbai (Table 1).

The Multiple Antibiotic Resistance indices (MARI) were calculated as follows: MAR index for isolates = [Number of antibiotics to which the isolate is resistance / Number of antibiotics tested]. While MAR index for an antibiotics = [Number of antibiotics resistance to the isolates / (Number of antibiotics x Number of isolates)].

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Table 1. Antibiotic discs used in this study.

Antibiotics	Quantity	Antibiotics	Quantity
Amikacin	30 mcg	Gatifloxacin	5 mcg
Ampicillin	10 mcg	Gentamycin	10 mcg
Cefazolin	30 mcg	Meropenem	10mcg
Cefdinir	5 mcg	Nalidixic acid	30 mcg
Cefixime	5 mcg	Nitrofurantoin	300 mcg
Ceftriazone	30 mcg	Norfloxacin	10 mcg
Cefuroxime	30 mcg	Novobiocin	30 mcg
Cephotaxime	30 mcg	Ofloxacin	5 mcg
Ciprofloxacin	5 mcg	Pefloxacin	5 mcg
Clarithromycin	50 mcg	Vancomycin	30 mcg
Co-trimoxazole	23.75 mcg		

RESULTS

A total of 174 urine samples were analyzed for isolation and identification of bacterial isolates as per standard methods. Out of which 68 samples were found to be significant bacteriuria and remaining 106 samples were either non-significant bacteriuria or very low bacterial count or sterile urine. In present study, out of 68 isolated uropathogens the most common isolate was *E. coli* (59%), followed by *Pseudomonas* a*eruginosa* (15%), *Klebsiella pneumoniae* (10%), *Proteus mirabilis* (9%), *Staphylococcus aureus* (6%) and *Citrobacter freundii* (1%). The urinary tract infections were found to most frequently in female (63%) than male (37%).

The multiple antibiotic resistant indices (MARI) calculated for *E. coli* was 0.9, 0.85, 0.52 and 0.38 in one each strain, 0.76 in 4 strains, and 0.71 in 3 strains. 0.66 in 10 strains, 0.61 in 7 strains, 0.57 in 10 strains and 0.47 in 3 strains. The MAR indices for *Ps. aeruginosa* were 0.95, 0.85, 0.61, 0.14 and 0.04 in 1 each strain, 0.76 in 3 strains and 0.52 in 2 strains. The MAR indices for *Pr. mirabilis* were 0.9, 0.71, 0.66, 0.57, 0.52 and 0.04 in 1 each strain and for *S. aureus* was 0.71 and 0.23 in 1 each strain and 0.61 in 2 strains. The MAR index for only one strain of *C. freundii* was 0.42 (Table 2).

All these isolated uropathogens were resistances to commonly used antibiotics such as co-trimoxazole (91.17%, MARI 0.043), pefloxacin (90%, MARI 0.042), nalidixic acid (88%, MARI 0.042), cefdinir (87%, MARI 0.041), ampicillin (87%, MARI 0.041), novobiocin (84%, MARI 0.039), cefixime (84%, MARI 0.039), clarithromycin (82%, MARI 0.039), vancomycin (81% MARI 0.038), ofloxacin (81%, MARI 0.038), ceftriazone (76%, MARI (75%, MARI 0.011), amikacin (79%, MARI 0.009), gentamycin (79%, MARI 0.009) and meropenem (82%, MARI 0.008) (Table 3).

Table 2. MAR Indexing of isolates against antibiotics.

Isolates	Resistance	Sensitive	MAR index	Isolates	Resistance	Sensitive	MAR index
E1	19	2	0.90	E35	14	7	0.66
E2	14	7	0.6	E36	12	9	0.57
E3	13	8	0.61	E37	12	8	0.61
E4	06	15	0.28	E38	13	8	0.61
E5	15	6	0.71	E39	13	8	0.61
E6	08	13	0.38	E40	12	9	0.57
E7	13	8	0.61	Ps1	20	1	0.95
E8	14	7	0.66	Ps2	01	20	0.04
E9	16	5	0.76	Ps3	18	3	0.85
E10	12	9	0.57	Ps4	03	18	0.14
E11	16	5	0.76	Ps5	16	5	0.76
E12	10	11	0.47	Ps6	16	5	0.76
E13	12	9	0.57	Ps7	11	10	0.52
E14	14	7	0.66	Ps8	11	10	0.52
E15	16	5	0.76	Ps9	13	8	0.61
E16	11	10	0.52	Ps1	16	5	0.76
E17	18	3	0.85	K1	20	1	0.95
E18	12	9	0.57	K2	03	18	0.14
E19	15	6	0.71	K3	12	9	0.57
E20	13	8	0.61	K4	14	7	0.66
E21	14	7	0.66	K5	11	10	0.52
E22	10	11	0.47	K6	14	7	0.66
E23	14	7	0.66	K7	11	10	0.52
E24	12	9	0.57	Pm1	01	20	0.04
E25	12	9	0.57	Pm2	19	2	0.90
E26	14	7	0.66	Pm3	15	6	0.71
E27	13	8	0.61	Pm4	14	7	0.66
E28	12	9	0.57	Pm5	11	10	0.52
E29	16	5	0.76	Pm6	12	9	0.57
E30	14	7	0.66	S1	13	8	0.61
E31	10	11	0.47	S2	05	16	0.23
E32	14	7	0.66	S3	15	6	0.71
E33	15	6	0.71	S4	13	8	0.61

E1 to E40 = *E. coli*
Ps.1 to Ps.10 = Ps. aeruginosa,
Pm1 to Pm6 = Proteus mirabilis
K1 to K7 = K. pneumoniae
S1 to S4 = Staphylococcus aureus
C1= Citrobacter freundii

DISCUSSION

E. coli was found to be most predominant (59%) urinary tract infection in our study; the identical finding (58.8%) was also reported by Inabo and Obanibi (2006). The

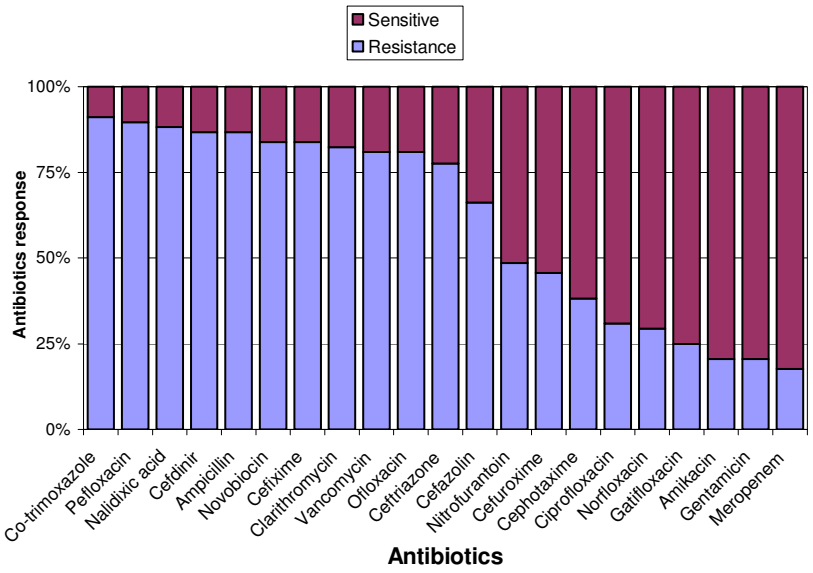

Figure 1. Antibiotics response of uropathogens.

Table 3. MAR index of antibiotics against isolated uropathogens.

Antibiotics	Resistance	Sensitive	MAR index
Co-trimoxazole	62	6	0.043
Pefloxacin	61	7	0.042
Nalidixic acid	60	8	0.042
Cefdinir	59	9	0.041
Ampicillin	59	9	0.041
Novobiocin	57	11	0.039
Cefixime	57	11	0.039
Clarithromycin	56	12	0.039
Vancomycin	55	13	0.038
Ofloxacin	55	13	0.038
Ceftriazone	52	15	0.037
Cefazolin	45	23	0.031
Nitrofurantoin	33	35	0.023
Cefuroxime	31	37	0.021
Cephotaxime	26	42	0.018
Ciprofloxacin	21	47	0.014
Norfloxacin	20	48	0.014
Gatifloxacin	17	51	0.011
Amikacin	14	54	0.009
Gentamycin	14	54	0.009
Meropenem	12	56	0.008

study reported that *Ps. aeruginosa* and *C. freundii* were 15 and 1%, respectively, in urinary tract infection, as was and *S. aureus* were observed to be 10 and 6%, respectively, which are in concordance with UTI frequency reported (Hussain et al., 2005). Urinary tract infection was frequently caused in female (63%) than male (37%), which were also observed by Schaeffer et al. (2001).

Tankhiwale et al. (2004) observed maximum resistant to ampicillin (79.6%), co-trimoxazole (82%) and nalidixic acid (73.8%). They also reported that nitrofurantoin (62%), cephotaxime (58.7%) and norfloxacin (45%), constitute the reasonable option for treatment of UTI. In present study, uropathogens were resistant to ampicillin (87%), co-trimoxazole (91%), nalidixic acid (88%) and sensitive to nitrofurantoin (52%), cephotaxime (54%) and norfloxacin (71%) (Figure 1).

Ehinmidu (2003) reported that E. coli, S. aureus and Ps. aeruginosa strains were highly sensitive to ciprofloxacin and gentamicin and these isolates were resistant to ampicillin. The author also reported that MAR index of isolated bacteria is greater than 0.2, which implies that strains of such bacteria originate from an environment where several antibiotics are used. MAR index of isolates in present study indicate large portion of bacteria were exposed to the antibiotics showing MAR index more than 0.2. Most of isolated uropathogens showed multiple antibiotics resistance in this area. It may be due to large portion of the bacterial isolate being previously exposed to several antibiotics.The present study data gives idea about the common trend of increased antibiotics resistance of uropathogens in this region, which may be due to geographic variation or indiscriminate or sublethal use of antibiotic. This data not only help in proper treatment of UTI patients but also discourage the indiscriminate use of antibiotics and prevent further development of bacterial drug resistance.

The data will also help the clinicians to give proper treatment and prescription of most sensitive antibiotic to the patient and avoid use of resistant antibiotics.

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