Study of Antibiotic Sensitivity Pattern In Urinary Tract Infection At A Tertiary Hospital

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Abstracts: This study was conducted in a tertiary hospital at Bareilly, Uttar Pradesh between Aug 2009 and July 2010 to check the changing pattern of antibiotic sensitivity among uropathogens causing urinary tract infections (UTI). A total of 170 urine culture sensitivity reports were analyzed. The predominant growth of single bacteria was seen in 143 (84.12%) samples. The most common organisms isolated were Escherichia coli, klebsiella, pseudomonas, and Staphylococcus aureus. (These represented 64.33%, 92; 20.3%, 29; 9.1%, 13 and 6.30%, 9 of isolates respectively). More than 80% of the isolates were sensitive to amikacin and nitrofurantoin, while more than 70% were sensitive to norfloxacin, ciprofloxacin and levofloxacin. Very high rate of resistance was seen against cotrimoxazole (81.82%), amoxicillin (77.42%) and amoxi-clav (64.34%). E. coli showed high sensitivity to Amikacin 98.91% (91), Nitrofurantoin 93.48% (86). 75% of E. coli isolates were sensitive to minocycline, showing a good utility of this drug for the treatment of outdoor patients with urinary tract infections. [Joshi M C et al. NJIRM 2011; 2(3): 43-46]

Key Words: Antibiotic Sensitivity, Uropathogens, Urinary Tract Infection.

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Introduction: Urinary tract infections (UTIs) are some of the most common infections experienced by humans, exceeded in frequency among ambulatory patients only by respiratory and gastrointestinal infections[1]. Neonates, girls, young women, and older men are most susceptible to UTIs. In women, bacterial cystitis is the most common bacterial infection. Every woman has a 60% lifetime risk of developing bacterial cystitis, which develops mostly before the age of 24. By contrast, men have a lifetime risk of only 13%[2]. In children approximately 5% of girls and 1% of boys have a UTI by 11 years of age[3]. It is also the most common cause of nosocomial infections in adults. Urinary tract infection is said to exist when pathogenic microorganisms are detected in the urine, urethra, bladder, kidney, or prostate with or without the presence of specific symptoms. In most instances, growth of more than 105 organisms per milliliter from a properly collected midstream "clean-catch" urine sample indicates infection. However, significant bacteriuria is lacking in some cases of true UTI, especially in symptomatic patients, a smaller number of bacteria (102 to 104/mL) may signify infection. In urine specimens obtained by suprapubic aspiration or "in-and-out" catheterization and in samples from a patient with an indwelling catheter, colony counts of 102 to 104/mL generally indicate infection. Conversely, colony counts of >105/mL of midstream urine are occasionally due to specimen contamination, which is especially likely when multiple species are found[4]. The vast majority of uncomplicated UTIs are caused by the Gram-negative bacillus Escherichia coli, with other pathogens including Enterococci, Staphylococcus saprophyticus, Klebsiella spp. and Proteus mirabilis[5]. 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[6]. In patients with suspected UTI, antibiotic treatment is usually started empirically, before urine culture results are available. To ensure appropriate treatment, knowledge of the organisms that cause UTI and their antibiotic susceptibility is mandatory[7]. As both temporal and local variables can modify these data, they need to be constantly re-evaluated to achieve a maximal clinical response before the antibiotic susceptibility the isolate is known. The aim of the present study was to assess the changing susceptibility of urinary pathogens to antimicrobial agents in UTIs.

Material and Methods: A total of 250 urine culture sensitivity reports were analyzed of patients who were suspected to be having urinary tract infection, from Aug 2009 to July 2010 with prior

permission from Institutional Ethical Committee in Rohilkhand Medical College & Hospital, Bareilly. Clean-catch midstream urine specimens from patients diagnosed clinically to be having UTI on the basis of symptoms (fever, dysuria & increased frequency of urination) were inoculated on Blood Agar and McConkey Agar plates, which were incubated aerobically at 37 ^{o}C overnight. Plates showing growth suggestive of significant bacteruria, with colony counts exceeding 10^{5} cfu/ml were subjected to standard biochemical tests for identification and antimicrobial sensitivity testing by Kirby- Bauer disc diffusion method. Interpretation as 'Sensitive' or 'Resistant' was done on the basis of the diameters of zones of inhibition of bacterial growth as recommended by the disc manufacturer. Antibiotics against which sensitivity was tested in the present study included Amoxycillin, Amoxiclav, Ciprofloxacin, Norfloxacin, Levofloxacin, Co-trimoxazole, Gentamicin, Amikacin, Nitrofurantoin, Minocycline and Ceftazidime.

Result: A total of 170 urine culture sensitivity reports were analyzed in the present study between Aug 2009 and July 2010. The predominant growth of single bacteria was seen in 143 (84.12%) samples. The most common organisms isolated were Escherichia coli, klebsiella, pseudomonas, and Staphylococcus aureus. (These represented 64.33%, 92; 20.30%, 29; 9.10%, 13 and 6.30%, 9 of isolates respectively). More than 80% of the isolates were sensitive to amikacin and nitrofurantoin, while more than 70% were sensitive to norfloxacin, ciprofloxacin and levofloxacin [Table 1]. E. coli showed high sensitivity to Amikacin 98.91% (91), Nitrofurantoin 93.48% (86) and ceftazidime 80.43% (74) with good susceptibility to Fluoroquinolones- {Levofloxacin 75% (69), Norfloxacin 73.91% (68), Ciprofloxacin 69.56% (64)} and Minocycline 75% (69). The Klebsiella showed highest sensitivity to Amikacin 89.65% (26) and Nitrofurantoin 75.86% (22), while it was also susceptible to the Ceftazidime 68.96% (20) and Fluoroquinolones {Levofloxacin 72.41% (21), Norfloxacin 72.41% (21), and Ciprofloxacin 68.96% (20)} and Gentamicin 62.10% (18). Pseudomonas showed highest sensitivity to Ceftazidime 84.62% (11) and Fluoroquinolones {Norfloxacin 76.92% (10), Ciprofloxacin 69.32% (9)} followed by Aminoglycosides {Amikacin 61.54% (8), Gentamicin 53.85% (7). The Staphylococcus aureus showed high sensitivity to Amoxiclav 88.9% (8), Amoxicillin 77.8% (7), Nitrofurantoin 88.9% (8), Ciprofloxacin 77.8% (7), Gentamicin 55.5% (5) [Table 2].

Table 1- Overall Percentage of uropathogens sensitivity to Antibiotics

Antibiotic	Sensitivity (%)	Resistance (%)
Amoxicillin	22.38%	77.42%
Amoxi-clav	35.66%	64.34%
Cotrimoxazole	18.18%	81.82%
Gentamicin	63.64%	36.36%
Amikacin	87.41%	12.59%
Ciprofloxacin	73.43%	26.57%
Norfloxacin	72.73%	27.27%
Levofloxacin	73.43%	26.57%
Nitrofurantoin	81.12%	18.88%
Ceftazidime	73.43%	26.57%
Minocycline	53.15%	46.85%

Table 2- Antibiotic Sensitivity & Resistance Pattern of Isolated Organism in UTI

	E.coli (n=92)		Klebsiella (n=29)		Pseudomonas (n=13)		Staph.aureus (n=9)	
	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
Amoxicillin	19.60%	80.40%	31.0%	69.0%	ND		55.55%	46.15%
Amoxi-clav	27.20%	72.80%	65.52%	34.48%	ND		77.80%	23.1%
Cotrimoxazole	19.60%	80.40%	10.34%	89.66%	ND		55.55%	46.15%
Gentamicin	66.30%	43.70%	62.10%	37.90%	53.85%	46.15%	55.55%	46.15%
Amikacin	98.91%	1.09%	89.65%	10.35%	61.54%	38.46%	ND	
Ciprofloxacin	69.56%	30.44%	68.96%	31.04%	69.32%	30.68%	77.8%	22.2%
Norfloxacin	73.91%	26.09%	72.41%	27.59%	76.92%	23.08%	66.70%	33.30%
Levofloxacin	75.0%	25.0%	72.41%	27.59%	61.54%	38.46%	77.77%	22.23%
Nitrofurantoin	93.48%	6.52%	75.86%	24.14%	ND		88.9%	11.10%
Ceftazidime	80.43%	19.57%	68.96%	31.04%	84.62%	15.38%	ND	
Minocycline	75.0%	25.0%	10.34%	89.66%	15.38%	88.89%	22.22%	84.60%

Discussion: In community and hospital settings the etiology of UTIs and the antimicrobial susceptibility of UTI causing bacteria's have been changing over the years[8,9]. Over the last decade, the treatment of choice for urinary tract infections (UTIs) has changed from co-trimoxazole to quinolones owing to the rate of resistance to co-trimoxazole and its high level of therapeutic failure[10].Antimicrobial resistance has been associated with an increased rate of clinical failure, and reports from Canada and the US indicate that the prevalence of cotrimoxazole resistance exceeds 15% and can be as high as 25%. Use of fluoroquinolones is recommended for uncomplicated UTIs in areas where the incidence of cotrimoxazole resistance exceeds 10%, as well as for the treatment of complicated UTIs and acute pyelonephritis[5].

Amongst the bacteria causing UTIs, Escherichia coli remains a common aetiology (< or =60%), other bacteria like Enterobacteriaceae other than E.coli, Gram-negative bacilli (e.g. Pseudomonas aeruginosa), and Gram-positive bacteria (e.g. Staphylococcus aureus) are frequently isolated. Patients with long-term catheterisation have UTIs typically caused by organisms that produce biofilms making eradication even more difficult. Overall, aetiology and resistance patterns are not predictable for those with serious UTIs, necessitating confirmation by culture and susceptibility testing[11].

A total of 170 urine culture sensitivity reports were analyzed in the present study between Aug 2009 and July 2010. The predominant growth of single bacteria was seen in 143 (84.12%) samples. In our study we found significant growth of Escherichia coli, klebsiella, pseudomonas, and Staphylococcus aureus. These represented 64.33%, 92; 20.30%, 29; 9.10%, 13 and 6.30%, 9 of isolates respectively.

From this study, it can be seen that cotrimoxazole and amoxicillin are virtually useless against uropathogens causing UTI, as they were effective against 18% and 22% of all isolated organisms, respectively. Amoxiclav and minocycline were slightly better and showed activity in 35% and 53% cases respectively. Some studies specifically indicate the higher use of oral minocycline in last five years because of the higher susceptibility of uropathogens against minocycline[12], probably because of good activity against E.coli which is also observed in our study that E.coli isolates showed 75% sensitivity.

Our study suggests nitrofurantoin (81.12% susceptibility) or levofloxacin (73.43% susceptibility) as the first-line drug against UTI before culture and sensitivity is done. Both were very active against Escherichia coli and Staph aureus particularly. Both are cost-effective and readily available in developing countries. Nitrofurantoin replaces levofloxacin in case of pregnancy, since it has been shown to be very safe in pregnancy[13] and also a recent study in India showed that Nitrofurantoin had the best in-vitro susceptibility profile against E.coli[14]. 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[15]. Recently some studies have found an increased microbial resistance to piperacillin, cephazolin, amikacin, and levofloxacin. Additionally, extended-spectrum β-lactamase (ESBL)-producing E. coli tended to be isolated more often in these studies[12].

In another recent study 29.5% of E. coli were suspected to produce extended-spectrum beta-lactamase (ESBL) and amikacin and nitrofurantoin were the only drugs to which >90% of E. coli were susceptible[16]. In the present study nitrofurantoin was effective against 93% isolates of E.coli, 89% isolates of Staph.aureus and 76% of Klebsiella, compared to levofloxacin which was effective in 75%, 77% and 72% cases respectively, but with an advantage of better activity against Pseudomonas (61% susceptibility). In our study E. coli showed highest sensitivity to Aminoglycoside- Amikacin 98.91% (91), along with good sensitivity to Minocyclines 75% (69).

Conclusion: In conclusion one can truly affirm that the choice of drugs in the treatment of UTI is quite narrow today due to the wide scale resistance that the common UTI pathogens show to drugs which have been used previously. Drugs like cotrimoxazole and aminopenicillins which were

considered as effective against uropathogens, are now rarely prescribed as empirical therapy in areas where resistance rate to theses antibiotics is high. But it is clear that nitrofurantoin, flouroquinolones and minocyclines are good choices for the treatment of outpatients. To tackle the upcoming problems of ESBL producing E.coli, nitrofurantoin is again a good choice along with amikacin.

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