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A Retrospective Analysis of Urine Culture and Its Antimicrobial Susceptibility Test Results.

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ABSTRACT

Laboratory diagnosed urinary tract infections (UTI) were retrospectively evaluated to document the common pathogens and their antimicrobial susceptibility patterns. In total 360 urine specimens from the patients (above 12 years) were cultured in microbiology laboratory, Yamunanagar. The urine full report of these patients was also showing presence of bacteria and cultures were considered positive which show significant number of colonies after incubation. The cultures that showed insignificant growth, mixed growth or no growth were counted as negative samples. There was high percentage of culture positive samples (53%) with very high coliform isolation (75.80%). Culture negative samples were 47%. Further these positive cultures were subjected to antimicrobial susceptibility testing using antibiotics (Disc diffusion assay/ Kirby Bauer method). It was observed that lowest resistance was shown to amikacin and lower to nitrofurantoin but highest resistance was shown to cotrimoxazole. Thus this study revealed that the coliforms were the commonest pathogens isolated and resistance was shown to many antibiotics. Furthermore antibiotics useful in the treatment of UTI in the decreasing order of their affectivity are amikacin > nitrofurantoin > norfloxacin > ciprofloxacin > meropenem > cotrimoxazole.

Keywords: Urinary tract infections, UTI, retrospective analysis, antibiotic resistance, antimicrobial susceptibility tests.

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INTRODUCTION

UTI is one of the commonest infections that can affect any part of the urinary system. Bacteria can enter the urinary system through urethra or more rarely through blood stream. Although urine itself contains variety of fluids, salts and waste products but sterile urine does not have bacteria in it. UTI can be of two types:

Lower UTI– it's an infection of lower part of urinary tract that includes bladder and urethra. An infection of bladder called cystitis and urethra named urethritis.

Upper UTI– it's an infection of upper part of urinary tract that includes kidneys and ureters. It is named as acute pyelonephritis. It is potentially more serious than lower UTI because there is possibility of kidney damage.

In an Iceland study 516 UTI cases were studied along with their antimicrobial profiles. *E.coli* was far most cause of UTI 83% followed by *Staphylococcus saprophyticus* 7%. *E.coli* showed resistance to ampicillin accounted for 36% cases with the corresponding figures, for sulfafurazole being 37%, cephalothin 45%, trimethoprim 13%. Only 1% of the strains were resistant to nitrofurantoin. The total use of antimicrobial drug was 17.4 DDD (daily defined doses)/1000 inhabitants /day [4].

Now a day's number of antibiotics are used for the treatment but sometimes without testing the susceptibility of urinary pathogen to common antibiotics. This lead to Antibiotic resistance: it's an ability of an organism to withstand the effects of antibiotics. It is a specific type of drug resistance.

According to one Canadian study *Escherichia coli* remains the predominant uropathogen (80%) isolated in acute community-acquired uncomplicated infections, followed by *Staphylococcus saprophyticus* (10% to 15%). *Klebsiella*, *Enterobacter*, and *Proteus* species, and enterococci infrequently cause uncomplicated cystitis and pyelonephritis [2]. The most common organisms isolated in children with uncomplicated UTI are *Enterobacteriaceae*. Etiologic pathogens associated with UTI among patients with diabetes include *Klebsiella* spp., Group B streptococci, and *Enterococcus* spp., as well as *E coli*. Other common uropathogens include *Pseudomonas* and *Proteus mirabilis*.

Another study conducted in West Indies revealed that out of 14,853 hospital specimens an isolation rate was 27.9%. *E.coli* was the predominant cause of UTI. The rate of isolation of other pathogens was relatively stable except for *Citrobacter sp.* which increases from 1.3% to 20.1%. Significantly more resistance to cefuroxime was observed while resistance to ampicillin and nalidixic acid was high. There was 99% resistance to tetracycline in relation to nitrofurantoin. They reported that for nosocomial UTI drugs most effective includes nalidixic acid, nitrofurantoin, gentamicin, cotrimoxazole and amoxicillin [3].

Another study conducted in Israel revealed clinical and epidemiological spectrum of 175 cases of UTI at a university hospital. Bacteraemia was detected in 18% cases. The rate of *E.coli* bacteriuria ranged from 64–94%. In these isolates 92% were susceptible to ciprofloxacin and significant high rate of resistance was shown for ampicillin, ceftazidime, cefuroxime and cotrimoxazole except for quinolones and nitrofurantoin [7].

A Spanish study has shown that out of 164 isolates of *E.coli* from urine cultures overall 57.3% of isolates were resistant to ampicillin, 25% to cotrimoxazole, 20% to nalidixic acid, 14% to norfloxacin and ciprofloxacin and 0% to fosfomycin and nitrofurantoin. A Spanish study has shown that out of 164 isolates of *E.coli* from urine cultures overall 57.3% of isolates were resistant to ampicillin, 25% to cotrimoxazole, 20% to nalidixic acid, 14% to norfloxacin and ciprofloxacin and 0% to fosfomycin and nitrofurantoin [5, 6].

UTI is much more common in sexually active women than in men. It can be easily treated with a short course of antibiotics. If treated properly UTI cause no further complication and infection soon passes. However if left untreated it can cause serious damage. *E.coli* is the common causative agent and others are *Klebsiella*, *Proteus*, *Pseudomonas* and *Enterococcus* etc. A urine analysis is a good screening test but to identify or diagnose the causative agent and antibiotics to be used for treatment, urine culture and sensitivity test is required [1].

The main objective of this retrospective analysis is to find out a) Common pathogens causing UTI b). Emphasize the importance of culture and antimicrobial susceptibility for UTI treatment.

MATERIAL AND METHODS

This descriptive study was performed on 360 patients with urinary tract infections referred to a microbiology laboratory, teaching institute and hospital Yamunanagar. Urine samples were collected according to the midstream method and in sterile containers. These were cultured on Blood agar and MacConkey's media. After 48 hours incubation at 37 degrees Celsius, plates were observed. The culture positive colonies were then spreaded on nutrient agar medium (antimicrobial sensitivity test). The disc diffusion assay was used. After incubation and diameter measurements, the sensitive and resistant micro-organisms were determined.

The sample in which the age of the patient was below 12 years was not considered. Generally the urine full report of these patients was also showing presence of bacteria and cultures were considered positive which show significant number of colonies after incubation. The cultures that showed insignificant growth, mixed growth or no growth were counted as negative samples. In all forms patient's age, sex and catheterized or not were mentioned.

RESULTS

For this review, we have analysed total 360 culture reports generated by microbiology laboratory, teaching institute and hospital Yamunanagar. There was high percentage of positive

samples (53%) predominantly with coliforms (75.80%). Other organisms showed lower percentage i.e. *Pseudomonas* 4.73% and *Staphylococcus* 19.47%. The culture negative samples were 47% (Table 1). Regarding resistance total 190 samples were tested for antimicrobial sensitivity. Numbers of antibiotics were used but only few antibiotics were analysed for this review. Out of six antibiotics least resistance was shown to amikacin 14% and lesser was shown to nitrofurantoin 30% followed by norfloxacin 57%. Highest resistance was shown to cotrimoxazole i.e. 84% (Table 2).

Table 1: Type of Bacterial growth isolated from urine cultures.

ORGANISMS	SAMPLES POSITIVE/NEGATIVE	PERCENTAGE (%)
SAMPLE POSITIVE 190/360= 53%		
Coliforms	144	75.80%
<i>Pseudomonas</i>	09	4.73%
<i>Staphylococcus</i>	37	19.47%
Total	190	100.00%
SAMPLE NEGATIVE 170/360= 47%		
No Growth	151	88.82%
Mixed insignificant Growth	19	11.18%
Total	170	100.00%
Grand Total	360	

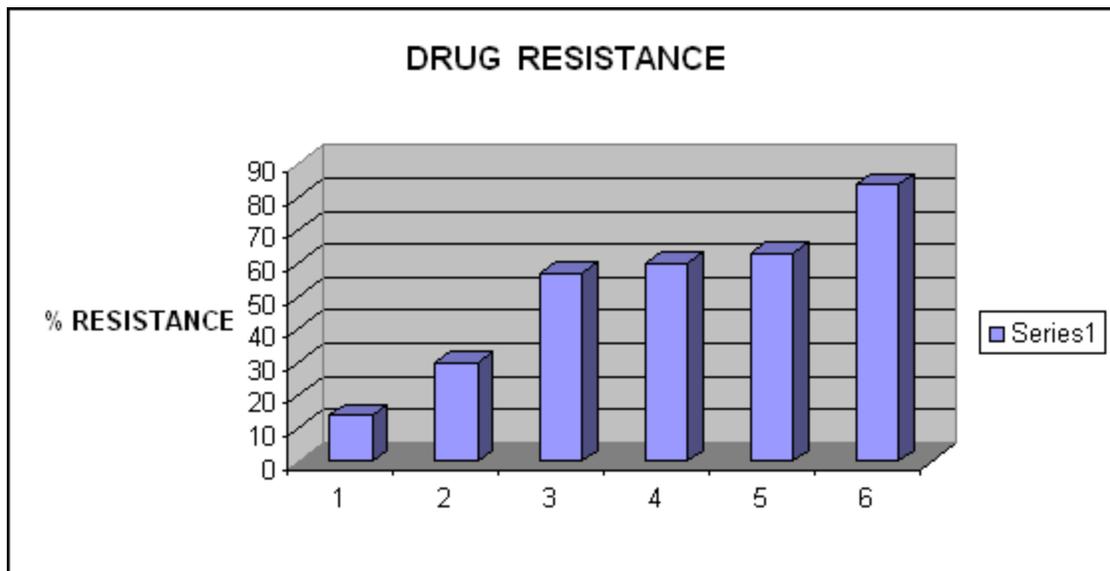
Table 2: Organisms from 190 positive samples tested for antimicrobial sensitivity using different drugs /antibiotics and their percentage resistance.

ANTIBIOTICS	RESISTANT SAMPLES	RESISTANCE PERCENTAGE (%)
Amikacin	27	14%
Ciprofloxacin	114	60%
Cotrimoxazole	159	84%
Meropenem	119	63%
Norfloxacin	108	57%
Nitrofurantoin	57	30%

DISCUSSION

UTI are among the most common types of bacterial infections and micro organisms from urinary tract are among the most common causes of septicaemia. Further development of antibiotic resistance ('Superbugs') is the growing concern in all areas of health care specially UTI. Methicillin resistant *Staphylococcus aureus* is the deadliest. In recent years analysis of 30 studies the average mortality rate from such infection was 36%. The main factors which contribute the highest resistance is (a) increased use of antibiotics for the treatment (b) antibiotic misuse, means inappropriate treatment without knowing the causative agent and its antimicrobial susceptibility. Common forms of antibiotic misuse include the failure to take the entire course of antibiotic or failure to rest for sufficient recovery allowing clearance from causative agent. This results in development of bacterial population with antibiotic resistance

or development of 'Superbugs'. A very common example is the use of antibacterial antibiotic to treat viral infection such as common cold.



1 Amikacin, 2 Nitrofurantoin, 3 Norfloxacin, 4 Ciprofloxacin, 5 Meropenem, 6 Cotrimoxazole

Furthermore most of the antibiotics available in the market are derived from natural molecules which microbes produce from natural molecules to protect themselves from other organisms or for competition. So genetic resistance to these antibiotics is to be expected; at least the microbe that produces the antibiotic must be resistant to it.

According to one American study *E.coli* remains the uropathogen (80%) isolated in acute community acquired infections followed by *Staphylococcus* (10-15%), *Klebsiella*, *Enterobacter* and *Proteus sp.* and Enterococci causing infrequently cystitis and pyelonephritis [2].

In the present study coliforms were predominantly identified. Highest percentage of coliforms (75.80%) was obtained and the *Pseudomonas sp.* infections were the least (4.73%). These organisms showed highest resistance to cotrimoxazole (84%) and least to amikacin and lesser to nitrofurantoin that means amikacin and nitrofurantoin can also be used as first line drug in the treatment of UTI which is presently rarely used as first choice.

CONCLUSION

In the present review, we emphasize the importance of culture and sensitivity testing in case of UTI. As antibiotic courses are started without knowing the pathogen and its sensitivity pattern. This will add to increase prevalence of resistance among pathogens to antibiotics that are now days used for the treatment of UTI. Furthermore, this retrospective analysis revealed the use of amikacin and nitrofurantoin as first line drug for the treatment of UTI.



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