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Original Research Article

Bacteriological profile of urinary tract infections at a tertiary care hospital in Western Uttar Pradesh, India

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ABSTRACT

Background: This prospective study was intended to identify the bacterial pathogens causing urinary tract infections and their antimicrobial resistance patterns in a tertiary care teaching hospital of Western Uttar Pradesh, India.
Methods: Clean-catch mid-stream urine samples were collected from patients symptomatic for UTI. Samples were cultured aerobically on CLED agar and strains having significant growth (>10^5cfu/ml) were further processed for identification using standard microbiological techniques and their antimicrobial susceptibility pattern evaluated by Kirby Bauer disk diffusion as per CLSI guidelines.
Results: Out of the 2250 urine samples processed, 750 showed significant growth on aerobic culture. Thus, the prevalence of UTI in the population was 33.3%. *E. coli* was the commonest isolate (33.3%) followed by *S. aureus* (20 %), *Klebsiella* spp. (13.3%), Coagulase Negative *Staphylococci* (13.3%), *Enterococcus spp*. (6.7%), *Pseudomonas spp*. (6.7%) and *Candida spp*. (6.7%). Amongst these isolates, Gram negative bacilli have shown a high susceptibility to imipenem, levofloxacin, nitrofurantoin, linezolid and amoxyclav and Gram positive organisms towards levofloxacin, nitrofurantoin, linezolid, vancomycin and amikacin.
Conclusions: This study has shown nitrofurantoin and fluoroquinolones to be the most effective drugs for the empirical therapy of UTI in our region. The study of antimicrobial susceptibility pattern of UTI in a particular area can guide the clinicians in the rational choice of antibiotic treatment so that misuse of antibiotics can be prevented.

Keywords: Antibiogram, Antibiotic susceptibility, CLED agar, Urine culture, Urinary tract infection

INTRODUCTION

Urinary tract infections remain one of the most common infections and a leading cause of morbidity in human population. It has been estimated that approximately 150 million people suffer with UTI annually all over the world accounting for as many as 40-50% of nosocomial infections.[1] They may lead to long term complications like hypertension and chronic renal disease. Hence timely detection and proper treatment of UTIs is very important.

The spectrum of micro-organisms causing UTIs is wide. Previous studies have suggested *E. coli* to be the most common cause of UTIs in Indian population, followed by other uropathogens like Gram negative bacilli (e.g. *Klebsiella spp*., *Pseudomonas spp*., *proteus spp*.) and Gram positive bacilli (*S. aureus*, *Enterococcus spp*.).[2-4] It has been observed that females are more susceptible to UTI as compared to males due to shorter and wider urethra.[5]

Due to the indiscriminate use of antibiotics by healthcare providers, resistance has been gradually increasing in uropathogens. Therefore, it is of utmost concern to formulate local antibiotic guidelines for the judicious treatment of UTI. The urinary antibiogram patterns help

clinicians a lot in deciding the empirical therapy of UTIs so that the incidence of antimicrobial resistance may decrease. Hence, we undertook this study on the isolation of urinary pathogens and their antibiogram pattern at our institute.

METHODS

This prospective study was conducted at the Department of Microbiology of a tertiary care teaching hospital of Western Uttar Pradesh, India over a period of 8 months from December 2015 to July 2016 after getting clearance from the institutional ethical committee.

Study population

Present study included 2250 urine samples collected from the suspected cases of UTI. It included all outpatients and inpatients irrespective of their age groups or genders presenting with symptoms of UTI (burning micturition, fever, hematuria, dysuria etc.).

Collection of urine samples

Patients were provided with sterile, wide mouthed screw capped containers and they were asked to give early morning mid-stream clean catch urine samples. The collected urine samples were properly labeled and all the patient particulars (name, age, sex, time of collection etc.) were indicated on the urine samples. Then the samples along with the requisition forms were sent to the microbiology laboratory. The samples were analyzed and processed according to the standard protocol within 2 hour of collection.[6]

Sample processing

Culture- Culture of urine samples was done using a sterile calibrated bacteriological loop of 4 mm diameter designed to deliver 0.01ml. A loopful of the well mixed urine sample was inoculated onto CLED Agar plate. The plate was then inverted and incubated in the incubator at 37°C for 18-24 hours. After the required incubation period, the plates were examined for bacterial growth. The colony count was done using semi-quantitative method & multiplied by 100 to give an estimate of the number of bacteria present per ml of urine.

A count equal to or in excess of 10^5 bacteria per ml was taken as a significant bacterial count.[6] If CFU was less than 10^5 bacteria per ml, it was considered as insignificant and not processed further. The patients were asked to submit repeat samples with early morning fresh midstream urine specimens in cases of mixed growth.

Identification of uropathogens- Identification of the isolated bacterial pathogens was done on the basis of gram staining, morphological characteristics and biochemical reactions by standard methods.[6] Antimicrobial susceptibility testing- Antimicrobial sensitivity of the isolated pathogens was determined by using a panel of 10-12 antibiotics by Kirby-Bauer disc diffusion method according to Clinical and Laboratory Standards Institute guidelines.[7] The Mueller Hinton agar (MHA) plates were incubated at 37°C for 18-24 hours and results were read on the next day. Negative cultures were incubated further for another 24 hours and report was given as no growth at the end of 48 hours of incubation.

RESULTS

Out of the 2250 urine samples that were processed in present study, 1500 samples showed no growth or insignificant growth while 750 showed significant growth on aerobic culture. Overall prevalence of UTI in the whole population was 33.3%. Females (45.4%) showed a higher prevalence as compared to males (22.3%).

Table 1: Gender wise distribution of the culture positive UTI cases.

Gender	Total samples	Positive cases (%)
Male	1175	262 (22.3)
Female	1075	488 (45.4)
Total	2250	750 (33.3)

Out of the remaining 750 urine samples that yielded significant growth, *E.coli* was the commonest isolate (33.3%) followed by *S.aureus* (20%), *Klebsiella spp*. (13.3%), Coagulase negative *Staphylococci* (13.3%), *Enterococcus spp*. (6.7%), *Pseudomonas spp*. (6.7%) and *Candida spp*. (6.7%).

Table 2: Distribution of uropathogens in culture positive cases (n=750).

Uropathogen	Isolation rate (%)
E. coli	250(33.3%)
S. aureus	150 (20%)
Klebsiella spp.	100 (13.3%)
Coagulase negative Staphylococcus	100 (13.3%)
Enterococcus spp.	50 (6.7%)
Pseudomonas spp.	50 (6.7%)
Candida spp.	50 (6.7%)
Total	750

In case of *E. coli*, Imipenem showed the highest sensitivity (92%) followed by nitrofurantoin (80%), levofloxacin (80%), linezolid (75%) and Amoxycillin Clavulanate (75%). Ampicillin showed the highest resistance (60%).

In case of *Klebsiella spp*., imipenem showed highest sensitivity (95%) followed by Levofloxacin (90%), norfloxacin (80%), Amoxycillin Clavulanate (80%) and nitrofurantoin (80%). Highest resistance rate was seen towards ampicillin and nalidixic acid. In case of

Pseudomonas spp., linezolid showed the highest sensitivity (92%). Other antibiotics with decent sensitivity were piperacillin tazobactam (90%), levofloxacin (86%) and Amoxycillin Clavulanate (84%). Highest resistance rate was seen towards ampicillin (48%). Amongst the gram-positive isolates, *S.aureus* was the commonest isolate (20%). Overall, it was the second most common isolate after *E. coli*. In case of *S. aureus*, linezolid (100%) and vancomycin (100%) showed highest sensitivity followed by amikacin (88%) while erythromycin showed the highest resistance. In case of *Enterococcus spp.*, nitrofurantoin (84%) and tetracycline (78%) showed decent sensitivities. High resistance rate was seen towards third generation cephalosporins and ampicillin.

Table 3: Antibiotic sensitivity pattern of isolated uropathogens.

Antibiotic	*E. coli* n=250 (%)	*Klebsiella spp.* n=100 (%)	*P. aeruginosa* n=50 (%)	*S. aureus* n=150 (%)	*Enterococcus* n=50 (%)
Ampicillin	40	44	52		20
Ampicillin sulbactam	54	58	65		32
Cefixime	60	65			
Cefuroxime	52	72	82		12
Ceftriaxone	60	65			25
Levofloxacin	80	90	86	84	40
Linezolid	75	70	92	100	65
Imipenem	92	95			40
Nalidixic acid	42	45			
Nitrofurantoin	80	80	82	74	84
Norfloxacin	60	84	86	75	
Amoxycillin Clavulanate	75	80	84	70	40
Erythromycin				50	
Doxycycline				65	
Piperacillin tazobactam			90	82	
Vancomycin				100	
Ciprofloxacin			80	82	
Amikacin				88	
Tetracyclin					78

DISCUSSION

The prevalence of UTI in the population was 33.3%. This figure corresponds to the prevalence rate of 31.35% reported by Savitha T et al.[8] However, other Indian studies have even reported higher prevalence.[9,10] The most common uropathogens isolated in these patients were *E. coli* (33.3%), *S. aureus* (20%) and *Klebsiella spp.* (13.3%). This finding pattern was almost similar with other studies by Supriya et al, Khanna P et al and Kumar R et al.[3,11,12]

In this study, the prevalence of UTI in females (45.4%) is more than in males (22.3%). It correlates to the findings of Kumar R et al, Aruna K et al and Acharya et al who have also reported high prevalence rate of UTI among females as compared to males.[3,13,14] The most effective antibiotics against Gram negative bacilli as depicted in this study were imipenem, levofloxacin, nitrofurantoin, linezolid, amoxycillin clavulanate and levofloxacin and against Gram positive organisms were nitrofurantoin, linezolid, vancomycin and amikacin. Present study suggests that levofloxacin or nitrofurantoin may be used for empirical therapy against UTI in this region before culture and sensitivity reports are available. Both these drugs have good overall sensitivity against both gram negative bacilli as well as gram positive cocci. Also both the drugs are cost effective as well as readily available. However, in case of pregnancy, levofloxacin can be replaced with nitrofurantoin as it is comparatively safer.[15] This finding is similar to other reports where nitrofurantoin and fluoroquinolones have been reported to be most effective drug for empirical therapy in UTI.[10,16,17]

CONCLUSION

The treatment of UTI in general population is often done empirically by the general practitioners. Antibiotic susceptibility tests are ordered by the doctors only when the patient has failed to recover from UTI even after taking one or more courses of antibiotics. The study of antimicrobial susceptibility pattern of UTI in a particular area can guide the clinicians in the rational choice of antibiotic treatment so that misuse of antibiotics may be

prevented. These data highlight the changing trends in the antimicrobial susceptibilities and it may be used by the healthcare agencies to formulate local antibiotic policies. From this study, we have found nitrofurantoin and fluoroquinolones to be most effective drugs for the empirical therapy of UTI in our region. This study has also revealed that the majority of uropathogens are commensals of perianal or vaginal regions. This finding emphasizes the need to maintain the personal hygiene by the patients. UTI is one of the major cause of nosocomial infection. Hence, hospital authorities should focus on training and implementing the universal precaution practices by the healthcare providers and the hospital staff.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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