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Nitrofurantoin Susceptibility Pattern in Urinary Isolates of E.coli in a Tertiary Care Hospital in North East India

KEYWORDS: UTI, Nitrofurantoin,antimicrobial susceptibility

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ABSTRACT *: Urinary tract infection is one of the most common bacterial infections seen in clinical practice particularly in developing countries. The present study shall focus on Nitrofurantoin susceptibility pattern in Urinary Isolates of E.coli in a Tertiary Care Hospital in North East India. Out of 376 urine samples, 216(57.44%) were found to be sterile and 160(42.56%) depicted bacterial growth. 120(75%) sample found to be positive for gram negative bacterial isolates and 40 are gram positive bacteria. The susceptibility and resistance profile of E.coli isolates in this study have shown that Nitrofurantoin (88.10%), Amikacin (85.71%) and Gentamicin(69.04%) possess the high efficacy while Cefazolin(86.90%), Cotrimoxazole(78.57%) and Amoxyclav(77.38%)possess lower efficacy. E.coli remained the most common isolate 84 (52.5%) followed by Klebsiella pneumoniae 14 (8.75%). This study suggested the need for constant monitoring of susceptibility of specific pathogens in different populations to commonly used anti-microbial agents and formulate local antibiotic policies.*

INTRODUCTION: UTI is defined as a significant bacteriuria in the presence of symptoms. Urinary tract infection results from the presence & multiplication of bacteria in one or more structures of the urinary tract with consequent tissue invasion, giving rise to a wide variety of clinical syndromes. Urinary tract infections (UTI) are the most common bacterial infections affecting humans throughout their lifetime. They are the frequent cause of morbidity in outpatients as well as most frequently involved in the cause of nosocomial infection in many hospitals[1]. UTI has become the most common hospital-acquired infection, accounting for as many as 35% of nosocomial infections, and it is the second most common cause of bacteraemia in hospitalized patients[2]. UTI can affect lower and sometimes both lower and upper urinary tracts. The term cystitis has been used to define the lower UTI infection and is characterized by symptoms such as dysuria, frequency, urgency, and suprapubic tenderness. Though UTI is more common in women than men, symptoms and physical exam findings are usually similar in both sexes. The common organisms causing UTI are E.coli, Klebsiella, Proteus, Staphylococcus aureus etc. Escherichia coli are the most common pathogen in LUTIs. Extended-spectrum-lactamase (ESBL)-producing E. coli-related UTI is an emerging problem in many parts of the world. Increasing multidrug resistance in bacterial uropathogens is an important and emerging public health problem. Nitrofurantoin has been used for decades as an alternative treatment of uncomplicated UTIs. Additionally, nitrofurantoin has retained a high prevalence of sensitivity to most uropathogens and has a favorable side-effect profile[3]. Knowledge of the local bacterial etiology and susceptibility patterns is required to trace any change that might have occurred in time so that updated recommendation for optimal empirical therapy of UTI can be made[4] .The study was done to find out the changing trend of antimicrobial resistance pattern of E.coli, isolated from suspected cases of urinary tract infections among both inpatients and outpatients department of a tertiary care hospital.

MATERIAL AND METHODS:

Study population

Present study was carried out for a period of one year during 2014-2015. Urine samples (376) were collected from the patient admitted as well as attending outdoor patient department of tertiary care hospital, in north east of India.

Sample collection and processing

A freshly voided midstream urine samples (10-20 ml) were collected from patients in wide mouth sterile container. The urine specimens were then delivered to the laboratory immediately and processed within one hour.

Culture and Identification

Urine samples were inoculated on Cysteine Lactose Electrolyte Deficient (CLED) agar, MacConkey and Blood agar plates (Hi-Media labs Ltd.) and incubated at 35-37°C for 24 hours using a calibrated loop method. For midstream urine samples, 10^5 CFU / ml were taken as significant. For catheterized specimens and gram positive bacteria lower colony counts were considered significant. The culture isolates were further identified by their morphologies and biochemical characteristics.

Antimicrobial susceptibility testing:

Antibiotic sensitivity testing was done by the Modified Kirby-Bauer disc diffusion method according to the Clinical and Laboratory Standards Institute (CLSI) guidelines[5]. A suspension of test organism was made in sterile normal saline and turbidity adjusted to 0.5 McFarland standards. The test organism was uniformly seeded over the surface of Mueller Hinton agar plates. The plates were allowed to dry for 10minutes before application of antibiotic impregnated discs. The plates were incubated at 37°C for 16-18 hours. After incubation clear zones around the antibiotic discs were measured with a ruler and recorded in millimeters. Their sensitivities to Amoxyclav (30µg), Nitrofurantoin (300µg), Cefazolin (30µg) , Gentamicin (10µg), Amikacin (30µg), Ciprofloxacin (5µg), Ofloxacin (5µg), Cefuroxime (30µg), Cefotaxime (30µg), and Cotrimoxazole (25µg) (Hi-Media Lab Ltd, Mumbai) were interpreted according to Clinical laboratory Standards Institute guidelines.

RESULTS

Out of 376 urine samples, 216(57.44%) were found to be sterile and 160(42.56%) depicted bacterial growth. Sample found to be positive for gram negative bacterial and

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gram positive bacterial isolates are 120(75%) and 40(25%) respectively. Sex wise Distribution of Urinary Tract Infection is shown in table 1.Ninety eight samples (61.25%) from females were culture positive, thus showing a female predominance. E.coli remained the most common isolate 84 (52.5%) followed by Klebsiella pneumoniae 14 (8.75%), Pseudomonas aeroginosa 9 (5.63%), Citrobacter spp 8(5%) and Proteus 5(3.12%). E.coli isolates reflected maximum sensitivity to Nitrofurantoin (88.10%) followed by Amikacin(85.71%),Gentamicin (69.04%).The resistance rate of urinary E.coli isolated was highest for Cefazolin (86.90%) followed by Cotrimoxazole (78.57%), Amoxyclav (77.38%), Ciprofloxacin (76.19%),Ofloxacin (73.80%) and Cefuroxime (71.42%) as shown in Table 2. As regards gender, females (58.34%) were more commonly infected with E.coli as compared to males (41.66%) and Nitrofurantoin sensitivity was better in females as compared to males is shown in Table 3.

Table 1.Sex wise Distribution of Urinary Tract Infection

Sex	No of Sample Investigated	No of Sample Positive
Female	210	98(61.25%)
Male	166	62(38.75)
Total	376	160

Table 2: Antibiogram of Escherichia coli

Antibiotic	Sensitive (percentage)	Resistant (percentage)
Cotrimoxazole(1.25/23.75µg)	18(21.43)	66(78.57)
Nitrofurantoin(300µg)	74(88.10)	10(11.90)
Amikacin(30µg)	72(85.71)	12(14.24)
Amoxyclav(20/10 µg)	19(22.62)	65(77.38)
Gentamicin(10µg)	58(69.04)	26(30.95)
Ciprofloxacin (5 µg)	20(23.80)	64(76.19)
ofloxacin (5µg)	22(26.19)	62(73.80)
Cefuroxime(30µg)	24(28.57)	60(71.42)
Cefotaxime(30 µg)	37(44.04)	47(55.95)
Cefazolin(30µg)	11(13.09)	73(86.90)

Table 3.Gender-wise distribution and Nitrofurantoin susceptibility of E.coli

Gender	Number of isolates	Sensitive	Resistant
Female	49(58.34%)	44(52.38%)	5(5.95%)
Male	35(41.66%)	30(35.71%)	5(5.95%)
Total	84	74	10

DISCUSSION:

In this study 376 sample are subjected for aerobic culture, 160(42.56%) depicted bacterial growth. The present study provided an outlook on sensitivity pattern of Common uropathogens which were isolated in this part of India. While historically it was believed that the causative organism in UTIs differed between men and women, study data has shown that for both sexes the primary causative pathogen is Escherichia coli. It was observed that the incidence of UTI is more among female(61.25%)than male(38.75%). This was in agreement with other studies by Keah *et al*[6]., Akram *et al*[7]., Kolawole *et al*[8]., Bashir MF *et al*[9]., GetenetB. *et al*[10]., Khadri *et al*[11].,Oladeinde B.H *et al*[12]., Manjunath *et al*[13]., and Barate D L *et al*[14]. Females are more prone to develop UTIs, probably due to their characteristic anatomical and physiological changes - short urethra, its proximity to the anus, urethral trauma during intercourse, dilatation of the urethra and the stasis of urine during pregnancy[15,16]. E.coli (52.5%) remained the predominate organism which was isolated followed by Klebsiella pneumoniae (8.75%), which was in comprehension with the findings of similar studies which were by Priya *et al*[17]., Pallavi *et al*[18]., S Babypadmini et al[19].,Manjunath *et al*[20]., Oladeinde B.H *et al*[21]., Gupta *et al*[22].,Moges *et al*[23]., Sibi *et al*[24]., Khameneh *et al*[25].and Chin *et al*[26].Majority of E.coli isolates were susceptible to Nitrofurantoin (88.10%), with resistant isolates only 11.90%, which is similar to results documented by Shalini *et al*[27].,Kibret M &Abera B[28]., Rijal A *et al*[29].and Bashir MF *et al*[30]. Nitrofurantoin has been used for more than five decades for the treatment of uncomplicated cystitis and it was found to remain active against most of the uropathogens. The antimicrobial susceptibility pattern of present study is clearly indicating that Cotrimoxazole, Am oxyclav,Ciprofloxacin,Ofloxacin and Cefuroxime are virtually useless as regards their efficacy against urinary E.coli isolates with 78.57%, 77.38%,76.19%,73.80% and 71.42% isolates being resistant. In present study aminoglycosides shows high susceptibility as regards Amikacin (85.71%) and Gentamicin(69.04%) which is similar to those reported by Shalini et al[31] &AshaPai KB et al[32].In context of gender, females (58.34%)were more commonly infected with E.coli as compared to males (41.66%) which are comparable to Khoshbakht R et al[33] .who mentioned 89.5% isolates in females and 10.5% in males.

CONCLUSION:

The susceptibility and resistance profile of E.coli isolates in this study have shown that Nitrofurantoin, Amikacin,Gentamicin and Cefotaxime possess the high efficacy while Cefazolin, Cotrimoxazole, Amoxyclav, Ciprofloxacin,Ofloxacin,and Cefuroxime possess lower efficacy. In current practice, urinary tract infections are often treated empirically and susceptibility tests are often carried out only when the patient has failed one or more courses of antibiotics. The susceptibility and resistance patterns of urinary pathogens should be considered before starting empirical treatment for UTI. The present study confirms that bacterial resistance would be a greatest problem in this part of country. Self-medication because of on counter availability of antibiotics and secondly the unwanted prescriptions of antimicrobials by physicians make the situation worst by development of resistance to commonly used antibiotics for treating UTI.The findings suggested that before prescribing an empirical anti microbial therapy, an in-depth knowledge of the aetiology, the predisposing factors, the cultural positivity and the continued evaluation of the susceptibility patterns of the uropathogens to the traditional as well as the new antimicrobials should be perform. These data may be used to determine trends in antimicrobial susceptibilities, to formulate local antibiotic policies, to compare local with national data and overall to assist clinicians in the rational choice of antibiotic therapy.

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