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Sensitivity of Nitrofurantoin to E. Coli in Urinary Tract Infection

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ABSTRACT

Background: Uncomplicated urinary tract infection is one of the most common indications for antibiotic use in the community. However, the Gram-negative organisms that can cause the infection are becoming more resistant to antibiotics. Our aim is to determine sensitivity of nitrofurantoin to E. Coli in patients with urinary tract infection.

Materials and Methods: The study was conducted at a tertiary care hospital of District Peshawar, i.e. Hayatabad Medical Complex (HMC). The survey was conducted as a descriptive cross-sectional study using open Epi calculator, keeping confidence interval of 95%, sample size calculated was 90. Urine samples were collected in sterile containers and was sent to laboratory for routine examination, culture and sensitivity (C/S). A colony 10^5 or more was considered E Coli growth. Nitrofurantoin was used to check the sensitivity for organisms as per operational definition.

Results: E coli was found in 51(56.6%) of patients out of total 90 patients. Patient showing positive UTI C/S resulted in 38 (74.5%) sensitivity to Nitrofurantoin.

Conclusion: Nitrofurantoin is still a good option in cases of UTI with most E. Coli C/S isolates showing sensitivity but emergence of high prevalence of drug-resistant urinary tract pathogens, suggests cautious use of antibiotic therapy for UTI treatment.

***Keywords**:* Antibiotic Resistance; Nitrofurantoin, Urinary Tract Infection

INTRODUCTION

Many multidrug resistant organisms retain susceptibility to an old antibiotic; nitrofurantoin. Advantages over newer drugs include their high urinary concentrations and minimal toxicity.

Antimicrobial resistance is increasing worldwide, resulting in infections that aremore difficult to treat and associated with higher mortality, morbidity and cost. [1-3] Multidrug resistant Gram-negative bacilli are responsible for a rising proportion of community-acquired uncomplicated urinary tract infections.Consequently, empiric therapy is more likely to fail. This has resulted in increasing numbers of patients with uncomplicated urinary tract infections requiring hospitalisation for intravenous antibiotics because there are no oral treatment options.

A large international survey of urinary isolates from 2015 found resistance rates in Escherichia coli of 43% for ampicillin, 9% for amoxicillin with clavulanic acid, 16% for cefazolin, 22% for trimethoprim, and 7% for ciprofloxacin. [4] It is likely that resistance rates have continued to rise since then.

There are few new antibiotics on the horizon and those that have been recently approved are mostly for intravenous use, so older ‘forgotten’ drugs are being re-explored for the treatment of cystitis. [5-7] Nitrofurantoin is an old antibiotic. They share some important properties including high

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concentrations in the urinary tract, a minimal impact on gastrointestinal flora and a low propensity for resistance.

The emergence ofresistance and consequent reduced efficacy of antibiotics in the management ofUTIs is indeed a serious public health problem. This is particularlyimportant in the developing countries like Pakistan, where apart from high levelof poverty, ignorance and poor hygienic practices and drugs of questionablequality are often in circulation. The current study is designed in this regardto find statistics about the efficacy of nitrofurantoin for the treatment of UTIs inour local population. UTI poses significant financial stress and reduced qualityof life due to non-availability sensitivity data. By finding individuals as well ascommunity local statistics of antibiotics sensitivity will help empiric therapyearly in our local population.

Nitrofurantoin has been available since 1953. Its exact mechanism of action is not well understood and presumably multifactorial. Nitrofurantoin requires reduction by bacterial enzymes producing 'highly reactive electrophilic' metabolites. These then inhibit protein synthesis by interfering with bacterial ribosomal proteins. [8]

MATERIALS & METHODS

The study was conducted at a tertiary care hospital of District Peshawar, i.e. Hayatabad Medical Complex (HMC). The survey was conducted as a descriptive cross-sectional study using open Epi calculator, keeping confidence interval of 95%, sample size calculated was 90. Urine samples were collected in sterile containers and was sent to laboratory for routine examination, culture and sensitivity (C/S). A colony 10^5 or more was considered E Coli growth. Nitrofurantoin was used to check the sensitivity for organisms as per operational definition.For the analysis of data SPSS version25.0 for MacBook wasused.

RESULTS

During the study period from January to March 2019, a total 230 urinary cultures were collected. Of a total isolate, positive cultures were representing 28.67% of all cultures collected.

E coli was found in 51(56.6%) of patients out of total 90 patients. Patient showing positive UTI C/S resulted in 38 (74.5%) sensitivity to Nitrofurantoin.There were 50 (55.55%) females and 40 (44.44%) males.Thestudyincluded age range 25 to 50 years. Average age was 31.21 Years + 5.6SD.

Sensitivity of Nitrofurantoin to E. Coli (74.5% Overall)		
Age Group	**Males**	**Females**
25-35	5	7
36-45	6	5
46 Above	8	7

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DISCUSSION

Escherichiacoli(E.coli) is the most commonuro-pathogen in both uncomplicated and complicated UTIs.E. coli remains the majority of pathogen which isolated from urine culture in pediatric, adult, and elderly [9-10] There is a wide spectrum of pathogens causing complicatedUTIsincludingE. coli, Klebsiella,Pseudomonas, Enterobacter, Enterococcus and Candida species.

In a settingwhere more than 20% of E. coli cultures are resistant to TMP-SMX, guidelines recommend ciprofloxacin, nitrofurantoin or Fosfomycin. Nitrofurantoin is an effective urinary tract antiseptic that is not used for other kind of infections.

A very high rate of culturenegative urine samples was received at the laboratory.This might imply that samples are sent for culture inappropriately. Routine urine culture is not necessary. Cost effectiveness can be achieved by only sending cultures from patients with both symptoms of UTI and abnormality on urine dipstick. The dipstick strategy is most likely to be costeffective. This criterion will also help to limit the unnecessary use of empiric antibiotics. Nitrofurantoin should be the empiric choice for uncomplicated UTIs.

E. coli showed the highest sensitivity to nitrofurantoin in thecurrent study, which are in line with those of previous studies [11-13] The data thus further supportsrecommendations made in previous studies, in which, nitrofurantoin may be more effective than co-trimoxazole or amoxicillin in the empiric treatment of UTIs

The present study has some limitations. First, the study was only conducted only in a single setting, which does not represent the other health care settings in the hospital. Thus, the findings cannot be generalized. Second, the study period was short (3 months) and small sample size. Third, there was no follow-up study to investigate the consequences of observed resistance. Therefore, large-scale prospective studies are recommended to determine the extent and outcomes of resistance and sensitivity in UTIs.

CONCLUSION

Nitrofurantoin is still a good option in cases of UTI with most E. Coli C/S isolates showing sensitivity but emergence of high prevalence of drug-resistant urinary tract pathogens, suggests cautious use of antibiotic therapy for UTI treatment.

REFERENCES

1. Walker E, Lyman A, Gupta K, Mahoney MV, Snyder GM, Hirsch EB. Clinical management of an increasing threat: outpatient urinary tract infections due to multidrug-resistant uropathogens. *Clin Infect Dis* 2016;63:960-5.
2. Prakash V, Lewis JS, 2nd, Herrera ML, Wickes BL, Jorgensen JH. Oral and parenteral therapeutic options for outpatient urinary infections caused by enterobacteriaceae producing CTX-M extended-spectrum β-lactamases. *Antimicrob Agents Chemother* 2009;53:1278-80.
3. Spellberg B, Guidos R, Gilbert D, Bradley J, Boucher HW, Scheld WM, et al. Infectious Diseases Society of America The epidemic of antibiotic-resistant infections: a call to action for the medical community from the Infectious Diseases Society of America. *Clin Infect Dis* 2008;46:155-64. 10.1086/524891
4. Australian Commission on Safety and Quality in Health Care. AURA 2017: second Australian report on antimicrobial use and resistance in human health. Sydney: ACSQHC; 2017

5. Boucher HW, Talbot GH, Benjamin DK, Jr, Bradley J, Guidos RJ, Jones RN, et al. Infectious Diseases Society of America 10 x ’20 Progress--development of new drugs active against gram-negative bacilli: an update from the Infectious Diseases Society of America. Clin Infect Dis 2013;56:1685-94.
6. Gardiner BJ, Golan Y. Ceftazidime-avibactam (CTZ-AVI) as a treatment for hospitalized adult patients with complicated intra-abdominal infections. Expert Rev Anti Infect Ther 2016;14:451-63.
7. Maseda E, Aguilar L, Gimenez MJ, Gilsanz F. Ceftolozane/tazobactam (CXA 201) for the treatment of intra-abdominal infections. Expert Rev Anti Infect Ther 2014;12:1311-24.
8. McOsker CC, Fitzpatrick PM. Nitrofurantoin: mechanism of action and implications for resistance development in common uropathogens. J Antimicrob Chemother 1994;33 Suppl A:23-30.
9. Al-Harthi AA, Al-Fifi SH. Antibiotic resistance pattern and empirical therapy for urinary tract infections in children. Saudi Med J. 2008;29(6):854-8.
10. Al-Tawfiq JA, Anani AA. Antimicrobial susceptibility pattern of bacterial pathogens causing urinary tract infections in a Saudi Arabian hospital. Chemotherapy. 2009;55(2):127-31.
11. Foxman B, et al. Urinary tract infection: self-reported incidence and associated costs. Ann Epidemiol. 2000;10(8):509-15.
12. Bours PH, et al. Increasing resistance in community-acquired urinary tract infections in Latin America, five years after the implementation of national therapeUTIsc guidelines. Int J Infect Dis. 2010;14(9):e770-4.
13. Bean DC, Krahe D, Wareham DW. Antimicrobial resistance in community and nosocomial Escherichia coli urinary tract isolates, London 2005-2006. Ann Clin Microbiol Antimicrob. 2008;7:13.