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RESEARCH ARTICLE

SUSCEPTIBILITY PATTERN OF URINARY ISOLATES FROM OBSTETRICS AND GYNAECOLOGY PATIENTS TO NITROFURANTOIN IN A TERTIARY CARE CENTRE

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ABSTRACT

The antimicrobial agent nitrofurantoin (*N*-[5-nitro-2furfurylidine]-1-aminohydantoin) is an orally used synthetic nitrofuran compound exclusively employed for the treatment and prophylaxis of urinary tract infections (UTI)**.** Nitrofurantoin is indicated only in treatment of acute uncomplicated cystitis and in prophylaxis of recurrent UTI**.** A significant rise in incidence of antimicrobial resistance, especially multi-drug resistance, in pathogens isolated in UTI is well-documented. However, in contrast with the other classes of antimicrobial agents, acquired resistance to nitrofurantoin is reported to be quite rare. In this study, we describe the susceptibility pattern of urinary isolates from obstetrics and gynaecology patients to nitrofurantoin, as UTI is one of the commonest infection encountered in obstetrics and gynaecology practice. This was a hospital data-based descriptive study. The total of 2,204 patients from the department of obstetrics and gynaecology who were subjected to urine culture in our laboratory from 01.01.2008 to 31.08.2011 were included in this study. Out of total of 2,204 samples that were received during the study period, 370 were culture-positive, and showed significant bacteriuria were analysed for susceptibility pattern. Out of, the 2,204 samples of urine sent for culture from the department of obstetrics and gynaecology during the time period of the study, 370 (16.79%) were culture positive. Among the 241 isolates from out-patients, 207 isolates (85.89%) were susceptible to nitrofurantoin. This data strongly supports the empirical use of nitrofurantoin for treating uncomplicated UTIs in outpatient and inpatient departments.

Key words: Antibiotic susceptibility pattern, Nitrofurantoin, Urinary tract infection

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INTRODUCTION

The antimicrobial agent nitrofurantoin (*N*-[5-nitro-2furfurylidine]-1-aminohydantoin) is an orally used synthetic nitrofuran compound exclusively employed for the treatment and prophylaxis of urinary tract infections (UTI).[1] This drug has been in use for almost six decades and is very inexpensive.[2,3]

The drug has a complex mechanism of action: it is activated inside bacterial cells by the enzyme nitrofuran reductase to yield multiple reactive intermediates that can act on ribosomal proteins, DNA, and other macromolecules within the cell.[4,5] At concentrations achieved in urine, nitrofurantoin is bactericidal to most susceptible pathogens.[1]

As nitrofurantoin is rapidly excreted in the urine, the serum concentrations never reach therapeutic levels: hence the drug is not useful in cases where there may be bacteraemia associated with UTI (such as pyelonephritis and other complicated UTIs). Therefore, use of nitrofurantoin is indicated only in treatment of acute uncomplicated cystitis and in prophylaxis of recurrent UTI. Nitrofurantoin is contraindicated in neonates. But, when clearly indicated, it can be safely used in pregnant women, except at term.[1]

Nitrofurantoin is especially useful in treating UTIs caused by *Escherichia coli*, *Citrobacter*, coagulase negative staphylococci (including *Staphylococcus saprophyticus*) group B streptococci and enterococci (including vancomycin resistant enterococci). In contrast, many isolates of *Klebsiella* and *Enterobacter* and virtually all isolates of *Proteus*, *Pseudomonas*, *Acinetobacter* and *Serratia* are resistant to nitrofurantoin.[1]

A significant rise in incidence of antimicrobial resistance, especially multi-drug resistance in pathogens isolated in urinary tract infections (UTI) is well documented.[6] This often necessitates the use of newer generation antibiotics for treating these cases, thus often driving up the cost of treatment. However, in contrast with the other classes of antimicrobial agents, acquired resistance to nitrofurantoin is said to be quite rare.[1]

In this study, we describe the susceptibility pattern of urinary isolates from obstetrics and gynaecology patients to nitrofurantoin. We limited our study to obstetrics and gynaecology patients, because UTI is one of the commonest infection encountered in obstetrics and gynaecology practice. The reasons for this are varied. Various hormonal and mechanical changes, coupled with a shorter urethra render pregnant women at a higher risk for developing UTI.[7] Also, post-operative gynaecology patients are at a higher risk of developing UTI.[8] Additionally, women with symptoms of UTI often end up consulting a gynaecologist, rather than a physician.

MATERIALS AND METHODS

The study was done in Sree Gokulam Medical College, a tertiary-care teaching hospital in Trivandrum, Kerala, India. This was a hospital data-based descriptive study. The total of 2,204 patients from the department of obstetrics and gynaecology who were subjected to urine culture in our laboratory from 01.01.2008 to 31.08.2011 were included in this study. Those cases with no available data on results of nitrofurantoin susceptibility of the urinary isolate were excluded from this study. However, urinary isolates known to be intrinsically resistant to nitrofurantoin, and thus were not tested with nitrofurantoin (such as *Pseudomonas aeruginosa*) were included in the study: these were counted as isolates resistant to nitrofurantoin.

Out of total of 2,204 samples that were received during the study period, 370 were culture-positive, and showed significant bacteriuria (more than 1,00,000 colony forming units per ml of urine): these were analysed for susceptibility pattern. These

isolates were identified by routine microbiological techniques. Antibiotic susceptibility testing was performed as per the most current CLSI guidelines available at that time.[9,10,11,12]. The data was entered in excel software and analysed using SPSS 16.

RESULTS

Of the 2,204 samples of urine sent for culture from the department of obstetrics and gynaecology during the time period of the study, 370 (16.79%) were culture positive. Among these culture positives, 241 (65.14%) were from out-patients, while the rest (129 isolates) were from in-patients.

Among the 241 isolates from out-patients, 207 isolates (85.89%) were susceptible to nitrofurantoin. Among the 129 isolates from in-patients, 102 isolates (79.07%) were susceptible to nitrofurantoin. Thus, among the total 370 isolates, 83.51% (309 isolates) were susceptible to nitrofurantoin (see Table 1).

Escherichia coli was the commonest isolate encountered in this study (188 isolates), out of which only two isolates (1.06%) were found to be resistant to nitrofurantoin. *Klebsiella pneumonia* was the next commonest isolate (67 isolates), of which, 38 isolates (56.72%) were resistant to nitrofurantoin. There were 49 isolates of coagulase negative staphylococci, all of which were susceptible to nitrofurantoin. Among the 31 isolates of streptococci encountered in the study, only three isolates (9.68%) were found to be resistant to nitrofurantoin. The details of other isolates are given in Table 2.

Table 1: Susceptibility pattern of isolates to nitrofurantoin

	Out-patient isolates	**In-patient isolates**	**Total**
Susceptible	207 (85.89%)	102 (79.07%)	309 (83.51%)
Resistant	34 (14.11%)	27 (20.03%)	59 (16.49%)
Total	241	129	370

Table 2: Urinary bacterial isolates in obstetrics and gynaecology patients

Organism	**No. of isolates**	**No. susceptible to nitrofurantoin**
Escherichia coli	188	186 (98.94%)
Klebsiella pneumonia	67	29 (43.28%)
Coagulase negative staphylococci	49	49 (100%)
Streptococcus spp.	31	28 (90.32%)
Acinetobacter baumanii	10	0 (0%)
Enterococcus faecalis	9	8 (88.89%)
Enterobacter aerogenes	6	0 (0%)
Citrobacter fruendii	5	4 (55.56%)
Staphylococcus aureus	3	3 (100%)
Proteus mirabilis	1	0 (0%)
Serratia marcescens	1	0 (0%)

DISCUSSION

Until recently, nitrofurantoin had never been considered as a first-line antimicrobial agent for the treatment of uncomplicated UTIs. In fact, the 1999 guidelines from the Infectious Diseases Society of America considered trimethoprim-sulfamethoxazole,
trimethoprim and fluoroquinolones as ideal antimicrobial agents for the treatment of such cases.[13]

In this study, however, 85.89% urinary isolates from obstetrics and gynaecology outpatient clinics were found to be susceptible to nitrofurantoin. Even in inpatients, 79.07% of urinary isolates were found to be susceptible to this drug. Furthermore, almost all urinary isolates of *Escherichia coli* (98.94%) and coagulase negative staphylococci (100%) were found to be susceptible to nitrofurantoin: these organisms are two of the commonest isolates encountered in UTIs in this group of patients. This data strongly supports the empirical use of nitrofurantoin for treating uncomplicated UTIs in such patients. Additionally, this high levels of susceptibility of urinary isolates to nitrofurantoin is in agreement with the data from other studies as well.[14,15,16]

This data also support the 2011 IDSA guidelines, which have elevated nitrofurantoin from an alternative agent to first-line therapy for uncomplicated UTIs.[17]

CONCLUSION

This study demonstrates that about 85% of urinary pathogens isolated in obstetrics and gynaecology outpatients are susceptible to nitrofurantoin: this drug is thus a very good choice as a first-line treatment option in uncomplicated UTIs in such patients. Furthermore, even in inpatients in obstetrics and gynaecology practice, about 79% of the urinary isolates remained susceptible to this drug, indicating the usefulness of nitrofurantoin even in these patients.

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