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Research Article

Antibiotic Susceptibility Pattern of Nitrofurantoin VS Fosfomycin in Urinary Tract Infections Caused by Escherichia Coli in a Tertiary Care Hospital, Visakhapatnam, Andhra Pradesh

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ABSTRACT

Aims and Objectives: Aim of the study is to estimate prevalence of Escherichia coli among clinically suspected Urinary Tract Infection cases and comparison of antibiogram between Nitrofurantoin VS Fosfomycin as the first line agent for treatment of Urinary Tract Infection caused by Escherichia coli. **Materials and Methods**: The study was conducted on urine samples over a period of six months (August 2022 to January 2023) during which 3215 urine samples were taken from patients at King George Hospital, Visakhapatnam and were processed for bacterial culture and sensitivity. Out of 3215 urine samples,816 were culture positives among them, 373 were Escherichia coli isolates and these isolates were subjected to Antibiotic susceptibility by Kirby-Bauer disc diffusion Method according to the Clinical Laboratory Standard Institute Guidelines 2022 in Microbiology department, Andhra Medical College. **Results**: Among 816 culture positives, 373 isolates were Escherichia coli (45.71%), followed by Klebsiella sps (26.5%), others were Acinetobacter sps, Candida sps, Pseudomonas sps, Proteus sps, Enterococcus sps, Citrobacter sps and MRSA. The Antibiotic susceptibility of Escherichia coli isolates to Nitrofurantoin and Fosfomycin was 89.54% and 73.99% respectively. **Conclusion**: This study helps us to understand that Escherichia coli is the common Urinary pathogen causing Urinary Tract Infection. The use of Nitrofurantoin and Fosfomycin against Escherichia coli indicates that these two drugs are therapeutic alternatives for Urinary Tract Infection. Among these two drugs, Nitrofurantoin is most effective in the empirical treatment of Urinary Tract Infections.

Key Words: *Urine, Infections, Antibiotics, Isolates, Sensitivity.*

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INTRODUCTION:

Urinary Tract Infections are one of the most common infections affecting people of all populations and age groups. Usually Urinary Tract Infections are managed empirically, leading to development of multi drug resistance among Urinary pathogens and failure of empirical therapy. Nitrofurantoin and Fosfomycin are Antibiotics of choice to treat uncomplicated Urinary Tract Infections because they remain active against bacteria resistant to other Antibiotics. Due to lack of effective therapeutic alternatives to treat Urinary Tract Infections, antibiotics like Nitrofurantoin and Fosfomycin have become important as they attain high concentrations in Urinary Tract with minimal systemic effect.[1][2]

Aims and Objectives:

Objective of this study is to isolate *Escherichia coli* in patients with Urinary Tract Infections at a Tertiary care hospital and comparison of sensitivity pattern between Nitrofurantoin VS Fosfomycin as the first line agent for treatment of Urinary Tract Infection caused by *Escherichia coli*. [3]

Materials and Methods:

The study was conducted on **3215** urine samples from symptomatic patients in the Department of Microbiology of Andhra Medical College over a period of six months (August 2022 to January 2023). Urine samples collected in sterile wide mouthed, screw capped containers were processed within 30 min of collection. Urine routine microscopy was done

to look for leucocytes, RBCs, casts and budding yeast cells. The Urine samples were inoculated on Blood agar and MacConkey agar, incubated at 37 °C for 18-24 hrs. A growth of more than or equal to 10^5 CFU/ml of urine was considered as significant bacteriuria, suggestive of Urinary Tract Infection. These isolates were subjected to Antibiotic susceptibility by Kirby-Bauer disc diffusion method according to the CLSI guidelines, 2022.Antibioticsusceptibility tests were done on Muller Hinton Agar medium. Nitrofurantoin Antibiotic disc (300mcg) and Fosfomycin Antibiotic disc (200 mcg) were tested along with other antibiotics Meropenem, Piperacillin- Tazobactam, Norfloxacin, Nalidixic acid, Ceftazidime, Ciprofloxacin, Cotrimoxazole and Amikacin .[4][5][2]

Results:

Among total of **3215** urine samples,**816** showed significant growth of organisms that implies culture positives. Among 816 culture positives, 373 were *Escherichia coli* followed by *Klebsiella* sps(217), Acinetobacter sps(105),Pseudomonas sps(55), MRSA (12),Proteus sps (10), Enterococcus sps (2){Table 1}. [6][7][8][2]Among these 816 culture positives females have higher preponderance of about 64.83% (529) when compared to males 35.17% (287)[figure 2].[3][8][2] Out of 816, 170 (20.83%) were of pediatric population and rest 646 (79.17%)were of adult population.[2]

Table 1:Bacterial isolates from urine causing Urinary Tract Infection(n=816)

Escherichia coli	**373**
Klebsiella sps.	217
Acinetobacter sps.	105
Pseudomonas sps.	55
MRSA	12
Proteus sps.	10
Enterococcus sps.	2
Candida sps.	41
Citrobacter sps	1

Total= 816

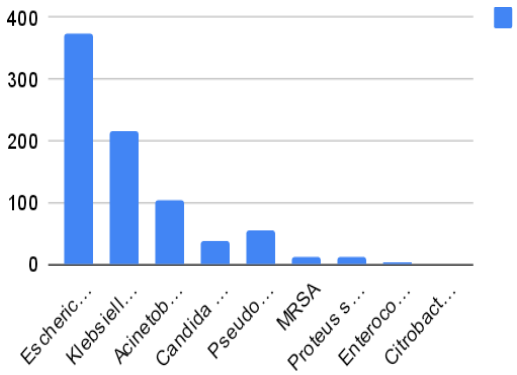

Figure 1: Distribution of Urinary pathogens causing UTI (n=816)

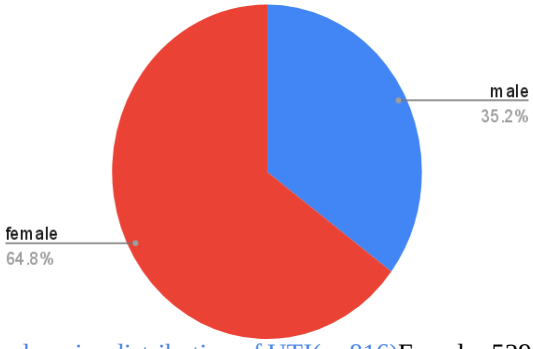

Figure 2:Gender wise distribution of UTI(n=816)Female=529;Male=287.

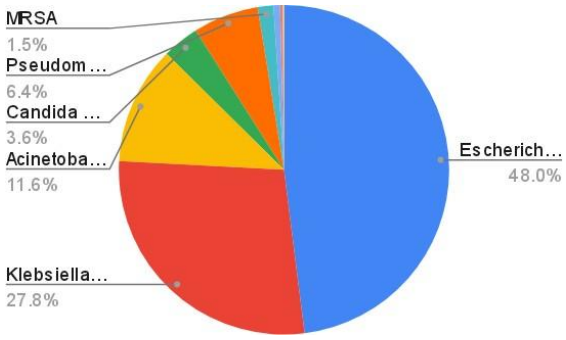

Figure 3:This shows percentage of uropathogens isolated(n=816)

Antibiogram:

These 373 isolates were subjected to Antibiotic susceptibility by Kirby-Bauer disc diffusion method according to the CLSI guidelines, 2022.Antibiotic susceptibility tests were done on Muller Hinton Agar medium. Nitrofurantoin Antibiotic disc (300mcg) and Fosfomycin (200mcg) were tested along with other Antibiotics. Among 373 *Escherichia coli* isolates, Nitrofurantoin susceptible strains were 334 (89.54%) and Fosfomycin susceptible strains were 276(73.99%). 39(10.46%) were resistant to Nitrofurantoin and 97 (26.01%) resistant to Fosfomycin.[Table 2]

Table 2: This table shows Nitrofurantoin and Fosfomycin susceptibility among *Escherichia Coli isolates* .

Susceptibility (n=373)	**Nitrofurantoin**	**Fosfomycin**
Susceptible	334(89.54%)	276(73.99%)
Resistant	39(10.46%)	97(26.01%)

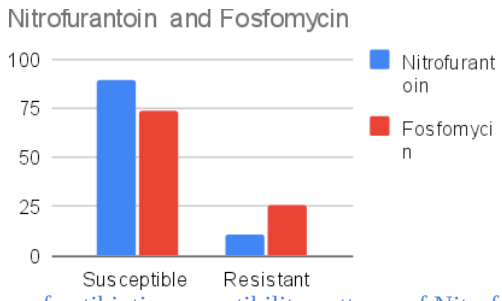

Figure 4 : This shows bar diagram of antibiotic susceptibility patterns of Nitrofurantoin VSFosfomycin(n=373)

DISCUSSION:

Urinary tract infection is one of the most common Infectious diseases worldwide. In the present study, Gram negative bacilli were predominant over Gram positive cocci in causing Urinary Tract Infections. [2][9]. The uropathogen isolated in the study is *Escherichia coli* (45.71%) and *Klebsiella sps* was the second most frequently isolated organism. These results were similiar to the study Kanauji et.al and its antibiotic susceptibility pattern also correlates with Kanauji et.al , (89.54%) sensitive to Nitrofurantoin and (73..99%) sensitive to Fosfomycin.[Table 3]

Table 3: Correlation with other studies

Studies	*Escherichia coli isolates*	**Nitrofurantoin Susceptibility**	**Fosfomycin Susceptibility**
Kanaujia Ret.al	40..50%	91.7%	65.66%
Nusrat Perween et.al	41.8%	95.1%	82%
Presentstudy	**45.71%**	**89.54%**	**73.99%**

Conclusion:

This study helps us to understand that *Escherichia coli* is the most common uropathogen isolated in clinically suspected cases of uncomplicated Urinary Tract Infections[10][11].The use of Nitrofurantoin and Fosfomycin against *Escherichia coli* indicates that these two drugs are therapeutic alternatives for Urinary Tract Infections.[12][13][2]Among these two drugs, Nitrofurantoin is most suitable for uncomplicated lower Urinary Tract Infections and bacterial resistance is uncommon whereas Fosfomycin is safe and effective antibacterial drug for UTI but its use should be limited to delay the development of resistance.[14][15]Hence Nitrofurantoin is best drug used in the empirical treatment of Urinary Tract Infections.[16][17].

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