Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i7.7273

ANTIMICROBIAL SUSCEPTIBILITY TO ORAL FLUROQUINOLONES AMONGST THE UROPATHOGENS ISOLATED FROM THE PAEDIATRIC POPULATION IN EASTERN INDIA

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Abstarct:
Background: Inspite of increasing resistance to Fluroquinolones in India, this group may be a good therapeutic choice to manage Urinary Tract Infections, especially when phosphomycin, nitrofurantoin and cotrimoxazole have restricted indication.
Aim & Objective (s): Estimation of the magnitude of UTI in a tertiary care hospital in Eastern India & to compare uropathogenic susceptibility against levofloxacin and ciprofloxacin.
Material & Methods: The descriptive cross-sectional study was done from April 01, 2024 to June 30, 2024 with 142 culture positive uncomplicated UTI cases. Case selection was done as per predefined inclusion and exclusion criteria. Mid-stream urine was collected in proper aseptic manner and inoculated on Nutrient Agar Media, MacConkey' s Agar media and Blood Agar media for bacterial isolation. Antimicrobial susceptibility testing was done by Kirby Bauer technique on Mueller Hinton Agar as per Clinical Laboratory Standards Institute guidelines.
Results: Age of majority of the cases is below 10 yrs with an average 4.8 yrs and There is no statistically significant difference in gender distribution. *Escherichia coli* may be considered as the leading uropathogenic bacteria (38%) in this study followed by *Klebsiella pneumoniae* (25%). Majority of the isolates is resistant to Ciprofloxacin (80%), on the contrary, sensitive to levofloxacin (48%).
Conclusion: Both being oral and broad spectrum, Levofloxacin and nitrofurantoin may be used as compatible therapeutic option and in comparison to Ciprofloxacin, Levofloxacin seems to be more effective against uropathogens in vitro.

Keywords: Urinary Tract Infection, Levofloxacin, Ciprofloxacin, Comparison

Introduction

Urinary tract infections (UTIs) are among the most common bacterial infections, affecting the urinary system, including the bladder, kidneys, ureters, and urethra. They are particularly prevalent among women, children, and the elderly. In Eastern India, UTIs pose a significant health burden, exacerbated by socio-economic disparities, limited healthcare access, and growing antimicrobial resistance. This literature review aims to provide a detailed synthesis of current research on UTIs in Eastern India, focusing on key aspects such as prevalence, causative pathogens, antimicrobial resistance, healthcare practices, and socio-economic factors. UTIs in children are often related to congenital anomalies of the urinary tract, vesicoureteral reflux, and poor hygiene practices.

Research by Chatterjee et al. (2020) highlights that girls aged 1-5 years are particularly vulnerable[1]. Levofloxacin and ciprofloxacin are fluroquinolones. These may be used in Central Nervous System (CNS) infection (Zusso et al., 2019), hematopoietic stem cell transplantation (Rambaran and Seifert, 2019)and even to inhibit SARS-CoV-2 replication (Karampela and Dalamaga, 2020) [2,3,4,5]. Fluoroquinolones can achieve high concentrations in urine. This pharmacokinetics make them an ideal complex to treat both complicated and uncomplicated urinary tract infections. In addition, they have excellent bioavailability in oral preparation[6]. Importantly, they have a notable role against both Gram positive and Gram negative Bacteria including *Pseudomonas aeruginosa*. These agents thus may be used against in patients with catheter and urinary calculi-associated infections[7]. Inspite of increasing resistance to this group of drug in India, it may be a good therapeutic choice to manage UTI especially when phosphomycin, nitrofurantoin and cotrimoxazole have restricted indication[8].

Objective (s):

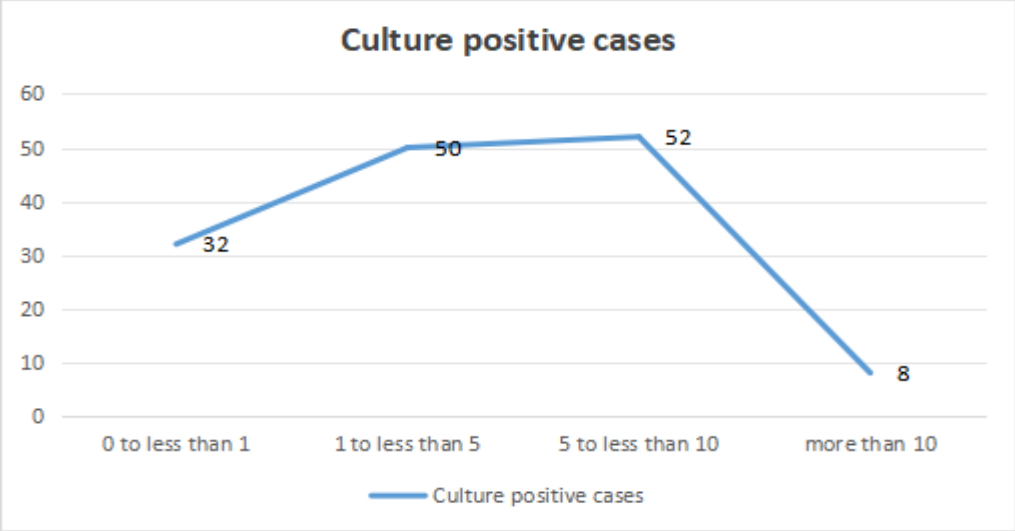
1. To estimate the magnitude of UTI in a tertiary care hospital in Eastern India.
2. To compare uropathogenic susceptibility against levofloxacin and ciprofloxacin.

Materials and Methods:

The descriptive cross-sectional study was done from April 01, 2024 to June 30, 2024 with 142 culture positive uncomplicated UTI cases. Inclusion criteria were set considering clinical, demographic, geographical, and temporal compliance. Patients who did not give informed consent, failed to get followed up, vulnerable or severely morbid, were excluded from the study. Mid-stream urine was collected in proper aseptic manner and inoculated on Nutrient Agar Media, MacConkey' s Agar media and Blood Agar media for bacterial isolation. Antimicrobial susceptibility testing was done by Kirby Bauer technique on Mueller Hinton Agar as per Clinical Laboratory Standards Institute guidelines[9]. Standard ethical guidelines were not violated.

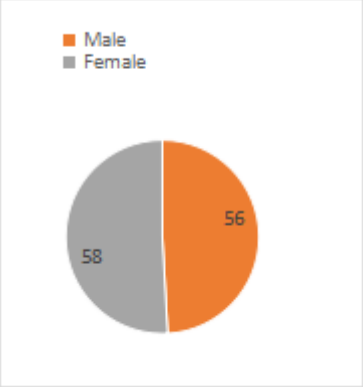
Results:

Figure 1: Age (In years) wise distribution of culture positive paediatric UTI cases (n=142)



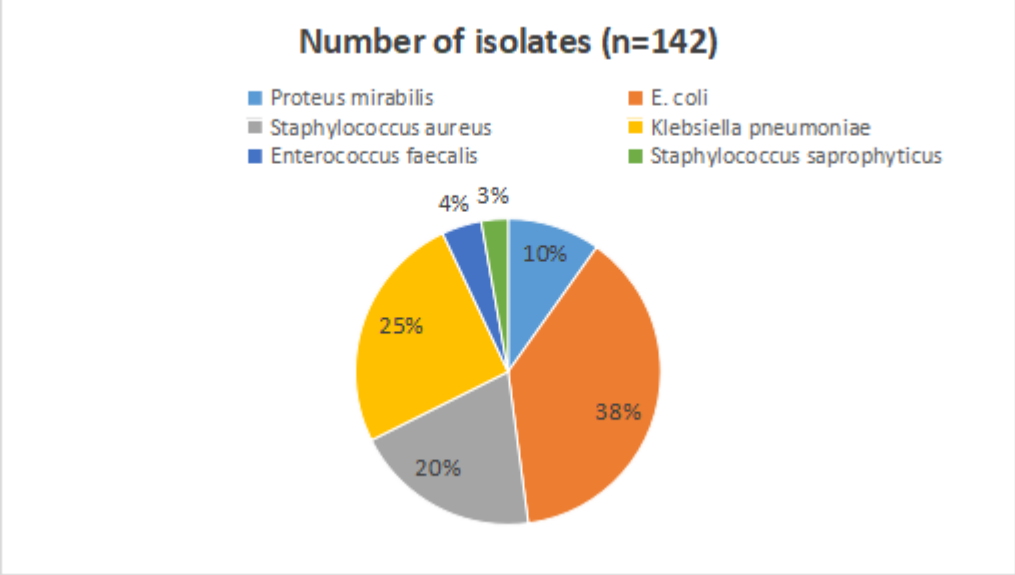
Age of majority of the cases is below 10 yrs with an average 4.8yrs.

Figure 2: Gender wise distribution of culture positive paediatric UTI cases (n=142)



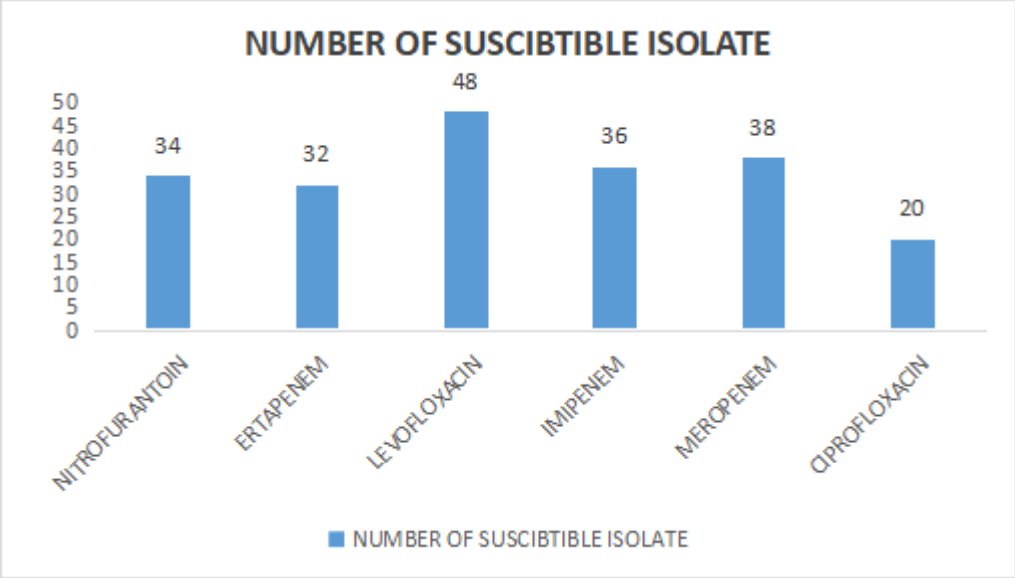
There is no statistically significant difference in gender distribution with a bit greater number of female.

Figure 3: Distribution of uropathogens



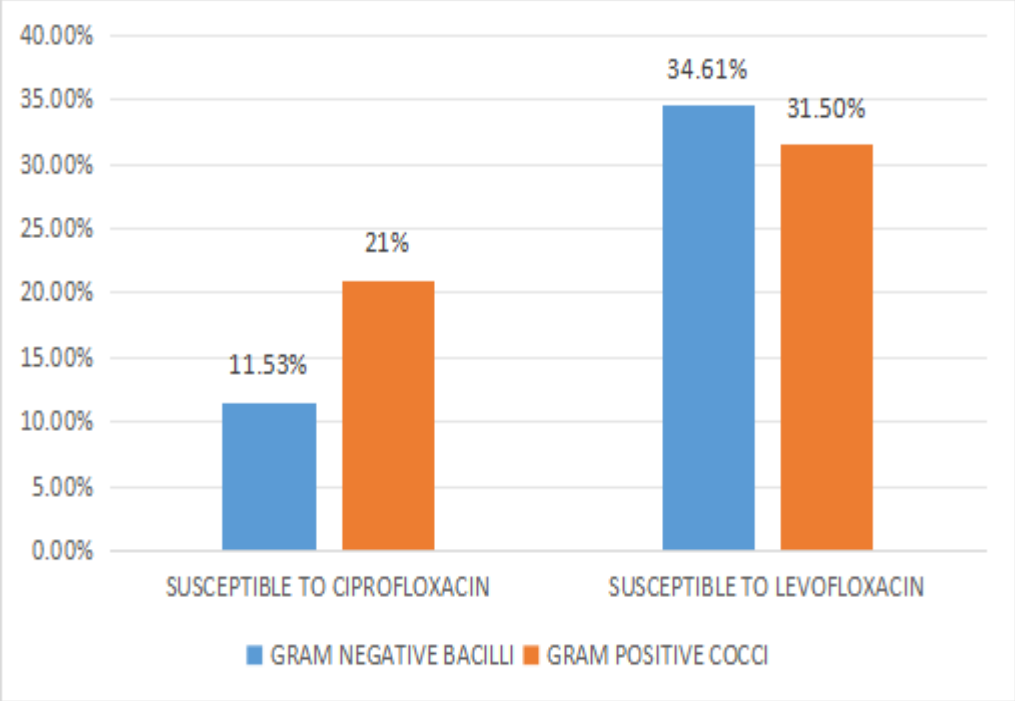
Escherichia coli may be considered as the leading uropathogenic bacteria in this study.

Figure 4: Distribution of antimicrobial susceptibility to uropathogens



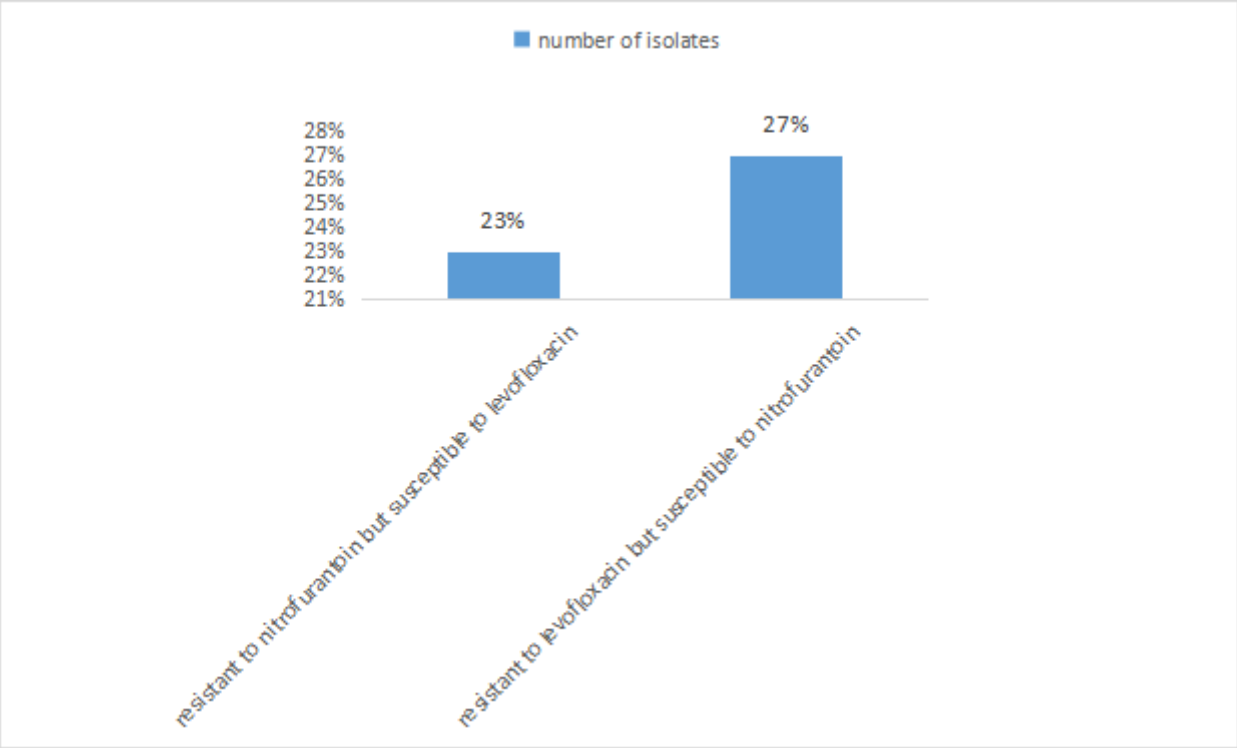
Majority of the isolates is resistant to Ciprofloxacin, on the contrary, sensitive to levofloxacin.

Figure 5: Distribution of levofloxacin and ciprofloxacin susceptibility to uropathogens



Levofloxacin seems to be more effective against uropathogens in vitro.

Figure 6: Comparison of levofloxacin and nitrofurantoin susceptibility to uropathogens



Both being oral and broad spectrum, Levofloxacin and nitrofurantoin may be used as compatible therapeutic option.

Discussion:

The descriptive cross-sectional study was done from April 01, 2024 to June 30, 2024 with 142 culture positive uncomplicated UTI cases. Age of majority of the cases is below 10 yrs with an average 4.8yrs with no significant difference in gender wise distribution. This finding is in acoordance with Tullus et al. Thay have found that by age 7 years, 8% of girls and 2% of boys suffered from atleast one UTI episode[10.] *Escherichia coli* followed by *Klebsiella pneumoniae* may be considered as the leading isolate found in thie present study. Gram positive isolates include *Staphylococcus aureus, Enterococcus spp*. and *Staphylococcus saprophyticus in our present study.* Similarly, several other studies have concluded that , *E. coli* is responsible for the majority of UTI cases globally, and Eastern India is no exception. Studies consistently report *E. coli* as the leading cause of both community-acquired and hospital-acquired UTIs (Chakraborty et al., 2018)[11]. According to Banerjee et al (2017), *Klebsiella spp.* is frequently isolated in hospital settings and is known for its multidrug resistant nature[12].

Both being oral and broad spectrum, Levofloxacin and nitrofurantoin may be used as compatible therapeutic option. In the present study, 23% of the isolates were resistant to Nitrofurantoin but sensitive to levofloxacin. Majority of the isolates is resistant to Ciprofloxacin (20%), on the contrary, sensitive to levofloxacin (48%). In comparison to ciprofloxacin, levofloxacin seems to be more effective against uropathogens in vitro. Worldwide several original studies and meta analyses have evaluating fluoroquinolones for the Treatment of Urinary Tract Infection since 2019 [13,14] . On the contrary, a study in Ghana(Daniel Kwame Afriyie et al) has stated the findings just the opposite to that of ours [15] . Some other studies have reported that in the management of UTI, the efficacy of levofloxacin and ciprofloxacin are similar statistically. If bacterial resistance is reported against one of the drugs, the other drug might become an alternative[16]. However, this present study also advocates the fact that inspite of increasing resistance to Fluroquinilones in India, may be a good therapeutic choice to manage uncomplicated UTI especially when few other drugs like

phosphomycin, nitrofurantoin and cotrimoxazole have restricted indication and levofloxacin is a more effective choice in that case as per in vitro findings.

References:

1. Chatterjee, S., et al. (2020). Urinary tract infections in children: An epidemiological study in a tertiary care hospital in Eastern India. Pediatrics International, 62(4), 482-488.
2. Zusso M., Lunardi V., Franceschini D., Pagetta A., Lo R., Stifani S., et al. (2019). Ciprofloxacin and levofloxacin attenuate microglia inflammatory response via TLR4/NF-kB pathway. *J. Neuroinflammation* 16 (1), 148.
3. Rambaran K. A., Seifert C. F. (2019). Ciprofloxacin vs. levofloxacin for prophylaxis in recipients of hematopoietic stem cell transplantation. *J. Oncol. Pharm. Pract.* 25 (4), 884– 890.
4. Karampela I., Dalamaga M. (2020). Could respiratory fluoroquinolones, levofloxacin and moxifloxacin, prove to be beneficial as an adjunct treatment in COVID-19? *Arch. Med. Res.* 51 (7), 741– 742.
5. Cao D, Shen Y, Huang Y, Chen B, Chen Z, Ai J, Liu L, Yang L, Wei Q. Levofloxacin Versus Ciprofloxacin in the Treatment of Urinary Tract Infections: Evidence-Based Analysis. Front Pharmacol. 2021 Apr 8;12:658095.
6. Thompson D, Xu J, Ischia J, Bolton D. Fluoroquinolone resistance in urinary tract infections: Epidemiology, mechanisms of action and management strategies. BJUI Compass. 2024;5(1):5– 11.
7. Thai T, Salisbury B, Zito P. Ciprofloxacin. [Updated 2021 Nov 15]. StatPearls [Internet] Treasure Island (FL): StatPearls Publishing. 2022.
8. Mohapatra S, Panigrahy R, Tak V, J V S, K C S, Chaudhuri S, Pundir S, Kocher D, Gautam H, Sood S, Das BK, Kapil A, Hari P, Kumar A, Kumari R, Kalaivani M, R A, Salve HR, Malhotra S, Kant S. Prevalence and resistance pattern of uropathogens from community settings of different regions: an experience from India. Access Microbiol. 2022 Feb 9;4(2):000321.
9. CLSI. Defining, Establishing, and Verifying Reference Intervals in the Clinical Laboratory; Approved Guideline, CLSI Document No. C28-A3. 3rd ed. United States: CLSI; 2008.
10. Tullus K, Shaikh N: Urinary tract infections in children. Lancet 395(10237):1659-1668, 2020.
11. Chakraborty, A., et al. (2018). Antimicrobial resistance patterns in uropathogens isolated from community-acquired and hospital-acquired infections in Eastern India. International Journal of Infectious Diseases, 74, 125-132.
12. Banerjee, S., et al. (2017). Extended-spectrum beta-lactamase producing Enterobacteriaceae in community-acquired urinary tract infections: A study from a tertiary care hospital in Eastern India. Journal of Clinical Microbiology, 55(2), 417-422.
13. Chao YS, Farrah K. Fluoroquinolones for the Treatment of Urinary Tract Infection: A Review of Clinical Effectiveness, Cost-Effectiveness, and Guidelines [Internet]. Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2019 Apr 26.
14. Cao D, Shen Y, Huang Y, Chen B, Chen Z, Ai J, Liu L, Yang L, Wei Q. Levofloxacin Versus Ciprofloxacin in the Treatment of Urinary Tract Infections: Evidence-Based Analysis.
15. Afriyie DK, Adu LB, Dzradosi M, Amponsah SK, Ohene-Manu P, Manu-Ofei F. Comparative *in vitro* activity of ciprofloxacin and levofloxacin against isolated uropathogens in Ghana: a pilot study. Pan Afr Med J. 2018 Jul 5;30:194.
16. Xue Z, Xiang Y, Li Y, Yang Q. A systematic review and meta-analysis of levofloxacin and ciprofloxacin in the treatment of urinary tract infection. Ann Palliat Med 2021;10(9):9765-97