

# A comparative study of efficacy of purlifloxacin with other quinolones and fluroquinolones among the escherichia coli isolates from various clinical specimens

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## Abstract

**Introduction:** Urinary tract infections (UTIs) remain the commonest infections diagnosed in outpatient as well as hospitalized patients. It refers to the presence of microbial pathogens within the urinary tract and classified by the site of infection - bladder [cystitis], kidney [pyelonephritis] or urine [bacteriuria]. **Aims and Objectives:** To study of efficacy of purlifloxacin with other quinolons and fluroquinolones among the Escherchia coli isolates from various clinical specimens. **Materials and Methods:** A cross sectional study was conducted between November 2012 and March 2013 at Clinical Microbiology laboratory of Sri Ramachandra University, a tertiary care center with more than 1,700 in-patients facility where in the anti microbial susceptibility of various quinolones like Nalidixic acid, Norfloxacin, Ciprofloxacin, Ofloxacin and Prulifloxacin were determined for *Escherichia coli* isolated from urine by Kirby-Bauer disc diffusion method and compared with that isolated from blood and exudates. Non repetitive *E.coli* isolates from Urine, Exudate and Blood specimen meant for culture and sensitivity were included in the study. Total number of isolates was 100, in which 50 were obtained from urine, 25 from blood and exudates each were enrolled for the study. Antimicrobial Susceptibility Testing Done By Diffusion Method: The Modified Kirby-Bauer Method Was Used. **Result:** Out of the 100 samples tested 66 of them were male and 44 of them females. Most of the patients of our study belong to the age group of 60 and above with 15,13,6 patients respectively for urine, blood and exudates. The antimicrobial susceptibility pattern of *E.coli* isolates obtained from urine samples were the susceptibility for Ofloxacin were 25 (50%;n=50) followed by Prulifloxacin 17 (34%;n=50), Ciprofloxacin 18 (36% n=50) Norfloxacin 16 (32%;n=50), Nalidixic acid 8 (16%n=50). Of the 25 blood *E.coli* isolates tested, 22 (88%; n=25) of them were susceptible to Ofloxacin, 19 (76%; n=25) susceptible to Prulifloxacin, 12 (48%; n=25) susceptible to Norfloxacin, 7(28%; n=25) susceptible to Ciprofloxacin and 3(12%;n=25) susceptible to Nalidixic acid. Among the 25 Exudate *E.coli* isolates 72% (18; n=25) were susceptible to Ofloxacin. The susceptibility pattern for Prulifloxacin was 34% (17; n=25).The susceptibility pattern of Ciprofloxacin, Norfloxacin and Nalidixic acid are 18% (9; n=25, 6% (3; n=25) and 2% (1; n=25) respectively. Overall susceptibility pattern for isolates obtained from Urine, Blood, Exudates were shown in the fig. , Ofloxacin 65%, and Prulifloxacin 55%, Ciprofloxacin 54%, Norfloxacin 35%, Nalidixic acid 12%. **Conclusion:** The study shows quinolones is a good drug for treating urinary tract infection. Ofloxacin is better drug than Prulifloxacin

**Key Words:** Purlifloxacin, Quinolons, Fluroquinolones, Escherchia coli isolates.

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## INTRODUCTION

Urinary tract infections (UTIs) remain the commonest infections diagnosed in outpatient as well as hospitalized patients. It refers to the presence of microbial pathogens within the urinary tract and classified by the site of infection - bladder [cystitis], kidney [pyelonephritis] or urine [bacteriuria]. UTI can be asymptomatic or symptomatic, characterized by a wide spectrum of symptoms ranging from mild burning micturation to severe urosepsis, or even death. UTI that occur in a

normal genitourinary tract with no prior instrumentation are considered uncomplicated whereas complicated infections are diagnosed in genitourinary tracts that have structural or functional abnormalities including instrumentation such as indwelling urethral catheters, and are frequently asymptomatic. It is estimated that 150 million cases of UTI occur on a global basis per year resulting in more than 4 billion pounds (6 billion dollars) in direct health care expenditure. Young, otherwise healthy, women are commonly affected with an estimated incidence of 0.5–0.7 infections per year. Of the women affected 25%–30% will go on to develop recurrent infections not related to any functional or anatomical urinary tract abnormality i.e., uncomplicated UTI.<sup>1,2</sup> Causes of UTI: *Escherichia coli*, *Klebsiella* spp, *Pseudomonas* spp, *Proteus* spp, *Morganella* spp, *Providentia* spp, *Citrobacter* spp, *Other Enterobacteriaceae*, *Staphylococcus aureus*, *Staphylococcus saprophyticus*, *Enterococcus* spp, *Staphylococcus epidermidis*, *Candida albicans* and *nonalbicans* Rare causes: *Ureaplasma urealyticum*, *Mycoplasma hominis*, and *Coxiella burnetii*. Uropathogenic *Escherichia coli* (UPEC) is the causative agent in 70%–95% of community acquired UTI and 50% of all cases of nosocomial infection.<sup>3</sup>

UTIs are often treated with different broad spectrum antibiotics like beta lactams, aminoglycosides, carbapenams etc., for Gram Negative organisms when one with a narrow spectrum of activity may be appropriate because of concerns about infection with resistant organisms. In this regard, the fluoroquinolones are currently considered to be amongst the drugs of choice. Moreover, fluoroquinolones are broad spectrum antibiotics widely used for the treatment of numerous diseases as well. These are entirely synthetic antimicrobials having a quinolones structure that are active primarily against Gram negative bacteria; though, newer fluorinated compounds also inhibit Gram positive ones. These drugs act by inhibiting bacterial (DNA gyrase) DNA synthesis. Quinolones are the fastest growing antibacterial class globally because being used both in the hospitals and community sectors to treat infections. Fluoroquinolones are also preferred as initial agents for empiric therapy of UTI in areas where resistance is likely to be of concern.<sup>4,5</sup> This is because they have high bacteriological and clinical cure rates, as well as low rates of resistance, among most common uropathogens. Generally used quinolones are Nalidixic acid (in pediatric age group), Norfloxacin, Ciprofloxacin, Ofloxacin, and the latest among them is Prulifloxacin. We also want to compare the efficiency of Prulifloxacin with that of other quinolones. As it is quite evident that the extensive uses of antimicrobial agents have invariably resulted in the

development of antibiotic resistance, which in recent years has become a major problem worldwide.<sup>5,6</sup> Prulifloxacin is the prodrug of ulifloxacin which is broad-spectrum oral fluoroquinolones. After absorption Prulifloxacin is metabolized by esterases to ulifloxacin.<sup>7</sup> The drug has a long elimination half-life, allowing once-daily administration. Ulifloxacin is generally more active in vitro than other fluoroquinolones against a variety of clinical isolates of gram negative bacteria, including community and nosocomial isolates of *Escherichia coli*, *Klebsiella* spp, *Proteus*, *Providentia*, and *Morganella* spp., Also active against *Moraxella catarrhalis* and *Haemophilus* spp. The activity of ulifloxacin against *Pseudomonas aeruginosa* varies between countries. Gram positive organisms, including methicillin or oxacillin-susceptible *Staphylococcus aureus*, *Enterococcus* spp. In well-designed clinical trials, good clinical and bacteriological efficacy (similar to that of ciprofloxacin, amoxicillin/clavulanic acid or pefloxacin) was seen with Prulifloxacin 600mg once daily for 10 days in patients with acute exacerbations of chronic bronchitis or complicated lower urinary tract infections (UTIs), and with single-dose Prulifloxacin 600mg in acute, uncomplicated lower UTIs.<sup>8</sup> As *Escherichia coli* is the commonest agent causing UTI in both community as well as hospitalized individual and most commonly treated with one of the quinolones we want to see the current prevalence of quinolone resistance and to see the efficacy of newly introduced Prulifloxacin in our study. Pathogenic isolates of *Escherichia coli* have a relatively large potential for developing resistance. In recent years, fluoroquinolones resistance has increased in some countries,<sup>9</sup> Because of resistance of many of these strains to beta-lactams, alternative antibiotic therapy can make use of aminoglycosides and quinolones. The prevalence of strains resistant to selected aminoglycosides (Gentamicin, Amikacin, Netilmicin) and quinolones (ciprofloxacin, Norfloxacin, Nalidixic acid) in the particular years was analyzed by Sekowska *et al.* and a statistically significant increase of multidrug-resistant strains, was demonstrated in the analyzed material.<sup>10</sup>

## MATERIALS AND METHODS

A cross sectional study was conducted between November 2012 and March 2013 at Clinical Microbiology laboratory of Sri Ramachandra University, a tertiary care center with more than 1,700 in-patients facility where in the antimicrobial susceptibility of various quinolones like Nalidixic acid, Norfloxacin, Ciprofloxacin, Ofloxacin and Prulifloxacin were determined for *Escherichia coli* isolated from urine by Kirby-Bauer disc diffusion method and compared with that isolated from blood and exudates. Non repetitive

*E.coli* isolates from Urine, Exudate and Blood specimen meant for culture and sensitivity were included in the study. Total number of isolates was 100, in which 50 were obtained from urine, 25 from blood and exudates each were enrolled for the study. All the isolates were subjected to biochemical reactions like Indole test, Triple sugar iron (TSI) agar test, test for Urease production, Citrate utilization test, Mannitol fermentation and motility tests were performed as per standard text book procedures to reconfirm the isolates. Antimicrobial Susceptibility Testing Done By Diffusion Method: The Modified Kirby-Bauer Method Was Used.

Quality Control – ATCC *E.coli* and its Zone diameter of inhibition (mm)

Antibiotic	Disc Potency (IU/ µg)	ATCC <i>E.coli</i> 25922 Zone(mm)
Nalidixic acid	30 mcg	22-28
Norfloxacin	10 mcg	28-35
Ciprofloxacin	5 mcg	30-40
Prulifloxacin	5 mcg	32-38
Ofloxacin	5 mcg	29-33

**RESULT**

**Table 1:** Gender wise distribution of the Samples

Sex	NO.	Percentage (%)
Male	66	66%
Female	44	44%
<b>Total</b>	<b>100</b>	<b>100%</b>

Out of the 100 samples tested 66 of them were male and 44 of them females.

**Table 2:** Distribution of the age and no of samples

Age Groups	No of Samples
1-10	4
11-20	6
21-30	17
31-40	11
41-50	14
51-60	14
60 above	34

Most of the patients of our study belong to the age group of 60 and above with 15,13,6 patients respectively for urine, blood and exudates.

**Table 3:** Susceptibility pattern of urinary isolates

Susceptibility pattern	No. (n=25)	Percentage (%)
Ofloxacin	25	50%;
Prulifloxacin	17	34%;
Norfloxacin	18	36%
Ciprofloxacin	16	32%;
Nalidixic acid	8	16%

The antimicrobial susceptibility pattern of *E.coli* isolates obtained from urine samples were as follows, the susceptibility for Ofloxacin were 25 (50%;n=50) followed by Prulifloxacin 17 (34%;n=50), Ciprofloxacin 18 (36%;n=50) Norfloxacin 16 (32%;n=50), Nalidixic acid 8 (16%;n=50) as shown in Table.

**Table 4:** Susceptibility pattern of Blood isolates

Susceptibility pattern	No.(n=25)	Percentage (%)
Ofloxacin	22	88%
Prulifloxacin	19	76%
Norfloxacin	12	48%
Ciprofloxacin	7	28%
Nalidixic acid	3	12%

Of the 25 blood *E.coli* isolates tested, 22 (88%; n=25) of them were susceptible to Ofloxacin, 19 (76%; n=25) susceptible to Prulifloxacin, 12 (48%; n=25) susceptible to Norfloxacin, 7(28%;n=25) susceptible to Ciprofloxacin and 3(12%;n=25) susceptible to Nalidixic acid.

**Table 5:** Susceptibility pattern of Exudates

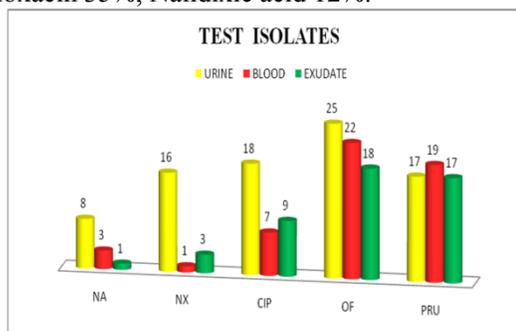
Susceptibility pattern	No.(n=25)	Percentage (%)
Ofloxacin	18	72%
Prulifloxacin	17	34%
Norfloxacin	9	18%
Ciprofloxacin	3	6%
Nalidixic acid	1	2%

Among the 25 Exudate *E.coli* isolates 72% (18; n=25) were susceptible to Ofloxacin. The susceptibility pattern for Prulifloxacin was 34% (17; n=25).The susceptibility pattern of Ciprofloxacin, Norfloxacin and Nalidixic acid are 18% (9; n=25, 6% (3; n=25) and 2% (1; n=25) respectively.

**Table 6:** Overall Susceptibility pattern

Susceptibility pattern	Percentage (%)
Ofloxacin	65%
Prulifloxacin	55%,
Norfloxacin	54%,
Ciprofloxacin	35%
Nalidixic acid	12%

Overall susceptibility pattern for isolates obtained from Urine, Blood, Exudates were shown in the fig. , Ofloxacin 65%, and Prulifloxacin 55%, Ciprofloxacin 54%, Norfloxacin 35%, Nalidixic acid 12%.



Among all the test isolates, 8 isolates were sensitive only to Ofloxacin while other quinolones tested were resistant.

On the whole, according to our study of *E.coli* isolated from urine, blood, and exudates and tested for in vitro susceptibility to quinolones like Nalidixic acid, Norfloxacin, Ciprofloxacin, Ofloxacin, and Prulifloxacin. Ofloxacin seems to be better drug.

## DISCUSSION

The earlier study done in 2001 and 2002 reported the susceptibility pattern for Nalidixic acid and Norfloxacin were more than 60% whereas a study done in 2004 by S.Manzoor<sup>12</sup>, reported 68% of their urinary study isolates susceptibility to Nalidixic and 5.9% for Ciprofloxacin. In other study done in 2003 Akbar M Rafay<sup>11</sup> quoted a resistance rate of *E.coli* isolated from urine ranging between 4.7% and 20.7% for Norfloxacin; 5.6% and 20.7% resistance to Nalidixic acid; 4.35 and 21.2% for Ciprofloxacin. However a study done in 2007 by Dr. Anbumani<sup>13</sup> had reported 77.5% urinary isolated *E.coli* resistance to Ciprofloxacin. In a study by Sharma *et al.*<sup>14</sup>, reported a resistance pattern of Nalidixic acid 63.6%, Norfloxacin 28.5%, Ciprofloxacin 15.7%, Ofloxacin 5.56% whereas in our study resistance to Nalidixic acid is 88% followed by Norfloxacin 65%, Ciprofloxacin 46%, Prulifloxacin 45% and Ofloxacin being effective among quinolones with resistance of 35%. Whereas in our study the susceptibility for Nalidixic acid and Norfloxacin were 16%, 32% respectively and 36% were susceptible to Ciprofloxacin, the susceptibility for Prulifloxacin was 50%, 34% respectively. When comparing the susceptibility pattern of urinary isolated *E.coli* with that of isolates obtained from blood and exudates the susceptibility to fluoroquinolones is comparable or almost equal. In case of Ofloxacin which have got good *invitro* susceptibility pattern. The effectiveness of recently introduced Prulifloxacin is not showed any significant advantage over Ofloxacin.

## CONCLUSION

In our study Ofloxacin is having good in vitro activity against *E.coli* isolated from urine as well as blood and exudates with 65% susceptibility followed by Prulifloxacin 53%, Ciprofloxacin 34%, Norfloxacin 20% and Nalidixic acid 11% Among the urine isolates of 50 *E.coli*, 25 of them showed susceptibility to Ofloxacin followed by Ciprofloxacin 18, Prulifloxacin 17, Norfloxacin 16 and Nalidixic acid 8. A total 8 *E.coli* isolates in this study showed susceptibility only to Ofloxacin and resistance to all other tested quinolones. In our study 17 out of 50 (34%; n=50) urinary isolates and 20% of rest of the *E.coli* isolated from blood and exudates showed resistance to all the tested quinolones. And 9 (18%; n=50) urinary isolates showed sensitive to all the drugs. The study shows quinolones is a good drug for treating urinary tract infection. Ofloxacin is better drug than Prulifloxacin

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