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## Study of Fluoroquinolone Usage–Sensitivity and Resistance Patterns

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### ABSTRACT

The Fluoroquinolones (FQs) have become an increasingly popular class of antibiotics for use in a variety of infections. The objective was to obtain information on the prescribing patterns of fluoroquinolones among hospitalized patients and detail the sensitivity patterns of isolated microorganisms. The study was carried out at the medicine and surgery wards of a 1000 bedded tertiary care teaching hospital. Total of 100 patients who received FQs were included. FQs were prescribed to 67 males and 33 females. Ciprofloxacin was the most commonly prescribed drug. Ciprofloxacin and Levofloxacin were the major drugs used for sensitivity testing. 56 patients were tested for culture and sensitivity for FQs. 29 patients showed sensitivity to various FQs out of which, 19 showed sensitivity towards both Ciprofloxacin and Levofloxacin. FQs were used in 27 (48.2%) patients though they showed either negative [14 (25%)] or resistance [13(23.2%)] to FQs on culture and sensitivity.

**Key words:** Drug Utilization, Fluoroquinolones, Sensitivity

### INTRODUCTION

Fluoroquinolones are broad-spectrum antibiotics (effective for both gram negative and gram positive bacteria) that play an important role in treatment of serious bacterial infections, especially hospital-acquired infections and others in which resistance to older antibacterial classes is suspected. The fluoroquinolone class of antimicrobial agents has broad acceptance in hospitalized and community patients, and usage appears to be increasing [1,2]. Fluoroquinolones inhibit the topoisomerase II ligase domain, leaving the two nuclease domains intact. This modification, coupled with the constant action of the topoisomerase II in the bacterial cell, leads to DNA fragmentation via the nucleic activity of the intact enzyme domains [3]. The prevalence of resistance to these drugs has increased steadily, around the globe [4]. Studies have shown a link between increased utilization of fluoroquinolones and increasing resistance among bacterial pathogens [5,6]. In the era of multidrug resistance among *S.pneumoniae* species, guidelines emphasize the need to restrict first-line use of respiratory fluoroquinolones (RFQs) to indications in which therapeutic superiority has been demonstrated, regardless of the setting [7,8]. Antimicrobial management programs, including prior authorization and formulary restrictions, have been promoted as a means of improving antibiotic selection among inpatients, but little data are available on potential interventions to modify antibiotic selection in emergency departments [9].

Information on the utilization of fluoroquinolones, the diseases for which the drug is prescribed and the sensitive and the resistance patterns of fluoroquinolones are lacking in hospitals in Dakshina Kannada. Hence the present study was carried out.

## MATERIALS AND METHODS

This study was carried out in the medicine and surgery wards of a 1000 bedded private tertiary care teaching hospital. The study was conducted for a period of seven months. Permission was obtained from Institutional Ethics Committee before starting the study. The data were collected from patients of all age groups from either sex, who got admitted to the medicine and surgery wards of the hospital.

A suitable data collection form was designed to collect and document the data. Data collection form includes demographic details of patient, drug therapy details (name of drug, dosage form, frequency, route of administration, duration of treatment) and sensitivity or resistance patterns. Data were collected from the patient's file on a daily basis

## RESULTS AND DISCUSSION

We have enrolled 100 patients in the study who, were prescribed with FQs during the study period. It includes 67 males and 33 female patients. The majority of the patients (22%) were in the age group of 15-25 years followed by (19%) in the age group 56-65 years. The age wise distribution of the patients is presented in table 1.

**Table 1. Age wise Distribution of Study Population**

Age (years)	No. of patients (n=100)
15-25	22
26-35	10
36-45	14
46-55	16
56-65	19
66-75	14
76-85	5

A total of 823 drugs were prescribed. The maximum number of patients 67 (67%) were admitted in the Medicine wards and rest 33 (33%) were admitted in the Surgery wards. Out of 100 patients 87 received FQs as monotherapy. Ciprofloxacin 47 (54.02%) was the highest prescribed drug followed by Levofloxacin. The rest 13 patients received FQ multiple therapy. Ciprofloxacin + Levofloxacin 7 (53.84%), was the highest prescribed followed by Ciprofloxacin + Norfloxacin 5 (38.47%). In our study we could find the predominant usage of Ciprofloxacin. The details of the use of FQs as monotherapy and multiple drug therapy are presented in table 2 & 3.

**Table 2. Fluoroquinolones Prescribed as Monotherapy in Study Population**

Fluoroquinolones	No. of patients (n=87)	Percentage (%)
Ciprofloxacin	40	45.98
Levofloxacin	27	31.03
Ofloxacin	12	13.79
Norfloxacin	8	9.2

**Table 3. Fluoroquinolone Prescribed as Multiple Drug Therapy in Study Population.**

Fluoroquinolone	No. of patients (n=13)	Percentage (%)
Ciprofloxacin + Levofloxacin	7	53.84
Ciprofloxacin + Norfloxacin	5	38.47
Ciprofloxacin + Gemifloxacin	1	7.69

Among 100 enrolled patients who received FQs, only 56 patients were tested for culture and sensitivity for FQs. In our study it was seen that among 56 patients, majority [29 (51.7%)] showed sensitivity to FQs and 13 patients showed resistant to FQs. The most widely used FQs for testing sensitivity were Ciprofloxacin and Levofloxacin. It was curious to see that, FQs were used in 27 (48.2%) patients though they showed either negative [14 (25%)] or resistance [13(23.2%)] to FQs on culture and sensitivity. Details of the culture and sensitivity reports are presented in table 4.

Table 4. Culture and Sensitivity

Sl. No	Description	No of samples	Percentage
1	Patients in whom culture and sensitive was tested	56	100
2	Patients sensitive to FQs	29	51.79
3	Patients resistant to FQs	13	23.21
4	Patients with negative sensitivity report	14	25

It was also noted that all the 56 patients who were screened for culture and sensitivity tests were prescribed with either parenteral or oral FQs therapy irrespective of report (whether it was positive or negative for culture or organism is sensitive or resistant to FQs. The most common clinical conditions treated using FQs, in which sensitivity of FQs proved were lower respiratory tract infection [08 (27.59%)], urinary tract infections [07 (24.14%)], diabetic foot ulcer [06 (20.69%)]. The details of various clinical conditions treated with FQs, sensitivity to FQs are presented in table 5.

Table 5. Clinical conditions treated with FQs, in which sensitivity to FQs was proved.

Clinical condition	No of Patients (N=29)	Percentage
Lower respiratory tract infection	08	27.59
Urinary tract infection	07	24.14
Diabetic foot ulcer	06	20.69
Abscess	01	3.45
Enteric fever	01	3.45
Other infections	05	17.23
Ulcer	01	3.45

The culture and sensitivity was tested on various types of samples such as urine (17), pus (23), sputum (17), stool (02) and blood (09). In our study, organisms isolated were *Klebsiella*(10 isolates), *S.aureus* (5), *E.coli* (5), *P.aeruginosa* (5), *Enterobacter* species (5), *Acinetobacter* species (3), *Alpha hemolytic streptococci* (3), *P.mirabilis* (2) *Salmonella* species (2), *Enterococcus* species (1), *Candida* species (1).

The sensitivity of organism was tested in three FQs, viz Ciprofloxacin, Norfloxacin and Levofloxacin. In majority [19 out of 29] patients the organisms were found to be sensitive to both Ciprofloxacin + Levofloxacin. The organisms found to be sensitive to FQs in various samples are presented in table 6.

Table 6.Details ofvarious organisms sensitive to FQs in various samples.

FLUOROQUINOLONES	<i>Staph.aureus</i>	<i>Enterobacter</i>	<i>P.aeruginosa</i>	<i>Klebsiella</i>	<i>Candida</i>	<i>P.mirabilis</i>	<i>Acinetobacter</i>	<i>E.Coli</i>	<i>Salmonella</i>	<i>Enterococcus</i>	<i>Alpha hemolytic Streptococci</i>
	CIPROFLOXACIN+ LEVOFLOXACIN	1	1	3	5	1	2	1	1	-	1
CIPROFLOXACIN+ NORFLOXACIN	-	1	-	1	-	-	-	-	-	-	-
CIPROFLOXACIN	2	1	1	2	-	-	-	-	2	-	-

It was noted that 14 patients received FQs even though the culture report was negative. The most common clinical conditions treated with negative culture report were enteric fever [n=3 (21.42%)], acute gastroenteritis [n=3 (21.42%)], urinary tract infections [n=3 (21.42%)]. In an American study it was found that FQs were most commonly prescribed for UTIs, sinusitis, skin, bone, joint infections, and URTIs [10]. In a previous study it was observed that Ciprofloxacin was mainly used to treat conditions like UTIs, chest infections, bacterial gastroenteritis, and bacteraemia [11].The details of clinical conditions treated in patients with negative culture report are presented in table 7.

**Table 7. Clinical conditions treated in patients with negative culture report.**

Clinical condition	No. of patients	Percentage
Enteric fever	03	21.42
Acute gastroenteritis	03	21.42
Urinary Tract Infections	03	21.42
Lower respiratory tract infection	02	14.29
Pseudocyst of pancreas	02	14.29
Abscess	01	7.14

We observed 13 patients who received FQs even though the culture report was proved to be resistant to FQs. The most common clinical conditions treated in patients with resistance to FQs were lower respiratory tract infection [04 (30.77%)], diabetic foot ulcer [03 (23.08%)], abscess [03 (23.08%)]. The details of clinical conditions treated in patients who were resistant to FQs and the organisms found to be resistant to FQs in various samples are presented in table 8&9.

**Table 8. Clinical conditions treated in patients with resistance to FQs.**

Clinical condition	No. of patients (n=13)	Percentage (%)
Lower respiratory tract infection	04	30.77
Diabetic foot ulcer	03	23.08
Abscess	03	23.08
Acute gastroenteritis	01	7.69
Other ulcers	01	7.69
Other infections	01	7.69

**Table 9. Organisms resistant to FQ in different samples.**

FLUOROQUINOLONES	<i>Staph. Aureus</i>	<i>Klebsiella</i>	<i>E. Coli</i>	<i>P. aeruginosa</i>	<i>Enterobacter</i>	<i>Acinetobacter</i>
CIPROFLOXACIN	1	-	2	1	-	-

Fluroquinolones are prescribed empirically for 35 patients. The most common clinical conditions treated empirically with FQs were acute gastroenteritis [15 (42.86%)], lower respiratory tract infections [06 (17.14%)] etc. The details of clinical conditions treated empirically with FQs are presented in table 10.

**Table 10. Clinical conditions treated empirically with FQs.**

Clinical condition	No. of Patients (n=35)	Percentage
Acute gastroenteritis	15	42.86
Lower respiratory tract infection	06	17.14
Diabetic foot ulcers	02	5.71
Urinary tract infection	02	5.71
Ascites	02	5.71
Deep vein thrombosis	02	5.71
Other infections	06	17.14

It was also found that 9 patients received FQs as surgical antibiotic prophylaxis. The details regarding the use of FQs as surgical prophylaxis are presented in table 11.

Table 11. FQs Used For Surgical Prophylaxis

Clinical Condition	No. of Patients (n=9)	Percentage (%)
Acute appendicitis	4	44.44
Hernia	2	22.22
Fistula	1	11.11
Hemorrhoids	1	11.11
Plastic surgery	1	11.11

### CONCLUSION

In our study Ciprofloxacin was the most frequently prescribed FQ followed by Levofloxacin. In our study we found majority of the samples shows sensitivity to FQs. But in few cases resistance to FQs was also noticed. Ciprofloxacin and Levofloxacin were the most widely used FQs in which sensitivity tests were carried out. It was observed that, FQs were used in 27 patients were, 14 patients received FQs even though the culture report was negative and the remaining 13 patients received FQs even though the culture report proved to be resistant to FQs. Among the study population, it was noted that 35 patients received FQs empirically. We recommend strict guidelines and policies regarding the use of FQs depending on the culture and sensitivity reports. This will effectively minimize the inappropriate use of antibiotics which in turn reduce the overall cost and economic burden.

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