Drug Utilization Pattern of Cephalosporins in In-Patient Departments of Tertiary Care Hospital

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Abstract

Antimicrobial resistance is one of the major threats to global health. It occurs due to widespread use of board spectrum antibiotics empirically. Drug utilization review is performed to assess the use of antibiotics which emphasis on improvement of drug use and provides better patient care. Hence the present study was carried to perform drug utilization of Cephalosporins in various department of Sagar hospitals, Bengaluru. A prospective, cross-sectional and observational study was carried in various in-patient departments. A total of 171 antibiotics prescribed, Cephalosporins contributed for 46.7%. Among Cephalosporins third generation Cephalosporins (83.75%) are predominately used followed by second generation Cephalosporins (15%). Ceftriaxone (42.5%) found to be highly prescribed Cephalosporins. Drugs were mostly prescribed as monotherapy as parenteral dosage forms. Cefoperazone+Sulbactam (22.5%) was the only fixed dose combination (FDC) prescribed. It was observed that Cephalosporins were highly used in general surgery (31%) followed by general medicine (26%), pulmonology (15%) and urology (12%). Irrational use of antibiotics can lead to emergence of resistance; thus, this study gives insight into a drug utilization of Cephalosporins which will promote rational use of drugs.

Keywords: Antimicrobial resistance, Drug utilization, Antibiotics, Cephalosporins.

INTRODUCTION

A bacterial resistance with the use of antimicrobial agents (AMA's) is the major concern globally [1]. It may be the results of widespread use of broad-spectrum antibiotics used for prophylaxis and empirically which is more likely to happen in case of severely ill, immunocompromised and patients having devices or implants [2]. There is an increase in the occurrence of known resistant pathogens and as well as emergence of newly resistant bacteria, such as *Enterococcus faecium, Staphylococcus aureus, Clostridium difficile, Klebsiella pneumoniae, Acinetobacter baumanii, Pseudomonas aeruginosa* and *Enterobacteriaceae* [3].

Cephalosporins are a class of β-lactams antibiotics, most commonly used in the hospital setting because of their extended spectrum of activity [4]. They are categorised into 5 generations but presently the fifth generations are under trials. First generations are active against gram positive bacteria whereas the later generations showed better activity against the gram-negative bacteria [5]. The wide use of Cephalosporins resulted in the emergence of resistance, which explain the necessity of Drug Utilization Evaluation (DUE). DUE is performed to assess the use of antibiotics which emphasis on improvement of drug use and provides better patient care [6].

According to WHO guidelines, drug utilization was defined as the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences. DUE is a part of pharmacoepidemiology, provide insights into extent, pattern, determinants and outcomes of drug use and prescribing [7].

DUE is an on-going, authorised and systematic quality improvement process, which is designed to review drug use and/or prescribing patterns, provide feedback of results to clinicians and other relevant groups. It develops criteria and standards which describe optimal drug use and promote appropriate drug use through education and other interventions [8 and 9].

The main aim of DUE program is to facilitate the rational use of drugs. The rational use of a drug implies the prescription of a well-documented drug at an optimal dose, together with the correct information, at an affordable price. It will helps to know the effectiveness of the treatment, treatment failures and ADRs [4].

Hence, present study was carried to perform drug utilization of Cephalosporins in various in-patient departments of Sagar hospitals, Bengaluru.

MATERIALS AND METHODS

Study design and setting

o A cross-sectional, prospective and observational study was carried out in the in-patient departments of Sagar Hospitals, Bengaluru for 3 months.

Source of data:

o Patient case sheets.
o Laboratory investigations.

Inclusion criteria:

o All the in-patients prescribed with antibiotics.

Exclusion criteria:

o OPD patients.
o Pregnant and Lactating women.
o Mentally retarded & unconscious patients.
o Patients unwilling to take part in study.

Method of collection of data and analysis:

Patients were selected based of inclusion and exclusion criteria, and informed consent will be taken. Patient demographics, final diagnosis, culture sensitivity test and data on drugs administered, it's dose, frequency and route of administration were collected from the patient's case

records and documented in patient profile forms for performing drug utilization evaluation. The data was analyzed using Microsoft excel to calculate the percentage.

Average number of antibiotics

$$= \frac{Total\ number\ of\ Patients}{Total\ number\ of\ antibiotics\ prescribed}$$

RESULTS

The results are based on the 100 prescriptions analyzed who met to our inclusion and exclusion criteria. Among 100 patients, a total 171 antibiotics were prescribed in which Cephalosporins contributed for 46.7%.

Results are divided into 3 parts demographics, lab investigation and prescribing pattern.

Demographics:
Gender wise distribution of study population
Out of 100 prescription we found that females (58%) were predominant than male patients (42%) as given in Table 1.

Age wise distribution of study population
For age wise distribution of study population, age was categorized into 4 groups i.e <18, 18-40, 41-60 and >60 years. Higher number of patients were belonged to age group between 41-60 followed by age above >60 years as given below in Table 2.

Laboratory investigation:
Culture sensitivity test
In our study culture sensitivity test was performed for 44 patients and 56 patients were given with the Cephalosporins without performing culture sensitivity test as illustrated in Figure 1.

Prescribing pattern:
Department wise distribution of study population
During the study we found that Cephalosporins were most widely used in the surgery department (31%) followed by general medicine (26%), pulmonology (15%) and urology (12%) shown in Figure 2 below.

Prescribing frequency of various generations of Cephalosporin
According to the study 3rd generation Cephalosporins (83.75%) were used more in numbers when compared to other generations of Cephalosporins as illustrated in Figure 3. The commonly used Cephalosporins during study is given in the Table 3.

Prescription of antibiotics per prescription
Among 100 prescriptions, 44 % of prescriptions contained only 1 antibiotic as monotherapy, 42 % of prescription contained 2 antibiotics and only 1% had 5 antibiotics as illustrated in Figure 4.

Based on monotherapy or combination therapy
A total of 171 antibiotics we found that monotherapy (69.66%) was more prefered over combination therapy(30.40%) as shown in Table 4.

Based on route of administartion (ROA)
Out of 100 prescription analysed, we have observed that parenteral dosage form (76.02%) was preferred over oral therapy (15.20%) as given below Table 5.

Based on generic or brand names
During the study we found that the greater number of antibiotics were prescribed by brand name (72.51%) than generic names (27.48%) which is illustrated in Table 6.

Table 1. Gender wise distribution of study population

Gender	Number (n=100)	Percentage (%)
Male	42	42
Female	58	58

Table 2. Age wise distribution of study population

Age group (years)	Average age with SD	Males (n=42)		Females (n=58)	
		Number	Percentage (%)	Number	Percentage (%)
<18	7.85±8.49	9	21.4	12	20.7
18-40	32.37±12.72	8	19.0	11	29
41-60	50.39±3.80	15	35.7	22	37.8
>60	72.52±9.19	10	23.80	13	22.4

Table 3. Commonly used Cephalosporins.

Generations	Drugs	Number	Percentage
2nd generation	Cefuroxime	12	15
3rd generation	Ceftriaxone	34	42.5
	Cefoperazone + Sulbactam	18	22.5
	Cefatoxime	8	10
	Cefixime + Clavunate	4	5
	Cefixime	2	2.5
4th generation	Cefpime	2	2.25
TOTAL		80	

Table 4. Prescription pattern

Prescription pattern	Number	Percentage (%)
Monotherapy	119	69.59
Combination therapy	52	30.40

Table 5. Prescription pattern based on route of administration

Prescription pattern	Number	Percentage (%)
Parenteral	130	76.02
Oral	26	15.20

Table 6. Prescription pattern based on generic name or brand name.

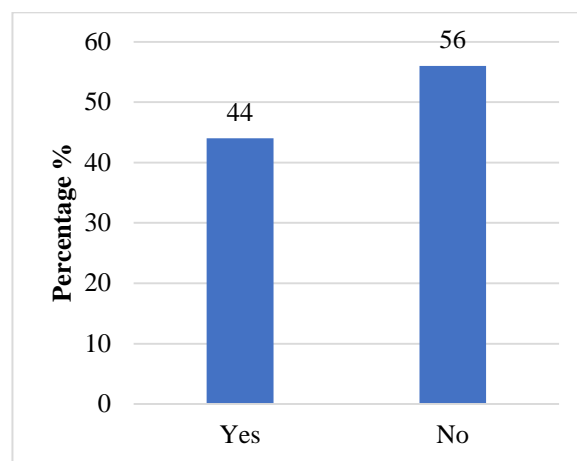| Prescription pattern	Number	Percentage (%)
Brand name	124	72.51
Generic name	47	27.48

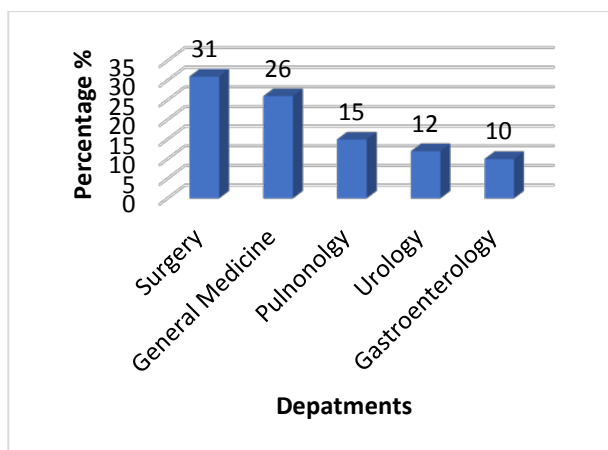**Figure 1. Culture sensitivity test**

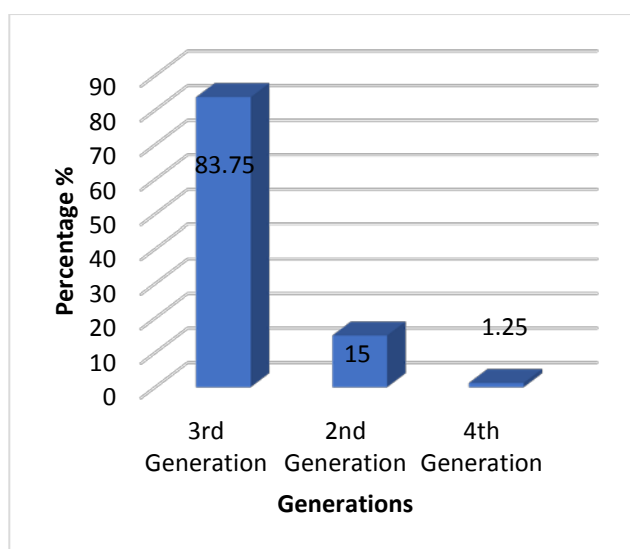**Figure 2. Department wise distribution**

Figure 3. Prescribing frequency of various generations of Cephalosporin
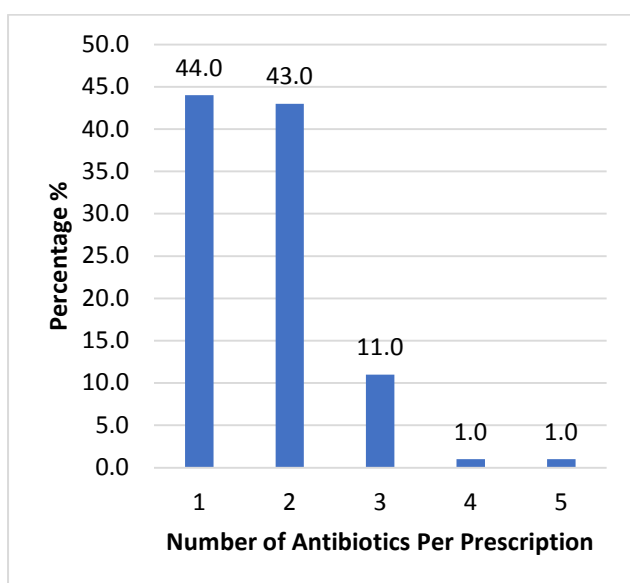

Figure 4. Prescription of antibiotics per prescription

DISCUSSION

Inappropriate use of antibiotics used in the hospital and community is leading to the crisis of antibiotic resistance which ultimately results in the pathogens becoming resistant to the older antibiotics. Thus, this study was focused on the drug utilization of Cephalosporins in the in-patient departments of tertiary care hospital.

The study was carried for 3 months and 100 prescriptions were enrolled in the study based on the inclusion and exclusion criteria. Out of 171 antibiotics prescribed, Cephalosporins contributed for 46.7%. The average number of drugs was 9.15% and Cephalosporins was 0.8%.

During the study we found that more number of females patients were seen over male patients which was similar to the previous study conducted [10] and another study showed contradictory results with our study in which male patients were larger in number than female patients [11].

The large number of patients were seen between the age group between 41-60 years followed by the age >60 years which was matching with earlier study conducted. Older people age 60 years and above are more prone for infection thus use of more antibiotics are seen [12].

Culture sensitivity test is performed to find the antimicrobial susceptibility to disease causing microorganism. In our study, we found that a greater number of prescriptions had empirical use of Cephalosporins; Cephalosporins were prescribed without performing the culture sensitivity test as some of the previous studies carried out in which, most of Cephalosporins were given without performing culture sensitivity test [13]. This results in the use of Cephalosporins without knowing the susceptibility pattern of pathogens which is the cause for development of resistance [4].

As the study was focused to find the drug utilization of Cephalosporins, we found that third generation Cephalosporins were predominantly used when compared to the other generations Cephalosporins. These results were parallel to the previous study [14] and opposing to the results by another study [15]. Third generations Cephalosporins has showed enhanced activity against many organisms, good tolerability and also, they are cost effective.

Cephalosporins were most widely used in the surgery department followed by general medicine, pulmonology and results were similar to the former study conducted [16]. The reason may be because of broad spectrum activity which allows them for empirical treatment which likely to happen in the surgery department and Cephalosporins are effective against the bacteria which cause respiratory tract infection.

Previous study showed that Cephalosporins were mostly prescribed by brand name similar to our study [17], wherein we also found that the Cephalosporins were mostly prescribed by brand names when compared to generic names and contrary to another study showed prescription by generic name [18]. Prescribing the drugs by generic names will helps to have good inventory

control, avoid confusion while dispensing and are economic when compared to brand drugs.

Monotherapy was preferred in this study over combination therapy because in our study most of Cephalosporins was used for surgical prophylaxis which requires single antibiotics. Ceftriaxone was highly used as monotherapy as it has greater potency, wide spectrum of activity and Cefoperazone+Sulbactam combination of third generation Cephalosporins, is active against both gram negative and gram-positive bacteria with β-lactamase inhibitors. Both in combination act synergistically to have effective action and sulbactam will prevent the degradation of β-lactam ring by β-lactamases enzyme which are produced by bacteria [19].

We found that parenteral route was most commonly used route of administration which may be because the study was conducted in the in-patient departments, better bioavailability and faster onset of action.

The study visions about the drug utilization pattern of Cephalosporins. However, the limitation of study was small sample size, only carried out in one class of antibiotics.

Future studies should focus on conducting similar studies in different class of antibiotics and also in newer antibiotics to promote rational use of antibiotics.

CONCLUSION

Ceftriaxone was highly utilized Cephalosporins as monotherapy, and Cefoperazone + Sulbactam as combination therapy. Irrational use of antibiotics can leads to emergence of resistance thus this study gives insight into a drug utilization of Cephalosporins which will promote rational use of drugs.

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