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Research article

A STUDY TO ASSESS THE DRUG UTILIZATION AND EVALUATION OF ANTIMICROBIAL AGENTS IN A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

To assess the utilization and evaluation of antimicrobial agents in a tertiary care teaching hospital. A prospective observational study was conducted for a period of 6 months. Data of our study was collected on the basis of inclusion and exclusion criteria. During the study period, 312 patients were covered, females (168) were receiving more antimicrobial agents (AMA) compared to males (144) and particularly the age group belongs to 36-50 years (35%) and average duration of stay in the hospital was 6.08 days. AMA's were most commonly received by respiratory disorder patients (24%) and renal disorder patients (15%). Commonly prescribed antimicrobials were ceftriaxone 180 (22.86%) and metronidazole 136 (16.75%). In antimicrobials class, antibiotics (523) were more prescribed followed by anti protozoal (136). Combinations of antibiotics were ceftriaxone + salbactum (45%) and piperacillin + tazobactum (22%) were mostly prescribed. In dosage forms, injections and tablets were more prescribed. Citrobacter species was the mostly isolated organism in many culture and sensitivity tests, it was showing resistance to doxycycline and norfloxicin as well as sensitivity to amikacin and nitrofurantoin. The rational use of AMAs is one of the main contributors to control worldwide emergence of antibacterial resistance**.** Clinical pharmacist and Clinicians need to play vital role in minimizing the antimicrobials problems by conducting continuous awareness programs regarding up-to-date prescribing guidelines in the hospital and also minimizing the antimicrobial resistance.

Key Words:-Antimicrobial agents, Utilization, Sensitivity and Resistance, Cephalosporins, Ceftriaxone.

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INTRODUCTION

Drug utilization and evaluation (DUE) has been recommended as a method for identifying inappropriate or unnecessary drug use that monitor, evaluate and promote rational therapy. Several factors like irrational drug use, polypharmacy, incorrect drug choices, incorrect dose, drug interactions, have contributed to increase morbidity, mortality and health care expenses. The misuse or inappropriate use of antimicrobials leads to increase in health care expenses, development of drug resistance and serious adverse drug reactions (Chitra B *et al.*, 2016).

DUE was defined by WHO in 1977 as the marketing, distribution, prescription and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences. Drug utilization research is thus an essential part of pharmacoepidemiology (Bharti Mahajan *et al.*, 2013).

The principal aim of drug utilization research is to facilitate appropriate use of drugs in patient populations, minimize the adverse event and drug interactions leading to better patient outcome. Drug utilization studies are powerful exploratory tools to ascertain the role of drugs in the society. They create a sound socio-medical and

health economic basis for making health care decisions (Kapure N L *et al.,* 2014).

Antimicrobials agents (AMA) have changed the outlook of physicians about the power of drugs on the diseases. Antimicrobials are the most common drugs used for various life threatening and trivial infections. Their importance is magnified in the developing countries, where infective diseases are predominant. But inappropriate and indiscriminate use of antimicrobials has led to the emergence of antimicrobial resistance (SenhaPallavi P *et al.,* 2016). Resistance of common hospital-acquired bacteria to antibiotics is a worldwide problem. It can lead to increased morbidity, mortality, length of hospital stay (LOS) and healthcare expenditure (Drupad H S *et al.,* 2016). The worldwide increase in antimicrobial resistant bacteria is of great concern but is not described adequately in the developing countries. It is the responsibility of the doctors to develop good prescribing habits which will help in reducing the intensity of the problem (SenhaPallavi P *et al.,* 2016).

Drug utilization study is the component of medical audit that monitors and evaluates the drug prescribing pattern and suggest necessary modification in prescribing practices to achieve rational therapeutic practices. Hence the study aimed on assessing the utilization pattern of antimicrobials in medical ward which helps in prescribing the antimicrobial agents and to avoid emergence of drug resistance and to improve better patient outcome.

MATERIALS AND METHODS

We conducted a prospective observational study for a period of 6 months considering the inclusion and exclusion criteria from general medicine ward (Male and Female) and in patient department of the Vijayanagara Institute of Medical Sciences, Ballari. A total of 312 patients were enrolled in this study. Ethical approval was obtained from Institutional ethics committee of TVM College of pharmacy, Ballari. Patients who are willing to participate in the study, patients of either sex from age group of 16- 80 years, patients prescribed with oral (tablets, capsules) and parenteral preparations (IV and infusions) of antimicrobial agents, patients with or without co-morbidities were enrolled in the study. Patients come under special population (Pediatrics, Pregnancy and Lactation) and patients in intensive care unit and postsurgical units were excluded from this study. The data was collected from patient medical record and patient medication box. The collected data was analyzed by using Microsoft excel. The data was presented using percentages along with appropriate tables and figures.

RESULTS AND DISCUSSION

A prospective observational study was conducted in Vijayanagara Institute of Medical Sciences regarding utilization and evaluation of antimicrobial agents over a period of six months. In our study, prescriptions of 312 patients were studied.

Gender wise distribution of patients

On analysis of the prescription, it is found that 144 patients were males and 168 were females. Here females were more predominant than males. In comparison with Prashanth P. *et al.,* study males were 97 patients (38.03%) and the females were 158 patients (61.96%).

Age wise distribution of patients

Majority of the study subjects who received more AMAs were belongs to the age group of 36-50 years (110 patients) followed by 51-65 (75 patients) and 21-35 years (73 patients). In correlation with the study done by Admane P.D. *et al.*, 35-50 years (858) 44.04% age groups of patients were received antimicrobial agents.

Duration of hospital stay

Out of 312 patients, 164 patients stayed in hospital for more than 5 days and 77 patients stayed in hospital for about less than 5 days. In contrast with Meher B.R. *et al.,* study average duration of hospital stay in their study was 5 days.

Disease wise distribution of patients

AMAs were most commonly received by respiratory disorder patients (117) followed by renal disorders (72) and immune disorders (57). In correlation with the Yuan-Yuan Wang *et al.,* study AMAs were commonly prescribed to respiratory tract disorders 64220 (41%) and renal disorders (12.6%).

Commonly prescribed antimicrobials

A total of 312 prescriptions ceftriaxone (180) was the most commonly prescribed AMAs followed by metranidazole (80), ciprofloxacin (62), and azithromycin (32) respectively.This study contrast with the Kapure N L *et al*., study they observed that cefuroxime (33%), cefotaxime (25.3%) were commonly prescribed AMAs.

Most common class of antimicrobial agents

The major class of AMAs prescribed among patients were antibiotics (523) followed by anti-protozoal (136), anti-tubercular (74) respectively. In comparision with the Maheshwari *et al.,* study antibiotics were 197 (90.78%), anti-malarials were 7 (3.22%) and anti-ameobics were 6 (2.76%).

Categorization of antibiotics

Out of 312 prescriptions cephalosporins (211) class of antibiotics were prescribed more followed by fluroquinolones (115) and macrolide (62) antibiotics. Compared with the Sneha Pallavi *et al*., in their study

cephalosporins 174 (51%) were prescribed more followed by aminoglycosides 34 (10%) and quinolones 42 (12%) were prescribed more.

Combination of antibiotics

Combination of ceftriaxone with sulbactum (64) antibiotics was more received by the patients followed by piperacillin with tazobactum (31). Compared with the Chitra B. *et al*., in their study piperacillin + tazobactum 61 (40.6%) and ceftriaxone + tazobactum 4 (2.6%) were prescribed more to the patients.

Dosage forms of antimicrobials agents

In this study 412 of patients were prescribed with injection form (412) of antimicrobials followed by 302 tablet form (302) of antimicrobial agents. And in contrast with Poonam Takhar *et al*., in their study site tablets 170 (51%) were preferred more followed by injections 83 (25%).

Culture and sensitivity towards organism

The antimicrobial sensitivity and resistance pattern were analysed which received that citrobacter species was highly sensitive towards amikacin and nitrofurantoin & resistance towards doxycycline, norfloxacin, and gentamycin. And in contrast with Ravi Pathiyil Shankar *et al*., during their study E. coli is showing more resistance towards co-amoxiclav and ampicillin.

Table 1. Gender wise distribution of patients

Gender	Total number (n=312)	Percentage
Male	144	46%
Female	168	54 %

Table 2. Age wise distribution of patients

Age group (in years)	Total (n=312)	Percentage
>20	27	9%
21-35	73	23%
36-50	110	35%
51-65	75	24%
66-80	27	9%

Table 3. Duration of hospital stay

No. of days	Total no. of patients (n=312)	Percentage
<5	77	25%
5	71	23%
>5	164	52%

Table 4. Disease wise distribution of patients

Disease condition	No. of patients	Percentage
Respiratory disorders	117	24%
Renal disorders	72	15%
Immune disorders	57	12%
Blood disorders	54	11%
GI disorders	48	10%
Cardio vascular disorders	42	9%
Metabolic disorders	36	7%
Endocrine disorders	26	5%
Nervous disorders	23	5%
Miscellaneous	9	2%

Table 5. Commonly prescribed antimicrobials

Antimicrobial class	Drug name	No. of prescription	Percentage
Antibiotics	Ceftriaxone	180	22.16%
	Ciprofloxacin	80	9.855%
	Azithromycin	62	7.63%
	Doxycycline	32	3.94%

	Levofloxacin	28	3.44%
	Amikacin	23	2.83%
	Ceftazidime	20	2.46%
	Vancomycin	18	2.21%
	Piperacillin	16	1.97%
	Rifaximin	16	1.97%
	Clindamycin	9	1.10%
	Cefotaxime	8	0.98%
	Norfloxacin	6	0.73%
	Linezolid	4	0.49%
	Meropenem	4	0.49%
	Imipenem	4	0.49%
	Amoxicillin	4	0.49%
	Cefixime	2	0.24%
	Streptomycin	2	0.24%
	Cefaparazone	1	0.12%
	Moxifloxacin	1	0.12%
	Gentamycin	1	0.12%
	Nitrofurantoin	1	0.12%
	Faropenem	1	0.12%
Anti protozoal	Metronidazole	136	16.74%
Anti tubercular	Category 1 ATT (HRZE)	67	8.40%
	Isoniazid + Rifampicin	7	0.86%
Anti fungal	Fluconazole	15	1.84%
	Amphotericin B	2	0.24%
Anthelmintic	Albendazole	7	0.86%

Table 6. Most common class of antimicrobial agents

Antimicrobials prescribed	No. of antimicrobials prescribed	Percentage
Antibiotics	523	64.40%
Anti- protozoal	136	16.74%
Anti-tubercular	74	9.11%
Anti-viral	40	4.92%
Anti-fungal	17	2.09%
Anti-malarial	15	1.88%
Anthelmentics	7	0.86%

Table 7. Categorization of antibiotics

Antibiotic class	Drug	No. of prescription	Percentage
Cephalosporins	Ceftriaxone	180	34.42%
	Ceftazidime	20	3.82%
	Cefotaxime	8	1.52%
	Cefixime	2	0.38%
	Cefaparazone	1	0.19%
Fluroquinolones	Ciprofloxacin	80	15.29%
	Levofloxacin	28	5.35%
	Norfloxacin	6	1.14%
	Moxifloxacin	1	0.19%
Macrolides	Azithromycin	62	11.85%
Tetracyclins	Doxycycline	32	6.11%
Aminoglycosides	Amikacin	23	4.39%
	Streptomycin	2	0.38%
	Gentamycin	1	0.19%
Pencillins	Piperacillin	16	3.05%

	Amoxicillin	4	0.76%
Glycopeptides	Vancomycin	18	3.44%
Miscellaneous	Rifaximin	16	3.05%
	Nitrofurantoin	1	0.19%
Carbapenems	Meropenem	4	0.76%
	Imipenem	4	0.76%
	Faropenem	1	0.19%
Lincomycins	Clindamycin	9	1.72%
Oxazolidinones	Linezolid	4	0.76%

Table 8. Combination of antibiotics

Combination of antibiotics	No. of drugs prescribed	Percentage
Ceftriaxone + Salbactum	64	45%
Piperacillin + Tazobactum	31	22%
Amoxicillin + Clavulanic acid	28	20%
Cefaperazone + Salbactum	15	10%
Sulfamethoxazole + Trimethoprim	5	3%

Table 9. Dosage form of antimicrobial agents

Dosage form	No. of drugs	Percentage
Injection	412	43%
Tablet	302	32%
Infusion	192	20%
Capsule	49	5%

Table 10. Antimicrobial drug sensitivity towards organism

ORGANISM	Drug sensitivity													
	Amikacin	Norfloxacin	Nitrofurantoin	Meropenem	Tetracycline	Cefotaxime	Azithromycin	Erythromycin	Ceftazidime	Gentamycin	Ciprofloxacin	Chloramphenicol	Ceftriaxone	Doxycycline
Citrobacter species	7	4	6	1	-	3	1	-	2	5	3	2	3	-
Streptococcus species	1	-	-	-	2	-	-	2	1	1	1	3	2	-
Pseudomonas species	2	3	1	3	-	-	1	2	-	-	1	-	-	1
Klebsiella species	2	1	-	-	2	1	-	-	-	2	1	2	1	-
Acitobacter species	1	1	1	-	-	1	-	1	-	-	1	-	1	1
Staphylococcus species	3	-	1	1	1	1	2	-	-	-	-	-	1	5

Table 11. Antimicrobial drug resistance towards organism

ORGANISM	Drug resistance											
	Doxycycline	Ampicillin	Ciprofloxacin	Gentamycin	Amikacin	Amoxycillin	Ceftazidime	Nitrofurantoin	Norfloxacin	Ceftriaxone	Cefotaxime	Cefepine
Citrobacter species	5	3	4	5	3	4	4	3	5	3	4	1
Streptococcus species	-	2	2	1	-	3	2	-	1	3		-
Pseudomonas species	1	1	1	2	-	1	1	1	1	1	-	-
Klebsiella species	-	1	1	2	1	4	1	-	-	-	2	-

Acitobacter species	-	-	-	-	-	1	1	1	-	1	-	-
Staphylococcus species	-	1	1	2	1	4	1	1	1	3	3	1

Fig1. Gender wise distribution
Total number(n=312)

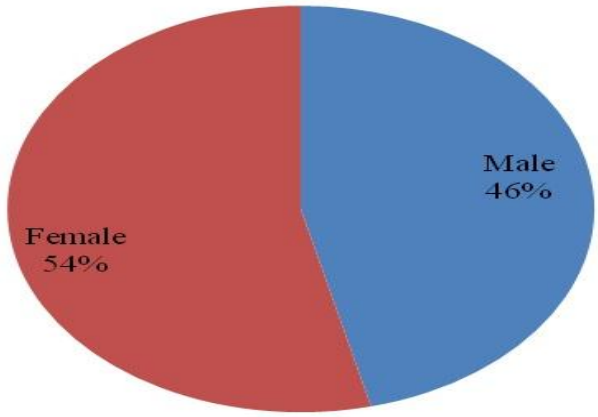


Fig 2. Age wise distribution
Total (n=312)

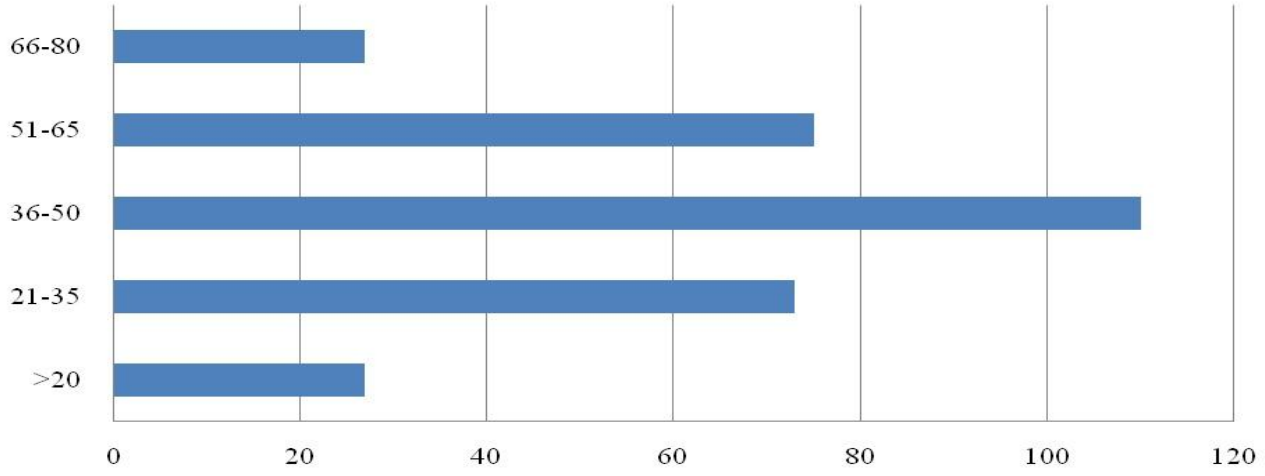


Fig 3. Duration of stay
Total (n=312)

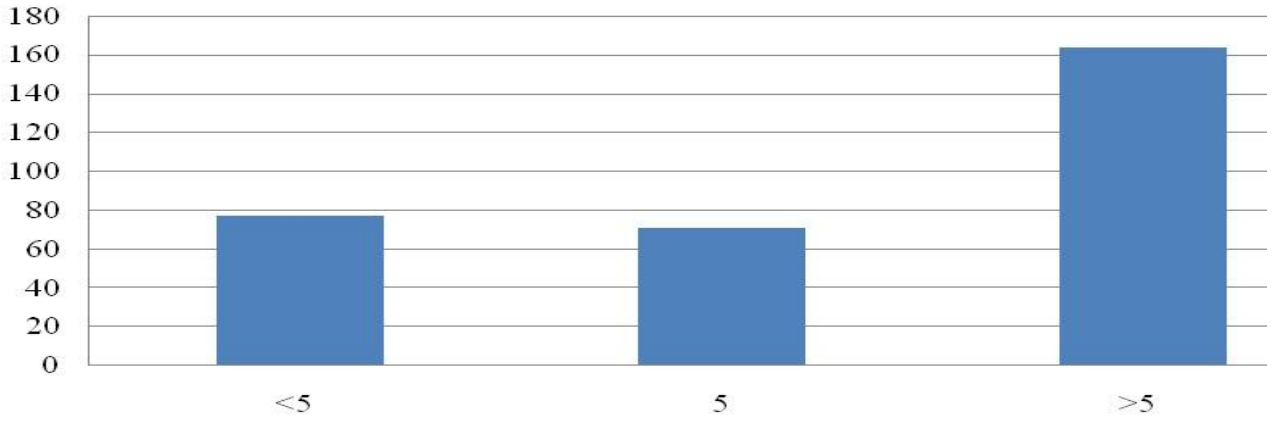


Fig 4. Disease wise distribution of patients

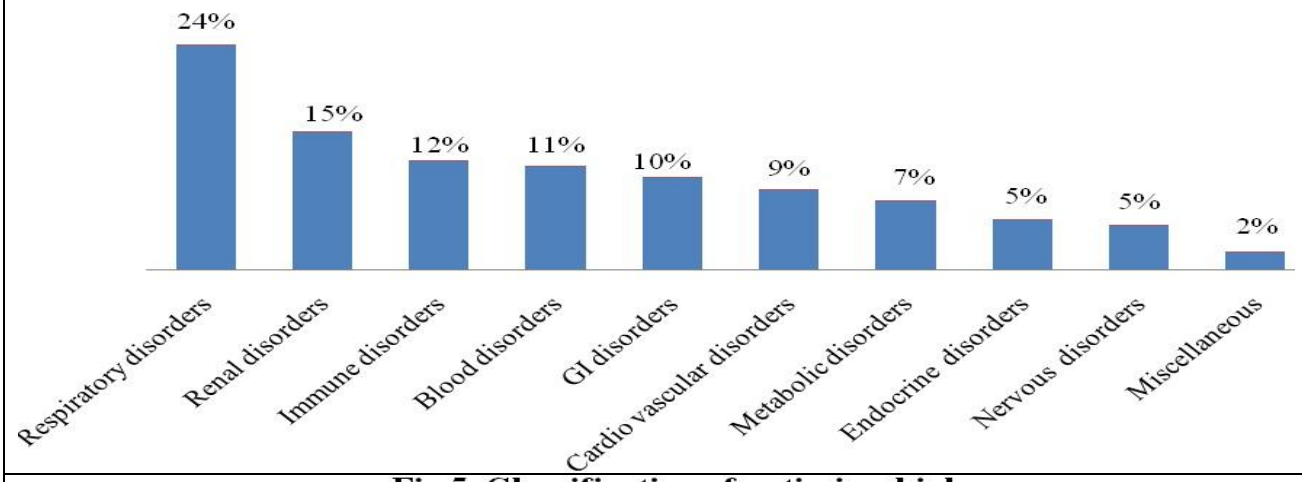


Fig 5. Classification of antimicrobials

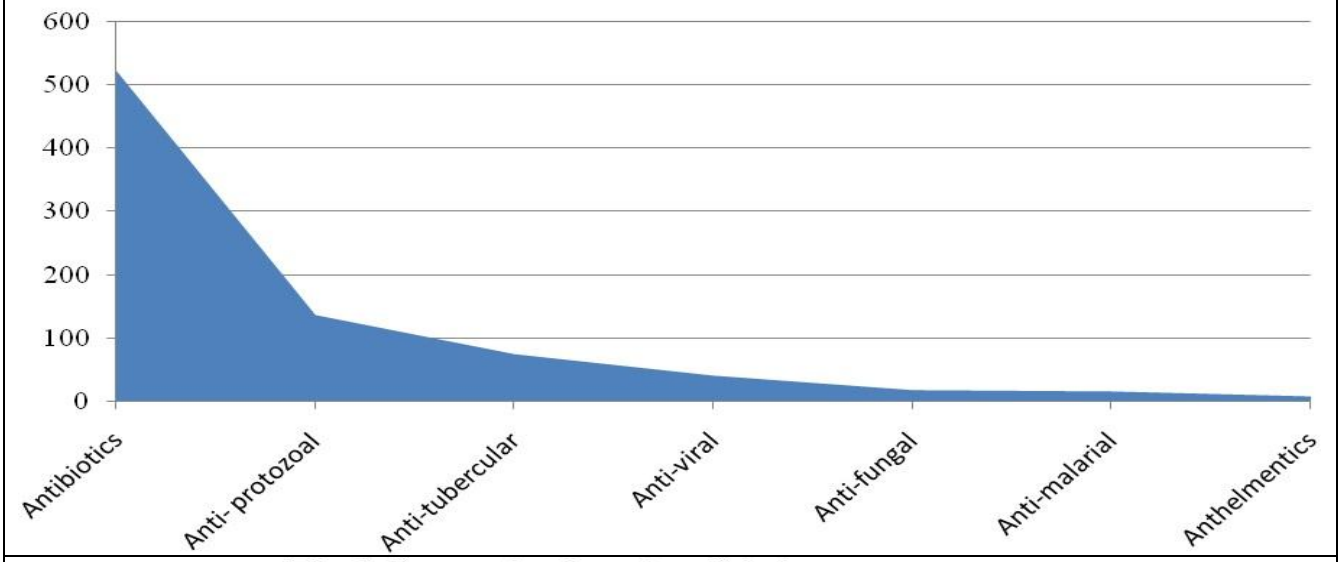


Fig 6. Categorization of antibiotics

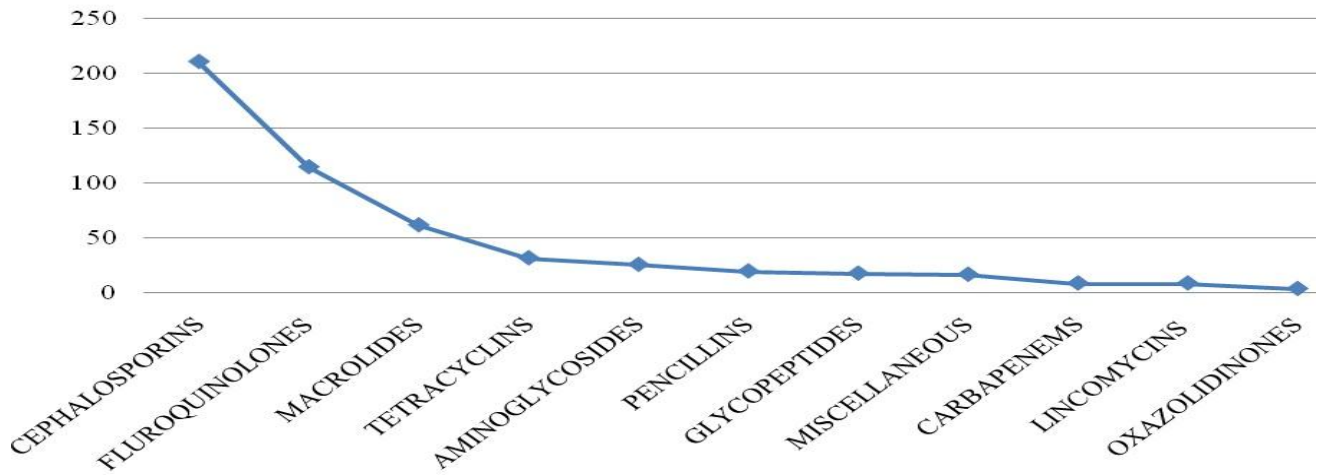


Fig 7. Combination of antibiotics

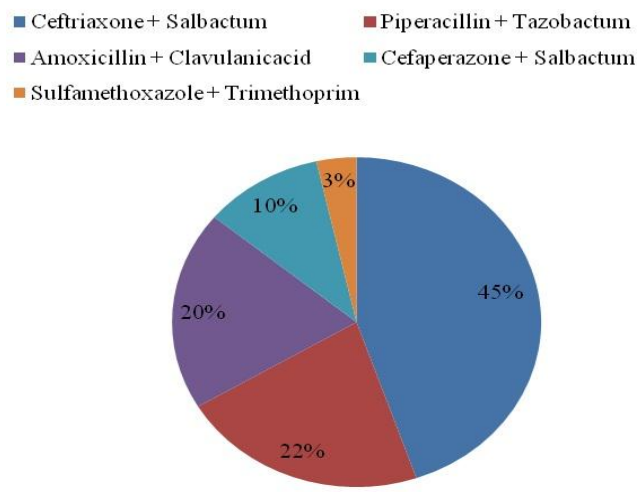
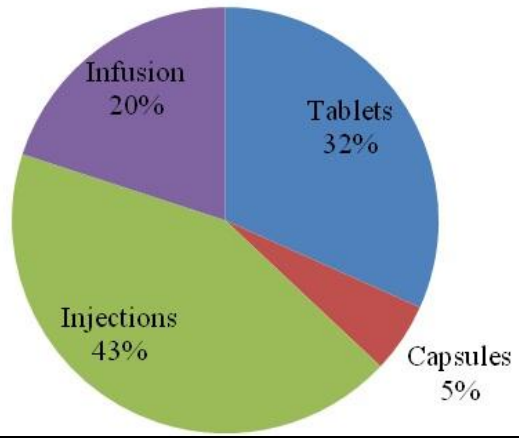


Fig 8. Dosage form of antimicrobial agents



CONCLUSION

Antimicrobials were playing a crucial role in management of diseases and definitely required in hospital set up. It is necessary to prescribe antimicrobials according to the standard guidelines. AMA prescriptions were rational regarding their dose, frequency, route of administration, indication and the culture and sensitivity reports. The report on culture and sensitivity pattern was helpful for the physician to select the appropriate AMA to the patient and it also decreases the length of hospital stay.

Clinical pharmacist and Clinicians need to play vital role in minimizing the antimicrobials problems by conducting continuous awareness programs regarding up-to-date prescribing guidelines in the hospital and also minimizing the antimicrobial resistance. And must be aware of the prevalence of various pathogens and resistance pattern in hospital and exercise good judgment in selection of the antimicrobial regimens.

So, measures should be taken to avoid the inappropriate use of AMA. Drug utilization review program must be carried out to study the rational use of antimicrobials. Standard guidelines should be preferred for prescribing antimicrobial agents. The rational use of AMAs is one of the main contributors to control worldwide emergence of antibacterial resistance**.**

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CONFLICT OF INTEREST

No interest

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