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Drug Utilization Evaluation of Antibiotics at a Tertiary Care Hospital

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ABSTRACT

Objective- The objective of study was to study the prescribing pattern of antibiotics, the pattern of antibiotic sensitivity, to identify the adverse effects of antibiotics and to assess the cost comparison of antibiotics. **Method-** A prospective observational study was carried out in general medicine department over a period of 10 months enrolling 150 patients. The prescriptions were individually screened to assess prescribing pattern of antibiotics. DDD/100 (Defined Daily Dose) of 10 most commonly prescribed antibiotic was calculated. The sensitivity patterns of the antibiotics were evaluated with the help of a suitable antibiogram. The adverse effects of the antibiotics were monitored during drug administration. The cost comparison of the antibiotics was assessed by analyzing the prescribed brand of antibiotic in the hospital with the other brand of the same antibiotic which is available in the hospital. **Results-** In the study most commonly prescribed antibiotics were Piperacillin / tazobactam followed by Ceftriaxone and 12 ADR's were reported. The antibiotic sensitivity pattern was analyzed which revealed that *Klebsiella pneumonia* was highly sensitive to Amikacin and Imipenem followed by the other organisms and their sensitivity pattern .The total cost was Rs. 1945.29±2175.39 for the prescribed antibiotics whereas for alternate antibiotics the cost was Rs. 1169.63±1282.04, which would help in minimizing the patient's expenditure. **Conclusion-** The drug utilization review program must be carried out by the Clinical Pharmacist to study the rational use of antimicrobials.

INTRODUCTION

DUE (Drug Utilization Evaluation) has been recommended as a method for identifying inappropriate or unnecessary drug use that monitor, evaluate and promote rational drug therapy. Several factors like irrational drug use, polypharmacy, incorrect drug choices, incorrect dose, drug interactions, have contributed to increased morbidity, mortality and health care expenses. The misuse or inappropriate use of antibiotics leads to increase in healthcare expenses, development of drug resistance and serious adverse drug reactions.

Evaluation of prescribing pattern will help in minimizing adverse drug reactions and it shall also aid in providing cost-effective medical care.

Therefore this study was planned to identify the prescribing pattern of antibiotics, sensitivity pattern of antibiotics, adverse effects of antibiotics and cost comparison of antibiotics

MATERIALS AND METHODS

- **Study Site:** General Medicine Department
- **Study Design:** Prospective observational study
- **Study Duration:** 10 months
- **Sample Size:** 150 patients

METHOD

The data was collected during regular ward round participation in the department of General Medicine. Standard data entry format was used to enter all the patient details collected during ward rounds. The prescriptions were individually screened to assess the prescribing pattern of antibiotics. The DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults.DDD/100 bed-days(Defined Daily Dose) of 10 most commonly prescribed antibiotic was calculated.DDD/100 bed- days provides at estimate of consumption of drugs in general medicine department.

The sensitivity patterns of the antibiotics were evaluated with the help of a suitable antibiogram provided from the microbiological laboratory.

The adverse effects of the antibiotics were monitored during drug administration and the information on any adverse effect of the drug experienced by the patient was gathered during

the ward rounds and reported

The cost comparison of the antibiotics was assessed by analyzing the prescribed brand of antibiotic in the hospital with the other brand of the same antibiotic which is available in the hospital. Cost of prescribed antibiotics and alternate antibiotics of same class were statistically analyzed.

STATISTICAL ANALYSIS

In this study SPSS (Statistical Package for the Social Sciences) was used to compare the cost of prescribed antibiotics to alternate antibiotics of same class. Other statistical tools like ANOVA and Chi-Square were also used in the study.

RESULTS

The study on gender distribution reports male predominance. The study was conducted in 90 males and 60 female patients. The reports on Age wise distribution found that most of the prescription were in the age group of 61-80 years followed by 41-60 years. The major class of antibiotics prescribed among patients were cephalosporins constituting about 55.3% followed by penicillins (46.6%), and other antibiotics in patients.

The most commonly prescribed antibiotic was piperacillin / tazobactam (40.6%) followed by ceftriaxone (24.6%) during the hospital stay (**Table no.1)**. The antibiotics prescribed was compared with gender, age and duration of treatment and it was found that only duration of stay was found to be statistically significant(p= 0.015) (**Table no.2**). In this study, 30% of patients were prescribed with oral antibiotics and 70 % with Intravenous antibiotics (**Figure no.1)**.

The study reports 12 ADR's (**Table no.3)**. The antibiotic sensitivity pattern was analyzed which revealed that *Klebsiella pneumonia* was highly sensitive to Amikacin and Imipenem, *E. coli* was sensitive to Piperacillin/ tazobactam, *E. faecalis* was sensitive to Piperacillin/ tazobactam, gentamycin and Ofloxacin and *Streptococcus aureus* was sensitive to Imipenem, Meropenem and Ceftriaxone **(Table no. 4)**. The total cost of the prescription for antibiotics in the study was Rs. 1945.29±2175.39 for the prescribed antibiotics whereas for alternate antibiotics the cost was Rs. 1169.63±1282.04, which would help in minimizing the patient's expenditure (**Table no.5)**

The severity of drug interactions was evaluated and categorized into major, moderate and minor type interactions. It was observed that 65% of the interactions had moderate severity 20% of the interactions had major severity and 15% come under minor interactions (**Figure 2)**

TABLE NO. 1: COMMONLY PRESCRIBED ANTIBIOTICS (n=150)

Sl.No.	Antibiotics prescribed	No. of prescription(n=150)	Percentage (%)
1	Piperacillin/tazobactum	61	40.6
2	Ceftriaxone	37	24.6
3	Metronidazole	12	8
4	Amikacin	10	6.6
5	Cefpodoxime	8	5.3
6	Rifaximin	7	4.6
7	Ofloxacin	6	4
8	Ceftriaxone + tazobactum	4	2.6
9	Cefixime	4	2.6
10	Clarithromycin	3	2

TABLE NO. 2: FACTORS AFFECTING THE NUMBER OF ANTIBIOTICS PRESCRIBED (n=150)

			No. of Antibiotics			p-value
		N	1 Antibiotics	2 Antibiotics	> 2 Antibiotics	
Gender	Male	90	46	23	21	0.248
	Female	60	29	22	9	
Age	< 20	3	1	1	1	0.850
	21-40	33	16	9	8	
	41-60	55	27	17	11	
	61-80	56	28	18	10	
	> 80	3	3	0	0	
Duration of stay	< 5 days	43	28	9	6	0.015*
	5 days	23	11	11	1	
	> 5 days	84	36	25	23	

P<0.05 is considered significant

TABLE NO. 3: ADR OBSERVED IN PATIENTS (n=12)

Sl.no	Age	Male	Female	Drug	Dose (gm/mg)	Reaction observed
1	<20	0	0	-	-	
2	20-40	3	0	Clarithromycin Piperacillin /tazobactum Ceftriaxone	500mg 4.5gm 1gm	Thrombophlebitis, rashes Eosinophilia Haemolytic anemia
3	41-60	2	1	Ofloxacin, Metronidazole Clindamycin	200mg 500mg 300mg	Itching Giddiness & Abdominal pain, Constipation
4	61-80	4	1	Clarithromycin Piperacillin/ Tazobactum	500mg 4.5 gm	Thrombophlebitis &Vomiting Haemolytic Uremic syndrome & Decreased Potassium level
5	>80	0	1	Metronidazole	500 mg	Giddiness & Abdominal pain,

TABLE NO. 4: SENSITIVITY PATTERN TOWARD VARIOUS ANTIBIOTICS (n=22)

ORGANISM	DRUG SENSITIVITY								
	Amikacin	Imipenem	Meropenem	Piperacillin/ tazobactum	Rifampicin	Co-trimamoxazole	Gentamycin	Ofloxacin	Ceftriaxone
Klebsiella pneumonia	9	9	7	1	1	3	3	1	1
E.coli	3	3	3	4	-	2	1	1	2
Enterococcus faecalis	1	1	1	3	-		3	3	-
Staphylococcus aureus	2	3	3	-	1	2	-	-	3

TABLE 5: COST COMPARISON OF ANTIBIOTICS

(n=150)

		N	Cost of antibiotics Mean ±S.D.	p value	Alternate cost Mean ±S.D.	p value
Gender	Male	90	2014.31±2199.70	0.636	1189.49±1320.03	0.817
	Female	60	1841.77±2152.65		1139.83±1233.23	
Age	< 20	3	1941.68±2043.03	0.883	1159.65±819.02	0.980
	21-40	33	1872.19±1950.19		1055.33±833.79	
	41-60	55	2144.59±2481.09		1220.00±1371.73	
	61-80	56	1843.45±2067.70		1198.11±1458.78	
	> 80	3	1000.23±970.46		981.66±984.19	
Duration of stay	< 5 days	43	1824.94±2394.95	0.323	1170.29±1503.86	0.612
	5 days	23	1412.87±1841.76		933.27±1215.11	
	> 5 days	84	1945.29±2175.39		1234.01±1181.16	
Total		150	1945.29±2175.39	<0.001	1169.63±1282.04	< 0.001

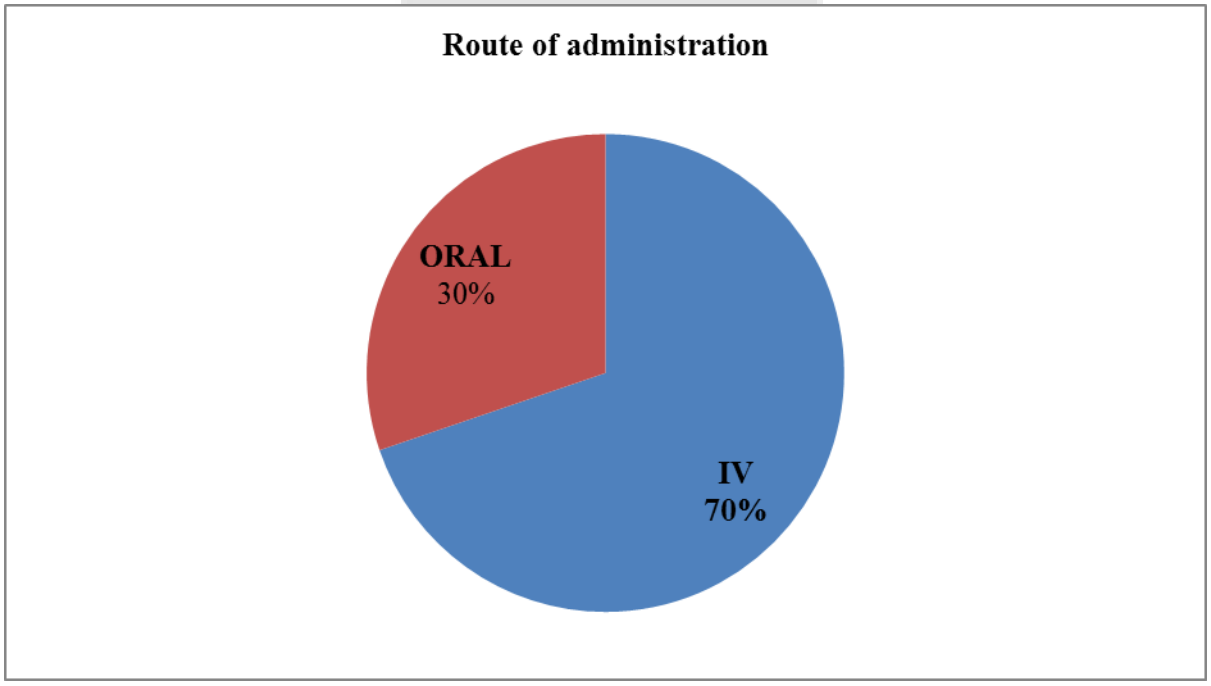

FIGURE NO.1: ROUTE OF ADMINISTRATION

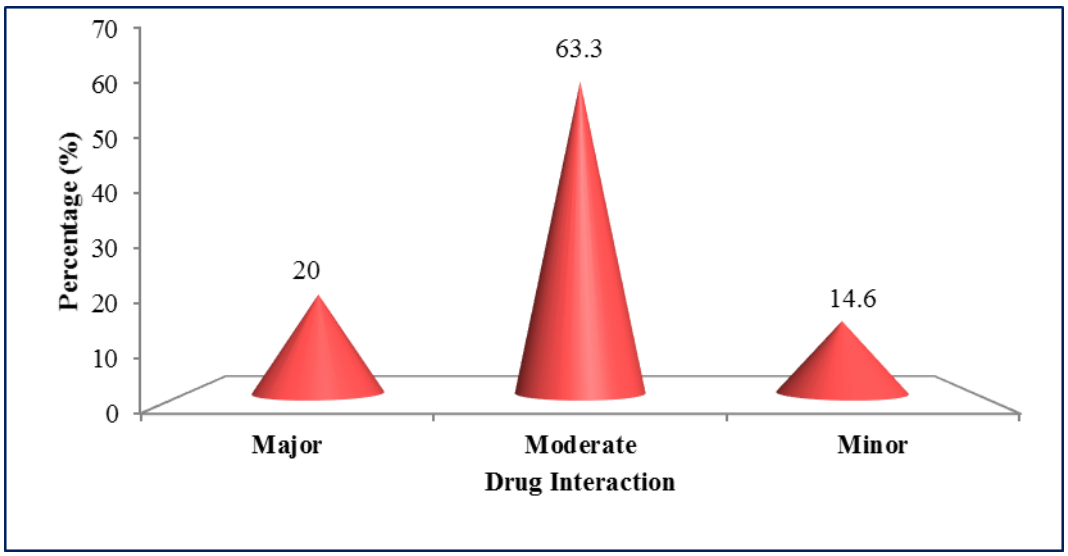

FIGURE NO. 2 DRUG INTERACTIONS

DISCUSSION

The current study on gender categorization had revealed that the overall study population was predominantly male population. In a similar study conducted by **Ravi Pathiyil Shankar** *et al* **(2003)** [5] also noted that majority of patients were males. Age wise distribution was analyzed and found that most of the prescription were in the age group of 61-80 years followed by 41-60 years. Similar study conducted by **MujtabaHussain** *et al* **(2014)** [6] also found that most of prescription were in age group of 46-60 years.

The current study reports on major class of antibiotics prescribed among patients were Cephalosporins followed by Penicillins. This study was similar to a study conducted by **VenuGopal D** *et al* **(2014)** [7] also found that cephalosporins were mostly prescribed to inpatients and Penicillin usage was found to be maximum in outpatients. The most commonly prescribed antibiotic was piperacillin / tazobactam (40.6%) followed by ceftriaxone (24.6%) during the hospital stay which could be compared to a similar study conducted by **Meher B. R** *et al* **(2014)**[8]**.** During the study most of the prescription had single antibiotics prescribed (48.6%), which was similar to a study conducted by **R Selvaraj** *et al* **(2015)** [9].

The reports on number of antibiotics prescribed and duration of stay was found statistically significant (p=0.015). A similar study conducted by **Aparna Williams** *et al* **(2011)** [10] also compared number of antibiotics prescribed with gender, age and duration of treatment and revealed that there was statistically significant.

Our study was compared with the study conducted by **Mohanraj Rathinavelu** *et al.* **(2015)**[11] analyzed DDD/100 bed- days and ATC code of 10 commonly used antibiotics were calculated and the drug Nitrofurantoin use was high as the dose of this drug used in study site was high when compared to WHO recommended DDD.

The organisms commonly seen in the study were *Klebsiella pneumoniae*, followed by *E.coli*, *Enterococcus Faecalis* and *Streptococcus aureus* which were similar to the study conducted by **Ravi Pathiyil Shankar** *et al* **(2003)**[5] were the most common organism isolated was *H. Influenzae, E. coli, K. pneumoniae, S.aureus.* The sensitivity pattern of the antibiotics were analyzed and the reports were found to be similar to the study conducted by **Bijoy Thomas** *et al* **(2014)** [1]. In a similar study conducted by **Bijoy Thomas** *et al* **(2014**) [12] the sensitivity pattern data revealed that E. coli were highly sensitive to Amikacin, followed by Klebsiella to Amikacin, and Pseudomonas to Meropenem

In the present study 12 ADRs were observed in an age group of 61-80 years (41.6%). A similar study conducted by **Farhan Ahmad Khan** *et al* **(2013)** [13] also found that most of ADR were reported in age group of 61-80 years.

The current study reports cost of antibiotics prescribed and cost of alternate antibiotics were calculated. The total cost was Rs. 1945.29±2175.39 for the prescribed antibiotics whereas for alternate antibiotics the cost was Rs. 1169.63±1282.04, which could be compared with a study conducted by **Aparna Williams** *et al* **(2011)**[10] the average cost of the antibiotics was Rupees 1995.08 (± SD 2099.99) per patient and antibiotics expenditure accounted for 73.2% of the total drug cost.

The study on the drug interactions shows that 63.3% of prescriptions had moderate drug interactions followed by major and minor interactions.

CONCLUSION

The current study could assess the prescribing pattern of antibiotics, pattern of antibiotic sensitivity, adverse effects of antibiotics prescribed and cost comparison of antibiotics. Fixed dose combination antibiotic was highly used in the study population which was found to be rational in the study. The report on sensitivity pattern was helpful for the physician to select the appropriate antibiotic to the patient. The ADR's observed in the study can be prevented by proper monitoring during drug administration and through educating the healthcare

professionals regarding commonly occurring ADR'S. The cost analysis reports that the cost of prescribed antibiotics was high and which can be reduced by prescribing alternate antibiotics at a lower cost, which would help in minimizing the patient's expenditure. The drug interactions can be minimized by screening the prescription with various drug database before dispensing by the clinical pharmacist.

Clinical pharmacists and Clinicians need to play vital role in minimizing the antibiotic problems by conducting continual awareness programs regarding up-to-date prescribing guidelines in the hospital and also minimizing the antibiotic resistance. The active participation of clinical Pharmacists in the clinical ward rounds and documentation of Pharmacist observation on prescription inpatient folder is highly recommended for safety and drug monitoring.

Also, physicians must have a clear understanding of rational therapeutic use of antibiotics. They must be aware of the prevalence of various pathogens and resistance patterns in their hospital and exercise good judgment in selection of the antibiotic regimens. Irrationality can be addressed by use of guidelines, educational activities and surveillance at all level of health care. So, measures should be taken to avoid the inappropriate use of antibiotics. Drug utilization review program must be carried out to study the rational use of antimicrobials.
The rational use of antimicrobial agents is one of the main contributors to control worldwide emergence of antibacterial resistance, side effects and reduced cost of the treatment.

CONFLICT OF INTEREST

Authors do not have any conflict of interest

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