Appraisal of Antibiotic Utilization in Various Departments of a Tertiary Care Hospital: A Retrospective Study

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Abstract: - The study aimed to ascertain the use and prescribing pattern of antibiotics in hospitalized patients in different departments of a tertiary care hospital. A retrospective cross-sectional observational study was performed in Guntur government hospital having 1200 bed capacity for a time period of six months from November 2020 to April 2021 on a total of 1036 patients from which 629 patients were considered based on the inclusion criteria. Of the total patients 340 (54%) were male and 289 (46%) were female and the most prevalent disease during our study period in Cardiology department was Ischemic stroke 33 (50%), followed by Hemorrhagic stroke 13(21%), Gastric ulcer and Gastroenteritis 34(50%) in Gastroenterology department, Hepatocyte growth factor deficiency 31(23%) followed by Acute febrile illness 22(16%) in General medicine department, and CKD 53(50%) followed by Acute kidney injury and pyelonephritis 18(17%) each in Nephrology department and in Pediatric department the most prevalent condition during our study period was Respiratory tract infection 42(26%), followed by Dog bite conditions with 31(19%) patients. During our study period the most prevalently used antibiotics were Ceftriaxone 292 (34.6%), followed by Metronidazole 150 (17.7%) and the least prevalent antibiotic used was Meropenem 6 (0.7%). The most prevalently used antibiotics in Cardiology department during our study were Ceftriaxone 42(51%), Ceftriaxone 71(48%) in Nephrology department, Metronidazole 30(30%) in Gastroenterology department, Ceftriaxone 109(46%) in General medicine department, Amoxicillin & Clavulanic acid 66(21%) in Pediatric department. During our study period, total antibiotics prescribed were broad-spectrum antibiotics. The mean number of antibiotics per prescription was 1.4. By this our study concludes that, lack of consciousness on the use of medicine especially antibiotic is the major cause of inappropriate use. Education and research on antimicrobial resistance, and regulation of use of antimicrobials in hospitals as well as in the community should be provided. This study states that development of clinical pharmacist services is also necessary to improve the rational prescribing of drugs mostly antibiotics.

Key Words: — *Prescribing pattern of antibiotics, Culture sensitivity test, Retrospective study, Antibiotic Education.*

I. INTRODUCTION

1.1 Rational Use of Antibiotics

It has been estimated that less than half of all medicines are prescribed, dispensed or sold inappropriately and that less than half of all patients take their medicines as prescribed or dispensed.

Irrational use of medicines can harm patients in terms of poor patient outcome, unnecessary adverse reactions and wastage of resources, often out of pocket payments by patients. Irrational use of antibiotics is particularly serious because it is contributing to antimicrobial resistance that is increasing rapidly worldwide and is causing significant morbidity and mortality.

1.2 Antibiotic Resistance

Antibiotic resistance needs to have a point of origin. Resistance can emerge in the organism of interest through random mutations to the antibiotic's target or other key elements. However, it is more common that a given species of bacteria acquired the genes, which enable a mechanism of resistance, from another species of bacteria that already had it

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through the transfer of mobile genetic elements. Bacteria are promiscuous little organisms and they are not picky—they often swap genes not only between their own species, but different species and even genera.

1.3 Antimicrobial Stewardship

Antimicrobial stewardship (AMS) is defined as "an organizational or healthcare-system-wide approach for monitoring judicious use of antimicrobials to preserve their effectiveness". The concept of AMS was promulgated by the Infectious Diseases Society of America (IDSA) in 2007.

- In April 2017, Indian Council of Medical Research advised 20 tertiary care hospitals in South India to put a strict control on the use carbapenems and polymyxins and labelled them as high need or end use antibiotics.

- This was in the context that these antibiotics were considered the last treatment options for the infections resistant to all other available antibiotics.

- This was coming from a study which was conducted in the Intensive Care Units of 20 tertiary care hospitals and it was observed that 5-7% critically ill patients are resistant to antibiotics.

- Notably, antibiotic resistance and overuse of antibiotics, especially in ICU contribute towards life threatening condition such as sepsis and even death.

- Overall, the emergence of infections by antibiotic resistant Gram positive and Gram negative microbes is on a great rise, taking a note on Escherichia coli, which is an increasing global concern for the resistance to antibiotics and in India the resistance is found to be more than 80% for these classes of antibiotics.

- When 66% surgical infections are caused by Gram negative bacilli, a study reported in 2013 that 13% of the E.Coli strain showed resistance to the last line of therapy antibiotics, such as Carbapenems.

- To control the antimicrobial resistance globally, comprehensive policies on antibiotics use are needed while different countries are at different stages of development of these policies.

- This could include bringing systematic interventions to educate healthcare professionals about prescribing antibiotics, developing infections control guidelines and keeping a control on the marketing and sales of the antibiotics.

1.4 Need Of The Study:

As most of the patients are prescribed with more antibiotic drugs which eventually leads to a greater number of Adverse Drug Reactions and Antibiotic resistance. Therefore, our study focuses on pattern of antibiotic use, their class and most prevalent diseases in different departments

II. METHODOLOGY

Study Site: Guntur government hospital having 1200 bed capacity.

Study Design: Retrospective cross-sectional observational study.

Study Duration: Six months from November 2020 to April 2021.

Sample Size: A total of 629 patients

Inclusion Criteria: Patients of all age groups , Hospitalized patients from General medicine, Cardiology, Paediatric, Gastroenterology, and Nephrology departments, Both male and female , Patients with any other co-morbidities , Most prevalent disease patients.

Exclusion Criteria: Pregnant women, Patients who had undergone surgical procedure, Out- patient department, less prevalent disease patients.

III. RESULTS & DISCUSSION

Out of 629 patients most patients are from pediatric department 212(33.7%), followed by General medicine 188(29.8%). From the total patients 187(29.7%) are from pediatric age group and 336(53.4 %) are adults and 106 (16.8 %) are from geriatric age group.

Table.1. Age Difference in Different Departments:

DEPARTMENT	AGE	FREQUENCY	PERCENTAGE
CARDIOLOGY	0-20	3	5%
	21-40	4	6%
	41-60	33	50%
	61-80	20	30%
	>80	6	9%
GASTROENTEROLOGY	30-40	11	16%
	41-50	22	32%

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	51-60	31	46%
	61-70	4	6%
GENERAL MEDICINE	0-20	2	1%
	21-40	45	25%
	41-60	83	47%
	61-80	46	26%
	>80	2	1%
NEPHROLOGY	0-20	1	1%
	21-40	29	28%
	41-60	49	46%
	61-80	25	24%
	>80	1	1%
PEDIATRIC	1MONTH-1YEAR	41	20%
	2-5	75	35%
	6-10	71	33%
	11-18	25	12%

Of the total cardiology patients most patients were seen at an age group of 41-60 with 33(50%) patients, in Gastroenterology 51- 60 years with 31(46%), in General medicine 41- 60 years with 83 (47%), in Nephrology 41- 60 years with 49(46%) and in Pediatric 2-5 years with 75(35%) of patients which is shown in table.1. The greater number of patients are seen at age group found in different departments are 41-60 years.

Table.2. Number of Patients by Gender.

GENDER	FREQUENCY	PERCENTAGE
FEMALE	289	46%
MALE	340	54%

Table.2.1. Gender Distribution in Different Department.

DEPARTMENT	GENDER	FREQUENCY	PERCENTAGE
CARDIOLOGY	MALE	34	51%
	FEMALE	32	49%
	MALE	32	47%

GASTROENTEROLOGY	FEMALE	36	53%
GENERAL MEDICINE	MALE	94	53%
	FEMALE	84	47%
NEPHROLOGY	MALE	57	54%
	FEMALE	48	46%
PEDIATRIC	MALE	123	58%
	FEMALE	89	42%

Based on gender-wise distribution of patients 340 (54%) were male and 289 (46%) were female which are shown in table.2.

Table.3. Disease Distribution in Different Departments.

DEPARTMENT	DISEASE	FREQUENCY	PERCENTAGE
CARDIOLOGY	CONGESTIVE CARDIAC FAILURE	1	1%
	HAEMORRHAGIC STROKE	13	21%
	ISCHEMIC STROKE	33	50%
	LV DYSFUNCTION	8	12%
	MYOCARDIAL INFARCTION	2	3%
	PERICARDIAL EFFUSION	9	13%
GASTROENTROLOGY	DUODENAL ULCER	8	12%
	GASTRIC ULCER	17	25%
	GASTROENTERITIS	17	25%
	GI BLEEDING	6	9%
	LIVER ABSCESS	7	10%
	PANCREATITIS	11	16%
	VIRAL HEPATITIS	2	3%
GENERAL MEDICINE	ACUTE FEBRILE IILNESS	22	16%
	ANEMIA	16	12%
	CELLULITIS	11	8%

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	CHRONIC LIVER DISEASE	19	14%
	DENGUE FEVER	11	8%
	GOUT	12	9%
	HEPATOCYTE GROWTH FACTOR	31	23%
	SEIZURES	12	9%
NEPHROLOGY	ACUTE KIDNEY INJURY	18	17%
	CKD	53	50%
	DIABETIC NEPHROPATHY	6	6%
	NEPHROTIC SYNDROME	10	10%
	PYELONEPHRITIS	18	17%
PEDIATRIC	DENGUE FEVER	13	8%
	DOG BITE	31	19%
	GASTROENTERITIS	13	8%
	MENINGITIS	20	12%
	RESPIRATORY TRACK INFECTION	42	26%
	SEIZURES	26	16%
	THALASSEMIA MAJOR	14	9%

Table.4. Total Antibiotics Used

ANTIBIOTICS	FREQUENCY	PERCENTAGE
AMIKACIN	63	7.4%
AMOXICILLIN & CLAVALANIC ACID	81	9.6%
CEFIXIME	82	9.7%
CEFOTAXIME	40	4.7%
CEFTRIAXONE	292	34.6%
CEPROFLOXACIN & TINIDAZONE	21	2.4%
DOXYCYCLINE	28	3.3%
MEROPENEM	6	0.7%
METRONIDAZOLE	150	17.7%
PIPERACILLIN & TAZOBACTAM	49	5.8%
RIFAXIMIN	9	1%
AZITHROMYCIN	14	1.6%
FRAMYCETIN	8	0.9%

Based on the disease distribution in different departments the most prevalent disease during our study period in Cardiology department was Ischemic stroke 33 (50%), and Hemorrhagic stroke 13(21%) respectively, Gastric ulcer and Gastroenteritis 34(50%) in Gastroenterology department, Hepatocyte growth factor deficiency 31(23%) followed by Acute febrile illness 22(16%) in General medicine department, and CKD 53(50%) followed by Acute kidney injury and pyelonephritis 18(17%) each in Nephrology department and in Pediatric department the most prevalent condition during our study period was Respiratory tract infection 42(26%), followed by Dog bite conditions with 31(19%) patients as shown in table.3.

During our study period the most prevalently used antibiotics were Ceftriaxone 292 (34.6%), followed by Metronidazole 150 (17.7%) and the least prevalent antibiotic used was Meropenem 6 (0.7%) as shown in the table.4.

Table.5. Antibiotic Distribution in Cardiology Department.

ANTIBIOTICS	FREQUENCY	PERCENTAGE
CEFIXIME	23	28%
CEFTRIAXONE	42	51%
METRONIDAZOLE	11	13%
NO ANTIBIOTICS	5	6%

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The most prevalently used antibiotics in Cardiology department during our study were Ceftriaxone 42(51%), Cefixime 23(28%), followed by Metronidazole 11(6%). Prescription with no antibiotic were seen in 5(6%) patients only. The details were shown in table.5. Cephalosporins were the highly prescribed class of antibiotics in cardiology department with 65(79%) prescriptions as shown in figure.2. and Prescription with One antibiotic are seen in 69% of patients, two antibiotics are seen in 22% patients and no antibiotics are used in 9% patientsas shown in figure.1.
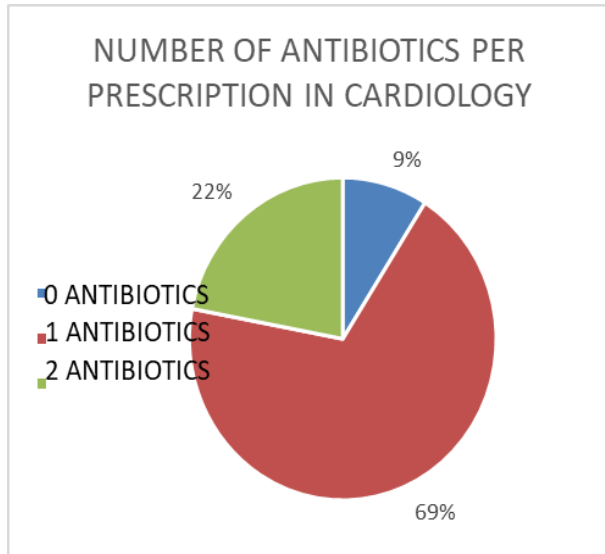
Fig.1.Number of Antibiotics per Prescription in Cardiology
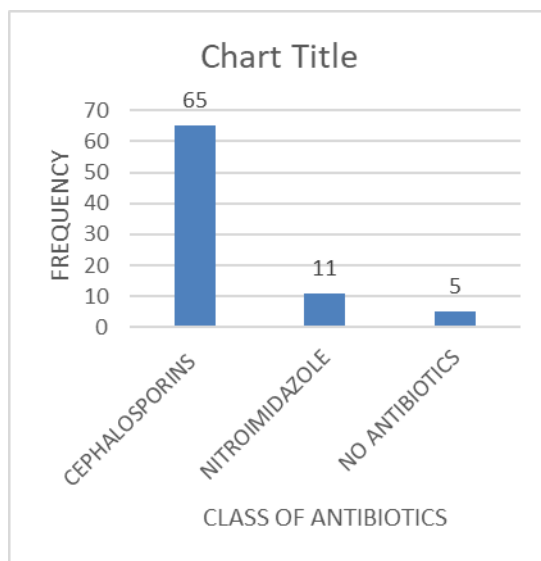
Fig.2. Group wise Distribution of Antibiotics in Cardiology

During our study period, antibiotics were prescribed majorly by I.V route (46) followed by oral route (19) in Cardiology department as shown in figure.3.
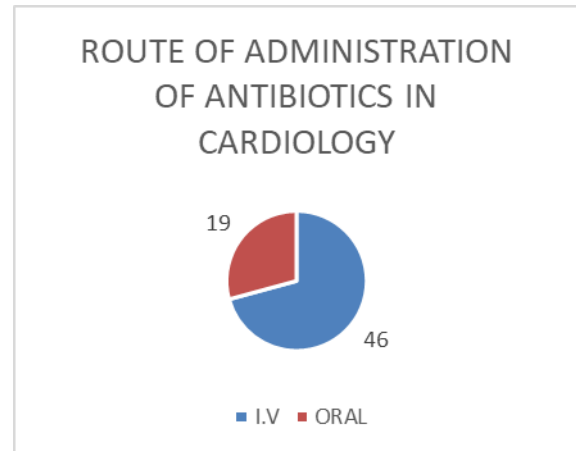
Fig.3. Route of Administration of Antibiotics in Cardiology.

Table.6. Antibiotic Distribution in Nephrology Department:

ANTIBIOTICS	FREQUENCY	PERCENTAGE
AMOXICILLIN & CLAVULANIC ACID	4	2%
CEFIXIME	18	13%
CEFTRIAXONE	71	48%
DOXYCYCLINE	7	4%
METRONIDAZOLE	36	24%
PIPERACILLIN & TAZOBACTAM	12	8%
NO ANTIBIOTICS	2	1%

The most prevalently used antibiotics in Nephrology department during our study period were Ceftriaxone 71(48%), Metronidazole 36(24%), followed by Cefixime 18(13%). Prescription with no antibiotic were seen in 2(1 %) patients only. The details were shown in table.6. Cephalosporins were the highly prescribed class of antibiotics in Nephrology department with 89(61%) prescriptions followed by Penicillin and Nitro imidazole's with 36(24%) during our study period as shown in figure.5. and Prescription with One antibiotic were seen in 58% of patients, two antibiotics were seen in 45% patients and no antibiotics were used in 2% patients as shown in figure.4.

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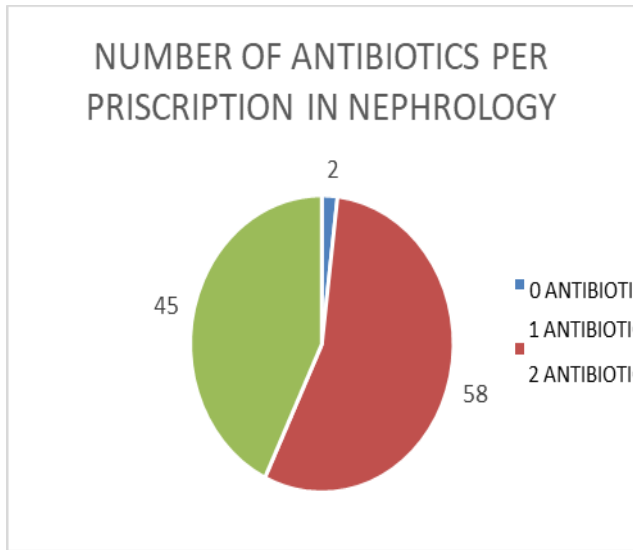
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Fig.4. Number of Antibiotics per Prescription in Nephrology.

During our study period the antibiotics were prescribed majorly by I.V route (76%) followed by oral route (24%) in Nephrology department as shown in figure.6.
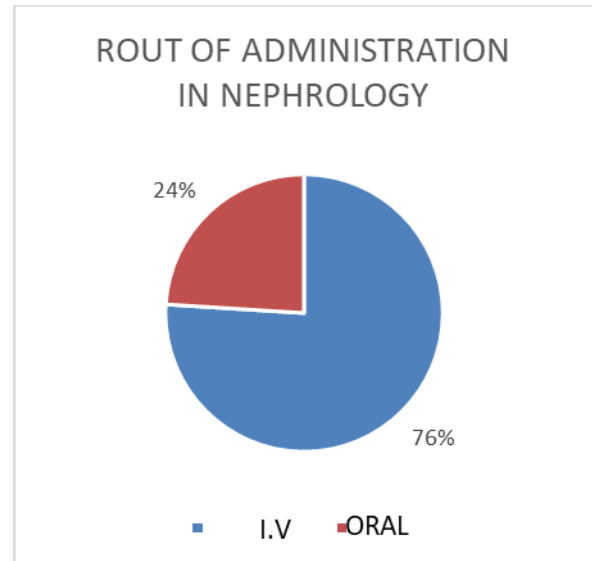

Fig.5. Group Wise Distribution of Antibiotics in Nephrology:

Fig.6. Route of Administration 0f Antibiotics in Nephrology.

Table.7. Antibiotic Distribution in Gastroentrology Department.

ANTIBIOTICS	FREQUENCY	PERCENTAGE
AMOXICILLIN & CLAVULANIC ACID	11	11%
CEFIXIME	13	13%
CEFTRIAXONE	13	13%
CIPROFLOXACIN & TINIDAZOLE	21	21%
METRONIDAZOLE	30	30%
PIPERACILLIN & TAZOBACTAM	7	7%
RIFAXIMIN	5	5%
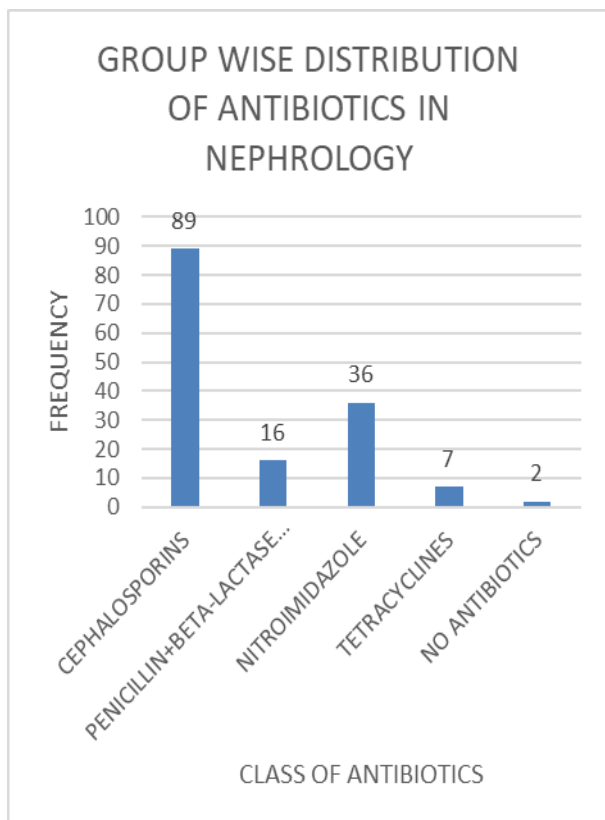
The most prevalently used antibiotics in Gastroenterology department during our study period were Metronidazole 30(30%), Ciprofloxacillin & Tinidazole 21(21%), followed by Cefixime and Ceftriaxone 13(13%) each as shown in table.7. Nitroimidazoles were the highly prescribed class of antibiotics in Gastroenterology department with 30(30%) prescriptions followed by Cephalosporins with 26(26%) as shown in figure.8. and Prescription with one antibiotic were seen in 53% of patients, two antibiotics were seen in 47% patients as shown in figure.7.
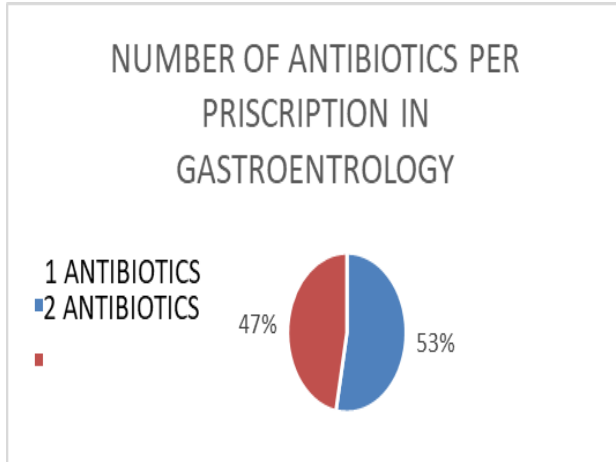
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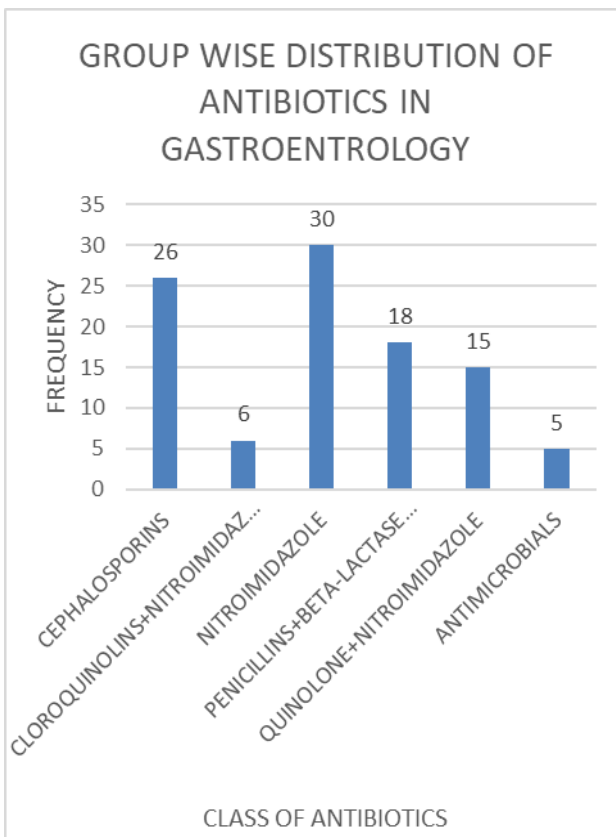Fig.7. Number of Antibiotics per Prescription in Gastroentrology.
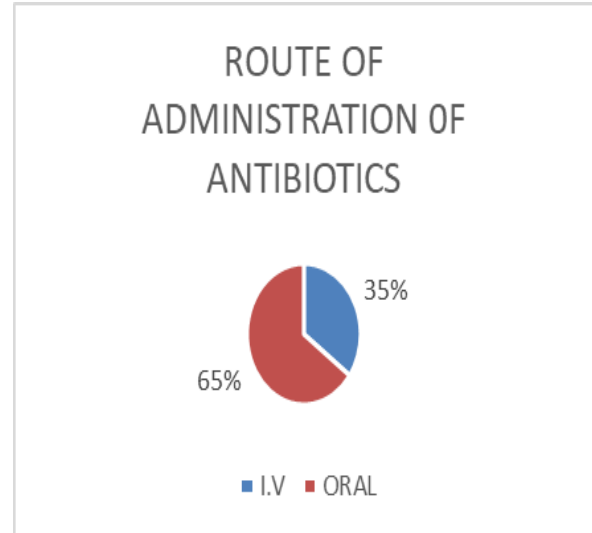
Fig.8. Group Wise Distribution of Antibiotics in Gastroentrology

During our study period the antibiotics were prescribed majorly by Oral route (65%) followed by I.V route (35%) in Gastroenterology departments shown in figure.9.

Fig.9.Route of Administration 0f Antibiotics in Gastroenterology

Table.8. Antibiotic Distribution in General Medicine Department

ANTIBIOTICS	FREQUENCY	PERCENTAGE
MEROPENEM	6	2%
CEFIXIME	20	8%
CEFTRIAXONE	109	46%
DOXYCYCLINE	21	9%
METRONIDAZOLE	51	23%
PIPERACILLIN & TAZOBACTAM	10	4%
AZITHROMYCIN	14	6%
RIFAXIMIN	4	2%

The most prevalently used antibiotics in department of General medicine during our study period were Ceftriaxone 109(46%), Metronidazole 51(23%), followed by Cefixime and Doxycycline 20(8%), 21(9%) as shown in table.8. Cephalosporins were the highly prescribed class of antibiotics in General medicine department with 129(54%) prescriptions followed by Nitroimidazoles with 51(23%) as shown in figure.11. and Prescription with one antibiotic were seen in 62% of patients, two antibiotics were seen in 35% patients and no antibiotics were seen in 3% patients as shown in figure.10.
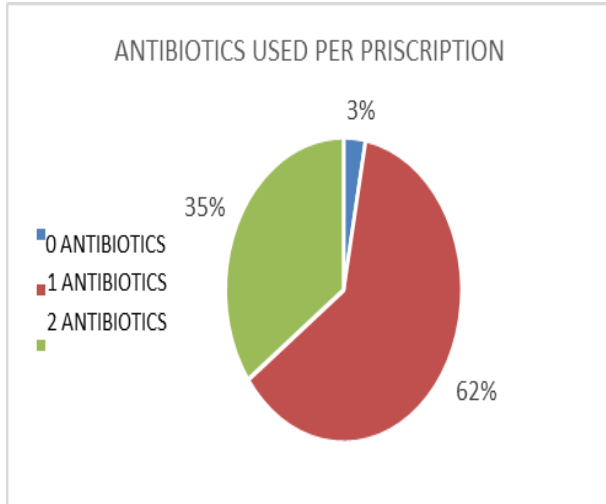
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Fig.10. Number of Antibiotics per Prescription in General Medicine.

Fig.12.Route of Administration 0f Antibiotics in General Medicine.

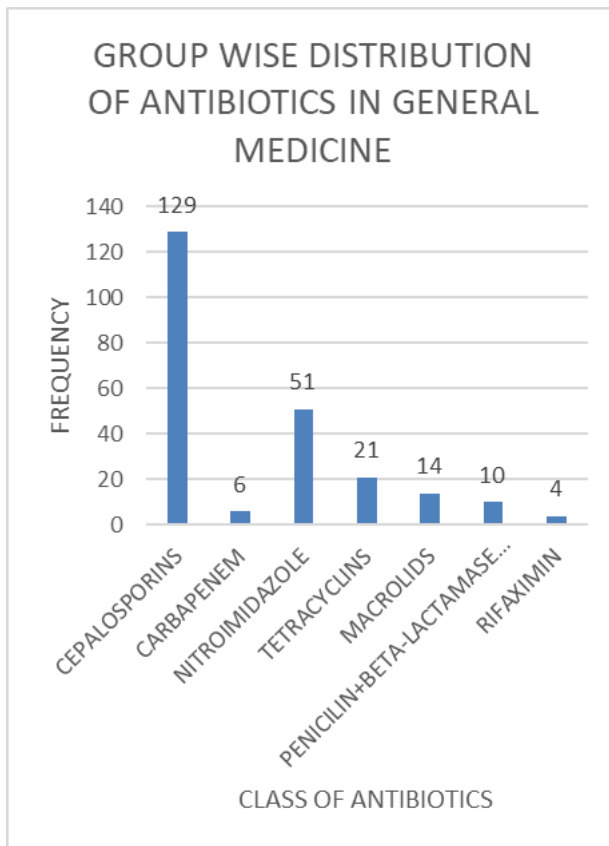Table.9. Antibiotic Distribution in Pediatric Department

ANTIBIOTICS	FREQUENCY	PERCENTAGE
AMIKACIN	63	20%
CEFIXIME	8	3%
CEFTRIAXONE	57	18%
AMOXICILLIN & CLAVULANIC ACID	66	21%
METRONIDAZOLE	22	7%
PIPERACILLIN & TAZOBACTAM	20	6%
CEFOTAXIME	40	13%
FRANYCETIN	8	3%
NO ANTIBIOTICS	29	9%
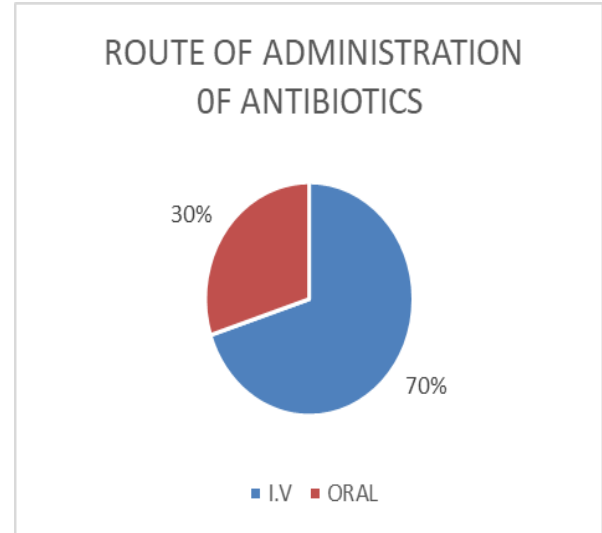
Fig.11.Group Wise Distribution of Antibiotics in General Medicine

During our study period the antibiotics were prescribed majorly by I.V route (70%) followed by Oral route (30%) in General medicine department as shown in figure.12.

The most prevalently used antibiotics in Pediatric department during our study period were Amoxicillin & Clavulanic acid 66(21%), Amikacin 63(20%), followed by Ceftriaxone 57(18%) as shown in table.9.

Cephalosporins were the highly prescribed class of antibiotics in General medicine department with 105 prescriptions followed by Penicillin beta lactamase inhibitors with 86 as shown in figure.14.

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and Prescription with one antibiotic were seen in 39% of patients, two antibiotics were seen in 47% patients and no antibiotics were seen in 14% patients as shown in figure.13.
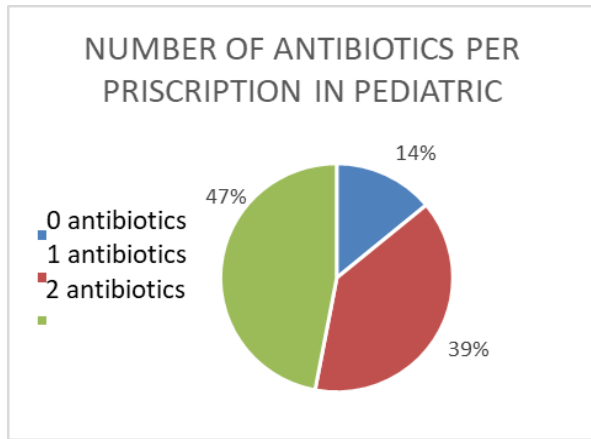

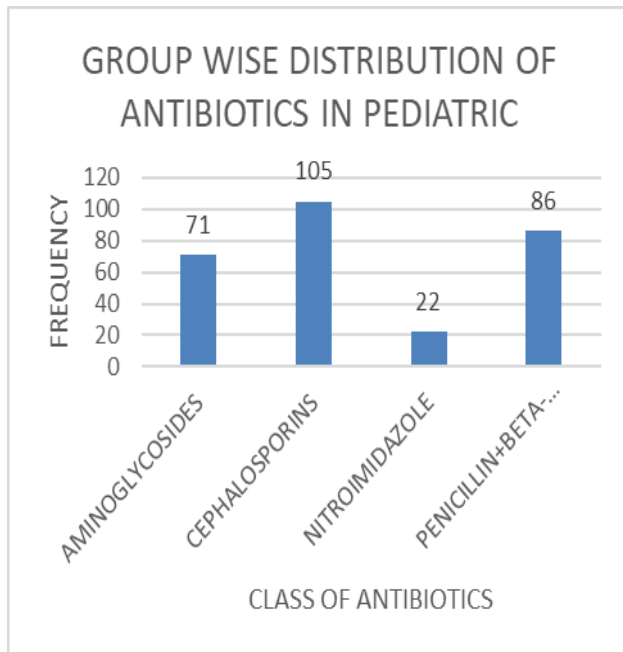Fig.13. Number of Antibiotics per Prescription in Pediatric Department

Fig.14. Group Wise Distribution of Antibiotics in Pediatric Department

During our study period the antibiotics were prescribed majorly by Oral route (78%) followed by I.V route (19%) and topical antibiotics were seen in (3%) patients in Pediatric department as shown in figure.15.
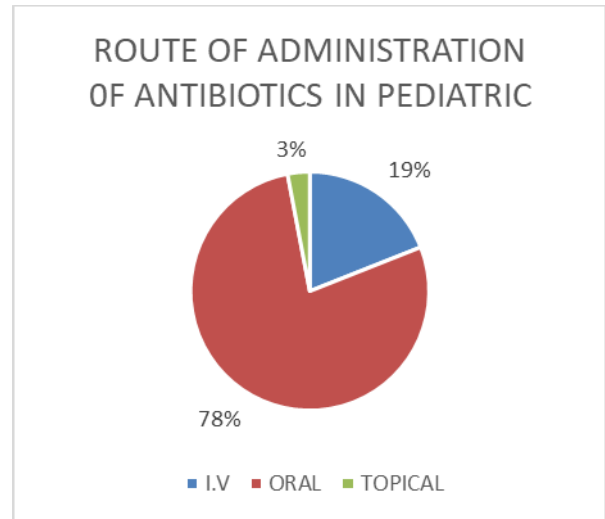

Fig.15. Route of Administration of Antibiotics in Pediatric Department

During our study period the antibiotics were prescribed majorly by Oral route (78%) followed by I.V route (19%) and topical antibiotics were seen in (3%) patients in Pediatric department as shown in figure.15.

IV. CONCLUSION

Lack of consciousness on the use of medicine especially antibiotic is the major cause of inappropriate use. Practice of identification of the organism by culture and sensitivity should be increased. A good, representative database on the current status of antibiotic resistance among common and important pathogens is essential for the proper treatment of infectious diseases in the country. Education and research on antimicrobial resistance, and regulation of use of antimicrobials in hospitals as well as in the community should be provided. This study states that development of clinical pharmacist services is also necessary to improve the rational prescribing of drugs mostly antibiotics.

REFERENCES

[1]. K D Tripathi; Essentials of MEDICAL PHARMACOLOGY 7th edition; 2013.

[2]. World Health Organization. Promoting rational use of medicines: core components: September 2002; World Health Organization Geneva.

[3]. Kathleen Anne Holloway, Laura Rosella, David Henry; The Impact of WHO Essential Medicines Policies on Inappropriate Use of Antibiotics; March 22, 2016.

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[4]. Kathleen Anne Holloway, David Henry; WHO Essential Medicines Policies and Use in Developing and Transitional Countries: An Analysis of Reported Policy Implementation and Medicines Use Surveys; September 2014; Volume 11; Issue 9 ; e1001724.

[5]. Naeem Arshad Chaudri, MD; Adherence to Long-term Therapies Evidence for Action; May-June 2004; ISBN 92-4-154599-2.

[6]. Jason C.Gallagher, Conan MacDougall; ANTIBIOTICS SIMPLIFIED 4th edition; 2017.

[7]. Richard J. Fair and yitzhak tor; Antibiotics and Bacterial Resistance in the 21st Century; June 24, 2014.

[8]. Md Anwarul Azim Majumder , Sayeeda Rahman , Damian Cohall , Ambadasu Bharatha , Keerti Singh , Mainul Haque , Marquita Gittens-St Hilaire; Antimicrobial Stewardship: Fighting Antimicrobial Resistance and Protecting Global Public Health; 2020:13; 4713-4718.

[9]. Standiford HC, Chan S, Tripoli M, Weekes E, Forrest GN. Antimicrobial stewardship at a large tertiary care academic medical center: cost analysis before, during, and after a 7-year program. Infect Control Hosp Epidemiol. 2012; 33(4):338–345.

[10]. Combes JR, Arespacochaga E, Appropriate use of medical resources. Chicago, IL: American Hospital Association's Physician Leadership Forum; 2013.

[11]. Naveed S, Hameed A, Sharif N, Urooj A, Mehak R (2014) Use of 3rd generation cephalosporins in different age groups in tertiary health care centers of Karachi. Journal of Scientific and Innovative Research 3:1-4.

[12]. Dubey AK, Subish P, Shankar PR, Upadhyay DK, Mishra P (2006) Prescribing patterns among pediatric inpatients in a teaching hospital in western Nepal. Singapore Med J 47:261-265.

[13]. Ghai OP, Paul VK, Bagga A (2009) Disorders of respiratory system. Essential Pediatrics (7thedn.)pp: 351-352.Bharathiraja R, Sridharan S, Chelliah LR.

[14]. Harbarth S. Samore MH. Antimicrobial resistance determinants and future control. Emerg. Infect. Dis. 2005; 11, 794-801.

[15]. A Chowdhary, R Gopalakrishnan, S Nambi, V Ramasubramanian et al. Antimicrobial susceptibility of Salmonella enteric serovars in a tertiary care hospital in South India. Ind J Med Res 2013; 137: 800-802.

[16]. . World Health Organization, Regional Office for South East Asia. Regional Strategy for prevention and containment of antimicrobial resistance. New Delhi: WHO-SEARO, 2010.

[17]. World Health Organisation. Improving the containment of antimicrobial resistance. World Health Assembly Resolution. Document No. WHA58.27.Geneva: WHO, 2005.

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