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STUDY TO OVERCOME ANTIMICROBIAL RESISTANCE AND HEALTHCARE ASSOCIATED INFECTIONS

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ABSTRACT

Aim: The global antimicrobial resistance burden is growing and is associated with increased morbidity and mortality in both clinical and community settings. The aim of this study is to highlight the use of antimicrobial stewardship which helps us achieve optimal outcome of the infection with minimizing toxicity, reducing costs and limiting microbial resistance throughout the rational use of antibiotics.

Objectives

- To assess the Prescription pattern in infectious diseases.
- To monitor the clinical outcomes in patients treated with different antimicrobial therapies in infectious diseases.
- To analyse the antibiotic sensitivity pattern of common microorganisms.
- Evaluation of the rational and irrational use of drugs.
- De-escalation of antimicrobial therapy (stewardship program)

Methods: This is a prospective observational study was conducted to assess antibiotic therapy and its clinical outcomes in infectious diseases over a period of six months using designed data collection form as a tool. **Results:** Of the 150 patients analysed over a period of six months, it was observed that, for the antibiotics prescribed by the hospital physicians, only 43% of antibiotics were observed to be rational while 57% were irrational. **Conclusion:** Our results show that the choices of antibiotics occasionally comply with the ICMR and NCDC guidelines for the management of infectious patients. It was therefore concluded that irrationality in prescribing was more prominent.

KEYWORDS: Antibiotics, Antibiotic Resistance, Culture/Sensitivity Patterns, Antibiotic Stewardship Program.

INTRODUCTION

Antibiotics: Medicines that suppress or delay bacterial growth are known as antibiotics. Antibiotics aren't effective against viruses like those that cause cold or flu. Antibiotics are either naturally occurring substances formed by microorganisms, or laboratory-prepared synthetic substances. Antibiotics function in many different ways. They can kill bacteria, simply disable them, or delay their multiplication, allowing more time for the immune system to clear the infection. Some antibiotics stop the bacteria from producing proteins which are essential for survival and replication, while others interfere with their ability to copy DNA. Before the administration of antibiotics, culture/sensitivity tests should be done to identify the organism present and provide suggestive medications to stop its growth.[1] [2]

Antibiotic Resistance: Resistance to antimicrobials occurs when microorganisms (such as fungi, bacteria, viruses, and parasites) alter through exposure to antimicrobials (such as antifungals, antibiotics, antivirals, anthelmintic, and antimalarial). Consequently, the antimicrobials become ineffective and infections persist. Microorganisms that acquire resistance to antimicrobials are often referred to as 'super-bugs'. Several major organizations, such as the Centres for Disease Control and Prevention (CDC), Infectious Diseases Society of America, the World Economic Forum and the World Health Organization (WHO), have deemed antibiotic resistance an "International public health problem". There are reported studies supporting, beyond doubt, that minimizing antibiotic misuse reduces resistance. Moreover, they all accept that the only way to

reduce antibiotic resistance is through appropriate use and abuse mitigation. They also all accept that joint training is needed for both doctors and patients in order to reduce the overuse of antibiotics. It is concluded that only through effective educational intervention by the right people with the right resources, for doctors and patients, can the issue of antibiotic misuse be adequately improved and the risk of antimicrobial resistance slowly eliminated.[3] [4] [5] [6]

Antibiotic Stewardship: Antimicrobial stewardship was defined as the "optimal selection, duration and dosage of antimicrobial medications resulting in the best clinical outcomes or infection prevention, with a minimum patient toxicity and minimal impact on resistance following therapy". This important initiative is entrusted to antimicrobial stewardship teams in hospital. The goal of antimicrobial stewardship is threefold. The first goal is to collaborate with healthcare professionals to provide each patient with the most effective antimicrobial with the correct dose and duration. The second objective is to avoid overuse, misuse and abuse of antimicrobials. The third goal is to reduce the development of resistance.[7] [8]

Most institutions are beginning to integrate stewardship as a tiered program designed to improve the comfort and acceptance of the practitioners. Feedback from practitioners is a critical step toward developing an effective stewardship program. Given the growing complexity of infections and the lack of development of new antimicrobials, the future of successful antimicrobial treatment looks grim. Antimicrobial stewardship may provide clinicians with tools to discourage improper use of the essential resources and to control antimicrobial resistance.[9] [10]

METHODOLOGY

Study Design: This is a prospective observational study was conducted to assess antibiotic therapy and its clinical outcomes in infectious diseases over a period of six months using designed data collection form as a tool.
Sample Size: 150 patients
Place of Study: Aster prime hospital, Ameerpet
Duration of Study: The study was conducted for a period of 6 months from August 2019 to January 2020

Data Collection

1. Using a suitably designed data collection form, the following details will be collected
2. Patient demographics
3. Prescription chart
4. Laboratory data
5. Culture sensitivity test
6. Diagnosis and Therapeutic management
7. Progress chart
8. Medical record
9. Doctors note

Statistical Tool: CHI SQUARE TEST (χ^2 TEST)

Criteria

Inclusion

- Patients aged between 18-90 yrs. of either sex.
- Patients having infectious diseases.
- Patients with mixed infections.
- Patients who are willing to participate in the study.
- Surgical and non-surgical patients.

Exclusion

- Pregnant women and nursing mothers.
- Patients aged less than 18 yrs.
- Patients with disinfected conditions.

Methodology and Collection of Data

- Patients will be interviewed at bedside to determine the chief complaints, history of the present illness, past medical and medication history.
- Patient's prescriptions were reviewed.
- Interviews with patients and/or caretakers.
- Medical records of inpatients.
- Laboratory data and Culture sensitivity tests were reviewed.

Study Plan of Work

Collection of demographic data
↓
Evaluation of infectious disease patterns
↓
Antibiotics prescribed in infectious diseases
↓
Analysis of Culture/Sensitivity reports
↓
Determining sensitivity patterns of microorganisms
↓
De-escalation

RESULTS AND DISCUSSION

1. Age and Gender Distribution in Infectious Patients

In our study, we found a preponderance of Female patients (62) in the age group of 50-59 years and in Male patients in the age group 70-79 years.

Table 1: Age and Gender Distribution in Infectious Patients.

AGE	*SEX*	
	MALE	**FEMALE**
20-29	3	4
30-39	3	2
40-49	7	3
50-59	17	24
60-69	25	13
70-79	27	13
80-89	5	3
90-99	1	0
Total	**88**	**62**
TOTAL NUMBER OF PATIENTS:150		

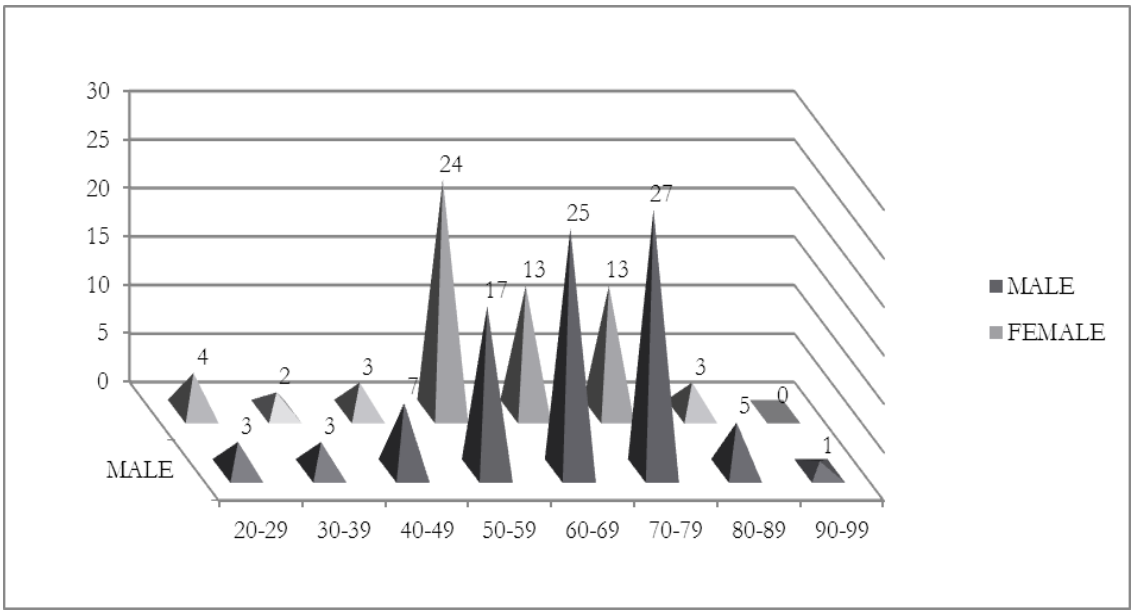

Figure 1: Age and Gender Distribution in Infectious Patients.

2. Assessment of Disease Conditions in Infectious Patients

The most common clinical conditions seen in our study were Sepsis 27(18%) followed by UTI 24(16%), Pneumonitis 15(10%), and LRTI 10(6.6%), Respiratory failure Type-2 10(6.6%), Encephalopathy 8(5.3%), Acute infective exacerbation 7(4.6%), Pressure ulcers 6(4%), Cellulitis 6(4%) and Gastroenteritis 6(4%).

Table 2: Assessment of Disease Conditions in Infectious Patients.

Disease	*Number of Patients*	*Percentage*
Pneumonitis	15	10%
Bed Sores/Pressure Ulcers	6	4%
UTI	24	16%
Acute Infective Exacerbation	7	4.6%
LRTI	10	6.6%
Encephalopathy	8	5.3%
Sepsis	27	18%
Surgeries	11	7.3%
Gastroenteritis	6	4%
Cellulitis	6	4%
Respiratory Failure (Type2)	10	6.6%
Others	20	13.3%
Total	150	100%

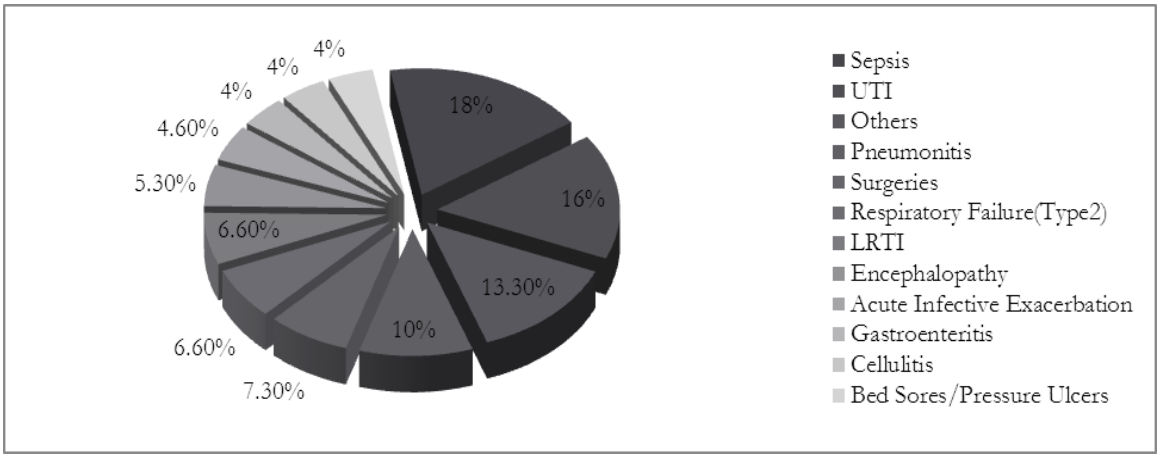

Figure 2: Assessment of Disease Conditions in Infectious Patients.

3. Commonly Prescrbed Antibiotics in Infectious Diseases

The most common Antibiotic agents prescribed in our study were Cefoperazone/Sulbactam (61) followed by Piperacillin/Tazobactam (59), Meropenem (39), Ceftriaxone (39), Levofloxacin (37), Faropenem (24), Colistin (24), Tigecycline (22) and Linezolid (20).

Table 3: Commonly Prescribed Antibiotics in Infectious Diseases.

Antibiotic Drugs	*Number of Drug*
Ceftriaxone	39
Vancomycin	9
Levofloxacin	37
Piperacillin/Tazobactam	59
Clindamycin	10
Meropenem	39
Linezolid	20
Moxifloxacin	11
Cefoperazone/Sulbactam	61
Cefuroxime	4
Ticarcillin/Clavulanic Acid	6
Faropenem	24
Nitrofurantoin	7
Tigecycline	22
Metronidazole	17
Colistin	24
Amoxicillin/Clavulanic Acid	17
Clarithromycin	16
Amikacin	8
Doxycycline	9
Azithromycin	5
Cefuroxime/Clavulanic Acid	12
Ofloxacin	6
Cefixime	3
Cefpodoxime/Clavulanic Acid	3
Cefuroxime Axetil	3
Others	29
Total Antibiotic Agents Prescribed In 150 Patients	500

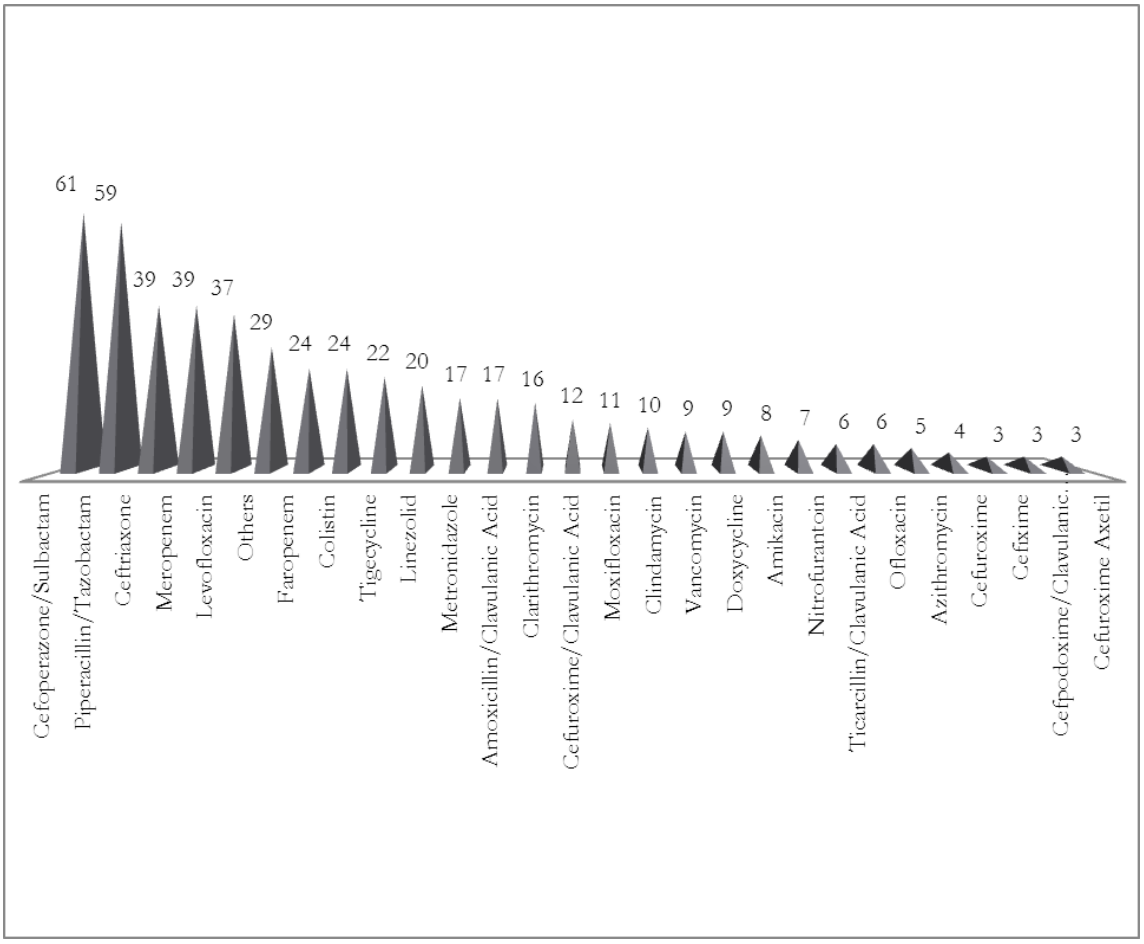

Figure 3: Commonly Prescribed Antibiotics in Infectious Diseases.

4. Monitoring Culture Sensitivity Patterns

Out of 195 bacterial culture isolates found in our study, 157 cultures were gram -ve bacteria and 38 cultures were gram +ve bacteria. The most frequent gram –ve isolate was E. coli (36), followed by Klebsiella (66), and the most frequent gram positive was Enterococcus (15), followed by streptococcus (22). In our study most of the patients had infection from gram –ve organisms such as E. coli and Klebsiella Pneumoniae.

Table 4: Monitoring Culture Sensitivity Patterns.

Specimen	*Bacteria*	*Microorganism*	*Number of Isolates*	*Percentage*
Blood	Gram +ve	Coagulase –ve Staphylococcus	9	4.61%
	Gram -ve	E. coli	5	2.56%
	Gram -ve	Klebsiella Species	6	3.07%
	Gram +ve	Staphylococcus aureus	3	1.53%
		Others	4	2.05%
Urine	Gram -ve	E. coli	24	12.30%
	Gram -ve	Klebsiella Species	20	10.25%
	Gram -ve	Pseudomonas aeruginosa	10	5.12%
		Others	8	4.10%
Sputum	Gram -ve	Klebsiella Species	20	10.25%
	Gram -ve	Enterobacter Species	5	2.56%
	Gram -ve	Pseudomonas aeruginosa	3	1.53%
	Gram -ve	Acinetobacter Species	3	1.53%
		Others	2	1.02%
Tracheal	Gram -ve	Klebsiella Species	13	6.66%
	Gram -ve	Enterobacter Species	7	3.58%
	Gram -ve	Acinetobacter Species	2	1.02%
	Gram -ve	Pseudomonas aeruginosa	3	1.53%
Pus	Gram +ve	Staphylococcus aureus	6	3.07%

	Gram -ve	E. coli	3	1.53%
	Gram -ve	Klebsiella Species	3	1.53%
		Others	4	2.05%
Swab	Gram +ve	MRSA	4	2.05%
	Gram +ve	Staphylococcus aureus	8	4.10%
	Gram -ve	Klebsiella Species	2	1.02%
	Gram -ve	E. coli	1	0.51%
	Gram -ve	Pseudomonas aeruginosa	2	1.02%
Tissue	Gram +ve	Staphylococcus aureus	3	1.53%
	Gram -ve	Proteus Species	2	1.02%
	Gram -ve	E. coli	2	1.02%
	Gram -ve	Klebsiella Species	1	0.51%
Fluid	Gram -ve	Klebsiella Species	1	0.51%
	Gram -ve	Pseudomonas aeruginosa	3	1.53%
	Gram +ve	Staphylococcus aureus	2	1.02%
Stool	Gram -ve	Shigella Species	1	0.51%
Total			195	100%

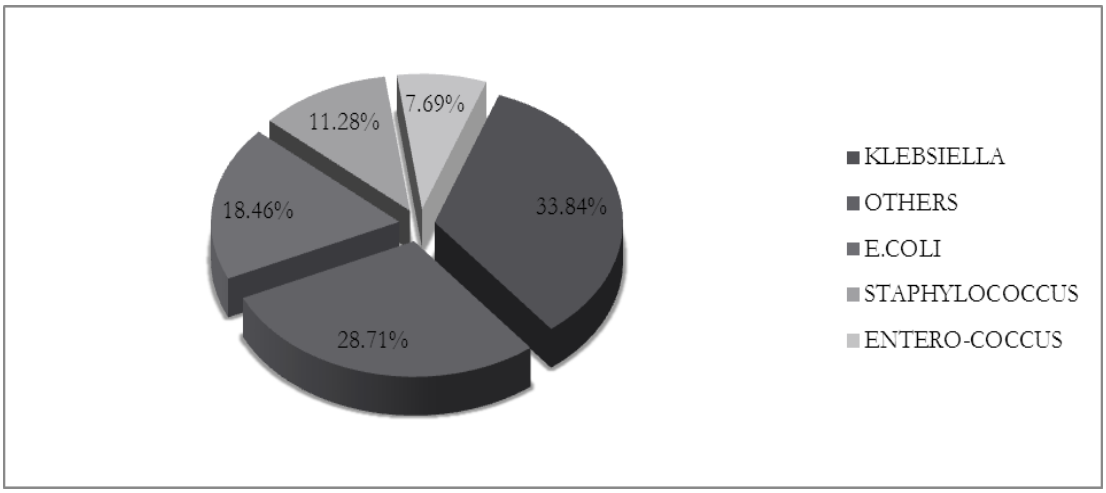

Figure 4: Monitoring Culture Sensitivity Patterns.

5. Pattern of Use of Antibiotic Agents

In our study of 150 patients, the most prescribed regimen was Mono therapy 186 (56.70%) followed by Dual therapy 100(30.48%), Triple therapy 29(8.84%) and Multiple therapy 13(3.96%).

Table 5: Pattern of Use of Antibiotic Agents.

Prescribing Patterns	*Number of Prescriptions*	*Percentage*
Mono-Therapy	186	56.70%
Dual-Therapy	100	30.48%
Triple Therapy	29	8.84%
Multiple Therapy	13	3.96%
Total	328	100%

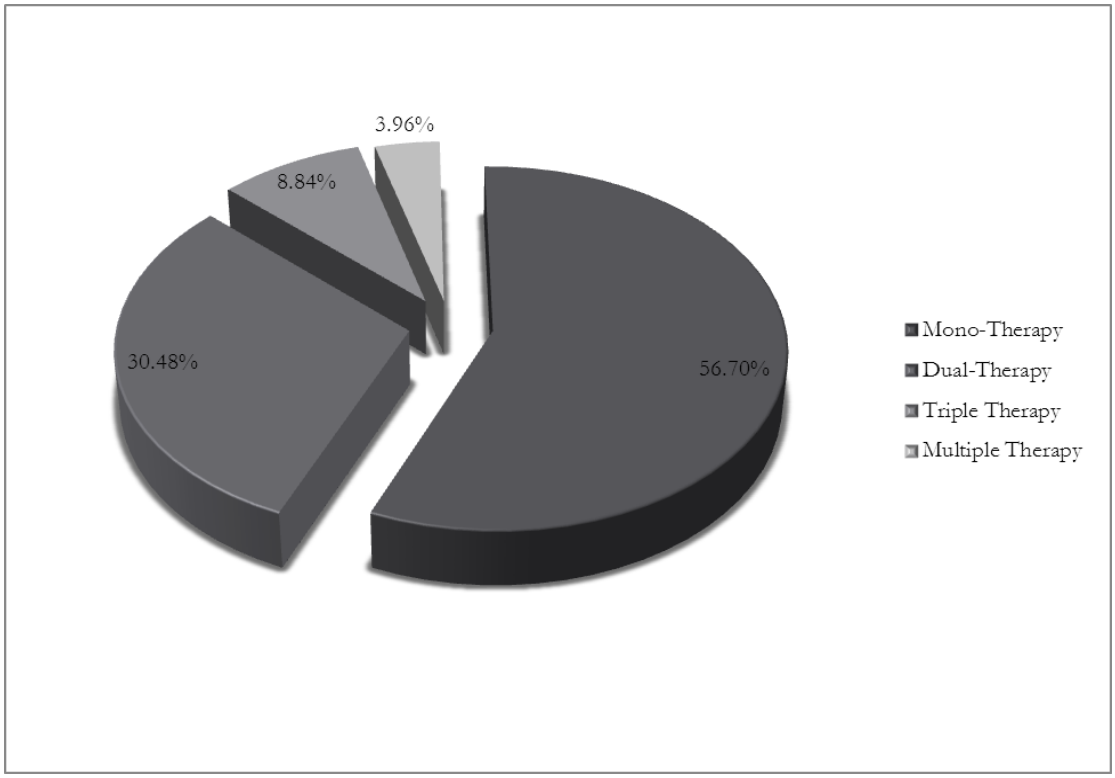

Figure 5: Pattern of Use of Antibiotic Agents.

6. De-escalation of Antibiotic Agents

Antibiotic Stewardship program was performed in our study through which 85 cases out of a total of 150 were de-escalated. Most commonly, de-escalations were observed in Sepsis 25(25%) followed by UTI 19(19%), LRTI 8(8%), Respiratory failure Type-2 7(7%) and Acute infective exacerbation 6(6%).

Table 6: De-escalation of Antibiotic Agents.

Disease	*De-escalation*	*Percentage*
Pneumonitis	4	4%
Bed Sores/Pressure Ulcers	5	5%
UTI	19	19%
Acute Infective Exacerbation	6	6%
LRTI	8	8%
Encephalopathy	2	2%
Sepsis	25	25%
Surgeries	9	9%
Gastroenteritis	2	2%
Cellulitis	3	3%
Respiratory Failure (Type2)	7	7%
Diabetic Foot	6	6%
Pulmonary Koch's	3	3%
Interstitial lung disease (ILD)	1	1%
Total	100	100%

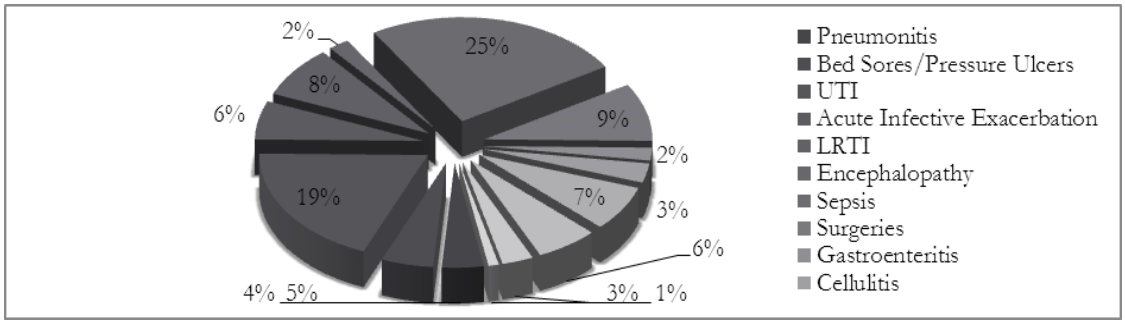

Figure 6: De-escalation of Antibiotic Agents.

7. Assessment of Rationality of Antibiotic Agents in Infectious Diseases

Out of the 150 patients included in our study, 65(43%) were prescribed antibiotics rationally while 85(57%) were irrationally prescribed.

Table 7: Assessment of Rationality of Antibiotic Agents in Infectious Disease.

Evaluation	*No. Of Patients*	*% Of Patients*
Irrational	85	57%
Rational	65	43%
Total	150	100%

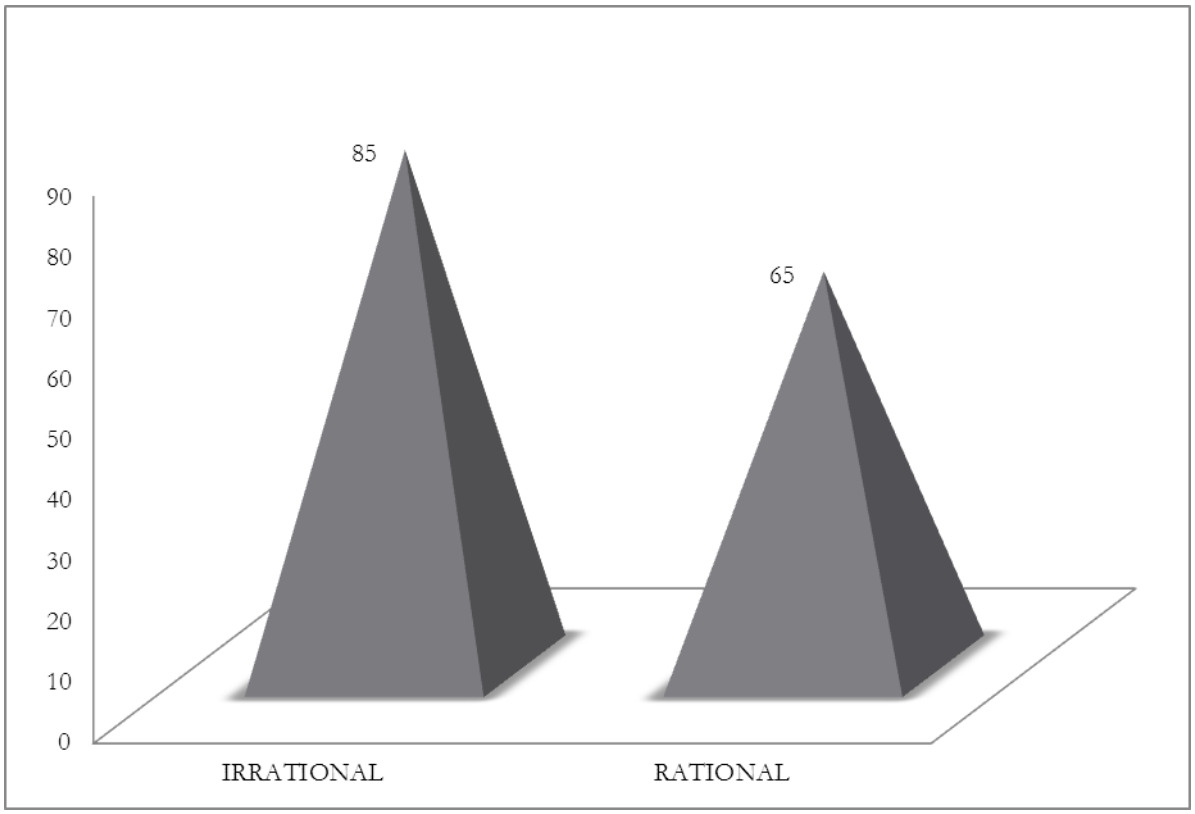

Figure 7: Assessment of Rationality of Antibiotic Agents in Infectious Disease.

CONCLUSION

Antibiotics are an essential tool of medical use in infections as well as common medical procedures, such as transplantation and chemotherapy. Over time, however, bacteria have developed resistance to antibiotics. The rising prevalence of antimicrobial resistance in both health care and community settings poses a formidable challenge as hospitalized patients become more difficult to treat. With the growing complexity of infections and a lack of new antibiotics, the future of effective antibiotic therapy looks grim. The only way to reduce the resistance of antibiotics is through proper use, reducing abuse and through intervention programs by both doctors and patients.

Antimicrobial stewardship will provide resources for all clinicians to avoid overuse of critical resources and help manage the increased resistance to antibiotics. Our research shows that antibiotics in critically ill patients tend to be frequently administered and constitute a large proportion of the total medicines consumed in the hospital. Our results show that the choices of antibiotics occasionally comply with the ICMR and NCDC guidelines for the management of infectious patients. Of the 150 patients analysed over a period of six months, it was observed that, for the antibiotics prescribed by the hospital physicians, only 43% of antibiotics were observed to be rational while 57% were irrational. It was therefore concluded that irrationality in prescribing was more prominent.

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Conflict of Interest: The author's state that there is no conflict of interest.

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