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STUDY THE ANTIBIOTIC RESISTANCE PATTERN IN A TERTIARY CARE TEACHING HOSPITAL

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Keywords:

Antibiotics, Antibiotic resistance pattern, Culture sensitivity, FDC: Fixed dose combination

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ABSTRACT: Introduction: Antibiotics suppress the growth of or kill another microorganism at very low concentrations. Therefore this is the one of the supreme invention need of this era. Most bacteria are becoming resistant to various antibiotics, make a limitation for treating minor and major infectious. Hence, determining the resistance patterns in the geographical area will help in choosing and use of the effectiveness of antibiotics. **Methods:** It is a prospective observational study carried out in 167 patients in an inpatient Department of Surgery and Medicine between October 2017- April 2018. The enrolled patient data was collected in data collection form and subjected to descriptive statistics. **Results:** Among 167 observed cases 71.8% was male, and 28.2% was female. The majority of the patient was at the age group of 61-70 years (28.1%). *E. coli* 27.5% is the most commonly found organism followed by *Klebsiella species* 16%, *E. coli* with ESBL producer 8%. Amoxiclav 44.3% was found as the most resistant antibiotic followed by Ampicillin 43.1%, Cefotaxime 37.7%, Ceftazidime 31.1%, Ciprofloxacin 31.1%, Amikacin 28.7%, Ofloxacin 25.7%, Levofloxacin 22.8%, Ceftriaxone 22.9%, Cefepime 21.6%. In surgery department the most commonly used antibiotic is Metronidazole 39.08%, followed by Amikacin 31.03%, and the medicine department the most commonly used antibiotic is Ceftriaxone 50% followed by Amoxicillin + clavulanic acid 31.25%. 41.91% recommendations suggested by the pharmacist about the usage of antibiotic was accepted by physician and patient. The antibiotic utilization cost was found higher for Meropenem (5380 ± 3043.38). **Conclusion:** This study showed that *E. coli* was found as the most commonly found organism. Amoxiclav is the most resistant antibiotic and among all the antibiotics Metronidazole is the most commonly used antibiotic in the Surgery Department and Ceftriaxone is the most commonly used antibiotic in the medicine department. For better use of antibiotics, a culture sensitivity test should be done for each patient and formulate the prescription as per the report by considering other suitable guidelines.

INTRODUCTION: Antibiotics are the substances produced by microorganisms, which suppress the growth or kill microorganisms at very low concentrations [1].

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Antibiotics are one of the greatest invention required for this era. It is the magic bullet from nature and embraced by the invention of scientists and philosophers into a tool to save lives from infective microorganisms. The antibiotic resistance is occurring due to various region like widespread use of antibacterial drugs, incorrect use of antibiotics, patient-related factors, prescriber's prescriptions habits, veterinary prescriptions, commercial promotion, over the counter sale of antibiotic, underuse of microbiological testing,

globalization and incorrect use of antibiotics such as too short a time/improper use like too low dose, at inadequate potency or wrong diagnosis. Wrong belief, about new and expensive medications, are more efficacious than older agents. Patient's misperception about the antibiotics useful in self-resolving viral infections, poor compliance, self-medication, lack of knowledge, unnecessary use of antimicrobial drugs, inappropriate dose, inadequate duration of therapy, use of irrational antimicrobial fixed-dose drug combinations (FDCs). This perception increases the unnecessary health care expenditure and encourages the selection of resistance to these newer agents as well as to older agents in their class [2]. Lack of opportunity for patient follow up, Insufficient training in infectious diseases and antibiotic treatment, the difficulty of selecting the appropriate anti-infective drugs empirically for self-reassurance are promoting the use of broad-spectrum drugs [2-10].

Due to emerging resistance to combination antibiotics, most of the developing countries are worried about the future availability of higher generation antibiotics for treating patients, especially the pediatric population, displaying resistance to a majority of existent antibiotics [8, 11, 12]. The antibiotic resistance consequences lead to prolonged illness and greater risk of death, longer periods of hospitalization and infections, which intern increases the number of infection and spreading in the community. Impact of resistance on public health and economy lead to a large pool of resistant genes and increased burden on society regarding morbidity, mortality and cost [2].

Several studies showed inappropriate antibiotic usage was 20-50% and 70% of the bacteria that cause infections in hospitals are resistant to at least one of the most commonly used antibiotic. Some organisms are resistant to all approved antibiotics and can only be treated with experimental and potentially toxic drugs. The present situation is showing that many of the second and third line agents are turning to be ineffective in clinical settings because of mutation in bacterial or host gene. The slow pace antimicrobial new molecules introduced into the market inadequately leading to increasing the thirst of antibiotics globally [2, 10]. Hence this study was carried out first time in our rural hospital. 1: To know the pattern of microbe's resistance in Surgery and Medicine Department, 2: To suggest/ formulate the proper and effective use of empirical antibiotics, 3: To find the medicine cost incurred in the disease management.

METHODOLOGY: A prospective, observational study was conducted in tertiary care 1050 bed teaching hospital (Adichunchanagiri Hospital and Research center) B. G. Nagar, throughout 6 months (October 2017-April 2108) after obtaining of institutional ethical clearance AIMS/IEC/1644/2017-18. Inclusion criteria include only in patients of Medicine and Surgery Departments; exclusion criteria include; outpatients, pregnant and lactating women, infants, neonates, and children. The consented patient's details were collected in a well-designed data collection form. The details include patient demographic details, medical history, medication history, and diagnosis/laboratory data, and microbiological/culture sensitivity report, duration of hospitalization, drug treatment chart, progress report, and clinical outcome. The patient and caretaker were provided with verbal counseling about the proper use of antibiotics and physician were advised on the rationality of antibiotic utilization. The obtained data were subjected to descriptive statistics.

RESULTS: Among 167 cases 71.8% was male, and 28.2% was female. The majority of patient was of age group 61-70 years (28.1%), followed by 41-50 years, 40(23.9%); 51-60 years, 29(17.36%); 71-80 years, 22(13.17%); 31-40 years, 16(9.58%); 21-30 years, 7(4.19%); 81-90 years, 3(1.79%); 91-100 years, 2(1.19%) and least were 10-20 years, 1(0.59%). The BMI results of the patients showed 2.39% were underweight, interestingly 77.24% were normal weight, 17.9% were overweight, 1.79% were class one obese category. The final diagnosis of the patients showed below in **Fig. 1**.

Diabetic foot (15.0%), diabetic foot with hyper-thyroidism (0.6%), pneumonia / respiratory issues (28.7%), respiratory issue + HTN (1.8%), respiratory + DM HTN (2.4%), abscess (6.6%), cholicystitis (4.2%), UTI / renal diseases (9.0%), burns (1.8%), varicose related issue (5.4%), cellulites other than DM (3.6%), appendicitis (2.4%), cancer (0.6%), cystitis (1.2%), gastritis (1.2%), hepatitis (1.2%), seizure with HTN (2.4%), sinusitis (0.6%), anemia (0.6%), CVA (4.2%),

hyperthyroidism (0.6%), cardiac diseases/IHD (4.8%), fever (1.2%). The mean stay of the patient was 7.23 ± 3.38. The majority of the patients output showed improvement. Among 167 cases the majority number of sample used was pus 62 (37.12%) followed by urine 15 (8.9%) and sputum 10 (5.9 %). Among 167 cases the majority number of sample was pus 62 (37.12%) followed by urine 15 (8.9%) and sputum 10 (5.9%) The organism most commonly found was *E. coli* 14.37%, followed by *Klebsiella species* 8.38%, *E. coli* (ESBL producer) 4.79%, non fermenting gram negative *Bacilli* 4.19%, methicillin resistant *Staphylococcus aureus* 4.19%, *Citobacter species* 2.39%, *K. oxytoca* 1.79%, *Staphylococcus aureus* 1.79%, *P. aeruginosa* 1.79%, *Pseudomonas species* 1.79%, mathicillin resistant coagulase positive 1.19%, *Enterobacter species* 1.19%, *Streptococcs species* 0.59%, methicillin resistant coagulase negative 0.59%, *Klebsiella species* (ESBL) 0.59%, coagulase negative *Staphylococcus* 0.59%, *Edwardsiella species* 0.59%, *Edwardsiella tarda* 0.59%.

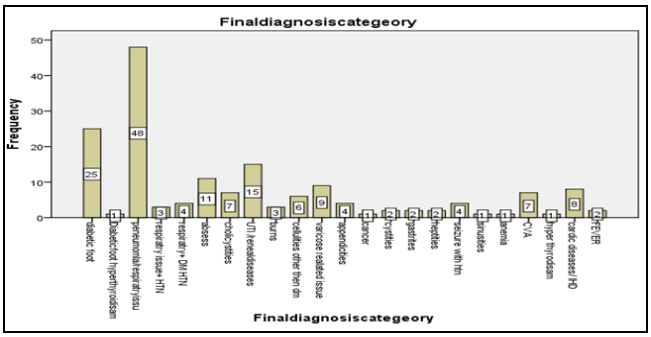

FIG. 1: DISTRIBUTION OF THE FINAL DIAGNOSIS OF THE PATIENTS

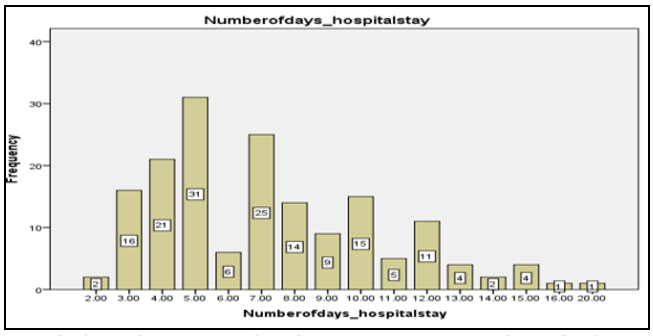

FIG. 2: DISTRIBUTION OF THE NUMBER OF DAYS PATIENTS STAYED IN THE HOSPITAL

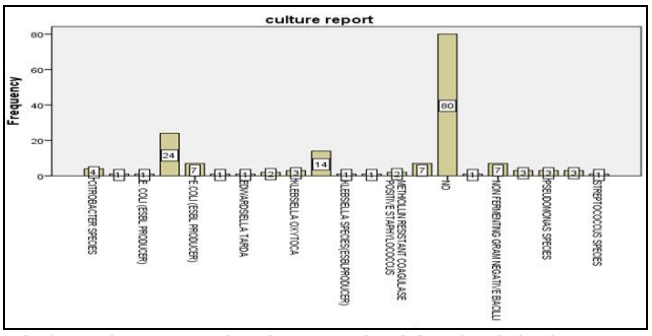

FIG. 3: DISTRIBUTION OF THE ORGANISMS OBSERVED /ISOLATED IN DIFFERENT DISEASE CONDITIONS

TABLE 1: DISTRIBUTION OF THE ORGANISM ISOLATED IN THE DIFFERENT DISEASE CONDITIONS

Final diagnosis category	Organisms isolated	Frequency	Percent
Diabetic foot	*Citrobacter species*	2	8.0
	Coagulase negative *Staphylococcus*	1	4.0
	E. coli	7	28.0
	E. coli (ESBL Producer)	3	12.0
	Edwardsiella tarda	1	4.0
	Klebsiella oxytoca	1	4.0
	Klebsiella species	2	8.0
	Klebsiella species (ESBL producer)	1	4.0
	Methicillin-resistant *Staphylococcus aureus*	2	8.0
	Methicillin-resistant *Staphylococcus aureus*	3	12.0
	Pseudomonas species	2	8.0
	Total	25	100.0
Diabetic foot hyperthyroidism	*E. coli*	1	100.0
Pneumonia/respiratory issue	*E. coli* (ESBL producer)	1	2.1
	Klebsiella species	3	6.3
	No	42	87.5
	Non fermenting gram negative *Bacilli*	1	2.1
	Pseudomonas species	1	2.1
	Total	48	100.0

Respiratory issue + HTN	No	3	100.0
Respiratory + DM HTN	No	4	100.0
Abscess	*E. coli*	2	18.2
	E. coli (ESBL producer)	1	9.1
	Enterobacter species	1	9.1
	Klebsiella species	5	45.5
	Methicillin-resistant *Staphylococcus aureus*	1	9.1
	Methicillin-resistant *Staphylococcus aureus*	1	9.1
	Total	11	100.0
Cholecystitis	*E. coli*	2	28.6
	Klebsiella oxytoca	1	14.3
	No	1	14.3
	Non fermenting gram negative *Bacilli*	2	28.6
	Streptococcus species	1	14.3
	Total	7	100.0
UTI / renal diseases	*E. coli*	8	53.3
	Klebsiella species	3	20.0
	No	3	20.0
	Pseudomonas aeroginosa	1	6.7
	Total	15	100.0
Burns	*Citrobacter species*	2	66.7
	Non fermenting gram negative *Bacilli*	1	33.3
	Total	3	100.0
Cellulitis other than DM	E. coli (ESBL)	1	16.7
	Enterobacter species	1	16.7
	No growth	1	16.7
	Pseudomonas aeroginosa	1	16.7
	Pseudomonas aeroginosa	1	16.7
	Staphylococcus aureus	1	16.7
	Total	6	100.0
Varicose related issue	*E. coli*	4	44.4
	Methicillin-resistant coagulase negative *Staphylococcus*	1	11.1
	Methicillin-resistant coagulase positive *Staphylococcus*	2	22.2
	Staphylococcus aureus	2	22.2
	Total	9	100.0
Appendicitis	*E. coli* (ESBL producer)	1	25.0
	Klebsiella species	1	25.0
	Non fermenting gram negative *Bacilli*	2	50.0
	Total	4	100.0
Cancer	Non fermenting gram negative *Bacilli*	1	100.0
Cystitis	*E. coli* (ESBL producer)	1	50.0
	No	1	50.0
	Total	2	100.0
Gastritis	*Klebsiella oxytoca*	1	50.0
	No	1	50.0
	Total	2	100.0
Hepatitis	*Edwardsiella species*	1	50.0
	No	1	50.0
	Total	2	100.0
Seizure with HTN	No	4	100.0
Sinusitis	No	1	100.0
Anemia	No	1	100.0
CVA	No	7	100.0
Hyperthyroidism	No	1	100.0
Cardiac diseases/ IHD	No	8	100.0
Fever	No	2	100.0

As shown in **Table 1**; *E. coli* (28%) is most commonly seen organism in 25(14.97%) diabetic foot patients; *E. coli* (100%) is seen in 1(100%) diabetic foot with hyperthyroidism; *Klebsiella species* (6.3%) is the most commonly seen in 48 (28.7%) pneumonia/respiratory issue; *Klebsiella species* (45.5%) is most commonly seen in 11 (6.58%) abscess; *E. coli* (28.6%) and non

fermenting gram negative *Bacilli* (28 .6%) is most commonly seen in cholycytitis; *E. coli* (53.3%) is most commly seen 15 (8.98%) UTI / renal disease; *Citrobacter species* (66.7%) is most commonly seen in (1.79%) burns; *Pseudomonas aeroginosa* (33.4%) is most commonly seen in 6 (3.59%) cellulitis other than DM; *E. coli* 44.4%) is most commonly seen in 9 (5.48%) varicose related issue; non fermenting gram negative *Bacilli* (50%) is most commonly seen in 4 (2.39%) appendicitis ; non fermenting gram negative *Bacilli* (100%) is seen in 1 (0.59%) cancer; *E. coli* ESBL producer (50%) is seen in 2 (1.21%) cystitis; *Klebsiella oxytoca* (5.5%) is seen in 2 (1.21%) gastritis; *Edwardsiella species* (50%) is seen in 2 (1.21%) hepatitis.

TABLE 2: DISTRIBUTION OF THE SENSITIVITY RESPONSE OF THE ORGANISMS FOR DIFFERENT ANTIBIOTICS

Final diagnosis category	Resistant	Intermediate	sensitive	Nil
Ampicillin	72(43.1)	Nil	2(1.2)	93(55.7)
Amoxicillin	2(1.2)	Nil	1(0.6)	164(98.2)
Penicillin	17(10.2)	nil	3(1.8)	147(88)
Piperacillin+tazobactum	24(14.4)	1	37(22.2)	105(62.9)
Cloxacillin	11(6.6)	Nil	4(2.4)	152(91)
Vancomycin	Nil	Nil	18(10.8)	149(89.2)
Carbenicillin	2(1.2)	Nil	5(3)	160(95.8)
High-level gentamycin	2(1.2)	Nil	1(0.6)	164(98.2)
Novobiocin	Nil	Nil	Nil	Nil
Meropenam	22(13.2)	3(1.8)	30(18)	112(67.1)
Azithromycin	10(6)	Nil	7(4.2)	150(89.8)
Tigecycline	6(3.6)	3(1.8)	12(7.2)	146(87.4)
Amikacin	48(28.7)	1(0.6)	27(16.2)	91(54.5)
Tobramycin	38(22.8)	Nil	29(17.4)	100(59.9)
Amoxiclav	74(44.3)	Nil	3(1.8)	90(53.9)
Imipenam	30(18)	3(1.8)	29(17.4)	105(62.9)
Cotrimaxazole	16(9.6)	1(0.6)	17(10.2)	133(79.6)
Chloramphenicol	6(3.6)	Nil	13(7.8)	148(88.6)
Linezolid	Nil	Nil	19(11.4)	148(88.6)
Colistin	3(1.8)	1(0.6)	14(18.4)	149(89.2)
Ticoplanin	8(4.8)	Nil	18(10.8)	141(84.4)
Gentamycin	32(19.2)	Nil	25(15)	110(65.9)
Erythromycin	10(6)	Nil	1(0.6)	156(93.4)
Cefotaxime	63(37.7)	Nil	11(6.6)	93(55.7)
Cefazolin	Nil	4(2.4)	Nil	163(97.6)
Ceftizoxime	Nil	4(2.4)	Nil	163(97.6)
Ceftriaxone	50(22.9)	Nil	16(19.6)	101(60.5)
Ceftazidine	52(31.1)	1(0.6)	10(6)	104(62.3)
Cefprozil	Nil	2(1.2)	Nil	165(98.8)
Cefexime	5(3)	Nil	4(2.4)	158(94.6)
Ciprofloxacin	52(31.1)	23(13.8)	3(1.8)	89(53.3)
Ofloxacin	43(25.7)	Nil	26(15.6)	98(58.7)
Levofloxacin	38(22.8)	Nil	30(18)	99(59.3)
Cefepime	36(21.6)	1(0.6)	19(11.4)	111(66.5)
Tetracycline	17(10.2)	Nil	15(9)	135(80.8)
Norfloxacin	9(5.4)	Nil	1(0.6)	157(94)
Nitrofurnatoin	4(2.4)	Nil	12(7.2)	151(90.4)
Nalidixic acid	9(5.4)	Nil	4(2.4)	154(92.2)
Clindamycin	8(4.8)	Nil	5(3)	154(92.2)

As seen in **Table 2**; Amoxyclav 44.3% is the most resistant antibiotic followed by Ampicillin 43.1%, Cefotaxime 37.7%, Ceftazidime 31.1%, Cipro-floxacin 31.1%, Amikacin 28.7%, Ofloxacin 25.7%, Levofloxacin 22.8%, Ceftriaxone 22.9%, Cefepime 21.6%. In **Table 3**, in surgery department the most commonly used antibiotic is Metronidazole (39.08%) followed by Amikacin 31.03%, Cefoperazone + sulbactum 21.83%, Ceftriaxone + sulbactum 21.83%, Cefexime 13.79%, Piperacillin + tazobactum 13.79%, Ceftriaxone + tazobactum 13.79%, Linezolid 12.6%, Amoxicillin + clavulanic acid 10.34%. And in medicine department the most commonly used antibiotic is Ceftriaxone 50% followed by Amoxycillin + clavulanic acid 31.25%, Azithromycin 10%, Piperacillin + tazobactum 10%.

TABLE 3: DISTRIBUTION OF THE CLASS OF ANTIBIOTICS UTILIZED IN THE PATIENTS

Unit code	Response	Ceftriaxone	Cefotaxime	Cefoperazone	Cefixime	Ceftazidine	Cefpodoxime
Surgery A	No	11(100)	10(90.9)	11(100)	9(81.8)	11(100)	11(100)
	Yes	0	1(9.1)	-	2(18.2)	-	-
	Total	11(100)	11(100)	11(100)	11(100)	11(100)	11(100)
Surgery B	No	21(91.3)	20(87)	23(100)	21(91.3)	23(100)	23(100)
	Yes	2(8.7)	3(13)	-	2(8.7)	-	-
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
Surgery C	No	23(100)	22(95.7)	23(100)	19	23(100)	23(100)
	Yes	-	1(43.)	-	4	-	-
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
Surgery D	No	26(89.7)	26(89.7)	27(93.1)	25	28	28
	Yes	3(10.3)	3(10.7)	2(6.9)	4	1	1
	Total	29(100)	29(100)	29(100)	29(100	29(100)	29(100)
Surgery E	No	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
	Yes	-	-	-	-	-	-
	Total	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
MED A	No	12(66.7)	18(100)	18(100)	18(100)	18(100)	18(100)
	Yes	6(33.3)	-	-	-	-	-
	Total	18(100)	18(100)	18(100)	18(100)	18(100)	18(100)
MED B	No	15(39.5)	35(9.21)	36(94.7)	38(100)	38(100)	38(100)
	Yes	23(60.5)	3(7.9)	2(5.3)	-	-	-
	Total	38(100)	38(100)	38(100)	38(100)	38(100)	38(100)
MED C	No	12(57.1)	21(100)	20(95.2)	21(100)	21(100)	21(100)
	Yes	9(42.9)	-	1(4.8)	-	-	-
	Total	21(100)	21(100)	21(100)	21(100)	21(100)	21(100)
MED D	No	1(33.3)	3(100)	3(100)	3(100)	3(100)	3(100)
	Yes	2(66.7)	-	-	-	-	-
	Total	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)

Unit code	Response	Cefazoline	Amikacin	Gentamycin	Levofloxacin	Nalidixic acid	Ciprofloxacin
	No	9(81.2)	8(72.7)	11(100)	11(100)	11(100)	10(90.9)
Surgery A	Yes	2(18.2)	3(27.3)	-	-	-	1(9.1)
	Total	11(100)	11(100)	11(100)	11(100)	11(100)	11(100)
	No	23(100)	17(73.9)	22(95.7)	22(95.7)	23(100)	22(95.7)
Surgery B	Yes	-	6(26.1)	1(4.3)	1(4.3)	-	1(4.3)
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
	No	23(100)	17(73.9)	23(100)	20(87)	23(100)	21(91.3)
Surgery C	Yes	-	6(26.1)	-	3(13)	-	2(8.7)
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
	No	28	17(58.6)	29(100)	26(89.7)	29(100)	27(93.1)
Surgery D	Yes	1	12(41.4)	-	3(10.3)	-	2(6.9)
	Total	29(100)	29(100)	29(100)	29(100)	29(100)	29(100)
	No	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
Surgery E	Yes	-	-	-	-	-	-
	Total	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
	No	18(100)	18(100)	17(94.4)	18(100)	18(100)	18(100)
MED A	Yes	-	-	1(5.6)	-	-	-
	Total	18(100)	18(100)	18(100)	18(100)	18(100)	18(100)
	No	38(100)	38(100)	38(100)	35	38(100)	38(100)
MED B	Yes	-	-	-	3	-	-
	Total	38(100)	38(100)	38(100)	38(100)	38(100)	38(100)
	No	21(100)	20(90)	20(90)	21(100)	21(100)	20(95.2)
MED C	Yes	-	1(10)	1(10)	-	-	1(4.8)
	Total	21(100)	21(100)	21(100)	21(100)	21(100)	21(100)
	No	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)
MED D	Yes	-	-	-	-	-	-
	Total	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)

Unit code	Response	Cefazoline	Amikacin	Gentamycin	Levofloxacin	Nalidixic acid	Ciprofloxacin
	No	9(81.2)	8(72.7)	11(100)	11(100)	11(100)	10(90.9)
Surgery A	Yes	2(18.2)	3(27.3)	-	-	-	1(9.1)
	Total	11(100)	11(100)	11(100)	11(100)	11(100)	11(100)
	No	23(100)	17(73.9)	22(95.7)	22(95.7)	23(100)	22(95.7)
Surgery B	Yes	-	6(26.1)	1(4.3)	1(4.3)	-	1(4.3)
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
Surgery C	No	23(100)	17(73.9)	23(100)	20(87)	23(100)	21(91.3)

	Yes	-	6(26.1)	-	3(13)	-	2(8.7)
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
	No	28	17(58.6)	29(100)	26(89.7)	29(100)	27(93.1)
Surgery D	Yes	1	12(41.4)	-	3(10.3)	-	2(6.9)
	Total	29(100)	29(100)	29(100)	29(100)	29(100)	29(100)
	No	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
Surgery E	Yes	-	-	-	-	-	-
	Total	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
	No	18(100)	18(100)	17(94.4)	18(100)	18(100)	18(100)
MED A	Yes	-	-	1(5.6)	-	-	-
	Total	18(100)	18(100)	18(100)	18(100)	18(100)	18(100)
	No	38(100)	38(100)	38(100)	35	38(100)	38(100)
MED B	Yes	-	-	-	3	-	-
	Total	38(100)	38(100)	38(100)	38(100)	38(100)	38(100)
	No	21(100)	20(90)	20(90)	21(100)	21(100)	20(95.2)
MED C	Yes	-	1(10)	1(10)	-	-	1(4.8)
	Total	21(100)	21(100)	21(100)	21(100)	21(100)	21(100)
	No	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)
MED D	Yes	-	-	-	-	-	-
	Total	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)

Unit code	Response	Metronidazole	Faropenam	Linezolid	Ceftriaxone + sulbactum	Cefipime+ tazobactum	Piperacillin+ tazobactum
	No	7(63.6)	10(90.9)	9(81.8)	10(90.9)	10(90.9)	10(90.9)
Surgery A	Yes	4(36.4)	1(9.1)	2(18.2)	1(9.1)	1(9.1)	1(9.1)
	Total	11(100)	11(100)	11(100)	11(100)	11(100)	11(100)
	No	15(65.2)	23(100)	21(91.3)	20(87)	23(100)	17(73.9)
Surgery B	Yes	8(34.8)	-	2(8.7)	3(13)	-	6(26.1)
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
	No	18(78.3)	23(100)	20(87)	14	22(95.7)	18(78.3)
Surgery C	Yes	5(21.7)	-	3(13)	9	1(4.3)	5(21.7)
	Total	23(100)	23(100)	23(100)	23(100)	23(100)	23(100)
	No	12(41.4)	29(100)	25(86.2)	23	28(96.6)	24(82.8)
Surgery D	Yes	17(58.6)	-	4(13.8)	6	1(3.4)	5(17.2)
	Total	29(100)	29(100)	29(100)	29(100)	29(100)	29(100)
	No	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
Surgery E	Yes	-	-	-	-	-	-
	Total	1(100)	1(100)	1(100)	1(100)	1(100)	1(100)
	No	18(100)	18(100)	18(100)	18(100)	18(100)	17(19.4)
MED A	Yes	-	-	-	-	-	1(5.6)
	Total	18(100)	18(100)	18(100)	18(100)	18(100)	18(100)
	No	36(94.7)	38(100)	38(100)	38(100)	38(100)	35(92.1)
MED B	Yes	2(5.3)	-	-	-	--	3(7.9)
	Total	38(100)	38(100)	38(100)	38(100)	38(100)	38(100)
	No	19(90.5)	21(100)	21(100)	21(100)	21(100)	19(90.5)
MED C	Yes	2(9.5)	-	-	-	-	2((9.5)
	Total	21(100)	21(100)	21(100)	21(100)	21(100)	21(100)
	No	2(66.7)	3(100)	3(100)	3(100)	3(100)	3(100)
MED D	Yes	1(33.3)	-	-	-	-	-
	Total	3(100)	3(100)	3(100)	3(100)	3(100)	3(100)

TABLE 4: DISTRIBUTION OF COMBINATION OF ANTIBIOTICS UTILIZED

Unit code	Response	Cefperazone+sulbactum	Ceftriaxone+tazabactum	Amoxycillin+clavulanic acid
Surgery A	No	9(81.8)	10(90.9)	10(90.9)
	Yes	2(18.2)	1(9.1)	1(9.1)
	Total	11(100)	11(100)	11(100)
Surgery B	No	20(87)	20(87)	18(78.3)
	Yes	3(13)	3(13)	5(21.7)
	Total	23(100)	23(100)	23(100)
Surgery C	No	17(73.9)	23(100)	22(95.7)
	Yes	6(26.1)	-	1(4.3)
	Total	23(100)	23(100)	23(100)
Surgery D	No	21(72.4)	21(72.4)	27(93.1)
	Yes	8(27.6)	8(27.6)	2(6.9)
	Total	29(100)	29(100)	29(100)

Surgery E	No	1(100)	1(100)	1(100)
	Yes	-	-	-
	Total	1(100)	1(100)	1(100)
MED A	No	18(100)	18(100)	7(38.9)
	Yes	-	-	11(61.1)
	Total	18(100)	18(100)	18(100
MED B	No	37(98.3)	37(98.3)	32(84.2)
	Yes	1(2.6)	1(2.6)	6(15.8)
	Total	38(100)	38(100)	38(100)
MED C	No	20(95.2)	20(95.2)	15(71.4)
	Yes	1(4.8)	1(4.8)	6(28.6)
	Total	21(100)	21(100)	21(100)
MED D	No	3(100)	3(100)	1(33.3)
	Yes	-	-	2(66.7)
	Total	3(100)	3(100)	3(100

The **Table 3** and **4**, in surgery department the most commonly used antibiotic is Metronidazole (39.08%) followed by Amikacin 31.03%, Cefo-perazone + sulbactum 21.83%, Ceftriaxone + sulbactum 21.83%, Cefexime 13.79%, Piperacillin + tazobactum 13.79%, Ceftriaxone + tazobactum 13.79%, Linezolid 12.6%, amoxicillin + clavulanic acid 10.34%. And in medicine department the most commonly used antibiotic is Ceftriaxone 50% followed by Amoxycillin + clavulanic acid 31.25%, Azithromycin 10%, Piperacillin + tazobactum 10%.

TABLE 5: DISTRIBUTION OF THE INDIVIDUAL ANTIBIOTICS COST

	Ceftriaxone total cost	Cefotaxime total cost	Cefoperazone total cost	Cefixime total cost	Ceftazidine total cost	Cefpodoxime total cost	Cefazoline total cost	Amikacin total cost
N	41	10	5	12	1	1	2	28
Mean ±SD	111.23 ± 361.44	13.71 ± 77.54	1006.80± 1446.55	197.91± 232.11	506.00	728.00	1518.00	420.21± 328.68

	Gentamycin total cost	Levofloxacin total cost	Nalidixic acid, total cost	Ciprofloxacin total cost	Nitro-function total cost	Mero-penam total cost	Norfloxacin total cost	Sulfa-methaxazole total cost	Erythromycin total cost	Azithromycin total cost
N	2	10	0	7	2	2	3	2	2	8
Mean± SD	1654.00± 642.05	29.60±24.81	-----	279.14± 179.16	108.00± 25.45	5380.00± 3043.38	73.33± 56.43	7.92±5.54	10.15±0	103.37± 38.10

	Metor-nidazole total cost	Albena-dazole total cost	Faro-penam total cost	Lina-zolid toal cost	Ceftriaxone sulbactum total cost	Cefipime tazobactum total cost	Piperacilin tazobactum total cost	Cefo-perazone sulbactum total cost	Ceftria-xone tazobactum total cost	Amoxy-cilin Clavalunic acid total cost
N	41	3	1	11	19	3	22	21	5	34
Mean +SD	244.35± 153.10	14.33± 7.02	660.00	424.36±165.46	2250.00± 1420.96	3883.66±3231.64	3206.95±2202.12	1861.04± 1477.16	1095.40±540.58	1443.56±766.74

TABLE 6: DISTRIBUTION OF THE TOTAL COST OF THE DRUGS UTILIZATION IN DIFFERENT DISEASE MANAGEMENT

S. no.	The total cost of the drugs	Number of cases	Mean ± SD
1	Diabetic foot	25	5081.33±2839.8
2	Diabetic foot hyperthyroidism	1	4591.00
3	Pneumonia/respiratory issue	48	2605.67±1933.589
4	Respiratory issue+ HTN	3	1860.00±225.894
5	Respiratory+ DM HTN	4	3234.75±845.950
6	Abscess	11	5244.60±3387.637
7	Cholecystitis	7	7133.66±4257.84
8	UTI/Renal diseases	15	2837.70±2111.18
9	Burns	3	2136.33±608.21
10	Cellulitis other than DM	6	4083. ±1609.62
11	Varicose related issues	9	3156.44±1626.68
12	Appendicitis	4	2302.54±739.00

13	Cancer	1	5048
14	cystitis	2	3236.8±2668.33
15	Gastritis	2	5599.85±7434
16	Hepatitis	2	1207.54±112.37
17	Seizure with HTN	4	1360.50±798.3
18	Sinusitis	1	2720
19	Anemia	1	4864
20	CVA	7	1278±1153
21	Hyperthyroidism	1	1085
22	Cardiac disease /IHD		1175.13±724.37
23	Fever	2	645±714.88

The antibiotic utilization cost was found high for Meropenem (Rs; 380 ± 3043.38), and the least was with Sulphamethoxazole (Rs; 7.92 ± 5.54). Among all the diseases cholecystitis medicine cost management was maximum (7133.66 ± 4257.84). Out of 74 cases in which recommendations were made, 70 recommendations were accepted.

DISCUSSION: This study showed that most commonly found organism was *E. coli* followed by *Klebsiella species*, MRSA and *Citrobacter species*. There are more than 20 antibiotics used in the hospital care units among which, the most commonly used antibiotics in surgery department are Metronidazole, Amikacin, Ceftriaxone+sulbactum, Cefoperazone + sulbactum, and Linezolid. Whereas, in the Medicine Department Ceftriaxone and Amoxiclav are the most commonly used antibiotics. Among 167 samples the most resistant antibiotic is Amoxiclav (44.3%) followed by Ampicillin (43.1%), Cefotaxime (37.7%), Ciprofloxacin (31.1%), Amikacin (28.7%) and Ofloxacin (25.7%). As the clinical pharmacists made the recommendations are considered by the physician and the patient to get a better outcome. Hence, a daily process of medication reconciliation helps in better patient care by forming a squad of physician, pharmacist, and patient altogether.

The most sensitive antibiotic are Ceftriaxone, Colistin, Tobramycin, Imipenem. The matter of fact to be noted is that before prescribing the antibiotics culture, sensitivity test must be done to minimize the resistance and for the effective result by giving a suitable (sensitive) antibiotic for certain organisms. Hence, it reduces the burden of a physician, to guess the appropriate antibiotics for following diseases and patients. In this study the maximum number of patients was of age group 61-70 (47) followed by 41-50 (40), 51-60(29), 71-80 (22), 31-40 (16), 21-30 (7), 81-90 (3), 91-100 (2) and 10-20 (1) which signifies the maximum number of patient get admitted age after 60, this is quite similar with the study conducted by Ruiz LA *et al*., in which 71% patient which are of the older age group are more susceptible to hospitalized; whereas, in our study 44.3% of older patients were more susceptible to diseases [19].

In this study, male patients were more (120) when compared with female patients (47). This study is compared with the study conducted on UTI by Ramanath *et al*., Pondei K, Orutugu L, Pondei J in which the number of female patients were more in contrast to this study, whereas this study is done on collective diseases such as diabetic foot, UTI, pneumonia, respiratory issues, abscess, cellulitis, appendicitis, as further [18, 13].

In our study *E. coli* 53.3% was the predominant bacteria followed by *Klebsiella species* 20% I UTI, whereas in the study conducted by Majumder MI, Ahmed T, Sakib N, Khan AR, and Saha CK, and Ramanath *et al*., studies showed in which most commonly isolated organism in UTI was *E. coli* 86% followed by *Klebsiella species* and *Enterococcus*. Both the study signifies the same result as the *E. coli* was the most commonly found organism in UTI case [15, 18].

In this study of antibiotic resistance pattern, *Klebsiella species* was found to be predominant in respiratory diseases which are compared with the study conducted by Sikka R, Hooda S, Singla P, Shamlal, Deep A, Chaudhary U, where *P aeruginosa* was found to be the most frequently isolated organism [14]. According to our observational study, 53.3% was *E. coli* in UTI cases whereas, in the study conducted by Pondei K, Pondei J, Orutugu L, current microbial culture sensitivity pattern of urinary tract infection in a private hospital setting, *Staphylococcus aureus*

38.9 % was the most common isolates followed by *E. coli* 36.1%. Therefore the study in comparison to our is in contrast with each other [13]. Among all the other antibiotics used Cephalosporin was the most commonly prescribed antibiotics in the hospital settings; whereas Gerardo A did the study, Seeba Z, Dixon T, the most commonly prescribed antibiotics were Aminopenicillin and third generation cephalosporin for in patients [16].

In our study among 167 patients, 120 were male, and 47 were female, which clearly defines the male is more than female. Which is compared to the study on antibiotic utilization pattern done by Soleimani M, Karamian S, out of 180 patients 100 were male, and 70 were female which is as approx as the above. Hence, both the study have a similar matter of fact to represent male as the most susceptible to hospitalization than female [17]. Among study, a total of 167 cases the sample considered was pus, urine, blood, and sputum. Among which the majority of sample collected was pus 62 (37.12%) followed by urine 15 (8.9%) and sputum 10 (5.9 %).

In compared with the study conducted by Behara B, Mathur P, on antimicrobial resistance at a tertiary trauma care center of India, AIIMS hospital New Delhi in which urine sample 27 % is the predominant one followed by pus 25%, exudates 21% and blood 17% [20].

In our study Ceftriaxone was found to be most commonly prescribed antibiotic in the tertiary teaching hospital followed by Metronidazole; whereas in the study done by Ramanath *et al*., Anand S *et al*., studies also showed Ceftriaxone was most commonly prescribed antimicrobial followed by Piperacillin/tazobactam. In both, the study Ceftriaxone was found to be the most commonly prescribed antibiotic [18, 21].

CONCLUSION: The study suggests that the rational use of antibiotics should be given great importance for better healthcare outcome. This study also gives information about the common resistant organism in different diseases. Antibiotic culture sensitivity test helps in determining the resistance and sensitivity pattern, which further helps in providing effective treatment. The clinical pharmacist presence in the medical team will also help in the proper selection of antibiotics.

Limitation: 1: This study was conducted for a short period, *i.e.* 6 months; even this study can be extended. 2: The culture sensitivity test is not recommended for every necessitates patient. 3: The exact antibiotic costs cannot be estimated due to a lack of collaboration from the physicians and nursing staffs.

Future Directions:

- ✓ This study may help to control antimicrobial resistance and develop a targeted approach to overcome resistance.
- ✓ Culturing and susceptibility testing helps in determining the resistance and sensitivity pattern, which further helps in providing effective treatment.
- ✓ This type of study can be conducted for a longer period for getting a clear understanding of the resistance pattern of antibiotics in a certain geographical area.
- ✓ Creating awareness among healthcare professionals to avoid irrational prescribing of antibiotics
- ✓ To decrease the unnecessary healthcare expenditure by encouraging the appropriate selection of antibiotics.

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