

Research Article



Study of Antibiotic Utilization and Resistance Pattern in Surgery Department in A Rural Tertiary Care Teaching Hospital

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ABSTRACT

Nowadays antibiotics are commonly prescribed drugs for surgical patients. Indiscriminate and inappropriate use of antibiotics results in emergence of antibiotics resistance and treatment failure. This study was carried out in 235 patients from October 2019 - March 2020 in the surgery department of Adichunchanagiri Hospital & Research Centre (AHRC), a tertiary care teaching hospital, BG Nagar, Karnataka. Among the 235 study population majority of the subjects were under the age group of 50-69 years – 79 (33.6%) patients, and the majority of the patients were males 157 (77%). Out of 235 patients, 29 (12.3%) patients diagnosed with hernia, followed by appendicitis 27 (11.5%). Total 555 antibiotics were prescribed in 235 patients, average antibiotic count prescribed for each patient was 3 and the average duration of antibiotic therapy was found to be 6.2 days. Maximum prescribed antibiotics was Cefoperazone+Sulbactam (18.4%) through IV route, followed by Cefixime (18.4%) through the oral route. Metronidazole (17.8%) was found to be the most frequently used antibiotics, and the least prescribed antibiotics were Cephalexin, Amoxicillin and Imipenem 1 (0.2%) each. Ofloxacin 77.8% was the most resistant antibiotic followed by Levofloxacin 75%, Cefotaxime 61.1%, Colistin was the least resistant antibiotic. Use of higher antibiotics and branded drugs were common. Performing resistance and culture sensitivity test in far more patients undergoing surgery can prevent the non-judicious use of antibiotics and the emergence of antimicrobial resistance. Urgent steps are also needed to be taken to correct some irrational approaches such as specific guidelines, training and monitoring of drug use which can also ensure individualization of dosage regimen of antibiotics and the minimization of drug-drug interactions.

Keywords: Antibiotics, Utilization pattern, Surgery department, Resistance.

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- To promote the rational use of antibiotics
- To provide feedback to prescribers.³

Drug requirements of patients undergoing surgery vary from one patient to the other. The accessibility, choice and appropriate use of parenteral antibiotics are of high priority. Appropriate surgical antibiotic prophylaxis which could be a brief course of antibiotics initiated closely before operative procedures, can reduce and minimize incidence of the postoperative wound and surgical site infection. Inappropriate use increases the selective pressure and favours the development of antimicrobial resistance.⁴ Judicious use of antibiotics will reduce the total costs associated with healthcare delivery, the incidence of possible adverse effects in patients and the proliferation of antibiotic-resistant pathogenic organisms.⁵

Antimicrobial resistance is a growing public health concern, particularly in the developing countries where the microorganism is able to survive exposure to antibiotic treatment causing more harm to the host even in the presence of an antibiotic.⁶

Various factors that cause emergence of antimicrobial resistance in the environment are irrational prescribing of anti-microbial agents, OTC dispensing, self-medication and unjustified use for human, animal, and industrial consumption.⁷ The spread of antimicrobial resistance is

INTRODUCTION

Since the availability of antibiotics in 1940s, its role has been expanded from treatment of severe infections to preventing nosocomial infections and used as prophylactic therapy in surgery patients and also in protecting immuno-compromised patients. Administration of rational antibacterial therapy is essential to avoid infection-related mortality and also morbidity.¹

In India the prevalence of use of antimicrobial agents ranges from 24 to 67% and accounts for 20-50% of total drug expenditure. Surgical patients are generally high consumers of antibiotics.²

Drug utilization studies must be evaluated periodically,

- To maximize the treatment efficacy
- To avoid the adverse effects
- To minimize the antibiotic resistance



influenced by various ecological, environmental, epidemiological, cultural, social and economic factors.⁸

Due to evolving in resistance to combination therapy of antibiotics, many of the developing countries are concerned about the future accessibility of higher generation antibiotic therapies. The antibiotic resistance consequences lead to prolonged illness and greater risk of death, longer periods of hospitalization and infections, which in turn 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.⁹

Several studies showed inappropriate antibiotic usage as 20-50% and 70% of the bacteria that cause infections in hospitals are resistant to at least one of the most commonly used antibiotics. 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 mutations in bacterial or host gene.⁹

The further progress of antibacterial resistance can be avoided through effective interventions like reducing the requirement of antibiotics, removing non-therapeutic antibiotic use, updating educational approaches and scrutiny of antibacterial resistance.¹⁰ Antibiotic stewardship programs often implement antibiotic policies that help in preventing unnecessary use of antibiotics and in optimizing management. To develop such a policy for management of infections in the surgery department, it is important to analyse the information regarding antibiotic utilization patterns in surgery patients and in various healthcare settings. The present study was undertaken to observe and analyse antimicrobial utilization pattern in patients undergoing surgery in tertiary care hospitals and compare them with International and National guidelines, which might establish benefit to a wide range of population.

MATERIALS AND METHODS

A Prospective, Observational Study was conducted at Adichunchanagiri Hospital and Research Centre (AH&RC), B.G Nagara by assessing patient's records and prescription from the surgery department.

All patients who were admitted to the surgery department and willing to participate were included in the study after getting their written informed consent. The study approved by Institutional Ethical Committee, AH&RC, B G Nagara (AHRC No: AIMS/IEC/195/2019-20).

Source of data:

Patient information which was required to the study was collected from,

- Patient case notes.
- Medication/Treatment chart.

- Laboratory data reports and other relevant sources.
- Patient interview
- Nurse's report

A well-designed data collection form was used to record all the necessary data like patient demographic details, patient medication history, and reason for admission, any allergic reaction, medication details, lab investigations was collected from the documents.

The study data was analysed by using descriptive statistics like mean, frequency, percentage etc. through Microsoft excel.

RESULTS

Among the 235-study population, 157 (77%) were male and majority of the subjects were under the age group of 50-69 years 79 (33.6%) patients (table 1). The average duration of hospital stay was 12.1 days.

Table 1: Distribution based on gender and age

Age in years	Male	Female	Total	Percentage
< 10	7(3.0%)	1(0.4%)	8	3.4%
10-29	31(13.19%)	17(7.2%)	48	20.4%
30-49	45(19.14%)	29(12.3%)	74	31.5%
50-69	57(24.25%)	23(9.8%)	79	33.6%
70-89	18(7.7%)	8(3.4%)	26	11.1%
Total	157	78	235	100.0%

In 235 patients, 29 (12.3%) patients diagnosed with hernia, 27 (11.5%) appendicitis, 19 (8.1%) cellulitis, 15 (6.4%) patients with cholelithiasis, diabetic foot and ulcer each (figure 1).

Distribution of antibiotics per prescription as shown in table 2. majority of the patients were prescribed with 2 antibiotics, as increased in length of hospital stay increases the number of antibiotics from 4 to 7. Minor surgeries and minimum hospital stay required least number of antibiotic.

Table 2: Distribution of Antibiotics per prescription

Number of antibiotics	Frequency	Percentage
1	57	24.4%
2	83	35.5%
3	60	25.6%
4	25	10.7%
5	6	2.6%
6	2	0.9%
7	1	0.4%

Out of 555 antibiotics, 66% of antibiotics were Beta-lactam antibiotics, 20% were DNA gyrase inhibitors, 8% were Protein synthesis inhibitors, 5% were DNA topoisomerases



and 1% Urinary antiseptics. Maximum prescribed antibiotics are Cefoperazone+Sulbactam 102 (18.4%) through IV route, followed by Cefixime 102 (18.4%) through oral route, Metronidazole 99 (17.8%), Ceftriaxone

48(8.6%), Cefoperazone+Tazobactam 25 (4.5%), Amikacin 19 (3.4%) and the least prescribed antibiotics were Cephalexin 1 (0.2%), Amoxicillin 1 (0.2%) and Imipenem 1 (0.2%) (table-3).

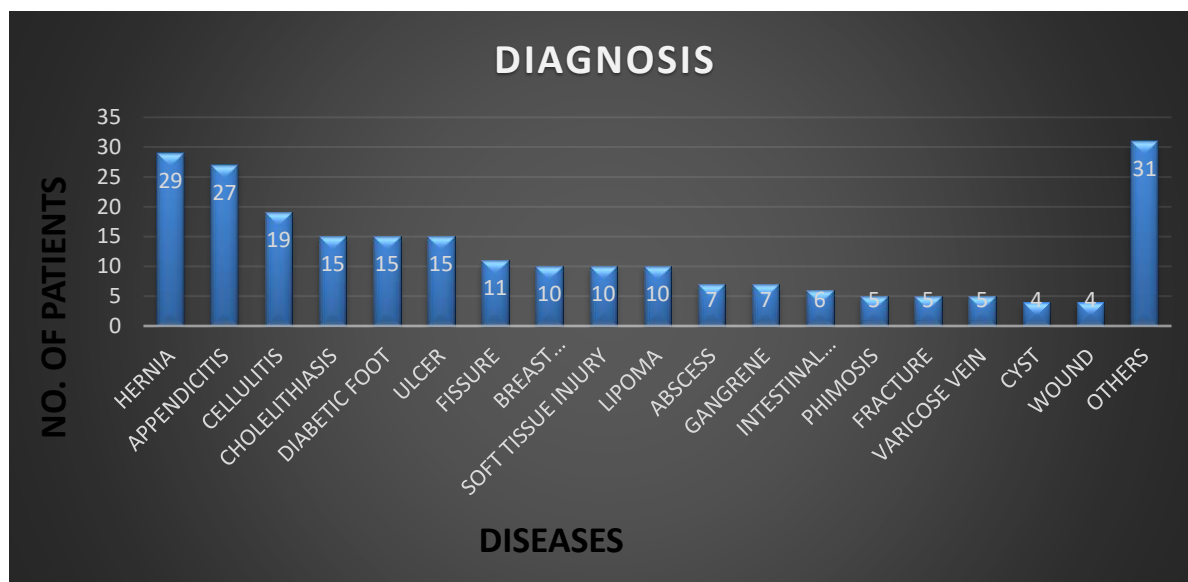


Figure 1: Distribution of Diagnosis

Table 3: Class wise distribution of Antibiotics

Class of antibiotics	Antibiotics	Number of drugs	Percentage (%)
Beta- lactam	Cephalosporin	327	58.91%
	Penicillin	33	5.94%
	Carbapenems	6	1.08%
DNA gyrase inhibitors	Nitroimidazoles	112	20.18%
Protein synthesis inhibitors	Aminoglycoside	22	3.96%
	Macrolide	7	1.26%
	Tetracycline	3	0.54%
	Others	14	2.52%
DNA topoisomerases	Fluroquinolone	27	4.86%
Urinary antiseptics		4	0.72%
Total		555	100%

Table 4: Antibiotics used for particular diagnosis

Disease	Cephalosporins			BLBLI				NIM	OXA	Others	Total
	CI	CT	CU	C+S	C+T	P+T	A+C	MET	LIN		
Hernia	21	4	1	3	1	0	1	5	0	11	47
Appendicitis	13	12	3	13	0	1	0	24	0	9	75
Cellulitis	8	6	1	7	3	2	4	11	4	7	53
Cholelithiasis	7	2	4	10	0	0	2	8	0	2	35
Diabetic Foot	6	1	1	8	0	7	3	7	6	12	51
Ulcer	9	1	0	4	4	2	0	5	0	6	31

*CI: Cefixime CT: Ceftriaxone, CU: Cefuroxime, BLBLI: Beta Lactam Beta Lactamase Inhibitor C+S:Cefoperazone+Sulbactam, C+T:Cefoperazone+Tazobactam P+T:Piperacillin+Tazobactam, A+C: Amoxicillin+Clavulanic Acid, NIM: Nitroimidazoles, MET: Metronidazole, OXA: Oxazolidinones LIN: Linezolid



Cefixime was used frequently in hernia, metronidazole was used more in Appendicitis and cellulitis, cefoperazone sulbactam combination was used more in cholelithiasis and cefixime was most used in ulcer patients (table 4).

Antibiotic resistance pattern and sensitivity test

Only 36 culture sensitivity tests were done out of 235 patients. Among 36 cases the majority number of samples used was wound swab 24 (66.7%) followed by pus 6 (16.7%), peritoneal fluid 3 (8.3%), urine 2 (5.6%) and blood 1 (2.8%).

The most commonly found organisms were *E. coli* 19.4%, followed by *Methicillin Resistance Coagulase Negative Staphylococcus* 16.7%, *Enterococcus species* 13.9%, *Klebsiella species* 11.1%, *Staphylococcus aureus* 11.1%, *Pseudomonas aeruginosa* 5.6%, *Coagulase negative Staphylococcus aureus* 5.6%.

Ofloxacin is the most resistant antibiotic found resistant in 28 patients followed by levofloxacin (27)75%, Cefotaxime (22)61.1%, Ampicillin (20)55.6%, Ceftriaxone (18)50%, Amikacin (16)44.4%, Gentamicin (15)41.7%, Piperacillin+Tazobactam and Ceftazidime (14)38.9%, Cefipime (13)36.1%, Penicillin (12)33.3% Imipenem (11)30.6% Colistin was not found resistant in our study. Gentamycin (20)55.6% is found to be the highest sensitive antibiotic, followed by Vancomycin (19)52.8%, Tetracycline (16)44.4%, Linezolid (15)41.7%.

DISCUSSION

This study provides data on the utilization pattern of antibiotics, resistance pattern and culture sensitivity test in the surgery department. A total of 235 patients who had been admitted as inpatients in the surgery department and prescribed with antibiotics were included in this study after obtaining the written consent from the patient or their guardian in case of paediatric patients.

In our study, most of the patients were male 77% and females were 33%. The findings of mean age of our study were similar to the study conducted by Asawari Raut et al. where they reported 32.5% were females and 67.5% were male¹⁰. In contrast to our result Mohd Rasheeduddin et al. reported 44% were males and 66% were females.¹¹ and most of the patients were from the age group of 50-69 years-79 (33.6%) and least was from the age group of <10 years-8 (3.4%). Found same results in the studies conducted by Jahnavi simhadri et al. reported that the majority patients were belongs to (33.5%) 41-60 years of age while the lowest number in the range of 18-40 years (16.65%).¹²

The average duration of hospital stay was 12.1 days. Whereas study conducted by Ambili Remesh et al. was 5.48 days.¹³ In our study, hernia appendicitis cellulitis cholelithiasis, diabetic foot and ulcer were the most common causes for admission in surgery department (figure-1). The findings were similar to the study conducted by Asawari Raut et al.¹⁰

The average number of drugs prescribed per patient in AHRC was found to be 8.5 and average antibiotics prescribed was found to be 3 and average duration of antibiotic therapy was found to be 6.2 days, whereas study conducted by Ambili Remesh et al. average number of drugs per patients was 4.1 and antibiotics per prescription was 1.5.¹³

In this study a total of 555 antibacterial agents were prescribed in 235 patients, most commonly prescribed antibiotics was third generation Cephalosporins (Cefixime (18.4%), Cefaperozone+Sulbactam (18.4%) because of their good safety profile and its wide spectrum activity. Most frequently prescribed antibiotics were Metronidazole (17.8%) as it covers most of the anaerobic.

Antimicrobial resistance

Out of 235 in-patients only 36 culture sensitivity tests were done, among 36 cases the majority number of samples used was wound swab. Ofloxacin is the most resistant antibiotic followed by levofloxacin. But in the study conducted by KV Ramnath et al., shows that Amoxiclav was found as the most resistant antibiotic followed by Ampicillin.⁹

Based on their resistance levels and clinical significance, Gajdacs M et al., stated that *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter* spp. *Pseudomonas aeruginosa*, *Enterobacter* species are the most resistive pathogens and termed them as "ESKAPE" pathogens.¹⁴ In a study conducted by Shimekaw M et al., they found Among 162 isolates, 59.3% (96/162) were gram-negative bacteria and 40.7% (66/162), were gram-positive bacteria. *S aureus* was the predominant isolates, 32.1% (52/162), followed by *Pseudomonas aeruginosa*, 15.4% (25/162), and *E coli* with 11.7% (19/162). High level of resistance was identified against penicillin G and ampicillin and tetracycline.¹⁵ In Hemmati H et al., studies antibiotic susceptibility results showed that *Acinetobacter* isolates were almost resistant to all of the tested antibiotics, except gentamicin, co-trimoxazole, and meropenem. *Enterobacteriaceae* isolates as the predominant etiology of SSIs showed the lowest resistance against amikacin, co-trimoxazole, and imipenem.¹⁶

CONCLUSIONS

From the results, it can be concluded that the use of the higher class of antibiotics and branded drugs were common, prescribing by generic names must be encouraged. Prescription audit among surgical patients should be done by clinical pharmacist. In surgical practice antibiotics are used for prophylaxis and treatment, whereas a rational approach to manage the infected patient (choosing appropriate antimicrobial agents, giving them by the optimal route and for the correct duration) is essential. Avoid inappropriate use of antibiotics as it will increase the chance for antibiotic resistance and also increase the cost burden to the patient and which can cause substantial morbidity, mortality and increases expenses for treatment resulting in extended hospitalization and increased health care burden so hospital antibiotic guidelines or national



antibiotic guidelines should be followed for rational use of antibiotics. Drug utilization studies should be carried out periodically to assess the prescription pattern and to improve the therapeutic efficacy and to minimize the drug related problems and it also helps to frame hospital protocols.

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