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Evaluation and Guideline Preparation of Antimicrobial Prophylaxis in General Surgery Departments of A Tertiary Care Referral Hospital

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A B S T R A C T

Antibiotic prophylaxis, a very brief course of antibiotics initiated just before the start of surgical procedures in clean, clean-contaminated and dirty procedures, is recommended to reduce postoperative infection. This study aimed to explore the evaluation of antibiotic usage in surgical prophylaxis to the hospital antibiotic policy and the incidences of Surgical Site Infection (SSI). Data was collected such as the timing of antibiotic dose, the antibiotic choice used, duration and type of surgery, etc. A total 100 patients who underwent elective surgical procedures fulfilled the criteria to be included in the study. The maximum percentage of cases (16%) were excision. In majority of the cases cefazolin (34%) and cefoperazone sulbactum combination (33%) was used as prophylaxis before surgery. Number of post-operative antibiotic prophylaxis mean =6.40 ± 4.568 dose. Gram-negative organisms isolated more like *E. coli* and *Staphylococcus. E. coli* are more seen in surgical pus than swab. 24 patients developed SSI. The duration of antibiotic prophylaxis not followed as per hospital antibiotic policy about 16%, dosing was about 36% and selection was 37%. Number of post-operative antibiotic prophylaxis consumption by DDD for 100 bed days =0.5908± 0.77228 dose. (Range 0-2.08 dose. *Staphylococcus aureus* was the most common pathogen found (29.44%). The rate of compliance with surgical antibiotic prophylaxis guidelines was still very poor. Building local hospital guidelines for surgical antibiotic prophylaxis, by adopting national or international guidelines needs to be done to overcome the problem of non-compliance to guidelines for antibiotic prophylaxis

1. Introduction

Antibiotics are medications used to treat bacterial infections [1]. Antibiotic prophylaxis, a very brief course of antibiotics initiated just before the start of surgical procedures in clean, clean- contaminated and dirty procedures, is recommended to reduce postoperative infection. Prophylaxis refers to the prevention of an infection and can be characterized as primary prophylaxis, secondary prophylaxis or eradication. Primary prophylaxis refers to the prevention of initial infection. Secondary prophylaxis refers to the prevention of recurrence or reactivation of preexisting infection. Eradication refers to the elimination of a colonized organism to prevent the development of an infection [2].

Establishing a "prophylaxis indicated" status for a given procedure requires consideration of the likelihood of infection without antibiotics and the morbidity and cost of an infectious complication. The discussion of these issues is facilitated by a taxonomy that classifies a procedure according to the level of microbial contamination routinely associated with that procedure and the likelihood of infection. Criteria are based on clinical information defined by the National Academy of Sciences, National Research Council (NRC), Division of Medicine, Ad Hoc Committee on Trauma [3]. The incidence of infection ranges widely across classes-less than 2 percent for clean procedures (e.g., Breast biopsy) to over 40 percent for dirty procedures (colon perforation with diffuse fecal contamination). It is generally agreed that antibiotic prophylaxis is warranted in all procedures in the categories of clean-contaminated, contaminated or dirty. The antibiotics selected for prophylaxis must cover the expected pathogens for that surgical site. The choice of antibiotic should take into account the local resistance pattern. Narrow spectrum, less expensive antibiotic should be the first choice of prophylaxis during surgery [3].

Strategies for antimicrobial prophylaxis should be determined based on the type of possible post- operative infections and classifications of operations according to contamination levels in individual operative fields. This process may involve the precise selection of prophylactic agents for suspected contaminating bacterial species in each operative organ and their administration regimens suitable for the individual surgery [4] Prophylactic antibiotics for surgical procedure should

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be administered intravenously [5]. The period of risk for surgical site infection begins with the incision. The time taken for antibiotics to reach an effective concentration in any particular tissue reflects its pharmacokinetic profile and the route of administration. Administration of prophylactic more than three hours after the start of the operation significantly reduces its effectiveness. For maximum effect; it should be given just before or just after the start of the operation. The single dose of antibiotic for prophylactic use is, in most circumstances, the same as would be used therapeutically. The value of surgical antibiotic prophylaxis in terms of the incidence of SSI after elective surgery is related to the severity of the consequences of SSI. However, for most operations prophylaxis only decreases short term morbidity. Surgical wound infection increases the length of hospital stay. Prophylaxis therefore has the potential to shorten hospital stay.

Infections that occur in the wound created by an invasive surgical procedure are generally referred to as Surgical Site Infections (SSI). SSIs are one of the most important causes of Health Care Associated Infections (HCAIs). Currently, in the United States alone, an estimated 27 million surgical procedures are performed each year. The CDC's National Nosocomial Infections Surveillance (NNIS) system, established in 1970, monitors reported trends in nosocomial infections in U.S. acute-care hospitals. Based on NNIS system reports, SSIs are the third most frequently reported nosocomial infection, accounting for 14% to 16% of all nosocomial infections among hospitalized patients. Advances in infection control practices include improved operating room ventilation, sterilization methods, barriers, surgical technique, and availability of antimicrobial prophylaxis. Despite these activities, SSIs remain a substantial cause of morbidity and mortality among hospitalized patients. This may be partially explained by the emergence of antimicrobial-resistant pathogens and the increased numbers of surgical patients who are elderly and/or have a wide variety of chronic, debilitating, or immune compromising underlying diseases. There also are increased numbers of prosthetic implant and organ transplant operations performed. Thus, to reduce the risk of SSI, a systematic but realistic approach must be applied with the awareness that this risk is influenced by characteristics of the patient, operation, personnel, and hospital [9].

Anti-microbial resistance patterns can vary regionally and even among different hospitals within the same community. Overuse of antibiotics contributes to antimicrobial resistance and puts the patients at greater risk of carrying and becoming infected with resistant bacteria. Infections are the most common reasons for patients to seek medical advice and for antibiotics to be prescribed.

Inappropriate or indiscriminate use of antibiotics can increase the cost of care by increasing drug cost, increasing toxicity, increasing resistance, and increasing laboratory costs. Prophylactic antibiotic use in some hospitals remains a problem. The majority of deaths result from respiratory tract infections occurs in developing countries with high poverty rates and inadequate medical care. The rise in anti-microbial resistance among the pathogens has been documented in many regions and now possesses a major challenge worldwide. Combinations of antibiotics are often used to broaden the spectrum of coverage for empiric therapy, achieve synergistic activity. Antibacterial medications are considered as the greatest discovery of the 20th century. The word "antibiotics" comes from the Greek word anti ("against") and bios ("life"). The first antimicrobial was discovered in the mid-20, and many new molecules were discovered between 1960 and 1980. This "golden era of antibiotics" saw a dramatic fall in the mortality from infections. Since the 80's, not many new class of molecules have been discovered and the funding into antimicrobial research is on the decline and now deaths due to resistant infections is slowly increasing; mortality due to nosocomial infections is now 4 times that due to road traffic accidents against the infecting organism, and prevent the emergence of resistance.

Most antimicrobial choices are empiric and made before the identification and susceptibility pattern of the infecting pathogen is known. Empiric antimicrobial choice is guided by many considerations, but local antimicrobial susceptibility patterns of commonly isolated bacteria are paramount among them. Since antimicrobial resistance has increased steadily in many institutions, and since resistance rates vary by geographic location and patient demographics, the ready availability of up-to-date cumulative antimicrobial susceptibility data is crucial. These data are also essential to monitor emerging trends in resistance at the local level to support clinical decision-making, evaluate infection-control interventions and antimicrobial-resistance containment strategies, optimize microbiology susceptibility testing and reporting methods, and guide Pharmacy and Therapeutics Committee formulary decisions. Other applications for the analysis of susceptibility test data may include methods not included in the CLSIM39-A3 manual, such as identifying isolates with specific antimicrobial resistance phenotypes.

The variable practices in surgical prophylaxis have been reported widely; the variation in practices could be attributed to the considerable variation in the published guidelines: especially regarding the timing and duration of antibiotic prophylaxis, the lack of agreement among the surgeons with the guideline; and the lack of awareness and distribution of the guideline [10].

Antimicrobial prophylaxis is indicated during selected clean surgical procedures and during procedures which involve incision of non-sterile mucosal surfaces (oral mucosa, respiratory tract, gastrointestinal tract and female genito-urinary tract). Local departmental protocols should be followed where available. Prophylactic antibiotics should be prescribed on the single dose/pre-medication section of the prescription chart [11].

2. Methodology

The prospective observational study was carried out for 6 months among in patients who had undergone elective surgical procedure in general surgery department. Study period were divided into four phases.

Prospective observational study by selection of the live in patient and day care admitted case records of the general surgery departments and with their outpatient visited records of a 500 bedded tertiary care referral hospital with prior permission from the hospital authority. The study aims to analyse the use of prophylactic antibiotic in general surgery, monitor the use of prophylactic antibiotic either single dose or in multiple dose. The study measures adherence percent for surgical antibiotics prophylaxis guidelines. Finally to prepare evidence based antibiogram and guideline for the use of antibiotic prophylaxis in general surgery. The study period was 6 months. Thus the study aims to promote safety in antibiotic use & ensure quality in health care service by effective utilization of clinical pharmacist.

The patient records were obtained from the nursing stations, operative procedure records outpatient records from the medical record department and culture reports from microbiology department of the hospital with prior permission from the hospital authority. Total 100 patients' records were evaluated.

I. Inclusion Criteria

Patients who were of any age, wounds classified as clean and clean-contaminated, and taking antibiotics before and after surgery (parenteral) will be included in the study.

II. Exclusion Criteria

The patient admitted under general surgery department, not undergoing any surgical procedure and Patients under antibiotics therapy for infectious wounds are excluded in this study, and also patient were operated on urgently and if their operation were classified as contaminated or dirty.

A standardized surveillance form was used to facilitate data collection. The data collection form contains patient demographic details like name, sex, age, height, weight and address of the patient. It also includes date of admission; date of discharge and In Patients (IP) number of the patient, the marital status, reason for admission, diagnosis, type of surgery/ surgical procedure, co-morbidities, if any previous hospitalization, details of Intensive Care Unit (ICU), Admission if any duration of operation. Antibiotic prophylaxis parameter includes Antibiotic choice, Route, Dose, Timing and duration of prophylaxis, Reasons for the prolonged usage of antibiotics, Number of postoperative doses, Cost of the antibiotic prophylaxis and Antibiotic allergy. Drug chart and date of surgical site of infection detected. And one year SSI culture reports of

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general surgery department from microbiology department by prospectively collected. Data collection from includes MRD no, patient name, sex, type of sample, month, name of the organism, and different antibiotic sensitivity pattern.

Relevant data was collected during the usual ward rounds participation and information on SSI was collected from outpatient visit record. Surgical Site Infection (SSI) is considered when there is at least one of the following symptoms: Redness, edema, tenderness, gaping, abscess or purulent discharge, occurrence of fever (>38°C), or positive culture of fluid or tissue from the surgical site within 30 days of the operation. Six months culture reports of general surgery department were collected from microbiology department at the end of each month.

Follow up was given for all patients included in the study. The follow up was divided into two, the first was early follow up, which is 3rd to 5th days after discharge; for those patients with post- operative hospital stay less than 7 days and patients with some signs and symptoms of infection during discharge. The second was delayed follow up which is two weeks to one month after discharge. During follow up patients were checked for any signs of surgical site infection.

The data was entered in Microsoft access sheet for easy reference and analysis of results later. The hospital antibiotic policy developed by the Pharmacy and Therapeutic Committee (PTC) was set as the standard for the measuring the appropriateness. The entire data was analyzed by using different statistical methods in consultation with bio statistician. All data will be collected and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistic will be used to summarize the demographic characteristics, surgical information, and antibiotic usage data. The association between usage of antibiotic in surgical prophylaxis and SSI will be analyzed using Fisher's exact test. Rates of baseline clinical characteristics are reported as means with standard deviation, or frequencies or percentage. Comparison of continues variables was performed with students t- test or Kruskal-Wallis test. The level of statistical significance was set at $p < 0.05$.

Defined Daily Dose (DDD) was calculated by using AMC tool software, and finally cumulative data of antimicrobial sensitivity pattern was analysed by using WHO net software.

Antibiogram data are based on the cumulative data from all different methods. These data should be organized into separate tables for gram-positive and gram-negative bacteria so that the users can easily find the data. The total numbers of isolates for each bacterial species should be listed, and susceptibility data are presented as the percent of strains that were susceptible to each drug. Bacteria that are "intermediate" should not be included as susceptible.

Systematic review and evidence-based guidance on antibiotic prophylaxis was prepared, in accordance with hospital antibiotic policy 2014-2015. An educational intervention was established for the various medical professionals emphasizing the findings of the study. Suggestion for the further improvement in the medical care using the antibiotic prophylaxis in surgery was also pointed, following the intervention; the study was continued for a short period for accessing the effectiveness of the intervention.

3. Results

A total number of 100 patient data were collected from both General Surgery departments. Among them, 69 (61%) were males and 31 (39%) females. On Binomial test, P-value found to be 0.035. Since p value less than 0.05, that the gender wise group has a highly statistical significance for the evaluation of antimicrobial prophylaxis in general surgery patients. Age category: Pediatric=7%, adult=80%, geriatric=13%. On statistical analysis using chi square test; $X^2=98.54$, d.f=2, $p<0.0010$. Since the p value is less than 0.0010, the age group has highly statisticalsignificancefortheevaluationofantimicrobialprophylaxisingeneralsurgery.

Maximum number of surgery cases was collected from the General surgery department II, with 45% cases from GSI- and 55% from GSII. On Binomial test used, P=0.368.

The mean stay duration $=3.20 \pm 2.701$ days (Range 0-17 days). 91% of the patients were admitted with in a range of 0-5 days. 7% of the patients, within a range of 5-10 days and remaining 2% were within a range of 10-20 days. 48% of the cases comes under clean cases, while 41% under clean contaminated. By using chi square test, $X^2=63.440$, d f 3, $P<0.0010$ since the P-value is less than 0.0010, it was concluded that wound Classification have highly statistical significance for the evaluation of antimicrobial prophylaxis in general surgery (Figure 1).

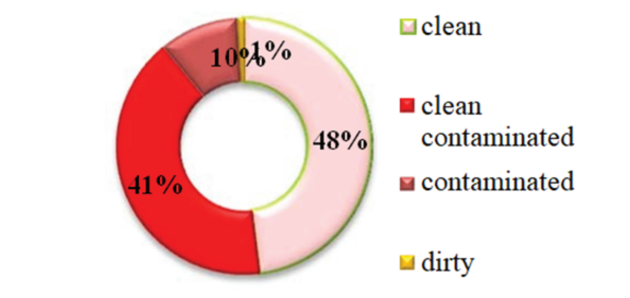

Figure 1: Type of Wounds Under Surgical Prophylaxis

Mean duration of Surgery $=1.03 \pm 0.36$ hrs. (Range 0:10-3:00 hrs.). One sample t-test was done at 95% confidence interval UL 0:55± LL 1:10 hrs. (Figure 2) More patients (n=25) were undergone surgeries within 0:15-0:30 hrs.

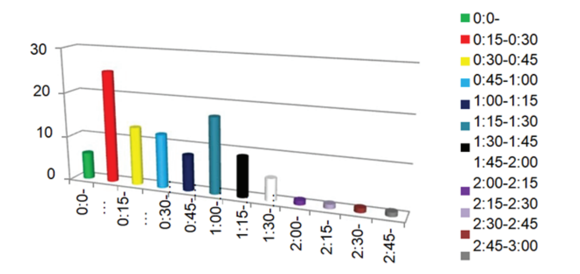

Figure 2: Mean Surgery Duration

In majority of the cases cefazolin (34%) and cefoperazone-sulbactum combination (33%) was used. Least consumption was cefoperazone + metronidazole + Amikacin combination on simple chi square test ($X^2=109.280$, df 7, $p<0.0010$. since the P-value is less than 0.0010, antibiotic prophylaxis choice is highly statistical significance for the evaluation of antimicrobial prophylaxis in generalsurgery.

Table 1

Antibiotic Choice	Frequency	Percent
cefoparazone+sulbactum	33	33.0
Cefazolin	34	34.0
cefoperazone+metronidazole	2	2.0
ampicillin cloxacillin	17	17.0
cefoperazoneES + sulbactum	3	3.0
Ampicillin + cloxacillin + amikacin	2	2.0
cefotaxime	8	8.0
Cefoperazone + metronidazole + amikacin	1	1.0

Figure 3 shows the time lapse in minutes from the first dose of prophylactic antibiotic administered and the skin incision. Timing of the first prophylactic antibiotic dose in most of the surgeries was within 30 minutes of the skin incision. Timing of antibiotic prophylaxis mean $=0.34 \pm 0.09$ hrs. (Range 0:15-1:10 hrs.).

Number of preoperative antibiotic prophylaxis mean $=1.200 \pm 0.40202$ dose. (Range 1-2 dose.). 80% patients were administered a single dose and 20% with double in 24 hrs time duration. 79% cases re dosing was not done, 13% of redosing due to increased blood loss, 3% due

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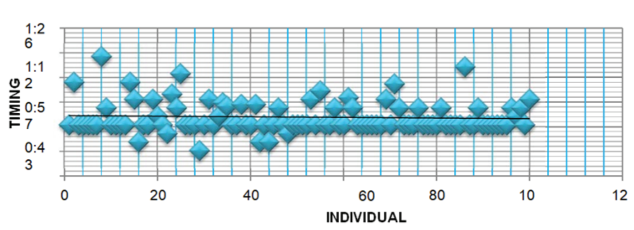

Figure 3: Shows the time lapse in minutes from the first dose of prophylactic antibiotic administered and the skin incision

to hypotension and 5% due to spilled viscous. One sample chi square test (X^2=157.76, df 3, p<0.0010. since the p value is less than 0.0010, reason for prolonged use (re- dosing) of antimicrobial prophylaxis for this study is highly statistical significance for the evaluation of antimicrobial prophylaxis in general surgery. Number of post-operative antibiotic prophylaxis mean =6.40 ± 4.568 dose. (Range 0-21 dose). Within a maximum range of 1-5 doses is (45%), 5-10 (41%), 10-15(9%), 15- 20(4%) and minimum 20-25 (1%). Cost comparison of different available brands with same strength shows a maximum percentage variation in cefazolin 250 mg (18.13%), 500 mg metronidazole (23.01%) and least percentage variation in cefazolin 500 mg (122.03).

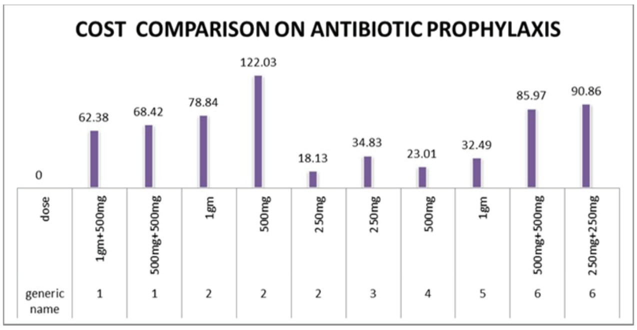

Figure 4: Cost Comparison on Antibiotic Prophylaxis

1. cefoperazone + sulbatum, 2. Cefazolinm 3. Amikacin, 4. Metronidazole, 5. Cefotaxim, 6. ampicillin + cloxacillin

Gram negative organisms isolated more like *E. coli* and *staphylococcus. E. coli* are more seen in surgical pus than swab. One sample chi square test was done for culture sample (X^2=82.460, df 2, p<0.0010. all the organisms resistance to the given prophylactic antibiotic.

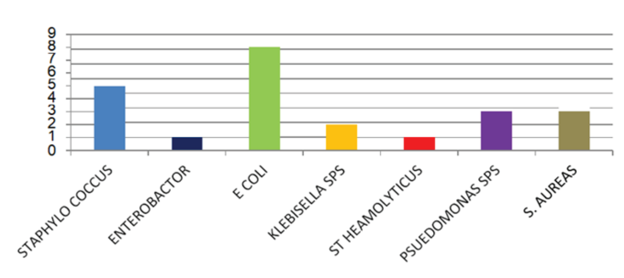

Figure 5: Type of Organism Isolated

Total number of surgical site infection is 24 and total population at risk is 100 numbers fig (14), incidence rate for surgical site infection 2.4e+23. Out of 100 cases, 24 patients developed SSI. One sample binomial test was used shows p value less than 0.0010. Culture sample 15% was swab and 9% was surgical pus. The timing deviating of the first prophylactic dose was as per the policy in 32% cases. The duration of antibiotic prophylaxis not followed as per hospital antibiotic policy about 16%, dosing was about 36% and selection was 37%. All adherence variables are statistically significant after applying binomial t-test, gives p value less than 0.05. The majorities of the surgeries cases (95%) are prophylactic antibiotics were necessary according to the ASHP guidelines and was administered. However, in 5% of the Surgeries, a prophylactic antibiotic was given, although it was not required according to the guideline.

Prophylactic Antibiotic	N (100)	%
Required and administered	95	95%
Not required and not administered	0	0%
Required but not administered	0	0%
Not required but administered	5	5%

The frequency of correct prophylactic antibiotic administration in the 95 operations that required a prophylactic antibiotic, out of 95 cases, only 11 cases are perfectly followed the 4 antibiotic prophylactic parameters i.e.: Correct choice, correct dose, correct time, and correct continuation.

Antibiotic Administration	N(95)	%
Correct choice of antibiotic	59	62.105
Correct choice + correct dose	36	37.89
Correct choice + correct dose + correct time	10	10.52
Correct choice + correct dose + correct continuation	7	7.36
Correct choice + correct dose +correct time + correct continuation	11	11.57

Number of post-operative antibiotic prophylaxis consumption by DDD for 100 bed days =0.5908± 0.77228 dose. (Range 0-2.08 dose) (TAB 5). Maximum consumption was for cefoperazone sulbactum (41%) combination and minimum consumption was metronidazole (3%) and amikacin (2%) (Figure 6).

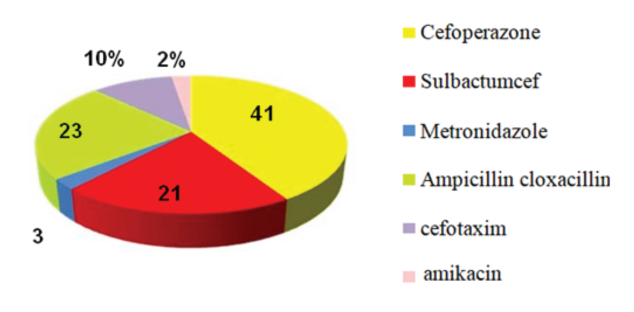

Figure 6: Consumption of Antimicrobial Prophylaxis by DDD Methodology

180 cases were evaluated to prepare an antibiogram. *Staphylococcus aureus* was the most common pathogen found (29.44%), followed by *Klebsiella .sp* (23.83%) and *Escherichia coli* (19.04%) in surgical set-up. Of the antimicrobials commonly used, impressive results of susceptibility pattern were observed, the following prepared antibiogram report shows different susceptibility pattern of antimicrobials to different organisms (Figure 7).

4. Discussion

Evaluation and updating of existing antibiotic guideline are the main clinical pharmacist role in clinical settings. The result of this study may be helpful for clinicians to improve the patient care. It is also very helpful for health system decision makers to reduce the incidence of surgical site infection related to cost of treatment and know pattern of antimicrobial sensitivity pattern in hospital. Antibiotic prophylaxis, a very brief course of antibiotics initiated just before the start of surgical procedures in clean, clean-contaminated and dirty procedures, is recommended to reduce postoperative infection. Prophylaxis refers to the prevention of an infection and can be characterized as primary prophy-

ISOLATES	NO. OF ISOLATES	COLISTIN	PIPER TAZOBACT	CEFOP-SULBACTUM	AMPICILLIN SULBACT	AMOX-CLAVULANIC	IMIPENEM	MEROPENEM	AMIKACIN	GENTAMICIN	NETILMICIN	TOBRAMYCIN	LEVOFLOXACIN	MOXIFLOXACIN	CIPROFLOXACIN	NORFLOXACIN	NITROFURANTOIN	NALIDIXIC ACID	COTRIMOXAZOLE
Acinetobacter sp.	1		100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Candida SP	1																		
Escherichia coli	32	90	90	90.6	93.8	54.8	51.6	93.8	90.6	90.6	81.2	90.6	83.9	65.6	62.5	54.8	41.7	42.9	46.9
Enterobacter sp.	9	100	100	88.9	88.9	28.6	12.5	100	87.5	50	37.5	50	37.5	50	62.5	62.5	50	66.7	
Enterococcus sp.	1			0	100	100	100	0	0	0	0	0	0	0	0	0	0		
Klebsiella sp.	43	100	100	75.8	76.7	50.2	50.2	81	76.2	69.8	47.6	60.5	45.2	45.2	46.5	40.5	36.8	31.6	40.5
Proteus sp.	3		100	100	66.7	100	100	66.7	66.7	66.7	33.3	66.7	33.3	66.7	0	0	33.3	66.7	
Pseudomonas sp.	16	100	100	100	100	9.1	14.3	93.3	93.3	75	75	75	75	73.3	73.3	68.8	66.7	66.7	50
Staphylococcus aureus	53	44.4	50	83.7	79.2	67.3	63	61.1	69.6	71.7	67.9	69.4	68.6	84.9	77.4	70.2	58.3	63.6	
Staphylococcus sp.	3			100	100	100	100		100	100	100	100	100	100	100	100			100
Streptococcus sp.	6			75	83.3	66.7	66.7	100		0	0	0	16.7	50	60	60	33.3	50	66.7

ISOLATES	DOXYCYCLIN HCL	CEFEPIME	CEFOXITIN	CEFEXIME	CEFTRIAXONE	CEFUROXIME	AZITHROMYCIN	AZTREONAM	CHLORAMPHENICOL	VANCOMYCIN	TEICOPLANIN	LINEZOLID	CLINDAMYCIN	CLOXACILLIN	ERYTHROMYCIN	AMPHOTERICIN B	FLUCANAZOLE	CLOTRIMAZOLE	ITRACONAZOLE	KETOCONAZOLE
Acinetobacter sp.	0	0	0	0	0	0	0	0	0											
Candida SP																100	100	100	100	100
Escherichia coli	46.9	61.3	65.5	64.5	50	45.5	53.6		90	100	100	100	66.7	100	100					
Enterobacter sp.	50	66.7	57.1	83.3	57.1	33.3	40	40												
Enterococcus sp.	0	100	0	0	0	0			100	100	100	100	100	0	100					
Klebsiella sp.	42.5	47.6	47.6	42.9	34.1	35	31.6		87.5	33.3	33.3	66.7	100							
Proteus sp.	33.3	66.7	33.3	66.7	33.3	33.3	66.7	33.3	66.7											
Pseudomonas sp.	31.2	25	50	50	50	38.5	76.9	50	100	100	100	100	100	100	0					
Staphylococcus aureus	68	73.2	72	74.1	70.6	66.7	57.1	96	98	98	93.9	85.4	80.4	85.4	40.9					
Staphylococcus sp.	66.7	100	100		100	100			66.7	100	100	100	100	100	50					
Streptococcus sp.	100	66.7	50		75	33.3	33.3		100	100	100	100	60	60	40					

ANTIBIOTICS - PERCENTAGE SUSCEPTIBLE (%)

GRAM NEGATIVE | GRAM POSITIVE | FUNGI

Figure 7: Antibiotics Percentage Susceptible

laxis, secondary prophylaxis or eradication. Primary prophylaxis refers to the prevention of initial infection. Secondary prophylaxis refers to the prevention of Recurrence or reactivation of preexisting infection. Eradication refers to the elimination of a colonized organism to prevent the development of an infection. Study statistics discloses the nature and extent of antibiotic prophylaxis in patients admitted to General Surgery department for elective surgical procedure. A total 100 patients who underwent elective surgical procedures fulfilled the criteria to be included in the study. All patients (100%) received prophylactic antibiotics before surgery. A total number of 100 patient data were collected from General Surgery department, of them 69 males and 31 females, demonstrating a male predominates over female population. Conflicting to this, Oh et al shows a 60% female supremacy. Male ascendancy in the current study can be better elucidated by the backup using the latest census report of the Malabar region.

Through the study, it was perceived that mean age = 40.35 ± 16.65 yrs., (Range- 2 to 84 yrs.). Age category: Pediatric=7%, adult=80%, geriatric=13%, 80% of the patients in adult category fit in the age group 18-60 years. One sample chi square test was done (X^2=98.54, df=2, p<0.0010. Since the p value is less than 0.0010, this age group is statistically significant. But the outcomes are conflicting to the outcomes of Tourmousoglou, *et al*., were mean age of the population was 58.8+15.2 years. The extended mean age can be an outcome of the advanced life styles, food habits and improved concern of heath of the community. Due to which adults more likely to underwent surgical procedure than any other age group. The mean duration of hospital stay was found to be 3.20 ± 2.701 days (Range 0-17 days) were 91% the patients admitted with in a range of 0-5 days, 7% within a range of 5-10 days and remaining 2% within a range of 10-20 days. Matching this effects with Rafati, *et al*., mean duration of hospital stay (days) 5.17±4.45. This prolonged duration of stay may due to the difference in the type of surgical procedure carried out.

In India, the average extra cost per patient due to misuse of antibiotics (the average percentage price variation of different brands of the same drug manufactured) is very inclusive. Cost analysis of different prophylactic antibiotics and percentage variation of cost among these antibiotics of different companies were done and realized that, all prophylactic antibiotics are cheaper in price, compared to other brands, so patients had minimum cost with maximum benefit.

Surgical site infection rate was analogous to results from other studies conducted in South and Southeast Asia. Nguyen, *et al*., described an overall incidence rate of 10.9% in Hanoi, Vietnam. Sohn. *et al*., documented a postoperative infection rate of 14.3% in Ho Chi Minh City, Vietnam. Surgical Site Infections were developed in 7.6% cases, in a community-based hospital in Japan. However, it was ominously higher when compared to western studies. Analysis of the efficacy of nosocomial infection control (SENIC) demonstrated the overall rate of SSI to be 4.1%, while Olson, *et al*., documented a rate of 2.5% at the end of their study, after 10 years. The overall SSI rate was 12% in a Bolivian study and around 2.6% in a Columbian study. A study conducted in underdeveloped countries like Tanzania, illustrated the overall incidence of SSIs to be around 19.4%. Surgical site infections of 16.9% were documented in Beograd, Serbia. In this study total number of surgical site infection is 24 (24%) and total population at risk is 100 numbers. In the current research, majority of the processes belonged to biliary tract surgery, with high proportion of gram-negative bacilli has been detected. High incidence of isolation of *E. coli* in the bile is well known. Through our research, it was evident that those cases, where there was leakage of bile in the peritoneal cavity developed SSI from biliary tract surgery. Recent studies indicated the higher incidence of gram-negative bacillus the cause of SSIs (Saito T, *et al*.).

Most of the North American studies showed a prevalence of gram-positive cocci as the etiology of SSIs. Two Indian studies also highlight the superiority of gram-positive cocci as the etiology of SSIs (Lilan, SP, *et al*., Murthy R, *et al*. Appropriate decision-making regarding, use or non-use of prophylactic antibiotics, choice of antibiotic, duration of prophylactic antibiotic use and timing of first dose, were four parameters with the least adherence to the standard guidelines in the contemporary study. As per the hospital policy, prophylaxis was indicated for all surgeries. The timing deviating of the first prophylactic dose was as per the policy in 32%. The duration of prophylaxis not following policy guideline was 16%, dosing was about 36% and selection was 37%. The high rate of inappropriate choice of prophylactic antibiotic and unnecessary continuation in this study may be due to the unavailability of a unit-based clinical pharmacist to assist physicians in correct choice of medications according to guidelines. The timing of administration of prophylactic antibiotics is important and this was correct in 76.5% (81 of 106 that required prophylaxis) of the surgeries performed. This is similar to the studies of Paradiso-Hardy, *et al*. In Canada and Lallem and *et al*., in France, who showed the timing of administration was correct in 72% and 61.4% of cases respectively. Appropriate timing was much higher in the study performed in Jordan (99.1%), and lower in studies performed in the Netherlands (50%) and Nicaragua (22%). Large-scale observational studies have shown that the rate of surgical site infections was decreased in more than 50% patients, when they were treated with timely antibiotic prophylaxis. The findings of the study showed that there is an urgent need to develop such guidelines for surgical prophylaxis in our hospital. Guidelines should cover aspects like type of surgery, the optimal time of antibiotic administration, choice of antibiotic and an alternative, address intra-operative re-dosing and duration of use. They should also be based on hospital-specific bacterial epidemiology patterns, the best evidence derived from the literature. The support and collaboration of hospital administrators and medical staff of such guidelines is essential for their development, implementation and maintenance.

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This work supports the team effort by surgeons, anesthetists, microbiologists, nurses and clinical pharmacists in the effective utilization of prophylactic antibiotics in hospital. It also climaxes the incidence of surgical site infections and prophylactic antibiotic usage in an Indian set-up.

5. Conclusion

The outcomes of the current study demonstrated that, pre and postoperative antibiotic prophylaxis need more monitoring to improve adherence to the guidelines, along with the need to clinical monitoring and intervention from clinical pharmacists to optimize the use of antibiotics which will lessen side effects and cost of treatment. An astronomical degree of resistance to each microorganism was isolated from General Surgery department of the hospital, with this evidence it could wrap up with, the chance of developing infection was higher in patients who stayed in the hospital for a long time. This was owing to the chances of developing nosocomial infection with the days the patient in the hospital. Owing to under privileged culture and sensitivity reporting, very few numbers of patients are treated according to their antibiogram report. In most of the cases the patients were treated with a board spectrum antibiotic. The multiple dose of prophylaxis was not having any benefits over the single dose antibiotic in surgery. Amikacin, Cefoperazone-Sulbactum, Cefazolin, Cefuroxime, Amoxicillin Clavulanate, Cefotaxime and Metronidazole were the most commonly used antibiotics for single or multiple doses. The multiple dose or multi drug use as a prophylactic shown little profit higher to single dose usage. Cefazolin, one among the mostly prescribed antibiotic, was least sensitive (50%) to most of the microorganism isolated suggesting its irrational use in the surgical department of the hospital. the antibiotics like cefuroxime and amikacin have almost same fate.

The rate of compliance with surgical antibiotic prophylaxis guidelines was still very poor. Therefore it is necessary to do some efforts to improve compliance with surgical antibiotic prophylaxis guidelines to reduce the risk of surgical site infection. Building local hospital guidelines for surgical antibiotic prophylaxis, by adopting national or international guidelines needs to be done to overcome the problem of non-compliance to guidelines for antibiotic prophylaxis. A multifaceted educational intervention involving a team effort of healthcare professionals can have a significant effect on effective antibiotic utilization and in reducing the incidence of surgical site infections. Local guidelines seem more likely to be accepted and followed than those developed nationally.

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