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Utilization of Antibiotics in Surgical Prophylaxis A - Prospective Study

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ABSTRACT

Surgery is the art of practice or work of treating diseases, injuries or deformities by manual or operative procedures. Before the start of operative procedures, a very brief course of antibiotics is initiated. This study aims to study the antibiotic utilization in surgical prophylaxis. This was a prospective and observational study conducted on 303 patients for a period of 06 months with the approval of institutional ethical committee from the Apollo multi specialty hospital & research center. Those who satisfied the study criteria were consented and participated for the study. Among 303 patients 183 male and 120 females were enrolled for the study. Most of the participants were in the age group of 31- 40 years. 205 patients had a clean- contaminated wound. Inj. Cefuroxime was the most prescribed prophylactic and post-surgical antibiotic in this study to avoid surgical site infection. None of the patients had developed any surgical site infections and the results which were satisfiable. Rational therapy with antibiotics helped patients to improve the quality of life by reducing financial and physical burden.

Keywords: Antibiotics; prescription pattern; surgical prophylaxis.

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INTRODUCTION

The term antibiotics have its origin in the word antibiosis. Antibiotics are the chemical substances obtained from various species of microorganisms that suppress the growth of other microorganisms & eventually may destroy them.^[01] Synthetic antibiotics which are usually chemically related to natural antibiotics, have since been produced to accomplish comparable tasks.^[02] Antibacterial action generally falls within one of four mechanisms, three of which involves the inhibition or regulation of enzymes involved in cell wall biosynthesis, nucleic acid metabolism & repair or protein synthesis respectively. Disruption of membrane structure is the fourth mechanism. Infection of the wound triggers the body's immune response, causing inflammation & tissue damage, as well as slowing the healing process after the surgery. Surgical antibiotic prophylaxis (SAP) is a very brief course of antibiotics initiated closely before the start of operative procedures to reduce postoperative surgical site infections (SSIs). Globally SSI rates have been found to be from 2.5 to 41.9%.^[03] The timing of antibiotic administration may vary but the goal of administering preoperative systemic prophylactic antibiotics is to have the concentration in the tissue as its highest at the start & during surgery. The risk of infection & the type of antibiotic prophylaxis required varies depending on the underlying state of the patient & the type of procedure. The use of antibiotic prophylaxis was a milestone in the effort to prevent surgical site infection. The aim of antibiotic prophylaxis in surgery is generally thought to be reduction in surgical site infection (SSI) & short-term morbidity.^[04] The use of antibiotics in surgical patients both for prophylaxis & treatment of infections is a justifiable practice that however requires a regular review of chosen regimen on the grounds of efficacy, diagnosis pattern, prescribing pattern & the aspects to maximize the benefits to the patients. By preventing surgical site infections, prophylactic antimicrobial agents have a potential to decrease patient morbidity & hospitalization costs for many surgical procedures that pose significant risk of infection. Prophylactic administration of antibiotics inhibits the growth of contaminating bacteria & their adherence, thus reducing the risk of infections. Administration of antibiotics also increases the prevalence of antibiotic-resistant bacteria.^[05] Antibiotics are among the most commonly prescribed drugs in hospitals & developed countries, around 30% of the hospitalized patients are treated with antibiotics.^[06] The comprehensive & consistent practice regarding the routine preoperative antibiotic prophylactic measures requires the coordination of the entire preoperative healthcare staff. This includes but is not limited to the entire operating room & preoperative staff members (including surgical technicians, preoperative based nursing staff, floor nurses, advanced practitioners & all clinicians participating in the care of surgical patients).^[07] This study concentrated on patient's,

surgery and wound characteristics. The most commonly used antibiotics used to prevent the surgical site infections were also identified as part of the study.

MATERIALS AND METHOD

This was a Prospective and Observational study and was performed on 303 patients over a period of 06 months starting from September 2018 to February 2019 to assess the utilization of antibiotics in surgical prophylaxis. A total of 303 patients from the surgical department of Apollo Multi Specialty Hospital & Research Centre were enrolled for the study. Ethical committee clearance has been obtained by the institutional ethical committee of Apollo Multi Specialty Hospital & Research Center. Patient demographics, clinical findings and therapeutic data were collected from inpatients and the main sources for the collection of data were patient's case notes, treatment chart/medication chart, patient discharge cards. Inclusion criteria are patients prescribed with antibiotics, all the age groups, pregnancy and lactating women & patients who stay minimum 24 hours in hospital. Exclusion criteria are patients who are not prescribed for any antibiotics & patient who have no recorded diagnosis of surgical prophylaxis. Therapeutic data such as the name of the drugs, doses, route of administration, duration, and other data are collected in a suitably designed data collection form. All patients admitted with different health conditions along with surgery during the study period in the respective surgical wards were screened for the use of any antibiotics prospectively. After the diagnosis is confirmed along with the demographics of the patient the antibiotic drug usage also studied. To identify the prophylactic therapy we used therapeutic data such as generic name of drugs, duration of therapy before and after the surgery, time interval between drug administration and incision was also studied. The above all data was collected and documented in a suitably designed data collection form. Patient's wound classification was also analysed. The most commonly observed surgery was urology with more male patients. Significance differences between the surgical specialties and gender was also studied. Information about the prophylactic antibiotic used was collected from the SSI tracking sheet of patient's case report in the hospital. Post surgical antibiotic used was identified from the medication chart. The details about whether the patients developed any surgical site infections were also analyzed by performing proper follow-up. This method was Descriptive statistics, frequency and percentage was drawn and charts were used to represent the consolidated data for inferential statistics. Chi square test of independent of attribution were used to test the categorized data. Significant figures used are Suggestive significant (p value: $0.005 < p < 0.10$), Moderately significant (p value: $0.01 < p \leq 0.05$), Strongly significant (p value: $p > 0.05$).

≤ 0.01). This statistical software namely SPSS version 23.0 used for the analysis of the data and as drawn charts and graph etc.

RESULTS AND DISCUSSION

Demographics

From the Table 1 it can be assessed as among the distribution of total 303 patients the age distribution was found with ranging from below 20 years and above 80 years. Similar findings were found in the reference in a study conducted by Kapil Sharda et al^[08] on Incidence and antibiotics prophylaxis of wound infection in postoperative surgery: a hospital-based study, in which 44% (majority) was from 31-40 age group and 26% belong to 40-60 age group out of 150 patients. The highest distribution was found in the ranging 31-40 years with a total number of 61 patients and a percentage of 20.1%. The lower age distribution was found in a number of 6 patients with age of above 80 years with percentage of 02%. The gender distribution among 303 patients, the highest distribution was male, i.e. 183 and female was lowest, i.e. 120. The percentage of the distribution of males and females were 60.4 and 39.6 respectively. The BMI was calculated on basis of the gender and age and the least average BMI among 183 males was found in the age group of below 20 years (15.59) and the standard deviation was found to be 4.31. Similar findings were found in a study conducted by Devesh Kumar J et al^[09] on Evaluation of prescription pattern of antibiotics for surgical prophylaxis in secondary care hospital. They found in the result that majority were reported in male patients than female. The total sample size was 100 patients in the surgery department. Highest average BMI was found to be in the age group 31-40 years (28.95) with a standard deviation of 5.58. The least average BMI among 120 females was found in the age group below 20 years (18.47) with the standard deviation of 4.68. And the highest average was found to be in the age group of 41-50 years (28.36) and the standard deviation was 5.30. The total mean and standard deviation of males was found to be 25.39 and 5.06 respectively, and in females it was 26.62 and 4.80 respectively.

Table 1: Age and gender wise distribution of patient's data.

Age Group	Gender		Total	Chi-square & Significance
	Male	Female		
Below 20 Years	10	04	14	5.024
21-30 Years	34	19	53	P-value=0. 657
31-40 Years	32	29	61	Not Significant
41-50 Years	33	19	52	
51-60 Years	25	14	39	
61-70 Years	30	21	51	
71-80 Years	17	10	27	
Above 80 Years	02	04	06	
Total	183	120	303	

Surgery characteristics

Among 303 surgical cases the association between wound classification and gender distribution was studied. It was found that out of 303 patients, 205 patients had a clean- contaminated wound. Out of that 126 were males and 79 were female patients. 95 patients had clean wound, in which 55 were male patients and 40 were female patients. 01 male patient case reported as contaminated wound. 01 female patient case reported as dirty wound case and 01 male patient case reported as dirty- infected wound. Similar result was found in the study conducted by Marise Gouvea et al ^[10] on Assessment of antibiotic prophylaxis in surgical patients at the Gaffree Guinle University hospital, and they observed that out of 250 cases 160 cases were clean contaminated. Among 303 patients the study about the surgical specialty and patient distribution was done to find out the statistical association in the data as shown in table number 02. 46 male patients were admitted in the urology surgical department, which was the most number of cases reported in the male patients. A total of 33 female surgery cases were reported in the gynecology department. Total 62 patients had done surgery in the orthopedics department and 54 patients had done surgery in the urology surgery department. In a study conducted by Seyed Mohammad Alavi et al ^[11] they found that out of 196 surgery cases 53 abdominal surgery procedures were reported and 37 gynecology cases were reported. In this study the association between the surgical specialty and gender distribution was analyzed and the p- value was found to be 0.000 that is less than 0.05 at 05 percent level of significance. It signifies that both the type of surgery and the gender are dependent to each other. Table 02 represents a clear representation of surgical specialty and gender distribution of patient's data.

Table 2: Surgical specialty based on gender distribution of patient's data.

Surgical Specialty	Gender		Total	Chi-square & Significance
	Male	Female		
Bariatric Surgery	01	01	02	86.124
Brain & Spine Surgery	08	0	08	P-value=0.000*
Cardiology	05	0	05	Statistically
Cosmetics & Plastic Surgery	02	03	05	Significant
ENT	14	11	25	
Gastroenterology	17	06	23	
Gastroenterology & Nephrology	01	0	01	
Gastroenterology & Bariatric Surgery	01	0	01	
Gastrointestinal Surgery	02	03	05	
General Surgery	18	07	25	
Gynecology	0	33	33	
Head & Neck Surgery	02	01	03	
Nephrology	01	02	03	
Neuro Surgery	11	03	14	
Oncology & Plastic Surgery	0	01	01	

Oncology Surgery	04	07	11
Ophthalmology	01	01	02
Oral & Maxillofacial Surgery	03	0	03
Orthopedics	35	27	62
Pediatric Surgery	02	01	03
Pulmonology	01	0	01
Urology	46	08	54
Vascular Surgery	08	05	13
Total	183	120	303

In 148 cases the time interval between prophylactic antibiotic drug administration and incision was found to be in between 05-10 minutes with a percentage of 48.8%. In 58 cases the time interval was in between 11-15 minutes with a percentage of 19.1%. In 33 cases the time interval was in between 15-20 minutes and a percentage of 10.9%. In 32 cases it was in between 20-25 minutes and in another 32 cases it was found to be 25-30 minutes and each had a percentage of 10.6%. Similar results were found in the study conducted by AI Ling Oh et al^[12] in which out of 87 cases 66 cases were having the time interval of 5-10 minutes. Similar study by Brij BA^[13] says that the most optimal time of administration has been found to be ½ hr preoperatively. A study conducted by Edin M et al^[14] states that the chance of occurring an SSI will be less if the drug is administered 30 minutes before the surgery. Prolonged prophylaxis duration was reported in 87.7% cases of Lallemand et al.^[15] In the current study we have found that the time interval between the incision and administration never exceeds 30 minutes.

Prophylactic treatment:

The prophylactic antibiotic distribution among 303 patients was analyzed (Table 3). The antibiotic which was prescribed most is Inj. Cefuroxime. It was prescribed in 113 patients out of 303 patients with a percentage of 37.3%. The second highest prescribed drug was Inj. Ceftriaxone. It was prescribed in 72 patients with a percentage of 23.8%. Cefuroxime & Combination (Amikacin, Amoxicillin+ Clavulanic acid, Ceftriaxone, Metronidazole, Piperacillin+Tazobactam) was the most commonly prescribed drugs and was used in total 114 patients which gave a percentage of 37.6%. Cefuroxime injection was preferred more in surgeries like Gastroenterology, Neuro Surgery, Oncology, Plastic Surgery and Orthopedics. Ceftriaxone injection was preferred more in the surgeries like Brain & Spine Surgery, Cosmetics & Plastic Surgery, ENT surgeries, Gastroenterology, nephrology, Gynecology and Urology departments. Inj. Amoxicillin+ Clavulanic acid was preferred more in Bariatric Surgery, Cardiology, Gastroenterology, General Surgery, and Head & Neck Surgery departments. Allergy to β -lactam antimicrobials may be a consideration in the selection of surgical prophylaxis. The β -lactam antimicrobials, including cephalosporins, are the

main stay of surgical antimicrobial prophylaxis and are also the most commonly implicated drugs when allergic reactions occur. Because the predominant organisms in SSIs after clean procedures are gram-positive. The decision to use prophylactic antibiotics depends on the cost of treating and the morbidity associated with infection compared with the cost and morbidity associated with using prophylaxis.

Table 3: Prophylactic antibiotic drug distribution

Prophylactic antibiotic	Frequency	Percentage
Inj. Amikacin	03	1.0
Inj. Amoxicillin+Clavulanic Acid	50	16.5
Inj. Cefazolin	05	1.7
Inj. Cefixime	03	1.0
Inj. Cefoperozone + Sulbactum	25	8.3
Inj. Cefoperozone+Sulbectum& Inj. Amikacin	02	0.7
Inj. Cefotaxime	11	3.6
Inj. Cefpodoxime	01	0.3
Inj. Ceftriaxone	72	23.8
Inj. Cefupirome+Sulbactum	02	0.7
Inj. Cefuroxime	113	37.3
Inj. Cefuroxime & Inj. Amikacin	02	0.7
Inj. Cefuroxime & Inj. Levofloxacin	01	0.3
Inj. Cefuroxime & Inj. Linezolid	01	0.3
Inj. Ciprofloxacin	01	0.3
Inj. Clindamycin	01	0.3
Inj. Gentamycin	06	2.0
Inj. Meropenem	01	0.3
Inj. Piperacillin+Tazobactum	03	1.0
Total	303	100.0

Post-surgical antibiotic usage

From the table 4, it was found that no antibiotics drugs were prescribed for post surgical therapy in 18 patients (12 male and 06 female patients). Inj. Cefuroxime was the most prescribed post surgical antibiotic. It was prescribed in about 90 patients (54 males and 36 females), which made a percentage of 29.7%. Cefuroxime injection was mostly prescribed in the surgeries in Gastroenterology, Gastrointestinal Surgery, Gynecology, Neuro Surgery, and Orthopedics departments. In a study conducted by Paniz Yousefi et al ^[16] out of 104 patients all patients received post surgical antibiotic prophylactic treatment. Patients belonging to the pre and post recommendation phase were of a similar group with respect to demographics, risk and type of procedures. Absence of SSIs during the post recommendation period is not solely due to appropriate antibiotic prophylaxis usage. It is well known fact that antibiotic prophylaxis is an adjuvant to and not a substitute for good aseptic

procedures in the surgical environment. During the post surgical period prophylactic antibiotics were stopped after 24-48 hours of surgery.

Table 4: Post-surgical antibiotic drug distribution.

Post-surgical antibiotic drug	Frequency	Percentage
Not Prescribed	18	5.9
Inj. Amikacin	01	0.3
Inj. Amikacin, Inj. Cefuroxime	02	0.7
Inj. Amikacin, Inj. Piperacillin+Tazobactam	01	0.3
Inj. Amoxicillin+Clavulanic Acid	43	14.2
Inj. Amoxicillin+Clavulanic, Inj. Amikacin	01	0.3
Inj. Amoxicillin+Clavulanic, Tab. Amikacin	01	0.3
Inj. Cefazolin	05	1.7
Inj. Cefixime	02	0.7
Inj. Cefoperazone+Sulbactam	18	5.9
Inj.Cefoperazone+Sulbactam,Inj. Amoxicillin+Clavulanic, Inj. Clindamycin	01	0.3
Inj. Cefoperazone+Sulbactam, Inj. Levofloxacin	01	0.3
Inj. Cefoperazone+Sulbactam, Inj. Metronidazole	04	1.3
Inj. Cefoperazone+Sulbactam, Inj. Amikacin	01	0.3
Inj. Cefotaxim, Tab. Cefixime	01	0.3
Inj. Ceftriazone, Inj. Cefuroxime, Inj. Amikacin	01	0.3
Inj. Ceftriaxone	46	15.2
Inj.Ceftriaxone, Inj.Amoxicillin+Clavulanic & Inj. Amikacin	01	0.3
Ceftriaxone, Inj. Cefotaxime	01	0.3
Inj. Ceftriaxone, Inj. Cefuroxime	01	0.3
Inj. Ceftriaxone, Inj. Gentamycin	01	0.3
Inj. Ceftriaxone, Inj. Levofloxacin	01	0.3
Inj. Ceftriaxone, Inj. Linezolid & Tab. Linezolid	01	0.3
Inj. Ceftriaxone, Inj. Metronidazole	01	0.3
Inj. Ceftriaxone, Inj. Cefixime	03	1.0
Inj. Ceftriaxone, Inj. Cefuroxime	09	3.0
Inj. Cefupirome+Sulbactum, Tab. Cefuroxime	01	0.3
Inj. Cefupirome+Sulbactum, Inj. Clarithromycin	01	0.3
Inj. Cefuroxime	90	29.7
Inj. Cefuroxime, Inj. Amikacin	02	0.7
Inj. Cefuroxime, Inj. Amikacin, Inj. Metronidazole	01	0.3
Inj.Cefuroxime,Inj.Amikacin, Tab.Amoxicillin+Clavulanic & Tab. Ofloxacin	01	0.3
Inj. Cefuroxime, Inj. Gentamycin	01	0.3
Inj. Cefuroxime, Inj. Levofloxacin	01	0.3
Inj. Ciprofloxacin, Tab Ciprofloxacin	02	0.7
Inj. Clindamycin	01	0.3
Inj. Linezolid	01	0.3

Inj. Meropenem	01	0.3
Inj. Piperacillin+Tazobactam	04	1.3
Tab. Amoxicillin+Clavulanic Acid	10	3.3
Tab. Cefixime	05	1.7
Tab. Cefixime, Inj. Ceftriaxone	01	0.3
Tab. Cefixime, Inj. Gentamycin	01	0.3
Tab. Cefpodoxime	01	0.3
Tab. Ceftriaxone	01	0.3
Tab. Cefuroxime	06	2.0
Inj. Cefuroxime, Inj. Ceftriaxone	04	1.3
Tab. Ciprofloxacin	01	0.3
Total	303	100.0

CONCLUSION

Cefuroxime & Combination (Amikacin, Amoxicillin+ Clavulanic acid, Ceftriaxone, Metronidazole, Piperacillin+Tazobactam) was the most commonly prescribed drugs and was used in total 114 patients which gave a percentage of 37.6%. Patients were enrolled in the study and in that 183 were male and 120 were female patients. The patients belonging to the age group 31-40 had more number of surgical procedures during the study period. BMI was also analyzed in the study and the patients were divided into males and females based on that to find the mean average and standard deviation. SSI may decrease the quality of life of the patients and also increases the economic burden. Hence minimization of SSI is very important in the developing countries by maintaining infection control plans by suitable organization which makes an impact on the infections. Indiscriminate antibiotic use, however, increases the risk of adverse events and super infections and will eventually fail with the emergence of resistance. From a professional perspective, it is the pharmacist's responsibility to ensure the appropriate use of antimicrobials. The pharmacist also has the ability to individualize therapy to patient characteristics and risk factor for infection. Although antimicrobial prophylaxis plays an important role in reducing the rate of SSIs, other factors such as attention to basic infection-control strategies, the surgeon's experience and technique, the duration of the procedure, hospital and operating-room environments, instrument sterilization issues, preoperative preparation (e.g., surgical scrub, skin antisepsis, appropriate hair removal), preoperative management (temperature and glycemic control), and the underlying medical condition of the patient may have a strong impact on SSI rates.

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