ASSESSMENT OF ANTIBIOTIC USAGE AMONG SURGICAL PATIENTS IN A TERTIARY CARE HOSPITAL

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Abstract:

Background: Irrational use of antibiotics has led to an increase in the rate of occurrence of Surgical Site Infection (SSI). The right choice of antibiotics and its dose, route, frequency and duration constitute the decision-making factor in prescribing rational antibiotic therapy for surgical patients in preventing surgical site infections.

Objectives: To assess the antibiotic usage in surgical patients and measure the prevalence of surgical site infections.

Methodology: A prospective observational study was carried out over period of six months in the Department of Surgery in a south Indian tertiary care hospital. All subjects aged 18 and above undergoing clean, clean contaminated and contaminated procedures were enrolled into the study while those undergoing dirty surgeries were excluded. Subjects who met study criteria were gathered with demographic details, past medical history, investigations carried out during the hospital stay, surgical history, details of the antibiotics prescribed with dose, route, frequency and duration. The data was further analysed to identify the most commonly used antibiotic and the prevalence of SSI was calculated.

Results: A total of 170 subjects were enrolled into the study, among which 84(49.40%) subjects were male and 86 (50.55%) subjects were female. The mean age of the subjects was found to be 41.83(16.24) years. Past medical history of the subjects reflected Hypertension

[21(12.3%)] to be the most common medical condition among the study population, followed by Diabetes Mellitus[17(10.00%)], Thyroid disorders[7(4.11%)], and other medical conditions [8(4.70%)] which included chronic fatigue, chronic constipation and Parkinson's disease. The remaining subjects [97(57.05%)] were found to have medical history nothing significant.

Among the study population, 134 underwent elective procedures and 36 underwent emergency procedures. The most commonly prescribed antibiotic for pre-operative prophylaxis was found to be Ceftriaxone [56(32.90%)]. Metronidazole [40(23.52%)] was mostly used as a second line agent in patients undergoing abdominal procedures. Ceftazidime was most commonly used in elective surgeries while Ceftriaxone was commonly prescribed in emergency procedures. The mean duration of therapy was found to be 6 (5.55) days. 1.17% (2) of patients developed an SSI after surgery. The prevalence was calculated and was found to be 0.011.

Conclusion: The study concluded that third generation cephalosporin antibiotics were the drug of choice for pre-operative prophylaxis in surgical patients irrespective of the type of procedure conducted. The prevalence of SSI in the chosen population was found to be lower. Hence, the inference made from this research study was that the antibiotic therapy in surgical patients was effective in preventing SSIs.

Keywords: Surgical Site Infection, Antibiotics, General Surgery, Prevalence.

INTRODUCTION: Antibiotics are drugs used to treat bacterial infections. These substances were derived from various microorganisms and was found to have the ability to kill or inhibit the growth of bacteria. Antibiotics are majorly classified into two; bactericidal and bacteriostatic. The former acts by inhibiting the DNA synthesis within bacteria and the latter by inhibiting the cell wall synthesis of the bacteria.

Antibiotics are used in surgical patients as a prophylaxis to prevent potential post-operative infectious complications. The choice of antibiotics in the surgical prophylaxis majorly depends on the type of surgery and the type of incision. WHO recommend use of antibiotic prophylaxis among surgical patients from fortyeight hours before surgery for maximum 4-5 days after surgery. Broad spectrum antibiotics are recommended to be used in surgical prophylaxis in comparison to narrow spectrum. Usually a single dose is sufficient for pre-operative prophylaxis. A second dose is administered in case in prolonged procedures or when there is a risk of contamination during the surgery. A single preoperative dose of

antibiotic is as effective as full five days course of therapy assuming uncomplicated procedures. It is very important to ensure rational use of antibiotics. The choice of drug, duration of therapy and dose at which the drug concentration attains MIC influences the effectiveness of the antibiotic therapy as well as the resistance pattern. Although it is desirable to perform a culture sensitivity testing before starting any antibiotic therapy than choosing empirical therapy as far as surgical prophylaxis is concerned where broad spectrum antibiotics should be given priority due to wide spectrum anti-microbial activity. Inappropriate use of antibiotics can increase resistance towards antibiotics which may lead to increase in morbidity, mortality and cost of health-care.

According to The Centres for Disease Control (CDC), surgical site infection (SSI) is defined as any infection that occurs at the site of the incision or where any infection occurs at the surgical site. SSIs are majorly classified into three; Superficial incision SSI, Deep incision SSI and organ space SSI. Superficial incisional SSI is further classified into superficial incision SSI primary and superficial incisional secondary. A surgical site infection is said to be occurred when there is a purulent drainage from the site or when an organism has been isolated under aseptic conditions from a sample obtained from the site of surgical incision. This SSI can occur from hours to 30 days after the surgery depending on the size and nature of the incision and post-operative care. Many factors influence SSIs, namely, patient related factors including endogenous and exogenous factors. Endogenous factors include pre-existing infections within the patients. Studies suggest that Diabetes pose a risk for developing surgical site infection. Exogenous factors include the factors that are related to the patients and also include the sterility of the environment and instruments used, personnel operating at the surgery ward.

The primary objective of antibiotic prophylaxis in surgical patients is to reduce the rate of incidence of surgical site infections. The nature of antimicrobial therapy in surgical patients depend on the type of incisional wound. These types include clean, clean contaminated and contaminated. According to CDC guidelines a clean wound is defined as "an uninfected surgical wound in which no inflammation has occurred", while clean-contaminated wound is defined as "a surgical wound in which the respiratory, alimentary, genital or uninfected urinary tracts are not entered under controlled conditioned without unusual contamination" and contaminated wounds are defined as "an open fresh accidental wound". Clean wounds have comparatively less risk of developing a surgical site infection than a clean contaminated or contaminated wound.

Commonly found organisms in an SSI after a clean surgery would include S.aureus and staphylococcus organisms while clean contaminated wound includes gram negative rods and enterococci species. Other organisms have also been found to cause SSIs depending on the region and hospital environment. Based on the organisms isolated most commonly preferred class of antibiotics for surgical prophylaxis include third generation cephalosporins, e.g. ceftriaxone, cefuroxime. Metronidazole is recommended to be used in abdominal procedures to eliminate anaerobic bacteria. Parenteral antibiotics are preferred in surgical prophylaxis as oral intake is not preferred before any surgical procedure. Antibiotics are administered 60 minutes prior to the procedure to attain MIC during the procedure.

Antibiotic as pre- and post- operative patients is quite essential to prevent the rate of occurrence of surgical site infection. Surgical site infections if not prevented can lead to further complications associated with the type of surgical procedure. A single line therapy is most commonly preferred as pre- operative prophylaxis but in cases of contaminated surgeries the surgeon may want to add another antibiotic to prevent occurrences of infection during the procedure.

Surgical site infection increases the hospital stay and prophylaxis has the potential to shorten the hospital stay and fasten return to normal activity after discharge from the hospital. Therefore, the present study was undertaken to observe and analyze antimicrobial prescription pattern and the common antibiotics prescribed among patients who had undergone surgery at tertiary care hospital

METHODOLOGY

Study Design:

A prospective observational study was conducted in Department of General Surgery at JSS Hospital, Mysore, over a period of six months from November 2017 to April 2018. The study was approved by Institutional Human Ethical Committee (IEC) of JSS College of Pharmacy, Mysore. Patients of either gender above 18 years of age and undergoing clean, clean contaminated and contaminated surgeries were included in the study. Patients getting discharged against the medical advice and surgical patients with dirty wounds were excluded in the study.

Study Procedure:

A total of 170 subjects were enrolled in the study. Patients who got admitted and prescribed with antibiotics in the surgery ward and those patients who met the study criteria were enrolled into the study. Patient demographic details (IP no, age, gender, weight, height, surgery unit, date of admission and date of discharge), reason for admission, past Medical History, social History and allergic status, current diagnosis and co-morbid conditions, laboratory and radiological investigations, information regarding surgical procedure, pre-operative and post-operative antibiotics (name of the drug, dose, route of administration, frequency and duration) were recorded. Details of post-operative patients who developed surgical site infections were recorded along with the date and the treatment provided (if any). The data was used to calculate the prevalence of Surgical Site Infection (SSI) among all surgical patients included in the study by applying the formula:

$$\text{Prevalence of SSI} = \frac{\text{Number of patients who developed SSI}}{\text{Total population}}$$

The data collected was further evaluated to identify the commonly used antibiotic in surgical patients within the study site and the prevalence was calculated.

Tools for the Study:

Informed consent form which was prepared in English and translated in Kannada. Consent was taken from the patients as per guidelines of principles of good clinical practice.

Data collection form was designed and used for the study which includes patient Demographic details (IP no, age, gender, weight, height, surgery unit, date of admission and date of discharge), Patient Information (reason for admission, past Medical History, social History and allergic status, current diagnosis and co-morbid conditions), Investigation (laboratory and radiological), Surgical Information (surgical procedure and date of surgical procedure), Antibiotics Associated with the Treatment (pre-operative and post-operative antibiotics which includes name of the drug, dose, route of administration, frequency and duration, elective or an emergency procedure, nature of antibiotic use, i.e., whether the therapy was prophylactic/ empirical/definitive), Determination of Prevalence (type of procedure could be clean/clean contaminated/contaminated, surgical site infection/not, if yes, the details of treatment and date of reporting), Antibiotic Sensitivity (isolated organism and susceptibility/resistance pattern of different antibiotics) were documented.

Electronic Data Compiling: The data collected using the data collection form was entered onto a specially designed online 'Google form' (Annexure IV) for easy retrieval of data for analysis. The database having two sections, master entry and data form entry. The collected data was entered into the data form entry, which was electronically prepared in the same format as that of the data collection form used. The data entered into the data form entry automatically registered into the master entry. The master entry constitutes the whole information entered in the data form entry at a glance, with provisions for filtering the required data as the analysis demands.

RESULTS

A total of 170 patients over the age of 18 years undergoing surgery were enrolled into the study between October 2017 and April 2018. Among all 170 patients, 2 were found to have developed surgical site infection. The most commonly used antibiotic was found to be Ceftriaxone (32.9%). The mean duration of therapy was calculated to be 5.55(SD) days.

The mean (SD) age of the patients included into the study was found to be 41.83(16.24) years. Among all the subjects, 84(49.4%) patients were Male and 86 (50.5%) of patients were Female.

Past medical history of the study population was calculated. 21(12.3%) were found to have hypertension, 17(10%) were found to have Diabetes Mellitus, 7(4.11%) were found to have Thyroid disorders, 12(7.05%) were found to have history of surgeries including tubectomy, haemorrhoidectomy, hernia etc., 3(1.76) were found to have Asthma/COPD, 4(2.35%) were found to have IHD and 8(4.70%) were found to have other conditions including obesity, fatigue, chronic constipation, Parkinson's disease, retroviral disease etc. Among the study population, 97(57.05%) were found to have no significant medical history.

Among the study population 37(21.7%) patients were diagnosed with Appendicitis, 36(21.17%) were diagnosed with Cholelithiasis, 35(20.58%) were diagnosed with Hernia, 11(6.4%) were diagnosed with Fissure in ano and 9(5.29) were diagnosed with Haemorrhoids. These were found to constitute major part of the diagnosis.

Among all the procedures conducted in the study subjects, 37 (21.76%) underwent Appendicectomy, 36 (21.17%) underwent Cholecystectomy and 35 (20.58%) underwent

Meshplasty/Hernioplasty. These were the common procedures that were indicated in these patients.

Antibiotics prescribed

Antibiotics prescribed to the patients as pre-operative prophylaxis were identified. Table 01 shows the list of antibiotics which were prescribed as first line pre-operative prophylaxis. Ceftriaxone was found to be the most commonly used antibiotic where 56(32.9%) patients were administered with it. Ceftazidime(29.14) was the second most commonly prescribed antibiotic followed by Cefoperazone(17.64%), Piperacillin(8.82%) and Metronidazole(5.88%). 6 patients were given with Cefuroxime and 4(2.35%) were given with Cefazolin. Other anitbiotics were also prescribed which was inclusive of Amoxicillin, Clindamycin, Imipenem and Meropenem. A total of 146 patients receives cephalosporin antibiotics, 16 patients received Penicillin antibiotics, 2 patients received carbapenem antibiotics and 11 patients received antibiotics from other classes which included metronidazole and clindamycin. Some these patients received a combination of 2 or 3 antibiotics.

Table 1: Antibiotics prescribed (first line)

Antibiotics	**Total number of subjects n=170 [n(%)]**
Cephalosporins	
First generation	
Cefazolin	04(2.35)
Second generation	
Cefuroxime	06(3.52)
Third generation	
Ceftriaxone	56(32.9)
Cefoperazone	30(17.64)

Ceftazidime	50(29.41)
Penicillin antibiotics	
Piperacillin	15(8.82)
Amoxicillin	01(0.58)
Carbapenems	
Imipenem	01(0.58)
Meropenem	01(0.58)
Others	
Clindamycin	01(0.58)
Metronidazole	10(5.88)

Among all 170 patients enrolled in this study, 70 were prescribed with a second line of antibiotic. Metronidazole [40 patients (23.52%)] was most commonly used as second line antibiotics in patients undergoing abdominal surgery followed by Tinidazole which was received by 10(5.88%) patients. Other antibiotics prescribed among surgical patients were found to be Cefoperazone(1.76%), Ceftriaxone(3.52%) and Piperacillin(4.77%).

Among the 70 patients, 50 received Nitromidazole antibiotics including Tinidazole and Metronidazole followed by 12 patients received cephalosporin antibiotics and 8 patients received antibiotics from other classes which included amikacin, amoxicillin and levofloxacin.

Table 2 :Antibiotics Prescribed(second line)

Antibiotics	**Total number of subjects n=170[n(%)]**

Nitromidazole	
Tinidazole	10(5.88)
Metronidazole	40(23.52)
Cephalosporins	
Second generation	
Cefuroxime	01(0.58)
Third generation	
Cefoperasone	03(1.76)
Ceftriaxone	06(3.52)
Cefuroxime	01(0.58)
Ceftazidime	01(0.58)
Others	
Amikacin	06(3.52)
Amoxicillin	01(0.58)
Levofloxacin	01(0.58)

Prevalence of Surgical Site Infection

The mean duration of antibiotic therapy in the subjects were found to be 6(5.55) days. Among 170 patients, 128(75.2%) patients underwent clean surgical procedures, 18(10.5%) patients underwent Clean Contaminated and 24(14.1%) patients underwent contaminated surgical procedures. These categorizations were according to the type and nature of surgical incision made.

Six months of the study involving 170 surgical patients revealed 2 patients to have developed Surgical Site Infections. Among the two patients, one of them developed an SSI after a Modified Radical Mastectomy (MRM) and was treated with Linezolid, Ceftriaxone and

Amikacin. The second patient developed an SSI after cholecystectomy and was treated with Linezolid and Clindamycin.

The Prevalence of SSI in these patients were calculated to be,

Prevalence = Number of patients with SSI/Study population

= 2/170

= 0.011

The Prevalence was found to be 0.011. The findings of our research study reflected that the current surgical antibiotic therapy in the present population was found to be effective

Table 3. Prevalence of Surgical site infection

Demographics	**Total number of subjects** **n = 170**
Duration of therapy (SD)	5.55 days
Type of surgery [n(%)]	128(75.2)
Clean	18(10.5)
Clean contaminated	24(14.1)
Contaminated	
Surgical Site Infection[n(%)]	
Yes	2(1.17)
No	118(69.4)
Maybe	52(30.2)

CONCLUSION

The study concluded that third generation cephalosporin antibiotics, among which Ceftriaxone was most commonly prescribed, were the drug of choice for pre-operative prophylaxis in surgical patients irrespective of the type of procedure. Metronidazole was found to be the most commonly used second line antibiotic which was indicated in abdominal surgeries. The prevalence of SSI in the chosen population was found to be lower. Hence, the inference made from this research study was that the antibiotic therapy in surgical patients was effective in preventing SSIs.

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