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A study to evaluate and assess the antibiotic prescription pattern for the surgical prophylaxis to prevent post-operative wound infection (SSI) in a tertiary care hospital

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ABSTRACT

Surgical site infection is a major complication following surgery affecting up to 50 % of operated patients which can be prevented by appropriate antibiotic prophylaxis. Hence this study aims to investigate the pattern of the prophylactic antibiotic usage in patients undergoing elective surgery and to assess the percentage of drugs included in the National List of Essential Medicines (NLEM). This is a Prospective study conducted at Saveetha Medical College and Hospital from April 2018 to April 2019 included medical records of 1093 Patients above 18yrs of age including both sex (male and female) who has undergone elective surgery in Department of General Surgery. Patient's demographic data and comorbidities was also collected and verified for antibiotic prophylaxis, i.e. choice and duration of antibiotics, time of administration, intra-operative dosing, choice and duration of the postoperative use. Pediatrics, Neonatal Surgeries, Pregnant and lactating women were excluded from this study. The obtained data was analyzed, and conclusions were drawn with the help of SPSS analysis software. The results shows Third-generation cephalosporin's injection Taxim (Cefotaxime) was mainly used preoperatively in 486(44.46%) patients by intravenous route followed by cefixime-191(17.47%),ciprofloxacin-161(14.73%). This study revealed that third-generation cephalosporin Cefotaxime was considered as the main pre and post-operative drug, which is based on surgeon's experience, type of surgery and local antibiotic resistance pattern. Various measures like the development of local hospital Policy, surveillance on SSIs, hospital antibiotic policy, promoting good surgical techniques and strict asepsis in the operating theatre, usage of single antibiotics, and completion of course of antibiotics can prevent the emergence of multi-resistant organisms.

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INTRODUCTION

The centers for disease control and prevention (CDC) term for infections associated with surgical procedures was changed from surgical wound infection to surgical site infection (Horan *et al.*, 1992). Incisional site infection are further divided into superficial (skin and subcutaneous tissue) and deep (deep soft tissue-muscle and fascia). Surgical antibiotic prophylaxis (SAP) refers to a course of an antibiotic initiated to patients just a few days prior to the operative procedures to prevent postoperative

surgical site infections because complications associated are with significant morbidity and mortality. Surgical site infections (SSIs) are the most common nosocomial infection, accounting for 38% of all infections among surgical patients(The Lancet Infect Diseases). Prevention of infection in patients undergoing a surgical procedure is of great challenge, and the best way to prevent such infections is the administration of appropriate antibiotics preoperatively. The guiding principle of systemic antibiotic prophylaxis is the belief that antibiotics in the host tissues can augment natural immune defence mechanisms and help to kill bacteria that are inoculated into the wound. Every effort should be made to ensure that adequate antibiotic levels are maintained above the minimum inhibitory concentration (MIC) of the pathogens of concern throughout the surgical procedure. (The Lancet Infect Diseases)

The main aim of prophylactic antibiotics is not eradicating pathogen but to achieve an immunity, level to eliminate possible infection caused from potential microorganism without any effect on microbial flora.

SSI incidence rates are reported at 2-20% annually. Kirkland et al. reported that at least 5% of patients undergoing surgical procedure develop SSI. Usage of prophylactic antibiotics to prevent postoperative infections is important because it reduces the incidence of infections, duration of stay in the hospital, side effects, cost of treatment, mortality, and helps the patient to return to routine life as early as possible.

Surgical antibiotic prophylaxis is widely accepted practices in surgery, and approximately 30-50% of the antibiotics used in hospitals for surgical prophylaxis is inappropriate. Nationalauthority'sguidelines such as the American Society of Health-System Pharmacists (ASHP), Society for Healthcare Epidemiology of America (SHEA), Infectious Diseases Society of America, recommends administration of antimicrobial agents 60 minutes (1 HOUR) prior to incision is enough. (ASHP guideline).Post-surgery when SSI occurs, it increases mortality, hospital re-admissions, duration of stay and charges, increase nearly 60% to the admitted patients to receive various antibiotics resulting in nosocomial infections and emerging of multidrug resistance organisms.

Hence hospital infection control committee should monitor the hospital antibiotic status, and susceptibility profiles regularly to observe if any change in trends in the development of multidrug resistance organisms. Post-operative wound differs from other wounds because they are anticipated and treatment is standardized depending upon the surgery performed, especially in patients with co-morbid conditions. Since the wounds are predictable, prior action can be taken beforehand(Prophylaxis) to reduce the complications, if not serious complications like infections, inflammations, permanent tissue injury resulting in life-threatening conditions like sepsis may occur. Prolonged antibiotic prophylaxis (more than 2 days) and Unnecessaryusage of antibiotics has been associated with a significant risk of emergence of antimicrobial resistance.

According to Karlatti and Havannavar (2016), Poor adherence to antibiotics has been reported by some studies, specifically in the area of the inappropriate antimicrobial selection and over-usage. Hence, this study was chosen to examine the prevalence of antimicrobial practices regarding the choice and usage of antimicrobial agents for surgical prophylaxis with respect to the type of surgical procedure involved, intraoperative dosing, its timing and the total duration of the administration of prophylaxisin our hospital. Hence to prevent these risk factors, antibiotic prophylaxis is a must in these situations, and this study is totally based on it.

MATERIALS AND METHODS

After obtaining institutional ethical committee's approval, a Prospective study conducted at Saveetha Medical College and Hospital from April 2018 to April 2019 included medical records of 1093 Patients above 18yrs of age including both sex(male and female) who has undergone elective surgery in Department of General Surgery. Pediatrics, Neonatal Surgeries, Pregnant and lactating women were excluded from this study. Respective Unit chiefs of surgery department was informed about the study, and their consent was obtained to record the patient's data. The relevant patient demographic details, co-morbidities and operative procedure-related information was also collected. Those case sheets with in-appropriate data were excluded. The collected data from the case sheets was entered into the excel sheet, and it was analysed by appropriate statistical methods by using SPSS software, and it was expressed in terms of averages, standard deviation, ratios and proportions.

RESULTS AND DISCUSSION

Of the total 1093 patients, 726 were males (66.42%), and 367 were females (33.58%) with a gender ratio of 1.98:1.Average(mean) age was 41.51 year (range -18 to 77 years)Tables 1, 2, 3, 4 and 5.

Table 1: Types of surgeries performed

Type of surgery	Percentage(%)
Hernia Repair(Meshplasty)	41
Appendectomy	25
Fissure in anus correction	11
Diabetic Foot Ulcer wound debridement	11
Cholecystectomy	8
Others	4

Table 2: Co-morbidities status of patients

Co-morbidities status	
Co-morbidity	Number
Smoking	127
Hypertension(HT)	174
Diabetes Mellitus(DM)	327
COPD	27
DM + HT	89
Obesity (BMI>30)	106

Table 3: The Percentage of antimicrobial agents used during the pre-operative period

	Pre-operative	
Drug	Dose & Route	No.of.cases
Cefotaxime	1gm IV OD BD	486
Cefixime	200mg IV BD	191
Ciprofloxacin	200mg IV BD	161
Cefaperazone+Sulbactam	1.5gm IV OD	125
Amoxicillin + clavulanic acid	1.2gm IV BD	71
Piperacillin+Tazobactam	2.25gm IV BD	33
Imipenam	500mg IV OD	8
Linezolid	600mg IV BD	2
Gentamicin	IV OD	2
Vancomycin	IV OD	3
Ceftriaxone	1gm IV OD/BD	11

Table 4: The combination pattern of the antibiotic

Combination	No of cases
Cefotaxime + Metronidazole	207
Cefotaxime + Inj.TT	131
Ciprofloxacin + Metronidazole	57
Amoxicillin-clavulanic acid + Inj.TT	41
Ciprofloxacin +Inj.TT	19
Cefixime + Metronidazole	3

Table 5: The antibiotics usage at post-operative period (parameters like drug, route, dose, frequency)

	Post-operative		
Drug	Dose & route	Duration	No.of cases
Cefotaxime	1gm IV BD	5 Days	461
Cefixime	200mg IV BD	5 Days	186
Ciprofloxacin	200mg IV BD	5 Days	186
Cefaperazone+Sulbactam	1.5gm IV BD	5 Days	109
Amoxicillin Clavulanic acid	1.2gm IV BD	5 Days	74
Piperacillin+Tazobactam	2.25gm IV BD	5 Days	44
Imipenam	500mg IV	5 Days	11
Linezolid	600mg IV BD	5 Days	2
Ceftriaxone	1gm IV BD	5 Days	2

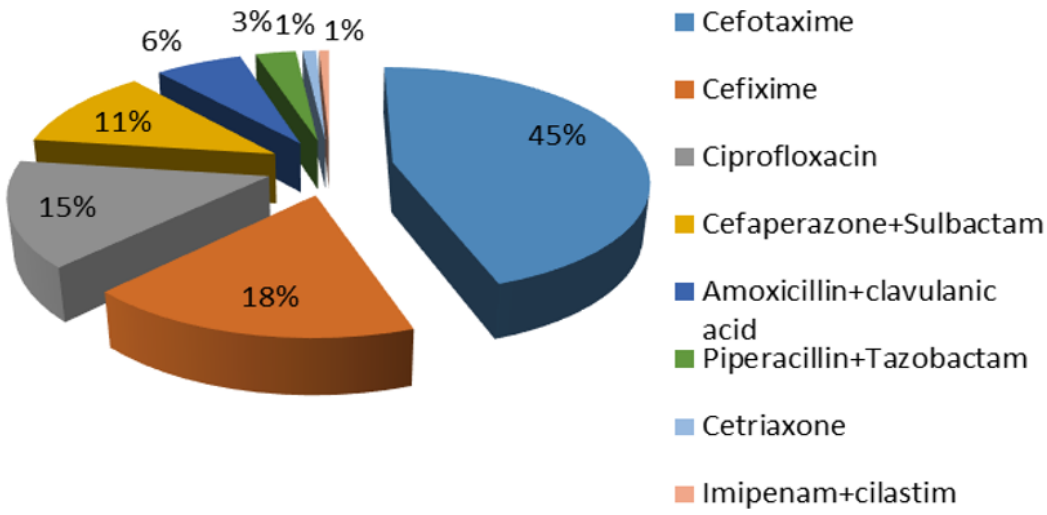
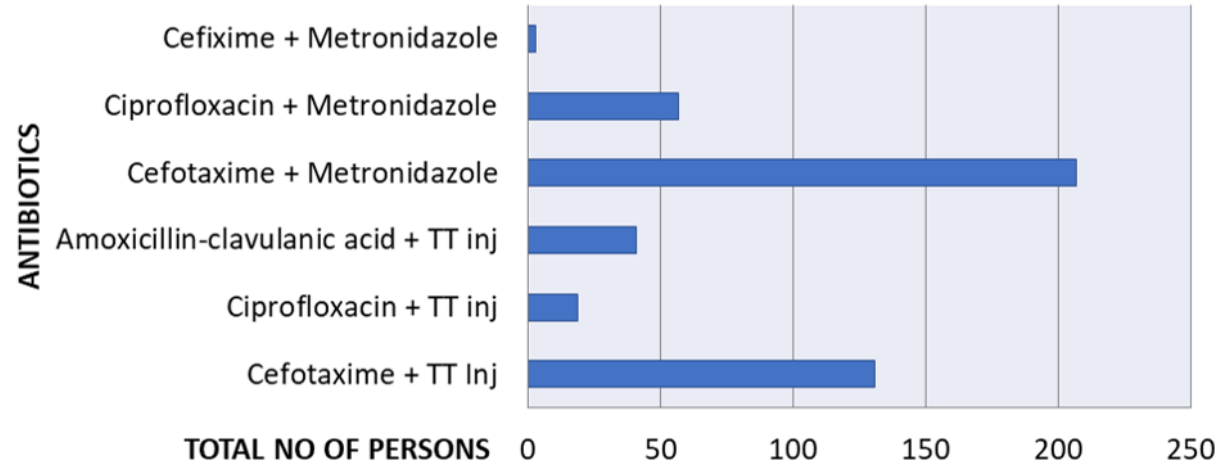


Figure 1: The various antibiotics prescribed in the pre-operative period

It was not until the late 1860s after Joseph Lister introduced the principles of antisepsis that post-operative infectious morbidity decreased substantially. Lister's work radically changed surgery form an activity associated with infection and death to a discipline that could eliminate suffering and prolong life (Mangram *et al.*, 1999). The main aim of our study is to investigate the pattern of the prophylactic antimicrobial agent used for the prevention of SSI and other parameters like time of administration, dose& durations. Cases with preoperative infections and those with different parameters of prophylaxis, such as preoperative choice of the antibiotics, its timing and duration, choice and the duration of the postoperative prophylaxis along with patient's demographic data and co-morbidities was collected. The CDC (center for disease control) guidelines, USA were used to identify surgical site infection.

SSI was identified in 25 cases, and overall incidence in our study is 2%, which is quite compatible with other studies and type of surgery undertaken has an important role in the development of SSI. SSI affects all the age group from 5 to 60 years, and the rate of incidence is maximum among 50 to 60 years and maximum cases belonging to 20 to 40 years (Karlatti and Havannavar, 2016). Incidence of SSI is common among patients with age-related risk factors and comorbidities, i.e., old age, anemia, obesity-associated co-morbidities like diabetics and Hypertension. (Rao and Harsha, 1975) study showed that the incidence of SSI doubled in Older age group, i.e. 60 to 70 years. In the present study, 15 infected patients were 60 years, and 10 cases were between 50 to 60 age group. Various studies showed that there is a direct relationship between infection rate and the length of operating time. Rate of infection



	Cefotaxime + TT Inj	Ciprofloxacin + TT inj	Amoxicillin-clavulanic acid + TT inj	Cefotaxime + Metronidazole	Ciprofloxacin + Metronidazole	Cefixime + Metronidazole
No.of cases	131	19	41	207	57	3

Figure 2: The Antibiotics Usage at Pre-Operative Period (Parameters Like Drug, Route, Dose, Frequency)

of clean wound double with every hour of operated time. In our SSI cases, all of them were due to infection at the hernia repair site(i.e. Due to infection of the mesh). Few days following surgery, patients had a fever, abdominal pain, discharge from the operating site. Ultrasound was done for few patients to rule out any pus collection around a surgical site. If pus collection is proven, immediate explantation of mesh was done, and pus was sent for acid-fast staining, culture and for antibiotic susceptibility testing for the identification of the causative organism. 5 patients with SSI, were managed by wound dressing with or without suture removal depending upon the severity of the infection.

Of 1093 patients, Hernia correction surgery 25%, Appendectomy 25%, Diabetic foot ulcer wound debridement 11%, Fissure in anus repair 11%, Cholecystectomy 8%, other procedure like lipoma, hydrocele correction, cellulitis, sebaceous cyst 4% was seen (illustrated in Table 1). Prior to the surgery, a few cases in our study received prophylactic antibiotics, even though prophylactic antibiotics are not indicated for clean surgical procedures. Ideally recommended route in most of the cases is intravenous as it produces a reliable amount of tissue concentrations and based on operating surgeon's clinical experience, antibiotics are selected and started empirically. In severely infected cases (Diabetic foot ulcer), wound swab was sent and depending upon the isolated organism, and drug susceptibility profile antibiotics was started.

Third-generation cephalosporin's cefotaxime(taxim) given pre operatively and post operatively was the most commonly used antibiotics in our hospital and contribute to 44.46%. It was also combined with metronidazole and injection TT (0.5CC IM) in 207(18.93%) and 131(11.98%) patients, respectively. Combination of Broad-spectrum antibiotics and Metronidazole has also been recommended in the surgical prophylaxis, to provide an adequate anaerobic cover.267(24.42%) Patients received metronidazole along with their first pre-operative drug and 191(17.47%) received tetanus toxin injection-0.5cc intramuscularly. Depending upon the type of surgery and surgeons clinical experience Cefotaxime(44.46%), Cefixime (17.47%), Ciprofloxacin(14.73%), Cefaperazone+Sulbactam(11.43%), Amoxicillin+ Clavulanic acid(6.49%) and other drugs like Piperacillin+tazobactam, imipenam, ceftriaxone, linezolid and aminoglycosides (gentamicin,vancomycin) was also used in few selective cases. A study showed that all patients received two-dose (i.e. first dose was given in the previous day of the surgery(overnight), and the second dose was given an hour before surgery.

Before the pre-incisional dose,251(23%) patients were receiving antimicrobial agent from the time of

hospital administration. Among them, metronidazole was prescribed to 15.82% of the cases and Cefotaxime and amoxicillin-clavulanic acid in 5.39% and 1.7% cases respectively.

Intraoperative antibiotics was not given to any patients, as the duration of the surgery did not exceed the recommended duration. Usually, a single dose of the antibiotics is found to be sufficient and reliable if the duration of the surgery is four hours or less (Karlatti and Havannavar, 2016).

When it comes to post-operative drug pattern,267 patients who were prescribed metronidazole at their pre-operative period were also prescribed metronidazole as one of the drugs in their post-operative period. An antimicrobial agent used in the post-operative period, its route, dose, timing, frequency and duration of administration was illustrated in Table 5. Among 1093 patients, 102 patients were changed from their pre-operative drug and prescribed another antimicrobial agent. The reason for this change is unclear (Borade and Syed, 2017).

Appropriate antimicrobial therapy is possible only with proper culture and sensitivity. Multidrug-resistant organisms are becoming increasingly associated with nosocomial infections. To prevent the emergence of multidrug-resistant in Hospitals and high-risk settings like intensive care units, Hospital Infection Control Committee should formulate local antibiotic Policy and surveillance on SSIs such as usage of single antibiotics, completion of course of antibiotics, promoting good surgical techniques and strict asepsis in the operating theatrened to be improved. Local antibiotic data of the susceptible organism should be updated at least yearly once, to facilitate and optimize the recommendations for the empirical therapy of antibiotics (Karlatti and Havannavar, 2016).

CONCLUSION

The overall incidence of SSI in our study is 2%which is quite compatible with other studies, this could be because of good clinical and surgical technique, strict aseptic conditions, less handling of tissue, and proper usage of prophylactic antibiotic policy followed here.

Efforts were taken to decrease the duration of surgery without compromising the patient's safety and outcome.

1. Prophylactic single-dose antibiotics can be administered within30 minutes prior to incision and have the desired safety from surgical site infection.
2. Complicated, contaminated, or dirty procedures should receive additional postoperative coverage
3. Regular monitoring of intensive care and medical wards
4. Proper usage of sterilization and disinfectants
5. A complete examination of poor-risk patients should be done, and appropriate care should be given to them to withstand the surgical pressure.
6. Postoperative care and a good immune response would help in decreasing the occurrence of SSI in the old age group of patients.
7. Periodic surveillance of SSI by the Infection Control Committee helps in laying strict guidelines for a further decrease in the incidence of SSI, which is an indicator of health care in a hospital to patients.

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