

RESEARCH ARTICLE

Study on use of antibiotics for prophylaxis of surgical site infection and compare with standard guidelines

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ABSTRACT

Background: Surgical site infection (SSI) is an infection that occurs at or near a surgical incision within 30 days of surgery or within 1 year if an implant is left in place. In low- and middle-income countries, SSI incidence may be approximately up to 4 times higher than in high-income countries. Proper choice of antibiotic is very important to prevent SSI. **Aims and Objectives:** This study was conducted with objectives to know the incidence of SSI, to study the use of various antibiotics for the prevention of SSI, and to compare the data with standard guidelines. **Materials and Methods:** An observational, prospective study was conducted after getting ethical clearance. All the patients, admitted in post-operative surgical wards, were enrolled in the study over the period of 2 months after getting informed consent. Data were collected from pre-formed Google questionnaire filled by the patients and indoor patients' file evaluated further. **Results:** Out of 198 enrolled patients, 192 patients were given antibiotics as single drug or in combination of two or three. Overall incidence of SSI was 7.57%. The highest incidence rate of SSI was reported in general surgery department, 12.69%. Cefazolin was prescribed as surgical antibiotic prophylaxis (SAP) in all the cases of general surgery. Out of 198, a total of 128 (64.64%) patients were given a single drug as prophylactic antibiotic. In total 124 patients, the duration of antibiotic prophylaxis was <24 h. **Conclusion:** There should be a preparation of local guidelines, language, region, and microbial susceptibility specific, with the support of local surgical, anesthetists, obstetrics, and orthopedic groups for proper use of SAP to prevent SSI.


KEY WORDS: Surgical Site Infection; Surgical Antibiotic Prophylaxis; WHO Guidelines; Cefazolin

INTRODUCTION

Surgical site infection (SSI) is an infection that occurs at or near a surgical incision within 30 days of surgery or within 1 year if an implant is left in place.^[1,2] SSIs are one of the most common nosocomial infections in surgical patients. It accounts approximately 500,000 infections annually.^[3] By

contrast, it is also easily preventable condition if proper care is taken.

There are various common pathogens which can lead to SSIs, such as Staphylococcus aureus, coagulase-negative staphylococci, enterococci, and Group B streptococci. SSIs are very common and occur in 2–5% of surgeries involving incisions in the United States.^[3] There is difference in occurring of SSIs according to the type and duration of surgery. Global estimate of SSI, according to studies, is from 0.5 to 15%. In low- and middle-income countries (LMIC), SSI incidence may be approximately up to 4 times higher than in high-income countries.^[4] In India, it ranges from 23 to 38%, which becomes one of the major concerns for a surgeon after an operation. Nowadays,

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it is one of the important causes of hospital-acquired infections.^[5]

During the first 8 weeks after hospital discharge, the cost of care for patients with SSIs is nearly three-fold higher than that without the infections.^[3] These infections reduce patients' quality of life, prolonged hospital stay, and even readmission to hospital postoperatively and more than \$1.6 billion in excess costs annually, overall.^[6,7] Furthermore, patients who develop SSIs, 60% more likely to spend time in the intensive care unit, and twice as likely to die compared with surgical patients without the infections.^[8]

Surgical antibiotic prophylaxis (SAP) is antibiotic given prophylactically to prevent SSIs. There are various guidelines suggesting types of antibiotics that are required for the prevention of SSI. Proper choice of antibiotic is very important to prevent SSI. The aim of the current study is to create data about choice of antibiotic for SAP and help in reducing the severity and impact of SSIs on the health and wealth of the population in India.

MATERIALS AND METHODS

It was observational prospective type of study conducted after getting institutional ethical clearance. All the patients, admitted in post-operative surgical wards, were enrolled in the study over the period of 2 months after getting informed consent. Data were collected by pre-formed Google questionnaire filled by the patients and indoor patients' file. All the data were entered into MS office Excel 2010 and evaluated further.

RESULTS

A total of 198 patients were enrolled and evaluated further. Reported incidence of SSI was 7.57% (15 out of 198) [Figure 1], while rest of 183 patients were discharged healthy. Out of 198 patients, a total of 192 patients were given the antibiotics, while remaining 6 patients were not given any antibiotic. Among these 6 patients, none of the patient developed SSI. Most of the cases were from general surgery, followed by orthopedic, gynecology, and obstetrics. The highest incidence rate of SSI was reported in general surgery department, 12.69%. Cefazolin was prescribed as SAP in all the cases of general surgery [Table 1].

Out of 198, a total of 128 (64.64%) patients were given a single prophylactic antibiotic, i.e., either cefazolin, cefoperazone, moxifloxacin, or ceftriaxone. In total 43 (21.71%) patients, combination of two antibiotics was given. Ceftriaxone + Amikacin was most commonly prescribed combination in total 29 patients for SAP. A total of 21 patients were given Ceftriaxone + Metronidazole + Amikacin combination (three drugs regimen) as SAP in gynecology department. No antibiotic was given in six patients [Figure 2].

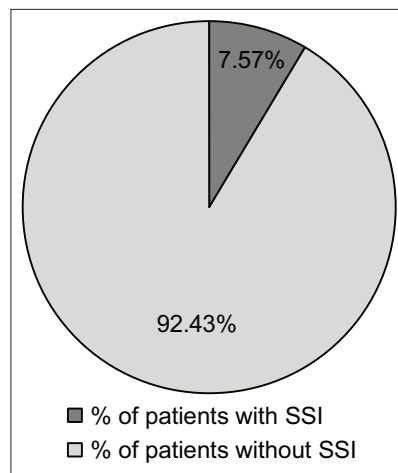


Figure 1: Total percentage of patients with surgical site infection

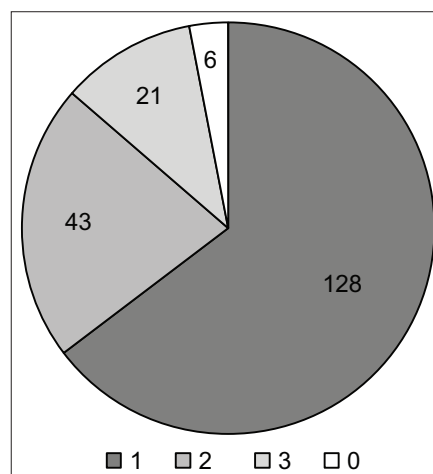


Figure 2: Total number of antibiotics given in patients

All the antibiotics were prescribed $\frac{1}{2}$ h before surgical incision. Out of 192 patients, in 124 patients, duration of antibiotic prophylaxis was <24 h, while in remaining patients, it was >24 h [Table 2].

DISCUSSION

SSIs are health burden on society by prolonging hospital stay or by readmitting patients to the hospital. Prevention of SSI is very important for improving health and reducing economic loss of patients. Antimicrobial therapy is the gold standard to prevent any infections. They are categorized as per Figure 3.^[9]

SAP is useful in prevention of SSIs in patients undergoing surgeries. To understand the value of giving prophylactic antibiotics, we enrolled 198 patients over a period of 2 months admitted in all surgical wards and evaluated further in our study. Out of 198 patients, a total of 192 patients were given SAP and a total of 177 patients were discharged healthy who received SAP. SSI incidence rate in our study was 7.57%. The highest incidence rate of SSI was reported in general surgery department, 12.69%. Cefazolin was prescribed as SAP in all

Table 1: Different types of given antibiotics and reported cases of SSI per department

Name of department	Type of antibiotics given	Number of patients given antibiotic	Reported number of SSI (%)	No antibiotic given
General surgery	Cefazolin	60	8 (12.69)	3
Orthopedic	Cefoperazone	44	5 (10.6)	3
Gynecology	Ceftriaxone+Metronidazole	8	--	--
	Ceftriaxone+Amikacin	7	2 (5.55)	
	Ceftriaxone+Amikacin+Metronidazole	21	--	
Cardiothoracic surgery	Ceftriaxone+Amikacin	22	--	--
Ophthalmology	Moxifloxacin	20	--	--
Pediatric	Metronidazole+Gentamicin	6	--	--
Emergency	Ceftriaxone	4	--	--
		192	15 (7.57)	6

SSI: Surgical site infection

Table 2: Effect of duration of SAP on incidence of SSI

Duration	Reported SSI (%)	Not reported SSI (%)	Total
<24 h	6 (4.9)	118 (95.1)	124
>24 h	9 (13.2)	59 (86.8)	68
Total	15	177	192

SSI: Surgical site infection, SAP: Surgical antibiotic prophylaxis

the cases of general surgery. In total 124 patients, duration of antibiotic prophylaxis was <24 h.

Incidence rate of SSI, for example, 7.57%, in our study, is less than the study done in India, 2016, a review of the prevention of SSIs in Indian hospitals based on global guidelines for the prevention of SSI, by Aroma *et al.*^[5] It was done in only one tertiary care teaching hospital. Further research on incidence rate of SSI, all over India, can help us to find out the exact incidence in recent times.

In our study, most of the cases of surgeries were from general surgery department followed by orthopedic, obstetrics, and gynecology. In all the cases of general surgery, prescribed antibiotic for SAP was cefazolin, while cefoperazone was prescribed as SAP in all the cases by orthopedic department. Ceftriaxone + Amikacin was the prescribed combination for SAP in cases of SSI in gynecology department. According to the American Society of Health-System Pharmacists (ASHP) guidelines and the WHO guidelines, recommendation for SAP varies with various departments and various procedures as per Table 3:^[9-11]

According to guidelines, cefazolin or cefuroxime is the first-line antibiotic in most of the procedures. Ideally, the second-line antibiotics should be used in cases of allergy to penicillins/cephalosporins.^[11] In our study, despite giving cefazolin as SAP with proper guidelines in general surgery department, incidence rate of SSI was 12.69%. It clearly indicates antibiotic resistance in microbes. A total of 62

patients received ceftriaxone in various departments, either as single agent or in combinations. Another third-generation antibiotic, cefoperazone, was given as SAP in all the 44 cases of orthopedic surgeries. Out of these, a total of seven patients developed SSI despite giving third-generation cephalosporins. Ceftriaxone should not be used for SAP as it belongs to antibiotics category listed in the WHO access and watch groups.^[11,12] Hence, the use of ceftriaxone and other antibiotics as first-line antibiotic in LMICs is inappropriate. In addition, it is included in the WHO highest priority, critically important antimicrobials list as third-generation cephalosporin and thus has a high risk of selection of bacterial resistance (in particular, extended spectrum beta-lactamase-producing enterobacteriaceae).^[13] It is also inferior to cefazolin for methicillin-sensitive *S. aureus* and creates an unnecessary risk of collateral damage to the gut flora.^[11] Therefore, its use should be limited to therapy of severely infected conditions and not as prophylaxis. Such rampant use of therapeutically highly useful third-generation cephalosporins (ceftriaxone and cefoperazone) for prophylaxis should be discouraged to prevent antimicrobial resistance against them.

In our study, combinations used for SAP were, Ceftriaxone + Amikacin (in 29 patients), Ceftriaxone + Metronidazole + Amikacin (in 21 patients), Ceftriaxone + Metronidazole (in 8 patients), and Metronidazole + Gentamicin (in 6 patients). According to the WHO criteria, combination of aminoglycosides (gentamicin or tobramycin) with metronidazole should be preferred over other, as second line of prophylaxis.^[11] Combinations of antibiotics, particularly containing ceftriaxone, should not be used to prevent SSI. Such combinations have no prophylactic benefits, rather they will increase antimicrobial resistance, adverse effects, and cost to the patient. Such economic burden on patient due to the use of antibiotics combinations can be avoided.

In our study, all the patients were given SAP minimum ½ h before surgical incision. Proper pre-operative timing, that is ½ h to 120 min before incision, and duration of <24 h should

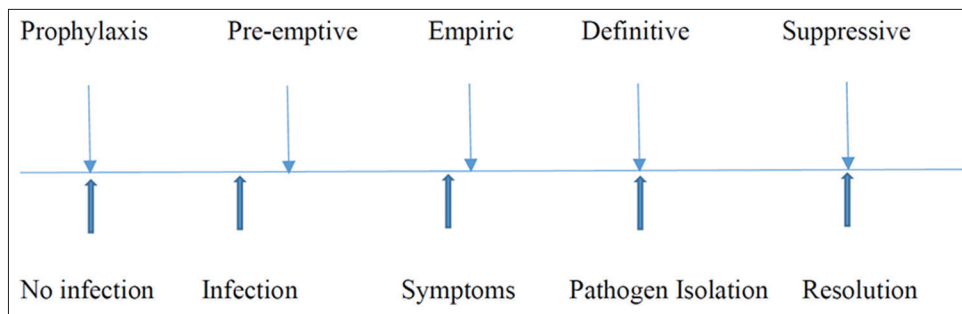


Figure 3: Types of antimicrobial therapy

Table 3: Comparison of various guidelines for surgical antibiotic prophylaxis

Type of procedure	ASHP guidelines		WHO guidelines		Goodman and Gilman
	First line	Second line*	First line	Second line*	
Cardiothoracic surgery procedures	C	Cl, V	C	V	C
Gastroduodenal or upper gastrointestinal tract surgery	C	Cl, V	C	Cl+G	C
Small intestines	C+M	M+A	C+M	M+G	C+M
Colorectal	C+M	Cl+A	C+M	G+M	C+M
Ophthalmic	Moxi				
Orthopedic	C	Cl, V	C	V	C
Cesarean delivery or hysterectomy	C	Cl+A	C	Cl+G	C

*If proven allergy to penicillins/cephalosporins. C: Cefazolin, Cl: Clindamycin, V: Vancomycin, G: Gentamicin, M: Metronidazole, Moxi: Moxifloxacin, A: Aminoglycosides, ASHP: American Society of Health-System Pharmacists

be preferred to give antibiotic for SAP.^[14-16] In our study, a total of 68 patients were given SAP for >24 h and SSI was reported in nine patients among them, while only six patients developed SSI, out of total 124 patients, who received SAP for <24 h. It clearly suggests that increase in duration of SAP for >24 h is not always clinically beneficial.

Small study population and lack of laboratory testing for antimicrobial resistance are limitations of our study.

CONCLUSION

Proper choice of antibiotic is highly dependent on region specific susceptibility of microbes. Hence, there should be preparation of local guidelines, which are language, region, and microbial susceptibility specific, with the support of local surgical, anesthetist, obstetric, and orthopedic groups for proper use of SAP to prevent SSI, one of the most common hospital-acquired infection and burden on the patients.

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