Original Article

Antimicrobial prophylaxis uses and incidence of surgical site infection in Jayanagar General Hospital, Bangalore, India

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Abstract

Objective: Wound infections are the commonest hospital-acquired infections in surgical patients. The aim of the present study was to evaluate the pattern of antimicrobial prophylaxis in general surgery in Jayanagar general hospital, Bangalore, India. **Method:** It is a prospective, observational study. The data were collected from 180 patients who satisfied inclusion and exclusion criteria in Jayanagar General Hospital. During the study, 180 prescriptions were studied and patient records were collected and analyzed using SPSS and Microsoft excel. **Result:** The patients were taken a crack at the investigation. More frequently used antibiotics are cefotaxime, ceftriaxone, and amikacin. About 98% of patients who undergo minor or major surgery received antibiotics. Among them, 27.22% received amikacin and cefotaxime, 12.22% received ceftriaxone and metronidazole, 12.22% received cefotaxime and metronidazole, and 10.55% received amikacin and ceftriaxone. About 20.5% received the triple combination. Among 180 patients, 37 patients were treated with one antibiotic, 120 patients were treated with two antibiotics, and the rest of 23 patients with three antibiotics and more; among them patients treated with single antibiotics had a high incidence of SSI. **Conclusion:** The study finished up about the abuse and inappropriate selections of antibiotics. Henceforth, our study likewise proposes following the guidelines for judicious utilization of antibiotics, and limiting inappropriate antibiotic use is the most ideal approach to minimize the odds of SSI. The clinic ought to set up prophylactic antibiotics guidelines which ought to be open and open by each individual from the careful group. The medical checklist ought to be polished viably. Incessant review of prophylactic antibiotic use is expected to improve legitimate practices (prophylactic antibiotics employments). Surgeons should adhere to prophylactic antibiotics guidelines.

Keywords: Infection, surgical antimicrobial prophylaxis, surgical site infections

Introduction

Health Care-Associated Infections (HAIs) remain an important public health concern. Amongst the prominent HAIs, Surgical Site Infections (SSIs) contributed to a substantial rate of mortality, significant morbidity, considerable prolongation in the length of hospitalization, and added treatment expenses.[1]

Wound infections are the commonest hospital-acquired infections in surgical patients. They result in increased antibiotic usage, increased costs, and prolonged hospitalization.[2] Appropriate antibiotic prophylaxis can reduce the risk of postoperative wound infections, but additional antibiotic use also increases the selective pressure favoring the emergence of antimicrobial resistance.[3]

Surgical antibiotic prophylaxis is defined as the use of antibiotics to prevent infections at the surgical site. It must be distinguished from pre-emptive use of antibiotics to treat early infection, for example, perforated appendix, hernia, and so forth, though the infection may not be clinically apparent. The original surgical

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antibiotic prophylaxis experiments were performed 40 years ago in pigs. The results concluded that 'the most effective period for prophylaxis begins when the moment bacteria gains access to the tissues and is over in 3 hours. Since then there have been many studies in animal models and humans undergoing surgery. This has resulted in the principles of antibiotic prophylaxis becoming an accepted part of surgical practice.[4]

Approximately 30–50% of antibiotic use in hospital practice is now for surgical prophylaxis. However, between 30% and 70% of this prophylaxis is inappropriate. Most commonly, the antibiotic is either given at the wrong time or continued for too long. Controversy remains as to the duration of prophylaxis and also as to which specific surgical procedure should receive prophylaxis.[5]

Antibiotic prophylaxis is part of a set of measures that aim to reduce SSI incidence. The main aim of antibiotic prophylaxis is to reduce the bacterial load in the wound and to assist the natural host defenses in preventing SSI7. Proper use of antibiotic prophylaxis in the perioperative period may reduce the rate of this complication by up to 50%.[6]

Implementation of these guidelines is a bigger problem in developing countries like ours; Physicians are bounded by many factors including patient burden, competitive business strategies, and pharmaceutical companies. Pharmacists on each level are vital for implementing levelheadedness in drug use; qualified pharmacists with expert specialized abilities work with the execution of proof-based antimicrobial prescribing. A clinical pharmacist plays a vital role to minimize the incidence of SSI, reduce the cost, and appropriate use of an antimicrobial agent to prevent cases of resistance. He re-evaluates the doses and interval and duration of drug used. This study also demonstrated that antimicrobial surgical prophylaxis works with focused intervention by educating surgeons along with co-workers to reduce SSI.

Implementation of SAP guidelines includes understanding both needs of the patient and medical practitioner; clinical pharmacists with proper inter-professional corresponding command can maneuver situations evolving during communicating about implementation issues with other healthcare professionals and can play an important role in implementing decisions. This study helps the patient to take the appropriate medication at the right time, right drug, right dose to the right patient. This also helps to adhere the surgeon to stick appropriately to the guidelines. This reduces the hospital stay, chances of infection, as well as the cost.[7]

Scope of the present research covers comprehensive management of antibiotics in surgery detailing information regarding antimicrobials prescribed, name of antibiotics, duration of antimicrobial therapy, and incidence of postoperative infection. Variables to be recorded in the study are age of the patient, gender, wound class, type of antibiotic used, the occurrence of infection, duration of hospital stay, and so on. The scope is limited to the data of surgical patients from Jayanagar general hospital, which is a government secondary care hospital. We compare the collected data with the different guidelines for the prevalence of SSI.

Methods

It is a prospective, observational study. The data were collected from 180 patients who satisfied inclusion and exclusion criteria. The variables analyzed were general characteristics of the patient (age, sex, height/weight, occupation, classification of wound, social habits, patient history). Antibiotics use in post-operative surgery were recorded. The follow-up was done within 30 days, if the patient was having an infection. Samples were collected and sent for cultural tests for identification of the organism and with the help of these data, we selected the antibiotics. Antibiotics were administered according to the institutional policy. Where dirty and clean-contaminated surgical wounds operations were covered with proper antibiotics. We analyzed the length of hospital stay and types of surgery performed, and if the wound was infected, we identified the bacteria in the wound. We also identified the no. of antibiotics and which all are the combination used in post-operative treatment. We also classified the no. of antibiotics used in association with SSI and also the length of hospital stays and the timing of administration of pre-operative antibiotics. The surgical sites were examined on the second postoperative day and then daily for pain, redness, warmth, and swelling, and purulent drainage. SSIs were diagnosed and defined by the surgeon according to the CDC definition (Mangram *et al*., 1999).[8] All patients' charts, including laboratory reports, were reviewed daily. Post-discharge examination of the surgical site was performed for all patients in the outpatient clinic for any evidence of SSIs. For daycare patients, a phone call was made on the second day to ascertain the condition of the patient. In cases where the infection was suspected, the patient was requested to come to the hospital for consultation with the resident doctor in the department of surgery for SSI diagnosis and management. To all outpatients, re-attendance to clinics after 7 days of discharge and other subsequent reviews are done. Casualty dressing clinics were used in the surveillance of SSIs. The surveillance was extended up to 30 days after surgery to detect SSIs that may have appeared after discharge. Descriptive statistics were used. Data analysis is done by using statistical methods such as frequency, percentage, mean, and standard deviation using SPSS and Microsoft excel.

Result and Discussion

A total of 180 patients were enrolled in the study, who satisfy inclusion and exclusion criteria. The above data shows that the percentage of females is greater than males. Among 180 patients enrolled in the study, 88 (48.89%) were males and 92 (51.11%) were females. Majority of the patients 59 (32.78%) are found under the age group of 41–50 years, followed by 52 (28.89%) patients under 31–40 years; 35 (19.44%) patients under

21–30 years, 22 (12.22%) patients under 0–20 (18–20) years, six (3.33%) patients under 51–60 years, and six (3.33%) patients over 60 years.

Among 180 patients in this study, 93 patients (51.66%) is having a previous risk factor, among them 40.86% were smokers, 27.96% are anemic, followed by patients associated with DM, DM/HTN, obesity, blood loss, and other infection. The coexisting infected patient is two among three, which is 66.67% [Table 1].

High incidence of SSI is associated with DM, DM/HTN, infection is 2.22%, 1.11%, 1.11% of the total population. Moderate incidence is associated with smoking and anemia, whereas less is associated with obesity. A similar study conducted shows that patients with an associated infection, DM, DM/HTN are highly associated with SSI.[2] The incidence of SSI with or without infection shows that patients having 66.01% more chances of having SSI rather than the patient not having associated infection. A study conducted by 'how's that patient with infection' is 69.22% more associated with co-existing infection.[4]

In this study, 11 patients were diabetic and out of these 11 patients, five got infected (i.e. 45.45%). In the case of the non-diabetic patient, out of 169 cases only 14 got infected (i.e 8.28%). So, it is found that the chances of getting SSI are more with a diabetic patient. Three patients had a co-existing infection and out of these three patients, two got infected (i.e. 66.1%). In the case of the non-infected patient, out of 177 cases, only 16 got infected (i.e. 9.03%). So, it is found that the chances of getting SSI are more with a co-existing infected patient. In the study, out of 88 male patients, 10 developed an infection (i.e. 5.55% of the total patient). Whereas among 92 female patients, nine developed infections (i.e. 5% of total patients enrolled in the study). This suggested that both sexes have equal chances of developing an infection.

Out of 180 surgeries performed, 24 (13.33%) patients have undergone excision surgery, 24 (13.33%) patients have undergone mesh repair, 23 (12.78%) patients have undergone incision and drainage, 22 (12.22%) patients have undergone appendicectomy, followed by eversion of the sac (7.22%), and amputation (5.56%) [Table 2].

Nineteen patients with SSI have undergone culture tests. Ten (52.63%) infected patients have staphylococcus infection, three (15.79%) are having Pseudomonous aerogenosa followed by two (10.53%) with E. coli, two (10.53%) with Enterococcus, two (10.53%) with Klebsiella pneumonia from culture, and the incidence of the isolated organism after SSI in different population. Staphylococcus was more in females rather than males and the Pseudomonas, E. coli, Klebsiella, Enterococcus are having similar incidences in male and female whose pathogens showed differences for sensitive *Staphylococcus aureus* and Pseudomonas aeruginosa, which were more frequent in women than men [Table 3].

Table 1: Presence of risk factors associated with infection

Risk factors	No. of patients	Percentage	No. of SSI	Percentage
Anemia	26	14.44%	4	2.22%
Blood loss	5	2.77%	-	-
DM	6	3.33%	3	1.66%
DM + HTN	5	2.77%	2	1.11%
HTN	4	2.22%	2	1.11%
Infection	3	1.66%	2	1.11%
Obesity	6	3.33%	-	-
Smoking	38	21.11%	2	1.11%
None	87	48.33%	4	2.22%
Total	180	100%	19	10.5%

Table 2: Surgery performed

Types of surgery	No. of patients	Percentage
Amputation	10	5.565%
Appendectomy	22	12.22%
Eversion of sac	13	7.22%
Excision of surgery	24	13.33%
Excision of primary closure	7	3.89%
Excision of fat	5	2.78%
Fissurectomy	14	7.78%
Fissurectomy with lateral sphincteroctomy	7	3.89%
Haemorrhoidectomy	9	5.00%
Hemioplasty	6	3.335
Incision and drainage	23	12.78%
Internal sphincterotomy with excision of bile	3	1.67%
Lateral sphincterotomy under SA	9	5.005
Mess repair	24	13.33%
Repair nasal bone	4	2.225%
Total	180	100%

Table 3: Distribution of bacteria associated with infection

Gender	Population	SSI rate	Isolated organism	No. of organism
Males	88	10	*Staphylococcus aureus*	3
			E. coli	1
			Pseudomonas aeruginosa	2
			Klebsiella	1
			Enterococcus	1
Females	92	09	*Staphylococcus aureus*	7
			E. coli	1
			Pseudomonas aeruginosa	1
			Klebsiella	1
			Enterococcus	1
Total	180	19		19

Almost all males and females have a similar incidence of developing SSIs, out of 88 male patients 10 people develop, out of 92 patients nine people develop an infection, that is, 5.55% for males and 5% for females, respectively. Langelotz *et al.*[9] reported that no gender-specific differences were found in general surgery, showed that five types of microorganisms identified in the culture test. *Staphylococcus aureus* was the most common organism identified in 10 (52.63%) patients followed by Pseudomonas

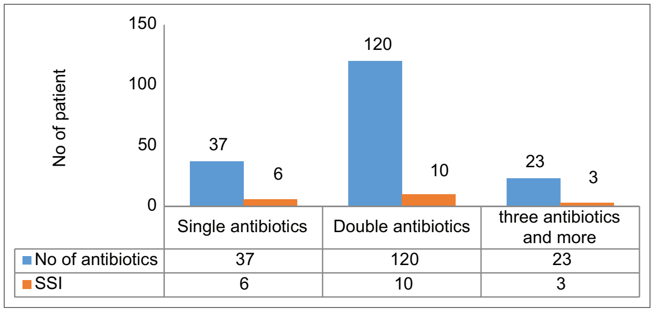

Figure 1: SSI and no. of antibiotics used

species (15.79%), Klebsiella (10.53%), Enterococcus (10.53%), and *E. coli* (10.53%). Starnoni, *et al.*[10] showed a similar result in their study where Staphylococcus is the major organism that develops SSI.

More frequently used antibiotics are cefotaxime, ceftriaxone, and amikacin. About 98% of patients who undergo minor or major surgery received antibiotics. Among them, 27.22% received amikacin and cefotaxime, 12.22% received ceftriaxone and metronidazole, 12.22% received cefotaxime and metronidazole, 10.55% received amikacin and ceftriaxone, whereas 20.5% received the triple combination. In single administration, ceftriaxone is the mostly received 15% of antibiotics [Table 4].

Among 180 patients, 37 patients were treated with one antibiotic, 120 patients were treated with two antibiotics, and the rest of 23 patients with three antibiotics and more. Among them, patients treated with single antibiotics are having a high incidence of SSI [Figure 1].

According to ASHP guidelines for antimicrobial prophylaxis in clean surgery, only no or one dose of antibiotics is enough, whereas clean-contaminated and others require two or more antibiotics to prevent infection,[10] showing the incidence of SSI in population age distribution. The incidence of getting an infection is more in the age above 40 years. Our study showed that in patients with >40 years chances of infection after surgery is increased, in age (51–60) three out of six is 50%, in >60 age two out of six is 33.33%, and age (41–50) is 8%.

Conclusions

Post-operative surgical patients are at risk of developing multiple types of hospital-acquired infections. Most common is surgical site infection, which leads to a prolonged hospital stay, increases the cost of therapy, causes morbidity, disability, and increases the cost of healthcare and even mortality.

Out of 180 patients, 10% of patients develop infection and we found that there is no difference in gender. It is found that the chances of getting infection increases with increasing age. Patients having diabetes and hypertension are found to be more susceptible to infection.

Table 4: Antibiotics used in surgery

Antibiotics combinations	No. of patient	Percentage
Amikacin + cefotaxime + metronidazole	7	3.88
Amikacin + ceftriaxone + metronidazole	7	3.88
Amikacin + cefotaxime + doxycycline	5	2.77
amoxiclav + cefotaxime + metronidazole	2	1.11
Cefotaxime + ciprofloxacin + metronidazole	2	1.11
Cefotaxime + ciprofloxacin	6	3.33
Amikacin + cefotaxime	49	27.22
Amikacin + ceftriaxone	19	10.55
Amikacin + metronidazole	2	1.11
Ceftriaxone + metronidazole	22	12.22
Cefotaxime + metronidazole	22	12.22
Cefotaxime	10	5.55
Ceftriaxone	27	15
Total	180	100

In our study, most of our patients are found with no formal education. The patient co-associated with other infections were more likely to have SSI that the length of hospital stays after surgery had increased incidence more than three times for patients with SSI than the patient without SSI.

In our study, majority of patients undergo Mess repair, Incision, and drainage, Excision, appendicectomy. The majority of cases are found to be clean-contaminated followed by contaminated. And least no. are found to be dirty.

Staphylococcus species and pseudomonas aeruginosa are seen in most of our infected cases. The majority of our patients are treated with three antibiotics and at least with two antibiotics. In our study, most of the patients are treated with two antibiotics and the least no. are treated with three antibiotics. The study revealed that most of the antibiotics prescribed is third generation cephalosporin, that is, cefotaxime, ceftriaxone are the most common antibiotics used in hospital.

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Conflicts of interest

There are no conflicts of interest.

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