Original Article

Analysis of Drug Utilization Pattern of Antimicrobials Used as Surgical Prophylaxis for General Surgical Procedures in a Tertiary Care Hospital of North Karnataka: An Observational Study

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Abstract

Background: Surgical site infection (SSI) is an infection presenting within 30 days after the surgical procedure if no prosthetic is placed and up to 1 year if prosthetic is implanted in the patient. Despite standard protocols for preoperative preparation and antimicrobial prophylaxis, the rate of SSI varies from 2.5% to 41.9%. Reasons could be multifactorial, but one among them is lack of adherence to any of the antibiotic policy. To review the drug utilization pattern of antimicrobials in the perioperative period and to study its impact on SSI, the above study has been carried out. **Materials and Methods:** A cross-sectional, observational study has been carried out in the Department of General surgery of SBM Patil Medical College Hospital. Patients of either sex who underwent surgical procedures such as appendectomy and hernioplasty have been included in the study. Data were collected using a predesigned pro forma. The study was approved by the institutional ethics committee. **Results:** A total of 140 patients underwent surgical procedures, of which 70 were male and 70 were female. Open appendectomy was the most common procedure performed, followed by hernioplasty in 18 patients. Ceftriaxone–sulbactam was the frequently prescribed antibiotic and six patients developed SSI. **Conclusion:** Despite use of antibiotics, six patients developed SSI. Hence, auditing of the antimicrobial usage as surgical prophylaxis is need of the hour. Because prescriber's worldwide running out of antibiotic options, it is mandatory for each hospital to have formulary for antibiotic use depending on the pattern of organisms isolated.

Keywords: *Antibiotic prophylaxis, perioperative period, surgical wound infection*

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Introduction

Surgical site infection (SSI) is defined as an infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue of the incision (superficial incisional) and/or the deep soft tissue (e.g., fascia and muscle) of the incision (deep incisional) and/or any part of the anatomy (e.g., organs and spaces) other than the incision that was opened or manipulated during an operation.[1,2] SSIs are the third most common type of hospital-acquired infections. Despite standard protocols for preoperative preparation and antimicrobial prophylaxis, the rate of SSI varies from low of 2.5% to high of 41.9%.[3]

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The American College of Surgeons–National Surgical Quality Improvement Program (ACS-NSQIP) classified surgical wound into four types: clean, clean/contaminated, contaminated, and dirty wound.[4] Prophylactic antibiotics are effective in reducing the risk of infection in clean-contaminated and contaminated

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operations.[5] Perioperative antibiotic prophylaxis (PAP) has been shown to be an effective measure for preventing SSIs. The use of PAP contributes considerably to the total amount of antibiotics used in hospitals and has been shown to be associated with increase in antibiotic resistance and health-care costs.[6] Four principles to guide the administration of an antimicrobial agent for prophylaxis include safety, an appropriate narrow spectrum of coverage of relevant pathogens, little or no reliance on the agent for therapy of infection, and administration within an hour before surgery and for a defined brief period thereafter. Several studies have demonstrated an increased length of hospitalization and the associated financial burden for patient with SSI, as compared to noninfected patient having the same surgical procedures.[7] Multiple risk factors are usually coupled with SSIs, in which patient correlated factors include diabetes mellitus, obesity, anemia, immune suppressant drugs, use of corticosteroids, and malnutrition.[8] Similarly, the operation related factors include preoperative skin preparation, skin antisepsis, antimicrobial prophylaxis, duration of surgery, and surgical techniques employed.[9] Infection at remote sites, preoperative temperature, and the presence of drains are also key elements in the progress of SSI.[10] Total quality management in hospitals is gaining emphasis these days; control of postoperative complication is an essential component of total quality management. In this context, it is essential to determine the prevalence of SSI, to assess the magnitude of the problem, to know drug utilization pattern, and to set priorities in infection control in the hospital.[11] To review the situation in our hospital and compare with other institutions, the current study has been undertaken.

Aims and objective

To determine the pattern of antimicrobial usage in the perioperative period and to study its impact on the occurrence of SSI.

Materials and Methods

A cross-sectional, observational study was conducted at inpatient department of General surgery, Shri. B.M. Patil Medical College Hospital, Vijayapur. This study was approved by the Ethics Committee of BLDE(DU) Vijaypura (Ref No: BLDE(DU)/IEC/283/2018-19, Dated 28-06-18) and is in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All the patients who were admitted and got operated between April 3, 2016, and March 31, 2017, were included in the study. Outpatient procedures (daycare surgeries) such as lymph node biopsy or fine-needle aspiration cytology and venous port placement were excluded from the study. Patients admitted in other surgical departments such as orthopedics, urology, and gynecology and those who refused to give informed consent were also excluded. A total of 140 patients were admitted and got operated during this period, that is, the basis for sample size. Details of 140 patients were collected using a predesigned pro forma, from the case records of surgical inpatients. The continuous data generated was expressed as mean and standard deviation. The categorical data were expressed as percentage. The data collected were analyzed using SPSS Version 23. Institutional ethical clearance from the BLDE (DU) ethics committee was obtained for this study.

Results

A total of 140 patients underwent general surgical procedures, of which 70 were male patients and 70 were female. Figure 1 shows the distribution of patients according to the age group. Most of the patients were in the age group of 20–50 years. Table 1 depicts the diagnosis in those patients who got admitted and underwent surgical procedures. Appendicitis (48 Patients) was the most common condition with which patients got admitted. Similarly, we can make out from Table 2 that open appendectomy, hernioplasty, incision and drainage, and excision of the lesion were the top four procedures being performed in our hospital during the study period.

The preoperative antibiotics utilized are shown in Table 3. According to that, ceftriaxone–sulbactam followed by amoxicillin–clavulanate was the most common antibiotics utilized as surgical prophylaxis. Time of administration of antibiotics was not mentioned properly in few case records. Hence, it is not included in the analysis. However, 45 patients received 2nd and 3rd dose of antibiotics before the surgery. Of 140 patients who underwent surgery, six patients developed SSIs. The organisms isolated were *Staphylococcus aureus* in two cases, Klebsiella in one case, and Enterococci in another case. In two patients, no specific organism was isolated. Among six cases with SSIs, only one patient had a history of type 2 diabetes mellitus and chronic alcoholism.

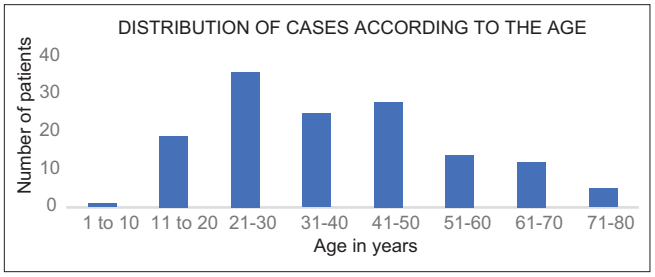

Figure 1: The distribution of study cases according the age group

Table 1: Describing the diagnosis in study participants who underwent surgical procedures

Diagnosis	Number of patients
Appendicitis (acute and recurrent cases)	48
Hernia	18
Abscess (cumulative)	17
Lipoma	7
Hydrocele	6
Fibroadenoma	6
Peritonitis	5
Sebaceous cyst	4
Acute fissure in ano	4
Miscellaneous	25

Table 2: The statistics of the surgical procedures being performed

Procedure	Number of cases
Open appendectomy	45
Laparoscopic appendectomy	3
Exploratory laparotomy	4
Hernioplasty	18
Herniorrhaphy	1
Laparoscopic hernioplasty	1
Incision and drainage	16
Excision	15
Jaboulay procedure	6
Fissurectomy	4
Hemithyroidectomy	4
Partial thyroidectomy	2
Graham s patch repair	3
Open cholecystectomy	2
Laparoscopic cholecystectomy	2
Modified radical mastectomy	5
Others	9

Table 3: The preoperative antibiotics given for patients before surgery

Antibiotics	Number of patients received (POD1)	POD2
Ceftriaxone - sulbactam	78	20
Amikacin	15	5
Metronidazole	23	7
Cefixime	2	1
Amoxicillin-clavulanate	36	7
Levofloxacin	3	2
Cefpodoxime proxetil	2	1
Ceftriaxone	7	1
Cefpodoxime-clavulanic acid	1	Nil
Gentamicin	4	1
Streptomycin	1	Nil
Piperacillin-tazobactam	3	Nil
Ofloxacin and ornidazole	1	Nil

POD1: Preoperative day 1, POD2: Preoperative day 2

Postoperatively, antibiotics were stopped within 72 h only in 40 patients and the remaining patients received antibiotics postoperatively for varying duration, in majority of the patients on an average for 5–7 days. Fixed protocols for antimicrobial usage for various categories of surgeries were not observed.

Discussion

Among 140 patients included in the study, male–to-female ratio was 1:1, as opposite to the study by Joshi *et al.,* which showed female predominance[12] and Sane *et al*. showed male preponderance.[13] Most of the patients who underwent surgical procedures were in the age group of 20–50 years, but no age preponderance was seen with regarding to the occurrence of SSIs. According to our study, 45 (37.5%) patients underwent open appendectomy, followed by hernioplasty 18 (15%) and 16 (13.3%) patients underwent incision and drainage. This was opposite to study by Venkateswarlu B and Swapna Y, in which most common surgery done was for hernia 29 (14.5%), followed by surgery for appendicitis 28 (14%) and cholelithiasis 6 (3%).[14]

The current study indicated that 78 patients received ceftriaxone–sulbactam, 37 received amoxicillin–clavulanate, 24 patients received metronidazole, and 15 received amikacin as presurgical prophylaxis. Cefera S was the most common brand prescribed for ceftriaxone–sulbactam, followed by Unitrax S and for amoxicillin–clavulanate combination, injection. Advent followed by augmentin was the common brands prescribed. According to Bratzler *et al.*, Cefazolin 2 g IV is the drug of choice for surgical prophylaxis in majority of the procedures. Because of its proven efficacy, reasonable safety & low-cost. Cefazolin also has a desirable duration of action, spectrum of activity against organisms commonly encountered in surgery. Hence it will be an ideal choice for surgical prophylaxis. As a replacement OR substitute-Cephamycins such as Cefoxitin, cefotetan are recommended in procedures of biliary tract, appendix & colorectal surgeries. But our drug utilization pattern was different from that of ASHP guidelines.[15]

A total of six patients developed SSI. According to the Centre for Disease Control and a study by Negi *et al*. from India, *Staphylococcus aureus* was the most common organism isolated from the SSI,[16] which is similar to our study and opposite to the study by Khairy *et al*.[17] According to them, *Escherichia coli* was the most common organism isolated. In our study, patients who underwent abdominal surgeries predominantly developed SSIs (4 out of 6), which is similar to the study by Fan *et al*.[18] Postoperatively, in 14 patients of 140, antibiotics were stopped within 24 h, which is similar to the survey of European hospitals. They have

reported that half of the surgical patients in 2006 had received PAP for more than 24 h after the end of surgery without a reason.[19] Limitations of the study include study design and lack of inclusion of data from other surgical departments of the same hospital. As this study provides an insight into the problem of antibiotic misuse and occurrence of SSI, despite of use of antimicrobial agents. Hence, we require antibiotic stewardship program.[20] Further research in this direction is needed to confirm above hypothesis.

Conclusion

Auditing of antimicrobial usage as surgical prophylaxis is need of the hour, because prescriber's worldwide running out of antibiotic options because of antimicrobial resistance. As the antimicrobial resistance is on the raise, there is an urgent need for taking steps to promote rational use of antibiotics. In our study, despite of use of antibiotics six cases of SSIs were seen. As the antibiotic drug resistance is on the raise, there is a need for taking steps to promote rational antibiotics use. Despite the use of antimicrobials, six cases of SSIs were seen and only one patient had risk factors for SSIs, and in the remaining cases, the cause might be due to wrong selection of antibiotics. Hence, it is mandatory for each hospital to have hospital infection control committee, which will formulate a policy for antibiotic use depending on the pattern of organisms isolated. Furthermore, surveillance for the implementation of the same is necessary as most of the surgeons prescribe antibiotics depending on the personal preference, rather than adhering to any specific guidelines. With the fear of SSI, they unnecessarily prolong postoperative antibiotic usage, which will add to the economic burden incurred by the patients and might select resistant strains.

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Conflicts of interest

There are no conflicts of interest.

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