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Original Research Article

A study on the antimicrobial usage pattern for the prevention of surgical site infections in a teaching hospital

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ABSTRACT

Background: Wrong antimicrobial selection and usage increase the incidence of drug resistance, drug toxicity and superinfections, thus decreasing the quality of healthcare delivery. Various approaches for rationalizing the antimicrobial usage have been recommended. Understanding the existing antimicrobial usage pattern is suggested as the first step in this approach, which would help to understand the current issues and to find the solution. The aim of the study was to evaluate the usage pattern of antimicrobial prophylaxis in surgical patients, to identify any inappropriateness of the usage.
Methods: A retrospective evaluation of the randomly selected 258 medical records of general surgical cases for eight months in a tertiary care teaching hospital were verified for the appropriateness of the antimicrobial prophylaxis. The collected data was studied, and conclusions were drawn with the help of appropriate statistics.
Results: All the 262 (100%) patients received a third generation cephalosporin through the intravenous route as a prophylactic dose. Also, 92 (35%) patients received nitroimidazole or aminoglycosides in addition to the cephalosporins. The antimicrobials were administered half an hour to one hour before the surgery. No intraoperative redosing was given.
Conclusions: The timing of administration of the preoperative dose was at par with international guidelines and well allotted to the nursing staff. The intraoperative dose was appropriately omitted in the short term surgeries. The main concern was the increasing use of the third generation cephalosporins and the long duration of the postoperative prophylaxis, which required to be addressed.

Keywords: Antibiotic usage pattern, Prophylaxis, Surgical site infection

INTRODUCTION

Healthcare-associated infections (HAI) are one of the leading causes of morbidity and mortality associated with inpatient care in the hospital. There are different types of HAIs occurred in the hospital settings. Surgical Site Infections (SSI) is of the most important HAI associated with surgical interventions, with an incidence of 1-18%.[1] It is the second most common HAI after catheter-associated urinary tract infection (CAUTI).[1] Genially, the incidence of SSI is prevented by the surgical antimicrobial prophylaxis (SAP) by a brief course of an antimicrobial agent just before the surgical procedure.[2] Surgical antimicrobial prophylaxis is one of the most widely accepted practices in surgery to prevent the occurrence of SSI. It is calculated that nearly 25-45% of the antimicrobial use in the hospitals are for surgical prophylaxis. However, in spite of the available information and various guidelines for the antimicrobial prophylaxis, its use is often found to be inappropriate.[3] Optimal antimicrobial prophylaxis includes the selection of a suitable, safe and effective antimicrobials, dosing and administration at correct timing and redosing if necessary, to establish a sufficient level in blood and

tissues during the surgery, It also includes the timely discontinuation when the recipient is no longer benefitted from the therapy.[3]

Prolonged and inappropriate administration of antimicrobial agents do not offer any additional benefits; rather they may increase the development of drug-resistant pathogens and subsequent HAIs.[4] The high prevalence of HAI including SSI may have a negative impact on healthcare quality and cost of patient care.[5]

The available data from various studies have pointed about the concern regarding the inappropriate use of antimicrobial agents during SAP. These studied strongly recommend that the need for antimicrobial drug utilization studies for better understanding and quality control or as the basis to formulate a protocol for antimicrobial therapy.[6]

Since errors in SAP is one of the errors remain one of the most common types of medication errors in hospitals and due to the lack of sufficient data regarding standard treatment guidelines for SAP in India, there is a requirement to generate baseline data on the current pattern of SAP to identify and recommend any desired modifications.[7,8] Moreover, some studies have observed poor adherence to the SAP guidelines especially in selection criteria, dosing, and duration of prophylaxis.[9] Hence, this study was undertaken to identify the prevalent practices in a teaching hospital regarding the antimicrobial therapy to identify any inappropriateness, so that corrective measures can be taken in future.

METHODS

The study was conducted in a tertiary care teaching hospital from Kerala. The medical record data of the patients who underwent surgeries in surgery department for a period of 11 months between March 2017 to February 2018 were randomly selected to find 300 case files, out of which only 262 cases were included for our study. Thirty-eight files were excluded due to incomplete and ambiguity in data. Since we mainly focused on the pattern of SAP, the case sheets with known preoperative infections and those with more than two days of preoperative antimicrobial use were also excluded. To make sure and verify the timing and pattern of the antimicrobial administration, and to determine the personnel who were accountable for administering the pre-incisional dosage, one author visited the operation theatres twice during the study. Approval from the institutional ethics committee and other concerned departments were obtained before the study commencement.

Primary outcome measures

We assessed four different parameters of the appropriateness of the SAP, such as the selection of the antimicrobial agent, the timing of preoperative dose, additional perioperative dosing if any and the choice and the period of the postoperative prophylaxis in our study. Additionally, information relevant to the study and patients were also obtained. The obtained data were analyzed by simple descriptive statistics, standard deviation, ratios and proportions.

RESULTS

We have analyzed 262 case sheets examined retrospectively. The mean age of the patients was 33.4 years (Range 1-69 years). All the study cases had undergone surgeries when they admitted in the general surgery department of the hospital. Appendicectomy was the most frequent surgical procedure (42%) followed by hernia repair (38%). The length of the hospital stay ranged four to thirteen days, with a mean stay length ± SD of 5.32±1.8 days, and a median stay length of 5.0 days (Table 1 and 2).

Table 1: Patient characteristics.

Patient related information	Frequency/values
No of case sheets analyzed	262
Mean age of patients (years)	33.4
Male (%)	48.4%
Preoperative length of stay (mean±SD) in days	1.7±1.4
Postoperative length of stay (mean±SD) in days	3.62±1.4

Table 2: Type of procedures.

Type of cases	Frequency (%)
Appendicectomy	42
Hernia repair	38
Cholecystectomy	10
Thyroidectomy	5
Other procedures	5

All patients who underwent surgeries had prescribed with preoperative antimicrobial agents. Out of 262 cases, 242 cases (92.3%) had prescribed with cefotaxime and ceftriaxone was prescribed in 20 (8.2%) cases. Nearly 92 cases (35%) had an additional prescription of nitroimidazole like metronidazole and aminoglycosides like amikacin or gentamycin along with cephalosporins.

We also assessed the timing of the antimicrobial administration, which was based on the beginning of the surgery; all the patients have received the pre-incisional intravenous dose, half an hour to one hour before the surgery before the administration of anaesthetic agents. Additionally, one of the authors confirmed the same, wherein a nursing staff was solely carried out the responsibility of administering the SAP dose to all the patients before the anaesthetic dose.

Twenty-six patients (9.9%) patients were already receiving antimicrobial drugs (oral cefdinir and

tinidazole), which were prescribed during their hospital admission, i.e. around two days before the scheduled operative procedure. We have noted that none of the patients received the intraoperative dose of SAP. Most commonly prescribed antimicrobial agent who was prescribed postoperatively in most of the cases was cefotaxime, which was given to 186 (70.9%) patients. About 70 (26.7%) patients were given cefoperazone, while 9 (3.4%) patients received cefuroxime, a second-generation cephalosporin. Metronidazole, tinidazole, ornidazole or amikacin was used along with the above antimicrobials in 92 (35%) patients. Postoperative intravenous antimicrobials were not used in 21 (8%) cases, which were instead given oral amoxicillin-clavulanic acid combination.

The duration of the postoperative prophylaxis lasted to 48 hours or more in 236 (90%) patients during their hospital stay. Only 26 (9.9%) patients received the postoperative prophylaxis for less than 48 hours. The average number of postoperative antimicrobial doses was 7.2, ranging from 2-13. Among 78 (29.7%) patients the intravenous antimicrobials were changed into oral dosage during their postoperative hospital stay, after a 3.62 (mean) days of postoperative hospital stay. Oral cefixime was prescribed in 82% of the cases as a replacement, and the rest of the patients received amoxicillin alone or in combination with clavulanic acid. About 240 (91%) patients received oral antimicrobial therapy after the discharge for an average duration of 4 days. Cefixime was the most commonly prescribed oral medication followed by metronidazole, tinidazole, cefpodoxime, levofloxacin, and amoxicillin. Apart from these, 140 (53.4%) patients were prescribed fusidic acid for the topical application and Povidone-iodine alone was used among 28 (10.6%) cases.

DISCUSSION

The present study was undertaken to identify the prevalent practices in a teaching hospital regarding the SAP to identify any inappropriateness so that corrective measures can be taken in future. To identify this, we have mainly analyzed four parameters of the appropriateness of the SAP, such as the selection of the antimicrobial agent, the timing of administration of the first dose, the perioperative redosing and the duration of the postoperative prophylaxis. The evaluation revealed that all patients in the selected case sheets received SAP dose before the surgery, although systemic SAP is not generally recommended for the patients who undergo surgeries under ideal conditions.[10,11]

All the patients in the study received the intravenous dosage of SAP which is an ideal route for the pre incisional administration of the antimicrobials because it ensures a prompt and assured response.[12]

In our study, we found that the third generation cephalosporins were commonly used in our hospital as a first choice SAP. Similar findings were observed in other studies conducted across the world.[13-15] In most of the studies, the authors found that the selection of the antimicrobial agent is an empirical basis based on the clinical experience of the surgeons.

Moreover, the pattern of the range may vary depending on the resistant pattern of the local strain of the bacteria. The combination of amikacin/tinidazole/ metronidazole with the third generation cephalosporins was noted in 35% of the cases. Nitroimidazoles such as metronidazole or tinidazole have shown good response to suppress the anaerobic infections, and it has been recommended as a combination in the surgical prophylaxis.[2] Several studies which compared a variety of broad-spectrum anti-microbial agents in combination with aminoglycosides did not show significant differences in SAP dosing.[16] Therefore, the additional aminoglycoside to other agents which have a broad-spectrum gram-negative coverage, such as the 3rd/4th generation cephalosporins, has been shown to provide no additional benefit.[16]

Generally, the guidelines are recommending that SAP should be given within sixty minutes before surgery and ideally, as near to the time of surgery as possible.[17] The selection of timing is dependent on multiple factors includes the interdisciplinary communication between the departments who are involved in the surgery and the routine workflow of the operation theatre.[5] Since our study was a case sheet based analysis, nearly 67 out of 262 cases had some ambiguity regarding the timing of the dosage. Similar problems were experienced by previous researchers as well.[1,14]

In the current study, we observed that none of the patients received a subsequent dosage intraoperatively. Most of the procedures were lasting less than 4 hours, and one dose of SAP is sufficient to cover such cases.[10,13]

In our study, the important concern noted was the use of antimicrobial dose after the discharge from the hospital. Similar findings were observed in several other previous studies.[7,9,12,13] Overall, only 15 (5.7%) patients in our study received the antimicrobials for less than 48 hours, though the guidelines suggest that postoperative antimicrobial therapy shall within 24-48 hours.[17] The unnecessary antimicrobial use may lead to the emergence of drug-resistant bacterial strain and also causes untoward effects to the patients.[17]

More than 60% of the patients were prescribed topical antimicrobial agents such as fusidic acid or Povidone-iodine alone or in combination with metronidazole. Recent studies have suggested that the postoperative use of topical antimicrobial agents does not have any rationale and the practice is not evidence-based approach. The use of topical antimicrobials as prophylaxis is not evidence-based. A recent prospective trial which examined the use of topical fusidic acid in addition to the routine systemic antibiotics which were applied

immediately after the surgical closure in the patients who underwent emergency caesarean sections found a decrease in the SSIs from 17.1%. The use of broad-spectrum topical antimicrobial agents may increase the epithelialization during the healing process, but they offer only a little or no benefit to the already epithelialized wounds.[1]

The findings in our study clearly revealed that SAP was clearly overused in the hospital where the study was carried out. Similar findings were obtained in several other previous studies which had observed an overuse and/or misuse of the SAP in different settings.[13] In order to curtail this issue, there should be some initiatives such as hospital-based guidelines, awareness programs for the healthcare providers, hospital antibiotic policy, and maintenance of strict asepsis in the operating theatre, from the authorities.[18] In collaboration with the Department of Microbiology, the list of local antibiograms data should be prepared and be updated at least yearly, which may help the clinicians to select proper agent for empirical therapy.[19] Our study has several limitations. We could not get the data regarding the incidence of postoperative infections and complications as we had to depend on the available case sheets data. Hence we could not compare the prevalence of SSI and the pattern of SAP in our study settings.

CONCLUSION

From the current study, we found that the current practice of the SAP in our hospital seems to be comparable with standard guidelines with regards to the preoperative timing and intraoperative redosing. The extensive use of third generation cephalosporins and the needless postoperative prophylaxis are the major concern of our study. To identify the correlation between the SAP pattern and incidence of SSI and postoperative complications, the authors may conduct a prospective study in future. The hospital antibiotic policy and guidelines should be prepared and implemented in respective departments to avoid the overuse of antimicrobials.

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