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Research Article

ANTIBIOTIC PROPHYLAXIS USE IN PATIENTS ADMITTED IN GENERAL SURGERY DEPARTMENT AT A TERTIARY CARE TEACHING HOSPITAL IN HARYANA

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ABSTRACT

Objective: In India, due to a lack of adequate information and guidelines for antimicrobial prophylaxis in surgery, there is a need to generate baseline data on the pattern of the use of prophylactic antibiotics. Hence, we planned this study with an objective to study the antimicrobial prophylaxis use in the patients admitted to the general surgery department.

Methods: The present study was a prospective observational study conducted in the department of pharmacology in collaboration with the department of surgery with the prior approval of the Institutional Ethical committee. All data were retrieved from the patients' case records. Using a convenient sampling method, 100 adult patients who underwent surgical procedures in MMIMSR during the study period were taken.

Results: A total of 100 patients admitted to the general surgery department of MMIMSR fulfilling the inclusion and exclusion criteria were enrolled. Out of 100 patients, 52 (52%) were male and 48 (48%) were female patients who underwent surgery and the majority of the patients enrolled are between 48 and 58 years (40%) of age. Cholecystectomy (28%) was the most frequent performed surgery type followed by hernial repair (24%) and hemorrhoidectomy (14%) Among all cases, surgical antibiotic prophylaxis was recommended in 93 (93%) patients. The most preferred route of administration of surgical antibiotic prophylaxis was parenteral route 100 (100%) and ceftriaxone was most commonly prophylactically prescribed antibiotic.

Conclusion: Surgical site infection is the most common nosocomial infections in surgical patients accounting for prolonged hospital stay, mortality, and increased cost of care. According to the analyzed results of our study and from view of literature, the present study provides us patterns of antibiotic usage in patients admitted in surgery wards.

Keywords: Antibiotic prophylaxis, Ceftriaxone, Nosocomial infections, Surgical site infections.

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INTRODUCTION

Antibiotics are antibacterial chemicals produced by diverse microorganisms (bacteria, fungi, and actinomycetes) that inhibit the growth of other microorganisms in the strictest sense. Synthetic antimicrobial drugs, such as sulfonamides and quinolones, are frequently included in the antibiotics world [1]. Antibiotics differ significantly in terms of their physical, chemical, and pharmacological properties. Antibiotic prophylaxis is the use of antibiotics before surgery or a dental procedure to prevent a bacterial infection [2]. Surgical site infection is the most common nosocomial infections in surgical patients accounting for prolonged hospital stay, mortality, and increased cost of care. The most common nosocomial infections in surgical patients are surgical site infections [3]. Prophylaxis is the measure taken to prevent an infection and can be characterized as primary prophylaxis (prevention of an initial infection), secondary prophylaxis (prevention of recurrence or reactivation of a pre-existing infection), or eradication (elimination of a colonized organism to prevent the development of an infection). This practice is not as widespread as it was even 10 years ago. This is due to the increase in the resistance of bacteria to antibiotics, the change in bacteria that cause infections, or improvements in technology that can detect infections. However, antibiotic prophylaxis is still used in patients who have certain risk factors for bacterial infection after different surgical procedures. Successful antimicrobial therapy of an infection ultimately depends on the concentration of antibiotic at the site of infection. Concentration of antibiotics must be sufficient to inhibit growth and kill the offending microorganism. If host defenses are intact and active, a minimum inhibitory effect, such as that provided by bacteriostatic agents (i.e., agents that interfere with growth or replication of the microorganism but do not kill it) may be sufficient. On the other hand, if host defenses are impaired, antibiotic-mediated killing (i.e., a bactericidal effect) may be required to eradicate the infection. The concentration of drug at the site of infection not only inhibits the organism but also must remain below the level that is toxic to human cells. If this can be achieved, the microorganism is considered susceptible to the antibiotic. If an inhibitory or bactericidal concentration exceeds that which can be achieved safely *in vivo*, then the microorganism is considered resistant to that drug. The achievable serum concentration for an antibiotic guides the selection whether microorganism is susceptible or resistant. However, the concentration at the site of infection may be considerably lower than achievable serum concentrations (e.g., vitreous fluid of the eye or cerebrospinal fluid), local factors (e.g., low pH, high protein concentration, and anaerobic conditions) may also impair drug activity. Thus, the drug may be only marginally effective or ineffective in such cases even though standardized *in vitro* tests would likely report the microorganism as "sensitive." Conversely, concentrations of drug in urine may be much higher than those in plasma. Microorganisms that might otherwise be considered "resistant" may be eradicated when infection is limited to the urinary tract. For an antibiotic to be effective, it must reach its target in an active form, bind to the target, and interfere with its function. Accordingly, bacterial resistance to an antimicrobial agent is attributable to three general mechanisms as drug does not reach its target, the drug is not active, or the target is altered [1]. Optimal and judicious selection of antimicrobial agents for the therapy of infectious diseases requires clinical judgment and detailed knowledge

of pharmacological and microbiological factors. Antibiotics have three general uses: empirical therapy, definitive therapy, and prophylactic or preventive therapy. When used as empirical, or initial, therapy, the antibiotic should cover all the likely pathogens because the infecting organism has not yet been defined. Either combination therapy or, preferably, treatment with a single broad-spectrum agent may be employed. However, once the infecting microorganism is identified, definitive antimicrobial therapy should be instituted with a narrow-spectrum, low-toxicity agent to complete the course of treatment. Failure to document the bacterial etiology so that a narrow-spectrum agent can be used and failure to narrow the spectrum when an organism has been identified are two common ways, in which antibiotics are misused [4]. The Centres for the Disease Control and Prevention guidelines for the prevention of surgical site infections emphasize the importance of good patient preparation, aseptic practice, and attention to surgical technique; antimicrobial prophylaxis is also indicated in specific circumstances. Emerging technologies, such as microbial sealants, offer the ability to seal and immobilize skin flora for the duration of a surgical procedure; a strong case therefore exists for evaluating such technologies and implementing them into routine clinical practice as appropriate [5]. In surgical patients, wound infections are the most common hospital-acquired infections. The risk of postoperative infections can be reduced by the use of antibiotic prophylaxis, but the additional use of antibiotics also increases the selective pressure that favors the emergence of antimicrobial resistance. Therefore, judicious use of antibiotics is essential in the hospital environment.

METHODS

The present study was a prospective observational study conducted in the department of pharmacology in collaboration with the department of surgery with the prior approval of the Institutional Ethical committee. All data were retrieved from the patients' case records and the study was approved by the Institutional Ethical Committee, and written consent from patients was taken. Using a convenient sampling method, 100 adult patients who underwent surgical procedures in MMIMSR during the study period were taken based on the following criteria: All the patients who were scheduled for surgery in general surgery department were included in the study. All clean patients based on CDC criteria were included [6]. The patients undergoing surgeries and were not on any antibiotic before surgery. Patients of both genders admitted in General Surgery Department. Patients of age more than 18 years were included in the study. Patient were assessed according to their demographics, Class of surgery, type of surgery, time of incision, duration of surgery, wound class and length of hospital stay, and prophylactic antibiotic given.

Statistical analysis

Descriptive statistics was used to summarize the demographic characteristics, surgical information, and antibiotic usage data. Frequencies and proportions/percentages were used to describe variables. Eligible candidates undergoing surgical procedures in the general surgery ward were enrolled in the study. An informed consent was obtained from each patient after explaining them benefits, possible shortcomings, and inconvenience, if any, during the study, complete medical history, clinical examination, and investigations were carried out. The patients are given antibiotic prophylaxis. At the end of the study, the number, type, type of administration, and duration of antibiotic given were recorded.

RESULTS

A total of 100 patients admitted to the general surgery department of MMIMSR fulfilling the inclusion and exclusion criteria were enrolled. Out of 100 patients, 52 (52%) were male and 48 (48%) were female patients who underwent surgery and the majority of the patients enrolled are between 48 and 58 years (40%) of age as shown in Table 1.

Cholecystectomy (28%) was the most frequent performed surgery type followed by hernial repair (24%) and hemorrhoidectomy (14%), anal fissure tag removal (7%), appendectomy procedures (8%), and gynecological procedures (19%) as shown in Table 2.

Among all cases, surgical antibiotic prophylaxis was recommended in 93 (93%) patients. The most preferred route of the administration of surgical antibiotic prophylaxis was parenteral route 100 (100%) Out of 93 prescriptions, the major prescriptions 74 (79.569%) were prescribed with single drugs, whereas two antibiotics were prescribed in 19 (20.43%) cases as shown in Table 3.

Out of 100 cases, first dose of surgical antibiotic prophylaxis was administered 30 min-1 h before operation in 49 (49%) cases as shown in Table 4. In 31 (31%) cases, the first dose of surgical antibiotic was administered before 1–2 h of operation not prescribed as it is not recommended as per ICMR guidelines. In 3% of cases, the prophylactic antibiotics were given in immediate emergency.

Table 5 shows the number of days the patient stay in the hospital after surgery. In maximum number of cases, it is 1–5 days after the surgery (78%).

Table 1: Demographic characteristics

Age range (years)	Number of patients	No. of male (s)	No. of female (s)
18–28	25	11	14
28–38	9	2	7
38–48	22	11	11
48–58	40	26	14
58–68	4	2	2
Total	100	52	48

Table 2: Types of surgeries performed

Diagnosis	Number	Percentage
Cholecystectomy	28	28
Hernial repair	24	24
Hemorrhoidectomy	14	14
Appendectomy	8	8
Anal fissure tag removal	7	7
Gynecological	19	19

Table 3: Choice of prophylactic antibiotic used

Name of the prophylactic agent	No. of procedures	Percentage
Ceftriaxone	39	39
Piperacillin + Tazobactam, metronidazole	19	19
Cefotaxime	19	19
Amoxicillin + Clavulanic acid	11	11
Piperacillin + Tazobactam	1	1
Ofloxacin	4	4
Total	93	93

Table 4: Time of pre-operative prophylactic agent

Time of prophylactic agent before Surgery	Number	Percentage
0–30 min	3	3
30 min–1 h	49	49
1 h–2 h	46	46
>2 h	2	2

Table 5: Duration of stay at hospital after surgery

Duration of stay	Number of patients
1–5 days	78
6–10 days	22
>10 days	-

Table 6: The price of antimicrobials fixed by government of India in rupee

Drugs used	Prices by GOI
Ceftriaxone (1 g)	53.75
Piperacillin + Tazobactam (1.5 g)	438.00
Metronidazole (500 mg)	0.20
Cefotaxime (1 g)	34.22
Amoxicillin + Clavulanic acid (1.2 g)	125.22
Ofloxacin (200 mg)	0.17

Table 6 shows the price of antimicrobials fixed by the Government of India in Rupee. Out of these antimicrobials Piperacillin and Tazobactam combination was most expensive.

DISCUSSION

The present study was a prospective observational study conducted among subjects who underwent surgery attending the general surgery department of our tertiary care hospital and focused mainly on the prescription pattern of antibiotics. Pre-operative data were analyzed. Antimicrobial agents are very important class of drugs which are essential in treating or preventing development of infections in patients [4]. Patients in surgical wards develop infections post-surgery; many of the infections are caused by bacteria that are highly virulent. As a result, there is a need for prophylactic or empirical treatment with antimicrobial agents that can cover broad spectrum of pathogens. However, antibiotic-resistant bacteria have emerged as an unavoidable result of the extensive use of antimicrobial medications, fuelling an ever-increasing demand for new treatments. Antimicrobial drug development, on the other hand, has slowed drastically, with only a handful of new drugs, few of which are unique, being developed, being introduced into clinical practice each year [7]. The greatest strategy to control resistance is to reduce incorrect antibiotic use. Despite growing knowledge of the dangers of antibiotic abuse, overprescribing is nevertheless common, owing to patient demand, physician time constraints, and diagnostic ambiguity. If advances in the treatment of infectious diseases are to be maintained, physicians must become wiser and more resourceful. This study provides an overview of total antimicrobial use in the surgery department of our tertiary care teaching hospital. Out of total 100 patients analyzed, 52% were male and 48% were females. Similar study by Rehan *et al.* [8] also included more male patients than female patients, whereas study by Elber *et al.* [9] included more female patients. Patients >18 years of age are taken into the study, and majority of the patients enrolled are between 48 and 58 (40%) years of age. Similar results were observed in the study conducted by Ram *et al.* [10]. The most preferred route of the administration of surgical antibiotic prophylaxis was parenteral route (100%); similar results were reported by the study conducted by Rehan *et al.*, [8] where all (100%) preoperative antibiotics were administered by parenteral route. Among the subjects, monotherapy was prescribed for 81% patients, combination therapy for 19%, similar results were observed in the study named Prescribing Pattern of Antimicrobials in Patients during Post-Operative Period An Observational Study, conducted by Revathi *et al.*,[11]. In our study, third-generation cephalosporins were prescribed to almost half of all the patients who received preoperative antibiotics (58 out of 100). For surgical prophylaxis, it is important to select an antibiotic with narrowest antibacterial spectrum to reduce the emergence of resistance and also because broad-spectrum antibiotics may be required later if patient develops serious sepsis. Therefore, it is recommended that the use of third-generation cephalosporins such as ceftriaxone and cefotaxime is avoided in surgical prophylaxis [8]. Out of all antibiotics recommended, cephalosporins (58%) haves the highest rate of concordance with ICMR guidelines followed by piperacillin-tazobactam (20%). A study conducted by Sharma and Goel [12] in 2018 reported that the most common group was the third-generation cephalosporins (61%), whereas individually, amikacin (58.5%) was the most commonly prescribed individual AMA, followed by metronidazole (55%) and ceftriaxone (44.5%).

CONCLUSION

Antibiotic prophylaxis is the use of antibiotics before surgery or a dental procedure to prevent a bacterial infection. Surgical site infection is the most common nosocomial infections in surgical patients accounting for prolonged hospital stay, mortality, and increased cost of care. The risk of postoperative infections can be reduced by the use of antibiotic prophylaxis, but the additional use of antibiotics also increase the selective pressure that favors the emergence of antimicrobial resistance. Therefore, judicious use of antibiotics is essential in the hospital environment. According to the analyzed results of our study and from view of literature, the present study provides us patterns of antibiotic usage in patients admitted in surgery wards.

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AUTHOR CONTRIBUTIONS

All the authors Dr Arvind Narwat, Dr Prem Prakash Khosla, Mamta Sharma, have equally made a substantial contribution in data collection, interpretation, and drafting the article and finalizing the topic.

CONFLICT OF INTEREST

None.

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Yes.

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