Effects of an Educational Module in Rationalizing Surgical Prophylaxis

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Abstract Assessment of current antibiotic prescribing patterns is an important step towards appropriate use of antimicrobial agents. This study was planned to know the surgical prophylaxis practices and the influence of educational intervention. In this educational interventional study, only clean and clean-contaminated surgeries were included. Preinterventional study was done by collecting data regarding the use of surgical prophylaxis in the Department of Surgery. After analyzing

the preinterventional data, educational intervention was done. A pretest questionnaire was given to all the surgeons to assess knowledge and practice of surgical prophylaxis in our institute. The questionnaire was designed to collect information regarding the use of prophylactic antibiotic, its duration, time of administration, and prevention of surgical site infections (SSI). In our study, third-generation cephalosporin was used in maximum cases in preinterventional analysis and prophylaxis was continued for 3–5 days. Surgeon's decision in selecting a prophylactic agent was based on information taken from departmental colleagues or drug companies. Two or more doses of antibiotic were used even when duration of surgery did not exceed more than two and half hours. Definite improvement was seen after the education where single antibiotic was used as prophylactic drug and the first dose of antibiotic was administered 30 to 60 min before incision. This shows that educational intervention makes a change in antibiotic prescribing habit. Hence, there is an urgent need for adoption of specific guidelines to ensure standardization of surgical antibiotic prophylaxis practices in hospitals.

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Introduction

Surgical site infections (SSI) are the second most common cause of nosocomial infections among hospitalized patients [1]. SSIs result in extended length of hospital

stay, increased cost, discomfort, sometimes prolonged or permanent disability, and death. These patients are also 60 % more likely to require an ICU admission and have a six times higher rate of readmission than those with no infection [2]. Centers for Disease Control and Prevention (CDC) recommends administration of a prophylactic antimicrobial agent only when indicated and selected based on its efficacy against the most common pathogens causing SSI for a specific operation [3]. Cephalosporins are one of the most commonly prescribed agents for surgical prophylaxis because of their favorable pharmacokinetic profiles, low incidence of adverse effects, and low costs [4], followed by quinolones and aminoglycosides. The timing of antibiotic prophylaxis is considered to be optimal if it is administered between 30 and 60 min before incision [5]. A single dose of an antimicrobial agent is sufficient for most surgical operations [6]. Prolonged use of prophylactic antimicrobials is associated with the emergence of resistant bacterial strains [7] and pathogens such as *Clostridium difficile* [8].

Although the principles of antimicrobial prophylaxis in surgery are clearly established and several guidelines have been published, the implementation of these guidelines is still problematic. Some data suggest that nearly 30–50 % of antibiotics used in hospitals are prescribed for surgical prophylaxis, and 30–90 % of this prophylaxis is inappropriate [9]. Studies from India had shown irrational practices such as overuse and misuse of single drug, combination of two or three antimicrobial agents preferred in clean-contaminated and dirty surgeries, and third-generation cephalosporins (particularly ceftriaxone and cefotaxime) were the commonly prescribed antibiotics (80 %) for all surgeries, and in majority of cases, antibiotics were prescribed for durations longer than recommended in guidelines [10, 11].

Assessment of current antibiotic prescribing patterns is an important step towards promoting appropriate use of antimicrobial agents. This study is planned to gain insight into the prevalent prescribing trends among surgeons for surgical prophylaxis and the influence of educational intervention in adhering to standard guidelines.

Aim: The study aims to rationalize and implement surgical prophylaxis practices at NKPSIMS, NAGPUR.

Objectives:

1. To assess the surgical prophylaxis practices in a specific group of surgeries (elective clean uncomplicated surgeries).
2. To orient the surgical team regarding surgical prophylaxis and its implication by developing an educational learning module.
3. To assess surgeon's compliance of adhering to the surgical prophylaxis guidelines.

Material and Methods

This was an educational interventional study carried out from October 2012 to December 2013 at NKPS IMS and Lata Mangeshkar Hospital, Nagpur. The study was approved by the hospital Ethics Committee. Only clean and clean-contaminated surgeries were included in this study. The study was divided into three parts—preintervention, educational intervention, and postintervention. Preinterventional study was done by collecting data regarding the use of surgical prophylaxis in the Department of Surgery (Annexure 1). The data was collected from the files of the 80 patients who had undergone surgeries.

After analyzing the preinterventional data, educational intervention was done. A pretest questionnaire (Annexure 2) was given to all the surgeons to assess knowledge and practice of surgical prophylaxis in our institute. The questionnaire was designed to collect information regarding the use of prophylactic antibiotic, its duration, time of administration, source of information, guidelines followed in hospital, prevention of SSI, rate of SSI, and about the Hospital Infection Control Committee in our hospital.

Table 1 Total Number of Surgeries/Procedures: 80

Diagnosis	No.
1) Epidermoid cyst	05
2) Hydrocele	14
3) Acute appendicitis	13
4) Inguinal hernia	28
6) Epigastric hernia	02
7) Dermoid tumor	02
8) Fibroadenoma	05
9) Lymph node excision	01
10) Lipoma	04
11) Cholelithiasis	03
12) Soft tissue mass	02
13) Granuloma oral cavity	01
Total	80

Education in the form of a powerpoint presentation was done in which surgeons were briefed regarding recommendations for surgical prophylaxis, and analysis of preinterventional data was shown to them. The educational program was carried out twice during the postgraduate activity, which was attended by all the staff members from the Department of Surgery.

Postintervention: After the educational program, again 80 cases were studied to know the compliance of the surgeons to the recommendations, and the data was analyzed. Posttest questionnaire was given to the surgeons to assess the gain in knowledge regarding surgical prophylaxis.

Results

Preinterventional Analysis

Out of the total 80 surgeries, maximum surgeries were of herniorrhaphy or hernioplasty, followed by eversion of sac for hydrocele and appendicectomy (Table 1).

As seen in Table 2, ceftriaxone was routinely used as a prophylactic agent in 67.5 % of the cases.

Table 3 shows that the maximum duration of surgery was two and half hours.

As evident from Table 4, in most of the surgeries, the prophylactic antibiotic was continued for 3–5 days. In this study, 2 patients (2.5 %) had a surgical site infection and the use of antimicrobials in these cases was empirical based on operating surgeon's clinical experience as culture and sensitivity report showed no growth. No adverse drug reaction was reported in the study.

Table 2 Commonly prescribed antibiotics for prophylaxis

Antimicrobial agents	No. of cases	Percentage, %
1) Ceftriaxone	54	67.5
2) Metronidazole	15	18.57
3) Ofloxacin	4	5
4) Amoxycillin + clavulanic acid	4	5
5) Cefixime	2	2.5
6) Ceftriaxone + sulbactam	2	2.5
7) Amikacin	2	2.5
8) Cefoperozone + sulbactam	1	1.25
9) Ciprofloxacin	1	1.25
10) Cefotaxim	1	1.25

Table 3 Duration of surgery

Duration of surgery	No. of surgeries
30 min	18
1 h	21
1 h and 30 min	23
2 h	11
2 h and 30 min	07
Total	80

Educational Intervention

A pretest questionnaire (Annexure 2) was given to all the surgeons to assess knowledge and practice of surgical prophylaxis in our institute. Education in the form of a powerpoint presentation was done in which surgeons were briefed regarding the recommendations for surgical prophylaxis, and analysis of preinterventional data was shown to them.

Analysis of pretest questionnaire: Pretest questionnaire was given to 22 surgeons. 10 surgeons reported use of third-generation cephalosporin in clean surgeries; 12 reported that antibiotic should be continued for 3 days. Only 12 surgeons were aware that antibiotic should be given at the time of induction of anesthesia. Source of information was mainly departmental colleagues and drug companies. Only 8 surgeons were aware about the guidelines of prophylaxis. The analysis showed good knowledge about rate and prevention of hospital infection, and everyone was aware about the functional Hospital Infection Control Committee (HICC) in our institute.

Postinterventional Analysis

After the educational program, data was collected from 80 surgical cases. Maximum cases were of inguinal hernia, followed by appendicitis. In all 80 cases, single antibiotic

Table 4 Duration of antibiotics prescribed

No. of surgeries	Days for IV drug	Days for oral drugs
21	1	5
24	2	3
30	3	5
2	4	3
2	5	5
1	6	5

either cefazoline (in 45 surgeries) or cefuroxime (in 30 surgeries) was used as a prophylactic drug. However, in 43 surgeries, the dose of antibiotic was repeated as 8-hourly dose for 1 day, while in 37 cases, only single dose of antibiotic was administered. In all the cases, the first dose of antibiotic was administered 30 to 60 min before incision.

Analysis of postinterventional questionnaire: Analysis of postinterventional questionnaire solved by 22 surgeons shows that the awareness regarding the use of prophylactic antibiotic, time of administration, dose, and duration of prophylaxis in clean surgeries has significantly increased.

Discussion

Widespread use of antimicrobials leads to emergence of multiple drug-resistant organisms. Antibiotics are not indicated for clean procedures according to the American Society of Health-System Pharmacists (ASHP) guidelines [12]. In our study, surgeon's decision in selecting a prophylactic antimicrobial agent was based on information taken from departmental colleagues or drug companies.

Optimal timing of antibiotic administration is considered an important factor for effective prophylaxis [13]. Inappropriate timing may result in low plasma concentration of the antimicrobial agent at the time of incision and throughout the procedure contributing to higher infection rates [14]. In our study, the time of administration of antibiotic was not mentioned in preinterventional analysis.

Many studies have shown that there is no benefit with extended prophylaxis [15]. Overuse of antibiotics may lead to drug toxicity and super infections. Most of the surgeons in our study used two or more doses of antibiotic even when the duration of surgery did not exceed more than two and half hours. In a Turkish study, 12 % of surgeons used a single dose of antimicrobial agent for clean-contaminated procedures, and in 20 % of the selected procedures, the antibiotic prophylaxis was within less than 24 h of the procedure [16].

According to ASHP guidelines, first-generation cephalosporin cefazoline is regarded as the drug of choice which is effective against commonly encountered organisms in surgical procedures and has a relatively low cost [12, 17]. In our study, third-generation cephalosporin ceftriaxone was used in 67.5 % of the cases in preinterventional analysis and prophylactic agent was continued for 3–5 days.

In a survey carried out in by R.A. Kulkarni et al., it was found that 55 % of the surgeons prescribed single antibiotic for clean surgeries; 29 % of the surgeons used two drug combinations. Out of the surgeons prescribing antibiotics in clean cases, only 8 % stopped prophylactic agent after 24 h [10].

In a study conducted by Chakane M. in India, 100 patients undergoing clean elective surgeries were studied. Single injection of ampicillin 500 mg + cloxacillin 500 mg was given 30 min before incision. Only 5 % developed wound infection in the form of stitch abscess [18]. Chandrashekhar et al. reported infection in 10.2 % of the cases with and 31.4 % without antibiotic prophylaxis [19].

In our study, after educational intervention, single antibiotic either cefazoline (in 45 surgeries) or cefuroxime (in 30 surgeries) was used as a prophylactic drug. However, in 43 surgeries, the dose of antibiotic was repeated as 8-hourly dose for 1 day, while in 37 cases, only single dose of antibiotic was administered. In all the cases, the first dose of antibiotic was administered 30 to 60 min before incision. This shows that educational intervention makes a change in antibiotic prescribing habit.

Conclusion

Inappropriate prophylaxis is characterized by unnecessary use of broad spectrum agents and continuation of therapy beyond the recommended time period. The preinterventional analysis in this study showed inappropriate use of third-generation cephalosporins for longer duration. Time of administration of antibiotic was not fixed. There was reluctance to follow guidelines. According to the surgeons, lack of guidelines was the most common reason for use of third-generation cephalosporins. But after the proper education of the surgeons regarding the guidelines for use of surgical prophylactic antibiotic, it was found that the surgeons have adopted the guidelines using a single antibiotic (cefazoline or cefuroxime) with a single dose. No surgical site infection was reported in postinterventional cases.

There is an urgent need for adoption of specific guidelines to ensure standardization of surgical antibiotic prophylaxis practices in hospitals. Continuous medical education programs may help to overcome this problem.

Conflict of Interest The authors declare that they have no competing interests.

Annexure –I Proforma

Name :

Age/ Sex:

Weight in kg-:

OP/IP no :

Ward & Unit:

Diagnosis:

Date of admission:

Any Co morbid conditions (Hypertension /Diabetes Mellitus/ Immunosuppression)– Yes / No

- If Yes,mention the condition and whether controlled.....

Date of Surgery:

Name of the operating Surgeon:

Type of Anaesthesia:

Type of surgery:

Time of Surgical incision:

Duration of surgery in hours:

Prophylactic Antibiotic given– Yes / No If yes

- Name of the antibiotic :
- Dosage:
- Frequency:
- Duration:
- Route of administration :
- Time of Antibiotic administration :
- Antibiotic administered by :
- Second dose indicated - Yes/No
 - IfYes , mention the time , dose &route of administration :
- Antibiotic prophylaxis continued for > 24hrs – Yes /No

Annexure –II Pre &Post Test Questionnaire**Annexure –II Pre &Post Test Questionnaire.**

- 1) For clean surgeries which antibiotic is used
 - a) 1st generation Cephalosporin
 - b) 2nd generation Cephalosporin
 - c) 3rd generation Cephalosporin
 - d) Fluroquinolone
- 2) In clean surgeries the duration of antibiotic prophylaxis should be
 - a) One day
 - b) 3 days
 - c) 5 days
 - d) 7 days
- 3) For surgical prophylaxis timing of first dose is
 - a) 1 hour before surgery
 - b) 1 hr after surgery
 - c) At the time of induction of anaesthesia
 - d) 2 Hours after surgery
- 4) which Sources of information are followed to adopt a protocol for surgical prophylaxis
 - a) Departmental colleagues
 - b) Hosp Inf. Control Committee
 - c) Drug Companies
 - d) Standard guidelines
- 5) Which guidelines are followed for surgical prophylaxis in our institute?
 - a) Unitwise
 - b) Departmental
 - c) Hospital
 - d) National
- 6) Surgical site infection in clean surgeries can be prevented
 - a) Only by higher antibiotic
 - b) Hand hygiene
 - c) Maintaining asepsis in OT
 - d) Using double gloves
- 7) Prevalence of SSI in our institute is
 - a) 1-2%
 - b) 5-10%
 - c) 15-20%
 - d) DON'T KNOW
- 8) Is there any Hospital Infection Control committee in your institute

YES	NO	DON'T KNOW
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- 9) Is there any format to report Hospital Acquired Infection?

YES	NO	DON'T KNOW
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- 10) Why is it necessary to have guidelines for surgical prophylaxis in any institute?
Give your opinion

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