Research Article

A Prospective Observational Study on Antibiotic Usage for Surgical Prophylaxis in a Tertiary Care Hospital

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ABSTRACT

Surgical site infections are frequent in hospitalization and which occurs in the wound created by an invasive surgical procedure. It is having a greater impact on morbidity, mortality and treatment cost. Use of appropriate antibiotic can reduce the risk of post operative wound infections. The aim of our study was to evaluate the antibiotic usage for surgical prophylaxis among various departments and to identify the level of adherence to national and hospital guidelines in a tertiary care hospital in Noida, Uttar Pradesh. A prospective observational study was conducted among 150 patients undergoing surgery. The data were collected from case records from which patient demographics, surgical department under which patient got admitted, type of surgery, type of wound, pre and post operative antibiotics and its dose, route, frequency, timing of administration, time interval between the incision and antibiotic administration time were collected. Appropriateness of antibiotic prescribing was evaluated based on National Treatment guidelines for Antimicrobial use in infectious diseases and hospital guidelines. Most of the surgical inpatients were administered with only one prophylactic antibiotic 101(67.3%), 38(25.33%) were with two antibiotic combination and 3(2%) were with three antibiotic combination. In some clean surgeries no antibiotic was given as surgical prophylaxis i.e., 8 (5.33%). Third generation cephalosporin was most commonly used antibiotic. Patients received post operative antibiotics for a mean duration of 5 days. There is a potential opportunity for clinical pharmacist to facilitate evaluation of quality assured surgical antibiotic prophylaxis across all surgeries.

Keywords: Antibiotic prophylaxis, Surgical site Infection, post operative antibiotics, Guidelines, Adherence.

INTRODUCTION

Wound Infections are the most commonly occurring hospital acquired infections on surgical patients[1]. It will results in increased antibiotic usage, increased costs and prolonged hospitalization. Appropriate antibiotic prophylaxis can able to reduce the risk of post operative wound infections, but additional antibiotic use also increases the selective pressure favoring the emergence of antimicrobial resistance. Judicious use of antibiotics in the hospital environment is therefore essential[2].

Surgical antimicrobial prophylaxis is defined as the use of antibiotics for the prevention of surgical site infections, and does not include preoperative decolonization or treatment of established infections.[3] Surgical antibiotic prophylaxis refers to the brief course of antibiotics initiated closely before the start of operative procedures to reduce post operative surgical site infections (SSI). According to Center for Disease control and prevention (CDC), SSI includes incisional and organ space infections. SSI is a major reason for increased mortality and health care costs. Of nearly 30millionoperations in United States each year, more than 2% are complicated by SSI, mortality rates are 2-3times higher in patients in whom SSI develops compared with uninfected patients.[4]

The risk of SSI depends on patient related factors such as age, nutritional status of the patient and any known infection in addition to surgical factors such as length of procedure, type of procedure (Clean, Contaminated, Clean-contaminated, Dirty/Infected), time of antibiotic administration. The basic principle of antimicrobial prophylaxis in surgery is to achieve adequate serum and tissue drug concentration for the entire duration of surgery. For optimal benefit, determining the appropriate indication, selecting agent that covers the likely pathogen on wound contamination, and administering sufficient bactericidal concentration during the whole period that the incision is open for risk of bacterial contamination is required.

The Center for Disease Control and Prevention (CDC) created a surgical wound classification system (1-CLEAN, 2-CLEAN-CONTAMINATED, 3-CONTAMINATED, 4-DIRTY) to identify patients at risk of surgical site infection (SSI)[5].

- **Clean** — an incision in which no inflammation is encountered in a surgical procedure, without a break in sterile technique, and during which the respiratory, alimentary and genitourinary tracts are not entered.
- **Clean-contaminated** — an incision through which the respiratory, alimentary or genitourinary tract is

entered under controlled conditions but with no contamination encountered.

- **Contaminated** — an incision undertaken during an operation in which there is a major break in sterile technique or gross spillage from the gastrointestinal tract, or an incision in which acute, non-purulent inflammation is encountered. Open traumatic wounds that are more than 12–24 hours old also fall into this category.
- **Dirty or infected** — an incision undertaken during an operation in which the viscera are perforated or when acute inflammation with pus is encountered during the operation (for example, emergency surgery for faecal peritonitis), and for traumatic wounds where treatment is delayed, and there is faecal contamination or devitalized tissue present"

Guidelines based on high quality studies had indicated that appropriate surgical antibiotic prophylaxis is among effective measures for preventing SSI. A single pre-operation antibiotic dose is sufficient for operations lasting up to 4 hours. In prolonged surgeries, however further antibiotic dose may be needed to maintain drug levels. Re- administration should be considered in the event of prolonged or excessive intraoperative bleeding. Timing of antibiotic prophylaxis is considered optimal if administered within 30 minutes prior to incision. However, Vancomycin or Fluroquinolone antibiotics should be given within 2 hour before first surgical incision. [6]About one third of SSI could be prevented by taking appropriate infection control measures in the pre, intra and post-operative period. Surgical Antibiotic prophylaxis (SAP) is critical in preventing infections that may lead to sepsis, organ failure and death during hospital stay.

It is the responsibility of clinical pharmacist to facilitate this process across all surgical disciplines. So to improve the patient care and decrease the gap between both practice and evidence based recommendation, we aimed to evaluate the current standard practice of care in the surgical wards by investigating whether the surgical antibiotic prophylaxis guidelines are correctly implemented for patients undergoing surgical procedure.

MATERIALS AND METHODS

The study was conducted on the surgical wards of Jaypee Hospital, Sector 128, Noida, Uttar Pradesh during the period of March-May 2019, for 3 consecutive months. Patients of any age undergoing surgery (Elective as well as emergency) in the department of General surgery, Orthopedics, Obstetrics and Gynecology, ENT, Plastic Surgery, Urology, Transplant and Gastro surgery were randomly selected for the study. Patients with current infections prior to surgery were excluded. Data were collected from case records from which patient demographics, surgical department under which patient got admitted, type of surgery, type of wound, pre and post operative antibiotics and its dose, route, frequency, timing of administration, time interval between the incision and antibiotic administration time were collected. Follow up data included additionally administered dose of antimicrobial agents and total duration of prophylaxis.

Appropriateness of pre-operative antibiotic prophylaxis was assessed as per National guidelines[7]and hospital guidelines. The surgical wound was classified based on Center for Disease control and prevention (CDC) guidelines. [5]These guidelines provides evidence based recommendations to the practitioners for rational use of prophylactic antibiotics.

RESULTS

In this study, 150 surgical inpatients were followed and monitored. Among 150 patients 81(54%) were male and 69 (46%) were female. The patients in age group of 0-20 years was 10(6.6%), 21-40 years was 40(26.6%),41-60 was 56(37.3%) and above 60 years was 44(29.3)%.

Among the 150 surgical patients, 37(25%) patients had undergone orthopedic surgery, amongst these most common surgery was total knee replacement followed by 30(20%) general surgery, 18(12%) obstetrics and gynecology related surgeries, 14 (9.3%) each of oncology surgery, GI and hepatobiliary surgery, urology, 9(6%) had undergone spine surgery and 15(10%) had undergone other surgeries (Table No:1).

Table 1: Distribution of Patients among Various Departments

Department	Frequency(n=150)	Percentage (%)
Orthopaedics	37	25
General surgery	30	20
Obg	18	12
Others	15	10
Urology	14	9.33
Gi & hepatobiliary surgery	14	9.33
Oncology	14	9.33
Spine	9	6
Total	150	100

About 145(97%) were elective surgeries and 5(3.3%) were emergency surgeries. In the five emergency surgeries ,3 were emergency LSCS cases and 2 were emergency road traffic accident cases (Table No:2)

Table 2: Scenario of Procedure

Scenario of Procedure	Frequency (n=150)	Percentage (%)
Elective	145	97
Emergency	5	3.3
Total	150	100

The surgical wound was classified based on CDC wound classification into four categories Clean, Clean-Contaminated, Contaminated and Dirty. 70(46.6%) were

Clean- Contaminated, followed by 57(38%) clean,9(8.6%) contaminated and 14(9.3%) were dirty/infected wounds. (Figure No:1)

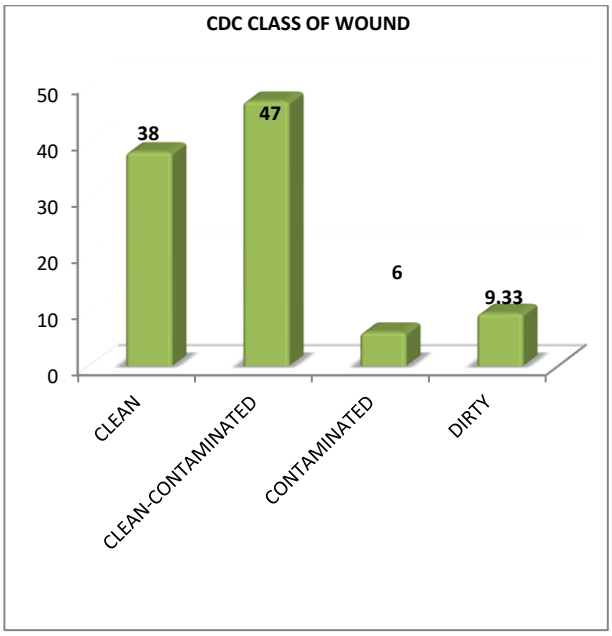

Figure 1: Classification of Wound

Most of the surgical inpatients were administered with only one prophylactic antibiotic 101(67.3%), 38(25.33%) were with two antibiotic combination and 3(2%) were with three antibiotic combination. In some clean surgeries no antibiotic was given as surgical prophylaxis i.e., 8 (5.33%). (Table No: 3)

In most of the surgeries, 94 (62.6%), antibiotics were given before skin incision, in 6(4%) cases antibiotics were given at the time of incision and in7 (4.66%) cases given after skin incision (Table No:5).

Table 3: Number of Prophylactic Antibiotic Used

No. of Prophylactic Antibiotic	Frequency (n=150)	Percentage (%)
No antibiotic	8	5.33
Only one	101	67.33
Two antibiotics	38	25.33
Three antibiotics	3	2

About 67.3% of patients took a single prophylactic drug and 25.3% were with two drug combination. 43(28.6%) patients received cefuroxime, 33 (22%) received Cefuroxime + Amikacin, 26(17.3%) received combination of Amoxicillin + clavulanic acid, 25(16.6%) received combination of Cefoperazone+Sulbactum.3(2%) patients were prescribed a combination of three antibiotics (Table No:4).

Table 4: Antibiotics Used for Prophylaxis

Name of Prophylactic Antibiotic	Frequency	Percentage (%)
Cefuroxime	**43**	**28.66**
Cefuroxime+amikacin	**33**	**22**
Amoxcillin/clavulanic acid	**26**	**17.33**
Cefoperazone +sulbactum	**25**	**16.66**
Meropenem	4	2.66
Cefuroxime + amikacin + teicoplanin	3	2
Ceftriaxone	2	1.33
Piperacillin+tazobactum	1	0.66
Amoxcillin/clavulanic acid+amikacin	1	0.66
Cefuroxime+teicoplanin	1	0.66
Amikacin+teicoplanin	1	0.66
Amikacin+vancomycin	1	0.66
Amikacin	1	0.66
NO ANTIBIOTIC	**8**	**5.33**
TOTAL	150	100

Table 5: Timing of Antibiotics among Surgical Inpatients

Timing of sap administration	Frequency (n=150)	Percentage (%)
Before incision	94	62.6
At incision	6	4
After incision	7	4.66
Not known	43	29.33
Total	150	100

About 66% of antibiotics were administered within 60 minutes before skin incision and 4.6% were administered more than 60 minutes before skin incision. For Clean surgical procedures, a combination of Cefuroxime + Amikacin was most commonly used 30(52.6%), for both Clean-Contaminated procedures (24.3%) and for Contaminated procedures (66.6%) cefuroxime was used and for Dirty procedures both cefuroxime and meropenem are mostly used (21.4%)(Table No: 6).

Table 6: Antibiotic Selection Based on Class of Wound

Class of wound	Frequency	Most commonly used AB	Frequency	Percentage (%)
Clean	57	Cefuroxime+amikacin	30	52.6
Clean-contaminated	70	Cefuroxime	24	34.2
Contaminated	9	Cefuroxime	6	66.6
Dirty	14	Cefuoxime and meropenem	3	21.4

Table 7: Compliance with National and Hospital Guidelines

Compliance	Frequency	Percentage (%)
Compliance with national guideline	44	29
Compliance with hospital policy	69	46

DISCUSSION

This study analyses the pattern of antibiotic usage for surgical prophylaxis at Jaypee Hospital, Noida. The use of surgical antimicrobial prophylaxis for preventing surgical prophylaxis is well established in literature. Based on the best available evidence to optimize the patient care and surgeon's practice the National guidelines on antibiotic prophylaxis in surgery was developed. Although such guidelines have been in place for years studies have showed that inappropriate prophylaxis and poor adherence to guidelines are still major issues.

In this study out of 150 patients, majority were males when compared to females. The patients within age group of 41-60 mainly undergone surgery. The average hospitalization periods of patients were 3-8days. Most of the surgeries were Orthopedic (TKR, THR, Various fractures), followed by general surgery making cholecystectomy the most frequently performed surgery. Among the Gynecology and Obstetrics procedures, most of them were hysterectomy and LSCS. Other surgery includes tumor excision, haemmarhoidectomy, spinal surgeries, tonsillectomy, tympanoplasty, etc. Among these surgeries, most of them were elective than emergency surgery.

The surgical wound was classified as per CDC wound classification and categorized into Clean, Clean-Contaminated, Contaminated and Dirty. Among these most of the surgeries were clean contaminated, followed by Clean. The majority of patients (94.6%) received antibiotics prior to surgery. This is comparable to a study conduct by HS Rehan *et. al*[6]. Most of them received a single antibiotic as surgical prophylaxis (67.33%). About 25% of patients received two drug combination and only 2% received three drug combination.

Although, use of two or more antimicrobials in combination may have certain rationale, the indiscriminate use can have negative consequences.

Similar to study conducted by Getachew Alemkere *et. al*[8], In our study, third generation cephalosporin, cefuroxime was prescribed for most of the patients who received antibiotic prophylaxis 43 out of 142, which was inappropriate as per ASHP guidelines.33(22%) of patients received combination of cefuroxime + Amikacin and 26(17.33%) received a combination of cefoperazone + sulbactum before incision. Other antibiotics used for surgical prophylaxis includes meropenem 4(2.66%), piperacillin/tazobactum, amoxicillin clavulanic acid, amikacin etc which are also inappropriate as per guidelines. Some patients received three drug combinations (cefuroxime + amikacin + teicoplanin) 2% for certain orthopedics surgeries.

The compliance with National guidelines of the country for antibiotic selection was found to be 29%, 44 out of 150 and the compliance with Hospital antibiotic policy was found to be 46%,69 out of 150.

Similar to study conducted by Vaisbrud *et al*[9], the timing of surgical antibiotic prophylaxis shows much compliance 62.6% than the selection of antibiotic as per the guidelines. Most of the antibiotics were administered before the skin incision and only few were administered after the incision. For clean wounds the antibiotic of choice was cefuroxime + amikacin (52.6%), for clean-contaminated (34.2%) and contaminated wounds cefuroxime (66.6%) was preferred. For the dirty wounds, Cefuroxime and Meropenem as single drug (21.4%) were preferred.

Despite the availability of first choice drugs, surgeons had been reported to comply with the guideline recommendation. Some of the reasons mentioned as a barrier to adherence to the guideline were lack of agreement of surgeons to the guideline, lack of awareness of appropriate guidelines etc.

CONCLUSION

The results highlight the challenges of evidence based protocols systematically into routine clinical practice. The study concludes that there was somewhat adherence to National and hospital guidelines. To improve appropriateness of prescriptions and adherence, development of evidence based guidelines, continuous education to the practitioners, surveys on antibiotic use

and reassessment of prescribing practices overtime should be implemented. The study highlights that there is a potential opportunity for clinical pharmacist to facilitate evaluation of quality assured surgical antibiotic prophylaxis across all surgeries. Further, prospective studies are recommended to address critical issues in more detail.

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