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Original Article

Prophylactic Antibiotics in Various Surgeries: A Prospective Study

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Abstract

Background: In recent years, there is an improvement of our clinician's approach to the appropriate and proper use of prophylactic antibiotics in surgical patients. The present study was done to evaluate the effect of Prophylactic antibiotics before operative procedures versus postoperative antibiotic.

Materials and Methods: This prospective, observational, and comparative study was conducted on 130 adult patients who underwent surgical procedures in the Gynecology and Surgery departments of Autonomous State Medical College and Hospital, Shahjahanpur, Uttar Pradesh, India from 1st January to 31st May 2021.

Results: Among 130 study subjects, 33 (25.38%) had Cesarean section, 25 (19.23%) patients had laparotomy, 20 (15.38%) patients had operative laparoscopy, 8 (6.15%) patients had abdominal hysterectomy, 12 (9.23%) patients had vaginal hysterectomy, 10 (7.69%) patients had diagnostic laparoscopy, while 22 (16.92%) patients had hydrocele/hernia repair. Majority, i.e. 78 (60%) patients had clean wound while 52 (40%) patients had a clean-contaminated wound. In 105 (80.76%) patients, the surgery lasted for 1–2 h while 25 (19.23%) had surgery for >2 h. Prophylactic antibiotic was not given for >24 h even if duration was more or blood loss was more. There was no infection in clean wounds. The prevalence of superficial surgical site infections (SSI) was 3.84% while the prevalence of deep SSI in the clean-contaminated wound was 1.53%. Organ-specific infection was not seen in any of the patient.

Conclusion: In the present study, prevalence of SSI was very low. This might be because proper and appropriate prophylactic antibiotic was given in all cases in tertiary care hospitals. Furthermore, proper skin preparation and strict asepsis and antisepsis was followed.

Key words: Surgical site infection, Surgical antibiotic prophylaxis, Timing, Dosage, Duration of surgery

INTRODUCTION

A surgical site infection (SSI) is defined as an infection that occurs at or near a surgical incision within 30 days of the procedure. It is within 1 year if an implant is left in place.[1]

Table 1 shows classification of surgical wounds.[1] SSI is one of the major complications of operative procedures. It is among the most common nosocomial infections.[2]

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SSI causes significant morbidity and mortality. It increases the healthcare costs.[3]

Patients who develop SSIs are 5 times more likely to be readmitted to the hospital. 60%of them are more likely to spend time in the intensive care unit. They are 2 times likely to die compared with surgical patients without the infections.[4]

The most common organisms causing SSIs are.[5]

- *Staphylococcus aureus*
- *Staphylococcus epidermidis*
- *Aerobic streptococci*
- *Anaerobic cocci*

Surgical antibiotic prophylaxis (SAP) is a very brief course of antibiotics initiated closely before the start of operative

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Table 1: CDC Classification of surgical wounds[1]

Class	Description
Class I-Clean	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered. In addition, clean wounds are primarily closed and, if necessary, drained with closed drainage.
Class II- Clean contaminated	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Specifically, operations involving the biliary tract, appendix, vagina, and oropharynx are included in this category
Class III- Contaminated	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from the gastrointestinal tract, and incisions in which acute, no purulent inflammation is encountered
Class IV- Dirty	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera means that the organisms causing postoperative infection were present in the operative field before the operation

procedures. The aim of this is to reduce postoperative SSI.[6]

Surgical Care Improvement Project performance measures to reduce postoperative SSI include (the first three comprise the core infection prevention measures).[7]

- Prophylactic antibiotics should be started within 1 h before giving surgical incision, or within 2 h if the patient is receiving vancomycin or fluoroquinolones.
- Prophylactic antibiotics should be appropriate for their specific procedure.
- Prophylactic antibiotics should be discontinued within 24 h of surgery completion.
- Postoperative 6 a.m. blood glucose levels should be controlled.
- Surgical site hair removal should be appropriate for the location and procedure.

Antimicrobial prophylaxis may be considered primary if it is given for prevention of an initial infection. It is considered secondary if given for prevention of the recurrence or reactivation of an infection. It may also be administered to prevent infection by eliminating a colonizing organism.[8]

At least 30 min, but no >60 min before the skin incision is made is the optimal timing for the pre-operative administration of most commonly used antibiotics.[9]

A single antibiotic dose, given immediately before the start of surgery is just as effective in preventing infection and reducing the risk of drug side effects.[10]

Cefazolin is the most often used drug for surgical prophylaxis in patients with no history of beta-lactam allergy, a history of MRSA infection [Tables 2 and 3].[11]

Aims and Objectives

- To evaluate the selection, timing and duration of prophylactic antibiotic in Gynecological and Surgical patients.

Table 2: FOGSI recommendations for prophylactic antibiotics for obstetrical procedures[17]

Procedure	Antibiotic	Dosage
Emergency or elective cesarean section	Cefazolin IV 15–60 min prior to skin incision	1–2 g IV
If penicillin allergic	Clindamycin or Erythromycin	600 mg IV 500 mg IV
PPROM without chorioamnionitis	Amoxy/ampicillin, antibiotics for latency e.g., erythromycin or erythromycin	2 g IV. 6 hourly for 48 h, 250 mg orally, 6 hourly for 10 days (400 mg orally, 6 hourly for 10 days)

Table 3: FOGSI recommendations for prophylactic antibiotics for gynecological procedures[17]

Procedure	Antibiotic	Dosage
Hysterectomy	Cefazolin (single dose)	1–2 g IV
Laparohysteroscopy	None	
Laparotomy	None	

- Follow-up monitoring to determine the success of antibiotic prophylaxis.

MATERIALS AND METHODS

This prospective, observational and comparative study was conducted on 130 adult patients who underwent surgical procedures in the Gynecology and Surgery departments of Autonomous State Medical College and Hospital, Shahjahanpur, Uttar Pradesh, India from 1st January to 31st May 2021, for five consecutive months.

Inclusion Criteria

- Adult surgical and gynecology patients
- Clean, clean-contaminated procedures
- Prophylactic antibiotic use.

Exclusion Criteria

- Pediatric patient (<18 years)
- Dirty, contaminated procedures
- Therapeutic and other non-surgical prophylaxis uses.

For group A, we administered 2 g of cefuroxime 30–60 min before scheduled incision in the anesthesia room for elective surgeries or in the operating room 0–30 min before scheduled incision for emergency surgeries to 75 patients.

For group B, Same antibiotic was administered to randomly selected 75 patients postoperatively after 2 h of surgery. These were followed for a 30-day duration.

For group A, repeat dose was given only if surgery was prolonged for more than 2 h or if blood loss was excessive before shifting from operation room. No patient received antibiotic for more than 24 h.

The following variables were recorded in a pre-designed proforma.

- Patient demographics (Age, Sex)
- Date of operation
- Type of operation performed
- Time at start and end of operation
- Classification of operation (clean, clean-contaminated, or contaminated)
- Status of operation (elective or emergency)
- Primary diagnosis
- Previous adverse reactions or allergies to antibiotics.

Duration of prophylaxis was considered "APPROPRIATE" if it was a single preoperative dose given for a duration not exceeding 24-h, based on recommendations.

Data was collected and analyzed in MS excel. Descriptive statistics was used for summarizing frequencies and proportions.

RESULTS

In present study, 25 (19.23%) of subjects were between 21 and 30 years, 27 (20.76%) of subjects were between 31 and 40 years, 40 (30.76%) of subjects were between 41 and 50 years while 38 (29.23%) of subjects were between 51 and 60 years.

In present study, males were 57 (43.84%) while females were 73 (56.15%).

Thus, majority were females.

In present study, in group A, average hospital stay for 45 (69.23%) patients was 1 day, for 18 (27.69%) patients, it was 4 days while 02 (3.07%) patients required readmission & stay for 10 days.

In present study, in group B, average hospital stay for 28 (43.07%) patients was 1 day, for 17 (26.15%) patients, it was 4 days while 20 (30.76%) patients required readmission & stay for 10 days [Table 4].

In present study, majority i.e., 33 (35.38%) (18.2–33.8%, 95% CI) had Cesarean section followed by 25 (19.23%) (12.8–27.1%, 95% CI) patients had laparotomy, 20 (15.38%) (9.7–22.8%, 95% CI) patients had operative laparoscopy, 8 (6.15%) (2.7–11.8%, 95% CI) patients had abdominal hysterectomy, 12 (9.23%) (4.9–15.6%, 95% CI) patients had vaginal hysterectomy, 10 (7.69%) (3.7–13.7%, 95% CI) patients had diagnostic laparoscopy while 22 (16.92%) (10.9–24.5%, 95% CI) patients had hydrocele/hernia repair [Table 5].

In present study, majority of subjects i.e., 78 (60%) (51.0–68.5%, 95% CI) patients had clean wound while 52 (40%) (31.5–48.9%, 95% CI) patients had clean-contaminated wound [Table 6].

In present study, 85 (65.38%) (56.5–73.5%, 95% CI) patients had elective surgery while 45 (34.61%) (26.5–43.5%, 95% CI) patients had emergency surgery.

Table 4: Demographic features

Age groups	No. of subjects (*n*=130)	Percentage
21–30 years	25	19.23
31–40 years	27	20.76
41–50 years	40	30.76
51–60 years	38	29.23
Sex distribution	**No. of subjects**	**Percentage**
Males	57	43.84
Females	73	56.15
Median hospital stay	**No. of subjects**	
	Group A (*n*=65)	**Group B (*n*=65)**
1 day	45 (69.23%)	28 (43.07%)
4 days	18 (27.69%)	17 (26.15%)
10 days (Readmission)	02 (3.07%)	20 (30.76%)

Table 5: Operations performed

Name of Operation	No. of subjects *n*=130	Percentage (95%CI)
Caesarean section	33	25.38 (18.2–33.8)
Laparotomy	25	19.23 (12.8–27.1)
Operative laparoscopy	20	15.38 (9.7–22.8)
Abdominal hysterectomy	8	6.15 (2.7–11.8)
Vaginal hysterectomy	12	9.23 (4.9–15.6)
Diagnostic laparoscopy	10	7.69 (3.7–13.7)
Hydrocele/ Hernia repair	22	16.92 (10.9–24.5)

In 105(80.76%) (72.9–87.2%, 95% CI) patients, surgery lasted for 1–2 h while 25(19.23%) (12.8–27.1% 95% CI) had surgery for >2 h.

Prophylactic antibiotic was not given for >24 h even if duration was more or blood loss was more. Thus, majority were elective surgeries lasting for 1–2 h [Table 7].

In present study, there was no infection in clean wounds. Prevalence of superficial SSI was 3.84% (1.3–8.7%, 95% CI) while prevalence of deep SSI in clean-contaminated wound was 1.53% (0.2–5.4%, 95% CI). Organ specific infection was not seen in any of the patient.

Thus, prevalence of SSI was very low in our study [Table 8].

DISCUSSION

In present study, in group A, average hospital stay for 45 (69.23%) patients was 1 day, for 18 (27.69%) patients, it was 4 days while 02 (3.07%) patients required readmission & stay for 10 days.

In present study, in group B, average hospital stay for 28 (43.07%) patients was 1 day, for 17 (26.15%) patients, it was 4 days while 20 (30.76%) patients required readmission & stay for 10 days [Table 4].

In present study, average hospital stay for 55 (42.30%) patients was 1 day, for 73 (56.15%) patients, it was 4 days while 2 (15.38%) patients required readmission and stay for 10 days [Table 4].

Alemkere *et al.* found that the median age of the study participants was 35.0 (Interquartile range [IQR]: 25–50) years. There were 58.8% of male patients. The median hospitalization period was 8.0 (IQR: 5–11) days.[12]

In present study, majority i.e., 33 (35.38%) (18.2–33.8%, 95% CI) had Cesarean section, followed by 25 (19.23%) (12.8–27.1%, 95% CI) patients had laparotomy, 20 (15.38%) (9.7–22.8%, 95% CI) patients had operative laparoscopy, 8 (6.15%) (2.7–11.8%, 95% CI) patients had abdominal hysterectomy, 12 (9.23%) (4.9–15.6%, 95% CI) patients had vaginal hysterectomy, 10 (7.69%) (3.7–13.7%, 95% CI) patients had diagnostic laparoscopy while 22 (16.92%) (10.9–24.5%, 95% CI) patients had hydrocele/hernia repair [Table 5].

Alemkere *et al.* found that most of the participants were from the general surgical ward (60.1%). Majority of the surgical cases were gastrointestinal (39.2%) followed by gynecology and obstetrics (15.7%).[12]

Tolba *et al.* found that the most common operations performed were plastic surgeries (22.7%), followed by general surgery (16%), breast and endocrine (11.3%), urology (10.7%), orthopedic (10%), and neurosurgery (9.33%) departments. Other departments comprised the remaining 20%.[13]

In present study, majority of subjects i.e. 78 (60%) (51.0–68.5%, 95% CI) patients had clean wound while 52 (40%) (31.5–48.9%, 95% CI) patients had clean-contaminated wound [Table 6].

Tolba *et al.* found that 74 (49.3%) operations were classified as clean, 74 9.3%) were clean-contaminated, while two (1.3%) surgeries were contaminated.[13]

In present study, majority i.e., 85 (65.38%) (56.5–73.5%, 95% CI) patients had elective surgery while 45 (34.61%) (26.5–43.5%, 95% CI) patients had emergency surgery.

In 105 (80.76%) (72.9–87.2%, 95% CI) patients, surgery lasted for 1–2 h while 25(19.23%) (12.8–27.1%, 95% CI) had surgery for >2 h.

Prophylactic antibiotic was not given for >24 h even if duration was more or blood loss was more [Table 7].

Table 6: Type of operation

Type of operation	No. of subjects *n*=130	Percentage (95%CI)
Clean	78	60 (51.0–68.5)
Clean-contaminated	52	40 (31.5–48.9)
Contaminated	Nil	Nil
Dirty	Nil	Nil

Table 7: Type of procedure and duration

Type of procedure	No. of subjects *n*=130	Percentage
Elective	85	65.38 (56.5–73.5)
Emergency	45	34.6 (26.5–43.5)
Duration of surgery		
1–2 h	105	80.76 (72.9–87.2)
>2 h	25	19.23 (12.8–27.1)

Table 8: Prevalence of SSI

Prevalence of SSI	No, of subjects	Percentage (95% CI)
Clean wound	Nil	Nil
Clean-contaminated wound	**No. of subjects**	**Percentage (95 CI)**
Superficial	5	3.84 (1.3–8.7)
Deep	2	1.53 (0.2–5.4)
Organ site	Nil 3	

Tolba *et al.* found that out of 150 operations of patients, 137 (91.3%) were elective while the remaining 13 (8.7%) operations were emergency cases.[13]

Tolba *et al.* found that Ninety-eight (65.3%) cases lasted <2 h while 52 (34.7%) exceeded the 2-h duration.[13]

Singh *et al.* found that the mean timing of administration of antibiotics was 3.22 ± 1.03 h prior to surgery. Patients received post operative antibiotics for a mean duration of 5 days while in hospital.[14]

Kefale *et al.* found that 53.4% of these surgical procedures were elective. Clean contaminated and contaminated wounds constituted 26.3%. 23.5% of surgical procedures respectively.[15]

Kefale *et al.* found that all procedures (62.6%) were performed between 1 h and 3 h.[15]

In present study, there was no infection in clean wounds. Prevalence of superficial SSI was 3.84% (1.3–8.7%, 95% CI) while prevalence of deep SSI in clean-contaminated wound was 1.53% (0.2–5.4%, 95% CI). Organ specific infection was not seen in any of the patient.

Thus, prevalence of SSI was very low in our study [Table 8].

Kefale *et al.* found that 19.6% (95% CI: 18–21.1) of patients developed SSIs. 14.5%, 3% and 3% involved superficial, deep, and organ structures, respectively.[15]

Weber *et al.* found that the rate of SSI was 5.1%. It did not significantly differ in the early group and the late group. This finding was confirmed in each population: surgical division, wound class, immunosuppressive drugs, body mass index, diabetes and age.[16]

CONCLUSION

In present study, prevalence of SSIs was very low. This might be because study setting was a tertiary care center where proper and appropriate prophylactic antibiotic was given in all cases. Also, proper skin preparation and strict asepsis was followed.

This study will help to improve future utilization of surgical antimicrobial prophylaxis.

Limitations of the Study

- This study is an observational study in a tertiary care setting. Hence the study finding is only generalized to the patient population of similar setting.
- This was a single group descriptive study but an analytical study with comparison group could only provide idea about possible role of other factors.
- Randomized clinical trials would be the best design.

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