



RESEARCH ARTICLE

To Compare the Effectiveness of single Dose Preoperative Antibiotic Coverage during Decisive Period with Conventional Postoperative Antibiotic Usage in Clean Elective Surgical Cases

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ABSTRACT

Background: Surgical site infections are the most common postoperative complications and frequently cause morbidity and mortality. Different antibiotic regimens were evaluated as prophylaxis in wound infection following elective surgical procedures. Prophylactic antibiotics should be given to cover the “decisive period” which is a period after incision to mobilization of host defences thus preventing an infection from developing.

Objectives: The aim is to study the effectiveness of short-term antibiotic coverage during decisive period in the prevention of postoperative wound sepsis in clean surgical cases.

Materials and Methods: The prospective randomized comparative study included 50 patients divided into two groups of 25 each. Group A (short-term ceftriaxone prophylaxis) patients received single dose of 1 g intravenous ceftriaxone, given 1 hr before operation. The Group B (conventional postoperative ceftriaxone prophylaxis) patients received postoperatively 1 g B.D intravenous ceftriaxone for 2 days. We compared the incidence of surgical site infection in two groups.

Study Period: November 2023 to October 2025. A predesigned and pretested proforma was used to collect the data. Surgical sites were examined for 30 days. Robertson grading was used to assess the severity of infection.

Results: Surgical site infection rate was 4% in Group A as well as in Group B. The severity of infection was same in both groups. Anaemia, nutritional status, and use of drain were other factors associated with postoperative wound infections.

Conclusion: Short course perioperative ceftriaxone prophylaxis is sufficient in preventing wound infection. Prophylactic antibiotic should be given to cover the decisive period to prevent an infection from developing. The judicious use of antibiotics can reduce the cost, unnecessary prolonged exposure, side effects, and the emergence of resistant micro-organisms.

Keywords: Antibiotic, clean wound, perioperative, surgical site infection

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INTRODUCTION

Infections remain an important complication of surgical procedures despite increased knowledge about prevention and technological advances in modern surgery. Appropriate antibiotic prophylaxis is directed toward the most likely pathogens encountered during

the surgery and should be administered before the skin incision is made [1]. Perioperative antibiotic prophylaxis must not be continued beyond the day of surgery in clean elective surgical cases, that is, cases in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered [2].

The basic concept in preventive antibiotic use is “decisive period” during which antibiotics will be effective. This decisive period is temporary and lasts only a few hours. Operations begin and end within the decisive period. There is a delay before host defences can become mobilized after

a breach in an epithelial surface, whether caused by trauma or surgery. The acute inflammatory, humoral, and cellular defences take up to 4 h to be mobilized. This is

called the “decisive period,” and it is the time when the invading bacteria may become established in the tissues. Strategies aimed at preventing infection from taking a hold become ineffective after this time. It is, therefore, logical that prophylactic antibiotics should be given to cover this period and that they could be decisive in preventing an infection from developing. The tissue levels of antibiotics should be above the minimum inhibitory concentration for the pathogens likely to be encountered [3].

The decision to use prophylactic antibiotic therapy must be based on balancing possible benefit against possible adverse effects. Indiscriminate use of antibiotics is discouraged because it may lead to the emergence of antibiotic-resistant strains of organisms or serious

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hypersensitivity reactions. In particular, prolonged use of prophylactic antibiotics may also mask the signs of established infections[4].

Prophylactic antibiotic therapy is no substitute for careful surgical technique using established surgical principles. Antibiotics can be used effectively only as adjuncts to

adequate surgery[5]. No evidence supports the practice of continuing prophylactic antibiotics until central lines, drains, and chest tubes are removed, and most regimens of prophylaxis are completed within 24 h of the time of incision. However, there is evidence of an increase in the recovery of resistant bacteria by this practice[1].

The differentiation between major and minor wound infection is important. There are various classifications to assess the severity of wound infection like Robertson classification in which severity of wound infection is assessed in grades[6].

With the fear of developing wound infection after surgery, many surgeons administer antibiotics for prolonged period even in clean surgeries. This practice is not only expensive but also can lead to hospital-acquired infections[7].

The purpose of conducting this study was to know whether prophylactic short course single dose preoperative administration of ceftriaxone be decisive in preventing an infection from developing. So that, it can decrease postoperative morbidity, shorten hospitalization, reduce the

overall cost attributable to infection and prevent unnecessary use of antibiotics for long periods.

Aims and objectives

To study the effectiveness of short course single dose preoperative ceftriaxone antibiotic regimen in the prevention of postoperative wound sepsis in clean surgical cases.

MATERIALS AND METHODS

The prospective, randomized and comparative study was conducted after approval from the Institutional Ethical Committee on fifty admitted patients who underwent clean elective surgical procedures in Government Medical College, Amritsar from November 2023 to October 2025

Inclusion criteria

All cases who underwent clean elective surgical procedures.

Exclusion criteria

- Concomitant infections processes related or unrelated to surgical procedure contemplated
- Gross contamination of operative site at the time of surgery
- Surgical procedures of oral cavity, anal, perianal area were considered contaminated
- Diabetes, steroid therapy, renal impairment, leukocytosis, and other factors predisposing the patient to infection
- Those administered systemic antibiotics within a week before surgery
- Allergy to ceftriaxone
- Emergency surgical procedures were not included.
- The selected patients were divided at random into two groups: A and B, comprising 25 cases each. Informed consent was obtained from all the patients.
- Group A: received single dose of ceftriaxone 1 g intravenously 1 h before operation. Thereafter, the antibiotic was withheld.
- Group B :received ceftriaxone B.D. intravenously postoperatively for 2 days

Operative and postoperative management was identical in both groups. Where drains were used they were brought out from a separate stab incision. Demographic characteristics such as age and sex were noted. Other variables such as nutritional status (body mass index [BMI]), co-morbid conditions such as anaemia, type of anaesthesia given, and use of drain were compared in two groups.

Follow-up was performed on the 3rd postoperative day, the 5th postoperative day [Table 1], on the day of stitch removal, and then on the 30th postoperative day. The severity of infection was graded as

- Grade 0: No infection
- Grade 1: Minimal infection (redness about a stitch)
- Grade 2: Pustules about a stitch or minor infection of wound edges without separation with no systemic reaction
- Grade 3: Frank infection of relatively small portion of wound with purulent discharge and some systemic reaction
- Grade 4: Frank infection of a large portion of wound usually with systemic reaction.

These grades of severity of infection were as per the Robertson classification⁶ [Table 1].

Observation in Group A and B was compared and then conclusion regarding the efficacy of regimen was drawn accordingly.

Statistical analysis

All data were analyzed using SPSS IBM software. The values were expressed as mean $\pm$ standard deviation, range, and percentages. Student's *t*-test was used to compare the

means and Chi-squared test was used to compare the data and $P < 0.05$ was considered statistically significant.

RESULTS

Age and sex distribution

Thirteen (52%) patients in Group A and 14 (56%) in Group B were of age < 40 years and rest were 40 years or more. The mean age of patients of Group A was 36.60 ± 10.47 , and in Group B, it was 37.44 ± 11.40 . The range of age was 21–60 years in Group A and 23–60 years in Group B [Table 1]. The difference in age between the two groups was not significant statistically ($P > 0.05$).

In Group A, 16 (64%) patients were females and 9 (36%) were males, whereas in Group B, 15 (60%) were females and rest 10 (40%) were males. The difference in sex incidence of the two groups was statistically insignificant ($P > 0.05$).

Incidence of postoperative wound infection

In Group A, one case developed postoperative wound infection and the incidence of postoperative wound infection in Group A patients was 4% which is same in Group B in which only one case developed postoperative wound infection [Table II].

Grades of wound infection

In Group A one case (4%) developed Grade I wound infection, none of the case in Group A had Grade II, III or IV infection. Similarly, in Group B, only one case developed wound infection, none of the case in Group B had Grade II, III or IV infection.

Statistical significance

No statistically significant relationship was found between type of procedure and occurrence of postoperative wound infections in both the groups.

Other factors associated with postoperative wound infection

Age

In Group A, none of the patients below 40 years of age developed infection postoperatively, but 8.33% of cases in age group forty and above developed postoperative wound infections. The difference in incidence of postoperative wound infection between the two age groups in Group A was statistically not significant ($df = 1, \chi^2 = 1.129, P > 0.05$). In Group B, none of the patients below 40 years and 9.09% of patients 40 years and above developed postoperative wound infection. This difference in the incidence of postoperative wound

Table 1: Factors associated with postoperative wound infection

Factors	Group A		Group B	
	No of cases	Infected %	No of cases	Infected %
Age				
<40	13	0	14	0
>40	12	1(8.33)	11	1(9.09)
Gender				
Female	16	1(6.25)	15	1(6.66)
Male	9	0	10	0
Haemoglobin				
<11 gm%	5	1(20)	5	1(20)
>11 gm%	20	0	20	0
Nutritional status (BMI)				
Normal	15	0	15	0
Underweight	8	0	7	0
Overweight	2	1(50)	3	1(33.33)
Drain				
Used	5	1(20)	8	1(12.5)
Not used	20	0	17	0

Table 2: incidence of postoperative wound infection Number of cases (%)

	Group A	Group B
Wound infection		
Absent	24(96)	24(96)
Present	1(4)	1(4)
Grades of infection		
Grade I	1(4)	1(4)
Grade II	0	0
Grade III	0	0
Grade IV	0	0

infection between the two age groups in Group B was not statistically significant ($df = 1$, $\chi^2 = 1.346$, $P > 0.05$).

Gender

In Group A, only one (6.25%) female but no male patient developed infection postoperatively. The difference in incidence of postoperative wound infection between the two genders in Group A was statistically not significant ($df = 1$, $\chi^2 = 0.586$, $P > 0.05$). In Group B, one (6.66%) female and no male patients developed postoperative wound infection. This difference in the incidence of postoperative wound infection between the two genders in Group B was not statistically significant ($df = 1$, $\chi^2 = 0.319$, $P > 0.05$).

Hemoglobin

None of the patient with preoperative hemoglobin (Hb) value above 11 gm% in both Groups developed postoperative wound infection. Whereas in patients with Hb level 11 gm% or less, one (20%) case in Group A and Group B developed postoperative wound infection. The difference of postoperative wound infection in patients with Hb level 11 gm% or less and those with Hb more than 11 gm% was statistically significant in both Groups ($df = 1$, $\chi^2 = 4.167$, $P < 0.05$), showing that postoperative infections occur more frequently in patients with lower preoperative Hb value.

Nutritional status (body mass index)

In Group A, out of 2 patients who were overweight, one

(50%) developed wound infection, and none patient in underweight group developed wound infection. In Group B, the rate of wound infection among patients with overweight nutritional status was 33.33%. These results showed that in Group A and B, wound infection was more common in patients with overweight nutritional status. The difference of postoperative wound infection in different categories of nutritional status was statistically significant in both Groups ($df = 2$, $\chi^2 = 11.979$, $P < 0.05$) showing significant statistically relationship between nutritional

status and postoperative wound infection.

Use of drain

One (20%) case developed postoperative wound infection in Group A where drain was put and none developed wound infection where drain was not used. This indicated that wound infection was statistically significant ($df = 1$, $\chi^2 = 4.167$, $P < 0.05$) in cases where drain

was put. Similarly, one patient (12.5%) developed postoperative wound infection in Group B where drain was used and none developed wound infection in cases where no drain was used, indicating that wound infection was statistically significant ($P < 0.05$) in cases where drain was used.

DISCUSSION

An effective prophylactic regimen should be directed against the most likely organisms. Infections can be prevented when effective concentrations of the drug are present in the blood and the tissue during and shortly after the procedure that is, during decisive period. Therefore, antibiotic prophylaxis should begin before the operation so that optimum drug concentration be there during decisive period. In spite of the use of prophylactic antibiotics, surgical site infections are still a risk of surgery and represent a substantial burden of disease in terms of morbidity, mortality and economic cost.

In our study, the overall infection rate was 4% in Group A as well as in Group B which is comparable to other studies. In developing countries, the surgical site infection rate is much higher than Europe and the US. The incidence of surgical site infection in the reported developing countries is 11.5% in clean cases. The overall global incidence of surgical site infection is 0.4–30.9/100 surgical patients and 1.2–23.6/100 surgical procedures [8].

In our study, there was similar incidence of wound infection in cases who received short course single preoperative dose of ceftriaxone sodium (Group A) or those who received ceftriaxone sodium for 2 days (Group B).

Similar results may be due to antibiotic coverage during decisive period specially in short course regimen.

The present study shows similar results in two groups. Thus, establishing the superiority of shorter, single dose decisive period covering antibiotic regime over the prolonged postoperative antibiotic use in concordance to Leuva et al. prolonged antibiotics administration are unnecessary and costlier [9].

In the present study, both the groups have statistically significant ($P < 0.05$) higher the infection rate where drain was used. The incidence of postoperative wound infection was higher in both groups where drain was used. Similar inference were reported by Lilani et al., [10] Mawalla et al [11]. and Mundhada and Tenpe [12]. In our study, the relationship of Hb levels with the difference in infection rates found to be statistically significant in both groups, corroborating with Nwankwo and Rasouli et al. This is probably due to anemia resulting reduced oxygen saturation and tissue resistance at potentially infected sites with retarded wound healing in cases having lower Hb concentration [13-14].

In the present study, none of the patient with good nutrition (normal BMI) category developed postoperative wound infection in both the groups. These results showed that wound infection was more common in patients with overweight patients in both groups. The difference of postoperative wound infection in different categories of nutritional status was statistically significant in both Group A and Group B ($P < 0.05$). It may be the result of relative under microperfusion, subcutaneous adipose tissue ischemia, decreased antibiotics delivery, increased wound tension cum tissue pressure, and the oxygen availability to the wound [15-17]. The difference in incidence of postoperative wound infection found to be not statistically significant ($P > 0.05$) with regard to age, gender and type of procedure in both groups. Thus, from our study, it is seen that short course single dose antibiotic coverage which cover decisive period appears to be better than prolonged use of antibiotics in

preventing postoperative wound infection. Furthermore, other factors such as low Hb concentration, use of drain and poor nutritional status increase the risk of postoperative wound infection.

Thus, with the appropriate and judicious use of antibiotics, we can reduce the cost and prolonged exposure to the unnecessary antibiotics which have its own side effects in

addition to the contribution to the emergence of resistant microorganisms.

CONCLUSION

Single dose preoperative ceftriaxone prophylactic regimen is better than conventional prolonged postoperative use of antibiotics in controlling the postoperative wound infection. Decisive period antibiotic coverage is very important to prevent postoperative wound infections. The factors such as Hb, nutritional status, and use of drain all influence the rate of postoperative wound infection. It is therefore recommended that for decreasing the incidence of postoperative wound infections antibiotics should commence preoperatively to cover the decisive period along with the basic principles of surgery such as complete asepsis, gentle tissue handling, prevention of hematoma formation, avoidance of putting unnecessary drains, and clean sharp dissection. A short course preoperative single dose ceftriaxone prophylaxis covering the decisive period can be efficacious and cost-effective for prevention of wound postoperative infections. Appropriate and judicious use of antibiotics can reduce the cost, unnecessary antibiotic administration, side effects, and microbial resistance.

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