

## **A comparative study of preoperative intra-incisional infiltration of cefotaxime and prophylactic intravenous administration of cefotaxime for prevention of surgical site infection**

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### **Abstract**

Surgical site infection continues to be one of most common postoperative health care associated infections worldwide. SSIs are associated with significant morbidity and complications in the patient. Identifying an appropriate and effective modality of administration of antibiotics is need of the hour to minimize the SSIs. A prospective study was done among 100 patients who underwent elective and emergency surgeries in the department of General Surgery between October 2019 and June 2021 were included in the study. The patients were divided into 2 groups to receive cefotaxime either as intraincisional infiltration or intravenous route. The proportion of patients with signs of wound infection such as redness/warmth was significantly less with intraincisional infiltration than intravenous route (8% vs 26%). Presence of seroma was also significantly less with intraincisional infiltration (32% vs 51%). Thus, it is evident that intraincisional infiltration is more effective in preventing SSI than intravenous route.

**Key words:** cefotaxime, surgical site infection, intravenous, intra-incisional infiltration, prevention

## Introduction

Surgical site infection is one of the most common health care associated infections.<sup>1</sup> Surgical site infection (SSI) denotes a surgical wound which has local signs and symptoms of infection that includes redness, heat, pain, and swelling. In severe cases it might be associated with systemic signs of infection which includes fever and/or elevated white blood cell (WBC) count.<sup>2</sup> Centre for Disease Control and Prevention has defined SSI as infection which occur following surgery in the body part where surgery was performed. Surgical site infection could be superficial involving skin or it could be deep involving other tissues and organs under the skin. Based on the extent of involvement, SSIs are categorized into 3 types as superficial incisional SSI which affects the area of skin where the incision was made, deep incisional SSI affecting tissues and muscle surrounding the incision and organ/space SSI affecting any organ or space.<sup>3</sup> These infections usually occur upto 30 days after surgery and it may also occur upto 1 year in patients those who receive implants.

Rate of SSI was 5% in a study done by Pathak et al. Independent risk factors associated with SSI were wound classification and duration of surgery. Antibiotics were prescribed in most of the patients (99%).<sup>4</sup> Another study reported the rate of SSI as 4.2% in their study.<sup>5</sup> The incidence of SSI could be as high as 20% depending on the risk factors, surgical procedure, preventive measures and surveillance of hospital acquired infections.<sup>6</sup> SSIs contribute to around 38% of all infections in the surgical patients.<sup>7</sup> SSIs are the most important health problems since they are associated with significant morbidity, mortality and high health care cost.<sup>6</sup> Post operative wound infection is associated with increased intensity of postoperative pain, anxiety and it also causes scar contraction. SSIs also increase the duration of hospital stay. Surgical site wound infections could be prevented by various approaches and prophylactic use of antibiotics is one such measure. Cefotaxime is a broad spectrum beta-lactum antibiotic which is used to treat gram positive, gram negative and anaerobic bacteria.<sup>8</sup> It is also used as a prophylaxis before surgery for prevention of surgical infections.<sup>9</sup> Though antibiotic use as a prophylactic measure has shown to reduce the incidence of SSIs, prolonged and inappropriate use of antibiotics is associated with development of antibiotic resistance and also high health care cost incurred by the patient. Thus, identifying

the optimal method of use of antibiotics becomes essential. Hence, the current study was conducted to identify the use of cefotaxime as preoperative intra-incisional infiltration and intravenous administration in preventing SSIs.

### **Objectives**

To compare and evaluate the efficacy of single dose of preoperative intra-incisional infiltration of cefotaxime with intravenous administration in preventing postoperative surgical site infections.

### **Materials and methods**

Study design: Prospective study.

Study location: Department of General Surgery at Vinayaka Mission's Medical College, Karaikal.

Study period: October 2019 to June 2021

Study population: Patients those who have come to Department of surgery for surgical intervention at Vinayaka Mission's Medical College and Hospital were evaluated based on the inclusion and exclusion criteria.

#### **Inclusion criteria**

Surgical patients coming to OPD and casualty

Patients of age more than 20 and less than 60 years

#### **Exclusion criteria**

Immunocompromised patients

Patients on steroid therapy for long duration

Age less than 20 years and more than 60 years

Study sample and study groups: A total of 100 patients were included in the study after applying inclusion and exclusion criteria. The study participants were divided into 2 groups. Group 1 with 50 patients to receive incision site infiltration of cefotaxime and another 50 patients in group 2 to receive intra venous administration of cefotaxime. The first patient was selected randomly for intra-incisional injection followed by every alternate patient for intravenous administration of the drug until reaching required sample size.

Methods of data collection: Detailed history was collected from the patient

Group 1: 1g cefotaxime plus 1:1000 dilution adrenaline was infiltrated at the proposed site of incision in the subcutaneous tissue and intramuscular plane 10 minutes prior to the incision. The dose of antibiotic was approximately 1 ml per cm

of incision (which corresponded to 100 mg of antibiotic per cm). A 22G spinal needle was used to inject the antibiotic with entry points depending on the length of incision.

Group 2: Single dose of 1 gram of Cefotaxime was administered intravenously 20 minutes before the surgical incision.

Post operative follow-up: Dressing was opened on second postoperative day and the wound was examined for any sign of infection or inflammation and suture status.

The condition of wound was again examined on the day of suture removal. In patients in whom any discharge was present, swab was taken and sent for culture and microbiological examination.

Patient was followed up until the day of discharge and 1 month after that.

Patients those who need secondary intervention were assessed on the basis of the wound condition and culture report whether they could be managed conservatively with prolonged IV antibiotics and wound dressings or they need an operative management again.

All the above informations were collected and entered in a structured proforma and the data was analysed. After data analysis, the quantitative variables were presented as mean and qualitative variables as percentage. When the p value was less than 0.05, it was considered as significant.

### Results:

A total of 100 patients were included in the study with 50 in each study group.

**Table 1: Characteristics of the study population**

Variable	Group 1	Group2	p value
Age (years)	51.88±13.27	46.30±14.88	0.08
Male	44 (88%)	39 (78%)	0.18
Preoperative hemoglobin	13.37±1.26	13.00±1.27	0.14
History of diabetes mellitus	16 (32%)	11 (22%)	0.26
History of hypertension	16 (32%)	10 (20%)	0.17

Table 1 describes the characteristics of the study population. The two study groups were similar in terms of age, gender distribution, preoperative hemoglobin level, history of diabetes mellitus and systemic hypertension.

**Table 2: Details of the surgery in the study group**

Variables		Group 1 n (%)	Group 2 n (%)	p value
Type of surgery	Elective	44 (88%)	44 (88%)	1
	Emergency	6 (12%)	6 (12%)	
Cleanliness of wound	Clean	40 (80%)	44 (88%)	0.88
	Contaminated wound	10 (20%)	6 (12%)	
Length of incision (cm)		7.82±1.81	7.58±2.19	0.55
Duration of surgery (minutes)		45.80±8.59	42.70±7.57	0.06
Method of closure	Single	2 (4%)	3 (6%)	0.64
	Multiple	48 (96%)	47 (94%)	
Day of suture removal		9.20±1.76	9.66±1.97	0.22

Equal number of patients underwent elective and emergency surgeries in both study groups. The proportion of patients with clean and contaminated wounds was also similar between both groups without any statistically significant difference. The length of incision, duration of surgery, method of closure and time of suture removal after surgery were also statistically similar between the groups. Table 2 describes the details of surgery in both study groups.

**Table 3: Signs of surgical site infection on day of suture removal**

Variables	Group 1 n (%)	Group 2 n (%)	p value
Redness/ warmth	4 (8%)	13 (26%)	0.01
Seroma	16 (32%)	27 (51%)	0.02
Fever	11 (22%)	23 (46%)	0.01
Haematoma	0	4 (8%)	0.04
Wound gaping	4 (8%)	12 (24%)	0.03

Signs of surgical site infection are presented in table 3. Proportion of patients with redness and warmth was higher in group 2 than group 1. Seroma was the most common SSI on day of suture removal in both Group 1 (32%) and Group 2 (51%).

Wound discharge was present in 15 (30%) patients in group 1 and 25 (50%) in group 2.

Serous wound discharge was the most common type of wound discharge which was seen in 24% in Group 1 and in 30% patients of Group 2. Seropurulent discharge was seen in 2 (4%) and 5 (10%) patients respectively in group 1 and group 2. Blood stained discharge was seen only in group 2 (6%). Purulent discharge was also seen only in group 2 (2%). Serous sanguineous discharge was seen in 1 patient each in group 1 and 2.

There was no growth in the wound discharge among 3 (60%) and 4 (33.3%) of the patients respectively in group 1 and 2. Atypical mycobacterium and E.coli were isolated in 1 (8.3%) patient in group 2. Klebsiella pneumoniae was isolated in 1 (20%) patients in group 1. Staphylococcus aureus was isolated in group 1 and 6 (50%) patients in group 2.

### **Discussion**

The present study was a prospective study done among patients undergoing elective and emergency surgical procedures. The current study showed that proportion of patients with redness and warmth, seroma and fever was significantly less in patients given intra-incisional infiltration of cefotaxime than intravenous cefotaxime. Similar to this study result, another study by patil AN et al also reported lower rate of SSI in patients given intra-incisional antibiotic than intravenous administration of antibiotic.<sup>10</sup> Another study by Taylor et al also reported significantly lower incidence of postoperative SSI in patients those who received intra-incisional Cefamandol compared to the control group patients those who did not receive antibiotic.<sup>11</sup>

Similar to these study results, another study by Singh et al also reported lower incidence of postoperative surgical site infection in patients provided with intraincisional infiltration compared to intravenous administration of ceftriaxone.<sup>12</sup> Such similar result was also reported by Dogra et al who also found lower incidence of SSI in patients who were given intra-incisional antibiotic infiltration with cefotaxime as compared to patients who received prophylactic intravenous cefotaxime.<sup>13</sup> Another study by Anand et al also reported lower incidence of SSI in patients provided with intraincisional infiltration with ceftriaxone compared to intravenous ceftriaxone.<sup>14</sup>

The study results published by Jambukala et al reported lower incidence of wound infection with use of intraincisional and intravenous cefotaxime. However, the results did not show any significant difference in the incidence of postoperative wound infection between intraincisional infiltration and intravenous administration of cefotaxime.<sup>15</sup> A study by Jambukala et al did not show any significant difference in the presence of wound discharge between the patients who received intraincisional infiltration and intravenous administration of cefotaxime. Whereas, the present study showed significantly lower incidence of seroma with intraincisional infiltration.<sup>15</sup>

### **Conclusion**

The study has shown that intraincisional infiltration of cefotaxime reduces the incidence of surgical site infection in patients those who have undergone elective and emergency surgeries.

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