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Original Research Article

A study of the wound performance following subcutaneous infiltration and topical instillation of ceftriaxone before primary closure of skin in laparotomy for peritonitis due to non-traumatic perforation of small intestine

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ABSTRACT

Background: Surgical site infection (SSI) continues to be a baffling problem since time immemorial. It is one of the major causes for postoperative morbidity and mortality. Many methods have been evolved to combat wound infection, but the rate of wound infection has been more or less static over past few years. The search for alternative modes of management is going on and one of the methods is intra incisional subcutaneous infiltration of antibiotics.
Methods: This is a prospective study comprising of control and study groups of 25 patients each. Control group patients did not receive subcutaneous infiltration of 1gm (diluted with 10 cc of distilled water) of ceftriaxone whereas study group received the infiltration. Precise examination of wound was done from post-operative day 3 up to day 10 for the presence of pus discharge or any subcutaneous collection.
Results: Wound infection rate was 48% in control group and 32% in study group that is 12 out of 25 patients wound were infected in control and 8 out of 25 were infected in study group and 13 out of 25 had no infection in control and 17 out of 25 had no wound infection in study group.
Conclusions: The incidence of SSI in the group which received subcutaneous infiltration of antibiotic was less than the group of patients, which did not receive ceftriaxone, showing that the use of subcutaneous infiltration of ceftriaxone injection at the time of wound closure may be more effective in reducing SSI.

Keywords: Ceftriaxone, Subcutaneous infiltration, Surgical site infection

INTRODUCTION

Surgical site infection (SSI) continues to be a baffling problem since time immemorial. It is one of the major causes for postoperative morbidity and mortality. Over the years, reasonable success has been achieved in this direction by taking various aseptic measures, which were initiated by Joseph Lister (1827-1912) in 1860.[1] Initially, the antibiotics were only administered post-operatively for treatment of already established surgical site infection.[2] Later, the concept of antibiotic prophylaxis was introduced. After administration of intravenous (IV) antibiotic, there is distribution of antibiotics, initially in the systemic pool and then in the peripheral pool, which results in a low concentration of the antibiotic at the site where it is needed the most.[3]

Therefore, the search for alternative modes of administration of prophylactic antibiotics was started so as to affect a further decrease in the rate of wound

infection. One such method is the intra-incisional infiltration of prophylactic antibiotics. This mode ensures a high concentration of antibiotic at the incision site and it has been proven to provide systemic cover by the absorption of the antibiotic from the incision site. Ceftriaxone an antibiotic with long half-life, was chosen because of its known effectiveness against a wide range of wound pathogens, including obligate anaerobes, at concentrations likely to be present locally. This study is done to evaluate the role of intra incisional infiltration of ceftriaxone in prevention of SSI.

METHODS

50 cases were selected by simple random technique from the in-patients admitted in Department of General Surgery at JSS Hospital, Mysore with clinical presentation of peritonitis due to non-traumatic perforation of small intestine during study period of October 2015 to October 2017.

A detailed history including the previous treatment was elicited in all patients and thorough clinical examination was done in them. Relevant preoperative investigations of blood, urine, plain erect x-ray abdomen and ultrasound abdomen were done in all possible cases. Informed consent was taken for the laparotomy and drug administration (injection ceftriaxone to subcutaneous tissue).

Patients were grouped into two of 25 each with random allocation (Randomization was done on the basis of admission into units, Patients admitted into 1,4 and 6 were taken into the study group and Patients admitted into 2,3 and 5 were taken into the control group). One group received ceftriaxone subcutaneous infiltration before primary closure of skin in laparotomy for peritonitis and in the other group no infiltration was used.

Inclusion criteria

- All patients presented with features clinically suggestive of peritonitis
- All patients radiologically diagnosed to have peritonitis.

Exclusion criteria

- Patients with traumatic perforation
- Patients with perforation of any other organs other than small intestines
- Patients having peritonitis secondary to other causes other than non-traumatic small intestinal perforation
- Patients with hypersensitivity to ceftriaxone
- Pregnancy and children below age of 18.

All patients were tested with test dose of ceftriaxone (0.5 cc into intradermal) for any reaction first pre-operatively such as rashes, difficulty in breathing, itching, angioedema, fever, chills. Then injection ceftriaxone 1gm diluted with 10cc of distilled water was infiltrated subcutaneously after the primary closure of rectus then skin approximation was done.

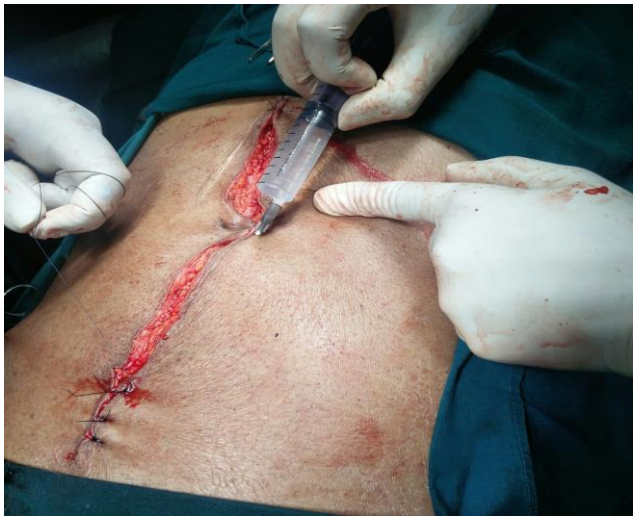

Figure 1: Infiltration of drug to subcutaneous tissue.

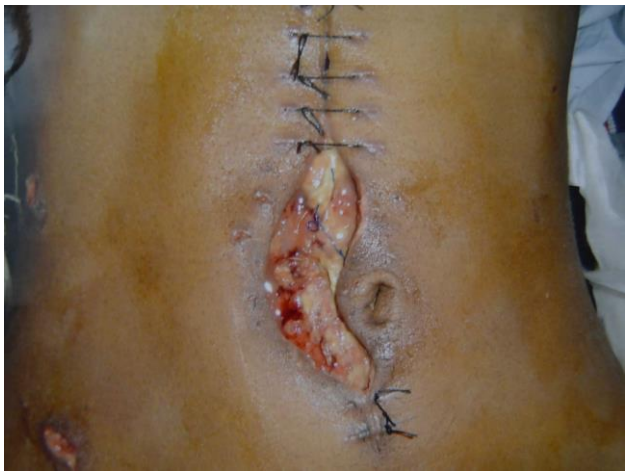

Figure 2: Wound infection post operation.

- Post-operatively, patients were assessed for the occurrence of wound infection
- Precise examination of wound was done from post-operative day 3 up to day 10 for the presence of pus discharge or any subcutaneous collection.
- In the presence of seroma or wound infection, few sutures were opened to let out the collection, examination of the integrity of fascia by digital examination of wound depth.
- Regular wound toileting was done in the presence of infection. Antibiotic coverage based on pus culture & sensitivity report and later wound closure by secondary suturing was done after infection control.

Statistical analysis

Statistical methods applied were Chi square test, Independent samples `t' test. Summary statistics was

done by mean standard deviation and proportions. All the statistical methods were carried out through the SPSS for Windows (version 21.0). P <0.050 was considered statistically significant.

RESULTS

In the Table 1 we are seeing that total 50 patients are divided into two groups of 25 each i.e., drug administration yes will be study group and drug administration no will be control group. Thus, percentile of each groups is 50%.

Table 1: Number of patients in each group.

		Count	Column N %
Drug administration	No	25	50.0%
	Yes	25	50.0%

(No-Control Group, Yes-Study Group)

In the Table 2 we are seeing that both the groups did not differ significantly with respect to the age i.e., mean age in control group is 43.48 and study group is 42.2 thus making this statistically insignificant and P value is 0.5.

Table 2: Mean age in both groups.

	Drug administration			
	No		Yes	
	Mean	SD	Mean	SD
Age	43.48	13.25	42.20	12.97

In the Table 3 age category are compared in both control and study group and seen that patients in each category in both groups did not differ significantly and p value of 0.7 is not statistically significant.

Table 3: Age category in both the groups.

		Drug administration			
		No		Yes	
		Count	Column N %	Count	Column N %
Age category	<30	4	16.0	4	16.0
	31-40	8	32.0	6	24.0
	41-50	6	24.0	10	40.0
	>50	7	28.0	5	20.0

In Table 4 the total number of patients are control 25 and study group 25. Among them the male and female distribution was 24(96%) and 1 (4%) in control cases respectively and 24 (96%) and 1 (4%) in study cases respectively, the difference in sex distribution in both the groups is not significant as values are equal.

In the Table 5 and Table 6, mean time of presentation of patients to hospital since the time of onset of pain in both groups was 2.4 and 1.8 in control and study groups respectively showing that they did not differ significantly, and p value is 0.2.

Table 4: Sex distribution in both groups.

		Drug administration			
		No		Yes	
		Count	Column N %	Count	Column N %
Sex	Female	1	4.0	1	4.0
	Male	24	96.0	24	96.0

Table 5: Time of presentation since the onset of pain in days in both groups.

		Drug administration			
		No		Yes	
		Count	Column N %	Count	Column N %
Time of presentation since onset of pain (days)	1.00	11	44.0	11	44.0
	2.00	3	12.0	9	36.0
	3.00	5	20.0	4	16.0
	4.00	4	16.0	1	4.0
	6.00	2	8.0	0	0.0

P=0.4

Table 6: Mean time of presentation in days in each group.

	Drug administration			
	No		Yes	
	Mean	SD	Mean	SD
Time of presentation (days)	2.40	1.58	1.80	.87

Table 7: Site of perforation in both groups.

Site of perforation	Drug administration			
	No		Yes	
	Count	Column N %	Count	Column N %
Duodenal	20	80.0	22	88.0
Ileal	4	16.0	3	12.0
Jejunal	1	4.0	0	0.0

In the Table 7 percentage of patients who site of perforation was first part of duodenum (D1), ileal and jejunum in control group was 80%,16% and 4% respectively and in study groups was 88%,12% and 0 respectively showing both groups did not differ significantly P value is 0.52.

As we can see in Table 8 in control cases the peritoneal contamination - fecal, minimal and moderate were 12%, 28% and 60% respectively and that of in study cases was 8%, 36% and 56% respectively which is statistically not significant as both groups did not differ significantly, and p value is 0.8.

Table 8: Peritoneal contamination in each group.

Peritoneal contamination	Drug administration			
	No		Yes	
	Count	Column N %	Count	Column N %
Fecal	3	12.0	2	8.0
Minimal (bilious)	7	28.0	9	36.0
Moderate (purulent)	15	60.0	14	56.0

In Table 9 we are seeing that in control group patients with comorbidities were 22 and in study group 21 thus showing both groups did not differ significantly, and p value is 0.6.

Table 9: Comorbidities (diabetes and/or hypertension) in both groups.

		Drug administration			
		No		Yes	
		Count	Column N %	Count	Column N %
Comorbidities	No	22	88.0	21	84.0
	Yes	3	12.0	4	16.0

Table 10: Habits (alcohol and/or smoking) in both groups.

		Drug administration			
		No		Yes	
		Count	Column N %	Count	Column N %
Habits	No	11	44.0	11	44.0
	Yes	14	56.0	14	56.0

Table 11: Age and wound infection rate.

		Wound infection			
		No		Yes	
		Count	Row N %	Count	Row N %
Age category	<30	4	50.0	4	50.0
	31-40	8	57.1	6	42.9
	41-50	12	75.0	4	25.0
	>50	6	50.0	6	50.0

In the below Table 10, Among control group patients with habits of smoking/alcohol were 56% and with no habits were 44% and in study group were 56% and 44% respectively which was also not significant as values are identical. In the Table 11 we are seeing that patients with age less than 30 and above 50 had more rate of wound infection than other age groups. P value is 0.4 which is also statistically insignificant. In the Table 12 we are seeing that patients with comorbidities had more wound infection rate i.e. 42.9 than without comorbidities i.e. 39.5. In the Table 13 both groups did not differ significantly with respect to habits.

Table 12: Comorbidities and wound infection rate.

		Wound infection			
		No		Yes	
		Count	Row N %	Count	Row N %
Comorbidities	No	26	60.5	17	39.5
	Yes	4	57.1	3	42.9

Table 13: Habits and wound infection rate.

		Wound infection			
		No		Yes	
		Count	Row N %	Count	Row N %
Habits	No	13	59.1	9	40.9
	Yes	17	60.7	11	39.3

In the Table 14 we are seeing that patients with ileal perforation had maximum wound infection rate 71% than duodenal or jejunal part.

Table 14: Site of perforation with wound infection rate.

		Wound infection			
		No		Yes	
		Count	Row N %	Count	Row N %
Site of perforation	D1	27	64.3	15	35.7
	Ileal	2	28.6	5	71.4
	Jejunal	1	100.0	0	.0

In the Table 15 we are seeing that 80% wound infection rate was seen in patients who had fecal contamination with those of minimal and moderate contamination were 41% and 25%.

Table 15: Peritoneal contamination with wound infection rate.

		Wound infection			
		No		Yes	
		Count	Row N %	Count	Row N %
Peritoneal Conta-mination	Fecal	1	20.0	4	80.0
	Minimal	12	75.0	4	25.0
	Moderate	17	58.6	12	41.4

In the Table 16, 12 out of 25 patients wound were infected in control and 8 out of 25 were infected in study group and wound infection rate was 48% in control group and 32% in study group showing that rate of wound infection reduced in study group but not statistically significant (P=0.3).

Table 16: Drug administration with rate of wound infection.

		Drug administration			
		No		Yes	
		Count	Column N %	Count	Column N %
Wound Infection	No	13	52.0	17	68.0
	Yes	12	48.0	8	32.0

DISCUSSION

SSI is one of the commonest complication following surgery. SSI is reportedly the third most commonly reported nosocomial infection and accounts for 14-16% of all nosocomial infections.[4] Risk of SSI has been described to be around 2.6% in all operations and SSI rates are likely to be greater than reported since all surgical wounds are contaminated by atmospheric bacteria but only a few actually develop clinical infection.[5] A study was carried out in Italy to find out the incidence of SSI in general surgery, where 3,066 surgical procedures were carried out in 2,972 patients and 154 (5%) of them developed SSI.[6] SSI also affects 2.6% of patients undergoing thyroid surgery. Bickel studied 210 patients who underwent open surgery for acute appendicitis and reported SSI in 5.6% cases.[7] Velezquez studied 80 patients who underwent open cholecystectomy and found SSI in 11.25% cases.[8] SSI has been brought down considerably by employing various aseptic measures in addition to the use of prophylactic systemic antibiotics. However, the rate has been static over the past few decades. The drawbacks associated with the use of prophylactic systemic antibiotics have been lesser concentration of antibiotic at the incision site, fibrin matrix formed at the incision site, and improper timing of administration of the antibiotics.

This prompted newer modes of administering prophylactic antibiotics, one of which is the intra-incisional (subcutaneous) infiltration of the antibiotic to ensure a higher concentration of the antibiotic at the incision site. In the study carried out by Taylor TV et al., the effect of preoperative intraparietal (intra-incisional) injection of Cefoxitin along the site of the intended incision on the incidence of wound infection has been investigated by a randomized prospective study of 181 consecutive patients undergoing abdominal surgery. A significant reduction in wound infection was evident in the Cefoxitin-treated group (8.4%) when compared with controls (16.7%) (Chi square=6; P= 0.02). Administration of antibiotic by this route did not delay wound healing or produce any undesirable side effects.[9] In our study, the group which received only intra incisional antibiotic 8 out of 25 patients (32%) developed SSI. The study carried out by Greenall et al., where the effect of intravenous and intra-incisional Cephaloridine was compared, both modes were found to be equally efficacious.[10] Four hundred and five consecutive patients undergoing emergency or elective abdominal operations under the care of one surgeon were randomly allocated to receive prophylaxis against SSI by means of a single dose of 1gm cephaloridine given either intravenously or into the incision at the beginning of the operation. The rates of SSI were not significantly different between the two groups i.e. 3.5% and 2.1%, respectively, for major wound sepsis and minor wound sepsis was present in 12.4% and I5.5% of the cases, respectively. But the rate of infection was less in the group which received intra incisional Cephaloridine.

In present study, the group which did not receive ceftriaxone, SSI was observed in 12 out of 25 patients (48%) as compared to the group which received subcutaneous infiltration of antibiotic, where 32% (8 out of 25) of the patients developed SSI. This shows that intra incisional (subcutaneous) mode of administration will be more effective in reducing wound infection. In our study it was observed that all confounding factors which effect wound infection such as age (old age patients are more prone for wound infection) , sex, site of perforation(more distal the site of perforation more contamination of peritoneum) , amount of contamination (more gut microbes causing more rate of wound infection), time of 22 presentation (older the perforation more contamination of peritoneum), comorbidities (hypertensive and/or diabetic) and habits (alcohol and/or smoking) which both hamper with wound healing and have influence on patients nutrition, in study and control groups both were statistically insignificant.

Limitations of this study were: Intravenous antibiotics generalization could not be done in both groups which might have resulted in reduction of wound infection rates in control group. There was no check on nutritional management in both groups which would influence better healing of wounds. Smaller sample size to interpret the exact incidence of wound infection.

CONCLUSION

The aim of this study was to find out the results of this route of administration of antibiotic to reduce the incidence of SSI. The incidence of SSI in the group which received subcutaneous infiltration of antibiotic was less than the group of patients, which did not receive ceftriaxone, showing that the use of subcutaneous infiltration of ceftriaxone injection at the time of wound closure may be more effective. Even though the difference between the rate of infection is not statistically significant among the two groups, considering the dreaded complications of wound infection like burst abdomen, intra peritoneal abscesses, delayed wound healing, incisional hernias, bad scars etc. and keeping in mind that there is no added financial burden or local antibiotic related complications we would advise the use of subcutaneous infiltration of antibiotics to prevent the same.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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