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Original Research Article

Role of intraoperative wound irrigation with antibiotics in reducing surgical site infection in patients undergoing contaminated and dirty midline laparotomy surgical wound: a pilot study

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ABSTRACT

Background: This study was carried to assess the effect of antibiotic wound irrigation in reducing the surgical site infection (SSI) in the patients undergoing midline laparotomy with contaminated and dirty surgical incision wound.
Methods: All patients operated with class-IV- dirty and class III (contaminated) abdominal operative wound according to CDC (Centre for Disease Control and Prevention) were included in this pilot study. Study patients were divided into antibiotic irrigation group and control group. In control group, after rectus sheath closure, the wound was irrigated with 100 mL of normal saline before the skin closure. In antibiotic irrigation group, after rectus sheath closure, the wound was irrigated with Ceftriaxone (10 mL) and Metronidazole (100 mL). Incidence of SSI, degree of SSI and length of hospitalization were compared between two groups.
Results: A total of 40 patients were included in the study, 20 in each group. Both the groups were comparable with respect the age, gender, co-morbidities and class of surgical wound. The incidence of SSI was lesser [10% versus 35%; p=0.06] in the antibiotic irrigation group compared to control group. However, the difference was not statistically significant. The length of hospitalization between the groups were comparable [13.5 versus 14.7 days; p=0.74]. The pain score was also not significantly different between the two groups.
Conclusions: On comparing to saline irrigation, antibiotic irrigation in patients with contaminated and dirty operative wound results in a lesser SSI with comparable hospital stay and postoperative pain. However, the difference was not statistically significant.

Keywords: Antiseptic, Laparotomy, Morbidity, Quality of life, Surgical site infection, Wound irrigation

INTRODUCTION

Surgical site infection (SSI) remains a major problem in managing the class III- contaminated and class IV- dirty surgical wounds, causing significant morbidity, prolonged hospital stay, considerable increases in the cost of the health care system and significantly compromises the quality of life.[1] A large number of patients develop long-term disabilities like incisional hernia and scar related complications as a result of poor wound healing and overt tissue destruction following these infections.[2]

Various measures have been reported in the literature to reduce the infection rate in dirty abdominal wound which include preoperative antiseptic skin preparation, selective preoperative hair clipping, local wound irrigation with antiseptic solution etc.[3] However, the reported rate of SSI in contaminated and dirty operative wound still ranges up to 40% in various studies.[1]

A noticeable higher incidence of wound infection is noted in the abdominal wounds owing to high intraluminal bacterial load, and thus irrigation of wounds with

antibiotics will prevent such contamination. Wound irrigation also facilitates progression of wound healing. Although irrigation with antibiotic containing solutions has been suggested to be beneficial in the prevention of infection no firm evidence-based recommendation can be made regarding its use until additional data from well - designed clinical trials become available.[4] Most of these studies had been done on appendicitis with only few well-designed studies comparing midline laparotomy.

Choosing an appropriate antibiotic for wound irrigation is also critical. Most common organisms isolated from the SSI of contaminated and dirty wounds include *Enterobacteriaceae and Bacteriodes*.[5-6] The recommended antibiotic prophylaxis in such cases includes a third generation Cephalosporins like Ceftriaxone and metronidazole against anaerobic infection.[7-9]

Hence this study was done to find out the efficacy of intraoperative antibiotic wound irrigation on reducing the rate of SSI in class III- contaminated and class IV- dirty midline laparotomy surgical wounds.

METHODS

This pilot study was carried out over the period of one year in a tertiary care centre in South India.

Inclusion criteria

This trial included all patients with all patients operated for abdominal conditions in which the incision of the surgical wound falls into class-IV- dirty abdominal surgical wound and class III- contaminated abdominal surgical wound according to CDC (Centre for Disease Control and Prevention) classification in the Department of Surgery.

Exclusion criteria

Study excluded patient treated outside with antibiotics before coming to the hospital, patients in whom primary rectus closure is not possible or in whom laparostoma is warranted, patients less than 12 years of age (paediatric patients) and patients more than 70 years of age. Analysis was not carried out in patients who requires re-exploration in the same hospital admission or expires before discharge from the hospital or within 30 days after surgery (before the outcome assessment).

The nature, methodology and risks involved in the study were explained to the patient and informed consent was obtained. All the information collected was kept confidential and patient was given full freedom to withdraw at any point during the study. All provisions of the Declaration of Helsinki were followed in this study. Considering the feasibility and expected time duration of the study, sample size was calculated to be 20 in each group. Study patients were divided into two groups like antibiotic irrigation group (laparotomy wound irrigated with antibiotic solution) and control group (saline irrigation).

All consecutive patients where the diagnosis was made and classified in to Class III- contaminated or Class IV- dirty laparotomy surgical wound as per the inclusion/ exclusion criteria were studied. All patients received prophylactic antibiotics including Ceftriaxone and Metronidazole unless contraindicated due to hypersensitivity, renal failure etc.

In both the groups- preoperative skin preparation was done with Io-prep and surgical spirit. Standard surgical procedure was carried out as per the diagnosis. Drainage tubes were placed if required. Peritoneum was not closed routinely. Fascial closure (rectus sheath) of the laparotomy wound was done using 1-0 prolene with cutting needle in an interrupted manner. No subcutaneous sutures were used.

In saline irrigation group, after rectus sheath closure, the wound will be irrigated with 100 mL of normal saline before the skin closure. In antibiotic irrigation group, after rectus sheath closure, the wound will be irrigated with Ceftriaxone (10 mL) and Metronidazole (100 mL).

Skin closure was done after saline or antibiotic irrigation of the wound with 3-0 nylon or 2-0 silk in a 45 mm reverse cutting needle by interrupted- vertical mattress technique. After skin closure, the wound was cleaned with surgical spirit. Sterile gauze dressing applied over the wound. Dressing opened after 24 to 48 hours, to check the immediate wound complications.

Wound was examined after 48 hours in both groups. Infected wounds were opened and packed. Possibly infected wounds were observed closely and opened if purulent drainage, increasing erythema, induration, or warmth developed. Dressing had been changed daily and wound was examined in both groups. SSI in both groups was defined as per CDC criteria. .

Primary objectives were incidence of SSI and degree of SSI (superficial incisional/ deep incisional) as per the definition of CDC in each group. Length of hospitalization was compared between two groups.

Statistical analysis

Categorical variables like class of laparotomy wound (Class III, Class IV) gender, co-morbidity (diabetes/ pulmonary tuberculosis) etc. will be assessed for association with SSI using chi-square test.

The changes in pain over time in each group were analysed using Friedman's test. For all statistical analysis, a p value<0.05 will be considered as statistically significant.

RESULTS

A total of 40 patients were included in the study, 20 in control group in which wound was irrigated with normal saline and 20 patients in antibiotic group in which wound is irrigated with ceftriaxone and metronidazole. The age of the patient in control group varied from 29 to 65 with a mean age of 46.7±13.6. The age of the patient in antibiotic group varied from 18 to 70 with a mean age of 50.64±16.0. Majority of the patients included in the study had duodenal ulcer perforation (87%). Three patients had ileal perforation.

Among the patients who were included in the control group, three patients had class III wound (15%) and 17 patients had class IV wound (85%).

Among the patients in antibiotic group, two patients had class III wound (10%) and 18 patients had class IV wound (90%). Among the patients in control group 14 patients had no co-morbidities (70%), three patients had hypertension (15%), one patient had diabetes (5%), and two patients had tuberculosis (10%). Among patients in antibiotic group, 16 patients did not have any co-morbidities, one patient had hypertension (5%), two patients had diabetes (10%) and one patient had underwent chemotherapy (5%) (Table1).

Table 1: Demographic parameters in study population.

	Antibiotic group (n=20)	Control group (n=20)	p-value
Age (mean)	50.64	46.7	0.53
Gender- male [N (%)]	14 (70 %)	11 (57%)	0.52
Co-morbidities [N (%)]	4 (20%)	6 (30%)	0.89
Class of wound-Class IV [N (%)]	18 (90%)	17 (85%)	0.33

The incidence of SSI (%) between the groups [35% versus10%; p=0.06] by chi-square test which was not statistically significant (Table 2).

Table 2: Comparison of Surgical Site Infection (SSI) between the two groups.

SSI	Antibiotic group (n=20)	Control group (n=20)	p-value
Yes [N (%)]	2 (10)	7 (35)	0.06
No [N (%)]	18 (90)	13 (65)	

Among the patients who developed SSI, in control group all patients (100%) had grade I SSI. In antibiotic group, one patient (50%) had grade I SSI and one patient (50%) had grade II SSI (Table 3).

Table 3: Comparison of grade of surgical site infection (SSI) between the two groups.

SSI grade	Antibiotic group (n=2)	Control group (n=7)	p-value
Grade I [N (%)]	1 (50)	7 (100)	0.22
Grade II [N (%)]	1 (50)	0 (0)	

The mean length of hospitalization of patients between the groups was [13.5±8 days versus 14.7±9.1 days; p=0.74] not statistically significant (Figure 1).

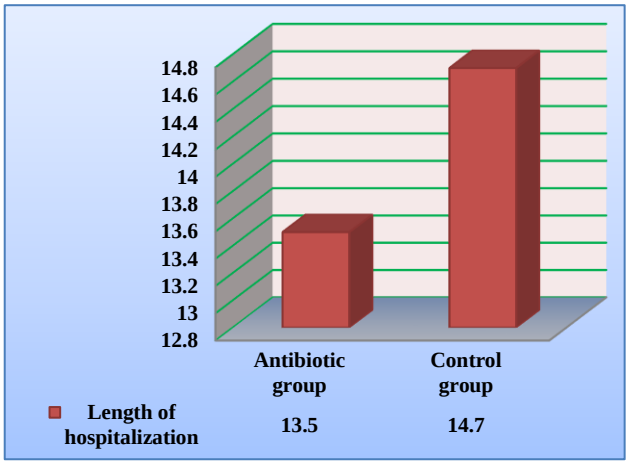

Figure 1: Wound quality parameters between the study patients.

The visual analogue scale (VAS) score was not significantly different in both the groups. The mean VAS score in both groups on 3rd day [8.4±0.51 versus 8.3±0.48; p=0.54] and on 5th day [7.3±0.61 versus 7.1±0.57; p =0.46] were not significantly significant (Table 4).

Table 4: Comparison of postoperative pain scores between the two groups.

Pain	Antibiotic group	Control group	p-value
Pain on 3rd day	8.3±0.48	8.4±0.51	0.54
Pain on 5th day	7.1±0.57	7.3±0.61	0.46

DISCUSSION

SSI is a frequent and serious complication of surgery. Postoperative infection often requires repeat surgery and prolonged hospitalization, and it may compromise ultimate surgical outcomes.[7] Prophylactic intra-operative wound irrigation before skin closure has been proposed to reduce wound contamination and risk of SSI.

But evidence-based recommendations are not available for its use.[8] Also, the concentration, volume of application and duration of application is not standardized. If irrigating wound with antibiotics found to

reduce SSI rates, recommendation for standardizing the antibiotics for wound irrigation and routine use of it before skin closure can be made. This study was thus carried to find the role of intra-operative wound irrigation with antibiotics in reducing SSI in contaminated and dirty abdominal wounds.

In the present study it was observe that the SSI was lesser in the antibiotic wound irrigation group compared to the control group, however, the difference was not statistically significant. Intra-operative wound irrigation with antibiotics seems to be a logical measure to reduce bacterial wound contamination and clean the wound from blood clots and necrotic tissue. Parcells et al compared the wound irrigation with saline, antiseptic solution and antibiotic (Imipenem) and found significantly lesser SSI in the antibiotic group.[9]

Concerns have been raised in infection prevention and epidemiology control studies; wherein they recommend that the current evidence is adequate to eliminate the wound irrigation due to variances in the antibiotic, volume, irrigation time and frequency of irrigation.[10]

The recent meta-analysis by Muller et al had shown significant reduction in incidence of SSI when intra-operatively wound is irrigated with antibiotics and recommended to focus on specific infection to extrapolate the financial benefit.[11] The sample size included in the study was lesser due to the time frame cloud be the reason for the insignificant difference in the SSI rate and larger number of patient could prove the reduction in the rate of SSI.

Length of hospitalization is one of the important factors that influences the total health care cost, loss of man hours and patient's satisfaction and overall quality of life. The length of hospitalization is affected by many factors including, the primary pathology for which patient was operated, the general condition of the patient, presence of sepsis, requirement for ventilator support, and presence of SSI and its grade. It has been proven in many studies that the presence of SSI significantly prolongs the length of hospitalization.

The study of Alphonso et al has reported an increase in duration of hospitalization of patients with SSI and thus resources were used intensively for them and for a prolonged period.[12] In this study, the patients who had SSI had a longer hospital course. However, comparison of antibiotic irrigation group, the control group did not show and significant difference in the length of hospital stay. The insignificant reduction could also be due to the lesser number of SSI in both the group to attain the statistical significance.

Post-operative pain on the wound site was comparable in both the group. Postoperative pain is affected by factors like type of wound, depth of incision, presence of SSI and the pain threshold of an individual. In this study, the gender, rate of SSI, grade of SSI and the length of hospital stay were not significantly increased in the control group where the antibiotic irrigation was not used. The comparable VAS score in both the groups could be due the insignificant difference in the factors which could possibly have an impact on the postoperative pain. Larger population could be useful to assess the difference in the pain reduction in the antibiotic irrigation.

Since the study was a pilot study, only a limited number of patients were included. Larger sample size with longer follow up could possibly substantiate the intraoperative wound irrigation with antibiotic to reduce the SSI.

CONCLUSION

On comparing to saline irrigation, antibiotic irrigation in the patients with contaminated and dirty surgical incision wound will result in a lesser SSI with comparable hospital stay and postoperative pain. However, the difference is not statistically significant.

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Ethical approval: The study was approved by the Institutional Ethics Committee (Human studies), JIPMER, India

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