



Original Article

Comparison Between Simple Closure and Subcutaneous Negative Pressure Drain Closure in Laparotomy Wound of Gastrointestinal Perforation

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Abstract

Background: surgical site infection (SSI) is an infection that occurs after surgery in the part of the body where the surgery took place. SSI is very common in patients of perforation peritonitis if the wound is primarily closed in the setting of gross abdominal contamination. Even after thorough peritoneal irrigation with normal saline, the incidence of wound infection is high. If the wound infection is controlled, then many complications related to it could be prevented. **Aim of the study:** The aim of this study was to compare simple closure and subcutaneous negative pressure drain closure in laparotomy wounds of gastrointestinal perforation regarding the features, incidences, management, and outcomes. **Methodology:** This clinical trial study was conducted at the surgical units of Dhaka Medical College Hospital, Dhaka, Bangladesh during the period from July 2014 to June 2015. A total of 108 cases were selected by inclusion criteria. All the patients were divided in two groups; group A-where negative suction drain was not used and Group B-where a negative suction drain was used in the subcutaneous space at the time of closure of the abdomen after perforation and thorough peritoneal toilet. As per the inclusion criteria of this study patients undergoing emergency laparotomy due to gastrointestinal perforation, aged up to 60 years old, non-diabetic, non-anemic, normal renal function, non-jaundiced and normal nutritional status were included. The outcome compared in the form of wound infection, hospital stay, second surgery and morbidity. **Results:** In this study, the average rate of SSI was found 55.76% (29/52) in group A and 30.36% (17/56) in group B. Average hospital stay for group A and group B were 19 days and 12 days respectively. Second surgery was needed in 4 cases in group A and for 8 cases in group B. The second surgery was done in the form of secondary suturing of wound or wound dehiscence and burst abdomen repair. Mortality in group A was 8 and in group B it was 4; but it was not related to SSI because all death occurred within 3 days after surgery mainly due delay presentation and to poor general condition pre-operatively. Overall morbidity was less with negative pressure closure compared to simple closure and it highly affects the morbidity and somehow mortality also. **Conclusion:** The application of a subcutaneous negative pressure drain may be effective in preventing superficial surgical site infection and may reduce hospital stay, treatment cost, morbidity, and mortality. There is more chance of wound infection in such laparotomy wound because of highly contamination of the peritoneal fluid with fecal material. Such wound constantly leads to serous discharge and bacterial colonization. But negative pressure closure removes that collection and avoids wound infection, and it helps in reducing hospital stay and morbidity.

Key words: Simple closure, Subcutaneous negative pressure drain closure, Laparotomy, Gastrointestinal Perforation.

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Introduction

Gastrointestinal perforation is a common emergency condition in the surgical ward and all surgeons manage it surgically with perforation repair and thorough peritoneal lavage. In the presence of perforation peritonitis, the gut is edematous and the presence of sepsis in the peritoneal cavity causes an outpouring of fluid, sometimes in the form of pus, till the infection is controlled¹. According to the

degree of contamination, the National Academy of Sciences and the National Research Council USA published a classification scheme for surgical wounds that has been widely adopted which includes clean, clean-contaminated, contaminated, and dirty². In 1970, the Centers for Disease Control and Prevention (CDC) in the US set up the National Nosocomial Infection Surveillance (NNIS) system

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and established the guidelines for the prevention of SSI³. Based on NNIS system reports, SSIs are the third most frequently reported nosocomial infection, accounting for 14-16% of all nosocomial infections among hospitalized patients. SSI and wound dehiscence are well-known postoperative complications in gastrointestinal surgery. SSIs have been responsible for prolonged hospitalization, increasing cost, morbidity and mortality related to surgical operations and continue to be a major problem worldwide⁴⁻⁶. Infection rarely occurs if contamination is minimum, if the wound has been made without undue injury, if the subcutaneous tissue is well-perfused and well oxygenated and if there is no dead space⁷. Reports of digestive surgery failed to show the utility of a closed suction drain in preventing incisional SSI^{8,9}. Fujii T, et al. described the utility of a subcutaneous drain in providing effective drainage and reducing dead space in the subcutaneous wound area¹⁰. The Centers for Disease Control and Prevention (CDC) definitions of surgical wound infection divides it into two major categories: (a) incisional surgical site infection (SSI) and (b) an organ/space surgical site infection (organ/space SSI)¹¹. The major objective of this study was to compare between simple closure and subcutaneous negative pressure drain closure in laparotomy wounds of gastrointestinal perforation regarding the features, incidences, management, and outcomes.

Materials & Methods

This was a clinical trial which was conducted at the Surgical Units of Dhaka Medical College Hospital, Dhaka, Bangladesh during the period from July 2014 to June 2015. A total of 108 cases were selected by inclusion criteria. All the patients were divided in two groups; group A, where negative suction drain was not used and Group B, where a negative suction drain was used in the subcutaneous space at the time of closure of the abdomen after perforation and thorough peritoneal toilet. Permission for the study was taken from the Ethical Review Committee of DMC. Informed consent from each subject was taken before the collection of samples. As per the inclusion criteria of this study, patients undergoing emergency laparotomy due to gastrointestinal perforation, aged up to 60 years old, non-diabetic, non-anemic, normal renal function, non-jaundiced and normal nutritional status were included as the study subjects. On the other hand, according to the exclusion criteria of this study, patients under 18 years of age and above 60 years, patients who had undergone a previous laparotomy for any condition and patients who are not willing to give consent or take participate in the study were excluded. Physical examination included general condition, pulse, blood pressure, temperature, respiration, state of hydration and abdominal examination to find out features of

pneumoperitoneum and peritonitis. Diagnosis of intra-abdominal infection was based on the history, clinical examination and plain X-ray abdomen in erect posture including both dome of diaphragm showing the features of pneumoperitoneum or peritonitis. The main outcome variable was presence of superficial surgical site infection. This was recorded as a binary variable-present/absent. The incidence of partial wound dehiscence and total hospital stay for treatment. All the demographic and clinical data of the participants were recorded. A predesigned questionnaire was used in data collection. All data were processed, analyzed, and disseminated by using MS-Excel and SPSS V23 program as per necessity.

Results

In this study, 108 participants were selected with the ages ranged from 18 to 60 years. Among our total participants, 12 patients were expired within 3 days and the mortality rate was 10%. Among the participants the majority (>90%) of the patient was between 18 to 47 years of age in both groups (Table-I). Most of the SSIs were found between the age of 28-47 years and was >70%. In analyzing the gender distribution of the participants, we observed that, most of the patients were male (82.35%), and female contributed 17.65%. In group A, 42 (80.77%) patients were male and 10 (19.23%) were female. In group B, 47 (83.93%) patients were male and 09 (16.07%) were female (Table-II).

Table-I: Age distribution of the total patients (n=108)

Age (years)	Group A Without drain (n=52)	Group B With drain (n=56)	p value
Mean ± SD	34.57 ±10.29	32.77 ±10.01	0.35
18-27	12 (23.07%)	20 (35.71%)	
28-37	23 (44.23%)	15 (26.79%)	
38-47	13 (25.00%)	18 (32.14%)	
48-60	04 (7.70%)	03 (5.36%)	

Table-II: Gender distributions of the participants (n=108)

Gender	Group A Without drain (n=52)	Group B With drain (n=56)	Total	p value
Male	42 (80.77%)	47 (83.93%)	89 (82.35%)	0.86
Female	10 (19.23%)	09 (16.07%)	19 (17.65%)	

As per the distribution of body mass index, 13 (25%) and 05 (8.99%) patients developed superficial surgical site infection in group A and group B respectively where the BMI was >25 kg/m² (Table-

III). In distributing the thickness of subcutaneous fat <3 cm, 19 (51.35%) and 11 (36.67%) patients developed superficial surgical site infection in group A and group B respectively. In analyzing the thickness of subcutaneous fat >3 cm we found, 10 (66.67%) and 06 (23.08%) patients developed superficial surgical site infection in group A and group B respectively (Table-IV, V).

Out of 108 patients with emergency laparotomy for gastrointestinal perforation, the rate of superficial SSI in different operations were observed. In group A and group B respectively, out of 23 and 19 duodenal perforation 08 (34.78%) and 07 (36.84%) patients, out of 07 and 05 antral perforation 02 (28.57%) and 01 (20%) patients, and out of 02 and 03 colonic perforation 02 (100%) and 01 (33.33%) patients developed superficial SSI. Statistical distribution of duodenal, antral, and colonic perforation between groups showed no significant variation. In group A and group B respectively, out of 13 and 18 ileal perforation 11 (84.62%) and 06 (33.33%) patients, out of 07 and 11 burst appendix 06 (85.71%) and 02 (18.18%) patients developed superficial SSI. Statistical distribution of burst

appendix and ileal perforation between groups showed significant variation (Table-VI).

In analyzing the total incidences, we observed that, in group A and group B, 29 (55.76%) and 17 (30.36%) patients developed superficial surgical site infection respectively. Statistical distribution of superficial surgical site infection between groups showed significant variation. (p<0.05) (Table-VII).

In total 46 patients (42.59%), who experienced the SSI, underwent various procedures for further management. Among them, in group A 11 (37.93%) undergone for secondary suturing, 13 (44.83%) treated conservatively in respect to group B 05 (29.41%) having secondary suturing and 11 (64.71%) treated conservatively. The incidence of burst abdomen was 17.24% (5 cases) in group A compared to group B had only 5.88% (01 case) (Figure-1). In Group A 32 (61.5%) patients had a length of hospital stay of more than 15 days which was 16 (28.57%) patients in group B patients. Mean hospital stay for group A patient was 19±1.63 days and for group B patient it was 12±1.76 days (Table-VIII).

Table-III: Body mass index distribution of the participants (n=108)

BMI (kg/m ²)	Group A Without drain (n=52)		Group B With drain (n=56)		p value
	s-SSI	No s-SSI	s-SSI	No s-SSI	
<18.5	06 (11.54%)	08 (15.38%)	03 (5.36%)	06 (10.71%)	1
18.5 – 25	10 (19.23%)	12 (23.08%)	09 (16.03%)	15 (26.77%)	0.7652
> 25	13 (25%)	03 (5.77%)	05 (8.99%)	18 (32.14%)	0.0003

Table-IV: Surgical site infection in subcutaneous fat <3 cm cases of the patients

s-SSI	Group A Without drain	Group B With drain	p value
Yes	19 (51.35%)	11 (36.67%)	0.34
No	18 (48.65%)	19 (66.33%)	
Total	37	30	

Table-V: Surgical site infection in subcutaneous fat >3 cm cases of the patients

s-SSI	Group A Without drain	Group B With drain	p value
Yes	10 (66.67%)	06 (23.08%)	0.02
No	05 (33.33%)	20 (76.92%)	
Total	15	26	

Table-VI: Site of perforation distribution of the site of perforation among the patients (n=108)

Site of perforation		Group A Without drain (n=52)			Group B With drain (n=56)			p value
		N	s-SSI	No s-SSI	N	s-SSI	No s-SSI	
Duodenum	(n=42)	23	08 (34.78%)	15 (65.22%)	19	07 (36.84%)	12 (63.16%)	0.752
Antral	(n=12)	7	02 (28.57%)	05 (71.43%)	5	01 (20%)	04 (80%)	1
Ileum	(n=31)	13	11 (84.62%)	02 (15.38%)	18	06 (33.33%)	12 (66.67%)	0.003
Colon	(n=05)	2	02 (100%)	00 (00%)	3	01 (33.33%)	02 (66.67%)	0.4
Appendix	(n=18)	7	06 (85.71%)	01 (14.29%)	11	02 (18.18%)	09 (81.82%)	0.0128
Total		52	29 (55.76%)	23 (44.23%)	56	17 (30.36%)	39 (69.64%)	

Table-VII: Incidence of post-operative s-SSI of the patients (n=108)

SSI	Group A Without drain	Group B With drain	Total n (%)	p value
Yes	29 (55.76%)	17 (30.36%)	46 (42.5)	0.0134
No	23 (44.23%)	39 (69.64%)	62 (57.4)	
Total	52	56	108	

Table-VIII: Total hospital stay of the patients (n=108)

Days	Group A Without drain (n=52)	Group B With drain (n=56)
< 10 days	4	8
10 - 15	16	32
16 - 20	25	16
> 20	7	0
Mean ± SD	19 ± 1.63	12 ± 1.76

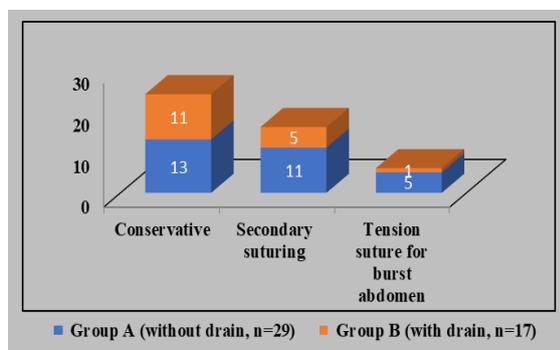


Figure-1: Category of the management of SSI wound (n=46).

Discussion

The aim of this study was to compare between simple closure and subcutaneous negative pressure drain closure in laparotomy wounds of gastrointestinal perforation regarding the features, incidences, management, and outcomes. Among the total of 120 participants, 12 patients were expired within 3 days and were excluded from the study and the mortality rate was 10%. A study done by Florence CR, et al. showed an overall mortality rate of 19%¹². This study showed the majority (>90%) of the patients were seen between 18-47 years of age in both groups. Most of the SSI found between the ages of 28 and 47 years which was 70%. A similar study done by Vashist M, et al. showed the age of the patients ranged from 16-71 years and the maximum number of patients (58%) was in the age group of 20-40 years¹.

In this study male was predominant than female (82% vs. 17.65%). A similar study done by Vaghani Y, et al. showed males 31 (62%) and females 19 (38%)⁴. This study showed most patients 13 (25%) developed superficial surgical site infection in group A and 05 (8.99%) patients in group B where the body mass index was higher. Watanabe A, et al. stated the SSI-positive group had a significantly higher mean body mass index (BMI) than the SSI-negative group¹³. For patients who had subcutaneous fat thickness >3 cm in this study, most of the patients 10 (66.67%) developed s-SSI (superficial surgical site infection) in group A than in Group B 06 (23.08%). Our finding was like previous study done by Cardoso RJ, et al.¹⁴ who found that, overall wound complication and wound disruption rates were not significantly different between groups: suture (12.8%, 7.7%), drain (17.9%, 14.9%), control (15.6%, 11.7%) respectively.

The most common complication observed in this study after laparotomy for gastrointestinal perforation was SSI. The overall percentage of postoperative SSI was 46 (42.59%) in our study which was like the other studies^{3,15,16}. The study by Vaghani Y, et al. showed that the group had a negative suction drain having a 25% rate compared to another group of simple closures having 57.7% which was almost like our study⁴. All the findings of this study may be helpful in similar further studies.

Limitation of the study

This was a single-centered study with small-sized samples. Moreover, the study was conducted over a very short period. So, the findings of this study may not reflect the exact scenario of the whole country.

Conclusion & Recommendation

Surgical site infection is inevitable in any kind of operation while having more chances in emergency laparotomy for gastrointestinal perforation. Application of subcutaneous negative pressure drain may be effective in preventing superficial surgical site infection and may reduce hospital stay, treatment cost, morbidity, and mortality. Further research is necessary in a large scale for guidance regarding the prevention of surgical site infections in our country.

Conflict of interest

The authors declared that they have no conflict of interest.

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