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A comparative study of subcutaneous negative pressure versus simple closure of skin incision following surgery for hollow viscus perforation

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Abstract

Background: Surgical site infection (SSI) is a significant problem associated with open abdominal surgery resulting in increased morbidity, mortality, and cost of treatment. Surgical site infection is one of the most common post-operative complications, occurring in at least 5% of all patients undergoing surgery and 30-40% of patients undergoing abdominal surgery, depending on the level of contamination. This study compares the subcutaneous single closed suction drain and simple conventional closure of skin incision in emergency laparotomy for hollow viscus perforation.

Aim: The aim of the study is to determine whether the insertion of a subcutaneous closed suction drain at the incisional site reduces the incidence of post-operative surgical site infection in emergency laparotomy for hollow viscus perforation.

Methodology: This is a prospective study. Fifty patients was enrolled, Patients diagnosed to have acute abdomen clinically and radiologically were planned for emergency exploratory laparotomy. They were further allocated alternately to Group I with subcutaneous closed suction drain and Group II without drain. All the patients underwent laparotomy. Postoperatively wound complications and hospital stay was recorded.

Conclusion: Our study shows that subcutaneous negative pressure drainage significantly reduces the post-operative surgical site infection and duration of hospital stay following surgery for hollow viscus perforation. This helps in early recovery, better wound healing, and decreases the financial burden on patients by decreasing hospital stay and infection. As post-operative complications depend on the level of contamination, we recommend use of closed negative pressure subcutaneous drain in all patients with contaminated or dirty wounds.

Keywords: Laparotomy wound complications, Hollow viscus perforation, Negative pressure drainage, Post laparotomy skin closure

Introduction

Surgical site infection (SSI) is a significant problem associated with open abdominal surgery resulting in increased morbidity, mortality, and cost of treatment. Surgical site infection is one of the most common post-operative complications, occurring in at least 5% of all patients undergoing surgery and 30-40% of patients undergoing abdominal surgery, depending on the level of contamination [1]. Patients requiring emergency laparotomy procedure has increased risk of surgical site infection and delayed wound healing. The incidence of SSI increases with the degree of contamination. Infection occurs at much higher rates after operations for perforation peritonitis with an incidence of 5-15%, compared to less than 5% for elective abdominal surgeries [1].

Numerous risk factors have been identified as causing SSIs. Body Mass Index and obesity have been linked to increased risk of SSIs, and wound complication rates increases from 7% to 23% due to obesity [2]. Many other factors as Diabetes mellitus, malnutrition, smoking, ASA class, operative time, contaminated surgeries, and the emergence of antimicrobial-resistant pathogens have been identified as important factors affecting SSI [3]. Various measures have been proposed for reducing SSIs. Some of them are used in routine practice. Hand washing, minimizing shaving, skin preparation, and preoperative antibiotics have been shown to decrease post-operative wound complications.

The presence of hematoma, serous fluid, and dead space in surgical wounds act as a culture medium and increases the risk of surgical site infection. Insertion of subcutaneous drain removes fluids and debris from the subcutaneous layer and eliminates dead space in the early post-operative phase before they become infected, resulting in a reduction of incisional SSIs. Surgical site infection leads to increased duration of hospital stay and increased morbidity [4] alongside increasing unnecessary patient suffering.

This study compares the subcutaneous single closed suction drain and simple conventional closure of skin incision in emergency laparotomy for hollow viscus perforation.

Aim and objectives of the study

The primary outcome of the study is to determine whether the insertion of a subcutaneous closed suction drain at the incisional site reduces the incidence of post-operative surgical site infection in emergency laparotomy for hollow viscus perforation.

The secondary outcome is to find the effect of closed suction drain in reducing the duration of hospital stay when compared to simple closure.

Methodology

This is a prospective study conducted in the Department of General Surgery over a period of 2 years. Fifty patients admitted to the Department of General Surgery were included in the study. The diagnosis was made clinically and confirmed by appropriate diagnostic modalities.

Patients were resuscitated with intravenous fluid and started with antibiotics. All the patients received piperacillin tazobactam 4.5 gm and metronidazole 500 mg intravenously. Patients diagnosed to have acute abdomen clinically and radiologically were planned for emergency exploratory laparotomy. They were further allocated alternately to Group I with subcutaneous closed suction drain and Group II without drain. In the operation theatre, the surgical site was cleaned with povidone iodine and alcohol. The abdomen was opened by a midline incision. After the surgical procedure, a thorough peritoneal wash was given. The Rectus sheath was closed by continuous non-absorbable monofilament suture material. A 16F Romovac subcutaneous suction drain was placed in Group I and fixed in position using 2-0 Mersilk suture material. The skin was approximated with skin staplers in all patients. Quantity of drainage in Group I patients was noted every 24hrs. Sterile dressing with Gamzee pads was done every day in all patients. A diagnosis of SSI was made if there is pain, swelling, redness, along with serous or purulent discharge. All wound collection was sent for microbiological evaluation, and antibiotics changed accordingly. Amount of drainage was recorded daily, and drain was removed when the output was less than 5 ml in 24hr. Patients were discharged only after the removal of the drain.

The data was analyzed in the statistical program SPSS. Chi-square test was applied for categorical variables to calculate frequencies and percentages, and Student's t-test was applied to compare the means among the groups. Value of $p < 0.05$ was considered statistically significant.

Result

Emergency laparotomy was performed in 50 patients out of which closed subcutaneous drain was placed in 25 patients. Primary closure of skin incision was done in another 25 patients.

Highest number of patients was seen between 41-50 years followed by age group 31-40 years. The mean age in this study was 44.2 years (Table-1).

Table 1: Age distribution

Age group	Frequency (n=50)	Percentage
21-30	9	18%
31-40	12	24%
41-50	22	44%
51-60	6	12%
61-70	1	2%
Total	50	100

Gender wise distribution of patients in our study is shown in Table-2. Total male patients were 36 (72%) and female patients were 14 (28%) Male to female ratio in our study was 2.6:1 (Table-2).

Table 2: Gender distribution

Sex	Frequency	Percentage
Male	36	72%
Female	14	28%
Total	50	100

In total of 50 patients, closed negative subcutaneous drain was placed in 25 patients. Six patients (24%) out of 25 had wound related complication. Out of 25 patients with primary skin closure 14 patients (56%) had local complication at surgical site (Table-3). Complication rate in patients with subcutaneous drain was significantly low with P value of 0.02.

Table 3: Association between status of drain and SSI

Group	Wound complication	No wound complication	
Group I (n=25)	6(24%)	19(76%)	Chi Square = 5.33 P = 0.02
Group II (n=25)	14(56%)	11(44%)	

The most common complication encountered was Surgical Site Infection. Other postoperative complications like chest complications, wound infection (22%), wound dehiscence (6%) and burst abdomen (2%) were also observed in the present study (Table-4). One patient in Group- II had burst abdomen with evisceration of bowel. This patient required re-exploration and closure of the abdomen wall by tension suturing. All other patients were managed conservatively with repeated dressing and antibiotics.

Table 4: Wound complication

Wound complication	Group I (n=25)	Group II (n=25)	P value
Seroma	1	3	0.29
Hematoma	1	0	0.78
SSI	3	8	0.09
Wound dehiscence	1	2	0.47
Burst abdomen	0	1	0.78

Table 5 represents association between status of drain (with and without) and post-operative stay. Our study shows there is reduction in the postoperative stay in cases with negative pressure drain as compared to cases without drain.

Table 5: Association between status of drain and Post-operative stay

Post-operative stay in days	Group I (n=25)	Group II (n=25)	
<7	1	0	Chi Square =3.95 P =0.27
8-10	18	12	
11-15	2	3	
>15	4	10	

Mean duration of hospital stay in patients with subcutaneous negative pressure drain was 9.12 days. The average duration of stay in patients without drain was 12.5 days. Table-6 shows that there is statistically significant reduction in hospital stay in patients with subcutaneous drain.

Table 6: Mean duration of hospital stay

Group	Mean	S.D	P-value
Group 1(n=25)	9.1200	1.4463	T test= 5.73 P=<0.01
Group 2(n=25)	12.5	2.572	

Discussion

Emergency laparotomies are commonly performed by general surgeons. Major indications for emergency surgery include hollow viscus perforation, intestinal obstruction, acute appendicitis, and abdominal trauma. Although the outcome of any emergency laparotomy is directly related to the underlying pathology, comorbid conditions, surgical expertise, and post-operative care also contribute to the final outcome. Patients undergoing emergency laparotomy have disproportionately high morbidity and mortality compared to elective laparotomies [5]. Commonly encountered local complications are seroma, hematoma, surgical site infections, wound dehiscence, burst abdomen, and delayed wound healing. Many techniques are being practiced to reduce surgical site infection, and one among them is the placement of a subcutaneous drain.

In our study, 68% of the patients were of age group 31 to 50 years. This finding is in agreement with the study conducted by Kapoor *et al.*, [6], in which 69% were between the age group 21 to 50 years. The male to female ratio in our study was 2.6:1. The incidence of perforation peritonitis is more common in young males due to a higher rate of smoking and analgesic abuse. This age group is also more prone to roadside accidents leading to intra-abdominal injury and perforation.

Wound complications occurred in 20 (40%) patients in our study. Fourteen patients (56%) in the primary closure group and six (24%) patients in the subcutaneous drain group had wound complications. The probability value is statistically significant in our study with P=0.02. The most common complication being surgical site infection. Other postoperative complications like chest complications, wound infection (22%), wound dehiscence (6%), and burst abdomen (2%) were also observed in the present study. This is in concordance with the study done by Fujii *et al.*, [7]. Putting subcutaneous drain immediately adjacent to the wound removes serous fluid and blood collection, thereby increasing capillary circulation, decreasing bacterial load, and promoting granulation tissue formation.

Postoperative stay in patients with drain is less as compared to patients without drain in our study. Overall mean postoperative stay in patients with drain was 9.1 days. Postoperative stay in patients without drain was 12.5 days (P<0.01). This is similar to a study done by Kagita *et al.* [1]. The more extended hospital stay may be due to the extra time required to manage wound infection. Such patients will require repeated dressings, prolonged antibiotic therapy, and additional surgical procedure

adding to their sufferings. In addition, an SSI, on an average, increases the hospital stay by approximately five days [8]. This will also add to the financial burden of the patient.

Conclusion

Our study shows that subcutaneous negative pressure drainage significantly reduces the post-operative surgical site infection and duration of hospital stay following surgery for hollow viscus perforation. This helps in early recovery, better wound healing, and decreases the financial burden on patients by decreasing hospital stay and infection. As post-operative complications depend on the level of contamination, we recommend use of closed negative pressure subcutaneous drain in all patients with contaminated or dirty wounds.

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