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Original Research Article

Abdominal wall closure in the presence of sepsis (acute abdomen): role of negative suction

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ABSTRACT

Background: To compare and find out the best method of abdominal wall closure in cases peritonitis between subcutaneous negative suction drainage tube and conventional primary skin and subcutaneous closure.
Methods: From September 2015 to September 2017, 100 patients who presented at the emergency department with acute abdominal pain and operated for the same, with features s/o peritonitis were enrolled into the study. 50 of them were managed with subcutaneous negative suction drainage tube during abdominal wall closure (Group A). 50 other patients underwent conventional method of abdominal wall closure (Group B). On table pus c/s was sent for all 100 cases. The surgical wound was observed for signs of infection. Any seropurulent collection from the drain or any discharge from the wound was sent for c/s and the results of which were compared with the results of on table pus c/s. If wound dehiscence was noted, secondary suturing was done after the wound healed. The duration of suction drain placement and stay in the hospital were noted in all cases. The results were analyzed with Chi-square test and Student t test (unpaired) and p values were calculated. A p value of less than 0.05 was considered significant.
Results: The incidence of SSI was significantly less in Group A (20%) than in Group B (64%). Similarly, wound dehiscence occurred in 30% of SSI cases in Group A as against 87.1% of SSI cases in Group B, the difference of which was statistically significant. The mean duration of hospital stay was significantly less when subcutaneous suction drain was placed (8 days).
Conclusions: Subcutaneous suction drainage tube is an effective method of abdominal wall closure in cases of peritonitis when compared to conventional primary skin closure as it significantly reduces the incidence of SSI, wound dehiscence, wound secondary suturing and duration of hospital stay.

Keywords: Negative suction, Peritonitis, Surgical site infection, Wound dehiscence

INTRODUCTION

Surgical Site Infection and delayed wound failure are reported more commonly in abdominal surgeries performed in cases of peritonitis than in other gastrointestinal surgeries.[1] Post-operative Surgical Site Infection (SSI) is a significant cause of morbidity in terms of prolonged hospital stay and increased expenses.[2] Though pre-operative antibiotic prophylaxis and per operative thorough peritoneal lavage play a major role in preventing SSI, an effective method of closure of wound is also important.[3] Burst abdomen following wound dehiscence in SSI is a major concern for surgeons as it can cause compromise of respiratory functions if recloser is done, whereas, nosocomial infection can occur if the wound is left open. Subcutaneous negative suction drainage has been shown to reduce the incidence of SSI and wound dehiscence by causing drainage of the infective material and promoting wound healing.[4]

This study was done to compare the effectiveness of sub-cutaneous negative suction drainage tube and

conventional abdominal wall closure in cases of peritonitis with regard to SSI, wound dehiscence, wound secondary suturing and duration of hospital stay.[5]

METHODS

Study population

The study was conducted among all eligible patients taken up for emergency surgery at JSS Medical College and Hospital between September 2015-september 2017, who satisfied the inclusion criteria. Sample size was 100 cases.

- In 50 cases, subcutaneous negative suction drain was used in abdominal wall closure- Group A.
- In 50 cases, conventional primary skin closure was done - Group B.

Inclusion criteria

- All adult patients who have undergone emergency abdominal surgery for peritonitis in the department of General Surgery in JSS medical college and hospital, Mysuru, between September 2015-September 2017.
- It includes midline laparotomy surgeries [ex-duodenal perforation etc.]
- Right subcostal incision [ex-perforated empyema of GB]
- Grid iron and below umbilicus midline mini laparotomy incision for appendicular abscess.

Exclusion criteria

- Patients with immunogenic disease or on immunosuppressive therapy
- Patients who need laparostomy
- Pediatric patients
- Patients with less than one-month post-operative follow-up.

Patients presenting at the emergency department who meet the inclusion criteria were recruited into the study. After obtaining a detailed history, all patients presenting with acute abdominal pain were isolated in the emergency ward.

Diagnostic criteria for peritonitis

Clinically

- Acute pain abdomen, nausea, vomiting
- Fever, Tachycardia
- Guarding, rigidity
- Absent or decreased bowel sounds

On investigations

- Leukocytosis
- X Ray- Abdomen erect-free air under diaphgram, distended bowel loops.
- USG Abdomen-Free fluid in peritoneal cavity

Laparotomy findings

- Whether pus fluid is present or abdominal cavity is contaminated with bowel contents.
- Patients who met the above mentioned diagnostic criteria for peritonitis were included in the study.
- Consent for participation in the study was obtained from the patients after pre-consent counselling. The consent for participation in the study was obtained simultaneously with the consent for surgery.
- 50 cases underwent abdominal wall closure with subcutaneous suction drain and were assigned to Group A. 50 other cases underwent conventional primary skin closure and were assigned to Group B.

Data collection

Data was collected by the principal investigator using pre-designed data collection sheets. Frequency tables and summary statistics were made for the socio-demographic characteristics and the various outcome variables in the two groups of the study. Means, medians were calculated and compared between the two groups of the study. To describe about the data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and the mean and S.D were used for continuous variables. To find the significant difference between the bivariate samples in independent groups, unpaired Student t-test was used. To find the significance in categorical data Chi-Square test was used. In all the above statistical tools the probability value 0.05 is considered as significant level.

RESULTS

The results of the study are explained below in detail with charts and tables for better understanding. The demographic details of the groups, followed by the outcome measures- SSI, wound dehiscence, secondary suturing, duration of stay and the cause of SSI are explained.

Age

Table 1: Mean age of patients in the study.

Demography	Group A (n-50)	Group B (n-50)	P value	Statistical test of significance
Mean age (years)	39.3	45.3	0.07	Student unpaired t-test

The mean age in group A was 39 years and in group B was 45.3 years. This is not statistically significant, as the p value is 0.07, calculated by Student unpaired t test. The

two groups do not differ significantly with regard to age distribution.

Sex

The difference in the Male:Female ratio between the two groups was not statistically significant, i.e. males were common in both the groups.

Table 2: Sex distribution of the patients in the study.

Demography sex	Group A (n-50)	Group B (n-50)	P value	Statistical test of significance
Male/Female	35/15	38/12	0.4	Chi-square test

Indications of surgery

The following were the indications for surgery in all peritonitis cases (on table finding pyo-peritoneum/fecal peritonitis) in the order of decreasing frequency. Appendicular perforation/ mass - (Most common). Small bowel perforation- duodenal/ ileal, obstruction with pyo-peritoneum.

- Cholecystitis
- Large bowel perforation- colon/ recto sigmoid
- Gastric entro pyloric
- Liver abscess
- Parietal wall abscess with pyo peritoneum, post appendicectomy fecal peritonitis, obstructive umbilical hernia with pyo peritoneum.

The difference in the indications of the surgery in both the groups was not statistically significant, i.e. the indications were similar in both the groups.

Table 3: Statistical significance of difference in indications for surgery.

Demography indications of surgery	Group A (n-50)	Group B (n-50)	P value	Statistical test of significance
Appendicular	22	20	0.8	Chi square test
Small bowel	13	12		
Gall bladder	4	3		
Large bowel	2	2		
Gastric	4	3		
Liver	4	2		
Others	1	8		

Type of incision

The most common incision performed was midline laparotomy in both the groups. Grid iron and right subcostal were the other incisions performed. There was no statistically significant difference in the type of incisions performed between the two groups.

Table 4: Statistical significance of difference in the type of incisions performed.

Demography type of incision	Group A (n-50)	Group B (n-50)	P value	Statistical test of significance
Midline laparotomy grid iron right subcostal	36 10 4	38 7 5	0.7	Chi square test

Hence, there was no statistical difference in all the demographic parameters like age, sex, indication for surgery and type of incision between both groups.

Surgical site infection, wound dehiscence and wound secondary suturing

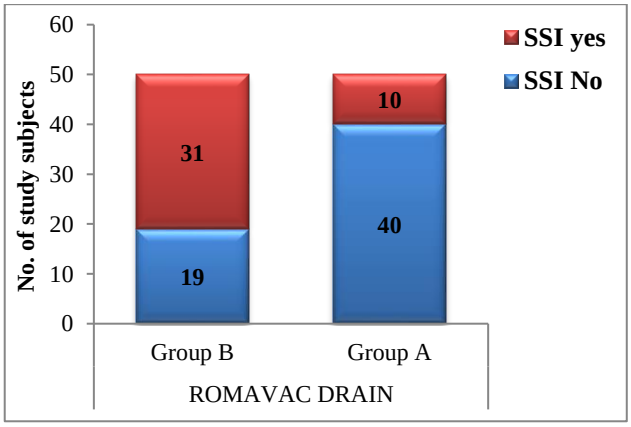

Figure 1: Incidence of SSI.

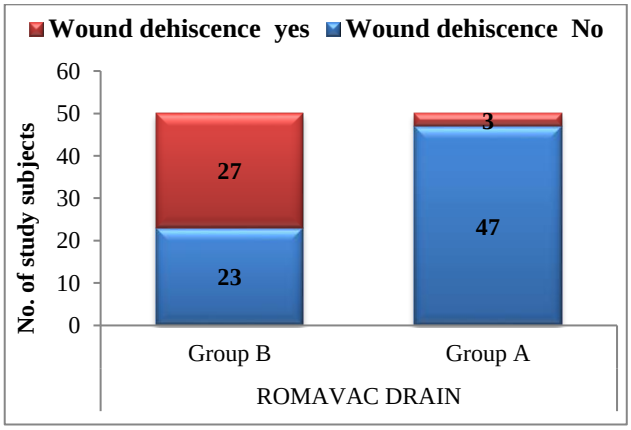

Figure 2: Incidence of wound dehiscence.

Overall Superficial Incisional Surgical Site Infection rate was 41% (41 out of 100 cases were infected), 20% in group A and 62% in group B. Dehiscence occurred in 73% of SSI cases (30 out of 41 overall cases), 30% of SSI cases (3 out of 10) in group A and 87% of SSI cases in group B (27 out of 31). The wound healed without dehiscence in 7 out of 10 patients in group A and 4 out of 31 patients in group B.

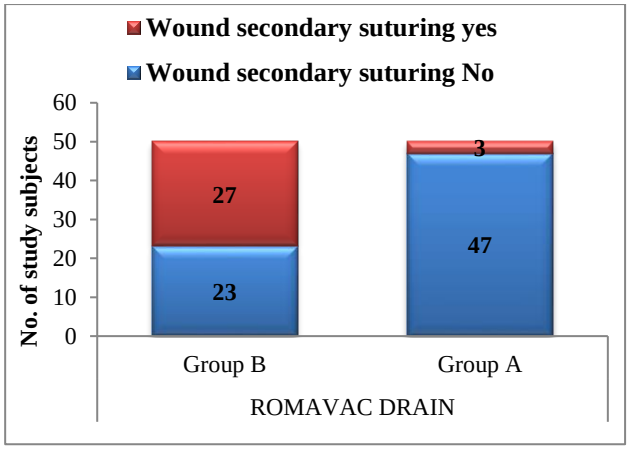

Figure 3: Incidence of secondary suturing.

All patients with wound dehiscence were taken for secondary suturing.

The incidence of SSI was significantly less in group A than in group B. Similarly, among the SSI cases the incidence of wound dehiscence was also significantly less in group A than in group B.

Cause of SSI

The various organisms isolated from the on-table cultures taken on the day of surgery include *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytocica* and *Acetobacter*. Of these, *Escherichia coli* was the most common isolate overall in both the groups (43%). It is to be noted that overall, no growth was isolated in 25% of the cases.

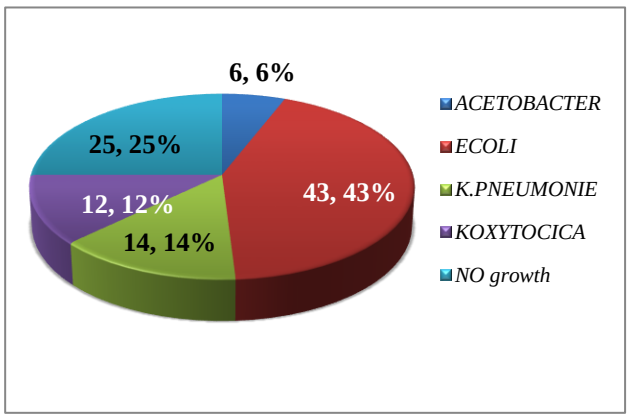

Figure 4: Overall on table C/S.

The sero purulent / purulent collection in the drain and the discharge from the surgical site was taken for C/S. The incidence of isolates in both the groups was not statistically significant. The most common organism to be isolated was Escherichia coli in both the groups (overall-53%, 60% in group A, 51.61% in group B).

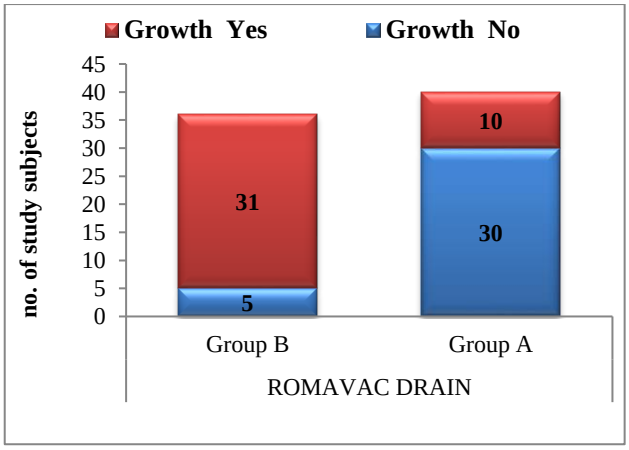

Figure 5: Drain sero-purulent collection/wound discharge C/S in group A and group B.

Table 5: Significance of the incidence of abdominal cavity infection and hospital acquired cross infection.

Drain sero-purulent collection/ wound discharge	Group A (n-50)	Group B (n-50)	P value	Statistical test of significance
Escherichia coli	6	16	0.55	Chi square test
Klebsiella pneumonia	2	5		
Klebsiella oxytocica	1	5		
Acetobacter	1	5		

On comparing the on-table C/S reports with the drain collection / wound discharge C/S reports the following findings were observed. SSI was more commonly due to abdominal cavity infection in both the groups, the incidence being 70% in group A and 87.1% in group B.

Table 6: Significance of the incidence of abdominal cavity infection and hospital acquired cross infection.

Cases of SSI	Group A (n-10)	Group B (n-31)	P value	Statistical test of significance
Abdominal cavity infection	7 (70%)	27 (87%)	0.3	Chi square test
Hospital acquired cross infection	3 (30%)	4 (12.9%)		

There was no statistical difference between the incidence of abdominal cavity infection and hospital acquired cross infection in both the groups (p value 0.3), i.e. SSI was more commonly due to abdominal cavity infection than hospital acquired infection in both the groups.

Role of drain in early identification of SSI

Sero purulent collection from the drain was picked up and sent for C/S as early as POD-2 in 80% of SSI cases in group A. Whereas, in group B, 54% of the SSI cases were detected on POD 4 by the presence of wound discharge.

Table 7: Significance of early detection of SSI.

SSI cases- POD of detection	Group A (n-10)	Group B (n-31)	P value	Statistical test of significance
POD 2	8	-	<0.001	Chi square test
POD 3	2	10		
POD 4	-	17		
POD 5	-	4		

There was statistically significant early detection of SSI due to the presence of drain in group A when compared to conventional closure in group B.

Duration of stay

The mean duration of hospital stay was significantly less when subcutaneous suction drain was placed.

Table 8: Mean duration of hospital stay.

Outcome measure	Group A (n-50)	Group B (n-50)	P value	Statistical test of significance
Mean duration of hospital stay (days)	7.92	14.4	<0.0001	Student unpaired t-test

Duration of suction drain placement in group A

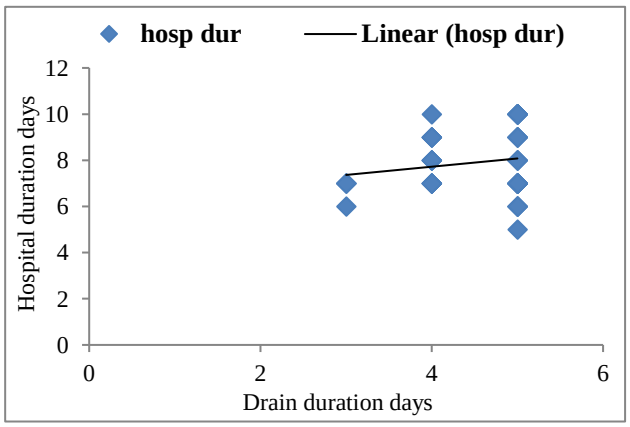

Figure 6: Duration of suction drain placement vs hospital stay in group A.

The mean duration of suction drain placement in Group A was 4.56 days.

Figure showing mean duration of suction drain placement.

DISCUSSION

The demographic parameters like age and gender were not statistically significant in both the groups (p values 0.07 and 0.4 respectively). The mean age was 39 years in group A and 45.3 years in group B.[6] This is in concordance with Sohn et al who in a study on 280 cases noted an average of 39 years. Males were common in both the groups. This result was similar to a study by Hernandez et al in 2005 who reported 65.6% males and 34.4% females among SSI cases.[7]

The indications for surgery were similar in both the groups (p value 0.8) Appendicular causes topping the list in both the groups.[8] The most common incision performed was midline laparotomy in both the groups.[9] Similar to this a recent study was done at D Y Patil Medical Hospital, Pune from 2013 to 2015 in 100 patients who were taken up for elective laparotomy, in which cholecystectomy was the most common surgery and right subcostal was the most common incision performed.

The incidence of SSI was significantly less in group A (20%) than in group B (62%), with a p value of 0.003.[10] Among the SSI cases the incidence of wound dehiscence and secondary suturing was also significantly less in group A (30%) than in group B (87.1%) with a p value 0.015.[11] Whatever be the cause for peritonitis, whatever be the type of incision, subcutaneous negative suction drains are effective in reducing the incidence of SSI, wound dehiscence, wound secondary suturing rate when compared to primary conventional abdominal wall closure.[12] There are a lot of studies on open vs closed technique/primary vs delayed abdominal wall closure in sepsis/peritonitis cases. Similarly, studies for and against the placement of subcutaneous drains in various scenarios like elective laparotomy wounds, colorectal surgeries are also available.[13] A recent study was done at D Y Patil Medical Hospital, Pune from 2013 to 2015 in 100 patients of elective laparotomy. The SSI rate with drain was 6% and without drain was 20%.

The most common organism to be isolated in drain/wound discharge was Escherichia coli in both the groups (overall- 53%, 60% in group A, 51.61% in group B).[14] Similar observations were made in the study at Pune in elective laparotomy cases (10%) and also in a study conducted by Sahu et al and Fadnis et al.

SSI was more commonly due to abdominal cavity infection than hospital acquired infection in both the groups (p value 0.3). Most of the SSI are due to abdominal cavity source.[15]

There was statistically significant early detection of SSI due to the presence of drain in group A when compared

to conventional closure in group B (POD 2 in group A vs POD 4 in group B, p value 0.0001). Subcutaneous negative suction drains not only help in reducing the incidence of SSI, but also help in early identification of SSI, and thus allowing us to ensure early treatment and prevention of wound dehiscence.[16]

The mean duration of suction drain placement in Group A was 4.56 days. The mean duration of hospital stay was significantly less when subcutaneous suction drain was placed (7.92 days vs 14.4 days, p value 0.0001). Kim et al in a study evaluated the hospital stay period in patients with and without wound drain. It was found to be 8 days in the group with drain and 11 days in the group without drain.

CONCLUSION

- Surgical site infection is commonly due to abdominal cavity infection rather than hospital acquired cross infection.
- Subcutaneous suction drainage tube is an effective method of abdominal wall closure in cases of peritonitis when compared to conventional primary skin closure as it significantly reduces the incidence of wound infection, dehiscence, wound secondary suturing and duration of hospital stay in SSI.
- Subcutaneous suction drainage tube enables improved rate of recovery and finally decreased morbidity and early rehabilitation. Hence, subcutaneous suction drainage tube should be considered in abdominal wall closure in patients who undergo surgery for peritonitis.

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

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