International Journal of Research in Medical Sciences
Raj PL et al. Int J Res Med Sci. 2023 May;11(5):1536-1540
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20231065

Original Research Article

Role of closed subcutaneous drain in prevention of surgical site infection in perforation peritonitis

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Received: 20 March 2023
Revised: 13 April 2023
Accepted: 14 April 2023

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ABSTRACT

Background: Surgery for perforation peritonitis is associated with the highest rates of infective complications, especially surgical site infection. SSI occurs due to failure of obliteration of dead space during abdominal wound closure resulting in formation of hematoma and seroma collection in the surgical wound viz. abdominal wound in cases of perforation peritonitis. This acts as a good culture medium for bacterial organisms to grow and cause wound infection. The bacterial pathogens can be either from intra-abdominal sepsis or nosocomial in origin. Closed suction drains can be used effectively to eliminate dead space in the wound and evacuates the seroma or hematoma collection, thereby reducing chances of SSI and also helps in early detection of SSI by inspecting the nature of drain output. Aim was to evaluate the role of closed suction drains in prevention of SSI in cases of perforation peritonitis.
Methods: Comparative study of 60 cases of perforation peritonitis divided into two equal groups (Group A patient with closed suction drain in subcutaneous space vs. Group B patient without closed suction drain). Outcomes of SSI were compared.
Results: The incidence of SSI in Group A was 33% whereas in Group B was 70%. 40% cases in SSI in Group A whereas 76% cases of SSI in Group B developed wound dehiscence. Most cases of SSI was diagnosed on POD 2 for Group A and on POD 4 for Group B.
Conclusions: The study supports use of closed suction drain in perforation peritonitis for prevention, early detection and appropriate management of SSI.

Key words: Surgical site infection, Perforation peritonitis, Closed suction drain, Wound dehiscence

INTRODUCTION

Surgery for perforation peritonitis is associated with the highest rates of infective complications, especially surgical site infections (SSI). Despite all precautious measures SSI develops in most of such cases in view of contamination of the operative field with micro-organisms originating from endogenous sources. According to CDC guidelines, a surgical wound in a case of peritonitis due to hollow viscus organ perforation is classified into either group III (contaminated) or group IV (dirty).[1] Surgical site infections being the most common and costly of all hospital acquired infections accounts for 20% of all nosocomial infections. Based on the depth and tissue layers involvement, CDC/NHSN classifies SSI into three types: Superficial incisional SSI (SIS), Deep incisional SSI (DIS) and Organ/space SSI.[2,3] In our study, we have emphasised more on superficial incisional SSI and ways to deal SIS, in order to prevent it. Factors contributing to SSI include patient factors and surgery related factors. Patient factors are advanced age, increased BMI, high ASA grade, diabetes mellitus, Smoking, malnutrition, anaemia, ascites. Factors related to surgery are duration of surgery, re-exploration, longer hospital stay, corticosteroid

medications, inadequate sterilization, skin antisepsis, emergency procedure, hypothermia, intra-operative blood transfusion, peri-operative shaving, implantation of prosthesis and failure to obliterate dead space. Superficial incisional SSI occurs due to failure of obliteration of dead space during abdominal wound closure resulting in formation of hematoma and seroma collection in the abdominal wound. Hematoma and seroma acts as a good culture media for bacterial organisms to grow and cause wound infection.[4,5] The bacterial pathogens can be either from the intra-abdominal sepsis or nosocomial in origin. In cases of hollow viscus perforation, due to the spillage of gut contents containing micro-organism into the peritoneal cavity, local or diffuse peritonitis occur which in longer duration irritates the gut wall causing gut oedema. The oedematous gut in turn causes more extravasation of fluids into the intra-abdominal cavity which if not drained adequately can get tracked to the subcutaneous space of the abdominal wound in the post-operative period causing SIS. SIS presents with localized redness, swelling, tenderness, warmth, presence of purulent discharge or failure of wound healing. Therefore, Early identification and management is necessary in such cases in order to prevent wound dehiscence or worse complication like burst abdomen, late sepsis, or death of the patient.

Various intervention have been proposed in a view of reducing SSIs. Many are used in routine practice including hand wash, minimizing shaving and preferring clipping of hairs, pre-operative antibiotics are all socially accepted methods. Physical examination of the wound with alternate day dressing, radiological investigations like ultrasound and computed tomography are used to diagnose fluid collection post- operatively along with guided aspiration. Intra-operative placement of drain in the subcutaneous space in order to remove the fluid collection have also been seen to reduce the risk of SIS. Drain can be used to effectively manage the dead space. Dead space is an abnormal space resulting from disruption of tissue or facial planes due to tissue dissection during surgery. Dead space becomes a potential site for growth of micro-organisms causing wound infection. A drain placed in the subcutaneous space eliminates the “dead space” in the wound and evacuates the seroma or hematoma collection, thereby reducing chances of SIS. Barriers to wound healing like exudative fluid, inadequate tissue perfusion, lack of granulation tissue and bacterial burden can all be overcome by using a drain. Drains can be seen of two types either open or closed. Closed drains can be of further seen as active / suction and passive/non- suction. Open drains aids in the passive drainage of a cavity based on gravity by forming a channel between the body and the external environment. e.g., penrose drain, corrugated drains, etc. Suction drains/active drains maintain negative pressure in them, thereby actively suctioning out fluid and/or obliterating dead space and preventing fluid accumulation. e.g.: Redon drain, non-suction/passive drains uses capillary action and gravity to drain fluid. e.g.: urinary catheters, Robinsons drain, nasogastric tubes. The purpose of this study was therefore to compare the effect of closed subcutaneous drain in prevention of laparotomy wound complications in perforation peritonitis cases in view of reducing the rate of surgical site infections in the post-operative period. Reduction in SSI rates provides a speedy recovery to the patient, reduces the duration of hospital stay, antibiotics cost and other additional procedural costs (long term dressings) and provides the patient a good quality of life.

Aim and objectives

To perform a prospective cohort study to evaluate the role of closed suction drains placed in subcutaneous space in preventing SSI in post laparotomy wounds in cases of perforation peritonitis. We also evaluated the role of closed suction drain in early detection of SSI for timely intervention with appropriate management hence preventing complications such as wound dehiscence and burst abdomen.

METHODS

This study was a prospective cohort study started after taking all necessary permissions from the institutional ethics committee of Patna Medical College and Hospital. The due permissions from the head of department of surgery were also obtained. The study was conducted at the department of surgery, Patna medical college and hospital.

Study subjects

The patients undergoing laparotomy for perforation peritonitis in the surgical emergency of department of surgery at, Patna medical college and hospital.

Sample size

Sample size was 60 obtained through convenience sampling method and the patients were divided into two groups group A (patients that had subcutaneous closed suction drain placed) and group B (patients that did not have any drain in subcutaneous space) by simple randomisation. Convenience sampling method is a type of non- probability sampling that involves the sample being drawn from that part of population that is close to hand. The sample size was taken by convenient sampling method after discussing with the college statistician. The sample size was also affected by the fact that many patients did not adhere to the treatment and did not give consent to be a part of the study. The fact that a portion of this study extends into the COVID-19 pandemic should also be kept in mind.

Study duration

The study took place from 1 October 2020 to 30 September 2022.

Inclusion criteria

Patients presenting in surgical emergency with presentation of perforation peritonitis of any age and sex giving consent to be a part of this study with radiologically proven hollow viscus perforation were included.

Exclusion criteria

Exclusion criteria for current study were; all such patients undergoing laparotomy for gynaecological causes were not included in this study. All such patients who accidentally removed closed suction drain before the evaluation of wound, the ones who died in post operative period and the ones requiring re-exploration after first surgery were also not included in this study.

Pre-requisites

A detailed history with complete physical examination and necessary blood investigation was done for all patients undergoing laparotomy. Pre-op diagnosis of perforation peritonitis was made with clinical signs of peritonitis along with radiological evidence of hollow viscus perforation. All the patients coming in the study were managed preoperatively with nasogastric tube insertion, correction of fluid and electrolyte imbalance and administering antibiotic, proton pump inhibitor, analgesics and anti emetics. All the patients were kept NPO prior to surgery.

Surgical technique

Laparotomy was performed by two experienced surgeons by vertical midline incision. Rectus closure was done by continuous running suture using loop nylon 1 round body following Jenkins rule. Closed subcutaneous drain was placed in the subcutaneous plane in GROUP A during abdominal wall closure.

Follow up

Intra operative pus was sent for culture and sensitivity and patient was started on broad spectrum antibiotics. In terms of post operative data, we studied the incidence of SSI, day of diagnosis of SSI, development of wound complications like wound dehiscence, etc. and duration of hospital stay. The data collected was compared between the two groups and presented in tabular form after analysis. The findings were compared with those of previous study to come to conclusion.

RESULTS

This study consists of a total of 60 cases of perforation peritonitis that underwent laparotomy. 2 groups, Group A and B were evaluated for incidence of SSI to evaluate the role of closed suction drain in prevention of SSI.

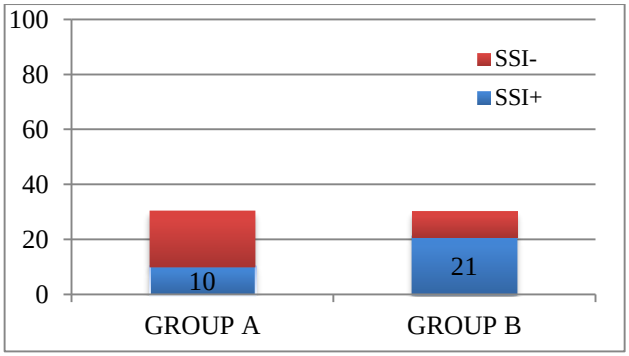

Figure 1: Incidence of SSI in the two study groups.

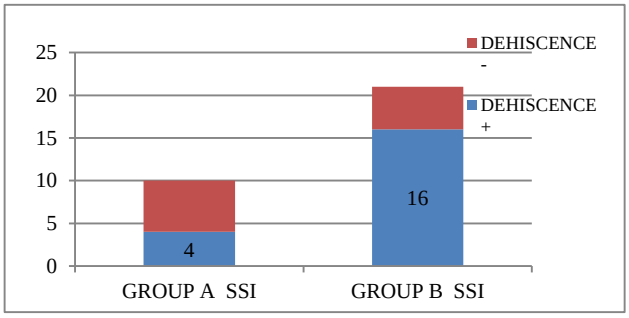

Figure 2: Incidence of wound dehiscence in SSI cases of the two study groups.

Incidence of SSI in the study group

Out of 30 patients in the group A, 10 developed SSI and in 30 group B patients, 21 developed SSI. Incidence of SSI in group A and group B was found to be 33% and 70% respectively. Hence, the overall incidence of SSI was calculated to be around 52%, p value was 0.004 and significant.

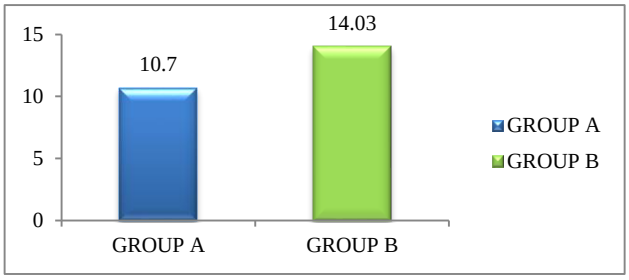

Figure 3: Mean duration of hospital stay in the two study groups.

Incidence of SSI related complications requiring secondary suturing

Patients who developed SSI showed wound dehiscence due to altered wound healing and underwent secondary suturing for the same. Wound dehiscence developed in 4 out of 10 (40%) SSI case of group A and 16 out of 21 (76%) SSI cases of group B, p value was 0.04 and significant.

Table 1: Role of drain in early detection of SSI.

POS of detection of SSI	Group A (N=10) Frequency (%)	Group B (N=21) Frequency (%)	P value	Test of significance
POD-2	7 (70)	0 (0)	0.001	Chi-square test
POD-3	3 (30)	8 (38)		
POD-4	0 (0)	12 (57)		
POD-5	0 (0)	1 (5)		

Role of drain in early detection of SSI

Sero-purulent collection from the drain was picked up and sent for c/s as early as POD-2 in 70% of SSI cases in Group A whereas, in group B, 57% of the SSI cases were detected as early as on POD-4 by the presence of wound discharge.

Duration of hospital stay

The mean duration of hospital stay in Group A was 10.7 days whereas it was 14.03 in case of Group B. Hence, it was reduced by 3.6 days with the use of closed suction drain, p value was 0.0001 which was significant.

DISCUSSION

Kaya et al in their study for elective abdominal operations found that the SSI rate in patients with subcutaneous drain was 5.7% and no subcutaneous drain was 9.9% , though the study results were insignificant there was a decrease in SSI rate.[6] Kumar et al posted that the SSI incidence was 16% in patients with subcutaneous drain and 58% in patients without subcutaneous drain in patients undergoing emergency surgery for perforative peritonitis.[7] Vaghani et al in their study on ileal perforation cases found SSI rate of 25% in patients with subcutaneous drain and 57.7% in patients without subcutaneous drain.[8] El-Badry et al in his study on emergency laparotomy cases found the SSI rate to be 11% in patients with subcutaneous drain and 44% in patients without subcutaneous drain.[9]

Present study revealed the incidence of SSI in patients with subcutaneous drain (group A) as 33% and without subcutaneous drain as 70%. Decreased incidence of SSI in patients with subcutaneous suction drain can be attributed to the fact that usage of subcutaneous suction drain is effective in reducing SSI incidence. Patients with SSI presented in the post-op complication like seroma / hematoma, wound dehiscence/burst abdomen, latter complications were managed by a reoperation (secondary suturing) in same hospital stay. El-Badry et al in his study posted the rate of wound dehiscence in patients with SSI as 15% in patients without subcutaneous drain and no wound dehiscence was seen in patients with subcutaneous drain placement.[9] Bindal et al in his study posted that the rate of wound separation in patients with SSI with subcutaneous drain was 4% and 8% without subcutaneous drain placement.[10] In our study the rate of wound dehiscence in patients with SSI was found to be 40% in patients with subcutaneous drain and 76% in patients without subcutaneous drain. Subcutaneous drain placement lead to decrease in rate of post-op complication like wound separation by actively removing the seroma formed in the post-op period and hence reduced the need for reoperation in patients undergoing emergency laparotomy. Drain placement provides active removal of exudate from the wound in the post-op period rather than alternate other methods like USG and CT guided aspiration. The exudate collected in the drain reservoir can be collected and sent for c/s based on which growth specific antibiotics can be started in the post-op period.

In our study there was exudate detection as early as on POD-2 in 70% patients with subcutaneous drain and 57% in patients without drain on POD-4. Similar comparable results were seen in study conducted by Manoharan et al who found the SSI detection rate as 86% on POD-2 and 56% on POD-5 in patients with and without subcutaneous drain placement respectively.[11] Duration of hospital stay was significantly reduced in this study due to reduction in incidence of SSI reduced rates of wound dehiscence providing resulting in fast recovery and early discharge of the patient. The mean duration of hospital stay in patients with drain placement was found to be approximately 10 days and 14 days in no drain placement patients. Zhen et al in his study posted that the duration of hospital stay was 9 days in patients with drain and 20 days in patients without drain.[12] Similarly, study conducted by Kagita et al found that overall mean duration stay in patients with drain to be 5 to 15 days and 5 to 20 days in patients without subcutaneous drain placement.[13]

Limitation of the study

The present study has sample size of 60 patients which resulted in very low number of patients in each group. This could not give the larger picture of the result. Also, the present study does not take into account patient factors responsible for poor wound healing which could have resulted in SSI in some cases.

CONCLUSION

Subcutaneous suction drainage tube placement is an effective method along with primary abdominal wall closure in cases of peritonitis when compared to conventional primary abdominal wall closure as it significantly reduces the incidence of wound infection, dehiscence, wound secondary suturing by early

identification of SSI and early treatment of SSI and thus reduces the duration of hospital stay in patients with perforation peritonitis. 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 emergency surgery for perforation peritonitis.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Raj PL, Ranjan A, Kumar A, Thakur IS. Role of closed subcutaneous drain in prevention of surgical site infection in perforation peritonitis. Int J Res Med Sci 2023;11:1536-40.