International Surgery Journal
Haque MM. Int Surg J. 2024 Oct;11(10):1585-1589
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20242756

Original Research Article

The role of subcutaneous drain in laparotomy patients

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Received: 17 August 2024
Accepted: 16 September 2024

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ABSTRACT

Background: In surgical incision wounds, hematoma, serous fluid, and dead space increase the risk of infection because they provide a surface for microbial growth. Subcutaneous drain reduces dead space in the subcutaneous tissue plane, which prevents fluid from accumulating and seroma from forming by removing infectious content, residual effusion, and blood from the wound. This study attempts to determine the efficacy of subcutaneous drain in laparotomy in the management of surgical site infection (SSI).
Methods: This prospective study was conducted at the Department of Surgery in various hospitals in Cumilla, Bangladesh. This study includes 150 adult patients aged between 18 to 70 years. A closed subcutaneous suction drain was inserted before the skin was closed in 75 patients at random (drain group), whereas the rest of the 75 patients' subcutaneous suction drains were not kept (no-drain group).
Results: The association between comorbidities and SSI in both the drain and no-drain groups were significant, p value <0.001 respectively. SSI was mainly in the group with fewer surgery hours (72.4%). Patients with SSI also have longer hospital stays on average.
Conclusions: Patients with SSI have increased morbidity, and those undergoing major procedures are more likely to experience SSI afterwards. The presence of a subcutaneous closed suction drain contributes to reducing SSI.

Keywords: Drains, Laparotomy, Surgery, Microbial growth, Surgical site infections

INTRODUCTION

Wound healing and its complications are significant concerns for postoperative patients as they can increase morbidity levels. Effective wound management and addressing infections associated with open wounds are crucial in surgical practice.[1,2] Surgical site infections (SSIs) are serious postoperative consequences where microorganisms infiltrate tissues within 30 days for superficial layers and within 30 or 90 days for deep layers after surgery. The global incidence of SSI varies between 0.5% and 15% but has increased significantly by 23% to 38% in India.[8] The likelihood of developing SSI after surgery depends on the virulence of the bacteria and the quantity of their inoculum. Factors such as increased dead space, hematoma, or devitalised tissue due to subpar surgical techniques, as well as foreign objects like stitches or drains, increase the risk of infection. Patients with high body mass index (BMI), histories of alcoholism, chronic cardiac disease, and diabetes are also at higher risk due to a decline in immune activity, which delays wound healing. Several strategies have been suggested to reduce surgical site infections, such as limiting shaving, practising hand hygiene, and administering preoperative antibiotics. Additionally, it is believed that gut microbes can thrive more easily in the presence of fluids and necrotic tissue in the subcutaneous layer, leading to surgical site infections.[3,4] Some studies suggest that utilizing subcutaneous suction drainage tubes in the early postoperative stage can help remove contaminated subcutaneous fluids and necrotic tissue, potentially decreasing the incidence of incisional SSIs.[5-7] The use of subcutaneous drains in surgical wounds, particularly in emergency laparotomies, has been shown to be beneficial. This practice aims to remove accumulated fluid or debris

and close dead spaces in the subcutaneous plane, reducing the risk of infection and wound problems.[8]

This study aims to measure the efficacy of subcutaneous drainage in the management of SSI in laparotomy.

Objective

General objective

The objective of this study is to evaluate the effectiveness of subcutaneous wound drainage in lowering SSIs.

Specific objective

This study prompts the efficacy of subcutaneous drainage in laparotomy patients.

METHODS

This prospective study was conducted at the Department of Surgery, in different hospitals of Cumilla, Bangladesh. This six-month study included 150 patients who visited various hospitals in Cumilla from January 2022 to June 2022 for laparotomy. 18 to 70 years old adult patients were included in his study.

Inclusion criteria

Patients aged more than 18 years, undergoing elective and emergency, laparotomy surgeries, and their subcutaneous fat thickness was more than 2.5 cm were included in this study.

Exclusion criteria

Patients with immune-compromised status such as HIV, radiotherapy, chemotherapy and had undergone laparotomy more than once were excluded.

Out of 150 patients, 75 were randomly selected to have a closed subcutaneous suction drain placed before skin closure, while the other 75 did not have the drain placed. SSI cases were diagnosed within 30 days after the surgery using criteria from the Centers for Disease Control and Prevention. The dressing for all 150 patients was done by the same person with aseptic precautions. The drainage was measured and emptied every 24 hours. Statistical tests, including the Chi-square test and t-test, were conducted to find any correlations, with a significance level of p value <0.05. The ethical review committee of the hospital approved the study, and a well-informed written consent form was signed by the participants.

RESULTS

A total of 150 patients from different hospitals were selected for this study. Total 75 patients in both no-drain and drain group were adult patients with the mean age of 47.38±18.14 and 45.40±13.93 respectively (Table 1). Figure 1 shows the comorbidities of the study patients. Mostly, patients with less comorbidities had less association with SSI compared to the higher comorbidities, for drain group it was significant (Table 2). In the case of comparison of mean hospital stay between the two groups in relation to presence or absence of surgical site infection, longer hospital stay was found in patients with SSI for both drain and no-drain group (Table 3).

Table 1: Distribution of study patients (n=150).

Variables	No-drain (N=75) (%)	Drain (N=75) (%)	Mean±SD	P value	"t" value, df
Age (in years)					
18-20	0 (0)	6 (8)	47.38±18.14 (no-drain)	0.986	0.017, df=48
21-40	30 (40)	12 (16)			
41-60	18 (24)	51 (68)	45.40±13.93 (drain)		
61-70	27 (36)	6 (2)			
Group					
No-drain	75		11.65±4.88	0.203	1.289, df=48
Drain	75		8.96±5.29		

Table 2: Association between comorbidities and SSI.

Comorbidities	Surgical site infection					
	No-drain group (N=75) (%)			Drain group (N=75) (%)		
	Present	Absent	Total	Present	Absent	Total
Present	21 (58.3)	15 (41.7)	36 (100)	15 (45.5)	18 (54.5)	33 (100)
Absent	21 (53.8)	18 (46.2)	39 (100)	3 (7.1)	39 (92.9)	42 (100)
Total	42 (56)	33 (44)	75 (100)	18 (24)	57 (76)	75 (100)
Chi-square, df	0.051, 1			4.957, 1		
P value	0.821			0.026		

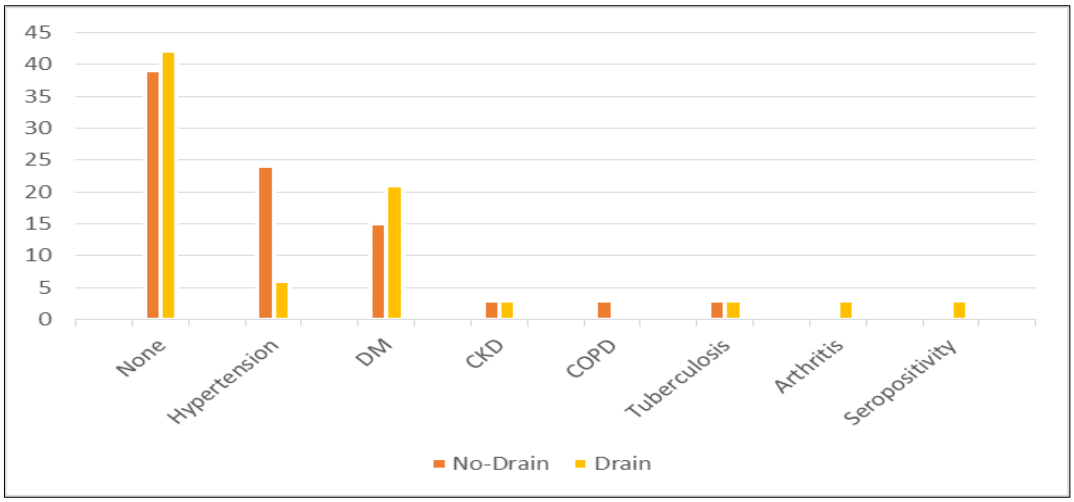

Figure 1: Comorbidities of the study patients.

Table 3: Comparison of mean hospital stay between the two groups in relation to presence or absence of surgical site infection.

Group	SSI	Number	Mean±SD	P value	"t" value, df
No-drain	Present	42	15.43±2.88	0.001	-9.393, df=23
	Absent	33	6.62±1.28		
Drain	Present	18	17.83±1.86	0.001	-11.071, df=23
	Absent	57	7.79±1.27		

DISCUSSION

In this study, we addressed the influence of subcutaneous closed suction drainage (SCSD) during the closure of midline laparotomy in both elective and emergency abdominal surgeries. This approach was associated with a significant reduction in SSI, wound dehiscence, repeat laparotomies, and increased rates of successful conservative management for intraperitoneal infection. Furthermore, it also led to a significant decrease in the incidence of incisional hernias. One of the primary reasons for morbidity in emergency laparotomies is SSI. The incidence, prevention, and treatment of SSIs have all been extensively studied. Colorectal procedures have shown a significant incidence of SSI due to organisms residing in the intestines.[9,10] "Cruse and Foord" demonstrated that the mean rate of infection was 4.8% in various surgical disciplines, with increased infections in the elderly, prolonged hospital stays, and certain procedures.[10] Our findings differ from theirs in that our research indicates that the rate of infection also rises due to the use of drains. A subcutaneous drain can help reduce the number of bacteria around the wound and remove residual effusion and blood from the wound, which could serve as a medium for bacterial growth. Several studies conducted in India at various locations have shown the SSI rate to vary from 6.09% to 38.7%.[11-13]

The present research found that the rate of SSI was 24% in patients with a subcutaneous drain and 56% in those without a drain. The mean age in the no-drain group was 46.48 ± 19.04 years, and in the drain group was 46.40±12.93 years, with no significant difference in mean age between the two groups. The incidence of SSI in this study was 40%, which is higher than in other countries such as the USA (2.8%) and European countries (2-5%).[8] Another study also found higher infection rates in emergency surgeries (25.2%) compared to elective surgeries (7.6%).[8] In this research, the infection rate was also higher in emergency surgeries (26%) compared to elective surgeries (14%). The high rates of infection in emergency surgeries can be attributed to inadequate preoperative preparation and the more frequent presence of contaminated or dirty wounds. Previous studies have shown that SSI development leads to longer hospital stays, which was also observed in this study. There was no significant association between comorbidities and the groups (p=0.105), showing that the groups are independent of comorbidities. Additionally, there was no statistically significant association between surgical site infection and comorbidities in the no-drain group (p=0.821), indicating that surgical site infection is not dependent on comorbidities in that group.

According to "Suragul" and his associates, 48% of the cultures tested positive for polymicrobial causes of SSI. The most frequent pathogens in abdominal surgery are *Enterococcus*, *E. coli*, and *Klebsiella pneumonia*, which are common occupants of the intestines. A research has indicated that E. coli was the most frequent bacterium isolated in the study, followed by *Klebsiella pneumonia*.[8] Several risk factors have been identified in numerous

studies regarding the occurrence of incisional SSIs following colorectal surgery. These risk factors include diabetes mellitus, preoperative anemia, hypoalbuminemia, wound classification, the thickness of the subcutaneous fat, and others.[18-23] The patients in another study were specifically selected to highlight the contrast in incisional SSI rates in two groups. These patients had diabetes mellitus, hypoalbuminemia (ALB 30 g/l), and anemia (Hb 10 g/l). The prevalence of SSI was higher in patients with a surgery duration of ≥5 hours and in patients with albumin levels ≤3. The prevalence of SSI was also higher in patients with hemoglobin levels <10 gm%. It was found that drainage tubes are not suitable for thin patients, so patients with a subcutaneous fat thickness greater than 2.5 cm were selected. After dissection and suture, particularly when using an electric knife, subcutaneous fat is easily necrosed and liquefied.[8,24] Several studies have shown that obesity increases the risk of postoperative infection.[25] It is believed that gut microbes will proliferate more readily in the presence of fluids and necrotic tissue in the subcutaneous layer, leading to a rise in SSI. The gut microbes from the colorectal tract are easily multiplied in this environment, particularly in individuals with inadequate immunity.[26] Incisional infection following colorectal surgery typically becomes apparent three to five days after the procedure.[27] Thus, the initial phase following surgery is crucial for SSIs. Prevention during this time is essential. Effective elimination of fluids and necrotic tissue that could encourage microorganism growth early after surgery, particularly through the insertion of a subcutaneous suction drainage tube, is believed to drastically reduce the frequency of incisional SSIs. Out of all the trials in the meta-analysis, only two trials showed a notable decrease in SSI incidence in the group with drains.[28] Fujii et al included high-risk patients such as those undergoing emergency laparotomies and patients with thick subcutaneous fat. They found that the risk ratio demonstrated a reduction in the SSI rate in the drain group (RR 0.37 (0.15–0.9)).[29] However, 'Baier' disagreed with this.[30] 'Pan' conducted research on patients who had ileostomy reversal and concurred with Fujii et al.[28] His findings indicated that patients without a drain developed SSI at a rate of 12.5%, while those with a drain had a rate of 1.2%. Similar results were found in this study. Additionally, Soper et al reported that the depth of subcutaneous fat in a patient is an independent risk factor for SSI.[8] Therefore, subcutaneous drains may be beneficial for high-risk and/or obese patients, even though this conclusion is not entirely clear from the meta-analysis due to underpowering. In fact, two studies described the different types of wounds in the control and drain groups. In this study, there was an overall 34% reduction in SSI when a subcutaneous drain was used.[8]

Limitations

The limitation of this study was its multi-centre nature which may lead to data loss. Patients of different ages and areas may face different outcomes.

CONCLUSION

The research discovered that using a subcutaneous suction drainage tube can lead to a faster recovery, resulting in shorter hospital stays, less morbidity, and quicker rehabilitation for patients undergoing abdominal surgery. Therefore, when closing the abdominal wall after surgery, the use of a subcutaneous suction drain should be considered.

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: Haque MM. The role of subcutaneous drain in laparotomy patients. Int Surg J 2024;11:1585-9.