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Role of Subcutaneous Negative Suction Drainage to Reduce Post-Operative Surgical Site Infection in Open Abdominal Surgery

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Abstract: *Surgical site infection is the most common infection after abdominal surgery due to collection of seroma in subcutaneous layer which is a good harbor media for microbial agents. However, the placement of subcutaneous drain in surgical wounds after the surgery has seemed to be quite promising especially in laparotomies. It is based on the principle of removing the collected fluid or debris and closing the dead space in the subcutaneous plane which in turn will reduce the possibilities of infection and wound complications.*

Objective: *The objective of this study is to evaluate the role of placement of negative suction drainage in subcutaneous space after open abdominal surgery for minimizing post-operative surgical site infection.*

Methods: *A prospective case control study was conducted over a period of one year from June 2023 to June 2024. A total of 60 patients were included in this study. All patients underwent open abdominal surgery under the department of General Surgery in Babgabandhu Sheikh Mujib Medical University (BSMMU). All patients were randomly selected, then 30 patients kept a suction drainage in the wound to observe the outcome regarding the post-operative wound infection. Data were collected from these patients by a preformed questionnaire and finally the data were analyzed by SPSS 29.*

Results: *Most of the patients were female 35 (58.33%). Among them 22(36.67%) cases were present in the 41-50 years of age group. Commonest risk factors were diabetes 11(36.67%), CKD 07(23.33%) and hypoalbuminemia 12(40%) in case groups. Surgical site infection (SSI) occurred in case groups 5(16.67%) and control groups 14(46.67%). Available organisms were Staphylococcus Aureus 6(10%) and Escherichia Coli 10(16.67%) in both groups.*

Conclusion: *Subcutaneous suction drains have proved to reduce Surgical Site Infection (SSI) in a large number of patients.*

Keywords: *Open abdominal surgery, Suction drainage, Surgical site infection (SSI).*

1. INTRODUCTION

Surgical site infections are one such serious postoperative consequence (SSIs). SSIs are infections wherein the microorganisms infiltrate the tissues within 30 days after the surgery for the superficial layers, and within 30 or 90 days for the deep layers. The cornerstone of surgical practice is wound management, and treating

infections in post-operatively at surgical site associated with open wounds is still debatable[1, 2].

There have been several suggested strategies to reduce surgical site infection. Many of them, such as limiting shaving, hand washing, and preoperative antibiotics, have been employed by surgeons on regular basis and are well-acknowledged. It is believed that gut microbes can grow more easily in the presence of fluids and necrotic tissue in subcutaneous layers, leading to surgical site infections.[3,4]. The incisional SSIs are therefore thought to be efficiently controlled by removing contaminated subcutaneous fluids and necrotic tissue[5]. Theoretically, incisional SSIs can be decreased by inserting subcutaneous suction drainage tube to remove contaminated subcutaneous fluids and necrotic tissue from the subcutaneous layer in early postoperative stage before they develop infections. Subcutaneous suction drainage tubes to prevent surgical site incisions were subject of numerous RCTs. However, some RCTs had favorable outcomes, while others had unfavorable outcomes[6,7]. These drains under flaps can be one of the ways to tackle seroma. It can then be removed under sterile condition and placement of pressure dressing. If the seroma gets collected again, then it should be removed by opening of the incision. If seroma reaccumulates after two aspirations, then it should be evacuated by opening the incision and packing the wound with saline gauze so that secondary healing is possible. Hematoma can be prevented by correcting the problems associated with the clotting factors.[8]. So, the aim of this study is to evaluate the effectiveness of negative suction drainage in subcutaneous space after open abdominal surgery.

2. METHODS

This study was a prospective case control study and conducted on 60 consecutive patients admitted in the Surgery department in the Babgabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh in between June 2023 to June 2024. Then all patients were selected randomly and 30 patients given negative suction drainage designed as case groups, other 30 patients closed abdomen without giving drainage designed as control group in open abdominal surgery. The age range of 30 to 60 years were included in this study. Patients with previous abdominal surgery, neoadjuvant given prior to surgery, known case of gynecological cases were excluded in this study. There were no ethical problems as before the study procedure conducted, verbal consent of every patient was taken. Disagreed cases were not included in this study. Relevant information (according to the questionnaire) were taken from patients and physical examinations were done in detail. In all cases evaluation of patients by clinically, relevant investigations and then performed open abdominal surgery with giving negative suction drainage in subcutaneous spaces of 30 cases. Then follow up of every patient in the form of seroma formation, stich infections, wound infections, wound disruption or burst abdomen, then compare the case and control groups. All the data were analyzed manually in view of the objective of this study. Frequency, distribution and proportions were calculated for the values. Results were published in tabulated form.

3. RESULTS

Most of the patients were female 35 (58.33%). Among them 22(36.67%) cases were present in the 41-50 years of age group. Commonest risk factors were diabetes 11(36.67%), CKD 07(23.33%) and hypoalbuminemia 12(40%) in case groups. Surgical site infection (SSI) occurred in case groups 5(16.67%) and control groups 14(46.67%). Available organisms were *Staphylococcus Aureus* 6(10%) and *Escherichia Coli* 10(16.67%) in both groups.

Table I. *Gender-wise Distribution of Participants in Case and Control Groups*

Variable		Case		Control	
		Number	Percentage	Number	Percentage
Gender	**Male**	12	40	13	43.33
	Female	18	60	17	56.67
Total		30	100	30	100

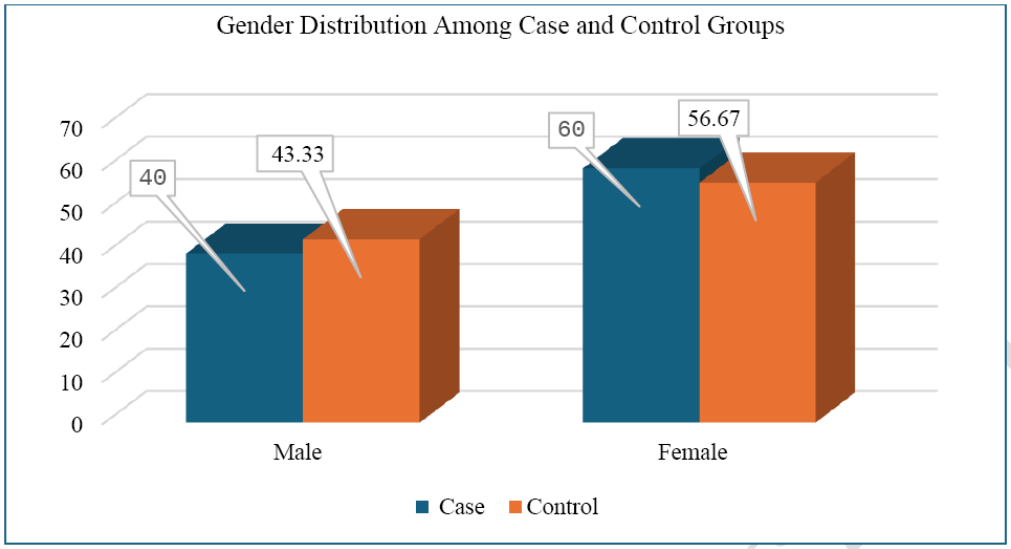

Figure I. *Line Chart Showed Gender Distribution among Case and Control Groups*

Table II. *Age-wise Distribution of Participants in Case and Control Groups*

Variable		Case		Control	
		Number	Percentage	Number	Percentage
Age	30-40	10	33.33	11	36.67
	41-50	12	40.00	10	33.33
	51-60	08	26.67	09	30.00
Total		30	100	30	100

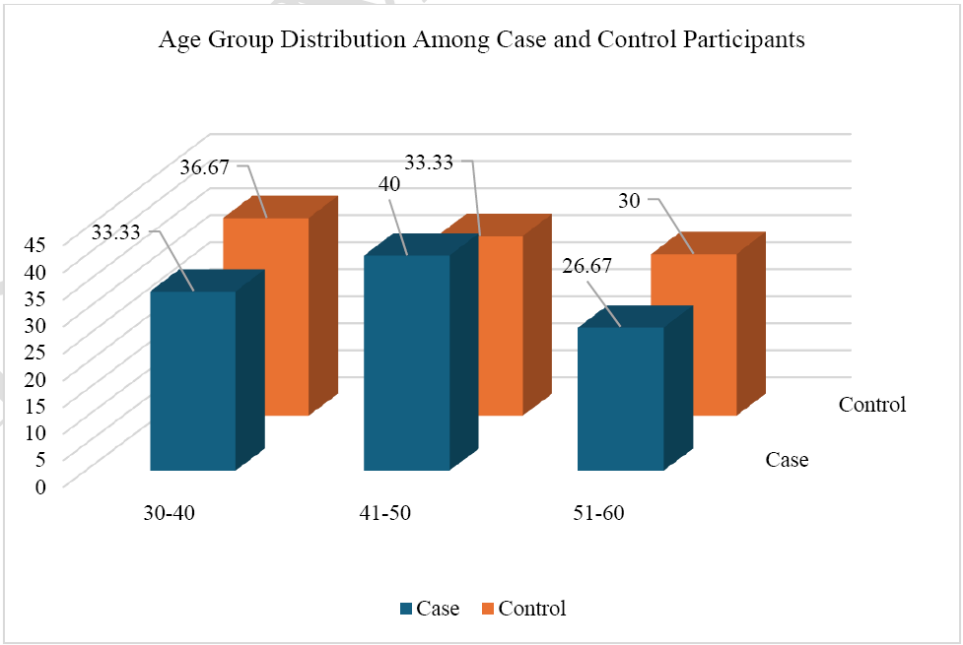

Figure II. *Line Chart Showed Age Group Distribution among Case and Control Participants*

Table III. *Distribution of Comorbid Conditions among Case and Control Groups*

Variable		Case		Control	
		Number	Percentage	Number	Percentage
Diabetes	Present	11	36.67	10	33.33
	Absent	19	63.33	20	63.67
CKD	Present	07	23.33	06	20.00
	Absent	23	76.67	24	80.00
Hypoalbuminemia	Present	12	40.00	14	46.67
	Absent	18	60.00	16	53.33

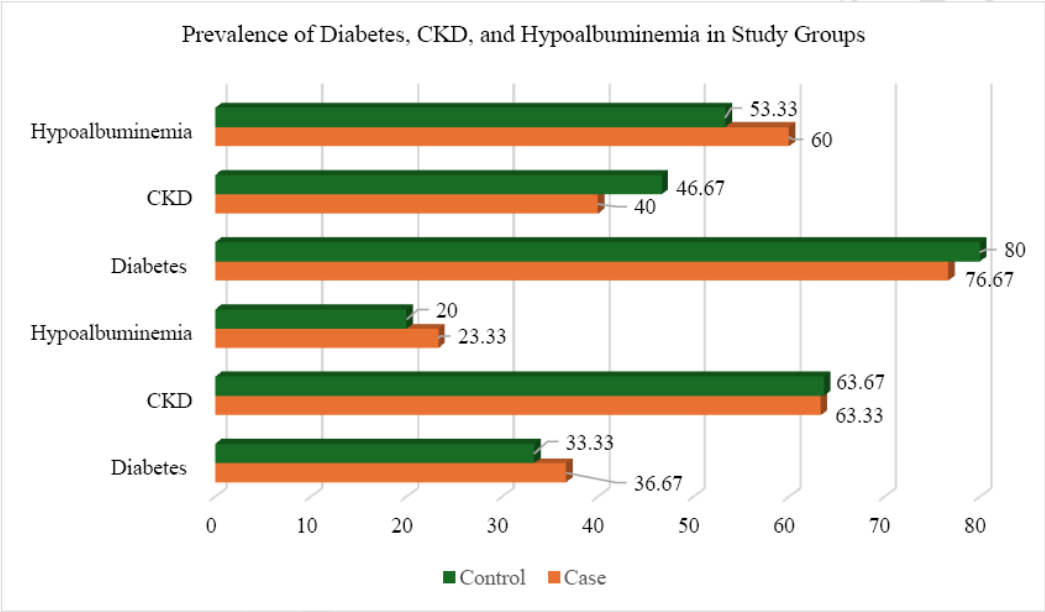

Figure III. *Bar Chart Showed Prevalence of Diabetes, CKD, and Hypoalbuminemia in Study Groups*

Table IV. *Incidence of Surgical Site Infection in Case and Control Groups*

Variable		Case		Control	
		Number	Percentage	Number	Percentage
SSI (Surgical Site Infection)	Present	05	16.67	14	46.67
	Absent	25	83.33	16	53.33
Total		30	100	30	100

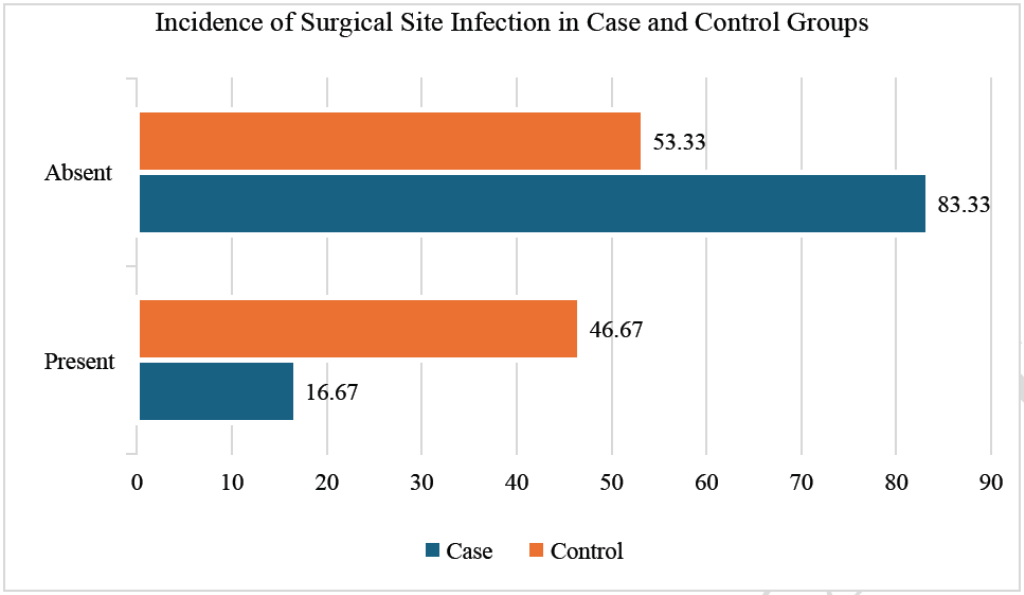

Figure IV. *Bar Chart Showed Incidence of Surgical Site Infection in Case and Control Groups*

Table V. *Distribution of Bacterial Isolates among Case and Control Groups*

Variable		Case		Control	
		Number	Percentage	Number	Percentage
Different Organisms	Absent	25	83.33	16	53.33
	Staphylococcus Aureus	02	6.67	04	13.33
	Escherichia Coli	03	10.00	07	23.33
	Klebsiella	00	00	01	3.33
	Pseudomonas Aeruginosa	00	00	02	6.67

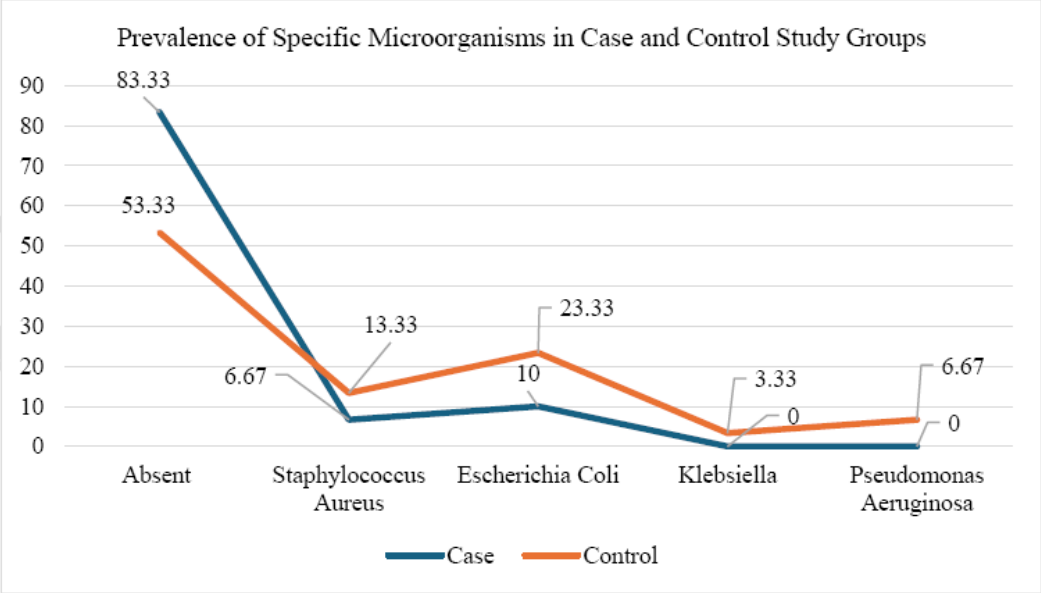

Figure V. *Line Chart Showed Prevalence of Specific Microorganisms in Case and Control Study Groups*

4. Discussion

Numerous risk factors for developing an incisional SSI are encountered for managing post-operatively. To reduce incisional SSI after open abdominal surgery, mechanical preventors, such as subcutaneous wound drainage [9–13] or negative-pressure wound therapy (NPWT) [14–17], have been tried; however, conclusive results have not been obtained[18,19]. Incisional SSI after laparotomy often occurs after colorectal surgery or abdominal cavity contamination and it is often accompanied by organ/space SSI [20, 21]. Total 60 patients were included in this study. The SSI were more common in female 35 (58.33%). The commonest age group of 41-50 years and it was 12(40%) in case group and 10(33.33%) in control groups. Harish et al. showed 26(52%) patients under 40 years and 24(48%) patients above 40 years in the cases group while there were 28(56%) patients below 40 years and 22(44%) patients in the control group. There was no significant difference in the age distribution between the two groups in the study.[22] The study showed common risk factors of developing SSI were diabetes 11(36.67%), CKD 07(23.33%) and hypoalbuminemia 12(40%) in case groups. Malone et al showed risk factors for causing SSI were diabetic mellitus, hypoalbuminemia (ALB 30 g/L), anaemia (Hb 10 g/L). The prevalence of SSI was higher in patients with a duration of surgery >=5 hours. Romy et al revealed the prevalence of SSI was higher in patients with albumin levels <=3. The prevalence of SSI was higher in patients with hemoglobin levels. [23-24]. The study revealed surgical site infection (SSI) in case groups 5(16.67%) and control groups 14(46.67%). Haris et al found that SSI rates came up to 14% in patients with a subcutaneous drain and 42% in those without a drain.[22]. In our study, the available organisms were *Staphylococcus Aureus* 6(10%) and *Escherichia Coli* 10(16.67%) in both groups. Suragul and his colleagues have stated that the cause of SSI was polymicrobial with 48% positive cultures. The most common organisms being *Enterococcus, E. coli*, and *Klebsiella pneumonia* which are the normal inhabitants of the intestines causing SSI in abdominal surgeries.[25]

5. Conclusion

Surgical site infections (SSIs) are the infections of wound after any abdominal surgery can be difficult and distressing to manage for a surgeon. Hematoma, seroma, and dead space in surgical incision raise the risk of infections due to harbor of different microbial agents. Studies have proved that the usage of subcutaneous suction drains has lowered the chances of infection.

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