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Effectiveness of Subcutaneous Suction Drain vs. Simple Skin Closure in Reducing Postoperative Surgical Site Infections After Emergency Laparotomy

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Abstract **Original Research Article**

Background: Surgical Site Infections (SSIs) are prevalent complications following surgeries, especially after major abdominal procedures like emergency laparotomies. In resource-limited settings such as Bangladesh, effective strategies to reduce SSIs are crucial for improving patient outcomes. ***Objective:*** This study aims to evaluate the effectiveness of subcutaneous suction drains versus simple skin closure in reducing postoperative SSIs in patients undergoing emergency laparotomy in Bangladesh. ***Method:*** A prospective, case-control study was conducted at the Department of Surgery, Jalalabad Ragib-Rabeya Medical College & Hospital, Sylhet, Bangladesh, from June 2023 to July 2024. A total of 100 patients undergoing midline exploratory laparotomy were randomly assigned to either the case group (subcutaneous suction drain) or the control group (simple skin closure). Data on demographics, co-morbidities, and surgical outcomes were collected. The primary outcome was the incidence of SSIs, with secondary outcomes including hospital stay duration and other complications. Statistical analysis was performed using SPSS version 22. ***Results:*** The SSI rate was significantly lower in the subcutaneous suction drain group (10%) compared to the simple skin closure group (42%). The average hospital stay was also significantly shorter for the subcutaneous suction drain group (8.84 days) versus the simple skin closure group (11.20 days). Co-morbidities such as hypertension and diabetes showed no significant difference between groups. ***Conclusion:*** The use of subcutaneous suction drains significantly reduces the incidence of SSIs and shortens hospital stays after emergency laparotomies. These findings support the implementation of subcutaneous suction drains as a beneficial practice in surgical management, particularly in resource-limited settings.

Keywords: Surgical Site Infections, subcutaneous suction drains, simple skin closure.

INTRODUCTION

Surgical Site Infections (SSIs) are one of the most common complications following surgery, particularly after major abdominal procedures such as emergency laparotomy. SSIs can lead to increased morbidity, prolonged hospital stays, and higher healthcare costs. In developing countries like Bangladesh, where healthcare resources are often limited, effective methods to reduce the risk of SSIs are crucial [1-2]. Among the strategies employed to minimize these infections are subcutaneous suction drains and simple skin closure techniques, both of which are commonly used in postoperative wound management. Understanding the relative effectiveness of these methods is essential to improving patient outcomes, especially in high-risk surgeries like emergency laparotomies [3].

Emergency laparotomies, which involve immediate surgical intervention for life-threatening abdominal conditions, present a higher risk of SSIs compared to elective surgeries. The urgency and complexity of these procedures, combined with the often

unstable condition of patients, contribute to the increased infection risk. Therefore, implementing an effective wound closure technique that minimizes SSIs is critical in the postoperative care of these patients. The choice between subcutaneous suction drains and simple skin closure can significantly impact the rates of infection and other complications [4-7].

Subcutaneous suction drains work by actively removing fluid and debris from the wound site, which may help prevent the accumulation of bacteria and reduce the chances of infection. This method is thought to promote faster healing by keeping the wound dry and decreasing the bacterial load. In contrast, simple skin closure involves suturing the wound without additional drainage, which, while simpler, may allow fluid buildup, potentially increasing the risk of infection. However, both techniques are widely used, and their effectiveness in reducing SSIs remains a topic of debate [8-11].

In Bangladesh, where healthcare facilities often face constraints in terms of equipment, personnel, and infection control measures, determining the most effective method to reduce SSIs is even more important. High SSI rates not only affect patient recovery but also place a significant burden on an already strained healthcare system. By comparing the outcomes of patients undergoing emergency laparotomy who receive either subcutaneous suction drains or simple skin closure, this study aims to provide insights into the most effective technique for minimizing SSIs in such settings.

Several studies conducted in different parts of the world have yielded mixed results regarding the effectiveness of subcutaneous suction drains. Some research suggests that they significantly reduce SSI rates, while others show no substantial benefit over traditional methods [9-1]. The lack of consistent evidence underscores the need for localized studies in regions like Bangladesh, where factors such as surgical techniques, patient demographics, and healthcare infrastructure may influence outcomes differently.

Objective

This study, therefore, seeks to fill this gap by evaluating the effectiveness of subcutaneous suction drains versus simple skin closure in reducing postoperative SSIs in patients undergoing emergency laparotomy in Bangladesh.

METHODOLOGY

Study Design

This is a prospective, case–control study conducted at the Department of Surgery, Jalalabad Ragib-Rabeya Medical College & Hospital, Sylhet, Bangladesh, from June 2023 to July 2024. The study involved a total of 100 patients who underwent midline exploratory laparotomy, with the objective of comparing the effectiveness of subcutaneous suction drain versus simple skin closure in reducing postoperative Surgical Site Infections (SSIs). Patients were randomly assigned to either the case group (subcutaneous suction drain) or the control group (simple skin closure), using simple randomization.

Study Groups

- **Case Group (Subcutaneous Suction Drain):** Fifty patients who underwent laparotomy had a subcutaneous suction drain placed before skin closure. The drain was kept in place for 7 to 15 days, with an average of 5.2 days.
- **Control Group (Simple Skin Closure):** The remaining fifty patients had their wounds closed without placing a subcutaneous drain.

Inclusion Criteria

- Adult patients aged 18 to 80 years.
- Patients undergoing both emergency and elective laparotomy surgeries.

Exclusion Criteria

- Patients younger than 18 or older than 80 years.
- Immunocompromised patients (e.g., HIV positive, undergoing radiotherapy or chemotherapy).
- Patients undergoing repeat laparotomy surgeries.

Procedure

Upon admission, all patients underwent clinical examination and relevant investigations after providing informed written consent. The decision on whether to place a subcutaneous suction drain was based on random selection. Data on demographics, co-morbidities, and surgical outcomes were collected for both groups. The primary outcome measure was the incidence of postoperative SSIs. Secondary outcomes included the duration of hospital stay and other complications.

Data Collection

Information was collected on the following:

1. Age, gender, type of surgery (emergency or elective), and presence of co-morbidities (e.g., hypertension, diabetes).
2. Surgical outcomes, including the presence of SSIs and the length of hospital stay.
3. Patients were monitored for 7 to 15 days postoperatively for signs of infection, and the use of antibiotics was recorded.

Statistical Analysis

The collected data was entered into Microsoft Excel and analyzed using SPSS version 22. Categorical data were represented as frequencies and proportions, while continuous data were expressed as means and standard deviations. The chi-square test was used for categorical variables, while the independent t-test or Mann-Whitney U test was employed to compare

continuous variables between the groups. A p-value of <0.05 was considered statistically significant.

Graphical Representation

Data were presented using various graphs and charts, generated through Microsoft Excel and Word, to visualize the distribution of age, the incidence of SSIs, and the duration of hospital stay. Additionally, ROC curves were plotted to assess the diagnostic value of different variables in predicting SSIs.

This methodology ensured a comprehensive comparison between the subcutaneous suction drain and simple skin closure groups, enabling an evaluation of the most effective strategy in reducing SSIs after emergency laparotomy in a Bangladesh healthcare setting.

RESULTS

In the simple skin closure group, 30% of patients fall in the highest age category, followed by 22%, 20%, 16%, and 12% in decreasing age ranges. In the subcutaneous suction drain group, the highest proportion is also in the 30% category, but with a slightly lower 24%. The distribution in the subcutaneous suction drain group shows more patients in the 22% and 20% categories (32% and 28%, respectively), with fewer patients in the 16% and 12% categories (12% and 4%).

Table-1: Age distribution between two groups

	Group			
	Simple Skin Closure		Subcutaneous Suction Drain	
	Count	%	Count	%
Age	15	30%	12	24%
	11	22%	16	32%
	10	20%	14	28%
	8	16%	6	12%
	6	12%	2	4.%

The mean age distribution between the two groups, simple skin closure and subcutaneous suction drain, shows little difference. The average age in the simple skin closure group was 39.54 years, while in the subcutaneous suction drain group, it was 40.94 years, with a standard deviation (SD) of 10.54. The p-value of 0.592 indicates that this difference is not statistically significant, suggesting that the age distribution between the two groups is comparable.

Table-2: Mean age distribution between two groups

	Group				*p* -Value
	Simple Skin Closure		Subcutaneous Suction Drain		
	Mean	Mean	Mean	SD	
Age	39.54	40.94	40.94	10.54	0.592

The comparison of the mean duration of stay between the two groups reveals that patients in the simple skin closure group had a significantly longer hospital stay, with an average of 11.20 days, compared to 8.84 days for those in the subcutaneous suction drain group. The standard deviation (SD) for the subcutaneous suction drain group was 4.85. The p-value of 0.004 indicates that this difference is statistically significant, suggesting that the use of subcutaneous suction drains may contribute to a shorter hospital stay.

Table-3: Mean duration of stay comparison between the two groups

	Group				*p* -Value
Duration of stay	Simple Skin Closure		Subcutaneous Suction Drain		
	Mean	Mean	Mean	SD	
	11.20	8.84	8.84	4.85	0.004*

The distribution of co-morbidities between the two groups, simple skin closure and subcutaneous suction drain, shows no significant difference for hypertensive and diabetic (DM) patients. In both groups, 84% of patients were hypertensive, while 16% were not, with a chi-square value of 0.000 and a p-value of 1.00, indicating no difference between the groups. For diabetes mellitus (DM), 76% of patients were affected in both groups, and 24% were not, with a chi-square value of 0.053 and a p-value of 0.817, again showing no significant difference.

Table-4: Co Morbidities distribution between the two groups

	Group				Chi-square
	Simple Skin Closure		Subcutaneous Suction Drain		
	Count	%	Count	%	
Hypertensive	42	84%	42	84%	$\chi2 = 0.000$, df = 1, $p = 1.00$.
	8	16%	8	16%	
DM	37	74%	38	76%	$\chi2 = 0.053$, df = 1, $p = 0.817$.
	13	26%	12	24%	

The distribution of the type of surgery between the two groups shows a fairly balanced split between elective and emergency surgeries for both the subcutaneous suction drain and simple skin closure groups. In the subcutaneous suction drain group, 44% of surgeries were elective, while 56% were emergency. Similarly, in the simple skin closure group, 46% were elective, and 54% were emergency. This near-equal distribution suggests that both groups had a comparable mix of elective and emergency surgeries.

Table-5: Type of surgery distribution between the two groups

Type of surgery	Group			
	Subcutaneous Suction Drain		Simple Skin Closure	
	Count	%	Count	%
Elective	22	44%	23	46%
Emergency	28	56%	27	44%

In the group with subcutaneous suction drains, 90% of patients did not develop SSIs, with only 10% affected. In contrast, the group with simple skin closure showed a much higher rate of infection, with 42% of patients experiencing SSIs, while 58% remained infection-free.

Table-6: SSI distribution between the two groups

		Group			
		Subcutaneous Suction Drain		Simple Skin Closure	
		Count	%	Count	%
SSI	Absent	45	90%	29	58%
	Present	5	10%	21	42%

In elective surgeries, 85% of patients did not develop SSI, while 15% did. Conversely, emergency surgeries showed a higher incidence of SSIs, with 40% of patients affected, while 60% remained free of infection. This indicates that emergency surgeries have a significantly higher risk of developing SSIs compared to elective procedures.

Table-7: SSI distribution with respect to type of surgery

		Type of surgery			
		Elective		Emergency	
		Count	%	Count	%
SSI	Absent	40	85%	32	60%
	Present	7	15%	21	40%

DISCUSSION

This study comparing the effectiveness of subcutaneous suction drains versus simple skin closure in reducing postoperative surgical site infections (SSIs) after emergency laparotomies in Bangladesh yielded important findings. The results indicate a clear benefit of subcutaneous suction drains in reducing SSIs, as demonstrated by a significantly lower infection rate in the subcutaneous suction drain group (10%) compared to the simple skin closure group (42%). These findings are consistent with other studies that have shown a reduced risk of SSIs with the use of drains, particularly in high-risk surgeries like emergency laparotomies [12].

In terms of age distribution, both groups in our study showed a comparable pattern, with the highest percentage of patients (30%) falling in the same age category in the simple skin closure group, and a slightly lower percentage (24%) in the subcutaneous suction drain group. The mean age between the two groups was also similar, with no statistically significant difference (p=0.592). This similarity in age distribution aligns with other studies where the age of patients did not significantly influence the outcome of SSI rates, suggesting that other factors, such as the presence of a drain or surgical technique, play a more pivotal role in infection prevention [13].

The duration of hospital stay differed significantly between the two groups, with patients in the subcutaneous suction drain group having a shorter average stay (8.84 days) compared to the simple skin closure group (11.20 days). This finding is in line with other research, which has reported that the use of suction drains can reduce fluid accumulation and infection risk, leading to faster recovery and shorter hospital stays. The statistically significant difference in our study (p=0.004) further supports the benefit of subcutaneous suction drains in enhancing recovery [14].

Regarding co-morbidities, our study showed no significant differences between the two groups in terms of the prevalence of hypertension or diabetes mellitus (DM), which are known risk factors for SSIs. Both groups had a similar distribution of hypertensive and

diabetic patients, with 84% being hypertensive and 76% having DM. The lack of significant difference in these co-morbidities between the groups suggests that the lower rate of SSIs in the subcutaneous suction drain group is not attributable to a healthier baseline condition but rather to the intervention itself. This finding is consistent with other studies, where co-morbidities did not significantly influence SSI rates when a drain was used [13, 15].

The distribution of surgery types (elective versus emergency) was also comparable between the two groups. In the subcutaneous suction drain group, 44% of surgeries were elective, while 56% were emergency, closely matching the distribution in the simple skin closure group (46% elective and 54% emergency). This balanced distribution ensures that the type of surgery did not skew the results, allowing for a fair comparison of the effectiveness of the two closure methods. Other studies have similarly demonstrated that emergency surgeries carry a higher risk of SSIs due to their urgency and complexity, which our study corroborates, as emergency surgeries had a higher infection rate (40%) compared to elective surgeries (15%) [12].

Our findings on SSIs are also in agreement with global research. Studies from different regions have shown that subcutaneous suction drains effectively reduce fluid accumulation in the wound, thereby lowering the bacterial load and preventing infection. The high rate of SSIs in the simple skin closure group, with 42% of patients affected, reflects the challenges of managing wound closure without drainage in high-risk surgeries, as observed in other studies. Conversely, the significantly lower infection rate in the subcutaneous suction drain group (10%) aligns with findings from other prospective studies, which highlight the benefits of drains in reducing postoperative complications [11, 13].

CONCLUSION

In conclusion, the results of this study strongly support the use of subcutaneous suction drains in emergency laparotomies in Bangladesh to reduce SSIs, shorten hospital stays, and improve patient outcomes. While the age distribution, co-morbidities, and type of surgery were similar between the two groups, the differences in SSI rates and hospital stay duration underscore the effectiveness of subcutaneous suction drains. These findings contribute to the growing body of evidence favoring the use of suction drains in high-risk abdominal surgeries and offer valuable insights for improving surgical practices in resource-limited settings.

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