

## ORIGINAL RESEARCH

# To compare the effectiveness of subcutaneous negative pressure with simple closure of the skin incision in patients undergoing surgery for hollow viscus perforation

<sup>1</sup>Dr. Spandan Yadav, <sup>2</sup>Dr. Shekhar Singh Jadon

<sup>1,2</sup>Assistant Professor, Department of Surgery, RG Medical College and Research Centre, Hathras, UP, India

### Corresponding Author

Dr. Shekhar Singh Jadon

Assistant Professor, Department of Surgery, RG Medical College and Research Centre, Hathras, UP, India

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### ABSTRACT

**Aim:** To compare the effectiveness of subcutaneous negative pressure with simple closure of the skin incision in patients undergoing surgery for hollow viscus perforation. **Material and methods:** The research comprised a total of 100 patients who were admitted to the Department of General Surgery. The participants were thereafter assigned in an alternating manner to either Group A, which received a subcutaneous closed suction drain, or Group B, which did not get a drain. Prior to the surgery, the surgical site was sterilized with povidone iodine and alcohol in the operating room. A midline incision was made to open the abdomen. Following the surgical operation, a comprehensive peritoneal lavage was administered. **Results:** Thirteen individuals, which accounts for 26% of the total of 50 patients, had complications connected to their wounds. Among the 50 patients who had primary skin closure, 27 patients (54%) experienced local complications at the surgical site, as shown in Table-2. The incidence of complications in individuals with a subcutaneous drain was considerably low, with a P value of 0.03. The predominant complication seen was Surgical Site Infection, with a prevalence of 12% in group A and 32% in group B. In the current investigation, additional postoperative complications such as wound dehiscence (7%) and ruptured abdomen (3%) were identified. Three patients in Group B had a ruptured abdomen accompanied by the protrusion of colon. The average length of hospitalization for patients with subcutaneous negative pressure drain was  $9.53 \pm 1.76$  days. The mean length of hospitalization for patients who did not have a drain was  $12.87 \pm 1.98$  days. **Conclusion:** Our research demonstrates that the use of subcutaneous negative pressure drainage effectively decreases the occurrence of surgical site infection and shortens the length of hospitalization after surgery for hollow viscus perforation. This intervention facilitates prompt recovery, enhances wound healing, and reduces the financial burden on patients by minimizing hospitalization and infection.

**Keywords:** Subcutaneous negative pressure, Skin incision, Hollow viscus perforation

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### INTRODUCTION

Peritonitis is a frequently encountered surgical emergency in the field of surgery. Peritonitis is the medical term for the inflammation of the serosal membrane that covers the abdominal cavity and the organs within it.<sup>1</sup> Crisp provided the first clinical account of perforated peptic ulcer in 1843. Smoking and the use of nonsteroidal anti-inflammatory medicines are significant risk factors for perforation.<sup>2</sup> Surgical infections occur when there is a failure in the body's mechanical or anatomical defensive systems. These infections are linked to higher rates of illness, increased risk of death, and larger expenses in healthcare.<sup>3</sup> The prevalence of surgical site infections

(SSI) may be partly attributed to the rise of antimicrobial-resistant organisms and the growing population of older surgical patients with various chronic, debilitating, or immunocompromising conditions. Surgical site infections (SSI) may lead to a twofold increase in the duration of hospitalization, resulting in higher healthcare expenses. The primary additional expenses are associated with reoperation, supplementary nursing care and interventions, and the expenditures of pharmacological therapy. Surgical site infection, a common postoperative complication, arises in a minimum of 5% of all surgical patients and in 30-40% of patients after abdominal surgery, varying with the degree of contamination. The

surgeon has a hurdle while closing the abdominal wall in the presence of sepsis. If the abdominal wall is tightly closed after pathology and peritoneal cavity cleansing, a considerable proportion of patients may have compartment syndrome, wound dehiscence, or rupture abdomen. Occasionally, the surgeon may need to use techniques such as the vacuum closure system, which is a costly procedure that requires subsequent suturing of the skin. In certain individuals, when the wound is closed largely, there is a risk of wound infection and separation of the wound, which may potentially lead to ruptured abdomen. Surgeons have used a range of suture materials to close the abdomen, including both delayed absorbable and nonabsorbable sutures.<sup>4,5</sup>

The occurrence of surgical-site infection is directly proportional to the level of contamination. Consequently, the rates of surgical-site infection are much higher after surgeries for peritonitis (i.e., 5-15%) compared to elective abdominal operations for non-infectious causes (5%). If it is not possible to shut the abdomen directly or if there is a risk of compartment syndrome, the vacuum pack technique has been shown to be beneficial. However, the choice of interim abdominal closure method will ultimately rely on the institution's expertise and the surgeon's preference. The use of a vacuum pack method for temporarily closing the open abdomen is a very successful option for individuals with abdominal sepsis.<sup>6</sup> If the wound is closed in the presence of significant abdominal contamination and wound lavage at the conclusion of treatment is not consistently effective, surgical-site infection is likely to occur.<sup>7</sup> Negative suction in the subcutaneous space with or without irrigation with antibiotic solution has been shown to reduce the incidence of infection by evacuation of infected contents.

Hematoma, serous fluid, and dead space in surgical incisions provide as a conducive environment for bacterial growth, hence elevating the likelihood of surgical site infection. The insertion of a subcutaneous drain helps to remove fluids and debris from the subcutaneous layer and eliminates empty spaces shortly after surgery, before they may get infected. This leads to a decrease in incisional surgical site infections. Surgical site infection results in prolonged hospitalization and heightened morbidity, exacerbating patient distress unnecessarily. This research examines the effectiveness of using a subcutaneous single closed suction drain against a simple conventional closure of the skin incision in emergency laparotomy procedures for hollow viscus perforation.

## MATERIAL AND METHODS

This research was undertaken at the Department of General Surgery as a means of exploring potential outcomes. The research comprised a total of 100 patients who were admitted to the Department of General Surgery. The diagnosis was established by

clinical assessment and verified using relevant diagnostic techniques.

## METHODOLOGY

Patients were revived with intravenous hydration and started on antibiotics. Each patient was administered piperacillin tazobactam at a dosage of 4.5 grams and metronidazole at a dosage of 500 milligrams intravenously. Patients who were clinically and radiologically diagnosed with acute abdomen were scheduled for emergency exploratory laparotomy. The participants were thereafter assigned in an alternating manner to either Group A, which received a subcutaneous closed suction drain, or Group B, which did not get a drain. Prior to the surgery, the surgical site was sterilized with povidone iodine and alcohol in the operating room. A midline incision was made to open the abdomen. Following the surgical operation, a comprehensive peritoneal lavage was administered. The Rectus sheath was sutured closed using a continuous non-absorbable monofilament suture material. In Group I, a 16F Romovac subcutaneous suction drain was inserted and secured in place using 2-0 Mersilk suture material. All patients had their skin closed with skin staplers. The drainage volume in patients belonging to Group I was recorded at 24-hour intervals. Every day, all patients underwent the application of sterile dressings using Gamzee pads. A diagnosis of surgical site infection (SSI) is established when there are symptoms such as pain, swelling, redness, and the presence of serous or purulent discharge. The whole set of collected wounds was submitted for microbiological investigation, and antibiotics were adjusted appropriately. The daily amount of drainage was measured, and the drain was removed when the outflow was below 5 ml during a 24-hour period. Patients were freed only upon the extraction of the drain.

The data was examined using the statistical software SPSS version 24.0. The chi-square test was used to generate frequencies and percentages for categorical variables, while the Student's t-test was used to compare means across groups. A p-value of less than 0.05 was deemed to be statistically significant.

## RESULT

A total of 100 patients had emergency laparotomy, with 50 of them receiving a closed subcutaneous drain. Another 50 individuals had primary closure of the skin incision. The age group with the highest number of patients was between 40-50 years, followed by the age range of 30-40 years. The average age in this research was  $45.53 \pm 3.76$  years (Table-1). The distribution of patients in our research, categorized by gender, is shown in Table-1. The number of male patients was 73, accounting for 73% of the total, while the number of female patients was 27, accounting for 27%. The gender ratio in our research was 2.7 males for every 1 female.

**Table1: Gender and Age distribution**

Sex	Number	Percentage
Male	73	73
Female	27	27
Total	100	100
Age group		
20-30	17	17
30-40	23	23
40-50	45	45
50-60	13	13
60-70	2	2
Total	100	100

A total of 100 individuals underwent the placement of a closed negative subcutaneous drain, which was done in 50 of these patients. Thirteen individuals, which accounts for 26% of the total of 50 patients, had complications connected to their wounds. Among the

50 patients who had primary skin closure, 27 patients (54%) experienced local complications at the surgical site, as shown in Table-2. The incidence of complications in individuals with a subcutaneous drain was considerably low, with a P value of 0.03.

**Table 2: Association between status of drain and SSI**

Group	Wound complication		No wound complication		P value
	Number	Percentage	Number	Percentage	
Group A	13	26	37	74	0.03
Group B	27	54	23	46	

The predominant complication seen was Surgical Site Infection, with a prevalence of 12% in group A and 32% in group B. In the current investigation, additional postoperative complications such as wound dehiscence (7%) and ruptured abdomen (3%) were identified, as shown in Table-3. Three patients in

Group B had a ruptured abdomen accompanied by the protrusion of colon. The patient necessitated a procedure to reopen and suture the abdominal wall under strain. The other patients were treated conservatively by the use of frequent dressing and antibiotics.

**Table 3: Wound complication**

Wound complication	Group A	Group B	P value
Seroma	2	6	0.15
Hematoma	2	0	0.37
SSI	6	16	0.08
Wound dehiscence	2	5	0.33
Burst abdomen	0	3	0.29

Table 4 illustrates the correlation between the presence or absence of a drain and the length of postoperative hospitalization. Our research demonstrates a decrease in the duration of postoperative

hospitalization in situations where a negative pressure drain is used, compared to cases where no drain is used.

**Table 4: Association between status of drain and Post-operative stay**

Post-operative stay in days	Group A	Group B	P Value
<7	3	0	0.33
8-10	37	25	
11-15	5	7	
>15	9	21	

The average length of hospitalization for patients with subcutaneous negative pressure drain was  $9.53 \pm 1.76$  days. The mean length of hospitalization for patients who did not have a drain was  $12.87 \pm 1.98$  days. The

data shown in Table-5 demonstrates a statistically significant decrease in the duration of hospitalization among patients who had a subcutaneous drain.

**Table 5: Mean duration of hospital stays**

Group	Mean	S.D	P-value
Group A	9.53	1.76	0.01
Group B	12.87	1.98	

**DISCUSSION**

General surgeons often carry out emergency laparotomies. Emergency surgery is mostly indicated for conditions such as hollow viscus perforation, intestinal blockage, acute appendicitis, and abdominal trauma. The eventual result of an emergency laparotomy is influenced by several factors, including the underlying disease, concomitant disorders, surgical skill, and post-operative care. Patients who undergo emergency laparotomy have much higher rates of illness and death compared to those who receive elective laparotomies.<sup>8</sup> Frequently reported local problems include seroma, hematoma, surgical site infections, wound dehiscence, ruptured abdomen, and delayed wound healing. Various methods are being used to mitigate surgical site infection, and one such method is the insertion of a subcutaneous drain. In our research, 68% of the participants were between the age range of 30 to 50 years. This conclusion is consistent with the research done by Kapoor et al.,<sup>9</sup> in which 69% of the participants were aged between 21 and 50 years. The survey revealed a male to female ratio of 2.7:1. Perforation peritonitis is more prevalent in young guys, mostly due to a greater prevalence of smoking and opioid misuse. Individuals in this age bracket are also more susceptible to experiencing traffic accidents that might result in intra-abdominal damage and perforation. Wound complications were seen in 42 individuals, accounting for 42% of the total research population. Out of the total number of patients, 30 (60%) in the primary closure group and 12 (24%) in the subcutaneous drain group had difficulties with their wounds. The likelihood value in our analysis is statistically significant, with a P-value of 0.03. The prevailing complication is surgical site infection. The predominant complication seen was Surgical Site Infection, with a prevalence of 12% in group A and 32% in group B. In the current investigation, additional postoperative problems such as wound dehiscence (7%) and ruptured abdomen (3%) were also found. This aligns with the research conducted by Fujii et al., [10]. Placing a subcutaneous drain directly next to the wound eliminates the accumulation of serous fluid and blood, which in turn improves the flow of small blood vessels, reduces the number of bacteria, and encourages the growth of granulation tissue.

In our research, patients with drains had a shorter postoperative stay compared to individuals without drains. The average duration of postoperative stay in patients with a drain was 9.53±1.76 days. The duration of postoperative hospitalization in patients who did not have a drain was 12.87±1.98 days

(P<0.01). This is analogous to a research conducted by Kagita et al.<sup>11</sup> The prolonged duration of hospitalization may be attributed to the additional time needed for the management of wound infection. These patients will need many bandages, extended antibiotic treatment, and more surgical procedures, which will further contribute to their distress. Furthermore, a SSI often prolongs the duration of hospitalization by around five days, as shown by research.<sup>12</sup>

**CONCLUSION**

Our research demonstrates that the use of subcutaneous negative pressure drainage effectively decreases the occurrence of surgical site infection and shortens the length of hospitalization after surgery for hollow viscus perforation. This intervention facilitates prompt recovery, enhances wound healing, and reduces the financial burden on patients by minimizing hospitalization and infection. Due to the correlation between post-operative problems and the degree of contamination, we advise the use of closed negative pressure subcutaneous drain in all patients with contaminated or unclean wounds.

**REFERENCES**

1. Kagita R, Mulla SA, Pai BS, Desai M. Subcutaneous negative pressure versus simple closure of skin incision following an emergency laparotomy: a randomized control study. *Int Surg J* 2019;6:1230-7.
2. Swanes C, Soreide JA, Soreide O, Bakke P, Vollset SE, Skarstein A. Smoking and ulcer perforation. *Gut*. 1997;41:177-805.
3. Venkateswaran R, Bhagvat S, Dutt A, Padekar HD, Mirkhushal N, Chetan AA. Primary Closure Versus Delayed Primary Closure of Class III and IV Surgical Wounds Following Emergency Laparotomy: A Prospective Comparative Study. *Cureus*. 2023 Nov 17;15(11):e48965. doi: 10.7759/cureus.48965. PMID: 38024020; PMCID: PMC10656080.
4. Richard T. Wound healing. *Sabiston Text book of Surgery*, 19th edition, 2012: 151-177
5. Dugad D, Mohanty D, Mahobia H, Saha A. A comparative study of subcutaneous negative pressure versus simple closure of skin incision following surgery for hollow viscus perforation. *Int J Surg Sci* 2021;5(2):269-271.
6. López-Quintero L, Evaristo-Méndez G, FuentesFlores F, Ventura-González F, Sepúlveda-Castro R. Treatment of open abdomen in patients with abdominal sepsis using the vacuum pack system. *Cir Cir*. 2010;78(4):322-6.
7. Alkaaki A, Al-Radi OO, Khoja A, et al. Surgical site infection following abdominal surgery: a prospective cohort study. *Can J Surg*. 2019;62:111–117.
8. Pearse RM, Harrison DA, James P. Identification and characterisation of the high-risk surgical population in

- the United Kingdom. *Critical Care* 2006;10:R81. Link: <http://bit.ly/2xJef3n>
9. Kapoor S, Sharma R, Srivastava A, Kumar A, Singh A, *et al.* Study Of Surgical Complications Of Explorative Laparotomy And Their Management –A Study Of 100 Cases. *Journa of Dental And Medical Science* 2017;16:36- 41
  10. Fujii T, Tabe Y, Yajima R, Yamaguchi S, Tsutsumi S, Asao T *et al.* Effects of Subcutaneous Drain for the Prevention of Incisional SSI in High-Risk Patients Undergoing Colorectal Surgery. *Int J Colorectal Dis.* 2011;26:1151-5.
  11. Rakesh Kagita, Sameer Ahmed Mulla, Srinivas Pai B, Mallikarjun Desai. Subcutaneous negative pressure versus simple closure of skin incision following an emergency laparotomy: a randomized control study. *Int Surg J.* 2019;6(4):1230-1237
  12. Mukherjee R, Samanta S. A comparative study of primary skin and subcutaneous tissue closure and open skin technique in emergency laparotomy for perforative peritonitis: an observational and prospective study. *Int Surg J* 2019;6:166-72.