

# Efficacy of Subcutaneous Negative Pressure Suction Drain in Preventing Surgical Site Infections Following Emergency Exploratory Laparotomy: A Cross-Sectional Study from North East India

Antara Ray Bhaumik<sup>1</sup>, Kalpadip Deb<sup>2</sup>

<sup>1</sup>Senior Resident, Department of General Surgery, Agartala Government Medical College and G.B.P. Hospital, Agartala, Tripura, India.

<sup>2</sup>Medical Officer, Chhattisgarh State Power Company (CSPC), Chhattisgarh, India.

Corresponding Author: Dr. Antara Ray Bhaumik

DOI: <https://doi.org/10.52403/ijhsr.20261017>

Received: 23/05/2026; Revised: 27/08/2026; Accepted: 24/10/2026

## ABSTRACT

**Background:** Surgical site infections (SSIs) are among the most common postoperative complications following emergency exploratory laparotomy, particularly in contaminated abdominal wounds. Subcutaneous negative pressure suction drains have been proposed to reduce dead space, evacuate exudates, and lower infection risk, but their efficacy remains uncertain in resource-limited settings.

**Objectives:** To evaluate the effectiveness of subcutaneous negative pressure suction drains in preventing SSIs after emergency exploratory laparotomy and to identify key patient-related risk factors influencing infection outcomes.

**Methods:** This prospective cross-sectional study was conducted at Agartala Government Medical College and G.B.P. Hospital, Tripura, over 18 months. A total of 100 patients undergoing emergency laparotomy were enrolled and divided into two groups: 50 with subcutaneous drains and 50 without. Wound healing was assessed daily using the Southampton Grading System, and SSI diagnosis was confirmed by clinical and microbiological criteria. Statistical analysis was performed using Chi-square and t-tests, with  $p < 0.05$  considered significant.

**Results:** Overall SSI incidence was 58%. Patients with drains had a lower infection rate (50%) than those without drains (66%), but the difference was not statistically significant ( $p = 0.156$ ). Comorbidities, hypoalbuminemia, and elevated total leukocyte count were strongly associated with SSI occurrence ( $p < 0.005$ ). All patients with comorbidities developed infection, while none with normal albumin levels developed SSI, compared with 27.6% among those without comorbidities. All patients with high TLC developed SSI (100%), whereas only 16% of those with low TLC experienced infection.

**Conclusion:** Subcutaneous negative pressure suction drains may modestly reduce SSI incidence in contaminated laparotomy wounds, but systemic risk factors such as comorbidities, nutritional status, and inflammatory markers exert a stronger influence. Comprehensive SSI prevention strategies should combine mechanical wound management

with optimisation of patient physiology and nutrition, particularly in resource-limited settings.

**Keywords:** Emergency laparotomy, Surgical site infection, Negative pressure suction drain, Hypoalbuminemia, Comorbidities, Total leukocyte count, Southampton wound grading, Resource-limited settings

## INTRODUCTION

Surgical site infections (SSIs) remain one of the most frequent postoperative complications in abdominal surgery, particularly in emergency exploratory laparotomy where contamination levels are high. SSIs are defined as infections occurring within 30 days of surgery, or up to one year in patients with implants, and may involve superficial, deep, or organ-space tissues at the operative site. [1] Globally, SSIs account for significant morbidity, prolonged hospitalisation, and increased healthcare costs, making their prevention a critical aspect of surgical practice. [2]

The incidence of SSIs varies depending on the type of surgery and wound classification. While clean wounds demonstrate relatively low infection rates, contaminated and dirty wounds, as classified by the Centres for Disease Control and Prevention (CDC), show SSI rates ranging from 30–50%. [3] Emergency laparotomy, often performed for conditions such as perforated viscus, intestinal obstruction, or peritonitis, carries a particularly high risk due to pre-existing contamination, delayed presentation, and compromised patient physiology. [4]

Multiple strategies, including perioperative antibiotics, meticulous surgical technique, and wound drainage, have reduced SSI rates. Among these, subcutaneous negative-pressure suction drains have gained attention for minimising dead space, evacuating seromas, and reducing bacterial colonisation. [5] Negative pressure drainage provides a controlled closed system that removes exudates and debris, thereby decreasing the risk of infection and promoting wound healing. [6] By maintaining a moist environment, reducing

peripheral oedema, and stimulating angiogenesis, negative pressure therapy enhances granulation tissue formation and epithelialization. [7]

Several studies have demonstrated that patients with comorbidities such as diabetes, obesity, chronic heart disease, and alcoholism are at increased risk of developing SSIs due to impaired immune function and delayed wound healing. [8,9] In such high-risk populations, the use of negative suction drains may provide additional protection against infection. Furthermore, antibiotic-resistant organisms have complicated SSI management, underscoring the importance of mechanical preventive measures. [10]

Postoperative seroma formation is another common complication in abdominal surgery, particularly when anatomical dead space is created. Seromas act as a culture medium for bacterial growth, increasing the likelihood of infection and wound dehiscence. [11] Negative suction drains effectively eliminate this dead space, thereby reducing seroma-related complications. Evidence also suggests that delayed primary closure combined with negative pressure therapy can significantly reduce SSI rates in contaminated laparotomy wounds. [12]

The burden of SSIs extends beyond clinical outcomes to economic implications. Patients with SSIs often require prolonged hospital stays, repeated wound care, and additional interventions, which increase healthcare expenditure and patient distress. [13] In resource-limited settings, such as tertiary care hospitals in northeastern India, strategies that reduce SSI incidence and shorten hospital stay are particularly valuable.

Given this background, this study evaluated the effectiveness of subcutaneous negative-pressure suction drains in preventing SSIs after emergency exploratory laparotomy and identified key patient-related risk factors influencing infection outcomes.

## **MATERIALS AND METHODS**

### **Study Design and Setting**

This prospective, hospital-based cross-sectional observational study was conducted in the Department of General Surgery at Agartala Government Medical College and G.B.P. Hospital, Tripura. The study was conducted over 1.5 years.

### **Study Population and Sampling**

All patients undergoing emergency exploratory laparotomy during the study period were included. Because no prior prevalence data were available for this region, we used census sampling. Hospital records indicated that approximately 161 emergency laparotomies were performed in the preceding two years, averaging 80 cases per year. Based on this, the expected sample size over one and a half years was approximately 100 patients.

Patients were divided into two groups:

- **Study group (n=50):** Patients in whom a subcutaneous negative pressure suction drain was placed.
- **Control group (n=50):** Patients who underwent standard closure without drain placement.

### **Inclusion Criteria**

1. Postoperative patients undergoing emergency exploratory laparotomy.
2. Age between 14 and 75 years.

### **Exclusion Criteria**

1. Patients or attendants refusing informed consent.

2. Patients with known malignancy.
3. Immunocompromised patients (HIV infection, long-term steroid therapy, chemotherapy).
4. Patients with accidental removal of drain.

### **Data Collection**

All patients were enrolled after obtaining written informed consent. A detailed case history was recorded, including demographic details (age, gender, etc.), duration of illness, diagnosis, comorbidities, and operative findings. Baseline investigations, including complete blood count, random blood sugar, renal and liver function tests, serum electrolytes, viral markers, ECG, and radiological studies (chest X-ray, abdominal X-ray, ultrasonography), were documented.

Intraoperative findings, including incision type, nature of peritoneal fluid, and presence of pus, were noted. For patients with drains, we recorded the quantity and colour of drain output daily. Drains were removed when output was <10 ml for two consecutive days.

### **Postoperative Assessment**

All patients were followed up until discharge. Wound assessment was performed daily, and wounds were graded according to the Southampton Grading System, which categorises wound healing and infection severity from Grade 0 (normal healing) to Grade V (deep or severe infection with tissue breakdown/hematoma requiring aspiration) [Table 1]. Wound swabs were collected in cases of suspected infection and sent to the Department of Microbiology for culture and sensitivity testing. Specimens were transported under sterile conditions.

**Table 1: Southampton Wound Grading System for postoperative wound assessment**

| Grade      | Main Feature                | Sub-Grade | Appearance / Clinical Signs                                                 |
|------------|-----------------------------|-----------|-----------------------------------------------------------------------------|
| <b>0</b>   | Normal healing              | –         | Normal wound recovery                                                       |
| <b>I</b>   | Mild changes                | I a       | Some bruising                                                               |
|            |                             | I b       | Considerable bruising                                                       |
|            |                             | I c       | Mild erythema                                                               |
| <b>II</b>  | Erythema inflammation +     | II a      | At one point                                                                |
|            |                             | II b      | Around sutures                                                              |
|            |                             | II c      | Along wound                                                                 |
|            |                             | II d      | Around wound                                                                |
| <b>III</b> | Clear/haemoserous discharge | III a     | At one point only ( $\leq 2$ cm)                                            |
|            |                             | III b     | Along wound ( $> 2$ cm)                                                     |
|            |                             | III c     | Large volume                                                                |
|            |                             | III d     | Prolonged ( $> 3$ days)                                                     |
| <b>IV</b>  | Pus                         | IV a      | At one point only ( $\leq 2$ cm)                                            |
|            |                             | IV b      | Along wound ( $> 2$ cm)                                                     |
| <b>V</b>   | Severe infection            | –         | Deep/severe infection $\pm$ tissue breakdown; hematoma requiring aspiration |

## Outcome Measures

- **Primary outcome:** Incidence of SSI, classified as superficial or deep according to CDC criteria.

## Statistical Analysis

Data were tabulated in Microsoft Excel and analysed using SPSS version 24.0. Descriptive statistics summarised demographic variables, wound types, and baseline characteristics, with results expressed as mean  $\pm$  standard deviation for continuous variables and frequency and percentage for categorical variables.

We compared categorical variables, such as SSI incidence across drain versus non-drain groups, diagnosis categories, comorbidity status, albumin levels, and total leukocyte count (TLC), using the Chi-Square test or Fisher's exact test where appropriate. We compared continuous variables, including age, using the Student's t-test. A p-value  $<0.05$  was considered statistically significant.

## Ethical Considerations

The Institutional Ethics Committee of Agartala Government Medical College approved the study (Ref. No. F.4 (6-13)/AGMC/Medical Education/IEC Approval/2022/24352). Written informed consent was obtained from all participants.

The study maintained patient confidentiality throughout.

## RESULTS

### Patient Demographics

A total of 100 patients were included. The age distribution shows that most patients were middle-aged, with the highest proportion in the 40–49 years category (23%). This was followed by patients aged 30–39 years (19%) and 60–69 years (20%), indicating that middle-aged and older adults made up the bulk of the surgical population. Younger patients (14–29 years) accounted for 23% of cases, while patients aged 70 years and older represented only 2%. The mean age was  $43.56 \pm 17.06$  years (range: 14–75 years), reflecting a balanced spread across age groups but with a predominance of individuals in their third to sixth decades of life (Table 2).

**Table 2: Age Distribution of Patients**

| Age Group (years) | Count | Percentage (%) |
|-------------------|-------|----------------|
| 14–19             | 11    | 11.0           |
| 20–29             | 12    | 12.0           |
| 30–39             | 19    | 19.0           |
| 40–49             | 23    | 23.0           |
| 50–59             | 13    | 13.0           |
| 60–69             | 20    | 20.0           |
| 70–75             | 2     | 2.0            |
| <b>Total</b>      | 100   | 100            |

The sex distribution of patients in this study shows a clear male predominance, with 69% male and 31% female (Figure 1).

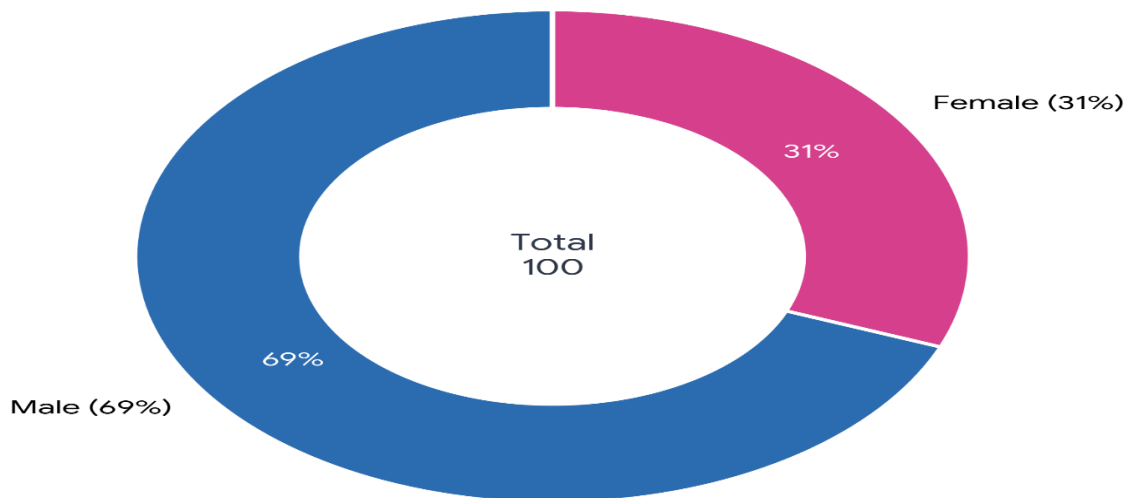


Figure 1: Sex Distribution

### Wound Classification

The wound type distribution shows that most patients presented with contaminated wounds (51%), followed closely by dirty

wounds (40%). Only a small fraction (9%) had clean-contaminated wounds, and no clean wounds were recorded (Figure 2).

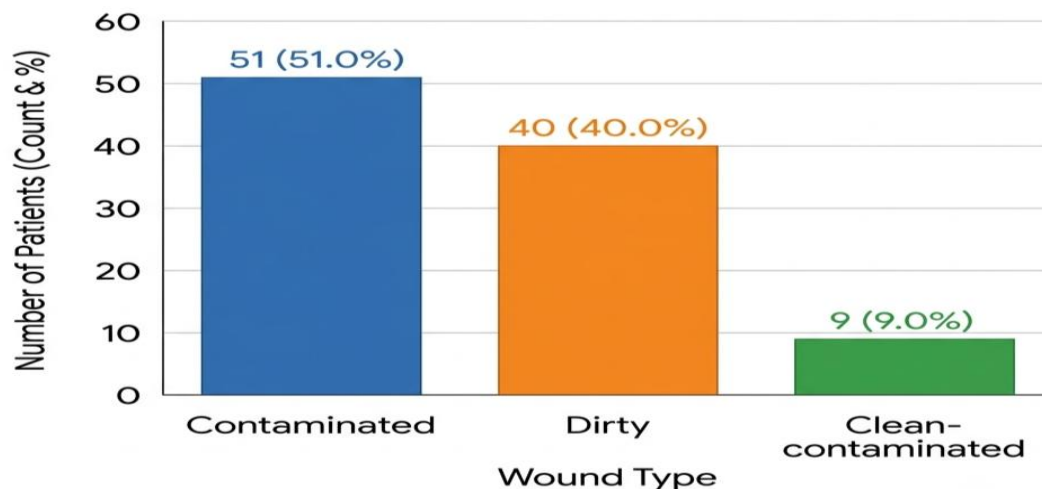


Figure 2: Wound type distribution

### Incidence of Surgical Site Infection (SSI)

Comparing SSI occurrence between patients with and without subcutaneous negative pressure suction drains shows that infections were more frequent in the non-drain group (66%) than in the drain group (50%). This indicates a relative reduction in infection rates among patients who received drains, suggesting a potential protective effect.

However, statistical analysis showed the difference was not significant (Chi-Square = 2.01,  $p = 0.156$ ), meaning drain use did not independently influence SSI occurrence in this dataset. While the trend favours drain placement, other factors such as comorbidities, nutritional status, and wound contamination likely played a stronger role in determining infection risk (Table 3).

**Table 3: SSI Occurrence in Drain vs. Non-Drain Groups.**

| Drain Usage      | No SSI | SSI + | Total Cases | SSI (%) |
|------------------|--------|-------|-------------|---------|
| No Drain         | 17     | 33    | 50          | 66      |
| Yes (Drain Used) | 25     | 25    | 50          | 50      |
| Total            | 42     | 58    | 100         | 58      |

### SSI by Diagnosis

The distribution of SSI across different diagnoses shows that hollow viscus perforation (HVP) accounted for the largest share, with 24 out of 42 cases developing SSI (41.38%). This was followed by intestinal obstruction (12 cases, 22.41%) and appendicitis (7 cases, 12.07%). Other conditions such as splenic injury,

obstructive biliopathy, and hernia contributed smaller proportions. Interestingly, although diagnoses such as HVP and intestinal obstruction were more frequently associated with SSI, statistical analysis showed no significant correlation between diagnosis type and SSI occurrence ( $p = 0.717$ ) [Table 4].

**Table 4: Distribution of SSI by Diagnosis**

| Diagnosis                    | No SSI | Yes SSI | Total Cases |
|------------------------------|--------|---------|-------------|
| Acute Cholecystitis          | 0      | 1       | 1           |
| Appendicitis                 | 10     | 7       | 17          |
| Cellulitis                   | 0      | 1       | 1           |
| FB in Abdominal Wall         | 1      | 0       | 1           |
| Feeding Jejunostomy          | 0      | 1       | 1           |
| Hemoperitoneum               | 1      | 2       | 3           |
| Hollow Viscus Perforation    | 18     | 24      | 42          |
| Intestinal Obstruction       | 6      | 12      | 18          |
| Obstructive Biliopathy       | 1      | 4       | 5           |
| Obstructed Inguinal Hernia   | 2      | 2       | 4           |
| Obstructed Incisional Hernia | 0      | 1       | 1           |
| Splenic Injury               | 2      | 2       | 4           |

### Wound Grading (Southampton Score)

The Southampton wound grading analysis shows that only 22% of patients achieved normal healing (Score 0), while the majority experienced varying degrees of wound complications. Mild changes such as bruising or erythema (Grade 1A–1B) were seen in 20% of cases, and moderate complications including inflammation and

serous discharge (Grades 2–3) accounted for nearly half of the cohort. Severe infections requiring intervention (Grades 4A–4B) were present in 13% of patients, reflecting deep tissue involvement and pus formation. Overall, 78% of patients demonstrated some level of wound complication, underscoring the high burden of surgical site infections in emergency laparotomy cases (Table 5).

**Table 5: Distribution by Southampton Score**

| Southampton Score | Count |
|-------------------|-------|
| 0                 | 22    |
| 1A                | 17    |
| 1B                | 3     |
| 2A                | 1     |
| 2B                | 3     |
| 2C                | 5     |
| 3A                | 13    |
| 3B                | 11    |
| 3C                | 12    |
| 4A                | 7     |
| 4B                | 6     |
| Total             | 100   |

## Risk Factors for SSI

The relationship between SSI and comorbidities in this study shows a striking pattern. Among patients without comorbidities, 42 out of 58 (72.4%) remained free of infection, while only 16 (27.6%) developed SSI. In contrast, all 42 patients with comorbidities experienced

SSI, indicating a 100% infection rate in this subgroup. Statistical analysis confirmed this difference to be highly significant ( $p < 0.005$ ), underscoring that comorbid conditions such as diabetes, hypertension, or chronic systemic illnesses are strong independent risk factors for postoperative infection (Table 6).

**Table 6: Relationship Between SSI and Comorbidities**

| Comorbidities | SSI- | SSI+ | Total | p-value |
|---------------|------|------|-------|---------|
| Absent        | 42   | 16   | 58    | <0.005  |
| Present       | 0    | 42   | 42    |         |

The relationship between hypoalbuminemia and SSI reveals a strong and statistically significant association. Patients with normal serum albumin levels ( $\geq 3.5$  g/dl) did not develop SSI, indicating that adequate nutritional and protein status provides protection against postoperative infection.

In contrast, 85.3% of patients with hypoalbuminemia ( $< 3.5$  g/dl) developed SSI, highlighting the vulnerability of this group. The p-value ( $< 0.005$ ) confirms that low albumin is an independent and highly significant risk factor for SSI (Table 7).

**Table 7: Relationship Between Hypoalbuminemia and SSI**

| Albumin Status        | SSI+ | SSI- | Total Cases | SSI % | p-value |
|-----------------------|------|------|-------------|-------|---------|
| Normal ( $\geq 3.5$ ) | 32   | 0    | 32          | 0     | <0.005  |
| Low ( $< 3.5$ )       | 10   | 58   | 68          | 85.3  |         |

The relationship between TLC and SSI is very strong and statistically significant. All patients with high TLC developed SSI (100%), whereas only 16% of those with low TLC experienced infection. This indicates that elevated TLC, often reflecting systemic inflammation or infection at

presentation, strongly predicts postoperative wound complications. The chi-square analysis confirmed this with a highly significant p-value ( $< 0.005$ ), underscoring that high TLC is an independent risk factor for SSI (Table 8).

**Table 8: Relationship Between TLC and SSI**

| TLC Category | No SSI | SSI+ | Total Cases | SSI % | p-value |
|--------------|--------|------|-------------|-------|---------|
| High TLC     | 0      | 50   | 50          | 100   | <0.005  |
| Low TLC      | 42     | 8    | 50          | 16    |         |

## DISCUSSION

SSIs remain a formidable challenge in emergency abdominal surgery, particularly exploratory laparotomy, where contamination and delayed presentation are common. In the present study, overall SSI incidence was 58%, with a notable reduction in patients managed with subcutaneous negative-pressure suction drains (50%) compared with those without drains (66%). Although this difference did not reach statistical significance, the trend

supports the hypothesis that negative pressure drainage may protect by reducing dead space, evacuating exudates, and limiting bacterial colonisation. Recent trials have reported similar findings, with negative pressure wound therapy (NPWT) reducing superficial SSI rates and improving wound healing dynamics. [14,15]

The Southampton wound grading analysis in this cohort revealed that only 22% of patients achieved normal healing, while the majority exhibited varying degrees of

wound complications. Severe infections requiring intervention (Grades IV–V) were observed in 13% of cases, underscoring the high burden of morbidity associated with contaminated laparotomy wounds. These findings are consistent with international data, where SSI rates in contaminated abdominal surgery range from 30–50%.<sup>[16]</sup> The persistence of high infection rates despite drain use highlights the multifactorial nature of SSI pathogenesis, where systemic host factors often outweigh local wound management strategies.

Comorbidities emerged as the most powerful determinant of infection in this study. All patients with comorbid conditions such as diabetes, hypertension, or chronic systemic illness developed SSI, compared to only 27.6% of those without comorbidities. This aligns with a meta-analysis demonstrating that diabetes and obesity independently increase SSI risk by nearly two-fold.<sup>[17]</sup> Impaired immune function, microvascular compromise, and delayed wound healing in these populations likely explain the heightened susceptibility. Consequently, while NPWT may reduce superficial contamination, its efficacy is limited when systemic risk factors remain unaddressed.

Nutritional status also played a decisive role. Hypoalbuminemia (<3.5 g/dl) was strongly associated with SSI, with 85.3% of affected patients developing infection. In contrast, none of the patients with normal albumin levels experienced SSI. This finding supports evidence that serum albumin reliably predicts postoperative outcomes, reflecting both nutritional reserve and systemic inflammatory burden.<sup>[18]</sup> Correction of hypoalbuminemia through perioperative nutritional support may therefore represent a critical adjunct to infection prevention strategies.

Elevated TLC was another independent predictor, and all patients with high TLC developed SSI. This likely reflects pre-existing systemic infection or inflammatory response at the time of surgery, which predisposes to poor wound

healing. Similar associations have been documented in emergency surgical cohorts, where elevated TLC correlates with increased postoperative morbidity and prolonged hospital stay.<sup>[19]</sup> These findings emphasise the importance of optimising systemic parameters before and after surgery, alongside local wound management.

From an economic perspective, SSIs impose substantial costs through prolonged hospitalisation, repeated interventions, and increased resource utilisation. International studies estimate that SSIs can increase hospital stay by 7–20 days and add thousands of dollars to treatment costs.<sup>[20]</sup> In resource-limited settings such as northeastern India, where healthcare infrastructure is constrained, strategies that reduce SSI incidence—even modestly—are of considerable value. Although negative pressure suction drains were not statistically significant in this study, they may still offer practical benefits by reducing seroma formation, facilitating wound healing, and potentially shortening hospital stay.

### **Study limitations**

Limitations include the study's single-centre design and relatively small sample size, which may have limited statistical power to detect differences between groups. Furthermore, the observational design precludes definitive causal inference. Nevertheless, the findings provide important insights into SSI risk factors in emergency laparotomy and highlight the need for multifaceted preventive strategies. Future research should focus on larger multicentre trials to validate the role of NPWT in contaminated abdominal surgery, particularly in high-risk populations with comorbidities and poor nutritional status.

### **CONCLUSION**

This study shows that subcutaneous negative pressure suction drains may reduce SSI incidence in emergency laparotomy, but their effect is modest compared with systemic risk factors such as comorbidities,

hypoalbuminemia, and elevated TLC. Effective SSI prevention requires a comprehensive approach that combines mechanical wound management with optimisation of patient physiology and nutritional status. In resource-limited settings, NPWT can be a valuable adjunct, particularly for contaminated wounds, but it should not replace control of systemic risk factors.

### Declaration

**Ethical Approval:** Approved

**Acknowledgement:** None

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

### Creative Commons Attribution License 4.0

This is an open-access article published under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0).

<https://creativecommons.org/licenses/by/4.0>

### REFERENCES

1. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Am J Infect Control. 1999;27(2):97-132. doi: 10.1016/S0196-6553(99)70088-X.
2. Allegranzi B, Bischoff P, de Jonge S, Kubilay NZ, Zayed B, Gomes SM, et al. New WHO recommendations on preoperative measures for surgical site infection prevention: an evidence-based global perspective. Lancet Infect Dis. 2016;16(12):e276-e287. doi: 10.1016/S1473-3099(16)30398-X.
3. GlobalSurg Collaborative. Surgical site infection after gastrointestinal surgery in high-income, middle-income, and low-income countries: a prospective, international, multicentre cohort study. Lancet Infect Dis. 2018;18(5):516-525. doi: 10.1016/S1473-3099(18)30101-4.
4. Bucataru A, Balasoioiu M, Ghenea AE, Zlatian OM, Vulcanescu DD, Horhat FG, et al. Factors contributing to surgical site infections: a comprehensive systematic review of etiology and risk factors. Clin Pract. 2024;14(1):52-68. doi: 10.3390/clinpract14010006.
5. Jeong YS, Cho SH, Park BS, Son GM, Kim HS. Role of subcutaneous closed suction drain in the prevention of incisional surgical site infection after loop ileostomy reversal with purse-string skin closure: a retrospective observational study. BMC Surg. 2024; 24(1):252. doi: 10.1186/s12893-024-02549-2.
6. Ohara Y, Owada Y, Kim J, Moue S, Akashi Y, Ogawa K, et al. Clinical benefits of reducing dead space using a closed suction drain and subcutaneous large-bite buried suture technique to prevent superficial surgical-site infections following primary closure of a diverting stoma. J Anus Rectum Colon. 2024;8(2):70-77. doi: 10.23922/jarc.2023-047.
7. Hasan MY, Teo R, Nather A. Negative-pressure wound therapy for management of diabetic foot wounds: a review of the mechanism of action, clinical applications, and recent developments. Diabet Foot Ankle. 2015; 6:27618. doi: 10.3402/dfa.v6.27618.
8. Everhart JS, Altneu E, Calhoun JH. Medical comorbidities are independent preoperative risk factors for surgical infection after total joint arthroplasty. Clin Orthop Relat Res. 2013;471(10):3112-3119. doi: 10.1007/s11999-013-2923-9.
9. Papadopoulos A, Machairas N, Tsourouflis G, Chouliaras C, Manioti E, Broutas D, et al. Risk factors for surgical site infections in patients undergoing emergency surgery: a single-centre experience. In Vivo. 2021; 35(6):3569-3574. doi: 10.21873/invivo.12660.
10. Dohmen PM. Antibiotic resistance in common pathogens reinforces the need to minimise surgical site infections. J Hosp Infect. 2008;70 Suppl 2:15-20. doi: 10.1016/S0195-6701(08)60019-5.
11. Kazzam ME, Ng P. Postoperative seroma management. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK585101/>
12. Singh PK, Sethi MK, Mishra TS, Kumar P, Ali SM, Sasmal PK, et al. Comparison of surgical site infection (SSI) between negative pressure wound therapy (NPWT) assisted delayed primary closure and conventional delayed primary closure in grossly contaminated emergency abdominal

- surgeries: a randomized controlled trial. *Langenbecks Arch Surg.* 2023;409(1):19. doi:10.1007/s00423-023-03202-x
13. Monahan M, Glasbey J, Roberts TE, Jowett S, Pinkney T, Bhangu A, et al. The costs of surgical site infection after abdominal surgery in middle-income countries: Key resource use In Wound Infection (KIWI) study. *J Hosp Infect.* 2023; 136:38-44. doi: 10.1016/j.jhin.2023.03.023.
  14. Wani JN, Bhat JA. Role of negative suction subcutaneous drains in contaminated abdominal surgeries. *J Gastrointest Dig Syst.* 2019;9(1):587. doi: 10.4172/2161-069X.1000587.
  15. Kagita R, Mulla SA, Srinivas Pai B, Desai M. 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. doi: 10.18203/2349-2902.isj20191254.
  16. Alkaaki A, Al-Radi OO, Khoja A, Alnawawi A, Alhawawi A, Maghrabi A, et al. Surgical site infection following abdominal surgery: a prospective cohort study. *Can J Surg.* 2019;62(2):111-117. doi: 10.1503/cjs.004818.
  17. Martin ET, Kaye KS, Knott C, Nguyen H, Santarossa M, Evans R, et al. Diabetes and risk of surgical site infection: a systematic review and meta-analysis. *Infect Control Hosp Epidemiol.* 2016;37(1):88-99. doi: 10.1017/ice.2015.249.
  18. Kumar S, Baitha KS, Dev A, Prakash P, Gunjan G. Correlation between postoperative complications and serum albumin levels in abdominal surgery: a prospective observational study. *Cureus.* 2025;17(6): e86508. doi: 10.7759/cureus.86508.
  19. Naga Rohith V, Arya SV, Rani A, Chejara RK, Sharma A, Arora JK, et al. Preoperative serum albumin level as a predictor of abdominal wound-related complications after emergency exploratory laparotomy. *Cureus.* 2022;14(11): e31980. doi: 10.7759/cureus.31980.
  20. Kebede ES, Abdalla S, Demeke B, Darmstadt GL. Factors in postoperative length of hospital stay among surgical patients in a rural Ethiopian hospital: an observational study. *Pan Afr Med J.* 2024; 47:212. doi: 10.11604/pamj.2024.47.212.36450.
- How to cite this article: Bhaumik AR, Deb K. Efficacy of subcutaneous negative pressure suction drain in preventing surgical site infections following emergency exploratory laparotomy: a cross-sectional study from North East India. *Int J Health Sci Res.* 2026; 16(10):160-169. doi: [10.52403/ijhsr.20261017](https://doi.org/10.52403/ijhsr.20261017)

\*\*\*\*\*