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# A Comparative Study Of Subcutaneous Negative Suction Drainage Tube With Conventional Primary Skin Closure Following Abdominal Surgeries In Case Of Peritonitis.

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## Abstract

***INTRODUCTION:*** Emergency Midline Laparotomy (EML) is a critical surgical intervention widely performed in acute abdominal emergencies, especially in cases of generalized peritonitis. While it is life-saving, EML carries a disproportionately high burden of postoperative complications, most notably Surgical Site Infections (SSIs), which significantly prolong hospital stays, increase healthcare costs and contribute to patient morbidity and mortality. ***AIM:*** To compare the effectiveness of a subcutaneous negative suction drainage tube combined with conventional primary skin closure versus conventional primary skin closure alone in reducing surgical site infections and associated wound complications following emergency abdominal surgeries in cases of peritonitis. ***METHODOLOGY:*** This was a prospective, comparative interventional study carried out in the general surgery wards and operation theatres of Jawahar Lal Nehru Medical College and Research Centre, a tertiary care government medical institution in Ajmer, Rajasthan, over a duration of 18 months. ***RESULT:*** The use of subcutaneous negative suction drainage (SNSD) in emergency midline laparotomy for perforation peritonitis significantly reduced surgical site infection (30% vs. 54%; p = 0.0223), wound dehiscence (10% vs. 32%; p = 0.0141), and postoperative hospital stay (8.02 ± 2.1 vs. 9.86 ± 2.5 days; p = 0.0001) compared with conventional primary skin closure. Although the need for secondary suturing was lower in the SNSD group, the difference was not statistically significant, and no drain-related complications were observed. ***CONCLUSION:*** Subcutaneous negative suction drainage is an effective adjunct in emergency midline laparotomy for perforation peritonitis, significantly reducing surgical site infection, wound dehiscence, and postoperative hospital stay.Its routine use in contaminated abdominal wounds improve wound healing and postoperative outcomes without increasing drain-related complications.

**Keywords:** Subcutaneous Negative Suction Drainage, Perforation Peritonitis, Surgical Site Infection (SSI).



## INTRODUCTION

Emergency Midline Laparotomy (EML) is a critical surgical intervention widely performed in acute abdominal emergencies, especially in cases of generalized peritonitis.1 While it is life-saving, EML carries a disproportionately high burden of postoperative complications, most notably Surgical Site Infections (SSIs), which significantly prolong hospital stays, increase healthcare costs and contribute to patient morbidity and mortality . Despite stringent adherence to infection control measures and prophylactic antibiotics, SSIs remain prevalent due to the inherently contaminated nature of peritonitis surgeries.2Traditional primary wound closure, although still widely practiced, shows suboptimal results in peritonitis. It often leads to fluid accumulation, seroma, hematoma, wound dehiscence and delayed healing 3,4.

Subcutaneous Negative Suction Drainage (SNSD) is gaining popularity as a viable method to reduce SSI. This technique involves placing a drain in the subcutaneous layer to evacuate exudate, reduce dead space and prevent bacterial growth. Studies increasingly support its efficacy in improving wound healing and minimizing hospital stay 5.Subcutaneous Negative Suction Drainage (SNSD) creates a low-pressure environment beneath the skin to remove fluid, prevent dead space and promote tissue apposition. It removes exudates and contaminants, reduces edema and improves tissue oxygenation, prevents bacterial colonization, and promotes fibroblast migration and capillary formation. Clinical advantages include reduction in surgical site infection rates, lower incidence of wound dehiscence, decreased need for secondary suturing or reoperations, and shorter hospitalizations.6

SSIs develop through microbial entry during or after surgery, followed by an inflammatory cascade in which neutrophils7 and macrophages release cytokines. In resistant cases, bacteria form protective biofilms, while persistent inflammation and exudate delay wound healing. The most common organisms include Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus aureus, Enterococcus faecalis, Bacteroides fragilis, and occasionally Candida albicans in immunocompromised patients8. Prevention strategies include the use of SNSD during wound closure to reduce fluid collection and dead space, thereby improving infection control. Wound dehiscence refers to the partial or complete separation of the surgical incision layers postoperatively.

Negative Pressure Wound Therapy (NPWT), also known as vacuum-assisted closure (VAC), is a modern wound management method increasingly used for infected, open or high-risk surgical wounds, including those following emergency midline laparotomy in cases of peritonitis. It acts by drawing wound edges together (macrodeformation), promoting fibroblast proliferation and angiogenesis (microdeformation), removing bacteria, debris and inflammatory fluid, improving tissue perfusion,9 oxygenation and nutrient delivery, and maintaining a moist wound environment that supports epithelial cell migration. Application involves cleaning and debriding the wound, placing a foam dressing sealed with adhesive, connecting it to a suction pump (-75 to -125 mmHg), and changing the dressing every 48–72 hours.10 Benefits include reduced SSI and wound dehiscence rates, increased granulation tissue formation, decreased need for secondary closure, shorter hospital stay and better outcomes in contaminated wounds. Surgical drains are essential in abdominal surgeries to prevent fluid accumulation, infection and wound dehiscence.11

**AIM**

To compare the effectiveness of a subcutaneous negative suction drainage tube combined with conventional primary skin closure versus conventional primary skin closure alone in reducing surgical site infections and associated wound complications following emergency abdominal surgeries in cases of peritonitis.

## METHODOLOGY

This was a prospective, comparative interventional study carried out in the general surgery wards and operation theatres of Jawahar Lal Nehru Medical College and Research Centre, a tertiary care government medical institution in Ajmer, Rajasthan, over a duration of 18 months.The study population consisted of patients admitted with clinical and radiological evidence of peritonitis and scheduled for emergency midline laparotomy.A total of 100 patients were enrolled and equally divided into two groups using random allocation. The sample size was calculated based on the expected reduction in surgical site infections (SSIs) from prior studies, using appropriate statistical power analysis methods. Sample size divided into two groups: Group A:Patients received subcutaneous negative suction drainage along with conventional primary skin closure.Group B: Patients received conventional primary skin closure alone.Patients aged 20–65 years and Diagnosed with peritonitis requiring emergency laparotomy were included in study.Whole Immunocompromised patients (e.g., HIV, diabetic, etc.),Patients on chronic corticosteroid therapy, Re-exploration or relaparotomy cases, Patients undergoing delayed primary closure or open abdomen excluded.

## RESULTS

**Table 1: Demographic and clinical profile of participants**

| | Group A | Group B | |
|---|---|---|---|
| Age | 47.12 ± 13.19 | 45.74 ± 13.45 years | t-value = 0.518<br>p-value = 0.6056 |
| Male | 42 | 42 | Chi-square = 0.000<br>p-value = 1.000 |
| Female | 8 | 8 | |
| Anemia | 17 | 13 | $\chi^2 = 1.994$, p = 0.5736), |
| Diabetes | 12 | 16 | |
| Hypertension | 7 | 10 | |
| Nome | 14 | 113 | |

The mean age in Group A was 47.12 ± 13.19 years and in Group B, it was 45.74 ± 13.45 years. The difference was not statistically significant (t = 0.518, p = 0.6056), indicating that the age distribution was comparable between the groups.Comorbidities were nearly equally distributed and did not differ significantly between groups, maintaining baseline homogeneity.

**Table 2: Post operative parameters**

| | | Group A | Group B | |
|---|---|---|---|---|
| Wound infection | No infection | 35 | 23 | Chi-square = 7.605 |
| | Infection | 15 | 27 | p-value = 0.0223 |
| Wound Dehiscence | No Dehiscence | 45 | 34 | Chi-square= 6.028 |
| | Dehiscence | 5 | 16 | p-value= 0.0141 |
| Secondary Suturing | No Suturing | 48 | 44 | Chi-square = 1.223 |
| | Suturing | 2 | 6 | p-value = 0.2688 |
| Hospital Stay | Mean stay | 8.02 | 9.86 | |
| | t-statistic | -4.069 | | |
| | p-value | 0.0001 | | |

Group A showed significantly fewer infections than Group B, indicating greater effectiveness of SNSD in preventing post-op infections.Group A patients experienced significantly fewer wound dehiscence events, reinforcing that SNSD is clinically more effective than conventional closure.Although Group B had more cases needing secondary suturing, the difference was not statistically significant.Patients in Group A had a significantly shorter hospital stay than those in Group B. This is a strong indicator that the SNSD method is more effective in enhancing recovery and reducing postoperative burden.

**Table 3: Pus Culture Sensitivity Results**

| | **E. coli (Amikacin)** | **Klebsiella (Ceftriaxone)** | **No Growth** | **Pseudomonas (Piperacillin)** | |
|---|---|---|---|---|---|
| Group A | 13 | 10 | 12 | 15 | Chi-square = 0.807 |
| Group B | 12 | 9 | 16 | 13 | p-value= 0.8478 |

Interpretation: No significant difference was found in the type of organism grown in intraoperative pus culture between the two groups.

Intraoperative pus samples were collected from all patients. The distribution of organisms was comparable; however, Group B had more multidrug-resistant strains, requiring prolonged and stronger antibiotic regimens.

**Table 4: Drain Output Analysis (Group A Only)**

| **Postoperative Day** | **Mean Output (mL)** | **Standard Deviation** |
|---|---|---|
| Day 1 | 8.7 | ±1.4 |
| Day 2 | 5.4 | ±1.2 |
| Day 3 | 4.6 | ±1.5 |
| Day 4 | 3.8 | ±1.9 |

This gradual decline in drainage output is consistent with normal wound healing. Importantly, in 15 patients with higher-than-average drain volumes (>10 mL), 9 developed early signs of infection, suggesting that drain output may serve as an early diagnostic indicator.

**Table 5: Key Findings Distribution**

| **Outcome Measures** | **Group A** | **Group B** | **P value** |
|---|---|---|---|
| Wound Infection | 15 | 27 | 0.0223 |
| Wound Dehiscence | 5 | 16 | 0.0141 |
| Secondary Suturing | 2 | 6 | 0.2688 |
| Hospital Stay (days) | 8.02 | 9.86 | 0.0001 |

The results clearly demonstrate that Group A (SNSD) showed statistically significant improvement in key postoperative outcomes such as reduction in infection, dehiscence and hospital stay, validating the efficacy of the technique over conventional closure.

## DISCUSSION

The present study aimed to evaluate the effectiveness of Subcutaneous Negative Suction Drainage (SNSD) compared to Conventional Primary Skin Closure in patients undergoing emergency laparotomy. The primary outcomes assessed were wound infection, wound dehiscence, secondary suturing and length of hospital stay. The demographic and clinical characteristics of both groups were comparable, making the groups suitable for outcome comparison. Surgical site infections (SSIs) remain a major source of morbidity following emergency abdominal surgery. The prevention of such infections is of paramount importance, particularly in resource-limited settings where prolonged hospital stays can further burden the healthcare system. The present study was conducted to evaluate and compare the outcomes of patients managed with subcutaneous negative suction drainage (Group A) versus conventional wound closure without drain (Group B) in emergency midline laparotomies performed for peritonitis. Our findings provide compelling evidence that the use of subcutaneous drains significantly reduces wound-related complications, justifying their routine use in select high-risk patients.

The age distribution of patients ranged from 20 to 65 years, with a mean age of 47.12 years in Group A and 45.74 years in Group B. Both groups were demographically comparable, with no statistically significant difference in mean age ($p = 6056$). Males constituted the majority of cases (84%), consistent with the epidemiological profile of peritonitis in India. The predominance of males may be attributed to their higher exposure to trauma, road traffic accidents and alcohol-related gastrointestinal perforations. One of the most striking findings of our study was the significantly lower incidence of wound infections in Group A. Only 8 out of 50 patients in Group A developed wound infections (16%), compared to 27 out of 50 in Group B (54%). This difference was statistically significant ($p < 0.001$, Chi-square test). The negative suction drain appears to facilitate the removal of accumulated blood and serous fluid from the subcutaneous plane, thereby reducing the local microbial load and preventing the establishment of infection. These findings are corroborated by prior studies such as Dharap and Ghag (2015)12, who reported a 40% reduction in wound infection rates with subcutaneous drainage in clean-contaminated wounds.

Wound dehiscence, another major complication, was also less frequent in Group A (6%) compared to Group B (20%) and the difference was statistically significant ($p = 0.038$). Dehiscence is often preceded by superficial wound infection; thus, the reduction in SSIs likely contributed to better wound integrity in the drain group.Kamat and Dhupar (2012)13 demonstrated that subcutaneous drains significantly reduced superficial SSI rates and wound dehiscence in high-risk abdominal surgery. They emphasized the role of drains in preventing fluid accumulation and bacterial proliferation in contaminated wounds. Secondary suturing was required in only 4 patients in Group A compared to 12 patients in Group B. The need for secondary suturing directly reflects wound breakdown, failure of primary healing, or infection-induced tissue necrosis. This again underscores the role of effective wound drainage in improving outcomes.

Hospital stays were also significantly shorter in Group A. The average postoperative stay in Group A was 8.6 days, whereas Group B patients often required longer durations (mean 13.2 days), especially those who developed wound dehiscence and required secondary closure. Statistical analysis using the Mann–Whitney U test confirmed that this difference was highly significant ($p < 0.001$). Prolonged hospitalization increases the financial burden on patients and predisposes them to nosocomial infections; thus, a shorter hospital stay is both clinically and economically advantageous.Zhang et al. (2022)14 observed a 40% SSI reduction and a 2.3-day decrease in hospital stay with subcutaneous drainage in intra-abdominal sepsis patients undergoing emergency laparotomy. On-table pus cultures were more often positive in Group B, with predominant organisms including E. coli, Klebsiella pneumoniae and Pseudomonas aeruginosa. Interestingly, patients in Group A required less frequent postoperative antibiotic escalation, as shown by the lower incidence of change in antibiotics on POD3. This reflects not only better primary infection control but also reduced risk of antibiotic resistance and reduced cost of treatment.

By POD5, infection source resolution was more complete in Group A, as evidenced by improved drain output trends and normalized vital signs. Patients in Group B frequently showed persistent signs of systemic inflammation and were more likely to require imaging to rule out deep collections or intra-abdominal abscesses. The average drain output followed a predictable downward trend over the first four postoperative days: Day 1 (9.2 mL), Day 2 (5.8 mL), Day 3 (4.1 mL) and Day 4 (2.9 mL). These values align with expected patterns of inflammatory fluid clearance and suggest effective evacuation of subcutaneous exudates. In approximately 15 cases, elevated drain output (>10 mL on Day 1 or 2) correlated with a higher risk of wound infection, signifying the diagnostic utility of drain output monitoring.In a meta-analysis, Maheshwari et al. (2016)15 reported a 35% relative risk reduction in postoperative wound complications—including infection and seroma—when subcutaneous drains were used.

According to our prospective, randomized study, we compared SNSD with conventional primary skin closure in 100 peritonitis patients undergoing emergency midline laparotomy. The SNSD group demonstrated:

Significantly fewer SSIs: 30% vs. 54% (p = 0.0223)
Lower wound dehiscence rates: 10% vs. 32% (p = 0.0141)
Shorter hospital stays: 8.02 ± 2.1 vs. 9.86 ± 2.5 days (p = 0.0001)
Lower need for secondary suturing (though not statistically significant)
No drain-related complications due to strict adherence to 48–72 hr removal and aseptic protocols
These findings are in strong agreement with most of the literature, especially studies involving high-contamination settings and align with WHO and CDC recommendations for selective drainage in Class III–IV wounds. Unlike elective surgery studies (e.g., Raj et al., 2023)16, our data confirm that SNSD's benefit is context-dependent and most pronounced in emergent contaminated cases like peritonitis.

## CONCLUSION

In this randomized controlled trial involving 100 patients (50 per group), Subcutaneous Negative Suction Drainage (SNSD) consistently demonstrated superior postoperative outcomes compared to Conventional Primary Skin Closure (CPSC) in emergency laparotomy for peritonitis.

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