

**Original article:**

**Corrugated Rubber Drains Versus Closed Suction Drain in Reducing Superficial Surgical Site Infection in Laparotomy Wounds**

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**Abstract**

**Background:** Surgical site infections (SSI) remain a substantial problem for patients. Surgery for perforation peritonitis is associated with the highest rate of infective complications, especially surgical site infections because there is contamination of the operative field with microorganisms from endogenous sources. Subcutaneous drains are commonly placed in the operative setting to prevent hematoma or abscess formation in surgical wounds. In contrast to open drains, closed suction drains establish a pressure gradient between the wound and the external environment. **Objectives:** To evaluate the role of wound drainage in preventing surgical site infections (SSI) in patients undergoing emergency laparotomy and draw comparison between the efficacy of open corrugated rubber drainage and closed suction drainage. **Methods:** A prospective study was conducted on 50 patients admitted under Department of Surgery, Government Medical College, Jammu, India, between January and July of 2020, who underwent emergency laparotomy for various indications, within 24 hours of admission. All investigations for requisite anaesthesia were conducted on emergency basis. Patients received either corrugated rubber drain (group A), closed suction drain (group B) or no drain (group C) for wound drainage. Patients were followed in the post operative period for development of wound infection. **Results:** Mean age was 39.2 years with median age of 35 years. Male to female ratio was 1.94:1. 8 out of 19 patients from group A developed wound dehiscence, while only 1 out of 20 patients in group B developed wound dehiscence. 6 out of 11 patients in group C developed wound dehiscence. The difference was statistically significant ( $P < 0.05$ ). **Conclusion:** Placement of subcutaneous drains in emergency laparotomy wounds is associated with lower incidence of wound infection. Closed suction drains appear to be more effective than open corrugated drains in reducing the risk of SSIs.

**Keywords:** Surgical site infection, perforation peritonitis, laparotomy

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**Introduction**

Surgical site infection (SSI) previously termed postoperative wound infection is defined as that infection presenting up to 30 days after a surgical

procedure if no prosthetic is placed and up to 1 year if a prosthetic is implanted in the patients<sup>1</sup>. These remain a substantial problem for patients undergoing procedures in spite of advances in

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surgical techniques and medical care.

Surgical site infections have been shown to contribute up to 20% of nosocomial infections with an overall incidence around 5% across all invasive surgical procedures<sup>2</sup>. Surgical site infections are a cause of significant discomfort for patients and excess morbidity and mortality, which also translates into a financial burden on the health system. Laparotomies carry a higher risk of wound infection and a combined rate of 15% has been reported in upper and lower gastrointestinal surgery, over three times the average risk<sup>3</sup>.

Surgery for perforation peritonitis is associated with the highest rate of infective complications, especially surgical site infections because there is contamination of the operative field with microorganisms from endogenous sources, thus increasing the chances of developing postoperative infective complications<sup>4</sup>.

It has been postulated that the presence of hematoma, serous fluid, and dead space in surgical incisional wounds increases the risk of infection as this acts as a culture medium<sup>5,6</sup>. Drains are commonly placed in the operative setting to prevent hematoma or abscess formation. In contrast to open drains, closed suction drains establish a pressure gradient between the wound and the external environment and empty into a sealed reservoir, and are believed to reduce the risk of retrograde microbial contamination<sup>7</sup>.

## Methods

This prospective interventional study was conducted at Government Medical College, Jammu, India, between January and July of 2020. A total of 50 patients were recruited for this study. Patients admitted to the emergency department as cases of perforation peritonitis and who underwent laparotomy within 24 hours of admission were included in the study. Rectus sheath was closed using PDS 1no. Drain (corrugated rubber drain/closed suction drain) was placed in subcutaneous space. Skin was closed using 2-0 Ethilon sutures. Patients were assessed in terms of development of post-operative wound infection.

Collected data were checked and compiled in an MS-Excel sheet. Data were presented in tabulated form as frequency and percentage using descriptive statistics.

## Results

50 patients undergoing laparotomy over a period of 7 months were included in our study out of which 15 (30%) patients developed wound dehiscence and 35 (70%) did not develop wound dehiscence. 33 patients were male and 17 were female. 23 out of 33 males and 12 out of 17 females did not develop wound dehiscence whereas 10 males and 5 females developed wound dehiscence. 35 patients were admitted with the diagnosis of perforation peritonitis, 2 as appendicular perforation, 1 as ruptured liver abscess and 12 as case of intestinal obstruction. Out of 50 patients, 15 (30%) patients had history of comorbidities. 4 patients were diabetic, 4 had history of cardiac disease, 3 patients were known hypertensive, 3 were obese and 1 patient had history of arthritis. 6 (40%) out of 15 patients with comorbidities developed wound infection whereas 9 (60%) patients with comorbidities did not develop any wound infection, while 9 (25.7%) out of 35 patients without any known comorbidity developed wound infection. In 19 (38%) patients corrugated rubber drain (CRD) was used (group A). In 20 (40%) patients, suction drain was used (group B) and no drain was used in 11 (22%) patients (group C). 8 (42%) out of 19 patients from group A developed wound dehiscence whereas only 1 (5%) out of 20 patients in group B developed wound dehiscence. 6 (54%) out of 11 patients in group C developed wound dehiscence. The difference was found statistically significant ( $P < 0.05$ ).

**Table 1.** Age distribution of patients

Age group	Number of Patients	Percentage
0-10	1	2%
11-20	4	8%
21-30	14	28%
31-40	11	22%
41-50	8	16%
51-60	7	14%
61-70	3	6%
71-80	2	4%
Total	50	100%

**Table 2:** Sex Distribution of patients

Sex	Number	Percentage
Male	33	66%
Female	17	34%
Total	50	100%

**Table 3:** Diagnosis of the patients

Diagnosis	Number	Percentage
Perforation Peritonitis	35	70%
Appendicular Perforation	2	4%
Ruptured liver abscess	1	2%
Intestinal Obstruction	12	24%
Total	50	100%

**Table 4:** Correlation of type of wound drainage with incidence of wound dehiscence

Type of Drainage	Wound Dehiscence		Total
	Yes	No	
CRD (Group A)	8	11	19
Suction Drain (Group B)	1	19	20
None (Group C)	6	5	11
Total	15	35	50

### Discussion

Surgical site infections involve invasion by microorganisms of the tissues within 30 days where the surgery has taken place involving the superficial layers and 30 or 90 days for deep layers<sup>8</sup>. Laparotomy poses a greater risk of wound infection with a combined rate of 15% being reported in upper and lower gastrointestinal surgery, which is over three times the average risk. It has been proposed that the presence of hematomas, serous fluid, and/or dead space in surgical wounds increases the risk of infection by behaving as a culture medium. The aim of this study was to evaluate the impact of wound drainage in incidence of surgical site infections (SSI) in patients undergoing emergency laparotomy and draw comparison between the efficacy of open corrugated rubber drainage and closed suction drainage. In our study, median age of patients was 35 years with a male to female ratio of 1.94:1. 9 out of 39 patients with wound drainage developed wound infection and 6 out of 11 patients without

any wound drainage developed wound infection whereas, in a study conducted by Arer et al., the mean age of patients was  $48.77 \pm 12.62$  years with a male-female ratio of 21:27, 2 (8.7%) patients in drainage group and 8 (32%) patients in No drainage group had incisional SSI but no statistically significant difference was observed ( $P > 0.05$ )<sup>9</sup>. In a study by Gupta et al., 24% of patients in drain group develop surgical site infections. 50% of patients in non-drain group develop infection. Incidence of infection in drain group was lower than the no drain group ( $P < 0.05$ ) and was statistically significant<sup>10</sup>. In a study done by Zhuang et al., the incidence of incisional SSIs rate was 27/119 (22.7%) in the overall patients, 22/61 (36.1%) in the control group, and 5/58 (8.6%) in the irrigation group. The rate of SSIs in the irrigation group was significantly lower than the control group ( $P < 0.001$ )<sup>11</sup>.

### Conclusion

Surgical site infections are a common cause of post-operative morbidity in patients undergoing emergency abdominal surgeries, especially if intra-peritoneal contamination exists due to hollow viscus perforation. However, their incidence can be reduced by the judicious use of subcutaneous wound drainage. Both open and closed suction drains may be used for this purpose, however, closed suction drains appear to be significantly more effective. Further studies with larger sample sizes and including different wound classes may be needed to elucidate the significance of difference between open and closed drainage.

**Conflict of interest:** None declared by the authors.

**Ethical Approval:** The study was approved by the Ethical Review Committee of Government Medical College, Jammu, Jammu and Kashmir, India.

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## References

1. Awad SS, Palacio CH, Subramanian A, Byers PA, Abraham P, Lewis DA, et al. Implementation of a methicillin-resistant Staphylococcus aureus (MRSA) prevention bundle results in decreased MRSA surgical site infections. *Am J Surg.* 2009;198(5):607-10.
2. NICE, Clinical Guideline 74: prevention and treatment of surgical site infection. NICE, October 2008, Available at: <http://www.nice.org.uk/nicemedia/pdf/CG74NICEguideline.pdf>. (Accessed September 16, 2021).
3. Watanabe A, Kohnoe S, Shimabukuro R, Yamanaka T, Iso Y, Baba H, et al. Risk factors associated with surgical site infection in upper and lower gastrointestinal surgery. *Surg Today.* 2008;38(5):404-12.
4. Martone WJ, Nicholas RL. Recognition, prevention, surveillance and management of SSI. *Clin Infect Dis* 2001;33(2):67-8.
5. Pal N, Guhathakurta R. Surgical site infection in surgery ward at a tertiary care hospital: Theinfection rate and the bacteriological profile, *IOSR J Pharmacy.* 2012;2(5):1-5.
6. Chelmow D, Rodriguez EJ, Sabatini MM. Suture closure of subcutaneous fat and wound disruption after cesarean delivery: a meta-analysis. *Obstet Gynecol.* 2004;103(5 Pt 1):974-80.
7. Mulholland MW, Doherty GM. Drains - Dead space management. In: *Complications in Surgery.* 2nd ed. Philadelphia, USA: Lippincott Williams & Wilkins; 2011. p.148.
8. NHSN. Surgical Site Infection Event. Available at: <http://www.cdc.gov/nhsn/pdfs/pscmanual/9pscscscurrent.pdf> (Assessed September 16, 2021).
9. Arer IM, Yabanoglu H, Aytac HO, Ezer A. The effect of subcutaneous suction drains on surgical site infection in open abdominal surgery A prospective randomized study. *Ann Ital Chir.* 2016;87:49-55.
10. Gupta P, Kumar R. Role of subcutaneous suction drain in reducing surgical site infections after emergency laparotomy. *Int Surg J.* 2017;4(8):2717-20.
11. Zhuang J, Zheng W, Yang S, Ye J. Modified subcutaneous suction drainage to prevent incisional surgical site infections after radical colorectal surgery. *Transl Cancer Res.* 2020;9(2):910-7.

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