VOLUME - 10, ISSUE - 02, FEBRUARY - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Surgery

ROLE OF SUBCUTANEOUS NEGATIVE-PRESSURE DRAIN IN CASES OF EMERGENCY LAPAROTOMIES

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ABSTRACT Surgical Site infection is one of the common complications in patients who underwent emergency laparotomies, leading to postoperative complications, purulent discharge, prolonged hospital stay, increased cost of treatment, increased morbidity etc. Even after culture sensitivity -based antibiotic use and judicious irrigation of wound with saline, it has remained a major concern.(1)

Aims and objectives:

1. To evaluate the role of subcutaneous Negative-pressure Drain in reduction of postoperative Surgical Site infection in cases of Emergency laparotomies when compared to laparotomy wounds without subcutaneous Negative-pressure drain.
2. To evaluate whether Subcutaneous Negative-pressure Drain is effective in reducing the hospital stays.
3. To evaluate whether Subcutaneous Negative-pressure Drain is effective in reducing the cost of treatment.
4. To evaluate whether Subcutaneous Negative-pressure Drain helps in early healing of wound and removal of sutures.

Materials and methods: This study is conducted on patients who underwent emergency laparotomies and we divided it into two groups: one with Subcutaneous Negative-pressure Drain in and other without it.

Conclusion: Subcutaneous Negative-pressure Drain prevented postoperative wound infection significantly, reduces hospital stay, reduces cost of treatment, and helped in early healing of wound and removal of sutures.

KEYWORDS : Discharge, Drain, Healing, Sepsis, Surgical Site infection,emergency laprotomies

Introduction

Surgical infection, particularly surgical site infection (SSI), has always been a major complication of surgery and trauma and has been documented for 4000–5000 years. The Hippocratic teachings described the use of antimicrobials, such as wine and vinegar, which were widely used to irrigate open, infected wounds before delayed primary or secondary wound closure. Microbes had been seen under the microscope, but Koch laid down the first definition of infective disease Koch's postulates. Louis Pasteur recognised through his germ theory that microorganisms were responsible for infecting humans and causing disease(2). The principles of antiseptic surgery were soon enhanced with aseptic surgery at the turn of the twentieth century. The risk of developing SSI is multifactorial and include the degree of microbial contamination of the operation site indicated by wound class as clean, clean contaminated, contaminated and dirty, and also by patient age, length of surgery, preoperative shaving of the operative site, hypothermia and comorbidities e.g. Diabetes and obesity.

The objective of this study was to compare the incidence of surgical site infections in cases of emergency laparotomies in which Subcutaneous Negative-pressure Drain were used versus those in which Subcutaneous Negative-pressure Drain were not used (3).

METHODS

A prospective observational 6 months study of 20 subjects (10 drain groups and 10 no-drain groups).

This prospective case series were conducted at Smt. Kashibai Navale Medical College and General Hospital, Pune a Tertiary Care Centre, between March 2020 to August 2020.

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MATERIALS AND METHODS

Type of Study

Prospective observational study.

Study Period

6 Months - March 2020 to August 2020.

Place of Study

Department of General Surgery, Smt. Kashibai Navale Medical College and General Hospital, Pune - A Tertiary Care Centre.

This study was conducted on 40 patients. Patients were chosen randomly irrespective of their age and sex. One control group included 20 cases, and the other study group comprised of other 20 cases. All details about the surgery/operation were being noted, and operative wounds were classified according to definition being given by the American College of Surgeons as:

- Clean
- Clean contaminated
- Contaminated
- Dirty

At the time to abdominal wall closure, first of all the peritoneum was sutured/closed appropriately with absorbable suture material, and then rectus sheath was closed by nonabsorbable suture material continuously like loop Ethilon.(4)One or more intraperitoneal drains were placed inside—in potential areas such as pelvis/sub

hepatic/peri-splenic(6).. A tube with multiple holes small in size was positioned with its tip lying extra peritoneal over the rectus sheath, and it was brought out through area of healthy skin by a different incision away from the wound site and fixed with non-absorbable suture material and connected with a Negative-pressure Drain(5). Incision was then closed with non-absorbable suture, and aseptic sterile dressing was done. First dressing was changed after 48 hours, and incision site was closely monitored for pain, tenderness, induration, redness, discharge, swelling, increased local warmth, and suture with tension (Table 1).

Table 1: Surgical wound infection sign and symptoms

Features	*Control group*	*Study group*	*Total*
Pain	10	8	18
Tenderness	12	6	18
Redness	6	2	08
Discharge	15	8	23
Raised local temperature	2	1	03
Suture under tension/cut through	2	1	03

If discharge was present, it was collected and sent for culture and sensitivity.

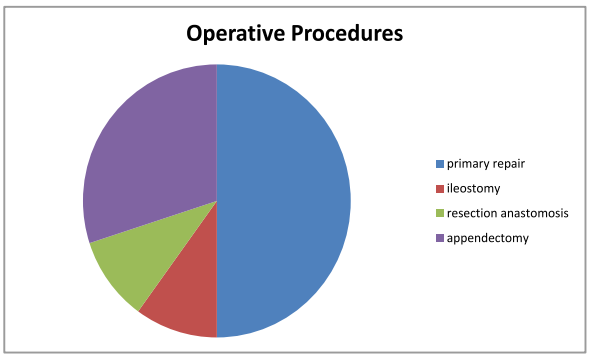
Types of discharges through the wound are:
Serous
Seropurulent
Purulent

Drain was taken out when the output was 5 mL or less. The sutures were cut and taken out either before or sometimes after the discharge of the patient at least after 8 days depending upon the wound site condition. Patient was followed up in the hospital outpatient department or through correspondence by phone/e-mail/messages/social media for up to 30 days postoperatively.Statistical analysis was made to find significant association.

OBSERVATION AND RESULTS :

The study was conducted on 20 patients—10 with negative-pressure subcutaneous drain and 10 without drain. Relevant findings noted in this study are highlighted here.

Operative Procedure - Most common operative procedure was primary repair (10) followed by resection anastomosis (2), ileostomy (2), appendectomy in (6).



The comparison in our study between the groups, that is control without closed suction drain and study group with closed suction drain, gave result that postoperative day of detection of wound infection among the group that used closed suction drain when compared to the group without closed suction drain is statistically highly significant with p value of 0.00015

It clarifies that closed suction drain is very effective in preventing the wound infection, especially in much prone first four postoperative days (Table 2).

Table 2 Postoperative day of detection of wound infection control vs study

Duration	Control	Study	Total	P value
≤4 days	16	2	18	
> 4 days	4	18	22	0.000015
Total	20	20	40	

The chi-square statistic is 19.798. The *p*-value is .0000154. The result is significant at $p < .05$.

The comparison in our study between the groups, that is control without closed suction drain and study group with closed suction drain, gave result that discharge from stitch line among the group that used closed suction drain when compared to the group without closed suction drain gave result that only of 2 patients in the study group developed stitch line infection, whereas 16 among control group developed stitch line infection and statistically is significantly high having a p value of 0.000016. It proves that closed suction drain is very effective in preventing the discharge from wound infection postoperative days (Table 3).

Table 3: Discharge from stitch: control vs study

Duration	Control	Study	Total	p value
≤ 4 days	16	2	18	
>4 days	04	18	22	0.000016
Total	20	20	40	

The chi-square statistic is 9.899. The *p*-value is .0000164. The result is significant at $p < .05$.

In this study, we found that in patients of this study group, abdominal collection and its abdominal drain was removed early as assessed with another group in the study. The results are significantly high with p value of 0.00091 (Table 4).

Table 4: Removal of drain: control vs study

Removal of drain	Control	Study	Total	p value
≤4 days	02	12	14	
>4 days	18	08	26	0.00091
Total	20	20	40	

The chi-square statistic is 10.989. The *p*-value is .000917. The result is significant at $p < .05$.'

In this study, we found that in the patient group in which negative-pressure suction drain was used a very early wound healing was seen when compared to the control in which drain was not used.In this study group 16 of 20 patients had their wound healed, so sutures were removed early within 10 days compared to control group where only 6 of 10 patients showed wound healing signs and only sutures were taken out. This comparison gave a very highly significant statistical data with p value of 0.00148 (Table 5).

Table 5: Removal of sutures: control vs study

Removal of Sutures	Control	Study	Total	p value
≤10 days	06	16	22	
>10 days	14	4	18	0.00148
Total	20	20	40	

The chi-square statistic is 10.101. The *p*-value is .001482. The result is significant at $p < .05$.

In this study; we found that patients with negative-pressure drain have an early recovery compared to the control group where negative-pressure drain was not used. Due to this, 14 of 20 patients recovered well without signs of infection and were discharged early within 10 days compared to control group in who only 14 of 20 patients showed recovery signs and were discharged within first 10 postoperative days. This comparison gave a very highly significant statistical data with p value of 0.0088.(Table 6).

Table 6: Average duration of hospital stay (in days) control vs study

Removal of sutures	Control	Study	Total	p value
≤10 days	04	14	18	
>10 days	14	08	22	0.0088
Total	20	20	20	

The chi-square statistic is 6.8605. The *p*-value is .008812. The result is significant at $p < .05$.

Subcutaneous Negative-pressure Drain helps in wound healing and its benefits are as follows:

Prevention Of Surgical Site Infection (7.)

Concomitant with the rise in blood flow and removal of stagnancy of fluid in wound, which is very good media for microbes, bacterial load is reduced. This is evidenced by a decrease in superficial purulence, slime production, and odour. Raise of oxygen and perfusion in compromised and damaged tissues enhances the resistance to infection (Bunt TK, 1998).

Vascular Supply

Both clinically and experimentally, the application of sub atmospheric pressure removes third space fluid from the area immediately adjacent to the wound. Removal of this fluid results in a decrease in tissue turgor and a decrease in capillary after load, which promotes better capillary circulation and better inflow. Additionally, the removal of excess fluid is thought to remove inhibitory factors present in the fluid.

Increased Granulation Tissue Proliferation

It is significantly higher in wounds managed with negative pressure application and is significantly higher than the rates reported for human growth factors and saline dressing–treated wounds (Morykwas MJ 1997). This significantly high rate of increment is due to the transmission of uniformly applied force on the wound periphery. Application of negative pressure changes the external forces, bridges, and cytoskeletons, thus releasing intracellular second messengers (PGs, Inositol phosphates, PKinase C and Ca++) (Ingber D, 1991). Studies proved mechanical stretching allows the cells to proliferate at a faster pace. Irritation, continuously by negative suction pressure, dramatically increases the rate of regrowth of the tissues.

Wound Contraction

Negative pressure when applied to the wound contracts. The suction drain applies a pressure of approximately 100 to 200 mm Hg below atmospheric pressure. Edema fluid is removed from the interstitial spaces that eliminate an extrinsic reason for microcirculatory deterioration and improves blood supply, local oxygenation, and promoting angiogenesis. The mechanical tension from the vacuum further directly stimulates cell proliferation and granulation. It also exerts a force of mechanical nature on the tissues and attracts the wound edges toward it.

Conclusion

This study concludes that placement of a Subcutaneous Negative-pressure Drain in emergency laparotomies reduces wound infection, helps in early postoperative recovery, better wound healing, and decreases financial burden on patient by decreasing hospital stay and infection.Therefore, this method of Subcutaneous Negative-pressure Drain is very strongly recommended for the prevention of Surgical Site infection in emergency laparotomies.

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