

Optimizing Wound Healing: The Impact Of Incisional Negative Pressure Wound Therapy In Reducing Ssis After Ostomy Reversal.

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Abstract

Introduction: Ostomy reversal is an inevitable conclusion of a long surgical journey in a patient with abdominal sepsis. It is often trivialized in comparison to the index operation. The superficial surgical site infections (SSIs) have been reported to range from 10-40%. SSI and their management cause great inconvenience and delayed resumption of work and daily activities. An adequate treatment of SSI if it occurs, is achieved by local interventions, analgesics, antibiotics and open wounds with impregnated dressings or lately by negative pressure wound therapy. The clinical usefulness of negative pressure wound therapy (NPWT) in reducing SSIs has been described in the literature. In the recent past prophylactic incisional negative pressure wound therapy (iNPWT) has become a useful adjunct for the prevention of SSI. However, application of iNPWT to ostomy reversed wounds has been less studied.

Methodology: The study had included 30 patients undergoing ostomy reversal satisfying the inclusion criteria. The primary and secondary objectives were studied postoperatively. The patients were followed up for a period of 30 days on an outpatient basis.

Results: The mean Age was 33.76 ± 15.56 years. 21 (70.0%) of the participants were Male and nine (30.0%) were Female. The mean BMI (kg/m^2) was 21.45 ± 2.59 . 13 (43.3%) of the participants had TB. The mean Duration of Procedure (Minutes) was 91.90 ± 13.68 . 27 (90.0%) of the participants had resumed oral diet on second post operative day and three (10.0%) on third post operative day. Three participants had Wound Occurrence. Two (6.66%) participants had Superficial SSI. None of the participants had Fascial Wound Dehiscence The mean duration of hospital stay (days) was 5.16 ± 2.40 . None of the participants was readmitted due to wound related issues. One (3.4%) of the participant had readmission due to non-wound related issue.

Conclusion: Incisional Negative Pressure Wound Therapy (iNPWT) is an effective modality in prevention of Superficial Surgical Site Infections (SSIs) following ostomy reversal.

Keywords: ostomy reversal, incisional negative pressure wound therapy (iNPWT), fascial wound dehiscence (FWD), superficial surgical site infections (SSIs).

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I. Introduction

The temporary fecal diversion (ostomy) is of utmost use as an adjunct to tenuous anastomosis more so in an immunocompromised patient undergoing emergency surgery for abdominal sepsis. [1] Although, ostomy does not prevent an anastomotic leak, it does reduce the potential morbidity and mortality from an anastomotic leak.

Ostomy reversal is typically undertaken several weeks to months later following construction, allowing sufficient time for physiological recovery from initial surgery, softening and lysis of intraabdominal adhesions and resolution of abdominal sepsis. [2]

While ostomy reversal is an inevitable conclusion, it is often trivialized in comparison to the index operation. Significant immediate postoperative complication rates (11-33.3%) have been reported after ostomy reversal which includes bowel obstructions, anastomotic leak, surgical site infections (SSIs), fascial wound

dehiscence (FWD) and also incisional hernias as a late sequelae. [3] The superficial surgical site infection (SSIs) has been reported to range from 10-40% of patients following reversal of ostomy. [4]

The US Centre for Disease Control and Prevention (CDC) defines Surgical Site Infections (SSIs) as infections of the incision or organ or space that occur after surgery in that part of the body. They are conventionally classified as superficial (involving skin and subcutaneous tissue), deep (involving the fascio-muscular layer) and organ/ space SSIs. [5]

An adequate treatment of SSI if it occurs, is achieved by local interventions, analgesics, antibiotics and open wounds with impregnated dressings or lately by negative pressure wound therapy. This incurs a substantial burden on the patients and the hospital in terms of morbidity and cost. SSI and their management cause great inconvenience and delayed resumption of work and daily activities.

In the recent past, prophylactic negative pressure wound therapy of incised wounds (iNPWT) has become a useful adjunct for the prevention of SSI.

Continuous application of negative pressure has been shown to work by allowing the formation of granulating tissue through angiogenesis which causes perfusion of wound edges. [6] NPWT induces a fourfold increase in local blood flow when applied at a negative pressure of 125 mmHg and affects the partial pressure of oxygen and lactate levels in and around the wound edges. [7] NPWT improves wound oedema, by stimulating the lymph clearance and approximates the wound edges. [8] NPWT also reduces stress on the wound and through induction of tissue micro-deformations, actually does encourage earlier wound healing compared with the conventional ways of wound healing. [9]

NPWT also has a positive impact by preventing unnecessary dressing changes and reducing exposure to the environment and therefore, reducing the chances of external contamination as an avoidable source of infection.

The clinical usefulness of incisional negative pressure wound therapy (iNPWT) in reducing SSIs has been described in the literature, mostly for sternal wounds after cardiac surgery, [8] laparotomy wounds after colorectal surgeries, [10] spinal surgery, [11] obstetric and gynecological surgeries [12] and Orthopedics surgeries. [13]

However, application of incisional negative pressure wound therapy to ostomy reversed wounds has been less studied. The current prospective observational study hypothesises that Incisional negative pressure wound therapy (iNPWT) reduces the incidence of SSIs following ostomy reversal as compared to simple occlusive dressing as suggested in retrospective studies.

II. Materials And Methods

Present study was conducted in the Department of General Surgery at Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi after obtaining approval from the Institution Ethics Committee (IEC) and the Review Board Committee (approval number: IEC/VMMC/SJH/Thesis/2022-11/CC-133). We aimed to evaluate the effect of incisional negative pressure wound therapy (iNPWT) in reducing the incidence of superficial surgical site infections (SSIs) following reversal of ostomy.

Primary objective is to assess the incidence of superficial surgical site infections (SSIs) as per CDC criterion till post op day 30.

Secondary objectives are to assess the incidence of fascial dehiscence in terms of separation of the margins of incision with or without protrusion of underlying tissue at single or multiple regions affecting some or all tissue layers, duration of postoperative hospital stay and 30 days hospital readmission rate due to wound related complications.

Study design

This observational prospective study with a sample size of 30 was conducted for 18 months. The sample size was estimated based on a study on management of surgical incisions using incisional negative pressure wound therapy. Taking the value of reference from the study of Schlooser KA, [14] assuming 95% confidence interval, 80% power and 5% level of significance minimum required value of sample size is 23 subjects. To reduce margin of error, total sample size taken is 30.

Inclusion criteria: All patients with age 18 years or more requiring ostomy reversal.

Exclusion criteria: Peristomal skin excoriation and other cutaneous factors that might interfere with the application of the NPWT device, parastomal hernia or stomal prolapse, BMI >35 and ASA >3.

Methods: A total of 30 subjects fulfilling inclusion criteria and giving consent for participating were included in study, Incisional negative pressure wound therapy (iNPWT) placements with black Granu-Foam dressing (V.A.C. TM Therapy, Kinetic Concepts Inc. [KCI], San Antonio, USA) was initiated in the immediate postoperative period. The device covers the incision site acting as a temporary dressing. Negative pressure will be set at 125

mm Hg with suction which was continued till four days. After which, iNPWT was removed and wound assessment was done. Enhanced recovery after surgery guidelines were followed. This included adequate analgesia, prophylactic antibiotics, early mobilisation, careful monitoring of fluid balance.

III. Results

The mean age was 33.76 ± 15.56 years. 21 (70.0%) of the participants were male and nine (30.0%) were female. The mean BMI (kg/m^2) was 21.45 ± 2.59 . 13 (43.3%) of the participants had tuberculosis. The mean Duration of Procedure (Minutes) was 91.90 ± 13.68 . 27 (90.0%) of the participants had resumed oral diet on the second postoperative day and three (10.0%) on the third postoperative day. Three participants had Wound Occurrence. Two (6.66%) of the participants had Superficial SSI. 13.33% patients had NPWT related cutaneous issues. 10% had skin hyperpigmentations and 3.33% patients has skin erosions.

None of the participants had Fascial Wound Dehiscence The mean Duration of Hospital Stay (Days) was 5.16 ± 2.40 . None of the participants was readmitted due to wound related issues. Only one (3.4%) participant had readmission due to non-wound related issue.

Table 1: Gender distribution		
Gender	Frequency	Percent
Male	21	70%
Female	9	30%
Total	30	100%

Table 2: NPWT related complaints distribution		
NPWT related complaints	Frequency	Percent (%)
Skin hyperpigmentation	3	10.0%
Skin erosions	1	3.33%
Nil	26	86.6%

Table 3: FWD distribution			
Post discharge SSI	Frequency	Percent (%)	95% CI
Yes	0	0%	0
No	30	100%	85.9% - 100.0%

Table 4: Distribution of the Participants in Terms of Indication of duration of hospital stay			
Duration of hospital stay (days)	Frequency	Percentage	95% CI
4	3	10.0%	2.4% - 17.5%
5	25	83.3%	75.8% - 90.8%
9	2	6.6%	1.5% - 14.2%



Figure 1: iNPWT application

Figure 2: wound after removal of iNPWT

IV. Discussion

A proximal temporary ostomy is of utmost use to prevent morbidity and mortality in patients when there is high probability of anastomotic or repair leak. Ostomy reversal is typically undertaken several weeks to months later following construction, allowing sufficient time for physiological recovery from initial surgery, softening and lysis of intra-abdominal adhesions and resolution of abdominal sepsis.

The superficial surgical site infection (SSIs) occurs in about 10-40% of ostomy reversed wounds. SSIs and other wound complications are associated with multiple deleterious effects. [5] Therefore, any strategy by which incidence of SSI may be reduced is of great significance to both healthcare providers and patients. Incisional negative pressure wound therapy (iNPWT) is a novel approach which has been shown to help in early wound healing.

The present prospective observational study was conducted in the Department of General Surgery, Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi on 30 participants satisfying inclusion criteria. All patients were optimised preoperatively. The patients were operated on elective basis after bowel preparation via local site approach under spinal anaesthesia. The ostomy site was sutured in linear fashion, iNPWT was applied in the immediate postoperative period till the fourth postoperative day.

We hypothesised that Incisional Negative Pressure Wound Therapy (iNPWT) reduces the incidence of Superficial Surgical Site Infections (SSIs) following ostomy reversal.

Ostomy can be created at any age and in any gender. In our study 40% patients were in the age group 20-29 years, followed by 16.6% in the age group 30-39 years. 70% of the patients were male while 30% of the females. All Patients with comorbidities were optimised preoperatively. All patients with abdominal kochs had completed an oral ATT course. Peristomal skin excoriation or infections were managed. All patients with a history of substance abuse were advised to quit their consumption six weeks prior to surgery.

Out of 30 patients two (6.6%) patients developed superficial SSI. Both patients had turbid discharge which were managed by opening the whole wound, pus culture and appropriate antibiotics, NPWT to open wounds and secondary suturing.

In the study of Poehnert D et al for similar purpose with 12.5% incidence of SSI was reported. [6] In 2014 pilot study of Cantero et al on effect of negative-pressure therapy to reduce the risk of wound infection following diverting loop ileostomy reversal showed the incidence of SSI was zero. [15] Another pilot study conducted by Shah AP, Kurian R, Leung E showed zero incidence of SSI. [16] This might be due to the smaller number of patients, as they were only a pilot study to evaluate the device. The incidence of SSI in the study conducted by Masumori K et al and Carrano FM et al showed 3% and 8% respectively.

None of the patients developed fascial wound dehiscence. Four patients had NPWT related cutaneous issues. Three of them developed hyperpigmentation and the only one developed skin erosion which did not require any intervention. One patient had serous discharge from ostomy reversed wound on fourth postoperative day. Which was managed conservatively.

In our study all patients were admitted a day prior to surgery, most of the patients were discharged on the fourth postoperative day. However, two patients who developed SSI were discharged on the eighth postoperative day once the discharge criteria were met.

There was no readmission due to wound related issues. Although, one patient was readmitted for small bowel obstruction and managed conservatively.

V. Conclusions

Surgical site infection is one of the common preventable complications, which is encountered following ostomy reversal. By implementing use of iNPWT as adjunct to primary closed ostomy reversed wound, we can conclude that postoperative wound outcomes were improved in terms of less incidence of superficial SSI (6.66%), zero incidence of fascial wound dehiscence, reduced hospital stay and no readmission due to wound- related complications.

Strength

All the patients were optimised pre operatively, the surgery was done by minimally invasive approach (local site). Along with incisional negative pressure wound therapy ERAS protocol was followed in the immediate postoperative period, which resulted in less postoperative pain, early ambulation, early resumption of oral diet and early resumption of daily activities.

Limitations

The percent reduction in SSI following iNPWT to be significant, study requires large sample size. It was not a randomised control trial where the outcomes can be compared with the control group. No risk stratification for development of SSI. The NPWT device is not feasible for home-based therapy due to cost related issues, which resulted in increased hospital stay despite the discharge criteria being met on the second postoperative day for most of the patients.

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