Primary linear closure with closed suction wound drain after ileostomy takedown

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**Purpose:** Wound infection after ileostomy takedown is one of the significant complications. Conventional linear closure has been reported to be associated with a significantly higher incidence of wound infection. We aimed to evaluate the surgical outcomes of primary linear closure with closed suction wound drain following a loop ileostomy takedown.

**Methods:** Between October 2007 and October 2012, a total of 121 patients who underwent primary linear closure with closed suction wound drain after ileostomy takedown were included, and their surgical outcomes were compared with those of 34 patients who underwent delayed wound closure between July 2002 and September 2007 as a historical control group.

**Results:** Between primary linear closure with closed suction wound drain group and delayed wound closure group, there were no differences of gender, age, body mass index, American Society of Anesthesiologists (ASA) scores and comorbidities such as pulmonary disease and hypertension and diabetes. The chemotherapy rate is similar in the two groups (group I, 52.9%; group II, 44.6%; P = 0.39). There was a significant difference in wound infection (group I, 23.5%; group II, 5.6%; P = 0.002). There was no significant difference in the length of postoperative hospital stay (P = 0.26). Small bowel obstruction was not significantly different between the two groups (group I, 11.8%; group II, 7.4%; P = 0.42).

**Conclusion:** Primary linear wound closure with closed suction wound after a loop ileostomy takedown showed comparable outcomes, in terms of wound infection rates to those of delayed wound closure. Thus, primary linear wound closure with closed suction drain after a loop ileostomy takedown could be a good alternative to the delayed closure or purse-string closure.

**Keywords:** Ileostomy closure, Ileostomy takedown, Wound infection, Closed suction drain

INTRODUCTION

Wound infection after an ileostomy takedown is one of the most commonly reported complications, ranging in the literature from 2% to 40% [1,2]. The complications and economic impact of wound infection are significant. For these reasons, many studies investigated better technique to prevent wound infection after ileostomy takedown. In recent studies reported various closure techniques such as delayed primary closure, purse-string skin closure and used subcutaneous drainage to reduce rate of wound infection.

Delayed primary closure is method that be left open to heal by second intention. Delayed primary closure after ileostomy takedown is a commonly used method that several studies were reported to reduce the infection rate. Purse-string skin closure after an ileostomy takedown is a secondary closure. The advantages are that until granulation tissues grow and the skin defect areas become natural drainage pathways, thus avoiding wound infection. Despite of many studied reported various closure techniques, wound infection after an ileostomy takedown is the most common complications.

Many reports demonstrated that the risk of incisional surgical site infection increases with obesity and that the most useful predictor of incisional surgical site infection is the thickness of subcutaneous fat and effects of subcutaneous drain for the prevention of incisional surgical site infection. Closed suction drain of wound is to remove and prevent accumulation of fluid and blood clot and to allow for early detection of wound problem [3,4].

Thus, we hypothesized that close suction drain is effective for
Preventing wound infection after ileostomy takedown. Primary linear closure is less traumatic, less painful and less costly than purse-string skin closure or delayed primary closure. And closed suction drain of wound is to remove and prevent accumulation of fluid and blood clot such as purse-string skin closure. This study evaluated the outcomes of primary linear closure with closed suction drain compared to delay primary closure after ileostomy take down.

**METHODS**

**Patients**

We reviewed all medical records from 155 patients who underwent wound closure after ileostomy repair with rectal cancer, sigmoid colon cancer, familial adenomatous polyposis (FAP) or malignant melanoma from December 2000 to October 2012. We divided patients into two subgroups; linear closure with closed suction drain (group II, n = 121) and delayed closure group (group I, n = 34).

**Perioperative manage and operative technique**

On the eve of surgery, patients took two liters of laxative with water or enema through loop ileostomy. Prior to surgery, as prophylactic antibiotics were administered from immediately prior to the initiation of surgery. Postoperative diets were initiated after confirming intestinal movement of patients who did not gastrointestinal retention symptoms.

The operative technique for delayed skin closure consisted of an elliptical incision around the stoma, with mobilization, and anastomosis of the ileum. The rectus fascia was repaired with interrupted sutures. Skin was performed with vertical mattress interrupted sutures and not approximated with normal saline wet gauze packing. After 4-5 days (mean, 4.27 ± 2.53 days), wound closure to approximate. Primary linear closure with closed drain consisted of identical operative technique, but skin incision was approximated using vertical mattress interrupted suture with Jackson-Pratt 100 mL drain on fascia layer. After 5-6 days, wound drain was removed.

**Wound infection**

In this study, we used definition of The Center for Disease Control and Prevention (CDC) criteria for defining a surgical site infections. Superficial surgical site infection (SSI) occurs within 30 days after the operation and infection involves only skin or subcutaneous tissue of the incision and at least one of the following, purulent discharge with or without tenderness, localized swelling, redness or heat. We evaluated wound infection during hospitalization and evaluated for wound infection of outpatient department follow-up periods.

**Statistical analysis**

Analysis was performed with the χ² test and Fisher’s exact test, when appropriate. For continuous variables, the Student t-test was applied. Statistical analysis was performed with SPSS ver. 20 (IBM Co., Armonk, NY, USA) and P < 0.05 was considered to be significant.

**RESULTS**

**Baseline characteristics of patients**

A total 158 patients were enrolled. The delayed primary skin closure group (group I) consisted of 21 men and 13 women, varying in age from 35 to 70 years (mean age, 53.7). The average body mass index (BMI) of group I is 23.5. Among them were 18 patients by preoperative chemotherapy, 3 patients by diabetes. The primary linear closure with closed suction drain on wound after ileostomy takedown group (group II) consisted of 83 men and 41 women, varying in age from 25 to 88 years with an average 61.1. The average BMI of group II is 23.6. Among them were 54 patients by preoperative chemotherapy, 21 patients by diabetes. There were no significant differences in clinical data between the two groups (Table 1). Wound closure days of group I is shorter, mean 4.27 ± 2.53 days than group II, mean 5.60 ± 7.85 days (P = 0.026). There was a significant difference in antibiotics periods (group I: mean, 7.12 ± 4.14 days; group II, mean, 0.55 ± 1.38 days; P = 0.000).

**Operative outcomes and wound infection rate**

The length of postoperative hospital stay between delayed primary linear skin closure group (mean, 11.21 days) and primary linear clo-

**Table 1. Patient characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group I (n = 34)</th>
<th>Group II (n = 124)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>53.7 ± 10.7</td>
<td>61.1 ± 12.3</td>
<td>0.10</td>
</tr>
<tr>
<td>Sex (male:female)</td>
<td>21:13</td>
<td>83:41</td>
<td>0.36</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.5 ± 2.8</td>
<td>23.6 ± 2.9</td>
<td>0.40</td>
</tr>
<tr>
<td>ASA score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>25</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Preoperative chemotherapy (+)</td>
<td>18 (52.9)</td>
<td>54 (44.6)</td>
<td>0.39</td>
</tr>
<tr>
<td>Time of wound closure (day)</td>
<td>4.27 ± 2.53</td>
<td>5.60 ± 7.85</td>
<td>0.026</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>3</td>
<td>20</td>
<td>0.20</td>
</tr>
<tr>
<td>Primary disease process</td>
<td></td>
<td></td>
<td>0.15</td>
</tr>
<tr>
<td>Cancer</td>
<td>28</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Diverticular disease</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

Values are presented as mean ± SD or number (%).

BMI, body mass index; ASA, American Society of Anesthesiologists.
Table 2. Operative outcomes and wound infection rates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group I (n = 34)</th>
<th>Group II (n = 124)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of antibiotics (day)</td>
<td>7.12 ± 4.14</td>
<td>0.55 ± 1.38</td>
<td>0.00</td>
</tr>
<tr>
<td>Hospitalization period (day)</td>
<td>11.21 ± 7.21</td>
<td>10.12 ± 11.85</td>
<td>0.26</td>
</tr>
<tr>
<td>Small bowel obstruction rates</td>
<td>4</td>
<td>9</td>
<td>0.39</td>
</tr>
<tr>
<td>Wound infection rates</td>
<td>8 (23.5)</td>
<td>7 (5.6)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Values are presented as mean ± SD or number (%).

sure with closed suction drain on wound after ileostomy group (mean, 10.12 days) was not significant difference (P = 0.26). Small bowel obstruction, one of the most common complications after ileostomy take down, was not significantly different between the two groups (P = 0.51). There was a significant difference in wound infection (group I, 23.5%; group II, 5.6%; P = 0.002). Wound infection type is superficial infection. All wound infection have discharge and involved skin and subcutaneous tissues (Table 2).

DISCUSSION

This study evaluated the effect of primary skin closure with close suction drain on wound after ileostomy takedown in wound infection. Recent studies investigated better technique to prevent wound infection after ileostomy takedown. It is surgical principle that contaminated wounds be left open to heal [5-7]. On this basis, previous studies reported benefit of delayed primary closure or purse-string skin closure, effective techniques for reducing wound infection after ileostomy takedown. Lahat et al. [1] reported that infection occurred more frequently, 20%, in primary linear wound closure group than in delayed primary closure group, 10%. Whereas Akiyoshi et al. [8] and Lee et al. [9] reported that purse-string skin closure after ileostomy takedown showed comparable outcomes, in terms of wound infection rate, 5.6% to 16.7% of linear skin closure. In addition, Reid et al. [10] reported that wound infection rate of purse-string skin closure group was 6.7%, which was significantly lower in comparison with the linear skin closure group, 38.7%. Different from previous studies, we evaluated effects of closed suction drain on wound after ileostomy take down to improve wound infection [4,11].

Recent many studies reported the advantage of purse-string skin closure after ileostomy takedown. But there are limitations such as long wound healing period, increasing cost and difficult surgical view for obese patients in purse-string skin closure [11-13]. This study shows primary skin closure with closed suction drain on wound after ileostomy reduced wound infection rate as well as purse-string skin closure, furthermore the wound closure period was short (mean, 5.6 days) and wound infection rate was signifi-

Cantly lower in primary linear closure with closed suction drain on wound group, 5.6% than delayed primary closure group, 23.5% (P = 0.002). Thus closed suction drain reduce wound infection rate after ileostomy takedown as closed suction drain on subcutaneous layer in the other colorectal surgery [3,5].

The limitation of our study are that it was retrospective study thus several variables could not be controlled and the outcomes could not be objectively compared. In addition, our study has small number of delayed primary closure group thus could not be compare between similar size groups. Furthermore most delayed primary closure was performed prior to 2007 while most primary linear closure with suction drain on wound was performed after 2007, thus there are different surgeon, residents and different environments of hospitalization. Consequently prospective studies need to investigate that hospitalization period is influenced with wound closure techniques. Furthermore primary linear closures with closed suction drain technique need to compare with purse-string skin closure group. In this study, we could not considered cosmetic effects of primary closure compared with delayed closure. Therefore, if cosmetic effects and so on are considered and used objective cosmetic scales, our results could suggest advantages of primary wound closure compared with delayed closure. Our conclusion is primary wound closure with closed suction drainage after a loop ileostomy could be a good alternative to the delayed closure or linear primary closure.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

5. Alexander JW, Solomkin JS, Edwards MJ. Updated recommenda-