Original Article

Comparison of Postoperative Outcomes between Gunsight and Traditional Loop Stoma Reversal: A Single-center Experience

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Key Words
Stoma reversal;
Surgical site infection;
Gunsight wound closure;
Gunsight technique

Purpose. Surgical site infection (SSI) is among the most common surgical complications. The SSI rate in loop stoma reversal procedures varies substantially, with some studies reporting rates up to 40%. Several skin incision and closure techniques, including the gunsight technique, have been reported. This study retrospectively reviewed patients who underwent loop stoma reversal surgery using the gunsight or. This study aimed to compare the outcomes of these two techniques and share our experience.
Methods. We enrolled all adult patients who underwent elective loop stoma reversal at National Cheng Kung University Hospital, excluding those with concomitant abdominal surgeries or incomplete medical records. Data and images were obtained through electronic chart reviews.
Results. Patient demographics, including sex, age, underlying medical conditions, and previous indications for stoma creation, were similar between the two groups. A higher proportion of ileostomies was observed in the gunsight technique group than in the traditional technique group. The gunsight technique was associated with numerically lower SSI, lesser dosage of postoperative antibiotic administration, and shorter hospital stays. No statistically significant differences were observed based on other complications between the two groups.
Conclusion. Gunsight loop stoma reversal technique provides benefits with shorter hospital stays and lesser antibiotic administration, compared with the traditional technique.

[*J Soc Colon Rectal Surgeon* (*Taiwan*) *2025;36:249-254*]

Surgical site infection (SSI) is one of the most common postoperative complications. SSI imposes substantial burdens on patients and medical care systems,[1-4] increasing health care requirements and expenses. SSI often requires frequent wound dressing and possible reoperation, additional antibiotic administration, and longer hospital stays, resulting in physical and mental stress to these patients.

The reported SSI rate in stoma reversal varies significantly, reaching up to 40% in some studies.[5] Efforts have been made in the past decades to reduce SSI rates in loop stoma reversal procedures, particularly with skin incision and wound closure techniques. Purse-string skin closure was first introduced in 1997.[6] It demonstrated a lowered SSI rate in subsequent studies,[7-9] however, the central high skin tension causes longer wound healing time,[10] reported up to 3 weeks.[5] The gunsight suture technique was first introduced by

Received: January 14, 2025. Accepted: March 20, 2025.
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Lim et al. in 2010,[11] offering advantages in better wound drainage, simplified wound care, and improvement in cosmetic outcomes than the purse-string technique. The gunsight skin closure technique and purse-string closure technique both showed low SSI rates; however, the gunsight technique was reported with shorter healing time and better patient satisfaction in some studies.[5,12]

We retrospectively reviewed patients receiving elective loop stoma reversal and compared their postoperative outcomes between the gunsight and the traditional reversal techniques.

Methods

This retrospective study enrolled patients who underwent elective loop stoma reversal at the National Cheng Kung University Hospital between January 2017 and July 2023. Patient information, medical data and images were collected through electronic chart reviews. Inclusion criteria were patients aged > 18 years, those who received elective loop stoma reversal surgery, and those without downstream anastomosis stenosis observed during the preoperative colonoscopy. Exclusion criteria were patients who underwent abdominal surgery other than stoma reversal, those who had emergent stoma reversal surgery, or patients who incomplete medical records.

Bowel preparation with polyethylene glycol and cleansing enema was used solely for colostomy reversal cases before the surgery. All the patients in the investigated cases received prophylactic dosing of second-generation cephalosporin within 30 minutes before surgery.

The patients were placed in a supine position under general anesthesia. In the traditional technique group, an elliptical incision was made around the stoma, the adjacent soft tissue was carefully dissected and the stoma was completely mobilized from the abdominal wall. Anastomosis was performed by hand-sewn or a stapler. After returning the bowel to the abdominal cavity, the wound was closed in layers, and interrupted sutures were used for the skin. In the gunsight group, triangular incisions were initially made at 12, 3, 6 and 9 o'clock directions, forming a "Shuriken" shape, and the dissection was carried out just like the traditional technique. After bowel anastomosis and abdominal wall closure, the medial angles of the shuriken-shaped skin incision were brought together subcuticularly using absorbable pure-string suture, leaving a small drainage tunnel in the middle (Fig. 1), and the wound eventually formed a cruciform shape (Fig. 2).

As a contaminated surgical wound, the default postoperative antibiotic protocol for stoma reversal in our patients was three doses of second-generation cephalosporin (one-day dosage), but extra dose of antibiotic could be modified according to patients' clinical presentation (persistent fever, amount of wound discharge, etc.) or by personal preference in some

Fig. 2. The photography of closure wound with gunsight technique.

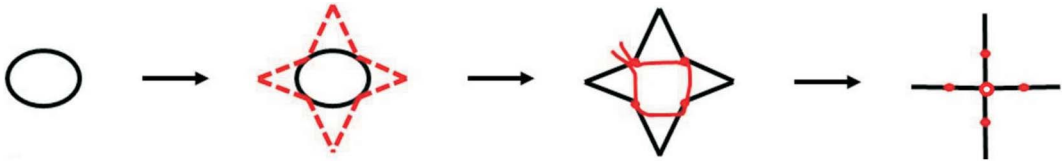

Fig. 1. Illustration of gunsight skin incision and closure.

cases. All extra doses of antibiotic were given at least for 2 days postoperatively.

The primary outcome was the SSI rate. The secondary outcomes were hospital stays duration, duration of antibiotic administration, and postoperative morbidities. SSI was defined as the presence of purulent discharge or symptoms of cellulitis at any time before wounds were completely healed.

Statistical analyses were done using PRISM for Windows version 6. The Mann-Whitney U-test was used for continuous variable comparison, while the Fisher exact test was used to analyze categorical variables. *p*-value lower than 0.05 was considered statistically significant.

Results

Between January 2017 and July 2023, a total number of 321 patients underwent loop stoma reversal surgery in our hospital. Of the 321 patients, 67 of them received gunsight technique, while the traditional technique was used on 254 patients. The gunsight technique was more significantly performed by a single surgeon, while all other surgeons performed the traditional technique. In total, there were 40 patients with ileostomy (59.7%) and 27 (40.3%) with colostomy in the gunsight group, while 60 underwent ileostomy, and 194 patients underwent colostomy in the traditional group (Table 1). No significant differences were observed between the groups based on characteristics, including sex, age, underlying systemic disease, and their previous causes for stoma creation.

SSI rate was numerically lower in 5 patients (7.5%) from the gunsight group compared to 28 patients (11%) in the traditional group although this difference did not reach statistical significance ($p = 0.5$). The duration of antibiotic administration in the gunsight group was shorter than 2 days in 46 cases (68.7%) and the traditional group revealed longer antibiotic use (more than 2 days) in 178 patients (70.1%). In short, the gunsight group demonstrated significantly shorter hospital stays and reduced antibiotic administration ($p < 0.05$). No significant differences were observed between the two groups based on other postoperative complications, including ileus, anastomosis leakage, and pulmonary complications (Table 2).

Discussion

In this retrospective study from a tertiary medical center in Southern Taiwan, the gunsight loop stoma

Table 1. Patient characteristics and clinical features

Variable	Gunsight technique (n = 67)	Traditional technique (n = 254)	*p* value
Sex, n (%)			0.25
Male	47 (70.1)	158 (62.2)	
Female	20 (29.9)	96 (37.8)	
Age, years (IQR)	63 (53-70)	62 (52-69)	0.49
Underlying disease, n (%)			
DM	18 (26.9)	48 (18.9)	0.17
HTN	22 (32.8)	75 (29.5)	0.65
Stoma type, n (%)			< 0.05
Ileostomy	40 (59.7)	60 (23.6)	
Colostomy	27 (40.3)	194 (76.4)	
Indication of stoma creation, n (%)			0.86
Bowel obstruction	8 (11.9)	37 (14.6)	
Bowel perforation	9 (13.4)	28 (11.0)	
Benign disease	5 (7.5)	15 (5.9)	
Malignant disease	45 (67.2)	174 (68.5)	

DM: diabetes mellitus, HTN: hypertension, IQR: interquartile range.

Table 2. Outcomes

Variable	Gunsight technique (n = 67)	Traditional technique (n = 254)	*p* value
SSI, n (%)	5 (7.5)	28 (11.0)	0.5
Duration of antibiotic use, n (%)			< 0.05
< 2 days	46 (68.7)	76 (29.9)	
≥ 2 days	21 (31.3)	178 (70.1)	
Duration of hospital stay, days (IQR)	8 (6-11)	11 (10-13)	< 0.05
Complication			
Ileus	6 (9.0)	24 (9.4)	1.00
Anastomosis leakage	2 (3.0)	1 (0.4)	0.11
Pulmonary complications (e.g. atelectasis, infection, pleural effusion)	0 (0)	5 (2.0)	0.58

SSI: surgical site infection.

reversal technique provides benefits with shorter hospital stays and lesser antibiotic administration, compared with the traditional technique.

In this study, the SSI rate was lower numerically in the gunsight group, although not reaching statistical difference. However, compared with the traditional technique, which frequently cause surgeons to worry about SSI and result in longer duration of antibiotic use, more frequent wound dressing and longer hospital stays, the gunsight technique provides benefits by larger surgical field for dissection and bowel anastomosis, better self-drainage from the wound and less wound edge tension,[5,9,11,12] consequently decreasing the unnecessary worries, antibiotic overuse and preventing the potential of excessive medical costs.

In our patients, the duration of hospital stay and antibiotic administration were significantly shorter in the gunsight technique group than in the traditional technique group. These findings were also consistent with previous studies.[5,11-13] In the gunsight group, clinical observation was noted that better wound drainage enhanced surgeon's confidence for less antibiotic use in both ileostomy and colostomy reversal, while many surgeons preferred prolonged antibiotic administration for loop colostomy reversal in the traditional group, which could also be observed in a previous study. In another study by Chen et al.,[5] the gunsight group showed not only shorter hospital stays, but also fewer number of wound dressing change and lower SSI than the traditional group with comparable operative time,[5] which corroborated well with the findings in our study.

A subgroup analysis based on different stoma types showed similar results. Due to small SSI number, it was not powerful enough to reach statistical difference and reflect real-world practice patterns, i.e., the gunsight technique was utilized by only one surgeon in this study. Currently, there is a lack of systematic evaluation of patient satisfaction and aesthetic outcomes regarding the stoma reversal in our hospital. Prospective studies in the future involving larger case numbers, standardized postoperative care protocol, documentation of wound healing time, comprehensive analysis of risk factors, adjustment of confounding factors are needed. Future research may also incorporate quantitative measure, such as Visual Analog Scale (VAS) for postoperative wound pain, or questionnaires for patients' satisfaction and aesthetic outcomes; may help provide more informative evidence to aid both surgeons and patients in the decision-making process.

This study has some limitations. First, this is a single-center study, and the gunsight technique was a single surgeon's preference; thus, an allocation bias was inevitable. Second, the retrospective study design had inherent selection bias and inadequate documentation of patient satisfaction and detailed pain scores. Third, the prior stoma creation selection, postoperative SSI definition and descriptions, decision for prolonged antibiotic administration, wound dressing preference and surgical steps of anastomosis all vary in each patient due to surgeons' preferences from multiple surgeons. Fourth, although colostomy has been proven to be one of the risk factors for higher SSI in

stoma reversal,[1] subgroup analysis did not demonstrate this tendency (data not shown), possibly due to limited SSI case numbers. A more detailed multivariate analysis with sufficient statistical power will be performed when more cases could be enrolled.

Conclusions

The gunsight loop stoma reversal technique may provide patients with shorter duration of hospital stays and lesser dosages of antibiotic administration, compared with the traditional technique.

Conflicts of Interest

None.

Funding Supports

None.

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原　著

十字環形造口復位與傳統環形造口復位之術後預後比較：單一醫學中心經驗

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目的　手術部位感染 (SSI) 是常見的手術併發症之一。以環形造口復位術來說，手術部位感染率差異很大，部分研究顯示可高達 40%。目前有許多針對皮膚切開縫合的手術方式已被提出，其中包含十字環形造口復位術。本研究回顧我們接受環形造口復位術之病人，包含採用十字切口縫合或傳統線形切口縫合，比較這兩種手術方式的預後及分享我們的經驗。

研究方法及對象　所有在成功大學醫院接受常規環形造口復位術的成年患者均包含在本研究分析對象，並排除同時接受其他腹部手術或醫療紀錄不完整的患者。所有數據及影像皆由電子病歷檢視收集。

結果　兩組患者在患者特徵部分大多均相似，含性別、年齡、系統性疾病和接受造口成形術原因。然而，十字環形造口復位組中有較高比例的迴腸造口。預後部分十字環形造口復位與較低的手術部位感染發生數目、較少的術後抗生素使用劑量和較短的住院時間呈現一些相關性。其他併發症在兩組之間則無統計學上顯著差異。

結論　與傳統環形造口復位相比，十字環形造口復位似乎具有較短的住院時間和較少的抗生素使用。

關鍵詞　造口復位術、手術部位感染、十字切口縫合、十字環形造口復位術。