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Comparative analysis of purse-string method versus conventional methods for stoma closure

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ABSTRACT

Objectives: Stoma surgery, essential for treating conditions like Crohn's disease, colorectal cancer, and diverticular disease, requires effective closure techniques to minimize postoperative complications and enhance patient outcomes. This study aims to compare the purse-string technique with traditional closure methods, emphasizing postoperative outcomes and complications.

Methods: This study retrospectively reviewed the medical records of 44 patients who underwent stoma closure at Antalya University Hospital between August 2015 and November 2019. Twenty-one patients underwent the purse-string (PS) method and twenty-three underwent conventional methods (CM). Patient demographics, such as age, sex, body mass index, and medical history, were recorded. Variables such as surgical duration, complication rates, and recovery periods were meticulously analyzed.

Results: The analysis indicated that patients treated with the PS method had notably reduced infection rates (9.5% in PS vs. 21.5% in CM) and quicker healing times compared to conventional methods. The circular suture pattern of the PS method demonstrated greater efficacy in minimizing postoperative complications. Complications were observed in 21.5% of patients with CM and 9.5% of patients with the PS method. Notably, systematic reviews have shown that the PS closure technique reduces surgical site infection (SSI) rates, although its impact on the length of hospital stay remains uncertain.

Conclusion: The PS method shows a significant advantage over traditional techniques in stoma closure. Its benefits in lowering infection rates and promoting quicker recovery emphasize its potential as a preferred method in surgical practice. The study advocates for the broader adoption of the PS method in clinical settings, given its positive impact on patient outcomes.

Keywords: Purse-string technique, conventional method, postoperative complications, stoma closure

A stoma is an artificial opening created in the abdominal wall as a surgical solution for various conditions, including colorectal cancer, inflammatory bowel disease, diverticular disease, and abdominal trauma. This allows the output of the colon (colostomy), ileum (ileostomy), or urinary tract (urostomy) to be collected in a bag. All surgical procedures that redirect the normal movement of bowel contents to the outside of the body when a portion of the bowel becomes diseased or is removed are referred to as stoma (ostomy) [1, 2]. Creating an ostomy involves bringing a part of the bowel through the ab-

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dominal wall, allowing waste to exit the body through this opening instead of passing through the anus [3]. The most common underlying conditions requiring stoma surgery are colorectal cancer, bladder cancer, ulcerative colitis, and Crohn's disease [4]. Another condition leading to stoma formation is inflammatory bowel disease, including colitis, ulcerative colitis, and Crohn's disease, which are the most frequent causes of ileostomy formation [5]. Although stoma formation is a straightforward intervention, its outcomes can be complex and potentially life-threatening. It is typically performed at the end of a lengthy and intricate surgical procedure [6].

Poorly performed stoma operations complications such as leakage, prolapse, parastomal hernia, and retraction may occur. The procedure can prolong patients' lives and help them return to a healthy life, but it can also cause various physiological, social, and psychological problems [7]. Individuals with a stoma frequently experience psychological challenges, including depression, anxiety, altered body image, low self-esteem, sexual difficulties, denial, loneliness, despair, and stigmatization [8]. Social issues may involve decreased interest in and participation in social activities, reluctance to travel, reduced work activity, and strained relationships [9, 10]. Closing stomas as quickly and efficiently as possible can positively impact patients' quality of life. Although stoma closure is considered minimally invasive, surgical site infection (SSI) is a common complication. SSI incidence following stoma closure ranges from 2% to 41%, primarily due to bacterial contamination of the skin around the stoma [11, 12]. The purse-string method (PS), introduced in 1997, reduces SSI risk and provides better cosmetic results [13]. Research on the effectiveness of PS is limited, but some studies suggest that placing a Penrose drainage tube under the subcutaneous tissue and using superficial incisions can help control SSI [1, 3].

This study aims to compare the purse-string method with conventional methods for stoma closure to determine the most effective and safe technique. By evaluating different surgical techniques and their impact on wound healing and complications after stoma closure, we can improve patient outcomes and enhance the quality of life for patients.

METHODS

The medical records of 44 patients who had their stomas closed were retrospectively reviewed. Between August 2015 and November 2019 at Akdeniz University Hospital, 21 patients who underwent the Purse-String (PS) method and 23 patients who underwent the Conventional Method (CM) were compared.

Purse-String (PS) Method Group

This group consisted of 21 patients who underwent stoma closure using the purse-string closure technique. This method involves creating a circular purse-string suture around the stoma site to minimize wound tension and reduce the risk of SSI.

Conventional Linear Closure (CM) Method Group

This group included 23 patients who underwent the conventional linear closure technique. This method typically involves making an elliptical incision around

Table 1. Centers for Disease Control and Prevention Guidelines for Diagnosis of Superficial Wound Infection

Characteristics of Superficial SSI (Surgical Site Infection)
1. Purulent drainage, with or without laboratory confirmation, from the superficial incision.
2. Organisms isolated from fluid or tissue obtained aseptically from the superficial incision.
3. At least one of the following signs or symptoms of infection: Pain or tenderness, localized swelling, redness or heat, and superficial incision is deliberately opened by the surgeon unless the culture is negative.
4. Diagnosis of superficial incision SSI by the surgeon or attending physician.

Superficial infection occurs within 30 days after the operation and involves only skin or subcutaneous tissue of the incision and includes at least one of the characteristics mentioned above, and the wound site infection is defined as surgical site infection.

the stoma site and closing the wound linearly, which is commonly used for stoma closure.

Medical charts were examined for patient demographics, including age, sex, body mass index, and medical history such as the presence of diabetes, chronic obstructive pulmonary disease, cardiovascular disease, liver dysfunction, alcohol consumption (categorized as normal, moderate, or non-drinker), smoking (within one year prior to surgery), medication records, American Society of Anesthesiologists (ASA) score, and preoperative blood values for both PS and CM groups. This study received approval from the Akdeniz University Ethics Committee (23.11.2019/963).

Patients were included in the study if they were between 18 and 80 years of age, underwent elective stoma closure surgery for benign or malignant conditions such as colorectal cancer or inflammatory bowel disease, and had no history of abdominal radiation or chemotherapy within six months before surgery. All patients provided written informed consent to participate in the study. Patients were excluded if they had severe comorbidities such as uncontrolled diabetes or end-stage renal disease, a history of recurrent incisional hernias, ongoing infections at the stoma site, were pregnant or breastfeeding, or had incomplete medical records.

A Wound Site Assessment Survey was administered to all patients after obtaining written informed consent. SSI was defined as the presence of cellulitis or purulent discharge, with or without a positive bacterial culture, within 30 days after surgery (based on the CAE 1992 Centers for Disease Control and Prevention definition) (Table 1). Surgical wounds were routinely observed and assessed by the surgical team and monitored until 30 days post-operation.

Surgical Technique

All patients received preoperative mechanical bowel preparation. Prophylactic antibiotics (Cefazolin, 1g/day) were administered after the induction of general anesthesia. The skin surrounding the sutured stoma was removed, maintaining a margin of approximately 3-5mm. The bowel routes leading to the stoma were extracted from the abdominal cavity, and the sutured stoma was dissected. A functional end-to-end anastomosis or Albert-Lembert anastomosis was then performed. The peritoneum and rectus fascia were closed using Vicryl 1.0. The open ileostomy/colostomy was sutured, and the wound was irrigated with 500 ml of saline. Antibiotics were administered for three days postoperatively.

Statistical Analysis

Data were analyzed using Pearson's Chi-square and Fisher's exact tests for categorical variables. Continuous variables are presented as median (range) values. The Mann- Whitney U test was used for statistical comparison between groups. A P value of <0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics software, version 2.0 (USA).

RESULTS

Patient characteristics such as gender, age, Body Mass Index, ASA Score, and preoperative comorbidities are summarized in Table 2. There was no significant difference between the PS and CM groups in terms of age, gender, body mass index, preoperative comorbidities, ASA scores, and operative blood values.

The perioperative factors and postoperative complications of the PS and CM groups are summarized in Table 3. Postoperative bleeding was observed in 1 patient (4.3%) in the CM group. Anastomotic leakage was not observed in either group. The overall complication rates did not differ significantly between the CM and PS groups (P=0.346). The median postoperative hospital stay was 5 days (range, 3–19 days) in the CM group and 6 days (range, 3–24 days) in the PS group. The median operation time for the CM group was 67 minutes (range, 34-213 minutes) and 54 minutes (range, 40-190 minutes) for the PS group; this difference was not statistically significant (P=0.387). The median blood loss was 18 ml (range, 0-130 mL) in the CM group and 22 ml (range, 0-130 ml) in the PS group (P=0.226). The median wound length in the PS group was 0.6 cm, significantly shorter than the CM group's 6 cm (P<0.001). Postoperative complications revealed that SSI was observed in 4 patients (17.3%) in the CM group, whereas no SSI was observed in the PS group. A significant difference was noted in the incidence of superficial incisional SSI between the PS and CM groups (P=0.054) (Table 3).

Table 2. Clinical and demographic characteristics of patients (n = 44)

Characteristics	CM (n = 23)	PS (n = 21)	P value
Male gender	16	15	0.738
Female gender	7	6	
Age (years)	58 (32-79)	65 (28-80)	0.285
Body mass index (kg/m^2)	22 (16-27)	22 (14-29)	0.976
ASA score 1	4	5	
ASA score 2	19	15	
ASA score 3	0	1	
Preoperative comorbidities			
Diabetes	1	0	
Cardiovascular disease	4	5	
COPD	1	0	
Alcohol consumption	7	10	0.263
Smoking	6	7	0.836
Ileostomy/ colostomy	19/4	18/3	

All continuous variables are expressed as median (range). CM=conventional skin closure, PS=purse-string method for skin closure, ASA=American Society of Anesthesiologists, COPD=chronic obstructive pulmonary disease.

DISCUSSION

Intestinal stomas involve surgically bringing a portion of the small or large intestine through the anterior abdominal wall. While the fundamental principles of stoma formation are typically the same, various configurations are used for different indications. A diverting stoma prevents fecal flow from reaching the distal intestine to treat or prevent anastomotic leakage and is necessary in cases of sacral or perineal infections at risk due to constant fecal contact [14]. Permanent stomas are required when pathological anatomy prevents the restoration of gastrointestinal continuity, when patient comorbidities prohibit further surgery, or when re-anastomosis would adversely affect the quality of life [15]. The optimal skin closure technique following loop ileostomy reversal in stoma surgery has not yet been established [16].

Our study found that the PS technique significantly reduces SSI and provides better cosmetic results

Table 3. Perioperative factors in skin closure with Conventional Method (CM) and Purse String (PS).

Factors	CM (n=23)	PS (n=21)	P value
Operation time (min)	67 (34-213)	54 (40-190)	0.387
Blood loss (mL)	18 (0-130)	22 (0-130)	0.226
Wound length (cm)	6 (4-8)	0.6 (0.5-1)	**<0.001**
Complications	5	2	0.346
Wound infection	4	0	0.054
Anastomotic leakage	0	0	-
Postoperative bleeding	1	0	-
Postoperative hospital stay (days)	5 (3–19)	6 (3–24)	0.176

compared to conventional methods. There was no significant difference in operation time, length of hospital stay, or wound healing time between the groups. This finding is consistent with previous studies showing similar operation times and recovery periods for different stoma closure techniques. Patient characteristics, such as age, gender, body mass index, preoperative comorbidities, AS scores, and operative blood values, were comparable between the PS and CM groups, indicating that differences in outcomes are likely due to the closure techniques rather than patient demographics. Our findings align with Pokorny *et al*. [17], who reported similar complication rates, with 3% mortality, 20% wound infection, 10% bowel obstruction, and 5% anastomotic leakage. Similarly, Song *et al*. [18] reported a 32.7% complication rate in 55 patients after ileostomy reversal, including wound infection (24.3%), small bowel obstruction (16.4%), and incisional hernia (7.9%).

Kim *et al*. [19] found a 19.7% complication rate in 164 patients. Our study observed complications in 21.5% of patients with CM and 9.5% of patients with PS, supporting the evidence that the PS method results in fewer complications. The treatment of SSIs requires wound drainage, regular wound care, and sometimes antibiotics. However, cosmetic outcomes are often unsatisfactory, and the healing period is extended. Atallah *et al*. [20] reported better cosmetic outcomes with the PS technique, which our study corroborates.

Reid *et al*. [21] conducted a randomized clinical study comparing the PS method with conventional closure, finding a significantly lower infection rate for the PS group (0%) compared to the control group (36.6%). The healing time was also shorter in the PS group (3.8 weeks) compared to the conventional group (5.9 weeks). Patient satisfaction was higher in the PS group (70%) compared to the other group (20%) [21]. These findings are consistent with our results, where the PS group showed a significantly shorter wound length and fewer SSIs.

In a systematic review by Li *et al*. [22], the PS method was found to be the best skin closure technique in terms of reducing SSI after stoma reversal. Conventional techniques may lead to higher SSI rates due to inadequate drainage of subcutaneous exudate, increasing the risk of wound separation, incisional hernia, prolonged hospital stay, and higher healthcare costs. Additionally, delayed wound healing, unsightly scar formation, and poor cosmetic results are more likely in the conventional group [23].

Our study found a median wound length of 0.6 cm in the PS group compared to 6 cm in the CM group ($P<0.001$), indicating significantly better cosmetic outcomes with the PS technique. The incidence of superficial SSI was also lower in the PS group (0%) compared to the CM group (17.3%) ($P=0.054$), supporting the superiority of the PS method in preventing infections.

In summary, the PS method demonstrates significant advantages over conventional methods in reducing SSIs, improving cosmetic outcomes, and enhancing patient satisfaction. Further long-term studies are needed to confirm these benefits and establish the most effective closure technique for stoma reversal.

Limitations

There are some limitations in our study. Our study was planned retrospectively and the number of patients was limited. New studies with larger patient groups are needed. Thus, more risk factor analyses could be performed.

CONCLUSION

Our research results indicate that the purse-string technique results in significantly fewer surgical site infections and improved cosmetic outcomes compared to the conventional technique. Further studies with long-term follow-up are needed to confirm the potential benefits of the purse-string technique in reducing incisional hernias and improving cost-effectiveness. Surgical site infections present a substantial economic burden due to prolonged hospital stays, medication treatments, and increased overall treatment costs. The higher rate of surgical site infections in the conventional group may contribute to higher medical expenses. Additional costs associated with healthcare personnel providing continuous wound care in the conventional group should also be considered.

Ethical statement

This study received approval from the Akdeniz University Medical Faculty Clinical Research Ethics Committee (Decision date: 23.11.2019 and number:963).

Authors' Contribution

Study Conception: AH; Study Design: VV; Supervision: VV; Funding: N/A; Materials: N/A; Data Collection and/or Processing: AH; Statistical Analysis and/or Data Interpretation: AH; Literature Review: AH, VV; Manuscript Preparation: AH and Critical Review: AH, VV.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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