

Complications of Purse-String Closure Technique Vs Linear Closure in Patients with Stoma

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ABSTRACT

Background: A variety of surgical techniques have been proposed for abdominal wall closure in patients with stoma with the aim of reducing the incidence of surgical site infection. However, the ideal skin closure technique has not yet been determined. Surgical site infection was one of the most common postoperative morbidities of ileostomy and colostomy reversal and although several skin closure procedures have been developed to reduce the rate of surgical site infection and its associated comorbidities, the incidence rates nationally and internationally range between 2% and 41% and it has been reported that it can increase costs, prolong hospitalization time and affect the patient's quality of life.

Objective: To compare the tobacco closure technique vs. linear closure in patients with stoma at the Regional General Hospital 01.

Materials and methods: Observational, analytical, retrospective study, information was collected from both outpatient and hospital records of patients with a stoma during the period 2022-2024, the evolution after stoma closure, its main post-surgical complications, type of wall closure technique, comorbidities, days of hospitalization and days of antimicrobial therapy. The data obtained were analyzed together with a methodological advisor in a specially created database and for statistical analysis, SPSS was used to create result graphs, as well as descriptive statistics.

Results: According to the inclusion criteria the total sample was 25 participants, the average age was 50.9 years predominating in the age range 51-66 years, according to sex with a higher frequency male 15 (60%), Regarding the type of stoma in greater presentation was the colostomy 13 (52%) and according to the technique used for stoma closure we found tobacco pouch 13 (52%) and linear 12 (48%) it was identified regarding the tobacco pouch technique did not have any complications in 11 (44%), in 2 (8%) presented dehiscence and regarding the linear technique 5 (20%) presented incisional hernia, followed by dehiscence 3 (12%), infection 2 (8%) and 2 (8%) presented no complications. According to statistical analysis SPSS Pearson Chi-Square was reported a value of 13.412 with significance $p = 0.004$ for the association of the tobacco pouch technique and linear technique with complications..

Conclusion: The tobacco purse technique had fewer complications compared to the linear technique

KEYWORDS: Stoma, tobacco pouch technique, linear technique, complications.

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I. INTRODUCTION

The closure of stomas in patients who have undergone surgical procedures is a clinically significant topic due to the potential for postoperative complications such as infections and hernias. Stomas are created for various reasons, including temporary protection of high-risk anastomoses or management of defecation obstruction and incontinence. However, this procedure can be associated with a complication rate of up to 70%. During stoma closure, both the cutaneous wound and the musculofascial layer must be addressed. The abdominal wall, composed of skin, fascia, muscle, and peritoneum, is prone to parastomal or incisional hernias. Temporary stoma closure, being exposed to intestinal contents, presents a higher risk of surgical site infection (SSI), with rates ranging from 0% to 41%¹.

Several techniques have been proposed for stoma skin closure, including open closure to allow granulation by secondary intention or primary closure with variations described in the literature². Bacterial contamination of the skin from prolonged contact with intestinal contents is a major cause of SSI, increasing hospital costs and morbidity. Temporary stomas are employed to prevent complications such as anastomotic leakage after colorectal resection, with postoperative infection rates reaching up to 40%. Techniques such as purse-string closure or negative-pressure therapy have been utilized to mitigate this risk³⁻⁶.

Stoma reversal is also associated with complications such as anastomotic leakage, postoperative ileus, and, most commonly, SSI. Studies like that of Rondelli F et al. (2018) compared purse-string closure with conventional closure, finding lower SSI rates with the former technique without significant differences in other postoperative complications⁴. Similarly, Brahmhatt R et al. (2014) reported that circumferential closure had a lower SSI rate compared to other techniques, such as primary closure⁵.

A clinical trial conducted between 2017 and 2018 found that purse-string closure was associated with lower infection rates and higher patient satisfaction compared to linear closure⁶. Linear primary closure shows high SSI rates, while the purse-string approach has proven to be a more effective option for reducing infections⁷. The literature also suggests that purse-string closure significantly improves patient satisfaction and reduces wound-related morbidity⁸.

Studies have identified risk factors for SSI, including subcutaneous fat thickness, time since stoma creation, and the presence of infection during the primary surgery^{7,10}. The purse-string technique has shown better outcomes, minimizing complications and reducing hospital stays, making it the preferred technique⁸⁻⁹.

Regarding stoma reversal, late complications such as stomal hernia have been reported, with an incidence ranging from 0% to 48%. Factors such as age, gender, obesity, and smoking are associated with increased risk¹¹. Some studies suggest that biological mesh can reduce the incidence of incisional hernias by reinforcing the abdominal wall during

stoma closure¹². Additionally, reoperation may be necessary in some cases to repair an incisional hernia¹³.

Despite the high complication rates associated with stomas, the debate over early versus late closure persists. While some reports suggest that late closure may improve morbidity outcomes and patient quality of life¹⁰⁻¹⁴, other studies emphasize the effectiveness of the purse-string technique, which significantly reduces complications and improves overall patient satisfaction⁸⁻⁹.

II. MATERIAL AND METHODS

A. Study Design:

This is an observational, retrospective, and analytical study conducted at the General Regional Hospital of Orizaba, specifically within the General Surgery and Coloproctology departments, during the period from January 2023 to August 2024.

B. Sample Size Calculation:

Due to the nature of the study, a consecutive non-probabilistic sampling method was employed. All patients meeting the inclusion criteria were included, and no estimated sample size calculation was performed. Participants were selected from the census of patients registered in the outpatient and inpatient services of the General Surgery and Coloproctology departments.

C. Sample Size:

Patients attended in the outpatient and inpatient services between 2022 and 2024 were included, resulting in a total of 25 participants who met the inclusion criteria.

D. Study Population Universe:

All medical records of patients who underwent stoma closure, either with the purse-string technique or linear closure, at the General Regional Hospital of Orizaba.

E. Population:

Medical records of patients who underwent stoma closure by the General Surgery and Coloproctology departments.

F. Data Analysis and Statistical Aspects:

The collected data were processed in a database specifically designed in Microsoft Excel. Statistical analysis was performed using SPSS software version 24. Descriptive and analytical results were obtained using Chi-square (X^2) tests to associate stoma closure techniques with the complications observed in each group.

G. Ethical Aspects

The participants declared no conflicts of interest, and all procedures in this study will be conducted in accordance with the General Health Law on Health Research, as well as the principles of the Declaration of Helsinki and the World Medical Association. In accordance with the procedure for evaluation, registration, monitoring, amendment, and cancellation of health research protocols submitted to the

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Local Health Research Committees and Ethics Committees for Research (R-2024-3101-024)

This study complies with the requirements outlined in Title V of the Federal Health Law dedicated to health research, specifically Articles 96, 97, 98, 99, 100, 101, and 102

III. RESULTS

A total of 25 patient records of stoma closure procedures, either using the purse-string technique or linear closure, were analyzed to identify the main complications. The study found that most patients were male (15, 60%) compared to female (10, 40%). Regarding the department performing the procedure, General Surgery accounted for 14 cases (56%), and Coloproctology for 11 cases (44%), as shown in Table 1. Patient characteristics showed a mean age of 54.6 ± 15.5 years for the purse-string group and 46.6 ± 14.7 years for the linear closure group. Hospital stays averaged 10.5 ± 9.7 days for purse-string closure and 16.5 ± 16.2 days for linear closure. The tobacco pouch stoma was more frequent, with 13 cases (52%) compared to the linear closure group with 12 cases (48%).

Overweight was the most common BMI category in both groups, observed in 11 cases (44%), followed by normal weight (16% in tobacco pouch vs. 20% in linear closure) and Obesity I (12% in tobacco pouch vs. 8% in linear closure). Hypertension was the most frequent comorbidity, affecting 14 patients (56%) in both groups. Diabetes mellitus was present only in the tobacco pouch group (16%), while cancer and other conditions were observed in 12% of patients each. No diabetes mellitus cases were found in the linear closure group, as detailed in Table 2.

The diagnosis of patients who underwent stoma closure primarily involved complicated diverticular disease, which was more frequent in the tobacco pouch group with 5 cases (38.5%) compared to 2 cases (16.7%) in the linear technique group. Intestinal perforation was observed in 2 cases (15.4%) in the tobacco pouch group and 5 cases (41.7%) in the linear group. Intestinal obstruction was less frequent, with 3 cases (23%) in the tobacco pouch group. Other pathologies (complicated appendicitis, fistula, tumor activity, ileal intussusception) accounted for 8.3% in the linear group, as detailed in Table 3.

The most frequent type of stoma observed was colostomy, performed using the tobacco pouch technique in 11 cases (44%) and the linear technique in 2 cases (8%). Ileostomy was performed using the tobacco pouch technique in 2 cases (8%) and the linear technique in 10 cases (40%), as shown in Graph 1.

The time from the initial intervention to stoma closure was one year or less in 7 cases (54%) for the tobacco pouch group and in 6 cases (50%) for the linear group. The remaining time intervals are detailed in Table 4

Regarding the duration of antimicrobial use during hospitalization, the tobacco pouch group averaged 9 ± 6 days, while the linear group averaged 13 ± 10 days.

Complications observed in the comparison groups were as follows: no complications in 11 cases (44%) for the tobacco pouch group and 2 cases (8%) for the linear group. Hernias were not observed in the tobacco pouch group but were present in 5 cases (20%) in the linear group. Dehiscence occurred in 3 cases (12%) in the linear group and 2 cases (8%) in the tobacco pouch group. Infection was exclusively observed in the linear group, affecting 5 cases (20%), as shown in Table 5.

IV. TABLE

TABLE 1. GENERAL CHARACTERISTICS OF THE COMPARISON GROUPS IN STOMA CLOSURE

Characteristics	Tobacco Pouch stoma f %	Linear f %	Total f %
Sex			
Masculine	6 (24)	9 (36)	15 (60)
Femenine	7 (28)	3 (12)	10 (40)
Department			
General Surgery	2 (8)	12 (48)	14 (56)
Coloproctology	11 (44)	0	11 (44)

TABLE 2. PATHOLOGICAL HISTORY OF THE COMPARISON GROUPS

Physical Constitution	Tobacco Pouch Stoma (f)	Tobacco Pouch Stoma (%)	Linear Closure (f)	Linear Closure (%)	Total (f)	Total (%)
Normal Weight	4	16%	5	20%	9	36%
Overweight	6	24%	5	20%	11	44%
Obesity I	3	12%	2	8%	5	20%
Comorbidities						
Hypertension	7	28%	7	28%	14	56%
Diabetes Mellitus	4	16%	0	0%	4	16%
Cancer	1	4%	2	8%	3	12%
Obesity	0	0%	1	4%	1	4%
Others	1	4%	2	8%	3	12%

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Table 3. Admission Diagnosis in the Comparison Groups

Diagnosis	Tobacco Pouch Stoma (f)	Tobacco Pouch Stoma (%)	Linear Closure (f)	Linear Closure (%)	Total (f)	Total (%)
Complicated Diverticular Disease	5	20%	2	8%	7	28%
Intestinal Perforation	2	8%	5	20%	7	28%
Intestinal Obstruction	3	12%	1	4%	4	16%
Complicated Appendicitis	1	4%	1	4%	2	8%
Enterovesical Fistula	0	0%	1	4%	1	4%
Colovesical Fistula	1	4%	0	0%	1	4%
Ileal Intussusception	0	0%	1	4%	1	4%
Strangulated Hernia	0	0%	1	4%	1	4%
Infiltration by AT*	1	4%	0	0%	1	4%

*AT: Tumor Activity

Table 4. Stoma Closure Time

Evolution Time	Tobacco Pouch Stoma (f)	Tobacco Pouch Stoma (%)	Linear Closure (f)	Linear Closure (%)	Total (f)	Total (%)
> 1 year	6	24%	5	20%	11	44%
2 years	7	28%	4	16%	11	44%
3 years	0	0%	2	8%	2	8%
5 years	0	0%	1	4%	1	4%

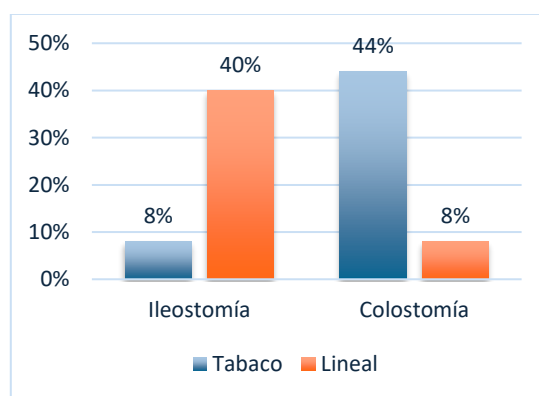
Table 5. Postoperative Complications of Stoma Closure

Complications	Tobacco Pouch Stoma (f)	Tobacco Pouch Stoma (%)	Linear Closure (f)	Linear Closure (%)	Total (f)	Total (%)
None	11	44%	2	8%	13	52%
Infection	0	0%	2	8%	2	8%
Hernia	0	0%	5	20%	5	20%

Complications	Tobacco Pouch Stoma (f)	Tobacco Pouch Stoma (%)	Linear Closure (f)	Linear Closure (%)	Total (f)	Total (%)
Dehiscence	2	8%	3	12%	5	20%

V. FIGURE

Graph 1. Type of Stoma in the Comparison Groups at Closure



VI. DISCUSSION

Several previous studies have shown that the purse-string closure technique may offer advantages over linear closure, particularly in terms of preventing infections and reducing stoma-related complications.

Bafford AC and Irani JL conducted research published in the Journal of Surgery of North America in 2013 on the importance of abdominal wall closure, highlighting its association with bacterial contamination caused by intestinal exposure to the abdominal wall. This contamination increases the risk of surgical site infection (SSI), with reported SSI rates after ileostomy closure ranging from 0% to 41%. In our study, SSI following ileostomy closure was observed in only 8% of cases¹.

According to Rondelli F and colleagues, a systematic review and meta-analysis of five trials published in the International Journal of Surgery in 2018 showed a lower frequency of SSI in circular closure compared to linear or conventional closure (95% CI, P > 0.00001). No significant differences in operative time were observed (P = 0.98). In comparison, our study demonstrated that the purse-string technique had no complications in 44% of cases (95% CI, P > 0.5). Regarding SSI, no frequency was reported, and the only complication observed was wound dehiscence⁵.

In comparison, Malik T and Kilinc G referenced studies from other countries, such as southern India, in 2018. A study with two groups of 40 participants each reported that the difference in average hospitalization days between the two groups was statistically insignificant (P = 0.927). However, the incidence of SSI was statistically significant (17 vs. 3; P = 0.003). Stoma-related complications ranged from 2.9% to 81.1%,

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with peristomal skin complications and parastomal hernias being the most common^{5,16}.

In this study, the main complications in both groups were wound dehiscence, with the presence of hernias at the surgical site being specific to the linear closure group, while in the tobacco pouch group, 44% had no complications. Based on the complications present in both groups, Pearson's Chi-square test reported a value of 13.412 with significance ($P = 0.004$), $N = 25$.

Regarding hospitalization time, no significant relationship was found, with an average stay of 10.5 ± 9.7 days for the purse-string group and 16.5 ± 16.2 days for the linear closure group. As noted earlier, hernia was the most frequent complication, suggesting future research should focus on the use of prophylactic mesh.

Neel B and Dimitri, in Denmark, published in *The Lancet* (2020) that using mesh in stoma closure over a two-year period required a sample of 790 patients. The primary outcome at two years showed a significant benefit (95% CI: 0.43–0.90; $P = 0.012$), with no significant differences in wound infection rates.

Similarly, Mohamed Ahmed AYY (2020) reported that mesh use was associated with a significantly lower risk of SSI ($P = 0.003$) and the need for surgical intervention to repair incisional hernias ($P = 0.04$) compared to no mesh use. In comparison with our study, the main complication observed in the linear closure group was incisional hernia, while in the purse-string group, wound dehiscence was observed in 8% of cases^{12,17,18}.

VII. CONCLUSIONS

The purse-string closure technique is associated with a lower frequency of complications compared to linear closure, particularly regarding surgical site infections (SSI). However, the most common complications observed in both groups were wound dehiscence and, in the case of linear closure, incisional hernia. These findings are important to consider in clinical decision-making for managing patients with stomas.

Future research should focus on evaluating the use of prophylactic meshes in stoma closure to prevent incisional hernias. Additionally, it would be valuable to assess the impact of comorbidities such as obesity and diabetes on the development of postoperative complications.

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