ORIGINAL ARTICLE

Incidence of Stoma-Related Complications after Loop Colostomy and Loop Ileostomy: A Single-Center Retrospective Cohort Study

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Background: Stoma formation is a common surgical procedure for managing colorectal conditions. Although it offers significant therapeutic benefits, stoma-related complications remain a major concern, adversely affecting patient outcomes and quality of life.

Objective: To determine the incidence of complications following stoma creation and to identify factors associated with their occurrence.

Materials and Methods: The present study was a single-center retrospective cohort study that included patients who underwent colostomy or ileostomy at the authors' institution between 2021 and 2022. Univariable and multivariable logistic regression analyses were conducted to identify factors associated with stoma-related complications.

Results: Among 120 patients, postoperative complications occurred in 32 patients (26.67%). Complication rates by stoma type were 46.7% (7 out of 15) for ileostomy, 17.3% (13 out of 75) for transverse colostomy, and 40.0% (12 out of 30) for sigmoid colostomy. The most common complications were parastomal dermatitis in 20 cases (16.6%), and mucocutaneous separation in eight cases (6.6%). Univariable and multivariable analyses revealed that ileostomy (adj. OR 4.02, 95% CI 1.2 to 13.53, p=0.025), sigmoid colostomy (adj. OR 3.62, 95% CI 1.36 to 9.59, p=0.010), and cancer-related (adj. OR 0.27, 95% CI 0.08 to 0.91, p=0.216) were the significant factors affected complication rates.

Conclusion: The overall complication rate was 26.67%. Transverse colostomy was associated with fewer complications than ileostomy and sigmoid colostomy. Patients with non-cancer-related conditions experienced a higher complication rate. These findings suggest that stoma type and indication should be carefully considered during surgical planning to reduce postoperative complications.

Keywords: Stoma; Colostomy; Ileostomy; Complication

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Colostomy and ileostomy are common surgical interventions for patients with colorectal diseases, used to divert fecal flow in cases of obstruction, perforation, anastomotic protection, or poor healing conditions. Although they are often lifesaving, these procedures are associated with significant complications that may impair quality of life and increase morbidity. The indications for stoma creation range from benign conditions such as perforated diverticulitis to malignant diseases like colorectal cancer such as obstructing colonic tumors[1].

Stomas can be broadly categorized as temporary or permanent, and further subdivided into end or loop configurations, depending on surgical indication. Temporary loop stomas, such as loop ileostomy or colostomy, are commonly used to protect distal anastomoses or divert stool in reversible conditions. In contrast, permanent end stomas are typically created when the distal bowel cannot be preserved or safely anastomosed, such as in abdominoperineal resection. Hartmann's procedure, often performed in emergency settings, involves creating an end colostomy with rectal stump closure.

The current gold standard for managing locally advanced rectal cancer, at stages T3 and 4 and N1 and 2, includes neoadjuvant concurrent chemoradiation therapy (CCRT) followed by total mesorectal excision (TME)[2-4]. This multimodal approach effectively

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downstages tumors and significantly lowers local recurrence rates[5-8]. However, evidence suggests that preoperative chemoradiation may increase the risk of anastomotic leakage[6,9-11]. To mitigate this risk, protective stoma during TME has become widely adopted, as it reduces the severity of complications associated with anastomotic failure[12-15].

As a result, the frequency of colostomy and ileostomy formation has increased and despite their therapeutic benefits, stoma-related complications such as dermatitis, prolapse, hernia, and high output can negatively impact outcomes and require additional interventions. Previous studies have reported complication rates ranging between 34% and 56%[16-28]. These complications can significantly impair the patients' quality of life and contribute to increased morbidity[29-32].

The present study institution, a tertiary care, managed a high volume of patients with colorectal cancer and those requiring stoma formation. Evaluating the incidence and risk factors of stoma-related complications is essential for benchmarking outcomes against international standards, identifying modifiable risk factors, and implementing strategies to improve patient care and surgical outcomes.

Materials and Methods

Study design and setting

The present study was a retrospective descriptive study that analyzed data from all patients who underwent colostomy or ileostomy procedures at Vajira Hospital between 2021 and 2022. The follow-up period ranged from one to twelve months. The primary objectives were to determine the incidence of stoma-related complications and to identify factors influencing their occurrence. Stoma-related complications assessed in the present study included wound infection, mucocutaneous separation, stoma ischemia or necrosis, stoma prolapse, stoma retraction, parastomal hernia, parastomal dermatitis, and high-output stoma. High-output stoma was defined as a stomal output exceeding 1,500 mL for many consecutive days, resulting in dehydration, electrolyte imbalance, or acute kidney injury[16-28].

Data were collected on various clinical and demographic variables, including gender, age, body mass index (BMI), serum albumin level, hemoglobin level, underlying and primary diseases, type of primary operation, operative time, metastatic status, urgency of surgery, prior abdominal surgery, stoma type such as colostomy or ileostomy, and stoma construction type. Patients with incomplete data, such as missing medical records or operative notes, were excluded from the analysis.

The requirement for informed consent was waived because the dataset does not contain personal identification or other personal identifiers. Ethical approval for the study was obtained from the Vajira Institutional Review Board (VIRB), Faculty of Medicine, Vajira Hospital (Bangkok), number 109/64 E.

Statistical analysis

All data were securely stored in Google Sheets. Statistical analyses were performed using PASW Statistics for Windows, version 18.0 (SPSS Inc., Chicago, IL, USA). Patients were stratified into two groups based on the presence or absence of postoperative complications. For categorical variables, crude odds ratios (ORs) were calculated using logistic regression analysis. The Pearson chi-square test and Fisher's exact test were applied where appropriate to assess associations between categorical variables. For continuous variables, descriptive statistics, including mean and median values, were calculated, and comparisons between groups were conducted using independent samples t-test. Variables with a p-value less than 0.20 in the univariable analysis were included in the multivariable logistic regression model. This threshold was selected to avoid excluding potentially important predictors too early in the modeling process, a common approach in clinical observational studies to maintain model sensitivity.

Adjusted odds ratios (aORs) were determined using a backward stepwise logistic regression model. Variables with p-value of less than 0.20 in the univariable analysis were initially included, and the model iteratively removed non-significant variables using p-value of more than 0.10, until the final model retained only independent predictors. This method was used to optimize model simplicity while retaining key explanatory variables. Statistical significance was defined as a p-value of less than 0.05.

Results

One hundred forty-three patients who underwent colostomy and ileostomy procedures at Vajira Hospital between 2021 and 2022 were initially identified. Following a thorough review of medical records, 23 patients were excluded based on predefined exclusion criteria, resulting in 120 patients included in the final analysis. Detailed demographic and clinical data are presented in Table 1. The mean

Table 1. Demographic data

Patient characteristic	n=120
Age (years); mean±SD	62±14
Range	22 to 93
BMI (kg/m^2); mean±SD	22.34±4.49
Range	14.57 to 37.24
Albumin (g/dL); mean±SD	3.4±0.8
Range	0.9 to 4.9
Hemoglobin (g/dL); mean±SD	11.2±2.1
Range	6.7 to 17.8
Operative time (minutes); mean±SD	191±145
Range	30 to 585
Total blood loss (mL); mean±SD	412±751
Range	2 to 4,000
Sex; n (%)	
Male	65 (54.2)
Female	55 (45.8)
Primary disease; n (%)	
Colorectal cancer	93 (77.5)
Recto-vaginal/colo-vesicle fistula	9 (7.5)
Diverticulitis	6 (5.0)
Gynecological cancer	6 (5.0)
Trauma with colon injury	2 (1.6)
Colitis with bowel gangrene	2 (1.6)
Pelvic sarcoma	1 (0.8)
TB ileal perforation	1 (0.8)
Operative procedure; n (%)	
Major anatomical resection with stoma formation	54 (45.0)
• Anterior resection	3
• Low anterior resection	8
• Ultralow anterior resection	9
• Abdominoperineal resection	8
• Lt hemicolectomy	4
• Rt hemicolectomy	4
• Sigmoidectomy	7
• Pelvic exenteration	4
• Subtotal colectomy	1
• Non oncologic bowel resection	6
Stoma formation without anatomical resection	66 (55.0)
• Trephine incision	49
• Explore laparotomy to stoma formation	17
Type of stoma; n (%)	
Ileostomy	15 (12.5)
Transverse Colostomy	75 (62.5)
Sigmoid Colostomy	30 (25.0)
Stoma construction; n (%)	
Loop	88 (73.3)
End	29 (24.2)
Double barrel	3 (2.5)
Patients underlying disease; n (%)	
Hypertension	52 (43.4)
Diabetes mellitus	26 (21.6)
Dyslipidemia	28 (23.3)
Chronic kidney disease	5 (4.2)
Congestive heart failure	10 (8.3)
Cirrhosis	2 (1.6)
Prior abdominal surgery; n (%)	34 (28.3)
Urgency of surgery; n (%)	60 (50.0)

SD=standard deviation; BMI=body mass index; TB=tuberculosis

age of the patients was 62 years. The cohort consisted of 65 male patients (54.2%) and 55 female patients (45.8%). The mean BMI was 22.34 kg/m².

Regarding underlying diagnoses, 93 patients (77.5%) were treated for colorectal cancer, nine patients (7.5%) had rectovaginal or colovesical fistulas, six patients (5.0%) were diagnosed with diverticulitis, and six patients (5.0%) had gynecological malignancies. In terms of surgical procedures, 54 patients (45.0%) underwent major oncologic resection combined with stoma creation, while 66 patients (55.0%) underwent stoma formation without organ resection. Among the latter group, 49 patients underwent a trephine incision, whereas 17 patients required exploratory laparotomy for stoma creation. Indications for exploratory laparotomy included failure to mobilize the colon through the trephine incision due to extensive bowel adhesions, bowel dilation, or intraoperative identification of advanced unresectable tumors. Stoma types were distributed as 15 patients (12.5%) received an ileostomy, 75 patients (62.5%) underwent transverse colostomy, and 30 patients (25.0%) underwent sigmoid colostomy. Regarding stoma construction techniques, 88 patients (73.3%) had a loop type, 29 patients (24.2%) had an end type, and three patients (2.5%) had a double-barrel colostomy.

As detailed in Table 2, 32 stoma-related complications were identified, reflecting an overall incidence of 26.67%. The most frequently observed complication was parastomal dermatitis, accounting for 20 cases (16.67%), followed by mucocutaneous separation in eight cases (6.67%). Other complications included stomal necrosis in six cases (5.0%), one of them required reoperation for colostomy revision, stomal retraction in four cases (3.33%), stomal

Table 2. Stoma-related complications stratified by stoma type with statistical comparison (n=120)

Stoma complication	Event number, n=32 (26.67%); n (%)	Ileostomy, n=15 (12.5%); n (%)	Colostomy, n=105 (87.5%); n (%)	p-value
Parastomal dermatitis	20 (16.67)	6 (40.00)	14 (13.33)	0.019
Mucocutaneous separation	8 (6.67)	1 (6.67)	7 (6.67)	1.000
Stomal Necrosis	6 (5.00)	0 (0.00)	6 (5.71)	1.000
Stomal retraction	4 (3.33)	1 (6.67)	3 (2.86)	0.418
Stomal prolapse	3 (2.50)	0 (0.00)	3 (2.86)	1.000
Stomal stenosis	1 (0.83)	0 (0.00)	1 (0.95)	1.000
Parastomal hernia	1 (0.83)	0 (0.00)	1 (0.95)	1.000
High output ostomy	6 (5.00)	6 (40.00)	0 (0.00)	<0.001

prolapse in three cases (2.5%), stomal stenosis in one case (0.83%), parastomal hernia in one case (0.83%).

Additionally, there were six cases (5.0%) of high-output ostomy, with two patients requiring hospital readmission for intravenous fluid resuscitation due to dehydration and acute kidney injury. The remaining complications were managed conservatively on an outpatient basis. Three out of 32 patients (9.4%) required surgical or inpatient interventions, while the rest were managed with wound care or medical treatment.

Of the 120 patients, 15 patients (12.5%) underwent ileostomy, while 105 (87.5%) underwent colostomy. Parastomal dermatitis was significantly more common in the ileostomy group, occurring in six out of fifteen patients (40.0%) compared to 14 of 105 patients (13.3%) in the colostomy group (p=0.019). The incidence of stomal retraction was slightly higher in the ileostomy group with one patient (6.67%) compared to the colostomy group with three patients (2.86%), though this difference was not statistically significant. Notably, high-output ostomy was a significant complication in the ileostomy group, affecting six out of fifteen patients (40.0%), whereas no cases were observed in the colostomy group (p<0.001), indicating a statistically significant difference.

The univariable analysis is summarized in Table 3. Patients younger than 60 years (OR 2.43, 95% CI 1.06 to 5.55, p=0.035), those with an ileostomy (OR 4.17, 95% CI 1.29 to 13.55, p=0.017), sigmoid colostomy (OR 3.18, 95% CI 1.24 to 8.17, p=0.016), and those who underwent exploratory laparotomy for stoma formation (OR 5.77, 95% CI 1.71 to 19.47, p=0.005) were at increased risk of stoma-related complications, contrary to patients with cancer-related conditions (OR 0.31, 95% CI 0.10 to 0.97, p=0.043).

In the multivariable analysis, both ileostomy (aOR 4.02, 95% CI 1.20 to13.53, p=0.025) and sigmoid colostomy (aOR 3.62, 95% CI 1.36 to 9.59, p=0.010) were significantly associated with an increased risk of stoma-related complications. Conversely, cancer-related cases were associated with a significantly reduced risk of complications (aOR 0.27, 95% CI 0.08 to 0.91, p=0.0216). Regarding the type of surgical approach, exploratory laparotomy for stoma creation was significantly associated with an increased risk of complications in the univariable analysis. However, this association was not statistically significant in the multivariable model (aOR 2.54, 95% CI 0.58 to 11.14, p=0.216).

Discussion

The present study's overall rate of stoma-related complications was 26.67%, which appears lower than previous reports. Data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) demonstrated a complication rate of 37% in elective stoma cases and up to 55% in emergency operations[33].

The most common complication was parastomal dermatitis, occurring in 20 cases (16.67%), followed by mucocutaneous separation in eight cases (6.67%), stomal necrosis in six cases (5%), and high-output ostomy in six cases (5%).

When comparing complication rates between the ileostomy and colostomy groups, ileostomy patients experienced significantly higher rates of parastomal dermatitis at 40.0% versus 13.3% (p=0.019) and were exclusively affected by high-output ostomy at 40.0% (p<0.001). The higher rate of parastomal dermatitis in ileostomy patients may be attributed to the enzymatic and alkaline nature of ileal effluent, which contains digestive enzymes such as bile salts and pancreatic secretions. These irritants can rapidly break down peristomal skin, especially in cases of leakage or improper pouching techniques. In contrast, colostomy output is more formed and less chemically irritating, resulting in a lower incidence of skin complications.

Table 3. Univariable and multivariable logistic regression analysis of risk factors for stoma-related complications

Factor	Complications (n=32) n (%)	Univariable analysis			Multivariable analysis		
		OR	95% CI	p-value	Adjusted OR	95% CI	p-value
Age (years)							
<60	17 (37.8)	2.43	1.06 to 5.55	0.035	2.35	0.94 to 5.90	0.068
≥60	15 (20.0)	1.00	Reference				
Sex							
Male	18 (27.7)	1.12	0.50 to 2.53	0.782			
Female	14 (25.5)	1.00	Reference				
BMI (kg/m^2)							
≥30	3 (42.9)	2.17	0.46 to 10.29	0.328			
<30	29 (25.7)	1.00	Reference				
Operative time (minutes)							
≥150	14 (24.6)	0.81	0.36 to 1.84	0.620			
<150	18 (28.6)	1.00	Reference				
Blood looss (mL)							
≥500	6 (25.0)	0.90	0.32 to 2.51	0.837			
<500	26 (27.1)	1.00	Reference				
Hemoglobin (g/dL)							
≥12	26 (29.5)	1.82	0.67 to 4.93	0.241			
<12	6 (18.8)	1.00	Reference				
Albumin (g/dL)							
≤2.8	11 (33.3)	1.57	0.66 to 3.77	0.311			
>2.8	21 (24.1)	1.00	Reference				
Stoma type							
Ileostomy	7 (46.7)	4.17	1.29 to 13.55	0.017	4.02	1.20 to 13.53	0.025
Sigmoid colostomy	12 (40.0)	3.18	1.24 to 8.17	0.016	3.62	1.36 to 9.59	0.010
Transverse colostomy	13 (17.3)	1.00	Reference				
Stoma construction							
End type	15 (27.8)	1.79	0.72 to 4.46	0.212			
Double barrel type	9 (52.9)	6.80	0.59 to 78.93	0.125			
Loop type	8 (16.3)	1.00	Reference				
Operation type							
Major anatomical resection with stoma formation	15 (27.8)	1.11	0.49 to 2.50	0.482			
Stoma formation without anatomical resection	17 (25.8)	1.00	Reference				
Surgical technique							
Explore laparotomy to stoma formation	9 (52.9)	5.77	1.71 to 19.47	0.005	2.54	0.58 to 11.14	0.216
Trephine incision	8 (16.3)	1.00	Reference				
Cancer related							
Yes	25 (23.6)	0.31	0.10 to 0.97	0.043	0.27	0.08 to0.91	0.216
No	7 (50.0)	1.00	Reference				
Urgency surgery							
Yes	19 (31.7)	1.68	0.74 to 3.81	0.218			
No	13 (21.7)	1.00	Reference				
Vergin abdomen							
Yes	22 (25.6)	0.83	0.34 to 1.99	0.669			
No	10 (29.4)	1.00	Reference				

OR=odds ratio; CI=confidence interval; BMI=body mass index

High-output ostomy was observed exclusively in ileostomy patients. This condition is more common in ileostomies due to the absence of colonic reabsorption and the liquid consistency of small bowel output. When output exceeds 1.5 to 2 liters per day, it can lead to dehydration, electrolyte imbalance, and acute kidney injury. The risk increases during the early postoperative period before intestinal adaptation occurs.

The present study analysis revealed that both ileostomy and sigmoid colostomy were significantly associated with increased rates of stoma-related complications. In addition, stomas created for non-cancer-related conditions appeared to have higher complication rates than those created for colorectal cancer. Several factors may explain this. First, patients with benign but complicated conditions such as perforated diverticulitis, inflammatory bowel disease, or peritonitis, often undergo emergency surgery under suboptimal physiological conditions, which may impair wound healing and stoma maturation. Second, elective cancer surgeries typically involve more controlled intraoperative environments and careful preoperative planning, including stoma site marking and patient education, all of which can reduce postoperative complications. Third, inflammation and local sepsis, more common in benign disease, may compromise tissue integrity and blood supply at the stoma site, increasing the risk of mucocutaneous separation, necrosis, or retraction. These findings emphasize the importance of optimized stoma formation techniques, careful patient selection, and perioperative management, particularly in emergency or non-oncologic settings.

The present study outcome may be attributed to the fact that non-cancer-related diseases, such as perforated diverticulitis or inflammatory bowel disease, often present with severe abdominal inflammation and require emergency surgery. These scenarios are frequently associated with confounding factors, including intra-abdominal sepsis, hemodynamic instability, lack of preoperative stoma site marking, and limited operative planning time, all of which may contribute to an increased risk of stoma-related complications.

Based on the present study findings, several strategies can be implemented in clinical practice to reduce the risk of stoma-related complications. These include preoperative stoma site marking by an enterostomal therapist, especially in high-BMI or emergency cases, meticulous assessment of mesenteric tension and blood supply during stoma creation, and early postoperative monitoring for high-output ostomy and skin complications. In patients with non-cancer-related diseases presenting with peritonitis or hemodynamic compromise need careful intraoperative decision-making regarding stoma type and location as it is critical.

Enhanced patient education, standardized follow-up, and early involvement of stoma care teams have also been shown to reduce complication rates and improve quality of life[34,35].

Therefore, future studies with larger patient cohorts and longer follow-up are warranted to clarify these associations and refine risk-adapted stoma care protocols.

The present study has limitations. First, its retrospective design may be subject to incomplete data collection and missing records, which could lead to information bias. Second, it was conducted at a single tertiary care center, potentially limiting the generalizability of the findings to broader populations. Third, the sample size, particularly for the ileostomy subgroup, was small, which may reduce the statistical power to detect certain associations. Fourth, potential selection and reporting biases inherent in retrospective data collection may have influenced the results. Finally, the follow-up duration of less than one year may not have captured late-onset complications such as parastomal hernia or stomal prolapse. Further prospective, multicenter studies with larger sample sizes and longer follow-up are warranted to confirm and expand upon these findings.

Conclusion

The overall stoma-related complication rate was 26.67%, with parastomal dermatitis being the most common. Stoma type significantly influenced complication rates, with ileostomy and sigmoid colostomy associated with higher complication rates than transverse colostomy. Moreover, stomas created for non-cancer-related conditions had a higher complication incidence than those for cancer-related indications. Based on these findings, surgeons should consider several factors during stoma creation. These include selecting the optimal stoma site, preferably marked preoperatively by an enterostomal therapist, ensuring adequate mesenteric length and tension-free mobilization, and avoiding excessive traction, particularly in obese patients or those undergoing emergency surgery. When feasible, transverse colostomy may be a favorable option in high-risk cases due to its lower complication profile. Further studies with larger sample sizes and longer follow-up

are warranted to validate these findings and guide evidence-based stoma creation strategies.

What is already known about this topic?

Stoma formation is common for colorectal conditions, but complications frequently occur, impacting patient outcomes.

What does this study add?

This study highlights the incidence of complications following stoma formation and identifies significant risk factors. Parastomal dermatitis was the most common complication, with ileostomy having higher complication rates than colostomy.

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Conflicts of interest

The authors declare that there are no conflicts of interest related to this study.

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