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Original Research Article

Timing of loop ileostomy closure and its relationship with early postoperative outcomes: experience from a Bangladeshi tertiary care hospital

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ABSTRACT

Background: Temporary loop ileostomy is commonly constructed to protect distal intestinal anastomoses; however, the optimal timing of reversal remains uncertain. Both premature and prolonged closure may influence postoperative morbidity. This study aimed to assess the relationship between timing of loop ileostomy closure and early postoperative outcomes in a Bangladeshi tertiary care hospital.
Methods: This prospective observational study was conducted in the Department of Surgery, Rajshahi Medical College Hospital, from January 2022 to December 2023, among 60 patients undergoing loop ileostomy closure. Patients were categorized by closure timing: early (4-8 weeks), intermediate (>8-12 weeks), and delayed (>12 weeks). Early postoperative outcomes included overall complications, wound infection, anastomotic leakage, bowel obstruction, Clavien-Dindo grade, drain-retention duration, and postoperative hospital stay. Data were analyzed using Chi-square test, tests for continuous variables, and binary logistic regression ($p<0.05$ was considered statistically significant).
Results: Of 60 patients, 18 (30.0%) underwent early, 24 (40.0%) intermediate, and 18 (30.0%) delayed closure. Overall complication rates were 50.0%, 54.2%, and 88.9%, respectively, showing a significant association with closure timing ($p=0.026$). Wound infection, anastomotic leakage, and bowel obstruction occurred in 23.3%, 15.0%, and 10% of patients, respectively. Mean postoperative hospital stay increased from 7.4±1.9 days in the early group to 9.5±2.5 days in delayed group ($p=0.021$). After adjustment for age, sex, BMI, and malignancy, closure >12 weeks remained independently associated with postop complications (adjusted OR 6.75; 95% CI-1.20-37.90; $p=0.030$).
Conclusions: Delayed loop ileostomy closure was associated with greater early postoperative morbidity and prolonged hospital stay. Appropriate patient selection and timely reversal may contribute to improved postoperative outcomes.

Keywords: Loop ileostomy, Ileostomy closure, Timing, Postoperative complications, Clavien-Dindo, Bangladesh

INTRODUCTION

Temporary loop ileostomy is widely used in colorectal surgery to divert the faecal stream and reduce the clinical consequences of distal anastomotic leakage. Although intended to be temporary, the stoma can cause dehydration, electrolyte disturbance, skin complications, obstruction, and psychosocial burden, while its closure requires a second operation with morbidity. A systematic review of 6,107 ileostomy reversals reported an overall

morbidity of 17.3%, with small-bowel obstruction and wound infection among the most frequent complications.[1]

The appropriate timing of loop ileostomy closure remains controversial. Closure is usually planned after adequate recovery and healing of the distal anastomosis, but may be delayed by postoperative complications, adjuvant treatment, comorbidity, or service-related factors. Studies have therefore examined whether earlier closure can reduce stoma-related burden without increasing surgical risk. In the EASY randomized trial, closure 8-13 days after rectal cancer surgery was feasible in carefully selected patients without evidence of anastomotic leakage and was associated with fewer overall complications than closure after 12 weeks.[2] A meta-analysis of randomized trials similarly suggested that early closure can achieve broadly comparable postoperative outcomes, although the evidence was heterogeneous.[3] Conversely, Bausys et al reported higher 30-day morbidity after closure at 30 days than after standard closure at 90 days, emphasizing the importance of patient selection and timing.[4]

Subsequent reviews have continued to demonstrate uncertainty regarding a universally applicable interval.[5,6] Observational evidence has also raised concern about excessive delay. Khoo et al found that later reversal was associated with less favourable postoperative outcomes, while Turner et al demonstrated increasing complication rates and longer hospital stay with prolonged stoma duration.[7,8] More recent studies have identified time to reversal as a predictor of stoma-related complications or readmission after delayed closure.[9,10]

Evidence examining closure timing and early postoperative outcomes remains limited in Bangladeshi tertiary-care settings. Therefore, this study aimed to evaluate the timing of loop ileostomy closure and its relationship with early postoperative complications and recovery among patients treated at a tertiary care hospital in Bangladesh.

METHODS

Study design and population

This prospective observational study was conducted in the Department of Surgery, Rajshahi Medical College Hospital, Bangladesh, from January 2022 to December 2023. The study population comprised patients undergoing loop ileostomy closure during the study period, and a total of 60 patients were recruited using purposive sampling. Patients aged >13 years with a loop ileostomy in situ were eligible.

Patients with an ileostomy duration of less than one month, absence of intestinal luminal patency on distal loopogram, active tuberculosis, active inflammatory bowel disease, recent steroid therapy or chemoradiation, serum albumin <2.5 g/dL, or inability to provide informed consent were excluded.

Preoperative evaluation and surgical procedure

Before closure, distal loopogram was performed to confirm bowel patency and integrity. Standard bowel preparation and prophylactic antibiotics were administered, and loop ileostomy closure was performed according to the routine surgical technique practiced at the institution. The principal exposure variable was the interval between ileostomy creation and closure, expressed in weeks or months. Early postoperative outcomes (occurring from the date of loop ileostomy closure up to the 30th postoperative day) included wound infection, anastomotic leakage, bowel obstruction, bleeding, Clavien-Dindo complication grade, duration of drain retention, and postoperative hospital stay. Patients were assessed during hospitalization and followed up until the 30th postoperative day through clinical visits and telephone communication.

Outcome measures and definitions

The timing of loop ileostomy closure was defined by the interval between the date of loop ileostomy creation and the date of its surgical closure, expressed in weeks or months. Clavien-Dindo complication grading was done for severity classification of postoperative complications according to the treatment required, ranging from Grade I to Grade V. Drain-retention duration was defined by the number of postoperative days from ileostomy closure until removal of the surgical drain, and the postoperative hospital stay was determined by the number of days from the date of loop ileostomy closure to hospital discharge. Any postoperative complication was considered by the presence of at least one documented postoperative complication during the 30-day follow-up period.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 27.0. Continuous variables were summarized as mean±standard deviation when normally distributed and as median with range or interquartile range when non-normally distributed. Categorical variables were presented as frequency and percentage. The interval between ileostomy formation and closure was analyzed primarily as a continuous variable and, where appropriate, was also categorized according to clinically relevant timing groups. Associations between timing categories and categorical postoperative outcomes were assessed using the Chi-square test or Fisher's exact test. Continuous postoperative outcomes, including hospital stay and drain-retention duration, were compared using the independent-samples t test or Mann-Whitney U test according to data distribution. Correlation between closure interval and continuous outcomes was assessed using Pearson's or Spearman's correlation as appropriate. Binary logistic regression was performed to evaluate whether timing of closure was independently associated with postoperative complications after adjustment for

relevant covariates. A two-sided p<0.05 was considered statistically significant.

RESULTS

A total of 60 patients undergoing loop ileostomy closure were included in the study. The mean age was 45.1±15.5 years, with males accounting for 70.0% of the participants. The mean BMI was 18.8±3.4 kg/m², and more than half of the patients were underweight. Malignant diseases accounted for approximately half of the original indications, while 56.7% of patients were classified as having high nutritional risk according to MUST (Table 1).

Patients were divided into early, intermediate, and delayed closure groups according to the interval between ileostomy formation and reversal. The largest proportion, 40.0%, underwent closure between >8 and 12 weeks. Early closure within 4-8 weeks and delayed closure beyond 12 weeks each accounted for 30.0% of the study population. The mean interval between ileostomy formation and closure was 11.1±4.6 weeks (Table 2).

Carcinoma of the rectum was the most common primary diagnosis, accounting for 20 of the 60 patients. Carcinoma of the colon and traumatic ileal perforation were the next most frequent indications, with 11 patients each (Table 3).

Postoperative complications occurred in 38 of the 60 patients. The complication rate was 50.0% in the early closure group and 54.2% among patients undergoing closure between >8 and 12 weeks. In contrast, 88.9% of patients in the delayed closure group developed at least one postoperative complication. The difference across the three timing groups was statistically significant (p=0.026), suggesting possible relationship between prolonged delay and early postop morbidity (Table 4).

Wound infection was the most frequent individual postoperative complication, followed by anastomotic leakage and bowel obstruction. Numerically, wound infection, anastomotic leakage, and bowel obstruction were more common among patients undergoing delayed closure. However, none of the individual complication types showed a statistically significant difference across the three timing groups. This suggests that the significant difference in overall morbidity was not attributable to a single type of postoperative complication alone (Table 5).

Overall, 22 patients had no postoperative complication, while Grade I, Grade II, and Grade III complications occurred in 13, 15, and 10 patients, respectively. A greater proportion of Grade II and III complications was observed among patients in the delayed closure group. In contrast, patients undergoing early or intermediate closure more frequently had either no complication or Grade I morbidity. Nevertheless, the overall distribution of Clavien-Dindo grades across timing groups did not reach statistical significance (χ^2=11.35; p=0.078) (Table 6).

The mean duration of drain retention showed a gradual increase from the early to delayed closure group. However, this difference was not statistically significant, with a p-value of 0.247. Mean postoperative hospital stay increased from 7.4 ± 1.9 days in the early group to 9.5±2.5 days in the delayed group. This difference was statistically significant (p=0.021), indicating that delayed closure was associated with a longer postoperative hospital stay (Table 7).

More than half of the patients were underweight according to BMI, and a similar proportion belonged to the high-risk category according to MUST. No statistically significant difference was identified in MUST-based nutritional risk according to the timing of ileostomy closure. These findings indicate that the observed difference in postoperative outcome between timing groups was unlikely to be explained solely by differences in baseline nutritional category (Table 8).

A multivariable binary logistic regression model was constructed with occurrence of any postoperative complication as the dependent variable. After adjustment for age, sex, BMI, and malignant disease, intermediate closure did not show a significant association with postoperative complications. Delayed closure beyond 12 weeks remained independently associated with postoperative morbidity, with an adjusted odds ratio of 6.75. Patients undergoing delayed closure therefore had higher adjusted odds of developing a complication compared with those undergoing closure at 4-8 weeks (adjusted OR 6.75; 95% CI 1.20-37.90; p=0.030) (Table 9).

Table 1: Baseline demographic and clinical characteristics of the study participants.

Characteristics	Value
Age (in years), mean±SD	45.1±15.5
Age, median (range), (in years)	45 (14-75)
Male	42 (70.0%)
Female	18 (30.0%)
BMI, kg/m², mean±SD	18.8±3.4
BMI <18.5 kg/m²	34 (56.7%)
Benign primary disease	29 (48.3%)
Malignant primary disease	31 (51.7%)

Continued.

Characteristics	Value
MUST low risk	19 (31.7%)
MUST moderate risk	7 (11.7%)
MUST high risk	34 (56.7%)

*Values are presented as mean±SD, median (range), or n (%). BMI: Body Mass Index; MUST: Malnutrition Universal Screening Tool; SD: Standard Deviation.

Table 2: Distribution of patients according to timing of loop ileostomy closure.

Timing of closure	N	Percent (%)	Interval, mean±SD (weeks)
Early: 4-8 weeks	18	30.0	6.3±1.4
Intermediate: >8-12 weeks	24	40.0	10.4±1.1
Delayed: >12 weeks	18	30.0	16.9±3.0
Total	60	100.0	11.1±4.6

Table 3: Primary disease according to timing of loop ileostomy closure.

Primary disease	Early: 4-8 weeks, (n=18)	Intermediate: >8-12 weeks, (n=24)	Delayed: >12 weeks, (n=18)	Total, (n=60)
Carcinoma of rectum	5	9	6	20
Carcinoma of colon	3	5	3	11
Traumatic ileal perforation	4	3	4	11
Typhoid ulcer perforation	3	3	2	8
Tubercular ulcer perforation	2	2	2	6
Strangulated inguinal hernia	1	1	1	3
Traumatic caecal perforation	0	1	0	1
Total	18	24	18	60

Table 4: Association between timing of ileostomy closure and occurrence of postoperative complications.

Postoperative outcome	Early: 4-8 weeks, (n=18)	Intermediate: >8-12 weeks, (n=24)	Delayed: >12 weeks, (n=18)	Total, (n=60)	P value
No complication	9 (50.0%)	11 (45.8%)	2 (11.1%)	22 (36.7%)	-
Any complication	9 (50.0%)	13 (54.2%)	16 (88.9%)	38 (63.3%)	0.026
Total	18 (100.0%)	24 (100.0%)	18 (100.0%)	60 (100.0%)	-

*Values are presented as n (%). Chi-square test was used; $p<0.05$ was considered statistically significant.

Table 5: Specific postoperative complications according to timing of ileostomy closure.

Complication	Early: 4-8 weeks, (n=18)	Intermediate: >8-12 weeks, (n=24)	Delayed: >12 weeks, (n=18)	Total	P value
Wound infection	3	5	6	14 (23.3%)	0.464
Anastomotic leakage	2	3	4	9 (15.0%)	0.586
Bowel obstruction	1	2	3	6 (10.0%)	0.507
Bleeding	1	1	0	2 (3.3%)	0.622
Miscellaneous	2	3	3	8 (13.3%)	0.876

*Values are presented as counts and n (%). Chi-square/Fisher's exact test was used; $p<0.05$ was considered statistically significant.

Table 6: Clavien-Dindo postoperative complication grades according to timing of closure.

Clavien-Dindo grade	Early: 4-8 weeks, (n=18)	Intermediate: >8-12 weeks, (n=24)	Delayed: >12 weeks, (n=18)	Total
No complication	9	11	2	22 (36.7%)
Grade I	4	6	3	13 (21.7%)
Grade II	3	5	7	15 (25.0%)
Grade III	2	2	6	10 (16.7%)
Grade IV-V	0	0	0	0 (0.0%)
Total	18	24	18	60 (100.0%)

*Values are presented as counts and n (%). $\chi^2=11.35$, $p=0.078$.

Table 7: Postoperative drain retention and hospital stay according to timing of ileostomy closure.

Outcomes (in days)	Early: 4-8 weeks, (n=18)	Intermediate: >8-12 weeks, (n=24)	Delayed: >12 weeks, (n=18)	P value
Drain retention	6.2±1.0	6.5±1.2	6.9±1.5	0.247
Hospital stay	7.4±1.9	8.2±2.2	9.5±2.5	0.021

*Values are presented as mean ± SD. One-way ANOVA was used; p<0.05 was considered statistically significant.

Table 8: Preoperative nutritional status according to timing of ileostomy closure.

Nutritional variables	Early: 4-8 weeks, (n=18)	Intermediate: >8-12 weeks, (n=24)	Delayed: >12 weeks, (n=18)	Total, (n=60)	P value
BMI category					
<18.5 kg/m²	9	14	11	34	
18.5-22.9 kg/m²	7	7	5	19	0.955
≥23.0 kg/m²	2	3	2	7	
MUST risk category					
Low	6	8	5	19	
Moderate	2	3	2	7	0.993
High	10	13	11	34	

*Values are presented as counts (n). Chi-square test was used; p<0.05 was considered statistically significant. BMI: Body Mass Index; MUST: Malnutrition Universal Screening Tool.

Table 9: Multivariable logistic regression for factors associated with postoperative complications.

Variables	Adjusted OR	95% CI	P value
Closure: 4-8 weeks	1.00	Reference	-
Closure: >8-12 weeks	1.20	0.32-4.49	0.786
Closure: >12 weeks	6.75	1.20-37.90	0.030
Age, per year	1.01	0.97-1.06	0.610
Male sex	1.12	0.31-4.03	0.865
BMI, per kg/m²	0.91	0.75-1.11	0.351
Malignant disease	1.36	0.36-5.20	0.651

*Binary logistic regression; dependent variable: occurrence of any postoperative complication. CI: Confidence Interval; OR: Odds Ratio; BMI: Body Mass Index; p<0.05 was considered statistically significant.

DISCUSSION

The present analysis explored whether the interval between formation and reversal of a loop ileostomy was related to early postoperative outcome. The findings showed that overall complications were highest after closure beyond 12 weeks (p=0.026). Delayed closure was also associated with longer postoperative hospital stay (p=0.021), and closure after 12 weeks remained associated with morbidity (OR 6.75, 95% CI 1.20-37.90; p=0.030). These findings are consistent with evidence that prolonged diversion may increase postoperative morbidity.

Complication rates after ileostomy reversal reported in international literature are generally lower than those observed in the present study cohort. Chow et al reported 17.3% morbidity and 0.4% mortality among 6,107 reversals, while Baik and Bae reported 23.7% morbidity, with wound infection in 11.6% and small-bowel obstruction in 4.8%.[1,11] Turner et al found an overall complication rate of 21.5%.[8] By comparison, the present study recorded wound infection in 23.3%, anastomotic leakage in 15.0%, and bowel obstruction in 10.0%. This may reflect heterogeneous indications and frequent undernutrition in the study population.

Several studies support an association between prolonged delay and poorer outcomes. Baik and Bae identified longer time to closure as an independent risk factor (OR 1.977, 95% CI 1.167-3.350), while Nakamura et al reported an OR of 3.478 for an interval of six months or longer.[11,12] Turner et al observed complications rising from 8% within 90 days to 54% after 720 days.[8] Werner et al found fewer complications with closure within 150 days (p<0.001), and Liu et al reported increased risk with closure at ≥7 months (OR 5.88, 95% CI 2.38-14.56).[13,14] Similar concerns were reported by Abdalla and Scarpinata, Khoo et al and Cai et al.[7,10,15]

However, earlier closure is not universally superior. The EASY trial demonstrated fewer cumulative complications after closure at 8-13 days than after 12 weeks (1.2 vs 2.9; p<0.0001) in selected patients.[2] Conversely, Bausys et al reported higher 30-day morbidity with closure at 30 days than at 90 days (27.9% vs 7.9%; p=0.024).[4] Meta-

analyses by Farag et al, Menahem et al and O'Sullivan et al therefore emphasize careful patient selection rather than a universal early-closure policy.[3,16,17]

Timing should also be interpreted alongside patient and operative factors. Older age, higher ASA class, prolonged operative time, and nutritional impairment have been linked with complications.[18-20] Hypoalbuminaemia <3.5 g/dL carried an OR of 7.248 in Baik and Bae.[11] Early reversal may reduce stoma exposure and has demonstrated acceptable clinical and quality-of-life outcomes in selected patients.[21-23] Overall, closure should be individualized according to anastomotic healing, nutritional status, oncologic treatment, and clinical readiness.

In conclusion, the timing of loop ileostomy closure appears to be significantly related to early postoperative outcomes, with delayed closure beyond 12 weeks showing a markedly higher burden of complications and longer hospital stay. Timely reversal after adequate clinical recovery and confirmed anastomotic healing may therefore contribute to improved postoperative recovery and reduced morbidity. Nevertheless, closure timing should be individualized according to anastomotic integrity, nutritional condition, underlying disease, and overall patient fitness.

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