



## Original Research

## Does the timing of loop ileostomy closure affect outcome: A case-matched study

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## HIGHLIGHTS

- The optimal timing for the closure of loop ileostomies remains controversial.
- To the best of our knowledge, this study is the highest number (358 patients) of case-matched patients (179 patients each) to demonstrate that ileostomy closure (<3 months) has similar outcomes compared to ileostomy closure (≥3 months).

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## ABSTRACT

**Introduction:** The optimal timing for the closure of loop ileostomies remains controversial. The aim of this study is to determine whether ileostomy closure (<3 months post formation) affects stoma-related morbidity compared to late closure (≥3 months post formation).

**Methods:** All patients who had loop ileostomy and ileostomy closure between 2012 and 2015 were identified from an IRB-approved, prospectively maintained institutional database. The patients who underwent ileostomy closure (<3 months) were compared against matched patients undergoing ileostomy closure (≥3 months). The outcomes for the two groups were compared.

**Results:** A total of 358 patients were analyzed. Mean age was 46 ± 17 years. There were 179 patients in each group [ileostomy closure (<3 months) and ileostomy closure (≥3 months)]. Both groups were matched. Groups were comparable in preoperative characteristics and demographics. All of the perioperative variables were comparable. No difference was observed in estimated blood loss (EBL), operative time (OT) and length of stay (LOS) (all  $p > 0.05$ ). Postoperative outcomes including wound infection, post-operative bleeding, intra-abdominal abscess, ileus, small bowel obstruction (SBO), anastomotic leak, reoperation, surgery related readmission, postoperative transfusion were also similar among the groups ( $p > 0.05$ ).

**Conclusions:** Ileostomy closure (<3 months) is practical and safe. It does not increase morbidity and significantly reduces the time patient has a stoma. This may be advantageous in regards to having a reduced possibility of stoma related complications.

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## 1. Introduction

Colorectal anastomotic leak is a potentially life-threatening complication. Loop ileostomies are generally formed in colorectal surgery in order to defunction distal enteric disease or anastomoses [1,2]. Diverting loop ileostomy maybe helpful in reducing the consequences of an anastomotic leak and is considered by some

authors to reduce the incidence of anastomotic complications. In patients with high risk colorectal anastomoses, construction of a temporary loop ileostomy is an effective surgical adjunct in reducing both the rate of symptomatic anastomotic leaks and the need for reoperation in such cases [3–5]. This protective benefit is often at the expense of stoma-related morbidity. As many as 19–74% of ileostomy patients will experience ileostomy-related complications [6–9]. The optimal timing for the closure of loop ileostomies remains controversial.

In this study, our goal is to analyze the short- and long-term outcomes of ileostomy closure (<3 months) and ileostomy closure

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( $\geq 3$  months) and determine whether there is a difference in peri-operative outcome and post-operative morbidity related to the timing of closure.

## 2. Patients and methods

All patients who underwent a loop ileostomy and ileostomy closure between 2012 and 2015 were analyzed. Data was obtained from Cleveland Clinic review board-approved, prospectively maintained Crohn's disease, cancer, laparoscopy, pouch, and diverticular disease databases as well as from patient charts if necessary. Exclusion criteria included: No follow up or  $< 3$  months follow up, anastomotic leak from original surgery, palliative stoma, wound infection from original surgery, or organ failure. Initially, patients were divided into two groups according to ileostomy closure time: less than 3 months and more than 3 months. The groups were matched according to diagnosis, age, gender, BMI, index operation, comorbid factors, ASA score, type of anastomosis, management of ileostomy skin site.

Ileostomy closure operations were offered to patients that made an uneventful recovery from their index operation and had no evidence of anastomotic leak following investigation with a water-soluble contrast enema. BMI, age, comorbidities, preoperative steroids, chemotherapy, radiotherapy, American Society of Anesthesiologists score (ASA), LOS, EBL, were compared between the two groups. Peri-operative variables analyzed were: blood loss, operative time, type of anastomosis, management of ileostomy skin site. These were compared between two groups. Post-operative variables analyzed included: morbidity, wound infection, time to bowel movement, length of stay (LOS), post-operative bleeding, intra-abdominal abscess, postoperative ileus, postoperative SBO, anastomotic leak, surgery related readmission, reoperation, and post-operative transfusion. These variables were compared among the groups. All of the patients examined by water-soluble contrast enema before ileostomy closure. All peri-operative and post-operative outcomes were obtained from chart review.

Statistical significance was present when P value (two-sided) was less than 0.05. Categorical variables were reported as frequency (%) and quantitative variables are reported as mean  $\pm$  standard deviation. Categorical variables were analyzed with Chi-square or Fisher's exact test. Quantitative variables were analyzed with a Wilcoxon rank-sum test.

## 3. Results

Between 2012 and 2015, a total of 1132 patients underwent closure of their ileostomy met the inclusion and exclusion criteria, including 278 cases in group of closure time  $< 3$  months, 854 cases in group of closure time  $\geq 3$  months. However, based on case-matched criteria, only 358 patients were eligible for inclusion (179 ileostomy closure time  $< 3$  months and 179 closure time  $\geq 3$  month). Patient characteristics are described in Table 1. The ileostomy closure time was  $64.5 \pm 13.1$  and  $126.8 \pm 44.2$  days, respectively for ileostomy closure ( $< 3$  months), ileostomy closure ( $\geq 3$  months). The mean age was comparable in ileostomy closure ( $< 3$  months) patients ( $45.7 \pm 17.0$  years) and late closure patients ( $45.6 \pm 17.0$  years) ( $p > 0.99$ ). There were no significant differences between groups with respect to diagnosis ( $p = 1$ ), gender ( $p > 0.99$ ), BMI ( $p = 0.98$ ), ASA ( $p > 0.99$ ), the type of anastomosis ( $p > 0.99$ ), COPD ( $p > 0.99$ ), DM ( $p = 1$ ), steroid use ( $p = 1$ ), management of ileostomy skin site ( $p = 1$ ). Other variables, including: chemotherapy ( $p = 0.86$ ) and radiotherapy ( $p = 0.83$ ), index operation ( $p = 0.33$ ) and follow up time ( $p = 0.71$ ) were also comparable among these groups. Just one patient in late closure group need dilation because of stricture, then reversal of the ileostomy. Among

patients that were matched, 36 patients index surgery was due to colorectal cancer respectively. Among them 31 in early closure and 30 in the late closure group had rectal cancer.

Operative details and LOS are described in Table 2. The median time from index operation to ileostomy closure was 65 days for ileostomy closure ( $< 3$  months) and 127 days for LC. The distribution of early closure group is shown like this. There were no patients who had closure less than 2 weeks, 63 patients underwent closure between 2 weeks and 8 weeks, 83 patients between 8 weeks and 10 weeks and 33 patients had closure more than 10 weeks but less than 3 months. Among the ileostomy closure ( $< 3$  months) group and late closure group, all of the variables, including estimated blood loss ( $33.26 \pm 106.93$  versus  $29.43 \pm 35.23$ ,  $p = 0.32$ ), operative time ( $79.01 \pm 43.66$  versus  $72.44 \pm 31.01$ ,  $p = 0.17$ ), LOS ( $4.47 \pm 3.44$  versus  $4.58 \pm 4.08$ ,  $p = 0.47$ ) were similar.

There were no deaths in either group during three months post operation. All of the postoperative complications, including wound infection, post-operative bleeding, intra-abdominal abscess, post-operative ileus, anastomotic leak, reoperation, surgery related readmission, postoperative transfusion were statistically not different among the groups (Table 3) In total, there were 4 reoperations: 1 patient in the ileostomy closure ( $< 3$  months) group for suspected anastomotic leak ( $n = 1$ ) and 3 patients in the LC group for small bowel obstruction ( $n = 2$ ), and suspected anastomotic leak ( $n = 1$ ).

## 4. Discussion

To mitigate the consequences of a colorectal anastomotic leak which is a potentially life-threatening complication, protective loop

**Table 1**  
Comparison of demographics, preoperative characteristics between the groups.

	$< 90$ (N = 179)	$\geq 90$ (N = 179)	P value
Gender (F/M)	88/91	88/91	$> 0.99$
BMI, kg/m <sup>2</sup>	$24.4 \pm 4.5$	$24.5 \pm 4.98$	0.98
Age, year	$45.7 \pm 17.0$	$45.6 \pm 17.0$	$> 0.99$
ASA score n (%)			$> 0.99$
I, II	101 (56.4%)	101 (56.4%)	
III, IIII	78 (43.6%)	78 (43.6%)	
COPD	7 (3.9%)	7 (3.9%)	$> 0.99$
DM	4 (2.2%)	4 (2.2%)	1
Steroid use	2 (1.1%)	2 (1.1%)	1
Chemotherapy	18 (10.1%)	20 (11.2%)	0.86
Radiotherapy	12 (6.7%)	10 (5.6%)	0.83
Follow-up time (day)	$532.21 \pm 298.53$	$546.41 \pm 310.50$	0.71
Index operation			0.33
Abdominal colectomy with loop ileostomy	65 (36.3%)	50 (27.9%)	
CP/IPAA	56 (31.3%)	55 (30.7%)	
LAR/DLI	18 (10.1%)	21 (11.7%)	
TP/IPAA	12 (6.7%)	12 (6.7%)	
Other	28 (15.6%)	41 (22.9%)	
Diagnosis			1
Cancer	36 (20.1%)	36 (20.1%)	
IBD	125 (69.8%)	125 (69.8%)	
Other	18 (10.1%)	18 (10.1%)	
Reason for forming the stoma			1
Suspicion of leak	177	177	
Suspicion of tension	2	2	
Suspicion of tissue ischemia	0	0	
Time interval between two operations (day)	$64.6 \pm 13.1$	$126.8 \pm 44.2$	$< 0.001$

\*Data were given as; mean  $\pm$  standard deviation (minimum - maximum).

BMI: Body mass index, ASA: American Society of Anesthesiologists, COPD: Chronic Obstructive Pulmonary Disease, DM: Diabetes Mellitus, CP/IPAA: Completion proctectomy with ileal-pouch anal anastomosis LAR/DLI: Low anterior resection/diverting loop ileostomy TP/IPAA: Total proctocolectomy with ileal-pouch anal anastomosis IBD: Inflammatory bowel disease.

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