

Original Article

Analysis of Complications after Loop Stoma Closure in Elderly Patients

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Key Words

Colorectal cancer;
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Purpose. Because their lifespans had increased, elderly patients undergo more colorectal cancer surgery with diverting stoma. Many risk factors of postoperative complications after stoma closure were reported. However, the risk factors of postoperative complications in the elderly are not well understood. The aim of this study was to evaluate the predictive factors of postoperative complications.

Methods. Between January 2011 and December 2016, 115 patients underwent colorectal cancer surgery with diverting loop stoma and then underwent stoma closure in Taichung Veterans General Hospital. Ninety-four patients had no complications (no-complications group [NCG]) after stoma closure surgery, but 21 patients (complications group [CG]) did. We reviewed and analyzed the clinicopathologic factors associated with the morbidity of stoma closure.

Results. The time to closure of the stoma was comparable in both groups: 100 days in the CG vs. 93.5 days in the NCG. The time to feeding and the hospital stay after stoma closure was longer in the CG. The complication rate after stoma closure was 18.2%. The most frequent complications were postoperative ileus, wound infection, and pneumonia. Multivariate logistic regression analysis showed that only an American Society of Anesthesiologists (ASA) Score > 2 was a significant predictor for postoperative complications (odds ratio [OR]: 3.12; 95% confidence interval [CI]: 1.13-8.66; $p = 0.03$).

Conclusions. For patients > 65 years old who underwent colorectal cancer surgery and diverting loop stoma, the duration to stoma closure was about 3 months. An ASA score > 2 rather than being extremely elderly (> 80 years old) predicted post-stoma closure complications.

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Creating diverting stoma is important for patients who undergo colorectal surgery. A large randomized controlled trial¹ and a recent meta-analysis² have highlighted the importance of low rates of symptomatic anastomotic leaks and subsequent morbidity and mortality.

Although diverting stoma can decrease the rate of

symptomatic anastomotic leakage and mortality, stoma-specific complications must not be neglected. The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) database showed a 37% unadjusted complication rate for elective surgery involving stoma and 55% for emergency surgery. One study³ reported that 72% of its patients

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had complications. Ten to 42% of patients with diverting stoma had peristomal skin problems, and 0 to 40% of patients had parastomal hernia. The stoma also reduced quality of life, disturbed sleep, impaired relationships with other people, generated sexual difficulties, and caused psychological problems. Most patients ask their doctor for stoma closure.

However, closure of stoma, has its own risks. The morbidity and mortality of a loop ileostomy closure were reported to be 17.3% and 0.4%, respectively, in one study.⁴ Of these patients, 3.7% required a laparotomy during ileostomy closure. The most common postoperative complications included small bowel obstruction (7.2%) and wound sepsis (5.0%).

Because elderly patients undergo more CRC surgery with diverting stoma than before, many complications after the reversal of loop stoma have been reported. However, the risk factors for the elderly are still unclear. Thus our desire to assess the predictive factors of postoperative morbidity in elderly patients with stoma closure.

Materials and Methods

Patients

In this single-center, retrospective cohort study and review of medical records, 115 patients > 65 years old underwent a CRC resection with protecting loop stoma and subsequently underwent stoma closure in Taichung Veterans General Hospital between January 2011 and December 2016. Outcome and cancer status follow-ups continued until 31 December 2018.

The following parameters were analyzed: age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) score, history of other cancers, comorbidities (e.g., hypertension [HTN], diabetes mellitus [DM], chronic kidney disease [CKD], chronic obstructive pulmonary disease [COPD], cerebral vascular accident [CVA], coronary artery disease [CAD]), cancer location, American Joint Committee on Cancer (AJCC) tumor, lymph node, metastasis (TNM) staging, carcinoembryonic antigen (CEA), preoperative chemotherapy or radiotherapy, emer-

gency or elective surgery, type of stoma, postoperative morbidity, stoma-related complications, length of hospital stay, time to feeding, and time to stomata closure.

ASA scores were divided into two groups: ASA score ≤ 2 and ASA score > 2 . The type of diverting stoma was recorded. All postoperative complications were recorded and classified using the Clavien-Dindo score. Postoperative ileus was defined as the occurrence of two or more of the following signs and symptoms on postoperative day (POD) 4 or after: a. nausea or vomiting, b. inability to tolerate an oral diet over the preceding 24 hours, c. absence of flatus over the preceding 24 hours, d. abdominal distension, e. radiologic confirmation. The 115 patients that underwent CRC and protective stoma surgery were divided into two groups: 94 patients in the no-complications group (NCG) and 21 in the complications group (CG).

Statistical analysis

Categorized variables were analyzed using the Fisher exact test. Continuous variables are expressed as medians and interquartiles (IQRs) and were analyzed using the Mann-Whitney test. Medcalc 1.58 (<https://www.medcalc.org/>) was used for univariate and logistic multivariate regressions. Significance was set at $p < 0.05$, and variables with a p -value < 0.20 in the univariate analysis underwent a multivariate analysis.

Results

Demographic data of patients

Of our 115 patients, 111 underwent a protective loop ileostomy, and the other 4 underwent a loop colostomy. Median ages were 74 years in the NCG and 78 in the CG; BMI was 24.1 in the NCG and 23.1 in the CG; 57 patients in the NCG were male, as were 16 in the CG; Thirty-six NCG and 13 CG patients had an ASA score > 2 ; and medical comorbidities were not significantly different in the two groups (Table 1, Table 2).

Table 1. Factor analysis of the no-complications (NCG) and complications (CG) groups after stoma closure

Variables	NCG (n = 94)		CG (n = 21)		p
	n	IQR	n	IQR	
Age (years old)	74	70.0 to 82.0	78	75.0 to 83.3	0.12
Sex					0.50
Female	37		6		
Male	57		15		
BMI (Kg/m ²)	24.1	21.6 to 26.1	23.1	19.5 to 25.2	0.09
ASA > 2					0.08
No	58		8		
Yes	36		13		
History of other cancer					0.97
No	87		20		
Yes	7		1		
HTN					0.56
No	54		10		
Yes	40		11		
DM					0.98
No	79		17		
Yes	15		4		
CKD					0.49
No	91		19		
Yes	3		2		
COPD					0.41
No	93		21		
Yes	1		0		
CVA					0.80
No	92		21		
Yes	2		0		
CAD					0.89
No	87		19		
Yes	7		2		
CEA > 5 (ng/ml)					0.89
No	45		11		
Yes	31		6		
Neoadjuvant therapy					0.78
No	82		19		
CCRT	10		2		
C/T	2		0		
Stage					0.44
0	4		0		
1	17		1		
2	20		5		
3	41		10		
4	11		4		

IQR, interquartile range; CCRT, concurrent chemoradiotherapy; C/T, chemoradiotherapy.

Results of CRC surgery with diverting stoma

The time from CRC surgery to feeding (3 days in NCG and 3 days in CG) and the length of hospital stay

(10 days in NCG and 13 days in CG) between two groups had no statistical difference (Table 3). The number of postoperative complications after CRC surgery in two groups were comparable. The most fre-

quent postoperative complications were postoperative ileus, including 16 patients in NCG (17%) and 7 patients in CG (33.3%). Seven patients in NCG and 2 patients in CG were diagnosed anastomotic leakage during or after the surgery. The stoma-related complications in the NCG included 4 patients with dehydration, 1 patient with stoma bleeding, 3 patients with stoma dermatitis, and 2 patients with stoma prolapsed. No stoma related complications were recorded in the CG.

Results after reversal of protecting stoma

The time to reversal of stoma was comparable in

Table 2. Operative factors of colorectal cancer surgery

Variables	NCG (n = 94)	CG (n = 21)	<i>p</i>
Primary tumor approach			0.42
Open	65	17	
Laparoscopy	29	4	
Lesion location			0.94
Rectum	75	16	
Colon	19	5	
Emergency operation			0.97
No	83	18	
Yes	11	3	
Type of stoma			0.76
Loop colostomy	4	0	
Loop ileostomy	90	21	

the two groups (93.5 days in the NCG and 100 days in the CG) (Table 4). The time to feeding water, time to soft diet and the length of hospital stay of stoma reversal were increased significantly in the CG. However, about readmission within 30 days and late morbidity after 90 days, there was no statistical significance. (In NCG, 5 patients readmitted within 30 days for ileus, urinary tract infection (UTI) or pneumonia; in CG, 2 patients readmitted for UTI or biliary tract infection (BTI)). There was no surgical mortality in two groups.

Complications after reversal of diverting stoma

In the CG, 14 surgical complications and 15 medical complications were reported (Table 5). Nine postoperative ileus and 3 wound infections were recorded. One patient had intestinal perforation during closure of ileostomy due to severe adhesion between loop ileostomy and rectus muscle. There was another case of anastomotic stenosis. This patient received exploratory laparotomy two weeks after closure of ileostomy due to abdominal distension and intolerance of diet, and the anastomotic stenosis was found. In medical complications, there were 3 patients with pneumonia, 2 with UTI and 2 with acute gouty arthritis.

Table 3. Postoperative factors of colorectal cancer surgery

Variables	NCG (n = 94)		CG (n = 21)		<i>p</i>
	n	IQR	n	IQR	
Length of hospital stay (days)	10	8.0 to 14.0	13	8.8 to 20.5	0.11
Time to feeding (days)	3	2.0 to 3.3	3	2.0 to 4.3	0.13
Time to soft diet (days)	6	6.0 to 9.0	7	6.0 to 15.0	0.11
Postoperative complications					0.97
No	56		12		
Yes	38		9		
CD score 3/4					0.69
No	86		18		
Yes	8		3		
Readmitted (\leq 30 days)					0.56
No	87		18		
Yes	7		3		
Stomata-related complication					0.65
No	84		21		
Yes	10		0		
Dehydration	4		0		
Stoma bleeding	1		0		

Table 4. Perioperative factors of stoma closure surgery

Variables	NCG (n = 94)		CG (n = 21)		p
	n	IQR	n	IQR	
Time to stoma closure (days)	93.5	75.0 to 140.0	100	75.3 to 128.0	0.99
Time to feeding (days)	3	2.0 to 3.0	4	3.0 to 7.3	0.0004
Time to soft diet (days)	5.5	5.0 to 6.0	9	5.5 to 13.5	0.0002
Length of hospital stay (days)	7	6.0 to 7.0	13	9.0 to 16.3	< 0.0001
Readmitted (\leq 30 days)					0.82
No	89		19		
Yes	5		2		
Late morbidity (> 90 days)					0.44
No	81		20		
Yes	13		1		

Table 5. Postoperative complications after stoma closure surgery

Complications after stomata reversal	n = 21
Surgical complication	n = 14
Adhesion + small bowel perforation	1
Anastomotic stenosis	1
Postoperative ileus	9
Wound infection	3
Medical complication	n = 15
Acute kidney injury	1
Arteriovenous shunt occlusion	1
Biliary tract infection	1
COPD with acute exacerbation	1
Delirium	1
Gouty arthritis	2
Limb cellulitis	1
Pneumonia	3
Transient ischemic attack	1
Urinary tract infection	1
Urinary retention	2

Risk factors

We identified the factors potentially associated with complication after stoma reversal. The result of the univariate and multivariate logistic regression analysis are presented in Table 6. In univariate analysis, an ASA score > 2 and BMI were significant. In multivariate analysis, the only independent risk factor was an ASA score > 2 (odds ratio OR: 3.12; 95% CI: 1.13-8.66; $p = 0.03$). Being > 80 years old was not a predictive factor of post-reversal complications.

Discussion

This is the first published study on post-stomata

reversal complications in patients > 65 years old. We found that 18.2% of patients who underwent stomata-reversal surgery after CRC surgery had postoperative complications. Stomata reversal was done between 93 and 100 days after primary CRC surgery. Postoperative ileus, pneumonia, and wound infections were the most common complications. Postoperative complications lengthened the time between surgery and feeding, and it lengthened the patient's hospital stay. An ASA score > 2 was the only significant risk factor for predicting post-reversal complications.

Some small series⁶⁻⁹ report that morbidity is about 3-30% and mortality about 0-4% after closing a loop ileostomy. One study¹⁰ of 5401 patients reported that 502 (9.3%) patients had major postoperative complications and 454 (8.4%) had minor complications. The most common were 389 small bowel obstructions and 270 wound infections. In our study, the most frequent complication was postoperative ileus (9/115 [7.8%]), which was not significantly different from what the literature reports. Three of our patients each had a wound infection or pneumonia (3/115 [2.6%]). The high rate of pneumonia can be attributed to the patients' being elderly, having their mobilization away from the bed relatively delayed, and practicing poor pulmonary hygiene. In a recent prospective cohort study of 72 patients undergoing abdominal surgery,¹¹ mobilization time away from the bed was independently associated with a diagnosis of postoperative pulmonary complications.

Age is significantly associated with stoma non-reversal^{12,13} and elderly patients had more post-reversal

Table 6. Predictive factors analysis of complications after stoma closure surgery

variable	Univariate			Multivariate		
	Odds ratio	95% CI	<i>p</i>	Odds ratio	95% CI	<i>p</i>
Age > 80 years	1.38	0.49 to 3.81	0.53			
Sex	1.62	0.58 to 4.56	0.36			
BMI	0.88	0.77 to 1.01	0.07	0.88	0.76 to 1.01	0.06
ASA score > 2	2.62	0.99 to 6.94	0.05	3.12	1.13 to 8.66	0.03
History of other cancer	0.62	0.07 to 5.34	0.66			
HTN	1.49	0.57 to 3.84	0.41			
DM	1.24	0.37 to 4.20	0.73			
CKD	3.19	0.49 to 20.43	0.22			
CAD	1.31	0.25 to 6.79	0.75			
CEA > 5	0.79	0.26 to 2.37	0.68			
CCRT	0.67	0.16 to 2.75	0.58			
Colon/rectum	1.23	0.40 to 3.79	0.71			
1stOP complication	1.11	0.42 to 2.88	0.84			
Angiolymphatic invasion	1.24	0.47 to 3.25	0.66			
Perineural invasion	0.97	0.32 to 2.96	0.96			
CRM	1.15	0.40 to 3.30	0.79			
Laparoscopy	0.53	0.16 to 1.71	0.29			
T34	2.81	0.77 to 10.29	0.12	3.05	0.79 to 11.62	0.10
LN metastasis	1.44	0.53 to 3.93	0.48			

CRM, circumferential resection margin; T34, AJCC tumor staging 3 or 4; LN, lymph node.

complications than did younger patients.¹⁴ There is currently no tool that predicts morbidity after stoma reversal in elderly patients. One study¹⁰ that reported risk factors for major post-reversal complications in the general population included dependent functional status, history of severe COPD, renal insufficiency, disseminated (metastatic) cancer, an ASA score of 3 or 4, and operation time > 100 min. Moreover, a BMI > 30, an ASA score of 3 or 4, and operation time > 100 min were independent risk factors for incisional infection. We also evaluated comorbidities, but only ASA scores and BMI were significant. None of our 7 patients with a BMI > 30 had post-stomata reversal complications, however, possibly because their high BMI meant that they were relatively well-nourished. One study¹⁵ claimed that a low BMI predicted surgical complications.

Our study has limitations. First, using a retrospective study design means that minor surgical complications and ostomy complications will be missed. Future work must use a prospective longitudinal design to eliminate this bias. Notwithstanding this limitation, stomata closures in elderly patients occur daily because the general population is living significantly

longer. Thus, our findings provide a reliable predictive factor for post-stomata reversal complications in the elderly.

Conclusion

Of patients over 65 years old who received colorectal cancer surgery and diverting loop stomata, an ASA score > 2 can reliably predict post-stomata reversal complications in the elderly.

Abbreviations

CRC: colorectal cancer, NCG: no-complications group after stomata reversal, CG: complications group after stomata reversal.

Conflict of Interest Statement

The authors declare no conflict of interest in the study.

Role of the Funding Source

The authors declare no role of funding source in the study.

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原 著

老年人關閉造口之併發症分析

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目的 隨著國民平均年齡上升，許多老年人接受大腸直腸癌切除合併保護性造口手術。關於關造口後發生併發症有許多危險因子曾被報導過，然而針對老年人關造口併發症的危險因子沒有被探討過，因此本研究試著分析危險因子。

方法 台中榮民總醫院共有 115 位大於 65 歲病患於 2011 至 2016 年間接受大腸直腸癌切除合併保護性造口手術，之後再接受關造口手術，其中有 94 位與關造口術後沒有併發症，而有 21 位關造口術後發生併發症，此篇文章針對這 115 位病患進行回顧性研究分析。

結果 在兩組病人中關造口間隔時間差不多 (有併發症組：100 天；沒併發症組：93.5 天)。有併發症組在手術後到進食時間以及總住院天數明顯較長。關造口後併發症機率为 18.2%。最常見併發症分別是術後腸阻塞，傷口感染及肺炎。多變相邏輯思回歸分析顯示只有 ASA score 大於 2 分能顯著預測術後會發生併發症。

結論 在接受大腸直腸癌合併保護性造口手術的 65 歲以上老年人中，手術到關造口的間隔時間約為三個月。而比起更老的年齡 (大於 80 歲)，ASA score 大於兩分反而較能做為關造口後有併發症的預測因子。

關鍵詞 大腸直腸癌、關造口、老年人、併發症。