

Early Postoperative Complications following a Resection for Colorectal Cancer

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Purpose: Understanding of early postoperative course is very important for planning of operation and postoperative management. However, reports regarding early postoperative complications following colorectal cancer surgery are rare. The aim of this study was to report the incidence of immediate postoperative complications associated with colorectal cancer surgery.

Methods: This prospective study examined clinicopathological data on 869 patients who underwent a resection for colorectal cancer between November 2002 and October 2003. Patients who underwent a palliative stoma, bypass, or emergent operation were excluded. Early postoperative complications were defined as complications occurring within 30 days of surgery. The male-to-female ratio was 518 : 351, and the mean age was 59 (range, 18~90) years.

Results: The tumor was located at right colon in 176, at left colon in 169, and at rectum in 510 patients. In 158 patients (18.2%), at least one postoperative complication occurred. The most common complication was ileus (5.5%), followed by wound complication (4.1%), the voiding disturbance (3.3%), anastomotic bleeding (1.4%), anastomotic leakage (1.1%), and bleeding (0.6%). The complication rate was 21.6% in patients with right colon cancer, 16% in those with left colon cancer, and 17.3% in those with rectal cancer. Ileus occurred on mean postoperative day 8 and required a mean of 12 days for resolution. The wound complications occurred on mean postoperative day 9 and were resolved after a mean of 10 days. Of the 8 anastomotic leakage patients, proximal stoma construction was required in 5 patients. Intra-luminal bleeding occurred most common in patients with right colon cancer. Higher frequency of postoperative complications occurred in male patients ($P=0.008$), patients older than 70 years ($P=0.02$),

and patients with co-morbid medical conditions ($P=0.01$).

Conclusions: The overall early postoperative complication rate following colorectal cancer surgery was 18.2%. The postoperative complication rate was higher in male, elderly, and patients with co-morbid medical conditions. Our results have allowed us to identify major complications and to better understand the postoperative course in patients undergoing colorectal cancer resections. **J Korean Soc Coloproctol 2005;21:213-219**

Key Words: Early, postoperative complications, colorectal cancer

조기, 수술 후 합병증, 대장암

INTRODUCTION

Major colorectal surgery is commonly performed on high-risk populations, with most patients being elderly and having multiple preoperative co-morbidities. Surgical complications after colorectal cancer surgery occur in up to 30% of the patients.^{1,2} The major complications that almost all published reports show are anastomotic leakage and bleeding, which require a laparotomy. Since reports regarding immediate postoperative morbidity are rare, understanding of the early postoperative course and management of early postoperative complications has depended on individual experience.

The aim of this study was to report on the prevalence of early postoperative complications associated with the procedure in patients with colorectal cancer who underwent a resection. Such information is likely to enhance our understanding of the postoperative course following such resection.

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METHODS

1) Patients and operation

This prospective study examined clinical, surgical, pathology, and follow-up data on consecutive patients who underwent a resection for colorectal cancer between November 2002 and October 2003. During this period, 869 patients underwent a resection for colorectal cancer. All operations were performed by three surgeons, and the procedure was standardized. Among the 869 patients, 28 patients underwent laparoscopic surgery. Patients who underwent a palliative stoma, bypass, or emergent operation were excluded. Co-morbidities, such as diabetes mellitus requiring oral hypoglycemic or insulin injection; cardiac disease, such as coronary artery disease, previous history of myocardial infarction, valvular heart disease, and arrhythmia; chronic liver disease, and chronic pulmonary disease showing abnormality on a pulmonary function test or requiring medical treatment, were recorded. For this study, the right colon was defined as the cecum, the ascending colon, and the transverse colon to the junction, with the splenic flexure. The left colon included the splenic flexure and the descending and sigmoid colons. The rectum included the recto-sigmoid junction, but excluded the anal canal. Surgery for all patients who had no evidence of intestinal obstruction involved mechanical bowel preparation with a polyethylene glycol solution. No mechanical bowel preparation was given to patients with obstructing cancer. Prophylactic antibiotics, such as metronidazole (500 mg preoperatively and then 8 hours later) and 2nd generation cephalosporin (1 g preoperatively and 2 g postoperatively), were used via intravenous injection. One type of drain was used. Closed-suction abdominal drains were inserted in all patients. For patients with a risk of postoperative bleeding or anastomotic leakage, two drains were inserted. Anastomoses were performed using either a double-stapled technique or a circular stapled technique. Patient-controlled anesthesia using fentanyl was used for 3 days, including the operative day, to control postoperative pain. Then, when necessary, ketoprofen was used via intramuscular injection for 2 days.

2) Definition of complications

Early postoperative complications were defined as complications occurring within 30 days of surgery and were classified into a number of categories. We examined surgical-procedure-related complications. Ileus was defined as the absence of bowel function until the postoperative day either when routine diet progression was possible in general or when nausea and vomiting required placement or reinsertion of a nasogastric tube or long intestinal tube or maintenance of abstinence from oral intake. Wound complications included seromas, hematomas, infections, and dehiscence. A complication was regarded as associated with a wound if intensive wound dressing or re-suturing in the ward or surgery was required. It was reported by a responsible physician and then checked by one physician. Anastomotic leakage was defined as gas, pus, or fecal discharge from the drain, pelvic abscess, or peritonitis. Anastomotic leakage was classified according to its clinical outcome. A significant clinical leak was one that necessitated a laparotomy. A subclinical leak was defined as one demonstrated by CT or one that resulted in an abscess that discharged following percutaneous drainage or was resolved by administration of antibiotics. Voiding disturbance included cases that necessitated reinsertion of a urinary catheter following removal of a preoperatively inserted catheter due to any cause, for example, difficulty in bladder emptying and increased residual volume. Intra-luminal bleeding complications were defined as those with definite signs of bleeding, such as hematochezia or melena, that required replacement with more than 2 units of red blood cells.

3) Statistical evaluation

Data were collected from patients with complications and were compared to those from patients without complications after colorectal tumor resection. The statistical analysis was performed using the Chi-square test to identify differences between patients with complications and patients with no complications. Data from the two groups were subjected to a multivariate analysis by using a logistic regression analysis. A P value ≤ 0.05 was deemed to indicate a statistically significant difference.

Table 1. Early postoperative complications following a resection for colorectal cancer (N=869)

Complication	No.	(%)
Ileus	56	(6.3)
Wound complication	36	(4.1)
Voiding disturbance	29	(3.3)
Intra-luminal bleeding	11	(1.4)
Anastomotic leakage	8	(1.1)
Intra-abdominal bleeding	5	(0.6)
Intra-abdominal abscess	4	(0.5)
Others	9	(1.0)

Percent (%) shows the fraction of the 869 patients experiencing the particular complication. Note: % could also represent the fraction of the total # of complication:

$$\times \% = \frac{\text{\# of complication}}{\text{total \# of complications}} \times$$

RESULTS

Between November 2002 and October 2003, 869 patients underwent resections for colorectal cancer. The male-to-female ratio was 518 : 351, and the mean age was 59 (range 18~90) years. In 312 (35.9%) patients, at least one co-morbidity was present. In 176 patients, the tumor was in the right colon, in 169 patients, it was in the left colon, and in 510 patients, it was in the rectum. For rectal cancer patients, 68 (13.3%) received preoperative radiotherapy, and a protective stoma was constructed in 25 (6.4%) patients. In 158 (18.2%) patients, at least one postoperative complication occurred. In the complication group, the male-to-female ratio was 107 : 49, and the mean age was 61 (28~89) years. The most common postoperative complication was ileus (5.5%), followed by wound complication (4.1%) and then voiding disturbance (3.3%) (Table 1). The complication rate was 21.6% (38/176) in patients with right colon cancer, 16.0% (27/169) in those with left colon cancer, 17.3% (88/510) in those with rectal cancer patients, and 21.4% (3/14) in those with recurrent cancer (Fig 1).

While ileus appeared to be most common in elderly male right colon cancer patients, this combination of characteristics was not significant (P=0.42). Ileus occurred more frequently in patients with co-morbid medical condi-

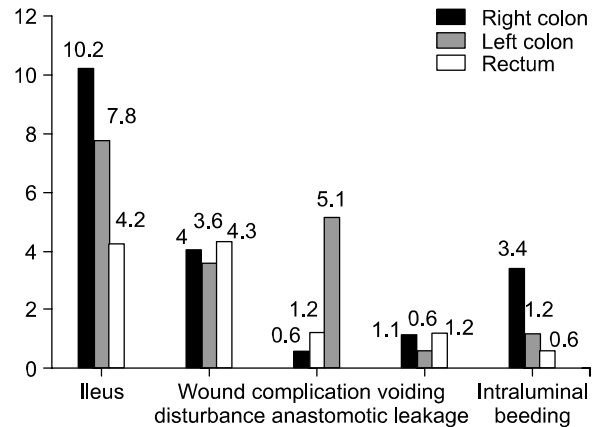


Fig 1. Major early postoperative complications in relation to primary tumor location.

tions (P=0.04). Ileus occurred on mean postoperative day 8 (4~22) and required a mean of 12 (4~26) days for resolution. Forty-seven of the 48 ileus cases were managed conservatively, with only one patient requiring a laparotomy. The mean duration of resolution was 9 days in patients managed by using Non-per-os, 11 days in those managed by using a nasogastric tube, and 16 days in those managed by using a long intestinal tube.

Regarding primary tumor location, the incidence of wound complication was 4.5% for the right colon, 3.6% for the left colon, and 4.1% for the rectum. Patients over the age of 70 had a higher frequency of wound complication (5.3%) than younger patients (2.9%)(P=0.04). Wound complications occurred on mean postoperative day 9 (3~15) and were resolved after a mean of 10 (0~52) days. Intensive wound management in the ward was required in 29 patients, and re-suturing for major defects or dehiscence was performed in 8 patients.

Voiding disturbance was a major complication in rectal cancer patients. There was no difference in the frequency of voiding disturbance between patients who underwent a Low anterior resection/Anterior resection (4.6%) and those who underwent an Abdominoperineal resection Hartmann procedure (6.7%)(P=0.34). While almost all voiding-disturbance patients were managed conservatively, voiding function was not recovered in 2 patients who were subsequently discharged with in-dwelling urinary catheters or intermittent catheterization.

Anastomotic leakage occurred in 8 patients. The rate

of anastomotic leakage was 1.1% following a right hemicolectomy, 0.5% following a left hemicolectomy, and 1.2% following a resection and anastomosis for rectal cancer. Of the anastomotic leakage patients, one received preoperative radiotherapy, and two had co-morbid medical conditions. Proximal stoma construction was performed in 5 anastomotic-leakage patients. Three patients had abscesses around the anastomosis and were managed using insertion of a percutaneous drain tube and administration of intravenous antibiotics.

Postoperative intra-luminal bleeding occurred in 11 (1.3%) patients. These patients showed hematochezia and required replacement of >2 units of red blood cells on postoperative day 1 or 2, and the complication was resolved after 2~3 days. Two patients with intra-luminal bleeding complications required further surgery. In these two patients who underwent a laparotomy, a definite bleeding point was found in one, but not in the other. In the latter patient, angiography also failed to identify the source of bleeding. Intra-luminal bleeding occurred more frequently in patients with right colon cancer ($P=0.03$).

Intra-abdominal abscesses requiring percutaneous drain insertion occurred in 5 patients. These cases were not associated with anastomoses. Intra-abdominal bleeding occurred in 6 patients. These patients showed a bloody discharge via a closed-suction drain that had been inserted intra-operatively near the anastomosis site, but they showed no evidence of hematochezia or melena and did not require a transfusion of more than 2 units to maintain their vital signs or hemoglobin level. All patients were managed conservatively, i.e., transfusion, resting, and coagulant administration.

A univariate analysis was performed to search for risk factors for postoperative complications. Sex, age, and co-morbid medical conditions were associated with occurrence of postoperative complications. Neither a multivisceral resection or combined operation, a protective stoma construction or preoperative radiotherapy in rectal cancer, nor the location of the primary tumor had any statistical influence on postoperative complications. A data analysis using a multivariate analysis showed that following a colorectal cancer resection, a higher frequency of postoperative complications occurred in male patients ($P=0.008$), patients over the age of 70 ($P=0.02$), and patients

Table 2. Factors associated with the occurrence of postoperative complications

Variable	Relative risk	95% CI	P value
Co-morbidities	1.56	1.10~2.21	0.01
Sex			0.008
female	1		
male	1.63	1.13~2.36	
Age			0.02
≤ 70 years	1		
> 70 years	1.48	1.04~2.09	

with co-morbid medical conditions ($P=0.01$)(Table 2).

DISCUSSION

The overall postoperative complication rate following a resection for colorectal cancer is relatively high.^{2,3} The most serious such complication is sepsis caused by anastomotic leakage, which is particularly relevant for rectal cancer patients. The frequency of clinical leakage after anterior resection varies from 3% to 19%,^{4,6} and the mortality rate associated with symptomatic anastomotic leakage varies between 6% and 22%.^{6,7} The present study found that the rate of anastomotic leakage after a resection was low, being 1.1% in all patients and 1.2% in rectal cancer patients. Leakage was more common in male patients and in patients with low rectal cancer. Most studies have shown that the level of anastomosis is the most important predictive factor for leakage in patients with rectal cancer.⁸⁻¹⁰ In the present study, 5 anastomotic leakages occurred in rectal cancer patients, with four of these being in patients who underwent a low anterior resection (4/212), and one in a patient who underwent a low anterior resection and coloanal anastomosis (1/92). While a lower level of anastomosis appeared to be associated with a greater possibility of leakage, this was not supported by a statistical analysis, possibly because of the low number of patients with anastomotic leakages.

It is generally believed that radiotherapy may compromise anastomotic healing. However, only one patient who had undergone preoperative radiotherapy developed anastomosis leakage. This finding may be in keeping with the British radiotherapy trial, referred to as MRC1, which

produced the surprising result that leakage was significantly less in the irradiated arm¹¹ and with the Dutch trial of TME (Total mesorectal excision) ± radiotherapy that produced similar findings.¹²

The decision to construct a protective stoma was left to the individual surgeon. It is generally believed that a proximal defunctioning stoma does not abolish leakage, but mitigates the consequences. However, controversy persists as to whether a prophylactic defunctioning stoma should be constructed routinely or selectively. While defunctioning undoubtedly protects the low anastomosis, the stoma itself is associated with both morbidity and mortality. We performed a double-stapling anastomosis for low rectal cancer, given that such a procedure is now established and satisfactory results have been reported.^{13,14} Considering the low rate of anastomotic leakage in cases of rectal cancer, the surgeon's judgement on the impact of an adverse event is more important than the construction of a proximal defunctioning stoma.

Another common complication associated with anastomosis is intra-luminal bleeding. Early postoperative bleeding from the anastomosis is uncommon. In the present study, intra-luminal bleeding was more common than leakage. Almost all such bleeding was resolved by conservative management, with only two cases requiring a laparotomy; the bleeding focus was identified in only one patient. In the identifiable case, bleeding occurred from the impinged vessel at the anastomosis site. If vital signs are stable, almost all intra-luminal bleeding can be managed conservatively.

Voiding disturbance is the major complication following a rectal cancer resection. In the present study, 26 of the 29 patients with voiding disturbance had undergone a rectal cancer resection, and this comprised 5.7% of all rectal cancer patients. These results compare favorably with those of other studies, which reported bladder denervation in 8% to 54% patients.¹⁵⁻¹⁷ Urinary dysfunction after rectal cancer surgery is often transient. The cause may be temporary nerve injury caused by traction or diathermy injury, or incomplete division of nerves that later degenerate.¹⁸ Urinary dysfunction is reported to be more common after an abdominoperineal resection than after a low anterior resection.¹⁹⁻²¹ However, in the present study, there was no greater incidence of voiding difficulty in

abdominoperineal resection patients compared to other patients. The influence of early postoperative urinary dysfunction, and its management, on the development of long-term urinary dysfunction is worthy of further study.

While the incidence of ileus was high in the present study, it was managed conservatively. The incidence of wound infections was disappointingly high, despite conventional perioperative antibiotic prophylaxis. Postoperative adhesions are as a common complication of colorectal surgery.²² In addition to adhesion, delayed recovery of gastrointestinal motility may result in postoperative ileus.²³ The exact cause of ileus was not identified in the present study. Perhaps the only clear point is that postoperative ileus is multifactorial in nature. A statistical analysis of the present data showed that postoperative ileus did not correlate with age, gender, co-morbidity, location of primary tumor, or type of operation. A previous study showed that adhesion after a total or a subtotal colectomy was associated with small-bowel obstruction. The differences between study findings may be due to the application of recent advances in adhesion prevention. Almost all patients with ileus complications had resolution via conservative management. Conservative management of ileus included intestinal decompression via a nasogastric tube or a long intestinal tube, and NPO. Regarding the type of management, the timings of occurrence and of resolution were different. However, while the onset time was similar between cases requiring nasogastric tube insertion and cases requiring long intestinal tube insertion, the timing of resolution was shorter in the cases requiring nasogastric tube insertion. The results of this study suggest the role of a long intestinal tube in postoperative ileus is questionable. Use of a long intestinal tubes should be reserved for patients with complex obstructive problems rather than for those undergoing routine postoperative colorectal surgery.

The postoperative complication rate was higher in male patients, elderly patients, and patients with co-morbid medical conditions. The incidence of overall complications was not affected by the location of the primary tumor. In rectal-cancer patients, voiding disturbance was more common than other complications. The incidence of anastomotic leakage following resection of a low and a mid rectal cancer was lower than reported elsewhere and was

not different from the incidence following a colon-cancer resection. In rectal-cancer patients, anastomotic leakage occurred more commonly in males, but was not associated with preoperative radiation therapy. These findings indicate that development of immediate complications after a resection for colorectal cancer is influenced by the type of patient rather than by the status and the location of the tumor.

Our results have allowed us to identify major complications and to better understand the postoperative course in patients undergoing colorectal cancer resections. Evaluating the quality of surgical care depends on the availability of valid and reliable measures for postoperative surgical outcomes. In addition to practical improvement, improvement in peri-operative management and attention to surgical detail are required for optimal surgical care.

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국문 초록

대장암 수술 후 조기 합병증

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박인자 · 김희철 · 유창식 · 김진천

목적: 수술 후 조기의 경과를 이해하는 것은 수술계획의 수립 및 수술 후 환자 진료에 필수적이다. 그러나 대장암 수술 후 조기 합병증 및 유병률의 빈도에 대한 보고는 매우 드물다. 본 연구는 대장암 환자에서 수술 후 발생하는 조기 합병증의 빈도와 경과를 알아보고자 하였다.

방법: 대장암으로 2002년 11월부터 2003년 10월까지 서울아산병원에서 절제술을 시행받은 869예의 환자를 전향적으로 분석하였다. 장루조성술, 우회술을 시행했거나 진단적 개복을 시행한 경우는 제외하였다. 조기 합병증은 수술 후 30일 이내에 발생한 경우로 정의하였다. 대상군의 남녀 비는 518 : 351이었고 평균 연령은 59 (18~90)세였다.

결과: 원발종양의 위치는 우결장 176예, 좌결장 169예,

직장 510예였고 재발 병변에 대해 수술을 시행한 경우가 14예였다. 합병증은 총 158예(18.2%)에서 발생했고, 빈도순으로 장마비 48예(5.5%), 창상 합병증 36예(4.1%), 배뇨장애 29예(3.3%), 문합부 출혈 11예(1.4%), 문합부 누출 8예(1.1%), 출혈 5예(0.6%)의 순이었다. 합병증이 발생한 군의 평균 연령은 61세였고, 우측결장암 중 38예(21.6%), 좌측결장암 중 27예(16%), 직장암 중 88예(17.3%)가 발생하여 원발병소 위치와 무관하게 유사한 분포를 보였다. 주요 합병증 중 장마비는 수술 후 평균 8 (4~22)일에 발생했고 회복기간은 평균 12 (4~26)일이었다. 창상 합병증은 수술 후 평균 9 (3~15)일에 발생하여 10 (0~52)일의 회복기간을 거치는 것으로 나타났다. 문합부 누출 8예 중 5예에서 재개복을 시행하였다. 문합부 출혈은 우결장암 수술 후 가장 빈번했고, 8예는 보존적 치료로 호전되었으나, 2예는 개복술, 1예는 혈관조영술을 시행했다. 수술 후 조기 합병증 발생은 원발종양의 위치 및 수술 종류, 수술 전 방사선 치료 여부와는 무관하였으나 동반질환이 있는 경우 (P=0.01), 남자(P=0.008), 고령(P=0.02)에서 호발하는 경향을 보였다.

결론: 대장암 수술 후 조기 합병증은 18.2%로 비교적 빈번한 양상이었고, 동반질환이 있거나 고령, 남자인 경우 호발하는 양상을 보였다. 대장암 수술 후 조기 합병증의 빈도에 대한 분석은 수술 후 환자의 경과를 이해하고, 향후 새로운 수술 방법의 결과를 비교하는 데 도움이 될 것으로 생각한다.