



Short- and long-term outcomes of subtotal/total colectomy in the management of obstructive left colon cancer

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Purpose: Surgical management of obstructive left colon cancer (OLCC) is still a matter of debate. The classic Hartmann procedure (HP) has a disadvantage that requires a second major operation. Subtotal colectomy/total abdominal colectomy (STC/TC) with ileosigmoid or ileorectal anastomosis is proposed as an alternative procedure to avoid stoma and anastomotic leakage. However, doubts about morbidity and functional outcome and lack of long-term outcomes have made surgeons hesitate to perform this procedure. Therefore, this trial was designed to provide data for morbidity, functional outcomes, and long-term outcomes of STC/TC.

Methods: This study retrospectively analyzed consecutive cases of OLCC that were treated by STC/TC between January 2000 and November 2020 at a single tertiary referral center. Perioperative outcomes and long-term outcomes of STC/TC were analyzed.

Results: Twenty-five descending colon cancer (45.5%) and 30 sigmoid colon cancer cases (54.5%) were enrolled in this study. Postoperative complications occurred in 12 patients. The majority complication was postoperative ileus (10 of 12). Anastomotic leakage and perioperative mortality were not observed. At 6 to 12 weeks after the surgery, the median frequency of defecation was twice per day (interquartile range, 1–3 times per day). Eight patients (14.5%) required medication during this period, but only 3 of 8 patients required medication after 1 year. The 3-year disease-free survival was 72.7% and 3-year overall survival was 86.7%.

Conclusion: The risk of anastomotic leakage is low after STC/TC. Functional and long-term outcomes are also acceptable. Therefore, STC/TC for OLCC is a safe, 1-stage procedure that does not require diverting stoma.

Keywords: Colectomy; Obstructive left colon cancer; Treatment outcome

Received: Jan 20, 2022 • Revised: Mar 28, 2022 • Accepted: Apr 16, 2022

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• This paper was presented as a poster at the meeting of the 53rd Korean Society of Coloproctology Annual Meeting on September 5 to 6, 2020 in Seoul, Korea.

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INTRODUCTION

Screening programs for the early detection of colon cancer have become common. Nevertheless, 8% to 29% of colon cancer patients visit the hospital with acute colonic obstruction [1]. Since the right colon has a larger diameter than the left colon, the rate of obstruction is relatively low (35% vs. 65%) and 1-stage right hemicolectomy and anastomosis are preferred over the 2-stage procedure [2]. On the other hand, the diameter of the left colon is relatively small, so obstruction is more likely to occur, and there is still debate over the appropriate surgical procedure in this situation. The traditional method is the 2-stage Hartmann procedure (HP), or primary diverting colostomy. However, HP has disadvantages surrounding complications related to stoma and the

need for a second operation. Moreover, about 45% of patients undergoing HP have to live with permanent stoma [3].

Perioperative placement of a self-expandable metallic stent (SEMS) has been used as a bridge to elective surgery and reported with a high success rate of 93.8%. Primary anastomosis was performed in 91.8% of patients and stoma creation was required only in 10.6% to 23.9% of patients [4–6]. In addition, SEMS makes preoperative colonoscopy possible with the advantage of being able to determine synchronous colon cancer in the proximal colon. However, colonic perforation occurred after SEMS in 1.5% to 8.9% of patients [4–6]. Moreover, stent-related perforation has been reported that is associated with an increased risk of global and locoregional recurrence of cancer [7]. As a result, a 1-stage procedure claimed to solve these problems that includes segmental colectomy (SC) with or without intraoperative colonic irrigation and subtotal colectomy/total abdominal colectomy (STC/TC).

SC and STC/TC are known to have low mortality and morbidity [8, 9]. In several studies comparing SC and STC/TC, different conclusions have been drawn. Kaser et al. [10] reported the rate of anastomosis leakage was lower in STC/TC compared to SC. On the other hand, Mege et al. [11] reported the rate of anastomotic leakage under SC was not higher than STC/TC. However, 15% of SC patients required diverting ileostomy. Ileostomy may have helped to reduce anastomotic leakage, but this procedure did not play a role as a true, 1-stage procedure [11]. In most studies, STC/TC is reported as a safe 1-stage procedure that does not require a stoma, and the rate of anastomotic leakage reported has been very low [12–14]. Also, in a functional aspect, 31.2% of patients had diarrhea in the immediate postoperative period but most symptoms naturally improved or were controlled by antidiarrheal medication, and disabling diarrhea was reported in only 6.2% of patients [15]. Average bowel movement after 3 to 6 months and 12 months after surgery was reported as 2 stools per day [13, 14].

Despite these advantages, STC/TC is not generally chosen for the treatment of obstructive left colon cancer (OLCC). Mege et al. [11] reported only 13% use of the STC/TC procedure for OLCC in France. This result is considered to be due to concerns about morbidity or mortality caused by extensive resection, functional status, and lack of long-term data. Therefore, this study evaluated the perioperative morbidity, mortality, functional, and oncologic feasibility by analyzing the short-term and long outcomes of STC/TC.

METHODS

Ethics statements

This retrospective study was approved by the Institutional Review Board of Kangbuk Samsung Hospital (No. 2020-11-024). The informed consent was waived because of the retrospective nature of the study.

Patient selection and data collection

Data were retrospectively collected from the medical records of Kangbuk Samsung Hospital from January 2007 to November 2020.

This study includes patients diagnosed with acute colonic obstruction caused by cancer located from the descending colon to the rectosigmoid colon where STC/TC was undergone. Patients who were diagnosed with combined colonic ischemia or perforation were included. Characteristics of patients including sex, age, American Society of Anesthesiologists (ASA) physical status (PS) classification, and length of hospital stay were collected from the medical records. Tumor location and stage were identified in pathologic and radiologic reports.

Procedure

All surgeries were performed by 3 colorectal specialists. Laparoscopic or open procedure was selected at the discretion of each surgeon. Distal rectal resection was always above the level above the pelvic promontory to preserve more than 10 cm of the rectum. The terminal ileum was carefully resected within 10 cm in length. If the rectum could not be preserved by more than 10 cm, STC/TC was not chosen, and these patients were excluded from this study. Lymph nodes were always dissected according to oncologic principle. The cases of ileorectal anastomosis after TC were defined as TC group and the cases of ileosigmoid or ileo-descending colon anastomosis with proximal colon resection were defined as STC group.

Statistical analysis

Collected data were statistically analyzed using IBM SPSS ver. 24.0 (IBM Corp). Results are expressed as median value with interquartile range. Disease-free survival (DFS) was defined as the time from diagnosis to recurrence or death without evidence of recurrence. Overall survival (OS) was defined as the time from diagnosis to death as a result of all causes. The Kaplan-Meier method was used to construct DFS and OS curves. The log-rank test was used to compare distributions by stage.

RESULTS

General characteristics

During this period, 55 patients met the criteria. Of these, 34 (61.8%) were male and 21 (38.2%) were female. The median age of the enrolled patients was 71 years, and 36 of the patients (65.5%) were of old age (65 years or older). The comorbidities of patients were evaluated by ASA PS classification, and the number of patients with ASA PS classification of III or more was 31 (56.4%).

Of the 55 enrolled patients, 14 patients (25.5%) underwent TC, and 41 patients (74.5%) underwent STC. Stoma was not created in any cases. The median operation time was 175 minutes (range, 155–210 minutes). The median number of harvested lymph nodes was 42.0 (range, 26–61), and the median length of postop-

Table 1. General characteristics of patients (n = 55)

Characteristic	Value
Age (yr)	71 (63–78)
Sex	
Male	34 (61.8)
Female	21 (38.2)
ASA PS classification	
I or II	24 (43.6)
III or IV	31 (56.4)
Type of surgery	
Total colectomy	14 (25.5)
Subtotal colectomy	41 (74.5)
Length of surgery (min)	175 (155–210)
No. of harvested lymph nodes	42.0 (26–61)
Total hospital stay (day)	14.0 (11–17)
Postoperative hospital stay (day)	11.0 (9–14)
Time to tolerance of regular diet (day)	6.0 (4–7)

Values are presented as median (interquartile range) or number (%). ASA, American Society of Anesthesiologists; PS, physical status.

erative hospital stay was 11.0 days (range, 9–14 days). The median time required to return to regular diet after surgery was 6.0 days (range, 4–7 days) (Table 1).

Tumor characteristics and stage

When classified according to tumor location, 25 tumors (45.5%) were located in the descending colon and 30 tumors (54.5%) were located in the sigmoid colon. At the time of operation, 25 (45.5%) patients were diagnosed as stage II, 20 patients (36.4%) were diagnosed as stage III, and 10 patients (18.2%) were diagnosed as stage IV. When each stage was subdivided, 15 (27.3%) were IIA, 6 (10.9%) IIB, 4 (7.3%) IIC, 16 (29.1%) IIIB, and 4 (7.3%) IIIC. When synchronous colon cancer was present, the stage of advanced cancer was applied.

Synchronous colon cancer was identified in 5 cases (9.1%). Combined tubular adenoma was identified in 23 patients (41.8%), and 4 of them were confirmed as high-grade dysplasia. Low-grade mucinous neoplasm of the appendix was identified in one case. Ischemia of the proximal colon was identified in 10 cases (18.2%) and perforation of the colon was identified in 5 patients (9.1%) (Table 2).

Complications

A total of 12 postoperative complications (21.8%) occurred. These included 2 pneumonia and 10 postoperative ileus cases. Nine patients with ileus improved with conservative treatment, but 1 patient needed reoperation. Except for this case, the Clavien-Dindo grades of other surgical complications were all grade II or lower. Anastomotic leakage and perioperative mortality were not ob-

Table 2. Tumor characteristics and stage (n = 55)

Variable	Value
Tumor location	
Descending colon	25 (45.5)
Sigmoid colon	30 (54.5)
Combined findings	
Synchronous colon cancer	5 (9.1)
Tubular adenoma	23 (41.8)
Appendiceal mucinous neoplasm	1 (1.8)
Ischemia of proximal colon	10 (18.2)
Perforation of proximal colon	5 (9.1)
Stage ^a	
II	25 (45.5)
IIA	15 (27.3)
IIB	6 (10.9)
IIC	4 (7.3)
III	20 (36.4)
IIIB	16 (29.1)
IIIC	4 (7.3)
IV	10 (18.2)

Values are presented as number (%).

^aWhen synchronous colon cancer was present, the stage of advanced cancer was applied.

served.

Functional outcomes

At 6 to 12 weeks postoperatively, the median number of bowel movements was twice per day (interquartile range, 1–3 times per day). At postoperative 6 months, 8 patients (14.5%) complained of diarrhea and needed medications, 14.6% (6 of 41) and 14.3% (2 of 14) in STC and TC group, respectively. Four patients (7.3%) complained of moderate diarrhea which needs antidiarrheal medication at 6 to 12 months postoperatively, 4.9% (2 of 41) and 14.3% (2 of 14) in STC and TC groups, respectively. After 1 year, only 3 of 8 patients still required medication, 2.4% (1 of 41) and 14.3% (2 of 14) in STC and TC groups, respectively. No patients complained of severe diarrhea requiring hospitalization.

Disease-free survival

Except for 10 stage IV patients, 45 patients were analyzed for DFS. The median follow-up duration was 17.0 months (range, 8.0–45.0 months). Eight tumor recurrences (17.8%) and 3 mortalities (6.7%) were observed during this period. The 3-year DFS was 78.9% in stage II and 66.0% in stage III patients. When both stage II and III patients were included, 3-year DFS was 72.7% (Fig. 1A).

Overall survival

The median follow-up duration was 18.4 months (range, 7.0–40.0

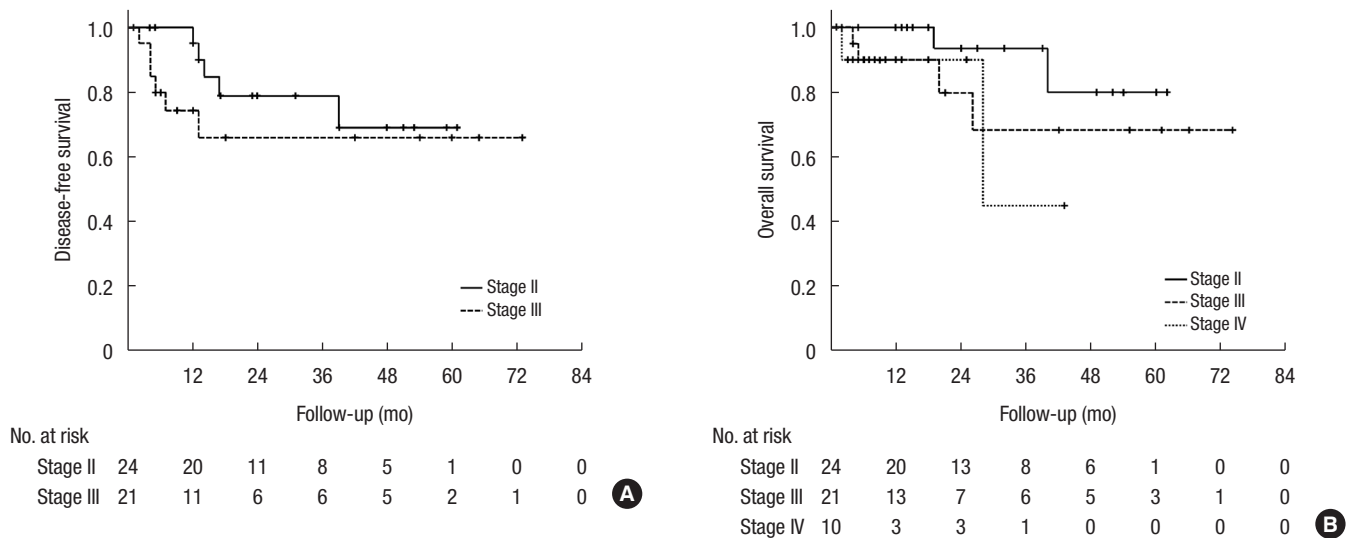


Fig. 1. Disease-free survival (A) and overall survival (B) of subtotal colectomy for obstructive left colon cancer.

months). During this period, 8 mortalities (14.5%) were observed and 5 of 8 were caused by progression of colon cancer. In all patients, the 3-year OS was 86.7%. When divided by stage, 3-year OS was 80.0% in stage II, 68.2% in stage III, and 44.4% in stage IV patients (Fig. 1B).

DISCUSSION

The rate of morbidity and mortality of emergency surgery for OLC has been reported as high [16, 17]. Therefore, 2-stage procedures have been the classic choice of treatment to reduce operative morbidity and mortality caused by an unprepared bowel. However, stoma that are created to avoid complications not only cause other complications associated with the stoma but also deteriorate the quality of life [18]. The stoma reversal rate after HP is significantly lower than diverting loop ileostomy (50% vs. 90%) [19]. Also, complications related to stoma reversal cannot be overlooked. Garber et al. [20] reported that 29.1% of patients had postoperative complications after reversal of HP. Especially, they reported 3.8% anastomotic leak and 1.9% mortality. Moreover, 35% of patients who underwent HP could not undergo reversal surgery because of underlying general conditions [3, 21]. Therefore, the demand for a safe, 1-stage procedure that does not require a stoma is high.

One-stage procedures mainly include segmental resection with perioperative SEMS or intraoperative colonic irrigation and STC/TC. Perioperative placement of SEMS to bridge elective surgery has been used and reports a high success rate of 93.8%. Also, primary anastomosis could be performed in 91.8% of patients, and stoma creation was required only in 10.6% to 23.9% of patients [4–6]. In addition, preoperative colonoscopy has the advantage of being able to determine the presence of synchronous colon cancer

in the proximal colon. However, complications such as perforation may occur in 1.5% to 8.9% of patients due to SEMS [4–6]. Stent-related perforation is also associated with an increased risk of global and locoregional recurrence [7]. Currently, the European Society of Gastrointestinal Endoscopy guidelines and the latest Cochrane Systematic Review state that stent placement is not the treatment of choice in patients with potentially curable diseases and may be considered as an alternative to emergency surgery in patients with increased risk of perioperative mortality [22, 23].

SC with intraoperative colonic irrigation and STC/TC are both known to have low mortality and morbidity [8, 9]. In several studies comparing SC and STC/TC, different conclusions were drawn. Kluger et al. [9] reported the rate of anastomotic leakage was lower in STC/TC compared to SC [10]. On the other hand, in a recent French multicenter trial, the rate of anastomotic leakage in SC was not higher than STC/TC. However, in that study, 15% of SC patients needed diverting ileostomy [11], indicating that these procedures, in reality, are not truly 1-stage procedures. Even loop ileostomy has the risk of morbidity in formation (12%) and reversal (17.3%–21%) [24, 25].

Another problem with SC with intraoperative irrigation is that it is difficult to detect synchronous colon cancer. In colon cancer patients without obstruction, preoperative colonoscopy could detect 5% to 7% of synchronous colon cancers [26–28]. In this study, synchronous colon cancer was detected in 9.1% of patients (5 of 55). When the range expanded, adenoma was detected in 41.8% of patients (23 of 55), and 17.4% of them (4 of 23) were reported as high-grade dysplasia. For these reasons, early colonoscopy follow-up is generally warranted after SC. However, if synchronous colon cancer is detected, reoperation is inevitable.

STC/TC is a safe 1-stage procedure that does not require a

stoma. The rate of anastomotic leakage is reported as 0% to 2.8% [10, 12–14]. The anastomotic leakage rate of STC/TC is not higher than the known rate of elective right hemicolectomy or SC (2.8% and 2.3%, respectively) [29]. One report showed that the rate of anastomotic leakage was as high as 14% after STC/TC [11]. However, compared with previous reports, the gap in the rate was too large. It is difficult to accept this rate as general. In this study, the rate of anastomotic leakage was 0% without any diverting ileostomy.

Compared to other surgeries, STC/TC requires a relatively longer operation time because the area to dissect is larger. In this study, the average length of surgery was 175 minutes (range, 155–210 minutes). Therefore, in hemodynamically unstable patients, primary diverting colostomy would be the safer option relative to STC/TC. Our study did not include hemodynamically unstable patients; however, compared with SC with intraoperative colonic irrigation, the operation time of STC/TC was reported as shorter [15]. Therefore, except for patients that are hemodynamically unstable or have severe comorbidities that require the avoidance of long operation time, STC/TC is accepted as an available operative option.

Morbidity and mortality for OLCC operation were reported as high as 28.0% and 7.0%, respectively, and the rate of severe complications (more than Clavien-Dindo grade III) was reported as 7.0% [11]. The rate of postoperative morbidity in this study was similar (21.8%) and the rate of severe complications and mortality was relatively low (1.8% and 0%, respectively). What is remarkable in this study is that anastomotic leakage or surgical site infection were not observed. There are several hypotheses for why the anastomotic leak rate is low in STC/TC. First, the mobility of the small bowel allows the surgeon to perform ileocolic or ileorectal anastomosis without tension. Second, the ileocolic anastomosis benefits from an optimal blood supply due to the high vascularity of the ileum [30]. Based on these concepts, there is no reason for the leakage rate of STC/TC to be higher than that of right hemicolectomy. However, postoperative ileus was relatively common (18.2%), and 1 patient needed reoperation due to prolonged postoperative ileus. The larger raw surface in the region of dissection and large defects created by excising the area of the colon are thought to be the cause of postoperative ileus.

Functional aspects are big concerns with respect to the use of STC/TC. In a previous randomized controlled trial, increased bowel frequency (3 or more bowel movements per day) was more common in the STC group than in the SC with intraoperative colonic irrigation group during the immediate postoperative period [8]. In another study, 31.2% of patients who underwent STC/TC had diarrhea during the immediate postoperative period. However, most symptoms naturally improved or were controlled by antidiarrheal medication, and disabling diarrhea was reported in only 6.2% of patients [15]. The average bowel movement after 3 to 6 months and 12 months after surgery was reported as 2 stools per day [13, 14]. This study showed similar results. In the 6 to 12

weeks after surgery, 14.5% of patients required antidiarrheal medication, 7.3% of patients complained of mild diarrhea (less than 4 times a day), and 7.3% of patients complained of moderate diarrhea (4 or more times a day). After 1 year, only 5.5% of patients required antidiarrheal medications. The length of the remaining colon and the resected terminal ileum are known to be important factors influencing the occurrence of diarrhea after surgery [31]. In our study, the terminal ileum was carefully resected within 10 cm, and the rectal resection was always above the level of the pelvic promontory to preserve more than 10 cm of the rectum.

Patients diagnosed with obstructive colon cancer and underwent 1-stage emergency curative treatment were reported with worse long-term survival than patients with nonobstructive lesions [32, 33]. The long-term outcome of this study was relatively favorable compared to previous studies [11, 34]. Since this study was not designed as a comparative study, it is difficult to directly compare results.

The number of lymph nodes evaluated after surgical resection of colorectal cancer is a known predictor of survival [35]. In this study, there are no cases involving less than 12 lymph nodes, and the median number was 42. Although this number is higher than that of SC, its clinical significance is not clear because it includes lymph nodes of the right-side colon. However, the main reasons for our results are that all surgeries involved were performed by colorectal specialists and the surgeries were performed according to the oncologic principle.

The noncomparative design, small number of included patients, and short period of follow-up are limitations of this study. However, the safety and the benefits of STC/TC were confirmed. In order to verify these results, prospective, large-scale, randomized controlled trials will be needed.

In conclusion, STC/TC for OLCC is a safe, 1-stage procedure that does not require diverting stoma. The advantages of STC/TC also include the elimination of synchronous and potentially metachronous colon tumors and the removal of proximal dilated colon, most importantly, the risk of anastomotic leakage observed is very low. Most patients did not complain of diarrhea or were well controlled with medication and severe diarrhea rarely occurred after surgery. In addition, the 3-year OS and DFS are also acceptable. Therefore, STC/TC is a reasonable treatment option for OLCC.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

FUNDING

None.

AUTHOR CONTRIBUTIONS

Conceptualization: HOK; Data curation: JTS; Formal analysis: all authors; Investigation: JTS, HOK; Methodology: HOK; Project administration: HOK; Supervision: HOK, HK; Visualization: JTS, YBK; Writing—original draft: JTS, YBK; Writing—review & editing: all authors. All authors read and approved the final manuscript.

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