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Surgical Treatment and Subsequent Outcome of Patients with Carcinoma of the Splenic Flexure

TOHRU NAKAGOE[1], TERUMITSU SAWAI[1], TAKASHI TSUJI[1], MASAAKI JIBIKI[1], MASAYUKI OHBATAKE[1], ATSUSHI NANASHIMA[1], HIROYUKI YAMAGUCHI[1], TORU YASUTAKE[1], NOBUKO KUROSAKI[1], HIROYOSHI AYABE[1], and HIROSHI ISHIKAWA[2]

[1] First Department of Surgery, Nagasaki University School of Medicine, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan
[2] Department of Surgery, Sasebo Municipal General Hospital, 9-3 Hirase-cho, Sasebo, Nagasaki 857-8511, Japan

Abstract Extended resection, comprising extended right hemicolectomy, splenectomy, and distal pancreatectomy, has been advocated for carcinoma of the splenic flexure because the lymphatic drainage at this site is variable. The present study addresses the problems associated with selecting the most appropriate operative procedure to achieve cure of splenic flexure cancers. We conducted a retrospective review of 27 patients with splenic flexure cancer who underwent curative resection. Left partial colectomy was performed in 20 patients and partial resection of the transverse/descending colon was performed in 7 patients. The combined resection of adjacent organs due to tumor adherence was performed in three patients. The spleen and distal pancreas were the organs most frequently resected among a collective total of six adjacent organs. The median duration of follow-up was 60.9 months after resection for splenic flexure cancer. No patient developed local recurrence. There was no significant difference in 5-year survival between patients with splenic flexure cancers and those with colon cancers at other sites. In conclusion, splenic flexure cancer resected by left partial colectomy or partial resection of the transverse/descending colon without routine extended resection was not associated with a worse prognosis than colon cancers at other sites.

Key words Splenic flexure · Colon cancers · Extended resection

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Introduction

While carcinoma of the splenic flexure is uncommon, it is associated with a high risk of obstruction and a poor prognosis.[1–3] Some surgeons recommend extended surgery, in the form of extended right hemicolectomy, splenectomy, and distal pancreatectomy, to improve the survival of patients with splenic flexure cancer.[1,4] Because carcinoma at this site has dual lymphatic drainage of the superior and inferior mesenteric vessels, the involved lymph nodes along both vessels can be removed during the extended right hemicoloctomy.[1,4] An additional rationale for extended surgery is that the splenic flexure has direct lymphatic drainage to the splenic hilum and along the pancreatic tail,[5] however, whether this extended surgery improves the prognosis of patients with splenic flexure cancer remains controversial.[1–4,6] This study reviews our experience of treating carcinoma at this site and discusses the problems associated with appropriate operative procedure selection for splenic flexure cancer.

Patients and methods

Between January 1982 and December 1998, a total of 840 patients with a single primary adenocarcinoma of the colon underwent curative resection at either Nagasaki University Hospital or Sasebo Municipal Hospital. Patients with more than one carcinoma of the colon, whether synchronous or metachronous, were excluded, as were those treated by definitive local excision. The splenic flexure was defined as the junction between the distal third of the transverse colon and the first part of the descending colon.[1,2] Colonic obstruction, the precise definition of which is elusive, was defined by the symptoms of increasing constipation, pain, and vomiting, by abdominal and abnormal gaseous distention of the gut seen on radiography, and the laparotomy

findings of proximal bowel distention and edema.[1] Local recurrence was defined as convincing evidence of cancer recurrence at the anastomosis, or in the abdominal wound, drain site, or peritoneum, but not as hepatic or peritoneal secondaries.[1]

Pathologic diagnoses and classification of the resected colon cancer tissue were made according to the Japanese Classification of Colorectal Carcinoma.[7] In this study, "Curability A"[7] was defined as curative resection; that is, removal of the primary tumor, with or without an anastomosis, the margins of which had no histologically evident malignant cells, and no metastasis to the liver, peritoneum, or other distant organs.

The patients underwent either a left partial colectomy[8] or partial resection of the transverse/descending colon. Left partial colectomy[8] was performed as careful mobilization of the splenic flexure and its mesentery, followed by division of the left branch of the middle colic artery and the left colic artery at their origin, the removal of the entire lymph node-bearing mesentery and transection of the bowel proximally, encompassing half of the transverse colon, and transection of the upper sigmoid colon distally. A decision was made by the surgeon about whether to remove the lymph nodes from the root of the middle colic artery and the inferior mesenteric artery. We generally decided to remove these lymph nodes for patients with a stage III tumor. Partial resection of the transverse/descending colon was performed with division of the left branch of the middle colic artery or the left colic artery at its origin, respectively, concurrent with removal of the lymph node-bearing mesentery. We principally selected the following operative procedures: left partial colectomy for stage II/III tumors; and partial resection of the distal third of the transverse colon or the first part of the descending colon for stage 0/I tumors.

Categorical data were analyzed by the chi-squared test. Survival analysis was performed using the Kaplan-Meier method,[9] and differences between the curves were tested using the log rank test.[10] Deaths from postoperative complications occurring within 1 month of surgery were not included in the survival analysis. All tests were two-tailed and a P value of less than 0.05 was considered significant.

Results

Of the total 840 patients, 27 (3.2%) were found to have splenic flexure carcinoma. There were 13 men and 14 women ranging in age from 53 to 78 years, with a median age of 67 years. The median duration of follow-up was 60.9 months, with a range of 47 days to 127.6 months, after resection. Table 1 summarizes the pathological features of those 27 patients and Table 2 lists the surgical procedures performed. The six patients (6/27; 22.2%) found to have colonic obstruction on admission underwent emergency surgery, one of whom died in the immediate postoperative period. This patient had an obstructive carcinoma which had also penetrated into his spleen, and septic shock developed as a result of a splenic abscess. A single-stage left partial colectomy was performed in four of these six patients, and a two-stage left partial colectomy concurrent with fecal diversion was performed in the other two. Intestinal continuity was reestablished in two patients within 24 months of the initial operation. Of the 27 patients with splenic flexure carcinoma, 21 (77.8%) underwent elective surgery; as single-stage left partial colectomy in 14 and as single-stage partial resection of transverse colon/descending colon in 7. There was no operative death in this group. None of the patients in this series underwent extended right hemicolectomy.

Table 1. Pathological features of carcinoma of the splenic flexure in the 27 patients studied

Variable	No. of patients (%)
Maximal tumor diameter (cm)	2.1 (1.0–6.0)[a]
Histologic type	
Well-differentiated adenocarcinoma	14 (51.9)
Moderately differentiated adenocarcinoma	12 (44.4)
Poorly differentiated adenocarcinoma	1 (3.7)
Depth of invasion	
Mucosal/submucosal/muscularis propria	7 (25.9)
Subserosa	15 (55.6)
Serosa	4 (14.8)
Direct invasion of adjacent organs	1 (3.7)
Lymph node metastasis	
Absent	20 (74.1)
Present	7 (25.9)
Lymphatic invasion	
Absent	12 (44.4)
Present	15 (55.6)
Venous invasion	
Absent	20 (74.1)
Present	7 (25.9)

[a] Median (range)

Left partial colectomy was performed in 2 of 7 patients with stage 0/I carcinoma, in 11 of 13 patients with stage II carcinoma, and in all 7 patients with stage III carcinoma (Table 3).

There were three patients (3/27; 11.1%) who underwent combined resection concurrent with surgery, two of whom underwent emergency surgery (2/6; 33.3%) and one, elective surgery (1/21; 4.8%). A collective total of six organs were resected, namely, two spleens, two distal pancreases, one diaphragm, and one stomach, with the spleen and distal pancreas being the organs most frequently resected. Combined resections

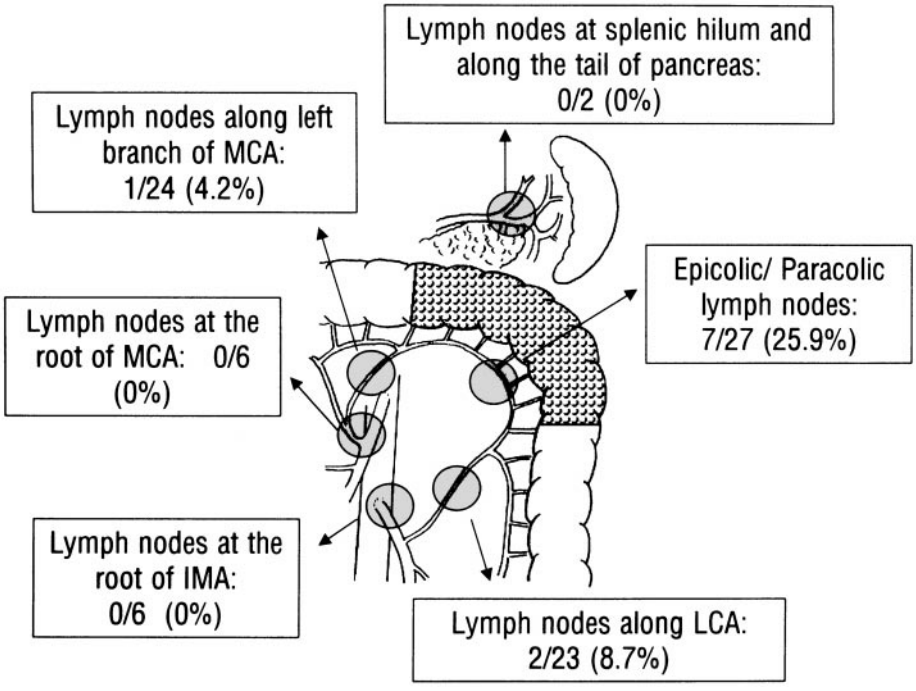


Fig. 1. Distribution of lymph node metastasis in the 27 patients who underwent curative resection for carcinoma of the splenic flexure. *MCA*, middle colic artery; *LCA*, left colic artery; *IMA*, inferior mesenteric artery

Table 2. Surgical procedures for carcinoma of the splenic flexure

Procedure	No. of patients		
	Elective surgery	Emergency surgery	Total
One-stage, left partial colectomy	14	4	18
One-stage, partial resection of transverse/descending colon	7	0	7
Two-stage, left partial colectomy with colostomy/ileostomy	0	2	2
Total	21	6	27

Table 3. Surgical procedures performed for carcinoma of the splenic flexure in relation to stage

Stage	No. of patients	
	Left partial colectomy	Partial resection of the transverse/descending colon
0/I	2	5
II	11	2
IIIa/IIIb	7	0
Total	20	7

were performed because of tumor adherence to the adjacent organs.

Postoperative complications developed in 3 (11.1%) of the 27 patients, all of whom had undergone either emergency (2/6; 33.3%) or elective surgery (1/21; 4.8%). A minor anastomotic leak developed in one patient who had undergone elective surgery, but this was resolved by bowel rest and total parenteral nutrition. Intra-abdominal abscess developed in two of the patients who had undergone emergency surgery with the combined resection of adjacent organs. The Intra-abdominal abscess in one patient was eradicated by abscess drainage, but in the other patient it resulted in septic shock and death. In this series, the operative mortality rate was 3.7% (1/27).

Removal of the lymph nodes at the root of the middle colic artery and the inferior mesenteric artery was performed in three patients with stage II disease and three with stage III disease. Lymph node metastasis developed in 7 (25.9%) of the 27 patients, the distribution of which is shown in Fig. 1. No metastasis was observed histologically in the lymph nodes at the splenic hilum, along the pancreas tail, or at the root of the inferior mesenteric artery and middle colic artery. No statistically significant difference was seen in the frequency of lymph node metastasis along the left colic

artery and the middle colic artery (8.7% *vs* 4.2%, $P = 0.6085$).

During the same period, 813 patients underwent curative resection for carcinoma occurring at other sites in the colon. There was no significant difference in stage between the splenic flexure cancers and the colon cancers at other sites ($P = 0.4542$) (Table 4). There was no significant difference in 5-year survival rates between the patients with splenic flexure cancers and those with colon cancers at other sites (Fig. 2). There was also no statistically significant difference in cumulative 5-year survival rates between these groups according to the stage of the cancer (Fig. 2).

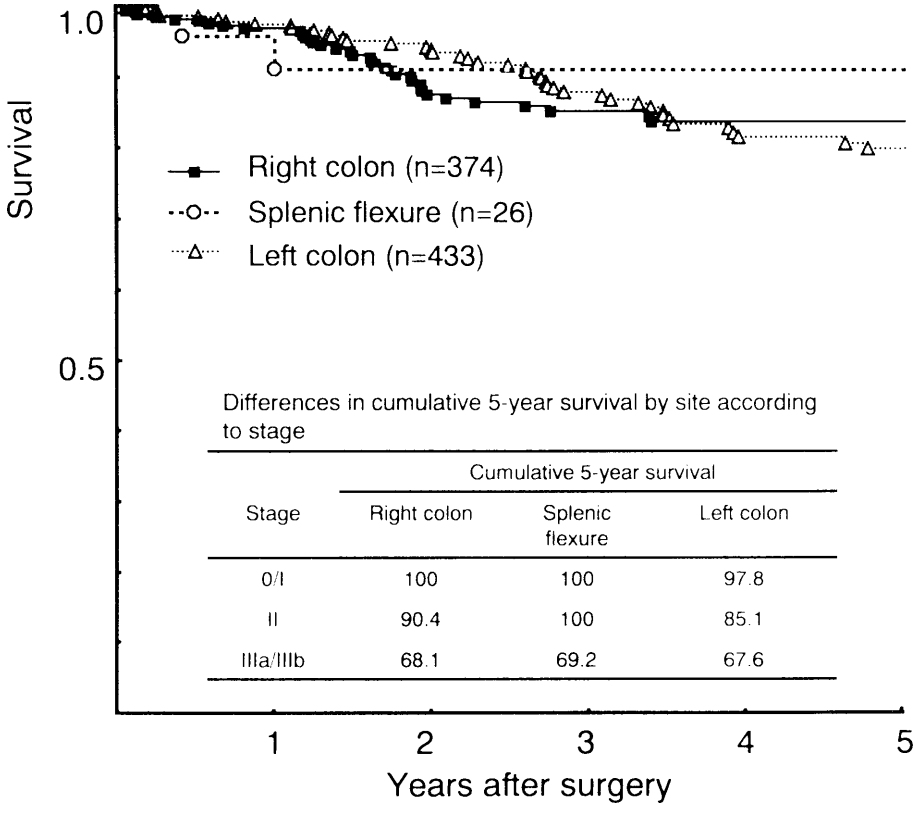
Table 4. Stage distribution of carcinoma at the splenic flexure and other sites

Stage	No. of patients			*P* value
	Right colon	Splenic flexure	Left colon	
				0.4542
0/I	84 (22.3)	7 (25.9)	112 (25.7)	
II	176 (46.7)	13 (48.1)	177 (40.6)	
IIIa/IIIb	117 (31.0)	7 (25.9)	147 (33.7)	
Total	377	27	436	

Follwing the curative resection of splenic flexure cancers, hematogenous metastases developed in the liver, spleen, and lung in these patients, but no local recurrence was seen.

Discussion

The objective of surgical treatment for resectable carcinoma of the colon is to remove the growth with an adequate margin by performing a wide excision of the tumor-bearing area and associated lymphatics, paying careful attention to the blood supply of that segment.[8] The resected area must encompass the mesentery to the origin of the major vessels in an attempt to reduce local recurrence by removing involved or potentially involved lymph nodes.[4] Two major vessels, the supperior and inferior mesenteric arteries, nourish the entire colon and the resection of carcinomas in the colon, with the exception of those in the splenic flexure, is logically simple because it is based on removal of the lymph nodes along the superior or inferior mesenteric vessels. However, the blood supply to the splenic flexure has been shown to be variable[4,11,12] in that it is carried by the inferior mesenteric artery via the left colic artery in 89% of cases and by the superior mesenteric artery via the middle colic artery in 11%.[11] The middle colic artery



Differences in cumulative 5-year survival by site according to stage

Stage	Cumulative 5-year survival		
	Right colon	Splenic flexure	Left colon
0/I	100	100	97.8
II	90.4	100	85.1
IIIa/IIIb	68.1	69.2	67.6

Fig. 2. Survival curves for the three groups of patients with right, splenic flexure, and left colon cancer who underwent curative surgery. There was no significant difference between the three groups. The table (*inset*) shows the differences in cumulative 5-year survival by site according to stage

Table 5. Lymph node metastasis in patients with splenic flexure cancer who underwent extended right hemicolectomy or colectomy concurrently with combined resection of the spleen and/or distal pancreas, according to a review of the literature

Study[Ref.]	No. of patients	Lymph node metastasis
Extended right hemicolectomy		
Sadler et al.[4]	1	One LN metastasis at the ileocolic junction
Present study[a]	6	No LN metastasis at the origin of the middle colic artery
Splenectomy and distal pancreatectomy		
Killingback[15]	1	No LN metastasis at the splenic hilum and along the pancreas tail
Khafagy and Stearns[6]	10	No LN metastasis at the splenic hilum and/or along the pancreas tail
Walfisch et al.[14]	1	No LN metastasis at the splenic hilum and along the pancreas tail
Present study[a]	2	No LN metastasis at the splenic hilum and along the pancreas tail

LN, lymph node

[a] In the present study, no patient underwent extended right hemicolectomy, although removal of lymph nodes from the origin of the middle colic artery was performed in six patients with splenic flexure cancer

is entirely absent in 5%–22% of cases.[11,12] Where the middle colic artery is absent, the splenic flexure is supplied by the right colic artery originating from the superior mesenteric artery and left colic artery.[4,11,12]

Aldridge et al.[1] reported that one of the factors accounting for the poor outcome of patients with splenic flexure cancer was inappropriate methodology in the surgical management of lymph nodes. This idea was supported by the high rate of local recurrence observed at this site, and an extended right hemicolectomy encompassing the lymphatic drainage of involved nodes around the origin of the middle colic artery was advocated. Sadler et al.[4] also recommended an extended right hemicolectomy with removal of involved nodes when lymphatic drainage does not follow the classical pattern (Table 5). It is possible that extended right hemicolectomy could improve the survival of patients with colon cancer at the splenic flexure because it removes the involved or potentially involved lymph nodes along the superior and inferior mesenteric vessels.[1,4]

On the other hand, Levien et al.[3] reported that because splenic flexure cancers do not carry a worse prognosis than other colon cancers, dual lymphatic drainage does not confer a survival disadvantage and therefore, extended resection is unnecessary. Other investigators[8,13] have also advocated left partial colectomy for splenic flexure carcinoma, ligating both the middle colic artery at its origin and the ascending branch of the left colic artery to remove those nodes likely to be involved. In this series, carcinomas of the splenic flexure were not associated with a worse prognosis than colon cancers at other sites after curative resection, even though we did not perform extended right hemicolectomy. Moreover, histological examination did not reveal lymph node metastasis at the root of the middle colic artery in six of the patients in this series (Fig. 1). Therefore, it is our opinion that extended right hemicolectomy is unnecessary to cure splenic flexure cancer. A prospective, randomized study might answer some questions about the putative superiority of extended right hemicolectomy, but it is unlikely to be undertaken due to the relative paucity of tumors in this location.[3]

Carcinoma of the splenic flexure is associated with a high risk of obstruction.[1–3] Subtotal colectomy or extended right hemicolectomy has been recommended for this type of cancer because it would seem to be a safe method of treating patients with an obstruction at this site.[2,4] In this series, no anastomotic leakage developed in patients who underwent single-stage coloanastomosis for obstructive carcinoma of the splenic flexure. Nevertheless, we recommend performing a two-stage or extended resection, in the form of a subtotal colectomy or an extended right hemicolectomy with ileo-descending colostomy, in patients found to have severe distention and edema of the proximal colon at laparotomy, and/or in poor-risk patients, because it might be associated with fewer anastomotic complications.

Anatomic studies of lymphatic drainage of the splenic flexure have demonstrated direct lymphatic drainage to the splenic hilum and along the pancreatic tail,[5] on the basis of which, routine splenectomy with distal pancreatectomy has been advocated for the treatment of carcinoma of the splenic flexure. Aldridge et al.[1]

reported that more extensive surgery to include even the hilum of the spleen might be appropriate for such tumors; however, Khafagy and Stearns[6] stated that splenectomy and distal pancreatectomy in the resection of carcinoma of the splenic flexure did not improve 5-year survival. In the studies reviewed (Table 5), no lymph node metastasis was found at the splenic hilum or along the pancreatic tail in patients with splenic flexure cancer who underwent splenectomy and distal pancreatectomy. Furthermore, in the present series, postoperative histology revealed no lymph node metastasis at the splenic hilum or along the pancreatic tail in two patients whose tumors were adherent to both the spleen and distal pancreas, and no local recurrence developed in these sites after curative resection. Our findings also showed that splenic flexure cancers were not associated with a worse prognosis than colon cancers at other sites. Therefore, we feel that it may be unnecessary to perform splenectomy and distal pancreatectomy in routine resection of splenic flexure cancer that is not adherent to these organs.

The current study revealed that the surgical outcome of patients with splenic flexure cancer who underwent left partial colectomy or partial resection of the transverse/descending colon without routine extended resection, in the form of extended right hemicolectomy, splenectomy, and distal pancreatectomy, was similar to that of patients with colon cancers at other sites. Thus, we believe that routine extended resection may be unnecessary to achieve cure of splenic flexure cancer. However, when splenic flexure carcinoma presents as severe obstruction, then extended right hemicolectomy would be indicated to prevent anastomotic complications. Splenectomy and distal pancreatectomy should be performed if the carcinoma is adherent to the spleen and the distal pancreas, respectively.

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