

# En bloc Resection for Right Colon Cancer Directly Invading Duodenum or Pancreatic Head

Won-Suk Lee,<sup>1</sup> Woo Yong Lee,<sup>2</sup> Ho-Kyung Chun,<sup>2</sup> and Seong-Ho Choi<sup>2</sup>

<sup>2</sup>Department of Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul;

<sup>1</sup>Department of Surgery, Gil Hospital, Gachon University of Medicine of Science School of Medicine, Incheon, Korea.

**Purpose:** We undertook this study to analyze clinical features and surgical outcome of en bloc resections of the right side colon cancer directly invading duodenum and/or pancreatic head. **Materials and Methods:** The records of all patients who underwent en bloc resection of duodenum and/or pancreas for right colon cancers were analyzed retrospectively. From September 1994 to September 2006, 1,016 patients underwent curative right hemicolectomy. Nine patients (0.9%) had en bloc resection of a right side colon cancer with duodenum or pancreatic head invasion. **Results:** The median operative time was 320 minutes (range, 200-420) and the median blood loss was 700 mL (range, 100-2,000). The mean size of tumor was 6.6 cm (range, 3.2-10.7). The mean preoperative carcinoembryonic antigen (CEA) was 10.6 ng/mL (range, 0.2-50.8). There was no 30 day perioperative mortality. The median disease-free survival was 23.5 months [95% confidence interval (CI) 5.2-41.8] and the median overall survival was 28.1 months (95% CI 9.7-46.5). **Conclusion:** In patients with locally advanced right side colon cancer that directly invades the duodenum or pancreas can be safely resected with curative potential with minimum morbidity and mortality. Long term disease free survival can occur in a significant number of patients undergoing curative en bloc resection in this particular subset of patients.

**Key Words :** Colonic neoplasms, duodenectomy, pancreaticoduodenectomy, survival

Received: April 17, 2008

Revised: January 9, 2009

Accepted: January 30, 2009

Corresponding author: Dr. Woo Yong Lee,  
Department of Surgery, Samsung Medical  
Center, Sungkyunkwan University School of  
Medicine, 50 Irwon-dong, Gangnam-gu,  
Seoul 135-710, Korea.

Tel: 82-2-3410-0261, Fax: 82-2-3410-0929

E-mail: lwy555@skku.edu

· The authors have no financial conflicts of  
interest.

## INTRODUCTION

Despite advances in imaging studies and preoperative screening for the extent of the primary cancer involvement, the accurate extent of cancer such as the extracolonic spread is frequently established at surgical field. Right colon cancer invading adjacent organ is rare (11-28%), and only a few series have described adjacent organ resection.<sup>1-4</sup> Although the right sided colon may invade various organs such as right kidney, ureter, liver, or gallbladder, the direct invasions of duodenum or pancreatic head are often the culprit of significant morbidity that pose surgical challenge. In such cases, it is the surgeon's decision whether to resect the tumor en bloc with possibility of cure or to regard the tumor as inoperable. Despite a large volume of colon cancer resections performed around the world, very little information on the mortality, morbidity, and outcome is available in this particular subset of patients-right colon cancer with duodenal and/or pancreatic invasions. Hence, we undertook this study to analyze clinical features and surgical outcome of en bloc resections of right colon cancer which invaded directly duodenum and/or pancreatic head.

## MATERIALS AND METHODS

From September 1994 to September 2006, 3,484 patients were registered for

© Copyright:

Yonsei University College of Medicine 2009

colon carcinoma surgery database at Samsung Medical Center. Of these patients, 1,016 patients underwent curative right hemicolectomy (29.2%). Ten patients (1.0%) underwent bypass surgery due to unresectable cancer and were excluded in the analysis. Nine patients (0.9%) had en bloc resection of a right side colon cancer with duodenum or pancreatic head invasion. The inclusion criterias were as follows: 1) biopsy proven T4 cancer either to duodenum or pancreas; 2) no evidence of M1 disease accompanied by no signs of disseminated disease in preoperative imaging; 3) patients who were able to complete the radiological follow-up at our institution; 4) patients with histologically proven colon carcinoma; and 5) age  $\geq$  18 years. We excluded patients who had metastatic lesions affecting the pancreas rather than direct spread. All patients underwent potential curative resections. The staging process was based on the TNM classification proposed by the American Joint Committee of Cancer, 6<sup>th</sup> edition.<sup>5</sup> Survival after resection was estimated by the Kaplan-Meier method.

## RESULTS

Nine patients with right sided colon cancer involving duodenum (n = 5) and pancreas (n = 4) were treated during the study period. The clinical details of these patients are presented in Table 1. There were five men and 4 women with a mean age of 48.0 years (range, 41-72). Five patients presented with a mass or abdominal pain, whereas 3 patients presented with anemia. None of the patients presented with colon obstruction or cancer perforation necessitating an emergency surgery. A preoperative abdominal CT scan was done in all patients and detected duodenal or pancreas infiltration in 6 (66.7%) of these patients. The median operative time was 320 minutes (range, 200-420) and the median blood loss was 700 mL (range, 100-2,000).

The mean size of tumor was 6.6 cm (range, 3.2-10.7). The mean preoperative CEA was 10.6 ng/mL (range, 0.2-50.8). Five patients underwent duodenectomy (55.6%) and four patients (44.4%) underwent either pancreaticoduodenectomy or pylorus preserving pancreaticoduodenectomy.

Pathologic examination of the specimen showed malignant infiltration of the duodenum and pancreas in all cases. None of the patients had positive resection margins. All patients undergoing pancreaticoduodenectomy or pylorus preserving pancreaticoduodenectomy had a standard reconstruction. Four patients with duodenal infiltration underwent duodenectomy with duodenojejunostomy. One patient had duodenal reconstruction after resection with primary transverse closure to avoid stenosis. There was no 30 day perioperative mortality. Two patients developed post-operative ileus, which were successfully managed during the course of primary admission. The median hospital stay was 18 days (range, 15-35) for both duodenal and pancreatic resections.

Six patients received adjuvant chemotherapy with fluorouracil and leucovorin with or without irinotecan or oxaliplatin. Three patients had lymph node involvement.

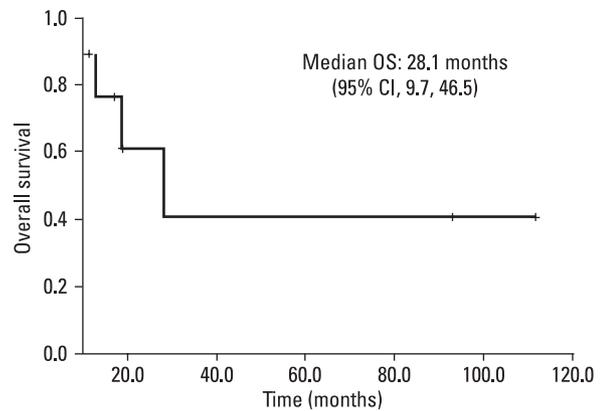


Fig. 1. Overall survival (OS) (n = 9). CI, confidence interval.

Table 1. Treatment Outcome of Advanced Right Colon Cancer Invading Duodenum Only

Age / gender	RH + D / PD	N stage	Lymphatic invasion	Perineural invasion	Adjuvant chemotherapy	Status (months)	F / U	Pattern of failure
F / 55	PD	0	No	No	FL	DOD	18.8	Systemic relapse
M / 72	D	0	No	No	FL	NED	111.6	No relapse
M / 64	D	0	No	No	No	DOD	28.1	Systemic relapse
M / 46	PD	0	No	No	No	NED	93.1	No relapse
F / 41	D	2	No	No	FOLFIRI	DOD	12.9	Systemic relapse
M / 47	D	2	No	No	FOLFIRI	NED	19.0	No relapse
F / 48	D	0	No	No	FOLFOX	NED	17.0	No relapse
F / 48	PD	0	Present	Present	FOLFOX	NED	11.3	No relapse
M / 67	PPPD	2	Present	No	No	DOD	6.3	Systemic relapse

PD, pancreaticoduodenectomy; D, duodenectomy; PPPD, pylorus preserving pancreaticoduodenectomy; NED, no evidence of disease; DOD, dead of disease; FL, 5-fluorouracil and leucovorin; FOLFOX, oxaliplatin plus 5-fluorouracil and leucovorin; FOLFIRI, irinotecan plus 5-fluorouracil and leucovorin.

Of the nine patients, 4 patients developed recurrent diseases in distant lymph nodes, lung and liver. One patient had recurrence at surgical bed with multiple hepatic metastases. After a median follow-up of 22.1 months, the disease-free survival was 23.5 months [95% Confidence interval (CI) 5.2-41.8] and the median overall survival was 28.1 months (95% CI 9.7-46.5) (Fig. 1). At this writing, five patients were alive without any evidence of recurrence.

## DISCUSSION

Advanced cancers infiltrating to contiguous structures or organs are not an infrequent finding at the time of operation for right sided colon cancer. However, local tumor growth into adjacent structures or organs does not necessarily preclude a curative resection, but the surgeon is faced with a "resection that is not standard and often requiring moment to moment improvisation".<sup>6</sup> A right hemicolectomy and en bloc duodenectomy or pancreaticoduodenectomy represents a surgical challenge to the surgeon and an extreme radical procedure to extirpate an advanced colon cancer. In the past decade, more centers are doing pancreaticoduodenectomy for periampullary and pancreatic cancer with low mortality.<sup>7</sup> However, there are very small case series (Table 2) available regarding the resection of pancreas and duodenum or both, which may be interpreted to suggest that these specific procedures are rarely undertaken.

Duodenal and pancreatic involvement from advanced right colon can be difficult to define preoperatively. The preoperative abdominopelvic CT scan imaging may provide unreliable information regarding the prediction of duodenal or pancreatic involvement by colon cancer.<sup>8</sup> In this series, duodenal infiltrations were not preoperatively detected in CT, but were identified during laparotomy in three of nine patients. Thus, despite widely used preoperative imaging such as CT scan, extracolonic spread is often

discovered at laparotomy for the first time.

Generally, it is extremely difficult to make a clear distinction between a direct tumor invasion and inflammatory process. Retrospective studies show that histologic infiltration is demonstrated in only 55-70% of cases in which the tumor is found to be adherent to the adjacent organs,<sup>1,9-11</sup> whereas the rest represents a tumor fixation with inflammatory adhesions. In our study, pathologic examinations of the specimen confirmed tumor infiltrations in all cases, concurring with surgeon's intraoperative inspection. As in others,<sup>2</sup> therefore, it is our recommendation to maintain high index of suspicion of malignant infiltration for tumor adherence to duodenum or pancreatic head during surgery and to circumvent any possibilities of under treatment. One study showed a high rate of early local recurrence, reaching 70-100% in patients who were not treated by en bloc resection.<sup>12</sup> However, Fuks, et al.<sup>13</sup> reported 46% recurrence rate in patients who were treated with en bloc resection.

The prolonged survival of many patients undergoing potential radical en bloc resection for advanced colon cancer may be explained by the relatively low incidence of regional lymph node metastases in these patients.<sup>2,4,13-15</sup> Although malignant invasion of the duodenum or pancreas was confirmed all in current nine patients, only three patients (33.3%) presented with lymph node metastases. This might suggest that these tumors behave in a locally aggressive manner rather than causing lymphatic or hematogenous spread which are prominent prognostic factors affecting recurrence and survival in colon cancer.<sup>4,16</sup>

The number of patients in this series is too small to make a definitive recommendation. However, it is our experience that locally advanced right colon cancer that directly invades the duodenum or pancreas can be safely resected with cure potential with minimum morbidity and mortality. Long term disease-free survival can occur in a significant number of patients undergoing curative en bloc resection in this particular subset of patients.

**Table 2. Results of Series Evaluating Outcomes in Patients with Duodenectomy or Pancreaticoduodenectomy for Advanced Right Colon Cancer**

Lead author	n	Dates of study	Median DFI, month	Complication, (%)	30-day mortality rate, (%)	Number of patients with positive lymph node
Curley, et al. <sup>1</sup>	12	1980 - 1993	42.0	3 (25)	N / A	3
Koea, et al. <sup>2</sup>	8	1986 - 1998	26.0	2 (25)	0	4
Kapoor, et al. <sup>4*</sup>	11	1992 - 2004	54.0	2 (18.1)	0	6
Saiura, et al. <sup>15</sup>	12	1957 - 2007	68.4	N / A	N / A	5
Fuks, et al. <sup>13</sup>	15	1988 - 2005	22.0	3 (20)	6.6	9
Current series	9	1994 - 2006	23.5	2 (22.2)	0	3

n, number; DFI, disease free interval; N/A, not available.

\*Includes two patients with liver and stomach resection.

## REFERENCES

1. Curley SA, Carlson GW, Shumate CR, Wishnow KI, Ames FC. Extended resection for locally advanced colorectal carcinoma. *Am J Surg* 1992;163:553-9.
2. Koea JB, Conlon K, Paty PB, Guillem JG, Cohen AM. Pancreatic or duodenal resection or both for advanced carcinoma of the right colon: is it justified? *Dis Colon Rectum* 2000;43:460-5.
3. Perez RO, Coser RB, Kiss DR, Iwashita RA, Jukemura J, Cunha JE, et al. Combined resection of the duodenum and pancreas for locally advanced colon cancer. *Curr Surg* 2005;62:613-7.
4. Kapoor S, Das B, Pal S, Sahni P, Chattopadhyay TK. En bloc resection of right-sided colonic adenocarcinoma with adjacent organ invasion. *Int J Colorectal Dis* 2006;21:265-8.
5. Greene FL, Page DL, Fleming ID, Fritz AG, Balch CM, Haller DG, et al. *AJCC cancer staging manual*. New York: Springer-Verlag; 2002.
6. Polk HC Jr. Extended resection for selected adenocarcinomas of the large bowel. *Ann Surg* 1972;175:892-9.
7. Yeo CJ, Cameron JL. Improving results of pancreaticoduodenectomy for pancreatic cancer. *World J Surg* 1999;23:907-12.
8. Charnsangavej C, Whitley NO. Metastases to the pancreas and peripancreatic lymph nodes from carcinoma of the right side of the colon: CT findings in 12 patients. *AJR Am J Roentgenol* 1993;160:49-52.
9. Gall FP, Tonak J, Altendorf A. Multivisceral resections in colorectal cancer. *Dis Colon Rectum* 1987;30:337-41.
10. Heslov SF, Frost DB. Extended resection for primary colorectal carcinoma involving adjacent organs or structures. *Cancer* 1988; 62:1637-40.
11. McGlone TP, Bernie WA, Elliott DW. Survival following extended operations for extracolonic invasion by colon cancer. *Arch Surg* 1982;117:595-9.
12. Eldar S, Kemeny MM, Terz JJ. Extended resections for carcinoma of the colon and rectum. *Surg Gynecol Obstet* 1985; 161:319-22.
13. Fuks D, Pessaux P, Tuech JJ, Mauvais F, Bréhant O, Dumont F, et al. Management of patients with carcinoma of the right colon invading the duodenum or pancreatic head. *Int J Colorectal Dis* 2008;23:477-81.
14. Curley SA, Evans DB, Ames FC. Resection for cure of carcinoma of the colon directly invading the duodenum or pancreatic head. *J Am Coll Surg* 1994;179:587-92.
15. Saiura A, Yamamoto J, Ueno M, Koga R, Seki M, Kokudo N. Long-term survival in patients with locally advanced colon cancer after en bloc pancreaticoduodenectomy and colectomy. *Dis Colon Rectum* 2008;51:1548-51.
16. Fielding LP, Phillips RK, Fry JS, Hittinger R. Prediction of outcome after curative resection for large bowel cancer. *Lancet* 1986;2:904-7.