Original Article

En Bloc Resection of Pancreaticoduodenectomy and Colectomy in Patients with Locally Advanced Right Colon Cancer

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Key Words
Pancreaticoduodenectomy and right hemicolectomy;
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Background. En bloc resection of right colon cancer with duodenum or pancreas invasion is a rare entity. We undertook this study to analyze clinical features and surgical outcomes of this subgroup of patients.
Methods. Between 1980 to 2011, there were eleven patients underwent en bloc resection of right hemi-colectomy and pancreaticoduodenectomy. The records of all patients were retrospectively analyzed.
Results. There were six males and five females with a mean age of 57.0 ± 13.0 years (range: 36-77 years old). Histologic examination showed malignant invasion to adjacent organs in ten cases (90.1%). The average operation time was 7.4 hrs and mean blood loss was 1014 ml. Three patients developed post-op complications and no 30-day post operative mortality was reported. The median disease free interval was 20.3 months and the median survival time was 37 months. Four patients had survived longer than 60 months.
Conclusion. In patients with locally advanced right colon cancer invading duodenum or/and pancreas, the role of en bloc resection of colectomy and pancreaticoduodenectomy should be justified for it could provide long term survival with minimal morbidity and mortality rate.
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Despite the improvement of advanced chemotherapy and target therapy, surgical resection remains the only potentially curative treatment for colorectal cancer. Free resection margin (R0 resection) is one of the crucial elements for ideal oncological result and incomplete resection margin could cause local recurrence and poor prognosis.[1,2] Right colon cancer with adjacent organ involvement is unusual (11-28%) and the complexity of the vital organs such as duodenum, pancreas and liver here poses surgical challenge for en bloc surgical resection.[3] In 1929, Grey Turner first published duodenal resection for locally advanced colon cancer and Van Prohaska et al. later reported first associated pancreaticoduodenectomy (PD), known as Whipple's operation, in 1953.[4,5] Since then, relative few studies had been reported because of the complexity and significant morbidity and mortality has discouraged surgeons to perform such procedure.[6,7]

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Patients and Methods

We retrospectively reviewed the database of colorectal cancer registry database between 1980 Jan. to 2011 Dec. During this period of time, there are eleven cases receiving PD or pylorus preserving pancreatoduodenectomy (PPPD) along with right hemi-colectomy due to locally advanced colon cancer. The demographic data of those patients were carefully reviewed with regard to clinical variables, surgical outcomes, and overall survival. The survival rate after resection was calculated by the Kaplan-Meier method.

Statistical analysis

Descriptive statistics were summarized as means, standard deviations, and as frequencies and ranges for the survival difference using the SPSS 17.0 statistical software. When inference testing was completed, results with a p value less than or equal to 0.05 were considered statistically significant.

Results

There were eleven patients received PD or PPPD during this period of time. Six of them were male and five were female with mean age of 57.0 ± 13.0 years (range: 36-77 years old). The mean post-op hospital stay was 26.8 ± 14.1 days and the median disease free interval was 20.3 months. Ten cases were proved with duodenum or pancreas invasion pathologically. Metastatic adenocarcinoma of superior mesenteric vein encasement was noted at the other one patient and staged PPPD was performed after right hemicolectomy and adjuvant chemotherapy with FOLFOX (5-FU + Leucovorin + Oxaliplatin) for four courses. Seven patients with involvement of duodenum, two other patients with invasion to both duodenum and pancreas and one patient had duodenum, liver and gall bladder invasion. The most common symptoms were right upper quadrant pain or abdominal fullness (10/11 patients). The second common symptoms were loss of body weight and bloody or tarry stool (five cases in each symptom). Other symptoms and signs include anemia, palpable abdominal mass and general weakness. In pre-op image evaluation, ten patients received computed tomography scan and another one had magnetic resonance image scan. All of them suggested adjacent organ invasion. Four patients received pan-endoscopy and gross tumor invasion was observed in only one patient (Fig. 1). No intra-operative frozen biopsy was performed. None of them had positive resection margins. The demographic data of the patients are presented in Table 1. No obstruction and perforation developed before surgery and all of them received elective surgery. The mean tumor size was 7.0 cm (range: 2-13 cm). PD was undertaken at four patients (36.4%) and PPPD was performed for the rest 7 patients (63.6%).

In histological examination, ten patients were adenocarcinoma type and nine of them belong to well

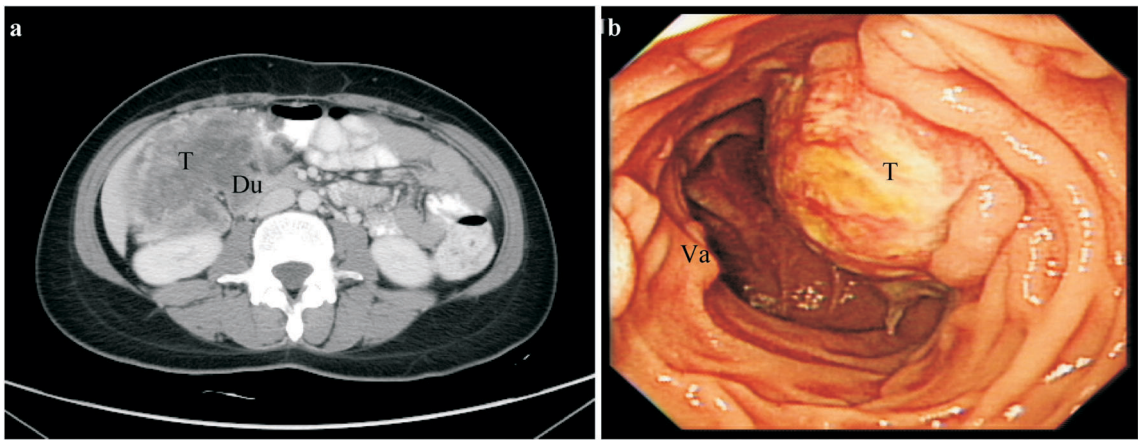

Fig. 1. Demonstration of one case with duodenal invasion on CT scan (a) and PES (b) in pre-operative image evaluation. T: Tumor; Du: duodenum; Va: papilla of Vater.

Table 1. Patients' demographic characteristics

Case	Age (yrs)/ Gender	Primary location	Site of invasion	Pathological T stage	Pathological N status	Pathological M status	Operation	Survival interval	Outcome*
1	77/M	Hepatic flexure	Duo	4	0/12	N/A	PPPD	24	Dead[a]
2	68/M	Hepatic flexure	Duo and panc	4	0/16	N/A	PPPD	141	Alive[b,c]
3	68/F	Hepatic flexure	Duo	4	2/16	N/A	PPPD	16.5	Dead[a]
4	36/M	Transverse colon	Duo	4	4/17	1 (liver)	Whipple	7	Dead[a]
5	51/M	Hepatic flexure	SMV	3	0/13	0	PPPD	50	Dead[a]
6	59/F	Transverse colon	Duo	4	0/37	0	Whipple	96	Alive[b]
7	68/F	Hepatic flexure	Duo	4	1/19	0	PPPD	118	Alive[b]
8	38/F	Hepatic flexure	Duo	4	1/31	0	PPPD	6	Alive[b]
9	53/M	Transverse colon	Duo and panc	4	0/16	1 (omentum)	Whipple	3	Alive[b,c]
10	49/M	Transverse colon	Duo	4	3/34	0	Whipple	56	Alive[b]
11	60/F	Hepatic flexure	Duo, liver, GB	4	11/22	0	PPPD	17	Dead[a]

Duo = duodenum; panc = pancreas; SMV = superior mesenteric vessel; GB = gall bladder; PPPD = Pylorus-preserving pancreatodudenectomy; N/A = Not Available. * till latest follow up status on record. [a] = Died of disease; [b] = Alive without disease; [c] = lost follow up.

to moderately differentiation while one patient was poorly differentiation. One patient was mucinous adenocarcinoma with moderately differentiation. The average sampled lymph nodes number is 21 (range: 12 to 37). No duodenal-colic fistula was identified by pathology report.

The mean operative time was 7.4 hrs (range: 3-11.5 hrs) and the average blood loss was 1014 ml (range: 150-2300 ml). There were total three patients with post operative complication. One patient developed gastric atonia, one patient had UGI bleeding and anastomosis leakage of pancreaticojejunostomy and the other was wound infection. All of them were managed with conservative treatment successfully. There was no surgical mortality. The median hospital stay post-operatively was 22.5 days (range: 11-62 days). The median survival time was 37 months (range: 3 to 141 months) (Fig. 2).

In survival analysis, none of the factors, such as gender, tumor size (> vs. ≦ 7.0 cm), nodal status, histology type, operation method or post-operative complication was related to survival rate.

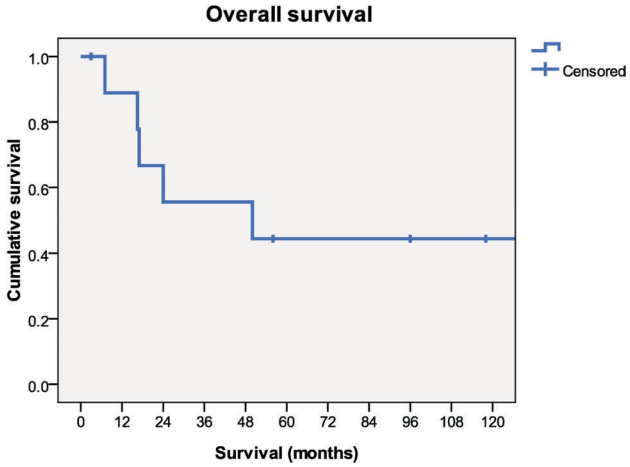

Fig. 2. Overall survival of the eleven patients. The 3- and 5-year survival rate was 55.6% and 44.4% respectively.

Discussion

Locally advanced right colon cancer occurred. However, this infrequent condition does not necessarily preclude a curative resection. A few case series studies suggested this procedure was rarely undertaken (Table 2).[8-13] Thomas et al has demonstrated multi-visceral resection is safe and long term survival is similar to that after standard resection in patients with locally advanced primary colon and rectal cancer.[14] Besides, Ellis et al indicated the benefits of curative surgical resection of colon cancer involving duodenum. The overall mean survival rate for locally advanced colon cancer after bypass surgery, non-extended resection and radical extended resections is 9, 11 and 40 months respectively.[5] Those studies suggested that aggressive surgical intervention should be

Table 2. Results of serial studies evaluating outcomes in patients receiving duodenectomy or pancreaticoduodenectomy with right hemicolectomy for advanced colon cancer

Study	Duration of study	Case number	Operation method (Duo, PD)	Complication[#] No. (%)	30-day mortality (%)	DFI (months)
Koea, et al.	1986-1998	8	Duo = 4, PD = 4	2 (25)	0 (0)	26
Saiura, et al.	1957-2007	12	PD = 12	NA	1 (8.3)	68.4
Berrospi, et al.	1990-2000	3	PD = 3	1 (33.3)	0	51
Kapoor, et al.	1992-2004	11*	Duo = 3, PD = 6	5 (45.4)	1 (9.1)	54
Lee, et al.	1994-2006	9	Duo = 5, PD = 4	2 (22.2)	0 (0)	23.5
Fuks, et al.	1988-2005	15	Duo = 12, PD = 3	6 (40)	2 (13.3)	NA
Current study	1980-2011	11	PD = 11	3 (27.2)	0 (0)	20.3

Duo = Duodenectomy; PD = Pancreaticoduodenectomy; DFI = Disease Free Interval; NA = not available; * = two other patients received gastrectomy and liver resection. [#] = both major and minor complications.

attempted in order to achieve better survival outcome.[7,8,15]

Clinically, it is sometimes difficult to distinguish between direct invasion of tumor and inflammatory process. In the current study, all but one case had pathological examination confirming tumor infiltration, consistent with intra-operative inspection. Retrospective studies had showed that only 55-70% cases with histological confirmation of neoplastic infiltration of adjacent organs while the rest were tumor fixation with inflammatory process.[7,16,17] High suspicion of tumor infiltration should be always kept to avoid inadequate resection.

In practice, if the tumor invaded to pancreas or Papilla of Vater, Whipple's procedure is mandatory. However, in cases of duodenal involvement, the alternative surgical interventions could vary from wedge resection with primary closure, Roux-en-Y duodenojejunostomy or duodenal patch grafting under the prerequisite of margin-free resection. The reported short-term outcome of duodenal grafting is fair and could be considered as an alternative method especially in aged patients.[18-20]

The average disease free interval (DFI) in the current study was 20.3 months which of shorter than other studies (range: 23.5 to 68.4 months, Table 2). The discrepancy may be due to heterogeneity of patient selection. Four of those studies include duodenectomy as well. Patients who underwent duodenectomy may have smaller tumor size compared with patients receiving PD who have higher chance of disseminated disease status and recurrence rate. Besides T status, the complete TNM stage of previous studies were not mentioned and this could affect disease free interval as well.

As for surgical complication, there were three patients (27.2%) with complication and all of them were managed conservatively without post-op mortality rate. The reported complication rate in literature was around 20% to 50% (Table 2), concurring with our study. It suggested that the sophisticated procedure was not necessarily with complex complications. In addition, there were four patients having survival time near or longer than 60 months (range: 56-141 months) in this present study. Two of them have regional positive lymph nodes metastasis. The radical procedure of concurrent colectomy and en bloc pancreaticoduodenectomy can be suitable clinically for properly selected patients.[8,14]

Conclusion

Right colon cancer with duodenum or/and pancreas invasion is a rare condition and no conclusive recommendation could be reached due to small case numbers in the present study. Our experience reveals that despite of longer hospital stay, the en bloc resection is relatively safe and could offer fair survival outcome. Long term disease free survival can be achieved for properly selected patients with minimal morbidity and mortality provided with experienced qualified skill in this subgroup of patients.

References

1. Taylor, Donohue, Gunderson, Nelson, Nagorney, Devine,

Haddock, Larson, Rubin, O'Connell. The Mayo Clinic experience with multimodality treatment of locally advanced or recurrent colon cancer. *Ann Surg Oncol* 2002;9:177-85.
2. Eisenberg, Kraybill, Lopez. Long-term results of surgical resection of locally advanced colorectal carcinoma. *Surgery* 1990;108:779-85; discussion 785-6.
3. Rowe, Frost, Huang. Extended resection for locally advanced colorectal carcinoma. *Ann Surg Oncol* 1997;4:131-6.
4. Cancer of the Colon. *Br Med J* 1929;1:920-2.
5. Ellis, Morgan, Wastell. 'Curative' surgery in carcinoma of the colon involving duodenum. A report of 6 cases. *Br J Surg* 1972;59:932-5.
6. Yoshimi, Asato, Kuroki, Shioyama, Hori, Itabashi, Amemiya, Koizumi. Pancreatoduodenectomy for locally advanced or recurrent colon cancer: report of two cases. *Surg Today* 1999; 29:906-10.
7. Curley, Evans, Ames. Resection for cure of carcinoma of the colon directly invading the duodenum or pancreatic head. *J Am Coll Surg* 1994;179:587-92.
8. Saiura, Yamamoto, Ueno, Koga, Seki, Kokudo. Long-term survival in patients with locally advanced colon cancer after en bloc pancreaticoduodenectomy and colectomy. *Dis Colon Rectum* 2008;51:1548-51.
9. Koea, Conlon, Paty, Guillem, Cohen. Pancreatic or duodenal resection or both for advanced carcinoma of the right colon: is it justified? *Dis Colon Rectum* 2000;43:460-5.
10. Turoldo, Balani, Tonello, Ziza, Roseano. Extended resection in locally advanced colon cancer. *Ann Ital Chir* 1998;69: 639-44; discussion 645-6.
11. Berrospi, Celis, Ruiz, Payet. En bloc pancreaticoduodenectomy for right colon cancer invading adjacent organs. *J Surg Oncol* 2002;79:194-7; discussion 198.
12. Kapoor, Das, Pal, Sahni, Chattopadhyay. En bloc resection of right-sided colonic adenocarcinoma with adjacent organ invasion. *Int J Colorectal Dis* 2006;21:265-8.
13. Lee, Lee, Chun, Choi. En bloc resection for right colon cancer directly invading duodenum or pancreatic head. *Yonsei Med J* 2009;50:803-6.
14. Lehnert, Methner, Pollok, Schaible, Hinz, Herfarth. Multivisceral resection for locally advanced primary colon and rectal cancer: an analysis of prognostic factors in 201 patients. *Ann Surg* 2002;235:217-25.
15. Vieira, Lopes, Almeida, Rossi, Nakagawa, Ferreira, Melo. Prognostic factors in locally advanced colon cancer treated by extended resection. *Rev Hosp Clin Fac Med Sao Paulo* 2004;59:361-8.
16. Perez, Coser, Kiss, Iwashita, Jukemura, Cunha, Habr-Gama. Combined resection of the duodenum and pancreas for locally advanced colon cancer. *Curr Surg* 2005;62:613-7.
17. Oono, Enomoto, Hosoya, Ueda, Otsuki, Motoyama. Pancreatoduodenectomy for locally advanced ascending colon cancer after neoadjuvant chemotherapy (mFOLFOX6). *Gan To Kagaku Ryoho* 2011;38:1529-31.
18. Ishiguro, Moriura, Kobayashi, Tabata, Yoshioka, Matsumoto. Pedicled ileal flap to repair large duodenal defect after right hemicolectomy for right colon cancer invading the duodenum. *Surg Today* 2004;34:386-8.
19. Richa, Camerlo, Campanile, Hardwigsen, Le Treut. Ileal patch duodenoplasty after right colectomy extended to the duodenal wall. *Hepatogastroenterology* 2008;55:1365-6.
20. Yuan, Zhou, Shu, Liu. Pedicled ileal flap for duodenal defect after right hemicolectomy. *Hepatogastroenterology* 2010; 57:493-6.

原　著

局部侵犯性右側大腸癌行大腸切除併胰頭十二指腸切除術

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目的　右側大腸癌合併十二指腸或胰臟侵犯同時進行手術整塊切除在臨床上屬於少見案例。針對此群少數病患進行臨床特徵及手術相關因子做預後分析。

方法　自 1980 至 2011 年間，台北榮民總醫院共有 11 位病患接受此類手術，此篇文章針對這 11 位病患進行回顧性研究分析。

結果　在這 11 位病患中，有 6 位男性，五位女性，平均年齡為 57.0 ± 13.0 歲 (範圍：36-77 歲)。其中有 10 件病例 (90.1%) 病理報告顯示有鄰近器官的侵犯。平均手術時間為 7.4 個鐘頭，平均術中出血量為 1014 毫升。共有 3 位患者有術後併發症出現，並無術後 30 天死亡案例。平均無病存活期為 20.3 個月，整體存活期為 37 個月。有 4 位患者術後存活時間超過五年之久。

結論　臨床上，雖然此類手術與一般手術相比時間較長及術中出血量較多，但術後併發症及致死率並無較高，並且對於長期存活率有提升，因此，對於右側大腸癌合併有十二指腸或是胰臟侵犯的病患，大腸及胰頭十二指腸整塊手術切除的角色是可行的且應被審慎考慮為治療方式之一。

關鍵詞　胰頭十二指腸切除術、大腸癌。