



Ileal Flap Duodenoplasty to Repair Large Duodenal Defects after R0 Resection for Malignant Tumor to Avoid a Complex Reconstruction: Experience with 6 Cases

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Abstract

Locally advanced malignant abdominal tumors of the right upper quadrant, as in colonic carcinomas, can lead to a major resection of the duodenal sidewall to create free resection margins (R0 resection). There is no standard surgical technique to manage this duodenal defect. We report here our experience of a standardized duodenal reconstruction using an ileal flap. Following a right colectomy with a major duodenal resection, the duodenal defect was covered with a pedicled ileal flap using the terminal ileum. This reconstruction is particularly suitable for performing a tension-free ileo-transverse anastomosis. Duodenal leakage did not occur in our study. Our experience as well as a literature review shows that this technique is feasible and safe and is a reliable surgical approach that avoids the need for a radical pancreaticoduodenectomy or a non-anatomical by-pass.

Keywords: Locally advanced tumors; Large duodenal defect; Ileal flap

Introduction

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Operative Technique

Following a Right Colectomy (RC) extending to a large portion of the duodenum, the duodenal defect can be covered with an ileal flap using the last loop of the ileum. A segment of the terminal ileum is isolated with a large pedicle of mesentery (it is better not to use a vascular section) (Figure 1a). The length of the ileal segment is adjusted to the size of the defect. The segment is opened along the antimesenteric border and then is easily transposed to the duodenum (Figure 1a) and sutured in isoperistaltic fashion on the duodenal defect using a continuous absorbable running suture (Figure 1b). A sealing test can be performed with air insufflation using a gastric probe. This reconstruction is particularly suitable for performing a tension-free ileo-transverse end-to-side anastomosis without torsion of the mesentery (Figure 1c). A gastric tube or gastrostomy tube can then be placed for gastric discharge.

Case Studies

We studied 6 cases with various kinds of tumors - adenocarcinoma of the right colon, gallbladder cancer, intrahepatic cholangiocarcinoma, and retroperitoneal sarcoma - macroscopically invading the sidewall of the first and/or second part of the duodenum (Table 1). Two cases have already been reported [2]. In all the cases, surgery allowed complete resection with safe margins (R0 resection) due to a major resection of the duodenal wall (duodenal defect measures 5 cm to 10 cm in length). In all the cases, we used an ileal flap to cover the duodenal defect. In one case that underwent a right hepatectomy extending to segment IV as well as bile duct confluence, a biliary-enteric anastomosis

Table 1: Patient characteristics.

Patient	Tumor type, size, R status	Site & size of the duodenal defect	Other organs removed	Postoperative stay - Outcome
F-78 years	Retroperitoneal leiomyosarcoma, 15 cm, R0 resection	D2, 8 cm	Right colon, right kidney, liver segment IV (metastasis)	20 days 2 mo - Alive
F-84 years	Retroperitoneal liposarcoma, 11 cm, R0 resection	D2, 10 cm	Right colon, right kidney	14 days 41 mo - Alive
F-54 years	Gallbladder carcinoma, 10 cm, R0 resection	D1-D2, 8 cm	Gallbladder, liver segments IV-V, common bile duct, right colon	13 days 8 mo - Died
M-63 years	Intrahepatic cholangio-carcinoma, 15 cm, R0 resection	D1, 5 cm	Right liver + segment IV, bile duct confluence, right colon, abdominal wall.	25 days - Died from sepsis and hepatic failure
F-79 years	Right colonic carcinoma, 11 cm, R0 resection	D2, 10 cm	Right colon, gallbladder, liver segments V-VI	9 days 79 mo - Died
M-64 years	Right colonic carcinoma, 11 cm, R0 resection	D2, 7 cm	Right colon	11 days 167 mo - Alive

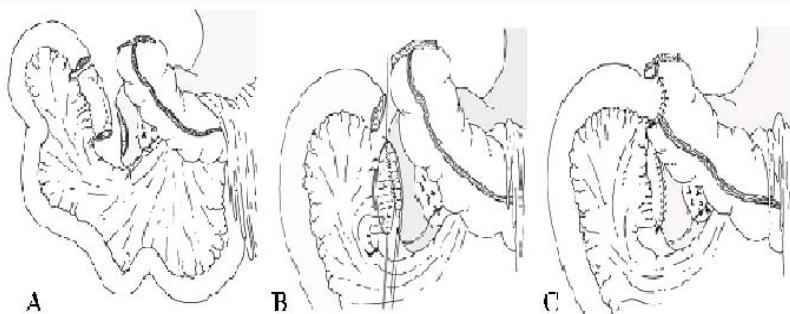


Figure 1: Schematic representation of the procedure. A. Resection of the right colon with the duodenal sidewall resulted in a large duodenal defect. A segment of terminal ileum was isolated on a large vascular pedicle of mesentery, and the antimesenteric border of the lumen was opened. B. The duodenal defect was covered with the pedicledileal flap using a continuous running suture. C. An end-to-side anastomosis was done between the ileum and the mid-transverse colon.

was done on the upstream end of the ileal segment, and the other end was used to cover the duodenal defect. An upper digestive tract X-ray series was done 7 days after surgery (Figure 2). Five patients had an uneventful course. One patient had a biloma in the bed of segmentectomy IV, which was treated with percutaneous drainage, and one patient died on day 25 from sepsis and hepatic failure without any sign of duodenal leakage.

Discussion

Our experience shows that this technique is feasible to achieve curative intent and is a safe and reliable surgical approach to avoid radical PD and non-anatomical bypass.

In the presence of locally advanced colonic cancer, an aggressive surgical approach can be effective and is associated with low morbidity-mortality and a high survival rate [1,3]. In the case of a right-sided colonic tumor, R0 resection extended "en bloc" to other organs, such as the abdominal wall, gallbladder, small intestine, kidney or ureter, can be safely performed. Regarding other duodenal tumors such as stromal tumors, safe surgical margins are feasible, with good survival rates. The severity of duodenal GIST appears to be linked to particularly high rate of mitosis [4]. When either the pancreas is involved or the duodenal invasion is massive, including the papilla of Vater, the consensus is that it is desirable to achieve an en bloc PD for curative intent. In contrast, when invasion is limited to the duodenal sidewall, there is no consensus if the duodenal defect does not allow for a simple closure. Several procedures can be used in this rare instance: a PD [5] or a duodenal resection followed by Roux-en-Y duodenojejunostomy [1], side-to-side duodenojejunostomy [6], and a jejunal [3] or ileal flap [7]. Gastric pedicle patches have also been described for duodenal stenosis [8].

A thorough literature review was conducted regarding locally advanced malignant tumors of the right upper quadrant invading the

duodenum without pancreatic involvement. Cases of small resections that may be simply closed as well as studies that did not describe the surgical technique were not included (Table 2). Forty-seven patients were collected, including our 6 cases. Most of the cases were those of colonic cancer invading the duodenum (n=37); 4 cases were duodenal GIST (with colonic invasion in 2 cases) and 6 cases were other various diseases. Ileal flap was the most used technique (n=23), followed by PD (n=9), Roux-en-Y duodenojejunostomy (n=9), lateral duodenojejunostomy (n=3), and jejunal flap (n=3). Intraoperative complexity and a high risk of postoperative complications for en-bloc RC plus PD often discourage surgeons from the procedure [9]. Thus, the ileal flap avoids PD, which involves increased risk of fistulas, especially when the pancreatic parenchyma is soft [9]. A duodenojejunostomy reconstruction can lead to difficulties in moving the jejunal loop closer to the duodenal defect in the case of a short mesentery, especially if an RC is not performed. Indeed, RC associated with duodenal resection allows for easier lifting of the ileal flap closer to the duodenal defect in anisoperistaltic fashion immediately upstream from the ileo-transverse anastomosis. In addition, the jejunal or ileal flap is the better anatomical solution because there is no bypass or risk of reflux. In our case review, no postoperative duodenal leakage was reported, and there was only one case of postoperative death. In our case studies, the main postoperative complication (biloma, hepatic failure) were unrelated to duodenoplasty.

Regarding the long-term results, the choice between RC plus PD or RC with major duodenal resection remains unclear. In a recent review, the 5-year survival rate was 52% after en bloc RC plus PD vs. 25% and 0% in the cases of duodenal resection with correction by direct suture or pedicledileal flap, respectively [9]. However, this review included 10 cases of major duodenal resections only (vs. 38 in our review), and survival rates were grossly estimated by the ratio of patients living more than 5 years irrespective of shorter follow-ups. In

Table 2: Review of the literature: Observations of duodenal resection for tumoral invasion.

Authors, year	Patient	Primary tumor	RC	Duodenal repair	Outcome & follow-up
Present series	F 78	RP leiomyosarcoma	Yes	Ileal patch	Alive 2 mo
	F 84	RP liposarcoma	Yes	Ileal patch	Alive 41 mo
	F 54	Gallbladder CA	Yes	Ileal patch	Died 8 mo
	M 63	Cholangiocarcinoma	Yes	Ileal patch	Died 25 days
	F 79	Right colonic CA	Yes	Ileal patch	Died 79 mo
	M 64	Right colonic CA	Yes	Ileal patch	Alive 167 mo
Mouaqit, 2013 [10]	F 65	Duodenal GIST	Yes	Roux-Y DJ	Alive 24 mo
Notani, 2013 [11]	F 83	Transverse colonic CA	No	Roux-Y DJ	NA
Yang, 2009 [5]	NA	Right colonic CA	Yes	Ileal patch	Alive 36 mo
	NA	Right colonic CA	Yes	Ileal patch	Alive 36 mo
	NA	Right colonic CA	Yes	Ileal patch	Alive 48 mo
	NA	Right colonic CA	Yes	Ileal patch	Alive 48 mo
	NA	Right colonic CA	Yes	Ileal patch	Alive 48 mo
Yuan, 2010 [7]	M 58	Right colonic CA	Yes	Ileal patch	Died 27 mo
	F 42	Right colonic CA	Yes	Ileal patch	Died 24 mo
	M 50	Right colonic CA	Yes	Ileal patch	Alive > 36 mo
	M 40	Right colonic CA	Yes	Ileal patch	Alive > 36 mo
	M 38	Right colonic CA	Yes	Ileal patch	Alive > 36 mo
	M 33	NH Lymphoma	Yes	Ileal patch	Alive 9 mo
Lee, 2009 [12]	F 55	Right colonic CA	Yes	PD	Died 19 mo
	M 46	Right colonic CA	Yes	PD	Alive 93 mo
	F 48	Right colonic CA	Yes	PD	Alive 11 mo
	M 67	Right colonic CA	Yes	PD	Died 6 mo
	M 72	Right colonic CA	Yes	Roux-Y DJ	Alive 19 mo
	M 64	Right colonic CA	Yes	Roux-Y DJ	Died 28 mo
	F 41	Right colonic CA	Yes	Roux-Y DJ	Died 13 mo
	F 47	Right colonic CA	Yes	Roux-Y DJ	Alive 17 mo
Liyanage, 2008 [13]	F 54	Duodenal GIST	No	Lateral DJ	NA
Kapoor, 2006 [6]	NA	Right colonic CA	Yes	Lateral DJ	NA
	NA	Right colonic CA	Yes	Lateral DJ	NA
	NA	Right colonic CA	Yes	PD	NA
Goh, 2005 [14]	F 72	Duodenal GIST	No	Roux-Y DJ	Alive 6 mo
	M 69	Duodenal GIST	No	Roux-Y DJ	Alive 3 mo
Perez, 2005 [15]	M 41	Right colonic CA	Yes	PD	Alive 24 mo
Ishiguro, 2004 [16]	F 86	Right colonic CA	Yes	Ileal patch	Alive 12 mo
Berrospi, 2002 [17]	F 65	Right colonic CA	Yes	PD	Alive 116 mo
	M 40	Right colonic CA	Yes	PD	Alive 10 mo
	M 51	Right colonic CA	Yes	PD	Alive 30 mo
Fujiwara, 2002 [18]	F 60	Duodenal adenoma	No	Roux-Y DJ	Alive 12 mo
Koea, 2000 [3]	M 48	Right colonic CA	Yes	Jejunal patch	Alive 24 mo
	F 75	Right colonic CA	Yes	Jejunal patch	Alive 26 mo
Xenos, 1999 [19]	M 53	Right colonic CA	Yes	Jejunal patch	NA
Curley, 1994 [1]	NA	Right colonic CA	Yes	Ileal patch	NA
	NA	Right colonic CA	Yes	Ileal patch	NA
	NA	Right colonic CA	Yes	Ileal patch	NA
	NA	Right colonic CA	Yes	Ileal patch	NA
Cawthorn, 1985 [20]	F 65	Right colonic CA	Yes	Ileal patch	Alive 72 mo

NA: Not Available; CA: Carcinoma; NH: Non-Hodgkin; DJ: Duodenojejunostomy; PD: Pancreaticoduodenectomy; RP: Retroperitoneal; RC: Right Colectomy



Figure 2: Postoperative day 7 upper gastrointestinal X-ray series. The arrow shows the pedicled ileal flap. The passage through the "new duodenum" was well maintained without stenosis or leakage.

our review, the cumulative survival of the patients was estimated by the Kaplan Meir method based on the duration of survival specified for each patient in each report. No follow-up was done in 9 of the 37 cases of colonic carcinomas. Among the remaining patients, the 3-year survival rate of patients treated with RC with duodenal resection ($n=20$) was 75%. This rate was comparable to the 3-year survival rate of patients treated with RC plus DP ($n=8$, 70%). Regardless of the treatment options, a complete R0 tumor removal remains the primary prognostic factor [21]. In the case of exclusive duodenal invasion, this goal is easier to achieve if the extent of duodenal resection is not restricted by the underlying difficulties of the repair.

Conclusion

Tumor invasion of the duodenum without pancreatic involvement is a rare and challenging condition. A radical approach is still possible by liberal resection of the lateral portion of the duodenum. Ileal flap duodenoplasty can then be ideally achieved with RC.

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