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Omental Pedicle Graft to Protect Compromised Double-Stapled Anastomosis in Anterior Resection for Rectal Cancer

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PURPOSE: The purpose of this study was to investigate the effects of omental pedicle graft (OPG) wrapping to limit leakage from compromised double-stapled anastomoses after anterior resection for rectal cancer.

PATIENTS AND METHODS: Between 1994 and 1997, a prospective study was conducted on 80 consecutive patients who had undergone double-stapled anastomoses after anterior resection for rectal cancer. Decisions to perform OPG were made intraoperatively because of compromised double-stapled anastomoses.

RESULTS: Twenty-one patients (26%) received OPG to protect anastomosis, the remainder of patients had no OPG. Ten of the 21 patients underwent OPG for stapler-related operative complications, 5 for rectal carcinoma with stenosis, 3 for obstructive colitis or diverticulitis in the sigmoid colon, and 6 for very low anterior resection with coloanal anastomosis after total mesorectal excision. Three of 21 patients had more than one indication for OPG. The two types of patients were comparable with respect to patient characteristics and operative procedures, although tumor diameter in the OPG patients was significantly larger than in the non-OPG patients. Anastomotic leakage was noted in 1 non-OPG patient (2%) but in none of the OPG patient. There were no statistically significant differences between the two types of patients with regard to postoperative course and anastomotic or other postoperative complications.

CONCLUSION: We conclude that OPG wrapping provides an effective protection for a compromised anastomosis of anterior resection in selected patients with rectal cancer

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Introduction

The circular stapling technique has facilitated anterior resection as a sphincter preserving surgery for rectal cancer. The double-stapling technique has gained widespread popularity for use in anterior resection for rectal carcinoma since its introduction by Knight and Griffen in 1980.[1-3] Cohen et al.[4] confirmed that anterior resection performed using the double-stapling technique has an acceptable clinical leak rate, local recurrence rate, and survival rate. However, the double-stapling technique is not without risks. Stapler misfiring, an incomplete resection ring, and other technical difficulties are associated with insertion of the circular and linear staplers.[5] Anastomotic leak remains a major problem in the early postoperative period.

The omental pedicle graft (OPG) is used widely in surgery, e.g., as a plug for perforated peptic ulcer, in the repair of vesicovaginal fistulas, in urinary tract reconstruction, and for the protection of vascular grafts.[6-9] Some investigators have demonstrated its clinical use for protection of gastrointestinal anastomoses, particularly after rectal and esophageal anastomoses.[10-12] However, there have been few clinical studies on the use of OPG to protect double-stapled anastomosis in anterior resection. At our institution, in order to reduce the risk of anastomotic leakage, we used OPG in rectal cancer patients with compromised double-stapled rectal anastomoses. The cases comprised rectal carcinoma with stenosis, left-sided colonic diverticulitis or obstructive colitis, intraoperative stapler-related complications, and very low anterior resection with coloanal anastomosis after total mesorectal excision. The purpose of this study was to investigate the use

of OPG to limit leakage from compromised double-stapled anastomoses after anterior resection for rectal cancer.

Materials and Methods

A prospective study was conducted on a consecutive series of patients who underwent anterior resections for primary rectal carcinoma. All surgeries were elective, and all were performed by a single surgeon between January 1994 and March 1997.

After standard resection for rectal tumor and anastomosis using the double-stapling technique (TA55® and PCEEA® staplers), the decision to perform an OPG for anastomosis was made intraoperatively for any one of the following reasons; (1) stapler-related operative complications including incomplete rectal tissue ring, rectal injuries, split of the sigmoid colon, stapler misfiring, or a positive leakage test; (2) stenosis; (3) obstructive colitis or diverticulitis in the sigmoid colon; or (4) very low anterior resection with coloanal anastomosis after total mesorectal excision.

No patient received radiation therapy preoperatively. The level of each tumor (distance from the dentate line) was determined by rigid proctoscopy or flexible colonoscopy. Tumor location was classified from the dentate line accordingly: lower rectum, 0 to 6 cm; middle rectum, 6 to 12 cm; upper rectum, 12 to 15 cm. Tumor size and histologic differentiation were obtained from surgical pathology reports. Tumor stage was assigned according to TNM classification. The resections were classified as high or low depending on whether the anastomosis was above or below the pelvic peritoneal reflection.

All 80 patients were observed on routine rounds, and temperature was recorded every 6 hours. The number of days of temperature elevation above 37.5℃ was noted. Between the 5th and 7th postoperative day, white blood cell count and C-reactive protein (CRP) were measured.

Statistical analyses were performed by the chi-square or Fisher's exact test and the Mann-Whitney U test.

OPG Surgical Procedure

We employed the OPG procedure that was reported by Lanter and Mason.[11] After resection of the lesion and mobilization of the rectum with anastomosis, the greater omentum was freed from the transverse colon. It was then divided longitudinally, care being taken to preserve the vascular arcade, and swung on a pedicle, while retaining the blood supply from the left gastroepiploic vessel and confirming pulsation of the artery in the OPG. With this minimal amount of freeing, the omentum can be delivered into the pelvis along the paracolic gutter and wrapped circumferentially around the double-stapled anastomosis. It is anchored to the rectum and colon with absorbable sutures, distal and proximal to the anastomosis. It thus forms a tube in which the newly constructed anastomosis resides.

Results

Double-stapled anastomosis after anterior resections of primary rectal carcinoma was performed in 80 patients. Of these 80 patients, 21 patients (26%) received OPG to protect their anastomosis. Ten of the 21 patients underwent OPG for stapler-related operative complications, 5 for rectal carcinoma with stenosis, 3 for obstructive colitis or diverticulitis in the sigmoid colon, and 6 for very low anterior resection with coloanal anastomosis after total mesorectal excision. Three of 21 patients had more than one indication for OPG (Table 1).

Table 1. Indications for Use of Omental Pedicle Graft to Protect Double-Stapled Anastomoses in Anterior Resection for Rectal Cancer

Patient	Age (years)	Sex	TMN staging of rectal cancer	Indications for omental pedicle graft
1	81	Male	Ⅲ	Carcinoma with stenosis
2	78	Female	Ⅱ	Very low anterior resection
3	60	Male	Ⅲ	Stapler-related operative complication
4	54	Male	Ⅰ	Stapler-related operative complication
5	46	Male	Ⅲ	Very low anterior resection
6	43	Male	Ⅳ	Carcinoma with stenosis
7	65	Male	Ⅳ	Carcinoma with stenosis
8	71	Male	Ⅰ	Stapler-related operative complication
9	59	Female	Ⅲ	Stapler-related operative complication
10	71	Female	Ⅱ	Stapler-related operative complication
11	61	Male	Ⅱ	Obstructive colitis
12	73	Female	Ⅱ	Very low anterior resection/diverticulitis
13	77	Male	Ⅱ	Carcinoma with stenosis
14	80	Female	Ⅱ	Very low anterior resection
15	62	Male	Ⅳ	Very low anterior resection/carcinoma with stenosis
16	82	Female	Ⅲ	Stapler-related operative complication
17	84	Male	Ⅰ	Very low anterior resection/diverticulitis
18	60	Female	Ⅱ	Stapler-related operative complication
19	39	Male	Ⅱ	Stapler-related operative complication
20	59	Male	Ⅱ	Stapler-related operative complication
21	62	Male	Ⅳ	Stapler-related operative complication

There were no statistically significant differences between the OPG and non-OPG patients with regard to sex, age, tumor location, tumor stage, and histologic differentiation, although tumor diameter in the OPG patients was significantly larger than in the non-OPG patients (P= 0.0174) (Table 2).

Table 2. Patient Characteristics

	OPG* patients (n = 21)	Non-OPG* patients (n= 59)	P value
Sex ratio, Male:Female	1:0.50	1:0.55	0.8521
Age† (years)	65±13	61±10	0.1874
Tumor localization			0.9168
Lower	7	17	
Middle	7	20	
Upper	7	22	
Tumor diameter† (mm)	52±21	39±20	0.0174
TMN staging			0.1552
I	3	21	
II	9	13	
III	5	17	
IV	4	8	
Histologic differentiation		–	0.5600
Well differentiated	2	13	
Moderately differentiated	18	43	
Poorly differentiated	0	1	
Mucinous	1	2	

*OPG, Omental pedicle graft
† Mean±s.d.

There were no statistically significant differences between the OPG and non-OPG patients with regard to the level of anastomosis, the performance of concurrent covering colostomy and hepatectomy, operation time, and amount of operative bleeding (Table 3). As the policy in our unit has been not to perform defunctioning colostomy during anterior resection, all were carried out without a covering colostomy except in 2 patients with intraoperative stapler-related complications. Each of these patients underwent OPG concurrent with a covering colostomy to protect double-stapled anastomosis. We performed hepatectomies for synchronous liver metastasis in 5 patients, 2 of whom underwent concurrent OPG for rectal anastomosis.

Table 3. Operative Course

	OPG* patients (n = 21)	Non-OPG* patients (n= 59)	P value
Level of anastomosis			0.3824
High	4	17	
Low	17	42	
Covering colostomy			0.0664
Yes	2	0	
No	19	59	0.6024
Concurrent hepatectomy			
Yes	2	3	
No	19	56	
Operating time† (min)	266±136	251±95	0.5953
Operative bleeding† (ml)	301±397	220±313	0.3576

*OPG, Omental pedicle graft
† Mean±s.d.

There were no operative deaths. As shown in Table 4, there were no statistically significant differences between the two types of patients with regard to days of elevated postoperative temperature, white blood cell counts, CRP, and postoperative stay. In the OPG patients, there were no clinically significant elevated temperatures, elevated leukocyte counts, or CRP and prolonged ileus.

Table 4. Postoperative Course

	OPG* patients (n = 21)	Non-OPG* patients (n= 59)	P value
Days of fever†	1.5 (0-12)	2.0 (0-15)	0.4609
White blood cell count‡ (/㎣)	6811±1795	6692±2942	0.5633
CRP‡	3.60±3.44	3.81±4.06	0.8995
Postoperative days in hospital†	19.5 (11-47)	17.5 (9-68)	0.5006

*OPG, Omental pedicle graft
† Median(range); ‡ Mean±s.d.

Anastomotic leakage was noted in one patient (2%) among the non-OPG patients, but in no patient among the OPG patients. There were no statistically significant differences between the two types of patients in the rate of postoperative anastomotic or other complications (Table 5, 6).

Table 5. Postoperative Anastomotic Complications

	OPG* patients (n = 21)	Non-OPG* patients (n= 59)	P value
Anastomotic complications:	3 (14%)	10 (17%)	0.7763
Anastomotic leakage	0	1	
Anastomoric stricture	3	5	
Anastomotic bleeding	0	1	
Rectovaginal fistula	0	2	

*OPG, Omental pedicle graft

Table 6. Other Postoperative Complications

	OPG* patients (n = 21)	Non-OPG* patients (n= 59)	P value
Other complications	5 (26%)	11 (20%)	0.7722
Urinary infection	1	0	
Neurogenic bladder	2	5	
Subphrenic abscess†	1	1	
Acute cholecystitis	0	1	
Wound infection	1	2	
Cardiovascular accidents	0	2	

*OPG, Omental pedicle graft
† 2 patients underwent hepatectomy for synchronous liver metastases.

Discussion

Anastomotic leak in low anterior anastomosis remains a major problem. It is well known that anastomosis between two segments of bowel, both having a peritoneal layer, is less prone to disruption than anastomosis involving bowel in which one segment is without peritoneum.[11,13] The presence of perianastomotic collections

of serum, blood, and cellular debris contributes significantly to anastomotic disruption.[14] If isolated from the peritoneum, the intestinal anastomosis frequently breaks down because of suture-line infection.[11,15]

Many surgeons have attempted to reduce this anastomotic complication using presacral drainage,[13] sump-irrigation,[14] and OPG.[10,11] The omentum has been found to be effective in preventing leakage after the re-establishment of gastrointestinal continuity.[10] Omentum can reabsorb fluid collections as an ideal biologic drain because it is rich in lymphatics and vascularity.[16] The omentum is also capable of transporting toxic material into the circulation system.[17]

Recently, Adams *et al*[18] reported an animal model of a vascular anastomosis that developed between the omental blood supply and bowel vessels as early as the third postoperative day to aid in anastomotic healing, and they concluded that the omental wrap can be used to protect a compromised anastomosis by providing both a biologically viable plug to prevent early leakage and neovasculature for later wound repair. Some authors have reported the clinical usefulness of OPG for low rectal anastomosis to avoid the leakage.[10,11,19,20]

In our study, OPG made an excellent protective wrapping for compromised double-stapled anastomoses in anterior resection for rectal cancer. The postoperative course for patients receiving OPG was comparable to the postoperative course for those without OPG. Colorectal surgeons are sometimes obliged to perform compromised anastomoses in anterior resection for rectal cancer in patients with stenosis, obstructive colitis or diverticulitis in the sigmoid colon, steroid therapy, or preoperatively irradiated rectum. Lanter and Mason[11] reported that all rectal cancer patients receiving preoperative irradiation were treated without a protective colostomy due to use of the protective OPG.

The double-stapling technique has gained widespread use in anterior resection for rectal cancer. Although the reported anastomotic leak rate of about 8% following anterior resection using the double-stapling technique compares favorably with the leak rate documented in the more traditional anastomotic approach,[2] the technique is not without risks.[5] Omental pedicle wrap is indicated to protect the double-stapled anastomosis when stapler-related complications including incomplete rectal tissue ring, rectal injuries, split of the sigmoid colon, staplers misfiring or a positive leakage test occur intraoperatively.

More recently, the sphincter-saving resection of the rectum with total mesorectal excision and anastomosis of the colon to the anal canal in patients with rectal cancer has been performed.[21] Although the long-term-outcome of coloanal anastomosis for rectal cancer in terms of disease-free survival and satisfactory function is excellent, it is associated with a high incidence of complications—leakage being the most feared.[22] The results in our study suggest that the anastomosis of the colon to the anal canal after very low anterior resection with total mesorectal excision is also a candidate surgery for the use of OPG to prevent anastomotic leakage.

The surgical technique for omental lengthening should be based on the arterial anatomy of the omentum.[16] Although there are some variations of vascular arcades in the omentum depending upon the level of bifurcation or the absence of the middle omental artery, we can usually identify the three major arterial branches, the right, middle, and left omental artery, that distribute blood throughout the greater omentum and come from the gastroepiploic arch.[16] The OPG reported by Lanter and Mason[11] is composed of two major arterial branches, the middle and left omental artery, which receive blood supply from the left gastroepiploic artery. The technique takes only 15-20 minutes to perform, and we had no postoperative complication such as hemorrhage from the cut edge of the omentum or early small bowel obstruction. In our opinion, this OPG is a simple and safe adjunct to rectal surgery. It is essential that the arterial branches at the top of the OPG are checked intraoperatively for pulsation, and the omentum should be brought down along the left paracolic gutter in order to avoid postoperative intestinal obstruction.

In summary, as a matter of course, adequate bowel preparation, good nutrition, proper drainage for pelvic fluid collections, and prompt intraoperative decision making as to how to establish intestinal continuity are the keys to preventing anastomotic leakage or disruption. We conclude that OPG wrapping provides effective protection for a compromised double-stapled anastomosis after anterior resection in selected patients with rectal cancer.

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