

Stomach-Partitioning Gastrojejunostomy for Gastroduodenal Outlet Obstruction

Keisuke Kubota, MD, PhD; Junko Kuroda, MD, PhD; Nobuto Origuchi, MD, PhD; Michio Kaminishi, MD, PhD; Hiromichi Isayama, MD, PhD; Takao Kawabe, MD, PhD; Masao Omata, MD, PhD; Ken-ichi Mafune, MD, PhD

Hypothesis: The outcome of the stomach-partitioning gastrojejunostomy (SPGJ) procedure is superior to that of stenting procedures.

Design: Data from patients who underwent an SPGJ were collected retrospectively from hospital medical records (body weight, hemoglobin and albumin levels, assessment of food intake, duration of hospitalization, complications, and survival rates), and we compared the results with those obtained from patients treated with stenting.

Setting: Departments of Gastrointestinal Surgery and Gastroenterology, Tokyo University Hospital, Tokyo, Japan.

Patients: A series of 16 consecutive patients with gastroduodenal outlet obstruction who underwent an SPGJ and 9 patients who were treated with stenting between January 5, 1998, and August 18, 2004.

Main Outcome Measures: Mann-Whitney, Fisher exact, and generalized Wilcoxon tests were used for statistical analyses.

Results: There were no differences between the 2 groups concerning background data, physiological status, or laboratory data. The starting point of food intake by patients treated with stenting was significantly earlier (at 4.2 days in the stent group vs at 6.0 days in the SPGJ group, $P < .004$). The numbers of patients taking a regular meal at 2 weeks after treatment were 12 of 16 patients in the SPGJ group and 1 of 9 patients in the stent group ($P < .001$). There was no significant difference between the 2 groups regarding the duration of hospitalization. The complication rates were significantly different between the 2 groups ($P = .48$). The median survival was 7.3 months in the SPGJ group and 2.8 months in the stent group ($P = .008$), and the mean 6-month survival rates were 81% (13 of 16) and 33% (3 of 9), respectively ($P < .04$).

Conclusion: Stomach-partitioning gastrojejunostomy achieved improved quality of life and a better prognosis compared with stenting procedures, and it is the treatment of choice for gastroduodenal outlet obstruction.

Arch Surg. 2007;142(7):607-611

FOR PATIENTS WITH GASTRODUODENAL outlet obstruction (GOO) due to unresectable advanced malignant disease in the upper gastrointestinal tract, several treatments are available (ie, bypass surgery, enteral stenting, jejunostomy, or intravenous hyperalimentation). The intestinal tract–nutrition method (bypass operation, stenting, and jejunostomy) seems to be superior to intravenous hyperalimentation in terms of (1) the activation of intestinal tract immunity, (2) the use of oral antineoplastic medication, and (3) safe and simple home management. Given the quality of life (QOL) issue in the setting of terminal illness, the bypass operation and stent placement method, if possible to perform, is desirable compared with jejunostomy because patients may be relieved of the discomfort of a nasogastric tube for decompression, and satisfactory oral ingestion may be obtained.

The most common bypass operation, conventional gastrojejunostomy (CGJ)

from the proximal part of the stomach to the proximal part of the jejunum, is not fully effective in this situation because of the retention of food or bleeding from the tumor. In the method comprising stomach transection and a Billroth II procedure, visualization of the tumor is impos-

See Invited Critique at end of article

sible, and the distal stump sometimes ruptures because of bleeding from the tumor. In another type of bypass operation, a procedure that includes transection of the stomach and anastomoses on both sides of the stomach to the upper jejunum is reportedly used to prevent liquid storage on the cancer side.¹ However, the adaptation of this method is limited because the procedure is intricate.

We introduced a new type of gastrojejunostomy, called *stomach-partitioning gastrojejunostomy* (SPGJ), which embodies a modification of the palliative method of

Author Affiliations: Department of Surgery, International University of Health and Welfare Mita Hospital (Drs Kubota, Kuroda, Origuchi, and Mafune), and Departments of Gastrointestinal Surgery (Dr Kaminishi) and Gastroenterology (Drs Isayama, Kawabe, and Omata), Tokyo University Hospital, Tokyo, Japan.

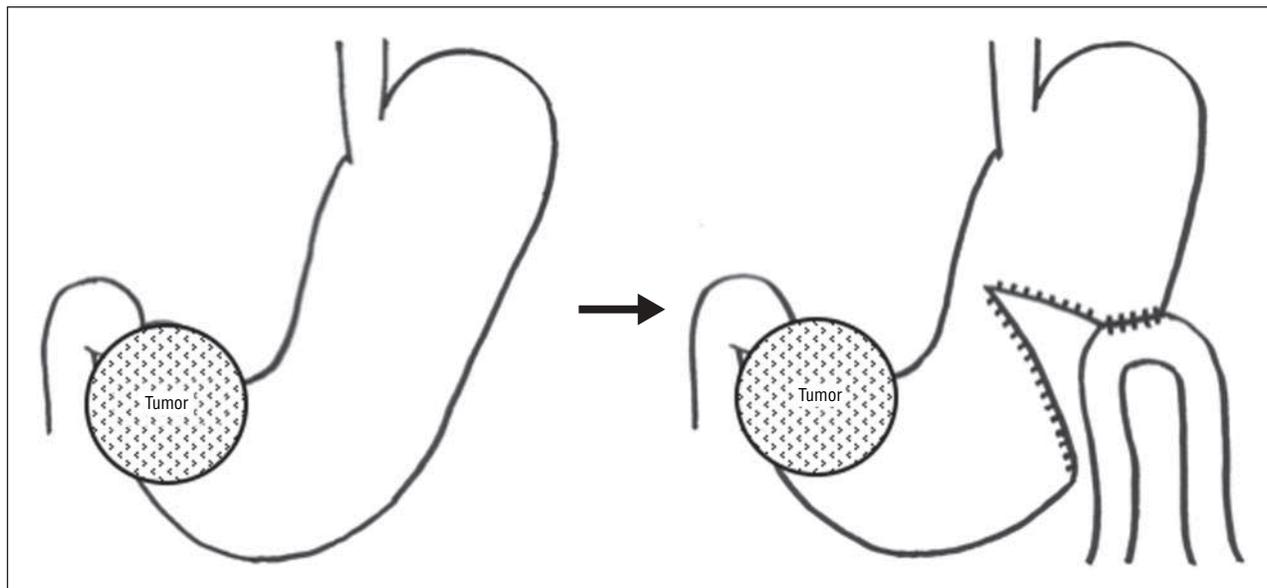


Figure 1. Stomach-partitioning gastrojejunostomy.

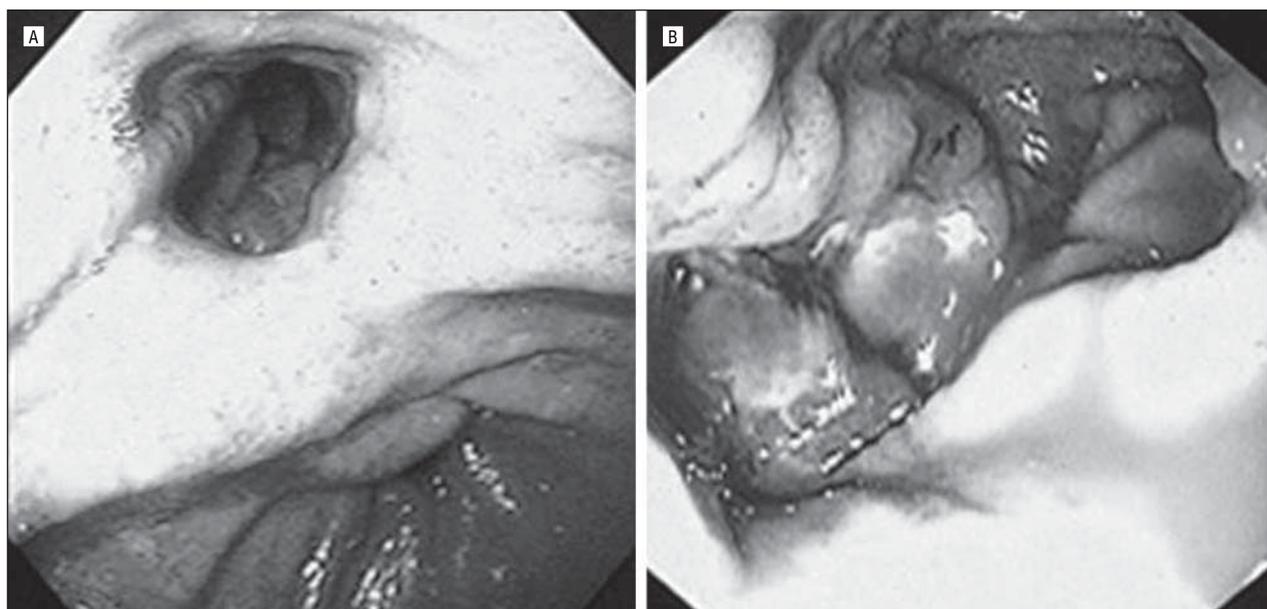


Figure 2. A, Lesser curvature lumen and anastomosis. B, Tumor observed through the lumen.

Schantz et al.² In this procedure, the stomach is partially partitioned between the proximal and distal parts, and the proximal part of the stomach is anastomosed to the proximal part of the jejunum (**Figure 1**). This procedure allows for unobstructed eating and for serial endoscopic observation of the tumor; it reduces bleeding from the tumor and allows for drainage when bleeding occurs (**Figure 2**). A previous study³ demonstrated that SPGJ in 8 patients achieved improved QOL and a better prognosis compared with CGJ in 13 patients and that it is the preferred bypass procedure for GOO. The rates of taking a regular meal at 2 weeks after operation were 80% in the SPGJ group and 31% in the CGJ group. The mean 1-year survival rates were 42.9% for the SPGJ group and 7.7% for the CGJ group. The mean survival times were

13.4 months in the SPGJ group and 5.8 months in the CGJ group. Since 2004 this procedure has been introduced in some institutes around the world.^{4,5}

We performed more SPGJ procedures after that year. The aims of the present study were to evaluate the outcome of the SPGJ procedure and to compare it with the performance of stenting procedures conducted during the same period. Study variables were food intake status and the perioperative and postoperative course.

METHODS

Between January 5, 1998, and August 18, 2004, a series of 16 consecutive patients with GOO caused by incurable malign-

nant disease underwent an SPGJ at the Department of Gastrointestinal Surgery, Tokyo University Hospital, Tokyo, Japan. The analysis was based on body weight, pretreatment and post-treatment hemoglobin and albumin levels, starting point and assessment of food intake, duration of hospitalization, complications, and survival rates. The assessment of food intake was classified as no meal, half-solid meal, or regular meal. Data from these patients were collected retrospectively from hospital medical records.

The SPGJ procedure was performed as follows: the upper third of the stomach was partitioned from the greater side to a point located 2 cm from the lesser curvature. The lesser curvature lumen was left at about 1 finger's width. The partitioned proximal part of the stomach was anastomosed to the proximal part of the jejunum. A retrocolic anastomosis was usually performed.

During the same period, 9 patients were treated with gastrooduodenal stenting at the Department of Gastroenterology, Tokyo University Hospital. The stents used (Ultraflex and Microvasive; Boston Scientific Corporation, Natick, Massachusetts) had a fully open diameter of 23 mm and a length of 70 mm and were commercially available for the esophagus. We evaluated outcomes among these 9 patients treated with stenting. Informed consent was obtained from all patients before surgery or treatment.

The background data, physiological status, laboratory data, starting point of food intake, and duration of hospitalization were compared by means of Mann-Whitney tests. Assessment of food intake and complications were compared by means of Fisher exact tests. Survival rates were calculated using the Kaplan-Meier method and were compared using generalized Wilcoxon tests. $P < .05$ was considered statistically significant.

RESULTS

The characteristics of the study groups are summarized in **Table 1**. The median age and male-female sex ratios were similar between the 2 groups. In terms of primary disease, gastric cancers had the highest prevalence in both groups. Other primary neoplasms in the SPGJ group included malignant lymphoma, rectal cancer, and renal cancer, while the types of malignancies in the stent group included pancreatic and ovarian cancers. The spread of the primary tumor was similar between the groups, with adjacent structure invasions, liver metastases, peritoneal disseminations, and other distant organ metastases (lung and brain).

There were no major differences in physiological status (body weight change) or laboratory data (hemoglobin and albumin levels) between the 2 groups. The details are given in **Table 2**.

The starting points of food intake were at 6.0 days in the SPGJ group and 4.2 days in the stent group; hence, food intake was significantly earlier in patients treated with stenting ($P < .001$) (**Table 3**). The numbers of patients taking a regular meal at 2 weeks after treatment were 12 of 16 patients in the SPGJ group and 1 of 9 patients in the stent group ($P = .008$).

There was no significant difference between the 2 groups regarding the duration of hospitalization ($P = .48$) (**Table 4**). In 2 patients in the SPGJ group and in 1 patient in the stent group, tumor growth occurred at the anastomotic site and through the stent, resulting in obstruction. In the stent group, one patient had massive tu-

Table 1. Background Data^a

Variable	SPGJ Group (n = 16)	Stent Group (n = 9)
Age, median (range), y	71 (50-87)	73 (46-92)
Sex		
Male	10	5
Female	6	4
Primary disease		
Gastric cancer	12	5
Rectal cancer	2	0
Malignant lymphoma	1	0
Renal cancer	1	0
Pancreatic cancer	0	3
Ovarian cancer	0	1
Cancer spread		
Adjacent structure invasion	12	5
Liver metastasis	2	2
Peritoneal dissemination	3	1
Other distant metastases	2	1

Abbreviation: SPGJ, stomach-partitioning gastrojejunostomy.
^aSome patients had 2 factors or more.

mor hemorrhage, and another patient experienced intestinal perforation by a migrating stent; both patients died of these complications. There was a significant difference in complication rates between the 2 study groups ($P = .14$).

The median survival was 7.3 months in the SPGJ group and 2.8 months in the stent group, but the difference was not statistically significant (**Figure 3**). The mean 6-month survival rates for the SPGJ group and for the stent group were 81% (13 of 16) and 33% (3 of 9), respectively ($P = .04$).

COMMENT

Conventional gastrojejunostomy, the most common bypass, is not fully effective in this setting because of impaired gastric motility or risk of bleeding from the tumor. In 1925, Devine¹ introduced antral exclusion gastrojejunostomy for GOO, but the procedure was too intricate. In 1946, Kajitani⁶ introduced a transverse resection in the greater curvature of the stomach and gastrojejunostomy technique by first maintaining a tunnel in the lesser curvature of the stomach.

The SPGJ procedure effects simple gastrojejunostomy by application of a single linear cutter.³ In that study and in the present study, the superiority of the SPGJ method is demonstrated compared with CGJ or stenting procedures in terms of simple manipulation, less postoperative morbidity, improved QOL, and better prognosis. In addition, an SPGJ allows for observation of the tumor through postoperative endoscopy.

During the past decade, the expandable stents developed for enteral use have shown favorable results equal to or better than those of the CGJ operation.^{7,8} In fact, the stenting procedure has enabled earlier food intake and seems useful for patients who need alimentation as soon as possible because of poor health and limited life expectancy.

Table 2. Physiological Status and Laboratory Data

Variable	Mean (SD)			
	SPGJ Group (n = 16)		Stent Group (n = 9)	
	Pretreatment	Posttreatment	Pretreatment	Posttreatment
Body weight, kg	55.9 (13.0)	52.0 (11.6)	44.5 (6.7)	43.8 (7.2)
Hemoglobin level, g/dL	11.4 (1.2)	11.0 (1.1)	10.5 (0.7)	10.0 (1.7)
Albumin level, g/dL	3.3 (0.3)	3.2 (0.4)	3.0 (0.7)	3.0 (0.6)

Abbreviation: SPGJ, stomach-partitioning gastrojejunostomy.

Table 3. Food Intake

Variable	SPGJ Group (n = 16)	Stent Group (n = 9)	P Value
Starting point of food intake, median (range), d	6.0 (4-21)	4.2 (3-5)	.0045
Assessment of food intake after 2 wk			
No meal	2	1	<.001
Half-solid meal	2	7	
Regular meal	12	1	

Abbreviation: SPGJ, stomach-partitioning gastrojejunostomy.

Table 4. Posttreatment Course

Variable	SPGJ Group (n = 16)	Stent Group (n = 9)	P Value
Duration of hospitalization, median (range), d	32 (10-54)	39 (8-55)	.48
Complication			
Restenosis	2	2	.008
Bleeding	0	1 ^a	
Perforation	0	1 ^a	
Prognosis, median (range), d	218 (34-1385)	84 (50-387)	
6-mo Survival rate, %	80	33	.04

Abbreviation: SPGJ, stomach-partitioning gastrojejunostomy.

^aThese patients died shortly after onset of the complications.

Most patients in the SPGJ group had taken a regular meal by 2 weeks after the operation, which may lead to better QOL. In the stent group, critical complications such as bleeding and perforation were observed in our study and in others.⁹⁻¹¹ In the SPGJ group, reobstruction caused by a neoplasm was observed in only 2 cases. Better QOL and lower morbidity might contribute to an improved general condition and prognosis.

In the past few years, good results have been obtained by laparoscopic gastrojejunostomy for palliation of GOO.^{12,13} It provides safe and efficient relief from symptoms of GOO, minimal suppression of immune function, and the same benefits of minimally invasive surgery associated with other laparoscopic procedures. Laparoscopic SPGJ surgery, if possible to perform, may be less invasive and more useful for patients with GOO and should be studied in the future.

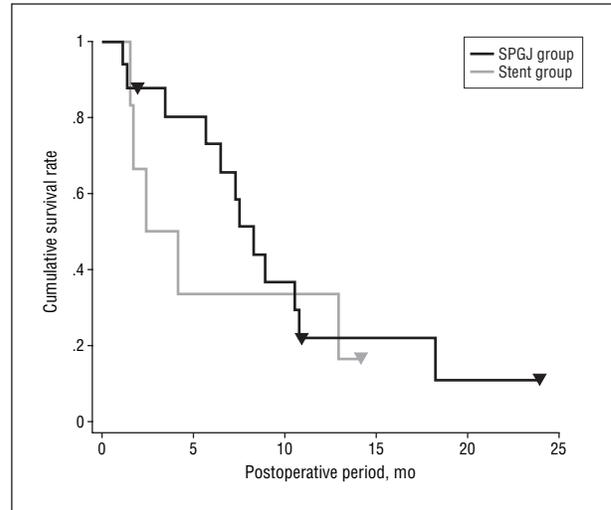


Figure 3. There was no significant difference between the survival curves in the stomach-partitioning gastrojejunostomy (SPGJ) group and the stent group ($P = .14$), but the mean 6-month survival rate was significantly higher in the SPGJ group (81% [13 of 16]) than in the stent group (33% [3 of 9]) ($P = .04$).

At present, SPGJ has achieved improved QOL (intake of solid food and fewer complications) and a better prognosis compared with other bypass operations or stenting procedures. It is the treatment of choice for GOO.

Accepted for Publication: March 4, 2006.

Correspondence: Keisuke Kubota, MD, PhD, Department of Surgery, International University of Health and Welfare Mita Hospital, Mita 1-4-3, Minato-ku, Tokyo 108-8329, Japan (kubota@iuhw.ac.jp).

Author Contributions: *Study concept and design:* Kubota, Kuroda, Origuchi, Kaminishi, Isayama, Kawabe, Omata, and Mafune. *Acquisition of data:* Kubota, Kaminishi, Isayama, Kawabe, Omata, and Mafune. *Analysis and interpretation of data:* Kubota, Kuroda, Origuchi, Kaminishi, Isayama, Kawabe, Omata, and Mafune. *Drafting of the manuscript:* Kubota, Kuroda, Origuchi, Kaminishi, Isayama, Kawabe, Omata, and Mafune. *Critical revision of the manuscript for important intellectual content:* Kubota, Kuroda, Origuchi, Kaminishi, Isayama, Kawabe, Omata, and Mafune. *Statistical analysis:* Kubota, Kuroda, Origuchi, Kaminishi, Isayama, Kawabe, Omata, and Mafune. *Obtained funding:* Kaminishi. *Administrative, technical, and material support:* Kubota, Kuroda, Kaminishi, Isayama,

and Mafune. *Study supervision*: Origuchi, Kaminishi, Kawabe, Omata, and Mafune.

Financial Disclosure: None reported.

Additional Contributions: Keiichiro Ohta, MD, PhD, provided expert advice about the history of bypass surgery.

REFERENCES

1. Devine HB. Basic principles and supreme difficulties in gastric surgery. *Surg Gynecol Obstet*. 1925;40(1):1-16.
2. Schantz SP, Schickler W, Evans TK, Coffey RJ. Palliative gastroenterostomy for pancreatic cancer. *Am J Surg*. 1984;147(6):793-796.
3. Kaminishi M, Yamaguchi H, Shimizu N, et al. Stomach-partitioning gastrojejunostomy for unresectable gastric carcinoma. *Arch Surg*. 1997;132(2):184-187.
4. Kwon SJ, Lee HG. Gastric partitioning gastrojejunostomy in unresectable distal gastric cancer patients. *World J Surg*. 2004;28(4):365-368.
5. Yamagishi F, Arai H, Yoshida T, et al. Partial separating gastrojejunostomy for incurable cancer of the stomach or pancreas. *Hepatogastroenterology*. 2004; 51(60):1623-1625.
6. Kajitani T. Transverse resection in the greater curvature of the stomach and gastrojejunostomy [in Japanese]. *J Jpn Surg Soc*. 1946;47(5):39-40.
7. Johnsson E, Thune A, Liedman B. Palliation of malignant gastroduodenal obstruction with open surgical bypass or endoscopic stenting: clinical outcome and health economic evaluation [published online ahead of print August 3, 2004]. *World J Surg*. 2004;28(8):812-817. doi:10.1007/s00268-004-7329-0.
8. Mittal A, Windsor J, Woodfield J, Casey P, Lane M. Surgical versus endoscopic palliation of malignant gastric outlet obstruction: big incision, little incision, or no incision? *Br J Surg*. 2004;91(2):205-209.
9. Lindsay JO, Andreyev HJ, Vlavianos P, Westaby D. Self-expanding metal stents for the palliation of malignant gastroduodenal obstruction in patients unsuitable for surgical bypass. *Aliment Pharmacol Ther*. 2004;19(8):901-905.
10. Dormann A, Meisner S, Verin N, Wenk Lang A. Self-expanding metal stents for gastroduodenal malignancies: systematic review of their clinical effectiveness. *Endoscopy*. 2004;36(6):543-550.
11. Baron TH, Harewood GC. Enteral self-expandable stents. *Gastrointest Endosc*. 2003;58(3):421-433.
12. Choi YB. Laparoscopic gastrojejunostomy for palliation of gastric outlet obstruction in unresectable gastric cancer [published online ahead of print June 20, 2002]. *Surg Endosc*. 2002;16(11):1620-1626. doi:10.1007/s00464-002-0010-5.
13. Chung RS, Li P. Palliative gastrojejunostomy: a minimally invasive approach. *Surg Endosc*. 1997;11(6):676-678.

Invited Critique

Kubota et al offer an alternative procedure for the relief of the vexing problem of malignant GOO in patients with tumors that are not resectable. While their procedure (SPGJ) may be a useful addition to available options, the suggestion that this is a fair comparison with endoscopic stenting is misleading. In the study by Kubota et al, Figure 3 reveals that 81% of patients in both groups were dead at 1-year follow-up. However, the median survival in the stent group was only 2.8 months (compared with 7.3 months in the SPGJ group). The patients in the stent group weighed a mean of 10 kg less than those in the SPGJ group. Finally, almost half of the stent group had advanced pancreatic or ovarian cancer. These facts strongly suggest that the patients in the stent group were more ill or had more advanced malignant neoplasms. This may well represent proper patient selection, but it precludes an “apples to apples” comparison.

There is a sizeable literature on stenting. In a prospective study from Sweden,¹ the authors concluded that stenting was less expensive, was associated with a shorter hospital stay, and had outcomes “just as good as gastrojejunostomy.” Findings from several large series suggest that stenting is a good option in patients expected to live less than 6 months.²⁻⁴

Malignant GOO in patients with nonresectable tumors remains a formidable problem. The patients are facing a limited life expectancy. There is no “one-size-fits-all” solution to this problem. Patients differ in many ways, including age, social situation, expectations, etc. The surgeon along with the patient should decide between surgical solutions, endoscopic stenting, no treatment at all, or, in some cases, intravenous narcotics alone.

Robert A. Kozol, MD

Correspondence: Dr Kozol, Department of Surgery, University of Connecticut School of Medicine, 263 Farmington Ave, MC 3955, Farmington, CT 06030 (Kozol@nso.uhc.edu).

Financial Disclosure: None reported.

1. Johnsson E, Thune A, Liedman B. Palliation of malignant gastroduodenal obstruction with open surgical bypass or endoscopic stenting: clinical outcome and health economic evaluation [published online ahead of print August 3, 2004]. *World J Surg*. 2004;28(8):812-817. doi:10.1007/s00268-004-7329-0.
2. Telford JJ, Carr-Locke DL, Baron TH, et al. Palliation of patients with malignant gastric outlet obstruction with the enteral Wallstent: outcomes from a multicenter study. *Gastrointest Endosc*. 2004;60(6):916-920.
3. Song HY, Shin JH, Yoon CJ, et al. A dual expandable nitinol stent: experience in 102 patients with malignant gastroduodenal strictures. *J Vasc Interv Radiol*. 2004;15(12):1443-1449.
4. Bessoud B, de Baere T, Denys A, et al. Malignant gastroduodenal obstruction: palliation with self-expanding metallic stents. *J Vasc Interv Radiol*. 2005;16(2, pt 1):247-253.