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Self-expandable metallic stent placement for palliation in gastric outlet obstructions caused by gastric cancer: a comparison with surgical gastrojejunostomy

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Background. In patients with gastric outlet obstruction (GOO), palliative enteral stenting is a less invasive procedure compared with gastroenterostomy. Most diseases analyzed in previous studies of such stenting were pancreaticobiliary malignancies. ***Methods.*** We reviewed the medical records of patients with GOO secondary to gastric cancer who were admitted to our institution between September 1994 and September 2004. The outcome of stent placement for GOO was compared with the outcome in patients who underwent palliative open gastrojejunostomy during the same period. Enrolled patients from both groups displayed symptomatic GOO. Patients with recurrent gastric cancer were excluded from this study. ***Results.*** Twenty-two patients underwent palliative enteral stenting, and 22 patients were subjected to surgical gastrojejunostomy (bypass). There were no significant differences between the two groups regarding patient baseline characteristics. Technical success and clinical success were obtained in 100% and 77.3%, respectively, of both groups. The operating time was shorter in the stent group (30 vs 118 min; $P < 0.0001$). The time from the procedure to the resumption of food intake was shorter in the stent group than in the bypass group (2 days vs 8 days; $P < 0.0001$). An improvement in performance score after the procedure was observed in both groups (stent group; $P = 0.0264$; bypass group; $P = 0.0235$). No significant differences were observed regarding the possibility of discharge. In patients discharged, the median postoperative hospital stays were 19 days and 28 days ($P = 0.0558$). The median survival periods were 65 days and 90 days. Minor complications were observed in 1 patient in the stent group and in 4 in the bypass group. No mortality or severe complications were observed for either group. ***Conclusions.*** Self-expandable metallic stent placement is a safe and efficacious procedure for palliation, with shorter operating time and more prompt restoration of oral intake, compared to surgical alternatives in patients with GOO caused by gastric cancer.

Key words: gastric cancer, palliation, stent, gastrojejunostomy, gastric outlet obstruction

Introduction

The efficacy of palliative stent placement for gastric outlet obstruction has been reported. Moreover, retrospective studies in patients with stent placement indicate lower cost and shorter hospital stay, compared with those with surgical bypass.[1–3] A previous study by our group revealed greater improvement in the performance score with this procedure than with surgical bypass.[4] A recent study showed that enteral stenting offered not only shorter times to oral intake and for hospital stay but also less frequent complications, compared with open and laparoscopic gastrojejunostomy.[5] Furthermore, a recent prospective randomized study revealed similar results.[6] However, most underlying diseases analyzed in previous studies of enteral stenting were pancreaticobiliary malignancies, and there have been no comparative studies specific for patients with gastric cancer. The purpose of the present study was to retrospectively evaluate the outcome of enteral stenting, compared with that of surgical gastrojejunostomy for the palliation of gastric outlet obstruction caused by gastric cancer.

Patients and methods

Records for patients who underwent palliative stenting from September 1994 to September 2004 at our hospital

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were reviewed. The indications for stent placement were obstructive symptoms, such as retention or vomiting, and confirmation of gastric outlet obstruction by radiography or endoscopy. Written informed consent was obtained before the procedures were performed. Follow-up studies were based on interviews and clinical examinations at least once a month. When patients could not be followed up directly for specific reasons, such as a move to another area, families or personal physicians were contacted monthly by telephone.

Clinical outcomes in these patients were compared with those in patients subjected to open surgical gastrojejunostomy during the same period. All patients were considered unresectable. Patients with either procedure performed because of recurrent gastric cancer were excluded from this study. Also, patients who had undergone prophylactic gastrojejunostomy were excluded. The technical success of stent placement was defined as satisfactory deployment and precise positioning at the location of the obstruction. Clinical success was defined as the ability to adequately maintain hydration and nutritional status independent of parenteral support. Dietary status for oral intake was classified into four grades; specifically, none, liquid, soft solid, and solid. For the bypass surgery, technical success was defined as satisfactory achievement of the scheduled surgery, and clinical success was classified similarly to that for stent placement. The postoperative performance score was determined, as the time taken for patients to reach prime condition following the procedure.

Techniques

Ultraflex (Boston Scientific, Natick, MA, USA; 17–23 mm in diameter, 7–15 cm long) was used in this study. When the delivery system could not reach the obstruction, the length was increased by connecting an additional plastic tube beforehand.[7] All stents were placed with endoscopic and fluoroscopic guidance. Initially, a 7-Fr catheter was passed endoscopically with the help of a guidewire (Jagwire; 0.035 inches, 480 cm; Boston Scientific) inserted through the stenosis. When the stricture was too narrow to be passed through with the gastroscope (XQ-240; 9 mm in diameter; Olympus, Tokyo, Japan), balloon dilation was performed with a wire-guided balloon dilator (12–18 mm; CRE Wireguided; Boston Scientific). After withdrawal of the balloon catheter, the guidewire was exchanged for a stiff guidewire (Surf wire; 0.038 inches, 420 cm; Piolax Medical Devices, Kanagawa, Japan). The guidewire was left in place, and the catheter and endoscope were removed. The delivery system was advanced over the guidewire to the stenosis. A number of patients underwent stent placement with the aid of abdominal compression.[8] Endoscopic assistance with grasping forceps, a custom-made sheath,[9] or an overtube for the enteroscope[10] (ST-S2; Olympus) was also used. Stent placement was performed with the patient under conscious sedation.

The surgical bypass procedure employed was open gastrojejunostomy, under general anesthesia. Where required, biliary bypass or stenting was performed concurrently with either procedure in both groups. Furthermore, chemotherapy following this procedure was performed in patients who displayed greater performance status and gave their informed consent.

Statistical analysis

Values for patient baseline characteristics are expressed as means plus or minus the SEM. Categorical data were examined using Fisher's exact test or the χ^2 test. Comparisons of patient age were determined using Student's *t*-test. The Mann-Whitney *U*-test was used for comparisons of other continuous data. Differences in performance scores before and after the procedure were analyzed by Wilcoxon signed rank test.

Cumulative survival was estimated with Kaplan-Meier life table analysis, and the two groups were compared using the log-rank test. A P value of less than 0.05 was considered statistically significant.

Results

Between September 1994 and September 2004, 22 patients received stent placement and 22 patients had bypass surgery. Patients referred to surgery underwent gastrojejunostomy in general. Patients referred to internal medicine underwent either procedure, based on the patients' choice, and they primarily selected stenting placement. There were more stent patients late in the 10-year period as the procedure became more widely accepted, although duodenal stenting was initially offered in March 1993.[8] Gastric cancer was considered inoperable in all patients because of their debilitated condition, advanced age, or the presence of distant metastasis and/or locally extensive invasion. With the exception of 2 patients in the stent group and 3 patients in the bypass group, an invasion to the adjacent organs, with lymph node metastasis or distant metastasis was observed.

In all but 1 patient, extension of the delivery system using a plastic tube was needed to reach the stenotic lesion. Of the 22 patients, 10 patients required the following further modifications: overtube, 8; custom-made sheath, 1, and endoscopic assistance with grasping forceps, 1. Three patients in the stent group also had

Table 1. Patient characteristics

	Stent	Bypass	*P* value
Patients (*n*)	22	22	
Mean age (years) ± SEM	72.3 ± 2.5	66.1 ± 2.3	0.1152
Sex (M/F)	13/9	13/9	>0.9999
Median KPS before procedure[a]	50.0 (50–62.5)	60.0 (50–60)	0.7140
Reason for unresectability (CE/DS/AA)	20/1/1	20/2/0	0.8559
Median time from initial diagnosis to intervention (days)[a]	45.5 (19.3–133.5)	26.0 (22.5–34.3)	0.0619

KPS, Karnofsky performance score; CE, cancer extension and/or metastasis; DS, debilitated status or severe coexisting illness; AA, advanced age
[a] Figures in parentheses indicate inter quartile ranges

Table 2. Outcome in patients who underwent palliative treatment for gastric outlet obstruction due to unresectable gastric cancer: enteral stent placement versus surgical gastrojejunostomy (bypass)

Variables	Stent	Bypass	*P* value
Technical success	22 (100%)	22 (100%)	>0.9999
Clinical success	17 (77.3%)	17 (77.3%)	>0.9999
Operating time (min)[a]	30 (26.5–40)	118 (92–148)	<0.0001
Complication	1 (4.5%)	4 (18.2%)	0.1967
Procedure-related mortality	0	0	>0.9999
Median survival time (days)	65	90	0.7875
Median time (days) from procedure to oral diet[a]	2 (1–3)	8 (6–10)	<0.0001
Median KPS after procedure[a]	60 (57.5–80)	65 (50–70)	0.5394
Improvement of performance score	16 (72.7%)	11 (50%)	0.2155
Median change of performance score after procedure[a]	10 (0–10)	10 (0–10)	0.3927
Possibility of discharge	12 (54.5%)	17 (77.3%)	0.2033
Median hospital stay (days) from procedure to initial discharge (12 vs 17 patients)[a]	19 (10–28.5)	28 (19–38.5)	0.0558

KPS, Karnofsky performance score
[a] Figures in parentheses indicate interquartile ranges

biliary stenosis due to cancer extension. One patient had scirrous-type gastric cancer with previous biliary stenosis. After the placement of a metal biliary stent, the patient had been receiving chemotherapy. Pyloroduodenal obstruction occurred 54 weeks after the placement of the metal biliary stent. In the remaining 2 patients, no biliary stricture was found at the time of the enteral stent placement. After 8 and 20 weeks, however, subsequent biliary obstruction occurred, due to cancer extension. These patients received percutaneous placement of a metal biliary stent. In the bypass group, there was only 1 patient with concomitant biliary obstruction. Five days before bypass surgery, percutaneous transhepatic biliary drainage was performed. Two weeks after the surgery, the percutaneous transhepatic biliary drainage (PTBD) tube was exchanged for an internal-external catheter.

There were no significant differences in patient baseline characteristics (Table 1). The mean observation period was 102 days for the stent group, and 120 days for the bypass group.

The procedures were successful in all patients. Hydrostatic pyloro-duodenal dilation was required before stenting in 12/22 (55%) patients. Twenty of 22 patients required one stent, while 2 patients required two stents; 1 patient received two overlapping stents at one time and the other patient had stenosis of the pylorus and the third part of the duodenum caused by cancer extension. In this patient, a pyloric stent was placed initially. Then a duodenal stent was placed 2 weeks after the initial stenting.

The clinical success rate was 77.3% in each group. Solid or soft solid food was ingested in 72.7% of patients in the stent group and in 91% of the bypass group. An improvement of dietary status was found in 86.4% in the stent group and in 68.2% in the bypass group. There were four patients who could not eat any food. In the three stent patients, this seemed to be caused by tumor dissemination, and in the bypass patient, the cause of clinical failure was dysfunction of the anastomosis. Nasogastric drainage was continuously required until death in this patient.

The median time from the procedure to resumption of oral diet was 2 days for the stent patients, and 8 days for the bypass patients ($P < 0.0001$; Table 2).

Complications occurred in one patient (4.5%) in the stent group (stent fracture; Fig. 1) and in four patients (18.2%) in the bypass group (Table 3). After fracture,

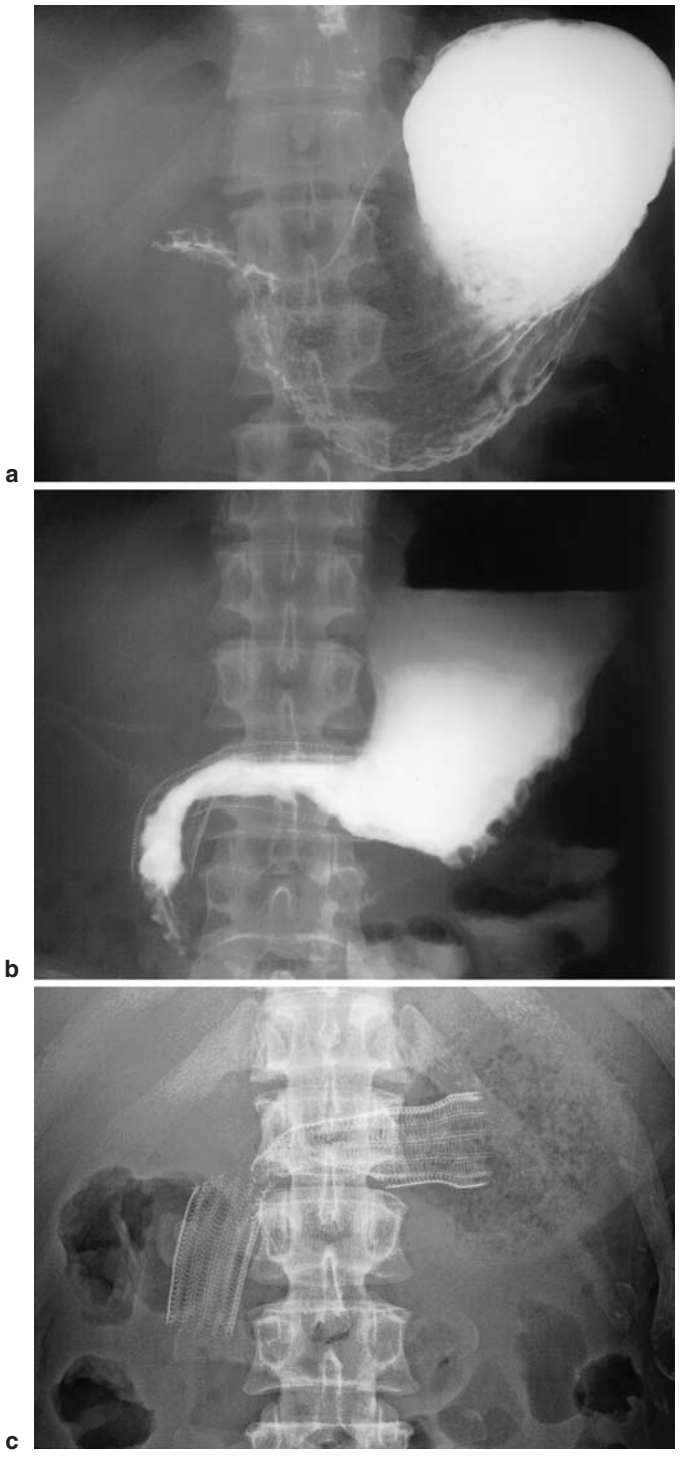

Fig. 1. **a** Gastrography, showing pyloroduodenal obstruction due to gastric cancer. **b** Stent was placed in the optimal position. **c** X-ray 8 weeks after stent placement revealed stent fracture

the stent allowed the patient to take solid food almost until death, without any management. Furthermore, this patient survived for 350 days after stent placement, with vigorous chemotherapy. Luminal patency was confirmed by autopsy. Three patients in the bypass group displayed dysfunction of the anastomosis, and one had wound infection. None of the three patients with dysfunction of the anastomosis could ingest sufficient food orally to live properly without hyperalimentation, and therefore could not be discharged. There was no procedure-related mortality in either group.

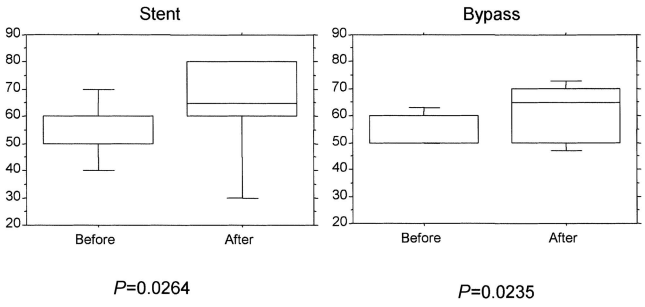

Fig. 2. Performance score changes after the procedure in both groups

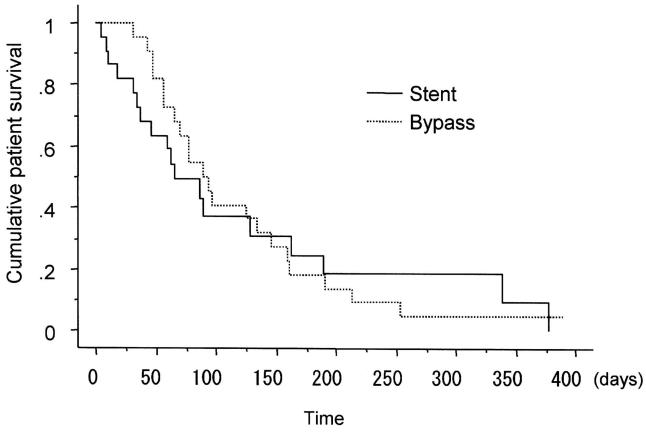

Fig. 3. Survival curves for all patients in both groups

Table 3. Complications

Stent (1 patient)	*n*	Bypass (4 patients)	*n*
Stent fracture	1 (1)	Dysfunction of anastomosis	3 (0)
		Wound infection	1 (1)
Total	1 (1)		4 (1)

Figures in parentheses indicate possibility of discharge

The performance score was significantly improved in both groups (Fig. 2). Improvement in performance score was observed in 16 stent patients (72.7%) and 11 bypass patients (50%).

The median survival was 65 days for stent patients, and 90 days for bypass patients, which showed no significant differences (Table 2; Fig. 3). There was no significant difference regarding possibility of discharge.

Median hospital stay from procedure to initial discharge in the stent group was shorter than that in the bypass group ($P = 0.0558$; Table 2).

Seven patients in the stent group and five patients in the bypass group received chemotherapy after stent placement.

The mean observation periods of the stent group and the bypass group were 103 days and 121 days, respectively.

Discussion

Self-expandable metallic stents are becoming increasingly popular for the palliation of malignant gastric outlet obstructions. The major reason is the lower degree of invasiveness of this procedure, in contrast to bypass surgery, which is associated with frequent morbidity or mortality.[11] In addition, bypass surgery may cause delayed gastric emptying in 14% to 29% of patients, resulting in delayed resumption of oral intake.[12,13] Although the efficacy of enteral stent placement is well recognized, most earlier investigations focused on gastric outlet obstructions caused by pancreaticobiliary malignancies. Few reports on these stents have dealt exclusively with gastric cancer.[14] In the present study, we focused on gastric outlet obstruction caused by gastric cancer and evaluated the clinical outcome of patients subjected to enteral stenting, compared with those treated by surgical bypass.

Previous comparisons have disclosed that stent placement offers shorter hospital stay[1–3] and is less expensive[1,2] than bypass surgery as conventional treatment for unresectable gastric outlet obstruction. In earlier studies, improvement in the performance score after the procedure was observed more frequently in stent-treated patients.[4] In the present investigation, a detailed comparison of stent placement and bypass surgery was carried out exclusively in patients with gastric outlet obstruction due to gastric cancer.

No significant differences were evident between the procedures with regard to the technical success rate. Through-the-scope type stents have never been available in Japan, and esophageal stents were therefore used for this study. Technical modifications were employed to overcome the slight complexity of the procedure using esophageal stents.[7,9] Clinical success rates were similar in the two groups. The major reason for clinical failure was peritoneal dissemination or dysmotility in stent patients, and dysfunction of the anastomosis in bypass patients. Eventually, the rate of independence from parenteral support was similar in the two groups, specifically, 75% in stent patients versus 72.2% in bypass patients.

Median time from the procedure to oral intake in stent patients was significantly shorter than that in bypass patients. This is a considerable advantage in patients with gastric outlet obstruction caused by gastric cancer, as well as that caused by pancreaticobiliary malignancies.[4,15]

The complication rate was 4.5% in the stent group and 18.2% in the bypass group, with no statistically significant difference. Stent fracture, the only stent-related complication, did not impair the patient's ability to have oral intake or necessitate intervention. This patient did not undergo procedures that cause stent damage, such as endoscopy.[16] Presumably, stent damage may be caused by acid.[17] This patient was discharged and for almost all of the rest of life was able to receive treatment as an outpatient. In the bypass group, by contrast, three of the four patients with complications could not be discharged. Notably, dysfunction of the anastomosis was a factor precluding the discharge of bypass patients. However, there were no serious complications and no mortality in either group.

Data from the present study indicate that complications of stent placement for gastric cancer occurred less frequently than in previous series.[4,15,18] In these studies, the most commonly observed complication was stent obstruction, especially by tumor ingrowth. A covered stent was used in 64% of the subjects in our present study, whereas only uncovered stents were used in other series.[15,18] Although there has been no consensus regarding covered stents for gastric outlet obstruction, this difference in stents may have led to the differences in results. Our previous report showed that complications occurred in 45% of patients with pancreaticobiliary malignancy who received duodenal stents.[4] Of these complications, however, only one-third (15%) were due to stent obstruction and migration. Another one-third were due to pancreatitis or jaundice associated with compression of the papilla by the duodenal stent.[4] Many periampullary malignancies necessitate the bridging of the papilla by a duodenal stent, which makes matters more complicated, and may present more frequent obstacles. In the present study, there were only three cases of biliary obstruction, which occurred before or subsequent to pyloroduodenal obstruction.

There were no statistically significant differences (19 days versus 28 days) in the median hospital stay from the time of the procedure to initial discharge home, probably due to the small sizes of the study groups (12 and 17 patients, respectively; power <0.8). The differences in the length of hospital stay between the two groups may be attributed to variations in the overall period from the time of the procedure to the resumption of oral intake.

The performance score improved following both procedures. In terms of frequency of improvement of the

performance score, there was no statistically significant difference between the two groups.

Data from esophageal stenting suggest a higher rate of delayed local complications following stent placement in patients previously exposed to radiation and/or chemotherapy.[17,19,20] In colorectal stenting, an earlier report indicated that stent placement prior to chemotherapy increased the risk of delayed perforation.[21] However, to date, there are no data on stent safety in gastric outlet obstruction.[22] Our results do not indicate that chemotherapy following the insertion of a metal stent increases the risk of complications. A recent multicenter study[23] reported that a multivariate regression test indicated the advantage of chemotherapy after enteral stent insertion, which was associated with prolonged oral intake. In our series, the only complication in the stent group was stent fracture, which did not require any intervention. The patient could ingest solid food for 11 months, until death.

In summary, in patients with gastric cancer, there are no significant differences between enteral stenting and surgical bypass in terms of success rates, morbidity, and mortality. Because stent placement is associated with the restoration of oral intake and quicker resumption of oral diet, it may be favorable as a rapid therapeutic option in patients with gastric outlet obstruction caused by gastric cancer. Prospective randomized comparisons with a larger number of patients are required.

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