Outcomes of patients with malignant esophagogastric junction obstruction receiving metallic stents: A single-center experience

Yu-Ling Pan[a,b], Pei-Shan Wu[a,b,c,*], Bing-Wei Ye[a,b,d], Chung-Pin Li[a,b,e], I-Cheng Lee[a,b], Kuei-Chuan Lee[a,b,*], Yi-Hsiang Huang[a,b], Ming-Chih Hou[a,b]

[a]Division of Gastroenterology and Hepatology, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan, ROC; [b]Department of Medicine, School of Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan, ROC; [c]Endoscopy Center for Diagnosis and Treatment, Taipei Veterans General Hospital, Taipei, Taiwan, ROC; [d]Division of Gastroenterology, Department of Medicine, Taiwan Adventist Hospital, Taipei, Taiwan, ROC; [e]Division of Clinical Skills Training, Department of Medical Education, Taipei Veterans General Hospital, Taipei, Taiwan, ROC

Abstract

Background: Malignancies-related esophagogastric junction (EGJ) obstruction is usually diagnosed in inoperable status with poor clinical outcomes. Metallic stent placement at EGJ could improve dysphagia for these patients. However, studies regarding the outcomes in these patients receiving metallic stents are still limited. This study aimed to investigate the outcomes of metallic stent placement in malignant EGJ obstruction.

Methods: Forty-one patients with inoperable malignant EGJ obstruction receiving metallic stent placement were retrospectively enrolled. The clinical outcomes between different stents and deployment techniques were analyzed.

Results: The overall technical success rate was 97.6% and clinical success rate was 92.1%. The median overall survival time was 77 (4-893) days, and the patency time was 71 (4-893) days, respectively. Poststent radiotherapy significantly prolonged survival and stent patency. Between patients receiving uncovered or partially covered metal stents, there was no difference in procedure-related complications, survival time, and stent patency time. Moreover, the clinical outcomes in patients receiving duodenal stents for malignant EGJ obstruction are not inferior to those receiving esophageal stents.

Conclusion: This study provides crucial information for endoscopists to establish individualized stenting strategies for malignant EGJ obstruction.

Keywords: Duodenal stent; Esophagogastric junction obstruction; Esophageal stent; Metal stent

1. INTRODUCTION

Malignant esophagogastric junction (EGJ) obstruction is uncommon (5%-10%) in patients with gastric cancer, esophageal cancer, or other cancers with gastric metastasis.[1,2] More than 50% of EGJ cancers are inoperable, and these patients often have poor clinical outcomes.[3] Dysphagia is one of the most important symptoms that cause malnutrition and poor quality of life in patients with advanced EGJ malignancies. According to national comprehensive cancer network guideline, patients with inoperable EGJ malignancies who develop dysphagia symptoms should be treated with palliative therapies, such as radiotherapy (external beam radiation therapy and brachytherapy), chemotherapy, esophageal dilatation, or a stent placement, either concurrently or sequentially.[4] With the increased incidence of EGJ malignancies, it has become an issue of concern about the optimal palliative treatment for these patients to improve their quality of life.[3,5,6] Of the aforementioned treatments, placement of a metallic stent has the advantage of immediate improvement with a high clinical success rate.[7] Although complications related to this intervention, such as vomiting, pain, bleeding, infection, and perforation, might develop during or after stent placement, it is commonly used to relieve dysphagia for patients with inoperable EGJ tumors.[6,8,9] Although few previous studies have shown good efficacy and safety in patients with malignant EGJ obstruction receiving metallic stents,[10,11] studies regarding the optimal treatment strategies about chemoradiotherapy and endoscopic therapies for malignant EGJ obstruction are limited.[3] Park et al[7] have reported that patients treated with covered metallic stents experienced higher migration rates than those treated with uncovered metallic stents. Radiation therapy prolongs the stent patency time, and poststent chemotherapy is a risk factor

*Address correspondence. Dr. Kuei-Chuan Lee, Division of Gastroenterology and Hepatology, Department of Medicine, Taipei Veterans General Hospital, 201, Section 2, Shi-Pai Road, Taipei 112, Taiwan, ROC. E-mail address: kclee2@vghtpe.gov.tw (K.-C. Lee); Dr. Pei-Shan Wu, Endoscopy Center for Diagnosis and Treatment, Taipei Veterans General Hospital, 201, Section 2, Shi-Pai Road, Taipei 112, Taiwan, ROC. E-mail address: pswu6@vghtpe.gov.tw (P.-S. Wu).

Dr. Yi-Hsiang Huang and Dr. Ming-Chih Hou, editorial board members at Journal of the Chinese Medical Association, have no roles in the peer review process of or decision to publish this article.

Conflicts of interest: The other authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

Journal of Chinese Medical Association. (2022) 85: 160-166.

Received August 6, 2021; accepted September 12, 2021.

doi: 10.1097/JCMA.0000000000000638.

for stent migration. The influence of different stent deployment strategies for esophageal stenting under fluoroscopic or endoscopic guidance has also been discussed, with no significant difference in efficacy and safety.[12]

With advances in cancer treatment and the development of new endoscopic modalities for stenting, questions are raised regarding the most suitable cancer treatment and endoscopic strategies for these patients in the current era. Therefore, this study aimed to investigate the outcomes of different endoscopic techniques, stent types, and oncological strategies in patients with malignant EGJ obstruction.

2. METHODS

2.1. Patient selection

This was a retrospective, comparative, single-center study. Consecutive patients with inoperable malignant EGJ obstruction requiring a metallic stent placement for palliative treatment of dysphagia were enrolled in the Taipei Veterans General Hospital between January 2008 and August 2020. Patient data were collected from medical records, including patient demographics, procedural characteristics, complications of the procedure, dysphagia scores, survival time, status of stent patency, reinterventions, and further palliative cancer treatments, such as chemotherapy and radiotherapy. The definitions of procedure-related complications, technical success, clinical success, and dysphagia scores[13,14] are described in Supplementary Table 1, http://links.lww.com/JCMA/A112. EGJ obstruction was diagnosed based on endoscopic findings and/or imaging studies. All patients were followed up until death or until August 2020. Patients were excluded if they were under 18 years of age, refused endoscopic treatment, or were lost to follow-up in our hospital. This study was approved by the Institutional Review Board (IRB) of Taipei Veterans General Hospital (IRB No. 2020-06-035BC).

2.2. Stenting procedure

The patients were treated in the supine position, and the severity of the EGJ stenosis was evaluated using a gastroscope (JF-240/260, Olympus, Shinjuku-ku, Tokyo, Japan) under fluoroscopic guidance as previously described.[10,11,15] A guidewire (Hydra Jagwire, Boston Scientific Corporation, USA) was inserted through the working channel of the gastroscope to reach the stenotic site. Then, a water-soluble contrast was injected to measure the location and length of the lesion. The optimal stent length was determined by the lesion length, which extended 1 to 3 cm long, to adequately cover the lesion boundary.[10,11,15] For deployment of the metal stents, two different methods were used. To deploy the esophageal stents (Ultraflex esophageal stent; Boston Scientific Corporation, Natick, MA, USA or Endoflex esophageal stent, GmbH, Voerbe, Germany), the stent was pushed through the stenosis and released by hand maneuvers under fluoroscopic guidance. For the deployment of the duodenal stents (Bonastent Pyloric/Duodenal stent; Standard Sci-Tech Inc., Seoul, South Korea), the stent was pushed through the stenosis and released by the endoscopic working channel under fluoroscopic guidance. Before the procedure, we provided the details of the available stents, including advantages, disadvantages, prices, manufacturing companies, and countries of origin to each patient, and the selection of the types of metallic stents was determined by the discussion of the endoscopists and patients. Procedure-related complications, such as abdominal pain, reflux esophagitis, perforation, bleeding, and aspiration pneumonia, were also explained. The catheter diameters of the Ultraflex and Endoflex stents before release were 18.5 Fr (6.2 mm) and 24 Fr mm (8 mm), respectively. The stents could fully expand to 23 mm after deployment. The diameter of a Bonastent before release was 10 Fr (3.3 mm), and it could fully expand to 22 mm.

All patients had a nil per os status for 24 hours after stenting. Oral intake with liquid or soft diet was resumed the day after checking the position and expansion status of the metallic stents by plain films.

2.3. Statistical analysis

The outcomes, complications, duration of stent patency, and survival were analyzed using IBM SPSS Statistics for Windows (version 24.0. Armonk, NY: IBM Corp.). Data are shown as medians with range or mean ± SD. The comparison distributions of basic characteristics were calculated using the Mann-Whitney *U* test and chi-square test. The prestent and poststent placement dysphagia scores were analyzed using the Wilcoxon signed-rank test. Variables with $p < 0.15$ in the univariate analysis were included in the multivariate Cox regression models. Univariate analyses of survival and stent patency were performed using the Kaplan-Meier analysis. Statistical significance was defined as $p < 0.05$.

3. RESULTS

3.1. Patient characteristics

Forty-one patients were enrolled in this study. The details are presented in Table 1. Twenty-six (63.4%) men and 15 (36.6%) women received metallic stent insertion, with a median age of 81 years (range, 36-96 years). Among these patients, eight (19.5%) had esophageal cancer, 30 (73.2%) had gastric cancer, and three (7.3%) had other malignancies with EGJ involvement. The most common pathologic findings were adenocarcinoma (31 patients, 75.6%) and squamous cell carcinomas (seven patients,17.1%). All EGJ tumors were stage IV. The mean dysphagia scores were 3.5 ± 0.6 points before placement of metallic stents.

3.2. Clinical outcomes after metallic stent placement

In this study, the technical and clinical success rates were 97.6% and 92.1%, respectively. One patient failed to undergo stent insertion because of esophageal perforation during the procedure. Procedure-related complications are shown in Table 2. The most common postprocedural complication was infection, which occurred in eight (19.5%) patients. Among the eight patients, four patients had aspiration pneumonia and the other four patients had subsequent sepsis after the procedure. Reflux esophagitis developed in three patients after metallic stent placement, as confirmed by endoscopic assessment. The severity of reflux esophagitis was Los Angeles grade A in two patients with partially covered metallic stents and grade C in one patient with an uncovered metallic stent. No procedure-related deaths were found.

After excluding the only case that failed to receive stent insertion, the clinical outcomes of stent placement in 40 patients were analyzed. The status of oral intake before and after successful metallic stent placement was assessed on days 0, 1, 7, and 30 by using dysphagia scores.[13,14] A significant decrease in dysphagia scores was found at 7 days and 30 days after stent placement as compared to the scores at day 0 (Table 2 and Supplementary Fig. 1, http://links.lww.com/JCMA/A112). Two patients died within 7 days, and 12 patients died within 30 days after metallic stent placement. A 90-year-old patient received successful partially covered metallic stent deployment (Boston Scientific) and resumed liquid diet the next day. However, he died of uncontrolled sepsis and multiple organ failure 4 days after stenting.

Among all adverse events, the restenosis rate was 15%, while migration and stent fracture rates were 0%. Four patients with stent restenosis underwent a restenting procedure (patency days of first metallic stent: 114-525 days), and two patients with stent restenosis underwent balloon dilatation (patency days of

Table 1

Patient characteristics

Variables	All (N = 41)
Age (y)	81.0 (36-96)
Gender (male:female)	26:15
Albumin, g/dL	3.0 (2.0-4.3)
Length of esophageal stenosis (cm)	5.0 (1.6-10)
Peritoneal carcinomatosis	8.0 (19.5)
Esophageal:gastric:other malignancies	8:30:3
Staging IV	41 (100)
Procedure time (min)	19.5 (8-58)
Stent length (cm)[a]	10 (5-16)
Width of stent on day 0 (cm)[a]	0.77 (0.26-1.79)
Width of stent on day 1 (cm)[a]	1.18 (0.84-1.81)
Type of stent (uncovered:partially covered)	
Boston Scientific	2:10
Bonastent	18:3
Endoflex	3:4

The data are expressed as median (range) or number (percent).

[a]Exclude one patient who failed to receive stent insertion due to esophageal perforation.

metallic stent: 7-69 days). Of these patients with stent restenosis, one patient received metallic stent insertion four times because of recurrent tumor ingrowth. The median overall survival time of all patients was 77 days (range, 4-893 days), and the patency time was 71 days (range, 4-893 days). Among the patients who received chemotherapy, nine patients received continuous chemotherapy before and after metallic stent placement.

Patients with inoperable EGJ tumors may receive combined treatment, such as chemotherapy, radiotherapy, or both, to achieve a better quality of life. In our study, the most commonly used regimen of chemotherapy was the PFL (cisplatin, 5-fluorouracil, and leucovorin) protocol, followed by capecitabine plus oxaliplatin. In five patients who received poststent radiotherapy, radiation therapy doses were suggested by radiation oncologists and calculated using a biologically effective dose calculator, ranging from 42.5 to 55 Gy in 17 to 30 fractions. On multivariate Cox regression analysis, poststent radiotherapy predicted lower mortality rates (hazard ratio [HR], 0.18; 95% CI, 0.04-0.86; $p = 0.032$) and restenosis rates (HR, 0.19; 95% CI, 0.04-0.92; $p = 0.039$). Furthermore, male patients had a higher risk of stent restenosis (HR, 2.65; 95% CI, 1.05-6.69; $p = 0.039$) than female patients (Tables 3 and 4). The Kaplan-Meier survival and stent patency of these patients are shown in Fig. 1.

Table 2

Clinical outcomes in patients receiving metallic stents[a]

Variables	All (N = 41)
Technical success, n (%)	40 (97.6)
Clinical success, n (%)[b]	35 (92.1)
Procedure-related complications, n (%)[a]	
Vomiting	7 (17.1)
Abdominal pain	5 (12.2)
Bleeding	6 (14.6)
Perforation	1 (2.4)
Infection	8 (19.5)
Reflux esophagitis	3 (7.3)
Dysphagia score[c]	
Day 0	3.5 ± 0.6
Day 1	2.9 ± 0.4
Day 7	2.3 ± 1.0
Day 30	2.5 ± 1.1
Stent dysfunction, n (%)	
Migration	0 (0)
Restenosis	6 (15.0)
Fracture of stent	0 (0)
Patency (d)	71 (4-893)
Survival (d)	77 (4-893)

The data are expressed as median (range) or number (percent).

[a]One patient failed to receive stent insertion. This patient was only calculated in technical success and procedure-related complications.

[b]Exclude one patient who failed to receive stent insertion due to esophageal perforation and two patients died before day 7.

[c]Dysphagia score was assessed by using the Mellow-Pinkas score.[13]

3.3. Comparison of clinical outcomes between partially covered and uncovered metallic stents

Patients were divided into groups treated with uncovered and partially covered metallic stents, and the details are shown in Table 5. Twenty-three patients received uncovered stent placement, and 17 patients received partially covered stent placement. There were no significant differences in age, complications, dysphagia scores, survival time, and stent patency time between patients receiving uncovered or partially covered metallic stents. The median length of esophageal stenosis and stents was longer in the group with partially covered stents. The opening width of the stent did not differ between the two groups on day 0 but was significantly wider in the group treated with partially covered stents at day 1 (1.49 vs 1.17 cm, respectively, $p = 0.048$). One restenosis event occurred in a patient treated with a partially covered metallic stent, which was caused by tumor compression, and five restenosis events occurred in those treated with uncovered metallic stents, all of which were caused by tumor growth. The Kaplan-Meier plots of overall survival and restenosis between patients receiving uncovered and partially covered stents showed no statistical significance ($p = 0.185$ and $p = 0.129$, respectively) (Supplementary Fig. 1, http://links.lww.com/JCMA/A112).

3.4. Comparison between duodenal stents and esophageal stents for malignant EGJ obstruction

A comparison of clinical outcomes in patients treated with duodenal or esophageal stents is shown in Table 6. Twenty-one patients received duodenal stents, and 20 patients received esophageal stents. The technical success rates and procedure-related complications did not differ between the two intervention groups ($p = 0.512$). However, in one patient treated with an esophageal stent, when pushing the esophageal stent outer sheath to negotiate the marked stenosis, the stent failed to pass the stenosis, and esophageal perforation unfortunately occurred. In addition, there was a higher rate of uncovered stent use in the group receiving duodenal stents.

4. DISCUSSION

In this study, we demonstrated high technical and clinical success rates for patients with malignant EGJ obstruction who received metallic stent placement. The clinical outcomes, including survival time, patency time, and procedure-related complications, did not differ between the groups treated with partially covered or uncovered metallic stent placement and those treated with different deployment methods. No stent migration was observed in our study. Additionally, poststent radiotherapy significantly prolonged survival and stent patency in patients with malignant EGJ obstruction. This study provides crucial information for endoscopists to establish individualized stenting strategies for malignant EGJ obstruction.

Palliative treatment for dysphagia to improve malnutrition and quality of life in patients with malignant EGJ obstruction

Table 3

Univariate and multivariate analysis for predictors of mortality

	Univariate analysis				Multivariate analysis		
Variables	**Number**	**HR**	**95% CI**	***p***	**HR**	**95% CI**	***p***
Age (≥80:<80 y)	21:19	0.83	0.42-1.654	0.599			
Gender (male:female)	25:15	1.68	0.81-3.49	0.165			
Albumin (≥3:<3 g/dL)	15:14	0.53	0.21-1.32	0.174			
Adenocarcinoma:squamous cell carcinoma	30:7	0.49	0.16-1.44	0.193			
Length of stenosis (≥5:<5cm)	23:17	1.38	0.68-2.78	0.373			
Length of stent (≥10:<10 cm)	26:14	1.78	0.85-3.73	0.126	1.10	0.51-2.40	0.810
Procedure time (≥20:<20 min)	20:20	1.09	0.55-2.17	0.806			
Events							
Bleeding (yes:no)	6:34	0.63	0.22-1.83	0.398			
Infection (yes:no)	8:32	1.67	0.70-3.98	0.244			
Restenosis (yes:no)	6:34	0.56	0.21-1.50	0.252			
Partially covered:uncovered	17:23	1.62	0.79-3.34	0.190			
CT_pre (yes:no)	15:25	1.08	0.54-2.16	0.834			
CT_post (yes:no)	16:24	0.77	0.38-1.55	0.765			
RT_pre (yes:no)	3:37	1.74	0.51-5.88	0.375			
RT_post (yes:no)	5:35	0.17	0.04-0.73	0.018	0.18	0.04-0.86	0.032
Surgery_pre (yes:no)	7:33	0.85	0.37-1.98	0.708			
Ascites (yes:no)	11:29	1.69	0.79-3.61	0.173			
Peritoneal carcinomatosis (yes:no)	8:32	1.47	0.65-3.31	0.357			

CT_post = chemotherapy after stent placement; CT_pre = chemotherapy before stent placement; HR = hazard ratio; RT_post = radiotherapy after stent placement; RT_pre = radiotherapy before stent placement; Surgery_pre = surgery before stent insertion.

has become an important issue. To date, several studies have shown the efficacy and safety of stenting for esophageal malignancies.[16–18] However, evidence regarding stenting in malignant esophagogastric junction obstruction is limited. In So et al's[19] study, which discussed the efficacy and safety of fully covered metallic stents in malignant esophageal obstruction at all sites, an increased risk of stent migration in the gastroesophageal junction location was addressed; this study included 24 patients. Park et al[7] conducted a larger study that specifically investigated the outcomes of stenting in malignant EGJ obstruction, which showed good clinical improvement in patients with advanced malignant EGJ obstruction receiving self-expanding covered metallic stents. Additionally, radiotherapy after metallic stent placement prolonged stent patency, whereas chemotherapy after metallic stent placement increased the stent migration rate.[7] In our study, high technical and clinical success rates for metal stent placement in malignant EGJ obstruction were demonstrated. Infection was the most common procedure-related complication, and aspiration pneumonia accounted for half of the infection episodes, which was higher than that reported by Park et al[7] (9.8% vs 1.3%, respectively). The reason for the higher rates of aspiration pneumonia may be attributed to the older age in our patient population (81.0 years vs 60.3 years, respectively). Moreover, poststent radiotherapy predicted a lower mortality rate and increased the duration of stent patency in our study. This result is similar to that of Park et al,[7] in which radiotherapy after stent placement prolonged stent patency.[7] In addition, male sex was associated with a higher risk for restenosis. In our study,

Table 4

Univariate and multivariate analysis for predictors of restenosis

	Univariate analysis				Multivariate analysis		
Variable	**Number**	**HR**	**95% CI**	***p***	**HR**	**95% CI**	***p***
Age (≥80:<80 y)	21:19	0.72	0.36-1.44	0.348			
Gender (male:female)	25:15	2.23	1.03-4.83	0.042	2.65	1.05-6.69	0.039
Albumin (≥3:<3 g/dL)	15:14	0.53	0.21-1.32	1.174			
Adenocarcinoma:squamous cell carcinoma	30:7	0.48	0.16-1.42	0.183			
Length of stenosis (≥5:<5 cm)	23:17	1.63	0.81-3.30	0.175			
Length of stent (≥10:<10 cm)	26:14	2.08	0.98-4.44	0.058	1.56	0.69-3.56	0.288
Procedure time (≥20:<20 min)	20:20	1.21	0.61-2.44	0.571			
Partially covered:uncovered	17:23	1.75	0.84-3.64	0.135	0.73	0.30-1.77	0.483
CT_pre (yes:no)	15:25	1.15	0.57-2.30	0.702			
CT_post (yes:no)	16:24	0.82	0.40-1.65	0.574			
RT_pre (yes:no)	3:37	1.59	0.47-5.34	0.454			
RT_post (yes:no)	5:35	0.17	0.04-0.76	0.020	0.19	0.04-0.92	0.039
Surgery _pre (yes:no)	7:33	0.78	0.34-1.81	0.565			
Ascites (yes:no)	11:29	1.35	0.65-2.80	0.427			
Peritoneal carcinomatosis (yes:no)	8:32	1.15	0.51-2.56	0.740			

CT_post = chemotherapy after stent placement; CT_pre = chemotherapy before stent placement; HR = hazard ratio; RT_post = radiotherapy after stent placement; RT_pre = radiotherapy before stent placement; Surgery_pre = surgery before stent insertion.

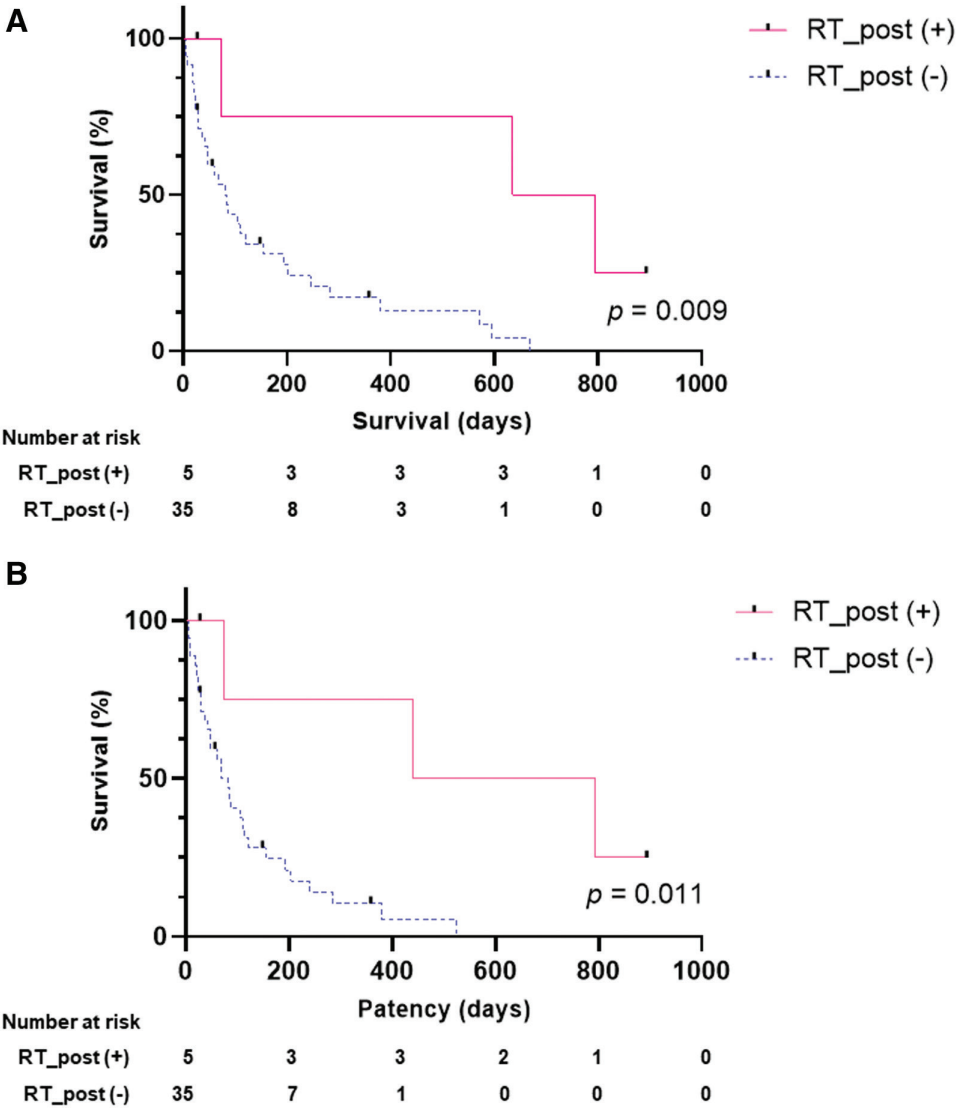

Fig. 1 The survival curve and stent patency in the study groups. Kaplan-Meier curves of survival (**A**) and stent patency (**B**) in patients with or without radiotherapy after metallic stent placement. RT_post (+), patients who received radiotherapy after stenting; RT_post (-), patients who did not receive radiotherapy after stenting. RT_post = radiotherapy after stent placement.

gastric cancer with EGJ involvement was the main cause of EGJ obstruction (73.2%). Male sex is a risk factor for poor prognosis.[20,21] This might explain the higher rate of restenosis after stent placement in male patients. Furthermore, no stent migration was found in our study, and poststent chemotherapy was not a risk factor for survival, stent patency, or stent dysfunction.

When EGJ obstruction was treated using an esophageal stent, the stent was released by hand maneuvers, and the position and expansion of the stent were evaluated fluoroscopically. However, this method could not easily provide accurate stent position while releasing and may cause stent malposition and migration.[12] A duodenal stent is released from the working channel of an endoscope under direct endoscopic visualization with fluoroscopic guidance, which could provide precise positioning for the stent. In addition, the diameter of the outer sheath of an esophageal stent is larger than that of a duodenal stent (18.5-24 Fr vs 10 Fr, respectively), which would be more difficult to pass through the marked stenosis compared with the duodenal stent. To overcome the marked stenosis when pushing an esophageal stent, the increased hand power may not transmit to the stenotic site, but cause a great distortion of the stent, which may be more likely to cause discomfort and esophageal perforation than a duodenal stent (Supplementary Fig. 3, http://links.lww.com/JCMA/A112). Our study is the first to compare the safety and efficacy of duodenal and esophageal stents in malignant inoperable EGJ obstruction. The technical success rate, clinical success rate, survival days, and stent patency time were similar between the two groups. Although there was no significance in procedure-related complications, the only esophageal perforation event, unfortunately, occurred when pushing the esophageal stent to negotiate the stenosis. Additionally, a shorter procedure time in deploying duodenal stents than in esophageal stents was noted.

When comparing the clinical outcomes between patients treated with partially covered and uncovered stents, there was no significant difference in stent patency and survival times between the two groups. Although there was no statistical significance in restenosis rates between the two groups, restenosis developed mostly in patients receiving uncovered metallic stents, which was caused by tumor growth. It has been shown that tumor ingrowth through the meshes of metallic stents is one of the most common

Table 5

Comparison between patients receiving uncovered or partially covered stents[a]

Variable	Uncovered (n = 23)	Partially covered (n = 17)	*p*
Age (y)	77 (36-95)	82 (41-96)	0.448
Gender (male:female)	9:14	16:1	0.001
Esophageal:gastric:other malignancies	3:18:2	5:11:1	0.356
Albumin (g/dL)	3.10 (2.0-4.3)	2.80 (2.1-4.3)	0.188
Peritoneal carcinomatosis, n (%)	6 (26.1)	2 (11.8)	0.428
Treatment (before:after stent insertion)			
Radiotherapy	1:5	2:0	0.107
Chemotherapy	8:9	7:7	0.896
Surgery	5:0	2:0	0.427
Length of stenosis (cm)	4 (1.6-7)	5 (3-10)	0.019
Stent length (cm)	9.0 (5-12)	10 (8-16)	0.039
Procedure time (min)	18 (10-37)	20 (8-58)	0.080
Width of stent on day 0 (cm)	0.74 (0.26-1.13)	1.01 (0.31-1.76)	0.051
Width of stent on day 1 (cm)	1.17 (0.84-1.57)	1.49 (0.99-1.81)	0.048
Dysphagia score[b]			
Day 0	3.6 ± 0.6	3.4 ± 0.6	0.239
Day 1	2.9 ± 0.3	3.0 ± 0.5	0.551
Day 7	2.3 ± 0.9	2.3 ± 1.1	0.768
Day 30	2.5 ± 1.2	2.6 ± 1.1	0.945
Procedure-related complications, n (%)			
Vomiting,	6 (26.1)	1 (5.9)	0.205
Abdominal pain,	4 (17.4)	1 (5.9)	0.373
Bleeding.	4 (17.4)	2 (11.8)	1.000
Perforation	0 (0)	0 (0)	-
Infection	4 (17.4)	3 (17.7)	1.000
Poststent reflux esophagitis, n (%)	1 (4.4)	2 (11.8)	0.450
Poststent PPI:H2B	12:3	7:2	0.235
Stent dysfunction, n (%)			
Migration	0 (0)	0 (0)	n/a
Restenosis	5 (21.7)	1 (5.9)	0.216
Fracture of stent	0 (0)	0 (0)	n/a
Patency (d)	104 (7-893)	56 (4-358)	0.201
Survival (d)	104 (7-893)	56 (4-596)	0.156

The data are expressed as median (range) or number (percent).

H2B = H2-receptor antagonists; n/a = not applicable; PPI = proton pump inhibitors.

[a]Exclude one patient who failed to receive stent insertion due to esophageal perforation.

[b]Dysphagia score was assessed by using the Mellow-Pinkas score.[13]

causes of uncovered metallic stent obstruction, which occurs in 26% to 36% of cases.[1,22] Importantly, in our study, no migration event occurred. Furthermore, there is a high rate of stent migration in EGJ location because the distal end of the stent is freely sited into the stomach, not fixed to any part of the gastric lumen.[19,23] Additionally, compared with fully covered stents, partially covered stents have short segments of uncovered part at both sites of stent ends, which could prevent stent migration.[24] In So et al's[19] study, all the stents used for EGJ tumors were fully covered stents, which may contribute to a higher rate of stent migration. Park et al[7] also mentioned that migration of an EGJ stent occurred only in patients treated with covered stents; however, whether the stents were partially covered or fully covered was not addressed in detail.[7] Therefore, the use of partially covered and uncovered stents in our study may contribute to the absence of stent migration. Moreover, although the clinical outcomes between partially covered and uncovered stents were similar, partially covered stents had better stent expansion at day 1 since the midportion of the stent was covered with a membrane,

Table 6

Comparison between patients receiving stent insertion under different deployment methods

Variable	Duodenal stent (n = 21)	Esophageal stent (n = 20)	*p*
Age (y)	75.0 (36-94)	81.0 (59-96)	0.594
Gender (male:female)	9:12	17:3	0.002
Esophageal:gastric:other malignancies	2:17:2	6:13:1	0.088
Length of stenosis (cm)	4 (2.5-10)	5 (1.6-7.7)	0.555
Stent length (cm)[a]	10 (8-16)	10 (5-15)	0.555
Stent type (Bonastent:Boston Scientific:Endoflex)[a]	21:0:0	0:12:7	<0.001
Partially covered:uncovered[a]	3:18	14:5	<0.001
Procedure time (min)	18 (12-37)	23 (8-73)	0.143
Technical success, n (%)	21 (100)	19 (95.0)	0.512
Procedure-related complications, n (%)			
Vomiting	5 (23.8)	3 (15.0)	0.238
Abdominal pain	2 (9.5)	3 (15.0)	1.000
Bleeding	4 (19.0)	2 (10.0)	0.410
Perforation	0 (0)	1 (5.0)	1.000
Infection	2 (9.5)	6 (30.0)	0.410
Reflux esophagitis	2 (9.5)	1 (5.0)	0.368
Stent dysfunction, n (%)			
Restenosis	5 (23.8)	1 (5.0)	0.186
Patency (d)[a]	109 (7-893)	56 (4-794)	0.117
Survival (d)[a]	148 (7-893)	56 (4-794)	0.061

The data are expressed as median (range) or number (percent).

[a]Exclude one patient who failed to receive stent insertion due to esophageal perforation.

which could prevent the tumor from protruding into the mesh. Furthermore, the length of EGJ stenosis and stents used was longer in the partially covered stent group. This may imply that our endoscopists and patients selected partially covered stents for longer stenosis to better prevent tissue ingrowth.

Our study had several limitations. First, this was a retrospective study with a small sample size. However, malignancy involving EGJ obstruction is less common than other sites of esophageal obstruction. Second, the distribution of uncovered or partially covered stents was not balanced in two different deployment methods, which is restricted to the retrospective nature of this study. Further prospective studies with larger sample sizes are needed to elucidate the efficacy of duodenal stents and esophageal stents for malignant EGJ obstruction.

In conclusion, metallic stent placement is effective and safe for patients with malignant EGJ obstruction. The clinical outcomes were similar between the partially covered and uncovered metallic stents. Deploying a duodenal stent through an endoscopic working channel is not inferior to an esophageal stent by hand maneuvers for malignant EGJ obstruction. Poststent radiotherapy is the only effective treatment for prolonging stent patency and survival in these patients.

ACKNOWLEDGMENTS

This study was supported in part by Taipei Veterans General Hospital (Grant No. V110A-001 and V110C-143).

The authors gratefully acknowledge Mr. Dong-Ming Liao for his excellent technical assistance.

APPENDIX A. SUPPLEMENTARY DATA

Supplementary data related to this article can be found at http://links.lww.com/JCMA/A112.

REFERENCES

1. Acunaş B, Rozanes I, Akpinar S, Tunaci A, Tunaci M, Acunaş G. Palliation of malignant esophageal strictures with self-expanding nitinol stents: drawbacks and complications. *Radiology* 1996;**199**:648–52.
2. Takeda J, Hashimoto K, Koufuji K, Tanaka T, Kodama I, Yoshida C, et al. Surgical management of adenocarcinoma in the gastric cardia. *Kurume Med J* 1991;**38**:81–5.
3. Siersema PD, Marcon N, Vakil N. Metal stents for tumors of the distal esophagus and gastric cardia. *Endoscopy* 2003;**35**:79–85.
4. National Comprehensive Cancer Network. (NCCN) [Accessed January, 2021]; Guidelines: Esophageal and Esophagogastric Junction Cancers. Version 5. 2020.
5. Kim JJ. Epidemiology of gastroesophageal junction adenocarcinoma in Korea. *J Gastric Cancer* 2018;**18**:328–38.
6. Allum WH, Blazeby JM, Griffin SM, Cunningham D, Jankowski JA, Wong R; Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland, the British Society of Gastroenterology and the British Association of Surgical Oncology. Guidelines for the management of oesophageal and gastric cancer. *Gut* 2011;**60**:1449–72.
7. Park JJ, Lee YC, Kim BK, Kim JH, Park JC, Kim YJ, et al. Long-term clinical outcomes of self-expanding metal stents for treatment of malignant gastroesophageal junction obstructions and prognostic factors for stent patency: effects of anticancer treatments. *Dig Liver Dis* 2010;**42**:436–40.
8. van Boeckel PG, Siersema PD, Sturgess R, Dwyer L, Raijman I, Hirdes MM, et al. A new partially covered metal stent for palliation of malignant dysphagia: a prospective follow-up study. *Gastrointest Endosc* 2010;**72**:1269–73.
9. Iwasaki H, Mizushima T, Suzuki Y, Fukusada S, Kachi K, Ozeki T, et al. Factors that affect stent-related complications in patients with malignant obstruction of the esophagus or gastric cardia. *Gut Liver* 2017;**11**:47–54.
10. Chang KB, Ye BW, Chou CK, Lee IC, Li CP, Chao Y, et al. Outcomes of enteral metallic stent in patients with pancreatic carcinoma and gastric outlet obstruction: a single center experience. *J Formos Med Assoc* 2020;**119**(1 Pt 2):238–46.
11. Lin CL, Perng CL, Chao Y, Li CP, Hou MC, Tseng HS, et al. Application of stent placement or nasojejunal feeding tube placement in patients with malignant gastric outlet obstruction: a retrospective series of 38 cases. *J Chin Med Assoc* 2012;**75**:624–9.
12. Ferreira F, Bastos P, Ribeiro A, Marques M, Azevedo F, Pereira P, et al. A comparative study between fluoroscopic and endoscopic guidance in palliative esophageal stent placement. *Dis Esophagus* 2012;**25**:608–13.
13. Mellow MH, Pinkas H. Endoscopic laser therapy for malignancies affecting the esophagus and gastroesophageal junction. Analysis of technical and functional efficacy. *Arch Intern Med* 1985;**145**:1443–6.
14. Knyrim K, Wagner HJ, Bethge N, Keymling M, Vakil N. A controlled trial of an expansile metal stent for palliation of esophageal obstruction due to inoperable cancer. *N Engl J Med* 1993;**329**:1302–7.
15. Ye BW, Chou CK, Hsieh YC, Li CP, Chao Y, Hou MC, et al. Metallic stent expansion rate at day one predicts stent patency in patients with gastric outlet obstruction. *Dig Dis Sci* 2017;**62**:1286–94.
16. May A, Selmaier M, Hochberger J, Gossner L, Mühldorfer S, Hahn EG, et al. Memory metal stents for palliation of malignant obstruction of the oesophagus and cardia. *Gut* 1995;**37**:309–13.
17. Sturgess RP, Morris AI. Metal stents in the oesophagus. *Gut* 1995;**37**:593–4.
18. Diamantis G, Scarpa M, Bocus P, Realdon S, Castoro C, Ancona E, et al. Quality of life in patients with esophageal stenting for the palliation of malignant dysphagia. *World J Gastroenterol* 2011;**17**:144–50.
19. So H, Ahn JY, Han S, Jung K, Na HK, Lee JH, et al. Efficacy and safety of fully covered self-expanding metal stents for malignant esophageal obstruction. *Dig Dis Sci* 2018;**63**:234–41.
20. Yang D, Hendifar A, Lenz C, Togawa K, Lenz F, Lurje G, et al. Survival of metastatic gastric cancer: significance of age, sex and race/ethnicity. *J Gastrointest Oncol* 2011;**2**:77–84.
21. Maguire A, Porta M, Sanz-Anquela JM, Ruano I, Malats N, Piñol JL. Sex as a prognostic factor in gastric cancer. *Eur J Cancer* 1996;**32A**:1303–9.
22. Adam A, Ellul J, Watkinson AF, Tan BS, Morgan RA, Saunders MP, et al. Palliation of inoperable esophageal carcinoma: a prospective randomized trial of laser therapy and stent placement. *Radiology* 1997;**202**:344–8.
23. Pavlidis TE, Pavlidis ET. Role of stenting in the palliation of gastroesophageal junction cancer: a brief review. *World J Gastrointest Surg* 2014;**6**:38–41.
24. Seven G, Irani S, Ross AS, Gan SI, Gluck M, Low D, et al. Partially versus fully covered self-expanding metal stents for benign and malignant esophageal conditions: a single center experience. *Surg Endosc* 2013;**27**:2185–92.