

# Fluoroscopy-Guided Peroral Placement of a Self-Expandable Metallic Stent for Malignant Jejunal Obstruction in a Non-surgically Altered Stomach

Zhe Wang<sup>1,2</sup> · Jung-Hoon Park<sup>1</sup> · Kun Yung Kim<sup>1</sup> · Joonmyeong Choi<sup>1</sup> · Hongtao Hu<sup>1,3</sup> · Nader Bekheet<sup>1,4</sup> · Sung Hwan Yoon<sup>1</sup> · Ho-Young Song<sup>1,5</sup> 

Received: 23 May 2018 / Accepted: 28 July 2018 / Published online: 7 August 2018

© Springer Science+Business Media, LLC, part of Springer Nature and the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) 2018

**Abstract** Malignant small bowel obstruction is a common and distressing complication in advanced cancer patients. Recently, stent placement was reported to be a safe and effective alternative treatment. However, there are only a few case reports associated with stent placement in malignant jejunal obstruction. Furthermore, most patients had a history of gastrectomy before stent placement, which shortens the catheterization pathway. In our case series, we present five cases of malignant proximal jejunal obstruction in a non-surgically altered stomach in the management of fluoroscopy-guided self-expandable metallic stent placement and discuss the interventional management and clinical outcomes.

*Level of Evidence* Level 4, Case Series.

**Keywords** Malignant small bowel obstruction · Self-expandable metallic stent · Non-surgically altered stomach · Jejunum

## Introduction

Malignant small bowel obstruction (MSBO) is a common and distressing complication in advanced cancer patients, particularly in those with abdominal tumors [1, 2]. Patients with MSBO usually describe a pattern of gradual worsening of symptoms that include episodes of abdominal cramps, nausea and vomiting, and abdominal distension.

Although palliative surgery can alleviate the obstructive symptoms and enable resumption of a diet, it causes high mortality and substantial hospitalization relative to the patient's remaining survival time [3]. Recently, different types of SEMSs and covered stents have been reported as alternative treatments for MSBO with minimal morbidity [4–7]. Most MSBO patients have a history of gastrectomy before stent placement. Their catheterization pathway shortens after surgery, and a stent delivery system can easily reach the obstruction site of the proximal jejunum. However, it is very difficult to insert a stent delivery system into the proximal jejunum of patients who have not had such a surgery. We report our experience of five patients with malignant proximal jejunal obstruction in a non-surgically altered stomach in the management of fluoroscopy-guided self-expandable metallic stent placement and discuss the interventional management and clinical outcomes.

---

Zhe Wang and Jung-Hoon Park contributed equally to this work.

✉ Ho-Young Song  
hysong@amc.seoul.kr

- <sup>1</sup> Department of Radiology and Research Institute of Radiology, Asan Medical Center, University of Ulsan College of Medicine, 388-1, Poongnap 2-dong, Songpa-gu, Seoul 05505, Republic of Korea
- <sup>2</sup> Department of Radiology, Tianjin Medical University General Hospital, Anshan Road 154, Heping District 300052, People's Republic of China
- <sup>3</sup> Department of Minimal-Invasive Intervention, The Affiliated Cancer Hospital of Zhengzhou University, 127 Dongming Road, Zhengzhou city 450003, Henan Province, China
- <sup>4</sup> Gastrointestinal Endoscopy and Liver Unit, Kasr Al-Ainy, Faculty of Medicine, Cairo University, Cairo, Egypt
- <sup>5</sup> Department of Radiology, Asan Medical Center, University of Ulsan College of Medicine, 88, Olymic-ro 43-gil, Songpa-gu, Seoul 05505, Republic of Korea

## Case Presentation

An exemption for ethics approval was granted from our institutional review board. Informed consent was obtained where possible.

Five patients (four men, one woman; age range 49–67 years old; mean age 60 years old) with malignant proximal jejunal obstruction underwent SEMS placement from November 2008 to January 2015. The underlying causes of jejunal obstruction were pancreatic cancer in three patients and lymph node metastases of colon cancer in two patients. The range of distances from the ligament of Treitz to the middle portion of the obstruction was 0–3 cm (mean 2.1 cm). Diagnoses were based on endoscopic biopsies, upper gastrointestinal contrast studies, and abdominal computed tomography. The characteristics of the patient population are summarized in Table 1.

All procedures were performed under fluoroscopic guidance. During the process, a stiff, angled, 260-cm-long, 0.035-inch exchange guidewire (Radifocus M; Terumo, Tokyo, Japan) was inserted through the mouth, across the obstruction, and into the distal part of the obstruction. A multifunctional coil catheter (S&G Biotech) was passed over the exchange guidewire, across the obstruction, to measure the length of the obstruction, as previously described [8]. The guidewire was replaced with a super-stiff, 400-cm-long Amplatz guidewire (Medi-tech/Boston Scientific, Watertown, Massachusetts, USA), and then, a 3.5-mm-diameter stent delivery system was passed over the guidewire through the obstruction. Finally, a stent was placed in the obstruction site. The stents we used in the procedure were partially covered COMVI Pyloric SEMS (Taewoong Medical, Seoul, Korea), which were 20 mm in

diameter and 6–14 cm in length. There were no flares or shoulders at both ends of the stents. For all patients, 6-mm-diameter J-shaped guiding sheaths (S&G Biotech, Gyeonggi-do, South Korea) were inserted to avoid the guidewire or stent delivery system looping in the enlarged stomach so that they can pass through the obstruction easily.

All patients underwent a contrast study 1–3 days after stent placement to assess the expansion and patency of the stent and possible complications. Patients also received a barium study 1 month after stent placement to identify any delayed complications (e.g., stent migration or obstruction). During a mean follow-up period of 167 days (range from 48 to 377 days), all patients died.

### Patient 1

The procedure was successfully performed. The food intake was gradually improved from liquid to solid food during the period of 1 month. However, a stent migration was occurred 32 days after the procedure. The downward-migrated stent was uneventfully passed through the anus, 9 days after the detected migration of the stent. This patient received an additional stent placement and showed symptom improvement. No other complications occurred until the patient died.

### Patient 2

During the procedure, the stent placement was abandoned when the stent delivery system could not pass through the obstruction due to the angulation of the bowel loop during the procedure. The patient underwent palliative bypass

**Table 1** Data on the five patients with malignant jejunal obstruction

Patient No./Age (years old)/Sex	Underlying cause	Distance *(cm)	Technical success	Stent diameter/ length (mm)	Food intake			Complication	Survival	Follow- up (days)
					Before	7 Days after	1 Month after			
1/62/M	Colon cancer	3	Success	20/60	Liquid	Soft	Solid	Stent migration	Dead	377
2/49/M	Colon cancer	0	Failure	NA	NA	NA	NA		Dead	102
3/66/M	Pancreatic cancer	1	Success	20/100	Liquid	Solid	Solid		Dead	101
4/58/M	Pancreatic cancer	2	Success	20/100	None	Soft	Solid		Dead	208
5/67/F	Pancreatic cancer	3	Failure	NA	NA	NA	NA		Dead	48

NA = Not Applicable

\*Distance between the ligament of Treitz to the middle portion of the jejunal obstruction

surgery 5 days after the failure of stent placement. His symptoms improved after the surgery until the end of follow-up.

### Patient 3

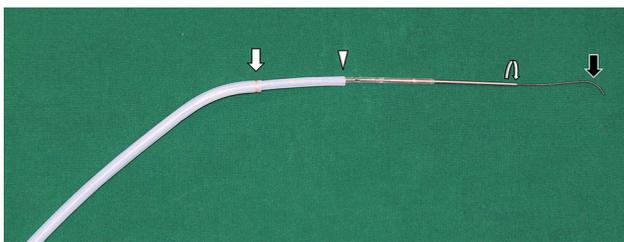
The stent was successfully placed during the procedure, after which an intraoperative contrast examination was performed and suggested that the stent was incompletely expanded. We decided to introduce an 18-mm-diameter and 60-mm-length balloon to expand the stent. But the balloon catheter failed to reach the stricture using 6-mm-diameter guiding sheath alone. Then a 4-mm-diameter guiding sheath was coaxially inserted into the 6-mm-diameter guiding sheath (Fig. 1) to give extra support force so that the balloon catheter can easily pass through the stricture. Finally, the stent was expanded entirely using the balloon (Fig. 2). The food intake was significantly improved 7 days after the procedure. The stent was completely expanded and maintained patency in a 1-month follow-up. The patient had no recurrence of the symptoms associated with intestinal obstruction until the end of the follow-up.

### Patient 4

The procedure was successfully performed and the symptoms relieved immediately after the procedure. The patient had no recurrence of the symptoms during the follow-up period of 208 days.

### Patient 5

Escape of contrast medium into the intraperitoneal space was seen when advancing the guidewire during the procedure, which suggested perforation. The procedure was therefore aborted. The patient had no additional intervention since the hole was so small that it can be healed in a short time. The patient underwent palliative bypass surgery 7 days after the technical failure of stent placement. Her



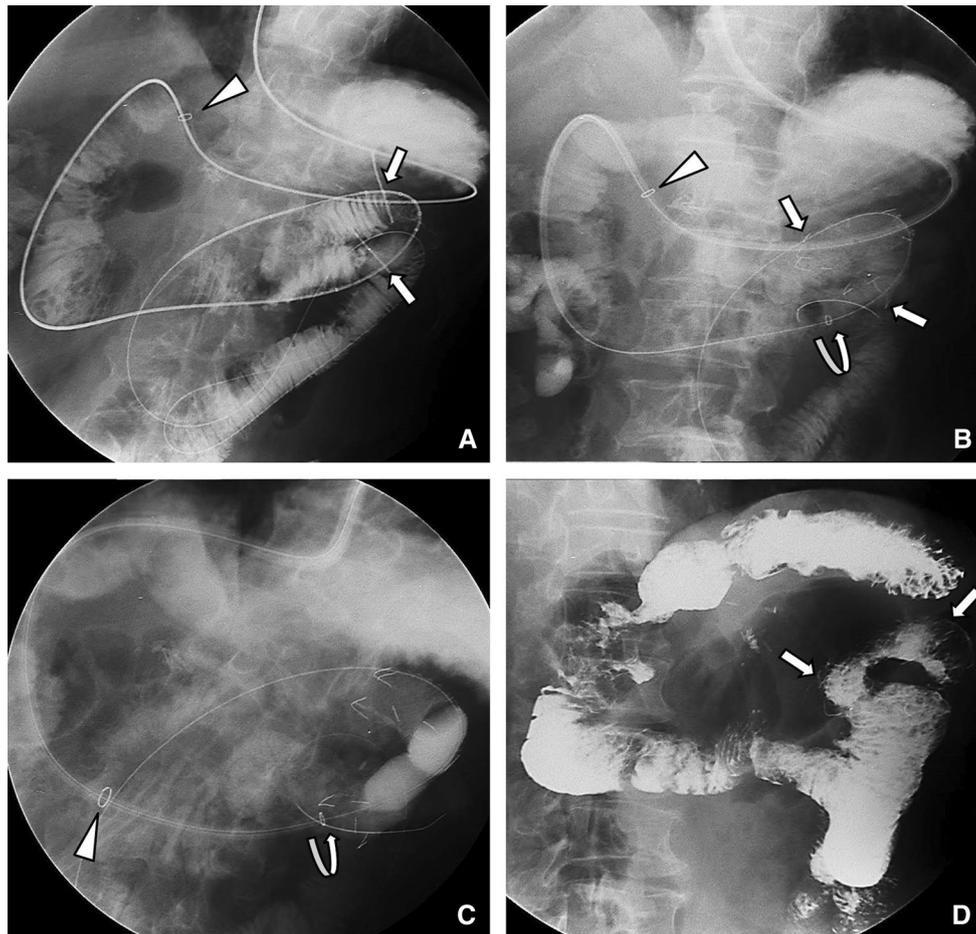
**Fig. 1** Photograph shows a combined coaxial set, consisting of a 6-mm-diameter guiding sheath (white arrow), a 4-mm-diameter guiding sheath (arrowhead), a multifunctional coil catheter (curved arrow), and a 0.035-inch guidewire (black arrow)

symptoms improved after the surgery. No bowel lumen obstruction or perforation occurred until the patient died.

### Discussion

Stent placement for patients with MSBO who underwent gastrectomy previously was not quite difficult because gastrectomy shortened the distance between oral cavity and jejunum. Also, the passage of stent placement was straight after gastrectomy, which is different from the normal anatomy. However, stent placement is more difficult in patients without a surgically altered anatomy. The patients with an unaltered anatomy have a long and tortuous route between the oral cavity and jejunum. The guidewire and/or stent delivery system is easily trapped in the long and winding gastroduodenal tract. Although double-balloon enteroscopy (DBE) can overcome looping, such as in a J-shaped stomach, and enable guidewire access to deeper segments of the small intestine, the working channel of DBE (2.8 mm in diameter) does not allow through-the-scope passage of currently available SEMS and there are no specially designed stents for enteroscopic use [9]. In our case series, the J-shaped guiding sheath was required to overcome the angulated route between the stomach fundus and the proximal jejunum. The guiding sheath was very helpful for negotiating the guidewire and cannulates the stent delivery system through the stricture. For patient 3, the coaxial insertion of a 4-mm-diameter guiding sheath through a 6-mm-diameter guiding sheath gave extra support force to overcome looping in the stomach and enabled the balloon catheter to reach the obstruction site. All patients in whom we successfully placed a stent achieved the resumption of oral intake immediately after stent placement, indicating that the procedure can provide fast relief of the symptoms. Therefore, in our opinion, fluoroscopic peroral placement of SEMSs could be a promising management option for malignant jejunal obstruction in unaltered anatomy, although we still need to overcome some technical difficulties.

Our procedure technically failed in patient 2. The main reason for the technical failure seemed to be that the guiding sheath was relatively short for a jejunal stricture due to the angulation of the guiding sheath in the stomach and duodenum; thus, it did not help advance the guidewire and stent delivery system into the distal area. Therefore, a steerable guiding sheath may be essential for the improvement of technical success rate since it can provide an additional support force to avoid trapping into the stomach and duodenum, leading to delivery to a farther place. Although manually steerable introducer sheaths for vascular intervention are commercially available, its use in nonvascular intervention still needs to be investigated.



**Fig. 2** Images obtained from a 66-year-old man with bowel obstruction at the ligament of Treitz caused by pancreatic cancer. **A** Using a 6-mm-diameter guiding sheath (arrowhead), a guidewire and a multifunctional coil catheter were successfully inserted through a severe stricture (arrows). **B** A 4-mm-diameter guiding sheath (curved arrow) was coaxially inserted through the 6-mm-diameter

sheath (arrowhead) for balloon dilation due to the incomplete expansion of the placed stent (arrows). **C** A balloon catheter was then inserted, and dilation was performed. **D** A contrast study obtained 1 month after stent placement showed a good passage of contrast medium through the stent (arrows)

Despite their ability to prevent tumor ingrowth, covered stents have been reported to migrate more often in the gastroduodenal tract than uncovered stents [4, 10]. The overall migration rate of covered stents in gastroduodenal obstruction is 7–26% [4, 6, 11–14]. The expanding force of covered stents is transferred to the tumor, which causes the tumor to shrink, reduces friction, and increases the risk of migration [11, 12]. To prevent stent migration, some changes have been made in their basic design, including the addition of a proximal funnel, a partial covering, and a shoulder at each end [12, 13]. The stents we used in the procedure were partially covered COMVI Pyloric SEMS (Taewoong Medical, Seoul, Korea), which have a covered middle part to prevent tumor ingrowth and both uncovered ends to prevent migration without flares or shoulders. Nevertheless, stent migration occurred in one patient. We surmise that the continuous peristaltic movement of the jejunum may lead to stent migration. For this patient, the

use of covered stents with enlarged flares or shoulders may help preventing migration.

In conclusion and based on our limited case series, fluoroscopy-guided peroral placement of SEMSs may be useful in patients with proximal jejunal obstruction and can provide fast symptom relief. A more flexible or steerable guiding sheath must be developed to improve the technical success rate of peroral placement of SEMSs into the jejunum.

#### Compliance with Ethical Standards

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

**Human and Animal Rights** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee.

**Informed Consent** Informed consent was obtained from all individual participants included in the study. Consent for publication was obtained for every individual person's data included in the study.

## References

1. Ripamonti CI, Easson AM, Gerdes H. Management of malignant bowel obstruction. *Eur J Cancer*. 2008;44:1105–15.
2. Tuca A, Guell E, Martinez-Losada E, Codorniu N. Malignant bowel obstruction in advanced cancer patients: epidemiology, management, and factors influencing spontaneous resolution. *Cancer Manag Res*. 2012;4:159–69.
3. Paul Olson TJ, Pinkerton C, Brasel KJ, Schwarze ML. Palliative surgery for malignant bowel obstruction from carcinomatosis: a systematic review. *JAMA Surg*. 2014;149:383–92.
4. Jung GS, Song HY, Kang SG, Huh JD, Park SJ, Koo JY, et al. Malignant gastroduodenal obstructions: treatment by means of a covered expandable metallic stent—Initial experience. *Radiology*. 2000;216:758–63.
5. Tringali A, Didden P, Repici A, Spaander M, Bourke MJ, Williams SJ, et al. Endoscopic treatment of malignant gastric and duodenal strictures: a prospective, multicenter study. *Gastrointest Endosc*. 2014;79:66–75.
6. Park KB, Do YS, Kang WK, Choo SW, Han YH, Suh SW, et al. Malignant obstruction of gastric outlet and duodenum: palliation with flexible covered metallic stents. *Radiology*. 2001;219:679–83.
7. Baron TH, Harewood GC. Enteral self-expandable stents. *Gastrointest Endosc*. 2003;58:421–33.
8. Song HY, Shin JH, Lim JO, Kim TH, Lee GH, Lee SK. Use of a newly designed multifunctional coil catheter for stent placement in the upper gastrointestinal tract. *J Vasc Interv Radiol*. 2004;15:369–73.
9. Elena RM, Riccardo U, Rossella C, Bizzotto A, Domenico G, Guido C. Current status of device-assisted enteroscopy: technical matters, indication, limits and complications. *World J Gastrointest Endosc*. 2012;4:453–61.
10. Lee KM, Choi SJ, Shin SJ, Hwang JC, Lim SG, Jung JY, et al. Palliative treatment of malignant gastroduodenal obstruction with metallic stent: prospective comparison of covered and uncovered stents. *Scand J Gastroenterol*. 2009;44:846–52.
11. Nassif T, Prat F, Meduri B, Fritsch J, Choury AD, Dumont JL, et al. Endoscopic palliation of malignant gastric outlet obstruction using self-expandable metallic stents: results of a multicenter study. *Endoscopy*. 2003;35:483–9.
12. Song HY, Jung HY, Park SI, Kim SB, Lee DH, Kang SG, et al. Covered retrievable expandable nitinol stents in patients with benign esophageal strictures: initial experience. *Radiology*. 2000;217:551–7.
13. Profili S, Meloni GB, Bifulco V, Conti M, Feo CF, Canalis GC. Self-expandable metal stents in the treatment of antro-pyloric and/or duodenal strictures. *Acta Radiol*. 2001;42:176–80.
14. Park JH, Lee JH, Song HY, Choi KD, Ryu MH, Yun SC, et al. Over-the-wire versus through-the-scope stents for the palliation of malignant gastric outlet obstruction: a retrospective comparison study. *Eur Radiol*. 2016;26:4249–58.