

Review

Endoscopic ultrasound-guided double stenting for biliary and duodenal obstruction

Takao Itoi*, Fumihide Itokawa, Atsushi Sofuni, Toshio Kurihara, Kentaro Ishii, Shujiro Tsuji, Nobuhito Ikeuchi, Junko Umeda, Rena Tanaka, Ryosuke Tonozuka, Fuminori Moriyasu

Department of Gastroenterology and Hepatology, Tokyo Medical University, Tokyo, Japan

Abstract:

Endoscopic biliary stenting for malignant biliary obstruction is currently the gold standard for biliary drainage. Biliary cancer treatment is crucial. Cases of gastric outlet obstruction that includes the duodenum because of cancer invasion and biliary obstruction are seldom observed. The required treatment for such cases is simple biliary stenting and a different treatment for duodenal obstruction. Hence, double stenting for bile duct and duodenal obstruction has drawn attention. In the present review, we state different treatment strategies for malignant duodenal obstruction and then describe double stenting in biliary obstruction that also includes non-biliary cancer malignant lesions and duodenal obstruction.

Keywords:

endoscopic ultrasound; biliary stenting; duodenal stenting; gastric outlet obstruction

Introduction

Endoscopic biliary stenting for malignant biliary obstruction is currently the gold standard for biliary drainage. Biliary cancer treatment is crucial. However, cases of gastric outlet obstruction (GOO) that includes the duodenum because of cancer invasion and biliary obstruction are seldom observed. The required treatment for such cases involves simple biliary stenting and a different treatment for duodenal obstruction. Hence, double stenting for bile duct and duodenal obstruction has drawn attention. The present review reports the treatment strategies for malignant duodenal obstruction and then describes double stenting in biliary obstruction that also includes non-biliary cancer malignant lesions and duodenal obstruction.

Treatment for malignant duodenal obstruction

Aside from the fundamental treatment consisting of tumor excision including areas of stenosis, duodenal obstruction can also be treated through palliative treatments, such as balloon dilatation, gastric tube

placement, gastrostomy, gastrojejunostomy, and duodenal stenting (**Table 1**). Among these treatments, gastrojejunostomy and duodenal stenting must be performed proactively. The former can be expected to enable oral ingestion and improve quality of life (QOL). Most patients are usually in the advanced stage of cancer when duodenal obstruction is present. Thus, death rate and incidence of accidental symptoms caused by surgery are high even with the relatively simple method gastrojejunostomy, excluding palliative gastrojejunostomy of non-resectable cases after a scheduled laparotomy. Low-invasive duodenal stenting via endoscopy or interventional radiology inflicts comparatively less stress on patients. However, a stent is still a foreign body that eventually occludes because of ingrowth, overgrowth, or food residues. Re-interventions such as stent cleaning and stent addition are required. Hence, various elements need to be considered when treatment choice is made. As previously mentioned, patients with duodenal obstruction are common cases of advanced cancer whose survival periods are prolonged by multimodality treatment centered on recent chemoradiotherapy, among other treatments. Thus, one needs to consider that the survival period of most of these cases is approximately 12 weeks.¹

Magnetic transgastric and ultrasound-guided gastrojejunostomy are still in the experimental stages. However, duodenal stenting through endoscopy

*To whom correspondence should be addressed.

E-mail: itoi@tokyo-med.ac.jp

Submitted: 2012-03-21; Received: 2012-03-25; Accepted: 2012-04-09

doi: 10.7178/eus.01.006

Table 1. Salvage therapy for malignant gastric outlet obstruction

1.	Gastro(GI tract)jejunostomy <ul style="list-style-type: none"> - Laparotomy anastomosis - Laparoscopic anastomosis - Magnetic compression anastomosis - Endoscopic ultrasound-guided anastomosis
2.	Duodenal stenting <ul style="list-style-type: none"> - Over-the-guidewire type stent - Through-the-scope type stent
3.	Others <ul style="list-style-type: none"> - Balloon dilation - Tentative gastric juice extraction <ul style="list-style-type: none"> • Stomach tube placement • Gastrostomy

has been performed in many institutions to date. Systematic reviews on retrospective and/or prospective comparisons of surgical gastrojejunostomy results have been reported.² The surgical success rates of duodenal stenting and surgical gastrojejunostomy are 96% and 99%, respectively, and the respective clinical response rates are 89% and 72%. The respective rates for the early stage/late stage with serious symptoms are 18%/1% and 4%/17%, with mean survival periods of 105 and 164 days, respectively. Of these cases, re-intervention was necessary for 7% and 13%, respectively. To date, three randomized comparative studies have reported on surgical gastrojejunostomy and duodenal stenting.³⁻⁵ These studies indicated that surgical gastrojejunostomy should be selected when a survival period exceeding 2 months was aimed for and when stent obstruction, the need for re-intervention, and cost were considered. In addition, the appearance of effective de-novo anticancer drugs that will likely change the prediction of prognosis in the future needs to be considered.

This paper is a review on double stenting. However, endoscopic duodenal stent should not always be considered for malignant duodenal obstruction. The background of a patient should be considered first before the form of treatment is selected.

Choice of duodenal stent

The through-the-scope type of duodenal stent has recently become available worldwide. Over-the-wire type of esophageal stent was commonly used. The length of the delivery system of these esophageal stents is inadequate for cases of gastric distension. Hence, methods such as using an over tube and inserting an endoscope to guide the opening of the obstruction with the grip of a forceps need to be developed. This

Table 2. Double stent procedure

1.	Biliary stenting during endoscopic retrograde cholangio-pancreatography
2.	Biliary stenting via percutaneous transhepatic route <ul style="list-style-type: none"> - Rendezvous methods (retrograde) - Antegrade biliary stenting
3.	Endoscopic ultrasound-guided biliary stenting <ul style="list-style-type: none"> - Hpatocogastrostomy/ choledochoduodenostomy - Rendezvous methods (retrograde) - Transgastric/transduodenal antegrade stenting

device could allow proper duodenal stenting. Maetani *et al.*⁶ compared Niti-S with the conventional over-the-wire type of stent (Ultraflex, Boston) and reported that the mean procedure time ranged from 40 to 15 min ($P<0.0001$).

The uncovered stent is the basic duodenal stent commonly used. However, a covered metallic stent similar to the biliary metallic stent is also under development. A Korean-randomized comparative study⁷ on covered and uncovered stents for GOO caused by gastric stomach reported no difference in the patency period at 2 months. In addition, migration and diversion were significantly common in the covered as compared with the uncovered stents (25.8% vs. 2.8%, $P<0.009$; 0% vs. 25%, $P<0.003$). Thus, the use of covered metallic stent in the double-stent procedure will likely make the bile duct quite impossible to approach. Thus, when performing the double-stent procedure, we should use undercovered metallic stent.

Facts on double stenting

In double stenting, a stent is placed both in the duodenum and bile duct. However, papillary endoscopic biliary stenting can be impossible depending on the degree of duodenal obstruction, the relationship between the duodenal papilla and the site of obstruction (whether it is an opening from the papilla, the anus, or a crossing over the papilla), simultaneous or metachronous obstruction of the bile duct and duodenum, and so on.⁸ In such cases, the approach is from the conventional percutaneous transhepatic biliary drainage (PTBD). Biliary stenting using endoscopic ultrasound (EUS) has been a recent procedure (Table 2).⁹

General-purpose double stenting using endoscopic retrograde cholangio-pancreatography (ERCP)/PTBD

Double stenting from the onset of obstruction

Metachronous obstruction led by biliary obstruction

This duodenal obstruction usually occurs after the

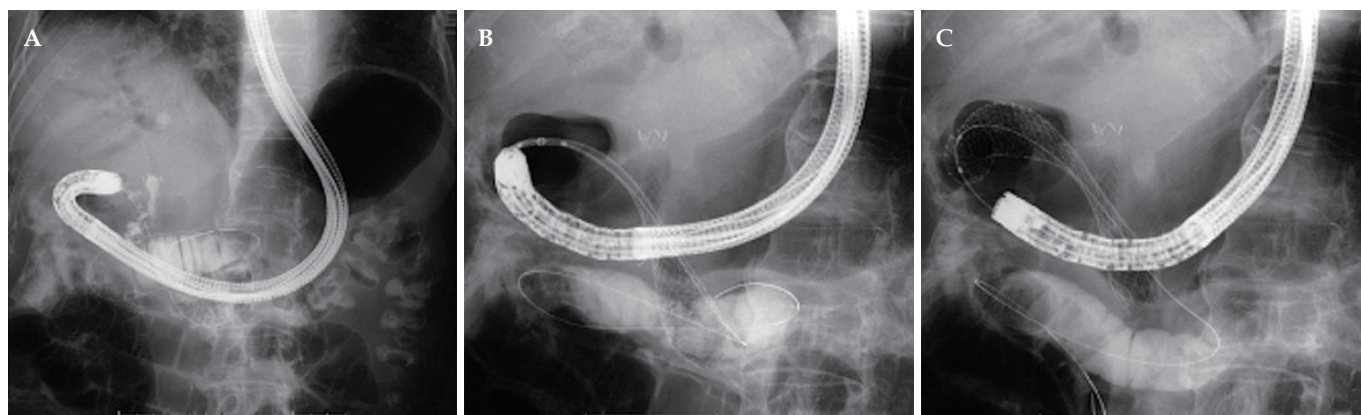


Figure 1. Realities of double stenting (biliary stent placed first). A: The stenosis site of the duodenum is captured from the guidewire-led catheter to measure the length of the stenosis; B: A 9 cm long WallFlex is introduced in the descending limb of the duodenum from the pylorus; C: The duodenal stent is placed by a side-to-end shape.

placement of a biliary stent. With the biliary stent, a metallic stent is preferable because subsequent re-intervention can be performed easily and long-term patency can be expected. When a stent is placed, in the presence of obstruction or the tendency for obstruction, the stent should be replaced or an additional stent should be placed whenever possible. If the duodenum is obstructed, the stent should be placed in such a way that the papilla will not be affected (i.e., approximately 2 to 3 cm from the papilla opening or the anus). Even if the stent is placed in the papilla opening because of the obstruction, re-intervention can be performed to insert a duodenal scope in the expanded duodenal stent when the biliary stent becomes obstructed.

When cancer engulfs a papilla or when stenosis is close to a papilla, re-intervention for a transpapillary biliary stent is commonly impossible to perform, and one can only place a duodenal stent (**Figure 1**). The problem in this case is stent migration in the bile duct and stent obstruction caused by the duodenal stent placement. In terms of stent patency, even a slight distance between the stenosis site and the papillary will commonly enable the creation of a slight gap between the duodenal stent and the papilla regardless of the type of stent. Stent patency is rather maintained in most cases. However, if a papilla is present at the stenosis site, the duodenal stent will naturally form into a shape that will likely crush the papilla, causing the stent to migrate readily into the bile duct or become obstructed.

If the papilla gets crushed by the duodenal stent, the transpapillary approach could be performed by approaching the bile duct from between the mesh of the duodenal stent or the mesh close to the papillary severed by argon plasma coagulation (APC) followed by the biliary approach. This approach is usually difficult when the stent in a stenosis site cannot be distended adequately, particularly when the stent is a duodenal stent with a narrow gapped mesh. In such case, PTBD

is performed. Transpapillary stenting is performed if a guidewire can be inserted inside the duodenal stent from the stent gap through the rendezvous technique. If this procedure is impossible, a metallic stent is added from the PTBD route followed by a side-to-side or partial stent-in-stent procedure.

Simultaneous obstruction

When both the bile duct and duodenum become obstructed simultaneously, initial double stenting is more desirable to perform. In this case, the biliary stenting is first performed followed by the duodenal stenting using the placement method mentioned earlier. However, if a delay occurs in the placement of the duodenal stent such as poor patient condition or the duodenal stent cannot be prepared, the duodenal stent must be promptly placed via biliary stenting. Particularly, this procedure should be followed if the site of duodenal obstruction is in the anal side rather than the papilla. Cholangitis can be triggered readily when the digestive juice remaining in the duodenum, particularly that caused by the insertion of a large diameter metallic stent into the bile duct, readily flows into the bile duct. If a transpapillary approach is a challenge, the duodenal stent is placed endoscopically and biliary drainage is performed via PTBD. A previous report stated that a duodenal stent should be first inserted followed by the insertion of duodenoscope days after stent expansion. The bile duct approach was then used to place the stent from the gap between the mesh. However, performing duodenal stenting using a duodenal stent with a narrow mesh gap is difficult.

Metachronous obstruction led by duodenal obstruction

This type of obstruction is the least frequent. If an embedded duodenal stent is more towards the anus than the papilla, a normal ERCP is performed. However, if it is more towards the opening than the papilla and the stent has not expanded adequately, a scope is inserted after

Table 3. Outcome of double stenting

Authors	Years	No. of cases	DU stent technical success	BD stent technical success	DU stent obstruction	BD stent obstruction	Complications
Maetani	1994	1	1 (100%)	N/A*	N/A	N/A	0
Kaw	2003	18	17 (94%)	16 (89%)	2 (35 days and 45 days)	2 (45 days and 68 days)	0
Profili	2003	4	4 (100%)	4 (100%)	1 (4 months)	0	0
Vanbiervliet	2004	18	NA	17 (94%)	N/A	N/A	0
Marie	2006	25	24 (96%)	21 (84%)	3 (median 6.3 months)	5 (median 1.5 months)	0
Mutignai	2007	64	64 (100%)	62 (97%)	early 6% m late 16%		0
Moon	2009	8	8 (100%)	7 (88%)	N/A	N/A	1 (mild pancreatitis)

DU: duodenal, BD: bile duct; N/A: not available; *: bile duct stent was placed 9 months ago.

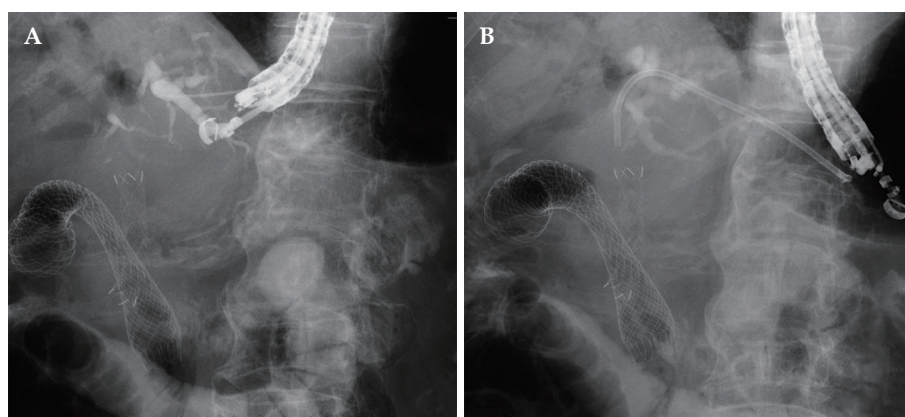


Figure 2. EUS-guided hepaticogastrostomy. A: The left intrahepatic bile duct is punctured transgastrically and captured by convex EUS; B: A 7Fr 12 cm plastic stent is placed after the fistula is expanded.

the stent is expanded with a balloon. If the duodenal stent crushes the papilla, a gap is created in the stent or the stent is cut by APC to create space. Cases where the papilla can be approached are rare. The basic procedure is biliary stenting from the PTBD route or transpapillary biliary stenting through the rendezvous technique.

Results of double stenting via ERCP/PTBD¹⁰⁻¹⁶

Results of the transpapillary double stenting are presented in **Table 3**. To date, surgical success rate for cases of duodenal stent placement by double stenting is 94% to 100%, whereas that for cases of biliary stent placement is 84% to 100%. Aside from mild pancreatitis observed in one patient, no other serious complications have been reported. However, patency periods of duodenal and biliary stents vary according to reports, and long patency periods of at least 6 months have also been observed.

Biliary stenting via double stenting using the EUS-guided procedure

EUS-guided hepaticogastrostomy and

choledochoduodenostomy

The aim of the biliary drainage in this type of double stenting is an antegrade and a retrograde physiological transpapillary drainage. Recently, transgastric or transduodenal biliary drainage has been performed with EUS. This procedure will likely be useful as a replacement drainage procedure for the conventional duodenal endoscopy when the papilla cannot be approached because of crushed papilla in the duodenal stenosis site, inadequate expansion of the stent even it is placed in the papilla opening, and so on (**Figure 2**). An established PTBD drainage procedure is certainly available. However, EUS-guided drainage may not necessarily be easy. This procedure will likely become a future drainage technique when the possibility of extensive fluid in the peritoneum, dislodgement of the PTBD tube, and so on is high.

EUS-guided biliary drainage has several variations, such as EUS-guided hepaticogastrostomy (**Figure 2**) and choledochoduodenostomy. A 100% success rate has been reported for both procedures, and the drainage success rate is at least 90%.⁹ However, leakage of bile into the peritoneum caused by perforation cannot be

avoided completely at present. The establishment of a safe and reliable procedure is expected in the future.

Retrograde biliary stenting through the EUS-guided rendezvous technique

This technique has been reported in approximately 160 case reports, all of which are from high volume institutions.⁹ The success rate of the rendezvous technique is only 67% (110/164). Drainage success rate is also related with the ERCP procedure and is therefore difficult to assess. However, post-surgical pancreatitis occurring after procedures different from the aforementioned two procedures is rare. Furthermore, when the biliary approach is performed after the duodenal stent is placed in the double stenting procedure, the introduction of a guidewire into the lumen from the mesh gap of the duodenal stent through the rendezvous technique is quite difficult. Therefore, when the double stenting is performed, a biliary stent is preferred to be placed first before a duodenal stent.

EUS-guided transgastric/transduodenal anterograde biliary stenting

In this procedure, a biliary stent is placed in the stenosis site by inserting it in an anterograde manner from a transgastric/transduodenal punctured route. However, as mentioned earlier, apart from introducing a guidewire into the lumen from the mesh gap of the duodenal stent, one needs to pass it further through the mesh gap of the stent delivery system under EUS guidance, which is not easy to perform. Thus, the placement of a biliary stent first before a duodenal stent is preferable in double stenting. This procedure is superior because of the fact that a stent can be placed first using the EUS scope. However, the puncture site and fistula need to be expanded to allow the insertion of the delivery system. In addition, one needs to consider the possibility of bile leakage if bile continues to buildup because of poor drainage even after placement of the stent.

Conclusion

Double stenting for malignant duodenal obstruction and biliary obstruction has been reviewed. Placement of the required stent using the double stenting technique will most likely improve the QOL of patients. However, given that an irremovable metallic stent is basically used, one must grasp the site of obstruction and fully understand the pathological condition up to the prognosis before

planning a treatment strategy.

References

1. Dormann A, Meisner S, Verin N, *et al.* Self-expanding metal stents for gastroduodenal malignancies: systematic review of their clinical effectiveness. *Endoscopy* 2004; 36:543-50.
2. Jeurnink SM, van Eijck CH, Steyerberg EW, *et al.* Stent versus gastrojejunostomy for the palliation of gastric outlet obstruction: a systematic review. *BMC Gastroenterology* 2007; 7:239-42.
3. Mehta S, Hindmarsh A, Cheong E, *et al.* Prospective randomized trial of laparoscopic gastrojejunostomy versus duodenal stenting for malignant gastric outflow obstruction. *Surg Endosc* 2006; 20:239-42.
4. Fiori E, Lamazza A, Volpino P, *et al.* Palliative management of malignant antro-pyloric strictures. Gastroenterostomy vs. endoscopic stenting. A randomized prospective trial. *Anticancer Res* 2004; 24:269-71.
5. Jeurnink SM, Steyerberg EW, van Hooft JE, *et al.* Surgical gastrojejunostomy or endoscopic stent placement for the palliation of malignant gastric outlet obstruction (SUSTENT study): a multicenter randomized trial. *Gastrointest Endosc* 2010; 71:490-9.
6. Maetani I, Ukita T, Nambu T, *et al.* Comparison of ultraflex and nits-s stents for palliation of unresectable malignant gastroduodenal obstruction. *Dig Endosc* 2010; 22:83-9.
7. Kim CG, Choi IJ, Lee JY, *et al.* Covered versus uncovered self-expandable metallic stents for palliation of malignant pyloric obstruction in gastric cancer patients: a randomized, prospective study. *Gastrointest Endosc* 2010; 72:25-32.
8. Maetani I, Ukita T, Tada T *et al.* Biliary duodenal double stenting for duodenal stenosis cases. *Kantansui* 2007; 28:293-8.
9. Itoi T, Sofuni A, Itokawa F, *et al.* EUS-guided biliary drainage and the rendezvous procedure (in Japanese). *Tan-to-Sui* 2010; 31:1221-7.
10. Maetani I, Tada T, Ukita T, *et al.* Comparison of duodenal stent placement with surgical gastrojejunostomy for palliation in patients with duodenal obstructions caused by pancreaticobiliary malignancies. *Endoscopy* 2004; 36:73-8.
11. Profili S, Meloni GB, Bifulco V, *et al.* Self-expandable metal stents in the treatment of antro-pyloric and/or duodenal strictures. *Acta Radiol* 2001; 42:176-80.
12. Kaw M, Singh S, Gagneja H. Clinical outcome of simultaneous self-expandable metal stents for palliation of malignant biliary and duodenal obstruction. *Surg Endosc* 2003; 17:457-61.
13. Vanbiervliet G, Demarquay JF, Dumas R, *et al.* Endoscopic insertion of biliary stents in 18 patients with metallic duodenal stents who developed secondary malignant obstructive jaundice. *Gastroenterol Clin Biol* 2004; 28:1209-13.
14. Maire F, Hammel P, Ponsot P, *et al.* Long-term outcome of biliary and duodenal stents in palliative treatment of patients with unresectable adenocarcinoma of the head of pancreas. *Am J Gastroenterol* 2006; 101:735-42.
15. Moon JH, Choi HJ, Ko BM, *et al.* Combined endoscopic stent-in-stent placement for malignant biliary and duodenal obstruction by using a new duodenal metal stent (with videos). *Gastrointest Endosc* 2009; 70:772-7.
16. Mutignani M, Tringali A, Shah SG, *et al.* Combined endoscopic stent insertion in malignant biliary and duodenal obstruction. *Endoscopy* 2007; 39:440-7.