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Original Article

Percutaneous metallic stent placement for malignant afferent loop syndrome via the blind end of the jejunal limb after biliary reconstruction

Yozo Sato^{1,*}, Shohei Chatani¹, Takaaki Hasegawa¹, Shinichi Murata¹, Takamichi Kuwahara², Kazuo Hara², Yasuhiro Shimizu³, and Yoshitaka Inaba¹

ABSTRACT

Background: Malignant afferent loop syndrome occurs after biliary reconstruction and is difficult to treat because of the complicated anatomical changes. The aim of this study was to investigate the safety and efficacy of percutaneous metallic stent placement for malignant afferent loop syndrome via the blind end of the jejunal limb after biliary reconstruction.

Methods: Percutaneous metallic stent placement via the jejunal limb was performed in five male patients (median age, 68 years; range, 51–88 years) with malignant afferent loop syndrome following pancreatoduodenectomy or bile duct resection with reconstruction at our institute from June 2009 to April 2019. Reconstruction was performed using a modified Child's method or the Roux-en-Y method, and blind end of the jejunal limb was surgically fixed to the abdominal wall. Percutaneous drainage of the afferent loop was performed via the blind end of the jejunal limb. Subsequently, percutaneous metallic stent placement was performed via the same route. Technical success, clinical success, and complications were retrospectively evaluated.

Results: Percutaneous metallic stent placement via the blind end of the jejunal limb was successfully achieved in all six procedures. Additional metallic stent placement was performed due to tumor ingrowth in a patient. Drainage catheters were removed from three patients, clamped in one, and could not be removed in one. Clinical success was achieved in four patients (80%) without major complications.

Conclusion: Percutaneous metallic stent placement for malignant afferent loop syndrome via the blind end of the jejunal limb after biliary reconstruction could be a safe and effective procedure.

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Keywords: Afferent loop syndrome; Radiology, interventional; Self expandable metallic stents

Introduction

Malignant afferent loop syndrome due to tumor recurrence occurs after pancreatoduodenectomy (PD) or bile duct resection with reconstruction.¹ This condition is treated by palliative surgical bypass or percutaneous transhepatic biliary drainage (PTBD).^{1–3} However, the success rate of palliative surgical revision is low due to the poor general condition of patients, peritoneal adhesions, or disseminated tumors.⁴ Although it provides excellent symptom relief, PTBD is associated with a certain risk of retrograde biliary infection and is unsuitable for patients with massive ascites.^{4,5}

Recently, the efficacy of metallic stent placement for afferent loop syndrome by PTBD has been described,^{4,6} and the usefulness of endoscopic intervention for afferent loop syndrome has also been reported.^{1,2,7,8} However, these procedures may be technically difficult in patients with adhesions or massive ascites. Percutaneous drainage via the blind end of the jejunal limb (BEJL) surgically fixed to the abdominal wall is an alternative treatment for afferent loop syndrome following PD or bile duct resection with reconstruction.⁹ However, no comprehensive investigation of metallic stent placement via the BEJL for afferent loop syndrome has been published.

¹Department of Diagnostic and Interventional Radiology, Aichi Cancer Center Hospital, Nagoya, Japan

²Department of Gastroenterology, Aichi Cancer Center Hospital, Nagoya, Japan

³Department of Gastroenterological Surgery, Aichi Cancer Center Hospital, Nagoya, Japan

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* Corresponding author. Department of Diagnostic and Interventional Radiology, Aichi Cancer Center Hospital, 1-1 Kanokoden, Chikusa-ku, Nagoya 464-8681, Japan.

E-mail address: ysato@aichi-cc.jp (Y. Sato).

In this study, the safety and efficacy of percutaneous metallic stent placement for malignant afferent loop syndrome via the BEJL after biliary reconstruction were investigated.

Methods

This retrospective study was approved by the institutional review board of our institution (approval no. 2020-1-199). The medical records of the patients included were thoroughly reviewed.

Patients

Percutaneous drainage via the BEJL was performed in 11 patients with afferent loop syndrome following PD or bile duct resection with reconstruction at our institute from June 2009 to April 2019. During PD and bile duct resection, reconstruction was performed using a modified Child's method or the Roux-en-Y method, and the BEJL was surgically fixed to the abdominal wall.¹⁰

Percutaneous metallic stent placement via BEJL was attempted in five patients with malignant afferent loop syndrome caused by tumor recurrence (Fig. 1). The obstruction sites were classified according to the afferent loop location (Fig. 2). The patient characteristics are summarized in Table 1. Two patients with hepaticojejunostomy-site obstruction (Patients 1 and 3) underwent PTBD in addition to percutaneous drainage via BEJL because access to intrahepatic biliary duct via BEJL was technically difficult. A patient with proximal-site obstruction (Patient 4) previously underwent endoscopic metallic stent placement for distal-site obstruction. However, further endoscopy-based approaches to manage proximal-site obstruction were impossible. All patients had elevated body temperatures ($> 38^{\circ}\text{C}$) and complained of abdominal pain. Cholangitis defined as the elevation of hepatobiliary enzyme and serum C-reactive protein level was observed with exception of one patient with the proximal-site obstruction (Patient 4). Another patient with distal-site obstruction developed massive ascites (Patient 2). The first two patients (Patients 1 and 2) were included in a previous publication.

The interval between surgery and percutaneous drainage via BEJL and between percutaneous drainage via BEJL and metallic stent placement ranged from 323 to 641 days (median, 449 days) and 5 to 17 days (median, 8 days), respectively.

Procedures

After obtaining informed consent for the procedure, all percutaneous procedures were performed under local anesthesia and conscious sedation using pentazocine and hydroxyzine. For percutaneous drainage, BEJL was punctured using an 18-gauge needle under ultrasound (US) guidance, and a drainage catheter

was inserted under fluoroscopic guidance (Fig. 3A–3C), as previously described.⁹

Metallic stent placement was attempted via BEJL to achieve drainage catheter removal. The metallic stent type (Zilver Stent: COOK, Limerick, Ireland; Niti-S Duodenal and Biliary Stent: Tae-Woong Medical, Gimpo, Korea; EGIS Biliary stent: S&G Biotech, Yongin, Korea) was determined based on the obstruction site. When the metallic stent was placed across the hepaticojejunostomy, a bare biliary or duodenal stent was used. With the patient in the supine position, a 0.035-inch hydrophilic guide-wire (Radiofocus M; Terumo, Tokyo, Japan) was inserted via BEJL and passed through the obstructed portion with a 6.5-F seeking catheter (Hanako Medical, Saitama, Japan) under fluoroscopic guidance. A guide-wire was exchanged with a super-stiff guide-wire (Amplatz Extra-stiff Wire, COOK Medical, Bloomington, IN, USA), and a metallic stent delivery system was passed through the obstructed portion. After deploying the metallic stent, the safety drainage catheter was placed. Basically, the balloon dilation was not performed. Contrast study via the drainage catheter was performed within one week after the procedure. After confirmation the stent patency, the drainage catheter was clamped. If no relapse of clinical symptoms was observed, the drainage catheter was removed.

Fig. 2. Schema of pancreatoduodenectomy with modified Child reconstruction and classified complication sites. A distal site was defined as an obstruction between the hepaticojejunostomy and the gastrojejunostomy in pancreatoduodenectomy or Roux-en-Y anastomosis. A proximal site was defined as an obstruction between the hepaticojejunostomy and the blind end of the jejunal limb (BEJL).

Fig. 1. Flowchart of patients included in this study. BEJL, blind end of the jejunal limb; PD, pancreatoduodenectomy.

Table 1 Patient Characteristics

Patient	Sex	Age (yr)	Disease	Surgery	Obstruction site	Cholangitis	Additional PTBD	Other specific conditions	Interval (day)*	Interval (day)†
1	Male	63	Biliary Ca	BDR with RY + hepatectomy	Hepaticojejunostomy	+	+	-	449	13
2	Male	68	Pancretaic Ca	PD with M-Child	Distal	+	-	Massive ascites	344	17
3	Male	88	Biliary Ca	BDR with RY	Hepaticojejunostomy	+	+	-	641	5
4	Male	71	Biliary Ca	PD with M-Child	Proximal	-	-	Endoscopic MS placement for distal obstruction	323	8
5	Male	51	Pancretaic Ca	PD with M-Child	Distal and proximal	+	-	-	614	6

PTBD, percutaneous transhepatic biliary drainage; Ca, cancer; BDR, bile duct resection; RY, Roux-en-Y reconstruction; M-Child, modified Child's reconstruction; PD, pancreaticoduodenectomy; MS, metallic stent; -, not available.

*Interval between the surgery and the drainage.

†Interval between the drainage and the procedure.

Fig. 3. A 71-year-old male with biliary cancer after pancreaticoduodenectomy with modified Child reconstruction underwent endoscopic metallic stent placement for distal-site obstruction previously (Patient 4). (A) Computed tomography showed the dilation of afferent loop (arrows) and the metallic stent placed endoscopically (arrow head). (B, C) Percutaneous drainage via the blind end of the jejunal limb (arrows) was performed under ultrasound guidance, and 8-F drainage catheter was inserted into the afferent loop. (D) Contrast study via the seeking catheter passed through the obstructed portion showed the short distance between the hepaticojejunostomy (black arrow) and the obstructed portion (white arrows). (E) A metallic stent delivery system could be passed through the obstructed portion along with a super-stiff guide-wire. (F) One bare metallic stent (Zilver Biliary Stent, 10 mm diameter, 80 mm long) was placed across the hepaticojejunostomy (black arrows). Subsequently, another covered metallic stent (Niti-S Biliary Stent, 10 mm diameter, 80 mm long) was placed across the obstructed portion using stent-in-stent technique (white arrows).

Assessment

Technical success, clinical success, and complications were retrospectively evaluated. Technical success was defined as the successful placement of the metallic stent at the obstructed portion via BEJL. Clinical success was defined as a resolution of the clinical symptoms of afferent loop syndrome without external drainage. Procedure-related complications were evaluated according to the Society of Interventional Radiology clinical practice guidelines.¹¹

Results

The clinical results are summarized in Table 2. Percutaneous

metallic stent placement via BEJL was successfully achieved in all six procedures in the five patients (100%). In three patients (Patients 1, 4, and 5), two metallic stents were placed in tandem using the stent-in-stent method for long-segment lesions (Fig. 3D–3F). In another patient (Patient 5), a contrast study via the safety drainage catheter showed distal-site metallic stent obstruction caused by tumor ingrowth, and an additional BEJL-mediated metallic stent placement was performed 28 days after initial metallic stent placement. In two patients with hepaticojejunostomy-site obstruction (Patients 1 and 3), another metallic stent was placed in parallel via the PTBD route at the same time as the procedure performed via BEJL.

The median follow-up period from the metallic stent placement was 67 days (range, 11–114 days). Drainage catheters were

Table 2 Clinical Results

Patient	MS placement (type, diameter/length)	Additional MS placement	Drainage catheter removal (day)*	Additional procedure	Follow-up time (day)	Clinical course
1	ZILVER Biliary Stent (Bare, 10 mm/80 mm) ZILVER Biliary Stent (Bare, 10 mm/40 mm)	-	None (external drainage)	MS placement via PTBD	114	Death
2	Niti-S Duodenal Stent (Bare, 20 mm/100 mm)	-	4	None	67	Death
3	Niti-S Duodenal Stent (Bare, 22 mm/120 mm)	-	10	MS placement via PTBD	11	Transfer [‡]
4	ZILVER Biliary Stent (Bare, 10 mm/80 mm) Niti-S Biliary Stent (Covered, 10 mm/80 mm)	-	5	None	98	Transfer [‡]
5	EGIS Biliary Stent (Bare, 10 mm/80 mm) EGIS Biliary Stent (Bare, 10 mm/80 mm)	Niti-S Biliary Stent (Covered, 10 mm/80 mm)	Clamped	None	66	Transfer [‡]

MS, metallic stent; PTBD, percutaneous transhepatic biliary drainage; -, not available.

*Interval after the procedure.

[‡]Transfer to other hospital.

removed from three patients and clamped in one. However, the drainage catheter could not be removed in a patient (Patient 1) due to tumor ingrowth, and the patient's poor general condition precluded further metallic stent placement. Clinical success was achieved in four patients (80%), and none of them developed any major complication. Two patients died due to disease progression, and three were transferred to another hospital.

Discussion

Percutaneous metallic stent placement for malignant afferent loop syndrome via BEJL could be performed without any major complication in all patients despite the complicated anatomical changes present after surgical reconstruction. Most patients experienced resolution of clinical symptoms with no need for external drainage during the follow-up period.

Technically, percutaneous metallic stent placement via BEJL was not very difficult because of easy access to the afferent loop. There was little risk of intraperitoneal leakage caused by dissociation of the adhesion between BEJL and the abdominal wall because BEJL was surgically fixed to the abdominal wall. The procedure could be adapted to patients with massive ascites (as Patient 2), for whom PTBD is not indicated. Also, PTBD was technically difficult in one patient with the proximal-site obstruction (Patient 4) because the intrahepatic bile duct was not dilated. However, in patients with hepaticojejunostomy-site obstruction (Patients 1 and 3), access routes via both BEJL and PTBD were needed because access to intrahepatic biliary duct via BEJL was technically difficult. Although subsequent afferent loop drainage was possible via PTBD tract, that procedure may introduce a risk of retrograde biliary infection. Therefore, drainage via both BEJL and PTBD was adequate. This procedure is impractical for patients subject to other surgical reconstruction methods, which do not introduce adhesions between BEJL and the abdominal wall.⁹ Under such conditions, the percutaneous jejunostomy may be an alternative access route. However, this approach introduces the risk of intraperitoneal digestive juice leakage from the afferent loop.^{12,13}

A lumen-apposing metal stent (LAMS) is used instead of plastic stents for walled-off pancreatic necrosis,^{14,15} and a few reports on endoscopic gastrojejunostomy with LAMS for afferent loop syndrome have been published.^{16–18} However, bleeding after LAMS placement due to friction ulceration has been reported as a procedure-related complication.^{15,18}

This study has some limitations. First, the data were retrospectively analyzed, and the number of patients included in the study

was very small. Second, the types of metallic stents used varied.

In conclusion, percutaneous metallic stent placement for malignant afferent loop syndrome via BEJL after biliary reconstruction could be a safe and effective procedure.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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ORCID

Yozo Sato, <https://orcid.org/0000-0001-7605-8434>
 Shohei Chatani, <https://orcid.org/0000-0001-5080-2333>
 Takaaki Hasegawa, <https://orcid.org/0000-0001-6701-8836>
 Shinichi Murata, <https://orcid.org/0000-0002-6163-5451>
 Takamichi Kuwahara, <https://orcid.org/0000-0001-8348-8926>
 Kazuo Hara, <https://orcid.org/0000-0002-2744-7182>
 Yasuhiro Shimizu, <https://orcid.org/0000-0002-2003-6110>
 Yoshitaka Inaba, <https://orcid.org/0000-0002-0850-6327>

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