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ORIGINAL ARTICLE

Endoscopic Retrograde Cholangiography Using an Anterior Oblique-Viewing Endoscope in Patients with Altered Gastrointestinal Anatomy

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Abstract

Background Endoscopic retrograde cholangiopancreatography (ERCP) is technically more challenging in patients who have undergone gastrointestinal (GI) reconstruction.

Aims The aim of this study was to evaluate the utility of the anterior oblique-viewing endoscope (AOE) for ERCP in patients with a retained major duodenal papilla after GI reconstruction.

Methods This was a retrospective study involving 40 patients (50 procedures) with a retained papilla after GI reconstruction who underwent ERCP using AOE. Reconstruction consisted of Billroth II gastrectomy (BII) in 25 patients (30 procedures) and Roux-en-Y anastomosis (RY) in 15 patients (20 procedures). In RY cases, the long single-balloon enteroscope (LSBE) was exchanged with AOE after reaching the papilla.

Results The overall rate of reaching the papilla using AOE was 90.0 % (45/50) [BII; 86.7 % (26/30), RY; 95.0 % (19/20)]. The overall rate of biliary cannulation was 97.8 % (44/45) [BII; 100 % (26/26), RY; 94.7 % (18/19)], and the rate of biliary cannulation for intact papilla was 96.6 % (28/29) [BII; 100 % (14/14), RY; 93.3 % (14/15)]. Treatment success rate in cases of successful biliary cannulation was 97.7 % (43/44) [BII; 100 % (26/26), RY; 94.4 % (17/18)]. The rate of adverse events was 6.0 % (3/50) [BII; 3.3 % (1/30), RY; 10.0 % (2/20)], with mild pancreatitis occurring in 3 cases.

Conclusions High biliary cannulation and treatment rates can be achieved during ERCP using AOE in altered GI anatomy cases with a retained papilla, as long as the papilla can be reached. In RY cases, exchanging AOE with LSBE is useful after reaching the papilla.

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Keywords Anterior oblique-viewing endoscope · Balloon enteroscope · Endoscopic retrograde cholangiopancreatography · Billroth II gastrectomy · Roux-en-Y anastomosis

Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) in patients with an altered gastrointestinal (GI) anatomy is more challenging because scope insertion to the papilla and the cholangiojejunostomy site is difficult. Selective biliary cannulation is particularly challenging in patients with a retained major duodenal papilla. Thus, for ERCP in altered GI anatomy cases with a retained papilla, the selection of a scope with good capability for intestinal tract intubation and biliary cannulation is necessary for successful completion of ERCP.

Recently, the usefulness of the short balloon enteroscope (Short-BE) with a working length of 152 cm has been reported for ERCP procedures in patients after GI reconstruction. Short-BE has an appropriate working length for scope insertion, and it is compatible with more devices than the long balloon enteroscope (Long-BE), which has a working length of 200 cm [1–4]. However, very few institutions are equipped with Short-BE, and there is a high demand for procedures to be performed using conventional forward-viewing endoscopes in the upper and lower GI tracts and Long-BE. Our institution is not equipped with Short-BE. Thus, to perform ERCP in altered GI anatomy cases, particularly those with a retained papilla, the anterior oblique-viewing endoscope (AOE) and long single-balloon enteroscope (LSBE) are usually employed.

In AOE, the channel outlet is at the 11 o'clock position; therefore, for biliary cannulation, it is advantageous to proceed toward the bile duct orifice located at the 5 o'clock position in altered GI anatomy cases with a retained papilla. Moreover, AOE has been reported to have a high cannulation rate [5–8]. It is equipped with a cannula elevator, allowing not only biliary cannulation but also biliary procedures. In addition, compared with Long-BE, AOE has fewer limitations in terms of devices that can be used with it. On the other hand, because AOE has a shorter working length than BEs, scope insertion using AOE is impossible in GI tracts with a long reconstructed GI tract.

Therefore, we use AOE in Billroth II gastrectomy (BII) cases with a relatively short reconstructed GI tract and Long-BE in Roux-en-Y anastomosis (RY) cases with a long reconstructed GI tract. In RY cases, biliary cannulation and subsequent biliary procedures is performed as far as possible through the overtube by exchanging with AOE after reaching the papilla. To date, a few of studies have reported on the method of exchanging the scope with a conventional forward-viewing upper GI endoscope after reaching the papilla using Long-BE [9, 10]. However, to the best of our knowledge, there has not been any large study on the method of scope exchange after reaching the papilla using AOE.

We hereby report the results of ERCP using AOE in altered GI anatomy cases with a retained papilla.

Methods

Patients

Forty patients (50 procedures; 39 males and 1 female; mean age: 74.2 ± 9.2 years) with altered GI anatomy and a retained papilla who underwent ERCP using AOE between February 2009 and March 2014 at the St. Marianna University School of Medicine Hospital were studied retrospectively. BII was performed on 25 patients/30 procedures, and RY was performed on 15 patients/20 procedures (total gastrectomy in 10 patients/15 procedures, subtotal gastrectomy in 5 patients/5 procedures). Among the BII cases, the primary disease was choledocholithiasis in 15 patients, cholangiocarcinoma in 5 patients, chronic pancreatitis in 3 patients, pancreatic head cancer in 1 patient, and gallbladder cancer in 1 patient. Among the RY cases, the primary disease was choledocholithiasis in 9 patients, bile duct stenosis due to lymph node metastasis in 3 patients, cholangiocarcinoma in 2 patients, and choledococele in 1 patient. Twenty-nine procedures were performed on cases with an intact papilla. Patient characteristics are shown in Table 1.

AOE Instrument Details

AOE used in this study (XK-240, Olympus Medical Systems, Tokyo, Japan) has an oblique angle of 45°, working length of 103 cm, outer diameter of 9.7 mm, working channel with a diameter of 2.8 mm, and includes a cannula elevator. The outlet of the channel is located at the 11 o'clock position in endoscopic vision.

LSBE Instrument Details

LSBE (SIF-Q260, Olympus Medical Systems, Tokyo, Japan) was used for intubation of the afferent loop in the RY cases. SIF-Q260 has a working length of 200 cm and a working channel diameter of 2.8 mm. The overtube (ST-SB1, Olympus Medical Systems, Tokyo, Japan) has a working length of 132 cm, outer and inner diameters of 13.2 and 11 mm, respectively, and a silicon balloon at its tip.

Table 1 Patient characteristics

	Billroth II gastrectomy	Roux-en-Y gastrectomy
Patients	25	15
Procedures	30	20
Age (mean ± SD)	73.1 ± 10.4	75.9 ± 6.7
Sex (Male/female)	24/1	15/0
Choledocholithiasis	15	9
Cholangiocarcinoma	5	2
Chronic pancreatitis	3	0
Lymph node metastasis	0	3
Pancreatic carcinoma	1	0
Gallbladder carcinoma	1	0
Choledochocele	0	1
Total gastrectomy	0	15
Partial gastrectomy	30	5
Intact papilla	14	15

SD standard deviation

Fig. 1 Endoscopic papillary large balloon dilation using a 15-mm balloon was performed

Procedure Description

All ERCP procedures were performed by a single ERCP expert (K.N.); however, in the RY cases, scope insertion using LSBE up to the papilla was performed by 3 BE experts (M.N., K.H., S.O.). The procedures were performed under conscious sedation using a combination of midazolam and pentazocine hydrochloride with constant monitoring of the vital signs, and the patients were placed in the semiprone or prone position. CO_2 insufflation was used in the RY cases. In all cases, gabexate mesilate was administered at a dosage of 600 mg/day on the day of the procedure to prevent post-ERCP pancreatitis.

Scope insertion was performed using AOE in the BII cases and LSBE in the RY cases. A standard push-and-pull technique was used for scope insertion under fluoroscopic guidance. In the RY cases, the overtube balloon was inflated and placed after reaching the papilla; LSBE was then removed via the overtube and exchanged with AOE. The shorter working length of AOE required modification of the overtube with the creation of an aperture in the overtube at 100 cm from its tip on the side opposite to the pressure line, to enable the balloon to remain inflated.

Biliary cannulation was performed using the conventional contrast-assisted cannulation method using a standard ERCP cannula (ERCP catheter, MTW Co. Ltd., Düsseldorf, Germany) or a bendable tip cannula (Swing Tip PR-233Q, Olympus Medical Systems, Tokyo, Japan). When biliary cannulation using the contrast-assisted cannulation method was difficult, wire-guided cannulation, the pancreatic duct guidewire placement method, or the pancreatic duct stent placement method was attempted. If these were still difficult, pre-cut was performed using a needle knife (KD-V441 M, Olympus Medical Systems, Tokyo, Japan).

Endoscopic sphincterotomy (EST) was performed following biliary stent placement. Using the needle knife, the common channel and the bile duct terminal were cut open along the stent. Endoscopic biliary stenting was performed using a 7-Fr or 5-Fr plastic stent before EST. For endoscopic papillary balloon dilation (EPBD), a dilator balloon with a diameter of 8 or 10 mm (CRE wire-guided dilator, Boston Scientific, MA, USA) was employed. In endoscopic papillary large balloon dilation (EPLBD), a balloon with a diameter of at least 12 mm (CRE wire-guided balloon dilator, Boston Scientific, Natick, MA, USA) was used (Fig. 1).

In cases with choledocholithiasis, a basket catheter, retrieval balloon catheter, and/or mechanical lithotripter (XEMEX Crusher catheter, Zeon Medical, Tokyo, Japan) were used for stone removal (Fig. 2). In endoscopic biliary stenting, a 7-Fr straight or pigtail plastic stent was used. In the endoscopic metallic stent placement, a noncovered type of self-expandable metallic stent was used. For endoscopic nasobiliary drainage, a 6-Fr or 7-Fr stent was employed.

Outcome Definitions

Apart from the rate and time for scope insertion to the papilla, we evaluated the rate of success of selective biliary cannulation, successful procedure completion, and complications. Scope insertion was considered successful when

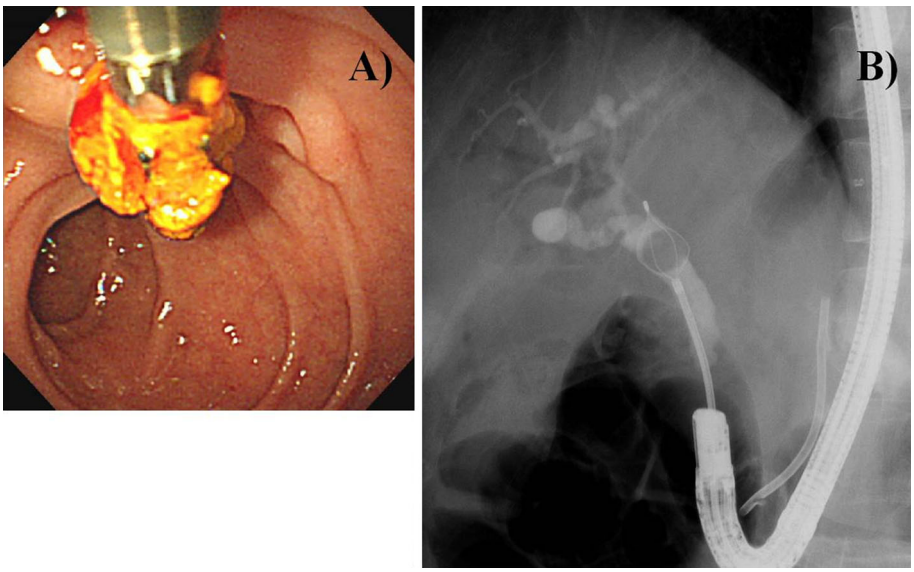

Fig. 2 Mechanical lithotripter was used for stone removal. **a** Endoscopic image, **b** fluoroscopic image

the papilla was effectively reached using AOE in the BII cases. In the RY cases, successful scope insertion was considered when scope exchange with AOE was possible among those cases in which the papilla could be reached using LSBE. In the BII cases, scope insertion time was defined as the time required to reach the papilla using AOE. In the RY cases, scope insertion time was defined as the sum of the time required to reach the papilla with LSBE and that required to exchange it with AOE. A successful procedure was defined as the completion of the intended therapeutic procedures. The diagnosis and severity of post-ERCP pancreatitis were determined according to the consensus guideline proposed by Cotton et al. [11]. Moreover, complications, such as bleeding, perforation, and cholangitis, were also diagnosed according to the consensus guidelines [11].

The study was approved by the institutional review board of our institute.

Results

Success Rates and Times of Scope Insertion to the Papilla

The overall rate of reaching the papilla was 90.0 % (45/50). In the BII cases, the rate of reaching the papilla and scope insertion time using AOE were 86.7 % (26/30) and 5.2 ± 4.2 min, respectively. In RY cases, the rate of reaching the papilla and scope insertion time using LSBE and AOE were 95.0 % (19/20) and 33.3 ± 24.0 min, respectively (Table 2). Reasons for failure to reach the papilla in 4 of the BII cases were steep curvature of the afferent loop ($n = 3$) and inability to insert the scope into the afferent loop because of acute angulation of the anastomosis site ($n = 1$). For these 4 cases, the procedure was reattempted using a conventional forward-viewing upper GI endoscope (GIF-Q260, Olympus Medical Systems, Tokyo, Japan) with a transparent cap attached to its tip. The papilla could be reached in 3 cases. However, it was still difficult to reach in 1 case, and open laparotomy for common bile duct stones was ultimately performed. The RY case with failed insertion using AOE was because of a severe kink in the overtube at the time of scope exchange (Fig. 3). Kinking of the overtube was retrospectively identified in 8 of the 13 cases. However, the kink could be rectified in all cases except for 1. In the remaining case, the kink was very severe.

Table 2 Summary of results (n (%))

	Billroth II gastrectomy	Roux-en-Y gastrectomy
Success of reaching the papilla	26/30 (86.7)	19/20 (95.0)
Mean time to reach the papilla (min ± SD)	5.2 ± 4.2	33.3 ± 24.0
Success of selective biliary cannulation		
Overall	26/26 (100)	18/19 (94.7)
Intact papilla	14/14 (100)	14/15 (93.3)
Successful procedure	26/26 (100)	17/18 (94.4)
Complications	1/30 (3.3)	2/20 (10.0)

SD standard deviation

Success of Selective Biliary Cannulation

The rate of biliary cannulation in the 45 cases in which the papilla was successfully reached was 97.8 % (44/45) [BII;

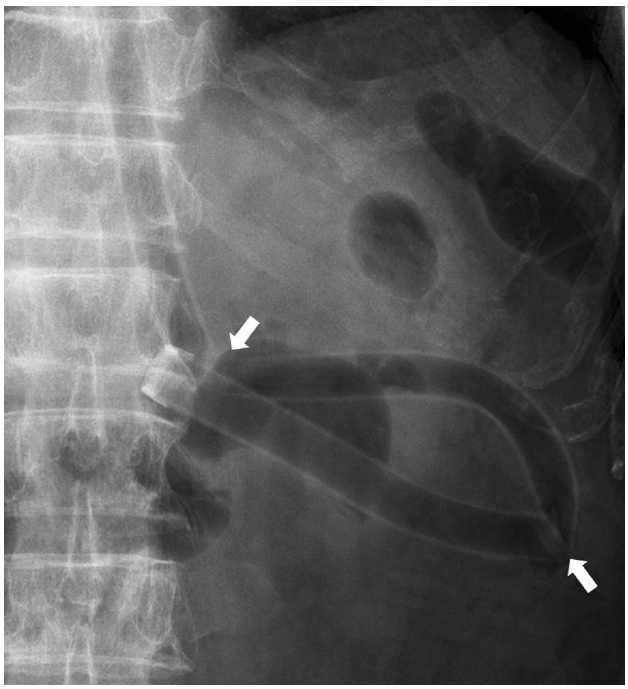

Fig. 3 Fluoroscopic image of a severely kinked overtube

100 % (26/26), RY; 94.7 % (18/19)]. The rate of biliary cannulation for intact papilla was 96.6 % (28/29) [BII; 100 % (14/14), RY; 93.3 % (14/15)] (Table 2). Biliary cannulation was achieved using the conventional contrast-assisted cannulation method in 35 cases. Of the 9 cases in which biliary cannulation using the contrast-assisted cannulation method was difficult, cannulation was successful using wire-guided cannulation in 6 cases, pancreatic duct guidewire placement in 1 case, pancreatic duct stent placement in 1 case, and pre-cut in 1 case. Percutaneous transhepatic biliary drainage (PTBD) was performed in 1 case in which biliary cannulation was impossible.

Successful Procedure

The details regarding procedures on the papilla were as follows: EST, 7 cases; EPBD, 10 cases; EST and EPBD, 4 cases; and EST and EPLBD, 2 cases. In terms of biliary procedures, stone removal was performed in 18 cases, endoscopic biliary plastic stenting in 16, endoscopic biliary metallic stenting in 4, and endoscopic nasobiliary drainage in 3 (Table 3). In Billroth II patients, three patients required two sessions of ERCP for complete stone removal, and two patients required two sessions of ERCP for good drainage by biliary stenting. In Roux-en-Y patients, three patients required two sessions, and one patient required three sessions of ERCP for complete stone removal. The treatment success rate in the cases of successful biliary cannulation was 97.7 % (43/44) [BII; 100 % (26/26), RY; 94.4 % (17/18)] (Table 2). One case of failed treatment was an RY case with bile duct cancer. In this case, PTBD was performed because stent placement was impossible without passing a guidewire through the stenotic site.

Table 3 ERCP interventions (*n*)

	Billroth II gastrectomy	Roux-en-Y gastrectomy
Papilla procedures		
EST	7	0
EPBD	3	7
EST + EPBD	1	3
EST + EPLBD	0	2
Biliary procedures		
Removal stones	10	8
EBD		
Plastic stent	12	4
Metallic stent	3	1
ENBD	1	2

ERCP Endoscopic retrograde cholangiopancreatography, *EST* Endoscopic sphincterotomy, *EPBD* Endoscopic papillary balloon dilation, *EPLBD* Endoscopic papillary large balloon dilation, *EBD* Endoscopic biliary drainage, *ENBD* Endoscopic nasobiliary drainage

Complications

The rate of adverse events was 6.0 % (3/50) [BII; 3.3 % (1/30), RY; 10.0 % (2/20)] (Table 2). Mild pancreatitis was seen in 3 cases; however, all cases improved after intravenous drug treatment alone. Procedural adverse events such as perforation, bleeding, and cholangitis were not observed.

Discussion

Recent reports have described the usefulness of double-balloon [1, 2, 10, 12–15] or single-balloon [9, 16, 17] enteroscopy for scope insertion in cases of GI reconstruction. Its usefulness is particularly notable in RY cases with long intestinal tract reconstruction. The rate of reaching the target site in RY cases was reported to be 33–84 % using a side-viewing duodenoscope [18], a forward-viewing colonoscope [19, 20], and AOE [7]. After the introduction of BEs, the rate of reaching the target site has remarkably improved to 75–100 % [1–4, 9, 10, 12–17]. However, because of their long working length and narrow working channel diameter, the devices that can be used when performing ERCP after reaching the papilla are limited. Recently, the usefulness of Short-BE with a working length of 152 cm has been reported [1–4]. However, only a few institutions are equipped with Short-BE.

Compared with RY cases, BII cases have shorter length of the reconstructed GI tract, and target site can be adequately reached in most cases using a conventional forward-viewing upper GI endoscope or AOE, which has a short working length of 103 cm. According to reports, the rate of reaching the papilla in BII cases is 91 % using a conventional forward-viewing upper GI endoscope [21, 22] and 88–92 % using AOE [5, 6, 8]. Even in this study, in which we used AOE, the rate of reaching the papilla in BII cases was 86.7 %, which is similar to that reported previously. However, in 3 of 4 cases in which reaching the papilla using AOE was difficult, it was achieved using a conventional forward-viewing upper GI endoscope with a transparent cap attached to its tip. Even when BE is used in RY cases, the rate of reaching the papilla may improve when a transparent cap is attached. However, in such a situation, scope exchange through the overtube is not possible; therefore, transparent cap attachment is not performed at our institution.

Biliary cannulation is difficult in cases of reconstruction in which the papilla is retained. This is because the procedure for the papilla has to be performed in the reversed position, which places the bile duct axis at the 5 o'clock position in the endoscopic view. This makes it technically difficult to achieve selective cannulation using a forward-viewing endoscope. Moreover, forward-viewing endoscopes are not equipped with a cannula elevator, which is also a disadvantage in biliary cannulation. It has been reported that this can be resolved by attaching a transparent cap to the tip of the forward-viewing endoscope [23–26]. However, as mentioned above, when a transparent cap is attached, scope exchange through the overtube is impossible. The success rate of biliary cannulation using BE is reported to be 70–94 % [1–4, 12–17]. After reaching the papilla using BE, the rate of biliary cannulation by exchanging with a forward-viewing upper endoscope through the overtube is reported to be 67–72 % [9, 10]. Thus, neither scope produces satisfactory results. The rate of biliary cannulation is particularly low, in the range of 60–67 %, in cases with an intact papilla [10, 15]. AOE, on the other hand, has a channel outlet located at the 11 o'clock position, making it easy to coincide with the bile duct axis at the 5 o'clock position during biliary cannulation. In addition, AOE is equipped with a cannula elevator, allowing not only biliary cannulation but also therapeutic procedures. Recent reports indicate that the rate of biliary cannulation using AOE could be as high as 95–100 % [5–8]. However, most of the reports involved BII cases, and only Kikuyama et al. [7] have reported on RY cases; they used a prototype AOE with a working length of 123 cm, in combination with an overtube. The rate of reaching the papilla was 66.7 %, which was not satisfactory; however, the rate of biliary cannulation in cases in which the papilla was reached was 100 %. In the present study, the overall rate of biliary cannulation was 97.8 %. In the RY cases, the overall rate was 94.7 %, and the rate in cases with intact papilla was 93.3 %, suggesting that AOE is very useful in biliary cannulation.

The disadvantages of performing scope exchange are as follows. (1) ERCP procedures become cumbersome. (2) In patients with steeply curved intestines, the overtube kinks, making AOE insertion impossible. In this study, kinking of the overtube was observed in 8 cases. However, the kink could be rectified relatively easily by angling the operation of the scope in all cases except 1, in which the kink was very severe. As the tip of AOE is slanted, we consider that passage of the kinked section through the overtube was better than that using a forward-viewing endoscope.

Finally, this study has the limitation of a single-center retrospective study. Therefore, further prospective studies using larger sample sizes will be needed to confirm our findings. However, on the basis of the results of the present study, ERCP using AOE in altered GI anatomy cases with a retained papilla can be expected to yield a high biliary cannulation rate if the papilla can be reached. In RY cases, performing scope exchange using AOE after reaching the papilla using BE offers the advantages of both BE, with a high rate of intestinal tract intubation, and AOE, with good biliary cannulation ability.

Conflict of interest None.

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