BMC Gastroenterology

RESEARCH

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Study of factors influencing the insertion failure of single balloon enteroscopy-assisted ERCP treatment after bilioenteric Roux-en-Y anastomosis

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Abstract

Background and study aims Fail to reach the bilioenteric anastomosis is the main cause of treatment failure during single-balloon enteroscopy-assisted endoscopic retrograde cholangiopancreatography (SBE-assisted ERCP) in patients after bilioenteric Roux-en-Y anastomosis. We aim to evaluate factors influencing the endoscopic insertion failure.

Patients and methods We retrospectively reviewed the clinical data of 231 cases undergoing SBE-assisted ERCP from January 2016 to December 2021. Treatment details and outcomes were studied to analyze the factors involved in endoscopic insertion failure.

Results The enteroscopy success rate and procedural success rate were 88.3% and 84.4%. Incidence of postoperative adverse events was 3.9%. No serious adverse events occurred. Risk factors of endoscopic insertion failure include first ERCP attempt, side to side anastomosis at the Rou-Y anastomosis, the use of Endo-GIA anastomosis, three bowel lumens seen at the Rou-Y anastomosis under endoscopy, steep angle of the afferent loop at the Rou-Y anastomosis with a U-shape, length of the afferent loop ≥ 50 cm, and twisted afferent loop. Among which the multifactorial analysis suggested that the presence of three bowel lumens at the Rou-Y anastomosis and twisted afferent loop were independent risk factors for enteroscopy failure. For case with twisted afferent loop, the use of a transparent cap with X-ray-assisted guidance during insertion is an effective strategy to improve the success rate.

Conclusions SBE-assisted ERCP is safe and effective in patients after bilioenteric Roux-en-Y anastomosis. The severity of afferent loop twisting and Rou-Y anastomosis shape were risk factors for endoscopic insertion failure. Surgeons should take into account the feasibility of postoperative ERCP treatment at the time of operation.

Keywords Bilioenteric Roux-en-Y anastomosis, Single-balloon Enteroscope (SBE), Endoscopic retrograde cholangiopancreatography (ERCP), Biliary tract diseases

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Introduction

The biggest difficulty in performing ERCP in patients after the bilioenteric anastomosis is the change in the digestive tract caused by the surgical procedure. This leads to changes in the path of ERCP insertion, thus making it difficult to correctly identify the insertion path and leading to failure of insertion [1, 2]. In addition, intestinal lumen angulation and stricture due to intra-abdominal adhesions after surgical procedures and other reasons may also be important causes of ERCP insertion failure [3, 4]. Previous studies have shown that the presence of Roux-en-Y anatomy is a risk factor for ERCP failure [5]. The success rate of ERCP in long limb Roux-en-Y is less compared to short limb [6].In this study, we analyzed the risk factors associated with failed single-balloon enteroscopy insertion and concluded the insertion techniques. We also suggest details for surgeons to perform anastomosis to further improve the success rate of single-balloon enteroscopy-assisted ERCP treatment after bilioenteric anastomosis.

Patients and methods

Patients

From January 2016 to December 2021, our general surgery department completed 231 cases of SBE-assisted therapeutic ERCP in 121 patients after bilioenteric Roux-en-Y anastomosis. The indications for ERCP included intrahepatic stones, anastomotic stricture of bilioenteric anastomosis, and foreign body remaining at the anastomotic site, among others. Before the operation, patient's history, especially the prior history of upper GI surgeries was reviewed. A digestivetract structure schema was drawn to guide the endoscopic progress. The study was approved by the institution of Xinhua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine (NO. XHEC-D-2022–268).

Endoscopic procedures

The procedures were performed by four highly experienced experts in ERCP, each with a track record of over 1000 successful ERCPs. Each expert has completed more than 100 small bowel endoscopy procedures. Patients were operated in the prone position and placed under general anesthesia through airway intubation. Carbon dioxide (CO2) insufflation was consistently employed throughout all procedures. The enteroscopy process involved repetitive inflation of the scope and overtube, followed by deflation and dragging movements. Manual abdominal compression was applied when deep insertion proved technically challenging. X-ray imaging was frequently utilized during the operation to monitor and guide the progress of enteroscopy. After reached bilioenteric anastomosis, The endoscopists completed the biliary duct cannulation, anastomosis dilation, stone extraction or biliary stent insertion, and subsequent ERCP operations.

Major devices

Olympus CV-260 central unit, SIF-Q260 small balloon enteroscope (working length 200 cm, outer diameter 9.2 mm, biopsy channel 2.8 mm) and ST-SB1 single use overture (working length 132 cm, outer diameter 13.2 mm, internal diameter 11 mm), and OBCU balloon control unit were used. Cottonsphincterotome (COOK, 320 cm length, United States), Glo-Tip ERCP catheter (COOK, 320 cm, United States), Tracer Metro Direct wire guide (COOK, 600 cm length, United States), OASIS stent introducer (COOK, 320 cm length, United States), 5 Fr pushing catheter (COOK, 320 length, United States), Quantum TTC biliary balloon dilator (COOK, 320 cm length, United States), Tri-EX triple lumen balloon extractor (Cook, 275 cm length, United States), A tip cap (D-201–10704, Olympus Medical Systems), and other conventional ERCP devices were also employed.

Outcome definitions

Enteroscopy success was defined as reaching the biliary-enteric anastomosis. Diagnostic success was defined as obtaining a cholangiogram. ERCP success was defined as completion of the intended ERCP intervention [7]. ERCP-related adverse events were categorized using the ERCP consensus guidelines [8]. Primary outcome was defined as completion of treatment using small bowel endoscopy-assisted ERCP. Secondary outcome was defined as successful intubation or access. Bowel twist was defined as endoscopic encounter of two and more 180-degree folds.

Statistical analysis

The analyses were performed using SPSS version 23.0. The results were expressed as median ± standard deviation (range). Continuous variables were compared using the Student t-test, and noncontinuous variables were compared using the Fisher exact test. P value < 0.05 was considered statistically significant.

Results

Patients

The patient characteristics with single balloon enteroscopy-assisted ERC after bilioenteric anastomosis are shown in Table 1. A total of 121 patients with 231 ERC operations were included in this study. There were 50 males (41.3%) and 71 females (58.7%), aged 4–83 years, with a mean age of 47.9 years. The original surgical procedures included Bilioenteric Roux-en-Y anastomosis, Bilioenteric

Table 1 Patient characteristics

No.of ptients	**121**
Gender, Male/Female	50/71
Age, years, median ± SD (range)	47.9 ± 17.3(4 ~ 83)
Primary disease	
Malignancy of the biliary tract	32(26.4%)
Benign bile duct stricture	25(20.7%)
Bile duct stone	43(35.5%)
Chronic pancreatitis	4(3.3%)
Biliopancreatic congenital abnormalities	4(3.3%)
Surgical Bile Duct Injuries	5(4.1%)
Decompensated cirrhosis	3(2.5%)
Others	5(4.1%)
Prior operation history	
Bilioenteric Roux-en-Y anastomosis	97(80.2%)
Bilioenteric Roux-en-Y anastomosis + pancreatico-duodenectomy	2(1.7%)
Bilioenteric Roux-en-Y anastomosis + Billroth II gastroenterostomy	5(4.1%)
Bilioenteric Roux-en-Y anastomosis + Liver resection	15(12.4%)
Bilioenteric Roux-en-Y anastomosis + Liver transplantation	2(1.7%)
Indication for ERCP	
Bile duct stone	81(66.9%)
Benign Stricture of choledocho- or hepaticojejunal anastomosis	47(38.8%)
Benign Stricture of intrahepatic bile duct	17(14.0%)
Foreign body at the anastomotic site	5(4.1%)
Malignant biliary obstruction	11(9.1%)

Roux-en-Y anastomosis + pancreaticoduodenectomy, Bilioenteric Roux-en-Y anastomosis + Billroth II gastroenterostomy ,Bilioenteric Roux-en-Y anastomosis + Liver resection, andBilioenteric Roux-en-Y anastomosis + Liver transplantation.

ERCP treatment and success rate

The treatment status and success rate of patients are shown in Table 2. Of all 231 ERCP operations, 204 cases were insertion into the intestinal loop where the bilioenteric anastomosis was located, and the success rate of insertion was 88.3%. After the completion of insertion, there were 4 cases of failed anastomosis identification or unsuccessful bile duct insertion, and 200 cases of completed cholangiography, so the diagnostic success rate was 86.7%. After the completion of cholangiography, 195 cases were operated on to complete anastomosis balloon dilation, bile duct stone removal, and other operations such as bile duct foreign body removal, etc. The success rate of completed treatment was 84.4%. For patients who failed in treatment suit the state of each patient, ERCP has performed again within 1 week in 6 cases, of which 3 cases were successful; PTCD was performed in 10 cases; surgical stone extraction and bilioenteric anastomosis reconstruction were performed in 7 cases; the rest of the cases were treated with conservative medical therapy.

Adverse event rates

The overall incidence of postoperative adverse events was 3.9% (9/231) in 231 ERC operations. There were 5 cases of postoperative cholangitis with an incidence of 2.2%. Patients presented with fever, chills, and elevated postoperative leukocytes, which all improved after symptomatic treatment with anti-infection, cholagogic and excretion-promoting of bilirubin from bile. No patient developed gastrointestinal perforation, but in 2 patients, mucosal damage to the small intestine was seen endoscopically during ERCP. These are anesthesia-related complications. One patient had black stool and a mild decrease in hemoglobin 1 day after ERCP. The bleeding was stopped after fasting and hemostatic drugs were used. In addition, one patient suffered cardiopulmonary arrest during the ERCP operation. After cardiopulmonary resuscitation and advanced life support, the vital signs were stable, and the patient was cured by active treatment (Table 3).

Table 2 Summary of endoscopic retrograde cholangiopancreatography results

Outcome	*n* (%)
Success rate	***N* = 231**
Enteroscopy success	204(88.3%)
Diagnostic success	200(86.7%)
Procedural success	195(84.4%)
Position of insertion failure	***N* = 27**
Gastric lumen to the Rou-Y anastomosis	13(48.1%)
Rou-Y anastomosis to the transverse colonic mesenteric poke	6(22.2%)
Transverse colonic mesenteric poke to the biliary-intestinal anastomosis	8(29.6%)
Reason for enteroscopy failure	***N* = 27**
Afferent loop opening inaccessible	12(44.4%)
Insufficient length of endoscope	3(11.1%)
Endoscope cannot pass through twisted bowel	10(37.0%)
Others (instrument failure, anesthesia accident, etc.)	2(7.4%)
Therapeutic schedule	***N* = 204**
Anastomosis balloon dilation	117(57.4%)
Bile duct stone removal	135(66.2%)
ERBD	72(35.3%)
Bile duct foreign body removal	11(5.4%)
ENBD	27(13.2%)

Table 3 Adverse event rates

	***N* = 231**
No Adverse events	222(96.1%)
Total Adverse events	9 (3.9%)
Cholangitis	5
Mucosal laceration	2
Intestinal perforation	0
Bleeding	1
Anesthetic accident	1

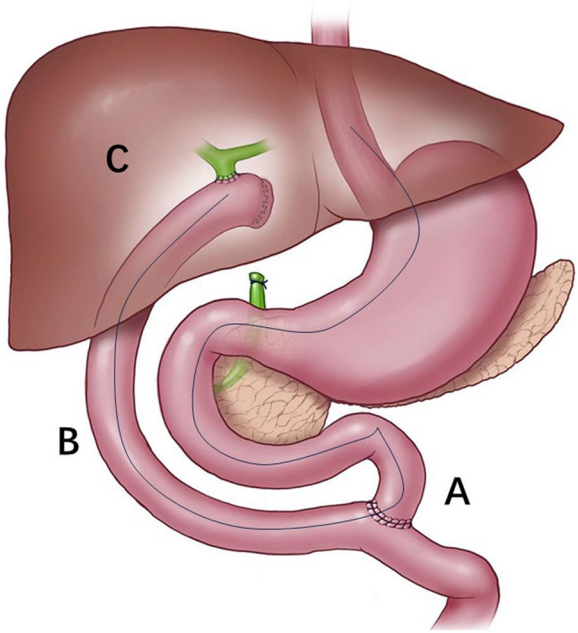

Fig. 1 Schema of endoscopic insertion path after Bilioenteric Roux-en-Y anastomosis and three main insertion failure location. **A** Roux-en-Y anastomosis site. **B** Transverse colonic mesenteric poke. **C** Bilioenteric anastomosis site

Analysis of the factors of the insertion failure and related risk factors

A total of 27 patients failed insertion in this study. The location of failed insertion was from the gastric lumen to the Rou-Y anastomosis in 13 cases (48.1%), from the Rou-Y anastomosis to the transverse colonic mesenteric poke in 6 cases (22.2%), and from the transverse colonic mesenteric poke to the bilioenteric anastomosis in 8 cases (29.6%) (Fig. 1) (Table 2). The most common reason for failed intubation was too large an angle of the input loop at the Rou-Y anastomosis, followed by too twisted bowel lumen. Univariate analyses were performed to evaluate factors associated with insertion failure showed that the patient's first single balloon enteroscopy-assisted ERCP, lateral anastomosis at the Rou-Y anastomosis, and the use of Endo-GIA anastomosis, three bowel lumens seen at the Rou-Y anastomosis under endoscopy, steep angle of the afferent loop at the Rou-Y anastomosis with a U-shape, length of the afferent loop $\geq$ 50 cm, and

twisted afferent loop were risk factors for insertion failure. Further multifactorial analysis suggested that the presence of three bowel lumens at the Rou-Y anastomosis (OR:8.003, 95% CIs:2.517–25.450) and twisted afferent loop (OR: 0.063, 95% CIs: 0.016–0.240) were independent risk factors for access failure (Table 4). Although the use of transparent caps was not associated with overall access success, we further analyzed 70 cases with afferent loop twist and found that for cases with bowel twist, ERCP insertion success was significantly higher with transparent caps than without them (Table 5).

Table 5 Effect of using transparent caps on the success rate of insertion in patients with an intestinal twist

Factors	Category	Successful insertion	Insertion failure	*p*
Using transparent caps	Yes	44	3	< 0.001
	No	11	12	

Discussion

Our center routinely employs the long single-balloon endoscope for patients after Biliary-intestinal anastomosis. Compared to Rou-Y anastomosis after total

Table 4 Failure factors for reaching the blind end

Factors	Category	Successful insertion	Insertion failure	Univariate analysis *p* value	Multivariate analysis *p* value	OR	95% CI
Age	< 50	85	13	0.522			
	≥ 50	119	14				
Sex	Male	88	10	0.547			
	Female	116	17				
Primary disease benign or malignant	Benign	162	24	0.243			
	Malignant	42	3				
Time from surgery to ERCP	< 5 years	105	18	0.137			
	≥ 5 years	99	9				
Combined with other gastrointestinal anastomoses	Yes	14	1	0.833			
	No	190	26				
Combined lobectomy or liver transplantation	Yes	26	3	1			
	No	178	24				
Laparoscopic surgery	Yes	21	6	0.135			
	No	183	21				
Rou-Y anastomosis structure	End-to-Side	119	4	< 0.001	0.798		
	Side-to-Side	85	23				
Rou-Y anastomosis method	Manual	142	6	< 0.001	0.228		
	Endo-GIA	62	21				
Rou-Y anastomosis distance from the Treitz	< 20 cm	122	12	0.192			
	≥ 20 cm	82	15				
Afferent loop length	< 50 cm	124	8	0.002	0.821		
	≥ 50 cm	80	19				
Position of afferent loop	Antecolic	33	5	0.974			
	Retrocolic	171	22				
First ERCP	Yes	96	23	< 0.001	0.159		
	No	108	4				
Number of endoscopic Rou-Y anastomosis intestinal lumen	2	176	9	< 0.001	< 0.001	8.003	2.517–25.450
	3	28	36				
Rou-Y afferent loop U-shape bend	Yes	143	6	< 0.001	0.265		
	No	61	21				
Afferent loop twist	Yes	55	15	< 0.001	< 0.001	0.063	0.016–0.240
	No	149	3				
Using transparent caps	Yes	111	6	0.117			
	No	186	21				

gastrectomy, patients with biliary-intestinal Rou-y-shape anastomosis have a longer endoscopic insertion distance of 130–160 cm due to the presence of the stomach [1, 3, 9]. The short single-balloon endoscope has a length of 152 cm, which is not enough to reach the anastomosis. By using specially designed longer instruments, it is made feasible to perform operations such as anastomosis balloon dilation, bile duct stone removal, and ENBD. In this study, the success rate of endoscopic insertion in our center was? and the treatment success rate was 86.7%, which was higher than that reported in other literature [7, 10–12]. No significant adverse events such as perforation and bleeding occurred in all cases. This shows that endoscopic treatment is safe and effective. Our experience is that before each ERCP operation, the operator needs to know the patient's past medical history and surgical records in detail. The endoscopic insertion route is then planned by drawing a diagram of the GI reconstruction. The four experts are also surgeons and have a deeper understanding of GI reconstruction. This helps us to anticipate the anastomoses and difficulties that may be encountered during endoscopic insertion. In this study, the success rate of endoscopic insertion was significantly improved in cases with repeat ERCP. This is because the previous procedure provided important information about the structure of the GI tract, enabling an improved success rate of repeat ERCP insertion. Another point that can significantly improve the success rate of endoscopic insertion is the collaboration between endoscopists and surgeons. The surgeon has a better understanding of the structure of the GI tract and the general route of endoscopic insertion, while the endoscopist is more skilled in controlling the endoscope and more sensitive to judging the mucosal structure of the bowel.

By analyzing all failed cases of endoscope insertion in our center, we summarized the most common locations and causes behind the failure. Among the cases, failed Rou-Y anastomosis crossing was the top factor, accounting for 8.1%. In this study, we found that four risk factors lead to the unsuccessful insertion: Rou-Y anastomosis performing a side-to-side anastomosis, anastomosis using the Endo-GIA, endoscopic Rou-Y anastomosis presenting three intestinal lumens, and the endoscope in a U-shape when attempting to insert the afferent loop. The presence of three intestinal lumens in Rou-Y anastomosis was an independent risk factor for insertion failure. A major challenge in entering the afferent loop through Rou-Y anastomosis is to accurately determine the opening of the afferent loop. When the endoscope reaches the Rou-Y anastomosis, two to three intestinal lumen openings would be seen. This poses a challenge in determining the opening of the intestinal lumen of the afferent loop. In patients with Roux-en-Y (RY) reconstruction for gastric resection, the newly defined "fold disruption" (FD) sign can be useful to distinguish the afferent limb from the efferent limb at the Y anastomosis when balloon endoscopy-assisted ERCP (BE-ERCP) is performed [13]. Our center has concluded three skills for judging the afferent loop opening. (a) The afferent loop bowel is often more difficult to be inserted since it probably forms a large angle with the bowel through which the endoscope previously passed. (b) The diameter of the bowel of the afferent loop is smaller than the efferent loop because no food passes through the afferent loop. (c)The afferent loop and the previously passed bowel are the different bowels, so the intestinal mucosa has no continuity. By applying the above three points, we can usually make the right choice. Another difficulty for the endoscopic insertion at the Rou-Y anastomosis is that the too-large deflection angle of the bowel, making it difficult to insert into the afferent loop. When a lateral anastomosis is made by surgery using Endo-GIA, the partial intestinal structure at this site is two segments of the intestinal lumen aligned in parallel. In some cases, the parallel portion of the bowel is longer and therefore the third intestinal lumen that exits is the blind end (Fig. 2). However, some blind ends are so short that the endoscopic visibility of the three intestinal lumens is not obtained. Under this circumstance, the endoscope often needs to be rotated 180 degrees to enter the afferent loop. The diameter of the intestinal lumen at anastomosis is large, and the endoscope does not have effective intestinal wall support to complete the large angle turning forward. Blindly pushing the endoscope often causes the endoscope to slip out of the afferent loop and bounce into the efferent loop. At this point, we often need to rely on the shaping effect of the balloon over-tube on the intestinal lumen and rely on a combination of the push–pull-rotate-hook insert technique. First, the intestinal bothering of the afferent loop is hooked through the endoscope head, and then the knob is adjusted slightly. Through the X-ray-assisted positioning, the endoscope will slowly slide deeper into the afferent loop. In addition, artificially creating an overbending point of contact by compressing the abdominal wall with an assistant can be effective in some cases.

The afferent loop through the poke hole of the transverse mesocolon and the intestinal tube around the bilioenteric anastomosis were also common sites of insertion failure, accounting for 22.2% and 29.6%, respectively. The two intestinal tubes mentioned above are secured to the surrounding tissues, which causes the plasticity and compliance of the surrounding intestinal tubes to be changed. Blind endoscopic insertion will result in an angle between the free intestine and the intestine at the anchor point, there is a risk of intestinal perforation. If the afferent loop is overlong and the intestine between the anchor points

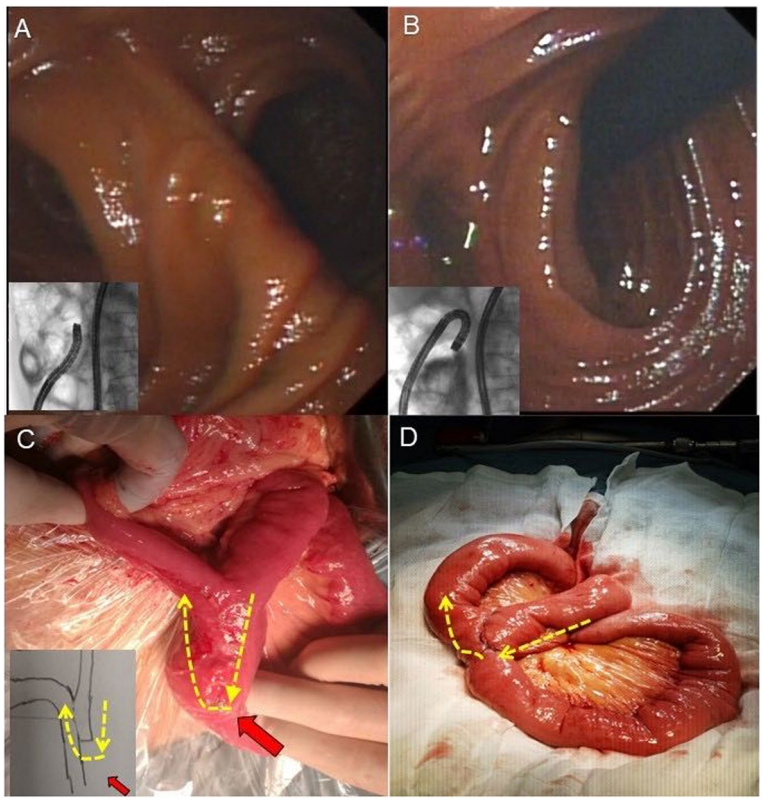

Fig. 2 Structure of Roux-en-Y anastomosis. **A** Endoscopic findings in a case failed to cross Roux-en-Y anastomosis site. Endoscopic presenting three intestinal lumens, two lumens right ahead were one efferent loop lumen and one blind end lumen. **B** The afferent loop lumen was in rear direction. Endoscope is in a U-shape when attempting to insert. **C** Structure of Roux-en-Y anastomosis in same patient during subsequent operation. Rou-Y anastomosis was performed in a side-to-side way by Endo-GIA. Yellow line indicated the endoscopic insertion path which requires endoscope make a U-shape bend. Red arrow indicated the location of blind end intestinal lumen. **D** In a case success to cross Roux-en-Y anastomosis, the anastomosis was perfomed manually in a end-to-side way.The yellow line indicated the endoscopic insertion path without a shape curve

is severely twisted. The endoscope cannot change direction continuously in a small space, which will result in failed endoscopic insertion. In this study, afferent loop length > 50 cm and afferent loop twisting were risk factors for failed endoscopic insertion. Among them, afferent loop twisting was an independent risk factor (Fig. 3). For twisted afferent loops, our experience is to avoid violent endoscopic insertion. Injection of a contrast medium into the intestinal lumen under x-ray helps to understand the direction of the bowel extension.(Video1) First, the balloon over-tube is inserted into the intestinal lumen near the anchor point. Then, the distal intestinal lumen is inserted by twisting the endoscope body and turning the endoscope head in small degrees. In addition, we found that adding a transparent cap to the endoscope end improves the view of the endoscope through the curve. It makes the turning of the endoscope through a narrow intestinal lumen easier, thus improving the success rate of endoscopic insertion.

When single balloon enteroscopy-assisted ERCP treatment with has failed, PTCD is an alternative treatment option [14, 15]. In this study, there were4 patients successfully treated with PTCD after the failure of ERCP. Although PTCD is also minimally invasive and has high safety. However, because the shape and location of the liver have changed by operation, PTCD puncture is more difficult in some cases where the intrahepatic bile ducts are not widened. PTCD in the treatment of patients with both bile duct diseases is not satisfied. It has a long treatment cycle, an increased number of treatments, and many other issues [16, 17]. Some studies have used EUS-BD as an alternative treatment option for such patients. Although EUS-BD has a high treatment success rate of 90–94%, some studies have shown a adverse event rate of 16.5%-23.3% [18–21]. Its higher adverse event rate is also an issue that should be taken into consideration.

In this study, 7 patients failed ERCP treatment we completed the treatment by open operation. The purpose of the open operation is to reconstruct the bilioenteric anastomosis and bile duct stone extraction. In addition, we also adjust the GI structures that cause difficulties in ERCP endoscopic insertion. The main surgical

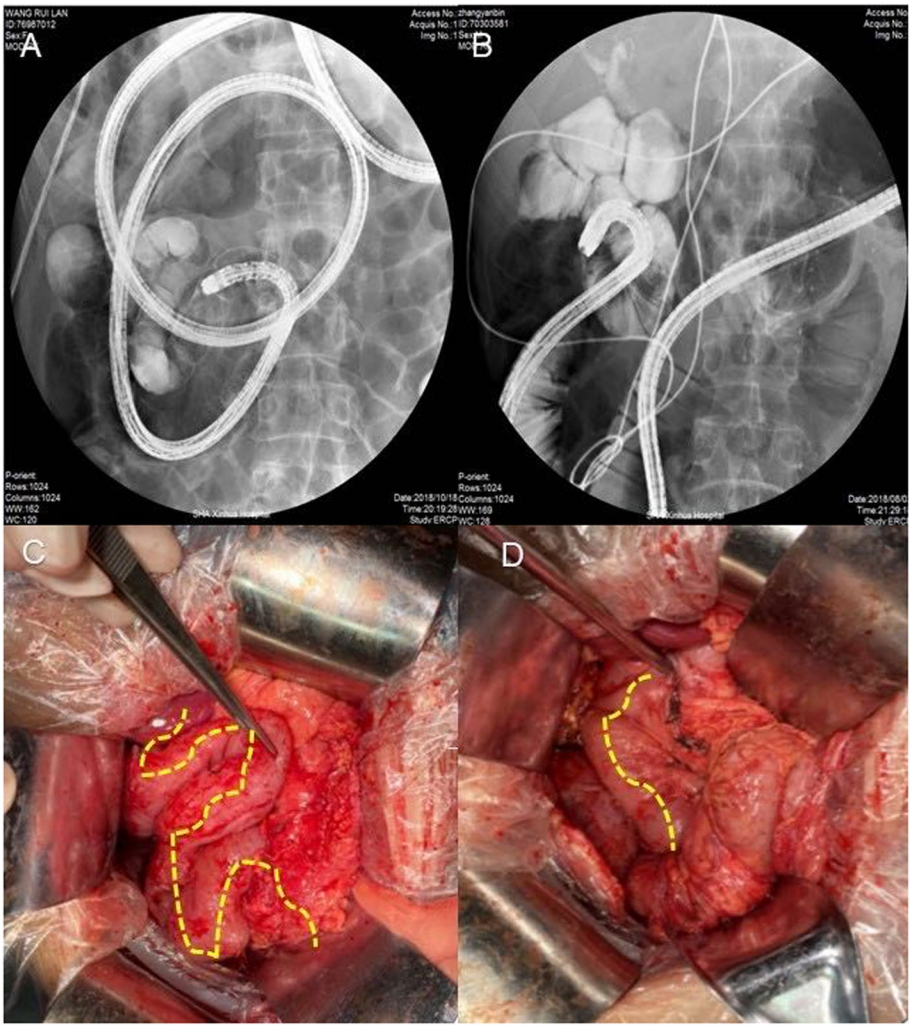

Fig. 3 Overlong or twisted afferent loop cause endoscopic insertion failure. **A** In a case with overlong afferent loop, the length of the enteroscope was insufficient to reach bilioenteric anastomosis site. **B** Afferent loop between poke hole of the transverse mesocolon and bilioenteric anastomosis was severely twisted, causing failed endoscopic insertion. **C** The same patient in figure B was then received surgical treatment. Yellow line indicated twisted afferent loop. **D** After reconstructed the bilioenteric anastomosis, surgeons shortened the length of the afferent loop to facilitate subsequent endoscopic treatment

procedures include adhesion lysis, shortening the length of the afferent loop, and adjusting the angle of the Rou-Y anastomosis (Fig. 3). Two patients had failed the first ERCP and had recurrent bile duct stones after an open operation, at this time ERCP was performed successfully. Our recommendations for surgeons performing Rou-Y anastomosis include avoiding long and twisted afferent loops and avoiding a U-shaped folding of the intestinal tube at the Rou-Y anastomosis. The conventional Rou-Y anastomosis routinely has a 40–60 cm length of the afferent loop to prevent backflow of the bowel contents over the anastomosis. Also, the afferent loop is made to form a U-shape with the proximal jejunum. The two intestinal loops need to suture in a parallel position for 6–8 cm [22, 23]. These structural features undoubtedly make endoscopic insertion extremely difficult. Some surgeons did not accurately estimate the length of the ascending intestinal tube at the anastomosis and did not straighten the afferent loop before securing it to the poke hole of the transverse mesocolon. Over-long afferent loops are repeatedly folding in a short length and a small space, and as postoperative adhesions form among the bowels, the twisted bowel makes it impossible to pass the endoscope. In some cases of lateral Rou-Y anastomosis using the Endo-GIA, the blind end of the input loop was overlong. Not only does it affect the endoscopic insertion, but it may also lead to food residue in the area, which instead increases the possibility of refluxing cholangitis.

Therefore, we recommend that surgeons should shorten the length of the afferent loop to less than 50 cm while observing the operating standard. Also, the shape and angle of the intestinal tube at the Rou-Y anastomosis should be paid attention to. The length of the afferent loop should be as short as possible, with an angle of less than 60 degrees between the two intestinal tubes and a parallel length of less than 10 cm.

In conclusion, in this study, we found that the degree of afferent loop twisting and Rou-Y anastomosis shape were risk factors for failed single-balloon enteroscopy-assisted ERCP insertion. However, this study was a retrospective single-center study and had some limitations. For twisted bowel, the use of a transparent cap with X-ray-assisted guidance for insertion is an effective strategy to improve the success rate. We also recommend that surgeons should take into account the feasibility of postoperative ERCP treatment at the time of operation in these days when endoscopic treatment can bring benefits to patients. Paying attention to the details of the operation and adding an improved success rate of postoperative endoscopic treatment to the operation quality should be a consideration.

Abbreviations

ERCP	Endoscopic retrograde cholangiopancreatography
SBE	Single-balloon endoscopy
PTCD	Percutaneous transhepatic cholangial drainage
ERBD	Endoscopic retrograde biliary drainage
ENBD	Endoscopic nasociliary drainage
IQR	Interquartile range
EUS-BD	Endoscopic ultrasound-guided biliary drainage

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12876-025-03689-2.

Supplementary Material 1: Video1： When endoscopic view is not available, X-ray fluoroscopy through the bowel can be used.

Supplementary Material 2.

Acknowledgements

We would like to thank all people who helped us conduct this study.

Author disclosures

Weng Hao, Fan Qingquan, Gu Jun, Weng Mingzhe, Zhao Mingning, Zhang Yi, Xu Leiming, Shu Yijun, Wei Ding, A Wang Suo Lang, Song Xiaoling and Wang Xuefeng have nothing to disclose.

Authors' contributions

Weng Hao, Fan Qingquan, Gu Jun and Weng Mingzhe. wrote the main manuscript text. Zhao Mingning, Zhang Yi, Xu Leiming, Shu Yijun, Wei Ding and A Wang Suo Lang. prepared figures and tables. Wang Xuefeng and Song Xiaoling Conception and design the research. All authors reviewed the manuscript.

Funding

This work was supported Funding: This study was supported by National Natural Science Foundation of China (82272691), Science Foundation of Shigatse City (RKZ2024ZR-006 (Z))and the Natural Science Foundation of Tibet Autonomous Region (XZ2024ZR-ZY050(Z)).

Data availability

The datasets used and analysed during the current study are available from the corresponding author on reasonable request. (Correspondence to: Xue-Feng Wang, Professor, MD. Department of General Surgery, Xinhua Hospital, Affiliated to Shanghai Jiao Tong University School of Medicine, 1665 Kongjiang Road, Shanghai, 200,092, China. Email: wangxuefengxinhua@163.com; Song Xiaoling, Professor, MD. Department of General Surgery, Xinhua Hospital, Affiliated to Shanghai Jiao Tong University School of Medicine, 1665 Kongjiang Road, Shanghai, 200,092, China. Email: sxl_dy@163.com;)

Declarations

Ethics approval and consent to participate

The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by institutional review board of Xinhua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine (NO. XHEC-D-2022–268), and the requirement for individual consent for this retrospective analysis was waived.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 27 August 2024 Accepted: 12 February 2025
Published online: 20 March 2025

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