

Double balloon enteroscopy for endoscopic retrograde cholangiopancreatography after Roux-en-Y reconstruction: case series and review of the literature

J.J. Koornstra

Department of Gastroenterology and Hepatology, University Medical Centre Groningen, University of Groningen, Groningen, the Netherlands, tel.: +31 (0)50-361 33 54, fax: +31 (0)50-361 93 06, e-mail: j.j.koornstra@int.umcg.nl

ABSTRACT

Background: Endoscopic access to the biliary system can be difficult in patients with surgically altered anatomy, such as a Roux-en-Y reconstruction. Double balloon enteroscopy (DBE) is a relatively new procedure that enables access to the small bowel. DBE has recently been advocated as a method for endoscopic retrograde cholangiopancreatography (ERCP) in patients with surgical reconstructions, with the potential to perform diagnostic and therapeutic interventions.

Methods: In three patients with a hepaticojejunostomy and Roux-en-Y reconstruction, the experiences using DBE to perform ERCP are described. The literature on DB-ERCP in patients with a Roux-en-Y reconstruction was reviewed.

Results: In all patients, the Roux limb was entered and a diagnostic cholangiography was carried out. In one patient, endoscopic therapy could be performed, consisting of balloon dilation of a stenotic biliodigestive anastomosis, repeated balloon dilation of biliary strictures and removal of bile casts.

Conclusion: This series confirms recent data emerging from the literature that double balloon enteroscopy is a safe and feasible technique to obtain biliary access in patients with surgically altered anatomical configurations, such as those with a Roux-en-Y reconstruction. The diagnostic and therapeutic potential of DB-ERCP is great, and the utility of the procedure could be further improved if customised accessories become more widely available.

KEYWORDS

Double balloon endoscopy, double balloon enteroscopy, ERCP, liver transplantation, Roux-en-Y

INTRODUCTION

Patients with altered anatomy, such as those with a Billroth II gastrojejunostomy or a biliodigestive anastomosis with Roux-en-Y reconstruction, pose a serious challenge to the endoscopist when access to the biliary system is required.¹ The Roux-en-Y reconstruction is a frequently used method of surgical reconstruction, which consists of the construction of a Y-branched jejunal limb. Roux-en-Y reconstructions are common in gastric bypass surgery (for obesity), after pylorus-preserving pancreaticoduodenectomy (PPPD) or after bile duct or liver surgery.² Diagnostic possibilities of suspected pancreatic or biliary diseases in patients with a Roux-en-Y reconstruction are limited and generally confined to magnetic resonance cholangiopancreatography (MRCP). Therapeutic or interventional options in these patients consist of endoscopic retrograde cholangiopancreatography (ERCP), percutaneous transhepatic cholangiography (PTC) or surgery.

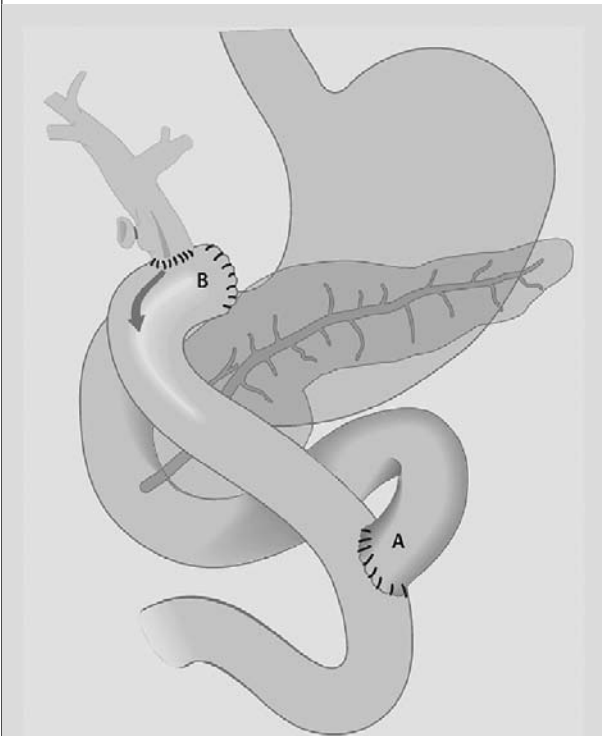
ERCP can be difficult in patients with surgically altered small bowel anatomy. One of the problems is the length of small bowel that has to be traversed to reach the bypassed small bowel limb and the biliary system. In patients after Billroth II reconstructive surgery, Whipple resection or PPPD, in which the gastric stump (BII, Whipple) or duodenal cap (PPPD) is anastomosed with the jejunum, the distance is relatively short. Access to the biliary tree in these situations is generally achievable with forward viewing endoscopes such as a standard gastroduodenoscope, a paediatric colonoscope or a push enteroscope.³ In contrast, patients with a Roux-en-Y reconstruction with a jejunojejunostomy distal from the ligament of Treitz have a long segment of small bowel that needs to be traversed to gain access to the Roux limb. In these cases,

the endoscope has to be advanced past the ligament of Treitz into the jejunum until the jejunojejunostomy is reached, and then another 40 to 80 cm up the Roux limb.³ This anatomical situation (*figure 1*), which is common after orthotopic liver transplantation (OLT) or biliary diversion procedures, is usually inaccessible for conventional endoscopes.⁴ Unfortunately, many patients develop biliary complications after OLT including anastomotic and nonanastomotic strictures.⁴ Endoscopic management of these complications is commonly difficult if a hepaticojejunostomy with Roux-en-Y reconstruction is present and often necessitates an alternative technique such as a percutaneous transhepatic approach. The introduction of the double balloon enteroscope (DBE) in 2001 has allowed endoscopic access into the small bowel.⁵ Recent data indicate that DBE also facilitates endoscopic entry into previously inaccessible areas and anatomical configurations that result from small bowel surgery.¹ In this report, the safety and feasibility of the DBE technique is described in a series of three patients with surgically altered anatomy in whom access to the biliary system was required. In addition, the currently available literature on DBE for ERCP in patients with a Roux-en-Y reconstruction was reviewed.

CASE REPORTS

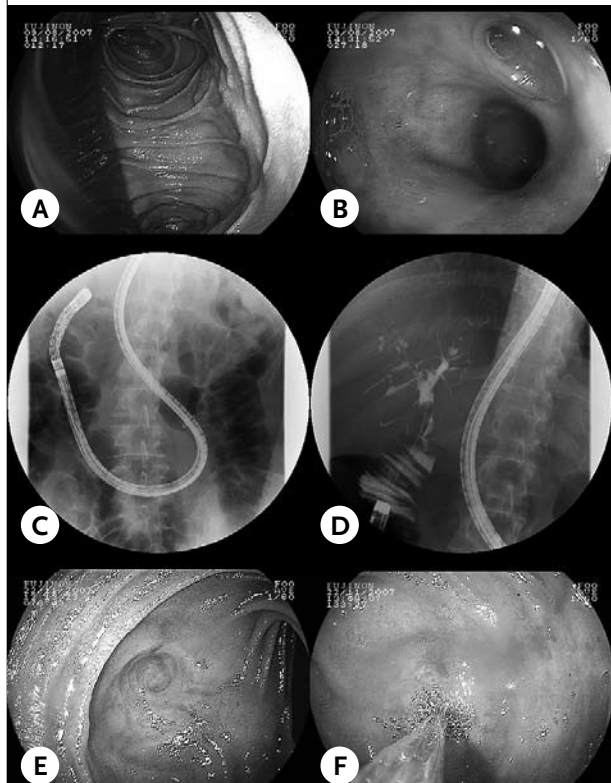
Case report 1, a 58-year-old female, was referred for evaluation of recurrent cholangitis. She had undergone a hepaticojejunostomy with Roux-en-Y reconstruction at the age of 38 for recurrent episodes of cholangitis. A liver biopsy at that time showed sclerosing cholangitis. Over the years, repeated periods of cholangitis occurred with increasing frequency. There was debate as to whether the frequent attacks of cholangitis were to be attributed to a stenotic hepaticojejunostomy or due to intrahepatic biliary strictures associated with sclerosing cholangitis. Endoscopy with conventional endoscopes was considered impossible, so a DBE was performed. The jejunojejunostomy was reached approximately 40 cm downstream of the ligament of Treitz (*figure 2A*). Under fluoroscopic control, the endoscope was then advanced into the Roux limb until the hepaticojejunostomy came into view (*figure 2B*). The hepaticojejunostomy did not appear stenotic (*figure 2C*). Cholangiography, using a 10 to 12 mm diameter controlled

Figure 1. Typical anatomy after hepaticojejunostomy with Roux-en-Y reconstruction showing A) the jejunojejunal anastomosis and B) the end-to-side hepaticojejunostomy¹



Source: Thieme Verlag.

Figure 2. A-D) Images of a 58-year-old female and E/F) a 27-year-old male



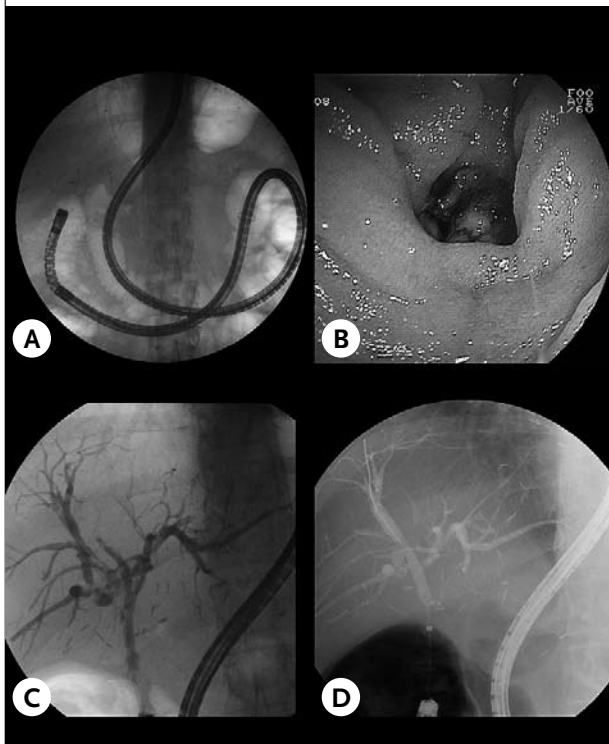
A) Endoscopic view of the jejunojejunal anastomosis. B) Endoscopic view of the opening of the hepaticojejunostomy, which appears normal. C) Fluoroscopic image of the endoscope and overtube advanced into the Roux limb. D) Cholangiography with inflated CRE balloon showing diffuse stricturing and dilation of biliary branches consistent with sclerosing cholangitis. E) Endoscopic view of the opening of the hepaticojejunostomy, which appears stenotic. F) Endoscopic view of an inflated balloon catheter in the opening of the hepaticojejunostomy.

radial expansion (CRE) balloon (Boston Scientific, Galway, Ireland), inflated in the biliodigestive anastomosis, showed diffuse intrahepatic strictures and dilation of biliary branches, consistent with sclerosing cholangitis (*figure 2D*). The abnormalities were considered unsuitable for endoscopic therapy. Given these findings and the endoscopically proven patency of the hepaticojejunostomy, the patient was listed for liver transplantation.

Case report 2, a 27-year-old male, was born with biliary atresia, for which a hepatoportoenterostomy, also known as Kasai procedure, was performed. At the age of 4, OLT was carried out, with a hepaticojejunostomy with Roux-en-Y reconstruction. For more than 20 years, follow-up was uneventful. He then developed cholestatic liver function tests. Abdominal ultrasonography revealed no abnormalities. A liver biopsy was performed showing signs of cholestatic disease, but no signs of rejection. An MRCP was performed, showing filling defects at the site of the central biliary branches. A DBE was performed, during which the Roux limb was accessed until the hepaticojejunostomy came into sight. The anastomosis appeared stenotic (*figure 2E*). Cholangiography, using an inflated 8 mm dilation balloon (Cook, Limerick, Ireland), showed numerous filling defects above the stenosis, suggestive of bile duct stones (*figure 2F*). Unfortunately, it was not possible to pass a guidewire through the anastomosis to perform balloon dilation or stone removal. The patient was therefore referred for surgery. Laparotomy revealed multiple biliary stones located just above a fibrotic hepaticojejunostomy. The bile ducts were cleared and a new hepaticojejunostomy was created. Following surgery, the liver function abnormalities gradually disappeared.

Case report 3, a 50-year-old male, underwent OLT for recurrent cholangitis in primary sclerosing cholangitis. A hepaticojejunostomy with Roux-en-Y reconstruction was carried out. Just six weeks after OLT, he developed severe cholangitis. An MRCP was performed which showed filling defects in the central biliary branches and suspicion of bile casts at the site of the hepaticojejunostomy. A DBE was performed seven weeks after OLT. Access into the Roux limb was obtained (*figure 3A*). At the hepaticojejunostomy, an obstructing bile cast was seen (*figure 3B*), which was removed with a biopsy forceps. The opening of the hepaticojejunostomy appeared small. Cholangiography using an inflated 8 mm CRE balloon showed filling defects in the distal biliary tree and several strictures of intrahepatic biliary branches (*figure 3C*). Balloon dilation with the 8 mm CRE balloon was performed for the hepaticojejunostomy and a few intrahepatic strictures (*figure 3D*). Not all strictures were treated as it was not possible to pass a guidewire through some strictures. The procedure was complicated by an *E. coli* bacteraemia

Figure 3. Images of a 50-year-old male



A) Fluoroscopic image of the endoscope advanced into the Roux limb. B) Endoscopic image of a hepaticojejunostomy obstructed by bile casts. C) Cholangiography showing irregular central bile ducts. D) Fluoroscopic image of balloon dilation of the right hepatic duct using an 8 mm CRE balloon.

the day after the procedure, probably due the extensive manipulation in the biliary system, which was successfully treated with antibiotics. Six weeks after the first procedure, a second DB-ERCP was performed, with additional dilation of biliary strictures. This procedure had an uncomplicated course.

DISCUSSION

This report illustrates the possibilities to diagnose and treat biliary abnormalities using double balloon enteroscopy in patients after surgery resulting in altered small bowel anatomy. In all of the three cases presented here, access to the Roux limb was obtained and a diagnostic cholangiography carried out, and therapeutic interventions were performed in one patient (*table 1*). These results are in line with recent reports that demonstrated the safety and feasibility of the DBE procedure for this indication. The DBE procedure, introduced in 2001, is based on the combined use of a balloon-loaded enteroscope and a similarly balloon-loaded overtube.⁵ The enteroscope has a working length of 200 cm and an outer diameter of 8.5 mm. The 12-mm-diameter overtube has a length of 140 cm. Alternately inflating and deflating the two

Table 1. Summary of four DB-ERCP procedures in three patients with a Roux-en-Y reconstruction

Case	Anatomy	Access into Roux limb	Diagnostic cholangiography	Therapeutic intervention	Complications
1	Roux-en-Y hepaticojejunostomy	Yes	Yes	Considered not indicated	None
2	OLT with a Roux-en-Y hepaticojejunostomy	Yes	Yes	Not possible	None
3*	OLT with a Roux-en-Y hepaticojejunostomy	Yes	Yes	Balloon dilation; cast removal	Bacteraemia
		Yes	Yes	Balloon dilation	None

OLT = orthotopic liver transplantation; *patient underwent two DB-ERCP procedures.

balloons and straightening the endoscope with the overtube achieves a stepwise progression of the enteroscope throughout the small intestine.⁵ There are two available DBE scopes: a diagnostic scope (EN-450P5, Fujinon Corp, Saitama, Japan) which has a working channel diameter of 2.0 mm, and a therapeutic scope (EN-450T5, Fujinon), with a 2.8 mm diameter working channel. Both endoscopes have a length of 200 cm. DBE has revolutionised the ability to visualise the small bowel. Currently available in 14 hospitals in the Netherlands, DBE is now routinely applied for the diagnosis and therapy of small bowel pathology, and to perform colonoscopy in patients with previously failed colonoscopy.^{6,7} The DBE technique allows endoscopic interventions such as mucosal biopsy, argon plasma coagulation, polypectomy, injection therapy and balloon dilation.^{6,7} Relative limitations of the technique are that DBE is an invasive and time-consuming procedure. The risk of complications is low, especially for diagnostic DBE procedures. In a recent survey, reporting on 2362 DBE procedures, the complication rate of diagnostic DBE procedures was 0.8% and that of therapeutic DBE procedures 4.3%.⁸

As illustrated in this report, the DBE technique can also be used in patients with altered small intestinal anatomy. A few aspects of the technique in this setting deserve attention. First, as it is important in patients with a Roux-en-Y reconstruction to recognise the jejunojejunal anastomosis and determine the limb that needs to be accessed, the procedure is best performed under fluoroscopic control, while DBE procedures for other indications are generally not performed under fluoroscopy. If the enteroscope is at the desired position in the Roux limb, the overtube should be advanced just behind the enteroscope, to fix the overtube and allow the enteroscope to approach the biliary system as flexibly as possible. Access to a hepaticojejunostomy is probably easier than a native major papilla given the fact that the endoscope is forward viewing and the straight angle with which accessories can be advanced. The endoscopic aspect of a hepaticojejunostomy can instantly be assessed, for example to determine whether an anastomotic stricture is present.

In this series, all four procedures were performed under fluoroscopic control with the patient placed in the prone position. In all procedures, the therapeutic double balloon endoscope was used. Three procedures were performed using conscious sedation, one under general anaesthesia. Antibiotics were routinely given prior to the procedure to diminish the risk of cholangitis as a consequence of instrumental manipulation. Apart from one case of post-procedure bacteraemia, there were no complications. An important issue is that of the accessories that can be used with this type of scope. There is a limited availability of suitable equipment, as all accessories have to be of sufficient length. Unfortunately for double balloon endoscopists, there is a current trend in ERCP equipment to develop shorter rather than longer accessories.⁹ Available accessories of sufficient length that can be used for DBE are guidewires, biopsy forceps, dilation balloons (CRE balloon catheter, Boston Scientific; biliary balloon dilation catheters, Cook), snares and argon plasma coagulator probes. At present, there is a lack of needle knives, sphincterotomes, extraction balloons, lithotripsy devices and retrieval baskets customised for the DBE system. In my view, cannulation and cholangiography with DBE in patients with a hepaticojejunostomy are best achieved with a CRE balloon. CRE balloons are available in many diameters (6-8 mm, 8-10 mm etcetera up to 18-20 mm), which can all be inserted through the working channel of the therapeutic DBE scope.

Recently, several others have reported their experience with the use of DBE in patients with a Roux-en-Y reconstruction.^{1,10-16} A review of these studies, updated until March 2008, is summarised in *table 2*. In total, data are available on 40 patients (age range 2 to 81 years). In 90% of patients (36/40), access into the Roux limb was obtained. A diagnosis was made in 80% of cases (32/40), based on findings of cholangiography and direct visualisation of the biliodigestive anastomosis. In those patients in whom therapeutic interventions were attempted, ERCP was successful in 77% of cases (20/26). Interventions such as balloon dilation, biliary stent placement, biliary stone extraction and pancreatic duct interventions have proved

Table 2. Overview of reports on DB-ERCP in patients with a Roux-en-Y reconstruction

Author, reference	n	Age	Type of surgery	Type of intervention
Haruta, 10	1	7	OLT with Roux-en-Y jejunojejunostomy and choledochojejunostomy	Repeated balloon dilation of stenotic hepaticojejunostomy
Mehdizadeh, 11	7	No data available	Postcholecystectomy Roux-en-Y hepaticojejunostomy	Balloon dilation of stenotic hepaticojejunostomy
Emmett, 12	14	27-73	Various (mostly Roux-en-Y gastric bypass and Whipple with pancreaticojejunostomy)	Balloon dilation; sphincterotomy; biliary stent placement; pancreatic stent placement and removal
Moreels, 13	1	72	Roux-en-Y hepaticojejunostomy	Balloon dilation of stenotic hepaticojejunostomy; biliary stent placement
Spahn, 14	1	34	Roux-en-Y hepaticojejunostomy	Balloon dilation of stenotic hepaticojejunostomy and stone removal
Chu, 15	1	79	Roux-en-Y gastrojejunostomy	Sphincterotomy and stone removal
Monkemuller, 16	2	58-60	Roux-en-Y gastrojejunostomy Pylorus-preserving pancreaticoduodenectomy with Roux-en-Y hepaticojejunostomy	Biliary stent placement and removal; balloon dilation of stenotic hepaticojejunostomy
Aabakken, 1	13	2-81	Various (mostly OLT with Roux-en-Y jejunojejunostomy and hepaticojejunostomy)	Biliary stent placement and removal; stone removal

OLT = orthotopic liver transplantation.

to be technically possible. Serious complications were not encountered in any of the reports. As such, the risk of complications using DBE for ERCP seems to be lower than that of percutaneous transhepatic biliary interventions, which is estimated to be around 5%.¹⁷

CONCLUSION

Double balloon enteroscopy has allowed endoscopists to access intestinal areas which until recently were inaccessible with the conventional endoscopes. Even after surgical procedures such as a Roux-en-Y reconstruction, diagnostic and therapeutic endoscopic interventions are feasible and safe. In Roux-en-Y patients with a suspected stricture of a hepaticojejunostomy or suspected choledocholithiasis, DB-ERCP should strongly be considered. The value of the procedure could further be improved by expanding the currently limited availability of adapted accessories.

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