

## Comparison of side-viewing duodenoscope and single-balloon enteroscope to perform ERCP in patients with Billroth II gastrectomy.

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### Abstract

Endoscopic retrograde cholangiopancreatography (ERCP) in Billroth II patients is challenging and different endoscopes can be used. We retrospectively analysed 67 ERCP procedures in 38 Billroth II patients focussing on endoscope type and respective technical success and adverse event rate. 33 (49.2 %) ERCPs were performed using a duodenoscope, 87.9 % were successful and 3 were completed with the single-balloon enteroscope. 28 (41.8 %) ERCPs were performed with the single-balloon enteroscope, 82.1 % were successful and 2 were completed with a paediatric colonoscope. For 6 (9.0 %) ERCPs a paediatric colonoscope was used but only 3 (50.0 %) were successful. Overall technical success rate was 82.1 % without difference between the success rate of the duodenoscope and the single-balloon enteroscope. Overall adverse event rate was 10.5 %: 6.1 % duodenoscope, 10.7 % single-balloon enteroscope, 33.3 % paediatric colonoscope. The duodenoscope allowed all conventional ERCP procedures, whereas the single-balloon enteroscope required dedicated ERCP catheters and did not allow metallic stent placement. However, the single-balloon enteroscope facilitated access to the papilla and sphincteroplasty allowed direct cholangioscopy. ERCP indications were bile duct stones (53.7 %), cholangitis (20.9 %), chronic pancreatitis (20.9 %), pancreatic cancer (1.5 %) and liver transplantation (3%).

Therapeutic ERCP success rate is high in patients with Billroth II gastrectomy using either a conventional duodenoscope or the single-balloon enteroscope, with an acceptable and comparable adverse event rate. The choice of endoscope may depend on local experience, post-operative anatomy and therapeutic indication. (*Acta gastroenterol. belg.*, 2017, 80, 493-497).

**Key words :** Billroth II gastrectomy, ERCP, duodenoscope, single-balloon enteroscope.

### Introduction

Billroth II partial gastrectomy is indicated to treat cancer of the distal stomach, or less frequently as a surgical treatment of complicated benign peptic ulcer disease (1). The surgical procedure consists of a distal gastric resection with closure of the gastric and duodenal stumps and the reconstruction of an ante- or retrocolic anterior gastrojejunostomy with an afferent and an efferent limb (1). The afferent limb drains the biliary and pancreatic ducts through Vater's papilla in the proximally closed duodenum. However, this surgical reconstruction excludes the normal transpyloric access to Vater's papilla with an endoscope (2).

Endoscopic retrograde cholangiopancreatography (ERCP) is an endoscopic procedure enabling direct access to the biliary and/or pancreatic ducts through Vater's papilla located in the vertical part of the duodenum. It

allows both diagnostic and therapeutic biliopancreatic endoscopic interventions. However, due to the risk of ERCP-related adverse events, indications are nowadays mainly therapeutic (3). Safer diagnostic alternatives are endoscopic ultrasound and magnetic resonance imaging of the biliopancreatic system (3).

A side-viewing duodenoscope with an elevator is used to reach Vater's papilla and to perform ERCP in patients with normal anatomy (4). However, in patients with altered anatomy, the access to Vater's papilla using a duodenoscope can become very difficult or even impossible (2). Recent recommendations of the European Society of Gastrointestinal Endoscopy (ESGE) suggest that ERCP in patients with Billroth II gastrectomy is challenging and should be performed in a tertiary referral center, using a side-viewing duodenoscope as a first option, and a forward viewing endoscope (gastroscope, colonoscope or device-assisted enteroscopy) as a second option (4). The insertion of a duodenoscope into the afferent limb is difficult, and success rate depends on the length of the limb. However, once in front of the papilla, a side-viewing duodenoscope with elevator facilitates cannulation of the biliopancreatic system. A forward viewing endoscope is easier to insert into the afferent limb up to the papilla, but its cannulation is more challenging (5). Although ESGE recommends the use of a side-viewing duodenoscope to perform ERCP in Billroth II patients, this recommendation is weak and based on low quality evidence (4). We performed a retrospective analysis of the endoscopes used to perform ERCP in patients with Billroth II altered anatomy.

### Aim of the study

We compared the efficacy and adverse events of the side-viewing duodenoscope and the forward viewing single-balloon enteroscope (SBE) when used to perform ERCP in patients with Billroth II gastrectomy.

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## Materials and methods

The endoscopic database of 2 Belgian university hospitals (Universitair Ziekenhuis Antwerpen and Cliniques universitaires Saint-Luc) was searched for ERCP procedures in Billroth II patients from 2006 to 2015. A retrospective chart review was performed. Patient characteristics, ERCP indication, success rate and adverse events were collected. Unsuccessful ERCP attempts were also collected. Special interest was given to the type of endoscope used. The choice of endoscope was left at the endoscopist's discretion and was changed whenever deemed necessary to complete the ERCP procedure. When an ERCP was started with one endoscope and completed with another, it was counted as two procedures, the first being a failure and the second being successful. In total, three types of endoscopes were used: side-viewing duodenoscope, single-balloon enteroscope and paediatric colonoscope. Conventional commercially available ERCP catheters (cannulation catheter, sphincterotome, extraction balloon, retrieval basket) and stents (plastic and metallic) were used with the side-viewing duodenoscope. However, the single-balloon enteroscope is not compatible with these catheters and stents because of a length and diameter mismatch. The following Olympus prototype catheters were used when performing ERCP with the single-balloon enteroscope: cannulation catheter (PR-Y0001), sphincterotome (KD-Y0005), extraction balloon (B-Y0003), retrieval basket (FG-Y0003) and stent pusher (MAJ-Y0025-1). Single-balloon enteroscope does not allow the short guidewire technique and only plastic stents up to 7 Fr can be inserted through the accessory channel. Statistical analysis was performed using the Chi-square test to compare ERCP success rate and adverse events related to the type of endoscope. P-values <0.05 were considered to be statistically significant. All patients signed an informed consent document to undergo ERCP, and all procedures were performed according to good clinical practice guidelines.

## Results

A total of 38 Billroth II patients underwent 67 ERCP procedures. The male / female ratio was 21/17 (55.3/44.7 %) with a mean age of 73.7±2.4 years and 73.9±1.9 years respectively, ranging from 48 to 91 years. All patients underwent ERCP under general anaesthesia with endotracheal intubation in the supine or the prone position. ERCP indications were treatment of common bile duct stones (53.7 %), cholangitis (20.9 %), treatment of chronic pancreatitis (20.9 %), treatment of pancreatic head cancer (1.5 %) and diagnostic cholangiography after liver transplantation (3.0 %). Analysis of the type of endoscope showed that 33 (49.2 %) ERCP procedures were performed using a side-viewing duodenoscope (Olympus TJF-140R, TJF-145, TJF-160R, TJF-160VR, TJF-Q180V), 28 (41.8 %) using a 200 cm long single-

balloon enteroscope (Olympus SIF-Q180, SIF-Y0011) and 6 (9.0 %) using a paediatric colonoscope (Olympus PCF-H180, PCF-H190L). Table 1 shows that the side-viewing duodenoscope was chosen as the initial endoscope in 47.8 % of the procedures and only in 1.5 % as a second line rescue endoscope, whereas the single-balloon enteroscope was chosen in 34.3 % to start the ERCP procedure and in 7.5 % as a rescue endoscope. The paediatric colonoscope was only rarely used. Switching from one endoscope to another was deemed necessary in 3 out of 32 (9.4 %) procedures starting

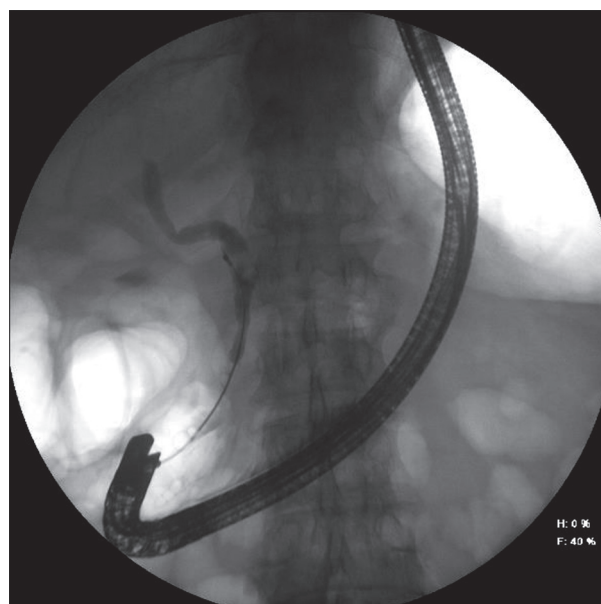


Figure 1. — Fluoroscopic ERCP image using a side-viewing duodenoscope in a Billroth II patient.

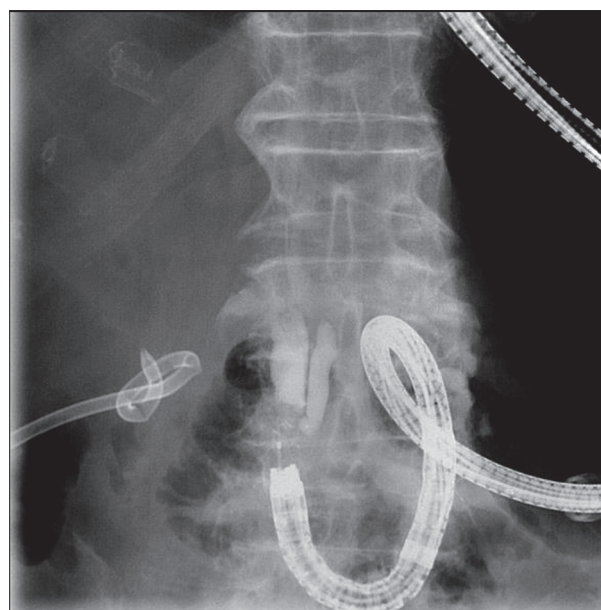


Figure 2. — Fluoroscopic ERCP image using a single-balloon enteroscope in a Billroth II patient with a long and tortuous afferent limb.

Table 1. — Types of endoscopes used for ERCP in patients with Billroth II gastrectomy

	Duodenoscope	Single-balloon enteroscope	Paediatric colonoscope	Total
Number of procedures N (% of total ERCPs)	33 (49.2 %)	28 (41.8 %)	6 (9.0 %)	67 (100 %)
Initial choice N (% of total ERCPs)	32 (47.8 %)	23 (34.3 %)	4 (6.0 %)	
Second choice N (% of total ERCPs)	1 (1.5 %)	5 (7.5 %)	2 (3.0 %)	
Replacement need N (% of initial choice) P vs. duodenoscope	3 (9.4 %)	2 (8.7 %) P=0.9311	3 (75.0 %) <b>P = 0.0090</b>	
Technical success N (% of procedures) P vs. duodenoscope	29 (87.9 %)	23 (82.1 %) P=0.7601	3 (50.0 %) <b>P = 0.0261</b>	55 (82.1 %)
Adverse events N (% of procedures) P vs. duodenoscope	2 (6.1 %)	3 (10.7 %) P=0.5091	2 (33.3 %) <b>P = 0.0429</b>	7 (10.5 %)

Statistical analysis using Chi-square test.

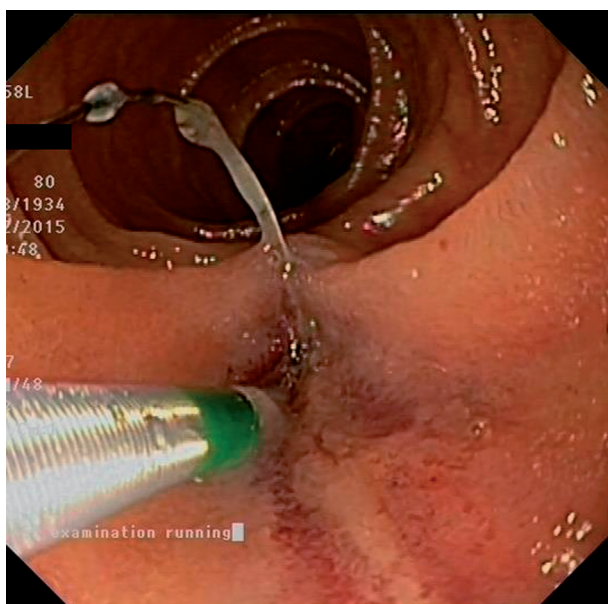


Figure 3. — Endoscopic image of a biliary sphincterotomy using a single-balloon enteroscope in a Billroth II patient.

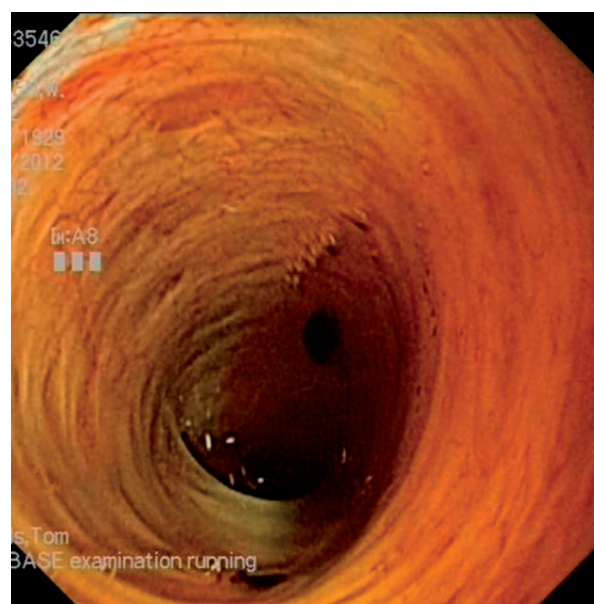


Figure 4. — Endoscopic image of direct cholangioscopy with a single-balloon enteroscope in a Billroth II patient.

with a duodenoscope. Failure to reach the papilla was the only reason why the duodenoscope was replaced by the single-balloon enteroscope to reach the papilla and to complete the ERCP. In 2 out of 23 (8.7 %) cases the single-balloon enteroscope was replaced by a paediatric colonoscope to allow the use of shorter ERCP catheters. The paediatric colonoscope was replaced in 3 out of 4 (75.0 %) cases. The single-balloon enteroscope was used to reach the papilla in 2 cases, and a duodenoscope was used in 1 case for the placement of a 10 Fr plastic stent in the common bile duct. Technical success to complete the ERCP was 87.9 % when using a duodenoscope, which was not significantly different from 82.1 % when using a single-balloon enteroscope ( $P=0.7601$  Chi-square) (Figs. 1 and 2). However, ERCP success rate was significantly

decreased to only 50.0 % with a paediatric colonoscope ( $P=0.0261$  Chi-square). Overall technical success rate was 82.1 %, irrespective of the type of endoscope used.

The use of a duodenoscope allowed complete sphincterotomy and both plastic and metallic stent placement. The use of the single-balloon enteroscope often needed to combine sphincterotomy with additional sphincteroplasty (8-16 mm) since the enteroscope lacks an elevator to steer the sphincterotomy direction (Fig. 3). Moreover, only 7 Fr plastic stent placement was possible with the enteroscope's 2.8 mm working channel diameter. However, the forward-viewing enteroscope allowed easy access to the papilla in the often tortuous afferent limb and sphincteroplasty even allowed direct cholangioscopy with the enteroscope (Fig. 4). As compared to the entero-



scope, the paediatric colonoscope was more difficult to handle and led to more severe adverse events.

Table 1 shows the serious adverse event rate of the 3 endoscope types used to perform ERCP in patients with Billroth II gastrectomy. Overall serious adverse event rate was 10.5 % (7 out of 67 procedures), with 6.1 % (2/33) using a duodenoscope, 10.7 % (3/28) using the single-balloon enteroscope and 33.3 % (2/6) using a paediatric colonoscope. In the duodenoscope group 1 case of post-ERCP pancreatitis was encountered and 1 case of atrial fibrillation during the ERCP. In the single-balloon enteroscope group we encountered 2 cases of post-ERCP pancreatitis and 1 case of liver capsule dehiscence and contrast leakage due to deep and traumatic guidewire insertion. All patients recovered from the adverse events with only conservative measures. Serious adverse events were more common up to 33.3 % ( $P = 0.0429$  Chi square) when using the paediatric colonoscope, with another case of capsule dehiscence and intra-abdominal contrast medium leakage, which finally resulted in sepsis and death of the patient.

## Discussion

ERCP in patients with altered anatomy is challenging and usually requires device-assisted enteroscopy to reach the biliopancreatic system (2). However, the afferent limb with the intact Vater's papilla after Billroth II partial gastrectomy can be reached with a conventional side-viewing duodenoscope in the majority of the cases, and therefore, ESGE suggests the use of a duodenoscope to perform ERCP in Billroth II gastrectomy patients, whereas others are in favour of device-assisted enteroscopy (4,6). Although the advantages of the side-viewing duodenoscope to perform ERCP are well-known, the intubation of the sometimes long and tortuous afferent limb is challenging with an increased perforation risk (4,7). ERCP using a forward viewing endoscope is an alternative to the side-viewing duodenoscope in patients with Billroth II altered anatomy (8,9). The use of a gastroscope, colonoscope or device-assisted enteroscope has been shown to be useful to perform ERCP in Billroth II patients. Irrespective of the type of endoscope used, overall ERCP success rate in Billroth II patients is lower (<85%) as compared to patients with normal anatomy (4,7). In the current study, ERCP success rate was 82.1 %, which is comparable with previous retrospective studies (8,10,11).

The majority of ERCP procedures was initiated with a side-viewing duodenoscope (47.8 %), and the single-balloon enteroscope was chosen as the initial endoscope in 34.3 % of the procedures. Due to the retrospective nature of this study, there was no randomisation to one endoscope or another. The choice of endoscope was at the endoscopist's discretion and mainly relied on personal experience. The advantage of the side-viewing duodenoscope is the easier cannulation of the papilla and a well-controlled sphincterotomy thanks to the elevator,

and a shorter (124 cm) and wider accessory channel (4.2 mm) allowing all conventional ERCP catheters and stents to be used. However, insertion of the duodenoscope across the gastrojejunostomy into the afferent limb up to the papilla is difficult with an increased risk of intestinal perforation. The advantage of a forward viewing endoscope is the easier access to the papilla, even in Billroth II patients with a long and tortuous afferent limb, and the possibility of performing direct cholangioscopy when indicated. However, the lack of oblique view and an elevator renders papillary cannulation more difficult. Moreover, the longer and smaller accessory channel excludes some ERCP catheters and stents. The use of a balloon-loaded overtube (single- and double-balloon enteroscopy) facilitates endoscope insertion into a long and tortuous afferent limb and increases endoscope tip stability for the cannulation of the papilla. Based on these technical aspects, it is suggested to use a side-viewing duodenoscope in Billroth II patients, and only to replace it by a device-assisted forward viewing endoscope in case of failure (4).

In the current study, technical ERCP success rate was highest (87.9 %) when using a duodenoscope. The duodenoscope needed to be replaced by a single-balloon enteroscope in only 3 patients (or 9.1 % of the ERCP procedures initiated with a duodenoscope) to complete the procedure, illustrating the good feasibility of a side-viewing duodenoscope in Billroth II patients. The 3 duodenoscope failures were due to the inability to reach the papilla. The single-balloon enteroscope was used as the initial endoscope in 34.3 % of the procedures with a technical success ratio of 82.1 %, and was replaced by a shorter paediatric colonoscope in 2 procedures (or 7.1 % of the ERCP procedures initiated with the single-balloon enteroscope) because of the colonoscope's shorter and wider accessory channel. These results show that the single-balloon enteroscope is probably as efficacious as the duodenoscope to perform ERCP in Billroth II patients in experienced hands and when dedicated accessory catheters are available. Future developments may facilitate ERCP in Billroth II patients using a single-balloon enteroscope: a distal cap helps to cannulate the papilla, a shorter single-balloon enteroscope allows the use of conventional ERCP catheters, a wider accessory channel allows the introduction of larger stents (12,13). Other alternatives encompass the use of a double channel gastroscope and the use of the isolated-tip needle-knife sphincterotome (14,15).

Serious adverse events were encountered in 6.1 % using a side-viewing duodenoscope, 10.7 % using a single-balloon enteroscope and 33.3 % using a paediatric colonoscope. All adverse events but one were treated conservatively. The one patient who needed surgical intervention and finally deceased because of sepsis underwent ERCP using a paediatric colonoscope with room air insufflation. A sphincterotomy and sphincteroplasty up to 16 mm was performed to retrieve a large common bile duct stone. The sphincteroplasty

also allowed direct cholangioscopy with the paediatric colonoscope. Direct cholangioscopy is particularly useful in case of biliary stones difficult to retrieve. However, air insufflation into the biliary tree resulted in a barotrauma and rupture of the liver capsule. Consequent contrast medium injection lead to intraperitoneal collection and free abdominal air. Direct cholangioscopy using a forward viewing endoscope should therefore only be done with minimal insufflation using CO<sub>2</sub> (5).

### Conclusion

ERCP in patients with altered anatomy is known to be challenging. In patients with Billroth II anatomy, challenges are represented by the intubation of the gastrojejunostomy, the length of the afferent limb and the cannulation of the intact papilla. We showed that the technical ERCP success rate is high and adverse event rate is acceptable in patients with Billroth II gastrectomy using either a conventional duodenoscope or the single-balloon enteroscope.

However, the use of a paediatric colonoscope was less successful. We therefore suggest to follow the ESGE guidelines stating that the side-viewing duodenoscope is probably the best endoscope to start ERCP in Billroth II patients, and it can be replaced by a device-assisted enteroscope if deemed necessary. Both endoscopes have their specific advantages and disadvantages to perform ERCP in patients with Billroth II gastrectomy and the endoscope choice may depend on the endoscopist's experience, the post-operative anatomy and the therapeutic indication.

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