

## TECHNICAL REPORT

# Biliary access in technically difficult biliary cannulation: the mucosal bridge technique

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## Abstract

**Background:** The use of precut sphincterotomy during endoscopic retrograde cholangiopancreatography (ERCP) facilitates selective bile duct access in difficult procedures. However, it is also associated with high rates of complications. Several techniques for precut sphincterotomy have been described in the literature. This paper reports our experience with a non-needle-knife technique for precut sphincterotomy, namely, the mucosal bridge technique.

**Methods:** We analysed the experience of a single surgical endoscopist at our centre in performing precut sphincterotomies by retrospectively examining information in the database for January 2002 to February 2008, which had been stored prospectively using Endoscribe.

**Results:** The mucosal bridge technique was performed in 16 (3.19%) of 501 patients. Success rates were 75% and 100% after first and second ERCPs, respectively. The failure of initial procedures was caused by bleeding, tissue oedema, poorly visualized papilla or a poorly distensible duodenum and oedematous papilla. There were four cases of complications, which included periductular extravasation of contrast, bleeding, and sepsis in two patients. However, these complications were not a direct consequence of the precut sphincterotomy.

**Conclusions:** The mucosal bridge technique can be used to increase the likelihood of successful bile duct cannulation, thus preventing the need for a second intervention.

## Keywords

ERCP, difficult biliary cannulation, non-needle-knife precut sphincterotomy

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## Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) with selective bile or pancreatic duct cannulation can be one of the most difficult gastrointestinal endoscopic procedures. However, it is a vital and prerequisite intervention in the treatment of cholangitis, benign or carcinomatous obstruction of the biliary system and biliary leaks.<sup>1</sup> Average complication rates of 5% to 10% and procedure-related mortality of 0.3% to 1% have been reported.<sup>2,3</sup> Failed attempts at cannulation of the papilla may traumatize it, thus increasing the complication rate, as may intramucosal injection and repeated pancreatic duct cannulation. These complications are caused by futile and repetitious attempted cannulation of the papilla which perpetrates trauma

to the papilla, intramucosal injection and repeated inadvertent pancreatic duct cannulation. Early and precut sphincterotomy – either needle-knife or non-needle-knife – may abort this vicious cycle when initial attempts at selective bile duct cannulation have failed.

Various precut techniques have been pioneered since the procedure was first introduced by Siegel.<sup>4</sup> Desilets and Howell divided precut techniques into two broad groups: needle-knife and non-needle-knife.<sup>5</sup> Some authors tend to refer to precut as needle-knife sphincterotomy as it is the most commonly used technique to date. However, non-needle-knife techniques are becoming more common. We present our experience with another non-needle-knife technique performed by an experienced endoscopist at our centre, namely, the mucosal bridge technique.<sup>6</sup> Herein, we report

the use of this technique for gaining access to the common bile duct (CBD) and its medium-term outcomes.

## Patients

We retrospectively examined data in the Royal Adelaide Hospital ERCP database which had been prospectively stored using Endoscribe (Version 2.25.05; Mediboss Pty Ltd, Adelaide, SA, Australia). Data pertaining to precut sphincterotomies performed by a single surgical endoscopist (CSW) from January 2002 to February 2008 were analysed. Patients who underwent ERCPs included inpatients, outpatients and emergency cases. We also examined the records of patients who had undergone failed procedures.

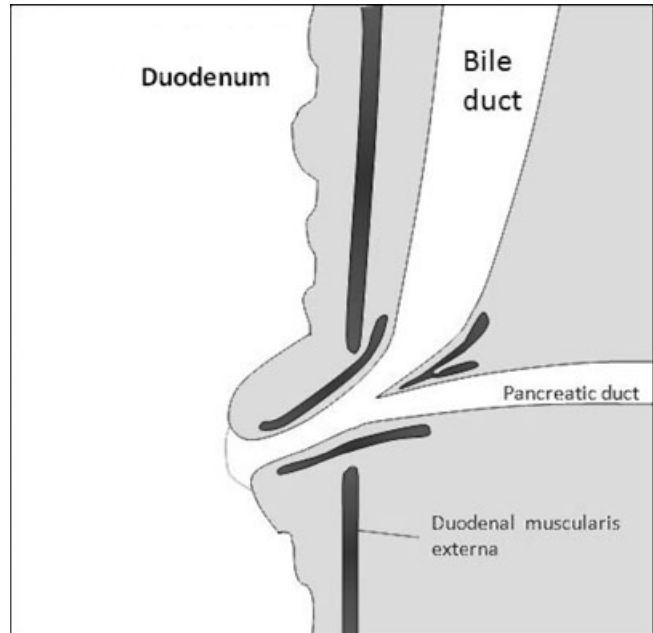
A total of 501 ERCPs were performed at our institution by the surgical endoscopist between January 2002 and February 2008. Of these 501 procedures, 16 precut sphincterotomies using the mucosal bridge technique were performed, thus giving us a precut rate of 3.19%. Success rates for the 16 cases were 75% after the first ERCP and 100% after the second.

## Materials and methods

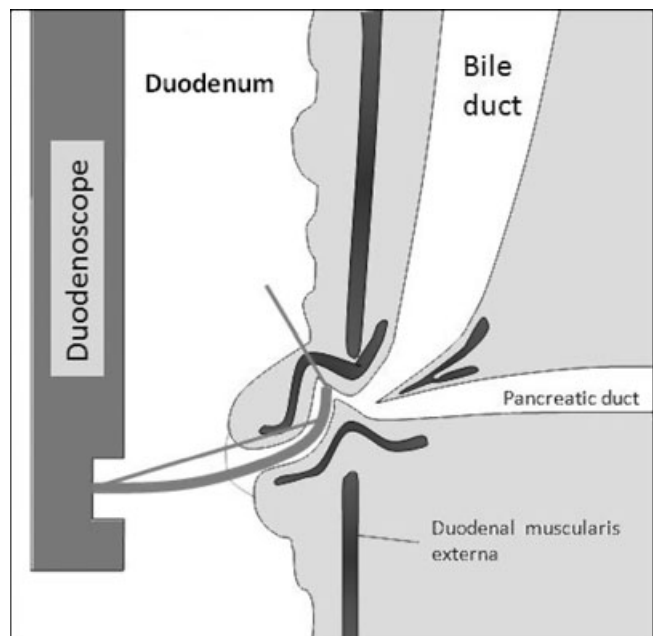
Informed consent was obtained for the ERCP in all patients. All patients received topical pharyngeal anaesthesia (Xylocaine spray; Astra GmbH, Wedel, Germany) and intravenous conscious sedation. Selective cannulation of the CBD was attempted with a standard wire-guided sphincterotome and a 0.035-inch guidewire using either an Olympus TJF 140 or an Olympus TJF 160 duodenoscope. Initial attempts at cannulation were made by the hepatobiliary pancreatic surgical fellow-in-training for no more than two to three well-placed attempts. If unsuccessful, the procedure was continued by the senior endoscopist. If initial CBD cannulation was still unsuccessful, alternative techniques were adopted.

The sphincterotome tip is curved acutely towards the 10-to-12 o'clock position to create a sharp angle in the sphincteric segment (Figs 1 and 2). A double-lumen sphincterotome (5 Fr) with a 5-mm tip and 20–25 mm wire (monofilament) was used. The guidewire (Hydra Jagwire® 0.035 in × 450 cm; Boston Scientific Corp., Natick, MA, USA) was left pushed through the sphincteric segment at an angle into the submucosal tissue and preferably through the mucosa so that the wire re-entered the duodenal lumen. The rationale for this is that if the wire is submucosal or has re-entered the duodenal lumen, it must be on the luminal side of the duodenal muscularis externa and transmural perforation will not be possible given the division of the so-formed mucosal and sphincteric bridge of tissue. The bile duct can then be entered via a straight route through the remaining sphincteric segment without being restricted by a sharply angled sphincter or intervening mucosal septum or false passage. (A false passage is often formed with passage of the sphincterotome if the ampulla has been ulcerated or inflamed by a calculus.)

If, while probing the papilla, the guidewire advanced into the submucosal plane in the desired direction of 10-to-11 o'clock, this tract was deroofed with the sphincterotome to allow visualization



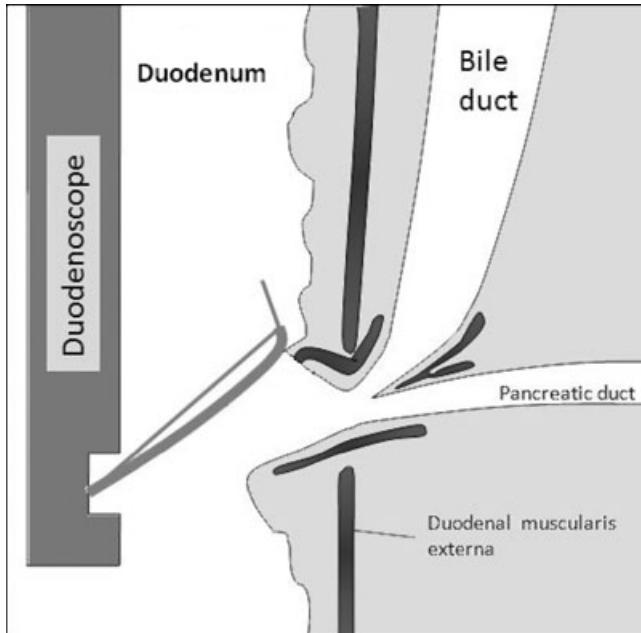
**Figure 1** Normal anatomy with common channel



**Figure 2** Guidewire passage into duodenal lumen creating a mucosal bridge through an acutely angulated sphincteric segment

and cannulation of the biliary orifice (Fig. 3). The sphincterotomy was then completed with the standard traction sphincterotome and an ERBE ICC 200 generator (set on 60 cut/30 coagulation Endocut on effect 3, Autocoag 'Forced'). Selective coagulation was used only for localized bleeding points.

In 16 patients, the mucosal bridge technique was performed with a cannulotome and guidewire to deroof the papilla. In five



**Figure 3** Division of the mucosal and sphincteric bridge, creating a straight route into the common bile duct

**Table 1** Reasons for abandoning endoscopic retrograde cholangiopancreatography

Excessive sedation requirement	1
Hypoxia	2
Duodenal stenosis	1
Large gastric residue	5
Perivaterian diverticulum	2
Billroth II operation	2

patients, needle-knife precut sphincterotomy was performed, over impacted ampullary calculi in two cases and over previously placed stents in three.

## Results

Of the 501 cases, the ERCP procedure was abandoned in 13 cases (2.6%) for various reasons (Table 1).

Of the 16 patients who underwent the mucosal bridge precut, 12 were successful at first ERCP (Table 2). Four were initially unsuccessful as a result of bleeding, tissue oedema, poorly visualized papilla or a poorly distensible duodenum and oedematous papilla, respectively. Success was achieved in all four patients at a second attempt carried out 1–12 weeks later. The final diagnoses are shown in Table 2.

Four patients suffered complications. One had periductular extravasation of contrast with post-procedural abdominal pain, which resolved with 7 days of antibiotics. Recovery was otherwise unremarkable as the patient remained stable and liver function

**Table 2** Mucosal bridge precut sphincterotomy

Successful at CBD cannulation	
• First ERCP	12
• Second ERCP	4
Final diagnoses	
• CBD stones	5
• Biliary pancreatitis	1
• Distal CBD stricture	3
• Possible stone passage	2
• Possible SOD	3
• Other*	2
Complications	
• Pancreatitis	0
• Periductular extravasation of contrast	1
• Bleeding	
○ Requiring termination of procedure	1
○ Minor bleeding	9
• Cholangitis	2

CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography; SOD, sphincter of Oddi dysfunction

\*‘Other’ alludes to one patient with a stricture at choledochojejunostomy and another with possible ampullary stenosis or microlithiasis causing cholangitis

tests and lipase slowly normalized. The problem was probably related to the transmural ulceration of the lower bile duct by an impacted stone. Another patient had bleeding that led to the termination of the procedure despite adrenaline injection submucosally. Two patients had post-ERCP sepsis secondary to residually obstructed biliary systems, which was controlled with antibiotics. In addition, nine patients had bleeding which settled spontaneously, allowing the procedure to be completed after lavage.

## Discussion

This report documents our experience with a novel technique for performing precut endoscopic sphincterotomy. This involves the creation of a mucosal bridge which is subsequently divided to facilitate bile duct cannulation. There have been other recent publications on this technique.<sup>6,7</sup> This paper reports our experience during a period that overlaps with those reported in these other studies. Our technique evolved from what was initially the inadvertent creation of a duodenal submucosal false passage. Knowledge of the histological anatomy of the perisphincteric region led us to believe that dividing the consequent bridge of duodenal mucosa and distal sphincter of Oddi’s musculature was not likely to cause problems. More probably, it would facilitate subsequent bile duct cannulation by resolving the problems related to the angulation of the ampulla and would also greatly shorten the length of the sphincteric segment.

In the period under consideration, this technique was used in 16 patients where there were difficulties in accessing the bile duct.

It facilitated successful completion of the procedure in 75% of patients at the initial procedure and in the remaining 25% at a subsequent procedure. Submucosal oedema and bleeding occasionally caused difficulties in the visualizing of the bile duct orifice. However, with time, gentle irrigation and watchful patience, bile duct cannulation could usually be achieved at the initial procedure.

Several novel alternative techniques can assist in selective CBD cannulation, including the additional use of guidewires, precut papillotomy and surapapillary fistulosphincterotomy with the needle-knife, endoscopic papillectomy, the rendezvous method, precut needle-knife over a pancreatic stent or pancreatic duct guidewire and transpancreatic duct precut.<sup>8–10</sup> Individual preferences and experience may dictate the specific procedure used in conjunction with ERCP to gain biliary access.

It has been firmly established that the elegant ERCP-related procedures are associated with a significant rate of complications despite their therapeutic efficacy. Repeated pancreatic cannulation is an independent risk factor for developing pancreatitis, the frequency of which ranges from 3.9% with no pancreatic injection to 17.6% after 10 injections.<sup>11,12</sup> Although an early precut sphincterotomy in experienced hands is preferable to exhaustive attempts at cannulation, the technique is considered a double-edged sword. Needle-knife precut papillotomy (NKPP) has a high rate of complications, such as pancreatitis, perforation and bleeding.<sup>4,13–18</sup> However, some authors have argued that the higher complication rate reported for the precut procedure reflects the number of difficult cases who had undergone multiple cannulation trials and are therefore more susceptible to complications.<sup>14,19,20</sup> Although numerous publications have emerged on the various techniques of precut sphincterotomies, data comparing these techniques are limited. Therefore, to date, there is no consensus on the safest and least technically demanding method of circumventing challenging biliary access.

In our study sample, there were only four cases of complications. The first case was a possible periductal extravasation. This patient was at increased risk of a perforation as the distal CBD was found to be friable. An impacted stone had probably eroded through the lower bile duct and the guidewire had passed submucosally when initially inserted. Therefore, it is unlikely that the precut contributed to the extravasation. The procedure was successful and, despite an extended hospital stay, the patient recovered well and had no further issues on follow-up.

The second case in which complications occurred involved bleeding that led to the termination of the procedure, which was controlled with adrenaline. A repeat ERCP was performed 14 days later and was successful. The patient recovered rapidly and was discharged 2 days later. In our sample, nine patients were observed to have minor bleeding which did not interfere with the procedure and six had no significant bleeding. Parlak *et al.* showed that although bleeding occurred more frequently in the precut group, the precut itself did not cause bleeding.<sup>16</sup> These authors concluded that patients in the precut group tended to have malignant

diseases and would therefore have had coagulopathy. Overall, our study supports the suggestion that a precut technique does not increase the risk of bleeding. It is possible that the bleeding reflects multiple attempts at cannulation.

Post-ERCP pancreatitis is considered to be the gravest complication of the procedure as a result of its high morbidity and mortality. In our study, no cases of post-ERCP pancreatitis occurred in the group that underwent precut sphincterotomy. Lee *et al.*<sup>21</sup> mentioned that different precut techniques, including avoiding cutting at the papillary orifice as suggested by Abu-Hamda *et al.*,<sup>22</sup> could reduce the risk of pancreatitis. The lack of post-ERCP pancreatitis in our study is consistent with this statement. Unfortunately, the small sample size prevents us from verifying that the mucosal bridge technique is useful for avoiding pancreatitis.

The disadvantage of the mucosal bridge technique is that it can only be used in circumstances in which the guidewire can be pushed submucosally in the optimal 10-to-12 o'clock position. Extreme upward angulation of the sphincterotome to create a 'dog-leg' bend in the ampullary segment facilitates this manoeuvre. As with all precut techniques, the procedure must be precise. It is difficult to control the orientation, length and depth of the tract. Only the mucosal bridge of tissue proximal to the papilla should be divided and only over sufficient length to expose the submucosal structures for 1–2 cm above the sphincteric orifice. Expedient use of the tract to deroof the papilla will expose the biliary orifice and swiftly facilitate the cannulation in the majority of situations.

Familiarity with the non-needle-knife mucosal bridge precut technique is a useful skill to add to one's endoscopic armamentarium and may save the patient a second endoscopic, radiological or surgical intervention.

#### Conflicts of interest

None declared.

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