

## Endoscopic approach through the minor papilla for the management of pancreatic diseases

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### Abstract

**AIM:** To clarify the efficacy and safety of an endoscopic approach through the minor papilla for the management of pancreatic diseases.

**METHODS:** This study included 44 endoscopic retrograde cholangiopancreatography (ERCP) procedures performed in 34 patients using a minor papilla approach between April 2007 and March 2012. We retro-

spectively evaluated the clinical profiles of the patients, the endoscopic interventions, short-term outcomes, and complications.

**RESULTS:** Of 44 ERCPs, 26 were diagnostic ERCP, and 18 were therapeutic ERCP. The most common cause of difficult access to the main pancreatic duct through the major papilla was pancreas divisum followed by distortion of Wirsung's duct. The overall success rate of minor papilla cannulation was 80% (35/44), which was significantly improved by wire-guided cannulation ( $P = 0.04$ ). Endoscopic minor papillotomy (EMP) was performed in 17 of 34 patients (50%) using a needle-knife (13/17) or a pull-type papillotome (4/17). EMP with pancreatic stent placement, which was the main therapeutic option for patients with chronic pancreatitis, recurrent acute pancreatitis, and pancreatic pseudocyst, resulted in short-term clinical improvement in 83% of patients. Mild post-ERCP pancreatitis occurred as an early complication in 2 cases (4.5%).

**CONCLUSION:** The endoscopic minor papilla approach is technically feasible, safe, and effective when the procedure is performed in a high-volume referral center by experienced endoscopists.

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**Key words:** Endoscopic papillotomy; Endoscopic retrograde cholangiopancreatography; Minor papilla; Pancreas divisum; Pancreatitis

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## INTRODUCTION

The endoscopic approach through the major papilla is generally considered the most common and effective method for the management of pancreatic diseases. However, access to the main pancreatic duct (MPD) through the major papilla is sometimes impossible due to pancreas divisum, distortion of Wirsung's duct, or other causes. When it is difficult to use a major papilla approach in diagnostic or therapeutic endoscopic retrograde cholangiopancreatography (ERCP), cannulation of the minor papilla is attempted as an alternative method<sup>[1]</sup>. Endoscopic treatment through the minor papilla, including endoscopic minor papillotomy (EMP) and endoscopic pancreatic stent (EPS) placement, have been developed in previous studies for patients with pancreas divisum<sup>[2-6]</sup>. For patients with pancreas divisum and recurrent acute pancreatitis (RAP), endoscopic treatment through the minor papilla is considered an effective therapeutic option<sup>[1]</sup>. However, a number of problems associated with these techniques are still unresolved, including the indications for using this approach, the procedures, and the therapeutic efficacy and safety. Therefore, in this study, we reviewed patients who underwent ERCP with a minor papilla approach and evaluated whether this procedure is useful for the management of pancreatic diseases. Herein, we describe a single center experience and review the literature on the endoscopic minor papilla approach.

## MATERIALS AND METHODS

### Patients

We retrospectively reviewed our ERCP database to find patients who underwent an endoscopic minor papilla approach at Kyushu University Hospital from April 2007 to March 2012. A total of 1418 ERCPs were performed during the study period, and 44 ERCPs using a minor papilla approach in 34 patients were included in the analysis. There were 19 men and 15 women, and the mean age was 55 (range, 13-79) years. The clinical profiles, endoscopic interventions through the minor papilla, short-term outcome, and complications associated with the endoscopic procedures were evaluated for all patients. Post-ERCP pancreatitis (PEP), one of the major complications, was diagnosed on the basis of the criteria proposed by Cotton *et al.*<sup>[7]</sup>. PEP was defined as pancreatic pain and hyperamylasemia occurring within 24 h of the procedure. Pancreatic pain was defined as persistent pain in the epigastric or periumbilical region. Hyperamylasemia was defined as an increase in serum amylase level to more than 3 times the upper normal limit<sup>[7,8]</sup>. All patients provided written informed consent for ERCP, including endoscopic treatment.

### ERCP, minor papilla cannulation and EMP

To achieve sedation and duodenal aperistalsis, patients usually received intravenous midazolam (5 mg), pentazocine (7.5 mg), and glucagon (1 mg). A side-viewing duodenoscope (JF-260V; Olympus Medical Systems, Tokyo,

Japan) was used, and the major papilla was first cannulated with a standard catheter (Tandem XL; Boston Scientific, Boston, MA). When endoscopists judged its access to the MPD through the major papilla difficult due to pancreas divisum, distortion of Wirsung's duct, or other causes, minor papilla cannulation was attempted. For 1 patient without pancreas divisum, in whom a guidewire was passed retrograde into Wirsung's duct *via* the major papilla and antegrade out of the minor papilla, a rendezvous technique was employed<sup>[9,10]</sup>.

The minor papilla was usually cannulated using a tapered catheter (PR-9Q-1; Olympus Medical Systems) loaded with or without a guidewire (Jagwire; 0.025 inch in diameter, 450 cm in length; Boston Scientific). Since April 2009, we have employed wire-guided cannulation (WGC) to the minor papilla approach. For WGC, a guidewire was advanced into the orifice of the minor papilla, and then the wire was carefully advanced 10-20 mm into Santorini's duct or until any resistance was encountered (Figure 1A and B)<sup>[11]</sup>. Subsequently, the cannula was lightly impacted on the minor papilla to obtain a dorsal pancreatogram. After we confirmed the course of Santorini's duct and the distal MPD, we advanced the guidewire and catheter deeply into the tail of the pancreas.

EMP was performed using a needle-knife (RX Needle-knife XL; Boston Scientific) or a pull-type sphincterotome (CleverCut; Olympus Medical Systems, or Autotome; Boston Scientific). A precut papillotomy with the needle-knife over a guidewire was typically performed because the orifice of the minor papilla was usually too small to deeply advance a pull-type sphincterotome (Figure 1C and D). However, when the orifice permitted passage of a pull-type sphincterotome, a standard sphincterotomy was performed (Figure 1E). The extent of the cut was determined by the size of the minor papilla, and generally ranged from 3 to 6 mm.

### EPS, endoscopic nasopancreatic drainage and peroral pancreatoscopy through the minor papilla

Following minor papillotomy, a 5 Fr to 7 Fr EPS (Geenen pancreatic stent, 5 to 9 cm in length; Cook Medical, Winston-Salem, NC) was inserted through the minor papilla as a therapeutic option. An endoscopic nasopancreatic drainage (ENPD) tube (5 Fr; Cook Medical) was inserted through the minor papilla for repeated cytology in diagnostic ERCP, or for pancreatic pseudocyst drainage in therapeutic ERCP. Peroral pancreatoscopy (POPS) (Spy-Glass; Boston Scientific) through the minor papilla was performed for the diagnosis of a patient with main-duct type intraductal papillary mucinous neoplasm (IPMN).

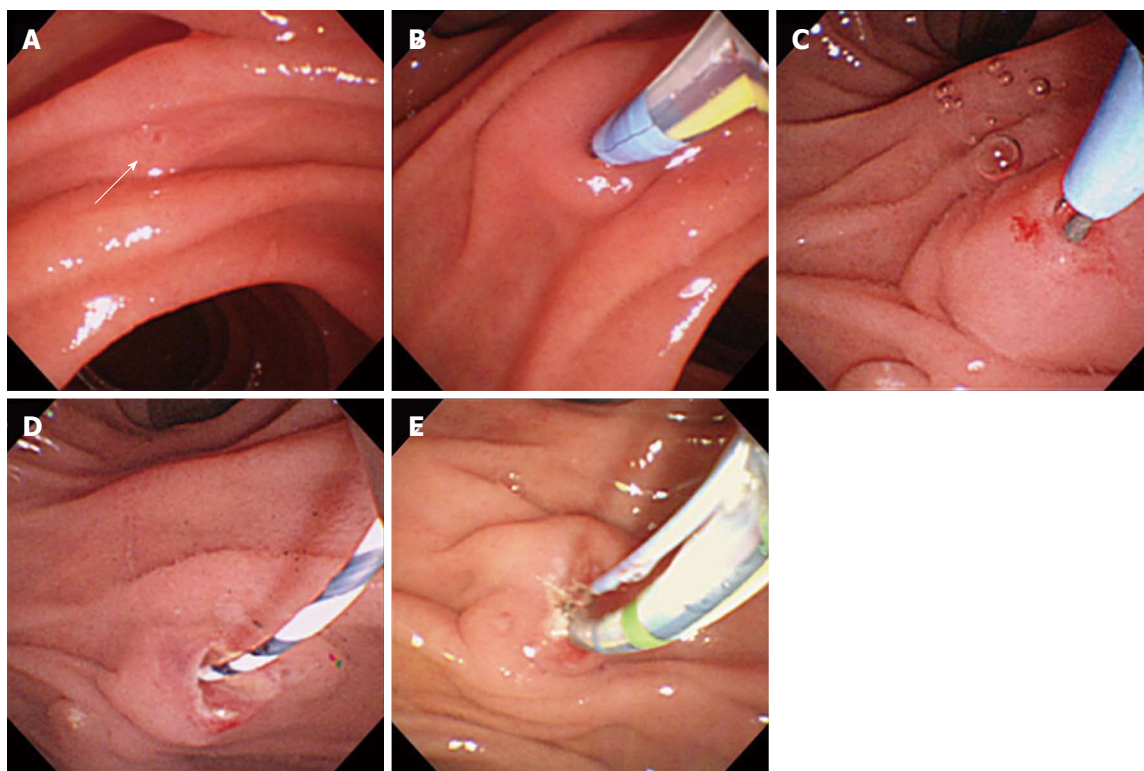
### Statistical analysis

Fisher's exact test was used for statistical analysis. A *P* value of less than 0.05 was considered statistically significant.

## RESULTS

### Clinical profiles of the patients

From April 2007 to March 2012, 44 ERCPs through the



**Figure 1** Minor papilla cannulation and endoscopic minor papillotomy. A: Endoscopic features of the minor papilla (arrow); B: Minor papilla cannulation using wire-guided cannulation; C: Endoscopic minor papillotomy with a needle-knife; D: Endoscopic view after minor papillotomy with a needle-knife; E: Endoscopic minor papillotomy with a pull-type sphincterotome.

minor papilla were attempted in 34 patients at our institution. Patient characteristics and procedure indications are summarized in Table 1. A total of 1418 ERCPs were performed in our department during the study period; therefore, the rate of approach through the minor papilla was 3.1%. Pancreas divisum was the most common cause of difficult access to the MPD through the major papilla (45%) (Figure 2). Of the 20 cases with pancreas divisum, 17 were complete pancreas divisum and 3 were incomplete pancreas divisum. Other causes of difficult access besides pancreas divisum were, in descending order, distortion (Figure 3), stenosis, and compression of Wirsung's duct (Table 1). In these cases, a guidewire could not be advanced through the major papilla to the MPD in the tail of the pancreas (Figure 3B and D). Of the 44 ERCPs, 26 were diagnostic (59%) and 18 were therapeutic (41%). The most common indication for diagnostic ERCP was pancreatic cystic neoplasm, such as IPMN. Other indications were autoimmune pancreatitis (AIP), pancreas divisum, RAP, and pancreatic mass, *etc.* In 3 cases with pancreatic masses, including pancreatic cancer, pancreatic neuroendocrine tumor, and metastatic pancreatic tumor, it was difficult to make a definite diagnosis by endoscopic ultrasound (EUS) or EUS-guided fine-needle aspiration, and we consequently performed diagnostic ERCP in these patients. Of the 19 diagnostic ERCP cases with successful cannulation of the minor papilla, 8 included a diagnostic pancreatogram only, 11 underwent aspiration of pure pancreatic juice for cytologic examination,

including 4 cases with placement of an ENPD tube for repeated cytology, and 2 cases underwent POPS through the minor papilla and pancreatic juice cytology for the evaluation of main-duct type IPMN. In addition, therapeutic ERCP was performed in patients with chronic pancreatitis (CP), RAP, pancreatic pseudocysts, or MPD injury due to pancreatic trauma. EMP was performed in 17 of 34 patients (50%) with naive minor papilla by using a needle-knife (13 cases) or pull-type papillotome (4 cases).

#### Minor papilla cannulation

Minor papilla cannulation was successful in 35 of 44 ERCPs (80%). After we included WGC in the minor papilla approach in April 2009, the success rate of cannulation showed significant improvement (conventional contrast cannulation *vs* WGC = 50% *vs* 86%,  $P = 0.04$ ) (Table 2). Application of WGC to the minor papilla may be useful as well as biliary cannulation.

#### Intervention through the minor papilla and short-term outcomes of therapeutic ERCP

The clinical profiles of the 13 patients who underwent 18 sessions of therapeutic ERCP are summarized in Table 3. Therapeutic procedures were completed in 16 of 18 cases (89%). Of the 16 therapeutic ERCP cases with completed treatment procedures, 11 underwent minor papillotomy with placement of an EPS or ENPD tube. One case received balloon dilation of the minor papilla

**Table 1 Patient demographics and procedure indications**

Number of patients	34
Mean age (range)	55 (13–79)
Male/female	19/15
Patients with pancreas divisum	16
ERCP sessions through the minor papilla	44
Total ERCPs during the study period	1418
Rate of minor papilla approach	3.10%
Causes of difficult access through the major papilla	44
Pancreas divisum (complete/incomplete)	20 (17/3)
Distortion of Wirsung’s duct	16
Stenosis or compression of Wirsung’s duct	6
Other	2
Diagnostic ERCP	26
Indications	
Cystic neoplasm (IPMN/ MCN/ SCN)	7 (5/1/1)
AIP	5
Pancreas divisum	4
RAP	5
Pancreatic mass	3
Others	2
Pancreatic juice cytology (with ENPD/ with POPS)	11 (4/ 2)
Therapeutic ERCP	18
CP	8
RAP	5
Pancreatic pseudocyst	4
Pancreatic trauma	1
Minor papillotomy	17
Needle-knife	13
Pull-type papillotome	4

ERCP: Endoscopic retrograde cholangiopancreatography; IPMN: Intraductal papillary mucinous neoplasm; MCN: Mucinous cystic neoplasm; SCN: Serous cystic neoplasm; AIP: Autoimmune pancreatitis; CP: Chronic pancreatitis; RAP: Recurrent acute pancreatitis; ENPD: Endoscopic nasopancreatic drainage; POPS: Peroral pancreatoscopy.

following a minor papillotomy, and 4 cases underwent exchange or removal of an EPS. In 1 case, it was difficult to perform the endoscopic treatment due to a MPD injury resulting from pancreatic trauma because a guidewire could not be advanced to the pancreatic tail.

Of the 16 cases in which therapeutic procedures were completed, 15 (94%) achieved short-term improvement, *i.e.*, pain relief in patients with CP, no recurrence in patients with RAP, or effective drainage in patients with pseudocyst. In 1 case of pancreatic pseudocyst, although an ENPD tube was successfully inserted into the pseudocyst through the minor papilla, the infection was not controlled. He underwent a surgical procedure (pseudocyst-jejunostomy), which resulted in immediate improvement. As a result, clinical improvement was achieved in 83% (15/18) of all therapeutic ERCP sessions.

**Complications**

There were no complications, such as bleeding or perforation, related to minor papillotomy or balloon dilation. However, 2 cases (4.5%) developed mild PEP. One case was a diagnostic ERCP for AIP and only a diagnostic pancreatogram was performed. The other was a therapeutic ERCP for a patient with RAP who underwent a minor papillotomy plus pancreatic stent placement through the minor papilla. In both cases, cannulation

**Table 2 Success rate of minor papilla cannulation**

	Success	Failure	Total	Success rate	P value
Before April 2009 (CC)	4	4	8	50%	0.04
After April 2009 (WGC)	31	5	36	86%	0.04
Total	35	9	44	80%	

CC: Conventional contrast cannulation; WGC: Wire-guided cannulation.

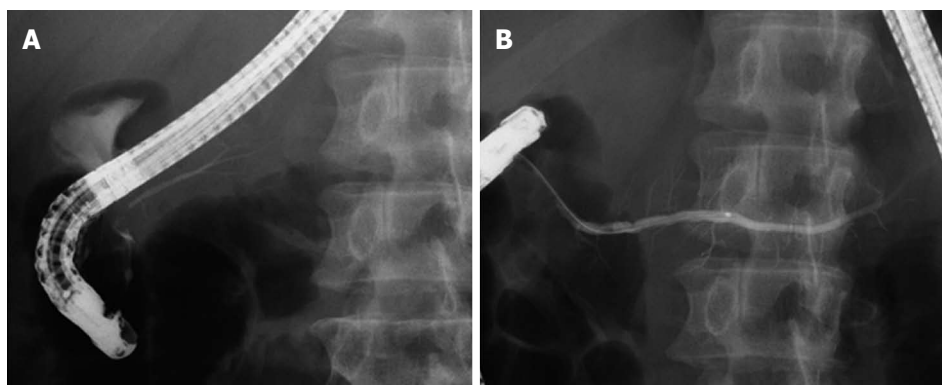
and contrast injection were attempted through the major papilla prior to the minor papilla approach. Conservative treatment promptly resolved PEP in both cases. No other complications, including problems in stent placement (migration or occlusion), occurred in the present study.

**DISCUSSION**

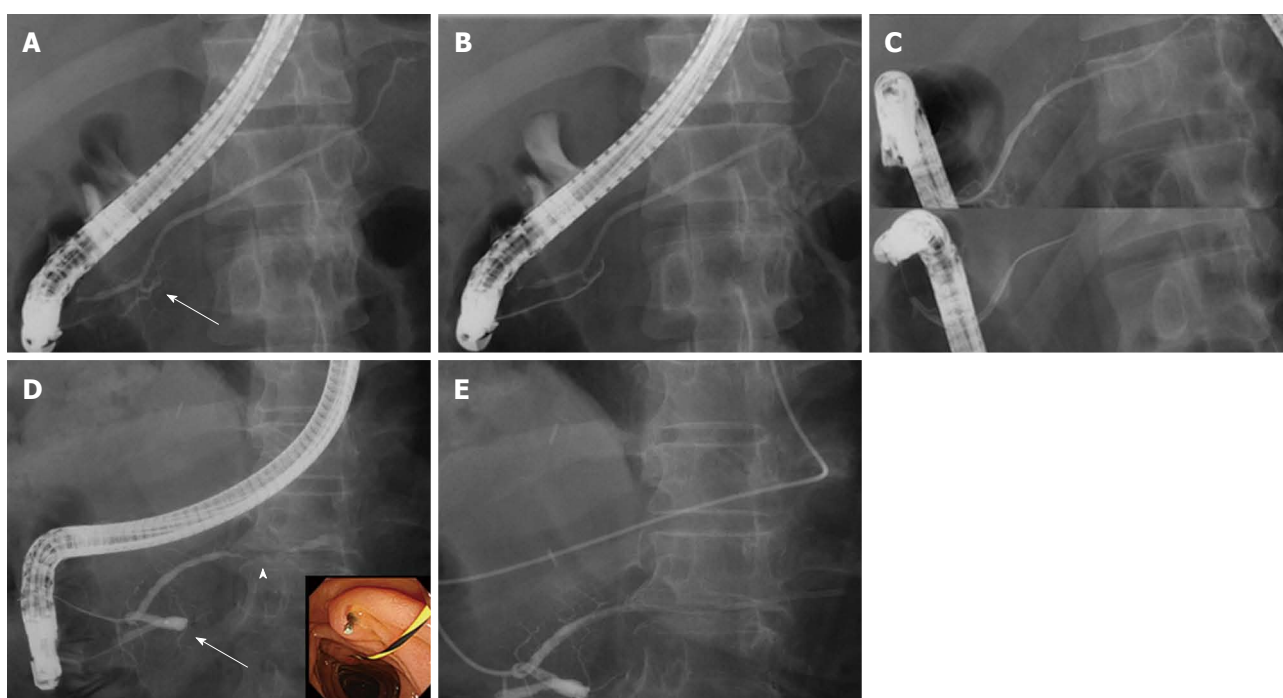
Endoscopic diagnosis or treatment of pancreatic diseases is usually performed through the major papilla. However, the major papilla approach is sometimes difficult for patients with pancreas divisum or distortion of the MPD. In those patients, an approach through the minor papilla is attempted as the only alternative for the management of pancreatic diseases, although minor papilla cannulation remains challenging even for experienced endoscopists. Inui *et al*<sup>[12]</sup> reported that an endoscopic approach through the minor papilla requires superior endoscopic skills, and the number of patients who require these procedures is relatively small, which should limit the use of this approach to select institutions with appropriate expertise. In this study, we reviewed patients who underwent procedures using an endoscopic minor papilla approach at our institution, evaluated the content, safety and outcome of this procedure.

In this study, minor papilla cannulation was successful in 35 of 44 ERCPs (80%). This result is lower than previously reported, as shown in Table 4.

However, the cannulation success rate improved after we employed a WGC technique (50% to 86%). Wire-guided biliary cannulation has recently attracted attention, and meta-analyses of randomized controlled trials (RCT) have demonstrated a higher cannulation success and lower PEP when a wire-guided technique is used, than with conventional contrast methods<sup>[13,14]</sup>. However, the number of studies on the application of WGC to the minor papilla is very limited. Maple *et al*<sup>[11]</sup> reported that physician-controlled WGC in the minor papilla approach is an effective and safe technique. In agreement with the previous study, WGC or wire-assisted cannulation in the minor papilla approach improved the success rate. Although skill development due to the high number of patients may be another reason for the cannulation success rate improvement, application of WGC to the minor papilla approach may be useful as well as biliary cannulation. Maple *et al*<sup>[11]</sup> also stated that a highly experienced assistant was required for wire management. At our institution, 2 experienced endoscopists usually perform this procedure; 1 handles the endoscope while the other assists with the guidewire. We believe that insertion of the



**Figure 2** Endoscopic retrograde pancreatography in a patient with pancreas divisum. A: Pancreatogram via the major papilla showing a short ventral pancreatic duct tapering into small side branches; B: Pancreatogram via the minor papilla showing a dorsal pancreatic duct without a connection to the ventral pancreatic duct, indicating complete pancreas divisum.



**Figure 3** Endoscopic retrograde pancreatography in a patient with a distortion of Wirsung's duct. A-C: A patient with recurrent acute pancreatitis; A: Pancreatogram via the major papilla showing a distorted Wirsung's duct (arrow); B: A guidewire could not be advanced along the main pancreatic duct (MPD) from the body to tail of the pancreas through the major papilla; C: Pancreatogram via the minor papilla. A guidewire could be advanced to Santorini's duct and the distal MPD through the minor papilla (upper row). An endoscopic pancreatic stent was inserted through the minor papilla after minor papillotomy (lower row); D, E: A patient with a metastatic pancreatic tumor; D: Pancreatogram via the major papilla showing stenosis of the MPD in the body of the pancreas (arrowhead). However, a guidewire could not be advanced to the distal MPD due to distortion of Wirsung's duct (arrow). The guidewire inserted through the major papilla entered duodenum via the minor papilla, and was confirmed by an endoscopic view; E: An endoscopic nasopancreatic drainage tube was inserted through the minor papilla after minor papilla cannulation using a rendezvous technique.

guidewire into Santorini's duct is the most important step during the procedure, and it requires close corporation between the endoscopist manipulating the catheter and the assistant advancing the guidewire<sup>[12]</sup>.

A summary of this study and recently published data on the minor papilla approach is shown in Table 4<sup>[2-6,9,11,15-17]</sup>. Most patients had pancreas divisum, which is the most common anatomical variation affecting the pancreatic ductal system<sup>[1]</sup>. Although most patients with pancreas divisum demonstrate no symptoms, relative

outflow obstruction of the minor papilla and increased ductal pressure may result in pancreatitis, such as CP and RAP, which require surgical or endoscopic treatment<sup>[2]</sup>. Many studies have demonstrated the benefit of minor papillotomy for patients with pancreas divisum and RAP, with response rates as high as 90%<sup>[6,18,19]</sup>. In this study, 4 patients with pancreas divisum underwent minor papillotomy as a therapeutic option (Table 3) and all of them clinically responded, that is, they experienced pain relief or no recurrence of AP. Although we only obtained

**Table 3 Patient characteristics and short-term outcomes of therapeutic interventions through the minor papilla**

Patients	Age/sex	Session	Disease	Causes of difficult access through the major papilla	Intervention	Technical success/failure	Short-term outcome	Complication
1	13/F	1	Trauma	MPD injury		Failure	NA	None
2	62/M	2	Pseudocyst	Compression of WD	EMP + ENPD	Success	Appropriate drainage	None
		3	Pseudocyst	Compression of WD	Exchange of EPS	Success	Appropriate drainage	None
		4	Pseudocyst	Compression of WD	Removal of EPS	Success	Collapse of pseudocyst	None
3	69/M	5	CP	Distortion of WD	EMP + EPS	Success	Pain relief	None
		6	CP	Distortion of WD	EMP + EPS	Success	Pain relief	None
5	69/M	7	CP	Divisum	EMP + EPS	Success	Pain relief	None
		8	CP	Divisum	Balloon dilation	Success	Pain relief	None
6	64/M	9	Pseudocyst	Compression of WD	EMP + ENPD	Success	Ineffective <sup>1</sup>	None
7	40/M	10	RAP	Stenosis of WD	EMP + EPS	Success	Appropriate drainage	PEP
		11	RAP	Stenosis of WD	Exchange of EPS	Success	No recurrence	None
8	36/M	12	RAP	Divisum	EMP + ENPD	Success	Appropriate drainage	None
		13	RAP	Divisum	Exchange of EPS	Success	No recurrence	None
9	62/M	14	CP	Divisum	EMP + EPS	Success	Pain relief	None
10	74/M	15	CP	Divisum	EMP + EPS	Success	Pain relief	None
11	42/M	16	CP	Distortion of WD		Failure	NA	None
12	68/F	17	CP	Distortion of WD	EMP + EPS	Success	Pain relief	None
13	68/M	18	RAP	Distortion of WD	EMP + EPS	Success	No recurrence	None

<sup>1</sup>Required a surgical procedure. F: Female; M: Male; CP: Chronic pancreatitis; RAP: Recurrent acute pancreatitis; MPD: Main pancreatic duct; WD: Wirsung's duct; EMP: Endoscopic minor papillotomy; EPS: Endoscopic pancreatic stent; ENPD: Endoscopic nasopancreatic drainage; PEP: Post-endoscopic retrograde cholangiopancreatography pancreatitis; NA: Not available.

**Table 4 Review of recently published data on an endoscopic approach through the minor papilla**

Ref.	No. of patients	Disease	Divisum	Cannulation method	Cannulation success	Intervention	Improvement	PEP
Borak <i>et al</i> <sup>[2]</sup>	113	RAP	100%	NA	NA	EMP + EPS	62%	10.60%
Maple <i>et al</i> <sup>[3]</sup>	64	RAP	100%	Endoscopists' preference	85	EMP + EPS	NA	14%
Chacko <i>et al</i> <sup>[4]</sup>	57	RAP/CP	100%	Tapered catheter and guidewire	86	EMP + EPS	58%	10.70%
Attwell <i>et al</i> <sup>[5]</sup>	184	CP	100%	Tapered catheter	NA	EMP + EPS	72%	6.50%
Song <i>et al</i> <sup>[9]</sup>	11	CP	0%	Rendezvous technique or CC	91	EMP + ENPD, ESWL	91%	0%
Heyries <i>et al</i> <sup>[6]</sup>	24	RAP	100%	Tapered catheter and guidewire	NA	EMP 8, EMP + EPS 16	92%	12.50%
Maple <i>et al</i> <sup>[11]</sup>	25	RAP	88%	Physician-controlled WGC	96	EMP + EPS	NA	12%
Gerke <i>et al</i> <sup>[13]</sup>	53	RAP	100%	NA	NA	EMP	60.40%	11.20%
Ertan <i>et al</i> <sup>[16]</sup>	25	RAP	100%	Tapered catheter and guidewire	74	Dilation	76%	0%
Boerma <i>et al</i> <sup>[17]</sup>	16	CP	100%	NA	NA	EPS with/without EMP	69%	6.30%
This study	34	RAP/CP	45%	WGC or CC	80	EMP + EPS	83%	4.50%

PEP: Post-endoscopic retrograde cholangiopancreatography pancreatitis; RAP: Recurrent acute pancreatitis; CP: Chronic pancreatitis; WGC: Wire-guided cannulation; CC: Conventional contrast cannulation; EMP: Endoscopic minor papillotomy; EPS: Endoscopic pancreatic stent; ENPD: Endoscopic nasopancreatic drainage; ESWL: Extracorporeal shock wave lithotripsy; NA: Not available.

short-term outcomes, clinical improvement was achieved in 83% of all therapeutic procedures, which is nearly equal to that in previous studies, as shown in Table 4. Endoscopic intervention through the minor papilla can be an effective therapeutic option when it is difficult to access the MPD through the major papilla.

Several previous studies of endoscopic intervention through the minor papilla have reported an early complication rate with PEP of 10% to 14%<sup>[2-4,6,11,15]</sup>. Another report by Moffatt revealed that patients with pancreas divisum undergoing minor papilla cannulation with or without minor papillotomy should be considered at high risk for PEP (10.2% with papillotomy and 8.2% without)<sup>[20]</sup>. Therefore, endoscopic minor papilla intervention is regarded as somewhat more hazardous than typical ERCP techniques<sup>[5]</sup>. Minor papillotomy is usually performed using either a needle-knife or pull-type sphincterotome,

however, which of these techniques is better remains uncertain. Attwell *et al*<sup>[5]</sup> reported that both techniques are equally safe and effective. At our institution, the needle-knife technique is used more often because the orifice of the minor papilla is usually too small to allow a pull-type sphincterotome to advance too deeply. We performed minor papillotomy with both techniques being careful not to cut too much, and the incision range was usually determined within the orifice of the minor papilla. Therefore, no major complications directly related to the incision such as bleeding and perforation were encountered. On the other hand, early complications with PEP occurred in 4.5% (2/44) of procedures in the present study. Both cases with PEP underwent major papilla cannulation and contrast injection prior to the minor papilla approach. In 1 case, a diagnostic ERCP was performed for AIP, and an EPS was not inserted through the minor

papilla after ERCP. In the other case, a therapeutic ERCP was performed for RAP with minor papillotomy and EPS placement through the minor papilla. His pancreatogram revealed stenosis of Wirsung's duct; therefore, the PEP may be related to the major papilla cannulation and contrast injection. Major papilla cannulation in these cases is inevitable because unanticipated findings of pancreas divisum or distortion of Wirsung's duct may be revealed during ERCP; however, the procedure should be performed with greater caution. We should also consider prophylactic pancreatic stent placement through the minor papilla, even in diagnostic ERCP, for the prevention of PEP<sup>[8,21]</sup>. No other complications, such as bleeding or perforation, were observed in this study. Although this study was small compared to previous studies, the results were favorable. We believe that the endoscopic minor papilla approach is technically feasible and safe when performed in a high-volume referral center by experienced endoscopists.

This study confirmed the feasibility, benefit of WGC, and safety of endoscopic intervention through the minor papilla for the management of pancreatic diseases. However, a number of limitations must be considered while evaluating the results of this study. For example, these data were obtained in a retrospective study, not a comparative study. We only described a single-center experience; therefore, the number of patients was small, and may be inadequate to compare the therapeutic effects with different procedures for various pancreatic diseases. However, it is difficult to design a large-scale RCT due to the relatively small number of patients requiring a minor papilla approach. Nonetheless, further large-scale studies are required to definitively assess the efficacy of endoscopic interventions through the minor papilla in the management of pancreatic diseases.

## COMMENTS

### Background

When an endoscopic approach through the major papilla is difficult because of pancreas divisum, distortion of Wirsung's duct, or other causes, the minor papilla approach is attempted as the alternative for the management of pancreatic diseases. However, the efficacy and safety of this procedure is not fully understood.

### Research frontiers

Minor papilla cannulation is challenging even for experienced endoscopists. Several previous studies revealed the success rate of minor papilla cannulation as approximately 70%-90%. Although the usefulness of wire-guided cannulation (WGC) for biliary tract has been reported, the number of studies on the application of WGC to the minor papilla is very limited. From the point of view of the endoscopic treatment through the minor papilla, several studies have demonstrated the benefit of minor papillotomy or endoscopic pancreatic stent placement in patients with pancreas divisum. However, endoscopic minor papilla intervention is regarded as somewhat more hazardous than typical endoscopic retrograde cholangiopancreatography (ERCP) techniques because of the high rates of post-ERCP pancreatitis (PEP).

### Innovations and breakthroughs

In this study, the most common cause for difficult access to the main pancreatic duct through the major papilla was pancreas divisum followed by distortion of Wirsung's duct. The overall success rate of minor papilla cannulation was 80%, which showed significant improvement with WGC. Endoscopic minor papillotomy with pancreatic stent placement, which was the main therapeutic option for

patients with chronic pancreatitis, recurrent acute pancreatitis, and pancreatic pseudocyst, resulted in short-term clinical improvement in 83% of patients. Mild PEP occurred as an early complication in 2 cases (4.5%). The authors could obtain the feasible results of clinical improvement and complications compared to previous studies.

### Applications

Application of WGC to the minor papilla approach may be as useful in biliary cannulation as well. The best candidates for endoscopic interventions through the minor papilla are patients with symptomatic pancreas divisum. The endoscopic minor papilla approach is technically feasible, safe and effective when the procedure is performed in a high-volume referral center by experienced endoscopists.

### Peer review

This is a nicely written paper on an old subject; the discussion underlines old controversies on pancreas divisum source of chronic pancreatitis or pancreatic pain. WGC is a promising method for minor papilla cannulation.

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