



# Precut Over a Pancreatic Duct Stent Versus Transpancreatic Precut Sphincterotomy for Difficult Biliary Cannulation in Endoscopic Retrograde Cholangiopancreatography: A Retrospective Cohort Study

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## Abstract

**Background** Precut over a pancreatic duct stent (PPDS) and transpancreatic precut sphincterotomy (TPS) with immediate pancreatic duct stent placement are techniques employed to promote biliary access during endoscopic retrograde cholangiopancreatography (ERCP) in cases of challenging biliary cannulation. However, limited data are available to compare the efficacy of these two pancreatic stent-assisted precut sphincterotomy techniques.

**Aims** The aim of this study was to compare the efficacy of PPDS versus TPS.

**Methods** A retrospective analysis was performed on the clinical data of consecutive patients who underwent ERCP between April 1, 2019 and May 31, 2023. According to the selected cannulation approaches, patients were assigned to two groups. In the PPDS group, a pancreatic duct stent was initially placed, followed by needle-knife precut over the stent. In the TPS group, transpancreatic precut sphincterotomy was initially performed, followed by immediate pancreatic stent placement. The success rate of biliary cannulation and the incidence of post-ERCP pancreatitis (PEP) between the two groups were analysed.

**Results** Among 864 patients who underwent ERCP, 46 patients were equally enrolled in the two groups. Selective bile duct cannulation was successfully achieved in 42 out of 46 (91.3%) cases using the PPDS and in 32 out of 46 (69.6%) cases using TPS technique alone, indicating significantly higher success rate of bile duct cannulation with PPDS compared to TPS (91.3% vs. 69.6%,  $P=0.009$ ). The overall success rates for bile duct cannulation were 93.5% and 97.8% in the PPDS and TPS groups, respectively, with no significant difference identified ( $P=0.307$ ). PEP occurred in 0 and 4 (8.7%) cases in the PPDS and TPS groups, respectively, with no significant difference between the two groups (8.7% vs. 0%,  $P=0.117$ ). There were no cases of bleeding or perforation in either group.

**Conclusions** Both PPDS and TPS followed by immediate pancreatic duct stent placement are viable options. TPS stands out for its simplicity and cost-effectiveness, while PPDS is more appropriate for patients who are at a high-risk of developing PEP.

**Keywords** Endoscopic retrograde cholangiopancreatography (ERCP) · Difficult biliary cannulation · Precut over a pancreatic duct stent · Transpancreatic precut sphincterotomy · Post-ERCP pancreatitis

## Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) has been widely used for the treatment of pancreaticobiliary diseases. Despite its effectiveness, ERCP faces two major challenges. The first one is the relatively high failure

rate of bile duct cannulation, ranging from 5 to 15% [1–5], and the second one is the elevated incidence of post-ERCP pancreatitis (PEP), with the rate of 3.5% to 9.7% [6]. As a result, improving the success rate of bile duct cannulation and minimizing associated adverse events pose a noticeable clinical challenge in the contemporary ERCP practice [7–9].

Successful bile duct cannulation is pivotal for ERCP, whereas conventional techniques may be associated with some challenges. Difficult biliary cannulation, characterized by prolonged duration (> 5 min), multiple attempts (> 5 attempts), or the guidewire entry or contrast injection into the pancreatic duct more than once, is a primary cause of ERCP failure and related adverse events [10–12]. When

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faced with difficult biliary cannulation, the recommendation is to transition to alternative techniques rather than persisting with conventional methods. In instances where the guidewire enters the pancreatic duct, both the transpancreatic precut sphincterotomy (TPS) and precut over the pancreatic duct stent (PPDS) are recommended [13]. However, there is currently a lack of comparative data on the efficacy of these two techniques.

In cases of difficult biliary cannulation during ERCP, inadvertent guidewire insertion into the pancreatic duct is not uncommon. The standard approach in such cases is to perform TPS or double guidewire technique (DGW) [14], which is undertaken sequentially using pancreatic duct stenting to reduce the risk of PEP [13, 15]. Alternatively, a prophylactic pancreatic duct stent can be initially placed, followed by precut sphincterotomy using a needle knife (PPDS) [16, 17]. Despite these approaches, limited data exist to determine the optimal timing for prophylactic pancreatic stenting and to compare the rates of efficacy and adverse events between PPDS and transpancreatic precut sphincterotomy (TPS) followed by immediate pancreatic duct (PD) stent placement. The present study aimed to compare successful cannulation rates and adverse events between PPDS and TPS with PD stent in cases of difficult biliary cannulation and accidental guidewire insertion into the pancreatic duct.

## Methods

### Patient Data

A retrospective analysis was conducted on consecutive patients who underwent ERCP procedures performed by two endoscopists with more than 1000 case experiences from April 1, 2019, to May 31, 2023.

The inclusion criteria were summarized as follows: (1) conforming to the criteria for difficult biliary cannulation; (2) inadvertent insertion of a guidewire into the pancreatic duct. Patients were excluded if they met any of the following criteria: (1) history of undergoing ERCP with sphincterotomy and/or balloon dilatation; (2) inability to reach the major papilla due to duodenal stenosis or other reasons; (3) presentation with surgically altered anatomy, such as Billroth II gastrectomy, Roux-en-Y anastomosis, etc.

Difficult biliary cannulation was defined according to the 5-5-2 criteria established by the European Society of Gastrointestinal Endoscopy (ESGE) [13]. Cannulation was considered difficult if any of the following conditions were met: (1) cannulation time exceeding 5 min; (2) more than 5 consecutive cannulation attempts; (3) unintended pancreatic duct cannulation or opacification occurring more than once.

Patients who met the inclusion criteria and did not meet the exclusion criteria were assigned to either PPDS group or TPS group according to the bile duct cannulation technique. Informed consent was obtained from all patients prior to undergoing ERCP. The study was approved by the Ethics Committee of our hospital (Approval No. KY2023-378) and financially supported by the Shanghai Municipal Health Bureau (Grant No. 201740203).

### ERCP Procedure

All instruments and surgical devices for therapeutic ERCP included a TJF 260 or a JF 260 side-viewing duodenoscope (Olympus, Tokyo, Japan), a three-lumen sphincterotome, and a 0.035-inch guidewire (Nanjing Micro-Invasive Medical Instrument, Nanjing, China). Additionally, a triple lumen needle knife was obtained from Boston Scientific (Boston, MA, USA), and a pancreatic duct stent was sourced from Cook Medical LLC (Bloomington, IN, USA). The cutting power was configured as a mixed current using the endoCUT mode provided by ERBE (Germany).

Before the procedure, all patients received a preoperative dose of the non-steroidal anti-inflammatory drug (NSAID) indomethacin (100 mg) rectally. At the onset of ERCP, patients underwent pharyngeal anesthesia along with intravenous premedication of diazepam, meperidine hydrochloride, and scopolamine. Additionally, oxygen supplementation and electrocardiographic monitoring were maintained throughout the ERCP procedure. In certain instances, general anesthesia with endotracheal intubation was administered.

Patients were placed in the prone position. The duodenoscope was advanced to the descending duodenum where the major papilla was identified and selective biliary cannulation was performed using a triple lumen, guidewire preloaded sphincterotome. In cases where standard biliary cannulation was unsuccessful and the guidewire inadvertently entered the pancreatic duct, either PPDS or TPS was used for biliary cannulation following PD stent placement. The PD stent was placed according to the following criteria: (1) if the cannulation time exceeded 5 min or more than 5 consecutive cannulation attempts were made without successful cannulation, and one inadvertent PD cannulation occurred, a PD stent was immediately placed; (2) if the cannulation time did not exceed 5 min and no more than 5 consecutive cannulation attempts were made, while the PD was inadvertently cannulated twice, a PD stent was immediately placed.

- (1) PPDS technique: A pancreatic duct stent (5F, 5 cm, with a side wing at the front end and a pigtail shape at the tail end) was advanced into the pancreatic duct over the guidewire by the triple-lumen sphincterotome until the metal marker on the stent surface reached the papil-

lary orifice. After removing the pancreatic guidewire, the stent was carefully placed in the pancreatic duct. Following this, a needle knife with a pre-loaded guidewire was utilized to conduct layer-by-layer sphincterotomy. The needle knife was extended approximately 2–3 mm from the sheath, which positioned above the papillary orifice. An incision was made in the papilla, directed toward the 12 o'clock position along the papilla's midline, with a length of 3–5 mm. Initially, the mucosal and submucosal layers were incised to identify the circular and rigid bile duct sphincter. The needle knife length was subsequently adjusted to 1–2 mm to incise the bile duct sphincter. Efforts were made to preserve the integrity of the pancreatic duct sphincter and parenchyma around the pancreatic duct stent whenever possible. Following the withdrawal of the needle knife, bile duct cannulation was performed using either the needle knife or the sphincterotome pre-loaded with a guidewire, ensuring that the incision remained less than 5 mm. Details are illustrated in Video 1.

- (2) **TPS technique:** A sphincterotome was used to conduct TPS over the guidewire in the pancreatic duct. The incision was started at the 11 o'clock of the papillary orifice and was extended at the 11–12 o'clock, including the biliopancreatic septum to expose the opening of the bile duct, with an incision length not exceeding 1/2 of the total length of the papilla. Subsequently, a pancreatic duct stent was promptly placed following the above-mentioned method. Once the pancreatic duct stent was successfully positioned, the sphincterotome was reutilized to cannulate the bile duct on the surface of the pancreatic duct stent in a left-upward direction. If repeated cannulation persisted for more than 10 min without success, a needle knife was introduced to create an incision starting from the top of the previous incision on the surface of the pancreatic duct stent in the bile duct direction for approximately 3 mm in length. Bile duct cannulation was subsequently reattempted until successful cannulation was achieved. Details are displayed in Video 2.

Following successful bile duct cannulation, therapeutic interventions were tailored to the specific etiologies for each patient. Interventions included endoscopic papillary balloon dilation, stone extraction using a retrieval basket (Cook Medical) and/or a retrieval balloon (Boston Scientific). Bile duct stent placement or nasobiliary drainage was undertaken if deemed necessary. In cases where initial bile duct cannulation was unsuccessful, no repeat ERCP was pursued.

## Post-ERCP Adverse Events

The definition and grading of post-ERCP adverse events followed the ESGE criteria [6]. PEP was identified by meeting at least two of the following three criteria [18]: (1) the new onset or exacerbation of upper abdominal pain post-ERCP; (2) amylase and/or lipase levels in blood and/or urine reaching at least three times the upper limit of normal on the first day after ERCP; (3) computed tomography (CT) scan revealing signs of pancreatitis, such as pancreatic enlargement and peripancreatic fluid collection. Bleeding manifested as hematemesis and/or melena or a drop in hemoglobin level by more than 2 g/dL. Perforation was confirmed by the existence of gas or luminal contents outside the gastrointestinal tract, as indicated by imaging methods, such as CT scan.

## Outcome Measures

The primary outcome was the success rate of selective bile duct cannulation. For the PPDS technique, success rate was calculated based on successful cannulation after needle-knife sphincterotomy. If an alternative technique led to the successful cannulation, the PPDS technique was deemed unsuccessful. Conversely, for the TPS technique, the success rate was determined by successful cannulation post-sphincterotomy using a sphincterotome; the utilization of a needle-knife instead resulted in categorizing the TPS technique as unsuccessful. The secondary outcome included the incidence of ERCP-related adverse events, such as PEP, bleeding, and perforation. Adverse events excluded cholangitis and cholecystitis, as these were considered to lack a direct relationship with biliary cannulation.

## Statistical Analysis

Statistical analysis was performed using SPSS 27.0 software (IBM, Armonk, NY, USA). For continuous variables, such as patients' age, *t*-test was employed for making comparison. Categorical variables, such as sex ratio, success rate, and complication rate, were assessed using Chi-square test or Fisher's exact test. A *P* value of less than 0.05 was considered statistically significant. Adverse events that were not directly associated with bile duct cannulation, such as cholangitis, cholecystitis, and hyperamylasemia, were excluded from the analysis.

## Results

During the study period, a total of 967 ERCP patients were evaluated, of whom 103 patients were excluded based on the exclusion criteria. Consequently, 864 consecutive ERCP patients were included, with 92 cases meeting the inclusion

criteria, representing 10.6% (92/864) of the total. Among these 92 cases, 46 were assigned to the PPDS group and the remaining 46 cases were allocated to the TPS group (Table 1). The patient selection flowchart was presented in Fig. 1.

No statistically significant differences were found between the two groups in terms of age, gender, common bile duct diameter, periampullary diverticulum, etiology, and other basic characteristics ( $P > 0.05$ ), as detailed in Table 2. Throughout all the ERCP procedures, no instances of stent dislodgement were identified. The overall successful rate of bile duct cannulation reached 98.8% (854/864). Remarkably, all patients in both groups achieved a successful outcome without reported mortality.

In the PPDS group, selective bile duct cannulation was successfully accomplished in 42 out of 46 cases utilizing the PPDS technique, yielding a success rate of 91.3% (42/46). One unsuccessful case in the PPDS group was attributed to the challenging location of the papillary orifice at the left margin of the diverticulum, making it difficult for the needle knife to reach the papilla. In this instance, the TPS technique was employed to incise the papillary sphincter, resulting in an overall bile duct cannulation success rate of 93.5% (43/46). There were no cases of PEP, bleeding, or perforation in the PPDS group.

In the TPS group, selective bile duct cannulation was successfully achieved through exclusive utilization of the TPS technique in 32 out of 46 cases, resulting in a success rate of 69.6% (32/46). Among 14 cases where the TPS technique was unsuccessful, additional papillary incision was performed along the surface of the pancreatic duct stent using a needle knife, leading to successful bile duct cannulation in 13 cases. Consequently, the overall success rate in the TPS group reached 97.8% (45/46). PEP occurred in 4 (8.7%, 4/46) cases in the TPS group, including 1 case of moderate severity (CT scan revealed peripancreatic fluid collection without organ dysfunction) and 3 cases of mild severity. The moderately severe PEP case involved a female patient with normal liver function and a dilated common bile duct. All 4 cases were successfully treated conservatively, without identification of instances with bleeding or perforation. All PEP cases in the TPS group occurred following TPS procedures,

including both TPS alone and TPS combined with needle-knife techniques.

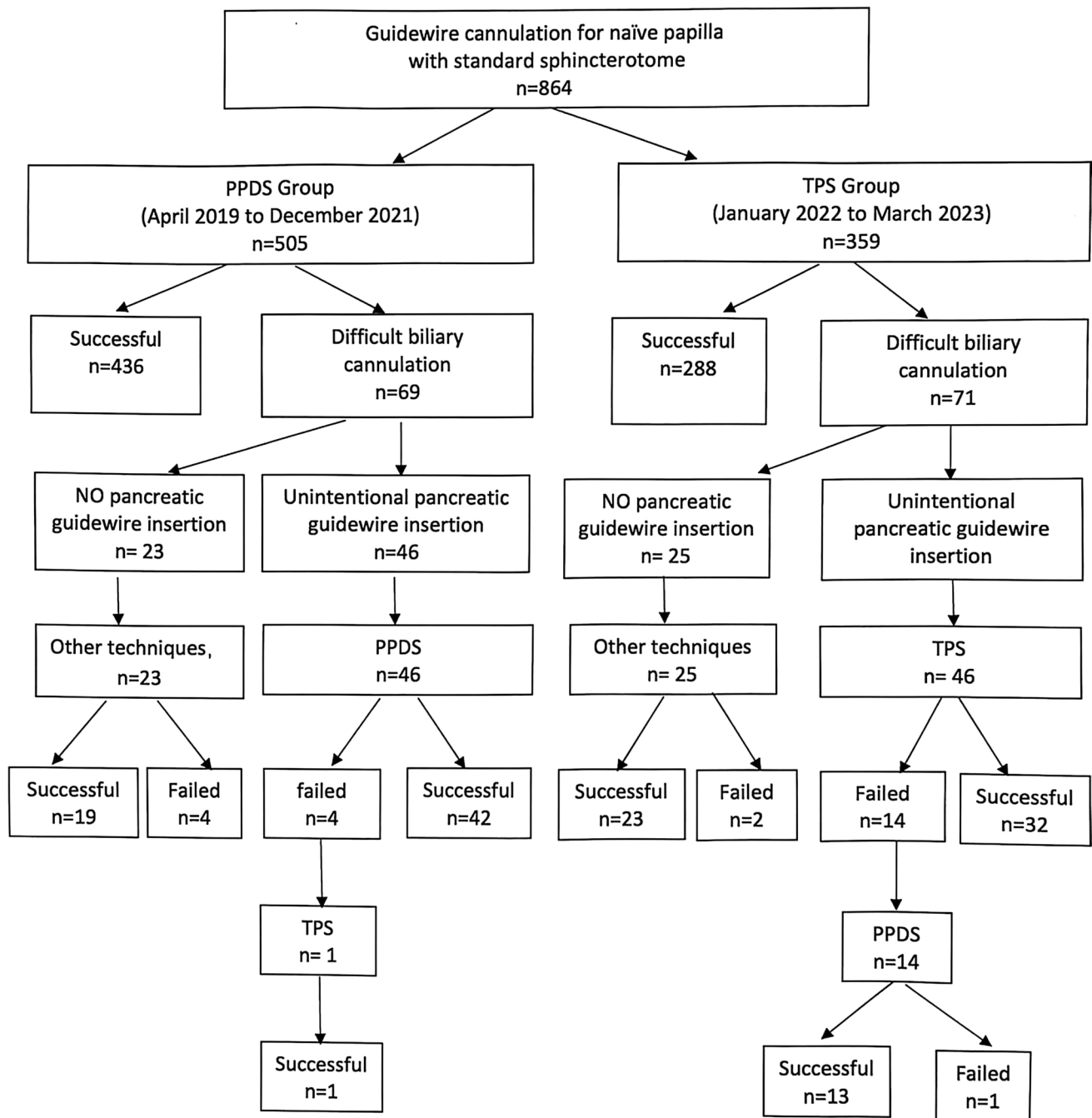
The comparative analysis between the two groups revealed a significant difference in the success rate of bile duct cannulation when employing the exclusive technique (91.3% vs. 69.6%,  $P < 0.01$ ). However, no statistically significant difference was identified in the overall success rate of bile duct cannulation between the two groups (93.5% vs. 97.8%). Although the incidence of PEP was higher in the TPS group than that in the PPDS group, no statistically significant difference was noted between the two groups (8.7% vs. 0%,  $P > 0.05$ ). Comprehensive details regarding the success rate of bile duct cannulation and the incidence of adverse events in both groups are presented in Table 3.

## Discussion

The results of the present study indicated that, in comparison to the TPS technique, the PPDS technique achieved a higher success rate in bile duct cannulation and a lower incidence of PEP. However, in instances where the TPS technique was unsuccessful, subsequent incision along the surface of the pancreatic duct stent toward the bile duct using a needle knife resulted in a total success rate comparable to the PPDS technique. Among cases where TPS technique involved immediate placement of pancreatic duct stents, all PEP instances were of mild-to-moderate in severity, and no severe cases were reported, suggesting an overall favorable outcome. The data of the present study exhibited a strong comparability on multiple aspects. Firstly, the two techniques were implemented during distinct periods: the PPDS technique was utilized from April 2019 to December 2021, and the TPS technique was employed from January 2022 to March 2023. Secondly, all patients received NSAID prophylaxis immediately prior to ERCP, the same type of pancreatic stents were placed for all patients during ERCP procedures. Additionally, both groups shared similar baseline characteristics, including age, gender, common bile duct diameter, periampullary diverticulum, and etiologies. Consequently, the results of the present study possess a high level of credibility.

**Table 1** Patients' selection

	PPDS group Apr 2019 to Dec 2021	TPS group Jan 2022 to Mar 2023
The number of ERCPs	505	359
Difficult biliary cannulation, n	69	71
Unintentional pancreatic guidewire insertion, n	46	46
Success, n (%)	42 (91.3)	32 (69.6)
Overall success, n (%)	43 (93.5)	45 (97.8)



**Fig. 1** The flowchart of patients' selection

TPS technique involves cutting the septum between the bile duct and pancreatic duct using a sphincterotome, exposing the lower end of the bile duct and aiding in cannulation [14]. TPS is recognized for its simplicity and controlled incision length. However, the procedure may induce pancreatic duct spasms, edema, and increase the risk of PEP [19, 20]. Guidelines suggested placing a pancreatic stent with TPS to prevent PEP [13, 15], while optimal timing remains uncertain. In this study, a pancreatic duct stent was immediately

placed after TPS, facilitating uninterrupted pancreatic duct outflow during the entire ERCP procedure. The stent served dual purposes. Firstly, it prevented PEP by maintaining the pancreatic duct unobstructed. Secondly, it acted as a guide to straighten the papilla, preventing guidewire re-entry and promoting bile duct cannulation. In instances of unsuccessful cannulation, mainly due to a long common channel or incomplete septum incision, using a needle-knife over the stent's surface resulted in the successful bile duct



**Table 2** Patients' demographic characteristics

	PPDS (n=46)	TPS (n=46)	Test value	P value
Male/female	26/20	27/19	$\chi^2=0.045$	0.833
Age (years)	67.1 ± 10.3	63.0 ± 12.4	$t=0.654$	0.515
Common bile duct diameter (mm)	13.3 ± 4.2	11.5 ± 4.2	$t=1.845$	0.069
Peripapillary diverticulum	8/38	9/37	$X^2=0.072$	0.788
Etiologies				
Cholelithiasis	34	38	$X^2=1.022$	0.312
Malignant biliary strictures	11	6	$X^2=1.804$	0.179
Benign biliary strictures	1	2	$X^2=0.345$	0.557

**Table 3** Success rate of bile duct cannulation and the incidence of adverse events

	PPDS (n=46)	TPS (n=46)	$\chi^2$ value	P value
Success rate of the pure technique (%)	42 (91.3)	32 (69.6)	6.907	0.009
Final success rate of the technique (%)	43 (93.5)	45 (97.8)	1.045	0.307
Complication rate (%)				
PEP	0	4 (8.7)	2.352	0.117
Bleeding	0	0	NS	NS
Perforation	0	0	NS	NS

cannulation. While pure TPS has exhibited a moderate success rate, the combined success rate, incorporating needle-knife incision, reached nearly 98%. Importantly, no instances of stent displacement occurred.

The PPDS technique represents an innovative approach to needle-knife precut sphincterotomy. Traditionally, needle-knife precut sphincterotomy involves two distinct techniques. The first is conventional needle-knife precut papillotomy (NKPP), entailing an incision commencing at the 11 o'clock margin and directs upwards towards the common bile duct (CBD). The second technique is needle-knife fistulotomy (NKF), where the initial incision occurs at the roof of the papilla and is directed either upwards or downwards based on the anatomical considerations. The objective of NKF is to preserve the delicate orifice area, thereby minimizing the risk of pancreatic duct damage related to electrical current and subsequent PEP [21–23]. Both techniques necessitate proficient ERCP endoscopists, particularly with NKF requiring a specific anatomical foundation, notably a longer papilla (e.g., papilla type 3) [24, 25]. The implementation of NKF may pose challenges in cases with flat or small papillae, especially those on the inner margins of diverticula (type IIa) [26]. The PPDS technique targets the same incision point as the NKPP

technique at the low end of the bile duct. However, its incision method aligns more closely with the NKF technique. Guided by a pancreatic duct stent, the PPDS technique precisely and briefly incises the low end of the bile duct, contrasting with NKPP's lengthier incision. Importantly, it preserves the pancreatic duct sphincter around the pancreatic duct stent in the lower part of the papilla, reducing adverse events, such as PEP and perforation. Thus, the PPDS technique combines the advantages of both NKPP and NKF techniques while mitigating their drawbacks. The ability of the PPDS technique to preserve the sphincter around the pancreatic duct stent while precisely incising the bile duct sphincter is rooted in the anatomical relationship between the bile duct and pancreatic duct in the papilla. Through extensive practical experience, it is demonstrated that in the endoscopic view, the bile duct lies left, anterior, and upward of the pancreatic duct, while the pancreatic duct is situated right, posterior, and downward under the bile duct. Anatomically, the bile duct runs from the left upper quadrant (at the 11 o'clock position) of the papillary orifice to the mid-point (12 o'clock position) of the papilla's upper part, and the pancreatic duct extends from the midpoint of the papillary orifice to the upper part of the papilla, spanning the 1–3 o'clock positions. By incising the mucosal and submucosal layers at the joint point using a needle-knife, about 2–3 mm thick, the bile duct sphincter can be identified. Additional incision, typically measuring 1–2 mm in thickness, effectively aids in the cannulation of the bile duct. Our research team's clarification of this anatomical relationship is groundbreaking, holding the potential to substantially enhance the success rate of both bile duct and pancreatic duct cannulation while reducing the rate of adverse events, pending further confirmation.

In a comparison between TPS and PPDS, the results of two meta-analyses indicated that TPS demonstrated a greater biliary cannulation rate compared with other advanced cannulation techniques, and both early needle-knife and TPS techniques outperformed in reducing the PEP rate [27, 28]. While some experts regarded TPS as a potential alternative for challenging biliary cannulation [7,

29], opinions on its efficacy vary [30, 31]. As a relatively recent needle-knife precut technique, PPDS currently lacks adequate data to assess its comparative effectiveness against other techniques.

According to the findings of this study, the following observations were highlighted. Firstly, PPDS exhibited a higher success rate in bile duct cannulation compared with TPS. However, when TPS was accompanied by needle-knife incision, it could consistently achieve successful bile duct cannulation, resulting in an overall success rate of 97.8%, which is consistent with previously reported results [32]. The final success rate of bile duct cannulation did not exhibit significant differences between the two techniques. The lower success rate with TPS alone (69.6%) was attributed to a limited incision length, especially inadequate for patients with a longer common channel of the bile duct and pancreatic duct. Secondly, TPS was associated with a higher incidence of PEP compared with PPDS. However, the majority of PEP cases were mild, with a smaller proportion being of moderate severity, and the overall outcomes remained satisfactory. Thirdly, PPDS may encounter challenges in cases of a deviated papilla, such as those within the inner margins of the diverticulum (type IIa), while TPS proved to be more versatile for all papilla types. Fourthly, TPS is a relatively simple procedure, eliminating the need to exchange the sphincterotome for a needle knife, thereby reducing costs. Consequently, PPDS may be more appropriate for high-risk PEP patients [33], including female patients with normal liver function and those with dysfunctional Oddi sphincter.

This single-center retrospective study with a relatively small sample size underscores the need for future multi-center prospective studies to validate the findings.

In conclusion, when encountered with difficult biliary cannulation and accidental guidewire insertion into the pancreatic duct, both PPDS and TPS followed by immediate pancreatic duct stent placement, are viable options. TPS stands out for its simplicity and cost-effectiveness, while PPDS is more appropriate for patients who are at a high-risk of developing PEP.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10620-024-08603-6>.

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**Author's contribution** YQ and QYL: Conceived and designed the experiments, collected and analyzed data, and drafted and revised the manuscript. WFY and YQW: Provided technical support for experiments, assisted in data analysis, and offered valuable insights during the writing process. NPL: Guided the overall research process, provided conceptual input, coordinated the collaborative efforts of the authors, and was responsible for the review and revision of the final manuscript. The manuscript was written through contributions of all authors. All authors have given approval to the final version of the manuscript.

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**Data availability** No additional data are available.

## Declarations

**Conflict of interest** The authors declare no competing interests.

**Informed consent** Patients were not required to give informed consent to participate in the study because the analysis used anonymous clinical data that were obtained after each patient agreed to the treatment by written consent.

**Institutional review board statement** The study was approved by the Ethics Committee of Ruijin Hospital Affiliated with Shanghai Jiaotong University School of Medicine (Shanghai, China; Approval No. KY2023-378).

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## References

1. Maharshi S, Sharma SS. Early precut versus primary precut sphincterotomy to reduce post-ERCP pancreatitis: randomized controlled trial (with videos). *Gastrointest Endosc* 2021;93:586–593.
2. Larkin CJ, Huibregtse K. Precut sphincterotomy: indications, pitfalls, and complications. *Curr Gastroenterol Rep* 2001;3:147–153.
3. Bailey AA, Bourke MJ, Williams SJ et al. A prospective randomized trial of cannulation technique in ERCP: effects on technical success and post-ERCP pancreatitis. *Endoscopy* 2008;40:296–301.
4. Williams EJ, Taylor S, Fairclough P et al. Are we meeting the standards set for endoscopy? Results of a large-scale prospective survey of endoscopic retrograde cholangio-pancreatograph practice. *Gut* 2007;56:821–829.
5. Freeman ML, Guda NM. ERCP cannulation: a review of reported techniques. *Gastrointest Endosc* 2005;61:112–125.
6. Dumonceau JM, Kapral C, Aabakken L et al. ERCP-related adverse events: European Society of Gastrointestinal Endoscopy (ESGE) Guideline. *Endoscopy* 2020;52:127–149.
7. Opden Winkel M, Schirra J, Schulz C et al. Biliary cannulation in endoscopic retrograde cholangiography: how to tackle the difficult papilla. *Dig Dis* 2022;40:85–96.
8. Fung BM, Pitea TC, Tabibian JH. Difficult biliary cannulation in endoscopic retrograde cholangiopancreatography: an overview of advanced techniques. *Eur Med J Hepatol* 2021;9:73–82.

9. Berry R, Han JY, Tabibian JH. Difficult biliary cannulation: historical perspective, practical updates, and guide for the endoscopist. *World J Gastrointest Endosc* 2019;11:5–21.
10. Halttunen J, Meisner S, Aabakken L et al. Difficult cannulation as defined by a prospective study of the Scandinavian Association for Digestive Endoscopy (SADE) in 907 ERCPs. *Scand J Gastroenterol* 2014;49:752–758.
11. Wang P, Li ZS, Liu F et al. Risk factors for ERCP-related complications: a prospective multicenter study. *Am J Gastroenterol* 2009;104:31–40.
12. Lou L, Wang X, Zhang Y et al. Prolonged cannulation time is an independent risk factor for moderate-to-severe post-endoscopic retrograde cholangiopancreatography (ERCP) pancreatitis: a large cohort study. *Ann Transl Med* 2023;11:188.
13. Testoni PA, Mariani A, Aabakken L et al. Papillary cannulation and sphincterotomy techniques at ERCP: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline. *Endoscopy* 2016;48:657–683.
14. Goff JS. Common bile duct pre-cut sphincterotomy: transpancreatic sphincter approach. *Gastrointest Endosc* 1995;41:502–505.
15. Liao WC, Angsuwatcharakon P, Isayama H et al. International consensus recommendations for difficult biliary access. *Gastrointest Endosc* 2017;85:295–304.
16. Cha SW, Leung WD, Lehman GA et al. Does leaving a main pancreatic duct stent in place reduce the incidence of precut biliary sphincterotomy-associated pancreatitis? A randomized, prospective study. *Gastrointest Endosc* 2013;77:209–216.
17. Kubota K, Sato T, Kato S et al. Needle-knife precut papillotomy with a small incision over a pancreatic stent improves the success rate and reduces the complication rate in difficult biliary cannulations. *J Hepatobiliary Pancreat Sci* 2013;20:382–388.
18. Banks PA, Bollen TL, Dervenis C et al. Classification of acute pancreatitis–2012: revision of the Atlanta classification and definitions by international consensus. *Gut* 2013;62:102–111.
19. Katsinelos P, Lazaraki G, Chatzimavroudis G et al. Risk factors for therapeutic ERCP-related complications: an analysis of 2,715 cases performed by a single endoscopist. *Ann Gastroenterol* 2014;27:65–72.
20. Chiriac S, Sfarti CV, Stanciu C et al. The relation between post-endoscopic retrograde cholangiopancreatography pancreatitis and different cannulation techniques: the experience of a high-volume center from North-Eastern Romania. *Life (Basel)* 2023;13:1410.
21. Swan MP, Alexander S, Moss A et al. Needle knife sphincterotomy does not increase the risk of pancreatitis in patients with difficult biliary cannulation. *Clin Gastroenterol Hepatol* 2013;11:430–436.e431.
22. Mavrogiannis C, Liatos C, Romanos A, Petoumenos C, Nakos A, Karvountzis G. Needle-knife fistulotomy versus needle-knife precut papillotomy for the treatment of common bile duct stones. *Gastrointest Endosc* 1999;50:334–339.
23. Huibregtse K, Katon RM, Tytgat GN. Precut papillotomy via fine-needle knife papillotome: a safe and effective technique. *Gastrointest Endosc* 1986;32:403–405.
24. Zhang QS, Xu JH, Dong ZQ, Gao P, Shen YC. Success and safety of needle knife papillotomy and fistulotomy based on papillary anatomy: a prospective controlled trial. *Dig Dis Sci* 2022;67:1901–1909. <https://doi.org/10.1007/s10620-021-06983-7>
25. Estela EL, Tovar NR, Maldonado FA, Tisoc LM, Goicochea-Lugo S, Rossell MC. Association between type of major duodenal papilla and difficult biliary cannulation at first endoscopic retrograde cholangiopancreatography in adults: a cross-sectional study with bootstrap method. *Ann Gastroenterol* 2023;36:216–222.
26. Shi HX, Ye YQ, Zhao HW et al. A new classification of periampullary diverticulum: cannulation of papilla on the inner margins of the diverticulum (Type IIa) is more challenging. *BMC Gastroenterol* 2023;23:252.
27. Pécsi D, Farkas N, Hegyi P et al. Transpancreatic sphincterotomy is effective and safe in expert hands on the short term. *Dig Dis Sci* 2019;64:2429–2444. <https://doi.org/10.1007/s10620-019-05640-4>
28. Facciorusso A, Ramai D, Gkolfakis P et al. Comparative efficacy of different methods for difficult biliary cannulation in ERCP: systematic review and network meta-analysis. *Gastrointest Endosc* 2022;95:60–71.e12.
29. Martin JA. Transpancreatic sphincterotomy: “I don’t get no respect.” *Dig Dis Sci* 2021;66:657–659. <https://doi.org/10.1007/s10620-020-06771-9>
30. Kozarek R. Flail, flay, or fail: needle-knife versus transpancreatic sphincterotomy to access the difficult-to-cannulate bile duct during ERCP. *Endoscopy* 2017;49:842–843.
31. Sundaram S, Jagtap N. Transpancreatic biliary sphincterotomy: justified or overkill? *Endoscopy* 2021;53:985.
32. Kylänpää L, Koskensalo V, Saarela A et al. Transpancreatic biliary sphincterotomy versus double guidewire in difficult biliary cannulation: a randomized controlled trial. *Endoscopy* 2021;53:1011–1019.
33. Madácsy L, Kurucsai G, Fejes R, Székely A, Székely I. Prophylactic pancreas stenting followed by needle-knife fistulotomy in patients with sphincter of Oddi dysfunction and difficult cannulation: new method to prevent post-ERCP pancreatitis. *Dig Endosc.* 2009;21:8–13.

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