ORIGINAL PAPERS

Biliary cannulation effectiveness and pancreatitis risk using two early precut techniques

Emilio J. de-la-Morena-Madrigal[1,2,3], M.ª Isabel Rodríguez-García[1], Ana Belén Galera-Ródenas[1] and Elena Pérez-Arellano[1]

Department of Digestive Diseases. [1]Hospital La Zarzuela. Madrid, Spain. [3]Hospital Moncloa. Madrid, Spain. [3]Hospital Beata María Ana. Madrid, Spain

Received: 25/07/2017 · **Accepted:** 06/10/2017

Correspondence: Emilio J. de la Morena Madrigal. Department of Digestive Diseases. Hospital Sanitas La Zarzuela. C/ Pléyades, 25. 28023 Madrid, Spain. **e-mail:** emorena@sanitas.es

ABSTRACT

Introduction: Precut techniques allow for successful biliary cannulation rates approaching 100% but there may be an associated increase in the risk of complications. Recently, early needle-knife precut has been shown to be a safe procedure and is now used as a pancreatitis prevention resource for difficult cannulation cases. The goal of the present study was to assess cannulation and pancreatitis rates using two early precut techniques.

Patients and methods: This was a retrospective study of endoscopic retrograde cholangio-pancreatography (ERCP) procedures performed from 2013 to 2016. The efficacy and safety of simple cannulation, needle-knife precut and transpancreatic precut were assessed.

Results: Simple cannulation was achieved in 369 (73.4%) of 503 evaluable ERCP procedures. Needle-knife precut was successful in 51 (96.2%) of 53 attempts and transpancreatic precut was successful in 75 (96.2%) of 78 attempts. The overall cannulation rate was 98.4%. There were eleven (2.4%) pancreatitis events, six (1.8%) with simple cannulation (two severe, one fatal), five (6.3%) with transpancreatic precut (two severe) and zero events with the needle-knife precut procedure. Among the patients undergoing the precut procedure, seven experienced perforations (two severe) and there were seven bleeding events. The overall complication rate was 14.4%.

Conclusions: The complementary use of either precut technique provides a satisfactory biliary cannulation rate. However, the rates of pancreatitis and other severe complications are higher for transpancreatic *versus* needle-knife precut, therefore the indications for both techniques should be modified.

Key words: ERCP. Biliary cannulation. Needle-knife precut. Transpancreatic precut. Post-ERCP pancreatitis.

INTRODUCTION

Biliary cannulation (BC) is a key requirement in the endoscopic management of conditions of the bile duct. BC rates using simple techniques (using cannulae and cannulotomes, contrast mapping and/or hydrophilic guidewires) are high but variable and depend on patient anatomy and disease, as well as endoscopist experience (1). In order to achieve rates above 90%, it is important to make multiple cannulation attempts (or repeated attempts). However, repeat attempts may lead to increased pancreatitis rates (2,3), either due to papillary or ductal trauma, the latter resulting from repeated unwanted pancreatic cannulation (PC). In the latter case, a "double guidewire" (DG) technique may be an alternative, although it has a modest BC rate and significant pancreatitis rates (4). In order to reach BC rates of 100%, advanced "precut" (cut before cannulation) techniques are needed. These include two general procedures with a number of technical variations:

1. *Precut biliary papillotomy* is performed by a minority of endoscopists using a precut traction papillotome and the majority using a needle-knife papillotome. *Traction precut* (5,6) and *needle-knife precut* (7-16) techniques cut from the papillary orifice and extend cephalad, whereas *needle-knife fistulotomy* (17-22) leaves the papillary orifice behind and starts at the most prominent portion of the papilla.
2. *Precut transpancreatic papillotomy* (23-29) uses a standard traction-type papillotome inserted into the pancreatic duct and follows the incidental or intended cannulation.

Since being reported in the 1980s, biliary precut techniques were considered as high-risk procedures that only experienced endoscopists should use, and only as a last resort

De-la-Morena-Madrigal EJ, Rodríguez-García MI, Galera-Ródenas AB, Pérez-Arellano E. Biliary cannulation effectiveness and pancreatitis risk using two early precut techniques. Rev Esp Enferm Dig 2018;110(2):74-81.

DOI: 10.17235/reed.2017.5175/2017

before more aggressive techniques (30,31). However, the high quality scientific evidence gathered during the past 35 years has shown that the risk for pancreatitis is not dependent upon the precut technique itself but on the timing (32-40). Needle-knife precut (NKP), when indicated early and performed with expertise, may obtain overall BC rates approaching 100%, with an associated incidence of pancreatitis nearing 0%. Transpancreatic precut (TPP), which was described ten years later, has been less accurately assessed. However, it stands to reason that early use, when limiting the number of unwanted PC to the minimum, will also reduce the pancreatitis risk.

The goal of the present study was to assess BC rates and pancreatitis rates associated with two complementary precut techniques when indicated early and performed according to a fixed, flexible protocol, adapted to individual needs.

PATIENTS AND METHOD

A retrospective analysis of a personal series of ERCP from 2013-2016 was performed. All procedures were performed by the same endoscopist (EJMM) with a prior experience of over 2000 ERCP (150-180 per year) and 250 precut (200 NKP and 50 TPP) procedures. All patients signed a standard informed consent form for the ERCP.

Materials

The procedures were carried out in different private hospitals in Madrid using the Pentax ED-3470TK (Tokyo, Japan), Olympus TJF-160VR (Tokyo, Japan) and Fujinon ED-250XT5 (Tokyo, Japan) therapeutic duodenoscopes with Boston Scientific (Natick MA, USA) AUTOTOME RX-44 cannulotomes assisted by JAGWIRE/HYDRA-JAGWIRE 0.035" guidewires. For a minority of cases, Cook Medical (Bloomington IN, USA) DASH-21-480 cannulotomes with TRACER-METRO 0.021" guidewires and Olympus (Tokyo, Japan) CLEVER-CUT-3V cannulotomes with VISIGLIDE 0.025" guidewires were used. TPP were performed using the same cannulotome as the simple cannulation procedure, whereas NKP were performed using the Cook Medical (Bloomington IN, USA) HPC-2 single-lumen needle-knife sphincterotomes. In a minority of cases, the Boston Scientific (Natick MA, USA) RX NEEDLE-KNIFE XL triple-lumen sphincterotomes was used. ERBE VIO-200S (Tubingen, Germany), Olympus HF-120 (Tokyo, Japan) and ERBE ICC-200 (Tubingen, Germany) diathermy generators were used by applying a mixed current in the "endocut" mode.

Cannulation strategy (Fig. 1)

BC was initially attempted with the aid of a hydrophilic guidewire, without prior cholangiography, for up to ten minutes. The cannulation time was extended to ten minutes only for non-pathological or mildly inflamed papillae. For severely inflamed papillae that appeared to be impacted by a stone or infiltrated by a neoplasm or if cannulation was deemed "difficult" for other reasons by the endoscopist (e.g. duodenoscope stability), the precut was carried out in less than ten minutes. If BC (or PC) failed under these conditions, NKP was attempted. When BC failed following NKP within the additional ten minutes, the procedure was discontinued to be completed later during a second stage (after 3-7 days).

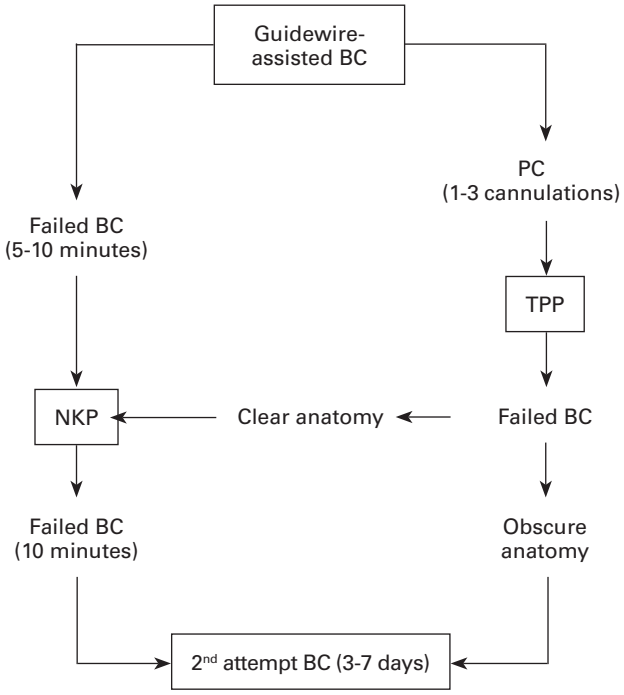

Fig. 1. *The biliary cannulation protocol applied during the study period (BC: biliary cannulation; PC: pancreatic cannulation; NKP: needle-knife precut; TPP: transpancreatic precut).*

If an incidental PC occurred during simple cannulation, the endoscopist performed a TPP or attempted BC again. When a first PC was fast (less than five minutes) and the papilla was deemed "easy" to cannulate, simple cannulation was attempted until a maximum of three PC. In the case of no other incidental PC and if BC failed during the additional ten minutes, a NKP procedure was performed. When a first PC was delayed (over five minutes) or if the papilla was deemed "difficult" to cannulate, a TPP procedure was performed. In the case of an intradiverticular papilla where the anatomy precluded a safe precut, BC was attempted using a DG technique following the first PC. If the BC failed following TPP and the papillary anatomy was clear with an apparent exposure of the intraduodenal bile duct, NKP was also performed (TPP + NKP). However, when the anatomy was unclear or hidden by blood remnants, a delayed second stage was decided upon.

Precut technique

NKP was performed using a two-step mixed technique. Step 1 involved a superficial or "mucosal" papillotomy of 10-15 mm in length, extending cephalad from the papillary orifice towards the "11 o'clock" position, which exposes the wall of the intraduodenal bile duct. The second step involves a deep or "muscular" fistulotomy of 3-5 mm in length, over the more clearly exposed portion of the bile duct, several millimeters cephalad to the papillary orifice. If the papilla appeared thickened, suggestive of an impacted stone or neoplastic involvement, a deep fistulotomy was initially performed on the most prominent area.

TPP was also a two-step procedure. The first step involved a pancreatic sphincterotomy about 5-10 mm in length, extending towards the "1 o'clock" position in order to incise the whole of the pancreatic sphincter, which exposes the septum including the intraduodenal bile duct. The second step involves a 3-5 mm incision of the bile duct, extending towards the "11 o'clock" position. The position of the cannulotome in the pancreatic duct was confirmed by the guidewire inside and pancreatography was restricted to those cases where the guidewire could not be advanced to the pancreatic body, thus casting doubt on its location. The guidewire was maintained within the pancreatic duct during the TPP.

BC was again attempted with a conventional cannulotome and a hydrophilic guidewire after the precut. Following BC, the precut was extended, always using a standard traction-type sphincterotome (STS) of an appropriate size for the papillary anatomy and therapeutic indication.

Analysis of results

An analysis of the efficacy was carried out using the endoscopic procedure reports, supported by static radiographic images and endoscopic video recordings. The analysis was performed for all diagnostic or therapeutic ERCP with intact papillae (absence of prior biliary or pancreatic endoscopic sphincterotomy, surgical sphincteroplasty or ampullectomy). Procedures where the papilla could not be accessed or identified due to stenosing conditions or anatomic or postsurgical distortion were excluded from the analysis. Duodenoscopies for extrapapillary duodenal conditions and procedures that were aborted due to precannulation complications or a scope breakdown were also excluded. Two-stage procedures were computed as single procedures.

The safety analysis was performed using available paper or electronic medical records, bearing in mind that a significant proportion of patients were referred from and then sent back to other hospitals, thus resulting in a loss of follow-up. Partial information was obtained for some cases from anamnesis prior to the second ERCP, some days, weeks or even months after the initial procedure. Pancreatic stents (PS) were not implanted in the ERCP group with the sole intention of preventing post-ERCP pancreatitis. Two-stage procedures were computed separately. Pancreatitis, perforation and bleeding were defined and graded according to updated consensus criteria (41).

Statistical analysis

Statistical analysis was performed with the IBM SPSS Statistics 24 package and the χ^2 test was used for independent variables.

RESULTS

Evaluable ERCP (Fig. 2)

During the period from 2013 to 2016, 737 ERCP procedures were carried out; 222 were excluded from the analysis, 86% of them due to a prior sphincterotomy. Twelve two-stage procedures were computed as single procedures; therefore, the number of ERCP procedures included in the efficacy analysis was 503. Simple BC was successful in 369 cases. BC was unsuccessful in three patients using simple strategies, and precut was not attempted. Among the 131 attempts at advanced cannulation, NKP was used in 53 (40%) cases and TPP in 78 (60%) cases. Seven TPP (9%) required NKP rescue.

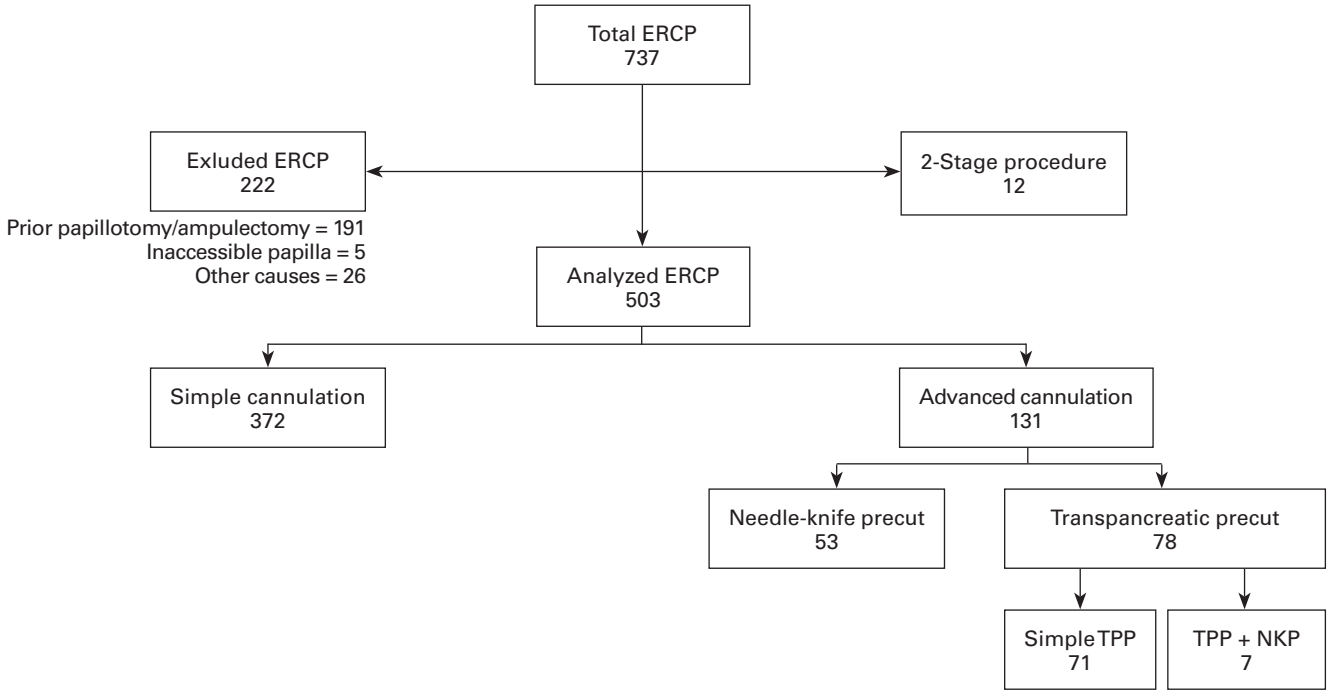

Fig. 2. *Distribution of patients that underwent ERCP during the study period, according to the biliary cannulation technique.*

Patients undergoing precut

Table 1 shows the main characteristics of the 53 patients that underwent NKP and 78 patients that underwent TPP. The most relevant trends included male sex, papillary obstruction, impacted stones at the papilla and benign proximal (postsurgical) obstruction among patients that underwent NKP. With regard to patients that underwent TPP, female sex, unobstructed papilla, diverticular papilla, choledocholithiasis and malignant (both distal and proximal) obstruction were relevant trends.

Efficacy analysis

The BC rate for the simple approach was 73.4% (369/503). A DG was used for two cases of intradiverticular papilla. Among patients who required a precut, the BC rate was 96.2% (126/131), which increased to an overall BC rate of 98.4% (495/503). The BC rate, which was 96.2% (p = 0.727), was identical for both precut groups. BC was successful in 100% of the 12 two-stage and seven combined (TPP + NKP) procedures.

Table 1. *Comparison of NKP and TPP groups*

	NKP	TPP
Patients (n)	53	78
Age	69.1 (21-92)	67.3 (27-97)
Males	29 (55%)	33 (41%)
Papilla		
Non-pathological	35 (66%)	67 (86%)
Pathological	18 (34%)	11 (14%)
Diverticular	6 (11%)	19 (24%)
Diagnosis		
Choledocholithiasis	18	32
Papillary obstruction	19	16
Stone	6	0
Malignant	2	2
Benign	11	14
Distal biliary obstruction	7	17
Malignant	7	16
Benign	0	1
Proximal biliary obstruction	4	6
Malignant	1	6
Benign	3	0
Postsurgical biliary fistula	3	3
Normal or no diagnosis	2	4
Two-stage biliary cannulation	8 (15%)*	4 (5%)*
Pancreatic procedure		
Incidental cannulation	12 (22.6%)	78 (100%)
Pancreatic stent	0	2
Rectal NSAID	31 (58.5%)	45 (57.7%)
Successful biliary cannulation	51 (96.2%)	75 (96.2%)
Pancreatitis	0†	5 (6.3%)†

*p = 0.049; †p = 0.062.

Table 1 shows the procedures and maneuvers undertaken in precut cases. The NKP group required more two-stage procedures as compared to the TPP group (p = 0.049). Per protocol, prior incidental PC was obtained for all TPP and for 22.6% of NKP. BC was achieved in three patients that underwent TPP with the DG approach and a PS was implanted and maintained for five and six days, respectively, in two cases. The use of rectal non-steroidal anti-inflammatory drugs (NSAID) was similar in both groups and showed an increasing trend over time (< 20% in 2013, > 80% in 2016).

Safety analysis

Follow-up data were available for 89.9% of the total procedures (463/515) and 92.3% of advanced cannulation procedures (132/143). The overall pancreatitis rate was 2.4% (11/463), 1.8% (6/331) for patients undergoing simple cannulation and 3.8% (5/132) (p = 0.208) for those undergoing precut.

Pancreatitis in advanced cannulation

No pancreatitis events (0%) were reported for the 53 NKP, whereas five (6.3%; p = 0.062) were reported among the 79 TPP cases. Pancreatitis was not reported in the seven patients who received TPP + NKP. Table 2 shows the distribution by severity and the risk/protective factors found for the eleven recorded pancreatitis events. The two severe pancreatitis events in the TPP group were more clinically serious conditions (4-month hospitalization and one surgical procedure) as compared to the two events reported for the simple cannulation group (24 and 35 days in hospital). However, the only reported fatal pancreatitis event occurred in the latter group, in a patient with a severely advanced malignancy who was unfit for extreme therapeutic measures.

Perforation in advanced cannulation

Three perforations were reported in the NKP group and four in the TPP group (p = 0.881). One retroperitoneal perforation in the NKP group and another one in the TPP group occurred during second-stage procedures and were not attributable to the precut procedure but rather to STS. These cases were resolved with medical treatment following hospitalization for 18 and eight days, respectively. A choledochal perforation after mechanical dilation (MD) occurred in another second-stage procedure and may not be attributed to NKP. This case was resolved by the implantation of a full-covered metal stent. In the NKP group, a third perforation was produced by the guidewire in an intrahepatic duct. This patient developed a fever and received antibiotic therapy for 12 days.

In the TPP group, two additional retroperitoneal perforations were reported. One occurred after a successful BC followed by STS and MD, and was resolved with medical treatment following hospitalization for nine days. The other case developed after TPP and failed BC in an intradiverticular papilla. The patient underwent surgery in order to concurrently manage a biliary fistula and the associated

Table 2.

A. Pancreatitis in patients undergoing simple BC								
Gender	**Age**	**T. bil mg/dl**	**Biliary dilation**	**Pancreatography**	**Pancreatic cannulation**	**Rectal NSAID**	**Endoscopic diagnosis**	**Pancreatitis severity**
M	36	1.7	Mild	No	No	Yes	Biliary fistula	Mild
F	51	-	Moderate	Body	Guidewire	No	Choledocholithiasis	Moderate
F	77	-	Moderate	No	No	No	Residual biliary dilation	Moderate
M	74	0.6	Mild	No	Guidewire	Yes	Choledocholithiasis	Severe (24 d.)
F	65	0.7	Mild	Body	Guidewire	Yes	Choledocholithiasis	Severe (35 d.)
M	75	13.9	Mild	No	No	No	Metastatic gallbladder carcinoma	Fatal
B. Pancreatitis in patients undergoing TPP								
Gender	**Age**	**T. bil mg/dl**	**Biliary dilation**	**Pancreatography**	**Pancreatic cannulation**	**Rectal NSAID**	**Endoscopic diagnosis**	**Pancreatitis severity**
M	45	9.8	No	No	Guidewire	Yes	Benign biliary stenosis	Mild
F	67	-	Moderate	Head	Guidewire	No	Stenosing papillitis	Moderate
M	41	0.7	No	No	Guidewire	Yes	Biliary fistula	Moderate
F	83	1.0	Mild	Body	Guidewire	No	Residual biliary dilation	Severe (4 m.)
M	67	6.2	No	Head	Guidewire (DG)	Yes	Choledocholithiasis	Severe (4 m. + surgery)

Table 2 shows the characteristics of patients with post-ERCP pancreatitis following simple BC (A) or TPP (B). Female gender (F), normal blood bilirubin (< 1.2 mg/dl) and no biliary dilation were identified as risk markers (2). A diagnosis of stenosing papillitis may be likened to type-I sphincter of Oddi dysfunction. Other patient-related markers including prior acute pancreatitis and the absence of chronic pancreatitis were not reported in any case. Pancreatography and pancreatic cannulation represent procedure-dependent risk factors (2) whereas rectal NSAIDs are a protective factor (2,3). Protective PS were not implanted. The median number of risk factors per patient was 3, but there was no correlation between the number of concurrent factors and pancreatitis severity.

abscess. A final duodenal perforation was reported after TPP + NKP, STS and MD, which were managed by surgical duodenal exclusion.

Bleeding in advanced cannulation

Three delayed bleeding episodes were recorded in the NKP group and four in the TPP group (p = 0.881). Two episodes in the NKP group occurred after STS on papillae that were obstructed by an impacted stone in one case and by carcinomatous infiltration in the other case. The first patient received endoscopic treatment whereas the second was transfused with two RBC packs. A third bleeding event was reported in a patient on anticoagulation therapy after a failed first-stage NKP and BC, which did not require endoscopic treatment or transfusion.

All bleeding episodes in the TPP group occurred after the STS. One was resolved without intervention, one case required two RBC packs and the remaining two cases were treated endoscopically with four and seven RBC packs, respectively.

DISCUSSION

The technical primary goal of ERCP is selective BC, which is a key requirement for sphincterotomy and/or other precise therapeutic biliary procedures in order to achieve the clinical primary goal to cure or alleviate disease. The secondary goal is to achieve the primary goal with the lowest possible morbidity. More recent recommendations report BC rates above 95% and complication rates below 5% (42). An endoscopist with sufficient expertise to resort to advanced BC techniques (43) must maintain a simple BC rate of at least 80%. During the study period, the overall BC rate was 98.4% of attempted and non-excluded procedures and this was achieved with a simple BC rate of 73.4% and an advanced BC (40% NKP, 60% TPP) rate of 96.2%. In contrast with the above mentioned, we will report the simple BC rate in our study as below 80%, as evidence of our conviction regarding the benefit of the early use and rigorous performance of the precut technique.

The BC protocol used in this study generally followed the agreed principles of the recommendations recently reported for cannulation and complication prevention (2,3,43,44). Major exceptions include early TPP rather than DG and the non-use of PS after TPP. A controlled randomized trial that compared DG *versus* TPP in 71 patients (45) showed the same BC rate (91.2% *vs* 91.9%, p = 0.732) and a significantly higher rate of pancreatitis for DG (38.2% *vs* 10.8%, p = 0.011), which supports our preference for TPP. Another similar trial compared DG *versus* early NKP (with a fistulotomy technique) in 134 patients (46) and showed the superiority of NKP over DG, both with regard to BC rate (79.1% *vs* 44.8%, p < 0.001) and the pancreatitis rate (4.5% *vs* 14.9%, p = 0.041). This also supports our preference for NKP over DG, even in a case of incidental PC.

With regard to PS placement after TPP, only two studies (26,29) used this selectively (in 25% and 75% of patients, respectively) and surprisingly reported a higher rate of pancreatitis (8% and 9%, respectively) compared to non-PS implantation after TPP (23-25,27,28). Prior to 2013, our experience with TPP without PS placement had low pancreatitis rates (47), which we attribute to the use of a complete pancreatic sphincterotomy to improve immediate pancreatic drainage and reduce the long term risk of a cicatricial stricture at the pancreatic orifice (48). Due to both of these reasons, in this study PS placement was restricted to two cases where BC was achieved with a guidewire maintained within the pancreatic duct after TPP. A third patient who underwent TPP + DG (before the other two) without PS developed severe pancreatitis despite the presence of only two risk factors, i.e., the absence of biliary dilation and cephalic pancreatography to confirm PC. This case and a second case of severe pancreatitis lead to a negative qualification of the pancreatitis rate of 6.3% in the TPP group. The same pattern was observed in patients with simple BC (Table 2), in contrast to the reported experience, with a rate of severe pancreatitis events of only 11% and a mortality rate of 3% (49). The simplest explanation for this finding would be the retrospective nature of the study and the fact that milder pancreatitis episodes would have been "missed". However, according to our follow-up protocol, patients stayed in hospital for least 24 hours after the ERCP and were only discharged in the absence of evidence or suspicion of pancreatitis. Thus, the "missing" of early complications such as pancreatitis seems unlikely. Due to the lack of a better explanation, we assume that our BC protocol is highly effective in order to reduce the risk of mild pancreatitis, whereas the risk of a more severe pancreatitis would require additional prevention measures, including a more liberal use of PS (2,3).

The most relevant fact in our study is the null incidence of pancreatitis among the 53 patients who underwent NKP, with a trend towards statistical significance compared with TPP ($p = 0.062$). Several factors may contribute to this fact. Firstly, our wider experience with regard to numbers and time for NKP *versus* TPP. This experience led to the development of a mixed NKP technique (superficial papillotomy + deep fistulotomy), which may be as safe as a classic fistulotomy (38) and still be applicable to most papillae, including the less prominent ones. Secondly, an early NKP spares the papilla the trauma of manipulations before the precut procedure. While TPP is also used early, the need to insert a cannulotome (not just a guidewire) in the most distal pancreatic duct to initiate the precut is likely to increase papillary trauma. Thirdly, we resorted to a two-stage approach in 15% of cases, which protected the papilla from the trauma of manipulations after the precut procedure. The 15% rate in the NKP group is significantly higher than the 5% rate reported in the TPP group ($p = 0.049$), which could be interpreted as a reduced effectiveness of NKP for BC. Nevertheless, salvage with NKP (TPP + NKP) was required in seven cases in the TPP group, which resulted in an equal BC rate for both techniques in the first stage with no alternative rescue (NKP 43/53, 81%; TPP 64/78, 82%). In a previous study (47), we reported two perforations among 14 TPP + NKP procedures. Hence, we recommended that salvage NKP only be used for clear anatomies revealed by TPP. Otherwise, a delayed strategy should be considered and a second-stage BC attempted. Our current results confirm this risk, as we observed one perforation among the seven TPP + NKP procedures. The relatively low rate of incidental PC with a guidewire (22.6%) during the NKP is a fourth factor that potentially accounts for the lack of pancreatitis in the NKP group, whereas the per protocol incidence is 100% for TPP. The retrospective nature of the study did not allow the assessment of the number of PC in each case. However, according to the protocol, it is reasonable to assume that most PC were isolated cases in the NKP group and repeated cases in the TPP group, which represents an additional risk factor (2). The null incidence of pancreatitis in the NKP group is even more relevant when taking into account the fact that no patients received a preventive PS, and rectal NSAIDs were scarcely used in 58.5% of cases.

An Italian prospective, multicenter study reported in 1998, before the development of the "early precut" concept and strategy, showed that the precut procedure was not a risk factor for pancreatitis but for perforation (50). In this study, there were three perforations in the NKP group, none of them attributable to the precut (two from second-stage STS and papillary MD, at days 7 and 6 after NKP, respectively, and one from intrahepatic guidewire) and all cases were resolved without surgery. There were four perforations in the TPP group, but only one after second-stage STS which cannot be attributed to TPP with certainty. The second perforation developed after three risky procedures (TPP + STS + MD), was associated with a technical success and was resolved conservatively. The third perforation occurred after a TPP of an intradiverticular papilla that was not cannulated hence it was clearly caused by the TPP. BC failure was an indication for surgery to treat the underlying condition (biliary fistula with an abscess) and the complication. The fourth perforation developed following four risky procedures (TPP + NKP + STS + MD) and required surgical duodenal exclusion.

The bleeding rate in this study was similar to the perforation rate, three in the NKP group and four in the TPP group, and none of the cases were severe. In six cases, precut was followed by STS as an additional risky procedure. Two NKP + STS procedures were performed on pathological papillae (one acute papillitis from a stone impaction and one neoplasm). Only precut was used in the third bleeding event reported in the NKP group due to a first-stage BC failure. However, the patient had received anticoagulation therapy before the bleeding developed hence its attribution to NKP may only be relative.

The 19 complications reported for the 132 precut procedures represent an incidence of 14.4%. However, aside from the frequency rates (and possible, probable or definite attributions), the most significant and worrisome events in this study were the four severe complications (two pancreatitis and two perforations) reported in the TPP group compared to the safety of NKP. Even though the technical outcome of the overall BC protocol was excellent (> 98%), severe morbidity needs to be reduced. Therefore, the procedure should be modified and NKP should be used earlier for patients with a higher risk of pancreatitis that are currently included in the TPP arm.

In conclusion, our experience with early NKP shows high efficacy and safety levels in difficult BC cases. Hence, the technique should become the primary alternative rescue

option. TPP in incidental PC cases attains the same high effectiveness with a significant severe morbidity. Therefore, we believe that it is necessary to change our protocol in order to include (rather than repeat PC) an immediate NKP or TPP with a preventive PS implantation in the case of a first incidental PC in high risk cases.

REFERENCES

1. DaVee T, García JA, Baron TH. Precut sphincterotomy for selective biliary duct cannulation during endoscopic retrograde cholangiopancreatogaphy. Ann Gastroenterol 2012;25:291-302.
2. Dumonceau JM, Andriulli A, Elmunzer BJ, et al. Prophylaxis of post-ERCP pancreatitis: ESGE guideline - Updated june 2014. Endoscopy 2014;46:799-815. DOI: 10.1055/s-0034-1377875
3. Chandrasekhara V, Khashab MA, Muthusamy VR, et al. ASGE guideline: Adverse events associated with ERCP. Gastrointest Endosc 2017;85:32-47. DOI: 10.1016/j.gie.2016.06.051
4. Herreros de Tejada A, Calleja JL, Díaz G, et al. Double-guidewire technique for difficult bile duct cannulation: A multicenter randomized, controlled trial. Gastrointest Endosc 2009;70:700-9. DOI: 10.1016/j.gie.2009.03.031
5. Siegel JH. Precut papillotomy: A method to improve success of ERCP and papillotomy. Endoscopy 1980;12:130-3. DOI: 10.1055/s-2007-1021728
6. Binmoeller KF, Seifert H, Gerke H, et al. Papillary roof incision using the Erlangen-type pre-cut papillotome to achieve selective bile duct cannulation. Gastrointest Endosc 1996;44:689-95. DOI: 10.1016/S0016-5107(96)70053-6
7. Huibregtse K, Katon RM, Tytgat GNJ. Precut papillotomy via fine needle-knife papillotome: A safe and effective technique. Gastrointest Endosc 1986;32:403-5. DOI: 10.1016/S0016-5107(86)71921-4
8. Dowsett JF, Polydorou AA, Vaira D, et al. Needle-knife papillotomy: How safe and how effective? Gut 1990;31:905-8. DOI: 10.1136/gut.31.8.905
9. Tweedle DEF, Martin DF. Needle-knife papillotomy for endoscopic sphincterotomy and cholangiography. Gastrointest Endosc 1991;37:518-21. DOI: 10.1016/S0016-5107(91)70819-5
10. Shakoor T, Geenen JE. Pre-cut papillotomy. Gastrointest Endosc 1992;38(5):623-7. DOI: 10.1016/S0016-5107(92)70537-9
11. Foutch PG. A prospective assessment of results for needle-knife papillotomy and standard endoscopic sphincterotomy. Gastrointest Endosc 1995;41(1):25-32. DOI: 10.1016/S0016-5107(95)70272-5
12. Bruins-Slot W, Schoeman MN, Disario JA, et al. Needle-knife sphincterotomy as a precut procedure: A retrospective evaluation of efficacy and complications. Endoscopy 1996;28:334-9. DOI: 10.1055/s-2007-1005476
13. Rabenstein T, Ruppert T, Schneider T, et al. Benefits and risks of needle-knife papillotomy. Gastrointest Endosc 1997;46(3):207-11. DOI: 10.1016/S0016-5107(97)70087-7
14. Rollhauser C, Johnson M, Al-Kawas FH. Needle-knife papillotomy: A helpful and safe adjunct to endoscopic retrograde cholangiopancreatograpy in a selected population. Endoscopy 1998;30(8):691-6. DOI: 10.1055/s-2007-1001390
15. Katsinelos P, Mimidis K, Paroutoglou G, et al. Needle-knife papillotomy: A safe and effective technique in experienced hands. Hepatogastroenterology 2004;51:349-52.
16. Espinel Díez J, Vivas Alegre S, Muñoz Núñez F, et al. Esfinterotomía de aguja como técnica de acceso a la vía biliar: estudio prospectivo. Gastroenterol Hepatol 2005;28(7):369-74. DOI: 10.1157/13077756
17. Siegel JH, Ben-Zvi JS, Pullano W. The needle-knife: A valuable tool in diagnostic and therapeutic ERCP. Gastrointest Endosc 1989;35:499-503. DOI: 10.1016/S0016-5107(89)72897-2
18. Leung JWC, Banez VP, Chung SCS. Precut (needle-knife) papillotomy for impacted common bile duct stone at the ampulla. Am J Gastroenterol 1990;85:991-3.
19. Kasmin FE, Cohen D, Batra S, et al. Needle-knife sphincterotomy in a tertiary referral center: Efficacy and complications. Gastrointest Endosc 1996;44:48-53. DOI: 10.1016/S0016-5107(96)70228-6
20. Gholson CF, Favrot D. Needle knife papillotomy in a university referral practice. Safety and efficacy of a modified technique. J Clin Gastroenterol 1996;23:177-80. DOI: 10.1097/00004836-199610000-00004
21. Mavrogiannis C, Liatsos C, Romanos A, et al. Needle-knife fistulotomy versus needle-knife precut papillotomy for the treatment of common bile duct stones. Gastrointest Endosc 1999;50:334-9. DOI: 10.1053/ge.1999.v50.98593
22. Kaffes AJ, Sriram PV, Rao GV, et al. Early institution of pre-cutting for difficult biliary cannulation: A prospective study comparing conventional vs. a modified technique. Gastrointest Endosc 2005;62:669-74.
23. Goff JS. Common bile duct pre-cut sphincterotomy: Transpancreatic sphincter approach. Gastrointest Endosc 1995;41:502-5. DOI: 10.1016/S0016-5107(05)80011-2
24. Goff JS. Long-term experience with the transpancreatic sphincter pre-cut approach to biliary sphincterotomy. Gastrointest Endosc 1999;50:642-5. DOI: 10.1016/S0016-5107(99)80012-1
25. Akashi R, Kiyozumi T, Jinnouchi K, et al. Pancreatic sphincter precutting to gain selective access to the common bile duct: A series of 172 patients. Endoscopy 2004;36:405-10. DOI: 10.1055/s-2004-814315
26. Kahaleh M, Tokar J, Mullick T, et al. Prospective evaluation of pancreatic sphincterotomy as a precut technique for biliary cannulation. Clin Gastroenterol Hepatol 2004;2:971-7. DOI: 10.1016/S1542-3565(04)00484-7
27. Espinel Díez J. Acceso a la vía biliar mediante esfinterotomía transpancreática. Gastroenterol Hepatol 2006;29:281-5. DOI: 10.1157/13087466
28. Weber A, Roesch T, Pointner S, et al. Transpancreatic precut sphincterotomy for cannulation of inaccessible common bile duct: A safe and successful technique. Pancreas 2008;36:187-91. DOI: 10.1097/MPA.0b013e31815ac54c
29. Sakai Y, Tsuyuguchi T, Sugiyama H, et al. Transpancreatic precut papillotomy in patients with difficulty in selective biliary cannulation. Hepato-Gastroenterology 2011;58:1853-8.
30. Cotton PB. Precut papillotomy - A risky technique for experts only. Gastrointest Endosc 1989;35:578-9. DOI: 10.1016/S0016-5107(89)72921-7
31. Baillie J. Needle-knife papillotomy revisited. Gastrointest Endosc 1997;46:282-4.
32. Bailey AA, Bourke MJ, Kaffes AJ, et al. Needle-knife sphincterotomy: Factors predicting its use and the relationship with post-ERCP pancreatitis. Gastrointest Endosc 2010;71:266-71. DOI: 10.1016/j.gie.2009.09.024
33. Zhou PH, Yao LQ, Xu MD, et al. Application of needle-knife in difficult biliary cannulation for endoscopic retrograde cholangiopancreatography. Hepatobiliary Pancreat Dis Int 2006;5:590-4.
34. Manes G, Di Giorgio P, Repici A, et al. An analysis of the factors associated with the development of complications in patients undergoing precut sphincterotomy: A prospective, controlled, randomized, multicenter study. Am J Gastroenterol 2009;104:2412-7. DOI: 10.1038/ajg.2009.345
35. 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;11:430-6. DOI: 10.1016/j.cgh.2012.12.017
36. Mariani A, Di Leo M, Giardullo N, et al. Early precut sphincterotomy for difficult biliary access to reduce post-ERCP pancreatitis: A randomized trial. Endoscopy 2016;48:530-5. DOI: 10.1055/s-0042-102250
37. Gong B, Hao L, Bie L, et al. Does precut technique improve selective bile duct cannulation or increase post-ERCP pancreatitis rate? A meta-analysis of randomized controlled trials. Surg Endosc 2010;24:2670-80. DOI: 10.1007/s00464-010-1033-y

38. Choudhary A, Winn J, Siddique S, et al. Effect of precut sphincterotomy on post-endoscopic retrograde cholangiopancreatography pancreatitis: A systematic review and meta-analysis. World J Gastroenterol 2014;20:4093-101. DOI: 10.3748/wjg.v20.i14.4093

39. Navaneethan U, Konjeti R, Venkatesh PGK, et al. Early precut sphincterotomy and the risk of endoscopic retrograde cholangiopancreatography related complications: An updated meta-analysis. World J Gastrointest Endosc 2014;6:200-8. DOI: 10.4253/wjge.v6.i5.200

40. Sundaralingam P, Masson P, Bourke MJ. Early precut sphincterotomy does not increase risk during endoscopic retrograde cholangiopancreatography in patients with difficult biliary access: A meta-analysis of randomized controlled trials. Clin Gastroenterol Hepatol 2015;13:1722-9. DOI: 10.1016/j.cgh.2015.06.035

41. Cotton PB, Eisen GM, Aabakken L, et al. A lexicon for endoscopic adverse events: Report of an ASGE workshop. Gastrointest Endosc 2010;71:446-54. DOI: 10.1016/j.gie.2009.10.027

42. Mammen A, Haber G. Difficult biliary access: Advanced cannulation and sphincterotomy technique. Gastrointest Endosc Clin N Am 2015;25:619-30. DOI: 10.1016/j.giec.2015.06.007

43. 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;48:657-83. DOI: 10.1055/s-0042-108641

44. Liao W, Angsuwatcharakon P, Isayama H, et al. International consensus recommendations for difficult biliary access. Gastrointest Endosc 2017;85:295-304. DOI: 10.1016/j.gie.2016.09.037

45. Yoo YW, Cha SW, Lee WC, et al. Double guidewire technique vs transpancreatic precut sphincterotomy in difficult biliary cannulation. World J Gastroenterol 2013;19:108-14. DOI: 10.3748/wjg.v19.i1.108

46. Kim SJ, Kang DH, Kim HW, et al. Needle-knife fistulotomy vs double-guidewire technique in patients with repetitive unintentional pancreatic cannulations. World J Gastroenterol 2015;21:5918-25.

47. De la Morena Madrigal EJ. Impacto de las técnicas combinadas de precorte sobre la canulación biliar. Rev Esp Enferm Dig 2013;105:338-44.

48. Kozarek RA, Ball TJ, Patterson DJ, et al. Endoscopic pancreatic duct sphincterotomy: Indications, technique, and analysis of results. Gastrointest Endosc 1994;40:592-8. DOI: 10.1016/S0016-5107(94)70260-8

49. Andriulli A, Loperfido S, Napolitano G, et al. Incidence rates of post-ERCP complications: A systematic survey of prospective studies. Am J Gastroenterol 2007;102:1781-8. DOI: 10.1111/j.1572-0241.2007.01279.x

50. Loperfido S, Angelini G, Benedetti G, et al. Major early complications from diagnostic and therapeutic ERCP: A prospective multicenter study. Gastrointest Endosc 1998;48:1-10. DOI: 10.1016/S0016-5107(98)70121-X