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Surgical treatment for biliary obstruction in patients with painful chronic pancreatitis and a dilated duct: choledochojejunostomy or biliopancreatic tunneling?

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Abstract

Introduction: Patients with painful chronic pancreatitis and a dilated duct are treated with extended surgical drainage procedures such as Frey or extended Partington procedures. In cases of biliary obstruction, an additional biliary derivation is performed. Either concurrent choledochojejunostomy or biliopancreatic tunneling may be chosen in such cases.

Methods: To assess the results of surgical treatment for biliary obstruction in patients with painful chronic pancreatitis and a dilated main pancreatic duct. This study was a case series comprising patients with chronic pancreatitis who underwent an extended drainage procedure combined with a biliary derivation including choledochojejunostomy or biliopancreatic tunneling.

Results: From December 2020 to July 2023, 58 patients underwent extended pancreatic duct drainage for chronic pancreatitis. Among them, eight patients (14%) had biliary obstruction. Three patients (38%) underwent concurrent choledochojejunostomy, whereas five patients (62%) underwent biliopancreatic tunneling. One patient (20%) in the group of biliopancreatic tunneling experienced a complication (Grade II), compared to no patient in the group of choledochojejunostomy. Another patient (20%) in the group of biliopancreatic tunneling developed recurrent biliary obstruction, compared to no patient in the group of choledochojejunostomy. Pain relief, quality of life, pancreatic function, and other outcomes did not differ between the two groups.

Conclusions: Both choledochojejunostomy and biliopancreatic tunneling were effective in treating biliary obstruction due to chronic pancreatitis. However, careful execution of biliopancreatic tunneling is critical to avoid recurrent biliary obstruction.

Keywords: pancreatitis, chronic; choledochojejunostomy; cholestasis; choledochostomy

1. INTRODUCTION

Chronic pancreatitis is an inflammatory disease in which fibrosis and calcifications progressively replace the normal parenchyma after several acute exacerbation attacks. This progression occurs primarily in the head of the pancreas, where a large amount of parenchyma is concentrated. The fibrotic tissue and calcifications can exert extrinsic pressure on the

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pancreatic duct, common bile duct, and duodenum. This ultimately results in the obstruction of these structures [1]. A dilated main pancreatic duct is most commonly seen the most in patients with chronic pancreatitis [2]. Less frequently, biliary obstruction occurs with an incidence of 3%–62%. If biliary obstruction is associated with a dilated pancreatic duct and incapacitating pain, surgery to treat these conditions simultaneously should be considered [3–5]. Extended pancreatic duct drainage, including Frey or extended Partington procedures, is the preferred operation of choice for painful chronic pancreatitis with a dilated duct [6–9]. When biliary derivation is concurrently performed, choledochojejunostomy is considered the optimal method [10–14]. The challenges of this procedures include the requirement for cholecystectomny and the need for an additional bilioenteric anastomosis.

To simplify of concurrent biliary derivation, Izbicki and collaborators introduced the reinsertion of the bile duct into the resection cavity – referred to as biliopancreatic tunneling - during the Frey procedure. This technique is considered safe, quick, and effective in restoring bile flow into the digestive tract, without the need for an additional biliary bypass [15]. Several authors later adopted this technique later and showed promising results [16–19]. We conducted this study to determine the effect of both biliopancreatic tunneling and choledochojejunostomy in patients with painful chronic pancreatitis and a dilated duct complicated by biliary obstruction.

2. METHODS

2.1. Study design, population, and ethical considerations

After receiving approval of the study by the medical ethics committee of the University of Medicine and Pharmacy at Ho Chi Minh City, number 90/HĐĐĐ-ĐHYD, coded 2186-ĐHYD, we conducted this case series in the Department of Hepatobiliary and Pancreatic Surgery, Cho Ray Hospital, Ho Chi Minh City, Viet Nam. This study included consecutive patients with chronic pancreatitis and a dilated duct complicated by biliary obstruction. Written informed consent was obtained from all patients before enrollment.

2.2. Inclusion and exclusion criteria

Patients were required to have experienced pain affecting daily activities for at least three months or continuous pain for one month prior to being considered for surgery. A dilated pancreatic duct of at least 5 millimeters, as detected by computed tomography or magnetic resonance imaging, was a prerequisite for a surgical drainage procedure. Pancreatic calcifications detected by imaging studies are needed to ensure the diagnosis of chronic pancreatitis. Biliary obstruction was defined as an elevated bilirubinemia and a dilated extrahepatic bile duct detected on imaging (diameter of at least 10 millimeters). Patients with pancreatic cancer, those who lost to follow-up for at least three months, patients who had an enlarged pancreatic head, and patients who met surgical contraindications (American Society of Anesthesiologists-ASA class IV, severe portal hypertension) were excluded from the study.

2.3. Surgical technique

As in the original Partington procedure, the pancreatic duct was incised longitudinally from the tail to the neck of the pancreas. In the head of the pancreas, the duct incision was extended to a point proximal to the duodenum with/without a minimal wedge resection of parenchyma (extended Partington procedure), or the coring out of the head and the uncinate process of the pancreas was performed (Frey procedure). The choice of procedure depended on the degree of calcifications, fibrotic tissue, and the preference of surgeons.

2.3.1. Choledochojejunostomy

After a Roux en Y lateral pancreaticojejunostomy was done, this limb was pulled proximal to the common bile duct to perform choledochojejunostomy. The biliary bypass was carried out in a lateral-to-lateral fashion, one layer, using a continuous absorbable suture, with a diameter of anastomosis of at least 10 mm. A cholecystectomy had to be done to prevent later cholecystitis (Fig. 1).

2.3.2. Biliopancreatic tunneling

After coring out of the head of the pancreas, a metal probe was passed through a small antegrade choledochotomy to reach the pancreatic cavity. Guided by the probe's tip, a tun-

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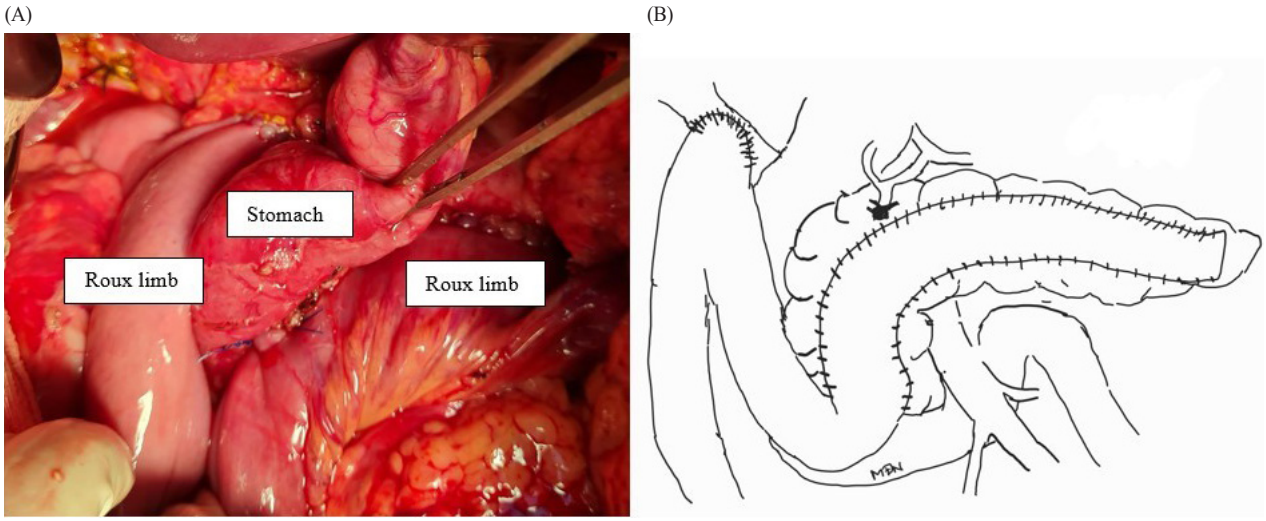

Fig. 1. Choledochojejunostomy. A concurrent choledochojejunostomy was performed on the same limb of pancreaticojejunostomy. (A) The intraoperative photo. (B) The hand-drawn illustration.

nel was created between the bile duct and the pancreatic cavity was made, with a diameter of at least 10 mm. The tunnel was made as short as possible and fixed to the surrounding pancreatic tissue using a circular single-stitch technique with an absorbable suture. The antegrade choledochotomy was then closed. A Roux en Y lateral pancreaticojejunostomy was then performed. A silastic tube was placed through this tunnel and was pulled out through the Roux limb to the skin. This tube was removed one month of surgery (Fig. 2).

The choice of biliary derivation based on which pancreatic duct drainage procedure was used. For the extended Partington procedure, choledochojejunostomy was performed, whereas biliopancreatic tunneling was applied when the Frey procedure was used, due to the thinness between the bile duct and the pancreatic cavity. Additionally, the choice of pancreatic duct drainage procedure depended on the degree of calcifications and fibrotic tissue in the head of the pancreas. If the head was fibrotic and severely calcified, a Frey procedure was performed.

2.4. Outcome assessment

The pain was assessed by the Izbicki pain score, a tool that comprising four elements and is specified for chronic pancreatitis [20]. Effective pain relief was defined as a reduction of >50% from the baseline Izbicki score. Complete pain relief was defined as an Izbicki score ≤10. Quality of life was assessed by the SF-12 questionnaire, which is concise, accurate, and easy to administer [21]. Pancreatic endocrine insufficiency was expressed as fasting glycemia≥126 mg/dL, any glycemia≥200 mg/dL, or the requirement of using glycemic control agents. Pancreatic exocrine insufficiency was defined as steatorrhea or unexplained weight loss.

Recurrent biliary obstruction is one of the essential outcomes. This was defined in the same way as preoperative biliary obstruction. During each postoperative visit, patients were asked about jaundice, itch, and dark urine, along with bilirubinemia samples and bile duct dilatation imaging.

2.5. Data collection

Data were collected preoperatively and postoperatively at three months and at the end of the study. Before surgery, patients were interviewed using a pre-designed questionnaire to obtain the Izbicki pain score and SF-12 quality of life scores. All necessary information about clinical and paraclinical examinations was obtained as well. Perioperative data were collected similarly. The mean postoperative length of stay was calculated. Any abnormal postoperative event was recorded and graded according to Clavien-Dindo's complication grading. Three months after surgery and at the time of the study, patients were asked to visit the outpatient clinic or

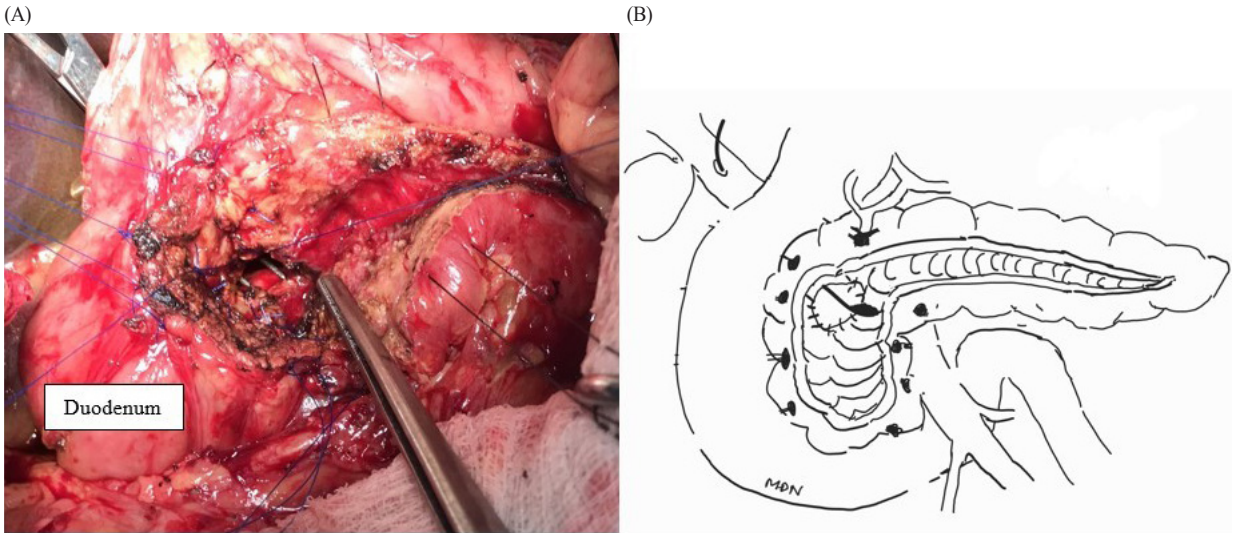

Fig. 2. Biliopancreatic tunneling. A tunnel between the common bile duct and the pancreatic cavity was made and demonstrated by the right-angle dissector or the metal probe. The forceps tip showed the tunnel insertion site into the pancreatic cavity. (A) The intraoperative photo. (B) The hand-drawn illustration.

be interviewed by telephone if they were unwilling to visit the hospital. During each visit, a standard examination, and an interview with a pre-designed questionnaire were conducted to collect the necessary data.

2.6. Statistical analysis

Quantitative variables were expressed as means±SD or medians with ranges depending on the distributional properties. For categorical variables, frequencies were reported. Shapiro-Wilk test was used to check the normal distribution of quantitative variables. A Student's t-test was used to assess the difference between two normally distributional quantitative variables. The Wilcoxon rank-sum test was used to check the difference between two non-normally distributional quantitative variables. The difference between two categorical variables was assessed by the chi-square test or Fisher exact test when the sample size in any group <5. Any p-value less than to 0.05 means a statistically significant difference.

3. RESULTS

3.1. Baseline characteristics

From December 2020 to July 2023, 58 patients underwent extended pancreatic drainage due to painful chronic pancreatitis. Among them, eight patients (14%) had biliary obstruction and needed biliary derivation. Five patients were unerwent biliopancreatic tunneling, and three others were underwent choledochojejunostomy. The baseline characteristics between the two above groups are presented in Table 1. All cholestasis patients were male. There was no significant difference in baseline characteristics between the two groups. All patients in the biliopancreatic tunneling group underwent the Frey procedure, in contrast to patients in the choledochojejunostomy group, who underwent theextended Partington procedure (Table 1).

3.2. Early postoperative results and outcomes after three months of surgery

The early postoperative results and outcomes after three months of surgery are shown in Table 2. One patient developed an early complication. This pancreatic fistula was treated conservatively and graded Grade II according to Clavien-Dindo's classification. We did not find any case of recurrent biliary obstruction. The Izbicki pain score, pain relief rate, and quality of life appeared to favor the biliopancreatic tunneling group, but a significant difference was not found. All other outcomes were similar between the two groups. The pain score and quality of life significantly improved in

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Table 1. Baseline characteristics

	Biliopancreatic tunneling (n=5)	Choledochojejunostomy (n=3)	p-value
Sex and gender (%)			
Male	100	100	
Female	0	0	
Age (yr)	49±11	50±9	p=0.9[1]
Time from onset to surgery (mo)	31±21	30±21	p=0.9[1]
Pattern of pain (%)			
Continuous	40	33	p=0.85[2]
Intermittent	60	67	
Alcohol abuse (%)	80	100	p=0.4[2]
BMI (kg/m^2)	19±2	19±2	p=0.9[1]
Weight (kg)	52±11	50±8	p=0.7[1]
ASA class (%)			
I	0	0	
II	100	100	
III	0	0	
Pseudocyst (%)	60	0	p=0.09[2]
Mean diameter of bile duct (mm)	14±4	15±5	p=0.8[1]
Mean diameter of pancreatic duct (mm)	11±5	11±1	p=0.9[1]
Mean diameter of pancreatic head (mm)	31±4	32±3	p=0.8[1]
Surgical procedure (%)			
Extended partington	0	100	
Frey	100	0	
Mean operative time (min)	244±71	257±71	p=0.8[1]
Mean blood loss (mL)	130±45	117±29	p=0.6[1]
Preoperative Izbicki score	64 (55–68)	59 (44–58)	p=0.4[3]
Preoperative SF-12 PCS	42 (0–58)	29 (13–79)	p=0.7[3]
Preoperative SF-12 MCS	62 (28–83)	29 (18–86)	p=0.4[3]
Preoperative endocrine insufficiency (%)	20	33	p=1[2]
Preoperative exocrine insufficiency (%)	20	0	p=1[2]
Nausea (%)	40	67	p=1[2]
Weight loss (%)	60	100	p=0.5[2]
Anorexia (%)	40	33	p=1[2]

[1] Student's t-test, with the Shapiro-Wilk test, showed a normal distribution of variables.
[2] Fisher exact test.
[3] Wilcoxon rank-sum test, with the Shapiro-Wilk test, showed an abnormal distribution of variables.
BMI, body mass index; PCS, physical component summary; MCS, mental component summary.

both groups compared to the baseline (Table 2).

3.3. Outcomes after the final assessment

The final assessment of the two groups is demonstrated in Table 3. All patients survived at the time of the study (July 2023). The length of follow-up duration in the group with biliopancreatic tunneling was shorter than in the group with choledochojejunostomy because we only adjusted the tunneling technique associated with the Frey procedure recently. In the final assessment, all outcomes were similar between the two groups. The pain score and quality of life showed significant improvement compared to baseline but not compared to the three months of follow-up in both groups. One patient in biliopancreatic tunneling group developed recurrent biliary obstruction. This patient did not respond to the endoscopic treatment and was reoperated to perform a cho-

Table 2. Early postoperative results and outcomes after three months of surgery

	Biliopancreatic tunneling (n=5)	Choledochojejunostomy (n=3)	p-value
Mean postoperative stay (days)	8±5	7±1	p=0.8[1]
Postoperative complication (%)	20	0	p=1[2]
Izbicki score	9 (0–24)	28 (18–56)	p=0.1[3]
Effective pain relief (%)	100	33	p=0.1[2]
Complete pain relief (%)	60	0	p=0.2[2]
SF-12 PCS	71 (58–100)	46 (46–63)	p=0.1[3]
SF-12 MCS	81 (77–93)	75 (55–83)	p=0.3[3]
Endocrine insufficiency (%)	20	33	p=1[2]
Exocrine insufficiency (%)	0	66	p=0.1[2]
Nausea (%)	0	0	
Weight loss (%)	0	66	p=0.1[2]
Anorexia (%)	0	33	p=0.4[2]
Recurrent biliary obstruction (%)	0	0	

[1] Student's t-test, with the Shapiro-Wilk test, showed a normal distribution of variables.
[2] Fisher exact test.
[3] Wilcoxon rank-sum test, with the Shapiro-Wilk test, showed an abnormal distribution of variables.
PCS, physical component summary; MCS, mental component summary.

Table 3. Outcomes after the final assessment

	Biliopancreatic tunneling (n=5)	Choledochojejunostomy (n=3)	p-value
Mean length of follow-up (months)	5 (4–16)	15 (15–16)	p=0.2[1]
Izbicki score	9 (0–20)	18 (0–20)	p=0.6[1]
Effective pain relief (%)	100	100	
Complete pain relief (%)	80	33	p=0.5[2]
SF-12 PCS	88 (58–100)	71 (54–100)	p=0.6[1]
SF-12 MCS	80 (56–97)	74 (70–100)	p=1[1]
Endocrine insufficiency (%)	20	33	p=1[2]
Exocrine insufficiency (%)	40	33	p=1[2]
Nausea (%)	0	0	
Weight loss (%)	20	0	p=1[2]
Anorexia (%)	0	0	
Recurrent biliary obstruction (%)	20	0	p=1[2]

[1] Wilcoxon rank-sum test, with the Shapiro-Wilk test, showed an abnormal distribution of variables.
[2] Fisher exact test.
PCS, physical component summary; MCS, mental component summary.

ledochojejunostomy at 16 months. We continued to follow the further outcomes of this patient (Table 3).

4. DISCUSSION

The concurrent obstruction of both the pancreatic duct and bile duct in patients with chronic pancreatitis is not rare. Prinz reported an incidence of 26% [22]. Huizinga and collaborators found 11 patients requiring concurrent pancreatic duct and bile duct drainage in their 509 patients with chronic pancreatitis [23]. Sugerman reported this incidence of 39% [14]. Choledochojejunostomy is considered the best choice for bile duct drainage. It reduces the incidence of recurrent jaundice, sump syndrome, and retrograde cholangitis compared to cholecystoenterostomy or choledochoduodenostomy [18,24–26]. A biliary anastomosis is simple when a Roux

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limb made already to perform pancreaticojejunostomy is available. The gallbladder should be resected in case of biliary anastomosis to prevent accumulation of food debris and cholecystitis [23,27].

To simplify the technique of biliary derivation in patients with a pancreaticojejunostomy, Izbicki et al. introduced the technique of reinserting the bile duct into the pancreatic resection cavity during the Frey procedure for chronic pancreatitis. In this apporach, the distal segment of the common bile duct is opened to the resection cavity, allowing bile to flow into the pancreatic cavity where it mixes with pancreatic juice to be drained through the lateral pancreaticojejunostomy [15]. This technique eliminates the need for a cholecystectomy or an extra biliary anastomosis, thus making it more straightforward and saving time compared to choledochojejunostomy. We modified this technique and termed it "biliopancreatic tunneling", given its resemblance to the construction of a tunnel between the bile duct and pancreatic resection cavity.

Izbicki reported a success rate of 100% during two years of follow-up. However, in recent papers, this technique had a high incidence of recurrent biliary obstruction. Rebibo reported two cases of recurrent jaundice among a total of three cases of reinsertion of the bile duct [18]. Merdrignac showed a recurrent rate of 60% in the group with biliopancreatic tunneling, compared to 11% in the group with choledochojejunostomy [17]. In a large series, Cataldegirmen extracted the recurrent rate of 18% in the group of bile duct reinsertion compared to 2.3% in other techniques [16].

In our series, there was one case of recurrent biliary obstruction in biliopancreatic tunneling group, compared to no cases in choledochojejunostomy group. The patient with recurrence experienced multiple episodes of jaundice starting in the fourth month after surgery, failed endoscopic treatment, and ultimately required reoperation to perform a choledochojejunostomy. This case occurred in the early period when we had not adjusted the technique. The critical point of this technique is that the pancreatic tissue around the tunnel has to be removed as much as possible. Coring out the pancreatic head (Frey procedure) must be completed before making the tunnel (Fig. 3). Additionally, we leave a silastic tube through the tunnel, removing it only more than one month post-opreratviely to prevent re-occlusion. When we refined the tunneling technique, no more patients with recurrent biliary obstruction were met. Our complication rates in both groups were similar to some studies concerning pancreatic surgery [28,29].

The pain relief and quality of life did not differ signif-

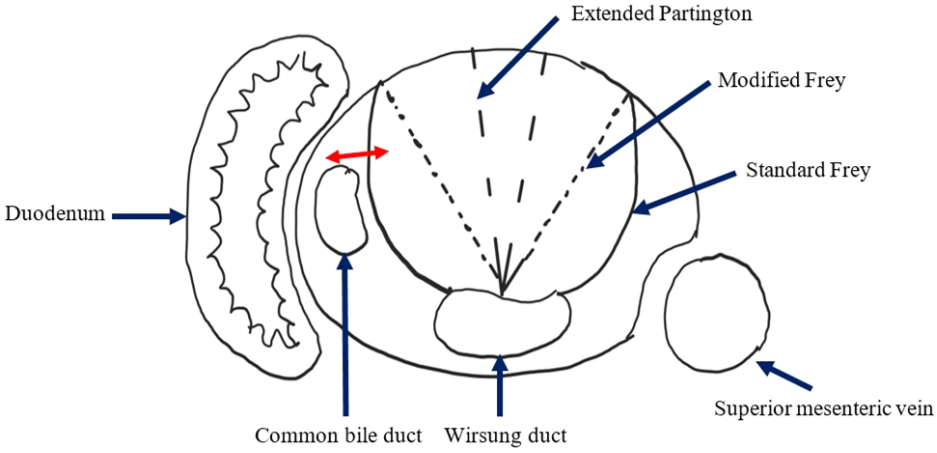

Fig. 3. Illustration of the biliopancreatic tunnel variants. A cross-section of the pancreatic head shows the tunnel length varying among the pancreatic duct drainage procedures. The length of the tunnel is the longest when associated with the extended Partington procedure. In the modified Frey procedure, the pancreatic tissue is removed less than the standard Frey procedure, thus making the tunnel somewhat longer. The tunnel length is the shortest when associated with the standard Frey procedure. The shorter the tunnel is, the less recurrent biliary obstruction may be seen. The case of recurrent biliary obstruction in our series occurred when associated with the modified Frey procedure. The red two-headed arrow indicated the length of the biliopancreatic tunnel.

icanlty between the two groups. However, three months post-surgery, pain relief and quality of life appeared more favorable in of biliopancreatic tunneling group. As previously mentioned, the Frey procedure was applied to all patients in the tunneling technique group. The choice of pancreatic duct drainage method may influence the early outcomes, but further studies are needed to investigate the potential difference between Frey and the extended Partington procedure.

5. CONCLUSION

Biliopancreatic tunneling is an alternative for biliary derivation in painful chronic pancreatitis with a dilated duct besides choledochojejunostomy. This technique relatively straightforward, time-saving and eliminates the need a cholecystectomy or an addiitonal biliary anastomosis. However, a potential drawback of this method is the risk of fibrotic pancreatic tissue developing around the tunnel, which may lead to further occlusion. Our study demonstrated that both choledochojejunostomy and biliopancreatic tunneling were effective in managing biliary obstruction in chronic pancreatitis. Nonetheless, proper exclusion of biliopancreatic tunneling is crucial to prevent recurrent biliary obstruction.

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Conflict of interest

No potential conflict of interest relevant to this article was reported.

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Investigation: MT Phan.
Writing - original draft: DN Mai, QV Nguyen.
Writing - review & editing: DN Mai, QV Nguyen, MT Phan, TM Doan.

Availability of data and material

Upon reasonable request, the datasets of this study can be available from the corresponding author.

Ethics approval

All procedures in this study were approved by the Institutional Review Board of University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam (IRB-VN01003/IRB00010293/FWA00023448).

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