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Original Article

# Endoscopic Drainage of Pancreatic Pseudocysts: An Experience with 77 Patients

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**Abstract**

**Background:** We evaluated short- and long-term results of endoscopic drainage (a minimally invasive nonsurgical treatment) of pancreatic pseudocysts (PPCs) and factors associated with its success at a multilevel teaching hospital in Northern India, as such data are scanty from India. **Patients and Methods:** Retrospective review of records of consecutive patients undergoing endoscopic drainage of PPC from January 2002 to June 2013 was undertaken. **Results:** Seventy-seven patients (56 males), median age 36 years (range, 15–73), underwent endoscopic drainage of PPC with 98% technical success. Pseudocysts drained were symptomatic (duration 11 weeks, range, 8–68), large (volume 582 mL [range, 80–2706]), located in head ($n$ = 32, 46%), body and tail ($n$ = 37, 54%), and infected ($n$ = 39, 49%). Drainage procedures included cystogastrostomy ($n$ = 54, 78%), cystoduodenostomy ($n$ = 9, 13%), transpapillary drainage ($n$ = 2, 3%), and multiple route ($n$ = 4, 6%), with additional endoscopic nasocystic drainage (ENCD) in 41 (59%). Sixty-nine patients were followed up (median 28 months, range 2–156; other eight lost to follow-up). Complications ($n$ = 21, 30%) included stent occlusion and migration (13), bleeding (5), perforation (2), and death (1). Endoscopic procedure had to be repeated in 19 patients (28%; 16 for sepsis, 3 for recurrence). The reasons for additional nonendoscopic treatment ($n$ = 8, 12%) included incomplete cyst resolution (3), recurrence (2), bleeding (1), and perforation (2). Overall success rate of endoscopic drainage was 88%. Whereas infected pseudocysts were associated with poorer outcome (odds ratio [OR] 0.016; 95% confidence interval [CI] 0.001–0.037), placement of ENCD led to better results (OR 11.85; 95% CI 1.03–135.95). **Conclusion:** Endoscopic drainage is safe and effective for PPC.

**Keywords:** *Cystoduodenostomy, cystogastrostomy, endoscopic nasocystic drain, pancreatic pseudocyst, trans-papillary drainage*

## Introduction

A pancreatic pseudocyst (PPC) is a localized collection of pancreatic juice in or around pancreas resulting from acute pancreatitis, pancreatic trauma, or chronic pancreatitis and lined by a wall of fibrous or granulation tissue.[1] Revised Atlanta classification defined PPC as an encapsulated collection of fluid with a well-defined inflammatory wall usually outside the pancreas with minimal or no necrosis. PPC usually appears more than 4 weeks after onset of interstitial and edematous pancreatitis.[2] Frequency of PPC varies from 10% to 20% following acute and 20%–40% after chronic pancreatitis.[3-5]

All PPCs do not require drainage. Intervention is needed if a patient is symptomatic with abdominal pain, infection, gastric outlet, or biliary obstruction or

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rupture.[6-8] Therapeutic options for drainage include surgery, endoscopic, and percutaneous drainage. Although creation of a surgical cystoenteric anastomosis has been the standard of care for a long time, it is associated with significant morbidity (7%–37%), mortality (0%–6%), and recurrence rate (~10%).[9-11] Percutaneous catheter drainage showed better short-term results but requires the presence of an indwelling catheter for an extended period and is associated with external fistula in a proportion of patients.[12-14]

Since the first report of transgastric endoscopic PPC drainage by Rogers *et al*. in 1973, it has become increasingly popular.[15] In the last 15 years, endoscopic drainage has emerged as an effective and safe technique for the management of PPC, with resolution and complication rates of 70%–85% and 4%–38%, respectively.[16-20] In a recent randomized trial, Varadarajulu *et al*. showed that endoscopic drainage and surgical cystogastrostomy were equally effective in patients with PPC.[21] Data on endoscopic management of PPC from India are scanty. Hence, we analyzed our experience with endoscopic PPC drainage over the last 11 years retrospectively with the following aims: (a) to evaluate safety and efficacy of endoscopic drainage of PPC and (b) to study factors associated with its outcome.

## Patients and Methods

This was a single-center, retrospective study conducted in a multilevel teaching hospital in Northern India. Medical records of consecutive patients undergoing endoscopic drainage of PPC during an 11.5-year period (between January 2002 and July 2013) were retrospectively reviewed. Data extracted from electronic hospital information system and files included information about demography, clinical presentation, investigations, and indications for PPC drainage, procedure details, hospital course, and follow-up. To assess long-term outcome, follow-up data were obtained by physical outpatient visits or telephone contact. Patients were asked about recurrence of symptoms, subsequent need for evaluation, intervention, recurrence of pseudocyst, and complications.

Pancreatitis was classified into acute or chronic as per the standard criteria.[7] Diagnosis of pancreatitis was based on the presence of any two of the following criteria: (i) Pancreatic pain, (ii) raised serum amylase or lipase (three times upper limit of normal), and (iii) typical findings on computerized tomography (CT) (pancreatic fluid collections (PFCs), necrosis, or edema) or abdominal ultrasonography (USG). Diagnosis of chronic pancreatitis was based on clinical symptoms, in combination with either morphological change (calcification, parenchymal/ductal changes) and/or pancreatic insufficiency.

Diagnosis of PPC was based on USG and/or CT scan. PPC with persistent symptoms or complications such as infection and biliary or gastric outlet obstruction were considered for drainage. Number, size, and location of PPC were assessed. Feasibility for endoscopic drainage was assessed based on CT (cyst closely apposing luminal wall with <1 cm intervening tissue and no major vessel) and a visible gastric or duodenal bulge on esophagogastroduodenoscopy. In addition, information about the indication for drainage, drainage technique used, and the short- and long-term outcome data were retrieved.

### Technique

Endoscopic procedures were done in left lateral or prone position, under sedation (midazolam or fentanyl) using a therapeutic side-viewing endoscope. Since this hospital is a public sector hospital, support from anesthesia services for endoscopic procedure is not always available. Hence, propofol sedation or endotracheal intubation was not used for the procedure. However, fortunately, no patient developed aspiration due to necessary precautions and most tolerated the procedure quite well. Prophylactic intravenous antibiotics were administered during the procedure and for 48 h thereafter. Digestive bulge was identified on endoscopy after the organ was insufflated adequately with air. It was seen as an unequivocal bulge with effacement of the mucosal folds as shown in Figure. The cyst was punctured at the site of maximum impression on over the gastric or duodenal bulge, using a needle-knife to enter into the cyst cavity. The cyst contents were then aspirated for confirmation and contrast medium was injected to confirm that the guiding catheter was inside the cyst. The puncture track was dilated using controlled radial expansion balloon (CRE, Boston Scientific Corp., USA, 12–18 mm), and one or two double pigtail stents (7 or 10 Fr) were placed across the track for transmural drainage [Figure 1]. Since multiple endoscopists did the procedure (VAS, UCG, and SM), it was endoscopists' decision to insert single or multiple stents; the decision was largely based on type and amount of the fluid, size of the pseudocyst, and endoscopists' comfort.

In patients with suspicion of debris in cavity, an additional 8 or 10 Fr endoscopic nasocystic drainage (ENCD) was placed for irrigation of cavity and drainage of pus or necrotic material. The cavity was lavaged through the nasocystic tube with saline solution and drain removed when aspirate became clear. Transpapillary drainage was performed when

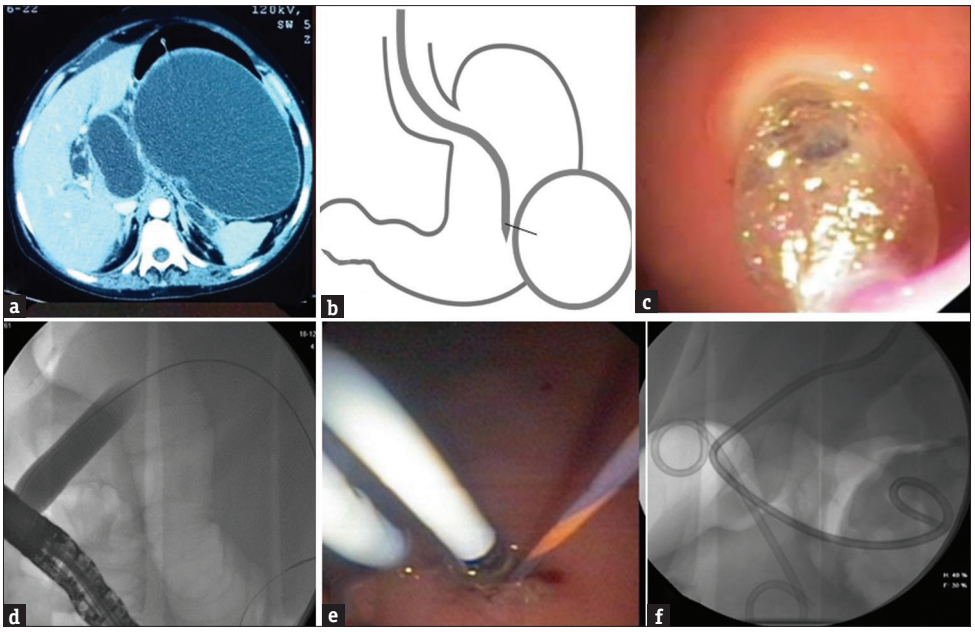


**Figure 1:** (a) Computerized tomography scan showing large gastric bulge and close apposition of pseudocyst with gastric wall, through which puncture is made, (b) schematic diagram showing the process of puncturing the pseudocyst, (c and d) dilation of the puncture track using controlled radial expansion balloon, (d and e) endoscopic and fluoroscopic view showing placement of double pigtail stent and endoscopic nasocystic drain placed in the cyst cavity

there was a suspicion of pancreatic duct leak on imaging. In these cases, both routes were used to facilitate complete and rapid drainage. These procedures were performed either simultaneously or in stages. Stents were removed when follow-up imaging showed resolution of pseudocyst.

Terminology used for assessing results was as follows: (a) technical success: successful placement of stent into PPC, (b) treatment success: complete resolution of PPC after stent removal, (c) treatment failure: need of surgical or percutaneous drainage due to procedure-related complications, failure, or recurrence of PPC, and (d) end of follow-up: time of treatment failure, death, or end of follow-up in December 2013.

### Statistical analysis

The primary outcome parameters studied were success, complication, and PPC recurrence rate. Quantitative data are expressed as median and range. Multivariate binary logistic regression analysis was used to identify independent prognostic factors for outcome of endoscopic PPC drainage. Level of statistical significance was set at 5% and 95% confidence intervals (CI) were calculated for adjusted odds ratios (ORs).

## Results

Of 77 patients undergoing endoscopic drainage of PPC, eight were lost to follow-up; hence, the remaining 69 patients (53 men; median age, 35 years [range 15–73]) were included in the final analysis. Sixty-one (88%) and 8 (12%) of them had chronic and acute pancreatitis (median symptom duration 11 weeks, range 4–68), respectively. The most common causes of acute pancreatitis were biliary stones and alcohol. Fifty-eight (58%) of the PPC had associated necrosis on CT. The common symptoms at presentation were abdominal pain, early satiety, fever, vomiting, and jaundice.

### Pseudocyst characteristics

Single, two, and more than two PPCs were present in 54 (78.3%), 12 (17.4%), and 3 (4.3%) patients, respectively. In patients with multiple PPCs, attempt was made to drain only the largest PPC. Median volume of PPC was 580 ml (range 80–2706). Thirty-four patients (49%) had an infected pseudocyst as indicated by the presence of fever, leukocytosis, purulent contents, or demonstration of bacteria on Gram stain and/or culture. The characteristics of the patients and cysts are summarized in Table 1.

### Drainage Procedure

Transgastric, transduodenal, and transpapillary drainage was performed in 54 (78%), 9 (13%), and 2 (3%) patients, respectively. Of the remaining four patients, three had a combination of transmural and transpapillary drainage and one had both transgastric and transduodenal drainage. Pancreatogram, done in 12 patients, revealed communication between the main pancreatic duct and PPC in ten patients. Single stent was placed in fifty and two in 19 patients; in addition, nasocystic drain

**Table 1: Patients and pseudocyst drainage characteristics**

| Patients | All (*n*=69), *n* (%) | Success (*n*=60), *n* (%) | Failure (*n*=9), *n* (%) |
|---|---|---|---|
| Age years; median (range) | 35 (15-73) | 34 (15-70) | 40 (22-73) |
| Gender (male) | 53 (77) | 45 (85) | 8 (15) |
| Type of pancreatitis | | | |
| Acute pancreatitis | 61 (88) | 53 (87) | 8 (13) |
| Chronic pancreatitis | 8 (12) | 7 (88) | 1 (12) |
| Biliary pancreatitis | 28 (41) | 23 (82) | 5 (18) |
| Alcoholic pancreatitis | 11 (16) | 10 (91) | 1 (11) |
| Necrotizing pancreatitis | 40 (58) | 32 (80) | 8 (20) |
| Disease duration (weeks); median (range) | 11 (4-68) | 10.5 (4-64) | 16 (4-68) |
| Number of pseudocyst | | | |
| Single | 54 (78) | 49 (91) | 5 (9) |
| Two | 12 (17) | 9 (75) | 3 (25) |
| Multiple | 3 (5) | 2 (67) | 1 (33) |
| Median size (mL); median (range) | 582 (80-2706) | 604 (122-2706) | 400 (80-1000) |
| Cyst location | | | |
| Head | 32 (46) | 29 (91) | 3 (9) |
| Body and tail | 37 (54) | 31 (84) | 6 (16) |
| Infected pseudocyst | 34 (49) | 26 (76) | 8 (24) |
| Drainage route | | | |
| Transgastric | 54 (78) | 47 (78) | 7 (78) |
| Transduodenal | 9 (13) | 7 (78) | 2 (22) |
| Transpapillary | 2 (3) | 2 (100) | - |
| Multiple routes | 4 (6) | 4 (100) | 0 |
| Number of stents; median (range) | 1 (1-2) | 1 (1-2) | 1 (1-2) |
| ENCD use | 41 (59) | 37 (88) | 5 (12) |
| Repeat procedures; median (range) | 1 (1-3) | 1 (1-3) | 1 (1) |

ENCD=Endoscopic nasocystic drain

was placed in 41 (59%) patients. Median duration of nasocystic drainage was 26 days (range 5–145) and median duration of drainage was 122 days (range 100–546).

## Technical success

Stents were placed successfully in 69 patients (success rate 98%). Stent placement failed in one patient; the procedure in this patient was complicated by gastric perforation which was managed surgically.

## Complications

Complication occurred in 21 (30%) patients, of which 8 (12%) were procedure related and 13 (18%) stent related [Table 2]. One of the 69 patients died of sepsis 5 days after the procedure (mortality rate 1.5%). Five patients had bleeding during or after the drainage procedure. Of these, two had minor bleed; one was managed by adrenaline injection at puncture site and second patient managed conservatively. Three patients had major bleeding. Of these, one patient with bleed from the puncture site underwent surgery. One patient with bleeding from splenic artery pseudoaneurysm, 3 days after the procedure, was managed with angiographic embolization, and the third patient with bleeding from left gastric artery pseudoaneurysm decided to leave the hospital. One patient with gastric perforation during the procedure was managed surgically with stent removal, closure of perforation, and cystogastrostomy.

**Table 2: Complications and management of endoscopic pseudocyst drainage**

| Complication | *n* | Management | *n* |
|---|---|---|---|
| Bleeding | | | |
| Minor bleed | 2 | Conservative | 2 |
| Major bleed | 3 | DSA (splenic artery pseudoaneurysm) | 1 |
| | | Surgery | 1 |
| | | Discontinued treatment (left gastric artery pseudoaneurysm) | 1 |
| Perforation | 2 | Surgery | 2 |
| Death | 1 | - | - |
| Stent block | 9 | Stent exchange | 9 |
| Stent migration | 4 | Stent exchange | 3 |

DSA=Digital subtraction angiography

Nine patients had stent occlusion; all of them were successfully treated by exchanging the stent. The diagnosis of stent occlusion was based on recurrence of abdominal pain, fever, leukocytosis, and inadequate resolution of pseudocyst on follow-up imaging.

Four patients had migration of the stent. Of these, three were successfully treated by stent exchange, In the remaining one patient, the stent had migrated into the pancreatic duct and attempt at removal failed. However, this patient remained asymptomatic after a follow-up of 16 months.

### Long-term results

Patients were followed up for a median period of 26 months (range, 0.5–156). During this period, six patients had persistent PPC; three were managed by repeat endoscopic procedure; and the other three by percutaneous drainage. Four patients had recurrence of PPC after a median period of 10.5 months (range, 5–24). Of these, two patients were managed conservatively and one each with surgery and percutaneous drainage. Overall, endoscopic drainage was successful in sixty patients with a success rate of 87%.

On logistic regression analysis, the presence of infected PPC was independently associated with treatment failure (OR 0.016; 95% CI 0.001–0.037) and placement of ENCD was associated with improved success (OR 11.85; 95% CI 1.03–135.95). Route of drainage could not be analyzed due to very few subjects in some groups. Overall predictability of the logistic model for the outcome observed was 88.4% [Table 3].

## Discussion

The results of the current study showed that endoscopic drainage of PPC is effective in 87% of selected patients. Only a few (12%) patients needed either surgery or percutaneous drainage for complications, failure, or recurrence. This is similar to success rates reported in previous series.[16-20] Similarly, the technical success rate of 98% was at par with the previous series.[16-20]

Many factors influence the success of endoscopic drainage for PPC. These include anatomic factors such as location of pseudocyst, digestive bulge, distance between the pseudocyst and lumen of the digestive tract, anatomy of the main pancreatic duct, and communication of the pseudocyst with the pancreatic duct. These features are usually delineated on a magnetic resonance cholangiopancreatography or contrast-enhanced CT abdomen, which are essential tools in planning therapy. For transmural endoscopic drainage, distance between the cyst and wall of digestive tract on imaging should be <10 mm with an appreciable digestive bulge.[8,19] In our series, drainage was attempted only if a bulge was identified on imaging or endoscopy. However, this limitation can be overcome by draining the cyst under direct endoscopic ultrasonography (EUS) guidance.

In this study, nonendoscopic treatment (surgery or percutaneous drainage) was needed in 8 (12%) patients, for incomplete cyst resolution in three, recurrence in two, and complications in three patients. In all three patients with incomplete cyst resolution, repeated endoscopic management attempts failed and percutaneous drainage was necessary. Recurrences occurred in 4 (6%) patients of whom two required surgery or percutaneous drainage and the remaining two had spontaneous cyst resolution on follow-up. In a study by Cahen *et al*., with long-term median follow-up of 43 months, 16% patients needed nonendoscopic measures for pseudocyst management.[16] The reason for good results in our study might be the placement of ENCD in our patients (59%) as compared to only 16% in that study.

Previous studies have shown that the outcome of endoscopic drainage would differ according to the type of PFC. If an initial contrast-enhanced CT (CECT) revealed significant pancreatic necrosis (>30%), the PFC is likely to contain necrotic material.[2] We also observed less favorable outcome in patients with significant necrotic material. Baron *et al*.[7] also found low success rate in necrotic collection (72%) as compared to chronic pseudocysts (92%) and acute pseudocysts (74%) [Table 4].

While several authors advocate pancreatogram to see the communication between pancreatic duct and pseudocyst, transpapillary pancreatic duct stents bridging the leak was successfully deployed in only 20%–27% patients in those studies and rest were drained transmurally.[7,16] However, a study from India by Sharma *et al*. with mean follow-up of 44 months and success rate of about 70%, concluded that endoscopic retrograde cholangiopancreatography (ERCP) before procedure is only required when cyst does not bulge into gut lumen to decide on transpapillary drainage.[20] In our study, we did pancreatogram only in 12 patients, of whom ten had cysts communicating with main pancreatic duct; however, transpapillary drainage was feasible only

**Table 3: Binary logistic regression: Factors predictive of outcome of endoscopic drainage**

| Predictors | *P* | OR | 95% CI |
|---|---|---|---|
| Infected pseudocyst | 0.010 | 0.016 | 0.001-0.372 |
| ENCD placement | 0.047 | 11.858 | 1.034-135.959 |
| Age >50 (years) | 0.358 | 0.349 | 0.037-3.294 |
| Male gender | 0.209 | 5.867 | 0.372-92.578 |
| Cyst in pancreatic body and tail | 0.189 | 0.163 | 0.011-2.442 |
| Acute pancreatitis | 0.343 | 0.247 | 0.014-4.430 |
| Necrotizing pancreatitis | 0.361 | 0.301 | 0.023-3.963 |
| Constant | 0.999 | 0.000 | |

ENCD=endoscopic nasocystic drain, OR=Odds ratio, CI=Confidence interval

**Table 4: Studies on endoscopic drainage of pancreatic pseudocysts**

| Authors reference (year) | Number of patients | Median Follow-up (months) | Type of drainage | Technical success, *n* (%) | Clinical success, *n* (%) | Recurrence, *n* (%) | Complications, *n* (%) |
|---|---|---|---|---|---|---|---|
| Binmoeller *et al*., (1995)[19] | 53 | 22 | TM and TP | 50 (91) | 47 (94) | 11 (23) | 4 (11) |
| Baron *et al*., (2002)[7] | 138 | 25 | TM and TP | NR | 113 (82) | 18 (16) | 33 (24) |
| Sharma *et al*., (2002)[20] | 38 | 44 | TM and TP | 38 (100) | 31 (94) | 5 (16) | 1 (3) |
| Cahen *et al*., (2005)[16] | 92 | 43 | TM and TP | 89 (97) | 65 (71) | 18 (20) | 31 (34) |
| Weckman *et al*., (2006)[18] | 170 | 34 | TM and TP | NR | 165 (86) | 8 (4.8) | 38 (10) |
| Our study | 69 | 24 | TM and TP | 68 (97) | 60 (87) | 4 (6) | 21 (30) |

TM=Transmural drainage, TP=Transpapillary drainage, NR=Not reported

in five patients. Some studies showed better though insignificant outcome with combined transduodenal and transpapillary approach than transgastric route, but we could not make a conclusion regarding route of drainage owing to insufficient sample size in some of the groups. Most of patients in our study were drained by transgastric route.

In our series, about 49% patients had infected pseudocyst. Although infected pseudocysts are often considered as unsuitable for endoscopic drainage, we achieved successful resolution with endoscopic management in about 75% of them.[7,17] However, these patients needed multiple procedures and use of ENCD for irrigation and lavage. Moreover, there are chances of selection bias as ours is retrospective study and patients with complicated cyst with extensive debris would have been treated by nonendoscopic methods. Infected pseudocysts were associated with poorer outcome and placement of ENCD lead to good results.

This study is important in the light of current era of EUS and lumen-apposing metal stent (LAMS). The observation from this retrospective study performed over a long period, when neither EUS was popular nor LAMS was available, may set the stage for prospective studies for evaluating utility of larger bore stents such as LAMS for patients with infected pseudocyst as depicted by the presence of echogenic content on EUS along with clinical suspicion of sepsis.

Complication rates were also in accordance to previously published studies.[7,16,18] In our study, complications occurred in 30% patients. Most of these were managed either by repeat endoscopic procedures or conservatively and only three patients had nonendoscopic management. Beside stent migration and stent blockage, as in other published series, bleeding was the most frequent complication. Three patients had injection site bleed, but only one of them required nonendoscopic (surgical) treatment. Other two patients had bleed related to splenic and left gastric artery pseudoaneurysm and were managed by coil embolization radiologically [Table 3]. Hence, if pseudoaneurysm is diagnosed before drainage, it should be managed before endoscopic drainage.

As shown in previously published series on endoscopic drainage [Table 4], we also confirm the safety and efficacy of endoscopic drainage of PPC. However, it should be done at centers where endoscopists have enough experience and skills in this technique. Predrainage evaluation by magnetic resonance imaging (MRI)/CECT and or EUS helps in guiding treatment plans and technique. In addition, interventional radiologist and experienced surgeons at the center are almost mandatory.

Our study has several limitations. First, the study design was retrospective and sample size was small, limiting the ability to investigate the effectiveness of several variables on treatment outcomes. Second, the duration of follow-up was only medium term. Third, pancreatogram and transpapillary drainage were not attempted in all patients. Finally, the good clinical outcomes reported in this study could be secondary to selection bias as sicker patient may have undergone surgery or percutaneous drainage.

## Conclusion

Endoscopic drainage is a safe and effective method of treating PPC. When done after proper prior assessment in terms of location, vascular collaterals and absence of pseudoaneurysm, and selection of patients suitable for this modality, procedural complications were infrequent. If infection or presence of debris of PPC is suspected, MRI/CECT or EUS should be done to decide about guide prolonged irrigation of PPC using a nasocystic catheter.

Being a less invasive procedure, endoscopic drainage should be considered as initial treatment of choice for drainage of PPC, and surgery or percutaneous drainage should be used only when this treatment fails or is not feasible.

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## Conflicts of interest

There are no conflicts of interest.

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