

Surgical management of pancreatic pseudocyst: a single-center experience

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Aim

Pancreatic pseudocyst is the commonest cystic lesion of the pancreas. It usually develops on a background of pancreatitis. Cyst recurrence is the most feared complication following surgical management of pancreatic pseudocyst.

Patients and methods

The authors reviewed the data of 48 patients who were managed surgically during the period between 2010 and 2019.

Results

Biliary pancreatitis was the commonest cause (24 cases – 50%). The mean cyst size was 13.5±6.4 cm (6–42 cm). Most lesions were located in the body and tail of the pancreas (32 cases – 66.7%).

Open approach was performed in 45 (93.8%) cases whereas the remaining cases were performed laparoscopically. Cases were managed by cystogastrostomy (39 cases – 81.3%), cyst-jejunostomy (seven cases – 14.6%), combined procedures (one case – 2.1%), or central pancreatectomy (one case – 2.1%). Cholecystectomy was performed in 17 (35.4%) cases. Early postoperative morbidity was encountered in nine (18.8%) cases.

After a median follow-up of 68 months, no recurrence was detected. One (2.1%) case developed incisional hernia, and another one (2.1%) had adhesive intestinal obstruction.

Conclusion

Surgical intervention for pancreatic pseudocysts is a safe and feasible approach. It offers the ability to deal with the primary cause during operation and excellent long-term outcome regarding pseudocyst recurrence.

Keywords:

cystogastrostomy, cystojejunostomy, pancreatic pseudocyst, pancreatitis

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Introduction

Pancreatic pseudocyst is a pancreatic fluid collection that is surrounded by a fibrous tissue wall. It represents the commonest cystic lesion of the pancreas. It usually results from previous attacks of acute or chronic pancreatitis or abdominal trauma [1,2]. Pancreatic pseudocyst is commonly located at the peripancreatic region, especially the lesser sac. It may be intrapancreatic or may be located at distant sites such as the pelvis, the mediastinum, and the thorax. Additionally, multiple pseudocysts may be encountered [3,4].

Patients with pancreatic pseudocyst usually present with prolonged abdominal pain, mass, and anorexia. They also may present with jaundice owing to biliary obstruction, or sepsis manifestations if got infected [5]. Diagnosis is often accomplished by abdominal ultrasonography (US) and triphasic abdominal computerized tomography (CT). Magnetic resonance cholangiopancreatography (MRCP) may be required

to detect underlying biliary stones and to evaluate connection with the pancreatic ductal system [6].

Most of these cysts are managed conservatively. However, intervention is recommended if they become symptomatic, enlarge in size, or develop complications [7,8]. There are three traditional surgical methods for managing pancreatic pseudocysts: external drainage, internal drainage, and surgical excision [9]. The latter usually involves either distal splenopancreatectomy in distal lesions, or central pancreatectomy for body lesions [10].

Open internal drainage into stomach, duodenum, or small intestine has been the traditional management

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options with good long-term outcomes. Nevertheless, there is an enlarging trend toward the minimally invasive procedures [1].

This study is conducted to evaluate our center experience of the surgical management of pancreatic pseudocysts, early postoperative outcomes, and late postoperative complications, especially cyst recurrence.

Patients and methods

Study design

We retrospectively reviewed the data of patients who underwent surgical interventions for pancreatic pseudocyst at Gastrointestinal Surgery Center, Mansoura University, Egypt, during the period between January 2010 and December 2019. Patient data were reviewed from a prospectively maintained

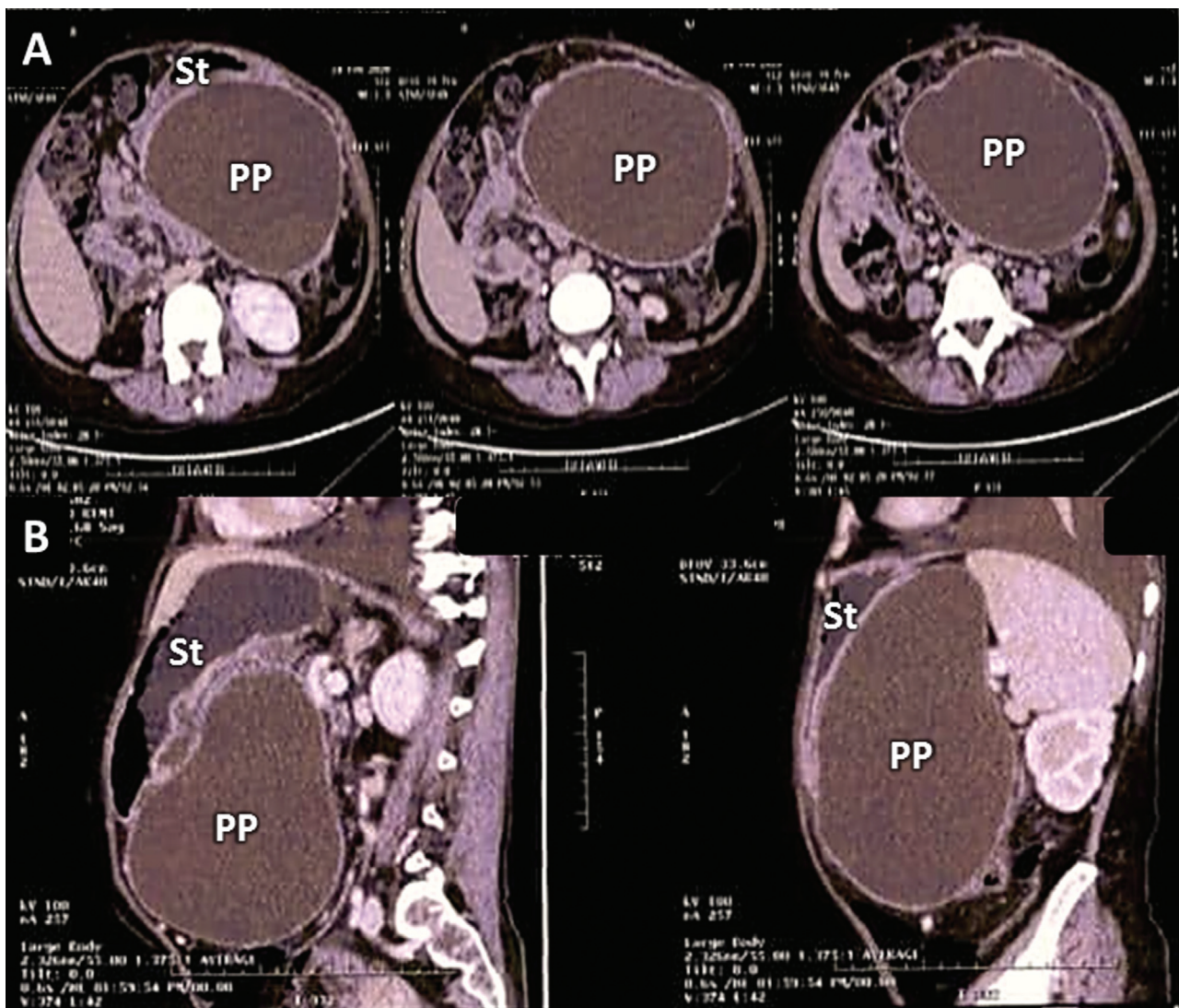
database for all patients undergoing pancreatic surgeries.

A written informed consent for the surgical procedures was obtained from each patient. Additionally, the study was approved by Institutional Review Board and Local Ethical Committee of the Faculty of Medicine, Mansoura University, Egypt.

Preoperative evaluation

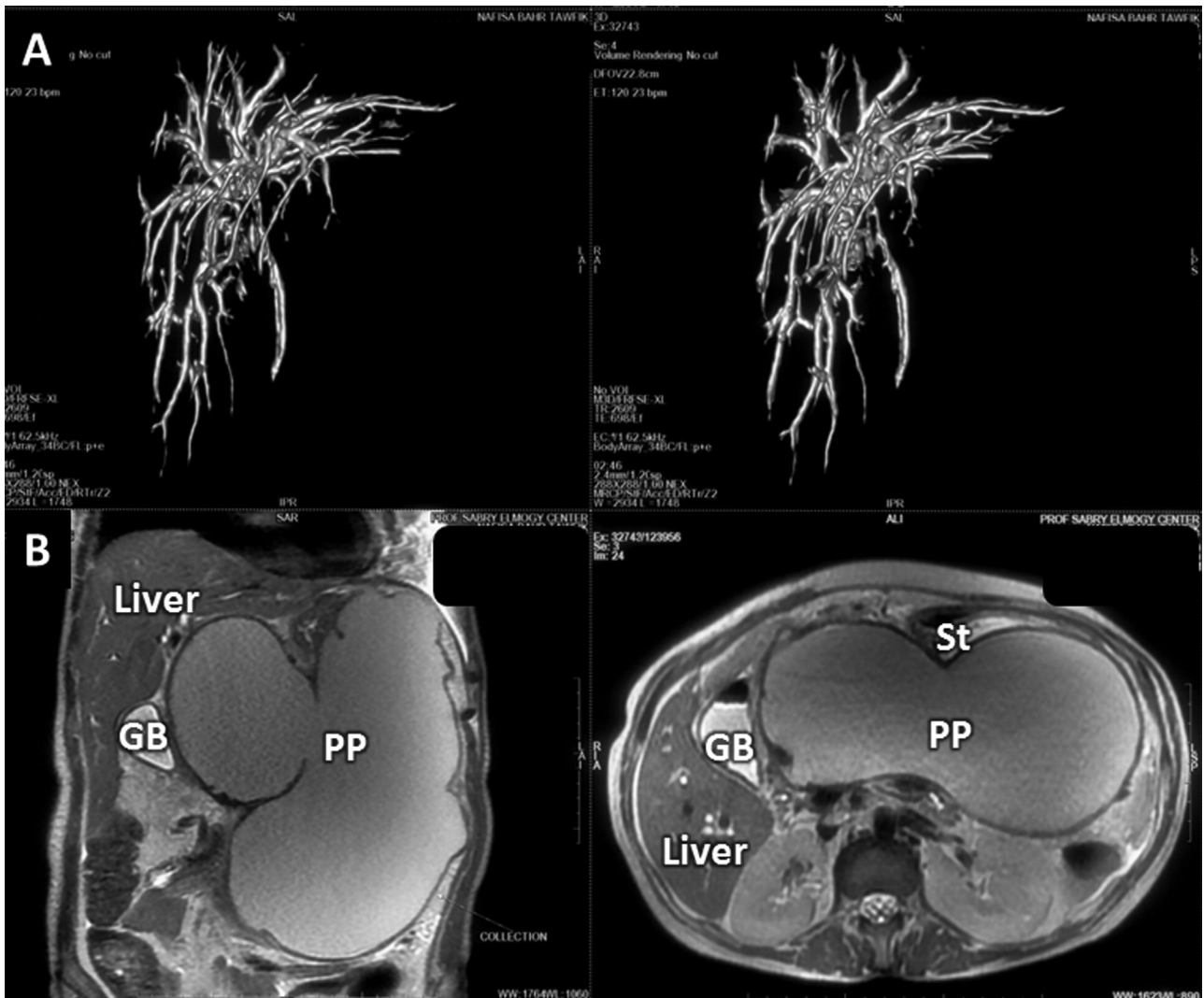
Preoperative evaluation included detailed history taking, clinical evaluation, and complete laboratory evaluation. Tumor markers including carcinoembryonic antigen and carbohydrate antigen 19-9 were also evaluated. Radiological evaluation included abdominal US, triphasic abdominal CT (Fig. 1), and abdominal MRCP for cases of biliary pancreatitis (Fig. 2). Preoperative endoscopic

Figure 1



Preoperative abdominal computed tomography of a large pancreatic pseudocyst (17×15 cm) occupying most of the abdominal cavity. (a) Axial view; (b) sagittal view; St, stomach; PP, pancreatic pseudocyst.

Figure 2



Preoperative abdominal magnetic resonance imaging. (a) Magnetic resonance cholangiography showing normal biliary tree with no evidence of bile duct stones. (b) Abdominal magnetic resonance image of a giant pancreatic pseudocyst (23x43 cm) extending to the pelvis. The gall bladder shows multiple small stones. GB, gall bladder; St, stomach; PP, pancreatic pseudocyst.

retrograde cholangiopancreatography was performed in cases of biliary pancreatitis with biliary stones detected on MRCP.

Surgical procedure

Patients were placed in supine position. Upper midline incision was utilized for open approach, whereas five ports were used for laparoscopic approach. The laparoscopic approach follows the same steps of the open approach. The choice of surgical intervention was based upon intraoperative findings and the surgeon's preference.

After abdominal exploration, the decision to proceed to cystogastrostomy or cystojejunostomy was determined according to the cyst location and proximity to the posterior wall of the stomach.

For cystogastrostomy, an anterior (transgastric approach) was preferred in most of the patients, otherwise posterior (retrogastric) approach was used. Anterior gastrotomy was performed to identify the bulging site on the posterior wall of the stomach. A wide fenestration was performed between the pancreatic pseudocyst and the bulging part of the posterior gastric wall of ~5 cm. Wide stoma was created allowing adequate debridement and drainage of the pseudocyst. Cyst fluid and part of the cyst wall were pathologically examined to exclude cystic pancreatic neoplasms. The edge of the stoma is routinely over-sewn with interrupted or continuous absorbable sutures (polygalactin or polydioxanone). The anterior gastrotomy was closed by continuous absorbable sutures in two layers (polygalactin or polydioxanone).

For cystojejunostomy, a proximal jejunal loop was identified that allows tension-free anastomosis. Antecolic approach was preferred to avoid adhesions between the stomach and the transverse mesocolon. A cystojejunostomy was performed between the pancreatic pseudocyst and the jejunum with the same principles as cystogastrostomy. A wide stoma was always essential to allow for adequate drainage. Finally, a jejunojejunosomy was performed between the jejunal loops.

For central pancreatectomy, the pancreas was exposed by division of the gastro-colic ligament. The neck and body of the pancreas were dissected from the underlying porto-mesentric and splenic veins with ligation and division of small draining tributaries. The pancreatic parenchyma was transected with at least 1 cm proximal and distal safety margins. The proximal pancreatic stump is closed by continuous absorbable sutures after separate closure of the pancreatic duct with interrupted absorbable sutures. The distal pancreatic stump was anastomosed to the jejunum. Pancreaticojejunosomy was performed in an end-to-side fashion in two layers. The outer seromuscular layer was sutured with nonabsorbable interrupted sutures. The inner duct to mucosa was sutured with interrupted absorbable sutures. No pancreatic stents were used. Finally, end-to-side jejunojejunosomy was performed in classical two layers.

Postoperative care

After surgery, all patients were transferred to the surgical ward for routine monitoring. Patients underwent detailed laboratory evaluation daily. Abdominal US was routinely performed and upon suspicion of abdominal collections. Oral fluids were allowed after regaining of bowel sounds, and patients were discharged after complete recovery with full oral intake and absence of any complications.

Postoperative follow-up

After discharge, patients were followed up regularly at the outpatient clinic. Patients were followed one week after discharge, then every 3 months for the first year, and then annually or on patient's demand. Follow-up visit included detailed history taking, clinical examination, detailed laboratory evaluation, and abdominal US. If any complication was suspected, further workup was performed for further management including abdominal CT (Fig. 3) and endoscopic evaluation.

Study outcomes

The primary outcome of the study is the incidence of recurrence of pancreatic pseudocyst after different

surgical intervention. Secondary outcomes included the overall incidence of postoperative complications and pancreas-specific complications.

Study clinical definitions

Postoperative morbidity is defined as adverse events occurring during the first 90 postoperative days and is graded according to the Clavien–Dindo classification. Major complications are defined as class 3 or higher [11]. Postoperative pancreatic fistula was defined according to the International Study Group for Pancreatic Fistula [12]. Identification of cyst recurrence is based on the radiological evaluation by abdominal US and triphasic CT.

Statistical analysis

Shapiro–Wilk test was used to assess the normality of the data. Categorical variables are expressed as number and percentages. Continuous variables were expressed as mean and SD or median and range, when appropriate.

Results

During the study period, 48 patients underwent different surgical interventions for pancreatic pseudocyst at Gastrointestinal Surgery Center, Mansoura University, Egypt, and were included in our study.

Demographic data

The baseline characteristics of the study patients are shown in Table 1. Biliary pancreatitis was the commonest cause for pseudocyst development (24 patients – 50%). Abdominal pain was the most common presentation (45 patients – 93.8%). Three (6.3%) patients underwent previous attempt for management of pancreatic pseudocyst.

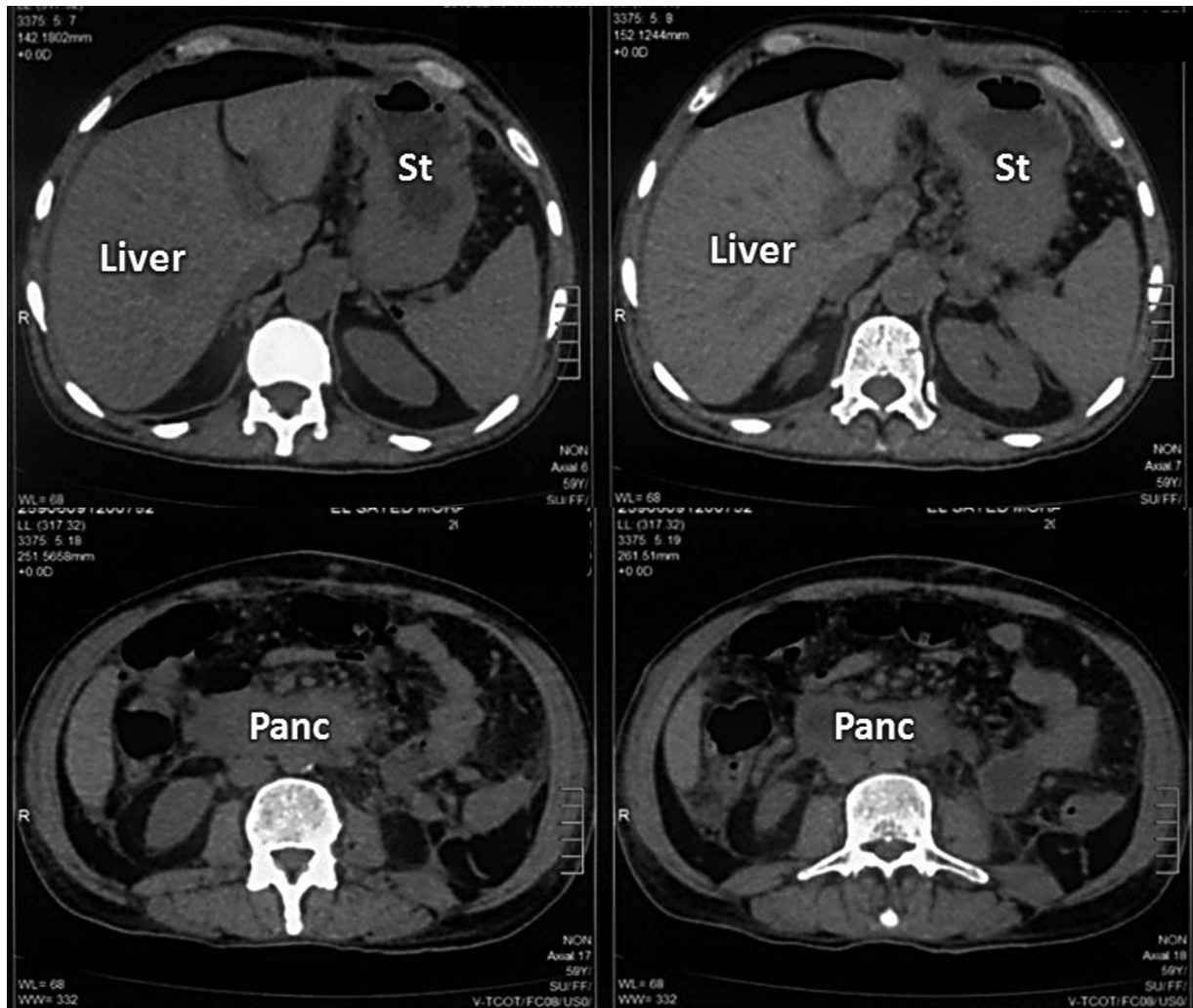
Preoperative laboratory and radiological data

Preoperative laboratory and radiological workup are shown in Table 2. Most of the study patients had only single pancreatic pseudocyst (47 patients – 97.9%). The mean cyst size on preoperative abdominal CT was 13.5 ±6.4 cm (range: 6–42 cm).

Operative data

Operative data of the study patients are summarized in Table 3. The median interval before the surgical intervention was 12 weeks (7–98). Cystogastrostomy was the most commonly performed procedure (39 patients – 81.3%). One (2.1%) patient required both cystogastrostomy and cyst-jejunosomy Roux-en-Y. One (2.1%) patient underwent central

Figure 3



Follow-up noncontrast abdominal computed tomography 1 year after cystogastrostomy for pancreatic pseudocyst. No evidence of pseudocyst recurrence. St, stomach; Panc, pancreas.

pancreatectomy for suspected true pancreatic cyst, which was confirmed to be pancreatic pseudocyst. Cholecystectomy was performed in 17 (35.4%) patients, but was not completed in two (4.2%) patients owing to severe liver cirrhosis.

Pathological analysis of cyst fluid revealed amylase-rich fluid without any atypical cells. Moreover, pathological examination of cyst wall showed fibrous tissue wall without any pathological abnormalities in all cases.

Postoperative data

Postoperative outcomes of the study patients are shown in Table 3. Postoperative morbidities occurred in nine (18.8%) patients. Only one (2.1%) case developed severe postoperative morbidity in the form of bile leakage following cholecystectomy that required endoscopic intervention and stenting of the common bile duct. It should be noted that none of our patients experienced early postoperative mortality.

Long-term follow-up

Median follow-up period was 68 months (4–116 months). No cases experienced pseudocyst recurrence detected on radiological evaluation after surgical interventions. One (2.1%) case experienced adhesive intestinal obstruction that required surgical exploration and adhesiolysis. One (2.1%) case experienced incisional hernia and required hernioplasty.

Discussion

Pancreatic pseudocysts are frequently developed as a complication of acute and chronic pancreatitis. It results from disruption of the pancreatic duct with subsequent extravasation of pancreatic secretions [8]. As it becomes mature, gradual absorption of its contents takes place. Nevertheless, persistent pseudocysts indicate the communication with the pancreatic duct system [13]. Usatoff *et al.* [14] reported that pseudocysts rarely resolve after 6 weeks, and the presence of chronic pancreatitis increases the risk

Table 1 Demographic data of the studied patients

Variables	Data [n (%)]
Age (years)	42.2±19.3
Sex	
Male	25 (52.1)
Female	23 (47.9)
Cause	
Traumatic	8 (16.7)
Biliary pancreatitis	24 (50)
Idiopathic pancreatitis	16 (33.3)
Clinical presentation	
Accidental	2 (4.2)
Abdominal pain	45 (93.8)
Back pain	15 (31.3)
Vomiting	13 (27.1)
Jaundice	6 (12.5)
Fever	5 (10.4)
Early satiety	5 (10.4)
Medical history	
Diabetes mellitus	14 (29.2)
Hypertension	11 (22.9)
Liver disease	0
Previous endoscopic retrograde cholangiopancreatography	12 (25)
Previous abdominal operations	6 (12.5)
Attempts for pseudocyst management	
No	45 (93.8)
EUS-guided drainage	2 (4.2)
Surgery	1 (2.1)

EUS, endoscopic ultrasound.

of pseudocyst complications. Therefore, early intervention is recommended. Surgical treatment is still the gold standard approach for managing persistent and complicated pancreatic pseudocysts.

This study was conducted aiming to evaluate the outcome of surgical management of pancreatic pseudocysts. A total of 48 consecutive cases were included with a mean age of 42.2 years. Males represented 52.1% of the included cases. Some studies from the USA and the Netherlands reported a tendency toward a more equal sex distribution [15,16]. Conversely, another study reported that pseudocysts were more frequent in female than in male (2 : 1) [17].

Biliary pancreatitis was the commonest cause of pancreatitis in our study (50%), followed by idiopathic pancreatitis (33.3%) and abdominal trauma (16.7%). Alcoholic pancreatitis was not present in the current study as alcoholism is rarely encountered in our community owing to religious beliefs. Pan *et al.* [18] reported higher prevalence of biliary pancreatitis (75.4%) in their series followed by alcoholic pancreatitis (10.3%). Johnson *et al.* [2]

Table 2 Preoperative laboratory and radiologic data of the study patients

Variables	Data
Preoperative laboratory data	
White blood cells ($\times 10^3/\text{mm}^3$)	6.2 (2.5–20)
Hemoglobin (g/dl)	11.5 (8.1–17.4)
Platelets ($\times 10^3/\text{mm}^3$)	246.5 (1124–759)
Albumin (g/dl)	4.1 (2.7–5.2)
Bilirubin (mg/dl)	0.5 (0.3–7)
Aspartate transaminase (IU/l)	21.5 (20–94)
Alanine transaminase (IU/l)	20 (20–87)
Alkaline phosphatase (KAU/l)	8.8 (5–65)
International normalized ratio	1.04 (1–1.4)
Creatinine (mg/dl)	0.7 (0.4–1.3)
Random blood glucose (mg/dl)	105 (68–262)
Amylase (U/l)	68 (32–632)
Preoperative radiological data	
Liver status	
Normal	46 (95.8)
Cirrhotic	2 (4.2)
Pseudocyst number	
Single	47 (97.9)
Double	1 (2.1)
Pseudocyst size (cm)	13.5±6.4 (5–42)
Pseudocyst site	
Pancreatic head	4 (8.3)
Pancreatic body	10 (20.8)
Pancreatic tail	2 (4.2)
Pancreatic body and tail	32 (66.7)
Gall bladder status	
Normal	24 (50)
Stones	19 (39.6)
Removed	5 (10.4)
Common bile duct	
Normal	45 (93.8)
Dilated	3 (6.3)
Pancreatic status	
Normal	34 (70.8)
Enlarged	12 (25)
Chronic pancreatitis	2 (4.2)
Pancreatic duct	
Normal	48 (100)

reported that the causes of the underlying pancreatitis were alcoholism (27%), followed by biliary stones (22%). Another study reported that the commonest risk factor for pancreatitis and subsequent pseudocyst formation was alcoholic pancreatitis (70.96%), followed by gall stone pancreatitis (16.12%) [16].

Several studies had reported that abdominal and anorexia were the commonest presentation of pancreatic pseudocyst [17]. Other symptoms included weight loss, indigestion, bloating, abdominal lump, and jaundice. In the current study, abdominal pain was the commonest presentation (93.8%), followed by back pain (31.3%) and

Table 3 Operative data and postoperative outcomes of the study patients

Variables	Data
Interval before surgery (weeks)	12 (7–98)
Approach	
Open	45 (93.8)
Laparoscopic	3 (6.3)
Procedure	
Cystogastrostomy	39 (81.3)
Cystojejunostomy Roux-en-Y	7 (14.6)
Both cystogastrostomy and cystojejunostomy Roux-en-Y	1 (2.1)
Central pancreatectomy with pancreaticojejunostomy Roux-en-Y	1 (2.1)
Associated cholecystectomy	17 (35.4)
Operation time (min)	120 (60–240)
Blood loss (ml)	175 (30–800)
Blood transfusion	0
Hospital stay (days)	4.5 (2–20)
Morbidity	9 (18.8)
Clavien–Dindo grade	
I	8 (16.7)
IIIb	1 (2.1)
Abdominal collection	4 (8.3)
Abdominal collections management	
Conservative	4 (8.3)
Pancreatic leakage	1 (2.1)
Pancreatic leakage management	
Conservative	1 (2.1)
Bile leakage	1 (2.1)
Bile leakage management	
ERCP and stenting	1 (2.1)
Wound infection	4 (8.3)
Mortality	0

ERCP, endoscopic retrograde cholangiopancreatography.

vomiting (27.1%). Beckingham *et al.* [19] reported 11% recurrence rate after endoscopic drainage procedures for pancreatic pseudocyst. Although endoscopic procedure for drainage offers rapid recovery compared with surgery, its success depends on some anatomical criteria. The cyst wall must be contiguous with stomach or duodenum, and cyst wall thickness should not exceed 1 cm [2]. Roughly, ~27–55% of pseudocysts meet these specifications, leaving surgical option as the gold option for the remaining cases [20]. In this study, EUS-guided drainage was attempted in two (4.2%) cases, whereas previous surgery was performed in only one (2.1%) case.

In the current study, the mean interval between presentation and surgical intervention was 12 weeks (range: 7–98 weeks). We preferred to operate these cases after more than 6 weeks of presentation. This

provides two advantages: we save the pseudocyst some time for spontaneous resolution, and that time allows maturation of the cyst wall, making it easier to construct an anastomosis between the cyst and the organ chosen for internal drainage.

Cystogastrostomy was the commonest internal drainage procedure performed in our study (81.3%), followed by cystojejunostomy Roux-en-Y (14.6%), and one case underwent both procedures for drainage (2.1%). Central pancreatectomy was done in one (2.1%) case. It was previously reported that cystogastrostomy allows treatment of pancreatic cyst with 8% risk of secondary hemorrhage, 5% risk of infection, and 10% risk of recurrence [21]. Moreover, this bypass avoids dissection through inflamed tissues, consisting of anterior gastrostomy and posterior gastrostomy centered on the cyst, after ensuring that the pseudocyst is adherent to the posterior gastric wall [21–23]. Regarding cystojejunostomy, it could be performed for cysts not adherent to the posterior gastric wall. Both of these two procedures have been performed laparoscopically. Laparoscopy offers the advantages of surgery (less recurrence) and minimally invasive techniques (rapid recovery) [6]. Roux-en-Y cystojejunostomy was the commonest operation in another study (42.9%). The remaining cases underwent cystoduodenostomy (30.6%), cystogastrostomy (14.3%), and distal pancreatectomy (12.2%) [18]. The difference in the operations reported could be attributed to different location and the number of lesions encountered after exploration.

Surgery usually offers an advantage of managing other pathologies detected that may contribute to pseudocyst formation. We performed cholecystectomy for 17 (35.4%) cases in our study. Other authors performed the same procedure for 11 (36.67%) cases, Puestow procedure for the existing chronic pancreatitis for 6.67%, and hepaticojejunostomy for 3.33% [2]. Within a median follow-up of 68 months, no cases experienced recurrence of pancreatic pseudocyst in our study. This indicated that surgery is an effective option to provide good drainage for such cysts. Creating a wide stoma for drainage is a great advantage of surgical internal drainage techniques compared with endoscopic techniques. Similarly, Crisanto *et al.* [23] reported no recurrence after management of pancreatic pseudocysts during the follow-up period of 40 months. Pan *et al.* [18] reported that resolution of the pancreatic pseudocyst was detected in 93.3% of cases, whereas this rate decrease down to 88.9% for endoscopic procedures. Johnson *et al.* [2] reported that resolution of the pseudocyst was achieved in 93.3%

of cases, whereas it was present in 87.5% of cases who were endoscopically managed. Although resolution rate was higher in the surgical group, that difference was statistically insignificant.

Morbidity was encountered in nine (18.8%) cases in the current study. All cases were managed conservatively apart from bile leakage, which was managed by endoscopic retrograde cholangiopancreatography and stenting, and deep wound infection, which were managed by stitch removal and drainage. Mortality was not encountered in our study. Nevertheless, on long-term follow-up, one case developed adhesive intestinal obstruction, and another one had incisional hernia. Rasch *et al.* [17] reported that no complications were encountered after surgical drainage for pancreatic pseudocysts. However, complications were encountered in 40% of cases that underwent resection. Furthermore, another study reported that complications were encountered in 6 of 30 (20%) cases. Three cases developed incisional hernias, whereas venous thrombosis was encountered in one case. Other complications included hemorrhage from pancreatic pseudoaneurysm (one case) and pancreatic fistula (one case) [2].

Our study has multiple limitations: first of all, it is a retrospective study that was conducted in a single center. Besides, the number of cases was relatively small. In addition, it evaluated only the surgical approach that is more preferred by our team. Thus, future studies should be conducted to fulfill these limitations.

Conclusion

In conclusion, surgical intervention for pancreatic pseudocysts appears to be safe and feasible approach. Despite having minor morbidity, it offers two advantages: ability to deal with the primary cause during operation (cholecystectomy) and excellent long-term outcome regarding recurrence.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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