Evaluation of laparoscopic cystogastrostomy in treatment of pancreatic pseudocysts

Mohamed S. El-Sebaie, Ayman A. Abd Rabo, Hesham M. Omran, Ahmed F. Amer, Hossam S. Abdelrahim

Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Correspondence to Mohamed S. El-Sebaie, MSC, Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo 11772, Egypt. Tel: 01005602549; e-mail: drsb3b3@gmail.com

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Background
Cystogastrostomy is the most effective drainage method for large, persistent pancreatic pseudocyst (PP). There are many approaches for cystogastrostomy either open cystogastrostomy, laparoscopic cystogastrostomy (LCG), or nonsurgical techniques (endoscopic or percutaneous radiologic drainage).
Patients and methods
This was a prospective clinical trial single-center experience study on patients with PP who presented at our outpatient clinic at Ain Shams University hospitals during the period from January 2019 till January 2021. It included patients with symptomatic cyst of more than 6 cm with well-formed wall after 6 weeks from the last attack. The included cases underwent LCG, aiming to assess our early experience of LCG and its short-term outcome.
Results
A total of 20 patients with PP presented to us during the study period, and 16 (80%) patients met the inclusion criteria, and these patients underwent LCG. The mean operative time was 170.31 min, and the mean blood loss was 156.88 ml. Overall, 6.3% of our cases had open conversion. Concomitant cholecystectomy was done in 56.3% of our cases. The mean hospital stay was 6.31 days, with 12.5% of our cases had postoperative wound infection and 6.3% had postoperative hematemesis. No cases of recurrence or mortality were encountered in our study.
Conclusion
Laparoscopic drainage of PP has major advantages over the open approach in the form of less postoperative pain, hospital stay, and wound complications with comparable recurrence incidence. Our early experience in laparoscopic anterior cystogastrostomy approach was promising with good results and acceptable morbidity, which encouraged us to expand this approach in drainage of PP.

Keywords:
cystogastrostomy, laparoscopic drainage, pancreatic pseudocyst

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Introduction

Pancreatic pseudocyst (PP) is an encapsulated collection in the peripancreatic area mostly located behind the stomach with well-formed fibrous wall; it contains inflammatory cells, pancreatic enzymes, and necrotic tissue [1]. Surgical management of PP depends on the presence of pressure symptoms such as epigastric pain, early satiety, loss of weight, persistent hyperpyrexia, or any complications such as bacterial contamination, vascular thrombosis, and biliary or gastric obstruction [2].

Several diagnostic techniques can be used for diagnosis such as pelviabdominal ultrasound, which has limited sensitivity owing to abdominal distention, and pelviabdominal computed tomography (CT) with contrast with pancreatic protocol, which is considered the investigation of choice as the presence of thick-walled, rounded, fluid-filled mass adjacent to the pancreas with a history of acute or chronic pancreatitis confirms the diagnosis of PP with no need for other diagnostic modalities [3].

Various treatment modalities can be used in PP management. Conservative treatment can be used in small cysts without persistent symptoms or complications, whereas invasive management can be done. Surgical internal drainage can be done either by laparoscopic approach (cystogastrostomy, cystojejunostomy, and cystoduodenostomy) or by open one. Moreover, endoscopic internal drainage or radiological guided percutaneous external drainage can be used in certain circumstances [4].

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Percutaneous external drainage is an effective modality in treating PP arising after an acute pancreatitis and is not suitable for PP in patients with chronic pancreatitis owing to higher risk of complications, infections, and long hospital stay [5]. Endoscopic internal drainage is done when PP is connected to the main pancreatic duct allowing the stent to be placed for internal drainage by using the endoscopic retrograde cholangiopancreatography, and also is done when endoscopic ultrasound shows adhesion of the PP to the stomach allowing transmural drainage via the stomach wall [6].

Open cystogastrostomy (OCG) has many advantages such as excellent control of hemostasis and creation of a wide communication between the cyst and the stomach minimizing the risk of recurrence and infection, with very good results in necrosectomy [7]. Laparoscopic cystogastrostomy (LCG) has superior advantages over OCG as it is less invasive, has better pain control, has less postoperative wound infection and chest problems, and has smoother recovery [8]. We aimed to assess our early experience of LCG and its short-term outcome.

Patients and methods

Study design

This was a prospective descriptive single-center experience study on patients with PP who presented at our outpatient clinic at Ain Shams University hospitals during the period from January 2019 till January 2021. All operations were done by the same surgical team. Approval of the ethical committee of General Surgery Department was obtained. An informed consent was taken from all patients to be included in this study.

Inclusion criteria

We included cases with symptomatic PP with a size more than 6 cm, 6 weeks after the last attack of pancreatitis with well-formed wall, and cysts are present in the lesser sac in close contact to the stomach not more than 1 cm away from the posterior gastric wall.

Exclusion criteria

We excluded contraindicated cases for laparoscopy, such as those with previous extensive upper abdominal laparotomies, severe cardiac or respiratory disease interfering with abdominal inflation, and patients with bleeding tendency. We also excluded contraindicated cases for internal drainage, such as those with suspected malignancy, acute attack of pancreatitis, and complicated cases (ruptured cysts, development of abscess within the cyst, hemorrhagic cysts, presence of thrombosed vessels, or aneurysm), which need special treatment for the complication before the internal drainage.

Preoperative workup

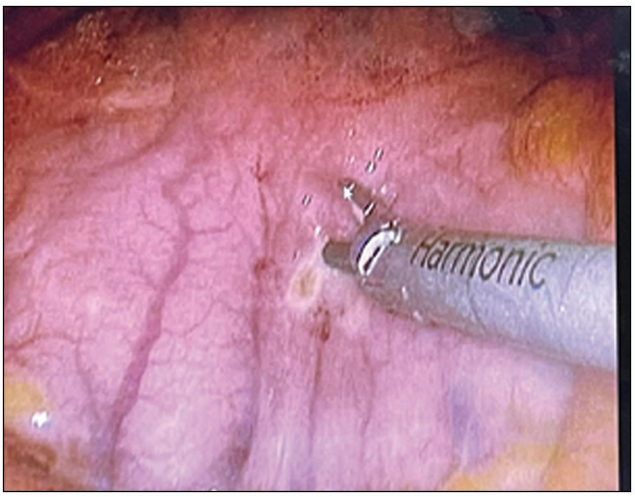
Full detailed medical and surgical history was taken including history of smoking, alcohol intake, recent abdominal trauma or operations, and recent attack of pancreatitis or biliary colic.

Inspection for any abdominal swelling, scars, and signs of trauma was done. Palpation for guarding or rigidity that may indicate rupture, abdominal mass, and Murphy's sign was done. Routine preoperative laboratory tests were performed, including serum amylase, lipase, and bilirubin levels. Pelviabdominal ultrasound was done to exclude cholelithiasis and to aspirate the cysts contents for analysis (mucin, CA 19,9). CT study of pelvi-abdomen with contrast (pancreatic protocol) is the gold standard and was done for all cases to comment on the size, site, and the thickness of the cyst wall.

Surgical technique

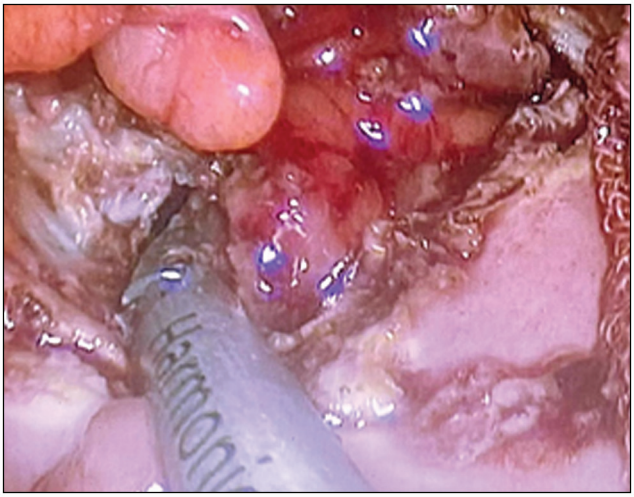
All patients included in our study underwent LCG (anterior approach) as a standard procedure. Abdominal inflation using Verres needle at the left subcostal area was done to create pneumoperitoneum. One port (10 mm) was placed at the periumbilical region, another port (12 mm) was placed at the left lumbar at the midclavicular line, and the last port (5 mm) was placed at the right lumbar at the midclavicular line. Other assisting (5 mm) ports may be placed at left subcostal region according to each case. The anterior gastric wall was opened using the harmonic device (Fig. 1). At the site of the bulge of the cyst into the posterior gastric wall, posterior gastrostomy including the anterior wall of the cyst was done using the harmonic device (Fig. 2). Drainage of the intracystic collection was done using the suction device (Fig. 3). The anterior cyst wall was anastomosed to the posterior gastric wall by the gastrointestinal anastomosis stapler with green

Figure 1



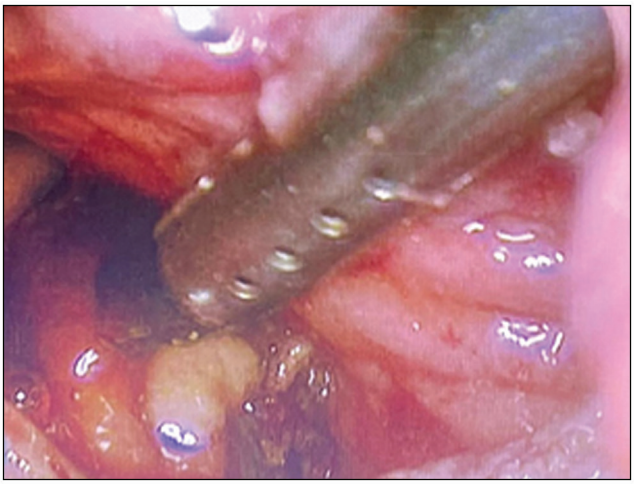
Opening the anterior gastric wall by harmonic.

Figure 2



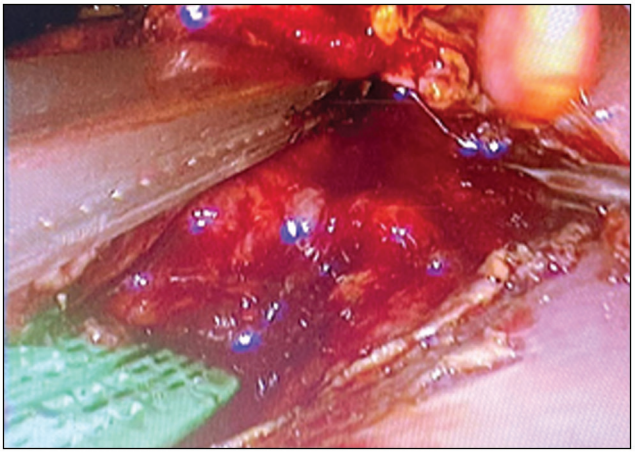
Opening the posterior gastric wall and cyst wall by harmonic.

Figure 3



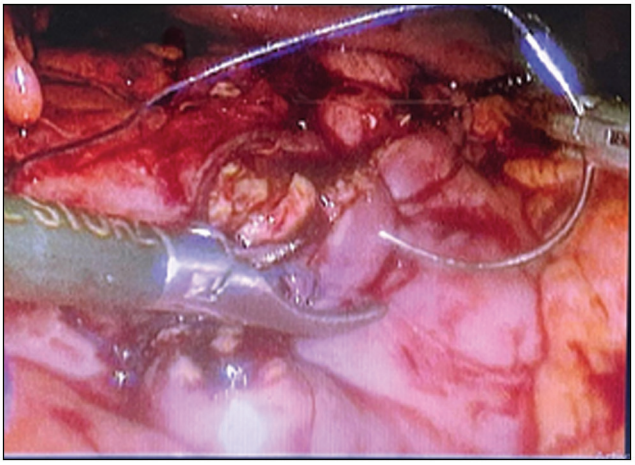
Suction of intracystic collection.

Figure 4



Stapling the anterior cyst wall and posterior gastric wall.

Figure 5



Closure of the anterior wall of the stomach.

cartridge (Fig. 4). Necrosectomy for the cysts debris was done. Ryle was introduced to be passed through the stoma. Closure of the anterior of the stomach was done using vicryl suture 2/0 continuous (two layers) (Fig. 5). Laparoscopic cholecystectomy was done in biliary causes of pancreatitis. A drain was left in the left subphrenic space.

Postoperative workup

All patients were followed up during the hospital stay for monitoring of the patients' vital data, urinary output, Ryle content and amount, intestinal sounds, wound dressing, postoperative bleeding (either endoluminal or intra-abdominal), postoperative pain using visual analog scale (VAS) score (Fig. 6), and hospital stay. Patients were ready for discharge once tolerating oral diet and abdominal pain. The VAS is an instrument to measure pain ranging across a continuum of values. The amount of pain that a patient feels ranges from none to an extreme amount of pain categorized as none, mild, moderate, and severe [10].

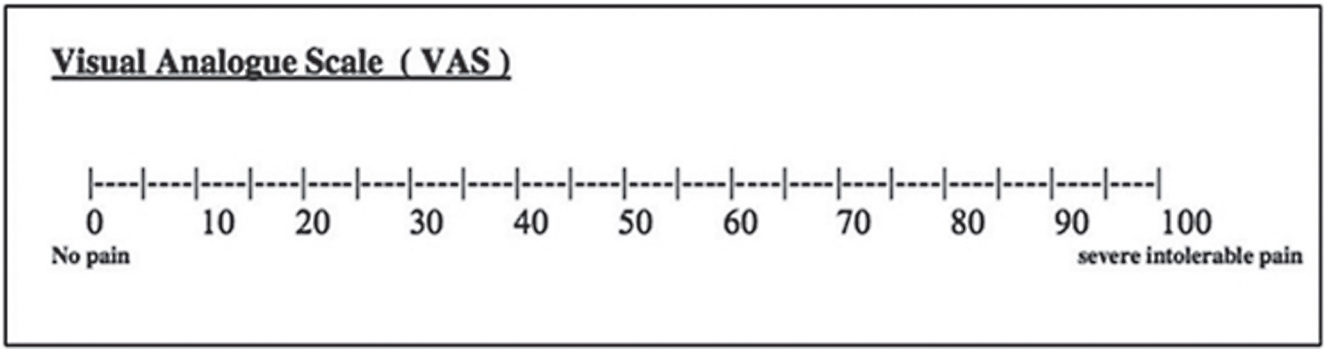
Follow up

All patients were followed up at the outpatient clinic at 1 week, 1 month, 3 months, 6 months, and 12 months postoperatively. CT pelviabdominal with contrast (pancreatic protocol) was done at 6 and 12 months to detect recurrence. Recurrence in our study was defined as presence of cyst more than 6 cm on CT or presence of abdominal pain and fever even with cysts less than 6 cm.

Data collection

From our operated cases, we collected the following items, including the preoperative demographic data [age, sex, BMI, and presence of diabetes mellitus (DM)], the preoperative cyst characteristics (size, etiology, and percentage of necrotic debris), the operative data (operative time, blood loss, visceral injury, conversion

Figure 6



The visual analog scale (VAS) used for evaluation [9].

to open, and concomitant cholecystectomy), and postoperative data (hospital stay, pain score, bleeding, wound infection, and recurrence). These data were analyzed to assess the outcome of our experience in the technique of the anterior transgastric cystogastrostomy approach in the management of PP.

Data management and analysis

Data were revised, coded, entered on a computer, and analyzed using SPSS, version 26 for Windows (SPSS Inc., Chicago, Illinois, USA). Quantitative data were tested for normality with Shapiro–Wilk test and described as mean and SD. Qualitative data were expressed as frequencies (*n*) and percentage (%). *P* value less than or equal to 0.05 was considered significant.

Results

In the study period, 20 patients presented to our outpatient clinic with PP. However, only 16 patients fulfilled the inclusion criteria and were operated upon via LCG, and the other four were managed conservatively and were excluded from our study.

The mean age of our cases was 40.56 years, ranging from 21 to 63 years old, with a male predominance [11 (68.8%) patients]. The mean BMI was 26.81 kg/m^2, and only three patients had DM. The most common etiology was biliary pancreatitis in 11 (68.7%) patients. Regarding the cyst characteristics, the mean size was 14.28 cm, ranging from 6.5 to 20 cm, and only five patients had more than or equal to 30% (31.2%) pancreatic necrosis by CT criteria. All of these data are illustrated in Table 1.

Concerning the operative data in Table 2, the mean operative time was 170.31 min ranging from 90 to 280 min with the longest operative time in the patient who was converted to open approach owing to difficult localization of the cyst and adhesions. Mean blood loss was 156.88 ml, and no intraoperative visceral injury was encountered. A total of nine (56.3%) patients underwent concomitant cholecystectomy in our study.

Table 1 Preoperative data of patients and cysts

Variables	
Age (mean±SD)	40.56 ± 13.39
Sex [*n* (%)]	
Male	11 (68.8)
Female	5 (31.2)
DM [*n* (%)]	
Yes	3 (18.8)
No	13 (81.2)
BMI (mean±SD)	26.81 ± 4.59
Etiology [*n* (%)]	
Biliary	11 (68.7)
Alcoholic	1 (6.3)
Traumatic	1 (6.3)
Idiopathic	1 (6.3)
Hyperlipidemia	2 (12.4)
Intracystic necrotic debris [*n* (%)]	
<30%	11 (68.8)
≥30%	5 (31.2)
Size (mean±SD) (cm)	14.28 ± 3.80

DM, diabetes mellitus.

Table 2 Operative data

Variables	
Operative time (mean±SD) (min)	170.31 ± 61.44
Blood loss (mean±SD) (ml)	156.88 ± 83.72
Visceral injury [*n* (%)]	0
Conversion to open [*n* (%)]	1 (6.3)
Concomitant cholecystectomy [*n* (%)]	9 (56.3)

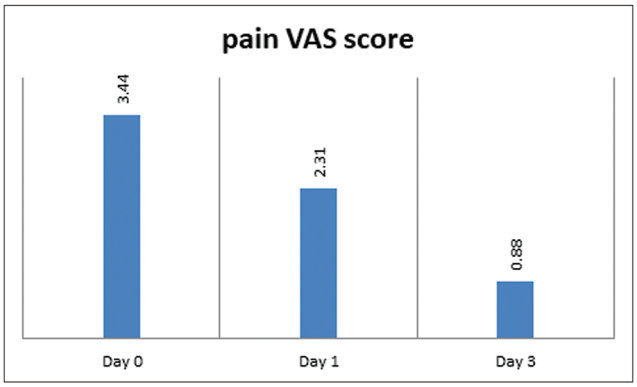
Regarding the postoperative data (Table 3), the mean hospital stay was 6.31 days, ranging from 2 to 14 days, with the longest hospital stay in the patient who was converted to open and the patient who developed postoperative bleeding in the form of hematemesis, who was managed conservatively. Regarding postoperative complications, only one (6.3%) patient had postoperative intraluminal bleeding (hematemesis) and no intra-abdominal bleeding was

Table 3 Postoperative data

Variables	
Hospital stay (mean±SD) (day)	6.31 ± 3.24
Pain score (VAS) (mean±SD)	
Day 0	3.44 ± 1.21
Day 1	2.31 ± 1.08
Day 3	0.88 ± 0.72
Bleeding [*n* (%)]	
Intraluminal	1 (6.3)
Intra-abdominal	0
Wound infection [*n* (%)]	2 (12.5)
Recurrence [*n* (%)]	
6 months	0
12 months	1 (6.3)

VAS, visual analog scale.

Figure 7



Pain VAS score improvement. VAS, visual analog scale.

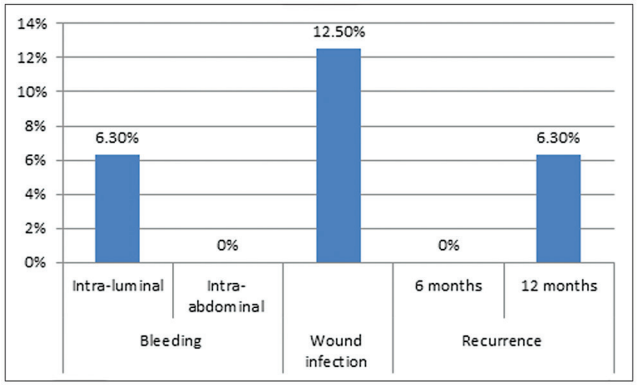
encountered. A total of two (12.5%) patients had wound infection, where one was encountered with the middle laparotomy wound in the open conversion case and port site wound infection was detected in the other case. They were managed conservatively by antibiotics and daily wound dressing. Using VAS score to assess postoperative pain, we found that pain decreased dramatically, being minimal at day 3, with a mean score of 0.88 (Fig. 7). For 6-month follow-up, there was no recurrence, but after 1 year, there was one case of recurrence with asymptomatic cyst more of than 6 cm in the CT that was scheduled for redo OCG (Fig. 8). We had no mortality cases in our study.

Discussion

PP is an inflammatory cyst lined by fibrous tissue and mostly located in the lesser sac behind the stomach. PP occurs in 2–10% of patients after acute pancreatitis and develops in ~10–30% of patients after repeated attacks of chronic pancreatitis and can be treated with different procedures [11].

Conservative management with bowel rest and parenteral nutrition is the ideal management in

Figure 8



Postoperative complications.

asymptomatic small cysts with thin wall [12]. However, large cysts with persistent symptoms and mature wall mostly need drainage management. Drainage of PP can be done by surgical internal drainage either laparoscopic or by open internal drainage, and also endoscopic internal drainage or radiologic percutaneous external drainage can be used in some patients [13].

In our study, 20 cases with PPs presented to outpatient clinic, and 16 patients fulfilled the inclusion criteria and then they underwent LCG. The data were collected and analyzed to evaluate our experience in this approach for management of PP. Our preoperative data showed that the mean age for included cases was 40.56 years, and the mean BMI was 26.81 kg/m^2. We had 11 (68.8%) male patients and five (31.2%) female patients enrolled in our study. Overall, three (18.8%) patients had DM. Biliary pancreatitis was the most common etiology in 11 (68.7%) patients, and the mean size of the PP was 14.28 cm. Regarding the incidence of intracystic necrotic tissue by CT criteria, five (31.2%) patients had more than or equal to 30% pancreatic necrosis.

Our mean operative time was 170.31 min in a prospective comparative study designed by Ambore *et al.* [14]. They found that the mean operative time required for OCG and LCG was 135 and 115 min, respectively. In the study by Palanivelu *et al.* [15] (a retrospective comparative study), their mean operative time was 110 min for OCG and 86 min for LCG. The study by Khaled *et al.* [16] (a case-matched comparative retrospective cohort study) reported that the mean operative time in OCG and LCG was 95 and 62 min, respectively. The increased time for OCG over LCG in these studies can be explained because of longer time required to open and close the abdomen during laparotomy.

Our mean blood loss was 156.88 ml. Ambore *et al.* [14] reported a mean blood loss 77.5 ml in LCG and 85 ml in OCG. Palanivelu *et al.* [15] had a mean blood

loss 66 ml in LCG and 120 ml in OCG. In the study by Khaled *et al.* [16], the mean blood loss was 91 ml in LCG and 150 ml in OCG. Our mean operative time and blood loss were greater than the previously mentioned studies owing to our early learning curve in this approach. No visceral injury was encountered in our study, and this result is comparable with most of studies in the literature.

We had one (6.3%) case with conversion to OCG due to failure to localize the cyst secondary to dense adhesions via the laparoscopic approach. The study by Ambore *et al.* [14] had two (9.09%) cases with open conversion, whereas Khaled *et al*. [16] had two (6.7%) cases with open conversion. Palanivelu *et al.* [15] had no cases with open conversion. Our result in open conversion was comparable to the study by Khaled *et al.* [16] but less than the study by Ambore *et al.* [14] because they had two cases with intractable bleeding requiring conversion to OCG.

Our mean hospital stay was 6.31 days. In the study by Ambore *et al.* [14], the mean hospital stay was 9 days in LCG and 11 days in OCG. Khaled *et al.* [16] reported that their mean hospital stay was 6 days in LCG and 11 days in OCG. Our mean hospital stay is nearly the same as Khaled *et al.* [16] in LCG but is less than that of Ambore *et al.* [14] in LCG because of postoperative complications requiring longer hospital stay to deal with fever, acute respiratory distress, and hospital-acquired pneumonia. It is obvious that the postoperative hospital stay in OCG is greater than in LCG and that is owing to longer duration required for analgesia control owing to large incisions besides the more incidence of postoperative wound complications in open approach.

Postoperative pain was assessed daily for all patients using the VAS score with minimal pain in cases that underwent LCG and severe intolerable pain in the case converted to OCG in the first few days till no pain in both approaches before discharge. This explains the prolonged hospital stay in the case converted to OCG and minimal hospital stay in the LCG cases when compared with OCG.

Postoperative wound infection in our study occurred in two (12.5%) patients. One case developed midline laparotomy wound infection after conversion to OCG, and another case developed port site infection. Ambore *et al.* [14] reported no cases of wound infection in LCG and three (10.71%) patients in OCG. Tan *et al.* [17] (a retrospective analytical study on PPs with variable drainage procedures) revealed that postoperative wound infection occurred in 13 (7.9%) patients in their LCG cases.

Recurrence in our study was defined as presence of cyst more than 6 cm on CT or presence of abdominal pain and fever even with cyst size less than 6 cm. Recurrence was documented in one (6.3%) case after 1 year of follow-up. This case of recurrence was mostly secondary to large incidence of necrotic tissue (>30%). Palanivelu *et al*. [15] had one (0.9%) case of recurrence in the LCG approach in 13 months of follow-up and no recurrent cases in the OCG approach in 18 months of follow-up. Khaled *et al*. [16] had one (3.3%) case of recurrence in the LCG approach in 53 months of follow-up and no recurrent cases in the OCG approach in the mean 18-month follow-up duration. Recurrence of the pseudocyst is not common after a perfect meticulous surgery either open or laparoscopic approach especially with low incidence of necrotic tissue.

It is important to point out that in contrast to other studies that used different types of laparoscopic internal drainage (transgastric cystogastrostomy, cystojejunostomy, etc.), only one laparoscopic technique (transgastric cystogastrostomy) was used at our hospital, which facilitates the learning process and the reproducibility of the technique. It is important to emphasize that there were several limitations in our study, as it was only a descriptive study and not comparative, and also had a small sample size and short follow-up time, so further studies are needed.

Conclusion

Laparoscopic drainage of PP has major advantages over open approach in form of less postoperative pain, hospital stay, and wound complications with comparable recurrence incidence. Our early experience in laparoscopic anterior cystogastrostomy approach was promising with good results and acceptable morbidity, which encouraged us to expand this approach in the drainage of PP.

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Nil.

Conflicts of interest

No conflict of interest.

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