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Laparoscopic pancreatic cystgastrostomy

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Abstract: Internal drainage of acute pancreatic pseudocysts is indicated 6 weeks after the first documentation of pseudocyst. It is also indicated for symptomatic chronic pseudocysts 6 cm or more in diameter. When pseudocysts are located in close contact with the posterior wall of the stomach, they are best drained by pseudocyst-gastrostomy. This procedure can also be completed making use of intragastric surgical techniques. Under standard laparoscopic observation, three intragastric ports are placed through the abdominal and anterior gastric walls, establishing working channels for a telescope and hand instruments. After the presence of pseudocysts is confirmed, the posterior wall of the stomach and the cyst wall can be incised by electrocautery. After a sufficient drainage orifice is made and the cyst contents are thoroughly debrided, the intragastric ports are removed and defects in the gastric wall are closed with sutures placed via the standard laparoscopic approach. This approach is much less invasive than the conventional approach, which entails a large gastrotomy in the anterior wall of the stomach. This procedure should be the method of choice when interventional radiology or endoscopic intervention fails to effectively drain retrogastric pseudocysts.

Key words: pancreatic pseudocyst, laparoscopic surgery, intragastric surgery, pancreatic pseudocyst-gastrostomy

Introduction

Acute pancreatitis and acute exacerbation of chronic pancreatitis are often followed by pseudocyst formation. Traditionally, surgery has been chosen when treatment is necessary.[1] With progress in our understanding of the pathophysiology of pseudocyst formation and of its natural history, many alternatives to standard surgery have been successfully employed, including catheter drainage of the cyst, making use of interventional radiology techniques and endoscopic intervention. In addition, laparoscopic surgery has been successfully performed in patients with pseudocysts who required internal drainage. In fact, there are many options to choose from when confronted with a patient with pseudocyst, but the most appropriate choice should be decided on the basis of an understanding of the pathophysiology of pseudocysts and their complications.

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Pathogenesis of pancreatic pseudocysts

It is widely accepted that pseudocysts have different origins depending on the underlying diseases. D'Egidio and Schein[2] have proposed a classification that differentiates between the pseudocysts of acute and chronic pancreatitis, identifying three distinct types. Type I or acute "postnecrotic" pseudocysts occur after an episode of acute pancreatitis. When an episode of acute pancreatitis results in pancreatic necrosis of limited extent, the potential for direct leakage of pancreatic juice from the gland exists. When this leakage persists after recovery from the acute inflammation, escaped pancreatic juice begins to accumulate in the space adjacent to the pancreas, most often in the lesser omental bursa. The ensuing inflammatory reaction, stimulated by pancreatic enzyme action and local fat and pancreatic necrosis, induces the development of a distinct surrounding wall. As the wall matures and thickens, it consists of granulation tissue, blood vessels, and connective tissue with fibrosis. There is a concept that pseudocysts arising after acute pancreatitis always initially communicate with the pancreatic duct; however, communication between the duct and the pseudocyst can be demonstrated by endoscopic pancreatography in fewer than half of the patients so studied. Contrast injection directly into the pseudocyst reveals a duct connection even less frequently.[3]

The pathogenesis of pseudocyst formation in chronic pancreatitis is uncertain, but at least two mechanisms may be involved.[2] First, the cyst may develop as a consequence of an acute exacerbation of the underlying disease, which corresponds to type II of the D'Egidio and Schein[2] classification. This explanation is appropriate for cysts that are diagnosed after an episode of acute-on-chronic pancreatitis and contain necrotic debris. In these patients, the pancreatic duct is diseased but not strictured. A second putative mechanism for the genesis of pseudocysts in patients with chronic pancreatitis probably accounts for most such pseudocysts. According to this proposed mechanism, a pancreatic duct branch becomes obstructed because of pancreatic ductal stones or inspissated proteinaceous pancreatic material. Ongoing secretion of pancreatic juice peripheral to this ductal occlusion leads to progressive dilatation of the duct, eventually resulting in the appearance of a cystic mass filled with pancreatic juice. Such pseudocysts, which are classified as type III pseudocysts by D'Egidio and Schein,[2] are sometimes termed "retention pseudocysts", and often appear to be within the parenchyma of the gland itself. Duct communication with the cyst cannot always be identified radiologically in chronic pancreatitis, possibly because the duct or ductules becomes completely obstructed. Endoscopic retrograde pancreatography can reportedly demonstrate pseudocyst-main pancreatic duct (MPD) communication in about half of these patients. It is also reported that the incidence of communication is similar in acute and chronic pancreatitis.[3]

Natural history of pseudocysts and the timing of intervention

Although it is widely known that acute pseudocysts may resolve spontaneously, the incidence of resolution in reported series varies markedly, depending upon the underlying circumstances.[4] Bradley et al.,[5] in 1979, published the results of a prospective trial of deliberate nonoperative management of pancreatic pseudocysts. Although not clearly established, the vast majority of patients probably had an acute pseudocyst. At least a few had chronic pancreatitis in addition to a pseudocyst. While this study is open to criticism that a substantial fraction of patients were lost to follow-up (and thus spontaneous regression may have been be underestimated), the cumulative occurrence of pseudocyst complications and the attendant mortality is undeniable. Within the first 6 weeks after pseudocyst documentation, 40% of the pseudocysts had resolved, while 20% of the patients suffered a pseudocyst complication. After 6 to 12 weeks' observation, resolution was uncommon and complications predominated. After 12 weeks, additional complications appeared, and no further resolution was documented. The conclusions of this carefully conducted study were that spontaneous resolution of acute pseudocysts occurs, rarely, but within 6 weeks after diagnosis; that after 6 weeks, the frequency of serious complications increases dramatically; and consequently, that operation should not be delayed beyond 6 weeks after diagnosis.

This conclusion firmly reinforced the traditional recommendation of a 6-week wait for cyst wall maturation before surgery.[6] The size of the pseudocyst has also been reported as an important predictor for operative drainage. In the experience of Yeo and colleagues,[7] 67% of pseudocysts 6 cm or more in diameter required surgical treatment, as opposed to 40% of those less than 6 cm in size. Similarly, O'Malley and colleagues[6] noted that pseudocysts less than 4 cm in size resolved spontaneously, at a range of 2–6 months after diagnosis, although in one patient resolution did not occur until 28 months. It would thus appear that smaller asymptomatic cysts can be managed safely by observation and do not require surgical intervention even if they are still present after several months. If the cyst is symptomatic, or is 6 cm or more in diameter, intervention is indicated.

It is generally agreed that acute and chronic pseudocysts have a different natural history, but relatively few authors have attempted to analyze these groups separately.[8] Crass and Way[9] compared the natural history of 22 acute pseudocysts with that of chronic lesions. An acute pseudocyst was defined as one diagnosed within 2–6 weeks of an episode of pancreatitis, while a chronic pseudocyst was defined as an established lesion with no recent episode of pancreatitis. Apparently, according to this definition, some of the chronic pseudocysts should have been classified as acute pseudocysts. Spontaneous resolution occurred in 3 of 22 acute and in none of the chronic pseudocysts. Internal drainage was possible for only 9 of 19 patient undergoing operation for acute pseudocysts but for 34 of 35 having elective surgery for chronic pseudocysts. The mortality rate in the patients with acute pseudocysts was 25%, compared with 4% in those with chronic cysts. Crass and Way a thus recommended that chronic pseudocysts be drained by immediate operation, since delay only exposes the patient to the risk of complications. The size of the pseudocyst is also a predictor for operative drainage in chronic pancreatitis. Chronic pseudocysts less than 4 cm in size are usually asymptomatic and can be safely observed.[7]

Hemorrhage from pseudoaneurysms in a peripancreatic artery, typically the splenic or the gastroduodenal artery, is a serious complication of chronic pseudocyst. The true incidence of aneurysmal hemorrhage is unknown, and, once it occurs, it is life-threatening. The mechanism for hemorrhage is erosion

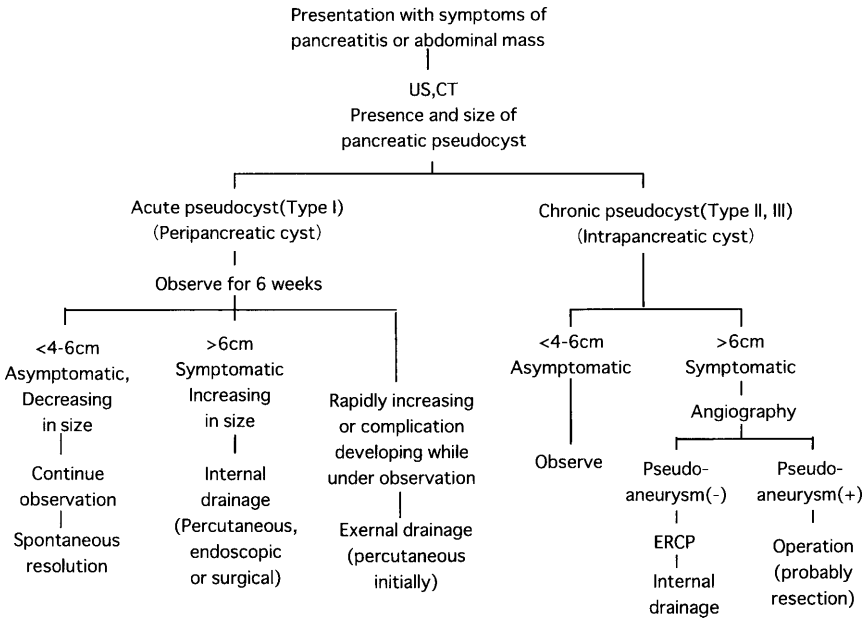


Fig. 1. Proposed algorithm outlining the steps in the management of a pancreatic pseudocyst. *US*, Ultrasound; CT, computed tomography; *ERCP*, endoscopic retrograde cholangiography; see text for explanation of types I, II, and III

of the artery, resulting perhaps from pressure necrosis from the adjacent pseudocyst rather than from true enzymatic digestion.[10] Arteriography should be performed before internal drainage is planned. When pseudoaneurysm of the involved artery is documented, transcatheter control, making use of a coil or other occluding agent, may be temporary or even definitive therapy[11] (Fig. 1).

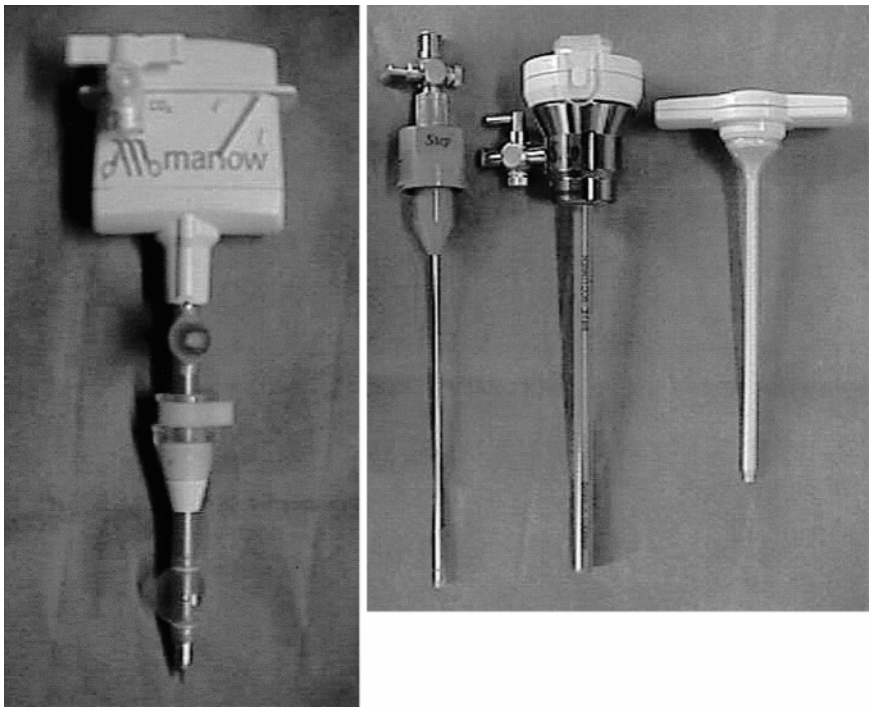
Laparoscopic pancreatic cystgastrostomy

The treatment of choice for most persistent mature pseudocysts of the pancreas is internal drainage. When surgery is indicated, pancreatic pseudocysts located in contact with the posterior wall of the stomach are best drained by cystgastrostomy.[10] In addition to open surgery, this procedure can be completed by a conventional laparoscopic method,[12] but it requires a long incision in the anterior wall of the stomach in order to obtain the necessary exposure, resulting in long hospital stay and delayed return to work. We have employed intragastric laparoscopic surgery to perform cystgastrostomy.

Techniques of cystgastrostomy by intragastric laparoscopic surgery

The first step of the operation consists of establishing a CO_2 pneumoperitoneum, and placing a standard port and laparoscope into the peritoneal cavity. The stomach is insufflated with CO_2 through a nasogastric tube. Intraabdominal pressure is reduced, to avoid the competition for space between intraperitoneal and intragastric gases, maintaining the laparoscopic view of the anterior surface of the stomach (eg, down to 8 cm H_2O). An intaraluminal trocar (Laparosac; Marlow, Fig. 2a, or STEP; Inner Dyne, Fig. 2b) is inserted under direct vision through the abdominal and anterior gastric walls (Fig. 3). A 5-mm laparoscope is passed down through this port to inspect the gastric lumen, verifying that positioning is good. Then, with the camera returned to the peritoneal laparoscope, second intraluminal port is placed in the gastric wall under direct vision, several centimeters away from the first one. A third port can be placed, if needed. At this point, the gas in the peritoneal cavity is completely evacuated, so the stomach can be inflated to its maximum size with 15 cm H_2O pressure. One of the intragastric ports is used for the laparoscope and the others for the hand instruments. After the establishment of this basic setup, the intragastric anatomy is inspected. The telescope can be passed about halfway down the second portion of the duodenum (Fig. 4).

Before the cystgastrostomy is begun, it is important to ascertain the location of the cyst in relation to the posterior wall of the stomach. In some patients, the pseudocyst is obvious, because it produces a prominent convexity on the back wall of the stomach. This phenomenon is exaggerated compared with observations in open surgery, probably because the stomach is distended. The location of the cyst is verified by inserting a long 18-G needle through the intragastric port and aspirating cystic fluid from the area where the cyst is thought to lie (Fig. 5). In only one patient has this been



a b

Fig. 2a,b. Intraluminal trocars. **a** Laparosac (Marlow); **b** STEP (InnerDyne)

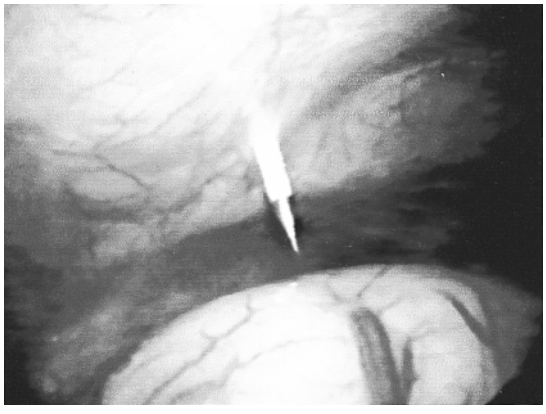


Fig. 3. Intragastric trocars are inserted in the stomach under the direct vision of the standard laparoscope

unsuccessful; in this patient, the cyst contained predominantly solid material, which plugged the needle. A preoperative computed tomography (CT) scan is also vital for gauging the position of the cyst. A hole is then made through the back wall of the stomach and into the cyst, using a hook electrocautery device. We proceed slowly, with the coagulation current set high to reduce the likelihood of bleeding from the stomach wall (Fig. 6). After the cyst is entered, its fluid contents are aspirated, giving a better view of the interior of the cyst and showing more clearly where the original incision was in relation to the center of the cyst. The incision is then extended to the desired length (ie, more than half the diameter of the cyst) and direction. Occasionally a small artery large enough to produce pulsatile bleeding is divided, but most vessels can be successfully controlled with electrocautery. We placed two sutures of 2-0 silk in the cystgastrostomy margin in one patient. It proved relatively difficult to tie the knots because the space to work within was so small. Otherwise, the cystgastrostomy was not sutured. In no patient did the operative blood loss exceed 50 ml, and no patient bled postoperatively. Solid contents of the cyst should be debrided thoroughly. This is the most difficult part of the operation, as debridement is best performed manually during open surgery. With the reliance entirely on instruments (eg, forceps), trauma to the cyst wall, which can cause bleeding, is a risk. On the other hand, unless the necrotic material is removed, it may plug culde-sacs in the cavity and prevent them from draining. Therefore, we spent an average of 30 min on this stage of the procedure. One question was what to do with the debris being pulled out of the cyst and into the stomach. In three early patients, we removed the debris through the trocars, which proved time-consuming. In later patients, the material was pushed down the duodenum, which appeared to cause no clinical difficulties postoperatively (Fig. 7).

After the cyst has been drained, the gastric trocars are withdrawn and the stomach is deflated. With the laparoscope returned to the subumbilical port and two other trocars appropriately placed in the abdominal cavity,

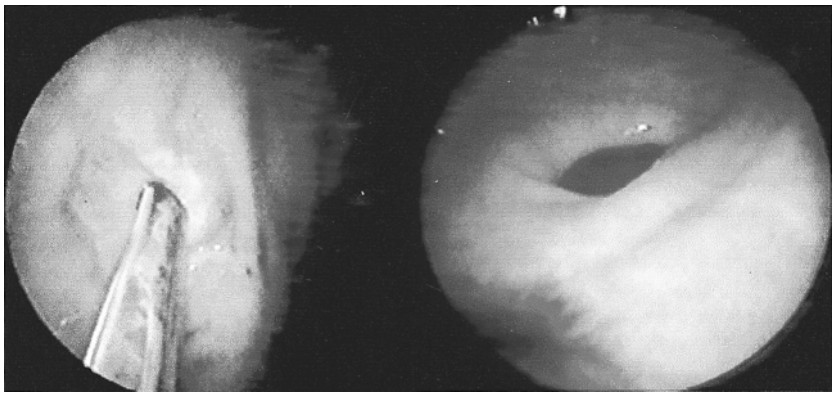


Fig. 4. Entire stomach can be easily observed with a 5-mm telescope

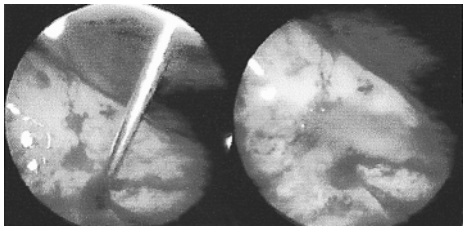


Fig. 5. An 18-G needle is introduced via a trocar to puncture the pseudocyst through the posterior wall of the stomach

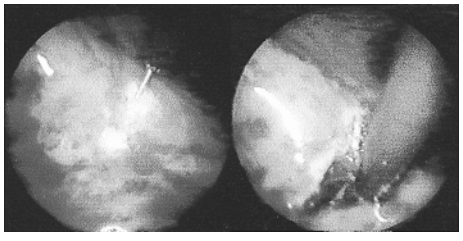


Fig. 6. With an electrocautery device, the pseudocyst is entered and the incision is extended to the desired length (3–6 cm)

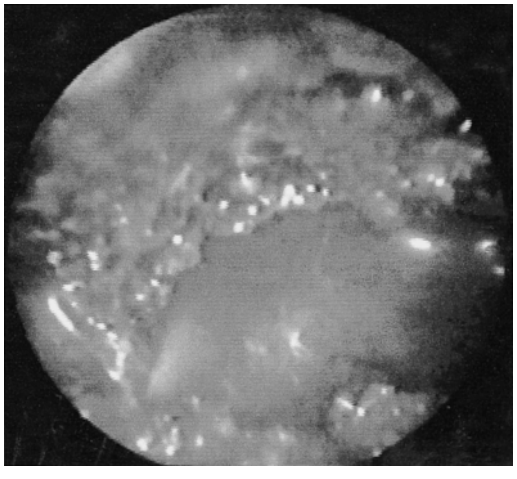


Fig. 7. Semisolid contents are thoroughly removed, with care, under direct vision of the inside of the cyst

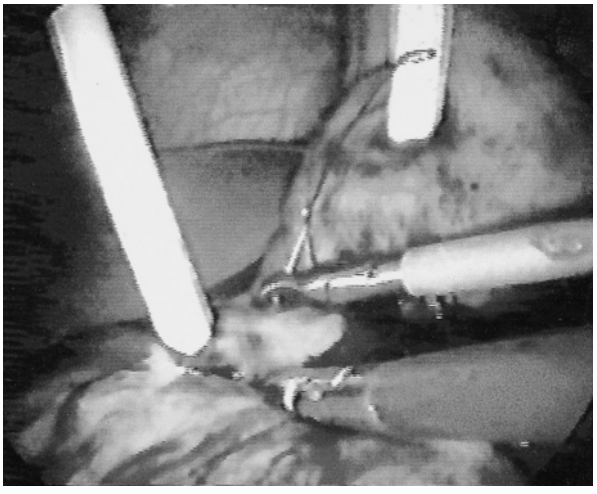


Fig. 8. The holes in the gastric wall are individually closed with sutures placed via the standard laparoscopic approach

the holes in the anterior wall of the stomach are each closed (in one layer) with one, or occasionally two, interrupted Lembert sutures of 2-0 silk (Fig. 8). All trocars are removed, and the procedure is concluded.

Patients and results

We have so far employed this procedure in 14 patients, 11 men and 3 women (mean age, 54.7 years; range, 23 to 67 years). Underlying diseases included gallstone pancreatitis in 7 and alcoholic pancreatitis in 4. Two patients had pseudocyst complicating acute pancreatitis after ERCP, and 1 patient had abdominal trauma.

In all patients, the intraluminal laparoscopy setup was successful. A cystgastrostomy was performed in 13 of the 14 patients. In one patient, whose last CT scan was 4 weeks preoperatively, a pseudocyst could not be found, even though a preoperative ultrasound scan showed that it was present.

In one patient, early on in our experience, the cyst recurred, as the incision though the stomach was not made large enough. This patient required an open operation several days later because of fever and CT evidence of gas bubbles in the cyst. In another patient, the cyst was found not to be adherent to the back wall of the stomach. In this operation, aspiration through the back wall of the stomach yielded typical cyst fluid. An incision was made through the back wall of the stomach into the cyst. A small (7.5-cm) laparotomy was then made, followed by a small gastrotomy. The cyst and posterior gastric walls were pulled up to the level of the abdominal wall. The edge of the incision in the back wall was then anastomosed to the cyst, and the gastrotomy was closed in two layers. The small abdominal incision was closed. Except for the small abdominal incision, this operation was identical to what would have been done through a conventional laparotomy. In another patient, pulasatile bleeding from the cyst wall could not be controlled by electrocautery or other hemostatic instrumentation. The tissue at the bleeding point was held with forceps and the procedure was completed through a small incision in the abdominal and anterior gastric walls (Fig. 9).

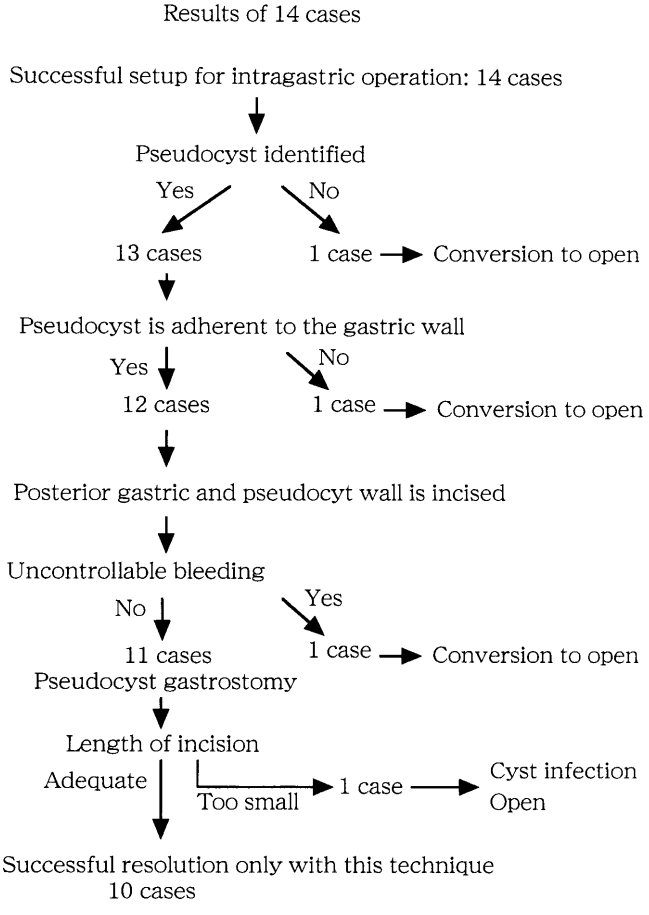


Fig. 9. Results of the 14 cases

One patient with concomitant pleural effusion had had a chest tube inserted and had been placed on suction several days before surgery. Because his was a chronic cyst, it contained no solid material in need of debridement, and a relatively small (3-cm) cystgastrostomy was adequate. He was able to leave hospital 4 days after surgery, with the chest tube out, feeling well, and eating a regular diet.

A nasogastric tube was used postoperatively in three patients, but it was removed in all three by the morning after surgery. A liquid diet was begun within 24 h and was advanced as tolerated. All but one of the patients improved immediately, exhibiting the kind of postoperative course typical of laparoscopic cholecystectomy. Consequently, the intraluminal laparoscopy was successful in all 14 patients, and the cystgastrostomy was successful in 13 of the 14 patients. In the 10 patients in whom this approach alone successfully drained the cyst (Fig. 9), the mean postoperative hospital stay was 8.6 days, much shorter than that with the conventional approach.

In follow-up ranging from 6 to 32 months, there have been no recurrent cysts after the initial success.

Comments

This experience demonstrates that cystgastrostomy with the intragastric surgical technique is a safe procedure for effectively draining pseudocysts, and is less invasive than the conventional approach. This approach, however, should not compete with interventional radiology or endoscopy. Percutaneous aspiration or drainage of pseudocysts is reportedly successful and may be useful in non-communicating pseudocysts.[13] Even with good indications, however, radiological or endoscopic interventions may fail to effectively drain the cyst, and the procedures are sometimes complicated by cyst infection or hemorrhage.[14] Intragastric pseudocyst-gastrostomy is the procedure which bridges the wide gap between these interventional techniques and conventional surgery.

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