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Classification and Management of Pancreatic Pseudocysts

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Abstract: This article aims to elucidate the classification of and optimal treatment for pancreatic pseudocysts.

Various approaches, including endoscopic drainage, percutaneous drainage, and open surgery, have been employed for the management of pancreatic pseudocysts. However, no scientific classification of pancreatic pseudocysts has been devised, which could assist in the selection of optimal therapy.

We evaluated the treatment modalities used in 893 patients diagnosed with pancreatic pseudocysts according to the revision of the Atlanta classification in our department between 2001 and 2010. All the pancreatic pseudocysts have course of disease >4 weeks and have mature cysts wall detected by computed tomography or transabdominal ultrasonography. Endoscopic drainage, percutaneous drainage, or open surgery was selected on the basis of the pseudocyst characteristics. Clinical data and patient outcomes were reviewed.

Among the 893 patients, 13 (1.5%) had percutaneous drainage. Eighty-three (9%) had type I pancreatic pseudocysts and were treated with observation. Ten patients (1%) had type II pseudocysts and underwent the Whipple procedure or resection of the pancreatic body and tail. Forty-six patients (5.2%) had type III pseudocysts: 44 (4.9%) underwent surgical internal drainage and 2 (0.2%) underwent endoscopic drainage. Five hundred six patients (56.7%) had type IV pseudocysts: 297 (33.3%) underwent surgical internal drainage and 209 (23.4%) underwent endoscopic drainage. Finally, 235 patients (26.3%) had type V pseudocysts: 36 (4%) underwent distal pancreatectomy or splenectomy and 199 (22.3%) underwent endoscopic drainage.

A new classification system was devised, based on the size, anatomical location, and clinical manifestations of the pancreatic pseudocyst along with the relationship between the pseudocyst and the pancreatic duct. Different therapeutic strategies could be considered based on this classification. When clinically feasible, endoscopic drainage should be considered the optimal management strategy for pancreatic pseudocysts.

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Abbreviations: ANC = acute necrotic collection, APFC = acute peripancreatic fluid collection, FNA = fine-needle aspiration, WON = walled-off necrosis.

INTRODUCTION

Pancreatic pseudocysts are fluid collections in the pancreatic tissue or the adjacent pancreatic space. It surrounded by a well-defined wall and contains essentially no solid material. Most pancreatic pseudocysts occur as a consequence of acute pancreatitis. However, they can also occur in the setting of chronic pancreatitis, postoperatively, or after pancreatic trauma.[1] Pseudocysts may be asymptomatic or may present with a variety of symptoms such as pain, satiety, upper gastrointestinal bleeding, nausea, and vomiting. The maturation period of pancreatic pseudocysts is reported to be approximately 2 to 6 weeks, and during this time, 33% of cysts are expected to spontaneously resolve. However, a substantial number of persistent cysts require treatment, owing to potential complications such as infection, hemorrhage, and cyst rupture.[2–5]

Pancreatic pseudocysts have been treated surgically for over 40 years, and this approach is still frequently used currently. With the advancements in surgical techniques, newer techniques such as internal drainage via cystogastrostomy and cystojejunostomy have been well established, and the permanent resolution of pseudocysts has been reported in 91% to 97% of patients. However, early studies describing external drainage report a failure rate of 20% to 30%.[6,7] In addition, although the efficacy of operative treatment for pancreatic pseudocysts is high, complication rates range from 4% to 30%. Accordingly, some researchers have suggested that a nonoperative approach such as endoscopic drainage is preferable. Endoscopic drainage, a minimally invasive technique, has a cyst resolution rate of 60% to 90%, with efficacy comparable to that of surgery.[7]

Although many studies have reported successful drainage through the use of various techniques, there is no consensus on the classification of pancreatic pseudocysts on the basis of individual pseudocyst characteristics. In this retrospective study, we analyzed the records of 893 patients who had received treatment for pancreatic pseudocysts at our institution and developed a classification system and treatment strategy for pancreatic pseudocysts. We also explored the optimal treatment for pancreatic pseudocysts.

MATERIALS AND METHODS

The records of 893 patients with pancreatic pseudocysts treated between January 2001 and December 2010 from a pancreatic database compiled by West China Hospital, Sichuan University, Sichuan, China, were evaluated retrospectively. This study was approved by the West China Hospital and got all patients informed consent. All the pancreatic pseudocysts have course of disease >4 weeks and have mature cysts wall detected by computed tomography or transabdominal ultrasonography.

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The acute peripancreatic fluid collection, acute necrotic collection, and walled-off necrosis are not included in our study.

Preoperative evaluation included a careful physical examination, chest radiography, and blood tests, including the measurement of tumor markers (carcinoembryonic antigen and carbohydrate antigen 19-9), liver function tests, and tests for thrombin levels. Preoperative computed tomography and transabdominal ultrasonography were performed to evaluate the size and location of the pseudocyst and relationship of the pancreatic pseudocyst to nearby structures. Magnetic resonance or endoscopic retrograde cholangiopancreatography was performed to obtain information on the anatomy of the pancreatic and biliary ducts and evaluate the relationship between the pseudocyst and the pancreatic duct.[8–12] The biopsy of the cyst was measured by fine-needle aspiration when patients underwent no operation. As for those patients who underwent operation, the biopsy of the cyst was confirmed by resection specimen. At the same, we should be complemented by assessment of amylase and carcinoembryonic antigen in cyst fluid.

Indications and Treatments

A new classification was devised based on the size, anatomical location, and clinical manifestations of the pancreatic pseudocyst along with the anatomical relationship between the pseudocyst and the pancreatic duct. The components of the classification are listed in Table 1.

Surgery

Drainage was the treatment of choice for a mature pseudocyst. This includes external drainage, internal drainage, and excision.[13,14] With regard to anatomy, cystogastrostomy was performed for pancreatic pseudocysts directly adherent to the posterior wall of the stomach. Cystoduodenostomy was performed when the cyst was located in the head and uncinate of the pancreas. Roux-en-Y cystojejunostomy was performed for all types of cysts.

Surgical resection was used as an alternative approach for pancreatic pseudocysts, and indications for this procedure included cystic neoplasia, splenic vein involvement, upper gastrointestinal bleeding, and technical inability to drain a pseudocyst located in the uncinate.

TABLE 1. Classification Scheme of Pancreatic Pseudocysts

Type	Description of Pancreatic Pseudocyst
I	<5 cm and without complications, symptom, and neoplasia
II	Suspected cystic neoplasia
III	The lLocation of pancreatic pseudocyst is uncinate
IIIa	Pseudocyst communication with the pancreatic duct
IIIb	Without communication between pseudocyst and pancreatic duct
IV	Location of pancreatic pseudocyst is head, neck, and body
IVa	Exist communication between pseudocyst and pancreatic duct (1)
IVb	Distance from the cyst to the gastrointestinal wall is <1 cm (2)
IVc	Neither 1 nor 2
V	Location of pancreatic pseudocyst is tail
Va	Splenic vein involvement or upper gastrointestinal bleeding
Vb	Distance from the cyst to the gastrointestinal wall is <1 cm, without splenic vein involvement or upper gastrointestinal bleeding

Endoscopic Drainage

The purpose of endoscopic drainage is to create a connection between the pseudocyst and the digestive canal. This is accomplished through transmural or transpapillary drainage.[15–17]

Transmural drainage was performed through the gastric, duodenal, or jejunal wall when the distance between the pseudocyst and the gastrointestinal wall was <1 cm. Transpapillary drainage was performed by endoscopic retrograde cholangiopancreatography when the pseudocyst cavity had a communication with the pancreatic duct.

External Drainage

External drainage was indicated for ruptured cysts and for patients with symptomatic or infected mature cysts and weak body situation.

Perioperative data, including pathology reports, length of hospital stay, operative blood loss, morbidity, and mortality, were obtained from the medical records. Long-term outcomes such as pseudocyst resolution and recurrence were evaluated through postoperative follow-up imaging at outpatient clinics. Pseudocyst recurrence was defined as the detection of a new pseudocyst by imaging studies after prior resolution. Complications were considered procedure related and were categorized as short-term complications such as technical feasibility related, bleeding, and wound infection or long-term complications such as incisional hernia. The results are presented as the mean ± standard deviation. Categorical variables were tested using the χ^2 test, and continuous variables were compared using Student t test. All statistical analyses were performed using SPSS version 19.0. $P < 0.05$ was considered statistically significant.

RESULTS

The therapeutic strategies of our study are listed in Figure 1. Of the 893 patients, 13 (1.5%) had percutaneous drainage. Eighty-three (9%) had type I pancreatic pseudocysts and were treated with observation. Ten patients (1%) had type II pseudocysts and underwent open surgery. Of the 46 patients (5.2%) with type III pseudocysts, surgical internal drainage was performed in 44 (4.9%) and endoscopic drainage was performed in 2 (0.2%). Of 506 patients (56.7%) with type IV pseudocysts, surgical internal drainage was performed in 297 (33.3%) and endoscopic drainage was performed in 209 (23.4%). Of 235 patients (26.3%) with type V pseudocysts, distal pancreatectomy or splenectomy was performed in 36 (4%) and endoscopic drainage was performed in 199 (22.3%).

The etiologies of the pancreatic pseudocysts are listed in Table 2. Pseudocysts were secondary to biliary pancreatitis in 75.4% of patients, secondary to alcoholic pancreatitis in 10.3% of patients, secondary to surgery in 3.9% of patients, idiopathic in 2.0% of patients, and secondary to trauma in 8.4% of patients.

The most common indications for therapy were symptomatic pancreatic pseudocysts (satiety, nausea and vomiting, pain, and upper gastrointestinal bleeding) and complicated pancreatic pseudocysts (compression of large vessels, gastric or duodenal outlet obstruction, stenosis of the common bile due to compression, and infection together with hemorrhage)[18,19]

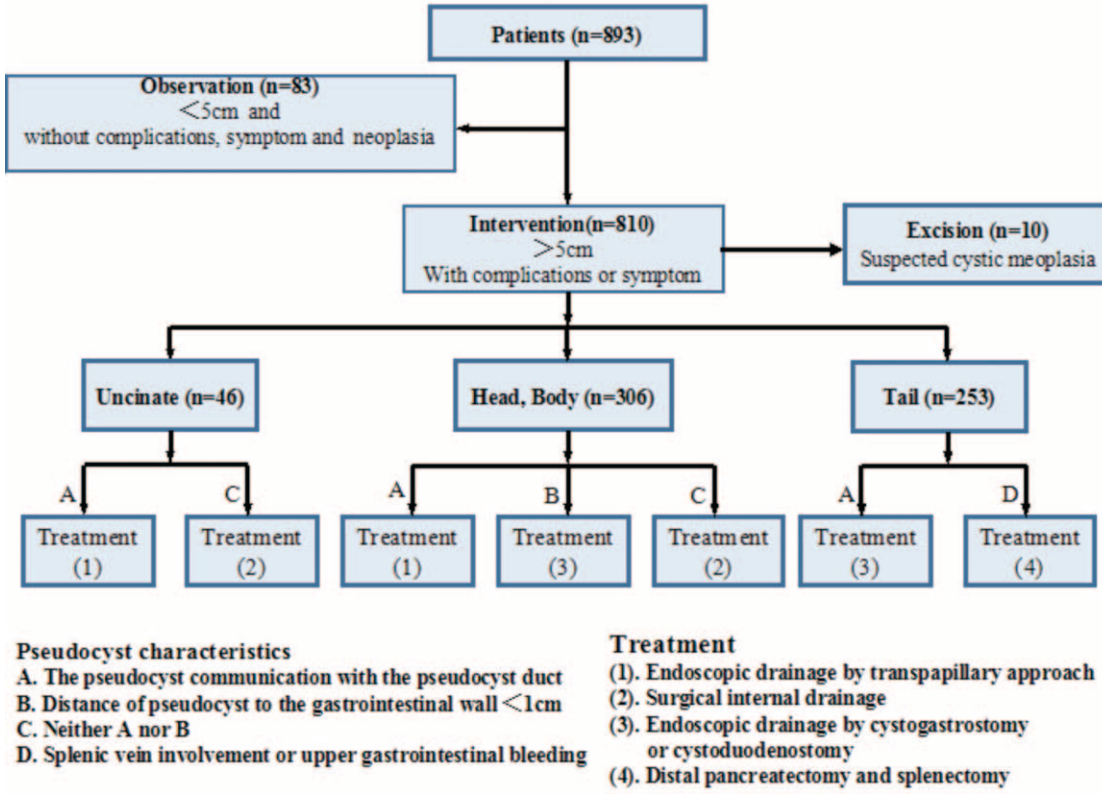

FIGURE 1. Therapeutic strategies for 893 patients of our study.

(646 patients, 72.3%), followed by increasing cyst size (154 patients, 17.2%).

The clinical characteristics of the surgical and endoscopic groups are summarized in Table 3. There were no significant differences in sex distribution, age, operative time, blood loss, and cyst size between the 2 groups. The mean follow-up duration was 12 months in the surgical group versus 11 months in the endoscopic group.

The outcomes in the surgical and endoscopic groups are listed in Table 4. The resolution rate of pancreatic pseudocysts was 93.3% in the surgical group versus 88.9% in the endoscopic group; this difference was not statistically significant ($P = 0.23$). Recurrent pseudocysts were observed on follow-up imaging in 23 patients in the surgical group versus 36 patients in the endoscopic group. An additional surgical procedure was required in 10 patients in the surgical group, because of hemorrhage, and in 49 patients in the endoscopic group, because of persistent cysts, hemorrhage, or symptomatic cysts. Table 5 lists the operative procedures in those 49 patients who required a second procedure after failure of attempted endoscopic drainage. The operative procedures performed were Roux-en-Y cystojejunostomy in 21 patients (42.9%), cystoduodenostomy in 15 patients (30.6%), cystogastrostomy in 7 patients (14.3%), and distal pancreatectomy in 6 patients (12.2%).

Overall, the interventions performed were the Whipple procedure in 6 patients, resection of the pancreatic body and tail in 4 patients, Roux-en-Y cystojejunostomy in 164 patients, cystogastrostomy in 90 patients, cystoduodenostomy in 87 patients, distal pancreatectomy and splenectomy in 36 patients, endoscopic drainage via the transpapillary approach alone in 170 patients, endoscopic drainage via cystogastrostomy in 160 patients, and endoscopic drainage via cystoduodenostomy in 80 patients.

TABLE 2. Etiology of Pancreatic Pseudocysts

Etiology	n
Biliary pancreatitis	673 (75.4%)
Alcohol pancreatitis	92 (10.3%)
Trauma	75 (8.4%)
Postoperative	35 (3.9%)
Idiopathic	18 (2.0%)

TABLE 3. Clinical Characteristics Among the Groups

Demographics	Surgical (n = 377)	Endoscopic (n = 410)
Sex (M/F)	197/180	210/200
Age, y	58	57
Mean size, cm	6.7	7.8
Site of cyst		
Uncinate	44	2
Head	76	94
Body	160	176
Tail	97	138
Operative time, min	126	114
Blood loss, mL	200	140

TABLE 4. Outcomes in Surgical Versus Endoscopic Intervention

Demographics	Surgical (n = 377)	Endoscopic (n = 410)
Pseudocyst resolution	352 (93.3%)	376 (88.9%)
Complication		
Episodes of sepsis	24 (6.4%)	54 (13.2%)
Hemorrhage	10 (2.7%)	21 (5.1%)
Pancreatic fistula	14 (3.7%)	19 (4.6%)
Pneumonia	3 (0.7%)	4 (1%)

Percutaneous drainage was performed in 13 patients, with a mean follow-up period of 6 months. Of these 13 patients, the cysts resolved in 8 patients and 5 cysts recurred. Four of these patients eventually required open surgery.

DISCUSSION

Based on the findings of this large retrospective study, a new classification system for pancreatic pseudocysts was devised on the basis of the anatomical location and clinical manifestations of the pseudocyst along with the relationship between the pseudocyst and the pancreatic duct. This classification system would help select the optimal treatment for a pancreatic pseudocyst. In addition, we have demonstrated that surgical and endoscopic treatments are efficacious and safe in the management of pancreatic pseudocysts. There were no obvious differences in pseudocyst resolution and complication rates between the surgical and endoscopic approaches. If clinically feasible, endoscopic drainage should be considered the first-line therapy for pancreatic pseudocysts.

The reported success rate of endoscopic drainage for pancreatic pseudocysts ranges from 60% to 90%, whereas the success rate of surgical drainage is 94% to 99%. In our study, the resolution rate of pancreatic pseudocysts did not differ significantly between the surgical and the endoscopic groups (93.3% vs 88.9%, $P = 0.23$). Therefore, being a minimally invasive technique, endoscopic drainage could be an appropriate alternative to surgery in the management of pancreatic pseudocysts. Indeed, it should be the first choice in appropriate clinical settings.[20]

In the present study, patients with ruptured cysts and symptomatic or infected mature cysts but who could not tolerate operation because of weak body situation were treated with percutaneous drainage. However, this procedure was associated with a high rate of complications (30.8%) and a frequent need for open surgery (38.5%). Therefore, we propose that percutaneous drainage not be used usually. Our results concur with prior studies reporting a complication rate of 18% and a failure rate of 16% with external drainage.

TABLE 5. Operation for Failed Endoscopic Intervention

Measures	n = 49
Roux-en-Y cystojejunostomy	21 (42.9%)
Cystoduodenostomy	15 (30.6%)
Cystogastrostomy	7 (14.3%)
Distal pancreatectomy	6 (12.2%)

For pancreatic pseudocysts with complications, symptoms, and increasing size, a classification system based on the individual characteristics of the cyst would offer physicians some guidance on therapeutic decision making.[21–24] When the pancreatic pseudocyst is located in the uncinate process of the pancreas, the relationship between the pseudocyst and the pancreatic duct must be evaluated. If a communication exists between them, endoscopic drainage via a transpapillary approach can be achieved.[25] If not, because of the unusual location, surgical internal drainage should be performed.[14] In our study, 46 patients had uncinate pseudocysts. Of these patients, 44 underwent surgical internal drainage because there was no communication between the pseudocyst and the pancreatic duct. The other 2 patients underwent endoscopic drainage via the transpapillary approach. Of the 46 patients, the cyst recurred in 2 patients (4.3%) and reoperation was necessary in 1 patient (2.2%) because of hemorrhage.

When the pseudocyst is located in the head, body, or neck of the pancreas, the relationship between the pseudocyst and the pancreatic duct needs to be initially evaluated. If a communication between them is detected on imaging studies, endoscopic drainage via the transpapillary approach can be performed. If the distance between the pseudocyst and the gastrointestinal wall is <1 cm, endoscopic drainage via cystogastrostomy or cystoduodenostomy should be performed.[17,23,25,26] If neither of the abovementioned conditions exist, patients should be treated with surgical internal drainage. In the group of patients undergoing endoscopic drainage in the present study, cyst recurrence was noted on follow-up imaging in 26 patients (5.1%) and reoperation was performed in 32 patients (6.3%) because of persistent cysts, hemorrhage, and symptomatic cysts.

With regard to pseudocysts in the pancreatic tail, a communication between the pseudocyst and the pancreatic duct is not important. Because endoscopic retrograde cholangiopancreatography does not facilitate access to the main pancreatic duct of the pancreatic tail, endoscopic drainage via the transpapillary approach cannot be accomplished in these patients.[23] In addition, we have previously found that most patients with pseudocysts in the pancreatic tail show splenic vein involvement or upper gastrointestinal bleeding. Previous studies have reported that 10% to 20% of pseudocysts located in the pancreatic tail present with upper gastrointestinal bleeding.[13,22] Therefore, these patients should be treated with distal pancreatectomy and splenectomy. In patients without splenic vein involvement or upper gastrointestinal bleeding and with a <1 cm distance between the pseudocyst and the gastrointestinal wall, endoscopic drainage via cystogastrostomy or cystoduodenostomy should be performed. In the present study, distal pancreatectomy or splenectomy was performed in 36 patients. Of these, 6 patients underwent a second operation because of endoscopic drainage failure.

CONCLUSION

We developed a new classification system for pancreatic pseudocysts based on the anatomical location and clinical manifestations of the pseudocyst as well as the relationship between the pseudocyst and the pancreatic duct. This classification system can guide the selection of optimal treatment for a pancreatic pseudocyst. In addition, we have shown that surgical and endoscopic treatments are efficacious and safe in the management of pancreatic pseudocysts. In the appropriate clinical setting, endoscopic drainage should be considered as first-line treatment for pancreatic pseudocysts because of its

minimal invasiveness. The choice between surgical and endoscopic therapy should be made on the basis of the individual characteristics of the pancreatic pseudocyst.

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