Selective Drainage for Pancreatic, Biliary, and Duodenal Obstruction Secondary to Chronic Fibrosing Pancreatitis

HARVEY J. SUGERMAN, M.D. GLENN R. BARNHART, M.D. HEBER H. NEWSOME, M.D.

Twenty-eight patients underwent surgery for intractable pain, duodenal or extrahepatic biliary obstruction secondary to chronic pancreatitis. Eleven had pancreatic duct obstruction alone, six biliary obstruction alone, seven combined pancreatic and biliary, two combined biliary and duodenal, one combined pancreatic and duodenal, and one simultaneous pancreatic, biliary, and duodenal obstruction. Pancreatitis was secondary to alcohol in all but one case. The following operations were performed: longitudinal pancreatojejunostomy (20), choledochoduodenostomy (8), choledochojejunostomy (7), cholecystojejunostomy (1), and gastrojejunostomy (4). Of the 20 patients with pancreatic duct drainage, pain relief was complete in 11 and partial in six. Initial incomplete relief of pain, or recurrence, stimulated further diagnostic procedures, leading to improvement or correction of the problem in five patients. A significant ($p < 0.01$) fall in alkaline phosphatase (935 ± 228 to 219 ± 61 U/L) occurred following surgery. One patient was subsequently found to have pancreatic carcinoma. Two patients were lost to follow-up and four patients died (one perioperative and three late). In conclusion, the possibility of pancreatic, biliary, and duodenal obstruction must be considered in symptomatic patients with chronic pancreatitis. Surgery must be individualized. Drainage procedures, either alone or in combination, are associated with a low morbidity and improved clinical condition and may be preferable to resection in the surgical management of these patients.

From the Division of Trauma and General Surgery, Department of Surgery, Medical College of Virginia, Virginia Commonwealth University, Richmond, Virginia

CHRONIC FIBROSING PANCREATITIS can cause duodenal, pancreatic ductal, or biliary ductal obstruction, either alone or in combination. Biliary obstruction, secondary to chronic fibrosing pancreatitis, has been associated with ascending cholangitis or been shown to lead to biliary cirrhosis when the alkaline phosphatase is persistently greater than twice its normal value.[1-3] Biliary drainage procedures, such as choledochoduodenostomy or choledochojejunostomy, will relieve the obstruction.[4-9] Duodenal obstruction has been reported to occur in less than 1% of patients with chronic pancreatitis and can be relieved with a gastrojejunostomy.[10,11] It has been clearly shown that drainage of a dilated pancreatic duct in patients with chronic pancreatitis with a longitudinal pancreatojejunostomy, a modification of the Puestow procedure,[12] is associated with effective pain relief (complete in 50 to 70% of patients and partial in 15 to 20%) with significantly less morbidity and mortality[13-22] than pancreatic resection procedures. The concept of combined drainage procedures was initially suggested by Mercadier et al. in 1968[23] and expanded in their monograph in 1973.[24] Two recent studies have noted a low morbidity when these obstructive problems were correctly identified and treated with combined drainage procedures.[25,26] This report relates our experience with selective drainage procedures in patients with chronic pancreatitis, their benefits, as well as their pitfalls.

Methods

The medical records were reviewed for all patients who underwent surgery for chronic pancreatitis, as well as biliary or duodenal obstruction associated with pancreatic disease at the Medical College of Virginia from January 1975 through June 1985. All patients with a diagnosis of pancreatic carcinoma made at the initial operative procedure were excluded from this review, as were patients who had undergone a radical pancreatoduodenectomy (Whipple procedure) for chronic pancreatitis or drainage of a pancreatic pseudocyst. The operations were performed by several surgeons, although the majority of patients were under the care of one of the authors (HS). The choice of biliary drainage procedure utilized, *i.e.*, choledochoduodenostomy or choledochojejunostomy, was at

Presented at the 97th Annual Meeting of the Southern Surgical Association, Hot Springs, Virginia, December 1-4, 1985.

Reprint requests: Harvey J. Sugerman, M.D., Professor of Surgery, Box 519, MCV Station, Richmond, VA 23298.

Submitted for publication: December 26, 1985.

the discretion of the operating surgeon. Patients were recalled, when possible, for follow-up history, examination, and laboratory evaluation. Data are presented as mean ± standard error of the mean (SEM). Statistical analyses were performed using Student's paired t-test.

Pain relief was evaluated by one of the authors (GB), who was directly involved with only one of the cases, and defined as follows: complete, if the patient stated that the operation completely relieved the pain and narcotic medications were no longer used; partial, if the patient stated that there was significant relief of pain and that oral narcotic medications were used only occasionally (*i.e.*, once or twice a week); and inadequate, if narcotics were used more frequently. If a patient developed recurrence of pain after one successful procedure (*i.e.*, longitudinal pancreatojejunostomy) as a result of a new problem (*i.e.*, duodenal or biliary obstruction) and this was subsequently relieved by another surgical procedure, the patient was considered to have a good result in both instances.

Patients with laboratory evidence of persistent extrahepatic biliary obstruction (*i.e.*, elevated bilirubin or alkaline phosphatase more than twice normal) were evaluated in the early years of this study with ultrasonography or, rarely, intravenous cholangiography (IVC). In more recent years, percutaneous transhepatic cholangiography (PTC), endoscopic retrograde cholangiopancreatography (ERCP), and computerized axial tomographic (CAT) scans were utilized. Pancreatic ductular dilatation was usually identified with ultrasonography and confirmed with ERCP. In two instances, operative pancreatograms were obtained. Duodenal obstruction was usually suspected from the patient's history of persistent vomiting and the plain abdominal films; it was confirmed with an upper gastrointestinal radiographic series (UGI). Plain films were evaluated for the presence of pancreatic calcification. Because of severe bleeding at exploratory surgery at another hospital, one patient underwent arteriography to determine the presence of portal venous obstruction.

Results

Twenty-eight patients have undergone 38 operations for intractable pain, recurrent vomiting, or extrahepatic biliary obstruction secondary to chronic fibrosing pancreatitis at the Medical College of Virginia Hospitals from January 1975 through June 1985. Eleven patients had pancreatic ductal obstruction alone, six had biliary obstruction alone, seven had combined pancreatic and biliary obstruction, two had combined biliary and duodenal obstruction, one had combined pancreatic and duodenal obstruction, and one had simultaneous pancreatic, biliary, and duodenal obstruction. Thus, 20 patients had a dilated pancreatic duct associated with chronic abdominal and back pain, 16 had common bile duct obstruction with persistent jaundice or alkaline phosphatase elevation, and four had duodenal obstruction associated with intractable vomiting (Table 1). The average age at operation was 45 ± 11 years. There were 16 black and 12 white patients; 19 were male and nine were female. Pancreatitis was secondary to alcohol in all but one case, which was secondary to pancreas divisum. No patient had preoperative ascites, although one patient had large, recurrent pancreatic pleural effusions. Thirteen patients had radiographic evidence of pancreatic calcifications.

TABLE 1. *Drainage Procedures for Chronic Pancreatitis**

	LPJ					11
	LPJ	+	CD			7
	LPJ			+	GJ	1
	LPJ	+	CD	+	GJ	1
			CD	+	GJ	2
			CD			6
Totals	20		16		4	28

* LPJ = longitudinal pancreatojejunostomy, CD = common duct drainage, GJ = gastrojejunostomy.

Mean follow-up was 35 ± 11 months. There were four deaths. One patient died after operation from sepsis and three patients died in the late postoperative period: one from metastatic pancreatic carcinoma, one from myocardial infarction 2 years after pancreatic surgery, and one cause unknown. Two patients were lost to follow-up.

Longitudinal Pancreatojejunostomy

Twenty patients underwent longitudinal pancreatojejunostomies for chronic abdominal pain associated with a dilated pancreatic duct noted on either ERCP in 14 patients (Fig. 1), ultrasonography or CAT scan in four patients, or combined with operative pancreatograms in two patients. Pain relief was complete in 11 patients and partial in six (Table 2), although a second surgical procedure was required in five patients to correct a second problem (*i.e.*, incisional herniorrhaphy, duodenal obstruction). Two patients died: one from metastatic pancreatic carcinoma and one from sepsis associated with a myocardial infarction. Pain relief was inadequate in two patients, one of whom had pancreas divisum and subsequently required an 80% distal pancreatectomy. Although ERCP revealed a high grade proximal stenosis in this patient, his distal duct was too small to undergo a drainage procedure, and he probably should have been resected initially. Three patients underwent intraoperative measurement of pancreatic ductal pressures, and the pressure was greater than 30 cm water in each instance.

Two patients had previously undergone drainage procedures for pancreatic pseudocyst: external drainage in

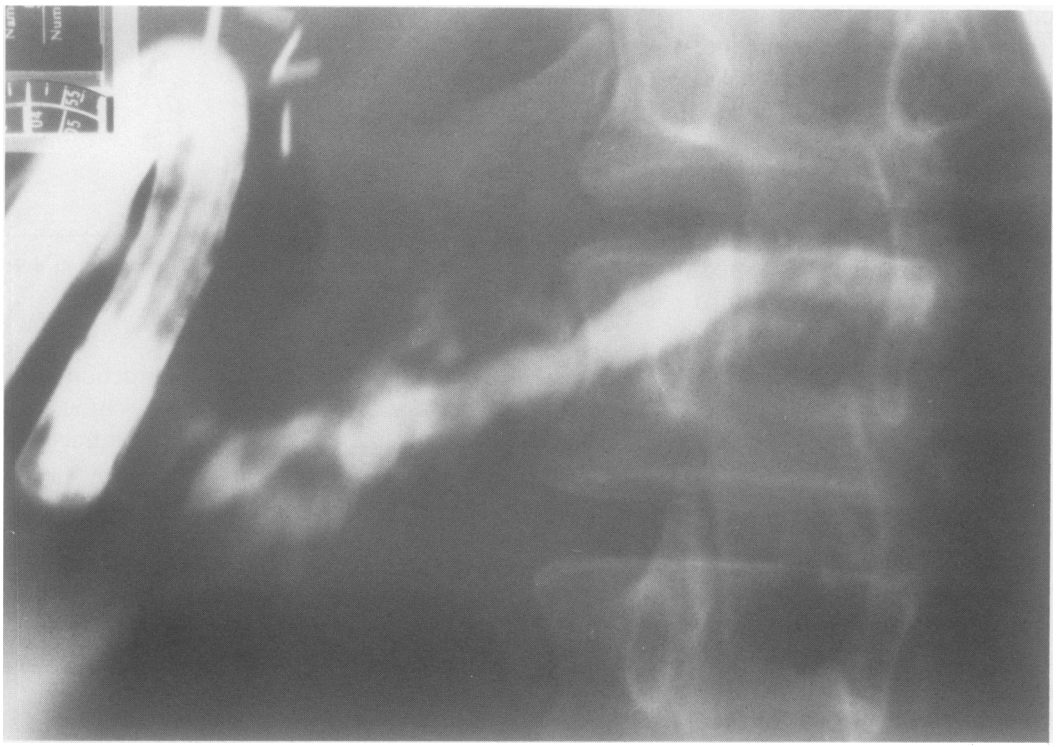

FIG. 1. Dilated pancreatic duct on ERCP with intraluminal filling defects consistent with pancreatolithiasis.

one without a persistent fistula and a pancreatic cystjejunostomy in the other. One of these patients developed persistent abdominal pain 2 years later, and the other manifested large, recurrent pancreatic pleural effusions (amylase > 60,000 Somogyi Units/dl), in association with chronic abdominal pain, 3 years after pseudocyst drainage. There were few technical difficulties in reoperation in these patients, and both were completely relieved of their pain. One patient had a markedly dilated pancreatic duct on ERCP, which was associated with a pseudocyst in the head of the pancreas; both were drained into the Roux-en-Y limb of jejunum.

Pain following a longitudinal pancreatojejunostomy was not attributed to failure of the drainage procedure until other possible causes were excluded. Partial obstruction of the proximal pancreatic duct was noted with repeat ERCP in two patients with recurrent, mild attacks of pain. Both refused reoperation, as their pain had markedly improved with the initial drainage procedures. Another patient, whose pancreatojejunostomy was limited to the distal half of the pancreatic duct, developed recurrent abdominal pain and fever and was subsequently found to have developed three small (2 cm) infected pseudocysts in the head of the pancreas, which were effectively treated with transduodenal cystduodenostomies. It is interesting that this patient had undergone closure of a perforated duodenal ulcer and then a vagotomy and pyloroplasty for intractable ulcer pain 19 years prior to his pancreatic drainage procedure.

TABLE 2. *Pain Relief after Longitudinal Pancreatojejunostomy*

Pain Relief	Initial Pain Relief	Late Problems	Corrective Surgery*†	Late Pain Relief
Complete	10	2	2	11
Partial	7		3†	6†
Inadequate	3			3‡

* Gastrojejunostomy (2), incisional herniorrhaphy (1), cystduodenostomy (1).

† Eighty per cent distal pancreatectomy in one patient with pancreas divisum.

‡ Two deaths (1 from pancreatic carcinoma, 1 sepsis and myocardial infarct).

Extrahepatic Biliary Obstruction

Sixteen patients had hyperbilirubinemia or an increased alkaline phosphatase to more than twice normal for 1 month or more and were noted to have radiographic evidence of extrahepatic biliary obstruction. Three patients, one of whom was subsequently found to have pancreatic carcinoma, were markedly jaundiced (*i.e.*, serum bilirubin > 14 mg/dl), and one patient had ascending cholangitis. The latter was initially treated with broad spectrum antibiotics and transhepatic biliary drainage. Operative drainage of the common bile duct was electively performed 5 days later.

Several common bile duct patterns were noted on PTC, including an "hour-glass" configuration, marked tapering with a long, narrow intrapancreatic segment (Fig. 2), or

tapering to a complete obstruction. One patient, with intermittent episodes of obstructive jaundice, was noted to have a long (2 cm) "common channel" on IVC with several filling defects. At surgery, when the pancreatic duct was opened, a large number of white, calcific pancreatic stones were retrieved with the sudden flow of bile into the main pancreatic duct. No gallstones were present in the resected gallbladder. This patient almost certainly had intermittent extrahepatic biliary obstruction secondary to pancreatolithiasis and a long "common channel" (Fig. 3).

Biliary drainage procedures included one cholecystojejunostomy, eight choledochoduodenostomies, and seven choledochojejunostomies. Many patients had markedly elevated alkaline phosphatase with minimally increased total serum bilirubin. The total bilirubin decreased from 3.8 ± 1.5 to 0.5 ± 0.1 mg/dl and the alkaline phosphatase from 935 ± 228 to 219 ± 61 U/L ($p < 0.01$) following biliary decompression. Two patients were lost to follow-up, and there were two late deaths, unrelated to biliary drainage, in this group.

Duodenal Obstruction

Four patients underwent gastrojejunostomy for duodenal obstruction (Fig. 4). Because of the potential for marginal ulcer, a truncal vagotomy was also performed. Two patients had gastric drainage at the time of the initial pancreatojejunostomy. One patient had undergone a choledochoduodenostomy at another hospital 3 years prior to developing duodenal obstruction. The second patient, already mentioned, was initially noted to have a partial obstruction at the second portion of the duodenum, secondary to chronic pancreatitis, and subsequently developed a high grade proximal jejunal obstruction following a Roux-en-Y pancreatojejunostomy, which was relieved with a vagotomy and gastrojejunostomy.

Combined Drainage Procedures

Combined biliary and pancreatic drainage. Seven patients underwent simultaneous, combined drainage of a dilated pancreatic and obstructed common bile ducts, and an additional patient also required a gastrojejunostomy for duodenal obstruction (Table 1). The combination of choledochoduodenostomy and pancreatojejunostomy was used in five patients (Fig. 5). In three patients, the Roux-en-Y jejunal limb was brought retrocolic to the common bile duct, beneath the gastric antrum and then anastamosed to the opened pancreatic duct (Fig. 6). Both procedures were equally effective in decompressing the biliary tree and relieving pain. No untoward effects were noted from bile bathing the opened pancreatic duct.

A Whipple operation had been attempted at another hospital on one of these patients 3 months before transfer to the Medical College of Virginia but had to be abandoned because of excessive bleeding. A celiac arteriogram revealed an open splenic vein, but the superior mesenteric arteriogram demonstrated superior mesenteric venous obstruction with extensive peripancreatic venous collaterals. A choledochoduodenostomy and longitudinal pancreatojejunostomy were performed; however, the pancreatojejunostomy could not be carried as far medially as desired because of excessive bleeding from the collateral vessels. This patient had significant but incomplete pain

FIG. 2. Markedly dilated common bile duct secondary to chronic pancreatitis with tapering to a long, narrow segment within pancreas. Obstruction incomplete as some flow into duodenum is noted.

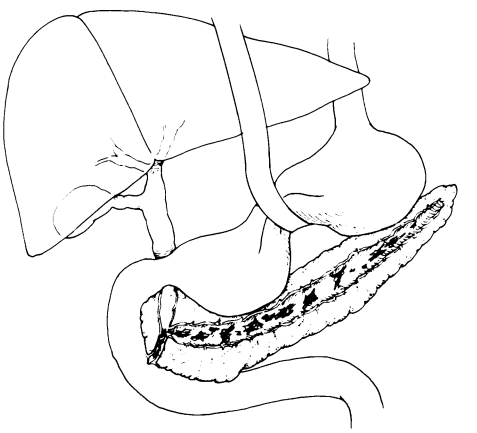

FIG. 3. Common duct obstruction secondary to pancreatolithiasis noted in one patient with a long "common channel."

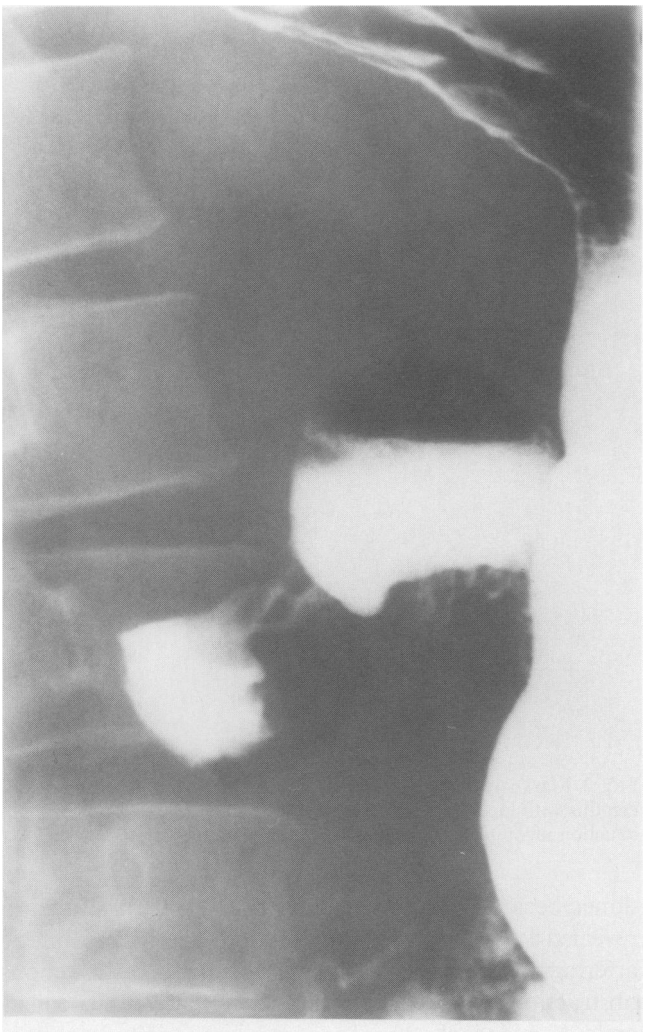

FIG. 4. High-grade obstruction, second portion of duodenum, due to chronic fibrosing pancreatitis.

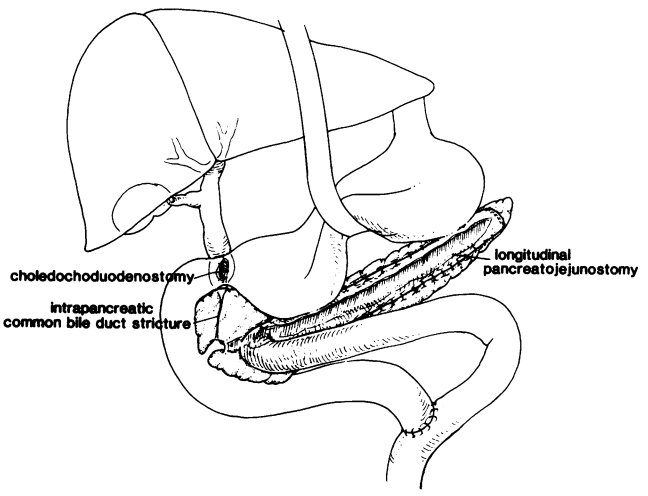

FIG. 5. Choledochoduodenostomy and longitudinal pancreatojejunostomy for combined biliary and pancreatic duct obstructions.

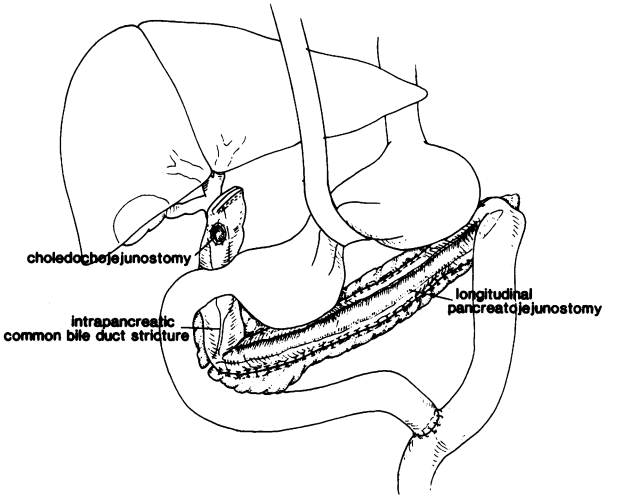

FIG. 6. Roux-en-Y choledochojejunostomy and longitudinal pancreatojejunostomy for combined biliary and pancreatic duct obstructions.

relief. ERCP the following year confirmed inadequate drainage of the pancreatic duct medially.

One of the major concerns in performing drainage procedures for pancreas related obstructions is the risk of missing a pancreatic carcinoma. One of our patients, with a bilirubin of 16 and alkaline phosphatase of 1500 U/L, had obstruction of her pancreatic duct and a smooth, tapered, incomplete obstruction of her common bile duct noted at ERCP. She did not have a mass in the head of her pancreas at the time of exploration. The pancreatic duct was completely opened, and a large amount of tissue in the head of the pancreas was biopsied and was free of malignancy. A choledochoscope was inserted into both the common bile duct and the markedly dilated pancreatic duct, and no tumor was noted. Pain persisted after operation, and, 9 months later, a CAT scan suggested the development of a malignant mass in the head of the pancreas, which was confirmed at the time of Whipple resection; she died 6 months later from metastatic disease.

Combined biliary and gastric drainage. Two patients underwent drainage of the biliary tree and the stomach. One of these had undergone a choledochoduodenostomy 2 years previously at another hospital and subsequently developed recurrent common duct obstruction as well as duodenal obstruction. She was converted to a Roux-en-Y choledochojejunostomy and gastrojejunostomy plus vagotomy with relief of symptoms. The second patient underwent a combined cholecystojejunostomy and gastrojejunostomy, had a massive pulmonary embolus after operation treated with open embolectomy, and died from overwhelming sepsis, as a result of a leaking gastrojejunostomy.

Combined pancreas and gastric drainage. One patient had complete pain relief initially following a longitudinal pancreatojejunostomy, at which time the second portion

of his duodenum was partially obstructed. Six months later, he developed recurrent episodes of abdominal pain, nausea, and vomiting and was found to have a high grade, proximal jejunal obstruction, which was treated with a vagotomy and gastrojejunostomy.

Combined biliary, pancreatic, and gastric drainage. One patient had simultaneous duodenal, pancreatic, and biliary obstructions that were treated with a Roux-en-Y limb to the common bile duct, pancreatic duct, and stomach (Fig. 7). A subsequent mechanical obstruction occurred at the 180° turn in the jejunum between the pancreatojejunostomy and the gastrojejunostomy, which was relieved with a jejunojejunostomy. This patient has been pain free for the past 3 years and has gained 45 pounds.

Discussion

Alcohol-induced chronic pancreatitis is frequently associated with an obstructed pancreatic duct, elevated ductal pressures,[32] and progressive abdominal pain. Although it has been suggested that the pain will eventually go away, the wait apparently requires an average of 5 years[27] and seems unreasonable to recommend, when prompt relief is frequently observed following a longitudinal pancreatojejunostomy, or modified Puestow procedure.[12-24] Furthermore, therapy with oral pancreatic enzymes, designed to decrease the stimulation to the formation of pancreatic juice,[28] has not been very effective for pain control in our experience.

Because of the strategic location of the pancreas, the extensive fibrotic reaction associated with chronic pancreatitis will often encompass one or more structures that course through or near the gland. These include the intrapancreatic portion of the common bile duct, the duodenum, and the superior mesenteric, portal,[29] or splenic veins.[30,31] Extrahepatic biliary obstruction associated with chronic pancreatitis can lead to ascending cholangitis[1] and biliary cirrhosis,[2,3] although the prognosis for patients with persistent incomplete biliary obstruction secondary to chronic pancreatitis is still not clear. Sixteen of our patients had persistent extrahepatic biliary obstruction, seven in conjunction with a dilated pancreatic duct. Although duodenal obstruction has been infrequently observed in chronic pancreatitis,[10,11] it has been noted far more often in patients with chronic fibrosing pancreatitis and a dilated pancreatic duct[25] and was seen in four of our 28 patients. In addition, one of our patients had an obstructed superior mesenteric vein.

Because many of these patients have a combination of obstructive lesions that may present simultaneously, thorough diagnostic evaluation is recommended. Persistent elevation of the bilirubin or alkaline phosphatase to twice normal should be investigated with hepatobiliary ultrasonography; if dilated biliary ducts are noted, either

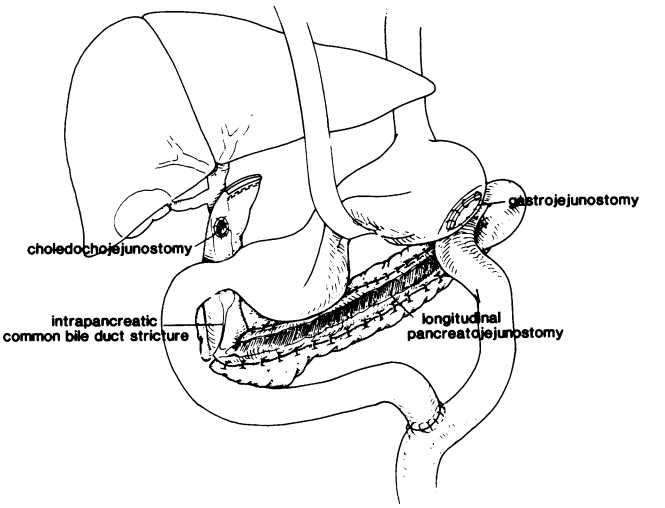

FIG. 7. Roux-en-Y choledochojejunostomy, pancreatojejunostomy, and gastrojejunostomy for simultaneous duodenal, biliary, and pancreatic ductal obstructions.

PTC or ERCP should be performed. The latter is preferable, since it may delineate pathology in both the pancreatic and biliary ductular systems. Unfortunately, although the pancreatic duct can be cannulated in over 90% of patients, the common bile duct, which comes into the Ampulla of Vater at a much more acute angle, may be much more difficult to enter. PTC should then be performed to delineate the biliary anatomy. Persistent or recurrent vomiting should suggest an UGI series to search for obstruction of the second portion of the duodenum.

In this series, 11 of 20 patients with a dilated pancreatic duct had complete relief of pain following a longitudinal pancreatojejunostomy, probably secondary to decompression of increased pancreatic ductal pressure,[32] as noted in each of our patients in whom it was measured. Seven patients had significant relief of pain initially but subsequently developed recurrent pain that was found to be associated with new problems. This new pain was relieved, or significantly reduced, in five patients following an additional surgical procedure. Thus, patients who develop pain following a Puestow procedure require aggressive diagnostic evaluation and not just be written off as failures. Excluding the perioperative death, jaundice and duodenal obstruction were relieved following biliary or gastric drainage procedures, although the alkaline phosphatase remained mildly elevated (125 to 250 U/L) in six patients. Two patients were lost to follow-up, and there were two late deaths in this group.

A radical pancreatoduodenectomy, or Whipple procedure, for the treatment of chronic pancreatitis has clearly been shown to be associated with a higher morbidity and mortality, with pain relief inferior to that associated with effective drainage of a dilated pancreatic duct.[13-21] In our experience, the modified Puestow procedure is a relatively

easy operation that takes only 2 to 3 hours and is associated with a very low morbidity. The pancreatic duct is usually palpable on the ventral surface of the gland and, if not, can be found without difficulty with needle aspiration. In four of our cases, we relied only on the preoperative CAT scan or ultrasound study and did not feel ERCP was necessary. This was also true, in retrospect, for the other two patients in whom preoperative ERCP was unsuccessful and operative pancreatograms were obtained. We have not had any pancreatojejunostomy anastomotic disruptions. This is not surprising, as the pancreatic tissue is quite firm and holds sutures well.

A Whipple operation for chronic pancreatitis can be technically quite difficult with the extensive scarring present in and around the pancreas. However, this fibrotic reaction does make the anastomosis to the residual pancreas less likely to disrupt and leak. The absence of a dilated pancreatic duct mandates resection for the treatment of pain.[13,16,18,19,25,26] Our patient with pancreas divisum belonged in this category. We have performed only three Whipple resections and two distal pancreatectomies (80 and 90%, respectively) for the treatment of chronic pancreatitis associated with a nondilated pancreatic duct in the past 10 years. This may be related to the reluctance of our gastroenterologists to refer patients for surgery in the absence of a dilated pancreatic ductal system on ERCP. If extensive bleeding is encountered, one can presume portal[29] or superior mesenteric venous obstruction, as in one of our cases; pancreatic resection in these circumstances would probably be a fatal.

One patient in this series had intermittent obstructive jaundice with a long common channel, pancreatolithiasis, but no cholelithiasis. When the pancreatic duct was opened, pancreatic juice and white, pancreatic stones exited under pressure, and, as the head of the pancreas was reached, stones and bile flowed into the pancreatic duct, strongly suggesting common duct obstruction secondary to pancreatolithiasis (Fig. 3).

Ten of our patients underwent simultaneous drainage procedures (Table 1). Seven patients had drainage of both the common and pancreatic ducts during the same operation, two patients had drainage of the biliary tree and stomach, and one patient had simultaneous drainage of the common bile duct, pancreatic duct, and stomach. One of these patients, who had undergone cholecystojejunostomy and gastrojejunostomy, suffered a near fatal pulmonary embolus, which was treated by open embolectomy, but succumbed to sepsis as a result of a gastrojejunal anastomotic leak. Except for this death, the morbidity for these combined drainage procedures was extremely low. One minor wound infection was encountered. Most patients were discharged from the hospital in 1 week. Similar results have been noted by Prinz, Aranha, and Greenlee[25] and Warshaw.[26] It is often difficult to know which duct is responsible for persistent abdominal pain in patients with chronic pancreatitis, a dilated pancreatic duct, or high-grade obstruction of the common bile duct. Many of our patients with biliary obstruction alone had painless jaundice. Therefore, it seems reasonable to presume that, if pain is present, it is probably from the pancreas. Because of the low morbidity, it makes sense to drain both ducts at the time of laparotomy.

To our knowledge, Mercadier et al.[24] were the first to report on the triple drainage procedure (Fig. 7) and felt that this should be the standard operation in all patients who undergo a pancreatic duct drainage, since 30% of their patients ultimately developed either biliary and/or duodenal obstruction.[24] This recommendation is not supported by our data, since only two of our patients required a second drainage procedure following a pancreatojejunostomy. The method of drainage, *i.e.,* choledochoduodenostomy plus pancreatojejunostomy *versus* a long jejunal limb from the common bile duct across the opened pancreatic duct, does not seem to be important and should probably depend on the anatomic findings. If significant but incomplete narrowing of the second portion of the duodenum is present, a choledochojejunostomy should probably be the procedure of choice, since subsequent duodenal obstruction, as in one of our patients, would interfere with the function of a choledochoduodenostomy. Three of our patients had bile flowing over the opened pancreatic duct and did not seem to suffer from any adverse consequences of this arrangement. Mercadier et al.[23,24] and Prinz et al.[25] also did not note any problem with bile bathing the opened pancreatic duct. Our only patient who had a cholecystojejunostomy died from postoperative complications, which were unrelated to his gallbladder drainage. However, the results in the literature from this procedure or sphincteroplasty are dismal, and they should be discouraged.[1,4,6]

One of the major concerns regarding the debate of resection *versus* drainage is the possibility of missing a resectable pancreatic or common bile duct carcinoma. An ampullary carcinoma should certainly be noted on endoscopy. One can usually differentiate on PTC or ERCP between extrahepatic biliary obstruction secondary to chronic pancreatitis and an obstructing pancreatic or bile duct carcinoma. In the former, there is usually a gradual tapering of the duct or an hour-glass configuration, without complete obstruction. In pancreatic carcinoma, there is usually a "shelf" from the tumor and often complete obstruction. However, these signs are not infallible, as they can occasionally be reversed. In chronic pancreatitis, the alkaline phosphatase is markedly abnormal, whereas the serum bilirubin may be normal or minimally elevated. In pancreatic carcinoma, the alkaline phosphatase and bilirubin are both usually quite elevated. In chronic pancreatitis, these values often wax and wane, in contrast to

carcinoma, where they usually progress inexorably upward.[33] One of our patients, without a mass in the head of the pancreas and with normal intraoperative endoscopy of both the markedly dilated common bile and pancreatic ducts, underwent a choledochojejunostomy and pancreatojejunostomy. Biopsy of the pancreas was negative for carcinoma. Because of persistent abdominal pain and CAT scan evidence of a new mass in the head of her pancreas, she underwent a Whipple procedure for pancreatic carcinoma 9 months later, only to die from her disease after another 6 months. The resection, following a previous modified Puestow procedure, was technically less demanding than had been anticipated. In the series of longitudinal pancreatojejunostomies by Prinz, Aranha, and Greenlee, two of 55 patients were subsequently found to have pancreatic carcinomas. Curative resection of pancreatic carcinoma is very infrequent, and effectiveness of any therapy for this disease is limited.

Recrudescence of symptoms following a longitudinal pancreatojejunostomy should demand thorough diagnostic evaluation. ERCP following a properly constructed longitudinal pancreatojejunostomy is usually not very interesting; the dye should flow immediately into the jejunum, where one can no longer see the opened pancreatic duct that makes up the posterior wall. In two of our patients, partial obstruction of the proximal duct was noted on ERCP and was probably due to inadequate proximal drainage. In one instance, this was a result of extensive peripancreatic venous collaterals secondary to superior mesenteric venous obstruction, making the proximal dissection extremely bloody and dangerous. In the other case, it was probably a technical error, although, if the head of the gland is quite large, the pancreatic duct can be very deep, especially in the uncinate process, and difficult to anastomose to the jejunum. Further surgical intervention was able to relieve, or significantly reduce, the recurrence of pain in five patients: repair of an incisional hernia, 80% distal pancreatectomy and cystduodenostomy in one case each and gastrojejunostomy in two.

In conclusion, drainage procedures for chronic pancreatitis are associated with a low morbidity when compared to the high morbidity and mortality reported for radical resectional operations for chronic pancreatitis and provide a high degree of pain relief. It does not seem reasonable to wait for the gland to "burn out" and the pain to resolve. Combined drainage of an obstructed duodenum or biliary and pancreatic ducts also carries a low operative risk and should be strongly considered in preference to resection. Furthermore, renewed pain, jaundice, or nausea and vomiting should not simply be attributed to a failed drainage procedure but should prompt diagnostic efforts to identify an additional obstructive process, which can often be corrected by further surgical intervention.

References

1. Warshaw AL, Schapiro RH, Ferrucci JT Jr, Galbadini JJ. Persistent obstructive jaundice, cholangitis, and biliary cirrhosis due to common bile duct stenosis in chronic pancreatitis. Gastroenterology 1976; 70:562–567.
2. Littenberg G, Afroudakis A, Kaplowitz N. Common bile duct stenosis from chronic pancreatitis: a clinical and pathologic spectrum. Medicine 1979; 58:385–412.
3. Afroudakis A, Kaplowitz N. Liver histopathology in chronic common bile duct stenosis due to chronic alcoholic pancreatitis. Hepatology 1981; 1:65–72.
4. Schulte WJ, LaPorta AJ, Condon RE, et al. Chronic pancreatitis: a cause of biliary stricture. Surgery 1977; 82:303–309.
5. Scott J, Summerfield JA, Elias E, et al. Chronic pancreatitis: a cause of cholestasis. Gut 1977; 18:196–201.
6. Bradley EL III, Salam AA. Hyperbilirubinemia in inflammatory pancreatic disease: natural history and management. Ann Surg 1978; 188:626–629.
7. Aranha GV, Prinz RA, Freeark RJ, et al. The spectrum of biliary tract obstruction from chronic pancreatitis. Arch Surg 1984; 119: 595–600.
8. Eckhauser FE, Knol JA, Strodel WE, et al. Common bile duct strictures associated with chronic pancreatitis. Am Surg 1984; 49: 350–358.
9. Newton BB, Rittenbury MS, Anderson MC. Extrahepatic biliary obstruction associated with pancreatitis. Ann Surg 1983; 197: 645–653.
10. Bradley EL III, Clements JL Jr. Idiopathic duodenal obstruction. An unappreciated complication of pancreatitis. Ann Surg 1981; 193:638–648.
11. Aranha GV, Prinz RA, Greenlee HB, Freeark RJ. Gastric outlet and duodenal obstruction from inflammatory pancreatic disease. Arch Surg 1984; 119:833–835.
12. Puestow CB, Gillesby WJ. Retrograde surgical drainage of pancreas for chronic relapsing pancreatitis. Arch Surg 1958; 76:898–907.
13. Proctor HJ, Mendes OC, Thomas CG Jr, Herbst CA. Surgery for chronic pancreatitis: drainage *versus* resection. Ann Surg 1979; 189:664–671.
14. Traverso LW, Tompkins RK, Urrea PT, Longmire WP Jr. Surgical treatment of chronic pancreatitis: twenty-two years' experience. Ann Surg 1979; 190:312–319.
15. White TT, Hart MJ. Pancreatojejunostomy versus resection in the treatment of chronic pancreatitis. Am J Surg 1979; 138:129–134.
16. Warshaw AL, Popp JW Jr, Schapiro RH. Long-term patency, pancreatic function, and pain relief after lateral pancreatojejunostomy for chronic pancreatitis. Gastroenterology 1980; 79:289–293.
17. Taylor RH, Bagley FH, Braasch JW, Warren KW. Ductal drainage or resection for chronic pancreatitis. Am J Surg 1981; 141:28–33.
18. Prinz RA, Greenlee HB. Pancreatic duct drainage in 100 patients with chronic pancreatitis. Ann Surg 1981; 194:313–320.
19. Sarles J, Nacchiero M, Garani F, Salasc B. Surgical treatment of chronic pancreatitis: report of 134 cases treated by resection or drainage. Am J Surg 1982; 144:317–321.
20. Hart MJ, Miyashita H, Morita N, White TT. Pancreatojejunostomy: report of a 25 year experience. Am J Surg 1983; 145:567–570.
21. Brinton MH, Pellegrini CA, Stein SF, Way LW. Surgical treatment of chronic pancreatitis. Am J Surg 1984; 148:754–759.
22. Frey CF, Child CG, Fry W. Pancreatectomy for chronic pancreatitis. Ann Surg 1976; 184:403–414.
23. Mercadier M, Clot JP, Regensberg C. Drainages et derivations du Wirsung dans les pancreatites chronicques. Ann Chir 1968; 22: 1279–1283.
24. Mercadier MP, Clot JP, Russell TR. Chronic recurrent pancreatitis and pancreatic pseudocysts. *In* Ravitch MM, ed. Current Problems in Surgery. Chicago: Yearbook Medical Publishers, 1973; 30.
25. Prinz RA, Aranha GV, Greenlee HB. Combined pancreatic duct and upper gastrointestinal and biliary tract drainage in chronic pancreatitis. Arch Surg 1985; 120:361–366.

26. Warshaw AL. Conservation of pancreatic tissue by combined gastric, biliary, and pancreatic duct drainage for pain from chronic pancreatitis. Am J Surg 1985; 149:563–569.
27. Ammann RW, Akovbiantz A, Largiader F, Schueler G. Course and outcome of chronic pancreatitis: longitudinal study of a mixed medical-surgical series of 245 patients. Gastroenterology 1984; 86:820–828.
28. Isaksson G, Ihse I. Pain reduction by an oral pancreatic enzyme preparation in chronic pancreatitis. Dig Dis Sci 1983; 28:97–102.
29. Longstreth GF, Newcomer AD, Green PA. Extrahepatic portal hypertension caused by chronic pancreatitis. Ann Intern Med 1971; 75:903–908.
30. Rignault D, Mine J, Moine D. Splenoportographic changes in chronic pancreatitis. Surgery 1968; 63:571–575.
31. Little AG, Moosa AR. Gastrointestinal hemorrhage from left-sided portal hypertension: an unappreciated complication of pancreatitis. Am J Surg 1981; 141:153–158.
32. Bradley EL III. Pancreatic duct pressure in chronic pancreatitis. Am J Surg 1982; 144:313–316.
33. Wapnick S, Hadas N, Purow E, et al. Mass in the head of the pancreas in cholestatic jaundice: carcinoma or pancreatitis? Ann Surg 1979; 190:587–591.

Discussion

Dr. Edward L. Bradley III (Atlanta, Georgia): In this very nice paper Dr. Sugerman and his coworkers remind us of the extrapancreatic complications that occur in chronic pancreatitis. In 28 patients followed an average of 3 years and collected over a 10-year period, they found a 43% incidence of parapancreatic fibrous obstruction.

This is an interesting and important point. If, in fact, the incidence of parapancreatic obstruction is this high, prophylactic bypass could be considered. In fact, Mercadier has recommended that we perform a triple bypass on all these patients, *i.e.*, the bile duct, the duodenum, and the pancreatic duct all at the same time.

About 2 years ago, we studied a similar group of patients at Emory. We followed 80 patients over a 10-year period with an average 6-year follow-up. We were able to find only a 14% incidence of so-called parapancreatic obstruction, and we came to the conclusion that prophylactic triple bypass on this basis was not warranted. Interestingly, in our study we found that if they were going to get another obstruction, it occurred within 6 years after longitudinal pancreatojejunostomy.

My first question to the authors of this paper is: How can they account for this marked difference in incidence? If we review the world literature, the incidence of common duct obstruction is on the order of 5%, and that of duodenal obstruction 1%. Do you think that this discrepancy may reflect delay in referral to your surgical unit?

There are two points in the paper that are particularly worthy of emphasis. The first is that, in patients who have simultaneous obstructions, conservation of pancreatic tissue by a simultaneous bypass is probably superior to resection as a first stage procedure. The second point, and perhaps even more important, is that if a longitudinal pancreaticojejunostomy fails to relieve pain, restudy the patient. There is an unappreciated stenosis and recurrence rate with this operation, and you can salvage many of these people by redoing the procedure.

Finally, there was mention in the paper that elevated intraductal pancreatic pressures were found in this group of patients. I hope that Dr. Sugerman will amplify this particular observation.

The authors have made a very valuable contribution by reminding us that chronic pancreatitis is a progressive disease, and long-term follow-up is necessary for these patients. I am grateful to the authors for the opportunity of reviewing the manuscript.

Dr. Joaquin S. Aldrete (Birmingham, Alabama): I wish to congratulate Dr. Sugerman and associates for an excellent paper that not only documents the effectiveness of drainage procedures to treat the complications of chronic pancreatitis, but also clearly notes that in some patients several of these anatomical deformities produced by the pancreatitis coexist. Therefore, a combination of drainage procedures is required.

I totally agree with the authors that attempts to correct the anatomical disturbances produced by the fibrotic process in the pancreas by drainage procedures should be preferred over pancreatic resections. Not only is the mortality lower but the effectiveness of the drainage procedure in relieving the pain and other symptoms is better. In fact, I feel that the indications for operation to treat complications of chronic pancreatitis are highly specific; they are: (1) obstruction of the pancreatic duct resulting in dilatation to a diameter above 5 mm, (2) obstruction of the common bile duct resulting in dilatation to a diameter of over 15 mm, (3) the presence of a pancreatic pseudocyst that measures over 4 cm in diameter, and (4) duodenal obstruction documented by varium studies, which persists after at least 4 days of treatment with nasogastric suction. Patients with fibrous chronic pancreatitis who do not have any of these specific complications and have severe pain should be treated with splanchnic blocks or surgical resection of the splanchnic ganglia. Only when these procedures fail, which is seldom, should resection of the pancreas be undertaken.

Our own experience at the University of Alabama in Birmingham parallels that reported here by Dr. Sugerman and associates. We have constructed choledochoduodenostomies in 40 patients with common bile duct obstruction by the chronic fibrous pancreatitis. In five of them, a side-to-side lateral pancreaticojejunostomy was also constructed because of coexistent dilatation of the main pancreatic duct. Side-to-side pancreaticojejunostomy alone was constructed in 14 other patients. Duodenal obstruction requiring gastrojejunostomy was found only in two patients.

(Slide) This slide shows our experience with 19 patients who underwent lateral pancreaticojejunostomy; they have been followed for a relatively long period of time. There was only one operative death in a young patient with vasculitis who died of an intracerebral hemorrhage 1 week after operation. The other 18 patients survived. There were four late deaths at 20, 45, 65, and 80 months, after operation. Two patients had recurrence of the pain, but this was only about 2 or 3 months prior to their death. Of the 14 patients alive, 11 were followed from 12 to 72 months; they are all free of pain. Three other patients followed from 12 to 32 months were free of pain from 6 to 12 months but then had recurrence of their pain coinciding with the time when they started to drink alcohol again, emphasizing that drainage procedures of the pancreas are effective only when the patient is willing to abstain from drinking alcohol.

Another important point already mentioned by Dr. Sugerman, but which I would like to emphasize, is that drainage procedures really do not treat the primary process of chronic pancreatitis. I believe that this is a relentless process that continues even after the operation; the drainage procedures, realistically, only treat the complications and not the primary disease. In the patients we have followed, after some years being free of pain, three of them developed exocrine pancreatic insufficiency and six of them developed diabetes mellitus. These findings suggest the relentless progression of the disease.

(Slide) A final comment: I feel the best way to document the dilatation of the common bile duct is a PTC as shown in this slide. (Slide) Furthermore, in the last 2 years, we have been using computerized tomography more and more often to assess the presence of dilatation of the pancreatic duct. CT clearly shows the dilated pancreatic duct in this slide; it is my impression that CT will eventually be more commonly used for these purposes than ERCP.

My only question for Dr. Sugerman is whether you agree that computerized tomography will eventually replace ERCP to assess the dilatation of the pancreatic duct in this specific group of patients? I enjoyed hearing this important paper, which puts into the right perspective the usefulness of bypass operations to treat the complications of chronic pancreatitis. I am also grateful for the privilege of discussing this paper.

Dr. Paul H. Jordan, Jr. (Houston, Texas): I want to congratulate Dr. Sugerman for a lovely paper, and I want to confine my comments to obstruction of the common duct.