Pancreatic Duct Drainage in 100 Patients with Chronic Pancreatitis

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Although the development of islet cell autotransplantation has focused attention on extended resections of the pancreas, drainage of a dilated pancreatic duct remains an effective means of relieving intractable pain of chronic pancreatitis. Between 1954 and 1980, 98 men and two women with chronic pancreatitis were treated for pain with ductal drainage. All patients had a history of chronic alcoholism. Pancreatic calculi were found in 68 patients. Operative procedures included: seven caudal pancreaticojejunostomies, 42 longitudinal pancreaticojejunostomies, and 54 side-to-side pancreaticojejunostomies. Two caudal pancreaticojejunostomies were converted to longitudinal pancreaticojejunostomies, and one longitudinal pancreaticojejunostomy required revision. The operative mortality rate was 4%. Follow-up studies, lasting up to 24 years, were conducted for all but seven patients. Eighty per cent of these patients have had substantial improvement or complete resolution of their pain. Diabetes, as evidenced by an elevated fasting blood sugar level, was present prior to operation in 30% of the patients, and developed after operation in 14%. Only nine of 21 insulin-dependent diabetics in this series did not require insulin prior to pancreaticojejunostomy. Pancreatic enzyme replacement was needed for control of steatorrhea in 18 patients. Four patients with continued pain underwent total or near total pancreatectomies. Three of these patients died of uncontrolled diabetes. Only one patient with a drainage procedure alone has died of uncontrolled diabetes. In patients with dilated pancreatic ducts, pancreaticojejunostomy is a safe, reliable means of providing pain relief, with minimal loss of endocrine and exocrine function.

MANY DIFFERENT SURGICAL procedures have been proposed to relieve the incapacitating abdominal and back pain associated with chronic pancreatitis, but only drainage of the pancreatic duct and resection of the diseased gland are widely accepted as beneficial. Proponents of ductal drainage believe that the pain of chronic pancreatitis is due, in large part, to obstruction and distention of the major pancreatic ducts. Drainage of these obstructed ducts with a pancreaticojejunostomy is relatively safe and simple, and it preserves as much exocrine and endocrine pancreatic function as possible.[1,2] Proponents of pancreatic resection counter that not all patients have major ductal obstructions[3] and that only removal of the diseased organ can reliably eliminate the source of pain.[4] The major drawback to extended pancreatic resection has been the inevitable development of diabetes. In patients with chronic pancreatitis, insulin-dependent diabetes is a major problem which is almost impossible to manage because of continued alcohol and/or narcotic abuse. Recently, islet cell autotransplantation has been advocated as an adjunct to prevent or reduce the severity of diabetes associated with pancreatic resection. Although islet cell autotransplantation is an intriguing option, initial reports have been characterized by a lack of reliable success and a substantial risk of complications.[5–7]

The controversy surrounding drainage versus resection of the pancreas stems from a lack of understanding that pain is the common end product of a wide spectrum of pathologic changes in the pancreas. When treating this disease, the surgeon must be flexible and choose the operation which best suits the pathologic anatomy and level of pancreatic function found in each patient. In patients with a dilated pancreatic duct, we favor drainage with a pancreaticojejunostomy. We believe that pancreatic resections are best reserved for the patient with no demonstrable dilation of the major pancreatic ducts, severe involvement of the gland primarily in the body and tail, and substantial impairment of endocrine and/or exocrine function.

This study reviews the authors' experience with 100 patients who have been treated with pancreatic duct drainage to relieve the incapacitating pain of chronic pancreatitis. The results in these patients have been examined in order to determine the effectiveness of drainage in achieving long-term pain relief, and the

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TABLE 1. *Results of Pancreaticojejunostomy*

	Complete Relief (%)	Substantial Relief	Minimal to No Relief	Operative Mortality	Unsuspected Carcinoma	Lost to Follow-up
Side-to-side	21/50 (42)	20/50 (40)	9/50 (18)	1/53	1/53	1/53
Longitudinal	10/36 (28)	18/36 (50)	8/36 (22)	2/43	1/43	4/43
Caudal	1/5 (20)	1/5 (20)	3/5 (60)	1/8	1/8	1/8

evolution of diabetes and steatorrhea after pancreaticojejunostomy.

Patients and Methods

From July, 1954 to March, 1980, 100 patients were treated for chronic relapsing pancreatitis with pancreatic duct drainage at the Hines VA Hospital and Loyola University Medical Center. The operation was performed in each patient to relieve intractable pain and interrupt a cycle of repeated hospital admissions and/or narcotic dependence. Drainage procedures performed primarily for pseudocysts are not included in this review.

There were 98 men and 2 women in this group. Their average age at operation was 45 years, with a range from 29 to 66 years. Every patient had a history of excessive alcohol intake, and alcoholism was considered the cause of chronic pancreatitis in each. Associated biliary tract disease was documented in 32 patients. Two patients had a questionable history of pancreatic trauma, and one patient underwent parathyroidectomy for primary hyperparathyroidism, which was diagnosed three years after pancreaticojejunostomy. The severity and disabling quality of the pain in these patients is illustrated by the frequency of antecedent operative attempts to ameliorate it. Thirty patients underwent 50 operations in an attempt to relieve their pain prior to ductal drainage. These operations included splanchnicectomy (one patient), sphincterotomy (four patients), various gastric procedures (six patients), drainage of pseudocysts (nine patients), exploratory laparotomy (12 patients), and cholecystectomy and/or common duct exploration (18 patients). Four patients had two prior operations, and three patients had three or more operations.

Radiologic evidence of pancreatic calcification was seen in 58 patients. Nineteen patients had a history of pseudocyst. Elevation of the fasting blood glucose level was the criterion used to diagnose the presence of diabetes mellitus. Thirty-four patients had diabetes mellitus at the time of pancreaticojejunostomy, and ten of these required insulin for control. Seventeen patients had pancreatic exocrine insufficiency, and were receiving oral therapy with pancreatic enzymes.

Pancreatic duct drainage was performed 104 times in these 100 patients. Drainage was accomplished by caudal pancreaticojejunostomy[8] in eight patients, longitudinal pancreaticojejunostomy[9] in 43, and side-to-side pancreaticojejunostomy[10] in 53 patients. Two caudal pancreaticojejunostomies were converted to longitudinal pancreaticojejunostomies; one caudal pancreaticojejunostomy was converted to a side-to-side pancreaticojejunostomy; and one longitudinal pancreaticojejunostomy was revised. The side-to-side pancreaticojejunstomy is now our method of choice for draining the major pancreatic ducts.

The hospital and outpatient records of these patients were reviewed. A personal or telephone interview was obtained from all living patients. If the patient had died, relatives were contacted, whenever possible, to corroborate follow-up information. Six patients were lost to follow-up study.

Results

The operative mortality rate in this series was 3.8%. One patient died from a leaking pancreaticojejunal anastomosis following a caudal pancreaticojejunostomy. After a longitudinal pancreaticojejunostomy, one patient died of acute renal failure and another died of septic complications of a leak from the jejunojejunal anastomosis. One patient died of intra-abdominal hemorrhage after a side-to-side pancreaticojejunostomy. There have been no operative deaths in the last 50 patients who underwent the drainage procedures we have performed. Three patients died of carcinomas of the pancreas within one year of pancreatic duct drainage. All three patients had pancreatic biopsies performed which only demonstrated histologic changes of chronic pancreatitis. Two of these patients had pancreatic calcifications noticed prior to pancreaticojejunostomy.

Postoperative complications occurred in 21 patients. These included six instances of pneumonia, six wound infections, four instances of gastrointestinal hemorrhage (including one patient requiring reoperation for bleeding from the jejunal side of the pancreaticojejunostomy), two subphrenic abscesses and two wound seromas. A stroke, parotiditis, and a small bowel obstruction requiring reoperation each occurred once.

Pain relief was the prime purpose for operation in these patients with chronic pancreatitis. If postoperative deaths, patients misdiagnosed with carcinoma, and

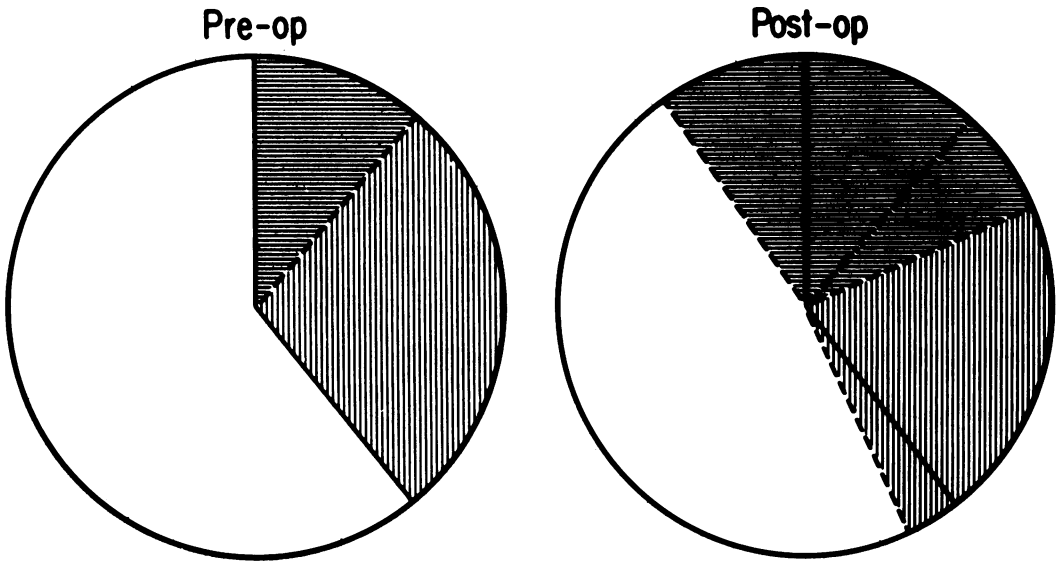

FIG. 1. Thirty-four of 87 patients available for follow-up study were diabetic as defined by an elevated fasting blood glucose prior to pancreaticojejunostomy, but only ten of these required insulin. Six patients with preoperative diabetes required insulin after operation. Diabetes has also developed in 11 of the 53 nondiabetic patients, and eight of these 11 require insulin. Only 28% of our patients are insulin dependent diabetics. Open area: nondiabetic; vertical stripes: diabetic—noninsulin dependent; horizontal stripes: diabetic—insulin dependent.

patients lost to follow-up study are excluded, 87 patients were available to assess the effectiveness of pancreaticojejunostomy in relieving pain (Table 1). Complete pain relief was attained in 32 patients, and substantial improvement was noticed in 39. Thus, 82% of the patients available for follow-up study were benefited by adequate pancreatic duct drainage. Side-to-side and longitudinal pancreaticojejunostomies were essentially equal in their effectiveness in relieving pain. Although only a small number of caudal pancreaticojejunostomies were performed, it seems to be less effective in achieving symptomatic improvement. Three of four patients who required second drainage procedures were benefited by them. One patient has been pain free since his caudal pancreaticojejunostomy was converted to a longitudinal pancreaticojejunostomy. Two other patients were substantially improved after conversion of a caudal to a side-to-side drainage and revision of a longitudinal pancreaticojejunostomy. There was, essentially, no difference in the results of pancreatic duct drainage in patients with evidence of calcification compared with those without. When calcifications were present, 79% of patients were improved.

Diabetes was not an inevitable consequence of chronic pancreatitis in these patients (Fig. 1). Ten of 34 patients who were diabetic prior to drainage procedures required insulin. Of the 24 patients who were not receiving insulin, only six have required insulin administration since operation. Diabetes has developed in 11 of the 53 nondiabetic patients, and eight of these 11 were treated with insulin. Thus, almost half of these patients never became diabetic and only 28% ever required insulin. After pancreaticojejunostomy, uncontrolled diabetes was a factor contributing to death in only one patient. Exocrine insufficiency requiring

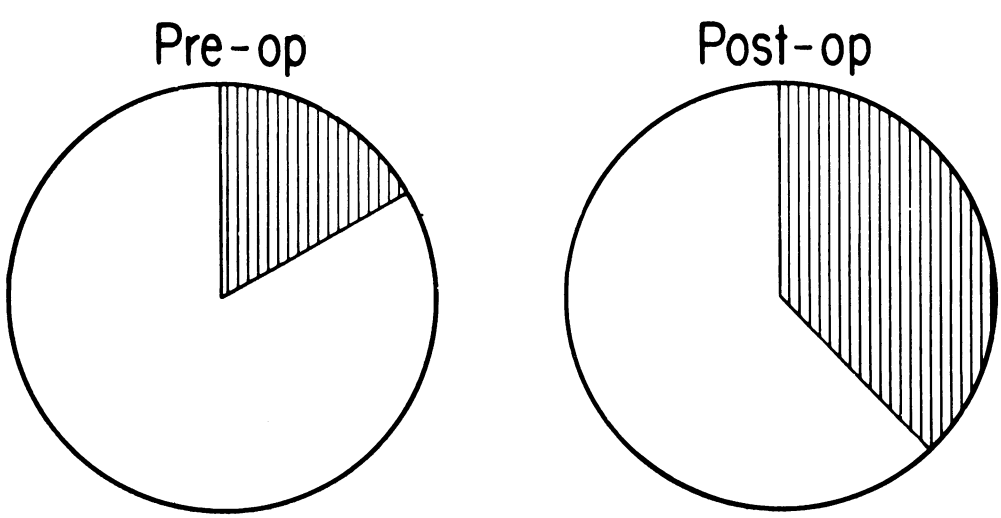

FIG. 2. Seventeen of 87 patients required treatment with pancreatic enzymes before pancreatic duct drainage. Twelve more patients required exocrine replacement therapy after operation. Verticle stripes: pancreatic enzyme therapy rquired; open area: pancreatic enzyme therapy not required.

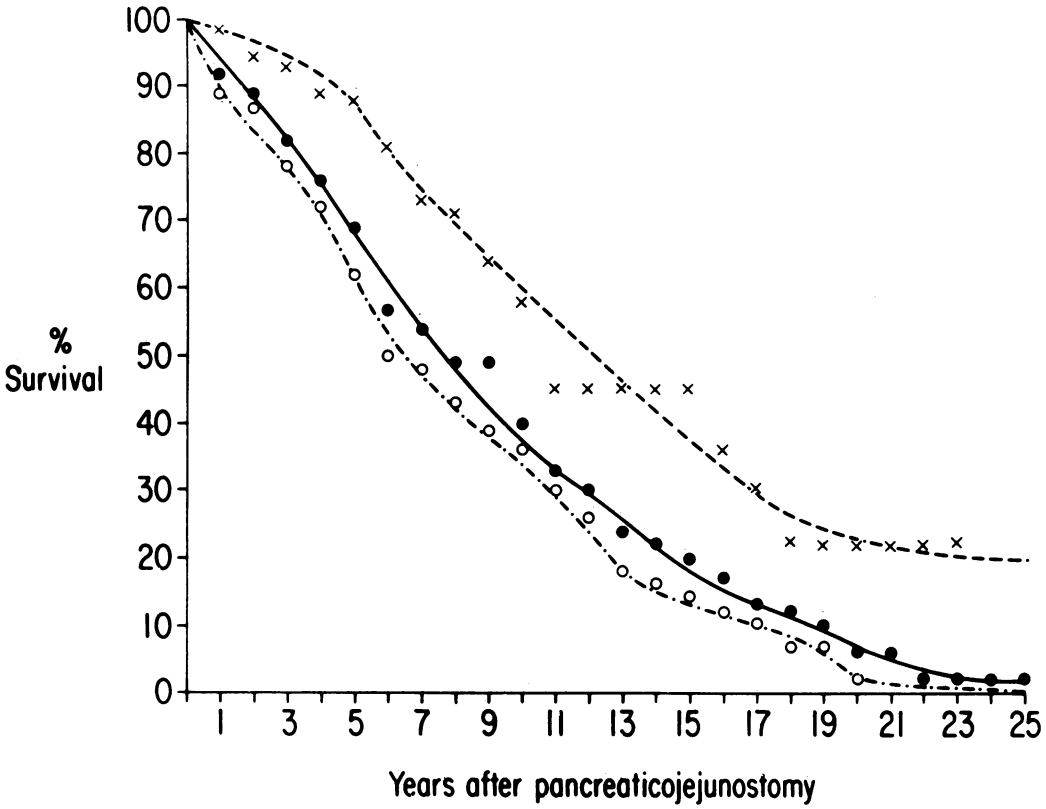

FIG. 3. Continued alcoholism is a crucial factor determining patient outcome. The survival rate of patients who abstain from alcohol is substantially better than the survival of those patients who continue to drink. •——•: all patients; o—•—•o: continued drinking; ×---×: quit drinking.

oral pancreatic enzymes developed in 12 patients after drainage. Thus, only 29 of the 87 patients ever developed clinically important exocrine insufficiency (Fig. 2).

Of the 87 patients available for follow-up study, 41 are still alive. They have been followed from one to 25 years since their drainage procedures, with an average period of 7.9 years. Forty-six patients have subsequently died—7 months to 20 years after operation. The average survival period in this group of patients was 6.1 years. Twelve patients died of cardiovascular disease, and eight patients died of complications of cirrhosis or chronic alcoholism. Pneumonia or pulmonary tuberculosis accounted for seven deaths. Carcinoma was responsible for seven deaths: two patients had lung cancer, four patients had oropharyngeal cancer, and one patient had carcinoma of the pancreas, diagnosed six years after operation. Four patients died of uncontrolled diabetes; in three of these, pancreatic resections had been performed. The cause of death was unknown in four patients. Two patients died of small bowel obstructions. Peptic ulcer disease and a gunshot wound were causes of two other deaths.

Continued alcoholism was a critical factor in determining patient outcome (Fig. 3). The lack of patient compliance was demonstrated by the fact that only 23 patients have refrained from alcohol intake. Substantial symptomatic improvement followed pancreatic duct drainage in 21 of these 23 patients. Of the 16 patients who had no improvement from ductal drainage, 14 continued to drink. Continued alcoholism is even more significant when considering long-term mortality rates. Only 25% of the patients who have quit drinking have died, while 75% remain alive and well. This contrasts with the group of patients who continued alcohol intake, in whom 63% have died and only 37% remain alive.

Pancreatic resection was performed in five patients. In four patients, the resection was performed because of continued pain. One patient had a total pancreatectomy when he developed obstructive jaundice, which was mistakenly thought to be due to carcinoma of the pancreas. Three of these patients died of uncontrolled diabetes. The two patients who remain alive have both experienced severe hypoglycemic reactions and have difficulty in regulating their insulin dose. Both patients continue to complain of some residual abdominal pain.

Discussion

The ideal operation for chronic pancreatitis should relieve pain and preserve endocrine and exocrine function. In those patients in whom pain can be attributed to ductal obstruction, we believe that complete drainage of the pancreatic duct best approximates this goal. Substantial relief of pain was achieved in over 80% of our patients available for follow-up study after pancreaticojejunostomy. These results are in agreement

with those reported in other series, which have shown that pain can be ameliorated in 65–90% of patients with chronic pancreatitis treated with ductal drainage.[1,11,12] Two recent reports have compared the efficacy of pain relief with internal drainage and pancreatic resection. Both Proctor and co-workers[13] and White and Hart[14] showed that pancreaticojejunostomy was extremely effective, in that 85% of patients in both series were improved by drainage. The results of pancreatic resections were less favorable, with 50% of the patients in White's series and 25% of the patients in Proctor's series showing no improvement following pancreatic resections.

Even though the fibrosis and inflammation of chronic pancreatitis is thought to be progressive, diabetes and pancreatic exocrine insufficiency are not inevitable outcomes. Almost one-half of our 87 patients have not become diabetic on long-term follow-up study after pancreaticojejunostomy, and only 24 patients have been placed on insulin therapy. This ability to preserve endocrine function is a crucial advantage for pancreatic duct drainage. Three out of every four patients will continue to drink following operation. This combination of insulin-dependent diabetes and alcohol dependence is, at best, difficult to manage if not lethal. Only one of our 87 patients has died from uncontrolled diabetes after pancreaticojejunostomy, but three of the five patients who have subsequently undergone pancreatic resection have died from uncontrollable diabetes.

Pancreaticojejunostomy avoids sacrifice of functioning pancreatic tissue, and it allows the remaining pancreatic secretions to enter the intestine and contribute to digestion. This advantage of drainage is illustrated by the small number of our patients who require pancreatic enzyme replacement. Only 29 patients have developed clinically important pancreatic exocrine insufficiency, and 17 of these were already being treated for steatorrhea prior to pancreaticojejunostomy. Thus, only 12 of 70 patients who were not receiving pancreatic enzymes before operation, eventually needed this treatment after operation.

All reports dealing with chronic pancreatitis note that 10–30% of patients have not been improved by direct operations on pancreas. These figures hold true even for near total pancreatectomy[4] and total pancreatectomy.[15] Thus, there is a subset of patients with chronic pancreatitis who have an established pain pattern in the setting of alcohol and narcotic dependence which cannot be broken by any operative procedure. This must be kept in mind when dealing with the patient who continues to have pain after pancreaticojejunostomy. Our approach in these patients begins with a complete re-evaluation to determine if some other cause such as peptic ulcer disease or biliary tract disease may be responsible for continued symptoms. Once this has been ruled out, the adequacy of drainage should be re-evaluated by endoscopic retrograde cholangiopancreatography (ERCP). If the pancreatic duct has not been completely drained, a second drainage operation is indicated. Three of our four patients who had second drainage procedures have benefited from this operation. When there is a patent anastomosis between the entire length of pancreatic duct and the Roux-en-Y limb of jejunum, we have used pancreatic resection in several instances. Our results in these patients are far from satisfactory. All five patients who have undergone pancreatic resections after drainage procedures failed to obtain relief of their pain, and continued to have residual symptoms. Three of these patients died within two years after pancreatectomy from problems associated with the control of diabetes.

The metabolic problems which develop after extended pancreatic resections have deterred us from recommending pancreatectomy with greater frequency. Refinements in autotransplantation of pancreatic islet cell tissue may eventually prevent the development or worsening of diabetes after pancreatectomy; but, at present, it has had limited success in preventing diabetes. All four patients described by Traverso and co-workers[7] became insulin-dependent in spite of islet cell autotransplantation. Only three of ten patients reported by Najarian and associates,[6] who had islet cell autotransplantation as an adjunct to pancreatectomy, did not require insulin. Late failure of insulin production by autotransplanted islet cell tissue has also been reported.[16]

Chronic pancreatitis can be impossible to differentiate from pancreatic carcinoma at operation. Three of our patients died within one year of pancreaticojejunostomy, from autopsy-proven carcinomas of the pancreas. Each patient had a long history of abdominal pain, and each had an intraoperative biopsy of the pancreas which only showed fibrosis and inflammation. Two patients even had preoperative evidence of pancreatic calcification. This problem of unsuspected carcinoma is not unique to our experience, and it has been discussed in several other reports.[14,17] A high index of clinical suspicion and liberal use of pancreatic biopsy procedures are necessary in order to recognize the presence of malignancy in these diffusely hard glands. It is also interesting that two other patients were found to have cancer of the pancreas at autopsy examination, six and ten years after pancreaticojejunostomies. One can speculate that chronic inflammation is a factor predisposing these patients to the development of pancreatic malignancy.

One of the most distressing findings of this review is the poor long-term survival rate among patients with chronic pancreatitis. More than one-half of our patients

died during the period of follow-up, and almost 40% survived less than five years after pancreaticojejunostomy. Continued alcoholism was the most important factor we could identify affecting survival. Three-fourths of the patients who have quit drinking are alive and well, but only one-third of those who have continued to drink are still alive. In a series of 45 patients, Leger and co-workers [18] found that 36% had died within ten years of pancreaticojejunostomy. They believe that continued alcoholism played a significant role in this high mortality rate. White and Keith [17] have also found that persistent alcoholism was responsible for the large number of late deaths following pancreaticojejunostomy. It is obvious that greater efforts must be made in convincing these patients to quit drinking.

This study confirms the effectiveness of draining a dilated pancreatic duct to relieve pain in chronic pancreatitis. The lateral side-to-side pancreaticojejunostomy is the optimal method of achieving drainage. The entire length of both the duct of Wirsung and the duct of Santorini can be opened and decompressed with a minimum of dissection. This is a distinct advantage in patients who may have adhesions from prior upper abdominal operations or coexistent portal hypertension from alcoholic cirrhosis. We have performed 53 side-to-side pancreaticojejunostomies, with an operative mortality rate of less than 2%, and pain was ameliorated in over 80% of these patients. Side-to-side pancreaticojejunostomy is a safe reliable means of providing pain relief without loss of endocrine and exocrine function.

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Discussion

Dr. George L. Jordan, Jr. (Houston, Texas): A few years ago, I reviewed the English literature to determine to some extent just what procedures were being used in the treatment of chronic pancreatitis. In a collected series of 1,558 patients, I found that the most common procedure was resection, being used in 28% of these patients. Ductal drainage of the type described here, with longitudinal opening of the entire ductal system, was being used in only 11%. This report by Dr. Prinz and Dr. Greenlee, therefore, is particularly important, emphasizing the value of this procedure.

The data presented are particularly valuable because, as has already been emphasized today, long-term follow-up studies are critical, even in treating benign disease.

My experience is somewhat smaller, but it correlates well with that reported, and there are certain points which I think should receive emphasis.

This is a disease that involves, primarily, young individuals, and the death rate is high. One hears the internists speak of the pancreatitis "burning out" and the patient recovering. This has not been my experience. In a follow-up study of patients with alcoholic pancreatitis who did not undergo operations, the disease persists unabated, and frequently ends in death. In our own experience, many of these patients, with or without operation, do not live past 50 years of age.

Second, although the operation relieves pain, as shown in this study and as confirmed in my experience, many of these patients have progressive pancreatic disease, and the incidence of diabetes and nutritional problems in the late follow-up period will be much higher than at the time of operation.

There have been those who have postulated that the pancreas regenerates after relief of this obstruction, but the data, to date, do not support that contention. To the contrary, it is my belief that patients who have nutritional improvement after the operation do so because of their relief of pain, their ability to ingest food without pain, rather than an improvement of digestive function resulting from the operation per se.

The late results, therefore, are not as good as the early results. The early results reported in the literature frequently are good, but the