

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-workers¹⁸ 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 Keith¹⁷ 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.

References

- Jordan GL, Jr, Strug BS, Crowder WE. Current status of pancreaticojejunostomy in the management of chronic pancreatitis. *Am J Surg* 1977; 133:46-51.
- Prinz RA, Kaufman BH, Folk FA, Greenlee HB. Pancreaticojejunostomy for chronic pancreatitis: two-to-21-year follow-up. *Arch Surg* 1978; 113:520-525.
- Grodsinsky C, Schuman BM, Block MA. Absence of pancreatic duct dilation in chronic pancreatitis: surgical significance. *Arch Surg* 1977; 122:444-449.
- Frey CF, Child CG, III, Fry W. Pancreatectomy for chronic pancreatitis. *Ann Surg* 1976; 184:403-413.
- Mehigan DG, Bell WR, Zuidema GD, et al. Disseminated intravascular coagulation and portal hypertension following pancreatic islet autotransplantation. *Ann Surg* 1980; 191:287-293.
- Najarian JS, Sutherland DER, Baumgartner D. Total or near total pancreatectomy and islet autotransplantation for treatment of chronic pancreatitis. *Ann Surg* 1980; 192:526-542.
- Traverso LW, Abou-Zamzam AM, Longmire WP, Jr. Human pancreatic cell autotransplantation following total pancreatectomy. *Ann Surg* 1981; 193:191-195.
- DuVal MK Jr. Caudal pancreaticojejunostomy for chronic relapsing pancreatitis. *Ann Surg* 1954; 140:775-785.
- Puestow CB, Gillesby WJ. Retrograde surgical drainage of pancreas for chronic relapsing pancreatitis. *Arch Surg* 1958; 76:898-907.
- Partington PF, Rochelle REL. Modified puestow procedure for retrograde drainage of the pancreatic duct. *Ann Surg* 1960; 152:1037-1043.
- Sato T, Saitoh Y, Noto N, Matsuno K. Appraisal of operative treatment for chronic pancreatitis with special reference to side-to-side pancreaticojejunostomy. *Am J Surg* 1975; 129:621-628.
- Way LW, Gadacz T, Goldman L. Surgical treatment of chronic pancreatitis. *Am J Surg* 1974; 127:202-209.
- Proctor HJ, Mendes OC, Thomas CG, Jr, Herbst CA. Surgery for chronic pancreatitis: drainage versus resection. *Ann Surg* 1979; 189:664-671.
- White TT, Hart MJ. Pancreaticojejunostomy versus resection in the treatment of chronic pancreatitis. *Am J Surg* 1979; 138:129-134.
- Braasch JW, Vito L, Nugent FW. Total pancreatectomy for end-stage chronic pancreatitis. *Ann Surg* 1978; 188:317-322.
- Cameron JL, Mehigan DG, Harrington DP, Zuidema GD. Metabolic studies following intrahepatic autotransplantation of pancreatic islet grafts. *Surgery* 1980; 87:397-400.
- White TT, Keith RG. Long-term follow-up study of fifty patients with pancreaticojejunostomy. *Surg Gynecol Obstet* 1973; 136:353-358.
- Leger L, Lenriot JP, Lemaigre G. Five to-twenty-year follow-up after surgery for chronic pancreatitis in 148 patients. *Ann Surg* 1974; 180:185-191.

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 pancrea-

titis "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

longer these patients are followed, the more will have trouble. On the other hand, in my experience with long-term follow-up studies similar to those reported today, the good results still approximate 70%. That is less than the 80% reported here, but when one considers the alternative for these patients, namely, virtually no good results, 70%, I think, is quite respectable.

In my experience, the patients with calcification did do better, but I agree that the number of patients that we have in this category is relatively small, and, therefore, perhaps the figures are not significant. We agree, however, that the evidence indicates that pancreaticojejunostomy can be performed safely, that it has a significant incidence of good results and relief of pain in these patients, and it is far preferable as an initial procedure to resection, which removes pancreatic tissue and increases the incidence of diabetes in these patients, whose disease is often difficult to manage.

DR. JEREMIAH G. TURCOTTE (Ann Arbor, Michigan): At Michigan, our interest has focused on resection therapy to relieve the pain of chronic pancreatitis. Recently, my associates and I rereviewed our data and updated our series from 1959 to 1980. This experience includes 82 patients (95%) or near-total, pancreatectomies, and 32 resections of lesser extent, for a total of 114 operations. We are thus in a good position at the present time to compare our results with those that were presented today.

I would like to emphasize certain points. First, the mortality rate following either resection or a drainage procedure is low, probably unexpectedly low when one considers the malnourished state of many of these patients. It was 2% in our patients, and 3.8% in the series presented today.

(slide) Second, pain relief is excellent or very good in most patients. In our series, a total of 88% of the patients had either complete relief of pain or substantial relief of pain, requiring only occasional or more frequent nonnarcotic analgesics. In the series presented today, 82% of the patients had either complete or substantial relief of pain.

(slide) Both of our series confirm that there is continued loss of life with the passage of time. The five-year probability rate of survival—this is an actuarial life table—is approximately 75% in our patients undergoing resection, and in Dr. Greenlee's series the absolute figure was about a 60% probability of survival at five years.

Now, as has been mentioned, the major disadvantage of near-total pancreatectomy is the induction of insulin-dependent diabetes. Eventually, two-thirds of our patients undergoing near-total pancreatectomy required insulin, and in the series reported today, 28% required insulin.

We believe that both operations should be used selectively. We agree with Dr. Greenlee that pancreaticojejunostomy is a good operation, if done as he has described it, and should be the procedure of choice for many patients, especially those with a dilated bile duct. However, I believe there are certain indications in which resectional therapy is the procedure of choice.

(slide) First, there are a substantial number of patients in whom the residual pancreas is a fibrotic cord, as illustrated in this slide, or in which the pancreatic duct is narrow, as can be confirmed with ERCP.

Second, we recommend resection when a drainage procedure has failed.

Third, a substantial number of patients had disease confined to the distal pancreas, and resectional therapy was indicated. These patients did have excellent relief of their pain, with a low incidence of recurrence of pain.

Last, we more seriously consider pancreatectomy or resectional therapy as a first procedure of choice for those patients who are already insulin-dependent diabetics.

Both of our experiences confirm that operative therapy is effective palliation and can be carried out with a low mortality rate. We recommend an operation for most patients with severe pain complicating their chronic pancreatitis.

What happened to Dr. Greenlee's patients who either had fibrotic glands, as we have illustrated, or who had narrow or nondilated ducts, since in our experience there are a fair number of patients with severe pain from pancreatitis whose ducts are not dilatable.

DR. THOMAS TAYLOR WHITE (Seattle, Washington): I certainly agree with Dr. Greenlee that this is a good operation that does not increase diabetes or steatorrhea.

One of the things that makes his series quite different from ours is that he has virtually all men; we have about one-third women. Only about one-fifth of our patients have calcification, and steatorrhea is occurring in only about one-fourth or less of the total, so that the population of patients on which this type of operation is performed should be considered in evaluating them.

As far as the steatorrhea is concerned, before and after studies have been made on eight patients who have been followed for some years without a great depression in fat absorption, provided the patients did not drink further.

These are our data as of two years ago. (slide) I have divided our patients with long pancreaticojejunostomy, the last procedure Dr. Greenlee described, into those with alcoholic pancreatitis—and our results are essentially the same as his—with the short pancreaticojejunostomy, such as was originally described by Duval, much less successful. As you can see, however, there are a variety of other operations used, with a total positive result of around 44%.

(slide) On the other hand, if you look at patients who had congenital problems with their pancreas, and who had been in auto accidents and situations of that sort, it does not seem to make much difference what kind of operation is performed. They do quite well. This was not brought out in his paper, particularly.

(slide) If you combine the whole lot, you come up with long pancreaticojejunostomy, the one which Dr. Greenlee is advocating, as being good or fair in 87% of the patients, and the short ones in less than half.

We have left out from this series another dozen patients who were later found to have carcinoma, and who, in spite of huge biopsy specimens and all sorts of things of this nature, had a pancreaticojejunostomy with relief of pain, and one or two years later turned out to have carcinoma. For this reason we believe resection is probably indicated in older patients, when the symptoms begin late in life. We agree in general with Dr. Turcotte and his ideas for the minor resections which he advocates.

DR. JOHN TERBLANCHE (Cape Town, South Africa): I think it worthwhile reminding the audience of the study undertaken by my colleague, Philip Bormman, and his co-workers in Cape Town. They performed ERCPs in a group of painless and a group of painful alcoholic chronic pancreatitis patients. This paper was published last year.

The interesting finding was that duct abnormalities demonstrated by Dr. Prinz were present in both groups, and this gives rise to three questions.

Is it, in fact, the large-duct dilatation that causes the pain in chronic pancreatitis? And if so, why does the same duct dilatation occur in patients without pain, and what is the cause of their problem? And finally, is it the surgical drainage of the large ducts that cures the patients as in this series?

DR. JOHN M. HOWARD (Toledo, Ohio): We summarized our studies two years ago (slide), with 86 patients with pancreatic calcifications. Seventy-six of those patients had dilations of the pancreatic duct, as seen either by ERCP or operative pancreatography. Ten patients had a normal, or small, pancreatic duct. Only two patients in the complete group had total roentgenographic obstruction of the pancreatic duct. I consider total obstruction usually as evidence of pancreatic carcinoma, and not chronic pancreatitis.

Twelve patients had dilation of the common bile duct—striking dilation—and this did not go away after an operation on the pancreas. No patient had complete roentgenographic obstruction of the common bile duct.

(slide) Forty-two patients underwent longitudinal pancreaticojejunostomies. Thirty-nine of the patients were male.

(slide) Thirty-five of the 42 patients had significant relief of pain at the end of one or two years of follow-up study.

(slide) By the end of ten years, only ten patients (34%) were living and had significant relief of pain.

At reexploration, three patients had the anastomosis taken down, secretin injected intravenously, and no pancreatic juice could be identified on the surface of the pancreas. Two of these patients had total pancreatectomy, and both patients ultimately died as a result of the operation.

At 15 or 19 years after the Puestow procedure, the results were worse. I, too, was shocked at the number who were dead. This leads me to think more of resection, a shift in my present therapy toward resection of the head and body of the pancreas, leaving, as Dr. Longmire had suggested, only about 5% of the tail.

PROFESSOR MAURICE P. MERCADIER (Paris, France): I think a pancreaticojejunostomy has absolutely precise indications. First, it must be a long side-to-side anastomosis to get the rate of drainage; so you must have a large duct of Wirsung. Second, these palliative operations are indicated when the patient is in the middle part of the course of the disease, does not have diabetes, and has no stenosis of the duodenal loop or stenosis of the low part of the common duct.

My series had a 65% rate of good results. I am speaking of a series beginning in 1951, that is, covering 30 years. Some of the bad results were due to the progress of the sclerosis as it developed at the head of the pancreas, involving the low part of the common duct and the duodenal loop. That is why in the last year I started performing the triple anastomosis, with a Roux-en-Y jejunal loop, a long side-to-side anastomosis between the duct of Wirsung and the jejunal loop; 10 cm further, an anastomosis with the hepatic duct, the upper part of the common duct; I prefer to remove the gallbladder, and after that to perform an anastomosis with the antrum.

It is always necessary in such an operation to direct bile and the pancreatic juice to prevent peptic ulceration; this is done by double vagotomy. At the moment, but with a quite short follow-up period, just ten years, results are better than with one operation.

About resection, you call that Whipple operation on the right side a near-total pancreatectomy, I do not call that 95% pancreatectomy. It is impossible to perform a 95% pancreatectomy. Otherwise, we would get in trouble with the blood supply of the duodenal loop.

If you are doing excisional revision of the pancreas, it must be done when the patients reach the last stage of the disease, when they have diabetes, cirrhosis at the level of the parenchyma, stenosis of the common duct, or stenosis of the second part of the duodenum. It is in such a situation and only in such a situation that I perform a Whipple operation, or almost total pancreatectomy. The results are a little better than with pancreaticojejunostomy with a triple anastomosis. That is, about 75%, but I will say, just like Dr. Howard, at the moment, because with the years the results are not improving, they are less and less good.

DR. HERBERT B. GREENLEE (Closing discussion): Dr. Jordan, I agree that the nutritional benefits we see in these patients are primarily related to increased food intake because of the abdominal pain relief, rather than the effect of the return of the pancreatic juice back to the intestine. I know that you had previously indicated that those patients with pancreatic calcifications generally obtained a better result from a drainage operation. Our data suggested that there is no difference between these two groups.

Dr. Turcotte indicated that the results in the resection and drainage groups are quite similar in terms of pain relief. The one disadvantage of pancreatic resection is a higher incidence of insulin-dependent diabetes. He continues to recommend pancreatic resection for the insulin-dependent diabetic with chronic pancreatitis and abdominal pain. It has been our experience that the patients undergoing resection with insulin-dependent diabetes are more difficult to manage than those insulin-dependent diabetics undergoing drainage procedures alone.

Dr. Turcotte asked what happened to those patients undergoing ductal drainage who had nondilated ducts? During many of the early years of the study we were unable to measure the size of the duct preoperatively by ERCP. Many of these patients did not undergo operative pancreatograms. I suspect there were some patients with nondilated ducts in contrast to the more typical chain-of-lakes ducts in whom ductal drainage was performed. I have no way of determining what percentage of these patients happened to fall into the good-result category.

Dr. White provided us with some additional information from his series on other causes in addition to alcohol. We concluded that, in our patients, alcohol was the primary etiologic factor even though biliary tract disease was present in almost one-third of the patients. Performing cholecystectomy on 18 of 32 patients with gallstones before pancreatic ductal drainage was ineffective in relieving the severe abdominal pain caused by the chronic pancreatitis. It appears that alcohol was undoubtedly the primary etiologic factor in these patients.

Steatorrhea, as Dr. White indicated, tends to worsen slowly after a drainage procedure even though no pancreatic tissue has been removed. Dr. Puestow believed that the return of the pancreatic juice to the intestine would prevent postoperative steatorrhea and prevent further deterioration in the exocrine and endocrine function of the gland. I think the destructive process in the pancreas probably continues in spite of ductal decompression. I think an occasional patient during the postoperative period unmasks steatorrhea by increased food intake now possible because of relief of the abdominal pain. If the patient had not been limited preoperatively in food intake, clinically apparent steatorrhea might have been noted.

Dr. Terblanche has asked a difficult question, one which I have thought about, and one for which I do not have a good answer. He has asked why some people with dilated ducts have no pain. On the other hand, some patients with nondilated ducts suffer from severe abdominal pain. What, then, is the mechanism of pain relief from ductal decompression in patients with chronic pancreatitis? I suspect that the problem boils down to this. We do not know what causes the pain in chronic pancreatitis in all instances. We find it convenient to think of the dilated ducts as indicating pancreatic juice under pressure within the ductal system, which will be relieved by incising the pancreatic duct, permitting the pancreatic juice to drain into a Roux-en-Y limb of jejunum with relief of pain. I suspect that this explanation is too simple for all patients. There are probably a number of mechanisms responsible for the abdominal pain. Perineural fibrosis, for example, has been identified about the sympathetic nerves in some patients with chronic pancreatitis. The question has often been asked: If normal ducts were identified on ERCP and the patient suffers from severe abdominal pain, would a drainage procedure appropriate? In these patients I tend to delay operation and persist with a longer period of medical management, as well as try ganglionic blocks in an attempt to control pain. If operation were elected, I would favor resection if localized disease is found in the distal pancreas. If diffuse disease were present, I would favor drainage as the initial operative approach.

Dr. Howard asked about dye tests as a measure of patency many years after drainage. We have performed ERCP on occasional postoperative patients. The results confirm that the pancreaticojejunostomy may remain open for years, but too few of these have been done to accurately establish patency rates in long term follow-up periods.

Professor Mercadier summarized his experience with large numbers of patients with pancreatitis. He suggested an aggressive approach that involves bypass of the biliary tract and stomach as well as decompression of the pancreas at one operation. We await with interest some additional follow-up data on this procedure.