

3-1976

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### Recommended Citation

Grodsinsky, C.; Schuman, B.; and Brush, B. E. (1976) "Endoscopic Retrograde Pancreatic Duct Cannulation (ERPC): An Aid to Pancreatic Surgery," *Henry Ford Hospital Medical Journal* : Vol. 24 : No. 1 , 9-18.

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# Endoscopic Retrograde Pancreatic Duct Cannulation (ERPC)

## An Aid to Pancreatic Surgery

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*Retrograde endoscopic pancreatic duct cannulation for evaluation of patients with chronic pancreatitis is reviewed over the last two years. Of 40 patients that were endoscoped, 30 had a successful pancreatogram. The X-ray findings fell into three groups: 1) single and multiple stenosis, 2) diffuse narrowing, and 3) apparently normal duct. This procedure proved of value in ruling out or delaying surgical operation in 10 persons. Twenty-one patients underwent operations. Thirteen had a 95% pancreatectomy, one had drainage of a necrotic collection thought to be a pseudocyst and one had a pseudocyst resected. One had a gastrojejunostomy and vagotomy bypassing a stenosis of the second portion of the duodenum and three had exploratory laparotomies. In five of the operated patients, the papilla could not be entered because of retraction, scarring or edema. In eight the correlation of the ductogram and the pathology found in resected specimen was good, while in another seven patients the resected specimen showed much more pathology than was suspected from the ductogram. While the pancreatogram fortifies clinical judgment, it is not always reliable as an indicator of the need for surgical versus medical treatment.*

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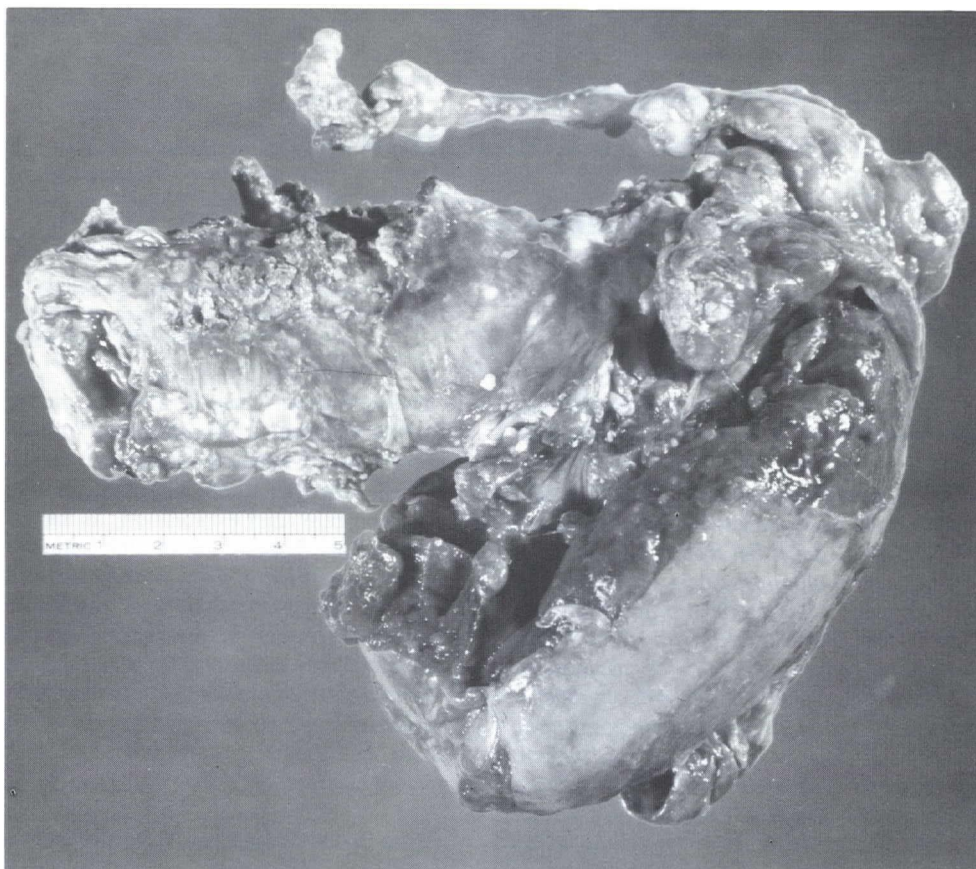
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The indications and operative procedures for the surgical treatment of acute and chronic pancreatitis are not well defined. It is well known that cholecystectomy and/or common bile duct exploration, as for calculus biliary disease, are of little benefit to patients suffering from alcoholic pancreatitis. The various surgical procedures performed on the sphincter of Oddi are beneficial only in those patients with definite stenosis of the sphincter of Oddi. Successful resective surgery of the pancreas at the time of acute inflammation is not often technically feasible.

The most difficult problem in chronic pancreatitis of alcoholic origin is in selecting patients who might benefit from surgery and then tailoring the operation to the individual. Until recently the surgical procedure was usually decided by time-consuming techniques, such as intra-operative pancreatic duct cannulation.<sup>1</sup> Currently, endoscopic retrograde pancreatic duct cannulation<sup>2-6</sup> has become available for the preoperative evaluation of patients with pancreatic disease.

### Clinical material

During a five-year period from 1968 through 1972, 464 patients were treated for pancreatitis at the Henry Ford Hospital. The diagnosis for 138 of these patients was chronic pancreatitis. This report reviews 40 patients with a substantiated diagnosis of chronic pancreatitis for whom a surgical procedure was considered advisable. Endo-



**Figure 1**  
Subtotal pancreatectomy specimen. Gross anatomical deformity. Unsuspected small pseudocyst on superior aspect of pancreas.

scopic retrograde pancreatic duct cannulation (ERPC) was attempted in each patient. To ascertain the efficacy of this procedure, ERPC was evaluated first as a determinant of the severity of pancreatitis and of the presence of unsuspected biliary tract disease. Secondly, the value of ERPC was analyzed for suggesting, preoperatively, the surgical procedure to be employed at the time of operation. Of the 40 attempted cannulations, 30 were successfully accomplished. Twenty of these 30 patients underwent operations.

Anatomic findings provided by ERPC could be categorized into three groups relative to the surgical management of chronic

pancreatitis. These will be illustrated by three case reports.

### Case 1

*ERPC to indicate the severity of chronic pancreatitis.*

A 32-year-old man, with a previous history of abdominal pain following the ingestion of alcohol, was admitted with the diagnosis of recurrent pancreatitis. His serum and urine amylase levels were within normal limits, but the serum lipase was 2.3 units (normal 0-1.5 units) and the serum calcium 7.3 mg% (normal 8.7-10.7 mg%). His serum was hyperlipemic (milky). Forty-eight hours later his condition deteriorated and abdominal exploration was carried out. Hemorrhagic pancreatitis was found and external drainage was instituted. The postoperative course was stormy

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**Table I**

Case	Age and Sex	Admissions for recurrent episodes		Etiology	Previous Surgery
		Number			
1	44 M	4		Alcohol	Expl. and drainage (elsewhere) (years ago)
2	49 F	3	Hypert.	"	8 years ago cholecystectomy (no stones found) CBDE - sphincterotomy
3	34 M	4 in 2 of these admissions: Bronchopn. and Hypovolemic Shock	"	"	Expl. and drainage (1 year before)
4	37 F	4	"	"	None
5	37 M	3	"	"	None
6	38 M	2 (several others elsewhere)	Narc. addict Diabetic on oral medication and diet	"	None
7	36 M	2	X Rays suggesting pseudocyst	"	None
8	38 M	3		"	None
9	27 F	1		"	None
10	35 F			Unknown	None
11	38 M	5		Alcohol	
12	40 M	4	Diabetes	Alcohol	Exp. lap. and drainage

with bronchopneumonia and prolonged fluid and electrolyte imbalances. The patient's condition gradually improved; all gastrointestinal studies showed no abnormalities. Only the common bile duct was visualized by ERPC, cannulation of the papilla of Vater being difficult. Ten months later, the patient again appeared in the Emergency Room with the same clinical picture of recurrent pancreatitis. He was severely ill, with gram negative bronchopneumonia. Serum and urinary amylase examinations were again normal. He was treated with fluid, electrolytes, calcium and antibiotics. Urinalysis showed a 4+ glycosuria. Eleven days after admission, a clear liquid diet was prescribed. Twenty days after admission repeat x-ray studies of the gastrointestinal tract were within normal limits. A second attempt to cannulate the papilla of Vater was unsuccessful because of marked edema.

At operation, 30 days after admission, severe chronic and acute inflammation of the pancreas was evident. Great technical difficulty was encountered in approaching the pancreas. Subtotal pancreatectomy was performed (Figure 1).

Postoperative respiratory insufficiency necessitated ventilatory support. Bronchopneumonia was treated with Gentamycin. A wound infection developed. Diabetes, which was evident immediately following operation, was controlled appropriately. Two weeks after the operation a gastric ulcer, thought to be a stress ulcer, was discovered. Discharged 20 days after the operation, the patient has been well for approximately two years.

### Comments

In some patients, ERPC can reveal pathological features of the pancreatic ductal system resulting from pancreatitis, such as stenosis, beading or dilatation. In others, cannulation of the papilla of Vater may not be possible because of the presence of edema, retraction or stenosis of the sphincter

Table II

Case	P. O. COURSE		Hospital Stay (P. O.)	Late Complications	Follow-up
	Insulin Requirements	Complications			
1	Reg. 2 weeks Lente 4 mos. Now on diet	Atelectasis	15 days	None	25 mos.
2	Reg. 2 days On diet	Wound infection	17 days	None	19 mos.
3	Reg. 6 days On diet	Stress gastric ulcer Atelectasis	23 days	None	20 mos.
4	Reg. 4 days Lente since	Hypoglycemic Shock (48 hrs. p. o.)	14 days	Continued to be a psych. problem	15 days
5	Reg. 3 days	None	10 days	None	14 mos.
6	Reg. 5 days Diet	Intraabd. abscess (Proteus morgagnii)	22 days	Abd. pain 2 mos. (duodenal deformity by UGI)	20 mos.
7	Reg. 3 days	None	14 days	None	14 mos.
8	Reg. 10 days Lente since	Wound infection	2 weeks	None	8 mos.
9	Reg. 1 week no insulin since		3 weeks	None	9 mos.
10	Reg. 5 days	Atelectasis	2 weeks	None	7 mos.
11	Reg. 1 week	Wound infection	10 days	None	5 mos.
12	Reg. 1 week L. Insulin since (pre-op diabetic)	None	12 days	Readmitted for Keto-acidosis	10 mos.

of Oddi. In some patients only the common bile duct is visualized, as in this case. These two findings, however, may indirectly indicate the presence of severe disease of the pancreatic parenchyma encroaching upon the main pancreatic duct. Although radical pancreatic resection is often complicated by diabetes mellitus and nutritional difficulty postoperatively, in some instances nothing short of a pancreatic resection will offer relief of disabling symptoms.

Eleven other patients underwent pancreatic resection. Significant historical data are

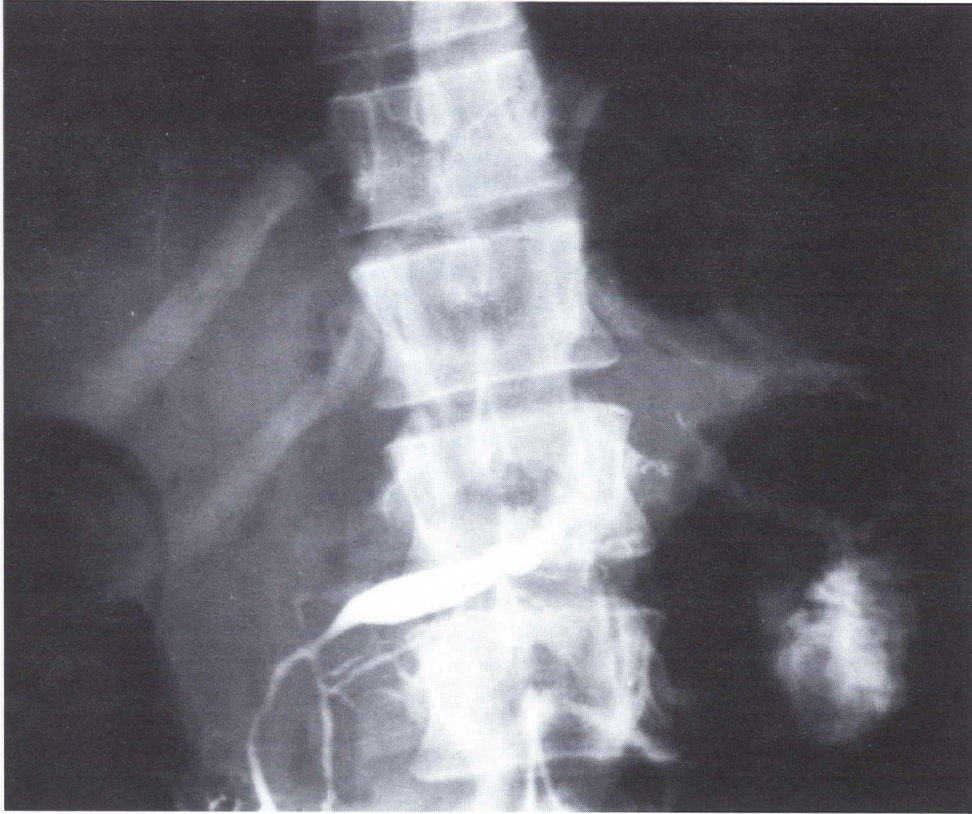
summarized in Table I. Their postoperative courses and follow-up information are shown in Table II.

### Case 2

*ERPC to permit selection of the operative procedure.*

This 37-year-old woman with a history of chronic pancreatitis was admitted for recurrent abdominal pain and distention. A leucocytosis of 15,500/cu mm with a shift to the left and a blood sugar of 200 mg% were present. The serum amylase on admission was 212 units (normal

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**Figure 2**

**ERPC showing stenosis of the duct in the head of pancreas with distal dilatation.**

60-150 units). Subsequently, this decreased to normal levels. Serum calcium and phosphorus levels and urine amylase were within normal limits. The serum lipase was elevated to 3.8 units (normal 0-1.5 units).

A tender epigastric mass was present. The patient's condition improved with medical treatment. Radiologic studies of the gastrointestinal tract were within normal limits. The pancreatic duct cannulation showed proximal obstruction of the pancreatic duct with distal dilatation (Figure 2). No evidence of a pseudocyst was found. Following cannulation, she developed abdominal tenderness for three or four days. Later, a positive Papanicolaou smear was reported, and a hysterectomy performed. This necessitated delay of pancreatic surgery to permit recovery. Six months later, she was readmitted to the hospital and underwent a distal pancreatectomy and a distal pancreateo Roux-en-Y jejunostomy.

The postoperative course was uneventful. She has been free of symptoms for the last year.

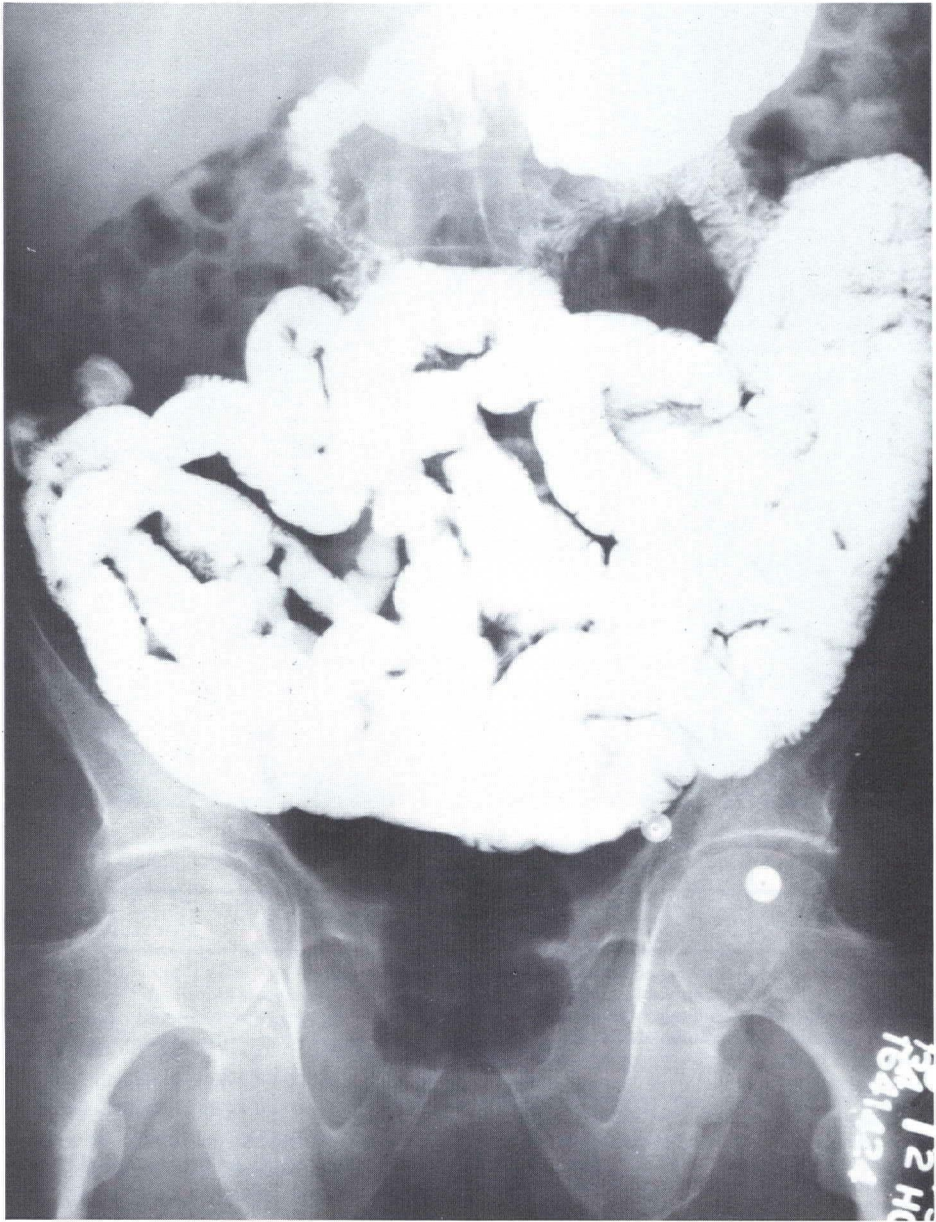
### Comments

The critical value of endoscopic cannulation of the pancreatic duct, by defining the presence and location of pancreatic duct obstruction, is illustrated by this patient. A good correlation was present between the preoperative study and the surgical findings, permitting the selection of an operation of reduced magnitude rather than a subtotal pancreatectomy.

### Case 3

*Discrepancy between the ERPC and operative findings.*

This 54-year-old male was referred because of

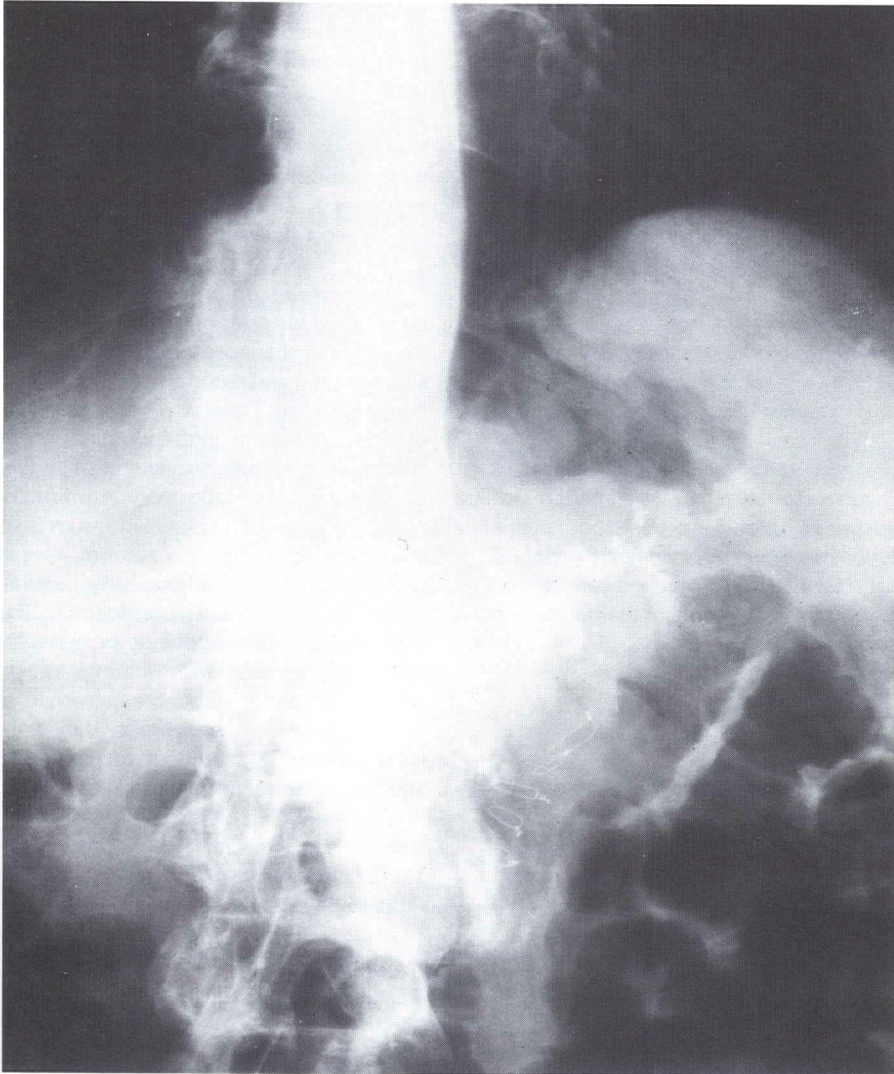


**Figure 3**  
UGI radiographic study showing stenosis of 2nd portion of duodenum and evidence of extrinsic pressure from pseudocyst of pancreas on antrum of stomach.

suspected gastric outlet obstruction. His past history revealed chronic alcoholism and several episodes of acute pancreatitis, one of which required an exploratory laparotomy and resulted in an attempt at drainage of a pseudocyst of the pancreas. At the time of the present admission, he complained primarily of vomiting after eating

either liquids or solid foods. Radiologic studies of the upper gastrointestinal tract revealed partial obstruction of the first and second portions of the duodenum, in addition to compression of the stomach by a suspected pancreatic mass. An area of stenosis was evident at the junction of the first and second portion of the duodenum (Figure 3).

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**Figure 4**  
ERPC showing proximal small pseudocyst with dilatation and multiple stenosis of the distal pancreatic duct.

The pancreatic duct cannulation revealed the presence of a small cyst in the head of the pancreas and multiple segments of stenosis and dilatation of the duct (Figure 4). Following the diagnosis of chronic pancreatitis and pseudocyst formation, an operation was performed. Approximately two hours were required to identify the pancreas, during which time the patient lost 2500 ml of blood. The spleen was mobilized and distal pancreatectomy was performed. Since there was a discrepancy between the size of the mass seen at operation and that shown by the cannulation, an intraoperative pancreatogram was performed. This showed the cyst cavity to be larger than anticipated and the pancreatic duct to be dilated.

Therefore, to preserve pancreatic function, a cystogastrostomy was elected, since the cyst was presenting at the posterior wall of the stomach. A distal pancreatectomy with a pancreato jejunostomy using a Roux-en-Y loop of jejunum was also performed. The patient made an uneventful recovery. He was discharged two weeks after operation and has been well for the last eight months.

### Comments

In approximately one-half of our cases, a good correlation was found between the



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preoperative endoscopic study and the intraoperative findings. This permitted preoperative planning of the operation. There was also a group of patients in whom the papilla of Vater could not be cannulated because of edema, stenosis or retraction. This finding gave us indirect evidence of severe and extensive parenchymatous and ductal involvement. Knowledge of the distortion of the pancreatic anatomy by disease had enormous importance not only in planning the operation but on the total length of the procedure. There is a group of patients, however, in whom the intraoperative findings may be more severe or different than those evidenced by the endoscopic procedure, as in case #3. In our opinion, in such patients, intraoperative pancreatograms should be performed. Although this involves a more complicated and prolonged technical procedure, it may indicate an operation which spares some of the pancreatic parenchyma.

### Discussion

Access to the pancreas has always been frustrating from both a diagnostic and therapeutic standpoint. Because the pancreas is hidden in a retroperitoneal position, evidence of abnormalities is evident only when advanced disease is present. This holds particularly true in chronic pancreatitis, where the surgeon finds that, after hours of tedious dissection and considerable loss of blood, the specific operation for the particular patient is still not evident.

Although ERPC is costly and requires considerable experience, the same information would be obtained by exploratory laparotomy only after a difficult technical procedure in the retroperitoneal area or after opening the duodenum or the common duct. Also, splenectomy may be required to cannulate the pancreatic duct. All such procedures can result in a considerable loss of blood. Furthermore, such operative steps bring one merely to the door of more cumbersome x-ray techniques.

Watson<sup>2</sup> first visualized the papilla of Vater endoscopically in 1965 and McCune<sup>3</sup> first cannulated it in 1968. But, it was not until later, through the efforts of Japanese and English investigators, that this procedure was frequently used for the investigation of pancreato-biliary disease. With time and experience, successful cannulation is possible for most patients.

Our review comprised 40 patients with established histories of chronic pancreatitis. The clinical diagnoses were based on episodes of pain and recurrent attacks requiring hospitalization. There was definite evidence of ileus, persistent intraabdominal inflammation, and laboratory evidence of pancreatic disease. The laboratory confirmation usually consists of an elevated serum lipase, hyperlipemic serum because of elevated triglycerides, and, infrequently, elevated serum amylase and hypocalcemia. There was often a history of one or more exploratory laparotomies, with findings of pancreatitis. Diabetes of pancreatic origin and severe pancreatic enzymatic deficiencies were present in a number of patients. An attempt to cannulate the papilla of Vater was made on all 40 patients; 30 had successful pancreatograms. Our 75% success rate for ERPC compares favorably with that of other workers.<sup>3-5</sup>

We evaluated the usefulness of ERPC in chronic pancreatitis as to: 1. efficacy in determining the severity of the disease and objective indications for operation and, 2. usefulness in selecting, preoperatively, the correct surgical approach for each individual patient.

The analysis of the endoscopic protocols for our 30 patients with chronic pancreatitis indicated three major categories. In the *first* category cannulation was not possible because of the presence of edema, retraction or stenosis of the sphincter of Oddi. The papilla was observed in over 90% of the endoscopic procedures. This in itself can provide valuable information. In five of our patients the papilla could not be entered because of

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these changes. All such patients showed findings at operation suggestive of extensive and severe chronic pancreatitis. The surgical specimens from resections also showed both parenchymatous abnormalities and abnormalities of the major pancreatic duct.

The second category was characterized by single or multiple stenosis of the pancreatic duct, sometimes with diffuse narrowing or beading (Figure 5). For eight patients there was good correlation between the preoperative ductogram and the operative findings (Table III). This was also shown by the pathological findings of the resected specimens. In all eight patients the endoscopic procedure was invaluable in verifying the diagnosis and in planning the surgical approach. In the series of Braasch and Gregg,<sup>4</sup>

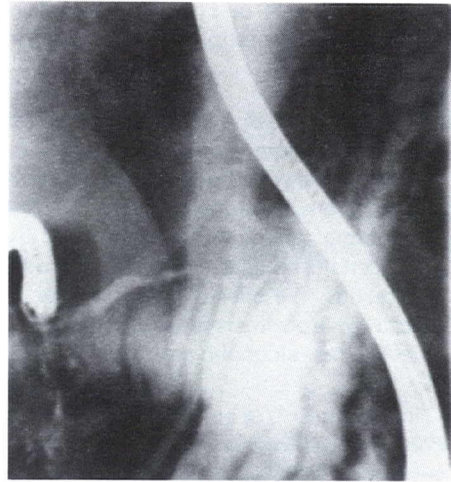


Figure 5  
ERPC showing dilatation, stenosis and areas of "beading" in the main pancreatic duct.

Table III

Case	Pancreatic duct Catheterization	Intraoperative Findings	Pathology
1	Irregularity - Stenosis	Acute and chronic inflammatory changes - nodular, hard pancreas	(fibrosis of acinar and islets) Chronic pancreatitis with pseudocyst
2	Calcifications - Dilatation - suggesting obstruction at the head	Acute inflammation hard, calcified pancreas fat necrosis	Chronic and acute pancreatitis - fat necrosis - calcification
3	Unsuccessful (because of edema, retraction?)	Acute and chronic inflammation - nodularity -	Necrosis - abscesses - acute and chronic inflammation
4	Unsuccessful	Chronic inflammation hard - nodular gland	Fibrosis - calcification
5	Irregularity - body beading - tail	Chronic inflammation	Nodular fibrosis calcifications
6	Unsuccessful (several attempts)	Chronic nodular changes	Duct encroached by fibrosis Acinar and islet tissue replaced by hyaline fibrosis
7	Unsuccessful (edema, retraction?)	Necrotic material no pseudocyst	-----
8	Successful - diffuse irregularity	Chronic inflammation hard - nodular pancreas	Diffuse fibrosis and calcification

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the changes seen by ERPC also correlated well with the endoscopic findings in three of nine patients.

The third category was characterized by an apparently normal pancreatic duct. Surgical operations were postponed for 10 of 30 patients. This decision was based not only on a normal appearing ductogram but also on uncertain clinical evidence of chronic pancreatitis. We offered these patients another avenue of either medical or psychiatric relief for their alcoholic problems.

In one-third (7) of our operated patients, a normal-appearing pancreatic duct was suggested by ERPC. Evidently such patients have severe parenchymatous disease without involvement of the main ducts. In these seven patients, both the intraoperative findings and the microscopic studies showed much more pathology than was suspected by ERPC. Braasch and Gregg,<sup>4</sup> as well as others,<sup>7-9</sup> have also mentioned the occurrence of chronic pancreatitis with normal appearing pancreatic ducts.

### Summary

The accurate objective diagnosis, clear surgical indications and the selection of the correct operation for each individual patient in chronic pancreatitis are notoriously difficult.

From our experience, ERPC is a diagnostic tool that may add significant information in the evaluation of patients with pancreatic disease. In planning the surgical procedure, it has obvious advantages over intraoperative pancreatography.

The method demonstrates the anatomy of the pancreatic duct system and the various pathological features that can develop in the clinical course of chronic pancreatitis. It may, therefore, suggest drainage and dilatation in patients with stenosis, thus sparing resection of some of the pancreatic tissue.

This procedure proved of value in ruling out or delaying the need for surgical operation in ten patients. Clear pancreatograms can be helpful when they show stenosis, dilatation, "beading" or pseudocyst. Such delineation helps in determining the proper surgical procedure. In seven of 20 operated cases, however, there was a discrepancy between the findings by ERPC and those at time of operation and, later, by pathology. In patients of this type, intraoperative pancreatography still may be needed.

The endoscopic pancreatogram is valuable in fortifying clinical judgment in diagnosing chronic pancreatitis and in planning the correct operation. It cannot, however, be considered always reliable as an indication for the need of surgical versus medical treatment.

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