

## The use of pancreatic ductoscopy in the operative management of benign and malignant pancreatic disorders

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**Abstract.** Direct visualization of the pancreatic duct was helpful in decision making during complex pancreaticobiliary operations. Two-, 3-, or 5-mm scopes were introduced into the pancreatic ducts of 32 patients with pancreatic disorders. Scopes were passed into the ductal system of: (1) 16 patients undergoing pancreaticojejunostomy; (2) six patients undergoing pancreaticoduodenectomy; (3) four patients with pancreatic pseudocysts or choledochal cysts; (4) two patients undergoing resection of the pancreatic tail; and (5) two patients undergoing accessory ductoplasty for pancreas divisum or stricture. Eight patients had calculi removed utilizing the scope, and multiple strictures were identified and filleted. Pancreatic ductoscopy was used in two patients to document successful sphincteroplasty of an accessory duct. In two instances benign pancreatic duct tumors were removed. Pancreatic ductoscopy was used to search for coexistent duct neoplasms in the eight patients who underwent resection. The technique permits intraoperative inspection, biopsy, and removal of lesions intrinsic to the ductal system. Combined with surgical procedures this endoscopic method proved a useful adjunct in difficult cases.

**Key words:** Pancreatic ductoscopy — Pancreaticojejunostomy — Pancreatitis — Pancreatic resection endoscopy

Direct evaluation of the pancreatic duct morphology would seem useful for intraoperative decision making. A variety of pathologic conditions including strictures,

stones, and neoplasms and the adequacy of reconstructive procedures can be evaluated using currently available video endoscopic equipment. A preliminary report of this technique in four patients was presented in 1989 [1]. Intraoperative pancreatic ductoscopy has now been used in patients undergoing a variety of pancreatic operations.

### Materials and methods

From August 1990 through August 1992, 32 patients undergoing operations on the pancreas or pancreatic duct underwent intraoperative pancreatic ductoscopy. The instrumentation used for ductoscopy included a 2-mm angioscope (Microvasive, Inc.), and 3- and 5-mm flexible choledochoscopes (Olympus, Inc.). The scopes had therapeutic ports for the introduction of baskets or forceps. Depending on the particular procedure, mobilization of the pancreas was performed using a combination of the Kocher maneuver and/or exposure of the anterior surface of the gland through the lesser sac. In patients who underwent Peustow procedures, the duct was identified by palpation, aspiration with a 20-gauge needle, or ultrasonography. Once the duct was located, a limited ductotomy was performed and the scope was introduced (Figs. 1, 2). In patients who underwent pancreaticoduodenectomy, pseudocyst drainage, resection of a choledochal cyst, or sphincteroplasty, the scope was introduced via the opening in the bile or pancreatic ducts.

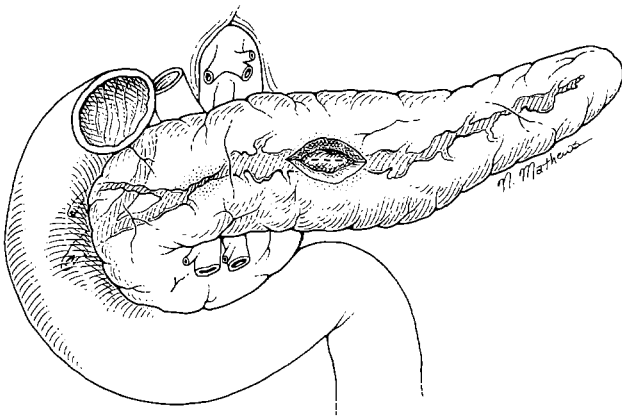
The 32 patients ranged in age from 25 to 77 years (mean 49). Twenty-one of the 36 patients (66%) were male. Chronic pancreatitis in 21 patients, ETOH related in 14 patients (67%), was the most common indication for operation. Other cases of chronic pancreatitis were related to pancreas divisum, gallstones, or pancreatic polyps. Ten patients had ductal strictures demonstrated on preoperative ERCP or identified by ductoscopy, and 11 patients had pancreatic duct stones. The findings varied according to the procedure, and therapeutic maneuvers were possible in 11 cases (34%) (Table 1).

### Pancreaticojejunostomy

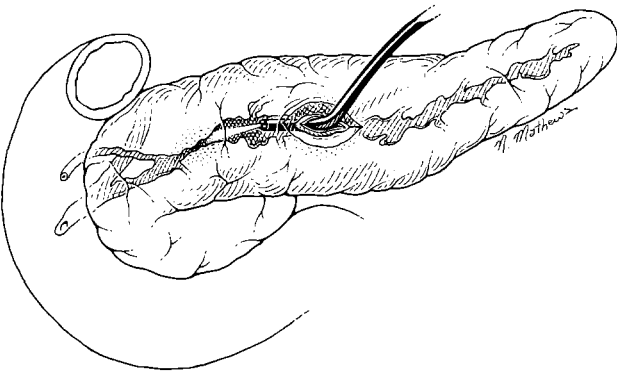
Following mobilization of the stomach and colon and after localization of the pancreatic duct using palpation, aspiration, and/or ultrasonography, partial ductotomy was performed. The scope was passed into the tail and toward the papilla. The ductotomy was ex-

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**Fig. 1.** The anterior surface of the pancreas is exposed and the duct identified with aspiration, palpation, or ultrasound. The anterior surface of the duct is incised with electrocautery.



**Fig. 2.** The ductoscope is introduced via the ductotomy and may be passed proximally and distally to identify strictures, stones, or tumors.

tended beyond the extent of the last identifiable stricture, thus assuring complete drainage of the ductal system. Seven patients (44%) undergoing pancreaticojejunostomy had strictures thus treated.

Five patients (31%) had inadequate evaluation of the pancreatic duct by ERCP due either to an ampullary or distal stricture. Removal of foreign bodies via ERCP failed in five additional cases (three stones and two pancreatic duct stents) in which removal was possible intraoperatively using the ductoscope and forceps or a basket. In the course of ductoscopy stones were identified and removed using a basket or forceps in a total of eight patients (50%). Stones were associated with strictures in five of the eight cases. The technique added little to cases in which an adequate ERCP revealed no stones or strictures.

No patients suffered postoperative pancreatitis, pancreatic leak, or pseudocyst. Average postoperative stay was 7 days. Three of the patients have gone on to subtotal pancreatectomy for recurrent pain.

### Pancreaticoduodenectomy and partial pancreatectomy

Following transection of the pancreas 2-mm or 3-mm scopes were passed into the ductal systems of six pa-

tients undergoing pancreaticoduodenectomy. A detailed search was made for ductal epithelial abnormalities, strictures, and stones. Once abnormalities were excluded, a routine pancreaticojejunostomy reconstruction was performed. Complications were limited to bleeding which spontaneously resolved on postoperative day 5 in one patient and pancreatic leak in another patient. This was treated with octreotide and TPN and resolved by postoperative day 14.

Two patients underwent distal pancreatectomy for severe pancreatitis involving primarily the tail. Following transection of the pancreas the scope was introduced toward the head. In both patients, strictures in the head were identified and in one patient a ductal stone was identified and removed with forceps. One patient had identification of a pedunculated ductal tumor. This was removed with a snare and pathology revealed villous adenoma. One patient (37-year-old male) developed postoperative left upper quadrant abscess requiring percutaneous CT drainage and was discharged on postoperative day 25.

### Ductoplasty and pseudocyst

Two patients underwent examination of the pancreatic duct following sphincteroplasty. One had undergone accessory sphincteroplasty for pancreas divisum and the scope was passed to ensure adequate size of neosphincter and to look for ductal abnormalities. A pedunculated tumor was identified, along with several stones. The polyp was removed revealing papilloma, and the stones were removed with forceps. The second patient with a familial polyposis syndrome had undergone resection of a 4-cm duodenal villous adenoma with reconstruction of the pancreatic and bile ducts. Examination of the pancreatic duct revealed multiple small pedunculated tumors which were removed with a snare. The pathologic diagnoses of these tumors were villous adenoma.

### Pseudocyst

Two patients with pancreatic pseudocysts underwent cystostomy and insertion of 5-mm scopes. One patient was hemorrhaging into the pseudocyst. The bleeding site was identified with the ductoscope, the cystostomy was extended, and the bleeding site was oversewn. The second patient had a simple pseudocyst and examination via the cystostomy revealed the site of ductal communication. In both patients enterocystostomy was performed without difficulty.

The patients underwent examination of the pancreatic duct during resection of choledochal cysts. In both cases the pancreatic duct orifice was identified, ensuring proper level of resection and oversewing of the distal common bile duct. In one patient (25-year-old female), stones in the pancreatic duct orifice were identified and removed.

### Discussion

Evaluation of pancreatic ductal morphology and pathology is important in a variety of disorders that re-

**Table 1.** Therapeutic pancreatic ductoscopy

Patient	Procedure	Pathology	Intervention
61M	Pancreaticojejunostomy	Stone	Extraction
37M	Pancreaticojejunostomy	Stone & stricture	Extraction, division
27M	Pancreaticojejunostomy	Stone & stricture	Extraction, division
44F	Pancreaticojejunostomy	Retained stent	Extraction
59M	Pancreaticojejunostomy	Stone, retained stent	Extraction
42M	Pancreaticojejunostomy	Stone	Extraction
28M	Pancreaticojejunostomy	Stone	Extraction
35F	Pancreaticojejunostomy	Stone	Extraction
25F	Pancreaticojejunostomy	Stone	Extraction
54F	Sphincteroplasty	Polyps	Removal
70F	Sphincteroplasty	Polyps	Removal

**Table 2.** Usefulness of pancreatic ductoscopy

Useful
Poor or absent preoperative ERCP
Intraductal lesions (stones, polyps, stents)
Unclear ductal pathology
Unclear ductal anatomy
Not useful
Pancreatic duodenectomy
Routine pancreaticojejunostomy when ERCP adequate
Sphincteroplasty when duct clear beyond stricture

quire operative intervention including chronic pancreatitis, pseudocysts, neoplasms, ductal strictures, and pancreas divisum. Currently available endoscopic technology may aid in such an evaluation. Experience with intraoperative pancreatic ductoscopy for diagnosis and/or therapy of intraductal pathology in 32 patients showed the technique to be easily performed. Therapeutic maneuvers were possible in 34% of the cases. These findings extend an earlier experience [1] and have helped identify cases in which the technique is a useful adjunct to currently available technologies such as ultrasonography, intraoperative pancreatography, and/or ERCP.

If multiple strictures are known to exist from the head to the tail of the pancreas, then a full-length ductotomy will be necessary, and ductoscopy will be of no benefit (Table 2). Contrary to the traditional view, we feel that patients with focal duct obstruction by one or two strictures or stones do not require so extensive a ductotomy. The potential morbidity of the lengthy pancreaticojejunostomy and incision of the duct in the pancreatic head may be avoided if ductoscopy identifies focal pathology.

Preoperative ERCP is routine in pancreatic surgery. Attempts at the test occasionally fail secondary to ampullary or ductal anatomy (stricture, obstruction, or divisum), and therapeutic maneuvers such as stone or stent extraction are even less reliable. Pancreatic ductoscopy proved useful as an alternative to pancreatic ductography in such cases to identify the actual ductal anatomy and remove stones, stents, or tumors. Identification of strictures may allow for more or less extensive ductotomy as necessary in pancreaticojejunostomy. The technique was helpful in choledochal

cyst resection if the site of the pancreatic duct junction was in question.

When preoperative ERCP excluded intraductal pathology or identified clearly any obstruction, ductoscopy added little to the management. Likewise, in pancreaticoduodenectomy and routine sphincteroplasty the technique was superfluous. The major complication rate in this series was 12.5% (4/32). It is unlikely that the complications described were attributable to ductoscopy since acute pancreatitis was not encountered. It is theoretically possible that high-pressure irrigation via the endoscope could induce back pressure and pancreatitis; thus, care should be taken not to wedge the scope tightly into the ductal system.

Intraoperative ultrasonography is currently used in pancreatic surgery to identify masses, ducts, and cystic lesions. It is relatively insensitive, however, in identifying intraductal pathology. Ultrasound was used to identify the pancreatic duct prior to performing ductotomy in most of the cases in this series. The use of small intraluminal ultrasonic probes has been described in the biliary tree [2, 4]. These probes may be passed endoscopically via the papilla or intraoperatively via a ductotomy. Experience with these probes in the biliary tree showed them to be a useful alternative to intraoperative cholangiography, though their use in the pancreas has yet to be described [3].

In summary, pancreatic ductoscopy is an adjunct to the intraoperative evaluation of the pancreatic duct. It is useful in complex cases of pancreatic ductal anatomy for diagnosis and may be used therapeutically in selected cases.

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