Radiographic evaluation of pancreatico-jejunal shunts

E. W. MILLER, H. I. GOLDBERG, S. B. GOLDBERG, AND H. SHAPIRO

From the University of California Hospital, San Francisco, California, U.S.A.

SUMMARY This paper describes opacification and identification of two surgically constructed pancreatico-jejunal shunts. A fiberoptic panendoscope was used with retrograde injection *via* the ampulla of Vater (ERCP). This procedure makes possible more accurate anatomical evaluation and so more precise clinical appraisal of both pre- and post-surgical states.

With the development of surgical shunts to adjacent gut and hence more adequate internal drainage of pancreatic secretions, the number of patients relieved of the agonizing pain of relapsing pancreatitis has increased (Puestow and Gillesby, 1958; Gillesby and Puestow, 1961; White, 1965; Warren and Mountain, 1971; Way *et al.*, 1974). Not only do the shunting procedures relieve pain but they may halt the destruction of pancreatic tissue with its loss of both exocrine and endocrine function.

One problem in the postoperative evaluation of these patients has been to determine the continued patency of the shunt itself. In the past, this evaluation has been largely a combination of the history of amelioration of pain, the clinical and laboratory evaluation of the activity of the pancreatic enzymes, and post-surgical insulin requirements. In spite of complete laboratory studies, such evaluations have often been less than satisfactory.

With the development of fiberoptic endoscopy and the ability mechanically to inject contrast material into the pancreatic ducts through the panendoscope, a more careful study of the gland has been possible preoperatively. Better selection of patients both for drainage procedures and for a combination of resection and drainage is now also possible (McCune *et al.*, 1968; Oi *et al.*, 1970; Takagi *et al.*, 1970).

Until recently, however, postoperative evaluation was still fraught with frustration.

Recently, we have had the opportunity to study two patients, some months after surgery, who had undergone pancreatico-jejunal shunts. The patients were evaluated using standard laboratory and clinical tests. In addition, panendoscopy was carried out

in both patients with visualization of the duct systems of the pancreas.

In each case, we were able, fortunately, not only to see the pancreatic ducts themselves, but to visualize the pancreatico-jejunal shunts. In the first case, we found that adequate drainage was still taking place and in the second that drainage was unsatisfactory and further surgery was indicated. Thus, the radiographic procedures were crucial in evaluating their postoperative status.

Case histories

CASE 1

J.C. was a 34 year old black male with a long history of drug abuse and of alcoholism dating back to the age of 15 years. Over the last seven or more years, he had developed diabetes and was requiring 40 units of NPH insulin per day. He had been recently detoxified and was off heroin. In addition to the diabetes, he had noted over the past three or four years a change in his stools, which had become frothy, foul-smelling, and frequent.

He experienced chronic weight loss and suffered severe upper abdominal distress after any intake of food. The abdominal pain was referred to the back in the typical pancreatic radiation.

Physical examination showed a well-developed black male with evidence of chronic weight loss. There was tenderness on deep pressure in the epigastrium but no enlargement of the liver. He had a moderate anaemia. Radiographs of the abdomen demonstrated calcifications throughout the entire pancreas and calcified stones in the gallbladder. An upper gastrointestinal series was entirely normal. The oral cholecystogram demonstrated a well-opacified gallbladder containing numerous small

stones with good contraction after a fatty meal. The total bilirubin was normal and the alkaline phosphatase was the only elevated liver enzyme.

The patient was maintained on a 3000 calorie diabetic diet and 40 units of NPH insulin per day. He was given pancreatic supplements and oral iron.

It was thought that he had a chronic relapsing pancreatitis and that visualization of his pancreatic duct system was indicated.

Accordingly, he was transferred to the University of California Hospital in San Francisco and on 12 September 1974 endoscopic retrograde cholangiopancreatography (ERCP) was carried out.

Excellent visualization of the pancreatic duct was obtained (Fig. 1a). The main duct was dilated from the head of the pancreas to the tail. The side branches were well visualized and were also grossly dilated, giving a 'chain of lakes' appearance. After removal of

Fig. 1 Case 1. (a) Preoperative appearance of a massively dilated main pancreatic duct and side branches typical of chronic pancreatitis. (b) Post pancreatico-jejunostomy pancreatogram shows a filled main pancreatic duct with early drainage into the jejunal segment (arrows). Note that duct dilatation and tortuosity has been altered by surgical drainage. (c) After the fiberoptic endoscope had been removed, the contrast material in the anastomotic jejunal loop is more clearly seen. Some contrast material has drained from the ampulla into the duodenum (arrow). (d) Lateral view of main pancreatic duct (black arrows) showing the anterior location of the segment of jejunum draining the pancreas (white arrows).

the cannula delayed films at 30 minutes showed only fair emptying of the pancreatic duct. Attempts to visualize the common bile duct were unsuccessful.

After ERCP examination, the patient experienced severe pancreatitis which was treated with sedation and gastric decompression using a nasogastric tube. During this pancreatitis, a pancreatic sonogram demonstrated pancreatic enlargement with no evidence of cyst formation.

After the patient had recovered, he was transferred to Children's Hospital in San Francisco and was taken to surgery on 21 October 1974 (Dr E. W. Miller). At operation, moderate enlargement and fatty infiltration of the liver was noted. The gallbladder was tense and contained a multitude of small stones. The biliary duct system was normal on intraoperative cholangiography. The pancreas was a firm, scarred, densely fibrous gland, shrunken in size. The pancreatic duct was dilated and contained 10 ml or more of milky fluid. A pancreatico-jejunostomy with Roux-en-Y jejunojejunostomy (Puestow procedure) and a cholecystectomy were performed.

After recovery from the surgical procedure, the patient was discharged on a 3 000 J diabetic diet. The insulin requirement dropped from 40 to 25 units NPH per day and he was instructed to continue the use of the pancreatic supplements. He continued to do well and returned to school.

In February of 1975, because of the recurrence of upper abdominal distress, the patient was readmitted to the University of California Hospital in San Francisco and a repeat panendoscopy with ERCP was carried out.

Injection of contrast material rapidly filled a dilated and ectatic ductal system (Fig. 1b). Very early in the course of injection, contrast material was seen to enter the loop of jejunum which was anastomosed to the mid-portion of the pancreatic duct and, throughout the procedure, contrast material readily spilled from the pancreatic duct into the jejunum through the Roux-en-Y anastomosis (Fig. 1 c and d).

The recurrence of the patient's symptoms, though mild, were found to be due to a resumption of his drinking, and he was instructed to stay away from alcohol entirely.

He was discharged improved on his insulin maintenance and prescribed diet and has remained well since, gaining 7 kg (15 lb) in the 11 months since his second ERCP.

Comment

By employing endoscopy and retrograde injection of the pancreatic duct it was possible to demonstrate that the pancreatico-jejunostomy was functioning

effectively and that the recurrent symptoms were not due to obstruction of the surgical drainage.

CASE 2

The second patient, a 49 year old black female school teacher, had a long history of chronic pancreatitis which presented with severe abdominal pain and required several hospitalizations beginning in 1971. The clinical diagnosis of pancreatitis was made shortly after the onset of her pain. With repeated hospitalizations she showed increasing pain and weight loss, but failed to develop diabetes or steatorrhea. Gallbladder studies showed no evidence of stones within either the gallbladder or duct system. The upper gastrointestinal series showed no evidence of ulcer. There was no history of significant alcohol intake or of drug abuse.

Because of the recurrent and increasingly severe pain and because of a history of surgery for malignancies of both the breast and the cervix, coeliac and superior mesenteric arteriograms were performed in July 1973 which demonstrated no evidence of malignancy in the upper abdomen but were consistent with chronic pancreatic disease.

She continued to work until February 1974, when, because of increasing pain and weight loss, she underwent surgery. A partial resection of the body and tail of the pancreas was carried out with a pancreatico-jejunostomy and a Roux-en-Y jejunum-to-jejunum drainage (Dr J. Gordon Holmes). The biliary system, in keeping with the negative cholecystogram, failed to show any evidence of gross disease.

After surgery, the patient continued to suffer from intermittent upper abdominal pain with meals and developed a diabetes easily controlled on insulin and steatorrhea which responded to oral pancreatic enzymes. She required frequent medication for pain.

An upper gastrointestinal series in October 1974 was normal and an abdominal sonogram performed on 14 February 1975 showed no enlargement of the pancreas or pseudocyst formation.

Because of the pain and weight loss in the presence of what appeared to be adequate replacement therapy, ERCP was performed in February 1975 (Alta Bates Hospital, Berkeley, California). The contrast material filled the pancreatic ducts satisfactorily and a small amount flowed distally into the pancreatico-jejunal anastomosis and so on into the jejunum.

The main pancreatic duct appeared moderately dilated and there was a narrowing at the pancreatico-jejunal anastomosis (Fig. 2 a-c). It was thought that a stone partially obstructed the drainage at this point.

For these reasons and because of continued pain,

Fig. 2 Case 2. (a) Retrograde pancreatogram demonstrating abnormal side branches in the region of the head of the pancreas. The main pancreatic duct narrows suddenly (arrow) at the site of pancreatico-jejunostomy. (b) Contrast material drains from the main pancreatic duct into jejunum (solid arrows). The anastomosis appears as a narrow channel (open arrow). (c) A radiograph taken 30 minutes after contrast material was instilled in the main pancreatic duct, and after the cannula had been withdrawn from the ampulla, shows retention of pancreatic duct contents.

a total pancreatectomy seemed indicated. Accordingly, on 16 April 1975, in addition to the total pancreatectomy, a choledochojejunostomy and a revision of the Roux-en-Y jejunal anastomosis was carried out. The patient's postoperative course was quite satisfactory, and she was discharged improved. Examination of the resected specimen demonstrated severe chronic pancreatitis with multiple calculi partially obstructing the main duct.

Follow-up examination in May 1975 found the patient gaining weight and looking well. Her diabetes was under control and with oral enzymes her digestive functions appeared to be satisfactory. Nine months after her last surgery she has occasional abdominal discomfort. Her weight is stable. The question of possible malignancy remains.

Comment

Again, the value of endoscopy and retrograde injection of the pancreatic duct was demonstrated.

It was apparent that the patient's continued pain and pancreatitis was secondary to inadequate drainage of the pancreatic duct, and the decision to perform a total pancreatectomy could be made on anatomical grounds firmly supporting the clinical evaluation of the patient.

Discussion

The usefulness of ERCP in postoperative study is just beginning to be realized. While this paper was in preparation an excellent article by Doctor Tohio Sato and others from Tohoku University appeared first in the Japanese, (Sato *et al.*, 1970) and then in the American literature, (Sato *et al.*, 1975). Doctor Tohio reported on three patients with pancreatico-jejunal shunts studied postoperatively by endoscopic pancreatography, and included films of one of these studies clearly demonstrating the shunt.

It is important for the radiologist carefully to

monitor the injection of contrast material into the pancreatic duct during this study. In our experience, contrast material does not enter the jejunal anastomosis in large amounts at any one time.

Therefore, one must look carefully to determine that, indeed, there is drainage. The major cause for concern is that contrast material will leak around the cannula placed in the pancreatic duct and into the duodenal sweep and from there travel backwards to the stomach or around the duodenum to the jejunum, giving a false picture of drainage from the pancreatico-jejunostomy. Careful monitoring during injection will prevent this mistake.

In both cases presented here, the main pancreatic duct retained contrast material after the cannula was removed from the ampulla (Figs. 1c and 2c). The retention of contrast material in the pancreatic duct does not necessarily mean that the pancreatico-jejunostomy is not functioning. It is well known that contrast material is retained in pancreatic ducts afflicted by chronic pancreatitis, with retention up to 25 and 30 minutes (Goldberg *et al.*, in press). Retention is simply a manifestation of dilatation and lack of functioning smooth muscle in the pancreatic duct, associated with decreased flow of pancreatic juices and occasionally obstruction by calculi. Therefore, there are many reasons for such retention beside failure of a pancreatico-jejunostomy.

In the armamentarium of the gastroenterologist and surgeon for study of pancreatic disease both pre- and postoperatively, the recently acquired fiberoptic panendoscope which allows retrograde injection of the pancreatic and biliary drainage systems has proved a valuable addition.

References

- Gillesby, W. J., and Puestow, C. B. (1961). Pancreatico-jejunostomy for chronic relapsing pancreatitis; an evaluation. *Surgery*, **50**, 859-862.
- Goldberg, H. I., Belbao, M. K., Stewart, E. T., Rohrman, C. A., and Moss, A. A. (1976). Endoscopic retrograde cholangiopancreatography (ERCP): radiographic technique. *American Journal of Digestive Disease*. (In press.)
- McCune, W. S., Shorb, P. E., and Moscovitz, H. (1968). Endoscopic cannulation of the ampulla of Vater. *Annals of Surgery*, **167**, 752-756.
- Oi, I., Kobayashi, S., and Kondo, T. (1970). Endoscopic pancreatocholangiography. *Endoscopy*, **2**, 103-106.
- Puestow, C. B., and Gillesby, W. J. (1958). Retrograde surgical drainage of pancreas for chronic relapsing pancreatitis. *American Medical Association Archives of Surgery*, **76**, 898-907.
- Sato, T., Saitoh, Y., Noto, N., and Matsuno, K. (1975). Appraisal of operative treatment for chronic pancreatitis with special reference to side to side pancreatico-jejunostomy. *American Journal of Surgery*, **129**, 621-628.
- Sato, T., Saitoh, Y., Noto, N., and Suda, Y. (1970). Evaluation of surgical treatment of chronic pancreatitis. *Tohoku Journal of Experimental Medicine*, **101**, 351-362.
- Takagi, K., Ikeda, S., Nakagawa, Y., Sakaguchi, N., Takahashi, T., Kumakura, K., Maruyama, M., Someya, N., Nakano, H., Takada, T., Takekoshi, T., and Kin, T. (1970). Retrograde pancreatography and cholangiography by fiber duodenoscope. *Gastroenterology*, **59**, 445-452.
- Warren, K. W., and Mountain, J. C. (1971). Comprehensive management of chronic relapsing pancreatitis. *Surgical Clinics of North America*, **51**, 693-710.
- Way, L. W., Gadacz, T., and Goldman, L. (1974). Surgical treatment of chronic pancreatitis. *American Journal of Surgery*, **127**, 202-209.
- White, T. T. (1965). Results of 89 operations for pancreatitis: a personal experience. *Surgery*, **58**, 1061-1074.
- Address for reprints: Dr. E. W. Miller, 750 Las Gallinas Avenue, San Rafael, California 94903, U.S.A.