

Pancreaticogastrostomy:

A Further Evaluation

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The anastomosis between the remaining pancreas and the intestinal tract after various types of pancreatic resection has been the site of complications responsible for considerable morbidity and mortality. After Whipple resections reestablishment of pancreatic-intestinal continuity has generally been accomplished in some manner between the pancreas and upper jejunum. This suture line has at times failed, often as the result of postoperative pancreatitis, giving rise to hemorrhage, abscess, and fistula formation. Since 1963, 25 patients undergoing pancreaticoduodenal resection have had some portion of their pancreas implanted into the back wall of the stomach. The operations have been done by the resident and senior staff of the Department of Surgery at the University of Pennsylvania. Morbidity has decreased and operative mortality has fallen from 20-30% to 8%. The technique is not difficult and there seems to be less tendency for the anastomosis to leak. Pancreatic function is usually adequate. The procedure is useful after radical resection of the pancreaticoduodenal region or at times after pancreatic trauma.

FOR MANY YEARS, postoperative deaths following pancreaticoduodenal resection occurred with great frequency. Operative mortality was in the range of 25-30% or above. However, in 1968 Howard reported a personal experience of 41 resections without an operative death. At the present time, operative mortality in several large centers is now around 10% or under. Other series still realize a death rate somewhat higher.

Difficulties with the remaining pancreas have usually been responsible for a major portion of serious postoperative complications and mortality. Removal of the entire pancreas obviates this problem to a great extent, but even with intensive endocrine and exocrine replacement, these patients do not thrive as well as those who still have part of their pancreas intact. After Whipple

resections, reestablishment of pancreatic-intestinal continuity has generally been accomplished in some manner between the remaining remnant of pancreas and the upper jejunum. This anastomosis has often failed, giving rise to fatal complications. Postoperative pancreatitis is, no doubt, part of the process that so often leads to hemorrhage, abscess, and fistula formation, originating at the pancreaticojejunostomy. Ligation of the duct of Wirsung with closure of the stump of the pancreas has also been unsatisfactory.

Pancreaticogastrostomy is an alternative method of restoring pancreatic-intestinal continuity which has been employed by members of the Department of Surgery of the University of Pennsylvania since 1963. The original animal and clinical experimental work on this problem was discussed in a previous publication.^{4,6}

The purpose of this study was to evaluate 11 years experience with pancreaticogastrostomy after radical resection of the pancreaticoduodenal region from the standpoint of operative mortality and postoperative complications, specifically those related to the remaining pancreas.

Clinical Data

From February 1963 through September 1974, 25 patients have undergone the Whipple operation and have had the remaining pancreas anastomosed to the back wall of the stomach. There have been two postoperative deaths, an operative mortality of 8%. Data for these patients are summarized in Table 1.

The first postoperative death occurred in patient J. H. who developed a fulminating postoperative pancreatitis

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TABLE 1. Operative Mortality—1974*

Tumor site	Number of Patients	Deaths
Pancreatic Head	13	
Ampulla of Vater	8	1
Duodenum	2	1
Chronic Pancreatitis	2	
	25	2

*Operative mortality: 8%

following resection of duodenal carcinoma. The entire pancreas sloughed, resulting in overwhelming sepsis and death. An error in management caused the second death of patient, F.S., who had an ampullary carcinoma resected. This patient developed a bile peritonitis when the T-tube was inadvertently clamped during the first 12 hours after surgery. The bile peritonitis became secondarily infected and the end result was an intraperitoneal hemorrhage with cardiac arrest on the 12th operative day. At postmortem examination the pancreatic anastomosis was still intact (Table 2). It should be noted that two of the patients thought to have carcinoma of the head of the pancreas had chronic pancreatitis after the final histological examination.

There were three nonfatal complications in the series. Patient H. W. developed a pancreatic anastomotic leak following an episode of acute dilatation on the first day oral fluids were administered. A sump drain was inserted and the fistula closed promptly. Two other patients had biliary cutaneous fistulae which closed without incident with sump suction after a short period of time.

The operative mortality from the world literature including our own experience is shown in Table III. Only four operative deaths have been reported including two from our own series for an overall mortality of 8%. Only one of the 4 deaths related to the pancreatic anastomosis.

Postoperative studies and postmortem examinations have demonstrated patency of the pancreatic duct as long as 11 months after the original surgery.⁶

TABLE 2. Operative Deaths and Complications

Patient	Age, Sex	Tumor Site	Complications
SH	49, M	Duodenum	Postoperative Pancreatitis—Died
ES	63, F	Ampulla	Bile Peritonitis—Died
		Deaths: 2	
HW	68, M	Head	Pancreatic Anastomotic Leak—Survived
CM	67, F	Ampulla	Biliary Cutaneous Fistula—Survived
LR	51, M	Pancreatitis	Biliary Cutaneous Fistula—Survived
		Non-fatal Complications: 3	

TABLE 3. Operative Mortality for Pancreaticogastrostomy After Radical Pancreaticoduodenectomy

Author and Year	Number of Cases	Operative Deaths	% Operative Mortality
Waugh & Clagett 1946 ¹⁰	1	0	0
Wells, Sheper & Gibbon 1952 ¹¹	3	1	33
Dill-Russell 1952 ²	2	1	50
Ingebrigtsen & Langfeldt 1952 ³	2	0	0
Sames 1952 ⁸	1	0	0
Nanson 1954 ⁵	1	0	0
Silverstone 1956 ⁹	1	0	0
Millbourn 1959 ⁴	7	0	0
Patak & Popik 1959 ⁷	1	0	0
Hurwitz 1967 ¹	6	0	0
Hospital of the University of Pennsylvania 1974	25	2	8
	50	4	8

Operative Technique

After the body of the pancreas has been divided and the line of transection proven free of tumor, the remaining pancreas is closed with interrupted sutures of 3-0 silk. It is important not to obliterate the pancreatic duct. Several of the silk sutures are left long and used to draw the pancreas through the gastrostomy into the stomach during the anastomosis. Approximately 2-3 cm of pancreas should be freed up from the retroperitoneal attachment to

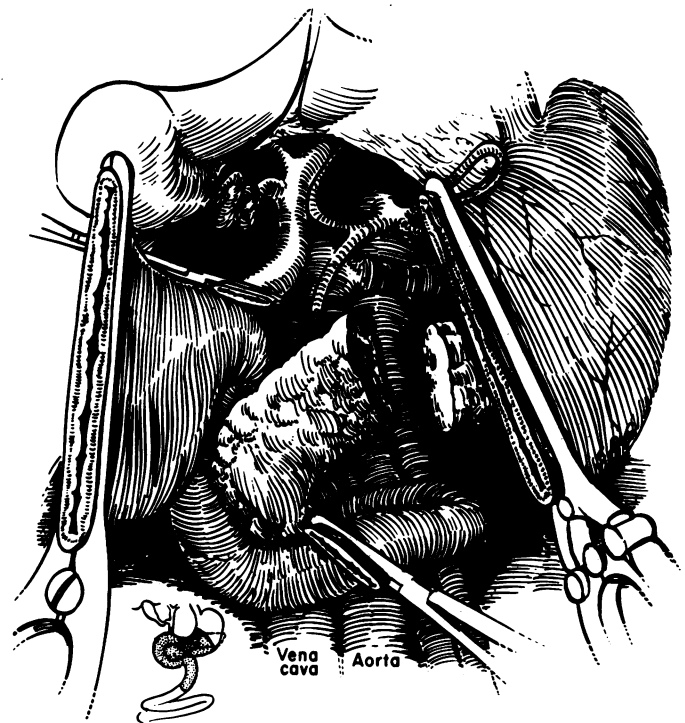


FIG. 1. Pancreaticogastrostomy—showing extent of resection.

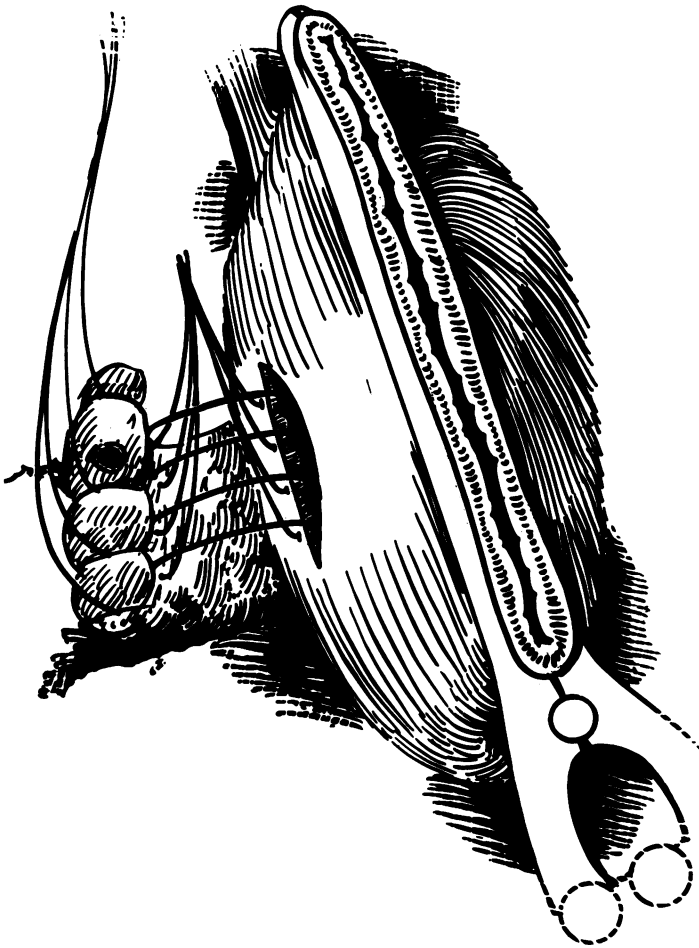


FIG. 2. Opening in the posterior wall of the stomach and row of silk sutures between anterior surface of pancreas and left lateral side of gastrostomy.

allow a sufficient amount of the gland to project into the stomach (Figs. 1 and 2).

A 50-60% distal gastrectomy provides enough proximal stomach to permit an easy approximation to the remaining pancreas. After division of the stomach between Payr clamps or clips inserted with an automatic suturing instrument, traction on the proximal stomach is released to allow approximation of the pancreas to the posterior wall without tension. An interrupted row of 3-0 silk is employed between the anterior serosal surface of the pancreas and the posterior wall of the stomach. A gastrostomy incision 2-3 cm in length is made in the posterior wall of the stomach (Fig. 2). This should be sufficiently proximal to the site of the intended gastroenterostomy to avoid complicating the anastomosis. The long ends of the silk suture used to close the pancreas are threaded on a straight needle and passed through the incision in the posterior wall and out the anterior wall of the stomach (Fig. 3). Traction on these sutures holds the cut end of the pancreas securely within the lumen of the stomach while the remainder of the posterior row of interrupted

silk sutures is put in place to complete the outside layer (Fig. 4). The stomach is opened and the anastomosis visualized from within the lumen. A second layer of continuous, locked 2-0 chromic catgut suture approximates the gastric mucosa to the pancreas within the lumen of the stomach (Fig. 5). On completion of this suture line, the silk sutures on the cut end of the pancreas are cut short and about 1½-2 cm. of pancreas should project into the lumen of the stomach without tension. The biliary anastomosis is then accomplished followed by a gastro-jejunostomy distal to it. Sump drains are placed to the right and left of the pancreaticogastrostomy posterior to the stomach (Fig. 6).

Gastroscopic observations and postmortem studies have shown that the intra-gastric portion of pancreas disappears either by sloughing or retraction and that gastric mucosa grows to the pancreatic duct, leaving its patency preserved.

Discussion

Current diagnostic techniques have not improved the curability of carcinomas of the pancreaticoduodenal re-

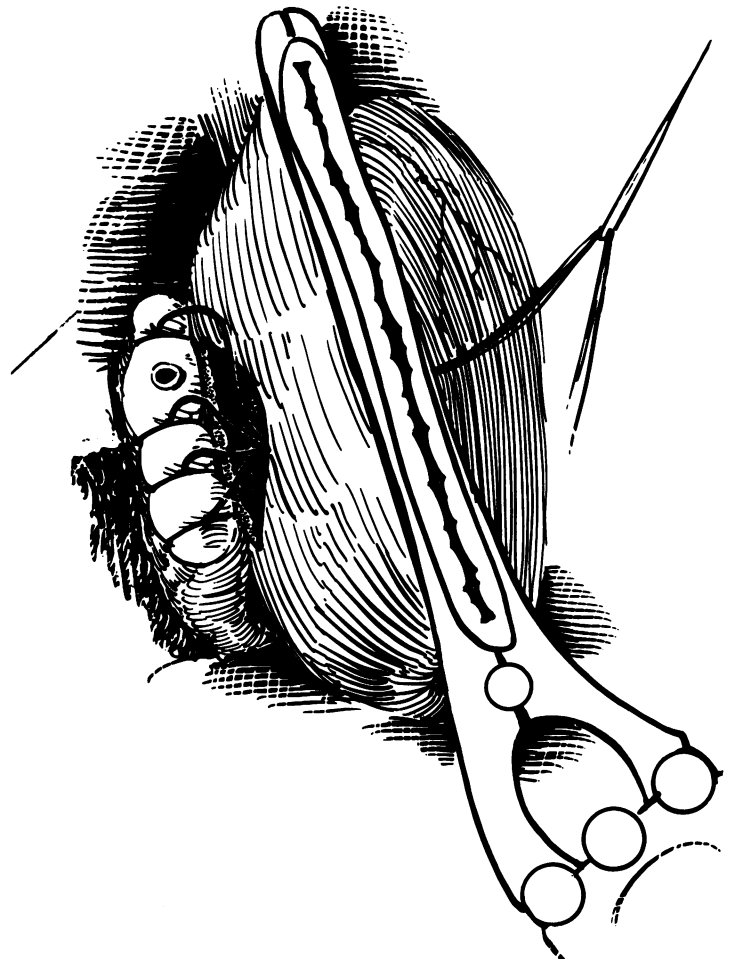


FIG. 3. Use of long end of sutures on the cut end of pancreas to draw the pancreas through the gastrostomy into the lumen of the stomach.

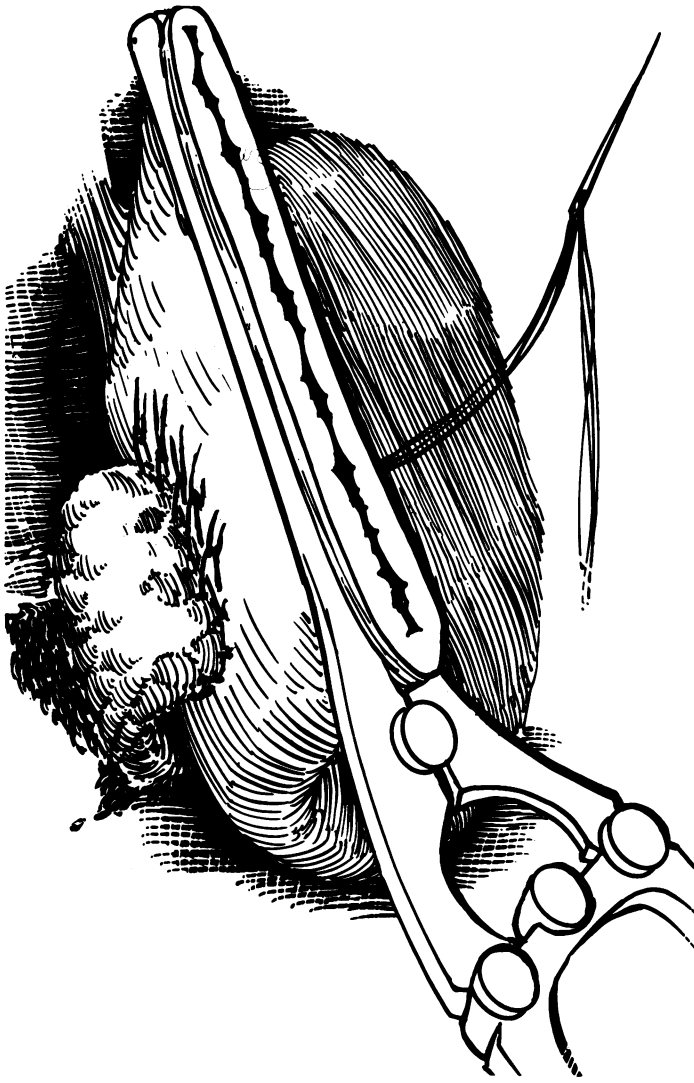


FIG. 4. Placement of silk sutures between the right edge of the gastrotomy and posterior wall of the pancreas.

gion. Usually, more effective palliation is achieved by resection than by bypass procedures, provided morbidity and mortality are not prohibitive.

Implantation of the pancreas into the stomach has lowered operative mortality in this institution from over 25% to 8% in the past 11 years. The operations have been performed by surgeons of varied experience, including the resident staff and not by one single surgical team.

The anastomosis is easy to accomplish technically. The pancreas lies in natural apposition to the posterior wall of the stomach. Sutures between the pancreas and the stomach seem more secure than between the pancreas and the jejunum since the stomach has a thicker wall and the anastomosis can be reinforced from within the lumen of the stomach.

The acid pH in the stomach is unfavorable for proteolytic activity. Pancreatic enzymes flow into the gastrointestinal tract proximal to the small bowel enzymes

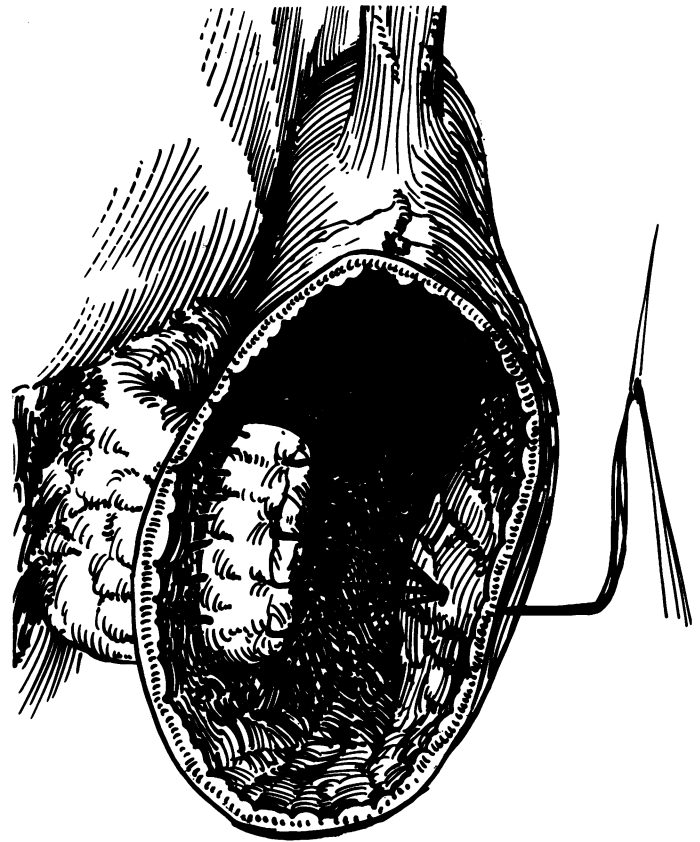


FIG. 5. Intraluminal suture of the pancreas to the gastric mucosa through the open end of stomach.

which activate trypsinogen and chymotrypsinogen. These factors tend to lessen the chances of postoperative pancreatitis and autodigestion with hemorrhage, fistula and abscess formation.

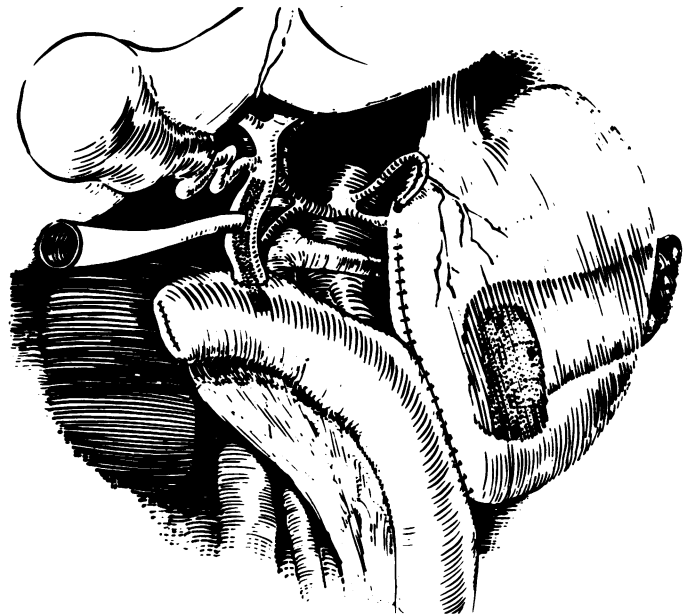


FIG. 6. Reconstruction of biliary, pancreatic and intestinal continuity.

Some patients may show varying degrees of pancreatic insufficiency postoperatively. This depends on the amount of functioning pancreas remaining rather than on an anastomotic obstruction.

Implantation of the pancreas into the stomach has been employed satisfactorily in patients with trauma or chronic pancreatitis, as well as those undergoing the Whipple operation for malignancy.

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DISCUSSION

PRESIDENT SABISTON: As is recognized, this technique which Dr. Rhoads has presented is an original contribution from the University of Pennsylvania. Its use has recently been emphasized by others, and it is particularly appropriate to have this series updated by the originators of the method.

DR. GEORGE H. BUNCH, JR. (Columbia, South Carolina): I would like to recount briefly one experience that I had one night last week. I received a call to come see a patient with massive upper G. I. bleeding. This had been going on for twelve hours and during this time his blood pressure had hit zero twice; he had had a "mayday" on his last episode, and they thought that perhaps surgery might be necessary.

As we prepared the patient for surgery, one thing bothered me—he said that he was operated upon by Dr. Bill ReMine about two years ago, and he had a pancreatic cyst drained. We thought he had a Roux-Y drainage.

I quickly tried to find Bill in the middle of the night on an emergency call telephone number, but I couldn't find it. So we took him to surgery, and to make a long story short, we opened the duodenum—no point for bleeding was found; opened the stomach widely—no point for bleeding, but blood was everywhere. Under the circumstances we thought, probably, a vagotomy and high gastrectomy would be the best we could do. This sounded pretty simple.

We approached the stomach again. We found that the pancreatic cyst had been drained into the posterior wall of the stomach rather than by Roux-Y and this had completely healed over. There was no recurrence of the cyst. But when we began to try to take this stomach out, which sounds like not too much of a procedure, it was found to be like a bag of wet cement that had been poured in there. There was no way of separating it from the pancreas or the liver. Doing a vagotomy was out of the question. We could hardly even find the diaphragm.

We did, after a long struggle, get out about 60% of the patient's stomach without vagotomy, and yesterday he was doing reasonably well.

DR. JULIUS A. MACKIE (Closing discussion): We have felt that the current diagnostic techniques for carcinomas of the periampullary region have really not improved the curability of this problem after surgery. We have also been of the opinion that in comparable patients more effective palliation is accomplished by end resection, rather than by a bypass procedure, provided the operative morbidity and mortality is not prohibitive.

As Dr. Rhoads pointed out, the implantation of the pancreas into the stomach has reduced our mortality considerably, from over 25% to 8%; and it should be emphasized that these procedures have been done quite frequently by members of the resident staff, and, in fact, neither of the two deaths which were reported occurred in patients done by the residents. Perhaps they should do them all.

The anastomosis is easy to accomplish technically, since the pancreas lies in natural apposition to the posterior wall of the stomach. Sutures between the pancreas and the stomach seem a bit more secure, since the stomach wall is thicker, and also since we can reinforce this anastomosis from within the lumen of the stomach.

We have wondered why it seems better in our hands. Perhaps it's because the acid pH of the stomach is unfavorable for proteolytic activity. These pancreatic enzymes flow into the gastrointestinal tract proximal to the small bowel, whose enzymes activate trypsinogen and chymotrypsinogen. These factors, we think, tend to lessen the post-operative pancreatitis, which causes hemorrhage, abscess and fistula formation.

Some of the patients may show varying degrees of pancreatic insufficiency postoperatively. This seems to depend on the amount of functioning pancreas that remains, rather than any obstruction at the anastomosis.