

# Management of the pancreatic remnant during Whipple operation

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## SUMMARY

**Pancreaticojejunostomy is the most frequent site of fistula formation in patients undergoing Whipple procedure (pancreaticoduodenectomy). The results of an end-to-side anastomosis of the pancreatic stump to the jejunum are discussed in this retrospective review of 21 patients who underwent Whipple procedure for cancer of the pancreas or periampullary region.**

**Key words:** Whipple procedure, pancreaticojejunostomy, pancreaticojejunal fistula

## INTRODUCTION

The role of surgical resection in the treatment of pancreatic cancer was established in 1935 by Whipple and associates with the demonstration that resections of the head of the pancreas could be technically performed<sup>1,2</sup>. Accumulated clinical experience with pancreatic resectioning has demonstrated that radical surgical treatment of pancreatic cancer results in significant morbidity and mortality and is applicable only to a small fraction of patients with pancreatic malignancies<sup>3</sup>. International literature suggests that in most patients, pancreatic malignancies are diagnosed at late stages when surgical cure by any type of procedure is not possible<sup>4</sup>.

Pancreaticoduodenectomy generally, is considered to be the standard operation for resection of carcinomas of the pancreas or periampullary region. The Whipple operation comprises an en bloc resection of the duodenum, the distal bile duct and the gastric antrum. Pancreaticoduodenectomy procedure has had many technical variations described, typically dealing with the extent of dissection or with the details of reconstructing the gastroin-

testinal tract after the resection.

Various series have appeared in the medical literature reporting the overall results of pancreaticoduodenal resections. Most series report operative mortality rates averaging 20% for pancreaticoduodenal resections for carcinoma of the pancreatic parenchyma with 3-year survivals averaging under 15% and 5-year survivals averaging 10% or less<sup>4</sup>. Pancreatico-duodenectomy series performed for peri-ampullary tumors show an average perioperative mortality of 15%, a 3-year survival of 30% and a 5-year survival approaching the 20% range<sup>5</sup>.

Complication rates are high in patients undergoing the Whipple procedure with complications of some type developing in more than 50% of patients<sup>6</sup>. The most common complication after pancreaticoduodenectomy is fistula formation from the anastomoses at the sites of gastrointestinal tract reconstruction. The pancreaticojejunal anastomosis is technically difficult to perform and is the most frequent site of fistula formation. It is important the pancreaticojejunostomy be a secure anastomosis because the leakage of pancreatic secretions from the anastomosis can have potentially fatal consequences.

Many technical modifications have been proposed such as an end-to-end or an end-to-side anastomosis<sup>7</sup>. Many other authors propose the avoidance of pancreaticojejunostomy (total pancreatectomy, oversewn of pancreatic remnant). In this paper an end-to-side anastomosis of the pancreatic stump to the jejunum is discussed.

## PATIENTS AND METHODS

Twenty-one patients (15 men and 6 women [mean age: 56.5 years]) with pancreatic or periampullary cancer, eligible for elective pancreatic resection were enrolled in this study (Table 1).

After pancreatic resection, the reconstruction of the alimentary tract has to be performed. Reconstruction

**Table 1.** Patients and indications for pancreatic operations.

	n=21
AGE (Median, Range)	56.5 years (37-72)
SEX (Male/Female)	15/6
Type of disease	
• Pancreatic cancer	15
• Periampullary cancer	6

involves gastro-jejunostomy, choledochojejunostomy and pancreaticojejunostomy. According to the method used in the 1<sup>st</sup> Surgical-Oncological Department of Theagenion Cancer Hospital, gastrojejunostomy is placed distal to choledochojejunostomy and pancreaticojejunostomy to allow the gastrojejunostomy to be bathed in alkaline biliary and pancreatic secretions. Exposure of the gastrojejunostomy to alkaline resections minimizes the risk of marginal ulceration caused by the sensitivity of the jejunal mucosa to gastric acid. Pancreatico-jejunostomy is the most proximal anastomosis. For the pancreaticojejunostomy two steps have to be performed:

1. The traumatic surface of the pancreatic stump is ligated with locking sutures 3-0 silk (1<sup>st</sup> step).

2. A two-layer end-to-side anastomosis is performed (1<sup>st</sup> layer: jejunal mucosa-pancreas, 2<sup>nd</sup> layer: jejunal serosa-pancreas).

For this study protocol, eleven typical complications were defined (Table 2) and each patient was followed for 90 days postoperatively. All patients received octrotide at 3/100 µg/day subcutaneously to achieve the maximal inhibition of pancreatic enzyme secretion<sup>9</sup>.

## RESULTS

The postoperative incidence of pancreatico-jejunal fistula was zero. No perioperative mortality was noticed. Although the complications rate was 48% (patients with one or more complications) most of them were unrelated to the formation of pancreaticojejunal anastomosis (Table 3). The most severe one, was a gastric marginal bleeding on the 9<sup>th</sup> postoperative day and the patient needed relaparotomy.

## DISCUSSION

The significant mortality and morbidity of pancreatic resection raises questions by surgeon oncologists of

**Table 2.** Definition of postoperative complications.

Complication	Definition
Death	Within 90 days postoperatively
Leakage of anastomosis	Leakage of pancreatic, biliary or intestinal anastomosis as determined by X-ray or intraoperative (relaparotomy) findings.
Pancreatic fistula	Concentration of amylase and lipase in the drainage fluid later than 3 days postoperatively of more than 3 times the serum concentration and a drainage volume of more than 10ml per day at the same time.
Abscess	Pus collection or an infected fluid collection revealed by CT or ultrasound or demonstrated by relaparotomy.
Fluid collection	Collection of sterile fluid of at least 5X5 cm in diameter by ultrasound or CT which did not qualify as an abscess.
Shock	Systolic blood pressure of less than 80mm Hg for more than 20 min (later than 24h postoperatively) which required continuous volume replacement and/or treatment with catecholamines.
Sepsis	4 or more of the following criteria: a) bacteria-positive blood culture, b) rectal temperature > 38,5 °C, c) leukocytosis > 12000/mm <sup>3</sup> or leukopenia < 3000 mm <sup>3</sup> , d) thrombocytopenia < 100.000 mm <sup>3</sup> , e) metabolic acidosis (base excess > -4).
Pulmonary insufficiency	Arterial PO <sub>2</sub> < 60 mmHg, despite oxygen application via the nose, or required prolonged postoperative mechanical ventilation (>24h after the end of operation) or reintubation.
Renal insufficiency	Serum creatinine more than twice the preoperative value.
Bleeding	Replacement of more than 3 units of blood later than 24h after the end of operation or the indication for relaparotomy due to intraabdominal bleeding.
Acute pancreatitis	More than 3-fold increase in serum amylase or lipase later than 3 days after surgery, accompanied by morphological signs of acute pancreatitis in a contrast-enhanced CT scan; CT was mandatory in patients with a 3-fold increase in serum amylase or lipase on postoperative day 4 or later.

**Table 3.** Number and type of complications in patients.

Complications	Patients
• Death	0/21
• Leakage of anastomosis	0/21
• Pancreaticojejunal Fistula	0/21
• Biliary fistula	1/21
• Gastric fistula	1/21
• Abscess	1/21
• Fluid collection	2/21
• Shock	1/21
• Sepsis	0/21
• Pulmonary insufficiency	1/21
• Renal insufficiency	1/21
• Bleeding	1/21
• Postoperative pancreatitis	1/21

whether the small possibility of cure is justified by the price of possible death from surgery or of complications that can lead to prolonged hospitalization<sup>10</sup>. The most common complication is the pancreatico-jejunal fistula formation. In a series reported by Pessaux and associates<sup>11</sup>, postoperative fistulas occurred in 177 patients, for an overall fistula complication rate of 21,5%. Leakage from the pancreaticojejunal anastomosis occurred in 114 patients (13,9%), biliary fistulas occurred in 45 patients (5,4%) and gastric fistulas developed in 18 patients (2,2%).

Although Cameron and associates<sup>12</sup> reported 145 pancreaticoduodenectomies without death, mortality and morbidity rates are the main problem of pancreatic resection.

In the study presented here, despite the fact that mortality was zero, morbidity rate was significantly high (10/21 patients - 47,6%) but with no pancreaticojejunal fistula formation among the complications.

Formerly, total pancreatectomy was proposed as a more appropriate operation for pancreatic carcinoma. Support was based on a reported 30-40% incidence of multifocality of pancreatic cancer, a concern about tumor cell implantation into the remnant pancreatic duct at Whipple resection and the high mortality and morbidity associated with the pancreaticojejuno-stomy<sup>13</sup>. As the literature has substantiated concerns about tumor seeding and multicentricity are not relevant, because the 5-year survival rate in patient who undergo the classic total pancreatectomy is equivalent to that in patients who undergo Whipple resection<sup>4</sup>. Also improved techniques

and postoperative management have made pancreatico-jejunostomy safer<sup>14</sup>. Total pancreatectomy removes all exocrine and endocrine pancreatic function, requiring exogenous pancreatic enzyme and insulin administration<sup>15</sup>.

An alternative method to avoid pancreaticojejunos-tomy is to ligate the remnant either with intraductal blocking or not and leave it free but well-drained in the abdominal cavity.

Despite the fact that ligation of the remnant causes more fistulas than pancreatico-jejunostomy, fistula formation after pancreatico-jejunostomy is more dangerous. Probably there is an activation of pancreatic enzymes caused by the enteric secretions. Activated pancreatic fluid is more corrosive compared to the fluid secreted by the isolated pancreatic remnant.

The modification described in this paper is simple. Excretion of pancreatic fluid inside jejunum is inhibited, in order to avoid mixing of pancreatic and enteric secretions and activation of pancreatic enzymes.

Even though, the number of treated cases was few, the early experience has indicated successful results in pancreaticojejunos-tomy formation.

## REFERENCES

- Whipple AO, Parson WV, Mullin CR. Treatment of carcinoma of the ampulla of Vater. *Ann Surg* 1935; 102:763.
- Whipple AO. The rationale of radical surgery for cancer of the pancreas and ampullary region. *Ann Surg* 1941; 114:612.
- Stanford P. Surgical approaches to pancreatic cancer. *Nurs Clin North Am* 2001; 36:567-577, XI.
- Fernandez -del Castillo C, Rattner DW, Warshaw AL. Standards for pancreatic resection in the 1990s. *Arch Surg* 1995; 130:295.
- Edge SB, Schmieg RE, Rosentof LK et al. Pancreas cancer resection outcome in American University Centers. *Cancer* 1993; 71:3502.
- Wade TP, Radforel DM, Virgo KS et al. Complications and outcomes in the treatment of pancreatic adenocarcinoma in the United States Veteran J Am Coll Surg 1994; 179:138.
- Poon RT, Fan ST. Opinions and commentary on treating pancreatic cancer. *Surg Clin North Am* 2001; 81:625-638.
- Buchler M, Friess H. Prevention of postoperative complications following pancreatic surgery. *Digestion* 1993; 54(Suppl 1):41-46.
- Buchler MW, Bassi C, Fingehut A, Klempa I. Does prophylactic octreotide decrease the rates of pancreatic fistula and other complications after pancreatico-duodenectomy? *Ann Surg* 2001; 234:262-263.

10. Lieberman MD, Kilburn H, Lindsen M, Brennani MF. Relation of perioperative deaths to hospital volume among patients undergoing pancreatic resection for malignancy. *Ann Surg* 1995; 222:638
11. Pessaux P, Tuech JJ, Arnaud JP. Prevention of pancreatic fistulas after surgical resection. A decade of clinical trials. *Presse Med* 2001;30:1359-1363.
12. Cameron JL et al. 145 consecutive pancreaticoduodenectomies without mortality. *Ann Surg* 1993; 217:430-438.
13. Van Heerden JA, McIlrath DC, Ilstrup DM et al. Total pancreatectomy for ductal adenocarcinoma of the pancreas: An update. *World J Surg* 1988; 12:658-662.
14. Kakita A, Yoshida M, Takahashi T. History of pancreaticojejunostomy in pancreaticoduodenectomy: development of a more reliable anastomosis technique. *J Hepatobiliary Pancreat Surg* 2001; 8:230-237.
15. Slezak LA, Andersen DK. Pancreatic effects on glucose metabolism. *World J Surg*. 2001; 25:452-460.