

Prevention of pancreaticojejunal anastomotic leakage after pancreaticoduodenectomy with separate internal drainage of bile and pancreatic fluid

Xian-Wei Dai, Kai Ma, Fu-Xiang Wang, Fu-Quan Yang, Bao-Sheng Wang, Hai-Ying Zhao, Wei Sun, Bao-Lin Liu, Fang Qiu, Xian-Min Pu, Liang Wang and Yang Dai

Shenyang and Xingcheng, China

OBJECTIVE: To introduce a new reconstructive procedure to decrease the complications after pancreaticoduodenectomy.

METHODS: Separate internal drainage of bile and pancreatic fluid in pancreaticoduodenectomy was performed in 256 patients. The digestive tract was reconstructed with Child method, with invaginated pancreaticojejunostomy using a long silastic tube to drain pancreatic fluid internally, an end-to-side choledochojejunostomy and an end-to-side duodenojejunostomy or gastrojejunostomy. Gastrostomy drainage was also performed.

RESULTS: No complications of pancreatic leakage were found.

CONCLUSION: The separate internal drainage of bile and pancreatic fluid plays an important role in preventing pancreaticojejunal anastomotic leakage.

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Key words: pancreaticoduodenectomy; reconstruction; internal drainage; invaginated pancreaticojejunostomy; pancreatic leakage; gastrostomy drainage

Introduction

Pancreaticoduodenectomy represents a considerable surgical challenge.^[1,2] Pancreaticojejunal anastomotic leakage after pancreaticoduodenectomy is still a very dangerous complication till now. In our series, separate internal drainage of bile and

pancreatic fluid in pancreaticoduodenectomy was performed in 256 patients without occurrence of pancreatic leakage.

Methods

Patients

Consecutive pancreaticoduodenectomies were performed in 152 men and 104 women (median age 55 years, range 32–83 years) between March 1992 and February 2002. The results of the patients were evaluated prospectively.

In these patients, 98 had ampullary carcinoma; 66 lower-end cholangiocarcinoma including carcinoma in all parts of the bile duct (4), carcinoma of the gallbladder involving the duodenum

From the Department of General Surgery, Second Clinical College, China Medical University, Shenyang 110004, China (Dai XW, Ma K, Yang FQ, Wang BS, Zhao HY, Sun W, Liu BL, Qiu F, Pu XM, Wang L and Dai Y); Department of Surgery, Xingcheng Central Hospital, Xingcheng 125100, China (Wang FX)
Correspondence: Xian-Wei Dai, MD (Tel: 86-24-8395 6216 ext 6490; Fax: 86-24-83951793; Email: daixianwei@hotmail.com)

(2) and enlarged No. 13 lymph nodes; 8 duodenal carcinoma including duodenal leiomyosarcoma (1); 80 pancreatic head carcinoma including pancreatic head cystadenocarcinoma (2); and 4 pancreatic cyst caused by chronic pancreatitis. Pylorus-preserving pancreaticoduodenectomy (PPPD) was performed in 153 patients, and pancreaticoduodenectomy (PD) in 103.

Surgical procedures

The digestive tract was reconstructed with Child method. Two patients with concomitant hepatic cancer received left hemihepatectomy. The jejunum was taken out of the fissure behind the root of the mesentery in the inferior portion of the duodenum to the superocolic zone for the reconstruction of the digestive tract in 176 patients. Poking in the transverse mesocolon was made to take the jejunum in 75 patients, and in front of the transverse colon, 5 patients. The remnant pancreas was freed for 2 cm to ensure an invaginated anastomosis satisfactorily. Most pancreatic stumps were U-sutured or interruptedly sutured to prevent bleeding and leakage of pancreatic fluid. The posterior wall of invaginated pancreaticojejunostomy was sutured in 3 rows to eliminate the dead space of stoma. The first layer of the anterior wall should be invertedly sutured to ensure invaginated pancreaticojejunostomy.

Internal drainage of pancreatic fluid

A silastic tube of 33 cm long and 0.3 cm in diameter was inserted with 5 small steel balls into the distal end, while at the proximal end two lateral apertures were made for the outflow of pancreatic fluid. The proximal end of the tube with 2–3 lateral apertures within 3 cm to the end was inserted into the pancreatic duct. Care was taken to prevent exposure of the apertures out of the pancreatic duct. The pancreatic duct was sutured in U-shape using No. 1 silk, while the silastic tube was fixed together with the pancreatic duct. After anastomosis of the posterior wall of pancreaticojejunostomy, the silastic tube was pushed into the jejunal loop by using an intestinal clamp, avoiding folding in it. Subsequently, the anterior wall was anastomosed

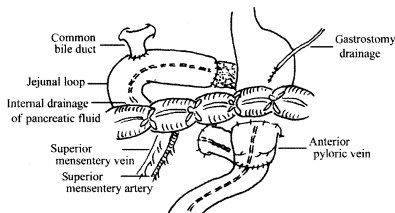


Fig. Prevention of pancreaticojejunal anastomotic leakage after PD and PPPD with separate internal drainage of bile and pancreatic fluid.

in U-shape (Fig.).

End-to-side choledochojejunostomy

The distance from the anastomosis of pancreaticojejunostomy to choledochojejunostomy was about 10 cm to avoid tension. The jejunum was poked for anastomosis. The diameter of the opening usually was half of that of the bile duct. The diameter of the opening dilated to be equal to that of the bile duct during anastomosis. Running suture was performed with 4–0 or 5–0 absorbable suture. Anastomosis started from the right side of the stoma of choledochojejunostomy with intraluminal running suture, and it was turned to the left side with mucosa-to-mucosa running suture in the anterior wall. The two sutures were met and ligated, finishing the full thickness anastomosis. The length of the jejunal loop in the superocolic zone was 20 cm, which ensures no tension of the loop.

Gastrojejunostomy or duodenojejunostomy

An opening was made in the vessel-free area of the transverse mesocolon corresponding to the area of the Treitz ligament or the area left to the middle colic artery. The jejunum was taken out of the opening. Duodenojejunostomy was performed about 10–15 cm from the Treitz ligament. Transversal anastomosis of gastrojejunostomy or duodenojejunostomy was used in both PD and PPPD by using running suture with 3–0 absorbable suture. After anastomosis, the transverse mesocolon was fixed on the gastric wall. Then the jejunum was fixed with the posterior wall of the stomach for 10 cm. The jejunum and the fissure of the Treitz liga-

ment were sutured to close the space.

Gastrostomy drainage

The seromuscular layer was cut open for about 1.5 cm in the vessel-free area of the anterior wall of the stomach. Then the mucosa in the inferior cornu was poked for insertion of a silastic tube of 40 cm long and 3 mm in diameter, with lateral apertures across the gastric wall and pylorus to the jejunum distal to the stoma. The incision of the gastric seromuscular layer was sutured and the tube embedded. The tube was passed through the abdominal wall and was closed after operation. The gastric tube could be removed early after operation (>24 hours), gastric fluid could be drained through this tube. In case of pancreatic leakage developed, enteral nutrition could be given via this tube. Gastrostomy internal drainage prevented delayed gastric emptying after operation.

Drainage of abdomen

We usually placed one tube for abdominal drainage in front of pancreaticojejunostomic stoma and behind the stomach. The tube was led out through the left or the right abdominal wall. Another tube was placed behind pancreaticojejunostomic stoma and was led out through the right abdominal wall.

Results

In this series, 241 patients recovered well after operation, and 204 patients (79.7%) were discharged in 21 days. There were 2 cases of intra-abdominal infection due to incision and 5 cases (5/153, 3.3%) of postoperative delayed gastric emptying. In the 256 patients, 5 (1.95%) died of intra-abdominal bleeding (1), cardiac arrest (2), and acute hepatic failure from deep obstructive jaundice after operation (2). Surgical complications occurred in 9 (3.6%), but no complications of pancreatic leakage were observed.

Discussion

Pancreaticoenteric anastomotic leakage is caused

by different factors: (1) inadequate length of the freed remnant pancreas (<2 cm), and insufficient invaginated anastomosis; (2) contaminated pancreaticojejunostomic stoma, loosened closure of the pancreas and jejunum in anastomosis, left over dead space, formation of small abscess or rupture of the abscess; (3) stastic pancreatic fluid and bile in the jejunum near the stoma, which elevates the pressure in the intestinal cavity, and delayed recovery of vermuculation in the early postoperative stage and damaged partial jejunum loop nerves leading to impaired small bowel peristalsis; (4) pancreatic enzymes, which digest and erode the stoma, activated with the mixing of pancreatic fluid and bile in the early stage after pancreaticojejunostomy and choledochojejunostomy; (5) poor blood perfusion of the jejunum after invaginated anastomosis, large intesion in the stoma, etc. Kakita et al^[3] devised a new surgical technique characterized by approximation of the pancreas stump and jejunal wall by six to eight interrupted sutures for avoidance of ischemia and necrosis of the pancreatic stump. Of all of the above mentioned causes, stastic pancreatic fluid and bile in the jejunum near the stoma and digestion of the stoma by activated pancreatic enzymes are the main causes of postoperative pancreatic leakage. It has been confirmed that the procedure of invaginated pancreaticojejunostomy can prevent pancreatic leakage. In this series, we freed 2 cm of the remnant pancreas to ensure the depth of invaginated anastomosis. The posterior wall of invaginated pancreaticojejunostomy was sutured in 3 rows to eliminate dead space of the stoma and to close the pancreas and jejunum tightly. In anastomosis of the anterior wall, the first layer was invertedly sutured. The jejunum was invaginated in about 2 cm. This procedure is time-saving and effective in preventing pancreatic leakage. Because the diameter of the jejunum is larger than that of the pancreas in most patients and the jejunum is elastic, invaginated anastomosis usually encounters less difficulty and the jejunum has sufficient blood perfusion.

Katsaragakis et al^[4] used external drainage of the pancreatic duct to deal with the problems caused by anastomotic leakage. In their group, the mortality was 4%. Since a long and thin silastic

tube was used to drain pancreatic fluid to the jejunum 30 cm distal to the pancreaticojejunostomy stoma in our series, the absence of stastic pancreatic fluid near the stoma in the jejunum decreased the pressure in the local intestinal lumen and avoided digestion and erosion of the stoma by pancreatic fluid. As bile is colloid and has large surface tension, it can be drained through the pancreatic drainage tube. The absence of stastic bile near the stoma may further decrease the intestinal luminal pressure, an important factor for prevention of pancreatic leakage. In this series, bile and pancreatic fluid were separated by the tube of internal pancreatic drainage. They met in the jejunum 30 cm distal to the stoma, where the pancreatic enzymes were activated. The activated pancreatic fluid far from the stoma could not reflux back to the stoma. Hence no digestive effect exerted on the stoma, ensuing the healing of the stoma. Further, the absence of external drainage of digestive fluid led to the absence of loss of bile and pancreatic fluid. With a stable internal environment, the patients recovered quickly and resumed food intake earlier.

Internal pancreatic drainage tube would fall off with stool in the late postoperative stage. In some patients it might not fall off in half a year after operation. However, it did not threaten their lives.

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