

## Original Research

# Central pancreatectomy with external drainage of monolayer pancreaticojejunostomy for prevention of postoperative pancreatic fistula: A retrospective cohort study

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## ABSTRACT

**Objective:** Postoperative pancreatic fistula (POPF) remains a common problem and leading cause of morbidity and mortality after central pancreatectomy (CP). The aim of this study was to present a technique of external drainage of monolayer pancreaticojejunostomy for prevention of POPF.

**Methods:** Patients received elective CP with external drainage of monolayer pancreaticojejunostomy between January 2010 and December 2016 were retrospectively analyzed. The occurrence and severity of POPF, overall complications, reoperation rate, in-hospital mortality, and length of postoperative hospital stay were measured. The 2016 updated definition and classification system of the International Study Group of Pancreatic Surgery (ISGPS) was used for POPF. In addition, a matched-pairs comparison with internal drainage of pancreaticojejunostomy was made.

**Results:** 33 consecutive patients underwent CP with external drainage of monolayer pancreaticojejunostomy during this period. 4 (12.1%) cases developed grade B POPF, among which one patient was classified as having Clavien-Dindo classification IIIa complication. None of the patients developed grade C POPF, delayed gastric emptying, or postpancreatectomy hemorrhage. There was no reoperation or in-hospital mortality occurred. Matched-pairs comparison revealed that patients with external drainage of pancreaticojejunostomy had significantly lower incidence of POPF.

**Conclusion:** External drainage of monolayer pancreaticojejunostomy seems effective in prevention of POPF after CP.

## 1. Introduction

Central pancreatectomy (CP), also known as middle pancreatectomy or medial pancreatectomy, is a parenchyma-sparing surgical procedure that enables risk reduction of postoperative exocrine and endocrine pancreatic insufficiency. It is considered an alternative to pancreaticoduodenectomy and distal pancreatectomy in order to preserve normal pancreatic tissue as much as possible. It has been used to remove benign and low-grade malignant tumors from the neck and proximal body of the pancreas, retaining the structure and function of the upper gastrointestinal tract and biliary duct compared with pancreaticoduodenectomy, and preserving the pancreatic tail and/or body and spleen in contrast with distal pancreatectomy. In recent years, the number of CP reported has increased rapidly. Goudard et al. [1] described 100 consecutive cases receiving CP in a single-center during a period of 12 years.

Although postoperative morbidity and mortality in high volume

centers has decreased as low as 46% and 0% [2,3], postoperative pancreatic fistula (POPF) remains by far the most lethal complication with lengthening hospital stay, increasing economic burden, and even leading to secondary complications such as hemorrhage, abscess, sepsis and death [1]. To reduce the risk of POPF, numerous techniques such as pancreaticogastrostomy [4] and double pancreaticojejunostomy [5] have been described. Studies assessing techniques of pancreaticoduodenectomy have identified multiple approaches associated with acceptable rates of POPF [6,7]. However, no single technique has been demonstrated to be superior across institutions [8]. This is due to the fact that there are two cut surfaces of the pancreatic remnant to be managed during CP, and the incidence of POPF from the cephalic stump is not low [1,9]. The use of stapler closure has been reported to reduce risk of POPF after distal pancreatectomy [10]. Thus, the proximal stump of the pancreas closed by stapling method may be effective in prevention of POPF after CP.

An ideal pancreaticojejunostomy should be safe and applicable to

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various pancreatic remnants. Nevertheless, it is difficult to choose an ideal technique of pancreaticojejunostomy for all patients. Patients with a small pancreatic duct or soft pancreatic texture had higher risks of POPF. External drainage of the pancreatic duct has been shown to decrease the rate of POPF in patients with high risk factors following pancreaticojejunostomy reconstruction [11,12]. We herein present our experience with stapler plus external drainage of monolayer pancreaticojejunostomy to prevent POPF after CP, and conduct a case-matched comparison with the internal drainage procedure.

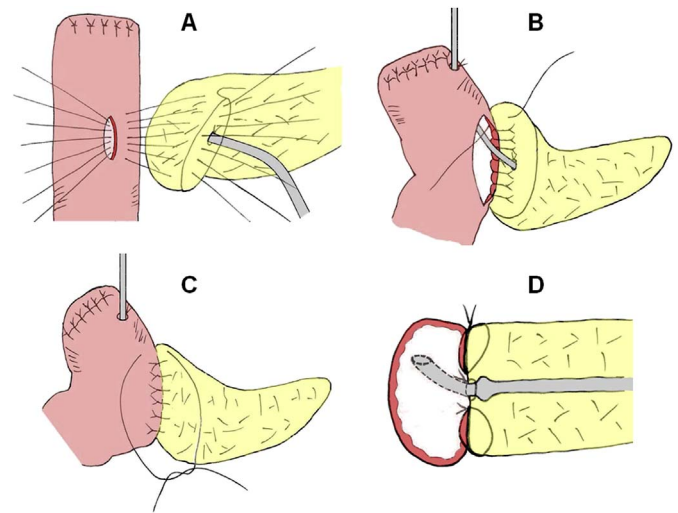
## 2. Methods

All patients with various benign and low grade malignant diseases of the pancreatic neck and body who underwent surgical resection in the Department of Pancreatic Surgery between January 2010 and December 2016 were identified from the review of the Hospital Physician Workstation. Patients were selected if they received elective CP, and were excluded if they underwent other types of pancreatic surgery, such as distal pancreatectomy and local resection. We also excluded patients who underwent CP with the left pancreatic remnant oversewn or stapled. As a result, 65 patients received CP during the study period. Among which, 33 patients whose pancreatic sections were performed using stapler plus external drainage of monolayer pancreaticojejunostomy were identified eligible for this study. Medical records including patient demographics, preexisting comorbidities, surgical notes, and perioperative data were collected. The study was approved by our hospital institutional review board and has been reported in line with the STROCSS criteria [13].

### 2.1. Surgical techniques and perioperative management

The surgical techniques were performed by one experienced surgeon. The pancreas was isolated at its superior and inferior margins, and the segment harboring the tumor was mobilized. The tunnel behind the pancreatic neck was opened by blunt dissection and a cotton tape was placed into it. By pulling this tape upward, the neck of the pancreas was dissected proximally and distally 2 cm far from the lesion. Then, a three-layer endoscopic stapler closure Echelon Flex 60 mm (Ethicon Endosurgery, LLC) was inserted to perform the proximal pancreatic transection. Staple cartridges were supplied in the white and blue colors with closed length of 2.5 and 3.5 mm, respectively. Additionally, the closed pancreatic duct was oversewn as far as possible with 4-0 absorbable suture. After placing two sutures on the superior and inferior edges near the distal pancreatic section line, the pancreas was transected above the portal/splenic vein using electrocautery. The resection margin of the distal stump of the pancreas was evaluated by frozen pathology. Approximately 1 cm distal to the cut end of the pancreatic remnant was mobilized off the splenic vessels.

A stent tube of 65 cm was inserted into the main pancreatic duct for about 3–5 cm inside. The proximal jejunum was brought in a retrocolic fashion to the left of the middle colic vessels. The pancreatic remnant and the jejunum were reconstructed by an end-to-side anastomosis in a monolayer. A longitudinal jejunotomy was tailored shorter than the width of the pancreatic stump (Fig. 1A). The posterior row anastomosis was performed between posterior half of the pancreatic remnant and the full-thickness jejunum with interrupted sutures. Careful attention was paid not to injure the pancreatic duct (Fig. 1B). Similar technique was performed for the anterior row anastomosis created by entering the ventral surface of the pancreas and coming out the middle of the way down the cut face of the pancreas, and including full-thickness jejunum (Fig. 1C). Special attention was paid to coat the pancreatic stump section with jejunal serosa when tying knots (Fig. 1D). The pancreatic stump was enclosed directly by the jejunum wall and only a linear drainage of anastomosis, but keeping the pancreatic duct opening. The external drainage tube was taken out the jejunal stump and fixed. An end-to-side jejunum-jejunostomy was performed approximately 45 cm



**Fig. 1.** Diagrammatic illustration of monolayer pancreaticojejunostomy with external pancreatic duct stent. **A.** The stent was inserted into the main pancreatic duct for 3–5 cm inside. A longitudinal jejunotomy was tailored shorter than the width of the pancreatic stump. **B.** The posterior row anastomosis was performed between posterior half of the pancreatic remnant and the full-thickness jejunum with no injury to the pancreatic duct. **C.** The anterior row anastomosis followed the similar technique in Fig. 1B. **D.** The pancreatic stump was coated by the jejunum wall. The external drainage tube was taken out the jejunal stump and fixed.

distal to the pancreaticojejunal anastomosis. Two closed suction drains were placed to lie above and below the completed pancreaticojejunal anastomosis and the proximal stump of the pancreas.

Patients received antibiotic prophylaxis 30 min before skin incision, and somatostatin/octreotide was given for about five days as prophylaxis of POPF. The drainage amylase levels were monitored daily from postoperative day (POD) one to POD 5 and then every two days until drainage removal. Drainage volumes were measured every day.

### 2.2. Outcome measurements and definitions of complications

The primary outcome measurements were the occurrence and severity of POPF, while the secondary outcome measurements were overall postoperative complications, reoperation rate, in-hospital mortality, and length of postoperative hospital stay. The 2016 updated definition and grading system of the International Study Group of Pancreatic Surgery (ISGPS) was used for POPF [14].

### 2.3. Matched-pairs analysis

To evaluate the effect of external drainage on surgical outcomes, a subset of these patients were compared with patients undergoing CP with internal drainage of pancreaticojejunostomy during the same period in a matched-pair analysis. Each patient was matched with a control in a 1:1 case-matched design selected from our prospective database. Match criteria were age ( $\pm 5$  years), sex, method of closing the proximal pancreatic stump, pancreatic duct diameter ( $\pm 1$  mm), and pancreatic texture.

### 2.4. Statistical analysis

Data were described as median (range) or mean  $\pm$  standard deviation, and frequencies (percentages of total). For the matched-pairs analysis, comparisons were performed using SPSS 15.0 for Windows (SPSS Inc, Chicago, IL, USA). Nominal variables were analyzed by chi-square test or Fisher's exact test when appropriate, and continuous variables were analyzed by the independent-samples *t*-test or Mann-Whitney *U* test. *P* value  $< 0.05$  was considered statistically significant.

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