

# Sealing Pancreaticojejunostomy in Combination with Duct Parenchyma to Mucosa Seromuscular One-Layer Anastomosis: A Novel Technique to Prevent Pancreatic Fistula after Pancreaticoduodenectomy



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Pancreaticoduodenectomy (PD) has been considered the surgical procedure of choice for ampullary cancer since Whipple and colleagues described 3 cases in 1935.<sup>1</sup> Currently, PD is the standard procedure for the management of pancreatic head and periampullary carcinoma, which includes ampullary carcinomas and carcinomas of the distal bile duct and the periampullary duodenum.<sup>2,3</sup> In recent years, the mortality rate of PD has decreased to <5%.<sup>4-7</sup> However, the postoperative morbidity rate remains high, ranging from 30% to 50%.<sup>5,7-9</sup> Postoperative pancreatic fistula (POPF) has been reported as the most frequent complication after PD, with a reported incidence ranging from 2% to 40%.<sup>10-12</sup> Several anastomotic surgical techniques have been used to minimize the occurrence of POPF after PD, although the optimal method remains a subject for debate among surgeons.<sup>13-15</sup> In the current study, we describe a novel technique involving pancreatic-jejunum reconstruction for POPF prevention after PD. To our knowledge, this method has not been reported in previous studies. We refer to this procedure as end to side sealing pancreaticojejunostomy (PJ) in combination with duct parenchyma to mucosa seromuscular one-layer anastomosis.

## METHODS

From January 2014 to March 2014, twenty-two consecutive patients underwent PD performed by the same surgical team. The patients included 15 males and 7 females with a mean age of 56.9 years (range 39 to 74 years). The underlying diseases of these patients are listed in Table 1. The surgical procedure performed in the majority of cases was classic PD without preservation of the pylorus. In selected patients, extended PD was performed, depending on

observations made during the operation. Two soft silicone drains were placed behind the PJ and the biliary-jejunal anastomosis (drainage 1) and in front of the PJ (drainage 2). The amylase concentration was measured on the first, third, and fifth postoperative days, as well as subsequent time points if necessary. Computed tomography scans (with contrast enhancement at the discretion of the radiologist) were obtained on the seventh to eighth postoperative day to assess the integrity of the anastomosis and to allow the patient to start a solid-food diet. Drains were removed when the output was <50 mL/d for 2 consecutive days.

Pancreatic fistula (PF) was defined and graded according to the International Study Group on Pancreatic Fistula's definition (Table 2).<sup>16</sup>

## SURGICAL TECHNIQUE

A scalpel is used to sharply transect the pancreas at the level of the portal vein. Hemostasis of the bleeding points of the pancreatic stump is achieved with either 4-0 nonabsorbable sutures or electrocautery. Two sutures are typically placed in both the superior and inferior border of the pancreatic stump for hemostasis and dragging. After the PD specimen has been removed, the pancreatic remnant is mobilized from the retroperitoneum and splenic vein for a distance of approximately 1 cm. The transected jejunum is brought through the bed of the resected duodenum (ie, posterior to the mesenteric vessels).

A small, full-thickness opening in the jejunum is made starting approximately 5 cm distal to the jejunal stump along the antimesenteric border. The size of the hole is determined by the diameter of the main pancreatic duct (Fig. 1).

Double needles with a 4-0 absorbable monofilament suture are used to complete the anastomosis between the pancreatic stump and the jejunum. In selected cases, a small silicone elastomer ureteral stent is placed in the pancreatic duct when the pancreatic duct is not dilated. To create the posterior suturing layers, the needle is inserted from the posterior interior side of the pancreatic duct, passing through the dorsal region of the parenchyma of the pancreatic stump to the posterior

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### Abbreviations and Acronyms

PD	= pancreaticoduodenectomy
PF	= pancreatic fistula
PJ	= pancreaticojejunostomy
POPF	= postoperative pancreatic fistula

surface of the pancreas approximately 0.5 cm distal to the cut edge (Video 1; available at: <http://www.journalacs.org>). The other side of the needle starts from the inside of the jejunum lumen to the subserosa and then passes through the seromuscular layer to the posterior surface of the bowel (Video 2; available at: <http://www.journalacs.org>). The extent of the distance is determined by the corresponding thickness of the pancreatic stump to fit the surface of the pancreatic cut edge on the surface area of the jejunum serosa (Fig. 2). If a stent is used, it is placed across the anastomosis before securing the anterior surface, so that it extends into the pancreatic duct and small bowel for a distance of approximately 2 to 3 cm. The anterior suturing layer is performed in the same manner. Both the anterior and posterior portions are sutured with 4-0 silk interrupted surgical sutures 60 degrees from each other (Fig. 3) (Video 3; available at: <http://www.journalacs.org>). All of the knots are tied on the outside, and each ligation should be performed carefully because the normal pancreas is soft and fragile (Video 4; available at: <http://www.journalacs.org>). The inferior and superior borders are reinforced by suturing the jejunal seromuscular layer and the capsular parenchyma of the pancreatic stump with 4-0 silk interrupted stitches (Fig. 4) (Video 5; available at: <http://www.journalacs.org>). These uniformly distributed sutures connect the pancreas stump with the jejunum tightly but without strain.

### Statistical analysis

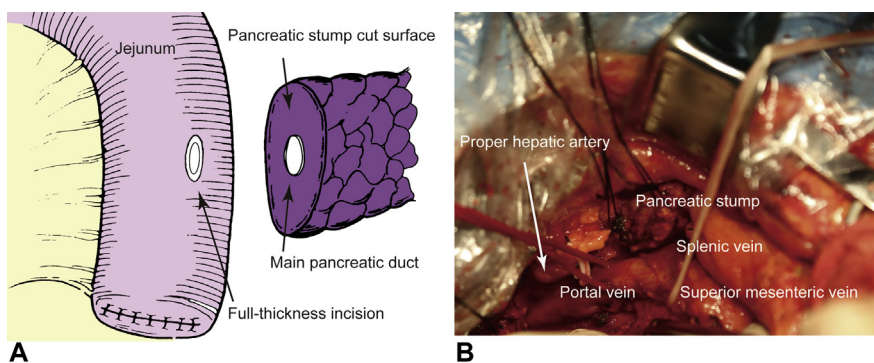
Because there was no control group in this study and because the study's main purpose was to describe a surgical technique, only descriptive measures were used.

### RESULTS

The PJ technique was performed on a total of 22 consecutive patients who underwent PD, including 7 women and 15 men with a mean age of 56.9 years (range 39 to 74 years). The underlying diseases of these patients are listed in Table 1. The mean  $\pm$  SD operative time was  $313 \pm 37$  minutes (range 228 to 360 minutes), and the mean time needed to perform the PJ technique was 12.8 minutes (range 7 to 22 minutes). Only 1 patient received a pancreatic stent during the operation. There were no operative or hospital deaths. Postoperative complications occurred in 4 patients (18.2%). Surgical site infection developed in 1 patient, pneumonia developed in 1 patient, and a gastric stress ulcer with postoperative bleeding developed in 1 patient. Postoperative pancreatic fistula (grade A) occurred in 1 elderly patient (4.5%) with a soft, thin pancreas and diabetes; the PF was managed nonoperatively by maintaining the external drainage. In the 22 patients included in this series, our technique of end to side sealing PJ in combination with duct parenchyma to mucosa seromuscular one-layer anastomosis prevented POPF occurrence and POPF-associated postoperative complications (eg, hemorrhage, infection, etc).

### DISCUSSION

Pancreatic anastomosis might be considered the major weakness of PD, and the major and most dangerous complication after PD is PF.<sup>17</sup> Pancreatic fistula can severely impair surgical outcomes and result in prolonged hospital stay, impaired quality of life, and even death.<sup>18</sup>



**Figure 1.** Preparation of the jejunal stump and the pancreatic stump. (A) The schema shows the dissected surface of the jejunum and the cut surface of the pancreas that are approximated. (B) Situs before pancreaticojejunostomy. Blood coagulation was achieved by suturing and thermocoagulation.

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