

# Tailored pancreatic reconstruction after pancreaticoduodenectomy: a single-center experience of 892 cases

Ayman El Nakeeb, Ahmad M Sultan, Ehab Atef, Ali Salem, Mostaffa Abu Zeid,  
Ahmed Abu El Eneen, Gamal El Ebidy and Mohamed Abdel Wahab

Mansoura, Egypt

**BACKGROUND:** Pancreatic reconstruction following pancreaticoduodenectomy (PD) is still debatable even for pancreatic surgeons. Ideally, pancreatic reconstruction after PD should reduce the risk of postoperative pancreatic fistula (POPF) and its severity if developed with preservation of both exocrine and endocrine pancreatic functions. It must be tailored to control the morbidity linked to the type of reconstruction. This study was to show the best type of pancreatic reconstruction according to the characters of pancreatic stump.

**METHODS:** We studied all patients who underwent PD in our center from January 1993 to December 2015. Patients were categorized into three groups depending on the presence of risk factors of postoperative complications: low-risk group (absent risk factor), moderate-risk group (presence of one risk factor) and high-risk group (presence of two or more risk factors).

**RESULTS:** A total of 892 patients underwent PD for resection of periampullary tumor. BMI >25 kg/m<sup>2</sup>, cirrhotic liver, soft pancreas, pancreatic duct diameter <3 mm, and pancreatic duct location from posterior edge <3 mm are risk variables for development of postoperative complications. POPF developed in 128 (14.3%) patients. Delayed gastric emptying occurred in 164 (18.4%) patients, biliary leakage developed in 65 (7.3%) and pancreatitis presented in 20 (2.2%). POPF in low-, moderate- and high-risk groups were 26 (8.3%), 65 (15.7%) and 37 (22.7%) patients, respectively. Postoperative morbidity and mortality were significantly lower with pan-

creaticogastrostomy (PG) in high-risk group, while pancreaticojejunostomy (PJ) decreases incidence of postoperative steatorrhea in all groups.

**CONCLUSIONS:** Selection of proper pancreatic reconstruction according to the risk factors of patients may reduce POPF and postoperative complications and mortality. PG is superior to PJ as regards short-term outcomes in high-risk group but PJ provides better pancreatic function in all groups and therefore, PJ is superior in low- and moderate-risk groups.

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**KEY WORDS:** periampullary tumor;  
pancreaticogastrostomy;  
pancreaticojejunostomy;  
pancreaticoduodenectomy;  
postoperative pancreatic fistula

## Introduction

Pancreaticoduodenectomy (PD) is the main line of treatment of periampullary tumors. PD is a complex operation which involves extensive dissection, resection and multiple reconstructions.<sup>[1-5]</sup> The mortality rate has reduced to 3%-5% in many published series while the rate of postoperative complications remains high, from 40% to 50%.<sup>[3-7]</sup> In most of patients, morbidity and mortality after PD are linked to features of pancreatic remnant and type of pancreatic reconstruction.<sup>[3-6]</sup> Postoperative pancreatic fistula (POPF) after PD remains a problem even at high-volume centers.<sup>[4-8]</sup> The rate of POPF following PD is ranging from 5% to 35%. POPF and its disastrous sequelae impact surgical outcome, hospital stay and cost.<sup>[5-9]</sup>

Ideally, the pancreatic reconstruction after PD should reduce the risk of POPF and its severity if occurred and also, preserve exocrine and endocrine pancreatic functions.<sup>[8-12]</sup> Several technical modulations of the pancreatic

**Author Affiliations:** Gastroenterology Surgical Center, Mansoura University, Mansoura 35516, Egypt (El Nakeeb A, Sultan AM, Atef E, Salem A, Abu Zeid M, Abu El Eneen A, El Ebidy G and Abdel Wahab M)

**Corresponding Author:** Ayman El Nakeeb, MD, Professor of General Surgery, Gastroenterology Surgical Center, Mansoura University, Mansoura 35516, Egypt (Tel: +20-10-6752021; Email: elnakeebayman@yahoo.com)

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## Tailored pancreatic reconstruction

reconstructions have been performed to prevent postoperative morbidities including: surgical techniques (isolated Roux loop pancreaticojejunostomy [PJ], binding PJ, reconstruction by pancreaticogastrostomy [PG], and uses of pancreatic duct stent), somatostatin administration, and use of adhesive sealants.<sup>[13-17]</sup> The most common types of pancreatic reconstruction are PJ and PG.<sup>[1-4]</sup> Many meta-analyses of both types of reconstruction showed no superiority of any technique as regards short-term outcomes. Long-term outcomes, including structural and functional outcomes of the remaining pancreas, have yet to be fully studied.<sup>[17-21]</sup>

The ideal and safe pancreatic reconstruction following PD is still under debate even for pancreatic surgeons. Shrikhande et al<sup>[22]</sup> found that a standardized single pancreatic reconstruction at a single institution can decrease the rate of morbidity following PD. Pancreatic reconstruction must be tailored to overcome the morbidity linked to the type of reconstruction. The current study was planned to review the surgical outcomes after different types of pancreatic reconstructions and to determine the best type of pancreatic reconstruction.

## Methods

### Study design

We studied all patients who underwent PD for periampullary tumor in Gastroenterology Surgical Center, Mansoura University, Egypt, from January 1993 to December 2015. Patient data were recorded in a prospectively maintained database for all patients undergoing PD since 2000 and before 2000, the data were recorded from the archive files of patients. Informed consent was signed from all patients after explanation of the surgical procedure. The current study was approved by institutional review board of Mansoura University.

The risk factors of development of postoperative complications according to recent studies included, obesity, soft pancreas, cirrhotic liver, pancreatic duct diameter <3 mm, and position of pancreatic duct from posterior edge <3 mm, vascular resection (combined resection of superior mesenteric vein and portal vein), estimated blood loss volume, elderly patients, re-exploration and final pathology.<sup>[4-7, 11, 12]</sup> Patients were categorized into three groups depending on presence of risk factors of development of postoperative complications: low-risk group (absent risk factor), moderate-risk group (presence of one risk factor) and high-risk group (presence of two or more risk factors).

### Preoperative assessment

Preoperative assessment for diagnosis and staging in-

cluded: clinical assessment, laboratory investigations, and radiological investigations. Preoperative biliary drainage was carried out by endoscopic retrograde cholangiopancreatography when biliary obstruction was associated with cholangitis or liver dysfunction as described in our previous publications.<sup>[4, 23]</sup>

### Surgical procedures

Operative details including different types of pancreatic reconstruction either simple PJ, PG, or isolated Roux loop PJ and different techniques either duct to mucosa or invaginated type.<sup>[23, 24]</sup> The types of reconstruction depend on surgeon choice or on randomization in the randomized study.

#### Simple PJ

PJ was performed in two layers after creation of 2-3 cm jejunostomy (in invagination PJ) or a small jejunostomy equal to pancreatic duct diameter (in duct to mucosa PJ) without pancreatic stenting. Biliary reconstruction was performed by end-to-side hepaticojejunostomy (HJ) (retocolic) in the same jejunal loop caudal to the PJ. Gastric reconstruction was performed by an antecolic end-to-side gastrojejunostomy (GJ) 30 cm distal to the HJ.<sup>[23, 24]</sup>

#### PG

The PG was performed in two layers after creation of 2.5-3.0 cm gastrostomy. Biliary reconstruction was carried out by end-to-side HJ (retocolic). Gastric reconstruction was achieved by an antecolic or retocolic end-to-side GJ 30 cm distal to the HJ.<sup>[23, 24]</sup>

#### Isolated Roux loop PJ

A separate Roux loop was created for the end-to-side HJ and the end-to-side antecolic GJ in one loop. The PJ loop was anastomosed to the main loop. This technique was done in our center from January 2011 to May 2013.<sup>[23]</sup>

### Postoperative management

All patients were transferred to the intensive care unit postoperatively. Antibiotics and analgesics were given to all patients. Sandostatin was given to most of patients postoperatively. Abdominal drains were monitored daily. Oral fluid was started once bowel sounds restarted and regular diet was provided later on.

Abdominal ultrasound was performed postoperatively. Serum amylase and liver function (albumin, alanine aminotransferase, bilirubin) were tested in postoperative days 1 and 5. Ultrasound-guided tubal drainage was done for abdominal collections.

Follow-up was scheduled at day 7, 90 and 180 postoperatively, and then yearly.

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