



Original research

Comparative study between duct to mucosa and invagination pancreaticojejunostomy after pancreaticoduodenectomy: A prospective randomized study



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ABSTRACT

Background: The ideal technical pancreatic reconstruction following pancreaticoduodenectomy (PD) is still debated. The aim of the study was to assess the surgical outcomes of duct to mucosa pancreaticojejunostomy (PJ) (G1) and invagination PJ (G2) after PD.

Methods: Consecutive patients treated by PD at our center were randomized into either group. The primary outcome measure was the rate of postoperative pancreatic fistula (POPF); secondary outcomes included; operative time, day to resume oral feeding, postoperative morbidity and mortality, exocrine and endocrine pancreatic functions.

Results: One hundred and seven patients treated by PD were randomized. The median operative time for reconstruction was significantly longer in G1 (34 vs. 30 min, $P = 0.002$). POPF developed in 11/53 patients in G1 and 8/54 patients in G2, $P = 0.46$ (6 vs. 2 patients had a POPF type B or C, $P = 0.4$). Steatorrhea after one year was 21/50 in G1 and 11/50 in G2, respectively ($P = 0.04$). Serum albumin level after one year was 3.4 gm% in G1 and 3.6 gm in G2 ($P = 0.03$). There was no statistically significant difference regarding the incidence of DM preoperatively and one year postoperatively.

Conclusion: Invagination PJ is easier to perform than duct to mucosa especially in small pancreatic duct. The soft friable pancreatic tissue can be problematic for invagination PJ due to parenchymal laceration. Invagination PJ was not associated with a lower rate of POPF, but it was associated with decreased severity of POPF and incidence of postoperative steatorrhea.

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Pancreaticoduodenectomy (PD) is a complex operative procedure and widely performed for various benign and malignant diseases of periampullary or pancreatic region [1–4]. With improvement in the operative techniques and the perioperative management, the operative mortality rate after PD has dramatically decreased to less than 5%, while the incidence of postoperative morbidity remains high, from 40% to 50% [1–6].

Postoperative pancreatic fistula (POPF) remains a challenge even at the specialized centers, and also affect significantly the surgical outcomes [2–6]. The incidence of POPF after PD among different studies, ranging from 5 to 30% [1–5].

The morbidity and mortality after PD are usually related to the surgical management of the pancreatic stump [3–7]. Several methods and techniques of pancreatic anastomosis have been proposed after PD to reduce the rate of POPF including the usage of an external or an internal pancreatic stent, isolated loop pancreaticojejunostomy (IPJ), pancreaticogastrostomy, binding PJ, or an administration of postoperative somatostatin [4–13]. The safe pancreatic reconstruction after PD continues to be a challenge at the high volume centers. The variety of reconstruction is a reflection of the lack of the ideal one [4–9].

No pancreatic reconstruction technique after PD was found to be applicable to all kinds of pancreatic remnants. No consensus exists regarding the ideal PJ reconstruction to reduce POPF. Duct to mucosa and invagination are two classic PJ techniques. Many studies have compared both techniques, but their surgical outcomes are

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still unclear [8,14–21].

The aim of the study was to assess the effectiveness and the surgical outcomes of both techniques of PJ after PD.

1. Patients and methods

1.1. Patients

Consecutive patients that were treated by PD at the Gastroenterology Surgical Center, Mansoura, Egypt, during the period from June 2011 to September 2013, were eligible for the study. The exclusion criteria included any patients with locally advanced periampullary tumor, metastases, patients received neoadjuvant chemoradiotherapy, patients underwent pancreaticogastrostomy (PG) and patients with advanced liver cirrhosis (Child B or C), malnutrition, or coagulopathy.

Informed consent was obtained from all patients to be included in this study, after a careful explanation of the disease and the possible treatment options with its complications. The study was approved by the local ethical committee.

All patients were subjected to careful history taking, clinical examination, routine laboratory investigation and tumor markers as CEA and CA19-9, an abdominal ultrasound, magnetic resonance cholangiopancreatography (MRCP), and an abdominal computerized tomography (CT).

1.2. Randomization

The patients included in the study were randomized into two groups using the closed envelope method. The envelopes were drawn and opened by a nurse in the operating room after pancreatic resection. The patients were randomized into two groups: Group I: patients underwent duct to mucosa PJ. Group II: patients underwent invagination PJ.

1.3. Operative techniques

Standard PD was performed in all patients. All patients underwent regional lymphadenectomy, which included resection of nodes within the outlines of the hepatoduodenal ligament, right side of the superior mesenteric vessels, and inferior vena cava. All anastomoses were performed by experienced surgeons.

1.4. *Duct to mucosa PJ group (Group 1)

The duct to mucosa PJ was performed by a two layer end to side PJ. The pancreatic capsule and the jejunal serosa were anastomosed by interrupted silk suture 3/0 to form the outer layer in both the anterior and posterior walls of the anastomosis. Jejunostomy was done matched to the pancreatic duct diameter. The inner layer duct to mucosa was performed in eight to twelve stitches with 5/0 prolene. A pancreatic duct stent was inserted during the anastomosis to allow an easy and accurate suture placement, ensure an adequate pancreatic duct exposure and protect the opposite wall from being inadvertently held by needles and then it was removed at the end of the anastomosis.

1.5. *Invagination PJ group (Group 2)

The invagination PJ was performed as an end to side. The pancreatic capsule and the jejunal serosa were anastomosed by an interrupted silk suture 3/0 to form the outer layer in both the anterior and posterior walls of the anastomosis. Jejunostomy was done matched to the pancreatic stump diameter. The inner layer was performed with 5/0 prolene between the pancreatic parenchyma

and mucosa. The duct was taken posteriorly and anteriorly to jejunal mucosa. A pancreatic duct stent was inserted during anastomosis and removed at the end of taking the stitches. The reconstruction was completed by end to side hepaticojejunostomy (retrocolic) and gastrojejunostomy (GJ) (antecolic) end to side manually.

1.6. Data collected

Preoperative variables included; age, sex, body mass index, patients' symptoms and signs, laboratory tests, tumor markers and preoperative biliary drainage.

Intraoperative variables included; liver status, tumor size, pancreatic duct diameter, texture of the pancreas, operative time, blood loss and blood transfusion.

Postoperative variables included; postoperative complications, drain amylase, liver function, day to resume oral feeding, postoperative stay, re-exploration, hospital mortality, postoperative pathology, and surgical safety margins.

1.7. Assessments

The primary outcome was POPF rate. POPF was defined by the International Study Group of Pancreatic Fistula (ISGPF) as any measurable volume of fluid on or after POD 3 with amylase content greater than 3 times the serum amylase activity [22,23]. A pancreatic fistula (PF) was graded according to the ISGPF into Grade A, B and C according to the clinical course [22,23].

The secondary outcomes were operative time, operative time needed for reconstruction, length of postoperative hospital stay, postoperative morbidities including (delayed gastric emptying (DGE), pancreatitis and biliary leakage). Complications were graded according to their severity on a validated five point scale using Dindo-Clavien complication classification system into (grades I, II, IIIa–b, IVa–b, V) [24]. The complications which were higher than Clavien–Dindo grade III were considered to be major complications [24]. The pancreatic exocrine function was evaluated clinically. It was assessed by the presence or the absence of the steatorrhea (passing stool more than three times per day, fecal output of >200 g/d for at least three days, pale or yellow stools, and appearance of stools as pasty or greasy), the need of pancreatic enzymes supplement and studied variation in the body weight pre and postoperative [25].

1.8. Follow up

Follow-up was carried out one week postoperatively, 3 months, 6 months and then after one year.

Statistical analysis in this study was performed using SPSS software, version 17. Descriptive statistics were calculated and described as median (range) for continuous variables. Categorical variables were represented using percentages. Student's t-test for paired samples was used to detect differences in the means of continuous variables and Chi-square test was used for categorical variables. P values <0.05 were considered to be significant. Significance was two tailed.

2. Results

2.1. Patients' characteristics

The study flow chart is shown in Fig. 1. Of 117 consecutive patients with periampullary tumor seen during the study period underwent PD, 107 patients (40 (37.4%) women and 67 (62.6%) men) were eligible and included in the study. The median age was 54 years. The demographic data of both randomized groups are presented in Table 1.

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