



# Can isolated pancreaticojejunostomy reduce pancreas fistula after pancreaticoduodenectomy with Roux-en-Y reconstruction?

Hasan Erdem<sup>1</sup>, Süleyman Çetinkünar<sup>1</sup>, Mehmet Aziret<sup>1</sup>, Enver Reyhan<sup>2</sup>, Alper Sözütek<sup>2</sup>, Selim Sözen<sup>3</sup>, Oktay İrkorucu<sup>1</sup>

## ABSTRACT

**Objective:** Pancreaticoduodenectomy is a surgical procedure which is commonly accepted in cases of ampulla of Vater, head of pancreas, distal common bile duct neoplasms and severe chronic pancreatitis. Pancreatic fistula is still a serious problem after reconstruction. Yet, there is no consensus on a single reconstruction method.

**Material and Methods:** The reconstruction methods on patients who had pancreaticoduodenectomy due to pancreatic tumor, and results of these reconstruction methods were retrospectively analyzed. Anastomosis was performed on all patients in the form of Roux-en-Y, but they varied as follows; Type 1: Only pancreatic anastomosis to the Y limb, Type 2: Pancreas and hepatic canal anastomosis together to the Y limb.

**Results:** 31 patients participated in the study. 21 of them were male, and 10 were female. In our study, postoperative complications included pancreatic fistula, hemorrhage, abscess, wound site infection, and pulmonary infection. Although more complications were observed in group 2 than in group 1, there was no statistically significant difference. There was one mortality in each group.

**Conclusion:** In our opinion, one of the reasons of leakage is that anastomosis of both the biliary and pancreatic ducts to the same loop increases anastomotic pressure due to the raised output thus leading to fistula formation. A limitation of our study was the low number of patients. Reconstruction of the pancreas and bile secretions through separate anastomosis may reduce the rate of pancreatic fistulas.

**Keywords:** Fistula, pancreatic cancer, pancreaticoduodenectomy

## INTRODUCTION

Pancreaticoduodenectomy (PD) is a surgical procedure that is commonly accepted in cases of malignant and benign diseases of the pancreas and periampullary region. Due to the developments in perioperative patient care and operative techniques, mortality and morbidity observed in PD cases have decreased gradually in recent years (1, 2). Operative mortality has fallen to 1% in broad series. Postoperative pancreatic fistula (POPF) is definitely the most important complication of PD, being the most important reason of perioperative mortality and morbidity (3, 4). Pancreaticojejunostomy is the weakest point of reconstruction, both due to the consistency of pancreatic tissue and the frequency of fistulas of this anastomosis (1, 5, 6). Conventional reconstructions include performing hepaticojejunostomy and gastrojejunostomy on the same loop together with an end-to-end or end-to-side pancreaticojejunostomy. In cases of pancreatic leakages, dangerous and high-output fistulas can be observed if bile juice and stomach content are included in the pancreatic leakage as a result of the proximity of pancreas and hepatic canal anastomosis (7). It is considered that mixing of the pancreatic enzymes and bile juice and stomach content delays in methods of Roux-en-Y reconstruction (RYR) and isolated pancreatic drainage, thus pancreatic fistulas and mortality and morbidity based on them may be decreased, therefore these methods have been preferred increasingly in the last years (8).

## MATERIAL AND METHODS

In this study, our objective is to provide information on whether isolated pancreaticojejunostomy decreases POPF rates or not in Roux-en-Y reconstructions performed after PD in General Surgery Clinic of Adana Numune Training and Research Hospital, as well as the technical details of the procedure.

The reconstruction methods applied on patients who underwent PD between March 2011 and December 2013 were retrospectively analyzed. In our clinic, all patients with a periampullary tumor are subjected to classic Whipple operation. Reconstruction was performed on all patients in the form of Roux-en-Y anastomosis, but they varied as follows; Type 1: Only pancreatic anastomosis to the Y limb, Type 2: Pancreas and hepatic canal anastomosis together to the Y limb (Figure 1, 2).

Demographic characteristics, preoperative comorbidities, operation and postoperative follow-up findings, complications, and histopathological findings of the patients were recorded.

<sup>1</sup>Clinic of General Surgery, Adana Numune Training and Research Hospital, Adana, Turkey

<sup>2</sup>Clinic of Gastroenterology Surgery, Adana Numune Training and Research Hospital, Adana, Turkey

<sup>3</sup>Department of General Surgery, Tekirdağ University School of Medicine, Tekirdağ, Turkey

## Address for Correspondence Hasan Erdem

e-mail: drhasanerdem@yahoo.com

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'International Study Group of Pancreatic Fistula Classification' was used to diagnose postoperative POPF in our clinic. The temporary and asymptomatic fistulas that have been diagnosed only by drain amylase level were regarded as Grade A, whereas symptomatic fistulas with clinically notable fever, stomach ache and peripancreatic fluid were regarded as Grade B. Fistulas that caused relevant symptoms and required aggressive treatment were regarded as Grade C. All treatment strategies were determined based on this classification.

### Statistical Analysis

Statistical analysis was conducted by using Statistical Package for the Social Sciences 16 (SPSS Inc.; Chicago, IL, USA). Variables were presented as median (min-max). Continuous variables were evaluated by Student's t test. On the other hand, nonparametric variables were analyzed with chi-square method by applying Fischer's exact test.

### RESULTS

Our study group consisted of 31 patients, 21 M/10 F, with a median age of 61. Any statistically significant difference with regard to age and gender distribution was not determined between the groups ( $p=0.148$  and  $p=0.617$ , respectively). The most frequent tumor localization was found to be the head of the pancreas in both groups (9 (60%) in Group 1, and 7 (43%) in Group 2). The number of patients with tumors of the ampulla of Vater, duodenum and distal bile duct were 2, 1, and 3 in group 1; and 5, 1, and 3 in group 2, respectively. Any statistically significant difference with regard to tumor localization was not determined between the groups. In addition, there was no statistically significant difference with regard to tumor sizes between the groups. The tumor sizes of group 1 and group 2 were determined as 3 (0.3-4) cm and 3.5 (0.8-4) cm, respectively ( $p=0.454$ ). Adenocarcinoma was the most frequent histopathologic tumor type for both groups (group 1=10 patients, group 2=14 patients). Other histopathologic type of tumors included neuroendocrine tumors (group 1=3 patients), stromal tumor (group 2=2 patients) and mucinous cystic neoplasm (group 1=2 patients). However, any statistically significant difference with regard to histopathologic analysis was not detected between the groups. Postoperative pancreatic fistula was determined in 4 patients in total including 1 patient from group 1 and 3 patients from group 2. There was no statistically significant difference with regard to postoperative pancreatic fistula development between the groups ( $p=0.596$ ). In our study; hemorrhage, abscess, wound site infection, and pulmonary infection were the complications observed in the postoperative period. Although the number of the complications in group 2 was higher as compared to group 1, a statistically significant difference was not determined. There was one mortality in each group. Demographic data, tumor localization, tumor size, histopathologic examination, postoperative complications and mortality rates of the patients are summarized in Table 1.

### DISCUSSION

Even though mortality and morbidity rates have declined significantly since Whipple et al. (7) first described PD technique, the complications after pancreas surgery are still difficult to cope with both for the patients and the surgeons (5, 8-10). Postoperative mortality rate that had exceeded 25% in the 1960's has declined to below 5% nowadays in surgi-

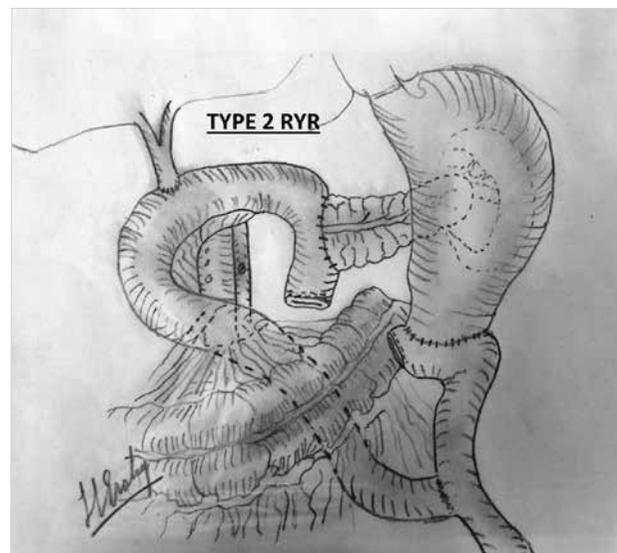


Figure 1. Classical Roux-en-Y reconstruction

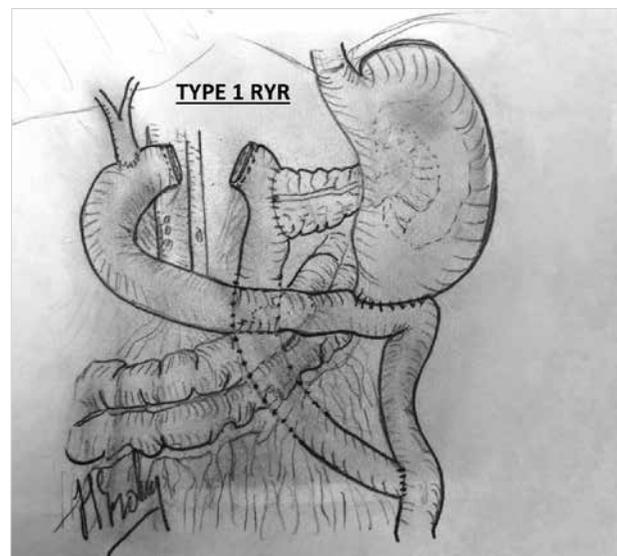


Figure 2. Isolated pancreatic loop reconstruction

cal centers performing specific pancreas surgery (5, 6, 11). The decline in mortality rate after pancreatic resection is attributed to the advancements in operative techniques, developments in perioperative care, and the increasing utility of endoscopic and percutaneous interventions. On the other hand, morbidity rates still correspond to 30-40% in broad series (11, 12). The most frequently observed specific complications after PD are anastomotic leakages, pancreas fistula, hemorrhage and delayed gastric emptying. Particularly, POPF is one of the major reasons of mortality and morbidity after PD (13-15). The predictive factors for pancreatic leakage and fistula development can be listed as a small sized duct, consistency of the pancreatic tissue, requirement for extended resections, drain localization, quantity of intraoperative blood loss and obesity (14, 16). Perhaps, the most significant ones among these are pancreatic anatomy and operative techniques (11, 17).

Numerous reconstruction methods have been applied to reduce POPF risk (13, 18-21). It is stated that RYRs were more effective than conventional loop reconstructions in recent years, and that fistula-related complications were decreased by this

method. The objective of RYR is enabling the contents of bile and pancreatic juice to encounter with gastric content later (22-24).

Another modification of RYRs is the one which is performed in the form of isolated pancreatic anastomosis. It was firstly described by Machado et al. (24) in 1976. In this study, fistula developed in 2 out of 15 patients, and both patients did not experience mortality. Kingsnorth et al. (23) mentioned that pancreatic fistula was not seen in a series of 52 cases when isolated Roux loop method was applied (23). Similarly, Funovics et al. (22) compared 4 different reconstruction methods in their study and reported that isolated pancreatic anastomosis technique yielded the optimum result. Another study conducted by Kaman et al. (13) showed that isolated Roux loop method did not reduce POPF rate.

	Group 1 (n=15)	Group 2 (n=16)	p
Age (min-max)/mean	(47-85)/62	(46-82)/60	NS
Gender (M/F)	9/6	12/4	NS
<b>Tumor localization</b>			
Head of pancreas	9 (60%)	7 (43%)	NS
Ampulla of Vater	2 (13%)	5 (31%)	
Duodenum	1 (6%)	1 (6%)	
Distal bile duct	3 (20%)	3 (18%)	
<b>Tumor size</b>	3 (0.3-4)	3,5 (0.8-4)	0.454
<b>Operation time (hour)</b>	6 (4-7)	5 (4-6)	0.376
<b>Histopathological classification</b>			
Adenocarcinoma	10 (66%)	14 (87%)	NS
Neuroendocrine tumor	3 (20%)	0 (0%)	
Stromal tumor	0 (0%)	2 (12%)	
Mucinous cystic neoplasm	2 (13%)	0 (0%)	
<b>Complication</b>			
POPF	1 (6%)	3 (18%)	0.596
Pulmonary infection	3 (20%)	4 (25%)	NS
Hemorrhage	0 (0%)	3 (18%)	0.221
Intra-abdominal abscess	0 (0%)	2 (12%)	0.483
Wound site infection	3 (0%)	8 (50%)	0.135
Mortality	1 (6%)	1 (6%)	NS

F: female; M: male; POPF: postoperative pancreatic fistula; NS: not significant

Fistula Patient No	Anastomosis type	Fistula Grade3	Symptom	Treatment	Result
1	RYR-isolated PJ	A	Asymptomatic	Conservative	Recovery
2	RYR	A	Asymptomatic	Conservative	Recovery
3	RYR	B	Intra-abdominal abscess	Percutaneous drainage	Recovery
4	RYR	B	Peritonitis	Re-laparotomy	Postoperative discharged on day 10

RYR: roux-en-Y reconstruction; PJ: pancreaticojejunostomy; POPF: postoperative pancreatic fistula; NS: not significant

One of the most comprehensive studies about RYR isolated pancreatic anastomosis technique is a multicenter prospective randomized study conducted by Ke et al. (21). In this study, Ke et al. compared conventional loop reconstruction (CLR) technique with RYR-isolated pancreatic anastomosis technique and they determined that isolated pancreatic anastomosis technique decreased fistula-related complications although it did not reduce pancreatic fistula rate (Table 2).

The objective of isolated pancreatic anastomosis is to prevent bile and intestinal content from mixing with the pancreatic content in anastomotic regions, since bile reflux in pancreatic region is one of the main reasons of especially pancreatitis and relevant leakage and sepsis (13, 22, 24).

All reconstructions in our clinical experiment were performed in form of RYR. We think that even the pancreatic anastomosis should be separated from biliary anastomosis in order to reduce pancreatic fistula rate and the relevant complications by means of RYR. In the literature, it is known that RYR isolated pancreatic anastomosis technique has many advantages. The most important advantage is preventing destruction of the biliary and gastric anastomosis through the isolation of pancreatic anastomosis. Another advantage is that in case of adequate drainage, oral intake is maintained despite the pancreatic fistula.

### CONCLUSION

Although the limited number of patients created a disadvantage in our study, no difference was determined between the two groups in terms of complications.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Ethics Committee of Adana Numune Training and Research Hospital.

**Informed Consent:** Written informed consent could not be obtained from the patients because it was a retrospective study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – H.E., S.Ç., O.İ.; Design – E.R.; Supervision – O.İ., E.R.; Resources – A.S., S.S.; Materials – H.E.; Data Collection and/or Processing – H.E., M.A.; Analysis and/or Interpretation – H.E., A.S., O.İ.; Literature Search – S.S.; Writing Manuscript – H.E.; Critical Review – S.S., O.İ., H.E.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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