

## Extramucosal Pancreatojejunostomy: Early Outcomes of an Easy Technique for a Challenging Stage of Pancreaticoduodenectomy

Servet Karagul<sup>1\*</sup>, Oktay Karakose<sup>2</sup>

<sup>1</sup>Division of Gastroenterological Surgery, Samsun Training and Research Hospital, University of Health Sciences, Samsun, Turkey

<sup>2</sup>Division of Surgical Oncology, Samsun Training and Research Hospital, University of Health Sciences, Samsun, Turkey

### Original Research Article

#### \*Corresponding author

Servet Karagul

#### Article History

Received: 11.10.2018

Accepted: 18.10.2018

Published: 30.10.2018

#### DOI:

10.36347/sjams.2018.v06i10.061



**Abstract:** Pancreatojejunostomy anastomosis is the most clinically important step of pancreaticoduodenectomy procedures. In this study we present the outcomes of an easy technique for patients who underwent pancreaticoduodenectomy. Patients who underwent pancreaticoduodenectomy with extra mucosal pancreatojejunostomy were evaluated retrospectively. Patients who underwent laparoscopic pancreaticoduodenectomy or emergency surgery, who were operated for reasons unrelated to cancer, and whose pancreatojejunostomy anastomosis were done using techniques other than the extramucosal technique were excluded from the study. The patients were evaluated in terms of age, gender, American Society of Anesthesiologists (ASA) operative risk score, body mass index (BMI), comorbid diseases, histopathological diagnosis, operative time, and intraoperative blood loss, length of hospital stay, and postoperative morbidity and mortality. The 17 patients operated with extra mucosal pancreatojejunostomy technique were included in the study. Nine of the patients were male, 8 were female and the mean age was  $68.2 \pm 13.1$  (range 36-85) years. Mean BMI was  $25.3 \pm 2.7$  kg/m<sup>2</sup> (range 22-30). Mean operative time was  $281.1 \pm 54.2$  minutes. Mean length of hospital stay was  $16.4 \pm 7.3$  (range 7-37) days and mean follow-up time was  $15.7 \pm 4.3$  months. Six patients (35%) developed postoperative complications. Three (18%) developed postoperative pancreatic fistula, 2 of which were classified as ISGPF grade A and the other as grade C. Postoperative mortality rate was 6% (n=1). Overall, the 1-year survival rate was 59%. The extra mucosal pancreatojejunostomy anastomosis technique can be safely and successfully used in pancreaticoduodenectomy procedures as a standard method independent of pancreatic tissue and duct features.

**Keywords:** Duodenum tumor, pancreas tumor, pancreatic fistula, Whipple procedure.

### INTRODUCTION

Pancreaticoduodenectomy (PD) is the most effective treatment method for cancers in the head of the pancreas. However, PD is a very difficult and complex procedure in terms of both resection and anastomosis. Although mortality rates of the procedure have fallen over the years, morbidity cannot be reduced below a certain level. This is mainly due to fistulas originating from the pancreatic anastomosis [1]. Postoperative pancreatic fistula is the most significant predictor of the patient's clinical condition.

High levels of morbidity still occur even in high-volume centers, and ways are being sought to prevent postoperative pancreatic fistulas (POPF). Currently, the most emphasized issue in reducing morbidity is which technique to use for pancreatic anastomosis. Many pancreatojejunal anastomosis techniques have been attempted in order to prevent

POPF, but none have shown superior performance over the others [2]. Although the pancreatojejunostomy (PJ) anastomosis technique has been practiced for decades, there are still new publications in the literature regarding this procedure [3-7]. As these anastomosis techniques generally yield comparable results, selecting between them must be based on other factors.

PD is a technically challenging procedure that requires surgical experience and has a long operative time. In our center, we also place importance on the feasibility of creating the anastomosis in this arduous surgical method. Therefore, we use the practical and reliable single-layer extramucosal technique for PJ anastomosis, which is a key stage in PD procedures. This report is presented to share our results with pancreatic anastomoses done with the extramucosal technique.

## MATERIALS AND METHODS

Patients who underwent PD between November 2016 and October 2017 in Division of Gastroenterological Surgery and Surgical Oncology in Samsun Education and Research Hospital, University of Health Sciences in Turkey were retrospectively analyzed. Data regarding the patients' age, gender, American Society of Anesthesiologists (ASA) operative risk score, body mass index (BMI), comorbid diseases, histopathological diagnosis, operative time, intraoperative blood loss, PJ anastomosis technique, length of hospital stay, postoperative morbidity and mortality, and clinical follow-up records were collected. Cases in which PJ anastomosis was done using the single-layer extramucosal technique were included in the study. Patients who underwent laparoscopic PD or emergency surgery, who were operated for reasons unrelated to cancer, and whose PJ anastomosis were done using other techniques were excluded from the study. Pancreatic fistulas were classified according to International Study Group on Pancreatic Fistula (ISGPF) guidelines [8]. Descriptive statistical methods were used to summarize data on demographic and clinical characteristics.

### Surgical Technique

All patients were operated under general anesthesia in supine position. Surgical procedures were done by the same two surgeons. Laparotomy was done with a midline incision extended to the right (modified hockey stick incision). Following intraabdominal exploration, the gastrocolic ligament was dissected and the Kocher maneuver was performed. Dissection was extended to the third section of duodenum to include the lymph nodes to the right of the superior mesenteric artery and posterior of the uncinate process. The neck of the pancreas was dissected above the portomesenteric vein and suspended. Following distal gastrectomy, the gastroduodenal artery was ligated and cut. Lymph nodes on the hepatoduodenal and celiac axes were dissected so as to remain within the specimen. The common bile duct was dissected and cut above the junction of cystic duct. The gallbladder was dissected from the liver and included in the specimen. The jejunum was cut 5 cm distal from the Treitz ligament and replaced to the retrocolic upper right quadrant. The neck of the pancreas was transected and the PD was completed by dissecting the pancreas head and the uncinate process from the portomesenteric vein.

The proximal end of the jejunum was approximated to the pancreas retrocolically. A catheter was placed in the duct of Wirsung if it was more than 3 mm wide. As we described previously [3], the posterior border of the pancreas was sutured to the antimesenteric border of the jejunum (Figure 1) as a single layer with 3/0 polypropylene seromuscular continuous suture to form an end-to-side anastomosis. If the stump of main pancreatic duct located near the lower edge of the pancreatic stump we used the posterior side of the

pancreatic remnant for suturing. A jejunotomy matching the width of the pancreas body was then made (Figure 2). The jejunum was again sutured extramucosally as a single layer with 3/0 polypropylene continuous suture (Figure 3, 4) to the superior border of the pancreas. Any loose points along the suture line were reinforced with one or two interrupted 3/0 polypropylene sutures. A hepaticojejunostomy (HJ) anastomosis was then created on the same limb using 4/0 polydioxanone continuous suture on the posterior border and interrupted suture on the anterior border. We used extramucosal technique for creating HJ. The jejunum was transected 60 cm distal of the HJ anastomosis and anastomosed to the stomach with a linear stapler to form an end-to-side gastroenterostomy (GE). The biliopancreatic limb was joined 50 cm distal of the GE in an end-to-side anastomosis. Two intraabdominal drains were placed adjacent to the HJ and PJ.

## RESULTS

A total of 26 patients underwent PD. Of these, 6 patients were excluded due to laparoscopic PD (n=4), emergency PD (n=1), and benign disease (n=1). Another 3 patients were excluded due to the use of a different PJ anastomosis technique. The 17 patients whose procedures were done using the extramucosal PJ technique were included in the study. Thirteen of the patients had pancreatic adenocarcinoma, 3 had duodenum adenocarcinoma, and 1 had gastrointestinal stromal tumor (GIST) of the duodenum.

Nine of the patients were male, 8 were female and the mean age was  $68.2 \pm 13.1$  (range 36-85) years. Mean BMI was  $25.3 \pm 2.7$  kg/m<sup>2</sup> (range 22-30). Seven patients were classified as ASA III, 9 as ASA II and 1 as ASA I. Mean tumor size was  $3.5 \pm 1.3$  cm. Seven of the patients had hypertension, 5 had diabetes mellitus, and 2 had coronary artery disease. Mean operative time was  $281.1 \pm 54.2$  minutes. Intraoperative blood loss was estimated as  $348.8 \pm 265.7$  mL. Mean length of hospital stay was  $16.4 \pm 7.3$  (range 7-37) days and mean follow-up period was  $15.7 \pm 4.3$  months (Table 1).

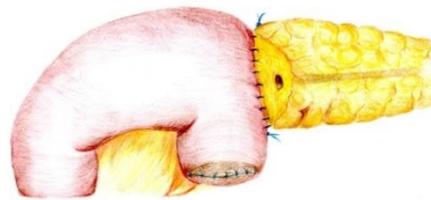
Six patients (35%) developed postoperative complications. Three (18%) developed postoperative pancreatic fistula (POPF), 2 of which were classified as ISGPF grade A and the other as grade C. The patient with Grade C POPF developed intraabdominal hemorrhage and was reoperated. This patient died as a result of postoperative liver failure. Delayed gastric emptying (DGE) was observed in 2 patients. DGE was managed with nasogastric decompression in 1 patient, but the other did not respond to medical treatment and was successfully treated with reoperation to reduce the size of the gastric remnant. One patient had surgical site infection that was managed medically. Postoperative mortality rate was 6% (n=1). Overall, the 1-year survival rate was 59% (Table 2).

**Table-1: Patient demographics and features**

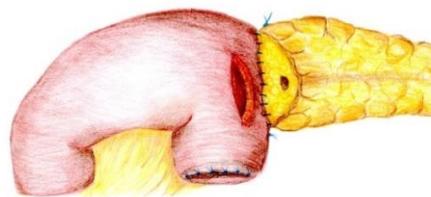
	n=17		
	Mean and standard deviation	Median	Range
Gender			
Male	9		
Female	8		
Age (years)	68.2±13.1	68	36-86
BMI	25.3±2.7	25	20-30
ASA III	7		
ASA II	9		
ASA I	1		
Diabetes Mellitus	5		
Hypertension	7		
Coronary Artery disease	2		
Pancreatic cancer	13		
Duodenal cancer	3		
Duodenal GIST	1		
Operation time (min)	281.1±54.2	270	220-390
Length of stay (day)	16.4±7.3	17	7-37
Estimated blood loss (mL)	348.8±265.7	300	130-1200
Tumor size (cm)	3.5±1.3	3.5	1-6
Follow up (month)	15.7±4.3	17	10-21
1 year survival	59%		

**Table-2: Postoperative outcomes after PD with extramucosal PJ**

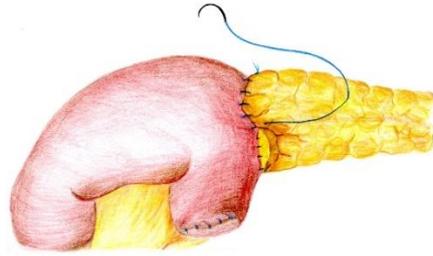
	n=17
Complications	6 (35%)
POPF	3 (18%)
Grade A	2
Grade C	1
Delayed gastric emptying	2 (12%)
Surgical site infection	1 (6%)
Postoperative mortality	1 (6%)



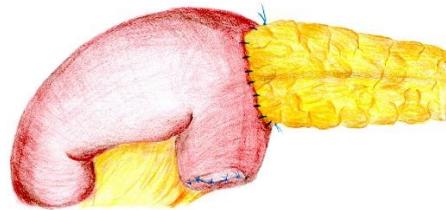
**Fig-1: Posterior extramucosal suturing layer of PJ anastomosis**



**Fig-2: Jejunotomy**



**Fig-3: Anterior extramucosal suturing layer of PJ anastomosis**



**Fig-4: Completed view of PJ**

## DISCUSSION

Although better outcomes are being achieved in PD procedure, they are still not completely satisfactory. While perioperative mortality is in the 3-5% range, complication rates remain high, and nearly half of all postoperative complications are the result of pancreatic fistulas [2, 9-10]. The main complications associated with POPF are DGE, bleeding, surgical site infection, intraabdominal abscess, and sepsis. Length of hospital stay and survival are closely dependent on the ability to overcome these complications [10-12]. Many different approaches have been attempted to solve this problem, ranging from anastomosis technique to the materials used in anastomosis. Despite the various methods that have been tested, such as duct-to-mucosa anastomosis, dunking technique, omental wrapping, anastomosis over a stent, and fibrin glue to reinforce the anastomosis, the desired degree of success has not been attained [13]. In fact, there is no consensus regarding any of these methods. The available data suggest that this will continue to be an active area of research for many years. The results of our study do not indicate any significant differences compared to other techniques. However, the method that we used was easily applicable. Therefore, considering that comparable outcomes are likely, a practical and comfortable suture technique may be preferable.

Soft pancreatic tissue texture is known to increase the risk of POPF. Other factors in fistula formation include the pancreatic duct being narrow, posteriorly situated, or not obstructed due to the underlying disease [14]. However, it is not possible to change these factors. While the anastomosis technique

is still not standardized, modifying it according to these factors makes it difficult to contribute to our existing knowledge. Therefore, it is extremely important to use an effective and standardized technique to minimize the risk of fistula. The extramucosal single-layer anastomosis technique enables creation of PJ anastomosis using a standard technique independent of the pancreatic tissue, pancreatic duct location, and diameter. The POPF rate in our study was 18%, which is at an acceptable level when compared to literature data [15]. All patients with POPF had pancreatic adenocarcinoma and only one of them had a soft pancreas texture. Two of the patients with POPF in our study had only biochemical leaks. One of our patients died due to hemorrhage and organ failure subsequent to anastomosis leak. The patients with grade A fistulas were discharged without complications following a drainage period of about 2 weeks.

The technique we used enables a practical pancreatic anastomosis using a single layer polypropylene continuous suture. This allows one of the most challenging stages of PD to be performed easily. We used the same technique for all patients in this study. We did not modify the technique based on pancreas features such as pancreatic tissue texture and duct location or diameter. This enabled us to both standardize our technique and increase our experience in terms of the reliability of the anastomosis. If stump of main pancreatic duct located near the lower edge, we placed the sutures posteriorly. Being a monofilament, polypropylene suture is easy to pass through the tissue and the suture line can also be tightened easily when necessary. In addition, using a monofilament suture

material causes less damage to the soft pancreatic tissue compared to the use of braided suture. As is possible with any continuous suture technique, we chose to make reinforcing stitches using one or two interrupted 3/0 polypropylene suture when there was slackening along the suture line that could not be tightened. A total of 6 patients required 1 or 2 reinforcement stitches, all of which were placed on the anterior suture line. None of these patients developed POPF.

PD can be performed laparoscopically with perioperative morbidity and mortality comparable to open PD [16-18]. However, laparoscopic pancreatic anastomosis in the reconstruction stage is a technically difficult and time-consuming procedure [19]. In order to make the procedure more practical, new methods that will not further complicate the surgeon's work have been reported in addition to the accepted open techniques (20, 21). A technique which can be reliably and easily performed laparoscopically and has also been proven effective in open surgeries could be a significant contribution to this issue, which is an important aspect of our study. For surgeons, performing extramucosal PJ anastomosis in open PD can be a useful step of training experience for a laparoscopic approach in the future. We have also applied and documented the extramucosal PJ technique that we prefer for open procedures in laparoscopic PD surgeries [3, 22]. Because we have used this technique in only a small number of laparoscopic surgeries, analyses with more reliable data will be possible as the number of cases grows. However, the open surgeries in which this method was used can provide some idea about the use of this technique.

We consider our results with the extramucosal PJ technique to be acceptable. Prospective comparative studies will yield stronger findings. A limitation of our study is that the time taken to perform PJ anastomosis was not recorded. If these data were available, we could evaluate to what extent the technique can shorten this crucial stage of a lengthy surgery. Based on available data, this technique simplifies the surgeon's work in terms of surgical technique and it should be evaluated in further studies.

## CONCLUSION

The extramucosal pancreaticojejunostomy anastomosis technique can be safely and successfully used in pancreaticoduodenectomy procedures as a standard method independent of pancreatic tissue and duct features.

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