

# Initial operative experience with pancreaticoduodenectomy after fellowship training

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## Abstract

**Aim:** Pancreaticoduodenectomy is a challenging procedure used primarily for the treatment of pancreatic head cancers. The aim of this study was to share early outcomes of the first pancreaticoduodenectomy operations performed by our surgery team after completing a gastroenterological surgery and surgical oncology fellowship program.

**Material and Methods:** Patients who underwent pancreaticoduodenectomy by the same surgical team between November 2015 and August 2018 were retrospectively analyzed. The patients' demographic data, diagnoses, tumor characteristics, postoperative complications, mortality, and clinical findings during follow-up were recorded.

**Results:** A total of 35 patients (21 men and 14 women) with a mean age of 65.6±18.1 years were included in the study. Mean length of hospital stay was 16.8±7.3 days. Postoperative pancreatic fistula was observed in 5 patients. Postoperative hemorrhage occurred in 3 patients and delayed gastric emptying (DGE) in 2 patients. Three patients died in the early postoperative period. Mean follow-up time of the remaining 32 patients was 22.9±8.4 months.

**Conclusion:** Our experience demonstrates that pancreaticoduodenectomy can be performed with acceptable outcomes after fellowship training that includes pancreatic surgery.

**Keywords:** Whipple; pancreaticoduodenectomy; initial experience.

## INTRODUCTION

Although the first successful pancreaticoduodenectomy (PD) was performed by Kausch in 1912, the procedure was popularized by Whipple in 1935 and became known by his name (1,2). Due to the high mortality and morbidity it caused, PD was once considered a surgery that should be avoided (3,4). However, with reductions in morbidity and mortality rates brought about by advances in surgical technique and perioperative patient care, the procedure has become increasingly common (5). Experienced centers currently report mortality rates below 3% (6). However, the operation is still associated with high complication rates (7).

The Whipple procedure, or PD, is a technically challenging and complicated surgery performed primarily in patients with pancreatitis or cancers and trauma of the pancreas head, duodenum, distal part of the common bile duct,

or ampulla of Vater, and is the only potentially curative treatment option in pancreatic or periampullary cancers (6-8).

In this study, we aimed to retrospectively evaluate and share the outcomes of PD surgeries we performed after completing a 2-year surgical oncology and gastroenterological surgery fellowship training program.

## MATERIAL and METHODS

We retrospectively analyzed postoperative outcomes in patients who underwent PD between November 2015 and August 2018 in the Samsun Training and Research Hospital, in Turkey under the supervision of a surgical oncology specialist and a gastroenterological surgery specialist. Patient characteristics, diagnoses, tumor characteristics, postoperative follow-up, complications, mortality, and oncological outcomes were evaluated. All data were recorded in Microsoft Excel. Postoperative

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pancreatic fistula (POPF) was classified according to the International Study Group on Pancreatic Fistula (ISGPF) guidelines (9).

## RESULTS

A total of 35 patients underwent PD during the study period. Twenty-one of the patients were men and 14 were women; their mean age was  $65.2 \pm 14.4$  (33-86) years. Diagnosis was pancreas cancer in 18 patients, duodenum cancer in 6 patients, cancer of the ampulla of Vater in 2 patients, pancreas neuroendocrine tumor (NET) in 2 patients, duodenal involvement of recurrent locoregional colon cancer in 2 patients, and duodenal gastrointestinal stromal tumor (GIST) in 1 patient. In 2 patients who were operated due to suspected malignant mass at the head of the pancreas based on radiology, histopathological examination revealed chronic pancreatitis. PD was performed in one patient due to delayed duodenal perforation after ERCP and in one patient because of gunshot injury (Table 1).

Table 1. Patient features	
	n=35
<b>Gender</b>	
Male	21
Female	14
Age (years)	$65.2 \pm 14.4$
Pancreas Cancer	18
Duodenum Cancer	6
Cancer of the ampulla of Vater	2
Pancreas neuroendocrine tumor	2
Locoregional recurrence of colon cancer with duodenal involvement	2
Chronic pancreatitis	2
Emergency pancreaticoduodenectomy	2
GIST of duodenum	1
Length of stay (days)	$16.8 \pm 7.3$

In 18 patients, a duct-to-mucosa anastomosis was used for pancreaticojejunostomy (PJ) as a modified Blumgart's technique. Extramucosal pancreaticojejunostomy was used in 21 patients and 4 of them underwent laparoscopic pancreaticoduodenectomy. Same jejunal limb used for hepaticojejunostomy and pancreaticojejunostomy. Roux-en-Y reconstruction was performed with gastrojejunostomy in all cases.

Mean tumor diameter was 3.3 (0.5–6) cm. Lymph node involvement was detected in 12 patients (37.5%) and the mean number of removed lymph nodes was  $15.2 \pm 10.2$  (9–53). Lymph node metastasis was detected in 10 patients with pancreatic tumor (50%) but only 1 patient with duodenal mass (14%). There was no lymph node involvement in the 2 patients with ampullary masses. One of the two patients with recurrent locoregional colon cancer had lymph node metastasis. Mean diameters of

the pancreatic, duodenal, and ampullary masses were 3.2 (0.5–6) cm, 3.1 (1–6) cm, and 2.5 (1–4) cm, respectively. The mean postoperative length of stay was  $16.8 \pm 7.3$  (7–37) days. Three patients (8.5%) died postoperatively. Of these, 2 patients were lost due to cardiac causes, and 1 due to hemorrhage after anastomotic leak and organ failure.

Five patients (14.2%) developed POPF. Postoperative hemorrhage was detected in 3 patients (8.5%). In 3 patients, POPF was ISGPF grade A and spontaneously resolved within about 2 weeks with no intervention. One patient had grade B POPF and surgical site infection which were managed with medical treatment. The other POPF was grade C and the patient required revision surgery due to hemorrhage. The patient developed multiple organ failure and died during follow-up. Other than this case, hemorrhage was observed in 2 other patients, from the anastomosis site of the stomach in one patient and from a branch of the superior mesenteric artery in the other. Both patients underwent revision surgery and the bleeding was controlled.

A total of 3 patients had chylous leak which was treated with medical therapy. Delayed gastric emptying (DGE) was observed in 2 patients (5.7%). One patient with DGE was treated with nasogastric decompression. The other did not respond to medical therapy and was successfully treated by revision surgery to reduce the gastric remnant. A total of 4 patients (11.4%) underwent a second surgery for postoperative complications (Table 2).

Table 2. Postoperative outcomes	
<b>POPF</b>	5 (14.2%)
Grade A	3
Grade B	1
Grade C	1
Re-operation	4 (11.4%)
Hemorrhage	3 (8.5%)
Chylous leak	3 (8.5%)
DGE	2 (5.7%)
Surgical site infection	1 (2.85%)
Mortality	3 (8.5%)

Mean follow-up time for the 32 patients who were discharged was  $22.9 \pm 8.4$  (7–37) months. Twenty of the 22 patients who are still under follow-up are healthy with no complications. One of the other 2 patients is in postoperative month 18 and continues to receive chemotherapy due to liver metastasis of pancreatic neuroendocrine carcinoma, and the other was diagnosed with pancreatic cancer in postoperative month 9 and is continuing chemotherapy due to metastatic lymph nodes. A total of 10 patients (28.5%) died during follow-up, 2 due to cancer recurrence, 3 due to pneumonia, 4 due to cardiac reasons, and 1 due to sepsis secondary to gastric

perforation. When the 7 patients who died of lung and heart problems during follow-up and the 2 patients who died in hospital for the same reasons were evaluated, it was found that these 9 patients had a mean age of 78 years and all had 2 or more chronic diseases, and were all ASA 3 patients.

## DISCUSSION

While mortality and morbidity rates after PD have decreased significantly in high-volume hospitals, the mortality rate can reach up to 16% in low-volume centers (10). Luft et al. showed the relationship between high surgical volume, which leads to centralization to improve the outcomes of high-risk operations, and low postoperative mortality rate (11). There are various studies demonstrating that postoperative mortality in PD is significantly lower in high-volume centers (<5%) than in low-volume centers (>10%) (12,13).

Our outcomes are consistent with a medium-volume center, with 14 patients in the first year, 15 in the second year, and 6 in the first half of the third year, and a mortality rate of 8.5%. However, 2 of the 3 patients who died in the early postoperative period and 7 patients who died due to comorbid disease in the first year after surgery had 2 or more comorbidities and their mean age was 78 (range, 68–86) years. From this perspective, we believe that patient selection plays an important role in short-term and 1-year postoperative mortality. In addition, this study encompassed the 2.5-year initial experience of the same surgical team following surgical oncology and gastroenterological surgery fellowship training, and included Whipple procedures performed with intraoperative assistance.

The number of patients in our study is compatible with a medium-volume center, defined as 10–24 cases per year, and our mortality rate (8.5%) is also compatible with outcomes in these centers. In a report by Cameron et al. on the outcomes of 1000 patients, the mortality rate was 1% (10). This and the fact that many centers that reach 100 patients have less than 3% mortality have been interpreted as an indicator that we are in the golden age of PD, and this success has been attributed to years of gaining knowledge and experience (14). Schell et al. reported that if appropriate conditions are established in small-volume hospitals, the outcomes can be similar to those in large-volume hospitals (15). Other authors stated that with careful patient selection, PD could be performed with low mortality and morbidity rates in hospitals with few surgeries per year (16). Considering that our study is an initial experience, we expect our outcomes to improve over time with increasing experience.

In a PD series of 650 patients, the mortality rate was reported as 1.4% and the most common complications were delayed gastric emptying (19%), pancreatic fistula (14%), and surgical site infection (10%) (17). In our study, pancreatic leakage occurred in 14.2% of the patients, hemorrhage in 8.5%, chylous leakage in 8.5%, DGE in 5.7%,

and surgical site infection in 2.85%. Pancreatic leakage was diagnosed based on amylase values in drain fluid after postoperative day 3 (18). One of the patients who had POPF also had surgical site infection at postoperative day 8 and exhibited leukocytosis and fever. Negative pressure wound therapy was applied to the surgical site and appropriate antibiotic therapy was given. The patient showed clinical recovery during follow-up and the leakage resolved within 1 month. One patient with POPF developed abundant hemorrhage and hemostasis was achieved with a surgical intervention, but the patient later died due to multiple organ failure. In the other 3 patients with POPF, the leakage was managed with conservative treatment. Although the incidence of pancreatic leakage varies due to the use of different diagnostic criteria, it has been reported as 9.9–28.5%. It can lead to mortality at rates as high as 20–40%.

One of the leading causes of post-PD morbidity is DGE, which appears in the early postoperative period and has been reported at rates of 6–50% in various series (17, 19). Although DGE is not associated with mortality, it may interfere with feeding and prolong postoperative hospital stay (19). In our study, DGE was observed in 2 patients (5.7%). One of these patients recovered with nasogastric decompression, while the other was re-operated at postoperative week 3. After revision surgery, the patient maintained a normal diet. The relatively lower rate of DGE in our study compared to the literature may be related to our gastrectomy technique, which includes resection of the distal third of the stomach instead of sparing the pylorus. However, this is a controversial topic, with some authors reporting no difference between pylorus-preserving and classical PD in terms of DGE (20,21).

Lymph node metastasis occurs in 56–79% of pancreatic cancers, 36–47% of duodenal cancers, 30–50% of ampullary cancers, and 56–69% of biliary duct cancers (22, 23). In our study, lymph node metastasis was detected 50% of the patients with pancreatic tumors but only 14% of those with duodenal masses. There was no lymph node involvement in the 2 patients with ampullary masses. We attribute our below-average results to the small number of patients in our study.

Emergency pancreaticoduodenectomy is rarely necessary and we performed this procedure in two patients. One is for duodenal multiple perforation and tissue defect that unable to primary repair due to gunshot injury. Additionally, primary inferior vena cava repair was done in this patient. The other patient had a history of laparoscopic cholecystectomy and ERCP three weeks ago. Patient had a septic shock with acute abdomen in physical examination. In exploration, necrosis of the second portion of duodenum with full thickness tissue defect was observed and patient underwent PD. Both patients were discharged uneventfully.

The 32 patients who were discharged were followed for a mean of 22.9±8.4 (7–37) months. A total of 13 patients were lost within the first 13 months after surgery. Only 2

of these deaths were due to recurrence and they occurred at postoperative months 8 and 13. Two of the patients still under follow-up have recurrence and are continuing chemotherapy. The remaining 20 patients are healthy.

## CONCLUSION

In conclusion, appropriate patient selection and surgeon experience are two of the important factors affecting the success of PD. As an initial experience after fellowship training that included pancreatic surgery, we believe our PD outcomes are acceptable and will improve as we continue to gain experience. We recommend specializing in centers experienced in hepatopancreaticobiliary surgery after general surgery training for surgeons wishing to practice pancreatic surgery.

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