LESS

Original Article

Laparosc Endosc Surg Sci 2026;33(3):154-158
DOI: 10.14744/less.2026.55823

# Pancreatic fistulas following surgical treatment of pancreatic masses: a single-center, single-surgeon experience

Egemen Çiçek,[1] Fatih Atalay,[1] Yahya Kaan Karatepe,[1] İsa Elbistan,[2] Tevfik Tolga Şahin[2]

[1]İnönü University Faculty of Medicine, Department of Gastroenterology and Surgery, Malatya, Türkiye
[2]İnönü University Faculty of Medicine, Department of General Surgery, Malatya, Türkiye

## ABSTRACT

**Introduction:** The aim of this study was to present the experience of a single surgeon performing pancreatic surgery at a single center and to evaluate the incidence of postoperative pancreatic fistulas.

**Materials and Methods:** In this retrospective study, data from 20 patients who underwent pancreaticoduodenectomy (Whipple procedure) or laparoscopic distal pancreatectomy with splenectomy performed by a single surgeon at the same center between 2020 and 2025 were analyzed. Patients were divided into two groups: those who underwent the Whipple procedure and those who underwent distal pancreatectomy with splenectomy. Postoperative pancreatic fistulas were classified according to the criteria defined by the International Study Group on Pancreatic Surgery (ISGPS).

**Results:** A total of 20 patients were included in the study. Of these, 12 underwent the Whipple procedure and 8 underwent distal pancreatectomy with splenectomy. In the Whipple group, 8 patients were ≥55 years old and 4 were <55 years old; 7 were male and 5 were female. Postoperative drain amylase levels were normal in 2 patients. Seven patients were classified as having a biochemical leak (BL). One patient died on postoperative day 0. Two patients developed pancreatic fistulas requiring reoperation and were classified as Grade C. In the laparoscopic distal pancreatectomy with splenectomy group, 2 patients were ≥55 years old and 6 were <55 years old; 6 were female and 2 were male. Postoperative drain amylase levels were normal in 2 patients. Five patients were classified as having a biochemical leak without the need for intervention. One patient underwent reoperation because of postoperative instability.

**Conclusions:** Although the number of patients in this study was limited, pancreatic fistula rates were found to be comparable to those reported in the literature. Larger, multicenter, prospective studies are needed to develop strategies for the prevention of clinically relevant pancreatic fistulas and to optimize perioperative management.

**Keywords:** Distal pancreatectomy, ISGPS, minimally invasive surgery, pancreatic fistula, pancreaticoduodenectomy

## Introduction

In recent years, with advancements in surgical techniques and increasing institutional experience, perioperative mortality rates in major pancreatic surgery have decreased to below 5%.[1,2] Nevertheless, morbidity rates remain high. Postoperative pancreatic fistula (POPF) is one of the most significant complications following pancreatic surgery, with a reported incidence ranging from approximately 20% to 35%.[3,4]

The development of POPF may lead to serious complications such as intra-abdominal abscess, postoperative hemorrhage, and sepsis, thereby increasing mortali-

**Received:** 28.04.2026 **Revision:** 12.07.2026 **Accepted:** 15.07.2026
**Correspondence:** Egemen Çiçek, İnönü University Faculty of Medicine, Department of Gastroenterology and Surgery, Malatya, Türkiye
**e-mail:** dregemencicek@gmail.com

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

ty, prolonging hospital stay, and elevating healthcare costs.[5]

Pancreatic fistulas were first defined in 2005 by the International Study Group on Pancreatic Surgery and classified as Grades A, B, and C. With the update published in 2016, Grade A fistulas were redefined as clinically insignificant and termed "biochemical leak (BL)."[6]

The aim of this study was to evaluate pancreatic fistulas developing after pancreatic surgery performed by a single surgeon at a single center and to compare the outcomes with the existing literature.

## Materials and Methods

Ethical approval for this retrospective study was obtained from the Inonu University Health Sciences Research Ethics Committee (2026/9009). Patients aged ≥18 years who underwent surgery for pancreatic masses between September 2020 and September 2025, with all procedures performed by the same surgeon, were included in the study.

In patients undergoing pancreaticoduodenectomy, reconstruction was performed using a duct-to-mucosa pancreaticojejunostomy. An internal stent appropriate to the diameter of the pancreatic duct was routinely placed in all patients. Drains were positioned both anterior and posterior to the pancreaticojejunostomy to facilitate the early detection and management of postoperative pancreatic leakage.

In patients undergoing distal pancreatectomy, pancreatic transection was performed using a black-cartridge tri-stapler. No additional reinforcement materials were applied to the staple line, and no supplementary closure or suturing techniques were used on the pancreatic remnant following stapler transection.

Preoperative evaluation included computed tomography (CT), magnetic resonance imaging (MRI), and endoscopic ultrasonography (EUS). Postoperative pancreatic fistulas were classified according to the 2016 ISGPS criteria as follows:

- Drain amylase level greater than three times the upper limit of normal serum amylase after postoperative day 3 → biochemical leak (BL)
- Conditions requiring clinical intervention → Grade B
- Presence of organ failure, need for reoperation, or mortality → Grade C

## Results

A total of 20 patients were included in the study. Of these, 12 underwent pancreaticoduodenectomy (Whipple procedure), and 8 underwent laparoscopic distal pancreatectomy with splenectomy.

In the Whipple group, 8 patients were older than 55 years and 4 were younger than 55 years. In the distal pancreatectomy group, 2 patients were older than 55 years and 6 were younger than 55 years. Regarding sex distribution, 7 patients were male and 5 were female in the Whipple group, whereas 6 patients were female and 2 were male in the distal pancreatectomy group.

Among patients who underwent the Whipple procedure, no evidence of malignancy was detected in 3 patients on pathological examination. In all patients with malignant pathology, negative surgical margins (R0 resection) were achieved.

Postoperative drain amylase levels were within normal limits in 2 patients in the Whipple group. Seven patients were classified as having a biochemical leak (BL). The patient who died on postoperative day 0 following pancreaticoduodenectomy was over 65 years of age and had significant pre-existing cardiac comorbidities. Severe postoperative cardiac instability developed immediately after surgery, and the patient could not be resuscitated despite intensive medical management. The mortality was therefore considered to be related to cardiovascular causes rather than postoperative pancreatic fistula (POPF). Because pancreatic fistula cannot reasonably develop and be diagnosed on postoperative day 0, this case was evaluated separately from POPF-related outcomes. Two patients required reoperation due to the development of pancreatic fistula and were classified as having Grade C pancreatic fistula.

In the laparoscopic distal pancreatectomy with splenectomy group, final pathology revealed adenocarcinoma in 3 patients, cystadenoma in 2 patients, and mucinous cystic lesions in 3 patients. Postoperative drain amylase levels were normal in 2 patients. Five patients had elevated drain amylase levels but did not require any surgical or interventional procedure and were therefore classified as having a biochemical leak (BL). One patient underwent relaparotomy due to postoperative hemodynamic instability (Table 1).

## Discussion

Pancreatic cancer is still considered one of the malignancies with the poorest prognosis worldwide. At the time of diagnosis, the majority of patients present with

**Table 1. Demographic and clinical characteristics of patients**

| | Pancreaticoduodenectomy (n=12) | (%) | Distal Pancreatectomy* (n=8) | (%) |
|---|---|---|---|---|
| Sex | | | | |
| Male | 7 | 58.33 | 2 | 25.00 |
| Female | 5 | 41.67 | 6 | 75.00 |
| Fistula Grade | | | | |
| Biochemical Leak (BL) | 7 | 77.78 | 6 | 85.71 |
| Grade C Fistula | 2 | 22.22 | 1 | 14.29 |
| Pathological Diagnosis | | | | |
| Adenocarcinoma | 7 | 58.33 | 3 | 37.50 |
| Ductal adenocarcinoma | 1 | 8.33 | 0 | 0.00 |
| Lymphoepithelial cyst | 1 | 8.33 | 0 | 0.00 |
| Mucinous cyst | 1 | 8.33 | 3 | 37.50 |
| Pseudocyst | 1 | 8.33 | 0 | 0.00 |
| Solid pseudopapillary tumor | 1 | 8.33 | 0 | 0.00 |
| Cystadenoma | 0 | 0.00 | 2 | 25.00 |
| Mean Age (years) | 54.6 | | 47.6 | |

*Laparoscopic distal pancreatectomy with splenectomy

advanced-stage disease, resulting in very limited opportunities for curative treatment. Therefore, surgical management is feasible only in a selected and relatively small group of patients. However, even potentially curative resections are associated with high morbidity and mortality rates, making pancreatic surgery one of the most challenging fields in surgical practice.

Major pancreatic procedures, particularly pancreaticoduodenectomy (Whipple procedure) and distal pancreatectomy, are associated with significant postoperative complications. Among these, postoperative pancreatic fistula (POPF) remains one of the most common and clinically relevant complications. POPF is not only an indicator of surgical outcomes but also a critical factor that directly influences the patient's recovery, length of hospital stay, need for readmission, and timing of adjuvant therapy.

According to the definition established by the International Study Group on Pancreatic Surgery, postoperative pancreatic fistula is defined as a drain fluid amylase level greater than three times the upper limit of normal serum amylase, measured on or after postoperative day 3.[7,8] Clinically relevant fistulas (Grades B and C) are generally reported in approximately 5% to 10% of cases; however, some series have demonstrated rates as high as 22%.[6,9,10] These findings highlight the clinical significance of POPF and the challenges associated with its management. The risk of pancreatic fistula formation varies depending on the type of operation and the surgical technique applied. In particular, soft pancreatic parenchyma and a small pancreatic duct diameter have been identified as significant risk factors for fistula development. In addition, procedures such as distal pancreatectomy and enucleation have been reported to be associated with higher rates of pancreatic fistula. In this context, various surgical techniques, pharmacological strategies, and intraoperative measures have been proposed to reduce fistula formation. However, there is still no consensus in the literature regarding the effectiveness of these interventions.

Current evidence suggests that the most important factor in reducing complications after pancreatic surgery is the performance of these procedures in high-volume, specialized centers.[11,12] Surgeon experience, a multidisciplinary team approach, meticulous preoperative risk assessment, and appropriate patient selection directly influence complication rates. Therefore, there is increasing consensus that pancreatic surgery should be performed in specialized centers by experienced surgical teams.

Reducing the risk of pancreatic fistula depends not only on intraoperative techniques but also on appropriate patient selection in the preoperative period and the prompt and effective management of potential complications in the postoperative phase. In this regard, accurate identification of risk factors and the use of fistula risk scoring systems may guide surgical planning.

In our study, although the number of patients was limited, the observed pancreatic fistula rates were consistent with those reported in the literature. However, increasing the sample size is essential to achieve more robust statistical outcomes. Furthermore, a comprehensive evaluation of factors influencing pancreatic fistula development from preoperative, intraoperative, and postoperative perspectives is crucial for enhancing the current body of knowledge. In this context, multicenter studies with larger sample sizes, including both retrospective and prospective designs, are needed.

### Limitations

Despite the valuable findings presented in this study, several limitations should be acknowledged. First, the retrospective nature of the study may have introduced selection and information biases, which could have influenced data collection and outcome assessment. Second, this was a single-center study in which all procedures were performed by a single surgeon. Although this ensured consistency in surgical technique and perioperative management, it may limit the generalizability of the results to other institutions, patient populations, and surgical teams. Third, the relatively small sample size limits the statistical power of the study and may have reduced the ability to detect significant associations between clinical variables and the development of postoperative pancreatic fistula. Therefore, the findings should be interpreted with caution. Nevertheless, the observed pancreatic fistula rates were comparable to those reported in the existing literature. Larger, multicenter studies with prospective designs are required to validate these findings and provide more robust evidence regarding risk factors and preventive strategies for postoperative pancreatic fistula.

## Conclusion

In conclusion, pancreatic surgery remains a complex and high-risk field. These procedures should be performed by experienced surgeons in well-equipped, specialized centers. Complications may be reduced and patient outcomes improved through multidisciplinary collaboration, advances in surgical techniques, and effective patient management that enables early detection and timely intervention.

### Disclosures

**Ethics Committee Approval:** This study was approved by The Inonu University Health Sciences Research Ethics Committee (2026/9009).

**Informed Consent:** Written informed consents were obtained from patients who participated in this study.

**Conflict of Interest:** The authors declare that there is no conflict of interest.

**Use of AI for Writing Assistance:** The authors declared that artificial intelligence was not used in the study.

**Financial Disclosure:** The authors declared that this study received no financial support.

**Authorship Contributions:** Concept – E.Ç., T.T.Ş.; Design – İ.E., F.A., Y.K.K.; Supervision – E.Ç., T.T.Ş.; Materials – İ.E., F.A.; Data Collection and/or Processing – E.Ç., İ.E., F.A.; Analysis and/or Interpretation – T.T.Ş.; Literature Search – Y.K.K., E.Ç.; Writing – Y.K.K., F.A.; Critical Reviews – E.Ç.

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

## References

1. DeOliveira ML, Winter JM, Schafer M, Cunningham SC, Cameron JL, Yeo CJ, et al. Assessment of complications after pancreatic surgery: A novel grading system applied to 633 patients undergoing pancreaticoduodenectomy. Ann Surg 2006;244(6):931–7; discussion 937–9.
2. Yang YM, Tian XD, Zhuang Y, Wang WM, Wan YL, Huang YT. Risk factors of pancreatic leakage after pancreaticoduodenectomy. World J Gastroenterol 2005;11(16):2456–61.
3. Gooiker GA, van Gijn W, Wouters MW, Post PN, van de Velde CJ, Tollenaar RA, et al. Systematic review and meta-analysis of the volume-outcome relationship in pancreatic surgery. Br J Surg 2011;98(4):485–94.
4. Ramacciato G, Mercantini P, Petrucciani N, Nigri GR, Kazemi A, Muroni M, et al. Risk factors of pancreatic fistula after pancreaticoduodenectomy: a collective review. Am Surg 2011;77(3):257–69.
5. Machado NO. Pancreatic fistula after pancreatectomy: definitions, risk factors, preventive measures, and management-review. Int J Surg Oncol 2012;2012:602478.
6. Bassi C, Marchegiani G, Dervenis C, Sarr M, Abu Hilal M, Adham M, et al. The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 Years After. Surgery 2017;161(3):584–91.

7. Butturini G, Daskalaki D, Molinari E, Scopelliti F, Casarotto A, Bassi C. Pancreatic fistula: definition and current problems. J Hepatobiliary Pancreat Surg 2008;15(3):247–51.
8. Bassi C, Dervenis C, Butturini G, Fingerhut A, Yeo C, Izbicki J, et al. Postoperative pancreatic fistula: an international study group (ISGPF) definition. Surgery 2005;138(1):8–13.
9. Lai EC, Lau SH, Lau WY. Measures to prevent pancreatic fistula after pancreatoduodenectomy: a comprehensive review. Arch Surg 2009;144(11):1074–80.
10. Cullen JJ, Sarr MG, Ilstrup DM. Pancreatic anastomotic leak after pancreaticoduodenectomy: incidence, significance, and management. Am J Surg 1994;168(4):295–8.
11. McPhee JT, Hill JS, Whalen GF, Zayaruzny M, Litwin DE, Sullivan ME, et al. Perioperative mortality for pancreatectomy: a national perspective. Ann Surg 2007;246(2):246–53.
12. Topal B, Van de Sande S, Fieuws S, Penninckx F. Effect of centralization of pancreaticoduodenectomy on nationwide hospital mortality and length of stay. Br J Surg 2007;94(11):1377–81.