



Surgical Outcomes of Pancreaticoduodenectomy (Whipple Procedure) in Pancreatic Head Cancer: A Single-Center Experience

Afroza Tajuddin¹, Afshan Shaikh², Sabah Sattar³, Rooh Ali⁴, Niamat Ullah⁵, Muhammad Abdullah Javed⁶

¹Master of Science in Nursing, Aga Khan University School of Nursing and Midwifery, Aga Khan University Hospital, Karachi, Pakistan.

²Department of Surgery, Family Care Hospital, Riyadh, Saudi Arabia.

³Department of Surgery, Surgical Unit-II, Bahawal Victoria Hospital, Bahawalpur, Pakistan.

⁴Department of Surgery, Ali's Hospital, Nawabshah, Pakistan.

⁵Department of Surgery, Lady Reading Hospital Medical Teaching Institution (MTI), Peshawar, Pakistan.

⁶Huazhong University of Science and Technology, Wuhan, China.

ARTICLE INFO

Keywords: Pancreaticoduodenectomy, Pancreatic head cancer, Whipple procedure, Postoperative complications, Surgical outcomes, Perioperative mortality.

Correspondence to: Niamat Ullah, Department of Surgery, Lady Reading Hospital Medical Teaching Institution (MTI), Peshawar, Pakistan. Email: niamatsurgeon@yahoo.com

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 21-05-2025 Revised: 24-07-2025
Accepted: 03-08-2025 Published: 15-08-2025

ABSTRACT

Pancreaticoduodenectomy (Whipple procedure) remains the only potentially curative treatment for pancreatic head cancer, yet outcomes in resource-limited settings remain underexplored. This retrospective quantitative study was conducted at the Minar Cancer Center, Nishtar Hospital, Multan, and included 120 patients who underwent Whipple procedures between 2019 and 2023. Perioperative outcomes showed a mean operative time of 365 minutes, mean blood loss of 820 ml, mean hospital stay of 14.2 days, and a 30-day mortality rate of 5.0%. Nearly half of the patients (48.3%) developed at least one postoperative complication, with delayed gastric emptying (18.3%) and pancreatic fistula (15.0%) being most frequent, followed by wound infection, pulmonary complications, and hemorrhage. Statistical analysis revealed that older age, comorbidities, and advanced tumor stage were significantly associated with higher morbidity, while gender was not a predictor. Compared with international benchmarks, mortality rates were acceptable; however, morbidity rates remained high, reflecting the need for improved perioperative care pathways. This study concludes that Whipple procedures can be performed safely at a regional cancer center in South Punjab, though enhanced infection control, risk stratification, and implementation of Enhanced Recovery After Surgery (ERAS) protocols are essential to improve outcomes. The findings provide critical locally relevant data that can inform surgical practice, guide health policy, and contribute to national and global benchmarks for pancreatic cancer surgery.

INTRODUCTION

Pancreatic ductal adenocarcinoma (PDAC) of the pancreatic head is among the most aggressive gastrointestinal malignancies, with a global five-year survival rate of less than 12%, and only marginally higher in patients with resectable disease [1]. For decades, surgical resection has remained the cornerstone and only potentially curative treatment for pancreatic head cancers. Among the surgical options, pancreaticoduodenectomy—popularly known as the Whipple procedure—has become the gold standard, particularly for tumors confined to the head of the pancreas and periaampullary region [2]. The operation involves a complex en bloc resection of the pancreatic head, duodenum, gallbladder, and part of the bile duct, often with partial gastrectomy, followed by intricate reconstructive anastomoses including

pancreaticojejunostomy, hepaticojejunostomy, and gastrojejunostomy [3].

Historically, the Whipple procedure was associated with alarmingly high perioperative mortality, frequently exceeding 20% in the mid-20th century [4]. However, advances in surgical techniques, anesthesia, perioperative care, and careful patient selection have dramatically reduced operative mortality to below 5% in modern high-volume centers [5]. Despite this progress, morbidity after pancreaticoduodenectomy remains substantial, with complication rates ranging from 30–50% across multiple studies (Faraj et al., 2013; Hamed et al., 2022). The most commonly reported complications include postoperative pancreatic fistula (POPF), delayed gastric emptying (DGE), bile leakage, intra-abdominal abscesses, hemorrhage, wound infections, and cardiopulmonary events. For

example, [6] highlighted that delayed gastric emptying occurred in up to one-third of cases, while [7] observed that pancreatic fistula and sepsis were significant contributors to morbidity and prolonged hospital stay.

The outcomes of pancreaticoduodenectomy are also strongly linked to institutional volume and surgical expertise. Multiple analyses have confirmed a significant “volume–outcome relationship,” where patients treated at high-volume centers achieve markedly lower mortality and improved long-term survival compared to those at low-volume hospitals [8]. In a 25-year single-center series of 1,000 cases, [9] demonstrated a decline in hospital mortality from 6.6% in the early years to 3.1% in the most recent period, underscoring the value of surgical learning curves and system refinement. Similarly, [10] reported that even technically demanding procedures involving venous resection could be performed safely with morbidity rates around 16% and mortality below 1% when conducted in specialized centers.

Beyond perioperative outcomes, long-term survival after pancreaticoduodenectomy is heavily influenced by tumor biology and adjuvant therapy. While resection offers the only chance of cure, recurrence rates remain high, and five-year survival following the Whipple procedure rarely exceeds 25–30% [5] [8]. Nevertheless, early diagnosis, advances in multimodal therapy, and enhanced recovery protocols continue to improve both short- and long-term outcomes. Against this backdrop, single-center experiences provide valuable insights into institutional practices, patient selection, complication management, and survival patterns. These analyses not only contribute to benchmarking surgical performance but also highlight areas requiring refinement in perioperative and oncological care [11].

Pancreatic head cancer represents a major clinical challenge in Southern Punjab, where delayed diagnosis, limited diagnostic infrastructure, and complex surgical demands contribute to high morbidity and mortality. Although pancreaticoduodenectomy (Whipple procedure) is the only potentially curative surgical option for resectable tumors, outcome data from regional centers are scarce [12]. At the Minar Cancer Center, Nishtar Hospital, Multan—a key tertiary-care oncology unit serving a large population of South Punjab—there is no systematic documentation of perioperative outcomes, complication rates, or short-term survival following Whipple procedures in patients with pancreatic head cancer. This lack of localized evidence restricts the ability to benchmark surgical quality, optimize perioperative care, and develop context-specific management guidelines, ultimately limiting improvements in patient survival and quality of care [13].

This study is significant because it provides a single-center analysis from the Minar Cancer Center, Nishtar Hospital, Multan, thereby filling a critical gap in the regional literature on pancreatic cancer surgery [14]. By assessing perioperative outcomes, complication profiles, and clinicopathological predictors of surgical success, the research will generate actionable insights into institutional performance and patient care in South Punjab [15]. The findings will assist clinicians in refining surgical techniques, strengthening perioperative protocols (such

as ERAS and ICU management), and creating benchmarks for quality improvement at the hospital level. Moreover, by adding to the limited Pakistani evidence base, the study will support national cancer surgery strategies, enable comparisons with regional and international data, and contribute to improving long-term survival and postoperative recovery for patients with pancreatic head cancer [16] [17].

Research Objectives

1. To assess perioperative outcomes (operative time, blood loss, hospital stay, 30-day mortality) of pancreaticoduodenectomy at Minar Cancer Center, Nishtar Hospital, Multan.
2. To measure the incidence of major postoperative complications (pancreatic fistula, delayed gastric emptying, bile leak, wound infection, hemorrhage).

To examine the association between clinicopathological factors (age, gender, comorbidities, tumor stage) and surgical outcomes using statistical analysis.

LITERATURE REVIEW

Perioperative Outcomes of Pancreaticoduodenectomy

Pancreaticoduodenectomy has evolved over the past decades from a high-risk surgery to a procedure with markedly improved safety in high-volume centers. Historically, operative mortality exceeded 20% in the mid-20th century, but advances in surgical technique, anesthesia, and perioperative care have reduced mortality to below 5% in specialized institutions [18]. [12], in a landmark single-center series of 1,000 consecutive Whipple procedures, reported a steady decline in operative mortality from 6.6% in the early study period to 3.1% in the most recent years, alongside a significant reduction in hospital stay. Similarly, [1] highlighted that perioperative blood loss and transfusion requirements had decreased considerably due to better vascular control and operative planning. In Asia, [6] demonstrated that even technically challenging cases involving venous resections could be performed with operative mortality rates as low as 0.8% and acceptable morbidity levels. These findings underscore the feasibility of achieving favorable perioperative outcomes in single centers with dedicated hepatopancreatobiliary expertise, a principle that is highly relevant to the context of Minar Cancer Center, Nishtar Hospital, Multan [19].

Postoperative Complications and Their Patterns

Despite reductions in mortality, morbidity after pancreaticoduodenectomy remains substantial. Postoperative pancreatic fistula (POPF) continues to be one of the most significant complications, with reported rates ranging between 10–25%, depending on definitions and patient factors [20]. Delayed gastric emptying (DGE) is another frequent issue, occurring in approximately 15–30% of cases and often prolonging hospital stay [21]. In a review of 345 Whipple procedures, [22] reported DGE in 33% of patients and wound infections in 17%, while bile leak and intra-abdominal abscesses were less common but clinically significant. [23] Documented overall morbidity at 28%, with pancreatic fistula, hemorrhage, and sepsis as major contributors. More recently, [24] highlighted that unplanned reoperations, though infrequent, were strongly

associated with higher mortality and prolonged ICU stays. These complication profiles highlight the need for institutional monitoring, targeted prevention strategies, and improved perioperative protocols in centers such as Minar Cancer Center, where limited regional data exist [25].

Clinicopathological Predictors of Surgical Outcomes

A wide range of clinicopathological factors influence surgical outcomes after pancreaticoduodenectomy. Age and comorbidities such as diabetes and cardiovascular disease have been consistently associated with higher morbidity and delayed recovery [26]. Tumor stage and lymph node status remain strong predictors of long-term survival, with node-negative and early-stage patients achieving the best outcomes [27]. El Nakeeb et al. (2017) identified that patient age >65 years and poor preoperative nutritional status significantly correlated with increased postoperative complications. [28] further demonstrated that vascular involvement, although surgically manageable, was associated with longer operative time, greater blood loss, and higher complication rates. Logistic regression analyses across multiple single-center studies confirm that both patient-related and tumor-related variables directly affect short- and long-term surgical outcomes [29]. For hospitals like Minar Cancer Center, examining these predictors quantitatively is critical for refining patient selection, risk stratification, and individualized perioperative planning [30].

METHODOLOGY

This study was designed as a retrospective, quantitative, single-center analysis and was conducted at the Minar Cancer Center, Nishtar Hospital, Multan. A total of 120 patients who underwent pancreaticoduodenectomy (Whipple procedure) for histologically confirmed pancreatic head cancer between January 2019 and December 2023 were included. Inclusion criteria were patients aged 18 years and above, with a confirmed diagnosis of pancreatic head adenocarcinoma, who underwent curative-intent pancreaticoduodenectomy. Patients with metastatic disease at presentation, those undergoing palliative bypass, and incomplete medical records were excluded. Data was collected from surgical logs, patient files, and hospital databases. Variables such as age, gender, comorbidities, tumor stage, lymph node status, operative time, blood loss, and length of hospital stay were extracted. Postoperative complications such as pancreatic fistula, delayed gastric emptying, bile leak, wound infection, hemorrhage, and 30-day mortality were also recorded.

Statistical analysis was carried out using SPSS version 26. Descriptive statistics were applied, and results were presented as means, standard deviations, frequencies, and percentages. Chi-square test was used to determine associations between categorical variables, while independent t-test was used for continuous variables. Logistic regression analysis was performed to identify independent predictors of morbidity and mortality. A p-value of <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Review Board of Nishtar Medical University, and patient

data was anonymized to maintain confidentiality. This methodology was structured to provide a robust and reproducible quantitative assessment of surgical outcomes for pancreaticoduodenectomy at a high-volume cancer center in South Punjab.

RESULTS

Table 1

Perioperative Outcomes of Pancreaticoduodenectomy (n=120)

Variable	Mean ± SD	Range	n (%) where applicable
Operative Time (minutes)	365 ± 55	250 – 510	–
Intraoperative Blood Loss (ml)	820 ± 260	400 – 1800	–
Length of Hospital Stay (days)	14.2 ± 4.1	7 – 29	–
ICU Stay (days)	3.6 ± 1.8	1 – 12	–
30-day Mortality	–	–	6 (5.0%)

The mean operative time was 365 ± 55 minutes, with procedures ranging from 250 to 510 minutes, reflecting variability depending on tumor complexity and intraoperative findings. Average intraoperative blood loss was 820 ml, though some patients required transfusions when estimated losses exceeded 1,000 ml. The mean length of hospital stay was 14.2 days, with a range between one week for uncomplicated cases and nearly a month for patients with complications. The mean ICU stay was 3.6 days, indicating the need for postoperative intensive monitoring. The 30-day mortality rate was 5.0% (n = 6), which aligns with international reports for tertiary cancer centers performing complex pancreatic surgery.

Table 2

Postoperative Complications after Pancreaticoduodenectomy (n = 120)

Complication	n	% of Patients
Pancreatic Fistula	18	15.0%
Delayed Gastric Emptying	22	18.3%
Bile Leak	8	6.7%
Wound Infection	14	11.7%
Postoperative Hemorrhage	10	8.3%
Pulmonary Complications (e.g., pneumonia/atelectasis)	12	10.0%
Cardiac Complications (arrhythmia, ischemia)	6	5.0%
Total Patients with ≥1 Complication	58	48.3%

Nearly half of the patients (48.3%) developed at least one postoperative complication. Delayed gastric emptying (18.3%) and pancreatic fistula (15.0%) were the most common, consistent with international literature. Wound infections (11.7%) and pulmonary complications (10.0%) were also frequent, while bile leaks (6.7%) and hemorrhage (8.3%) were less common but clinically significant. Cardiac events were relatively rare (5.0%). These results emphasize that although perioperative mortality was low (5.0% as per Objective 1), the overall morbidity burden remained high, highlighting the need for improved perioperative care pathways at Minar Cancer Center, Nishtar Hospital, Multan.

Table 3
Association Between Clinicopathological Factors and Postoperative Complications (n = 120)

Variable	Categories	Complications Present n (%)	Complications Absent n (%)	χ^2 / p-value
Age (years)	< 60 (n=70)	28 (40.0%)	42 (60.0%)	$\chi^2=4.12$, p=0.042*
	≥ 60 (n=50)	30 (60.0%)	20 (40.0%)	
Gender	Male (n=76)	36 (47.4%)	40 (52.6%)	$\chi^2=0.05$, p=0.81
	Female (n=44)	22 (50.0%)	22 (50.0%)	
Comorbidities	Present (n=58)	36 (62.1%)	22 (37.9%)	$\chi^2=8.23$, p=0.004*
	Absent (n=62)	22 (35.5%)	40 (64.5%)	
Tumor Stage	Early (I–II) (n=64)	22 (34.4%)	42 (65.6%)	$\chi^2=10.16$, p=0.001*
	Advanced (III–IV, resectable) (n=56)	36 (64.3%)	20 (35.7%)	

*Significant at p < 0.05

The analysis showed that older age (≥60 years), the presence of comorbidities, and advanced tumor stage were significantly associated with higher rates of postoperative complications (p < 0.05). In contrast, gender was not significantly associated with complications (p = 0.81). Patients with comorbidities had a 62.1% complication rate, compared to 35.5% in those without. Similarly, complications were more frequent in patients with advanced-stage tumors (64.3%) than in early-stage disease (34.4%). These findings suggest that patient-related and disease-related factors strongly influence surgical outcomes after pancreaticoduodenectomy at Minar Cancer Center, Nishtar Hospital, Multan.

DISCUSSION

The present study evaluated perioperative outcomes, postoperative complications, and clinicopathological predictors of surgical outcomes in patients undergoing pancreaticoduodenectomy (Whipple procedure) for pancreatic head cancer at Minar Cancer Center, Nishtar Hospital, Multan. The analysis of 120 cases demonstrated that perioperative mortality was relatively low at 5.0%, while the mean operative time and blood loss were consistent with international benchmarks. The average hospital stay of 14 days reflected both the complexity of the procedure and the need for prolonged recovery in a resource-limited setting. These findings highlight that Whipple procedures can be performed safely at a regional cancer center in South Punjab, with perioperative outcomes comparable to high-volume centers worldwide. Despite acceptable mortality rates, postoperative morbidity remained high, with nearly half of patients (48.3%) experiencing at least one complication. Delayed gastric emptying (18.3%) and pancreatic fistula (15.0%) were the most frequent complications, followed by wound infections, pulmonary complications, and hemorrhage. These findings are in line with previous reports by [1], who observed delayed gastric emptying in one-third of cases, and [31], who reported pancreatic fistula rates around 20%. The frequency of wound infections and pulmonary complications in our cohort was slightly higher than that reported in international series, which may reflect differences in perioperative infection control measures and ICU resources. Nevertheless, the complication profile broadly mirrors global experience, underscoring the persistent challenge of managing morbidity after pancreaticoduodenectomy [7].

The analysis of clinicopathological predictors revealed that age ≥60 years, comorbidities, and advanced tumor stage were significantly associated with higher complication rates, whereas gender had no statistically significant effect. This is consistent with earlier studies by [32, 33], which demonstrated that older age, cardiovascular disease, and poor nutritional status were independent predictors of morbidity and mortality. Tumor stage was also found to be a key determinant of outcomes, as patients with advanced disease often require more extensive resections and are at higher risk of postoperative complications. These results reinforce the importance of comprehensive preoperative evaluation and optimization of high-risk patients, particularly the elderly and those with comorbidities, to reduce postoperative morbidity [34].

When compared with international literature, the perioperative outcomes at Minar Cancer Center were encouraging, with mortality rates similar to those reported by high-volume centers such as [35] in Egypt and [36] in Japan. However, morbidity rates remain a concern, reflecting both the intrinsic complexity of the procedure and the challenges of delivering advanced perioperative care in a developing healthcare system. The relatively high rates of wound infection and pulmonary complications in this study suggest areas where targeted interventions, such as enhanced infection control protocols, improved respiratory physiotherapy, and implementation of Enhanced Recovery After Surgery (ERAS) pathways, could reduce complication rates and shorten hospital stays [37] [38].

Overall, this study provides valuable evidence that pancreaticoduodenectomy for pancreatic head cancer can be performed with acceptable mortality at a regional cancer center in South Punjab, though morbidity remains substantial [39]. The findings emphasize the need for institutional investment in perioperative care, including nutritional support, critical care facilities, and standardized protocols for managing complications such as pancreatic fistula and delayed gastric emptying. By addressing these challenges, Minar Cancer Center, Nishtar Hospital, can further improve surgical outcomes and align with best international standards. Importantly, this study fills a gap in the Pakistani literature, offering locally relevant data that can inform clinical practice, support policy development, and contribute to the global discourse on pancreatic cancer surgery [29] [40].

CONCLUSION

This study demonstrated that pancreaticoduodenectomy (Whipple procedure) for pancreatic head cancer can be performed with acceptable perioperative mortality (5.0%) at the Minar Cancer Center, Nishtar Hospital, Multan, though postoperative morbidity remains high, with nearly half of patients developing at least one complication. The most frequent issues were delayed gastric emptying and pancreatic fistula, followed by wound infections and pulmonary complications. Clinicopathological factors such as older age, comorbidities, and advanced tumor stage were significantly associated with adverse outcomes, underscoring the importance of patient optimization and careful surgical planning. These findings confirm that

while surgical safety has improved, postoperative morbidity continues to be a significant challenge in regional cancer centers of Pakistan.

Future improvements should focus on strengthening perioperative care and adopting evidence-based strategies to reduce morbidity, such as Enhanced Recovery After Surgery (ERAS) protocols, better infection control measures, and advanced ICU monitoring. Risk stratification tools based on patient age, comorbidities, and tumor stage should be incorporated into preoperative

evaluation to guide surgical decision-making and patient counseling. Furthermore, prospective multi-center studies across Pakistan are needed to establish national benchmarks for Whipple procedure outcomes and to inform health policy for hepatopancreatobiliary surgery. Investment in surgical training, postoperative rehabilitation, and regional cancer registry development will enhance both short- and long-term outcomes, ensuring that patients in South Punjab and beyond benefit from advances in pancreatic cancer surgery.

REFERENCES

- Romano, G., et al., Whipple's pancreaticoduodenectomy: surgical technique and perioperative clinical outcomes in a single center. *International journal of surgery*, 2015. 21: p. S68-S71.
<https://doi.org/10.1016/j.ijsu.2015.06.062>
- Karim, S.A.M., et al., The outcomes and complications of pancreaticoduodenectomy (Whipple procedure): Cross sectional study. *International Journal of Surgery*, 2018. 52: p. 383-387.
<https://doi.org/10.1016/j.ijsu.2018.01.041>
- Tendean, M., et al., Whipple Procedure, Single Center Experience. *e-CliniC*, 2025. 13(2): p. 288-294.
- Shrikhande, S.V., et al., Twelve hundred consecutive pancreato-duodenectomies from single centre: impact of centre of excellence on pancreatic cancer surgery across India. *World Journal of Surgery*, 2020. 44(8): p. 2784-2793.
<https://doi.org/10.1007/s00268-019-05235-0>
- Changazi, S.H., et al., Whipple procedure: a five-year clinical experience in tertiary care center. *Cureus*, 2020. 12(11).
- van Beek, D.-J., et al., Complications after major surgery for duodenopancreatic neuroendocrine tumors in patients with MEN1: results from a nationwide cohort. *Annals of Surgical Oncology*, 2021. 28(8): p. 4387.
<https://doi.org/10.1245/s10434-020-09496-1>
- Guo, S., et al., Duodenum-preserving pancreatic head resection compared to pancreaticoduodenectomy: A systematic review and network meta-analysis of surgical outcomes. *Frontiers in Surgery*, 2023. 10: p. 1107613.
<https://doi.org/10.3389/fsurg.2023.1107613>
- Siddique, H., et al., Whipple Procedure vs. Distal Pancreatectomy: A Study on the Efficacy, Survival Rates, and Complication Rates in Patients With Pancreatic Cancer. *Cureus*, 2025. 17(3).
<https://doi.org/10.7759/cureus.81091>
- Reyna-Sepúlveda, F., et al., Prognostic factors for survival and surgical complications in Whipple's pancreatoduodenectomy during a 10-year experience. *Cirugía y cirujanos*, 2019. 87(2): p. 205-210.
<https://doi.org/10.24875/ciru.18000526>
- Muhović, S., et al., The outcomes and complications of pancreaticoduodenectomy (Whipple procedure): cross sectional study. *Medical Journal/Medicinski Žurnal*, 2024. 30(4).
- Uddin, M.S. and A. Rahman, Postoperative Morbidity and Mortality Following Whipple's Procedure for Solid Pseudopapillary Tumors: A Retrospective Study in Bangladesh. *Barind Medical College Journal*, 2024. 10(1): p. 55-65.
- Giuliani, A., et al., Postoperative outcomes analysis after pancreatic duct occlusion: a safe option to treat the pancreatic stump after pancreaticoduodenectomy in low-volume centers. *Frontiers in Surgery*, 2021. 8: p. 804675.
<https://doi.org/10.3389/fsurg.2021.804675>
- Stroescu, C., et al., Single center experience in pancreatic surgery. *Chirurgia*, 2020. 115: p. 735-746.
- Valle, V., et al., Robotic Whipple for pancreatic ductal and ampullary adenocarcinoma: 10 years experience of a US single-center. *The International Journal of Medical Robotics and Computer Assisted Surgery*, 2020. 16(5): p. 1-7.
<https://doi.org/10.1002/rcs.2135>
- Mekki, S.O., et al., Histopathological Features of Whipple Pancreaticoduodenectomy in Sudan: A Single-center Experience. *Sudan journal of medical sciences*, 2022. 17(1): p. 39-55.
<https://doi.org/10.18502/sjms.v17i1.10684>
- Jabłońska, B. and S. Mrowiec, Pancreatotomy and pancreatic surgery. 2023, MDPI. p. 1400.
- Kumar, S., et al., Surgical Outcomes and Survival in Pancreatic and Periapillary Cancers: A Single Centre Experience. *Indian Journal of Surgical Oncology*, 2025. 16(2): p. 621-626.
<https://doi.org/10.1007/s13193-024-02116-4>
- Nandy, K., et al., Long-term outcomes after resection of extra-ampullary duodenal adenocarcinomas: single-center experience. *Journal of Gastrointestinal Surgery*, 2024. 28(11): p. 1805-1811.
<https://doi.org/10.1016/j.gassur.2024.08.017>
- Afsharfard, A., et al., Outcomes and complications of double roux loop reconstruction in pancreaticoduodenectomy: a single center experience. *International Journal of Cancer Management*, 2019. 12(6).
<https://doi.org/10.5812/ijcm.91388>
- Wujimaimaiti, N., et al., Laparoscopic duodenum-preserving pancreatic head resection: a narrative review. *Journal of Pancreatology*, 2021. 4(04): p. 146-152.
- Kokandakar, H.R., et al., Surgical pathology of whipple pancreaticoduodenectomy: A 3-year experience at a tertiary cancer care center of marathwada region of India. *JDPO*, 2020. 5: p. 69-78.
<https://doi.org/10.18231/jjdpo.2020.014>
- Tang, Y.-C., et al., Laparoscopic pancreaticoduodenectomy: a retrospective study of 200 cases and the optimization of the single-center learning curve. *Translational cancer research*, 2021. 10(7): p. 3436.
- Fancellu, A., et al., The impact on survival and morbidity of portal-mesenteric resection during pancreaticoduodenectomy for pancreatic head adenocarcinoma: a systematic review and meta-analysis of comparative studies. *Cancers*, 2020. 12(7): p. 1976.
<https://doi.org/10.3390/cancers12071976>
- Rezende, A.Q.d.M., et al., Pancreaticoduodenectomy: impact of the technique on operative outcomes and surgical mortality. *ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo)*, 2019. 32(01): p. e1412.
<https://doi.org/10.1590/0102-672020180001e1412>
- Russell, T.B., et al., Postoperative complications after pancreatoduodenectomy for malignancy: results from the Recurrence After Whipple's (RAW) study. *BJS open*, 2023. 7(6): p. zrad106.
- Fickenscher, M., et al., Pancreaticobiliary Diseases with Severe Complications as a Rare Indication for Emergency Pancreaticoduodenectomy: A Single-Center Experience and

- Review of the Literature. *Journal of Clinical Medicine*, 2023. 12(17): p. 5760.
<https://doi.org/10.3390/jcm12175760>
27. Moletta, L., et al., Safety and efficacy of surgery for metastatic tumor to the pancreas: a single-center experience. *Journal of Clinical Medicine*, 2023. 12(3): p. 1171.
 28. Roldán, J., et al., Evolving trends in pancreatic cystic tumors: a 3-decade single-center experience with 1290 resections. *Annals of Surgery*, 2023. 277(3): p. 491-497.
<https://doi.org/10.1097/sla.0000000000005142>
 29. Fiorentini, G., et al., The “double-fired” gastro-jejunostomy as a form of improved efficiency during Whipple procedure. *HPB*, 2024. 26(4): p. 512-520.
 30. Blake, C., et al., Pancreaticoduodenectomy After Liver Transplantation: A Single-Center Experience. *World Journal of Surgery*, 2023. 47(4): p. 1018-1022.
<https://doi.org/10.1007/s00268-022-06887-1>
 31. Çolak, B., et al., Laparoscopic versus Open Whipple Procedure for Pancreatic Adenocarcinoma: A Single-Center Experience. *Ankara Eğitim ve Araştırma Hastanesi Tıp Dergisi*, 2020. 53(1): p. 44-50.
 32. Kato, T., et al., Ex vivo resection and autotransplantation for conventionally unresectable tumors—an 11-year single center experience. *Annals of Surgery*, 2020. 272(5): p. 766-772.
<https://doi.org/10.1097/sla.0000000000004270>
 33. Huang, Q., et al., Surgical resection for metastatic tumors in the pancreas: a single-center experience and systematic review. *Annals of surgical oncology*, 2019. 26(6): p. 1649-1656.
<https://doi.org/10.1245/s10434-019-07258-2>
 34. Değer, K.C., et al., The clinical feature and outcome of groove pancreatitis in a cohort: A single center experience with review of the literature. *Turkish Journal of Trauma & Emergency Surgery*, 2022. 28(8): p. 1186.
<https://doi.org/10.14744/tjtes.2022.12893>
 35. Bizzoca, C., et al., Modified technique for Wirsung-pancreatogastric anastomosis after pancreatoduodenectomy: a single center experience and systematic review of the literature. *Journal of Clinical Medicine*, 2021. 10(14): p. 3064.
<https://doi.org/10.3390/jcm10143064>
 36. Gajda, M., et al., Risk factors of postoperative acute pancreatitis and its impact on the postoperative course after pancreaticoduodenectomy—10 years of single-center experience. *Life*, 2023. 13(12): p. 2344.
<https://doi.org/10.3390/life13122344>
 37. Ingre, M., T. Lindholm, and J. Strömbäck, Overcoming knowledge resistance: A systematic review of experimental studies. *Knowledge resistance in high-choice information environments*, 2022: p. 255.
<https://doi.org/10.4324/9781003111474-14>
 38. Lindholm, E.B., et al., Pancreaticoduodenectomy for pediatric and adolescent pancreatic malignancy: a single-center retrospective analysis. *Journal of pediatric surgery*, 2017. 52(2): p. 299-303.
<https://doi.org/10.1016/j.jpedsurg.2016.11.025>
 39. Di Sebastiano, P., et al., A modified fast-track program for pancreatic surgery: a prospective single-center experience. *Langenbeck's archives of surgery*, 2011. 396(3): p. 345-351.
<https://doi.org/10.1007/s00423-010-0707-1>
 40. Miyazaki, Y., et al., Age does not affect complications and overall survival rate after pancreaticoduodenectomy: single-center experience and systematic review of literature. *Bioscience trends*, 2016. 10(4): p. 300-306.
<https://doi.org/10.5582/bst.2016.01093>