Outcome of laparoscopy assisted pancreaticoduodenectomy at the department of gastrointestinal surgery, Viet Duc University Hospital

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Abstract

Introduction: Laparoscopic-assisted pancreaticoduodenectomy is a complex surgical procedure associated with a high rate of complications, particularly those arising from anastomotic leakage. The combination of laparoscopic dissection and resection with a mini-laparotomy for specimen retrieval and anastomosis construction is thought to potentially reduce perioperative morbidity.

Patients and Methods: A cross-sectional descriptive case series was conducted involving 18 patients who underwent laparoscopically-assisted pancreaticoduodenectomy at the Department of Gastrointestinal Surgery, Viet Duc University Hospital, during the period from 2023 to 2025.

Results: A total of 18 patients underwent laparoscopic-assisted pancreaticoduodenectomy. Among these, 55.6% were diagnosed with ampullary adenocarcinoma, 22.2% with solid pseudopapillary neoplasms of the pancreas, and 11.1% with pancreatic neuroendocrine tumors. The mean operative time was 352.44 ± 44.59 minutes. The average length of the mini-laparotomy incision was 6.78 ± 1.67 cm. Mean intraoperative blood loss was 163.89 ± 136.99 ml. Postoperative complications included pancreatic fistula (27.7%), postoperative hemorrhage (5.6%), bile leak (5.6%), chyle leak (5.6%), and gastrointestinal bleeding (5.6%). All patients were alive at the time of analysis. The average postoperative hospital stay was 11.33 ± 3.27 days. The rate of discharge with good outcomes was 50.0%.

Conclusions: Laparoscopic-assisted pancreaticoduodenectomy is a safe alternative to open surgery and represents an appropriate transitional approach toward fully laparoscopic pancreaticoduodenectomy.

Keywords: Pancreaticoduodenectomy, Laparoscopy assisted surgery, Ampulla of Vater.

Introduction

Periampullary tumors are defined as tumors located within 2 cm of the major duodenal papilla and include pancreatic head tumors, duodenal tumors, distal bile duct tumors, and ampullary tumors. Due to the close anatomical relationships between the biliary tract, pancreatic duct, and duodenum, surgical management often necessitates pancreaticoduodenectomy (PD) [1]. This is a technically demanding procedure with a high rate of perioperative morbidity and complications, particularly anastomotic leaks, with a reported mortality rate ranging from 1% to 5% and an overall complication rate of approximately 30–40% [2]. Laparoscopic-assisted pancreaticoduodenectomy (LAPD) has emerged as an alternative to open surgery, offering advantages such as faster recovery, reduced postoperative pain, and improved cosmetic outcomes. Additionally, the use of a small laparotomy allows for both safe specimen retrieval and more controlled anastomosis creation, making it safer and technically more feasible than a fully laparoscopic approach [3-4]. Globally, this surgical technique has been widely adopted since the early stages of laparoscopic surgery development. Numerous studies have demonstrated its therapeutic efficacy and compared its outcomes with those of open surgery. According to Nigri (2014), performing anastomoses through a mini-laparotomy is as feasible as in open procedures [5]. Similarly in 2020, Feng Tian reported that LAPD yields comparable short-term and oncological outcomes to open surgery [3]. In Vietnam, the adoption of laparoscopic PD has been reported in several major hospitals, including Viet Duc University Hospital (since 2008), 108 Military Central Hospital (2008), Gia Dinh People's Hospital (2010), 103 Military Hospital (2011), and Ho Chi Minh City University Medical Center (2013). More recently, Bach Mai Hospital has performed an increasing number of such procedures, further demonstrating the safety and effectiveness of this approach. This study was conducted to evaluate the safety and feasibility of LAPD at the Department of Gastrointestinal Surgery, Viet Duc University Hospital.

Patients and Methods

Study Subjects:

The study included 18 patients diagnosed with periampullary tumors who underwent LAPD at the Department of Gastrointestinal Surgery, Viet Duc University Hospital, during the period 2023–2025.

Exclusion criteria:

Patients with unresectable advanced cancer or severe comorbidities contraindicating general anesthesia were excluded from the study.

Study Design:

A descriptive case series with a convenience sampling method.

Study Procedure:

Patient information was recorded using standardized research case report forms. All patients underwent elective surgery with preoperative antibiotic prophylaxis. LAPD procedure included the following steps:

Step 1: Trocar placement. The abdominal cavity was accessed through five trocars: a 10 mm trocar at the umbilicus, a 10 mm trocar at the right midclavicular line at the umbilical level, a 10 mm trocar at the left midclavicular line at the umbilical level, a 5 mm trocar at the right anterior axillary line below the costal margin, and a 5 mm trocar at the left anterior axillary line below the costal margin. The liver was suspended using a suture.

Step 2: Exploration of the abdominal cavity to assess peritoneal and liver metastasis and tumor resectability.

Step 3: Kocher maneuver and mobilization of the pancreaticoduodenal mass. The anterior surface of the pancreas was exposed by dissecting the greater omentum from the transverse colon to enter the lesser sac. The right gastroepiploic vessels

were ligated to fully expose the anterior surface of the pancreatic head. The posterior aspect of the duodenum and pancreatic head was mobilized using the Kocher maneuver, freeing the mass from the aorta and inferior vena cava.

Step 4: Vascular control and ligation for pancreaticoduodenal resection. The gastroduodenal artery was ligated. The common bile duct was separated from the proper hepatic artery and portal vein. Regional lymphadenectomy was performed around the common hepatic artery and hepatoduodenal ligament. The superior mesenteric vein was exposed from the lower border of the pancreas.

Step 5: Resection of the gastric antrum, pancreatic neck, and mobilization of the uncinate process.

Step 6: En bloc resection of the pancreaticoduodenal mass: the proximal jejunum was transected first. The pancreatic head was resected en bloc to the right and posterior to the superior mesenteric vein. The superior and inferior pancreaticoduodenal vessels were ligated. Cholecystectomy was performed, and the common bile duct was transected.

Step 7: Creation of a mini-laparotomy incision for specimen retrieval.

Step 8: Reconstruction of gastrointestinal continuity: pancreaticojejunostomy (via the transverse mesocolon) or pancreaticogastrostomy (with optional pancreatic duct stenting), hepaticojejunostomy (10–15 cm distal to the pancreatic anastomosis), and gastrojejunostomy (40–50 cm distal to the biliary anastomosis).

Step 9: Peritoneal lavage, placement of surgical drains, closure of trocar sites and mini-laparotomy incision.

Data Collection and Analysis:

Data were collected using standardized case report forms ensuring consistency, objectivity, and accuracy. Data entry was performed using Microsoft Excel 2019, and statistical analysis was conducted using SPSS version 26.0.

Results

Clinical and Paraclinical Characteristics of the Patients

The mean patient age was 49.94 ± 13.65 years (range: 17–73), with a female-to-male ratio of 1.6.

The average BMI was 21.62 ± 2.42 kg/m² (range: 19.03–27.0).

Preoperative biliary intervention: Two patients underwent common bile duct stenting, and three patients had biliary drainage prior to surgery due to biliary obstruction.

Table 1. Histopathological findings

Histopathology	Number of Patients (n)	Percentage (%)
Diagnosis (N = 18)		
Ampullary adenocarcinoma	10	55.6
Pancreatic neuroendocrine tumor	2	11.1
Solid pseudopapillary neoplasm of the pancreas	4	22.2
Serous cystadenoma of the pancreas	2	11.1
Tumor invasion (n = 10)		
T1	2	20.0
T2	3	30.0
T3	4	40.0
T4	0	0
Lymph node metastatsis (n = 10)		
N0	8	80.0
N1	2	20.0

The mean tumor size was 3.4 ± 1.7 cm (range: 1.0–6.4 cm), with 55.5% of patients (10/18) presenting with tumors smaller than 4 cm.

The mean number of lymph nodes harvested was 9.00 ± 4.74 (range: 4–20), and the mean number of metastatic lymph nodes was 0.31 ± 0.75 (range: 0–2).

Surgical characteristics and early outcomes

Table 2. Surgical characteristics of LAPD

Characteristic		n = 18
Mean operative time (minutes)		352.44 ± 44.59
Mean laparoscopic time (minutes)		224.72 ± 45.13
Mean open surgery time (minutes)		127.72 ± 25.04
Mean intraoperative blood loss (ml)		163.89 ± 136.99
Mean length of mini-laparotomy (cm)		6.78 ± 1.67
Pancreatic anastomosis	Pancreaticojejunostomy	12 (66.7%)
	Pancreaticogastrostomy	6 (33.3%)
Billiary-enteric anastomosis	Interrupted sutures	8 (44.4%)
	Continuous sutures	10 (55.6%)
Gastrojejunostomy	Interrupted sutures	0 (0%)
	Continuous sutures	18 (100%)

All patients received pancreatic duct stents using suction drains. One patient had external drainage of the pancreaticojejunostomy. No patients received a Volkmann drain.

No major intraoperative complications such as vascular injury, bowel perforation, or colonic necrosis were recorded.

Three cases had anatomical variants: right hepatic artery arising from the superior mesenteric artery, and left hepatic artery from the left gastric artery.

Table 3. Early postoperative outcomes

Characteristic			n = 18
Mean postoperative hospital stay (days)			11.33 ± 3.27
Mean time to first flatus (days)			3.61 ± 1.58
Mean time to nasogastric tube removal (days)			3.67 ± 1.19
Mean time to oral intake (days)			4.33 ± 1.37
Postoperative complications	Pancreatic fistula	Grade A	3 (16.7%)
		Grade B	2 (11.1%)
		Grade C	0 (0%)
	Bile leak		1 (5.6%)
	Postoperative hemorrhage		2 (11.1%)
	Chyle leak		1 (5.6%)
	Total complication rate		9 (50.0%)

Management of complications: One patient with postoperative hemorrhage on day 2 required reoperation for hemostasis and was discharged in stable condition. One patient had a bile leak (500 ml/24h) which was successfully managed with stent placement at the anastomotic site. Five patients developed pancreatic fistulas, all of whom were treated conservatively and discharged in stable condition.

Discharge status: 50.0% of patients were rated as having a good outcome at discharge, 44.4% fair, and 5.6% moderate. No patients had poor outcomes. At the time of study completion, 100% of patients were alive.

Long-term follow-up: All 18 patients are currently under regular follow-up with no evidence of recurrence.

Discussion

Indications for Laparoscopic-Assisted Pancreaticoduodenectomy

Patient age and general condition are key factors

in determining suitability for complex surgical procedures, including laparoscopic approaches. In this study, the average age of the 18 patients was 49.94 ± 13.65 years, with a female-to-male ratio of 1.6:1. In contrast, Meng et al. (2018), studying patients with ampullary carcinoma, reported a higher average age of 59.95 ± 9.12 years and a male predominance (55.17%) [6]. This difference can be explained by our inclusion of solid pseudopapillary neoplasms, which typically occur in younger, female patients.

Notably, none of the patients in our study were underweight. This may be attributed to the implementation of a nutritional intervention program for patients with a BMI below 18.5 kg/m², aimed at optimizing their condition prior to surgery and reduce postoperative complications.

Smaller, less invasive tumors are more favorable for laparoscopic dissection. In our study, the average tumor size measured by CT scan was 3.4 ± 1.7 cm (range: 1.0–6.4 cm), with eight patients having tumors ≥ 4 cm. Larger tumors were typically of pancreatic origin. We observed that large tumors often pose challenges for laparoscopic procedures, particularly during the Kocher maneuver used to mobilize the duodenum and pancreatic head. Pancreatic cancers are also frequently invasive, complicating dissection from the superior mesenteric vascular bundle.

Ampullary adenocarcinomas are particularly amenable to LAPD, as they are often detected early due to symptoms such as jaundice, and tend to be small and less invasive. In high-volume centers globally, ampullary tumors are more common than distal bile duct and duodenal tumors, but less common than pancreatic head tumors. The reported incidence of ampullary tumors was 15.1% in Asbun (2012) [7], 26% in Dokmak (2015) [8], and 31.5% in Senthilnathan (2015) [9]. In our study, 56.3% of patients had ampullary adenocarcinoma, as shown in Table 1. The remaining 44.4% had tumors originating from the pancreas, including two cases of neuroendocrine tumors, four solid pseudopapillary neoplasms, and two serous cystadenomas (preoperatively suspected as mucinous cystic neoplasms).

Lymph node yield is a key consideration in oncologic laparoscopic surgery. Our mean number of harvested lymph nodes was 9.00 ± 4.74, with a mean of 0.31 ± 0.75 metastatic nodes. According to Kuesters et al. (2018), in LAPD for pancreatic cancer, there was no significant difference in lymph node retrieval between laparoscopic-assisted and open approaches. However, the laparoscopic-assisted group had a higher rate of negative resection margins compared to open surgery (87% vs. 71%, $p < 0.01$), supporting the oncologic adequacy of minimally invasive approaches [10].

Early outcomes of laparoscopic – assisted pancreaticoduodenectomy

Prolonged operative and anesthesia times are often considered limitations of fully laparoscopic PD. In our study, the mean operative time was 352.44 ± 44.59 minutes (range: 240–420), with the laparoscopic phase accounting for 224.72 ± 45.13 minutes (range: 110–300) and the open phase 127.72 ± 25.04 minutes. The average intraoperative blood loss was approximately 163.89 mL (Table 3). In the study by Tran Que Son, the mean operative time was 290.8 minutes, with an estimated blood loss of 350.2 mL [4]. Our findings suggest that laparoscopic-assisted PD may reduce operative time compared to fully laparoscopic procedures. For example, Lee et al. reported a mean laparoscopic operative time of 426 minutes, which was longer than that of open surgery (355 minutes); however, blood loss was lower in the laparoscopic group (477.42 ± 374.8 mL vs. 800 ± 531.35 mL) [11]. A 2019 meta-analysis of 28 studies involving 3,543 patients also concluded that laparoscopic surgery had a significant advantage in terms of lower intraoperative blood loss and reduced transfusion rates compared to open surgery ($p < 0.00001$) [12]. Furthermore, a recent study by the American College of Surgeons found no significant correlation between prolonged operative time and increased postoperative complications [13], indicating that

operative duration should not be considered a major disadvantage of laparoscopic PD.

Both fully laparoscopic and laparoscopic-assisted approaches offer the benefit of avoiding large abdominal incisions, thereby reducing the risk of wound infections, incisional dehiscence, and hernias. In laparoscopic-assisted surgery, a small incision is made to facilitate anastomoses and specimen retrieval. Recent studies comparing postoperative outcomes between laparoscopic and open PD have shown a lower incidence of surgical site infections and postoperative pneumonia in the laparoscopic group [12]. In our study, the mean incision length was 6.78 ± 1.67 cm (range: 5–10 cm). No patients experienced wound infections or incisional hernias, underscoring the advantages of the laparoscopic-assisted approach.

The small incision also facilitates safer and more controlled construction of anastomoses, potentially reducing the rate of postoperative complications. It allows greater flexibility in the choice of pancreatic anastomosis technique (pancreaticojejunostomy vs. pancreaticogastrostomy), which often depends on the surgeon's experience and preference. Aranha (2006), Fang (2007), Lee (2013), and Zhu (2013) favored pancreaticogastrostomy, reporting low complication and mortality rates (0–3.7%). In contrast, Peng (2002), Kleespies (2009), and Fujii (2014) preferred pancreaticojejunostomy and also reported favorable outcomes, with postoperative pancreatic fistula (POPF) rates ranging from 2.5% to 36% depending on the technique used [14]. In our study, pancreaticojejunostomy was performed in 66.7% of patients, with a POPF rate of 27.7% (5/18 patients).

Hepaticojejunostomy was performed using either interrupted or continuous suturing techniques, depending on the thickness and diameter of the bile duct and the surgeon's preference. In our series, 56.3% of patients underwent continuous suturing, and no patients received Volkmann sutures.

The overall postoperative complication rate in our study was 50.0%. The most common complication was POPF, occurring in 27.7% of patients (5/18), followed by intra-abdominal hemorrhage (5.6%), bile leak (5.6%), chyle leak (5.6%), and gastrointestinal bleeding (5.6%) (Table 3). One patient (5.6%) required reoperation due to postoperative hemorrhage. Song et al. (2020) analyzed outcomes from 500 laparoscopic PD cases, reporting an overall complication rate of 37.2%, with POPF in 54.6%, acute bleeding in 2.6%, and mortality in 0.6% due to septic shock with colonic necrosis and hemorrhagic shock [15]. In comparison, Tran Que Son et al. (2020) reported POPF in 22.2%, bile leak in 16.7%, gastrointestinal leakage in 8.3%, upper upper gastrointestinal bleeding in 11.1%, and postoperative bleeding in 2.8% [14]. These findings highlight the necessity for such surgeries to be performed in well-equipped centers with experienced surgical, anesthetic, and critical care teams to manage potential complications effectively.

Postoperative recovery evaluation: The mean time to first flatus was 3.61 days, and the mean time to oral feeding was 4.33 ± 1.37 days. In a study by Ho Van Linh (2016), the mean time to flatus was approximately 3.5 days, and nasogastric tube removal occurred at 5.9 days [16]. A 2019 meta-analysis showed that patients who underwent laparoscopic surgery resumed oral intake earlier than those undergoing open surgery ($p < 0.04$) [12]. In our study, the mean postoperative hospital stay was 11.33 ± 3.27 days, with the longest stay being 19 days in a patient with grade B POPF who required drainage of residual fluid via the mini-laparotomy site and was successfully managed conservatively. Tran Que Son (2021) reported a longer mean hospital stay of 19.5 ± 13.7 days [4]. Xu (2019) noted a mean stay of 18.3 ± 11.6 days following fully laparoscopic PD [17]. Notably, although laparoscopic procedures may take longer intraoperatively, patients in the laparoscopic group had significantly shorter intensive care unit and overall hospital stays compared to those in the open group [12, 18]. This suggests faster recovery and potentially lower healthcare costs, while also allowing for earlier initiation of adjuvant chemotherapy in cases of malignancy.

Discharge condition: In our study, 50.0% of patients were discharged in good condition, 44.4% in fair condition, and 5.6% in moderate condition. No patients were in poor condition. Tran Que Son (2021) reported 66.7% with good outcomes, 12.5% fair, 12.5% moderate, and 8.3% poor (including fatalities) [4]. A recent study by Dagorno et al. (2024) on 948 patients comparing laparoscopic and open PD found that laparoscopic surgery significantly improved long-term quality of life, particularly regarding pancreatic function ($p < 0.002$) [19].

At the time of this study, all 18 patients in our series were alive and under regular follow-up, with no evidence of tumor recurrence.

Conclusion

LAPD is a safe and feasible alternative to open surgery and represents an appropriate transitional approach prior to the implementation of fully laparoscopic PD. Ampullary cancer, particularly in its early stages, represents an ideal indication for this technique due to its favorable anatomical and oncological characteristics. The procedure should be performed in specialized centers equipped with adequate surgical, anesthetic, monitoring, and interventional resources to ensure patient safety and effective management of potential complications.

However, our study is limited by a small sample size and relatively short follow-up period. Further research with larger patient cohorts and extended follow-up is necessary to draw more robust and generalizable conclusions.

Declarations

Ethics approval and consent to participate: Owing to design of case report, institutional review board approval was waived. Informed consent was obtained from all patients and their legal representatives.

Consent for publication: Consent for publication of individual patient data was obtained during the post-discharge visit and documented in the patient's paper medical record.

Availability of data and material: The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests: There are no conflicts of interest to declare.

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Authors' contributions: All authors prepared, drafted and revised manuscript critically for important intellectual content. Each author gave the final approval of the version to be published and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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