Postoperative Outcomes and Intensive Care Management Following Cephalic Duodenopancreatectomy

Abstract

Background:
Cephalic duodenopancreatectomy (CDP), also known as the Whipple procedure, is one of the most complex surgeries in digestive oncology. Despite advances that have significantly reduced perioperative mortality in specialized centers, this procedure continues to carry substantial morbidity requiring meticulous perioperative and intensive care management.

Objective:
This study aimed to analyze the epidemiological characteristics, perioperative care, postoperative complications, and outcomes of patients undergoing CDP, with a specific focus on their management in the surgical intensive care unit.

Methods:
We conducted a retrospective review of 30 patients who underwent CDP and were admitted to the surgical ICU at Ibn Rochd University Hospital in Casablanca between March 2021 and January 2025. Data on demographics, clinical presentation, perioperative management, postoperative complications, and outcomes were collected and analyzed.

Results:
The mean age was 57 years, with a male predominance (55%). Pancreatic head carcinoma was the most common indication (73%), followed by ampullary and duodenal tumors (13.3% each). All patients presented with cholestasis, and 66% had hepatomegaly. Abdominal ultrasound was the primary imaging modality (70%), complemented by CT scans (50%) and MRCP (33%). The mean surgical duration was 7.5 hours. Intraoperative management included balanced general anesthesia, hemodynamic monitoring with arterial and central venous catheters, and prophylactic antibiotics. Intraoperative transfusions were required in 50% of cases. Postoperatively, complications included pancreatic fistula (13.3%), gastrointestinal hemorrhage (6.6%), acute kidney injury (13.3%), and respiratory infections. Ten patients (33%) died, with pancreatic fistula being the leading cause of death (40% of deaths). The mean ICU stay was 10 days (range: 3–20 days).

Conclusion:
CDP remains a high-risk but essential procedure for the management of tumors of the pancreatobiliary region. Effective perioperative optimization, vigilant ICU monitoring, and prompt management of complications are critical to improving patient outcomes. Multidisciplinary collaboration is key to reducing morbidity and mortality associated with this demanding surgery.

Introduction

Cephalic duodenopancreatectomy (CDP), commonly referred to as the Whipple procedure, is one of the most complex and demanding operations in digestive surgery. Advances in surgical techniques and perioperative management have significantly reduced perioperative mortality, which now approaches 5% in high-volume centers. Despite its considerable morbidity, CDP remains the standard of care for resectable tumors involving the pancreatic head, periampullary region, and duodenum, offering a substantial survival benefit compared to non-surgical treatments.

However, the procedure is still associated with a high rate of postoperative complications, which can compromise patient recovery and prognosis. Early detection and appropriate management of these complications are essential to improving outcomes and reducing ICU length of stay.

The aim of this study is to analyze the epidemiological characteristics, therapeutic approaches, and postoperative outcomes of patients undergoing CDP, with particular focus on the management of complications in the surgical intensive care unit.

Materials and Methods

This is a retrospective study of 30 patients admitted to the surgical intensive care unit (Pavilion 17) at Ibn Rochd University Hospital in Casablanca following CDP between March 2021 and January 2025. Data were collected from medical records, including demographic, clinical, paraclinical, therapeutic, and outcome variables.

Results

The mean age of the patients included in this study was 57 years, with the most affected age group being those between 60 and 69 years. The majority of patients were male, accounting for 55% of the cohort.

Regarding the underlying pathology, pancreatic head carcinoma was the most common diagnosis, observed in 73% of patients. Ampullary carcinoma and duodenal tumors were each identified in 13.3% of cases. All patients presented with a cholestatic syndrome at admission, and clinical examination revealed hepatomegaly in 66% of the patients.

Abdominal ultrasound was the most frequently used imaging modality, performed in 70% of cases, mainly to detect intrahepatic and extrahepatic bile duct dilatation or tumor masses. Gallbladder stones were incidentally found in four patients. Abdominopelvic computed tomography (CT) was performed in 50% of the cases to further assess the extent of the disease, and magnetic resonance cholangiopancreatography (MRCP) was indicated for 10 patients with inconclusive or complex imaging findings.

All patients demonstrated biochemical evidence of cholestasis. Serum amylase levels were measured in six patients; only one had elevated values suggestive of associated pancreatic inflammation.

The mean duration of surgery was 7.5 hours, with a range of 5.5 to 9 hours. A classical cephalic duodenopancreatectomy with pancreatojejunostomy was performed in 60% of the cases, whereas a pancreatogastrostomy reconstruction was chosen in the remaining 40%.

Intraoperative management included continuous monitoring of respiratory and cardiovascular parameters, along with depth of anesthesia. All patients underwent balanced general anesthesia and received prophylactic antibiotics: amoxicillin–clavulanic acid was the first-line choice in 50% of the cases, while third-generation cephalosporins or ampicillin were used in the others based on bacterial resistance patterns and institutional protocols. Intraoperative fluid resuscitation was maintained at an average rate of 10 mL/kg/h. Blood transfusions were necessary in 15 patients due to intraoperative blood loss.

Postoperative monitoring focused on vital signs, blood glucose levels, urine output, and the surveillance of abdominal drains. Abdominal ultrasound was repeated postoperatively in 20 patients to assess for fluid collections or biliary leaks, and follow-up CT scans were obtained in 16 patients when complications were suspected.

Postoperative infectious complications required targeted antibiotic therapy in several patients. Thromboembolic prophylaxis with low-molecular-weight heparin was administered for an average duration of 10.4 days. Stress ulcer prophylaxis consisted of H2 receptor antagonists in four patients and proton pump inhibitors in 26 patients.

Pain management in the immediate postoperative period included centrally administered morphine at a mean dose of 10 mg/day for four days, supplemented by paracetamol in 24 patients for an average of five days. Ten patients required postoperative red blood cell transfusions, and four patients received fresh frozen plasma for coagulopathy. Two patients developed acute kidney injury necessitating hemodialysis.

The mean length of stay in the intensive care unit (ICU) was 10 days (range: 3–20 days). Overall, 67% of patients had a favorable postoperative course. Pancreatic fistula was the most frequent surgical complication, occurring in 13.3% of cases. The overall postoperative mortality rate was 33% (10 patients). Among these, pancreatic fistula was the leading cause of death (40% of fatalities), followed by gastrointestinal hemorrhage, septic shock, and acute renal failure, each accounting for 20% of deaths.

Discussion

In this study, the mean patient age was 57 years, which is notably lower than the average age reported in Western populations, where pancreatic cancer commonly presents around the age of 70 due to longer life expectancy and earlier detection through screening programs (1). The slight male predominance observed in our cohort is consistent with previous studies, which generally report male-to-female ratios ranging from 1.2 to 2 (2,3).

Globally, pancreatic cancer accounts for approximately 2% of all malignancies and nearly 10% of gastrointestinal cancers (4). The primary indication for performing a cephalic duodenopancreatectomy (CDP) remains malignant tumors involving the pancreatic head, periampullary region, distal common bile duct, or duodenum (5). In line with international data, pancreatic head carcinoma was the most frequent diagnosis in our series, affecting 74% of patients (6).

Classical contraindications to CDP include the presence of distant metastases (hepatic or pulmonary), peritoneal carcinomatosis, and interaortocaval lymph node involvement, which significantly limit the potential for curative resection (7). Obstructive jaundice is the most common presenting symptom (8), often accompanied by pruritus, upper abdominal pain, anorexia, and progressive weight loss.

Preoperative optimization plays a critical role in improving surgical outcomes and must be tailored to each patient. This includes nutritional support, correction of vitamin deficiencies (notably fat-soluble vitamins), strict glycemic control, and preoperative respiratory physiotherapy to reduce postoperative pulmonary complications (9). Adequate intraoperative fluid management is essential to maintain hemodynamic stability throughout this prolonged and technically demanding procedure (10). In our series, intraoperative blood transfusions were required in 50% of cases, reflecting both the complexity and the extent of tissue dissection involved in CDP.

General anesthesia with careful intraoperative monitoring such as the use of an arterial catheter for hemodynamic monitoring, a jugular venous catheter, and the placement of an epidural catheter, remains the standard of care for this major abdominal surgery (11). The use of prophylactic antibiotics is well established to minimize the risk of postoperative infectious complications; combinations such as ticarcillin–clavulanate with gentamicin have demonstrated efficacy in this setting (12).

Despite improvements in surgical technique and perioperative care, postoperative morbidity following CDP remains high, with reported rates ranging from 40% to 55% (13). Pancreatic fistula is the most feared complication due to its potential for severe secondary infections and hemorrhage, with incidence reported between 10% and 30% (14). In our study, 13% of patients developed a pancreatic fistula, which is within the lower end of this range. According to the International Study Group on Pancreatic Fistula (ISGPF) consensus, these are classified into Grades A, B, and C, with escalating clinical impact(15).

Delayed gastric emptying and postoperative hemorrhage are other notable complications. Gastrointestinal hemorrhage occurs in approximately 4% to 16% of patients and contributes significantly to postoperative mortality, which can reach up to 20% in severe cases (16). In our cohort, two patients (6.6%) experienced significant gastrointestinal bleeding, requiring endoscopic or surgical intervention.

Postoperative peritonitis, although less frequent, remains a life-threatening event with reported mortality rates ranging from 30% to 73% (17). Acute postoperative

pancreatitis following CDP is rare but carries a very high mortality rate, reported up to 77% (18); fortunately, no cases of this severe complication occurred in our series.

Acute kidney injury (AKI) is another serious complication, observed in four patients in our study, with two resulting in mortality despite multiple sessions of hemodialysis. This aligns with published data indicating that AKI develops in approximately 20% of patients undergoing pancreatic surgery and is associated with high morbidity and mortality (19). Respiratory complications, such as pneumonia and pleural effusion, were also noted but generally responded well to antibiotic therapy and supportive measures.

Since Whipple first described this procedure in 1935, with an initial mortality rate of around 33%, significant advances in surgical techniques, perioperative care, and critical care medicine have dramatically improved patient outcomes (20). Nevertheless, CDP remains a high-risk intervention, and careful patient selection, meticulous surgical technique, and vigilant postoperative monitoring remain essential to minimize morbidity and mortality.

Conclusion

Cephalic duodenopancreatectomy remains one of the most challenging yet essential surgical procedures for the management of malignant tumors of the pancreatobiliary junction. Despite significant improvements in surgical techniques, anesthesia, and perioperative care, this operation continues to carry a high risk of complications that can adversely affect patient outcomes.

Our study highlights the importance of rigorous preoperative optimization, meticulous intraoperative monitoring, and vigilant postoperative management in the intensive care unit to detect and address complications early. Pancreatic fistula, postoperative hemorrhage, and acute kidney injury remain the major causes of morbidity and mortality in this setting.

A multidisciplinary approach involving surgeons, anesthesiologists, intensivists, and nursing staff is crucial to improve recovery and survival rates. Continued efforts to refine surgical techniques and enhance perioperative protocols are essential to further reduce morbidity and mortality associated with this demanding procedure.

Future prospective studies with larger sample sizes are warranted to better identify risk factors and develop standardized postoperative care pathways tailored to high-risk patients undergoing CDP.

References

1. Siegel RL, Kratzer TB, Giaquinto AN, Sung H, Jemal A. Cancer statistics, 2025. CA Cancer J Clin. 2025;75(1):10-45.

2. Hatzaras I, George N, Muscarella P, Melvin WS, Ellison EC, Bloomston M. Predictors of survival in periampullary cancers following pancreaticoduodenectomy. Ann Surg Oncol. avr 2010;17(4):991-7.

3. Sohn TA, Yeo CJ, Cameron JL, Koniaris L, Kaushal S, Abrams RA, et al. Resected adenocarcinoma of the pancreas—616 patients: results, outcomes, and prognostic indicators. J Gastrointest Surg. 1 nov 2000;4(6):567-79.

4. Rawla P, Sunkara T, Gaduputi V. Epidemiology of Pancreatic Cancer: Global Trends, Etiology and Risk Factors. World J Oncol. févr 2019;10(1):10-27.

5. Tanović H, Juricić R, Aksamija G, Sabanović J, Muhović S, Mulabdić A. [Broad indications for cephalic duodenopancreatoctomy]. Med Arh. 1 janv 2006;60(6 Suppl 1):34-6.

6. Lada PE, JaniKow C, Sánchez M, Massa M, Caballero F, Menso N, et al. Cephalic duodenopancreatectomy resection: technique, morbidity and mortality. HPB. 1 mars 2019;21:S168-9.

7. Vera R, Díez L, Martín Pérez E, Plaza JC, Sanjuanbenito A, Carrato A. Surgery for pancreatic ductal adenocarcinoma. Clin Transl Oncol. 1 nov 2017;19(11):1303-11.

8. Hidalgo M. Pancreatic Cancer. N Engl J Med. 29 avr 2010;362(17):1605-17.

9. Braga M, Gianotti L, Nespoli L, Radaelli G, Di Carlo V. Nutritional approach in malnourished surgical patients: a prospective randomized study. Arch Surg Chic Ill 1960. févr 2002;137(2):174-80.

10. Ostermann M, Auzinger G, Grocott M, Morton-Bailey V, Raphael J, Shaw AD, et al. Perioperative fluid management: evidence-based consensus recommendations from the international multidisciplinary PeriOperative Quality Initiative. Br J Anaesth. 1 déc 2024;133(6):1263-75.

11. Losco X. Anesthetic Management Impact on Cephalic Duodenopancreatectomy Outcomes: A Retrospective Study. 4 déc 2018 [cité 14 juin 2025]; Disponible sur: https://policycommons.net/artifacts/15472566/impact-of-modifications-in-the-anesthetic-management-of-patients-undergoing-cephalic-duodenopancreatectomy-on-short-and-long-term-outcomes/16365922/

12. Martin C, Auboyer C, Boisson M, Dupont H, Gauzit R, Kitzis M, et al. Antibioprophylaxie en chirurgie et médecine interventionnelle (patients adultes). Actualisation 2017. Anesth Réanimation. 1 nov 2019;5(6):544-66.

13. Hajri M, Omrani S, Guizani R, Ferjaoui W, Mestiri H, Bayar R. Morbi-mortalité après duodéno-pancréatectomie céphalique pour ampullome vatérien. J Chir Viscérale. 1 sept 2022;159(4, Supplement):S78.

14. Malgras B, Dokmak S, Aussilhou B, Pocard M, Sauvanet A. Prise en charge des fistules pancréatiques après duodénopancréatectomie céphalique. J Chir Viscérale. 1 févr 2023;160(1):42-56.

15. Bassi C, Dervenis C, Butturini G, Fingerhut A, Yeo C, Izbicki J, et al. Postoperative pancreatic fistula: an international study group (ISGPF) definition. Surgery. juill 2005;138(1):8-13.

16. Yekebas EF, Wolfram L, Cataldegirmen G, Habermann CR, Bogoevski D, Koenig AM, et al. Postpancreatectomy hemorrhage: diagnosis and treatment: an analysis in 1669 consecutive pancreatic resections. Ann Surg. août 2007;246(2):269-80.

17. Jacquemin M. Incidence, Risk Factors, and Management of Hemorrhagic Complications Following Cephalic Duodenopancreatectomy. 2 avr 2021 [cité 14 juin 2025]; Disponible sur: https://policycommons.net/artifacts/15541088/duodenopancreatectomie-cephalique/16433835/

18. Sledzianowski JF, Muscari F, Suc B, Fourtanier G. Pancréatites récidivantes après duodénopancréatectomie céphalique : réintervention pour sténose de l'anastomose pancréatico-jéjunale. Ann Chir. 1 févr 2004;129(1):37-40.

19. Swartling O, Evans M, Larsson P, Gilg S, Holmberg M, Klevebro F, et al. Risk factors for acute kidney injury after pancreatoduodenectomy, and association with postoperative complications and death. Pancreatol Off J Int Assoc Pancreatol IAP Al. mars 2023;23(2):227-33.

20. Barbier L, Jamal W, Dokmak S, Aussilhou B, Corcos O, Ruszniewski P, et al. Impact of total pancreatectomy: short- and long-term assessment. HPB. 1 nov 2013;15(11):882-92.