

Factors Associated with ERCP Failure in Patients with Pancreatic Head Cancer

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DOI: <https://doi.org/10.36347/sjmc.2026.v14i10.029>

| Received: 08.08.2026 | Accepted: 08.10.2026 | Published: 12.10.2026

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Abstract

Original Research Article

Background: Endoscopic retrograde cholangiopancreatography (ERCP) is an essential technique for biliary drainage in obstructive jaundice caused by pancreatic head cancer. However, failure of biliary cannulation remains a major limitation of the procedure. **Objective:** To determine the rate of ERCP failure and identify clinical, radiological, and endoscopic factors associated with failure in patients with pancreatic head cancer. **Patients and Methods:** Single-center observational study including 43 patients who underwent ERCP for pancreatic head cancer between January 2023 and January 2026 at the Mohammed V Military Instruction Hospital in Rabat. ERCP failure was defined as the inability to achieve effective endoscopic biliary drainage. Categorical variables were compared between successful and failed ERCP groups using Fisher's exact test or the Chi-square test. **Results:** The mean age was 67.4 ± 11.5 years; 35 patients were male (81.4%). ERCP failure occurred in 13 patients (30.2%), primarily due to failed papillary cannulation (10 cases). Failure was significantly associated with the absence of sphincterotomy ($p < 0.001$), absence of common bile duct (CBD) dilatation ($p < 0.001$), absence of distal CBD stricture on cholangiography ($p < 0.001$), and non-placement of a biliary stent ($p < 0.001$). No significant differences were observed regarding age, sex, smoking history, diabetes, tumor stage, or presence of hepatic metastases. **Conclusion:** In this series, ERCP failure occurred in approximately one in three patients and was mainly driven by failed papillary cannulation. These findings highlight the importance of early recognition of difficult ERCP procedures and prompt referral to rescue techniques, particularly interventional endoscopic ultrasound (EUS).

Keywords: ERCP; pancreatic cancer; cannulation failure; biliary drainage; biliary stent.

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1. INTRODUCTION

Pancreatic head cancer frequently presents as obstructive jaundice secondary to malignant stricture of the intrapancreatic segment of the common bile duct (CBD). Endoscopic retrograde cholangiopancreatography (ERCP) with biliary stent placement constitutes a primary modality for biliary drainage, particularly in patients with unresectable disease, those awaiting definitive oncological therapy, or those presenting with acute cholangitis.

Selective cannulation of the bile duct is the decisive step of ERCP. Biliary cannulation can be challenging in cases of papillary infiltration or distortion, duodenal invasion, malignant distal strictures, or duodenal inflammatory changes. The European Society of Gastrointestinal Endoscopy (ESGE) defines difficult biliary cannulation as more than 5 attempts, a duration exceeding 5 minutes after contact with the papilla, or

more than one inadvertent pancreatic duct opacification or cannulation.

The aim of this study was to describe the rate of ERCP failure in patients with pancreatic head cancer and to identify the clinical, radiological, and endoscopic factors associated with failure.

2. PATIENTS AND METHODS

2.1 Study Design and Population

This was a single-center observational study conducted at the Department of Gastroenterology I of the Mohammed V Military Instruction Hospital in Rabat, Morocco. We included 43 consecutive patients who underwent ERCP for obstructive jaundice related to pancreatic head cancer between January 2023 and January 2026.

2.2 Data Collection and Definitions

Collected data included demographic characteristics (age, sex), clinical history (smoking, diabetes), serum total bilirubin levels, imaging findings (abdominal ultrasound, CT scan, or MRI), endoscopic findings, cholangiographic characteristics, ERCP outcomes, and early procedure-related complications.

ERCP failure was defined as the inability to achieve effective endoscopic biliary drainage. Mechanistically, failure was categorized as failed papillary cannulation, failure of guidewire passage across the stricture, or inability to place a biliary stent.

2.3 Statistical Analysis

Qualitative variables were expressed as counts and percentages. Quantitative variables were expressed as mean $\pm$ standard deviation (SD). Comparisons between the 'Successful ERCP' and 'Failed ERCP' groups were performed using Fisher's exact test for small expected cell counts and the Chi-square test for categorical variables. A p -value < 0.05 was considered statistically significant. Multivariate analysis was not performed due to the limited sample size.

3. RESULTS

3.1 Patient Characteristics

The study population comprised 43 patients, including 35 males (81.4%) and 8 females (18.6%), with a male-to-female ratio of 4.38. The mean age was 67.4 ± 11.5 years (range: 40 to 90 years). All patients presented with clinical obstructive jaundice.

A history of active or former smoking was present in 16 patients (37.2%), diabetes mellitus in 12 patients (27.9%), and hepatic metastases at presentation in 13 patients (30.2%).

3.2 ERCP Outcomes and Complications

ERCP was technically successful with effective biliary drainage in 30 patients (69.8%), whereas

procedure failure occurred in 13 patients (30.2%). The primary mechanism of failure was failure of initial papillary cannulation, observed in 10 patients (76.9% of failures). Guidewire advancement failure across the malignant stricture occurred in 2 patients (15.4% of failures).

Endoscopic sphincterotomy was performed in 31 patients, including 30 patients in the successful group and 1 patient in the failed group. A biliary stent was successfully placed in 32 patients, including 30 in the successful group and 2 in the failed group.

Early post-procedure complications occurred in 5 patients (11.6%), all belonging to the successful ERCP group. Post-ERCP pancreatitis occurred in 3 patients (7.0%), and post-sphincterotomy hemorrhage occurred in 2 patients (4.7%). No cases of post-procedure cholangitis or procedure-related mortality were observed.

3.3 Factors Associated with ERCP Failure

The comparison between successful and failed ERCP groups is detailed in Table 1.

Mean age was 65.4 ± 10.8 years in the successful ERCP group compared to 71.4 ± 12.8 years in the failed ERCP group, with no statistically significant difference ($p = 0.157$). Mean total serum bilirubin was 174.0 ± 116.8 mg/L in the successful group vs. 152.1 ± 121.8 mg/L in the failed group, showing no significant difference ($p = 0.589$). Similarly, gender, smoking, diabetes, and presence of hepatic metastases were not significantly associated with procedural failure.

In contrast, non-performance of sphincterotomy ($p < 0.001$), absence of CBD dilatation ($p < 0.001$), absence of lower CBD stricture on cholangiography ($p < 0.001$), and failure of stent placement ($p < 0.001$) were strongly associated with ERCP failure. These variables serve as technical markers and anatomical correlates of successful cannulation and opacification.

Table 1: Comparison of clinical, radiological, and procedural variables between successful and failed ERCP groups (N = 43)

Variable	Successful ERCP, n (%) (n = 30)	Failed ERCP, n (%) (n = 13)	p-value
Sex			1.000
Male	24 (80.0%)	10 (76.9%)	
Female	6 (20.0%)	3 (23.1%)	
Smoking			1.000
No	19 (63.3%)	8 (61.5%)	
Yes	11 (36.7%)	5 (38.5%)	
Diabetes Mellitus			0.727
No	21 (70.0%)	10 (76.9%)	
Yes	9 (30.0%)	3 (23.1%)	
Hepatic Metastases			1.000
No	22 (73.3%)	9 (69.2%)	
Yes	8 (26.7%)	4 (30.8%)	
Sphincterotomy			< 0.001*
Performed	30 (100.0%)	1 (7.7%)	
Not performed	0 (0.0%)	12 (92.3%)	

Variable	Successful ERCP, n (%) (n = 30)	Failed ERCP, n (%) (n = 13)	p-value
Common Bile Duct (CBD) Dilatation			< 0.001 *
Present	30 (100.0%)	3 (23.1%)	
Absent	0 (0.0%)	10 (76.9%)	
Distal CBD Stricture (Cholangiography)			< 0.001 *
Present	28 (93.3%)	1 (7.7%)	
Absent	2 (6.7%)	12 (92.3%)	
Biliary Stent Placement			< 0.001 *
Placed	30 (100.0%)	2 (15.4%)	
Not placed	0 (0.0%)	11 (84.6%)	

CBD: Common Bile Duct. *Statistically significant difference ($p < 0.001$). Variables such as sphincterotomy, CBD dilatation, distal CBD stricture, and stent placement serve as technical markers of ERCP success.

4. DISCUSSION

In this single-center series, the ERCP failure rate among patients presenting with pancreatic head cancer was 30.2%. This failure rate is higher than those reported in general ERCP series, where selective biliary cannulation fails in approximately 5% to 15% of cases even in expert hands. This discrepancy is likely attributable to several factors: the small sample size, the single-center setting, the inherent anatomical complexity of malignant cephalic pancreatic tumors, and the frequent presence of duodenal tumor compression or direct ampullary infiltration.

The primary driver of procedural failure in our study was failed papillary cannulation, accounting for nearly 77% of all failures. This finding aligns with established literature. In distal malignant biliary obstruction caused by pancreatic adenocarcinoma, tumor progression distorts or infiltrates the papilla, alters the axis of the terminal bile duct, and hides or fixes the ampullary orifice. Recent prospective data specifically focusing on distal malignant obstruction from pancreatic cancer demonstrated that the absence of an ampullary bile duct and the presence of a type III (enlarged/prominent) papilla are independent predictors of difficult biliary cannulation.

In our study, the absence of CBD dilatation and lower CBD stricture on initial cholangiography were strongly associated with failure. When cannulation cannot be achieved, contrast opacification is absent, accounting for the strong statistical association. Similarly, the non-performance of sphincterotomy was strongly correlated with failure; however, this represents procedural sequence bias rather than an independent predictive factor, as sphincterotomy is performed subsequently to successful biliary deep wire cannulation.

Difficult cannulation is known to increase the incidence of post-ERCP pancreatitis due to repeated papillary trauma, sphincter of Oddi edema, and inadvertent pancreatic duct manipulation. Interestingly, in our study, all 3 cases of post-ERCP pancreatitis occurred in the successful ERCP group, with no cases in the failed group. This may be explained by early procedure termination in unsuccessful cases, limiting prolonged pancreatic duct trauma.

When standard ERCP cannulation fails, advanced rescue options should be promptly deployed. Endoscopic options include double-guidewire technique, early needle-knife pre-cut, and transpancreatic sphincterotomy. Should advanced ERCP techniques fail, interventional endoscopic ultrasound (EUS-guided biliary drainage) or percutaneous transhepatic biliary drainage (PTBD) are indicated. Interventional EUS offers technical success rates exceeding 90% following failed ERCP and represents a safe, internal alternative to PTBD in centers with relevant expertise.

5. CONCLUSION

ERCP failure affects approximately one in three patients with obstructive jaundice secondary to pancreatic head cancer and is predominantly caused by failed papillary cannulation. Papillary anatomical distortion, ampulloduodenal tumor infiltration, and altered ductal axis represent key mechanisms. Early recognition of difficult cannulation and rapid transition to rescue techniques—specifically interventional EUS-guided biliary drainage—are essential to optimize technical success and clinical safety.

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