Endoscopic management of post-cholecystectomy cystic duct stump biliary leakage: Single-centre experience

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ABSTRACT

Objective: Biliary leakage from the cystic duct stump following cholecystectomy is a significant postoperative complication. Endoscopic retrograde cholangiopancreatography (ERCP) with stenting has become the preferred treatment due to its minimally invasive nature and high success rates.

Material and Methods: This study retrospectively evaluates the efficacy of ERCP for managing cystic duct stump leakage. A total of 29 patients treated between February 2017 and April 2024 were analyzed. Inclusion criteria included patients with confirmed cystic duct leakage. Primary and secondary success rates were defined as bile leakage cessation and absence of biliary fistula after stent removal, respectively.

Results: The group consisted of 20 females and 9 males, with an average age of 64.14 years and median body mass index of 27.7 kg/m². Cholelithiasis without acute cholecystitis was the primary surgical indication in 48% of cases. ERCP was the first-choice treatment for 89.7% of patients, using stents based on common bile duct width. Initial success was achieved in 89.7% of cases, with a mean drain removal time of 14.3 days. Secondary success was seen in 96.4% of patients. Complications, such as pancreatitis and stent migration, occurred in 13.8% of cases.

Conclusion: The study highlights the effectiveness of ERCP in managing cystic duct leaks, with high success and acceptable complication rates, confirming it should be the treatment of choice for this condition.

Keywords: Cholecystectomy, biliary leakage, endoscopy

INTRODUCTION

Cholecystectomy, a surgical removal of the gallbladder, has evolved significantly over the past few decades, with laparoscopic techniques becoming the gold standard due to their minimally invasive nature. However, despite advancements, the risk of bile duct injuries and leaks remains a pertinent issue (1,2).

Bile leakage after cholecystectomy, particularly from the cystic duct stump, is a significant postoperative complication that can lead to considerable morbidity. The incidence of bile leaks ranges from 0.3% to 2.7% and is often associated with increased hospital stay, readmissions, and a need for additional interventions (1,3). The pathophysiology of cystic duct stump leaks involves incomplete closure or ischemic necrosis of the cystic duct remnant, leading to persistent biliary drainage into the peritoneal cavity (1,2). Early identification and management of this condition are crucial to prevent complications such as bile peritonitis, sepsis, and long-term biliary fistula formation (1). While surgical re-intervention was traditionally the mainstay of treatment, endoscopic approaches have shown superior outcomes in terms of patient recovery and complication rates (1,2,4). Endoscopic retrograde cholangiopancreatography (ERCP) with stenting has emerged as the preferred treatment modality due to its minimally invasive nature and high success rates (1).

Current literature emphasizes the importance of early ERCP intervention to manage bile leaks effectively. Studies have shown that timely ERCP can significantly reduce morbidity and improve patient outcomes compared to delayed interventions (1,2,5). Nowadays, clinicians are focused on optimizing ERCP techniques, including the development of more advanced stents and improved imaging modalities to enhance the detection and management of biliary leaks (1,4).

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Aim

This study aims to evaluate the efficacy and safety of endoscopic transpapillary drainage using ERCP for managing postoperative cystic duct stump leaks after cholecystectomy.

MATERIAL and METHODS

Twenty-nine consecutive patients with biliary leakage from the cystic duct stump after cholecystectomy, with no evidence for choledocholithiasis or cystic duct stones treated in our department between February 2017 and April 2024 were enrolled in the study. The data from the electronic medical records of the patients was collected and analysed. Due to the retrospective character of the study, it was not subject to the assessment of the institutional review board. Inclusion criteria: patients with cystic duct stump leakage confirmed by cholangiography (during ERCP) (Figure 1), clinical assessment (typical content and drainage volume of the external drain placed at the time of surgery), and abdominal ultrasonography, who underwent ERCP with stenting of the biliary tract, were included in the study. In all patients, the cystic duct was closed with two metal clips and drainage of the peritoneal cavity was performed during the primary surgery.

The initial success of the endoscopic procedure was defined as the reduction of bile leakage confirmed by clinical examination and ultrasound assessment, which indicated cessation of bile leakage and an absence of abdominal fluid collections, resulting in removal of the percutaneous drain.

The secondary success of the endoscopic procedure was defined as the lack of the fistula after removal of the biliary stent.



Figure 1. Cholangiogram showing cystic duct stump leakage.

Statistical Analysis

Descriptive statistics were used to summarize patient demographics, clinical characteristics, and treatment outcomes. Continuous variables were presented as means with standard deviations and medians with ranges, while categorical variables were reported as frequencies and percentages. Success rates and complication rates were calculated as proportions.

RESULTS

The study group consisted of 29 patients, with a gender distribution of 20 females (69%) and 9 males (31%). The average age of the patients was 64.14 years, with a median age of 66 years, ranging from 24 to 86 years. The average body mass index (BMI) of the patients was 28.53 kg/m²; the median BMI was 27.7 kg/m², ranging from 21.8 to 38.9 kg/m² (Table 1).

The indication for primary surgical treatment (cholecystectomy) was cholelithiasis without acute cholecystitis in 14 patients (48%), gangrenous acute cholecystitis in 7 patients (24%), acute cholecystitis without gangrene in 5 patients (17%), chronic cholecystitis in 2 patients (7%), and empyema of the gallbladder in 1 patient (3%). Laparoscopic cholecystectomy was the treatment of choice in these patients. In 5 cases (17.2%), the technique was changed to laparotomy intraoperatively due to difficult surgical conditions caused by inflammation during the procedure (3 cases of acute cholecystitis without gangrene, 1 case of gangrenous cholecystitis, 1 case of empyema of the gallbladder) (Table 2).

An endoscopic procedure was the first choice for the treatment in 26 patients (89.7%), 2 patients had previously undergone laparotomy with an unsuccessful attempt to close the fistula due to clinical instability in the course of peritonitis and sepsis, and 1 patient had undergone percutaneous ultrasoundguided drainage of the biloma. All the ERCP procedures were performed in a surgical theatre under intravenous sedation using midazolam (5 milligrams) and fentanyl (200 micrograms). During the procedure, the patients had their heart rate and oxygen saturation monitored and remained under intensive care 1 hour after the procedure.

Table 1. Patient characteristics		
Characteristic	p-value	
Total patients	29	
Gender distribution	20 females (69%), 9 males (31%)	
Average age (years)	64.14±14	
Median age (years)	66 (24-86)	
Average BMI (kg/m²)	28.53	
Median BMI (kg/m²)	27.7 (21.8-38.9)	
BMI: Body mass index		

During the procedure, each patient underwent successful sphincterotomy or precutting of the ampulla of Vater. Self-expandable metallic stents (SEMS) and Amsterdam biliary stents were used in 20 patients (69%) and 9 patients (31%), respectively. In the SEMS group, additional implantation of double pigtail plastic stents (7 Fr, 12 cm) was performed in 2 patients to achieve proper management of the leakage. Stent type was chosen depending on the width of the common bile duct (CBD). Amsterdam-type straight plastic stent was implanted in CBD \leq 4 mm, SEMS for CBD 4-8 mm and SEMS with double pig-tail drainage biliary catheter for CBD >8 mm (Table 3).

The mean time from cholecystectomy to ERCP was 12.4 days, with a median of 5 days (ranging 1-63 days). Only two patients waited for ERCP longer than 35 days (55 and 65 days respectively); this was caused by technical difficulties and transfer from other hospitals. Excluding these patients, the mean time decreases to 9 days, and the median remains the same, which ranges from 1 to 35 days. The waiting time for the procedure was dictated by the patient's stable clinical condition, the time needed to perform imaging diagnostics, and the technical capabilities of the endoscopy facility.

Initial Success

Initial endoscopic success, confirmed through ERCP (fixing the distal stent ring above the leakage site), clinical examination (the bile leakage stopped), and ultrasound (no fluid collection in the abdominal cavity), was achieved in 26 patients (89.7%) (Figure 2). In this group of patients, a external drain was removed between 3 and 40 days after ERCP (mean 14.3 days, median 10 days).

In the group of patients with no initial endoscopic success (persistent bile leakage despite proper stent placement), all underwent the ERCP procedure again. The mean time was 5.6 days and the median was 6 days (ranging from 3 to 8 days). In all these patients, bile leakage was stopped after the second ERCP with stent reimplantation, which allowed the removal of the external drain 12-14 days (median 14 days) after the second endoscopic intervention.

Secondary Success

Secondary success was evaluated during the cholangiography after endoscopic removal of the biliary stent. Twenty-eight patients underwent this procedure 30-180 days after successful

Table 2. Indications for primary surgical treatment			
Indication	Number of patients (%)		
Cholelithiasis without acute cholecystitis	14 (48%)		
Gangrenous acute cholecystitis	7 (24%)		
Acute cholecystitis without gangrene	5 (17%)		
Chronic cholecystitis	2 (7%)		
Empyema of the gallbladder	1 (3%)		

biliary stenting (mean 78 days, median 62 days). One patient died during the follow-up due to non-surgical causes. No signs of persistent biliary fistula were found in 27 patients (96.4%) (Figure 3). In one patient (3.6%) signs of a biliary fistula were found despite maintaining the plastic biliary stent (Amsterdam 10 Fr 9 cm) for 50 days. This patient underwent reimplantation of the biliary stent and remains in follow-up (Table 4).

Complications

Four patients (13.8%) presented complications resulting directly from ERCP. Two of them were diagnosed with acute pancreatitis (successfully treated conservatively), and in two cases the biliary stent migrated proximally or distally, resulting in failure to achieve the initial success, which required further endoscopic procedures.

Six patients (20.7%) were diagnosed with complications caused by primary surgical condition and treatment. Surgical site infection requiring additional treatment and prolonged hospitalisation occurred in 3 patients (10.4%). Additionally, enteroenteric fistula occurred in 1 patient, and acute appendicitis occurred in 1 patient. One patient developed respiratory failure due to sepsis, requiring intensive care unit hospitalization (Table 5).

DISCUSSION

The findings of this study reinforce the efficacy of endoscopic transpapillary drainage using ERCP in managing cystic duct stump leaks after cholecystectomy. The initial success rate of 89.7% aligns with existing literature, which reports success rates ranging from 85% to 95% for ERCP in treating postoperative bile



Figure 2. Initial endoscopic success (no bile leakage) after SEMS implantation.

SEMS: Self expandable metal stent

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leaks (2,6,7). This high success rate underscores the reliability of ERCP as a first-line treatment, particularly when compared to more invasive surgical options (2,8).

When compared to other treatment modalities, such as surgical re-intervention, ERCP offers several advantages. It is less invasive,



Figure 3. Secondary success-no bile leakage after removal of the stent.

Table 3. ERCP treatment details		
Variable	p-value	
Patients treated with SEMS	20 (69%)	
Patients treated with Amsterdam biliary stents	9 (31%)	
Additional DPT plastic stents in SEMS group	2	
Mean time from cholecystectomy to ERCP (days)	12.4 (median 5, range 1-63)	
SEMS: Self expandable metal stent, BMI: Body mass index, DPT: Double pig-tail		

Table 4. Initial and secondary success rates		
Success rate	p-value	
Initial success	26 patients (89.7%)	
Secondary success	27 patients (96.4%)	
No persistent biliary fistula	27 (96.4%)	

Table 5. Complications		
Complication	Number of patients (%)	
Acute pancreatitis	2 (6.9%)	
Stent migration	2 (6.9%)	
Surgical site infection	3 (10.4%)	
Enteroenteric fistula	1 (3.4%)	
Acute appendicitis	1 (3.4%)	
Respiratory failure due to sepsis	1 (3.4%)	

has a shorter recovery time, and is associated with fewer complications. For instance, a study by Baron and Harewood (1) demonstrated that ERCP had a higher success rate and a lower complication rate compared to surgical approaches (2,7). Additionally, the use of SEMS improved the outcomes, especially in patients with wider CBDs (2,7-9).

Despite its high success rate, ERCP is not without challenges. Complications such as acute pancreatitis and stent migration are well-documented risks associated with the procedure (2,10). The incidence of these complications in our study (13.8%) is comparable to other reports, suggesting that while ERCP is effective, it requires careful patient selection and management to mitigate risks (2,10). Furthermore, the need for repeating ERCP in a subset of patients highlights the importance of close follow-up and the potential for multiple interventions to achieve optimal outcomes (2,8,10).

The management of postoperative bile leaks is inherently complex and often requires a multidisciplinary approach. Collaboration between surgeons, gastroenterologists, and radiologists is essential to ensure comprehensive care. For example, the involvement of interventional radiologists can be crucial for managing complications such as bile collections and abscesses that may arise during treatment (2,9,11). Additionally, the role of nursing and supportive care in monitoring and managing patients post-ERCP cannot be overstated (2,12).

CONCLUSION

In conclusion, this study confirms that endoscopic transpapillary drainage is a highly effective and relatively safe treatment for cystic duct stump leaks following cholecystectomy. Given its minimally invasive nature and high success rates, ERCP should be considered the treatment of choice for this complication. Future research should focus on optimizing patient selection criteria and procedural techniques to further enhance outcomes and minimize complications.

Ethics

Ethics Committee Approval: This retrospective study is not a medical experiment or a clinical trial performed on a patient, therefore it did not require a ethics committee approval.

Informed Consent: Retrospective study.

Footnotes

Author Contributions

Concept - W.C., T.K., P.H.; Design - J.S.; Supervision - A.D., J.S., P.H.; Materials - T.K.; Data Collection or Processing - W.C., T.K.; Analysis or Interpretation - W.C., T.K.; Literature Search - W.C., A.D.; Critical Review - A.D., J.S.; Writing - W.C., P.H.

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