ORIGINAL ARTICLE

Endoscopic management of cystic stump leaks: Insights from a tertiary care center

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ABSTRACT

BACKGROUND: Cystic stump leakage is the most common cause of bile leakage following cholecystectomy, representing a significant postoperative complication that requires prompt intervention. Currently, endoscopic treatment is the preferred management approach. This study aims to identify factors influencing the success of endoscopic therapy for cystic stump leaks by analyzing cases treated at our institution.

METHODS: Thirty-seven patients who underwent endoscopic retrograde cholangiopancreatography (ERCP) for cystic stump leakage were included in this study. Patient demographics, associated complications, and length of hospital stay were analyzed.

RESULTS: All patients showed clinical improvement, with a mean hospital stay of 5.1 days. The presence of comorbidities, emergency surgery, or conversion to open surgery did not significantly impact treatment efficacy. Post-procedure, percutaneous drainage was required in 10 patients (27%). Procedure-related pancreatitis was noted in one patient (2.7%). Statistical analysis revealed that both the need for percutaneous drainage and the length of hospital stay were significantly lower in patients who had pre-existing drains ($p<0.03$). Additionally, early ERCP was associated with a significantly shorter hospital stay ($p<0.01$).

CONCLUSION: Stent placement via ERCP is a safe and effective strategy for managing cystic stump leaks. Early ERCP intervention following cystic stump leak detection is recommended. Furthermore, percutaneous drainage may be necessary in patients who do not respond adequately to initial treatment.

Keywords: Cholecystectomy; cystic stump; endoscopic retrograde cholangiopancreatography (ERCP).

INTRODUCTION

Cholecystectomy is one of the most frequently performed elective surgical procedures, with over 500,000 operations conducted annually in the United States alone.[1] Laparoscopic cholecystectomy is considered the gold standard treatment for gallbladder stones.[2] Bile leakage has been reported in 0.1%-2% of cases following cholecystectomy. The most common source of bile leakage is the cystic stump. Anatomical challenges, the presence of calculi in the common bile duct, and technical errors may contribute to this complication.[3,4]

The diagnostic process can be complex. Recent literature identifies magnetic resonance cholangiopancreatography (MRCP) as the first-line imaging modality. MRCP is a non-invasive technique that provides visualization of the entire biliary tree, particularly useful in suspected cases of biliary tract injury. Nevertheless, endoscopic retrograde cholangiopancreatography (ERCP) has traditionally been used for both diagnostic and therapeutic purposes. Sphincterotomy or stent placement via ERCP offers a reliable solution in most cases. Variability in diagnostic approaches is observed among surgeons.[5,6]

Delays in diagnosis or the accumulation of bile, particularly in

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the absence of adequate drainage, may lead to complications such as biloma or abscess. The presence of bile in the drain tube can be a key indicator in some cases, while the absence of drainage, severe abdominal pain, or jaundice may also signal a problem. Although laboratory parameters may change in these situations, they are generally not reliable in the early postoperative period. When an abscess or biloma is detected in the abdomen, drainage is required. If feasible, this can be performed percutaneously; however, surgical lavage and drainage are viable options, particularly when acute abdominal symptoms occur or percutaneous drainage is not possible.[7,8]

Following the diagnosis of cystic stump leakage, the first-line treatment is ERCP. Sphincterotomy, either performed alone or in combination with stent placement, is highly effective in managing the leakage.[9] Studies suggest that stent placement may lead to faster resolution; however, it requires an additional procedure and carries a risk of complications.[10,11]

While it remains relatively uncommon in experienced centers, ERCP may still lead to complications such as hemorrhage, perforation, pancreatitis, cholangitis, and stent migration or occlusion.[12] Nevertheless, in cases of bile leakage, ERCP is generally considered significantly safer than surgical intervention. Currently, surgical exploration is regarded as the last resort for managing cystic stump leakage.[13,14]

In this study, we aimed to evaluate data from a tertiary center where endoscopic treatment is performed for cystic stump leaks. Our objective was to identify cases of cystic stump leakage following cholecystectomy and assess the outcomes of endoscopic treatment.

MATERIALS AND METHODS

Following approval from the Clinical Research Ethics Committee, a retrospective analysis of our hospital's database was conducted to identify all patients who underwent ERCP in the endoscopy unit between January 2015 and September 2024. Informed consent was obtained from all patients prior to the procedures, and all data were handled in accordance with ethical standards, ensuring patient confidentiality and institutional review board approval. The study included all patients aged 18 years and older who underwent cholecystectomy for any indication and were subsequently diagnosed with an isolated cystic stump leak during ERCP. Patients who underwent ERCP for other indications or were found to have bile leaks from sources other than the cystic stump were excluded. All ERCP reports in the endoscopy unit were retrospectively reviewed. For patients who met the inclusion criteria, inpatient discharge summaries and outpatient follow-up records were examined. For those who did not attend follow-up visits, telephone contact was made to obtain their current clinical status and any missing data. Figure 1 illustrates contrast agent leakage from the cystic stump during ERCP.



Figure 1. Contrast agent leakage from the cystic duct during ERCP.

In this study, we collected detailed information from patient epicrisis reports, including demographic characteristics, comorbidities, the surgical center, and whether the surgery was performed electively or under emergency conditions. The type of surgery was categorized as either laparoscopic or open, and the presence of drains was also recorded. Additionally, we systematically evaluated the imaging methods used to detect bile leakage, such as MRCP, ultrasound (US), and computed tomography (CT). The timeframe from detection of bile leakage to ERCP was documented, along with relevant laboratory parameters—specifically, leukocyte counts, C-reactive protein (CRP) levels, and liver function tests, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), and bilirubin levels—measured prior to ERCP. A threefold increase in these values was considered significant. Other factors evaluated included the length of hospital stay, potential complications following ERCP, and the follow-up period after patient discharge.

Statistical Analysis

The data were analyzed using IBM SPSS Statistics software (version 28.0; IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic characteristics and complications. The Mann-Whitney U test was employed to compare continuous variables between two independent groups, while Fisher's Exact Test was used for categorical variables with small sample sizes. For further analysis of significant variables, logistic regression was performed to identify factors associated with the outcome, reporting odds ratios (OR) and 95% confidence intervals (CI). Associations between categorical variables were examined using the Chi-square test, and relationships between continuous variables were assessed using Pearson's correlation coefficient. A p-value of less than 0.05 was considered statistically significant.

RESULTS

During the study period, 6,482 cholecystectomies were performed at our center, and 11 cases of cystic stump leakage (0.16%) were identified. Additionally, 26 patients were referred from other centers. Thus, a total of 37 patients were included in the study.

Table 1. Comparison of demographic and clinical characteristics according to the need for additional intervention after endoscopic retrograde cholangiopancreatography (ERCP)

Variables	All Patients (n=37)	No Intervention After ERCP (n=27)	Additional Inter-vention After ERCP (n=10)	P-value
Age (years, median, range)	52 (20-77)	45 (20-76)	61 (43-77)	0.024[a]
Sex (n, %)				
Female	26 (70.3%)	20 (54.1%)	6 (16.2%)	0.442[b]
Male	11 (29.7%)	7 (18.9%)	4 (10.8%)	
Comorbidities (n, %)				
No	25 (67.6%)	21 (56.8%)	4 (10.8%)	0.049[b]
Yes	12 (32.4%)	6 (16.2%)	6 (16.2%)	
Types of Comorbidities (n, %)				
Hypertension	6 (16.2%)	2 (5.4%)	4 (10.8%)	0.052[b]
Cardiac Disease	4 (10.8%)	2 (5.4%)	2 (5.4%)	
Renal Disease	1 (2.7%)	1 (2.7%)	0 (0%)	
Pulmonary Disease	1 (2.7%)	1 (2.7%)	0 (0%)	
No Comorbidities	25 (67.6%)	21 (56.8%)	4 (10.8%)	
ERCP Before Cholecystectomy (n, %)				
No	30 (81.1%)	22 (59.5%)	8 (21.6%)	1.000[b]
Yes	7 (18.9%)	5 (13.5%)	2 (5.4%)	
Emergency Surgery (n, %)				
No	16 (43.2%)	12 (32.4%)	4 (10.8%)	1.000[b]
Yes	21 (56.8%)	15 (40.5%)	6 (16.2%)	
Conversion to Open Surgery (n, %)				
No	26 (70.3%)	18 (48.6%)	8 (21.6%)	0.688[b]
Yes	11 (29.7%)	9 (24.3%)	2 (5.4%)	
Drain Placement (n, %)				
Yes	31 (83.8%)	26 (70.3%)	5 (13.5%)	0.003[b]
No	6 (16.2%)	1 (2.7%)	5 (13.5%)	
Radiologic Imaging (n, %)				
None	26 (70.3%)	22 (59.5%)	4 (10.8%)	0.045[b]
MRCP	7 (18.9%)	3 (8.1%)	4 (10.8%)	
US	2 (5.4%)	1 (2.7%)	1 (2.7%)	
CT	2 (5.4%)	1 (2.7%)	1 (2.7%)	
Postoperative Days to ERCP (median, IQR)	3 (2-7)	3 (2-4)	9 (6-15)	<0.001[a]
Length of Hospital Stay (days, median, IQR)	8 (5-14)	6 (4-9)	19 (15-23)	<0.001[a]
APR Levels Before ERCP (n, %)				
Normal	16 (43.2%)	13 (35.1%)	3 (8.1%)	0.461[b]
Increased	21 (56.8%)	14 (37.8%)	7 (18.9%)	
LFT Levels Before ERCP (n, %)				
Normal	30 (81.1%)	22 (59.5%)	8 (21.6%)	1.000[b]
Increased	7 (18.9%)	5 (13.5%)	2 (5.4%)	

[a]Mann-Whitney U-test; [b]Fisher's Exact test. APR: Acute phase reactants; CT: Computed tomography; ERCP: Endoscopic retrograde cholangiopancreatography; IQR: Interquartile range; LFT: Liver function tests; MRCP: Magnetic resonance cholangiopancreatography; US: Ultrasonography.

Table 2. Multivariate logistic regression analysis for predictors of additional intervention after endoscopic retrograde cholangiopancreatography (ERCP)

Variable	Odds Ratio	95% CI (Lower)	95% CI (Upper)	p-value
Age	0.927	0.822	1.045	0.216
Comorbidity (Yes vs. No)	1.495	0.052	42.953	0.815
Imaging (Yes vs. No)	0.877	0.083	9.229	0.913
Postoperative Intervention Day	0.608	0.407	0.908	0.015

Binomial logistic regression analysis. Ref: Reference category; 95% CI: 95% confidence interval. p<0.05 was considered statistically significant.

Table 3. Association between drain placement and the need for percutaneous drainage

Drain Placement	Patients Requiring Drainage	Total Patients	Percentage	p-value
Yes	5	31	16.1%	p=0.049
No	5	6	83.3%	p=0.003

A Chi-square test was used to evaluate the association between intraoperative drain placement and the need for percutaneous intervention.

Demographic analysis revealed that the median age of the study population was 52 years. Among the cohort, 11 patients (29.7%) were male, and 26 (70.3%) were female. The prevalence of comorbid conditions was 32.4%, involving 12 patients. Regarding the type of cholecystectomy, 16 patients (43.2%) underwent elective procedures, while 21 patients (56.8%) required emergency surgery. Laparoscopic surgical techniques were initially attempted in all cases of cystic stump leakage; however, 11 patients (29.7%) ultimately required conversion to open surgery. Bile leakage was identified in 31 patients (83.8%) who presented with bile in the drain, while imaging studies were conducted in only 11 patients (29.7%) based on preliminary diagnoses of bile leakage. Notably, acute phase reactants were elevated in 21 patients (56.8%), and liver function tests were abnormal in seven patients (18.9%). Endoscopic retrograde cholangiopancreatography was performed in seven patients (18.9%) prior to cholecystectomy. Among those who underwent ERCP for cystic stump leakage, only 10 patients (27%) required additional percutaneous intervention. Further ERCP procedures were necessary in five patients (13.5%). Additionally, stones in the common bile duct were detected in three patients (8.1%) who underwent ERCP. The relationship between demographic data and the requirement for percutaneous intervention following ERCP is presented in Table 1.

In the univariate analysis, significant associations were found between several variables and the need for percutaneous drainage. These included age (p=0.024), comorbidity (p=0.049), the presence of a drain (p=0.003), imaging utilization (p=0.045), the time interval to ERCP (p<0.001), and total length of hospital stay (p<0.001).

According to the multivariate logistic regression analysis, only the timing of postoperative intervention (postoperative intervention day) was significantly associated with the need for an additional procedure after ERCP. Each additional day of delay in intervention was associated with a 39% reduction in the odds of requiring further procedures (OR: 0.608, 95% CI: 0.407–0.908, p=0.015). Other factors such as age, comorbidity, and the use of imaging were not found to be statistically significant predictors in the model. When evaluated using the Chi-square test, five out of six patients (83.3%) without a drain required additional drainage for abscess or fluid collection. In contrast, only five out of 31 patients (16.1%) with a drain required further drainage. These results indicate that complication rates were significantly lower in patients who had drains in place (Tables 2 and 3).

As shown in Figure 2, a strong positive and statistically significant correlation was found between the timing of ERCP and the length of hospital stay, based on Pearson correlation analysis (r=79.8%, p<0.001).

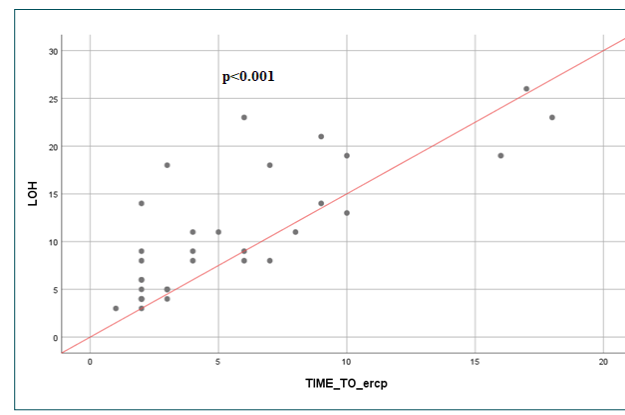


Figure 2. Relationship between ERCP timing and lenght of stay.

In a cohort of 37 patients who underwent ERCP for the management of bile leakage and had stents inserted, a follow-up ERCP was performed after an average duration of 56 days, during which the stents were removed. Notably, in all patients from whom the stents were removed, cholangiographic evaluations were reported as normal.

Regarding procedural complications, one patient (2.7%) developed pancreatitis following the intervention; however, no instances of stent migration were observed throughout the study.

DISCUSSION

Cystic stump leakage is the most common cause of bile leakage following cholecystectomy. According to current clinical guidelines, the first-line treatment is ERCP.[3,6] The literature identifies several etiological factors associated with cystic stump leakage. The primary causes include the presence of residual stones in the common bile duct, patency of the cystic stump due to inflammation or ischemia, and inadequate surgical closure.[10,13,14] In our patient cohort, remnant stones were identified in three patients (8.1%), and acute cholecystitis was present in 21 patients (56.8%). The absence of these findings in the remaining patients suggests that these factors alone may not fully account for the occurrence of bile leakage. Furthermore, 25 patients (67.6%) in the cohort had various comorbidities, indicating that comorbid conditions may also significantly impact wound healing and contribute to the risk of cystic stump leakage.

In a study by Kim et al.,[15] it was reported that the diagnosis of bile leakage following cholecystectomy was primarily established by the appearance of bile in the drain in 68.8% of cases. Implementing imaging studies at the diagnostic stage is beneficial for identifying the source of bile leakage and detecting potential complications, such as abscess formation. In our study, a similar diagnostic pattern was observed, with bile identified in the drain in 31 cases, accounting for 83.8%. Elevated acute phase reactants due to cystic stump leakage were found in 21 patients (56.8%), while liver enzyme elevation occurred in seven patients (18.9%). It is noteworthy that laboratory parameters may serve as more reliable indicators of secondary infection rather than as standalone tools for diagnosing cystic stump leakage. In our study, MRCP was performed in 11 patients (29.7%) under such conditions, while ERCP was used as both a diagnostic and therapeutic tool in the remaining patients. Despite ongoing debate about the diagnostic use of ERCP, given that it is an invasive procedure, its dual functionality as both a diagnostic and therapeutic tool offers a practical advantage in patients suspected of having cystic stump leakage.

Endoscopic treatment is the recommended first-line approach for managing cystic stump leakage. Surgical repair or drainage is considered a secondary option, particularly in light of its associated complications and comparatively lower effectiveness.[4,6,9] The comparative efficacy of performing only sphincterotomy during ERCP versus combining it with stent placement remains a subject of ongoing discussion in the literature. While sphincterotomy alone is associated with favorable success rates, stent placement has been shown to support faster recovery. Nevertheless, the potential complications of stent placement must be carefully considered.[10,12] In a retrospective analysis involving 100 cases of bile leakage following cholecystectomy, Kaffes et al. reported a clinical success rate of 93% with endoscopic treatment; however, pancreatitis occurred in four patients. Furthermore, they observed no stent-related morbidity among the 73 patients who underwent stent placement.[16] In our study, stents were used in all patients, with only one patient (2.7%) developing pancreatitis after ERCP. Therefore, stent placement appears to be a safe option for this patient population.

Conservatively monitoring based on the volume of bile collected from the drain has also been recognized as a viable approach for managing patient care. However, previous studies emphasize that prolonged delays in intervention may exacerbate the clinical condition in some patients.[11,14,17] In our study, the median time to procedure was 5.1 days, with evidence indicating that longer delays were associated with extended hospital stays (r=79.8%, p<0.001). The most common complications identified were abscess formation and the need for percutaneous drainage. Notably, our findings showed that the incidences of these complications, and the subsequent need for percutaneous intervention, was significantly lower in patients who had postoperative drain placement. In contrast, the increased need for percutaneous intervention in patients without drains is logically consistent with these findings. The routine use of drains following cholecystectomy is a separate point of discussion. However, it is reasonable to suggest that the presence of a drain may reduce the risk of developing abscesses and bilomas.

In our multivariate logistic regression analysis, only the timing of ERCP was found to be a statistically significant independent predictor of the need for additional percutaneous intervention. Specifically, each day of delay in performing ERCP was associated with a 39% reduction in the odds of requiring further intervention (OR: 0.608, 95% CI: 0.407–0.908, p=0.015). While univariate analysis showed associations with age, comorbidity, and imaging use, these variables did not remain significant in the multivariate model. This finding underscores the importance of early endoscopic management, aligning with previous reports that emphasize the clinical benefits of prompt intervention in cases of biliary leakage.[18] Notably, the absence of a drain during the initial surgery was associated with a markedly higher rate of subsequent abscess formation and the need for percutaneous drainage. Although this association did not reach statistical significance in the multivariate model—possibly due to sample size limitations—it was strongly evident in the chi-square analysis and supports previous data suggesting that intraoperative drain placement

may play a protective role in selected patients. In a meta-analysis involving 1,274 patients, Cirocchi et al. evaluated the routine use of abdominal drainage after cholecystectomy and reported that the incidence of postoperative abdominal collections requiring drainage was lower in the no-drain group, although the difference did not reach statistical significance (Relative Risk [RR]: 1.20, 95% CI: 0.35–4.12; I^2=0%).[19] The apparent lack of benefit from routine drainage in standard cholecystectomy may obscure its latent prognostic value in cases complicated by bile leakage—a nuance that large-scale studies may inadvertently overlook. However, this study is not without limitations. As a retrospective, single-center analysis, it is subject to selection bias—particularly given that a significant proportion of patients were referred from outside institutions. Additionally, drain placement was not standardized and may have been influenced by intraoperative clinical judgment, introducing potential confounding factors. Future prospective studies are needed to validate these findings under standardized clinical protocols. From a clinical perspective, our results support a more proactive approach: timely ERCP within the early postoperative period and the selective use of surgical drains may reduce the need for secondary interventions, shorten hospital stays, and potentially improve outcomes in patients with cystic stump leaks.

Unlike many previous studies that assess bile leaks as a broad entity, this study specifically focuses on isolated cystic duct stump leaks confirmed during ERCP. This allows for a more targeted analysis of prognostic factors—particularly the timing of intervention and the role of intraoperative drains—which remain underexplored in the current literature.

The limitations of this study are primarily related to its retrospective design and small sample size, which may impact the generalizability of the findings. As a single-center experience, the results reflect the specific practices and protocols of our institution. Additionally, without comparisons to alternative approaches, the evaluation may lack comprehensiveness. To strengthen the robustness of future research, multicenter studies with larger sample sizes are needed to provide deeper insights into the efficacy of the interventions examined.

CONCLUSION

Endoscopic retrograde cholangiopancreatography with stent placement is an effective and minimally invasive approach for managing cystic stump leakage, offering a low complication profile and a high success rate. The timing of intervention following the onset of bile leakage is crucial, as it influences both the length of hospital stay and overall morbidity. Moreover, the use of intraoperative drain placement substantially reduces the need for subsequent percutaneous drainage procedures, thereby improving patient outcomes. By adopting these strategies, the management of cystic stump leakage can be optimized, ultimately enhancing patient care in similar clinical settings.

Ethics Committee Approval: This study was conducted in accordance with the principles of the Declaration of Helsinki. The study was approved by the SBU Van Education and Research Hospital Non-Interventional Clinical Research Ethics Committee (Date: 24.01.2025, Decision No: GO-KAEK/2025-01-05).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Sistik kanal kaçaklarının endoskopik yönetimi: Üçüncü basamak merkezde elde edilen bulgular

AMAÇ: Kistik kanal kaçağı, kolesistektomi sonrasında safra sızıntısının önde gelen nedenidir ve acil müdahale gerektiren önemli bir postoperatif komplikasyon oluşturmaktadır. Şu anda tercih edilen tedavi yöntemi endoskopik müdahaledir. Bu çalışma, kurumumuzda tedavi edilen vakaların detaylı bir şekilde analiz edilerek, sistik kök sızıntıları için endoskopik tedavi başarısını etkileyen faktörleri belirlemeyi amaçlamaktadır.
GEREÇ VE YÖNTEM: Sistik kanal sızıntısı sonrası endoskopik retrograd kolanjiyopankreatografi (ERCP) uygulanan toplam 37 hasta bu çalışmaya dahil edildi. Hastaların demografik özellikleri, komplikasyonlar ve hastanede kalış süreleri değerlendirildi.
BULGULAR: Tüm hastalar klinik iyileşme gösterdi ve ortalama hastanede kalış süresi 5,1 gün olarak kaydedildi. Eşlik eden hastalıkların varlığı, acil cerrahi müdahale ve açık cerrahiye dönüş, tedavi etkinliği üzerinde herhangi bir anlamlı etki göstermedi. İşlem sonrası, kohort'un 10 (%27) hastasında perkütan drenaj gerekti. İşlemle ilişkili pankreatit, 1 (%2.7) hastada tespit edildi. Ayrıca, istatistiksel analiz, perkütan drenaj gereksinimi ve hastanede kalış süresinin, drenajı olan hastalarda anlamlı derecede daha düşük olduğunu ortaya koydu ($p<0.03$). Ek olarak, ERCP'nin erken bir zamanda yapılmasının, hastanede kalış süresini anlamlı şekilde azalttığı gözlemlendi ($p<0.01$).
SONUÇ: ERCP ile stent yerleştirme, sistik kanal sızıntılarının yönetimi için güvenli ve etkili bir stratejidir. Sistik kanal sızıntısı tespit edildikten sonra erken müdahale ile ERCP uygulanması önerilmektedir. Ayrıca, başlangıç tedavi yöntemlerine yeterli yanıt vermeyen hastalarda perkütan drenajın gerekebileceği göz önünde bulundurulmalıdır.

Anahtar sözcükler: ERCP; kolesistektomi; sistik kaçak.

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