



# The Role of Endoscopic Retrograde Cholangiopancreatography in the Management of Biliary Complication Post-Laparoscopic Cholecystectomy

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## Abstract

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**BACKGROUND:** Laparoscopic cholecystectomy considers a golden surgery for gallbladder removal nowadays, and it carries some complications like biliary injuries, which can manage successfully by endoscopic retrograde cholangiopancreatography.

**AIM:** To estimate the role of endoscopic management of bile duct injury (BDI) following laparoscopic cholecystectomy.

**PATIENT AND METHODS:** A prospective study conducted at Al-Sader Medical City, Najaf City, Iraq, during the period between September 2018 and December 2020, included 44 patients complicated by the biliary injury resulting in a persistent biliary leak and/or jaundice after laparoscopic cholecystectomy and evaluated by endoscopic retrograde cholangiopancreatography (ERCP).

**RESULTS:** Findings revealed that 25% of cases had complete BDI, only one managed by plastic stent placement, the other 10 referred for open surgical constructions, 61% had partial injury associated with the biliary leak, all managed by sphincterotomy and plastic stent placement through ERCP, almost 7% had a partial clipping of bile duct all managed with sphincterotomy, balloon dilatation/stone extraction, and plastic stent placement, 5% had slipped clips of cystic duct stump, are managed with sphincterotomy and plastic stent placement. Moreover, only one patient, 2%, had distal common bile duct stone with bile leak, managed by sphincterotomy and stone extraction.

**CONCLUSIONS:** Laparoscopic cholecystectomy, a gold standard therapeutic option for symptomatic cholecystolithiasis, is associated with an increased risk of biliary injury due to many factors. ERCP is a safe means of diagnosing the cause of bile leakage after laparoscopic cholecystectomy. It also offers definitive treatment in most cases by endoscopic sphincterotomy and plastic stent placement.

## Introduction

Today, laparoscopic cholecystectomy is the treatment of choice for symptomatic gallstones with a minimally invasive procedure, minor pain, scarring, and early return to full activity [1], [2], [3]. The spectrum of complications in laparoscopic gallstone surgery (incidence of 0.85%, major, i.e., complete transection or clipping  $\approx$  0.55% and minor, i.e., cystic stump leak, partial bile duct injury [BDI]  $\approx$  0.3%) has changed compared to open procedure such as BDI tends to be complex (as there is the involvement of new instruments such as stapling device and energized instruments), being more proximal and often associated with concomitant vascular injury [4], [5]. This along with injuries during access into peritoneal cavity such as bowel and major retroperitoneal vascular injury [6-8]. The bile duct complications can attribute to basic errors such as misinterpretations of the anatomy and technical errors or risk factors related to the surgeon, patient, or local pathology [9], [10], [11], [12]. Endoscopic retrograde cholangiopancreatography (ERCP) has evolved from a

purely diagnostic to an almost exclusively therapeutic procedure. ERCP performs with a side-viewing duodenoscopy that allows identification of the major papilla. The bile duct cannulated under endoscopic and fluoroscopic guidance. A variety of catheters, guide wires, and stents is available to allow diagnostic and therapeutic interventions to perform [13], [14]. Many biliary indications for ERCP including bile duct stones, bile leaks [15], and benign biliary strictures [16]. The objective of our study was to demonstrate the effective role of ERCP in the management of post-laparoscopic cholecystectomy biliary complications.

## Patients and Methods

A prospective study included 44 patients subjected to laparoscopic cholecystectomy in different hospitals (official and private) and complicated by biliary injury (leak and/or jaundice). They referred to the ERCP unit in Al-Sader Medical City from September 2018 to

December 2020. Baseline investigations performed, supportive treatment administered, all the patients received prophylactic antibiotics, bowel relaxation achieved. ERCP evaluation performed with a side-viewing duodenoscopy that allows identification of the major papilla. The bile duct cannulated under endoscopic and fluoroscopic guidance. A variety of catheters, guide wires, and plastic stents are available to allow therapeutic interventions to introduce a water-soluble contrast (Iohexol 350) under low pressure after bile duct cannulation to identify the biliary tree configuration under fluoroscopic guidance. After completing the procedure, the patient had kept under observation for at least 24 h. Patients who had a significant injury and subjected to therapeutic interventions were kept for longer (maximum 2 weeks) until their biochemical and clinical conditions started to improve. Follow-up endoscopic cholangiogram was performed for all the 44 patients after 8 weeks to confirm the healing by contrast configuration of the biliary tree and stent removal. Data managed using the Statistical Package for the Social Sciences (SPSS) version 17. Ethical approval took from all patients to share their data.

## Results

Patients were 30 (68%) females and 14 (32%) males, with a mean age of  $47.9 \pm 15.6$  (range: 20–78) years. Duration of symptomatic gallstone disease ranged from 10 days to 18 months (mean  $5.8 \pm 4.8$  months), and the majority of the patients had their symptomatic gallstone disease for 2–6 months. In general, bile leak was more than 200 ml/day and jaundice, out of the 44 patients, 9% presented with jaundice only, 14% with persistent leak and jaundice, while 77% with persistent leak only as shown in Table 1 and Figure 1. The mean time between the surgery and ERCP intervention was 22.7 days. Out of the 44 patients, 27 had partial transection injury, 11 complete injuries, three partial clipping of bile duct, two slipped clips of the cystic duct

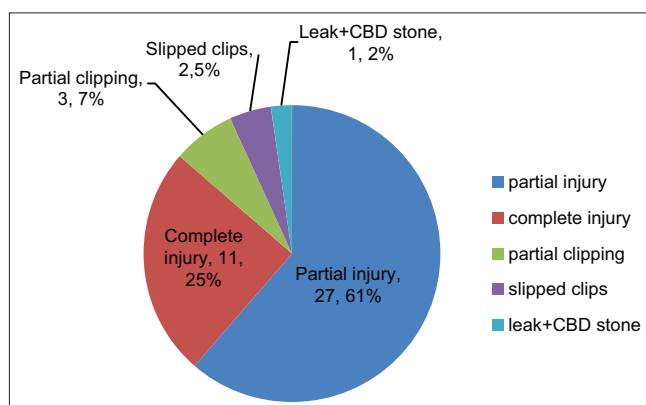


Figure 1: The type of the biliary complications post-laparoscopic cholecystectomy

Table 1: The duration of symptoms pre-operative and the type of complications

Duration interval	Laparoscopic complications					Total (%)
	CBD stone+mild leak	Complete injury (cut and clipping)	Partial clipping of CBD	Partial injury	Slipped clips	
<=1 month	0	1	0	3	0	4 (9)
2–6 months	1	9	2	12	1	25 (57)
7–11 months	0	0	0	6	0	6 (14)
12–18 months	0	1	1	6	1	9 (20)
Total	1	11	3	27	2	44 (100)

CBD: Common bile duct

stump, and only one patient had distal common bile duct (CBD) stone with mild bile leak, as shown in Figure 2. The 27 patients who had partial injury managed by sphincterotomy and stent placement of size (8.5 or 10 F), 7/27, required more than 1 stent replacement or placement every 12-week distal CBD stricture up to 1 year. In contrast, the other 20/27 required one stent that

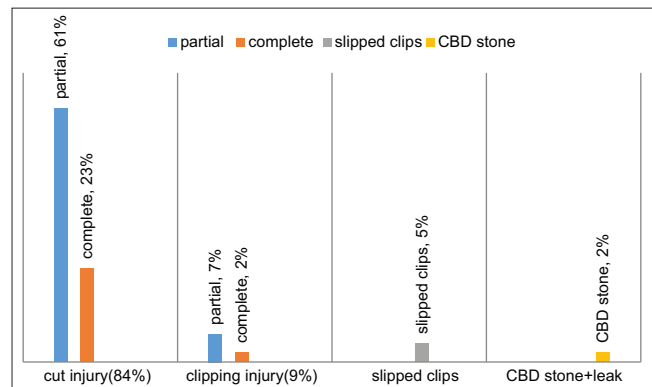


Figure 2: The type of biliary injuries

had been removed 2 months after confirmation that there was no more leak with good visualization of the proximal biliary tree by endoscopic retrograde cholangiogram as shown in Table 2 and Figure 3. The two patients who had slipped clips managed by sphincterotomy and stent placement removed 2 months later. The one patient with mild bile leak and on ERCP founded to have distal CBD stone only, so he was managed by sphincterotomy and balloon stone

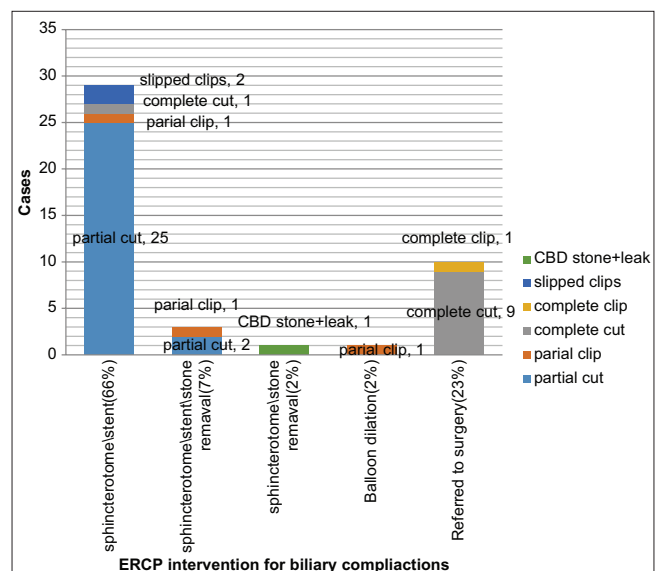


Figure 3: Endoscopic retrograde cholangiopancreatography intervention for biliary complication

**Table 2: Laparoscopic complications and ERCP management**

Laparoscopic complication	ERCP interventions					Total
	Sphincterotomy/stent	Sphincterotomy/stent/stone removal	Sphincterotomy/stone removal	Balloon dilation	Referred to surgery	
Partial CBD cut	25	2	0	0	0	27
Partial CBD clipping	1	1	0	1	0	3
Complete CBD cut	1	0	0	0	9	10
Complete CBD clipping	0	0	0	0	1	1
Slipped clips	2	0	0	0	0	2
CBD stone+leak	0	0	1	0	0	1
Total (%)	29 (66)	3 (7)	1 (2)	1 (2)	10 (23)	44 (100)

ERCP: Endoscopic retrograde cholangiopancreatography, CBD: Common bile duct

extraction. 3/44 patients who had a partial clipping of bile ducts managed by sphincterotomy, balloon dilation of stricture, and plastic stent placement after introducing a guidewire to bypass the stricture, only one patient had distal CBD stone and extracted by the balloon, the patient who had distal CBD stricture required multiple sessions of balloon dilation and stent replacement every 12 weeks for 1 year as shown in Table 3 and Figure 3. Eleven out of 44 patients (25%) diagnosed to have complete injury 10/44 (22.73%) had complete transection injury confirmed by non-visualization of the proximal part of bile duct with leakage of contrast material into the surrounding spaces so that they were referred for surgical intervention except one case which successfully managed to bypass the guidewire to the divided proximal segment then placing 8.5 F\*12 cm stent connecting both distal and proximal

**Table 3: ERCP intervention sessions and follow-up**

Laparoscopic complication	Only 1 ERCP session		≥2 ERCP sessions	
	Diagnosis	Diagnosis and treatment	Stent removal after 2 months	≥2 stents
Partial cut	0	0	20	7
Partial clipping	0	1	1	1
Complete cut	9	0	1	0
Complete clipping	1	0	0	0
Slipped clips	0	0	2	0
CBD stone + leak	0	1	0	0
Total (%)	10 (22)	2 (5)	24 (55)	8 (18)

ERCP: Endoscopic retrograde cholangiopancreatography, CBD: Common bile duct

segments of the bile duct. Two months later, endoscopic retrograde cholangiogram revealed complete healing, no further contrast leak, and visualization of the biliary tree permitting stent removal. Further, follow-up had been planned because stricture may develop later on. One of 44 (2.27%) had complete clipping injury, that is, visualization of the distal part of bile duct with cut line proximally and contrasted backflow to the duodenum, and referred for surgical reconstruction as shown in Table 3 and Figure 4.

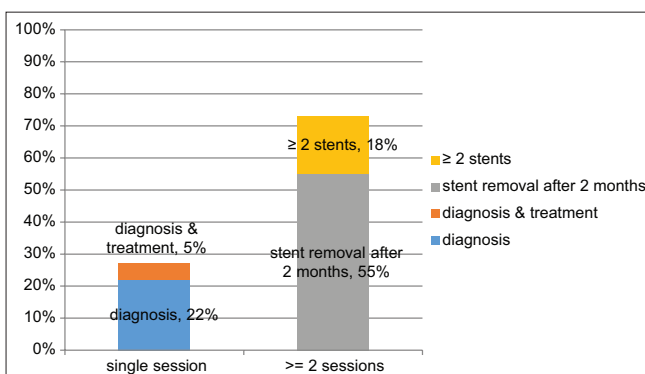


Figure 4: Endoscopic retrograde cholangiopancreatography intervention sessions and follow-up

## Discussion

In our results, we found that biliary complications were more frequent in female patients. Our study agreed with the previous studies and agreed with regard to age distribution [17], [18], [19], [20], but disagreed with them regarding the distribution of complications by age groups. Symptomatic gallstone disease in 57% of patients reported for 2–6 months, and this agreed with findings of Harboe and Bardram, Al-Kubati, and Lo *et al.* [18], [21], [22], the latter observed that the presence of dense fibrous adhesions in the delayed group made laparoscopic dissection difficult and unsafe [22]. The least proportion of patients was from Baghdad teaching hospital; this may reflect the surgeons' expert, which agrees with Boddy *et al.* [23]. They found that as a result of consultant appointments and a greater degree of specialization within the general surgical department, a larger proportion of cholecystectomies had a shorter theatre time and was more likely to be completed with a lower rate of BDI. The results disagree with Al-Kubati [21] that found the most laparoscopic complications occurred by a senior surgeon rather than a junior surgeon. In Iraq, tube drain has generally been used in cholecystectomy surgeries (open or laparoscopic), decreasing the chances of biloma and bilious peritonitis, allowing bile leak discovered early. Therefore, the most significant symptom was a persistent bile leak of more than 200 ml/day. The ERCP intervention revealed different types of injuries; however, in the previous studies, the sequences of these injuries were different than ours, and this attributed to the differences in the facilities of different countries and hospitals [21], [24], [25], [26] Management by ERCP was successful in minor biliary complications, while in the complete injury, ERCP was restricted to diagnostic advantage. Nonetheless, the majority of patients in our study had been diagnosed and treated successfully by ERCP. The study agreed with Christoforidis *et al.* [26], Abdel-Raouf *et al.* [25], Bose *et al.* [27], and Al-Kubati [21], also agree with Karvonen *et al.* [28] regarding the cystic stump leak and complete injury but disagree with him regarding partial BDI as they treat this injury surgically.

## Conclusions

Laparoscopic cholecystectomy was associated with an increased risk of biliary injury. ERCP is a safe

procedure for diagnosing the cause of biliary leakage following laparoscopic cholecystectomy. It also offers a definitive treatment in most cases (partial injury and cystic leak) either by endoscopic sphincterotomy alone or in conjunction with biliary plastic stenting. In contrast, the major biliary complications (complete transection or clipping), the ERCP intervention is limited to a diagnostic role, and these cases need to be constructed by open surgery.

## Authorship

1. Mohammad Abdzaid Akool: Study design, conception, data analysis, and interpretation
2. Samer Makki Mohamed Al-Hakkak: Corresponding author, data collection and analysis, drafting the article, revising it critically for important intellectual content, and final approval of the version to be submitted
3. Alaa Abood Al-Wadees: Data acquisition, analysis, and interpretation.

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