Optimal gap for laparoscopic cholecystectomy in choledochocystolithiasis after endoscopic retrograde cholangiopancreatography

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Background
Common bile duct stones were recorded in 10–18% of cases with gall bladder stones and vary in line with age. Almost 55% of those cases are symptomatic, and complications develop in half of them.
Patients with choledochocystolithiasis may undergo immediate laparoscopic cholecystectomy (LC) after endoscopic retrograde cholangiopancreatography (ERCP) with endoscopic sphincterotomy (ES) in one setting, which is recommended, as it prevents recurrent complications of biliary tract and reduces morbidity and hospitalization, or undergo delayed LC after ERCP. The conversion from LC to open cholecystectomy after ES for choledochocystolithiasis reaches up to 20%, at least when LC was postponed for 4–8 weeks after ES.
Aim
To evaluate the advantages of early over delayed LC in patients with common bile duct stones regarding outcome, safety, and complications.
Patients and methods
This prospective randomized study was carried out from December 2018 to December 2020 at Department of General Surgery, and Department of Gastroenterology, Hepatology and Infectious Diseases, Al Azhar University Hospitals, Assiut, Egypt. It included 100 consecutive patients with cholelithiasis and choledocholithiasis who underwent LC after ERCP. All cases were classified into two groups. Group A included cases with choledochocystolithiasis that underwent immediate LC after ERCP, and group B included cases with choledochocystolithiasis that underwent delayed LC after ERCP.
Results
The duration of operation was much longer in group B (75.4±16.8, range: 40–90 min) than in group A (40±10, range: 30–45 min). The conversion rate was also significantly more incident in delayed group (21.8%).
Conclusion
The immediate LC after ERCP had better outcome than delayed LC after ERCP. It had lower conversion rate, less operative time, short hospitalization, and less postoperative complications.

Keywords:
choledochocystolithiasis, endoscopic sphincterotomy, endoscopic retrograde cholangiopancreatography, laparoscopic cholecystectomy

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Introduction

Nowadays, gall bladder (GB) stones are one of the most common diseases all over the world. It is responsible for at least 1 000 000 hospitalizations, and greater than 700 000 surgical approaches were performed yearly in the USA [1]. Although the recorded mortality of this disease is fairly low (0.6%), it is related to the associated with increased complications [2]. Common bile duct (CBD) stones occur in 10–18% of the cases undergoing cholecystectomy. Although approximately one-third of those cases will spontaneously be cured without intervention within 6 weeks [3], drastic effects of untreated choledocholithiasis including ascending cholangitis and pancreatitis may be extensive. So consequently, the usual recommendations were the detection and management of CBD stones together with laparoscopic cholecystectomy (LC) [4].

Currently, LC is the preferred management for GB stones [5], and at the same time, endoscopic retrograde cholangiopancreatography (ERCP) with endoscopic sphincterotomy (ES) is the procedure usually used for clearance of CBD from stones [6]. There is still controversy about the order wherein ERCP and LC

need to be achieved, in addition to the suitable time between the two approaches [7]. Many authors agree with the opinion that LC needs be completed shortly following ERCP [8–13].

Nowadays, in cases presented with GB and CBD stones, the gold standard management is the clearance of CBD stones via ERCP and LC. However, the controversy was when to do and whether we will able to do it concurrently or one after another and what optimal gap needs to be there. The aim was to find the most suitable gap for LC after ERCP [14].

Symptomatic cholelithiasis and choledocholithiasis are more recorded gastrointestinal surgical entities, complicated by accumulation of GB stone. Although treatment modalities include laparoscopic [15], endoscopic, conventional open technique, or via a combination of them or through carrying out those in a step-wise series to treat GB stone and CBD stone, there is no clear consensus on the correct procedures [16]. Obviously, ERCP remains the most accepted procedure to assess the CBD stone. Often, the removal of CBD stone was performed by ERCP with ES before LC, as the preferred strategy [17].

The recent management for calcular obstructive jaundice is the removal of stones using ES. ES is broadly used as an option of management for those with CBD stone [18]. Stone removal of CBD via ERCP with ES has a success rate up to 97% [19].

Multiple studies argue that endoscopic therapy of CBD stone without cholecystectomy is the best treatment. However, more than 24% of patients in the retrospective and prospective series experienced biliary complications after various intervals of observation, and subsequently, cholecystectomy rate is high [20]. So, the ideal treatment of CBD stone should be safe and cost-effective [21]. Patients with combined gall stones and CBD stone need management for both CBD and GB stones. There are various treatment modalities for the clearance of CBD stone (preoperatively, peroperatively, and postoperatively) collectively with LC [22]. Standard treatment in lots of western countries includes ES followed by LC [23]. ES is usually carried out in cases with choledochocystolithiasis followed by LC. However, many cases undergo LC 4–8 weeks after ES. The rate of conversion of elective LC after ES is high, and the cases can develop recurrent biliary complications throughout the period of waiting [24].

ERCP is one of the best procedures used for treatment of CBD stone [25]. Many worldwide research studies have shown that this approach is safe before LC, whereas other research studies, however, show that immediate LC after ERCP is associated with low risk of cholangitis and recurrent pancreatitis [26,27].

The appearance of endoscopic methods changes surgical intervention in several ways. There are various treatment modalities for the clearance of CBD stone including ERCP with ES, laparoscopic common bile duct exploration through the transcystic approach or LC [28,29], or open CBD exploration [15,30].

The greatest risk of CBD stone extraction by ERCP before or after surgery are cholangitis and pancreatitis; additionally, more than 10% of the preoperative ERCP cases are normal. The creation of LC has reopened the controversy on the best treatment of cases with CBD stones or suspected CBD stones that undergo cholecystectomy. The main purpose for this is to extend the advantages of minimally invasive technique to this group of patients. The strategy of treatment for GB stones with secondary CBD stones is ERCP followed by LC. Although immediate LC is recommended, there is no consensus about suitable gap between LC and endoscopic retrograde cholangiopancreatography [31,32].

Possibly, the timing of LC after ES may affect the complexity of the operation. Many authors agree with that delayed LC is safe if done 4–8 weeks after ES [11].

Patients and methods

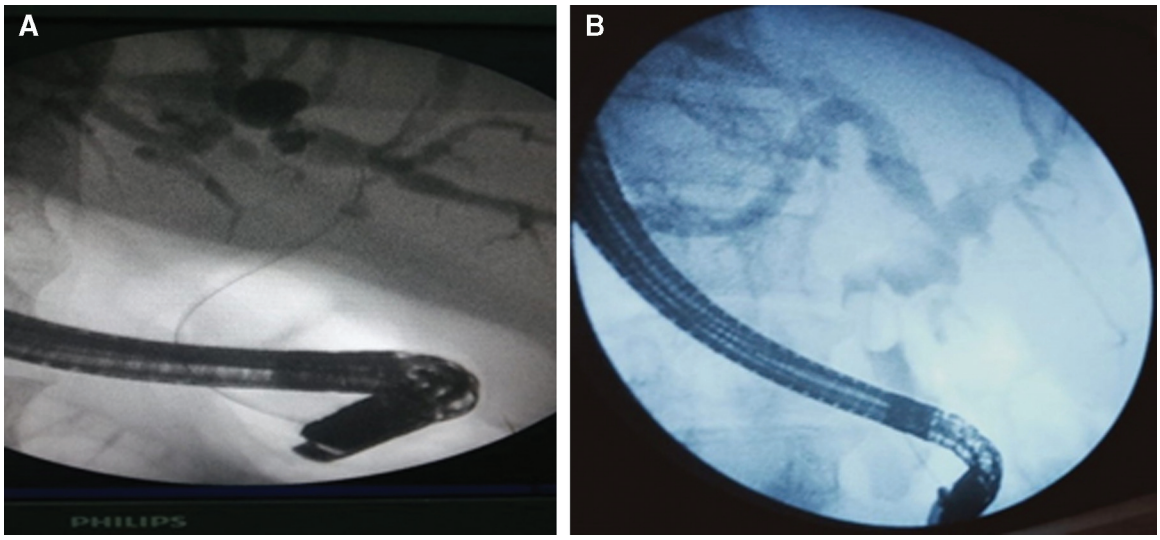
This prospective randomized study was carried out from December 2018 to December 2020 at the Department of General Surgery, and Department of Gastroenterology, Hepatology and Infectious Diseases, Al Azhar University Hospitals, Assiut, Egypt. It included 100 consecutive adult patients with cholelithiasis and choledocholithiasis who underwent LC after ERCP. After approval from local ethical committee and an informed written consent was taken from all patients who accepted to participate in the study, full history was taken, physical examination was done, and radiological investigations (ultrasound and/or magnetic resonance cholangiopancreatography) were reported. Choledocholithiasis was suspected in patients who had one or more of the following criteria: history of obstructive jaundices, elevated bilirubin, serum gamma-glutamyl transpeptidase and alkaline phosphatase, dilated CBD (>8 mm)

by ultrasonography, and CBD stone diagnosed by ultrasound and/or magnetic resonance cholangiopancreatography.

Our exclusion criteria were patients with evidence of inflammation (ascending cholangitis, acute pancreatitis, and acute cholecystitis), patients with hepatitis B and C, patients with known allergy to contrast media, those with abdominal adhesions, or those with failed ERCP.

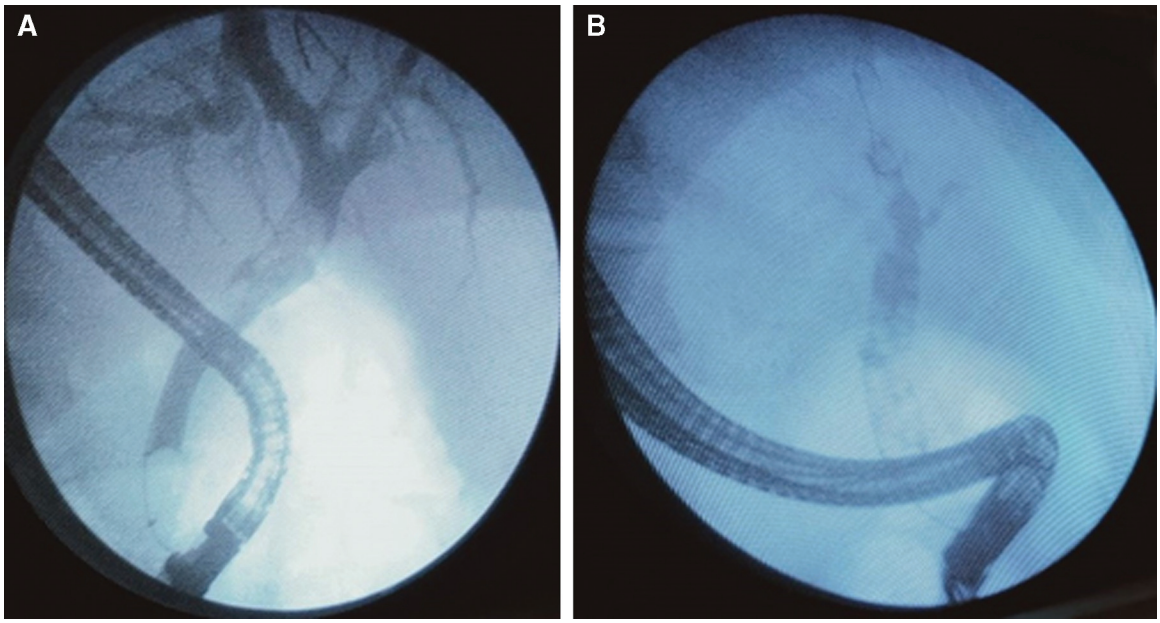
All patients underwent ERCP under general anesthesia (Fig. 1a). The presence of CBD stone was reported on endoscopic cholangiography (Figs 1b and Fig. 22a,b), and the extraction of stones was done by either dormia basket or balloon catheter. In cases of occlusion via large stones (Fig. 1b), mechanical lithotripsy was done [30]. At the end of ERCP, intraoperative cholangiography was done to ensure that there are no missed stones.

Figure 1



(a) ERCP in CBDs. (b) Cholangiogram showing large CBD stone. CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography.

Figure 2



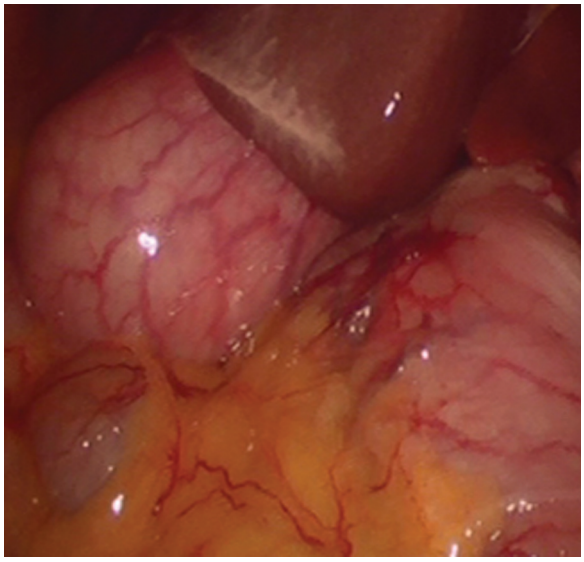
(a) Cholangiogram showing single distal CBD stone with multiple proximal stones. (b) Cholangiogram showing multiples CBD small stone. CBD, common bile duct.

After ERCP, all cases were classified into two groups:

Group A was the immediate group, in which LC was done immediately after ERCP in the same session, or underwent LC within 72 h after ERCP.

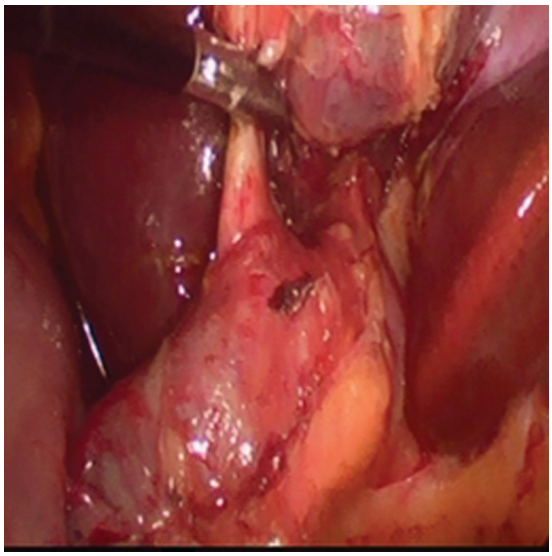
Group B was the delayed group in which LC was done after 4–8 weeks. LC was done in all patients by the same surgical team and the standard 4-port technique was used (Figs. 3 and 4). The calculation of the time of the operation was from beginning of the incision until closure of the skin. The outcome and complications of ERCP and LC, the conversion rate to an open approach, the time of the operation, hospitalization, and mortality were recorded. Hospital stays included all periods of admission for ERCP, LC, and recurrent biliary symptoms. The followed up period ranged from 3 and 6 months, and patients were instructed to notify the surgeon if there were any biliary symptoms.

Figure 3



Distended gall bladder.

Figure 4



Dissection showed cystic duct and dilated CBD. CBD, common bile duct.

Statistical analysis

The collected data had been processed using SPSS, version 15 (SPSS Inc., Chicago, Illinois, USA). Quantitative data had been expressed as mean±SD, whereas qualitative data were expressed as numbers and percentages. Student *t* test was used to test significance of difference for quantitative variables, whereas χ^2 was used to test significance of difference for qualitative variables. A *P* value less than 0.05 was considered statistically insignificant.

Results

Throughout the study period, 100 patients with calcular obstructive jaundice underwent successful ERCP (85 females and 15 males, with mean age of 46±12.8; range: 25–65 years. The cases were classified to two groups (immediate and delayed groups). Both groups were matched with each other regarding age, sex, and laboratory and ultrasound characteristics. The demographic and clinical data are summarized in Table 1. After endoscopic sphincterotomy, stone extraction was done by the use of dormia basket and/or balloon catheter. Mechanical lithotripsy was done in 30 patients. No complications owing to ERCP were recorded in any group except 20 cases of mild acute pancreatitis, that is, 15 in the delayed group and five in immediate groups, which were treated successfully with conservative treatment.

LC was planned and performed after 4–8 weeks in 50 patients (delayed group) and immediately after ERCP in 50 patients (immediate group). During the waiting period, 15% of the patients in group B complained of biliary complications in the form of recurrent biliary colic (10 patients), acute cholecystitis (five patients), and cholangitis (seven patients); those patients required hospitalization and were managed conservatively.

Outcome data

The mean duration of surgery was significantly longer in the delayed group (75.4±16.8), with range of 40–90 min, than in the immediate group (40±10), with range of 30–45 min. The conversion rate was also significantly more incident in delayed group (21.8%). The main reasons for conversion were

Table 1 Patients' characteristics

	Immediate group	Delayed group	*P* value
Age (mean±SD) (years)	46.2±11.2	48.2±14.1	0.89 (NS)
Sex (female/male)	40/10	45/5	NS
Proportion of abnormal LFTs (%)	43/50	45/50	0.06 (NS)
US findings			
Dilated CBD diameter (>8 mm)	40/50	30/50	0.7 (S)
CBD stone (s)	47/50	45/50	0.9 (S)
Recurrent biliary symptoms	10/50	25/50	0.001

CBD, common bile duct; LFT, liver function test; NS, nonsignificant; S, significant; US, ultrasound.

Table 2 Patient outcomes

	Immediate group	Delayed group	*P* value
Operative time (min) (mean±SD)	40±10.4	75.4±16.8	0.001
Conversion rate	0%	21.8%	0.02
Length of postoperative hospital stay (days) (mean±SD)	2±l	5.4±3.2	0.001
Postoperative complications			
Bleeding	0	0	NS
Bile leak	0	3/50	NS
Wound infection	0	5/50	NS

NS, nonsignificant.

dense adhesions, unclear anatomy, and bleeding [31,32]. In spite of less postoperative complications in the immediate group, the complications in both groups were minor and insignificant and responded well to conservative management. The mean length of postoperative hospitalization in the immediate group was significantly shorter 2±1 (range: 3 days) versus 5.4 ±3.2 (range: 3–8 days) in the delayed group. There were no deaths in any group. The outcome of patients is shown in Table 2.

Discussion

In this study, evaluation of two different procedures (ERCP followed immediately by LC, versus ERCP followed by LC after 4–8 weeks). The baseline differences in our work (age, sex, abnormal liver function tests, and ultrasound findings) were not statistically significant. Our results showed that cases that underwent immediate LC after ERCP have considerably lower conversion rate to open cholecystectomy when compared with patients who underwent delayed LC (0 vs. 21.8%) [27,33]. This was in agreement with Salman *et al.* [5] who conducted randomized trial to compare patients who underwent the operation between 24 and 72 h after ERCP and those who were underwent surgery more than 72 h after ERCP. Moreover, Hanns *et al.* [24] found that patients who underwent LC within 72 h after ERCP showed a significantly low incidence of conversion to open cholecystectomy in comparison with those patients who underwent LC after 4 weeks. De Vries and Donkervoort [27] found that a significant high rate of conversion was encountered when LC was delayed 4 weeks after ES. There are studies showing some technical problems or complications owing to the presence of the inflamed bowels when ERCP followed immediately by LC. The cardinal etiologies for conversion in our study were bleeding, dense adhesions, and unclear anatomy [33,34].

In our study, the operative time and postoperative hospital stay were longer in the delayed group compared with immediate group, which was statistically significant, and this came in accordance with the results of Hanns *et al.* [24]. Moreover, the duration of the operation was prolonged in patients who underwent delayed cholecystectomy after 6 weeks, possibly owing to scarring and fibrosis of the biliary tree and Calot's triangle, which may promote an error during dissection of the junction among Calot's triangle [35,36]. This study shows that a higher degree of complications was noted with group B [26,27].

The reasons of longer operative time in our study were dense adhesions, unclear anatomy of the biliary tree, and Calot's triangle, whereas longer hospital stay was explained by the higher percentage of conversion rate and the more encountered postoperative complications. Regarding complications, we noticed that the prolonged hospital stay includes wound infection; most of the complications occur in the duct in the form of recurrent biliary symptoms, biliary colic, and cholecystitis. A total of six patients

in the delayed group developed acute pancreatitis who needed prolonged hospital stay with successful conservative treatment [28].

Early LC after ES may prevent the recurrence of biliary complications which occurred during the waiting period and associated with an increase in postoperative morbidity and prolonged hospitalization [36]. However, several authors did not justify the routine use of LC after endoscopic clearance of CBD [31] and preferred to select it for those suffering from untreatable, acute calcular cholecystitis [37], or recurrent biliary symptoms; the concept for this is that ES alone, besides management of CBD stones, may prevent (or decrease) biliary complications in many cases [33].

In our present study, the incidence of recurrent biliary symptoms was significantly high in the delayed group (27.2%) compared with the immediate group (0%) [26]. Regarding the postoperative complications, they were minor and treated with conservative treatment, with no statistical significance between both groups, with no mortality [34].

A lot of research studies have compared early LC (up to 72 h) with interval LC (up to 6–10 weeks), and they have proven that early LC has low rate of conversion, less drastic effects postoperatively, and short hospitalization, with comparable operative time and overall complications [5,25]. Immediate LC may also prevent recurrent biliary complications, which are associated with increased postoperative morbidity and prolonged hospital stays [36].

Recommendation

In cases with GB and CBD stones, we recommend immediate LC following ERCP, as it is safer and cost-effective than delayed LC after ERCP, which was in agreement with Mallick *et al.* [38]. Guidelines for treatment of CBD stone should include this option. So, performance of single-session ERCP and LC is safer, associated with great effectiveness, more economically, and shows marked reduction of hospitalization in comparison with that performing ERCP and LC during separate sessions [38].

Conclusion

This study clearly revealed that performing immediate LC after ERCP in comparison with delayed LC after ERCP had better outcome. It had the lower conversion rate, less operative time, short hospitalization, and less postoperative complications. The comparison between two groups revealed that immediate LC after ERCP had the upper hand regarding the aforementioned advantages and the least disadvantages rather than the other group.

Implementation

The results of this study have encouraged us to consider early LC after ERCP as an adopted policy in the management of the patient with calcular obstructive jaundice. Immediate LC after ERCP is a possible and safe approach.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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