

Same-session versus scheduled laparoscopic exploration of common bile duct after failure of extraction of common bile duct stones by endoscopic retrograde cholangiopancreatography

Ahmed Zowaied^a, Mohamed Ammar^b, Ahmed Nabil^b, Hatem Soltan^b

^aDepartment of General Surgery, Elshohada Hospital, ^bDepartment of General Surgery, Faculty of Medicine, Menoufia University, Menoufia, Egypt

Correspondence to Ahmed Zowaied, MSc, 32632, Tel: 01006426274; e-mail: ahmed.zowaied@yahoo.com

Received: 11 June 2021

Accepted: 14 July 2021

Published: xx Month 2021

The Egyptian Journal of Surgery 2021, 40:1205–1214

Aim

To compare between same-session and scheduled laparoscopic exploration of common bile duct (LECBD) after failure of extraction of CBD stones by endoscopic retrograde cholangiopancreatography (ERCP) regarding feasibility, operative time, conversion to open surgery, length of hospital stay, and complications.

Patients and methods

It is a comparative randomized prospective study that was done at Menoufia University Hospital from January 2018 to February 2021. Among all patients scheduled for CBD stone(s) extraction by ERCP, we selected 40 patients of failed stone extraction by ERCP to be enrolled in this study. We divided them randomly into two groups, LECBD will be done for the patients either in the same session (group A) or scheduled 1 week later (group B).

Results

LECBD was successful in 18 out of 20 patients who underwent CBD exploration at the same session. On the other hand, LECBD was successful in 19 patients out of 20 who underwent CBD exploration after 1 week with insignificant *P* value of 0.1. Three cases were converted to open CBD exploration (two in the same session and one in the scheduled group).

Mean duration of ERCP was 29.5±5.9 min in the same-session group, while it was 33.3±8.2 in the scheduled group with no significant difference between two groups (*P*=0.12). Mean duration of laparoscopic CBD exploration in the same-session group was significantly higher (89.2±8.8 min) than scheduled session (79.5±5.9 min) (*P*=0.001).

No significant difference on the rate of complications regarding minor bile leak, postoperative chest infection, postoperative wound infections, and missed stone occurred between two groups (*P*=0.4). Cholangitis and mild pancreatitis (15 and 20%, respectively) were significantly higher in the scheduled group than the same-session group (0 and 10%, respectively) with *P* value of 0.01 and .02, respectively. Total hospital stay was lower in patients who underwent the same-session CBD exploration (3.4±1.1 days) rather than scheduled-session CBD exploration (5±1.7 days) with significant *P* value of 0.001. The total cost for patients in the scheduled-session group (6450±591) Egyptian pounds was significantly higher than the same-session group (5450±1169) with a highly significant *P* value of 0.001.

Conclusion

Same-session LECBD after failure of ERCP for management of CBD stones is feasible. It shows lower cost, shorter hospital stay, and lower rate of complications than scheduled LECBD, in spite of a higher rate of conversion to open surgery and longer operative time in same-session group.

Keywords:

endoscopic retrograde cholangiopancreatography, laparoscopic exploration of common bile duct, same session, scheduled session

Egyptian J Surgery 40:1205–1214
© 2021 The Egyptian Journal of Surgery
1110-1121

Introduction

The incidence of gallstones varies from 6 to 10% in adult population. Three percent to 14.7% of patients of gallstones have concurrent common bile duct (CBD) stones as well [1].

Primary stones are formed de novo in the bile duct and are usually of brown-pigment variety, single or

multiple, often oval-shaped, and lie along the long axis of the duct. Primary stones are formed due to biliary stasis and infection [2].

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

The ideal management of concomitant CBD stones with gallbladder stones is still controversial [3].

Management of gallstones is laparoscopic cholecystectomy (LC), but there is no consensus for treatment of CBD stones. In the era of open surgery, treatment was straightforward; open cholecystectomy with open CBD exploration although it carried high morbidity and mortality [1].

With the advent of noninvasive and minimally invasive techniques, the option of endoscopic retrograde cholangiopancreatography (ERCP) followed by LC either in the same session or in two stages emerged as adequate treatment [1].

The question addressed was: in patients with symptomatic gallstones and concomitant CBD stones, is a single-stage surgical strategy (LC with CBD exploration preferable or a single-stage procedure involving LC with ERCP) [4].

With refinements in technique and expertise in the field of minimal-access surgery, many centers in the world have started offering one-stage management of choledocholithiasis by LC with laparoscopic common bile duct exploration (LCBDE). Only few randomized trials are available comparing single-stage preoperative ERCP and LC with single-stage LC and LCBDE [1].

When CBD stone removal by endoscopic procedure fails, CBD exploration is an alternative procedure [5].

Despite the simplicity and success of LCBDE, many surgeons across the globe are still not comfortable or confident regarding the procedure [1].

The timing of LCBDE (either in the same session or in the two-stage (scheduled operation) after failure of stone extraction by ERCP is still controversial and needs more evaluation.

Aim

The aim of this study was to compare between the same session and scheduled laparoscopic exploration of common bile duct (LECBD) after failure of extraction of CBD stones by ERCP regarding feasibility, conversion to open surgery, operative time, length of hospital stay, and complications.

Patients and methods

It was a comparative randomized prospective study that was done at Menoufia University Hospital from January 2018 to February 2021. This research was

performed at the Department of General Surgery, Elshohada Hospital and Menoufia University. Ethical Committee approval and written, informed consent were obtained from all participants. Among all patients scheduled for CBD stone(s) extraction by ERCP, we selected 40 patients of failed stone extraction by ERCP (due to big stone(s) or the presence of narrowing at the distal part of CBD) to be enrolled in this study. We divided them randomly into two groups, LCBDE will be done for the patients either in the same session (group A) or 1 week later (scheduled) (group B).

Our primary outcome is to compare between the same session and scheduled session regarding the efficacy of stone extraction. The secondary outcomes include comparison between same session and scheduled session regarding postoperative complication, hospital stay, and cost burden.

All patients included in this study have calculi obstructive jaundice proved by laboratory investigations (elevated liver-function tests, elevated total and direct bilirubin, and elevated alkaline phosphatase) and imaging (abdominal ultrasound showing gallbladder stones with dilated CBD with CBD stone(s) and magnetic resonance cholangiopancreatography (MRCP).

Shocked patients, patients who need ICU admission, patients unfit for general anesthesia, patients with malignant obstructive jaundice, and patients with severe pancreatitis were excluded from this study.

For all patients in this study, informed consent was taken. Detailed history was taken, including personal history, complaint, present, past, and family history, and general and local examination (inspection, palpation, percussion, and auscultation).

Investigations that were done for all patients included complete blood picture, prothrombin time and concentration, liver-function tests, kidney-function tests, total and direct bilirubin, alkaline phosphatase, abdominal ultrasound, and MRCP.

ERCP was done first for stone extraction and if failed due to big stone(s) or the presence of narrowing at the distal part of CBD, the patient either underwent LECBD in the same session (group A) or scheduled for LECBD after 1 week (group B). ERCP was done in the operation room under C-arm machine by the same surgeon who did LECBD.

In case of failure of ERCP to extract the stone(s) (due to big stone(s) or the presence of narrowing at the distal

part of CBD), the patient was prepared for LCBDE in the same session in group A or after 1 week in group B because it is the routine in our center to become after 1 week. As it is enough period for laboratory parameters to return to normal values in spite of pain may be still present in some cases because it was due to either acute cholecystitis or mild form of pancreatitis and a week is a good interval for intervention.

In same-session group, the patient was rotated to supine position and a wide-pore Ryle tube was inserted to get rid of air inside the duodenum and stomach, which was sufficient to get rid of air inside the stomach, duodenum, and small intestine in most cases. For LECBD procedure, the patient should be in the head-up position (anti-Trendelenburg position) (Fowler position) with right side up (left-tilt position).

Initially, we proceed in LC as usual till the CBD was identified.

The CBD is identified, CBD opened by the scissor about 1–2-cm opening. The previously inserted stent was identified, after that, compressing the CBD in two directions by noncrushing graspers was done till the big stone (s) is delivered. Attempts of balloon trawling were done to ensure complete clearance of the CBD.

Closure of the CBD over the plastic stent is done by three interrupted Vicryl 3/0 sutures.

Then we continued LC. A final look and washing were done.

In all cases, a drain was inserted. Removal of ports was done under vision.

The site of umbilical port was closed by using the two U-shaped stitches placed at the beginning of the procedure.

All skin incisions were closed using 3/0 nonabsorbable suture and then the patient was extubated and transferred to postanesthesia care unit.

Postoperatively, vital signs were measured (arterial blood pressure, pulse, temperature, and respiratory rate). Drain and its content, movement from bed, peristalsis auscultation, and passing flatus were followed. All patients had a follow-up visit after 10 days postoperatively.

In follow-up, total direct bilirubin alanine aminotransferase (ALT), aspartate aminotransferase

(AST), and alkaline phosphatase were measured every 3 days. In all cases, the plastic stent was removed 3 months later after doing plain radiograph to ensure the presence of the stent (three cases showed stent migration passed in the stool).

All data were statistically analyzed using Statistical Package of Social Science (SPSS software version 21 (SPSS Inc., Chicago, IL, USA)). Quantitative data were expressed as a mean±SD, while qualitative data were expressed as frequency and percentages. Qualitative variables were compared using a χ^2 test, while quantitative continuous data were compared using the Mann–Whitney test. A *P* value less than 0.05 was considered statistically significant.

Results

Among all patients scheduled for CBD stone(s) extraction by ERCP, 40 patients of failed stone extraction by ERCP were selected to be enrolled in this study. They were divided randomly into two groups, LECBD will be done for the patients either in the same session (group A) or scheduled 1 week later (group B).

Age varies from 23 to 72 years with mean 47.6±20.4. No significant difference between two groups regarding age (*P*=0.792). Female represents the majority of included patients (80%), males represent 20% of included patients with no significant difference between males and female patients (*P*=0.331) (Table 1) (Fig. 1a,b).

Eighty percent of patients had no comorbidities with no significant difference between two groups (*P*=0.69) (Fig. 1d).

Fifty-five percent of patients presented with epigastric pain, while 100% of patients presented with obstructive jaundice. No significant difference between two groups regarding patient presentation (0.12) (Table 1) (Figs 1 and 2c,a).

Nine patients underwent previous abdominal surgery, five cases in same-session group and four cases in scheduled-session group with no significant difference (*P*=0.5) (Table 1) (Fig. 1a).

All patients included underwent abdominal ultrasonography and MRCP before progress to ERCP.

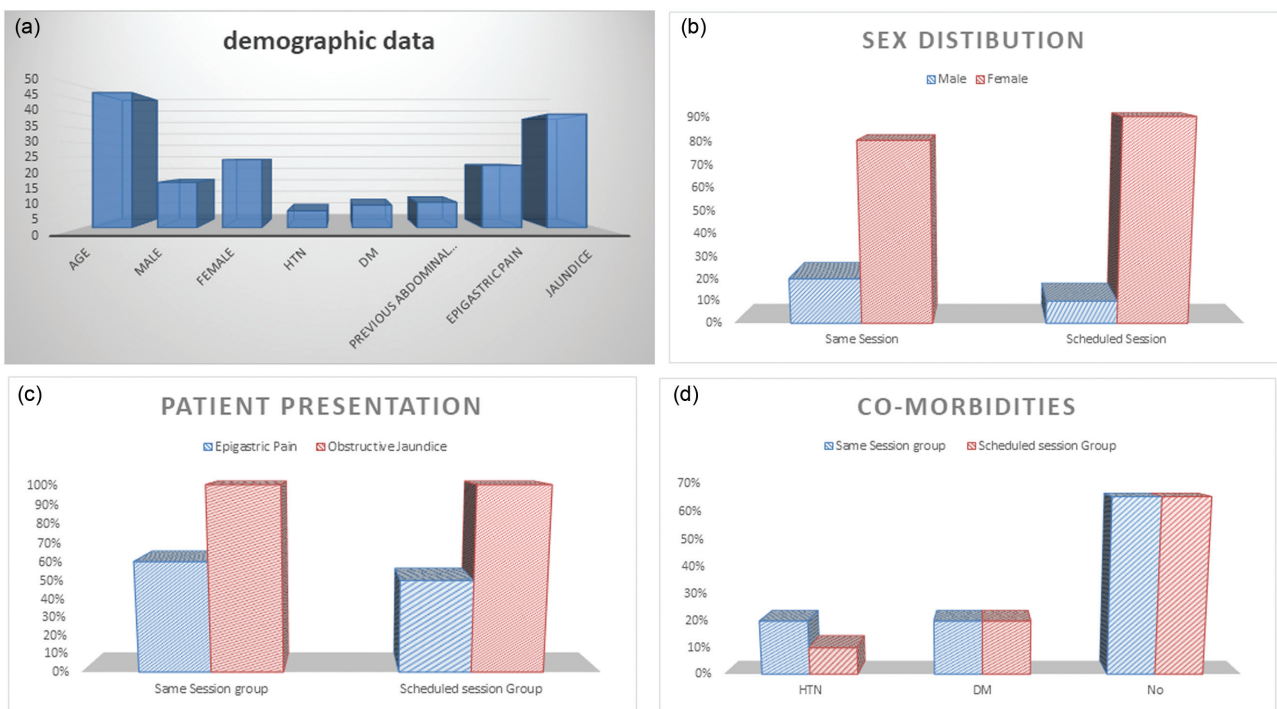
Regarding ultrasonography, mean CBD diameter of patients was 12.09±5.1. No significant difference was

Table 1 Demographic data of all patients

| Parameters | All patients | Same session group (N=20) | Scheduled session group (N=20) | Test | P value |
|----------------------------|--------------|---------------------------|--------------------------------|------|---------|
| Age | | | | 0.07 | 0.792 |
| Mean±SD | 47.6±20.4 | 45.6±16.1 | 48.9±17.3 | | |
| Range | 23–72 | 20–60 | 20–60 | | |
| Sex [n (%)] | | | | 0.66 | 0.331 |
| Male | 8 (20) | 4 (20) | 2 (10) | | |
| Female | 32 (80) | 16 (80) | 18 (90) | | |
| Comorbidities [n (%)] | | | | 1 | 0.69 |
| HTN | 6 (15) | 4 (20) | 2 (10) | | |
| DM | 8 (20) | 5 (25) | 3 (15) | | |
| No | 32 (80) | 15 (75) | 17 (85) | | |
| Presentation [n (%)] | | | | 2.3 | 0.13 |
| Previous abdominal surgery | | 12 (60) | 10 (50) | | |
| Yes | 9 (22.5) | 20 (100) | 20 (100) | | |
| No | 31 (77.5) | 15 (75) | 13 (65) | | |
| Epigastric pain | 22 (55) | 5 (25) | 7 (35) | | |
| Jaundice | 40 (100) | | | 1.2 | 0.23 |
| Manifest jaundice (>3 mg) | 28 (70) | 5 (25) | 4 (20) | | |
| Latent jaundice (<3 mg) | 12 (30) | 15 (75) | 16 (80) | | |

DM, diabetes mellitus; HTN, hypertension.

Figure 1



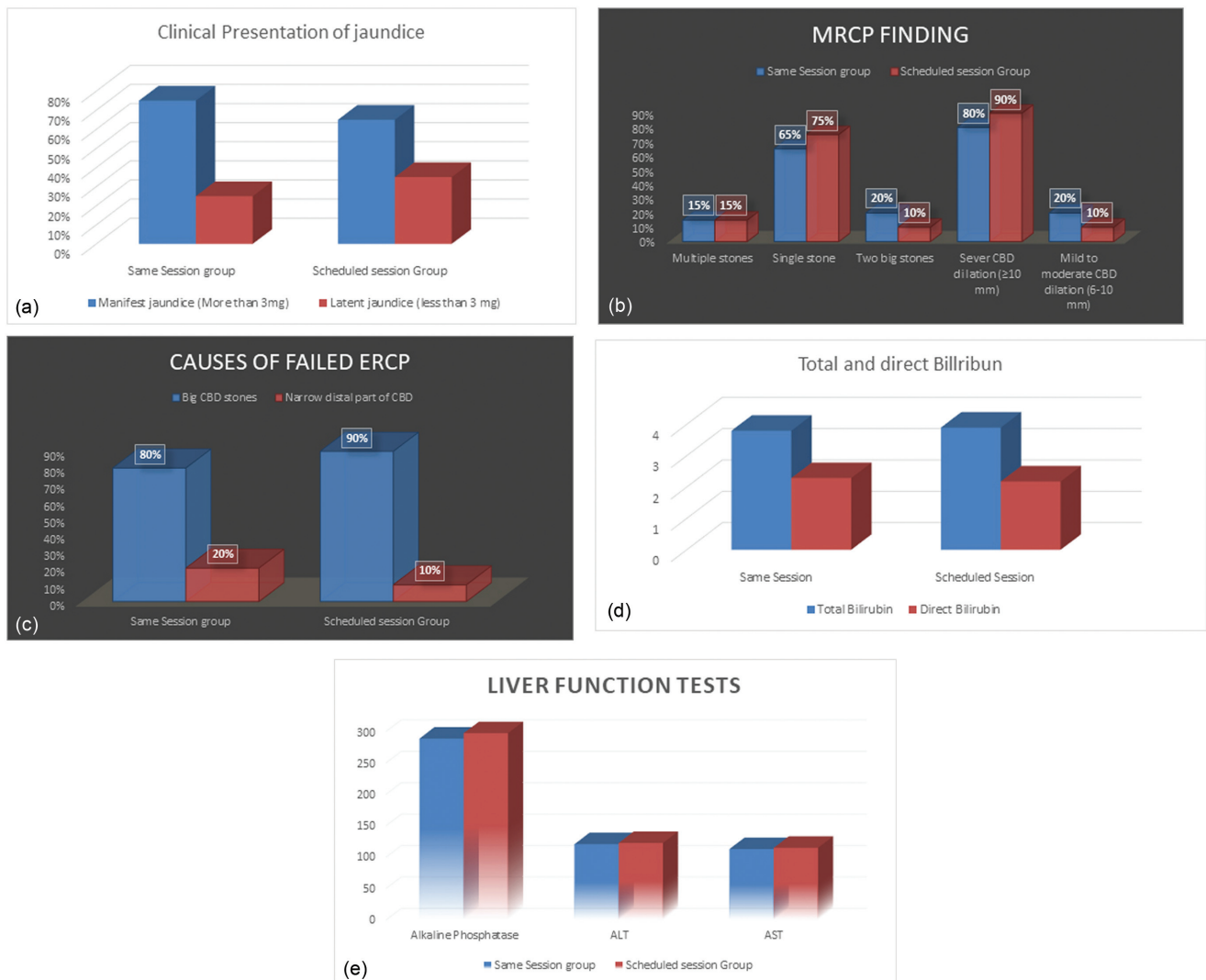
(a) Demographic data, comorbidities, and complaints. (b) Sex distribution of all patients and its relation of the group of patients. (c) Presentation of patients and its relation of the group of patients. (d) Comorbidities of included patients.

found between CBD diameters between two groups. Twenty-eight (70%) patients had a single stone and six (15%) patients had two (15%) big stones and six patients had multiple stones. There was no significant difference between the presence of stones and procedures undergone during either the same

session or scheduled session ($P=0.264$) (Table 2) (Fig. 2b).

Regarding MRCP finding, 85% of patients had severe dilatation of CBD (>10 mm) with no difference between groups ($P=0.5$). While 15% had mild-to-

Figure 2



(a) Clinical presentation of obstructive jaundice of both groups. (b) MRCP finding in two groups. (c) Causes of obstructive jaundice in the two groups. (d) Total and direct bilirubin in two groups. (e) Alkaline phosphatase, ALT, and AST between the two groups. ALT, alanine aminotransferase; AST, aspartate aminotransferase.

moderate dilatation of CBD and intra hepatic biliary radicals (IHBRs). There was no significant difference between two groups regarding IHBRs ($P=0.68$). MRCP can differentiate the causes of obstructive jaundice; all patients had CBD stones (Table 2) (Fig. 2b).

The causes of failed ERCP: 85% of patients had big CBD stones (>1 cm), 15% of patients had a narrow distal part of CBD with no significant difference between two groups ($P=0.435$) (Table 2) (Fig. 2c).

Total and direct bilirubin, alkaline phosphatase, and liver-function test (ALT and AST) were measured. Mean total bilirubin of all patients was 4.8 ± 0.4 , while direct bilirubin was 3.24 ± 0.6 . There was no significant difference between bilirubin (total, direct) and two

groups either underwent the same session or scheduled session. Mean alkaline phosphatase was 292.9 ± 144 , ALT mean number was 120.4 ± 10.5 , and AST mean number 112.6 ± 9.5 with no significant relationship between two groups (Table 3) (Fig. 2d,e).

In same-session group that underwent CBD exploration after failed ERCP, we measured total and direct bilirubin on admission and follow-up every 3 days.

Assessment of the efficacy of two groups in comparison to each other was done. The outcome of efficacy according to successful LECBD was measured. LECBD was successful in 18 out of 20 patients who underwent CBD exploration at the same session (90%) (two cases were converted to open surgery due to severe

Table 2 Radiology and laboratory findings of all patients

| Parameters | All patients | Same Session group (N=20) | Scheduled session Group (N=20) | Test | P value |
|------------------------------|--------------|---------------------------|--------------------------------|------|---------|
| Abdominal ultrasonography | | | | 2.3 | 0.3 |
| CBD diameter | 12.09±5.1 | 11.9±5.1 | 12.5±4.9 | | |
| CBD stones [n (%)] | | | | 0.9 | 0.264 |
| Single big stone | 28 (70) | 13 (65) | 15 (75) | | |
| Two big stones | 6 (15) | 4 (20) | 2 (10) | | |
| Multiple stones | 6 (15) | 3 (15) | 3 (15) | | |
| MRCP (CBD dilation) [n (%)] | | | | 0.36 | 0.5 |
| Sever (≥10 mm) | 34 (85) | 16 (80) | 18 (90) | | |
| Mild to moderate (6–10 mm) | 6 (15) | 4 (20) | 2 (10) | | |
| IHBRS [n (%)] | | | | 0.36 | 0.5 |
| Sever | 34 (85) | 16 (80) | 18 (90) | | |
| Mild to moderate | 6 (15) | 4 (20) | 2 (10) | | |
| Cause of Failed ERCP [n (%)] | | | | 0.36 | 0.5 |
| Big CBD stones | 34 (85) | 16 (80) | 18 (90) | | |
| Narrow distal part of CBD | 6 (15) | 4 (20) | 2 (10) | | |
| Total bilirubin | | | | 0.06 | 0.93 |
| Mean±SD | 4.8±0.4 | 4.8±0.3 | 4.9±0.4 | | |
| Range | 2–11.2 | 2–11.2 | 2.1–11.1 | | |
| Direct bilirubin | | | | 0.01 | 0.89 |
| Mean±SD | 3.24±0.6 | 3.29±0.9 | 3.18±0.5 | | |
| Range | 1.6–8 | 1.6–8 | 1.7–7.5 | | |
| Alkaline phosphatase | | | | 0.03 | 0.85 |
| Mean±SD | 292.9±144 | 288.5±146.4 | 297.15±145 | | |
| Range | 126–560 | 240–560 | 126–544 | | |
| ALT | | | | 0.01 | 0.985 |
| Mean±SD | 120.4±10.5 | 120.4±10.5 | 122.4±11.5 | | |
| Range | 60–150 | 60–150 | 60–150 | | |
| AST | | | | 0.02 | 0.99 |
| Mean±SD | 112.6±9.5 | 112.6±9.5 | 114.6±11.5 | | |
| Range | 65–160 | 65–160 | 65–160 | | |

ALT, alanine aminotransferase; AST, aspartate aminotransferase; CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography.

Table 3 Outcome measures between two groups

| Parameters | Same Session group (N=20) | Scheduled session Group (N=20) | Test | P value |
|-----------------------------|---------------------------|--------------------------------|------|---------|
| Stone extraction [n (%)] | | | 0.9 | 0.42 |
| Yes | 18 (90) | 19 (95) | | |
| No | 2 (10) | 1 (5) | | |
| Duration of ERCP | 29.5±5.9 | 33.3±8.2 | 2.7 | 0.103 |
| Duration of CBD exploration | 89.2±8.8 | 79.5±5.9 | 16.7 | 0.001 |

CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography.

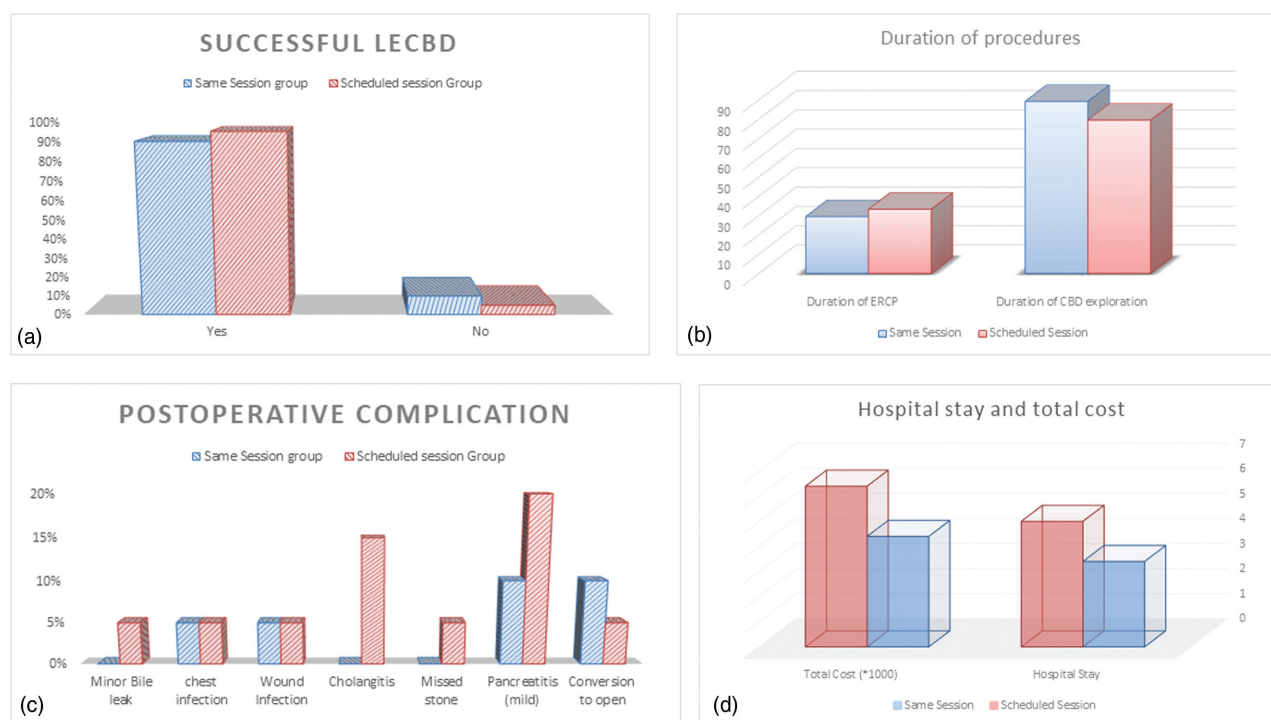
adhesions found due to multiple acute attacks and previous abdominal surgery). On the other hand, LECBD was successful in 18 patients out of 20. One case was converted to open surgery due to severe adhesions and one case showed missed stones in follow-up (one patient was excluded from scheduled CBD exploration due to severe pancreatitis developed after failed ERCP and substituted with another case: eligible for intention-to-treat analysis), who underwent CBD exploration after 1 week (90%) with insignificant *P*-value of 0.1 (Table 4) (Fig. 3a).

Mean duration of ERCP was 29.5±5.9 min in same-session group, while it was 33.3±8.2 in the scheduled group (*P*=0.12). Mean duration of LCBDE in same-session group was significantly higher (89.2±8.8 min) than scheduled session (79.5±5.9 min) (*P*=0.001). This may be due to gas distension following ERCP, which made LCBDE difficult (Table 4) (Fig. 3b).

One case was excluded from scheduled group due to severe pancreatitis post-ERCP and replaced with another case. We underwent follow-up of patients

Table 4 Postoperative parameters between two groups

| Parameters | Same Session group (N=20) | Scheduled session Group (N=20) | Test | P value |
|----------------------|---------------------------|--------------------------------|-------|---------|
| Complication [n (%)] | | | | |
| Minor Bile leak | 0 | 1 (5) | 2.8 | 0.09 |
| Chest infection | 1 (5) | 1 (5) | 1 | 0.9 |
| Wound Infection | 1 (5) | 1 (5) | 1 | 0.9 |
| Cholangitis | 0 | 3 (15) | 87.5 | 0.01 |
| Missed stone | 0 | 1 (5) | 12.4 | 0.08 |
| Pancreatitis (mild) | 2 (10) | 4 (20) | 55.3 | 0.02 |
| Conversion to open | 2 (10) | 1 (5) | 11.3 | 0.09 |
| Hospital stay | | | | |
| Mean±SD | 3.4±1.1 | 5±1.7 | 11.9 | 0.001 |
| Range | 2–5 | 3–7 | | |
| Total cost | | | | |
| Mean±SD | 4450±591 | 6450±590 | 114.2 | 0.0001 |
| Range | 3500–5000 | 4500–7000 | | |

Figure 3

(a) Outcome parameter (successful LECBD). (b) Outcome parameter (duration of ERCP and CBD exploration). (c) Postoperative parameters (complication). (d) Total hospital stay and total cost in both groups. ERCP, endoscopic retrograde cholangiopancreatography; LECBD, laparoscopic exploration of common bile duct.

regarding bile leak, missed stone, cholangitis, and pancreatitis post-CBD exploration. No significant difference in the rate of complications regarding minor bile leak, postoperative chest infection, postoperative wound infections, and missed stone occurred between two groups ($P=0.4$). Cholangitis and mild pancreatitis (15 and 20%, respectively) were significantly higher in scheduled group than same-session group (0 and 10%, respectively) with P value of 0.01, 0.02, respectively (Fig. 3c).

Total hospital stay was lower in patients who underwent same-session CBD exploration (3.4±1.1 days) rather than scheduled-session CBD exploration (5±1.7 days) with significant P value of 0.001. Four cases of failed LCBDE [two in the same session (adhesion one due to multiple acute attacks or previous abdominal surgery), in scheduled (adhesions due to multiple acute attacks and missed stone found in follow-up)] were converted to open CBD exploration (Fig. 3d).

The total cost for patients in scheduled-session group (6450±591) Egyptian pounds was significantly higher than same-session group (5450±1169) with a high significant *P* value of 0.001 (Fig. 3d).

Eighty percent of same-session group patients returned to normal values of total and direct bilirubin levels and liver-function tests on follow-up through 3–5 days. However, in scheduled-session group, bilirubin remains high for 1 week with risk of attacks of cholangitis and pancreatitis (15% of patients develop cholangitis and 20% of patients develop pancreatitis).

Discussion

The incidence of gallstones varies from 6 to 10% in adult population. Three percent to 14.7% of patients of gallstones have concurrent CBD stones as well [1].

Primary stones are formed de novo in the bile duct and are usually of brown-pigment variety, single or multiple, often oval-shaped, and lie along the long axis of the duct. Primary stones are formed due to biliary stasis and infection [2].

The ideal management of concomitant CBD stones with gallbladder stones is still controversial [3].

Management of gallstones is LC, but there is no consensus for treatment of CBD stones. In the era of open surgery, treatment was straightforward: open cholecystectomy with open CBD exploration although it carried high morbidity and mortality [1].

With the advent of noninvasive and minimally invasive techniques, the option of ERCP followed by LC either in the same session or in two stages emerged as adequate treatment [1]. This matches with Soltan and colleagues who found ERCP and LC as an urgent single step is an effective, more, safe and has less complications than other methods of treatment of CBD stones.

The question addressed was in patients with symptomatic gallstones and concomitant CBD stones, is a single-stage surgical strategy (LC) with CBD exploration preferable or a single-stage procedure involving LC with ERCP [4].

With refinements in technique and expertise in the field of minimal-access surgery, many centers in the world have started offering one-stage management of choledocholithiasis by LC with LCBDE. Only few

randomized trials are available comparing single-stage ERCP and LC with single-stage LC and LCBDE [1].

When CBD stone removal by endoscopic procedure fails, CBD exploration is an alternative procedure [5].

Despite the simplicity and success of LCBDE, many surgeons across the globe are still not comfortable or confident regarding the procedure [1].

The timing of LCBDE (either in the same session or in the two-stage (scheduled) operation) after failure of stone extraction by ERCP is still controversial and needs more evaluation.

In this study, 85% of cases were females. This agrees with Soltan *et al.* [6], who found that 75% of patients with calculous obstructive jaundice were females.

The majority of our patients were presented with (epigastric pain) biliary colic (55%), these results align with Abd Alrahem *et al.* [7] study, which reported that 60% of patients with CBD stones presented with biliary colic.

In the present study, there was a significant difference between preoperative and postoperative decrease in each of total bilirubin and liver enzymes. This agrees with Zhang *et al.* [8] who reported about preoperative laboratory investigations, serum total, and direct bilirubin were elevated in 13 cases, serum amylase, and lipase was in the normal range in all cases, whereas liver functions including SGOT and SGPT were elevated in 17 cases.

In the current study, mean CBD diameter of included patients was 12.09±5.1, 70% of patients had a single big stone, agreeing with Soltan *et al.* [9] study that reported CBD diameter 12.09±4.9 but disagreeing with him that 74.6% of patients had multiple stones. We found that 97.5% of patients had dilated CBD in MRCP finding, which makes LCBDE feasible.

In this study, successful clearance of CBD is more than 90% in the two groups. This agrees with Kim *et al.* [10] who found that the CBD stone clearance rate was more than 96% in both groups.

In this study, for all patients, we did ERCP first and then LECBD either in the same session or after 1 week. We primarily close the CBD over a plastic stent inserted during ERCP. This disagrees with Alhamdani *et al.* [11] who believe that primary duct closure is not performed in the patients with failed ERCP for the

following reasons: (a) spasm or edema of sphincter could appear after the trauma of CBDE, (b) cholangitis may occur after ERCP in patients with malignant biliary obstruction or failed drainage, and (c) failure to drain may result in leakage, cholangitis, or disruption of duct closure with biliary peritonitis. Also, Salama *et al.* [12] closed the choledochotomy over the T-tube in 20 (55%) of 36 cases of their study; when there was concern in terms of retained fragments or tiny stones, they used primary closure over a stent in five (15%) of 36 cases and primary closure without a stent in four (12.5%) of 36 cases.

One of the possible consequences of primary closure of the CBD is papillary edema or biliary obstruction that leads to an increase in pressure within the biliary tree and then increasing the risk of biliary leak through the choledochotomy [13]. But, after sphincterotomy, the pressure of sphincter is significantly lower, which is highly advantageous to CBD drainage. In the meantime, dilated CBD alleviates the growth of pressure within the biliary tree. In our opinions, it is feasible for primary closure of the dilated CBD (diameter >1.0 cm) in the patients after sphincterotomy and plastic stent insertion.

In the current study, the mean operative time of LCBDE was 85.2±8.8 min. This was less operative time with most similar studies as Chander *et al.* [14] reported that the mean duration of surgery was 139.9 min (90–205 min). In addition to that, mean duration of LCBDE in same-session group was significantly higher (89.2±8.8 min) than scheduled session (79.5±5.9 min) ($P=0.001$). This may be due to gas distension following ERCP, which made LCBDE difficult. Bansal *et al.* [15] reported that the time of operation for LCBDE varied between 120 and 240 min. Sharma *et al.* [16] reported that the average surgical duration was 139.9 min. In the study by Karaliotas *et al.* [17], the mean time of the procedure was 155 min (average, 75–270 min), and in Darkahi *et al.* [18], the mean time of the procedure was 194 min, in the range of 75–420 min.

In the present study, the mean hospital stay was 3.4 days. This agrees with ElGhamry *et al.* [19], who reported that when analyzing correlations of length of hospital stay with other data, we noticed an increased hospital stay with increased gallbladder wall thickness and CBD diameter on ultrasound and magnetic resonant cholangiopancreatography and with increased liver enzymes. In scheduled-session group, staying at the hospital becomes 5 days. Tse and Yuan [20] showed significant differences in the duration of

staying at the hospital between the primary LCBDE patients (9.82 days) and the secondary LCBDE patients (10.74 days). There was a marked rise in the duration of staying at hospital with the incidence of bile leakage, which was also reported in the studies of Yi Topal *et al.* [21] and Karaliotas *et al.* [17], who reported increased length of hospital stay with bile leakage. Nonetheless, it has been documented in the literature that the duration of hospital stay should not be a criterion for evaluation of surgery, because it is not only based on the surgical technique used, but is affected by various criteria, irrespective of postoperative recovery of the patient.

In this study, there was no bleeding. This agrees with Ricci *et al.* [22] who found that LC plus LCBDE was the most successful for avoiding overall bleeding rather than LC plus intra-ERCP and least total cost.

In the present study, bile leakage occurred in 10.0% of cases in the same-session group, three cases had cholangitis in scheduled-session group. Liu *et al.* [23] reported that bleeding and bile leak were the most imminent mishaps after LCBDE. Helmy and Ahmed reported that the occurrence of postoperative complications was seen in three (5%) patients, where two patients had minor bile leaks.

In the current study, there was only one case with missed stone in the scheduled group, which disagrees with Parra-Membrives *et al.* [24], who found that the rate of missed choledocholithiasis was 14.1% after LECBD.

Conclusion

Same-session LECBD after failure of ERCP for management of CBD stones is feasible. It shows lower cost, shorter hospital stay, and lower rate of complications than scheduled LECBD, in spite of a higher rate of conversion to open surgery and longer operative time in same-session group.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Gupta N. Role of laparoscopic common bile duct exploration in the management of choledocholithiasis. *World J Gastrointest Surg* 2016; 8:376–381.
- Upwanshi MH, Shaikh ST, Ghetla SR, Shetty TS, *et al.* De novo choledocholithiasis in retained common bile duct stent. *J Clin Diagn Res* 2015; 9:PD17–PD18.

- 3 Tan C, Ocampo O, Ong R, Tan K, *et al.* Comparison of one stage laparoscopic cholecystectomy combined with intra-operative endoscopic sphincterotomy versus two-stage pre-operative endoscopic sphincterotomy followed by laparoscopic cholecystectomy for the management of pre-operatively diagnosed patients with common bile duct stones: a meta-analysis. *Surg Endosc* 2018; 32:770–778.
- 4 Kenny R, Richardson J, McGlone ER, *et al.* Laparoscopic common bile duct exploration versus pre or post-operative ERCP for common bile duct stones in patients undergoing cholecystectomy: is there any difference?. *Int J Surg* 2014; 12:989–993.
- 5 Jinfeng Z, Yin Y, Chi Z, Junye G, *et al.* Laparoscopic management after failed endoscopic stone removal in nondilated common bile duct. *Int J Surg* 2016; 29:49–52.
- 6 Soltan HM, Gaber A, Ammar MS, *et al.* Endoscopic retrograde cholangiopancreatography and laparoscopic cholecystectomy in single session management of acute biliary pancreatitis. *Int J Surg* 2017; 4:3218–3224.
- 7 Mohamed AA, Ahmed MH, Karim MNT. The safety and efficacy of laparoscopic common bile duct exploration for the management of choledocholithiasis after endoscopic retrograde cholangiopancreatography failure: an observational study carried out in Al-Azhar University Hospital in Assiut. *Al-Azhar Assiut Med J* 2020; 18:413.
- 8 Zhang Z, Liu Z, Liu L, Song M, Zhang C, Hongwei Yu, *et al.* Strategies of minimally invasive treatment for intrahepatic and extrahepatic bile duct stones. *Front Med* 2017; 11:576–589.
- 9 Soltan H, Makhlof M, Ammar M, Hagag M, *et al.* Value of magnetic resonance cholangiopancreatography prior to endoscopic retrograde cholangiopancreatography in ultrasonographically and laboratory diagnosed obstructive jaundice. *Egypt J Surg* 2021; 40:153.
- 10 Kim H, Shin SP, Hwang JW, Lee JW. Outcomes of laparoscopic common bile duct exploration (LCBDE) after failed endoscopic retrograde cholangiopancreatography versus primary LCBDE for managing cholecystocholedocholithiasis. 2020; 48:300060520957560.
- 11 Alhamedani A, Mahmud S, Jameel M, Baker A, *et al.* 'Primary closure of choledochotomy after emergency laparoscopic common bile duct exploration'. *Surg Endosc* 2008; 22:2190–2195.
- 12 Salama AF, Helmy AH, Hedaya MS, Rizk H, Esmat E. Laparoscopic common bile duct exploration for choledocholithiasis: Theodor Bilharz Research Institute preliminary experience. *Egypt J Surg* 2016; 35:54–58.
- 13 Laparoscopic CBD, and More Than. 2017 Scientific Session of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) Houston, Texas, USA, 22–25 March 2017. *Surg Endosc* 2017; 31:S1–S60.
- 14 Chander J, Vindal A, Lal P, Gupta N, Vinod Ramteke K, *et al.* Laparoscopic management of CBD stones: an Indian experience. *Surg Endosc* 2011; 25:172–181.
- 15 Bansal VK, Misra M, Rajan K, Kilambi R, Kumar S, Krishna A, *et al.* Single-stage laparoscopic common bile duct exploration and cholecystectomy versus two-stage endoscopic stone extraction followed by laparoscopic cholecystectomy for patients with concomitant gallbladder stones and common bile duct stones: a randomized controlled trial. *Surg Endosc* 2014; 28:875–885.
- 16 Sharma A, Sharma A, Dahiya P, Khullar R, Soni V, Baijal M, Chowbey P, *et al.* Management of common bile duct stones in the laparoscopic era. *Indian J Surg* 2012; 74:264–269.
- 17 Karaliotas C, Karaliotas C, Sgourakis G, Goumas C, Papaioannou N, Lilis C, Leandros E, *et al.* Laparoscopic common bile duct exploration after failed endoscopic stone extraction. *Surg Endosc* 2008; 22:1826–1831.
- 18 Darkahi B, Liljeholm H, Sandblom G. Laparoscopic common bile duct exploration: 9 years experience from a single center. *Front Surg* 2016; 3:23.
- 19 ElGhamry E, ElGhamry E, Elsheikh M, Abdelhady H, Hablus M, *et al.* An auspicious experience with laparoscopic common bile duct exploration. *Egypt J Surg* 2019; 38:459.
- 20 Tse F, Yuan Y. Early routine endoscopic retrograde cholangiopancreatography strategy versus early conservative management strategy in acute gallstone pancreatitis. *Cochrane database of systematic reviews* 2012 (5).
- 21 Yi H, Hong G, Min S, Lee H, *et al.* Long-term outcome of primary closure after laparoscopic common bile duct exploration combined with choledochoscopy. *Surg Laparosc Endosc Percutan Tech* 2015; 25:250–253.
- 22 Ricci C, Pagano N, Taffurelli G, Pacilio C, Migliori M, Bazzoli F, *et al.* Comparison of efficacy and safety of 4 combinations of laparoscopic and intraoperative techniques for management of gallstone disease with biliary duct calculi: a systematic review and network meta-analysis. *JAMA Surg* 2018; 153:e181167.
- 23 Liu J, Xiong X, Cheng Y, Lin Y, Zhou R, You Z, Wu S, *et al.* One-stage versus two-stage management for concomitant gallbladder stones and common bile duct stones in patients with obstructive jaundice. *Am Surg* 2013;79:1142–1148
- 24 Parra-Membrives P, Martínez-Baena D, Lorente-Herce JM, Jiménez-Riera G, Sánchez-Gálvez M, *et al.* Choledocholithiasis recurrence following laparoscopic common bile duct exploration. *Cir Esp (Engl Ed)* 2019; 97:336–342.