

Synchronous Approach versus the Sequential Approach in Laparoscopic Cholecystectomy with Endoscopic Retrograde Cholangiopancreatography in Patients with Gallstones and Suspected Common Bile Duct Stones

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ABSTRACT

Introduction: Common Bile Duct Stone (CBDS) is concomitant with Gallstone (GS) in 10-18% of patients. The most common procedure to treat CBDS with GS is with Endoscopic Retrograde Cholangiopancreatography (ERCP) and Laparoscopic Cholecystectomy (LC) which has commonly been done using a sequential approach. Currently, the one-step synchronous approach is commonly practiced. However, superiority of one protocol over another is yet to be established.

Aim: To compare the operative outcomes between synchronous approach LC followed by ERCP in the same anaesthetic time (group I) and sequentially separated LC and ERCP (group II).

Materials and Methods: A retrospective review of 66 patients from May 2015 to June 2017. The patients were diagnosed as having GS and were suspected of also having CBDS. They were divided into two groups: Group I had 41 patients and Group II had 25 patients. The baseline characteristics, operative

findings and outcomes including success rate, operative time, postoperative complications and the Length Of Hospital Stay (LOS) of the two groups were compared.

Results: There were no significant difference between the operative outcomes of the two groups regarding the CBDS cannulation rate (95.1% versus 100.0%) and clearance rate (89.7% versus 80.0%). The cannulation rate difference was -5.0% (95% CI=-11.5to1.7; p-value=0.26) and the clearance rate difference was 9.7% (95% CI=-8.6 to 28.1; p-value=0.27). Postoperative complications showed no statistically significant difference, however the LOS was significantly lower in group I with a mean difference of -4.0 days (95% CI=-5.4 to -2.6; p-value <0.001).

Conclusion: The synchronous approach is as safe and effective as the sequential ERCP and LC. Moreover, it has advantages for patients such as a reduction in the number of procedures and requiring a shorter LOS.

Keywords: Combined gallstone and CBD stones, CBD cannulation, Synchronous approach LC with ERCP

INTRODUCTION

GS and CBDS are common problems of the biliary tract. The CBDS can be primary, originating in the bile duct or secondary from GS and 10-18% of GS cases have the concomitant CBDS [1]. In the current minimally invasive era, treatment of GS and CBDS has changed from an open to a minimally invasive procedure [2]. LC has become gradually accepted as the first choice for treatment of GS whereas ERCP has been proven to be a safe treatment for CBDS in most cases [3-5].

Various treatment modalities have been applied to patients with GS and suspected CBDS. There are two main modalities, either one or two step approaches [6,7]. The techniques used in the one step approach are, open cholecystectomy with bile duct exploration, LC with laparoscopic bile duct exploration [8,9] or synchronous LC with intra-operative ERCP [10-12]. In the two-step approach, LC and ERCP are done in separate settings. Results from different institutions varied for both approaches [13,14].

Thabo Crown Prince Hospital is a district hospital in Northeastern Thailand with 700-800 cases of LC and 300-400 cases of ERCP annually. The concomitant GS with CBDS cases accounted for 7-12% of these patients. In the past, these patients were treated by one step approach by open surgery or two step approach by

sequential ERCP then LC. Currently, the synchronous approach of LC with ERCP, in a single anaesthetic period, has been applied in our hospital. The aim of the new approach is to reduce the number of anaesthesia sessions, the LOS and the hospital cost. However, the data which compare outcomes of both approaches is still limited [15,16]. The objective of this study was to assess the operative outcomes of the synchronous and sequential approaches in author's experience.

MATERIALS AND METHODS

In this retrospective study, the patient information was reviewed from patients' files and the electronic hospital database after ethical approval was obtained. The inclusion criteria was patients who were admitted for surgical treatment of GS and CBDS in a single admission at Thabo Crown Prince Hospital from 1 May 2015 to 30 June 2017. The exclusion criteria were patients undergoing LC and ERCP in separate admission and if there was incomplete patient information in the file.

The diagnosis of GS and CBDS was established by clinical symptoms, laboratory finding and imaging studies. All patients were documented to have GS by ultrasonography. Patients were suspected of having CBDS if they had evidence of bile duct stones

or dilated CBD on ultrasonography (defined as ultrasonographic CBD size greater than 10 mm) [17,18] with clinical symptoms including one or more of the following; jaundice or acute pancreatitis on admission, previous episodes of jaundice or pancreatitis, abnormal liver function tests (elevated liver enzymes and bilirubin levels). The presence of jaundice was defined as serum bilirubin level greater than 2 mg/dL. Pancreatitis was defined as the finding of at least three fold increase in serum amylase or serum lipase [19,20]. The indications for stenting in the current patients were severe cholangitis and need for complete drainage, swelling of the ampulla of Vater which might cause temporary biliary obstruction, uncertain bile leakage and unsecured cystic duct stump.

The LC and ERCP procedures were performed by two different approaches on patients who had no contraindication for laparoscopic surgery. The one-step synchronous approach (group I) was done by LC followed by ERCP in a single anaesthetic period. The sequential approach (group II) was done by LC and ERCP in separate operations. The sequence of operations in the sequential group was different due to individual clinical condition and depending on the operative team at the time of the operation. There were 17 patients in this study who did ERCP before LC while the remainder of the patients had LC first. The time interval between LC and ERCP was 1-7 days depending on the patient's condition and the availability of the operative theater's schedule.

The contraindications for laparoscopic surgery were: 1) American Society of Anaesthesiologist (ASA) Class>4; 2) abdominal surgical history that correlated with difficult laparoscopy or endoscopy; 3) abdominal malignancy; and 4) pregnancy or any unsuitable condition for laparoscopy or endoscopy.

The primary outcome of the study was to compare the success rate (CBDS cannulation and clearance rate) of group I and group II. The secondary outcomes were to compare the operative time, time interval, postoperative complications and LOS of both groups.

The patient characteristics for both groups were presented as number and percentage for categorical outcomes, and mean with standard deviation for continuous outcomes. The comparison of continuous variables between the two groups was done using independent t-test while the comparison of categorical outcomes was done using Z-test. The magnitude of effects was presented in terms of mean/rate differences and their 95%CI. The p-value less than 0.05 were considered statistically significant. All statistical analysis was done by program STATA version 13 [21].

The study protocol was approved by Nongkhai Province Ethics Committee for Human Research (No. 3/2561). The use of patients' files and database was approved by Director of Thabo Crown Prince Hospital. The written informed consent was obtained from all patients before their surgery.

RESULTS

There was a total of 1,657 GS patients, however of these 1,591 patients were excluded from this study (1,530 patients had no CBDS and 61 patients were treated for CBDS in different admission). The remaining 66 symptomatic GS patients with suspected CBDS were enrolled in this study. Of these, 41 patients (62.1%) were treated with the synchronous approach (group I) and 25 patients (37.9%) were treated with the sequential approach (group II) [Table/Fig-1].

Baseline characteristics of both groups are presented in [Table/ Fig-1]. The characteristics of both groups were comparable with the exception of age. The most common clinical presentation for both groups was abdominal pain (58.5% versus 60.0%). The most common preoperative diagnosis in group I was GS with CBDS (43.9%), and in group II it was acute cholecystitis (72.0%), without a statistically significant difference.

The sequence of operation in group II was 17 patients had ERCP before LC and the rest of the patients had LC first. The mean time

| Demographic and clinical Presentation | Operative approach (n=66) | | | | p-value |
|---|---------------------------|--------|-----------------------|--------|---------|
| | Synchronous (n=41) | | Sequential (n=25) | | |
| | Number | (%) | Number | (%) | |
| Age (years), mean±SD (range) | 62.2±14.2 (25-87) | | 55.5±16.3 (18-80) | | 0.08 |
| Sex | | | | | 0.40 |
| Male | 17 | (41.5) | 13 | (52.0) | |
| Female | 24 | (58.6) | 12 | (48.0) | |
| ASA classification | | | | | 0.17 |
| I | 19 | (36.4) | 5 | (20.0) | |
| II | 18 | (43.9) | 15 | (60.0) | |
| III | 3 | (7.3) | 4 | (16.0) | |
| IV | 1 | (2.4) | 1 | (4.0) | |
| Underlying diseases | | | | | *** |
| None | 25 | (61.0) | 13 | (52.0) | |
| Diabetes mellitus | 4 | (9.7) | 9 | (36.0) | |
| Hypertension | 7 | (17.1) | 2 | (8.0) | |
| Others | 5 | (12.2) | 1 | (4.0) | |
| Clinical presentation | | | | | NA |
| Asymptomatic | 5 | (12.2) | 0 | (0.0) | |
| Abdominal pain | 24 | (58.5) | 15 | (60.0) | |
| Jaundice | 4 | (9.8) | 2 | (8.0) | |
| Fever/sepsis | 8 | (19.5) | 8 | (32.0) | |
| Total bilirubin (mg%), mean±SD (range) | 3.3±5.1 (0.3-23.0) | | 4.4±5.0 (0.3-18.5) | | 0.40 |
| Alkaline phosphatase (mg%), mean±SD (range) | 269.9±64.7 (62-707) | | 328.12±22.92 (71-985) | | 0.25 |
| Preoperative diagnosis | | | | | |
| GS with CBDS | 18 | (43.9) | 4 | (16.0) | 0.13 |
| GS with CBD obstruction | 7 | (17.1) | 3 | (12.0) | |
| GS with cholangitis | 2 | (4.9) | 1 | (4.0) | |
| Acute cholecystitis | 14 | (34.1) | 17 | (72.0) | |

[Table/Fig-1]: Demographic and clinical presentation of patients.
NA: Not applicable due to some cell of these variables have zero observation

interval between both operations in group I was 15.0 minutes (range 8.4-28.2) and 51.0 hours (range 19.3-212.3) in group II. CBDS was found in most of the patients in both groups (80.0% versus 72.0%), with most having a single stone (53.0% versus 81.0%). The success rate of CBD cannulation in group I and Group II were 95.1% and 100%, while the stone clearance rate in group I and II were 89.7% and 80.0% respectively. The operative results between two groups are shown in [Table/Fig-2]. The rate difference were -5.0% (95%CI=-11.5to1.7; p value=0.26) and 9.7% (95%CI=-8.6 to 28.1; p-value=0.27) which was not statistically significant. The residual CBDS rate was 10.3% in group I and 20% in the group II.

The mean LOS was 3.8 days (range 2-8) in group I and was 7.9 days (range 4-23) in group II which was significantly lower in group I with a mean difference of -4.0 days (95% CI=-5.4 to -2.6; p-value <0.001) [Table/Fig-3].

There were two failure CBD cannulated cases, one patient had ERCP performed again within two days after their first procedure with successful cannulation in the same admission, another patient had a successful ERCP cannulation two weeks later.

The postoperative complication rate (e.g., acute pancreatitis and bile leakage in 24 hours after the operation) was 2.4% (1/41) in group I and 16.0% (4/25) in group II. Additionally, Group II had a higher bile leakage (2.4% versus 8.0%) which was managed conservatively until stopped without additional intervention [Table/Fig-3].

The bile leakage in Group I which occurred at the time of laparoscopic operation were corrected with drainage and ERCP stenting. The other bile leakage cases were detected after finishing LC and were successfully treated conservatively. A plastic stent was placed in

| Operative results | Operative approach (n=66) | | | |
|---|---------------------------|--------|-------------------|---------|
| | Synchronous (n=41) | | Sequential (n=25) | |
| | Number | (%) | Number | (%) |
| Success of CBDS cannulation | 39 | (95.1) | 25 | (100.0) |
| Success of CBDS clearing | 35 | (89.7) | 20 | (80.0) |
| Time for LC (minutes) {mean±SD (range)} | 30.9±11.2 (14-57) | | 32.0±11.6 (16-63) | |
| Time for ERCP (minutes) {mean±SD (range)} | 25.6±12.9 (11-60) | | 33.8±38.8 (7-172) | |
| ERCP finding | | | | |
| Negative finding | 0 | (0.0) | 1 | (4.0) |
| CBDS | 32 | (80.0) | 18 | (72.0) |
| CBD stricture | 3 | (7.5) | 4 | (16.0) |
| Passing stones | 5 | (12.5) | 2 | (8.0) |
| CBD size (mm) {mean±SD (range)} | 15.0±5.6 (8-30) | | 11.3±2.9 (6-16) | |
| Number of stones | | | | |
| Single | 17 | (53.1) | 17 | (81.0) |
| Multiple | 15 | (46.9) | 4 | (19.0) |
| Size of stones (mm) {mean±SD (range)} | 8.6±5.9 (3-15) | | 6.75±3.04 (3-13) | |
| Plastic stent insertion | 9 | (23.1) | 10 | (40.0) |

[Table/Fig-2]: Operative results.

| Postoperative results | Operative approach (n=66) | | | | p-value |
|--------------------------------------|---------------------------|--------|-------------------|--------|---------|
| | Synchronous (n=41) | | Sequential (n=25) | | |
| | Number | (%) | Number | (%) | |
| Length of stay (day) mean±SD (range) | 3.8±1.5 (2-8) | | 7.9±4.1 (4-23) | | *** |
| Postoperative complication | | | | | |
| None | 40 | (97.6) | 21 | (84.0) | NA |
| Acute pancreatitis | 0 | (0.0) | 2 | (8.0) | |
| Bile leakage | 1 | (2.4) | 2 | (8.0) | |

[Table/Fig-3]: Postoperative results.

NA: Not applicable due to some cell of these variables have zero observation

9 patients in group I and 10 patients in group II. This was done because of either: severe cholangitis; swelling of the ampulla of Vater that might cause temporary biliary obstruction; or uncertain bile leakage or unsecured cystic duct stump.

DISCUSSION

The data from this study shows that the synchronous approach of LC with ERCP had a high success rate of CBD cannulation and CBDS clearance. The success rate of CBD cannulation in group I was 95.1% and the CBDS clearance rate was 89.7%, which was not statistically different from the sequential approach.

The high success rate of our approach is similar to previous studies from Akaraviputh T et al., at Siriraj Hospital which reported 93.0% success rate and Lv S, et al., from China which reported 90.0% success rate from this approach [22,23]. The postoperative complication was found in 2.4% in this study compared with 7.0% in Akaraviputh T et al., study [22]. Previous studies also reported some technical problems and complications resulting from the presence of dilated bowels, when LC was performed immediately after ERCP [15,22,24-26]. This problem was prevented in this study by performing LC before ERCP in all group I cases.

This study revealed that the operative time of LC and ERCP between group I and group II was not statistically different. This demonstrates that the synchronous approach did not increase the operation's level of difficulty. This was similar to Suvikapakornkul R et al., and Mohamed MA et al., studies [20,27]. The mean time interval between LC and ERCP in group I was only 15 minutes which demonstrated the short preparation time between LC to ERCP operation. This

time however was dependent on the experience of the surgical and anaesthetic teams.

The major advantage of the synchronous approach is a decrease in the waiting time in the hospital between both operations. In present study, the mean waiting time interval was 51.0 hours. This reduction in the mean LOS of patients for 4 days increased patients' convenience and decreased hospital cost. This result was similar to a previous study [28].

The clinical implication from this study is the advantage of the synchronous approach for treating GS with suspected CBDS. The preferred sequence of the operation should be LC before ERCP. This sequence will decrease the potential for bowel dilatation from the ERCP procedure which would interfere with the latter operation.

LIMITATION

The limitation of this study is the number of cases. Though this study included our experience with 1,657 GS patients over three years, the number of cases of GS with suspected CBDS in present study was still limited. The patients' allocation to group I and group II also depended on the preference of surgeon which was a limitation of this retrospective study.

CONCLUSION

The synchronous approach is as safe and effective as the sequential ERCP and LC approach. Moreover, it has advantages for patients such as a reduction in the number of procedures and requiring a shorter time interval and length of stay.

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Date of Submission: **Aug 25, 2018**

Date of Peer Review: **Oct 31, 2018**

Date of Acceptance: **Dec 19, 2018**

Date of Publishing: **Feb 01, 2019**

FINANCIAL OR OTHER COMPETING INTERESTS: None.