Laparoscopic Bile Duct Exploration in Treating Difficult Common Bile Duct Stones in Sawanpracharak Hospital, A Tertiary Center in the Lower Northern Region of Thailand

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ABSTRACT

Objective: To study the effectiveness of laparoscopic bile duct exploration in treating patients with difficult common bile duct stones (CBD stones) in Sawanpracharak Hospital, a single tertiary hospital.

Methods: Retrospective data collection of patients with difficult common bile duct stones treated with laparoscopic bile duct exploration (LBDE) from September 2015 to December 2016.

Results: Thirteen patients were included in the study (nine males, six females) ranging from 26 to 92 years of age (Mean: 67.3 ± 23.3). Operative time and hospital stay averaged 169 minutes (95% CI: 144.3 - 194.9) and 7.6 days (95% CI: 4.8 - 10.4) respectively. All bile duct stones were successfully cleared. There were no mortalities and one patient (8.3 %, 95% CI: 2.1 - 38.5) suffered from a superficial surgical site infection. Conversion to open surgery was required in three cases (20.0 %, 95% CI: 4.3 - 48.1), due to Mirizzi's syndrome.

Conclusion: In patients with difficult common bile duct stones, laparoscopic bile duct exploration appears to be a safe and effective form of treatment. However, due to the variety of difficult common bile duct stones cases, the open surgery conversion rate and duration of treatment times were both relatively high.

Keywords: Laparoscopic bile duct exploration (LBDE); difficult common bile duct stones (Siriraj Med J 2018;70: 12-16)

INTRODUCTION

Common bile duct stones (CBD stones) or choledocholithiasis develops in about 10-20% of patients with gallstones.[1] Endoscopic management is accepted as a mainstay intervention.[1,2] However, in approximately 10 -15% of CBD stones endoscopic management may prove to be challenging, and in some studies these are commonly referred to as "difficult CBD stones".[3,4] The primary characteristics of difficult CBD stones include the presence of a large number of stones (>10), a large stone (a diameter of >15 mm), unusual morphology, the stone being in a difficult location (e.g. intra hepatic, cystic duct, proximal to stricture), or the presence of Mirrizi's syndrome.[3]

Other contributing factors may include difficulty of accessing the bile duct (such as periampullary diverticulum), post-gastrectomy Billroth type II anatomy or Roux-en -Y-gastrojejunostomy.[3] In such cases, challenging endoscopic techniques and/or more sophisticated endoscopic equipment are required.[3,4] Subsequent endoscopic sessions may also be required in order to clear all stones and stone fragments, and in some cases, additional surgical procedures may be required.[3-5]

Sawanpracharak Hospital is a tertiary hospital located in the lower northern region of Thailand. Endoscopic treatment is the mainstay management of CBD stones, although the ability to deal with difficult CBD stones cases endoscopically remains limited and restricted by the lack of more specialized endoscopic equipment. Therefore, laparoscopic bile duct exploration (LBDE) has been

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utilized as an alternative option. It's efficacy has been supported by medical evidence[6,7] and it has been practiced in some centers, as the mainstay management of CBD stones.[5,8,9] Studies have shown that in many aspects it is comparable to endoscopic treatment. Benefits include a shorter treatment period and the possibility of removing the gallbladder in the same session.[6,7,10] It follows then, that in locations, where specialized endoscopic equipment is lacking, but general laparoscopic equipment is readily available, LBDE appears to be a plausible solution for difficult CBD stones. The aim of this study was to explore the safety and effectiveness of LBDE treatment for patients affected by difficult CBD stones.

MATERIALS AND METHODS

The target population were patients with difficult CBD stones, who were treated with LBDE in Sawanpracharak Hospital from September 2015 to December 2016. The methods that were utilized to detect the presence of CBD stones in the bile duct were endoscopic retrograde cholangiography (ERC), magnetic resonance cholangiopancreatography (MRCP) or ultrasonography (US).

Classification criteria for classifying the stones as "difficult CBD stones" included if stone's diameter was ≥ 15mm, if the numbers of stones was more than 10, if the CBD stone(s) could not be completely cleared in one session of endoscopic treatment (endoprothesis- stent inserted during sessions), and finally if the bile duct could not be accessed after one or two attempts.

The data collected included sex, age, classification of difficult CBD stones as described above, bile duct diameter (as acquired from ERC and MRCP), duration of operation in minutes, if the case was converted to open surgery (inclusing reason), usage of T tube and/or drain, length of hospital stay and any complications.

Data Collection and Statistical Analysis

Data was retrospectively acquired from our database utilizing endoscopic data collection software (Endosmart, Kainatic engineering Co., Ltd., Thailand) and hospital records.

Data was expressed using mean ± standard deviation or percentage concurrently with a 95% confidence interval.

This study was approved by the Sawanpracharak Hospital Medical Ethics Committee (Certification number: 14/ 2560).

RESULTS

There were a total of fifteen patients included. Characteristics of the patients were summarized in Table 1 concurrently with the respective- definition of difficult CBD stones. Most of the LBDE results indicated that the stones were too large to be cleared by general endoscopic equipment. All except two patients, were diagnosed as having difficult CBD stones by ERC and preliminarily treated with biliary stent insertion. In respect of the two patients, accessing of bile duct failed in both cases due to excessively redundant duodenal folds resulting in failure to identify the ampulla's opening. MCRP and ultrasound for CBD stone detection was then utilized for investigation and confirmation in these cases.

There was one case where three attempts of ERC and stone removal were performed, before resorting to LBDE. In three cases, during the LBDE session, open surgery was deemed necessary, due to the detection of Mirizzi's syndrome, cholecysto-biliary fistula type (Corlette Classification type II[11]) and Csendes classification of at least type III since it involved more than two thirds of common bile duct diameter.[12] In only one case, was the pathology suspected during ERC as it was indicated by impacted stones in the cystic duct junction area. In another two cases, ERC only revealed the presence of numerous stones filling the proximal part of the bile duct which narrowed distally.

The results of LBDE were displayed in Table 2 and all the patients' data was summarized in Table 3. On average, the patients were 67.3 ± 23.3 years of age, ranging from 26 to 92 years of age. The patients were mostly male (60 %). The average duration of operation was 169 (± 39.9) minutes or approximately three hours. The conversion rate to open surgery was 20 % (three cases). All three patients subsequently had their bile ducts reconstructed with Roux-en-Y hepaticojejunostomy.

All but three patients treated with LBDE were discharged after approximately one week. One of the three LBDE patients with an extended stay in the hospital suffered a superficial surgical site infection.

T-tubes were inserted in two patients because of an inability to pass a choledochoscope into the duodenum (uncertain of bile duct stricture). Nevertheless, T-tube cholangiograms were done and showed no stricture and no retained stones in both cases. The tubes were then subsequently withdrawn.

Tube drains were inserted in four patients because of contaminated operative field. Three patients with tube drains were hospitalized for more than a week and one of them contracted an *Escherichia Coli* wound infection.

All the bile duct stones in the fifteen patients were successfully cleared during the surgical session and no further endoscopic treatment was required. There was no mortality. Morbidity rate was 8.3% (one case). Although quite high proportionally, it only had to be treated by local wound drainage and intravenous antibiotics.

TABLE 1. Characteristic of patients, endoscopic findings and number of session.

No	Sex	Age	Definition of difficult CBD stone	CBD size (cm)	ERCP session before surgery
1	Male	81	Number 2-3, Size 1.5 -2 cm	2	1
2R	Male	40	Number 2, Size 1 and 2 cm, cystic duct junction impaction	2	1
3	Female	86	Number 1, Size 1.5 cm	1.5	1
4	Male	92	Number 4-5, Size 1 - 2 cm	1.8	1
5	Male	74	Number 1, Size 1.5 cm	1.5	1
6	Female	87	Failed endoscopi bile duct cannulation*	1.2	1
7	Male	82	Number 2-3, Size 1 - 1.5 cm	1.5	1
8	Female	38	Number >5, Size largest 1.5 cm	1.5	3
9R	Male	26	Number 3-4, Size largest 1.5, Narrowed distal bile duct	1.5	1
10	Female	84	Failed endoscopi bile duct cannulation†	1.8	1
11R	Female	45	Number >5, Size 1 - 1.2	1.2	1
12	Male	46	Number 1, Size 1.5 cm, abnormal ampullar location	1.5	1
13	Male	50	Number 1, Size 1.5, Narrowed distal bile duct	1.8	1
14	Female	92	Number >5, Size 1 - 1.5 cm	2	1
15	Male	86	Number >5, Size 1 - 1.5 cm	1.8	1

* CBD stones was confirmed by MRCP, † CBD stones was confirmed by US, R Mirizzi syndrome was later diagnosed

TABLE 2. Results of laparoscopic bile duct exploration.

No	Sex	Age	Operative time (Minutes)	Hospital stay (Days)	Complication (Yes/No)	Conversion (Yes/No)	T tube (Yes/No)	Drain (Yes/No)
1	M	81	125	7	No	No	No	No
2*	M	40	-	-	-	Yes	-	-
3	F	86	180	16	Yes	No	No	Yes
4	M	92	210	11	No	No	No	Yes
5	M	74	180	16	No	No	Yes	Yes
6	F	87	110	5	No	No	No	No
7	M	82	165	6	No	No	No	No
8	F	38	240	4	No	No	No	No
9*	M	26	-	-	-	Yes	-	-
10	F	84	210	7	No	No	No	No
11*	F	45	-	-	-	Yes	-	-
12	M	46	180	4	No	No	Yes	No
13	M	50	170	5	No	No	No	No
14	F	92	115	3	No	No	No	No
15	M	86	150	7	No	No	No	Yes

* Converted to open surgery subjects.
Abbreviations: M = Male, F = Female

TABLE 3. Summary of the results of laparoscopic bile duct exploration.

	Mean (± SD)	95% Confidence Interval
Age (Years)	67.3 (± 23.3)	54.4 - 80.2
Sex (Male): N (%)	9 (60.0)	32.3 - 83.7
Operative time (Minutes)	169 (± 39.9)	144.3 - 194.9
Hospital stay (Days)	7.6 (± 4.4)	4.8 - 10.4
Conversion: N (%)	3 (20.0)	4.3 - 48.1
Complication: N (%)	1 (8.3)	2.1 - 38.5
Drain: N (%)	4 (33.3)	9.9 - 65.1
T tube: N (%)	2 (16.7)	2.1 - 48.4

* In total 12 patients, converted to open surgery subjects excluded

DISCUSSION

CBD stone treatment has been changing and advancing for many decades. In the past, the common approach was bile duct exploration during open surgery. Not only could this procedure clear CBD stones but it could also remove gallstones in the same operation. The results were also excellent, with very low morbidity and mortality.[13] Later, laparoscopic cholecystectomy (LC) was introduced and proved to set a new standard of surgical management.[14] With greater technological advances in the field of endoscopy, endoscopic treatment has also been accepted and proven as a complementary procedure[1,2] These two procedures, when combined, are not only highly effective, but also on par with the current trend of minimally invasive procedures. Today, surgeons have gained greater experience in laparoscopic surgery while concurrently witnessing the introduction of more sophisticated laparoscopic equipment. Thus, laparoscopic bile duct exploration has now returned as an attractive option for dealing with patients with CBD stones, with the additional benefit of being able to remove the gallbladder in the same session.

Studies, including systematic review and meta-analysis, have shown the advantages of LBDE over endoscopic (combined with LC) being a single-stage approach, requiring a shorter hospital stay and incurring lower medical costs, with comparable efficacy regarding stone clearance. It is also safe with no difference in morbidity, mortality and incidence of retained stones.[6,7,10] However, although the term "single stage approach" is appealing, studies revealed that the single stage approaches incurred high costs of investigation, such as MRCP or CT to confirm the existence of CBD stones before surgery.[5, 8]

LBDE also required a prolonged learning curve for acquisition of the requisite laparoscopic skills.[5] Furthermore, in a situation where the stones are detected in a small bile duct, the trans-cystic approach, which requires more sophisticated laparoscopic instruments and/or a small sized choledochoscope, appears to be more suitable than the trans-ductal approach.[15] Nevertheless, considering the divergent views and opinions in medical reviews and textbooks, there is to date no "best" approach for dealing with CBD stones. The approach should therefore depend on the situation and resources available in each individual institute, such as whether specialists and /or facilities are available or not.[5,13]

In the context of Sawanpracharak Hospital, there are adequate facilities readily available to treat CBD stones endoscopically, although if the stones are classified as difficult[3], the endoscopic capability is limited. Laparoscopic instruments are readily available, though there is a lack of some instrumentation (e.g. no miniature choledochoscope to retrieve CBD stones in small sized bile duct). For these reasons, within the context of this situation, endoscopic treatment appears to be a suitable choice to treat non-difficult CBD stones especially in small sized bile duct whereas LBDE, trans-ductal approach, should be the preferred alternative in cases of difficult CBD stones.

From our results, LBDE appears to be both safe and effective. There was only one minor (and treatable) complication without necessitating further invasive intervention and no mortality resulted. LBDE can also be performed with minimal risk for elderly patients who comprised the majority of the target sample in our study. Most patients could return home in about one week. For all cases, stones were cleared in only one session of surgery without further treatment.

There was a high incidence of patients with Mirizzi's type II syndrome (Csendes classification type III or greater[12]). ERC failed to detect the likelihood of this

condition in two out of three patients. In other studies, difficulties were reported in diagnosing this syndrome preoperatively, and for ERC detection rate was around 55 to 90%.[16] Even if combined with MRCP, detection rate would still be only 68.5%.[17] In one of our patients, this condition was suspected from ERC and computer tomography was done, but this also failed to confirm the presence of this pathology. The high rate of conversion might primarily be due to the fact that only extreme cases were selected for LBDE. Coupled with the difficulty of preoperative diagnosis, physicians who are willing to adopt this approach should be prepared to deal with potential challenges.

Not only was there a high rate of conversion, but most of the gallbladders in this group of patients appear to have been difficult. Although this could not be displayed as a variable, it is reflected in the operation times. The length of the surgeries, at nearly three hours on average, is a likely indicator of the level of difficulty involved. Close to half of the duration of the procedures were dedicated to dealing with the gallbladders.

With regard to T tubes and tube drains, a systematic review reported against the routine usage of T tubes.[18] In this study, T tubes were inserted in only two cases. However, most of the subjects had already undergone endoscopic sphincterotomy during ERC. A positive result without T tube insertion might not be possible in general cases. Although all four cases with tube drain required longer hospital stays, this author suggests that intra-operative pathology rather than the tube itself was the operative cause for their prolonged stay.

Admittedly, there are some limitations in this study. Firstly, regarding, methodology, the study was only a small, observational study in the absence of a more sizable group, which was reflected in the wide 95% confidence interval. Secondly, the study was focused on a single hospital with a potentially unique availability of resources. Lastly, the medium-long term results are not yet available.

CONCLUSION

LBDE with trans-ductal approach appears to be both a safe and effective management for patients with difficult CBD stones. It should be noted that this subgroup of patients represented extreme cases. Accordingly, physicians who are willing to adopt this approach should be aware of and anticipate problems arising from both difficult gallbladder and difficult bile duct pathology entailing reconstruction. In order to establish and confirm treatment efficacy, a further and larger scale study is required.

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