

## ORIGINAL ARTICLE

# Laparoscopic common bile duct exploration for elderly patients: as a first treatment strategy for common bile duct stones

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**Purpose:** Common bile duct (CBD) stone is a relatively common disease in elderly patients. There have been many reports about the efficacy and safety of LCBDE. But for elderly patients, only a few studies about its efficacy and safety exist. The aim of this study is to evaluate the efficacy, safety and the surgical outcome of LCBDE in patients who are 70 years or older and compare the results with those of the younger group. **Methods:** From January 2000 to November 2009, 132 patients underwent LCBDE. We divided these patients into two groups according to age and conducted a retrospective analysis. The elderly group included patients who were 70 years old or older (n = 64), and the younger group included those who were younger than 70 (n = 68). The elderly group was compared to the younger group with respect to their clinical characteristics, operation time, postoperative hospital stay, open conversion rate, first meal time, postoperative complication, recurrence rate and mortality. **Results:** The elderly group showed high American Society of Anesthesiologists score (2.2 vs. 1.9) (P = 0.003), preoperative morbidity (47 vs. 29) (P < 0.001), and previous abdominal operation (18 vs. 14) (P = 0.046). There were no significant differences in mean operation time, postoperative hospital stay, first meal time, recurrence rate, remnant stone, complication rates or mortality in both groups (P > 0.05). **Conclusion:** LCBDE is a safe and effective treatment modality for CBD stones not only for younger patients but also for elderly patients.

**Key Words:** Laparoscopic common bile duct exploration, Common bile duct stone, Aged

## INTRODUCTION

Economic and social development has brought about a longer life expectancy for man. The increasing age of the population leads to an increasing prevalence of comorbid disease such as cardiovascular disease, diabetes mellitus, pulmonary disease, etc. Cholelithiasis is also a common

disease for elderly people. Common bile duct (CBD) stone is one of the most common complications in cholelithiasis and occurs in 10% to 15% of the patient pool. It occurs more frequently with advanced age [1,2]. This results in an increasing number of biliary tract operations for older and higher risk patients.

The advent of endoscopic retrograde cholangiopan-

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creatography (ERCP) with endoscopic sphincterotomy (ES) enables elderly patients to avoid open CBD exploration dramatically reducing their morbidity and mortality [3]. The development of laparoscopy surgery has also dramatically changed the field of biliary surgery. Laparoscopic cholecystectomy (LC), has been used as a gold standard for cholecystectomy since its introduction [4]. Many studies have reported on the safety of LC for elderly patients [5-8]. However, in the case of laparoscopic CBD exploration (LCBDE), more operating time is required and its procedure is relatively complicated compared to LC. For this reason, there are many reports about the efficacy and safety of LCBDE compared to ERCP with LC or without LC [3,9-11]. But for elderly patients, there are only a few studies about its efficacy and safety [12]. ERCP also has a lot of complications and indication limits due to self-risk, especially in elderly patients with comorbidity. Finally, we should be concerned with the treatment of CBD stone disease with cholangitis in elderly patients.

The aim of this study is to evaluate the efficacy, safety and the surgical outcome of LCBDE in patients who are 70 years or older and compare the results with those of the younger group.

## METHODS

From January 2000 to November 2009, 132 patients underwent LCBDE at the Department of Surgery, Ewha Womans University Mokdong Hospital, Seoul, Korea. We divided these patients into two groups and conducted a retrospective analysis. All patients were diagnosed with abdominal computed tomography (CT), ERCP or magnetic resonance cholangiopancreatography (MRCP), informed about their health conditions whereupon they agreed to the surgical procedure before the operation. We performed LCBDE for the patients 1) who had contraindication for ERCP with ES, 2) who had failed ERCP with ES, 3) who had multiple CBD stones or large impacted CBD stone, 4) who had concurrent intrahepatic stones, 5) who had CBD stricture. And for the other cases, ERCP with ES was performed as a first treatment modality.

The elderly group (group A; age  $\geq$  70) was compared to

the younger group (group B; age  $<$  70) with respect to their clinical characteristics (sex, age, height, body weight, comorbidity, American Society of Anesthesiologists [ASA] score, previous abdominal operation history), operation time, postoperative hospital stay, conversion rate to open surgery, first meal time, postoperative complication, recurrence rate of CBD stones, and mortality.

Operations were performed by two surgeons. Levin tube and Foley catheter were inserted before operation. We isolated cystic duct and cystic artery and dissected gallbladder from liver first, using a 10-mm trocar in the subumbilical area for camera port, a 10-mm trocar in the epigastric area, and a 5-mm trocar in the right upper abdomen as a working port. After this procedure, another 10-mm trocar was inserted in the right subcostal area, which was used for choledochoscope and stone removal. After another working port insertion, cystic ducts were pulled with laparoscopic grasper to easily expose CBD and CBD was opened longitudinally, approximately 1 to 1.5 cm with laparoscopic scissors. After the identification of CBD stones through a 5-mm flexible choledochoscope, we removed them by flushing method with sterile saline, stone basket, Fogarty catheter, and/or electro-hydraulic lithotripsy. After the stone removal, the choledochotomy site was closed by continuous suture, using vicryl 3-0, with or without T-tube insertion and cholecystectomy was performed. After this, we ended the operation with 6-mm penrose drain insertion into the operation site. For the patients with T-tube, we performed cholangiography through T-tube seven days after operation to identify any remnant stones. If residual stones were identified, they were removed through T-tube under local anesthesia. But if there was no abnormality, T-tube was removed immediately after cholangiography. Mostly T-tubes were used prior to 2006. Recently, with the development of choledocoscope, there are fewer instances of uncertainty as to complete elimination stones, which was one of the results of T-tube insertion after LCBDE. Thus, we had inserted T-tubes in only some cases, such as possibility of postoperative stricture or transient outflow obstruction due to severe inflammation existing since 2006.

In respect to patients' follow-up, we gave patients physical examinations and performed laboratory tests within

the first 3 months after surgery. After that, we followed up with these patients with 3-month intervals for 1 year. After this period, patients were followed up by physical exam and laboratory test with 6-month intervals. Abdominal ultrasound was performed at 6 months and 12 months after surgery. If there were unusual findings in these tests, we performed abdominal CT or magnetic resonance imaging.

Statistical significance was analyzed using the chi-square test, Student's t-tests.  $P < 0.05$  was considered as positive finding.

## RESULTS

During the study period, a total number of 132 patients underwent LCBD for CBD stones in our hospital. This population comprised 70 (53.0%) males and 62 (47.0%) females with a mean age of  $66.9 \pm 15.1$  years (range, 28 to 92 years). We divided these patients into two groups according to age. Sixty-four Patients (group A) were 70 years old or older with mean age of  $78.9 \pm 6.3$  years (range, 70 to 92 years), otherwise 68 patients (group B) were younger than 70 years with mean age of  $55.6 \pm 11.8$  years (range, 28 to 69 years). In terms of male to female ratio, mean height, weight, and follow-up duration, there were no significant differences (Table 1).

Preoperative status is presented in Table 2. In terms of preoperative risk factors, group A had significantly higher comorbidities than group B ( $P < 0.001$ ). Cardiovascular disease, diabetes mellitus, pulmonary disease, renal insufficiency and rheumatoid arthritis were significantly more frequent in group A ( $P < 0.05$ ). However, in the case

**Table 1.** Demographic data

Variable	Total	Group A	Group B	P-value
No. of patients	132	64	68	
Male : Female	70 : 62	32 : 32	38 : 30	0.349
Mean age (yr)	$66.9 \pm 15.1$	$78.9 \pm 6.3$	$55.6 \pm 11.8$	<0.001
Age range (yr)	28-92	70-92	28-69	
Height (cm)	$160.1 \pm 9.3$	$157.3 \pm 8.2$	$162.6 \pm 9.6$	0.229
Weight (kg)	$59.8 \pm 11.6$	$55.2 \pm 9.2$	$64.2 \pm 11.7$	0.165
Follow-up duration (mo)	$18.6 \pm 23.4$	$16.28 \pm 19.4$	$20.8 \pm 26.6$	0.264

Values are presented as mean  $\pm$  SD or number.

of liver disease, there was no significant difference between the two groups ( $P = 0.202$ ). ASA score was also higher in group A ( $P = 0.003$ ). Previous abdominal operation histories involving the upper abdomen and upper with lower abdomen were significantly more frequent in group A. There was gastrectomy, laparoscopic or open cholecystectomy for upper abdominal operation, while there was appendectomy, cesarean section, hysterectomy and inguinal herniorrhaphy for lower abdominal operation. One patient had a history of gastrectomy and appendectomy.

The mean operation time was  $187.0 \pm 60.4$  minutes in group A and  $176.5 \pm 53.2$  minutes in group B, but there was no significant difference ( $P = 0.684$ ). For the time until first meal and postoperative hospital stay, there were no significant differences between the two groups. For remnant stone cases, there were two cases in group A and B, respectively. In three cases, remnant stones were cleared through T-tube under local anesthesia. For the remaining case, stone was removed by itself. No significant difference was observed in the incidence of recurrent stone, which occurred two cases (3.1%) in group A and one case (1.5%) in group B. For the stone removal, Roux-en-Y Hepatico-jejunostomy was performed in two cases and ERCP was performed in one case. There were two cases of conversion to open surgery in group B. In one case, it was performed owing to the possibility of malignancy. In the other case, it was performed because of severe stricture,

**Table 2.** Preoperative status

Variable	Group A	Group B	P-value
Preoperative risk factors <sup>a)</sup>	47	29	<0.001
Cardiovascular disease	35	22	0.008
Diabetes mellitus	15	8	<0.001
Liver disease	3	5	0.202
Pulmonary disease	5	2	0.012
Renal insufficiency	2	0	0.003
Rheumatoid arthritis	1	0	0.038
ASA score (mean)	2.2	1.9	0.003
Previous abdominal operation			0.046
Upper abdomen	13	8	0.007
Lower abdomen	4	6	0.267
Upper with lower abdomen	1	0	0.038

ASA, American Society of Anesthesiologists.

<sup>a)</sup>Includes repeated count on the same patient.

**Table 3.** Operation results

Variable	Group A	Group B	P-value
Operation time (min)	187.0 ± 60.4	176.5 ± 53.2	0.684
First meal time (day)	3.0 ± 1.6	2.68 ± 2.1	0.668
Postoperative hospital stay (day)	11.6 ± 6.3	10.5 ± 7.0	0.997
Remnant stone	2 (3.1)	2 (2.9)	0.903
Recurrent stone	2 (3.1)	1 (1.5)	0.205
Open conversion	0 (0.0)	2 (2.9)	0.005

Values are presented as mean ± SD or number (%).

which had been caused by a previous operation (Table 3). We could identify the type, size and number of CBD stones only for one third of all patients by patients' record review. The most common type of CBD stone was black pigment stone (58.1%) and the second most common type was calcium bilirubinate stone (16.3%). And their mean numbers were 4.0 in group A, and 2.5 in group B ( $P = 0.22$ ). The mean size of CBD stones was 13.1 mm in group A, and 10.1 mm in group B ( $P = 0.093$ ).

No significant difference in the rate of postoperative complication was observed between two groups ( $P = 0.085$ ) (Table 4). The overall incidence of complication was 18.8% in group A and 13.2% in group B. There was one case of postoperative pulmonary edema in group B. Three cases of pneumonia and one case of pleural effusion occurred in group A. They all recovered through conservative treatment. Bile leakage was observed two cases in group A and four cases in group B. For five patients, we performed endoscopic nasobiliary drainage. For the remaining one patient, we performed percutaneous drainage because of observed biloma. An intraabdominal abscess was observed and recovered through conservative treatment in group B. In group B, one patient had postoperative jaundice. She was confirmed as postoperative CBD stricture by T-tube cholangiography and transferred to another hospital by her own accord. There was one case of postoperative ileus, ileocolitis, respectively, in group B. Fever occurred three cases in group A and in one case in group B. Urinary retention was observed in two cases in group A. The overall incidence of mortality was 3.1% in group A and 1.5% in group B. However, there was no significant difference between two groups in mortality ( $P = 0.205$ ). In

**Table 4.** Complication and mortality

Variable	Group A	Group B	P-value
Postoperative complication	12 (18.8)	9 (13.2)	0.085
Pulmonary edema	0	1	0.051
Pneumonia	3	0	<0.001
Pleural effusion	1	0	0.038
Bile leakage	2	4	0.129
Intraabdominal abscess	0	1	0.051
CBD stricture	0	1	0.051
Postoperative ileus	1	0	0.038
Ileocolitis	0	1	0.051
Fever	3	1	0.031
Urinary retention	2	0	0.003
Mortality	2 (3.1)	1 (1.5)	0.205

Values are presented as number (%).

CBD, common bile duct.

group A, there were two mortality cases, where one of them occurred from pneumonia 29 days after the operation in a patient who had had steroid and cytotoxic medications because of rheumatoid arthritis (RA). In this patient, RA had been well controlled and CBD inflammation was not severe, so we tried LCBDE as a first treatment strategy. The other mortality occurred eight days after the operation from a sudden respiratory failure in a patient who had a well-controlled asthma history. In group B, mortality occurred from hepatic failure in a patient who had had jaundice and severe depressed liver function because of severe CBD obstruction due to multiple CBD stones. Because of depressed liver function, ERCP was tried first, but failed. Despite successful CBD stone removal, he expired 11 days after the operation.

## DISCUSSION

Gallstone is a common disease for elderly patients. CBD stone is one of the most common complications in cholelithiasis and occurs in 10 to 15% of these patients [1,2]. It occurs more frequently with advanced age. Also, the risk of complications such as acute cholecystitis, cholangitis, increases with age [13]. This results in significant morbidity and mortality, especially for elderly patients. After operation for these patients, cardiovascular disease was re-

ported as the most common cause of death [14]. In another study, it was reported that mortality was much higher in cases of emergency operation for the elderly than that of elective operation [13,15].

After the introduction of ERCP, single ERCP with ES or ERCP with ES followed by cholecystectomy enables elderly patients to avoid the burden of major operative risk and to relieve cholangitis symptoms. With the diffusion of laparoscopic surgery, ERCP with ES followed by LC has become a generalized method and their efficacy and safety has been compared to those of LCBDE [3,9-11]. Tranter and Thompson [3] reported the combined morbidity rate for ERCP with ES followed by LC was from 1% to 19% (median, 13%) and from 2% to 17% (median, 8%) for LCBDE. In the case of ERCP with ES or ERCP with ES followed by cholecystectomy, there can be bleeding, pancreatitis, duodenal perforation, sepsis as short-term complications and stenosis of the sphincter of Oddi, cholangitis associated with duodenal content reflux as long-term complications. An increased risk of cholangiocarcinoma related to postsphincterotomy cholangitis was also reported [16-18]. However, we can avoid complications such as pancreatitis, stenosis of the sphincter of Oddi and cholangitis associated with duodenal content reflux in the process of LCBDE because sphincter of Oddi is preserved.

Similar to LC, LCBDE has an advantage of less postoperative pain, short duration of hospitalization and early return to society. Already, LC replaced open cholecystectomy (OC) as the gold standard treatment for acute cholecystitis. Many studies reported safety and efficacy of LC for elderly patients [5-8]. However, in the case of LCBDE, more studies relating to elderly patients are needed, because operation takes more time and the procedure is relatively complicated, compared to LC.

LCBDE, which replaced OCBDE, is a relatively complicated procedure, because it must be performed with a variety of techniques under laparoscopy. So it is considered as a demanding technique with a long learning curve [19]. Nevertheless, it has been reported that LCBDE is superior to ERCP with LC in terms of patient risk and cost effectiveness [3,20], because it can be performed during a single procedure. Choleidoscope, is useful for removing a large stone, which is difficult for ERCP, and easier to in-

spect CBD.

In our study, no significant difference was observed in operation time between the young and elderly groups. Paganini et al. [12] previously reported 165 minutes (mean) for operation time in elderly group and 148 minutes (mean) in younger group, also with no significant difference. However, our operation time was about 25 minutes longer than that of the previous study in the younger and elderly patients groups. This may have been due to the operative procedure. We performed LCBDE only through the transcholedochal method, for all cases. Although the transcholedochal approach is a demanding technique with a long learning curve compared to the transcystic approach, multiple stones as well as large stones can be removed more easily, which cannot be done with the transcystic method. Prior to 2006, T-tubes were routinely used. After this period, we inserted T-tubes only in some cases, such as possibility of postoperative stricture or when transient outflow obstruction due to severe inflammation existed. There have been some reports on the necessity of T-tube insertion after CBD exploration. According to those reports, primary closure choledochostomy after CBD exploration can prevent the disadvantages associated with T-tube use and shorten hospital stay. Additionally, with the development of the choledoscope, there are fewer instances of uncertainty as to complete elimination stones after primary closure [21-23]. So we have routinely performed primary closure without T-tube insertion after LCBDE since 2006, except in some special cases. In our study, the mean hospital stay was 13.4 days in T-tube insertion group (n = 76), and 7.8 days in primary closure group (n = 56). There was a significant difference between two groups in hospital stay ( $P < 0.001$ ). However, the follow-up methods were the same for both groups, as mentioned above.

In the previous report, the length of hospital stay was slightly longer for the elderly than for the younger group, possibly because of high preoperative risk factors for the elderly, which influence recovery time [12]. In this study, however, post operative hospital stay, complication and first time to meal were not significantly different between the two groups, while preoperative risk factors and ASA score were significantly higher in the elderly group than

those of the younger group. Among complications for younger patients, there was one case of intraabdominal abscess and one of CBD stricture. Their length of hospital stay was 43 days and 31 days, respectively. This contributed to the longer duration of hospital stay for younger patients in our study.

LCBDE must be attempted for CBD stone in elderly patients but for the patients with severe comorbid disease such as myocardial infarction or with emergency situation such as severe cholangitis, it must be considered carefully.

LCBDE is a safe and effective treatment procedure for CBD stone not only for younger patients but also for elderly patients. Therefore, LCBDE must be considered as a first strategy also for elderly patients who have CBD stones. However for patients with severe comorbid disease or for emergency patients it must be performed carefully as with other operation strategies.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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