

Management of choledocholithiasis: Comparison between laparoscopic common bile duct exploration and intraoperative endoscopic sphincterotomy

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Abstract

AIM: Choledocholithiasis is present in 5 to 10 percent of patients who have cholelithiasis. In the area of laparoscopic cholecystectomy (LC), laparoscopic common bile duct exploration (LCBDE) and intraoperative endoscopic sphincterotomy (IOES) have been used to treat choledocholithiasis. The purpose of this study was to compare the clinical outcomes and hospital costs of LCBDE with IOES.

METHODS: Between November 1999 and October 2002, patients with choledocholithiasis undergoing LC plus LCBDE (Group A, $n=45$) were retrospectively compared to those undergoing LC plus IOES (Group B, $n=57$) at a single institution.

RESULTS: Ductal stone clearance rates were equivalent for the two groups (88 % versus 89 %, $P=0.436$). The conversion rate was higher for Group B (8.8 % versus 4.4 %, $P=0.381$), as was the morbidity (12.3 % versus 6.7 %, $P=0.336$). There were no other significant differences between the two groups. The complications were mainly related to endoscopic sphincterotomy (ES), and the hospital costs were significantly increased in this subset of Group B (median, 23 910 versus 14 955 RMB yuan, $P=0.03$). Although hospital stay was longer in Group A (median, 7 versus 6 days, $P=0.041$), the patients in Group A had a significantly decreased cost of hospitalization compared with those in Group B (median, 11 362 versus 15 466 RMB yuan, $P=0.000$).

CONCLUSION: The results demonstrate equivalent ductal stone clearance rates for the two groups. LCBDE management appears safer, and is associated with a significantly decreased hospital cost. The findings suggest LCBDE for choledocholithiasis is a better option.

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INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the standard

method for cholecystectomy, but the same cannot be said of the management of choledocholithiasis. There is still no standard algorithm. Laparoscopic common bile duct exploration (LCBDE) and intraoperative endoscopic sphincterotomy (IOES) have been used to treat choledocholithiasis for many years in clinical practice^[1-6]. The purpose of this study was to determine the most cost-effective approach for patients with choledocholithiasis.

MATERIALS AND METHODS

Between November 1999 and October 2002, patients with choledocholithiasis undergoing LC plus LCBDE (Group A, $n=45$) were retrospectively compared to those undergoing LC plus IOES (Group B, $n=57$) at a single institution.

The clinical demographic details and the pretreatment biochemical findings are shown in Table 1. There were no significant differences between the groups. Preoperative investigations included liver function tests and external ultrasound examination of the gallbladder and bile duct. Four patients in Group A underwent preoperative ERCP. Endoscopic sphincterotomy (ES) was unsuccessful in three patients, and another ERCP was performed but no stones were found. Five patients in Group B underwent preoperative ERCP. ES was not performed in two patients. The three other patients underwent ERCP but no stones were found.

Table 1 Clinical and demographic details in patients of groups A and B

	Group A	Group B
Total no.	45	57
Age range (yr)	29-79	18-75
Male patients	17	20
Female patients	28	37
Abnormal LFTa	40	38
Jaundice	18	19
Acute cholecystitis	19	12
Pancreatitis	11	6
Preoperative ERCP	4	5

a: Liver function test.

Laparoscopic ductal stone clearance was performed either by the transcystic duct route ($n=10$) or by direct CBDE with placement of T-tube ($n=35$). Intraoperative cholangiography (IOC) was done in all patients. Complete clearance of the ductal stones was determined by the end of IOC. The necessity to convert to a different technique or the presence of an unexpected retained stone was considered as a failure. LCBDE was performed at the same institution by experienced surgeons. Two experienced gastroenterologists performed IOES^[5,6]. The exact technique was left up to the individual physician.

All hospital cost data were obtained from the hospital admission department. The cost of complications the patients

incurred was included in the cost data. If LCBDE or IOES failed and the patient required postoperative ES or chledochoscopy through the sinus tract, the cost of that intervention was included. The cost of additional anesthesia or IOC was also included.

Data and statistical analysis

Statistical analysis was performed using chi square test with a likelihood ratio and Mann-Whitney test for nonparametric data. Significance was set at the 5 % level.

RESULTS

Outcome of Group A (LCBDE)

Ductal stone clearance was successful in 40 out of 45 patients (88 %). There were two cases of conversions to open surgery (4.4 %)(Table 2). One patient had large impact stones, the other had multiple stones. Two patients (4.4 %) had unexpected retained stones, one requiring ES at readmission, the other choledochoscopy through the sinus tract.

Postoperative complications occurred in 3 patients (6.7 %)(Table 3). Two patients had infection around the T-tube, and the other had bile leak after the T-tube was removed.

The cost ranged from 6 979 to 23 813 RMB yuan with a median 11 362 RMB yuan (Table 2). Of the 42 patients having uncomplicated hospital stays, the median cost was 11210 RMB yuan compared with a cost of 15121 RMB yuan for the three patients with complications (Table 4). The hospital stay ranged from four to eighteen days with a median stay of seven days. The median postoperative stay was four days (range, 2-14)(Table 2).

Outcome of Group B (IOES)

Ductal stone clearance was successful in 51 out of 57 patients (89 %). There were five cases of conversions to open surgery (8.8 %)(Table 2). One had a microperforation of the duodenum, one had bleeding at the sphincterotomy, and the other three patients had unsuccessful ES. One patient (1.8 %) had an unrecognized retained stone and required ES at a second admission.

Seven cases had complications (12.3 %)(Table 3). Three patients developed pancreatitis, two of them had severe pancreatitis, and the other required open surgery for an abdominal abscess that resulted in a 51-day hospital stay

with a cost of 133 239 RMB yuan. Two patients developed postoperative pneumonia.

The cost ranged from 8 823 to 133 239 RMB yuan with a median of 15 466 RMB yuan (Table 2). Of the 50 patients having uncomplicated hospital stays, the median cost was 14 955 RMB yuan compared with a cost of 23910 RMB yuan for the seven patients with complications (Table 4). The hospital stay ranged from 2 to 51 days with a median stay of six days. The median postoperative stay was three days (range, 1-51)(Table 2).

Table 3 Morbidity of two groups

	Group B	Group A
Patient no(%)	7 (12.3)	3 (6.7)
Bleeding	1	
Microperforation	1	
Pancreatitis	3	
Pneumonia	2	
Infection with t-tube		2
Bile leak		1

Comparison of clinical outcome and hospital costs of two groups

Statistical analysis and comparison between Groups A (LCBDE) and B (IOES) are presented in Table 2.

The ductal stone clearance rates were equivalent in the two groups (88 % versus 89 %, $P=0.436$). The conversion rate was higher in Group B (8.8 % versus 4.4 %, $P=0.381$), as was the morbidity (12.3 % versus 6.7 %, $P=0.336$). The operating time was shorter in Group B (median, 155 min versus 180 min, $P=0.661$). But there were no significant differences between the two groups. Although the hospital stay was longer in Group A (median, 7 versus 6 days, $P=0.041$), the patients in Group A had a significantly decreased cost of hospitalization compared with those in Group B (median, 11 362 versus 15 466 RMB yuan, $P=0.000$), and the hospital costs significantly increased in complicated Group B (Table 4).

DISCUSSION

The presence of common bile duct stones (CBDS) significantly increases the morbidity, mortality, and cost of patients with gallstones. The potential complications of choledocholithiasis,

Table 2 Comparison of clinical outcome and cost between groups A and B

	Group A	Group B	χ^2 (Z)	P value
Ductal stone clearance (%)	88	89	0.607	0.436 ^b
Conversion to open surgery (%)	4.4	8.8	0.767	0.381 ^b
Morbidity (%)	6.7	12.3	0.927	0.336 ^b
Operative time(min)	180,130-220 ^a	155,130-210 ^a	(-0.439)	0.661 ^c
Hospital stay(days)	7,6-9 ^a	6,4,5-8 ^a	(-2.046)	0.041 ^c
Postoperative stay(days)	4,3-6 ^a	3,2-5 ^a	(-2.259)	0.024 ^c
Cost (RMB)	11362,10196-14822 ^a	15466,13555-17689 ^a	(-4.822)	0.000 ^c

a: Median, 25-75 % quartile range; b: Chi square test with a likelihood ratio; c: Mann-Whitney test.

Table 4 Comparison of cost with or without complication between two groups

	Without complication cost (RMB)	n	With complication cost (RMB)	n	P value
Group A	11210,10119-14380 ^a	42	15121,11706-19895 ^a	3	0.08 ^b
Group B	14955,12650-16793 ^a	50	23910,20746-111289 ^a	7	0.03 ^b
P value		0.000 ^b		0.000 ^b	

a: Median, 25-75 % quartile range; b: Mann-Whitney test.

cholangitis, and pancreatitis could be life-threatening^[7,8]. The safest and most cost-effective approach for patients with CBDS could decrease suffering and disability and save millions of health care us dollars each year^[9,10].

ES was first described in 1974. Today, ES for choledocholithiasis remains the most difficult and dangerous procedure routinely performed by endoscopists. The application of ES to CBDS was advocated for patients with cholangitis, acute biliary pancreatitis, and for elderly high-risk patients^[11]. Gong *et al* from China reported a ductal stone clearance rate of 91.7 % and a complication rate of 8.8 %^[12]. In our experience, the ductal stone clearance rate was 89 %, the morbidity was 12.3 %. Although IOES was performed by experienced gastroenterologists, it still resulted in procedure-related complications that could be life-threatening^[13-16]. The cost was significantly increased in complicated Group B (IOES) (median, 23 910 versus 14 955 RMB yuan, $P=0.03$)(Table 4), and the hospital stay was much longer.

Successful LCBDE has been reported in several large series in 57 to 98 percent of cases^[17]. Our experience compared favorably with these results. LCBDE was used in our recent management of choledocholithiasis for the vast majority of patients, whereas early IOES was more commonly performed in the past two years. The clearance rate in Group A (LCBDE) was 88 %, and the complication rate was 6.7 %. With the experience and new instrumentation, the limiting factor in successful LCBDE was not the CBD access but the CBD pathologic alterations such as large impact stones or multiple stones^[17].

On the other hand, Group A was associated with a significantly decreased cost of hospitalization compared with Group B (median, 11 362 versus 15 466 RMB yuan, $P=0.000$)(Table 2). The total hospital cost of Group B included two parts, and was higher even for uncomplicated patients (median, 14 955 versus 11 210 RMB yuan, $P=0.000$). The cost of complicated patients was significantly increased (Table 4). Therefore, a thorough evaluation and consideration of management options would reduce the risk of complications and the cost of CBDS management.

Although the hospital stay was longer in Group A (LCBDE), it was mainly related to postoperative stay (median, 4 versus 3 days, $P=0.024$) with placement of T-tube. Therefore, primary closure of CBD without T-tube would be more cost-effective.

The operation time was shorter in Group B (IOES) (median, 155 min versus 180 min, $P=0.661$). In most situations, we had to wait for gastroenterologists, and the waiting time was not included in the operation time. The actual procedure time was delayed, which partially contributed to an increased hospital cost^[18].

The results demonstrate that the ductal stone clearance rate was equivalent in the two groups. The conversion rate and morbidity were higher in Group B (IOES), and mainly related to ES. The hospital cost was significantly increased in complicated Group B patients. LCBDE management appears safer, and has no life-threatening complications, and can significantly decrease the hospital cost. The findings suggest LCBDE for CBDS is a better option.

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