



Laparoscopic common bile duct exploration in children is associated with decreased cost and length of stay: Results of a two-center analysis[☆]

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Received 30 September 2012; accepted 13 October 2012

Key words:

Common bile duct exploration;
Endoscopic retrograde cholangiopancreatography;
Laparoscopic cholecystectomy;
Choledocholithiasis

Abstract

Purpose: Our aim was to compare outcomes of children undergoing laparoscopic cholecystectomy with laparoscopic common bile duct exploration (LC+CBDE) to those undergoing laparoscopic cholecystectomy with adjunctive endoscopic retrograde cholangiopancreatography (LC+ERCP).

Methods: We performed a two-center retrospective chart review of all children (<18 years) undergoing LC+CBDE or LC+ERCP between January 2000 and July 2011. Wilcoxon test was performed on continuous variables and logistic regression modeling on categorical data. A *P* value < 0.05 was considered significant. Outcomes with a *P* value < 0.2 were selected for multivariable analysis.

Results: Forty-two patients were identified. Twenty-four (57%) underwent LC+ERCP, and eighteen (43%) underwent LC+CBDE. Demographic and clinical factors were well matched between groups. Total operative time was similar between groups (157 min vs. 152 min, *P* = .26). LC+CBDE patients had zero major complications and five minor complications (retained stone: 3, pancreatitis: 1, late recurrence: 1). LC+ERCP patients experienced two major complications (duodenal perforation: 1, bleeding requiring transfusion: 1), and four minor complications (pancreatitis: 2, retained stone: 2, *P* = .57). Median length of stay was significantly longer (15.7 days vs. 6.6 days, *P* = .02), and median hospital cost was significantly higher (\$18,132 vs. \$12,735, *P* < .01) in the LC+ERCP group. Multivariable analysis revealed that cost was significantly lower in patients undergoing LC+CBDE (*P* = .05, OR = 0.71; 95% CI: 0.51–0.97).

Conclusion: LC+CBDE at the time of cholecystectomy is associated with decreased length of stay, decreased cost, and has similar or improved morbidity compared to LC+ERCP.

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[☆] Presented at the meeting of the American Pediatric Surgical Association in San Antonio, TX, May 2012.

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The treatment algorithm for children with choledocholithiasis has not been well defined perhaps because of the relative rarity of the condition in children. It has been reported that cholelithiasis develops in only 0.13% to 0.22% of children [1] with choledocholithiasis occurring in 6% to 8% of these children [2].

The laparoscopic approach to choledocholithiasis presents the lowest overall morbidity and mortality compared to the open technique or endoscopic retrograde cholangiopancreatography (ERCP) in the adult literature [3]. Studies in children have supported common duct exploration (CBDE) at time of laparoscopic cholecystectomy (LC). However, these studies [4,5] are limited by a small number of patients and fail to adequately compare outcomes to LC+ERCP. Further, studies have demonstrated overall safety of ERCP in children with complication rates as low as 4% [6]. Therefore, the optimal treatment approach remains unknown.

In the paper, we report a two-center retrospective study on the management of children with choledocholithiasis to test the hypothesis that LC+CBDE versus LC+ERCP is associated with shorter length of hospital stay and lower overall cost.

1. Methods

1.1. Patients

A two-center (Cedars-Sinai Medical Center (CSMC) and Children's Hospital Los Angeles (CHLA)), retrospective review of all children (<18 years) undergoing LC+CBDE or LC+ERCP between January 2000 and July 2011 was performed. Charts were identified by CPT code 47564 or any combination of codes 47562–47564 and 43260–43273. IRB approval was obtained at both institutions (CHLA # 11-0051 and CSMC # 25387). All patients undergoing laparoscopic cholecystectomy with adjunctive ERCP and/or laparoscopic common duct exploration were included. No patients were excluded from the analysis. Patients undergoing laparoscopic common duct exploration were enrolled in the CBDE group even if ERCP was required. All patients underwent trans-cystic duct exploration.

Although there was some variability in procedure, all patients underwent laparoscopic trans-cystic duct exploration as previously reported [7]. In brief, after performing a ductotomy in the cystic duct, balloon dilation of the duct was performed due to the relative smaller size of the cystic duct in children in most instances. Dilatation was generally preceded by a dose of glucagon. A balloon of appropriate diameter was chosen, advanced into the cystic duct and dilated to five atmospheres. 25% Hypaque was used to fill the balloon for fluoroscopy. Balloons were typically left inflated for a period of three to five minutes. A choledochoscope (Karl Storz Endoscopy, Inc.) was then advanced into the duct. Prior passage of a flexible wire was sometimes necessary to guide the scope through the cystic duct into the common duct. If a distal common bile duct stone could not be flushed or pushed antegrade into the duodenum, it was extracted in a retrograde fashion out the cystic ductotomy using a 2.4 French Segura basket via the working port on the choledochoscope. In most instances, a completion cholangiogram (IOC) was performed to confirm clearance of the duct. Trans-ampullary stents were not placed.

ERCP procedures were performed by high volume ERCP endoscopists. In some cases the lack of a dedicated on-site endoscopist required transfer to an outside facility and of 33 total ERCP's performed in both groups, 24 operative reports were available for review. ERCP was performed in standard fashion with a duodenoscope advanced into the second portion of duodenum. 20 of 24 patients underwent biliary sphincterotomy, 17 of 24 underwent stone extraction or sweep of the duct with a balloon, two underwent a basket sweep, and one underwent biopsy of the papilla. Four patients had no evidence of stones and did not undergo sphincterotomy. Documented complications at time of procedure include bleeding requiring an epinephrine injection and a duodenal perforation. The perforation occurred in the sole patient who underwent needle knife sphincterotomy. The remaining 19 individuals underwent sphincterotomy with a standard sphincterotome.

1.2. Evaluated Factors

Multiple presenting factors were evaluated and include: age, gender, race, body mass index, presence of biliary colic, right upper quadrant pain, jaundice, tachycardia, presence of fever (temperature > 38.5), pancreatitis, and evidence of biliary ductal dilatation or choledocholithiasis on radiographic imaging. All laboratory data were recorded within 24 h of admission. Intra-operative variables included American Society of Anesthesia classification, estimated blood loss, total ERCP time, total operative time (defined as all procedures except ERCP) and total procedure time (defined as ERCP plus operative time). Post-operative outcomes include minor complications (defined as surgical site infection, bile leak, pancreatitis, retained stone, recurrent stones), major complications (defined as blood loss requiring transfusion, duodenal perforation, death), total length of stay, total billed charges and total hospital cost. Six patients at CHLA required transfer to outside facilities when an endoscopist was not available for ERCP at CHLA. These patients underwent a total of nine ERCP's and were excluded from cost analysis as their total cost could not be determined.

1.3. Statistical analysis

All data were recorded into a standardized database program (Microsoft Excel©, Seattle, WA). Wilcoxon test was performed on continuous variables and logistic regression modeling on categorical data. A *P* value < 0.05 was considered significant. Multivariable analysis was performed on variables with *P* < .2 using multiple stepwise logistic regression model, using the R software.

2. Results

42 patients were identified. 24 (57%) underwent LC+ERCP and 18 (43%) underwent LC+CBDE. Higher numbers

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