

Is There a Role for Routine Preoperative Endoscopic Retrograde Cholangiopancreatography for Suspected Choledocholithiasis in Children?

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Hypothesis: Endoscopic retrograde cholangiopancreatography (ERCP) is frequently used preoperatively in adult patients with suspected choledocholithiasis. Cholelithiasis occurs much less often in children, and the indications for ERCP are not established. We hypothesized that the natural history of choledocholithiasis in children is spontaneous passage of stones through the papilla and that these children can be managed without routine preoperative ERCP.

Design: Retrospective analysis of patients treated over a 10-year period.

Setting: Tertiary care children's hospital.

Patients: All patients with cholecystectomy for biliary disease.

Interventions: Cholecystectomy; intraoperative cholangiography for suspected choledocholithiasis; hyperbilirubinemia, gallstone pancreatitis, and ultrasonographic evidence of common bile duct dilation or common bile duct stones; and postoperative ERCP for symptomatic choledocholithiasis: pain and jaundice.

Main Outcome Measures: Incidence and complications of choledocholithiasis and frequency of ERCP.

Results: One hundred patients (63 females) were studied. Indications included acute cholecystitis (10%), chronic cholecystitis (59%), gallstone pancreatitis (26%), and choledocholithiasis (5%). An intraoperative cholangiography was performed in 45 patients, and common bile duct stones were identified in 13. Expectant management of asymptomatic common bile duct stones was associated with sonographic resolution within 1 week. One patient with intraoperative cholangiography-proven choledocholithiasis required ERCP for symptoms 24 hours after operation. One additional patient, who did not undergo intraoperative cholangiography, developed symptomatic choledocholithiasis and required ERCP. There were no choledocholithiasis- or ERCP-related complications.

Conclusions: This study suggests that choledocholithiasis occurs frequently in children and that spontaneous passage of common bile duct stones is common. This could explain the relatively high incidence of gallstone pancreatitis. Conservative management of choledocholithiasis is successful in the majority of patients. Routine preoperative or postoperative ERCP is usually not indicated.

Arch Surg. 2005;140:359-361

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ALTHOUGH STILL RARE, PEDI-
atric cholelithiasis ap-
pears to have been on the
rise since the early 1970s.¹
The causes of this increase
are multifactorial and include an im-
proved ability to detect gallstones as well
as an actual increased incidence.² Laparoscopic
cholecystectomy has become the
procedure of choice for children and adults,
and open cholecystectomy is now per-
formed only rarely.³ There has been a con-
comitant change in the management of
common bile duct (CBD) stones. In adults,
CBD exploration at the time of the initial
operation has been replaced, for the most
part, by preoperative or postoperative en-

doscopic retrograde cholangiopancreatog-
raphy (ERCP). The best approach for CBD
stones in children is even less well de-
fined. The role of intraoperative cholangi-
ography (IOC) and the indications and tim-
ing of ERCP remain unclear.^{4,5} The purpose
of this study was to examine the natural his-
tory of choledocholithiasis in children un-
dergoing laparoscopic cholecystectomy, in
an attempt to provide guidelines for the use
of ERCP.

METHODS

This study is a retrospective evaluation of pa-
tients younger than 18 years who underwent

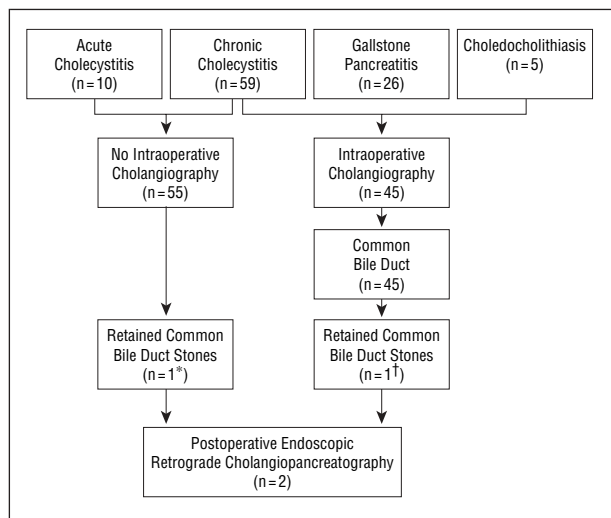


Figure. Preoperative, intraoperative, and postoperative choledocholithiasis in 100 pediatric cholecystectomy patients. Asterisk indicates the original diagnosis was chronic cholecystitis; dagger, the original diagnosis was choledocholithiasis.

cholecystectomy between 1994 and 2003 at Hasbro Children's Hospital in Providence, RI, a tertiary pediatric care center. Patient data collection included age, sex, admitting diagnosis, associated medical diagnoses, preoperative and postoperative biliary tract symptoms, white blood cell count, serum total bilirubin, sonographic findings, operative procedures, complications, and adjunctive procedures such as ERCP. Although not a prospective study, this review reflects a standard of care for calculous disease based on a selective, rather than routine, use of ERCP.⁶

The operative technique was either a standard 4-trocar laparoscopic⁷ or an open cholecystectomy.³ Intraoperative cholangiography was performed for 1 or more of the following indications: (1) diagnosis of gallstone pancreatitis, (2) hyperbilirubinemia (total bilirubin >1.3 mg/dL), and (3) dilated CBD (diameter >6 mm) or presence of choledocholithiasis by preoperative ultrasonography.

Referral for ERCP was limited to patients with postoperative jaundice, abdominal pain, and nausea or vomiting that lasted more than 24 hours and who had choledocholithiasis by postoperative ultrasonography. In these patients, liver function tests were also performed. They underwent ERCP with sphincterotomy and stone extraction under general anesthesia.⁴ Patients with IOC-proven choledocholithiasis who remained asymptomatic were evaluated within 1 week after cholecystectomy with surveillance ultrasonography and liver function tests.

Data analysis focused on the frequency of ERCP and the complications associated with expectant management of asymptomatic choledocholithiasis. Categorical variables are reported as percentage. The study was approved by the institutional review board at Hasbro and Rhode Island Hospitals.

RESULTS

One hundred children underwent a cholecystectomy for acute cholecystitis (n=10), chronic cholecystitis (n=59), choledocholithiasis (n=5), and gallstone pancreatitis (n=26). Of these, 63 patients were girls and 37 were boys. The study group included 22 children (<12 years of age; median, 8.4 years) and 78 adolescents (≥12 years of age; median, 16.2 years), with an age range from 3 to 18 years. The open cholecystectomy rate was 8%. Hemolytic dis-

orders associated with biliary disease were identified in 17 patients. Patients who underwent gallbladder removal as part of either liver resection or Kasai portoenterostomy were not included.

Forty-five patients underwent an IOC for 1 or more of the following criteria: gallstone pancreatitis (n=26), hyperbilirubinemia (n=21), and preoperative ultrasonographic evidence of CBD stones (n=18). In 51%, only 1 criterion applied; in 43%, 2; and in 6%, 3.

Twelve of these 45 patients were found to have choledocholithiasis by IOC. No intraoperative intervention was performed to clear the duct. Eleven patients were asymptomatic on the first postoperative day and remained so for the following week. Results from surveillance ultrasonography and liver function tests between the fifth and seventh postoperative days were normal. These patients remained asymptomatic at the first follow-up office visit. One patient underwent ultrasonography and laboratory evaluation on the second postoperative day for abdominal pain. She had persistent choledocholithiasis and underwent ERCP with sphincterotomy and successful stone extraction. She became asymptomatic immediately after the procedure and was still asymptomatic at the first follow-up office visit.

Five of the 55 children who did not meet the criteria for an IOC remained symptomatic after the first postoperative day. They underwent surveillance ultrasonography and liver function tests on the second postoperative day; in 4 patients, the results were normal and their symptoms resolved within 5 days to 2 months. The fifth patient was diagnosed as having impacted CBD stones and was managed with ERCP.

The **Figure** summarizes the preoperative, intraoperative, and postoperative findings by initial diagnosis. Common bile duct stones were found intraoperatively in 19% of patients with gallstone pancreatitis (5/26) and in 80% of patients with ultrasonographic evidence of choledocholithiasis (4/5). The classic indicators of choledocholithiasis (hyperbilirubinemia, CBD dilatation, ultrasonographic evidence of choledocholithiasis, and gallstone pancreatitis) did not reliably predict the risk of symptomatic choledocholithiasis postoperatively: only 1 of 45 patients undergoing an IOC had a retained CBD stone (44 false positive, 1 true positive), while 1 of 55 patients without indication of choledocholithiasis had a retained stone postoperatively (54 true negative, 1 false negative). Consequently, the classic indicators of choledocholithiasis had a sensitivity of 2%, a specificity of 55%, a positive predictive value of 2%, and a negative predictive value of 2% for the need for postoperative ERCP.

COMMENT

Cholelithiasis, although still rare, has become a more frequent diagnosis in children.¹ Its incidence has tripled during the last decade.² Currently, it is reported to occur in 0.15% to 0.22% of children.⁸ The availability of ultrasonography for abdominal evaluation, the high teenage pregnancy rates, and the increased prevalence of childhood obesity may all contribute to this trend. By comparison, cholelithiasis is recognized in approximately 10% of adults.⁹

Choledocholithiasis occurs in 11% of children who are diagnosed as having cholelithiasis.⁴ This was confirmed in our series, where 13% of children had evidence of CBD stones. This incidence is similar to the 15% incidence reported for adult patients younger than 60 years (15%).¹⁰ Choledocholithiasis occurs in only 3% of children with a low-suspicion diagnosis (acute or chronic calculous cholecystitis).⁵ Its incidence is almost 20% in children with gallstone pancreatitis (high-suspicion diagnosis), similar to reports in adults.¹¹

Although CBD stones were found intraoperatively (by IOC) in almost 30% of patients with 1 or more preoperative indicators of choledocholithiasis, only 1 of these children became symptomatic in the postoperative period. This very low incidence of retained CBD stones limited the need for postoperative ERCP and does not justify the routine use of preoperative ERCP. An additional patient, who lacked any of the classic indicators of choledocholithiasis, required a postoperative ERCP for retained stones. Thus, neither the classic criteria for suspected CBD stones nor a positive IOC result could predict the presence of retained CBD stones in the postoperative period.

The optimal management of suspected or confirmed choledocholithiasis in children is unclear, and the natural history of this condition is not yet fully elucidated. In the pediatric population, there is no consensus on whether the suspicion of CBD stones warrants a preoperative ERCP⁴ or whether an IOC should be performed routinely.⁵ Holcomb et al.¹² in their first 100 pediatric laparoscopic cholecystectomies, found 6 children with preoperative ultrasonographic evidence of choledocholithiasis. These 6 children underwent preoperative ERCP to clear the duct, and interestingly, CBD stones were confirmed in only 2.

There is also a lack of consensus regarding the management of CBD stones seen by IOC.⁵ Routine CBD exploration or choledochoscopy, whether open or laparoscopic, is generally deemed too invasive, particularly in children. Postoperative ERCP seems a reasonable alternative and is advocated by many. However, the present report indicates that only a small percentage of patients with intraoperative documentation of choledocholithiasis will have retained stones postoperatively. Liu et al.¹³ reiterate this conclusion, with their data showing a 50% negative ERCP for documenting CBD stones in at-risk patients. Moreover, ERCP, besides its well-documented morbidity (especially in cases of gallstone pancreatitis⁶), carries the additional risk of general anesthesia and the unknown long-term effects of sphincterotomy in children.⁵ Prasil et al.¹⁴ cite a 33% incidence of ERCP complications in children. In their study of 21 pediatric ERCP, 7 of the children developed pancreatitis or bleeding. This complication rate is much higher than the adult percentage of 5.4% cited in the multicenter trial of 2769 consecutive patients by Loperfido et al.¹⁵ This difference in the literature between adult and pediatric ERCP is probably a function of the technical difficulty of ERCP in children.

The relatively high incidence of gallstone pancreatitis (26% of all children with calculous disease) suggests

that choledocholithiasis is more common in children than is generally recognized. The fact that 80% of the stones passed preoperatively and that the remaining 20% passed perioperatively suggests that the natural history of CBD stones in children differs from that in adults. A competent sphincter of Oddi and the absence of scarring may reduce the risk of stone impaction. The absence of untoward effects of retained CBD stones in our series further suggests that an expectant attitude is preferable for choledocholithiasis and that ERCP should be reserved only for the rare cases of retained CBD stones in the postoperative period.

Accepted for Publication: December 20, 2004.

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Previous Presentation: This study was presented at the annual meeting of the New England Surgical Society; October 2, 2004; Montreal, Quebec; and is published after peer review and revision.

REFERENCES

1. Bailey PV, Connors RH, Tracy TF Jr, Sotelo-Avila C, Lewis JE, Weber TR. Changing spectrum of cholelithiasis and cholecystitis in infants and children. *Am J Surg.* 1989;158:585-588.
2. Waldhausen JHT, Benjamin DR. Cholecystectomy is becoming an increasingly common operation in children. *Am J Surg.* 1999;177:364-367.
3. Ellison EC, Carey LC. Cholecystostomy, cholecystectomy and intraoperative evaluation of the biliary tree. In: Baker RJ, Fischer JE, eds. *Mastery of Surgery.* Philadelphia, Pa: Lippincott Williams & Wilkins; 2001:1142-1151.
4. Newman KD, Powell DM, Holcomb GW III. The management of choledocholithiasis in children in the era of laparoscopic cholecystectomy. *J Pediatr Surg.* 1997;32:1116-1119.
5. Waldhausen JHT, Graham DD, Tapper D. Routine intraoperative cholangiography during laparoscopic cholecystectomy minimizes unnecessary endoscopic retrograde cholangiopancreatography in children. *J Pediatr Surg.* 2001;36:881-884.
6. Folsch UR, Nitsche R, Ludtke R, Hilgers RA, Creutzfeldt W. Early ERCP and papillotomy compared with conservative treatment for acute biliary pancreatitis. *N Engl J Med.* 1997;336:237-242.
7. Holcomb GW III. Laparoscopic cholecystectomy. *Semin Pediatr Surg.* 1993;2:159-167.
8. Holcomb GW III. Gallbladder disease. In: O' Neill JA Jr, Grosfeld JL, Fonkalsrud EW, et al, eds. *Principles of Pediatric Surgery.* St Louis, Mo: Mosby Co; 2003:645-646.
9. Ahrendt SA, Pitt HA. Biliary tract. In: Townsend CM Jr, ed. *Sabiston Textbook of Surgery.* Philadelphia, Pa: WB Saunders; 2001:1082-1084.
10. Kalsner SC. National Institute of Health consensus development conference on gallstones and laparoscopic cholecystectomy. *Am J Surg.* 1993;165:390-396.
11. Waters GS, Crist DW, Davoudi M, et al. Management of choledocholithiasis encountered during laparoscopic cholecystectomy. *Am Surg.* 1996;62:256-258.
12. Holcomb GW III, Morgan WM III, Neblett WW III, Pietsch JB, O' Neill JA Jr, Shyr Y. Laparoscopic cholecystectomy in children: lessons learned from the first 100 patients. *J Pediatr Surg.* 1999;34:1236-1240.
13. Liu CL, Lai ECS, Lo CM, et al. Combined laparoscopic and endoscopic approach in patients with cholelithiasis and choledocholithiasis. *Surgery.* 1996;119:534-537.
14. Prasil P, Loberger JM, Barkun A, Flageole H. Endoscopic retrograde cholangiopancreatography in children: a surgeon's perspective. *J Pediatr Surg.* 2001;36:733-735.
15. Loperfido S, Angelini G, Benedetti G, et al. Major early complications from diagnostic and therapeutic ERCP: a prospective multicenter study. *Gastrointest Endosc.* 1998;48:1-10.