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Laparoscopic Cholecystocholangiography as an Effective Alternative Exploratory Laparotomy for the Differentiation of Biliary Atresia

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Abstract

Purpose. Exploratory laparotomy with cholecystocholangiography is often performed for the definitive diagnosis of biliary atresia (BA) when radiological and biochemical studies are inconclusive. Laparoscopic cholecystocholangiography (LCC) has recently been introduced as an alternative procedure to avoid unnecessary laparotomy. We discuss the advantages and indications of LCC based on our experience of performing this diagnostic procedure in four infants with prolonged direct hyperbilirubinemia.

Methods. We performed LCC in four infants by direct percutaneous puncture of the gallbladder by inserting a cholangiocatheter into the gallbladder or cystic duct. The decision to perform LCC was based on ultrasonography and computed tomography findings of an atrophic gallbladder with a patent lumen, although analysis of duodenal juice and hepatobiliary scintigraphy showed no sign of the excretion of bile into the small intestine.

Results. In three infants, LCC did not show the entire biliary system, and laparotomy was necessary to confirm the diagnosis of BA. However, in the other patient LCC showed a normal biliary system and BA was excluded.

Conclusion. Laparoscopic cholecystocholangiography may be useful for the differential diagnosis of BA in patients with a patent gallbladder when imaging and biochemical findings are inconclusive. Furthermore, unnecessary exploratory laparotomy may be avoided in patients without BA.

Key words Laparoscopic cholecystocholangiography · Prolonged neonatal jaundice · Differential diagnosis of biliary atresia

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Introduction

Prompt and accurate differentiation of biliary atresia (BA) from nonsurgical prolonged neonatal jaundice is essential, because the success of Kasai's procedure depends on age at the time of the operation.[1–3] The diagnosis of BA is commonly based on ultrasonography or computed tomography (CT) images and the passage of bile, as shown by hepatobiliary scintigraphy or analysis of duodenal juice.[4–8] However, these studies are not always confirmative because of occasional false-positive results.[8] Thus, exploratory laparotomy with direct cholecystocholangiography is often performed to establish a definitive diagnosis.[8] With the improved design and modification of instruments for laparoscopic surgery in infants, laparoscopic cholecystocholangiography (LCC) is now being performed as a less invasive procedure.[10–16] We performed LCC in four infants with prolonged jaundice, and report our experience to help establish whether LCC could replace open laparotomy.

Patients and Methods

The age of the patients at the time of LCC ranged from 28 to 83 days (Table 1). Total and direct bilirubin values ranged from 6.8 to 8.7 mg/dl and from 3.4 to 4.8 mg/dl, respectively. The excretion of bile into the small intestine was not shown by analysis of duodenal juice or hepatobiliary scintigraphy in any of the infants; however, ultrasonography and CT showed an atrophic gallbladder, with a patent lumen. Therefore, the diagnosis of BA was inconclusive.

Technique

After the induction of general anesthesia, we used the open Hasson technique to introduce a 5-mm umbilical port for the laparoscope (30° side view, Olympus,

Table 1. Characteristics of the patients undergoing laparoscopic cholecystocholangiography

	Case 1, F	Case 2, F	Case 3, M	Case 4, F
Profile				
Age at LCC (days)	28	83	48	44
T (D) Bil (mg/dl)[a]	6.8 (3.7)	8.6 (4.8)	8.7 (4.5)	7.3 (3.4)
Gmelin test of duodenal juice	Negative	Slightly positive	Slightly positive	Slightly positive
Hepatobiliary scintigraphy	Negative passage	Negative passage	Negative passage	Negative passage
Gallbladder form	Atrophic	Atrophic	Atrophic	Atrophic
Lumen[b]	Patent	Patent	Patent	Patent
Laparoscopic findings				
No. of ports	2	4	3	2
Final diagnosis	BA	BA	NH	BA

T (D) Bil, total (direct) bilirubin; BA, biliary atresia; NH, neonatal hepatitis; LCC, laparoscopic cholecystocholangiography
[a] All patients passed an acholic stool shortly after birth
[b] Detected by ultrasonography or computed tomography

Tokyo, Japan). The maximal CO_2 insufflation was 6 mmHg. Additional 5-mm trocars with a reducer were used for grasping the gallbladder or retracing the liver, as required. Laparoscopic cholecystocholangiography was attempted by direct percutaneous puncture of the gallbladder with an 18-gauge cannula or by the insertion of a cholangiocatheter (5 F × 500 mm, cholangiocatheter TY type, Hakko, Tokyo, Japan) toward the cystic duct.

Results

Two to four trocars were used for the procedure. Laparoscopic cholecystocholangiography did not show the entire biliary system in three infants (patients 1, 2, and 4) with a thickened gallbladder wall (Fig. 1a). Laparotomy subsequently revealed an atretic extrahepatic biliary system, confirming the diagnosis of BA in these three patients. In the other patient (patient 3), who had a family history of neonatal hepatitis (NH), LCC showed the bilateral hepatic, common hepatic, and common bile ducts (Fig. 1b). We resected the gallbladder because of transmural injury by the cholangiocatheter and obtained 1 ml of liver tissue from the anterior surface of the right lobe by wedge resection using electrocautery. Histological examination confirmed a diagnosis of NH.

Comparison of Perioperative Data Between Infants Diagnosed by LCC and Infants Diagnosed by Direct Cholecystography Under Laparotomy

First, we compared the perioperative data of our patient 3 who underwent LCC, which confirmed the absence of BA, with those of three other infants without BA who underwent laparotomy and direct cholecystography. The mean age of the non-BA infants who underwent laparotomy was 61 days (range, 46–82 days). The perioperative data of patient 3 and those of the infants who underwent laparotomy were as follows: operation time, 175 min vs 110–150 min (mean 127 min); blood loss, minimal vs minimal — 40 ml (mean 23 ml); start of oral feeding, 2 days vs 2 days and hospitalization, 56 days vs 67–145 days (mean 119 days), respectively.

Next, we compared the perioperative data of our three infants who underwent LCC, which confirmed the diagnosis of BA (patients 1, 2, and 4) with those of three other infants who underwent laparotomy and cholecystography to confirm the diagnosis of BA. The mean age of the BA infants who underwent laparotomy was 71 days (range, 50–85 days). The perioperative data of our patients 1, 2, and 4 and those of the other three BA infants were as follows: operation time, 307–400 min (mean 364 min) vs 280–365 min (mean 328 min); blood loss, 45–200 ml (mean 135 ml) vs 75–100 ml (mean 88 ml); start of oral feeding, 6–8 days (mean 6.7 days) vs 6–8 days (mean 7.3 days); and hospitalization, 54–91 days (mean 76 days) vs 74–200 days (mean 153 days), respectively.

Discussion

The development of smaller instruments and sophisticated techniques have popularized laparoscopic surgery, even in infants.[16] In the field of hepatobiliary surgery, the first description of LCC in an adult was reported in 1947,[17] and the first report of LCC in an infant, for the differentiation of prolonged neonatal jaundice, was reported in 1977.[18] Although the gallbladder is atrophic in most infants with BA, the gallbladder lumen is patent in certain types of BA, as well as in patients without BA. We think that LCC is indicated if a definitive diagnosis of BA cannot be made in infants whose gallbladder has a patent lumen, based on

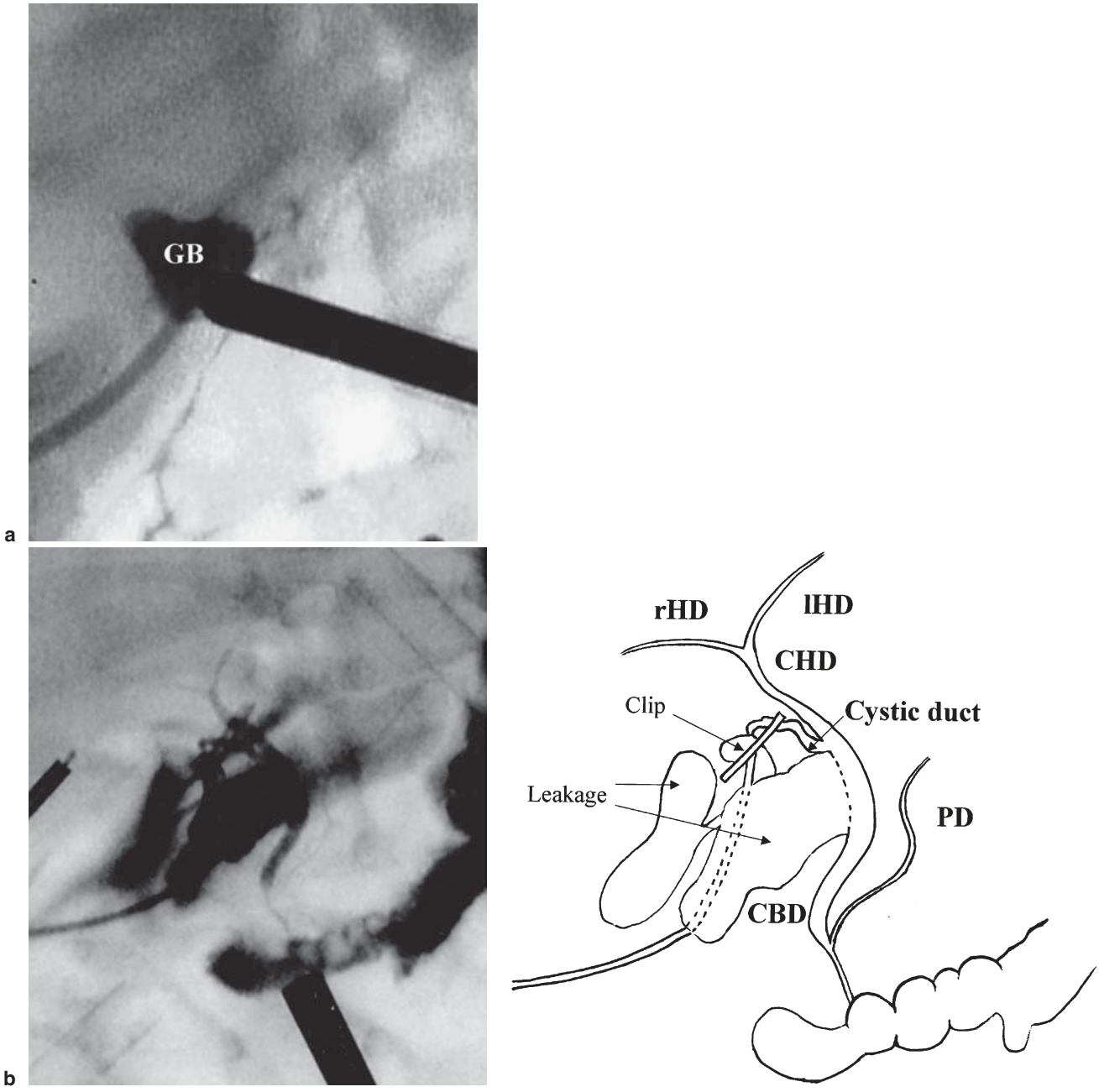

Fig. 1. **a** Cholangiography showed only the gallbladder in an infant with biliary atresia. **b** (*Left*) Cholangiography showed a normal biliary tract system and normal drainage into the duodenum in the infant with neonatal hepatitis. (*Right*) Schema of the cholangiography. *GB*, gallbladder; *rHD*, right hepatic duct; *lHD*, left hepatic duct; *CHD*, common hepatic duct; *CBD*, common bile duct; *PD*, pancreatic duct

the findings of ultrasonography or CT, even if it is atrophic.

To our knowledge, there are 120 reports in the English literature of preoperative laparoscopy performed in infants with BA.[10–16] Laparoscopic cholecystocholangiography was successfully employed in 62 (51.7%) of these infants, resulting in the exclusion of BA without unnecessary laparotomy in 52 (83%). In our small series, exploratory laparotomy was avoided in one (25%) infant confirmed by LCC to have NH. In all four patients, we could see the small gallbladder under direct laparoscopic vision, and cholecystocholangiography was performed easily by direct puncture of the gallbladder or insertion of a cholangiocatheter toward the cystic duct. As an alternative method, percutaneous cholecystocholangiography under ultrasono-

graphic guidance seems to have less chance of success because of the difficulty in inserting the needle into the small, collapsed gallbladder lumen. No serious complications developed in any of our patients undergoing LCC. Although there has been no mortality related to this laparoscopic procedure, some complications have been reported,[11,13,14] including adhesive small bowel obstruction, port site infection, injury of epigastric vessels, creation of a small hernia, and perforation of the gallbladder, as in our patient 3. However, this complication might be avoided by refining the technique.

We also compared the perioperative data, including operation time, blood loss, start of oral feeding, and hospitalization, between BA and non-BA patients who underwent LCC and those who underwent laparotomy with cholecystography. We could not find any disadvantages of LCC in comparison with direct cholecystography.

Our experience suggests that diagnostic LCC may be useful for the differential diagnosis of BA in infants with a patent gallbladder when the diagnosis cannot be established by imaging and biochemical studies. Unnecessary exploratory laparotomy is also able to be avoided in patients without BA.

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