

Laparoscopic Choledochal Cyst Excision and Hepaticojunostomy: A Case Series

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Purpose: Choledochal cysts are congenital dilatations of the biliary tract and are generally surgically excised. Laparoscopic total excision of choledochal cysts and hepaticojunal biliary tract reconstruction has gained acceptance among pediatric surgeons. We report our early experience with this procedure.

Methods: From May 2013 to April 2016, 10 consecutive patients (7 females and 3 males) underwent laparoscopic choledochal cyst excision and hepaticojunostomy at our center. We retrospectively reviewed their medical records for age, sex, clinical symptoms, Todani classification, anomalous pancreaticobiliary duct union, operative time, starting day for enteral feeding, complications, and hospital stay.

Results: The median patient age was 22 months. Four patients were aged less than 6 months, 3 of whom received prenatal diagnosis using ultrasonography. Patients presented with abdominal pain, jaundice, vomiting and fever. No abdominal mass was palpated in any patient. One patient was classified as Todani type Ia, 4 as Ic, and 5 as IVa. Six patients had an anomalous pancreaticobiliary duct union. The mean operative time was 319.4 minutes. There were no surgery-related complications. Sips of water were allowed from mean postoperative day 2.4 and regular diet from mean postoperative day 3.4. The mean hospital stay was 6.5 days.

Conclusion: Laparoscopic excision of choledochal cyst and hepaticojunostomy in children is feasible with favorable cosmesis.

Keywords: Choledochal cyst, Laparoscopy, Child

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INTRODUCTION

Choledochal cysts are congenital dilatations of the biliary tract; they are more prevalent among Asian females and are commonly associated with anomalous pancreaticobiliary duct union (APBDU).^{1,2} Choledochal cyst related complications include cholecystitis, cholangitis, pancreatitis, cholelithiasis, and perforation of the choledochal cyst. Furthermore, choledochal cysts can transform into biliary malignancies if not treated.^{2,3}

Hence, complete surgical excision of the choledochal cyst and enterobiliary reconstruction has been recommended as the standard treatment.

Since its first report in 1995,⁴ laparoscopic choledochal cyst excision has gained acceptance as a safe and effective approach among pediatric surgeons.⁵⁻⁷ Our center started performing laparoscopic choledochal cyst excision and hepaticojunostomy in May 2013. Herein we report our early experience with this procedure.

MATERIALS AND METHODS

From May 2013 to April 2016, 10 consecutive patients underwent laparoscopic choledochal cyst excision and hepaticojejunostomy at our center. We retrospectively reviewed the medical records of these patients. The variables investigated were age, sex, clinical symptoms, Todani classification, anomalous pancreaticobiliary duct union, operative time, starting day for enteral feeding, complications, and hospital stay. All procedures were performed by the same pediatric surgery team. This study was approved by the ethics committee/institutional review board (IRB no. 2016-11-072) of our medical center.

Operative techniques

The patient was placed in the supine position under general anesthesia. The patient's hip was positioned at the end of the table, with the legs on extended supports. Infants and small children were placed in the frog-leg position, whereas larger children were placed in the dorsal lithotomy position, with the legs in stirrups. The operating surgeon stood between the patient's legs and the assistant stood on the surgeon's right side (Fig. 1). A nasogastric tube was inserted to decompress the stomach, and a Foley catheter was inserted. We used a four-port technique. A 10-mm (or 5 mm for infants) umbilical trocar was inserted for the camera and a pneumoperitoneum was created using CO₂ gas at a pressure of 10~12 mmHg. Three

additional trocars (3~5 mm) were inserted in the right and left lower quadrants. The right flank port was used to hold the gallbladder to aid in dissection and anastomosis of the bile duct. This trocar was also used to insert a closed drain at the site of hepaticojejunostomy. The 3 mm/5 mm working port and the assistant port were placed on the left upper abdomen under laparoscopic guidance. Intraoperative cholangiography was performed for all 10 patients (Fig. 2A). The cystic artery and duct were dissected and ligated with intracorporeal sutures or with 5-mm Hem-o-Lok® clips (Teleflex Inc., Morris-

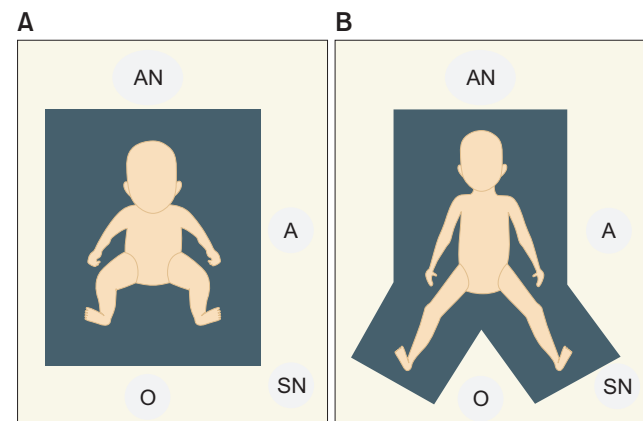


Fig. 1. Positions for the operator, assistant, scrub nurse, and anesthesiologist. (A) Position for infants. (B) Position for children. O = operator; A = assistant; SN = scrub nurse; AN = anesthesiologist.

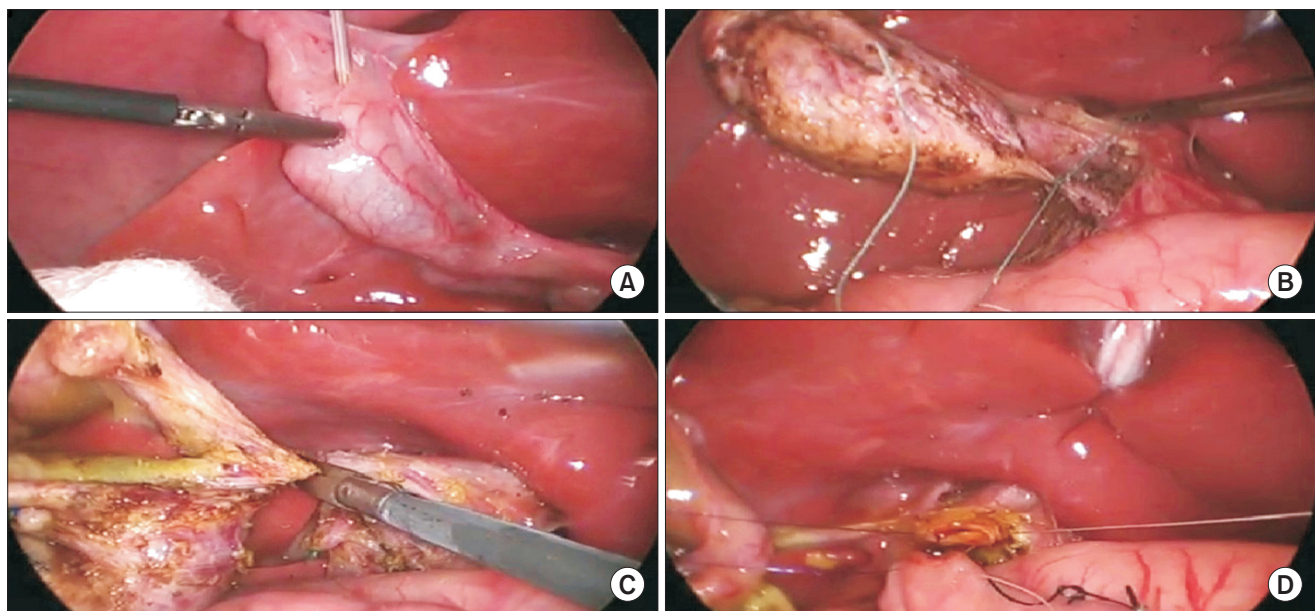


Fig. 2. The laparoscopic operating field. (A) Intraoperative cholangiography. (B) Ligation of distal CBD. (C) Resection of proximal CBD. (D) Hepaticojejunostomy.

ville, NC, USA). The common bile duct (CBD) was dissected using monopolar hook electrocautery. The distal CBD was ligated using 4-0 Ethibond suture (ETHICON Inc., Somerville, NJ, USA) and 5-mm Hem-o-Lok clips, and then separated (Fig. 2B). Subsequently, the proximal CBD was dissected to the normal CBD diameter level. A one-point suture with black silk was performed on the jejunum 20 cm distal from the ligament of Treitz to identify the resection line of jejunum. The umbilical incision was extended superiorly to 1 cm and the small bowel was extracted through the umbilical incision. The jejunum was resected at approximately 20 cm from the ligament of Treitz using the GIA® stapler (Medtronic Inc., Minneapolis, MN, USA), and a Roux-en-Y jejunojejunostomy was created with an extracorporeal end-to-side anastomosis. The mean length of the Roux loop was 50 cm (range, 40~60 cm). The small bowel was reintroduced into the abdominal cavity. The dissected proximal CBD was excised at the level of the normal CBD (Fig. 2C). Retrocolic hepaticojejunostomy was performed intracorporeally with Monosyn (B. Braun, Melsungen, Germany) 5-0 interrupted sutures: stitches for the posterior wall preferably and then another for the anterior wall subsequently. The anastomosis was constructed a few millimeters from the stapled end of the Roux limb to prevent a blind pouch (Fig. 2D).

RESULTS

Seven patients were females and 3 were males. The median age at the time of surgery was 22 months (range, 2~90 months). Four of the 10 patients were aged less than 6 months; diagnosis was made using prenatal ultrasonography in 3 of these patients, while it was incidental (during ultrasonography on the second day of birth) in 1. The mean age for these patients was 3.75 months (range, 2~5 months). Overall, one patient was classified as Todani type Ia, 4 as Ic, and 5 as IVa. Six patients had APBDU (Table 1).

Preoperative symptoms and signs were assessed (Table 2). No patients had palpable abdominal masses. Chief complaints included abdominal pain (n=4), jaundice (n=3), vomiting (n=4), and fever (n=2). Four of 10 patients had pancreatitis and 1 had cholangitis. Three patients had stones in the CBD.

The mean operative time was 319.4 minutes (range, 255~465 minutes) (Fig. 3), including the time for intraoperative cholangiography. For the 4 patients aged less than 6 months, the mean operative time was 284.5 minutes (range, 255~318 minutes). There were no surgery-related major complications such as anastomosis leakage, stricture, cholangitis, bleeding, and ileus. Two patients developed fever (1 on postoperative day 5 and the other on postoperative day 8). One patient had upper respiratory tract infection and was treated with intravenous

Table 1. Characteristics of patients (N = 10)

Characteristic	Value (n)
Sex	
Male	3
Female	7
Age at surgery (median, months)	22 (range, 2 ~ 90)
Todani classification (MRCP)	
Ia	1
Ic	4
IV	5
APBDU	6

APBDU = anomalous pancreaticobiliary duct union; MRCP = magnetic resonance cholangiopancreatography.

Table 2. Preoperative symptoms and signs

Symptom/sign	n (%)
Pain	4 (40)
Jaundice	3 (30)
Palpable RUQ mass	0 (0)
Vomiting	4 (4)
Fever	2 (2)
Cholangitis	1 (1)
Pancreatitis	4 (40)
CBD stones	3 (30)
Incidental diagnosis	1 (10)
Antenatal detection	3 (30)

CBD = common bile duct; RUQ = right upper quadrant.

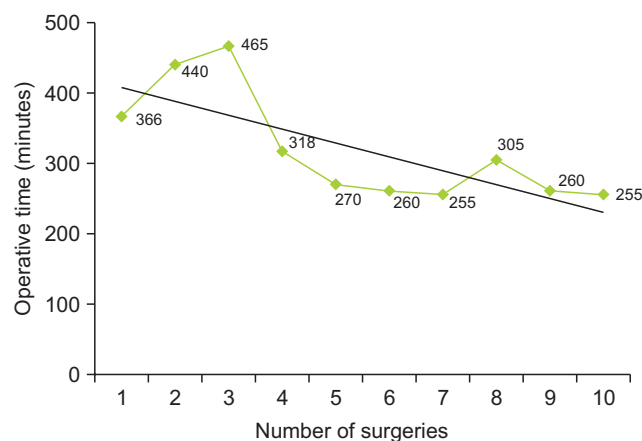


Fig. 3. Operative time (minutes).

Table 3. Operative and postoperative outcomes

Outcome	Mean (range)
Operative time (minutes)	319.4 (255 ~ 465)
Sips of water (postoperative day)	2.4 (1 ~ 3)
Regular diet (postoperative day)	3.4 (2 ~ 4)
Postoperative hospital stay (days)	6.5 (5 ~ 9)
Immediate postoperative complications	
Major complications (anastomosis leakage, stricture, cholangitis, bleeding, ileus)	0
Fever	2
Wound complications	0

antibiotics for 3 days. Another patient had dehydration but recovered with fluid resuscitation. No wound-related complications were reported. The cosmetic outcome was excellent (Fig. 2). Sips of water were allowed from mean postoperative day 2.4 (range, 1–3 days), and diet including milk feeding was started on mean postoperative day 3.4 (range, 2–4 days). The mean hospital stay was 6.5 days (range, 5–9 days) (Table 3).

DISCUSSION

Laparoscopic choledochal cyst excision and hepaticojunostomy in children is widely accepted, and several studies have described the advantages of laparoscopic surgery.^{2,6} Liem et al. and Nguyen Thanh et al. reported laparoscopic choledochal cyst excision and reconstruction of the biliary–digestive system as safe and effective with cases of a large number of choledochal cyst patients.^{2,8}

Diao et al.⁹ reported a learning curve for laparoscopic hepaticojunostomy in children with choledochal cysts; no differences in operative time were observed between the open surgery and the laparoscopic surgery groups. In our study, a long operative time was required initially, it shortened with improving surgeon's proficiency (Fig. 3). It remains unclear whether the learning curve was overcome based on experience only with cases of choledochal cysts, because of the very low incidence of this disease entity. It is possible that the improvement in surgical skill, and hence the operative time, was a result of the surgeons gaining experience with other common laparoscopic pediatric surgeries such as laparoscopic appendectomy and laparoscopic hernioplasty.

Laparoscopic surgery is associated with technical challenges, particularly in pediatric cases. The abdominal cavity in pediatric patients is very small compared to that in adults; the space constraints make free use of laparoscopic instruments difficult. Nevertheless, the surgeon should ensure precise laparoscopic suturing for a successful hepaticojunostomy. He-

paticojunostomy is difficult even with open surgery owing to the narrow space and the small diameter of the proximal CBD in pediatrics. The laparoscopic view might help overcome the challenges of space constraints in open surgery if the surgeon is proficient in laparoscopic suturing.

In our early experience, the outcome has been favorable, with no conversion to open surgery even in complicated cases. One patient had cholangitis and 4 had pancreatitis. Three patients had CBD stones. They underwent preoperative endoscopic retrograde cholangiopancreatography and endoscopic sphincterotomy. Kim et al.⁷ suggested broadening the indications for the laparoscopic approach to cholangitis- and/or pancreatitis-associated cases, with adequate preoperative management.

In our study, diagnosis was prenatal in 3 cases, and in 1 case, it was incidental (during ultrasonography on the 2nd day of birth). They recovered satisfactorily without complications. Chan et al.¹⁰ reported on the laparoscopic management of 10 cases with antenatally detected choledochal cysts and the safety of laparoscopic excision and hepaticojunostomy. Further studies on patients with antenatal diagnosis might be needed to determine the best timing for surgery and the long-term outcomes.

All patients in our study recovered without major surgery-related complications. Biliary tract obstruction may occur after laparoscopic hepaticojunostomy.¹¹ Ono et al.³ reported liver dysfunction, dilatation of intrahepatic bile ducts, recurrent abdominal pain, and biliary tract malignancy as long-term complications after choledochal cyst excision and hepaticojunostomy. The laparoscopic approach can magnify the operative view, which may assist in dissecting the whole choledochal cyst without a remnant duct, and in anastomosis. Future long-term studies are required to compare the incidence of malignancy between open and laparoscopic surgeries.

In conclusion, our results suggest that laparoscopic excision of choledochal cysts and hepaticojunostomy in children is a

safe and feasible method, with an excellent cosmetic outcome.

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