

Laparoscopic Total Intracorporeal Correction of Choledochal Cyst in Pediatric Population

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Abstract

Background: The laparoscopic correction of the choledochal cyst is an attractive treatment option. However, even the skilled surgeons do not prefer the intracorporeal jejunojunctional anastomosis due to the technical difficulties. In this article, we present the feasibility of laparoscopic total intracorporeal correction of the choledochal cyst, including the retrocolic Roux-en-Y hepaticojejunostomy and jejunojunctionostomy.

Methods: A prospective review of 6 cases of consecutive laparoscopic surgery for choledochal cyst in the pediatric population from March 2007 to April 2008 was performed. All patients underwent laparoscopic excision of a choledochal cyst and total intracorporeal Roux-en-Y reconstructions. The intracorporeal jejunojunctionostomy was made by introducing an endoscopic gastrointestinal anastomosis device (Endo-GIA; US Surgical, Norwalk, CT) through the umbilical port with hand-sewn reinforcement. We evaluated the patient's age at the time of operation, time taken for total operation, time taken for jejunojunctionostomy, and intra- and postoperative events.

Results: All 6 cases were girls (age ranging from 4 months to 7 years). All had type I choledochal cyst. Five ports were utilized: one telescopic port at the umbilicus, one left subcostal port for liver retraction, two operating ports on the right flank and left side of the umbilicus, and one right-lower quadrant port for the assistant. The mean time for total operation was 275 ± 58 minutes (range, 210–360). Total intracorporeal jejunojunctionostomy took 38 ± 10 minutes (range, 25–55). All patients were symptom free during the median follow up of 3.5 months.

Conclusion: In the pediatric population with choledochal cyst, total intracorporeal Roux-en-Y hepaticojejunostomy and jejunojunctionostomy during laparoscopic surgery is feasible without the need for exteriorization of the bowel.

Introduction

THE TREATMENT OF CHOICE for the type I choledochal cyst is excision of the cyst and Roux-en-Y hepaticojejunostomy, regardless of age or symptom. Recently, several researchers have reported their experience with laparoscopic surgery for choledochal cyst. However, the previous reports are mainly of adult experience and very limited in children.^{1–4} Further, even the surgeons familiar with laparoscopic surgery for choledochal cyst do not prefer the intracorporeal jejunojunctional anastomosis due to the technical difficulties and the longer operation time.⁵ During the last 13 months, we carried out laparoscopic excision of choledochal cyst and biliary-enteric anastomosis, including intracorporeal jejunojunctionostomy, in the pediatric population. In this report, we introduce the feasibility of laparoscopic surgery for choledochal cyst with total intracorporeal retrocolic Roux-en-Y hepaticojejunostomy and jejunojunctionostomy.

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Methods

Six consecutive pediatric patients with choledochal cyst received the laparoscopic excision of their choledochal cyst with hepaticojejunostomy in Hallym University Medical Center (Anyang, Korea) from March 2007 to April 2008. Three patients were referred from the pediatric department in the collaborating hospitals. Informed consent was obtained from each patient's parents. There was no selection criterion, except

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the image study of preoperative magnetic resonance cholangiopancreatography (MRCP) to confirm the type of choledochal cyst. One patient was asymptomatic and was diagnosed during prenatal ultrasonography. Preoperatively, we performed three-dimensional computed tomography and MRCP. Intraoperative cholangiography was not performed for the purpose of reducing the total operation time. We evaluated the patient's age at the time of operation, time taken for total operation, time taken for jejunojejunostomy, and intra- and postoperative untoward events. In addition, a comparison of the time taken for intracorporeal jejunojejunostomy was performed with those of previous reports.

Operative technique

Under general anesthesia, the patients were placed supine with a frog-legged position at the foot end of the bed with a reverse Trendelenburg tilt. The older children were placed in the lithotomy position, rather than the frog-legged one. An 11-mm port was inserted through the infraumbilical vertical incision for a telescope and the introduction of Endo-GIA (US Surgical, Norwalk, CT). A carbon dioxide pneumoperitoneum was created at the pressure of 8–10 torr. A 30-degree 5-mm telescope was used for visualization. Four additional ports were utilized: one 5-mm port at left subcostal mid-clavicular line for liver retraction, a 3-mm operating port at right flank, a 5-mm operating port slightly above, and to the left side of, the umbilicus, and a 5-mm assistant port at the right-lower quadrant.

A percutaneous stay suture just below the xyphoid process was used to retract the liver superiorly. The gallbladder was aspirated from outside by using a long needle for better visualization and was used for liver retraction during the operation. Under laparoscopic guidance, dissection of the choledochal cyst started from its anterior superior surface and continued distally to the transition area of the cyst at the head of the pancreas. The monopolar electrocautery device was used to ensure the hemostasis of the epicholedochal venous plexus. After the complete dissection along both sides and the posterior wall of the choledochal cyst, the distal portion of the cyst was ligated and divided by using 5-mm metal clips. Dissection was continued by pulling the choledochal cyst upward until the right and left hepatic ducts were identified following the ligation and division of the cystic artery and duct. By using endoscopic shears, the proximal end of the choledochal cyst was transected just below the hepatic bifurcation of the common hepatic duct. The Roux limb was developed by using an Endo-GIA, 20 cm distal to the ligament of Treitz and brought up to the porta hepatis through the transverse mesocolic defect. After an approximation of the Roux limb and hepatic duct, enterotomy was made at the antimesenteric border of the end-to-side hepaticojejunostomy. On the posterior row of the hepaticojejunostomy, interrupted 4-0 absorbable polyglactin sutures were applied. After confirming the five points of adequate suturing of the posterior row, the anterior row was also sutured in same manner.

Then, the operative field was changed to the above and left side of the umbilicus, and the intracorporeal jejunojejunostomy was performed. The telescope was moved to the right-lower quadrant accessory port, and the intracorporeal suture instruments were introduced through the right flank

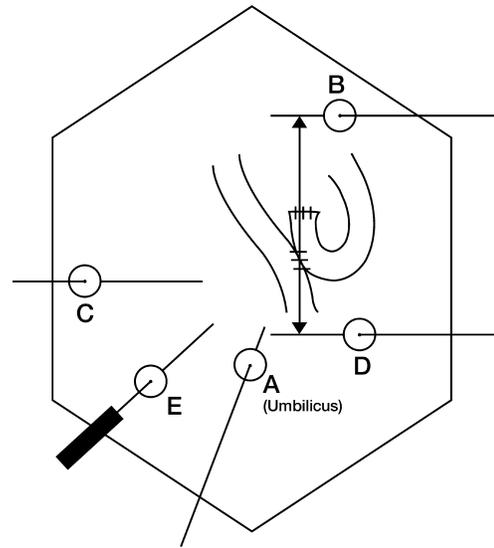


FIG. 1. Schematic illustration of telescope and instruments for intracorporeal jejunojejunostomy. A, needle holder; B, upward traction grasper; C, bowel grasper; D, downward traction grasper; E, telescope.

and umbilical ports. In the operative field, the Y limb was positioned on the left side of the vertical Roux limb. The distal end of the Y limb was bended up to a J shape. The antimesenteric border of the Roux limb 40 cm distal to hepaticojejunostomy site and that of the distal Y limb directed to the cephalad were approximated by using two-point seromuscular anchoring sutures, which were 4 cm distant from each other. The first stitch was applied between the most distal part of the Y limb and corresponding Roux limb. Then, the Roux limb 4 cm distal to the initial stay suture was anchored to the corresponding Y limb with the second stay suture. The first stay suture was then held with upward traction by a grasper through the left subcostal port and the second stay suture with downward traction by a grasper through the left para-umbilical port (Fig. 1). The anastomosis between the two limbs was made by using an endo-GIA through the 11-mm umbilical port. The enterotomy opening after the firing of the

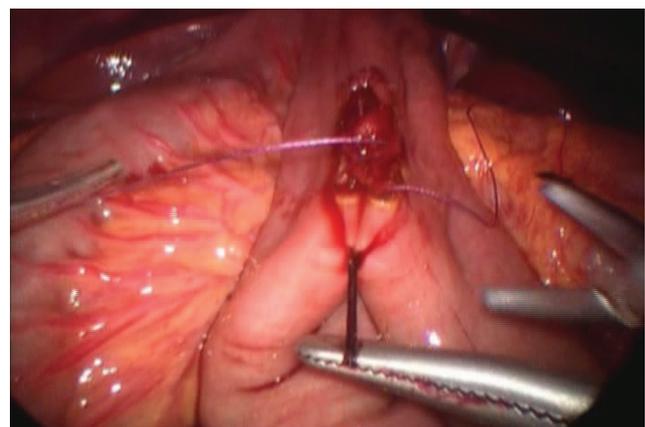


FIG. 2. View of intracorporeal jejunojejunostomy.

TABLE 1. CLINICAL DETAILS OF ALL THE CHILDREN

No.	Sex	Age (years)	Symptoms/signs	Todani classification	Operation time (minutes)	Jejunojejunostomy time	Follow-up duration (months)
1	F	5	Pain	Ia	360	55	13
2	F	5	Pancreatitis	Ia	310	40	9
3	F	3	Pain	Ic	290	40	4
4	F	5	Pain	Ia	210	30	3
5	F	0.3	Prenatal	Ia	270	40	2
6	F	7	Pain	Ia	210	25	2

Endo-GIA was closed with 4-0 interrupted absorbable sutures and nonabsorbable seromuscular reinforcement. All of the procedures for jejunojejunostomy were performed under the guidance of two traction sutures, which provide an optimal visual field and instrument performance angle (Fig. 2). The Roux limb was fixed to the mesocolic spaces, and the mesenteries of the both jejunal limbs were secured with several stitches. A closed suction drain was placed in the hepatic hilum, and the specimens were extracted via the umbilical port site.

Results

During the study period, laparoscopic total intracorporeal correction of choledochal cyst was performed in all patients without any open conversion. There were 6 girls, whose ages ranged from 4 months to 7 years. All had type I choledochal cyst, according to Todani's classification. The mean time taken for the total operation was 275 ± 58 minutes (range, 210–360). Total intracorporeal jejunojejunostomy took 38 ± 10 minutes. For the first patient, the time for performing jejunojejunostomy was approximately 1 hour and the total operation time was 6 hours (Table 1). There was no specific untoward event during the operation. Intra- and postoperative transfusions were not required. Enteral feeding was able to be started on postoperative day 3. The mean hospital stay after the operation was 6 days. There was no jaundice, cholangitis, or pancreatitis during the median follow-up of 3.5 months (range, 2–13).

Discussion

Farello et al.⁶ first reported laparoscopic surgery for choledochal cyst in a 6-year-old girl and described the advantages, including magnification of intracorporeal structures, improved immediate postoperative recovery, and excellent cosmetics. Since then, several researchers have described their experience with laparoscopic excision of choledochal cyst. However, those were largely case reports. With the lapse of time, the accumulation of the laparoscopic technique made the intracorporeal hepaticoenterostomy a valid procedure for the very small baby and child.¹⁻⁴ Today, a relatively larger number of cases are reported in the pediatric population (Table 2).⁷⁻¹¹ According to their reports, jejunojejunostomy was always performed extracorporeally after exteriorization of the bowel loop. The proximal jejunum, approximately 20 cm distal to the ligament of Treitz, was captured and delivered out via the intraumbilical trocar site after extending the incision.⁷ To date, complete laparoscopic management of choledochal cyst with intracorporeal jejunojejunostomy was

reported only in 3 pediatric patients.^{5,12} Under the present circumstances, the surgeons avoid intracorporeal bowel anastomosis due to the technical difficulties and time-consuming steps. In our own experience, we did not need any extra time to complete the total laparoscopic correction of choledochal cyst. Although we performed jejunojejunostomy without exteriorization of the small intestines, the time required for a total operation was not longer than those of other series (Table 2).⁷⁻¹¹

Le et al.⁵ described that the creation of the Roux limb and jejunojejunostomy was performed much faster by exteriorizing the bowel out of the umbilical port site. According to their report, intracorporeal jejunojejunostomy took longer than those performed extracorporeally (66 vs. 13 minutes). The time range for our most recent cases was 25–30 minutes. Therefore, we suggest the technical tips that reduce the duration of performing intracorporeal jejunojejunostomy. Before making the enterostomy for applying an endoscopic stapler, the two limbs were approximated side by side, and two stay sutures were placed on the antimesenteric border of the limbs and tied. Upward traction through the left subcostal port and downward counter-traction through the left paraumbilical port by using two stay sutures facilitate Endo-GIA firing and intracorporeal suturing for closure of the enterotomy. During the procedures, the telescope was moved to the right-lower quadrant accessory port. These maneuvers can offer in-line working axis between telescope and endoscopic stapler or suture instruments and reduce the time-consuming steps.

In terms of hepaticojejunostomy, continuous suturing on the posterior row was recommended, even though it may be technically challenging.¹⁰ Here, we prefer the interrupted suture posteriorly, because it is easy to be performed. We also propose that the posterior row suture should begin from the center to both lateral aspects. When the first two stay sutures are positioned at both end of the anastomosis site, the

TABLE 2. SUMMARY OF RECENT REPORTS FOR LAPAROSCOPIC SURGERY FOR CHOLEDOCHAL CYST

Authors (year)	No. of cases	Age	Operation time
Long et al. (2004)	35	Mean 3.6 yrs	Mean 4.3 hrs (3.5 to 7.6)
Ure et al. (2005)	11	Mean 1.6 yrs	Mean 4.8 ± 1 hrs
Ramesh et al. (2006)	10	Mean 5.5 yrs	Mean 4.2 hrs
Laje et al. (2007)	6	Median 3.8 yrs	Mean 5.6 hrs
Wu et al. (2008)	31	Mean 3.8 yrs	Mean 5.2 hrs (4.5 to 7.5)

following medial side sutures could be technically difficult to tie outside the lumen. Intraluminally positioned stitches might be choledocholithogenic. All patients were symptom free during the median follow-up of 3.5 months without jaundice, cholangitis, or pancreatitis and required no transfusion.

Conclusions

Based on the results of our series, we believe that the Roux-en-Y hepaticoenteral reconstruction without jejunal exteriorization during the laparoscopic correction of choledochal cyst is technically feasible and no longer time-consuming in pediatric patients.

Disclosure Statement

No competing financial interests exist.

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