

Laparoscopic resection of choledochal cyst with Roux-en-Y hepaticojejunostomy: a case report and review of the literature

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Received: 29 August 2016 / Accepted: 9 November 2016 / Published online: 21 November 2016
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Abstract

Background Choledochal cysts are associated with ductal strictures, stone formation, cholangitis, rupture, secondary biliary cirrhosis and increased incidence of cholangiocarcinoma. The surgical approach to choledochal cysts has evolved from the cyst-enterostomy to a complete excision with more recent use of minimally invasive approaches. We report a complete minimally invasive approach to a Type 1 choledochal cyst and summarize the literature containing large case series of similar approaches.

Methods and operative technique A 38-year-old female with a history of vague epigastric pain for multiple years was diagnosed with a Type 1 choledochal cyst on MRCP. The operative approach was an elective laparoscopic resection of choledochal cyst and Roux-en-Y hepaticojejunostomy. There were no intraoperative complications and discharge occurred on postoperative day three. Approximately 1 month after resection, she was diagnosed with a small retrohepatic fluid collection which was treated percutaneously and was diagnosed as a hematoma. A PubMed literature review focusing on surgical approaches to Type 1 choledochal cysts methods of repair and postoperative complications was performed and summarized.

Results and discussion The literature search performed on the subject of choledochal cyst management in adults and laparoscopic approaches resulted in a review of twenty-one articles. Ten of the articles were review articles regarding surgical approach and management of the disease. An additional two were case reviews, and eight reported on laparoscopic approaches to management of choledochal cysts. In this paper, we summarize the eight articles that provide information on the laparoscopic management and outcomes for choledochal cysts. While operative times were longer on the laparoscopic procedures, hospital stay was shorter and there was no increase in complication rates. The most common complications reported were postoperative bile leak followed by anastomotic stricture.

Conclusion This case highlights the management of laparoscopic resection of choledochal cyst as a viable, safe and feasible approach based on this case and a literature review.

Keywords Choledochal cyst · Laparoscopic resection · Laparoscopy · Type I choledochal cyst · Complications · Minimally invasive surgery

Electronic supplementary material The online version of this article (doi:10.1007/s00464-016-5346-3) contains supplementary material, which is available to authorized users.

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More than 60% of patients with choledochal cysts are diagnosed during the first decade of life; however, adults with this disease are being increasingly encountered [1, 2]. Choledochal cysts occur infrequently in the Western population (1 in 100,000 to 1 in 150,000) compared with the considerably higher incidence in Asian populations (approximately 1 in 13,000 individuals) [3]. By the Todani classification, Type 1 cysts represent up to 80% of these lesions [4]. Although these cysts are relatively rare, coexisting biliary tract carcinoma as a complication has been well documented. A mixture of bile and pancreatic

secretions may promote the development of carcinoma because 90% of choledochal cysts are associated with an anomalous pancreaticobiliary ductal junction (APBDJ) [5]. Management of these cysts has evolved from the cyst-enterostomy to a complete excision whenever possible. More recently, minimally invasive approaches are being used for the treatment of choledochal cyst with acceptable morbidity and mortality [1]. Studies have shown longer operative time with laparoscopic approach but less postoperative morbidity [4, 5].

Methods

We report a totally laparoscopic approach to a Type 1 choledochal cyst and summarize the literature containing large case series of similar approaches. A PubMed literature review focusing on surgical approaches to Type 1 choledochal cysts, methods of repair and postoperative complications was performed and summarized.

Case presentation

A 38-year-old female was referred to the surgical clinic with a history of vague epigastric pain for multiple years. The pain increased following meals and occurred 1–2 times daily. She also reported a history of chronic pancreatitis and a “cyst” that was noted at another hospital, but was thought to be a pancreatic pseudocyst. Endoscopic ultrasound study was suspicious for choledochal cyst. She was subsequently diagnosed with a Type 1 choledochal cyst on magnetic resonance cholangiopancreatography (MRCP), as

demonstrated (Fig. 1). The cyst was approximately $5 \times 4 \times 4$ cm fusiform dilation with an additional area of outpouching cephalad. Liver function test results were normal. Her previous surgical history was notable for tubal ligation and medical history was significant for obstructive sleep apnea, moderate asthma, diabetes mellitus (non-insulin dependent, Type II), hypertension and gastro-esophageal reflux disorder. She was taken to the operating room for a laparoscopic choledochal cyst excision and Roux-en-Y hepaticojejunostomy.

Operative technique

Under general anesthesia, the patient was positioned in supine position. After prepping and draping, a Veress needle was placed in the left upper quadrant via a stab incision and the peritoneal cavity was insufflated to 15 mm Hg pressure of carbon dioxide gas followed by an optical 10-mm trocar placement in the left upper quadrant of the abdomen. Diagnostic laparoscopy demonstrated fatty liver and omental adhesions to the gallbladder.

Additional trocars were placed, one supraumbilical 5-mm trocar, another 12-mm trocar in the right side of the abdomen a handbreadth below the right costal margin at the right midclavicular line and two other 5-mm trocars were placed, one in the right upper quadrant area lateral to the right midclavicular line and the last one in the left lower quadrant area. The suggested port site placement for laparoscopic choledochal cyst excision is demonstrated (Fig. 2).

The procedure commenced with full dissection of the structures within Calot’s triangle, but the gallbladder

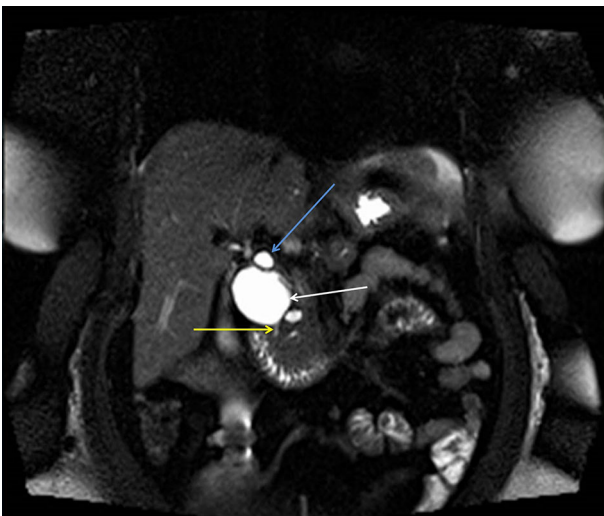


Fig. 1 Preoperative MRCP (magnetic resonance cholangiopancreatography) showing the choledochal cyst (*white arrow*), cyst outpouching (*blue arrow*) and the intrapancreatic common bile duct (*yellow arrow*) (Color figure online)

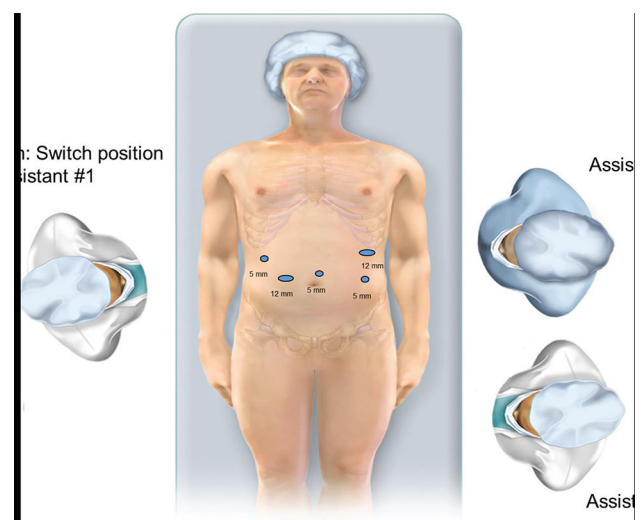


Fig. 2 Suggested port site placement for laparoscopic choledochal cyst excision

remained attached to the liver for retraction during the remainder of the dissection.

Laparoscopic intraoperative ultrasonography was used to identify the proximal common hepatic, distal common bile ducts and the choledochal cyst itself. Intraoperative ultrasonography demonstrating the wall of the cyst and vessels of the porta hepatis are demonstrated (Fig. 3). We identified the communication with the pancreatic duct, and there was sludge in the lumen of the cyst. There was no evidence of intrahepatic biliary passage dilatation or filling defects.

The choledochal cyst was dissected from all surrounding structures. Laparoscopic view of the choledochal cyst is demonstrated (Fig. 4). The dissection was initiated on the left side followed by the right side of the choledochal cyst. This way, both hepatic artery and portal vein were separated circumferentially. A Penrose drain was placed around the cyst to assist with retraction (Fig. 5). The cyst was then dissected distally toward then pancreas until it tapered to normal duct size. At the distal end, it was transected while safeguarding the pancreatic duct confluence.

Dissection of the choledochal cyst was then performed by advancing cephalad. The common hepatic duct was divided proximal to the cyst, leaving a cuff and the entire cyst specimen was resected, including the outpouching area. The choledochal cyst was sent for pathological examination with final results demonstrating no evidence of malignancy.

To create the Roux limb, attention was turned to the jejunum 40-cm distal to the duodenojejunal flexure where a Roux limb of 60 cm in length was created. The limb was then pulled through an opening created in the mesentery of the transverse colon in preparation for hepaticojejunostomy anastomosis. The anastomosis was performed end-to-side using the distal end of the common hepatic duct end and the anti-mesenteric side of the jejunum using absorbable

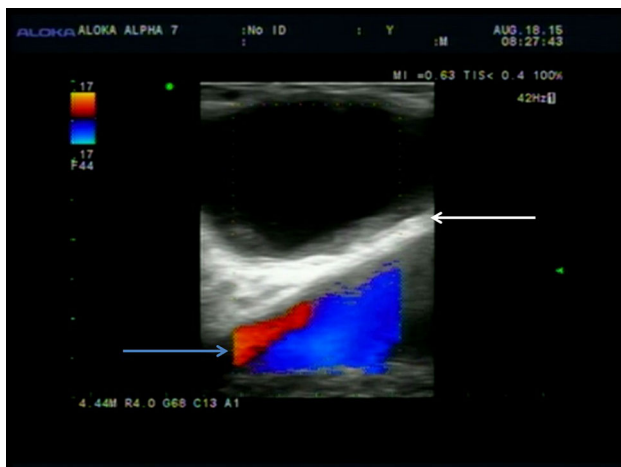


Fig. 3 Intraoperative ultrasonography showing thickened cyst wall with bile sludge (*white arrow*) and Porta hepatic vessels (*blue arrow*) (Color figure online)

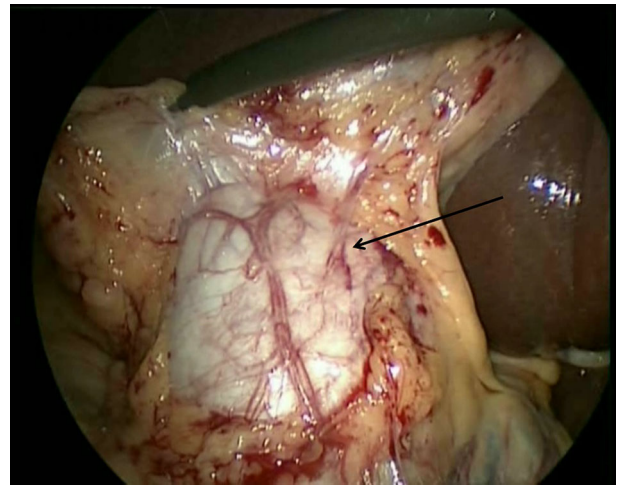


Fig. 4 Laparoscopic view of the choledochal cyst (*black arrow*) (Color figure online)

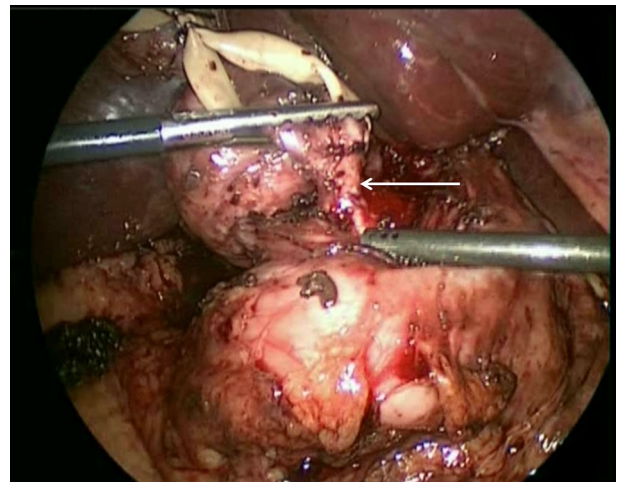


Fig. 5 A Penrose drain encircles the choledochal cyst for assistance with retraction during distal dissection to a normal size intrapancreatic common bile duct (*white arrow*) (Color figure online)

suture material in an interrupted fashion (Fig. 6). The cholecystectomy was then completed, and a 19 French round Blake drain was placed under the liver.

Please refer to the online video material: Choledochal cyst 69556 Bestoun Ahmed.

(This material was presented at SAGES spring meeting, Boston, MA 2016).

Postoperative care

The operative time was 250 min. The patient ambulated the same day of the procedure and tolerated oral food intake. The peritoneal drain was removed at postoperative day 2, and she was discharged the following day. She was readmitted 1 month later for abdominal pain and a decrease

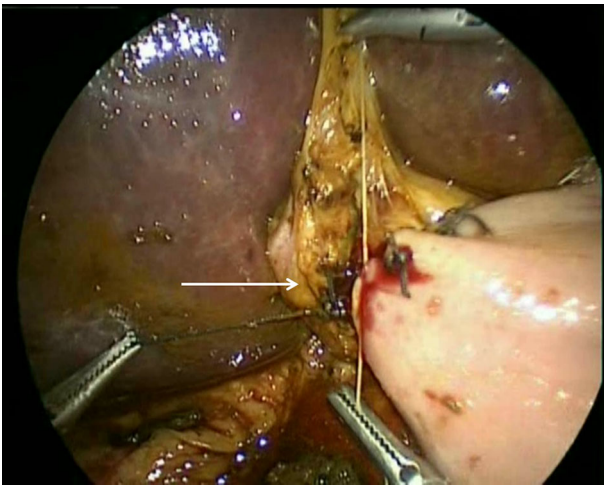


Fig. 6 Intraoperative view of anterior layer of Roux-en-Y hepaticojejunostomy (*white arrow*) demonstrating end-to-side technique with interrupted sutures (Color figure online)

of 2 g of hemoglobin. CT scan showed a liquefied hematoma which was drained radiologically and she had a smooth recovery afterward.

Results

The literature search performed on the subject of choledochal cyst management in adults and laparoscopic approaches resulted in a review of twenty-one articles. Ten

of the articles were review articles regarding surgical approach and management of the disease. An additional two were case reviews, and eight reported on laparoscopic approaches to management of choledochal cysts. In this paper, we summarize the eight articles that provide information on the laparoscopic management and outcomes for choledochal cysts. While operative times were longer on the laparoscopic procedures, hospital stay was shorter and there was no increase in complication rates. The most common complications reported were postoperative bile leak followed by anastomotic stricture (Table 1).

Discussion

Laparoscopic techniques are rapidly advancing the treatment of hepatobiliary disease. In the treatment of choledochal cysts, meticulous dissection of the cyst, ligation of the distal common bile duct, techniques for possible hepatic duct stenosis and protein plug clearance have contributed to controversy in the successful use of laparoscopic approaches for the anatomical disease. While most cases are diagnosed and treated in the pediatric population, adult cases are being diagnosed more frequently due to delayed presentation [4, 6]. Laparoscopic approaches are more frequently used due to advantages over open approaches. These advantages include small incisions, magnification of the surgical field with laparoscopy which enhances the accuracy of the dissection and

Table 1 Laparoscopic choledochal cyst excision: a review of the literature indicating surgical technique, operative time, length of stay and complications

References	Year	Patients (n)	Age	Procedure	Open versus laparoscopic	OR time (min)	Length of stay (days)	Complication
Lü et al [3]	2007–2011	34	32.3 ± 11.5	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic	280 ± 30	4.7 ± 1.3	Anastomotic stricture 3%
Jang et al [5]	2003–2011	82	32.7 ± 13.9	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic	232.9 ± 87.4	8.6 ± 5.2	Bile leak 7% Fluid collection 2.5% Total 18%
Liu et al [8]	2007–2011	35	24.2 ± 8.3	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic	249 ± 15	6.2 ± 1.3	Bile Leak 5.6% Total 17.1%
		39	26.7 ± 6.9		Open	132 ± 15	9.8 ± 0.8	Biliary 12.8% Total 20.5%
Tian et al [9]	2006–2009	45	34.4 ± 12.6	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic	307 ± 58	8.3 ± 3.2	Bile leak 12.1% Cholangitis 4.9% Total 17.1%

Table 1 continued

References	Year	Patients (n)	Age	Procedure	Open versus laparoscopic	OR time (min)	Length of stay (days)	Complication
Senthilnathan et al [7]	1998–2013	55	35.2 ± 15.1	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic	251.6 ± 54.25	7.0 ± 2.66	Bile leak 3.6% Total 14.5%
Jang et al [10]	2003–2005	12	37.3	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic	228 (150–3302)	5.8	Total 0%
Palanivelu et al [6]	1996–2008	35	26.5	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic	295	6.5	Total 14.3
Hwang et al [11]	2009–2011	20	37.8 ± 11.1	Cyst excision and Roux-en-Y hepaticojejunostomy	Laparoscopic Laparoscopic converted to open (n = 7)	395.8 ± 58.7 397.9 ± 82.8	11.2 ± 6.1 11.0	Total 7.6% None reported

anastomosis, less intraoperative blood loss and abdominal wall complications like infection, hernia and abdominal pain [7, 8]. Furthermore, laparoscopic technique may also lead to earlier return to preoperative lifestyle.

The application of laparoscopy to biliary reconstructive surgery has been limited in part because of the complexity of these procedures and the necessity for meticulous surgical technique to achieve good outcomes [6, 7]. Hepaticojejunostomy, choledochojejunostomy and hepaticoduodenostomy are the common forms of reconstruction that follow laparoscopic choledochal cyst excision. Liu et al. showed that compared with open operation, the total laparoscopic approach had a longer operative time (249 +/-58 vs. 132 +/-15 min with open approach). Notably in their study, the laparoscopic operative time decreased significantly to 190 min after the first twenty cases [8]. This demonstrates the trend toward similar operative times compared to open operations as the learning curve progresses.

Similar to other laparoscopic trends, patients were noted to have shorter hospital stays. Our patient was discharged in 3 days as opposed to 5–7 days had it been an open procedure. Lü et al. [3] noted hospital stay of 4.7 days with laparoscopic approach versus 8.4 days with open approach. See average hospital stay compared in (Table 1).

Tian et al. [9] reported a morbidity rate of 20% and a mortality of 3.3% in a series of 60 adult patients who underwent conventional surgery. See Table 1 for a comparison of total complication rate after laparoscopic approach. Notably these complications are less than if not equal to those documented with the open approach, showing that laparoscopy is as safe as the open procedure.

Risk of malignancy following excision is reported to be 1.6–11.3%. This incidence increases overtime. Therefore, long-term postoperative follow-up is advised for patients with choledochal cysts [5].

A recent study by Wen et al. summarized the outcomes of 104 consecutive patients undergoing laparoscopic choledochal cyst excision and Roux-en-Y hepaticojejunostomy by a single surgeon. This study demonstrated that the learning curve of the operative technique improved outcomes for this rare biliary anomaly [12].

Conclusion

Total laparoscopic resection of choledochal cyst is safe and feasible based on our case and literature review. While operative times are longer initially, this is markedly reduced after several cases. Patients have shorter hospital stay, and complication rates have not exceeded those of open operations. There is opportunity for looking at long-term follow-up of these patients, late complications and incidence of malignancy after laparoscopic resection.

Compliance with ethical standards

Disclosures Drs. Bestoun Ahmed, Priya Sharma and Cynthia L. Leaphart have no conflicts of interest or financial ties to disclose.

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