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CHOLEDOCHAL CYST: A SURGICAL EXPERIENCE IN ADULTS

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Background: Choledochal Cyst are congenital dilatation of the biliary system including the common, intrahepatic and intrapancreatic bile duct. Cysts have a tendency for complication and high risk of malignant changes over time. Surgery is the treatment of choice. We present our surgical experience of choledochal cyst excision with bilioenteric anastomosis.

Methods: A total 78 Choledochal cyst cases that underwent surgery at our hospital were included in the study. Cysts were classified according to the Todani modification of the Alonso-Lej classification. Surgical management included Choledochal cyst excision followed by bilioenteric anastomosis in form of Roux-en-Y hepaticojejunostomy. Anastomotic patency and liver function tests were checked in all patients before transanastomotic tube removal.

Results: Mean age of study subject was 16.67 years with most cases below 20 years age. Female preponderance was seen among study cases with 56 (71.79%) female and 22 male patients. Most common presenting complaint was abdominal pain 60 (76.92%), followed by jaundice 32 (41.03%), nausea/vomiting in 20 (25.64%), palpable mass 18 (23.06%) and cholangitis with fever in 16 (20.51%) patients. Pancreatitis was observed in 15 (19.23%) patients. Prior history of cholecystectomy was seen in 12 (15.38%) of cases. In 78 cases (Type I, and IVb) included in our study, cyst excision was done followed by Roux-en-Y hepaticojejunostomy. Surgical site infections were reported in 5 cases (6.4%), transient bile leak which was treated conservatively in 1 case (1.25%) and intra-abdominal collections seen in 2 cases (2.5%). No mortality was reported in present study. Malignancy (Cholangiocarcinoma) was seen in 1 case (0.9%). A satisfactory Anastomotic patency and liver function tests were achieved in all patients after 3 weeks of surgery, when transanastomotic tube was removed.

Conclusion: Choledochal cyst require an accurate diagnosis and surgical treatment in order to decrease the risk of complications which includes malignant transformation and progression of the disease. Most cases of choledochal cysts are Type I and IV cyst that can be treated with good results by early surgical excision of the cyst followed by bilioenteric continuity preferably by Roux-en-Y hepaticojejunostomy.

Keywords: Choledochal cyst, Todani classification, Hepaticojejunostomy, Cholangiogram.

Introduction:

Choledochal cysts (CC) are congenital cystic dilatations of any portion of the bile ducts, but most often occur in the main portion of the common bile duct (CBD) [1]. This entity occurs more frequently in Asia than in western countries with most reports originating from Japan [2-11]. The incidence ranges from 1 in 13,000 in Japan [2, 3] to 1 in 2 million in England [4, 5]. Nearly 20% of choledochal cysts present in adulthood; malignant transformation is the most feared complication [12]. A 6% to 30% risk of developing malignancy is estimated in patients with choledochal cysts; the risk is low in childhood (<1%), but increases to about 30% to 40% with age greater than 50 years [13]. A marked female preponderance has been widely recognized (female to male ratio3:1) [3-9,11].

Presence of anomalous pancreaticobiliary duct junction (APBDJ) allowing pancreatic juice to reflux into biliary tree is the most widely accepted etiopathogenic concept [2-6, 11-15]. CCD is associated with biliary tree stasis and lithiasis and the whole biliary epithelium is considered at risk of malignant transformation [10, 14, 15].

Magnetic resonance cholangiopancreaticography (MRCP) is currently the most accurate preoperative imaging study to assess cyst anatomy and classify the disease according to standard Todani classification [3, 4, .10, 11].

Complete cyst excision with cholecystectomy followed by bilioenteric reconstruction using Roux-en-Y hepaticojejunostomy is the treatment of choice for the extrahepatic component of the disease (type I and type IV CCD), In type V CCD (Caroli's disease), liver resection is tailored to the extent of intrahepatic disease and the presence and severity of underlying chronic liver (congenital hepatic fibrosis) and the associated kidney disease are taken into consideration [3,4,8].

Materials and Methods: All the patients with choledochal cyst who underwent Excision with Bilioenteric anastomosis at the Department of Surgical Gastroenterology, NHLM Medical College, VS Hospital, Ahmedabad where included in the study. All surgeries were carried out by surgeon experienced in Hepatobiliarypancreatic surgery at our center which is the one of the first centers in the country to have superspeciality degree course in Surgical Gastroenterology. A total of 87 Choledochal cysts cases admitted, 78 patients operated at our hospital between January 2009 to January 2016, and satisfying the eligibility criteria were taken in the study after informed consent.

All patients were informed about the operative technique, and written informed consent was obtained. Patients were subjected to complete imaging starting with abdominal ultrasound. The identified cysts were further delineated by both computed tomography scan (CT) and MRCP to estimate the size and extent of the disease and to assess for malignancy. Endoscopic retrograde cholangiopancreatography (ERCP) was included when done. Routine preoperative investigation included blood test for blood counts, liver function tests and viral markers. Cysts were classified according to the Todani modification of the Alonso-Lej classification [7].

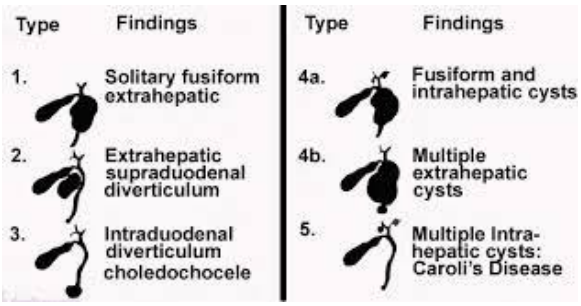

Figure 1: Types of Choledochal cysts

Surgical excision was started with right subcostal incision which was extended as per need. After exploration of abdomen, the hepatic flexure of the colon was mobilized, and the duodenum was kocherized. The length of the common channel between the distal end of the common bile duct (CBD) and the pancreatic duct, abnormal junction, or abrupt obstruction was recorded. For Type I and IVa cysts, the choledochal dilatation was then dissected in and extramural plane between the peritoneum and the anterior wall. Dissection progressed across the lateral walls downwards, separating the cyst from the first part of the duodenum. The distal bile duct was then oversewed by polyglactin 3/0 sutures and transected just above the pancreatic duct at the head of the pancreas to avoid leaving any intrapancreatic part of the cyst. In cases of difficulties caused by the close posterior proximity and adhesions of CC to adjacent structures in the hepatoduodenal ligament (mainly to the portal vein), the adherent cyst wall mucosa was only removed leaving non mucosal wall behind, a technique described as Lilly's method. The proximal part was dissected until the level of the hilar bifurcation and then transected. Proper hemostasis was achieved. A 45-cms retrocolic jejunal Roux loop was used to construct the end-to-side bilioenteric anastomosis using interrupted absorbable sutures (3/0 polyglactin) with accurate apposition. The anterioinferior wall of the extrahepatic segment of the left hepatic duct was incised for a spacious hepaticojejunal anastomosis when needed. An infant feeding tube was inserted through the anastomotic site for postoperative cholangiogram to confirm the anostomosis patency after 3 weeks. An abdominal drain was inserted in all cases in Morrison's pouch. All resected specimens were sent for histopathological examination. Patients resumed oral fluid intake after 1-2 days and then gradually to full diet before discharge. Operative complications were noted up to 90 days postoperative. Perioperative findings, Operative notes, pathology results and follow-up outcome we collected in a pre-

designed structured schedule. Routine blood investigation including complete blood counts and liver function tests; and Cholangiogram through peroperatively placed infant feeding tube were done after 3 weeks of surgery. Anastomotic patency and normal liver function tests were checked in all patients before tube removal.

Statistical Analysis

The quantitative data was represented as their mean +/_ SD. Categorical and nominal data was expressed in percentage. All analysis was carried out by using SPSS software version 21 and graphical representation was done using MS Excel sheet 2013.

Results

In this study there was a female preponderance with 56 (71.79%) female and 22 male patients. Mean age of the study subjects was 16.67 +/- 11.33 years, with most of the cases below 20 years of age (Table 1). Most common presenting complaint was abdominal pain 60 (76.92%), followed by jaundice 32 (41.03%), nausea/vomiting in 20 (25.64%), palpable mass 18 (23.06%) and cholangitis with fever in 16 (20.51%) patients (Table 2). Pancreatitis was observed in 15 (19.23%) patients. Prior history of cholecystectomy was seen in 12 (15.38%) of cases. As per Todani classification, 67 cases had Type I Choledochal cyst while Type II, III, IVa, IVb and V cysts were seen in 0, 3, 2, 11 and 4 cases respectively. In 78 cases (Type I, and IVb) included in our study, cyst excision was done followed by Roux-en-Y hepaticojejunostomy. Out of these 78 cases, Laparoscopic excision of the choledochal cyst was done in 23 cases. Operating time ranged from 180 to 250 minutes. Peroperative blood loss ranged from 100 to 220 ml. Three duct opening was observed at the hilum in 2 cases and two opening in all other cases. Bile duct incision was extended to the left hepatic duct in two cases to get satisfactory anastomosis. In all cases hilar bile ducts were anastomosed to the jejunum as single hepaticojejunostomy. In cases with Type III cysts treatment was done by ERCP and Sphincterotomy . Initially conservative management was done in cases of Type IVa and V cysts but were lost to follow up. Surgical site infections were reported in 5 cases (6.4%), transient bile leak which was treated conservatively in 1 case (1.25%) and intra-abdominal collections seen in 2 cases (2.5%). No mortality was reported in present study. On histopathology, cyst wall inflammation was seen in almost all cases while acute cholecystitis was seen in 25.6% cases. An early malignant change (T1, Cholangiocarcinoma) was seen in 1 case (1.2 %). On histopathology of excised cyst, cholangiocarcinoma was seen limited to mucosal layer and so was cured by surgical cyst excision. Routine blood investigation including complete blood counts and liver function tests; and Cholangiogram through peroperatively placed infant feeding tube were done after 3 weeks of surgery. Anastomotic patency was satisfactory and normal liver function tests were achieved in all patients before tube removal.

Table 1. **Age distrubution**

Age Group (Years)	N	%
<10	16	20.51

10-20	38	48.72
21 - 30	15	19.23
31 - 40	4	5.13
>40	5	6.41
Total	78	100

Table 2. Clinical Presentation

Presentation	**N**	**%**
Abdominal pain	60	76.92
Jaundice	32	41.03
Nausea/Vomiting	20	25.64
Abdominal mass	18	23.08
Fever	16	20.51
Pancreatitis	15	19.23
Prior Cholecystectomy	12	15.38

Discussion

Bile duct cysts are one of the distinguished congenital disorders that cause dilatation mainly of the extrahepatic and sometimes the intrahepatic biliary tree. Despite being a congenital disorder, adult presentation can exist in up to one-third of the cases of CC as the disease may be asymptomatic [16-18]. In present study, we share our experience of surgical excision and bilioenteric anastomosis in patients with choledochal cyst.

Mean age of the study subjects was 16.67 years with most of the cases below 20 years of age and a female preponderance. Chijiiwa K. et al. [20] in a similar study reported 46 patients with 41 (89%) females and a mean age of 24 years at the time of initial operation. Jesudason B et al. [21] analyzed the clinical data of 57 adults with choledochal cyst with male to female ratio of 1:1.38 and a mean age of 34.5 years. Machado ON et al. [22] in a retrospective review of all patients above 15 years who underwent therapeutic intervention found 10 cases of choledochal cyst of which 8 were female and mean age was 31 years.

In present study the most common presenting complaint was abdominal pain (76.92%) followed by jaundice (41.03%) and palpable mass (23.08%). Chijiiwa K et al. [20] in their study of 46 patients, observed 78% of patients presenting with abdominal pain, 43% with jaundice and 33% with an abdominal mass. Jesudason B et al [21] in their study observed abdominal pain and recurrent cholangitis with jaundice as the commonest presentations followed by acute pancreatitis, palpable mass and bronchobiliary fistula. She WH et al. [23] in their study (N-83) observed most common symptoms as abdominal pain (n-39) and jaundice (n-35). Machado ON et al. [22] in their study also observed predominant symptoms as abdominal pain and jaundice.

Kassem MI et al. [24] in their study observed pain as the most common symptom at presentation (20 patients, 83.3%).

As per Todani classification, 67 cases had Type I Choledochal cyst while Type II, III, IVa, IVb and V cysts were seen in 0, 3, 2, 11 and 4 cases respectively in our study. Chijiiwa K et al. [20] in their study observed that according to Todani classification , 26 patients (57%) had type I cysts, 2 (4%) had type II and 18 (39%) had type IV cysts. Safiolens et al. [25] studied 15 adult patients with 7 patients type I, 5 patient type II, 1 patient type III and 2 patients had type IVa choledochal cysts. Palanivelu C et al. [26] studied 35 patients with 27 type Ib choledochal cysts (77%) and 23% had type IVa choledochal cysts. Gadelhak N et al. [27] reported 72.9% Type I and 25% Type IVa cyst. Liu Y et al. [28] reported 54 cases of which 39 (72.22%) were type I, 13 (24.07%) Type II and 2 (3.7%) were type III. Consensus has established that the best treatment for choledochal cysts is surgical excision whenever possible. This helps to avoid long-term complications of the cyst including pancreatitis, cholangitis, choledocholithiasis, biliary cirrhosis and malignant transformation. To achieve complete cyst excision, accurate recognition of the beginning and the termination of the cyst are mandatory.

In present study, in 78 cases (Type I, IVb) cyst excision was done followed by Roux-en-Y Hepaticojejunostomy. Surgical site infections were reported in 5 cases (6.4%), transient bile leak which was treated conservatively in 1 case (1.25%) and intra-abdominal collections seen in 2 cases (2.5%). There was no early postoperative mortality. She Wh et al. [23] observed an overall early complication rate of 5.3% (4/73). Palanivelu C et al. [26] retrospectively studied 35 patients observed an overall morbidity rate of 14.3/5 and mortality rate of 0%. Gadelhak N et al. [27] reported overall early complication rate of 23.4% (n-11) with no early postoperative mortality. Early postoperative complications included wound disruption (n-1), collection (n-4), biliary leakage (n-3), pancreatic leakage (n-1), internal hemorrhage on top of acute hemorrhagic pancreatitis (n-1) and air embolism (n-1).

An early malignant change (cholangiocarcinoma) was seen in 1 male patient who was 62 years old. The lesion involving mucosa only so was cured by cyst excision.

Most CC show some degree of pathologic changes in the liver including portal fibrosis, central venous distention, parenchymal inflammation, and bile duct proliferation. [28] Except for portal fibrosis and central venous distention, these resolve after appropriate surgical management. Case studies repeatedly demonstrate an increased risk of malignant transformation with age: half of CC patients more than 50 years old have invasive biliary neoplasms vs less than 1% before the age of 10.[11,29,30] Malignancy is most commonly associated with types I and IV cysts, while types II, III, and V CC have minimal neoplastic risk.[1,29]

In a randomized controlled clinical trial, Diao and colleagues[31] demonstrated that early CC excision (less than 1 month old) in prenatally diagnosed asymptomatic CC resulted in significantly less hepatic fibrosis and improved the rate of liver function normalization. Early excision is recommended.[32,33,34] Type I and IV CC management consists of complete extrahepatic bile duct cyst excision down to the level of communication with the pancreatic duct, cholecystectomy, and restoration of bilioenteric continuity.[11,23,35] Care should be

taken to not injure the pancreatic duct. The extent of liver resection in type IVA CC depends on the nature of the extrahepatic component of the CC. In some cases, excision of the extrahepatic duct alone is reasonable because intrahepatic duct dilatation typically resolves in 3 to 6 months.[36,37]

Hepaticoduodenostomy and Roux-en-Y hepaticojejunostomy (RYHJ) bilioenteric reconstruction after type I and IV CC resection are both reported in the literature, but RYHJ is preferred. Hepaticoduodenostomy has been associated with increased rates of gastric cancer (due to bile reflux) and biliary cancer.[38,39] Moreover, a recent meta-analysis comparing RYHJ with hepaticoduodenostomy reported significantly more postoperative reflux and gastritis with hepaticoduodenostomy.[40] A wide anastomosis allowing free flow of bile into the intestine is imperative in order to avoid anastomotic stricture and bile reflux, and may prevent complications and carcinoma arising in the intrahepatic ducts after cyst excision.[41-43]. We routinely did Tube cholangiogram through peroperative placed Transanastomotic infant feeding tube after 3 weeks to check for anastomotic patency and then only removed the tube. A satisfactory cholangiogram and liver function tests were achieved in all our patients after excision of the choledochal cyst and hepaticojejunostomy. This demonstrates that surgical treatment done at a dedicated hepatobiliary center by experienced surgeon can provide excellent results in patients with choledochal cyst disease.

Conclusion: Choledochal cyst require an accurate diagnosis and surgical treatment in order to decrease the risk of complications which includes malignant transformation and progression of the disease. Most cases of choledochal cysts are Type I and IV cyst that can be treated with good results by early surgical excision of the cyst followed by bilioenteric continuity preferably by Roux-en-Y hepaticojejunostomy

References

1. Lee HK, Park SJ, Yi BH, et al. Imaging features of adult choledochal cysts:a pictorial review. Korean J Radiol. 2009;10:71–80.

2 .M. Yamaguchi, “Congenital choledochal cyst. Analysis of 1,433 patients in the Japanese literature.”. The American Journal of Surgery, vol. 140, no. 5, pp. 653-657, 1980.

3. C. Y.-L. Woon, Y.-M. Tan, C.-L. Oei, A. Y.-F. Chung, P. K.-H. Chow, and L.L.P.-J. Ooi. “Adult choledochal cysts: an audit of surgical management.” ANZ Journal of Surgery, vol. 76, no. 11, pp. 981-986, 2006.

4. M.-J Cho, S. Hwang, Y.-J Lee et al., “Surgical experience of 204 cases of adult choledochal cyst disease over 14 years.” World Journal of Surgery, vol. 35, no. 5, pp. 1094-1102, 2011.

5. J. P. Lenriot, J. F. Gigot, P. Segol, P.L. Fagniez, A. Fingerhut, M. Adloff. “Bile duct cysts in adults: a multi-institutional retrospective study.” Annals of Surgery, vol. 228, no. 2, pp. 159-166, 1998.

6. J. S. de Vries, S. de Vries, D. C. Aronson et al., “Choledochal cysts: age of presentation, symptoms, and late complications related to Todani’s classification.” Journal of Pediatric Surgery, vol. 37., no. 11. Pp. 1568-1573, 2002.

7. T. Todani, Y. Watanabe, M. Narusue, K. Tabuchi and K. Okajima, “Congenital bile duct cysts. Classification, operative procedures, and review of thirty-seven cases including cancer arising from choledochal cyst.” The American Journal of Surgery, vol. 134, no. 2, pp. 263-269, 1977.

8. V. T. Ninan, M. R. N. Nampoory, K. V. Johny et al., “Caroli’s disease of the liver in a renal transplant recipient,” Nephrology Dialysis Transplantation, vol. 17, no. 6, pp. 1113-1115, 2002.

9. S. Crankson and S. Ahmed, “Cholodochal cyst: case report and review of literature,” Annals of Saudi Medicine, vol. 11, no. 5, pp. 585-588, 1991.

10. J.-Y. Mabrut, G. Bozio, C. Hubert, and J.-F. Gigot, “Management of conginetal bile duct cysts,” Digestive Surgery, vol. 27, no. 1, pp. 12-18, 2010.

11. P. A. Lipsett, H. A. Pitt, P.M. Colombani, J. K. Boitnott, and J. L. Cameron, “Choledochal cyst disease: a changing pattern of presentation, “ Annals of Surgery, vol. 220, no. 5, pp. 644-652, 1994.

12. Soares KC, Kim Y, Spolverato G, et al. Presentation and clinical outcomes of choledochal cysts in children and adults: a multiinstitutional analysis, JAMA Surg 2015;150:577-84.

13. Edil BH, Cameron JL, Reddy S, et al. Choledochal cyst disease in children and adults: a 30-year single-institution experience. J am Coll Surg 2008:;206:1000-5. Discussion 1005-8.

14. J. Z. Jona, D. P. Babbitt, R. J. Starshak, A. J. Laporta, M. Glicklich, and R. D. Cohen, “Anatomic observations and etiologic and surgical considerations in choledochal cyst,” Journal of Pediatric Surgery, vol. 14, no. 3, pp. 315-320, 1979.

15. K. Soreide, H. K. Orner, J. Havnen, and J. A. Soreide, “Bile duct cysts in adults,”British Journal of Surgery, vol. 91, no. 12, pp. 1538-1548, 2004.

16. Urushihara N, Fukumoto K, Fukuzawa H, Mitsunaga M, Watanabe K, Aoba T et al. Long-term outcomes after excision of choledochal cysts in a single institution: operative procedures and late complications. J Pediatr Surg 2012;47:2169-2174.

17. Dutta HK. Hepatic lobectomy and mucosectomy of intrahepatic cyst for type IV-A choledochal cyst. J Pediatr Surg 2012: 47: 2146-2150. Back to cited text no. 7

18. Lin SF, Lee HC, Yeung CY, Jiang CB, Chan WT. Common bile duct dilatations in asymptomatic neonates: incidence and prognosis. Gastroenterol Res Pract 2014:2014:392562.

19. Saing H, Tam PK, Lee JM. Surgical management of choledochal cysts: a review of 60 cases. Journal of pediatric surgery. 1985 Aug 1;20(4):443-8.

20. Chijiiwa K, Koga A. Surgical management and long-term follow-up of patients with choledochal cysts. The American Journal of surgery. 1993 Feb 1: 165(2):238-42

21. Jesudason S, Jesudason MR, Mukha RP, Vyas FL, Govil S, Muthusami JC. Managementof adult choledochal cysts-a 15 year experience. HPB 2006 Aug;8(4):299-305.

22. Machado NO, Chopra PJ, Al-Zadjali A, Younas S. Choledochal Cyst in Adults; Etiopathogenesis, Presentation, Management and Outcome-Case series and Review. Gastroenterology research and practice. 2015;2015.

23. She WH, Chung HY, Lan LC, Wong KK, Saing H, Tam PK. Management of choledochal cyst: 30 years of experience and results in a single center. Journal of pediatric surgery. 2009 Dec1:44(12):2307-11.

24. Kassem MI, El-Haddad HM, Elriwini MT. Surgical outcome of choledochal cysts in adults: a prospective cohort study. Egypt J Surg 2017;36:274-82.

25. Safioleas MC, Moulakakis KG, Misiakos EP, Lygidakis NJ. Surgical management of choledochal cysts in adults. Hepato-gastroenterology. 2005; 53(64)>1030-3.

26. Palanivelu C, Rangarajan M, Parthasarathi R, Amar V, Senthilnathan P. Laparoscopic management of choledochal cysts: technique and outcomes- a retrospective study of 35 patients from a tertiary center. Journal of the American College of Surgeons.2008 Dec 1;207(6):839-46.

27. Gadelhak N, Shehta A, Hamed H. Diagnosis and management of choledochal cyst: 20 years of single center experience. World Journal of Gastroenterology: WJG. 2014 Jun 14;20(22):7061.

28. Sugandhi N, Agarwala S, Bhatnagar V, et al. Liver histology in choledochal cyst- pathological changes and response to surgery: the overlooked aspect? Pediatr Surg Int. 2014; 30:205–211. [PubMed: 24370791]

29. Bismuth H, Krissat J. Choledochal cystic malignancies. Ann Oncol. 1999; 10:94–98. [PubMed: 10436795]

30. Voyles CR, Smadja C, Shands WC, Blumgart LH. Carcinoma in choledochal cysts. Age-related incidence. Arch Surg. 1983; 118:986–988. [PubMed: 6870530]

31. Diao M, Li L, Cheng W. Timing of surgery for prenatally diagnosed asymptomatic choledochal cysts: a prospective randomized study. J Pediatr Surg. 2012; 47:506–512. [PubMed: 22424346]

32. Suita S, Shono K, Kinugasa Y, et al. Influence of age on the presentation and outcome of choledochal cyst. J Pediatr Surg. 1999; 34:1765–1768. [PubMed: 10626850]

33. Fumino S, Higuchi K, Aoi S, et al. Clinical analysis of liver fibrosis in choledochal cyst. Pediatr Surg Int. 2013; 29:1097–1102. [PubMed: 23975015]

34. Burnweit CA, Birken GA, Heiss K. The management of choledochal cysts in the newborn. Pediatr Surg Int. 1996; 11:130–133. [PubMed: 24057535]

35. Rattner DW, Schapiro RH, Warshaw AL. Abnormalities of the pancreatic and biliary ducts in adult patients with choledochal cysts. Arch Surg. 1983; 118:1068–1073. [PubMed: 6615217]

36. Lopez RR, Pinson CW, Campbell JR, et al. Variation in management based on type of choledochal cyst. Am J Surg. 1991; 161:612–615. [PubMed: 2031547]

37. Joseph VT. Surgical techniques and long-term results in the treatment of choledochal cyst. J Pediatr Surg. 1990; 25:782–787. [PubMed: 2166158]

38. Takeshita N, Ota T, Yamamoto M. Forty-year experience with flow-diversion surgery for patients with congenital choledochal cysts with pancreaticobiliary maljunction at a single institution. Ann Surg. 2011; 254:1050–1053. [PubMed: 21659852]

39. Shimotakahara A, Yamataka A, Yanai T, et al. Roux-en-Y hepaticojejunostomy or hepaticoduodenostomy for biliary reconstruction during the surgical treatment of choledochal cyst: which is better? Pediatr Surg Int. 2005; 21:5–7. [PubMed: 15372285]

40. Narayanan SK, Chen Y, Narasimhan KL, Cohen RC. Hepaticoduodenostomy versus hepaticojejunostomy after resection of choledochal cyst: A systematic review and meta-analysis. J Pediatr Surg. 2013; 48:2336–2342. [PubMed: 24210209]

41. Urushihara N, Fukumoto K, Fukuzawa H, et al. Long-term outcomes after excision of choledochal cysts in a single institution: operative procedures and late complications. J Pediatr Surg. 2012; 47:2169–2174. [PubMed: 23217870]

42. Todani T, Watanabe Y, Toki A, et al. Reoperation for congenital choledochal cyst. Ann Surg. 1988; 207:142–147. [PubMed: 3341813]

43. Kim JW, Moon SH, Park do H, et al. Course of choledochal cysts according to the type of treatment. Scand J Gastroenterol. 2010; 45:739–745.