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ORIGINAL ARTICLE

Wide hilar hepatico-jejunostomy: the optimum method of reconstruction after choledochal cyst excision

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Abstract Standard reconstruction after choledochal cyst excision is by Roux-en-Y hepaticojejunostomy to the common hepatic duct. Long-term follow up studies have shown a 10% incidence of late complications, including anastomotic stricture. By extending the bilio-enteric anastomosis along the left hepatic duct, a wide hilar bilio-enteric anastomosis is created which may help to minimize late anastomotic complications. Forty-one consecutive patients (24 girls, 18 infants) with a median age of 2.3 years (range 44 days to 15.6 years) and median weight 11.5 kg (range 2.1–59 kg) underwent radical choledochal cyst excision with a wide hilar hepticojejunostomy. Thirty-eight were followed-up both clinically and by ultrasound scan and biochemical liver function tests for a median of 2.7 years (range 0.1–12.5 years). The median width of the hilar hepaticojejunostomy was 8 mm (range 6–25 mm) in 18 infants, and 15 mm (range 10–25 mm) in 22 older children. In one patient it was not measured. Only one surgical complication occurred—a self-limiting bile leak which settled spontaneously. Median postoperative stay was 6 days (range 5–21 days). No patient has had an episode of cholangitis or adhesive small bowel obstruction to date. Postoperative biochemical liver function tests have remained normal in all but one child (with pre-existing biliary cirrhosis). After radical resection of a choledochal cyst, a wide hilar hepaticojejunostomy is a, safe, effective and durable reconstructive technique that can be performed at any age and may help to minimize the long-term risk of complications.

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Introduction

Standard reconstruction after choledochal cyst excision is by Roux-en-Y hepaticojejunostomy to the common hepatic duct [1–4]. Long-term follow up studies after choledochal cyst excision have shown a significant incidence of late complications requiring reoperation, including anastomotic stricture at the hepaticojejunostomy [3, 5]. Since 1994, the author has used a reconstructive technique based on the Hepp-Couinaud approach used for the treatment of hilar bile duct strictures in adults [6, 7]. By extending the bilio-enteric anastomosis along the left hepatic duct, a wide hilar anastomosis is created which may help to minimize late anastomotic complications. The purpose of this report is to highlight the technical aspects of this procedure and to document medium-term outcomes in a consecutive series of patients.

Patients and methods

Between April 1994 and October 2006, 45 consecutive children with congenital choledochal dilatation or related pathology were referred to the author. Three children with Caroli's syndrome and one with a type V cyst without pancreaticobiliary malunion (PBM) did not require surgery and are excluded from this analysis. The remaining 41 patients consisted of 24 girls (F:M ratio 1.4:1) with a median age at surgery of 2.3 years (range 44 days to 15.6 years) and median weight 11.5 kg (range 2.1–59 kg). Eighteen were infants.

All patients underwent radical choledochal cyst excision with a wide hilar hepticojejunostomy [8]. In brief, after defining the biliary anatomy by preoperative imaging and/or intraoperative cholangiography, the operative procedure consisted of a circumferential extramural dissection of the choledochal dilatation in continuity with the gallbladder. The distal bile duct was transected just above the pancreatic duct within the head of the pancreas after removing any debris from a common pancreaticobiliary channel. The choledochal dilatation was then transected proximally at the level of the common hepatic duct in order to verify the position of the internal openings of the hilar ducts. Provided that there were no aberrant bile ducts entering the proximal part of the common hepatic duct, this segment of bile duct was resected, exposing the hilar bifurcation. Any dilated proximal intrahepatic ducts were then cleared of debris by irrigation with or without choledochoscopy. The anteroinferior wall of the extrahepatic segment of the left hepatic duct was then incised in order to facilitate the construction of a wide hilar enteric anastomosis (Figs. 1, 2). The incision in the left hepatic duct was extended medially almost as far as Glisson's capsule, leaving a small margin (a few millimeters) of ductal tissue for suturing this corner of the anastomosis. A 40 cm retrocolic jejunal Roux loop was used in all patients except infants under 6 months of age when, in the last 5 years, a 30 cm Roux loop was used. An end-to-side bilioenteric anastomosis was constructed approximately 5 mm from the stapled end of the Roux loop using fine interrupted absorbable monofilament sutures (6/0 or 7/0 polydioxanone), ensuring accurate mucosal apposition.

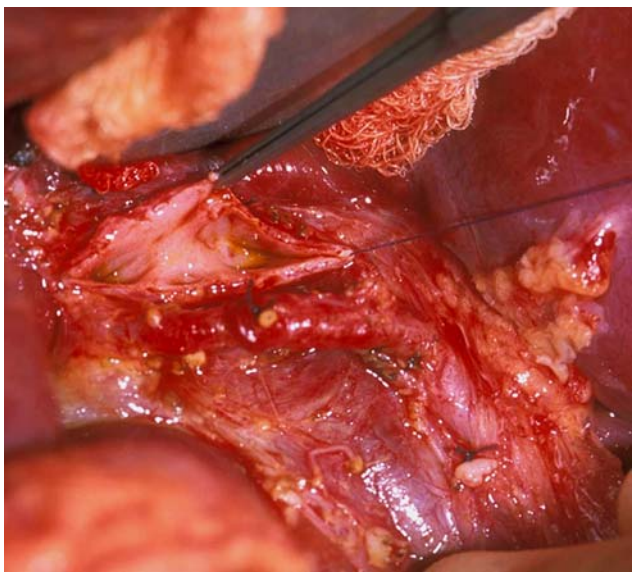

Fig. 1 Operative view of the hilar confluence after radical excision of a choledochal cyst. The left hepatic duct has been incised to create a wide bilio-enteric anastoamosis

Two infants with a complex, dilated common pancreaticobiliary channel containing debris also underwent a concomitant transduodenal pancreatic sphincteroplasty. An abdominal drain was inserted in only three cases—two patients at the beginning of the series and one child operated on abroad.

All patients received broad spectrum intravenous antibiotics (typically Cefuroxime and Amoxycillin) on induction of anesthesia and for 5 days postoperatively. Thereafter, patients were not given prophylactic antibiotics.

Three patients were followed up clinically. The remainder have been followed both clinically and by ultrasound scan and biochemical liver function tests (including gamma glutamyl-transpeptidase, a sensitive marker of biliary obstruction) at approximately 3 to 6 months postoperatively and every 1–2 years thereafter.

Results

The types of congenital choledochal dilatation [8] were as follows: 20 type Ic (14 with PBM); 14 type If (13 with PBM); 5 type IVa (3 with PBM); one forme fruste [9]; and one redo hepaticojejunostomy (after surgery complicated by a biliary leak and hilar stricture at another centre). Fourteen children were referred after prenatal ultrasound detection of a choledochal cyst, three of whom were symptomatic, one child presented with an acute abdomen after spontaneous cyst rupture, one infant presented with cholangitis and multiple liver abscesses, and one older child with cholangitis alone. Presenting features in the remaining 24 children consisted of abdominal pain, jaundice or both.

In two cases, the extrahepatic ductal anatomy favoured extending the incision along the right hepatic duct rather than along the left hepatic duct. The median width of the hilar hepaticojejunostomy was 8 mm (range 6–25 mm) in 18 infants, and 15 mm (range 10–25 mm) in 22 older children. The width of the anastomosis in the single patient operated on abroad was not recorded. Patients were discharged home after a median postoperative stay of 6 days (range 5–21 days). Only 8 of the 41 patients had a postoperative stay of longer than 7 days and in only one case was this related to a surgical complication—the girl operated on abroad had a bile leak which settled spontaneously but delayed her discharge home for 14 days. Other reasons for delayed discharge were prematurity (2), symptomatic congenital heart disease (1), ongoing antibiotic treatment of pre-existing liver abscesses (1) or following spontaneous cyst perforation (1), and social reasons (2). All 40 patients from the UK were followed up for a median of 2.7 years (range 0.1–12.5 years).

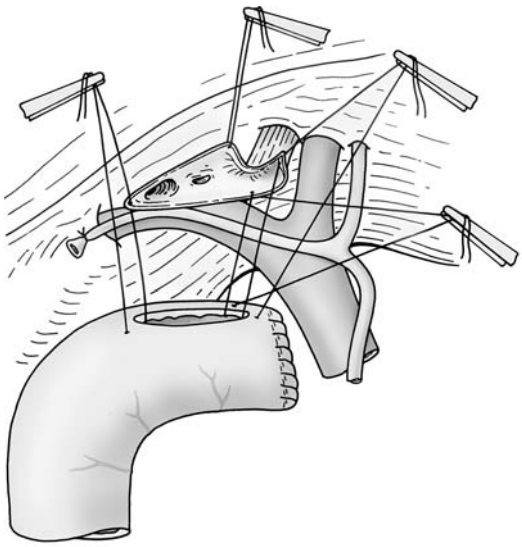

Fig. 2 Schematic illustration of the wide hilar hepaticojejunostomy. The cystic artery has been ligated. N. B. The right hepatic artery is obscured by the right hepatic duct

Only two complications occurred: the girl with the self-limiting bile leak and another girl with a single mild episode of acute pancreatitis 2 months postoperatively. Neither patient required further surgery and both are currently well, the latter 4 years later. None of the patients has had an episodes of cholangitis or adhesive small bowel obstruction to date. Biochemical liver function tests have been normal in all but one of 38 patients in whom they were monitored; one boy who was referred at 4 years of age with a fusiform choledochal cyst complicated by secondary biliary cirrhosis has persistent mildly abnormal biochemical liver function but no evidence of residual biliary obstruction.

Discussion

In the last 20 years, the concept of radical cyst excision and Roux-en-Y hepaticoenterostomy has been accepted as the optimum treatment of the common types (I and IV) of congenital choledochal malformations. Debate about the method of bilioenteric anastomosis has focused on the relative merits of hepaticoduodenostomy and hepaticojejunostomy and end-to-end versus end-to-side anastomosis [10, 11]. This controversy has largely been settled in favour of hepaticojejunostomy by the valuable contributions of the team at Juntendo University in Japan [4, 12]. Less attention has been paid to the level or width of the bilio-enteric anastomosis, most reports simply describing an anastomosis to the common hepatic duct [1, 2, 4].

However, long-term follow up studies have shown a 10% incidence of late complications requiring reoperation [5, 10, 13], including anastomotic stricture at the hepaticojejunostomy. In a large Japanese series of 200 children with type I or IVa cysts followed up for a mean period of 11 years after cyst excision and hepaticoenterostomy (principally Roux-en-Y hepaticojejunostomy) there were 25 late complications in 18 children (9%) [13]. These included ascending cholangitis, intrahepatic and common channel calculi, anastomotic stricture, pancreatitis and adhesive bowel obstruction. No anastomotic strictures developed in those children undergoing surgery before 5 years of age which the authors considered may be because anastomotic strictures are related to fibrosis and inflammation at the site of the bilio-enteric anastomosis, which is much more likely in older children. A wide hilar anastomosis should help to prevent an anastomotic stricture not only in older patients with a history of cholangitis but also in infants with small calibre bile ducts.

A similar wide hepaticoenterostomy at the hepatic hilum has been advocated previously. Lilly used an extended anastomosis selectively, reserving it for patients with a common hepatic duct or hilar duct stricture complicating a choledochal cyst [14]. Todani et al. [15] described incising the lateral wall of both the right and left hepatic ducts; they used an inner layer of continuous 4/0 absorbable sutures and an outer layer of interrupted 4/0 silk for the bilio-enteric anastomosis, which in most cases was a hepatico-duodenostomy. Only about 10% of the patients undergoing primary cyst excision in their series were infants [10]. Despite the differences in technique and patient characteristics as compared to the present report, these authors deserve credit for establishing the principle of a wide hilar anastomosis in reconstruction after choledochal cyst excision. The author's technique focuses principally on incising the left hepatic duct, as with the Hepp-Couinaud approach used in adults for the treatment of hilar bile duct strictures [6, 7]. Underpinning this technique is the anatomy of the left hepatic duct which has a consistently long transverse extrahepatic course. By extending the bilio-enteric anastomosis onto the extrahepatic segment of the left hepatic duct, a wide anastomosis is created. The anastomosis is ''splinted open'' by the fixed margins of the right and left hepatic ducts, counteracting any tendency to contraction. Furthermore, ductal blood supply at this level after excision of the choledochal malformation is usually excellent. Such a wide anastomosis may be particularly beneficial where previous cholangitis has caused ductal inflammation that could heal with fibrous scarring and in infants with small calibre bile ducts.

Although the period of follow-up in this series is too short to offer conclusive evidence of an advantage to the wide hilar hepaticojejunostomy, no patient has had clinical,

biochemical or imaging evidence of recurrent biliary obstruction to date. In addition, the technique has proved perfectly feasible in babies as small as 2 kg. Reports of the Hepp-Couinaud technique in adults have shown good long-term results with few anastomotic complications even in the presence of primary sclerosing cholangitis [16].

The incidence of surgical complications in this series was acceptably low with only one postoperative complication, a biliary leak in a child operated on in an unfamiliar environment. Other experienced units have also reported low complication rates [4]. These results should provide a useful yardstick for those developing laparoscopic choledochal cyst excision [17]. There have been no instances of adhesive small bowel obstruction during a median follow up of almost 3 years—a problem which occurred in 5% of patients in one large series [13] and which has encouraged some authors to promote hepaticoduodenostomy [10]. Careful follow-up has shown excellent outcomes. However, the wide hilar bilio-enteric anastomosis will not avoid all potential biliary complications e.g. the intrahepatic ductal problems occuring with some type IVa cysts [10].

In conclusion, after radical resection of a choledochal cyst, a wide hilar hepaticojejunostomy is a, safe, effective and durable reconstructive technique that can be performed at any age and may help to minimize the long-term risk of complications.

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References

1. Tan KC, Howard ER (1988) Choledochal cyst: a 14-year surgical experience with 36 patients. Br J Surg 75:892–895
2. Joseph VT (1990) Surgical techniques and long-term results in the treatment of choledochal cyst. J Pediatr Surg 25:782–787
3. Todani T, Watanabe Y, Urushihara N et al (1995) Biliary complications after excisional procedure for choledochal cyst. J Pediatr Surg 30:478–481
4. Miyano T (2006) Choledochal cyst. In: Stringer MD, Oldham KT, Mouriquand PDE (eds) Pediatric surgery and urology: long term outcomes. 2nd edn. Cambridge University Press, New York
5. Saing H, Han H, Chan K et al (1997) Early and late results of excision of choledochal cysts. J Pediatr Surg 32:1563–1566
6. Hepp J, Couinaud C (1956) L'abord et l'utilisation du canal hépatique gauche dans les réparations de la voie biliaire principale. Presse Med 64:947–948
7. Hepp J (1985) Hepaticojejunostomy using the left biliary trunk for iatrogenic biliary lesions: the French connection. World J Surg 9:507–511
8. Stringer MD (2006) Choledochal cyst. In: Spitz L, Coran AG (eds) Operative pediatric surgery. 6th edn. Hodder Arnold, London, pp 673–682
9. Lilly JR, Stellin GP, Karrer FM (1985) Formefruste choledochal cyst. J Pediatr Surg 20:4451
10. Todani T (1998) Choledochal cysts. In: Stringer MD, Oldham KT, Mouriquand PDE, Howard ER (eds) Pediatric surgery and urology: long-term outcomes. WB Saunders Co., Philadelphia, pp 417–429
11. Takada K, Hamada Y, Watanabe K et al (2005) Duodenogastric reflux following biliary reconstruction after excision of choledochal cyst. Pediatr Surg Int 21:1–4
12. Shimotakahara A, Yamataka A, Yanai T et al (2005) Roux-en-Y hepaticojejunostomy or hepaticoduodenostomy for biliary reconstruction during the surgical treatment of choledochal cyst: which is better? Pediatr Surg Int 21:5–7
13. Yamataka A, Ohshiro K, Okada Y et al (1997) Complications after cyst excision with hepaticoenterostomy for choledochal cysts and their surgical management in children versus adults. J Pediatr Surg 32:1097–1102
14. Lilly JR (1979) Surgery of coexisting biliary malformations in choledochal cyst. J Pediatr Surg 14:643–647
15. Todani T, Watanabe Y, Mizuguchi T, Fujii T, Toki A (1981) Hepaticoduodenostomy at the hepatic hilum after excision of choledochal cyst. Am J surg 142:584–587
16. Myburgh JA (1994) Surgical biliary drainage in primary sclerosing cholangitis: the role of the Hepp-Couinaud approach. Arch Surg 129:1057–1062
17. Li L, Feng W, Jing-Bo F et al (2004) Laparoscopic-assisted total cyst excision of choledochal cyst and Roux-en-Y hepatoenterostomy. J Pediatr Surg 39:1663–1666