Hepaticoduodenostomy for Biliary Reconstruction After Surgical Resection of Choledochal Cyst: a 25-Year Experience

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Abstract We reviewed our experience of hepaticoduodenostomy done for choledochal cyst from 1982 to 2007 at our center. The aim of the study was to evaluate the efficacy of hepaticoduodenostomy as a mode of biliary reconstruction after surgical resection of choledochal cyst, to look for any complications associated with hepaticoduodenostomy, with review of the literature. A total of 56 patients underwent hepaticoduodenostomy after surgical resection of choledochal cyst, of which 54 patients underwent primary cyst excision with hepaticoduodenostomy and 2 patients underwent redo surgery (hepaticoduodenostomy). Most of the patients had an uneventful postoperative recovery. Early complications were biliary leak in three patients which subsided on conservative treatment. Long-term complication was seen in only one patient who developed anastomotic stricture 18 years after primary resection of choledochal cyst and hepaticoduodenostomy. Hepaticoduodenostomy is a relatively safe procedure with very low complication rates. It requires a single anastomosis and is simple to perform.

Keywords Choledochal cyst · Hepaticoduodenostomy · Hepaticojejunostomy

Introduction

The most commonly performed operations for biliary reconstruction after complete surgical resection of choledochal

cyst are Roux-en-Y hepaticojejunostomy or hepaticoduodenostomy. There is a debate regarding the optimal technique for biliary reconstruction.

Roux-en-Y hepaticojejunostomy requires anastomoses, resulting in a higher incidence of adhesive bowel obstruction. Long-term follow-up has shown a significant incidence of late complications, namely anastomotic stricture, cholangitis, peptic ulcer, fat malabsorption, diarrhea, and malnutrition [1–4].

Hepaticoduodenostomy is preferred by surgeons since it is a more physiological procedure, is simpler to perform, and is associated with fewer complications such as adhesive bowel obstruction, anastomotic leakage, and peptic ulcer as compared with Roux-en-Y hepaticojejunostomy [2, 5]. Hepaticoduodenostomy requires less operative time, allows faster recovery of bowel function, and produces fewer complications requiring reoperation [6].

Some surgeons prefer Roux-en-Y hepaticojejunostomy since studies have shown a high incidence of endoscopy-proven bilious gastritis secondary to duodenogastric reflux after hepaticoduodenostomy, and they feel that the reflux of duodenal contents (including activated pancreatic enzymes) into the intrahepatic bile ducts through the hepaticoduodenostomy anastomosis may be hazardous to the bile duct mucosa, causing hilar bile duct carcinoma [7, 8].

Patients and Methods

Between 1982 and 2007, 56 patients of choledochal cyst underwent hepaticoduodenostomy, of which 54 patients underwent primary cyst excision with hepaticoduodenostomy and 2 cases underwent redo hepaticoduodenostomy. The ages ranged from 3 months to 36 years (mean, 18.25 years). According to the classification of Todani, all our patients had type I choledochal cyst. Seventy percent of the patients presented with pain in the abdomen, and 30 % of the

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patients presented with a lump in the abdomen. Fever and jaundice were present in 15 % of the patients. The classical triad of jaundice, lump, and pain was present in only 10 % of the patients. Ultrasonography was diagnostic in 77 % of the patients. The diagnosis was established by ultrasonography, CT scan, and magnetic resonance cholangiopancreatography (MRCP) (Fig. 1).

A complete hemogram, liver function test, blood grouping, and cross-matching were done. The preoperative preparation included hydration, antibiotics, and vitamin K if indicated.

The surgery was started with a right subcostal incision. The liver was retracted superiorly. The colon and stomach were retracted aside, so that the cyst and the gallbladder could be easily seen (Fig. 2). The gallbladder was dissected off the liver bed. The cystic artery was ligated. The gallbladder with cystic duct was kept in situ. Dissection of the cyst was made and separated all around with blunt and sharp dissection without opening the cyst. The terminal end of the cyst opening in the duodenum was isolated, clamped, cut, and transfixed (Fig. 3). The whole of the cyst was separated from vessels up to the liver bed. The cyst was opened, and the openings of the cystic duct and right and left hepatic ducts were identified. The cyst along with the gallbladder was excised completely above the opening of the cystic duct at the confluence of the right and left hepatic ducts (Fig. 4). The duodenum was mobilized, and two stay sutures were taken over the first part of the duodenum. An adequate incision was taken over the duodenum between the stay sutures, 2 cm distal to the pylorus. An anastomosis was done between the duodenum and hepatic duct with polydioxane. The posterior layer was sutured initially in two layers, first with running sutures between the seromuscular layer of the duodenum and the common bile duct, followed by full-thickness interrupted sutures. The anterior layer was closed with full-thickness interrupted sutures. The duodenum was anchored to the liver at porta to avoid tension on the

Fig. 1 MRCP showing choledochal cyst, gall bladder, and pancreatic duct

Fig. 2 Intraoperative photograph showing the choledochal cyst

anastomosis. A drain was kept in Morrison's pouch. Liver biopsy was done. The wound was closed in layers.

The patients were kept nil by mouth for 5 days. Ryle's tube aspirations were continued for 5 days after which the tube was removed. Patients were kept on liquid diet for 2 days, and then soft diet was started. Intravenous antibiotic and fluids were given for 1 week. The intra-abdominal drain was removed on the seventh postoperative day. Most of the patients were discharged by the tenth postoperative day.

On initial follow-up, complete blood count, liver function test, and ultrasonography of the abdomen were done. On subsequent follow-up, investigations were done only in symptomatic patients. For the first 3 years after surgery, patients were followed up every 6 months. Later, early follow-up was done. The mode of long-term follow-up of our patients was by visits to our center, telephonic conversations, and postal inquiry.

Fig. 3 Intraoperative photograph showing right and left hepatic ducts after excision of the choledochal cyst

Fig. 4 Intraoperative photograph showing communication of the choledochal cyst with the pancreatic duct

Results

There were 29 male and 27 female patients. The age of presentation ranged from 3 months to 36 years. Forty patients were less than 12 years and 16 patients were above 12 years.

A total of 56 patients underwent hepaticoduodenostomy, of which 54 patients underwent primary cyst excision with hepaticoduodenostomy. Out of the 54 patients who underwent primary cyst excision, approximately 70 % patients presented with pain in the abdomen, and 30 % of the patients presented with a lump in the abdomen. Fever and jaundice were present in 15 % of the patients. The classical triad of pain, lump, and jaundice was present in only 10 % of the patients. Only one patient presented with signs and symptoms of cirrhosis with portal hypertension.

Two patients had a history of previous surgery done for choledochal cyst. One of them was a 35-year-old female who had undergone cystoduodenostomy at another center 15 years ago. She presented to us with pain in the abdomen and jaundice. MRCP was done, which revealed anastomotic stricture and multiple calculi in the cyst. She underwent resection of choledochal cyst with hepaticoduodenostomy. The second case was a 23-year-old male who had undergone hepaticoduodenostomy at 5 years of age at our center. He presented with pain in the abdomen and jaundice. CT scan was done, which revealed anastomotic stricture with intrahepatic biliary radicle dilatation. He underwent redo hepaticoduodenostomy.

The diagnosis was made on ultrasonography in 42 patients. CT scan was done in ten patients to confirm diagnosis, and MRCP was done in four patients.

Of the 54 patients who underwent primary cyst excision with hepaticoduodenostomy, postoperative biliary leak was

seen in two patients. They had a minor biliary leak for about 10 to 12 days, which subsided with conservative treatment. Anastomotic stricture and cholangitis were seen in one patient, 18 years after hepaticoduodenostomy. He underwent redo hepaticoduodenostomy. He developed a biliary leak after redo surgery, which lasted for about 6 weeks. Liver biopsy in three infants showed varying degree of hepatic fibrosis. Among the rest, 30 % of the patients had evidence of cirrhosis.

Eight patients were lost to follow-up after a period ranging from 1 to 2 years in spite of postal request. A 5-year follow-up was possible in 23 patients. Thirteen patients were followed up for 10 years, and 11 patients were followed up for more than 10 years. Maximum follow-up of 22 years was done by one patient. Most of the patients were asymptomatic on postoperative long-term follow-up; seven patients developed vague abdominal pain but no jaundice. Ultrasonography and liver function tests were normal in all these patients. They responded to medical treatment.

Only one patient presented with pain in the abdomen, jaundice, and fever, 18 years after hepaticoduodenostomy. On investigations, he had an anastomotic stricture. He underwent endoscopic dilatation with placement of a stent, which was later removed.

Discussion

In 1959, Alonso Lej et al. reported the first clinical series of patients with choledochal cysts [9]. Todani et al. classified choledochal cysts into five types. Of these, 90 to 95 % of choledochal cysts are type I cysts [10]. In our series, all patients had type I choledochal cysts.

The classical triad of jaundice, pain in the abdomen, and mass was present in 13 to 63 % of unselected series [11]. It is uncommon in children [12]. The classical triad was seen in only 10 % of patients in our series. We had one patient who was antenatally diagnosed and referred to us at 3 months of age. He was asymptomatic at presentation and was operated on at 3 months of age. Some authors have proposed that antenatally diagnosed asymptomatic cases may be followed up till about 6 weeks and then operated on [13]. There is a potential hazard of cyst enlargement, perforation, and hepatic dysfunction if operation is delayed, so some authors have recommended repair at 1 to 2 weeks of age [14].

Ultrasonography is required to diagnose choledochal cyst in most patients. It also gives information of the status of the liver. It was done in all our patients. CT scan may be required in few patients to confirm diagnosis. MRCP gives information about the extent of the cyst, defects within the biliary tree, and presence or absence of the anomalous junction of the pancreaticobiliary duct. It can play an important role as a noninvasive

examination and should be considered a first-choice imaging technique for evaluation of choledochal cyst [15].

Various treatment options of biliary reconstruction after complete cyst excision described are hepaticojejunostomy, hepaticoduodenostomy, jejunal interposition hepaticoduodenostomy, valved jejunal interposition hepaticoduodenostomy, nonrefluxing biliary appendicoduodenostomy, hepaticoanastomosis, and wide hilar hepaticojejunostomy [5, 7, 16–19]. Cystoduodenostomy and cystojejunostomy have been abandoned because of high frequency of cholangitis, stone formation, portal hypertension, secondary biliary cirrhosis, and cholangiocarcinoma arising from the retained cyst [5].

Roux-en-Y hepaticojejunostomy is considered as an ideal technique for repair of choledochal cyst, but hepaticoduodenostomy has gained wide acceptance and favored by many open as well as laparoscopic surgeons because of its advantages over hepaticojejunostomy. Hepaticoduodenostomy is a more physiological procedure, simpler to perform, and associated with fewer complications such as adhesive bowel obstruction, anastomotic leakage, and peptic ulcer as compared to Roux-en-Y hepaticojejunostomy [2, 5]. Hepaticoduodenostomy requires less operative time, allows faster recovery of bowel function, and produces fewer complications requiring reoperation [6]. If there is an anastomotic stricture following hepaticoduodenostomy, it can be easily managed by endoscopy as against hepaticojejunostomy.

It is advocated not to perform hepaticoduodenostomy if intrahepatic biliary dilatation is present or when the diameter of the common hepatic duct is more than 10 mm, because duodenal contents are likely to reflux easily into the intrahepatic bile ducts through the hepaticoduodenostomy anastomosis and remain longer in the intrahepatic bile ducts and cause cholangitis or anastomotic stricture formation. Some studies have shown high incidence of endoscopy-proven bilious gastritis secondary to duodenogastric reflux after hepaticoduodenostomy [7]. Recently, a case of hilar bile duct carcinoma that has been developing for 19 years following primary cyst excision and hepaticoduodenostomy for biliary reconstruction at the age of 13 months was reported. It is thought that reflux of duodenal contents (including activated pancreatic enzymes) into the intrahepatic bile ducts through the hepaticoduodenostomy anastomosis may be hazardous to the bile duct mucosa [8].

Roux-en-Y hepaticojejunostomy requires the creation of a Roux-en-Y jejunal limb and two anastomoses, resulting in a higher incidence of adhesive bowel obstruction than hepaticoduodenostomy. Other complications described are cholangitis, peptic ulcer, fat malabsorption, diarrhea, and malnutrition [1]. Long-term follow-up studies after choledochal cyst excision hepaticojejunostomy have shown a significant incidence of late complications requiring reoperation, including anastomotic stricture at the hepaticojejunostomy [2–4]. To prevent a stricture, a wide hilar hepaticojejunostomy extending into the left hepatic duct is advocated [19].

We have done hepaticoduodenostomy for all of our patients. We have been doing hepaticoduodenostomy since 1982 when it was not so popular, and we did not encounter any major complications.

The surgical technique followed is described above. We prefer to dissect the cyst without opening it, as it is easy, maintains a clear operative field, and avoids damage to the underlying structures. The anastomosis is done between the duodenum and the hepatic duct with polydioxane. The posterior layer being dependent is sutured initially in two layers, first with running sutures between the seromuscular layer of the duodenum and the common bile duct, followed by full-thickness interrupted sutures. The anterior layer was closed with full-thickness interrupted sutures. The duodenum was anchored to the liver at porta to avoid tension on the anastomosis.

We did not encounter any major complications after hepaticoduodenostomy, except for biliary leak which stopped spontaneously and one case of anastomotic stenosis, 18 years after the primary surgery. To conclude, we feel that hepaticoduodenostomy for biliary reconstruction after complete cyst excision is simple, safe, and effective with very low incidence of long-term complications.

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