



# Laparoscopic Treatment of Congenital Choledochal Cysts in Children



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## Introduction

A congenital choledochal cyst (CHC) is a congenital malformation of the outer biliary tracts that leads to the blockage of bile flow and jaundice. If left untreated it causes episodes of cholangitis and due to long-term biliary hypertension results in the formation of biliary cirrhosis. Prospectively chronic inflammation biliary epithelium can be the cause of a cholangiocarcinoma. Thus, a surgical treatment is needed for all patients [1,2].

The first anatomical classification of a CHC was introduced by Alonso-Lej et al. [1], and later edited by Todani et al. [2,3] stating five types of a CHC [1-3]. The most common types to appear in the pediatric age are type I and IV. In type one the dilatation occurs in the common bile duct and has a fusi-form. Type IV is a combination of fusi-form choledochus dilatation and cystic dilatation of the inner bile tracts. In both these types the dilatation expands to the intra- pancreatic part up to the pancreatic duct.

A widely accepted pathogenesis theory of the type I and IV CHC formation is the anomaly of the biliopancreatic junction, where the pancreatic duct meets with the choledochus higher than the sphincter apparatus, thus leads to a reflux of the pancreatic enzymes into the choledochus resulting in constant inflammation of the choledochus epithelium [4,5].

Clinically a CHC presents with a classic triad: abdominal pain; a cyst in the right upper quadrant of the abdomen; obstructive jaundice. The surgical treatment of a choledochal cyst underlines a radical excision of the cyst and the formation of a biliodigestive anastomosis (hepaticoduodenostomy or Roux-and-Y hepaticojejunostomy). Since Farelo et al. [6] first described the laparoscopic treatment for a choledochal cyst it has been

gaining more and more approval in different age groups [6]. On the other hand, its feasibility and safety remain a challenge in comparison with the open operation.

## Materials and Methods

In the last 5 years we admitted to our clinics 5 patients with a CHC. The median age was 4.3 years (range 11 months- 12 years).

Three patients presented with type I CHC and two children with type IV CHC according to Todani's classification. Three patients had large cysts up to 6-8cm, average size of the cyst was 4.5cm.

Clinical presentation in two children was abdominal pain and obstructive jaundice. The other three patients experienced only abdominal pain and the instrumental pre-op diagnosing included an ultrasound (US) and computed tomography (CT) of the abdomen and a magnetic resonance cholangiopancreatography (MRCP). Such studies gave us the ability to differentiate the type of CHC, the absence or appearance of stones in the choledochus, the length of the hepatic duct before it meets the cyst, and also localize the pancreatic duct. Blood tests were a routine procedure.

## Surgical Options

Patients were positioned in the "French" position. For all the cases we used a 5mm camera positioned transumbilically, and 4 working trocars 5mm or 3mm- depending on the age of the patient. After revision of the abdominal cavity and visualization of the cyst we performed a traction of the liver by placing two stay-sutures at the fundus of the gall bladder directed to the abdominal wall.

Mobilization of the cyst was performed with the help of monopolar coagulation in a circular fashion until a good visualization of the right and left lobular hepatic ducts was reached. Resection of the cyst was made by excision of the hepatic duct from the cyst with a maximal dissection of the distal part of the cyst up to the pancreas followed by an excision of the cyst and suturing the underlying space. After revising the length of the hepatic duct remnant, a biliodigestive reconstruction variant was chosen.

The Roux-en-Y jejunal loop (40cm) was carried out extracorporally through the umbilicus. In three cases we performed a cyst excision with a Roux-en-Y hepaticojejunostomy, and in two cases we performed hepaticoduodenostomy. The anastomosis was made with a 6/0 absorbable material. For the back wall we used a running suture, and the front wall had interrupted suturing.

### Results

All five patients underwent a laparoscopic procedure without conversion. The average time of operation was  $160 \pm 25$  minutes. There were no bile leakages in the post-op period. Average hospital stay was  $5 \pm 2$  days. The follow-up was 24.5 months and in all cases, it was uneventful. Post-op US and blood test studies revealed normal liver function and an absence of stone formation with no dilatation of the inner biliary tracts.

**Discussion.** The incidence of a CHC is variable and ranges up to 1 in 100,000–150,000 live births in Western countries [7] and 1 in 13,000 individuals in Japan [4]. In 85% of cases CHC is diagnosed during the first year of life.

Clinical presentation consists of a triad of symptoms: jaundice; pain in the right upper quadrant of the abdomen; presence of an abdominal mass. In this series of patients only one child had all the symptoms of the triad. In three cases clinical presentation was abdominal pain and a cystic mass localized at the hepatic hilum on US. In one case a 7-month-old patient presented with obstructive jaundice that showed as cholestasis and cholestatic hepatitis in lab testing, and thus required transcutaneous drainage of the outer bile tracts [5].

An US study is an un-invasive first line diagnosing method for CHC that gives the ability to visualize the cyst, evaluate the liver structure, investigate the presence or absence of dilatation of the inner biliary tracts. CT and MRCP are specialized diagnostic methods that not only let us detect dilatation of the outer biliary tracts but let us study the relationship between the cyst itself and other neighboring anatomical structures. In our opinion such visualization increases the efficacy of surgical treatment and lessens intra-operative complications [8].

The method of choice for a CHC should be a full excision of the cyst with a biliodigestive reconstruction. The first report of a laparoscopic approach for a CHC was presented by Farelo et al. [6] in a 6-year-old child. Using this method goes along with a number of intra-operative difficulties (limited work space, high

risk of trauma of the liver hilum structures, difficulty of applying a biliodigestive anastomosis). All the above increases the number of post-op complications. Also, it is still controversial whether or not to use a hepaticoduodenostomy as a variant of biliodigestive reconstruction [9,10].

A Roux-en-Y hepaticojejunostomy is a method of choice for most surgeons. Never the less hepaticoduodenostomy is a more preferable method of reconstruction as it is more physiologic and causes fewer complications in the post-op period.

In our short statement we would like to discuss the anatomical opportunities for performing a Roux-en-Y hepaticojejunostomy or a hepaticoduodenostomy.

The criteria for choosing to perform a hepaticoduodenostomy were: cyst size less than 3cm, localization of the cyst in the distal part of the choledochus; length of the remnant of the hepatic duct after cyst excision not less than 1cm and its distance to the duodenum not more than 1.5cm after its mobilization. In other cases, the biliodigestive reconstruction was performed by a Roux-en-Y hepaticojejunostomy.

In the lower age group 11-15months where the diameter of the hepatic duct was less than 5mm to prevent stenosis of anastomosis we formed the biliodigestive anastomosis after a longitudinal transection of the front wall of the hepatic duct remnant. Thus, gave us the ability to perform an anastomosis with a diameter of 10-12mm.

When evaluating the duration of operative time, we stated that it took us  $65 \pm 14$  less to perform hepaticoduodenostomy than a Roux-en-Y hepaticojejunostomy in the post-op period we stated an early recovery of the peristalsis and passage of intestinal content. On the other hand, we didn't see a drastic difference in the post-op hospital stay between the two types of biliodigestive reconstruction.

In the follow-up period none of the children had symptoms of cholangitis or any other complications.

Our experience verifies the ability of treating a CHC with the laparoscopic approach even for different types of biliodigestive reconstruction. The offered methods of biliodigestive reconstruction with a Roux-en-Y hepaticojejunostomy or a hepaticoduodenostomy didn't show a reliable difference in the post-op period and the complications. On the other hand, a decrease in the time of operation when performing a hepaticoduodenostomy is an important criterion when performing some laparoscopic procedures. In result this minimizes the influence of CO<sub>2</sub> when undergoing a laparoscopic operation especially in small children.

### Conclusion

Laparoscopic resection of CHC in children is an excellent treatment option and can be the method of choice. Selecting the type of reconstruction of the bile system whether to perform a Roux-en-Y hepaticojejunostomy or a direct hepatico-

duodenostomy depends on the size and localization of the cyst, and also the length of the bile duct after resection.

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