Robot-assisted Complete Excision of Choledochal Cyst with Hepaticojejunostomy and Roux-en-Y Anastomosis

Vitoon Chinswangwatanakul
Minimally Invasive Surgery Unit, Department of Surgery
Faculty of Medicine Siriraj Hospital
Mahidol University, Thailand

Atthaphorn Trakarnsanga
Minimally Invasive Surgery Unit, Department of Surgery
Faculty of Medicine Siriraj Hospital
Mahidol University, Thailand

Chainarong Phalanusitthepha
Minimally Invasive Surgery Unit, Department of Surgery
Faculty of Medicine Siriraj Hospital
Mahidol University, Thailand

Nutnicha Suksamanapun
Minimally Invasive Surgery Unit, Department of Surgery
Faculty of Medicine Siriraj Hospital
Mahidol University, Thailand

Thawatchai Akaraviputh
Minimally Invasive Surgery Unit, Department of Surgery
Faculty of Medicine Siriraj Hospital
Mahidol University, Thailand
1 Introduction

Choledochal cyst is a rare congenital anomaly of the biliary tract system in western countries, but there is a higher incidence in Asia. This abnormality is more common in females. After being described firstly by Vater in 1723 (Shimura H, Tanaka M, Shimizu S & Mizimoto K, 1998), at present, choledochal cysts are classified using the Todani-Alonzo-Lej classification system (Tan HL, Shankar KR & Ford WD, 2003). The most common is choledochal cyst type I consisting of cystic, fusiform dilatation of the extrahepatic common bile duct (CBD) (Figure 1).

![Figure 1: MRCP demonstrated a large cystic dilatation of common bile duct with proximal dilatation of both left and right intrahepatic duct. A small pancreatic duct was revealed with long common channel.](image)

Untreated choledochal cysts are associated with complications such as recurrent cholangitis, acute pancreatitis and carcinoma of bile duct. The standard procedure is complete resection of the cyst with a Roux-en-Y hepaticojejunostomy anastomosis (Akaraviputh T, Boonnuch W, Watanapa P, Lert-Akayamanee N & Lohsiriwat D, 2005). Recently, many centers reported their experiences with laparoscopic resection of the cyst (Metcalfe MS, Wemyss-Holden SA & Maddern GJ, 2003). Although this approach has been shown to be feasible and safe, most reports emphasized the technical challenge of the

### 2.1 Preoperative Evaluation

Imaging study such as MRCP, MDCT is very important for identify type of choledochal cyst and for planning of surgical procedure. If the patients have deep jaundice, ascending cholangitis, acute renal failure or poor nutrition, preoperative biliary drainage such as ERCP with plastic stenting or percutaneous biliary drainage should be done. Prophylaxis antibiotic covered gram negative need to be given at least 30 min. before the operation.

### 2.3 Surgical Technique

After general anesthesia was administrated, the patient was placed in reverse Trendelenburg position. A small subumbilical skin incision was done and the 12 mmHg-pneumoperitoneum was applied by closed technique using Veress needle puncture. Then the camera and working ports were placed with 10 cm length between the ports (Figure 2). We used a 12-mm and the other three additional 8-mm robotic trocars and one 5 mm accessory port (for suction and irrigation instruments). The surgical cart was brought in direct to the patient head followed by the standard docking process. We put a monopolar hook cautery on the surgeon’s right hand (R3). For the surgeon’s left hand, we used the bipolar forceps (R2) and the grasper forceps (R1).

#### 2.3.1 Step 1: Dissection of the Common Bile Duct

The liver was retracted more cephalad to get a better exposure of the dilated common bile duct (CBD) using the third arm of robotic system (R1). Firstly, the cyst was carefully dissected (keep very close to the cyst wall), with meticulous preserving of the hepatic arteries as well as the portal vein lying posterior to it (Figure 3). The dissection was started on the inferior half of the cyst. Once the portal vein and hepatic arteries were separated from the cyst, the dissection was carried inferiorly toward the pancreatic part of distal CBD. The cyst was eventually found to taper rapidly into a small duct. The CBD was then closed with plastic clips (hemolock) and transected (Figure 4). The cyst was then dissected cephalad until normal caliber common hepatic duct (CHD) was identified and transected using hook electrocautery of the robotic arm (R3).

#### 2.3.2 Step 2: Cholecystectomy

The gallbladder was dissected in fundus-down fashion. The cystic artery was identified, clipped and divided. The CHD was transected and then complete cyst excision was done (Figure 5). The resected gallbladder was removed with the cyst in en-block specimen. The all resected specimen was placed in right subdiaphragmatic space in an endopouch. It would be removed through small incision after the last anastomosis was performed.
Figure 2: Position of ports placement (C=camera port, A: assistant port, R: port of robotic instruments)

Figure 3: The cystic dilatation of CBD was firstly dissected downward. Cystic artery was carefully identified.
2.3.3 Step 3: Hepaticojejunostomy Anastomosis

The ligament of Treitz was located and the jejunum was transected at 20 cm. from the ligament by endo GIA staple where a loop of jejunum easily approximated to the liver (Figure 6). An end-to-side hepaticojejunostomy (HJ) anastomosis, anticolic route, was created using interrupted 3-0 Vicryl suture (Figure 7).

2.3.4 Step 4: Jejunojejunostomy Anastomosis

Side-to-side jejunojejunostomy anastomosis could be created extra- or intra-corporeally (upto the sur-
geons’ preference) approximately 40 cm distal from the roux limb. We used endo-GIA staple for intra-corporeal technique (Figure 8). After completion of the HJ anastomosis, for extra-corporeal technique, the robotic system was undocked and the jejunojejunostomy anastomosis would be created through a small upper midline incision. However the extra-corporeally technique could reduce the total operative time. The Roux-en-Y limb and jejunojejunostomy were re-checked and confirmed to be in good position without any evidence of torsion, bleeding, or bile leak. Jackson Pratt drain was placed at hepatorenal pouch under the HJ anastomosis. Finally the resected specimen was removed through this incision using endobag. The fascial and skin incisions were closed with absorbable sutures.

Figure 6: The jejunum (2-3 cm from duodenojejunal junction) was identified and mesentery was dissected for transection using Endo GIA. From this point, Roux-en-Y limb was created for HJ anastomosis.

Figure 7: End-to-side HJ anastomosis was created using robotic hand-sewn technique.
2.3 Results

Since the da Davinci Robotic surgical system was launched at the Department of Surgery, Faculty of Medicine Siriraj Hospital in 2006, 6 female patients with choledochal cyst underwent robot-assisted surgery (Table 1). There were 2 patients developing post-operative complications such as collection, bleeding which can be treated conservatively without surgical intervention. In the follow up period, they are doing well without any evidences of stricture or cholangitis.

<table>
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<tr>
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<th>Gender</th>
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<th>Operation</th>
<th>OPT (min)</th>
<th>EBL (ml)</th>
<th>JJ anas</th>
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</table>

*Extracorporeally; *Jejuno-jejunostomy anastomosis; *Hepaticojejunostomy

Table 1: The outcomes of robot-assisted choledochal cyst excision with hepaticojejunostomy Roux-en-Y anastomosis at Minimally Invasive Surgery Unit, the Department of Surgery, Faculty of Medicine Siriraj Hospital.
Tips & Tricks

1. Using gallbladder for upward traction of the liver.
2. Countertraction of assistant’s instrument for creating dissection plane.
3. The portal dissection is done closely to the cyst wall.
4. Transection of the pancreatic part of CBD firstly.

3  Discussion

The morbidity rates for the robotic-assisted approach are comparable with previously reported results. Regard to the surgical technique, preoperative infection such as recurrent cholangitis may cause increasing technical difficulty. Although operative blood loss, mean operation time, and hospital stay were greater than laparoscopic approaches in some previous studies, this probably reflected the surgical teams’ learning curve for this technically challenging procedure. The postoperative complications seem to be decreased after the experiences of the surgical team are increased.

4  Conclusion

In summary, we described the technique of robot-assisted laparoscopic total resection of the choledochal cyst with Roux-en-Y hepaticojejunostomy anastomosis. Robot-assisted surgery is excellent for the most difficult part of the procedure such as total cyst excision, dissection of pancreatic part of CBD and the creation of the hepaticojejunostomy anastomosis. We believe robotic-assisted approaches will eventually become an advantageous treatment option for laparotomy in selected choledochal cyst patients. However further study is needed to properly evaluate the advantages and applicability of this approach.

References


