A Case of Robot-assisted Excision of Choledochal Cyst, Hepaticojejunostomy, and Extracorporeal Roux-en-y Anastomosis Using the da Vinci Surgical System

Chang Moo Kang, MD, Hoon Sang Chi, MD, Jun Young Kim, MD, Gi Hong Choi, MD, Kyung Sik Kim, MD, Jin Sub Choi, MD, Woo Jung Lee, MD, and Byong Ro Kim, MD

Abstract: Choledochal cyst is a rare disease in the Western world, but a high incidence is noted in Asia. Complete cyst excision with Roux-en-y hepaticoenterostomy is the treatment of choice for choledochal cyst, which has been attempted laparoscopically with the advancement of laparoscopic experience. Recently, a telemanipulative robotic surgical system was introduced, providing instruments with wrist-type end-effectors and 3-dimensional visualization of the operative field. Herein, we present a case of robot-assisted correction of a choledochal cyst.

Key Words: choledochal cyst, robot, da Vinci

(C) Surg Laparosc Endosc Percutan Tech 2007;17:538–541)

Cholecystic cyst is a rare disease in the Western world, but has a higher rate of occurrence in Asia. This disorder is frequently diagnosed in infancy and childhood, with a reported incidence of 1:1000 to 150,000 live births.

Complete cyst excision with Roux-en-y hepaticoenterostomy is the treatment of choice for choledochal cyst. This complex procedure has been attempted laparoscopically with the development of laparoscopic experiences and techniques. Even though laparoscopic correction of a choledochal cyst is technically feasible, the restricted movements of laparoscopic equipment make this procedure quite difficult. Recently, a telemanipulative robotic surgical system was introduced, providing instruments with wrist-type end-effectors and 3-dimensional visualization of the operative field. It has been applied to many minimally invasive surgical procedures.

Herein, we present a case of robot-assisted correction of a choledochal cyst, discuss the technical aspects, and describe the role of robot-assisted surgery in this complex procedure.

CASE REPORT

Patient

A 63-year-old female patient diagnosed with a choledochal cyst was referred to our department. She had undergone an appendectomy several decades before. She had been experiencing intermittent epigastric pain for more than 3 years. She had no palpable mass in the abdomen; neither was she jaundiced. Almost all her blood laboratory examinations were within normal limits, except the levels of serum amylase and lipase (868 and 61 U/L, respectively). Diffuse common bile duct dilatation with a suspected anomalous pancreaticobiliary duct union was noted (Fig. 1). The patient underwent da Vinci robot-assisted excision of the choledochal cyst, hepaticojejunostomy, and extracorporeal Roux-en-y hepaticojejunostomy.

Operative Techniques

The da Vinci system was prepared with sterile drapes before the patient arrived at the operating room. The patient was placed in a supine position on the operating table and underwent general endotracheal anesthesia. The abdomen was prepared and draped in the usual sterile manner. A 12-mm supraumbilical camera port was placed through a vertical minilaparotomy and pneumoperitoneum was achieved by CO₂ insufflation. Under the laparoscopy-providing vision, 3 additional 8-mm robotic instrument ports and a 5-mm conventional laparoscopic port were placed: port 1 on the lower right abdomen over the scar of previous appendectomy, port 2 on the mid-left abdomen, port 3 on the epigastric area, and the 5-mm accessory laparoscopic port was placed right lateral at the mid axillary line for upward retraction of the gallbladder during the dissection of the choledochal cyst (Fig. 2). All 3 working robotic arms were used at first. Port 3 was alternatively used for application of the laparoscopic clip, scissor application, and suction/irrigation by the table-side assisting surgeon when they were needed. The patient was placed in a reverse Trendelenburg position slightly tilted to the left. The da Vinci surgical cart was rolled in to position, 10 to 20 degrees off the right head of the table. The robotic camera arm and the other 3 instrument arms were then connected to their respective ports. The right accessory port was used for placement of the grasper for the upward and outward retraction of the gallbladder by a self-table-side holder. At this point, the surgeon was sitting at the surgical console, located about 3 m from the operating table. The patient-side assistant surgeon was positioned on the patient’s left to apply manual laparoscopic instrument for...
ligation, division, and suction through port 3 and to change the robotic instrumentation. The operating surgeon controlled the da Vinci system to dissect the hepatoduodenal ligament for the excision of the choledochal cyst. The cyst was carefully separated from the hepatic artery and portal vein using a monopolar dissector (Fig. 3). After circumferential dissection of the dilated choledochal cyst, the cyst was dissected down from the hepatic hilum to the intrapancreatic portion of the common bile duct. The distal portion of the choledochal cyst near the pancreatic duct was safely ligated and divided by using 5-mm endoclips (Fig. 4). The jejunum, at 20 cm distal to the Treitz ligament, was exteriorized through a slightly extended supraumbilical port site. A Roux-en-y anastomosis was performed 40 cm distally, with continuous Lambert sutures with interrupted seromuscular sutures. The laparoscopy using the da Vinci system was continued after the bowel was repositioned into the peritoneal cavity. Hepaticojejunostomy using the da Vinci surgical system was performed in the same manner as the laparotomy; that is, a posterior row was sutured with continuous Lambert sutures and an anterior row with interrupted ones (Fig. 5). After ensuring that there was no bleeding, a 200-mL 2-armed closed suction drain was placed with 1 arm under the hepaticojejunostomy and the other in the pelvic cavity.

**Postoperative Outcome**
Total operation time was 380 minutes and total robot working time was 270 minutes. Although the operation went excellently and without problems, the patient experienced postoperative bleeding (with the level of hemoglobin down to 8.6 g/dL) on the second postoperative day and it was managed successfully in a conservative way. The patient was able to start an oral diet on the eighth postoperative day and discharged on the fifteenth postoperative day with no further clinical problems.
In addition, the surgeon was able to reproduce the same procedures of hepaticojejunostomy as are performed in conventional open laparotomy. According to our experience, even medical students could perform a laparoscopic tie using the da Vinci system immediately after the introduction of the robot system in a simulation training session. The laparoscopic hepaticojejunostomy is the most technically demanding and time-consuming portion of the operation. With this robot system providing 3-dimensional visualization and the “wrist” movement of instruments, we could easily perform a hepaticojejunostomy in this case.

However, one of the main drawbacks of the system was the complete absence of tactile sensation. Several absorbable sutures were accidentally cut in the middle of traction or tied during the hepaticojejunostomy procedure. Owing to the lack of tactile sensation, the surgeon was unable to feel how strongly the instruments mounted on the robotic arms were holding and retracting the tissues or thread. The holding strength or traction had to be estimated using only the elasticity of the tissue or the tension of the thread visualized at the surgical console. However, just as conventional laparoscopic surgery has evolved and improved over the 10 years, this new robotic surgical system will also evolve as surgeons gain experience with it. Another disadvantage of this procedure is the need for a specially trained table-side assistant surgeon and nurses who are very familiar with laparoscopic surgery. Additionally, the relatively high cost of robotic surgical equipment is a compelling reason not to use robot surgery routinely.

The proper technique of Roux-en-y anastomosis has been a matter of debate. Some authors suggest using an endoGIA; however, in that case, another 12-mm port needed to be placed. As other authors performed the anastomosis via a minilaparotomy, we exteriorized the small bowel easily via a small extension of the supraumbilical incision.

According to the literature review, robotic choledochal cyst excisions have been performed and Woo et al recently reported a robot-assisted laparoscopic resection of a type I choledochal cyst in a child. We found the results to be quite satisfactory; however, further experience will surely reduce the instances of postoperative complications, preparation time, and operative time. Our patient experienced postoperative bleeding, which was successfully managed in a conservative way. The cause of the bleeding was not documented, but we suspect mesentry minor bleeding might have been the leading cause because easy touch bleeding occurred during the external preparation for Roux-en-y anastomosis. However, a short-term follow-up (1mo postoperative) revealed a good cosmetic result and a rapid return to physical activity.

Since July 2005, when the da Vinci robot system was first introduced in our country (Yonsei medical center is the unique institution which has the da Vinci system in Korea), more than 200 operations using the da Vinci system have been performed at our institution, including
cholecystectomy, choledochal cyst excision, gastrectomy, prostatectomy, partial bladder excision, hysterectomy, excision of mediastinal tumor, low anterior resection, and open heart surgery.\textsuperscript{21} Compared to our experience with conventional laparoscopic surgeries, the da Vinci robotic system's 3-dimensional visualization and 7 degrees of freedom of motion allowed for more delicate and precise procedures, especially when dissecting soft tissues around major vessels, performing hepaticejunostomy, and working in narrow spaces such as the pelvic cavity. Further research on the cost-effectiveness and benefits of robotic surgery over conventional laparoscopic surgery are still required.

REFERENCES