



Robotic-assisted excision of a type Ib choledochal cyst with Roux-en-Y hepaticojejunostomy in an adult with a 4-mm hepatic duct: A technical perspective

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ABSTRACT

Choledochal cysts are rare congenital dilatations of the biliary tree and are increasingly diagnosed in adults due to widespread use of cross-sectional imaging. Complete cyst excision with Roux-en-Y hepaticojejunostomy (RYHJ) is the standard of care to prevent long-term complications such as cholangitis and malignant transformation. Biliary reconstruction in the presence of a narrow hepatic duct remains technically challenging and is associated with a higher risk of postoperative bile leak. This video article describes a stepwise robotic technique for cyst excision and precise biliary reconstruction in an adult patient with a 4-mm common hepatic duct. A 40-year-old woman presented with recurrent right upper abdominal pain and was diagnosed on magnetic resonance cholangiopancreatography with a 3-cm saccular dilatation of the mid-common bile duct consistent with a Todani type Ib choledochal cyst. She underwent elective robotic-assisted cyst excision and RYHJ using the da Vinci Xi system. Key technical steps included standardized port placement for optimal hilar exposure, use of indocyanine green fluorescence imaging to delineate biliary anatomy, circumferential cyst dissection and transection at healthy ductal margins. A tension-free duct-to-mucosa hepaticojejunostomy was fashioned using interrupted fine absorbable sutures. The procedure was completed with minimal blood loss and no intraoperative complications. The postoperative course was uneventful, with no bile leak or infective complications, and the patient was discharged on postoperative day three. Robotic-assisted excision with RYHJ enables precise dissection and secure biliary reconstruction, even in the presence of a narrow hepatic duct, when meticulous technique is applied.

Keywords: Choledochal cyst, robotic-assisted surgery, hepaticojejunostomy, minimally invasive biliary surgery

INTRODUCTION

Choledochal cysts (CDC) represent congenital dilatations of the intrahepatic and/or extrahepatic biliary tree. Although the majority of cases are identified in childhood, a substantial proportion are now diagnosed in adulthood because of widespread availability of cross-sectional imaging and routine health screening. Adult patients often present incidentally or with complications arising from chronic biliary obstruction. According to the Todani classification, type I cysts, characterized by dilatation of the extrahepatic bile duct, constitute the most frequent variant and show a female predominance. Untreated CDC are associated with significant morbidity, including recurrent cholangitis, pancreatitis, biliary lithiasis, and an increased risk of biliary tract cancers (1).

Complete cyst excision with biliary reconstruction using a Roux-en-Y hepaticojejunostomy (RYHJ) remains the treatment of choice (1,2). In recent years, minimally invasive approaches, particularly robotic-assisted excision, have gained popularity in adult patients owing to improved ergonomics, enhanced precision, and superior cosmetic outcomes. However, biliary reconstruction in a thin bile duct remains technically challenging, and biliary leakage reported in up to 14% of cases continues to be the most feared postoperative complication. Other potential complications include bleeding, pancreatic fistula, and intra-abdominal collections (1-3). Herein, we present a technical perspective on robotic-assisted excision of a Todani type Ib CDC with RYHJ in a patient with a narrow 4-mm hepatic duct, highlighting the operative nuances and strategies to minimize biliary complications.

Materials and Surgical Techniques

A 40-year-old woman presented with several months of recurrent, dull, non-radiating pain localized to the right upper abdomen. There was no history of fever,

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pancreatitis, jaundice, or previous biliary procedures. Clinical examination was unremarkable, and baseline laboratory investigations, with no derangement in liver function parameters. Abdominal ultrasonography demonstrated a localized cystic enlargement of the extrahepatic bile duct. Magnetic resonance cholangiopancreatography revealed a 3-cm cystic outpouching arising from the mid bile duct with smooth distal narrowing and a proximally narrow common hepatic duct measuring approximately 4-mm, consistent with a Todani type Ib CDC (Figure 1). No intrahepatic ductal dilatation or pancreaticobiliary maljunction was identified. This video article (Video 1) describes a stepwise robotic technique for safe cyst excision and precise biliary reconstruction.

The patient was scheduled for elective robotic excision of the choledochal cyst with RYHJ using the da Vinci Xi system. She was positioned in reverse Trendelenburg with the legs abducted to allow the assistant to stand between the lower limbs. Following creation of pneumoperitoneum, four robotic ports were placed in a horizontal configuration at the umbilical level, approximately 20-cm inferior to the target area, maintaining an inter-port spacing of at least 8-cm to avoid arm interference. A 10-mm assistant trocar was inserted between the camera port and the right working port (Figure 2A, B). After docking, careful dissection of Calot's triangle was performed, and the cystic duct and artery were individually identified, clipped, and divided. The gallbladder was preserved initially to facilitate liver retraction and was removed at the completion of the procedure.

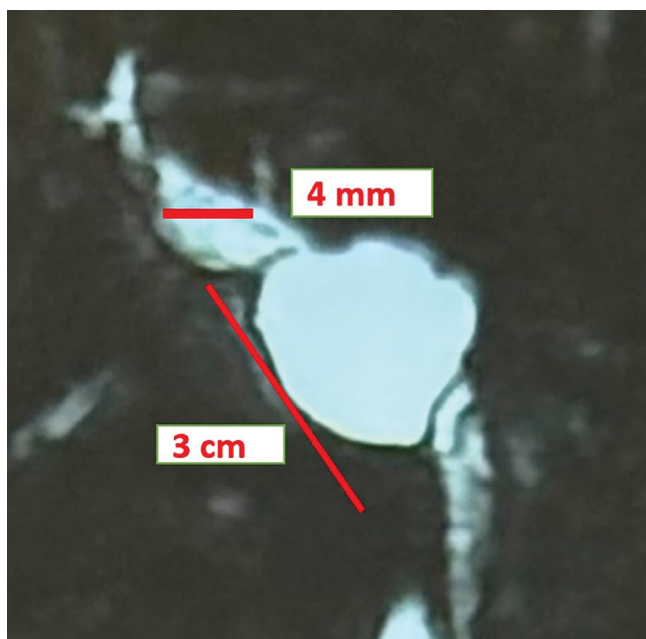


Figure 1. Magnetic resonance cholangiopancreatography demonstrates 3-cm saccular mid common bile duct dilatation with smooth tapering and 4-mm proximal hepatic duct consistent with type Ib choledochal cyst.

The duodenum was meticulously Kocherized to expose the dilated cystic segment, with judicious use of cautery to avoid thermal injury. Clear cystic fluid with multiple septations was noted within the cyst. Circumferential dissection was initiated laterally and progressed medially using a meticulous fibre-by-fibre dissection, as small feeding vessels were frequently encountered. A posterior window was created behind the distal end of choledochal cyst and clipped just above the pancreas (Figure 3A). Indocyanine green fluorescence imaging was used to delineate the hepatic duct confluence and plan proximal transection. Complete circumferential mobilization of choledochal cyst was achieved, and proximal transection was performed at the level of the common hepatic duct (Figure 3B).

The transverse colon was mobilized to identify the duodenojejunal flexure, and a Roux limb was created 40 cm beyond the duodenojejunal flexure using a linear stapler. After retrocolic transfer from infra-colic to supra-colic compartment, bilateral fixation sutures were placed to ensure a tension-free anastomosis. A duct-to-mucosa hepaticojejunostomy was fashioned using absorbable interrupted 4-0 polydioxanone sutures for both posterior and anterior layers under high magnification, ensuring a watertight anastomosis (Figure 4A, B). An intraoperative bile-leak test was negative, and an extracorporeal hand-sewn jejunojunctionostomy through 4-cm midline incision completed the reconstruction.

RESULTS

The total robotic operative time was 185 minutes, with minimal blood loss and no requirement for transfusion. There were no intraoperative complications, including vascular or visceral injury. The patient had an uneventful postoperative course. She resumed oral liquids on postoperative day one and advanced to a semisolid diet on postoperative day two. The abdominal drain showed no evidence of bile leak and was removed on postoperative day three. She was discharged in stable condition on postoperative day three. No postoperative complications were observed, including surgical site infection, intra-abdominal collection, biliary leak, or pancreatic fistula. At two months postoperatively, the patient remained symptom-free with normal liver function parameters.

CONCLUSION

Robotic-assisted excision of a Type Ib choledochal cyst with hepaticojejunostomy in a non-dilated (4-mm) hepatic duct is feasible. Enhanced visualization and precision facilitate meticulous suturing, offering a valuable minimally invasive option for complex biliary reconstruction.

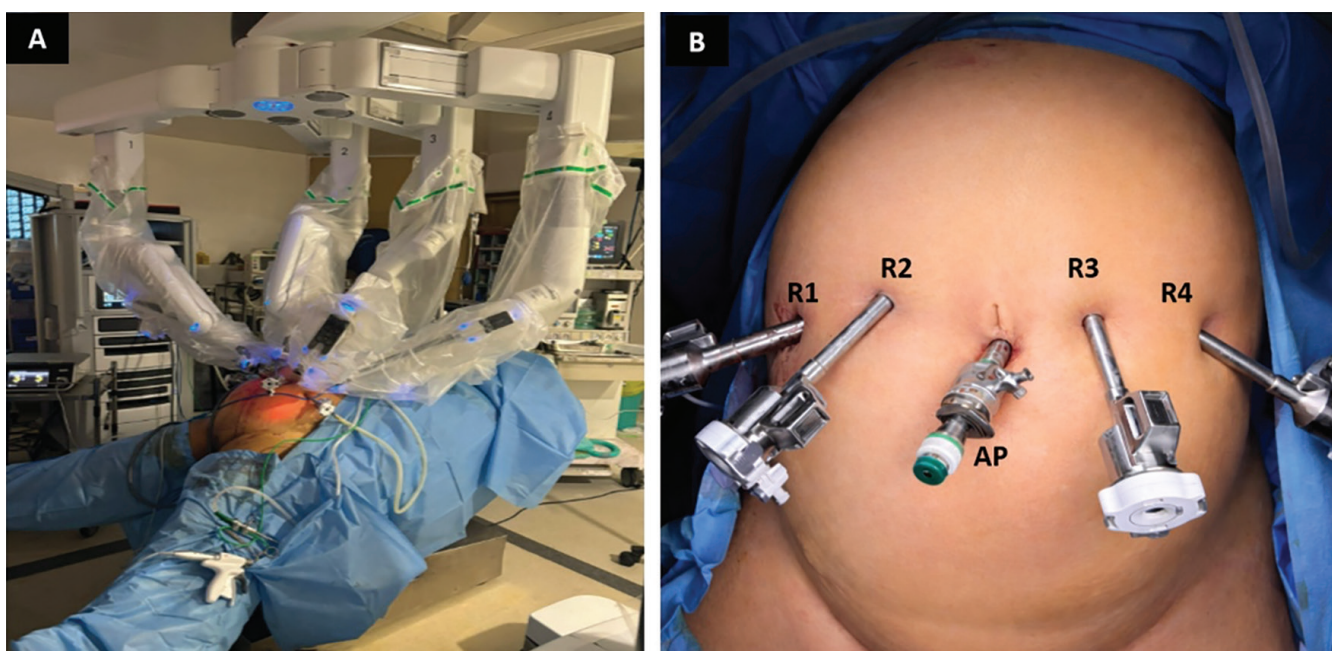


Figure 2. (A) Docking of the da Vinci Xi system in reverse Trendelenburg position before robotic choledochal cyst excision. **(B)** Port placement showing four robotic trocars: R1 and R3 working arms, R2 camera, R4 retraction arm, and assistant port (AP) positioned between R2 and R3.

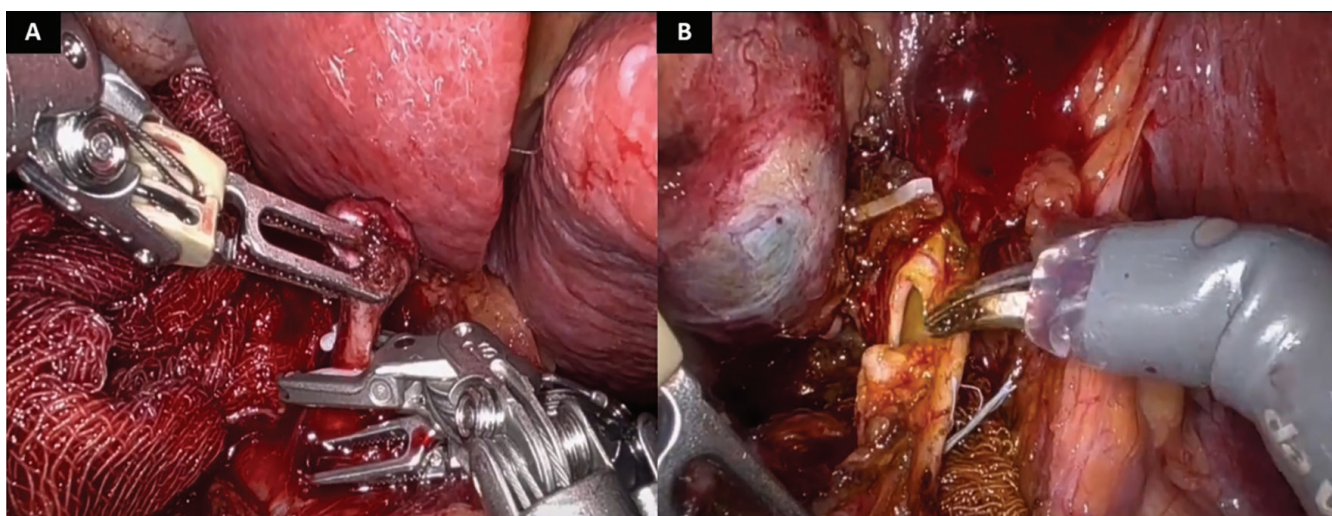


Figure 3. (A) Creation of a posterior window and distal end clipping of the choledochal cyst just above the pancreas. **(B)** Indocyanine green guided proximal end transection at the common hepatic duct after complete mobilization of choledochal cyst.

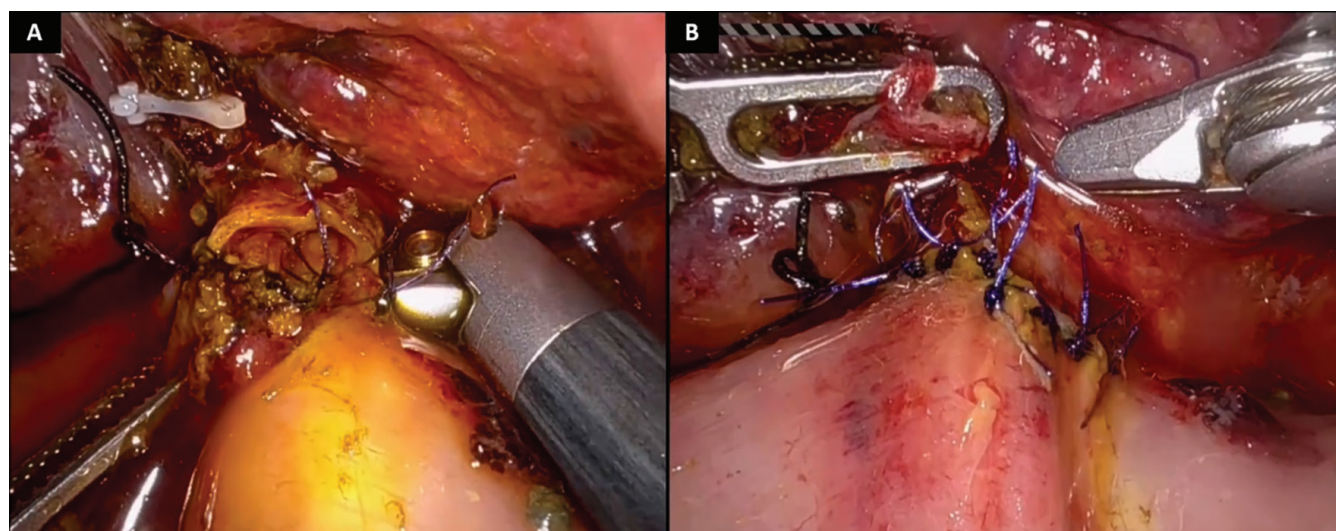


Figure 4. (A) Completion of the posterior layer of the hepaticojejunostomy using interrupted 4-0 polydioxanone sutures, (B) followed by completion of the anterior layer of the anastomosis.

Video 1: Step-wise robotic technique for choledochal cyst excision and Roux-en-Y hepaticojejunostomy.

Video Link: <https://youtu.be/EUi3V0LqMEI>

Ethics

Informed Consent: Written informed consent was obtained from the patient for the publication.

Footnotes

Financial Disclosure: The author declared that this study received no financial support.

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