Robotic Roux-en-Y Bilioenteric Reconstruction

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Abstract The authors report technical details of robotic bilioenteric reconstruction done for variable indications: choledochal cyst and biliary stricture. Robotic bilioenteric anastomosis as alternative to open reconstruction, offers advantages of minimal access surgery without compromising the precision of open surgery for hilar dissection and reconstruction. Both patients recovered uneventfully and remain symptom-free 18 and 15 months after surgery.

Keywords Roux-en-Y · Hepatico-jejunostomy · Robotic surgery · Choledochal cyst · Biliary stricture

Introduction

Despite advances in minimal invasive surgery, laparoscopic Roux-en-Y hepaticojejunostomy (RYHJ) remains a challenge. Robotic-assisted technique for the same procedure has not been fully described. We describe our technique in two cases of robotic RYHJ performed for choledochal cyst and biliary stricture.

Choledochal Cyst

A 35-year-old female presented to us with history of recurrent upper abdominal pain associated with nausea/vomiting and fever. Liver function tests were normal,

imaging (computed tomography and magnetic resonance cholangiopancreatography-MRCP) showed fusiform dilation of common hepatic duct and bile duct with maximum diameter of 4.2 cm, dilated cystic duct and distended gallbladder with a diagnosis of type IVa choledochal cyst (Fig. 1). Robotic excision of choledochal cyst was performed followed by creation of end-to-side Roux-en-Y hepaticojejunostomy (Fig. 2). Patient had uneventful intraoperative and postoperative course with hospital discharge after 5 days and remains symptom-free at 18 months follow-up. Pathology findings were consistent with inflamed choledochal cyst.

Biliary Stricture

A 57-year-old male during workup for abdominal pain and jaundice was found to have a short segment distal biliary stricture. He had undergone ERCP, sphincterotomy and stent

Fig. 1 MRCP image of choledochal cyst type IVa

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Fig. 2 End-to-side Roux-en-Y hepaticojejunostomy

placement few months before followed by a stent change and presented to us with recurrent symptoms of cholangitis. Brush cytology did not show any evidence of malignancy. Imaging including CT and MRI showed cholelithiasis, diffuse dilation of intra and extrahepatic biliary system with bird beak tapering at distal bile duct. EUS-guided biopsy was normal. PET scan did not show abnormal FDG avidity. Patient underwent robotic side-to-side Roux-en-Y hepaticojejunostomy and cholecystectomy. Patient's intraoperative and postoperative course was uneventful with hospital stay of 6 days and is doing well at follow-up of 15 months.

Surgical Technique

Patient Position and Port Placement

Operation table is kept in neutral position with patient supine. Pneumoperitoneum up to 12 mmHg was created using open Hassan technique. Six-port technique was used as shown in Fig. 3, 12 mm trocar umbilical port for camera was put under direct vision, three 8 mm robotic trocars, two on the left (1 and 3) one on the right (2), 12 mm assistant port for stapling and a 5-mm assist port on the left lateral to the umbilical port. For the fixity of table and robotic arms, ports were placed lower down so as to have access to both supra and infra colic compartment. Docking is done after port placement.

Jejunojejunostomy

We normally perform jejunojejunostomy first as it avoids switching back and forth between supra- and infracolic compartment. Roux limb is created approximately 15 cm from ligament of Treitz by transecting jejunum with endo-GIA stapler. The end of the jejunum is oversewn with 3–0 prolene suture. Intracorporeal anastomosis is done in a side-to-side

fashion using endo-GIA stapler keeping Roux limb around 40 cm. Afferent and efferent loops are fixed with interrupted suture (vicryl 3–0). Distal interrupted suture is kept longer which is held by a third arm and traction is maintained towards the left upper quadrant, thus facilitating introduction of stapler (Fig. 4). Mesenteric window closed with few interrupted 3–0 vicryl sutures to prevent internal herniation, position of the bowel should be rechecked so to ensure no torsion.

Portal Dissection

The extent of portal dissection would depend upon the etiology. The basic principle is similar to open technique, Hepp-Couinaud principle is followed. The hilar plate is lowered

Fig. 3 Robotic port placement (R robotic, AS assistant)

Fig. 4 Stapled jejunojejunostomy

and usually the incision over the duct is extended towards left so to achieve wide patent anastomosis.

Hepaticojejunostomy

The edge of the duct is freshened to ensure good vascularity. The roux limb is brought to the supracolic compartment by antecolic approach and fixed there by one or two interrupted sutures between seromuscular layer of roux limb and cystic plate. Enterotomy is made on the jejunum with ultrasonic scissors, and the size of the stoma is kept slightly smaller than that of the duct. The anastomosis is done in end-to-side/side-to-side (depending on indication) fashion with 4–0 PDS suture, suture size depending on the size of the duct. The posterior layer is continuous (PDS 4–0) and reinforced with few

interrupted sutures starting at the right corner and anterior layer is interrupted (PDS 4–0). Full thickness bite is taken on either side so as to ensure good mucosa to ductal approximation (Fig. 5).

Discussion

RYHJ is a time honoured procedure to establish bilioenteric continuity, either as a definitive procedure for biliary stricture or essential component of biliary reconstruction following procedures such as choledochal cyst excision, pancreaticoduodenectomy, hepatectomy or liver transplantation. The basic tenet of the procedure being wide tension-free anastomosis between the hepatic

Fig. 5 Bilioenteric reconstruction with full thickness duct to mucosa suturing

duct and jejunal roux limb, with reported success rate close to 90% [1].

By the turn of this century, there has been a paradigm shift from open surgical approach to minimally invasive ways with feasibility and applicability extending to complex hepatobiliary procedures. Small incision, decreased hospital stay, decreased pain and better cosmesis have established laparoscopic surgery as an attractive option. Encouraging results both in terms of morbidity and mortality have been shown [2]. However fulcrum effect rendering compromised hand eye coordination, restricted degree of motion, precise suturing, long learning curve and reproducibility are the limitations inherent to laparoscopy. These make the delicate dissection and anastomosis as in RYHJ more difficult if not impossible [2]. Robotic platforms can largely overcome these limitations. Da Vinci robotic surgical system provides the advantage of 3D visualisation through stereo endoscope, tremor reduction, motion scaling and additional degree of freedom with wristed instrument. This simplifies the task of delicate dissection and fine suturing. Normal motion scaling of 2:1 was used by the surgeons during the entire procedure with no variation. The authors are trained liver transplant and hepatobiliary surgeons with extensive experience in living donor liver transplant and complex hepatobiliary cases. This background training makes adoption of robotic surgery easier with prior laparoscopic training. With all these advantages, surgical robots have been envisioned to expand the horizon of minimal invasive surgery; however, the size of the robotic hardware, the initial cost of installation and maintenance are something that cannot be overlooked. Overall cost in these cases was approximately 55,000 more compared to open procedure taking into account the increased operative cost but discounting for cost of treatment due to decreased length of stay and faster recovery.

The feasibility of robotic RYHJ was first studied in 2004 [3] in an experimental setting and 3 years later Kang et al. [4]

successfully applied it in clinical practice by performing complete excision of choledochal cyst with extracorporeal RYHJ, and the result was found to be non-inferior to laparoscopic approach. Similar outcome has been shown by few others [5]; however, the experience with robotic RYHJ has been so far sparse in the literature with only few case reports and series. However, the data showing long-term results or head to head comparison between already established conventional techniques is still awaited.

Compliance with Ethical Standards

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Conflict of Interest The authors declare that they have no conflict of interest.

References

1. Bismuth H, Franco D, Corlette MB, Hepp J (1978 Feb) Long term results of Roux-en-Y hepaticojejunostomy. *Surg Gynecol Obstet* 146(2):161–167
2. Moris D, Papalampros A, Vailas M, Petrou A, Kontos M, Felekouras E (2016) The hepaticojejunostomy technique with intra-anastomotic stent in biliary diseases and its evolution throughout the years: a technical analysis. *Gastroenterol Res Pract* 2016:3692096
3. Villegas L, Lagoo S, Schwartz T, Athar N, Greene R, Eubanks WS (2004 Jul-Sep) Robotically assisted laparoscopic Roux-en-Y hepaticojejunostomy. *JSLs* 8(3):239–244
4. Kang CM, Chi HS, Kim JY, Choi GH, Kim KS, Choi JS, Lee WJ, Kim BR (2007 Dec) A case of robot-assisted excision of choledochal cyst, hepaticojejunostomy, and extracorporeal roux-en-y anastomosis using the da Vinci surgical system. *Surg Laparosc Endosc Percutan Tech* 17(6):538–541
5. Chan OC, Tang CN, Lai EC, Yang GP, Li MK (2011 Jul) Robotic hepatobiliary and pancreatic surgery: a cohort study. *J Hepatobiliary Pancreat Sci* 18(4):471–480