

Robotic pancreas drainage procedure for chronic pancreatitis: robotic lateral pancreaticojejunostomy (Puestow procedure)

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Abstract: Lateral pancreaticojejunostomy (LPJ), also known as the Puestow procedure, is a complex surgical procedure reserved for patients with refractory chronic pancreatitis (CP) and a dilated pancreatic duct. Traditionally, this operation is performed through an open incision, however, recent advancements in minimally invasive techniques have made it possible to perform the surgery using laparoscopic and robotic techniques with comparable safety. Though we do not have enough data yet to prove superiority of one over the other, the robotic approach appears to have an advantage over the laparoscopic technique in better visualization through 3-dimensional (3D) imaging and availability of wristed instruments for more precise actions, which may translate into superior outcomes. This paper is a description of our technique for robotic LPJ in patients with refractory CP. Important principles of patient selection, preoperative workup, surgical technique and post-operative management are discussed. A short video with a case presentation and highlights of the important steps of the surgery is included.

Keywords: Lateral pancreaticojejunostomy (LPJ); Puestow procedure; chronic pancreatitis (CP)

Received: 14 March 2017; Accepted: 12 October 2017; Published: 18 April 2018.

doi: 10.21037/jovs.2017.10.10

View this article at: <http://dx.doi.org/10.21037/jovs.2017.10.10>

Introduction

Chronic pancreatitis (CP) is a debilitating condition that is often associated with incapacitating pain, pancreatic endocrine and exocrine insufficiency, and significant impairment in the patient's quality of life (1,2). The treatment of CP is challenging with surgical intervention being the most effective treatment modality for symptom control; however, not every patient is a candidate for surgery. Broadly, surgical intervention for CP can be divided into two main categories: (I) resectional (e.g., pancreaticoduodenectomy or distal pancreatectomy), or (II) decompressive [e.g., lateral pancreaticojejunostomy (LPJ)], with the choice of operation being determined by the location and extent of disease and surgeon preference (1-4). Decompressive surgery has the advantage of preserving pancreatic parenchyma with lesser risk of exocrine and/or endocrine insufficiency (3).

LPJ (Puestow procedure) is the most commonly performed decompressive procedure for CP and is indicated in symptomatic patients who have failed medical management and have a dilated pancreatic duct (PD) (1-3). The surgery is technically challenging and traditionally was done as an open procedure; however, in recent years there have been a few reports describing outcomes after laparoscopic LPJ (2,3). Laparoscopic surgery offers advantages associated with lesser post operative pain and a shorter recovery but is limited by the degrees of freedom and the non-articulating wrist motion of the instruments. Robotic LPJ is a more recent advancement in the treatment of symptomatic CP with only a few reported cases (4,5) and marries the minimally invasive benefits of laparoscopic surgery with the freedom of articulation of open surgery (6). The most significant advantages of robotic LPJ include enhanced optics with 3-dimensional (3D) imaging and

improved degrees of freedom with articulating instrumentation that can allow for a more precise anastomosis that is less likely to leak (4-6). This paper describes our technique for robotic LPJ (Puestow); a short video with a case presentation and highlights of the important steps of the surgery are included.

Patient selection and pre-operative workup

Robotic LPJ is reserved for select patients with severe symptomatic CP and a dilated PD on imaging. The gastroenterology team evaluates all patients and surgery is only considered for those with refractory symptoms after treatment with opioid analgesics, enzyme supplements, and/or endoscopic intervention. Medical history is reviewed for any potential medical or surgical contraindications to robotic surgery such as unstable or untreated coronary artery disease, prior open abdominal surgeries, or use of hernia repair mesh. Cross sectional imaging with a contrast enhanced pancreas protocol computed tomography (CT) scan or magnetic resonance cholangiopancreatography (MRCP) is obtained for all patients to confirm diagnosis, evaluate extent of PD dilation, rule out malignancy, and assess for active acute pancreatitis, peri-pancreatic fluid collections, and associated biliary strictures. All patients are seen preoperatively by anesthesia and are scheduled for surgery after the patient has been deemed a suitable candidate for robotic LPJ.

Equipment preference card

The surgery is performed using the da Vinci Xi or Si robot system (Intuitive Surgical, Sunnyvale, CA, USA). Robotic instruments commonly used in the surgery are monopolar curved scissors, fenestrated bipolar forceps, ProGrasp forceps, and a vessel sealer device. A large needle driver is typically employed for sewing and locking plastic clips are used for hemostasis control for most blood vessels greater than 3 mm in diameter. Robotic staplers are used for transecting small intestine and Monocryl® (poliglecaprone 25, Ethicon, Sommerville, NJ, USA) and V-Loc® sutures (Medtronic, Minneapolis, MN, USA) are typically used for all anastomoses.

Procedure

Patient positioning

After induction with general anesthesia, two intravenous

lines and an arterial line are placed. The patient is then positioned supine with legs together and left arm abducted about 90 degrees on an arm board for anesthesia access. Only slight reverse Trendelenburg position is utilized during surgery. The abdomen is prepped from the levels of the nipples down to the pubis using ChlorPrep® (chlorhexidine gluconate and isopropyl alcohol) and draped using laparoscopic drapes.

Port access

Initial access is obtained with a Veress needle at the umbilicus and pneumoperitoneum is established. The Veress needle is then upsized to a 12-mm camera port and three additional 8-mm robotic ports are placed in the right mid-axillary line, left mid-clavicular line and left mid-clavicular line respectively. Lastly, a 12-mm laparoscopic assistant port is placed in the lower right mid-clavicular line for suctioning and passing suture.

Surgical steps

The stomach is mobilized and the robotic bipolar vessel sealing device is used for dividing the gastro-colic ligament to enter the lesser sac (video 00:34) (*Figure 1*). The lesser sac is opened and the pancreas is exposed along its length. The greater curvature of the stomach is sutured to the anterior abdominal wall with V-Loc suture to keep the stomach retracted for the duration of the case (video 00:40) (*Figure 1*). An intra-operative ultrasound of the pancreas is then performed to identify the PD and review the vascular anatomy, especially the location of the gastroduodenal artery in the region of the pancreatic neck (video 00:51 and 1:36) (*Figure 1*). Monopolar electrocautery is then used to longitudinally open the dilated PD from the neck to the tail (video 00:55) (*Figure 1*). Any stones that are seen in the duct are carefully extracted (video 1:07) (*Figure 1*).

Next, a 30-cm Roux limb is created. For this, the transverse colon is reflected superiorly and the ligament of Treitz is identified. A window is made in the mesentery of the proximal jejunum approximately 20 cm distal to the ligament with the vessel sealer (video 1:51) (*Figure 1*) and the jejunum is divided using the robotic stapler (video 2:05) (*Figure 1*). A side-to-side jejunotomy is first fashioned by aligning the two loops of jejunum next to each other and placing anchoring seromuscular sutures on either side. Small enterotomies are made in both intestinal loops using monopolar electrocautery and a side to side anastomosis



Figure 1 Robotic lateral pancreaticojejunostomy (Puestow procedure) performed for chronic pancreatitis (7). Case presentation details are provided within the video while operative details are included in the corresponding article text.

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is fashioned using a single firing of the robotic stapler (video 2:35) (*Figure 1*). The resulting enterotomy is then closed in a single layer using a continuous inverting V-loc suture (video 2:46) (*Figure 1*). Next, the Roux limb is then brought into the lesser sac through a window in the transverse mesocolon and laid adjacent to the length of the pancreas. The mesentery of the Roux limb is released as needed to ensure that the future anastomosis will not be under tension. Monopolar electrocautery is used to make a longitudinal enterotomy of the same length as the incised portion of the PD (video 3:06) (*Figure 1*). The pancreaticojejunostomy is then fashioned using running 4-0 Monocryl suture (video 3:20) (*Figure 1*). The first stitch is placed at the apex in the distal pancreas and the back row of the anastomosis is run towards the head of the pancreas taking care to ensure approximation of the jejunal serosa to pancreatic edge. The anterior anastomosis layer is similarly run from left to right taking care to invert the mucosal edge. At the completion of the anastomosis, fibrin sealant is injected over the area (video 4:46) (*Figure 1*) and a surgical drain is left adjacent to the pancreaticojejunostomy.

Post-operative management

After recovering in the post anesthesia care unit, most patients are placed on the surgical floor. Nasogastric tube is left overnight and removed on the morning of post-operative day (POD) 1, after which diet is slowly initiated. Surgical drains are left intraoperatively only if there are any concerns about the anastomosis. If a drain is left, fluid

amylase is checked once the patient is tolerating a full liquid diet (POD 2–4) and removed as long as the output is less than 200 cc/day and fluid amylase levels are less than 3 times the upper normal limit. Typically, patients are discharged on POD 3–5 depending on tolerance of diet and pain control. Somatostatin analogues (e.g., octreotide and pasireotide) are not routinely used.

Tips, tricks and pit-falls

- (I) Intraoperative ultrasound is critical for identifying the dilated pancreatic duct (PD) for initial entry as well as to identify any stones proximal or distal to the incised PD.
- (II) Care should be taken to avoid injury to the gastroduodenal or splenic artery during the surgery. Risk of inadvertently injuring these vessels can be minimized through use of intraoperative ultrasound.
- (III) The genu of the roux limb is typically placed at the proximal extent of the anastomosis (near pancreatic neck).
- (IV) It is important to make the initial jejunal opening slightly smaller than the length of pancreatic duct opening as the jejunal enterotomy can stretch. If care is not taken, a dog edge deformity can result in the corner of the anastomosis due to excessive length of jejunum, which can increase the risk of developing a pancreatic leak.

Conclusions

Robotic LPJ is a safe technique for management of select patients with refractory CP and a dilated pancreatic duct. Compared with the laparoscopic approach, the robotic approach offers the advantages of a 3D view and a wide range of freedom of motion through use of articulating instruments.

Acknowledgements

None.

Footnote

Conflicts of Interest: JB Martinie serves as a proctor, speaker, and course director for Intuitive Surgical (Sunnyvale, CA). The other authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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doi: 10.21037/jovs.2017.10.10

Cite this article as: Khan AS, Siddiqui I, Vrochides D, Martinie JB. Robotic pancreas drainage procedure for chronic pancreatitis: robotic lateral pancreaticojejunostomy (Puestow procedure). *J Vis Surg* 2018;4:72.