13 Distal Subtotal Gastrectomy with D2 Lymph Node Dissection

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Introduction

Since the first laparoscopic distal gastrectomy for gastric cancer was first reported in 1994 [1], the minimally invasive surgery has drawn much attention worldwide. As the accumulation of the data showed the favorable short-term outcomes and accelerated postoperative recovery without compromising the oncologic safety [2–4], laparoscopic distal gastrectomy has been widely accepted as an option of minimally invasive treatments for early cancer. However, the application of laparoscopic gastrectomy for advanced gastric cancer remains debatable, because of the technical difficulties of D2 lymphadenectomy and digestive tract reconstruction, as well as lack of long-term survival data of large-scale randomized controlled trials.

Meanwhile, new technology represented by robotic surgical systems has been proven useful in allowing surgeons to readily perform procedures regarded as difficult with conventional laparoscopic surgery, enabling complex procedures to be carried out with a minimally invasive approach [5–11]. To overcome the limitation associated with laparoscopic surgery, surgical robot was adopted as alternative minimally invasive surgery by experienced laparoscopic surgeons.

In this chapter, we demonstrated the current status, advantages, indication, and detailed procedures of robotic distal gastrectomy for gastric cancer.

Advantages of Robotic Gastrectomy and Clinical Assessment of Its Application

Overview

The first case of robotic-assisted gastrectomy was reported in 2003 [5]. With the development of a decade, robotic gastrectomy has been proven to be safe and feasible in terms of mortality, morbidity, conversion rate, postoperative hospital stay, and oncological safety when compared with conventional laparoscopic gastrectomy.

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Generally, compared with conventional laparoscopic surgery, robotic surgery may offer more precise lymphadenectomy around vessels by providing various technical advantages, such as three-dimensional image, motion scaling, tremor filtering, coaxial alignment, and articulated endoscopic wrist with seven degrees of freedom, which could minimize blood loss and invasiveness and improve the dexterity of surgeons [12]. Furthermore, ergonomic design of the robotic console could reduce the discomfort and fatigue of surgeons, especially for the operations with long durations. In addition, the camera arm and 30° endoscope could lift the abdominal wall, just like the gasless procedure in laparoscopic surgery, and expand the space for manipulation and provide excellent visions.

Specific Advantages in Robotic Gastrectomy with D2 Lymphadenectomy

With its mechanical superiority, robotic surgical systems provide 3-D views and ambidextrous tremor-filtered bidirectional dissection around complex vascular structures, contributing to constantly keeping the right surgical plane, such as the plane between lymph nodes bearing fatty tissues and major suprapancreatic vessels (or pancreatic parenchyma) in the process of suprapancreatic lymph node dissection, providing more thorough and precise dissection, and reducing the possibility of injuries to vessels or the pancreas [12]. Moreover, the equipment of wristed instruments via the robotic arms aids in the approach to and traction of the stomach and pancreas, as well as proper and stable exposure of the peripancreatic area, even to the dorsal side of the pancreas where it is difficult for current laparoscopic instrument and camera system to identify and reach. Stable retraction of tissues without tremor can reduce potential risk of injury to lymphatic tissues and bleeding from dissection plane. All of these features could make it somewhat easier for surgeons to perform D2 lymphadenectomy during gastrectomy. Additionally, the 3-D views and the scaled movements of robotic instruments offer an optimal identification of vascular anomalies, such as an aberrant left hepatic artery originating from the left gastric artery, and allow the aberrant hepatic artery-preserving lymph node dissection. Furthermore, the robotic system facilitates intracorporeal hand-sewn sutures in all anastomosis even in deep and narrow spaces, which might promote the shift from extracorporeal to intracorporeal anastomosis in robotic surgery [13]. In addition, 3-D views and articulated instruments of robotic system could make the control of major bleeding due to vascular injury more easily [13]. Meanwhile, robotic distal gastrectomy exhibits a shorter learning curve than that for laparoscopic gastrectomy [14], which may enable a greater number of surgeons to perform D2 lymph node dissection during gastrectomy for gastric cancer. Shorter learning curves might also permit experienced surgeons to apply advanced or complicated procedures more easily for gastric cancer treatment.

Clinical Assessment of Robotic Gastrectomy

Although high-level evidence is still wanting since robotic gastrectomy for gastric cancer treatment is a relatively novel field, the feasibility, safety, and short-term outcomes of robotic gastrectomy have been reported to be comparable with conventional laparoscopic gastrectomy [15–17].

The morbidity and mortality rate, as well as conversion rate, did not differ significantly between laparoscopic gastrectomy and robotic gastrectomy [9, 15–17]. Some study even reported that the robotic gastrectomy could decrease the morbidity significantly, compared with laparoscopic gastrectomy [18]. Several studies have showed that robotic gastrectomy was associated with reduced intraoperative blood loss compared with laparoscopic gastrectomy, which can provide extra potential oncologic benefits through decreasing the intraperitoneal free cancer cell dissemination and immunosuppressing caused by perioperative transfusions, especially for locally advanced cancer [19].

The postoperative hospital stay after the robotic gastrectomy was much shorter than that of open gastrectomy [15, 16]. No significant differences were observed between robotic gastrectomy and laparoscopic gastrectomy in terms of time to ambulation, time to start food intake, and postoperative hospital stay [9, 20]. However, some studies showed shorter mean postoperative hospital stay in robotic gastrectomy group compared to laparoscopic gastrectomy group [18, 21]. Faster recovery allows patients to receive adjuvant chemotherapy timely.

Given the lack of long-term survival data of robotic gastrectomy, the numbers of harvested lymph nodes and the resection margin are often used to evaluate the oncological safety. Some meta-analysis which compared the robotic gastrectomy to laparoscopic gastrectomy showed that there was no significant difference in the number of retrieved lymph nodes [15–17]. Even some authors reported that robotic gastrectomy can yield more lymph nodes located in the extra-perigastric area (2nd tier) in D2 lymphadenectomy [11, 22], compared with laparoscopic gastrectomy. For the resection margin, one study showed that no positive margins were observed in the robotic group, while some cases in the laparoscopic group had tumor involvement in the margin [23].

Regarding the comparisons of long-term survival between robotic gastrectomy with other approaches, retrospective studies revealed that long-term survival was similar between laparoscopic gastrectomy and robotic gastrectomy [11, 24]. However, because of the lack of randomized controlled trials demonstrating long-term outcomes, advantages of robotic gastrectomy from an oncologic view are still to be clarified.

Indication

Basically, the indications for robotic gastrectomy for gastric cancer are similar to those of the conventional laparoscopic gastrectomy. Candidates for robotic surgery include patients with a preoperative diagnosis of gastric cancer without serosa involvement and without evidence of lymph node metastasis to an extraperigastric area, except those with lesions suitable for endoscopic treatment. Distal gastrectomy is selected when a satisfactory proximal resection margin can be obtained. For early gastric cancer patients without lymph node involvement (cT1N0M0), limited lymphadenectomy (D1 or D1+) could be performed. The indications for D2 lymph node dissection comprise patients with a primary tumor of the deep submucosal layer or deeper invasion or patients with suspicious lymph node metastasis on preoperative diagnostic workup.

Patients with serosal involvement in locally advanced tumors, direct invasion to adjacent organs, or suspicion of extraperigastric lymph node metastasis are usually excluded from undergoing minimally invasive surgery. However, robotic gastrectomy for such cancers could be decided according to the surgeon's expertise and experience but should be performed within the context of clinical trials.

Operative Procedures [7, 25, 26]

Operating Room Setup

The patient cart is positioned at the head of the patient. The vision cart is located caudal to the patient. The surgeon's console is placed where the operator could see and check the patient cart and the patient. The assistant should have a position at the left side of the patient. And it is useful to have a second monitor on the right side of the table across from the assistant. Sterile back tables (instruments) are located at the patient's knee and at the foot of the bed. The scrub nurse locates at the lower right side of the table, opposing to the patient-side assistant. Operating room configuration is usually dependent on the room dimension as well as the preferences and experience of the surgeons. The operating room setup is shown in Fig. 13.1a.

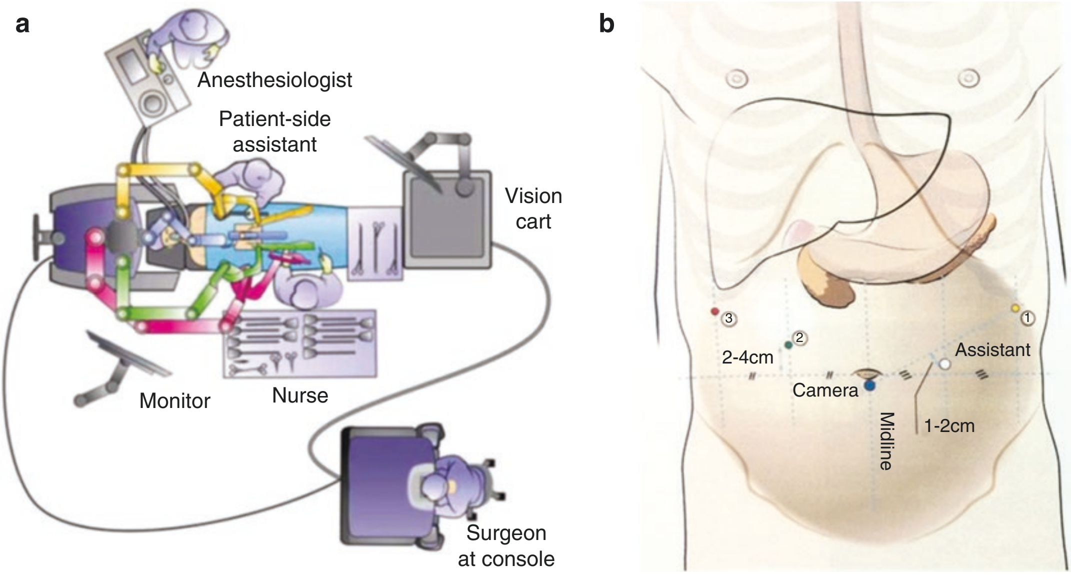

Fig. 13.1 Operating room setup and placements of trocars (cited from da Vinci Gastrectomy Procedure Guide [25]). (**a**) Operating room setup, (**b**) placements of trocars

Patient Positioning and Port Placement

Under general anesthesia, the patient's arms are placed alongside the body to prevent injury to the upper extremities by the robotic arms. In order to prevent the patients from translocation, the patients should be carefully secured and fixed by strap and gel pads across the thigh. After positioning, securing, and preparing the patient in the supine position, a 12-mm trocar is placed at the midline just below the umbilicus for inserting a dual lens laparoscope. After pneumoperitoneum of 12-mm Hg is achieved, the table is then placed in a reverse Trendelenburg position (15°). After laparoscopic exploration and checking for the optimal locations of the port sites, four additional ports could be inserted under camera visualization: one 12-mm and three 8-mm ports. Specifically, an 8-mm diameter port for the 1st arm of the robot is placed 1 cm below the costal angle, as far lateral as possible, on the patient's left side; the port should be at least 1 cm above the level of the bowel when viewed internally. Another 8-mm port for the 3rd arm should be inserted 1 cm below the costal angle, as far lateral as possible, on the patient's right side; it should also be positioned 1 cm above the bowel. Another 8-mm port for the 2nd robotic arm should be inserted 2–4 cm above along an imaginary line that intersected the middle of the camera port and the right subcostal port; this step allows easier access to the pancreatic head and duodenum and achieves a proper angle with the non-wristed ultrasonic shears. The assistant port should be placed 1–2 cm below an imaginary line drawn from the insertion site of the 1st robotic arm to the umbilical camera port (Fig. 13.1b). Maximizing the distance between the ports (at least 8 mm, especially between 2nd arm and 3rd arm) for the robotic arms would help to prevent external collision of the robotic arms. If the patient is thin, the port for the 2nd arm must be placed more caudally; the ports for the 1st and 3rd arms can be positioned more medially for obese patients. During the operation, the camera port should be lifted as high as possible to make sufficient use of the space made by the pneumoperitoneum.

Docking

The position of the operating table should be reconfirmed before docking since it's impossible to adjust the operating table after docking. Adjust the camera arm setup joint toward the left side of the patient with only 1st arm and confirm sweet spot. The blue arrow should align within the blue marker on the second joint or assure an angle less than 90 degrees between the 1st and 3rd joints on the camera arm. The arm of the patient cart should be positioned high enough to provide space above the patient's head. Then, the patient cart is rolled up and positioned over the patient's head. The camera arm, camera arm setup joint, column, camera port, and target anatomy are aligned. Once the correct position is reached, the patient cart can be locked. Dock the camera arm firstly and then the other three robotic arms. The space between the 2nd and 3rd arms, as well as the space between the 1st arm and the camera arm, should be maximized by spreading these arms as far apart as possible. Remember to keep instruments in the center of their range of motion.

Instrumentations

The instrumentation and settings consist of a 30-degree down endoscope in the camera arm, Maryland bipolar forceps in the 1st arm, ultrasonic shears or the monopolar curved scissors in the 2nd arm, and Cadiere forceps in the 3rd arm, interchangeably. The 3rd arm is applied at the patient's right side because the 3rd arm should be at the opposite side of the 1st arm for better countertraction. Surgeons control the 1st arm by the right hand while 2nd and 3rd arms by the left hand through switching button. The assistant aids the surgeon to suck, irrigate, and apply stapler or other additional procedures through the assistant port.

Liver Retraction

Appropriate liver retraction to prepare for the sufficient operative field is very important, not only for maximizing the application of instruments by liberating the arm used for liver retraction but also for facilitating dissection, particularly for suprapancreatic lymph node dissection. Various methods of liver retraction such as suspension using Penrose drains [27], the gauze suspension method [28], and retraction using liver retractor [29] have been described. Each of the aforementioned methods could be used provided that satisfied operative view is reached. To the authors' opinion, the gauze suspension method is simple and economic and almost harmless to the liver [28]. Briefly, two 4 × 4 inch gauze pads threaded by a 2-0 Prolene suture with 70-mm double straight needles are introduced into the intraperitoneal cavity via the assistant port. Next, the lesser omentum is divided up to the right side of the esophageal hiatus, and the Prolene suture is secured to the pars condensa with two Hemolocks. The straight needles are used to pierce the anterior abdominal wall directly on both sides of the xiphoid process and externally tied to suspend the liver toward the abdominal wall by the assistant.

Left-Side Dissection and Greater Curvature Mobilization (Lymph Node #4sb and #4d Dissection)

The greater omentum attaching to the greater curvature of the stomach is retracted cranially and ventrally by the 3rd arm, while the gravity of the transverse colon would act as countertraction. Left-side dissection and greater curvature mobilization begin by dividing the omentum and entering the lesser sac from the middle of the greater curvature, which comprises the fewest number of vessels, to the lower pole of the spleen using the ultrasonic shears. By continuing dissection, the left gastroepiploic artery and vein can be identified, ligated using clips via a robotic clip applier, and divided after giving the branch to the omentum (Fig. 13.2a). Division of adhesions between the lower pole of the spleen and greater omentum can prevent tearing of the splenic capsule. The short gastric vessels are usually preserved for a distal gastrectomy; however, if the tumor is in a high location, one or two short gastric arteries need to be divided for proper margins and create enough space for the resection and anastomosis. After ligating the left gastroepiploic vessels, all of the soft tissue along the greater curvature area

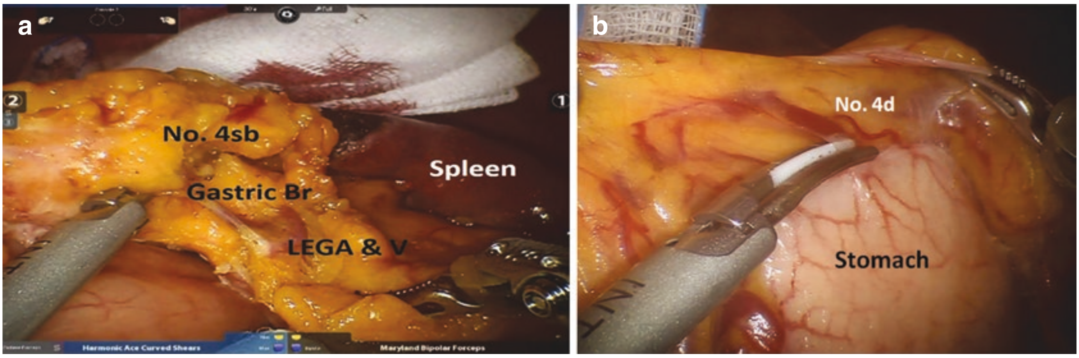

Fig. 13.2 Left-side dissection and greater curvature mobilization. (**a**) The left gastroepiploic artery and vein can be identified and divided after giving the branch to the omentum. (**b**) The greater curvature is skeletonized to remove No. 4sb and No. 4d lymph nodes. LEGA and V, left gastroepiploic artery and vein; Br, branch

should be removed by skeletonizing along the greater curvature toward the pylorus to complete the No. 4sb and No. 4d lymph node dissection for a distal gastrectomy (Fig. 13.2b).

Right-Side Dissection and Infrapyloric Area Dissection (Lymph Node #6 and #14v Dissection)

Right-side dissection and infrapyloric dissection are performed by dissecting soft tissue from the middle colic vessels to the surface of the superior mesenteric vessels while exposing the head of the pancreas and removing lymph node-bearing tissues around the right gastroepiploic vessels.

Retract the gastroepiploic pedicle ventrally and appropriately by the 3rd arm. Before performing the infrapyloric dissection, the physiological adhesions between the posterior wall of the stomach and pancreas should be fully dissected, and the inferior pancreatic border is exposed, which is very helpful to seek and keep the correct dissected planes. Then, the transverse mesocolon should be detached from the gastroepiploic pedicle and the pancreatic head by identifying the middle colonic artery and following the pulsations to the inferior pancreatic border. The physiological adhesions between the transverse colon and the descending part of the duodenum should also be released at the same time. The right colonic vein and the Henle's trunk that drains into the superior mesenteric vein are used as landmarks to identify the origin of right gastroepiploic vein. Soft tissues located on the right side and left side of the right gastroepiploic vein, as well as the soft tissues anterior to the anterior superior pancreaticoduodenal vein and Henle's trunk, should be dissected together using the Harmonic shears and the Maryland bipolar forceps until the pancreatic parenchyma is exposed. Next, the right gastroepiploic vein is clipped and divided distal to the confluence of the anterior superior pancreaticoduodenal vein (Fig. 13.3a). In case of No. 6 lymph node metastasis, the No. 14v lymph nodes should be also removed. Note that the venous drainage from the pancreatic head should be preserved when approaching the right side of the right gastroepiploic vein and the proper membrane of the pancreas which directly covers the pancreatic parenchyma should be kept intact to avoid the postoperative pancreatitis. If the middle colonic artery cannot be seen in some obese patients, dissect the opposite side first. Dissection to expose the right gastroepiploic artery is continued, and the artery is ligated and divided distal to the origin of anterior superior pancreaticoduodenal artery (Fig. 13.3b). Finally, the infrapyloric artery is identified and divided between clips. Thus, the right gastroepiploic vessels are dissected en bloc with lymphatic tissue (Fig. 13.3c). Sometimes, a ligule of pancreatic parenchyma is extended toward the duodenal bulb, or the pancreas is unexpectedly lifted up, which should be prevented from injuring. And there are many tiny branches around the root of

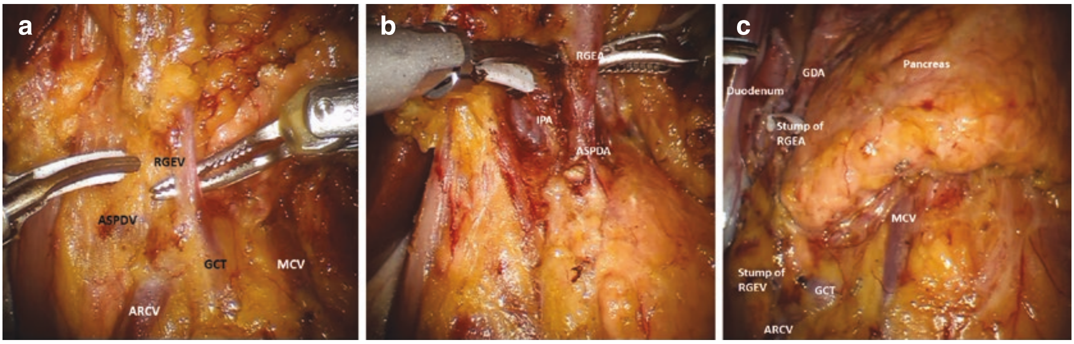

Fig. 13.3 Infrapyloric dissection. (**a**) The right gastroepiploic vein is clipped and divided distal to the confluence of the anterior superior pancreaticoduodenal vein. (**b**) The right gastroepiploic artery is ligated and divided distal to the origin of anterior superior pancreaticoduodenal artery. (**c**) View to show the dissection efficacy of No. 6 lymph node dissection. GCT, gastrocolic trunk; RGEV, right gastroepiploic vein; ASPDV, anterior superior pancreaticoduodenal vein; MCV, middle colonic vein; ARCV, accessory right colic vein; RGEA, right gastroepiploic artery; ASPDA, anterior superior pancreaticoduodenal artery; IPA, infrapyloric artery; GDA, gastroduodenal artery

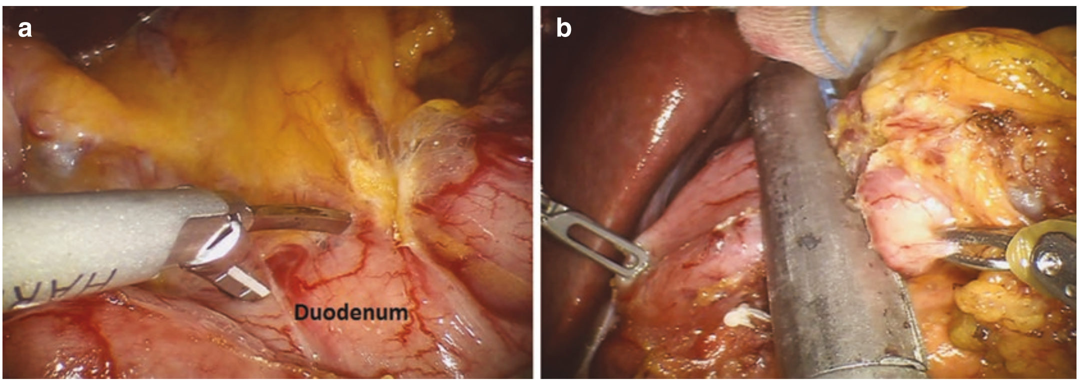

Fig. 13.4 Supraduodenal dissection and duodenal transection. (**a**) Supraduodenal vessels are divided by ultrasonic shears directly, and the duodenum is naked for transection. (**b**) The duodenum is stapled and divided about 2 cm distal to the pylorus using an endoscopic linear stapler through the assistant port

right gastroepiploic artery and infrapyloric artery; ultrasonic shears benefit to avoid bleeding and keep a clear surgical field.

Supraduodenal Dissection and Duodenal Transection

The duodenum is mobilized from the pancreas along the gastroduodenal artery to prepare for the duodenal transection, and the anterior side of the gastroduodenal artery is exposed. The dissection continues to the bifurcation of the proper hepatic artery and the gastroduodenal artery. Be sure to coagulate the small vessels from the head of the pancreas to the duodenum. After identification of the proper hepatic artery, a 4-inch by 4-inch gauze is inserted between the supraduodenal tissues and pancreas and acts like a “tent” to facilitate the dissection of the supraduodenal area and to avoid unexpected injuries to the pancreas and major vessels (such as the proper hepatic artery, gastroduodenal artery, or common hepatic artery). Supraduodenal vessels are divided by ultrasonic shears directly, and the duodenum is naked for transection (Fig. 13.4a). The duodenum is stapled and divided about 2 cm distal to the pylorus using an endoscopic linear stapler through the assistant port (Fig. 13.4b). The staple line of the duodenal stump could be reinforced by sutures if the Billroth-II or Roux-en-Y anastomosis is considered.

Suprapancreatic Area Dissection (Lymph Node #5, #7, #8a, #9, #11p, and #12a Dissection)

After transection of the duodenum, the stomach is retracted to the patient's left and ventral side to identify the right gastric vessels. In order to have an easier dissection of the anterior layer of the gastrohepatic ligament, the liver hilum is retracted by the Cadiere forceps of the 3rd robotic arm which is padded by a gauze. Dissection continues along the proper hepatic artery until the right gastric vessels are exposed. The anterolateral surface of proper hepatic artery is also exposed. Identify and skeletonize the root of the right gastric vessels for proper clip application. Divide the right gastric vessels at roots and dissect the No. 5 lymph node (Fig. 13.5a). When approaching the medial side of the proper hepatic artery, retraction of the liver hilum should be reduced. The tissues containing the vagus nerve around the proper hepatic artery are grasped by the Cadiere forceps and retracted to the right and caudal side, and the soft tissue located anterolateral to the proper hepatic artery which has been dissected before is countertracted to the left. Thus, a surgical plane could be created between the No. 12a lymph node-bearing tissue and the proper hepatic artery. Then all the tissues are removed en bloc along the surgical plane by Harmonic shears until the exposure of anterolateral wall of the portal vein (Fig. 13.5b). After finishing the No. 12a and No. 5 lymph node dissections, retract and tense the gastropancreatic fold using the Cadiere forceps ventrally. Lymph nodes bearing soft tissues at the surface of the common hepatic artery are gently pulled up by Maryland bipolar forceps, while the ultrasonic shears are used to skeletonize the common hepatic artery and dissect No. 8a lymph nodes from right to left. Avoid using active blade of Harmonic in direct contact with vessels; rotate the Harmonic shears away from vessels while skeletonizing. When dissecting the No. 8a lymph nodes cephalad to the common hepatic artery, retract the common hepatic artery dorsally and caudally by grasping the tissues around the artery, which is useful to expose easily and prevent injuries to major vessels. Complete the dissection of No. 8a and 12a lymph nodes around the proper and common hepatic artery and portal vein until the left gastric vein is identified. Clip and divide the left gastric vein at the root. Constantly dissect in the right plane between the nerve sheaths around the major arteries and lymph nodes bear-

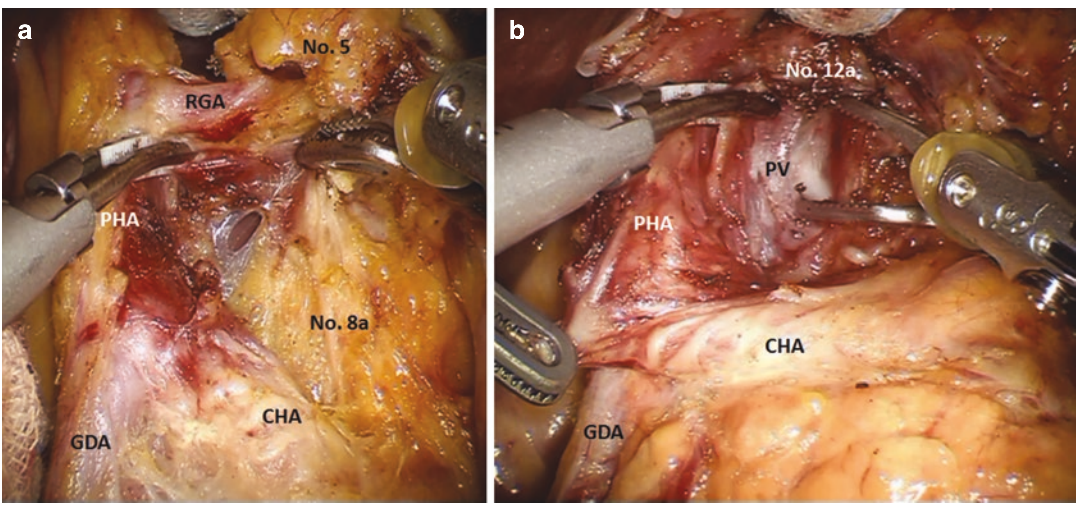

Fig. 13.5 Dissection of No. 5 and 12a lymph nodes. (**a**) Identify and skeletonize the root of the right gastric vessels for proper clip application, and divide the right gastric vessels at roots and dissect the No. 5 lymph nodes. (**b**) Dissection of No. 12a lymph nodes until the exposure of anterolateral wall of the portal vein. CHA, common hepatic artery; GDA, gastroduodenal artery; RGA, right gastric artery; PHA, proper hepatic artery; PV, portal vein

ing fatty tissues, and utilization of the articulation and grasping capabilities of the Cadiere and Maryland forceps to create the proper dissection angles for the non-wristed Harmonic shears during the process of suprapancreatic lymphadenectomy is necessary for a technically safe and radical lymphadenectomy.

Continue the dissection along the common hepatic artery toward the celiac trunk, and expose the origin of the splenic artery (Fig. 13.6a). Soft tissues around the celiac trunk are dissected and pulled up to the specimen side. The root of the left gastric artery is skeletonized, clipped, and divided (Fig. 13.6b). When skeletonizing the left gastric artery, rotating the camera can reveal the posterior side of the left gastric artery in the oblique view, making the following dissections easier. Also, division of the left gastric artery is important as it allows for greater exposure for the dissection of No. 11p lymph nodes. The nerve plexus around the celiac trunk could be preserved in the cases with prophylactic D2 lymph node dissection. If an aberrant left hepatic artery with thick diameter derived from the left gastric artery exists, or a normal left hepatic artery originating from the common hepatic artery is absent, the aberrant hepatic artery-preserving No. 7 lymph node dissection should be performed, which means to skeletonize the trunk of the left gastric artery without injuring and dividing and only divide the gastric branches at their origins.

With the 3rd arm padded with gauze to roll down the pancreas, compression and retraction provide the best possible exposure of the soft tissues containing No. 11p lymph nodes. Also, natural traction to the left side can be acquired with compression via the 3rd arm. If compression of the pancreas via the 3rd arm is insufficient, an assistant can help. Use the Maryland bipolar to create the proper angles and Harmonic shears to dissect the soft tissues along the superior border of the pancreas and the splenic artery until the origin of posterior gastric artery (if there is not an obvious posterior gastric artery, make sure to dissect at least 5 cm along the splenic artery) (Fig. 13.6c). If it is not possible to dissect the suprapancreatic area with traction via the Cadiere and Maryland forceps, the use of other endo-wristed devices (e.g., hook or monopolar scissors) may be helpful. For a complete No. 11p lymphadenectomy, the proximal part of the splenic vein should be exposed. Thereafter, the retroperitoneal attachment of the stomach was detached up to the diaphragmatic cruses, completing the removal of the perigastric lymph nodes. Utilization of the Cadiere forceps (3rd arm) to provide necessary countertraction and the articulated Maryland bipolar forceps to create proper angles is critical to the dissection of the soft tissues along the superior border of the pancreas and the proximal part of the splenic artery

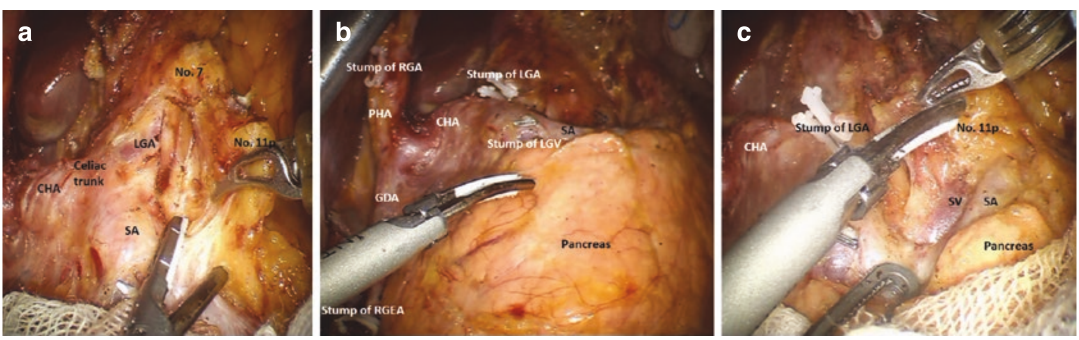

Fig. 13.6 Dissection of No. 7, 8a, 9, and 11p lymph nodes. (**a**) Continue the dissection along the common hepatic artery toward the celiac trunk, and expose the origin of the splenic artery. (**b**) Soft tissues around the celiac trunk are dissected, and the root of left gastric artery is skeletonized and divided. (**c**) Dissect the No. 11p lymph nodes along the superior border of the pancreas and the splenic artery until the origin of posterior gastric artery, and expose the proximal part of the splenic vein. CHA, common hepatic artery; LGA, left gastric artery; LGV, left gastric vein; SA, splenic artery; SV, splenic vein; GDA, gastroduodenal artery; RGA, right gastric artery; PHA, proper hepatic artery; RGEA, right gastroepiploic artery

(No. 11p lymph nodes), which facilitate surgeons to completely dissect the deep portion of No. 11p lymph nodes, one of the most technically complex procedures in conventional laparoscopic gastrectomy.

Lesser Curvature Dissection (Lymph Node #1 and #3 Dissection)

There are two ways to remove No. 1 and 3 lymph nodes. Posterior-side approach is known as dissection of soft tissues along the lesser curvature from the hiatus down to the transection line and from the posterior to the anterior side of the lesser curvature (Fig. 13.7), while anterior-side approach is characterized by keeping the dissection plane from anterior and from transection line up to the hiatus along the lesser curvature. The anterior and the posterior branches of vagal nerve should be divided.

Gastric Resection, Anastomosis, and Specimen Retrieval

After ensuring the proximal margin, the stomach is transected using endo-linear staplers via the assistant port for a distal gastrectomy. The specimen is bagged intracorporeally and placed aside for later removal. Various methods, such as Billroth-I, Billroth-II, or Roux-en-Y reconstruction, could be used to restore the digestive continuity [12, 24, 30, 31]. Both intracorporeal and extracorporeal anastomoses are acceptable. Either linear or circular staplers or hand-sewn sutures could be applied. Each method has its advantages and disadvantages. Surgeons could choose the optimal reconstruction method according to the tumor location, stage, life expectancy, and surgeon's preference, as well as their experience. If the robotic wristed linear stapler which could be applied by robotic arm can be introduced, the anastomoses would be more comfortable and stable.

Here, we describe our reconstruction procedures after distal gastrectomy as follows. After the resection of the stomach, gastroduodenostomy or gastrojejunostomy is performed intracorporeally, using an endo-linear stapler. Gastroduodenostomy is performed using linear staplers, similar to so-called delta-shaped anastomosis. The duodenum should be transected from the posterior to the anterior wall using an endoscopic linear stapler with blue cartilage inserted through the 12-mm assistant port. After the distal subtotal gastrectomy, small holes are created along the edge of the greater curvature of the remnant stomach and the medial edge of the duodenum. An endoscopic linear stapler is then placed between the remnant stomach and duodenum (cartridge in the stomach and anvil into the duodenum), and the posterior wall of the remnant stomach and the posterior wall of the duodenum

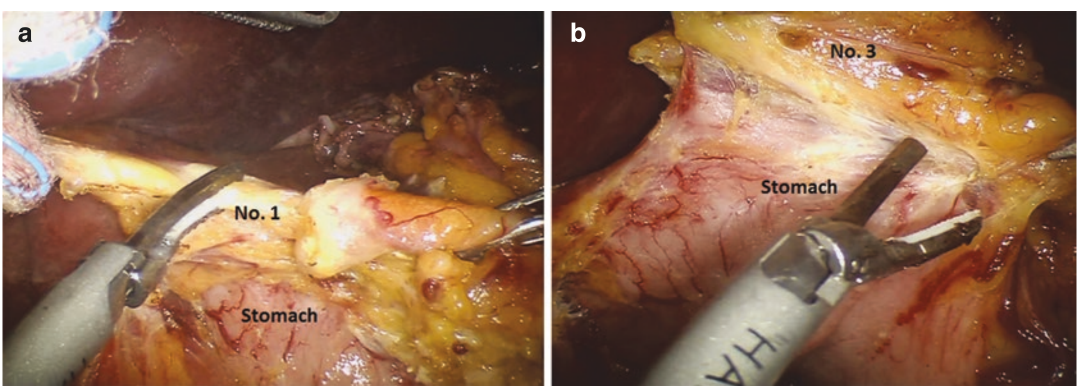

Fig. 13.7 Dissection of No. 1 and 3 lymph nodes. Dissection of soft tissues along the lesser curvature from the hiatus down to the transection line and from the posterior to the anterior side of the lesser curvature. (**a**) Dissection of No. 1 lymph nodes. (**b**) Dissection of No. 3 lymph nodes

are approximated by the stapler. By firing the stapler, a common channel between the stomach and the duodenum is made. When closing the common entry hole, the previously stapled duodenal stump is also removed to secure the blood supply to the duodenum. For intracorporeal gastrojejunostomy, identification of the ligament of Treitz and creation of an enterotomy in the jejunum 15–20 cm from the ligament of Treitz using the ultrasonic shears are undertaken. After an enterotomy is created in the remnant stomach with ultrasonic shears, the endo-wristed grasping instrument is used to place endo-linear staplers first on the stomach and then on the jejunum. The stapler is fired after approximation, and the entry hole is closed with another stapler as well. Finally, a drain is placed below the left lobe of the liver. The specimen can then be retrieved through the extended infraumbilical trocar site.

Limitation and Future Perspectives

Higher cost and longer operative time seem to be the disadvantages of robotic surgery. Since robotic gastrectomy is considered to have little benefit compared with laparoscopic surgery, whether these disadvantages of robotic surgery can be justified by the advantages in radical lymphadenectomy still debatable. Although clinically negligible yet, the aforementioned benefits of robotic surgery undoubtedly make the minimally invasive gastrectomy easier, especially in the relatively complicated procedures such as aberrant hepatic artery-preserving lymph node dissection and function-preserving gastrectomy, compared with conventional laparoscopic surgery. Therefore, the surgeons are not reluctant to perform the robotic procedures [19].

The future developments of robotic gastrectomy are novel platforms, haptic feedback, improvement of flexible instruments, and application of diverse emerging technologies, such as fluorescent image-guided surgery or Tilepro™ function. The development of robotic system's advanced technology enables surgeons to challenge the new horizons of minimally invasive gastrectomy [32].

Conclusion

Robotic distal gastrectomy with radical lymphadenectomy is regarded as safe and feasible provided that the operations are performed by experienced surgeons, compared with conventional laparoscopy. Longer operation time, higher costs, and oncologic equivalency to its counterparts are still unresolved issues, which need further development and investigation. However, robotic distal gastrectomy for gastric cancer would be a promising approach by providing advantages in an accurate, complete, and delicate D2 lymphadenectomy.

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