

A case of laparoscopy-assisted radical distal gastrectomy

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The past decades have witnessed the rapid development of laparoscopy in radical treatment of gastric cancer since its first application in distal gastrectomy in 1992. Currently, laparoscopy-assisted radical distal gastrectomy is one of the standard operations for early gastric cancer in Japan. We have been applying this technique since 2011, and a summary of our operation and findings for a recent case is presented below:

A 58-year-old man, surnamed Guan, was admitted to our hospital due to gastric cancer. Preoperative examination confirmed a cT2N0M0 stage, and laparoscopy-assisted radical gastrectomy was performed on April 18, 2013.

Surgical procedure

The patient was placed supine and in a split-legged position, followed by general anesthesia via endotracheal intubation (*Video 1*). A 10 mm incision was made to establish CO₂ pneumoperitoneum, with the pressure maintaining at 13 mmHg. A port for observation was then inserted below the umbilical edge with a 12 mm trocar at an angle of 15 degrees above the horizontal plane of the organs. A 30-degree laparoscope was used for abdominal exploration. A 12 mm trocar was placed in the left anterior axillary line 2 cm below the costal margin as the working port; a 5 mm trocar was inserted within the left midclavicular line parallel to umbilicus for elevating certain structures; and two 5 mm trocars were placed within the right anterior axillary line 5 mm below the costal margin and within the right midclavicular line parallel to umbilicus, respectively, for elevating operations by the assistant. The surgeon stood on the left side of the patient by routine.

The gastrocolic ligament was transected. With the greater curvature and the transverse colon elevated to the opposite side, the left part of the gastrocolic ligament was cut with an ultrasonic scalpel near the transverse colon, and then divided to the splenic flexure. The attachment of the greater omentum to the transverse colon was extended and stretched tightly, and then separated to enter the greater sac, along which the division was continued into the anterior and posterior space of the transverse mesocolon near the splenic flexure, until the lower edge of the tail of the pancreas was exposed. The gastrosplenic ligament was transected. The gastric body was flipped towards the head side and withdrawn to the right along with the greater omentum, and the splenic flexure to the left inferior side to create a vertical tension against the gastrosplenic ligament. The posterior wall of the gastric fundus was thus pulled aside to expose the splenic hilum and the tail of the pancreas. The capsule of the pancreas was opened from the lower to the upper edge of the pancreatic tail with an



Video 1 A case of laparoscopy-assisted radical distal gastrectomy

ultrasonic scalpel. A Hem-o-lok clip was used to close the upper edge at the root. The left gastroepiploic artery and vein were cut (with due caution to avoid necrosis of the lower splenic pole by preserving the supplying branches). Meanwhile, lymph node stations 4sb and 4d were dissected. The separation was continued towards the upper region, in which a branch of the short gastric vessels was dissected.

The right segment of the gastrocolic ligament was cut near the transverse colon using the ultrasonic scalpel, and separated through the hepatic flexure, and the colon was isolated from the descending part of the duodenum and from the duodenal bulb. The mesogastrium and the mesocolon were separated along the joining line between the posterior wall of the gastric antrum and the mesocolon. The posterior wall of the gastric antrum was pulled to the left anterior side, and the colon and its mesentery to the right inferior side, revealing fully the underlying loose fascial space at the junction between the two. The right portion of the transverse colon and its mesentery were freed from the descending part of the duodenum and the duodenal bulb, along the surface of the head of the pancreas and the lower edge of the pancreatic neck. At this point, the right gastroepiploic vein, the right colic vein and their convergence, the gastrocolic trunk, were completely exposed. The right gastroepiploic vein was transected above the point where it joined the anterior superior pancreaticoduodenal vein. With the pancreas as a starting point, the pancreatic capsule was lifted and tissues were separated from the lower edge of the pancreas along the anterior pancreatic space on the surface of the pancreas towards the external superior region, until the origin of the

right gastroepiploic artery at the gastroduodenal artery was reached. The right gastroepiploic artery was then clamped with a Hem-o-lok clip and cut. The posterior inferior wall of the duodenal bulb was dissociated near the surface of the pancreatic head along the anterior pancreatic space. The 6th station lymph nodes were dissected.

As the stomach was put back into place, the antrum was pulled to the right inferior side, and the liver to the right superior side, maintaining a tension over the hepatogastric ligament. After the hepatogastric ligament was dissected, the lesser sac was cut open along the left lobe of the liver, until the right side of the cardia was reached. The whole stomach was lifted. The separation of the pancreatic capsule was continued until the gastroduodenal artery, common hepatic artery, pyloric vein, proper hepatic artery, right gastric artery, portal vein, coronary vein, left gastric artery, splenic artery, and posterior gastric artery and vein were exposed. The prepyloric vein, right gastric artery, coronary vein, and left gastric artery were clamped with Hem-o-lok clips and cut. Lymph node stations 5, 8a, 9, 12a, 7, and 11p were dissected along the course. The right crus of the diaphragm feet was divided from right to left to the lower esophageal cardia region; and stations 1a and 1b were dissected. The separation was continued along the lesser curvature into the cardia, extending closely along the gastric wall to the feeding vessels of the lesser curvature, while dissecting stations 3a and 3b.

The distal portion of the stomach was resected and removed as a specimen, and the reconstruction of the digestive tract was completed, through the auxiliary port. An incision of about 5 cm was made in the midline over the xiphoid for pulling out the removed stomach and omentum, while the adjacent tissues were covered by an incision protector. The duodenal bulb was closed with purse-string suture with an anvil placed.

A stapler was triggered at the posterior wall of the residual greater curvature to complete the gastroduodenal anastomosis.

Findings and recommendations

Gastric cancer mainly spreads across local lymph nodes via the lymphatic vessels, which forms the theoretical basis of radical gastrectomy. Therefore, removal of sufficient stomach tissues and thorough dissection of the gastric lymph nodes can achieve complete remission for patients with gastric cancer. At present, the widely recognized principles for the radical treatment of gastric cancer include: (I) en

bloc resection of the lesion; (II) surgical margins of ≥ 5 cm from the tumor; (III) complete dissection of lymph nodes; (IV) non-contact and complete elimination of tumor cells shed in the abdominal cavity. Most gastrointestinal surgeons in China have accepted D2 lymph node dissection as the standard operation for radical gastrectomy. Laparoscopy-assisted radical resection must comply with the same principles as for traditional open surgery, including the requirement for tumor-free margins and en bloc resection, where lymph node dissection is always the key and challenging link. Due to the differences in the field of vision and instrumental operation, laparoscopy-assisted surgery employs unique procedures of lymph node dissection. Despite a limited number of reports on laparoscopy-assisted radical resection of advanced gastric cancer, the currently available data show improved short-term efficacy and comparable long-term outcomes in favor of the technique compared with open surgery. Lymph node dissection begins from the peripheral normal tissues, not along the common hepatic artery, by gradually exposing the various vessels and branches. The lymph nodes are harvested by bundle, rather than individually, for elimination of all stations as well as the pathways for tumor metastases. No fat or lymph node residue can be found in the lesser curvature region after the dissection. In theory, this technique combines tumor-free radial margins with en bloc resection, which is a genuine embodiment of the oncologic principles for radical gastrectomy. With the beneficial larger field of view, laparoscope allows more detailed presentation of small vessels, nerves, fascia and other structures, facilitating the creation of the gastric fascial space by vaporization using the ultrasonic scalpel. All these contribute to a more refined process of lymph node dissection under laparoscope compared with open surgery.

As with traditional operations, the laparoscopic technique

follows the same requirements with higher demand on the operating skills. There is no shortcut to expose the vascular roots and dissect lymph nodes—a series of steps should be followed to complete the operation on a layer-by-layer basis so that all vascular structures are clearly revealed in a proper order.

When dealing with lymph nodes within dense or fragile structure layers, rupture and bleeding of small blood vessels seem to be inevitable, particularly in a surgeon's first several operations. Most of these cases can be properly handled with adequate caution by the surgeon in a calm and confident manner, thus avoiding transition to open surgery.

For a blood vessel smaller than 5 mm in diameter but with high probability of bleeding, coagulation can be applied to the proximal stump of the vessel at small power with the ultrasonic scalpel before cutting off. When dividing any blood vessel, the operating surface of the ultrasonic scalpel should always be pointed towards the external side of that vessel to avoid injury.

The use of ultrasonic scalpels during an open gastrectomy following the same surgical approach as in the laparoscopic technique will considerably shorten the learning curve for laparoscopic gastric surgery. In addition, a designated cooperation team is also indispensable for the smooth implementation of laparoscopic radical gastrectomy.

To sum up, laparoscopy-assisted radical gastrectomy with lymph node dissection is a practical treatment for gastric cancer in better compliance with the oncologic principles, with the advantages of minimal invasiveness, reduced organ exposure, and rapid postoperative recovery.

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