

Laparoscopy-assisted radical total gastrectomy plus D2 lymph node dissection/dissection of lymph node station 16

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Abstract: Laparoscopy-assisted D2 radical resection for gastric cancer has been carried out in quite a few Chinese hospitals. However, the techniques that are feasible for the dissection of lymph node station 3, particularly for lymph node station 16, under the laparoscope require further investigation. We have successfully employed the “middle approach” under the laparoscope for the implementation of D2+No.16 dissection in 18 patients with advanced gastric cancer. This video (Video 1) describes the process of laparoscopy-assisted radical total gastrectomy (D2 + No. 16 dissection). In conclusion, upon the completion of laparoscopy-assisted radical D2 surgery for gastric cancer, laparoscopic dissection of lymph node station 16 is feasible for carefully selected patients with advanced gastric cancer.

Key Words: Advanced gastric cancer; laparoscopic surgery; D2+No. 16 dissection; total gastrectomy



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Introduction

While D2 radical resection remains the “gold standard” treatment for the advanced gastric cancer, whether the lymph node station 3 should be dissected remains controversial (1,2). It has been proposed that a moderately extended radical resection can improve the long-term efficacy for the advanced gastric cancer (3). Zhan *et al.* (4) analyzed the aortic lymph node metastasis in patients with advanced gastric cancer and found the dissection of lymph nodes around the abdominal aorta can improve the 5-year survival in patients with positive lymph node station 16 less than 3 (or negative). For gastric cancer patients with suspected lymph node station 2 involvement, the lymph node station 16 should be actively dissected. In recent years, laparoscopy-assisted D2 radical resection for gastric cancer has been carried out in quite a few Chinese hospitals (5,6). However, the techniques that are feasible for the dissection of lymph node station 3, particularly for lymph node station 16, under the laparoscope require further investigation. We have successfully employed the “middle approach” under the laparoscope for the implementation of D2+No.16 dissection in 18 patients with advanced gastric cancer. This video (*Video 1*) describes the process of laparoscopy-assisted radical total gastrectomy (D2 + No. 16 dissection).



Video 1 Laparoscopy-assisted radical total gastrectomy plus D2 lymph node dissection/dissection of lymph node station 16

Surgical methods

Patient characteristics

A 65-year-old male patient (body height: 168 cm; body weight: 58 kg) was clinically diagnosed as poorly differentiated adenocarcinoma of the gastric body, with a pre-operative pathologic stage of $T_3N_2M_0$.

Body position and five-hole method

The patient was placed supine and in a split-legged position after general anesthesia. The surgeon stood at the left side of the patient, the assistant at the right side of the patient, and the camera holder between his two legs. A “curved 5-hole method” was applied: the CO_2 pneumoperitoneum was created by umbilicus puncture, maintaining the pressure at 12 mmHg. A 10-mm trocar was placed in the left anterior axillary line below the costal margin as the working port; a 5-mm auxiliary port was created slightly above and 5 cm to the left of the umbilical fossa; a 5-mm port was created in the right anterior axillary line below the costal margin; and finally, a 10-mm port was created in the right midclavicular line slightly above and 10 cm to the umbilical fossa.

Dissection of lymph node stations 1 and 2

After the abdomen was opened, the tumor location was routinely explored to identify the lesions, lymph node involvement, and intra-abdominal metastasis. Open the

greater omentum to the head side; transect the greater omentum using an electric hook from the middle of transverse colon and then enter the lesser omental bursa. After the left gastroepiploic vein was divided and ligated, the lymph node stations 4d and 4sb were dissected. After the gastrosplenic ligament and posterior gastric arteries were transected using HIFU along the splenic hilum, the lymph node stations 4sa and 10 were dissected. The separation continued to the left side of the gastric cardia, and then the lymph node station 2 was dissected. After the greater omentum was flipped and raised, the operator stretched the transverse colon, and separated the omentum along its attachment to the hepatic flexure of the colon. Then the anterior lobe of the transverse mesocolon was removed. After the middle colonic artery and its branches were separated, the superior mesenteric vein, right colic vein, and right gastroepiploic vein were exposed. After the right gastroepiploic vein was cut off at its root, the lymph node stations 15, 14v, and 6 were dissected. The separation continued along the deep surface of the anterior fascia of pancreatoduodenum till the duodenum. Isolate the right gastroepiploic artery and cut it at the root. The lower edge of the duodenum bulb was exposed. Dissect the pancreatic capsule. After the splenic artery was separated and exposed along the upper edge of the pancreas, the lymph node station 11 was dissected. After the celiac artery was exposed along the splenic artery and cut off with titanium clip at the root of left gastric artery, the lymph node stations 7 and 9 were dissected. The separation continued before the hepatic artery and along its upper edge, and then the lymph node station 8a was dissected. Then the capsule of the hepatoduodenal ligament was cut open, and the lymph node station 12a in front of and at the external side of the proper hepatic artery was dissected. The lymph node station 5 was dissected at the root of right gastric artery. The hepatogastric ligament was cut open using HIFU, and then the dissociation continued closely along the lower edge of liver till the right side of esophagus, where the lymph node station 3 was dissected. Cut open the serosal surface of the esophagus till the separation site at the left side; after the esophagus was thoroughly exposed till 5 cm above the gastric cardia, the lymph node station 1 was dissected. Thus, the dissection of lymph node N1 and N2 levels were completed, reaching the level of D2 radical treatment. Make a 5-cm median longitudinal incision on upper abdomen (depending on the tumor size) and then drag the stomach and greater and lesser omentums out from the abdominal cavity and remove the tumor.

Dissection of lymph node station 16

With the pancreas and transverse colon as the borders, the level 3 lymph nodes were dissected in the upper and lower regions: in the upper region, the lymph node stations 8p, 12p, 12b, 16a. The lymph node stations 8p, 12p, and 12b are located behind the common hepatic artery and proper hepatic artery. The arteries must be exposed and lifted to effectively remove the lymphatic/adipose tissues behind the arteries. Although the lymph node station 16a is located at the surface of the abdominal aorta between the celiac artery and the left renal vein, the common hepatic artery and the proximal portion of the splenic artery must be lifted before these lymph nodes could be thoroughly dissected. Therefore, the offending artery suspension method was applied: The assistant gently lifted the common hepatic artery with a separation clamp in her right hand. The operation pressed the upper edge of the pancreas with a separation clamp in his left hand; then, the operator divided hepatic common artery from the portal vein along the lower edge of the hepatic common artery. After the hepatic common artery was lifted with a sling, the lymph node station 8p behind the hepatic common artery was dissected. The operation continued to the distal side along the hepatic common artery, during which the proper hepatic artery was divided and hung. Then, the lymph node stations 12p and 12b behind the proper hepatic artery and before the portal vein were dissected. The operator pressed the pancreatic body downward with his left hand; the assistant lifted the hepatic common artery and splenic artery using a sling with the forceps in her right hand; the operator then dissected the lymph node station 16a2 that is located between the celiac artery and the lower edge of the left renal vein using HIFU in his right hand. The “middle approach” was applied for the dissection of the lymph node station 16b1. The transverse colon was lifted to the head side. The patient’s body position was changed to “left high and right low”. The assistant lifted the small intestine to the right abdominal cavity to expose the lower portion of the abdominal aorta. The operator lifted the peritoneum at the surface of abdominal aorta using a separation clamp in his left hand, and then separated the peritoneum longitudinally along the tissue between the abdominal aorta and inferior vena cava using an electric hook or HIFU in his right hand. Beginning from the root of the inferior mesenteric artery, the lymph node station 16b1 (located in the anterior and lateral sides of tissues between the abdominal aorta and inferior vena cava and inside the fossa) was dissected

upwards till the lower edge of the left renal vein. Then, the lymph node station 16 was dissected.

Results

Laparoscopy-assisted radical total gastrectomy plus D2 lymph node dissection/dissection of lymph node station 16, followed by oesophagus-jejunum Roux-en-Y reconstruction, were successfully performed. The surgical operation lasted 260 min, and the intraoperative blood loss was about 110 mL. Post-operative pathology showed that the tumor had invaded the serosal layer. Thirteen of 33 positive lymph nodes were detected, among which 3 of 5 lymph nodes in station 16 were positive. The clinicopathological diagnosis was poorly differentiated adenocarcinoma of the gastric body, T3N3M0, and IIb stage. He recovered well and was smoothly discharged 8 days after surgery. No complication was noted.

Discussion

The lymph nodes near the stomach are divided into three levels: the first level includes stations 1, 2, 3, 4, 5, and 6, which are close to the gastric tissue; the second level include stations 7, 8a, 9, 10, 11, and 12a, which are on the surface of the specific arteries; and the third level, which include stations 8p, 12b, and 12p (which are on the posterior side of the specific arteries or behind these arteries) and stations 16a2 and 16b1 (which are near the abdominal aorta). The D2 radical resection for gastric cancer requires the en bloc removal and resection of the first and second lymph node levels along with the gastric tissue. However, the lymph nodes of the third level are located in deeper anatomic layers and are not mutually connected; also, they are located among arteries and the deep portion of trunk vein and therefore need to be removed separately, which is challenging even via open surgery.

The lymph node stations 2 and 4sa belong to the third-level lymph nodes for tumors in the lower stomach but are the second-level lymph nodes for tumors in the upper stomach. On the contrast, the lymph node stations 5, 6, and 12a belong to the third-level lymph nodes for tumors in the upper stomach but are the second-level lymph nodes for tumors in the lower stomach. Therefore, the absolute third-level lymph nodes only include stations 8p, 12p, 12b, 14v, 16a2, 16b1, 19, and 20 (7).

For the dissection of lymph node stations 16a2 and 16b1 (i.e. paraaortic lymph nodes), the lateral approach is often

employed during open surgery: separate the right colon or left colon from the lateral abdominal wall and then lift it to the opposite side (8). After the retroperitoneal tissues are thoroughly exposed, dissection is performed. However, this approach is not feasible for the laparoscopic surgeries: the workload will be heavy for either left approach or right approach, because it roughly equals the additional work needed for right hemicolectomy or left hemicolectomy; in addition, the colon relaxation is not helpful for the exposure of abdominal aorta and inferior vena cava. Therefore, for laparoscopic surgeries, the middle approach was adopted in our series: The assistant lifted the transverse colon to the head side and the small intestine to the right side to expose the lower portion of abdominal aorta. The operator separated the peritoneum using an electric hook or HIFU, and then can easily dissect the lymph node station 16b1 located from the root of the inferior mesenteric artery to the lower edge of the left renal vein.

When performing laparoscopic lymph node dissection for gastric cancer, the following issues must be carefully considered: (I) its main indications include gastric cancer at stage IIIa, stage IIIb, or stage IV without distant metastasis. Less experienced surgeons should operate on slim young and mid-aged patients firstly; (II) When dissecting the lymph node stations 8p, 12p, 12b, and 16a2, the hepatic common artery, splenic artery, and proper hepatic artery must be completely exposed and then lifted before the lymph nodes can be completely dissected; (III) The lymph node stations 16a2 and 16b1 are close to the deep and fragile splenic vein, portal vein, left renal vein, and inferior vena cava and are also adjacent to the chylous pool. These structures can be easily injured and bleed during the dissection, resulting in postoperative lymphatic leakage. Therefore, efforts should be made during the dissection to avoid any possible deep vein damage and lymphatic leakage; if the presence of any lymphatic tube is suspected, it should be clamped with titanium clip or slowly transected with HIFU; (IV) Before the dissection of the third-level lymph nodes, the omentum, gastric tissues, and tumor should be removed firstly, so as to keep surgical field clear; meanwhile, an abdominal incision should be preserved for emergency treatment.

In conclusion, upon the completion of laparoscopy-assisted radical D2 surgery for gastric cancer, laparoscopic dissection of lymph node station 16 is feasible for carefully selected patients with advanced gastric cancer.

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