

Standard lymph node dissection (D2 surgery) for antral carcinoma

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Gastric cancer is one of the most common cancers in China, and most are already at an advanced stage when they are diagnosed. Although the range of lymph node dissection for gastric cancer remains controversial in the East and the West, a consensus in eastern Asia is: the standard lymph node dissection should reach D2. Take antral carcinoma as an example. Lymph node stations 1, 3, 4, 5, 6, 7, 8, 9, 11, 12a, and 14 should be dissected. The standard dissection should be based on the anatomical characteristics of the stomach. Dissection should be performed in the spaces between tissues. The corresponding vessels should be ligated at their roots to ensure the complete dissection of lymph nodes.

The video of the standard lymph node dissection (D2 surgery) for antral carcinoma is described as follows (*Video 1*).

(00:00:00-00:00:50): dissection of lymph node station 15

The first step is to remove the first three lobes of greater omentum and dissect the lymph node around colonic vessels (i.e., lymph node station 15). The assistant extends the transverse colon to find the correct anatomic layer, so as to completely remove the lymph nodes and soft tissues without causing unnecessary injury and bleeding. The power of electric knife is typically set at 50 Hz, which helps to avoid injuring the adjacent vessels and solidify the small blood vessels around the lymph nodes to keep the field clear in operation. The operator uses tweezers (or the assistant uses hemostatic forceps) to hold the lymph nodes and soft tissues that are to be removed, to form certain tension after moderate traction, which helps to automatically expose the tissue gaps and avoid the electric knife to injure the colonic vessels. Dissection of lymph node station 15 must maintain the integrity of transverse mesocolon.

(00:00:51-00:02:04): dissection of lymph node station 14v

After the dissection of lymph node station 15, the surgeon then divides along the colonic vessel towards the lower edge of the pancreas. The dissection must be performed layer by layer, with vessels as the axes. Dissection of lymph node station 14 is a challenging and dangerous step in the radical resection of gastric carcinoma. For new surgeons, the operation should be performed step by step until the origin of the superior mesenteric vein is exposed. The new surgeons should set their electric knife at low power to avoid the accidental injury of the superior mesenteric vein. The operator uses clamps or tweezers to hold the lymph nodes and soft tissues that are to be removed to form certain tension, which helps to expose the anatomic gaps and avoid accidental injury.



Video 1 Standard lymph node dissection (D2 surgery) for antral carcinoma

(00:02:05-00:02:58): dissection of lymph node station 4sb at the greater curvature of the stomach

Lift the spleen with gauze pads to alleviate the tension of vessels at the hilus of spleen. During the dissection, the assistant must cautiously protect the spleen. Beginning from the splenic lower pole, the operator dissects individual lymph node from left to right towards the greater curvature of stomach. If condition allows, ultrasonic scalpel can be used to completely remove lymph nodes and soft tissues without causing excessive bleeding. Finally, the lymph node station 4sb is removed en bloc. When distal subtotal gastrectomy is performed, the lymph node station 4d is also removed.

(00:02:59-00:04:43): dissection of lymph node station 13 via Kocher incision

After the Kocher incision is opened, the assistant lifts the head of the pancreas and duodenal loop to the right side of the patient, and the operator dissects the lymph nodes along the gaps at the vascular archs. There are many vessels behind the head of the pancreas and should be carefully protected. The lymph node station 12b near the common bile duct is not within the range of standard radical treatment. Injury of common bile duct (and thus biliary fistula) should be avoided during the dissection of lymph node station 12b. Excessive peeling of tissue from the common bile duct surface should be avoided to affect its blood supply. In addition, during the

skeletonization of common bile duct, portal vein, and hepatic artery, any damage to the vena cava (beneath) or portal vein (left rear) should be avoided.

(00:04:45-00:06:12): dissection of lymph node station 12a (i.e., lymph nodes near the proper hepatic artery)

The anatomic relationships among common bile duct, portal vein, and hepatic artery inside the hepatoduodenal ligament should be carefully considered to avoid the accidental injury of the portal vein. The skeletonization of common bile duct, portal vein, and hepatic artery should be performed by an experienced operator; however, attention should be paid to protect the nerves and blood supply of the gallbladder, so as to avoid post-surgical cholecystitis and cholelithiasis. Accidental injury of the cystic artery may cause the necrosis of the gallbladder.

(00:06:14-00:06:32): dissection of lymph node station 12b

Dissection of lymph node station 12b is not within the range of standard D2 dissection. Accidental injury of the portal vein and common bile duct should be avoided during the operation.

(00:06:33-00:06:58): dissection of suprapyloric lymph node

After the lymph nodes and soft tissues around the right gastric vessels are dissected, ligate the right gastric artery at the root. One or two pyloric veins should be preserved.

(00:06:59-00:07:56): dissection of lymph node station 8a (lymph nodes near the common hepatic artery)

The first assistant pushes down the pancreas, and the second assistant pulls up the residual stomach and liver with S-hooks. The operator looks for the inter-tissue gaps along the upper edge of the pancreas. The lymph node station 8a is typically distributed along the common hepatic artery. It has rich blood supply; after having been completely removed, the bleeding naturally stops.

(00:07:58-00:08:39): transection of duodenum

The duodenum is transected at the proper site using purse-

string clamp. Place circular stapler into the screw base.

(00:08:40-00:10:18): dissection of lymph nodes around the left gastric artery

This is one of the most common lymph node metastasis locations. Therefore, with the left gastric artery as the anatomic marker, lymph nodes in this location must be completely dissected. The lymph nodes at the front, left back, and right back of the left gastric artery should be dissected firstly. Then, from the left or right approach, the lymph nodes behind the left gastric artery should be dissected. After lymph node dissection, the left gastric artery should be ligated at the root (typically double ligated with a 4-0 silk suture).

(00:10:20-): dissection of lymph node station 9

After the dissection of lymph node station 7, the lymph node station 9 (lymph nodes around the celiac trunk) is then dissected along the root of left gastric artery. The left gastric artery is ligated.

(00:11:26-00:11:35): dissection of lymph node station 11p

The operation continues along the upper edge of the pancreas, and, at the left side, the lymph node station 11p surrounding the splenic artery is dissected. The splenic artery is coil-shaped and tortuous, and therefore must be carefully identified. Otherwise it may be mistakenly ligated

as lymph nodes. In addition, about 60% of patients have posterior gastric artery arising from the splenic artery. It should also be cautiously identified and ligated.

(00:11:36-00:11:46): dissection of lymph node station 12p

Any injury to the portal vein should be avoided.

(00:11:58-00:12:12): dissection of lymph node stations 1 and 3

Finally, the lymph nodes at the right side of the cardia and the lesser curvature of stomach are dissected. Ultrasonic scalpel can easily achieve the complete resection of lymph node stations 1 and 3. When performing ligation, the operator must ligate vessels at the anterior and posterior walls of the lesser curvature of stomach layer by layer to achieve the complete resection of lymph nodes in this region and the proper hemostasis.

Digestive tract reconstruction

B-1 Digestive tract reconstruction is performed after the specimen removal. The surgical field after dissection is displayed.

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