Huang's three-step maneuver for laparoscopic spleen-preserving No. 10 lymph node dissection for advanced proximal gastric cancer

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Abstract: Due to the complexity of the splenic hilar vessels, their anatomical variation and the narrow and deep space, as well as the bleeding-prone splenic parenchyma and the difficulty to manage splenic or vascular bleeding at the splenic hilum,the procedure remains challenging and technically demanding procedure for the performance of laparoscopic pancreas- and spleen-preserving splenic hilar lymph nodes dissection. Based on our experiences, we gradually explored a set of procedural operation steps called "Huang's three-step maneuver". In this paper, we not only provide the concrete operation steps for the surgeon, but we also provide our recommended technique of pulling and exposure for assistants. This new maneuver simplifies the complicated procedure and improves the efficiency of laparoscopic spleen-preserving splenic hilar lymphadenectomy, making it easier to master and allowing for its widespread adoption.

Keywords: Stomach neoplasms; spleen preservation; laparoscopy; lymph node dissection

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Clinical vignette

The lymph nodes (LNs) in the splenic hilar area, including the LNs along the distal splenic vessels (No. 11d) and the splenic hilum (No. 10), should be removed for normative D2 LN dissection during total gastrectomy for advanced proximal gastric cancer (1). However, spleen-preserving splenic hilar lymphadenectomy is now widely used in total gastrectomy with D2 LN dissection due to combined resection of the pancreas and spleen significantly increasing postoperative morbidity and mortality rather than improving prognosis, as well as decreasing immunological function (2-4). With the rapid development of minimally invasive surgery, the application of laparoscopic surgery for gastric cancer is gradually gaining popularity. However, due to the complexity of the splenic hilar vessels, their anatomical variation and the narrow and deep space, as well as the bleeding-prone splenic parenchyma and the difficulty to manage splenic or vascular bleeding at the splenic hilum, the procedure remains challenging and technically demanding procedure for the performance of laparoscopic pancreas- and spleen-preserving splenic hilar LN dissection.

Based on our experiences with laparoscopic pancreas- and spleen-preserving splenic hilum LN dissection in more than 350 gastric cancer patients, we gradually explored a set of procedural operation steps called "Huang's three-step maneuver". Herein, the detailed procedure is presented.

Surgical techniques

The patient was placed in the reverse Trendelenburg position with their head elevated approximately 15 to 20 degrees and tilted left-side up approximately 20 to 30 degrees. The surgeon stood between the patient's legs, with the assistant and camera operator both on the patient's right side. The *Table 1* lists a timed narrative to help locate specific points in the procedure.

Comments

Splenic hilar lymphadenectomy is an important component in laparoscopy-assisted radical total gastrectomy for advanced proximal gastric cancer, and it is quite sophisticated and technically demanding. The surgeon should fully understand

Table 1 Narration of operative steps presents in the video clips (*Video 1*)

Time stamp	Highlighted maneuvers
First step—dissection of lymph nodes in the inferior pole region of the spleen	
00 min 09 sec	The assistant places the free omentum in the anterior gastric wall and uses his or her left hand to pull the gastrosplenic ligament (GSL)
00 min 20 sec	The surgeon gently presses the tail of the pancreas and separates the greater omentum toward the splenic flexure of the colon along the superior border of the transverse mesocolon
00 min 33 sec	the anterior pancreatic fascia (APF) is peeled toward the superior border of the pancreatic tail, along the direction of the pancreas
00 min 48 sec	the peeled anterior lobe of the transverse mesocolon (ATM) and APF are completely lifted toward the cephalad, to expose fully the superior border of the pancreas and enter the retropancreatic space (RPS)
01 min 07 sec	The lower lobar vessels of the spleen (LLVSs) or lower pole vessels of the spleen can then be exposed
01 min 15 sec	The assistant's right hand pulls up the lymphatic fatty tissue on the surface of the vessels, and the surgeon uses the non-functional face of the ultrasonic scalpel to dissect these lymphatic tissues, closing toward the vessels
01 min 59 sec	The left gastroepiploic vessels (LGEVs) can then be revealed
02 min 05 sec	the assistant gently pulls the LGEVs, while the surgeon meticulously separates the fatty lymphatic tissue around them to denude them completely
02 min 43 sec	dividing the LGEVs at their roots with vascular clamps
03 min 00 sec	The division point is used as the starting point for the splenic hilar lymphadenectomy, to skeletonize one or two branches of the short gastric vessels (SGVs), which are divided at their roots toward the direction of the splenic hilum
Second step—dissection of the lymph nodes in the region of the splenic artery trunk	
03 min 28 sec	The assistant places the free omentum between the inferior border of the liver and the anterior gastric wall and continually pulls the greater curvature of the fundus to the upper right
03 min 58 sec	The surgeon's left hand presses the body of the pancreas. The assistant's right hand pulls the isolated fatty lymphatic tissue on the surface of the splenic artery trunk
04 min 12 sec	The surgeon denudes the middle of the splenic artery trunk until the crotch of the splenic lobar arteries lies along the latent anatomic spaces on the surface of the splenic vessels
04 min 48 sec	The posterior gastric artery, which derives from the splenic artery, will always be encountered in this region; at this time, the assistant should clamp and pull the vessels upward, while surgeon denudes them and closes toward the splenic artery trunk
05 min 07 sec	Then, the surgeon divides them at their roots with vascular clamps and completely dissected the fatty lymphatic tissue around the splenic vessels (No. 11d)
Third step—dissection of lymph nodes in the superior pole region of the spleen	
05 min 21 sec	The assistant continually pulls the greater curvature of the fundus to the lower right, while the surgeon's left hand presses the vessels of the splenic hilum
05 min 43 sec	Taking the division point of the LGEVs as the starting point, the assistant gently pulls up the fatty lymphatic tissue at the surface of the terminal branches of the splenic vessels and keeps it under tension
05 min 59 sec	During the dissection process, two or three branches of the SGVs arise from the terminal branches of the splenic vesselsand enter the GSL
06 min 13 sec	At this time, the assistant should clamp and pull the vessels upward, while the surgeon meticulously dissects the surrounding fatty lymphatic tissue, closing toward the roots of the SGVs
06 min 27 sec	The surgeon divides the vessels at their roots with vascular clamps after confirming their destinations in the wall of the stomach

Table 1 (*continued*)

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Time stamp	Highlighted maneuvers
Third step—dissection of lymph nodes in the superior pole region of the spleen	
06 min 42 sec	The surgeon uses the non-functional face of the ultrasonic scalpel to cut the surface of the terminal branches of the splenic vessels, completely skeletonizing the vessels in the splenic hilum with meticulous sharp or blunt dissection
07 min 25 sec	The last SGV in the superior pole region of the spleen is often very short and easy to damage, causing bleeding. At this time, the assistant should adequately pull the fundus to the lower right to expose the vessel completely and should assist in the careful separation of the surgeon
07 min 58 sec	the separation is continued to dissect completely the fatty lymphatic tissue in the splenic hilar
08 min 25 sec	the splenic hilar lymphadenectomy is complete
08 min 30 sec	An intraoperative view after splenic hilar lymphadenectomy is shown after the procedure

Video 1 Huang's three-step maneuver for laparoscopic spleen-preserving No. 10 lymph node dissection for advanced proximal gastric cancer.

the anatomical features of the splenic hilar vessels under laparoscopic viewing, and he or she should undertake a reasonable surgical approach, as well as procedural operation steps based on vascular anatomy. We have summarized our experience, learned lessons and gradually explored this set of procedural operation steps after laparoscopic pancreas- and spleen-preserving splenic hilar LN dissection in more than 350 gastric cancer patients. We have realized in practice that a steady and tacit understanding and teamwork play important roles in this procedure. Hence, we not only provide the concrete operation steps for the surgeon, but we also provide our recommended technique of pulling and exposure for assistants. This new maneuver simplifies the complicated procedure and improves the efficiency of laparoscopic spleen-preserving splenic hilar lymphadenectomy, making it easier to master and allowing for its widespread adoption.

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