

## 2016 Laparoscopic Surgery: Global view

## Strategies of laparoscopic spleen-preserving splenic hilar lymph node dissection for advanced proximal gastric cancer

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### Abstract

For advanced proximal gastric cancer (GC), splenic hilar (No. 10) lymph nodes (LN) are crucial links in lymphatic drainage. According to the 14<sup>th</sup> edition of the Japanese GC treatment guidelines, a D2 lymphadenectomy is the standard surgery for advanced GC, and No. 10 LN should be dissected for advanced proximal GC. In recent years, the preservation of organ function and the use of minimally invasive technology are being accepted by an increasing number of clinicians. Laparoscopic spleen-preserving splenic hilar LN dissection has become more accepted and is gradually being used in operations. However, because of the complexity of splenic hilar anatomy, mastering the strategies for laparoscopic spleen-preserving splenic hilar LN dissection is critical for successfully completing the operation.

**Key words:** Gastric neoplasm; Laparoscopic; Splenic hilus; Lymphadenectomy; Strategy

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**Core tip:** According to the 14<sup>th</sup> edition of the Japanese gastric cancer (GC) treatment guidelines, a D2 lymphadenectomy is the standard surgery for advanced GC and No. 10 lymph nodes (LNs) should be dissected for advanced proximal GC. In recent years, the preservation of organ function and the use of minimally invasive technology are being accepted by an increasing number of clinicians. Laparoscopic spleen-preserving splenic hilar LN dissection has become more accepted. However, because of the complexity of splenic hilar anatomy, mastering the strategies for laparoscopic

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## VALUE OF SPLEEN-PRESERVING SPLENIC HILAR (NO. 10) LYMPH NODE DISSECTION FOR ADVANCED PROXIMAL GASTRIC CANCER

### *Value of No. 10 LN dissection for advanced proximal gastric cancer*

The most important purpose of radical operations for gastric cancer (GC) is to increase the long-term survival of patients. The thoroughness of lymph nodes (LNs) dissection during the surgery is directly related to a patient's postoperative survival rate. No. 10 LN dissection is an important but difficult part of a D2 radical resection for advanced proximal GC. The rate of No. 10 LN metastasis has been reported to be 9.8%-27.9%<sup>[1-3]</sup>. Shin *et al*<sup>[4]</sup> reported that of 319 patients, 41 (12.9%) had No. 10 LN metastasis. No. 10 LN metastasis was not observed in patients with early GC. Data from Japanese patients also revealed that the No. 10 LN metastasis rate in early proximal GC is so low (0.9%) that the No. 10 LN does not need to be dissected. However, in advanced GC, the No. 10 LN metastasis rate is 13.4% in stage T3 and 34.4% in stage T4<sup>[5]</sup>. A 346-case analysis of laparoscopic spleen-preserving No. 10 LN dissection for proximal GC conducted by our center indicated that the incidence of No. 10 LN metastasis is 10.1% in advanced proximal GC<sup>[6]</sup>. No. 10 LN metastasis is mainly associated with the tumor size, depth of invasion, Borrmann type and histological type. The rate of GC in the upper region is significantly higher than that in the lower third of the stomach<sup>[7]</sup>. Koga *et al*<sup>[8]</sup> reported that No. 10 LN metastasis frequently appears in Borrmann type IV cancer or when the primary tumor involves the serosa or the entire stomach. Okajima *et al*<sup>[9]</sup> reported a higher No. 10 LN metastasis rate (26.7%) in GC involving the entire stomach. Moreover, the survival rate is significantly associated with No. 10 LN metastasis. Shin *et al*<sup>[4]</sup> reported that the 5-year survival rate was significantly lower for a No. 10 LN metastasis group (11.04%) than for a non-metastasis group (51.57%) ( $P < 0.05$ ). Chikara *et al*<sup>[10]</sup> reported that the 5-year survival rate of patients with No. 10 LN metastasis was 23.8%, whereas the rate in patients without No. 10 LN

metastasis was 41.4% ( $P < 0.05$ ). Thus, the No. 10 LN metastasis status is a significant prognostic factor for GC. No. 10 LN dissection is necessary in advanced upper GC because the radical excision of a tumor seems to be insufficient. Kosuga *et al*<sup>[11]</sup> reported on 280 patients who underwent curative total gastrectomy with simultaneous splenectomy. No significant difference was found in the 5-year survival rates between patients with and without No. 10 LN metastasis (51.3% and 42.1%, respectively). Ikeguchi *et al*<sup>[12]</sup> reported a study of patients who underwent curative total gastrectomy with simultaneous No. 10 LN dissection. This study also revealed that the 5-year survival curves of No. 10 LN-positive patients did not differ from those of No. 10 LN-negative patients. Therefore, the value of LN dissection in this area is significant. No. 10 LN dissection is becoming more accepted by an increasing number of clinicians.

### *Value of spleen-preserving No. 10 LN dissection for advanced proximal GC*

Before the 1990s, a pancreateosplenectomy was performed to completely excise No. 10 LNs. The prophylactic dissection of No. 10 LNs using this surgical method increases the risk of distal pancreatectomy-associated complications<sup>[13,14]</sup>. Currently, this surgical method is only performed when direct invasion of the spleen or of the body and tail of the pancreas is observed. Many subsequent studies have reported that pancreas-preserving splenectomy with No. 10 LN dissection has a similar survival rate and morbidity but significantly lower incidence of complications and mortality compared with pancreateosplenectomy. Therefore, pancreas-preserving splenectomy with No. 10 LN dissection has been recommended as a curative procedure for standard D2 dissection in place of pancreateosplenectomy<sup>[9,15,16]</sup>. However, Yang *et al*<sup>[17]</sup> reported a meta-analysis of 466 patients showing that gastrectomy with splenectomy was not associated with a significantly different 5-year overall survival rate relative to splenic preservation, with an RR of 1.17 (95%CI: 0.97-1.41,  $P < 0.05$ ). Splenectomy did not prolong survival. The RR of splenectomy did not significantly influence postoperative morbidity and mortality based on a 5-year overall survival rate outcome compared to splenic preservation for proximal and whole GC (RR = 1.14, 1.76 and 1.58, respectively). In recent years, many subsequent studies have shown that the spleen is the largest peripheral immune organ in the human body. The spleen can participate in normal operation of the circulatory system for immune regulation and also has roles in the immune and endocrine systems; additionally, it contains numerous immune cells, which play important roles in anti-tumor immunity. Some researchers have applied immunotherapy postoperatively in cases of advanced GC and determined that natural killer (NK) cell activity and the IL-2 concentration were significantly higher in a spleen-preserving group than a splenectomy group. They concluded that spleen preservation in a radical

operation enables immunotherapy for patients with advanced GC<sup>[18,19]</sup>. The Dutch scholar H.H. Hartgrink performed a multicenter randomized controlled trial that followed up 1078 patients for more than 10 years and found that morbidity and mortality were significantly increased if splenectomy was performed. In contrast, pancreas- and spleen-preserving LN dissection (D2) improved patient prognosis<sup>[20]</sup>. Schwarz<sup>[21]</sup> reported that with the development of surgical techniques, spleen-preserving No. 10 LN dissection is technically feasible. Therefore, spleen-preserving No. 10 LN dissection is becoming more accepted by an increasing number of clinicians.

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## VALUE AND PROCEDURE OF LAPAROSCOPIC SPLEEN-PRESERVING NO. 10 LN DISSECTION

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### *Value of laparoscopic spleen-preserving No. 10 LN dissection*

This operation tends to reduce surgical trauma, increase safety, and protect organ function. With further study of the disease, surgical instruments and technology have been continuously developed. Traditional open operations do not meet patients' needs. Laparoscopic D2 LN dissections are conducted by many surgeons who demonstrate a mature grasp of laparoscopic technology. The first report of laparoscopic spleen-preserving No. 10 LN dissection regarding the treatment of GC in the upper third of the stomach was published by Hyung *et al.*<sup>[22]</sup> in 2008. In our study, the average number of LNs retrieved using laparoscopic surgery was 3.6 per patient, and no patients required an open conversion resulting from an injury to the spleen or its vessels. No complications such as hemorrhage, splenic ischemia or splenic necrosis associated with dissection of the splenic hilar region were observed postoperatively, indicating favorable short-term outcomes<sup>[23]</sup>. Although to date the prognostic benefit of laparoscopic splenic hilar LN dissection for advanced GC is under debate, a randomized controlled trials on laparoscopic spleen-preserving No. 10 LN dissection for advanced middle or upper third GC (No. NCT02333721) is ongoing in our center. We think it could demonstrate that this procedure has potential benefit for those patients without increase in morbidity in experienced center.

### *Operative procedure of laparoscopic spleen-preserving No. 10 LN dissection*

Regarding the different surgical approach, some experts use a medial approach. Dissection of the No. 11p, 11d, and 10 LNs is then performed with ultrasonic shears from the root of the splenic artery (SpA) toward its distal end. This procedure requires severing of the short gastric vessels (SGVs) prior to LN dissection, which is facilitated when the surgeon stands on the patient's right side. Other experts use a retropancreatic approach in which the surgeon starts

with division of the gastrosplenic ligament and severing of the left gastroepiploic and short gastric vessels. We utilize a left-sided approach in which the LNs are excised from the SLA toward the root of the SpA, and the SGVs are severed at their roots. This approach, which enables the complete removal of No. 10 LNs and the stomach, is consistent with the concept of oncological radical resection. Our center performed laparoscopic spleen-preserving No. 10 LN dissections in January 2010 during more than 500 laparoscopic GC surgeries. We have summarized an effective procedure called Huang's three-step<sup>[24]</sup> maneuver for performing laparoscopic spleen-preserving No. 10 lymphadenectomies in clinical practice. We divided the originally complex operation steps into three steps as follows: The first step includes the dissection of LNs in the inferior pole region of the spleen, the second step includes dissection of the LN in the region of the SpA trunk, and the third step includes the dissection of LNs in the superior pole region of the spleen.

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## STRATEGIES OF LAPAROSCOPIC SPLEEN-PRESERVING NO. 10 LN DISSECTION

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To safely and effectively perform laparoscopic spleen-preserving No. 10 LN dissection, the following points should be considered.

### *Importance of teamwork*

At our center, we realized that stable and automatic teamwork plays an important role in laparoscopic spleen-preserving No. 10 LN dissection. Above, we not only introduced the concrete operative steps taken by each participant but also indicated the scope and methodology of each technique to simplify the complicated No. 10 LN dissection procedure and to improve the efficiency of the operation. By presenting this information, we hope to promote laparoscopic spleen-preserving No. 10 LN dissection, and we hope that this technique will become more popular.

### *Step over the learning curve*

Similar to other laparoscopic surgeries, performing laparoscopic spleen-preserving No. 10 LN dissection requires an initial learning phase to allow the surgeon to develop adequate and stable skills. Thus, when a certain number of surgeries are performed, the surgeon's operative technique significantly improves, typically reaching a plateau over time. With respect to achieving proficiency in laparoscopic GC surgical techniques, a surgeon can be considered to have stable skills after he has performed 40 surgical training procedures<sup>[25]</sup>. To shorten the learning curve, the surgeon should perform the procedure on patients in good condition who are younger and have fewer complications, smaller tumors, or leaner figures. These criteria facilitate a reduction in surgical risk while

increasing the surgeon's confidence, helping him to eventually achieve proficiency. An adequate ability to summarize one's experiences and lessons and to explore the operative position and anatomical approach that are most suitable for oneself will help the surgeon to gradually establish relatively stable surgical abilities.

### ***Be familiar with the complex anatomy in this region***

Because of the deep location of the splenic hilar, the narrow operative space, the fragile texture of the spleen, the tortuosity of splenic vessels and the complicated branching of the SLA, adequate exposure of the splenic hilar area is difficult. There is a high risk of injury to the splenic parenchyma or to adjacent organs such as the pancreas and adrenal gland in a No. 10 LN dissection. In addition, the splenic vessels exhibit a tortuous course, and their branches are complex. This configuration may lead to a high risk of vessel injury and result in uncontrollable hemorrhage during laparoscopic dissection in this region. Therefore, we hypothesize that 3-dimensional computed tomography (3DCT) reconstruction can be used preoperatively to detect the distribution of the splenic vessels. The research outcomes of our unit also revealed that the operative time and intraoperative blood loss were significantly decreased in the 3DCT group compared with the non-3DCT group<sup>[26]</sup>.

## **PROSPECT OF LAPAROSCOPIC SPLEEN-PRESERVING NO. 10 LN DISSECTION**

Presently, although the long-term curative effect of laparoscopic spleen-preserving No. 10 LN dissection for advanced proximal GC is still not fully supported by evidence-based medical research, the development of minimally invasive technology, represented here by laparoscopic technology, is an inevitable trend in GC surgery. Therefore, a randomized controlled trial for spleen-preserving No. 10 LN dissection for advanced proximal GC should be conducted to further confirm the efficacy of laparoscopic spleen-preserving No. 10 LN dissection.

Moreover, not all centers can presently complete independent laparoscopic spleen-preserving No. 10 LN dissection. Surgeons at these centers must first master techniques for laparoscopic spleen-preserving No. 10 LN dissection despite the substantial learning curve. Mastery of these techniques is the key to successfully completing the operation. Providing professional training for GC surgeons, establishing an active, hands-on training program and employing experienced and senior surgeons who can convey their knowledge and experience to young doctors are critical. Improving the level of integration of laparoscopic spleen-preserving No. 10 LN dissection is also challenging. Therefore, laparoscopic spleen-preserving No. 10 LN dissection will likely become one of the standard treatments for advanced proximal GC following improvement of the

standardized operation training system and laparoscopic technology and the promotion of Huang's three-step technique.

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