



# How I do it: technical tips of laparoscopic surgery for advanced gastric cancer

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**Abstract:** Laparoscopic distal gastrectomy with radical lymphadenectomy for early gastric cancer is technically established, and it has penetrated clinical scene worldwide. Meanwhile, in terms of expanding its indication to more advanced gastric cancer, there are still a lot of arguments in both technical and oncological viewpoints, and we should wait for the upcoming long-term results of large-scaled randomized studies. Technically, without doubt accurate complete D2 dissection is necessary for advanced gastric cancer, and additionally in whatever situation surgeons should follow oncological principles, not to cause cancer cell spillage or local residue due to inadequate dissection during the surgery. To keep dry operative fields, water absorptive surgical sponges are effective. Special gauze for endoscopic surgery or pre-tied loop can be utilized to create efficient traction without touching the tumor surface. Several kinds of recovery measures for intraoperative hemorrhage should be noted in surgical team, in case.

**Keywords:** Advanced gastric cancer; laparoscopic surgery; lymph node dissection

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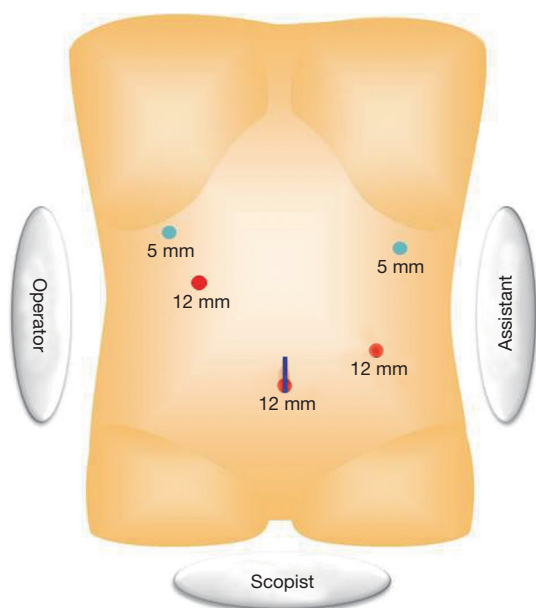
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Laparoscopic distal gastrectomy with radical lymphadenectomy for early gastric cancer is technically established, and it has penetrated clinical scene worldwide, especially in East Asian countries, where the incidences of stomach cancer are higher than the rest of the world (1-3). Meanwhile, in terms of expanding its indication to more advanced gastric cancer, there are still a lot of arguments in both technical and oncological viewpoints. In East Asian countries, several large-scaled prospective randomized studies have been conducted to prove non-inferiority of laparoscopic surgery to open surgery, and presently patients' accruals of these trials have been completed (4-6). Now we are watching over their upcoming long-term outcomes for reaching final conclusion. Technically, without doubt accurate complete D2 dissection is necessary for advanced gastric cancer, and additionally in whatever situation surgeons should follow oncological principles, not to cause cancer cell spillage or local residue due to inadequate dissection during the surgery. In fact, in large tumors or in cases with actual nodal metastases, surgical maneuvers tend to be even more

difficult than usual prophylactic lymphadenectomy in early cancer. In this article, we focus on our technical tips of performing laparoscopic surgery for advanced gastric cancer aiming safe procedures in technical as well as oncological aspects.

## Indication of surgery

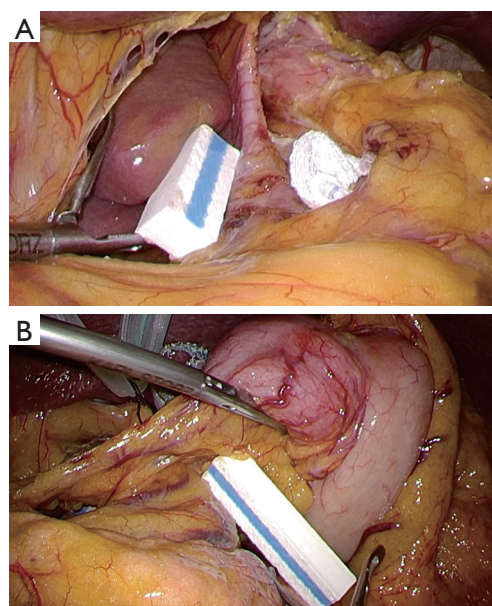
Safety and feasibility of laparoscopic distal gastrectomy for cStage II/III gastric cancer has been demonstrated by several prospective large-scaled studies, which compared with open surgery (4-6). On the other hand, oncological validity in terms of long-term outcomes has not been well shown. In our institution, sufficient informed consent is offered to all of the patients with explaining currently available scientific evidences, and if it is obtained, laparoscopic surgery is applied. Huge tumors larger than 8 cm, type 4 tumors, or tumors with gross lymph nodes metastases adjacent to the major vessels are out of the indication in our institution.



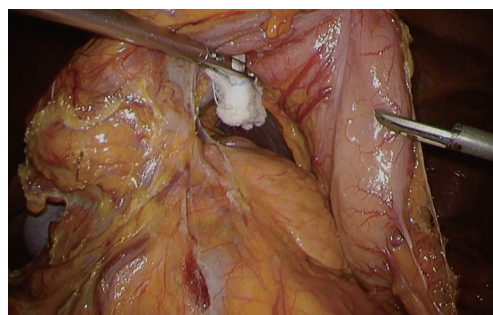
**Figure 1** Port placements and operators' positions.

### Basic set-up, necessary instruments and port placement

When a surgical team has enough experiences of laparoscopic surgery with prophylactic lymphadenectomy for early stage gastric cancer, basic concept of surgical approach can be extrapolated. Our standard port placement is shown as *Figure 1*, which is almost same as that for early cancer, but the right lower port is placed a little closer to median to facilitate approach to supra-pancreatic region by energy devices. A camera port is placed above or below the umbilicus according to the patient's habitus; and as for optics we routinely use a 12-mm flexible high-definition endoscope (VISERA ELITE™, Olympus, Tokyo, Japan) to provide better visualization around the supra-pancreatic area or the splenic hilum, where views from upside obtained by articulation function of the flexible endoscope up to 90 degrees is effective. In most of operative steps, the operator stands at the right of patient except dissection of No.6 nodal station. The assistant surgeon stands at the opposite side, and the camera assistant between patient's legs. In advanced cancer, surgical situation may be tougher owing to tumor's progression. In general, tissue around the lesion is likely to be wet or sometimes firm due to inflammation related with tumor infiltration. Especially, excessive lymphatic discharge tends to hamper placid dissection. During the surgery, we place a couple of water absorptive surgical sponges



**Figure 2** Water absorptive surgical sponges. (A) Besides the right diaphragmatic crus; (B) between the stomach and the pancreatic body.

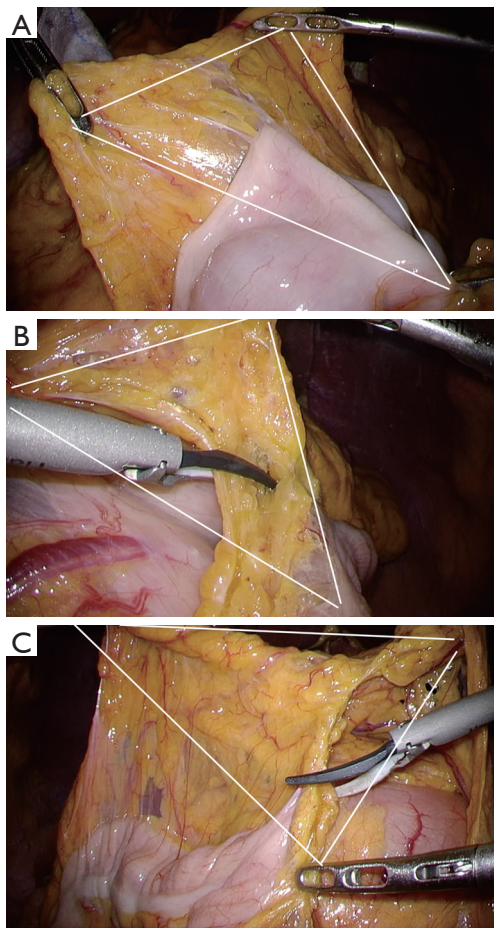


**Figure 3** Gentle retraction using a gauze.

(KAIMEN™, Kawamoto Corporation, Osaka, Japan) in the operative fields, exactly besides the right diaphragmatic crus and between the stomach and the pancreas body, in which space discharge are easily pooled (*Figure 2*). By using this, dry operative fields can be kept. Suction device is also frequently used to suck superfluous discharge. Specialized gauze for endoscopic surgery (TROX™, Oosaki Medical, Nagoya, Japan) is essential to be used for gentle retraction of the organs (*Figure 3*).

### Omentectomy

In T3-4 tumors in surgical findings, omentectomy is



**Figure 4** Triangulation during the omental resection.

recommended in the current Japanese guidelines (7). Survival impact of bursectomy, which excises the anterior leaf of the transverse mesocolon as well as capsule of the pancreas aiming complete removal of micrometastasis on the neighboring peritoneum, has been denied by JCOG 1001 randomized trial, which compared omentectomy versus bursectomy (8). Nowadays bursectomy is not performed as a routine procedure anymore in Japan. Furthermore, some researchers have suggested the doubt even in potential effectiveness of omentectomy, because there has been no persuasive scientific evidence to verify its survival impact. Regarding this issue, further investigations with well-designed prospective studies are required. In this context, presently omentectomy is regarded as a standard procedure for T3–4 tumors.

Technically, in laparoscopic surgery, wide traction of the transverse mesocolon is not so as easy as in open surgery. For overcoming this limitation, triangulation to make

tension to the attachment between the omentum and the transverse colon in cooperation with assistance is essential in laparoscopic surgery (Figure 4). When the posterior wall of the stomach is recognized by sight, we can confirm entering the omental bursa. Once the space of the omental bursa is identified, another triangulation should be formed to make tension to the attachment between the omentum and the transverse colon. On the right side of patients, physiological adhesion of the anatomical structure is more complex, so that the correct plane in front of the transverse mesocolon should be carefully kept. During the procedures of omentectomy, head-up tilt of the operative table is necessary to extent the transverse colon mesentery using the traction by the gravity.

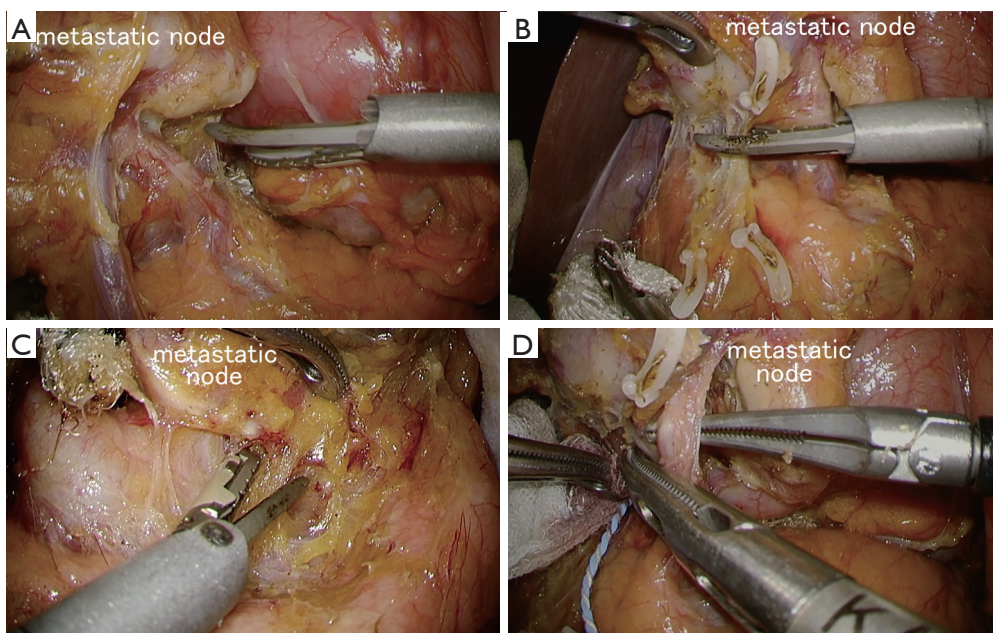
### Management of metastatic lymph nodes

As mentioned, laparoscopic surgery techniques of prophylactic D2 lymph node dissection have been almost established. However, when encountering swollen lymph nodes with actual metastasis, technical difficulty will remarkably increases. Surgeons should pay the utmost attention not to cause destruction of the nodal capsule to maintain safe excisional margin (Figure 5). Careless manipulation with forceps will cause damage of the nodal capsule, which will lead to cancer cell spillage. In order to avoid such adverse events, surgeons should not directly grasp swollen nodes. We sometimes use forceps with closing this jaw, and just push up structures including metastatic nodes. Once, the proper dissection plane is exposed, it is important to keep this plane without any hemorrhage. Nevertheless, in extensive metastatic cases, finding the dissection plane is difficult between tumor and the preserving organs. Laparoscopic surgery lacks tactile feedbacks, thus in such cases we use a fine dissector, which is useful to find the dissection space or make a decision regarding its resectability.

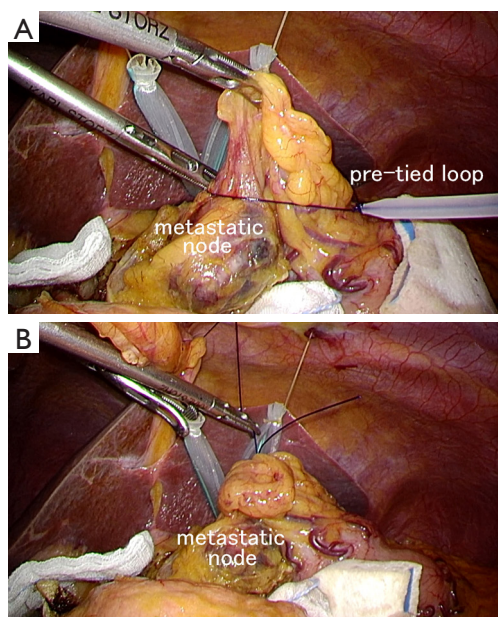
### Management of large tumor or tumors with serosal invasion

In laparoscopic surgery, surgeons cannot use their hands for retraction. Thus, in large tumors with serosal invasion, gentle manipulation without surgeon's hand is really crucial to prevent cancer cell spillage in the abdominal cavity. Direct grasping of gastric wall using forceps should be absolutely avoided. Retraction using gauze can be effective for atraumatic handling as an alternative solution. We





**Figure 5** Lymph node dissection in a node positive case. (A) Dissection identifying the proper plane; (B) tissue traction using closed forceps (push up); (C) tissue traction using closed forceps (push up); (D) dissection nearby the artery using a fine dissector.



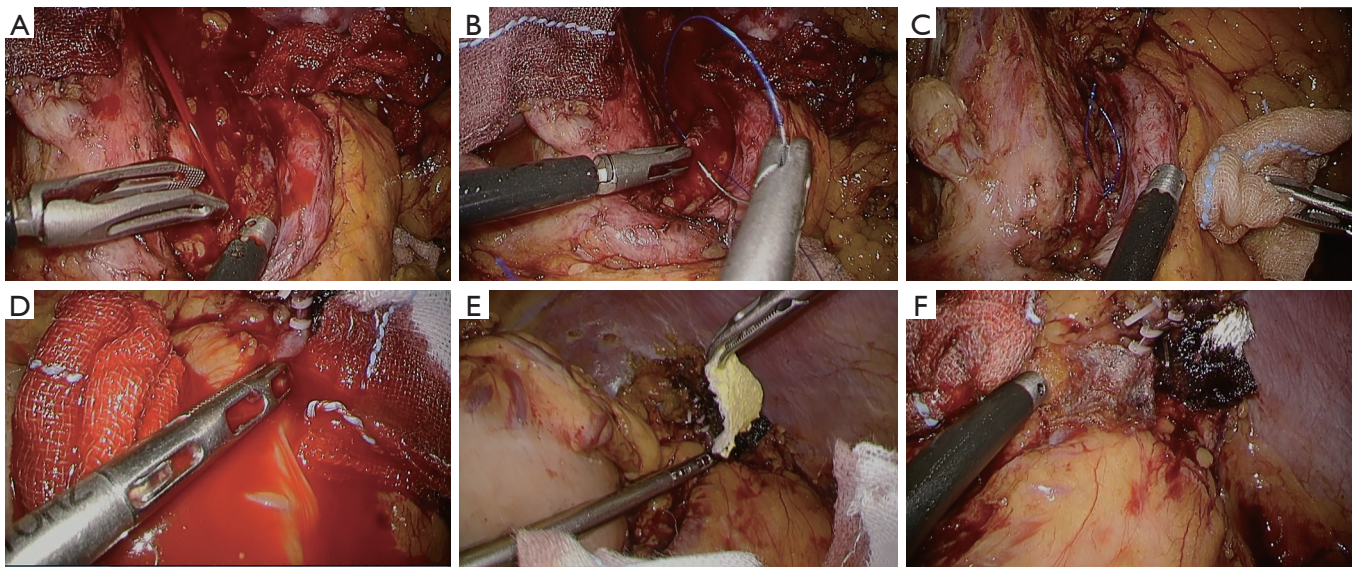
**Figure 6** Traction using a pre-tied loop.

sometimes utilize pre-tied loop to ligate perigastric fat tissue to be lifted up through the abdominal wall (*Figure 6*). Tilt function of the operative table should be considerably used, in which the gravity can be utilized for retraction. Head-up

or left side-up tilt is effective to obtain sufficient visibility around the splenic hilum. Nonetheless, we believe gross tumors larger than 8 cm are not appropriate candidates for laparoscopic surgery due to oncological safety.

#### Trouble-shoot for intraoperative hemorrhage

In operation for advanced gastric cancer, we have more probability to encounter intraoperative troubles, such as hemorrhage from the major vascularity. When major hemorrhage is recognized during the surgery, surgeons should attempt to achieve primary hemostasis by gauze compression or by grasping a bleeding point directly by forceps. Once tentative hemostasis is obtained, blood in the operative fields should be sucked or swept to make the relevant anatomy clear, eventually the bleeding point may be correctly understood. If the target vessel is separated from other structures, a detachable vascular clip is useful for controlling hemorrhage or subsequent hemostatic procedures. Regarding means to complete hemostasis, there are various options, such as clips, suturing, pre-tied suture loop or tissue sealing sheet, and surgeons should choose a proper one considering each situation. Suturing is one of the most reliable ways to control bleeding; however, for accurate procedures enough proficiency is required



**Figure 7** Management of intraoperative bleeding from the splenic vein. (A-C) Hemostasis by intracorporeal suturing techniques; (D-F) hemostasis by a tissue sealing sheet.

(Figure 7A,B,C), particularly for that from the major vein. Currently, tissue sealing sheets are available, which is effective for hemostasis on the vein. We always prepare one of that (TachoSil™, CSL Behring, King of Prussia, PA, USA) for emergent situation (Figure 7D,E,F).

### Postoperative managements

We usually put 19-Fr closed-type drainage tube with continuous aspiration along the supra-pancreatic rim. Amylase levels of the discharge in the tube are measured on 1<sup>st</sup> and 3<sup>rd</sup> postoperative days. When there is no abnormal elevation of the amylase levels or cloudiness in discharge, the tube is removed on the 4<sup>th</sup> postoperative day. Drinking water is started on 1<sup>st</sup> postoperative day, and soft meal is on 3<sup>rd</sup> postoperative day. When there is no complication, patients are allowed to be discharged on 7<sup>th</sup> postoperative day.

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*Conflicts of Interest:* All authors have completed the ICMJE

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