

# Pure Single-Port Laparoscopic Distal Gastrectomy for Early Gastric Cancer: Comparative Study with Multi-Port Laparoscopic Distal Gastrectomy

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- BACKGROUND:** The purpose of this study was to show the feasibility and safety of pure single-port laparoscopic distal gastrectomy (SDG) by comparing its short-term outcomes with those of conventional multiport totally laparoscopic distal gastrectomy (TLDG).
- STUDY DESIGN:** Prospectively collected data of 50 gastric cancer patients who underwent pure SDG from November 2011 through October 2013 were compared with the matched data of 50 TLDG patients.
- RESULTS:** Mean operation time (144.5 vs 140.3 minutes;  $p = 0.561$ ) and number of harvested lymph nodes ( $51.7 \pm 16.3$  vs  $52.4 \pm 17.9$ ;  $p = 0.836$ ) were comparable. Estimated blood loss was lower in the SDG patients ( $50.5 \pm 31.5$  mL vs  $87.5 \pm 79.6$  mL;  $p = 0.007$ ). Postoperative recovery was faster in the SDG patients in terms of lower maximum pain score on the operative day ( $6.1 \pm 1.4$  vs  $6.9 \pm 1.5$ ;  $p = 0.015$ ) and postoperative day 1 ( $4.6 \pm 1.0$  vs  $5.5 \pm 1.4$ ;  $p < 0.001$ ), less use of parenteral analgesics ( $0.8 \pm 1.0$  vs  $1.4 \pm 1.0$ ;  $p = 0.020$ ), and less increase in C-reactive protein level on postoperative day 5 ( $4.57 \pm 6.26$  mg/L vs  $8.51 \pm 5.25$  mg/L;  $p = 0.008$ ). Postoperative morbidity occurred in 6 (12%) and 5 (10%) patients in the SDG and TLDG group, respectively.
- CONCLUSIONS:** This study showed that pure SDG is both safe and feasible for early gastric cancer, with similar operation time and better short-term outcomes than TLDG in terms of postoperative pain, estimated blood loss, inflammatory reaction, and cosmetic result. (J Am Coll Surg 2014;219:933–943. © 2014 by the American College of Surgeons)

Laparoscopic gastrectomy has been widely adopted as an alternative treatment option for early gastric cancer (EGC) and has been reported to be beneficial for patients, with better early postoperative outcomes and long-term oncologic outcomes comparable with open gastrectomy.<sup>1–3</sup>

Efforts are underway to reduce the invasiveness of laparoscopy. Natural orifice transluminal endoscopic surgery

(NOTES) and single-port laparoscopic surgery (SLS) are results of these efforts. Although NOTES is still being researched because of limitations in terms of equipment and difficulty with closure of the incised lumen, extensive reports on single-port surgery are found in various clinical and surgical fields.<sup>4,5</sup>

Single-port laparoscopic surgery was introduced to reduce abdominal wall scarring and stress, and SLS through the umbilicus provides easy access to the peritoneum without any visible scar. Apart from better cosmetic results, it has been reported that SLS decreases postoperative pain and hospital stay and leads to faster postoperative recovery than conventional laparoscopy.<sup>6,7</sup> Although long-term data on the outcomes of SLS are still lacking, the reported data on oncologic patients undergoing SLS support the technical feasibility of a single-port surgery.<sup>7,8</sup>

However, the feasibility of pure single-port laparoscopic distal gastrectomy (SDG) for EGC in comparison with laparoscopic distal gastrectomy has not been demonstrated.

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### Abbreviations and Acronyms

ECG	= early gastric cancer
G-Jstomy	= gastrojejunostomy
LN	= lymph node
NOTES	= natural orifice transluminal endoscopic surgery
PCA	= patient-controlled analgesic
SDG	= single-port laparoscopic distal gastrectomy
SLS	= single-port laparoscopic surgery
TLDG	= totally laparoscopic distal gastrectomy

We compared 50 cases of pure SDG with 50 cases of conventional multiport totally laparoscopic distal gastrectomy (TLDG) performed during the same period to evaluate the feasibility of pure SDG. Our hypothesis on this study was that pure SDG offers short-term outcomes that are better or at least as good as those of TLDG for EGC. To the best of our knowledge, this is the first study to compare pure SDG with conventional TLDG.

## METHODS

### Study design and data collection

Prospectively maintained data of patients who underwent laparoscopic distal gastrectomy for gastric cancer were reviewed. From November 2011 to July 2013, fifty consecutive patients who underwent pure SDG for EGC at Seoul National University Bundang Hospital in Korea were enrolled. The TLDG group comprised 50 patients who underwent TLDG during the same period as pure SDG, which was from November 2011 to July 2013. The TLDG group was also matched for number, sex, age, BMI, and stage. The initial cases of TLDG were compared with the initial cases of pure SDG.

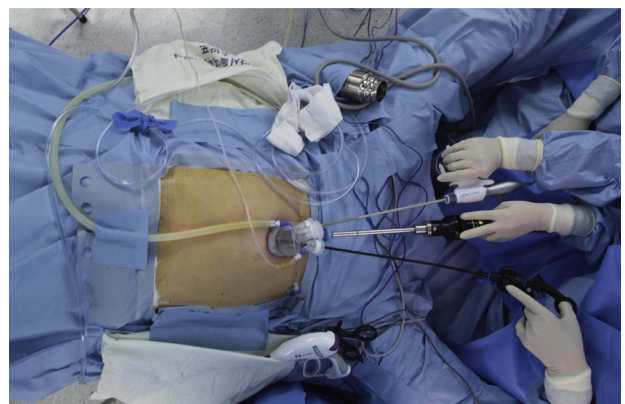
All 100 operations were performed by a single surgeon who had performed >100 laparoscopic distal gastrectomies before starting the single-port surgery and >50 conventional open gastrectomies. In this study, patient eligibility criteria were preoperative diagnosis of stage I gastric cancer according to the *American Joint Committee on Cancer Staging Manual*, 7<sup>th</sup> edition<sup>9</sup>; no lymph node (LN) enlargement; age 20 to 80 years; no history of other malignancies, chemotherapy, or radiotherapy; and no severe comorbidity. This study was approved by the Ethics Committee of Seoul National University Bundang Hospital.

### Surgical technique

#### Pure single-port laparoscopic distal gastrectomy with D1+ lymph node dissection

The patient was placed in the lithotomy position with reverse Trendelenburg. The operator and a scopist were

positioned between the patient's legs. A longitudinal 2.5-cm transumbilical skin incision was made. A commercial 4-hole single port (Gloveport; Nelis) was then placed in the umbilical incision and the abdominal cavity was insufflated with carbon dioxide at a pressure of 13 mmHg (Fig. 1). No additional assistant trocar was used. A 10-mm flexible high-definition scope (Endoeye flexible HD camera system; Olympus Medical Systems Corp) and a 45-cm version of Harmonic scalpel (Ethicon EndoSurgery Inc.) were used to visualize every corner of the operative field and facilitate dissection. We used the conventional laparoscopic grasper when operating on the greater curvature side and the curved instruments for single-port surgery (Olympus Medical Systems Corp.) when operating on the lesser curvature side, including the suprapancreatic LN dissection. Modified combined suture retraction of the falciform ligament and the left lobe of the liver was performed using 2-0 Prolene (Ethicon) on a straight needle and 5-mm hemoclips.<sup>10</sup> Partial omentectomy was initiated distally approximately 3 to 4 cm away from the gastroepiploic arcade, which included the LN 4d. To prevent omental infarction, the left gastroepiploic vessels were ligated distal to the omental branch (LN 4sb). Then, the omentum was dissected and taken down from the mesocolon to the head of the pancreas and the duodenum. The right gastroepiploic arcade was approached in a retrograde fashion. We first dissected the space between the duodenum and the basin, including the right gastroepiploic vessels and LN station 6, and then detached these from the duodenum and the distal stomach. We could easily dissect and divide the right gastroepiploic area without any substantial bleeding (Fig. 2A). After dissecting LN 6, the right gastric artery and the proper hepatic artery were adequately exposed to dissect LNs 5 and 12a (Fig. 2B), and the operator exchanged



**Figure 1.** An operative illustration of pure single-port laparoscopic distal gastrectomy.

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