

# Comparison of Postoperative Pain in Laparoscopy-Assisted Distal Gastrectomy and Totally Laparoscopic Distal Gastrectomy by Location of Mini-Laparotomy Site

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**Purpose:** We aimed to evaluate the clinical outcomes and determine the degree of postoperative pain associated with the location of mini-laparotomy sites in gastric cancer patients who underwent laparoscopy-assisted distal gastrectomy (LADG) or totally laparoscopic distal gastrectomy (TLDG).

**Methods:** Between November 2011 and December 2016, 153 patients who underwent surgery for gastric cancer at Kyung Hee University Hospital at Gangdong were reviewed retrospectively. We divided the patients into LADG with epigastric incision, TLDG with umbilical incision (TLDG\_U), and TLDG with Pfannenstiel incision (TLDG\_P) groups according to the location of incision for anastomosis and specimen removal. There were 37 cases in the LADG group, 85 in the TLDG\_U group, and 31 in the TLDG\_P group. The clinical characteristics, numeric rating scale (NRS) scores, and postoperative analgesic usage for 7 days of the three groups were compared.

**Results:** There was no statistically significant difference in clinical characteristics including age, sex, body mass index (BMI), TNM staging, and complications among the three groups. There was no significant difference in the amount of total analgesics received; however, the TLDG\_P group received more analgesics ( $5.26 \pm 5.053$ ,  $p=0.412$ ) during the first 7 postoperative days. The TLDG\_P group showed higher NRS scores on postoperative days 0, 2, 3, 4, and 5 ( $p=0.04$ , 0.001, 0.003, 0.006, and 0.002 respectively).

**Conclusion:** Laparoscopic distal gastrectomy can be performed through various incision sites for increasing the safety of mini-laparotomy. However, a Pfannenstiel incision was shown to be more painful than other incisions.

**Keywords:** Stomach neoplasms, Laparoscopy-assisted distal gastrectomy, Totally laparoscopic distal gastrectomy, Surgical wound, pain

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## INTRODUCTION

Gastric cancer is the most common cancer in Korea and the proportion of early gastric cancer has increased accounting for 61% of cancer cases in 2014.<sup>1</sup> The proportion of open surgery cases has been decreasing while the use of the laparoscopic

approach has increased from 6.6% to 48.0% in 2014.<sup>2</sup> Totally laparoscopic distal gastrectomy (TLDG), which was first introduced in 1992,<sup>3</sup> has been associated with a shorter hospital stay and less blood loss than that in laparoscopy-assisted distal gastrectomy (LADG).<sup>4,5</sup> Anastomosis and specimen removal are commonly performed by mini-laparotomy through

a transverse or vertical incision in the epigastrium in LADG and primarily through a vertical incision in the umbilicus and rarely through a Pfannenstiel incision in TLDG. However, there is no sufficient data comparing postoperative pain according to the mini-laparotomy sites. Therefore we evaluated clinical outcomes to determine the degree of pain in relation to the location of mini-laparotomy in gastric cancer patients who underwent LADG or TLDG.

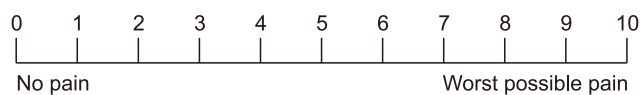
## MATERIALS AND METHODS

### Patient selection

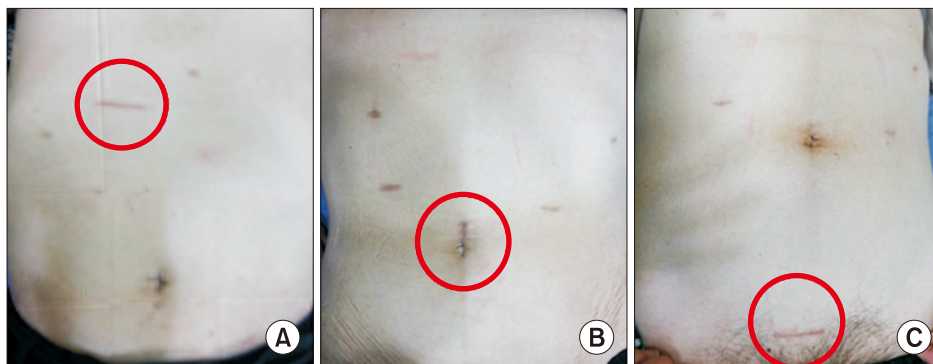
The clinical records of 153 patients who underwent surgery for gastric cancer at Kyung Hee University Hospital at Gangdong from Nov. 2011 to Dec. 2016 were retrospectively reviewed. Patient demographics, type of operation, pathology, and American Society of Anesthesiologists (ASA) class were noted. Complications were classified according to the Clavien–Dindo classification. This study was approved by the Institutional Review Board of Kyung Hee University Hospital at Gangdong (KHNMC IRB file no. 2019–06–04).

### Numeric rating scale (NRS) score

The numeric rating scale (NRS) is a single 11-point numeric scale broadly validated across various patient types (Fig. 1). Data obtained with NRS can be easily documented and intuitively interpreted, while meeting regulatory requirements for pain assessment and documentation.<sup>6,7</sup> The NRS score was checked for 7 days postoperatively in patients who underwent LADG or TLDG for gastric cancer.



**Fig. 1.** Numerical Rating Scale (NRS).



**Fig. 2.** Incisions according to operation type. (A) LADG, (B) TLDG with umbilical incision, (C) TLDG with Pfannenstiel incision.

## Specimen removal

### Laparoscopy-assisted distal gastrectomy (LADG)

In LADG, the greater omentum and lesser omentum were divided, and D1+ or D2 lymph node dissection according to tumor stage was performed. After mobilization of the stomach, an approximately 5-cm sized vertical or transverse incision through the epigastric area (Fig. 2A) was made. The stomach was mobilized, followed by anastomosis and removal of the specimen through this incision.

### Totally laparoscopic distal gastrectomy (TLDG)

Division of omentum, lymph node dissection, and stomach mobilization was identical to LADG. After full mobilization and resection of the stomach, a 3~5-cm wound extension of the port insertion site through the umbilicus (Fig. 2B) or Pfannenstiel incision (Fig. 2C) was made. In the TLDG with umbilical incision (TLDG\_U) group, specimen removal was performed through the umbilical incision. In the TLDG with Pfannenstiel incision (TLDG\_P) group, specimen removal was performed through the Pfannenstiel incision.

## Statistical analysis

Statistical analyses were performed using SPSS software, version 20 (IBM Corporation, Armonk, NY, USA). Sex, ASA score, T stage, N stage, TNM stage and complication were compared using linear-by-linear association. Age, BMI and the difference between the NRS score in the LADG and TLDG groups were evaluated by one-way analyses of variance (ANOVA) followed by post-hoc Turkey's Honestly Significantly Different (HSD) test. Probability values less than 0.05 were considered statistically significant.

## RESULTS

### Clinical characteristics

In the LADG group, 37 patients were enrolled, whereas 85 patients were enrolled in the TLDG\_U and 31 patients were enrolled in the TLDG\_P group. Age, sex, BMI were similar in all three groups. T1, N0 and stage I were most frequent among the three groups. American Society of Anesthesiologists (ASA) score was similar in each group. There was no difference in the postoperative complication rate. In the LADG group, one patient underwent reoperation for bleeding and one patient had an anastomotic stricture. In the TLDG\_U group, 2 patients

had anastomotic stricture, and 3 patients underwent percutaneous drainage due to anastomotic leakage or duodenal stump leakage. In the TLDG\_P group, one patient underwent reoperation for duodenal stump leakage (Table 1). In addition, there were no wound complications in all three groups.

### Analgesic usage

Postoperative pain was controlled with intravenous patient controlled analgesia (PCA) in all patients. When the patient complained of pain or requested further analgesia, additional analgesics were administered. Analgesics used included pethidine and tramadol. There was no statistically significant dif-

**Table 1.** Comparison of clinical characteristics among LADG, TLDG\_U and TLDG\_P

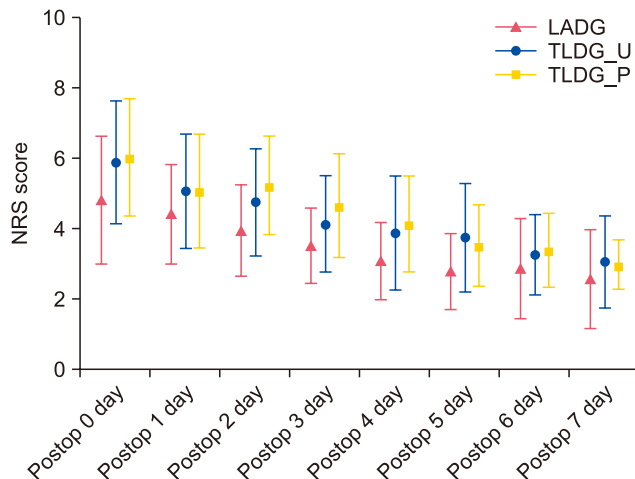
	LADG (n=37)	TLDG_U (n=85)	TLDG_P (n=31)	p value
Age	57.95±11.783	61.65±12.102	56.90±11.452	0.095
Sex				0.504
Male	20 (54.1%)	55 (64.7%)	19 (62.5%)	
Female	17 (45.9%)	30 (35.3%)	12 (38.7%)	
BMI	23.56±4.215	24.72±3.927	24.26±3.300	0.320
ASA* score				0.147
1	7 (18.9%)	7 (8.2%)	3 (9.7%)	
2	30 (81.1%)	73 (85.9%)	27 (87.1%)	
3	0 (0.0%)	5 (5.9%)	1 (3.2%)	
T stage				0.579
T1	26 (70.2%)	66 (77.6%)	24 (77.4%)	
T2	8 (21.6%)	6 (7.1%)	1 (3.2%)	
T3	3 (8.1%)	9 (10.6%)	6 (19.4%)	
T4	0 (0.0%)	4 (4.7%)	0 (0.0%)	
N stage				0.543
N0	29 (78.4%)	64 (75.3%)	25 (80.6%)	
N1	6 (16.2%)	9 (10.6%)	2 (6.5%)	
N2	0 (0.0%)	4 (4.7%)	0 (0.0%)	
N3	2 (5.4%)	8 (9.4%)	4 (12.9%)	
TNM stage				0.614
1	30 (81.1%)	69 (81.2%)	25 (80.6%)	
2	5 (13.5%)	4 (4.7%)	2 (6.5%)	
3	2 (5.4%)	12 (14.1%)	4 (12.9%)	
Complications				0.814
CD**I ~ II	4 (10.8%)	10 (11.8%)	4 (12.9%)	
CDIII ~ V	2 (5.4%)	6 (7.1%)	1 (3.2%)	

\*American Society of Anesthesiologists. \*\*Clavien-dindo classification.

**Table 2.** Comparison of analgesic use among LADG, TLDG\_U and TLDG\_P

	LADG (n=37)	TLDG_U (n=85)	TLDG_P (n=31)	$p$ value <sup>†</sup>	$p$ value <sup>‡</sup>
Number of analgesics injection	4.84±4.856	3.69±6.470	5.26±5.053	0.360	0.412

Values are mean±standard deviations. <sup>†</sup> $p$  value was estimated by the one-way ANOVA test. <sup>‡</sup> $p$  value was estimated by post-hoc (Turkey HSD) between TLDG\_U and TLDG\_P.

**Fig. 3.** Changes in NRS score. Day after operation is on the x-axis and NRS score is on the y-axis.

ference in the three groups, but the TLDG\_P group received more analgesics ( $5.26 \pm 5.053$ ,  $p=0.412$ ) during the first 7 days postoperatively (Table 2).

### Postoperative NRS score

The postoperative NRS score gradually decreased (Fig. 3). The difference in the NRS score on postoperative days 0, 2, 3, 4, and 5 was statistically significant ( $p < 0.05$ ) according to the results of the one-way ANOVA test. In the post-hoc (Turkey HSD), there was no difference between the TLDG\_U and TLDG\_P, but there was a significant difference between the LADG and TLDG\_P on postoperative days 0, 2, 3, 4, and 5. Overall, there was little difference between the LADG and TLDG\_U groups, but the NRS score was higher in the TLDG\_P group than in the other groups (Table 3).

## DISCUSSION

Laparoscopy-assisted distal gastrectomy (LADG), which was introduced in 1994, has gradually become a popular method for management of early gastric cancer (EGC).<sup>7</sup> In the mid-1990s, many surgeons preferred LADG because intracorporeal anastomosis was difficult in totally laparoscopic

distal gastrectomy (TLDG). However, TLDG gradually gained popularity due to the development of laparoscopic skills and instruments.<sup>8</sup> In several studies, surgical outcomes of TLDG were safe as well as feasible, compared with LADG. Also, TLDG has several advantages over LADG, such as a shorter hospital stay, lesser estimated blood loss, and a smaller wound size.<sup>9,10</sup>

In obese patients, TLDG has more advantages than LADG. Intracorporeal anastomosis with endoscopic linear staplers helps form an anastomosis without forceful tension, which may lead to injuries to the structures around the anastomosis. Also, there is no manipulation of the operative field, and the incision for specimen removal is smaller than that in LADG.<sup>11</sup>

In LADG, an approximately 5-cm sized transverse or vertical incision was made in the epigastrium, whereas in TLDG an approximately 3-cm sized vertical incision was made in the umbilicus. We initially thought that LADG would be more painful than TLDG as it involves longer incisions which would be cosmetically less appealing as well. Therefore, in TLDG, we thought that a Pfannenstiel incision (TLDG\_P) would be superior considering pain with a less conspicuous wound which can be covered with clothing than an umbilical incision (TLDG\_U). In this study, patients in the LADG group showed higher NRS scores on postoperative days 0, 2, 4, and 5 compared to that of TLDG\_U group but there was no significant difference in analgesic usage between the two groups.

The location and orientation of the incision are known to affect postoperative pain scores as well as the length of the incision.<sup>12-14</sup> Research has shown that there is relatively dense sensory innervation in the umbilicus, comparable to that in the lips and external genitalia.<sup>15</sup> On the contrary, the TLDG\_P group showed higher NRS scores and more analgesic usage than the TLDG\_U group. In the Pfannenstiel incision, innervating nerves of the suprapubic area and lower abdomen, such as branches of the iliohypogastric or ilioinguinal nerves are easily damaged.<sup>16</sup> Therefore, nerve damage in the suprapubic area caused more postoperative pain than the TLDG\_U group.

With further emphasis on the patient's quality assessment, the attitude of the medical staff and the policies of the hospital have evolved to provide more sensitive and meticulous care. There have been efforts to assess pain more frequently and exactly accompanied with a more vigorous control of pain

**Table 3.** Comparison of postoperative NRS scores

	LADG (n=37)	TLDG_U (n=85)	TLDG_P (n=31)	p value <sup>a</sup>	p value <sup>b</sup>	p value <sup>c</sup>	p value <sup>d</sup>
NRS #0	4.81±1.808	5.88±1.742	6.03±1.663	<b>0.004</b>	0.912	<b>0.013</b>	<b>0.006</b>
NRS #1	4.41±1.404	5.06±1.628	5.06±1.611	0.092	1.000	0.201	0.092
NRS #2	3.95±1.311	4.76±1.533	5.23±1.407	<b>0.001</b>	0.290	<b>0.001</b>	<b>0.014</b>
NRS #3	3.51±1.070	4.13±1.378	4.65±1.473	<b>0.003</b>	0.158	<b>0.002</b>	0.052
NRS #4	3.08±1.090	3.87±1.609	4.13±1.360	<b>0.006</b>	0.673	<b>0.010</b>	<b>0.018</b>
NRS #5	2.78±1.084	3.75±1.535	3.52±1.151	<b>0.002</b>	0.687	0.074	<b>0.001</b>
NRS #6	2.86±1.417	3.27±1.138	3.39±1.054	0.142	0.888	0.175	0.200
NRS #7	2.57±1.405	3.06±1.303	2.97±0.706	0.130	0.934	0.380	0.111

Values are meanstandard deviations. <sup>a</sup>p value was estimated by the one-way ANOVA test. <sup>b</sup>p value was estimated by post-hoc Turkey HSD between TLDG\_U and TLDG\_P. <sup>c</sup>p value was estimated by post-hoc Turkey HSD between LADG and TLDG\_P. <sup>d</sup>p value was estimated by post-hoc Turkey HSD between LADG and TLDG\_U.

compared to that of before. This may be another explanation for the relatively higher NRS scores and higher dosages of analgesics in the TLDG group where the operations were performed more recently.

This study has a few limitations. First, it is a retrospective study based on medical records of a single institution for 6 years from 2011 to 2016. Second, LADG significantly reduced since 2012 due to introduction of TLDG, and LADG is no longer being performed after 2015. Third, we did not assess patient satisfaction of wound, with respect to cosmetic satisfaction and degree of wound pain, which would have enhanced our study.

Laparoscopic distal gastrectomy can be safely performed through various incision sites of mini-laparotomy. However, the Pfannenstiel incision was shown to be more painful than other incisions. A larger scale study including assessments of patient satisfaction is warranted.

## CONFLICT OF INTEREST

None.

## FUNDING

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## ACKNOWLEDGMENTS

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