



Title	Robotic Distal Gastrectomy With a Novel "Preemptive Retropancreatic Approach" During Dissection of Suprapancreatic Lymph Nodes for Gastric Cancer
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Citation	Surgical Laparoscopy Endoscopy & Percutaneous Techniques, 31(4), 457-461 https://doi.org/10.1097/SLE.0000000000000897
Issue Date	2021-08
Doc URL	http://hdl.handle.net/2115/86502
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Type	article (author version)
Additional Information	There are other files related to this item in HUSCAP. Check the above URL.
File Information	Ebihara manuscript (clean revise).pdf



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1 SURGICAL TECHNIQUE

2
3 Robotic distal gastrectomy with a novel “*Preemptive retropancreatic approach*” during dissection of
4 suprapancreatic lymph nodes for gastric cancer

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17 Running title

18 Usefulness of RDG using our novel “*Preemptive retropancreatic approach*”

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20 An authorship declaration

21 YE and YK drafted the manuscript; SM, TN, TS and SH critically revised the manuscript.

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26 Word count, excluding title page, abstract, references, figures and tables.

27 Word count: 1302 words

1 **Abstract**

2 **Introduction:** Abrogating contact with the pancreas in suprapancreatic lymph nodes dissection for
3 gastric cancer can prevent pancreatic fistula due to postoperative pancreatic damage. Our novel
4 “*Preemptive retropancreatic approach*” is a useful technique that minimizes pancreatic compression
5 during robotic distal gastrectomy (RDG) with multi-jointed forceps. Here, we report the usefulness
6 of RDG for gastric cancer surgery using our novel “*Preemptive retropancreatic approach*”.

7 **Materials and Surgical Technique:** “*Preemptive retropancreatic approach*”: initial dissection of
8 the bilateral retropancreatic space, the adherence between the retroperitoneum surface and the
9 pancreas (fusion fascia) is released, providing a good operative field and hindering contact with the
10 pancreas in suprapancreatic lymph nodes dissection during RDG. We herein reported consecutive 30
11 patients with gastric cancer who underwent RDG at Hokkaido University from September 2014 to
12 March 2020.

13 **Results:** All operations were performed by a single surgeon (YE). The median operating time was
14 281 minutes (132-415). The median intraoperative bleeding was 0 ml of blood (0-255). There were
15 two incidences of postoperative complications (\geq Clavien-Dindo classification II), and there were no
16 cases of postoperative pancreas-related complications. The median length of hospital stay after the
17 surgery was 10 days (6-33).

18 **Conclusion:** As RDG for gastric cancer is still in its early introductory phase, its superiority has
19 yet to be definitively established. However, we believe that “*Preemptive retropancreatic approach*”
20 may reduce postoperative pancreatic-related complications in suprapancreatic lymph nodes
21 dissection.

22
23 **Keywords**

24 robotic distal gastrectomy, suprapancreatic lymph nodes, postoperative complications, pancreatic
25 fistuula

1 **Introduction**

2 Recently, among the minimally invasive treatments such as laparoscopic gastrectomy (LG) for gastric
3 cancer, robotic gastrectomy (RG) has been gaining popularity. In RG, high-resolution three-
4 dimensional images and the use of forceps with multi-joint functions eliminate the limitations of
5 conventional LG and enable sophisticated procedures¹. In particular, it is expected that improvement
6 in local operability will ensure lymph node dissection for malignant tumor surgery and reduce
7 postoperative complications². In LG, it is often difficult to maintain a good operative field during
8 suprapancreatic lymph node dissection. In RG, unique multi-joints may be useful for suprapancreatic
9 lymph nodes dissection³. A unique approach with RG during suprapancreatic lymph node dissection
10 may further reduce postoperative pancreatic-related complications.

11 We report about our novel “*Preemptive retropancreatic approach*” technique and its usefulness
12 during suprapancreatic lymph nodes dissection.

14 **Materials**

15 From September 2014 to March 2020, we enrolled 30 consecutive patients who underwent robotic
16 distal gastrectomy (RDG) in the Department of Gastroenterological Surgery II at the Hokkaido
17 University Hospital (Sapporo, Japan). All operations were performed by a single surgeon (YE). The
18 eligibility criteria were preoperative cStage I/II gastric cancer diagnosed by endoscopy, computed
19 tomography, and endoscopic ultrasound. Written informed consent to participate in the study was
20 obtained from all the patients. Specimens were evaluated essentially according to the Japanese
21 Classification of Gastric Carcinoma established by the Japanese Research Society for Gastric Cancer.
22 This study was a retrospective clinical trial (UMIN000012763).

24 **Surgical technique**

25 **Setup for robotic distal gastrectomy**

26 Patients were placed under general anesthesia in the supine position as previously reported⁴. For
27 RDG, we usually used a 5-trocar system with Nathanson hook liver retractor (Yufu Itonaga, Tokyo,
28 Japan). After carbon dioxide pneumoperitoneum was achieved at a pressure of 10 mmHg, an
29 electrolaparoscope was introduced through the trocar, and four other trocars were positioned as shown
30 in Figure 1. Robotic third, first, and second arms were docked on 8-mm left upper, left lower, and right
31 upper trocars, respectively. The 8-mm left lower trocar was placed through the 12/75-mm trocar
32 (trocar-introcar technique) and the assistant surgeon used the right lower trocar (Fig.1). The basic
33 extent of lymph node dissection was D1+ (D1+ No.7, 8a and 9 lymph nodes) or D2, and lymph node
34 dissection was performed. Regions of lymph nodes and lymph node dissection were defined according
35 to the Japanese Classification of Gastric Carcinoma⁵.

1 *“Preemptive retropancreatic approach”*

2 Initially, the peritoneum is opened in the lesser omentum of the stomach, preserving the vagus nerve
3 branch of the liver. After the right margin of the crus was exposed, the abdominal branch of the vagus
4 nerve was identified and divided on the dorsal side of the esophagus. Thereafter, the retropancreatic
5 space is dissected with confirming anterior surface of the left adrenal gland and the left inferior phrenic
6 artery as landmarks. The adherence between the retroperitoneum surface and the retropancreatic fascia
7 (Toldt fusion fascia) is released. Gauze is placed in the dissected left retropancreatic space.
8 Mesenterization of the mesogastrium was performed by dissection of the left retropancreatic space
9 (Fig.2). On the right side, the peritoneum is incised from in front of the inferior vena cava to the front
10 of the right inferior phrenic artery, and gauze is placed in the dissected right retropancreatic space
11 (Fig3.). By the dissection of bilateral retropancreatic space, the adherence between the retroperitoneum
12 and the retropancreatic fascia is released, providing a good operative field and hindering contact with
13 the pancreas in suprapancreatic lymph nodes dissection (Fig.4).

15 **Results**

16 Table 1 shows the clinical characteristics and operative outcomes of the patients. All 30 patients
17 underwent RDG for gastric cancer using our novel *“Preemptive retropancreatic approach”*. The
18 patients’ median age was 69 years (45-82), twenty male and ten female, the median BMI was 22.5
19 kg/m² (16.1-32.1). Of the 30 patients, 28 patients underwent D1+ lymphadenectomy, and the
20 remaining 2 patients underwent D2 lymphadenectomy, and 2 patients underwent Billroth I
21 reconstruction, and 28 patients underwent Roux-en-Y. The median operating time was 281 minutes
22 (132-415). The median intraoperative bleeding was 0 ml of blood (0-255). There were two incidences
23 of postoperative complications (\geq CD II: Clavien-Dindo classification II).

24 However, there were no cases of postoperative pancreas-related complications (\geq CD II). The median
25 length of hospital stay after the surgery was 10 days (6-33). None of the patients died during surgery
26 or hospitalization.

28 **Discussion**

29 In 2003, Hashizume et al⁶⁾. reported the world’s first robot-assisted gastrectomy for gastric cancer.
30 Studies comparing RG with LG for gastric cancer have mainly been retrospective, with almost all of
31 them reporting prolonged operation time, reduced blood loss, and similar incidence of postoperative
32 complications for RG. Further, a meta-analysis of 10 studies conducted up until 2017 reported
33 outcomes similar to those of the retrospective studies and concluded that both RG and LG had similarly
34 short operation times^{7),8)}. In RG, high-resolution three-dimensional images and the use of forceps with
35 multi-joint functions eliminate the limitations of conventional laparoscopic surgery and enable
36 sophisticated procedures However, few studies have assessed the advantages of RG over LG^{9),10)}. In

1 RG, there is a risk of serious postoperative pancreatic-related complications due to the lack of
2 palpation and pancreatic damage by the arm, which can lead to serious postoperative pancreatic-
3 related complications. The incidence of POPF after LG is reported to range from 5 % to 7 %^{(11), (12)}.
4 One cause of postoperative pancreatic-related complications may be the compression of the pancreas
5 during dissection of suprapancreatic lymph nodes. Regarding pancreatic juice leakage during
6 gastrectomy in particular, Tsujira et al⁽³⁾. reported that pancreatic juice leakage after laparoscopic
7 gastrectomy may be attributable to either operator or assistant-related causes. The operator can injure
8 pancreatic tissue by direct cutting or causing thermal injury from energy devices used during dissection
9 of suprapancreatic lymph nodes. In their study using a swine model, Ida et al⁽¹³⁾. reported that
10 pancreatic compression by the assistant's forceps can contribute to pancreatic juice leakage and that
11 their findings will help to improve the procedure for lymph node dissection around the pancreas during
12 laparoscopic gastrectomy. Numerous studies have similarly reported postoperative pancreatic juice
13 leakage due to pancreatic compression during surgical field preparation for the dissection of
14 suprapancreatic lymph nodes during gastrectomy. Hence, with our novel "*Preemptive retropancreatic*
15 *approach*", maximum avoidance of pancreatic compression may be adopted as a safe and precise
16 standard technique in RG where tactile sensation is absent. The initial dissection of the bilateral
17 retropancreatic space in this approach is a useful technique that minimizes pancreatic compression
18 during robotic surgery with multi-jointed forceps. Moreover, gastrointestinal cancer surgery requires
19 en bloc removal of the primary tumor and organ-specific mesentery⁽¹⁴⁾. Kumamoto et al⁽¹⁵⁾. reported
20 about a systematic mesogastric excision (SME) concept for gastric cancer, SME takes advantage of
21 the surgical anatomy and achieves en bloc removal of the primary tumor and gastric mesentery. In our
22 novel "*Preemptive retropancreatic approach*", bilateral retropancreatic space is dissected for robotic
23 suprapancreatic lymphadenectomy using SME concept.

24 Further, although the number of patients investigated was low, the extensively prolonged operation
25 times reported during the initial period when robotic surgery was first introduced were not observed
26 in this study's surgical outcomes. Reduced operation time due to the "*Preemptive retropancreatic*
27 *approach*" was noted, indicating its effectiveness. In the present study, drain amylase measurements
28 were not performed because an intraperitoneal drain was not placed. However, there were no cases of
29 postoperative pancreas-related complications (\geq CD II).

30 We intend to further substantiate this approach's usefulness through studies with more participants.
31 As robot-assisted gastrectomy for gastric cancer is still in its early introductory phase, its superiority
32 has yet to be definitively established. In the future, robot-assisted surgeries that take the patient's
33 physical constitution, cancer stage, and research regarding optimal operative approach into
34 consideration can be expected to continue building solid evidence toward its universal acceptance as
35 conventional therapy.

36

1 **Conclusion**

2 Our novel “*Preemptive retropancreatic approach*” is a useful technique that minimizes pancreatic
3 compression and creates a good operative field for the supra-pancreatic lymphadenectomy, allowing
4 the dissection to proceed following SME concept during RDG with multi-jointed forceps. We believe
5 that this approach may reduce postoperative pancreatic-related complications.

6
7 **Ethics and consent**

8 This study was approved by the Hokkaido University Ethics Committee (No. 017-0016). The
9 consent form stated the aim of the study on the hospital’s website and offered the participants the right
10 to decline to participate or opt out at any time. Comprehensive informed consent to use patient
11 information for this study was obtained from all individual participants before surgery.

12
13 **Acknowledgment**

14 None.

15
16 **Figure legend**

17 Fig. 1: Positions of surgical trocars. For robotic distal gastrectomy, we usually used a 5-trocar
18 system with Nathanson hook liver retractor (Yufu Itonaga, Tokyo, Japan). Robotic third, first, and
19 second arms were docked on 8-mm left upper, left lower, and right upper trocars, respectively. The 8-
20 mm left lower trocar was placed through the 12/75-mm trocar (trocar-introcar technique) and the
21 assistant surgeon used the right lower trocar. ○; 12-mm trocar site, △; 8-mm trocar, ×; Umbilicus.

22
23 Fig. 2: Operative findings of the suprapancreatic lymph node dissection (“*Preemptive*
24 *retropancreatic approach*”; left side). A: The peritoneum is opened in the lesser omentum of the
25 stomach. *Arrow heads; Incision line of the peritoneum. B: The retropancreatic space is dissected with
26 confirming anterior surface of the left adrenal gland and the left inferior phrenic artery. The adherence
27 between the retroperitoneum surface and the retropancreatic fascia (Toldt fusion fascia) is released.
28 *Arrow heads; the left inferior phrenic artery. *Circle; left side of retropancreatic space. C: Gauze is
29 placed in the dissected left retropancreatic space. D: Mesenterization of the mesogastrium was
30 performed by dissection of the left retropancreatic space. *Arrow; Dissection line of the
31 suprapancreatic lymph node dissection. E: Left side of the mesogastrium was dissected. *Arrow;
32 Dissection line of the mesogastrium. F: Final view of the suprapancreatic lymph node dissection.
33 LGA; left gastric artery.

1 Fig. 3: Operative findings of the suprapancreatic lymph node dissection (“*Preemptive*
2 *retropancreatic approach*”; Right side). A: The peritoneum is incised from in front of the inferior vena
3 cava to the front of the right inferior phrenic artery. *Arrow heads; Incision line of the peritoneum.
4 IVC; inferior vena cava. B: Mesenterization of the mesogastrium was performed by dissection of the
5 right retropancreatic space. C: Right side of the mesogastrium was dissected. *Arrow heads; the right
6 inferior phrenic artery. D: Final view of the suprapancreatic lymph node dissection. *Circle; right side
7 of retropancreatic space.

8
9 Fig. 4: Operative schema of the suprapancreatic lymph node dissection (“*Preemptive retropancreatic*
10 *approach*”; left side). A: The schema of the fusion fascia and mesogastrium. B: Dissection of the
11 retropancreatic space, the adherence between the retroperitoneum surface and the retropancreatic fascia
12 (Toldt Fusion fascia) is released. The mesogastrium (including suprapancreatic lymph nodes) was
13 lifted forward and providing a good operative field and hindering contact with the pancreas in
14 suprapancreatic lymph nodes dissection.

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Table1. Clinicopathological patient characteristics and operative outcomes

	n=30
Clinicopathological patient characteristics	
Age, years, median (range)	69 (45-82)
Gender, male/ female	20/10
BMI, kg/m ² , median (range)	22.5 (16.1-32.1)
TMN* pStage I/II	28/2
Lymphadenectomy; D1+/D2	28/2
Reconstruction; Billroth I/ Roux-en-Y	2/28
Operative outcomes	
Operation time, min, median (range)	281 (132-415)
Intraoperative blood loss, ml, median (range)	0 (0-255)
Postoperative complications (CD ≥II)	2
(gastric emptying / intra-abdominal hematoma)	(1/1)
Postoperative pancreas-related complications (CD ≥II)	0
Hospital stay after surgery, day, median (range)	10 (6-33)
Mortality	0

BMI: body mass index, TMN: tumor-node-metastasis, CD: Clavien-Dindo classification

*International Union Against Cancer TMN classification Eighth Edition.