

A comparison of quality of life between patients with small and large gastric remnant volumes after gastrectomy for gastric cancer

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Abstract

The impact of gastric remnant volumes (GRVs) after gastrectomy on patients' quality of life (QOL) has not yet been clarified. The aim of the present study was to compare QOL after gastrectomy between small and large gastric remnant volume patients.

We prospectively collected clinical data from 78 consecutive patients who underwent distal gastrectomy with Billroth II gastrojejunostomy for gastric cancer. The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-Stomach questionnaire and gastric computed tomography scans were performed. The patients were subdivided into 2 groups by remnant stomach volume (the S group ≤ 110 mL vs L group > 110 mL).

The worst scores for most items were observed at postoperative month 1 and usually improved thereafter. There was no difference in the STO22 score except for dysphagia between the S and L groups after gastrectomy ($P > .05$). The QOL score of dysphagia was different at postoperative 6 months (S vs L, 12.4 vs 22.8, $P < .03$), but there was no difference at postoperative months 1, 3, 12, 24, or 36 ($P > .05$).

The remnant gastric volume after partial gastrectomy affects neither functional differences nor QOL after 6 months following appropriate radical surgery.

Abbreviations: CT = computed tomography, EORTC QLQ-STO22 = the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-Stomach, GC = gastric cancer, GRV = gastric remnant volume, POM = postoperative month, QOL = quality of life, TG = total gastrectomy.

Keywords: EORTC, gastrectomy, quality of life

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1. Introduction

Although both gastric cancer (GC) incidence and mortality have gradually decreased in East Asia, GC is the fifth most common type of cancer and the third leading cause of cancer death worldwide.^[1,2] GC is an aggressive neoplasm associated with a poor prognosis, and the rate of GC incidence has notably increased in East Asia. Surgery is recommended if endoscopic resection of the gastric tumor is not indicated for cases of M0 GC.^[3] After radical gastrectomy, anatomical and physiological changes result in postgastrectomy syndrome in most cases.^[4] GC patients suffer from fatigue, diarrhea, constipation, appetite loss, and dumping syndrome after gastrectomy.^[5] These symptoms are most severe at the first postoperative month and slowly resolve 6 to 12 months after the operation.^[6,7]

After gastrectomy, most patients must eat small amounts of food frequently, and many are curious about when it is possible to return to preoperative eating patterns. In addition, most physical functioning and role functioning decrease after gastrectomy and gradually improve afterward.^[7,8] The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-Stomach (EORTC QLQ-STO22) is used for patients with GC varying in disease stage and treatment modality.

In a previous study, we found that there was no significant difference in diet amount and nutritional status between patients with small and large gastric remnant volumes (GRVs).^[9] However, the impact of GRV size on patients' quality of life (QOL) has not yet been clarified. The aim of the present study

was to compare patients' QOL between those with small and large GRVs after gastrectomy for GC.

2. Materials and methods

2.1. Ethical approval

All procedures followed were in compliance with the ethical standards of the relevant committees on human experimentation (institutional and national) and with the Declaration of Helsinki of 1964 and later versions. The exemption from the informed consent requirement was permitted by Gyeongsang National University Hospital in Jinju, Korea Institutional Review Board (GNUH-IRB-5219).

2.2. Patients

We prospectively collected a questionnaire on dietary habits and clinical data from 78 consecutive patients who underwent radical distal gastrectomy with Billroth II reconstruction for GC between September 2009 and February 2012. All data on sex, age, body weight, and operation methods, and pathologic results were collected. The following data were obtained before the operation and at postoperative month (POM) 1, 3, 6, 12, 24, and 36: nutrition-related serum laboratory data (levels of hemoglobin, albumin, and cholesterol) and questionnaire survey results on dietary habits. Gastrofibroscopy and stomach computed tomography (CT) were performed before the operation and at POM 6, 12, 24, and 36. Patients who did not undergo a CT scan during the follow-up period or who failed to complete follow-up were excluded. Of the 78 patients, 15 were lost to follow-up at 2 years postoperatively ($n=63$) and 7 were lost at 3 years postoperatively ($n=56$).

2.3. Inclusion and exclusion criteria

The inclusion criteria for the present study were as follows: histologically proven primary gastric adenocarcinoma at the lower or middle longitudinal level of the stomach, no evidence of distant metastasis, and R0 resection. The exclusion criteria were as follows: double primary cancer (synchronous or metachronous double cancer within 5 disease-free years), carcinoma in situ (intraepithelial cancer), and the cases of recurrent GC or after total gastrectomy (TG).

2.4. CT volumetry for gastric volume check

The change in gastric volume after distal gastrectomy was reviewed using CT volumetric measurements. The detailed protocol is described in a previous study (Fig. 1).^[9] To investigate the QOL of patients after distal gastrectomy, we divided the patients into 2 groups based on the mean CT gastric volume (CT gastric volumes at [POM 6+12+24+36]/4). The groups were divided by averaging 4 periods to reduce the difference due to large individual deviation because the CT scan was conducted by inflating the stomach with gas-producing granules (Robas granules, Dong In Dang, Kyungkido, Korea) to achieve gastric distension. Among the total of 78 patients, the patients with a large GRV were allocated to the L group, and those with a small GRV were allocated to the S group. The QOLs related to dietary habits, reflux, and other post-gastrectomy symptoms were compared between the L and S groups.

2.5. Questionnaire survey of dietary habits and EORTC QLQ-STO22

To investigate the patients' QOL, we used a questionnaire from the EORTC QLQ-STO22 that was collected from the participants.^[10] The EORTC QLQ-STO22 has a function scale (body image) and 8 symptom scales (dysphagia, pain, reflux symptoms, eating restriction, anxiety, dry mouth, taste, and hair loss) with 22 questions. We calculated the scale score from the EORTC manuals.^[11] Then, for the functional scale, $\text{score} = \{1 - (\text{RS} - 1) / \text{range}\} * 100$, and for the symptom scale, $\text{score} = \{(\text{RS} - 1) / \text{range}\} * 100$. The questionnaire was collected at the POM 1, 3, 6, 12, 24, and 36, and each participant's QOL was studied.

2.6. Statistical analysis

A statistical analysis was performed using the paired *T* test in SPSS version 24.0 (SPSS, Chicago, IL, USA). A *P* value of less than .05 (2 sides) was considered statistically significant.

3. Results

3.1. Patient characteristics and remnant gastric volume

The mean patient age was 62.1 ± 10.7 years ($n=78$), and the sex ratio (M:F) was 2:1 (52:26). The tumors were located in the gastric lower third ($n=70$, 89.7%) and gastric middle third ($n=8$, 10.3%). In the TNM classification, 73.1% ($n=57$) of the patients showed stage I, 17.9% ($n=14$) stage II, and 9% ($n=7$) stage III. For the treatment modalities, laparoscopic surgery was conducted in 82% of patients ($n=64$), and the open method was performed in 18% ($n=14$).

3.2. Changes in each scale after subtotal gastrectomy

We compared each item serially as POM# 1 and 3, 3 and 6, 6 and 12, and 12 and 24. We found that eating restriction, dry mouth and taste showed significant differences at POM 1 and 3 but not in other periods. Pain exhibited no difference in the first few months but was different postoperatively at 2 and 3 years. Body image also showed no large postoperative difference between 1 and 2 years. Dysphagia, reflux symptoms, anxiety, and hair loss showed no significant differences.

All calculated values improved from 1, 3, and 6 months. The QLQ STO-22 score reached a plateau at 6 months after gastrectomy (Table 1).

3.3. Comparison of the QOL-STO22 module between the small and large GRV groups

We checked the gastric volume using CT volumetry in a previous study.^[9] Based on the CT volumetric database, the patients were divided into 2 groups (the S group ≤ 110 mL vs L group >110 mL) in accordance with the median value of the GRV (110 mL).

We compared the STO-22 score between the L and S groups, and we found that the dysphagia score was different at POM 6 (S vs L, 12.4 vs 22.8, $P < .03$), but there was no significant difference at POM 1, 3, 12, 24, and 36. We also found that there was no statistically significant difference in dysphagia, pain, reflux symptoms, eating restriction, anxiety, dry mouth, taste, body image, or hair loss scores between the S and L groups after the operation ($P > .05$) (Fig. 2).

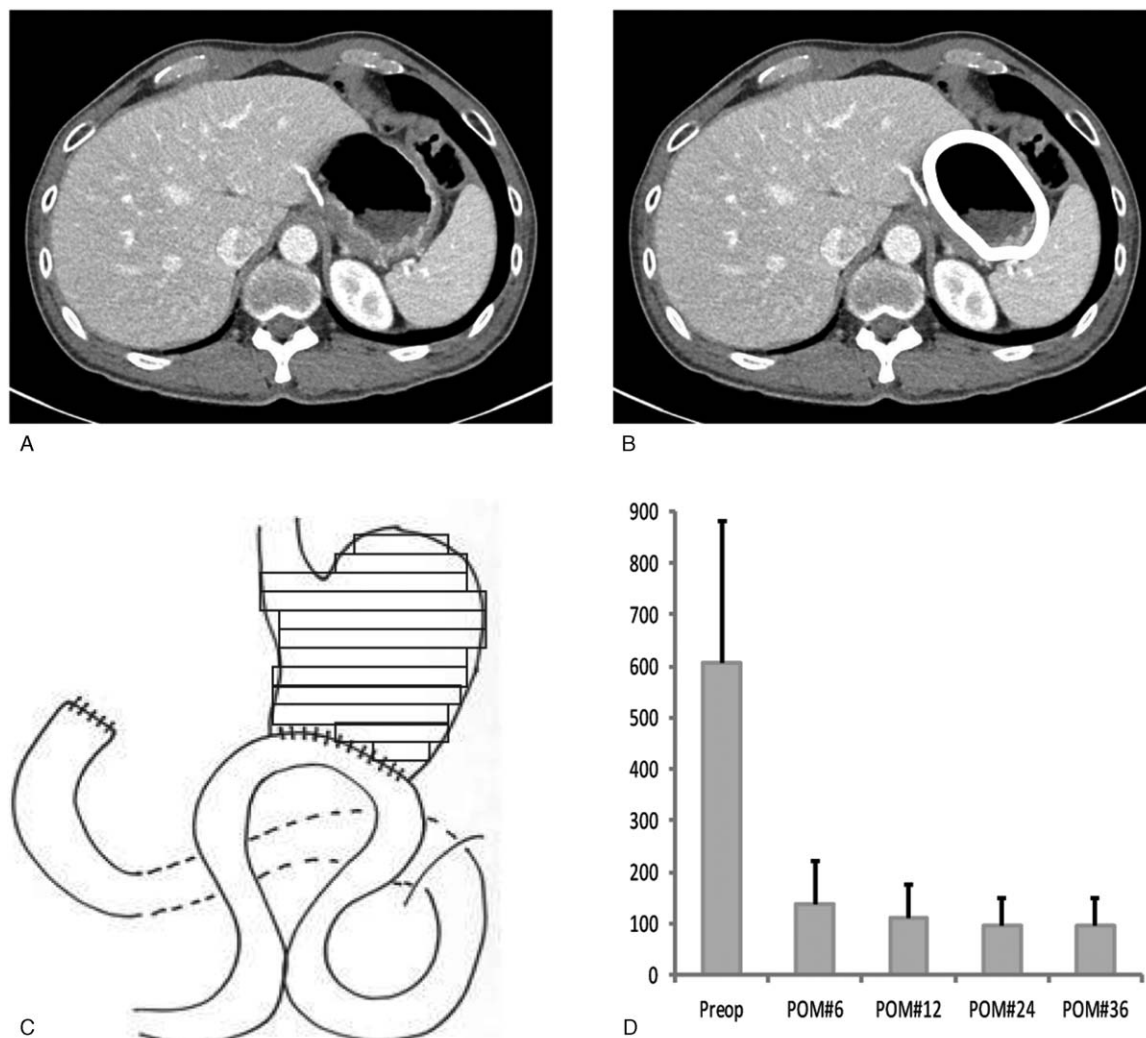


Figure 1. (A) Original CT image. (B) Manually outlined on slice using a Picture Archiving and Communication System workstation. (C) The area measured on each slice was summed. (D) Serial remnant stomach volume preoperatively and 36 months postoperatively. CT=computed tomography.

4. Discussion

The aim of the present study was to compare QOL between patients with small and large GRVs after gastrectomy for GC. We found that the worst scores for most QOL scales and items were observed at POM 1 and usually improved thereafter in distal

gastrectomy with B-II gastrojejunostomy for GC. There was no difference in the EORTC QLQ-STO22 score (reflux, pain, eating restriction, anxiety, dry mouth, taste, body image, and hair loss) except for dysphagia between the S and L groups. To the best of our knowledge, the present study is the first to examine the

Table 1
Changes in each scale after subtotal gastrectomy.

	POM#1	POM#3	POM#6	1 year	2 years	3 years
Dysphagia	39.3	22.0	17.7	16.2	15.0	12.1
Pain	18.3	14.2	13.3	10.8	10.9*	6.6*
Reflux symptoms	9.3	7.2	7.0	7.0	6.7	6.3
Eating restriction	10.4*	6.1*	4.8	5.4	5.4	2.5
Anxiety	27.3	23.0	21.0	21.6	17.3	13.2
Dry mouth	28.0**	18.0**	18.0	15.5	18.6	19.4
Taste	14.6*	7.1*	3.8	2.9	4.7	5.3
Hair loss	23.6	23.1	19.9	17.5	22.8	9.9
Body image	72.0	79.5	82.0	80.4*	88.5*	90.0

EORTC QLQ-STO22—the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-Stomach, POM= postoperative month.

* P < .05.

** P < .01, EORTC QLQ-STO22 has a function scale (body image) and 8 symptom scales (dysphagia, pain, reflux symptoms, eating restriction, anxiety, dry mouth, taste, and hair loss) with 22 questions.

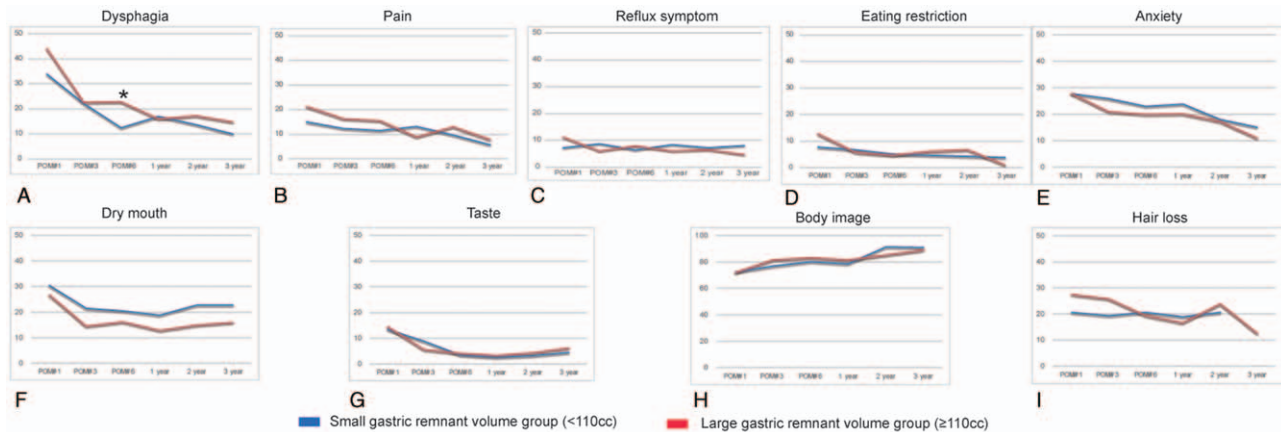


Figure 2. Comparison of mean scores of the QOL-STO22 module between the small and large gastric remnant volume groups. QOL-STO22 = Quality of Life Questionnaire-Stomach.

impact of GRV on QOL after distal gastrectomy in patients with GC.

The role of the stomach includes temporary food storage by the proximal part, crushing and mixing by the distal part in the process of digestion of food, and exocrine and endocrine functions by various cells distributed in the mucous membrane.^[12] The stomach also secretes gastric juice, which consists of hydrochloric acid, pepsin, intrinsic factor, mucus, and water. Hydrochloric acid provides the H⁺ needed to activate pepsinogen to digest protein. Pepsinogen, which is the proenzyme of pepsin, is released by gastric chief cells when mixed with hydrochloric acid in the gastric juice. Various neurons and signaling systems, including the vagus nerve, are involved in the regulation of these functions.^[13] Gastrointestinal tract disorders that can occur after surgery are disorders caused by damage to a part of the stomach or the vagus nerve by gastric surgery.^[14] The anemia that occurs after gastrectomy results in a reduction in HCl secretion and certain intrinsic factors, resulting in lower iron solubility and poor absorption of vitamin B12.^[15] These postoperative disorders include a postgastrectomy syndrome caused by gastric resection and reconstruction and a postvagotomy syndrome caused by damage to the vagus nerve, which is the main nerve that controls the stomach.^[4] Postgastrectomy syndrome is induced by gastric resection for the treatment of gastric benign or malignant diseases.^[16–18] Gastrectomy induces anatomical and physiological changes by postgastrectomy syndromes in some patients. Most of the symptoms occur due to impairment in gastric motor function, including gastric storage dysfunction. Postgastrectomy syndrome includes the late postoperative complication that presents as the symptoms and signs, such as delayed gastric emptying, Roux stasis, dumping syndrome, bile reflux gastritis, postvagotomy diarrhea, and small gastric remnant syndrome.^[19–22] The intractable symptoms from postgastrectomy syndrome can affect the QOL of gastrectomized patients.^[23,24] Considering the recent number of early detections of GC through health screening systems and the increase in morbidly obese patients, interest in QOL is gradually increasing.^[2,25–27]

Radical gastrectomy with sufficient lymph node dissection is necessary for the treatment of GC.^[3]

It is inescapable that patients experience various serious symptoms after GC surgery. Additionally, patients' QOL is impaired, especially in patients with GC after radical gastrectomy.

After radical gastrectomy, most QOL features, including physical and role functioning, worsen and gradually recover in the early postoperative period with some differences.^[7,8] However, some QOL characteristics do not recover after the early postoperative period.^[7] The changes in QOL in patients who undergo gastrectomy are influenced by the reconstruction methods, the minimal invasiveness approach, and the extent of gastric resection.^[28–31] Considering the effects of anastomotic methods after gastrectomy, the research results on QOL are somewhat diverse.^[32–34] The laparoscopic approach showed improved QOL outcomes in patients compared to those for the open approach in early GC patients.^[6,35] After TG, the jejunum that replaces the stomach has a restricted food reservoir and worsens QOL compared to the status after distal gastrectomy.^[36–39] The distal jejunal pouch after TG could improve postoperative weight loss and increase food intake.^[40] Even long-term survivors after TG still suffer from impaired QOL due to the symptoms and outcomes of TG.^[37,41] In cases of early GC tumors located in the middle third longitudinal level of the stomach, the laparoscopy-assisted pylorus-preserving gastrectomy obtains better QOL than distal gastrectomy.^[42] However, little has been reported on the impact of a small GRV on QOL after distal gastrectomy.

The loss of gastric reservoir function may lead to small gastric remnant syndrome, also referred to as early satiety syndrome.^[43] The symptoms of small gastric remnant syndrome comprise early satiety, epigastric pain immediately after eating, and vomiting. Symptoms commonly occur when the stomach is removed in greater than approximately 80% of cases. The clinical manifestations are weight loss and vitamin and mineral deficiencies. The primary treatment of small gastric remnant syndrome is dietary modification. In a previous study, we reported that compared to those with a large GRV, the patients with a small GRV showed no differences in diet habits, volumes, and other nutritional benefits.^[9] The average size of the stomach was approximately 600 cc when inflated with gas in a previous study. We measured the average difference between small and large GRVs to be approximately 100 cc, but an average meal of 100 cc is unlikely to affect the patient significantly. In addition, after distal gastrectomy, the GRV decreased and small bowel motility was enhanced with time.

This study had the following limitations: the number of enrolled patients was relatively small; there were no EORTC-QOL-C30 data; the only reconstruction method used was the B-II

anastomosis method, and the study had a retrospective design. However, to the best of our knowledge, the present study is the first report to investigate the impact of GRV based on CT volumetry on QOL after radically distal gastrectomy for patients with GC.

In conclusion, the remnant gastric volume after partial gastrectomy affects neither functional differences nor QOL after 6 months following appropriate radical surgery

Author contributions

Jae-Seok Min, Sang-Ho Jeong, Ji-Ho Park, and Taehan Kim were involved in study concept and design and writing the article; Eun-Jung Jung, Young-Tae Ju, and Chi-Young Jeong were involved in the analysis and interpretation of the data; and Miyeong Park and Young-Joon Lee were involved in the analysis and collection of the data.

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