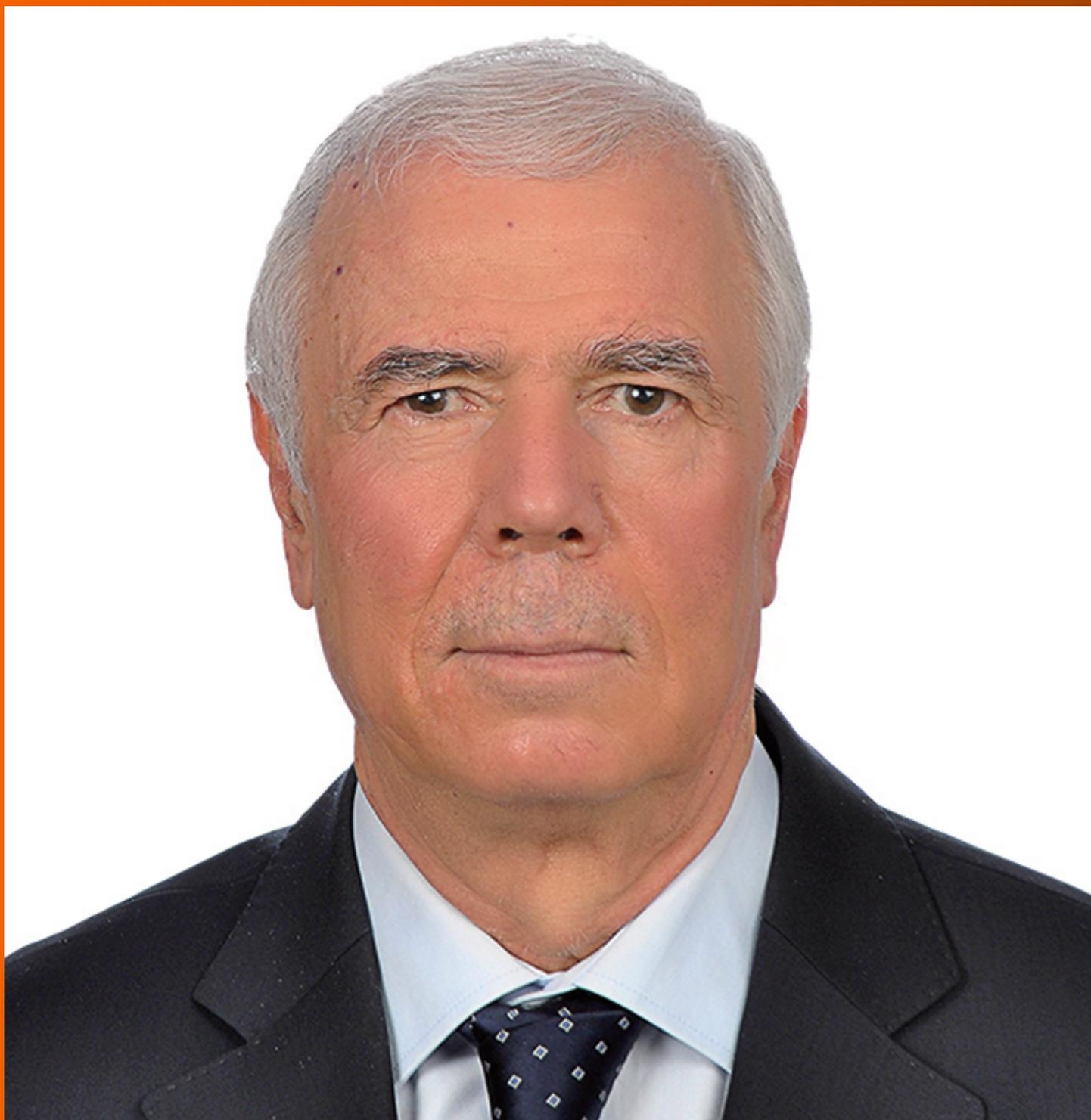


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The primary aim of *World Journal of Gastrointestinal Surgery* (WJGS, *World J Gastrointest Surg*) is to provide scholars and readers from various fields of gastrointestinal surgery with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGS mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal surgery and covering a wide range of topics including biliary tract surgical procedures, biliopancreatic diversion, colectomy, esophagectomy, esophagostomy, pancreas transplantation, and pancreatectomy, etc.

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Observational Study

Defecation disorders are crucial sequelae that impairs the quality of life of patients after conventional gastrectomy

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Abstract

BACKGROUND

Defecation disorders are obscure sequelae that occurs after gastrectomy, and its implication on daily lives of patients have not been sufficiently investigated.

AIM

To examine the features of defecation disorders after gastrectomy and to explore its implication on daily lives of patients in a large cohort using the Postgast-

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rectomy Syndrome Assessment Scale (PGSAS)-45.

METHODS

We conducted a nationwide multi-institutional study using PGSAS-45 to examine the prevalence of postgastrectomy syndrome and its impact on daily lives of patients after various types of gastrectomy. Data were obtained from 2368 eligible patients at 52 institutions in Japan. Of these, 1777 patients who underwent total gastrectomy (TG; $n = 393$) or distal gastrectomy (DG; $n = 1384$) were examined. The severity of defecation disorder symptoms, such as diarrhea and constipation, and their correlation with other postgastrectomy symptoms were examined. The importance of defecation disorder symptoms on the living states and quality of life (QOL) of postgastrectomy patients, and those clinical factors that affect the severity of defecation disorder symptoms were evaluated using multiple regression analysis.

RESULTS

Among seven symptom subscales of PGSAS-45, the ranking of diarrhea was 4th in TG and 2nd in DG. The ranking of constipation was 5th in TG and 1st in DG. The symptoms that correlated well with diarrhea were dumping and indigestion in both TG and DG; while those with constipation were abdominal pain and meal-related distress in TG, and were meal-related distress and indigestion in DG. Among five main outcome measures (MOMs) of living status domain, constipation significantly impaired four MOMs, while diarrhea had no effect in TG. Both diarrhea and constipation impaired most of five MOMs in DG. Among six MOMs of QOL domain, diarrhea impaired one MOM, whereas constipation impaired all six MOMs in TG. Both diarrhea and constipation equally impaired all MOMs in DG. Male sex, younger age, division of the celiac branch of vagus nerve, and TG, independently worsened diarrhea, while female sex worsened constipation.

CONCLUSION

Defecation disorder symptoms, particularly constipation, impair the living status and QOL of patients after gastrectomy; therefore, we should pay attention and adequately treat these relatively modest symptoms to improve postoperative QOL.

Key Words: Postgastrectomy syndrome; Defecation disorders; Quality of life; Patient-reported outcome measures; Gastrectomy

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Core Tip: Symptoms of defecation disorders, such as diarrhea and constipation, are relatively modest and have not received sufficient attention among various postgastrectomy symptoms; therefore, their implication on the daily lives of patients have not been adequately investigated. We evaluated these symptoms using a nationwide multi-institutional collaborative study called the Postgastrectomy Syndrome Assessment Study. The severity of symptoms of defecation disorders were unexpectedly high and both symptoms, particularly constipation, impaired the living status and quality of life (QOL) of patients after gastrectomy; therefore, we should also pay attention and adequately treat these symptoms to improve postoperative QOL.

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INTRODUCTION

Various symptoms have been known to appear after gastrectomy and these symptoms affect the daily lives of patients[1-4]. Among these symptoms, dumping[5-8], small stomach syndrome[9-11], and esophageal reflux[12-14] have been noted as characteristic postgastrectomy symptoms and have frequently become clinical problems. However, symptoms of defecation disorders, such as diarrhea and constipation, and especially constipation, are often less conspicuous compared to other characteristic postgastrectomy symptoms, and their features have not yet been adequately assessed. Therefore, in this study, we used data from a large number of patients that were collected in the Postgastrectomy Syndrome Assessment Study (PGSAS), in order to identify the actual distribution and features of defecation disorders, their effects on living status and quality of life (QOL), and clinical factors that strengthen the symptoms of defecation disorders in patients who underwent conventional gastrectomy [total gastrectomy (TG) and distal gastrectomy (DG)].

MATERIALS AND METHODS

Patients

Fifty-two institutions participated in this study. The patient eligibility criteria were: (1) Diagnosis of pathologically-confirmed stage IA or IB gastric cancer; (2) First-time gastrectomy status; (3) Age ≥ 20 and ≤ 75 years; (4) No history of chemotherapy; (5) No indication of recurrence or distant metastasis; (6) Underwent gastrectomy one or more years prior to the date of enrollment; (7) Performance status ≤ 1 on the Eastern Cooperative Oncology Group scale; (8) Full capacity to understand and respond to the questionnaire; (9) No history of other diseases or surgeries that might influence the patient's responses to the questionnaire; (10) Absence of organ failure or mental illness; and (11) Written informed consent. Patients with dual malignancy and those that underwent concomitant resection of other organs (with a co-resection equivalent to a cholecystectomy being the exception) were excluded (Figure 1).

QOL assessment

The postgastrectomy Syndrome Assessment Scale (PGSAS)-45[15] is a newly developed, multidimensional QOL questionnaire that is based on the 8-item short form health survey (SF-8)[16] and the Gastrointestinal Symptom Rating Scale (GSRs)[17]. The PGSAS-45 questionnaire consists of a total of 45 questions, with eight items from the SF-8, 15 items from the GSRs, and 22 important clinical items selected by the Japan Postgastrectomy Syndrome Working Party. The PGSAS-45 questionnaire includes 23 items that pertain to postoperative symptoms (items 9–33), including 15 items from the GSRs and eight newly selected items. In addition, 12 questionnaire items that pertain to dietary intake (eight items), work (one item), and level of satisfaction with daily life (three items) were selected. Twenty-three symptom items were consolidated into seven symptom subscales using factor analysis. Afterwards, 19 main outcome measures (MOMs) were refined through the process of consolidation and selection, and were classified into three domains, namely, symptoms, living status, and QOL (Table 1). Details of the PGSAS-45 have been reported previously[15].

Study methods

Continuous sampling from a central registration system was used to enroll participants into this study. The questionnaires were distributed to all eligible patients during their visits to the participating clinics. After completing the questionnaire, patients were instructed to return the forms to the data center. All QOL data from the questionnaires were matched with the data of individual patients that were collected *via* the case report forms.

This study was registered with the University Hospital Medical Information Network's Clinical Trials Registry (UMIN-CTR; registration number 000002116), and was approved by the local ethics committees at each institution. This study also conformed to the principles of the Declaration of Helsinki, and written informed consent was obtained from all enrolled patients. Of the 2922 patients who were given questionnaires between July 2009 and December 2010, 2520 (86%) responded and 2368 were confirmed to be eligible for the study. Of these, data from 1777 patients who underwent either TG or DG were analyzed in this study.

Table 1 Relationship of the domains and main outcome measures of the Postgastrectomy Syndrome Assessment Scale-45

Domain	Main outcome measures
Symptoms	<i>Esophageal reflux SS</i>
	<i>Abdominal pain SS</i>
	<i>Meal-related distress SS</i>
	<i>Indigestion SS</i>
	<i>Diarrhea SS</i>
	<i>Constipation SS</i>
	<i>Dumping SS</i>
	<i>Total symptom score</i>
Living status	Change in BW
	Ingestion amount of food per meal
	Necessity for additional meals
	<i>Quality of ingestion SS</i>
	Ability for working
QOL	Dissatisfaction with symptoms
	Dissatisfaction at the meal
	Dissatisfaction at working
	<i>Dissatisfaction for daily life SS</i>
	<i>PCS of SF-8</i>
	<i>MCS of SF-8</i>

Integrated subscales are italicized in the table. SS: Subscale; BW: Body weight; PCS: Physical component summary; MCS: Mental component summary.

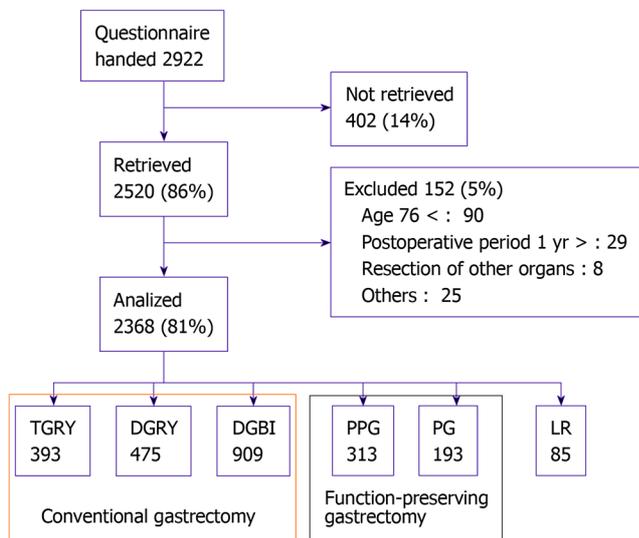


Figure 1 CONSORT flowchart of the Postgastrectomy Syndrome Assessment Study. TGRY: Total gastrectomy with Roux- en-Y reconstruction; DGRY: Distal gastrectomy with Roux-en-Y reconstruction; DGBI: Distal gastrectomy with Billroth-I reconstruction; PPG: Pylorus-preserving gastrectomy; PG: Proximal gastrectomy; LR: Local resection.

Statistical analysis

The statistical methods used to compare patients’ characteristics and severity of symptoms of defecation disorders (*i.e.*, diarrhea and constipation) after TG and DG, included the *t*-test and chi-square test. Correlations between each symptom of defecation disorders and other postgastrectomy symptoms were calculated in terms of

Pearson's product-moment correlation coefficient (r). The impact of each symptom of defecation disorders on the living status and QOL of patients after gastrectomy were examined using multiple regression analysis. Furthermore, multiple regression analysis was used to explore the effects of independent clinical factors on symptoms of defecation disorders. P value of < 0.05 were considered statistically significant.

To evaluate effect sizes, Cohen's d , Pearson correlation coefficient (r), standardization coefficient of regression (β), and coefficient of determination (R^2) were used. Interpretation of effect sizes were as follows: using Cohen's d : ≥ 0.2 , small; ≥ 0.5 , medium; and ≥ 0.8 , large; using Pearson correlation coefficient (r) and standardization coefficient of regression (β): ≥ 0.1 , small; ≥ 0.3 , medium; and ≥ 0.5 , large; while using coefficient of determination (R^2): ≥ 0.02 , small; ≥ 0.13 , medium; and ≥ 0.26 , large. Statistical analyses were performed using the JMP version 12.0.1 software (SAS Institute Inc., Cary, NC, United States).

RESULTS

Patient background

Of the 2368 patients whose data were collected in the PGSAS, data from a total of 1777 patients were analyzed, comprising 393 TG cases and 1384 DG cases (Billroth-I method: 909 cases; Roux-en-Y method: 475 cases). Comparisons of patients' characteristics between those that underwent TG and those that underwent DG showed that those that underwent TG were significantly older, likely to be males, had a shorter postoperative period, and were less likely to undergo laparoscopic approaches as well as preservation of the celiac branch of the vagus nerve (Table 2).

Ranking of severity of defecation disorders

Among the seven symptom subscales, the most prominent among patients that underwent TG were meal-related distress (including small stomach syndrome) (1st) and dumping (2nd). The ranking of the severity of symptoms of defecation disorders after TG revealed that diarrhea was the 4th and constipation was the 5th most severe. Meanwhile, the most severe symptoms after DG were constipation (1st) and diarrhea (2nd) (Table 3). Comparisons of the symptoms of defecation disorders between patients that underwent TG and those that had DG showed that diarrhea was significantly more severe after TG; however, no differences were observed between the severity of constipation after TG and after DG (Table 3).

Correlation with other postgastrectomy symptoms

Both diarrhea and constipation had significant positive correlations with all other postgastrectomy symptoms ($P < 0.001$). However, diarrhea had particularly strong correlations with dumping (1st) and indigestion (2nd) after both TG and DG (Table 4). On the other hand, constipation had particularly strong correlation with abdominal pain (1st) and meal-related distress (2nd) after TG; and meal-related distress (1st) and indigestion (2nd) after DG (Table 4).

Effects of defecation disorders symptoms on postgastrectomy living status

Multiple regression analysis was used to investigate the effects of diarrhea and constipation on five MOMs that belong to the living status domain covered in PGSAS-45. No significant effects due to diarrhea were seen after TG; however, constipation had significant adverse effects on the amount of food ingested per meal, necessity for additional meals, quality of ingestion, and ability to work (Table 5).

In patients that underwent DG, both diarrhea and constipation were found to be independent factors that had significant adverse effects on the amount of food ingested per meal, necessity for additional meals, quality of ingestion, and ability to work. However, the effect of constipation was larger in terms of the magnitude of effect size β . Diarrhea had significant adverse effects on weight loss, while constipation had no effect on weight loss (Table 5).

Effects of defecation disorders symptoms on postgastrectomy QOL

Multiple regression analysis was used to investigate the effect of diarrhea and constipation on six MOMs that belong to the QOL domain covered in PGSAS-45. For TG, diarrhea was found to have significant adverse effects on the mental component summary of SF-8 and had a significant tendency to worsen dissatisfaction with symptoms. Meanwhile, constipation had a significant adverse effect on all six MOMs

Table 2 Patients' characteristics, *n* (%)

	TG (<i>n</i> = 393)	DG (<i>n</i> = 1384)	<i>P</i> value
Age (yr) ¹	63.4 ± 9.2	61.8 ± 9.1	0.002 ²
Gender:			0.080 ³
Male	276 (71.0)	912 (66.2)	
Female	113 (29.0)	465 (33.8)	
Postoperative period (mo) ¹	35.0 ± 24.6	37.6 ± 27.4	0.092 ²
Preoperative BMI (kg/m ²) ¹	23.0 ± 3.3	22.8 ± 3.0	0.176 ²
Surgical approach:			< 0.001 ³
Laparoscopic	97 (24.9)	567 (41.2)	
Open	293 (75.1)	809 (58.8)	
Celiac branch of vagus:			< 0.001 ³
Preserved	12 (3.1)	161 (11.9)	
Divided	371 (96.9)	1196 (88.1)	

¹Data are presented as mean ± SD.

²*t*-test.

³Chi-square test.

BMI: Body mass index.

Table 3 Comparison of the severity and ranking of postgastrectomy symptoms between total and distal gastrectomy

	TG (<i>n</i> = 393)		DG (<i>n</i> = 1384)		<i>P</i> value	Cohen's <i>d</i>
	Mean ± SD	Ranking	Mean ± SD	Ranking		
<i>Esophageal reflux SS</i>	2.00 ± 1.03	6	1.64 ± 0.78	7	< 0.001	0.43
<i>Abdominal pain SS</i>	1.77 ± 0.79	7	1.68 ± 0.77	6	0.055	0.11
<i>Meal-related distress SS</i>	2.65 ± 1.11	1	2.07 ± 0.88	3	< 0.001	0.62
<i>Indigestion SS</i>	2.30 ± 0.91	3	2.01 ± 0.84	4	< 0.001	0.34
<i>Diarrhea SS</i>	2.28 ± 1.19	4	2.10 ± 1.11	2	0.007	0.16
<i>Constipation SS</i>	2.09 ± 0.93	5	2.19 ± 1.03	1	0.107	0.09
<i>Dumping SS</i>	2.30 ± 1.10	2	1.96 ± 1.01	5	< 0.001	0.32

Integrated subscales are italicized in the table. The interpretation of effect size, Cohen's *d*: Small, ≥ 0.2; medium, ≥ 0.5; large, ≥ 0.8. SS: Subscale.

(Table 5).

In patients that underwent DG, both diarrhea and constipation were factors that worsened all the MOMs in the QOL domain. The effects of diarrhea and constipation were similar in terms of the effect size β ; however, the effect of constipation on the physical component summary (PCS) of SF-8 was larger (Table 5).

Background factors that worsen defecation disorders symptoms

Multiple regression analysis was used to investigate the background factors that strengthen diarrhea and constipation. Significant factors that worsened diarrhea were young age, division of the celiac branch of vagus, being a male, and undergoing total gastrectomy. Meanwhile, the significant factor that worsened constipation was being a female (Table 6).

DISCUSSION

The various symptoms that appear after gastrectomy and the resultant lower QOL are

Table 4 Correlation between each defecation disorder symptom and other postgastrectomy symptoms after total and distal gastrectomy

		TG (n = 393)			DG (n = 1384)		
		<i>r</i>	<i>P</i> value	Ranking	<i>r</i>	<i>P</i> value	Ranking
<i>Diarrhea SS</i>	<i>Esophageal reflux SS</i>	0.273	< 0.001	6	0.260	< 0.001	5
	<i>Abdominal pain SS</i>	0.340	< 0.001	4	0.377	< 0.001	3
	<i>Meal-related distress SS</i>	0.305	< 0.001	5	0.358	< 0.001	4
	<i>Indigestion SS</i>	0.443	< 0.001	2	0.420	< 0.001	2
	<i>Constipation SS</i>	0.341	< 0.001	3	0.232	< 0.001	6
	<i>Dumping SS</i>	0.447	< 0.001	1	0.467	< 0.001	1
<i>Constipation SS</i>	<i>Esophageal reflux SS</i>	0.392	< 0.001	3	0.396	< 0.001	5
	<i>Abdominal pain SS</i>	0.436	< 0.001	1	0.444	< 0.001	3
	<i>Meal-related distress SS</i>	0.402	< 0.001	2	0.479	< 0.001	1
	<i>Indigestion SS</i>	0.365	< 0.001	4	0.469	< 0.001	2
	<i>Diarrhea SS</i>	0.341	< 0.001	6	0.232	< 0.001	6
	<i>Dumping SS</i>	0.350	< 0.001	5	0.415	< 0.001	4

Integrated subscales are italicized in the table. The interpretation of effect size, Pearson correlation coefficient (*r*): Small, ≥ 0.1 ; medium, ≥ 0.3 ; large, ≥ 0.5 . SS: Subscale.

known clinical problems[1-4]. Among these symptoms, dumping[5-8], small stomach syndrome[9-11], and esophageal reflux[12-14] are well known postgastrectomy symptoms, and have been reported to worsen living status and the QOL[11]. Symptoms of defecation disorders, such as diarrhea and constipation, also occur after gastrectomy[3,18]; however, these symptoms are relatively inconspicuous, particularly constipation. Therefore, their actual distribution, features, and effects on daily life have not been clarified.

Therefore, we used multiple data from the PGSAS to investigate defecation disorders among patients after conventional gastrectomy. Arranging symptoms of defecation disorders in order of severity among the seven symptom subscales that occur after gastrectomy showed that constipation and diarrhea were the most severe in patients that underwent DG. In those that had TG, diarrhea and constipation were ranked relatively low in terms of the severity of symptoms; however, the severity of constipation was almost the same as in those that underwent DG, and diarrhea, was significantly more severe than in those that underwent DG. The correlation results between each symptom of defecation disorders and other symptoms showed that diarrhea had a strong and significant correlation with dumping and indigestion after both TG and DG. Furthermore, constipation showed a strong positive correlation with abdominal pain and meal-related distress after TG; and meal-related distress and indigestion after DG. A multivariate analysis was performed to investigate the impact of defecation disorders on living status and QOL, and this showed that diarrhea had a small effect after TG, whereas constipation had an adverse effect on almost all MOMs. Both diarrhea and constipation had adverse effects on almost all MOMs of living status and QOL after DG, with the effects of constipation being slightly greater. A multivariate analysis that was performed to investigate those clinical factors that strengthened these defecation disorders showed that significant factors that worsened symptoms were being a male, being young, division of the celiac branch of the vagus nerve, and TG for diarrhea; and being a female for constipation. This is the first study to report the actual features, and effects of defecation disorders on daily life, as well as the background factors that enhance defecation disorders.

Various symptoms appear after gastrectomy and are known to interfere with the daily lives of the patients and cause clinical problems[1-4]. Our previous study on which postgastrectomy symptoms had a significant effect on the daily life of patients, showed that among the various postgastrectomy symptoms the daily life of patients after gastrectomy was impaired the most by meal-related distress (including small stomach syndrome) and dumping[11]. Furthermore, esophageal reflux and abdominal pain also had a clear effect on the daily life of patients after gastrectomy[11]. These

Table 5 The effects of defecation disorder symptoms on the living status and quality of life after total and distal gastrectomy (multiple regression analysis)

		TG (n = 393)						DG (n = 1384)					
		Diarrhea SS		Constipation SS		R ²	P value	Diarrhea SS		Constipation SS		R ²	P value
		β	P value	β	P value			β	P value	β	P value		
Living status	Change in BW	-0.003	0.960	-0.052	0.359	0.003	0.613	-0.061	0.034	-0.039	0.170	0.006	0.017
	Ingested amount of food per meal	0.087	0.113	-0.182	0.001	0.030	0.004	-0.150	< 0.001	-0.183	< 0.001	0.069	< 0.001
	Necessity for additional meals	-0.060	0.270	0.147	0.008	0.019	0.027	0.111	< 0.001	0.182	< 0.001	0.055	< 0.001
	<i>Quality of ingestion SS</i>	0.058	0.292	-0.177	0.001	0.028	0.006	-0.080	0.004	-0.138	< 0.001	0.030	< 0.001
	Ability for working	-0.071	0.189	0.275	< 0.001	0.068	< 0.001	0.122	< 0.001	0.260	< 0.001	0.097	< 0.001
QOL	Dissatisfaction with symptoms	0.100	0.055	0.276	< 0.001	0.105	< 0.001	0.257	< 0.001	0.244	< 0.001	0.155	< 0.001
	Dissatisfaction at the meal	0.012	0.813	0.275	< 0.001	0.078	< 0.001	0.266	< 0.001	0.269	< 0.001	0.176	< 0.001
	Dissatisfaction at working	0.066	0.205	0.292	< 0.001	0.102	< 0.001	0.234	< 0.001	0.237	< 0.001	0.137	< 0.001
	<i>Dissatisfaction for daily life SS</i>	0.067	0.189	0.338	< 0.001	0.134	< 0.001	0.297	< 0.001	0.294	< 0.001	0.216	< 0.001
	<i>PCS of SF-8</i>	-0.058	0.258	-0.323	< 0.001	0.120	< 0.001	-0.140	< 0.001	-0.242	< 0.001	0.094	< 0.001
	<i>MCS of SF-8</i>	-0.147	0.005	-0.227	< 0.001	0.096	< 0.001	-0.214	< 0.001	-0.244	< 0.001	0.130	< 0.001

Integrated subscales are italicized in the table. The interpretation of effect size, standardization coefficient of regression (β): Small, ≥ 0.1; medium, ≥ 0.3; large, ≥ 0.5. The interpretation of effect size, coefficient of determination (R²): Small, ≥ 0.02; medium, ≥ 0.13; large, ≥ 0.26. QOL: Quality of life. SS: Subscale; BW: Body weight; PCS: Physical component summary; MCS: Mental component summary.

relatively prominent postgastrectomy symptoms have often been reported and are widely recognized[5-14]. However, symptoms of defecation disorders, such as diarrhea and constipation are also often seen after gastrectomy. Diarrhea has been reported to become worse after vagotomy[9,19] and gastrectomy[3,19], and it is a relatively well recognized symptom. Meanwhile, constipation has not received adequate attention and has not been sufficiently investigated.

The relationship between the type of surgical procedure and the ranking of the severity of defecation disorder symptoms showed that defecation disorders were most severe after DG, and constipation ranked first, and diarrhea ranked second. The most severe symptoms after TG were meal-related distress and dumping, which were the first and second, respectively. Symptoms of defecation disorders were ranked relatively low after TG, as diarrhea and constipation ranked fourth and fifth, respectively, among the seven symptoms. However, comparison of the symptom severity in patients that underwent DG showed that constipation was almost identical

Table 6 The effects of various clinical factors on defecation disorder symptoms after gastrectomy (multiple regression analysis)

Explanatory variables	Objective variables			
	<i>Diarrhea SS</i>		<i>Constipation SS</i>	
	β	<i>P</i> value	β	<i>P</i> value
Type of gastrectomy	0.061	0.013	-0.032	0.198
Postoperative period (mo)	-0.038	0.123	-0.010	0.697
Age (yr)	-0.102	< 0.0001	0.031	0.213
Gender (Male)	0.062	0.010	-0.073	0.003
Approach (laparoscopic)	-0.027	0.288	-0.002	0.947
Celiac branch of vagus (preserved)	-0.070	0.004	0.007	0.790
<i>R</i> ²	0.023	< 0.0001	0.007	0.068

Integrated subscales are italicized in the table. SS: Subscale

after either DG or TG, and diarrhea was significantly more severe after TG than after DG. In other words, the results showed that the symptoms of defecation disorders after TG were not necessarily mild compared to those that occur after DG, and that they were only less prominent due to the presence of other more severe symptoms. Therefore, paying attention to the occurrence of symptoms of defecation disorders and taking appropriate measures are also important after TG.

Correlation analyses between each symptom of defecation disorders and other postgastrectomy symptoms showed that diarrhea had a strong correlation with dumping (1st) and indigestion (2nd) for both TG and DG. Accelerated gastric emptying has been observed after gastrectomy[20,21], and the increased dumping and diarrhea that occurs is considered consistent with the pathogenesis of these symptoms[8,22,23]. Previous studies has revealed that there was a significant relationship between accelerated gastric emptying and diarrhea as well as dumping after gastrectomy[24, 25]. The results of their study may, in part, explain the results of the present study.

Furthermore, constipation was strongly correlated with abdominal pain (1st) and meal-related distress (2nd) after TG; and meal-related distress (1st) and indigestion (2nd) after DG. Postprandial distress syndrome of functional dyspepsia, abdominal pain, abdominal distension and indigestion are known to be often accompanied with constipation[26,27]. Similarly, these symptoms were shown to be commonly accompanied with postgastrectomy constipation.

Symptoms of defecation disorders, such as diarrhea and constipation have been reported to decrease the QOL of patients with irritable bowel syndrome (IBS)[28,29]. Our results showed that symptoms of defecation disorders were factors that also had significantly adverse effects on living status and QOL in postgastrectomy patients. The magnitude of the effects of symptoms of defecation disorders on QOL after gastrectomy was significantly greater with regards to constipation than diarrhea after TG. Meanwhile, both constipation and diarrhea had significant effects on living status and QOL after DG, but constipation had slightly larger effects than diarrhea. Symptoms of defecation disorders, particularly constipation, are not prominent when compared to other characteristic postgastrectomy symptoms and are not often noticed. However, as our results showed that their effects on daily life were more significant than expected; hence, it is thought that taking appropriate measures to relieve these symptoms without overlooking their appearance would lead to the improved daily lives of patients.

Results of the multivariate analysis of factors that strengthen the symptoms of postgastrectomy defecation disorders showed that those significant independent factors in descending order of their effect on diarrhea were young age, division of the celiac branch of the vagus nerve, being male, and undergoing TG; and being female was a significant independent factor for constipation. The relationship between sex, age, and defecation disorders has been reported and diarrhea was found to be more significant in males and younger patients, while constipation was found to be more significant in females and older patients[30-32]. Regarding IBS, which is a functional gastrointestinal disease, it has also been reported that the diarrhea-type is more common among men, and the constipation-type is more common among women[33]. Reports on the relationship between surgical procedures and defecation disorders

have shown that vagotomy worsens diarrhea[9,19], and diarrhea became more severe after TG compared to other surgical procedures[34,35]. The results of our study were consistent with those of previous reports, therefore, these clinical factors should be recognized as valid factors that worsen postgastrectomy defecation disorders.

Factors that cause diarrhea after gastrectomy were thought to include rapid influx of food into the small intestine due to accelerated gastric emptying[23], accelerated intestinal peristalsis due to increased load on the small intestine[36], changes in intestinal flora due to low or no acidity[18,37], decreased pancreatic exocrine function [38], and discrepancies in the timing of the mixing of food and duodenal fluid such as pancreatic juice and bile (postcibal pancreatico-biliary asynchrony)[39]. Meanwhile, factors that cause constipation after gastrectomy are thought to include reduced gastro-colic reflex due to vagotomy[40], decreased food intake (especially fiber, water, fat)[4,41], decreased abdominal pressure due to decreased skeletal muscle mass (especially abdominal muscles)[42], lack of exercise[43], and changes in the intestinal flora and intestinal environment[18,44].

Gastrectomy induces the above-mentioned changes that can induce defecation disorders; hence, attention must also be paid to the occurrence of defecation disorders after gastrectomy.

This study has several limitations. First, this is a retrospective study; there is a possibility that unknown clinical factors other than gastrectomy may have affected the results. Second, this is a cross-sectional study at a single-time point, and there are variations in the postoperative period. However, this effect is considered minimal even if present because it has been reported that postgastrectomy QOL decreased the most in the first month postoperatively and stabilized after approximately 6 mo to a year[45], and this study used stable patients over one year postoperatively as subjects. Despite these limitations, we were able to obtain clinically useful information on postgastrectomy defecation disorders by investigating a rather large number of cases from various perspectives using the PGSAS-45 questionnaire, which is specialized for the evaluation of postgastrectomy.

CONCLUSION

In this study, we were able to clarify the features of postgastrectomy defecation disorders and its effects on daily life, although they have not been regarded as significant problems to date. Attention has often been given to characteristic postgastrectomy symptoms, such as dumping and small stomach syndrome. However, since inconspicuous symptoms of defecation disorders (especially constipation) also affect the daily lives of post-operative patients to some extent, paying attention to the occurrence of these symptoms as well and implementing the appropriate guidance and treatment were considered necessary in order to improve the QOL of postgastrectomy patients.

ARTICLE HIGHLIGHTS

Research background

Various symptoms that can interfere with the postoperative quality of life (QOL) of patients occur after gastrectomy. The symptoms of defecation disorders, particularly constipation, are relatively modest compared to other postgastrectomy symptoms; therefore, their features and implications on the daily lives of patients have not been adequately investigated.

Research motivation

Several studies have investigated the effect of characteristic postgastrectomy symptoms, such as dumping, small stomach syndrome, and esophageal reflux on the daily lives of patients. However, the implications of symptoms of defecation disorders on patient's QOL postgastrectomy are poorly understood.

Research objectives

The central goal of this research was to reveal the features of symptoms of defecation disorders and their effects on the daily lives of patients in a large population of gastrectomized patients using the Postgastrectomy Syndrome Assessment Scale (PGSAS)-45, and analyze the data derived using multivariate analysis.

Research methods

The 1777 patients who underwent total gastrectomy (TG; $n = 393$) or distal gastrectomy (DG; $n = 1384$) were enrolled in this study. The severity of defecation disorder symptoms, such as diarrhea and constipation, and their correlation with other postgastrectomy symptoms were examined. The importance of defecation disorder symptoms on the living states and QOL of postgastrectomy patients, and those clinical factors that affect the severity of defecation disorder symptoms were evaluated using multiple regression analysis.

Research results

The ranking of defecation disorder symptoms were unexpectedly high in DG among seven symptom subscales of PGSAS-45. There were significant correlation between defecation disorder symptoms and other postgastrectomy symptoms. The defecation disorder symptom, constipation in particular, impaired postgastrectomy living status and QOL. Male sex, younger age, division of the celiac branch of vagus nerve, and TG, independently worsened diarrhea, while female sex worsened constipation.

Research conclusions

The severity of symptoms of defecation disorders were unexpectedly high and both symptoms, particularly constipation, impaired the living status and QOL of patients after gastrectomy.

Research perspectives

Paying attention to the symptoms of defecation disorders as well as characteristic postgastrectomy symptoms and treating these symptoms adequately may improve the QOL of patients after gastrectomy.

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