

Risk Factors for Food Residue after Distal Gastrectomy and a New Effective Preparation for Endoscopy: The Water-Intake Method

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Background/Aims: Food residue is frequently observed in the gastric remnant after distal gastrectomy, despite adequate preparation. We devised a water-intake method to reduce food residue in the gastric remnant by drinking large quantities of water in a short time. The aims of this study were to identify the risk factors for food residue and to study the effectiveness of this new method for endoscopy preparation. **Methods:** A cohort of 708 patients who underwent distal gastrectomy for gastric cancer was reviewed prospectively. Sixty patients with large amounts of food residue were randomly divided into two groups: a water-intake group (n=40) and a prolonged fasting group (n=20). **Results:** The incidences of a large amount of food residue were 15.7%, 5.8%, 7.5%, and 2.8% at 3, 12, 24, and 36 months, respectively, after distal gastrectomy. Independent risk factors for food residue were endoscopy at 3 months, diabetes mellitus, a body mass index of <19.5, and laparoscopic surgery. The proportion of successful preparations at follow-up endoscopy was higher for the water-intake group (70%) than for the prolonged fasting group (40%, p=0.025). **Conclusions:** The water-intake method can be recommended as a preparation for endoscopy in patients who have had repetitive food residue or risk factors after distal gastrectomy. (*Gut and Liver* 2009;3:186-191)

Key Words: Stomach neoplasms; Distal gastrectomy; Endoscopy; Food residue

INTRODUCTION

The gastric remnant after distal gastrectomy has a high risk of metachronous cancer and adenoma in the patient with gastric cancer.¹⁻³ The prognosis of patients can be improved through early detection by endoscopic surveillance and endoscopic or surgical resection for recurrent cancer or adenoma occurring in the gastric remnant.⁴⁻⁶ Regular endoscopic surveillance has become important for follow-up programs for patients who have undergone a distal gastrectomy for the early detection of cancer or adenoma, as well as for functional evaluation.^{1,7}

Incidences of food residue during upper endoscopic examination are known to vary from 18% to 42% in gastric cancer patients after distal gastrectomy because of varying dietary habits and methods of preparation for endoscopy.⁷⁻¹⁰ Food residue in the gastric remnant interferes with close endoscopic observation, and may increase the risk of pulmonary aspiration during upper endoscopy.⁹ Furthermore, it is common that food residue still remains even if an endoscopic examination is performed again after prolonged fasting or liquid diet as with other methods of preparation in those patients with large amounts of food residue at prior endoscopy. In patients with distal gastrectomy, food residue during endoscopic examination is a very important clinical consideration, but there have been few studies or discussions related to effective methods of preparation for reducing food residue.

Food residue can be reduced through dietary preparation, such as prolonged fasting or liquid diet, or through combined medication, but these methods are not effective

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in some patients.^{9,11} For such patients, we devised water intake method, which reduces food residue in the gastric remnant by drinking a large quantity of water in a short time. This method was expected to reduce patient's inconvenience imposed by prolonged fasting and to be easily applied without side effects.

The present study was proposed to identify the risk factors for food residue in the gastric remnant during endoscopic examination in patients who had previously undergone distal gastrectomy for gastric cancer, and to examine the utility of the water intake method for reducing food residue as a new method of preparation for endoscopy to be compared with a conventional preparation of prolonged fasting.

MATERIALS AND METHODS

1. Patients

We evaluated the incidence and risk factors for food residue through a prospective investigation of 708 patients who met the criteria for inclusion among 818 patients who had distal gastrectomies for gastric cancer followed by upper endoscopic examination during the period from January to September, 2008. We excluded those who did not follow the defined preparation for endoscopy

(n=84), those who had anastomotic stricture or recurrent advanced cancer (n=17), those who had a poor general condition ≥ 1 on a physical score (n=6) and those who had a serious systemic disease like another cancer (n=8).

Among the 708 patients, 60 patients had moderate or large amounts of food residue that made it impossible for close endoscopic observation. These 60 patients were randomly assigned to either a water intake group (n=40) or a prolonged fasting group (n=20). We excluded those who had renal failure or congestive heart failure and those who had uncontrolled diabetes mellitus or previous hypoglycemic event in diabetes mellitus in order to avoid adverse events related to prolonged fasting and fluid overload in water intake group. The amount of food residue was assessed again after 1-2 weeks by endoscopic examination in order to evaluate the effects of the water intake method.

From all patients, we obtained consent for providing their clinical information for the research and for their participation in the research. Endoscopic surveillance for patients with distal gastrectomy for gastric cancer was scheduled at 3 months after their operations, and then once a year.

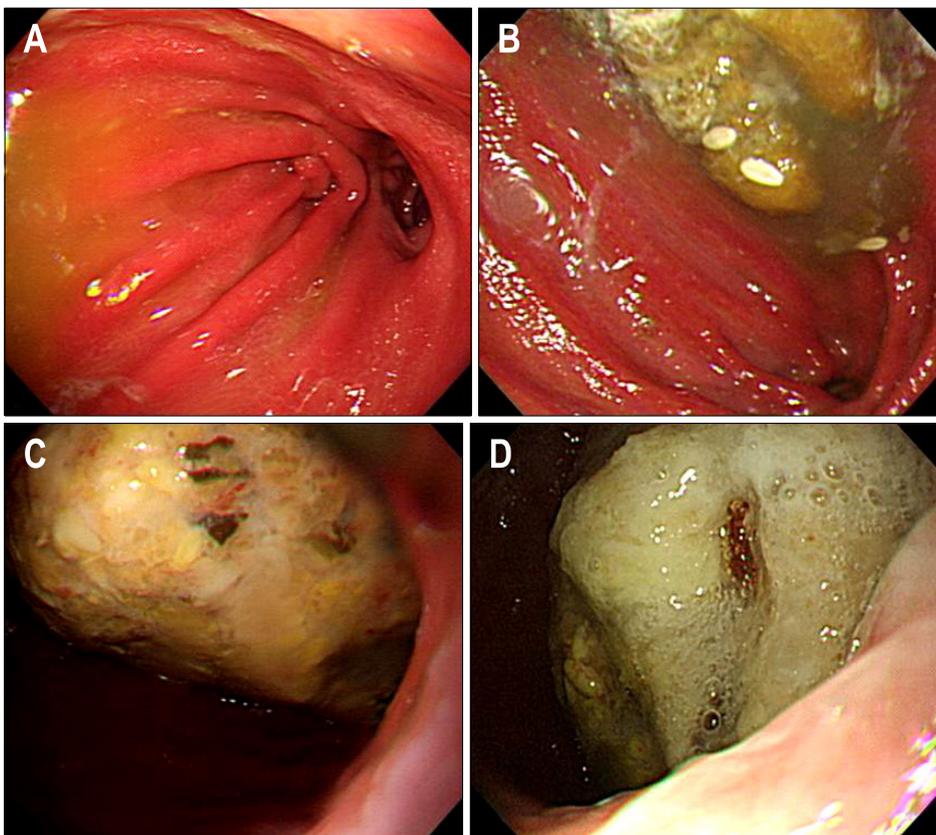


Fig. 1. Endoscopic classifications for degrees of food residue in the gastric remnant. (A) Grade 0 was defined as no food residue. (B) Grade 1 was a small amount of food residue. (C) Grade 2 was a moderate amount of food residue in which only the side of the posterior wall and the lesser curvature could be observed. (D) Grade 3 was a large amount of food residue in which endoscopic observation was impossible.

2. Protocol for preparation before endoscopy

All 708 patients had a soft diet for lunch and fasted from 14:00 on the day before endoscopy. They had their upper endoscopic examination between 9:00 and 12:00 on the day of endoscopy, so they had fasted for about 20 hours.

For the 60 patients who had moderate or large amount of food residues, the water intake group had a soft diet for lunch, fasted from 14:00, and drank 150-200 mL of water at intervals of 10 minutes for a total of 1 L between 19:00-20:00 on the day before endoscopy (water intake method). The prolonged fasting group had a soft diet for breakfast on the day before endoscopy, and fasted from 9:00 and for over 24 hours (control preparation).

3. Degree of food residue

The degree of food residue was graded by 2 endoscopic specialists according to the following criteria. Grade 0 was defined as no food residue, Grade 1 was a small amount of food residue, Grade 2 was a moderate amount

Table 1. Relationships between Clinicopathologic Factors and Food Residue

	Food residue Gr 0,1 (n=648)	Food residue Gr 2,3 (n=60)	p-value
Age	60.4±11.5	62.3±10.8	0.228
Sex (M/F)	409/239	41/19	0.422
Height (cm)	161.8±8.6	163.7±9.4	0.102
Body weight (kg)	59.3±10.3	57.5±11.9	0.208
Body mass index	22.6±3.0	21.1±2.9	0.000
Food residue			
Gr 0/Gr 1/Gr 2/Gr 3	595/53/0/0	0/0/22/38	
Underlying disease			
Diabetes mellitus	40	8	0.035
Hypertension	98	12	0.318
History of abdominal surgery	24	4	0.260
Tumor location			0.275
Antrum/others	298/350	32/28	
Depth of tumor invasion			0.422
T1/T2/T3/T4	393/175/72/8	42/14/4/0	
Lymph node dissection			0.610
D1/D2	185/463	19/41	
Reconstruction			0.063
Billroth I/II	533/115	55/5	
LADG	144	29	0.000
Gastrectomy to endoscopy interval			0.000
3 month follow up	188	35	
1 year follow up	162	10	
2 year follow up	124	10	
>3 year follow up	174	5	

LADG, laparoscopic assisted distal gastrectomy.

of food residue in which only the side of the posterior wall and the lesser curvature could be observed, and Grade 3 was a large amount of food residue in which endoscopic observation was impossible (Fig. 1).^{7,8}

Successful preparation in the 2 groups was defined as the food residue had either disappeared or decreased to Grade 1 at follow up endoscopy after 1-2 weeks.

4. Statistical analysis

All statistical analyses were performed using SPSS 15.0 (SPSS Inc., Chicago, IL, USA). The relationship between food residue and clinical factors was analyzed by Chi-square test, and the relationship between food residue and risk factors was analyzed by Cox regression analysis. p-values<0.05 were considered significant.

RESULTS

1. Food residue and clinico-pathological surgical factors

Food residue was observed in 113 (16.0%) of the 708 patients. Moderate or large amounts of food residue that interfered with endoscopic examination were observed in 60 patients (8.5%). Clinical factors related to moderate or large amounts of food residue were the time of post-operative endoscopy, body mass index (BMI), diabetes and laparoscopy assisted distal gastrectomy (LADG) (Table 1).

2. Multivariate analysis of risk factors related to food residue

By multivariate analysis, the most significant risk factor related to moderate or large amounts of food residue in the gastric remnant was a three-month follow-up endoscopy (odds ratio [OR]=42.2, 95% confidence interval [CI]=17.2-103.3). Diabetes (OR=3.5, 95% CI=1.6-7.8), BMI<19.5 (OR=2.3, 95% CI=1.3-4.0) and LADG (OR=

Table 2. Multivariate Analysis for Risk Factors Related to Food Residue

	OR	95% CI	p-value
3 month follow up EGD	42.25	17.26-103.38	0.000
Diabetes mellitus	3.59	1.65-7.82	0.001
Body mass index≤19.5	2.30	1.32-4.00	0.003
LADG	1.98	1.16-3.39	0.012
Billroth I	2.21	0.86-5.66	0.098
Antral tumor location	1.40	0.83-2.35	0.208
T1 stage	1.38	0.78-2.43	0.268
Lymph node dissection (D1)	0.90	0.51-1.57	0.703

OR, odds ratio; CI, confidence interval; LADG, laparoscopic assisted distal gastrectomy.

Table 3. Comparisons of Clinicopathologic Factors between the Water-Intake Group and the Prolonged Fasting Group

	Water group (n=40)	Fasting group (n=20)	p-value
Age	62.6±10.4	61.7±11.8	0.765
Sex (M/F)	26/14	15/5	0.432
Body mass index	21.1±2.6	21.2±3.3	0.860
Underlying disease			
Diabetes mellitus	5	3	0.788
Liver cirrhosis	1	1	0.611
Hypertension	10	2	0.171
History of abdominal surgery	2	2	0.464
Depth of tumor invasion			
T1/T2/T3	28/9/3	14/5/1	0.923
Lymph node dissection			
D1/D2	12/28	7/13	0.695
Reconstruction			
Billroth I/II	36/4	19/1	0.509
LADG	20	9	0.715
Gastrectomy to endoscopy interval			0.939
3 month follow up	24	11	
1 year follow up	6	4	
2 year follow up	7	3	
>3 year follow up	3	2	
Endoscopic findings			
Food residue (Gr2/3)	15/25	7/13	0.850
Previous endoscopy	14	8	0.705
Food residue at previous endoscopy	11	6	0.839

LADG, laparoscopic assisted distal gastrectomy.

1.9, 95% CI=1.1-3.3) were also independent risk factors (Table 2).

3. Efficacy of the water intake method

There was no significant difference in clinical factors between the water intake group (n=40) and the prolonged fasting group (n=20) (Table 3).

The proportion of successful preparations was significantly higher in the water intake group (70%) than the prolonged fasting group for food residue in the previous endoscopy (p=0.025). For the grade of negative food residue, there were 12 cases (30%) in the water intake group and 2 cases (10%) in the prolonged fasting group. After successful preparations, 3 cases of hyperplastic polyp and 1 case of adenoma (high grade dysplasia), which had not been detected in the previous examination due to food residue, were newly detected. The adenoma was resected by endoscopic submucosal dissection. Two patients in the water intake group complained of slight discomfort due to the excessive water drinking, but all other patients drank water without complication (Table 4).

Table 4. Efficacy of the Water-Intake Method Compared with Endoscopy Preparation by Prolonged Fasting

	Water group (n=40)	NPO group (n=20)	p-value
Food residue			0.014
Grade 0	12	2	
Grade 1	16	6	
Grade 2	10	5	
Grade 3	2	7	
Successful preparation	28	8	0.025
Negative food residue	12	2	0.084
Intolerance to protocol	2	1	1.000
Detect to new lesion			0.714
High grade dysplasia	1	0	
Hyperplastic polyp	2	1	

DISCUSSION

Gastric cancer is the most common cancer in Korea. For early gastric cancer, the five-year survival rate after successful surgical resection is over 90%.¹² The frequency of recurrent cancer in the gastric remnant after distal gastrectomy is around 1-5%,^{5,13} and it is known that 20% of the patients who died from the recurrence of gastric cancer had recurrent cancer that was limited to the gastric remnant.¹⁴ The risk of recurrent cancer in the gastric remnant is known to be proportional to the amount of time after the operation. But, because the frequency of synchronous gastric cancer is as high as 6-14%, there are cases of early recurrence caused by micro-carcinomas in the gastric remnant.¹⁵⁻¹⁷ Accordingly, it is essential to have regular endoscopic examinations in order to observe the residual stomach after surgery.

In many cases, however, endoscopic observation is impossible because of food residue that results from delays of gastric emptying due to gastric hypomotility, subacidity or pyloric function loss caused by vagotomy and distal gastrectomy.¹⁸ According to previous research, risk factors related to food residue are underlying diseases, such as diabetes and hypothyroidism, the stomach reconstruction method, the diameter of anastomotic site, the amount of time since the operation and others.^{8,9} As different from other studies regarding food residues, however, our study had all the patients fast for over 20 hours prior to performing the endoscopic examination. As a result, the frequency of food residue was as low as 8.5% compared to 18-42% in previous research that applied conventional preparation (fasting after diet at evening).⁷⁻⁹

The most relevant risk factor related to food residue was first follow up endoscopy at 3 month after surgery. The proportion of patients with food residue was sig-

nificantly high at 15.7% at follow-up endoscopy 3 months after the operation, but 5.8% after 1 year, 7.5% after 2 years and 2.8% after 3 years. Interestingly, the incidence of food residue showing up was high at 3 months after surgery, but it was likely to decrease with time after surgery. This patterns were similar to result of other study as the incidence of food residue was 56%, 32%, 21% at 3, 12 and 24 months of postoperative duration after conventional preparation (fasting after diet at evening).⁸ This suggests that patients with first follow-up endoscopy were lacking in dietary modification and education and require a time of adaptation in order to recover gastro-intestinal motility after surgery. Further research would be necessary on this matter.

For laparoscopic surgery patients, who were not investigated in other studies, the frequency of food residue was significantly higher compared to patients with exploratory laparotomy. As for the reason that the frequency of food residue was higher after laparoscopic surgery than for laparotomy, we considered differences according to the time of surgery due to a recent increase in the number of laparoscopic surgeries or the possibly larger volume of gastric remnant after laparoscopic surgery for early gastric cancer than that after laparotomy. The same 28 mm stapler as that used in laparotomy patients was also used for laparoscopic surgery patients for the gastroduodenal anastomotic suture, but there was no difference in the reconstruction methods.

There have been few studies regarding preparation methods to reduce the amount of food residue for endoscopic examination in distal gastrectomy patients.^{9,19} A preparation method that is different from conventional methods is necessary for patients who have risk factors or who had food residue during a prior examination. It has been reported that preparation using a hypermotility drug, such as domperidone, was not effective, and that dietary controls, such as fasting or a liquid diet, can reduce food residue.⁹ However, excessively prolonged fasting for reducing food residue worsens the patient's discomfort and, in many cases, food residue is still observed even after dietary control.

The effective preparation method is important to detect the recurred lesion or perform endoscopic resection for polyp or dysplastic lesion in gastric remnant during follow up endoscopy. Food residue can be reduced through dietary modification, such as prolonged fasting or liquid diet, or through medication. However, these methods are not effective in some patients. So we devised so called the water intake method. The water intake method, which reduces food residue by drinking a large quantity of water in a short time, is convenient and free from

complications and additional cost. Thus, it can reduce food residue more effectively than conventional prolonged fasting. Limitations of water intake method are complaint of slight discomfort caused by drinking an excessive amount of water and retained water found during the endoscopic examination. This study show no serious complication in water intake group, but fluid overload by bolus water intake may be harmful to patients with renal failure or congestive heart failure. The effect of the water intake method is expected to increase by controlling the quantity of water and the drinking time, or by different postures like right lateral decubitus for increasing gastric emptying by gravity. The predictive clinical factors of non-responder for food residue after secondary preparation were important. But the predictive clinical factors between good and poor preparation groups after secondary preparation were not found because of small number of sample size in this study.

In conclusion, for patients who had distal gastrectomy, food residue can be reduced through dietary preparation, such as prolonged fasting or liquid diet, or through combined medication, but these methods are not effective in some patients. For patients with repetitive food residue or who had risk factors, preparation for endoscopy by the water intake method was effective in this study.

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