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ORIGINAL ARTICLE

One-day nasogastric tube decompression after distal gastrectomy: a prospective randomized study

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Abstract
Purpose Many surgeons in Japan use 1-day nasogastric tube (NGT) decompression after gastrectomy as a standard procedure. This prospective randomized study aimed to define whether 1-day NGT decompression is necessary after distal gastrectomy.
Methods The subjects were 233 patients with gastric cancer, randomized into two groups immediately after distal gastrectomy: one group received 1-day NGT decompression (NGT group, $n=119$) and the other did not (no-NGT group, $n=114$). The primary outcome measure was postoperative surgery-related and respiratory complications, whereas secondary measures were the postoperative course to recovery and patient complaints.
Results The incidence of surgery-related complications did not differ significantly between the NGT and no-NGT groups (21.0 and 19.2%, respectively; $p=0.87$). The rate of respiratory complications was 6.7% in the NGT group and 7.0% in the no-NGT group ($p>0.99$). The time to passage of first flatus and the postoperative hospital stay did not differ between the groups. Twenty-five patients in the NGT group and none in the no-NGT group complained of nasopharyngeal discomfort ($p<0.0001$).
Conclusion Considering the physical discomfort caused by the NGT, we believe that routine 1-day NGT decompression is unnecessary after distal gastrectomy.

Keywords Nasogastric tube · Distal gastrectomy · Randomized trial

Introduction

Nasogastric intubation for several days until the patient first passes flatus has been a routine part of perioperative care after gastrectomy, to achieve gastrointestinal decompression and prevent anastomotic leakage [1–3]. However, the need for nasogastric tube (NGT) decompression after partial gastrectomy has been questioned recently [4, 5]. In fact, nasogastric decompression is now not believed to be useful because the NGT may cause complications such as aspiration pneumonia and nasopharyngeal discomfort [6–11]. Although some studies have demonstrated that partial gastrectomy can be performed safely without postoperative nasogastric decompression, many surgeons in Japan and Korea continue to use 1-day NGT decompression as part of their standard procedure according to the clinical pathway, to monitor postoperative anastomotic bleeding or prevent vomiting [12–15].

Previous studies have shown that routine nasogastric decompression after gastric surgery, including partial and/or total gastrectomy, does not decrease postoperative morbidity and mortality [8–11, 16–19]. All these studies compared patients with an NGT retained for several days after gastrectomy, with patients who did not have an NGT left in place; however, to our knowledge, no study has compared

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Table 1 Clinical characteristics of the patients

	NGT ($n=119$)	No-NGT ($n=114$)	p
Age			
Median (range)	64 (38–96)	63 (37–84)	0.4843[a]
Gender			
Male	84	84	0.7717[b]
Female	35	30	
ASA physical status classification			
1	33	31	0.6831[b]
2	74	75	
3	12	8	
Preoperative pyloric stenosis			
Absent	105	104	0.5213[b]
Present	14	10	
Histological type			
Intestinal	72	77	0.2778[b]
Diffuse	47	37	
Stage (UICC 6th edition)			
IA	57	58	0.9256[b]
IB	18	16	
II	22	16	
IIIA	13	16	
IIIB	5	4	
IV	4	4	
Operating time (min)			
Median (range)	227 (95–402)	229 (136–642)	0.3378[a]
Operative bleeding			
Median (range)	179 (20–1572)	175 (10–1521)	0.7981[a]
Operative approach			
Open	117	113	>0.9999[b]
Laparoscopic	2	1	
Operative method			
Distal gastrectomy	114	110	>0.9999[b]
Pylorus-preserving gastrectomy	5	4	
Reconstruction			
Billroth I*	56	64	0.6933[b]
Roux-en-Y	63	50	
Lymph node dissection			
D0	2	1	0.377[b]
D1	55	51	
D2	62	62	
Combined resection			
Absent	38	30	0.458[b]
Cholecystectomy	79	81	
Others	10	6	
Curability			
R0	107	109	0.1434[b]
R1	6	4	
R2	6	1	

UICC Union for International Cancer Control

*Including gastroanastomosis, *NGT* nasogastric tube, *ASA* American Society of Anesthesiologists

[a]Student's *t* test

[b]χ^2 test

patients treated with 1-day NGT decompression with those without a retained NGT. Therefore, we conducted a prospective randomized trial to assess the need for 1-day NGT decompression after distal gastrectomy.

Patients and methods

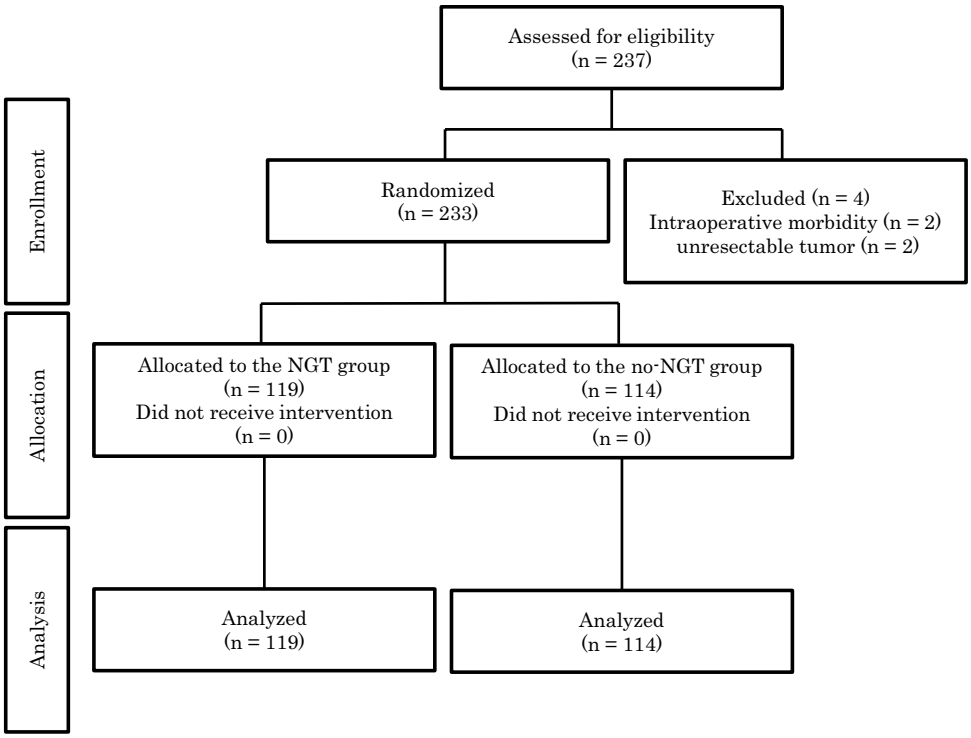
The protocol of this study was approved by the institutional review board (IRB) of NTT West Osaka Hospital (IRB Approval No. 42). Informed consent was obtained from the patients before they were enrolled in the study. A total of 237 patients with gastric cancer, who were scheduled to undergo open distal gastrectomy, including pylorus-preserving gastrectomy (PPG), between January 2005 and December 2009 were enrolled.

After the exclusion of four patients prior to randomization, because of intraoperative morbidity or an unresectable tumor, 233 patients (168 men and 65 women) with a median age of 63 years (range, 37–96 years), who underwent open distal gastrectomy at NTT West Osaka Hospital were enrolled and randomized into two groups: the NGT group ($n=119$) and the no-NGT group ($n=114$; Fig. 1). The NGT group comprised 114 patients with distal gastrectomy and 5 with PPG, and the no-NGT group included 110 patients with distal gastrectomy and 4 with PPG. The patient characteristics and surgical factors were similar in the two groups (Table 1).

Surgery was performed with the patient under epidural and general anesthesia. A 14Fr NGT was introduced after anesthesia induction with its tip placed in the remnant stomach. The patients were randomized into two groups at the end of the operation: one group received 1-day NGT decompression (NGT group) and the other group did not (no-NGT group). In the NGT group, the NGT was maintained with free drainage and monitoring of fluid volume, and the tube was removed the following morning. In the no-NGT group, the tube was removed immediately after the operation.

During the postoperative course, all patients received parenteral fluid administration until oral food intake was resumed. Any postoperative complications, the postoperative course to recovery, and patients' complaints were recorded. Postoperative complications were evaluated using the Common Terminology Criteria for Adverse Events version 3.0 (CTCAE v3.0) and were classified into surgery-related complications (including anastomotic leakage: leak—anastomosis; anastomotic stenosis: stricture/stenosis—anastomosis; ileus; anastomotic bleeding: hemorrhage—anastomosis; intraperitoneal bleeding: hemorrhage—peritoneal cavity; pancreatic juice leakage: leak—pancreas; intraperitoneal abscess: infection—peritoneal cavity; wound infection: infection—wound; and ascites),

Fig. 1 Study flowchart



pulmonary complications (including pneumonitis, atelectasis, and pleural effusion) and other complications (including bacteremia: infection—blood; cardiac complications: cardiac general and arrhythmia; liver function: AST/ALT; amylase; bilirubin; delirium: confusion; and others). All surgery-related complications and pulmonary complications of more than grade 1 were considered postoperative complications [20]. The day of the passage of flatus, oral fluid and oral food intake, and the length of postoperative hospital stay were recorded. Vomiting, discomfort from the NGT (nasal soreness and/or throat pain), removal of the NGT, and NGT reinsertion were noted. A nurse questioned the patient about any nasopharyngeal soreness and/or throat pain the next morning and recorded the patient's response on the medical chart.

The primary objective for comparison was the incidence of postoperative surgery-related and respiratory complications. The secondary objectives were postoperative course to recovery and patients' complaints. The Chi-square test and Student's *t* test were used for statistical comparisons. *p* values <0.05 were considered significant.

Results

No patient died after surgery in either group. Table 2 summarizes the morbidity of the patients. No significant difference was noted in the incidence of postoperative complications, including all grades of surgery-related complications and respiratory complications of more than grade 1, between the NGT group and the no-NGT group (24.3 and 22.8%, respectively; $p=0.88$). There was also no significant difference in the incidence of surgery-related complications (21.0 versus 19.2%; $p=0.87$; Table 3). The rate of respiratory complications in the NGT and no-NGT groups was 6.7 and 7.0%, respectively ($p>0.99$; Table 3). There was no significant difference between the groups in any other kind of complication (Table 3).

In the NGT group, the fluid volume drained by the nasogastric tube until the following morning was 8 mL (range 0–250 mL). Table 4 summarizes the patients' postoperative course. The median time to the passage of first flatus was 3 days in both groups ($p=0.51$). The median postoperative hospital stay was 19 days in both groups ($p=0.58$). Six patients from each group suffered

Table 2 Summary of the postoperative complications

	NGT ($n=119$)	No-NGT ($n=114$)	*p*
Postoperative complications			
No. (%)	29 (24.3)	26 (22.8)	0.8775[a]
Surgery-related complications (all grades)			
No. (%)	25 (21.0)	22 (19.2)	0.8704[a]
Pulmonary complications (>grade 1)			
No. (%)	8 (6.7)	8 (7.0)	>0.9999[a]

[a] χ^2 test

Table 3 Postoperative complications

	NGT			No-NGT		
	($n=119$)			($n=114$)		
Surgery-related complications	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
Leak—anastomosis	0	0	1	0	0	2
Stricture/stenosis—anastomosis	0	0	12	0	0	11
Leak—pancreas	0	2	0	0	3	0
Infection—peritoneal cavity	0	4	0	0	2	0
Infection—wound	5	0	0	3	0	0
Ileus	0	0	2	0	0	3
Hemorrhage—anastomosis	0	0	1	0	0	0
Hemorrhage—peritoneal cavity	0	0	1	0	0	0
Ascites	0	1	1	0	1	1
Total	5	5	17	2	5	15
All grades (%)	25 (21.0)			22 (19.2)		
Pulmonary complications		Grade 2	Grade 3		Grade 2	Grade 3
Pneumonitis		2	1		3	0
Atelectasis		1	0		3	0
Pleural effusion		4	0		2	0
Total		7	1		8	0
>Grade 1 (%)		8 (6.7)			8 (7.0)	
Other complications		Grade 2	Grade 3		Grade 2	Grade 3
Infection—blood		3	0		2	0
Cardiac general		3	1		4	0
Cardiac arrhythmia		2	0		2	0
AST/ALT		12	1		15	0
Amylase		8	8		6	9
Bilirubin		0	1		0	2
Confusion		5	2		4	0
Others		4	0		2	0
Total		28	10		23	11
>Grade 1 (%)		35 (29.4)			30 (26.3)	

vomiting. Twenty-four patients in the NGT group, but none in the no-NGT group, reported nasopharyngeal discomfort, such as nasal soreness and throat pain. Four patients pulled out their NGT during the night and it was removed because of discomfort in three patients, on the day of surgery. Six patients in the NGT group and 12 patients in the no-NGT group required subsequent NGT decompression for anastomotic leakage or stenosis.

Discussion

Distal gastrectomy is one of the most common operations in Japan, but postoperative complications are not infrequent [21, 22]. Postoperative complications must be graded by established classifications, such as the CTCAE or the Clavien–Dindo classification [23]. Although the incidence of postoperative complications in the past studies on NGTs was usually measured as the endpoint, the complications were not evaluated by the standard methods. In the present study, we evaluated postoperative complications using the CTCAE v3.0 [20].

The results of the past studies demonstrate that leaving an NGT in place for several days after gastrectomy is not necessary, but they did not clarify if 1-day NGT placement has clinical benefits in preventing postoperative complications. This is the first report to compare patients who received 1-day NGT decompression with patients in whom the NGT was not retained after gastrectomy. For patients undergoing partial gastrectomy, Wu et al. proved that routine nasogastric decompression did not increase postoperative abdominal complications [16]. A meta-analysis of the results of gastrectomy by Yang et al. showed that anastomotic leakage was similar in a tube decompression group and a no-tube group [5]. In the present study, we noted that patients who underwent distal gastrectomy, including PPG, with or without 1-day NGT decompression, had similar complication rates. Other previously reported

Table 4 Postoperative course

	NGT ($n=119$)	No-NGT ($n=114$)	p
Vomiting			
Absent	113	108	>0.9999[a]
Present	6	6	
Discomfort from the NGT			
Absent	95	114	<0.0001[a]
Present	24	0	
Removal of the NGT before the next morning			
Absent	114	–	
Present	5	–	
Drainage volume (mL)			
Median (range)	8 (0–250)	–	
Postoperative reinsertion of the NGT			
Absent	113	102	0.1436[a]
Present	6	12	
Timing of reinsertion (day)			
Median (range)	8 (2–15)	10 (2–15)	0.5994[b]
Passage of flatus (day)			
Median (range)	3 (1–7)	3 (1–24)	0.5132[b]
Return to oral fluid intake(day)			
Median (range)	4 (3–20)	4 (3–16)	0.5186[b]
Return to oral food intake(day)			
Median (range)	5 (3–30)	5 (4–30)	0.4507[b]
Postoperative hospital stay (day)			
Median (range)	19 (8–98)	19 (8–60)	0.5796[b]

[a] χ^2 test

[b] Student's t test

complications related to the NGT, such as necrosis of the nasal septum, laryngeal injury and perforation of the esophagus or jejunum, were not observed in this study [24].

Some studies have found that the NGT may increase the incidence of pulmonary complications, such as atelectasis and pneumonia [2, 7, 10, 25]. In the present study, documented pneumonia, atelectasis, or pleural effusion greater than grade 1 occurred in 6.7% of the NGT group patients and 7.0% of the no-NGT group patients ($p=0.87$). The median and maximum fluid volume drained from the NGT from the end of surgery until the next morning were 8 and 250 mL; however, this volume of drainage did not lead to vomiting or aspiration irrespective of whether an NGT was placed. Since there were only six cases of vomiting in each group during the 3 days after surgery (data not shown), we do not believe that 1-day NGT decompression reduced the risk of vomiting, which could have contributed to aspiration and pneumonitis. Accordingly, retaining the NGT overnight was not judged to cause pulmonary complications. We hoped that an NGT would provide clinical information about postoperative intraluminal bleeding, but we encountered only one case of intramural bleeding in the NGT group. The NGT was removed from this patient the following morning without revealing any information about postoperative bleeding based on the 8 mL of bloody discharge (data not shown). Therefore, we concluded that postoperative intraluminal bleeding was not easy to diagnose by the volume and the nature of the retained NGT owing to poor drainage of blood.

Although several studies have found that the placement of an NGT tends to delay the time to flatus, we noted that the time to passing flatus was similar in both groups in this study, because the NGT was removed the following morning and did not interfere with the patients' activities, such as walking, drinking, and eating [9, 10, 16–18]. Since the postoperative time schedule was defined by the clinical pathway unless complications occurred, there was no difference between the groups in resuming food intake and the length of the postoperative hospital stay.

More than 40% of patients who had an NGT in place for a few days complained of nasopharyngeal discomfort and a sore throat [6, 8, 9]. Although no patient in our no-NGT group suffered nasopharyngeal discomfort, four in the NGT group removed the NGT themselves and 20% reported nasopharyngeal discomfort. The reason for this proportion being lower than in previous reports is that the NGT was removed the following morning; so, the time that the NGT was in place was shorter. Moreover, the use of the NGT requires additional medical resources such as a nursing care for the patient with nasopharyngeal discomfort and added entries in the patient's medical records (data not shown).

In conclusion, there was no significant difference in the postoperative complications or postoperative course to recovery between the NGT and no-NGT groups. Ultimately, the NGT appeared to offer no benefit either to the patient or to the medical staff. The results of the present study suggest that routine 1-day NGT decompression is not necessary after distal gastrectomy, including PPG.

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Compliance with ethical standards

Conflict of interest Yutaka Kimura, Hiroshi Yano, Takashi Iwazawa, Hirokazu Taniguchi, Junya Fujita, Shoichiro Fujita, Kazuyoshi Yamamoto and Takushi Yasuda have no conflicts of interest to declare with regard to any part of this study.

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