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Reprint Volume 34 - 2002

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Stuttgart - New York
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Ruedigerstraße 14
D-70469 Stuttgart
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Mechanism of the Development of Gastric Ulcer after Percutaneous Endoscopic Gastrostomy

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Background and Study Aims: The present study was carried out in order to elucidate the mechanism of the development of gastric ulcer, one of the serious complications of PEG tube placement.

Patients and Methods: This retrospective study included 92 patients who underwent gastric endoscopy after PEG tube placement. Gastric ulcers detected at gastroscopy were examined in relation to the length of the protrusion from the PEG tubes intra-gastric bumper and the use of histamine H₂-receptor antagonists.

Results: Gastric ulcers were found in nine of the 92 patients, and in all nine the ulcer was found on the posterior wall of the gastric

body, where the tip of the PEG tube was attached. Seven of the 21 patients (33.3%) who had a PEG tube with a long protrusion from the intragastric bumper developed gastric ulcer. By contrast, only two of the 71 patients (2.8%) who had a PEG tube with a short protrusion developed gastric ulcer. The use of H₂-blockers had no significant impact on the development of gastric ulcer.

Conclusions: The occurrence of gastric ulcer after PEG placement was attributable to the shape of the PEG tube within the intragastric space, and not to the use of H₂-blockers, suggesting that appropriate placement of the PEG tube is an important factor in preventing gastric ulcer.

Introduction

The value of tube feeding with percutaneous endoscopic gastrostomy (PEG) has been clearly recognized, and PEG tube feeding is now widely used in elderly patients with dysphagia due to cerebral apoplexy or senile dementia; nasogastric tube feeding is also still widely used, however [1–3]. With the widespread use of PEG feeding, there have been reports of several complications peculiar to PEG feeding [4–8], as well as reports on ways of preventing these [9–12]. However, these reports have been limited to complications during the acute postoperative phase, with the exception of buried bumper syndrome in the chronic postoperative phase [13–15]. There have been few reports of other complications during the chronic phase, particularly the development of gastric ulcer as a severe complication of PEG tube placement. The aims in the present study were to investigate the incidence

of gastric ulcer detected at gastroscopy after PEG placement, and to examine the contribution to the development of gastric ulcer of two possible factors – the shape of the intragastric bumper and the use of histamine H₂-receptor antagonists (H₂-blockers).

Patients and Methods

Patients

The study included 92 patients (29 men, 63 women, mean age 78.3, range 39–97) who underwent gastric endoscopy after PEG tube placement. Gastroscopy was carried out when the tubes were being exchanged. The disease backgrounds for all the patients included are shown in Table 1. Gastric endoscopy was carried out a mean of 249 days (range 6–1833 days) after PEG tube placement during tube exchange, except in patients who pres-

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Submitted 14 August 2001 · Accepted after Revision 4 December 2001

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Endoscopy 2002; 34 (6): 480–482 © Georg Thieme Verlag Stuttgart · New York · ISSN 0013-726X

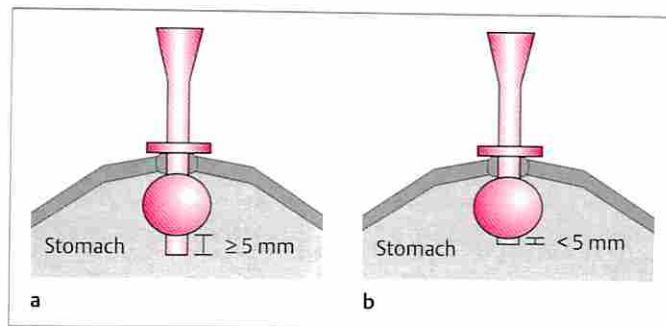
Table 1 Characteristics of the patients who underwent gastroscopy after placement of a percutaneous endoscopic gastrostomy (PEG) tube

	Group 1* (n = 21)	Group 2** (n = 71)	Total (n = 92)
Diseases			
Cerebral infarction	6	31	37
Dementia	8	26	34
Cerebral hemorrhage	4	2	6
Subarachnoid hemorrhage	0	3	3
Brain contusion	1	2	3
Brain anoxia	0	2	2
Amyotrophic lateral sclerosis	1	1	2
Parkinson's syndrome	0	1	1
Gastric cancer	0	1	1
Progressive supranuclear palsy	0	1	1
Encephalitis	0	1	1
Brain tumor	1	0	1
Sex			
Male	6	23	29
Female	15	48	63
Age (y; mean, range)	79.24 (55–97)	78.04 (39–94)	78.32 (39–97)
Interval after PEG*** (days; mean, range)	237 (6–1833)	252 (13–801)	249 (6–1833)

* Group 1: protrusion from intragastric bumper ≥ 5 mm.

** Group 2: protrusion from intragastric bumper < 5 mm.

*** Interval between the day of a percutaneous endoscopic gastrostomy and that of gastroscopy.

**Figure 1** Categorization of the percutaneous endoscopic gastrostomy tubes relative to the length of the protrusion from the intragastric bumper as observed by gastroscopy. **a** Group 1: protrusion from intragastric bumper ≥ 5 mm. **b** Group 2: protrusion from intragastric bumper < 5 mm**Table 2** Relationship between the shape of the percutaneous endoscopic gastrostomy (PEG) tube and the development of gastric ulcer

	Group 1*	Group 2**	Total
Gastric ulcer	7 (33.3%)	2 (2.8%)	9
No gastric ulcer	14 (66.7%)	69 (97.2%)	83
Total	21 (100%)	71 (100%)	92

* Group 1: protrusion from intragastric bumper ≥ 5 mm.

** Group 2: protrusion from intragastric bumper < 5 mm.

$P < 0.05$ (Fisher's exact test).

ented with clinical symptoms of gastrointestinal bleeding. None of the patients had any past history of gastric ulcer, and no gastric ulcers were detected when the initial PEG placement was carried out. The patients or their relatives agreed to the gastroscopy examinations after PEG tube placement, and provided written informed consent after receiving a sufficient explanation of the procedure.

Methods

The 92 patients were divided into two groups on the basis of the length of tube protruding from the intragastric bumper of the PEG tube. Group 1 consisted of patients in whom the tube protruded 5 mm or more from the intragastric bumper, and group 2 included those in whom the protruding tube was less than 5 mm (Figure 1). Two different types of bumper were used in both groups (balloon bumper and Malecot bumper in group 1, balloon bumper and silicon bumper in group 2). The numbers of patients in the two groups are shown in Table 1. The patients were also divided according to their use of H₂-blockers. H₂-blocker administration was started after the onset of stroke to prevent complications such as Cushing's ulcer, and was continued up to the time gastroscopy was performed.

Statistical analyses were carried out using Fisher's exact test.

Results

Incidence of Gastric Ulcer after PEG Tube Placement

Of the 92 patients who underwent gastroscopy after PEG placement, nine (9.9%) were found to have gastric ulcers. Among the nine patients diagnosed with gastric ulcer at gastroscopy, three patients in group 1 showed clinical symptoms of gastrointestinal bleeding. The other four patients in group 1 and two patients in group 2 were asymptomatic. There were no differences between the groups with regard to complications or other confounding factors (e.g., age, types of medication, disorders such as respiratory, renal, or hepatic dysfunction) capable of increasing the risk of gastric ulcer. In all nine patients, the gastric ulcers were located on the posterior wall of the body of the stomach, where the tip of the PEG tube was in contact with the mucosa. Seven (33.3%) of the 21 patients in group 1 (long protrusion), and two (2.8%) of the 71 patients in group 2 (short protrusion) developed gastric ulcer. The occurrence of gastric ulcer was significantly higher in group 1 patients compared with group 2 patients ($P < 0.05$, Fisher's exact test) (Table 2).

Effect of H₂-Blocker Administration

An H₂-blocker was administered to four of the 92 patients who underwent gastroscopy after PEG tube placement. Among the 21 patients in group 1, gastric ulcer was observed in one of the two patients who were receiving an H₂-blocker, and in six of the 19 patients who were not receiving an H₂-blocker. In group 2, none of the patients who were on an H₂-blocker developed gas-

Table 3 H₂-blocker medication and the risk of gastric ulcer among patients in groups 1 and 2

	Group 1			Group 2		
	H ₂ -blockers	No H ₂ -blockers	Total	H ₂ -blockers	No H ₂ -blockers	Total
Gastric ulcer	1	6	7	0	2	2
No gastric ulcer	1	13	14	2	67	69
Total	2	19	21	2	69	71

N.s. (Fisher's exact test).

tric ulcer, while two of the 69 patients who were not on an H₂-blocker developed gastric ulcer. The use of H₂-blockers had no significant impact on the onset of gastric ulcer in either group (Table 3).

Discussion

PEG was first described by Gauderer et al. in 1980 [16], and PEG tube placement is highly regarded as a useful method for managing patients who require long-term transtubular feeding. We previously reported [17] that complications are more frequent after PEG than reported by Jain et al. [18]. In our experience in 441 patients who underwent PEG, there were 144 incidents of post-PEG complications, including gastric ulcer.

Some speculations have been published regarding the mechanism underlying the development of gastric ulcer after PEG tube placement. Several reports [19,20] have suggested the possibility that contact between a nasogastric feeding tube and the gastric wall may be a cause of gastric ulcer. However, this mechanism has not previously been demonstrated for the onset of gastric ulcer in patients undergoing PEG placement. In the present study, in all nine patients who developed gastric ulcer after PEG tube placement, the gastric ulcer was observed on the posterior wall of the gastric body, where the tipp of the PEG tube came into contact with the mucosa. None of the 92 patients in the present study had any previous history of gastric ulcer. In addition, it was confirmed that the gastroscope was aseptic for *Helicobacter pylori* before the gastroscopy procedure in each patient. It is therefore likely that mechanical stimulation by the PEG tube on the mucosa of the stomach led to the development of the gastric ulcers, and this view is supported by the finding that gastric ulcer occurred in a significantly higher percentage of group 1 patients, in whom the PEG tube was more likely to cause injury to the gastric mucosa due to the longer protrusion from the bumper.

Only four of the 92 patients studied had received H₂-blocker treatment before PEG tube placement. However, H₂-blocker administration did not significantly reduce the incidence of gastric ulcer. As detailed above, we would speculate from these results that the development of gastric ulcer after PEG tube placement may be due to mechanical injury caused by the PEG tube to the gastric mucosa, and that the administration of H₂-blockers may not prevent the development of gastric ulcer.

Conclusion

Use of a PEG tube with a long protruding tipp was associated with a significantly higher frequency of post-PEG gastric ulcer due to contact injury to the gastric mucosa caused by the tipp of the tube. Choosing the appropriate PEG tube may be crucial in preventing gastric ulcer after PEG placement.

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