ORIGINAL ARTICLE

A Prospective Comparison of Percutaneous Endoscopic Gastrostomy and Nasogastric Tube Feeding in Patients with Acute Dysphagic Stroke

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Summary

Dysphagia following stroke is a common problem and is of particular concern because of its potential for malnutrition. Nasogastric (NG) and percutaneous endoscopic gastrostomy (PEG) tube feeding are recognized methods for nutritional support for patients with persistent neurologic dysphagia. However, the former is associated with tube dislodgement and blockage that might compromise the patients' nutritional status. There have been few randomized prospective studies to date comparing the efficacy and safety of these 2 modes of dysphagia management in stroke patients. The objective of this study was to compare PEG with NG tube feeding after acute dysphagic stroke in terms of nutritional status and treatment failure. This was a randomized prospective clinical trial. A total of 23 consecutive patients who fulfilled the criteria were recruited from the medical wards in Hospital Universiti Kebangsaan Malaysia. The diagnosis of stroke (acute cerebral infarct) was based on clinical and brain computed tomographic (CT scan) findings, and the diagnosis of dysphagia was done clinically by using the 'swallowing test'. At recruitment, upper-arm skin fold thickness (triceps and biceps) and mid-arm circumference were measured, and blood was drawn for serum albumin level. They were then followed up at 4 weeks where the above tests were repeated. A total of 22 patients completed the study (12 patients in the NG group and 10 patients in the PEG group). Serum albumin levels ($p = 0.045$) were significantly higher in the PEG as compared to the NG group at 4 weeks post-intervention. There were statistically significant improvements in serum albumin level ($p = 0.024$) in the PEG group, and statistically significant reductions in serum albumin level ($p = 0.047$) in the NG group 4 weeks after the intervention. However, there were no significant differences in anthropometric parameters between the two groups and no significant changes in these parameters for each group 4 weeks after the intervention. Treatment failure occurred in 5 out of 10 patients (50.0%) in the NG group, but none in PEG group ($p = 0.036$). PEG tube feeding is more effective than NG tube feeding in improving the nutritional status (in terms of the serum albumin level) of patients with dysphagic stroke. NG tube feeding, in fact, reduced the nutritional status (in terms of the serum albumin level) of the patients.

Key Words: Stroke, Dysphagia, Nutritional status

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Introduction

Stroke is a major cause of morbidity and mortality world - wide. It is a common problem, affecting 5 to 8 people in every 1000 over 25 years of age or an estimated 47 people in every 1000 over 55 years of age in the community[1]. In Malaysia, stroke remains an important cause of morbidity and mortality. A study done in Hospital Kuala Lumpur reported an incidence rate of 1000 cases per year[2] and another study conducted in Hospital Universiti Kebangsaan Malaysia showed an incidence rate of 330 cases per year[3].

In the acute stages, its effects produce a wide range of neurologic impairments which affect eating such as lack of postural control; upper-limb dysfunction; visual, cognitive, perceptual and communication impairments; dyspraxia; and dysphagia[4]. Dysphagia is a particular concern because of its potential for malnutrition. Enteral nutrition is the preferred route for long-term nutritional support for patients with persistent neurologic dysphagia, compared with parenteral nutrition, if the gastrointestinal tract is functionally preserved. Nevertheless, problems frequently occur in patients with nasogastric (NG) tube feeding such as tube dislodgement or blockage that might result in interference of patients' feeding, and thus affecting their nutritional status. Percutaneous endoscopic gastrostomy (PEG) tube insertion was performed for the first time in 1981 by Ponsky and Gauderer[5]. PEG tube is now accepted as the preferred technique to establish long-term enteral feeding. Large studies have reported success rates for insertion of over 95%[6,7], procedure time of 15 to 30 minutes, excellent tolerance by patients, low morbidity (6% to16%), and a very low procedure related mortality (0% to 1%)[8,9,10,11]. This method has several advantages over a NG tube, including beneficial cosmetic aspect and less discomfort; no risk of sinusitis, parotitis, nasal cartilage erosion or esophageal erosion; less frequent plugging of the tubes necessitated replacement; fewer chances of tube dislocation or dislodgement; lower risk of gastroesophageal reflux, reflux esophagitis or oesophageal erosion; and aspiration syndrome including aspiration pneumonia[12]. The objective of this study was to compare the nutritional status and the occurrence of treatment failure between dysphagic stroke patients receiving NG and PEG tube feeding at 4 weeks.

Materials and Methods

This was a randomized prospective clinical trial. Patients were recruited from the medical wards in Hospital Universiti Kebangsaan Malaysia. The patients were randomly assigned to either PEG or NG group. All patients or their next of kin gave written consent. The study was approved by the research and ethics committee of the Medical Faculty, Universiti Kebangsaan Malaysia. All patients who were admitted with acute ischaemic stroke (acute cerebral infarct) and persistent dysphagia for seven or more days, were eligible for this study. The patients were recruited consecutively over a six-month period commencing March 2004. Acute cerebral infarct was diagnosed clinically and confirmed by computed axial tomography (CT scan) of the brain.

Each patient was reassessed clinically to confirm the dysphagia using the 'Swallowing test'[13]. Written consent was obtained from patients who fulfilled the above criteria or next of kin after a full explanation. Standardized data sheets were used to record the variables. The patients were randomly assigned (block randomization) by using computer generated randomized tables to receive either PEG or fine bore NG tube. PEG tubes (Wilson Cook silicone tube, 24 French gauge with internal diameter of 5.5 mm) were inserted by a surgeon or gastroenterologist by using a percutaneous approach and pull through technique. Sedation was induced by using intravenous midazolam 2.5 to 5mg and intravenous pethidine 25mg was used for analgaesia. The patients were also given a prophylactic antibiotic one hour before the procedure by using intravenous ceftriaxone 1g. NG tubes (Steril Cathline polyurethane tube, size 14 with internal diameter of 3.3 mm) were passed by experienced staff nurses in a standard fashion and their position was checked by aspirating gastric contents.

Each patient in both groups was assessed by a dietician and received a standard enteral feed according to their body weight (Nutren 1.0). The patients' relatives or caregivers who were responsible for administering the prescribed enteral feed to the patients were taught how to take care of the tube and how to administer the enteral feed. Each of them was also given a feeding self-monitoring chart and asked to chart down each feeding.

The patients were discharged one or two days after the intervention and followed-up 4 weeks later. The main outcome measures at 4 weeks were nutritional status and treatment failure rate. A follow-up phone call was made for each patient a week after the discharge to enquire about any problems with the tube such as tube dislodgement or blockage. Patients were reminded

about the appointment date by a phone call a week prior to the follow-up date.

If a patient failed to turn up on that day, a phone call was made to ascertain the reason for it. The patient's relative or caregiver informed the investigator of any occurrence of tube dislodgement or blockage; and the patient was brought to the hospital for tube reinsertion.

Measurements

Nutritional status was assessed by recording anthropometric parameters and nutritional markers.

1. Anthropometric parameters
   - Measurements were done on the non-paralyzed limb.
   - Skin-fold thickness (triceps-TSFT and biceps-BSFT) were measured by using a pair of Holtain callipers (standard error 0.1mm) and calibrated to zero before each measurement.
   - Mid-arm circumference (MAC) were measured by using a flexible, non-extensible plastic measuring tape (standard error 0.05cm).
2. Nutritional markers
   - Blood was analyzed for serum albumin level by a standard method in the biochemical lab of HUKM.

Diagnosis and Definition

1. Treatment failure was defined as recurrent tube dislodgement and/or blockage on three or more occasions.
2. Cerebral infarct subtype[14]:
   - Lacunar infarct (< 15mm)
   - Large infarct (> 15 mm): total anterior circulation
     partial anterior circulation
     posterior circulation

Assessment

At recruitment

Baseline upper-arm skin fold thickness (biceps and biceps) and mid-arm circumference were measured; and blood was drawn for serum albumin level. The patients' relatives or caregivers were given the feeding self-monitoring chart.

At 4 weeks follow-up

The patients' upper-arm skin fold thickness (triceps and biceps) and mid-arm circumference were measured; and blood was drawn for serum albumin level.

Statistical analysis

Statistical analysis was done by using the SPSS package version 11.0 software. The associations between the type of feeding tube and non-parametric quantitative data (anthropometric parameters and serum albumin level) were analyzed by using the Mann-Whitney U test. The associations between pre-intervention and post-intervention non-parametric quantitative data (as above) were analyzed by using the Wilcoxon-Rank signed test. The associations between the type of feeding tube and qualitative data (treatment failure) was analyzed by using the Fisher exact test. For non-parametric quantitative data, results were expressed as median (minimum – maximum range). P value of less than 0.05 was regarded as significant.

Results

A total number of 44 patients with acute ischaemic stroke and dysphagia were admitted over a six-month period from March to August 2004. However, only 29 patients (65.9%) had persistent dysphagia after a week and a total of 23 patients who fulfilled the criteria were recruited into the study. Thirteen patients were randomly assigned to the NG group and 10 patients to the PEG group. However, there was 1 dropout from the NG group due to failure to turn-up at 4 weeks follow-up. The number of patients who completed the study was 22 (12 patients in the NG group and 10 patients in the PEG group).

There were 4 deaths, 2 from each group. All 4 deaths were due to recurrent cerebral infarct and all of them occurred within a week of the intervention. The total number of patients by the end of the 4-week study was 18 patients (10 patients in NG group and 8 patients in PEG group).

There were no statistically significant differences between the NG and PEG groups in terms of baseline characteristics (including the total number of prescribed feeding) as well as baseline anthropometric parameters and serum albumin level as shown in Table I and Table II respectively.

There were no statistically significant differences in anthropometric parameters (TSFT, BSFT and MAC) and serum albumin level between the NG and PEG group at baseline (0 week) as mentioned earlier. However, after 4 weeks of the intervention, serum albumin level

were significantly higher in the PEG as compared to the NG group (median Alb 39.50 for PEG versus 36.00 for NG, p = 0.045). There were no significant differences in all anthropometric parameters between the two groups at 4 weeks post-intervention (Table III).

In the PEG group, there were statistically significant improvements in serum albumin level in 7 out of 8 patients (87.5%, median Alb 37.00 at 0 week versus 39.50 at 4 weeks, p = 0.024) at 4 weeks post-intervention. There were also some improvements in TSFT (5 out of 8 patients, 62.5%) and MAC (5 out of 8 patients, 62.5%) after 4 weeks, but they were not statistically significant (Table IV).

In the NG group, there were significant reductions in and serum albumin level in 7 out of 10 patients (70.0%, median Alb 41.00 at 0 week versus 36.00 at 4 weeks, p = 0.047) after 4 weeks of the intervention. There was also some reduction in MAC (5 out of 10 patients, 50%) after 4 weeks of the intervention, but it was not statistically significant (Table V).

Throughout the study period, treatment failure occurred in 5 out of 10 patients (50.0%) in the NG group, but none in the PEG group and the difference was statistically significant. Three of the treatment failures were due to recurrent tube dislodgement (3 or more occasions) and the other two were due to the combination of tube dislodgement and blockage (3 or more occasions) (Table VI).

Table I: Comparison of baseline characteristics between the NG and PEG group

		NG	PEG	p value
Number of patients		12	10	
Median age (years)		72.0 (54 – 77)	65.0 (48 – 79)	0.766
Gender	Female (N)	6	5	1.00
	Male (N)	6	5	
Race	Malay (N)	5	3	0.675
	Chinese (N)	7	7	
Mean number of risk factors		3.7 +/- 1.4	3.80+/- 1.5	0.463
Mean Glasgow coma score		12.9+/- 1.2	12.80 +/- 1.135	0.757
Cerebral infarct subtype	Lacunar (N)	4	3	1.00
	Large (N)	8	7	
Total number of prescribed feeding	196 (N)	6	3	0.637
	203 (N)	4	5	

Abbreviations: N- number of patients

Table II: Comparison of anthropometric parameters and serum albumin level between the NG and PEG group at baseline (0 week)

	NG (N = 12)	PEG (N = 10)	p value
Median TSFT (mm)	12.4 (11 – 33)	19.4 (8.8 – 34)	0.052
Median BSFT (mm)	7.8 (4.8 – 17)	10.5 (4.8 – 12)	0.974
Median MAC (cm)	28.7 (24 – 38)	31.1 (24 – 37)	0.099
Median Alb (g/L)	39.5 (33 – 46)	37.0 (31 – 41)	0.144

Table III: Comparison of anthropometric parameterson and serum albumin level between the NG and PEG group at 4 weeks post-intervention

	NG (N = 10)	PEG (N = 8)	p value
Median TSFT (mm)	12.7 (9.8 –32)	20.1 (9.6 – 34)	0.076
Median BSFT (mm)	7.4 (4.4 – 15)	10.3 (4.8 – 13)	0.533
Median MAC (cm)	27.8 (21 – 37)	31.4 (22 – 36)	0.182
Median Alb (g/L)	36.0 (31 – 45)	39.5 (36 – 44)	0.045

Table IV: Comparison of anthropometric parameters and serum albumin level between 0 week and 4 weeks post-intervention for the PEG group (N = 8)

	At 0 week	At 4 weeks	p value
Median TSFT (mm)	19.4 (8.8 – 34)	20.1 (9.6 – 34)	0.141
Median BSFT (mm)	11.2 (4.8 – 12)	10.3 (4.8 – 13)	0.865
Median MAC (cm)	31.1 (24 – 37)	31.4 (22 – 36)	0.674
Median Alb (g/L)	37.0 (31 – 41)	39.5 (36 – 44)	0.024

Table V: Comparison of anthropometric parameters and serum albumin level between 0 week and 4 weeks post-intervention for the NG group (N = 10)

	At 0 week	At 4 weeks	p value
Median TSFT (mm)	12.4 (11 – 33)	12.7 (9.8 –32)	0.312
Median BSFT (mm)	7.8 (4.8 – 17)	7.4 (4.4 – 15)	0.399
Median MAC (cm)	28.6 (24 – 38)	27.8 (21 – 37)	0.141
Median Alb (g/L)	41.0 (33 – 46)	36.0 (31 – 45)	0.047

Abbreviations:
TSFT- triceps skin-fold thickness
BSFT- biceps skin-fold thickness
MAC- mid-arm circumference
Alb- serum albumin level

Table VI: Comparison of the occurrence of treatment failure between the NG and PEG group at 4 weeks post-intervention

		NG	PEG	Total	p value
Treatment failure	No	5 (50.0%)	8 (100.0%)	13	0.036
	Yes	5 (50.0%)	0 (0%)	5	
Total		10	8	18	

Discussion

Percutaneous endoscopic gastrostomy tube insertion was first performed in 1981 by Ponsky and Gauderer as an alternative method for enteral feeding[5]. It was originally designed to provide nourishment for children who were unable to swallow because of neurological problems. PEG tubes are now frequently used in adults who have diseases or conditions that make it difficult to swallow or eat voluntarily. Currently, most patients receiving PEG tubes are elderly and the most common reasons are stroke, neurological disease and head trauma. An audit done in United States showed the number of hospitalized elderly patients undergoing the procedures increased from 61,000 to 121,000 between 1988 to 1995[11]. Unfortunately, no audit had being carried out in our local setting for comparison. In this study, the success rate for PEG tubes insertion was 100%. This is comparable with the average success rate for PEG tubes insertion of 95% or more in American studies[6,7,15].

There are not many studies comparing prospectively the outcome of NG with PEG tube[16-19] especially comparing prospectively the efficacy of PEG with NG at such an early stage after acute dysphagic stroke[12,16]. In our study that involved 22 patients, the two study groups were well matched in terms of the age, gender, race, number of risk factors, subtype of cerebral infarct and Glasgow coma score. The total number of prescribed feeding, baseline anthropometric parameters and serum albumin level were also comparable between these two groups.

In this study, there was a significantly higher serum albumin level in the PEG as compared to the NG group at 4 weeks post-intervention. In comparison with a previous study conducted by Norton et al[17] there were earlier significant change in the serum albumin level in our study (4 versus 6 weeks).

There was statistically significant improvement in the serum albumin level in the PEG group; and statistically significant reduction in the serum albumin level in the NG group 4 weeks after the intervention. Our result is consistent with the study done by *Park et al* that showed improvement in the serum albumin level in the PEG group[18] after 4 weeks and the study done by Kim et al that demonstrated statistically significant reduction in the serum albumin level in the NG group[16]. The statistically higher serum albumin level in the PEG than NG group and the statistically significant improvement in serum albumin level in the PEG group after 4 weeks can be explained by the lower treatment failure in the PEG than NG group.

In the study done by Norton et al, there was statistically significant improvement in MAC in the PEG group; and statistically significant reduction in MAC in the NG group after 6 weeks[17]. In our study, there was also some improvement in MAC in the PEG group; and some reduction in MAC in the NG group after 4 weeks. However, these were not statistically significant and most probably ascribable to the small number of patients and shorter study follow-up in our study. The study done by *Park et al* also demonstrated some improvement in MAC in the PEG group after 4 weeks, but this was also not statistically significant[18].

This study also demonstrated some improvement in TSFT in the PEG group after 4 weeks, however this was not statistically significant as demonstrated in the study conducted by Park et al[18]. This could be also due to the small number of patients and shorter study follow-up in this study. There were no previous studies comparing BSFT between the NG and PEG group. Our studies did not show any statistical difference in BSFT between the NG and PEG group at 4 weeks post-intervention; and statistically no significant changes in BSFT in each group after 4 weeks of the intervention. One previous study demonstrated statistically significant improvement in body weight in PEG group; and statistically significant reduction in body weight in the NG group after 4 weeks of the intervention[17]. Another study also showed similar results as early as one week after the intervention[18]. However, we did not include this anthropometric parameter in our study because it is not a good indicator of the nutritional status as it is very dependent on the total body fluid.

However, few studies done previously on the long-term nutritional effect of tube feeding among demented elderly patients in nursing homes demonstrated that weight loss and depletion of lean body mass persisted; and other nutritional markers such as haemoglobin concentration and serum albumin level did not show any significant improvements despite generous amounts of standard enteral formulas were provided via PEG feeding tubes. The persistent malnutrition in these chronically tube-fed patients in the face of adequate amounts of formula suggest that "the long-term effects of chronic disease, immobility, and neurologic defects may undermine attempts at long-term nutritional support"[20-22].

In our study, the rate of treatment failure was significantly lower in the PEG group (0%, none out of 8 patients) than NG group (50.0%, 5 out of 10 patients). The significantly higher treatment failure rate in the NG group can be explained by their smaller internal diameter as compared to the PEG tube (3.3 mm versus 5.5 mm) leading to blockage. NG tube also causes discomfort leading to self-extubation and treatment failure. This result is comparable to the study done by *Norton et al*, where the occurrence rate of treatment failure was 0% for the PEG group as compared to 50.0% (3 out of 6 patients) for the NG group[17]. In addition, the study done by *Park et al* showed a significantly lower occurrence rate of treatment failure in the PEG group (0%) than NG group (95.0%, 18 out of 19 patients)[18].

The shortcomings of the present study were the small number of subjects and short study follow-up. There were not many patients admitted with dysphagic stroke who fulfilled the inclusion and exclusion criteria over the 6-month period. In addition, not all eligible subjects were keen for PEG tube insertion as the procedure is quite invasive. Therefore, a longer recruitment period is necessary in order to obtain a larger number of subjects. A longer study follow-up is also necessary in order to obtain a significant improvement in some of the anthropometric parameters. Thus, a longer recruitment period and a longer study follow-up, may affect some of the outcome measures, which were not significant in this study.

Conclusion

PEG tube feeding is more effective than NG tube feeding in improving the nutritional status (in terms of the serum albumin level) of patients with dysphagic stroke.

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