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Original Article

Effect of tube feeding method on establishment of oral intake in stroke patients with dysphagia: comparison of intermittent tube feeding and nasogastric tube feeding

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ABSTRACT

Sugawara H, Ishikawa M, Takayama M, Okamoto T, Sonoda S, Miyai I, Fujitani J, Tsubahara A. Effect of tube feeding method on establishment of oral intake in stroke patients with dysphagia: comparison of intermittent tube feeding and nasogastric tube feeding. Jpn J Compr Rehabil Sci 2015; 6: 1−5.

Purpose: To compare the effects of two tube feeding management methods; nasogastric tube feeding and intermittent tube feeding, implemented during the process of rehabilitation for dysphagia due to cerebrovascular disorders on the outcome of oral intake.

Methods: Dysphagic patients who were admitted to convalescent rehabilitation wards because of cerebrovascular disorders were divided into two groups: 398 patients who underwent nasogastric tube feeding (NG group) and 114 patients who underwent intermittent tube feeding (ITF group). The two groups were compared with respect to outcome of dysphagia rehabilitation.

Results: The proportion of patients who were able to meet nutrition needs by oral intake of three meals alone at discharge was significantly higher in the ITF group than in the NG group (71% versus 53%, $p = 0.0007$). The proportion of patients showing improvement in food intake level scale (FILS) during hospitalization was also significantly higher in the ITF group ($p = 0.007$). The mean duration from admission to start of direct training was significantly shorter in the ITF group than in the NG group (9.6 ± 13.9 days versus 19.1 ± 25.8 days, $p = 0.001$). The mean duration from admission to start of oral food intake was also significantly shorter in the ITF group than in the NG group (20.1 ± 26.4 days versus 27.3 ± 31.8 days, $p = 0.049$).

Conclusion: The results in this study suggest that tube feeding management using ITF achieves better outcome of dysphagia rehabilitation compared to using NG.

Key words: intermittent tube feeding, nasogastric tube feeding, convalescent rehabilitation ward, dysphagia rehabilitation, cerebrovascular disorder

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Introduction

Tube feeding methods are mainly classified into nasogastric tube feeding (NG), intermittent tube feeding (ITF), gastrostomy tube feeding, and enterostomy tube feeding. NG and ITF require no

surgical procedures and can be implemented more simply and rapidly than gastrostomy and enterostomy tube feeding, and are therefore commonly used in nutrition management from the acute to convalescent phase of cerebrovascular disorders [1−3].

NG has the merits of "easy to initiate because medical professionals are familiar with the technique" and "low-cost". Conversely, many demerits have been reported, including "feeding tube interferes with the epiglottis and impairs swallowing movement", "the regurgitation preventing mechanism of the cardia is reduced, increasing the risk of gastroesophageal reflux", "since a fine tube is commonly used, feeding takes time with negative impact on the schedule of ambulation and rehabilitation", "nose and throat become contaminated easily", "upper respiratory tract secretion increases", "constant discomfort in the nose and throat, causing great distress to patients", and "unnecessary patient restraint may be used to prevent self-extraction" [1−6].

On the other hand, ITF has many merits in facilitating the progress of rehabilitation, including "swallowing the tube at every feeding is a swallowing training", "since food is introduced into the esophagus, the more physiological passage of food bolus stimulates the peristaltic motion of the esophagus with favorable effects on digestive functions; reduced risk of diarrhea and gastroesophageal reflux can be expected", "the duration of feeding can be reduced, so that ambulation and rehabilitation can be scheduled more easily", "patient distress is reduced because they are relieved from the feeding tube except during feeding", and "can undergo direct training in a state without the feeding tube". On the other hand, demerits of "medical care personnel is not familiar with the technique", "more labor intensive for nurses than NG", "cough during feeding may induce vomiting", and "patient distress may increase as the number of tube insertion increases" have been cited [1−3, 7].

Although the superiority of ITF in facilitating progress of dysphagia rehabilitation has been reported [1−3], to what extent ITF affects the outcome of swallowing function has not been adequately verified.

We conducted a multicenter study on dysphagia rehabilitation in convalescent rehabilitation wards with the purpose to examine the effect of tube feeding methods on the outcome of oral intake.

Subjects and Methods

Subjects

A multicenter survey on dysphagia rehabilitation in 25 convalescent rehabilitation wards was conducted in February 2013. A total of 641 "stroke patients who were not able to meet the required energy and water intake by oral intake alone at admission to a convalescent rehabilitation ward" (mean number of patients per facility: 25.6 ± 5.1) were identified and studied retrospectively with respect to the items described below. The 641 patients were divided into a group of 398 who underwent nasogastric tube feeding (NG group) and a group of 114 who underwent intermittent tube feeding (ITF group) at admission to the convalescent rehabilitation ward. The two groups were compared. 129 patients who received gastrostomy tube feeding, central parenteral nutrition or peripheral parenteral nutrition at admission were excluded.

Items analyzed (*: evaluated at admission, **: evaluated at admission and at discharge)

The items analyzed were as follows: gender, age, diagnosis (cerebral infarction, cerebral hemorrhage, subarachnoid hemorrhage, others), lesion (supertenorial, infratentorial), number of previous strokes, modified Rankin Scale (m-RS)**, functional independence measure (FIM)**, tracheotomy status*, body mass index (BMI)**, recommended calorie intake**, serum albumin (Alb), serum total protein (TP)**, status of pneumonia during admission, day of onset, length of stay (days) in convalescent rehabilitation ward, day of starting direct training, day of starting oral intake, and FILS**. To facilitate comparison of swallowing outcome, patients were stratified according to FILS into three categories: levels 1 to 3; no oral intake (NOI), levels 4 to 6; oral intake and alternative nutrition (OAN), and levels 7 to 10; oral intake alone (OIA).

Statistical analysis

Statistical analyses were performed using JMP version 9.0.2 (SAS Institute Inc., USA) for Windows. Comparison of continuous variables between two groups was conducted using *t*-test. Comparisons of mRS scores among three FILS categories was conducted using Mann-Whitney *U* test. Category variables were compared using χ^2 test. The significance level was set at two-tailed 5%.

Results

1. Patient background (Table 1)

No significant differences between the NG group and ITF group were observed with respect to gender, age, diagnosis, lesion, number of previous strokes, as well as BMI, m-RS, FIM score, tracheotomy status, recommended calorie intake, TP, and FILS categories at admission. Alb at admission was significantly higher in the ITF group than in the NG group ($p = 0.029$). The duration from onset to admission to convalescent rehabilitation ward was significantly shorter in the ITF group than in the NG group ($p = 0.011$).

2. Outcome (Table 2)

2.1 Time of starting direct training and oral food intake (Figure 1)

The mean duration from admission to start of direct

Table 1. Patient background.

Item	NG group	ITF group	*P* value
Gender (male/female)	241/157	65/49	0.497†††
Age (mean ± SD); years	72.9 ± 12.6	73.2 ± 12.1	0.848†
Diagnosis (cerebral infarction / cerebral hemorrhage / subarachnoid hemorrhage / others)	171/161/51/13	56/45/13/0	0.201†††
Lesion (supertenorial / infratentorial / both)	64/270/8	20/89/1	0.635†††
No. of previous strokes (none / once / twice or more)	273/85/29	73/29/11	0.468†††
mRS at admission (1/2/3/4/5)	2/3/9/89/275	1/2/4/37/70	0.497††
FIM motor score at admission (mean ± SD)	18.6 ± 12.2	19.5 ± 14.5	0.508†
FIM cognitive score at admission (mean ± SD)	11.7 ± 7.7	10.3 ± 7.2	0.092†
Tracheotomy (no / yes)	353/44	106/8	0.206†††
BMI at admission (mean ± SD)	20.6 ± 3.6	20.5 ± 3.1	0.811†
Recommended calorie intake at admission (mean ± SD); kcal/kg	25.1 ± 6.1	25.7 ± 5.8	0.351†
Alb at admission (mean ± SD); g/dl	3.3 ± 0.4	3.4 ± 0.4	0.029†
TP at admission (mean ± SD); g/dl	6.5 ± 0.6	6.6 ± 0.6	0.628†
FILS category at admission (NOI/OAN/OIA)	304/77	96/18	0.293††
FILS score at admission (1/2/3/4/5/6)	15/204/85/35/29/13	0/53/43/10/8/0	0.150††
Duration from onset to admission (mean ± SD); days	43.7 ± 20.3	38.4 ± 16.3	0.011†

NG, nasogastric tube feeding; ITF, intermittent tube feeding; mRS, modified Rankin Scale; FIM, functional independence measure; Alb, serum albumin; TP, serum total protein; FILS, food intake level scale ; NOI, no oral intake; OAN, oral intake and alternative nutrition; OIA, oral intake alone. † *t*-test, †† Mann-Whitney *U* test, †††χ^2 test.

Table 2. Outcome.

Item	NG group	ITF group	*P* value
Change in mRS from admission to discharge (worsened / unchanged / improved)	2/181/190	2/53/44	0.213†††
FIM-motor gain from admission to discharge (mean ± SD); points	14.1 ± 17.0	14.1 ± 16.7	0.977†
FIM-cognitive gain from admission to discharge (mean ± SD); points	4.2 ± 5.6	5.3 ± 6.1	0.070†
Change in BMI from admission to discharge (mean ± SD)	− 0.6 ± 1.7	− 0.4 ± 1.5	0.213†
Change in recommended calorie intake from admission to discharge (mean ± SD); kcal/kg	3.7 ± 7.0	4.6 ± 6.8	0.265†
Change in Alb from admission to discharge (mean ± SD); g/dl	0.21 ± 0.40	0.19 ± 0.43	0.712†
Change in TP from admission to discharge (mean ± SD); g/dl	0.02 ± 0.61	− 0.06 ± 0.68	0.346†
Onset of pneumonia during hospitalization (no /yes)	290/87	91/23	0.515†††
FILS category at discharge (NOI / OAN / OIA)	113/62/201	18/15/80	0.0007††
Change in FILS from admission to discharge (worsened / unchanged / improved)	19/76/272	1/13/99	0.007†††
Duration from admission to start of direct training (mean ± SD); days	19.1 ± 25.8	9.6 ± 13.9	0.001†
Duration from admission to start of oral intake (mean ± SD); days	27.3 ± 31.8	20.1 ± 26.4	0.049†

NG, nasogastric tube feeding; ITF, intermittent tube feeding; mRS, modified Rankin Scale; FIM, functional independence measure; Alb, serum albumin; TP, serum total protein; FILS, food intake level scale; NOI, no oral intake; OAN, oral intake and alternative nutrition; OIA, oral intake alone. † *t*-test, †† Mann-Whitney *U* test, †††χ^2 test.

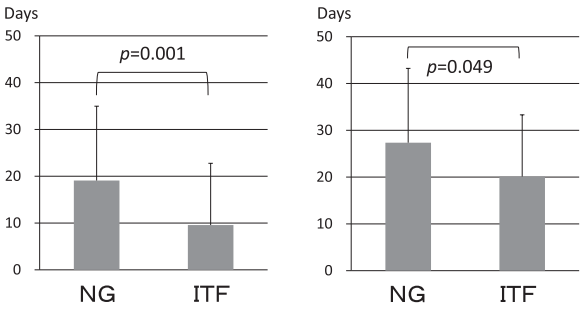

Figure 1. Mean duration (days) from admission to start of direct training (left) and of oral intake (right).
NG, nasogastric tube feeding; ITF, intermittent tube feeding. The ITF group started direct training earlier than the NG group. The ITF group also started oral food intake earlier than the NG group.

training was 9.6 ± 13.9 days in ITF group and 19.1 ± 25.8 days in the NG group, with the ITF group starting direct training significantly earlier (p = 0.001). The mean duration from admission to start of oral food intake was 20.1 ± 26.4 days in the ITF group and 27.3 ± 31.8 days in the NG group and, with the ITF group starting oral food intake significantly earlier (p = 0.049).

2.2 Swallowing outcome

The proportion of patients achieving oral intake alone (OIA) at discharge was 71% in the ITF group and 53% in the NG group, and was significantly higher in the ITF group (Figure 2). In addition, the proportion of patients with improved FILS during hospitalization was 88% in the ITF group and 74% in the NG group, and was also significantly higher in the ITF group (Figure 3).

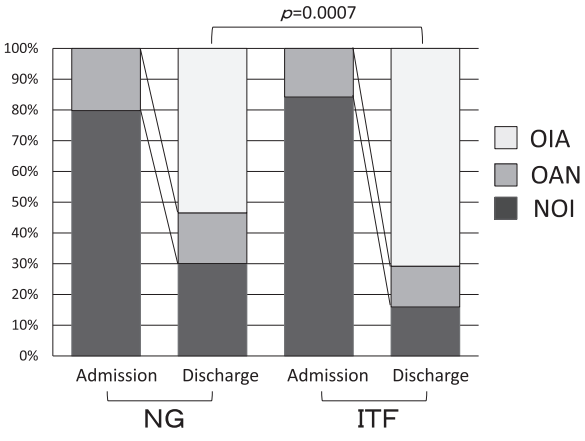

Figure 2. The proportions of three FILS categories at admission and at discharge.
NG, nasogastric tube feeding; ITF, intermittent tube feeding; FILS, food intake level scale; NOI, no oral intake; OAN, oral intake and alternative nutrition; OIA, oral intake alone. The proportion of oral intake alone at discharge was 71% in the ITF group and 53% in the NG group, and was significantly higher in ITF group.

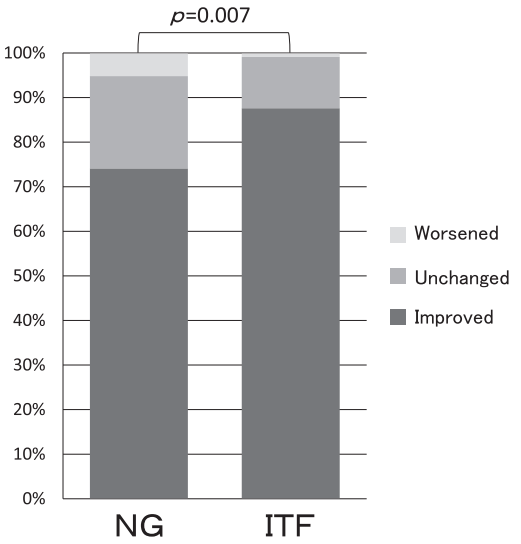

Figure 3. Changes in FILS during hospitalization in ITF group and TF group.
NG, nasogastric tube feeding; ITF, intermittent tube feeding; FILS, food intake level scale. The proportion of improved FILS was 88% in the ITF group and 74% in the NG group, and was significantly higher in the ITF group.

2.3 Other items

The complication rate of pneumonia was 23.1% in the NG group and 20.2% in the ITF group, with no significant difference between two groups. Other items including change in mRS from admission to discharge, FIM gains, change in BMI, change in recommended calorie intake, change in Alb, and change in TP were not significantly different between two groups.

Discussion

We divided stroke patients who required tube feeding at admission to convalescent rehabilitation wards into the NG group and ITF group, and compared the outcome of oral intake of the two groups. Regarding the clinical profiles of the two groups, while differences in Alb and duration from onset to admission were observed, all other items showed no significant differences.

The proportion of patients requiring tube feeding at admission who were able to meet nutritional needs by oral intake of three meals alone at discharge was higher in the ITF group (71%) than in the NG group (53%), and the proportion of patients showing improved FILS during hospitalization was also higher in the ITF group. Similar results were reported previously by Kisa et al. [3], who divided stroke patients with dysphagia into NG group (30 patients) and ITF group (29 patients) and compared the two groups. The proportion of patients capable of oral intake was 69.0% in the ITF group 36.7% in the NG groups, showing a higher rate of achieving oral intake

in the ITF group. Our results were consistent with their findings, suggesting a possibility that implementation of ITF has favorable impact on the outcome of dysphagia rehabilitation.

The present study was conducted in convalescent rehabilitation wards, and the quantity and quality of dysphagia rehabilitation are unlikely to differ greatly among facilities, but the time and details of dysphagia training was not surveyed in the study. It is noteworthy that the rate of conducting ITF differed considerably among the participating facilities. If facilities that are capable of conducting ITF provide higher level of dysphagia rehabilitation, then the possibility that this is a confounding factor that impacts the outcome cannot be denied.

Previous studies have reported that implementation of ITF has a positive impact on the outcome of dysphagia rehabilitation, and the factors involved include "swallowing the tube at every feeding is a swallowing training", "the time of feeding can be reduced, so that ambulation and rehabilitation can be scheduled more easily", "patient distress is reduced since they are relieved from the feeding tube except during feeding", and "can undergo direct training in a state without the feeding tube" [1−3].

Nohara et al. [7] inserted and placed nasogastric tubes in normal subjects and reported increased swallowing activity immediately after insertion, but conversely reduced swallowing activity with prolonged placement. A possible explanation is that stimulation by insertion of the nasogastric tube induces swallowing reflex, while adaptation to the tube upon prolonged placement increases the threshold of swallowing reflex. Because ITF promotes swallowing reflex during insertion and avoids reflex inhibition due to long-term placement, it may be considered a better feeding management method than NG.

Nishi et al. [5] placed nasogastric tubes in healthy subjects and observed increases in pharyngeal residue and esophageal reflux. Ohno et al. [4] compared the videofluorographic findings of dysphagic patients during nasogastric tube placement and after tube extraction, and reported improvements in epiglottis inversion, pharyngeal residue, and aspiration after the nasogastric tube was extracted. Placement of a nasogastric tube probably impairs patients' natural swallowing performance, delays the start of direct training, and consequently lowers the efficacy of rehabilitation. In the present study also, the durations to start of direct training and of oral food intake were shorter in the ITF group. Early start of direct training increases the practice of swallowing and improves rehabilitation efficacy, which is probably a factor that improves the outcome.

On the other hand, various demerits in implementing ITF have been cited, including "medical care personnel is not familiar with the technique", "more labor intensive for nurses than NG", "tube cannot be swallowed in the presence of strong pharyngeal reflex", "cough or hiccup during feeding may induce vomiting", and "patient distress may increase as the number of tube insertion increases". Therefore, indication for ITF has to be considered carefully.

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