ORIGINAL

Swallowing rehabilitation with nutrition therapy improves clinical outcome in patients with dysphagia at an acute care hospital

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Abstract : Dysphagia is associated with nutritional deficits and increased risk of aspiration pneumonia. The aim of the present study was to evaluate the impact of nutrition therapy for the patients with dysphagia at an acute care hospital. We also tried to clarify the factors which improve swallowing function in these patients. Seventy patients with dysphagia were included in the present study. Multidisciplinary nutrition support team evaluated swallowing function and nutrition status. Most patients were fed by parenteral or enteral nutrition at the time of the first round. Of these 70 patients, 36 became able to eat orally. The improvement of swallowing function was associated with higher BMI in both genders and higher AMC in men. Mortality was high in the patients with lower BMI and %AMC, suggesting importance of maintaining muscle mass. Thirteen (38.2%) of 34 patients who did not show any improvement in swallowing function died, but no patients who showed improvement died (p<0.001). In addition, the patients with nutrition intake about <22 kcal/kg/day during follow-up period, showed significantly poorer recovery from dysphagia and poor outcome, compared to those with about >22 kcal/kg/day. These results suggest that it is important to maintain nutritional status to promote rehabilitation in patients with dysphagia even in an acute care hospital. J. Med. Invest. 61 : 353-360, August, 2014

Keywords **:** *dysphagia, nutrition therapy, swallowing rehabilitation, acute care hospital*

INTRODUCTION

Dysphagia occurs by various pathological conditions including stroke, neurological disorders, head and neck cancers, pneumonia and dementia. Dysphagia is associated with increased mortality and morbidity (1). In addition, dysphagia is a major risk factor for malnutrition, that in turn, delays patient recovery, and is an independent predictor of poor clinical outcome (2, 3). Swallowing function changes with ageing, therefore, in the elderly, the prevalence of dysphagia is higher than younger peoples (1, 4-7). For treatment of dysphagia, various methods were developed, i.e., acupuncture, drug

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therapy, electrical stimulation, surgical therapy and rehabilitation. Nutrition therapy is also one of the important treatments for dysphagia.

In our acute care hospital, we usually start treatment soon after the onset of dysphagia. Nutrition support team (NST) assessed swallowing function of patients with dysphagia and evaluated whether the provided meals were appropriate to them. At the rounds by NST, we always suggest preferable route of feeding and amount of required nutrients depending on the swallowing function and rehabilitation program for the patients.

There are many studies concerning relation with the dysphagia and nutrition therapy during the rehabilitation periods, however, there are few studies that described the effect of combination nutrition therapy and swallowing rehabilitation on the clinical outcome at an acute care hospitals. The aim of the present study was to evaluate the usefulness of nutrition therapy for the patients with dysphagia at an acute care hospital. We also tried to clarify the factors which improve dysphagia in these patients.

PATIENTS AND METHODS

We recruited retrospectively all patients who had dysphagia at an acute care hospital, Kobe City Medical Center General Hospital, Kobe, Japan, between November 2008 and October 2010. At this rounds, multidisciplinary nutrition support team, consisting of doctors, dentists, registered dietitians, speech therapists, and nurses, evaluated swallowing function and nutritional status, such as height, weight, triceps skinfold thickness (TSF ; mm), and arm circumference (AC ; cm), amount of energy and protein intake, route of feeding at the time of the round (before support) and the day before leaving the hospital (after support). After excluding patients with missing data, 70 patients (53 men, 17 women) were included for analysis in the present study. The study was undertaken with the approval of the research ethics committee of Kobe City Medical Center General Hospital and in accordance with the Declaration of Helsinki.

The heights were measured at the time of admission and the weight values were used at the most recent day of the round. TSF and AC were measured by registered dietitians with Adipometer and Inser-Tape (Abbott Japan Co., Ltd., Tokyo, Japan). Arm muscle circumference (AMC ; cm) was calculated by using the following formula : $AMC(cm) = AC(cm) - 3.14 \times TSF(mm)$. %TSF and %AMC were calculated based on the Japanese Anthropometric Reference Data : JARD2001 (8). Basal energy expenditure (BEE) was estimated using the Harris-Benedict Equation (HBE).

Women : $BEE = 655 + (9.6 \times Weight) + (1.8 \times Height) - (4.7 \times Age)$,

Men : $BEE = 66.5 + (13.8 \times Weight) + (5 \times Height) - (6.8 \times Age)$.

The amount of energy and protein intake was calculated from all routes of feeding, i.e., oral intakes, enteral nutrition (EN) and parenteral nutrition (PN) before and after support. Amounts of oral intakes on the days before the first rounds and before leaving the hospital were obtained from the dietary recordings of medical chart of each patient. The values were normalized by actual body weight, i.e. body weight on first round.

The patient outcome was evaluated as discharge to home (discharge group), transfer to other hospital for rehabilitation (hospital transfer group) and death (death group). Furthermore, we categorized the final swallowing function into the following two groups, improved group and non-improved group. We defined the group who became able to eat orally and who did not have to use "swallowing modified diet" as the improved group, and the group who became unable to eat (including the patients who became able to eat only "swallowing modified diet") or who fed only EN or PN as the non-improved group. We investigated these groups whether there is relationship between amount of nutrients, energy and protein, and type of discharge or improvement of swallowing function. Primary outcome is type of discharge (death), and secondary outcome is improvement of swallowing function.

Data were expressed as mean $\pm$ SD. Statistical significance was assessed by one-way ANOVA followed by post-hoc testing using the Turkey-Kramer procedure for the comparison of patient outcome. The swallowing function was compared using Mann-Whitney U-test. $P \leq 0.05$ was considered statistically significant in all analyses.

RESULTS

1. Patients background

Table 1 shows the underlying diseases of studied 70 patients ; pulmonary disease (20 patients), heart disease (14 postoperative patients and 8 patients in internal medicine), general surgery (11 patients),

Table 1 Background of the Patients.

	n	Age (years)	BMI	%TSF	%AMC
Pulmonary disease	20	76.5±10.9	18.7±3.6	58.9±33.9	87.8±12.4
Heart disease (Postoperative)	14	73.8±8.4	22.0±2.9	90.5±32.4	96.5±14.9
General surgery	11	75.6±6.7	21.4±3.1	95.6±34.8	94.0±11.0
Heart disease (Internal medicine)	8	76.1±12.4	21.4±3.1	92.5±38.5	100.7±15.8
Gastrointestinal disease	4	73.3±11.9	21.6±4.3	102.4±83.2	95.6±13.9
Neurosurgery	3	58.3±14.5	19.4±2.3	88.0±25.7	89.7±3.0
Kidney disease	3	78.3±1.2	18.4±0.9	65.0±50.7	87.7±6.6
Others	7	64.4±10.3	21.4±6.1	75.5±54.6	91.7±9.8
All	70	73.7±10.6	20.5±3.7	80.5±41.8	92.9±12.9

Data are mean±SD.
BMI : body mass index, %TSF : % triceps skinfold thickness, %AMC : % arm muscle circumference.

gastrointestinal disease (4 patients), neurosurgery (3 patients), kidney disease (3 patients), and the others (emergency department, nephrology, orthopedics, respiratory surgery, urology, otolaryngology, 7 patients in total). Table 1 also shows baseline demographic and clinical characteristics. The mean days of observation were 45.5 days (range 5-244 days).

Although no patients showed severe malnutrition in the present study, patients with pulmonary diseases and kidney disease tended to have lower BMI and %TSF compared to other patients, suggesting the decreased energy reserves as fat. Furthermore, patients with pulmonary disease, kidney disease and neurosurgery showed slightly lower %AMC, i.e., wasting of the body muscle.

Of 70 patients, swallowing function was improved in 36 patients after support and was not improved in 34 patients. Of 70 patients, 31 were discharged, 26 were transferred to different hospitals and 13 died.

2. Relationship between nutritional states and outcome of the patients

Table 2 compared the various parameters of patients with and without improvement of dysphagia by swallowing rehabilitation. Those who succeeded in rehabilitation and became able to eat orally (the improved group), showed significantly higher BMI (p=0.004) and BEE (p=0.010) at baseline compared to those without improvement (the non-improved group). Figure 1 shows AMC before support in men and women with and without improvement of dysphagia. Although there was no significant difference in %AMC between two groups in total (Table 2), there was a highly significant difference in AMC of men (22.3±4.0 cm vs 19.1±3.4 cm ; p=0.001) as well as %AMC (97.0±11.6% vs 89.4±10.0% ; p=0.013) between those with and without improvement of dysphagia. In women, however, there was no difference in AMC between two groups. No significant difference was observed in %TSF between two groups.

Table 3 also compared various parameters patients. BMI and BEE at baseline were significantly higher in the discharge group than the death group (p=0.028, p=0.041). The %AMC and %TSF tended to be greater in the discharge group compared to other groups, although it did not reach the levels of statistical significance.

Table 2 The various parameters of patients with and without improvement of dysphagia by swallowing rehabilitation.

	All (n=70)	Improvement (n=36)	Non-improvement (n=34)	p-value
Age (years)	73.69±10.64	72.17±10.25	75.29±10.95	0.070
BMI	20.54±3.71	21.79±3.44	19.22±3.57	0.004
BEE (kcal/day)	1131.77±206.50	1192.69±217.08	1067.27±175.64	0.010
%AMC	92.90±12.85	95.66±12.45	89.98±12.80	0.111
%TSF	80.47±41.78	84.24±45.31	76.47±37.95	0.729
Support days (days)	45.47±43.31	36.03±23.45	55.47±56.02	0.213

Data are mean±SD.
BMI : body mass index, BEE : basal energy expenditure, %TSF : % triceps skinfold thickness, %AMC : % arm muscle circumference, Improved : the group who became able to eat orally or who did not have to use "swallowing modified diet", Non-improved : the group who became unable to eat (including the patients who became able to eat only "swallowing modified diet") or who fed only enterally or parenterally.

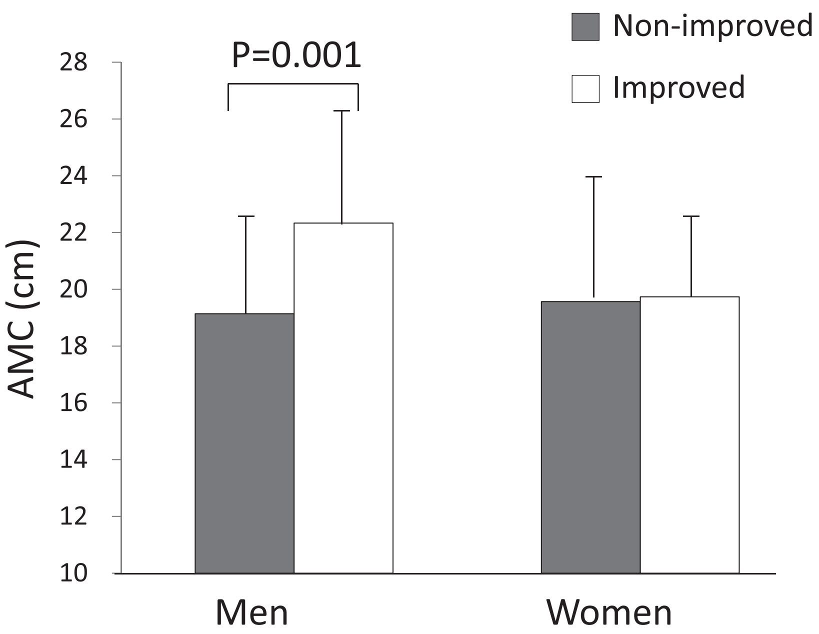

Figure 1 Difference in baseline arm muscle circumference (AMC) in those with and without improvement of dysphagia. The patients who became able to eat orally and did not have to use "swallowing modified diet" (Improved group) showed significantly greater AMC in men than those who could not eat and fed only enterally or parenterally (Non-improved group). However, there was no significant difference between two groups in women.

Table 3 The various parameters of patients of clinical outcome.

	All (n=70)	Discharge (n=31)	Hospital transfer (n=26)	Death (n=13)
Age (years)	73.69±10.64	72.23±10.43	74.58±10.85	75.38±11.10
BMI	20.54±3.71	21.61±3.03	20.30±4.14	18.49±3.59*
BEE (kcal/day)	1131.77±206.50	1188.17±179.90	1118.26±231.69	1024.31±177.00*
%AMC	92.90±12.85	95.13±10.59	92.93±14.55	87.51±13.55
%TSF	80.47±41.78	90.84±44.34	70.17±38.62	76.33±38.56
Support days (days)	45.47±43.31	37.39±28.25	44.04±38.59	67.62±70.59

Data are mean±SD.
*Significantly different from discharge group ($p< 0.05$)
BMI : body mass index, BEE : basal energy expenditure, %TSF : % triceps skinfold thickness, %AMC : % arm muscle circumference, Discharge : the group who discharge to home, Hospital transfer : the group who transfer to other hospital for rehabilitation, Death : the group who died.

3. Relationship between amount of energy and protein intake and outcome of the patients

At the time of the first round, there was no significant difference in energy and protein intake between the improved and non-improved groups, and even shortly after support (Table 4). However, several weeks after the support, energy intake tended to be higher in the improved group than in the non-improved group.

Similarly, there was no significant difference in energy and protein intake among the discharge, hospital transfer and death groups before support (Table 5). On the other hand, after support, energy intake was significantly higher in the discharge group than in the death group ($p=0.002$), and protein intake was significantly higher in the discharge group than the hospital transfer group ($p=0.017$) and the death group ($p< 0.001$).

4. Relationship between route of feeding and outcome of the patients

Most patients were fed from PN or EN at the first round. Of these patients, 40 became able to eat orally (Figure 2). Regarding the final route of feeding, no patients of the death group became able to eat orally (Figure 3). Furthermore, most patients (9 of 11 patients) who were fed only parenterally died. On the contrary, more than half of patients who became able to eat were discharged. Figure 4

Table 4 The energy and protein intake in the improved and non-improved group.

	All (n=70)	Improvement (n=36)	Non-improvement (n=34)	p-value
Before support				
Energy intake (kcal/day)	940.50±586.76	999.89±566.42	877.62±609.64	0.242
(kcal/kg/day)	18.26±11.43	18.55±10.70	17.96±12.39	0.556
Protein intake (g/day)	37.65±28.04	41.22±29.67	33.85±26.10	0.258
(g/kg/day)	0.75±0.61	0.79±0.68	0.71±0.54	0.706
After support				
Energy intake (kcal/day)	1124.77±507.41	1233.75±384.45	1009.38±595.74	0.092
(kcal/kg/day)	21.64±10.86	22.48±7.92	20.76±13.36	0.332
Protein intake (g/day)	45.60±22.23	49.55±14.99	41.22±27.56	0.258
(g/kg/day)	0.88±0.47	0.96±0.31	0.85±0.59	0.655

Data are mean±SD.
Improved : the group who became able to eat orally or who did not have to use "swallowing modified diet", Non-improved : the group who became unable to eat (including the patients who became able to eat only "swallowing modified diet") or who fed only enterally or parenterally, Before support : at the time of the first round, After support : the day before leaving the hospital.

Table 5 The energy and protein intake in clinical outcome.

	All (n=70)	Discharge (n=31)	Hospital transfer (n=26)	Death (n=13)
Before support				
Energy intake (kcal/day)	940.50±586.76	1021.55±539.20	819.96±627.86	988.31±616.91
(kcal/kg/day)	18.26±11.47	18.78±10.77	15.68±11.37	22.19±12.86
Protein intake (g/day)	37.65±28.04	39.48±24.83	33.73±33.02	41.06±29.67
(g/kg/day)	0.75±0.61	0.72±0.47	0.69±0.78	0.95±0.53
After support				
Energy intake (kcal/day)	1124.77±507.41	1327.84±370.45	1053.15±456.68	783.77±677.67**
(kcal/kg/day)	21.64±10.86	23.95±7.91	20.61±9.64	18.18±17.29
Protein intake (g/day)	45.60±22.23	56.01±14.06	40.89±20.01*	30.23±30.47***
(g/kg/day)	0.88±0.47	1.01±0.33	0.79±0.39	0.71±0.76

Data are mean±SD.
*Significantly different from the discharge group ($p< 0.05$)
**Significantly different from the discharge group ($p< 0.01$)
***Significantly different from the discharge group ($p< 0.001$)
Discharge : the group who discharge to home, Hospital transfer : the group who transfer to other hospital for rehabilitation, Death : the group who died, Before support : at the time of the first round, After support : the day before leaving the hospital.

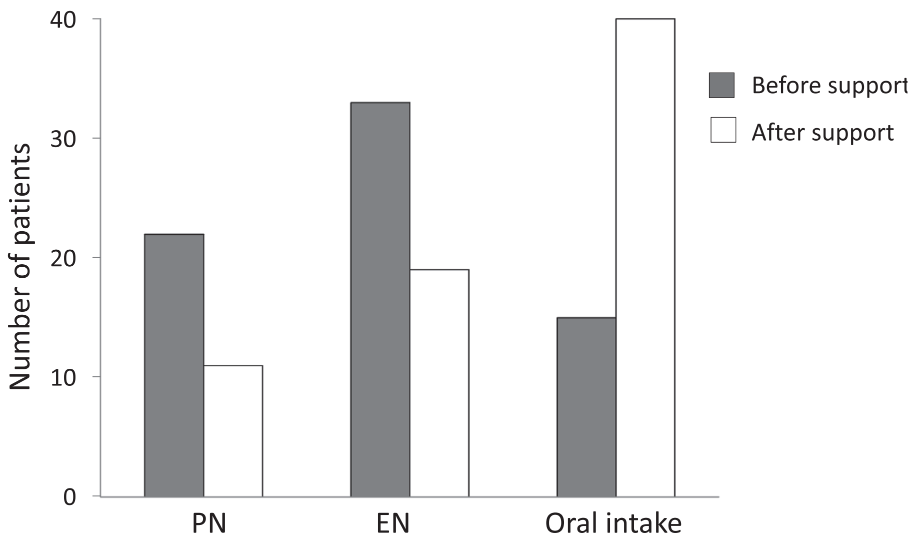

Figure 2 The routes of feeding before and after support. Of the patients, 40 became able to eat orally.
EN : enteral nutrition, PN : parenteral nutrition.

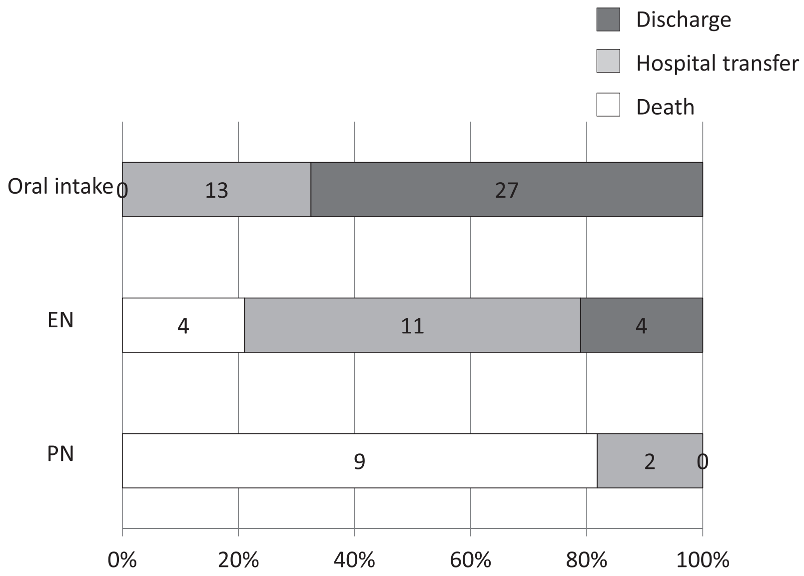

Figure 3　Relationship between route of feeding and outcome of the patients. The patients who became able to eat orally did not die, and they were discharged to their home or transferred to other hospitals. Most patients (9 out of 11 patients) who were fed parenterally (PN) died.
Discharge : the group who were discharged to home, Hospital transfer : the group who were transfered to other hospital for rehabilitation, Death : the group who died, EN : enteral nutrition.

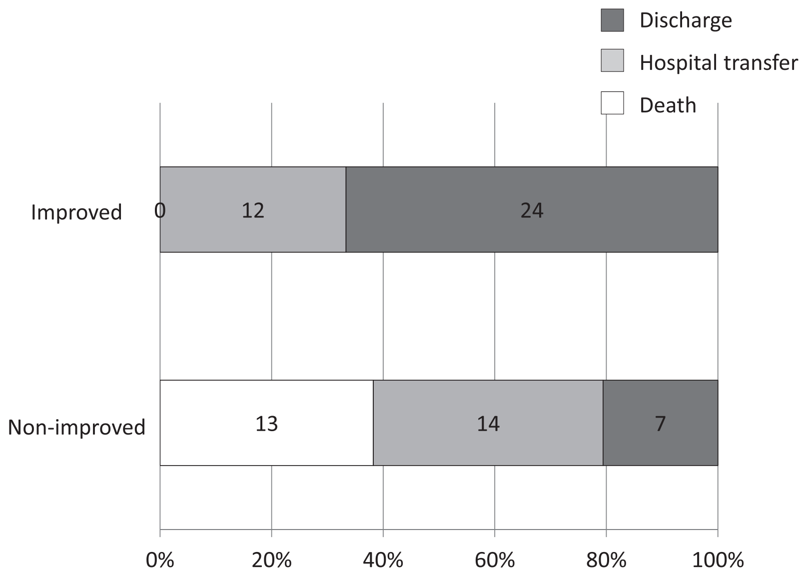

Figure 4　Relationship between the improvement of swallowing function and outcome of patients. Thirteen of 34 patients who did not show any improvement in swallowing function died, but no patients died who showed improvement.
Improved : the group who became able to eat orally or who did not have to use “swallowing modified diet”, Non-improved : the group who became unable to eat (including the patients who became able to eat only “swallowing modified diet”) or who fed only enterally or parenterally, Discharge : the group who discharge to home, Hospital transfer : the group who transfer to other hospital for rehabilitation, Death : the group who died.

shows that 13 (38.2%) of 34 patients who did not show any improvement in swallowing function died, but no patients died who showed improvement ($p < 0.001$), suggesting that the improvement of swallowing function is an important indicator of prognosis of the patients.

DISCUSSION

We assessed swallowing function of patients with dysphagia by multidisciplinary team and evaluated the relationship between the nutritional status, amount of provided nutrients, swallowing function and clinical outcome of patients at an acute care hospital. We found that BMI, and muscle mass in men, is strongly correlated with improvement of swallowing function and clinical outcome. Mortality was also high in the patients with lower BMI and %AMC. These results suggest that maintaining body weight especially muscle mass, is important for success in swallowing rehabilitation.

Lean body mass (LBM) and BMI are the important predictor of nutritional status or clinical prognosis (9, 10), and lower BMI is reported to be a risk factor to increase mortality in Japanese (11). It was reported that malnutrition is associated with poor rehabilitation outcome (12), but there was no study on the relationship between BMI and improvement of swallowing function. Our results showed that nutritional status is an important factor for successful swallowing rehabilitation. Especially, muscle mass was important to improve dysphagia in men in the present study. However, we could not find this improvement in women. We do not know exactly the mechanism of this gender difference, but it might be due, at least in part, to smaller sample size in women.

There was no study which reported how many nutrients should be fed to patients with dysphagia during an acute care hospital. We found that the clinical outcome was better in patients with higher provision of nutrients at the end of follow-up. The energy intake after support of the discharge group was about 1328 kcal/day, which is about 24 kcal/kg/day and about 1.1 times of BEE. Protein intake was 56 g/day and 1.01 g/kg/day, which also satisfied the recommended requirement for elderly person (13). According to Dietary Reference Intake for Japanese -2010 (14), the reference basal metabolic rate of 70s of age, is 21.5 kcal/kg/day for men and 20.7 kcal/kg/day for women. Alix *et al.* (15) showed that resting energy expenditure of the hospitalized elderly patients was 18.8 kcal/kg/day. Foley *et al.* (16) reported that the average energy intakes of acute stroke patients ranged from 19.4-22.3 kcal/kg/day and Aquilani *et al.* (17) recommended daily energy intakes > 25 kcal/kg/day after acute ischemic stroke.

Improvement of swallowing function was also related to the amount of nutrition intake. We provided adequate amount of nutrients to the patients after round by NST. Thus, there was no difference in initial provision of nutrients concerning to the improvement of swallowing function. However, at the end of intervention, energy intake of the hospital transfer group became less, i.e., about 1050 kcal/day, which did not reach the BEE. In present study, about 77% of patients who discharged to home improved the swallowing function and their intake was greater than BEE. On the other hand, more than half of the patients who were transferred to other hospitals for further rehabilitation did not show improvement in swallowing function. Similarly, energy intake of the non-improved group was also less than BEE. The present study showed that energy intake was more than BEE both in the improved groups. These results suggest that it is necessary to provide energy more than BEE (or about 22 kcal/kg/day) for successful swallowing rehabilitation even after transfer to other hospitals, or after discharge to home from rehabilitation hospital.

Present study is a retrospective study, which included patients with various kind of diseases and the causes of dysphagia and underlying diseases of the patients was variable. Another limitation of this study was randomization of the patients. It is often difficult to feed enough nutrients to critically ill patients, and this might be a reason why total energy intake was less in these patients. Therefore, we could not rule out the possibility that the patients without improved swallowing function had poorer outcome and were unable to be fed enough nutrients because of underlying diseases or of a poor durability.

In disagreement with our study, Crary *et al.* (4) reported no significant relationship between dysphagia and nutritional status in patients with ischemic stroke at hospital admission. On the other hand, malnutrition becomes more prevalent during post-acute rehabilitation phase (18-20), suggesting the importance of nutrition support. Dysphagia has been associated with increased mortality and morbidity (1). In addition, dysphagia is a major risk factor for malnutrition, and in turn, delays patient recovery from illness (2, 3). These studies as well as our study suggest importance of feeding enough nutrients in acute care hospitals in order to avoid malnourishment.

In conclusion, we found that it is important to provide adequate amount of nutrients to maintain the body weight and muscle during rehabilitation, and that success of swallowing rehabilitation leads to better clinical outcome in patients with dysphagia.

CONFLICTS OF INTEREST

The authors declare no conflict of interest relevant to this manuscript.

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