

〈Regular Article〉

## Physical activities in elderly patients with aspiration pneumonia after hip fractures

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**ABSTRACT** The present study aimed to investigate changes in physical activities during acute hospitalization in hip fracture patients with aspiration pneumonia. The medical records of 20 hip fracture patients (7 males, 13 females; mean age,  $84.8 \pm 7.6$  years) with aspiration pneumonia were retrospectively reviewed. Moreover, the pneumonia group was divided into two groups (9 preoperative pneumonia, 11 postoperative pneumonia). Twenty hip fracture patients (8 males, 12 females; mean age,  $82.2 \pm 6.4$  years) without comorbid pneumonia were randomly selected as a control group that was matched for sex and age. Patients' physical activities (ability to transfer from bed to wheelchair and to walk) before the fractures and at the time of discharge from the acute care wards were extracted from the medical records. Mean physical activity levels and mean decreases in physical activities were compared using the Functional Independence Measure version 3.1. The mean levels of the ability to transfer and walking ability at the time of discharge from the acute care wards decreased significantly in all groups and were significantly lower in the pneumonia groups than in the control group, with no differences between the preoperative and postoperative pneumonia groups. These results suggest that aspiration pneumonia might be significantly associated with decreased physical activities in hip fracture patients.

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Key words : Ability to transfer, Aspiration pneumonia, Hip fracture, Physical activity level, Walking ability

### INTRODUCTION

Aspiration pneumonia commonly occurs in persons who tend to aspirate food, liquid, or saliva because of dysphagia due to conditions such

as stroke, other brain damage, neuro-muscular diseases, oropharyngolaryngeal diseases, esophageal disorders, ingestion of sedatives, and altered levels of consciousness<sup>1-3)</sup>. The incidence of aspiration

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pneumonia is likely to increase with the increase in the elderly population with factors predisposing them to aspiration<sup>4-6</sup>. On the other hand, the incidence of hip fractures is also known to increase from around the age of 60 years<sup>7</sup>. Hip fractures in elderly persons lead to a decrease in physical activities and seriously affect their life expectancy due to various factors<sup>8</sup>. Nevertheless, there have been few reports demonstrating the influence of aspiration pneumonia in patients with hip fractures<sup>9, 10</sup>.

We previously reported the incidence of pneumonia before or after hip surgery in patients with fall-related hip fractures, and found that the rate was surprisingly high, at 15%<sup>11</sup>. Hip fractures are common in elderly persons, and their physical activity levels begin to decrease gradually even before the fractures. Even if the operation for hip fracture is successful, their postoperative physical activities may decrease even more due to continual aging and so on. Moreover, swallowing function also decreases with aging, and there is concern that decreases in the physical activities of the elderly will be complicated by aspiration pneumonia. Although aspiration pneumonia is known to be a quite common cause of death in patients with dysphagia<sup>6</sup>, it is not clear how aspiration pneumonia affects the physical activities of patients with hip fractures. Therefore, this study investigated the changes in physical activities of patients with aspiration pneumonia and hip fractures in acute care wards.

## SUBJECTS AND METHODS

### *Study participants*

The medical records of 20 patients (13 females, 7 males; mean age,  $84.8 \pm 7.6$  years), who were known to have aspiration pneumonia and hip fractures from our previous study<sup>11</sup>, were retrospectively reviewed (pneumonia group). In addition, the patients with pneumonia were further divided into two groups: occurrence of

pneumonia before surgery (preoperative pneumonia group) and occurrence of pneumonia after surgery (postoperative pneumonia group). All were hospitalized in our acute care wards for the treatment of new-onset hip fractures, and they subsequently underwent hip surgeries between January 2008 and June 2010. The inclusion criteria were: 1) age  $\geq 65$  years; 2) fracture caused by falling down or a fall from a bed; 3) underwent appropriate hip surgery; 4) received rehabilitation therapies before and after surgery; 5) survived to discharge; and 6) satisfied the diagnostic criteria for aspiration pneumonia as described below. Pathological fractures due to malignant tumors were excluded.

The diagnostic criteria for aspiration pneumonia were: 1) fever  $> 37.5^\circ\text{C}$  or respiratory symptoms, including productive cough, wheezing, or cyanosis; 2) pneumonia on chest X-ray diagnosed by expert radiologists; and 3) leukocytosis with a left shift and elevation of C-reactive protein confirmed by blood tests.

In addition, 20 hip fracture patients (12 females, 8 males; mean age,  $82.2 \pm 6.4$  years) without comorbid pneumonia were randomly selected as a control group that was matched for sex and age from among patients who underwent hip surgeries between January 2008 and June 2010.

### *Investigation*

Information on the physical activities of 40 patients (20 with aspiration pneumonia; 20 without aspiration pneumonia) before the fractures and at the time of discharge from acute care wards was extracted from medical records. The extracted items were ability to transfer from bed to wheelchair and ability to walk. These two items at the time of admission to acute care wards and discharge from acute care wards were evaluated with the Functional Independence Measure (FIM) version 3.1 by occupational therapists with extensive experience who were thoroughly trained in FIM assessment

(Table 1)<sup>12</sup>. An occupational therapist also evaluated FIM scores before the fractures on the basis of information obtained from the family members of each of patient.

#### Data analysis

The sex ratio was compared between the pneumonia group as a whole and the control group using the  $\chi^2$  test. The age, length of stay (LOS) in acute care wards, and physical activities before the fracture and at the time of discharge from acute care wards were compared among the three groups using one-way analysis of variance (ANOVA) followed by Tukey's multiple comparison test. Subsequently, the decrease in physical activities was calculated according to the difference between the levels before

the fracture and at discharge. The mean values were compared among the three groups using one-way ANOVA with Tukey's post-hoc test. *P* values less than 0.05 were considered to be significant for all analyses. Statistical analyses were performed using IBM SPSS Statistics 17 (SPSS Inc., Chicago, IL, USA).

The protocol of this study was approved by the Ethics Review Board of our university before the investigation (Receipt Number: 707-1).

## RESULTS

### Demographic data

The general characteristics of the 40 study patients are shown in Table 2. No significant differences in age, sex ratio, LOS, and physical activities before

Table 1. Seven-level rating system for physical activities

1. Ability to transfer from bed to wheelchair	
Level 7: Complete independence: patient transfers safely from bed to wheelchair independently without assistive devices.	
Level 6: Modified independence: patient requires an adaptive or assistive device or takes longer than a reasonable amount of time.	
Level 5: Supervision or setup: patient requires supervision or setup of devices.	
Level 4: Minimal contact assistance: patient requires no more help than touching or performs > 75% of the transferring tasks.	
Level 3: Moderate assistance: patient requires lifting assistance and performs 50-74% of the transferring tasks.	
Level 2: Maximal assistance: patient requires lifting assistance and performs 25-49% of the transferring tasks.	
Level 1: Total assistance: patient requires mechanical lift or two helpers.	
2. Walking ability (Locomotion)	
Level 7: Complete independence: patient walks independently and safely > 50 m without assistive devices.	
Level 6: Modified independence: patient walks > 50 m with devices (canes, crutches, orthosis, or walker) or takes longer than could be considered a reasonable amount of time.	
Level 5: Supervision: patient walks > 50 m with supervision, cueing, or coaxing for safety or walks only a short distance (15 m) independently.	
Level 4: Minimal contact assistance: patient walks more > 50 m requiring incidental help such as contact guarding (< 25% help).	
Level 3: Moderate assistance: patient walks > 50 m requiring 25-50% help.	
Level 2: Maximal assistance: patient walks > 15 m requiring 50-75% help.	
Level 1: Total assistance: patient walks < 15 m or requires the assistance of two helpers (> 75% help).	

The seven-level rating system was determined based on the Functional Independence Measure (FIM) version 3.1.

Table 2. Patients' characteristics and clinical data

Characteristic	Pneumonia Groups (n = 20)		Control Group (n = 20)	P-value
	Preoperative (n = 9)	Postoperative (n = 11)		
Sex (female : male)	6 : 3	7 : 4	12 : 8	0.74
Age (y)	84.9 ± 8.7	84.6 ± 7.0	82.2 ± 6.4	0.54
† LOS (days)	35.7 ± 19.7	61.9 ± 46.3	40.3 ± 22.9	0.11
†† Transfer BF	6.7 ± 0.7	6.5 ± 0.5	6.5 ± 0.8	0.84
††† Walking BF	6.7 ± 0.7	6.0 ± 1.7	6.4 ± 1.4	0.54

Values are presented as numbers or means ± standard deviations (SD).

† LOS: Length of stay

†† Transfer BF: Ability to transfer before fracture

††† Walking BF: Walking ability before fracture

Table 3. Mean decreases in physical activities among the three groups

Ability	Pneumonia Groups (n = 20)		Control Group (n = 20)	P-value
	Preoperative (n = 9)	Postoperative (n = 11)		
Transfer	3.44 ± 1.94	4.18 ± 1.53	1.30 ± 0.73	0.01*
Walking	4.44 ± 1.59	4.18 ± 1.83	2.10 ± 1.45	0.01*

Values are presented as means ± standard deviations (SD).

\* Significant

the fractures were observed among the three groups. Although the LOS in the acute care wards tended to be longer in the postoperative pneumonia group than in the other two groups, there were no significant differences in the LOS among the groups.

#### *Comparisons of physical activities among the preoperative and postoperative pneumonia groups and the control group*

No differences in the ability to transfer before the fractures were observed among the three groups; the ANOVA with Tukey's post hoc test showed that the value at the time of discharge from the acute care wards was significantly lower in the pneumonia groups than in the control group ( $3.2 \pm 2.2$  for the preoperative pneumonia group,  $2.4 \pm 1.8$  for the postoperative pneumonia group, and  $5.2 \pm 1.1$  for the control group;  $F(2,37) = 12.625$ ;  $p < 0.01$ ). Similarly, the ability to walk at the time of discharge from the acute care wards was significantly lower in the pneumonia groups than in the control group ( $2.2 \pm 1.7$  for the preoperative pneumonia group,  $1.8 \pm 1.4$  for the postoperative pneumonia group, and  $4.3 \pm 1.7$  for the control group;  $F(2,37) = 10.202$ ;  $p < 0.01$ ), whereas there were no differences in the values before the fractures among the three groups. The mean reduction in physical activities was determined according to the difference between the levels from before the fracture and at the time of discharge from the acute care wards (Table 3). Ability to transfer decreased significantly in the pneumonia groups taken as a whole ( $F(2,37) = 19.556$ ;  $p < 0.01$ ). There was no difference in the decreased ability to transfer between the

preoperative and postoperative pneumonia groups. Decreases in walking ability were determined by the same process as for transfer. Walking ability also decreased significantly in the pneumonia groups taken as a whole ( $F(2,37) = 9.628$ ;  $p < 0.01$ ). The reductions in walking ability did not differ significantly between the preoperative and postoperative pneumonia groups.

#### **DISCUSSION**

At the time of discharge from acute care wards, both the ability to transfer and walking ability were significantly lower in the pneumonia groups. These findings indicate that aspiration pneumonia may have a significant effect on the physical activities of patients with hip fractures. A decrease in physical activities causes muscle disuse and affects skeletal muscles, respiratory function, and so on<sup>13-15</sup>. It seems that the hip fracture patients developed disuse muscle atrophy due to bed rest as a result of decreased respiratory function and the treatment of aspiration pneumonia.

Byun *et al.*<sup>10</sup> reported that a longer duration of surgery, delayed surgery, aging, lower body mass index, and malnutrition were risk factors related to the prognosis of aspiration pneumonia in older hip fracture patients. Metani *et al.*<sup>11</sup> reported a significant decrease in the serum albumin level in older hip fracture patients with aspiration pneumonia who had a lower body mass index, indicating that patients with a lower body mass index, including those with malnutrition, may develop infections more easily. Moreover, it was considered that the risk of aspiration increased due

to age-related decreases in both the swallowing function and cough reflex. However, we did not perform assessments of the body size, nutritional status, aging, time of operation, and duration from admission until surgery in this study.

In the present study, the mean decrease in physical activities was not significantly different between the preoperative pneumonia and postoperative pneumonia groups. It appears that the timing of developing aspiration pneumonia is not related to the degree of the decrease in physical activities.

Previously, Merchant *et al.*<sup>16)</sup> reported that postoperative complications resulted in significantly longer hospitalization periods. Our finding that the LOS tended to be longer for patients in the postoperative pneumonia group than for those in the control group was consistent with their finding. Our study results indicated that the LOS in acute care wards might have been extended for the treatment of aspiration pneumonia in patients in the postoperative pneumonia group. However, since there are no established criteria for discharge from the acute care wards, we consider that there are likely multiple factors for the prolonged LOS.

In the clinical setting, we often encounter patients with restricted physical activities due to complication in the perioperative period who need a significant amount of time to improve their activities of daily living through further intensive rehabilitation after discharge from the acute care wards. On the other hand, it is considered that the functions of individual hospitals, and the status of cooperation with peripheral medical institutions and long-term care facilities also affect the LOS.

Since the present study was only performed while the patients were admitted in the acute care wards, it is unclear how aspiration pneumonia influenced their physical activities six months after discharge. The study results suggest that pneumonia-related dyspnea and oxygen administration led to long-term bed rest, which may have caused disuse muscle

weakness as a factor that reduced the physical activities of hip fracture patients with aspiration pneumonia.

The present study had several limitations. First, the sample size was small due to the retrospective design, and the number of participants was insufficient to collect relevant data. Second, since a multivariate analysis based on multiple risk factors, including body size (body mass index), number of comorbidities, oxygen flow rate during hospitalization, and nutritional status, was not performed, we could not rule out the possibility that these factors affected the changes in physical activities. Third, the lack of specific criteria for discharge from the acute care wards may have affected the LOS.

## CONCLUSION

Hip fracture patients with aspiration pneumonia during the perioperative period showed remarkably less physical activities than hip fracture patients without aspiration pneumonia.

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## DISCLOSURE STATEMENT

The authors declare no conflict of interest.

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