—Regular Articles—

Introduction of Simple Swallowing Ability Test for Prevention of Aspiration Pneumonia in the Elderly and Investigation of Factors of Swallowing Disorders

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Aspiration pneumonia is a major cause of death in the elderly. In this study, a water swallowing test was introduced as a method of evaluating the swallowing ability of patients, and a swallowing ability evaluation team investigated an appropriate procedure and evaluation method for the situation of our hospital. We also investigated the relationship between the swallowing ability of patients examined by the water swallowing test and underlying diseases, complications, and medicated drugs. In the water swallowing test, the water-drinking method was fixed, and evaluation was made based on the time required for drinking, profile, and episodes, by which patients suspected of swallowing disorder were detected, confirming the usefulness of this method. The frequency of developing swallowing disorder was significantly higher in patients with cerebrovascular disorders, Parkinson's syndrome ($p<0.01$, respectively) and symptomatic epilepsy, hypertension ($p<0.05$, respectively) as underlying disease/complication. Regarding medicated drugs, H_2 blockers were related to swallowing disorder ($p<0.05$). It was confirmed that patients who were judged as having swallowing disorder (including suspected cases) by the water swallowing test, and patients with underlying diseases and complication that may cause the disorder, and patients medicated with drugs that may affect the swallowing ability require appropriate management by medical care staff.

Key words——swallowing disorder; water swallowing test; cerebrovascular disorders; pneumonia

INTRODUCTION

Pneumonia is reported to be a major cause of death in the elderly. Pneumonia in the elderly generally does not develop typical symptoms such as fever, and is characterized by nonspecific symptoms such as loss of appetite, immobility, incontinence, and intellectual deterioration, called ''4I symptoms''.[1] Pulmonary defense function against infection is also reduced in the elderly. Pneumonia easily becomes intractable and fatal. Thus, pneumonia latently progresses and is likely to rapidly aggravate into a serious condition in the elderly.

The cause of pneumonia in the elderly is aspiration in many cases.[2] Aspiration pneumonia is likely to recur, and the prognosis is poor. Particular attention should be given to silent aspiration, in which patients repeatedly aspirate a very small amount of secretion in the oral cavity and the pharyngeal region without being noticed by nurses and those caring for the patient. Cerebrovascular disorder is reported to be closely involved in the occurrence of silent aspiration.[3] According to Nakagawa et al., silent aspiration occurs in 60% or more of patients with cerebral infarction in the unilateral basal nuclei, and in 90% or more of patients with infarction in the bilateral basal nuclei.[4] Moreover, bacteria such as gram-negative rods are generally present in the oral cavity and the pharyngeal region in the elderly. Repeated swallowing of secretion containing the bacteria finally exceeds the capacity of processing the bacteria in the lung, and intractable pneumonia develops.[5]

Our hospital is for long-term treatment for the elderly consisting of two wards designated for the elderly and one ward for long-term care insurance. About 90% of inpatients have cerebrovascular disorders as underlying disease, and the patients receive various long-term treatments for chronic complications. Therefore, the prevention of aspiration pneumonia is very important in our hospital, and it is necessary to evaluate the swallowing ability of each patient for this purpose.

Evaluation methods of swallowing ability include video-fluorography examination[6] in which patients swallow contrast medium and images are taken, swallowing provocation test[7] in which swallowing is induced and electromyogram of the submandibular

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muscle, tracheal sound, and breathing movements are continuously recorded, and imaging examination in which radio isotope indium chloride is adhered to the teeth and pulmonary uptake of the indium dissolved in the oral cavity during the night is imaged.[4] All these tests use apparatuses and require specialized medical care staff. Tests that do not require an apparatus include the repetitive saliva swallowing test.[8] In this test, swallowing reflex is examined by palpation of muscles of the larynx, but it requires palpation training.

We decided to employ the water drinking test,[9] which is a simple procedure reported by Kubota et al. and is less invasive and applicable without a specific apparatus, and modified the test to adjust to the situation at our hospital. We formed a team consisting of physicians, nurses, and pharmacists for the evaluation of swallowing ability, and investigated the water swallowing test method. We applied the designed test to inpatients and investigated the evaluation method. We also investigated the relationship between the swallowing ability of patients examined by the water swallowing test and underlying diseases, complications, and medicated drugs.

METHODS

1. Investigation of Cause of Death

To clarify the cause of death in our hospital, we investigated the causes of death of patients who died between January and December 1999 using case records. In patients who died of pneumonia, the cause of developing pneumonia and underlying diseases were also investigated.

2. Evaluation Criteria of Swallowing Ability

2-1. Formation of Evaluation Team A team for evaluating swallowing ability was formed by physicians, nurses, and pharmacists. We examined the water swallowing test method reported by Kubota et al. and modified it as follows. We also established original evaluation criteria.

2-2. Water Swallowing Test Method When a physician identified swallowing disorder based on the general condition and the state of swallowing function, the patient was excluded from the water swallowing test group. When a patient had a difficulty in drinking water due to hemiplegia, two nurses helped the patient in the water swallowing test. The measurement of the time required for drinking was begun upon holding water in the mouth to avoid the effect of activity of daily living (ADL) on the result of the experiment.

The same two pharmacists observed all subjects and discussed about the results before the judgment.

1) The patient drank 10 ml of water (room temperature) from a cup in the sitting position, and the time required for drinking all the water was noted.

2) The frequency of swallowing and choking were observed based on the five-step profiles below.

①Drink without interruption and choking. ②Drink with interruption without choking. ③Drink without interruption with choking. ④Drink with interruption and choking. ⑤Unable to drink all the water due to choking.

3) While drinking, the presence or absence of the following episodes was observed.

①Careful drinking such as holding in the mouth and sipping. ②Strong coughing. ③Outflow of water from the lip. ④Abnormal voice and forced respiration after drinking water.

4) The water swallowing test was repeated in the same patient after two weeks.

2-3. Timing of Water Swallowing Test The test was performed between 11：20 and 12：00 in the morning because this time zone is before lunch and the consciousness level of patients is high. In addition, patients sit up in a posture appropriate for drinking water. The patients moistened their mouth with tea served before lunch to avoid elevation of the positivity rate due to sudden swallowing of 10 ml of water.

3. Execution of Water Swallowing Test

3-1. Patients The test was performed in 120 inpatients in two wards designated for the elderly and 55 inpatients in a ward for long-term care insurance of our hospital, a total of 175 patients, during the period between September 1, 2000 and February 28, 2001. Patients with an indwelled tracheal tube and patients diagnosed with swallowing disorder by a physician were excluded.

3-2. Investigation of Evaluation Method of Water Swallowing Test Based on the results of the water swallowing test, the evaluation team established an evaluation method and investigated the usefulness of the test as a screening method of swallowing ability.

4. Investigation of Patient Background

Age, gender, underlying diseases, complications, medicated drugs, and previous pneumonia for the

patients who underwent the water swallowing test were investigated using case records and prescriptions, and the relationship with swallowing ability as determined by the water swallowing test was investigated.

5. Investigation of Medical Care Based on the Results of Water Swallowing Test and Incidence of Pneumonia after the Medical Care

For patients judged as having ''normal swallowing ability'', ''swallowing disorder'' and '' suspected swallowing disorder'', the evaluation team investigated medical care to be given by each medical care staff, and each patient was given the medical care.

Furthermore, the incidence of pneumonia after adopting the medical care was investigated.

6. Statistical Analysis

Wilcoxon rank sum test was applied to analysis of age and Pearson chi-square test was applied to analysis of gender difference. For underlying diseases/complications and medicated drugs, multivariate analysis was performed using Pearson chi-square test by logistic regression analysis. For analysis of the incidence of pneumonia after adopting the water swallowing test, Wilcoxon signed-ranks test was used. A significance level lower than 5% was defined as significant.

RESULTS

1. Investigation of Dead Patients

Sixty-two patients died at our hospital between January and December 1999. Table 1 shows the detailed causes of death. Twenty-seven patients died of pneumonia, which was the most frequent cause of death. The cause of developing pneumonia seemed to be aspiration in 12 patients, accounting for 40%. Two patients and 13 patients may have died of MRSA (*methicillin-resistant Staphylococcus aureus*) infection and other causes such as virus infection, respectively. Regarding underlying diseases, 20 of the 27 patients had cerebral infarction, and the underlying disease was cerebral infarction in all 12 patients who seemed to have died of aspiration pneumonia.

Table 1. Causes of Death in 1999 in Sakamoto Dai-2 Hospital

Rank	Cause of death		Number of deaths	
1	Pneumonia	Aspiration pneumonia	27	12
		MRSA pneumonia		2
		Virus infection/others		13
2	Respiratory failure			10
3	Cerebrovascular disease			6
4	Acute myocardial infarction			4
4	Cardiac failure			4
6	Acute renal failure			3
7	Hemorrhagic shock			3
8	Others			5

2. Judgment of Swallowing Ability in Water Swallowing Test

2-1. Time Required for Drinking Water and Profiles There were 21 patients with an indwelled tracheal tube and four patients diagnosed with swallowing disorder by a physician in 175 patients. The other 150 patients underwent the water swallowing test twice.

The time required for drinking all the water was classified into five groups, as reported by Kubota et al., and the relation with the profiles is shown in Table 2. Profile ⑤ was judged to be immeasurable because patients could not drink all the water due to choking.

Of 300 test cases, 191 cases were judged as profile ① (drink without interruption and choking), and the mean time required for drinking was 3.04±1.32 seconds. Drinking was completed within five seconds in 179 cases, but five seconds or more was required in 12 cases. Sixty-nine cases were judged as profile ②, and the mean time required for drinking was 12.61±6.25 seconds. Profiles ③ and ④ were observed in 10 and 26 cases, respectively, and the time required for drinking water was 11.5±5.97 and 13.58±4.47 seconds, respectively. Profile ⑤ was observed in 4 cases. Thus, when profiles ②–⑤ were observed, the time required for drinking water markedly prolonged.

2-2. Profiles and Episodes The profiles and episodes are shown in Table 3. Of 191 cases showing profile ①, no episode was observed in 176 cases and all these patients were able to drink the water within five seconds. However, episode ① (careful drinking such as holding in the mouth and sipping) was observed in 15 cases showing profile ①. The time required for drinking the water was within five seconds in three cases and within 6–10 seconds in 12 cases. Either episode ①–④ was observed in patients showing profiles ②–⑤.

2-3. Evaluation Criteria of Swallowing Ability Established by the Evaluation Team The evaluation team established the following evaluation criteria

Table 2. Relationship between Time Required for Drinking Water and Each Profile

($n=300$)

Time	Profile				
	1 (drink without interruption and choking)	2 (drink with interruption without choking)	3 (drink withouti nterruption with choking)	4 (drink with interruption and choking)	5 (difficult to drink all volume due to choking)
Within 5 seconds	179	6	3	1	0
6—10 seconds	12	35	1	7	0
11—15 seconds	0	14	4	10	0
16 seconds or longer	0	14	2	8	0
Immeasurable					4
Mean ± SD (sec.)	3.0 ± 1.3	12.6 ± 6.3	11.5 ± 6.0	13.6 ± 4.5	

Note: The values are combined numbers of cases of two water swallowing tests.

Table 3. Relationship between Profiles and Episodes

($n=300$)

Profile		Episode				
		None	1 (careful drinking such as holding in the mouth and sipping)	2 (strong coughing)	3 (outflow from the lip)	4 (abnormal voice after drinking, forced respiration)
1	drink without interruption and choking	176*	15**	0	0	0
2	drink with interruption without choking	0	60	1	8	0
3	drink with interruption and choking	0	1	9	0	0
4	drink with interruption and choking	0	1	19	1	5
5	difficult to drink all volume due to choking	0	0	3	1	0

Note: The values are combined numbers of cases of the two water swallowing tests.
* The time required for drinking water was within 5 seconds in all cases.
** The time required for drinking water was within 5 seconds in three and 6—10 seconds in 12.

of swallowing ability examined by the water swallowing test.

The normal range of swallowing ability established by Kubota et al. was drinking water within five seconds. The normal range of time required for drinking water was also set to within five seconds without interruption and choking (profile ①) in our water swallowing test. The absence of episodes was additionally included in the conditions because the episodes may reflect risk factors of swallowing disorders. We evaluated profile ② (drink with interruption without choking) as a possible decrease in the swallowing ability and profiles ③–⑤ with choking as decreased swallowing ability.

Normal swallowing ability: Drink within five seconds with profile ① without episode.

Possible decrease in swallowing ability: Profile ① with an episode or profile ② is observed regardless of the time required for drinking.

Decreased swallowing ability: Profiles ③–⑤ are observed.

2-4. Collective Results of the Two Tests Table 4 summarizes the results of the test performed twice in each evaluation criterion. Seventy-nine of 150 patients (52.7%) were judged ''normal'' in both tests, and 26 and 9 patients were judged ''possible decrease'' and ''decreased'' in both tests, respectively. The evaluations in the first and second tests were inconsistent in 36 patients. The evaluation in the first test was worse than that in the second test in 19 patients and better in 17 patients. Judgment of three patients differed: ''normal'' and ''swallowing disorder''. When the third water swallowing test was preliminarily performed in some patients, the result

Table 4. Results of Water Swallowing Test Based on the Evaluation Criteria of Swallowing Ability

($n=150$)

Test result	Number of patients (%)	Judgment (number of patients)
"Normal" in both test	79(52.7)	No swallowing disorder(79)
1st: Normal, 2nd: Possible decrease	10(6.7)	Suspected swallowing disorder(40)
1st: Possible decrease, 2nd: Normal	4(2.7)	
1st and 2nd: Possible decrease	26(17.3)	
1st: Normal, 2nd: Decrease	2(1.3)	Swallowing disorder(31)
1st: Decrease, 2nd: Normal	1(0.7)	
1st: Decrease, 2nd: Possible decrease	12(8.0)	
1st: Possible decrease, 2nd: Decrease	7(4.7)	
1st and 2nd: Decrease	9(6.0)	

Table 5. Correlation between the Presence or Absence of Swallowing Disorder and Age and Gender

($n=175$)

	With swallowing disorder $n=96$	Without swallowing disorder $n=79$	p value
Age(Mean±SD)	79.7±11.2	77.4±11.0	$p=0.104^{a)}$
Males/females(number of patients)	47/49	38/41	$p=0.910^{b)}$

Note: *a*) Wilcoxon rank sum test, *b*) Pearson chi-square test.

did not worsen in any patient compared to the results of the first and second tests.

These findings showed that patients may become accustomed to the test as the test is performed repeatedly and become able to drink faster without choking, and that judgment of the disorder based on a single test has a risk since the daily general condition varies in patients.

2-5. Judgment Method of Swallowing Ability Established by Evaluation Team The evaluation team confirmed that it is necessary to perform the water swallowing test twice, the third test is not necessary because the negativity rate may increase due to that the patient may become accustomed to the test, and a two-week interval between the two tests is appropriate. The judgment criteria were established as follows. Only patients evaluated as "normal" in both tests were judged as having "no swallowing disorder". Patients evaluated as "possible decrease" in at least one test were judged as having "suspected swallowing disorder", and those who were evaluated as "decreased" in at least one test were judged as having "swallowing disorder".

Of the 150 patients in this study, 79 were judged as having "no swallowing disorder", 40 were judged as having "suspected swallowing disorder", and 31 were judged as having "swallowing disorder". The suspected swallowing disorder group and the swallowing disorder group included patients in whom nurses did not notice the disorder in daily life.

3. Presence or Absence of Swallowing Disorder and Patient Background

The suspected swallowing disorder group in the water drinking test had mild swallowing disorder and was considered to be a high risk group of developing swallowing disorder. Thus, the group was included in the swallowing disorder group in investigating the background factors. Twenty-five patients excluded from the water swallowing test were included in the swallowing disorder group.

3-1. Age and Sex As shown in Table 5, the presence or absence of swallowing disorder was not related to either age or sex.

3-2. Underlying Diseases and Complications As shown in Table 6, 162 of 175 patients had cerebrovascular disorder, accounting for 92.6%. The prevalence of swallowing disorder was significantly higher in patients with cerebrovascular disorder ($p<0.01$). Association of underlying disease/complication with swallowing disorder was also suggested for hypertension ($p<0.05$), symptomatic epilepsy ($p<0.05$), and Parkinson's syndrome (including primary

Table 6. Correlation between the Presence or Absence of Swallowing Disorder and Underlying Disease/Complication ($n=175$)

Underlying disease (with/without)	With swallowing disorder $n=96$	Without swallowing disorder $n=79$	p value
Cerebrovascular disorder	94/2	68/11	$p=0.006^{**}$
Parkinson's syndrome	15/81	9/70	$p=0.003^{**}$
Symptomatic epilepsy	12/84	4/75	$p=0.016^{*}$
Peptic ulcer	36/60	24/55	$p=0.135$
Asthma, bronchitis	6/90	4/75	$p=0.900$
Hiatal hernia	2/94	0/79	$p=0.634$
Dementia	27/69	56/23	$p=0.752$
Hypertension	41/55	47/32	$p=0.013^{*}$
Ischemic heart disease	12/84	10/69	$p=0.952$
Cardiac failure	13/83	6/73	$p=0.069$
Osteoporosis	45/51	52/27	$p=0.120$
Previous pneumonia	37/59	12/67	$p=0.009^{**}$

Note: Pearson chi-square test by logistic regression analysis. **; $p<0.01$, *; $p<0.05$.

Table 7. Correlation between the Presence or Absence of Swallowing Disorder and Medicated Drugs ($n=175$)

Drug (with/without)	With swallowing disorder $n=96$	Without swallowing disorder $n=79$	p value
Antipsychotic agent	35/61	25/54	$p=0.567$
H_2 blocker	24/72	9/70	$p=0.024^{*}$
Antiparkinson agent	12/84	7/72	$p=0.645$
Antiepileptic drug	10/86	5/74	$p=0.421$
Dopamine preparation	0/0	0/0	—
Amantadine	3/93	1/78	$p=0.457$
Hypotensive drugs	43/53	37/42	$p=0.661$
Drugs for the cardiovascular system	24/72	18/61	$p=0.603$
Drugs for the digestive organs excluding H_2 blockers	28/68	20/59	$p=0.752$

Note: Pearson chi-square test by logistic regression analysis. *; $p<0.05$, —; not tested.

and symptomatic types) ($p<0.01$). Only two patients had been diagnosed with primary Parkinson's disease (Yahr's stage IV) in the swallowing disorder group, and the others had been diagnosed with Parkinson's syndrome.

There was no relation with symptomatic epilepsy, peptic ulcer, asthma, or bronchitis, which were reported to be related to swallowing disorder. Although hiatal hernia was reported to be the cause of developing swallowing disorder, there were a few patients with hiatal hernia and the relation was not observed in this study. There were no relations in patients with dementia, ischemic heart disease, cardiac failure or osteoporosis. The frequency of previous pneumonia was significantly high in the swallowing disorder group ($p<0.01$).

3-3. Medicated Drugs As shown in Table 7, among drugs medicated to 175 patients, medication of H_2 blockers was related to swallowing disorder ($p<0.05$). Cimetidine, ranitidine, and famotidine are used in our hospital, but the type of H_2 blocker was not related to swallowing disorder (data not shown). There were no correlations with antipsychotic agents, antiparkinson agents, or antiepileptic drugs, which were reported to be related to swallowing disorder. No patient was medicated with dopamine preparations, which were reported to improve swallowing function.[10] Amantadine[11] was medicated to three patients in the swallowing disorder group and one in the normal group, but no significant difference was observed. There were no relations of hypotensive drugs, drugs for the cardiovascular system, or drugs

for the digestive organs excluding H_2 blockers to swallowing disorder ($p>0.05$).

3-4. Investigation of Medical Care Based on the Results of the Water Swallowing Test and Incidence of Pneumonia after Adopting the Care

1) Care given by each medical care staff based on the results of the water swallowing test The evaluation team established the care for each patient as follows. For patients judged as having ''normal swallowing ability'', the water swallowing test will be occasionally performed depending on the general symptoms because swallowing function may decrease in the future. Particularly, patients with underlying diseases/complications that may be related to swallowing disorder and patients being medicated with related drugs will be observed well. For patients judged as having ''suspected swallowing disorder'', nursing staff will pay special attention during meal, medication, and drinking, and the oral cavity will receive thorough care. Physical therapists will perform an effective swallowing training for each patient. Pharmacists will check administered drugs and when a drug that may reduce the swallowing function is administered, the pharmacist will inform the physician and change the prescription. For patients judged as having ''swallowing disorder'', the care described above will be given and attention will be also paid to the sputum volume and regurgitation of the gastric content.

2) Incidence of pneumonia after adopting the care During the half year after adopting the care corresponding to the water drinking test and the test results from March 1, 2001 to August 31, 2001, 16 patients in the swallowing disorder and suspected swallowing disorder groups (96) and three patients in the group without swallowing disorder (79) developed pneumonia.

Among the patients who underwent the water swallowing test during the period from September 1, 2000 to February 28, 2001, 33 patients in the swallowing disorder and suspected swallowing disorder groups (96) and six patients in the group without swallowing disorder (79) had developed pneumonia during the previous half year. Therefore, the incidence of pneumonia significantly decreased after adopting the care (Wilcoxon signed-ranks test, $p<0.01$).

DISCUSSION

Among patients who died of pneumonia in 1999 in our hospital, the cause was aspiration in 40%, the most frequent cause of death. The underlying disease was cerebral infarction in all these patients. Many patients were admitted for sequelae of cerebral infarction in facilities for the elderly such as designated hospitals for the elderly and long-term nursing care facilities. This study re-confirmed that the introduction of an accurate test method of the swallowing ability of inpatients is necessary to screen candidate patients for developing aspiration pneumonia.

However, many institutions including our hospital do not have an advanced apparatus to determine the swallowing ability. The water swallowing test employed in this study is relatively noninvasive and does not require a specific apparatus. In the water swallowing test, the water drinking procedure was fixed, and the swallowing ability was evaluated based on the time required for drinking water, profiles, and episodes, by which even patients suspected of having swallowing disorder were detected. Since slight changes in environmental factors such as temperature and weather and mental factors affect the physical symptoms in the elderly, a single test may miss latent swallowing disorder. Patients with latent swallowing disorder can be detected by repeating the water swallowing test under the same conditions after two weeks. Using this test, patients with the disorder previously unnoticed by nurses were detected. Therefore, the water swallowing test may be very useful as a simple method of evaluating the swallowing ability in the elderly.

Regarding the cause of swallowing disorder, a close involvement of a decrease in the nigrostriatal dopamine secretion due to injury in the basal nuclei region regulating the swallowing movement has been reported.[12—15] Since the basal nuclei is a frequent primary site of cerebral infarction, patients with cerebrovascular disorder caused by cerebral infarction are considered likely to develop swallowing disorder. In this study, 94 of 96 patients judged as having swallowing disorder had cerebrovascular disorder, showing a significantly difference from patients without swallowing disorder. It has been reported that swallowing disorder develops in 50% of patients with Parkinson's disease,[16] and that the cause of death from Parkinson's disease is silent aspiration-induced pneumonia in many cases.[17] Furthermore, many patients develop Parkinson's syndrome as sequelae of cerebral infarction, indicating that careful

observation of Parkinson's syndrome is necessary as a factor inducing swallowing disorder. Thus, patients with cerebrovascular disorder, Parkinson's disease, and Parkinson's syndrome as an underlying disease/complication have a high risk of developing swallowing disorder, and it is necessary to evaluate the swallowing ability to provide the necessary care.

Medicated drugs may also serve as a risk factor of swallowing disorder.[18] Antipsychotic agents and antiepileptic drugs, which inhibit the central nervous system, may decrease the consciousness level and decrease the swallowing reflex. Many antipsychotic agents exhibit an anti-cholinergic effect that may decrease the swallowing function by decreasing salivary secretion and drying the oral cavity. Antiparkinson agents may cause abnormal movement of the oral cavity. Since gastric acid secretion generally decreases in the elderly, H_2 blockers further inhibit gastric acid secretion and increase the risk of aspirating intestinal bacteria contained in the regurgitated gastric content. It was also reported that a decrease in the acidity of gastric juice facilitates the growth of pathogenic bacteria.[19]

In this study, the frequency of swallowing disorder was significantly higher in patients medicated with H_2 blockers, suggesting that the use of the drug should be thoroughly investigated for patients with cerebrovascular disorder. The evaluation team confirmed that the use of these drugs should be refrained from patients judged to have ''swallowing disorder'' and ''suspected swallowing disorder''.

It was confirmed that medical care given by each specialty staff are necessary for patients with underlying diseases/complications that may be related to swallowing disorder, patients being medicated with related drugs, and patients judged as having swallowing disorder and suspected swallowing disorder. Sufficient caution should be paid by nursing staff during meal, medication, and drinking water and for the sputum volume and regurgitation of the gastric content. Daily management such as oral cavity care should be performed thoroughly and effective swallowing training should be given by speech therapists and physical therapists based on the episodes. Pharmacists also provide sufficient information to physicians and nurses, when the drugs that may reduce the swallowing function described above are prescribed, to avoid the risk of aggravating swallowing disorder. The enriched care given by the medical care team described above inhibited the development of pneumonia during the six-month period after adopting the water swallowing test. The cautions and active care given based on the test results by the medical care staff may have been effective and reduced the development of pneumonia.

Therefore, the water swallowing test, which is a simple method with less stress for patients, for evaluation of the swallowing ability and care given based on the test results are very useful for facilities with many elderly patients with cerebrovascular disorder as an underlying disease like our hospital.

We are planning to continue evaluation of the swallowing ability judged by the test developed in this study and investigation of the effect of care given based on the test results on the development of aspiration pneumonia. Furthermore, as future subjects, we are planning to investigate the relation of the patient's ADL level to swallowing disorder and the uses of angiotensin-converting enzyme inhibitors and hangekoubokuto, which were reported to improve swallowing function.

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