

[Original]

A Simple Assessment of the Eating and Swallowing Functions in Elderly Patients with Pneumonia

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Abstract : It is important to assess the eating and swallowing functions of elderly people because they often develop aspiration pneumonia due to dysphagia. The most reliable modalities for assessing the eating and swallowing functions are videofluoroscopic examinations and videoendoscopic evaluations; however, these diagnostic modalities often cannot be performed in elderly people. Therefore, we established the Assessment of Swallowing Ability for Pneumonia (ASAP), which is an assessment of eating and swallowing functions in elderly patients with pneumonia that can be conducted by all health care professionals, and examined the usefulness thereof. The subjects included 130 patients with pneumonia (58 males, 72 females, average age: 82.2 ± 13.0) who had been admitted to the internal medicine department at our hospital between January 2016 and June 2016. The coefficient of correlation between ASAP and the Mann Assessment of Swallowing Ability (MASA) was 0.97, indicating a strong correlation, and the area under the curves (AUC) between the ASAP and the degrees of severity were 0.98, 0.95, and 0.94, respectively. We suggest that ASAP can be useful as a modality for assessing the eating and swallowing functions in elderly patients with pneumonia.

Keywords : ASAP, dysphagia, elderly, pneumonia, screening test.

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Introduction

More than 100,000 Japanese die of pneumonia every year. Over the past 135 years, life expectancy has continued to increase in most developed countries, and particularly in Japan, which has the highest percentage of persons aged 65 years or older (22.1%) [1, 2]. Comorbid diseases, such as cerebrovascular disease, Parkinson's disease and dementia, are known to cause dysphagia in elderly people. Leopold and coworkers classified dysphagia into 5 stages (anticipatory stage, preparatory stage, lingual stage, pharyngeal stage, and

esophageal stage) [3]. Dysphagia causes aspiration pneumonia which often leads to a fatal outcome [4–8]. Therefore, assessing eating and swallowing functions are important in the treatment of elderly patients with pneumonia.

The most reliable assessments of eating and swallowing functions are videofluoroscopic examination (VF) and videoendoscopic evaluation of swallowing (VE), but they cannot be conducted while the general condition of the patient is unstable, and/or often cannot be conducted due to facility issues. It is our experience that VF and VE cannot be effectively conducted

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because elderly people often suffer a decrease in both understanding and attentiveness.

Other assessments of eating and swallowing functions that are generally conducted are the water swallow test (WST), the Standardized Swallowing Assessment (SSA), the Toronto Bedside Screening Test (TOR-BSST), the Mann Assessment of Swallowing Ability (MASA), and the volume-viscosity swallow test (V-VST) [9–13]. The V-VST is used with various bolus volumes and viscosities (nectar, liquid and pudding); its sensitivity for aspiration is 100%, but the specificity is 28.8% [13]. It is difficult to assess the severity of eating and swallowing functions using the TOR-BSST or the WST, because if you suspect abnormalities in these tests you have to consult a speech-language-hearing therapist. The MASA, a quantified test, is a useful tool for assessing the severity of eating and swallowing functions, and it is useful in determining a recommended diet, but only a few expert therapists in Japan can currently perform the MASA. Most hospitals do not employ expert therapists (such as speech-language-hearing therapists and dental hygienists), and there is no test other than MASA that is quantified or can be used to determine a recommended diet.

Because there is a significant difference among facilities in Japan in the assessment of dysphagia, we established the Assessment of swallowing ability for pneumonia (hereinafter referred to as ASAP), which is an assessment of the severity of eating and swallowing functions in elderly patients with pneumonia, and which can be conducted by all health care professionals.

Patients and Methods

Development of ASAP

1) Outline

We established the protocol for the ASAP while referring to the V-VST and TOR-BSST. The ASAP consists of two main parts:

a) information regarding consciousness and vocalization/respiratory function required for assessment, as well as cranial nerve function related to swallowing; and b) assessment of swallowing functions, including pharynx reaction and clearance. These can be done in a bedside examination in approximately 5 to 10 min-

utes using only a minimum of articles such as a tongue blade, cotton swab (ice bar), jelly and water, and thickening agent.

The ASAP was created assuming that the ASAP evaluators would be health care professionals (physicians, nurses, speech-language-hearing therapists, physical therapists, occupational therapists, dental hygienists), and was conducted in elderly patients aged 65 or older with pneumonia.

2) Evaluation items

Due to a possible risk of suffocation and aspiration without any prior preparation, we believed that assessments of the conscious level, vocalization, cough intensity at the time of aspiration, tongue muscle, and swallowing were necessary. Various viscosities (nectar, liquid and pudding) can be used in the V-VST, so we use thickened water, jelly, and water to perform ASAP. In conclusion, ASAP consists of eight items (evaluations of consciousness, vocalization, cough, tongue muscle, and the ability to swallow thickened water, jelly and water) (Fig. 1).

3) Score of each item

A score from 0 to 20 points is set for each item, taking severity into consideration. Swallowing and Water are 20 points, while the other items are 10 points, because swallowing is the most important item, and water is the highest risk to aspirate. The point allocation was weighted by the clinical experience of three speech-language-hearing therapists (more than three years and 500 cases). A maximum score in the ASAP is 100 points, and the severity of dysphagia can be determined using the total points.

4) Implementation method of ASAP

Sitting posture in a chair or wheelchair is preferred, depending on the general condition and stability of the cervical region. The posture in the cervical anteflexion position should be taken, but a reclining position may also be taken. Standard safety should be taken into consideration. An aspirator, *etc.* should be prepared, as needed.

In the event of zero points for the “swallowing” item and also zero points for “consciousness”, which is the first item, a re-assessment will be conducted at a later date without conducting the “thickened water”, “jelly” and “water” items.

Total:	/100 points
Severity:	

Cutoff values for severity of ASAP	
No abnormalities	≥ 77 - 100
Mild level	≥ 62 - 76
Moderate level	≥ 16 - 61
Severe level	≤ 15

(1) Consciousness	<input type="checkbox"/> 0	<input type="checkbox"/> 5	<input type="checkbox"/> 10
	No opening of eyes or vocalization is observed	Opening of eyes or vocalization in response to calls is observed	Lucidity
(2) Vocalization	<input type="checkbox"/> 0	<input type="checkbox"/> 3	<input type="checkbox"/> 6
	Unable to produce an "Ahhh" sound or only able to produce an "Ahhh" sound shorter than 3 seconds	Able to produce an "Ahhh" sound longer than 3 seconds but shorter than 6 seconds	Able to produce an "Ahhh" sound longer than 6 seconds but shorter than 10 seconds
(3) Cough	<input type="checkbox"/> 0	<input type="checkbox"/> 3	<input type="checkbox"/> 5
	No coughing	Coughing by the tracheal compression method	Able to voluntarily cough weakly but not to the extent of coughing up phlegm
(4) Tongue muscle	<input type="checkbox"/> 0	<input type="checkbox"/> 5	<input type="checkbox"/> 8
	Difficult to assess/significantly weak	Unilaterally weak	Slightly weak
(5) Swallowing	<input type="checkbox"/> 0	<input type="checkbox"/> 10	<input type="checkbox"/> 20
	Swallowing does not occur or is difficult to assess	Swallowing occurs after contact with the arch of the palate/posterior pharyngeal wall	Able to voluntarily swallowing within 10 seconds
(6) Thickened water	Posture at the time of assessment (chair sitting/wheelchair sitting/reclining degrees)		
	<input type="checkbox"/> 0	<input type="checkbox"/> 2	<input type="checkbox"/> 5
(7) Jelly	<input type="checkbox"/> 0	<input type="checkbox"/> 2	<input type="checkbox"/> 5
	Unable to swallow, a lot of food left in the mouth, or difficult to assess	Cannot handle due to pharynx sounds or choking after swallowing	Able to handle although pharynx sounds or choking are observed after swallowing
(8) Water	<input type="checkbox"/> 0	<input type="checkbox"/> 2	<input type="checkbox"/> 10
	Unable to swallow or difficult to assess	Cannot handle due to pharynx sounds or choking after swallowing	Able to handle although pharynx sounds or choking are observed after swallowing
Re-assessment (6)'	Posture at the time of assessment (reclining degrees) * Add the better points of either (6) or (6)'		
	<input type="checkbox"/> 0	<input type="checkbox"/> 2	<input type="checkbox"/> 5
Re-assessment (7)' Jelly	<input type="checkbox"/> 0	<input type="checkbox"/> 2	<input type="checkbox"/> 5
	Unable to swallow, a lot of food left in the mouth, or difficult to assess	Cannot handle due to pharynx sounds or choking after swallowing	Able to handle although pharynx sounds or choking are observed after swallowing

Fig. 1. Assessment of Swallowing Ability for Pneumonia Score Sheet. ASAP consists of eight items (consciousness, vocalization, cough, tongue muscle, swallowing, thickened water, jelly, and water)

[Items]

(1) Consciousness (2) Vocalization (3) Coughing (4) Tongue muscle (5) Swallowing (6) Thickened water (with re-assessment) (7) Jelly (with re-assessment) (8) Water

[Tools required]

One sheet of gauze moistened with water and lightly squeezed, 3 ml of thickened water (cold water, honey-like viscosity) × 3 times,

approximately 30 ml of cold water (cup), jelly (4 g per time × 3 times: those unlikely to cause syneresis are preferred), cotton swab moistened with water and lightly squeezed or an ice bar, etc., spoon, tongue depressor, and stopwatch. A syringe and aspirator as needed.

[Termination criteria]

In the event of 0 points in (5) Swallowing and also 0 points in (1) Consciousness, do not conduct (6), (7), and (8).
* When conducting (6), (7), and (8) in the event of 0 or 5 points in (1) Consciousness and also 0 or 10 points in (5) Swallowing without falling under termination criteria, considerations at the time of aspiration shall be taken into account, for example preparing an aspirator.

[Posture at the time of assessment]

Assessments shall be conducted depending on the general condition and stable state of the cervical region. Chair sitting or wheelchair posture is preferred.

The posture in the cervical anteflexion position shall be taken.

When conducting on the bed, it is preferred to elevate the head as much as possible using a Gatch bed; however, considerations shall be taken in to account so that the subjects are in a comfortable posture.

<<Regarding re-assessments of (6) Thickened water and (7) Jelly>>

If a perfect score is not achieved in each item of items (6) and (7), a re-assessment can be conducted in a position reclining at 30 degrees (or 45 to 60 degrees) or cervical anteflexion position (for example, heightening the pillow), and then adding the better of the assessment points .

The posture at that time must be written down.

The posture in the cervical anteflexion position reclining at 30 degrees



[Item details]

(1) Consciousness: Call subjects.

Determination: 10 points Lucidity.

5 points Opening of the eyes or vocalization in response to calls is observed.

0 points No opening of the eyes or vocalization is observed.

(2) Vocalization: Give subjects the instruction, "Please say "Ahhh" as long as possible."

Determination: 10 points Able to produce an "Ahhh" sound longer than 10 seconds.

6 points Able to produce an "Ahhh" sound longer than 6 seconds but shorter than 10 seconds

3 points Able to produce an "Ahhh" sound longer than 3 seconds but shorter than 3 seconds.

0 point Unable to produce an "Ahhh" sound or able to produce an "Ahhh" sound shorter than 3 seconds.

* In the event of an inability to voluntarily produce an "Ahhh" sound, the score shall be 0 points.

(3) Cough: Give subjects the instruction, "Please strongly cough so as to cough up phlegm." If they cannot follow the instruction, conduct the tracheal compression method.

Determination: 10 points Able to voluntarily cough to the extent of coughing up phlegm.

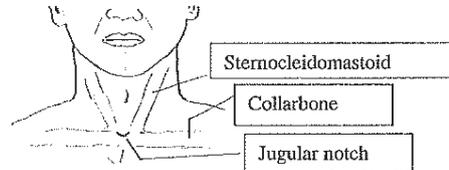
5 points Able to voluntarily cough weakly but not to the extent of coughing up phlegm.

3 points Coughing by the tracheal compression method.

0 points No coughing.

* The tracheal compression method is a method to induce coughing by lightly pressing the trachea immediately above the jugular notch using the thumb, etc.

This should be conducted depending on the situation.



(4) Tongue muscle: Using a tongue depressor, assess the muscle when the tongue protrudes/deviates to the side (ask subjects to push the tongue depressor using their tongue).

Give them the instruction, "Please push this spatula (tongue depressor) using your tongue."

Determination: 10 points No abnormalities.
 8 points Slightly weak, difficult to hold
 5 points Obviously and unilaterally weak
 0 points Significantly weak or difficult to assess

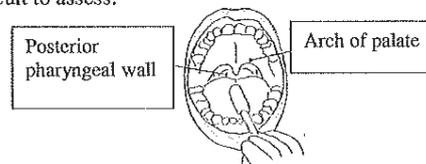
(5) Swallowing: After moistening the oral cavity using a moistened gauze, etc., give them the instruction, "Please swallow audibly."

In the event of an inability to swallow liquids, confirm whether or not swallowing occurs by contacting the vicinity in the back of the tongue/arch of palate/posterior pharyngeal wall using a cotton swab, etc. moistened with water and lightly squeezed.

Determination: 20 points Able to perform voluntary swallowing within 10 seconds.
 10 points Swallowing occurs upon contacting the back of the tongue/arch of palate/posterior pharyngeal wall using a cotton swab, etc.
 0 point Swallowing does not occur or difficult to assess.

*To confirm swallowing, confirm the rise of the Adam's apple.

If it is difficult to observe movement of the Adam's apple, touch the Adam's apple and conduct a palpation.



(6) Thickened water: Pour 3 ml of thickened water (honey-like viscosity) using a spoon and give the instruction, "Please swallow audibly."

Confirm swallowing and ask them to say "Ahhh."

Conduct this three times and write down the worst evaluation.

* In the event of trismus, use a syringe (pour it on the dorsum of the tongue or floor of the oral cavity).

Determination: 10 points Able to swallow without choking and also no wet hoarseness/pharynx sounds are observed after swallowing.
 5 points Able to handle although wet hoarseness/pharynx sounds or choking are observed after swallowing. *1
 2 points Cannot handle due to wet hoarseness/pharynx sounds or choking after swallowing.
 0 points Unable to swallow, collects in the mouth, or difficult to assess.

(7) Jelly: Pour 4 g of jelly into the oral cavity and give them the instruction, "Please swallow audibly."

Confirm swallowing and ask them to say "Ahhh."

Conduct this three times and write down the worst evaluation.

Determination: 10 points Able to swallow without choking and also no wet hoarseness/pharynx sounds are observed after swallowing.
 5 points Able to handle although wet hoarseness/pharynx sounds or choking are observed after swallowing. *1

2 points	Cannot handle due to wet hoarseness/pharynx sounds or choking after swallowing.
0 points	Unable to swallow, a lot of food left in the mouth, or difficult to assess.
<u>* In the event of 0 points in item (5) and also less than 2 points in (6) Thickened water, do not conduct this test and give a score of 0 points.</u>	
(8) Water: Instruct them to drink approximately 3/4 cup of water, giving the instruction, "Please drink it as usual." Once finished drinking, ask them to say "Ahhh." Conduct this once and write down the evaluation.	
Determination: 20 points Able to swallow without choking and also no wet hoarseness/pharynx sounds are observed after swallowing.	
10 points Able to handle although choking or wet hoarseness/pharynx sounds are observed after swallowing*1, or able to drink without choking/wet hoarseness/pharynx sounds by slowly making an adjustment instead of drinking it in one gulp.	
2 points Cannot handle due to choking or wet hoarseness/pharynx sounds after swallowing.	
0 points Unable to swallow or difficult to assess.	
<u>* In the event of less than 5 points in item (6) Thickened water, do not conduct (8) Water and give a score of 0 points. Moreover, regarding the assessments of (1) to (7), if the risk of aspiration has been determined as high, the assessment shall be discontinued.</u>	
*1 "handle" means wet hoarseness/pharynx sounds (wet hoarseness (hoarse voice) or rumbling around the throat after producing an "Ahhh" sound following swallowing) no longer occurs after swallowing again .	
Determination criteria	
15 points or lower (severe level)	
Unable to initiate the oral intake or training level	
16 to 61 points (moderate level)	
Able to initiate meals with adjusted meals	
62 to 76 points (mild level)	
Able to initiate meals in addition to there being a low rate of recurrence, but thickening is required for liquids	
77 to 100 points (no abnormalities)	
Able to initiate meals in addition to there being a low rate of recurrence	

Fig. 2. Assessment of Swallowing Ability for Pneumonia Implementation Manual. ASAP manual was created to perform ASAP safely.

5) ASAP manual

We also created a manual for the implementation of the ASAP (Fig. 2). Due to the risks of suffocation and aspiration, we would like an examiner to carefully read about the discontinuation criteria and posture at the time of assessment and to implement them.

6) Severity of ASAP

The ASAP was designed to determine severity, which is divided into no abnormalities, mild, moderate, and severe levels. It is also designed to be able to determine the initiation (continuation) of meals and recommended diet (swallowing adjusted foods such as thickening only liquids, thickened foods and mousse foods).

Study population

This study was prospectively conducted at our hospital from January 2016 to June 2016, in consecutively enrolled adult hospitalized patients with pneumonia. The following patients were excluded: (1) those younger than 20 years old; (2) those with other fatal diseases; (3) those with esophageal/thyroid tumors; and (4) those not evaluated for using the ASAP.

Definition of pneumonia

Pneumonia was defined when the patient met all three of the following criteria: (1) at least one clinical symptom (fever, cough, sputum, chest pain); (2) new infiltrates on chest radiography and/or computed tomography; and (3) a white blood cell count of $>10,000/\mu\text{l}$ and/or increase

levels of serum C-reactive protein.

Methods

For patients with pneumonia for whom assessments of eating and swallowing functions were requested by their physicians (within three days of admission), speech-language-hearing therapists conducted MASA while pulmonologists/nurses conducted ASAP in the presence of speech-language-hearing therapists. Their food intake levels at the time of assessment of eating and swallowing functions were assessed using the functional oral intake scale (FOIS) [16]. FOIS is classified into 7 levels, and the FOIS level is high for people who have normal oral intake. The assessments of eating and swallowing functions were conducted for those whose conscious level was Japan coma scale (JCS) 0 to 3 and 10 or JCS 20 or more, along with those who could not open their eyes but could swallow through oral stimulation to enable assessment by oral intake. Based on the findings of MASA and ASAP, their physicians determined whether or not initiation of meals was possible. The food intake levels at the time of discharge of patients, excluding cases of death, were assessed by the FOIS level.

Statistical Analysis

The StatFlex ver.6.0 software program (Artech. Co., Ltd, Osaka, Japan) was used for statistical processing. The Pearson's correlation coefficient was calculated, and a $P < 0.05$ was considered to be significant. The Wilcoxon signed rank test was performed and a $P < 0.05$ was considered to be significant. The K statistic was calculated, and a $P < 0.05$ was considered to be significant. The area under the curves (AUC) was calculated using the receiving operating characteristic (ROC) curve by each severity of ASAP.

Ethical considerations

This study was approved by the ethics committee at Tobata Kyouritsu Hospital (No.15-15) and registered as a clinical trial (UMIN000020371). We also considered personal information protection from an ethical aspect and conducted the analysis/examination while managing data in a format such that individuals could not be identified.

Results

Patients characteristics

The subjects included 130 patients with pneumonia (58 males, 72 females, average age: 82.2 ± 13.0). 80 patients had cerebrovascular disease (61.5%) and 89 had dementia (68.5%). 5 patients had no underlying disease (3.8%) (Table 1).

Relationship between diet and ASAP/MASA

The diet at the time of assessment of eating and swallowing functions was categorized using FOIS. The average ASAP score and the average MASA score were calculated and were found to be high when FOIS was high (Table 2). The correlation coefficient between the MASA score and FOIS Level was $r = 0.87$ ($P < 0.001$), indicating a strong correlation. The correlation coefficient between the ASAP score and MASA score at the time of admission was $r = 0.97$ ($P < 0.001$), indicating a strong correlation (Fig. 3). The correlation coefficient between the ASAP score and FOIS Level was $r = 0.89$ ($P < 0.001$), indicating a strong correlation.

Table 1. Characteristics of 130 patients

Average age (years)	82.2 ± 13.0
Male : Female (n)	58 : 72
	n (%)
ECOG-PS 3 or more	116 (89.2)
NHCAP	118 (90.8)
Underlying diseases	
no	5 (3.8)
Malignant tumors	23 (17.7)
Cerebrovascular diseases	80 (61.5)
Esophageal diseases	14 (10.8)
Cardiac diseases	89 (68.5)
Chronic respiratory diseases	52 (40.0)
Liver diseases	8 (6.2)
Kidney diseases	4 (3.1)
Diabetes	22 (16.9)
Dementia	89 (68.5)

ECOG-PS: Eastern Cooperative Oncology Group performance status, NHCAP: nursing and healthcare-associated pneumonia

Table 2. Categorization of the meal style at the time of admission using functional oral intake scale (FOIS)

FOIS scale	1	2	4	5	6	7
Number of subjects	24	6	24	16	4	56
Average age	87.5 ± 4.6	85.3 ± 3.4	85.0 ± 10.5	86.0 ± 8.4	91.0 ± 2.9	76.7 ± 15.9
Gender Female n (%)	16 (66.6)	3 (50)	12 (50)	11 (68.7)	3 (75.0)	27 (48.2)
Average ASAP	15.7 ± 12.0	49.5 ± 23.5	45.7 ± 18.5	57.4 ± 16.5	84.2 ± 8.0	93.9 ± 8.5
Average MASA	74.8 ± 14.8	121.8 ± 41.3	119.0 ± 30.9	134.9 ± 29.4	178.2 ± 9.3	183.2 ± 10.5
BI at the time of admission	2.0 ± 5.1	7.5 ± 10.7	5.6 ± 9.0	9.6 ± 12.0	18.3 ± 12.4	46.7 ± 25.6
BI at the time of discharge	1.2 ± 3.3	21.6 ± 31.9	19.5 ± 20.2	20.6 ± 18.1	55.0 ± 21.2	77.3 ± 22.6
Modified water swallow test (4 or higher) n (%)	9 (37.5)	5 (83.3)	24 (100)	15 (93.7)	4 (100)	56 (100)
Food test (4 or higher) n (%)	5 (20.8)	5 (83.3)	21 (87.5)	14 (87.5)	4 (100)	56 (100)

* None applicable to FOIS 3. ASAP: Assessment of Swallowing Ability for Pneumonia, MASA: Mann Assessment of Swallowing Ability, BI: Barthel index

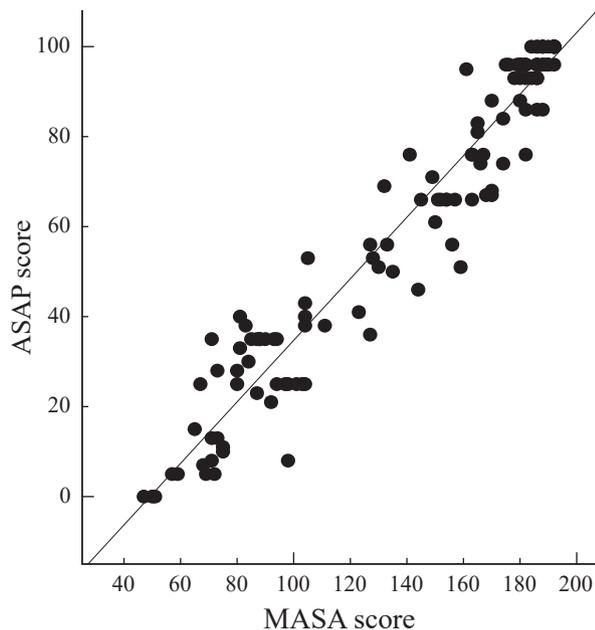


Fig. 3. The correlation coefficient between the assessment of swallowing ability for pneumonia score and the mann assessment of swallowing ability score at the time of admission. The correlation coefficient between the ASAP score and MASA score at the time of admission was $r = 0.97$ ($P < 0.001$), indicating a strong correlation.

Sensitivity of the cutoff value for the severity of the ASAP/specificity/positive predictive value/negative predictive value/AUC

When the cutoff value was set at 76 points (those with 76 points or lower were mildly dysphagia positive) among the 60 patients with a FOIS Level of 6 or higher and 70 patients with a FOIS Level of 5 or lower, the sen-

sitivity was 0.93, specificity was 0.93, positive predictive value was 0.94, negative predictive value was 0.92, and AUC was 0.98 (Fig. 4A). When the cutoff value was set at 61 points (those with 61 points or lower were moderately dysphagia positive) among the 76 patients with a FOIS Level of 5 or higher and 54 patients with a FOIS Level of 4 or lower, the sensitivity was 0.90, specificity was 0.87, positive predictive value was 0.85, negative predictive value was 0.91, and AUC was 0.95 (Fig. 4B). When the cutoff value was set at 15 points (those with 15 points or lower were severely dysphagia positive) among the 100 patients with a FOIS Level of 4 or higher and 30 patients with a FOIS Level 3 of or lower, the sensitivity was 1.00, specificity was 0.50, positive predictive value was 1.00, negative predictive value was 0.87, and AUC was 0.94 (Fig. 4C).

Relationship between diet at time of admission and at time of discharge

Because death case's food intake levels at the time of discharge of patients were the FOIS level 1, we excluded 13 patients. We compared the FOIS level at the time of admission and at the time of discharge of 117 patients. 95 patients had no change (81.2%), 14 patients had an increase (11.9%), and 8 patients had a decrease (6.8%). The changes in the FOIS at the time of admission and at discharge are shown in Fig. 5. The correlation coefficient between the FOIS Level at time of admission and the FOIS Level at time of discharge was $r = 0.87$ ($P < 0.001$), indicating a strong correlation.

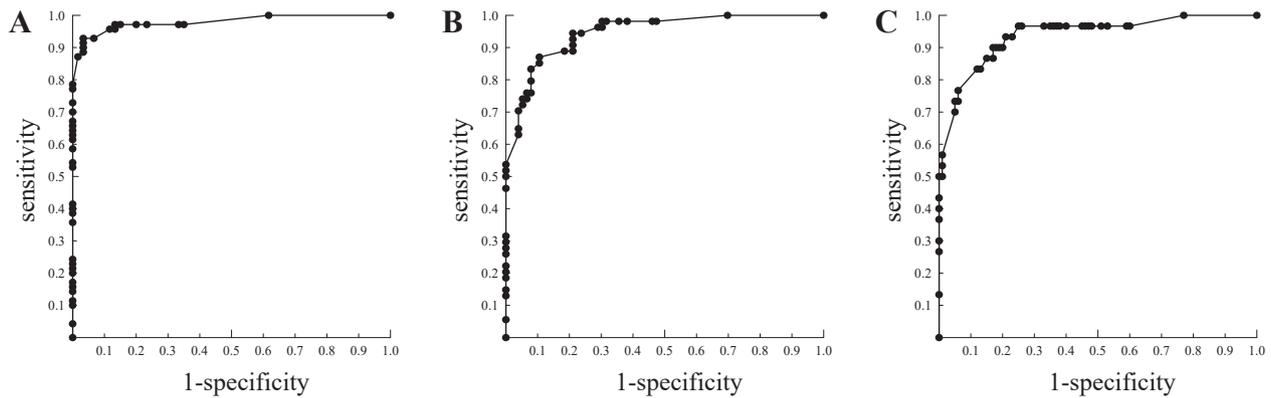


Fig. 4. Receiver operating characteristic curve for severity of Assessment of Swallowing Ability for Pneumonia. A: mildly, B: moderately, C: severely. The Area under the curves (AUC) between the Assessment of Swallowing Ability for Pneumonia and the degrees of severity was 0.98, 0.95, and 0.94.

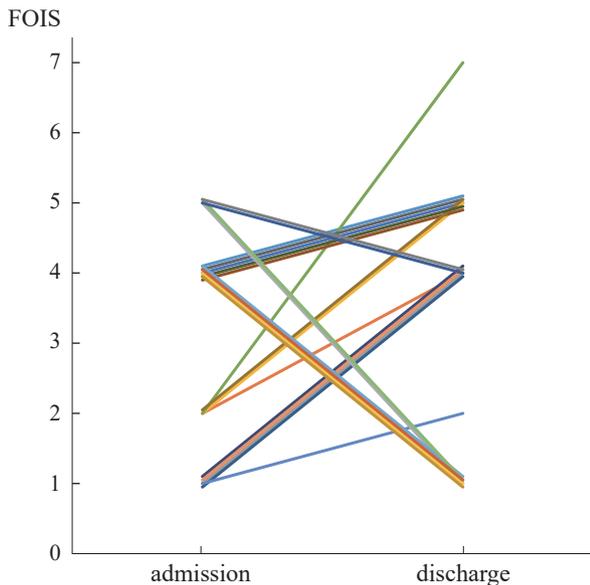


Fig. 5. Changes in the FOIS at time of admission and at time of discharge. Colored lines mean 22 patients. 14 patients showed an increase of FOIS, and 8 patients showed a decrease of FOIS. FOIS: functional oral intake scale.

Examination of the differences among ASAP evaluators

ASAP was preliminarily conducted in 20 patients with pneumonia (average age: 86.6 ± 9.4 , 9 males/11 females) to confirm individual differences in ASAP by speech-language-hearing therapist A with 16 years of clinical experience, pulmonologist B with 11 years of experience, and nurse C with 22 years of experience/nurse D with 1 year of experience. Because these examinations could not be conducted on the same day,

the results may include not only individual differences but also daily variances; that said, the average ASAP scores were 54.4 ± 29.9 , 53.8 ± 30.1 , 52.3 ± 31.1 , and 55.2 ± 30.4 , respectively, with no significant difference observed in respective average ASAP scores when setting the significance level at $P < 0.05$ for the Wilcoxon test. The K statistic between A and B, A and C, A and D, B and C, B and D, C and D were 1.0, 0.91, 0.91, 0.91, 1.0 ($P < 0.001$).

Discussion

Among the clinical dysphagia scales which have currently been announced, few are based on strict psychological statistical evaluation. MASA is a screening method of eating and swallowing functions, for which both the reliability and validity have already been established based on psychological statistical evaluation. Recently, we occasionally come across reports that describe MASA to be useful as an effective method to assess the eating and swallowing functions in elderly people [14,15].

In this study we compared ASAP with MASA to validate the usefulness of ASAP, and found a correlation between the MASA score and FOIS Level at the time of admission in 130 elderly patients with pneumonia. There is also a strong correlation between the MASA score and ASAP score. As a result, there is a strong correlation between the ASAP score and FOIS Level at the time of admission.

There is a strong correlation between the FOIS Level at time of admission and the FOIS Level at time of discharge. In approximately 80% of the patients, the FOIS level at time of discharge was no different from the FOIS level at the time of admission. For the patients who had an increase in the FOIS level, we made the food intake level at admission lower because of aspiration risk. We thought the increase group was no clinical problem. In this study, the patients who had a decrease in the FOIS level was approximately 7%, and it was possible that the decrease group was given an inappropriate diet. Our study suggests that ASAP can be useful as a tool to assess the eating and swallowing functions in elderly patients with pneumonia.

We examined the differences among ASAP evaluators. To examine the differences among speech-language-hearing therapist and the other staff, the K statistic between A and B, A and C, A and D were calculated. These K statistic were high, and there were no differences between the speech-language-hearing therapist and the others. To examine the differences among medical staff who were not expert therapists, the K statistic between B and C, B and D, C and D were calculated. These K statistic were high, and there were no differences among medical staff who were not expert therapists. This suggests that for many health care professionals ASAP can be useful as an assessment of eating and swallowing functions.

The severity of ASAP was divided into no abnormalities (77 to 100 points), mild (62 to 76 points), moderate (16 to 61 points), and severe (0 to 15 points) levels, with AUC of 0.98 / 0.95/ 0.94 for each degree of severity. Based on these results, the cutoff value for the severity of ASAP was believed to be reasonable. Conducting ASAP at the time of admission was believed to enable us to determine whether or not the initiation (continuation) of meals was possible. However, because the moderate cutoff values had a wide range of 16 to 61 points, further examinations will be required in the future.

The ASAP items were created by speech-language-hearing therapists based on clinical experience and used by pulmonologists and nurses. Going forward, it will be necessary to broaden the range of medical institutions, as well as the kinds of occupations of evaluators who will use the ASAP, and to examine in more detail the items, point allocation, and reliability/valid-

ity of the cutoff value.

The guidelines of the Japanese Respiratory Society for the management of pneumonia in adults suggest that the risk assessment of aspiration pneumonia and the assessment of terminal stage (such as underlying diseases or senile decay) are important factors in the development of in-hospital-acquired pneumonia and nursing and healthcare-associated pneumonia [17]. There is no doubt that the assessment of dysphagia in elderly patients with pneumonia is important. We previously reported that MASA is useful for predicting the 6-month mortality in elderly patients with pneumonia [18], which indicates that ASAP can be useful for predicting long-term mortality. We therefore consider ASAP to be a useful tool for assessing dysphagia and predicting the long term mortality in elderly patients with pneumonia.

Conclusion

We believe that the Assessment of Swallowing Ability for Pneumonia will be a useful modality to assess the eating and swallowing functions in elderly patients with pneumonia.

Conflict of Interest

The authors declare that they have no conflicts of interest regarding the publication of this article.

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高齢者肺炎患者の簡易的な摂食嚥下機能評価法の検討

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要 旨：高齢者はしばしば嚥下障害から誤嚥性肺炎を発症するため嚥下機能評価は重要である。もっとも信頼性の高い嚥下機能検査は嚥下造影検査や嚥下内視鏡検査であるが、これらの検査は高齢者には施行できないことも多い。そのため我々は医療従事者なら誰でもできる高齢者肺炎患者に対する摂食嚥下機能評価法の Assessment of Swallowing Ability for Pneumonia (ASAP)を開発し、その有用性を検討した。この研究は2016年1月から2016年6月に戸畑共立病院内科に入院した肺炎患者130名(男58名・女72名, 平均年齢 82.2 ± 13.0 歳)を対象にした。ASAPとthe Mann Assessment of Swallowing Abilityの相関係数は0.97と強い相関を認めた。ASAPと重症度ごとのthe area under the curvesはそれぞれ0.98, 0.95, 0.94であった。ASAPは高齢者肺炎患者の嚥下機能評価法として有用である。

キーワード：ASAP, 嚥下障害, 高齢者, 肺炎, スクリーニング。